



**FCC OET BULLETIN 65 SUPPLEMENT C
IC RSS-102 ISSUE 3**

SAR EVALUATION REPORT

For

**802.11ag/Draft 802.11n WLAN PCI-E Minicard
(Tested inside of HP Notebook PC, HSTNN-Q45C)**

MODEL: BCM943224HMS

FCC ID: QDS-BRCM1041

IC: 4324A-BRCM1041

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Prepared for

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	August 20, 2009	Initial Issue	--
A	September 9, 2009	1. Update probe info in system performance check plots for 2.4GHz 2. Update probe info at page 15	Chao Lin

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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 HP Notebook PC, HSTNN-Q45C)

MODEL NUMBER: BCM943224HMS

DEVICE CATEGORY: Portable

EXPOSURE CATEGORY: General Population/Uncontrolled Exposure

DATE TESTED: August 13 - 19 , 2009

THE HIGHEST SAR VALUES:

FCC / IC Rule Parts	Frequency Range [MHz]	The Highest SAR Values (1g_mW/g)	Limit (mW/g)
15.247 / RSS-102	2400 – 2483.5	0.043	1.6
	5725 – 5850	0.152	
15.407 / RSS-102	5150 – 5250	0.136	
	5250 – 5350	0.153	
	5470 – 5725	0.168	

APPLICABLE STANDARDS AND TEST PROCEDURES:

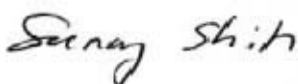
STANDARD	TEST RESULTS
FCC OET BULLETIN 65 SUPPLEMENT C	Pass
RSS-102 ISSUE 3	Pass

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:

Tested By:




SUNNY SHIH
 ENGINEERING SUPERVISOR
 COMPLIANCE CERTIFICATION SERVICES

CHAO YEN 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, 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	14	2009
Signal Generator	Agilent	8753ES-6	MY40001647	11	14	2009
E-Field Probe	SPEAG	EX3DV4	3686	3	23	2010
Thermometer	ERTCO	639-1S	1718	5	1	2010
Data Acquisition Electronics	SPEAG	DAE3 V1	427	10	20	2009
System Validation Dipole	SPEAG	D835V2	4d002	4	23	2011
System Validation Dipole	SPEAG	D900V2	108	1	21	2010
System Validation Dipole	SPEAG	D1800V2	294	1	29	2010
System Validation Dipole	SPEAG	D1900V2	5d043	1	29	2010
System Validation Dipole	SPEAG	D2450V2	748	4	14	2010
System Validation Dipole	SPEAG	D5GHzV2	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	SPAEG	H2450	N/A	Within 24 hrs of first test		
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 Mechanical Tolerance	0.40	R	1.732	1	1	0.23	0.23
Probe Positioning With Respect to Phantom Shell algorithms for max. SAR evaluation	2.90	R	1.732	1	1	1.67	1.67
	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
Notes for table							
1. Tol. - tolerance in influence quantity							
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 Mechanical 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
Notes for table							
1. Tol. - tolerance in influence quantity							
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 HP Notebook PC, HSTNN-Q45C)

Normal operation:

Lap-held only

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

Antenna tested:

Manufactured Model Number

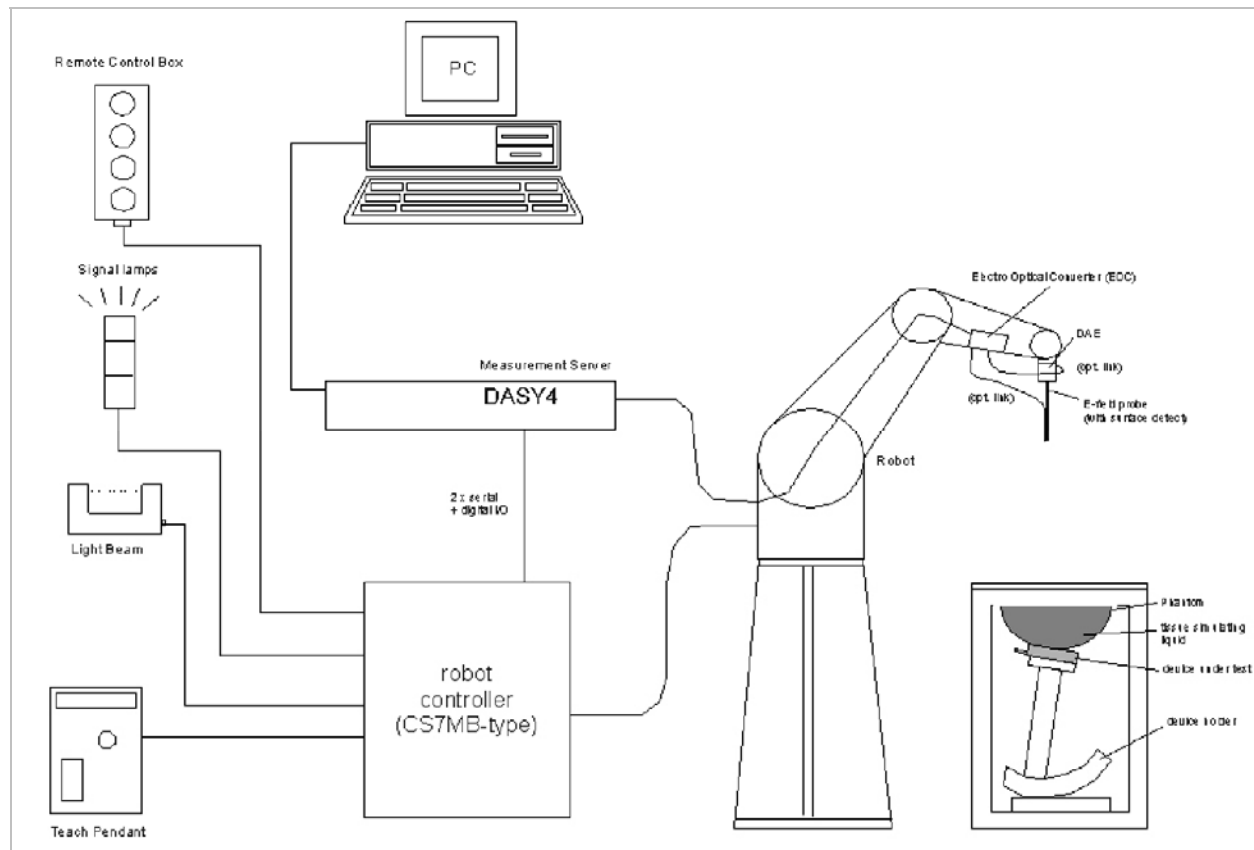
WNC 81.EKA15.G01(DQ6A15G0100) (Main)

 81.EKA15.G01(DQ6A15G0100) (Aux)

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 if the dielectric parameters are within the tolerances of the specified target values. The relative permittivity and conductivity of the tissue material should be within $\pm 5\%$ 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 $\rho = 1000 \text{ kg/m}^3$)

8.1. LIQUID CHECK RESULTS FOR 2450 MHZ

Simulating Liquid Dielectric Parameters for Muscle 2450 MHz

Room Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Chaoyen Lin

f (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
2450	e'	52.33	Relative Permittivity (ϵ_r):	52.334	52.7	-0.69	± 5
	e"	13.89	Conductivity (σ):	1.894	1.95	-2.89	± 5

Liquid Temperature: 23 deg. C

August 13, 2009 1:10 PM

Frequency	e'	e"
2400000000	52.4304	13.646
2405000000	52.4183	13.7194
2410000000	52.4037	13.7846
2415000000	52.4001	13.8281
2420000000	52.3862	13.8543
2425000000	52.3816	13.8725
2430000000	52.3873	13.8658
2435000000	52.3715	13.8719
2440000000	52.3671	13.8864
2445000000	52.3381	13.9141
2450000000	52.3342	13.8932
2455000000	52.2652	13.8698
2460000000	52.2291	13.8417
2465000000	52.1653	13.8045
2470000000	52.1499	13.7569
2475000000	52.1348	13.7327
2480000000	52.1426	13.7398
2485000000	52.1358	13.7589
2490000000	52.1382	13.8162
2495000000	52.1401	13.89
2500000000	52.1352	13.9929

The conductivity (σ) can be given as:

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

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

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

8.2. LIQUID CHECK RESULTS FOR 5 GHZ

Simulating Liquid Dielectric Parameters for Muscle 5800 MHz

Room Ambient Temperature = 25°C; Relative humidity = 38%

Measured by: Chao Lin

f (MHz)	Muscle Liquid Parameters			Measured	Target	Delta (%)	Limit (%)
5200	e'	47.0126	Relative Permittivity (ϵ_r):	47.0126	49.0	-4.06	± 10
	e''	18.1392	Conductivity (σ):	5.24736	5.30	-0.99	± 5
5500	e'	46.7216	Relative Permittivity (ϵ_r):	46.7216	48.6	-3.87	± 10
	e''	18.3901	Conductivity (σ):	5.62686	5.65	-0.41	± 5
5800	e'	45.7162	Relative Permittivity (ϵ_r):	45.7162	48.2	-5.15	± 10
	e''	19.0111	Conductivity (σ):	6.13415	6.00	2.24	± 5

Liquid temperature: 24 deg. C

August 18, 2009 12:38 PM

Frequency	e'	e''
4600000000	48.276	17.239
4650000000	48.3573	17.4067
4700000000	48.0918	17.3065
4750000000	48.0913	17.6121
4800000000	48.0647	17.4865
4850000000	47.9001	17.6563
4900000000	47.8941	17.77
4950000000	47.546	17.7282
5000000000	47.5238	17.9323
5050000000	47.2641	17.8906
5100000000	47.0515	18.0702
5150000000	47.1262	17.9622
5200000000	47.0126	18.1392
5250000000	47.2275	18.1587
5300000000	46.9618	18.302
5350000000	47.0847	18.4375
5400000000	46.821	18.361
5450000000	46.737	18.538
5500000000	46.7216	18.3901
5550000000	46.4653	18.5751
5600000000	46.4296	18.6066
5650000000	46.117	18.6188
5700000000	46.3304	18.9353
5750000000	46.1832	18.6834
5800000000	45.7162	19.0111
5850000000	46.0833	19.0866
5900000000	45.7526	18.8927
5950000000	45.3933	19.1145
6000000000	45.8036	19.4344

The conductivity (σ) can be given as:

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

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

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

9. SYSTEM CHECK

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 $\pm 10\%$.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Head or 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 fine cube was chosen for cube
- 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 power (forward power) was 250 mW $\pm 3\%$.
- 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

Reference SAR Values for HEAD & BODY-tissue from calibration certificate of SPEAG. Certificate no: D5GHzV2-1003_Nov07

f (MHz)	Head Tissue		Body Tissue	
	SAR _{1g}	SAR _{10g}	SAR _{1g}	SAR _{10g}
5200	78.6	22.1	74.7	21.1
5500	80.4	22.7	80.1	22.5
5800	79.9	22.4	70.8	19.8

9.1. SYSTEM CHECK RESULTS FOR D2450V2

System Validation Dipole: D2450V2 SN: 748

Date: August 13, 2009

Ambient Temperature = 24°C; Relative humidity = 40%

Measured by: Chao Lin

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Body	2450	250	1g SAR:	47.2	51.2	-7.81	±10
			10g SAR:	21.9	23.7	-7.59	

9.2. SYSTEM CHECK RESULTS FOR D5GHzV2

System Validation Dipole: D5GHzV2 SN 1003

Date: August 18, 2009

Ambient Temperature = 25°C; Relative humidity = 40%

Measured by: Chao Lin

Medium	CW Signal (MHz)	Forward power (mW)	Measured (Normalized to 1 W)		Target	Delta (%)	Tolerance (%)
Muscle	5200	250	1g SAR:	78.9	74.7	5.62	±10
			10g SAR:	22.8	21.1	8.06	
Muscle	5500	250	1g SAR:	77.4	80.1	-3.37	±10
			10g SAR:	21.8	22.5	-3.11	
Muscle	5800	250	1g SAR:	71.3	70.8	0.71	±10
			10g SAR:	20.1	19.8	1.52	

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

If the SAR measured at the middle channel for each test configuration is at least 3.0 dB (0.8 mW/g) lower than the SAR limit (1.6 mW/g), testing at the high and low channels is optional for such test configuration(s).

