



**FCC OET BULLETIN 65 SUPPLEMENT C 01-01
Class II Permissive Change
IC RSS-102 ISSUE 4**

SAR EVALUATION REPORT

For

**802.11bg/Draft 802.11n WLAN PCI-E Minicard
(Tested inside of HP HSTNN-W82C)**

MODEL: BCM94313HMG2L

FCC ID: QDS-BRCM1050

IC: 4324A- BRCM1050

REPORT NUMBER: 10U13562-2, Revision A2

ISSUE DATE: March 30, 2011

Prepared for

**BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086**

Prepared by

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



NVLAP LAB CODE 200065-0


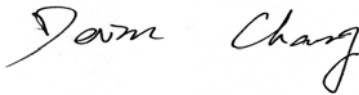
Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	December 17, 2010	Initial Issue	--
A	December 17, 2010	Revised Host Model Number	A. Zaffar
A1	March 24, 2011	<ol style="list-style-type: none">1. Updated output power table in section 11.2. Deleted note "<u>(Tx disabled by software)</u>" at Secondary landscape test configuration. Refer to Cetecom SAR report # SAR_BROAD_094_11001_HMG2 for SAR data at Secondary landscape configuration.	Sunny Shih
A2	March 30, 2011	<ol style="list-style-type: none">1. Deleted Note: "WiFi TX is disabled by software..." from section 5 and section 12.2. Added justification statement with regard to WiFi and BT simultaneous transmission in section 5.3. Updated output power table in section 11	Sunny Shih

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1. ATTESTATION OF TEST RESULTS

Applicant:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086			
EUT description:	802.11g/Draft 802.11n WLAN PCI-E Minicard (Tested inside of HP HSTNN-W82C)			
Model number:	BCM943224HMS			
Device category:	Portable			
Exposure category:	General Population/Uncontrolled Exposure			
Date tested:	December 10, 2010			
FCC / IC rule parts	Freq. range (MHz)	The Highest SAR (W/kg)		Limit (W/kg)
		1g	10g	
15.247 / RSS-102	2412 - 2462	0.099	0.047	1g = 1.6 10g = 2.0
		@ primary portrait		
Applicable Standards				Test Results
<ul style="list-style-type: none"> - FCC OET Bulletin 65 Supplement C 01-01 - IC RSS 102 Issue 4 				Pass
<ul style="list-style-type: none"> - 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. 				Pass
<p>Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.</p> <p>Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.</p>				
Approved & Released For UL CCS By:		Tested By:		
				
Sunny Shih Engineering Team Leader Compliance Certification Services (UL CCS)		Devin Chang EMC Engineer Compliance Certification Services (UL CCS)		

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C 01-01, IEEE Std 1528-2003, 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 4.

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.

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
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		
Dielectric Probe Kit	HP	85070C	N/A	N/A		
S-Parameter Network Analyzer	Agilent	E5071B	MY42100131	8	2	2011
Signal Generator	Agilent	E5071B	MY42100131	8	2	2011
E-Field Probe	SPEAG	EX3DV3	3531	2	23	2011
Data Acquisition Electronics	SPEAG	DAE3 V1	427	7	21	2011
System Validation Dipole	SPEAG	D2450V2*	706	4	19	2013
Thermometer	ERTCO	639-1S	1718	7	19	2011
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		

Note: Per KDB 450824 D02 requirements for dipole calibration, UL CCS has adopted three years calibration intervals. On annual basis, each measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole
2. System validation with specific dipole is within 10% of calibrated value.
3. Return-loss is within 20% of calibrated measurement (test data on file in UL CCS)
4. Impedance is within 5Ω of calibrated measurement (test data on file in UL CCS)

4.2. MEASUREMENT UNCERTAINTY

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

Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1) @ Body 2450 MHz	5.50	Normal	1	1	5.50
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	3.09	Normal	1	0.64	1.98
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.6	1.73
Liquid Permittivity - measurement	-2.04	Normal	1	0.6	-1.22
Combined Standard Uncertainty Uc(y) =					9.72
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				19.45	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.54	dB

