



**MOTOROLA**

Exhibit 11: SAR Test Report IHDT6DQ1

**Date of test:** 08/13/2003 – 08/17/2003  
**Date of Report:** 08/20/2003

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

**Test Responsible:** Firass Badaruzzaman  
 Senior RF Engineer

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



<p><u>Tests:</u>                  Electromagnetic Specific Absorption Rate</p> <p>Simulated Tissue Preparation                  RF Power Measurement</p>	<p><u>Procedures:</u>                  ANSI/IEEE C95.1-1992, 1999                  (SAR) IEEE C95.3-1991                  IEEE P1528 (<i>DRAFT</i>)                  FCC OET Bulletin 65 (<i>including Supplements A, B, C</i>)                  Australian Communications Authority Radio                  Communications (Electromagnetic Radiation – Human                  Exposure) Standard 1999                  CENELEC EN 50361 (2001)                  APP-0247                  DOI-0876, 0900, 0902, 0904, 0915</p>
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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 under its sole responsibility that portable cellular telephone FCC ID IHDT6DQ1 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.

**Table of Contents**

1) Introduction	3
2) Description of the Device Under Test	3
Antenna description	3
Device description	3
3) Test Equipment	3
3.1 Dosimetric system	3
3.2 Additional equipment used	4
4) Electrical parameters of the tissue simulating liquid	4
5) System Accuracy Verification	5
6) Test Results	5
6.1 Head Adjacent Test Results	6
6.2 Body-Worn Test Results	7

**References:**

Appendix 1: SAR distribution comparison for the system accuracy verification	9
Appendix 2: SAR distribution plots for Phantom Head Adjacent Use	10
Appendix 3: SAR distribution plots for Body Worn Configuration	12
Appendix 4. Probe Calibration Certificate	14
Appendix 5. Dipole Characterization Certificate	15
Appendix 6: Measurement Uncertainty Budget	16
Appendix 7. Photographs of the device under test	19

**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 IDHT6DQ1). 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**

<b>Type</b>	Internal Antenna	
<b>Location</b>	Back of Phone	
<b>Dimensions</b>	Length	38 mm
	Width	38 mm
<b>Configuration</b>	FICA Antenna	

**Device description**

<b>FCC ID Number</b>	IHDT56DQ1				
<b>Serial number</b>	L8406F0017				
<b>Mode(s) of Operation</b>	EGSM900	GSM 1800	GSM 1900	UMTS	BlueTooth
<b>Modulation Mode(s)</b>	GSM	GSM	GSM	WCDMA	BlueTooth
<b>Maximum Output Power Setting</b>	33.00dBm	30.00dBm	30.00dBm	21.00dBm	0 dBm
<b>Duty Cycle</b>	1:8	1:8	1:8	1:1	1:1
<b>Transmitting Frequency Rang(s)</b>	880.2-914.8MHz	1710.2-1784.8MHz	1850.2-1909.8MHz	1920.3-1979.7MHz	2400.0-2483.5MHz
<b>Production Unit or Identical Prototype (47 CFR §2.908)</b>	Identical Prototype				
<b>Device Category</b>	Portable				
<b>RF Exposure Limits</b>	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 ±11.7% (K=1) with an expanded uncertainty of ±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	SN 434	02/19/2004
E-Field Probe ET3DV6	SN1522	03/21/2003
Dipole Validation Kit, D1800V2	SN273tr	06/24/2004
S.A.M. Phantom used for 1900MHz	TP-1235	

**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,  $\epsilon_r$ , and the conductivity,  $\sigma$ , 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		
			$\epsilon_r$	$\sigma$ (S/m)	Temp (°C)
1880	Head	Measured, 08/16/2003	39.6	1.45	19.9-21.0
		Recommended Limits	40.0	1.40	20-25
	Body	Measured, 08/16/2003	51.00	1.48	19.9-21.0
		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 ±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)
			$\epsilon_r$	$\sigma$ (S/m)		
1800	Measured, 08/16/2003	39.43	39.9	1.36	21	20.1
	Recommended Limits	39.70	n/a	n/a	n/a	n/a

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	SN1522	1800	3.4	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 (± 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 IHDT6DQ1) has the following battery options:

SNN5639B – 830 mAh

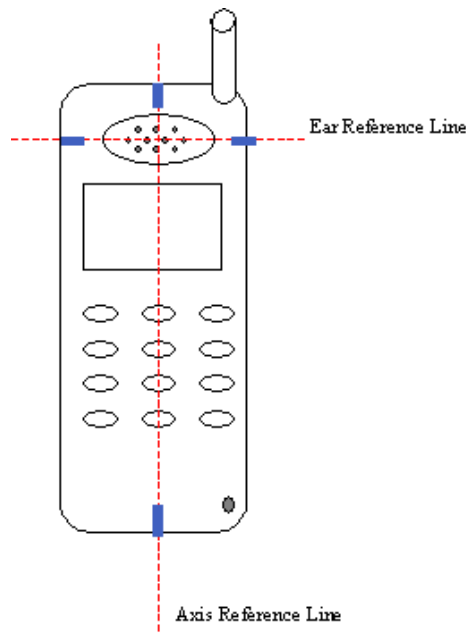
This battery was used to do all of the SAR testing. The phone was placed in the SAR measurement system with a fully charged battery.

### 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 15.0cm ±0.5cm. 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	SN1522	1800	3.4	2 of 10

f (MHz)	Description	Conducted Output Power (dBm)	Left Head								
			Cheek Touch				15° Tilt				
			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	30.06									
	Channel 661	29.96	0.344	-0.29	0.37	20	0.192	0.03	0.19	20	
	Channel 810	29.93									

**Table 1: SAR measurement results for the portable cellular telephone FCC ID IHDT6DQ1 at highest possible output power. Measured against the left head in the Cheek/Tilt Position.**

f (MHz)	Description	Conducted Output Power (dBm)	Right Head								
			Cheek Touch				15° Tilt				
			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	30.06									
	Channel 661	29.96	0.352	0.06	0.35	20	0.202	0.16	0.20	20	
	Channel 810	29.93									

**Table 2: SAR measurement results for the portable cellular telephone FCC ID IHDT6DQ1 at highest possible output. Measured against the right head in the Cheek/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  $New\ SAR = Old\ SAR * 10^{(-drift/10)}$ . 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 currently is no body-worn accessories available for this device, so SAR testing was performed in accordance with the supplement C testing guidelines for devices that do not have body worn accessories. The back part of the phone was placed 1 inch away from a flat phantom per the supplement C standard guidelines to perform SAR measurement. Then the front part of the phone was placed 1 inch away from a flat phantom per the supplement C standard guidelines to perform SAR measurement.

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	SN1522	1800	3.10	8 of 10

f (MHz)	Description	Conducted Output Power (dBm)	Body Worn							
			Back of phone 1" away from phantom				Front of phone 1" away from phantom			
			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	30.06								
	Channel 661	29.96	0.22	-0.03	0.22	20	0.029	-0.04	0.03	20
	Channel 810	29.93								

**Table 5: SAR measurement results for the portable cellular telephone FCC ID IHDT6DQ1 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# 273tr / Forward Power = 246mW / Acceptable Temp Range is 18-25°C Room Temp at time of measurement = 21.0°C. Simulant Temp at time of measurement = 20.1°C

R# 2 TP-1235 GLYCOL SAM Expanded (Rev. 2)-9Jan03 Phantom; Flat Section; Position: (90°,90°); Frequency: 1800 MHz

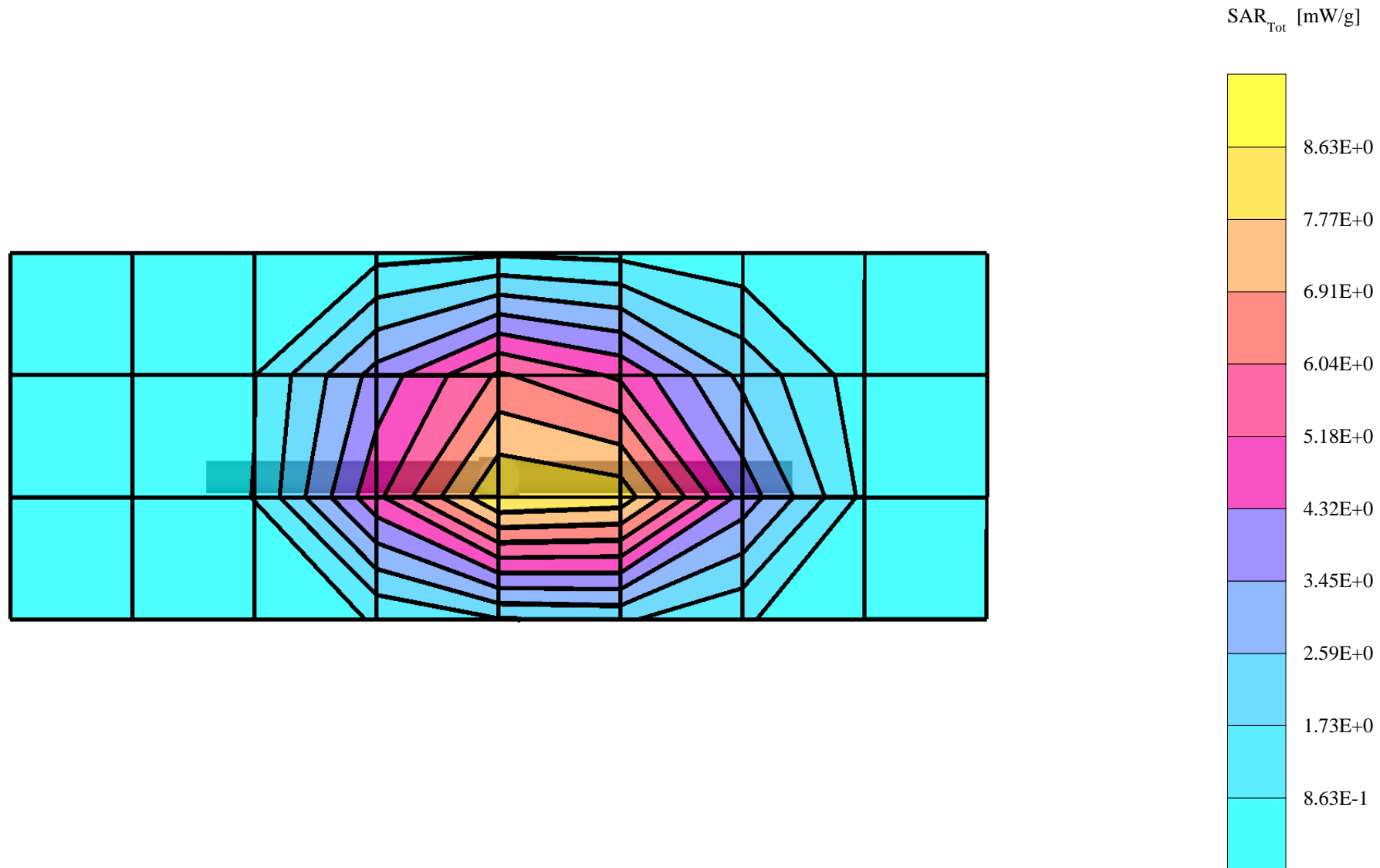
Probe: ET3DV6 - SN1522 - Validation2; ConvF(3.40,3.40,3.40); Crest factor: 1.0; 1800 MHz VALIDATION:  $\sigma = 1.36$  mho/m  $\epsilon_r = 39.9$   $\rho = 1.00$  g/cm<sup>3</sup>

