FCC PART 15.247

EMI MEASUREMENT AND TEST REPORT

For

Ruckus Wireless

883 North Shoreline Blvd, Suite A-100
CA 94043, USA

FCC ID: S9GVX2X25

This Report Concerns:	Equipment Type:
☒ Original Report	802.11b/g Access Point

Test Engineer:	Daniel Deng/ Taylor Tsai
Report No.:	R0602242
Report Date:	2006-03-08
Reviewed By:	James Ma
Prepared By:	Bay Area Compliance Laboratory Corporation (BACL) 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Ruckus Wireless* product, *FCC ID: S9GVX2X25*, or the "EUT" as referred to this report is a 2.4GHz 802.11b/g Access Point, which measures approximately 233mmL x 153mmW x 75mmH and the EUT operates at the frequency range of 2412~2462MHz.

** The test data gathered are from typical production sample, serial number: AP51 provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Ruckus Wireless* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for Output Power, Antenna Requirements, 6 dB Bandwidth, power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emission, Conducted and Spurious Radiated Emission.

Related Submittal(s)/Grant(s)

No Related Submittals.

Test Methodology

All measurements contained in this report were conducted 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.

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.

Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the parking lot of the building at 230 Commercial Street, Sunnyvale, California 94085, USA.

Test site at BACL has 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 and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC 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

SYSTEM TEST CONFIGURATION

Justification

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

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

EUT Exercise Software

ART is using for testing, and the following power setting was used during the testing:

	2412 MHz	2437 MHz	2462 MHz	Data rate
802.11b	24 dBm	24 dBm	24 dBm	ALL
802.11g	22 dBm	22 dBm	22 dBm	others
	21 dBm	21 dBm	21 dBm	36Mbps
	19 dBm	19 dBm	19 dBm	48Mbps
	18 dBm	18 dBm	18 dBm	54Mbps

Special Accessories

As shown in following test block diagram, all interface cables used for compliance testing are shielded.

Schematics / Block Diagram

Please refer to Appendix A.

Equipment Modifications

No modifications were made to the EUT.

Power Supply

Manufacturer	Description	Model	Serial Number	FCC ID
DVE	ADC Power Supply	DSA-0131F-12 US 12	N/A	N/A

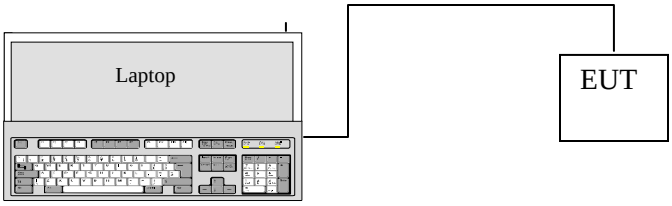
Local Support Equipment

Manufacturer	Description	Model	Serial Number	FCC ID
IBM	Laptop PC	2662	N/A	N/A
Agilent	Analyzer, Spectrum	8565EC	6042	N/A

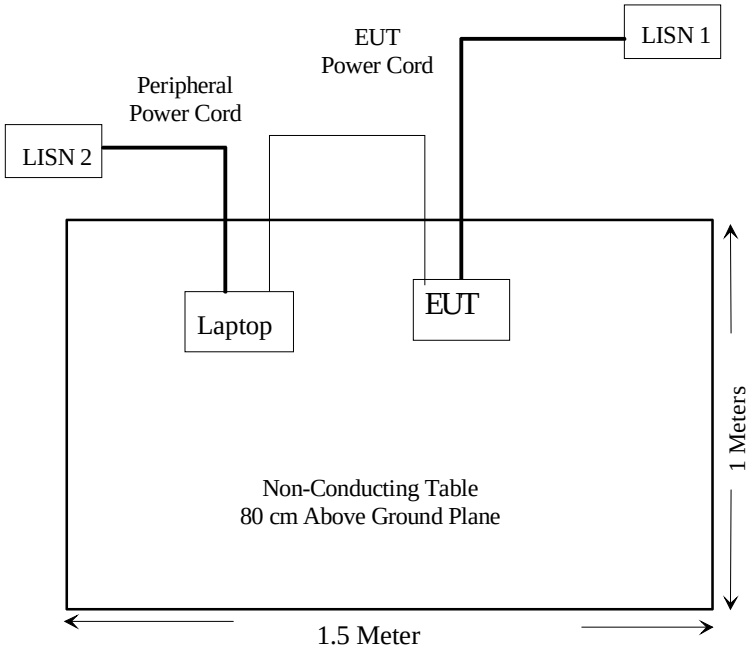
Interface Ports and Cabling

Cable Description	Length (M)	From	To
Ethernet Cable	2.0	Ethernet port / EUT	Ethernet Port / PC

Configuration of Test System



Test Setup Block Diagram



SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC RULES	DESCRIPTION OF TEST	RESULT
§2.1091	RF Exposure	Pass
§15.203	Antenna Requirement	Pass
§ 15.207 (a)	Conducted Emissions	Pass
§2.1051 & §15.247(d)	Spurious Emission at Antenna Port	Pass
§15.205	Restricted Band	Pass
§15.209 (a) & §15.247(d)	Radiated Emission	Pass
§15.247 (a)(2)	6 dB Bandwidth	Pass
§15.247 (b)(3)	Maximum Peak Output Power	Pass
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Pass
§15.247 (e)	Peak Power Spectral Density	Pass

§15.203 - ANTENNA REQUIREMENT

Standard Applicable

According to § 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.

And according to § 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.

The antenna for this device is an integral antenna with gain of 3.3 dBi.

§15.207 (a) - CONDUCTED EMISSION

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are receiver, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ±2.4 dB.

Test Setup

The measurement was performed at shield room, using the same 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 connected with LISN-1.

Receiver Setup

The EMI receiver was set to investigate the spectrum from 150 kHz to 30MHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	LISN	ESH2-Z5	871884/039	2005-11-14
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2005-09-15
Fluke	Calibrated Voltmeter	189	18485-38	2005-04-22

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

Test Procedure

During the conducted emission test, the power cord of the EUT was connected to the mains 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".

Environmental Conditions

Temperature:	21° C
Relative Humidity:	67%
ATM Pressure:	1026 mbar

**The testing was performed by Daniel Deng on 2006-03-08.*

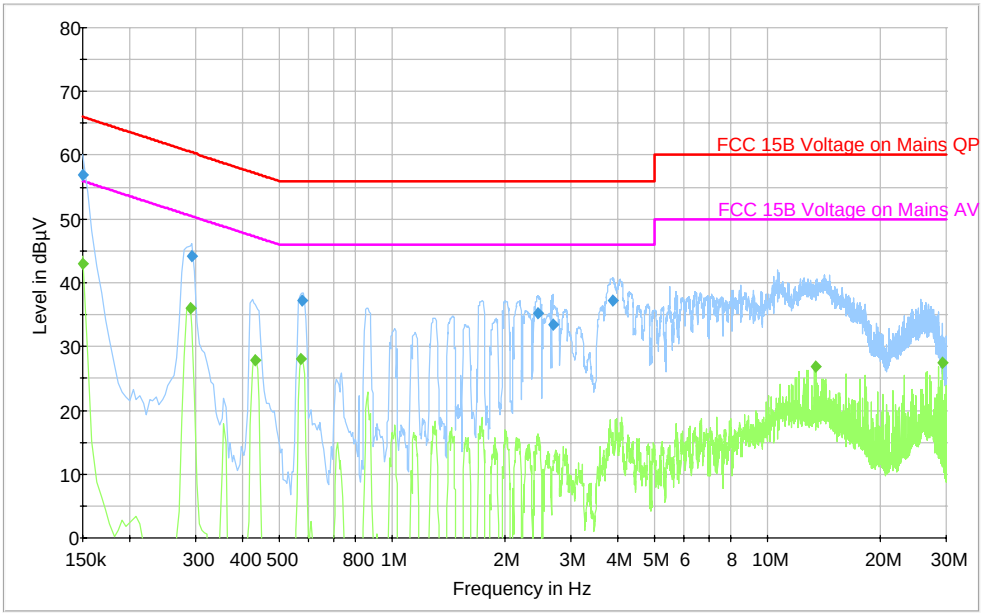
Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Conducted limit for a Class B device, with the *worst* margin reading of:

9.1 dB at **0.150 MHz** in the **Line** conductor

Conducted Emissions Test plots and Data

Line:



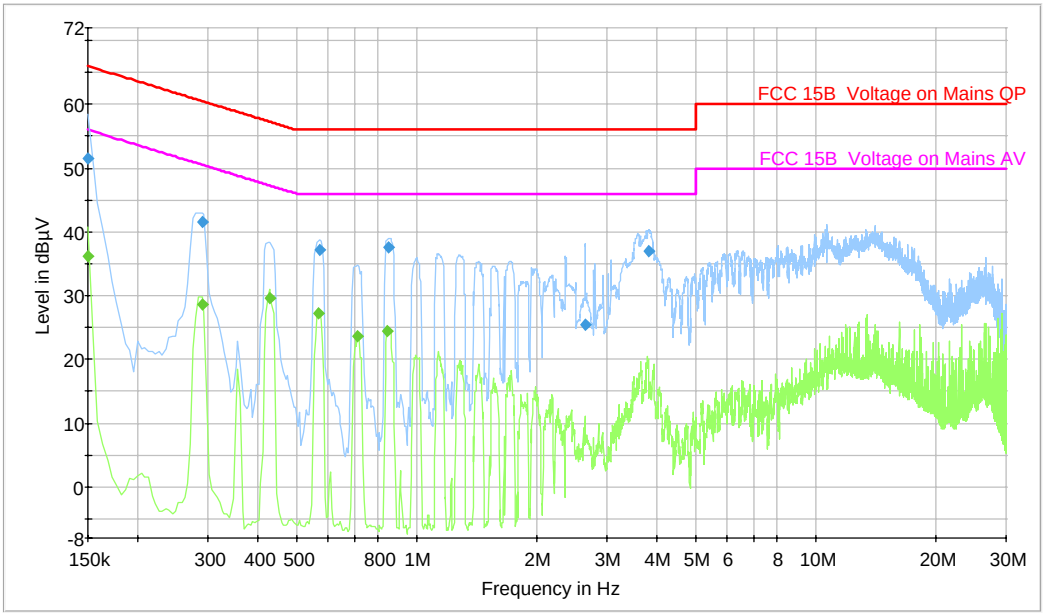
Final Measurement Detector 1 (QP)

Frequency (MHz)	QuasiPeak (dBµV)	PE	Line	Margin (dB)	Limit (dBµV)
0.150000	56.9	FLO	L1	9.1	66.0
0.294000	44.1	FLO	L1	16.3	60.4
0.577500	37.3	FLO	L1	18.7	56.0
3.862500	37.2	FLO	L1	18.8	56.0
2.454000	35.3	FLO	L1	20.7	56.0
2.683500	33.4	FLO	L1	22.6	56.0

Final Measurement Detector 2 (AV)

Frequency (MHz)	Average (dBµV)	PE	Line	Margin (dB)	Limit (dBµV)
0.150000	43.0	FLO	L1	13.0	56.0
0.289500	35.9	FLO	L1	14.6	50.5
0.573000	28.1	FLO	L1	17.9	46.0
0.433500	27.8	FLO	L1	19.4	47.2
29.238000	27.5	FLO	L1	22.5	50.0
13.420500	26.9	FLO	L1	23.1	50.0

Neutral :



Final Measurement Detector 1 (QP)

Frequency (MHz)	QuasiPeak (dBµV)	PE	Line	Margin (dB)	Limit (dBµV)
0.150000	51.5	FLO	N	14.6	66.0
0.847500	37.6	FLO	N	18.4	56.0
0.573000	37.1	FLO	N	18.9	56.0
0.289500	41.5	FLO	N	19.0	60.5
3.813000	36.9	FLO	N	19.1	56.0
2.652000	25.5	FLO	N	30.5	56.0

Final Measurement Detector 2 (AV)

Frequency (MHz)	Average (dBµV)	PE	Line	Margin (dB)	Limit (dBµV)
0.429000	29.7	FLO	N	17.6	47.3
0.568500	27.2	FLO	N	18.9	46.0
0.150000	36.2	FLO	N	19.8	56.0
0.843000	24.4	FLO	N	21.6	46.0
0.289500	28.7	FLO	N	21.8	50.5
0.712500	23.6	FLO	N	22.5	46.0

§2.1051 & §15.247(d) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Standard Applicable

Requirements: CFR 47, § 2.1051.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	8565EC	6042	1/11/2006

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

Measurement Result

Please refer to following pages for plots of spurious emission.

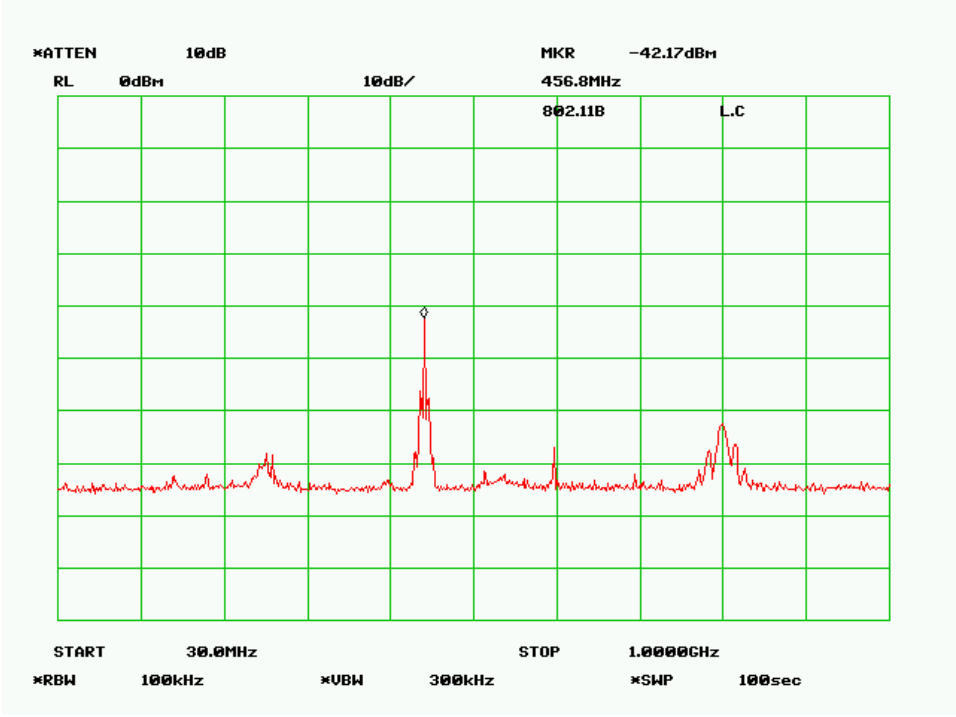
Environmental Conditions

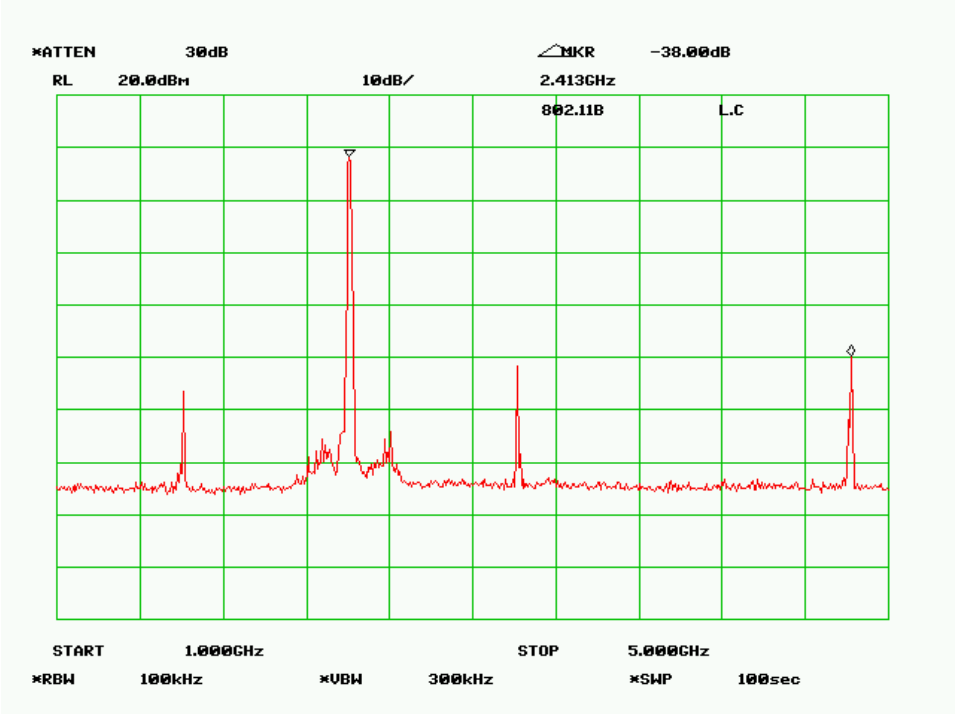
Temperature:	21° C
Relative Humidity:	67%
ATM Pressure:	1026 mbar

