



Portable Cellular Phone Class II Permissive Change SAR Test Report

Tests Requested By: Motorola Mobility, Inc.
600 N. US Highway 45
Libertyville, IL 60048

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Date of Report: May 15, 2013
Date of Test: May 7, 2013
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Generic Name: M0CE5

Test Laboratory: Motorola Mobility, Inc. - ADR Test Services Laboratory
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This laboratory is accredited to ISO/IEC 17025-2005 to perform the following tests:

Accreditation:



2404

Tests:
Electromagnetic Specific Absorption Rate

Procedures:
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:

(none)

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Revision History

Revision Version	Date	Notes
Rev. 0	15-May-2013	Initial report release

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], [5], [7] and per FCC KDB 941225 D06 for mobile hotspot operation. 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 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)	Mobile Hotspot SAR (1 g ^W /kg)
Wi-Fi 2.45 GHz	0.58	0.03	0.26

2. Description of the Device Under Test

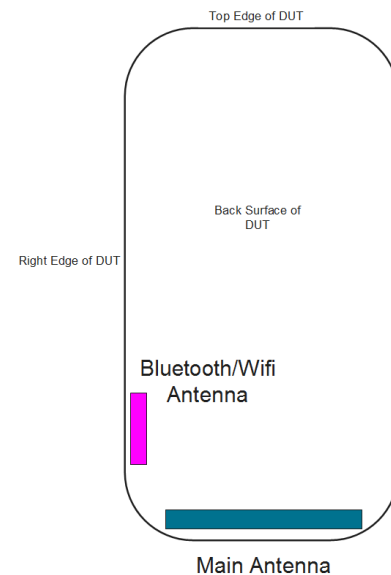
2.1 Antenna description

Main Antenna

Type	Internal	
Location	Bottom of Transceiver	
Dimensions	Width	47.5 mm
	Length	10.5 mm

Bluetooth/Wi-Fi 2 GHz Antenna

Type	Internal	
Location	Right-Side Rear of Transceiver	
Dimensions	Width	9.0 mm
	Length	19.0 mm



2.2 Device Signaling¹

Serial Number(s) (Functional Use)	Q59RVG22F2 (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 850	GMSK	33.5 dBm	1:8	824.2 - 848.8 MHz
GSM 900	GMSK	33.5 dBm	1:8	880.2 - 914.8 MHz
GSM 1800	GMSK	30.5 dBm	1:8	1710.2 - 1784.8 MHz
GSM 1900	GMSK	30.5 dBm	1:8	1850.2 - 1909.8 MHz
WCDMA 1700	QPSK	24.0 dBm	1:1	1712.4 - 1752.6 MHz
WCDMA 1900	QPSK	24.0 dBm	1:1	1852.4 - 1907.6 MHz
WCDMA 2100	QPSK	24.0 dBm	1:1	1922.4 - 1977.6 MHz
Wi-Fi 802.11b/g/n	BPSK	19.13 dBm	1:1	2412.0 - 2462.0 MHz
Bluetooth	GFSK	10.38 dBm	1:1	2402.0 - 2480.0 MHz

¹ **Bolded** entries indicate data mode configurations of highest time-average power output per band and data mode type, and thus were utilized for SAR testing in this report.

2.3 Device Conducted Power Measurements

2.3.1 Wi-Fi 802.11 modes

Technical Description

The phone under test contains a Wi-Fi 802.11b/g/n transmitter capable of data transmission in the 2.45 GHz ISM band.

Exposure Conditions and Test Exclusions

Mode	Type	Head-Adjacent	Body-Worn Accessory	Mobile Hotspot
802.11b	Data	Tested (1)	Tested (1)	Tested (1)
802.11g / 802.11n	Data	Excluded (1)	Excluded (1)	Excluded (1)

Notes:

- (1) Per FCC KDB 248227 D01 and the April 2010 FCC/TCB Meeting Notes, the highest average output power channel for the lowest data rate for 802.11b or 802.11a was selected for SAR evaluation. Other 802.11 modes (including 802.11g, 802.11n, and 802.11ac) were not investigated when the average output powers over all channels and data rates were not more than ¼ dB higher than the tested channel in the lowest data rate of the 802.11b or 802.11a mode. The **bolded** data rates and channels in the following conducted power tables were used for SAR testing.