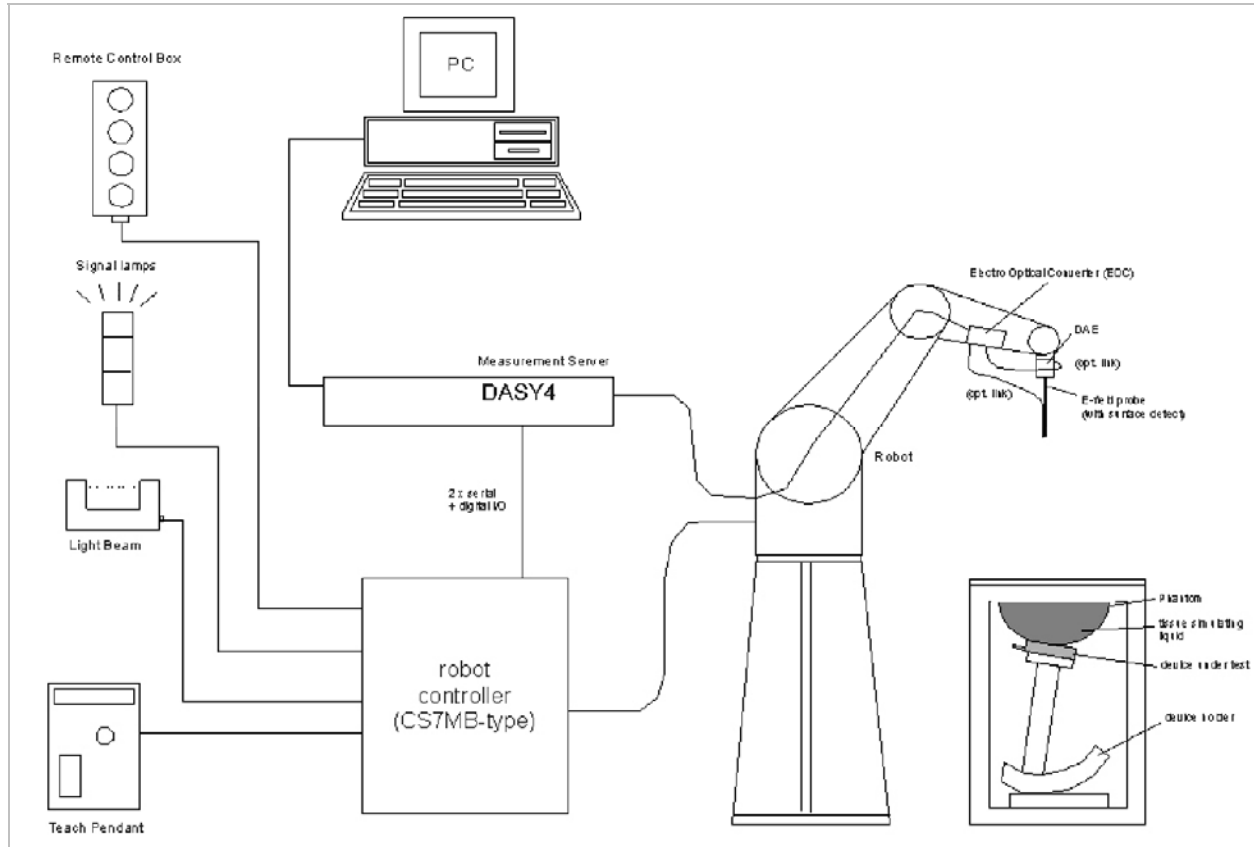
Measurement uncertainty for 300 MHz to 3 GHz averaged over 10 gram

Component	error, %	Probe Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1) @ 2450 MHz	5.50	Normal	1	1	5.50
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	0.43	1.24
Liquid Conductivity - measurement	3.09	Normal	1	0.43	1.33
Liquid Permittivity - deviation from target	5.00	Rectangular	1.732	0.49	1.41
Liquid Permittivity - measurement uncertainty	-2.04	Normal	1	0.49	-1.00
Combined Standard Uncertainty Uc(y), % =					9.43
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				18.87	%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.50	dB