Cubes (2): SAR (1g): 9.70 mW/g  $\pm$  0.02 dB, SAR (10g): 5.21 mW/g  $\pm$  0.04 dB, (Worst-case extrapolation)

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

Penetration depth: 8.7 (8.3, 9.7) [mm]

Powerdrift: -0.22 dB



# Dipole 1800 MHz

1800 MHz Dipole Validation / Dipole Sn# 273tr / Forward Power = 246mW / Acceptable Temp Range is 18-25°C Room Temp at time of measurement = 21.0°C. Simulant Temp at time of measurement = 20.1°C

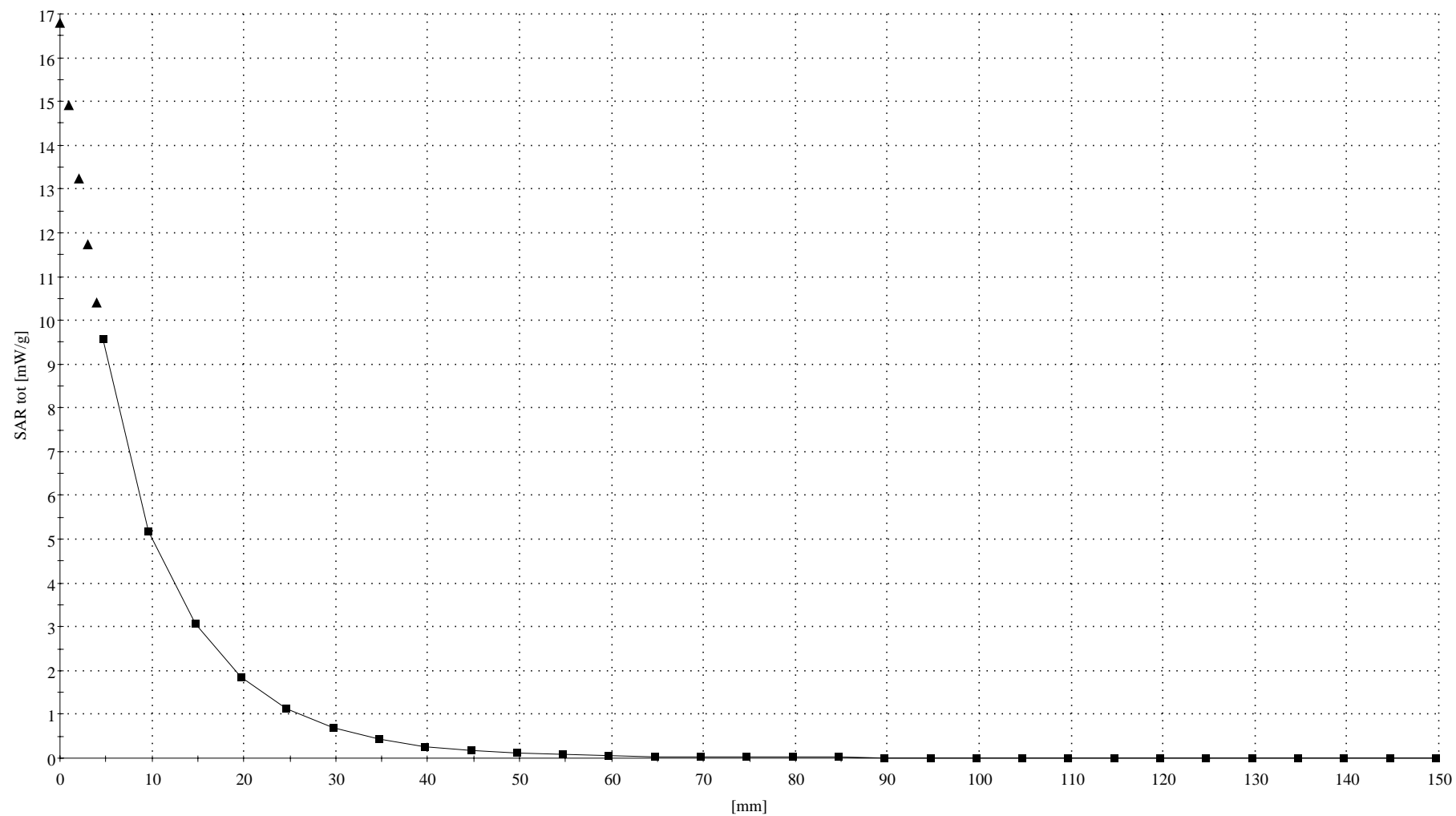
R# 2 TP-1235 GLYCOL SAM Expanded (Rev. 2)-9Jan03 Phantom; Section; Position: ; Frequency: 1800 MHz

Probe: ET3DV6 - SN1522 - Validation2; ConvF(3.40,3.40,3.40); Crest factor: 1.0; 1800 MHz VALIDATION:  $\sigma = 1.36$  mho/m  $\epsilon_r = 39.9$   $\rho = 1.00$  g/cm<sup>3</sup>

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Z-Axis: Dx = 0.0, Dy = 0.0, Dz = 5.0

Penetration depth: 8.6 (8.2, 9.5) [mm]



## Appendix 2

### SAR distribution plots for Phantom Head Adjacent Use

**SN# L8406F0017**

Ch# 661 Pwr Step:0 (OTA) / Antenna Position: Internal / Battery Model #: SNN5639B / DEVICE POSITION: CHEEK

R# 2 TP-1235 GLYCOL SAM Expanded (Rev. 2)-9Jan03 Phantom; Left Hand Section; Position: (90°,180°); Frequency: 1880 MHz

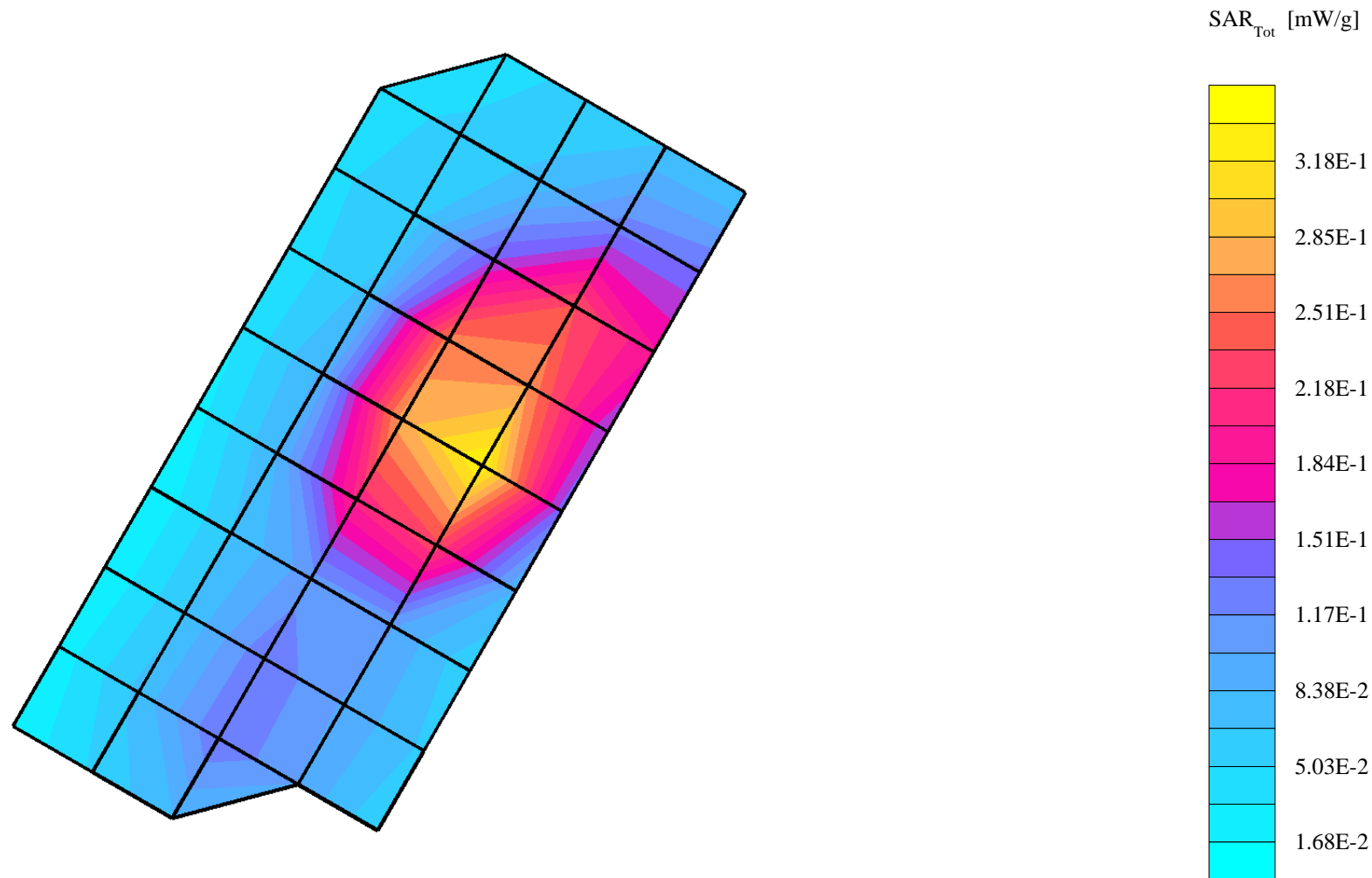
Probe: ET3DV6 - SN1522 - IEEE Head; ConvF(3.40,3.40,3.40); Crest factor: 8.0; 1880 MHz Head & Body:  $\sigma = 1.45$  mho/m  $\epsilon_r = 39.5$   $\rho = 1.00$  g/cm<sup>3</sup>