Device Test Setup

For Wi-Fi 802.11 modes, the test sample was operated using manufacturer test mode software per guidance provided in FCC KDB 248227. The test software was set up for the proper channel, transmitter power level and transmit modes of operation on the phone's uplink

Conducted Power Measurements

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	17.47	17.88	18.42	18.45
	6	18.06	18.26	18.95	19.13
	11	17.67	17.77	18.69	18.64

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	17.23	17.15	16.86	16.99	15.5	15.66	14.05	13.91
	6	17.86	17.81	17.55	17.55	15.81	15.86	14.37	14.35
	11	17.02	16.94	17.11	17.18	15.41	15.35	14.03	13.87

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	17.21	16.86	16.92	15.49	15.32	13.92	13.96	12.93
	6	17.67	17.32	17.35	15.81	15.75	14.32	14.18	13.28
	11	16.78	16.84	16.91	15.24	15.42	13.71	13.77	12.79

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	17.22	16.88	16.91	15.36	15.19	13.91	13.76	12.89
	6	17.55	17.16	17.3	15.66	15.61	14.18	14.1	13.23
	11	16.75	16.73	16.82	15.15	15.18	13.63	13.68	12.63

2.3.2 Bluetooth

Technical Description

The phone under test contains a Bluetooth transmitter capable of data transmission in the 2.4 GHz ISM band.

Exposure Conditions and Test Exclusions

Mode	Type	Head-Adjacent	Body-Worn Accessory	Mobile Hotspot
All Modes	Data	Excluded (1) (2)	Excluded (1) (2)	Excluded (1) (2)

Notes:

(1) Per FCC KDB 447498 D01, standalone SAR measurements of the Bluetooth transmitter in this phone were not required based on the maximum conducted power and the Bluetooth antenna-to-user separation distance. As detailed by the KDB publication, the SAR exclusion threshold for distances < 50 mm is defined by the following equation:

$$\frac{[maximum\ power\ of\ channel,\ including\ tune - up\ tolerance]_{(mW)}}{[minimum\ test\ separation\ distance]_{(mm)}} \times \sqrt{f_{(GHz)}} \leq 3.0$$

Based on the maximum conducted power of Bluetooth and the most conservative antenna-to-user separation distance used in testing, standalone SAR measurements for Bluetooth were not required.

$$\frac{[10.91]_{(mW)}}{[21.5]_{(mm)}} \times \sqrt{2.44_{(GHz)}} = 0.8 \leq 3.0$$

3. Test Equipment Used

3.1 Dosimetric Measurement System

The Motorola Mobility ADR Test Services Laboratory utilizes a DASY52™ Dosimetric Assessment System manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. All SAR measurements are taken within a shielded enclosure. The overall 10 g RSS uncertainty of the measurement system is $\pm 11\%$ (K=1) with an expanded uncertainty of $\pm 22\%$ (K=2). The overall 1 g RSS uncertainty of the measurement system is $\pm 11\%$ (K=1) with an expanded uncertainty of $\pm 22\%$ (K=2). The measurement uncertainty budget is given in Appendix 5. Per IEEE 1528, this uncertainty budget is applicable to the SAR range of 0.4 W/kg to 10 W/kg.

The list of calibrated equipment used for the measurements is shown in the following table. All equipment was brought into service and used only during its noted calibration period, except where indicated. Equipment without a calibration period was in service for the entirety of the test period.

Description	Serial Number	Cal Date	Cal Due Date	Service Notes
DASY™ DAE V1	376	3-Sep-2012	3-Sep-2013	Measurement System 2
E-Field Probe ES3DV3	3124	20-Aug-2012	20-Aug-2013	Measurement System 2
Twin SAM Phantom V4.0	TP-1136			Measurement System 2
MFP V5.1 C Triple Modular Flat Phantom	1102			Measurement System 2
DASY™ DAE V1	784	6-Mar-2013	6-Mar-2014	Measurement System 3
E-Field Probe EX3DV4	3730	24-Aug-2012	24-Aug-2013	Measurement System 3
Twin SAM Phantom V4.0	TP-1106			Measurement System 3
Twin SAM Phantom V4.0	TP-1153			Measurement System 3
MFP V5.1 C Triple Modular Flat Phantom	1103			Measurement System 3
Dipole Validation Kit, D1800V2	2d190	5-Jan-2012	5-Jan-2013	Calibration extension, see note.
Dipole Validation Kit, D2450V2	740	7-Feb-2012	7-Feb-2013	Calibration extension, see note.

