MOTOROLA

Portable Cellular Phone SAR Test Report

Tests Requested By:	Motorola Mobility, Inc. 600 N. US Highway 45 Libertyville, IL 60048
Test Report #:	24926-1F
Date of Report:	Mar-31-2012
Date of Test:	Mar-01-2012 to Mar-09-2012, May-08-2012 to May-15-2012
FCC ID #:	IHDT56NH1
Generic Name:	M0C7D
Test Laboratory:	Motorola Mobility, Inc. - ADR Test Services Laboratory No.1 Wang Jing East Road, Chaoyang District Beijing, P. R. China, 100102
Report Author:	HaiLiang Tang RF Engineer

Accreditation:

2404

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

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

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

Statement of Compliance:

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:

Motorola's ISO 17025 accreditation scope does not currently include SAR testing in the 5 GHz band. Therefore, SAR testing performed in this band was performed outside of our ISO 17025 accreditation. The general procedures and guidelines provided within; FCC KDB 248227 D01, FCC KDB 648474 D01, FCC KDB 865664 D01 and IEC 62209-2 were utilized for testing.

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Revision History

Revision Version	Date	Notes
Rev. 0	31-Mar-2012	Initial report release
Rev. A	16-May-2012	SAR value changes on WiFi band

1. Introduction

The Motorola Mobility ADR Test Services 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 1 g average set in [3] and 2.0 W/kg in a 10 g average set in [2].

For ANSI / IEEE C95.1 (1 g), the final stand-alone SAR readings for this phone are given in the table below. These measurements were performed using a DASY4™ v4.7 or DASY52™ system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich Switzerland.

Transmit Band	Head SAR (1 g $^{W}/_{kg}$)	Body SAR (1 g $^{W}/_{kg}$)
GSM 1900	**0.3**	**0.21**
Wi-Fi 2.45 GHz	**0.83**	**0.03**

2. Description of the Device Under Test

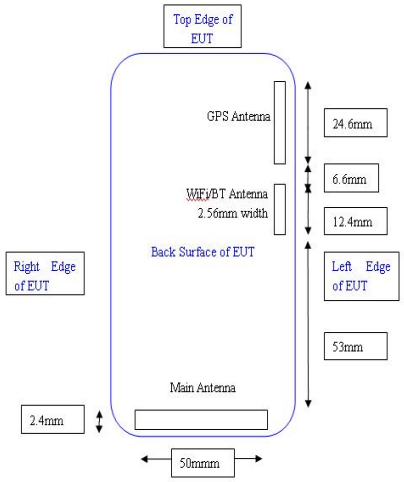
2.1 Antenna description

Main (1900 MHz) Antenna

Type	Internal	
Location	Bottom of Transceiver	
Dimensions	Width	2.40 mm
	Length	50.00 mm

Bluetooth/Wi-Fi 2 GHz Antenna

Type	Internal	
Location	Right-Side Rear of Transceiver	
Dimensions	Width	2.56 mm
	Length	12.40 mm



2.2 Device Signaling[1]

Serial Number(s) (Functional Use)	351915050012594 (GSM/GPRS/EDGE conducted power measurements, GSM/EDGE head/body SAR testing) TA2460028F (Wi-Fi 2.4 GHz SAR testing) 351915050001308 (Wi-Fi 2.4 GHz conducted power measurements)
Production Unit or Identical Prototype (47 CFR §2..908)	Identical Prototype
Device Category	Portable (Mobile Station Class B)
RF Exposure Limits	General Population / Uncontrolled

Mode(s) of Operation	Modulation Mode(s)	Maximum Output Power Setting	Duty Cycle	Transmitting Frequency Range(s)
GSM 1900	GMSK	29.3 dBm	1:8	1850.2 - 1909.8 MHz
Wi-Fi 802.11b/g/n	BPSK	18.67 dBm	1:1	2412.0 - 2462.0 MHz
Bluetooth	GFSK	8.3 dBm	1:1	2402.0 – 2480.0 MHz

GSM Data Functionality	GPRS/EDGE Class 12 (4 uplink timeslots; 4 downlink timeslots; 5 total timeslots per frame)
	Class B (DTM not supported)

