



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

(Class II Permissive Change)

SAR EVALUATION REPORT

**For
802.11g / 802.11n WLAN + Bluetooth PCI-E Minicard
(Tested inside of HP Notebook PC, Model TPN-C107)**

**Model: BCM94313HMGB
FCC ID: QDS-BRCM1051I**

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Revision History



<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	04/02/2012	Initial Issue	--
A	04/16/2012	Updated average power and SAR test results to include data rate. Included note in section 9 justifying data rate selection.	Dave Weaver

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1. Attestation of Test Results

Applicant	Broadcom Corporation		
DUT description	802.11g / 802.11n WLAN + Bluetooth PCI-E Minicard (Tested inside of HP Notebook PC, Model TPN-C107)		
Model	BCM94313HMGB		
Test device is	An identical prototype		
Device category	Portable		
Exposure category	General Population/Uncontrolled Exposure		
Date tested	03/20/2012		
FCC Rule Parts	Freq. Range	Highest 1-g SAR	Limit
15.247	2412 - 2472 MHz	0.104 W/kg	1.6 W/kg
Applicable Standards			Test Results
FCC OET Bulletin 65 Supplement C 01-01, IEEE Std 1528:2003			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:	
			
Dave Weaver Staff Engineer Compliance Certification Services (UL CCS)		Elijah Garcia SAR Engineer Compliance Certification Services (UL CCS)	

2. Test Methodology

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C Edition 01-01, IEEE STD 1528:2003 and the following KDB Procedures.

- 248227 SAR measurement procedures for 802.11a/b/g transmitters
- 447498 D01 Mobile Portable RF Exposure v04
- 616217 D03 SAR Supp Note and Netbook Laptop V01

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. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
Dielectronic Probe kit	HP	85070C	N/A	N/A		
Base Station Simulator	Agilent	8960	GB46160222	6	17	2012
Base Station Simulator	R & S	CMU 200	106291	6	24	2012
Base Station Simulator	Anritsu	MT8820C	6200985430	6	17	2012
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	2	11	2013
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV3	3531	12	19	2012
Thermometer	ERTCO	639-1S	1718	7	19	2012
Data Acquisition Electronics	SPEAG	DAE4	1259	2	13	2013
System Validation Dipole	SPEAG	D2450V2	748	2	7	2013
Power Meter	HP	437B	3125U16345	5	13	2012
Power Sensor	HP	8481A	2702A60780	5	13	2012
Amplifier	MITEQ	4D00400600-50-30P	1620606	N/A		
Directional coupler	Werlatone	C8060-102	2141	N/A		