Note: Per FCC KDB 450824 D02, evaluations for the extensions of the dipole calibrations were carried out. Results are provided in Appendix 7 in addition to the original calibration certificates.

3.2 Additional Equipment

Description	Serial Number	Cal Date	Cal Due Date	Service Notes
Power Meter 437B	3125U08032	28-Aug-2012	28-Aug-2013	
Power Sensor 8481A	US37296470	2-Nov-2012	2-Nov-2013	
10 dB Attenuator 8491A	62165	24-Sep-2011	27-Sep-2013	
Signal Generator HP8648C	3847A04810	26-Sep-2011	26-Sep-2013	
Power Meter E4419B	GB39511090	12-Aug-2011	12-Aug-2013	
Power Sensor #1 - E9301A	US39211009	28-Aug-2012	28-Aug-2013	
Power Sensor #2 - E9301A	US39211013	2-Nov-2012	2-Nov-2013	
3 dB Attenuator 8491A	50577	15-Aug-2011	15-Aug-2013	
Dual Directional Coupler 778D	50790	2-Nov-2012	2-Nov-2014	
Amplifier ZHL-42-SMA	N120299-25			
Power Meter 437B	3125U08939	12-Aug-2011	12-Aug-2013	
Power Sensor 8481A	US37296475	2-Nov-2012	2-Nov-2013	
10 dB Attenuator 8491A	3929M50702	12-Sep-2011	12-Sep-2013	
Signal Generator HP8648C	3847M01245	23-Aug-2011	23-Aug-2013	
Power Meter E4419B	GB39511084	28-Mar-2011	28-Mar-2013	Removed from service 28-Mar-2013
Power Meter E4419B	GB39511087	28-Aug-2012	28-Aug-2014	Placed into service 28-Mar-2013
Power Sensor #1 - E9301A	US39210915	14-Jan-2013	14-Jan-2014	
Power Sensor #2 - E9301A	US39210916	14-Jan-2013	14-Jan-2014	
3 dB Attenuator 8491A	MY39267604	13-Oct-2011	13-Oct-2013	
Dual Directional Coupler 778D	18376	29-Aug-2012	29-Aug-2014	
Amplifier ZHL-42-SMA	N120299-23			
Signal Generator HP8648C	3847A04632	13-Aug-2011	13-Aug-2013	
Power Meter E4419B	GB39511086	4-Nov-2011	4-Nov-2013	
Power Sensor #1 - E9301A	US39211007	28-Aug-2012	28-Aug-2013	
Power Sensor #2 - E9301A	US39211008	28-Aug-2012	28-Aug-2013	
3 dB Attenuator 8491A	50555	13-Sep-2011	13-Sep-2013	
Dual Directional Coupler 778D	18621	18-Aug-2011	18-Aug-2013	
Amplifier ZHL-42-SMA	N120299-26			
Power Meter E4416A	GB41293246	5-Nov-2011	5-Nov-2013	
Power Sensor #3 - E9323A	MY44442067 6	29-Aug-2012	29-Aug-2013	
10 dB Attenuator 8491A	MY39267982	31-Jul-2012	31-Jul-2013	
Signal Generator N5181A	MY50143026	27-Oct-2011	27-Oct-2014	
Power Meter E4419B	GB39511088	11-Aug-2011	11-Aug-2013	
Power Sensor #1 - E9301A	US39210929	27-Jul-2012	27-Jul-2013	
Power Sensor #2 - E9301A	US39210930	27-Jun-2012	27-Jun-2013	
3 dB Attenuator 8491A	36902	13-Sep-2011	13-Sep-2013	
Dual Directional Coupler 772D	MY46151266	1-Aug-2012	1-Aug-2013	
Amplifier ZVA-183-S+	988901030 A			
Network Analyzer E5071C	MY46212851	10-May-2012	10-May-2013	
Dielectric Probe Kit DAK-3.5	1072			

4. Electrical parameters of the tissue simulating liquid

Validation, System Performance Check, and device SAR measurements are performed using the DASY52™ system along with liquids specified to simulate head and body tissues subjected to electromagnetic exposure. The list of ingredients and the percent composition of the tissue-simulating liquids used for testing are indicated in the following table.