5. EQUIPMENT UNDER TEST

802.11bg/Draft 802.11n WLAN PCI-E Minicard (Tested inside of HP HSTNN-W82C)							
Normal operation:	Laptop mode (display open at 90° to the keyboard) Tablet bottom face, and Tablet edges - Multiple display orientations supporting both portrait and landscape configurations						
Antenna tested:	Install inside of HP HSTNN-W82C <table border="0"> <tr> <td><u>Manufactured</u></td> <td><u>Model Number</u></td> </tr> <tr> <td>Ethertronics</td> <td>Main: 25.90A1Z.001</td> </tr> <tr> <td></td> <td>Aux: 25.90A20.001</td> </tr> </table>	<u>Manufactured</u>	<u>Model Number</u>	Ethertronics	Main: 25.90A1Z.001		Aux: 25.90A20.001
<u>Manufactured</u>	<u>Model Number</u>						
Ethertronics	Main: 25.90A1Z.001						
	Aux: 25.90A20.001						
Antenna-to-antenna/user separation distances:	See Sec. 14 for details						
Assessment for SAR evaluation for Simultaneous transmission:	WiFi can transmit simultaneously with Bluetooth. Due to Bluetooth's (FCC ID: QDS-BRCM1043) maximum output is 2.67 mW [$<60/f(\text{GHz})$ mW] and stand alone SAR is not required, thus WiFi and Bluetooth are not considered as co-located transmitters each other WWAN co-located RF exposure assessment will be addressed in a separate FCC application filed under WWAN application.						

6. 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 validating the proper functioning of the system.

7. 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

8. LIQUID PARAMETERS CHECK

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. For frequencies in 300 MHz to just under 2 GHz, the measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values. For frequencies in the range of 2–3 GHz and above the measured conductivity should be within $\pm 5\%$ of the target values. The measured relative permittivity tolerance can be relaxed to no more than $\pm 10\%$.

Reference Values of Tissue Dielectric Parameters for Head and Body Phantom (for 300 – 3000 MHz and 5800 MHz)

The 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)	Body	
	ϵ_r	σ (S/m)
300	58.20	0.92
450	56.70	0.94
835	55.20	0.97
900	55.00	1.05
915	55.00	1.06
1450	54.00	1.30
1610	53.80	1.40
1800 – 2000	53.30	1.52
2450	52.70	1.95
3000	52.00	2.73
5800	48.20	6.00

(ϵ_r = relative permittivity, σ = conductivity and $\rho = 1000 \text{ kg/m}^3$)

8.1. LIQUID CHECK RESULTS FOR 2450 MHZ

Room Ambient Temperature = 24°C; Relative humidity = 48%

Measured by: David Lee

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	51.62	Relative Permittivity (ϵ_r):	51.625	52.7	-2.04	± 5
	e''	14.75	Conductivity (σ):	2.010	1.95	3.09	± 5

Liquid Check

Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 48%

December 10, 2010 01:57 PM

Frequency	e'	e''
2400000000.	51.7364	14.7017
2405000000.	51.7350	14.7444
2410000000.	51.7321	14.7807
2415000000.	51.7175	14.7952
2420000000.	51.7324	14.8129
2425000000.	51.7302	14.8031
2430000000.	51.7122	14.7983
2435000000.	51.7056	14.7934
2440000000.	51.6863	14.7729
2445000000.	51.6551	14.7586
2450000000.	51.6248	14.7494
2455000000.	51.5930	14.7376
2460000000.	51.5576	14.7341
2465000000.	51.5236	14.7432
2470000000.	51.4880	14.7566
2475000000.	51.4545	14.7806
2480000000.	51.4275	14.8104
2485000000.	51.3996	14.8531
2490000000.	51.3780	14.8979
2495000000.	51.3618	14.9491
2500000000.	51.3497	15.0007

The conductivity (σ) can be given as:

$$\sigma = \omega \epsilon_0 e'' = 2 \pi f \epsilon_0 e''$$

where $f = \text{target } f * 10^6$

$$\epsilon_0 = 8.854 * 10^{-12}$$

9. SYSTEM VERIFICATION

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

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 EX3DV3-SN: 3531 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 3.0 mm.
 For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input powers (forward power) were 100 mW.
- The results are normalized to 1 W input power.