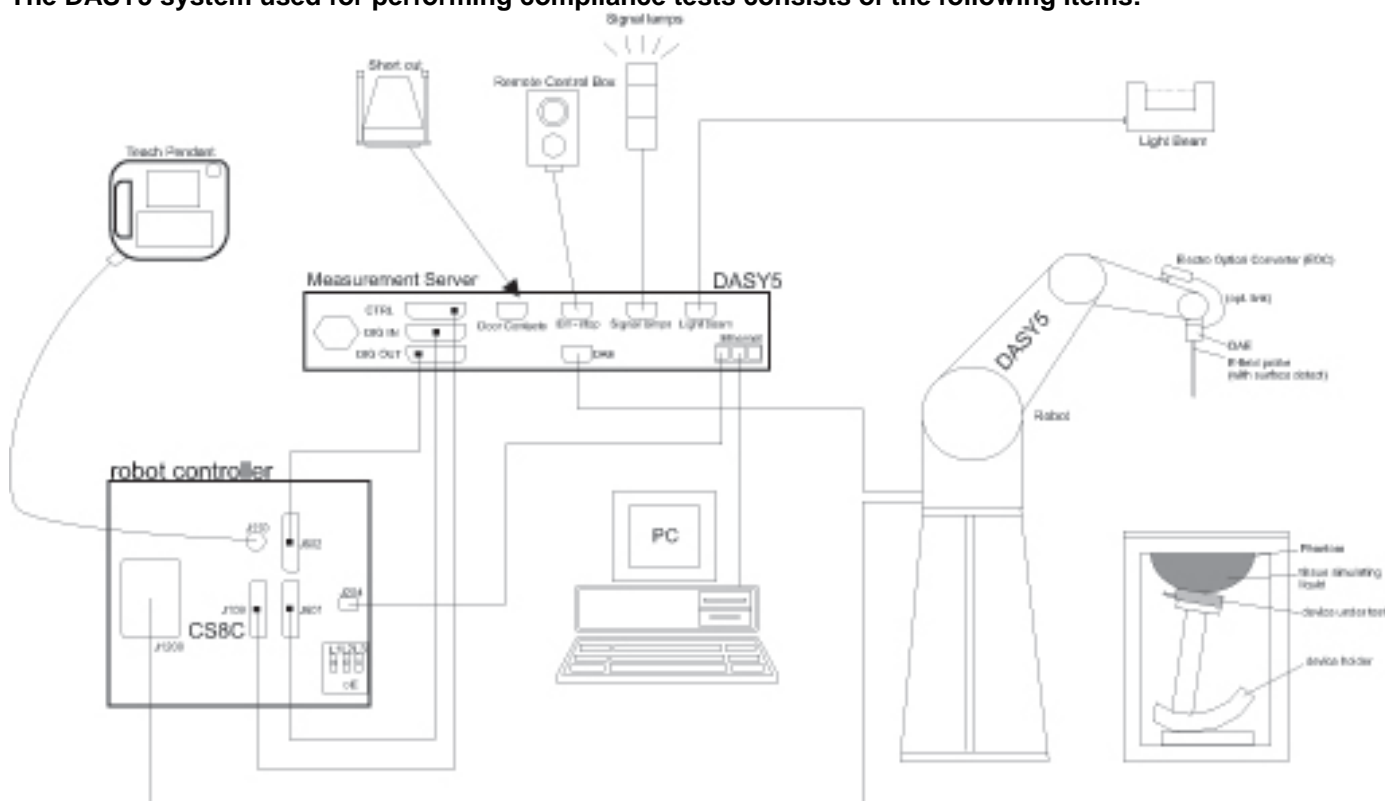
4.2. Measurement Uncertainty

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

Component	Error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	6.00	Normal	1	1	6.00
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Conditions - Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Conditions - Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner Mechanical Tolerance	0.40	Rectangular	1.732	1	0.23
Probe Positioning with respect to Phantom	2.90	Rectangular	1.732	1	1.67
Extrapolation, Interpolation and Integration	1.00	Rectangular	1.732	1	0.58
Test Sample Related					
Test Sample Positioning	2.90	Normal	1	1	2.90
Device Holder Uncertainty	3.60	Normal	1	1	3.60
Output Power Variation - SAR Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness)	4.00	Rectangular	1.732	1	2.31
Liquid Conductivity - deviation from target	5.00	Rectangular	1.732	0.64	1.85
Liquid Conductivity - measurement	4.65	Normal	1	0.64	2.98
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty	-2.83	Normal	1	0.6	-1.70
Combined Standard Uncertainty $U_c(y) =$					10.33
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				20.65 %	
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.63 dB	

5. Measurement System Description and Setup

The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

6. SAR Measurement Procedures

6.1. Normal SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures $\geq 7 \times 7 \times 9$ (above 4.5 GHz) or $5 \times 5 \times 7$ (below 3 GHz) points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation, the extrapolated distance should not be larger than the step size in Z-direction.

6.2. Volume Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures $\geq 7 \times 7 \times 9$ (above 4.5 GHz) or $5 \times 5 \times 7$ (below 3 GHz) points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Step 4: Volume Scan

Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

Step 5: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

7. Device Under Test

802.11g / 802.11n WLAN + Bluetooth PCI-E Minicard (Tested inside of HP Notebook PC, Model TPN-C107)			
Normal operation	Laptop mode (notebook)		
Antenna tested	<u>Manufacturer</u>	<u>Part number</u>	<u>Ant Gain (dBi)</u>
	<input type="checkbox"/> WNC	Main/Tx1: DC330014C10	-2.04
		Aux/Tx2: DC330014C00	-2.58
	<input checked="" type="checkbox"/> WHAYU	Main/Tx1: C435-520153-A	-0.60
		Aux/Tx2: C435-520152-A	1.41
	<input type="checkbox"/> SMA	Main/Tx1: SE-ECC50-002	-1.17
		Aux/Tx2: SE-ECC50-001	0.45
Note: The manufacturer with the highest antenna gain was selected for SAR testing.			