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	5 GHz Head	5 GHz Body
Sugar	57.0	44.9	--	--	--	--	--	--
DGBE	--	--	47.0	30.8	6.89	8.0	--	--
Water	40.45	53.06	52.62	68.8	57.95	71.8	65.52	78.66
Salt	1.45	0.94	0.38	0.4	0.15	0.2	--	--
HEC	1.0	1.0	--	--	--	--	--	--
Bact.	0.1	0.1	--	--	--	--	--	--
Triton X-100	--	--	--	--	35.02	20.0	17.24	10.67
Di(ethylene glycol) Hexyl Ether	--	--	--	--	--	--	17.24	10.67

Prior to conducting SAR measurements, the relative permittivity, ϵ_r , and conductivity, σ , of the tissue-simulating liquids were measured with a SPEAG™ DAK-3.5 Dielectric Assessment Kit across the frequency ranges of interest. These values, along with recommended targets, percent deviation from the targets, and the temperature of the simulated tissue are shown in the tables below.

For SAR measurements, the dielectric measurements from the DAK-3.5 are imported into the DASY software which performs interpolation to determine the dielectric parameters at the specific frequencies used for device testing. The DASY software also implements SAR error compensation algorithms to automatically correct the measured SAR results for deviations between the measured and target dielectric parameters. This error compensation has been verified by the lab to meet the requirements in FCC KDB 865664 D01. Therefore, where frequencies of test fall within ± 50 MHz of a calibration point of the probe used for test, the acceptable range of tissue variation is $\pm 10\%$ per FCC KDB 865664 D01 section 2.4. For test frequencies outside of ± 50 MHz of a probe calibration point, the range of tissue variation is reduced per section 2.6 part 2 of the same KDB, to ensure that tissues used in testing are within the required specification regardless of device performance. A mass density of $\rho = 1 \text{ g/cm}^3$ was entered into the system for all cases. It can be seen that the measured parameters are within tolerance of the recommended targets specified in [1] and [5].

Head Simulated-Tissue Dielectric Parameters									
Index	Date Measured	f (MHz)	Target σ (S/m)	Target ϵ_r	Measured σ (S/m)	Deviation σ (%)	Measured ϵ_r	Deviation ϵ_r (%)	Temp (°C)
1730	15-May-2013	1709.0	1.35 -5%/+10%	40.13 -10%/+5%	1.31	-2.9%	36.9	-8.1%	20.5
		1730.0	1.36 -5%/+10%	40.10 -10%/+5%	1.34	-1.5%	36.8	-8.3%	
		1755.0	1.37 -5%/+10%	40.06 -10%/+5%	1.36	-1.1%	36.7	-8.5%	
2450	7-May-2013	2412.0	1.77 $\pm 10\%$	39.27 $\pm 10\%$	1.77	0.3%	36.9	-6.0%	20.2
		2450.0	1.80 $\pm 10\%$	39.20 $\pm 10\%$	1.90	5.6%	37.2	-5.3%	
		2462.0	1.81 $\pm 10\%$	39.18 $\pm 10\%$	1.89	4.3%	37.3	-4.9%	
	15-May-2013	2412.0	1.77 $\pm 10\%$	39.27 $\pm 10\%$	1.74	-1.5%	37.1	-5.6%	20.5
		2450.0	1.80 $\pm 10\%$	39.20 $\pm 10\%$	1.78	-1.2%	36.9	-5.8%	
		2462.0	1.81 $\pm 10\%$	39.18 $\pm 10\%$	1.79	-1.3%	36.9	-5.9%	

Body Simulated-Tissue Dielectric Parameters									
Index	Date Measured	f (MHz)	Target σ (S/m)	Target ϵ_r	Measured σ (S/m)	Deviation σ (%)	Measured ϵ_r	Deviation ϵ_r (%)	Temp (°C)
2450	7-May-2013	2412.0	1.91 $\pm 10\%$	52.75 $\pm 10\%$	1.96	2.4%	50.0	-5.3%	20.2
		2450.0	1.95 $\pm 10\%$	52.70 $\pm 10\%$	2.06	5.7%	50.1	-4.9%	
		2462.0	1.97 $\pm 10\%$	52.68 $\pm 10\%$	2.06	4.8%	50.2	-4.9%	

5. System Accuracy Verifications

System accuracy verifications of the DASY52™ were performed using the measurement equipment listed in Section 3.1. The daily system performance check occurs within the flat section of the SAM phantom.

