



**FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE STD 1528:2003**

SAR SUPPLEMENTAL EVALUATION REPORT

For

iPhone / Wi-Fi/BT BoM Variant

**MODEL: A1387
FCC ID: BCG-E2430A
IC: 579C-E2430A**

REPORT NUMBER: 11U13896-5ABoM

ISSUE DATE: OCT 01, 2011

Prepared for

**APPLE INC.
1 INFINITE LOOP
CUPERTINO, CA 95014-2084**

Prepared by

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NVLAP LAB CODE 200065-0

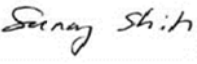
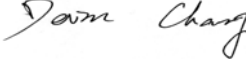
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Revision History

Version	Date	Revisions	By
	08/27/2011	Initial	Sunny Shih
A	10/01/2011	Typo Correction	Sunny Shih

1 Attestation of Test Results

Tested for:	Apple Inc. 1 Infinite Loop, Cupertino, CA 95014-2084			
EUT description:	The device is an internet and multimedia-capable phone that incorporates a number of wireless technologies, including cellular voice and data, Wi-Fi, Bluetooth, and GPS.			
Model number:	A1387 (Wi-Fi/BT BoM Variant)			
Serial Number(s) and IMEI or MEID Numbers	Serial Number(s)		IMEI or MEID Number(s)	
	<ul style="list-style-type: none"> • C39FW00BDR2Y • C39G101KDR2W • C39G801GDT4V 		<ul style="list-style-type: none"> • 99 000085 003204 8 • 99 000085 002414 4 • 99 000085 018869 1 	
Device category:	Portable	Exposure category:	General Population/Uncontrolled Exposure	
Date tested:	07/20/2011 – 08/23/2011			
Freq. Range [MHz]	BoM Variant	Test Position	Highest 1-g SAR (W/kg)	Limit (W/kg)
2412-2462	1	Head: RHS Touch	0.372	1.6
		Body: Back Side, Distance: 1cm	0.191	
		Hotspot mode: Back Side, Distance: 1cm	0.191	
2412- 2462	2	Head: RHS Touch	0.372	
		Body: Back Side, Distance: 1cm	0.162	
		Hotspot mode: Back Side, Distance: 1cm	0.162	
2412-2462	3	Head: RHS Touch	0.366	
		Body: Back Side, Distance: 1cm	0.146	
		Hotspot mode: Back Side, Distance: 1cm	0.146	
2402-2480	1	Body: Back Side, Distance: 1cm	0.055	
	2	Body: Back Side, Distance: 1cm	0.052	
	3	Body: Back Side, Distance: 1cm	0.043	
Applicable Standards				Test Results
FCC OET Bulletin 65 Supplement C 01-01, IEEE STD 1528: 2003 IC RSS 102 Issue 4				Pass
<p>Compliance Certification Services, Inc. (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.</p> <p>Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.</p>				
Approved & Released For UL CCS By:		Tested By:		
				
Sunny Shih Engineering Team Leader / UL CCS		Devin Chang EMC Engineer / UL CCS		

2 Test Methodology

These test plans were performed in accordance with FCC OET Bulletin 65 Supplement C 01-01, IEEE STD 1528: 2003, IC RSS 102 Issue 4 and the following specific FCC Test Procedures:

- KDB 648474 D01, D02 SAR Handsets Multi Transmitters and Ant, v01r05
- KDB 941225 D06 Hot Spot SAR v01
- KDB 248227 D01 SAR Measurement Procedure for 802.11 abg v01r02
- KDB Inquiry 651190

3 Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4 Description of DUT

The device is an internet and multimedia-capable phone that incorporates a number of wireless technologies, including cellular voice and data, Wi-Fi, Bluetooth, and GPS.	
Model Number:	A1387
FCC ID:	BCG-E2430A
IC ID:	579C-E2430A
Test Configurations:	<ul style="list-style-type: none"> • Held to head, • Worn on body (LCD facing up and LCD facing down) with 1cm separation distance, • Personal hot spot function with 1cm separation distance to all sides and edges.
Wi-Fi BoM Variant	<p>There are three Bill of Material variations of the Wi-Fi/Bluetooth Radio to support the production volumes of the device. The three BOM variants are:</p> <ul style="list-style-type: none"> • BOM Variant 1 • BOM Variant 2 • BOM Variant 3 <p>The Wi-Fi/BT SKUs share the same Wi-Fi/Bluetooth chipset, have the same mechanical outline (e.g., the same dimension package and pin-out layout), use the same on-board antenna matching circuit, have an identical antenna structure, and are built and tested to conform the same specifications and to operate within the same tolerances.</p> <p>In compliance with section 7c) from the FCC response to KDB 651190 on April 19, 2011, complete SAR evaluation is performed on the BOM Variant that has the highest SAR, and then, the test is repeated for the other BOM variants at the highest peak SAR value..</p>