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG.

System validation dipole	Cal. certificate #	Cal. date	SAR Avg (mW/g)		
			Tissue:	Head	Body
D2450V2	D2450V2-706_Apr10	04/19/10	SAR _{1g} :	51.6	52.4
			SAR _{10g} :	24.4	24.5

9.1. SYSTEM CHECK RESULTS FOR D2450V2

Ambient Temperature = 24°C; Relative humidity = 38%

Measured by: Devin Chang

System validation dipole	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D2450V2	12/10/10	SAR _{1g} :	53.7	52.4	2.48	± 10
		SAR _{10g} :	25.2	24.5	2.86	

SYSTEM CHECK PLOT

Date/Time: 12/10/2010 2:33:28 PM

Test Laboratory: Compliance Certification Services

System Performance Check - D2450V2

DUT: D2450V2; Type: D2450V2; Serial: 706

Communication System: CW 2450MHz; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2450$ MHz; $\sigma = 2.01$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

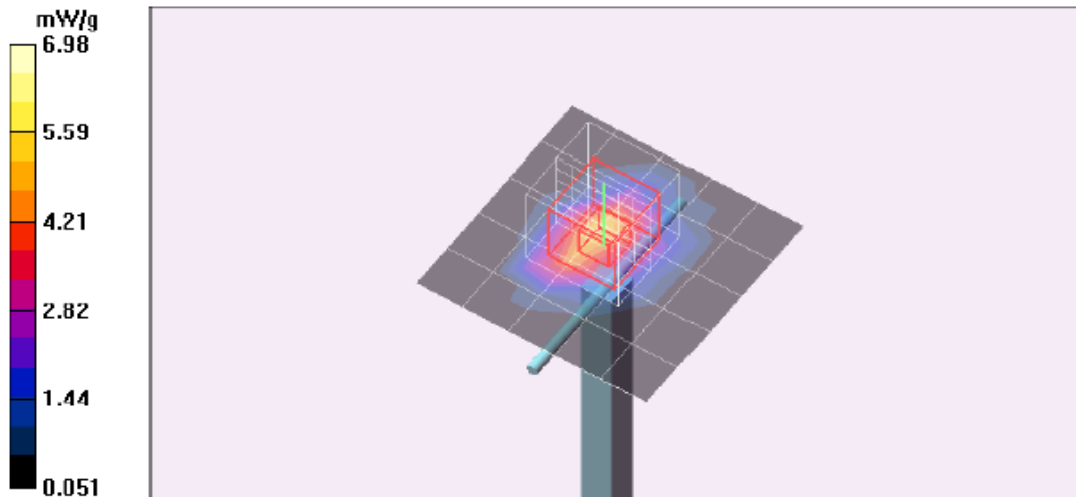
Room Ambient Temperature: 24.0 deg. C; Liquid Temperature: 23.0 deg. C

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=100mW/Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 5.95 mW/g

d=10mm, Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.8 V/m; Power Drift = -0.007 dB
Peak SAR (extrapolated) = 10.9 W/kg
SAR(1 g) = 5.37 mW/g; SAR(10 g) = 2.52 mW/g
Maximum value of SAR (measured) = 6.98 mW/g