11.1. SAR TEST RESULT FOR THE 2.4 GHZ BAND

Mode	Channel	f (MHz)	Antenna	1g SAR (mW/g)	Limit (mW/g)
802.11b	6	2437	Main	0.043	1.6
			Aux	0.041	

11.2. SAR TEST RESULT FOR THE 5 GHZ BANDS

Band	Mode	Channel	f (MHz)	Antenna	1g SAR (mW/g)	Limit (mW/g)
5.2 GHz	802.11a	40	5200	Main	0.136	1.6
				Aux	0.135	
5.3 GHz	802.11a	60	5300	Main	0.153	
				Aux	0.148	
5.5 GHz	802.11a	120	5600	Main	0.168	
				Aux	0.166	
5.8 GHz	802.11a	157	5785	Main	0.027	
				Aux	0.152	

12. WORST-CASE SAR TEST PLOTS

WORST-CASE SAR PLOT for 2.4 GHz Band

Date/Time: 8/14/2009 11:24:31 AM

Test Laboratory: Compliance Certification Services

Lapheld Position

DUT: HP; Type: Vasco; Serial: NA

Communication System: 802.11bg; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.88$ mho/m; $\epsilon_r = 52.4$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(6.48, 6.48, 6.48); Calibrated: 3/23/2009
- 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 Main Antenna/Area Scan (13x17x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.047 mW/g

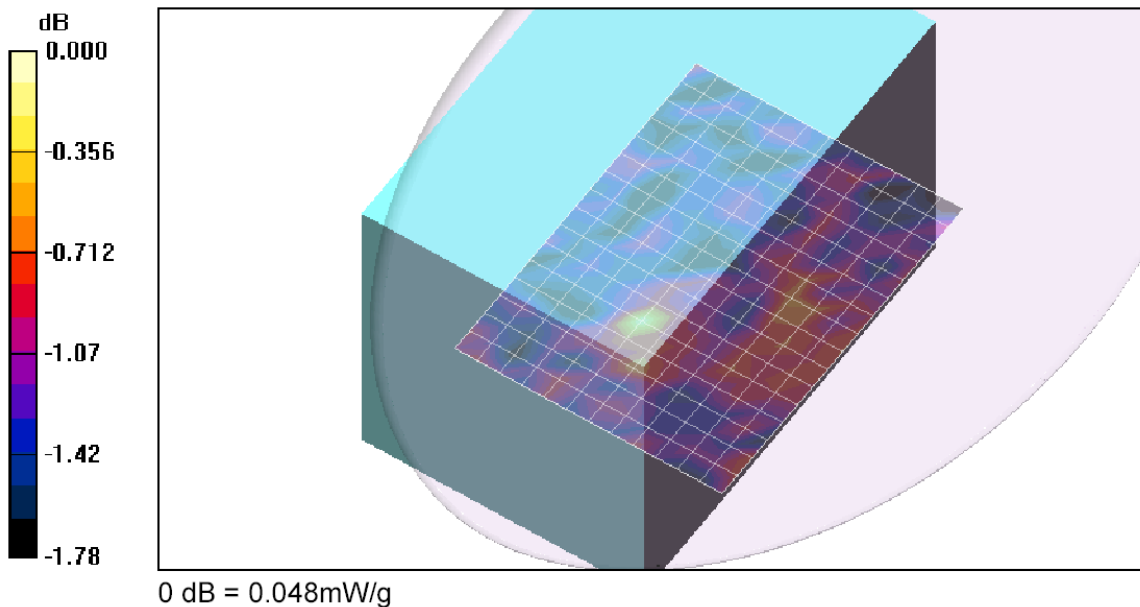
802.11b M-ch Main Antenna/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=3mm

Reference Value = 4.29 V/m; Power Drift = 0.016 dB

Peak SAR (extrapolated) = 0.065 W/kg

SAR(1 g) = 0.043 mW/g; SAR(10 g) = 0.040 mW/g

Maximum value of SAR (measured) = 0.048 mW/g



WORST-CASE SAR PLOT for 5.2 GHz Band

Date/Time: 8/18/2009 3:29:25 PM

Test Laboratory: Compliance Certification Services

802.11a 5.2GHz

DUT: HP; Type: Vasco; Serial: NA

Communication System: 802.11abgn; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 5200$ MHz; $\sigma = 5.25$ mho/m; $\epsilon_r = 47$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