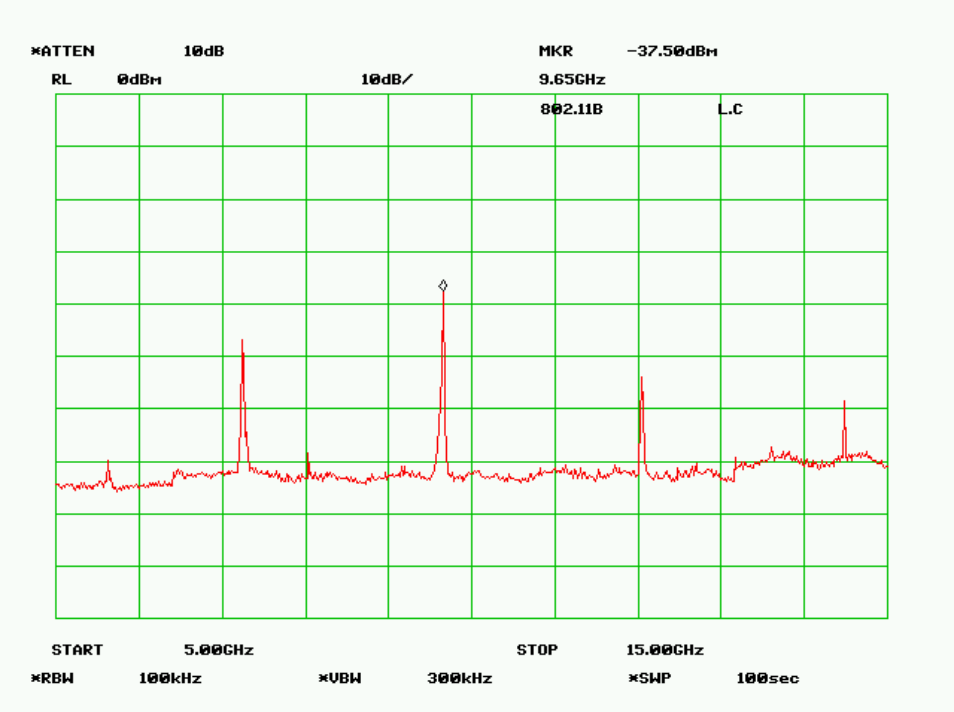
**The testing was performed by Daniel Deng on 2006-03-08.*

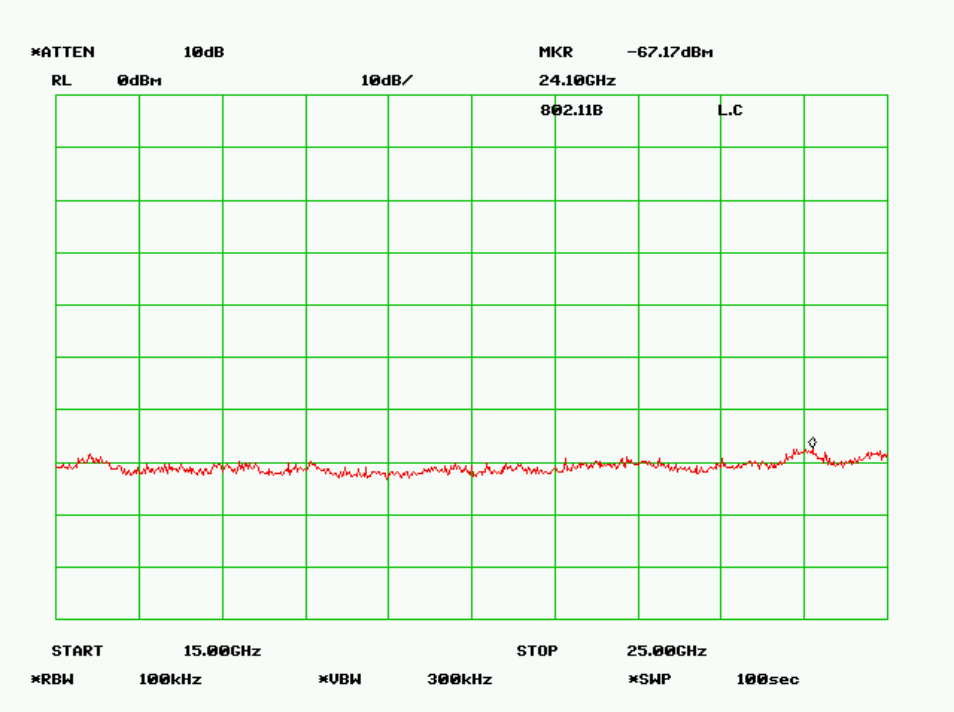
802.11b:

Low Channel

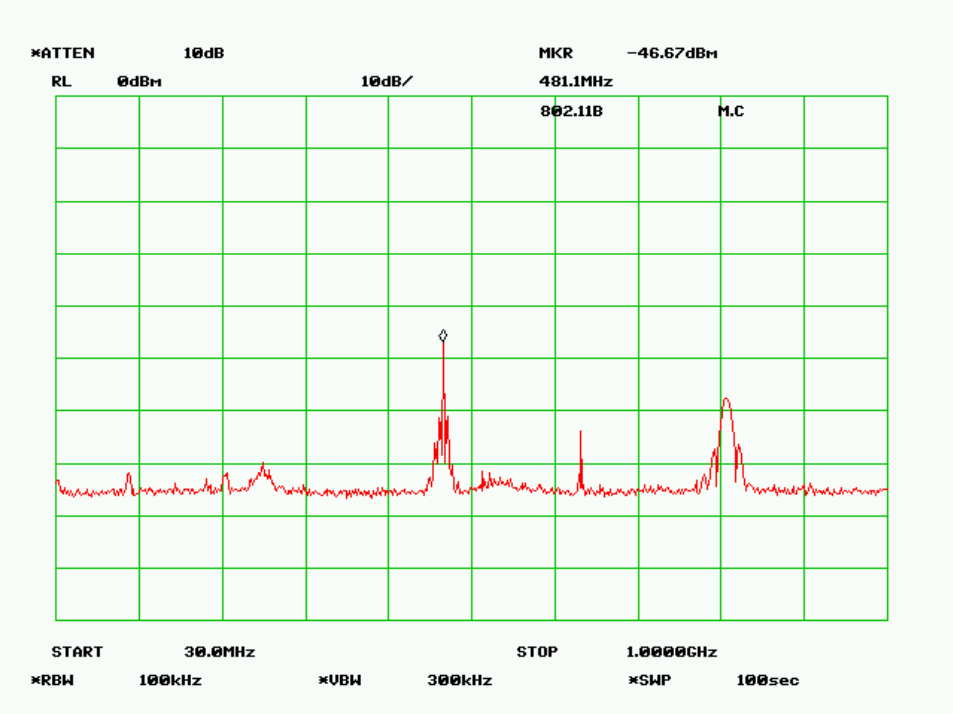


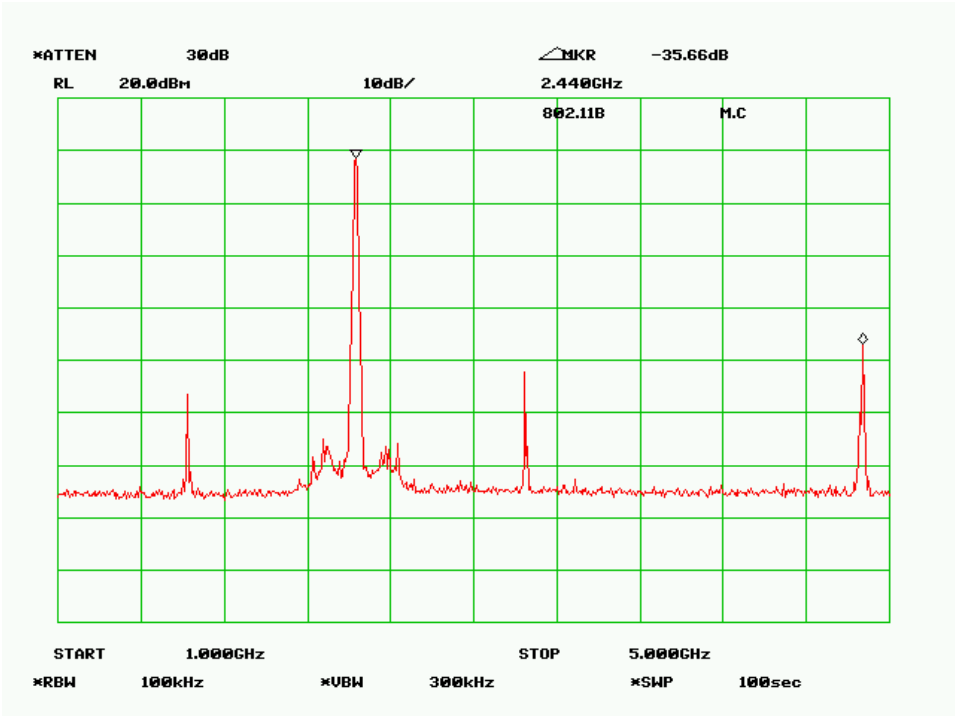


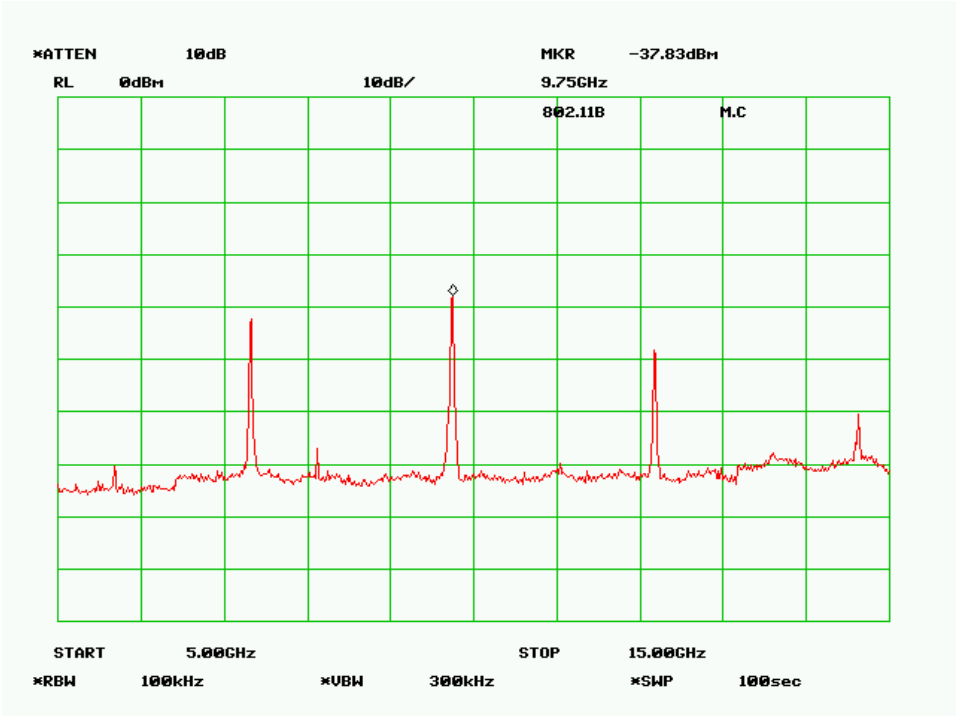

*ATTEN 10dB
MKR -37.50dBm
RL 0dBm
10dB/
9.65GHz
802.11B
L.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

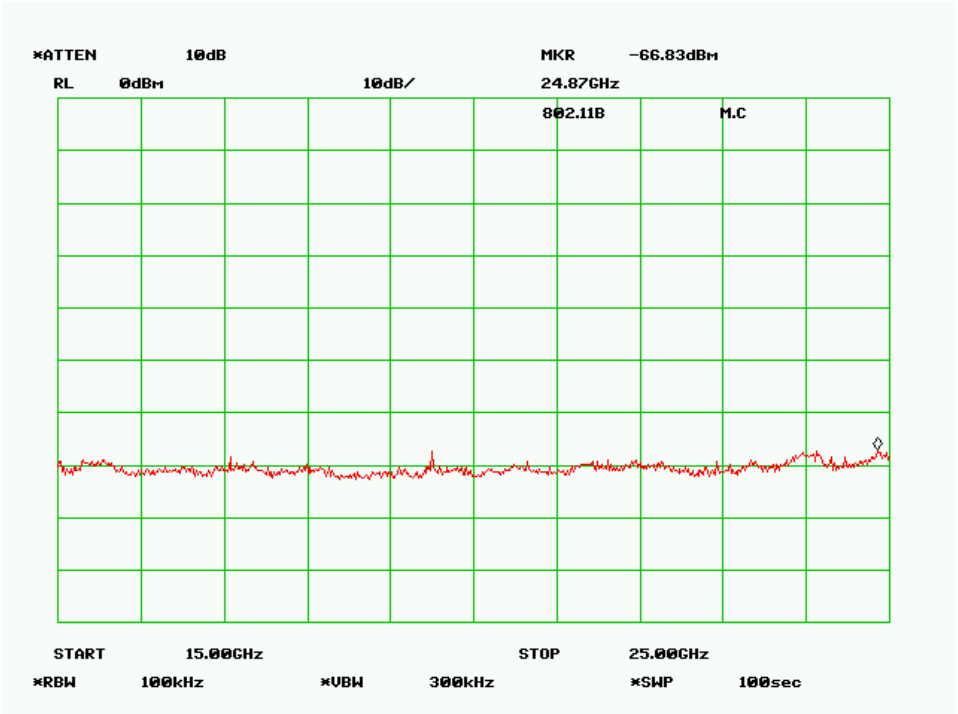

*ATTEN 10dB
MKR -67.17dBm
RL 0dBm
10dB/
24.10GHz
802.11B
L.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

Mid Channel

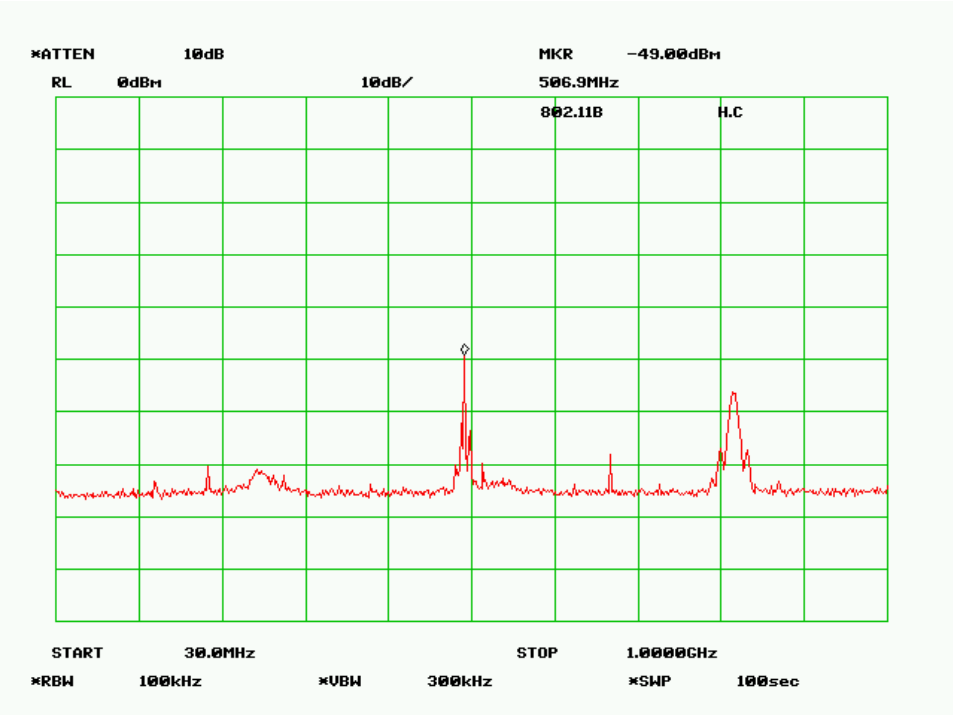

*ATTEN 10dB
MKR -46.67dBm
RL 0dBm
10dB/
481.1MHz
802.11B
M.C
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

