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

SAR EVALUATION REPORT

For

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

MODEL: BCM943224HMS

FCC ID: QDS-BRCM1041
IC: 4324A-BRCM1041

REPORT NUMBER: 10U13561-2A

ISSUE DATE: April 8, 2011

Prepared for

BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086

Prepared by

COMPLIANCE CERTIFICATION SERVICES (UL CCS)
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	December 21, 2010	Initial Issue	--
A	April 8, 2011	Deleted note "(Tx disabled by software)" at Secondary landscape test configuration. Refer to Cetecom SAR report # SAR_BROAD_094_11001_HMS dated 2011-03-10 for SAR data at Secondary landscape configuration.	Sunny Shih

TABLE OF CONTENTS

COMPLIANCE CERTIFICATION SERVICES (UL CCS) FORM NO: CCSUP4031B
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1. ATTESTATION OF TEST RESULTS

Applicant:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086
EUT description:	802.11ag/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:	2.4 GHz Band - December 10, 2010; 5 GHz Bands – December 17-18, 2010

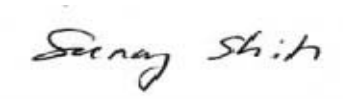
FCC / IC rule parts	Freq. range (MHz)	The Highest SAR (W/kg)		Limit (W/kg)
		1g	10g	
15.247 / RSS-102	2412 - 2462	0.085	0.037	1g = 1.6 10g = 2.0
	5725 – 5850	0.162	0.060	
15.407	5150 – 5250	0.110	0.377	
	5250 – 5350	0.150	0.054	
	5470 – 5725	0.158	0.058	

Applicable Standards	Test Results
- FCC OET Bulletin 65 Supplement C 01-01 - IC RSS 102 Issue 4	Pass
- 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

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.

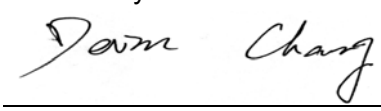
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this 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:



Sunny Shih
Engineering Team Leader
Compliance Certification Services (UL CCS)

Tested By:



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
E-Field Probe	SPEAG	EX3DV3	3508	2	19	2011
Data Acquisition Electronics	SPEAG	DAE3 V1	427	7	21	2011
System Validation Dipole	SPEAG	D2450V2	706	4	19	2013
System Validation Dipole	SPEAG	D5GHzV2	1075	9	3	2011
Thermometer	ERTCO	639-1S	1718	7	19	2011
Power Meter	Giga-tronics	8651A	8651404	5	13	2012
Power Sensor	Giga-tronics	80701A	1834588	5	13	2012
Power Meter	Boonton	4541	12414	2	26	2011
Power Sensor	Boonton	57006	6871	2	23	2011
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	SPEAG	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) @ 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	0.43	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	-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	

3 to 6 GHz averaged over 1 gram

Component	error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1) @ 5GHz	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	3.68	Normal	1	0.64	2.36
Liquid Permittivity - deviation from target	10.00	Rectangular	1.732	0.6	3.46
Liquid Permittivity - measurement uncertainty	-4.01	Normal	1	0.6	-2.41
Combined Standard Uncertainty Uc(y), %:					10.98
Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =				21.52	%
Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =				1.69	dB

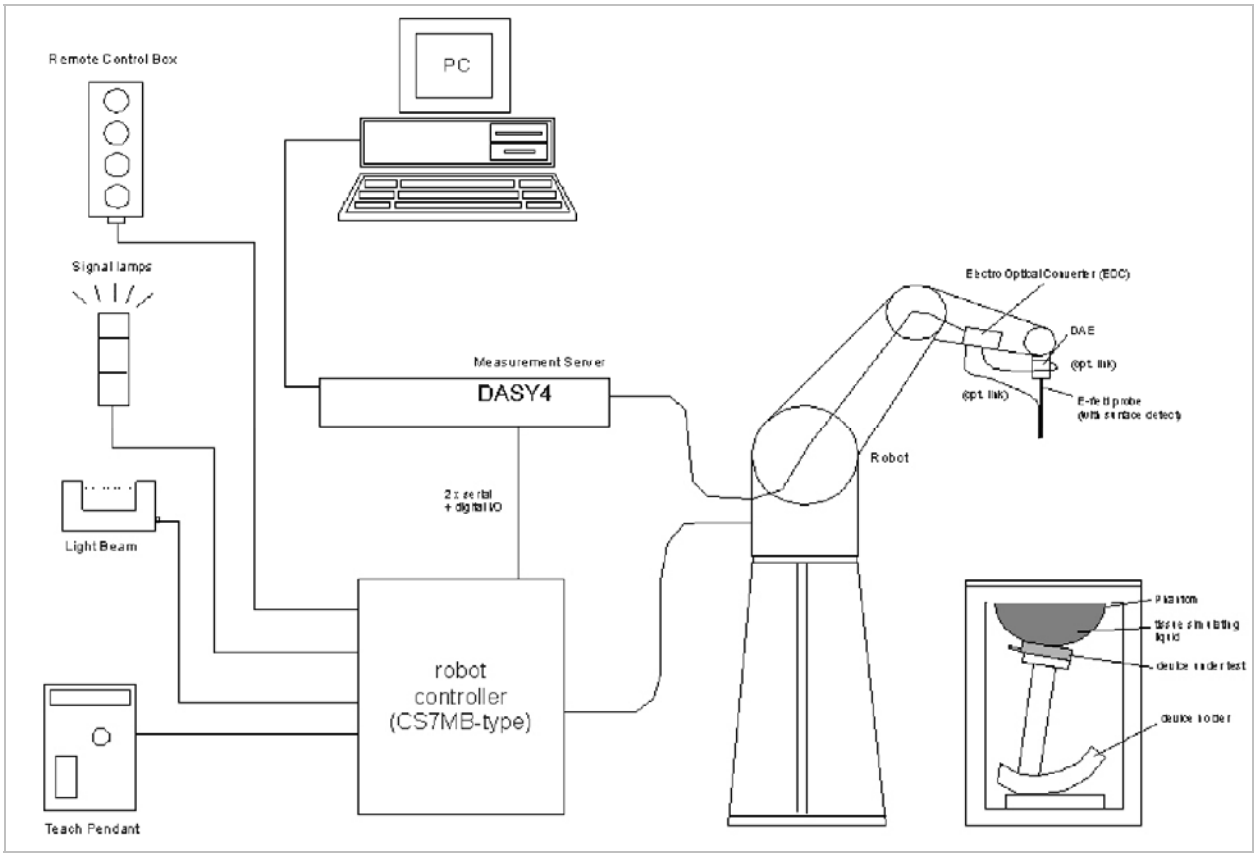
3 to 6 GHz averaged over 10 gram

Component	error, %	Distribution	Divisor	Sensitivity	U (Xi), %
Measurement System					
Probe Calibration (k=1) @ 5GHz	6.55	Normal	1	1	6.55
Axial Isotropy	4.03	Rectangular	1.732	0.7071	1.64
Hemispherical Isotropy	6.90	Rectangular	1.732	0.7071	2.82
Boundary Effect	1.00	Rectangular	1.732	1	0.58
Probe Linearity	9.20	Rectangular	1.732	1	5.31
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	0.43	1.24
Liquid Conductivity - measurement	3.68	Normal	1	0.43	1.58
Liquid Permittivity - deviation from target	10.00	Rectangular	1.732	0.49	2.83
Liquid Permittivity - measurement uncertainty	-4.01	Normal	1	0.49	-1.96
Combined Standard Uncertainty Uc(y), %:					11.98
Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =				23.96	%
Expanded Uncertainty U, Coverage Factor = 1.96, > 95 % Confidence =				1.87	dB

5. EQUIPMENT UNDER TEST

802.11ag/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 Manufactured — Model Number Ethertronics — Main: 25.90A1Z.001 Aux: 25.90A20.001
Antenna-to-user separation distances:	See Sec. 14 for details
Assessment for SAR evaluation for Simultaneous transmission:	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. TISSUE DIELECTRIC 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. For frequencies in 300 MHz to 2 GHz, the measured conductivity and relative permittivity should be within ± 5% of the target values. For frequencies in the range of 2–3 GHz and above the measured conductivity should be within ± 5% of the target values. The measured relative permittivity tolerance can be relaxed to no more than ± 10%.

Reference Values of Tissue Dielectric Parameters for Body (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 (Supplement C 01-01)	
	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 ρ = 1000 kg/m^3)

Reference Values of Tissue Dielectric Parameters for Body (for 3000 MHz – 5800 MHz)

In the current guidelines and draft standards for compliance testing of mobile phones (i.e., IEEE P1528, OET 65 Supplement C), the dielectric parameters suggested for head and body tissue simulating liquid are given only at 3.0 GHz and 5.8 GHz. As an intermediate solution, dielectric parameters for the frequencies between 5 to 5.8 GHz were obtained using linear interpolation (see table below).

SPEAG has developed suitable head and body tissue simulating liquids consisting of the following ingredients: de-ionized water, salt and a special composition including mineral oil and an emulgators. Dielectric parameters of these liquids were measured suing a HP 8570C Dielectric Probe Kit in conjunction with HP 8753ES Network Analyzer (30 kHz – 6G Hz). The differences with respect to the interpolated values were well within the desired ±5% for the whole 5 to 5.8 GHz range.

f (MHz)	Body Tissue		Reference
	rel. permitivity	conductivity	
3000	52.0	2.73	Standard
5100	49.1	5.18	Interpolated
5200	49.0	5.30	Interpolated
5300	48.9	5.42	Interpolated
5400	48.7	5.53	Interpolated
5500	48.6	5.65	Interpolated
5600	48.5	5.77	Interpolated
5700	48.3	5.88	Interpolated
5800	48.2	6.00	Standard

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

7.1. TISSUE PARAMETERS CHECK RESULTS FOR 2450 MHZ

Simulating Liquid Dielectric Parameters for Body 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:

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

where f = target f * 10^6

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

7.2. TISSUE PARAMETERS CHECK RESULTS FOR 5 GHZ

Simulating Liquid Dielectric Parameter Check Result @ Body 5 GHz Measured by: David Lee

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	50.5936	Relative Permittivity (ε_r):	50.5936	49.0	3.25	± 10
	e"	18.7992	Conductivity (σ):	5.43828	5.30	2.61	± 5
5500	e'	46.652	Relative Permittivity (ε_r):	46.6520	48.6	-4.01	± 10
	e"	18.1136	Conductivity (σ):	5.54225	5.65	-1.91	± 5
5800	e'	49.4526	Relative Permittivity (ε_r):	49.4526	48.2	2.60	± 10
	e"	19.2788	Conductivity (σ):	6.22052	6.00	3.68	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 40%
December 17, 2010 09:35 AM

