SAR Evaluation Report

IN ACCORDANCE WITH THE REQUIREMENTS OF
FCC REPORT AND ORDER:
ET DOCKET 93-62, AND OET BULLETIN 65 SUPPLEMENT C

FOR

AR5BXB6 802.11ABG PCI EXPRESS MODULE

MODEL: AR5BXB6

FCC ID: PPD-AR5BXB6-M

REPORT NUMBER: 05U3787-6

ISSUE DATE: DECEMBER 15, 2005

Prepared for

ATHEROS COMMUNICATIONS INC
5480 GREAT AMERICA PARKWAY
SANTA CLARA, CA 95054, USA

Prepared by

COMPLIANCE CERTIFICATION SERVICES
561F MONTEREY ROAD,
MORGAN HILL, CA 95037, USA
TEL: (408) 463-0885

LAB CODE:200065-0

Revision History

Rev.	Issued date	Revisions	Revised By
A	December 15, 2005	Initial Issue	HS

CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

DATES OF TEST: December 9, 12 & 13, 2005

APPLICANT: ADDRESS:	Atheros Communications Inc 5480 Great America Parkway Santa Clara, CA 95054, USA
FCC ID: MODEL:	PPD-AR5BXB6-M AR5BXB6
DEVICE CATEGORY: EXPOSURE CATEGORY:	Portable Device General Population/Uncontrolled Exposure

AR5BXB6 802.11abg PCI Express module is installed in Apple 15" Power Book, including collocation with the Bluetooth module, FCC ID: MCLJ07H081.

Test Sample is a:	Production unit		
Modulation type:	Direct Sequence Spread Spectrum (DSSS) for 802.11b Orthogonal Frequency Division Multiplexing (OFDM) for 802.11ag		
Antenna(s)	Inverted F, PN: 631-0153 12-5, Tyco		
FCC Rule Parts	Frequency Range [MHz]	The Highest SAR Values [1g_mW/g]	Collocation SAR Values [1g_mW/g]
15.247	2412 - 2462	1.097	1.090
	5745 - 5825	1.001	0.985
15.401	5180 - 5320	0.167	0.153

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for General Population/Uncontrolled Exposure limits specified in ANSI/IEEE Std. C95.1-1992 and had been tested in accordance with the measurement procedures specified in FCC OET 65 Supplement C (Edition 01-01).

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 Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services 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:

Hsin-Fu Shih

Hsin Fu Shih
Senior Engineer
Compliance Certification Services

Tested By:

Ninous Davoudi

Ninous Davoudi
EMC Engineer
Compliance Certification Services

Table Of Contents

1 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

AR5BXB6 802.11abg PCI Express module is installed in Apple 15" Power Book, including collocation with the Bluetooth module, FCC ID: MCLJ07H081.	
Normal operation:	Lap-held 
Accessory:	N/A
Earphone/Headset Jack:	N/A
Duty cycle:	99% for a, b, & g modes
Host Device(s):	Apple 15" Power Book
Power supply:	Power supplied through the laptop computer (host device)
Antenna(s)	Inverted F, PN: 631-0153 12-5, Tyco

2 FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

NVLAP®

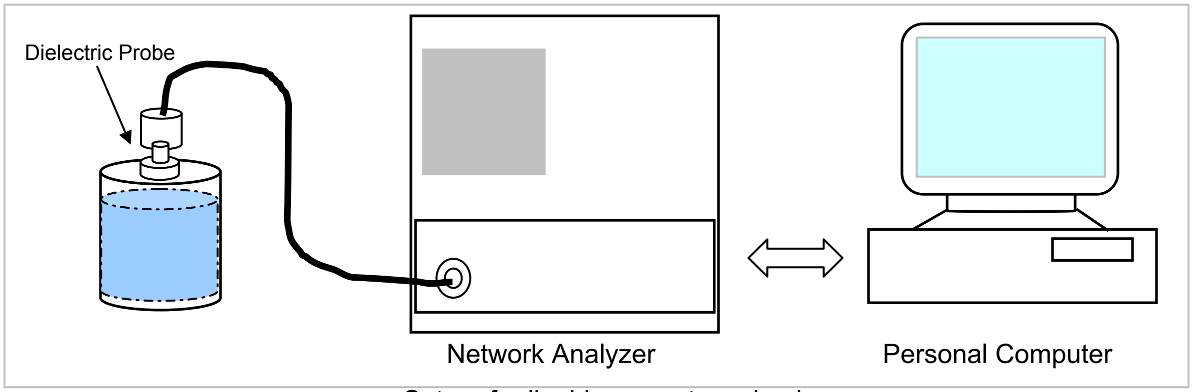
LAB CODE:200065-0

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

No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

3 SIMULATING 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.



Set-up for liquid parameters check

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	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

