



**MOTOROLA**

**Portable Cellular Phone SAR Test Report**

**Tests Requested By:** MOTOROLA BEIJING  
NO. 1 WANG JING EAST ROAD, CHAO YANG DISTRICT, 100102  
BEIJING, CHINA

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Motorola Mobile Devices Business Product Safety & Compliance Laboratory

**Test Laboratory:** 11th Floor, Hibrand Living Hall,  
215, Yanjae-Dong, Seocho-Gu, Seoul, 137-130,  
South Korea

**Report Author:** Brian Lee  
RF Engineer

This laboratory is accredited to ISO/IEC 17025-2005 to perform the following tests:

**Accreditation:**



TESTING CERT #2518-03

<u>Tests:</u>	<u>Procedures:</u>
Electromagnetic Specific Absorption Rate	IEC 62209-1
	RSS-102
	IEEE 1528 - 2003
	FCC OET Bulletin 65 ( <i>including Supplement C</i> )
	Australian Communications Authority Radio
	Communications (Electromagnetic Radiation – Human
	Exposure) Standard 2003
	CENELEC EN 50360
	ARIB Std. T-56 (2002)

**Statement of Compliance:**

On the following products or types of products:

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

Motorola declares under its sole responsibility that the portable cellular telephone model 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) as well as with CENELEC en50360:2001 and ANSI / IEEE C95.1. It also declares that the product was tested in accordance with IEEE 1528 / CENELEC EN62209-1 (2006), as well as other appropriate measurement standards, guidelines and recommended practices. Any deviations from these standards, guidelines and recommended practices are noted below:

(none)

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**1. Introduction**

The Motorola Mobile Devices Business Product Safety Laboratory has performed measurements of the maximum potential exposure to the user of the portable cellular phone covered by this test report. The Specific Absorption Rate (SAR) of this product was measured. The portable cellular phone was tested in accordance with [1], [4] and [5]. The SAR values measured for the portable cellular phone are below the maximum recommended levels of 1.6 W/kg in a 1g average set in [3] and 2.0W/kg in a 10g average set in [2].

For ANSI / IEEE C95.1 (1g), the final SAR reading for this phone is 0.36 W/kg for head adjacent use and 0.14 W/kg for body worn use. These measurements were performed using a Dasy4™ v4.7 system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich Switzerland.

**2. Description of the Device Under Test**

**2.1 Antenna description**

<b>Type</b>	Internal Antenna	
<b>Location</b>	Bottom of the transceiver	
<b>Dimensions</b>	Length	6.40mm
	Width	33.50mm
<b>Configuration</b>	FJA	

**2.2 Device description**

<b>Serial Number</b>	<b>TLU3110130</b>			
<b>Mode(s) of Operation</b>	GSM 900	GSM 1800	GSM 1900	Bluetooth
<b>Modulation Mode(s)</b>	GMSK	GMSK	GMSK	GFSK
<b>Maximum Output Power Setting</b>	32.50 dBm	29.50 dBm	30.00 dBm	9.0 dBm
<b>Duty Cycle</b>	1:8	1:8	1:8	1:1
<b>Transmitting Frequency Range(s)</b>	880.2 - 914.8 MHz	1710.2 - 1784.8 MHz	1850.2 - 1909.8 MHz	2400.0 - 2483.5 MHz
<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			

<b>Mode(s) of Operation</b>	GPRS 900		GPRS 1800		GPRS 1900	
<b>Modulation</b>	GMSK		GMSK		GMSK	
<b>Maximum Output Power Setting</b>	32.50 dBm	<b>32.50 dBm</b>	29.50 dBm	<b>29.50 dBm</b>	30.00 dBm	<b>30.00 dBm</b>
<b>Duty Cycle</b>	1:8	<b>2:8</b>	1:8	<b>2:8</b>	1:8	<b>2:8</b>
<b>Transmitting Frequency Range(s)</b>	880.2 - 914.8 MHz		1710.2 - 1784.8 MHz		1850.2 - 1909.8 MHz	

<b>Mode(s) of Operation</b>	EDGE 900		EDGE 1800		EDGE 1900	
<b>Modulation</b>	8PSK		8PSK		8PSK	
<b>Maximum Output Power Setting</b>	28.20 dBm	<b>26.20 dBm</b>	27.20 dBm	<b>25.20 dBm</b>	27.20 dBm	<b>25.20 dBm</b>
<b>Duty Cycle</b>	1:8	<b>2:8</b>	1:8	<b>2:8</b>	1:8	<b>2:8</b>
<b>Transmitting Frequency Range(s)</b>	880.2 - 914.8 MHz		1710.2 - 1784.8 MHz		1850.2 - 1909.8 MHz	

Note: Bolded entries indicate data mode of highest time-average power per band and data mode type.

### 3. Test Equipment Used

#### 3.1 Dosimetric System

The Motorola Mobile Devices Business Product Safety & Compliance Laboratory utilizes a Dosimetric Assessment System (Dasy4™ v4.7) manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. All the SAR measurements are taken within a shielded enclosure. The overall 10g RSS uncertainty of the measurement system is ±10.8% (K=1) with an expanded uncertainty of ±21.6% (K=2). The overall 1g RSS uncertainty of the measurement system is ±11.1% (K=1) with an expanded uncertainty of ±22.2% (K=2). The measurement uncertainty budget is given in Appendix 5. Per IEEE 1528, this uncertainty budget is applicable to the SAR range of 0.4W/kg to 10W/kg.

The list of calibrated equipment used for the measurements is shown in the following table.

Description	Serial Number	Cal Due Date
DASY4™ DAE V1	656	19-May-2009
E-Field Probe ES3DV3	3178	14-Jul-2009
S.A.M. Phantom used for 1800/1900/2450MHz	TP-1134	
Dipole Validation Kit, DV1800V2	277tr	22-Apr-2009
Dipole Validation Kit, DV2450V2	767	22-Apr-2009

#### 3.2 Additional Equipment

Description	Serial Number	Cal Due Date
Signal Generator HP8648C	3847A04840	28-Jan-2009
Power Meter E4419B	GB39511085	28-Jan-2009
Power Sensor #1 - 8481A	MY41095450	28-Jan-2009
Power Sensor #2 - 8481A	2702A82671	28-Jan-2009
Network Analyzer HP8753ES	US39172714	30-Jul-2009
Dielectric Probe Kit HP85070C	US99360207	

**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 a HP85070 Dielectric Probe Kit. These values, along with the temperature of the simulated tissue are shown in the table below. The recommended limits for permittivity and conductivity are also shown. A mass density of  $\rho=1\text{g/cm}^3$  was entered into the system in all the cases. It can be seen that the measured parameters are within tolerance of the recommended limits specified in [1] and [5].

f (MHz)	Tissue type	Limits / Measured	Dielectric Parameters		
			$\epsilon_r$	$\sigma$ (S/m)	Temp (°C)
1880	Head	Measured, 09-Dec-2008	40.1	1.46	21.2
		Recommended Limits	40.0 ±5%	1.40 ±5%	18-25
	Body	Measured, 09-Dec-2008	52.9	1.59	21.0
		Recommended Limits	53.3 ±5%	1.52 ±5%	18-25
2450	Body	Measured, 11-Dec-2008	49.3	2.04	21.6
		Recommended Limits	52.7 ±10%	1.95 ±5%	18-25

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

Ingredient	835MHz / 900 MHz	835MHz / 900 MHz	1800MHz / 1900 MHz	1800 MHz / 1900 MHz	2450MHz	2450 MHz
	Head	Body	Head	Body	Head	Body
Sugar	57	44.9	--	--	--	--
DGBE	--	--	47	30.8	--	30
Diacetin	--	--	--	--	51	--
Water	40.45	53.06	52.62	68.8	48.75	70
Salt	1.45	0.94	0.38	0.4	0.15	--
HEC	1	1	--	--	--	--
Bact.	0.1	0.1	--	--	0.1	--

**5. System Accuracy Verification**

A system accuracy verification of the DASY4™ was performed using the measurement equipment listed in Section 3.1. The daily system accuracy verification occurs within the flat section of the SAM phantom.

