Lab Code: 200167-0

FCC PART 15.247

INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007

MEASUREMENT AND TEST REPORT

For

Ruckus Wireless, Inc.

880 West Maude Ave
Sunnyvale, CA 94085, USA

FCC ID: S9GMM2225
IC ID: 5912A-MM2225
Model: MM2211, MM2225, MM22x1

Report Type:	**Product Type:**
☒ Class II Permissive Change: Supplemental Report (rev.1)	Wireless 802.11b/g Router

Test Engineer(s):	Oscar Au
Report Number:	R0706211a
Report Date:	2007-06-25
Reviewed By:	James Ma, Test Engineer
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1 GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Ruckus Wireless, Inc.* product, *FCC ID: S9GMM2225, IC: 5912A-MM2225, models: MM2211, MM2225, MM22x1* or the "EUT" as referred to this report are Wireless 802.11b/g Router which operates from 2412 – 2462 MHz and utilizes DSSS and OFDM modulation techniques. Each model is identical with regard to router hardware and software but are differentiated by the antenna that it is marketed with (internal, external omni, or external patch). Please see technical specifications for additional details.

1.2 Mechanical Description of EUT

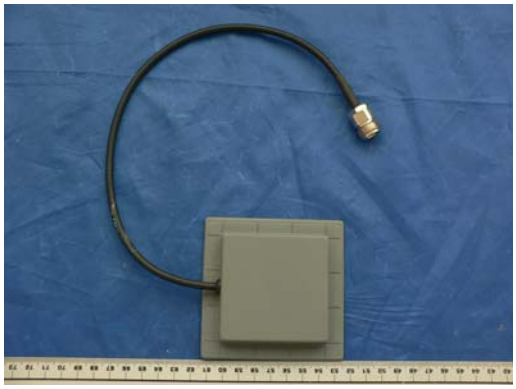
The *Ruckus Wireless, Inc.* product, *FCC ID: S9GMM2225, IC: 5912A-MM2225, models: MM2211, MM2225, MM22x1,* are of plastic construction and measure approximately 233 mm (L) x 153 mm (W) x 75 mm (H), weighing approximately *120 g*.

1.3 Antenna Description

Item Number	Model/Type	
Antenna 1	Model number:	MET-ANT-OMNI-W9-RPSMA
	Manufacturer:	Metrix Communication LLC
	Frequency Range:	2.4-2.5 GHz
	Connector Type/ Maximum Gain	Reverse Polarity SMA Plug/ 9 dBi
	Antenna Type/ Pattern:	Monopole / omni-directional
	Measurement:	Length: 13 mm (D) x 137 mm (L); Weight: 20 g

Item Number	Model/Type	
Antenna 2	Model number:	MET-ANT-9DBI-MOBILE-PATCH
	Manufacturer:	Metrix Communication LLC
	Frequency Range:	2.4-2.5 GHz
	Connector Type/ Maximum Gain	N-type female Plug/ 9 dBi with 1 dBi cable loss
	Antenna Type/ Pattern:	Patch / directional
	Measurement:	Length: 80 mm (L) x 80 mm (H) x 15 mm (W); Weight: 20 g

Omni antenna



Patch antenna

1.4 EUT Photograph

Please refer to Exhibit C for addition EUT photographs.

1.5 Objective

This permissive change II supplemental report is prepared on behalf of *Ruckus Wireless, Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules and Industry Canada RSS-210 Issue 7, June 2007

The objective is to determine compliance with FCC and IC standards rules and limits for Antenna Requirements, conducted emissions, and Spurious Emissions after the addition of two external antennae detailed in the Antenna Description section of this report and in Exhibit C.

1.6 Related Submittal(s)/Grant(s)

Please refer to Bay Area Compliance Laboratories Corp's project number: R0604185 (FCC ID: S9GMM2225, and IC: 5912A-MM2225) for all original test data and all compliance information not covered by this supplemental report.

1.7 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.8 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from $\pm$2.0 for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.9 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: C-2463 and R-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The host system was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the testing mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The EUT is programmed with the following data rate settings that were used during testing:

Channel	2412 MHz	2437 MHz	2462 MHz
802.11b Data rate	11Mbps	11Mbps	11Mbps
802.11g Data rate	24Mbps	24Mbps	24Mbps

2.3 Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
IBM	Laptop	Satellite R15-S829	Y5040228H

3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC & RSS-210 RULES	DESCRIPTION OF TEST	RESULT	NOTE
FCC §15.247 (e) (i) and §2.1091,IC RSS-Gen 5.5 & RSS-102	RF Exposure	Compliant	-
FCC §15.203, IC RSS-Gen §7.1.4	Antenna Requirement	Compliant	-
FCC §15.207,IC RSS-Gen §7.2.2	Conducted Emissions	Compliant	-
FCC §2.1051 & §15.247(d)	Spurious Emissions at Antenna Port	Compliant	Please see original report
FCC §15.205	Restricted Band	Compliant	Please see original report
FCC §15.109, §15.205, §15.209 & §15.247(c), IC RSS-Gen §4.9	Radiated Spurious Emissions	Compliant	-
RSS-Gen §6(a)	Receiver Spurious Emissions	Compliant	-
§15.247 (a)(2)	6 dB Bandwidth	Compliant	Please see original report
§15.247 (b)(3), RSS210 § A8.4	Maximum Peak Output Power	Compliant	Please see original report
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant	Please see original report
§15.247 (e), RSS-210 §A8.2 (2)	Power Spectral Density	Compliant	Please see original report
RSS-210 §A8.2	99% Bandwidth	Compliant	Please see original report
RSS210 §A8.5	Out of Band Emission	Compliant	Please see original report

