



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

SAR EVALUATION REPORT

**For
PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card
(Tested inside of Samsung Notebook PC, Model NP535U3C)**

**Model: AR5B22
FCC ID: PPD-AR5B22
IC Certification ID: 4104A-AR5B22**

**Report Number: 12I14416-1-A
Issue Date: 5/30/2012**

Prepared for
**Qualcomm Atheros, Inc.
1700 Technology Drive
San Jose, CA 95110, USA**

Prepared by
**COMPLIANCE CERTIFICATION SERVICES (UL CCS)
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	5/21/2012	Initial Issue	--
A	5/30/2012	Updated antenna photographs and corrected chain A and B designations	Dave Weaver

Table of Contents

1. Attestation of Test Results	5
2. Test Methodology	6
3. Facilities and Accreditation	6
4. Calibration and Uncertainty	7
4.1. <i>Measuring Instrument Calibration.....</i>	<i>7</i>
4.2. <i>Measurement Uncertainty.....</i>	<i>8</i>
5. Measurement System Description and Setup.....	9
6. SAR Measurement Procedures	10
6.1. <i>Normal SAR measurement procedure.....</i>	<i>10</i>
7. Device Under Test	11
8. RF Output Power Verification	12
8.1. <i>WiFi (2.4GHz Band).....</i>	<i>13</i>
8.2. <i>WiFi (5GHz Bands).....</i>	<i>14</i>
9. Summary of Test Configurations	19
10. Tissue Dielectric Property.....	20
10.1. <i>Composition of ingredients for the tissue material used in the SAR tests.....</i>	<i>21</i>
10.2. <i>Tissue dielectric parameters check results</i>	<i>22</i>
11. System Performance Check.....	24
11.1. <i>System performance check measurement conditions</i>	<i>24</i>
11.2. <i>Reference SAR values for system performance check.....</i>	<i>24</i>
11.3. <i>System performance check results</i>	<i>24</i>
12. SAR Test Results	25
12.1. <i>WiFi (2.4GHz Band)</i>	<i>25</i>
12.2. <i>WiFi (5GHz Bands)</i>	<i>26</i>
13. Summary of Highest 1g SAR.....	27
14. Worst-case SAR Plots.....	28
15. Appendixes	48
15.1. <i>System Check Plots</i>	<i>48</i>
15.2. <i>SAR Test Plots for 2.4GHz</i>	<i>48</i>
15.3. <i>SAR Test Plots for 5GHz Bands</i>	<i>48</i>
15.4. <i>Calibration certificate for E-Field Probe EX3DV4 SN 3749.....</i>	<i>48</i>

15.5.	Calibration certificate for D2450V2 SN: 748	48
15.6.	Calibration certificate for D5GHzV2 SN 1075	48
16.	Host Device Photo	49
17.	Antenna Locations & Separation Distances.....	50
18.	Setup Photos	51

1. Attestation of Test Results

Applicant	Qualcomm Atheros, Inc.		
EUT description	PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card		
Model numbers	AR5B22		
Test device is	A production unit		
Device category	Portable devices		
Exposure category	General Population/Uncontrolled Exposure		
Date tested	5/3/2012 – 5/9/2012		
FCC Rule Parts	Freq. Range	Highest 1-g SAR	Limit
15.247	2412-2462 MHz	0.708W/kg (Lap-Held)	1.6 W/kg
15.407	5150-5250 MHz	0.371W/kg (Lap-Held)	
	5250-5350 MHz	1.170W/kg (Lap-Held)	
	5500-5700 MHz	0.795W/kg (Lap-Held)	
15.247	5725-5850 MHz	0.655W/kg (Lap-Held)	
Applicable Standards			Test Results
FCC OET Bulletin 65 Supplement C 01-01, IEEE Std 1528-2003			Pass
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. 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. Approved & Released For UL CCS By:  Tested By: 			
Dave Weaver Staff Engineer Compliance Certification Services (UL CCS)		David Rodgers 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
- 865664 SAR 3 to 6 GHz Rev
- 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		
ESA Series Network Analyzer	Agilent	E5071B	MY42100131	2	11	2013
Synthesized Signal Generator	HP	83732B	US34490599	7	14	2012
E-Field Probe	SPEAG	EX3DV4	3749	1	27	2013
Thermometer	ERTCO	639-1S	1718	7	19	2012
Data Acquisition Electronics	SPEAG	DAE3	427	1	17	2013
System Validation Dipole	SPEAG	D2450V2	748	2	7	2013
System Validation Dipole	SPEAG	D5GHzV2	1075	2	14	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

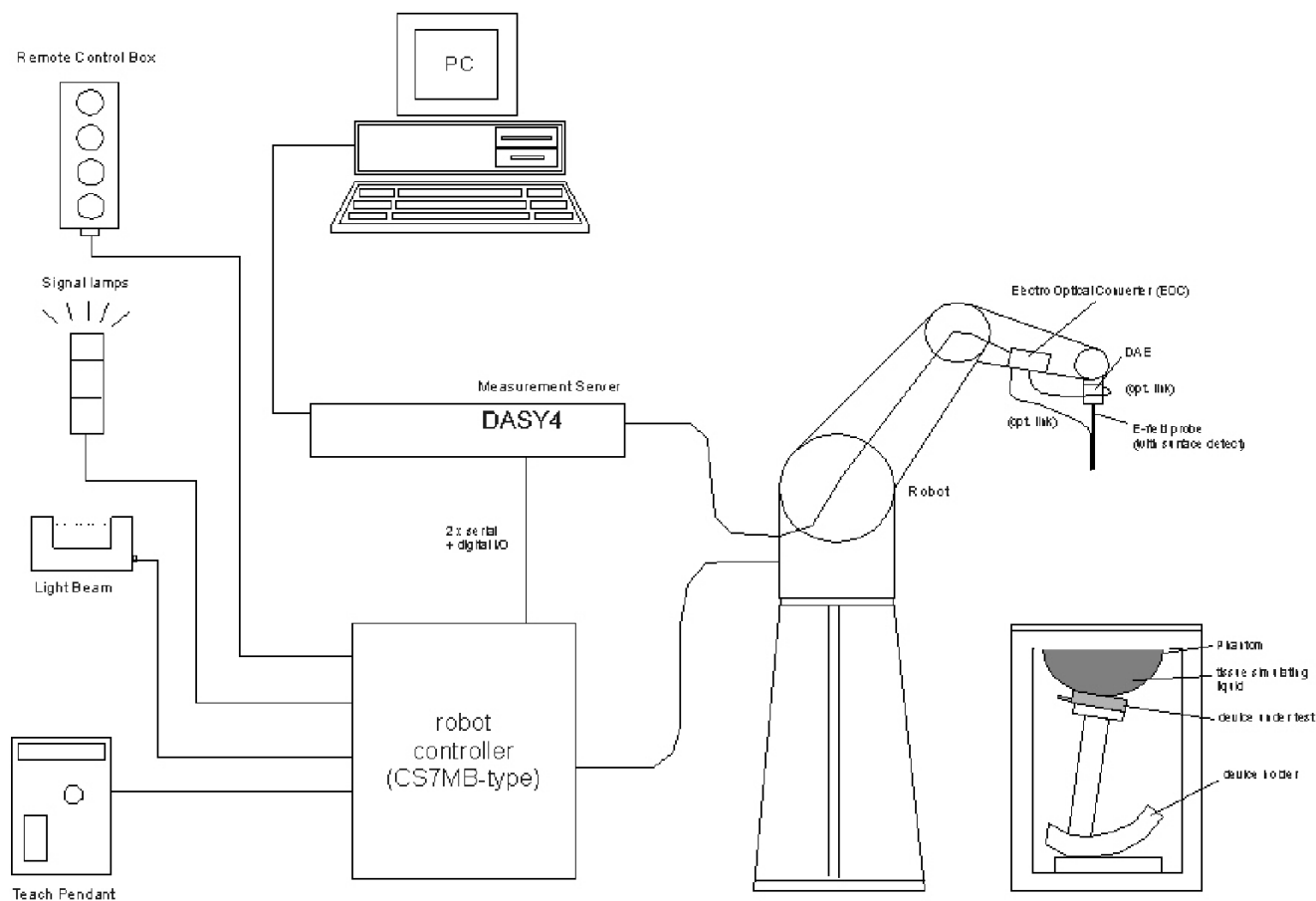
Component	Error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	6.00	Normal	1	1	6.00
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	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	2.78	Normal	1	0.64	1.78
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty	0.26	Normal	1	0.6	0.16
Combined Standard Uncertainty $U_c(y)$ =					9.90
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				19.80 %	
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.57 dB	

Measurement uncertainty for 3 to 6 GHz averaged over 1 gram

Component	Error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1)	6.55	Normal	1	1	6.55
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	1.00	Normal	1	1	1.00
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	3.90	Rectangular	1.732	1	2.25
Test Sample Related					
Test Sample Positioning	1.10	Normal	1	1	1.10
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	4.62	Normal	1	0.64	2.96
Liquid Permittivity - deviation from target	10.00	Rectangular	1.732	0.6	3.46
Liquid Permittivity - measurement uncertainty	4.60	Normal	1	0.6	2.76
Combined Standard Uncertainty $U_c(y)$, %:					11.21
Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =				21.96 %	
Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =				1.72 dB	

5. Measurement System Description and Setup

The DASY4 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid.
- 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 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows XP.
- DASY software.
- Remote controls with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

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.

7. Device Under Test

PCIE 802.11a/b/g/n 2.4GHz/5GHz + USB BT 4.0 card (Tested inside of Samsung Notebook PC, Model NP535U3C)							
Normal operation:	Laptop mode (notebook)						
Antenna tested:	<table><tr><td><u>Manufacturer</u></td><td><u>Part number</u></td></tr><tr><td>Galtronics</td><td>Main (Chain B) Ant: 02102140-05311</td></tr><tr><td></td><td>Aux (Chain A) Ant: 02102140-05311</td></tr></table>	<u>Manufacturer</u>	<u>Part number</u>	Galtronics	Main (Chain B) Ant: 02102140-05311		Aux (Chain A) Ant: 02102140-05311
<u>Manufacturer</u>	<u>Part number</u>						
Galtronics	Main (Chain B) Ant: 02102140-05311						
	Aux (Chain A) Ant: 02102140-05311						
Simultaneous transmission:	WiFi 2.4 GHz can transmit simultaneously with BT WiFi 5 GHz can transmit simultaneously with BT						
Assessment for SAR evaluation for Simultaneous transmission:	WiFi vs Bluetooth Due to Bluetooth's maximum output being 5 mW [$<60/f(\text{GHz})$ mW] stand-alone SAR is not required. Therefore the assessment of simultaneous transmission for WiFi and Bluetooth is not required.						