A SAR measurement was performed to verify the measured SAR was within ±10% from the target SAR indicated in Appendix 6. These frequencies are within ±10% of the compliance test mid-band frequency as required in [1] and [5]. The test was conducted on the same days as the measurement of the DUT. Recommended limits for permittivity and conductivity, specified in [5], are shown in the table below. The obtained results from the system accuracy verification are also displayed in the table below. SAR values are normalized to 1W forward power delivered to the dipole. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values. 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.

f (MHz)	Description	SAR (W/kg), 1gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			$\epsilon_r$	$\sigma$ (S/m)		
1800	Measured, 09-Dec-2008	38.53	40.4	1.37	21.6	21.2
	Recommended Limits	37.7	40.0 ±5%	1.4 ±5%	18-25	18-25
2450	Measured, 11-Dec-2008	52.50	36.4	1.89	21.0	22.2
	Recommended Limits	56.5	39.2 ±10%	1.80 ±5%	18-25	18-25

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 ES3DV3	SN3178	1810	4.82	8 of 9
		2450	4.29	8 of 9

## 6. Test Results

The test sample was operated using an actual transmission through a base station simulator. The base station simulator was setup to the proper channel, transmitter power level and transmit mode of operation. The phone was tested in the configurations stipulated in [1], [4] and [5]. The phone was positioned into these configurations using the device holder supplied with the DASY4™ SAR measurement system. The measured dielectric constant of the material used for the device holder 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 used for measurements. The grid spacing of the course scan was set to 15 mm as shown in the SAR plots included in Appendix 2 and 3. Please refer to the DASY4™ manual for additional information on SAR scanning procedures and algorithms used.

The Cellular Phone model covered by this report has the following battery options:

SNN5819B - 1140 mAH Battery

SNN5813A - 910 mAH Battery

SNN5804B - 910 mAH Battery

The battery with the highest capacity is the SNN5819B. This battery was used to do most of the SAR testing. The phone was placed in the SAR measurement system with a fully charged battery. The configuration that resulted in the highest SAR values were tested using the other batteries listed above.

### 6.1 Head Adjacent Test Results

The SAR results shown in tables 1 through 8 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to the [6]. Also shown are the measured conducted output power levels, the temperature of the simulated tissue 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 DASY4™ 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 left head and right head SAR contour distributions are similar. Because of this similarity, the cheek/touch and 15° tilt test conditions with the highest SAR values in each band are indicated as bold numbers in the following tables and are included in Appendix 2. All other test conditions measured lower SAR values than those included in Appendix 2.

The SAR measurements were performed using the SAM phantoms listed in section 3.1. Since the same phantoms and simulated tissue were used for the system accuracy verification and the device SAR measurements, the Z-axis scans included in Appendix 1 are applicable for verification of simulated tissue depth to be 15.0cm  $\pm$ 0.5cm.

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 ES3DV3	SN3178	1810	4.82	8 of 9

Left Head Cheek Position								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz	Channel 512	30.01						
	Channel 661	30.09	21.5	0.08	0.156	0.16	0.244	0.24
	Channel 810	29.85						

Table 1: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.

Right Head Cheek Position								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz	Channel 512	30.01						
	Channel 661	30.09	21.2	-0.01	0.218	0.22	0.357	0.36
	Channel 810	29.85						

Table 2: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.

Highest Head Cheek Position with SNN5813A Battery								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz <i>Right</i>	Channel 512	30.01						
	Channel 661	30.09	22.2	0.06	0.177	0.18	0.283	0.28
	Channel 810	29.85						

Table 3: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.

Highest Head Cheek Position with SNN5804B Battery								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz <i>Right</i>	Channel 512	30.01						
	Channel 661	30.09	22.0	-0.01	0.187	0.19	0.301	0.30
	Channel 810	29.85						

Table 4: SAR measurement results at the highest possible output power, measured in a head cheek position against the ICNIRP and ANSI SAR Limit.

Left Head 15° Tilt Position								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10g SAR value		1g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz	Channel 512	30.01						
	Channel 661	30.09	21.3	0.01	0.0313	0.03	0.0474	0.05
	Channel 810	29.85						

Table 5: SAR measurement results at the highest possible output power, measured in a head 15° Tilt position against the ICNIRP and ANSI SAR Limit.

Right Head 15° Tilt Position								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10g SAR value		1g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz	Channel 512	30.01						
	Channel 661	30.09	21.1	0.04	0.0288	0.03	0.0444	0.04
	Channel 810	29.85						

Table 6: SAR measurement results at the highest possible output power, measured in a head 15° Tilt position against the ICNIRP and ANSI SAR Limit.

Highest Head 15° Tilt Position with SNN5813A Battery								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10g SAR value		1g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz <i>Left</i>	Channel 512	30.01						
	Channel 661	30.09	21.8	0.01	0.0288	0.03	0.0441	0.04
	Channel 810	29.85						

Table 7: SAR measurement results at the highest possible output power, measured in a head 15° Tilt position against the ICNIRP and ANSI SAR Limit.

Highest Head 15° Tilt Position with SNN5804B Battery								
f (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	10g SAR value		1g SAR value	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz <i>Left</i>	Channel 512	30.01						
	Channel 661	30.09	21.6	0.02	0.0294	0.03	0.0453	0.05
	Channel 810	29.85						

Table 8: SAR measurement results at the highest possible output power, measured in a head 15° Tilt position against the ICNIRP and ANSI SAR Limit.

## 6.2 Body Worn Test Results

The SAR results shown in tables 9 through 16 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to the [6]. Also shown are the measured conducted output power levels, 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 DASY4™ 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 that produced the highest SAR values in each band are indicated as bold numbers in the following tables and are included in Appendix 3. 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 no Body-Worn Accessories available for this phone at the time of testing hence the device was tested per the supplement C testing guidelines for devices that do not have body worn accessories. A separation distance of 15mm between the device and the flat phantom was used for testing body-worn SAR. The device was tested with the front and back of the device facing the phantom.

In addition to accessory testing, the cellular phone was tested in data mode operations with the front and back of the phone facing the phantom. For these tests, a separation distance of 25mm between the device and the flat phantom was used. The device was tested with the front and back of the device facing the phantom.

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 ES3DV3	SN3178	1810	4.50	8 of 9
		2450	3.90	8 of 9

Body-Worn; Front of Phone 15mm from Phantom								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz	Channel 512	30.01						
	Channel 661	30.09	21.0	-0.02	0.0653	0.07	0.108	0.11
	Channel 810	29.85						

**Table 9: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.**

Body-Worn; Back of Phone 15mm from Phantom								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz	Channel 512	30.01						
	Channel 661	30.09	21.0	0.04	0.0852	0.09	0.142	0.14
	Channel 810	29.85						

**Table 10: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.**

Body-Worn; Highest (Front or Back) position 25mm away from flat phantom with GPRS Class 10 mode								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz <i>Back</i>	Channel 512	29.93						
	Channel 661	29.99	21.1	0.07	0.0645	0.06	0.103	0.10
	Channel 810	29.88						

**Table 11: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.**

Body-Worn; Highest (Front or Back) position 25mm away from flat phantom with EDGE Class 10 mode								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
1900MHz <i>Back</i>	Channel 512	25.53						
	Channel 661	25.19	21.6	-0.21	0.0291	0.03	0.045	0.05
	Channel 810	25.46						

**Table 12: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.**

Highest Body-Worn with SNN5813A Battery								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
<b>1900MHz</b> <i>Back 15mm</i>	Channel 512	30.01						
	Channel 661	30.09	20.7	0.02	0.0807	0.08	0.134	0.13
	Channel 810	29.85						

Table 13: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

Highest Body-Worn with SNN5804B Battery								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
<b>1900MHz</b> <i>Back 15mm</i>	Channel 512	30.01						
	Channel 661	30.09	20.9	0.03	0.0794	0.08	0.132	0.13
	Channel 810	29.85						

Table 14: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

Bluetooth Stand-alone : Highest Body-Worn Position on each band								
<i>f</i> (MHz)	Description	Conducted Output Power (dBm)	Temp (°C)	Drift (dB)	<i>10g SAR value</i>		<i>1g SAR value</i>	
					Measured (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Extrapolated (W/kg)
<b>2450MHz</b> <i>Back 15mm</i> <i>SNN5819B</i>	Channel 0							
	Channel 39		21.8	999	0.0000286	0.00	0.000248	0.00
	Channel 78							

Table 15: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

Highest Extrapolated Body-Worn SAR values summation with Bluetooth Stand-alone							
<i>f</i> (MHz)	Description	<i>10g SAR value</i>			<i>1g SAR value</i>		
		Measured (W/kg)	Bluetooth Measurement (W/Kg)	Extrapolated (W/kg)	Measured (W/kg)	Bluetooth Measurement (W/Kg)	Extrapolated (W/kg)
<b>1900MHz</b>	Body-Worn: <b>Back</b> of phone 15mm away from phantom with SNN5819B	0.09	0.00	0.09	0.14	0.00	0.14

Table 16: SAR measurement results at the highest possible output power, calculated in a body-worn position against the ICNIRP and ANSI SAR Limit.