4 FCC §15.247 (i) and §2.1091, IC RSS-Gen 5.5 & RSS-102 - RF EXPOSURE

4.1 Applicable Standard

According to §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

4.2 MPE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm):	23.01
Maximum peak output power at antenna input terminal (mW):	200.00
Prediction distance (cm):	20
Prediction frequency (MHz):	2437
Maximum Antenna Gain, typical (dBi):	9.0
Maximum Antenna Gain (numeric):	7.9433
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.3161
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

4.3 Test Result

The power density level at 20 cm is 0.3153 mW/cm^2, which is below the uncontrolled exposure limit of 1.0mW/cm^2 at 2437 MHz.

According to RSS-102 Issue 2, November 2005 §2.5.2 exception from Routine Evaluation Limits- RF Exposure Evaluation:

RF exposure evaluation is required if the separation distance between the user and the device is greater than 20 cm, except when the device operates:

1) below 1.5 GHz and its e.i.r.p. is equal to or less than 2.5 W;
2) at or above 1.5 GHz and the e.i.r.p. of the device is equal to or less than 5 W.

RF limits for device used by the general public is provided hereinafter table:

Frequency Range (MHZ)	Electric Field (V/M rms)	Magnetic Field (A/m rms)	Power Density (W/m2)	Time Averaging (min)
0.003 – 1	280	2.19	-	6
1 – 10	280 / f	2.19 / f	-	6
10 – 30	28	2.19 / f	-	6
30 – 300	28	0.073	2*	6
300 - 1500	$1.585\ f^{0.5}$	$0.0042\ f^{0.5}$	f / 150	6
1500 – 15 000	61.4	0.163	10	6
15 000 – 150 000	61.4	0.163	10	$616000 / f^{1.2}$
150 000 – 300 000	$f^{0.5}$	$4.21 \times 10^{-4}\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000 / f^{1.2}$

Note: f is the frequency in MHz
* Power density limit applicable at frequency greater than 100 MHz.

4.4 Result

The power of this device is 23.01 dBm (200 mW) for 802.11b mode and 22.79 dBm (190.00 mW) for 802.11g mode, and the antenna gain used for evaluation was 9 dBi (representing the worst case), according to RSS-102 section 2.5.2, this device exempt the RF exposure evaluation is.

5 FCC §15.203, IC RSS-Gen §7.1.4 – ANTENNA REQUIREMENT

5.1 Applicable Standard

According to FCC §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

As per IC RSS-Gen §7.1.4: Transmitter Antenna, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

5.2 Result

The antennae model: MET-ANT-OMNI-W9-RPSMA and MET-ANT-9DBI-MOBILE-PATCH for this device are omni-directional and patch style antennae both with a maximum gain of 9 dBi. The omnidirectional model utilizes a reverse polarity SMA plug and the patch model utilizes an N-type female plug; both prevent the attachment of other non approved/aftermarket antennae.

☒ **Compliant** ☐ **N/A**

Please refer to the following antenna photos for details.

Antenna photo

6 FCC §15.207, IC RSS-Gen §7.2.2 - CONDUCTED EMISSIONS

6.1 Section 15.207 & RSS-Gen 7.2.2 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

** Decreases with the logarithm of the frequency.*

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was powered via connection to AC/DC adapter which was plugged into the LISN.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Solar Electronics	LISN	9252-R-24-BNC	511205	7/7/2006
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100338	4/5/2007
Sunol Science Corp	System Controller	SC99V	113005-1	NA

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

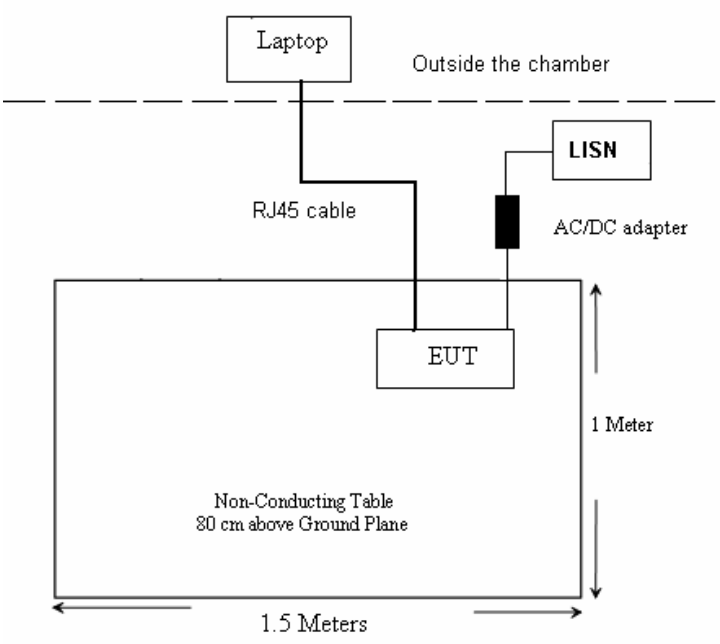
6.4 Test Procedure

During the conducted emissions test, the power cord of the system was connected to the main outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a "QP". Average readings are distinguished with an "Ave".