7.1. Band and Air Interfaces

Tx Frequency Bands	<ul style="list-style-type: none"> - 802.11b/g/n: 2412 - 2472 MHz, HT20 - Bluetooth: 2402 - 2480 MHz
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7.2. Simultaneous Transmission

Simultaneous transmission	WiFi 2.4 GHz cannot transmit simultaneously with BT
Assessment for SAR evaluation for Simultaneous transmission	N/A

8. Summary of Test Configurations

Test Configuration	Antenna-to-edge/surface	SAR Required	Note
Lap-held with display open at 90° to the keyboard	13.1 mm from Main/Tx1-to-user	Yes	
Lap-held with display open at 90° to the keyboard	13.1 mm from Aux/Tx2-to-user	Yes	

9. RF Output Power Verification

9.1. WiFi (802.11bgn)

Mode	Ch. #	Data Rate Mb/s	Freq. (MHz)	Original Target Pwr (dBm)		Measured Pwr (dBm)	
				Main/Tx1	Aux/Tx2	Main/Tx1	Aux/Tx2
802.11b	1	1	2412	16.04		16.10	
	6	1	2437	16.24		16.30	
	11	1	2462			16.20	
	13	1	2472	11.00		11.10	
802.11g	1	6	2412		16.10		16.10
	6	6	2437		16.14		16.15
	11	6	2462				16.14
	13	6	2472		11.03		11.10
802.11n HT20	1	6	2412		16.10		16.10
	6	6	2437		16.14		16.14
	13	6	2472		11.03		11.05

Note(s):

- The worst case data rates were based upon those given in CCS test report 10U13391-1. Refer to the original report (FCC ID: BCM941313HMBG).
- 802.11b doesn't operate for Aux antenna. Thus, 802.11g is performed for Aux antenna instead.

9.1. Bluetooth

Bluetooth's max average power is 2.79 mW [$<60/f(\text{GHz})$ mW].

10. Tissue Dielectric Properties

IEEE Std 1528-2003 Table 2

Target Frequency (MHz)	Head	
	ϵ_r	σ (S/m)
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
1450	40.5	1.20
1800 – 2000	40.0	1.40
2450	39.2	1.80
2600	39.0	1.96
3000	38.5	2.40

FCC OET Bulletin 65 Supplement C 01-01

Target Frequency (MHz)	Head		Body	
	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.8
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.9	55.2	0.97
900	41.5	0.97	55	1.05
915	41.5	0.98	55	1.06
1450	40.5	1.2	54	1.3
1610	40.3	1.29	53.8	1.4
1800 – 2000	40	1.4	53.3	1.52
2450	39.2	1.8	52.7	1.95
3000	38.5	2.4	52	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

10.1. Composition of Ingredients for the Tissue Material used in the SAR Tests

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized, 16 MΩ+ resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

10.2. Tissue Dielectric Parameter Check Results

Tissue dielectric parameters measured at the low, middle and high frequency of each operating frequency range of the test device.

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit \pm (%)
03/20/2012	Body 2450	e'	51.2754	Relative Permittivity (ϵ_r):	51.28	52.70	-2.70	5
		e"	14.9795	Conductivity (σ):	2.04	1.95	4.65	5
	Body 2410	e'	51.3970	Relative Permittivity (ϵ_r):	51.40	52.76	-2.58	5
		e"	14.8126	Conductivity (σ):	1.98	1.91	4.06	5
	Body 2435	e'	51.3226	Relative Permittivity (ϵ_r):	51.32	52.73	-2.66	5
		e"	14.9190	Conductivity (σ):	2.02	1.93	4.60	5
	Body 2475	e'	51.1792	Relative Permittivity (ϵ_r):	51.18	52.67	-2.83	5
		e"	15.0852	Conductivity (σ):	2.08	1.99	4.58	5

11. System Performance Check

The system performance check is performed prior to any usage of the system in order to verify SAR system measurement accuracy. The system performance check verifies that the system operates within its specifications of $\pm 10\%$.