## References

- [1] CENELEC, en62209-1:2006 “Human Exposure to Radio Frequency Fields From Hand - Held and Body - Mounted Wireless Communication Devices – Human Models, Instrumentation, and Procedures”
- [2] CENELEC, en50360:2001 “Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300MHz – 3GHz)”.
- [3] ANSI / IEEE, C95.1 1999 Edition “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz”
- [4] FCC OET Bulletin 65 Supplement C 01-01
- [5] IEEE 1528 2003 Edition “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”
- [6] ICNIRP Guidelines “Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)”

## **Appendix 1**

### **SAR distribution comparison for the system accuracy verification**

## Test Laboratory: Motorola 1209'2008\_1800MHz\_Good +2.2%

Procedure Notes: 1800 MHz System Performance Check / Dipole Sn# 277tr PM1 Power = 200 mW

Sim.Temp@meas = 21.4C Sim.Temp@SPC = 21.2C Room Temp @ SPC = 21.6C

Communication System: CW - Dipole; Frequency: 1800 MHz; Channel Number: 8; Duty Cycle: 1:1

Medium: VALIDATION Only; Medium parameters used:  $f = 1800$  MHz;  $\sigma = 1.37$  mho/m;  $\epsilon_r = 40.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3178; ConvF(4.82, 4.82, 4.82); Calibrated: 7/14/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn656; Calibrated: 5/19/2008
- Phantom: PCS-9\_Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**Daily SPC Check/Dipole Area Scan (4x9x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 7.99 mW/g

**Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 77.6 V/m; Power Drift = 0.165 dB

Peak SAR (extrapolated) = 14.4 W/kg

**SAR(1 g) = 7.91 mW/g; SAR(10 g) = 4.19 mW/g**

Maximum value of SAR (measured) = 8.70 mW/g

**Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:**

Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 77.6 V/m; Power Drift = 0.165 dB

Peak SAR (extrapolated) = 13.7 W/kg

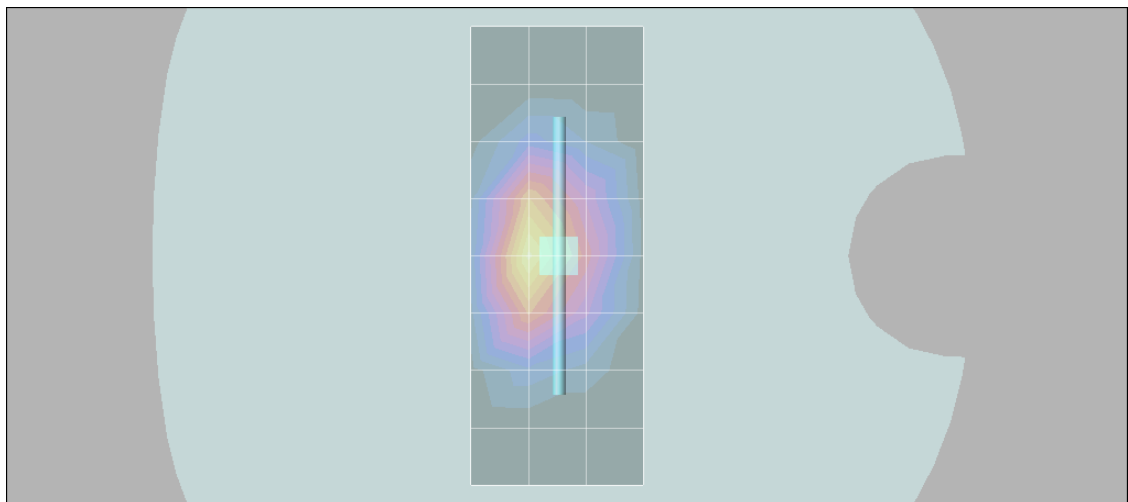
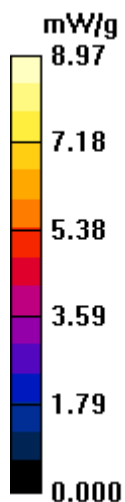
**SAR(1 g) = 7.5 mW/g; SAR(10 g) = 3.96 mW/g**

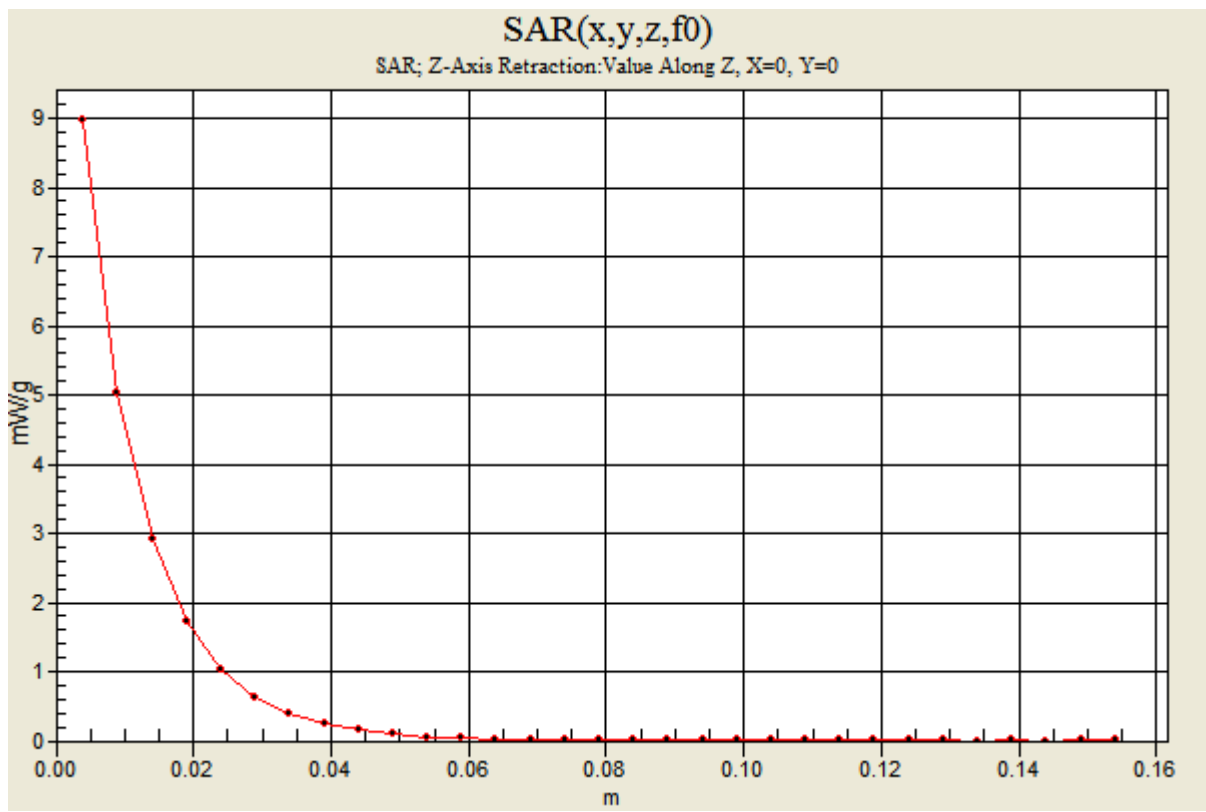
Maximum value of SAR (measured) = 8.42 mW/g

**Daily SPC Check/Z-Axis Retraction (1x1x31):**

Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 8.97 mW/g





## Test Laboratory: Motorola 1211'2008\_2450MHz\_Good -7.1%

Procedure Notes: 2450 MHz System Performance Check / Dipole Sn# 767 PM1 Power = 200 mW

