FCC OET BULLETIN 65 SUPPLEMENT C
CLASS II PERMISSIVE CHANGE
IC RSS-102 ISSUE 3

SAR EVALUATION REPORT

FOR

802.11abg/Draft 802.11n WLAN + Bluetooth PCI-E MiniCard
(Tested inside of MacBook Pro)

Model: BCM943224PCIEBT

FCC ID: QDS-BRCM1047

IC: 4324A-BRCM1047

REPORT NUMBER: 10U13011-1

ISSUE DATE: February 5, 2010

Prepared for

BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086

Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	February 5, 2010	Initial Issue	--

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086
EUT DESCRIPTION:	802.11abg/Draft 802.11n WLAN + Bluetooth PCI-E MiniCard (Tested inside of MacBook Pro)
MODEL NUMBER:	BCM943224PCIEBT
DEVICE CATEGORY:	Portable
EXPOSURE CATEGORY:	General Population/Uncontrolled Exposure
DATE TESTED:	January 15 - 25, 2010

THE HIGHEST SAR VALUES:

FCC/IC Rule Parts	Frequency Range [MHz]	1g SAR (mW/g)	Limit (mW/g)
15.247 / RSS-102	2400 – 2483.5	1.06	1.6
	5725 – 5850	0.991	
15.407 / RSS-102	5150 – 5250	0.888	1.6
	5250 – 5350	1.16	
	5470 – 5725	1.10	

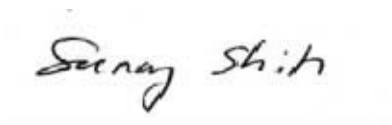
APPLICABLE STANDARDS:

STANDARD	TEST RESULTS
FCC OET BULLETIN 65 SUPPLEMENT C and the following Test Procedures: ○ KDB 248227 SAR measurement procedures for 802.11a/b/g transmitters ○ 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.

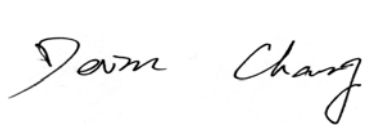
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this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

Tested By:



DEVIN CHANG
EMC ENGINEER
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	D2450V2	748	4	14	2010
System Validation Dipole	SPEAG	D5GHzV2	1075	10	3	2011
ESG Vector Signal Generator	Agilent	E4438C	US44271090	9	17	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

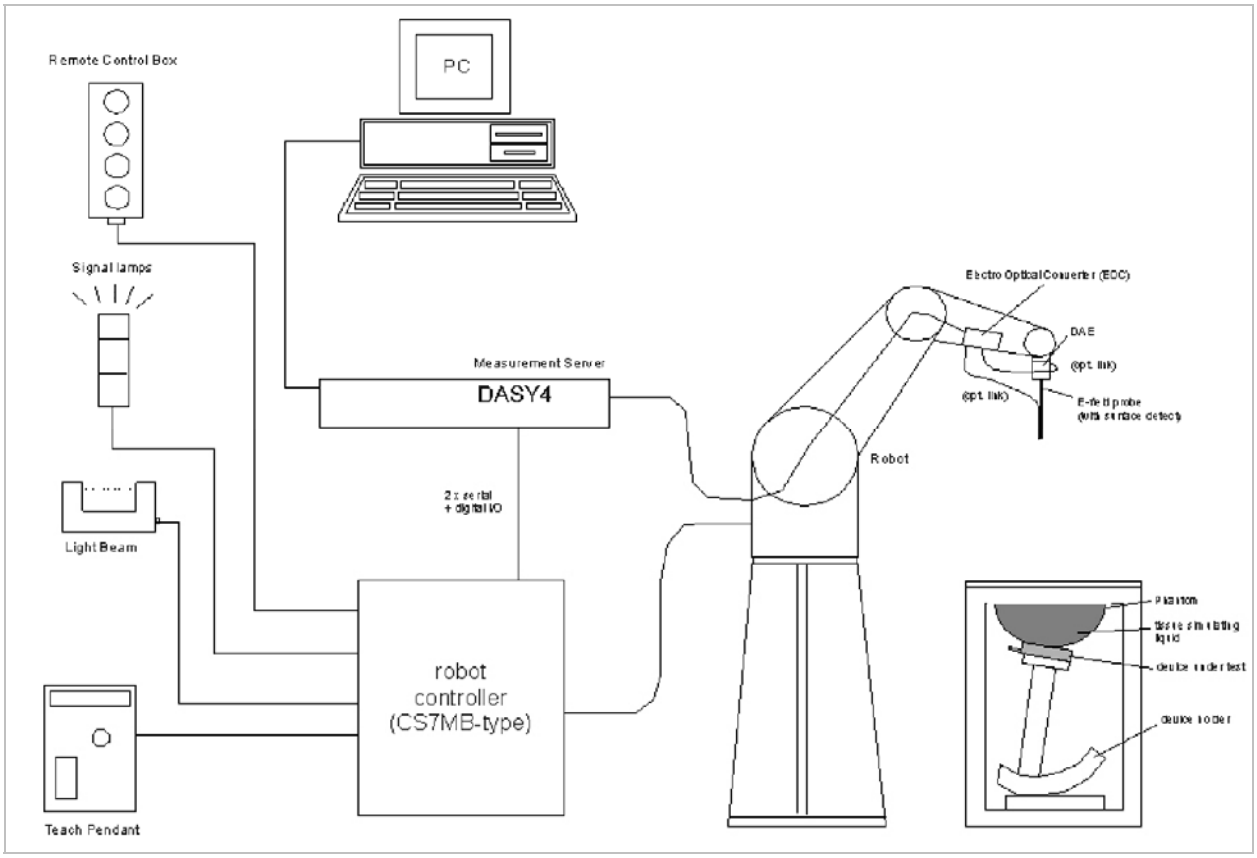
Uncertainty component	Tol. (±%)	Probe Dist.	Div.	Ci (1g)	Ci (10g)	Std. Unc.(±%)	
						Ui (1g)	Ui(10g)
Measurement System							
Probe Calibration	4.80	N	1	1	1	4.80	4.80
Axial Isotropy	4.70	R	1.732	0.707	0.707	1.92	1.92
Hemispherical Isotropy	9.60	R	1.732	0.707	0.707	3.92	3.92
Boundary Effects	1.00	R	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. EQUIPMENT UNDER TEST

