FCC OET BULLETIN 65 SUPPLEMENT C
CLASS II PERMISSIVE CHANGE
IC RSS-102 ISSUE 2

SAR EVALUATION REPORT

FOR

802.11ag/Draft 802.11n WLAN PCI-E Minicard
(Tested inside of Dell Notebook PC, PP19S)

MODEL: BCM94322HM8L

FCC ID: QDS-BRCM1031
IC: 4324A-BRCM1031

REPORT NUMBER: 09U12428-1

ISSUE DATE: March 25, 2009

Prepared for

BROADCOM CORPORATION
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	March 25, 2009	Initial Issue	--

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086
EUT DESCRIPTION:	802.11ag/Draft 802.11n WLAN PCI-E Minicard (Tested inside of Dell Notebook PC, PP19S)
MODEL NUMBER:	BCM94322HM8L
DEVICE CATEGORY:	Portable
EXPOSURE CATEGORY:	General Population/Uncontrolled Exposure
DATE TESTED:	March 22 - 25, 2009

MAX SAR VALUE:

FCC / IC Rule Parts	Frequency Range [MHz]	The Highest SAR Values (1g_mW/g)	Limit (mW/g)
15.247 / RSS-102	2400 – 2483.5	0.015	1.6
	5725 – 5850	0.058	
15.407 / RSS-102	5150 – 5250	0.038	
	5250 – 5350	0.047	
	5470 – 5725	0.050	

APPLICABLE STANDARDS:

STANDARD	TEST RESULTS
FCC OET BULLETIN 65 SUPPLEMENT C	Pass
RSS-102 ISSUE 2	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. 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. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By: Tested By:

SUNNY SHIH
ENGINEERING SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

CHAOYEN LIN
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 820.11abg Transmitters and IC RSS 102 Issue 2.

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://ts.nist.gov/Standards/scopes/2000650.htm.

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 Number	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	14	2009
Signal Generator	Agilent	8753ES-6	MY40001647	11	14	2009
E-Field Probe	SPEAG	EX3DV3	3531	4	23	2009
Thermometer	ERTCO	639-1S	1718	5	28	2009
Data Acquisition Electronics	SPEAG	DAE3 V1	427	10	20	2009
System Validation Dipole	SPEAG	D2450V2	748	4	14	2009
System Validation Dipole	SPEAG	D5GHzV2	1003	11	21	2009
MXA Signal Analyzer	Agilent	N9020A	US48350984	10	23	2009
ESG Vector Signal Generator	Agilent	E4438C	US44271090	9	17	2010
Power Meter	Giga-tronics	8651A	8651404	1	11	2010
Power Sensor	Giga-tronics	80701A	1834588	1	11	2010
Amplifier	Mini-Circuits	ZVE-8G	90606	N/A		
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A		
Simulating Liquid	CCS	M2450	N/A	Within 24 hrs of first test		
Simulating Liquid	SPEAG	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

802.11ag/Draft 802.11n WLAN PCI-E Minicard (Tested inside of Dell Notebook PC, PP19S)

Normal operation: Lap-held only

Note: SAR test with display open at 90° to the keyboard

Antenna tested:

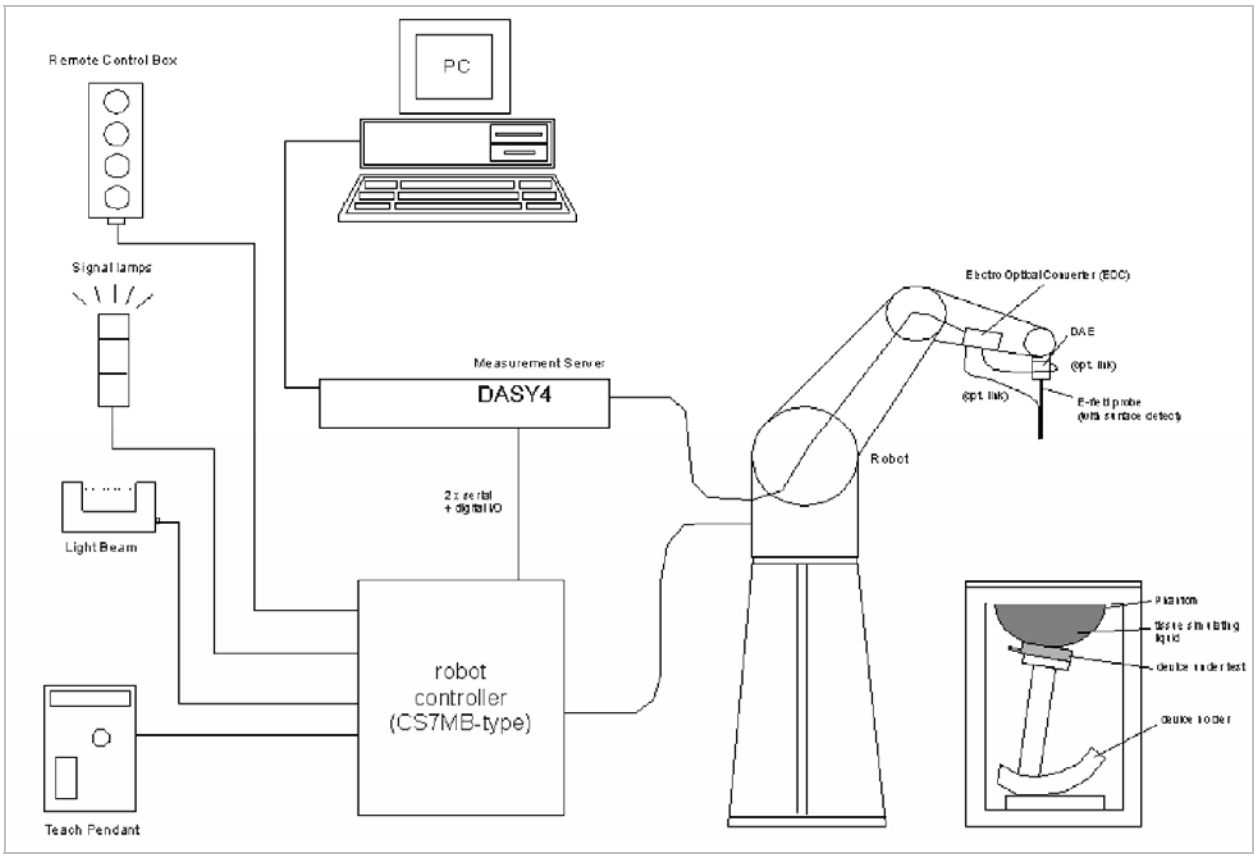
		Max Peak Gain (dBi)	
Manufactured	Model Number	2.4GH	5GHz
WNC	Main: 81.EJU15.G06	0.35 (Main)	0.22 (Main)
	Aux: 81.EJU15.G07		
Yageo	**TX1**: CAN4313887032501B	***1.34 (TX1)**	1.21 (TX1)
	TX2: 2023776-1		
Tyco	**TX1**: 2023775-1	0.98 (TX1)	****1.33 (TX1)**
	TX2: 2023776-1		

* : Antenna under testing (with highest antenna gain 1.34 dBi) for 2.4 GHz band

** : Antenna under testing (with highest antenna gain 1.33 dBi) for 5 GHz band

Power supply: Power supplied through laptop computer (host device)

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

Simulating Liquid Dielectric Parameters for Muscle 2450 MHz

Room Ambient Temperature = 25°C; Relative humidity = 38% Measured by: Chaoyen Lin

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	51.7	Relative Permittivity (ϵ_r):	51.700	52.7	-1.90	± 5
	e"	14.6	Conductivity (σ):	1.990	1.95	2.05	± 5

Liquid Temperature: 24 deg. C
March 25, 2009 09:02 AM

Frequency	e'	e"
2400000000.	51.8665	14.3570
2405000000.	51.8353	14.3585
2410000000.	51.8091	14.3577
2415000000.	51.7962	14.3854
2420000000.	51.7616	14.4104
2425000000.	51.7349	14.4593
2430000000.	51.7136	14.4943
2435000000.	51.6856	14.5265
2440000000.	51.6755	14.5517
2445000000.	51.6444	14.5808
2450000000.	**51.6519**	**14.6104**
2455000000.	51.6590	14.6482
2460000000.	51.6717	14.6752
2465000000.	51.6846	14.7020
2470000000.	51.6834	14.7469
2475000000.	51.6824	14.7916
2480000000.	51.6799	14.8347
2485000000.	51.6536	14.8442
2490000000.	51.6276	14.8535
2495000000.	51.6085	14.8504
2500000000.	51.5836	14.8512