Cube 7x7x7: SAR (1g): 0.344 mW/g, SAR (10g): 0.206 mW/g, (Worst-case extrapolation)

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

Penetration depth: 11.3 (10.6, 12.1) [mm]

Powerdrift: -0.29 dB



# SN# L8406F0017

Ch# 661 Pwr Step:0 (OTA) / Antenna Position: Internal / Battery Model #:SNN5639B / DEVICE POSITION:TILT

R# 2 TP-1235 GLYCOL SAM Expanded (Rev. 2)-9Jan03 Phantom; Right Hand Section; Position: (90°,180°); Frequency: 1880 MHz

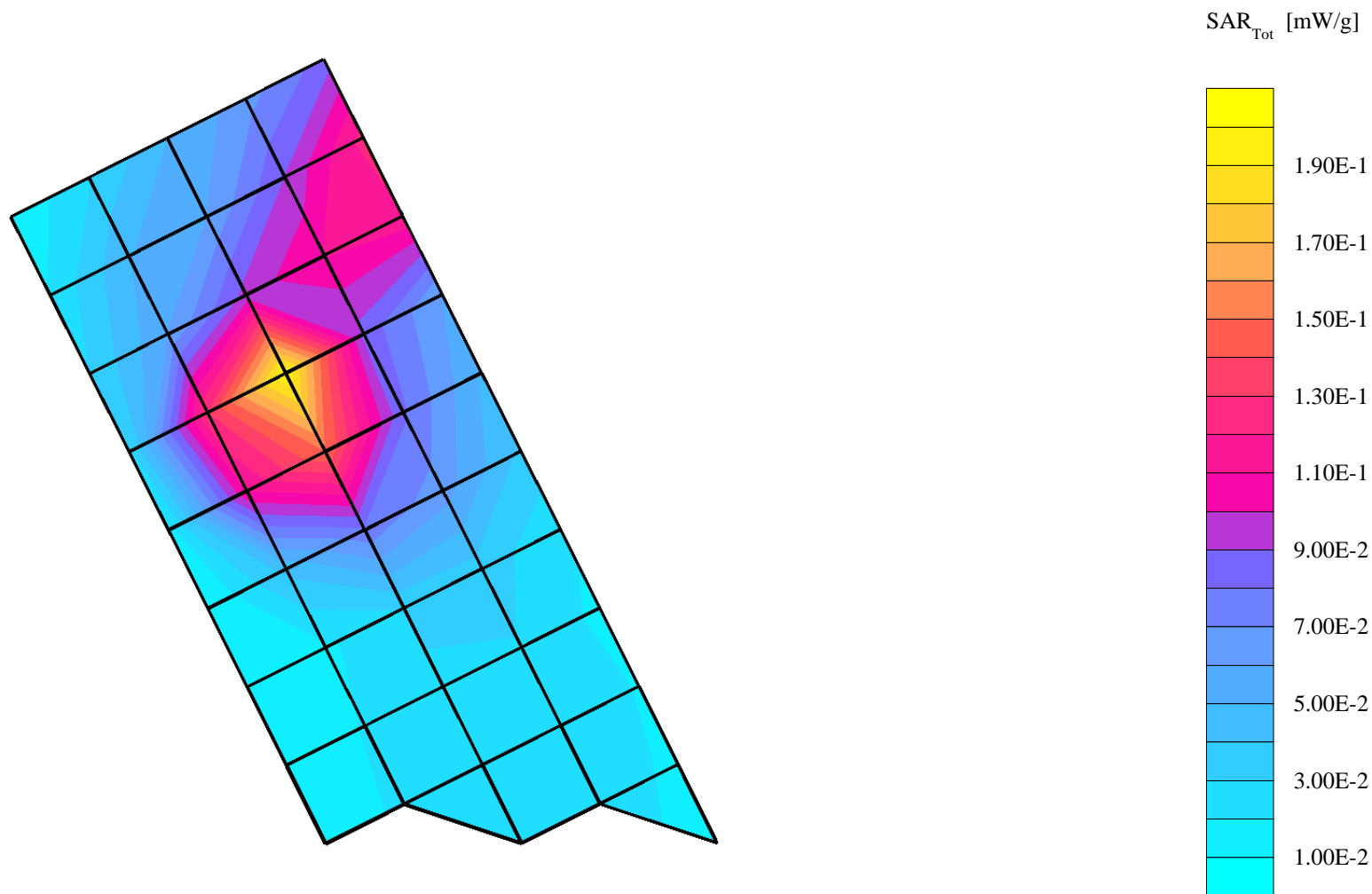
Probe: ET3DV6 - SN1522 - IEEE Head; ConvF(3.40,3.40,3.40); Crest factor: 8.0; 1880 MHz Head & Body:  $\sigma = 1.45$  mho/m  $\epsilon_r = 39.6$   $\rho = 1.00$  g/cm<sup>3</sup>

Cube 7x7x7: SAR (1g): 0.202 mW/g, SAR (10g): 0.113 mW/g, (Worst-case extrapolation)

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

Penetration depth: 10.2 (9.4, 11.2) [mm]

Powerdrift: 0.16 dB



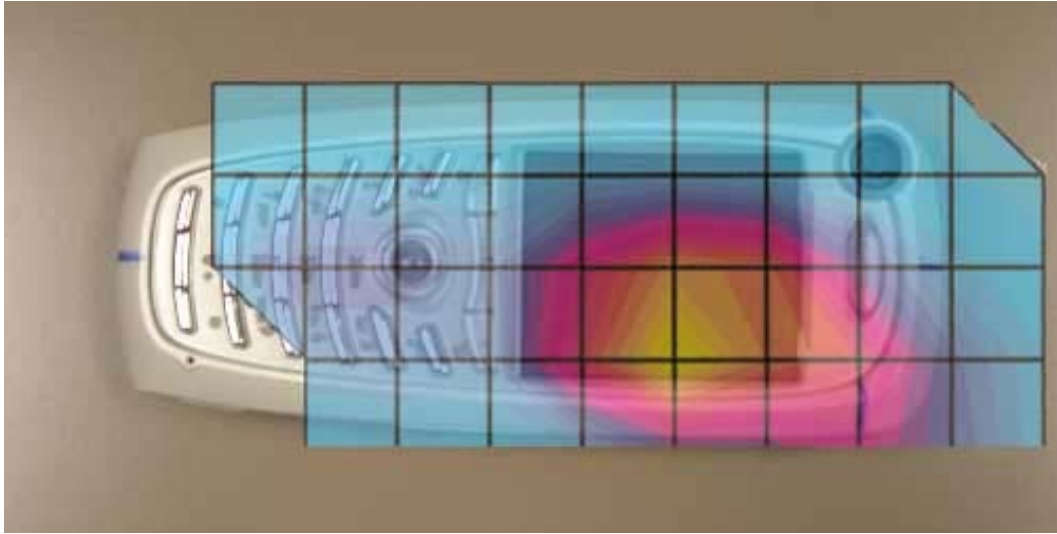


Figure 1. Typical 1900MHz Left Head Adjacent Contour Overlaid on Phone with Antenna Fixed (Cheek Touch)

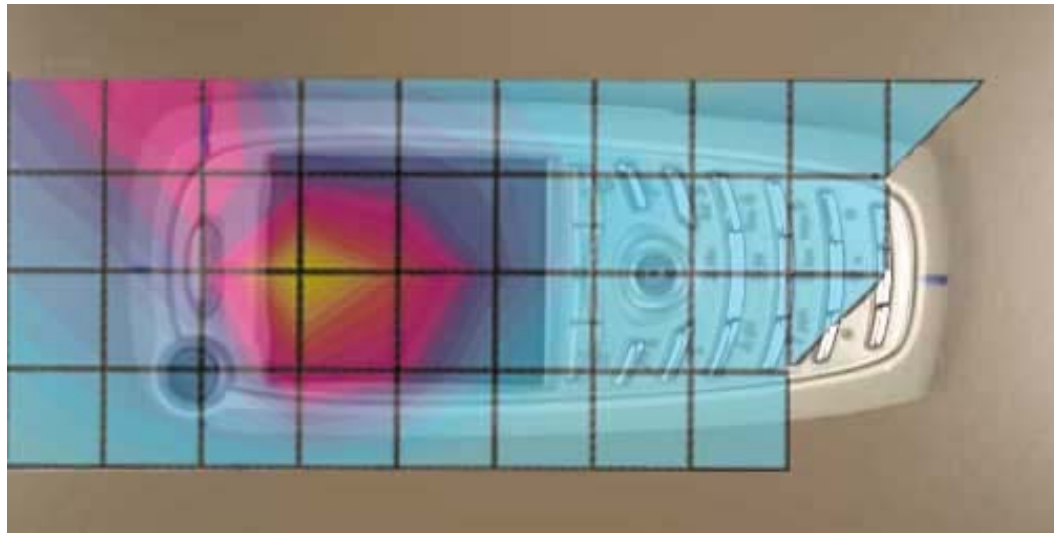


Figure 2. Typical 1900MHz Right Head Adjacent Contour Overlaid on Phone with Antenna Fixed (15 ° Tilt)