SYSTEM CHECK – Z Plot

Date/Time: 12/10/2010 2:49:33 PM

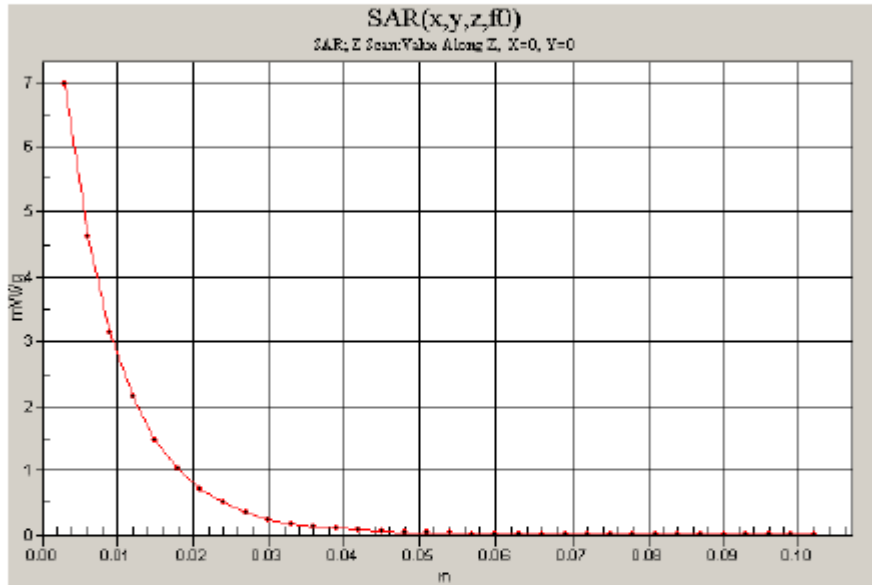
Test Laboratory: Compliance Certification Services

System Performance Check - D2450V2

DUT: D2450V2; Type: D2450V2; Serial: 706

Communication System: CW 2450MHz; Frequency: 2450 MHz; Duty Cycle: 1:1

d=10mm, Pin=100mW/Z Scan (1x1x34): Measurement grid: dx=20mm, dy=20mm, dz=3mm
Maximum value of SAR (measured) = 6.97 mW/g



10. DASY4 SAR MEASUREMENT 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 (for example, 1.2 mm for an EX3DV3 probe type).

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 DASY4 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, EN 50361 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 7 x 7 x 9 points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Step 4: Power drift measurement

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

Step 5: Z-Scan

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

11. RF OUTPUT POWER VERIFICATION

Results

802.11b					
Channel #	Freq. (MHz)	Conducted Avg Power			
		from EMC report		*Actual measured	
		(dBm)	(mW)	(dBm)	(mW)
6	2437	16.13	41.0	19.00	79.4

802.11g					
Channel #	Freq. (MHz)	Conducted Avg Power			
		from EMC report		Actual measured	
		(dBm)	(mW)	(dBm)	(mW)
6	2437	16.22	41.9	18.70	74.1

Notes:

- *: SAR testing is based on 19.0dBm (b mode) and 18.7dBm (g mode) from actual measured RF output power.
- 802.11b doesn't operate for Aux antenna. Thus, 802.11g is performed for Aux antenna instead.
- Measured output power on the highest output power channels only.
- KDB 248227 - SAR is not required for 802.11g/n 20 MHz channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.b/g channels.
- The SAR measured at the middle channel for this configuration is at least 3 dB lower (0.8 mW/g) than SAR limit (1.6 mW/g), thus testing at low & high channel is optional.

12. SUMMARY OF SAR TEST RESULTS

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

Separation distance: 22.7 cm from Main/Aux antenna-to-phantom

Note:

SAR is not required due to Tx antennas (Main/Aux)-to-user's separation distances are > 20 cm.

2. Tablet – Bottom face

Separation distance: 2.9 cm from Main/Aux antenna-to-phantom

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	Main	0.061	0.035
802.11g	6	2437	Aux	0.045	0.026

3. Edge - Primary Landscape (No SAR)

Separation distance: 21.6 cm from Main/Aux antenna-to-phantom

Note:

SAR is not required due to Tx antennas (Main/Aux)-to-user's separation distances are > 20 cm.