8. RF Output Power Verification

Required Test Channels per KDB 248227 D01

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2.412	1 [#]	√	▽
		2.437	6	√	▽
		2.462	11 [#]	√	▽

Mode		Band	GHz	Channel	"Default Test Channels"	
802.11a	UNII (15.407)		5.180	36	√	
			5.200	40		*
			2.220	44		*
			5.240	48	√	
		5.3 GHz	5.260	52	√	
			5.280	56		*
			5.300	60		*
			5.320	64	√	
		5.5 GHz	5.500	100		
			5.520	104	√	
			5.540	108		*
			5.560	112		*
			5.580	116	√	
			5.600	120		*
			5.620	124	√	
			5.640	128		*
			5.660	132		*
			5.680	136	√	
			5.700	140		*
	DTS (15.247)	5.8 GHz	5.745	179	√	
			5.765	153		*
			5.785	157	√	
			5.805	161		*
			5.825	165	√	

* = possible 802.11a channels with maximum average output > the "default test channels"

√ = "default test channels"

▽ = possible 802.11g channels with maximum average output ¼ dB ≥ the "default test channels"

[#] = when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

8.1. WiFi (2.4GHz Band)

Mode	Ch. #	Freq. (MHz)	Original Target Pwr (dBm)		Actual Measured Pwr (dBm)	
			Chain A	Chain B	Chain A	Chain B
802.11b	1	2412	17.8		17.9	
	2	2417			19.9	
	6	2437	19.8		19.9	
	10	2457			19.9	
	11	2462	18.9		19.0	
	1	2412		17.8		17.8
	2	2417				19.9
	6	2437		19.8		19.9
	10	2457				19.9
	11	2462		18.9		19.0
	1	2412	17.2	16.3	17.3	16.4
	6	2437	17.2	16.3	17.4	16.5
	11	2462	17.2	16.3	17.3	16.5
802.11g	1	2412	16.1		16.3	
	2	2417			19.9	
	6	2437	19.9		19.9	
	10	2457			19.9	
	11	2462	15.9		16.1	
	1	2412		16.1		16.3
	2	2417				19.9
	6	2437		19.9		19.9
	10	2457				19.9
	11	2462		15.9		16.1
	1	2412	13.2	12.3	13.3	12.5
	2	2417			17.3	16.4
	6	2437	17.1	16.3	17.3	16.4
	10	2457			17.2	16.3
	11	2462	12.5	12.2	12.5	12.3
802.11n HT20	1	2412	13.0	12.6	13.2	12.7
	2	2417			17.1	16.5
	6	2437	17.1	16.5	17.2	16.5
	10	2457			17.1	16.5
	11	2462	12.0	11.4	12.0	11.5
802.11n HT40	3	2422	9.5	9.0	9.7	9.1
	4	2427			14.4	13.7
	6	2437	14.4	13.6	14.5	13.8
	8	2447			14.4	13.7
	9	2452	11.3	10.6	11.4	10.6

Notes:

1. The modes with highest output power channel were chosen for the conducted output power.
2. Original target power is from EMC report RF110907E02 R1. Refer to original report (FCC ID: PPD-AR5B22) for Average Power information as documented in 2/3/2012 original filing.

8.2. WiFi (5GHz Bands)

5.2 GHz

Mode	Ch. #	Freq. (MHz)	Original Target Pwr (dBm)		Actual Measured Pwr (dBm)	
			Chain A	Chain B	Chain A	Chain B
802.11a	36	5180	14.8		14.9	
	40	5200	14.7		14.9	
	44	5220			14.8	
	48	5240	14.8		14.9	
	36	5180		14.8		14.9
	40	5200		14.7		14.9
	44	5220				14.9
	48	5240		14.8		14.9
	36	5180	11.5	11.4	11.5	11.5
	40	5200	11.4	11.3	11.5	11.5
	44	5220			11.4	11.5
	48	5240	11.7	11.3	11.9	11.5
802.11n HT20	36	5180	11.2	11.1	11.2	11.2
	40	5200	11.3	11.0	11.4	11.2
	44	5220			11.3	11.1
	48	5240	11.0	10.9	11.0	11.0
802.11n HT40	38	5190	9.6	9.4	9.8	9.6
	46	5230	13.8	13.2	14.0	13.4

Notes:

1. The modes with highest output power channel were chosen for the conducted output power.
2. Original target power is from EMC report RF110907E02-1 R1. Refer to original report (FCC ID: PPD-AR5B22) for Average Power information as documented in 2/3/2012 original filing.

5.3 GHz

Mode	Ch. #	Freq. (MHz)	Original Target Pwr (dBm)		Actual Measured Pwr (dBm)	
			Chain A	Chain B	Chain A	Chain B
802.11a	52	5260	19.9		20.0	
	56	5280			20.0	
	60	5300	20.0		20.0	
	64	5320	17.6		17.8	
	52	5260		19.9		19.9
	56	5280				19.9
	60	5300		20.0		20.0
	64	5320		17.6		17.7
	52	5260	17.0	15.8	17.0	16.0
	56	5280			17.0	16.8
	60	5300	17.0	16.7	17.0	16.9
	64	5320	14.5	14.2	14.7	14.4
802.11n HT20	52	5260	15.0	14.3	15.1	14.3
	56	5280			15.1	14.3
	60	5300	14.5	14.2	14.5	14.3
	64	5320	14.2	14.1	14.4	14.1
802.11n HT40	54	5270	15.3	14.6	15.5	14.7
	62	5310	9.7	9.5	9.8	9.7

Notes:

1. The modes with highest output power channel were chosen for the conducted output power.
2. Original target power is from EMC report RF110907E02-1 R1. Refer to original report (FCC ID: PPD-AR5B22) for Average Power information as documented in 2/3/2012 original filing.

5.5 GHz

Mode	Ch. #	Freq. (MHz)	Original Target Pwr (dBm)		Actual Measured Pwr (dBm)	
			Chain A	Chain B	Chain A	Chain B
802.11a	100	5500	14.6		14.7	
	104	5520			17.6	
	108	5540			17.6	
	112	5560			17.6	
	116	5580	17.5		17.7	
	120	5600			17.6	
	124	5620			17.6	
	128	5640			17.6	
	132	5660	16.8		16.8	
	136	5680			16.8	
	140	5700	13.7		13.8	
	100	5500		14.6		14.7
	104	5520				17.5
	108	5540				17.5
	112	5560				17.5
	116	5580		17.5		17.6
	120	5600				17.6
	124	5620				17.6
	128	5640				17.5
	132	5660		16.8		16.9
	136	5680				16.8
	140	5700		13.7		13.9
	100	5500	11.1	11.9	11.2	12.0
	104	5520			14.3	14.8
	108	5540			14.3	14.8
	112	5560			14.3	14.8
	116	5580	14.2	14.8	14.3	14.9
	120	5600			14.3	14.9
	124	5620			14.2	14.8
	128	5640			14.2	14.8
	132	5660	14.0	13.6	14.0	13.7
	136	5680			14.0	13.7
	140	5700	10.2	11.1	10.2	11.2

Notes:

1. The modes with highest output power channel were chosen for the conducted output power.
2. Original target power is from EMC report RF110907E02-1 R1. Refer to original report (FCC ID: PPD-AR5B22) for Average Power information as documented in 2/3/2012 original filing.

5.5 GHz Cont.

Mode	Ch. #	Freq. (MHz)	Original Target Pwr (dBm)		Actual Measured Pwr (dBm)	
			Chain A	Chain B	Chain A	Chain B
802.11n HT20	100	5500	12.1	13.1	12.1	13.2
	104	5520			14.5	16.6
	108	5540			14.5	16.6
	112	5560			14.5	16.6
	116	5580	14.4	16.5	14.5	16.6
	120	5600			14.4	16.6
	124	5620			14.4	16.6
	128	5640			14.4	16.5
	132	5660	14.5	14.8	14.7	15.0
	136	5680			14.7	15.0
	140	5700	11.6	12.8	11.7	13.0
802.11n HT40	102	5510	8.5	8.9	8.6	9.0
	110	5550			14.3	15.6
	118	5670	14.2	15.6	14.4	15.7
	134	5670	11.3	12.8	11.5	13.0

Notes:

1. The modes with highest output power channel were chosen for the conducted output power.
2. Original target power is from EMC report RF110907E02-1 R1. Refer to original report (FCC ID: PPD-AR5B22) for Average Power information as documented in 2/3/2012 original filing.

5.8 GHz

Mode	Ch. #	Freq. (MHz)	Original Target Pwr (dBm)		Actual Measured Pwr (dBm)	
			Chain A	Chain B	Chain A	Chain B
802.11a	149	5745	14.3		14.3	
	153	5765			14.8	
	157	5785	14.7		14.8	
	161	5805			15.2	
	165	5825	15.2		15.4	
	149	5745		14.3		14.4
	153	5765				14.8
	157	5785		14.7		14.9
	161	5805				15.5
	165	5825		15.2		15.3
	149	5745	12.0	12.5	12.0	12.6
	153	5765			12.1	12.6
	157	5785	12.1	12.6	12.1	12.7
	161	5805			12.1	12.7
	165	5825	12.5	12.8	12.6	12.9
802.11n HT20	149	5745	13.2	13.7	13.3	13.8
	157	5785	13.8	14.0	14.0	14.1
	165	5825	14.1	13.8	14.2	14.0
802.11n HT40	151	5755	14.2	14.3	14.4	14.5
	159	5795	14.1	14.0	14.1	14.2

Notes:

1. The modes with highest output power channel were chosen for the conducted output power.
2. Original target power is from EMC report RF110907E02 R1. Refer to original report (FCC ID: PPD-AR5B22) for Average Power information as documented in 2/3/2012 original filing.

9. Summary of Test Configurations

Configuration	Antenna-to-edge/surface	SAR Required	Note
Lap-Held	6 mm from Main to-user	Yes	Chain B
Lap-Held	6 mm from Aux to-user	Yes	Chain A

10. Tissue Dielectric Property

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 & IC RSS-102

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 parameters 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 ±(%)
05/03/2012	Body 2450	e'	52.7701	Relative Permittivity (ε _r):	52.77	52.70	0.13	5
		e''	14.7119	Conductivity (σ):	2.00	1.95	2.78	5
	Body 2410	e'	52.8980	Relative Permittivity (ε _r):	52.90	52.76	0.26	5
		e''	14.5443	Conductivity (σ):	1.95	1.91	2.18	5
	Body 2435	e'	52.8197	Relative Permittivity (ε _r):	52.82	52.73	0.18	5
		e''	14.6507	Conductivity (σ):	1.98	1.93	2.72	5
	Body 2460	e'	52.7358	Relative Permittivity (ε _r):	52.74	52.69	0.09	5
		e''	14.7544	Conductivity (σ):	2.02	1.96	2.75	5
05/04/2012	Body 5180	e'	49.5563	Relative Permittivity (ε _r):	49.56	49.05	1.04	10
		e''	18.5214	Conductivity (σ):	5.33	5.27	1.20	5
	Body 5200	e'	49.5269	Relative Permittivity (ε _r):	49.53	49.02	1.03	10
		e''	18.5288	Conductivity (σ):	5.36	5.29	1.18	5
	Body 5500	e'	48.9682	Relative Permittivity (ε _r):	48.97	48.61	0.73	10
		e''	18.8070	Conductivity (σ):	5.75	5.64	1.90	5
	Body 5800	e'	48.4359	Relative Permittivity (ε _r):	48.44	48.20	0.49	10
		e''	19.0593	Conductivity (σ):	6.15	6.00	2.44	5
	Body 5825	e'	48.3963	Relative Permittivity (ε _r):	48.40	48.20	0.41	10
		e''	19.0773	Conductivity (σ):	6.18	6.00	2.98	5
05/07/2012	Body 5180	e'	50.5413	Relative Permittivity (ε _r):	50.54	49.05	3.05	10
		e''	18.6391	Conductivity (σ):	5.37	5.27	1.84	5
	Body 5200	e'	50.5141	Relative Permittivity (ε _r):	50.51	49.02	3.05	10
		e''	18.6642	Conductivity (σ):	5.40	5.29	1.92	5
	Body 5500	e'	49.9498	Relative Permittivity (ε _r):	49.95	48.61	2.75	10
		e''	18.9804	Conductivity (σ):	5.80	5.64	2.84	5
	Body 5800	e'	49.3910	Relative Permittivity (ε _r):	49.39	48.20	2.47	10
		e''	19.3243	Conductivity (σ):	6.23	6.00	3.87	5
	Body 5825	e'	49.3606	Relative Permittivity (ε _r):	49.36	48.20	2.41	10
		e''	19.3807	Conductivity (σ):	6.28	6.00	4.62	5

Tissue dielectric parameters check results cont.