6.5 Test Setup Diagram



6.6 Environmental Conditions

Temperature:	20 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

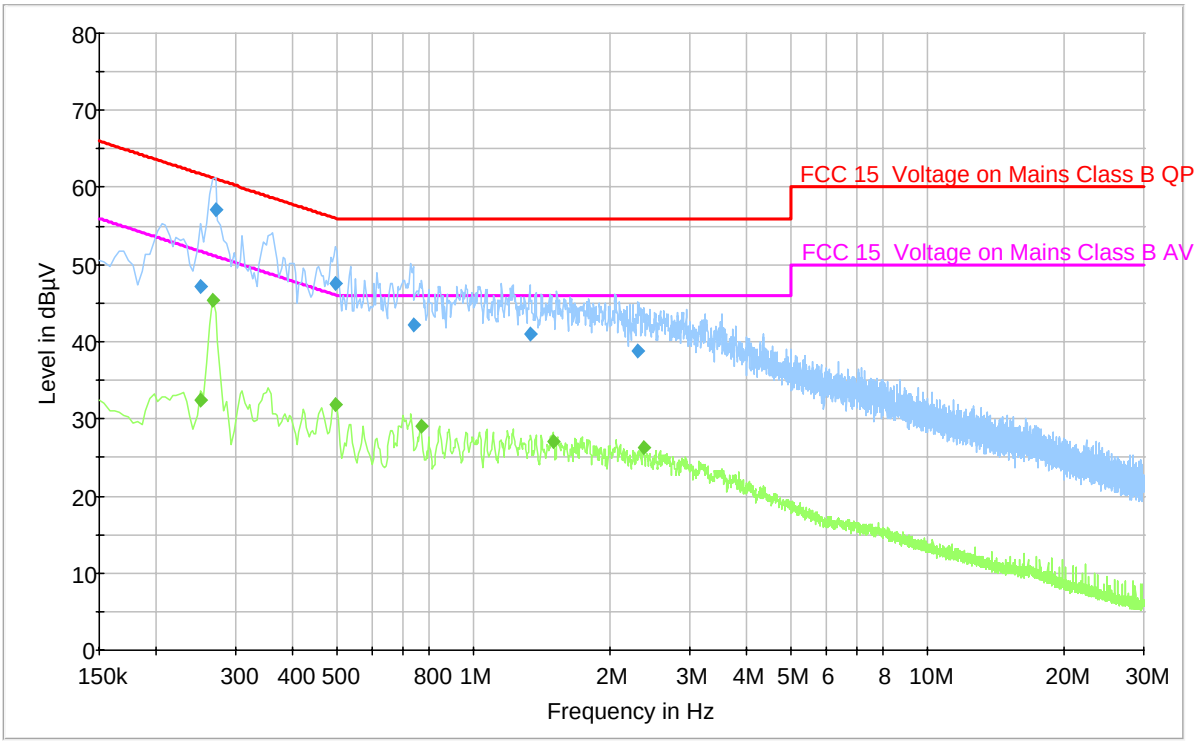
**The testing was performed by Oscar Au from 2007-06-22.*

6.7 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC & IC standard's conducted emissions limits for Class B devices, with the *worst* margin reading of:

Connection: AC/DC Adapter			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Hot/Neutral)**	**Range (MHz)**
-4.1	0.27000	Hot	0.150 MHz to 30 MHz

120V/60 Hz Hot:



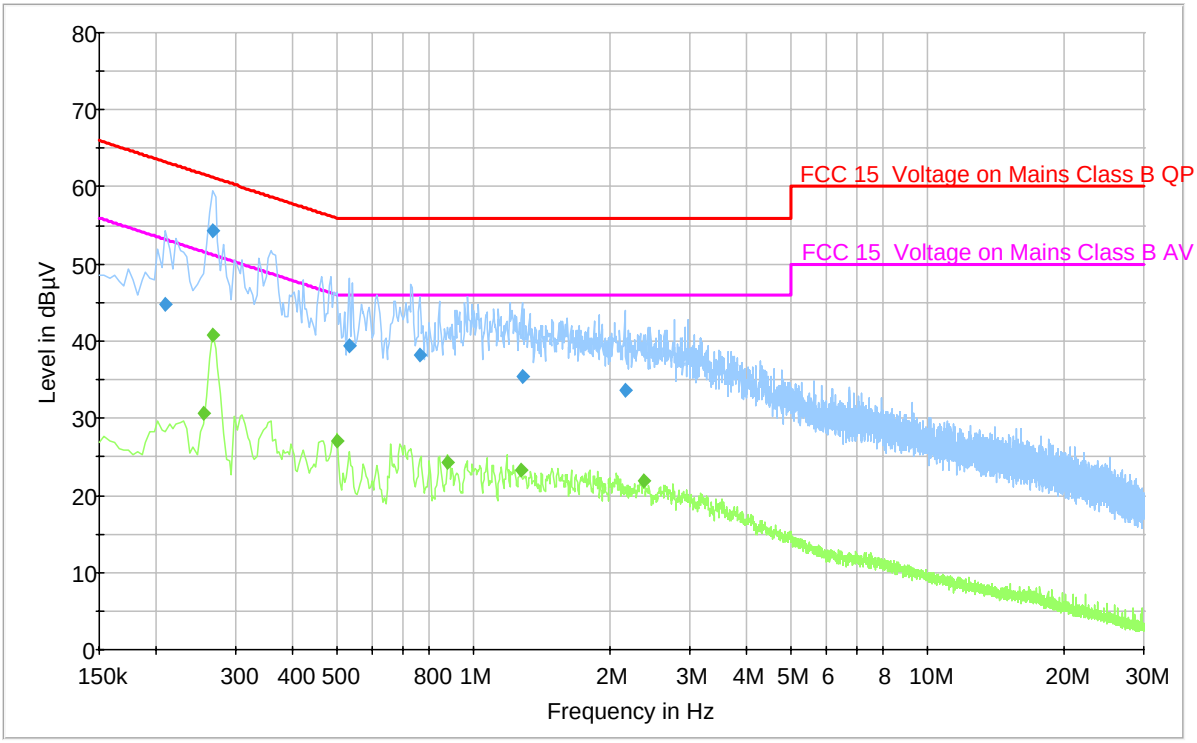
Final Measurement Quasi-Peak Detector

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Hot/Neutral)	Limit (dBµV)	Margin (dB)
0.270000	57.0	H	61.1	-4.1
0.498000	47.6	H	56.0	-8.4
0.738000	42.2	H	56.0	-13.8
0.250000	47.1	H	61.8	-14.7
1.334000	41.0	H	56.0	-15.0
2.310000	38.8	H	56.0	-17.2

Final Measurement Average Detector

Frequency (MHz)	Average (dBµV)	Conductor (Hot/Neutral)	Limit (dBµV)	Margin (dB)
0.266000	45.4	H	51.2	-5.8
0.498000	31.9	H	46.0	-14.2
0.766000	29.0	H	46.0	-17.0
1.498000	27.0	H	46.0	-19.0
0.250000	32.4	H	51.8	-19.3
2.370000	26.3	H	46.0	-19.7

120V/60 Hz Neutral:



Final Measurement Quasi-Peak Detector

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Hot/Neutral)	Limit (dBµV)	Margin (dB)
0.266000	54.4	N	61.2	-6.9
0.534000	39.4	N	56.0	-16.6
0.762000	38.1	N	56.0	-17.9
0.210000	44.8	N	63.2	-18.4
1.282000	35.4	N	56.0	-20.6
2.158000	33.7	N	56.0	-22.3

Final Measurement Average Detector

Frequency (MHz)	Average (dBµV)	Conductor (Hot/Neutral)	Limit (dBµV)	Margin (dB)
0.266000	40.7	N	51.2	-10.5
0.502000	27.2	N	46.0	-18.8
0.254000	30.6	N	51.6	-21.0
0.878000	24.2	N	46.0	-21.8
1.270000	23.2	N	46.0	-22.8
2.374000	21.9	N	46.0	-24.1

7 FCC §15.109, §15.205, §15.209 & §15.247(c), IC RSS-Gen §4.9 - SPURIOUS RADIATED EMISSIONS

7.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247(c)(1)(i): Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

IC RSS-GEN §4.9 the measurement method shall be described in the test report. The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements. The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

7.2 Test Setup

The radiated emissions tests were performed in the 3-meter open area test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

7.3 EUT Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

7.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonoma Instruments	Pre amplifier	317	260407	2006-03-20 (2 yrs)
HP	Pre amplifier	8449B	3147A00400	2006-08-21
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
Agilent	Spectrum Analyzer	E4440A	MY44303352	2007-03-07
A.R.A	Antenna Horn	DRG-118/A	1132	2006-08-17

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

7.5 Test Procedure

For the radiated emissions test, the EUT, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 mete, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

7.6 Corrected Amplitude & Margin Calculation

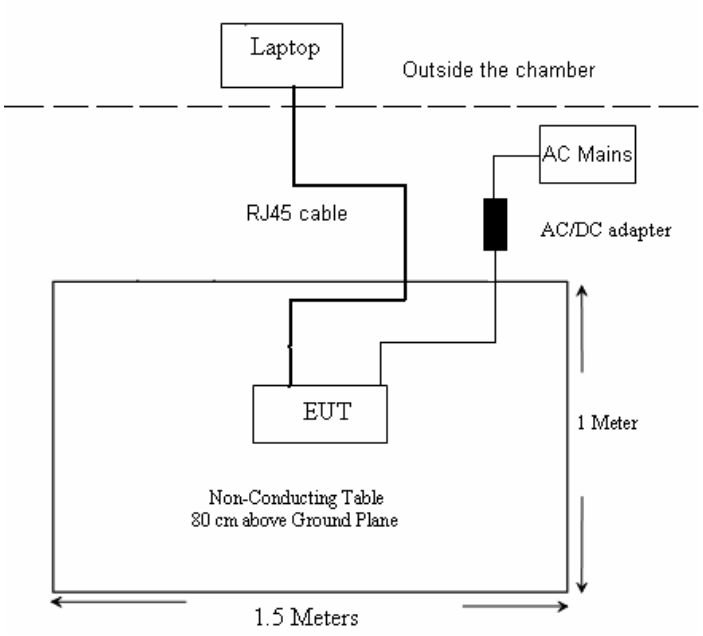
The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit.
The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

7.7 Test Setup Diagram



7.8 Environmental Conditions

Temperature:	22 °C
Relative Humidity:	51 %
ATM Pressure:	102.1 kPa

** The testing was performed by Oscar Au on 2007-06-22.*

7.9 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC and IC requirements, and had the worst margin readings of:

Unintentional Emissions, (30-1000 MHz):

Mode: Receiver			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-0.3	175.015000	Horizontal	30 MHz to 1000 MHz

Out of Band Emissions:

Mode: Omni Antenna 802.11 b (2412-2462 MHz)			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range (GHz)**
-1.0	4824.0000	Vertical	Low, 1 GHz – 25GHz
-1.1	4874.0000	Vertical	Middle, 1 GHz – 25GHz
-6.4	9848.0000	Vertical	High, 1 GHz – 25GHz

