Portable Cellular Phone Supplemental SAR Test Report

Tests Requested By:	Motorola Mobility, Inc. 600 N. US Highway 45 Libertyville, IL 60048
Test Report #:	24975-1F Supplemental
Date of Report:	June 11, 2012
Date of Test:	Apr 4, 2012 – Jul 3, 2012
FCC ID #:	IHDT56NH5
Generic Name:	M0D6B
Test Laboratory:	Motorola Mobility, Inc. - ADR Test Services Laboratory 600 N. US Highway 45 Libertyville, IL 60048
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Accreditation:

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)

2404

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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This test report shall not be reproduced except in full, without written approval of the laboratory. The results and statements contained herein relate only to the items tested. The names of individuals involved may be mentioned only in connection with the statements or results from this report. Motorola encourages all feedback, both positive and negative, on this test report.

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1. Introduction

The Motorola 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].

Per direction of the FCC, the following SAR test data is being provided to demonstrate the device's effective utilization of power reduction conditions specified in Exhibit 12 - Operational Description. The values in the table in Section 6.0 are provided solely for purposes of confirming compliant power reduction operation and do not represent maximum SAR values of the product. For maximum reported SAR compliance values, refer to the Exhibit 11 SAR test report.

2. Description of the Device Under Test

2.1 Device Signaling

Serial Number(s) (Functional Use)	352513050003959 , 352513050007521
Production Unit or Identical Prototype (47 CFR §2..908)	Identical Prototype
Device Category	Portable (Mobile Station)
RF Exposure Limits	General Population / Uncontrolled

Mode(s) of Operation	Modulation Mode(s)	Maximum Output Power Setting	Duty Cycle	Transmitting Frequency Range(s)
CDMA 800	QPSK	25.0 dBm	1:1	824.70 - 848.31 MHz
CDMA 1900	QPSK	25.0 dBm	1:1	1851.20 - 1908.75 MHz

2.2.1 Power limit reduction schemes

For specified modes of operation, the DUT utilizes reduced maximum power limits to maintain compliance to SAR exposure limits. Complete descriptions of the following functionalities are provided in the Operational Description contained within Exhibit 12. The implementations to trigger the reductions in power require the device to be radiating, which prevents conducted power measurements of these functionalities without modification of the DUT.

The DUT utilizes reduced limits for the maximum transmit power when the mobile hotspot functionality is enabled in CDMA 1900 band only. These limits are utilized when in a data connection during a mobile hotspot session. A table of the reduced limits used for testing is given below. There is no power cutback in CDMA 800 band in mobile hotspot mode.

Mode(s) of Operation	CDMA 850	CDMA 1900
Maximum Output Power Setting (dBm)	25.0	25.0
Reduced Maximum Output Power Setting (dBm)	25.0	21.5
Power Reduction (dB)	0	3.5

3. Test Equipment Used

3.1 Dosimetric System

The Motorola Mobility ADR Test Services 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 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	1313	Jan-20-2012	Jan-20-2013
E-Field Probe ES3DV3	3180	Jan-11-2012	Jan-11-2013
DASY4™ DAE V1	699	Sep-22-2011	Sep-22-2012
E-Field Probe ES3DV3	3115	Jan-11-2012	Jan-11-2013
S.A.M. Phantom used for 800/900 MHz	TP-1154		
S.A.M. Phantom used for 1800/1900/2450 MHz	TP-1684		
Dipole Validation Kit, DV835V2	425TR	Jul-08-2011	Jul-08-2012
Dipole Validation Kit, DV1800V2	2d129	Jul 22, 2011	Jul 22, 2012
Dipole Validation Kit, DV2450V2	863	Mar-17-2012	Mar-17-2013