A SAR measurement was performed to verify the measured SAR was within $\pm 10\%$ from the target SAR indicated in Appendix 7. These frequencies are within $\pm 10\%$ of the compliance test mid-band frequency as required in [1] and [5]. The test was conducted within 24 hours prior to the measurement of the phone. 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 \pm 0.5 cm. For frequencies above 3 GHz, the simulated tissue depth was verified to be 10 cm \pm 0.5 cm. Z-axis scans showing the SAR penetration are also included in Appendix 1.

DASY52™ Measurement System 3											
System Verification Measurements for Head SAR Measurements											
<i>f</i> (MHz)	Description	Probe	Dipole	Measured SAR (W/kg), 1 gram	Normalized SAR (W/kg), 1 gram	Dielectric Parameters				Ambient Temp (°C)	Tissue Temp (°C)
						Measured σ (S/m)	Deviation σ (%)	Measured ϵ_r	Deviation ϵ_r (%)		
1800	Measured, 15-May-2013	3124	2d190	7.51	37.55	1.41	+0.01%	36.5	-8.8%	20.5	19.8
	Recommended Limits	3124	2d190		39.3	1.40	$\pm 10\%$	40.0	$\pm 10\%$	18-25	18-25
2450	Measured, 7-May-2013	3730	740	5.58	55.8	1.899	+5.5%	37.22	-5.1%	21.3	20.1
	Recommended Limits	3730	740		52.3	1.80	$\pm 10\%$	39.2	$\pm 10\%$	18-25	18-25
	Measured, 15-May-2013	3730	740	5.37	53.7	1.78	-1.12%	36.94	-5.8%	20.5	19.8
	Recommended Limits	3730	740		52.3	1.80	$\pm 10\%$	39.2	$\pm 10\%$	18-25	18-25

DASY52™ Measurement System 3											
System Verification Measurements for Body SAR Measurements											
<i>f</i> (MHz)	Description	Probe	Dipole	Measured SAR (W/kg), 1 gram	Normalized SAR (W/kg), 1 gram	Dielectric Parameters				Ambient Temp (°C)	Tissue Temp (°C)
						Measured σ (S/m)	Deviation σ (%)	Measured ϵ_r	Deviation ϵ_r (%)		
2450	Measured, 7-May-2013	3730	740	5.39	53.9	2.13	+9.2%	50.43	-4.3%	21.6	19.3
	Recommended Limits	3730	740		49.5	1.95	$\pm 10\%$	52.7	$\pm 10\%$	18-25	18-25

6. Test Setup Information, SAR Measurement Results and Analysis

The phone was tested in the exposure configurations stipulated in [1], [4], [5] and per FCC KDB 941225 D06 for mobile hotspot operation. The phone was positioned into these configurations using the device holder supplied with the DASY52™ SAR measurement system. The default settings for the SAR scans are set in accordance with FCC KDB 865664 D01 for all area scan resolutions, zoom scan resolutions and volumes, and probe positioning. Please refer to the DASY52™ manual for additional information on SAR scanning procedures and algorithms used.

The SAR measurements were performed using the SAM and Flat phantoms listed in section **Error! Reference source not found.** The same phantoms and simulated tissues were used for the system performance checks and the device SAR measurements. Consequently the Z-axis scans included in Appendix 1 are applicable for verification of the required simulated tissue depths of 15.0 cm ± 0.5 cm for frequencies less than 3 GHz.