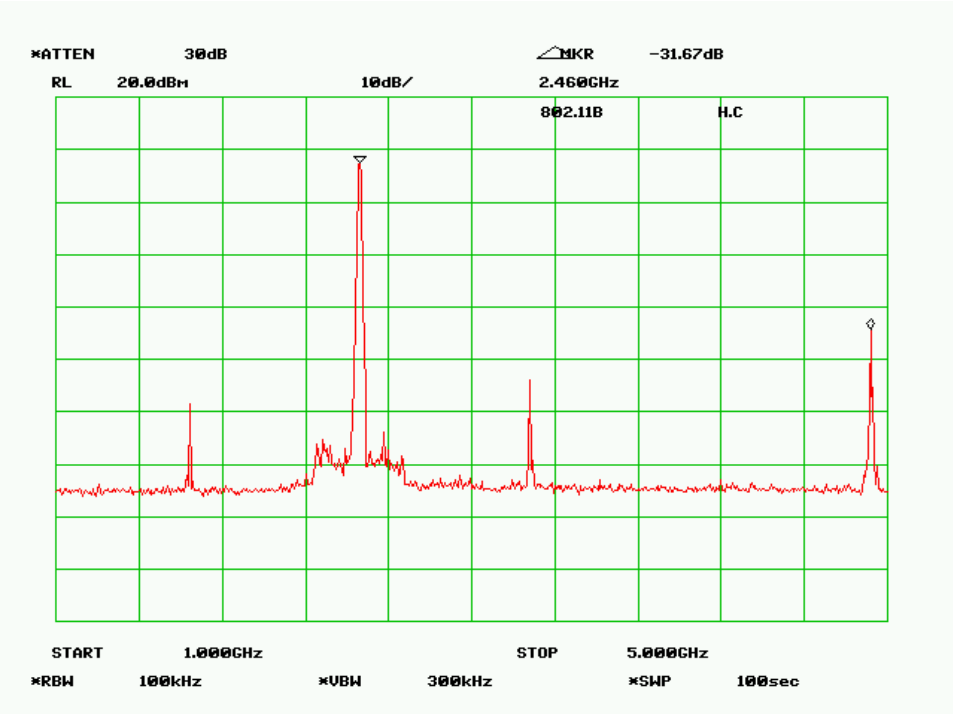

*ATTEN 30dB
MKR -35.66dB
RL 20.0dBm
10dB/
2.440GHz
802.11B
M.C
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

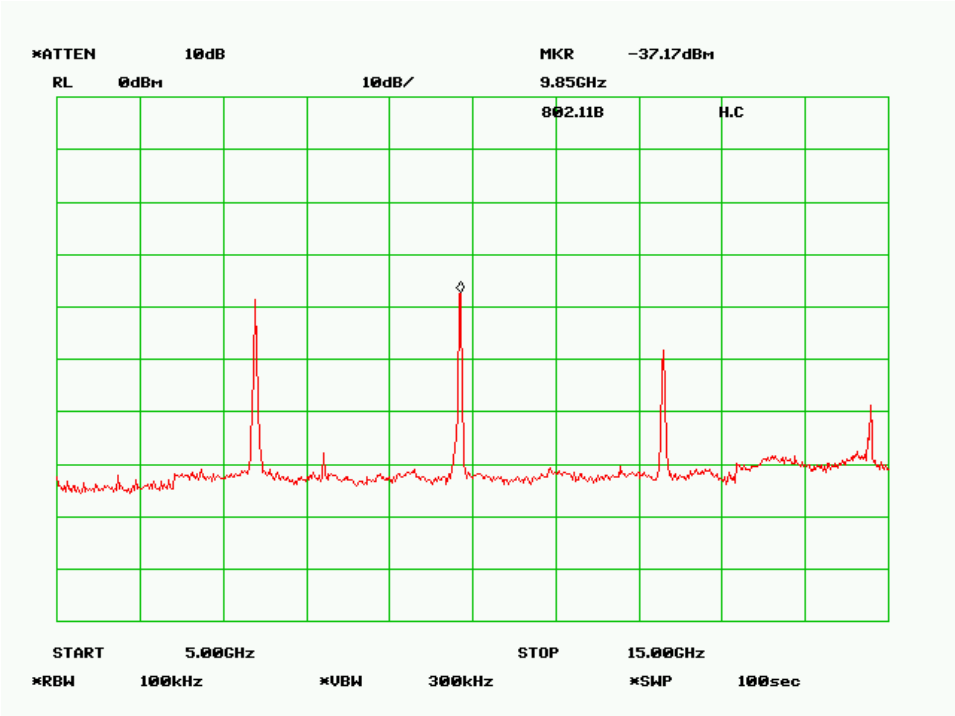

*ATTEN 10dB
MKR -37.83dBm
RL 0dBm
10dB/
9.75GHz
802.11B
M.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

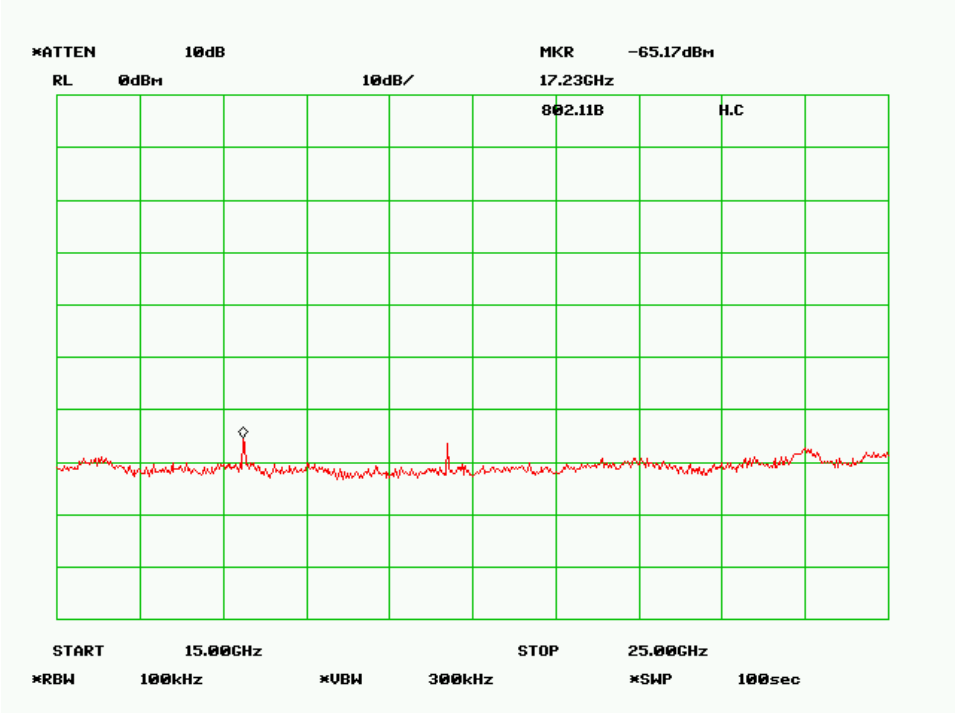

*ATTEN 10dB
MKR -66.83dBm
RL 0dBm
10dB/
24.87GHz
802.11B
M.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

High Channel



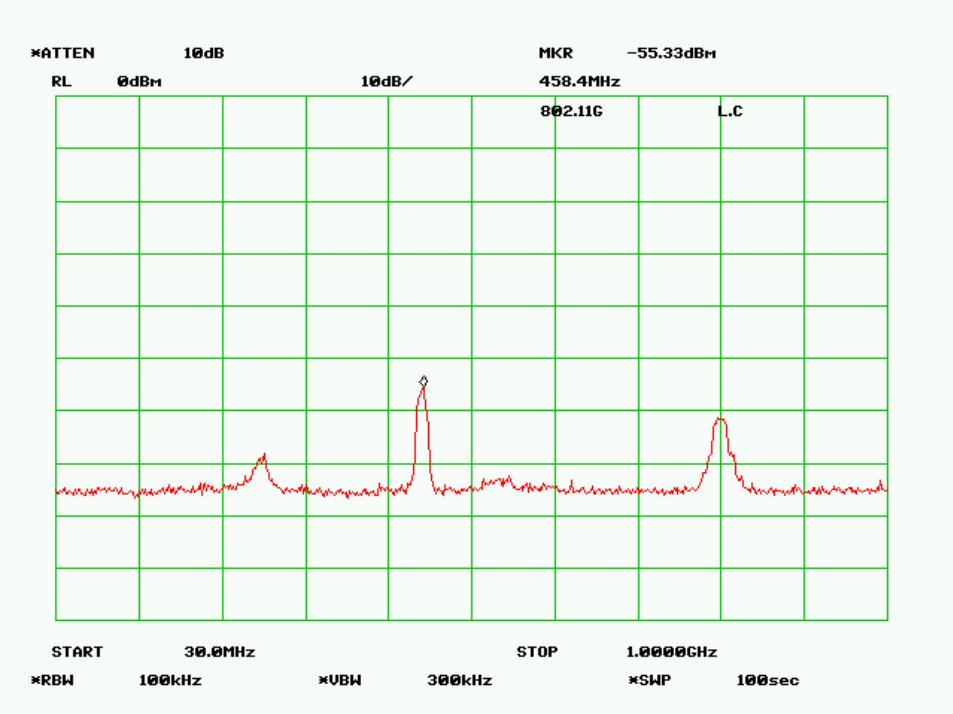


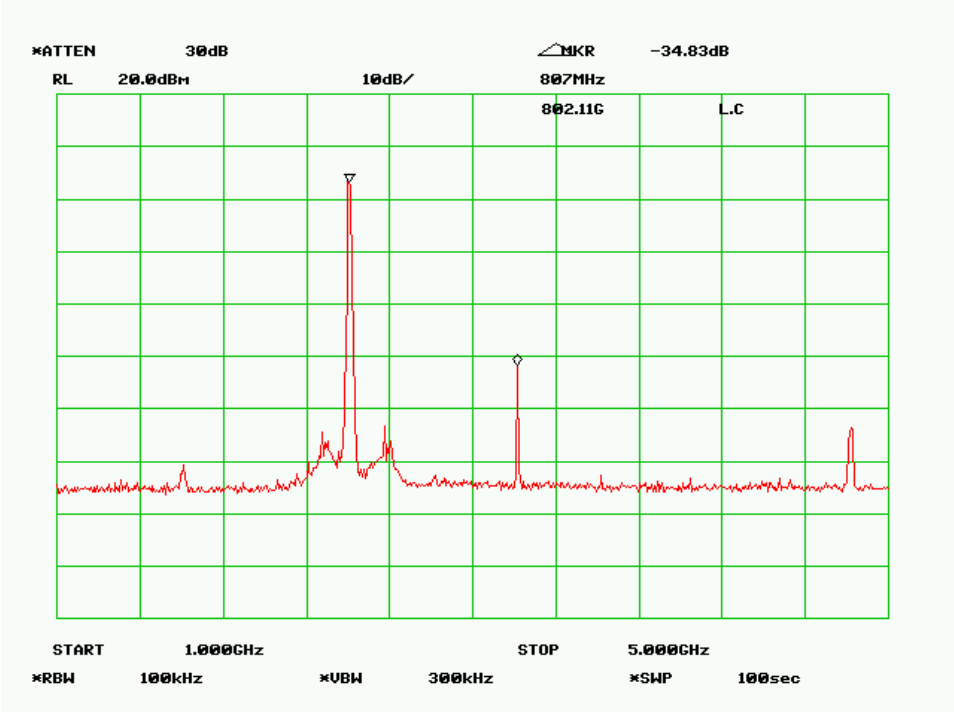

*ATTEN 10dB
MKR -37.17dBm
RL 0dBm
10dB/
9.85GHz
802.11B
H.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

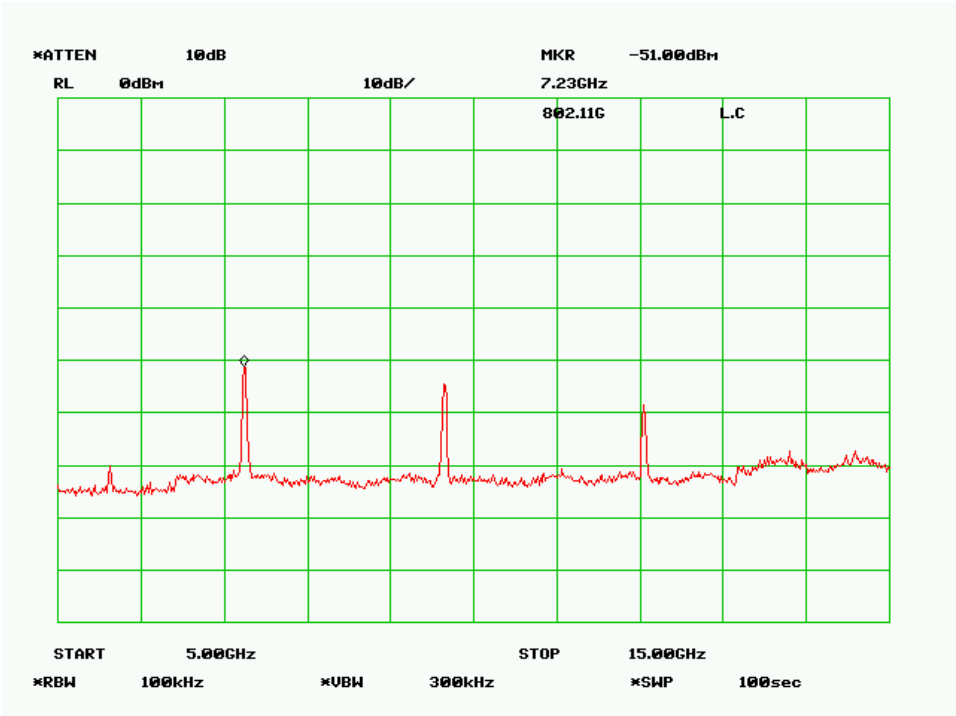

*ATTEN 10dB
MKR -65.17dBm
RL 0dBm
10dB/
17.23GHz
802.11B
H.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

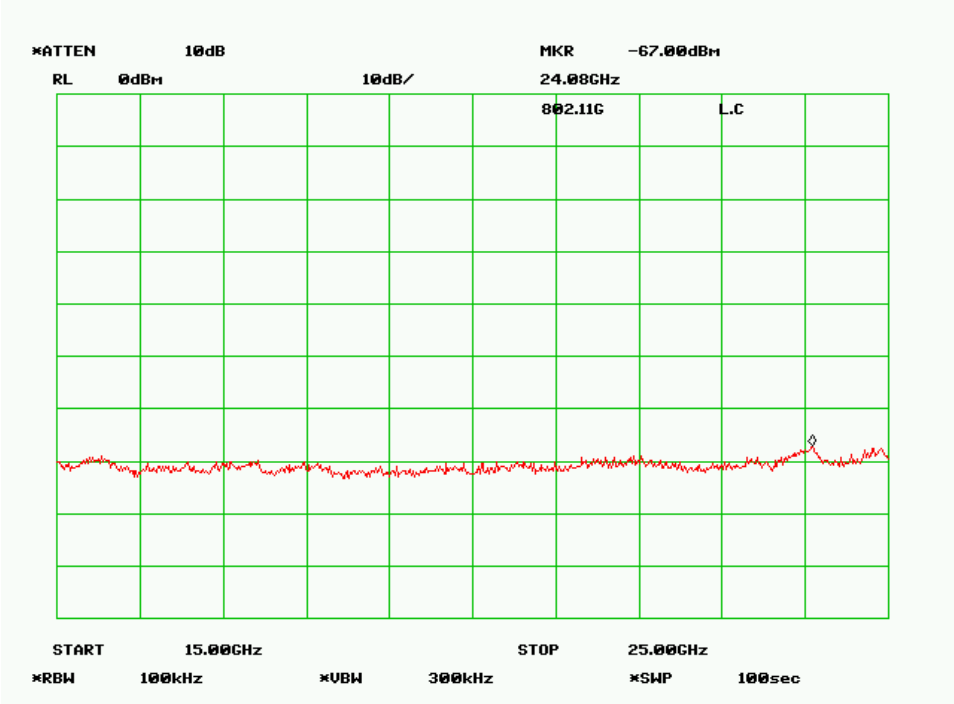
802.11g:

Low Channel

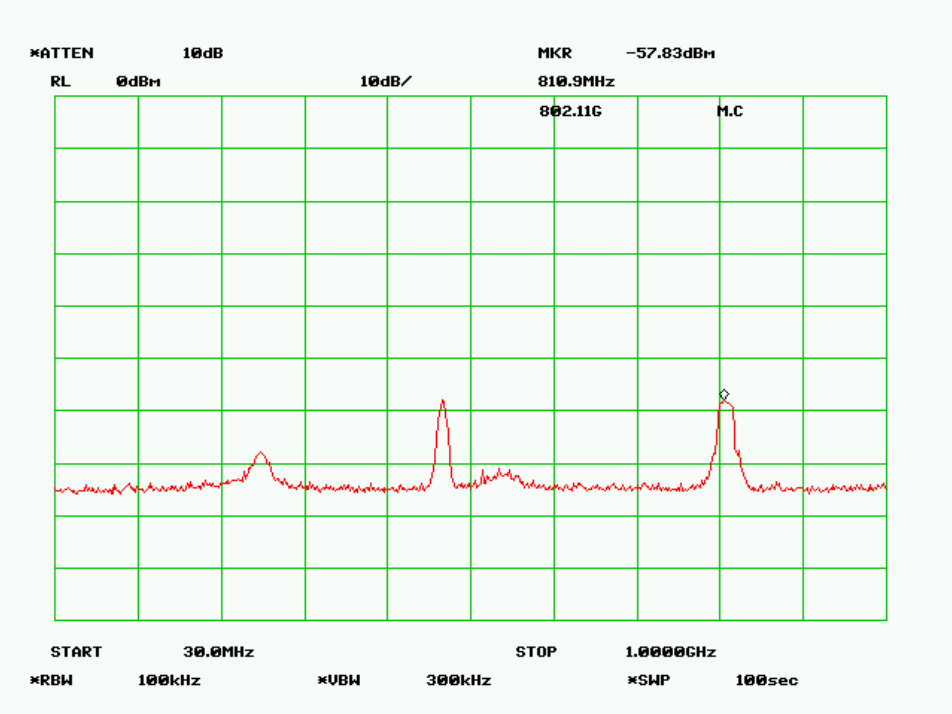


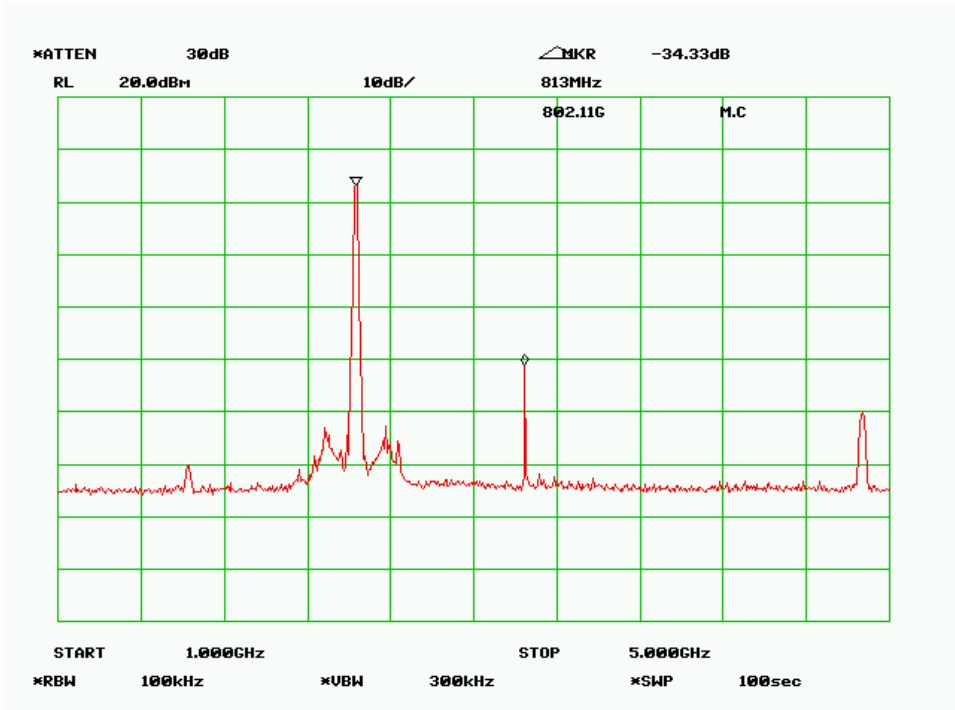


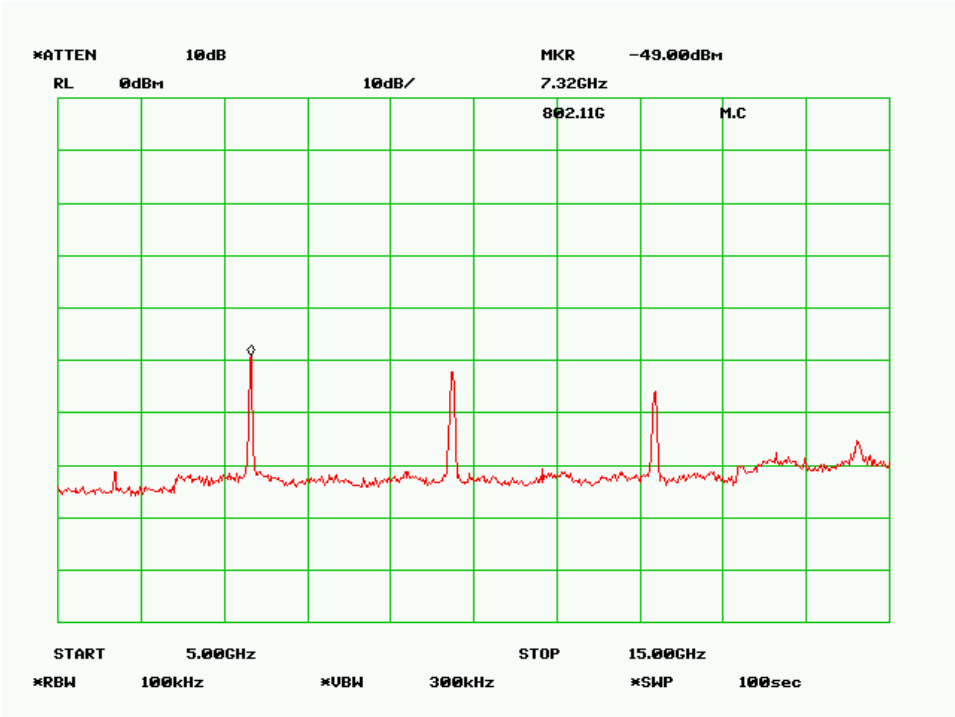

*ATTEN 10dB
MKR -51.00dBm
RL 0dBm
10dB/
7.23GHz
802.11G
L.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

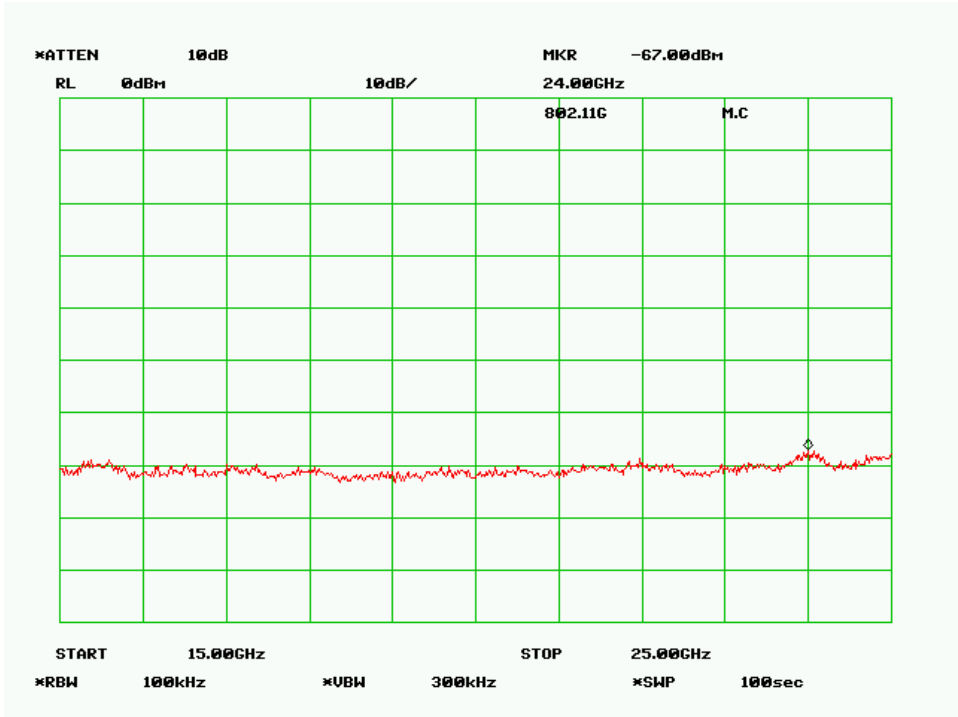

*ATTEN 10dB
MKR -67.00dBm
RL 0dBm
10dB/
24.08GHz
802.11G
L.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

Mid Channel

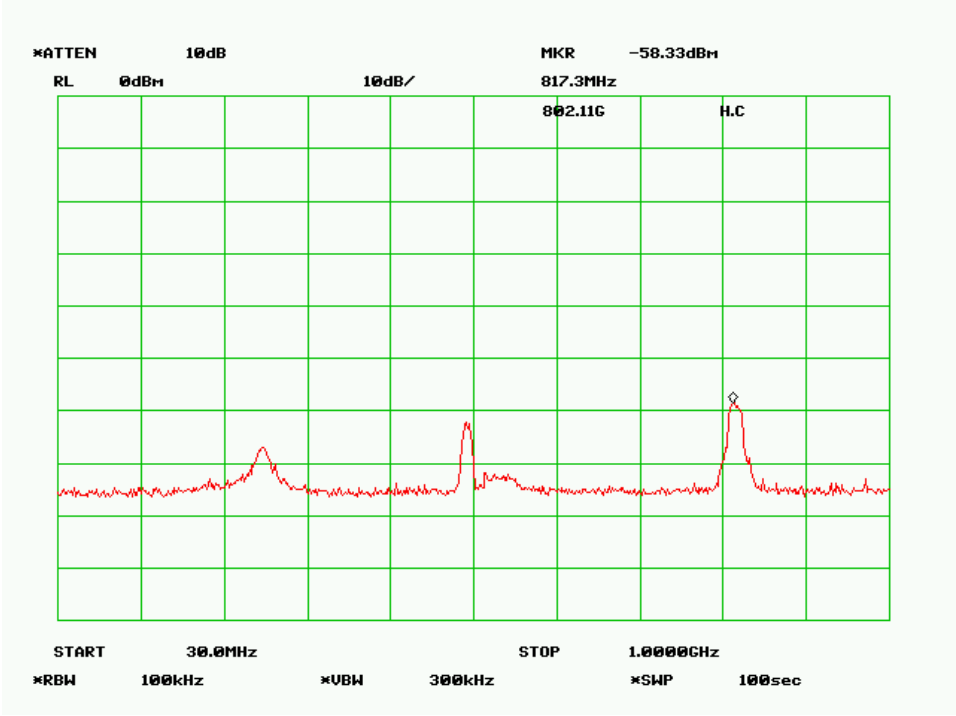

*ATTEN 10dB
MKR -57.83dBm
RL 0dBm
10dB/
810.9MHz
802.11G
M.C
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

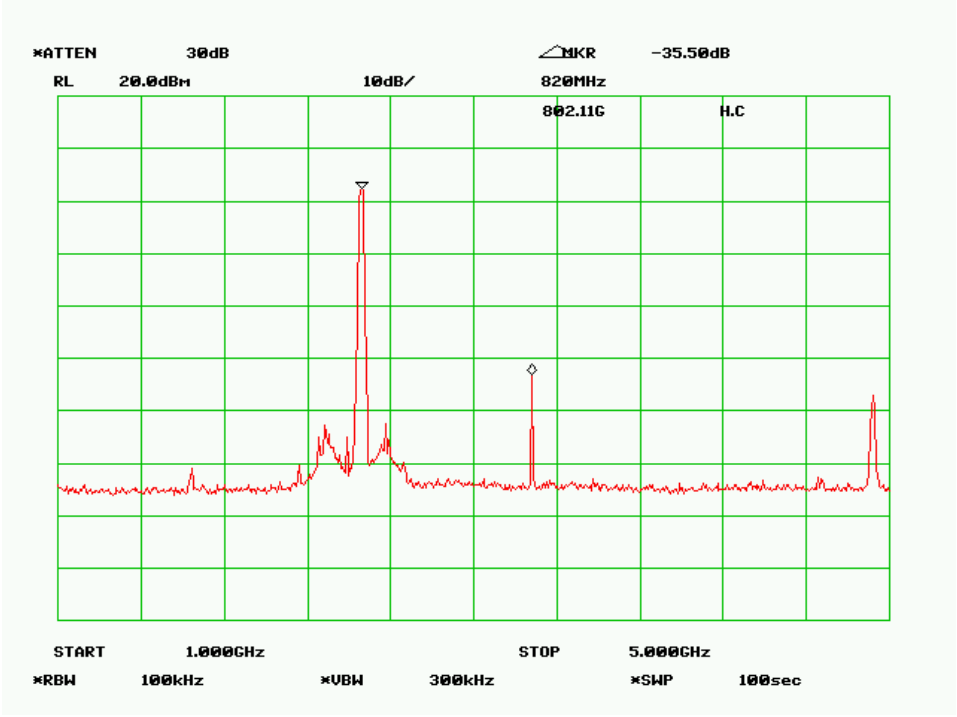

*ATTEN 30dB
MKR -34.33dB
RL 20.0dBm
10dB/
813MHz
802.11G
M.C
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

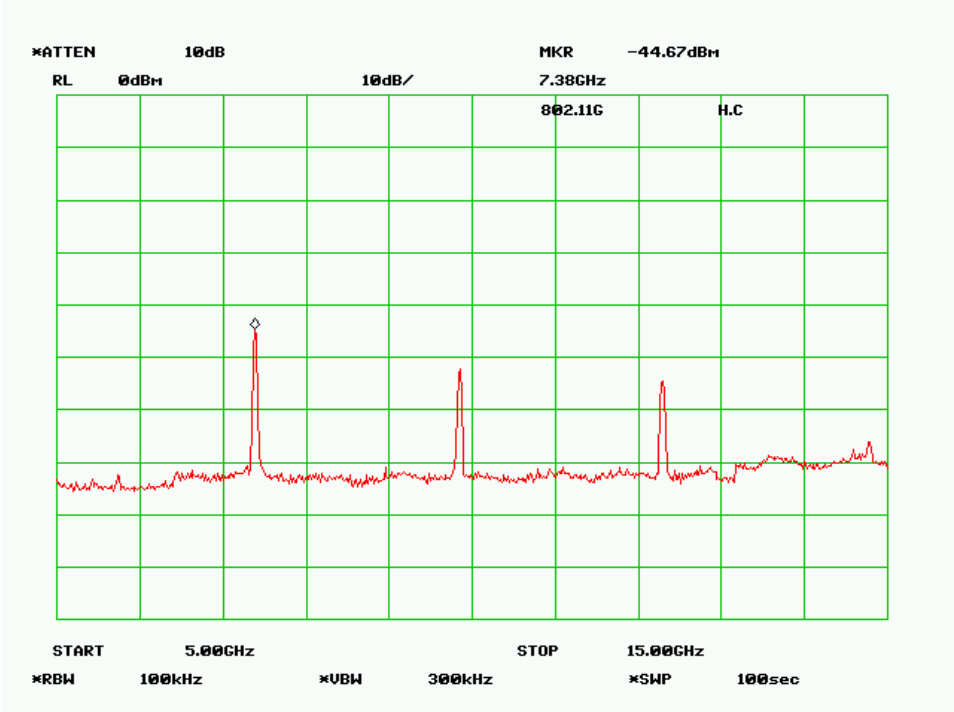

*ATTEN 10dB
MKR -49.00dBm
RL 0dBm
10dB/
7.32GHz
802.11G
M.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

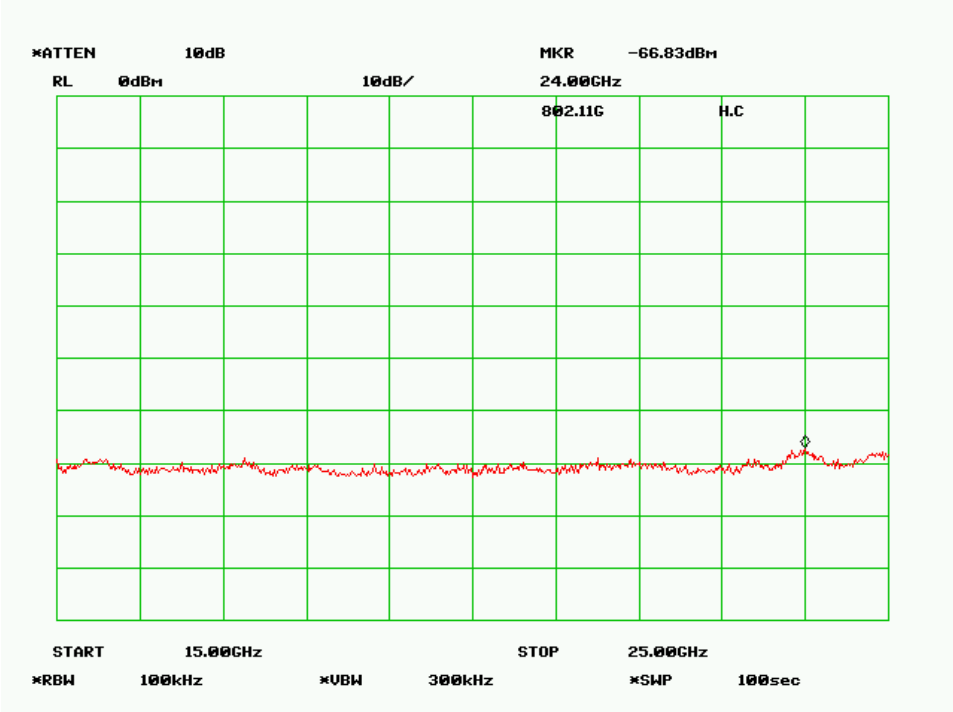

*ATTEN 10dB
MKR -67.00dBm
RL 0dBm
10dB/
24.00GHz
802.11G
M.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

High Channel






*ATTEN 10dB
MKR -44.67dBm
RL 0dBm
10dB/
7.38GHz
802.11G
H.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec


*ATTEN 10dB
MKR -66.83dBm
RL 0dBm
10dB/
24.00GHz
802.11G
H.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

§15.205 & §15.209 & §15.247(c) - SPURIOUS RADIATED EMISSION

Measurement Uncertainty

All measurements involve certain levels of uncertainties. 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 best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

According to §15.205, except as shown 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	16.42 – 16.423	399.9 – 410	4.5 – 5.15
[1]0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2655 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.57725	240 – 285	3345.8 – 3358	36.43 – 36.5
13.36 – 13.41	322 – 335.4	3600 – 4400	([2])

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510MHz
[2] Above 38.6

Except as provided in paragraph (d) and (e), the filed strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

According to §15.209, the device shall meet radiated emission general requirements.