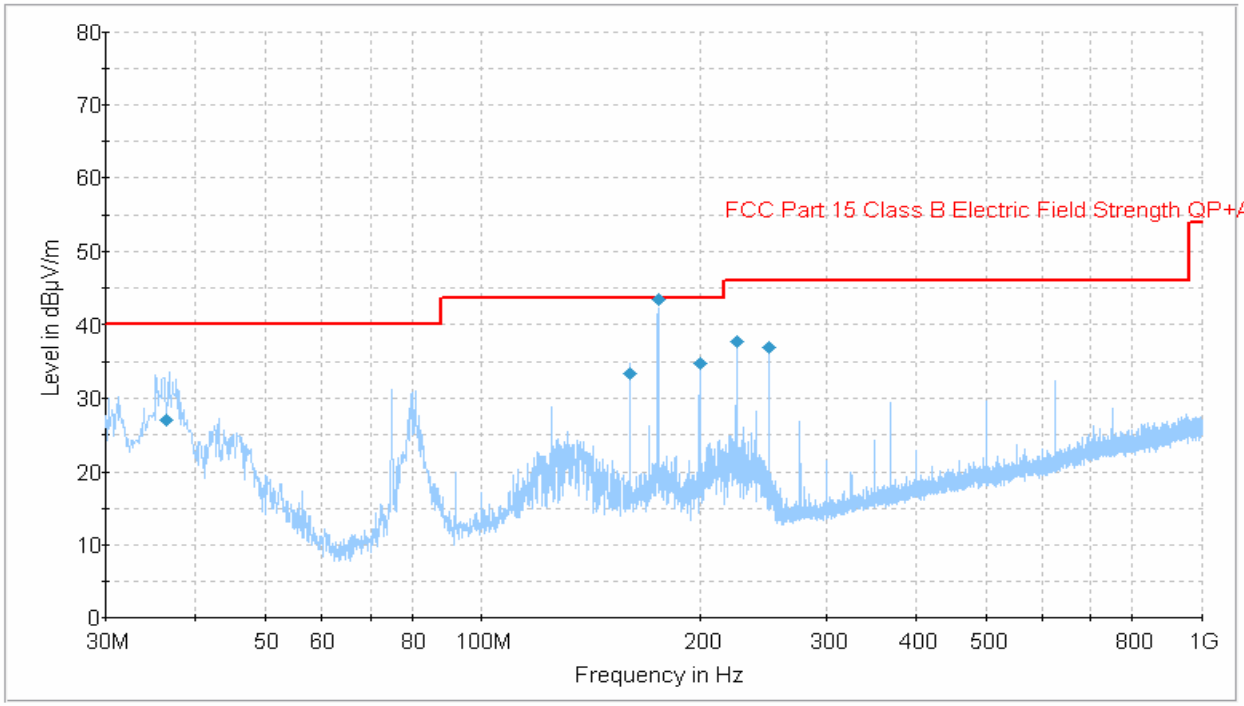
Mode: Omni Antenna 802.11 g (2412-2462 MHz)			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range (GHz)**
-2.0	4824.0000	Vertical	Low, 1 GHz – 25GHz
-2.1	4874.0000	Vertical	Middle, 1 GHz – 25GHz
-8.3	7386.0000	Horizontal	High, 1 GHz – 25GHz

Mode: Patch Antenna 802.11 b (2412-2462 MHz)			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range (GHz)**
-3.0	4824.0000	Horizontal	Low, 1 GHz – 25GHz
-1.7	4874.0000	Vertical	Middle, 1 GHz – 25GHz
-8.0	4924.0000	Horizontal	High, 1 GHz – 25GHz

Mode: Patch Antenna 802.11 g (2412-2462 MHz)			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range (GHz)**
-2.8	4824.0000	Vertical	Low, 1 GHz – 25GHz
-5.3	4874.0000	Vertical	Middle, 1 GHz – 25GHz
-6.9	4924.0000	Horizontal	High, 1 GHz – 25GHz

7.10 Radiated Emissions Test plot & data:

Primary scan 30MHz -1GHz



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (degrees)	Limit (dBµV/m)	Margin (dB)
175.015000	43.2	171.8	H	247.0	43.5	-0.3
225.030000	37.9	134.0	H	262.0	46.0	-8.1
199.992500	34.8	156.9	H	262.0	43.5	-8.7
250.008750	37.0	128.8	H	283.0	46.0	-9.0
160.040000	33.4	173.6	H	258.0	43.5	-10.1
36.370000	27.0	99.9	V	328.0	40.0	-13.0

7.11 Radiated Spurious Emissions Test Data

Omni-directional antenna (9 dBi)