4. Edge - Secondary Landscape

Refer to Cetecom SAR report # SAR_BROAD_094_11001_HMG2L

5. Edge - Primary Portrait (Main antenna)

Separation distance: 9.0 cm from Main antenna-to-phantom

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	6	2437	Main	0.099	0.047

6. Edge - Secondary Portrait (Aux Antenna)

Separation distance: 8.7 cm from Aux antenna-to-phantom

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11g	6	2437	Aux	0.083	0.039

13. SAR TEST PLOTS

Tablet – Bottom face (Main Antenna)

Date/Time: 12/10/2010 7:23:46 PM

Test Laboratory: Compliance Certification Services

Tablet - Bottom face

DUT: Broadcom; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.7$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- 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 M-ch Mian Ant/Area Scan (8x8x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.070 mW/g

802.11b M-ch Mian Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

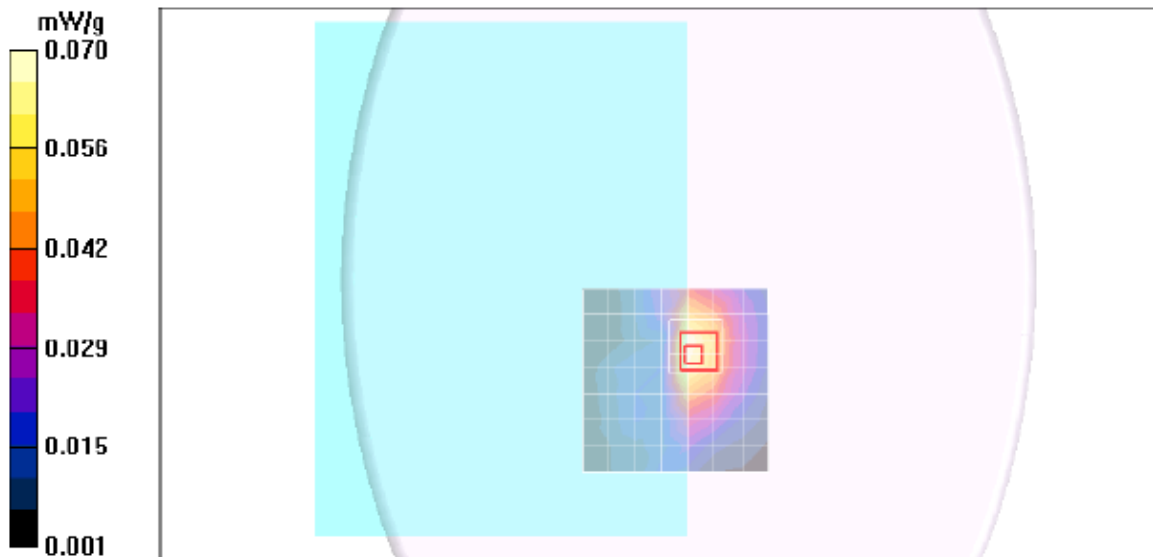
Reference Value = 6.04 V/m; Power Drift = -0.142 dB

Peak SAR (extrapolated) = 0.107 W/kg

SAR(1 g) = 0.061 mW/g; SAR(10 g) = 0.035 mW/g

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

Maximum value of SAR (measured) = 0.075 mW/g



Tablet – Bottom face (Aux Antenna)

Date/Time: 12/10/2010 7:55:33 PM

Test Laboratory: Compliance Certification Services

Tablet - Bottom face

DUT: Broadcom; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.7$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11g M-ch Aux Ant/Area Scan (7x8x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.056 mW/g