<table>
<tr><td colspan="2">802.11abg/Draft 802.11n WLAN + Bluetooth PCI-E MiniCard, model BCM943224PCIEBT
(Tested inside of MacBook Pro)</td></tr>
<tr><td>Normal operation:</td><td>Lap-held only
SAR test with display open at 90° to the keyboard</td></tr>
<tr><td>Antenna tested:</td><td>Install in MacBook Pro
<table>
<tr><th>Display Size</th><th>Manufactured</th><th>Part number</th></tr>
<tr><td>15-inch</td><td>Amp + Acon</td><td>DQ6AP193800</td></tr>
<tr><td></td><td>Tyco + Foxconn</td><td>DQ611802502</td></tr>
<tr><td>17-inch</td><td>Amp + Acon</td><td>DQ6AP194200</td></tr>
<tr><td></td><td>Amp + Foxconn</td><td>DQ6AP193700</td></tr>
</table></td></tr>
<tr><td>Antenna-to-user distances:</td><td>1.5 cm from WiFi Main antenna-to-user.
1.5 cm from WiFi Aux antenna-to-user.</td></tr>
<tr><td>Require SAR evaluation for Simultaneous transmission?</td><td>Bluetooth’s output power is ≤ 60/f(GHz) mW..
Therefore, SAR evaluation for simultaneous transmission is not required.</td></tr>
</table>

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 to validate 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 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)

8.1. LIQUID CHECK RESULTS FOR 2450 MHZ

Simulating Liquid Dielectric Parameters for Body 2450 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	53.93	Relative Permittivity (ϵ_r):	53.932	52.7	2.34	± 5
	e"	13.94	Conductivity (σ):	1.900	1.95	-2.55	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C
January 15, 2010 02:54 PM

Frequency	e'	e"
2400000000.	55.1897	14.3423
2405000000.	55.2276	14.3133
2410000000.	55.2004	14.2844
2415000000.	55.1313	14.2278
2420000000.	55.0188	14.1545
2425000000.	54.8626	14.0818
2430000000.	54.6787	14.0122
2435000000.	54.4870	13.9628
2440000000.	54.2998	13.9365
2445000000.	54.1258	13.9252
2450000000.	**53.9318**	**13.9422**
2455000000.	53.7541	13.9851
2460000000.	53.6398	14.0449
2465000000.	53.5754	14.1004
2470000000.	53.5575	14.1722
2475000000.	53.5858	14.2602
2480000000.	53.6775	14.3532
2485000000.	53.8230	14.4642
2490000000.	53.9899	14.5864
2495000000.	54.1722	14.7037
2500000000.	54.3357	14.8032

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 Parameters for Body 2450 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	54.09	Relative Permittivity (ϵ_r):	54.088	52.7	2.63	± 5
	e"	14.02	Conductivity (σ):	1.910	1.95	-2.04	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C
January 17, 2010 10:58 AM

Frequency	e'	e"
2400000000.	55.3348	14.4127
2405000000.	55.3816	14.3750
2410000000.	55.3448	14.3507
2415000000.	55.2773	14.2952
2420000000.	55.1736	14.2253
2425000000.	55.0202	14.1519
2430000000.	54.8380	14.0750
2435000000.	54.6467	14.0204
2440000000.	54.4568	14.0013
2445000000.	54.2801	13.9970
2450000000.	**54.0875**	**14.0155**
2455000000.	53.9106	14.0650
2460000000.	53.7941	14.1118
2465000000.	53.7269	14.1710
2470000000.	53.7035	14.2503
2475000000.	53.7282	14.3354
2480000000.	53.8243	14.4225
2485000000.	53.9660	14.5271
2490000000.	54.1378	14.6549
2495000000.	54.3111	14.7854
2500000000.	54.4886	14.8941

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 Parameters for Body 2450 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Devin Chang

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	54.25	Relative Permittivity (ϵ_r):	54.249	52.7	2.94	± 5
	e"	14.00	Conductivity (σ):	1.908	1.95	-2.14	± 5

Liquid Check
Ambient temperature: 24 deg. C; Liquid temperature: 23 deg. C
January 18, 2010 10:56 AM

Frequency	e'	e"
2400000000.	55.3174	14.4119
2405000000.	55.3525	14.3865
2410000000.	55.3247	14.3539
2415000000.	55.2634	14.2940
2420000000.	55.1508	14.2324
2425000000.	55.0014	14.1618
2430000000.	54.8168	14.0802
2435000000.	54.6265	14.0321
2440000000.	54.4410	14.0189
2445000000.	**54.2486**	**14.0003**
2450000000.	54.0557	14.0272
2455000000.	53.8926	14.0577
2460000000.	53.7744	14.1148
2465000000.	53.7073	14.1740
2470000000.	53.6800	14.2506
2475000000.	53.7179	14.3336
2480000000.	53.8069	14.4185
2485000000.	53.9564	14.5404
2490000000.	54.1249	14.6689
2495000000.	54.3017	14.7903
2500000000.	54.4713	14.9022