5 Wi-Fi Mode

5.1 Output Power Verification

The measured conducted power for all the three BOM variants for each modulation mode is below.

Test Results

Band	Mode	Channel	Frequency (MHz)	BOM Variant # 1 Avg Tx Pwr (dBm)	BOM Variant # 2 Avg Tx Pwr (dBm)	BOM Variant # 3 Avg Tx Pwr (dBm)
2.4GHz	802.11b	1	2412	17.2	17.0	17.0
		6	2437	17.1	17.1	17.0
		11	2462	17.1	17.1	17.0
	802.11g	1	2412	14.0	14.0	14.0
		6	2437	17.0	17.1	17.0
		11	2462	14.0	14.0	14.0
	802.11n (HT20)	1	2412	13.5	13.5	13.5
		6	2437	17.0	17.0	17.0
		11	2462	13.5	13.5	13.5

5.2 Head SAR Configuration

Head SAR measurements for BOM Variant 1 are performed for all exposure conditions.

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	802.11b	LHS Touch	6	2437	17.1	0.133 ^{1,2}
2.4GHz	Wi-Fi/BT	802.11b	LHS Tilt	6	2437	17.1	0.105 ^{1,2}
2.4GHz	Wi-Fi/BT	802.11b	RHS Touch	6	2437	17.1	0.372^{1,2}
2.4GHz	Wi-Fi/BT	802.11b	RHS Tilt	6	2437	17.1	0.272 ^{1,2}

In compliance with section 7c) from the FCC response to KDB 651190 on April 19, 2011, the test is repeated for the other BOM variants at the highest peak SAR value.

BOM Variant 2

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	802.11b	LHS Touch	6	2437	17.1	0.132 ²
2.4GHz	Wi-Fi/BT	802.11b	RHS Touch	6	2437	17.1	0.372 ²

BOM Variant 3

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	802.11b	LHS Touch	6	2437	17.0	0.124 ²
2.4GHz	Wi-Fi/BT	802.11b	RHS Touch	6	2437	17.0	0.366 ²

5.3 Body-worn SAR Configuration

Body-worn SAR measurements for BOM Variant 1 are performed for all exposure conditions.

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	802.11b	Front side	6	2437	17.1	0.076 ^{1,2}
2.4GHz	Wi-Fi/BT	802.11b	Back side	6	2437	17.1	0.191^{1,2}

In compliance with section 7c) from the FCC response to KDB 651190 on April 19, 2011, the test is repeated for the other BOM variants at the highest peak SAR value.

BOM Variant 2

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	802.11b	Back side	6	2437	17.1	0.162 ²

BOM Variant 3

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	802.11b	Back side	6	2437	17.0	0.146 ²

Test mode reduction considerations

Note # 1: Per KDB 248227, SAR is not required for 802.11g/n (HT20) channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

Note # 2: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0dB lower than the SAR limit, testing at the low and high channels is optional for such test configuration(s).

5.4 Body-hotspot SAR Configuration

Wi-Fi/BT Antenna is located at the Top-edge; Antenna-to-bottom edge distance is more than 2.5cm. Per KDB 941225 D06 Hotspot SAR, when the Antenna-to-edge distance is greater than 2.5cm, such position does not need to be tested. Bottom-edge with 1cm separation distance is excluded from SAR evaluation.

Body-hotspot SAR measurements for BOM Variant 1 are performed for all exposure conditions.