802.11g M-ch Aux Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

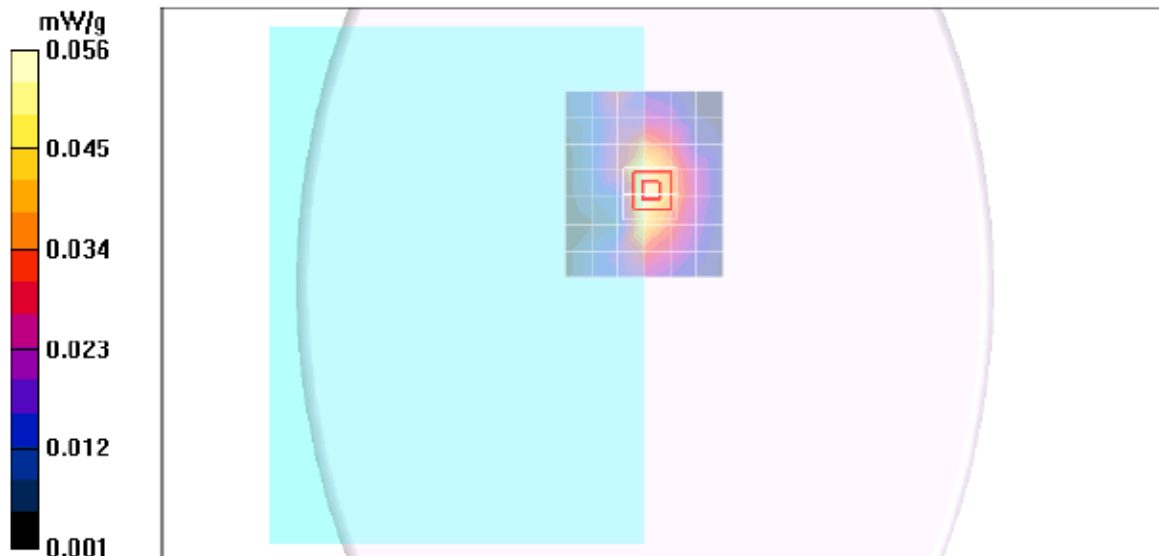
Reference Value = 5.29 V/m; Power Drift = -0.171 dB

Peak SAR (extrapolated) = 0.076 W/kg

SAR(1 g) = 0.045 mW/g; SAR(10 g) = 0.026 mW/g

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

Maximum value of SAR (measured) = 0.054 mW/g



Edge - Primary Portrait

Date/Time: 12/10/2010 8:50:18 PM

Test Laboratory: Compliance Certification Services

Primary Portrait

DUT: Broadcom; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.7$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- 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 M-ch Main Ant/Area Scan (7x8x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (measured) = 0.111 mW/g

802.11b M-ch Main Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

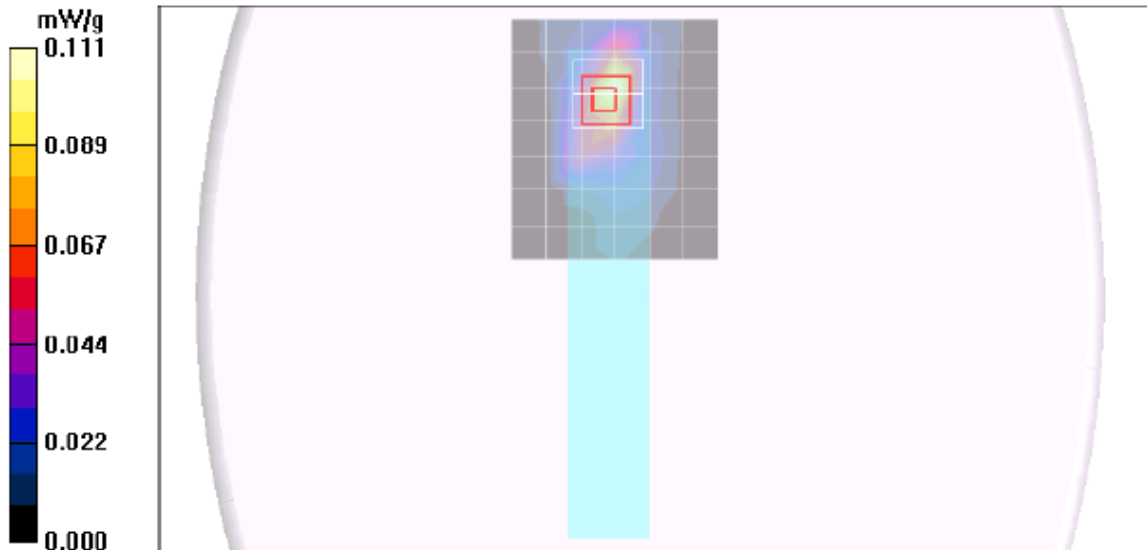
Reference Value = 1.85 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.199 W/kg