Sim.Temp@meas = 22.5C Sim.Temp@SPC = 22.2C Room Temp @ SPC = 21C

Communication System: CW - Dipole; Frequency: 2450 MHz; Channel Number: 11; Duty Cycle: 1:1

Medium: VALIDATION Only; Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.89$  mho/m;  $\epsilon_r = 36.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3178; ConvF(4.29, 4.29, 4.29); Calibrated: 7/14/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn656; Calibrated: 5/19/2008
- Phantom: PCS-9\_Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**Daily SPC Check/Dipole Area Scan (4x9x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 11.0 mW/g

**Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 76.5 V/m; Power Drift = 0.073 dB

Peak SAR (extrapolated) = 23.8 W/kg

**SAR(1 g) = 10.8 mW/g; SAR(10 g) = 4.9 mW/g**

Maximum value of SAR (measured) = 12.2 mW/g

**Daily SPC Check/90-Degree 5x5x7 Cube (5x5x7)/Cube 0:**

Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 76.5 V/m; Power Drift = 0.073 dB

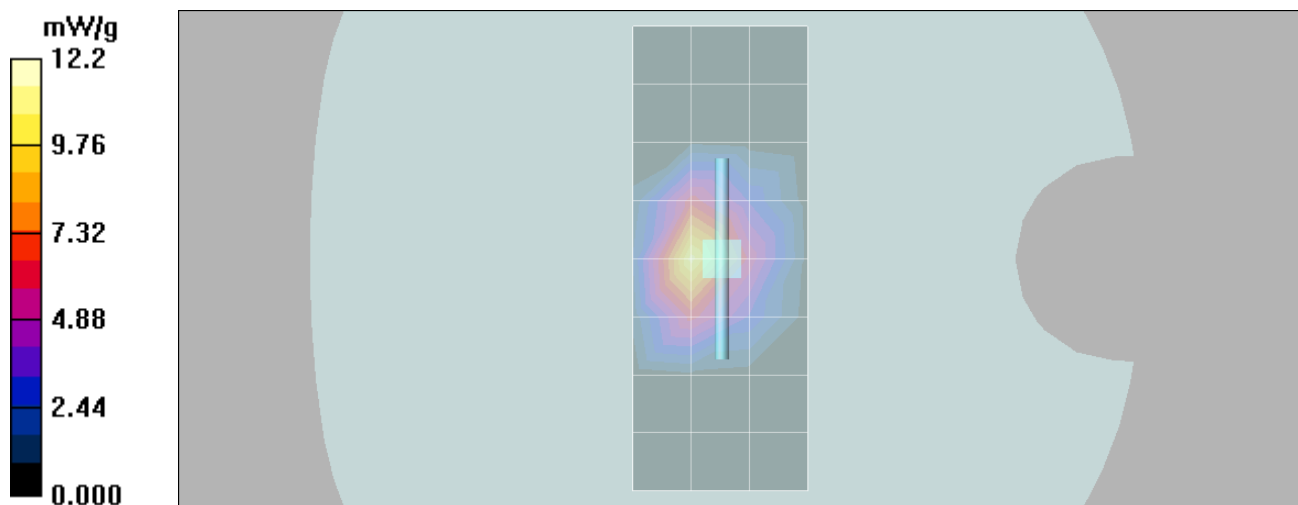
Peak SAR (extrapolated) = 22.7 W/kg

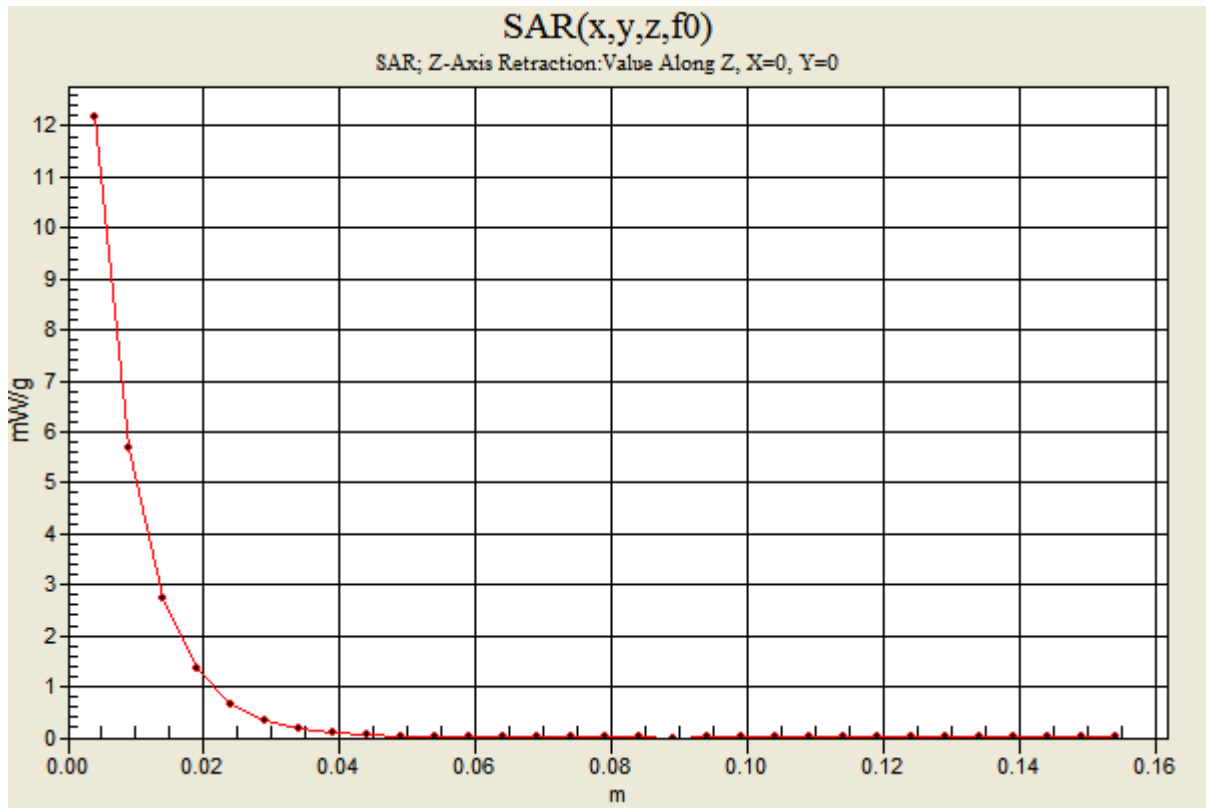
**SAR(1 g) = 10.2 mW/g; SAR(10 g) = 4.63 mW/g**

Maximum value of SAR (measured) = 11.1 mW/g

**Daily SPC Check/Z-Axis Retraction (1x1x31):**

Measurement grid: dx=20mm, dy=20mm, dz=5mm





## **Appendix 2**

### **SAR distribution plots for Phantom Head Adjacent Use**

## Test Laboratory: Motorola GSM1900 Cheek

### TLU3110130 ;

Procedure Notes: Pwr Step: 00(OTA) Antenna Position: Internal

Battery Model #: SNN5819B DEVICE POSITION (cheek or rotated): Cheek

Communication System: GSM 1900; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:8

Medium: Regular Glycol Head 1750/1880; Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.46$  mho/m;  $\epsilon_r = 40.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

### DASY4 Configuration:

- Probe: ES3DV3 - SN3178; ConvF(4.82, 4.82, 4.82); Calibrated: 7/14/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn656; Calibrated: 5/19/2008
- Phantom: PCS-9\_Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