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	802.11b	Front side	6	2437	17.1	0.076 ^{1,2}
2.4GHz	Wi-Fi/BT	802.11b	Back side	6	2437	17.1	0.191^{1,2}
2.4GHz	Wi-Fi/BT	802.11b	Right edge	6	2437	17.1	0.015 ^{1,2}
2.4GHz	Wi-Fi/BT	802.11b	Left edge	6	2437	17.1	0.141 ^{1,2}
2.4GHz	Wi-Fi/BT	802.11b	Top edge	6	2437	17.1	0.058 ^{1,2}

In compliance with section 7c) from the FCC response to KDB 651190 on April 19, 2011, the test is repeated for the other BOM variants at the highest peak SAR value.

BOM Variant 2

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	802.11b	Back side	6	2437	17.1	0.162 ²

BOM Variant 3

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	802.11b	Back side	6	2437	17.0	0.146 ²

Test mode reduction considerations

Note # 1: Per KDB 248227, SAR is not required for 802.11g /n (HT20) channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

Note # 2: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0dB lower than the SAR limit, testing at the low and high channels is optional for such test configuration(s).

6 Bluetooth Mode

Standalone Bluetooth SAR in head exposure conditions is not evaluated because there is no use-case for this configuration.

Standalone Bluetooth SAR in body-worn accessory exposure conditions is evaluated.

Standalone Bluetooth SAR in wireless router (hotspot exposure condition is not evaluated because Bluetooth and Wi-Fi time-share the same antenna and cannot transmit simultaneously.

6.1 Output Power Verification

The measured conducted power for all the three BOM variants for each modulation mode is below.

Test Results

Band	Mode	Channel	Frequency (MHz)	BOM Variant # 1 Avg Tx Pwr (dBm)	BOM Variant # 2 Avg Tx Pwr (dBm)	BOM Variant # 3 Avg Tx Pwr (dBm)
2.4GHz	EDR, GFSK	0	2402	13.5	12.45	13.1
		39	2441	13.7	13.0	13.3
		78	2480	13.7	12.45	13.4
	EDR, $\pi/4$ DQPSK	0	2402	11.7	11.15	11.65
		39	2441	11.8	11.6	11.65
		78	2480	11.7	11.15	11.5
	EDR, 8-DPSK	0	2402	12.0	11.05	11.65
		39	2441	12.0	11.5	11.8
		78	2480	11.7	10.75	11.55
	LE, GFSK	0	2402	9.4	8.7	9.4
		39	2441	9.9	9.4	9.4
		78	2480	9.9	9.1	9.5

6.2 Body-worn Accessory SAR Configuration

Body-worn SAR measurements for BOM Variant 1 are performed for all exposure conditions.

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	Bluetooth	Front side	39	2441	13.7	0.024 ¹
2.4GHz	Wi-Fi/BT	Bluetooth	Back side	39	2441	13.7	0.055 ¹

In compliance with section 7c) from the FCC response to KDB 651190 on April 19, 2011, the test is repeated for the other BOM variants at the highest peak SAR value.

BOM Variant 2

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	Bluetooth	Back side	39	2441	13.0	0.052 ¹

BOM Variant 3

Band	Antenna	Mode	Test Position	Ch #	Freq. (MHz)	Power (dBm)	SAR (W/Kg) 1-g
2.4GHz	Wi-Fi/BT	Bluetooth	Back side	39	2441	13.3	0.043 ¹

Test mode reduction considerations

Note # 1: Per FCC/OET Bulletin 65 Supplement C (June 2001) and Public Notice DA-02-1438, if the SAR measured at the middle channel for each test configuration is at least 3.0dB lower than the SAR limit, testing at the low and high channels is optional for such test configuration(s).

7 Highest SAR Test Plots

Worst-case HEAD SAR Plot for Part 15 – 2400MHz Band

Date/Time: 7/25/2011 4:50:56 PM

Test Laboratory: UL CCS SAR Lab D

Wi-Fi_Right Hand Side_Wi-Fi_BOM_Variant_1

DUT: Apple; Type: N/A; Serial: N/A

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.73$ mho/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³
Phantom section: Right Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(6.69, 6.69, 6.69); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM B (Twin); Type: SAM B; Serial: TP-105
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Touch_M-ch/Area Scan (61x101x1): Measurement grid: dx=15mm, dy=15mm[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.577 mW/g