Date	Freq. (MHz)		Liquid Parameters		Measured	Target	Delta (%)	Limit $\pm$ (%)
05/08/2012	Body 5180	e'	50.7939	Relative Permittivity (ϵ_r):	50.79	49.05	3.56	10
		e''	18.2752	Conductivity (σ):	5.26	5.27	-0.15	5
	Body 5200	e'	50.7692	Relative Permittivity (ϵ_r):	50.77	49.02	3.57	10
		e''	18.3117	Conductivity (σ):	5.29	5.29	0.00	5
	Body 5500	e'	50.2205	Relative Permittivity (ϵ_r):	50.22	48.61	3.31	10
		e''	18.6762	Conductivity (σ):	5.71	5.64	1.19	5
	Body 5800	e'	49.6338	Relative Permittivity (ϵ_r):	49.63	48.20	2.97	10
		e''	18.9961	Conductivity (σ):	6.13	6.00	2.10	5
05/09/2012	Body 5180	e'	49.5975	Relative Permittivity (ϵ_r):	49.60	48.20	2.90	10
		e''	19.0607	Conductivity (σ):	6.17	6.00	2.89	5
	Body 5180	e'	51.2957	Relative Permittivity (ϵ_r):	51.30	49.05	4.59	10
		e''	17.6090	Conductivity (σ):	5.07	5.27	-3.79	5
	Body 5200	e'	51.2747	Relative Permittivity (ϵ_r):	51.27	49.02	4.60	10
		e''	17.6289	Conductivity (σ):	5.10	5.29	-3.73	5
	Body 5500	e'	50.7745	Relative Permittivity (ϵ_r):	50.77	48.61	4.45	10
		e''	17.9045	Conductivity (σ):	5.48	5.64	-2.99	5
	Body 5800	e'	50.2875	Relative Permittivity (ϵ_r):	50.29	48.20	4.33	10
		e''	18.1719	Conductivity (σ):	5.86	6.00	-2.33	5
	Body 5825	e'	50.2528	Relative Permittivity (ϵ_r):	50.25	48.20	4.26	10
		e''	18.2154	Conductivity (σ):	5.90	6.00	-1.67	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	53.6	50.8
				10g	24.8	23.64
D5GHzV2	1075	3/14/2012	5200	1g	79.7	72.8
				10g	22.9	20.5
			5500	1g	86.1	77.7
				10g	24.5	21.7
			5800	1g	79.4	72.4
				10g	22.7	20.2

11.3. System performance check results

Date Tested	System dipole		Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
5/3/2012	Body	D2450V2 SN: 748	1g SAR	52.5	50.8	3.35	± 10
			10g SAR	24.3	23.64	2.79	
5/4/2012	Body	D5GHzV2 SN: 1075	1g SAR	71.8	72.8	-1.37	± 10
			10g SAR	20.4	20.5	-0.49	
5/7/2012	Body	D5GHzV2 SN: 1075	1g SAR	70.8	77.7	-8.88	± 10
			10g SAR	20.3	21.7	-6.45	
5/8/2012	Body	D5GHzV2 SN: 1075	1g SAR	69.6	72.4	-3.87	± 10
			10g SAR	20.0	20.2	-0.99	
5/9/2012	Body	D5GHzV2 SN: 1075	1g SAR	67.1	72.8	-7.83	± 10
			10g SAR	19.3	20.5	-5.85	

12. SAR Test Results

12.1. WiFi (2.4GHz Band)

Test Reduction Consideration

SAR is not required for 802.11g/n (HT20 & 40) 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.

Band	Mode	Antenna Port	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g) 1g-SAR		Note
					Chain A	Chain B	Chain A	Chain B	
2.4GHz	802.11b	A	2	2417	19.9				1
			6	2437	19.9		0.648		
			10	2457	19.9				1
		B	2	2417		19.9			1
			6	2437		19.9		0.631	
			10	2457		19.9			1
		A+B	1	2412	17.3	16.4			1
			6	2437	17.4	16.5	0.634	0.708	
			11	2462	17.3	16.5			1

Note(s):

1. Testing was performed on the channel with the highest output power only as the SAR was ≤ 0.8 W/kg with the operating frequency band having a range of < 100 MHz. Per KDB 447498 1) e) i).

12.2. WiFi (5GHz Bands)

Test Reduction Consideration

SAR is not required for 802.11n (HT20 & HT40) channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a channels as per KDB 248227.

Band	Mode	Antenna Port	Ch. #	Freq. (MHz)	Avg. Output Power (dBm)		Measured Result (mW/g)		Note	
					Chain A	Chain B	Chain A	Chain B		
5.2GHz	802.11a	A	36	5180	14.9		0.281			
			48	5240	14.9		0.319			
		B	36	5180		14.9		0.263		
			48	5240		14.9		0.371		
		A+B	36	5180	11.5	11.5	0.160	0.172		
			48	5240	11.9	11.5	0.169	0.268		
	802.11n HT20	A	36	5180	11.2	11.2			1	
			40	5200	11.4	11.2	0.235			
			48	5240	11.0	11.0			1	1
	802.11n HT40	A+B	38	5190	9.8	9.6				1
			46	5230	14.0	13.4	0.217	0.331		
5.3GHz	802.11a	A	52	5260	20.0		1.09			
			60	5300	20.0		1.17			
		B	52	5260		19.9		1.09		
			60	5300		20.0		1.11		
	802.11n HT20	A+B	56	5280	15.1	14.3	0.573	0.765		
			60	5300	14.5	14.3	0.581	0.518		
5.5GHz	802.11a	A	104	5520	17.6		0.492			
			116	5580	17.7		0.425			
			124	5620	17.6		0.418			
			136	5680	16.8		0.428			
		B	104	5520		17.5		0.762		
			116	5580		17.6		0.741		
			124	5620		17.6		0.795		
			136	5680		16.9		0.792		
5.5GHz	802.11a	A+B	104	5520	14.3	14.8	0.245	0.363		
			116	5580	14.3	14.9	0.221	0.386		
			120	5600	14.3	14.9	0.240	0.409		
			136	5680	14.0	13.7	0.192	0.335		
	802.11n HT20		104	5520	14.5	16.6	0.435	0.515		
			116	5580	14.5	16.6	0.352	0.508		
			124	5620	14.4	16.6	0.346	0.517		
			136	5680	14.7	15.0	0.398	0.565		
5.8GHz	802.11a	A	153	5765	14.8				1	
			161	5805	15.2				1	
			165	5825	15.4		0.250			
		B	153	5765		14.8			1	
			157	5785		15.5		0.655		
			165	5825		15.3			1	
		A+B	153	5765	12.1	12.6			1	
			161	5805	12.1	12.7			1	
			165	5825	12.6	12.9	0.096	0.180		
	802.11n HT40	A+B	151	5755	14.4	14.5	0.310	0.562		
			159	5795	14.1	14.2			1	

Note(s):

- Testing was performed on the channel with the highest output power only as the SAR was ≤ 0.8 W/kg with the operating frequency band having a range of < 100 MHz. Per KDB 447498 1) e) i).
- Testing was performed on the channel with the highest output power only as the SAR was ≤ 0.4 W/kg with the operating frequency band having a range of ≤ 200 MHz. Per KDB 447498 1) e) ii).

13. Summary of Highest 1g SAR

Technology/Band	Test configuration	Mode	Separation distance (mm)	Highest 1g SAR (W/kg)
WiFi 2.4 GHz	Lap-Held 1 TX	802.11b	0	0.648
	Lap-Held 2 TX			0.708
WiFi 5.2 GHz	Lap-Held 1 TX	802.11a	0	0.371
	Lap-Held 2 TX			0.331
WiFi 5.3 GHz	Lap-Held 1 TX	802.11a	0	1.17
	Lap-Held 2 TX			0.765
WiFi 5.5 GHz	Lap-Held 1 TX	802.11a	0	0.795
	Lap-Held 2 TX			0.565
WiFi 5.8 GHz	Lap-Held 1 TX	802.11a	0	0.655
	Lap-Held 2 TX			0.562

14. Worst-case SAR Plots

Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/3/2012 10:12:30 PM

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; $\sigma = 1.99$ mho/m; $\epsilon_r = 52.8$; $\rho = 1000$ kg/m³;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012
- Probe: EX3DV4 - SN3749; ConvF(6.66, 6.66, 6.66); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003

802.11b, Chain A_Ch 6/Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.749 mW/g

802.11b, Chain A_Ch 6/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

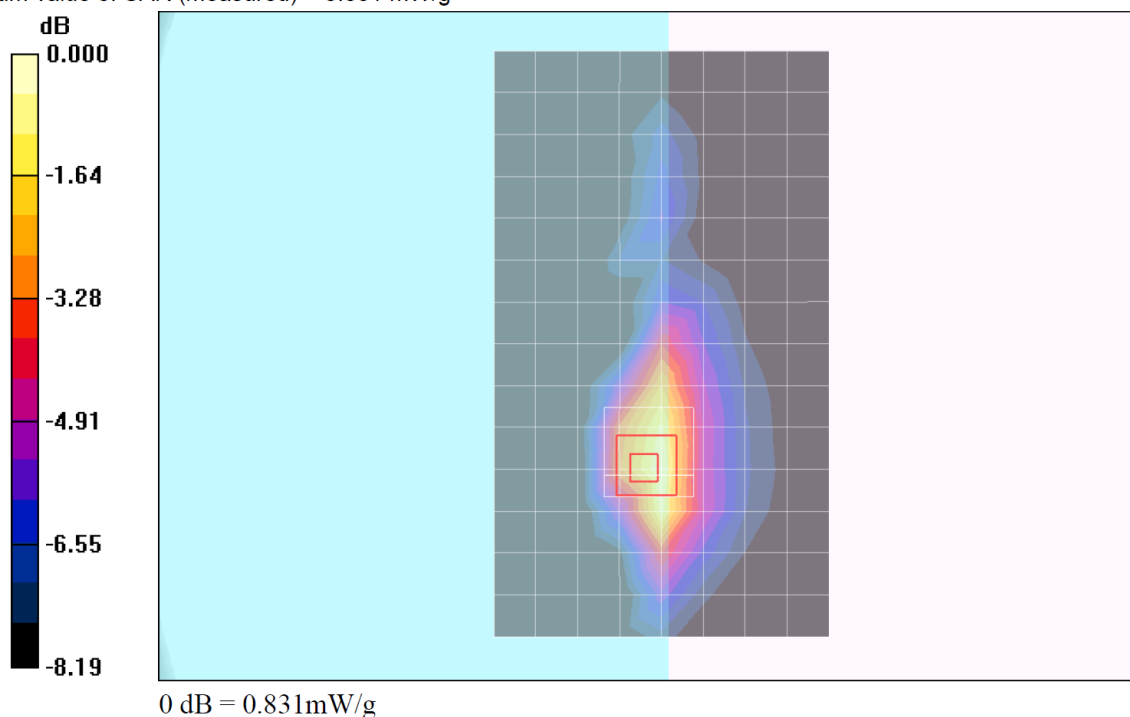
Reference Value = 18.1 V/m; Power Drift = 0.0552 dB

Peak SAR (extrapolated) = 1.18 W/kg

SAR(1 g) = 0.648 mW/g; SAR(10 g) = 0.372 mW/g

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

Maximum value of SAR (measured) = 0.831 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/3/2012 10:47:10 PM