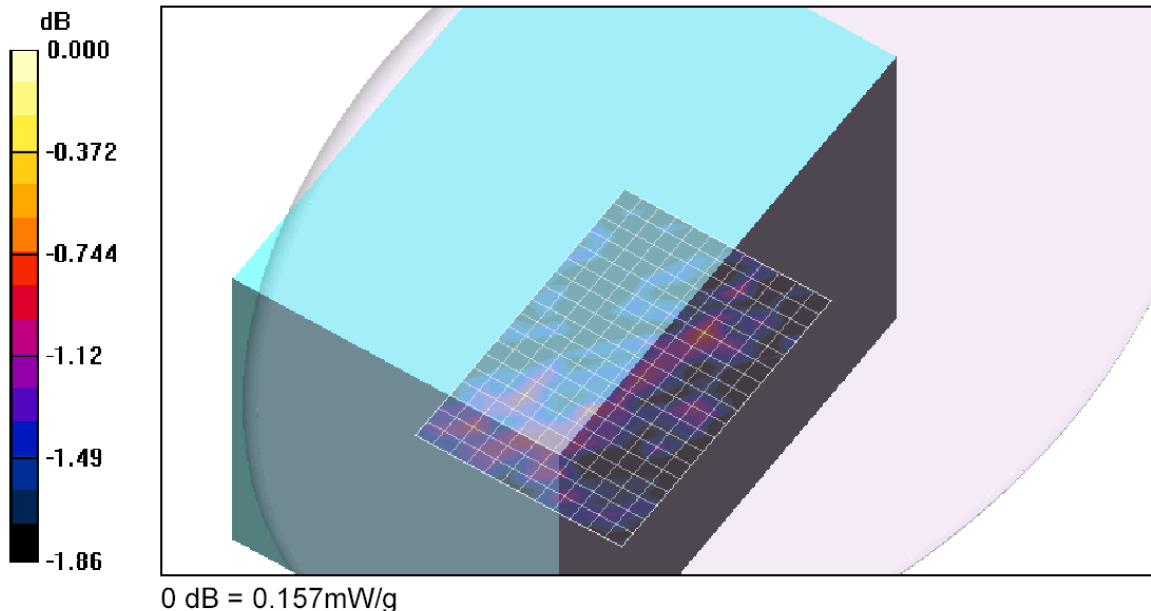
DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(4.08, 4.08, 4.08); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Lapheld, Main Ant/Area Scan (13x19x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.135 mW/g

Lapheld, Main Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 4.40 V/m; Power Drift = 0.979 dB
Peak SAR (extrapolated) = 0.157 W/kg
SAR(1 g) = 0.136 mW/g; SAR(10 g) = 0.127 mW/g

Maximum value of SAR (measured) = 0.157 mW/g



WORST-CASE SAR PLOT for 5.3 GHz Band

Date/Time: 8/18/2009 4:09:32 PM

Test Laboratory: Compliance Certification Services

802.11a 5.3GHz

DUT: HP; Type: Vasco; Serial:NA

Communication System: 802.11abgn; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium parameters used: $f = 5300$ MHz; $\sigma = 5.4$ mho/m; $\epsilon_r = 47$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