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

8.2. LIQUID CHECK RESULTS FOR 5 GHZ

Simulating Liquid Dielectric Parameters for Body 5 GHz

Room Ambient Temperature = 25°C; Relative humidity = 38% Measured by: Devin Chang

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	45.4497	Relative Permittivity (ε_r):	45.4497	49.0	-7.25	± 10
	e"	17.8980	Conductivity (σ):	5.17758	5.30	-2.31	± 5
5500	e'	46.1472	Relative Permittivity (ε_r):	46.1472	48.6	-5.05	± 10
	e"	17.4613	Conductivity (σ):	5.34267	5.65	-5.44	± 5
5800	e'	44.8269	Relative Permittivity (ε_r):	44.8269	48.2	-7.00	± 10
	e"	18.4564	Conductivity (σ):	5.95517	6.00	-0.75	± 5

Liquid temperature: 24 deg. C
January 20, 2010 01:09 AM

Frequency	e'	e"
4600000000.	46.7278	16.9378
4650000000.	48.1447	17.4212
4700000000.	46.7156	16.5527
4750000000.	47.3098	17.8971
4800000000.	47.3370	16.7198
4850000000.	46.3899	17.6900
4900000000.	47.6601	17.2489
4950000000.	45.8542	17.2723
5000000000.	47.1444	17.8840
5050000000.	45.9012	17.0375
5100000000.	46.0726	18.1421
5150000000.	46.4104	17.0411
5200000000.	**45.4497**	**17.8980**
5250000000.	46.8489	17.5737
5300000000.	45.3426	17.6679
5350000000.	46.5227	18.1866
5400000000.	45.5900	17.3964
5450000000.	45.6614	18.3800
5500000000.	**46.1472**	**17.4613**
5550000000.	45.0805	18.3233
5600000000.	46.0915	18.0523
5650000000.	44.8524	18.0149
5700000000.	45.8260	18.4206
5750000000.	45.3422	17.8593
5800000000.	**44.8269**	**18.4564**
5850000000.	45.3814	18.2185
5900000000.	44.4488	18.1705
5950000000.	44.7403	18.2830
6000000000.	44.6473	18.5171

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 Parameters for Body 5 GHz

Room Ambient Temperature = 25°C; Relative humidity = 38% Measured by: Devin Chang

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	45.7255	Relative Permittivity (ε_r):	45.7255	49.0	-6.68	± 10
	e"	18.3590	Conductivity (σ):	5.31094	5.30	0.21	± 5
5500	e'	46.4025	Relative Permittivity (ε_r):	46.4025	48.6	-4.52	± 10
	e"	17.8949	Conductivity (σ):	5.47534	5.65	-3.09	± 5
5800	e'	45.0737	Relative Permittivity (ε_r):	45.0737	48.2	-6.49	± 10
	e"	18.9355	Conductivity (σ):	6.10975	6.00	1.83	± 5

Liquid temperature: 24 deg. C
January 21, 2010 09:11 AM

Frequency	e'	e"
4600000000.	47.0555	17.3596
4650000000.	48.4880	17.8453
4700000000.	47.0211	16.9644
4750000000.	47.6527	18.3391
4800000000.	47.6583	17.1219
4850000000.	46.6960	18.1403
4900000000.	47.9695	17.6585
4950000000.	46.1784	17.7269
5000000000.	47.4666	18.3247
5050000000.	46.1930	17.4625
5100000000.	46.3810	18.5918
5150000000.	46.7148	17.4535
5200000000.	**45.7255**	**18.3590**
5250000000.	47.1507	18.0127
5300000000.	45.6145	18.1223
5350000000.	46.8240	18.6502
5400000000.	45.8573	17.8309
5450000000.	45.9337	18.8558
5500000000.	**46.4025**	**17.8949**
5550000000.	45.3431	18.8103
5600000000.	46.3623	18.5151
5650000000.	45.0877	18.4851
5700000000.	46.0861	18.8933
5750000000.	45.5820	18.3297
5800000000.	**45.0737**	**18.9355**
5850000000.	45.6204	18.6900
5900000000.	44.6825	18.6491
5950000000.	44.9812	18.7530
6000000000.	44.8733	19.0008

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 Parameters for Body 5 GHz

Room Ambient Temperature = 25°C; Relative humidity = 38% Measured by: Devin Chang

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	45.6184	Relative Permittivity (ε_r):	45.6184	49.0	-6.90	± 10
	e"	18.4497	Conductivity (σ):	5.33718	5.30	0.70	± 5
5500	e'	46.285	Relative Permittivity (ε_r):	46.2850	48.6	-4.76	± 10
	e"	17.9704	Conductivity (σ):	5.49844	5.65	-2.68	± 5
5800	e'	44.9397	Relative Permittivity (ε_r):	44.9397	48.2	-6.76	± 10
	e"	19.0500	Conductivity (σ):	6.14670	6.00	2.44	± 5