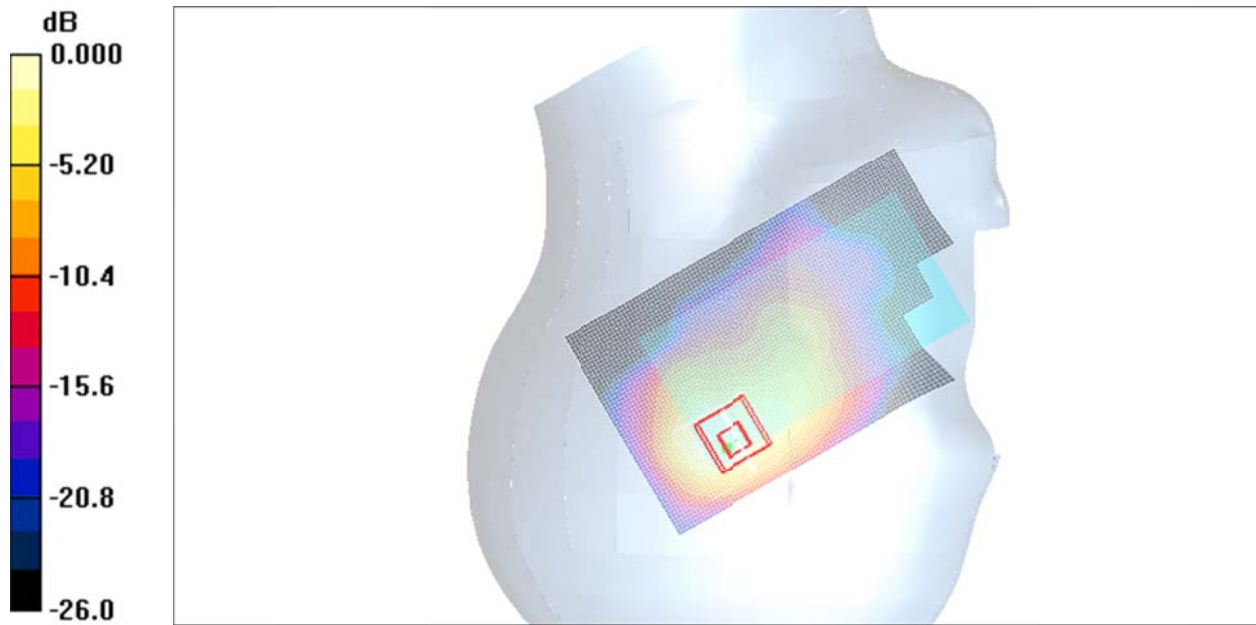
Touch_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 15.3 V/m; Power Drift = 0.047 dB

Peak SAR (extrapolated) = 0.809 W/kg

SAR(1 g) = 0.372 mW/g; SAR(10 g) = 0.176 mW/g[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.525 mW/g