Frequency	e'	e''
4600000000.	51.8135	17.8046
4650000000.	49.5426	17.6750
4700000000.	51.0909	18.5204
4750000000.	50.1892	17.4574
4800000000.	49.5406	18.6782
4850000000.	51.0768	17.8910
4900000000.	48.4522	18.1706
4950000000.	51.0320	18.7663
5000000000.	48.6651	17.6316
5050000000.	49.6162	19.2070
5100000000.	49.8483	17.8143
5150000000.	47.9044	18.6592
5200000000.	**50.5936**	**18.7992**
5250000000.	47.4272	17.7706
5300000000.	49.7910	19.6366
5350000000.	48.3727	17.5571
5400000000.	47.9860	19.3542
5450000000.	49.7002	18.3821
5500000000.	**46.6520**	**18.1136**
5550000000.	49.8422	19.7562
5600000000.	47.0800	17.3144
5650000000.	48.3795	20.0582
5700000000.	48.4726	17.7327
5750000000.	46.7306	18.8714
5800000000.	**49.4526**	**19.2788**
5850000000.	46.1914	17.2247
5900000000.	48.7298	20.5616
5950000000.	47.2127	16.8973
6000000000.	46.9734	19.9628

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

Simulating Liquid Dielectric Parameter Check Result @ Body 5 GHz Measured by: David Lee

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	47.8571	Relative Permittivity (ε_r):	47.8571	49.0	-2.33	± 10
	e"	18.3465	Conductivity (σ):	5.30732	5.30	0.14	± 5
5500	e'	47.3216	Relative Permittivity (ε_r):	47.3216	48.6	-2.63	± 10
	e"	18.7845	Conductivity (σ):	5.74753	5.65	1.73	± 5
5800	e'	46.7182	Relative Permittivity (ε_r):	46.7182	48.2	-3.07	± 10
	e"	19.1172	Conductivity (σ):	6.16838	6.00	2.81	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C; Relative humidity = 45%
December 18, 2010 08:03 AM

Frequency	e'	e"
4600000000.	48.9856	17.4247
4650000000.	48.9019	17.5157
4700000000.	48.8185	17.5926
4750000000.	48.7246	17.6751
4800000000.	48.6352	17.7702
4850000000.	48.5399	17.8248
4900000000.	48.4685	17.9425
4950000000.	48.3662	17.9634
5000000000.	48.2610	18.0865
5050000000.	48.1712	18.1218
5100000000.	48.0521	18.2230
5150000000.	47.9833	18.2901
5200000000.	**47.8571**	**18.3465**
5250000000.	47.7979	18.4462
5300000000.	47.6749	18.4710
5350000000.	47.5988	18.5811
5400000000.	47.5059	18.6167
5450000000.	47.3881	18.6835
5500000000.	**47.3216**	**18.7845**
5550000000.	47.2047	18.7840
5600000000.	47.1139	18.9282
5650000000.	47.0274	18.9156
5700000000.	46.9053	19.0482
5750000000.	46.8795	19.0896
5800000000.	**46.7182**	**19.1172**
5850000000.	46.6691	19.2641
5900000000.	46.5388	19.2138
5950000000.	46.4471	19.4076
6000000000.	46.3723	19.3650

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 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 ±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: 3508 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 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	Cal. Freq. (GHz)	SAR Avg (mW/g)		
				Tissue:	Head	Body
D2450V2	D2450V2-706_Apr10	4/19/10	2.4	SAR_{1g}:	51.6	52.4
				SAR_{10g}:	24.4	24.5
D5GHzV2	D5GHzV2-1075_Sep09	9/3/09	5.2	SAR_{1g}:		79.0
				SAR_{10g}:		22.0
			5.5	SAR_{1g}:		85.4
				SAR_{10g}:		23.5
			5.8	SAR_{1g}:		73.2
				SAR_{10g}:		20.1

8.1. 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	

8.2. SYSTEM CHECK RESULTS FOR D5GHzV2

Measured by: Devin Chang

	Date Tested	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
		Tissue:	Body			
D5GHzV2 (5.2GHz)	12/17/10	SAR_{1g}:	74.9	79.0	-5.19	±10
		SAR_{10g}:	21.6	22.0	-1.82	
D5GHzV2 (5.5GHz)	12/17/10	SAR_{1g}:	81.4	85.4	-4.68	±10
		SAR_{10g}:	23.1	23.5	-1.70	
D5GHzV2 (5.8GHz)	12/17/10	SAR_{1g}:	74.1	73.2	1.23	±10
		SAR_{10g}:	21.1	20.1	4.98	
D5GHzV2 (5.2GHz)	12/18/10	SAR_{1g}:	73.1	79.0	-7.47	±10
		SAR_{10g}:	21.1	22.0	-4.09	
D5GHzV2 (5.5GHz)	12/18/10	SAR_{1g}:	84.4	85.4	-1.17	±10
		SAR_{10g}:	24.0	23.5	2.13	
D5GHzV2 (5.8GHz)	12/18/10	SAR_{1g}:	73.5	73.2	0.41	±10
		SAR_{10g}:	20.9	20.1	3.98	

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

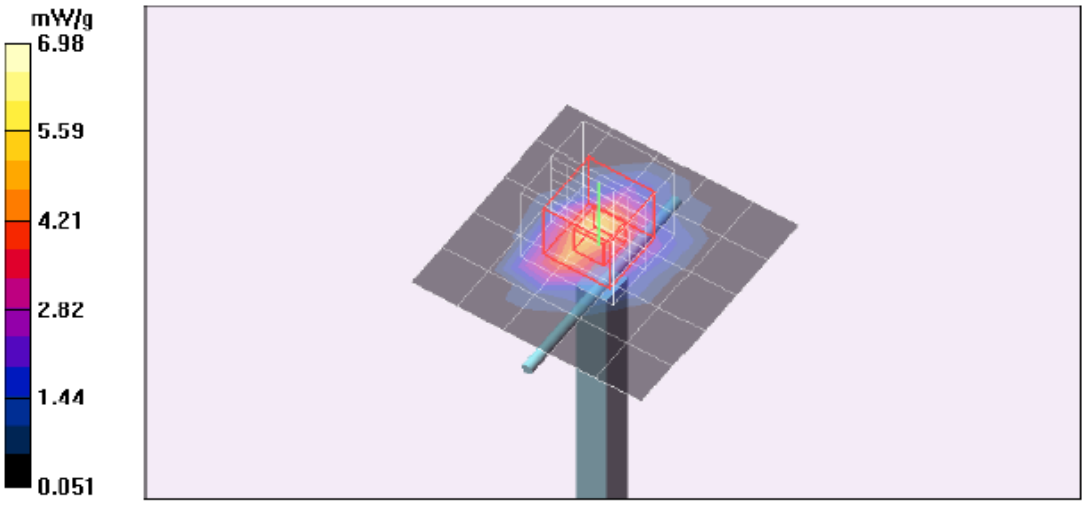
Communication System: CW 2450MHz; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 2.01 mho/m; ε_r = 51.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: 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

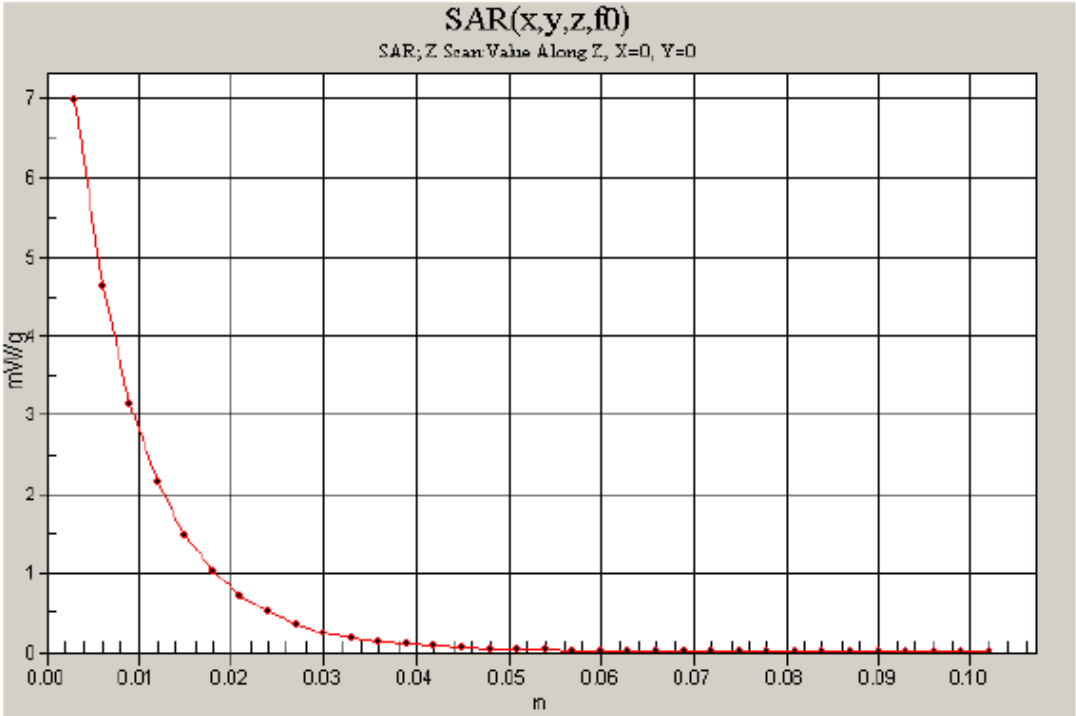
Test Laboratory: Compliance Certification Services

