FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE Std 1528-2003 and IEEE Std 1528a-2005

SAR EVALUATION REPORT

For
Intel Centrino Advanced-N 6235
(Tested inside of Panasonic Convertible Laptop/Tablet PC CF-C2)

Model: WL12A
FCC ID: ACJ9TGWL12A

Report Number: 12J14611-1
Issue Date: 10/22/2012

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	10/22/2012	Initial Issue	--

Table of Contents

1. Attestation of Test Results

Applicant	PANASONIC CORPORATION OF NORTH AMERICA		
DUT description	Intel Centrino Advanced-N 6235		
Model	WL12A		
Test device is	An identical prototype		
Device category	Portable		
Exposure category	General Population/Uncontrolled Exposure		
Date tested	8/27/2012 – 9/27/2012		
FCC Rule Parts	Freq. Range	Highest 1-g SAR	Limit
15.247	2412-2462 MHz	1.29 W/kg (Aux Antenna, Edge 4 with 0 mm distance)	1.6 W/kg
	5725-5850 MHz	1.41 W/kg (Aux Antenna, 45° Vertex at Bottom Left Corner with 0 mm distance)	
15.407	5150-5250 MHz	1.31 W/kg (Aux Antenna, 45° Vertex at Bottom Left Corner with 0 mm distance)	
	5250-5350 MHz	1.22 W/kg (Main Antenna, Edge 1 with 0 mm distance)	
	5500-5700 MHz	1.4 W/kg (Aux Antenna, 45° Vertex at Bottom Left Corner with 0 mm distance)	
Applicable Standards			Test Results
- FCC OET Bulletin 65 Supplement C 01-01, - IEEE Std 1528-2003 and IEEE Std 1528a-2005			Pass

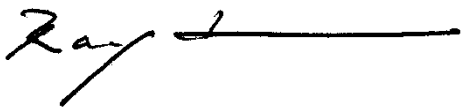
UL CCS tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and 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:

Dave Weaver
Program Manager
UL CCS

Tested By:



Ray Su
SAR Engineer
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, IEEE Std 1528a-2005 and the following KDB Procedures:

- 447498 D01 Mobile Portable RF Exposure v04
- 616217 D03 SAR Supp Note and Netbook Laptop V01
- 865664 SAR 3 to 6 GHz Rev
- 248227 D01 SAR meas for 802 11abg v01r02

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 used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' 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	85070E	594	N/A		
ENA Series Network Analyzer	Agilent	E5071B	MY42100131	2	11	2013
Synthesized Signal Generator	HP	8665B	3438A00633	2	22	2013
E-Field Probe	SPEAG	EX3DV4	3749	1	27	2013
Thermometer	ERTCO	639-1S	1718	7	30	2013
Data Acquisition Electronics	SPEAG	DAE43	500	6	13	2013
System Validation Dipole	SPEAG	D2450V2	748	2	7	2013
System Validation Dipole	SPEAG	D5GHzV2	1075	2	14	2013
Power Meter	Agilent	N1912A	MY50001018	8	10	2013
Power Sensor A	HP	8481A	MY52050011	1	17	2013
Power Sensor B	HP	8481A	MY52050012	7	24	2013
Power Meter	Agilent	N1912A	MY52310061	7	5	2013
Power Sensor A	HP	8481A	MY52260009	7	5	2013
Power Sensor B	HP	8481A	MY52270022	7	21	2013
Amplifier	MITEQ	4D00400600-50-30P	1620606	N/A		
Directional coupler	Werlatone	C8060-102	2141	N/A		

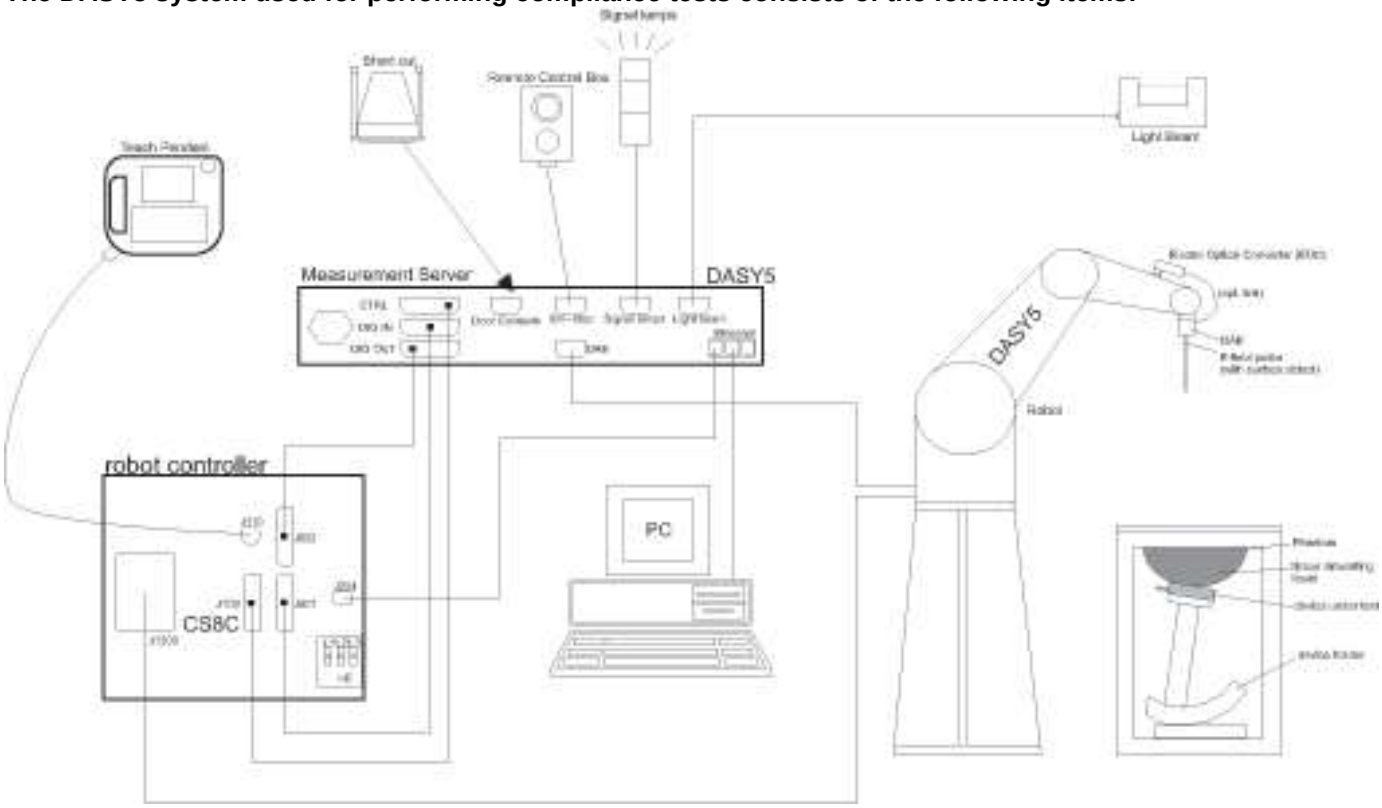
4.2. Measurement Uncertainty

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	**3.67**	Normal	1	0.64	2.35
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement uncertainty	**-3.20**	Normal	1	0.6	-1.92
				Combined Standard Uncertainty Uc(y) =	10.20
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =	20.40 %
				Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =	1.61 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	**4.46**	Normal	1	0.64	2.85
Liquid Permittivity - deviation from target	10.00	Rectangular	1.732	0.6	3.46
Liquid Permittivity - measurement uncertainty	**-4.32**	Normal	1	0.6	-2.59
				Combined Standard Uncertainty Uc(y), %:	11.14
				Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =	21.83 %
				Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =	1.72 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 Procedure

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 ≥ 7x7x9 (above 4.5 GHz) or 5x5x7 (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 (FCC only)
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 ≥ 7x7x9 (above 4.5 GHz) or 5x5x7 (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

Intel Centrino Advanced-N 6235 (Tested inside of Panasonic Convertible Laptop/Tablet PC CF-C2) Model: WL12A	
Normal operation	- Laptop Mode - Tablet Mode
Accessory	None

7.1. Band and Air Interfaces

Tx Frequency Bands	- 802.11a/b/g/n: 2412 - 2462 MHz, b / g / HT20 / HT40 5150 - 5250 MHz, a / HT20 / HT40 5250 - 5350 MHz, a / HT20 / HT40 5500 - 5700 MHz, a / HT20 / HT40 5725 - 5850 MHz, a / HT20 / HT40 - Bluetooth: 2402 - 2480 MHz
Simultaneous Transmission	- WiFi 2.4 GHz Radio cannot transmit simultaneously with Bluetooth Radio. - WiFi 5 GHz Radio can transmit simultaneously with Bluetooth Radio. As its max average power is 4.47 mW [<60/f (GHz) mW], standalone SAR is not required for Bluetooth. Therefore, Bluetooth need not be considered in the simultaneous transmission SAR evaluation of other transmitters

8. Summary of Test Configurations

Refer to Section 17 "Antenna Location and Separation Distances" for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

8.1. Test Configurations for the Main Antenna

Laptop Mode

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	229 mm	No	The Main Antenna does not require testing in this position when operating in Laptop Mode as the same test position for Tablet Mode is far more conservative.
Top Edge of Display Screen against Phantom	2.3 mm	No	The Main Antenna does not require testing in this position as it is accounted for by the Edge 1 test position for Tablet Mode.

Tablet Mode

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	18 mm	Yes	
Edge 1	2.3 mm	Yes	
Edge 2	24 mm	Yes	
Edge 3	211 mm	No	This is not the most conservative antenna-to-user distance at edge mode. According to KDB 447498 4) b) ii) (2)
Edge 4	200.5 mm	No	This is not the most conservative antenna-to-user distance at edge mode. According to KDB 447498 4) b) ii) (2)

8.2. Test Configurations for the Aux Antenna

Laptop Mode

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	8.2 mm	No	The Aux Antenna does not require testing in this position when operating in Laptop Mode as it is accounted for by the same test position in Table t Mode.

Tablet Mode

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	8.2 mm	Yes	
Edge 1	194 mm	No	This is not the most conservative antenna-to-user distance at edge mode. According to KDB 447498 4) b) ii) (2)
Edge 2	282 mm	No	This is not the most conservative antenna-to-user distance at edge mode. According to KDB 447498 4) b) ii) (2)
Edge 3	2.8 mm	Yes	
Edge 4	2.3 mm	Yes	
45° Vertex at Bottom Left Corner	2.3 mm	Yes	As the Aux Antenna is positioned at a 45° angle, testing was conducted with the phantom parallel to the antenna to ensure the worst-case exposure condition was captured for the Aux Antenna.

9. Summary of Required Test Modes

9.1. 2.4 GHz Band

Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)
				Main	Aux	Main	Aux	
802.11b	1 Tx	1	2412	16.8		12.0		Yes
		6	2437	16.8		14.5		
		11	2462	16.8		11.5		
		1	2412		16.6		12.0	Yes
		6	2437		15.0		15.0	
		11	2462		16.0		11.5	
802.11g	1 Tx	1	2412	14.1		12.0		Yes
		6	2437	16.6		14.5		
		11	2462	14.0		11.5		
		1	2412		13.9		12.0	Yes
		6	2437		16.7		15.5	
		11	2462		13.5		11.5	
802.11n HT20	1 Tx	1	2412	13.1		12.0		No
		6	2437	16.5		14.5		
		11	2462	12.5		11.5		
		1	2412		12.5		11.5	No
		6	2437		16.6		15.0	
		11	2462		12.4		11.5	
802.11n HT20	2 Tx	1	2412	11.6	11.6	11.5	11.5	Yes
		6	2437	13.3	13.0	12.5	12.5	
		11	2462	11.1	10.4	10.5	10.4	
802.11n HT40	1 Tx	3	2422	10.6		10.6		No
		6	2437	13.6		13.6		
		9	2450	10.1		10.1		
		3	2422		9.2		9.2	No
		6	2437		12.7		12.7	
		9	2450		10.1		10.1	
802.11n HT40	2 Tx	3	2422	7.3	7.0	7.3	7.0	No
		6	2437	12.3	12.3	12.3	12.3	
		9	2450	6.5	6.7	6.5	6.7	

Note(s):

1. Per KDB 248227, SAR is not required for 802.HT20 or HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels.

9.2. 5.2 GHz Band

Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)
				Main	Aux	Main	Aux	
802.11a	1 Tx	36	5180	16.2		13.0		Yes
		40	5200	16.2		15.0		
		44	5220					
		48	5240	15.9		15.0		
		36	5180		15.9		13.0	
		40	5200		15.8		15.0	
		44	5220					
		48	5240		15.7		15.0	
802.11n HT20	1 Tx	36	5180	15.9		13.0		No
		40	5200	16.5		15.0		
		44	5220					
		48	5240	16.4		15.0		
		36	5180		16.0		14.0	
		40	5200		16.0		15.0	
		44	5220					
		48	5240		15.9		15.0	
802.11n HT20	2 Tx	36	5180	13.3	13.3	12.0	12.0	Yes
		40	5200	12.2	13.2	12.0	12.0	
		48	5240	13.0	12.9	12.0	12.0	
802.11n HT40	1 Tx	38	5190	12.8		12.8		No
		46	5230	16.4		14.5		
		38	5190		12.7		12.7	
		46	5230		15.8		14.5	
802.11n HT40	2 Tx	38	5190	10.0	10.8	10.0	10.8	No
		46	5230	13.4	13.3	12.0	12.0	

Note(s):

1. Per KDB 248227, SAR is not required for 802.HT20 or HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels.

9.3. 5.3 GHz Band

Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)
				Main	Aux	Main	Aux	
802.11a	1 Tx	52	5260	15.9		15.0		Yes
		56	5280					
		60	5300	16.3		15.0		
		64	5320	16.4		14.5		
		52	5260		15.3		15.0	
		56	5280					
		60	5300		15.4		15.0	
		64	5320		15.9		14.5	
802.11n HT20	1 Tx	52	5260	16.1		15.0		No
		60	5300	16.6		15.0		
		64	5320	16.6		14.5		
		52	5260		15.4		15.0	
		60	5300		15.3		15.0	
		64	5320		15.7		14.5	
802.11n HT20	2 Tx	52	5260	12.7	12.5	12.0	12.0	Yes
		60	5300	13.2	12.6	12.0	12.0	
		64	5320	12.9	13.1	12.0	12.0	
802.11n HT40	1 Tx	54	5270	16.0		15.0		No
		62	5310	11.5		11.5		
		54	5270		15.2		15.0	
		62	5310		12.4		12.4	
802.11n HT40	2 Tx	54	5270	12.6	12.5	12.0	12.0	No
		62	5310	12.4	12.3	12.4	12.3	

Note(s):

1. Per KDB 248227, SAR is not required for 802.HT20 or HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels.

9.4. 5.5 GHz Band

Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)
				Main	Aux	Main	Aux	
802.11a	1 Tx	100	5500	16.4		15.0		Yes
		104	5520					
		108	5540					
		112	5560					
		116	5580	16.5		15.0		
		120	5600					
		124	5620					
		128	5640					
		132	5660					
		136	5680					
		140	5700	16.5		15.0		
		100	5500		15.6		15.0	Yes
		104	5520					
		108	5540					
		112	5560					
		116	5580		15.7		15.0	
		120	5600					
		124	5620					
		128	5640					
		132	5660					
		136	5680					
		140	5700		15.5		15.0	
802.11n HT20	1 Tx	100	5500	16.4		15.0		No
		116	5580	16.4		15.0		
		140	5700	16.3		15.0		
		100	5500		15.6		15.0	
		116	5580		15.7		15.0	
		140	5700		15.5		15.0	
802.11n HT20	2 Tx	100	5500	12.7	13.2	12.5	12.5	Yes
		120	5600	12.7	13.2	12.5	12.5	
		140	5700	12.4	12.4	12.4	12.4	
802.11n HT40	1 Tx	102	5510	15.5		13.5		No
		110	5550	16.5		15.0		
		134	5670	16.4		15.0		
		102	5510		14.8		13.5	
		110	5550		15.8		15.0	
		134	5670		15.6		15.0	
802.11n HT40	2 Tx	102	5510	13.1	13.0	11.5	11.5	No
		110	5550	13.1	13.2	12.5	12.5	
		134	5670	12.6	12.8	12.5	12.5	

Note(s):

1. Per KDB 248227, SAR is not required for 802.HT20 or HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels.

9.5. 5.8 GHz Band

Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)
				Main	Aux	Main	Aux	
802.11a	1 Tx	149	5745	16.5		15.0		Yes
		153	5765					
		157	5785	16.5		15.0		
		161	5805					
		165	5825	16.5		15.0		
		149	5745		16.7		15.0	Yes
		153	5765					
		157	5785		16.7		15.0	
		161	5805					
		165	5825		16.6		14.5	
802.11n HT20	1 Tx	149	5745	16.6		15.0		No
		157	5785	16.6		15.0		
		165	5825	16.5		15.0		
		149	5745		16.7		15.0	No
		157	5785		16.6		15.0	
		165	5825		16.6		15.0	
802.11n HT20	2 Tx	149	5745	13.6	13.5	12.0	12.0	Yes
		157	5785	13.5	13.4	12.0	12.0	
		165	5825	13.3	13.7	12.0	12.0	
802.11n HT40	1 Tx	151	5755	16.5		15.0		No
		159	5795	16.5		15.0		
		151	5755		16.6		15.0	No
		159	5795		16.6		15.0	
802.11n HT40	2 Tx	151	5755	13.5	13.5	12.0	12.0	No
		159	5795	13.5	13.5	12.0	12.0	

Note(s):

1. Per KDB 248227, SAR is not required for 802.HT20 or HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels.

10. RF Output Power Measurement

10.1. Wi-Fi 2.4 GHz Band

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[#]	√	∇

Notes:
√ = "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.

Mode	Number of Transmitters	Ch #	Freq. (MHz)	Target Avg Pwr (dBm)		Measured Avg Pwr (dBm)	
				Main	Aux	Main	Aux
802.11b	1 Tx	1	2412	12.0		12.0	
		6	2437	14.5		14.0	
		11	2462	11.5		11.5	
		1	2412		12.0		12.0
		6	2437		15.0		15.0
		11	2462		11.5		11.5
802.11g	1 Tx	1	2412	12.0		12.0	
		6	2437	14.5		14.3	
		11	2462	11.5		11.5	
		1	2412		12.0		12.0
		6	2437		15.5		15.5
		11	2462		11.5		11.5
802.11n HT20	2 Tx	1	2412	11.5	11.5	11.5	11.5
		6	2437	12.5	12.5	12.5	12.5
		11	2462	10.5	10.5	10.5	10.5

10.2. Wi-Fi 5 GHz Bands

Required Test Channels per KDB 248227 D01

Mode		Band	GHz	Channel	"Default Test Channels" 802.11a	
802.11a	UNII (15.407)	5.2 GHz	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	149	√	
			5.765	153		*
			5.785	157	√	
			5.805	161		*
			5.825	165	√	

√ = "default test channels"

* = possible 802.11a channels with maximum average output > 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.

10.2.1. 5.2 GHz Band

Mode	Number of Transmitters	Ch #	Freq. (MHz)	Target Avg Pwr (dBm)		Measured Avg Pwr (dBm)	
				Main	Aux	Main	Aux
802.11a	1 Tx	36	5180	13.0		13.0	
		40	5200	15.0		15.0	
		44	5220			15.0	
		48	5240	15.0		15.0	
		36	5180		13.0		13.0
		40	5200		15.0		15.0
		44	5220				15.0
		48	5240		15.0		15.0
802.11n HT20	2 Tx	36	5180	12.0	12.0	12.0	12.0
		40	5200	12.0	12.0	12.0	12.0
		48	5240	12.0	12.0	12.0	12.0

10.2.2. 5.3 GHz Band

Mode	Number of Transmitters	Ch #	Freq. (MHz)	Target Avg Pwr (dBm)		Measured Avg Pwr (dBm)	
				Main	Aux	Main	Aux
802.11a	1 Tx	52	5260	15.0		15.0	
		56	5280			14.9	
		60	5300	15.0		14.7	
		64	5320	14.5		14.2	
		52	5260		15.0		15.0
		56	5280				15.0
		60	5300		15.0		14.9
		64	5320		14.5		14.5
802.11n HT20	2 Tx	52	5260	12.0	12.0	12.0	12.0
		60	5300	12.0	12.0	11.9	12.0
		64	5320	12.0	12.0	12.0	12.0

10.2.3. 5.5 GHz Band

Mode	Number of Transmitters	Ch #	Freq. (MHz)	Target Avg Pwr (dBm)		Measured Avg Pwr (dBm)	
				Main	Aux	Main	Aux
802.11a	1 Tx	100	5500	15.0		15.0	
		104	5520			14.8	
		108	5540			15.0	
		112	5560			14.9	
		116	5580	15.0		14.9	
		120	5600			15.0	
		124	5620			15.0	
		128	5640			15.0	
		132	5660			15.0	
		136	5680			15.0	
		140	5700	15.0		15.0	
		100	5500		15.0		15.0
		104	5520				15.0
		108	5540				15.0
		112	5560				14.9
		116	5580		15.0		15.0
		120	5600				15.0
		124	5620				15.0
		128	5640				15.0
		132	5660				15.0
		136	5680				15.0
		140	5700		15.0		14.9
802.11n HT20	2 Tx	100	5500	12.5	12.5	12.4	12.5
		116	5580	12.5	12.5	12.5	12.5
		140	5700	12.4	12.4	12.4	12.3

10.2.4. 5.8 GHz Band

Mode	Number of Transmitters	Ch #	Freq. (MHz)	Target Avg Pwr (dBm)		Measured Avg Pwr (dBm)	
				Main	Aux	Main	Aux
802.11a	1 Tx	149	5745	15.0		15.0	
		153	5765			14.8	
		157	5785	15.0		15.0	
		161	5805			15.0	
		165	5825	15.0		15.0	
		149	5745		15.0		15.0
		153	5765				15.0
		157	5785		15.0		15.0
		161	5805				14.3
		165	5825		14.5		14.0
802.11n HT20	2 Tx	149	5745	12.0	12.0	11.9	11.9
		157	5785	12.0	12.0	12.0	12.0
		165	5825	12.0	12.0	12.0	12.0

11. 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	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	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

11.1. 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

MSL/HSL750 (Body and Head liquids for 700 – 800 MHz)

Item	Head Tissue Simulation Liquids HSL750 Muscle (body) Tissue Simulation Liquids MSL750
Type No	SL AAH 075
Manufacturer	SPEAG
The item is composed of the following ingredients:	
H^2O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40-60%
NaCl	Sodium Chloride, 0-6%
Hydroxyethel-cellulsoe	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone, 0.1-0.7%

Simulating Liquids for 5 GHz, Manufactured by SPEAG

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

11.2. Tissue Dielectric Parameter Check Results

Tissue dielectric parameters were 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 ±(%)
8/24/2012	Body 5180	e'	49.3347	Relative Permittivity (ϵ_r):	49.33	49.05	0.59	10
		e''	18.2660	Conductivity (σ):	5.26	5.27	-0.20	5
	Body 5200	e'	49.3124	Relative Permittivity (ϵ_r):	49.31	49.02	0.60	10
		e''	18.2982	Conductivity (σ):	5.29	5.29	-0.08	5
	Body 5500	e'	48.7805	Relative Permittivity (ϵ_r):	48.78	48.61	0.34	10
		e''	18.5816	Conductivity (σ):	5.68	5.64	0.68	5
	Body 5800	e'	48.2732	Relative Permittivity (ϵ_r):	48.27	48.20	0.15	10
		e''	18.8345	Conductivity (σ):	6.07	6.00	1.23	5
	Body 5825	e'	48.2409	Relative Permittivity (ϵ_r):	48.24	48.20	0.08	10
		e''	18.8916	Conductivity (σ):	6.12	6.00	1.98	5
8/28/2012	Body 5180	e'	47.6399	Relative Permittivity (ϵ_r):	47.64	49.05	-2.87	10
		e''	18.5812	Conductivity (σ):	5.35	5.27	1.53	5
	Body 5200	e'	47.6341	Relative Permittivity (ϵ_r):	47.63	49.02	-2.83	10
		e''	18.6093	Conductivity (σ):	5.38	5.29	1.62	5
	Body 5500	e'	47.0819	Relative Permittivity (ϵ_r):	47.08	48.61	-3.15	10
		e''	18.9415	Conductivity (σ):	5.79	5.64	2.63	5
	Body 5800	e'	46.5878	Relative Permittivity (ϵ_r):	46.59	48.20	-3.34	10
		e''	19.3159	Conductivity (σ):	6.23	6.00	3.82	5
	Body 5825	e'	46.6039	Relative Permittivity (ϵ_r):	46.60	48.20	-3.31	10
		e''	19.3506	Conductivity (σ):	6.27	6.00	**4.46**	5
8/31/2012	Body 5180	e'	48.8894	Relative Permittivity (ϵ_r):	48.89	49.05	-0.32	10
		e''	18.0591	Conductivity (σ):	5.20	5.27	-1.33	5
	Body 5200	e'	48.8420	Relative Permittivity (ϵ_r):	48.84	49.02	-0.36	10
		e''	18.0838	Conductivity (σ):	5.23	5.29	-1.25	5
	Body 5500	e'	48.3549	Relative Permittivity (ϵ_r):	48.35	48.61	-0.53	10
		e''	18.3912	Conductivity (σ):	5.62	5.64	-0.36	5
	Body 5800	e'	47.7704	Relative Permittivity (ϵ_r):	47.77	48.20	-0.89	10
		e''	18.6165	Conductivity (σ):	6.00	6.00	0.06	5
	Body 5825	e'	47.7092	Relative Permittivity (ϵ_r):	47.71	48.20	-1.02	10
		e''	18.6884	Conductivity (σ):	6.05	6.00	0.88	5
9/1/2012	Body 5180	e'	48.3880	Relative Permittivity (ϵ_r):	48.39	49.05	-1.34	10
		e''	18.3106	Conductivity (σ):	5.27	5.27	0.05	5
	Body 5200	e'	48.8420	Relative Permittivity (ϵ_r):	48.84	49.02	-0.36	10
		e''	18.0838	Conductivity (σ):	5.23	5.29	-1.25	5
	Body 5500	e'	47.7643	Relative Permittivity (ϵ_r):	47.76	48.61	-1.75	10
		e''	18.3748	Conductivity (σ):	5.62	5.64	-0.44	5
	Body 5800	e'	47.5895	Relative Permittivity (ϵ_r):	47.59	48.20	-1.27	10
		e''	18.8369	Conductivity (σ):	6.07	6.00	1.25	5
	Body 5825	e'	47.3977	Relative Permittivity (ϵ_r):	47.40	48.20	-1.66	10
		e''	18.7009	Conductivity (σ):	6.06	6.00	0.95	5

Tissue Dielectric Parameter Check Results (continued)

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/2/2012	Body 5180	e'	48.8783	Relative Permittivity (ϵ_r):	48.88	49.05	-0.34	10
		e''	18.1590	Conductivity (σ):	5.23	5.27	-0.78	5
	Body 5200	e'	48.8400	Relative Permittivity (ϵ_r):	48.84	49.02	-0.37	10
		e''	18.1614	Conductivity (σ):	5.25	5.29	-0.82	5
	Body 5500	e'	48.3155	Relative Permittivity (ϵ_r):	48.32	48.61	-0.61	10
		e''	18.3555	Conductivity (σ):	5.61	5.64	-0.55	5
	Body 5800	e'	47.9094	Relative Permittivity (ϵ_r):	47.91	48.20	-0.60	10
		e''	18.6655	Conductivity (σ):	6.02	6.00	0.33	5
	Body 5825	e'	47.8540	Relative Permittivity (ϵ_r):	47.85	48.20	-0.72	10
		e''	18.6060	Conductivity (σ):	6.03	6.00	0.44	5
9/10/2012	Body 5180	e'	49.7737	Relative Permittivity (ϵ_r):	49.77	49.05	1.48	10
		e''	18.5092	Conductivity (σ):	5.33	5.27	1.13	5
	Body 5200	e'	49.7226	Relative Permittivity (ϵ_r):	49.72	49.02	1.43	10
		e''	18.5524	Conductivity (σ):	5.36	5.29	1.31	5
	Body 5500	e'	49.2331	Relative Permittivity (ϵ_r):	49.23	48.61	1.28	10
		e''	18.8444	Conductivity (σ):	5.76	5.64	2.10	5
	Body 5800	e'	48.6841	Relative Permittivity (ϵ_r):	48.68	48.20	1.00	10
		e''	19.2146	Conductivity (σ):	6.20	6.00	3.28	5
	Body 5825	e'	48.7042	Relative Permittivity (ϵ_r):	48.70	48.20	1.05	10
		e''	19.1765	Conductivity (σ):	6.21	6.00	3.52	5
9/11/2012	Body 5180	e'	47.6268	Relative Permittivity (ϵ_r):	47.63	49.05	-2.90	10
		e''	18.3241	Conductivity (σ):	5.28	5.27	0.12	5
	Body 5200	e'	47.6202	Relative Permittivity (ϵ_r):	47.62	49.02	-2.85	10
		e''	18.4882	Conductivity (σ):	5.35	5.29	0.96	5
	Body 5500	e'	47.0324	Relative Permittivity (ϵ_r):	47.03	48.61	-3.25	10
		e''	18.6692	Conductivity (σ):	5.71	5.64	1.15	5
	Body 5800	e'	48.6841	Relative Permittivity (ϵ_r):	48.68	48.20	1.00	10
		e''	19.2146	Conductivity (σ):	6.20	6.00	3.28	5
	Body 5825	e'	46.5388	Relative Permittivity (ϵ_r):	46.54	48.20	-3.45	10
		e''	18.9175	Conductivity (σ):	6.13	6.00	2.12	5
9/12/2012	Body 5180	e'	48.3372	Relative Permittivity (ϵ_r):	48.34	49.05	-1.45	10
		e''	18.3860	Conductivity (σ):	5.30	5.27	0.46	5
	Body 5200	e'	48.4206	Relative Permittivity (ϵ_r):	48.42	49.02	-1.22	10
		e''	18.2702	Conductivity (σ):	5.28	5.29	-0.23	5
	Body 5500	e'	47.9551	Relative Permittivity (ϵ_r):	47.96	48.61	-1.35	10
		e''	18.5861	Conductivity (σ):	5.68	5.64	0.70	5
	Body 5800	e'	47.4850	Relative Permittivity (ϵ_r):	47.49	48.20	-1.48	10
		e''	18.9365	Conductivity (σ):	6.11	6.00	1.78	5
	Body 5825	e'	47.4973	Relative Permittivity (ϵ_r):	47.50	48.20	-1.46	10
		e''	18.8633	Conductivity (σ):	6.11	6.00	1.83	5
9/13/2012	Body 5180	e'	48.6748	Relative Permittivity (ϵ_r):	48.67	49.05	-0.76	10
		e''	18.1109	Conductivity (σ):	5.22	5.27	-1.04	5
	Body 5200	e'	48.4774	Relative Permittivity (ϵ_r):	48.48	49.02	-1.11	10
		e''	18.0106	Conductivity (σ):	5.21	5.29	-1.65	5
	Body 5500	e'	48.0280	Relative Permittivity (ϵ_r):	48.03	48.61	-1.20	10
		e''	18.3952	Conductivity (σ):	5.63	5.64	-0.33	5
	Body 5800	e'	47.4858	Relative Permittivity (ϵ_r):	47.49	48.20	-1.48	10
		e''	18.5916	Conductivity (σ):	6.00	6.00	-0.07	5
	Body 5825	e'	47.6394	Relative Permittivity (ϵ_r):	47.64	48.20	-1.16	10
		e''	18.6486	Conductivity (σ):	6.04	6.00	0.67	5

Tissue Dielectric Parameter Check Results (continued)

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/17/2012	Body 2450	e'	51.6219	Relative Permittivity (ϵ_r):	51.62	52.70	-2.05	5
		e''	14.0914	Conductivity (σ):	1.92	1.95	-1.56	5
	Body 2410	e'	51.7720	Relative Permittivity (ϵ_r):	51.77	52.76	-1.87	5
		e''	13.9428	Conductivity (σ):	1.87	1.91	-2.05	5
	Body 2435	e'	51.8216	Relative Permittivity (ϵ_r):	51.82	52.73	-1.72	5
		e''	13.9522	Conductivity (σ):	1.89	1.93	-2.18	5
	Body 2460	e'	51.6529	Relative Permittivity (ϵ_r):	51.65	52.69	-1.96	5
		e''	14.1057	Conductivity (σ):	1.93	1.96	-1.76	5
9/18/2012	Body 2450	e'	52.8306	Relative Permittivity (ϵ_r):	52.83	52.70	0.25	5
		e''	14.5656	Conductivity (σ):	1.98	1.95	1.76	5
	Body 2410	e'	53.0586	Relative Permittivity (ϵ_r):	53.06	52.76	0.57	5
		e''	14.3695	Conductivity (σ):	1.93	1.91	0.95	5
	Body 2435	e'	52.9506	Relative Permittivity (ϵ_r):	52.95	52.73	0.43	5
		e''	14.5654	Conductivity (σ):	1.97	1.93	2.12	5
	Body 2460	e'	52.9146	Relative Permittivity (ϵ_r):	52.91	52.69	0.43	5
		e''	14.6146	Conductivity (σ):	2.00	1.96	1.78	5
9/19/2012	Body 5180	e'	49.6048	Relative Permittivity (ϵ_r):	49.60	49.05	1.14	10
		e''	18.3076	Conductivity (σ):	5.27	5.27	0.03	5
	Body 5200	e'	49.6573	Relative Permittivity (ϵ_r):	49.66	49.02	1.30	10
		e''	18.2812	Conductivity (σ):	5.29	5.29	-0.17	5
	Body 5500	e'	49.0583	Relative Permittivity (ϵ_r):	49.06	48.61	0.92	10
		e''	18.6259	Conductivity (σ):	5.70	5.64	0.92	5
	Body 5800	e'	48.5055	Relative Permittivity (ϵ_r):	48.51	48.20	0.63	10
		e''	18.9346	Conductivity (σ):	6.11	6.00	1.77	5
	Body 5825	e'	48.4843	Relative Permittivity (ϵ_r):	48.48	48.20	0.59	10
		e''	19.0590	Conductivity (σ):	6.17	6.00	2.88	5
9/20/2012	Body 5180	e'	48.8131	Relative Permittivity (ϵ_r):	48.81	49.05	-0.48	10
		e''	18.4864	Conductivity (σ):	5.32	5.27	1.01	5
	Body 5200	e'	48.8217	Relative Permittivity (ϵ_r):	48.82	49.02	-0.40	10
		e''	18.3224	Conductivity (σ):	5.30	5.29	0.06	5
	Body 5500	e'	48.3844	Relative Permittivity (ϵ_r):	48.38	48.61	-0.47	10
		e''	18.7272	Conductivity (σ):	5.73	5.64	1.46	5
	Body 5800	e'	47.7203	Relative Permittivity (ϵ_r):	47.72	48.20	-1.00	10
		e''	18.9032	Conductivity (σ):	6.10	6.00	1.60	5
	Body 5825	e'	47.7527	Relative Permittivity (ϵ_r):	47.75	48.20	-0.93	10
		e''	19.0508	Conductivity (σ):	6.17	6.00	2.84	5
9/21/2012	Body 5180	e'	48.9553	Relative Permittivity (ϵ_r):	48.96	49.05	-0.19	10
		e''	18.3448	Conductivity (σ):	5.28	5.27	0.23	5
	Body 5200	e'	48.8941	Relative Permittivity (ϵ_r):	48.89	49.02	-0.26	10
		e''	18.3924	Conductivity (σ):	5.32	5.29	0.44	5
	Body 5500	e'	48.5119	Relative Permittivity (ϵ_r):	48.51	48.61	-0.21	10
		e''	18.6627	Conductivity (σ):	5.71	5.64	1.11	5
	Body 5800	e'	47.9524	Relative Permittivity (ϵ_r):	47.95	48.20	-0.51	10
		e''	19.0088	Conductivity (σ):	6.13	6.00	2.17	5
	Body 5825	e'	48.0096	Relative Permittivity (ϵ_r):	48.01	48.20	-0.40	10
		e''	18.9945	Conductivity (σ):	6.15	6.00	2.53	5

Tissue Dielectric Parameter Check Results (continued)

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/21/2012	Body 5180	e'	48.9553	Relative Permittivity (ϵ_r):	48.96	49.05	-0.19	10
		e''	18.3448	Conductivity (σ):	5.28	5.27	0.23	5
	Body 5200	e'	48.8941	Relative Permittivity (ϵ_r):	48.89	49.02	-0.26	10
		e''	18.3924	Conductivity (σ):	5.32	5.29	0.44	5
	Body 5500	e'	48.5119	Relative Permittivity (ϵ_r):	48.51	48.61	-0.21	10
		e''	18.6627	Conductivity (σ):	5.71	5.64	1.11	5
	Body 5800	e'	47.9524	Relative Permittivity (ϵ_r):	47.95	48.20	-0.51	10
		e''	19.0088	Conductivity (σ):	6.13	6.00	2.17	5
	Body 5825	e'	48.0096	Relative Permittivity (ϵ_r):	48.01	48.20	-0.40	10
		e''	18.9945	Conductivity (σ):	6.15	6.00	2.53	5
9/26/2012	Body 5180	e'	47.2783	Relative Permittivity (ϵ_r):	47.28	49.05	-3.61	10
		e''	18.1466	Conductivity (σ):	5.23	5.27	-0.85	5
	Body 5200	e'	47.1816	Relative Permittivity (ϵ_r):	47.18	49.02	-3.75	10
		e''	18.0348	Conductivity (σ):	5.21	5.29	-1.51	5
	Body 5500	e'	46.5993	Relative Permittivity (ϵ_r):	46.60	48.61	-4.14	10
		e''	18.2869	Conductivity (σ):	5.59	5.64	-0.92	5
	Body 5800	e'	46.1278	Relative Permittivity (ϵ_r):	46.13	48.20	-4.30	10
		e''	18.3336	Conductivity (σ):	5.91	6.00	-1.46	5
	Body 5825	e'	46.1181	Relative Permittivity (ϵ_r):	46.12	48.20	**-4.32**	10
		e''	18.2650	Conductivity (σ):	5.92	6.00	-1.40	5
9/27/2012	Body 2450	e'	51.0631	Relative Permittivity (ϵ_r):	51.06	52.70	-3.11	5
		e''	14.8402	Conductivity (σ):	2.02	1.95	**3.67**	5
	Body 2410	e'	51.2309	Relative Permittivity (ϵ_r):	51.23	52.76	-2.90	5
		e''	14.6054	Conductivity (σ):	1.96	1.91	2.61	5
	Body 2435	e'	51.0378	Relative Permittivity (ϵ_r):	51.04	52.73	**-3.20**	5
		e''	14.7471	Conductivity (σ):	2.00	1.93	3.40	5
	Body 2460	e'	51.0867	Relative Permittivity (ϵ_r):	51.09	52.69	-3.04	5
		e''	14.8101	Conductivity (σ):	2.03	1.96	3.14	5

12. 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 ±10%.

12.1. 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 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the 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.

12.2. 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)	Target SAR Values (mW/g)		
				1g/10g	Head	Body
D2450V2	748	2/7/12	2450	1g	52.7	49.9
				10g	24.6	23.4
D5GHzV2	1075	2/14/12	5200	1g	79.4	72.7
				10g	22.8	20.5
			5500	1g	85.7	77.7
				10g	24.3	21.7
			5800	1g	78.9	72.5
				10g	22.5	20.2

12.3. System Performance Check Results

Date Tested	System Dipole		T.S.	SAR Measured		Target	Delta (%)	Tolerance
	Type	Serial No.	Liquid	(Normalized to 1 W)		(Ref. Value)		(%)
8/27/2012	D5GHzV2 (5.8GHz)	1075	Body	1g	74.6	72.5	2.90	±10
				10g	21.3	20.2	5.45	
8/28/2012	D5GHz V2 (5.2 GHz)	1075	Body	1g	75.70	72.8	3.98	±10
				10g	21.70	20.5	5.85	
	D5GHzV2 (5.8GHz)	1075	Body	1g	74.1	72.5	2.21	±10
				10g	21.2	20.2	4.95	
8/31/2012	D5GHz V2 (5.2 GHz)	1075	Body	1g	71.40	72.8	-1.92	±10
				10g	20.70	20.5	0.98	
	D5GHzV2 (5.8GHz)	1075	Body	1g	74.0	72.5	2.07	±10
				10g	21.2	20.2	4.95	
9/1/2012	D5GHz V2 (5.2 GHz)	1075	Body	1g	73.5	72.8	0.96	±10
				10g	20.7	20.5	0.98	
	D5GHzV2 (5.5GHz)	1075	Body	1g	74.5	77.7	-4.12	±10
				10g	21.1	21.7	-2.76	
	D5GHzV2 (5.6GHz)	1075	Body	1g	78.9	77.7	1.54	±10
				10g	22.4	21.7	3.23	
9/2/2012	D5GHzV2 (5.5GHz)	1075	Body	1g	81.60	77.7	5.02	±10
				10g	23.30	21.7	7.37	
	D5GHzV2 5.6GHz	1075	Body	1g	80.3	77.7	3.35	±10
				10g	22.7	21.7	4.61	
9/10/2012	D5GHz V2 (5.2 GHz)	1075	Body	1g	75.70	72.8	3.98	±10
				10g	21.50	20.5	4.88	
	D5GHzV2 (5.5GHz)	1075	Body	1g	79.70	77.7	2.57	±10
				10g	22.80	21.7	5.07	
	D5GHzV2 (5.6GHz)	1075	Body	1g	80.2	77.7	3.22	±10
				10g	22.8	21.7	5.07	
	D5GHzV2 (5.8GHz)	1075	Body	1g	74.4	72.5	2.62	±10
				10g	21.0	20.2	3.96	
9/11/2012	D5GHz V2 (5.2 GHz)	1075	Body	1g	72.00	72.8	-1.10	±10
				10g	20.60	20.5	0.49	
	D5GHzV2 (5.5GHz)	1075	Body	1g	81.30	77.7	4.63	±10
				10g	23.10	21.7	6.45	
	D5GHzV2 (5.6GHz)	1075	Body	1g	81.9	77.7	5.41	±10
				10g	23.2	21.7	6.91	
	D5GHzV2 (5.8GHz)	1075	Body	1g	72.9	72.5	0.55	±10
				10g	20.7	20.2	2.48	
9/12/2012	D5GHz V2 (5.2 GHz)	1075	Body	1g	73.00	72.8	0.27	±10
				10g	21.00	20.5	2.44	
	D5GHzV2 (5.5GHz)	1075	Body	1g	79.10	77.7	1.80	±10
				10g	22.70	21.7	4.61	
	D5GHzV2 (5.6GHz)	1075	Body	1g	79.4	77.7	2.19	±10
				10g	22.5	21.7	3.69	
	D5GHzV2 (5.8GHz)	1075	Body	1g	72.3	72.5	-0.28	±10
				10g	20.6	20.2	1.98	

System Performance Check Results (continued)

Date Tested	System Dipole		T.S. Liquid	SAR Measured (Normalized to 1 W)		Target (Ref. Value)	Delta (%)	Tolerance (%)
	Type	Serial No.						
9/13/2012	D5GHz V2 (5.2 GHz)	1075	Body	1g	72.20	72.8	-0.82	±10
				10g	20.80	20.5	1.46	
	D5GHzV2 (5.5GHz)	1075	Body	1g	77.70	77.7	0.00	±10
				10g	22.10	21.7	1.84	
	D5GHzV2 (5.6GHz)	1075	Body	1g	76.2	77.7	-1.93	±10
				10g	21.6	21.7	-0.46	
	D5GHzV2 (5.8GHz)	1075	Body	1g	73.6	72.5	1.52	±10
				10g	21.0	20.2	3.96	
9/17/2012	D2450V2	748	Body	1g	51.4	49.9	3.01	±10
				10g	23.5	23.4	0.43	
9/18/2012	D2450V2	748	Body	1g	52.9	49.9	6.01	±10
				10g	24.5	23.4	4.70	
9/19/2012	D5GHz V2 (5.2 GHz)	1075	Body	1g	74.6	72.8	2.47	±10
				10g	21.3	20.5	3.90	
	D5GHzV2 (5.5GHz)	1075	Body	1g	79.4	77.7	2.19	±10
				10g	22.5	21.7	3.69	
	D5GHzV2 (5.6GHz)	1075	Body	1g	78.9	77.7	1.54	±10
				10g	22.4	21.7	3.23	
	D5GHzV2 (5.8GHz)	1075	Body	1g	72.8	72.5	0.41	±10
				10g	20.7	20.2	2.48	
9/20/2012	D5GHz V2 (5.2 GHz)	1075	Body	1g	73.2	72.8	0.55	±10
				10g	21.0	20.5	2.44	
	D5GHzV2 (5.5GHz)	1075	Body	1g	79.5	77.7	2.32	±10
				10g	22.6	21.7	4.15	
	D5GHzV2 (5.6GHz)	1075	Body	1g	78.2	77.7	0.64	±10
				10g	22.3	21.7	2.76	
9/21/2012	D5GHzV2 (5.5GHz)	1075	Body	1g	79.9	77.7	2.83	±10
				10g	22.8	21.7	5.07	
	D5GHzV2 (5.6GHz)	1075	Body	1g	78.6	77.7	1.16	±10
				10g	22.4	21.7	3.23	
	D5GHzV2 (5.8GHz)	1075	Body	1g	73.9	72.5	1.93	±10
				10g	21.2	20.2	4.95	
9/26/2012	D5GHzV2 (5.8GHz)	1075	Body	1g	70.1	72.5	-3.31	±10
				10g	19.9	20.2	-1.49	
9/27/2012	D2450V2	748	Body	1g	52.6	49.9	5.41	±10
				10g	24.3	23.4	3.85	

13. SAR Test Results

As its max average power is 4.47 mW [<60/f (GHz) mW], standalone SAR is not required for Bluetooth. Therefore, Bluetooth need not be considered in the simultaneous transmission SAR evaluation of other transmitters

13.1. Wi-Fi (2.4 GHz Band)

Tablet Mode

Test Position/Dist	Mode	Tx Ant.	Ch #.	Freq. (MHz)	Avg Pwr (dBm)		1-g SAR (mW/g)		Note
					Main	Aux	Main	Aux	
Rear, 0 mm	802.11b	Main	1	2412	12.0				1
			6	2437	14.0		0.00975		
			11	2462	11.5				1
		Aux	1	2412		12.0			1
			6	2437		15.0		0.093	
			11	2462		11.5			1
	802.11g	Main	1	2412	12.0				1
			6	2437	14.3		0.00478		
			11	2462	11.5				1
		Aux	1	2412		12.0			1
			6	2437		15.5		0.093	
			11	2462		11.5			1
	802.11n HT20	Main + Aux	1	2412	11.5	11.5			1
			6	2437	12.5	12.5	0.00319	0.017	
			11	2462	10.5	10.5			1
Edge 1, 0 mm	802.11b	Main	1	2412	12.0		0.784		
			6	2437	14.0		1.270		
			11	2462	11.5		1.090		
	802.11g	Main	1	2412	12.0		0.729		
			6	2437	14.3		1.280		
			11	2462	11.5		1.010		
Edge 2, 0 mm	802.11b	Main	1	2412	12.0				1
			6	2437	14.0		0.052		
			11	2462	11.5				1
	802.11g	Main	1	2412	12.0				1
			6	2437	14.3		0.036		
			11	2462	11.5				1

Note(s):

1. For frequency bands with an operating range of < 100 MHz, when the SAR measured 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)

Tablet Mode

Test Position/Dist	Mode	Tx Ant.	Ch #.	Freq. (MHz)	Avg Pwr (dBm)		1-g SAR (mW/g)		Note
					Main	Aux	Main	Aux	
Edge 3, 0 mm	802.11b	Aux	1	2412		12.0		0.502	
			6	2437		15.0		0.858	
			11	2462		11.5		0.453	
	802.11g	Aux	1	2412		12.0			1
			6	2437		15.5		0.578	
			11	2462		11.5			1
Edge 4, 0 mm	802.11b	Aux	1	2412		12.0		0.671	
			6	2437		15.0		**1.290**	
			11	2462		11.5		0.801	
	802.11g	Aux	1	2412		12.0			1
			6	2437		15.5		0.771	
			11	2462		11.5			1
45° Vertex @ Bottom Left Corner, 0 mm	802.11b	Aux	1	2412		12.0		0.578	
			6	2437		15.0		1.070	
			11	2462		11.5		0.578	
	802.11g	Aux	1	2412		12.0			1
			6	2437		15.5		0.664	
			11	2462		11.5			1

Note(s):

1. For frequency bands with an operating range of < 100 MHz, when the SAR measured 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)

13.2. Wi-Fi 5 GHz Bands

13.2.1. 5.2 GHz Band

Tablet Mode

Test Position/ Dist. (mm)	Mode	Tx Ant.	Ch #.	Freq. (MHz)	Avg Pwr (dBm)		1-g SAR (mW/g)		Note
					Main	Aux	Main	Aux	
Rear, 0 mm	802.11a	Main	40	5200	15.0		0.025		
			48	5240	15.0		0.027		
		Aux	40	5200		15.0		0.124	
			48	5240		15.0		0.134	
	802.11n HT20	Main + Aux	36	5180	12.0	12.0	0.00922	0.100	
			48	5240	12.0	12.0	0.004	0.114	
Edge 1, 0 mm	802.11a	Main	40	5200	15.0		1.110		
			48	5240	15.0		1.030		
Edge 2, 0 mm	802.11a	Main	40	5200	15.0		0.023		
			48	5240	15.0		0.020		
Edge 3, 0 mm	802.11a	Aux	40	5200		15.0		0.909	
			48	5240		15.0		0.728	
Edge 4, 0 mm	802.11a	Aux	40	5200		15.0		0.721	
			48	5240		15.0		0.553	
45° Vertex @ Bottom Left Corner, 0 mm	802.11a	Aux	40	5200		15.0		**1.310**	
			48	5240		15.0		1.040	

13.2.2. 5.3 GHz Band

Tablet Mode

Test Position/ Dist. (mm)	Mode	Tx Ant.	Ch #.	Freq. (MHz)	Avg Pwr (dBm)		1-g SAR (mW/g)		Note
					Main	Aux	Main	Aux	
Rear, 0 mm	802.11a	Main	52	5260	15.0		0.023		
			60	5300	14.7		0.022		
		Aux	52	5260		15.0		0.132	
			60	5300		14.9		0.132	
	802.11n HT20	Main + Aux	54	5270	12.0	12.0	0.012	0.108	
			64	5320	12.0	12.0	0.00761	0.112	
Edge 1, 0 mm	802.11a	Main	52	5260	15.0		1.180		
			60	5300	14.7		**1.220**		
Edge 2, 0 mm	802.11a	Main	52	5260	15.0		0.023		
			60	5300	14.7		0.028		
Edge 3, 0 mm	802.11a	Aux	52	5260		15.0		0.862	
			60	5300		14.9		1.010	
Edge 4, 0 mm	802.11a	Aux	52	5260		15.0		0.530	
			60	5300		14.9		0.708	
45° Vertex @ Bottom Left Corner, 0 mm	802.11a	Aux	52	5260		15.0		1.020	
			60	5300		14.9		1.200	

13.2.3. 5.5 GHz Band

Tablet Mode

Test Position	Mode	Tx. Ant	Ch #.	Freq. (MHz)	Avg Pwr (dBm)		1-g SAR (mW/g)		Note
					Main	Aux	Main	Aux	
Rear, 0 mm	802.11a	Main	100	5500	15.0		0.025		
			116	5580	14.9		0.025		
			124	5620	15.0		0.031		
			136	5680	15.0		0.019		
		Aux	104	5520		15.0		0.153	
			116	5580		15.0		0.188	
			124	5620		15.0		0.206	
			136	5680		15.0		0.108	
	802.11n HT20	Main + Aux	100	5500	12.4	12.5	0.013	0.126	
			116	5580	12.5	12.5	0.00661	0.131	
			140	5700	12.4	12.3	0.00352	0.129	
Edge 1, 0 mm	802.11a	Main	100	5500	15.0		1.300		
			116	5580	14.9		1.050		
			124	5620	15.0		1.080		
			136	5680	15.0		1.080		
Edge 2, 0 mm	802.11a	Main	100	5500	15.0		0.028		
			116	5580	14.9		0.022		
			124	5620	15.0		0.034		
			136	5680	15.0		0.025		
Edge 3, 0 mm	802.11a	Aux	104	5520		15.0		1.050	
			116	5580		15.0		1.080	
			124	5620		15.0		0.885	
			136	5680		15.0		0.560	
Edge 4, 0 mm	802.11a	Aux	104	5520		15.0		0.871	
			116	5580		15.0		1.010	
			124	5620		15.0		0.702	
			136	5680		15.0		0.480	
45° Vertex @ Bottom Left Corner, 0 mm	802.11a	Aux	104	5520		15.0		1.300	
			116	5580		15.0		**1.400**	
			124	5620		15.0		1.160	
			136	5680		15.0		0.819	

13.2.4. 5.8 GHz Band

Tablet Mode

Test Position/Dist	Mode	Tx Ant.	Ch #.	Freq. (MHz)	Avg Pwr (dBm)		1-g SAR (mW/g)		Note
					Main	Aux	Main	Aux	
Rear, 0 mm	802.11a	Main	149	5745	15.0		0.023		
			157	5785	15.0		0.027		
			165	5825	15.0		0.031		
		Aux	149	5745		15.0		0.108	
			157	5785		15.0		0.168	
			161	5805		14.3		0.189	
	802.11n HT20	Main + Aux	149	5745	11.9	11.9	0.012	0.127	
			157	5785	12.0	12.0	0.012	0.125	
			165	5825	12.0	12.0	0.013	0.129	
Edge 1, 0 mm	802.11a	Main	149	5745	15.0		1.220		
			157	5785	15.0		1.010		
			165	5825	15.0		1.160		
Edge 2, 0 mm	802.11a	Main	149	5745	15.0		0.028		
			157	5785	15.0		0.024		
			165	5825	15.0		0.031		
Edge 3, 0 mm	802.11a	Aux	149	5745		15.0		0.644	
			157	5785		15.0		0.991	
			161	5805		14.3		1.000	
Edge 4, 0 mm	802.11a	Aux	149	5745		15.0		0.537	
			157	5785		15.0		0.947	
			161	5805		14.3		1.100	
45° Vertex @ Bottom Left Corner, 0 mm	802.11a	Aux	149	5745		15.0		0.873	
			157	5785		15.0		1.290	
			161	5805		14.3		**1.410**	

14. Summary of Highest SAR Values

Results of highest SAR values for each frequency band and mode

Technology/Band	Test configuration		Mode	Highest 1g SAR (W/kg)
WiFi 2.4 GHz	Body	Aux Antenna, Edge 4	802.11b 1Mbps	1.29
WiFi 5.2 GHz	Body	Aux Antenna, 45° Vertex @ Bottom Left Corner	802.11a 6Mbps	1.31
WiFi 5.3 GHz	Body	Main Antenna, Edge 1	802.11a 6Mbps	1.22
WiFi 5.5 GHz	Body	Aux Antenna, 45° Vertex @ Bottom Left Corner	802.11a 6Mbps	1.4
WiFi 5.8 GHz	Body	Aux Antenna, 45° Vertex @ Bottom Left Corner	802.11a 6Mbps	1.41

14.1. Scaled SAR Values to the Maximum Target Output Power

Technology/ Band	Test Configuration			Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		SAR (W/kg)	
	Exposure	Position	Tx Ant.					Tune-up limit	Measured	Measured	Scaled
WiFi 2.4 GHz	Body	Edge 4	Aux	802.11b 1Mbps	0	6	2437	15.0	15.0	1.290	*
WiFi 5.2 GHz	Body	45° Vertex	Aux	802.11a 6Mbps	0	40	5200	15.0	15.0	1.310	*
WiFi 5.3 GHz	Body	Edge 1	Main	802.11a 6Mbps	0	60	5300	15.0	14.7	1.220	1.307
WiFi 5.5 GHz	Body	45° Vertex	Aux	802.11a 6Mbps	0	116	5580	15.0	15.0	1.400	*
WiFi 5.8 GHz	Body	45° Vertex	Aux	802.11a 6Mbps	0	161	5805	14.5	14.3	1.410	1.476

Note(s):

*: SAR Scaling was not applied when the measured output power is equal or greater than the maximum target output power.

14.2. SAR Plots (from Summary of Highest SAR Values)

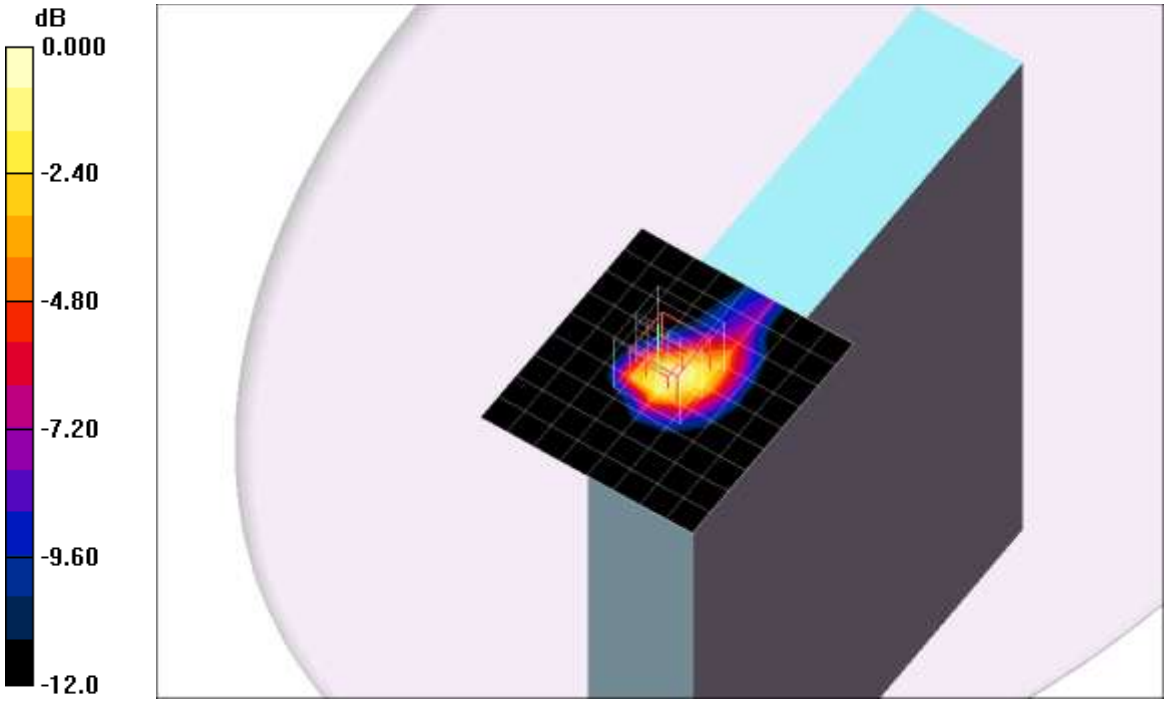
Test Laboratory: UL CCS SAR Lab D Date/Time: 9/18/2012 1:04:04 AM

WiFi 2.4 GHz

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; σ = 1.9 mho/m; ε_r = 51.8; ρ = 1000 kg/m^3 ;
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE3 Sn500; Calibrated: 6/13/2012
- 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: QDOVA001BB; Serial: SN:1017

Aux_Edge 4_802.11b_ch 6/Area Scan (9x10x1): Measurement grid: dx=12mm, dy=12mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.68 mW/g

Aux_Edge 4_802.11b_ch 6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 30.2 V/m; Power Drift = 0.058 dB
Peak SAR (extrapolated) = 2.70 W/kg
SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.606 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.78 mW/g



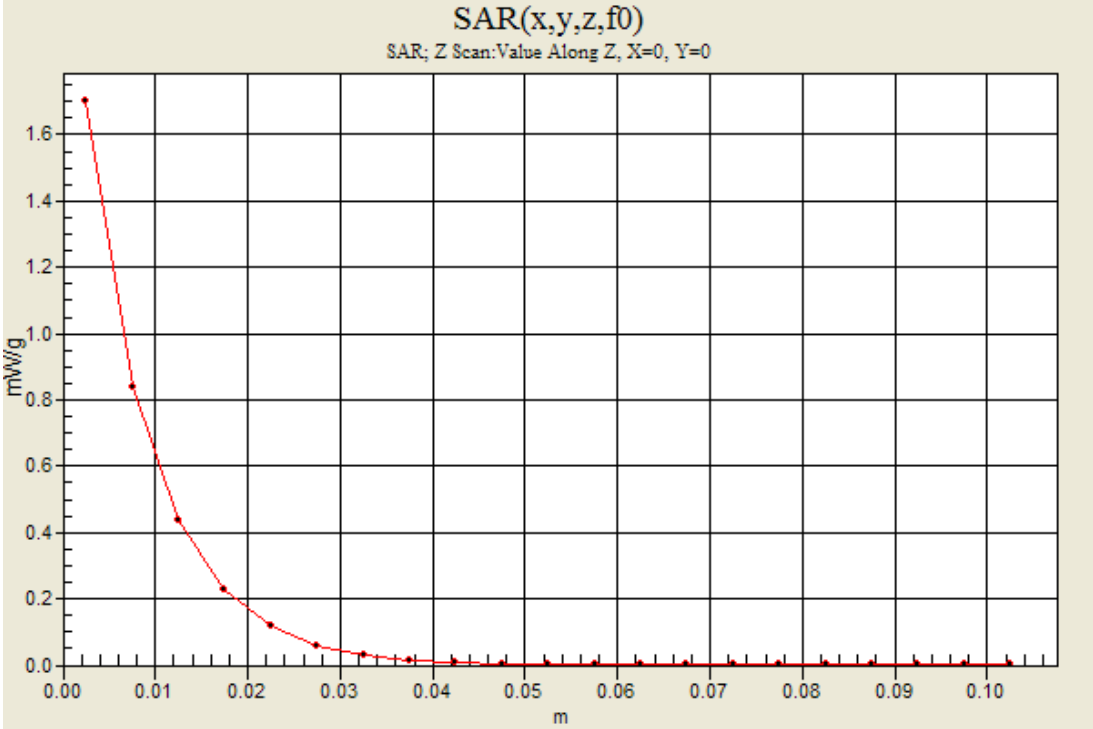
0 dB = 1.78mW/g

Test Laboratory: UL CCS SAR Lab D Date/Time: 9/18/2012 1:19:26 AM

WiFi 2.4 GHz

Frequency: 2437 MHz; Duty Cycle: 1:1

Aux_Edge 4_802.11b_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) = 1.70 mW/g



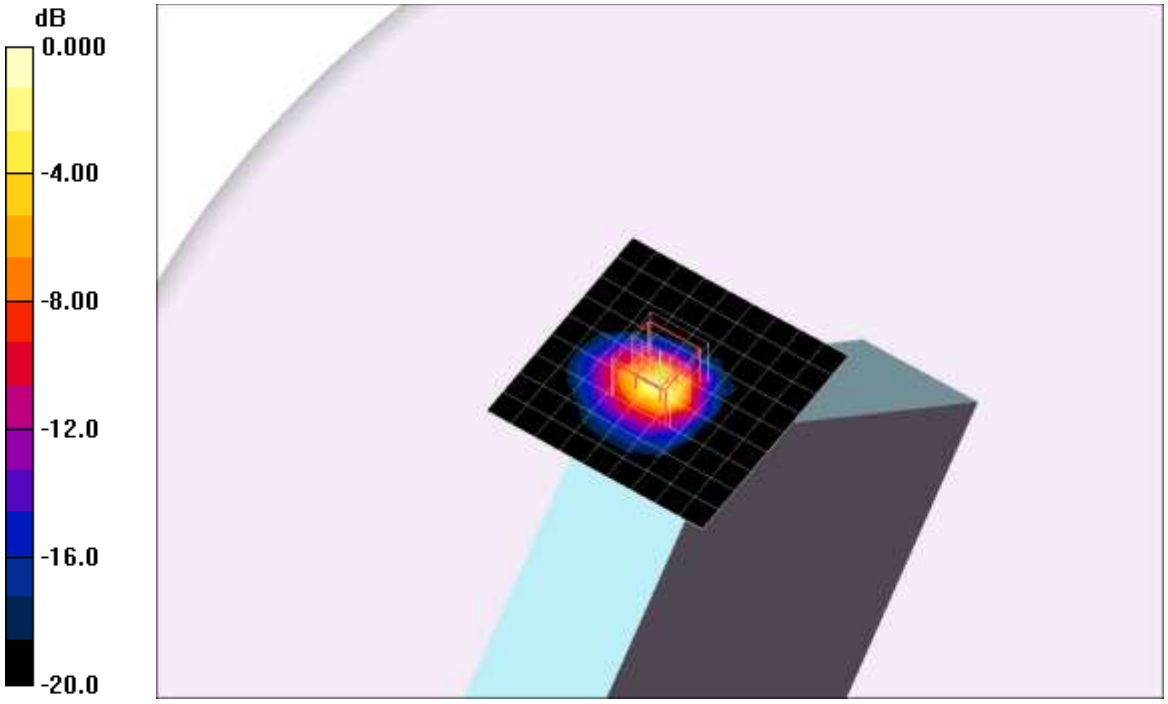
Test Laboratory: UL CCS SAR Lab D Date/Time: 9/13/2012 10:40:43 PM

WiFi 5 GHz

Frequency: 5200 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C
Medium parameters used: f = 5200 MHz; σ = 5.21 mho/m; ε_r = 48.5; ρ = 1000 kg/m^3 ;
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE3 Sn500; Calibrated: 6/13/2012
- 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: 2mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

Aux_45 deg. Vertex @ Bottom Left_802.11a_ch 40/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.92 mW/g

Aux_45 deg. Vertex @ Bottom Left_802.11a_ch 40/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 21.8 V/m; Power Drift = -0.138 dB
Peak SAR (extrapolated) = 5.84 W/kg
SAR(1 g) = 1.31 mW/g; SAR(10 g) = 0.354 mW/g
Maximum value of SAR (measured) = 2.63 mW/g



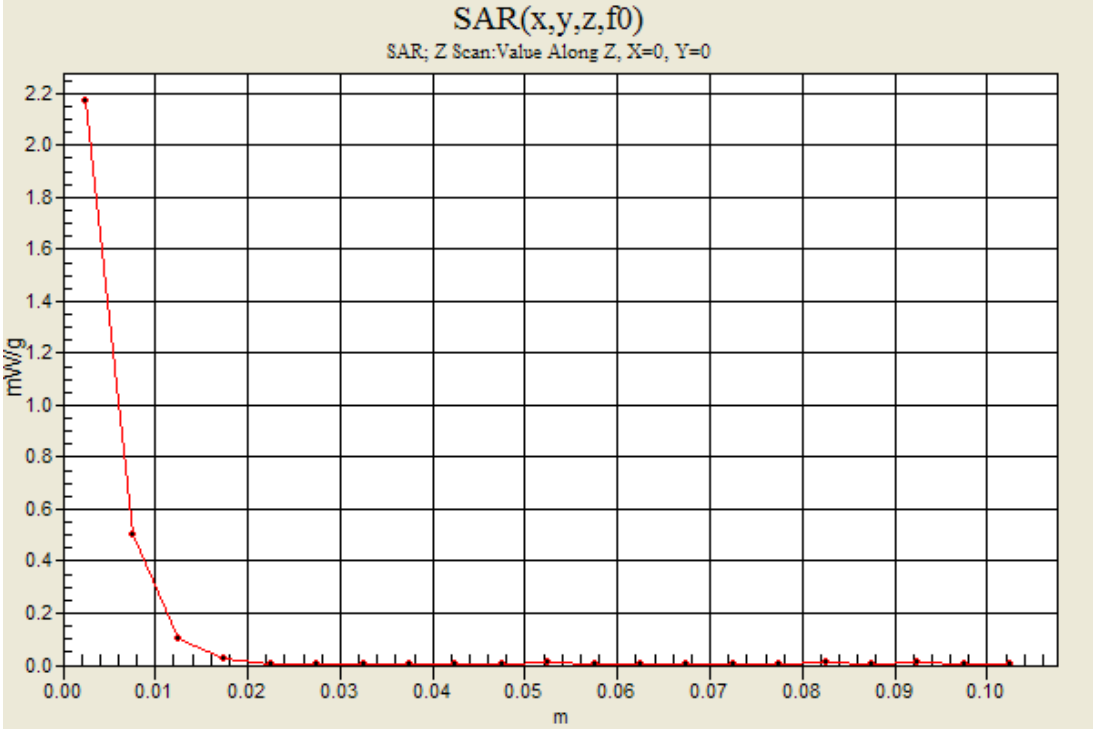
0 dB = 2.63mW/g

Test Laboratory: UL CCS SAR Lab D Date/Time: 9/13/2012 11:01:47 PM

WiFi 5 GHz

Frequency: 5200 MHz; Duty Cycle: 1:1

Aux_45 deg. Vertex @ Bottom Left_802.11a_ch 40/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 2.17 mW/g



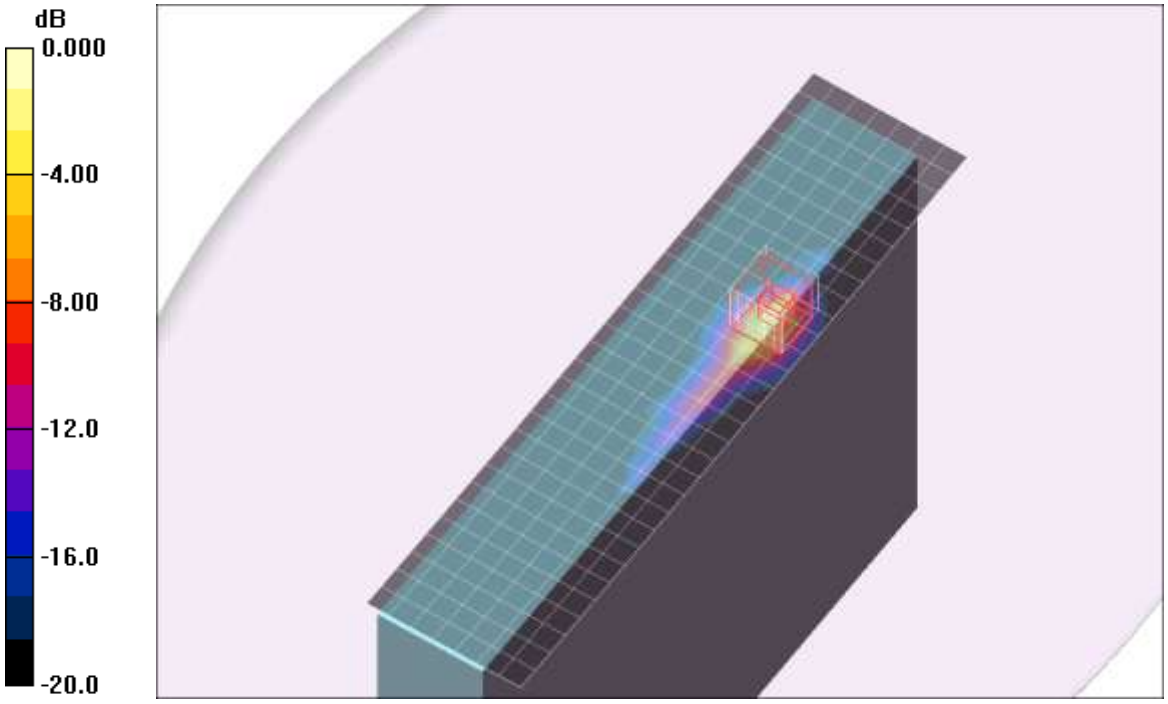
Test Laboratory: UL CCS SAR Lab D Date/Time: 9/2/2012 6:20:30 AM

WiFi 5 GHz

Frequency: 5300 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C
Medium parameters used: f = 5300 MHz; σ = 5.42 mho/m; ε_r = 48.2; ρ = 1000 kg/m^3 ;
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE3 Sn500; Calibrated: 6/13/2012
- 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: 2mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

Main_Edge 1_802.11a_ch 60/Area Scan (8x31x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 2.09 mW/g

Main_Edge 1_802.11a_ch 60/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 22.2 V/m; Power Drift = -0.164 dB
Peak SAR (extrapolated) = 8.02 W/kg
SAR(1 g) = 1.22 mW/g; SAR(10 g) = 0.336 mW/g
Maximum value of SAR (measured) = 2.91 mW/g



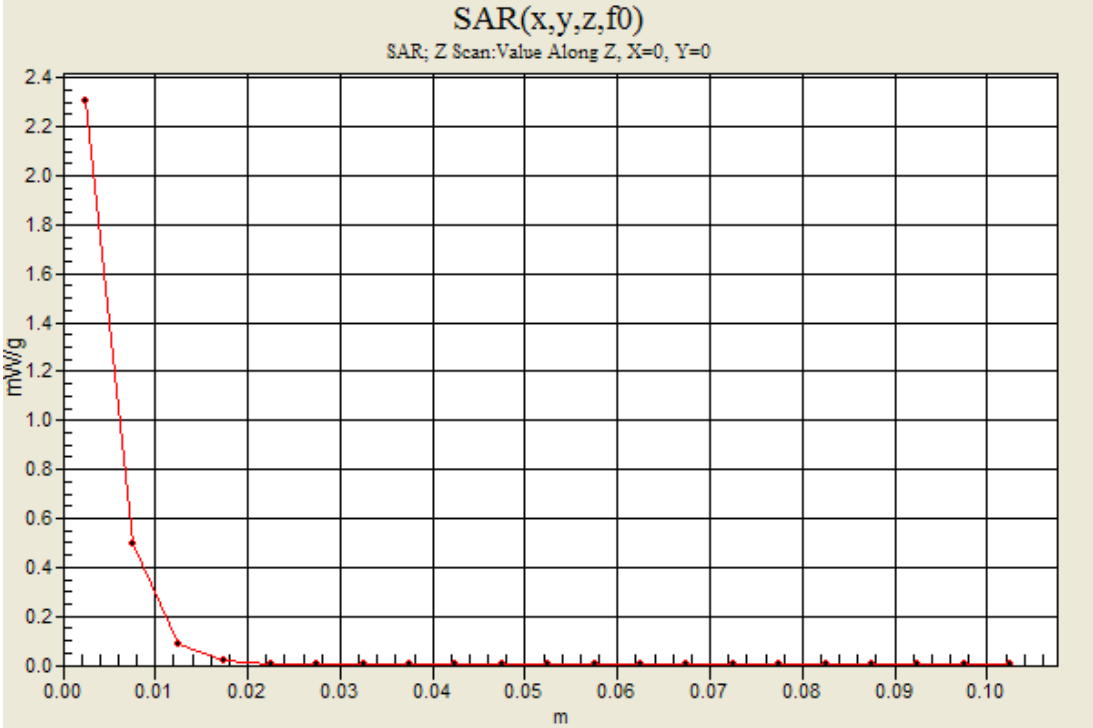
0 dB = 2.91mW/g

Test Laboratory: UL CCS SAR Lab D
Date/Time: 9/2/2012 6:47:58 AM

WiFi 5 GHz

Frequency: 5300 MHz; Duty Cycle: 1:1

Main_Edge 1_802.11a_ch 60/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 2.31 mW/g



Test Laboratory: UL CCS SAR Lab D Date/Time: 9/14/2012 1:05:25 AM

WiFi 5 GHz

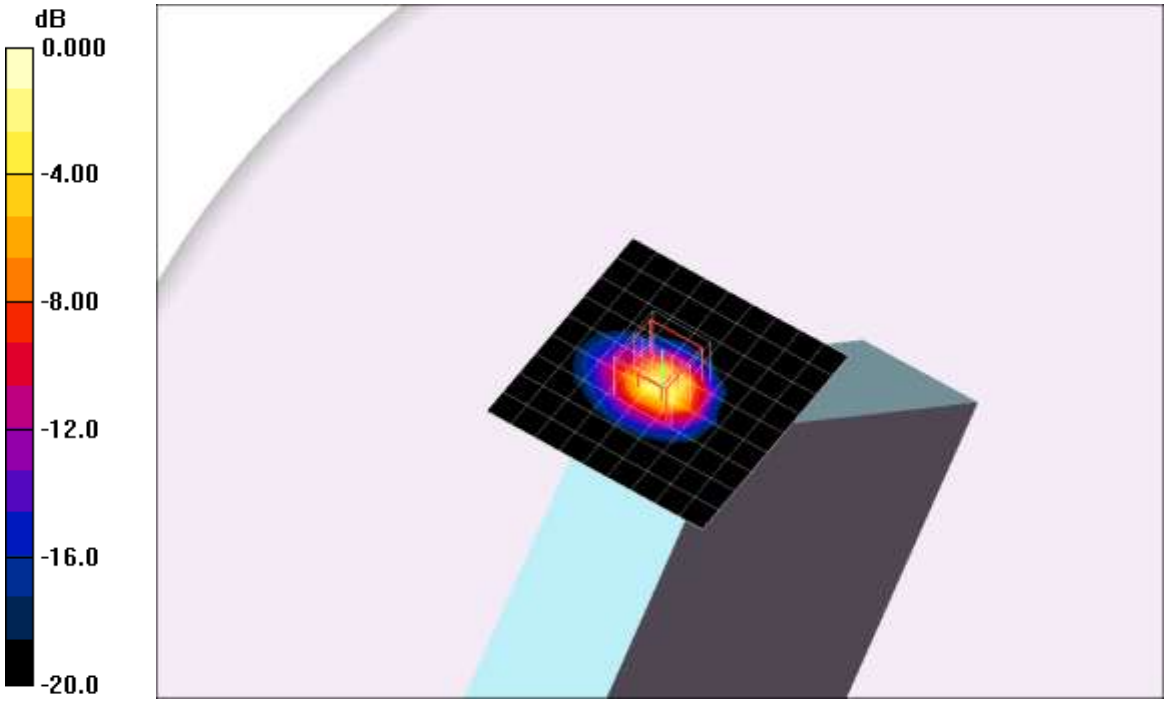
Frequency: 5580 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C
Medium parameters used: f = 5580 MHz; σ = 5.74 mho/m; ε_r = 47.8; ρ = 1000 kg/m^3 ;
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE3 Sn500; Calibrated: 6/13/2012
- 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: 2mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