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 Muscle 5800 MHz

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

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	44.9846	Relative Permittivity (ε_r):	44.9846	49.0	-8.19	± 10
	e"	18.7377	Conductivity (σ):	5.42049	5.30	2.27	± 5
5500	e'	44.852	Relative Permittivity (ε_r):	44.8520	48.6	-7.71	± 10
	e"	18.9215	Conductivity (σ):	5.78945	5.65	2.47	± 5
5800	e'	43.9261	Relative Permittivity (ε_r):	43.9261	48.2	-8.87	± 10
	e"	19.4313	Conductivity (σ):	6.26973	6.00	4.50	± 5

Liquid temperature: 24 deg. C
March 22, 2009 06:01 PM

Frequency	e'	e"
4600000000.	46.6821	17.7370
4650000000.	46.6809	18.1573
4700000000.	46.5819	17.8206
4750000000.	46.1225	18.2579
4800000000.	46.5178	18.1454
4850000000.	45.8571	18.1183
4900000000.	46.0986	18.3973
4950000000.	45.7295	18.1780
5000000000.	45.5189	18.5834
5050000000.	45.5546	18.3678
5100000000.	45.0391	18.6588
5150000000.	45.4327	18.6203
5200000000.	**44.9846**	**18.7377**
5250000000.	45.2397	18.8723
5300000000.	45.0714	18.8598
5350000000.	44.9604	19.0581
5400000000.	45.0389	18.8735
5450000000.	44.6400	19.0688
5500000000.	**44.8520**	**18.9215**
5550000000.	44.5752	19.3009
5600000000.	44.5004	19.1681
5650000000.	44.1258	19.3436
5700000000.	44.3669	19.2936
5750000000.	44.1545	19.3899
5800000000.	**43.9261**	**19.4313**
5850000000.	43.6810	19.5143
5900000000.	43.6625	19.4451
5950000000.	43.1414	19.3339
6000000000.	43.6173	19.9377

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 EX3DV3-SN: 3531 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (2.4 GHz) fine cube was chosen for cube integration and Special 8x8x10 (5 GHz) fine cube was chosen for cube integration
- Distance between probe sensors and phantom surface was set to 4 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5mm
- The dipole input power (forward power) was 250 mW±3%.
- The results are normalized to 1 W input power.

450 to 2450 MHz Reference SAR Values for BODY-tissue

In the table below, the numerical reference SAR values of a SPEAG validation dipoles placed below the flat phantom filled with body-tissue simulating liquid are given. The reference SAR values were calculated using the finite-difference time-domain method and the geometry parameters.

Dipole Type	Distance (mm)	Frequency (MHz)	SAR (1g) [W/kg]	SAR (10g) [W/kg]	SAR (peak) [W/kg]
D450V2	15	450	5.01	3.36	7.22
D835V2	15	835	9.71	6.38	14.1
D900V2	15	900	11.1	7.17	16.3
D1450V2	10	1450	29.6	16.6	49.8
D1800V2	10	1800	38.5	20.3	67.5
D1900V2	10	1900	39.8	20.8	69.6
D2000V2	10	2000	40.9	21.2	71.5
D2450V2	10	2450	51.2	23.7	97.6

Note: All SAR values normalized to 1 W forward power.

5 GHz Reference SAR Values for BODY-tissue

In the table below, the numerical reference SAR values of a SPEAG validation dipoles placed below the flat phantom filled with body-tissue simulating liquid are given. The reference SAR values were calculated using finite-difference time-domain FDTD method (feed point-impedance set to 50 ohms) and the mechanical dimensions of the D5GHzV2 dipole (manufactured by SPEAG).

f (MHz)	Head Tissue		Body Tissue		
	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}	SAR_{Peak}
5000	72.9	20.7	68.1	19.2	260.3
5100	74.6	21.1	78.8	19.6	272.3
5200	76.5	21.6	71.8	20.1	284.7
5500	83.3	23.4	79.1	22	326.3
5800	78	21.9	74.1	20.5	324.7

Note: All SAR values normalized to 1 W forward power.