Liquid temperature: 24 deg. C
January 22, 2010 08:32 AM

Frequency	e'	e"
4600000000.	46.9406	17.4203
4650000000.	48.3791	17.8985
4700000000.	46.8997	17.0292
4750000000.	47.5454	18.4094
4800000000.	47.5312	17.1794
4850000000.	46.5980	18.2221
4900000000.	47.8520	17.7172
4950000000.	46.0324	17.7902
5000000000.	47.3482	18.3921
5050000000.	46.0666	17.5430
5100000000.	46.2679	18.6822
5150000000.	46.5826	17.5288
5200000000.	**45.6184**	**18.4497**
5250000000.	47.0217	18.0884
5300000000.	45.4849	18.2201
5350000000.	46.7066	18.7376
5400000000.	45.7157	17.9190
5450000000.	45.8140	18.9541
5500000000.	**46.2850**	**17.9704**
5550000000.	45.2252	18.9043
5600000000.	46.2333	18.5995
5650000000.	44.9566	18.5710
5700000000.	45.9630	18.9926
5750000000.	45.4473	18.4237
5800000000.	**44.9397**	**19.0500**
5850000000.	45.4759	18.7700
5900000000.	44.5414	18.7562
5950000000.	44.8262	18.8523
6000000000.	44.7184	19.0921

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 Parameters for Body 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'	45.5114	Relative Permittivity (ε_r):	45.5114	49.0	-7.12	± 10
	e"	18.6670	Conductivity (σ):	5.40004	5.30	1.89	± 5
5500	e'	45.8131	Relative Permittivity (ε_r):	45.8131	48.6	-5.73	± 10
	e"	18.2651	Conductivity (σ):	5.58861	5.65	-1.09	± 5
5800	e'	44.5622	Relative Permittivity (ε_r):	44.5622	48.2	-7.55	± 10
	e"	19.2623	Conductivity (σ):	6.21520	6.00	3.59	± 5

Liquid temperature: 24 deg. C
January 23, 2010 08:15 AM

Frequency	e'	e"
4600000000.	46.7482	17.4540
4650000000.	48.0836	17.7717
4700000000.	46.6288	17.1374
4750000000.	47.4145	18.2903
4800000000.	47.1381	17.2232
4850000000.	46.5351	18.2169
4900000000.	47.4922	17.7469
4950000000.	45.8686	17.8918
5000000000.	47.1765	18.3846
5050000000.	45.8521	17.7159
5100000000.	46.2938	18.6978
5150000000.	46.2804	17.8022
5200000000.	**45.5114**	**18.6670**
5250000000.	46.6213	18.2938
5300000000.	45.1986	18.4564
5350000000.	46.3522	18.8583
5400000000.	45.3502	18.2016
5450000000.	45.6237	19.1327
5500000000.	**45.8131**	**18.2651**
5550000000.	44.9302	19.0674
5600000000.	45.7853	18.7884
5650000000.	44.5953	18.8033
5700000000.	45.5040	19.2299
5750000000.	44.9698	18.7352
5800000000.	**44.5622**	**19.2623**
5850000000.	45.0236	19.1138
5900000000.	44.2716	19.0396
5950000000.	44.3248	19.1664
6000000000.	44.3060	19.4185

The conductivity (σ) can be given as:

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

where f = target f * 10^6

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

9. 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 2.5mm
- 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

9.1. SYSTEM CHECK RESULTS FOR D2450V2

Date: January 15, 2009

Ambient Temperature = 24°C; Relative humidity = 40% Measured by: Devin Chang

Medium	CW Signal (MHz)	Forward Pwr (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	2450	100	1g SAR:	52.8	49.5	6.67	±10
			10g SAR:	24.4	23.3	4.72	

9.2. SYSTEM CHECK RESULTS FOR D5GHzV2

Date: January 20, 2009

Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Devin Chang

Medium	CW Signal (MHz)	Forward Pwr (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Muscle	5200	100	1g SAR:	77.4	78.7	-1.65	±10
			10g SAR:	22.3	21.9	1.83	
Muscle	5500	100	1g SAR:	79.7	85.0	-6.24	±10
			10g SAR:	22.6	23.4	-3.42	
Muscle	5800	100	1g SAR:	69.9	72.9	-4.12	±10
			10g SAR:	19.9	20.0	-0.50	

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:

802.11bgn (2.4 GHz band)

Mode	Channel	Freq. (MHz)	RF Conducted Pwr (dBm)
802.11b	1	2412	18.0
	6	2437	19.0
	11	2462	18.0
802.11g	1	2412	17.0
	6	2437	19.0
	11	2462	16.0
802.11n (HT20)	1	2412	14.0
	6	2437	19.0
	11	2462	13.5

802.11a (5 GHz bands)

Band	Channel	Freq. (MHz)	RF Conducted Pwr (dBm)
5.2 GHz	36	5180	14.0
	40	5200	14.0
	48	5240	14.0
5.3 GHz	52	5260	14.2
	60	5300	15.0
	64	5320	14.5
5.6 GHz	100	5500	16.0
	120	5600	16.0
	140	5700	16.0
5.8 GHz	149	5745	16.0
	157	5785	16.0
	165	5825	16.0

802.11n HT20 (5 GHz bands)

Band	Channel	Freq. (MHz)	RF Conducted Pwr (dBm)
5.2 GHz	36	5180	9.5
	40	5200	9.5
	48	5240	9.5
5.3 GHz	52	5260	15.0
	60	5300	15.0
	64	5320	13.0
5.6 GHz	100	5500	14.0
	120	5600	14.0
	140	5700	14.0
5.8 GHz	149	5745	16.0
	157	5785	16.0
	165	5825	16.0