### **Appendix 3**

#### **SAR distribution plots for Body Worn Configuration**

**SN# L8406F0017**

Ch# 661 Pwr Step: 0 (OTA) / Antenna Position: Internal / Battery Model #: SNN5639B / Accessory Model # = back 1"

R2 Amy Twin Phantom Rev.3 Phantom; section 1 Section; Position: (0°,0°); Frequency: 1880 MHz

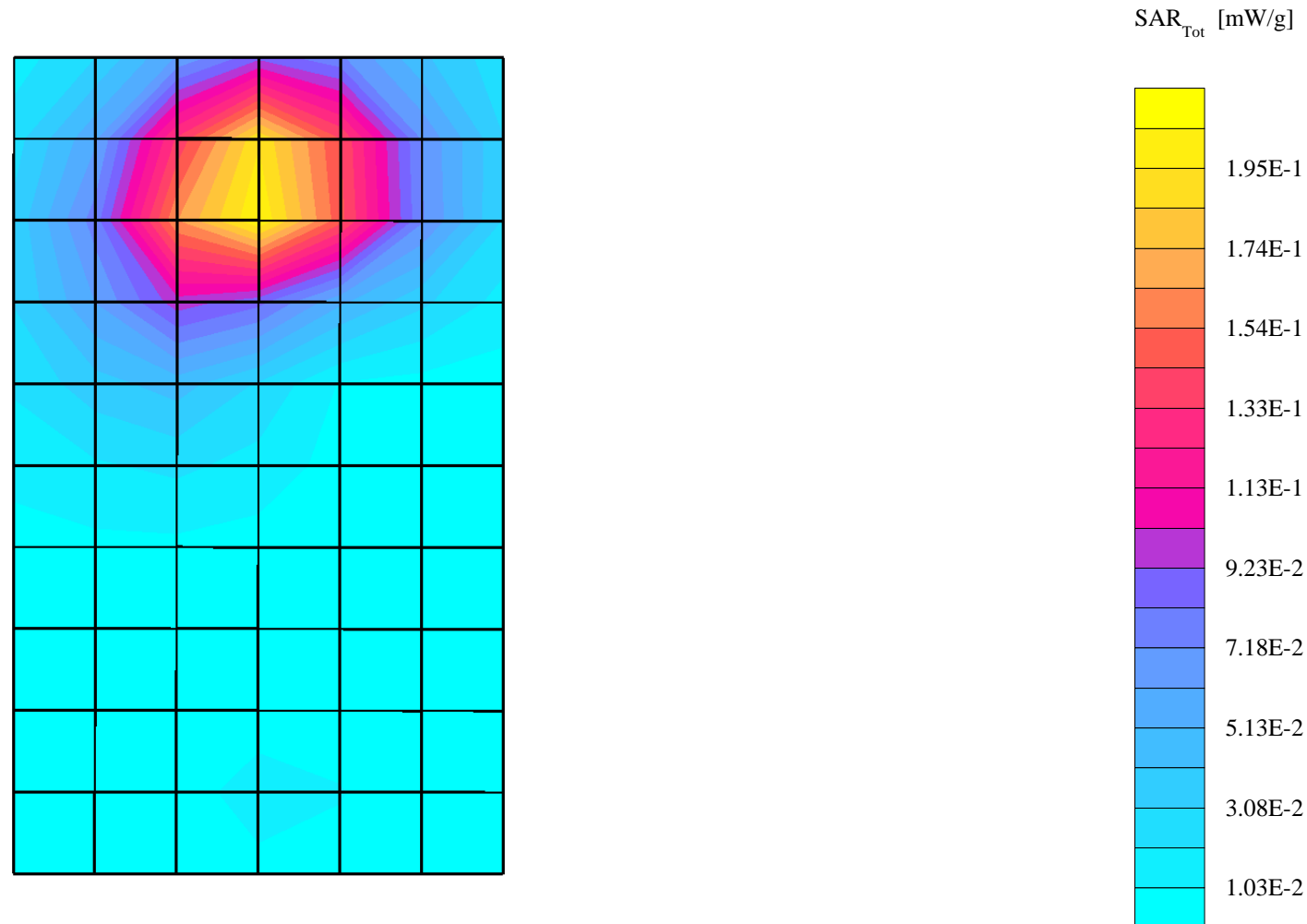
Probe: ET3DV6 - SN1522 - FCC Body; ConvF(3.10,3.10,3.10); Crest factor: 8.0; 1880 MHz Head & Body:  $\sigma = 1.48$  mho/m  $\epsilon_r = 51.0$   $\rho = 1.00$  g/cm<sup>3</sup>

Cube 7x7x7: SAR (1g): 0.221 mW/g, SAR (10g): 0.133 mW/g, (Worst-case extrapolation)

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

Penetration depth: 10.6 (9.3, 12.4) [mm]

Powerdrift: -0.03 dB



**SN# L8406F0017**

Ch# 661 Pwr Step:0 (OTA) / Antenna Position:Internal / Battery Model #: SNN5639B / Accessory Model # = front 1"

R2 Amy Twin Phantom Rev.3 Phantom; section 1 Section; Position: (0°,0°); Frequency: 1880 MHz

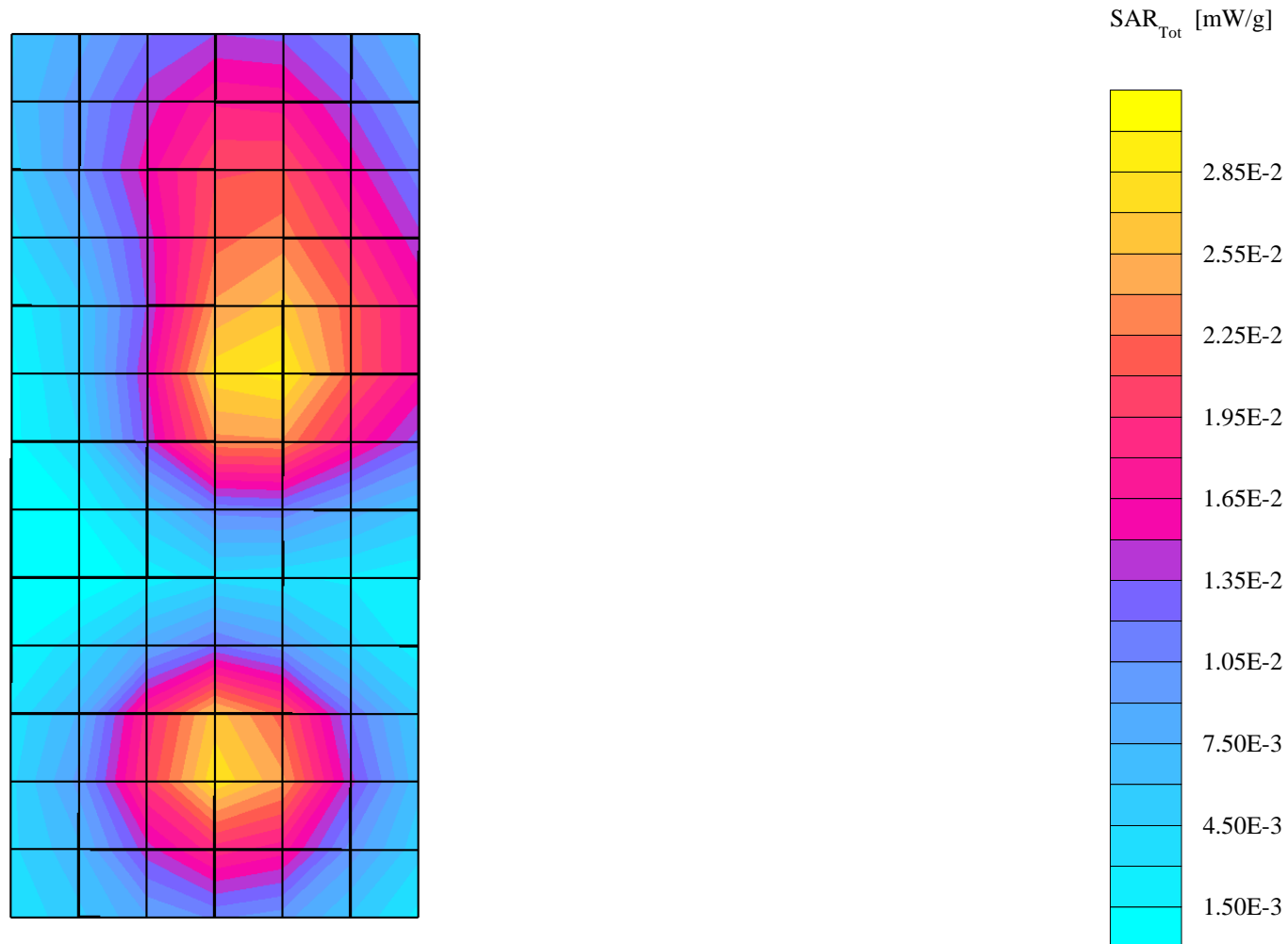
Probe: ET3DV6 - SN1522 - FCC Body; ConvF(3.10,3.10,3.10); Crest factor: 8.0; 1880 MHz Head & Body:  $\sigma = 1.48$  mho/m  $\epsilon_r = 51.0$   $\rho = 1.00$  g/cm<sup>3</sup>

Cube 7x7x7: SAR (1g): 0.0297 mW/g, SAR (10g): 0.0189 mW/g, (Worst-case extrapolation)

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

Penetration depth: 10.7 (9.6, 12.2) [mm]