802.11b, 2412 - 2462 MHz, Measured at 3 meters, 1 GHz – 25 GHz

Low channel 2412 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
4824.0000	47.5	224	1.4	V	32.5	7.8	34.8	53.0	54	-1.0	Ave
4824.0000	47.0	80	1.8	H	32.5	7.8	34.8	52.5	54	-1.5	Ave
4824.0000	61.1	224	1.4	V	32.5	7.8	34.8	66.6	74	-7.4	Peak
4824.0000	60.6	80	1.8	H	32.5	7.8	34.8	66.1	74	-7.9	Peak
7236.0000	32.5	120	1.4	V	36.7	9.9	34.9	44.2	54	-9.8	Ave
7236.0000	31.8	150	1.3	H	36.7	9.9	34.9	43.5	54	-10.5	Ave
9648.0000	27.6	50	1.4	H	38.1	12.0	36.9	40.8	54	-13.2	Ave
9648.0000	26.5	120	1.6	V	38.1	12.0	36.9	39.7	54	-14.3	Ave
7236.0000	42.7	120	1.4	V	36.7	9.9	34.9	54.4	74	-19.6	Peak
7236.0000	41.3	150	1.3	H	36.7	9.9	34.9	53.0	74	-21.0	Peak
9648.0000	37.2	120	1.6	V	38.1	12.0	36.9	50.4	74	-23.6	Peak
9648.0000	36.9	50	1.4	H	38.1	12.0	36.9	50.1	74	-23.9	Peak

Middle channel 2437 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
4874.0000	47.4	355	1.6	V	32.5	7.8	34.8	52.9	54	-1.1	Ave
9748.0000	39.5	140	1.6	V	38.1	12.0	36.7	52.9	54	-1.1	Ave
9748.0000	39.2	160	1.7	H	38.1	12.0	36.7	52.6	54	-1.4	Ave
4874.0000	45.6	80	1.8	H	32.5	7.8	34.8	51.1	54	-2.9	Ave
4874.0000	61.1	355	1.6	V	32.5	7.8	34.8	66.6	74	-7.4	Peak
4874.0000	59.2	80	1.8	H	32.5	7.8	34.8	64.7	74	-9.3	Peak
7311.0000	30.6	230	1.6	V	36.7	9.9	35.1	42.1	54	-11.9	Ave
7311.0000	29.8	150	1.5	H	36.7	9.9	35.1	41.3	54	-12.7	Ave
9748.0000	43.7	140	1.6	V	38.1	12.0	36.7	57.1	74	-16.9	Peak
9748.0000	42.3	160	1.7	H	38.1	12.0	36.7	55.7	74	-18.3	Peak
7311.0000	41.3	230	1.6	V	36.7	9.9	35.1	52.8	74	-21.2	Peak
7311.0000	39.7	150	1.5	H	36.7	9.9	35.1	51.2	74	-22.8	Peak

High channel 2462 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
9848.0000	34.5	53	1.4	V	38.1	12.0	37.0	47.6	54	-6.4	Ave
9848.0000	33.4	70	1.6	H	38.1	12.0	37.0	46.5	54	-7.5	Ave
4924.0000	40.6	130	1.5	V	32.5	7.8	35.0	45.9	54	-8.1	Ave
7386.0000	32.5	330	1.3	V	36.7	9.9	35.1	44.0	54	-10.0	Ave
4924.0000	38.3	220	1.3	H	32.5	7.8	35.0	43.6	54	-10.4	Ave
7386.0000	30.4	150	1.5	H	36.7	9.9	35.1	41.9	54	-12.1	Ave
4924.0000	54.5	130	1.5	V	32.5	7.8	35.0	59.8	74	-14.2	Peak
4924.0000	51.4	220	1.3	H	32.5	7.8	35.0	56.7	74	-17.3	Peak
7386.0000	43.3	330	1.3	V	36.7	9.9	35.1	54.8	74	-19.2	Peak
9848.0000	41.7	53	1.4	V	38.1	12.0	37.0	54.8	74	-19.2	Peak
9848.0000	40.2	70	1.6	H	38.1	12.0	37.0	53.3	74	-20.7	Peak
7386.0000	41.2	150	1.5	H	36.7	9.9	35.1	52.7	74	-21.3	Peak

Omni-directional antenna (9 dBi)

802.11g: 2412 – 2462 MHz, Measured at 3 meters

Low channel 2412 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
4824.0000	46.5	223	1.5	V	32.5	7.8	34.8	52.0	54	-2.0	Ave
4824.0000	45.1	180	1.6	H	32.5	7.8	34.8	50.6	54	-3.4	Ave
9648.0000	37.0	350	1.7	V	38.1	12.0	36.9	50.2	54	-3.8	Ave
9648.0000	35.7	260	1.6	H	38.1	12.0	36.9	48.9	54	-5.1	Ave
7236.0000	34.5	110	2.0	V	36.7	9.9	34.9	46.2	54	-7.8	Ave
4824.0000	60.3	223	1.5	V	32.5	7.8	34.8	65.8	74	-8.2	Peak
7236.0000	32.6	220	1.8	H	36.7	9.9	34.9	44.3	54	-9.7	Ave
4824.0000	58.6	180	1.6	H	32.5	7.8	34.8	64.1	74	-9.9	Peak
7236.0000	44.6	110	2.0	V	36.7	9.9	34.9	56.3	74	-17.7	Peak
9648.0000	40.9	350	1.7	V	38.1	12.0	36.9	54.1	74	-19.9	Peak
7236.0000	40.8	220	1.8	H	36.7	9.9	34.9	52.5	74	-21.5	Peak
9648.0000	38.5	260	1.6	H	38.1	12.0	36.9	51.7	74	-22.3	Peak