The SAR results shown in following tables 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 maximum device power, measured device power, temperature of the simulated tissue after the test, the measured drift and the scaled SAR. The exact method of scaling is:

$$\text{Scaled SAR} = (\text{Measured SAR}) * 10^{\left(\frac{(\text{Maximum Power}) - (\text{Measured Power})}{10}\right)} * 10^{\left(\frac{-\text{Drift}}{10}\right)}$$

The SAR reported at the end of the measurement process by the DASY52™ 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. Note that measured SAR is scaled only in the manner which results in a more conservative scaled value, i.e. to a higher SAR value as a consequence of measured power being below the maximum allowed power, or for negative drift values.

Per FCC KDB 447498 D01, area-scan based 1 g SAR estimation was used for initial testing in all combinations of device modes and exposure conditions. The DASY5 system was set to use the polynomial version of the algorithm. The maximum distance from the closest measurement point to the phantom surface was setup to be 4mm for tests < 3GHz and 2mm for tests > 3 GHz. The highest SAR measurements for each combination of device mode and exposure condition, and all conditions where the area scan estimation reported values greater than 1.2 W/kg, were further evaluated with a zoom scan and presented in the tables below. When operating conditions for the SAR system verifications did not demonstrate that the verification area scan 1 g SAR estimation resulted in values within 3% of zoom scan 1 g SAR, zoom scans were executed for all SAR tests.

The test conditions that produced the highest SAR values for each combination of DUT mode and exposure condition are indicated as **bold** numbers in the following tables. Plots of these tests are included in Appendices 2 through 4.

6.1 Head Adjacent Test Results

Left Cheek-Touch Position											
Mode	Battery/ Accessory	Channel	f (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)
802.11b, 1 Mbps	SNN5875A	6	2437.0		19.13	20.0	0.23	0.123	0.12	0.226	0.23

Table 6-1: SAR measurement results in a head-adjacent position against the ICNIRP and ANSI SAR Limit.

Right Cheek-Touch Position											
Mode	Battery/ Accessory	Channel	f (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)
802.11b, 1 Mbps	SNN5875A	6	2437.0		19.13	19.7	0.18	0.27	0.27	0.578	0.58

Table 6-2: SAR measurement results in a head-adjacent position against the ICNIRP and ANSI SAR Limit.

Left 15° Tilt Position											
Mode	Battery/ Accessory	Channel	f (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)
802.11b, 1 Mbps	SNN5875A	6	2437.0		19.13	20.1	0.06	0.0832	0.08	0.0434	0.04

Table 6-3: SAR measurement results in a head-adjacent position against the ICNIRP and ANSI SAR Limit.

Right 15° Tilt Position											
Mode	Battery/ Accessory	Channel	f (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)
802.11b, 1 Mbps	SNN5875A	6	2437.0		19.13	19.7	-0.16	0.0311	0.03	0.0717	0.07

Table 6-4: SAR measurement results in a head-adjacent position against the ICNIRP and ANSI SAR Limit.

6.2 Body Worn Test Results

Body-Worn Accessory Position, Front of Phone 25 mm from Phantom											
Mode	Battery/ Accessory	Channel	f (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)
802.11b, 1 Mbps	SNN5875A	6	2437.0		19.13	19.0	-0.14	0.0187	0.02	0.0322	0.03

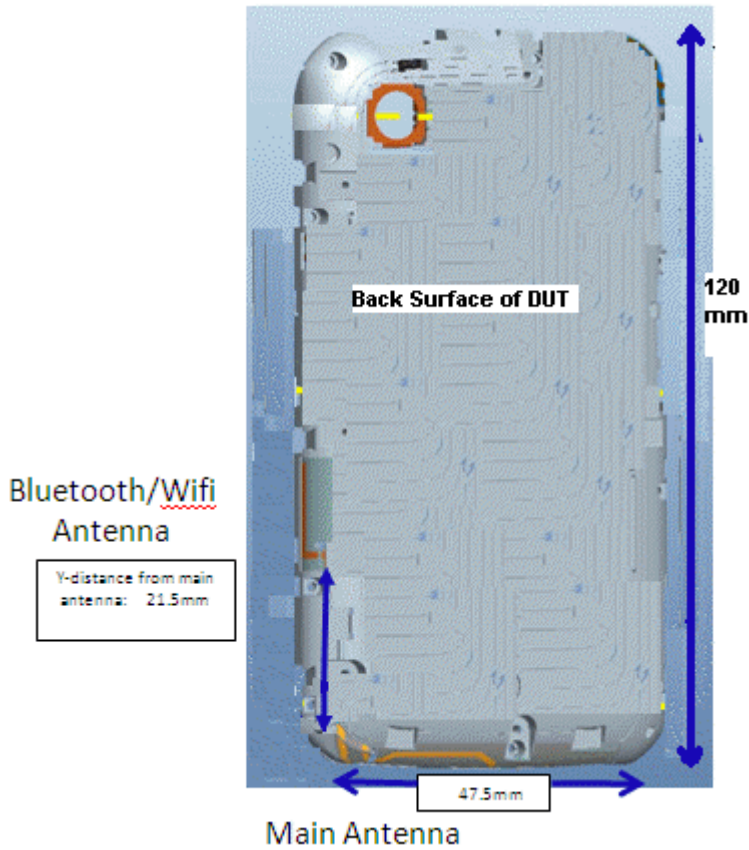
Table 6-5: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