Mode(s) of Operation	GPRS/EDGE 1900				EDGE 1900			
Modulation	GMSK				8PSK			
Maximum Output Power Setting (dBm)	29.5	26.5	**25.5**	24.0	25.5	23	22	20
Time Average Output Power Setting (dBm)	20.5	20.5	**21.2**	21.0	16.5	17	17.7	17
Duty Cycle	1:8	2:8	**3:8**	4:8	1:8	2:8	3:8	4:8
Transmitting Frequency Range(s)	1850.2 - 1909.8 MHz				1850.2 - 1909.8 MHz			

2.3 Device Conducted Power Measurements

2.3.1 GSM modes

Band	**Channel**	**Conducted power (dBm) for GSM modes[2] (Burst Average Power)**								
		GSM *CS Voice* (1 Slot)	**GPRS *PS Data* (1 Slots)**	**EDGE *PS Data* (1 Slots)**	**GPRS *PS Data* (2 Slots)**	**EDGE *PS Data* (2 Slots)**	**GPRS *PS Data* (3 Slots)**	**EDGE *PS Data* (3 Slots)**	**GPRS *PS Data* (4 Slots)**	**EDGE *PS Data* (4 Slots)**
GSM 1900	512	29.55	29.67	25.62	26.50	23.12	25.48	21.98	23.98	20.00
	661	29.80	29.88	25.66	26.94	23.25	25.60	21.80	24.34	20.16
	810	29.33	29.42	25.74	26.26	23.23	25.19	21.92	23.63	20.04

Band	**Channel**	**Conducted power (dBm) for GSM modes[2] (Source-Based Time-Averaged Power)**								
		GSM *CS Voice* (1 Slot)	**GPRS *PS Data* (1 Slots)**	**EDGE *PS Data* (1 Slots)**	**GPRS *PS Data* (2 Slots)**	**EDGE *PS Data* (2 Slots)**	**GPRS *PS Data* (3 Slots)**	**EDGE *PS Data* (3 Slots)**	**GPRS *PS Data* (4 Slots)**	**EDGE *PS Data* (4 Slots)**
GSM 1900	512	20.55	20.67	16.62	20.50	17.12	21.22	17.72	20.98	17.00
	661	20.80	20.88	16.66	20.94	17.25	21.34	17.54	21.34	17.16
	810	20.33	20.42	16.74	20.26	17.23	20.93	17.66	20.63	17.04

[1] **Bolded** entries indicate data mode configurations of highest time-average power output per band and data mode type, and thus wee utilized for SAR testing in this report.
[2] *CS Voice* denotes circuit-switched transmission for voice calling, and *PS Data* denotes packet-switched transmission for data sessions.

2.3.2 Wi-Fi 802.11 modes

Per "SAR Measurement Procedures for 802.11 a/b/g Transmitters" (FCC KDB 248227), power measurements were performed for 802.11 operational modes. The average conducted power measurements for each mode are shown in the tables below. SAR testing for 802.11 was performed with the transmitter set to the lowest data rate on the default test channels **highlighted in bold** in the tables below. The head and body positions that resulted in the highest SAR values were further tested on the additional channels and higher data rates **highlighted in pink** in the tables below.

Band	Channel	Average Conducted Power (dBm) for 802.11b Mode Data Rates			
		1 Mbps	2 Mbps	5.5 Mbps	11 Mbps
Wi-Fi 2450 MHz	1	**16.82**	17.1	18	**18.06**
	6	**17.49**	17.6	18.53	**18.67**
	11	**16.79**	16.98	17.72	**18.1**

Band	Channel	Average Conducted Power (dBm) for 802.11g Mode Data Rates							
		6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
Wi-Fi 2450 MHz	1	13.15	13.09	12.64	12.59	11.1	11.16	12.69	12.79
	6	13.75	13.69	13.16	13.24	11.58	11.57	13.18	13.12
	11	13.3	13.19	12.61	12.67	11.15	11.21	12.77	12.81

Band	Channel	Average Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 800 ns Guard Interval)							
		6.5 Mbps	13 Mbps	19.5 Mbps	26 Mbps	39 Mbps	52 Mbps	58.5 Mbps	65 Mbps
Wi-Fi 2450 MHz	1	12.1	12.56	12.56	11.22	11.26	12.74	12.73	11.88
	6	12.49	13.08	13.11	11.68	11.7	13.1	13.12	12.3
	11	12.11	12.57	12.61	11.23	11.25	12.75	12.72	11.91