9.1. SYSTEM PERFORMANCE CHECK RESULTS

System Validation Dipole: D2450V2 SN: 748

Date: 3/25/09

Ambient Temperature = 25°C; Relative humidity = 40% Measured by: Chaoyen Lin

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Muscle	2450	250	1g SAR:	50.6	51.2	-1.17	±10
			10g SAR:	23.6	23.7	-0.42	

System Validation Dipole: D5GHzV2 SN 1003

Date: March 22, 2009

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

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Muscle	5200	250	1g SAR:	80.6	74.7	7.90	±10
			10g SAR:	22.9	21.1	8.53	
Muscle	5500	250	1g SAR:	78.9	80.1	-1.50	±10
			10g SAR:	22.1	22.5	-1.78	
Muscle	5800	250	1g SAR:	75.7	70.8	6.92	±10
			10g SAR:	21.2	19.8	7.07	

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:

See Broadcom's Operational Description document for Average Power information.

11. SUMMARY OF TEST RESULTS

11.1. SAR TEST RESULT FOR THE 2.4 GHZ BAND

11.1.1. LAPHELD POSITION

Mode	Channel	f (MHz)	Antenna	1g SAR (mW/g)	Limit (mW/g)
802.11b	6	2437	TX1	0.015	1.6

Notes:

1. The modes with highest output power channel were chosen for the testing.
2. Test configuration: Lapheld with display open at 90° to the keyboard.
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.

11.2. SAR TEST RESULT FOR THE 5 GHZ BANDS

11.2.1. LAPHELD POSITION

Band	Mode	Channel	f (MHz)	Antenna	1g SAR (mW/g)	Limit (mW/g)
5.2 GHz	802.11a	40	5200	TX1	0.038	1.6
5.3 GHz	802.11a	60	5300	TX1	0.047	
5.5 GHz	802.11a	120	5600	TX1	0.050	
5.8 GHz	802.11a	157	5785	TX1	0.058	

Notes:

1. The modes with highest output power channel were chosen for the testing.
2. Test configuration: Lapheld with display open at 90° to the keyboard.
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.

12. SAR TEST PLOTS

SAR PLOT for 2.4 GHz

Date/Time: 3/25/2009 2:39:54 PM

Test Laboratory: Compliance Certification Services

Lapheld Position - Dell Notebook PC PP19S

DUT: Dell Notebook PC; Type: PP19S; Serial: n/a

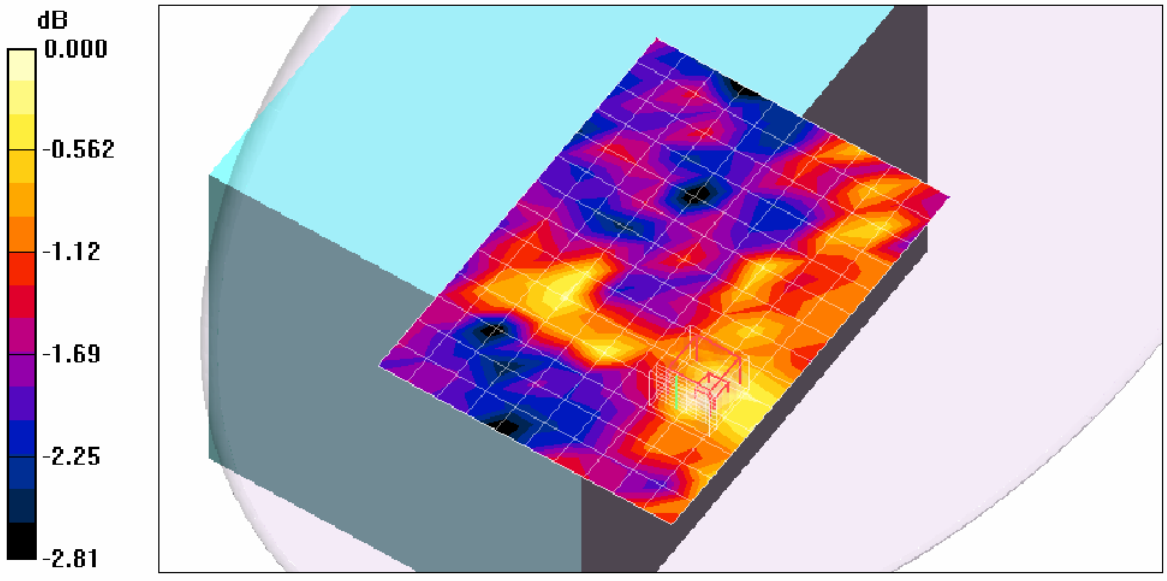
Communication System: 802.11bg; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.97 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

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 - SN3531; ConvF(7.91, 7.91, 7.91); Calibrated: 4/23/2008
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11b M-ch TX1 Antenna/Area Scan (11x15x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.018 mW/g

802.11b M-ch TX1 Antenna/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm
Reference Value = 2.41 V/m; Power Drift = -0.279 dB
Peak SAR (extrapolated) = 0.041 W/kg
SAR(1 g) = 0.015 mW/g; SAR(10 g) = 0.014 mW/g
Info: Interpolated medium parameters used for SAR evaluation.