802.11n HT40 (5 GHz bands)

Band	Channel	Freq. (MHz)	RF Conducted Pwr (dBm)
5.2 GHz	38	5190	12.0
	46	5230	12.0
5.3 GHz	54	5270	15.5
	62	5310	12.0
5.6 GHz	112	5510	15.5
	118	5590	16.0
	134	5670	16.0
5.8 GHz	151	5755	16.0
	159	5795	16.0

11. SUMMARY OF TEST RESULTS

11.1. SAR TEST RESULTS FOR 2.4 GHZ BAND

17-inch_PT480109_Amp + Acon

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	1	2412	Main	0.765	0.379
	6	2437	Main	**1.050**	0.514
	11	2462	Main	0.815	0.399
802.11g	6	2437	Aux	0.623	0.304
802.11n HT20	6	2437	Main / Aux	0.778	0.400

17-inch_PT480173_Amp + Foxconn

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	1	2412	Main	0.818	0.400
	6	2437	Main	**1.060**	0.518
	11	2462	Main	0.853	0.413
802.11g	6	2437	Aux	0.548	0.268
802.11n HT20	6	2437	Main / Aux	0.732	0.374

15-inch_PT462541_Amp + Acon

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	1	2412	Main		
	6	2437	Main	**0.728**	0.365
	11	2462	Main		
802.11g	6	2437	Aux	0.461	0.224
802.11n HT20	6	2437	Main / Aux	0.670	0.344

15-inch_PT482643_Tyco + Foxconn

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11b	1	2412	Main		
	6	2437	Main	0.661	0.325
	11	2462	Main		
802.11g	6	2437	Aux	0.586	0.288
802.11n HT20	6	2437	Main / Aux	**0.720**	0.365

11.2. SAR TEST RESULTS FOR 5 GHZ BANDS

17-inch_PT480109_Amp + Acon

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11a (5.2 - 5.3 GHz)	36	5180	Main		
	40	5200	Main	0.777	0.287
	48	5240	Main		
	52	5260	Main		
	60	5300	Main	0.765	0.267
	64	5320	Main		
802.11a (5.6 GHz)	100	5500	Main		
	120	5600	Main	0.755	0.273
	140	5700	Main		
802.11a (5.8 GHz)	149	5745	Main		
	157	5785	Main	0.512	0.193
	165	5825	Main		
802.11a (5.2 - 5.3 GHz)	36	5180	Aux		
	40	5200	Aux	0.467	0.189
	48	5240	Aux		
	52	5260	Aux	1.020	0.410
	60	5300	Aux	0.837	0.337
	64	5320	Aux	0.555	0.216
802.11a (5.6 GHz)	100	5500	Aux	0.747	0.270
	120	5600	Aux	**1.100**	0.430
	140	5700	Aux	0.607	0.224
802.11a (5.8 GHz)	149	5745	Aux		
	157	5785	Aux	0.743	0.267
	165	5825	Aux		
802.11n HT20 (5.8GHz)	149	5745	Main / Aux		
	157	5785	Main / Aux	0.672	0.271
	165	5825	Main / Aux		
802.11n HT40 (5.6GHz)	102	5510	Main / Aux	0.915	0.334
	118	5590	Main / Aux	1.020	0.400
	134	5670	Main / Aux	0.705	0.265

17-inch_PT480173_Amp + Foxconn

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11a (5.2 - 5.3 GHz)	36	5180	Main	0.733	0.267
	40	5200	Main	0.823	0.304
	48	5240	Main	0.692	0.253
	52	5260	Main	1.050	0.392
	60	5300	Main	0.948	0.354
	64	5320	Main	0.900	0.319
802.11a (5.6 GHz)	100	5500	Main		
	120	5600	Main	0.746	0.288
	140	5700	Main		
802.11a (5.8 GHz)	149	5745	Main	0.457	0.176
	157	5785	Main	0.807	0.307
	165	5825	Main	0.786	0.299
802.11a (5.2 - 5.3 GHz)	36	5180	Aux		
	40	5200	Aux	0.525	0.212
	48	5240	Aux		
	52	5260	Aux	1.050	0.424
	60	5300	Aux	0.927	0.373
	64	5320	Aux	0.820	0.333
802.11a (5.6 GHz)	100	5500	Aux	0.907	0.335
	120	5600	Aux	1.040	0.423
	140	5700	Aux	0.624	0.248
802.11a (5.8 GHz)	149	5745	Aux		
	157	5785	Aux	0.521	0.188
	165	5825	Aux		
802.11n HT20 (5.8GHz)	157	5785	Main / Aux	0.515	0.195
802.11n HT40 (5.6GHz)	102	5510	Main / Aux	0.869	0.372
	118	5590	Main / Aux	0.981	0.433
	134	5670	Main / Aux	0.765	0.315