Band	Channel	Average Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 400 ns Guard Interval)							
		7.2 Mbps	14.4 Mbps	21.6 Mbps	28.8 Mbps	43.3 Mbps	57.7 Mbps	65 Mbps	72.2 Mbps
Wi-Fi 2450 MHz	1	11.97	12.39	12.45	11.01	11.07	12.6	12.64	11.69
	6	12.55	12.97	12.94	11.55	11.56	13.03	13.07	12.18
	11	12.08	12.53	12.62	11.15	11.16	12.62	12.67	11.78

3. Test Equipment Used

3.1 Dosimetric System

The Motorola Mobility ADR Test Services Laboratory utilizes a Dosimetric Assessment System (DASY4™ v4.7 and DASY52™) manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. All the SAR measurements are taken within a shielded enclosure. The overall 10 g RSS uncertainty of the measurement system is ±10.8% (K=1) with an expanded uncertainty of ±21.6% (K=2). The overall 1 g 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 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 in the following table.

Description	Serial Number	Cal Date	Cal Due Date
DASY4™ DAE V1	784	Apr-13-2011	Apr-13-2012
E-Field Probe ES3DV3	3191	Apr-07-2011	Apr-07-2012
S.A.M. Phantom used for 1800/1900/2450 MHz	TP-1160		
Dipole Validation Kit, DV1800V2	2d128	Apr-06-2011	Apr-06-2012
Dipole Validation Kit, DV2450V2	788	Jul-12-2011	Jul-12-2012
DASY4™ DAE V1	1313	Jan-20-2012	Jan-20-2013
E-Field Probe ES3DV3	3180	Feb-06-2012	Feb-06-2013
S.A.M. Phantom used for 1800/1900/2450 MHz	TP-1684		

3.2 Additional Equipment

Description	Serial Number	Cal Date	Cal Due Date
Signal Generator HP8648C	3847A04633	Mar-14-2012	Mar-14-2013
Power Meter E4419B	MY45101158	Mar-16-2012	Mar-16-2013
Power Sensor #1 - E9301A	MY41497903	Mar-16-2012	Mar-16-2013
Power Sensor #2 - E9301A	US39211011	Mar-16-2012	Mar-16-2013
Power Meter E4419B	GB43310686	Feb-23-2012	Feb-23-2013
Power Meter 437B	3125U09525	Feb-23-2012	Feb-23-2013
Power Sensor - 8481A	MY41096692	Feb-23-2012	Feb-23-2013
Power Meter E4419B	GB43310686	Feb-23-2012	Feb-23-2013
Power Sensor #1 - E9301A	MY41495336	Feb-23-2012	Feb-23-2013
Power Sensor #2 - E9301A	MY41497905	Feb-23-2012	Feb-23-2013
Amplifier - Mini Circuits ZHL42	061906		
3dB Fixed Attenuator 8491A	MY39263438	Jan-28-2012	Jan-28-2013
10dB Fixed Attenuator 8491A	MY39263627	Jan-28-2012	Jan-28-2013
Dual Directional Coupler 778D	20076	Jan-28-2012	Jan-28-2013
Power Supply HP6632B	MY43002724	Feb-24-2012	Feb-24-2013
Signal Generator HP8648C	3847U02385	Feb-21-2012	Feb-21-2013
Network Analyzer E5071B	MY42301800	Jan-28-2012	Jan-28-2013
Dielectric Probe Kit HP85070E	MY44300245		

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 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 $\rho = 1\ ^{g}/_{cm^3}$ 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].