Except for Class A device, the filed strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field Strength (Microvolts/meter)	(dBμV/meter)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

EUT Setup

The radiated emission tests were performed using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15.209 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.

Spectrum Analyzer Setup

According to FCC Rules, 47 CFR, Section 15.33, the frequency was investigated from 30 to 25000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Range	***RBW***	***Video B/W***
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

For Average measurement: RBW = 1MHz, VBW = 10Hz (above 1000MHz)

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Amplifier, Pre	8449B	3008A01978	8/10/2005
Agilent	Analyzer, Spectrum	8565EC	6042	1/11/2006
HP	Pre, Amplifier	8449B	3147A00400	03/14/2005
ETS - Lindgren	30MHz – 3 GHz Antenna	JB3	A020106-2/S006628	02/14/2006
A.R.A.	Antenna, Horn, DRG	DRG-118/A	1132	8/17/2005

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

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.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -4 dBμV of specification limits), and are distinguished with a "**Qp**" in the data table.

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:

Corr. Ampl. = 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 = Corr. Ampl. - FCC 15.247 Limit

Environmental Conditions

Temperature:	21° C
Relative Humidity:	67%
ATM Pressure:	1026 mbar

**The testing was performed by Daniel on 2006-03-01.*

Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247, and had the worst margin of:

802.11b:

-0.1 dB at **4824.00 MHz** in the **Horizontal** polarization, Low Channel*
-1.1 dB at **4874.00 MHz** in the **Vertical** polarization, Middle Channel*
-0.8 dB at **4924.00 MHz** in the **Vertical** polarization, High Channel*

802.11g:

-4.1 dB at **4824.00 MHz** in the **Horizontal** polarization, Low Channel
-0.4 dB at **4874.00 MHz** in the **Horizontal** polarization, Middle Channel*
-0.3 dB at **4924.00 MHz** in the **Horizontal** polarization, High Channel*

Unintentional Emission:

-0.5 dB at **63.00 MHz** in the **Vertical** polarization, Unintentional Emission*
** The test data was within the measurement of uncertainty.*

Radiated Emission Test Result @ 3 meter

802.11b:

For Low Channel 2412MHz, 1-25GHz

Frequency MHz	Reading dBuV/m	Direction Degree	Height Meter	Polar H / V	Antenna factor dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	15.247 Limit (dBuV/m)	15.247 Margin	Comments	Testing Condition Mode/Distance
4824.0000	54.3	66	1.3	h	32.5	1.9	34.8	53.9	54	-0.1*	Ave	CW / 3
9648.0000	45.5	15	1.0	v	38.1	3.7	34.2	53.1	54	-0.9*	Ave	CW / 3
7236.0000	44.5	223	1.3	v	36.7	4.2	34.7	50.7	54	-3.3*	Ave	CW / 3
4824.0000	48.0	250	1.3	v	32.5	1.9	34.8	47.6	54	-6.4	Ave	CW / 3
4824.0000	66.7	66	1.3	h	32.5	1.9	34.8	66.3	74	-7.7	Peak	CW / 3
9648.0000	58.3	295	1.0	h	38.1	3.7	34.2	66.0	74	-8.0	Peak	CW / 3
7236.0000	59.2	250	1.1	h	36.7	4.2	34.7	65.4	74	-8.6	Peak	CW / 3
4824.0000	61.5	250	1.3	v	32.5	1.9	34.8	61.1	74	-12.9	Peak	CW / 3
7236.0000	53.8	223	1.3	v	36.7	4.2	34.7	60.1	74	-13.9	Peak	CW / 3
9648.0000	29.5	295	1.0	h	38.1	3.7	34.2	37.1	54	-16.9	Ave	Normal burst mode/3
9648.0000	49.3	15	1.0	v	38.1	3.7	34.2	57.0	74	-17.0	Peak	CW / 3
7236.0000	29.8	250	1.1	h	36.7	4.2	34.7	36.1	54	-17.9	Ave	Normal burst mode/3

For Mid Channel 2437MHz, 1-25GHz

Frequency MHz	Reading dBuV/m	Direction Degree	Height Meter	Polar H / V	Antenna factor dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	15.247 Limit (dBuV/m)	15.247 Margin	Comments	Testing Condition Mode/Distance
4874.0000	53.3	180	1.0	v	32.5	1.9	34.8	52.9	54	-1.1*	Ave	CW / 3
4874.0000	72.5	225	1.0	h	32.5	1.9	34.8	72.1	74	-1.9*	Peak	CW / 3
7311.0000	61.5	247	1.0	h	36.7	4.2	34.7	67.7	74	-6.3	Peak	CW / 3
9748.0000	40.0	193	1.0	v	38.1	3.7	34.2	47.6	54	-6.4	Ave	CW / 3
9748.0000	58.8	42	1.0	h	38.1	3.7	34.2	66.5	74	-7.5	Peak	CW / 3
7311.0000	59.8	137	1.1	v	36.7	4.2	34.7	66.1	74	-7.9	Peak	CW / 3
4874.0000	65.7	180	1.0	v	32.5	1.9	34.8	65.3	74	-8.7	Peak	CW / 3
9748.0000	50.8	193	1.0	v	38.1	3.7	34.2	58.5	74	-15.5	Peak	CW / 3
9748.0000	30.4	42	1.0	h	38.1	3.7	34.2	38.0	54	-16.0	Ave	Normal burst mode
7311.0000	30.6	247	1.0	h	36.7	4.2	34.7	36.8	54	-17.2	Ave	Normal burst mode
7311.0000	30.1	137	1.1	v	36.7	4.2	34.7	36.3	54	-17.7	Ave	Normal burst mode
4874.0000	31.2	225	1.0	h	32.5	1.9	34.8	30.8	54	-23.2	Ave	Normal burst mode

For High Channel 2462MHz, 1-25GHz

Frequency MHz	Reading dBuV/m	Direction Degree	Height Meter	Polar H / V	Antenna Factor dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	15.247 Limit (dBuV/m)	15.247 Margin	Comments	Testing Condition Mode/Distance
4924.0000	53.6	186	1.0	v	32.5	1.9	34.8	53.2	54	-0.8*	Ave	CW / 3
4924.0000	72.9	215	1.0	h	32.5	1.9	34.8	72.5	74	-1.5*	Peak	CW / 3
4924.0000	65.9	186	1.0	v	32.5	1.9	34.8	65.5	74	-8.5	Peak	CW / 3
7386.0000	59.2	231	1.1	h	36.7	4.2	34.7	65.4	74	-8.6	Peak	CW / 3
9848.0000	57.3	210	1.0	h	38.1	3.7	34.2	65.0	74	-9.0	Peak	CW / 3
7386.0000	58.7	138	1.1	v	36.7	4.2	34.7	64.9	74	-9.1	Peak	CW / 3
9848.0000	54.0	210	1.2	v	38.1	3.7	34.2	61.6	74	-12.4	Peak	CW / 3
9848.0000	30.1	210	1.0	h	38.1	3.7	34.2	37.7	54	-16.3	Ave	Normal burst mode
9848.0000	29.2	210	1.2	v	38.1	3.7	34.2	36.8	54	-17.2	Ave	Normal burst mode
7386.0000	29.8	231	1.1	h	36.7	4.2	34.7	36.0	54	-18.0	Ave	Normal burst mode
7386.0000	29.7	138	1.1	v	36.7	4.2	34.7	35.9	54	-18.1	Ave	Normal burst mode
4924.0000	31.5	215	1.0	h	32.5	1.9	34.8	31.1	54	-22.9	Ave	Normal burst mode

802.11g

Note: test was conducted at data rate which has highest output power

For Low Channel 2412MHz, 1-25GHz

Frequency MHz	Reading dBuV/m	Direction Degree	Height Meter	Polar H / V	Antenna Factor dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	15.247 Limit (dBuV/m)	15.247 Margin	Comments	Testing Codition Mode/Distance
4824.0000	50.3	67	1.2	h	32.5	1.9	34.8	49.9	54	-4.1	Ave	CW / 3
7236.0000	43.0	256	1.3	h	36.7	4.2	34.7	49.2	54	-4.8	Ave	CW / 3
9648.0000	38.7	291	1.2	h	38.1	3.7	34.2	46.3	54	-7.7	Ave	CW / 3
7236.0000	39.5	227	1.5	v	36.7	4.2	34.7	45.7	54	-8.3	Ave	CW / 3
4824.0000	63.7	67	1.2	h	32.5	1.9	34.8	63.3	74	-10.7	Peak	CW / 3
4824.0000	43.0	139	1.4	v	32.5	1.9	34.8	42.6	54	-11.4	Ave	CW / 3
7236.0000	56.3	256	1.3	h	36.7	4.2	34.7	62.6	74	-11.4	Peak	CW / 3
9648.0000	33.0	228	1.8	v	38.1	3.7	34.2	40.6	54	-13.4	Ave	CW / 3
9648.0000	52.7	291	1.2	h	38.1	3.7	34.2	60.3	74	-13.7	Peak	CW / 3
7236.0000	53.2	227	1.5	v	36.7	4.2	34.7	59.4	74	-14.6	Peak	CW / 3
4824.0000	57.2	139	1.4	v	32.5	1.9	34.8	56.8	74	-17.2	Peak	CW / 3
9648.0000	46.2	228	1.8	v	38.1	3.7	34.2	53.8	74	-20.2	Peak	CW / 3

For Mid Channel 2437MHz, 1-25GHz

Frequency MHz	Reading dBuV/m	Direction Degree	Height Meter	Polar H / V	Antenna Factor dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	15.247 Limit (dBuV/m)	15.247 Margin	Comments	Testing Codition Mode/Distance
4874.0000	54.0	68	1.2	h	32.5	1.9	34.8	53.6	54	-0.4*	Ave	Thruoghput mode
7311.0000	47.2	247	1.1	h	36.7	4.2	34.7	53.4	54	-0.6*	Ave	Throughput mode
4874.0000	72.3	68	1.2	h	32.5	1.9	34.8	71.9	74	-2.1*	Peak	CW / 3
7311.0000	45.5	211	1.3	v	36.7	4.2	34.7	51.7	54	-2.3*	Ave	CW / 3
7311.0000	63.8	247	1.1	h	36.7	4.2	34.7	70.1	74	-3.9*	Peak	CW / 3
4874.0000	50.3	252	1.5	v	32.5	1.9	34.8	49.9	54	-4.1	Ave	CW / 3
7311.0000	58.7	211	1.3	v	36.7	4.2	34.7	64.9	74	-9.1	Peak	CW / 3
9748.0000	36.8	170	1.3	h	38.1	3.7	34.2	44.4	54	-9.6	Ave	CW / 3
9748.0000	36.7	166	1.3	v	38.1	3.7	34.2	44.3	54	-9.7	Ave	CW / 3
4874.0000	63.8	252	1.5	v	32.5	1.9	34.8	63.4	74	-10.6	Peak	CW / 3
9748.0000	50.2	170	1.3	h	38.1	3.7	34.2	57.8	74	-16.2	Peak	CW / 3
9748.0000	49.5	166	1.3	v	38.1	3.7	34.2	57.1	74	-16.9	Peak	CW / 3

For High Channel 2462MHz, 1-25GHz

Frequency MHz	Reading dBuV/m	Direction Degree	Height Meter	Polar H / V	Antenna Factor dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	15.247 Limit (dBuV/m)	15.247 Margin	Comments	Testing Codition Mode/Distance
4924.0000	54.1	71	1.1	h	32.5	1.9	34.8	53.7	54	-0.3*	Ave	Thruoghput mode
7386.0000	46.9	248	1.2	h	36.7	4.2	34.7	53.1	54	-0.9*	Ave	Throughput mode
4924.0000	72.4	71	1.1	h	32.5	1.9	34.8	72.0	74	-2.0*	Peak	CW / 3
9848.0000	43.2	55	1.0	h	38.1	3.7	34.2	50.8	54	-3.2*	Ave	CW / 3
7386.0000	44.3	138	1.1	v	36.7	4.2	34.7	50.6	54	-3.4*	Ave	CW / 3
4924.0000	50.1	248	1.3	v	32.5	1.9	34.8	49.7	54	-4.3	Ave	CW / 3
4924.0000	68.2	248	1.3	v	32.5	1.9	34.8	67.8	74	-6.2	Peak	CW / 3
7386.0000	61.0	248	1.2	h	36.7	4.2	34.7	67.2	74	-6.8	Peak	CW / 3
9848.0000	37.5	142	1.3	v	38.1	3.7	34.2	45.1	54	-8.9	Ave	CW / 3
7386.0000	58.8	138	1.1	v	36.7	4.2	34.7	65.0	74	-9.0	Peak	CW / 3
9848.0000	56.5	55	1.0	h	38.1	3.7	34.2	64.1	74	-9.9	Peak	CW / 3
9848.0000	50.7	142	1.3	v	38.1	3.7	34.2	58.3	74	-15.7	Peak	CW / 3

Unintentional Emission @ 3 Meter

30MHz – 1GHz

Frequency	Reading	Direction	Height	Polar	Antenna Factor	Cable Loss	Amplifier	Corrected Reading	FCC 15B Limit	FCC 15B Margin
MHz	dBuV	Degree	Meter	H / V	dB	dB	dB	dBuV/m	dBuV/m	dB
63.00	59.6	180	1.3	V3	8.0	0.4	28.5	39.5	40.0	-0.5*
250.00	53.7	175	1.0	V3	12.6	0.9	27.4	39.8	46.0	-6.2
150.00	51.2	310	1.8	H3	13.1	0.9	28.0	37.2	43.5	-6.3
250.00	54.1	305	1.1	H3	11.9	0.9	27.4	39.5	46.0	-6.5
87.60	52.3	200	3.0	H3	8.4	1.0	28.5	33.2	40.0	-6.8
305.00	50.6	55	1.2	H3	13.8	1.5	27.4	38.5	46.0	-7.5
500.00	46.2	300	1.3	H3	17.7	1.8	28.5	37.2	46.0	-8.8
305.00	47.8	340	1.2	V3	13.8	1.5	27.4	35.7	46.0	-10.3
500.00	43.1	60	1.5	V3	18.2	1.8	28.5	34.6	46.0	-11.4

** The test data was within the measurement of uncertainty.*

§15.247(a)(2) – 6 dB BANDWIDTH

Standard Applicable

According to §15.247(a)(2), for digital modulation techniques, the minimum 6dB bandwidth shall be at least 500 kHz.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth. (6 dB bandwidth for DTS)
4. Repeat above procedures until all frequencies measured were complete.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	8565EC	6042	1/11/2006