15-inch_PT462541_Amp + Acon

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11a (5.2 - 5.3 GHz)	36	5180	Main	0.826	0.309
	40	5200	Main	**0.888**	0.332
	48	5240	Main	0.842	0.307
	52	5260	Main	1.120	0.419
	60	5300	Main	0.832	0.304
	64	5320	Main	0.540	0.199
802.11a (5.6 GHz)	100	5500	Main	0.704	0.245
	120	5600	Main	0.908	0.341
	140	5700	Main	0.398	0.149
802.11a (5.8 GHz)	149	5745	Main		
	157	5785	Main	0.432	0.153
	165	5825	Main		
802.11a (5.2 - 5.3 GHz)	36	5180	Aux		
	40	5200	Aux	0.281	0.099
	48	5240	Aux		
	52	5260	Aux	0.784	0.310
	60	5300	Aux	1.030	0.401
	64	5320	Aux	0.832	0.318
802.11a (5.6 GHz)	100	5500	Aux		
	120	5600	Aux	0.644	0.236
	140	5700	Aux		
802.11a (5.8 GHz)	149	5745	Aux		
	157	5785	Aux	0.783	0.303
	165	5825	Aux		
802.11n HT20 (5.8GHz)	157	5785	Main / Aux	0.697	0.264
802.11n HT40 (5.6GHz)	102	5510	Main / Aux	0.695	0.268
	118	5590	Main / Aux	0.943	0.345
	134	5670	Main / Aux	1.030	0.383

15-inch_PT482643_Tyco + Foxconn

Mode	Channel	f (MHz)	Antenna	Results (mW/g)	
				1g-SAR	10g-SAR
802.11a (5.2 - 5.3 GHz)	36	5180	Main		
	40	5200	Main	0.570	0.208
	48	5240	Main		
	52	5260	Main	1.120	0.412
	60	5300	Main	**1.160**	0.421
	64	5320	Main	0.995	0.365
802.11a (5.6 GHz)	100	5500	Main	0.627	0.227
	120	5600	Main	0.992	0.355
	140	5700	Main	0.862	0.319
802.11a (5.8 GHz)	149	5745	Main		
	157	5785	Main	0.441	0.150
	165	5825	Main		
802.11a (5.2 - 5.3 GHz)	36	5180	Aux		
	40	5200	Aux	0.369	0.141
	48	5240	Aux		
	52	5260	Aux	0.836	0.314
	60	5300	Aux	1.010	0.397
	64	5320	Aux	0.768	0.300
802.11a (5.6 GHz)	100	5500	Aux		
	120	5600	Aux	0.728	0.278
	140	5700	Aux		
802.11a (5.8 GHz)	149	5745	Aux	0.849	0.317
	157	5785	Aux	0.984	0.377
	165	5825	Aux	**0.991**	0.382
802.11n HT20 (5.8GHz)	149	5745	Main / Aux	0.887	0.319
	157	5785	Main / Aux	0.976	0.379
	165	5825	Main / Aux	0.950	0.355
802.11n HT40 (5.6GHz)	102	5510	Main / Aux	0.682	0.263
	118	5590	Main / Aux	0.837	0.311
	134	5670	Main / Aux	1.090	0.425

12. SAR TEST PLOTS

WORST-CASE SAR PLOT FOR 2.4 GHZ

Date/Time: 1/18/2010 7:24:36 PM

Test Laboratory: Compliance Certification Services

Laptop Mode

DUT: Apple; Type: NA; Serial: NA

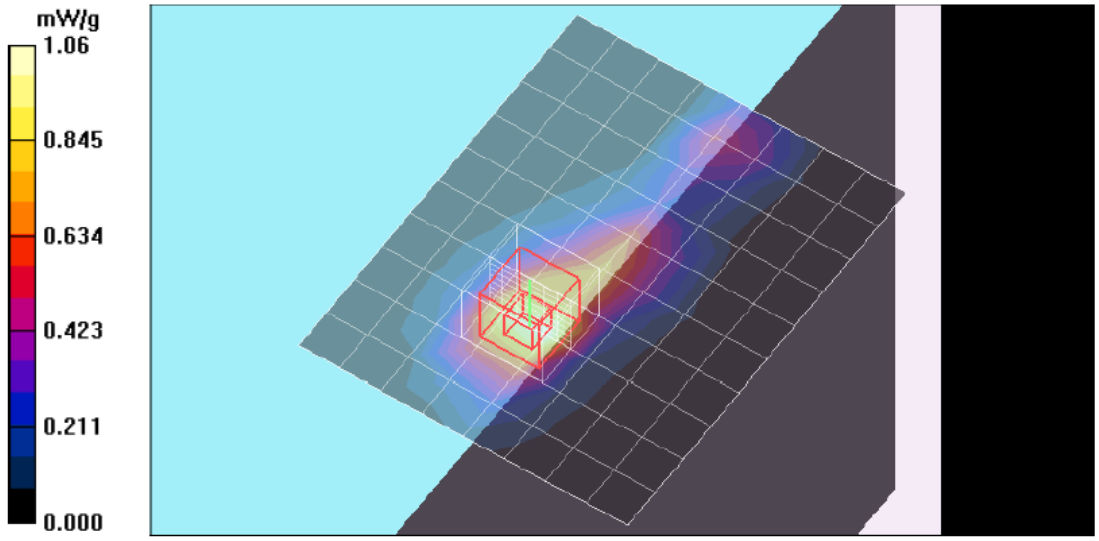
Communication System: 802.11bgn; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.9 mho/m; ε_r = 54.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

Room Ambient Temperature: 23.0 deg. C; Liquid Temperature: 22.0 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 M-ch Main Ant/Area Scan (9x11x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.06 mW/g

802.11b M-ch Main Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 23.6 V/m; Power Drift = 0.582 dB
Peak SAR (extrapolated) = 2.20 W/kg
SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.518 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.38 mW/g