Body-Worn Accessory Position, Back of Phone 25 mm from Phantom											
Mode	Battery/ Accessory	Channel	f (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)
802.11b, 1 Mbps	SNN5875A	6	2437.0		19.13	19.0	-0.05	0.0203	0.02	0.0338	0.03

Table 6-7: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

6.4 Mobile Hotspot Test Results

The DUT is capable of functioning as a Wi-Fi to Cellular mobile hotspot. Additional SAR testing was performed according to the test guidelines provided per FCC KDB 941225 D06. Testing was performed with a separation of 1 cm between the DUT and the “flat” phantom. The DUT was positioned for SAR tests with the front and back surfaces facing the phantom, and also with the edges facing the phantom in which the transmitting antenna is less than 2.5 cm from the edge.



Mobile Hotspot Surfaces for SAR testing						
Mode	Front	Back	Left	Right	Top	Bottom
Wi-Fi	Yes	Yes	No	Yes	No	Yes

Mobile Hotspot Position, Front of Phone 10 mm from Phantom											
Mode	Battery/ Accessory	Channel	f (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)
802.11b, 1 Mbps	SNN5875A	6	2437.0		19.13	19.0	0.04	0.0914	0.09	0.183	0.18

Table 6-8: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

Mobile Hotspot Position, Back of Phone 10 mm from Phantom											
Mode	Battery/ Accessory	Channel	f (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)
802.11b, 1 Mbps	SNN5875A	6	2437.0		19.13	19.0	-0.13	0.103	0.11	0.21	0.22

Table 6-9: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

Mobile Hotspot Position, Right Edge of Phone 10 mm from Phantom											
Mode	Battery/ Accessory	Channel	f (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)
802.11b, 1 Mbps	SNN5875A	6	2437.0		19.13	19.0	-0.02	0.128	0.13	0.263	0.26

Table 6-10: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

Mobile Hotspot Position, Bottom Edge of Phone 10 mm from Phantom											
Mode	Battery/ Accessory	Channel	f (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value	
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)
802.11b, 1 Mbps	SNN5875A	6	2437.0		19.13	19.0	0.19	0.0261	0.03	0.0474	0.05

Table 6-11: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

6.5 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/WCDMA 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 2.2 cm. Pictorial representation of the antenna locations and separation distances are given in Exhibit 7d. The Wi-Fi and the Bluetooth cannot transmit simultaneously, so there is no co-location test requirement for Wi-Fi and Bluetooth.

For the transmitters requiring stand-alone SAR testing (GSM, WCDMA 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.