E-field probes calibrated at 1810 MHz were used for "1900 MHz" band (1850 MHz - 1910 MHz) SAR measurements. FCC KDB 450824 provides additional requirements on page 3 of 6 for SAR testing that is performed with probe calibration points that are more than 50 MHz removed from the measured bands. The KDB requires; "(2) When nominal tissue dielectric parameters are specified in the probe calibration data, the tissue dielectric parameters measured for routine measurements should be less than the target Er and higher than the target Sigma values to minimize SAR underestimations". The 1900 MHz simulated tissues listed below meet this criteria.

f (MHz)	Tissue type	Limits / Measured	Dielectric Parameters		
			ε_r	σ (S/m)	Temp (°C)
1880	Head	**Measured,** Mar-01-2012	38	1.46	21.3
		Measured, Mar-06-2012	38	1.45	22.1
		Recommended Limits	40.0 ±5%	1.40 ±5%	18-25
	Body	**Measured,** Mar-02-2012	51.7	1.58	21.7
		Recommended Limits	53.3 ±5%	1.52 ±5%	18-25
2450	Head	**Measured,** May-07-2012	37.8	1.88	20.6
		Measured, May-09-2012	37.3	1.89	19.7
		Recommended Limits	39.2 ±10%	1.80 ±5%	18-25
	Body	**Measured,** Mar-05-2012	50.6	1.98	19.8
		Recommended Limits	52.7 ±10%	1.95 ±5%	18-25

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

Ingredient	782 / 835 / 900 MHz Head	782 / 835 / 900 MHz Body	1800 MHz / 1900 MHz Head	1800 MHz / 1900 MHz Body	2450 MHz Head	2450 MHz 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 Verifications

A system accuracy verification of the DASY4™ or DASY52™ 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 7. 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 1 W 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). For frequencies below 3 GHz, the simulated tissue depth was verified to be 15.0 cm ± 0.5 cm. Z-axis scans showing the SAR penetration are also included in Appendix 1.

System Accuracy Verification Measurements for Head SAR Measurements						
f (MHz)	Description	SAR (W/kg), 1 gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			ε_r	σ (S/m)		
1800	**Measured,** Mar-01-2012	38	38	1.46	22	21.4
	Measured, Mar-06-2012	37.65	38.4	1.36	22.2	21.5
	Recommended Limits	37.8	40.0 ±5%	1.40 ±5%	18-25	18-25
2450	**Measured,** May-05-2012	57	37.8	1.88	21.6	20.3
	Measured, May-07-2012	57.5	37.3	1.89	21.6	19.9
	Recommended Limits	53.8	39.2 ±10%	1.80 ±5%	18-25	18-25

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

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3191	1810	5.21	5 of 11
		2450	4.49	5 of 11
E-Field Probe ES3DV3	3180	1810	5.20	5 of 11
		2450	4.51	5 of 11

System Accuracy Verification Measurements for Body SAR Measurements						
f (MHz)	Description	SAR (W/kg), 1 gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			ε_r	σ (S/m)		
1800	**Measured,** Mar-02-2012	37.55	52	1.48	22	21.2
	Recommended Limits	37.9	53.3 ±5%	1.52 ±5%	18-25	18-25
2450	**Measured,** May-14-2012	51.5	50.63	1.98	21.9	19.6
	Recommended Limits	51.3	52.7 ±10%	1.95 ±5%	18-25	18-25

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

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3191	1810	4.76	6 of 11
		2450	4.11	6 of 11
E-Field Probe ES3DV3	3180	1810	5.09	6 of 11
		2450	4.46	6 of 11

6. Test Results

The test sample was operated using an actual transmission through a base station simulator. Wi-Fi testing was conducted using manufacturer test mode software, per guidance given in FCC KDB 248227. The base station simulator or test software was set up for the proper channels, transmitter power levels and transmit modes 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™ or DASY52™ SAR measurement system. The default settings for the "coarse" and "cube" scans were chosen and used for measurements. The grid spacing of the coarse scan was set to 15 mm or less as shown in the SAR plots included in Appendices 2 through 4. Please refer to the DASY4™ or DASY52™ manual for additional information on SAR scanning procedures and algorithms used.

The DUT covered by this report has an integrated battery (p/n SNN5899A – 1780mAH) that is not intended for removal by the end user.

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

The SAR results shown in tables 1 through 4 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 temperature of the simulated tissue after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is:

$$Extrapolated\ SAR = (Measured\ or\ Corrected\ SAR) * 10^{(-drift/10)}$$

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.