0 dB = 0.018mW/g

SAR PLOT for 802.11a 5200 MHz

Date/Time: 3/23/2009 12:41:16 PM

Test Laboratory: Compliance Certification Services

Lap Held - 5.2 GHz Band

DUT: Dell Notebook PC; Type: PP19S; Serial: n/a

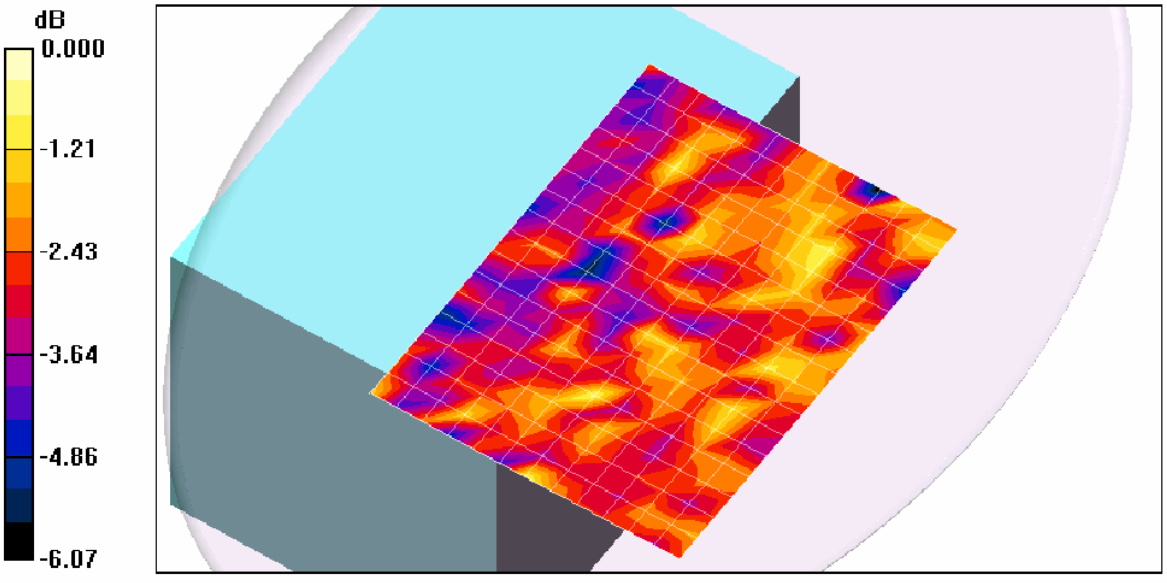
Communication System: 802.11abgn; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.42 mho/m; ε_r = 45; ρ = 1000 kg/m^3
Phantom section: Flat Section

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 - SN3531; ConvF(4.21, 4.21, 4.21); Calibrated: 4/23/2008
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a TX2/Area Scan (13x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.046 mW/g

802.11a TX2/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 2.14 V/m; Power Drift = -1.81 dB
Peak SAR (extrapolated) = 0.079 W/kg
SAR(1 g) = 0.038 mW/g; SAR(10 g) = 0.033 mW/g
Maximum value of SAR (measured) = 0.054 mW/g