### Right Head Template/Area Scan - Normal (15mm) (7x17x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.352 mW/g

### Right Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:

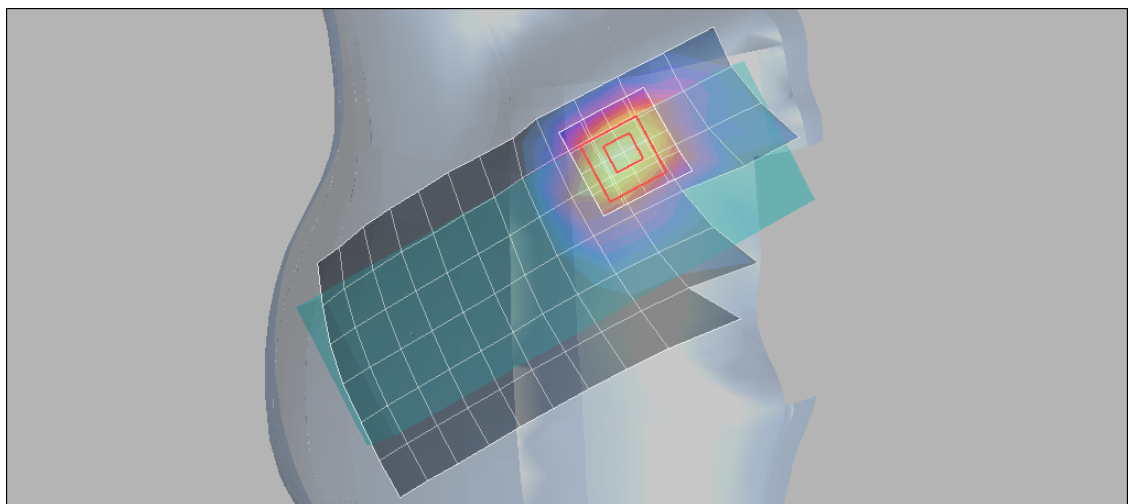
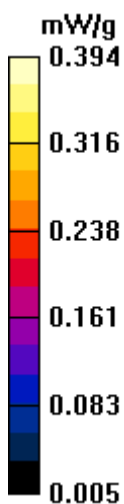
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.4 V/m; Power Drift = -0.007 dB

Peak SAR (extrapolated) = 0.564 W/kg

**SAR(1 g) = 0.357 mW/g; SAR(10 g) = 0.218 mW/g**

Maximum value of SAR (measured) = 0.394 mW/g



## Test Laboratory: Motorola GSM1900 Tilted

### TLU3110130 ;

Procedure Notes: Pwr Step: 00(OTA) Antenna Position: Internal

Battery Model #: SNN5819B; DEVICE POSITION (check or rotated): Rotated

Communication System: GSM 1900; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:8

Medium: Regular Glycol Head 1750/1880; Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.46$  mho/m;  $\epsilon_r = 40.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

### DASY4 Configuration:

- Probe: ES3DV3 - SN3178; ConvF(4.82, 4.82, 4.82); Calibrated: 7/14/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn656; Calibrated: 5/19/2008
- Phantom: PCS-9\_Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1134;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

### Left Head Template/Area Scan - Normal (15mm) (7x17x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.048 mW/g

### Left Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:

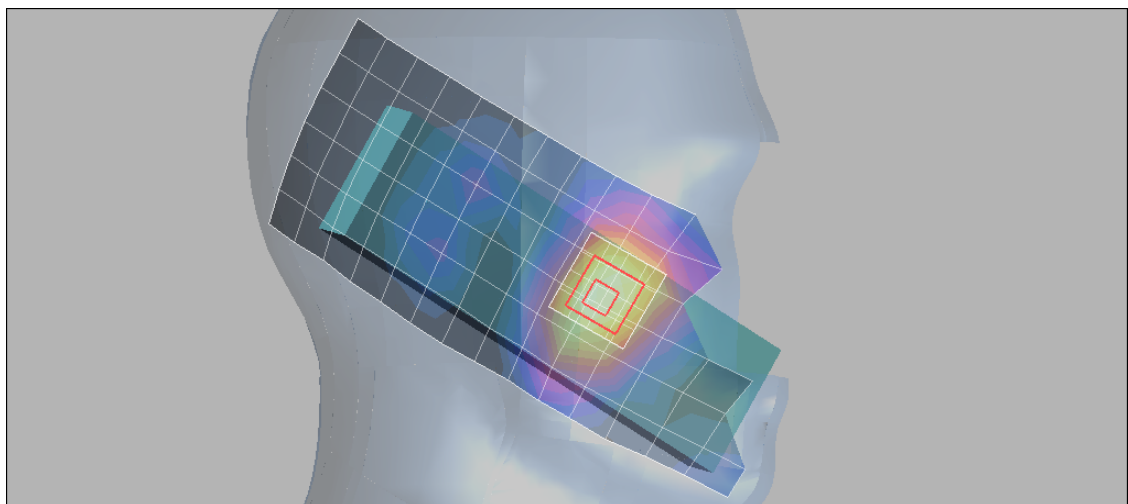
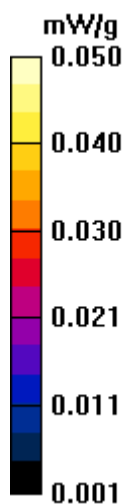
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.71 V/m; Power Drift = 0.011 dB

Peak SAR (extrapolated) = 0.069 W/kg

**SAR(1 g) = 0.047 mW/g; SAR(10 g) = 0.031 mW/g**

Maximum value of SAR (measured) = 0.050 mW/g



## **Appendix 3**

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

## Test Laboratory: Motorola GSM1900 BodyWorn

### TLU3110130 ;

Procedure Notes: Pwr Step: 00(OTA) Antenna Position: internal

Battery Model #: SNN5819B; Device Position: Back of phone 15mm away from the flat phantom

Communication System: GSM 1900; Frequency: 1880 MHz; Channel Number: 661; Duty Cycle: 1:8

Medium: Regular Glycol Body 1750/1880; Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.59$  mho/m;  $\epsilon_r = 52.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

### DASY4 Configuration:

- Probe: ES3DV3 - SN3178; ConvF(4.5, 4.5, 4.5); Calibrated: 7/14/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn656; Calibrated: 5/19/2008
- Phantom: R#9 \_ Section 2, Amy Twin, Rev2 (23-June-04); Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

### Amy Twin Phone Template/Area Scan - Normal Body (15mm) (13x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.144 mW/g

### Amy Twin Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:

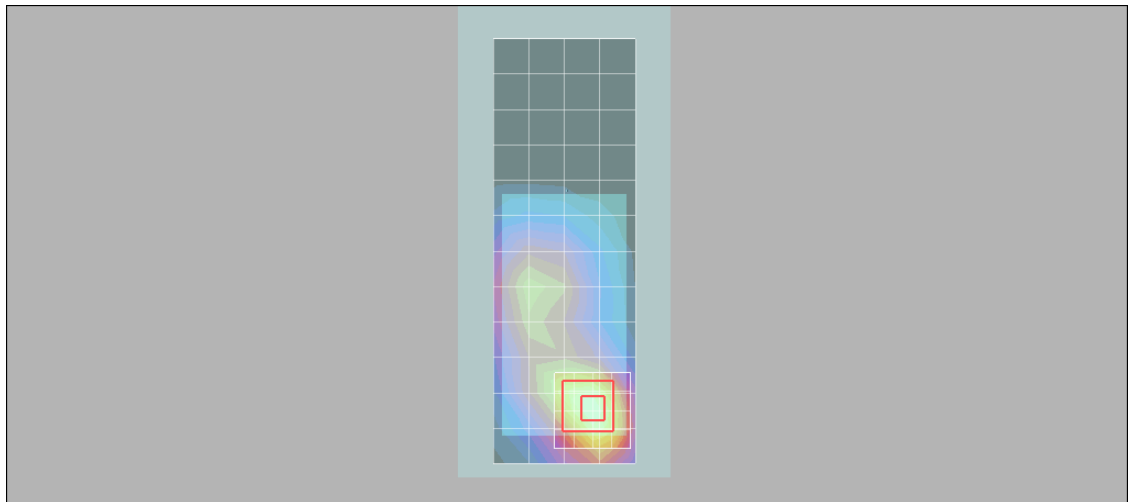
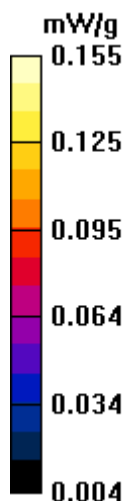
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.07 V/m; Power Drift = 0.042 dB

Peak SAR (extrapolated) = 0.229 W/kg

**SAR(1 g) = 0.142 mW/g; SAR(10 g) = 0.085 mW/g**

Maximum value of SAR (measured) = 0.155 mW/g



## Test Laboratory: Motorola Bluetooth2450 BodyWorn

### TLU3110130 ;

Procedure Notes: Pwr Step: BT Antenna Position: internal

Battery Model #: SNN5819B; Device Position: Back of phone 15mm away from the flat phantom