WORST-CASE SAR PLOT FOR 5.2 GHZ

Date/Time: 1/21/2010 11:27:27 AM

Test Laboratory: Compliance Certification Services

Lapheld_Main 5.2GHz

DUT: Apple; Type: NA; Serial: NA

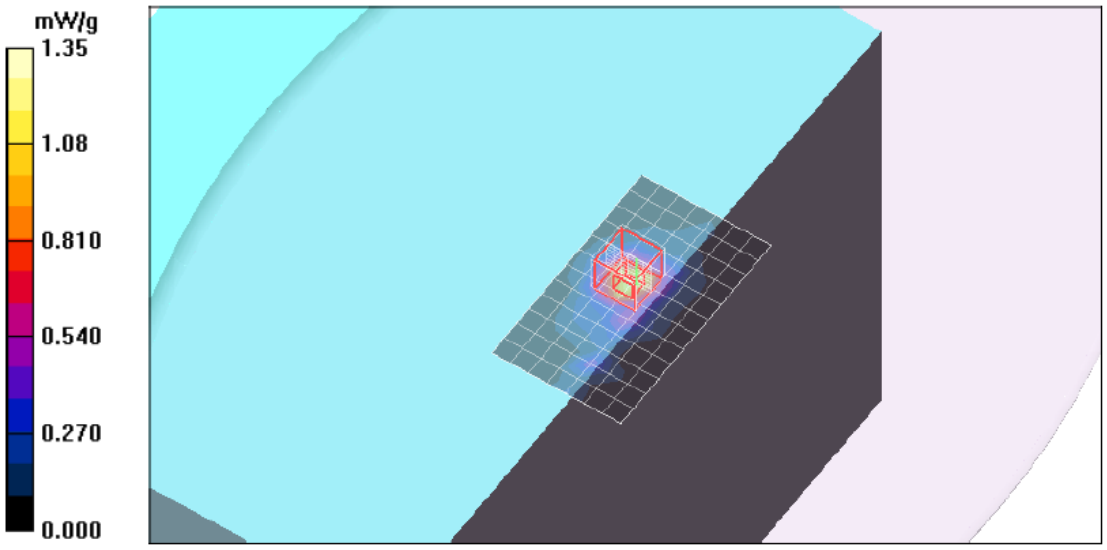
Communication System: 802.11abgn; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.31 mho/m; ε_r = 45.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: 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_M Ch 40/Area Scan (8x13x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.35 mW/g

802.11a_Main Ant_M Ch 40/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 17.5 V/m; Power Drift = -0.142 dB
Peak SAR (extrapolated) = 2.71 W/kg
SAR(1 g) = 0.888 mW/g; SAR(10 g) = 0.332 mW/g
Maximum value of SAR (measured) = 1.41 mW/g



WORST-CASE SAR PLOT FOR 5.3 GHZ

Date/Time: 1/22/2010 5:45:22 PM

Test Laboratory: Compliance Certification Services

Laptop - Lapheld_5.3GHz

DUT: Apple; Type: NA; Serial: NA

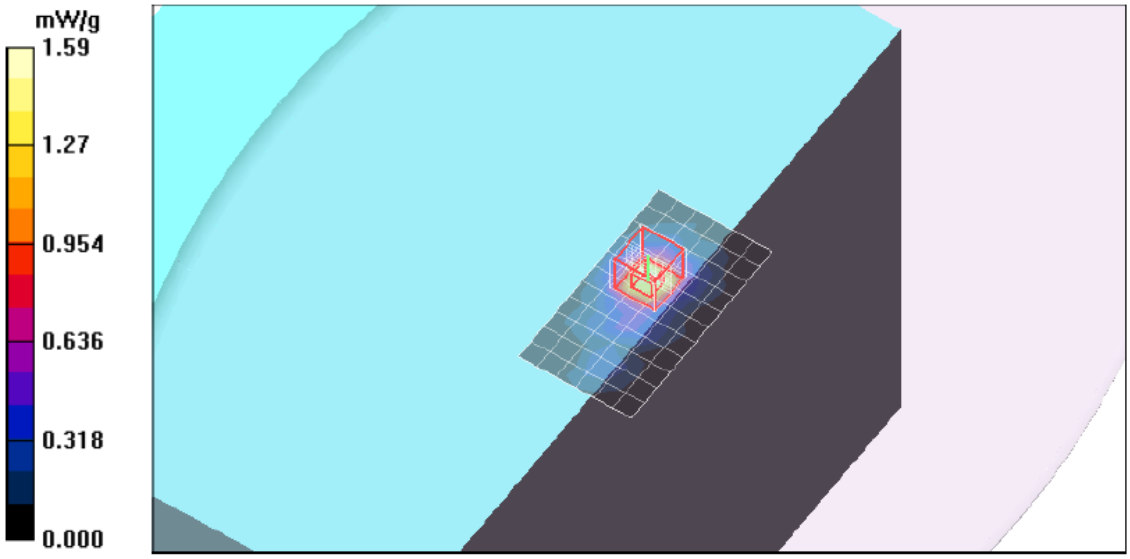
Communication System: 802.11abgn; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.37 mho/m; ε_r = 45.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

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_Main Ant_M Ch 60/Area Scan (7x12x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.59 mW/g

802.11a_Main Ant_M Ch 60/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 18.5 V/m; Power Drift = -0.426 dB
Peak SAR (extrapolated) = 3.58 W/kg
SAR(1 g) = 1.16 mW/g; SAR(10 g) = 0.421 mW/g
Maximum value of SAR (measured) = 1.89 mW/g