Powerdrift: -0.04 dB



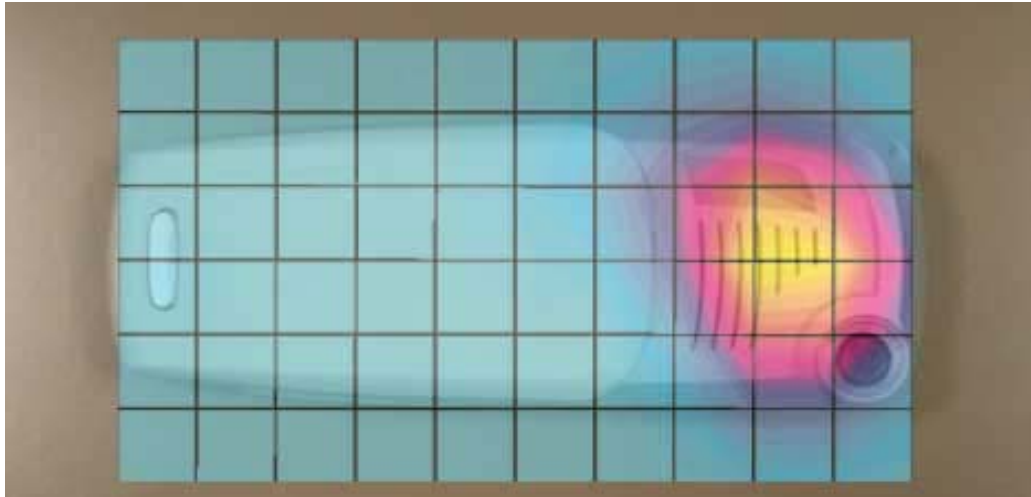


Figure 3. Typical 1900 MHz Body-Worn Contour Overlaid on Phone (Back 1" away)

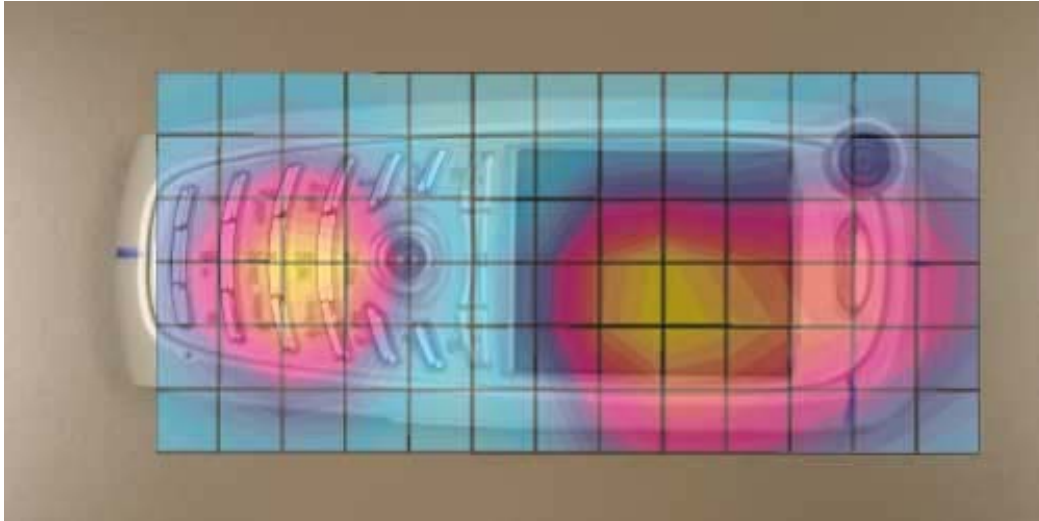




Figure 4. Typical 1900 MHz Body-Worn Contour Overlaid on Phone (Front 1" away)

**Appendix 4**  
**Probe Calibration Certificate**

Client **Motorola MRO**

CALIBRATION CERTIFICATE																															
Object(s)	ET3DV6 - SN:1522																														
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes																														
Calibration date:	March 21, 2003																														
Condition of the calibrated item:	In Tolerance (according to the specific calibration document)																														
<p>This calibration statement documents traceability of M&amp;TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity &lt; 75%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Model Type</th> <th>ID #</th> <th>Cal Date</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>RF generator HP 8684C</td> <td>US3642U01700</td> <td>4-Aug-99 (in house check Aug-02)</td> <td>In house check: Aug-05</td> </tr> <tr> <td>Power sensor E4412A</td> <td>MY41495277</td> <td>Mar-02</td> <td>Mar-03</td> </tr> <tr> <td>Power sensor HP 8481A</td> <td>MY41092180</td> <td>18-Sep-02</td> <td>Sep-03</td> </tr> <tr> <td>Power meter EPM E4419B</td> <td>GB41293874</td> <td>13-Sep-02</td> <td>Sep-03</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US38432426</td> <td>3-May-00</td> <td>In house check: May 03</td> </tr> <tr> <td>Fluke Process Calibrator Type 702</td> <td>SN: 6295803</td> <td>3-Sep-01</td> <td>Sep-03</td> </tr> </tbody> </table>				Model Type	ID #	Cal Date	Scheduled Calibration	RF generator HP 8684C	US3642U01700	4-Aug-99 (in house check Aug-02)	In house check: Aug-05	Power sensor E4412A	MY41495277	Mar-02	Mar-03	Power sensor HP 8481A	MY41092180	18-Sep-02	Sep-03	Power meter EPM E4419B	GB41293874	13-Sep-02	Sep-03	Network Analyzer HP 8753E	US38432426	3-May-00	In house check: May 03	Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01	Sep-03
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Calibrated by	Name Nico Velters	Function Technician	Signature 																												
Approved by	Name Katja Pokovic	Function Laboratory Director	Signature 																												
Date issued: March 21, 2003																															
<p>This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid &amp; Partner Engineering AG is completed.</p>																															

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info@speag.com, <http://www.speag.com>

# Probe ET3DV6R

## SN:1522

Manufactured:	March 21, 2000
Last calibration:	April 25, 2002
Recalibrated:	March 21, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

## DASY - Parameters of Probe: ET3DV6R SN:1522

### Sensitivity in Free Space

NormX	<b>1.41</b> $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	<b>1.23</b> $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	<b>1.29</b> $\mu\text{V}/(\text{V}/\text{m})^2$

### Diode Compression

DCP X	<b>96</b>	mV
DCP Y	<b>96</b>	mV
DCP Z	<b>96</b>	mV

### Sensitivity in Tissue Simulating Liquid

Head	<b>900 MHz</b>	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
Head	<b>835 MHz</b>	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
	ConvF X	<b>4.7</b> $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	<b>4.7</b> $\pm 9.5\%$ (k=2)	Alpha <b>0.57</b>
	ConvF Z	<b>4.7</b> $\pm 9.5\%$ (k=2)	Depth <b>1.94</b>
Head	<b>1800 MHz</b>	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
Head	<b>1900 MHz</b>	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
	ConvF X	<b>3.4</b> $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	<b>3.4</b> $\pm 9.5\%$ (k=2)	Alpha <b>0.49</b>
	ConvF Z	<b>3.4</b> $\pm 9.5\%$ (k=2)	Depth <b>3.01</b>