Evaluations for Simultaneous SAR (Head, Body, Mobile Hotspot)									
Position	Transmitter Stand-Alone 1 g SAR Values (W/kg)					1 g SAR Summations (W/kg)			
	GSM 850	WCDMA 1700	WCDMA 1900	GSM 1900	Wi-Fi 2450 GHz	GSM 850+ Wi-Fi	WCDMA 1700+ Wi-Fi	WCDMA 1900+ Wi-Fi	GSM 1900+ Wi-Fi
Left Head Cheek	0.49	0.71	0.65	0.31	0.23	0.72	0.94	0.88	0.54
Right Head Cheek	0.46	1.07	1.23	0.45	0.58	1.04	>1.60	>1.60	1.03
Left Head 15° Tilt	0.28	0.29	0.30	0.15	0.04	0.32	0.33	0.34	0.19
Right Head 15° Tilt	0.31	0.36	0.33	0.13	0.07	0.38	0.43	0.40	0.20
Body Worn, Front of Phone 25 from Phantom	0.36	0.21	0.19	0.11	0.03	0.39	0.24	0.22	0.14
Body Worn, Back of Phone 25 from Phantom (GPRS for 1900)	0.42	0.24	0.20	0.10	0.03	0.45	0.27	0.23	0.13
Mobile Hotspot, Front of Phone 10mm from Phantom	0.21	0.34	0.27	0.09	0.18	0.39	0.52	0.45	0.27
Mobile Hotspot, Back of Phone 10mm from Phantom	0.27	0.42	0.26	0.08	0.22	0.49	0.64	0.48	0.30
Mobile Hotspot, Bottom Edge of Phone 10mm from Phantom	0.04	0.42	0.34	0.16	0.05	0.09	0.47	0.39	0.21
Mobile Hotspot, Right Edge of Phone 10mm from Phantom	0.17	0.11	0.07	0.03	0.26	0.43	0.37	0.33	0.29

For the configurations noted as requiring simultaneous SAR evaluation, combined SAR measurements were required to determine the aggregate 1 g SAR. The results of these measurements are given in the table below, with additional SAR plots of the combined measurements provided on the next page.

Additional SAR measurements for simultaneous transmission evaluation were performed for each of the single transmitters using an extended zoom scan. This extended zoom scan was created to encompass the zoom scan volumes that were found previously in each of the stand-alone transmit SAR tests.

The location of these extended zoom scans was established by using X, Y grid offsets from the "Grid Reference Point" in DASY5.2. The results were then combined via the DASY5 Multi-Band Combiner feature. A comparison can be performed between the stand-alone measurements for each noted transmitter and the measurements provided for simultaneous transmission. The measurements were not performed sequentially and thus may show slightly different results due to a number of reasons including, but not limited to, measurement system performance, slight differences in DUT positioning, or variations in simulated tissue parameters.

Measurements for Simultaneous SAR					
Cellular Mode	Wi-Fi Mode	Configuration	WCDMA Mode 1 g SAR Value (W/kg)	Wi-Fi Mode 1 g SAR Value (W/kg)	Simultaneous 1 g SAR Value (W/kg)
WCDMA 1700, 12.2 kbps RMC Ch 1413	Wi-Fi 2450 802.11b, 1 Mbps Ch 11	RH Cheek	0.95	0.56	1.36
WCDMA 1900, 12.2 kbps RMC Ch 9262	Wi-Fi 2450 802.11b, 1 Mbps Ch 11	RH Cheek	1.06	0.56	1.47

References

- [1] CENELEC, EN 62209-1:2006 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)"
- [2] CENELEC, EN 50360:2001 "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)"
- [7] IC RSS-102 "Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
- [8] IC Notice 2012-DRS1203 "RE: Applicability of Latest FCC RF Exposure KDB Procedures (Publication Date: October 24, 2012) and Other Procedures"
- [9] CENELEC, EN 62209-2:2010 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)"
- [10] FCC KDB Publication 248227 D01 v01r02 "SAR Measurement Procedures for 802.11 a/b/g Transmitters"
- [11] FCC KDB Publication 447498 D01 v05 "Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies"
- [12] FCC KDB Publication 648474 D04 v01 "SAR Evaluation Considerations for Wireless Handsets"
- [13] FCC KDB Publication 865664 D01 v01 "SAR Measurement Requirements for 100 MHz to 6 GHz"
- [14] FCC KDB Publication 865664 D02 v01 "RF Exposure Compliance Reporting and Documentation Considerations"
- [15] FCC KDB Publication 941225 D01 v02 "SAR Measurement Procedures for 3G Devices"
- [16] FCC KDB Publication 941225 D03 v01 "Recommended SAR Test Reduction Procedures for GSM/GPRS/EDGE"
- [17] FCC KDB Publication 941225 D05 v02r01 "SAR Evaluation Considerations for LTE Devices"
- [18] FCC KDB Publication 941225 D06 v01 "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities"