FCC OET BULLETIN 65 SUPPLEMENT C
CLASS II PERMISSIVE CHANGE

SAR EVALUATION REPORT

FOR

802.11ag/Draft 802.11n WLAN PCI-E Minicard

(Tested inside of HP Tablet PC, HSTNN-I77C)

MODEL: BCM943224HMS

FCC ID: QDS-BRCM1041

REPORT NUMBER: 09U12939-3

ISSUE DATE: December 29, 2009

Prepared for

BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086

Prepared by

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

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	December 29, 2009	Initial Issue	--

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086
EUT DESCRIPTION:	802.11ag/Draft 802.11n WLAN PCI-E Minicard (Tested inside of HP Notebook PC, HSTNN-I77C)
MODEL NUMBER:	BCM943224HMS
DEVICE CATEGORY:	Portable
EXPOSURE CATEGORY:	General Population/Uncontrolled Exposure
DATE TESTED:	November 24 - 29, 2009

FCC / IC Rule Parts	Frequency Range [MHz]	The Highest SAR Values (1g_mW/g)	Limit (mW/g)
15.247 / RSS-102	2400 – 2483.5	0.138 (Secondary Portrait)	1.6
	5725 – 5850	0.063 (Primary Portrait)	
15.407 / RSS-102	5150 – 5250	0.052 (Secondary Portrait)	
	5250 – 5350	0.139 (Primary Portrait)	
	5470 – 5725	0.072 (Primary Portrait)	

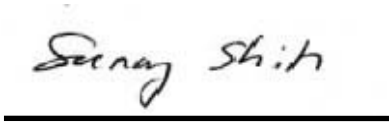
APPLICABLE STANDARDS:

STANDARD	TEST RESULTS
FCC OET BULLETIN 65 SUPPLEMENT C and the following Test Procedures: o KDB 248227 SAR measurement procedures for 802.11a/b/g transmitters o KDB 447498 D01 Mobile Portable RF Exposure v04, supplemental to KDB 616217 D03	Pass
RSS-102 ISSUE 3	Pass

Compliance Certification Services, Inc. (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 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by 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.

Approved & Released For CCS By:



SUNNY SHIH
ENGINEERING SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C, Specific FCC Procedure KDB 248227 SAR Measurement Procedure for 802.11abg Transmitters, KDB 447498 D01 Mobile Portable RF Exposure v04, supplemental to KDB 616217 D03 and IC RSS 102 Issue 3.

And Schedule 2 of Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard 2003 incl Amendment No 1, 2007 and NZS 2772.1:1999 Radiofrequency fields - Maximum exposure levels - 3 kHz to 300 GHz incl Amendment No. 1, 1999.

3. FACILITIES AND ACCREDITATION

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

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
Robot - Six Axes	Stäubli	RX90BL	N/A	N/A		
Robot Remote Control	Stäubli	CS7MB	3403-91535	N/A		
DASY4 Measurement Server	SPEAG	SEUMS001BA	1041	N/A		
Probe Alignment Unit	SPEAG	LB (V2)	261	N/A		
SAM Phantom (SAM1)	SPEAG	QD000P40CA	1185	N/A		
SAM Phantom (SAM2)	SPEAG	QD000P40CA	1050	N/A		
Oval Flat Phantom (ELI 4.0)	SPEAG	QD OVA001 B	1003	N/A		
Electronic Probe kit	HP	85070C	N/A	N/A		
S-Parameter Network Analyzer	Agilent	8753ES-6	MY40001647	11	22	2010
Signal Generator	Agilent	8753ES-6	MY40001647	11	22	2010
E-Field Probe	SPEAG	EX3DV4	3686	3	23	1010
Data Acquisition Electronics	SPEAG	DAE3 V1	500	9	15	2010
System Validation Dipole	SPEAG	D900V2	108	1	21	2010
System Validation Dipole	SPEAG	D1800V2	294	1	29	2010
System Validation Dipole	SPEAG	D1900V2	5d043	1	29	2010
System Validation Dipole	SPEAG	D2450V2	748	4	14	2010
System Validation Dipole	SPEAG	D5GHzV2	1075	10	3	2012
ESG Vector Signal Generator	Agilent	E4438C	US44271090	9	17	2010
Power Meter	Giga-tronics	8651A	8651404	1	11	2010
Power Sensor	Giga-tronics	80701A	1834588	1	11	2010
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	SPAEG	M2450	N/A	Within 24 hrs of first test		
Simulating Liquid	SPAEG	M5800	N/A	Within 24 hrs of first test		

4.2. MEASUREMENT UNCERTAINTY

Measurement uncertainty for 300 MHz – 3000 MHz

Uncertainty component	Tol. (±%)	Probe Dist.	Div.	Ci (1g)	Ci (10g)	Std. Unc.(±%)	
						Ui (1g)	Ui(10g)
Measurement System							
Probe Calibration	4.80	N	1	1	1	4.80	4.80
Axial Isotropy	4.70	R	1.732	0.707	0.707	1.92	1.92
Hemispherical Isotropy	9.60	R	1.732	0.707	0.707	3.92	3.92
Boundary Effects	1.00	R	1.732	1	1	0.58	0.58
Linearity	4.70	R	1.732	1	1	2.71	2.71
System Detection Limits	1.00	R	1.732	1	1	0.58	0.58
Readout Electronics	1.00	N	1	1	1	1.00	1.00
Response Time	0.80	R	1.732	1	1	0.46	0.46
Integration Time	2.60	R	1.732	1	1	1.50	1.50
RF Ambient Conditions - Noise	1.59	R	1.732	1	1	0.92	0.92
RF Ambient Conditions - Reflections	0.00	R	1.732	1	1	0.00	0.00
Probe Positioner Mechnical Tolerance	0.40	R	1.732	1	1	0.23	0.23
Probe Positioning With Respect to Phantom Shell	2.90	R	1.732	1	1	1.67	1.67
algorithms for max. SAR evaluation	3.90	R	1.732	1	1	2.25	2.25
Test sample Related							
Test Sample Positioning	1.10	N	1	1	1	1.10	1.10
Device Holder Uncertainty	3.60	N	1	1	1	3.60	3.60
Power and SAR Drift Measurement	5.00	R	1.732	1	1	2.89	2.89
Phantom and Tissue Parameters							
Phantom Uncertainty	4.00	R	1.732	1	1	2.31	2.31
Liquid Conductivity - Target	5.00	R	1.732	0.64	0.43	1.85	1.24
Liquid Conductivity - Meas.	8.60	N	1	0.64	0.43	5.50	3.70
Liquid Permittivity - Target	5.00	R	1.732	0.6	0.49	1.73	1.41
Liquid Permittivity - Meas.	3.30	N	1	0.6	0.49	1.98	1.62
Combined Standard Uncertainty	RSS					11.44	10.49
Expanded Uncertainty (95% Confidence Interval)	K=2					22.87	20.98

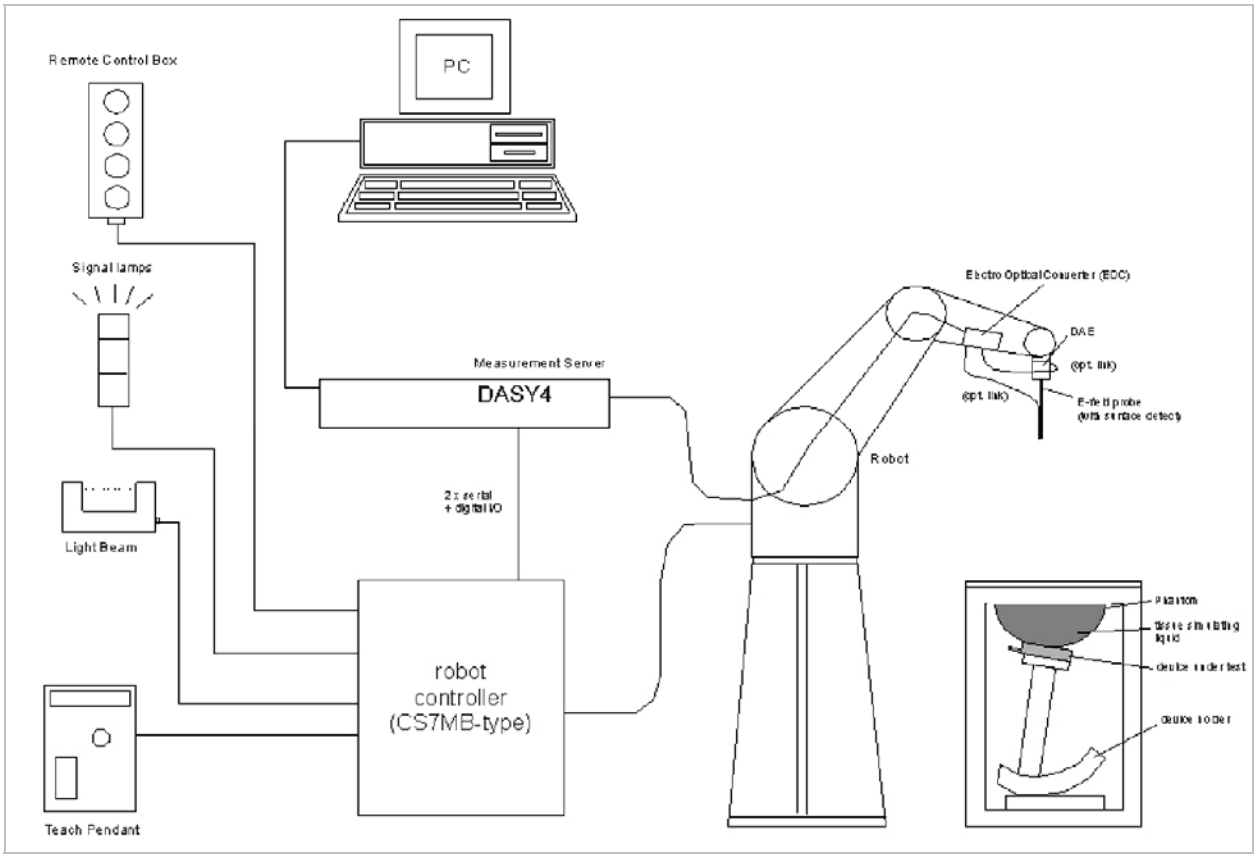
Notesfor table
1. Tol. - tolerance in influence quaitity
2. N - Nomal
3. R - Rectangular
4. Div. - Divisor used to obtain standard uncertainty
5. Ci - is te sensitivity coefficient

Measurement uncertainty for 3 GHz – 6 GHz

Uncertainty component	Tol. (±%)	Probe Dist.	Div.	Ci (1g)	Ci (10g)	Std. Unc.(±%)	
						Ui (1g)	Ui(10g)
Measurement System							
Probe Calibration	4.80	N	1	1	1	4.80	4.80
Axial Isotropy	4.70	R	1.732	0.707	0.707	1.92	1.92
Hemispherical Isotropy	9.60	R	1.732	0.707	0.707	3.92	3.92
Boundary Effects	1.00	R	1.732	1	1	0.58	0.58
Linearity	4.70	R	1.732	1	1	2.71	2.71
System Detection Limits	1.00	R	1.732	1	1	0.58	0.58
Readout Electronics	1.00	N	1	1	1	1.00	1.00
Response Time	0.80	R	1.732	1	1	0.46	0.46
Integration Time	2.60	R	1.732	1	1	1.50	1.50
RF Ambient Conditions - Noise	3.00	R	1.732	1	1	1.73	1.73
RF Ambient Conditions - Reflections	3.00	R	1.732	1	1	1.73	1.73
Probe Positioner Mechnical Tolerance	0.40	R	1.732	1	1	0.23	0.23
Probe Positioning With Respect to Phantom Shell	2.90	R	1.732	1	1	1.67	1.67
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	3.90	R	1.732	1	1	2.25	2.25
Test sample Related							
Test Sample Positioning	1.10	N	1	1	1	1.10	1.10
Device Holder Uncertainty	3.60	N	1	1	1	3.60	3.60
Power and SAR Drift Measurement	5.00	R	1.732	1	1	2.89	2.89
Phantom and Tissue Parameters							
Phantom Uncertainty	4.00	R	1.732	1	1	2.31	2.31
Liquid Conductivity - Target	5.00	R	1.732	0.64	0.43	1.85	1.24
Liquid Conductivity - Meas.	8.60	N	1	0.64	0.43	5.50	3.70
Liquid Permittivity - Target	5.00	R	1.732	0.6	0.49	1.73	1.41
Liquid Permittivity - Meas.	3.30	N	1	0.6	0.49	1.98	1.62
Combined Standard Uncertainty			RSS			11.66	10.73
Expanded Uncertainty (95% Confidence Interval)			K=2			23.32	21.46

Notesfor table
1. Tol. - tolerance in influence quaitity
2. N - Nomal
3. R - Rectangular
4. Div. - Divisor used to obtain standard uncertainty
5. Ci - is te sensitivity coefficient

5. SYSTEM SPECIFICATIONS



The DASY4 system 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. The probe is equipped with an optical surface detector system.
- 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 2000 or Windows XP.
- DASY4 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 to validate the proper functioning of the system.

6. COMPOSITION OF INGREDIENTS FOR TISSUE SIMULATING LIQUIDS

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

7. LIQUID PARAMETERS CHECK

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values. The relative permittivity and conductivity of the tissue material should be within ± 5% of the values given in the table below.

Reference Values of Tissue Dielectric Parameters for Head and Body Phantom (for 150 – 3000 MHz and 5800 MHz)

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in IEEE Standard 1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE Standard 1528.

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
5800	35.3	5.27	48.2	6

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

7.1. LIQUID CHECK RESULTS FOR 2450 MHZ

Simulating Liquid Dielectric Parameters for Muscle 2450 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Sunny Shih

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	52.80	Relative Permittivity (ϵ_r):	52.804	52.7	0.20	± 5
	e"	14.97	Conductivity (σ):	2.040	1.95	4.61	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C
November 29, 2009 09:23 AM

Frequency	e'	e"
2400000000.	53.1494	14.9766
2405000000.	53.1400	14.9664
2410000000.	53.1306	14.9681
2415000000.	53.1200	14.9596
2420000000.	53.0928	14.9651
2425000000.	53.0499	14.9521
2430000000.	52.9944	14.9441
2435000000.	52.9328	14.9521
2440000000.	52.8824	14.9536
2445000000.	52.8440	14.9671
2450000000.	**52.8041**	**14.9672**
2455000000.	52.7742	14.9896
2460000000.	52.7444	15.0238
2465000000.	52.7411	15.0778
2470000000.	52.7286	15.1364
2475000000.	52.7004	15.2003
2480000000.	52.6899	15.2567
2485000000.	52.6874	15.3186
2490000000.	52.6724	15.3619
2495000000.	52.6757	15.4126
2500000000.	52.6780	15.4297

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

ε_0 = 8.854 * 10^{-12}

7.2. LIQUID CHECK RESULTS FOR 5 GHZ

Simulating Liquid Dielectric Parameters for Muscle 5 GHz

Room Ambient Temperature = 25°C; Relative humidity = 38% Measured by: Sunny Shih

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	47.3508	Relative Permittivity (ε_r):	47.3508	49.0	-3.37	± 10
	e"	17.8783	Conductivity (σ):	5.17188	5.30	-2.42	± 5
5500	e'	46.8419	Relative Permittivity (ε_r):	46.8419	48.6	-3.62	± 10
	e"	18.1813	Conductivity (σ):	5.56297	5.65	-1.54	± 5
5800	e'	46.2463	Relative Permittivity (ε_r):	46.2463	48.2	-4.05	± 10
	e"	18.5883	Conductivity (σ):	5.99773	6.00	-0.04	± 5

Liquid Check
Ambient temperature: 25 deg. C; Liquid temperature: 24 deg. C
November 24, 2009 6:30 AM

Frequency	e'	e"
4600000000.	48.6940	16.7364
4650000000.	48.6819	16.9186
4700000000.	48.5196	16.8811
4750000000.	48.3951	17.1629
4800000000.	48.3555	17.1149
4850000000.	48.1111	17.2370
4900000000.	48.1352	17.2695
4950000000.	47.9391	17.3271
5000000000.	47.9160	17.5380
5050000000.	47.7897	17.4612
5100000000.	47.6568	17.7544
5150000000.	47.6624	17.7402
5200000000.	**47.3508**	**17.8783**
5250000000.	47.3439	17.9024
5300000000.	47.1679	17.9175
5350000000.	47.1244	18.0758
5400000000.	47.0093	18.0029
5450000000.	46.8628	18.1773
5500000000.	**46.8419**	**18.1813**
5550000000.	46.6796	18.3242
5600000000.	46.6063	18.3698
5650000000.	46.4708	18.4303
5700000000.	46.4782	18.4733
5750000000.	46.2715	18.5456
5800000000.	**46.2463**	**18.5883**
5850000000.	45.9637	18.6165
5900000000.	45.9574	18.7163
5950000000.	45.8251	18.7240
6000000000.	45.7608	18.8298

The conductivity (σ) can be given as:

$$\sigma = \omega \varepsilon_0 e'' = 2 \pi f \varepsilon_0 e''$$

where f = target f * 10^6

$\varepsilon_0 = 8.854 * 10^{-12}$

8. SYSTEM PERFORMANCE

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of ±10%.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Body simulating liquid of the following parameters.
- The DASY4 system with an Isotropic E-Field Probe EX3DV4-SN: 3686 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 (2.4 GHz) fine cube was chosen for cube integration and Special 8x8x10 (5 GHz) fine cube was chosen for cube integration
- Distance between probe sensors and phantom surface was set to 3mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) were 100 mW (5GHz) and 250 mW (2.4GHz) ±3%
- The results are normalized to 1 W input power.

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.
Certificate no: D2450V2-748_April 14, 2008

f (MHz)	Head Tissue		Body Tissue	
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
2450			49.5	23.3

Reference SAR Values for BODY-tissue from calibration certificate of SPEAG.
Certificate no: D5GHzV2-1075_Sep09

f (MHz)	Head Tissue		Body Tissue	
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
5200			78.7	21.9
5500			85.0	23.4
5800			72.9	20.0

8.1. SYSTEM CHECK RESULTS FOR D2450V2

System Validation Dipole: D2450V2 SN: 748

Date: November 29, 2009

Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Sunny Shih

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	2450	250	1g SAR:	54.4	49.5	9.90	±10
			10g SAR:	24.8	23.3	6.44	

8.2. SYSTEM CHECK RESULTS FOR D5GHzV2

System Validation Dipole: D5GHzV2 SN: 1075

Date: November 24, 2009

Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Sunny Shih

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Muscle	5200	100	1g SAR:	71.8	78.7	-8.77	±10
			10g SAR:	20.8	21.9	-5.02	
Muscle	5500	100	1g SAR:	79.6	85.0	-6.35	±10
			10g SAR:	22.6	23.4	-3.42	
Muscle	5800	100	1g SAR:	67.6	72.9	-7.27	±10
			10g SAR:	18.9	20.0	-5.50	

9. EQUIPMENT UNDER TEST

802.11a/Draft 802.11n WLAN PCI-E Minicard **(Tested inside of HP Tablet PC, HSTNN-I77C)**	
Normal operation:	• Laptop - Lap-held, • Tablet - Edge (underarm) & lap-held
Antenna tested:	Manufactured / Model Number ☒ WNC — Main: 81.EGG15.G12 Aux: 81.EGG15.G13 ☐ Yageo — TX1: CAN43139WLIN00081 TX2: CAN43139WLIN00082
Antenna-to-user separation distance:	Refer to Section 11 for antenna-to-user separation distance
Antenna-to-antenna distance:	Refer to antenna specifications
Require SAR evaluation for Simultaneous transmission?	WWAN co-located RF exposure assessment will be addressed in a separate FCC application filed under WWAN application.
Power supply:	Power supplied through laptop computer (host device)

10. OUTPUT POWER VERIFICATION

The following procedures had been used to prepare the EUT for the SAR test.
The client provided a special driver and program, wl_tools, which enable a user to control the frequency and output power of the module.

RF Conducted Output Power Measurement Results:

Please refer to Broadcom's Operational Description document for Average Power information (confidential exhibit) as documented in 04/02/2009 original filing.

Before SAR evaluation, CCS has verified the RF conducted average powers which are in an agreement with previous reported average output powers.

11. SUMMARY OF TEST RESULTS

11.1. SAR TEST RESULT FOR THE 2.4 GHZ BAND

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

Note: WLAN main and aux antennas are more than 20 cm from phantom for laptop mode, SAR test is not required.

2) Tablet - Lap-held (2.3 cm from Main/Aux antennas-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	Main	0.086	0.046
802.11g	6	2437	Aux	0.105	0.054

3) Tablet - Primary Landscape

Note: WLAN main and aux antennas are more than 20 cm from phantom for laptop mode, SAR test is not required.

4) Tablet - Edge - Secondary Landscape (0.4 cm from Main/Aux antennas-to-user)

Note: Both Main & Aux antennas disabled by software.

5) Tablet - Primary Portrait (8.8 cm from Aux antenna-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11g	6	2437	Aux	0.129	0.056

6) Tablet– Secondary Portrait (9.0 cm from Main antenna-to-user)

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	Main	**0.138**	0.043

Notes:

1. 802.11b doesn't operate for Aux antenna. Thus, 802.11g is performed for Aux antenna instead.
2. The modes with highest output power channel were chosen for the testing.

11.2. SAR TEST RESULT FOR THE 5 GHZ BANDS

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

Note: WLAN main and aux antennas are more than 20 cm from phantom for laptop mode, SAR test is not required.

2) Tablet - Lap-held

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2 GHz	802.11a	40	5200	Main	0.013	0.0026
				Aux	0.026	0.0081
5.3 GHz	802.11a	60	5300	Main	0.009	0.0008
				Aux	0.062	0.0150
5.5 GHz	802.11a	120	5600	Aux	0.030	0.0100
5.8 GHz	802.11a	157	5785	Aux	0.029	0.0110

3) Tablet - Primary Landscape

Note: WLAN main and aux antennas are more than 20 cm from phantom for laptop mode, SAR test is not required.

4) Tablet - Edge - Secondary Landscape (0.4 cm from Main/Aux antennas-to-user)

Note: Both Main & Aux antennas disabled by software.

5) Tablet - Primary Portrait (8.8 cm from Aux antenna-to-user)

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2 GHz	802.11a	40	5200	Aux	0.040	0.0084
5.3 GHz	802.11a	60	5300	Aux	**0.139**	0.0360
5.5 GHz	802.11a	120	5600	Aux	**0.072**	0.0230
5.8 GHz	802.11a	157	5785	Aux	**0.063**	0.0180

6) Tablet– Secondary Portrait (9.0 cm from Main antenna-to-user)

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2 GHz	802.11a	40	5200	Main	**0.052**	0.0077
5.3 GHz	802.11a	60	5300	Main	0.054	0.0170
5.5 GHz	802.11a	120	5600	Main	0.059	0.0190
5.8 GHz	802.11a	157	5785	Main	0.049	0.0160

12. ENHANCED ENERGY COUPLING (KDB 447498)

According to KDB 447498, the test configuration with the highest 1-g SAR must be used to determine if additional SAR evaluation is required due to enhanced energy coupling at increased separation distances.

From the test results below, additional 1-g SAR evaluation is not required.

Test configuration	Band	Antenna-to-person distance (cm)		Peak SAR (mW/g)	E-field (V/m)	Lower than Initial (%)
Tablet mode - Secondary portrait	2.4 GHz	Initial	Touch	0.163	8.94	
		Increased	5	0.043	4.58	26.2%
Tablet mode Primary portrait	5.3 GHz	Initial	Touch	0.286	3.57	
		Increased by:	5	0.092	2.02	32.1%

13. SAR TEST PLOTS

WORST-CASE SAR PLOT for 2.4 GHz Band

Date/Time: 11/29/2009 12:53:05 PM

Test Laboratory: Compliance Certification Services

Tablet - Secondary Portrait Main ant

DUT: HP; Type: NA; Serial: NA

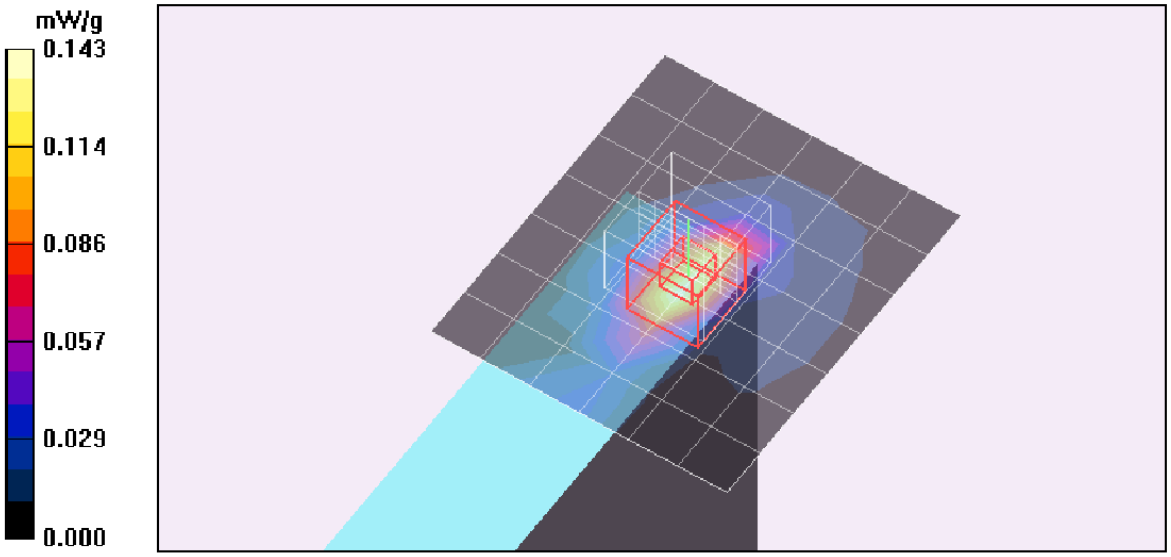
Communication System: 802.11bg; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 2.03 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

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

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(6.48, 6.48, 6.48); Calibrated: 3/23/2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11b_Main Ant/Area Scan (7x8x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.143 mW/g

802.11b_Main Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 8.43 V/m; Power Drift = 0.352 dB
Peak SAR (extrapolated) = 0.722 W/kg
SAR(1 g) = 0.138 mW/g; SAR(10 g) = 0.043 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.163 mW/g



WORST-CASE SAR PLOT for 5.2 GHz

Date/Time: 11/24/2009 8:32:38 PM

Test Laboratory: Compliance Certification Services

Tablet - Secondary Portrait Main ant_5.2G

DUT: HP; Type: NA; Serial: NA

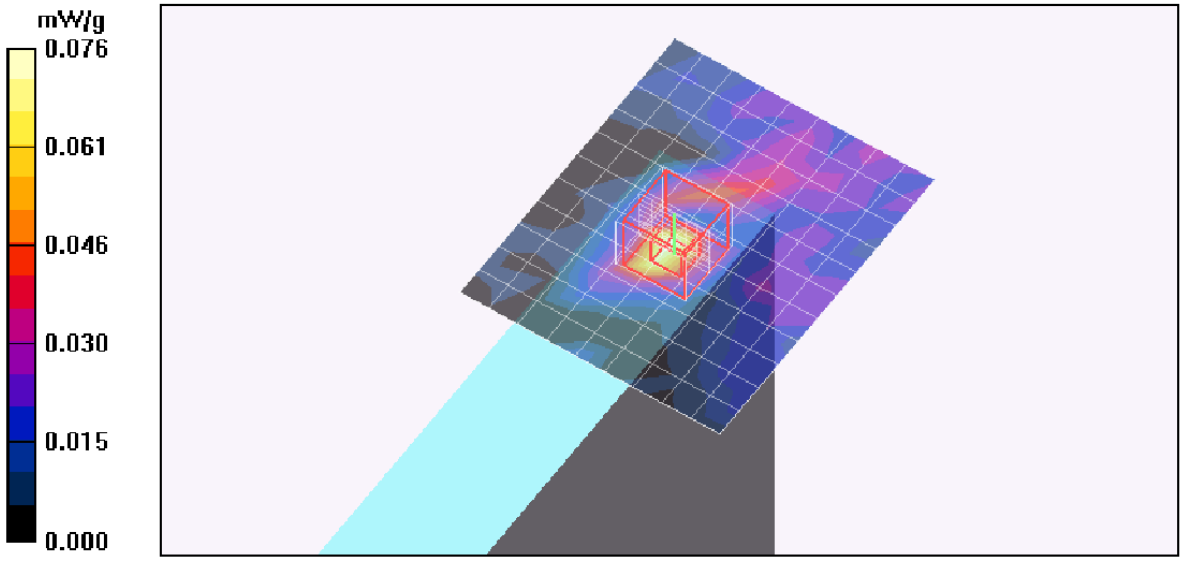
Communication System: 802.11abgn; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.17 mho/m; ε_r = 47.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(4.08, 4.08, 4.08); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a_Main Ant/Area Scan (10x12x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.076 mW/g

802.11a_Main Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 2.20 V/m; Power Drift = 1.43 dB
Peak SAR (extrapolated) = 0.676 W/kg
SAR(1 g) = 0.052 mW/g; SAR(10 g) = 0.00769 mW/g
Maximum value of SAR (measured) = 0.090 mW/g



WORST-CASE SAR PLOT for 5.3 GHz

Date/Time: 11/24/2009 3:15:36 PM

Test Laboratory: Compliance Certification Services

Tablet - Primary Portrait Aux ant_5.3G

DUT: HP; Type: NA; Serial: NA

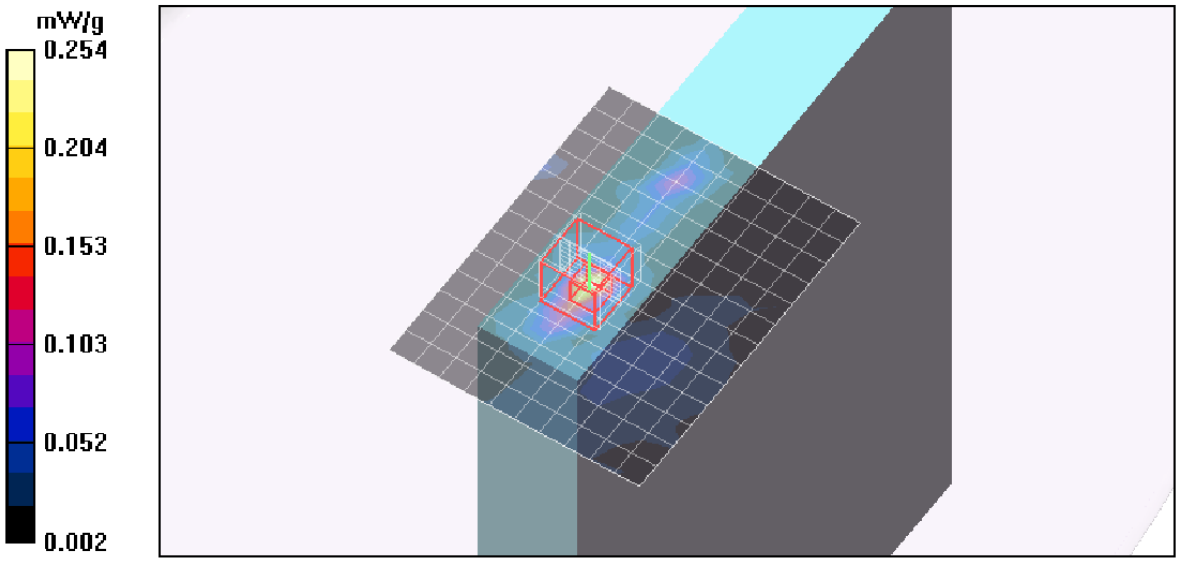
Communication System: 802.11abgn; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.28 mho/m; ε_r = 47.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(3.81, 3.81, 3.81); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a_Aux Ant/Area Scan (11x14x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.254 mW/g

802.11a_Aux Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 2.30 V/m; Power Drift = -0.240 dB
Peak SAR (extrapolated) = 0.507 W/kg
SAR(1 g) = 0.139 mW/g; SAR(10 g) = 0.036 mW/g
Maximum value of SAR (measured) = 0.286 mW/g



WORST-CASE SAR PLOT for 5.6 GHz

Date/Time: 11/24/2009 4:20:22 PM

Test Laboratory: Compliance Certification Services

Tablet - Primary Portrait Aux ant_5.6G

DUT: HP; Type: NA; Serial: NA

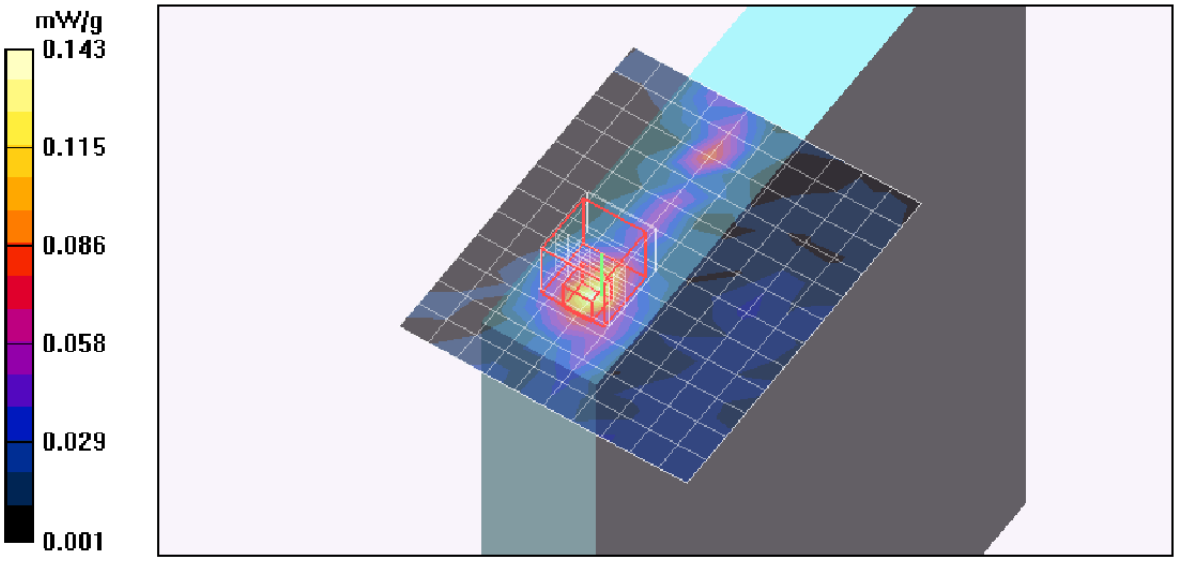
Communication System: 802.11abgn; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.72 mho/m; ε_r = 46.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(3.61, 3.61, 3.61); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a_Aux Ant/Area Scan (11x13x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.143 mW/g

802.11a_Aux Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 2.11 V/m; Power Drift = 1.45 dB
Peak SAR (extrapolated) = 0.338 W/kg
SAR(1 g) = 0.072 mW/g; SAR(10 g) = 0.023 mW/g
Maximum value of SAR (measured) = 0.145 mW/g



WORST-CASE SAR PLOT for 5.8 GHz

Date/Time: 11/24/2009 5:08:07 PM

Test Laboratory: Compliance Certification Services

Tablet - Primary Portrait Aux ant_5.785G

DUT: HP; Type: NA; Serial: NA

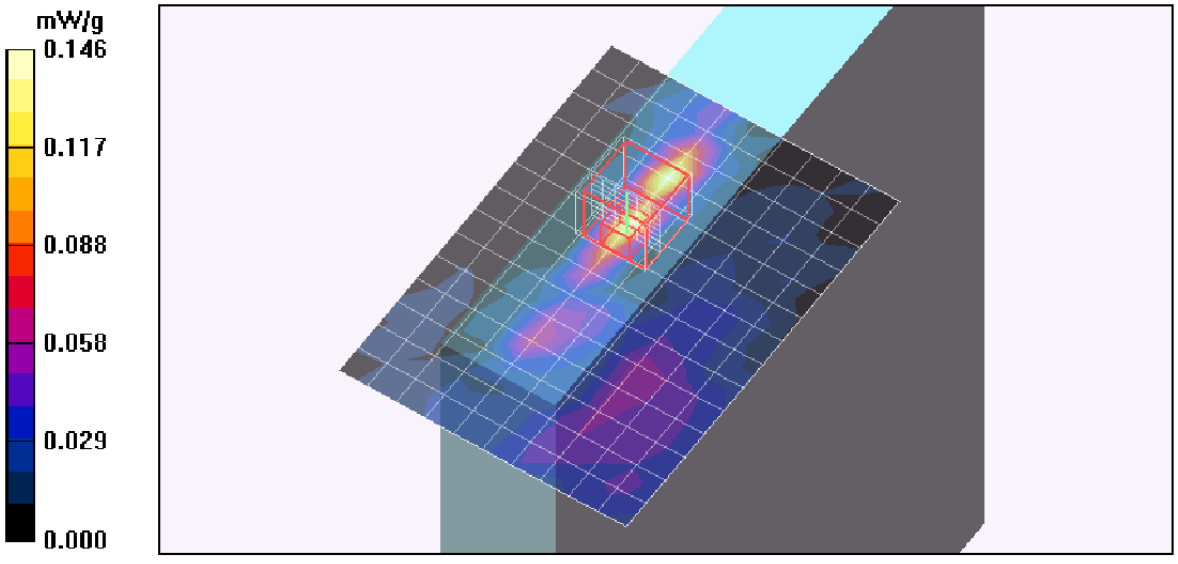
Communication System: 802.11abgn; Frequency: 5785 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5785 MHz; σ = 5.98 mho/m; ε_r = 46.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 25.0 deg. C; Liquid Temperature: 24.0 deg. C

DASY4 Configuration:
- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(3.84, 3.84, 3.84); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn500; Calibrated: 9/15/2009
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a_Aux Ant/Area Scan (11x15x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.146 mW/g

802.11a_Aux Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 0.805 V/m; Power Drift = 5.44 dB
Peak SAR (extrapolated) = 0.285 W/kg
SAR(1 g) = 0.063 mW/g; SAR(10 g) = 0.018 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.162 mW/g



14. ATTACHMENTS

No.	Contents	No. of page (s)
1	System Validation Plots	4
2-1	SAR Test Plots for 2.4 GHz	5
2-2	SAR Test Plots for 5GHz	14
3	Certificate of E-Field Probe - EX3DV4 SN 3686	10
4	Certificate of System Validation Dipole D2450V2	6
5	Certificate of System Validation Dipole - D5GHzV2 SN 1075	9