Aux_45 deg. Vertex @ Bottom Left_802.11a_ch 116/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 1.89 mW/g

Aux_45 deg. Vertex @ Bottom Left_802.11a_ch 116/Zoom Scan (7x7x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 21.1 V/m; Power Drift = -0.115 dB
Peak SAR (extrapolated) = 6.55 W/kg
SAR(1 g) = 1.4 mW/g; SAR(10 g) = 0.378 mW/g
Maximum value of SAR (measured) = 2.97 mW/g



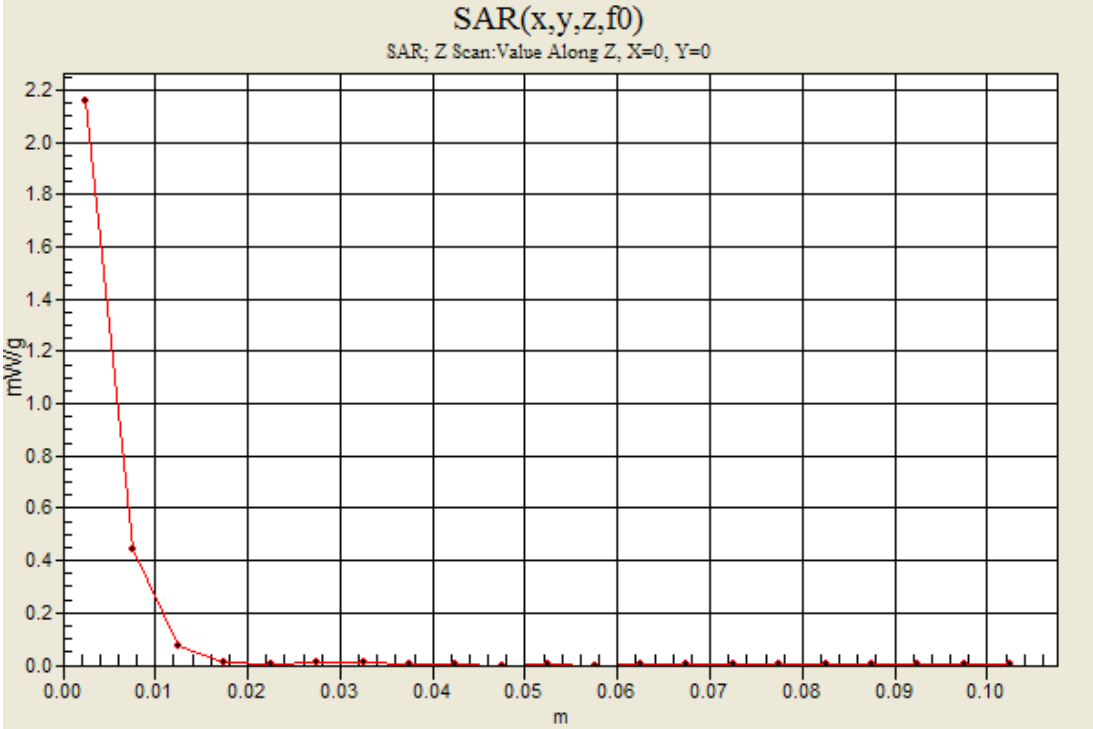
0 dB = 2.97mW/g

Test Laboratory: UL CCS SAR Lab D Date/Time: 9/14/2012 1:26:30 AM

WiFi 5 GHz

Frequency: 5580 MHz; Duty Cycle: 1:1

Aux_45 deg. Vertex @ Bottom Left_802.11a_ch 116/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 2.16 mW/g



Test Laboratory: UL CCS SAR Lab D Date/Time: 9/26/2012 9:00:56 PM

WiFi 5 GHz

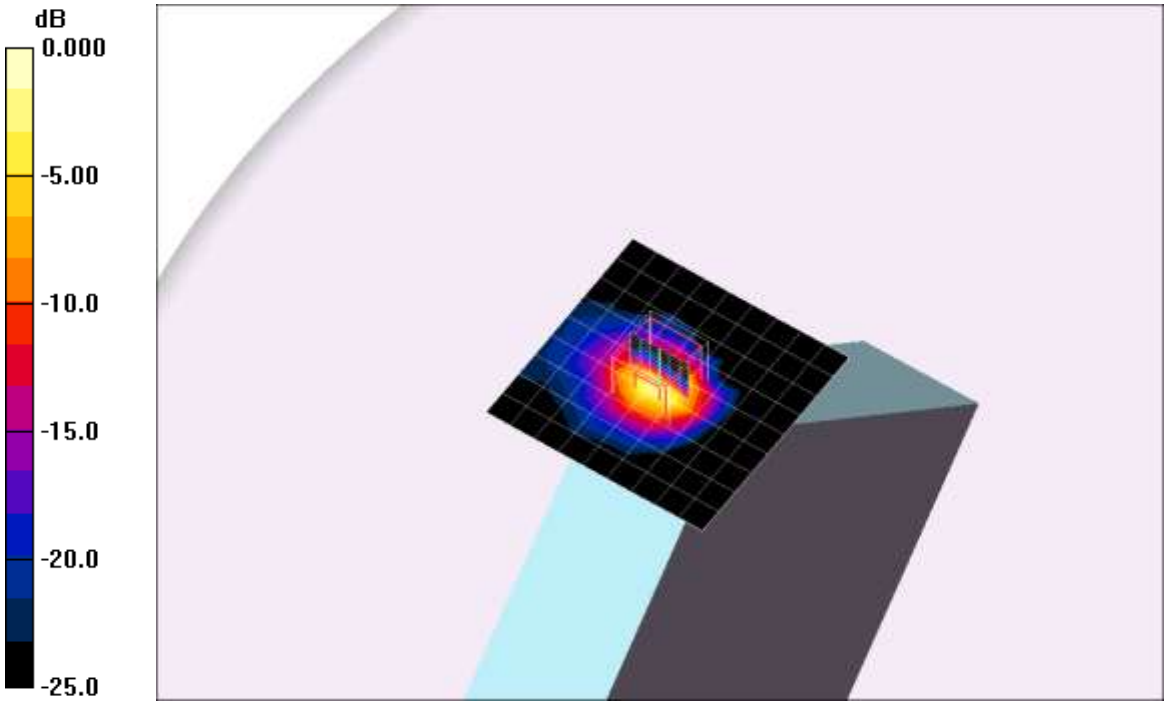
Frequency: 5805 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 25.0°C; Liquid Temperature: 24.0°C
Medium parameters used: f = 5805 MHz; σ = 5.92 mho/m; ε_r = 46; ρ = 1000 kg/m^3 ;
DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE3 Sn500; Calibrated: 6/13/2012
- 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: 2mm (Mechanical Surface Detection)
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BB; Serial: SN:1017

Aux_45 deg. Vertex @ Bottom Left_802.11a_ch 161/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 2.02 mW/g

Aux_45 deg. Vertex @ Bottom Left_802.11a_ch 161/Zoom Scan (7x7x12)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 20.4 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 6.81 W/kg
SAR(1 g) = 1.41 mW/g; SAR(10 g) = 0.383 mW/g
Maximum value of SAR (measured) = 2.92 mW/g



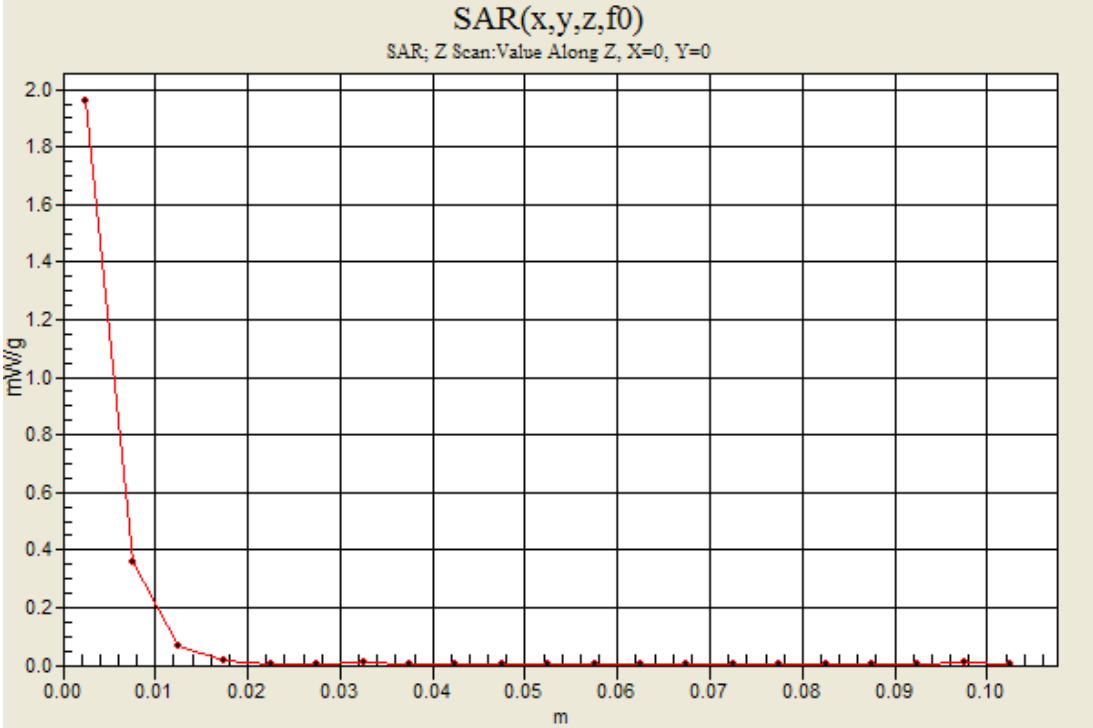
0 dB = 2.92mW/g

Test Laboratory: UL CCS SAR Lab D
Date/Time: 9/27/2012 12:09:58 AM

WiFi 5 GHz

Frequency: 5805 MHz; Duty Cycle: 1:1

Aux_Edge 4_802.11a_ch 161/Z Scan (1x1x21): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 1.96 mW/g



15. Appendixes

Refer to separated files for the following appendixes.

15.1. System Performance Check Plots

15.2. SAR Test Plots for Wi-Fi 2.4 GHz Band

15.3. SAR Test Plots for Wi-Fi 5 GHz 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