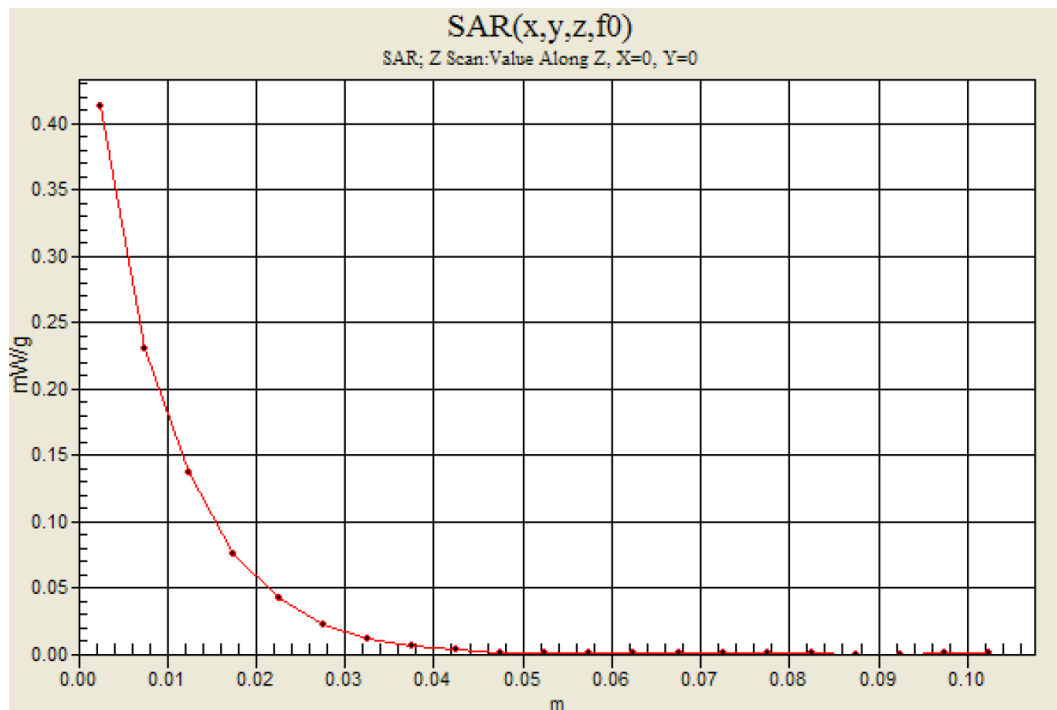
2.4GHz

Frequency: 2437 MHz; Duty Cycle: 1:1

802.11b, Chain A_Ch 6/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

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

Maximum value of SAR (measured) = 0.413 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/3/2012 9:19:12 PM

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; $\sigma = 1.99$ mho/m; $\epsilon_r = 52.8$; $\rho = 1000$ kg/m³;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012
- Probe: EX3DV4 - SN3749; ConvF(6.66, 6.66, 6.66); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003

802.11b, Chain A, B_Ch 6/Area Scan (9x15x1):

Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.777 mW/g

802.11b, Chain A_Ch 6/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.8 V/m; Power Drift = 0.020 dB

Peak SAR (extrapolated) = 1.17 W/kg

SAR(1 g) = 0.634 mW/g; SAR(10 g) = 0.375 mW/g

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

Maximum value of SAR (measured) = 0.813 mW/g

802.11b, Chain B_Ch 6/Zoom Scan (5x5x7)/Cube 1:

Measurement grid: dx=8mm, dy=8mm, dz=5mm

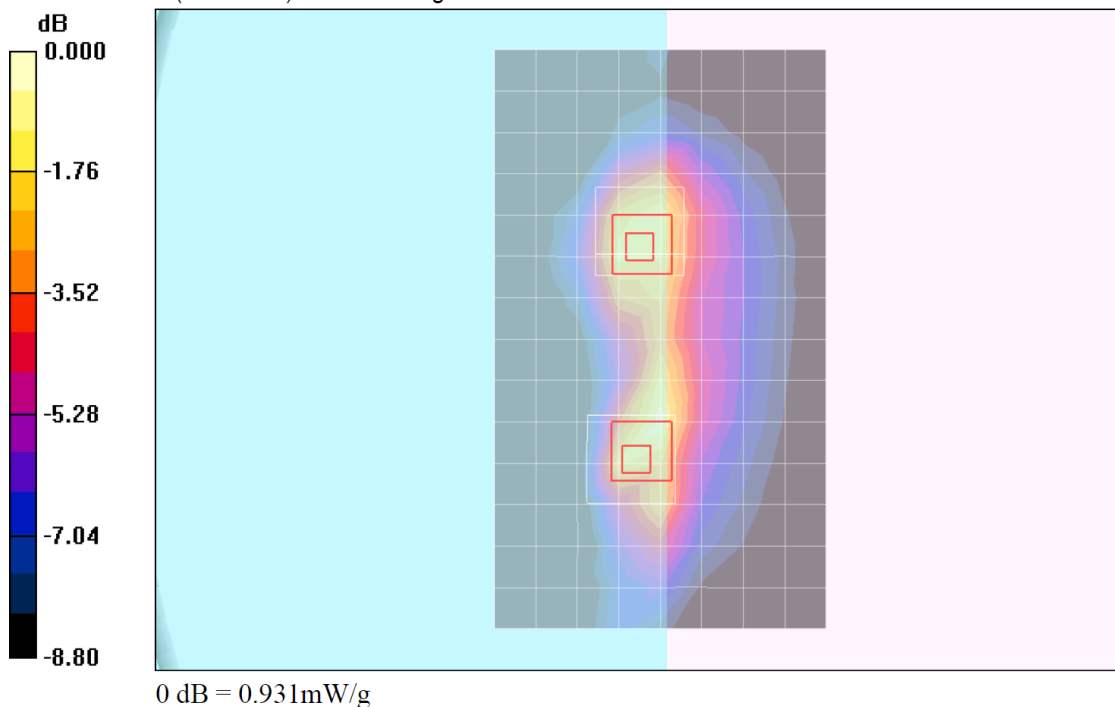
Reference Value = 19.8 V/m; Power Drift = 0.020 dB

Peak SAR (extrapolated) = 1.25 W/kg

SAR(1 g) = 0.708 mW/g; SAR(10 g) = 0.413 mW/g

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

Maximum value of SAR (measured) = 0.931 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/3/2012 10:46:16 PM

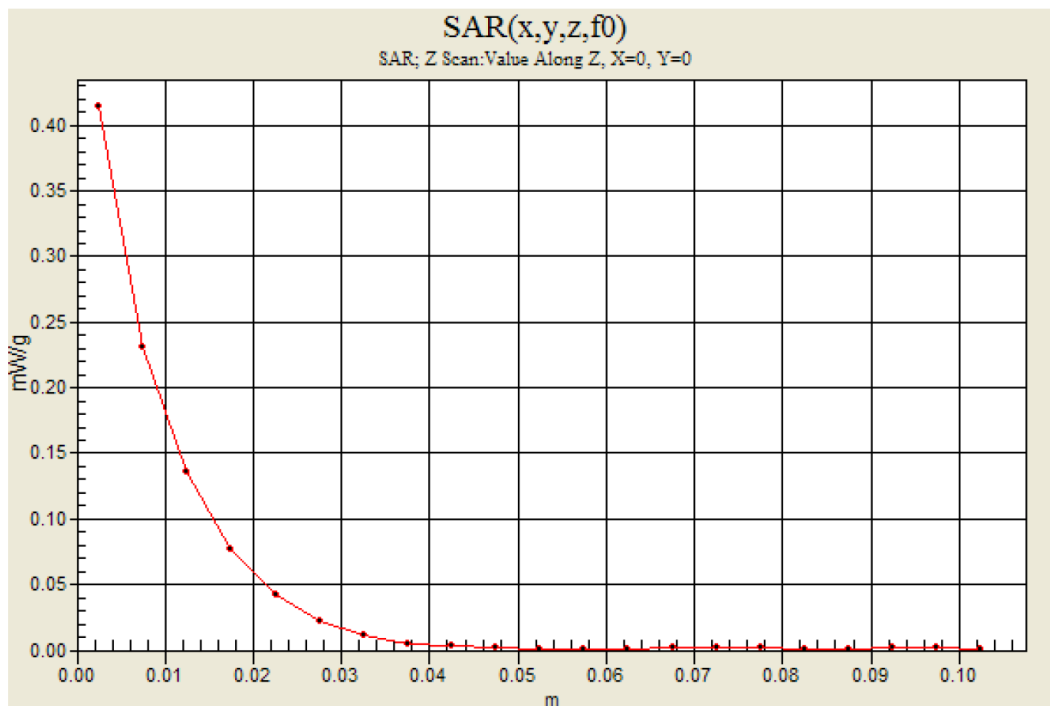
2.4GHz

Frequency: 2437 MHz; Duty Cycle: 1:1

802.11b, Chain A, B_Ch 6/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

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

Maximum value of SAR (measured) = 0.414 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/4/2012 10:26:42 PM

5.2GHz Band

Frequency: 5240 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C

Medium parameters used: $f = 5240$ MHz; $\sigma = 5.41$ mho/m; $\epsilon_r = 49.4$; $\rho = 1000$ kg/m³;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012

- Probe: EX3DV4 - SN3749; ConvF(4.23, 4.23, 4.23); Calibrated: 1/27/2012

- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003

802.11a, Chain B_Ch 48/Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.487 mW/g

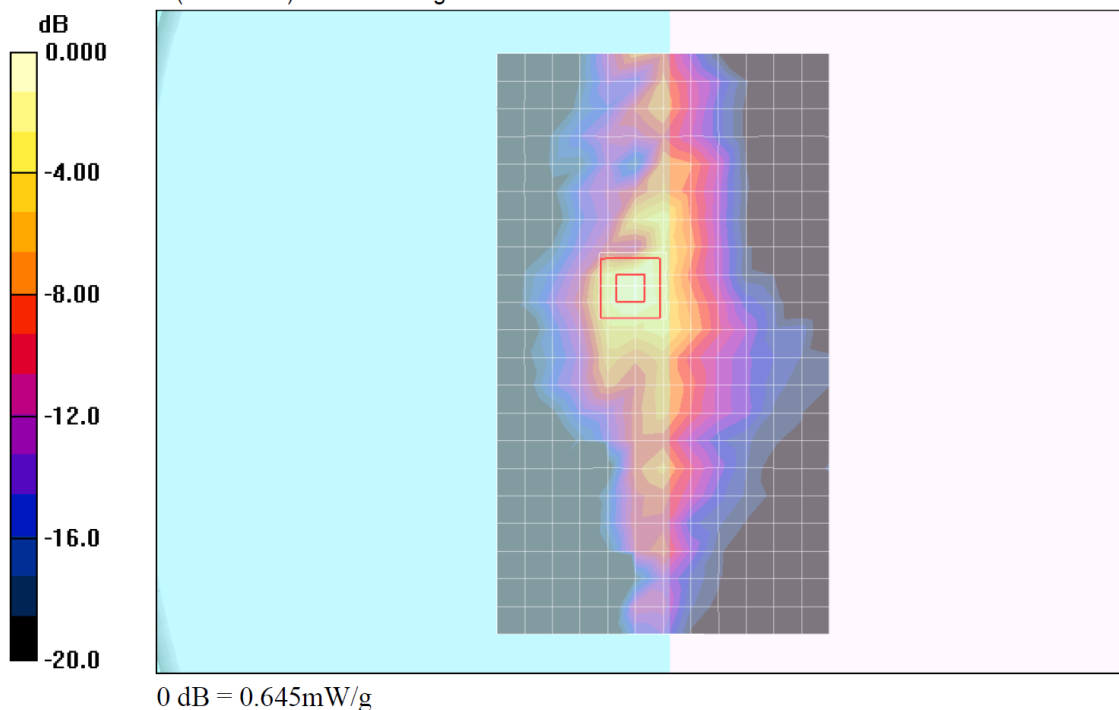
802.11a, Chain B_Ch 48/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 9.93 V/m; Power Drift = 0.057 dB