11.1. System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ± 0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube.
- Distance between probe sensors and phantom surface was set to 3 mm.
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

11.2. Reference SAR Values for System Performance Check

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	SAR Measured (mW/g)		
				1g/10g	Head	Body
D2450V2	748	2/7/2012	2450	1g	53.60	50.80
				10g	24.80	23.64

11.3. System Performance Check Results

Date Tested	System dipole		Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
3/20/2012	Body	D2450V2 SN: 748	1g SAR	52.6	50.80	3.54	± 10
			10g SAR	24.2	23.64	2.37	

11.4. System Performance Check Plots

Test Laboratory: UL CCS SAR Lab B Date: 3/20/2012

20120320_SystemPerformanceCheck-D2450V2 SN 748

Frequency: 2450 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.024$ mho/m; $\epsilon_r = 50.812$; $\rho = 1000$ kg/m³

DASY5 Configuration:

- Electronics: DAE4 Sn1259; Calibrated: 2/13/2012
- Probe: EX3DV3 - SN3531; ConvF(7.44, 7.44, 7.44); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1118

Body/Pin=100 mW/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 5.063 mW/g

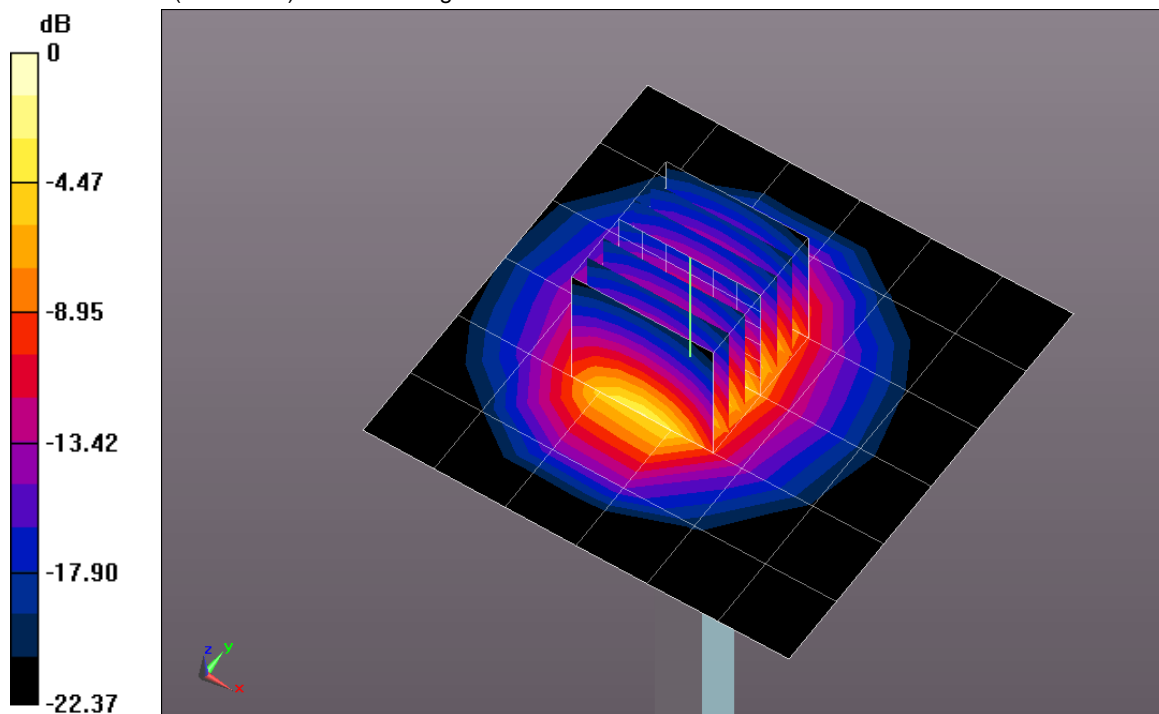
Body/Pin=100 mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.915 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 11.1360