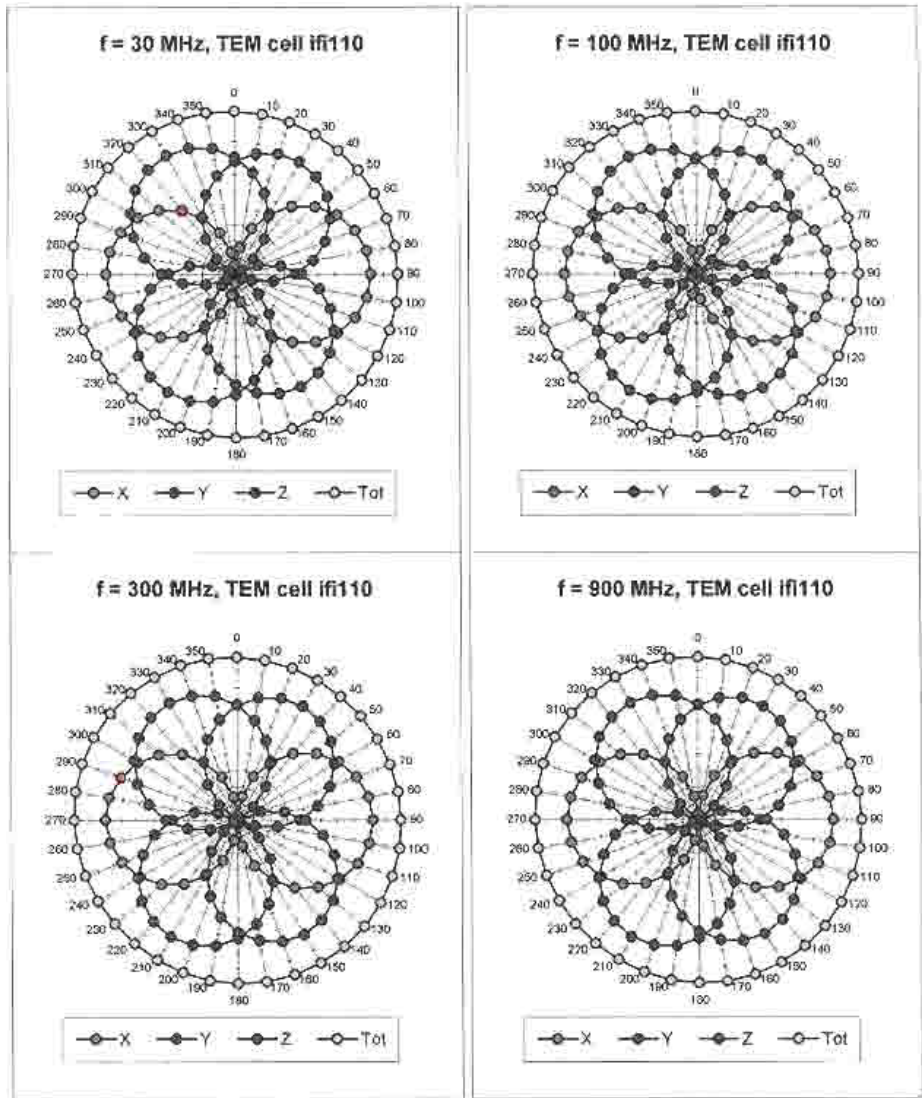
### Boundary Effect

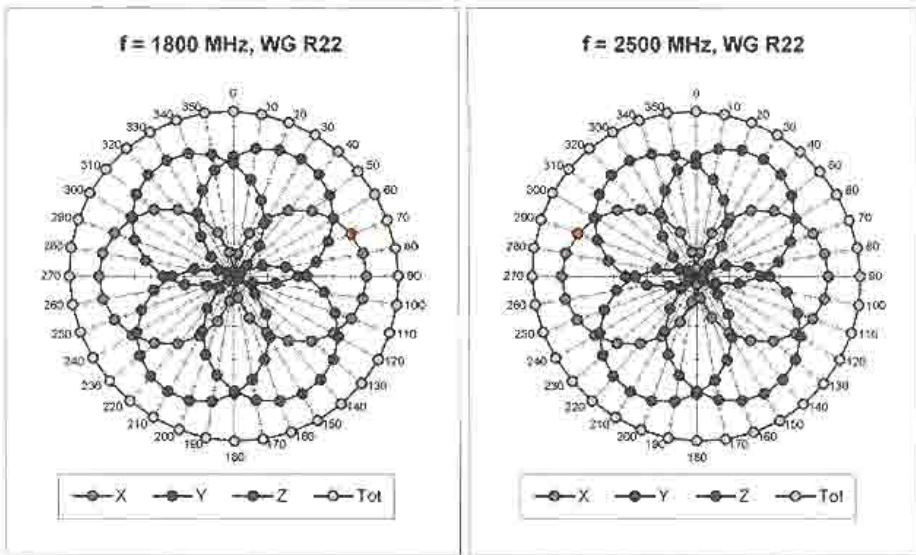
Head	<b>900 MHz</b>	Typical SAR gradient: 5 % per mm	
	Probe Tip to Boundary	<b>1 mm</b>	<b>2 mm</b>
	SAR <sub>ave</sub> [%] Without Correction Algorithm	9.3	5.1
	SAR <sub>ave</sub> [%] With Correction Algorithm	0.1	0.2
Head	<b>1800 MHz</b>	Typical SAR gradient: 10 % per mm	
	Probe Tip to Boundary	<b>1 mm</b>	<b>2 mm</b>
	SAR <sub>ave</sub> [%] Without Correction Algorithm	16.1	12.0
	SAR <sub>ave</sub> [%] With Correction Algorithm	0.5	0.5

### Sensor Offset

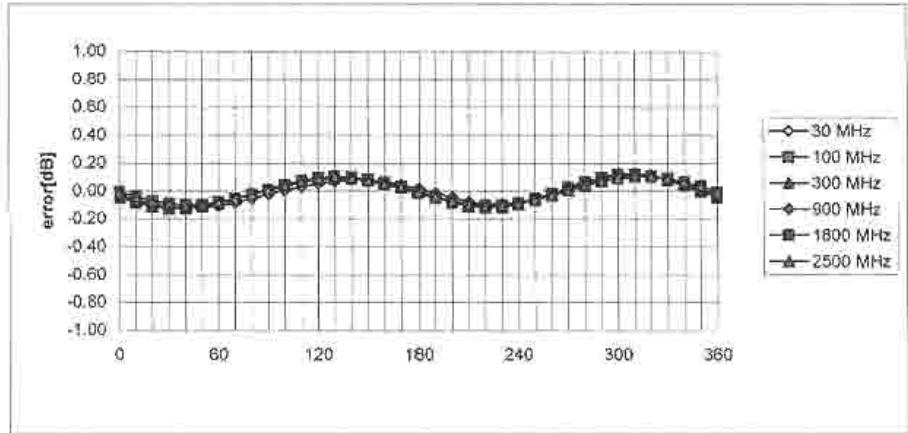
Probe Tip to Sensor Center	<b>2.7</b>	mm
----------------------------	------------	----

### Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$



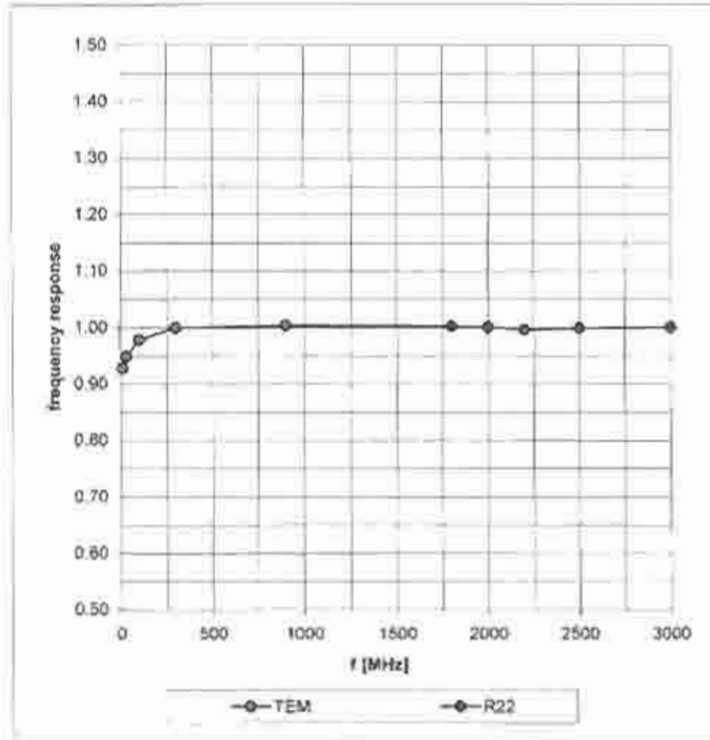


Isotropy Error ( $\phi$ ),  $\theta = 0^\circ$



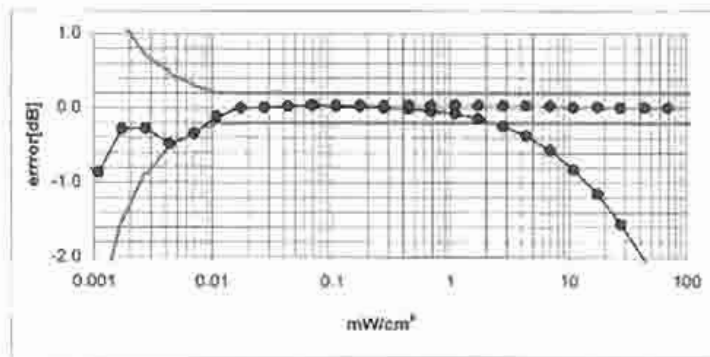
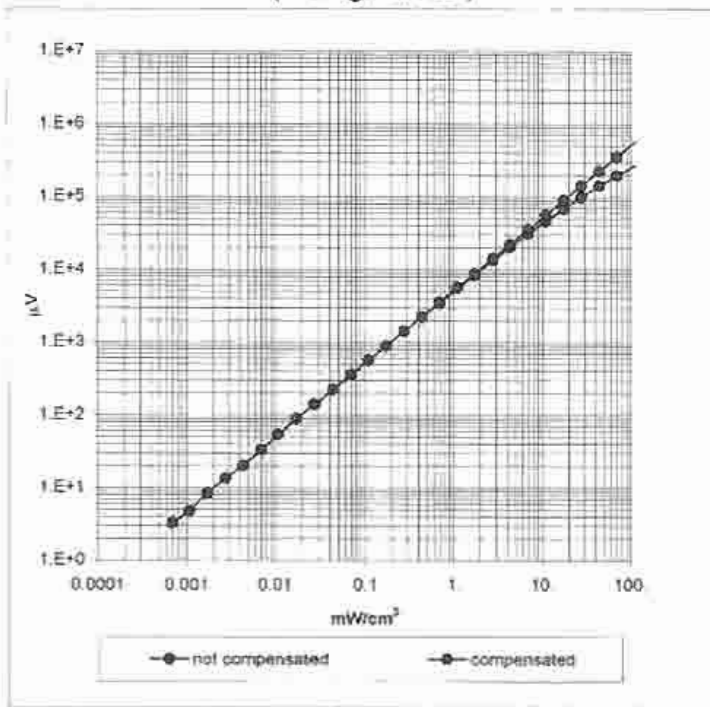
# Frequency Response of E-Field

( TEM-Cell:ifi110, Waveguide R22)

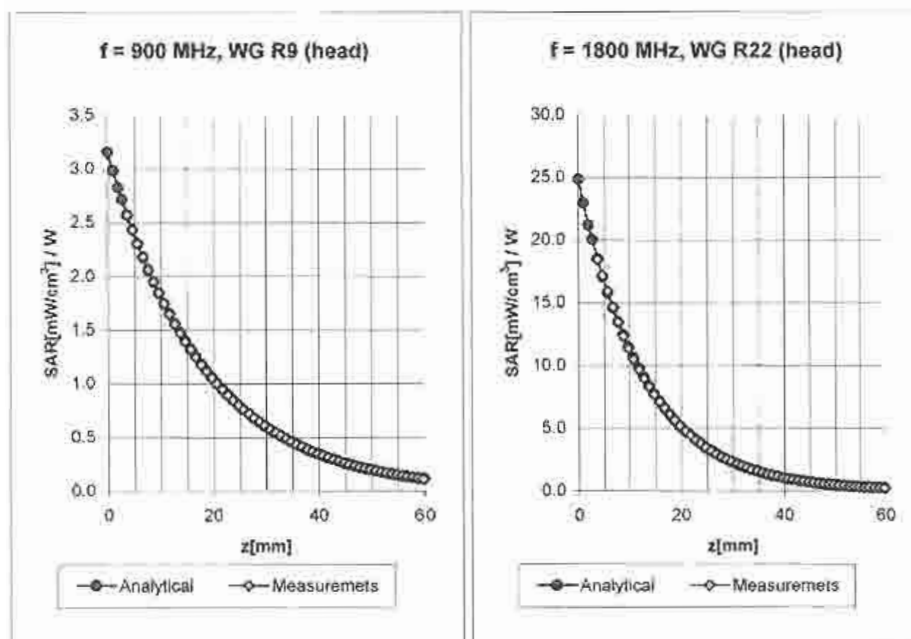


# Dynamic Range $f(\text{SAR}_{\text{brain}})$

( Waveguide R22 )