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

Measurement Result

Environmental Conditions

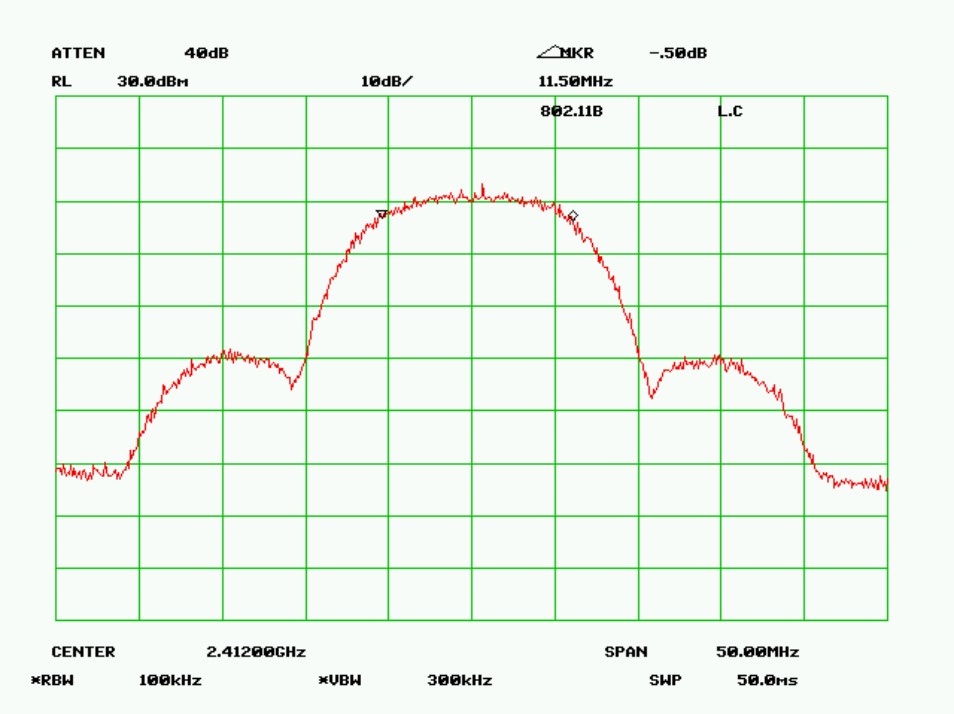
Temperature:	21° C
Relative Humidity:	67%
ATM Pressure:	1026 mbar

**The testing was performed by Daniel Deng on 2006-03-01.*

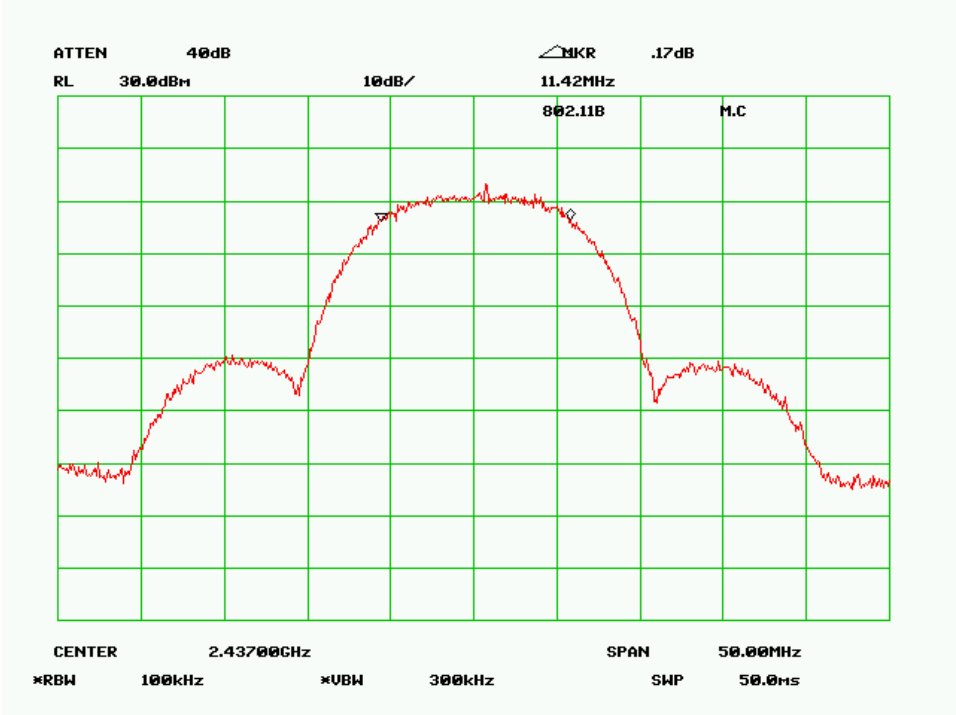
Test Result

802.11b:

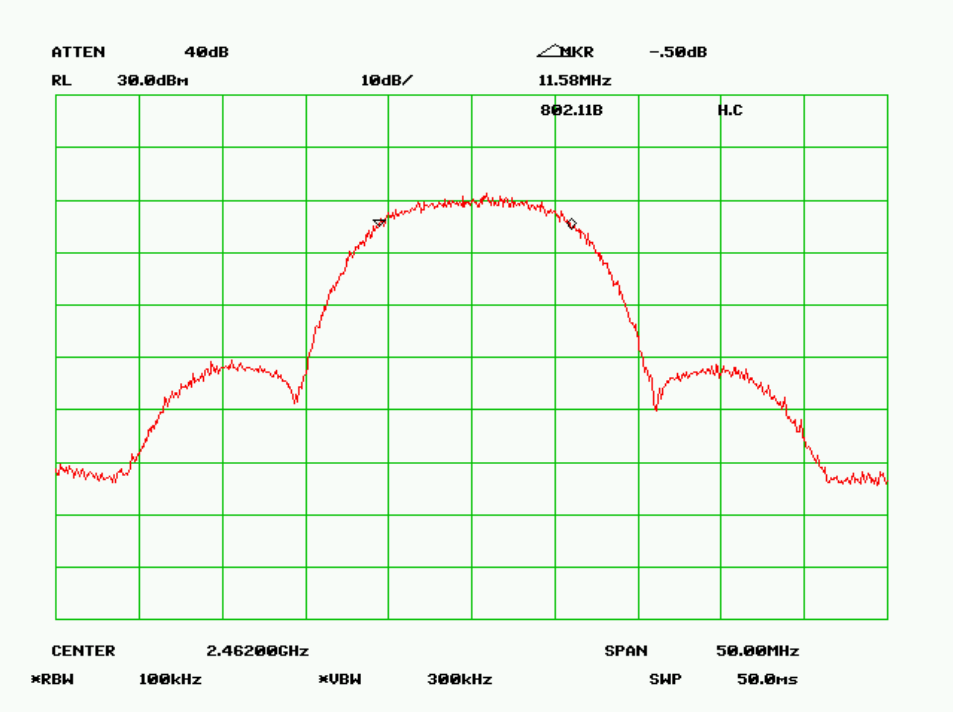
Low Channel



Middle Channel

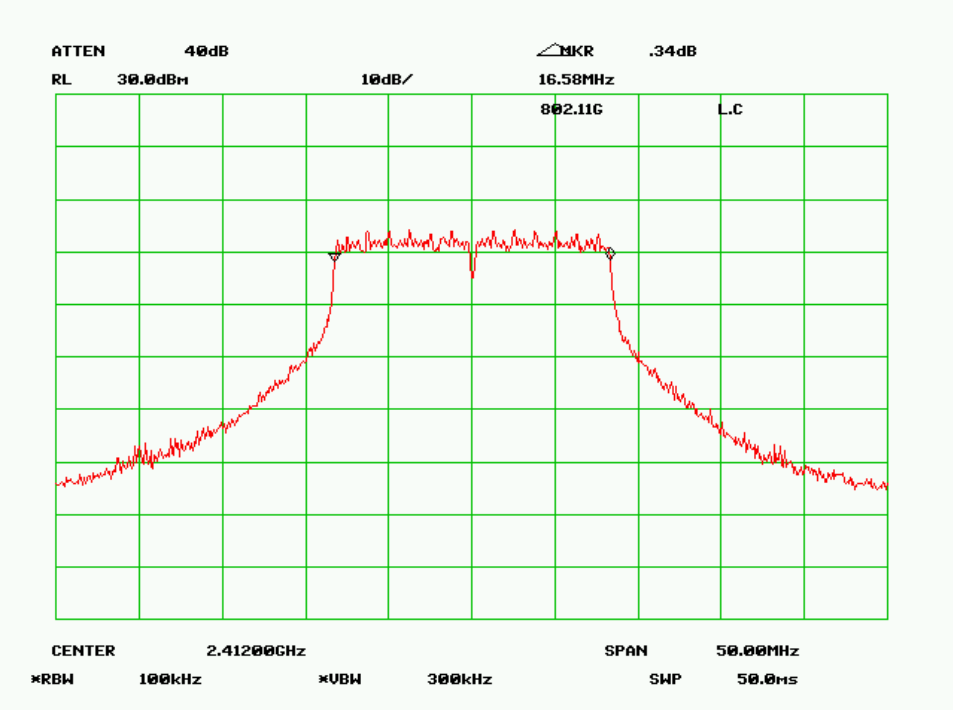


High Channel

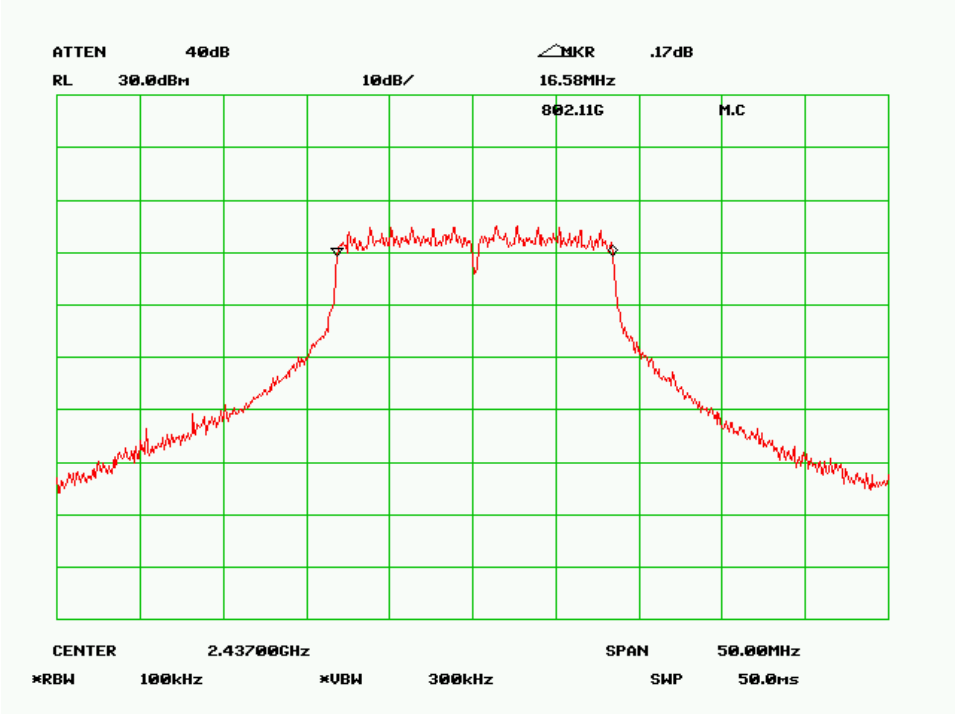


802.11g:

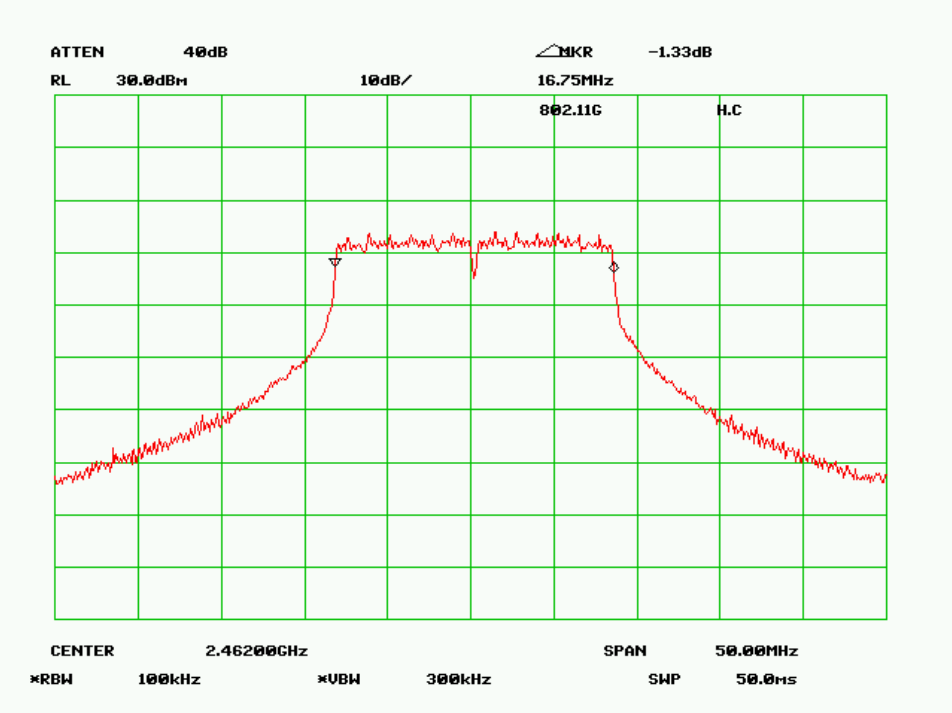
Low Channel



Mid. Channel



High Channel



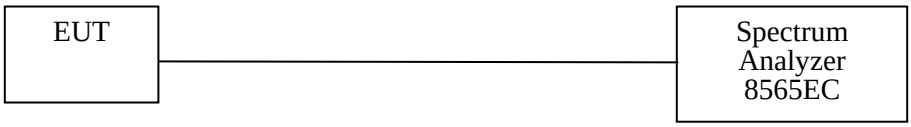
§15.247(b)(3) - PEAK OUTPUT POWER MEASUREMENT

Standard Applicable

According to §15.247(b) (3), for systems using digital modulation in 2400-2483.5 MHz: 1 Watt

Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.



Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	8565EC	6042	1/11/2006

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

Measurement Result

Environmental Conditions

Temperature:	24° C
Relative Humidity:	69%
ATM Pressure:	1027 mbar

**The testing was performed by Taylor Tsai on 2006-03-05.*

RF Output Power

802.11b:

802.11b @ 11Mbps

Frequency	Reading	Output in Watt	FCC 15.247	FCC 15.247
MHz	dBm		Limit(dBm)	Margin (dB)
2412.00	22.5	0.18	30	-7.5
2437.00	23.0	0.20	30	-7.0
2462.00	22.4	0.17	30	-7.6

802.11g:

802.11g @ 24Mbps

Frequency	Reading	Output in Watt	FCC 15.247	FCC 15.247
MHz	dBm		Limit(dBm)	Margin (dB)
2412.00	22.7	0.19	30	-7.3
2437.00	22.9	0.19	30	-7.1
2462.00	22.1	0.16	30	-7.9

802.11g @ 36Mbps

Frequency	Reading	Output in Watt	FCC 15.247	FCC 15.247
MHz	dBm		Limit(dBm)	Margin (dB)
2412.00	21.5	0.14	30	-8.5
2437.00	21.8	0.15	30	-8.2
2462.00	20.8	0.12	30	-9.2

802.11g @ 48Mbps

Frequency	Reading	Output in Watt	FCC 15.247	FCC 15.247
MHz	dBm		Limit(dBm)	Margin (dB)
2412.00	19.7	0.09	30	-10.3
2437.00	20.1	0.10	30	-9.9
2462.00	19.1	0.14	30	-10.9

802.11g @ 54Mbps

Frequency	Reading	Output in Watt	FCC 15.247	FCC 15.247
MHz	dBm		Limit(dBm)	Margin (dB)
2412.00	18.6	0.07	30	-11.4
2437.00	19.6	0.09	30	-10.4
2462.00	18.5	0.07	30	-11.6

§15.247(c) - 100 KHZ BANDWIDTH OF BAND EDGES

Standard Applicable

According to §15.247(d), in *any* 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. 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)).