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

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3191	1810	5.21	5 of 11
		2450	4.49	5 of 11
E-Field Probe ES3DV3	3180	1810	5.20	5 of 11
		2450	4.51	5 of 11

Left Head Cheek Position																
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GSM 1900, CS Voice	SNN5899A	512												
			661	20	0.142	29.8		0.115		0.12	0.194		0.19		
			810												
2450	802.11b, 1 Mbps		**1**	**19.4**	**-0.17**	**16.82**		**0.376**		**0.39**	**0.801**		**0.83**	**5x5x7**	**A18**
			6	19.5	0.065	17.49		0.33		0.33	0.722		0.72		
			11	19.2	-0.063	16.79		0.225		0.23	0.486		0.49		
	802.11b, 11 Mbps		1	19	-0.067	18.06		0.379		0.38	0.816		0.83		
			6	19.5	-0.046	18.67		0.332		0.34	0.72		0.73		
			11	19	0.037	18.1		0.246		0.25	0.544		0.54		

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															
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GPRS 1900, Class 11	SNN5899A	512												
			661	**22.1**	**-0.06**	**29.8**		**0.179**		**0.18**	**0.299**		**0.3**	**5x5x7**	**A17**
			810												
2450	802.11b, 1 Mbps		1												
			6	19.4	0.11	17.49		0.238		0.24	0.457		0.46		
			11												
	802.11b, 11 Mbps		1												
			6	19.4	0.17	18.67		0.264		0.26	0.505		0.51		
			11												

Table 2: 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)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GSM 1900, CS Voice	SNN5899A	512												
			661	21.3	0.085	29.8		0.0719		0.07	0.117		0.12		
			810												
2450	802.11b, 1 Mbps		1												
			6	19.4	0.052	17.49		0.101		0.1	0.207		0.21		
			11												
	802.11b, 11 Mbps		1												
			6	19.4	-0.066	18.67		0.096		0.1	0.194		0.2		
			11												

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

Right Head 15° Tilt Position															
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GSM 1900, CS Voice	SNN5899A	512												
			661	**21.3**	**-0.064**	**29.8**		**0.0747**		**0.08**	**0.133**		**0.13**	**5x5x7**	**A19**
			810												
2450	802.11b, 1 Mbps		1												
			6	19.4	-0.071	17.49		0.116		0.12	0.231		0.23		
			11												
	802.11b, 11 Mbps		1												
			6	**19.4**	**-0.21**	**18.67**		**0.126**		**0.13**	**0.25**		**0.26**	**5x5x7**	**A20**
			11												

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

6.2 Body Worn Test Results

The SAR results shown in tables 5 through 6 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 [6]. Also shown are the temperature of the simulated tissue after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is:

$$\textit{Extrapolated SAR} = (\textit{Measured or Corrected SAR}) * 10^{(-drift/10)}$$

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 SPEAG™ MFP V5.1 C Triple Modular Phantom was used for the body-worn tests. The triple modular phantom consists of three identical modules that can be installed and removed separately without emptying the liquid. Each module of the triple phantom is constructed of glass-fiber reinforced vinylester (VG-GF) with a thickness at the bottom of 2.0 mm. It measures 29.2 cm(long) by 17.8 cm(wide) by 17.8 cm(tall). Or A "flat" phantom was used for the body-worn tests. This "flat" phantom is made out of 1" thick natural High Density Polyethylene with a

thickness at the bottom of 2.0 mm. It measures 52.7 cm(long) by 26.7 cm(wide) by 21.2 cm(tall). The simulated tissue depth was verified to be 15.0 cm ± 0.5 cm. The same device holder described in section 6 was used for positioning the phone.

The simulated tissue depth was verified to be 15.0 cm ± 0.5 cm for frequencies less than 3 GHz, or 10.0 cm ± 0.5 cm for frequencies greater than 3 GHz. The same device holder described in section 6 was used for positioning the phone. 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 thus the device was tested per the Supplement C testing guidelines for devices that do not have body-worn accessories. A separation distance of 25 mm between the device and the flat phantom was used for testing body-worn SAR. The chosen separation distance of 25 mm is utilized in order to support any case or holder accessories offered or to be offered by Motorola for this product. The device was tested with the front and back of the device facing the phantom. Both sides of the device were tested for Body SAR for the purpose of including the SAR evaluation for body-worn accessories that support the device with the front side facing the user.

The cellular phone was also tested in data mode operations. For these tests, a separation distance of 25 mm between the device and the flat phantom was used. The device was tested in the worst-case SAR position and channel configuration from the voice-mode body-worn testing.

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	3191	1810	4.76	6 of 11
		2450	4.11	6 of 11
E-Field Probe ES3DV3	3180	1810	5.09	6 of 11
		2450	4.46	6 of 11

Body-Worn, Front of Phone 25 mm from Phantom																
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GSM 1900, CS Voice	SNN5899A	512												
			661	21.7	-0.018	29.8		0.0931		0.09	0.151		0.15		
			810												
2450	802.11b, 1 Mbps		1												
			6	19.1	0.17	17.49		0.009		0	0.016		0.17		
			11												
	802.11b, 11 Mbps		1												
			6	19.7	-0.43	18.67		0.01		0.01	0.017		0.02		
			11												

Table 5: 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 25 mm from Phantom																
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
1880	GSM 1900, CS Voice	SNN5899A	512												
			661	**21.2**	**-0.011**	**29.8**		**0.126**		**0.13**	**0.205**		**0.21**	**5x5x7**	**A22**
			810												
	GPRS 1900, Class 11		512												
			661	21.2	-0.02	25.60		0.123		0.12	0.2		0.2		
			810												
2450	802.11b, 1 Mbps		1	19	0.2	16.82		0.011		0.01	0.02		0.02		
			6	19	-0.14	17.49		0.014		0.01	0.025		0.03		
			11	19	0.12	16.79		0.015		0.01	0.025		0.03		
	802.11b, 11 Mbps		1	19.6	-0.13	18.06		0.01		0.01	0.019		0.02		
			6	**19.7**	**0.027**	**18.67**		**0.016**		**0.02**	**0.027**		**0.03**	**5x5x7**	**A23**
			11	19.5	0.022	18.1		0.013		0.01	0.022		0.02		

Table 6: SAR measurement results at the highest possible output power, measured in a body-worn position against the ICNIRP and ANSI SAR Limit.

6.3 Description and Evaluation of Simultaneous Transmitters

Per "SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas" (FCC KDB 648474), the necessity of stand-alone and simultaneous SAR testing was evaluated for the licensed and unlicensed transmitters of the device under test.

By device design the GSM transmitters may operate simultaneously with either the Wi-Fi 802.11 transmitter or the Bluetooth transmitter. The separation distance between the Wi-Fi 802.11/Bluetooth antenna and the main antenna is 5.3 cm. Pictorial representation of the antenna locations and separation distances are given in Exhibit 7d.

The Bluetooth transmitter of the device under test can be excluded from stand-alone and simultaneous SAR evaluation, per the highlighted requirements from FCC KDB 648474, as follows:

1. The highest output conducted power measured for Bluetooth on the device under test is 6.6 mW [≤ 24 mW]
2. The separation distance between the Bluetooth antenna and the main antenna is 5.3 cm [≥ 5.0 cm]

For the transmitters requiring stand-alone SAR testing (GSM, and Wi-Fi 802.11), the KDB guidelines direct that if the sum of the 1 g SAR measured for the simultaneously transmitting antennas is less than the SAR limit, SAR measurement for simultaneous transmission is not required. Further, if the SAR-to-peak-location separation ratio for two simultaneously transmitting antennas is less than 0.3 then SAR measurement for simultaneous transmission is likewise not required. Evaluations of the head and body simultaneous SAR summations for the worst-case SAR transmitter configurations are presented in the tables below.

Evaluations for Simultaneous SAR							
Cellular Mode	Wi-Fi Mode	Configuration	Cellular Mode 1 g SAR Value (W/kg)	Wi-Fi Mode 1 g SAR Value (W/kg)	Summation 1 g SAR Value (W/kg)	SAR-to-peak-location Separation Ratio	*Simultaneous Measurements Required?*
GSM 1900, CS Voice	Wi-Fi 2450 802.11b, 11 Mbps	Left Cheek with Battery SNN5899A	0.19	0.83	1.02		No
GSM 1900, CS Voice	Wi-Fi 2450 802.11b, 1 Mbps	Body Worn, Back of Phone 25 mm from Phantom with Battery SNN5899A	0.21	0.03	0.24		No

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 (300 MHz – 3 GHz)”.

[3] ANSI / IEEE, C95.1 1992 Edition “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”

[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)”