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

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

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

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

f (MHz)	Head Tissue		Body Tissue		Reference
	rel. permitivity	conductivity	rel. permitivity	conductivity	
3000	38.5	2.40	52.0	2.73	Standard
5800	35.3	5.27	48.2	6.00	Standard
5000	36.2	1.45	49.3	5.07	Interpolated
5100	36.1	4.55	49.1	5.18	Interpolated
5200	36.0	4.66	49.0	5.30	Interpolated
5300	35.9	4.76	48.9	5.42	Interpolated
5400	35.8	4.86	48.7	5.53	Interpolated
5500	35.6	4.96	48.6	5.65	Interpolated
5600	35.5	5.07	48.5	5.77	Interpolated
5700	35.4	5.17	48.3	5.88	Interpolated

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

3.1 Simulating Liquid Parameter Check Result

Simulating Liquid Dielectric Parameter Check Result @ Muscle 2450 MHz

Room Ambient Temperature =23.5°C; Relative humidity = 30% Measured by: Ninous Davoudi

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
2450	22	15	e"	Relative Permittivity (e'):	52.7	53.3661	1.26	± 5
			14.9259	Conductivity (σ):	1.95	2.03435	4.33	± 5

Liquid Check
Ambient temperature: 23.5 deg. C; Liquid temperature: 22.0 deg C
December 09, 2005 09:14 AM

Frequency	e'	e"
2400000000.	53.5291	14.7002
2410000000.	53.4889	14.7482
2420000000.	53.4558	14.8033
2430000000.	53.4168	14.8435
2440000000.	53.3987	14.8923
2450000000.	53.3661	14.9259
2460000000.	53.3103	14.9673
2470000000.	53.2517	14.9937
2480000000.	53.2309	15.0059
2490000000.	53.2013	15.0427
2500000000.	53.1801	15.1401

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 Parameter Check Result @ Muscle 5800 MHz

Ambient Temperature = 25 °C; Relative humidity = 30% Measured by: Ninous Davoudi

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
5800	24.5	15	e'	Relative Permittivity (e"):	48.2	46.8407	-2.82	± 5
			19.3773	Conductivity (σ):	6.00	6.25231	4.21	± 5

Liquid Check
Ambient temperature: 25.0 deg. C; Liquid temperature: 24.5 deg C
December 12, 2005 09:29 AM

Frequency	e'	e''
4600000000.	49.1535	17.8027
4650000000.	49.0500	17.8628
4700000000.	48.9617	17.9538
4750000000.	48.8801	18.0254
4800000000.	48.7776	18.1132
4850000000.	48.7053	18.1714
4900000000.	48.5963	18.2477
4950000000.	48.5187	18.3406
5000000000.	48.3991	18.3879
5050000000.	48.2924	18.4682
5100000000.	48.2009	18.5206
5150000000.	48.0975	18.6106
5200000000.	47.9758	18.6472
5250000000.	47.8911	18.7192
5300000000.	47.7906	18.7847
5350000000.	47.6797	18.8514
5400000000.	47.5976	18.8925
5450000000.	47.4987	18.9761
5500000000.	47.4023	19.0300
5550000000.	47.2973	19.0684
5600000000.	47.2217	19.1363
5650000000.	47.1020	19.1841
5700000000.	47.0383	19.2648
5750000000.	46.9074	19.3098
5800000000.	46.8407	19.3773
5850000000.	46.7228	19.4182
5900000000.	46.6567	19.4935
5950000000.	46.5463	19.5365
6000000000.	46.4454	19.6117

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 Parameter Check Result @ Muscle 5200 MHz

Ambient Temperature = 25.5 °C; Relative humidity = 30% Measured by: Ninous Davoudi