Communication System: Bluetooth; Frequency: 2441 MHz; Channel Number: 39; Duty Cycle: 1:1

Medium: 2450 Glycol Body; Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.04$  mho/m;  $\epsilon_r = 49.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

DASY4 Configuration:

- Probe: ES3DV3 - SN3178; ConvF(3.9, 3.9, 3.9); Calibrated: 7/14/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn656; Calibrated: 5/19/2008
- Phantom: R#9\_ Section 2, Amy Twin, Rev2 (23-June-04); Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

### Amy Twin Phone Template/Area Scan - Normal Body (15mm) (13x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.006 mW/g

### Amy Twin Phone Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0:

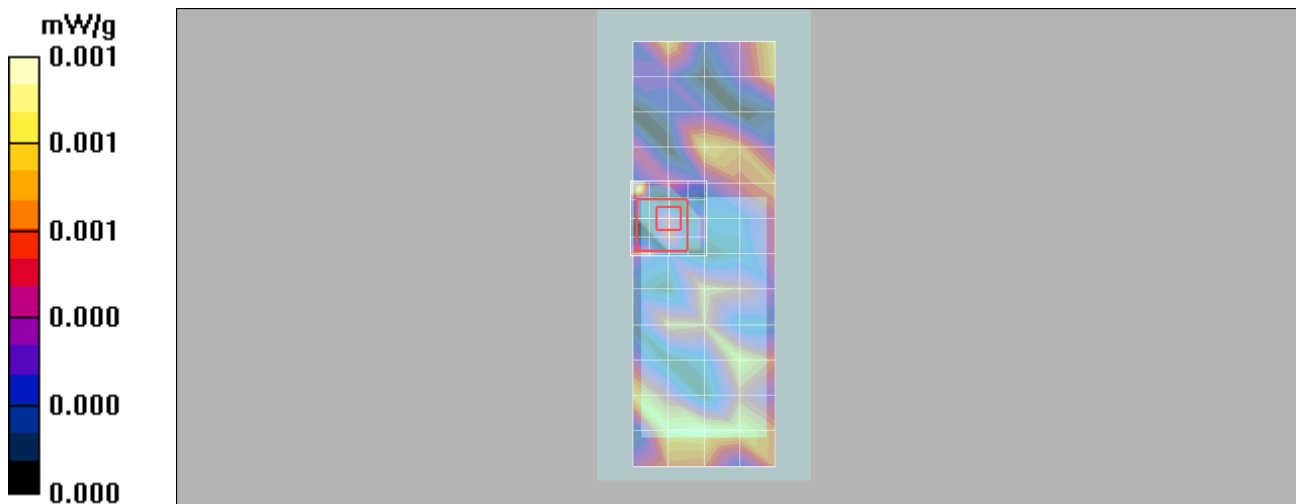
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 0.000 V/m; Power Drift = 999.0 dB

Peak SAR (extrapolated) = 0.034 W/kg

**SAR(1 g) = 0.000248 mW/g; SAR(10 g) = 2.86e-005 mW/g**

Maximum value of SAR (measured) = 0.034 mW/g



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



Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Motorola Korea**

Certificate No: **ES3-3178\_Jul08**

**CALIBRATION CERTIFICATE**

Object **ES3DV3-SN:3178**

Calibration procedure(s) **QA CAL-01.v6 and QA CAL-23.v3  
Calibration procedure for dosimetric E-field probes**

Calibration date: **July 14, 2008**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ES3DV2	SN: 3013	2-Jan-08 (No. ES3-3013_Jan08)	Jan-09
DAE4	SN: 660	3-Sep-07 (No. DAE4-660_Sep07)	Sep-08
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: July 14, 2008

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

### Glossary:

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* frequency\_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

# Probe ES3DV3

## SN:3178

Manufactured:	January 23, 2008
Calibrated:	July 14, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

**DASY - Parameters of Probe: ES3DV3 SN:3178****Sensitivity in Free Space<sup>A</sup>****Diode Compression<sup>B</sup>**

NormX	1.30 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	91 mV
NormY	1.21 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	87 mV
NormZ	1.33 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	94 mV

**Sensitivity in Tissue Simulating Liquid (Conversion Factors)**

Please see Page 8.

**Boundary Effect**

**TSL**                      **900 MHz**      **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		<b>3.0 mm</b>	<b>4.0 mm</b>
SAR <sub>be</sub> [%]	Without Correction Algorithm	9.7	5.9
SAR <sub>be</sub> [%]	With Correction Algorithm	0.6	0.5

**TSL**                      **1810 MHz**      **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		<b>3.0 mm</b>	<b>4.0 mm</b>
SAR <sub>be</sub> [%]	Without Correction Algorithm	8.1	4.6
SAR <sub>be</sub> [%]	With Correction Algorithm	0.4	0.3

**Sensor Offset**

Probe Tip to Sensor Center                      **2.0 mm**

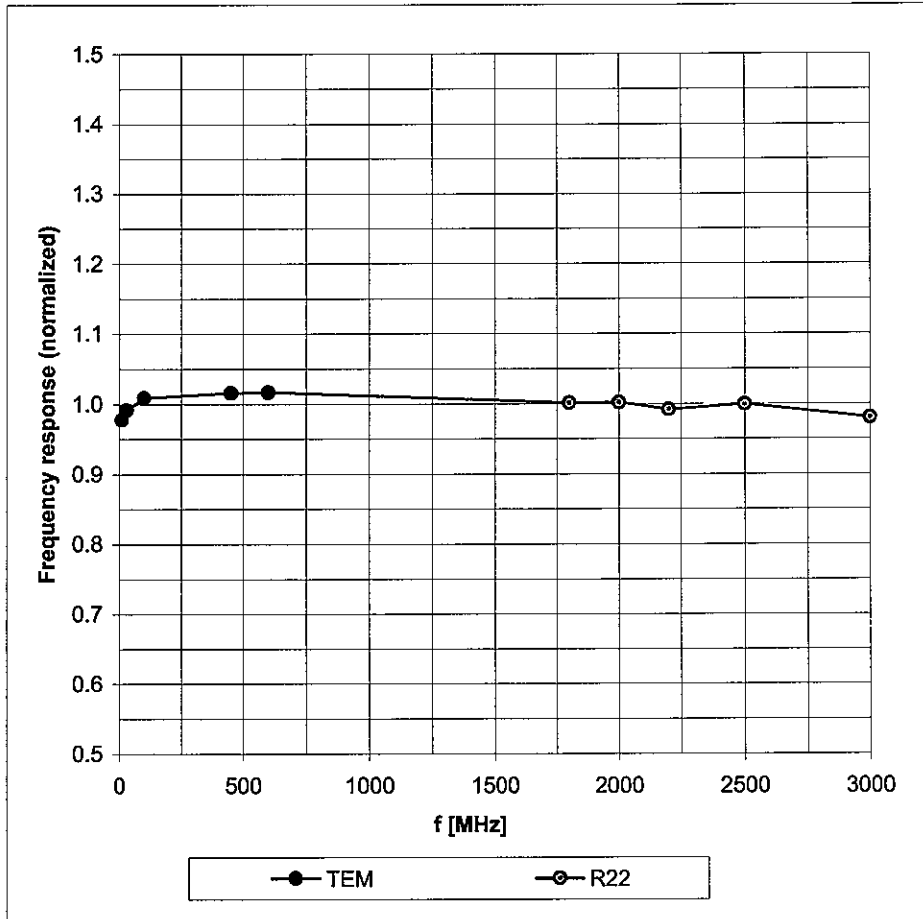
**The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.**

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 8).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