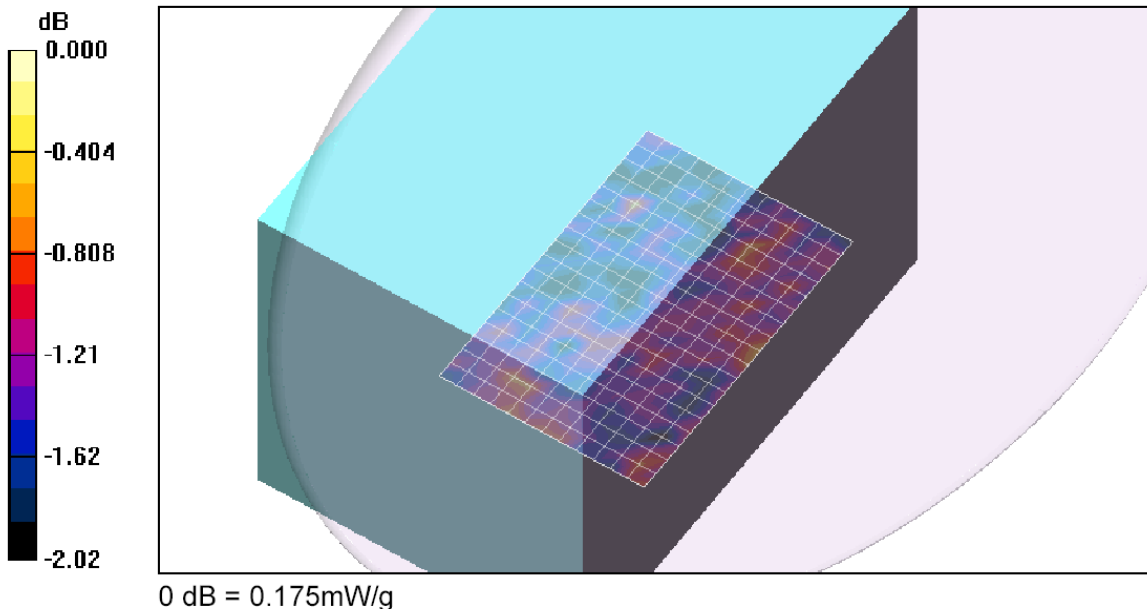
DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(3.81, 3.81, 3.81); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Lapheld, Main Ant/Area Scan (13x19x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.155 mW/g

Lapheld, Main Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 5.30 V/m; Power Drift = -0.196 dB
Peak SAR (extrapolated) = 0.176 W/kg
SAR(1 g) = 0.153 mW/g; SAR(10 g) = 0.144 mW/g

Maximum value of SAR (measured) = 0.175 mW/g



WORST-CASE SAR PLOT for 5.5 GHz Band

Date/Time: 8/18/2009 5:29:38 PM

Test Laboratory: Compliance Certification Services

802.11a 5.5 GHz

DUT: HP; Type: Vasco; Serial: NA

Communication System: 802.11abgn; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 5600$ MHz; $\sigma = 5.8$ mho/m; $\epsilon_r = 46.4$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

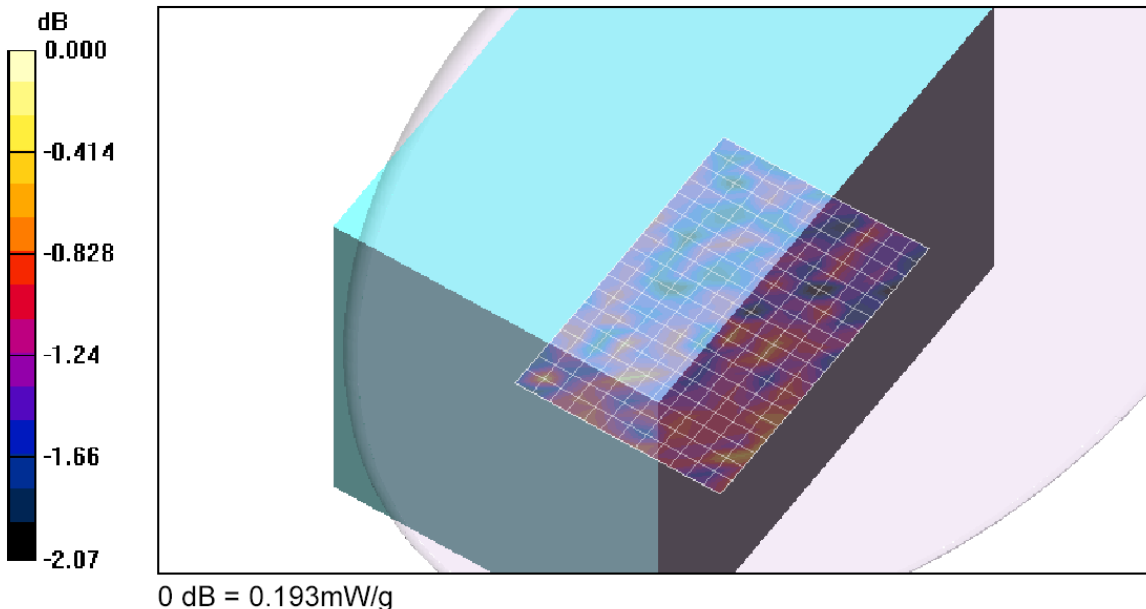
DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(3.61, 3.61, 3.61); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Lapheld, Main Ant/Area Scan (13x19x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.172 mW/g