Peak SAR (extrapolated) = 1.23 W/kg

SAR(1 g) = 0.371 mW/g; SAR(10 g) = 0.120 mW/g

Maximum value of SAR (measured) = 0.645 mW/g



Test Laboratory: UL CCS SAR Lab D

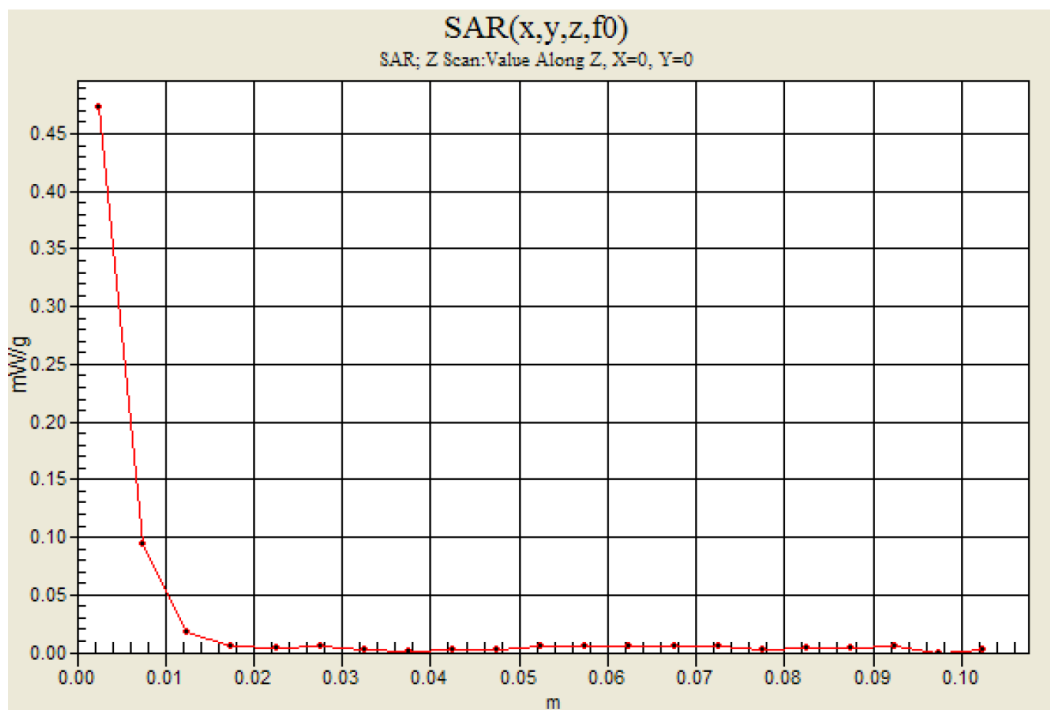
Date/Time: 5/4/2012 10:55:55 PM

5.2GHz Band

Frequency: 5240 MHz; Duty Cycle: 1:1

802.11a, Chain B_Ch 48/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 0.473 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/9/2012 5:09:22 PM

5.2GHz Band

Frequency: 5230 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C

Medium parameters used: $f = 5230$ MHz; $\sigma = 5.14$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012

- Probe: EX3DV4 - SN3749; ConvF(4.23, 4.23, 4.23); Calibrated: 1/27/2012

- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003

802.11n HT40, Chain A,B_Ch 46/Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.590 mW/g

802.11n HT40, Chain A_Ch 46/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 9.72 V/m; Power Drift = 0.062 dB

Peak SAR (extrapolated) = 0.712 W/kg

SAR(1 g) = 0.217 mW/g; SAR(10 g) = 0.076 mW/g

Maximum value of SAR (measured) = 0.366 mW/g

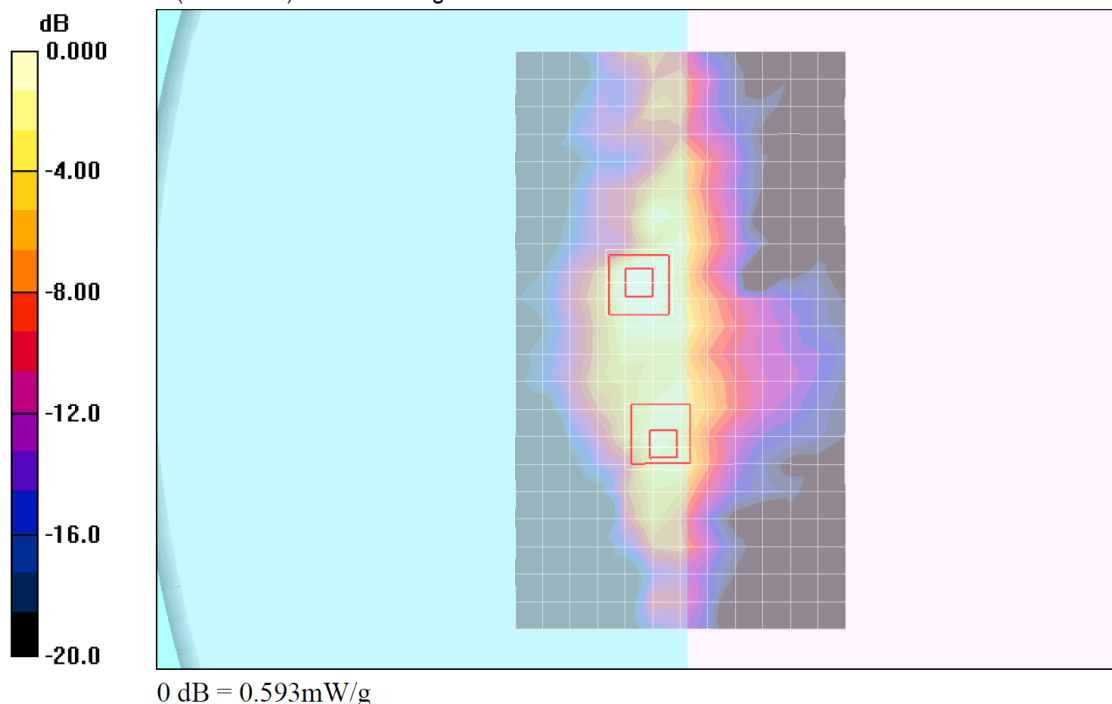
802.11n HT40, Chain B_Ch 46/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 9.72 V/m; Power Drift = 0.062 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.331 mW/g; SAR(10 g) = 0.116 mW/g

Maximum value of SAR (measured) = 0.593 mW/g



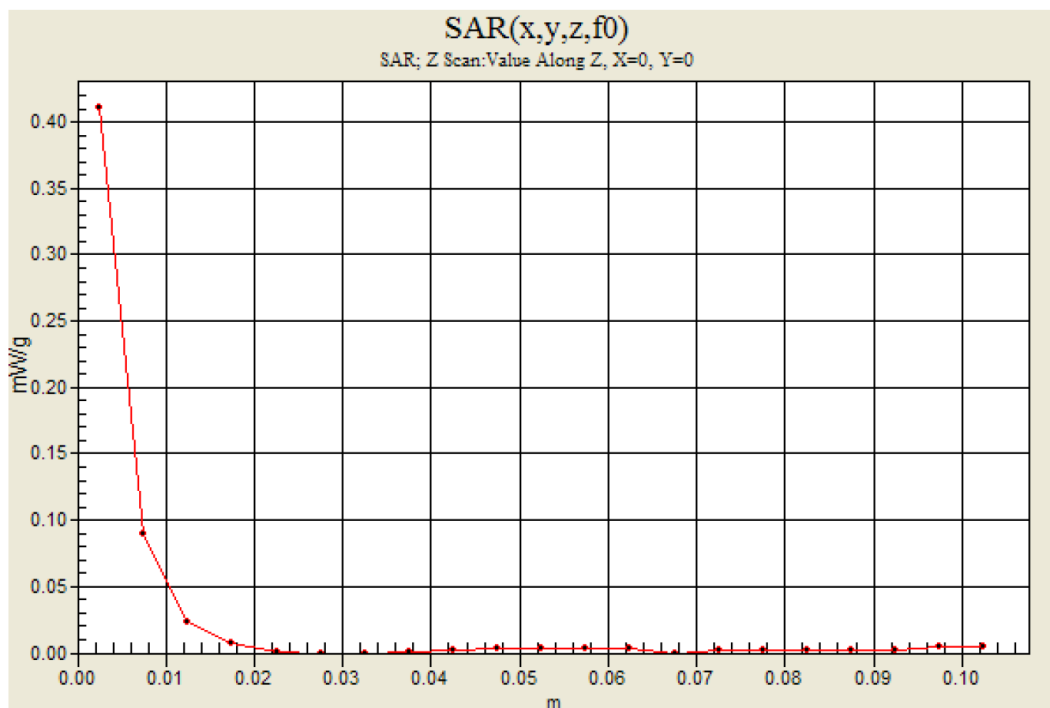
Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/9/2012 6:23:22 PM

5.2GHz Band

Frequency: 5230 MHz; Duty Cycle: 1:1

802.11n HT40, Chain A,B_Ch 46/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.411 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/4/2012 1:59:04 AM

5.3GHz Band

Frequency: 5300 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C

Medium parameters used: $f = 5300$ MHz; $\sigma = 5.49$ mho/m; $\epsilon_r = 49.3$; $\rho = 1000$ kg/m³;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012

- Probe: EX3DV4 - SN3749; ConvF(4.11, 4.11, 4.11); Calibrated: 1/27/2012

- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003

802.11a, Chain A_Ch 60/Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 1.84 mW/g

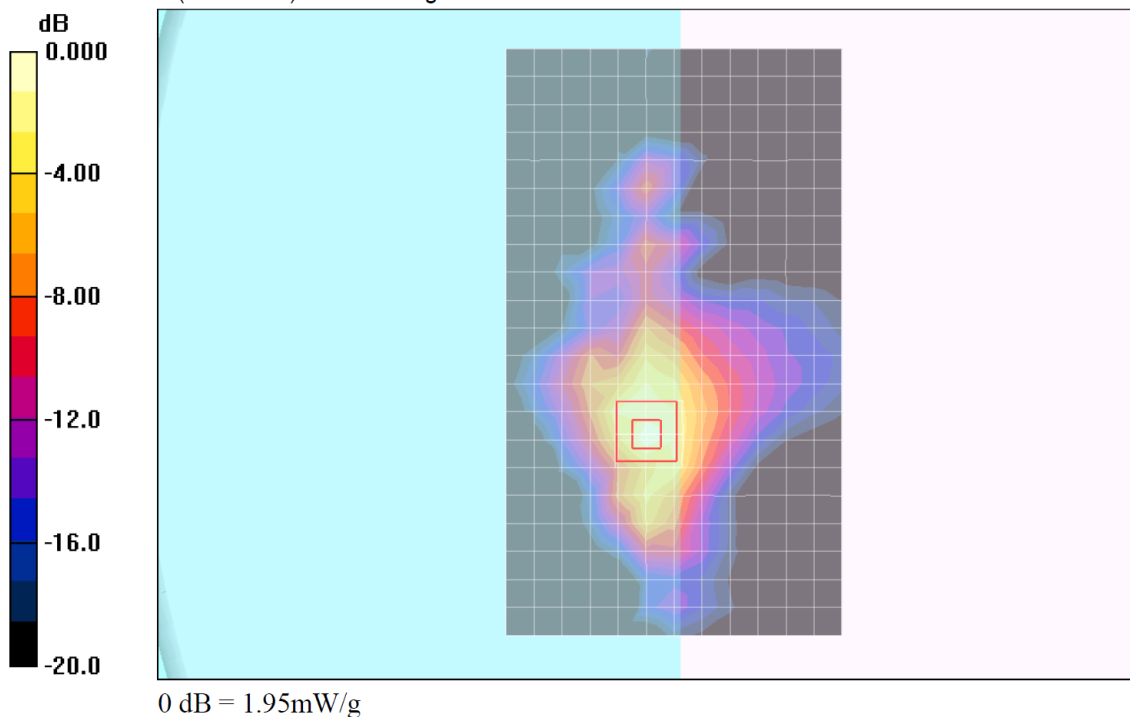
802.11a, Chain A_Ch 60/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 20.3 V/m; Power Drift = -0.017 dB