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



System check plot for D5GHzV2 5.2 GHz

Date/Time: 12/17/2010 9:44:41 AM

Test Laboratory: Compliance Certification Services

System Performance Check - D5GHzV2_5 GHz

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1075

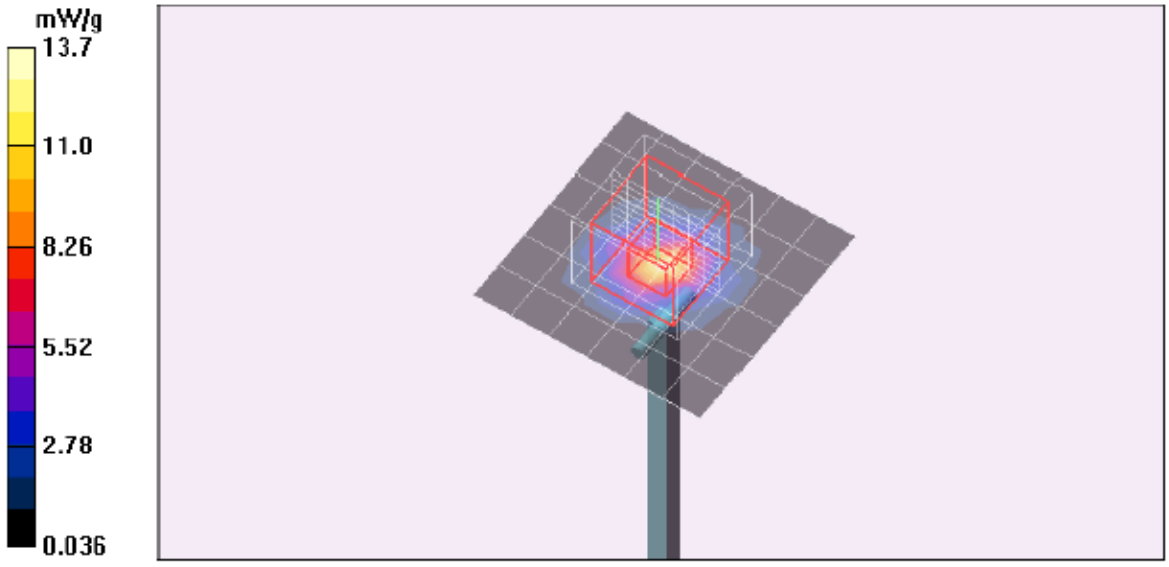
Communication System: CW 5GHz; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.44 mho/m; ε_r = 50.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3508; ConvF(4.12, 4.12, 4.12); Calibrated: 2/19/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=100mW, 5.2GHz/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.7 mW/g

d=10mm, Pin=100mW, 5.2GHz/Zoom Scan (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 55.7 V/m; Power Drift = -0.102 dB
Peak SAR (extrapolated) = 26.8 W/kg
SAR(1 g) = 7.49 mW/g; SAR(10 g) = 2.16 mW/g
Maximum value of SAR (measured) = 13.1 mW/g



System check plot for D5GHzV2 5.5 GHz

Date/Time: 12/17/2010 11:47:46 AM

Test Laboratory: Compliance Certification Services

System Performance Check - D5GHzV2_5 GHz

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1075

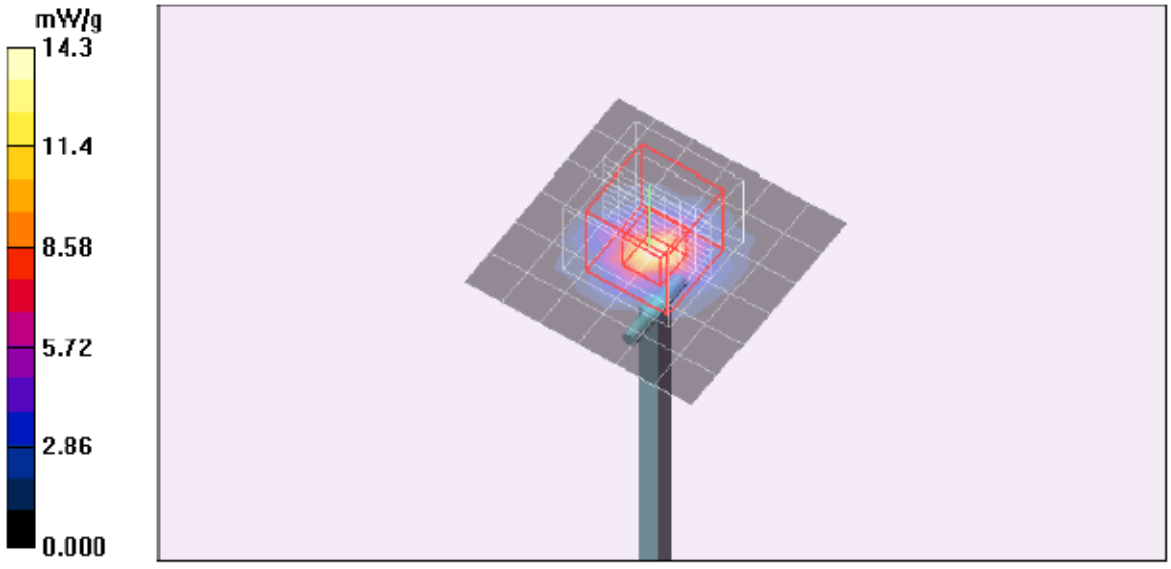
Communication System: CW 5GHz; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5500 MHz; σ = 5.54 mho/m; ε_r = 46.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3508; ConvF(3.8, 3.8, 3.8); Calibrated: 2/19/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=100mW, 5.5GHz/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 15.0 mW/g

d=10mm, Pin=100mW, 5.5GHz/Zoom Scan (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 56.1 V/m; Power Drift = -0.131 dB
Peak SAR (extrapolated) = 30.8 W/kg
SAR(1 g) = 8.14 mW/g; SAR(10 g) = 2.31 mW/g
Maximum value of SAR (measured) = 14.3 mW/g



System check plot for D5GHzV2 5.8 GHz

Date/Time: 12/17/2010 12:21:22 PM

Test Laboratory: Compliance Certification Services

System Performance Check - D5GHzV2_5 GHz

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1075

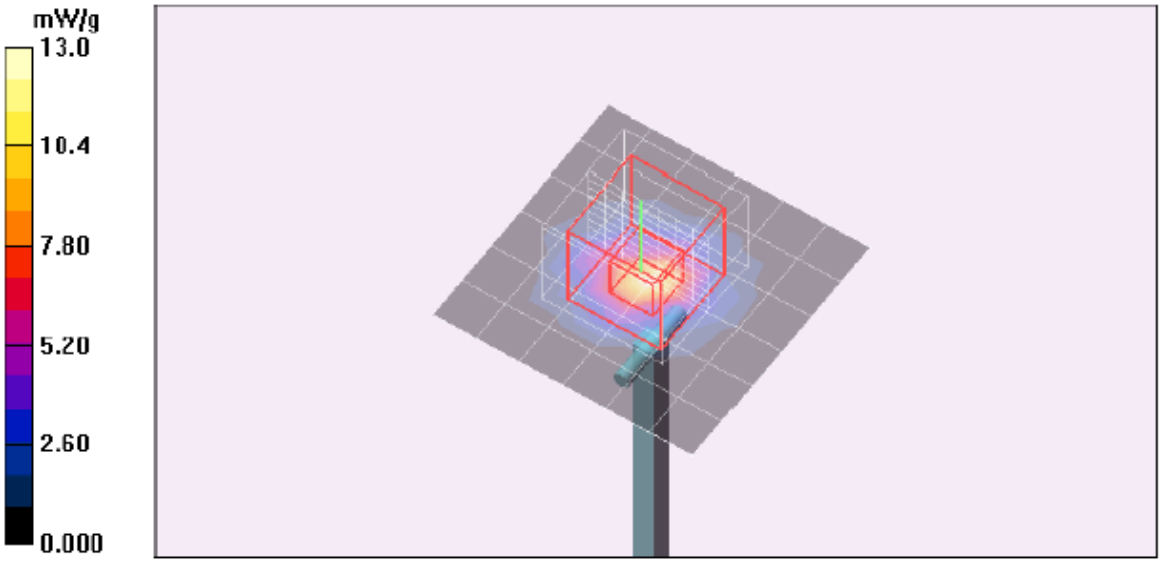
Communication System: CW 5GHz; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 6.22 mho/m; ε_r = 49.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3508; ConvF(3.64, 3.64, 3.64); Calibrated: 2/19/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=100mW, 5.8GHz/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.4 mW/g

d=10mm, Pin=100mW, 5.8GHz/Zoom Scan (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 50.2 V/m; Power Drift = 0.108 dB
Peak SAR (extrapolated) = 29.1 W/kg
SAR(1 g) = 7.41 mW/g; SAR(10 g) = 2.11 mW/g
Maximum value of SAR (measured) = 13.0 mW/g



System check Z-plot for D5GHzV2 5.8 GHz

Date/Time: 12/17/2010 12:49:56 PM

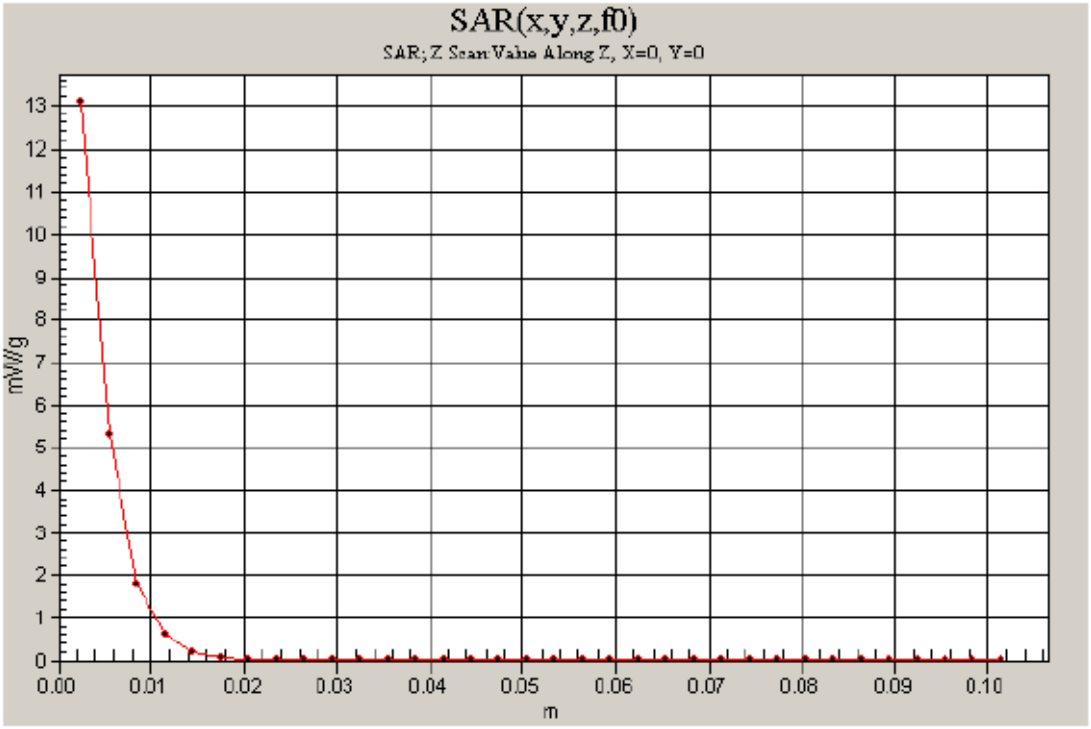
Test Laboratory: Compliance Certification Services