Lapheld, Main Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm
Reference Value = 5.13 V/m; Power Drift = -0.414 dB
Peak SAR (extrapolated) = 0.193 W/kg
SAR(1 g) = 0.168 mW/g; SAR(10 g) = 0.158 mW/g

Maximum value of SAR (measured) = 0.193 mW/g



WORST-CASE SAR PLOT for 5.8 GHz Band

Date/Time: 8/19/2009 9:40:03 AM

Test Laboratory: Compliance Certification Services

802.11a 5.8 GHz

DUT: HP; Type: Vasco; Serial: NA

Communication System: 802.11abgn; Frequency: 5785 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 5785$ MHz; $\sigma = 6.09$ mho/m; $\epsilon_r = 45.9$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

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

DASY4 Configuration:

- Area Scan setting - Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Probe: EX3DV4 - SN3686; ConvF(3.84, 3.84, 3.84); Calibrated: 3/23/2009
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn427; Calibrated: 10/20/2008
- Phantom: Flat Phantom ELI4.0; Type: QDOVA001BA; Serial: SN:1003
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Lapheld, Aux Ant/Area Scan (13x19x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.157 mW/g

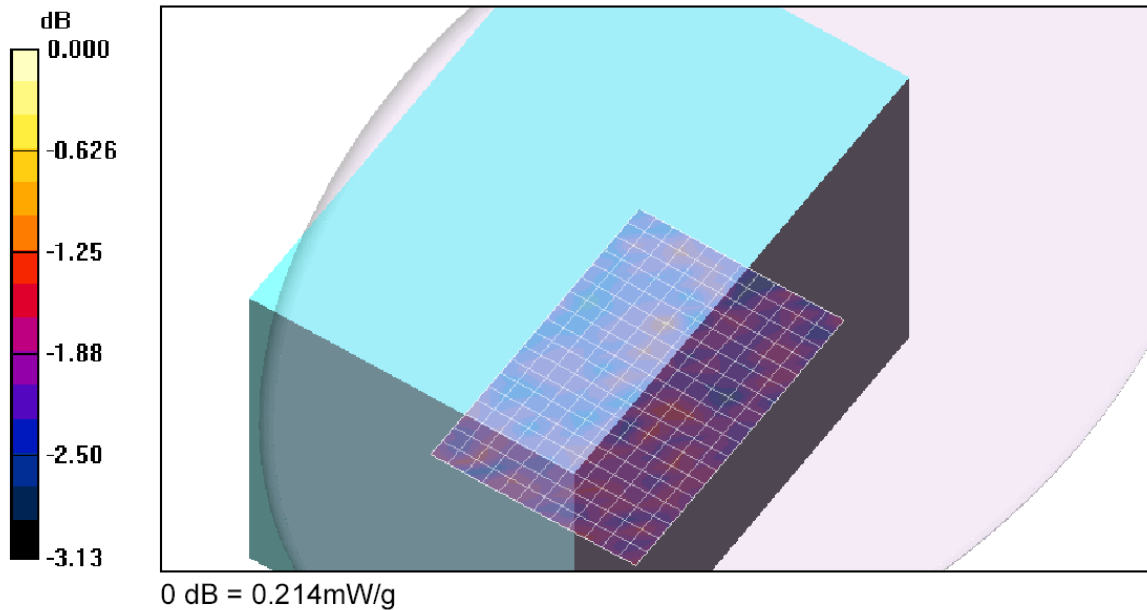
Lapheld, Aux Ant/Zoom Scan (7x7x9)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 4.90 V/m; Power Drift = -0.043 dB

Peak SAR (extrapolated) = 0.214 W/kg

SAR(1 g) = 0.152 mW/g; SAR(10 g) = 0.144 mW/g

Maximum value of SAR (measured) = 0.214 mW/g



13. ATTACHMENTS

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