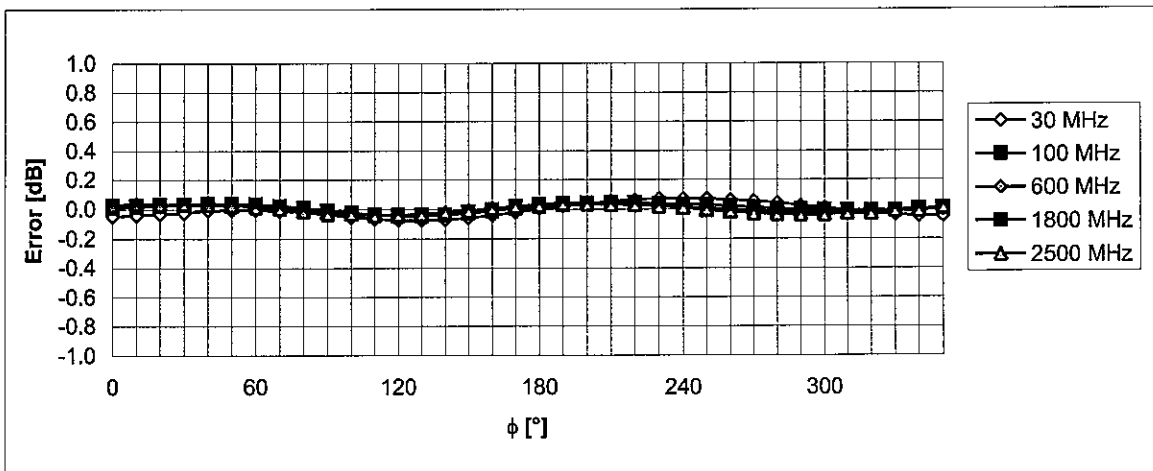
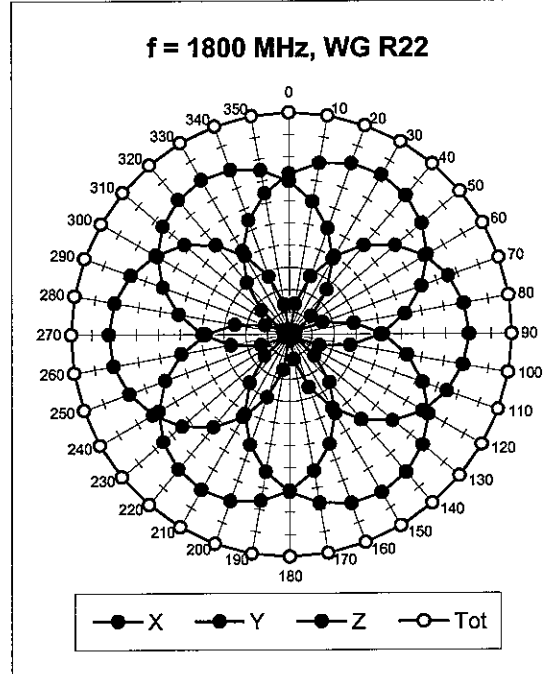
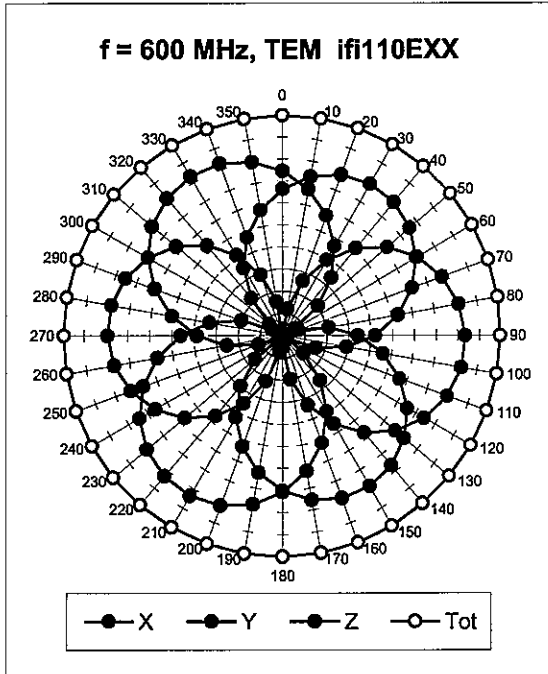
# Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)



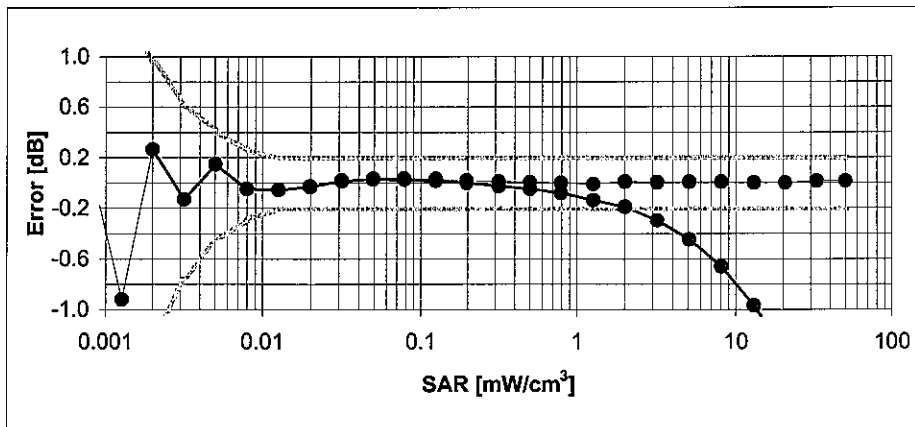
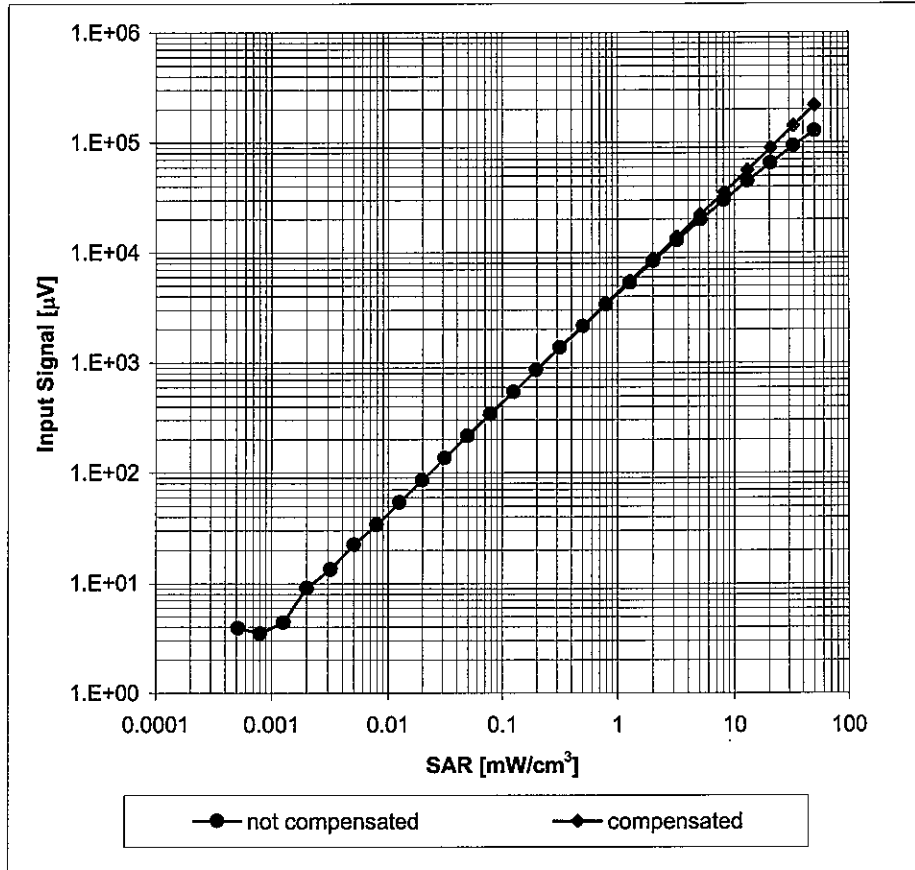
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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