System Performance Check - D5GHzV2_5 GHz

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1075

Communication System: CW 5GHz; Frequency: 5800 MHz;Duty Cycle: 1:1

d=10mm, Pin=100mW, 5.8GHz/Z Scan (1x1x34): Measurement grid: dx=20mm, dy=20mm, dz=3mm
Maximum value of SAR (measured) = 13.1 mW/g



System check plot for D5GHzV2 5.2 GHz

Date/Time: 12/18/2010 9:11:21 AM

Test Laboratory: Compliance Certification Services

System Performance Check - D5GHzV2_5 GHz

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1075

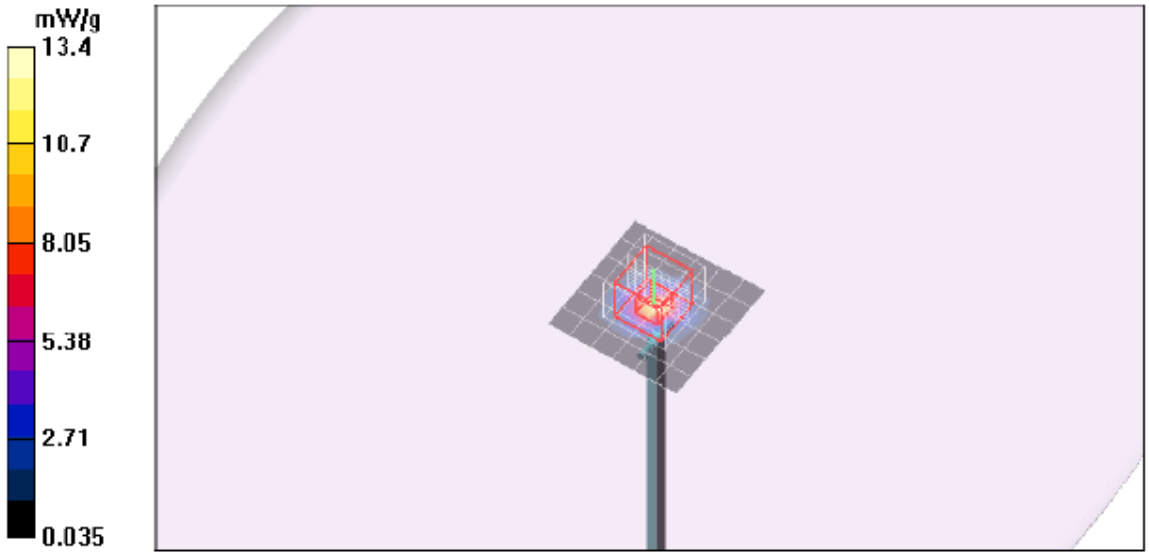
Communication System: CW 5GHz; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.31 mho/m; ε_r = 47.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3508; ConvF(4.12, 4.12, 4.12); Calibrated: 2/19/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=100mW, 5.2GHz/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.4 mW/g

d=10mm, Pin=100mW, 5.2GHz/Zoom Scan (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 55.7 V/m; Power Drift = -0.002 dB
Peak SAR (extrapolated) = 26.2 W/kg
SAR(1 g) = 7.31 mW/g; SAR(10 g) = 2.11 mW/g
Maximum value of SAR (measured) = 12.8 mW/g



System check plot for D5GHzV2 5.5 GHz

Date/Time: 12/18/2010 9:47:46 AM

Test Laboratory: Compliance Certification Services

System Performance Check - D5GHzV2_5 GHz

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1075

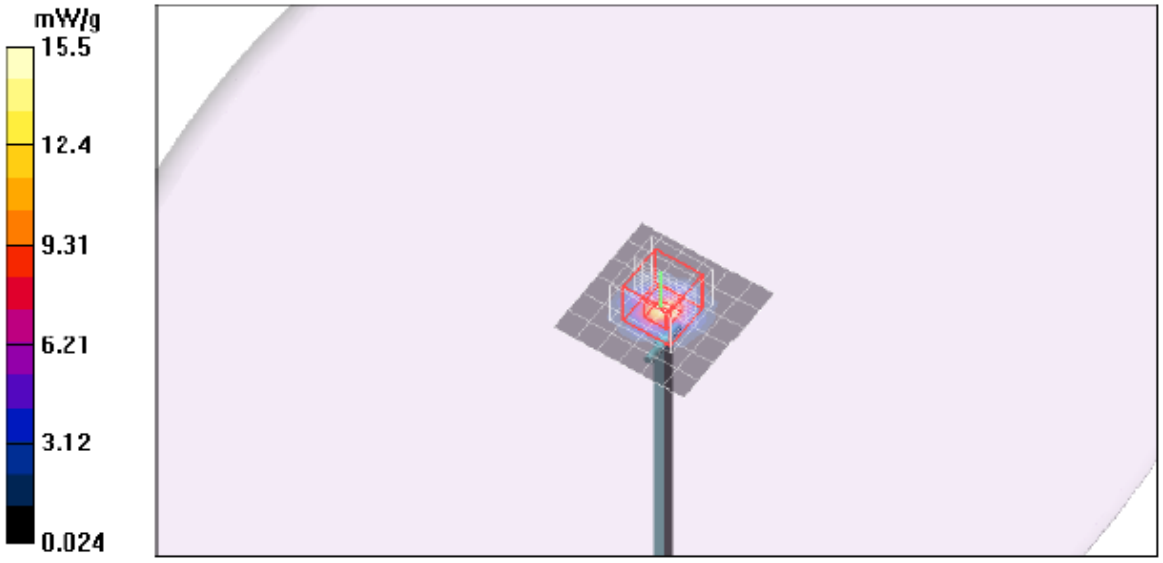
Communication System: CW 5GHz; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5500 MHz; σ = 5.75 mho/m; ε_r = 47.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3508; ConvF(3.8, 3.8, 3.8); Calibrated: 2/19/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=100mW, 5.5GHz/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 15.5 mW/g

d=10mm, Pin=100mW, 5.5GHz/Zoom Scan (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 56.1 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 8.44 mW/g; SAR(10 g) = 2.4 mW/g
Maximum value of SAR (measured) = 14.8 mW/g



System check plot for D5GHzV2 5.8 GHz

Date/Time: 12/18/2010 10:33:18 AM

Test Laboratory: Compliance Certification Services

System Performance Check - D5GHzV2_5 GHz

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1075

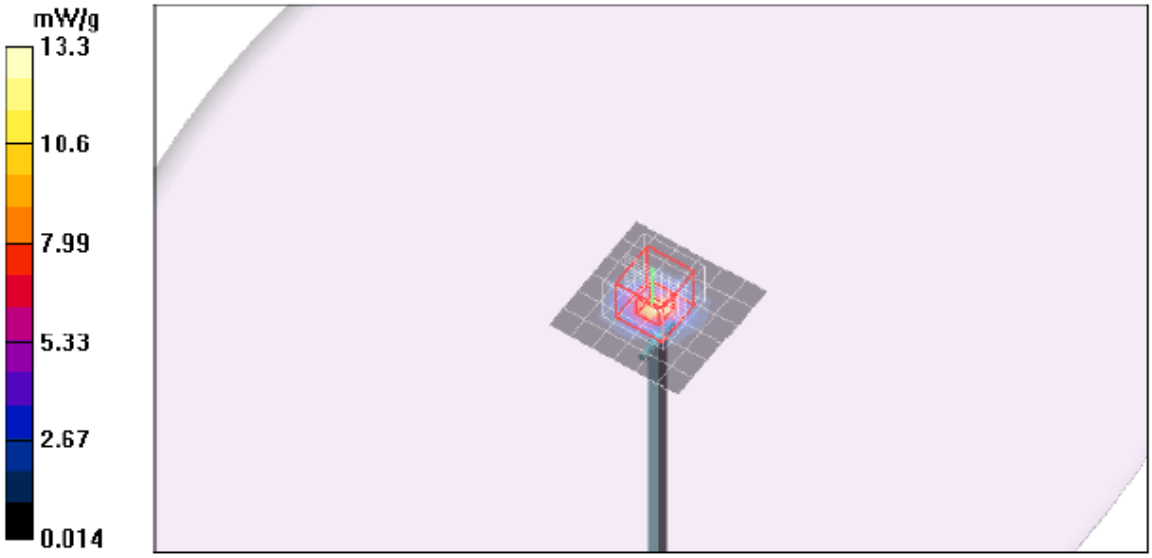
Communication System: CW 5GHz; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 6.17 mho/m; ε_r = 46.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3508; ConvF(3.64, 3.64, 3.64); Calibrated: 2/19/2010
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 7/21/2010
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=100mW, 5.8GHz/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.3 mW/g

d=10mm, Pin=100mW, 5.8GHz/Zoom Scan (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 50.2 V/m; Power Drift = 0.018 dB
Peak SAR (extrapolated) = 28.9 W/kg
SAR(1 g) = 7.35 mW/g; SAR(10 g) = 2.09 mW/g
Maximum value of SAR (measured) = 12.8 mW/g