SAR(1 g) = 5.26 mW/g; SAR(10 g) = 2.42 mW/g

Maximum value of SAR (measured) = 7.515 mW/g



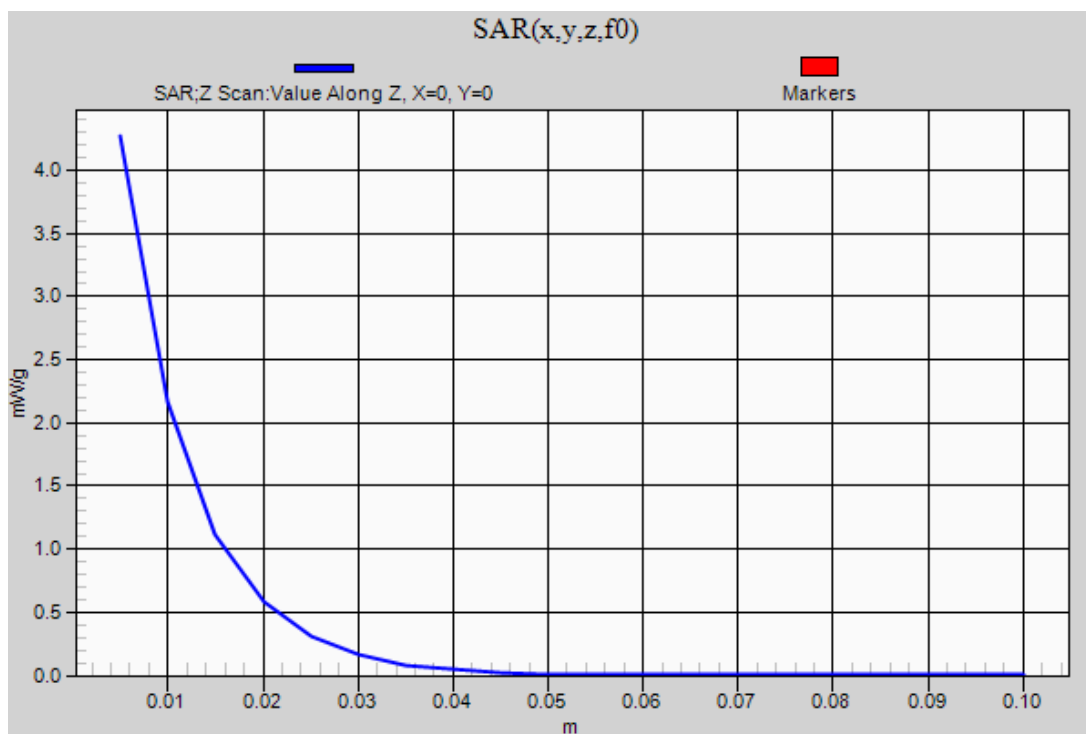
0 dB = 7.520mW/g = 17.52 dB mW/g

Test Laboratory: UL CCS SAR Lab B Date: 3/20/2012

20120320_SystemPerformanceCheck-D2450V2 SN 748

Frequency: 2450 MHz; Duty Cycle: 1:1

Body/Pin=100 mW/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 4.270 mW/g



12. SAR Test Results

12.1. WiFi (802.11bgn)

Test Reduction Consideration

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 as per KDB 248227.

Laptop - Lap-held (with the display open at 90° to the keyboard)

Band	Mode	Ch. #	Freq. (MHz)	Data Rate Mb/s	Avg. Output Power (dBm)		SAR (W/kg)		Note
					Main/Tx1	Aux/Tx2	Main/Tx1	Aux/Tx2	
2.4GHz	802.11b	1	2412	1	16.10				
		6	2437	1	16.30		0.064		1
		11	2462	1	16.20				
		13	2472	1	11.10				1
	802.11g	1	2412	6		16.10			
		6	2437	6		16.15		0.104	1
		11	2462	6		16.14			
		13	2472	6		11.10			1

Note(s):

- For frequency bands with an operating range of < 100 MHz, when the SAR for the highest output power channel within is ≤ 0.8 W/kg, SAR for the remaining channels is not required. Per KDB 447498 1) e) i)
- 802.11b doesn't operate for Aux antenna. Thus, 802.11g is performed for Aux antenna instead.

13. SAR Test Plots

Test Laboratory: UL CCS SAR Lab B Date: 3/21/2012

WiFi 2.4GHz

Frequency: 2412 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.971$ mho/m; $\epsilon_r = 50.943$; $\rho = 1000$ kg/m³

DASY5 Configuration:

- Electronics: DAE4 Sn1259; Calibrated: 2/13/2012
- Probe: EX3DV3 - SN3531; ConvF(7.44, 7.44, 7.44); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1118

Lap-Held/802.11b_CH 6_Main_Tx1/Area Scan (14x25x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.080 mW/g

Lap-Held/802.11b_CH 6_Main_Tx1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.500 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.1290

SAR(1 g) = 0.064 mW/g; SAR(10 g) = 0.032 mW/g

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

Maximum value of SAR (measured) = 0.086 mW/g

Lap-Held/802.11b_CH 6_Main_Tx1/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm

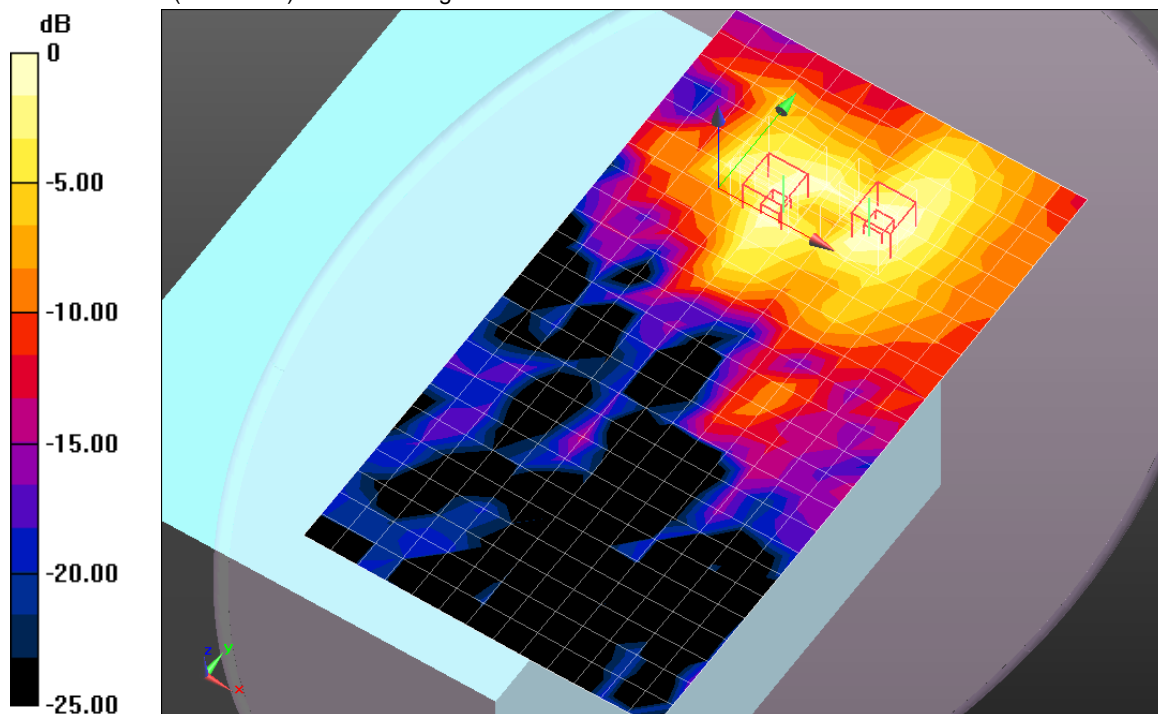
Reference Value = 5.500 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.1080