Middle channel 2437 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
4874.0000	46.4	136	1.6	V	32.5	7.8	34.8	51.9	54	-2.1	Ave
4874.0000	44.1	120	1.5	H	32.5	7.8	34.8	49.6	54	-4.4	Ave
7311.0000	32.8	75	1.3	V	36.7	9.9	35.1	44.3	54	-9.7	Ave
7311.0000	52.6	75	1.3	V	36.7	9.9	35.1	64.1	74	-9.9	Peak
4874.0000	56.9	136	1.6	V	32.5	7.8	34.8	62.4	74	-11.6	Peak
9748.0000	28.9	230	1.3	V	38.1	12.0	36.7	42.3	54	-11.7	Ave
7311.0000	30.3	90	1.6	H	36.7	9.9	35.1	41.8	54	-12.2	Ave
7311.0000	49.5	90	1.6	H	36.7	9.9	35.1	61.0	74	-13.0	Peak
9748.0000	27.4	160	1.4	H	38.1	12.0	36.7	40.8	54	-13.2	Ave
4874.0000	53.2	120	1.5	H	32.5	7.8	34.8	58.7	74	-15.3	Peak
9748.0000	40.2	230	1.3	V	38.1	12.0	36.7	53.6	74	-20.4	Peak
9748.0000	36.5	160	1.4	H	38.1	12.0	36.7	49.9	74	-24.1	Peak

High channel 2462 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
7386.0000	54.2	90	1.6	H	36.7	9.9	35.1	65.7	74	-8.3	Peak
4924.0000	40.2	220	1.3	V	32.5	7.8	35.0	45.5	54	-8.5	Ave
7386.0000	33.8	90	1.6	H	36.7	9.9	35.1	45.3	54	-8.7	Ave
7386.0000	53.5	30	1.3	V	36.7	9.9	35.1	65.0	74	-9.0	Peak
4924.0000	39.4	110	1.5	H	32.5	7.8	35.0	44.7	54	-9.3	Ave
7386.0000	33.2	30	1.3	V	36.7	9.9	35.1	44.7	54	-9.3	Ave
9848.0000	29.2	160	1.3	H	38.1	12.0	37.0	42.3	54	-11.7	Ave
9848.0000	29.0	300	1.4	V	38.1	12.0	37.0	42.1	54	-11.9	Ave
4924.0000	52.3	220	1.3	V	32.5	7.8	35.0	57.6	74	-16.4	Peak
4924.0000	51.5	110	1.5	H	32.5	7.8	35.0	56.8	74	-17.2	Peak
9848.0000	40.9	160	1.3	H	38.1	12.0	37.0	54.0	74	-20.0	Peak
9848.0000	40.7	300	1.4	V	38.1	12.0	37.0	53.8	74	-20.2	Peak

Patch antenna (9 dBi)

802.11b, 2412 - 2462 MHz, Measured at 3 meters, 1 GHz – 25 GHz

Low channel 2412 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
4824.0000	45.5	90	1.6	H	32.5	7.8	34.8	51.0	54	-3.0	Ave
4824.0000	42.1	260	1.8	V	32.5	7.8	34.8	47.6	54	-6.4	Ave
4824.0000	58.5	90	1.6	H	32.5	7.8	34.8	64.0	74	-10.0	Peak
7236.0000	30.7	73	1.8	V	36.7	9.9	34.9	42.4	54	-11.6	Ave
4824.0000	54.8	260	1.8	V	32.5	7.8	34.8	60.3	74	-13.7	Peak
7236.0000	28.6	95	1.5	H	36.7	9.9	34.9	40.3	54	-13.7	Ave
9648.0000	26.9	15	1.7	V	38.1	12.0	36.9	40.1	54	-13.9	Ave
9648.0000	24.8	10	1.6	H	38.1	12.0	36.9	38.0	54	-16.0	Ave
7236.0000	41.0	73	1.8	V	36.7	9.9	34.9	52.7	74	-21.3	Peak
7236.0000	38.8	95	1.5	H	36.7	9.9	34.9	50.5	74	-23.5	Peak
9648.0000	34.5	15	1.7	V	38.1	12.0	36.9	47.7	74	-26.3	Peak
9648.0000	33.1	10	1.6	H	38.1	12.0	36.9	46.3	74	-27.7	Peak

Middle channel 2437 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
4874.0000	46.8	245	1.6	V	32.5	7.8	34.8	52.3	54	-1.7	Ave
4874.0000	46.3	83	1.5	H	32.5	7.8	34.8	51.8	54	-2.2	Ave
9748.0000	32.2	340	1.8	V	38.1	12.0	36.7	45.6	54	-8.4	Ave
9748.0000	32.1	300	1.5	H	38.1	12.0	36.7	45.5	54	-8.5	Ave
4874.0000	59.5	245	1.6	V	32.5	7.8	34.8	65.0	74	-9.0	Peak
4874.0000	58.8	83	1.5	H	32.5	7.8	34.8	64.3	74	-9.7	Peak
7311.0000	30.1	78	1.6	V	36.7	9.9	35.1	41.6	54	-12.4	Ave
7311.0000	27.1	70	1.4	H	36.7	9.9	35.1	38.6	54	-15.4	Ave
7311.0000	39.9	78	1.6	V	36.7	9.9	35.1	51.4	74	-22.6	Peak
9748.0000	37.1	340	1.8	V	38.1	12.0	36.7	50.5	74	-23.5	Peak
9748.0000	36.3	300	1.5	H	38.1	12.0	36.7	49.7	74	-24.3	Peak
7311.0000	37.9	70	1.4	H	36.7	9.9	35.1	49.4	74	-24.6	Peak