System check Z-plot for D5GHzV2 5.8 GHz

Date/Time: 12/18/2010 10:47:26 AM

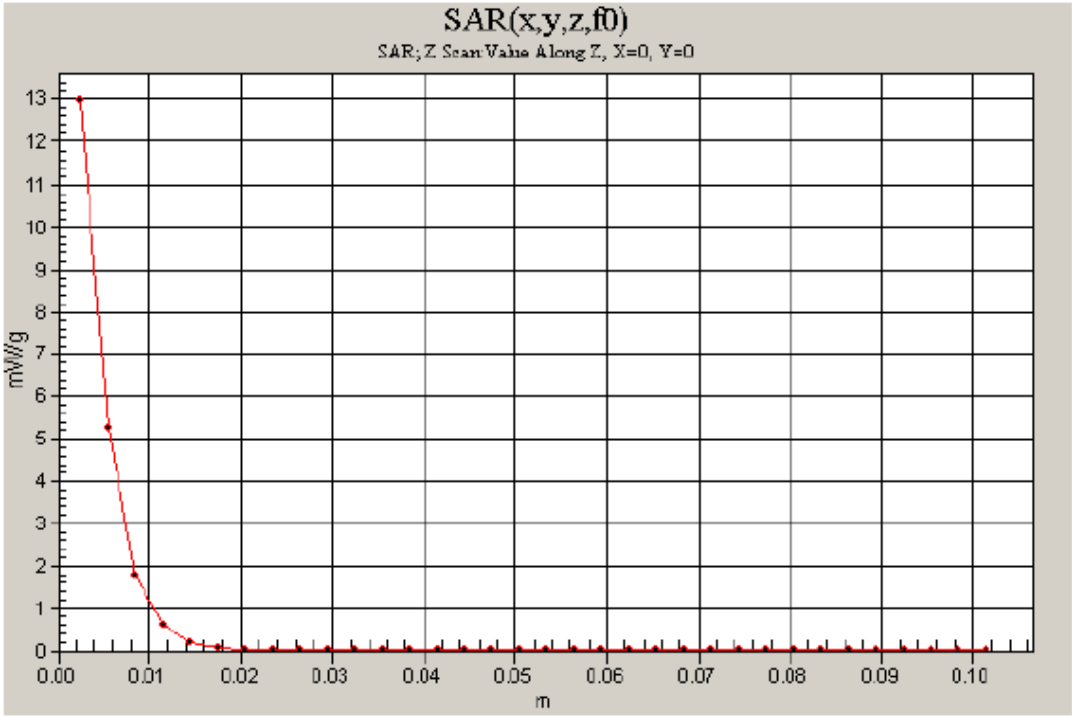
Test Laboratory: Compliance Certification Services

System Performance Check - D5GHzV2_5 GHz

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1075

Communication System: CW 5GHz; Frequency: 5800 MHz;Duty Cycle: 1:1

d=10mm, Pin=100mW, 5.8GHz/Z Scan (1x1x34): Measurement grid: dx=20mm, dy=20mm, dz=3mm
Maximum value of SAR (measured) = 13.0 mW/g



9. 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.

10. RF OUTPUT POWER VERIFICATION

Results

Band	Ch #	Frequency	AVG Conducted Pwr (dBm)
802.11b	6	2437	18.5
802.11g	11	2462	19.0
802.11a (5.2 GHz)	36	5180	n/a
	40	5200	14.0
	48	5240	14.0
802.11a (5.3 GHz)	52	5260	17.5
	60	5300	17.5
	64	5320	17.5
802.11a (5.6 GHz)	100	5500	17.0
	120	5600	17.5
	140	5700	18.0
802.11n 40 MHz	118	5590	18.5
502.11a (5.8 GHz)	149	5745	17.5
	157	5785	17.5
	165	5825	17.5
802.11n 40 MHz	151	5755	18.0
	159	5795	19.0

Notes:

1. 802.11b doesn't operate for Aux antenna. Thus, 802.11g is performed for Aux antenna instead.
2. Measured output power on the highest output power channels only.
3. 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.

11. SUMMARY OF SAR TEST RESULTS

11.1. 2.4 GHZ BAND

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	0.017	0.00603
802.11g	6	2437	Aux	0.017	0.00956

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 Landscap

Separation distance: 0.4 cm from Main/Aux antenna-to-phantom.

Refer to Cetecom SAR report # SAR_BROAD_094_11001_HMS

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	0.030	0.013

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	**0.085**	0.037

11.2. 5 GHZ BANDS

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

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2 GHz	802.11a Legacy	40	5200	Main	0.018	0.00674
		40	5200	Aux	0.00469	0.00174
5.3 GHz	802.11a Legacy	60	5300	Main	0.031	0.011
		60	5300	Aux	0.011	0.00448
5.5 GHz	802.11n HT40	118	5590	Main	0.027	0.012
		118	5590	Aux	0.047	0.019
5.8 GHz	802.11n HT40	159	5795	Main	0.024	0.00958
		159	5795	Aux	0.037	0.014

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

Separation distance: 0.4 cm from Main/Aux antenna-to-phantom.

Refer to Cetecom SAR report # SAR_BROAD_094_11001_HMS.

5. Edge - Primary Portrait (Main antenna)

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

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2 GHz	802.11a Legacy	40	5200	Main	0.013	0.00476
5.3 GHz	802.11a Legacy	60	5300	Main	0.013	0.00482
5.5 GHz	802.11n HT40	118	5590	Main	0.088	0.030
5.8 GHz	802.11n HT40	159	5795	Main	0.078	0.027

6. Edge - Secondary Portrait (Aux Antenna)

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

Band	Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
					1g-SAR	10g-SAR
5.2 GHz	802.11a Legacy	40	5200	Aux	**0.110**	0.038
5.3 GHz	802.11a Legacy	60	5300	Aux	**0.150**	0.054
5.5 GHz	802.11n HT40	118	5590	Aux	**0.158**	0.058
5.8 GHz	802.11n HT40	159	5795	Aux	**0.162**	0.060

11.3. WORST CASE SAR TEST PLOTS

WORST-CASE SAR PLOT FOR 2.4 GHZ

Date/Time: 12/10/2010 4:59:02 PM

Test Laboratory: Compliance Certification Services

Secondary Portrait

DUT: Broadcom; Type: NA; Serial: NA

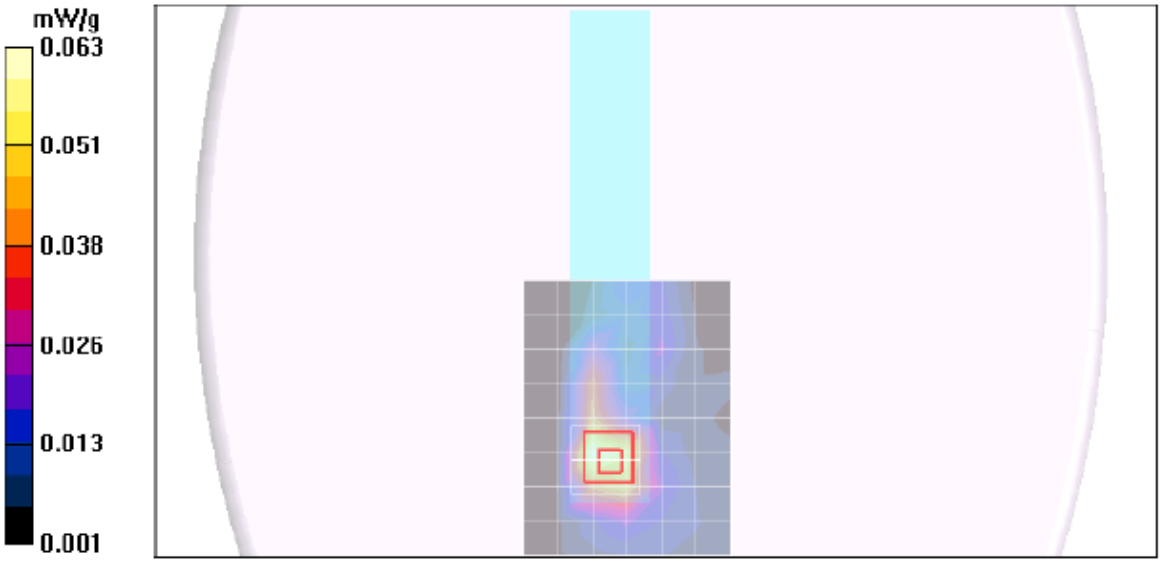
Communication System: 802.11b/g 2.4GHz; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 2 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: 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) = 0.063 mW/g

802.11g M-ch Aux Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 4.29 V/m; Power Drift = 0.134 dB
Peak SAR (extrapolated) = 0.188 W/kg
SAR(1 g) = 0.085 mW/g; SAR(10 g) = 0.037 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.112 mW/g



WORST-CASE SAR PLOT FOR 2.4 GHZ – Z plot

Date/Time: 12/10/2010 5:21:04 PM

Test Laboratory: Compliance Certification Services

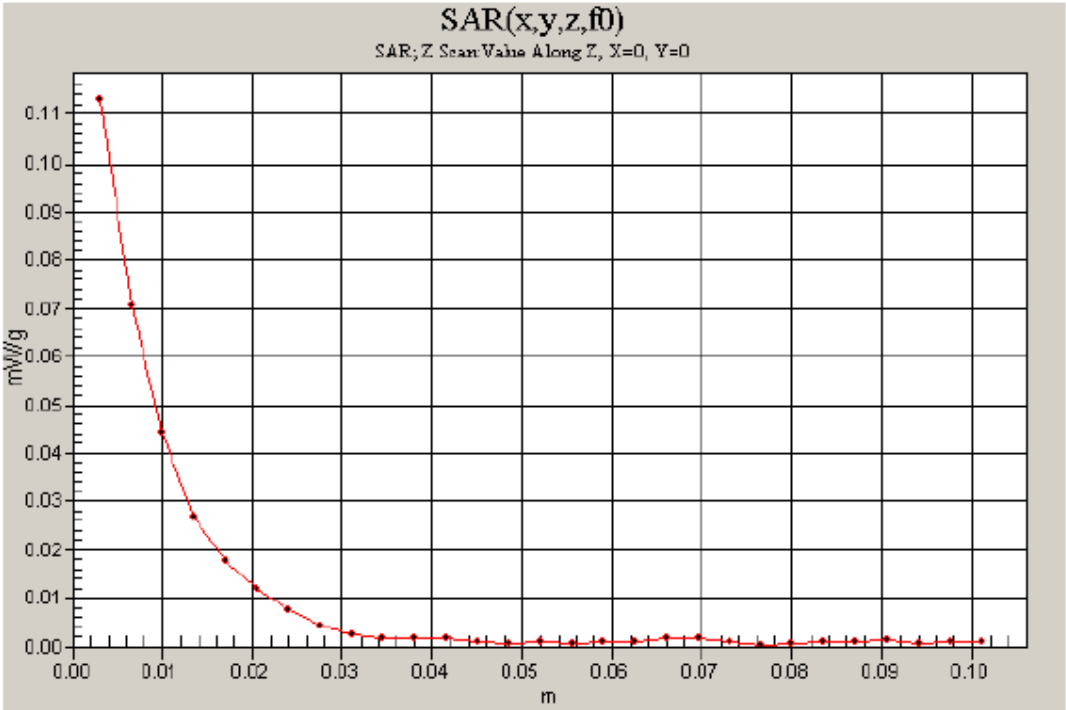
Secondary Portrait

DUT: Broadcom; Type: NA; Serial: NA

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

802.11g M-ch Aux 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) = 0.113 mW/g