Date/Time: 7/25/2011 5:10:32 PM

Test Laboratory: UL CCS SAR Lab D

Wi-Fi_Right Hand Side_Wi-Fi_BOM_Variant_1

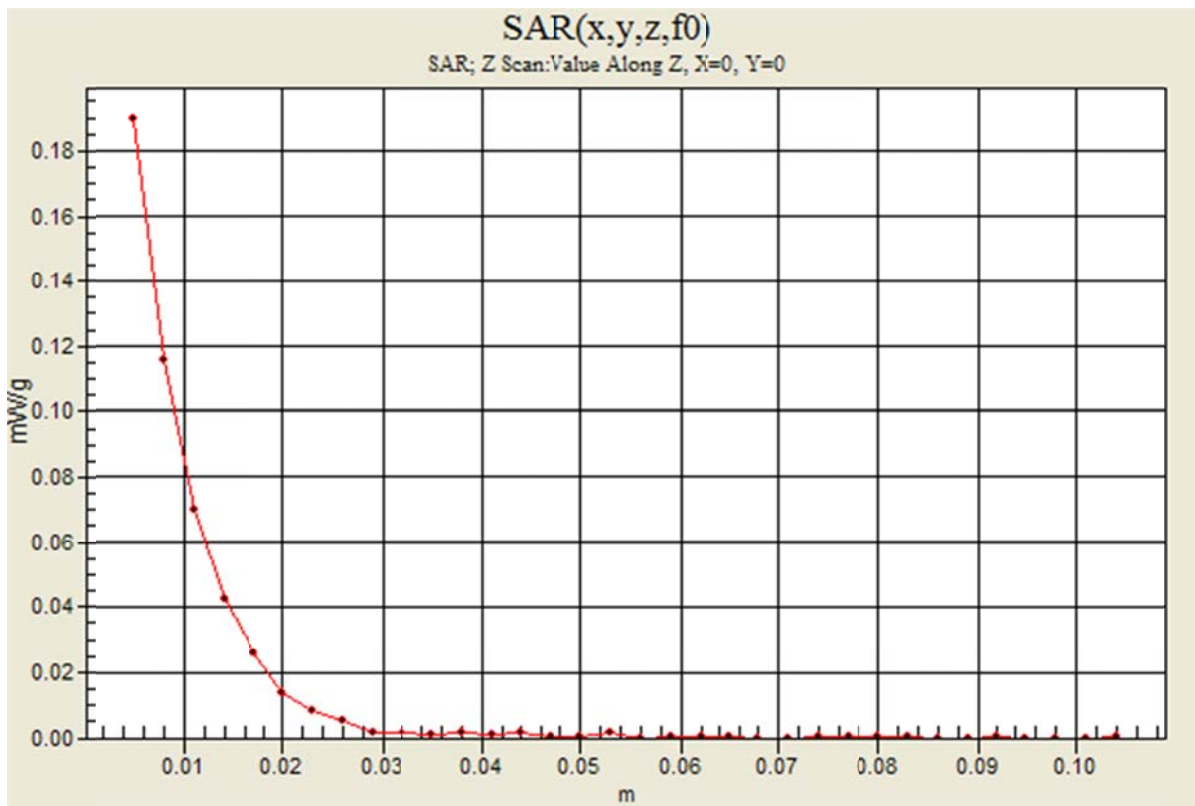
DUT: Apple; Type: N/A; Serial: N/A

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz;Duty Cycle: 1:1

Touch_M-ch/Z Scan (1x1x34): Measurement grid: dx=20mm, dy=20mm, dz=3mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.190 mW/g



Worst-case Body-worn accessory SAR Plot for Part 15 – 2400MHz Band

Date/Time: 7/28/2011 5:17:57 PM

Test Laboratory: UL CCS SAR Lab D

Wi-Fi_Body_Wi-Fi_BOM_Variant_1

DUT: Apple; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 50.6$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(6.9, 6.9, 6.9); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM B (Twin); Type: SAM B; Serial: TP-105
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back side_M-ch/Area Scan (71x91x1): Measurement grid: dx=15mm, dy=15mm[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.304 mW/g

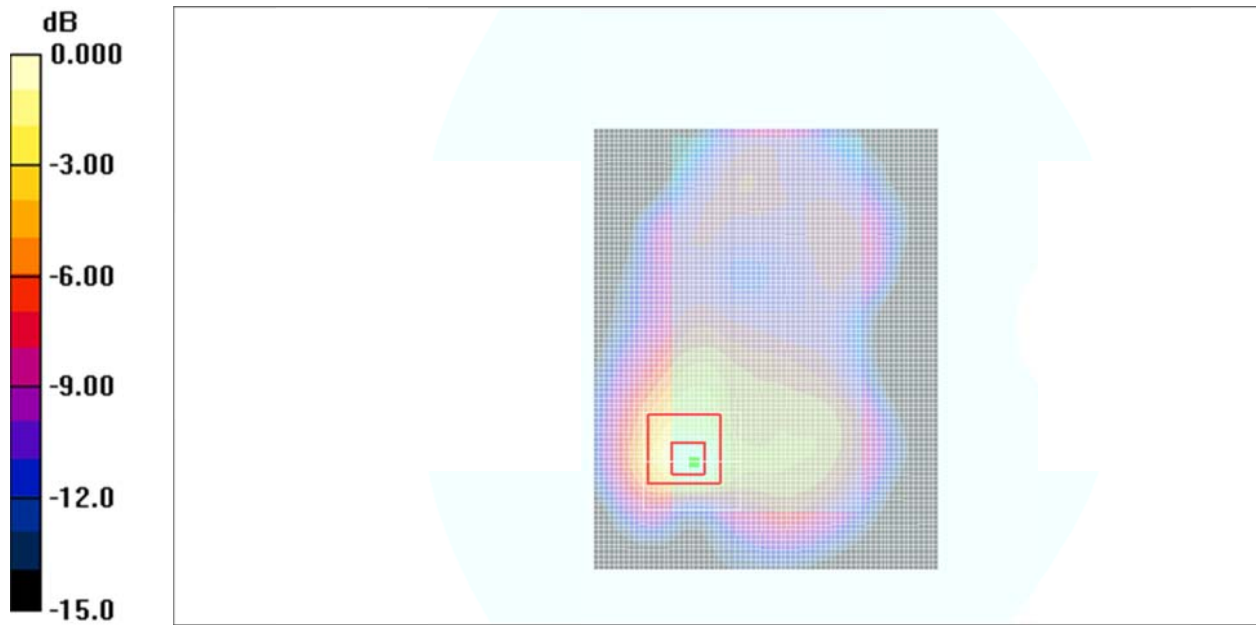
Back side_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 11.5 V/m; Power Drift = -0.014 dB