High channel 2462 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
4924.0000	40.2	120	1.4	H	32.5	8.3	35.0	46.0	54	-8.0	Ave
4924.0000	40.1	145	1.5	V	32.5	8.3	35.0	45.9	54	-8.1	Ave
9848.0000	31.7	160	1.4	V	38.1	12.0	37.0	44.8	54	-9.2	Ave
9848.0000	31.4	120	1.5	H	38.1	12.0	37.0	44.5	54	-9.5	Ave
7386.0000	31.1	95	1.5	H	36.7	10.0	35.1	42.7	54	-11.3	Ave
7386.0000	30.8	200	1.3	V	36.7	10.0	35.1	42.4	54	-11.6	Ave
4924.0000	52.8	145	1.5	V	32.5	8.3	35.0	58.6	74	-15.4	Peak
4924.0000	52.5	120	1.4	H	32.5	8.3	35.0	58.3	74	-15.7	Peak
7386.0000	41.6	95	1.5	H	36.7	10.0	35.1	53.2	74	-20.8	Peak
7386.0000	41.3	200	1.3	V	36.7	10.0	35.1	52.9	74	-21.1	Peak
9848.0000	38.1	160	1.4	V	38.1	12.0	37.0	51.2	74	-22.8	Peak
9848.0000	37.8	120	1.5	H	38.1	12.0	37.0	50.9	74	-23.1	Peak

Patch Antenna (9 dBi)

802.11g: 2412 – 2462 MHz, Measured at 3 meters

Low channel 2412 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
4824.0000	45.7	128	1.8	V	32.5	7.8	34.8	51.2	54	-2.8	Ave
4824.0000	42.3	200	1.4	H	32.5	7.8	34.8	47.8	54	-6.2	Ave
4824.0000	59.1	128	1.8	V	32.5	7.8	34.8	64.6	74	-9.4	Peak
9648.0000	30.6	52	1.2	V	38.1	12.0	36.9	43.8	54	-10.2	Ave
7236.0000	28.9	100	1.4	H	36.7	9.9	34.9	40.6	54	-13.4	Ave
4824.0000	54.9	200	1.4	H	32.5	7.8	34.8	60.4	74	-13.6	Peak
7236.0000	28.5	120	1.3	V	36.7	9.9	34.9	40.2	54	-13.8	Ave
9648.0000	25.4	200	1.5	H	38.1	12.0	36.9	38.6	54	-15.4	Ave
7236.0000	43.1	100	1.4	H	36.7	9.9	34.9	54.8	74	-19.2	Peak
9648.0000	39.8	200	1.5	H	38.1	12.0	36.9	53.0	74	-21.0	Peak
7236.0000	39.2	120	1.3	V	36.7	9.9	34.9	51.0	74	-23.1	Peak
9648.0000	36.9	52	1.2	V	38.1	12.0	36.9	50.1	74	-23.9	Peak

Middle channel 2437 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
4874.0000	43.2	130	1.7	V	32.5	7.8	34.8	48.7	54	-5.3	Ave
4874.0000	42.6	220	1.5	H	32.5	7.8	34.8	48.1	54	-5.9	Ave
9748.0000	29.1	260	1.7	H	38.1	12.0	36.7	42.5	54	-11.5	Ave
7311.0000	30.3	180	1.6	H	36.7	9.9	35.1	41.8	54	-12.2	Ave
4874.0000	55.5	130	1.7	V	32.5	7.8	34.8	61.0	74	-13.0	Peak
9748.0000	27.5	290	1.9	V	38.1	12.0	36.7	40.9	54	-13.1	Ave
7311.0000	28.8	190	1.8	V	36.7	9.9	35.1	40.3	54	-13.7	Ave
4874.0000	54.2	220	1.5	H	32.5	7.8	34.8	59.7	74	-14.3	Peak
7311.0000	42.6	180	1.6	H	36.7	9.9	35.1	54.1	74	-19.9	Peak
9748.0000	40.5	260	1.7	H	38.1	12.0	36.7	53.9	74	-20.1	Peak
9748.0000	38.7	290	1.9	V	38.1	12.0	36.7	52.1	74	-21.9	Peak
7311.0000	40.1	190	1.8	V	36.7	9.9	35.1	51.6	74	-22.4	Peak

High channel 2462 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polar. H / V	Antenna Factor (dB/m)	Cable loss (dB)	Pre-Amplifier (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
4924.0000	41.8	220	1.6	H	32.5	7.8	35.0	47.1	54	-6.9	Ave
4924.0000	41.4	140	1.5	V	32.5	7.8	35.0	46.7	54	-7.3	Ave
7386.0000	33.2	125	1.6	V	36.7	9.9	35.1	44.7	54	-9.3	Ave
7386.0000	32.5	160	1.5	H	36.7	9.9	35.1	44.0	54	-10.0	Ave
4924.0000	54.5	220	1.6	H	32.5	7.8	35.0	59.8	74	-14.2	Peak
4924.0000	53.6	140	1.5	V	32.5	7.8	35.0	58.9	74	-15.1	Peak
9848.0000	25.5	248	1.5	V	38.1	12.0	37.0	38.6	54	-15.4	Ave
9848.0000	24.7	180	1.3	H	38.1	12.0	37.0	37.8	54	-16.2	Ave
7386.0000	45.4	125	1.6	V	36.7	9.9	35.1	56.9	74	-17.1	Peak
7386.0000	44.3	160	1.5	H	36.7	9.9	35.1	55.8	74	-18.2	Peak
9848.0000	38.8	248	1.5	V	38.1	12.0	37.0	51.9	74	-22.1	Peak
9848.0000	37.5	180	1.3	H	38.1	12.0	37.0	50.6	74	-23.4	Peak