WORST-CASE SAR PLOT FOR 5.6 GHZ

Date/Time: 1/23/2010 4:20:27 PM

Test Laboratory: Compliance Certification Services

Laptop - Lapheld_5.6GHz

DUT: Apple; Type: NA; Serial: NA

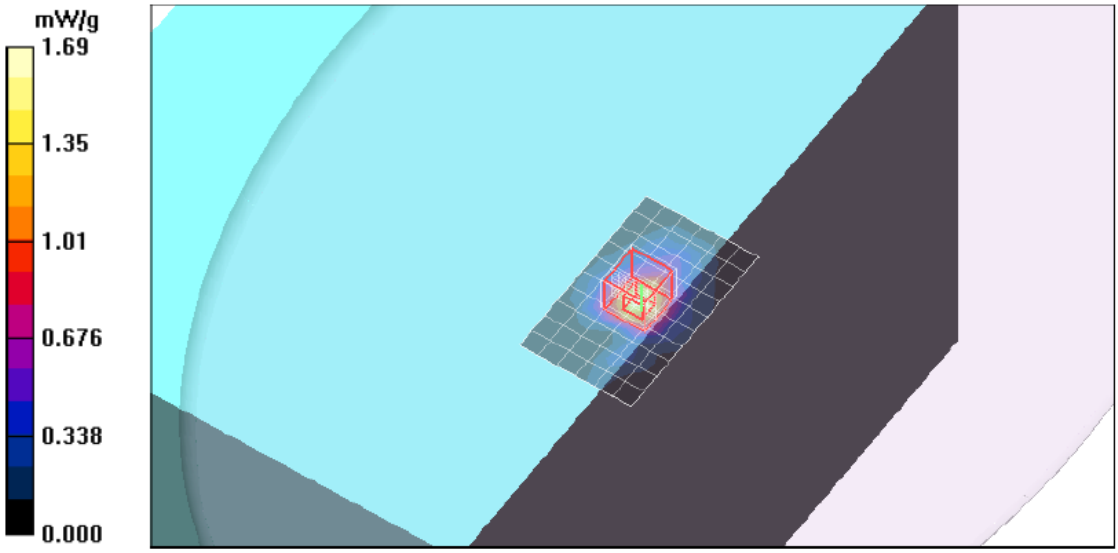
Communication System: 802.11abgn; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.85 mho/m; ε_r = 45.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: 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_M Ch 120/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.69 mW/g

802.11a_Aux Ant_M Ch 120/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 18.4 V/m; Power Drift = -0.312 dB
Peak SAR (extrapolated) = 3.54 W/kg
SAR(1 g) = 1.1 mW/g; SAR(10 g) = 0.430 mW/g
Maximum value of SAR (measured) = 1.74 mW/g



WORST-CASE SAR PLOT FOR 5.8 GHZ

Date/Time: 1/22/2010 10:40:42 PM

Test Laboratory: Compliance Certification Services

Laptop - Lapheld_5.8GHz

DUT: Apple; Type: NA; Serial: NA

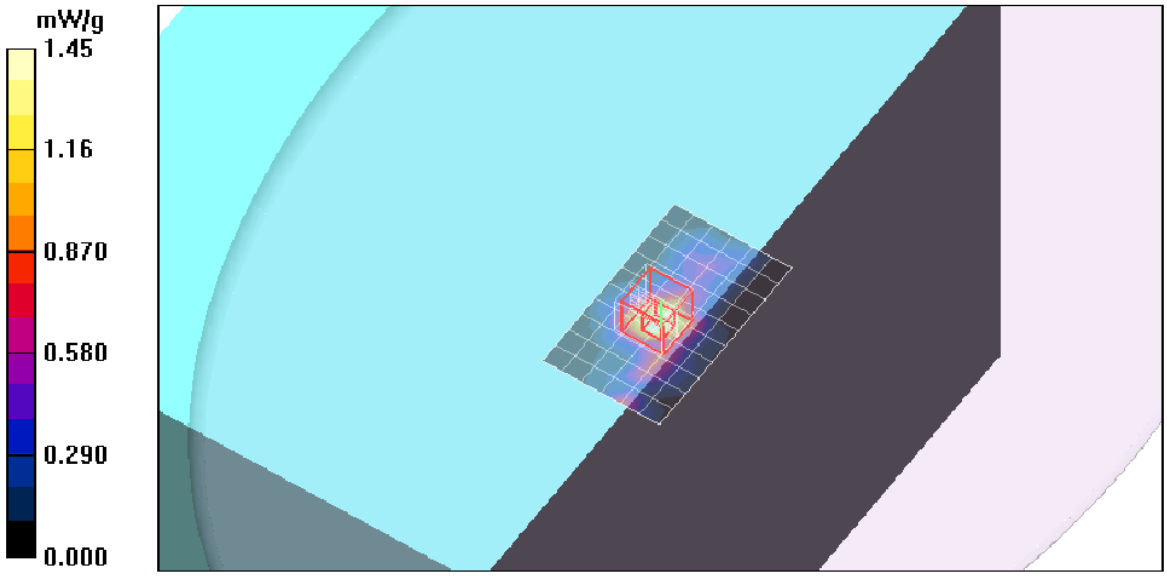
Communication System: 802.11abgn; Frequency: 5825 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5825 MHz; σ = 6.13 mho/m; ε_r = 45.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

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(3.84, 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_H Ch 165/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.45 mW/g

802.11a_Aux Ant_H Ch 165/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 16.5 V/m; Power Drift = 0.116 dB
Peak SAR (extrapolated) = 3.16 W/kg
SAR(1 g) = 0.991 mW/g; SAR(10 g) = 0.382 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.60 mW/g



13. ATTACHMENTS

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