Peak SAR (extrapolated) = 3.69 W/kg

SAR(1 g) = 1.17 mW/g; SAR(10 g) = 0.423 mW/g

Maximum value of SAR (measured) = 1.95 mW/g



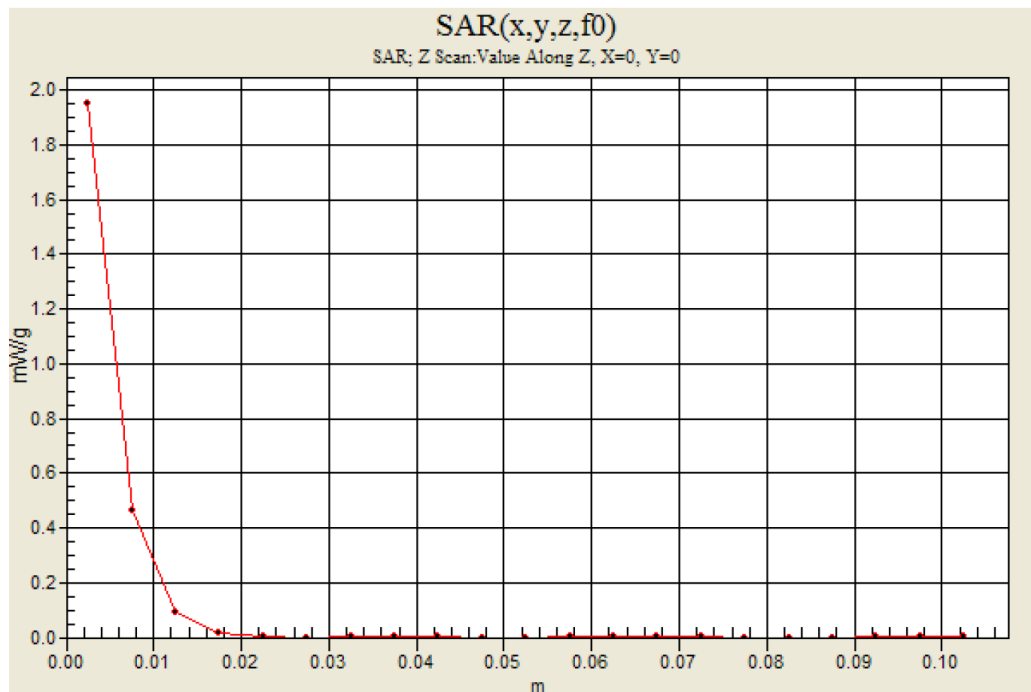
Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/4/2012 2:23:56 AM

5.3GHz Band

Frequency: 5300 MHz; Duty Cycle: 1:1

802.11a, Chain A_Ch 60/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.95 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/4/2012 2:16:02 PM

5.3GHz Band

Frequency: 5260 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C

Medium parameters used: $f = 5260$ MHz; $\sigma = 5.44$ mho/m; $\epsilon_r = 49.4$; $\rho = 1000$ kg/m³;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012

- Probe: EX3DV4 - SN3749; ConvF(4.11, 4.11, 4.11); Calibrated: 1/27/2012

- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003

802.11n HT20, Chain A, B_Ch 52/Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.964 mW/g

802.11n HT20, Chain A_Ch 52/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm,

dz=2.5mm

Reference Value = 11.5 V/m; Power Drift = -0.074 dB

Peak SAR (extrapolated) = 1.68 W/kg

SAR(1 g) = 0.573 mW/g; SAR(10 g) = 0.218 mW/g

Maximum value of SAR (measured) = 0.941 mW/g

802.11n HT20, Chain B_Ch 52/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm,

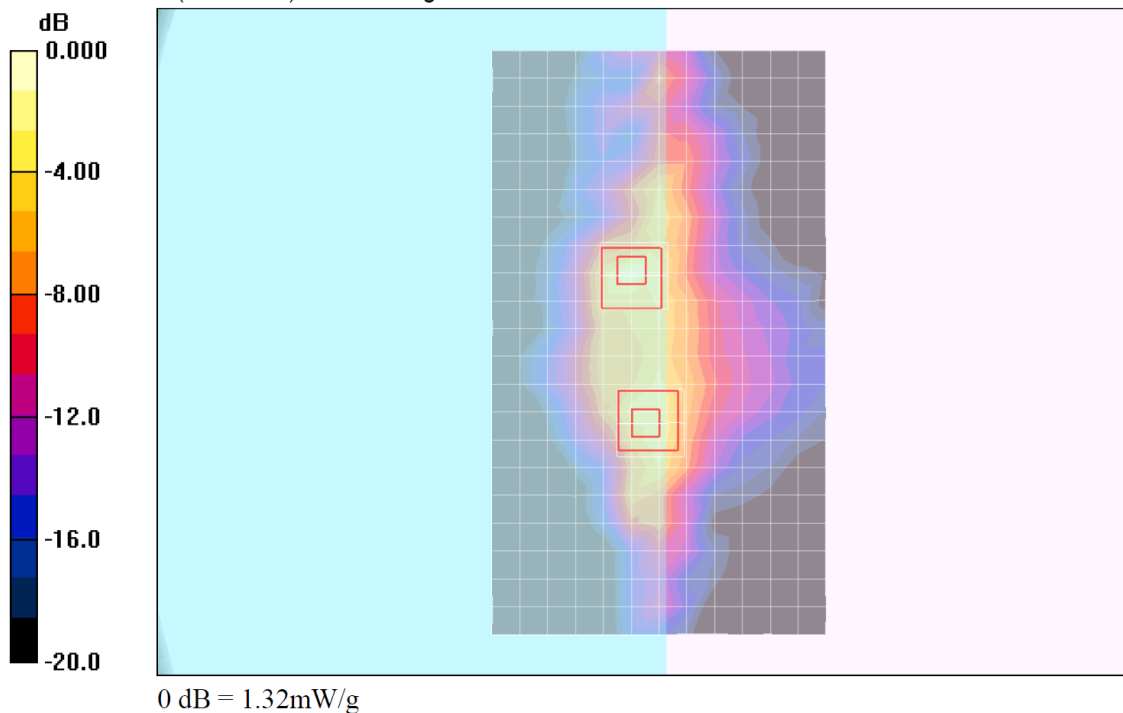
dz=2.5mm

Reference Value = 11.5 V/m; Power Drift = -0.074 dB

Peak SAR (extrapolated) = 2.66 W/kg

SAR(1 g) = 0.765 mW/g; SAR(10 g) = 0.264 mW/g

Maximum value of SAR (measured) = 1.32 mW/g



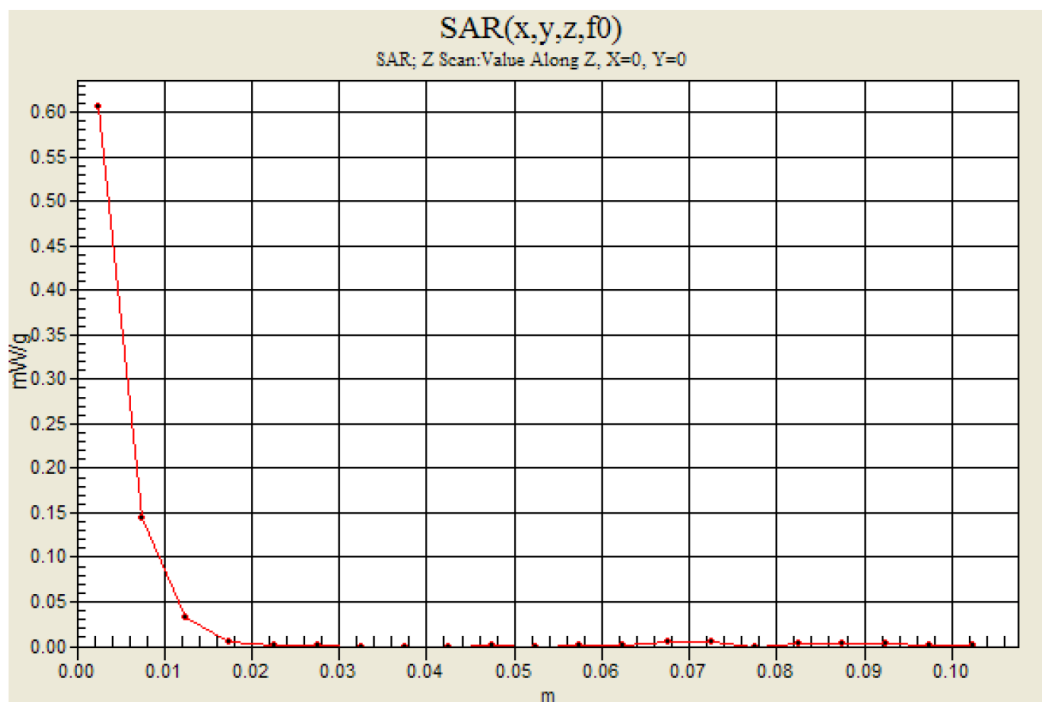
Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/4/2012 2:56:08 PM

5.3GHz Band

Frequency: 5260 MHz; Duty Cycle: 1:1

802.11n HT20, Chain A, B_Ch 52/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 0.606 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/7/2012 4:42:14 PM

5.5GHz Band

Frequency: 5620 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C
Medium parameters used: $f = 5620 \text{ MHz}$; $\sigma = 5.98 \text{ mho/m}$; $\epsilon_r = 49.7$; $\rho = 1000 \text{ kg/m}^3$;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012
- Probe: EX3DV4 - SN3749; ConvF(3.57, 3.57, 3.57); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003

802.11a, Chain B_Ch 124/Area Scan (13x22x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (measured) = 0.837 mW/g

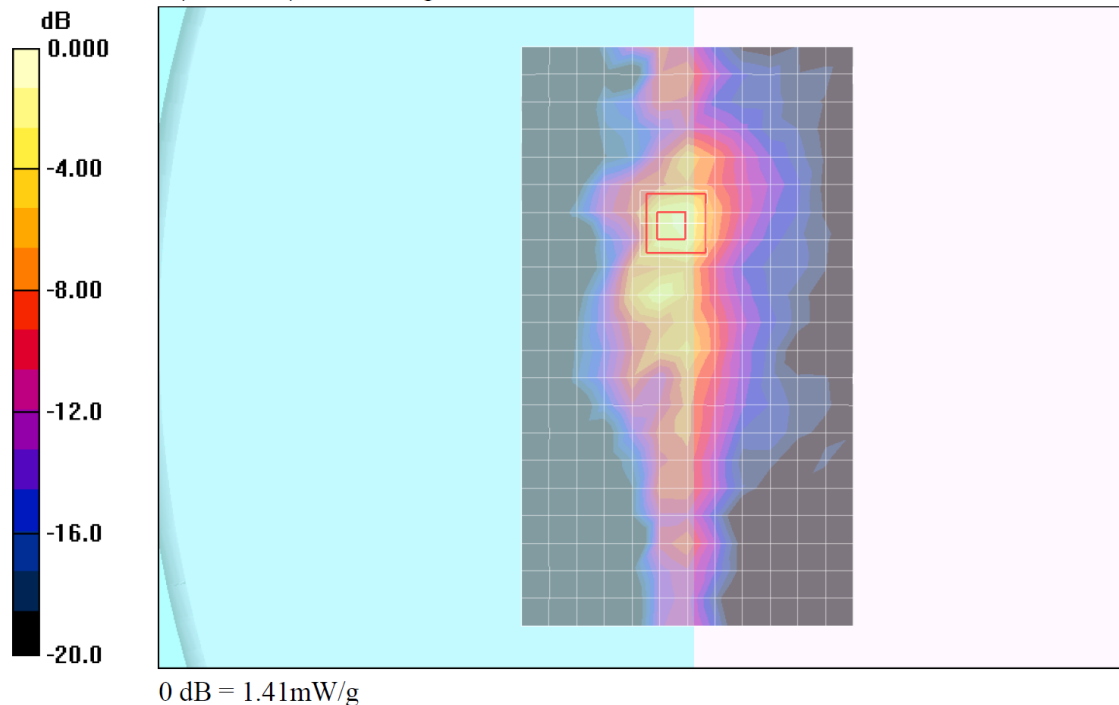
802.11a, Chain B_Ch 124/Zoom Scan (7x7x9)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2.5\text{mm}$