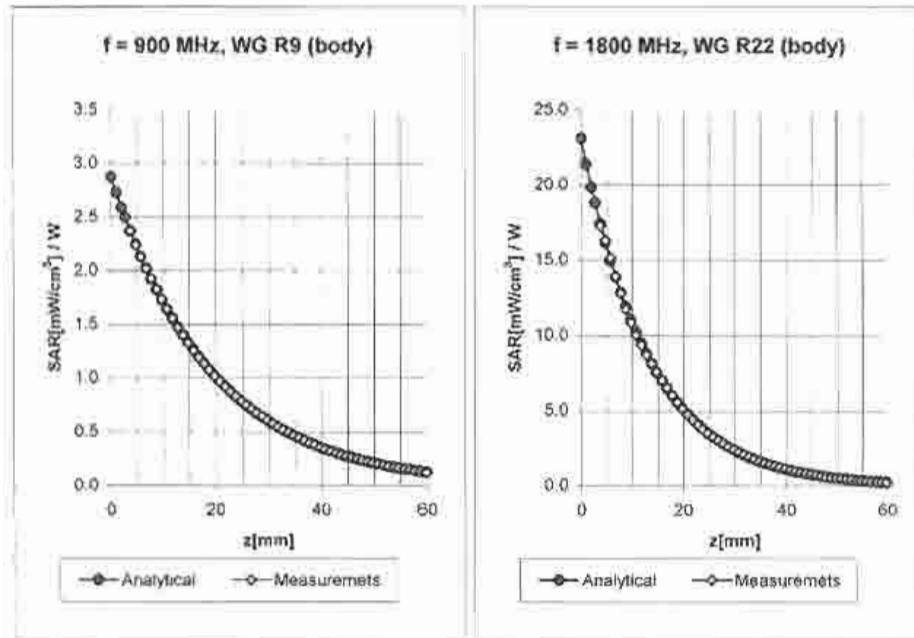


## Conversion Factor Assessment



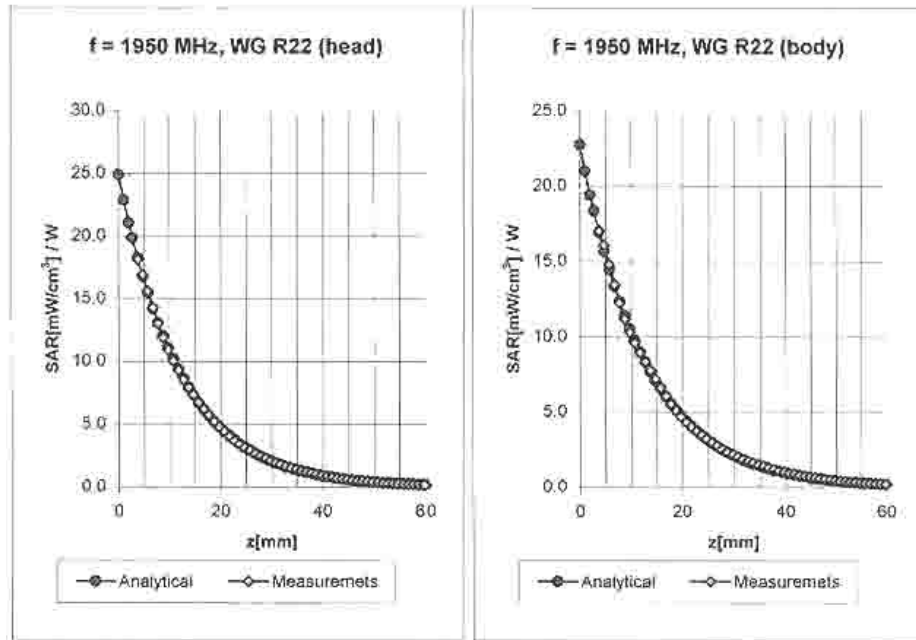
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
Head	836 MHz	$\epsilon_r = 41.6 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
	ConvF X	<b>4.7</b> $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	<b>4.7</b> $\pm 9.5\%$ (k=2)	Alpha <b>0.57</b>
	ConvF Z	<b>4.7</b> $\pm 9.5\%$ (k=2)	Depth <b>1.94</b>
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
	ConvF X	<b>3.4</b> $\pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	<b>3.4</b> $\pm 9.5\%$ (k=2)	Alpha <b>0.49</b>
	ConvF Z	<b>3.4</b> $\pm 9.5\%$ (k=2)	Depth <b>3.01</b>

## Conversion Factor Assessment



Body	<b>900 MHz</b>	$\epsilon_r = 55.0 \pm 5\%$	$\sigma = 1.05 \pm 5\% \text{ mho/m}$
Body	<b>835 MHz</b>	$\epsilon_r = 55.2 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
	ConvF X	<b>4.4</b> $\pm 9.5\%$ (k=2)	Boundary effect
	ConvF Y	<b>4.4</b> $\pm 9.5\%$ (k=2)	Alpha <b>0.36</b>
	ConvF Z	<b>4.4</b> $\pm 9.5\%$ (k=2)	Depth <b>2.79</b>
Body	<b>1800 MHz</b>	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
Body	<b>1900 MHz</b>	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
	ConvF X	<b>3.1</b> $\pm 9.5\%$ (k=2)	Boundary effect
	ConvF Y	<b>3.1</b> $\pm 9.5\%$ (k=2)	Alpha <b>0.58</b>
	ConvF Z	<b>3.1</b> $\pm 9.5\%$ (k=2)	Depth <b>2.97</b>

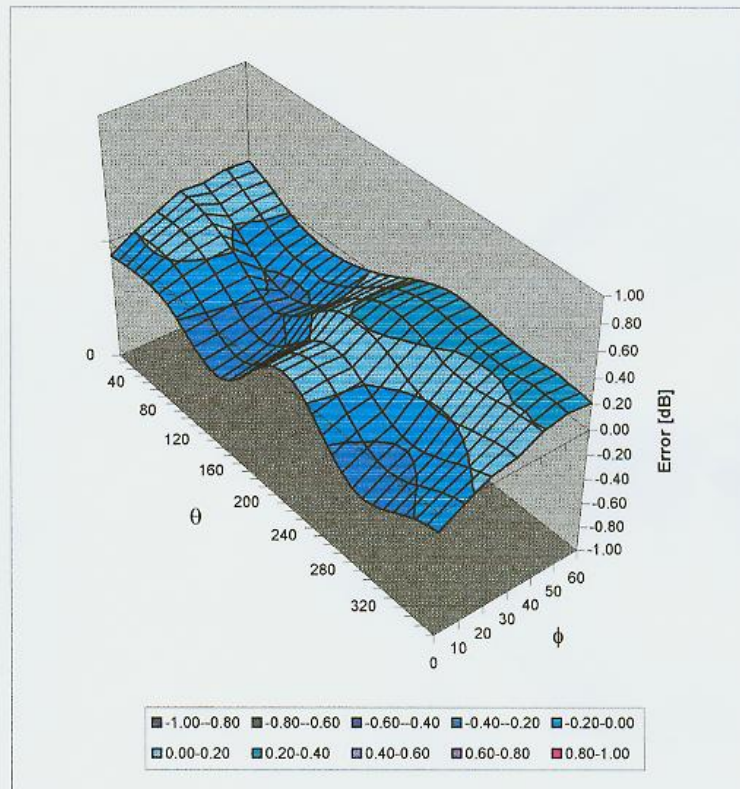
## Conversion Factor Assessment



<b>Head</b>	<b>1950</b>	<b>MHz</b>	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
	ConvF X	<b>3.2</b>	$\pm 8.9\% (k=2)$	Boundary effect:
	ConvF Y	<b>3.2</b>	$\pm 8.9\% (k=2)$	Alpha <b>0.55</b>
	ConvF Z	<b>3.2</b>	$\pm 8.9\% (k=2)$	Depth <b>2.95</b>
<b>Body</b>	<b>1950</b>	<b>MHz</b>	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
	ConvF X	<b>2.7</b>	$\pm 8.9\% (k=2)$	Boundary effect:
	ConvF Y	<b>2.7</b>	$\pm 8.9\% (k=2)$	Alpha <b>0.65</b>
	ConvF Z	<b>2.7</b>	$\pm 8.9\% (k=2)$	Depth <b>2.71</b>

# Deviation from Isotropy in HSL

Error ( $\theta, \phi$ ),  $f = 900$  MHz



**Appendix 5**  
**Dipole Characterization Certificate**

# Interim Dipole Correlation Certificate

FCD-0359, Rev.001

<b>Dipole Serial Number:</b>	273(TR)	Last Calibration Date:	July 17, 2002
Dipole Type (MHz):	D1800V2 w/ Teflon Rings	Calibration Due:	July 17, 2004
		Manufacturer:	SPEAG

**-Manufacturer's Original Calibration Information-**

**Dipole to be correlated:** [Serial Number: 273(TR) ]

1g SAR normalized to 1W forward power (mW/g):	39.6 mW/g
Relative Dielectric:	40.3
Conductivity:	1.36
Probe Serial Number:	1507
Forward Power:	250mW

**Primary Dipole Referenced:** [Serial Number: 246(TR) ]

1g SAR normalized to 1W forward power (mW/g):	38.8 mW/g
Relative Dielectric:	39.6
Conductivity:	1.37
Probe Serial Number:	1507
Forward Power:	250mW

**-Correlation Method Utilized-** per DOI-1265

(select one)

By Similarity:  By Transfer Calibration:

**-Measured Data-**

Probe S/N:	1515	Conductivity (meas.):	1.36
Robot Cell #:	PCS-2	Permittivity (meas.):	38.9

**Primary Standard** (average of 0-degree & 90-degree 1g cubes):

9.805 mW/g		
	(if required)	(if required)

**Secondary Standard** (average of 0-degree & 90-degree 1g cubes): Mayo Tic

9.900 mW/g		
	(if required)	(if required)

=====

**-NEW Correlated Target-**

1g SAR normalized to 1W forward power (mW/g):	38.8 mW/g
Relative Dielectric:	39.6
Conductivity:	1.37

=====

Approved by:  Date: 7-Nov-02

**Comments:** Secondary dipole measured +1% from primary dipole.  
(this correlation required for use with Teflon ring endcaps.)