SAR(1 g) = 0.099 mW/g; SAR(10 g) = 0.047 mW/g

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

Maximum value of SAR (measured) = 0.128 mW/g



Worst case Z-plot for Primary Portrait

Date/Time: 12/10/2010 9:11:42 PM

Test Laboratory: Compliance Certification Services

Primary Portrait

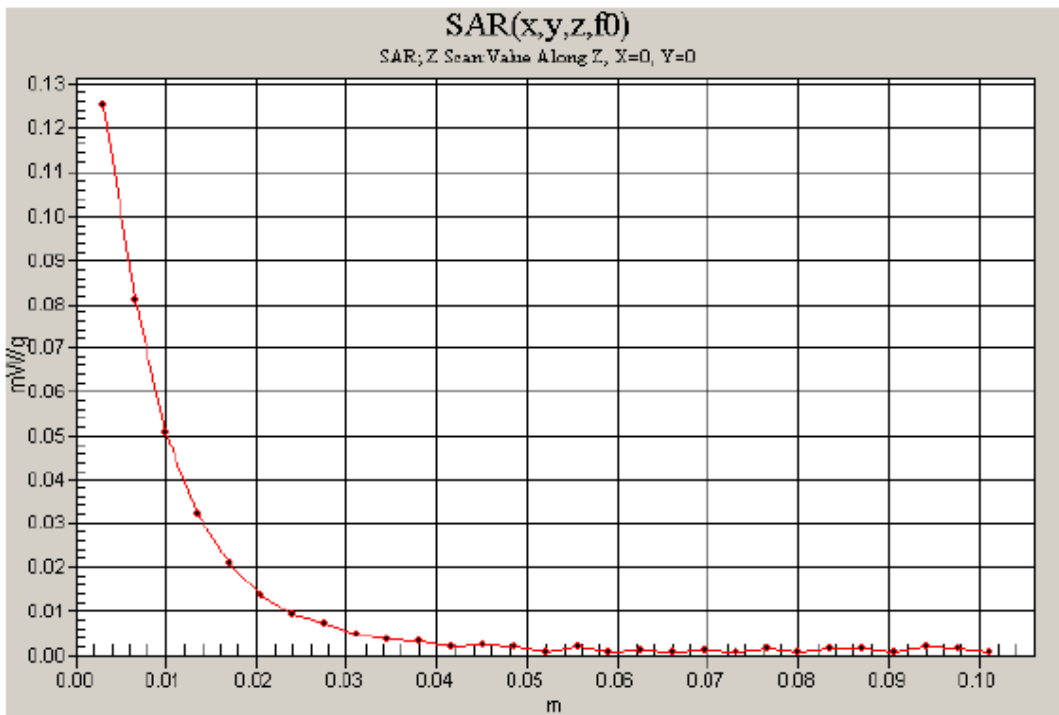
DUT: Broadcom; Type: NA; Serial: NA

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

802.11b M-ch Main Ant/Z Scan (1x1x29): Measurement grid: dx=20mm, dy=20mm, dz=3.5mm

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

Maximum value of SAR (measured) = 0.125 mW/g



Edge - Secondary Portrait

Date/Time: 12/10/2010 8:24:49 PM

Test Laboratory: Compliance Certification Services

Secondary Portrait

DUT: Broadcom; Type: NA; Serial: NA

Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2$ mho/m; $\epsilon_r = 51.7$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV3 - SN3531; ConvF(7.58, 7.58, 7.58); Calibrated: 2/23/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11g M-ch Aux Ant/Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm

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

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

802.11g M-ch Aux Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 3.01 V/m; Power Drift = 0.136 dB

Peak SAR (extrapolated) = 0.165 W/kg

SAR(1 g) = 0.083 mW/g; SAR(10 g) = 0.039 mW/g

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

Maximum value of SAR (measured) = 0.111 mW/g