Simulating Liquid			Parameters		Target	Measured	Deviation (%)	Limit (%)
f (MHz)	Temp. (°C)	Depth (cm)						
5200	25	15	e'	Relative Permittivity (e"):	49.0	48.9032	-0.20	± 5
			18.8433	Conductivity (σ):	5.30	5.45104	2.85	± 5

Liquid Check
Ambient temperature: 25.5 deg. C; Liquid temperature: 25.0 deg C
December 13, 2005 08:50 AM

Frequency	e'	e''
4600000000.	50.0677	17.9374
4650000000.	49.9880	18.0321
4700000000.	49.8979	18.1169
4750000000.	49.7952	18.2002
4800000000.	49.7143	18.2759
4850000000.	49.6006	18.3489
4900000000.	49.4986	18.4304
4950000000.	49.4097	18.5117
5000000000.	49.3070	18.5815
5050000000.	49.2034	18.6400
5100000000.	49.1031	18.7149
5150000000.	49.0031	18.7967
5200000000.	48.9032	18.8433
5250000000.	48.7956	18.9185
5300000000.	48.7011	18.9872
5350000000.	48.6055	19.0544
5400000000.	48.5081	19.0908
5450000000.	48.4052	19.1725
5500000000.	48.3091	19.2404
5550000000.	48.2007	19.2833
5600000000.	48.1344	19.3347
5650000000.	48.0001	19.4069
5700000000.	47.9547	19.4745
5750000000.	47.8205	19.5003
5800000000.	47.7368	19.5873
5850000000.	47.6322	19.6263
5900000000.	47.5549	19.7109
5950000000.	47.4421	19.7507
6000000000.	47.3581	19.8225

The conductivity (σ) can be given as:

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

where f = target $f * 10^{6}$
$\varepsilon_0 = 8.854 * 10^{-12}$

4 SYSTEM PERFORMANCE 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 ±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 5 x 5 x 7 fine cube was chosen for cube integration(dx=dy=7.5mm; dz=5mm).
  (For 5 GHz band - Special 8x8x8 fine cube was chosen for cube integration(dx=dy=4.3mm; dz=3mm))
- Distance between probe sensors and phantom surface was set to 2.5 mm.
  (For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.0 mm
- The dipole input power (forward power) was 250 mW±3%.
- The results are normalized to 1 W input power.

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	850	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

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
5800	78.0	21.9	74.1	20.5	324.7

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

4.1 System Performance Check Results

System Validation Dipole: D2450V2 SN: 748

Date: December 9, 2005

Ambient Temperature = 23.5°C, Relative humidity = 30% Measured by: Ninous Davoudi

Body Simulating Liquid			Mrasured		Target 1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
2450	22	15	12.1	48.4	51.2	-5.47	± 10
			1g	Normalized to 1 W	Target 10g	Deviation[%]	Limit [%]
			5.6	22.4	23.7	-5.49	± 10

System Validation Dipole: D5GHzV2 SN 1003

Date: December 12, 2005

Ambient Temperature = 25.0°C; Relative humidity = 30% Measured by: Ninous Davoudi

Body Simulating Liquid			Mrasured		Target 1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
5800	24.5	15	19.5	78	74.1	5.26	± 10
			1g	Normalized to 1 W	Target 10g	Deviation[%]	Limit [%]
			5.45	21.8	20.5	6.34	± 10

Date: December 13, 2005

Ambient Temperature = 25.5°C; Relative humidity = 30% Measured by: Ninous Davoudi

Body Simulating Liquid			Mrasured		Target 1g	Deviation[%]	Limit [%]
f (MHz)	Temp. [°C]	Depth [cm]	1g	Normalized to 1 W			
5200	25	15	18.6	74.4	71.8	3.62	± 10
			1g	Normalized to 1 W	Target 10g	Deviation[%]	Limit [%]
			5.27	21.08	20.1	4.88	± 10

5 SAR MEASUREMENT PROCEDURE

A summary of the procedure follows:

a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the EUT. The SAR at this point is measured at the start of the test, and then again at the end of the test.

b) The SAR distribution at the exposed flat section of the flat phantom is measured at a distance of 2.5 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 15 mm x 15 mm. Based on this data, the area of the maximum absorption is determined by Spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

(For 5 GHz band - The SAR distribution at the exposed flat section of the flat phantom is measured at a distance of 2.0 mm from the inner surface of the shell. The area covers the entire dimension of the EUT and the horizontal grid spacing is 10 mm x 10 mm. Based on this data, the area of the maximum absorption is determined by Spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified)

c) Around this point, a volume of X=Y= 30 and Z=21 mm is assessed by measuring 5 x 5 x 7 mm points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:

(For 5 GHz band - Around this point, a volume of X=Y=Z=30 mm is assessed by measuring 8 x 8 x 8 mm points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:)

(i) The data at the surface are extrapolated, since the center of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.

(ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional Splines with the “Not a knot”- condition (in x, y and z-direction). The volume is integrated with the trapezoidal – algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.

(iii) All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

(iv) The SAR value at the same location as in Step (a) is again measured to evaluate the actual power drift.

DASY4 SAR MEASUREMENT PROCEDURE

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties (for example, 1.2 mm for an EX3DV3 probe type).

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures 5 x 5 x 7 points within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

(For 5 GHz band – Same as above except the Zoom Scan measures 8 x 8 x 8 points.)

Step 4: Power drift measurement

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

Step 5: Z-Scan

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

6 PROCEDURES USED TO ESTABLISH TEST SIGNAL

The following procedures had been used to prepare the EUT for the SAR test.

The client provided a special driver and program, installed in the host Apple laptop to set the frequency and control the output power.

The cable assembly insertion loss of 10.12 dB (including 9.92 dB pad and 0.2 dB connectors) was entered as an offset in the power meter to allow for direct reading of power.

802.11b Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	12.80
Middle	2437	17.47
High	2462	13.35

802.11g Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	13.30
Middle	2437	19.50
High	2462	13.60

The cable assembly insertion loss of 9.46 dB (including 9.26 dB pad and 0.2dB connectors) was entered as an offset in the power meter to allow for direct reading of power.

802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5745	17.02
Middle	5785	17.10
High	5825	17.26

The power measurements for 5.2 GHZ band is done using UNII Method with following setting for the spectrum analyzer: RSBW= 1MHz, VBW= 8MHz, Span = 51MHz.

802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5180	13.20
Middle	5260	16.08
High	530	14.26

7 SAR MEASUREMENT RESULT

7.1 SAR Measurement Result @ 2.4GHz

802.11b (1Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
1	2412	0.319	-0.226	0.336	0.80	1.6
6	2437	0.757	-0.256	0.803	0.80	1.6
11	2462	0.229	-0.219	0.241	0.80	1.6
802.11g (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
1	2412	0.365	-0.274	0.389	0.80	1.6
6	2437	1.040	-0.233	**1.097**	0.80	1.6
11	2462	0.205	-0.219	0.216	0.80	1.6
6 [4)]	2437	1.090	0.000	**1.090**	0.80	1.6

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see the attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) Co-location with BlueTooth FCC ID: MCLJ07H081

7.2 SAR Measurement Result @ 5GHz

802.11a, 5.2 GHz (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
36	5180					
52	5260	0.167	0.000	**0.167**	0.80	1.6
64	5320					
52 [4)]	5260	0.153	0.000	**0.153**	0.80	1.6
802.11a, 5.8 GHz (6 Mbps)						
Channel	f (MHz)	Measured 1g (mW/g)	Power Drift (dBm)	Extrapolated 1g (mW/g)	3 dB Limit (mW/g)	Limit (mW/g)
149	5745	0.781	-0.110	0.801	0.80	1.6
157	5785	0.608	0.000	0.608	0.80	1.6
165	5825	1.000	-0.004	**1.001**	0.80	1.6
165 [4)]	5825	0.945	-0.182	**0.985**	0.80	1.6

Notes:

1) The exact method of extrapolation is *measured SAR x 10^(-drift/10)*. The SAR reported at the end of the measurement process by the DASY4 measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process
2) The SAR measured at the middle channel for this configuration is at least 3 dB lower than SAR limit, thus testing at low & high channel is optional.
3) Please see the attachments for the detailed measurement data and plots showing the maximum SAR location of the EUT.
4) Co-location with Bluetooth FCC ID: MCLJ07H081

8 MEASUREMENT UNCERTAINTY

8.1 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
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					11.44	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