Peak SAR (extrapolated) = 0.431 W/kg

SAR(1 g) = 0.191 mW/g; SAR(10 g) = 0.085 mW/g[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.273 mW/g



0 dB = 0.273mW/g

Date/Time: 7/28/2011 5:39:49 PM

Test Laboratory: UL CCS SAR Lab D

Wi-Fi_Body_Wi-Fi_BOM_Variant_1

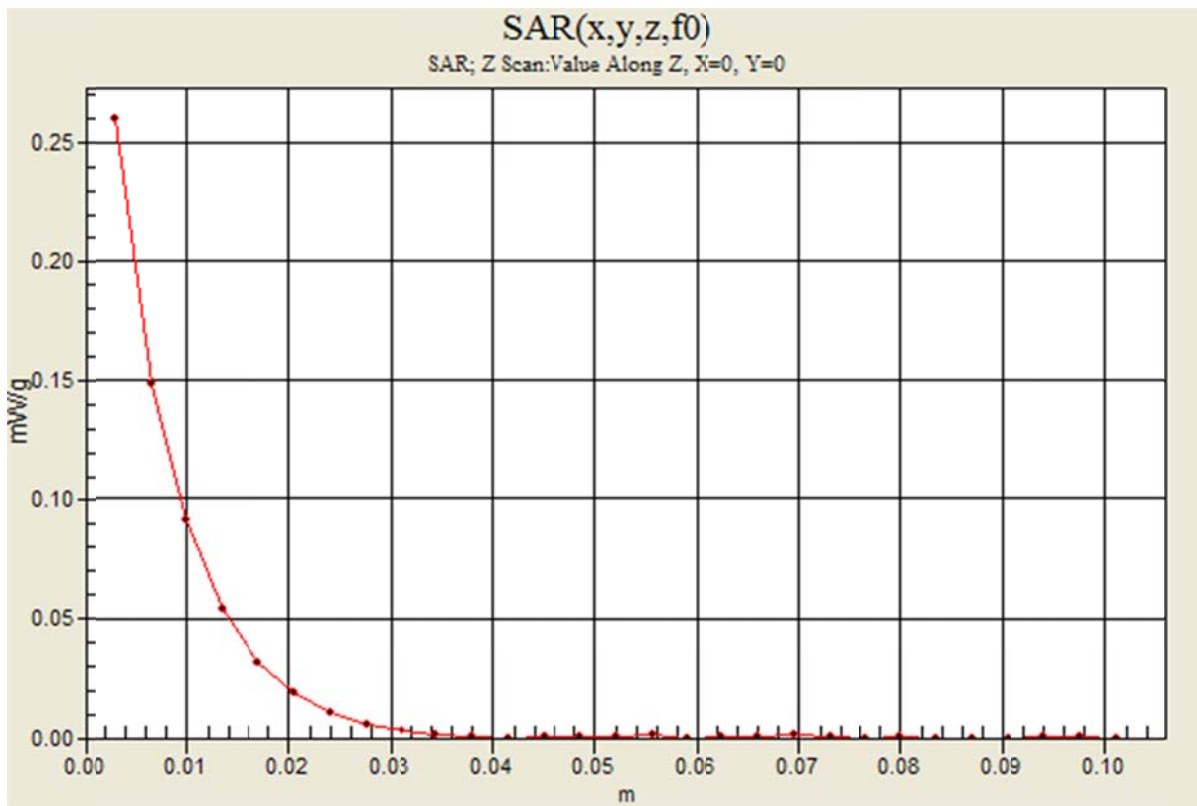
DUT: Apple; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Back side_M-ch/Z Scan (1x1x29): Measurement grid: dx=20mm, dy=20mm, dz=3.5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.260 mW/g