3.2 Additional Equipment

Description	Serial Number	Cal Date	Cal Due Date
Power Meter E4419B	MY45101158	Mar-16-2012	Mar-16-2013
Power Meter 437B	3110A05196	Mar-16-2012	Mar-16-2013
Power Sensor - 8481A	MY41096757	Mar-16-2012	Mar-16-2013
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
Amplifier - Mini Circuits ZHL42	101705		
3dB Fixed Attenuator 8491A	MY39263202	Feb-23-2012	Feb-23-2013
10dB Fixed Attenuator 8491A	MY39263155	Feb-23-2012	Feb-23-2013
Dual Directional Coupler 778D	18369	Mar-16-2012	Mar-16-2013
Power Supply HP6632B	MY43002619	Mar-19-2012	Mar-19-2013
Signal Generator HP8648C	3847A04633	Mar-14-2012	Mar-14-2013
Network Analyzer E5071B	MY42301800	Jan-28-2012	Jan-28-2013
Dielectric Probe Kit DAK-3.5	1028		

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 SPEAG DAK-3.5 Dielectric Assessment 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)
835	**Body**	**Measured,** Jun-04-2012	54.2	1.00	19.7
		Measured, Jun-08-2012	53.4	1.00	20.1
		Recommended Limits	55.2 ±5%	0.97 ±5%	18-25
1880	**Body**	**Measured,** Jun-05-2012	51.3	1.58	20.2
		Measured, Jun-07-2012	51.9	1.55	20.2
		Measured, Jul-03-2012	50.7	1.57	20.0
		Recommended Limits	53.3 ±5%	1.52 ±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 Verification

A system accuracy verification of the DASY4™ or DASY5™ 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 Body SAR Measurements						
f (MHz)	Description	SAR (W/kg), 1 gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			ε_r	σ (S/m)		
835	**Measured,** Jun-04-2012	9.85	54.2	1.00	21.3	19.7
	Recommended Limits	9.35	55.2 ±5%	0.97 ±5%	18-25	18-25
1800	**Measured,** Jun-05-2012	36.25	51.7	1.48	21.2	20.2
	Measured, Jul-03-2012	35.25	51.1	1.48	21.0	20.2
	Recommended Limits	38.8	53.3 ±5%	1.52 ±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	3180	835	5.97	6 of 11
		1810	5.09	6 of 11
E-Field Probe ES3DV3	3115	2450	4.12	6 of 11

6. Test Results

The test sample was operated using an actual transmission through a base station simulator. 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 configurations specified by the FCC for this device in order to demonstrate the effective utilization of power reduction conditions specified in Exhibit 12. Testing was performed with a separation of 1 cm between the DUT and the "flat" phantom. The phone was positioned into these configurations using the device holder supplied with the DASY4™ 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 Appendix 2. Please refer to the DASY4™ manual for additional information on SAR scanning procedures and algorithms used.

The SAR results shown in the table below are maximum SAR values averaged over 1 gram of phantom tissue. Also shown is the extrapolated SAR to account for drift. The exact method of extrapolation is Extrapolated SAR = Measured 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 DUT utilizes a reduced limit for the maximum transmit power for the CDMA 1900 mode when the mobile hotspot functionality is enabled. A description of this functionality is provided in the "Operational Description" contained within Exhibit 12.

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). Alternately, 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 for frequencies below 3 GHz, or 10.0 cm ± 0.5 cm for frequencies greater than 3 GHz.

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

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3180	835	5.97	6 of 11
		1810	5.09	6 of 11
E-Field Probe ES3DV3	3115	2450	4.12	6 of 11

Per direction of the FCC, the following SAR test data is being provided to demonstrate the device's effective utilization of power reduction conditions specified in Exhibit 12 - Operational Description. The values in the table are provided solely for purposes of confirming compliant power reduction operation and do not represent maximum SAR values of the product. For maximum reported SAR compliance values, refer to the Exhibit 11 SAR test report.

Mobile Hotspot, Phone 10 mm from Phantom									
				1 g SAR value w/o Pwr Reduction		*1 g SAR value w/ Pwr Reduction*			
F **(MHz)**	**Mode**	**Test Configuration**	**Channel**	**Measured (W/kg)**	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**	**Pwr Reduction Specification (dB)**	**Measured Pwr Reduction (dB)**
835	**CDMA 800**	Back of Device 10 mm from Phantom	1013	1.01	1.01				
			384	1.31	1.31				
			777	1.34	1.34				
1880	**CDMA 1900**	Bottom Edge of Device 10 mm from Phantom	25						
			600	3.52	3.52	1.42	1.43	3.5	3.9
			1175						

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)”

END OF REPORT