Reference Value = 13.0 V/m; Power Drift = 0.027 dB

Peak SAR (extrapolated) = 2.87 W/kg

SAR(1 g) = 0.795 mW/g; SAR(10 g) = 0.237 mW/g

Maximum value of SAR (measured) = 1.41 mW/g



Test Laboratory: UL CCS SAR Lab D

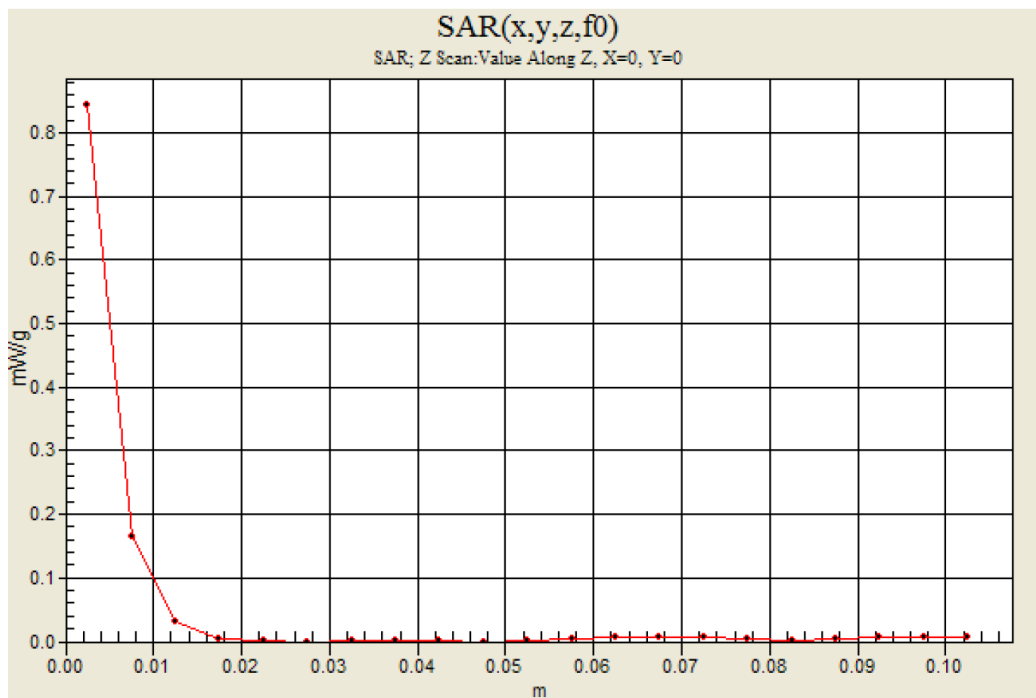
Date/Time: 5/7/2012 5:07:33 PM

5.5GHz Band

Frequency: 5620 MHz; Duty Cycle: 1:1

802.11a, Chain B_Ch 124/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 0.844 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/8/2012 3:44:20 AM

5.5GHz Band

Frequency: 5680 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C

Medium parameters used: $f = 5680$ MHz; $\sigma = 6.06$ mho/m; $\epsilon_r = 49.6$; $\rho = 1000$ kg/m³;

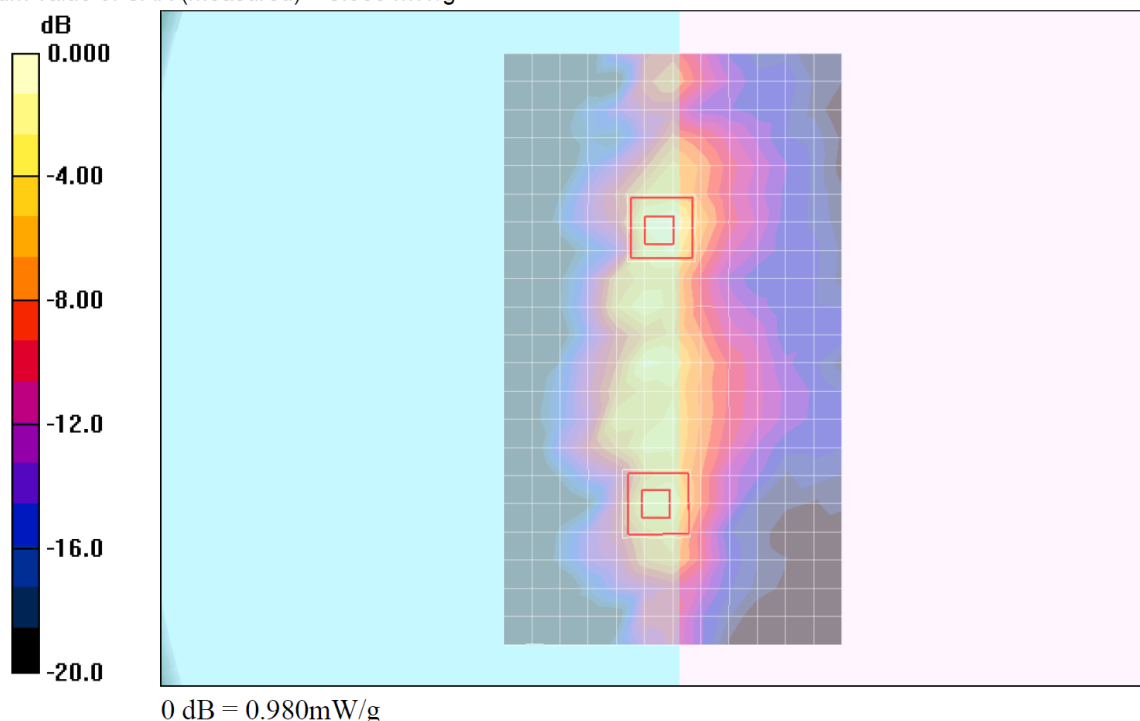
DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012
- Probe: EX3DV4 - SN3749; ConvF(3.57, 3.57, 3.57); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003

802.11n HT20, Chain A, B_Ch 136/Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.785 mW/g

802.11n HT20, Chain A_Ch 136/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 11.8 V/m; Power Drift = 0.004 dB
Peak SAR (extrapolated) = 1.29 W/kg
SAR(1 g) = 0.398 mW/g; SAR(10 g) = 0.131 mW/g
Maximum value of SAR (measured) = 0.690 mW/g

802.11n HT20, Chain B_Ch 136/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 11.8 V/m; Power Drift = 0.004 dB
Peak SAR (extrapolated) = 2.01 W/kg
SAR(1 g) = 0.565 mW/g; SAR(10 g) = 0.173 mW/g
Maximum value of SAR (measured) = 0.980 mW/g



Test Laboratory: UL CCS SAR Lab D

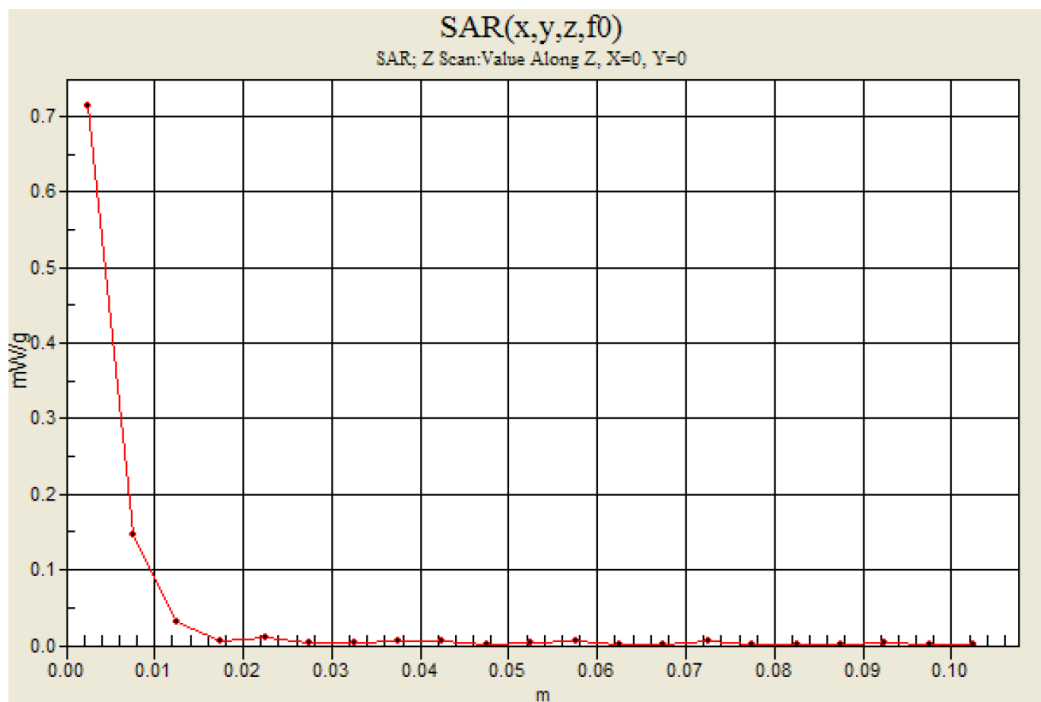
Date/Time: 5/8/2012 4:24:10 AM

5.5GHz Band

Frequency: 5680 MHz; Duty Cycle: 1:1

802.11n HT20, Chain A, B_Ch 136/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 0.714 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/8/2012 12:21:20 AM

5.8GHz Band

Frequency: 5785 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C

Medium parameters used: $f = 5785$ MHz; $\sigma = 6.1$ mho/m; $\epsilon_r = 49.7$; $\rho = 1000$ kg/m³;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012

- Probe: EX3DV4 - SN3749; ConvF(3.81, 3.81, 3.81); Calibrated: 1/27/2012

- Sensor-Surface: 2.5mm (Mechanical Surface Detection (Locations From Previous Scan Used)) Sensor-Surface: 2.5mm (Mechanical Surface Detection)

- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003

802.11a, Chain B_Ch 157/Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.965 mW/g