WORST-CASE SAR PLOT FOR 5.2 GHZ

Date/Time: 12/17/2010 8:21:09 PM

Test Laboratory: Compliance Certification Services

Primary Portrait_5.2GHz

DUT: Broadcom; Type: NA; Serial: NA

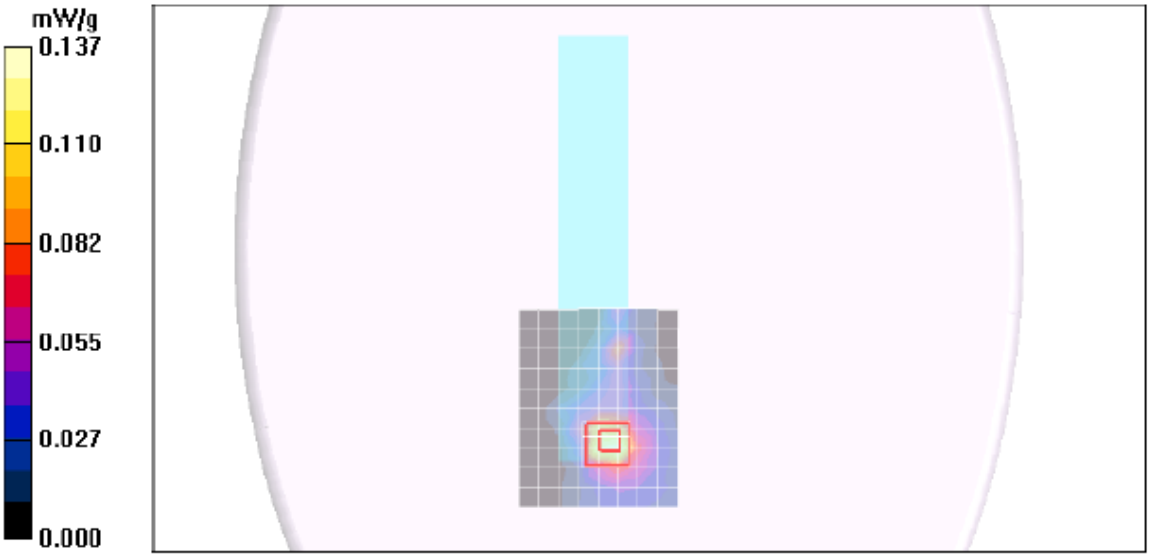
Communication System: 802.11a 5.2GHz; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.44 mho/m; ε_r = 50.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3508; ConvF(4.12, 4.12, 4.12); Calibrated: 2/19/2010
- Sensor-Surface: 2.5mm (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

802.11a_Aux Ant M-Ch 40/Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.137 mW/g

802.11a_Aux Ant M-Ch 40/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 5.63 V/m; Power Drift = 0.056 dB
Peak SAR (extrapolated) = 0.359 W/kg
SAR(1 g) = 0.110 mW/g; SAR(10 g) = 0.038 mW/g
Maximum value of SAR (measured) = 0.186 mW/g



WORST-CASE SAR PLOT FOR 5.2 GHZ – Z plot

Date/Time: 12/17/2010 8:45:03 PM

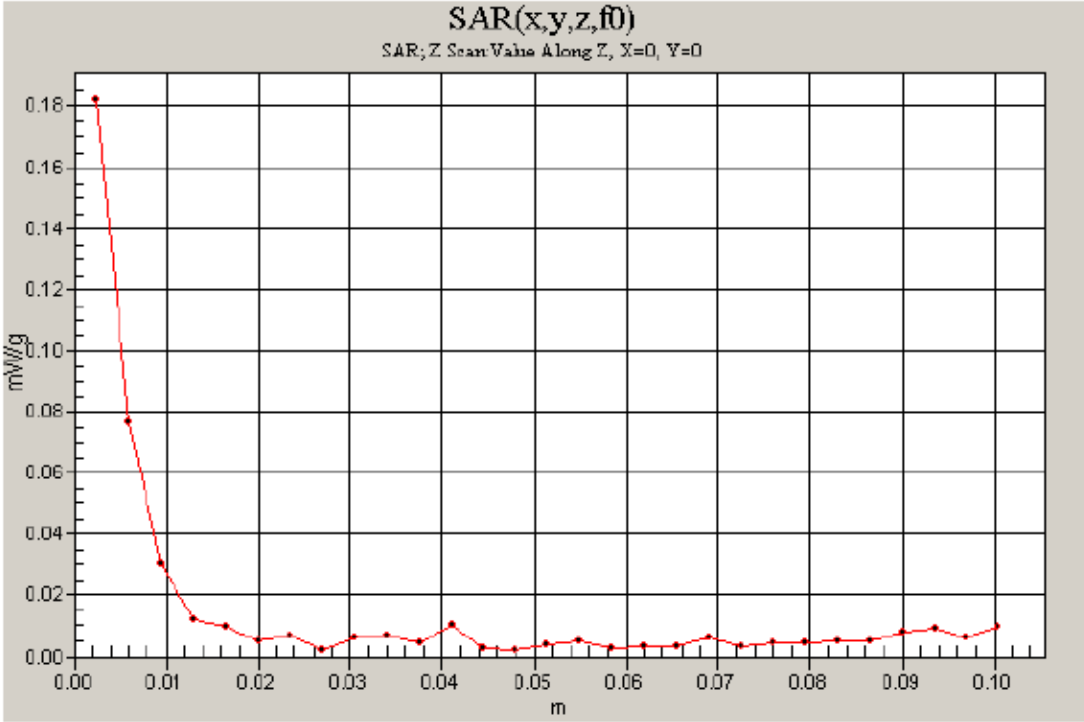
Test Laboratory: Compliance Certification Services

Primary Portrait_5.2GHz

DUT: Broadcom; Type: NA; Serial: NA

Communication System: 802.11a 5.2GHz; Frequency: 5200 MHz;Duty Cycle: 1:1

802.11a_Aux Ant M-Ch 40/Z Scan (1x1x29): Measurement grid: dx=20mm, dy=20mm, dz=3.5mm
Maximum value of SAR (measured) = 0.182 mW/g



WORST-CASE SAR PLOT FOR 5.3 GHZ

Date/Time: 12/17/2010 7:54:35 PM

Test Laboratory: Compliance Certification Services

Primary Portrait_5.3GHz

DUT: Broadcom; Type: NA; Serial: NA

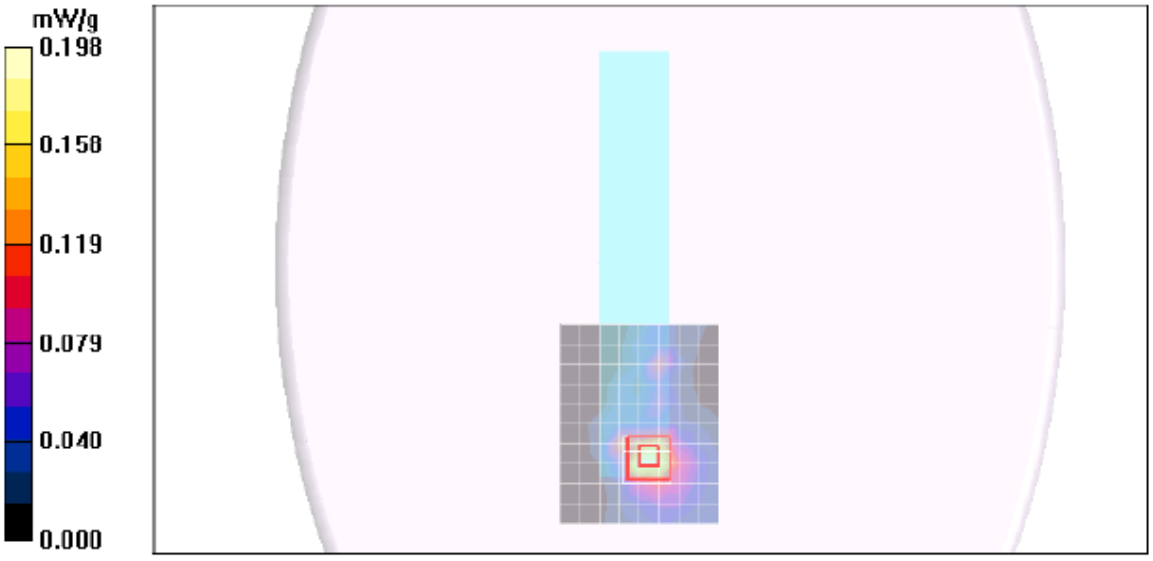
Communication System: 802.11a 5.2GHz; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.48 mho/m; ε_r = 49.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3508; ConvF(4.12, 4.12, 4.12); Calibrated: 2/19/2010
- Sensor-Surface: 2.5mm (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

802.11a_Aux Ant M-Ch 60/Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.198 mW/g

802.11a_Aux Ant M-Ch 60/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 6.47 V/m; Power Drift = -0.068 dB
Peak SAR (extrapolated) = 0.475 W/kg
SAR(1 g) = 0.150 mW/g; SAR(10 g) = 0.054 mW/g
Maximum value of SAR (measured) = 0.254 mW/g