0 dB = 0.054mW/g

SAR PLOT for 802.11a 5300 MHz

Date/Time: 3/23/2009 1:45:57 PM

Test Laboratory: Compliance Certification Services

Lap Held - 5.3 GHz Band

DUT: Dell Notebook PC; Type: PP19S; Serial: n/a

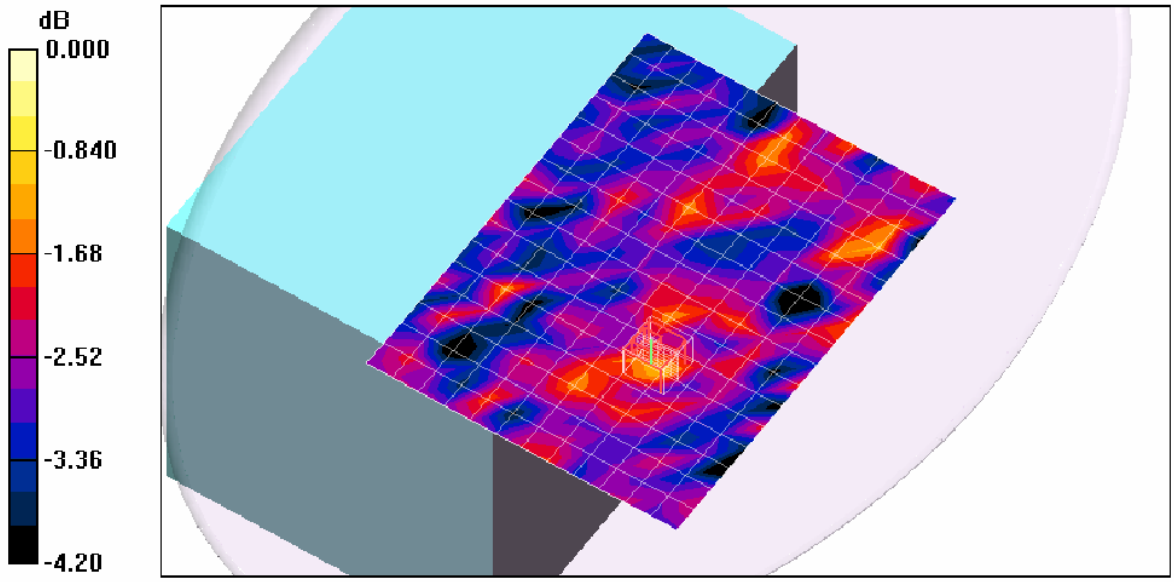
Communication System: 802.11abgn; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.56 mho/m; ε_r = 45.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

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 - SN3531; ConvF(3.92, 3.92, 3.92); Calibrated: 4/23/2008
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a TX2/Area Scan (13x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.050 mW/g

802.11a TX2/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 1.35 V/m; Power Drift = 6.31 dB
Peak SAR (extrapolated) = 0.098 W/kg
SAR(1 g) = 0.047 mW/g; SAR(10 g) = 0.041 mW/g
Maximum value of SAR (measured) = 0.064 mW/g



0 dB = 0.064mW/g

SAR PLOT for 802.11a 5600 MHz

Date/Time: 3/23/2009 2:34:21 PM

Test Laboratory: Compliance Certification Services

Lap Held - 5.5 GHz Band

DUT: Dell Notebook PC; Type: PP19S; Serial: n/a

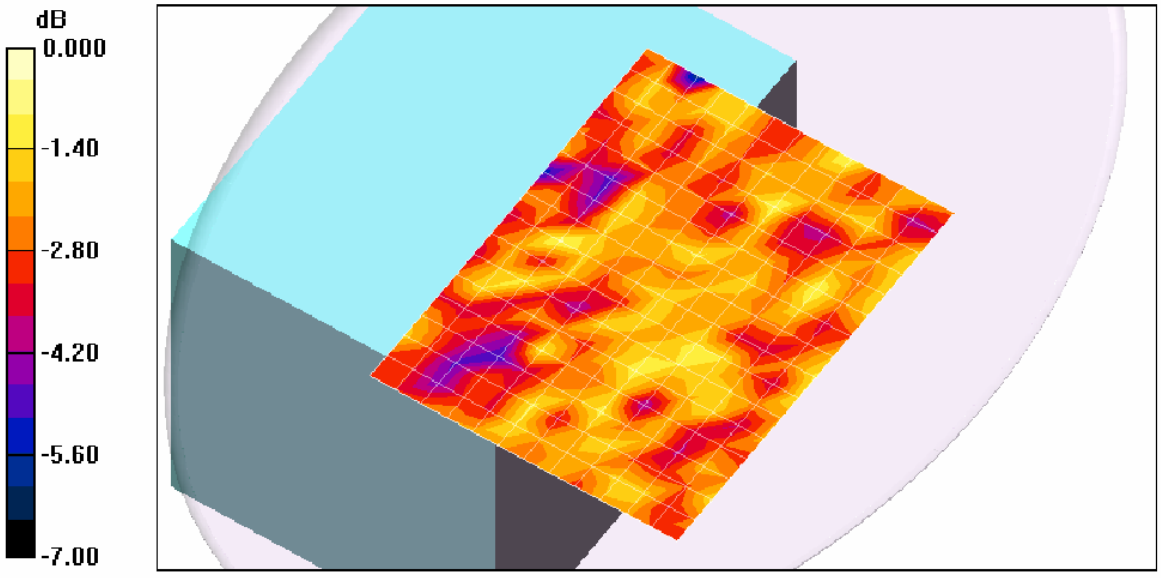
Communication System: 802.11abgn; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.97 mho/m; ε_r = 44.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