SAR(1 g) = 0.052 mW/g; SAR(10 g) = 0.025 mW/g

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

Maximum value of SAR (measured) = 0.067 mW/g



Test Laboratory: UL CCS SAR Lab B Date: 3/21/2012

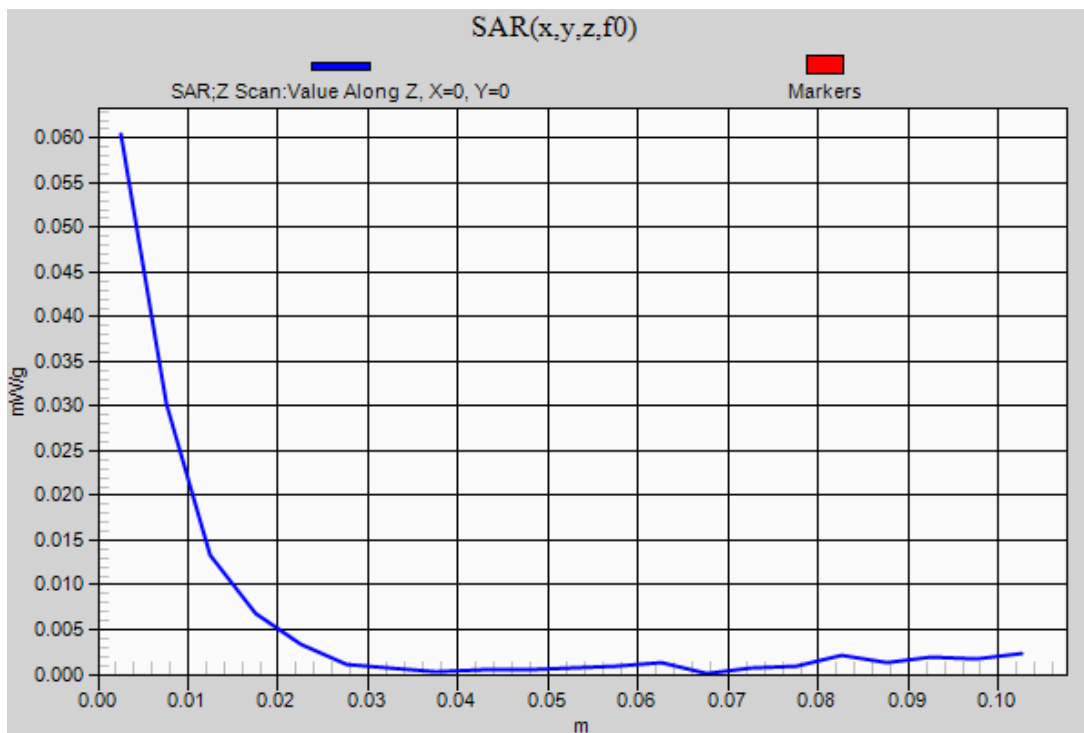
WiFi 2.4GHz

Frequency: 2412 MHz; Duty Cycle: 1:1

Lap-Held/802.11b_CH 6_Main_Tx1/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

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

Maximum value of SAR (measured) = 0.060 mW/g



Test Laboratory: UL CCS SAR Lab B Date: 3/21/2012

WiFi 2.4GHz

Frequency: 2437 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 24.0°C; Liquid Temperature: 23.0°C
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2.005$ mho/m; $\epsilon_r = 50.856$; $\rho = 1000$ kg/m³

DASY5 Configuration:

- Electronics: DAE4 Sn1259; Calibrated: 2/13/2012
- Probe: EX3DV3 - SN3531; ConvF(7.44, 7.44, 7.44); Calibrated: 12/19/2011
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: ELI v5.0 (B); Type: QDOVA001BB; Serial: 1118

Lap-Held/802.11g_CH 6_Aux_Tx2/Area Scan (14x25x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.130 mW/g

Lap-Held/802.11g_CH 6_Aux_Tx2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

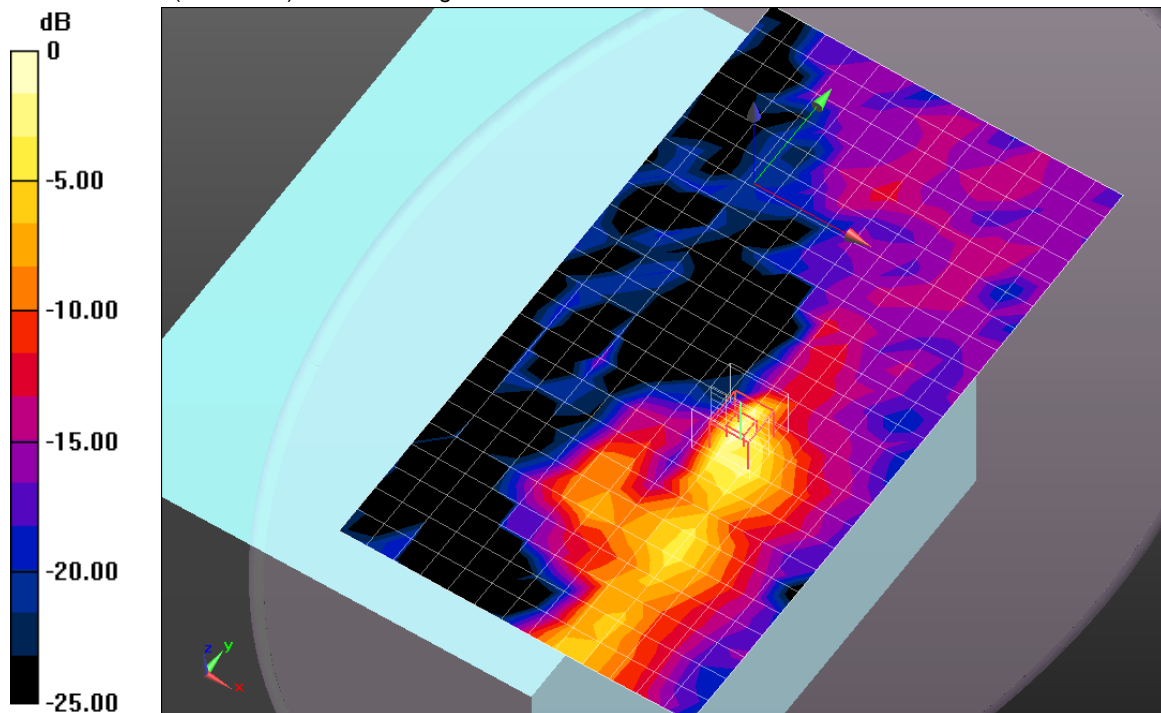
Reference Value = 8.175 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.2370