WORST-CASE SAR PLOT FOR 5.3 GHZ – Z plot

Date/Time: 12/17/2010 8:18:33 PM

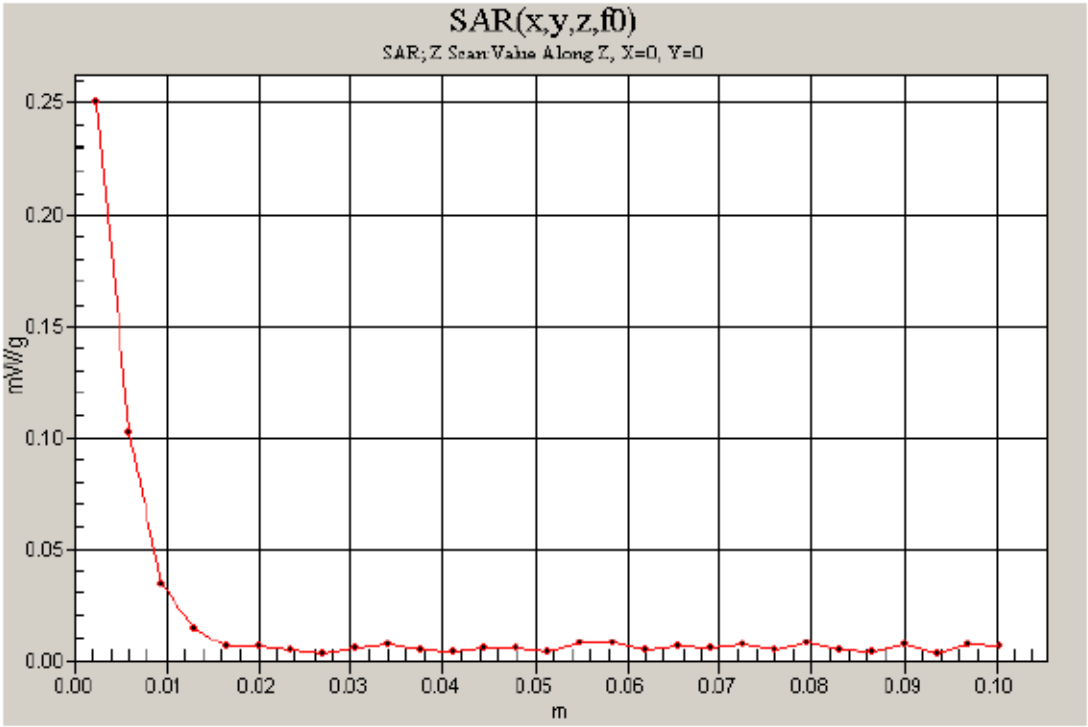
Test Laboratory: Compliance Certification Services

Primary Portrait_5.3GHz

DUT: Broadcom; Type: NA; Serial: NA

Communication System: 802.11a 5.2GHz; Frequency: 5300 MHz;Duty Cycle: 1:1

802.11a_Aux Ant M-Ch 60/Z Scan (1x1x29): Measurement grid: dx=20mm, dy=20mm, dz=3.5mm
Maximum value of SAR (measured) = 0.250 mW/g



WORST-CASE SAR PLOT FOR 5.6 GHZ

Date/Time: 12/17/2010 7:28:01 PM

Test Laboratory: Compliance Certification Services

Primary Portrait_5.6GHz

DUT: Broadcom; Type: NA; Serial: NA

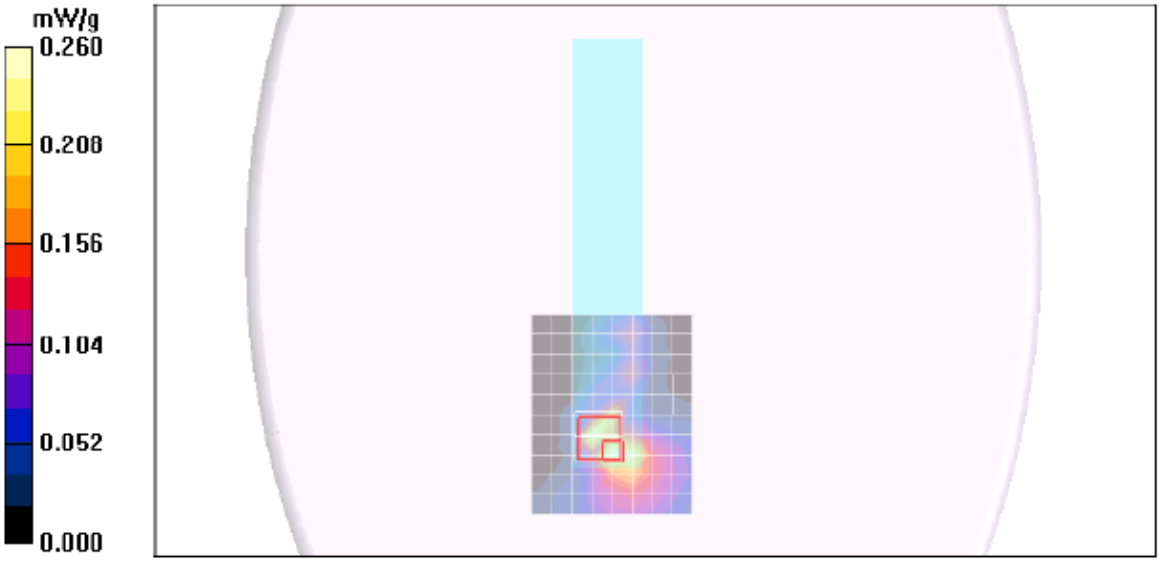
Communication System: 802.11a 5.6GHz; Frequency: 5590 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5590 MHz; σ = 5.54 mho/m; ε_r = 47.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3508; ConvF(3.8, 3.8, 3.8); Calibrated: 2/19/2010
- Sensor-Surface: 2.5mm (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

802.11n HT40_Aux Ant M-Ch 118/Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.260 mW/g

802.11n HT40_Aux Ant M-Ch 118/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 7.60 V/m; Power Drift = -0.194 dB
Peak SAR (extrapolated) = 0.766 W/kg
SAR(1 g) = 0.158 mW/g; SAR(10 g) = 0.058 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.305 mW/g



WORST-CASE SAR PLOT FOR 5.6 GHZ – Z plot

Date/Time: 12/17/2010 7:51:50 PM

Test Laboratory: Compliance Certification Services

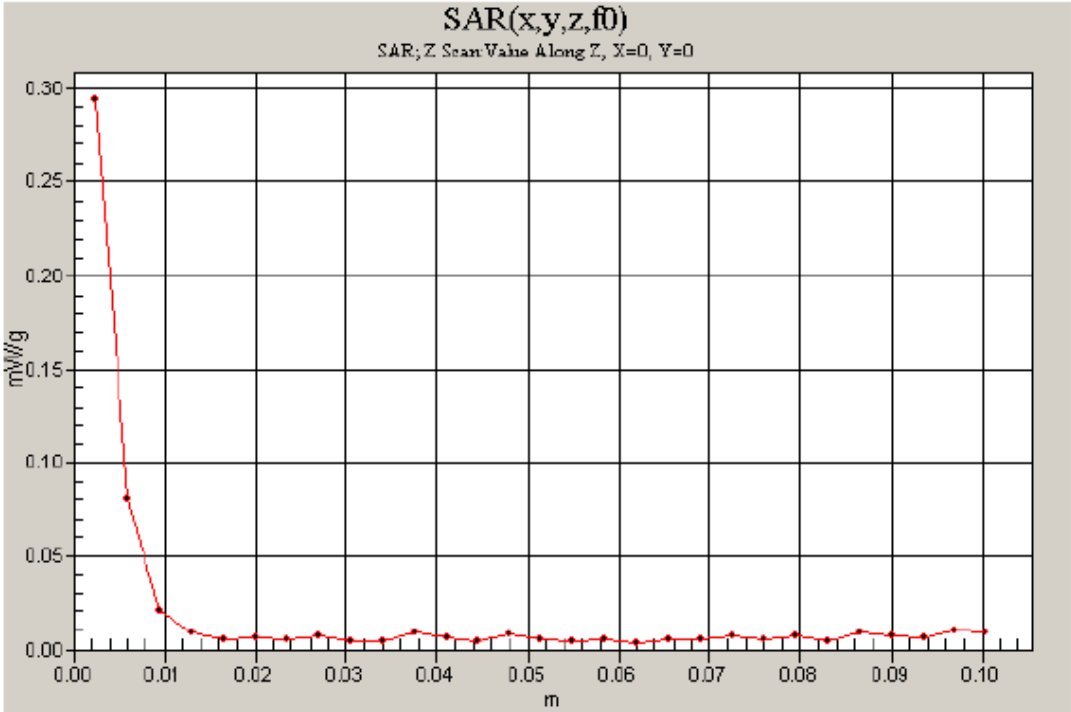
Primary Portrait_5.6GHz

DUT: Broadcom; Type: NA; Serial: NA

Communication System: 802.11a 5.6GHz; Frequency: 5590 MHz;Duty Cycle: 1:1

802.11n HT40_Aux Ant M-Ch 118/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) = 0.294 mW/g



WORST-CASE SAR PLOT FOR 5.8 GHZ

Date/Time: 12/17/2010 6:45:43 PM

Test Laboratory: Compliance Certification Services

Primary Portrait_5.8GHz

DUT: Broadcom; Type: NA; Serial: NA

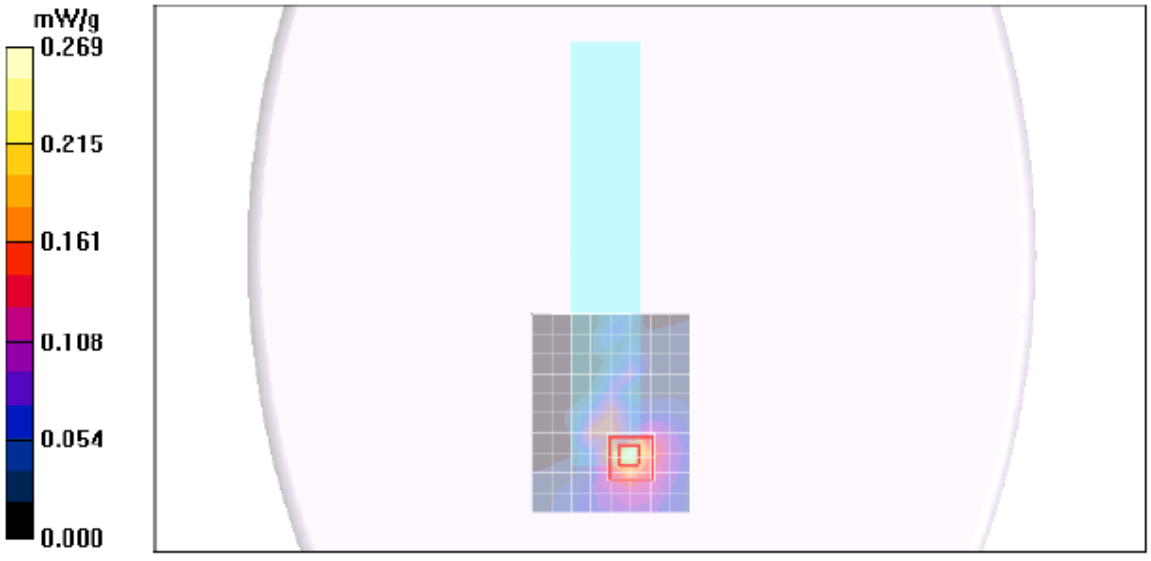
Communication System: 802.11a 5.8GHz; Frequency: 5795 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5795 MHz; σ = 6.2 mho/m; ε_r = 49.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3508; ConvF(3.64, 3.64, 3.64); Calibrated: 2/19/2010
- Sensor-Surface: 2.5mm (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