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: EX3DV3 - SN3531; ConvF(3.5, 3.5, 3.5); Calibrated: 4/23/2008
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a TX2/Area Scan (13x17x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.060 mW/g

802.11a TX2/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 2.46 V/m; Power Drift = 2.48 dB
Peak SAR (extrapolated) = 0.157 W/kg
SAR(1 g) = 0.050 mW/g; SAR(10 g) = 0.045 mW/g
Maximum value of SAR (measured) = 0.072 mW/g



0 dB = 0.072mW/g

SAR PLOT for 802.11a 5785 MHz

Date/Time: 3/23/2009 3:21:55 PM

Test Laboratory: Compliance Certification Services

Lap Held - 5.8 GHz Band

DUT: Dell Notebook PC; Type: PP19S; Serial: n/a

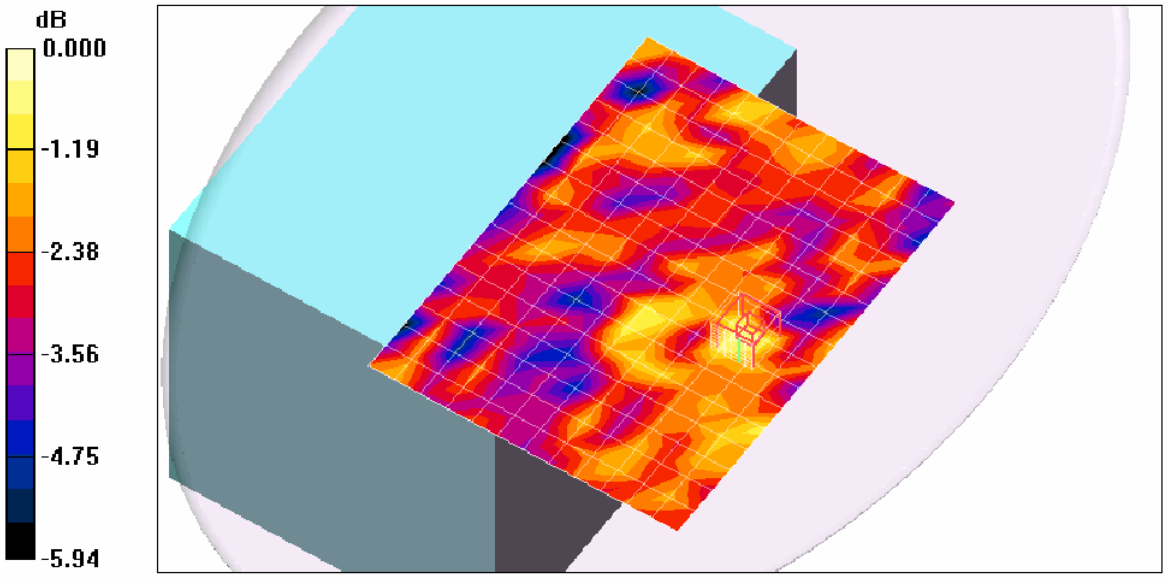
Communication System: 802.11abgn; Frequency: 5785 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5785 MHz; σ = 6.25 mho/m; ε_r = 44; ρ = 1000 kg/m^3
Phantom section: Flat Section

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 - SN3531; ConvF(3.7, 3.7, 3.7); Calibrated: 4/23/2008
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:XXXX
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

802.11a TX2/Area Scan (13x17x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.069 mW/g

802.11a TX2/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 2.53 V/m; Power Drift = 1.55 dB
Peak SAR (extrapolated) = 0.092 W/kg
SAR(1 g) = 0.058 mW/g; SAR(10 g) = 0.050 mW/g
Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.078 mW/g



0 dB = 0.078mW/g

13. ATTACHMENTS

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