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	8565EC	6042	1/11/2006

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

Measurement Result

Environmental Conditions

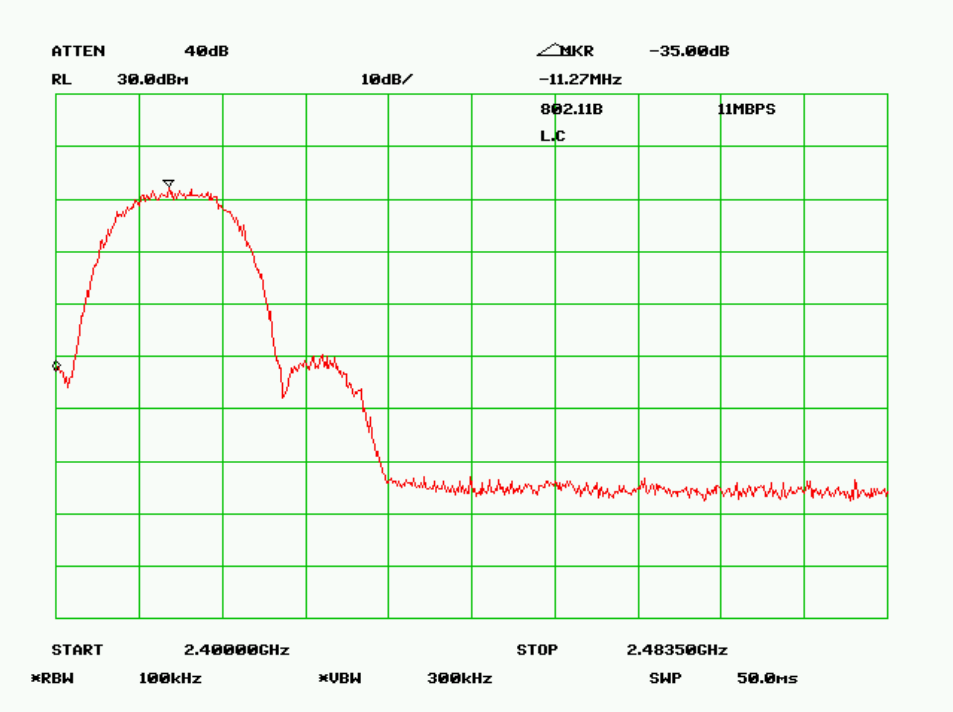
Temperature:	21° C
Relative Humidity:	67%
ATM Pressure:	1026 mbar

**The testing was performed by Daniel Deng on 2006-03-01.*

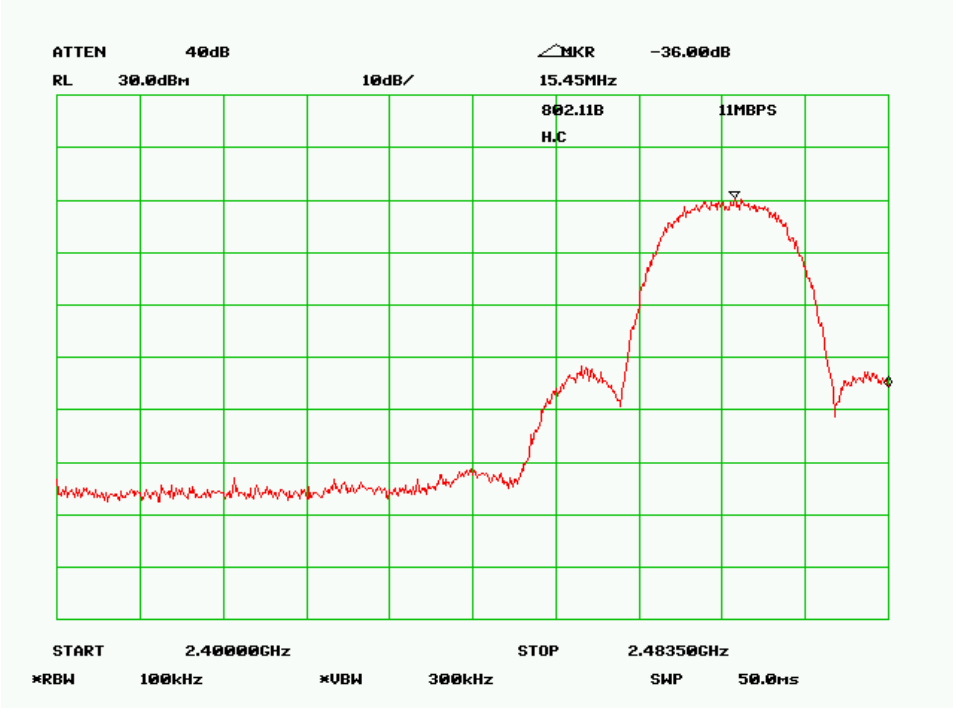
Please refer to following pages for plots of band edge.

802.11b:

Low Channel

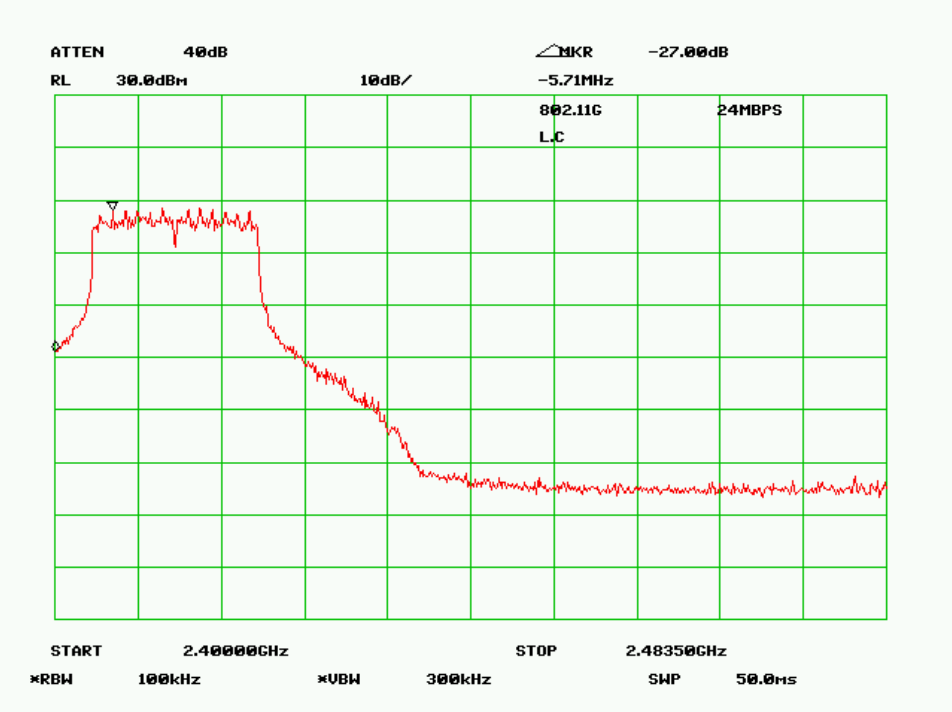


High Channel

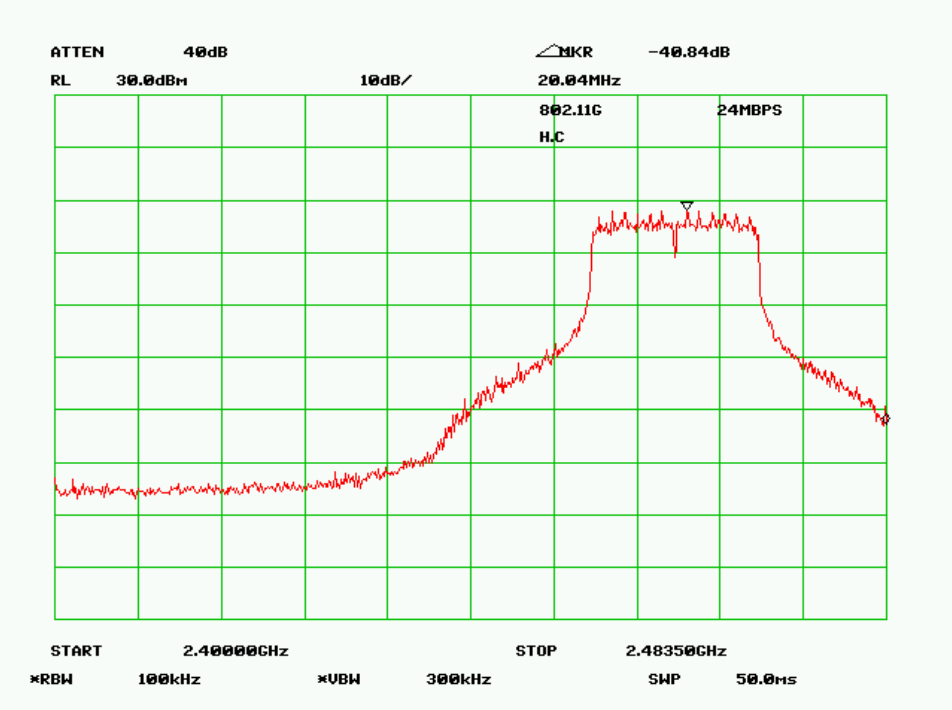


802.11g:

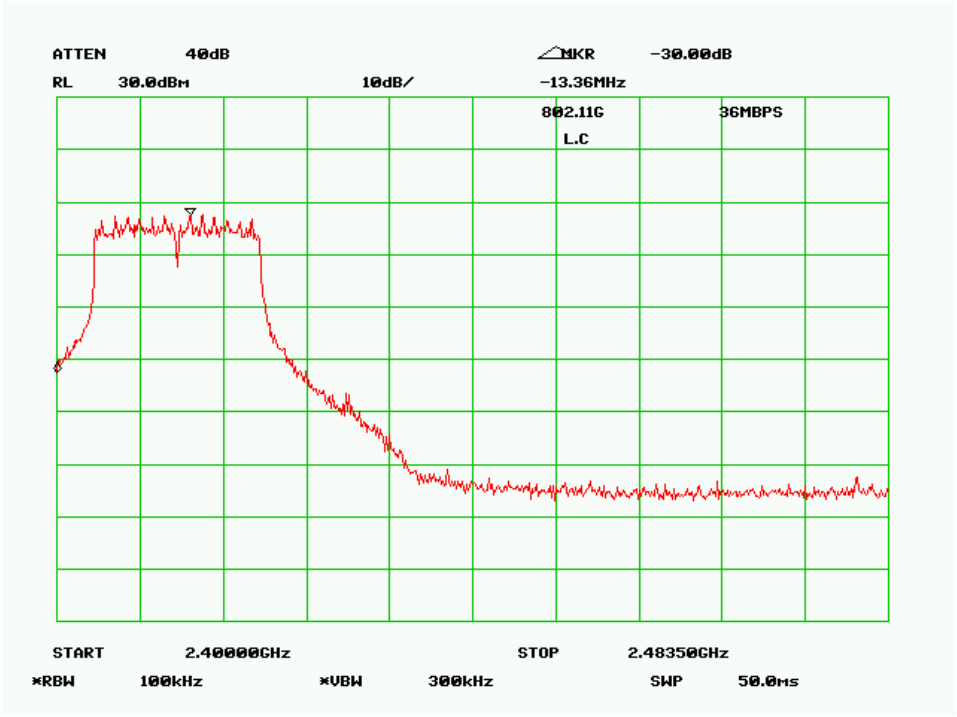
Low Channel, 24Mbps



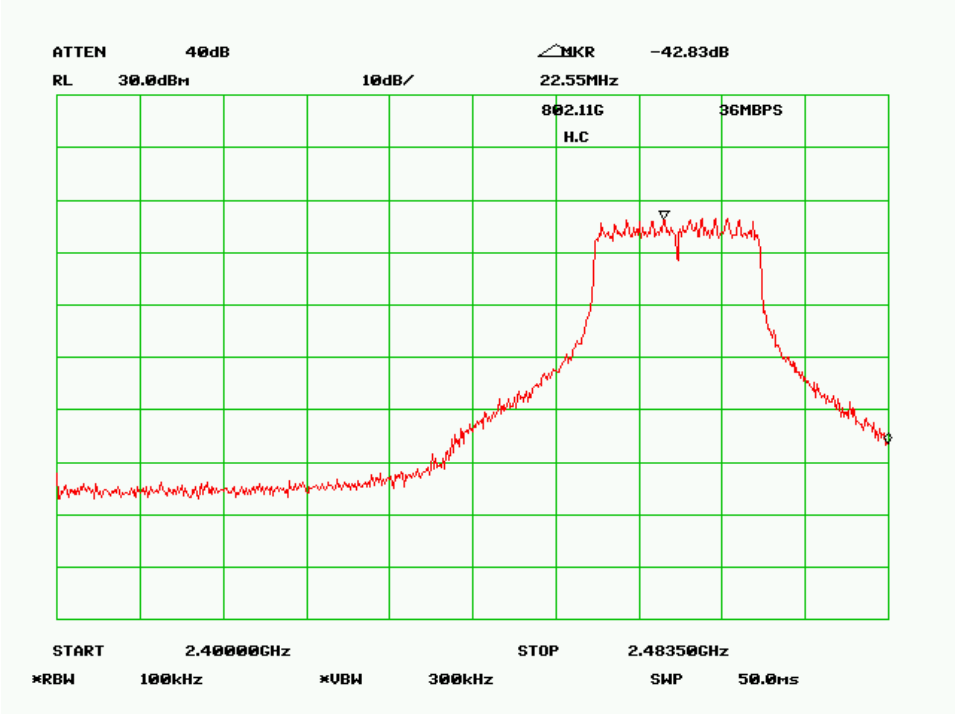
High Channel, 24Mbps



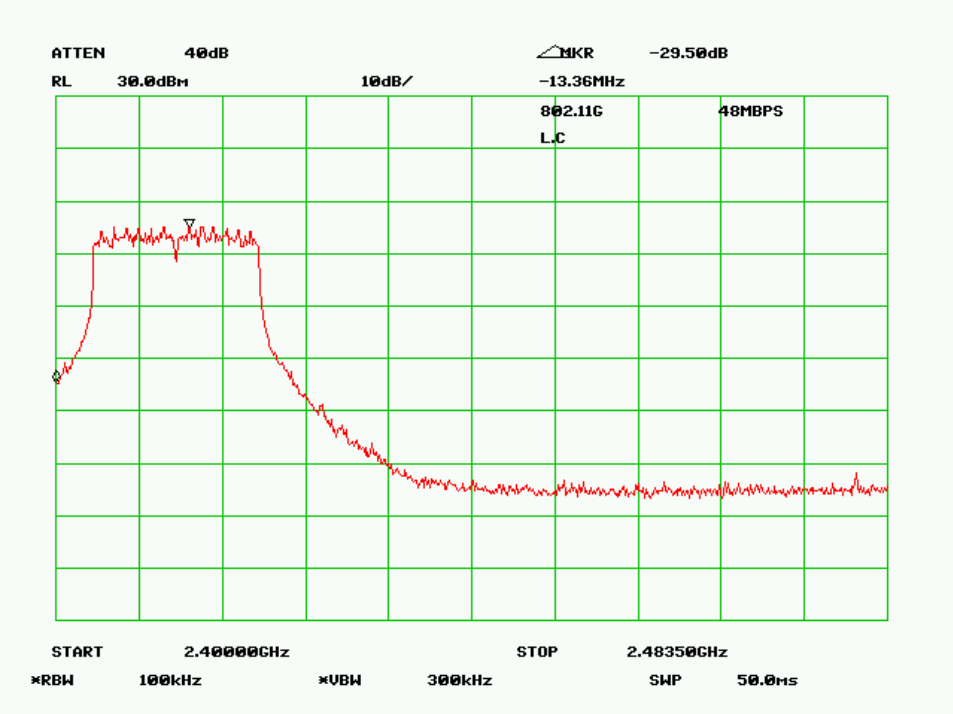
Low Channel, 36Mbps



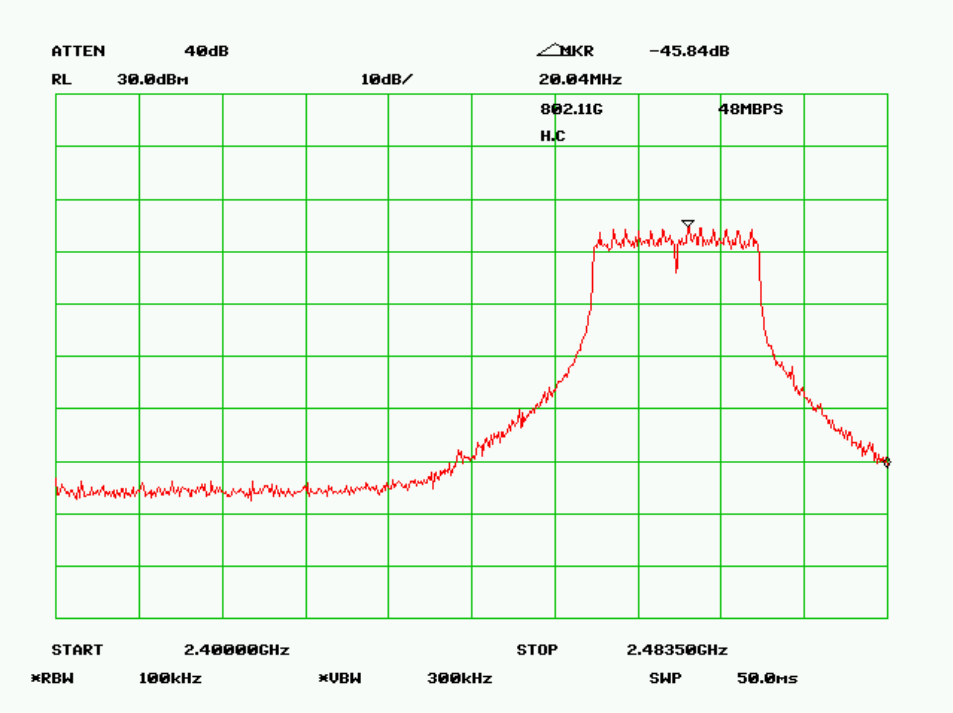
High Channel, 36Mbps



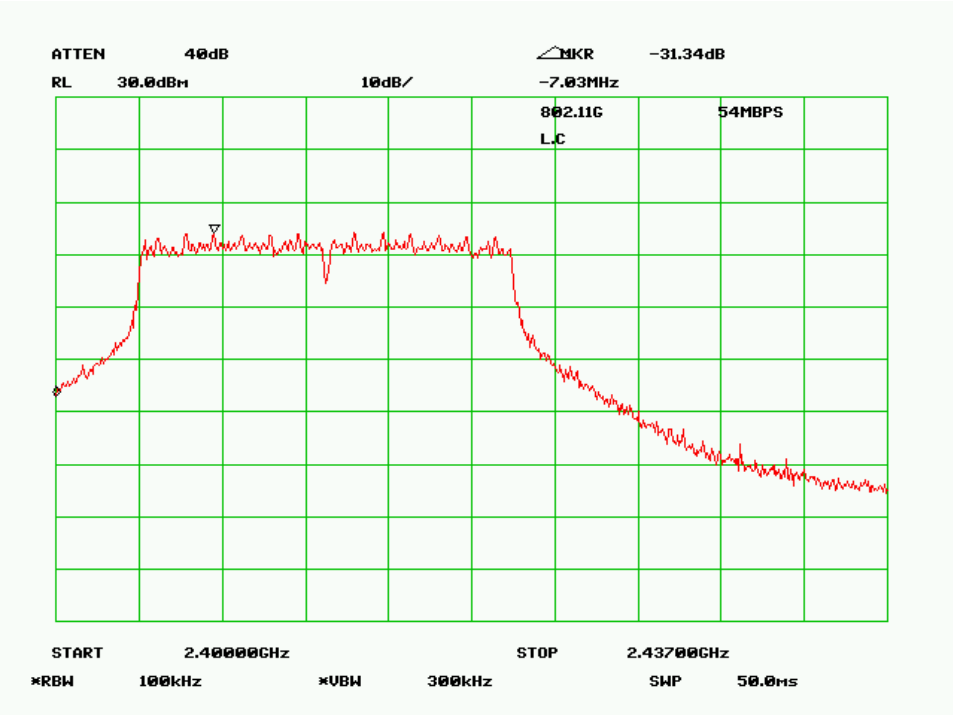
Low Channel, 48Mbps



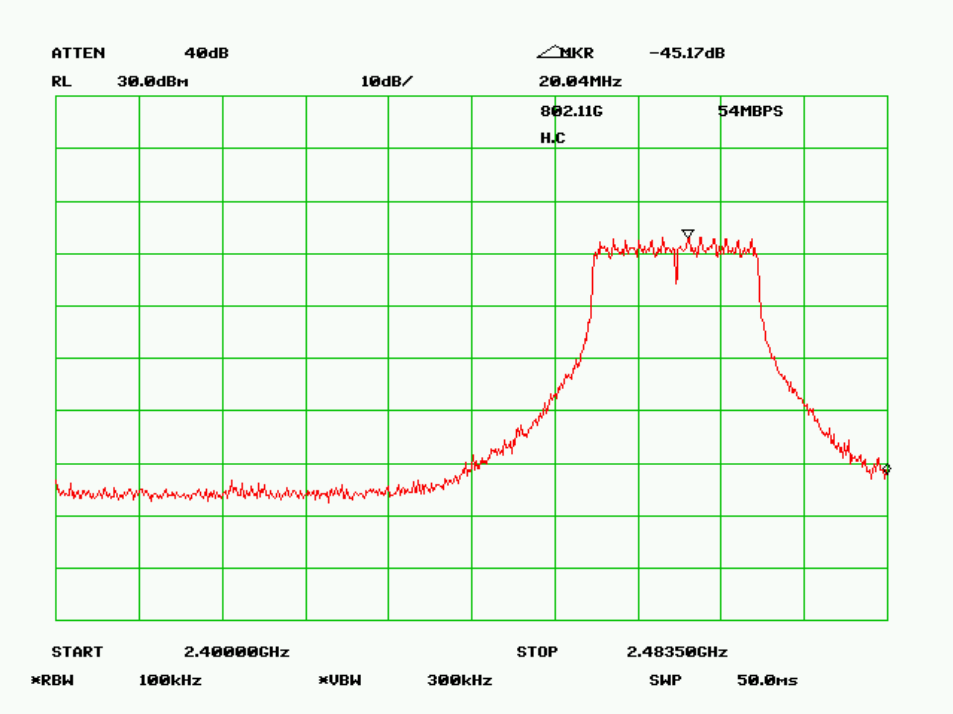
High Channel, 48Mbps



Low Channel, 54Mbps



High Channel, 54Mbps



§15.247(d) - POWER SPECTRAL DENSITY

Standard Applicable

According to §15.247 (d), for direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value. (DTS)
4. Repeat above procedures until all frequencies measured were complete.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Analyzer, Spectrum	8565EC	6042	1/11/2006

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

Measurement Result

Environmental Conditions

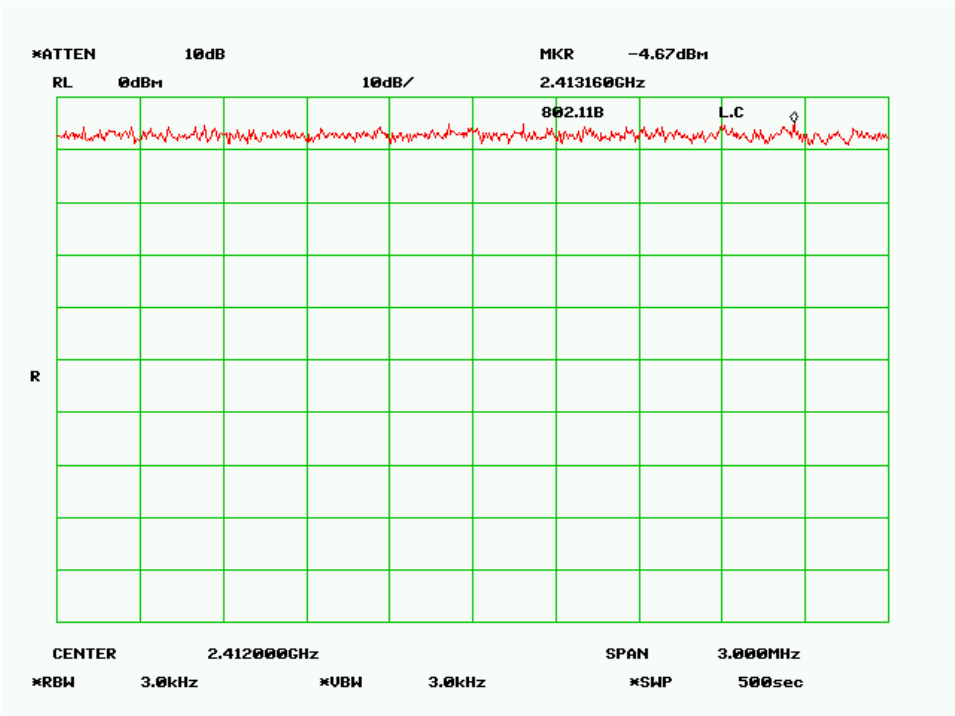
Temperature:	21° C
Relative Humidity:	67%
ATM Pressure:	1026 mbar

**The testing was performed by Daniel Deng on 2006-03-01.*

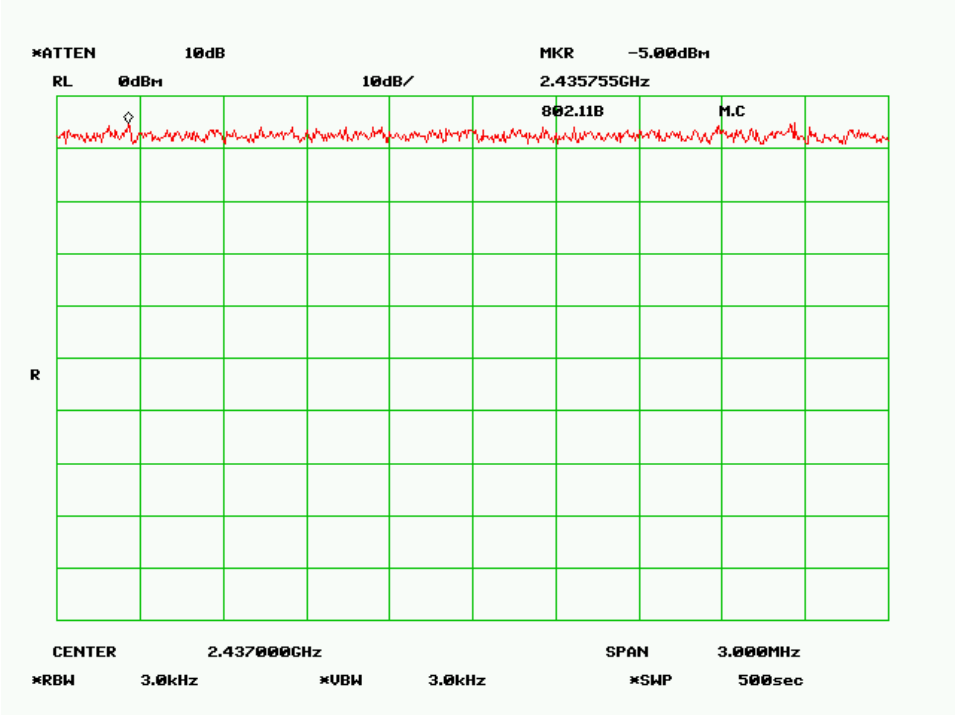
Test Result

802.11b:

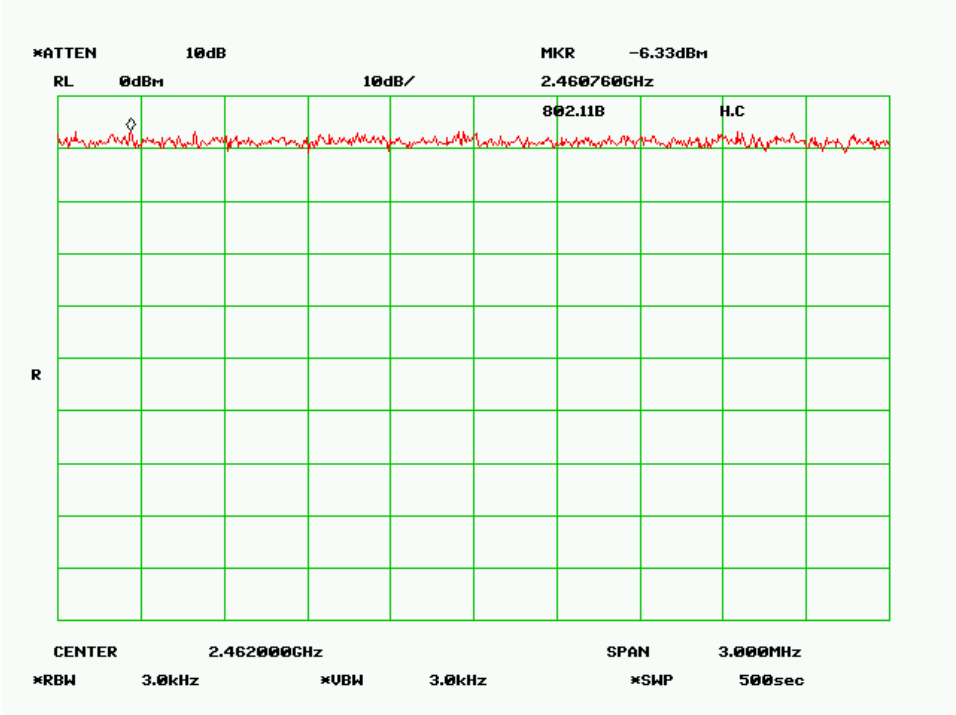
Low Channel



Mid. Channel

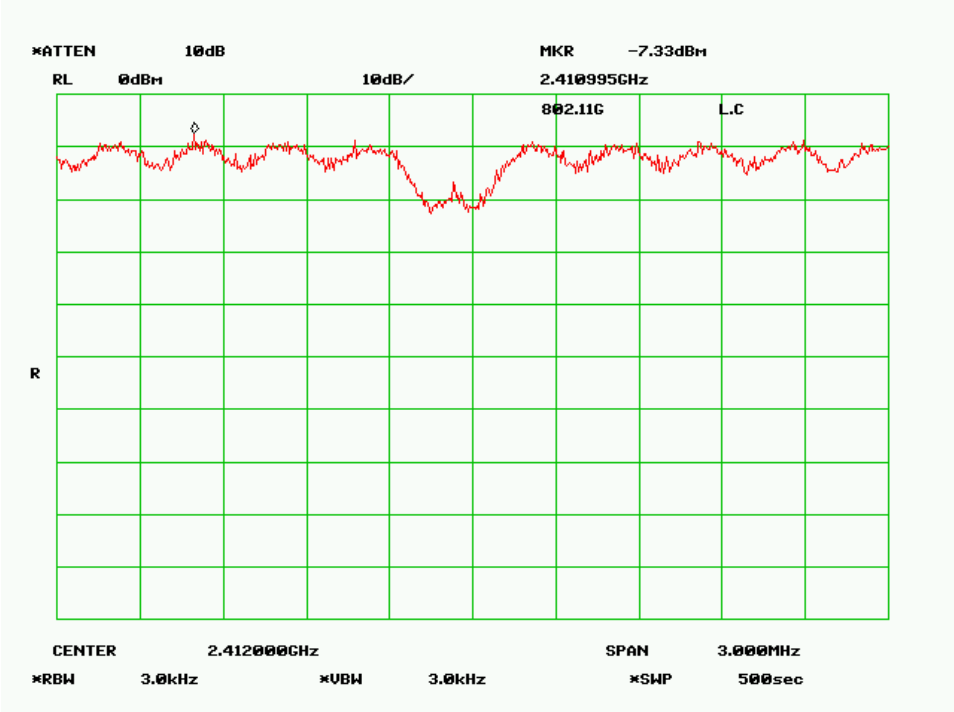


High Channel

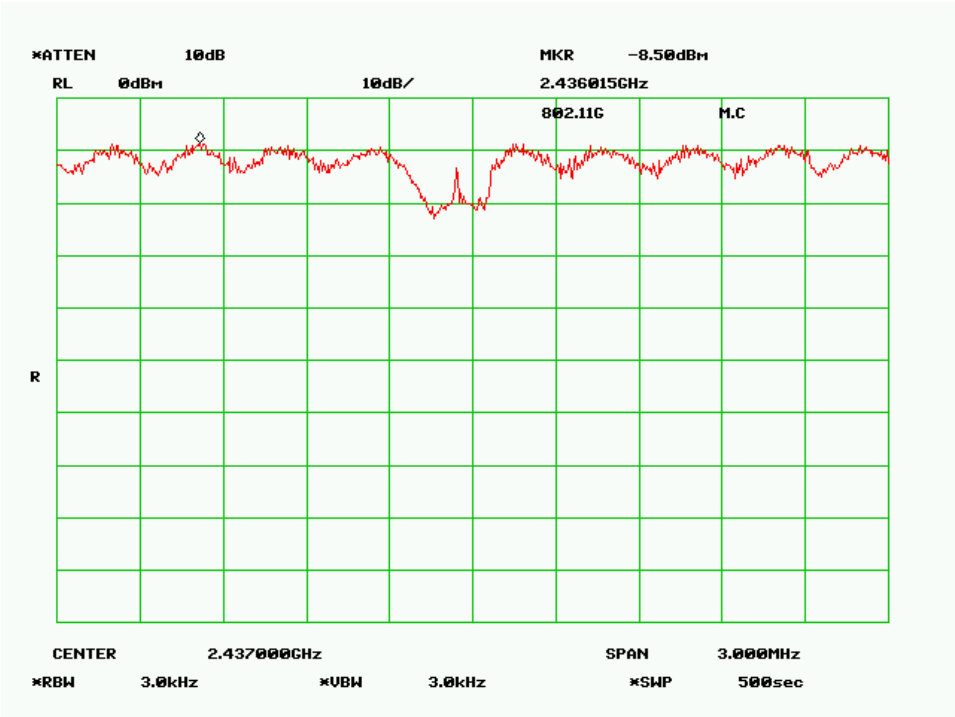


802.11g:

Low Channel



Mid Channel



High Channel