SAR(1 g) = 0.104 mW/g; SAR(10 g) = 0.047 mW/g

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

Maximum value of SAR (measured) = 0.139 mW/g



0 dB = 0.140mW/g = -17.08 dB mW/g

Test Laboratory: UL CCS SAR Lab B Date: 3/21/2012

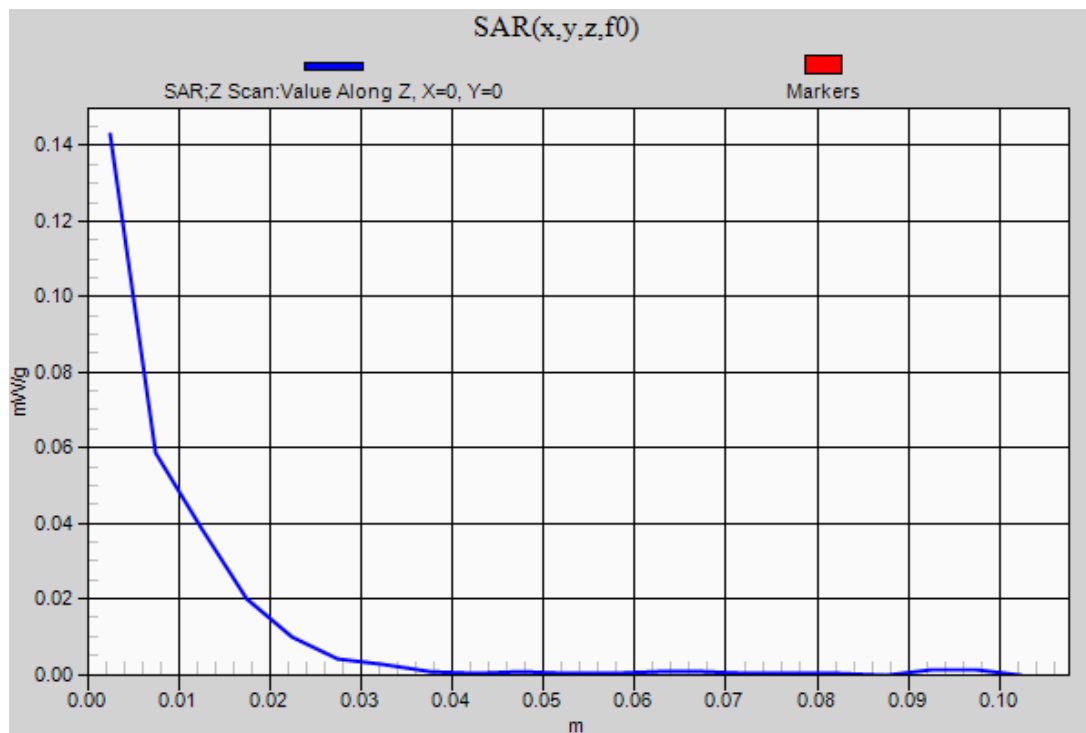
WiFi 2.4GHz

Frequency: 2437 MHz; Duty Cycle: 1:1

Lap-Held/802.11g_CH 6_Aux_Tx2/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

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

Maximum value of SAR (measured) = 0.143 mW/g



14. Simultaneous Transmission SAR Analysis

WiFi and BT cannot transmit simultaneously; therefore, SAR evaluation for simultaneous transmission is not required.

15. Appendixes

Refer to separated files for the following appendixes.

- 15.1. Calibration Certificate for E-Field Probe EX3DV3 SN 3531**
- 15.2. Calibration Certificate for D2450V2 SN: 748**