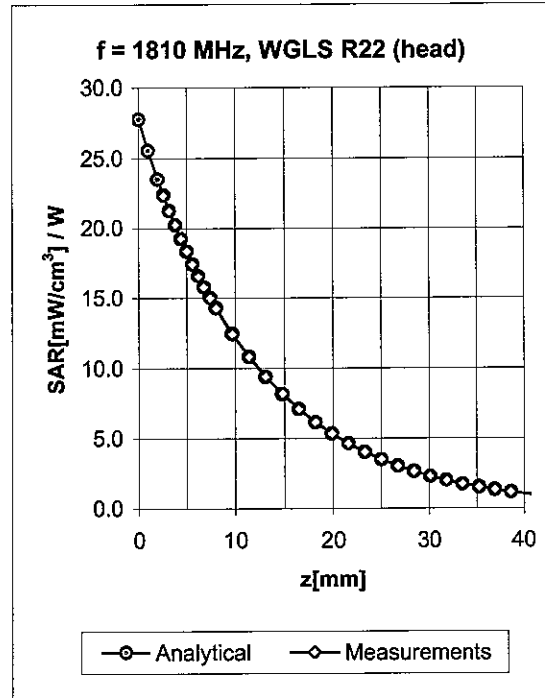
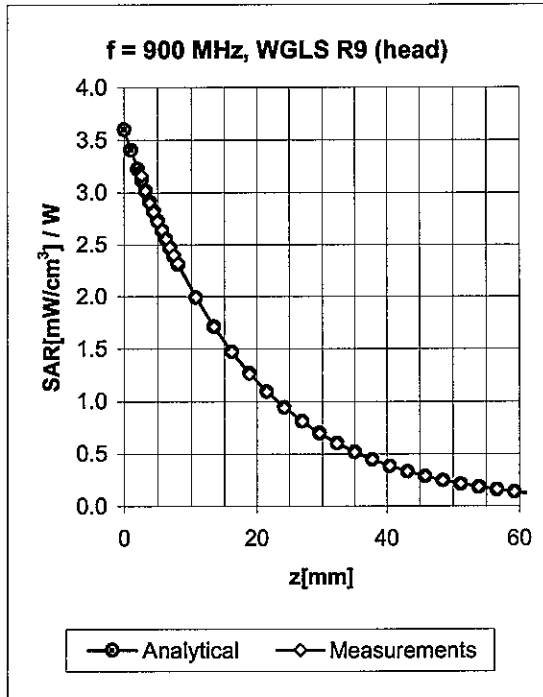
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

### Dynamic Range f(SAR<sub>head</sub>) (Waveguide R22, f = 1800 MHz)



Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

### Conversion Factor Assessment

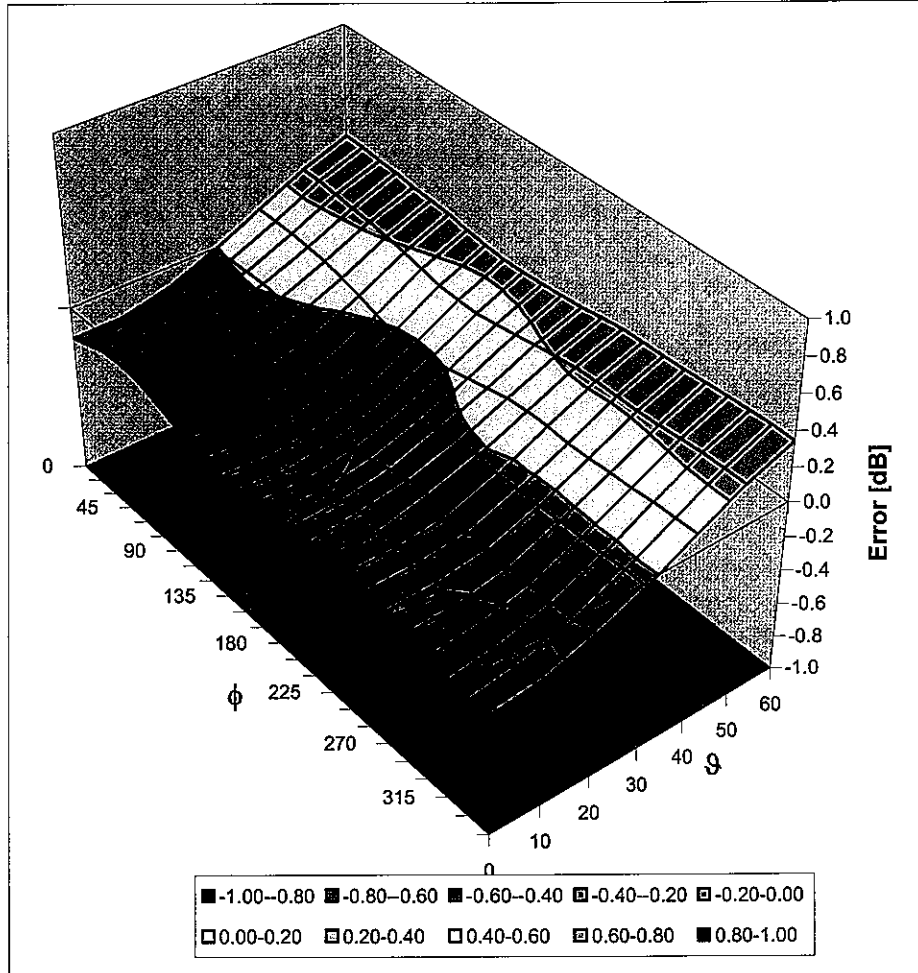


f [MHz]	Validity [MHz] <sup>c</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.30	1.91	5.63 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.58	1.33	4.82 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.45	1.50	4.63 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.70	1.25	4.29 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.52	1.41	5.64 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.36	1.82	4.50 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.51	1.48	4.47 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.70	1.25	3.90 ± 11.0% (k=2)

<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

### Deviation from Isotropy in HSL

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



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

**Appendix 5**  
**Measurement Uncertainty Budget**

MOTOROLA, INC. Portable Cellular Phone SAR Test Report Number: **22643-1F**

<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	IEEE 1528 section	Tol. (± %)	Prob  Dist	Div.	<i>c<sub>i</sub></i>	<i>c<sub>i</sub></i> (10 g)	1 g	10 g	<i>v<sub>i</sub></i>
					(1 g)	(10 g)	<i>u<sub>i</sub></i> (±%)	<i>u<sub>i</sub></i> (±%)	
<b>Measurement System</b>									
Probe Calibration	E.2.1	5.9	N	1.00	1	1	5.9	5.9	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
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	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
<b>Test sample Related</b>									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
<b>Combined Standard Uncertainty</b>			RSS				11.1	10.8	411
<b>Expanded Uncertainty (95% CONFIDENCE LEVEL)</b>			<i>k=2</i>				22.2	21.6	

## **Appendix 6**

### **Dipole Characterization Certificate**

# Certification of System Performance Check Targets

Based on WI-0396

-Historical Data-

1800MHz	
Reference Target:	38.4 (W/kg)
Measurement Uncertainty (k=1):	9.0%
Measurement Period:	18-April-07 to 14-April-08
# of tests performed:	1,028
Grand Average:	37.7 (W/kg)
% Delta (Average - Reference Target)	-1.7%
Is % Delta <= Expanded Measurement Uncertainty (k=2)?	Yes
Accept/Reject <u>Average</u> as new system performance check target?	ACCEPT
<u>Applies to Dipole SN's:</u> 246tr, 250tr, 251tr, 259tr, 263tr, 271tr, 272tr, 276tr, 277tr, 279tr, 280tr, 281tr, 283tr, 284tr, 2d128, 2d129	

-New System Performance Check Targets- per WI-0396

(based on analysis of historical data)

Frequency	SAR Target (W/kg)	Permittivity	Conductivity (S/m)
1800MHz	37.7	40.0 ± 5%	1.40 ± 5%

-Approvals-

Submitted by:  Date:

Signed: 

Comments:

Approved by:  Date:

Signed: 

Comments:

# Certification of System Performance Check Targets

Based on WI-0396

-Historical Data-

2450MHz	
Reference Target:	52.4 (W/kg)
Measurement Uncertainty (k=1):	9.0%
Measurement Period:	18-April-07 to 14-April-08
# of tests performed:	77
Grand Average:	56.5 (W/kg)
% Delta (Average - IEEE1528 Target)	7.8%
Is % Delta <= Expanded Measurement Uncertainty (k=2)?	Yes
Accept/Reject <u>Average</u> as new system performance check target?	ACCEPT
<u>Applies to Dipole SN's:</u> 740, 766, 767, 788, 789	

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

Frequency	SAR Target (W/kg)	Permittivity	Conductivity (S/m)
2450MHz	56.5	39.2 ± 5%	1.80 ± 5%

-Approvals-

Submitted by:  Date:

Signed: 

Comments:

Approved by:  Date:

Signed: 

Comments:

MOTOROLA, INC. Portable Cellular Phone SAR Test Report Number: **22643-1F**

**END OF REPORT**