Worst-case Wireless Router (hotspot) SAR Plot for Part 15 – 2400MHz Band

Date/Time: 7/28/2011 5:17:57 PM

Test Laboratory: UL CCS SAR Lab D

Wi-Fi_Body_Wi-Fi_BOM_Variant_1

DUT: Apple; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 50.6$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3749; ConvF(6.9, 6.9, 6.9); Calibrated: 12/13/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1259; Calibrated: 5/3/2011
- Phantom: SAM B (Twin); Type: SAM B; Serial: TP-105
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back side_M-ch/Area Scan (71x91x1): Measurement grid: dx=15mm, dy=15mm[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (interpolated) = 0.304 mW/g

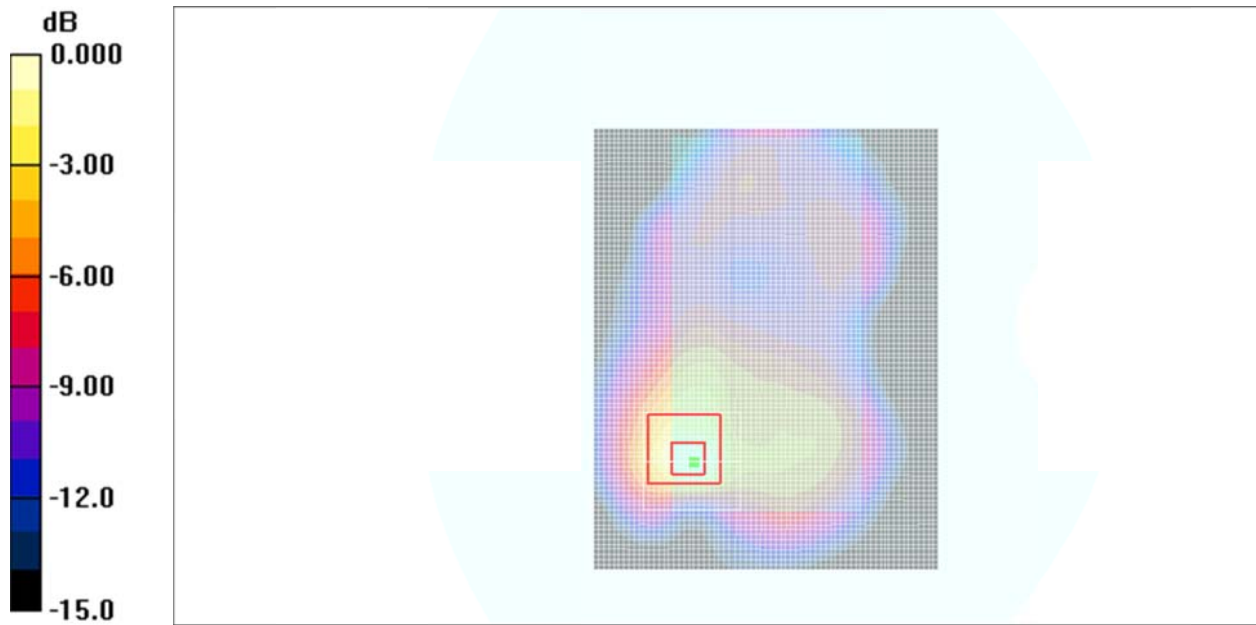
Back side_M-ch/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 11.5 V/m; Power Drift = -0.014 dB

Peak SAR (extrapolated) = 0.431 W/kg

SAR(1 g) = 0.191 mW/g; SAR(10 g) = 0.085 mW/g[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.273 mW/g



0 dB = 0.273mW/g

Date/Time: 7/28/2011 5:39:49 PM

Test Laboratory: UL CCS SAR Lab D

Wi-Fi_Body_Wi-Fi_BOM_Variant_1

DUT: Apple; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1

Back side_M-ch/Z Scan (1x1x29): Measurement grid: dx=20mm, dy=20mm, dz=3.5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.260 mW/g