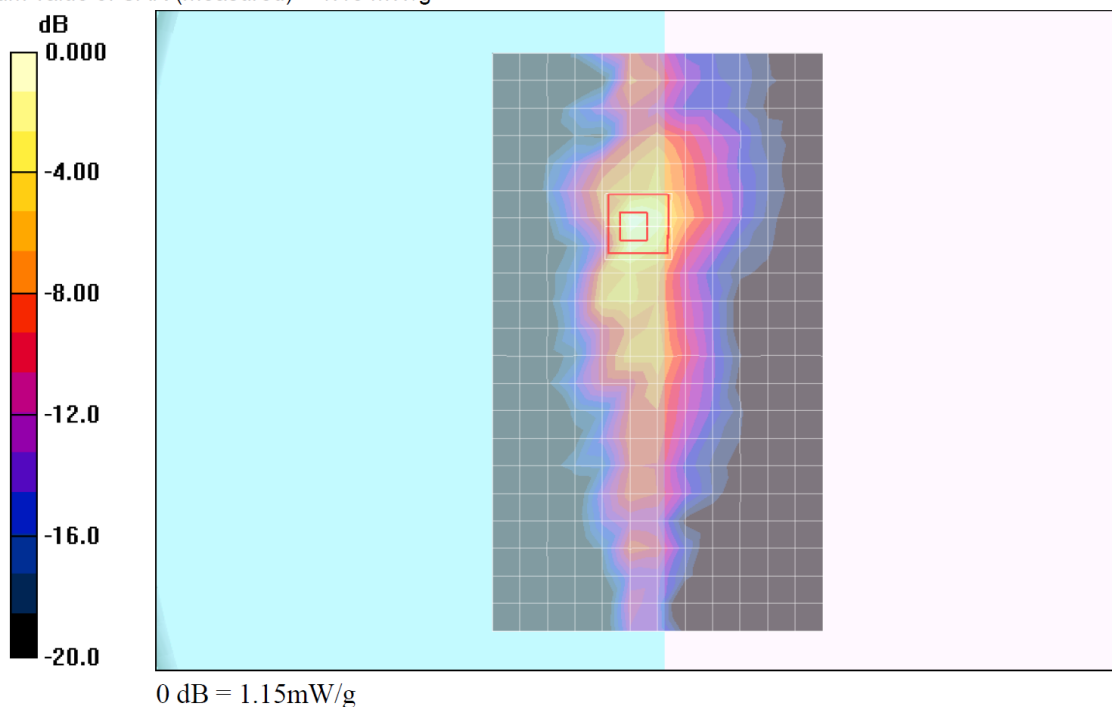
802.11a, Chain B_Ch 157/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 14.2 V/m; Power Drift = -0.007 dB

Peak SAR (extrapolated) = 2.32 W/kg

SAR(1 g) = 0.655 mW/g; SAR(10 g) = 0.198 mW/g

Maximum value of SAR (measured) = 1.15 mW/g



Test Laboratory: UL CCS SAR Lab D

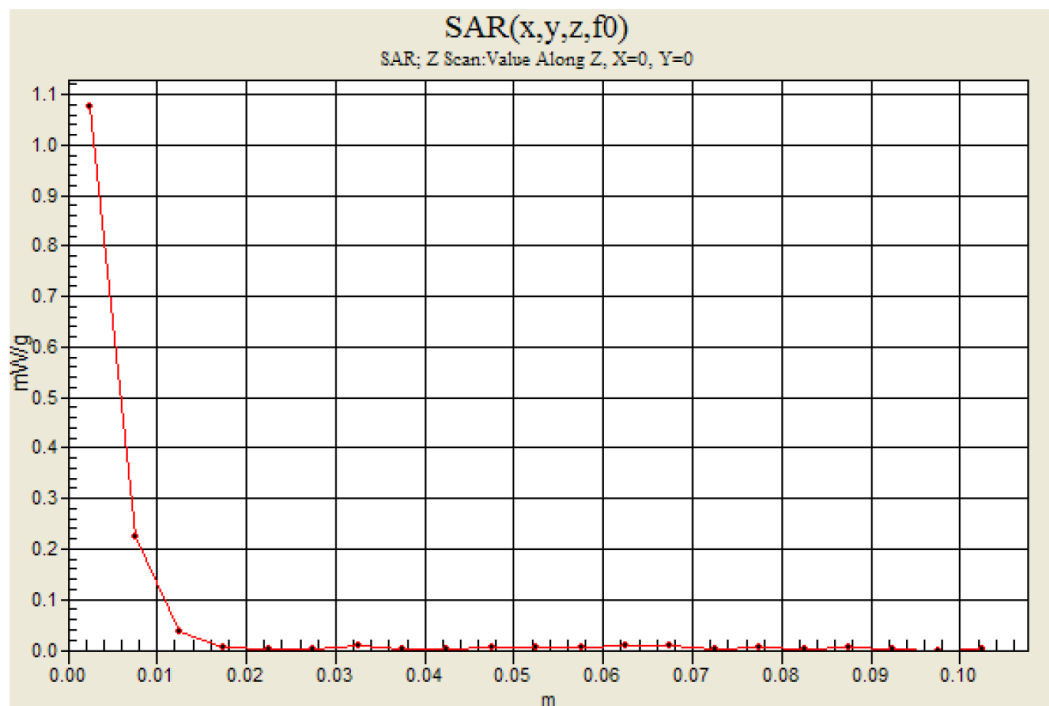
Date/Time: 5/8/2012 12:46:20 AM

5.8GHz Band

Frequency: 5785 MHz; Duty Cycle: 1:1

802.11a, Chain B_Ch 157/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 1.08 mW/g



Test Laboratory: UL CCS SAR Lab D

Date/Time: 5/8/2012 10:44:21 PM

5.8GHz Band

Frequency: 5755 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C

Medium parameters used: $f = 5755$ MHz; $\sigma = 6.06$ mho/m; $\epsilon_r = 49.8$; $\rho = 1000$ kg/m³;

DASY4 Configuration:

- Electronics: DAE3 Sn427; Calibrated: 1/17/2012
- Probe: EX3DV4 - SN3749; ConvF(3.81, 3.81, 3.81); Calibrated: 1/27/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003

802.11n HT40, Chain A, B_Ch 151/Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.905 mW/g

802.11n HT40, Chain A_Ch 151/Zoom Scan (7x7x9)/Cube 1: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 13.3 V/m; Power Drift = -0.014 dB

Peak SAR (extrapolated) = 1.01 W/kg

SAR(1 g) = 0.310 mW/g; SAR(10 g) = 0.102 mW/g

Maximum value of SAR (measured) = 0.550 mW/g

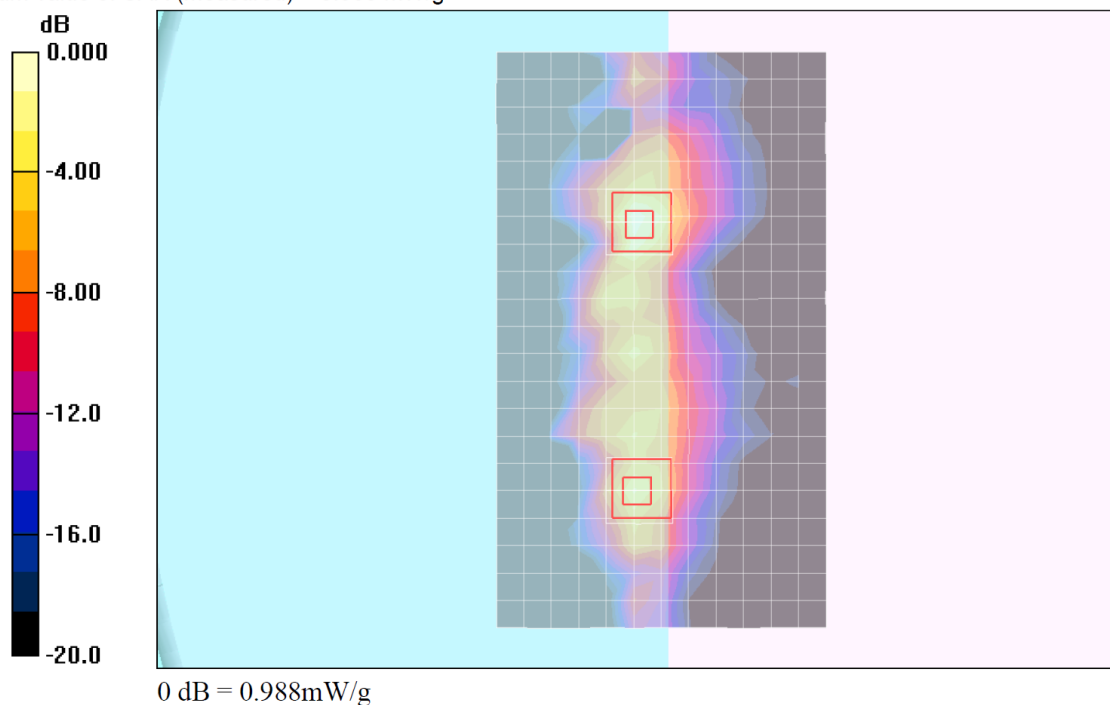
802.11n HT40, Chain B_Ch 151/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 13.3 V/m; Power Drift = -0.014 dB

Peak SAR (extrapolated) = 1.98 W/kg

SAR(1 g) = 0.562 mW/g; SAR(10 g) = 0.175 mW/g

Maximum value of SAR (measured) = 0.988 mW/g



Test Laboratory: UL CCS SAR Lab D

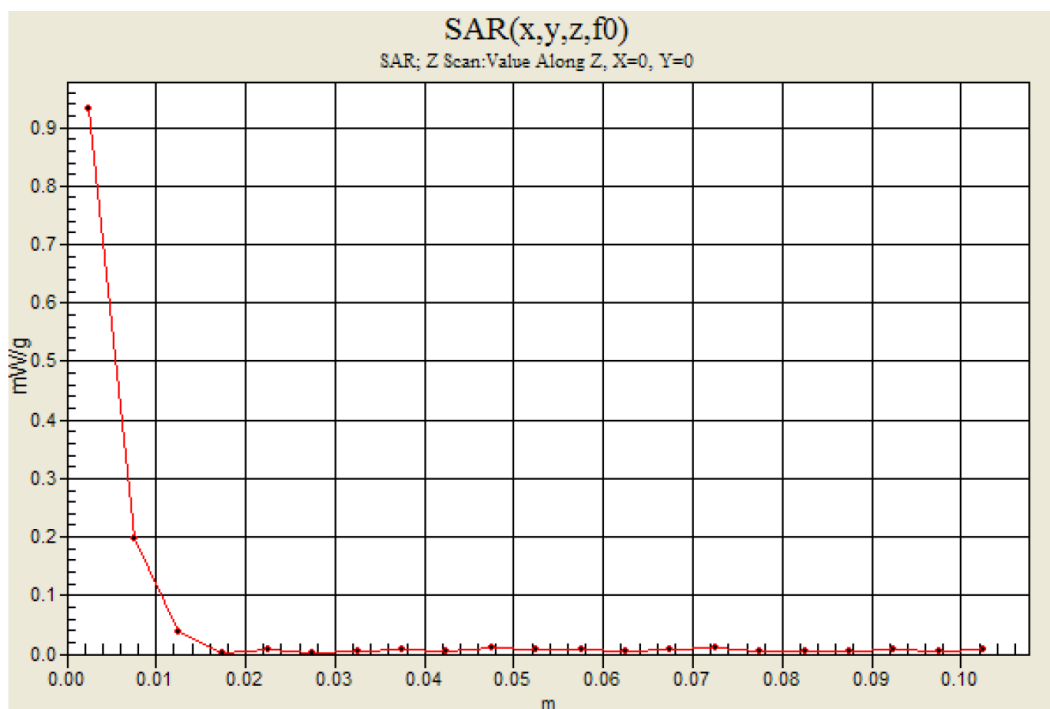
Date/Time: 5/8/2012 11:34:56 PM

5.8GHz Band

Frequency: 5755 MHz; Duty Cycle: 1:1

802.11n HT40, Chain A, B_Ch 151/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Maximum value of SAR (measured) = 0.932 mW/g



15. Appendixes

Refer to separated files for the following appendixes.

- 15.1. System Check Plots**
- 15.2. SAR Test Plots for 2.4GHz**
- 15.3. SAR Test Plots for 5GHz Bands**
- 15.4. Calibration certificate for E-Field Probe EX3DV4 SN 3749**
- 15.5. Calibration certificate for D2450V2 SN: 748**
- 15.6. Calibration certificate for D5GHzV2 SN 1075**