8.2 Measurement Uncertainty 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

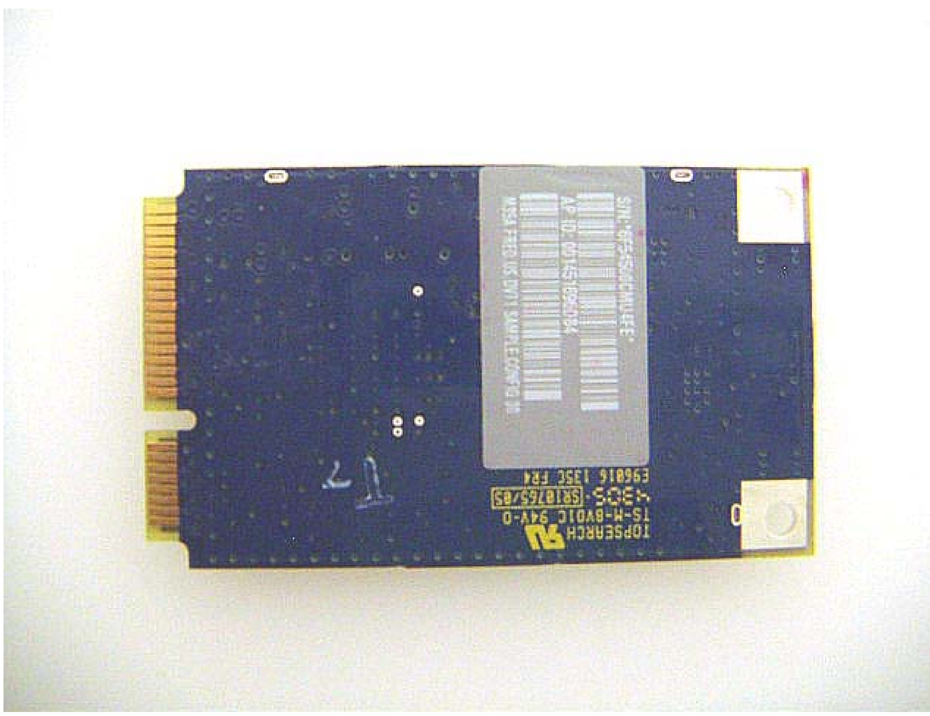
9 EQUIPMENT LIST & CALIBRATION

Name of Equipment	Manufacturer	Type/Model	Serial Number	Cal. Due date
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
S-Parameter Network Analyzer	Agilent	8753ES-6	US39173569	2/9/07
Electronic Probe kit	Hewlett Packard	85070C	N/A	N/A
E-Field Probe	SPEAG	EX3DV3	3531	7/21/06
SAM Phantom (SAM1)	SPEAG	TP-1185	QD000P40CA	N/A
SAM Phantom (SAM2)	SPEAG	TP-1015	N/A	N/A
Data Acquisition Electronics	SPEAG	DAE3 V1	500	2/7/06
System Validation Dipole	SPEAG	D2450V2	748	5/14/06
System Validation Dipole	SPEAG	D5GHzV2	1003	11/22/06
Signal Generator	R&S	SMP 04	DE34210	6/2/06
Power Meter	Giga-tronics	8651A	8651404	12/27/06
Power Sensor	Giga-tronics	80701A	1834588	12/27/07
Amplifier	Mini-Circuits	ZVE-8G	0360	N/A
Amplifier	Mini-Circuits	ZHL-42W	D072701-5	N/A
Radio Communication Tester	R&S	CMU 200	838114/032	12/17/06
Simulating Liquid	CCS	M2450	N/A	Within 24 hrs of first test
Simulating Liquid	SPEAG	M5200-5800	N/A	Within 24 hrs of first test

10 EUT PHOTOS

EUT PHOTOS

AR5BXB6 802.11abg PCI Express module



HOST DEVICE
Apple 15" Power Book

11 ATTACHMENT

No.	Contents	No. of page (s)
1	System Performance Check Plots	6
2-1	SAR Test Plots (2.4 GHz)	8
2-2	SAR Test Plots (5 GHz)	8
3	Certificate of E-filed Probe EX3DV4 SN 3531	10
4	Certificate of System Validation Dipole D2450V2 SN 748	9
5	Certificate of System Validation Dipole D5GHzV2 SN 1003	10
6	Material Specification Data Sheet of Body Simulating Liquid (5GHz)	3

END OF REPORT