802.11n HT40_Aux Ant M-Ch 159/Area Scan (9x11x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.269 mW/g

802.11n HT40_Aux Ant M-Ch 159/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 7.31 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 0.583 W/kg
SAR(1 g) = 0.162 mW/g; SAR(10 g) = 0.060 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.263 mW/g



WORST-CASE SAR PLOT FOR 5.8 GHZ – Z plot

Date/Time: 12/17/2010 7:23:31 PM

Test Laboratory: Compliance Certification Services

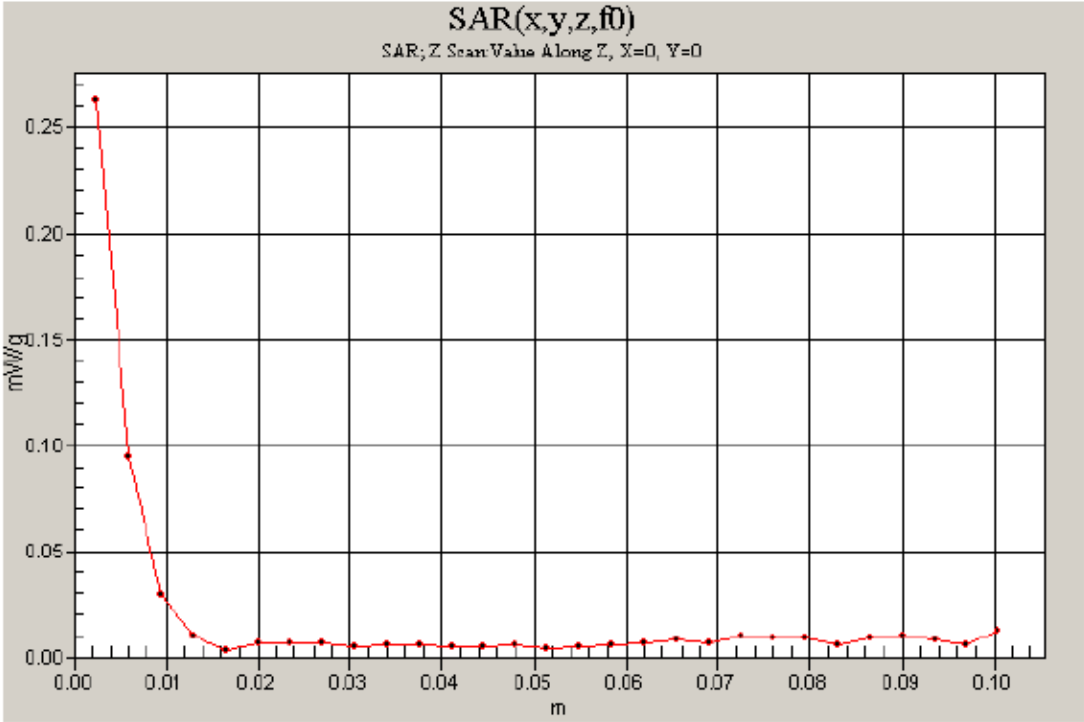
Primary Portrait_5.8GHz

DUT: Broadcom; Type: NA; Serial: NA

Communication System: 802.11a 5.8GHz; Frequency: 5795 MHz;Duty Cycle: 1:1

802.11n HT40_Aux Ant M-Ch 159/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) = 0.263 mW/g

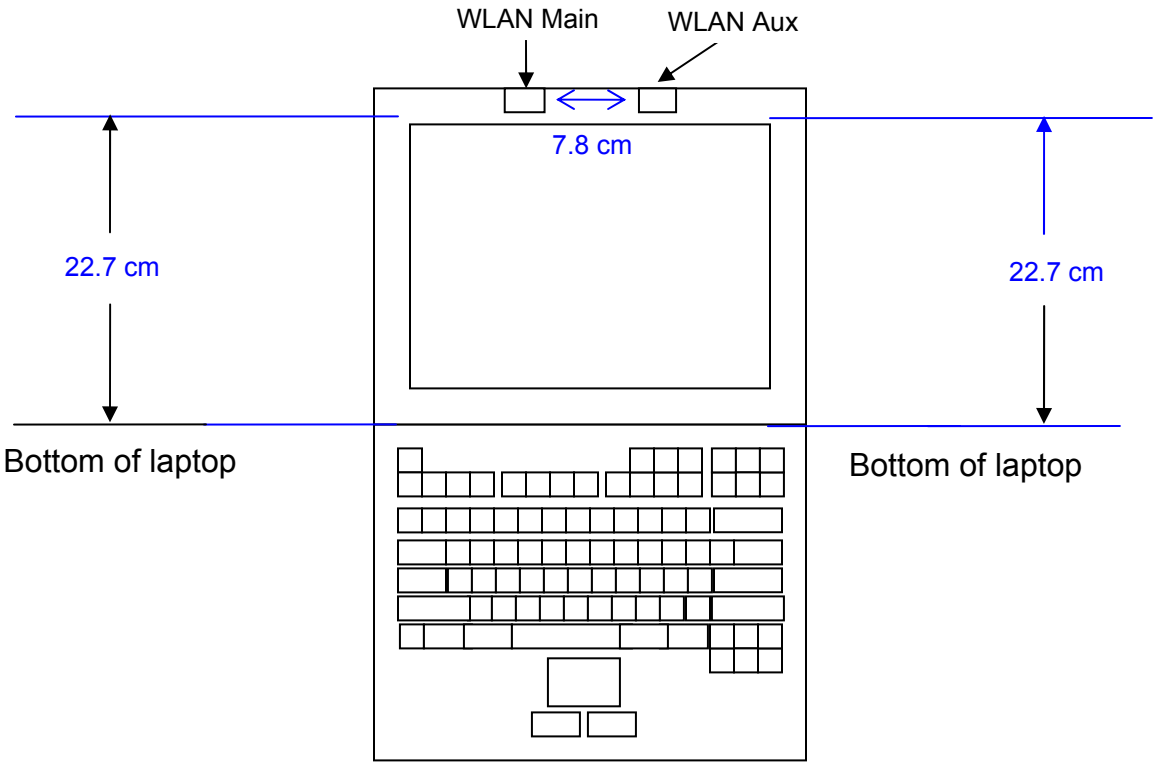


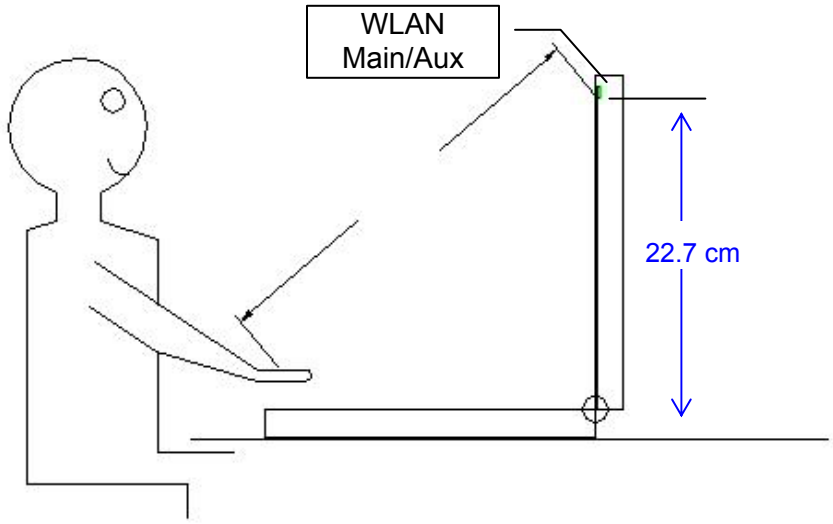
12. ATTACHMENTS

No.	Contents	No. of page (s)
1	SAR Test Plots for 2.4 GHz band	5
2	SAR Test Plots for 5 GHz bands	18
3	Certificate of E-Field Probe - EX3DV3 SN 3508	10
4	Certificate of E-Field Probe - EX3DV3 SN 3531	11
5	Certificate of System Validation Dipole - D2450 SN:706	9
6	Certificate of System Validation Dipole D5GHzV2 SN 1075	9

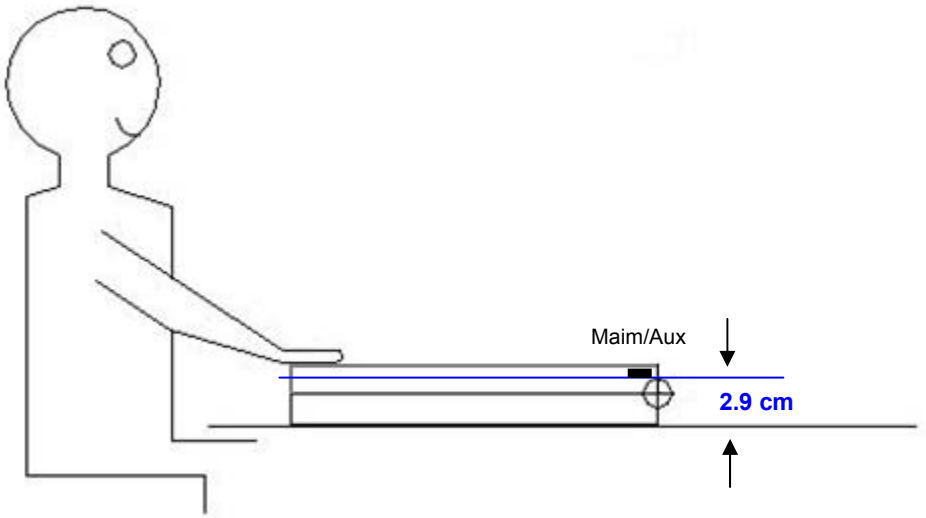
13. ANTENNA LOCATIONS AND SEPARATION DISTANCES

Laptop Mode





Tablet – Bottom Face



Tablet – Edges (Landscape & Portrait)