**Appendix 6**  
**Measurement Uncertainty Budget**

<b>Uncertainty Budget for Device Under Test</b>									
<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>
<b>Uncertainty Component</b>	Sec.	Tol. (± %)	Prob. Dist.	Div.	<i>c<sub>i</sub></i> (1 g)	<i>c<sub>i</sub></i> (10 g)	1 g <i>u<sub>i</sub></i> (±%)	10 g <i>u<sub>i</sub></i> (±%)	<i>v<sub>i</sub></i>
<b>Measurement System</b>									
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	∞
<b>Test sample Related</b>									
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	∞
<b>Phantom and Tissue Parameters</b>									
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	∞
<b>Combined Standard Uncertainty</b>			RSS				11.72	11.09	1363
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>			<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>
<b>Uncertainty Component</b>	Sec.	Tol. (± %)	Prob. Dist.	Div.	<i>c<sub>i</sub></i> (1 g)	<i>c<sub>i</sub></i> (10 g)	1 g <i>u<sub>i</sub></i> (±%)	10 g <i>u<sub>i</sub></i> (±%)	<i>v<sub>i</sub></i>
<b>Measurement System</b>									
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	∞
<b>Dipole</b>									
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	∞
<b>Phantom and Tissue Parameters</b>									
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	∞
<b>Combined Standard Uncertainty</b>			RSS				10.16	9.43	99999
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>			<i>k</i> =2				19.92	18.48	

## **Appendix 7**

### **Photographs of the device under test**



**Figure 5. Front of Phone**



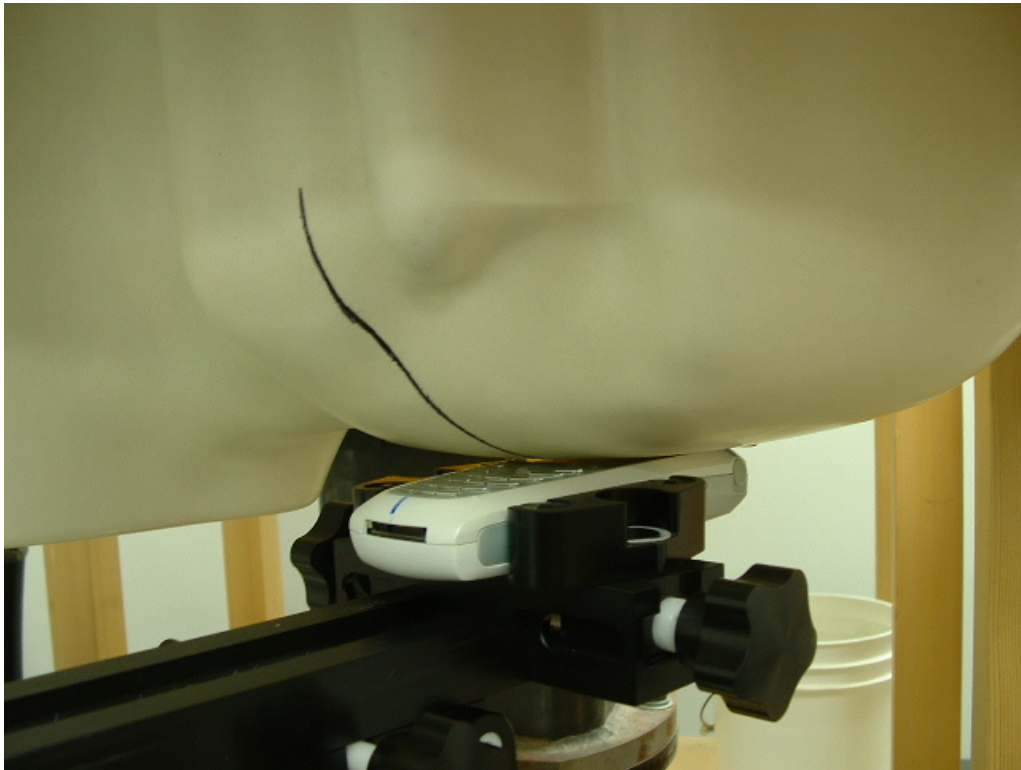
**Figure 6. Back of Phone**



**Figure 7. Back of phone 1" away from phantom**



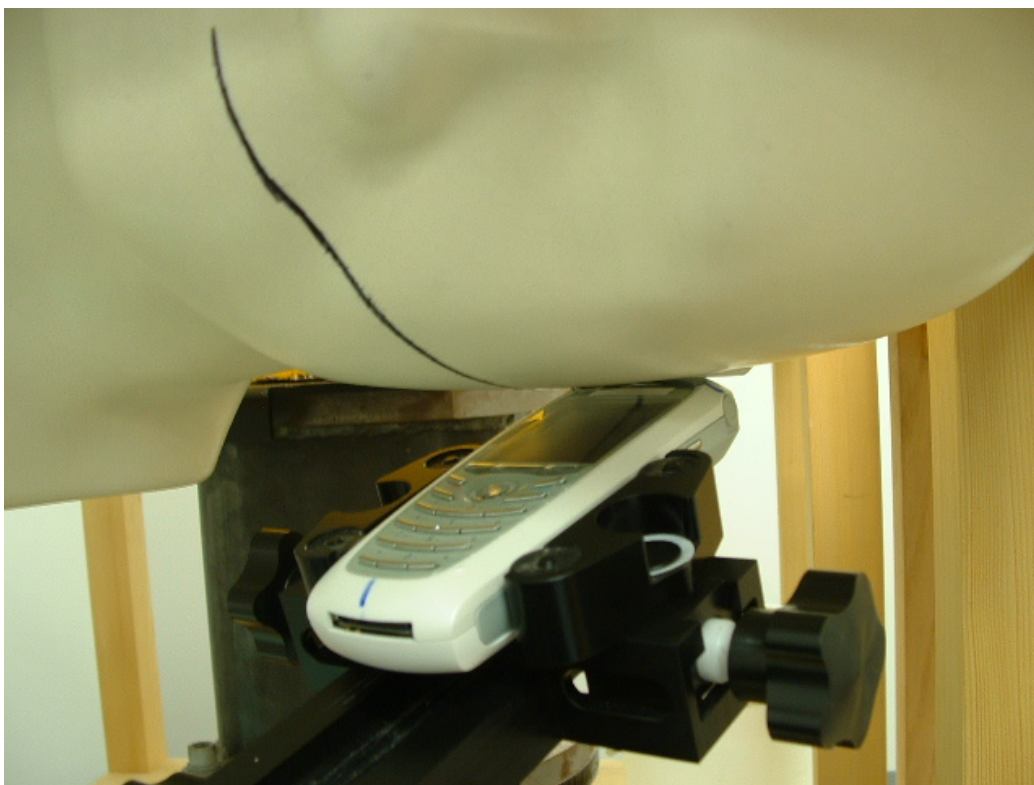
**Figure 8. Front of phone 1" away from phantom**



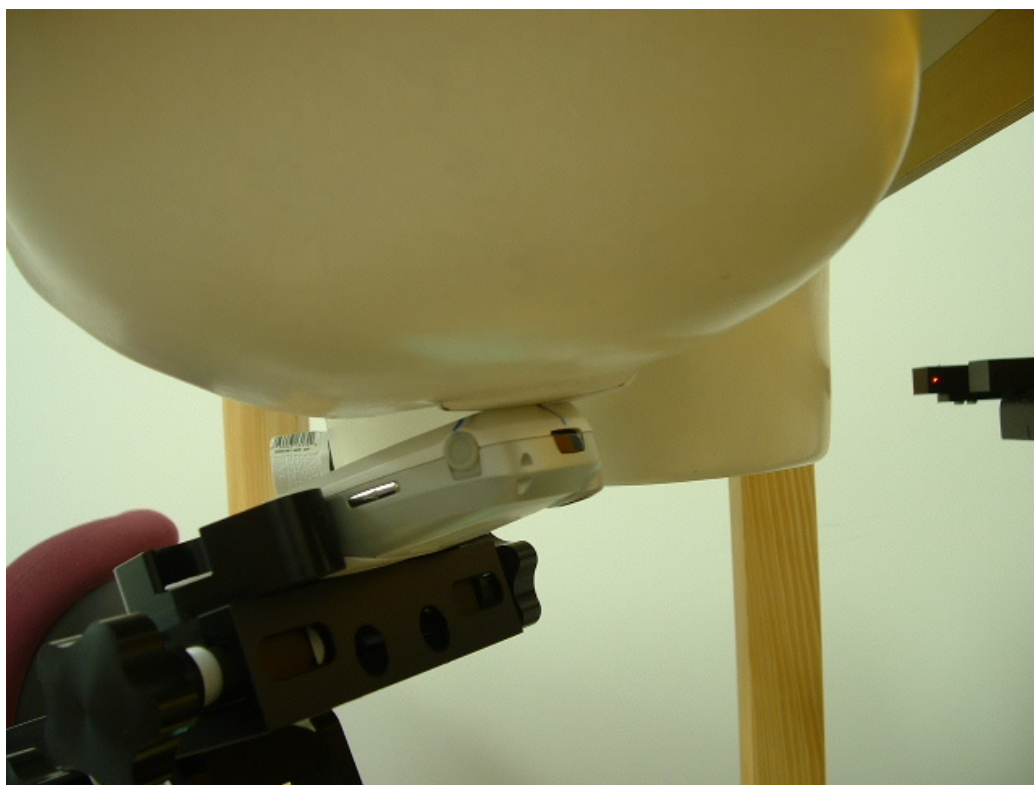
**Figure 9. Phone against the head (Cheek Touch)**



**Figure 10. Phone against the head (Cheek Touch)**



**Figure 11. Phone against the head (15° Tilt)**



**Figure 12. Phone against head (15° Tilt)**