Lab Code: 200167-0

FCC PART 15.247

EMI MEASUREMENT AND TEST REPORT

For

Ruckus Wireless, Inc.

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

FCC ID: S9GMM2225
Model: MM2225/MM22X1

This Report Concerns:	Product name:
☒ Original Report	Wireless 802.11b/g Router

Test Engineer: Snell Leong

Report No.: R0604185

Report Date: 2006-04-30

Reviewed By: Daniel Deng

Prepared By: Bay Area Compliance Laboratory Corporation (BACL)
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Ruckus Wireless, Inc.* product, *FCC ID: S9GMM2225,* or the "EUT" as referred to this report is a Wireless 802.11b/g Router which measures approximately 233mmL x 153mmW x 75mmH.

** The test data gathered are from production sample, serial number: AP51 for MM2225 and AP71 for MM22X1, provided by the manufacturer.*

EUT Photo

MM2225

MM22X1

Additional photos in Exhibit B

Objective

This type approval 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.

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

MM2225 (5 ports) and MM22X1 (1 port) have the same antenna but different Ethernet port. MM2225 was tested as the worst case for radiated emissions tests in this report.

Related Submittal(s)/Grant(s)

No Related Submittals.

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.
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 Test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at it's facility in Sunnyvale, California, 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 have 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

N/A

Equipment Modifications

No modifications were made to the EUT.

Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
IBM	Laptop PC	2662	N/A

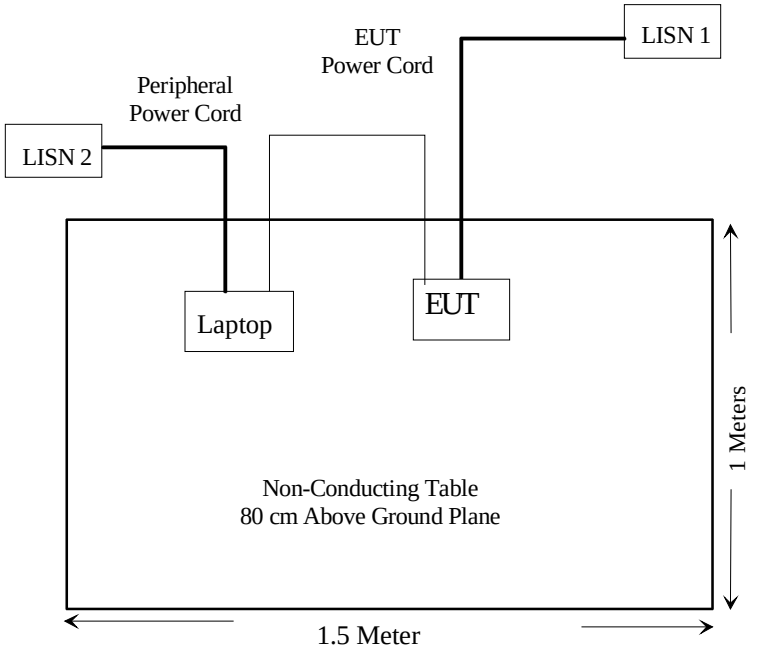
Power Supply Information

Manufacturer	Description	Model	Serial Number
DVE	ADC Adaptor	DSA-0131F-12 US 12	N/A
DVE	ADC Adaptor	DSA-12W-10 Fxx	N/A
Leader Electronic	ADC Adaptor	MU-12-2120100-A1	N/A

Interface Ports and Cabling

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

Test Setup Block Diagram



SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

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

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

§15.247(e)(i),§2.1091 - RF EXPOSURE

According to §15.247(e)(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

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
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

MPE Prediction

For MM2225

Predication 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: 23.0(dBm)
Maximum peak output power at antenna input terminal: 200.00 (mW)
Prediction distance: 20 (cm)
Predication frequency: 2400 (MHz)
Antenna Gain (typical): 3.3 (dBi)
antenna gain: 2.14 (numeric)
Power density at predication frequency at 20 cm: 0.085(mW/cm^2)

MPE limit for uncontrolled exposure at prediction frequency: 1.0 (mW/cm^2)

For MM22X1

Predication 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: 23.0(dBm)
Maximum peak output power at antenna input terminal: 200.00 (mW)
Prediction distance: 20 (cm)
Predication frequency: 2400 (MHz)
Antenna Gain (typical): 3.3 (dBi)
Antenna gain: 2.14 (numeric)
Power density at predication frequency at 20 cm: 0.085(mW/cm^2)

MPE limit for uncontrolled exposure at prediction frequency: 1.0 (mW/cm^2)

Test Result

The EUT is a mobile device. The power density level at 20 cm is 0.085mW/cm², which is below the uncontrolled exposure limit of 1.0mW/cm² at 2400 MHz. for MM2225 and MM22X1

§15.203 - ANTENNA REQUIREMENT

Applicable Standard

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 EMISSIONS

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 $\pm$2.4 dB.

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 connected with LISN-1.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal Date
Rohde & Schwarz	Artificial-Mains Network	ESH2-Z5	871884/039	2005-11-14
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2006-03-13

*** 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 emissions 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:	20° C
Relative Humidity:	65%
ATM Pressure:	1027 mbar

**The testing was performed by Snell Leong 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:

For MM2225:

5.6 dB at **0.406 MHz** in the **Line** conductor mode for **(DVE) DSA-12W-10Fxx**.
9.1 dB at **0.15 MHz** in the **Line** conductor mode for **(DVE) DSA-013 F12 US 12**
9.0 dB at **0.490 MHz** in the **Neutral** conductor mode for **(Leader Electronics) MU-12-2120100-A1**

For MM22X1:

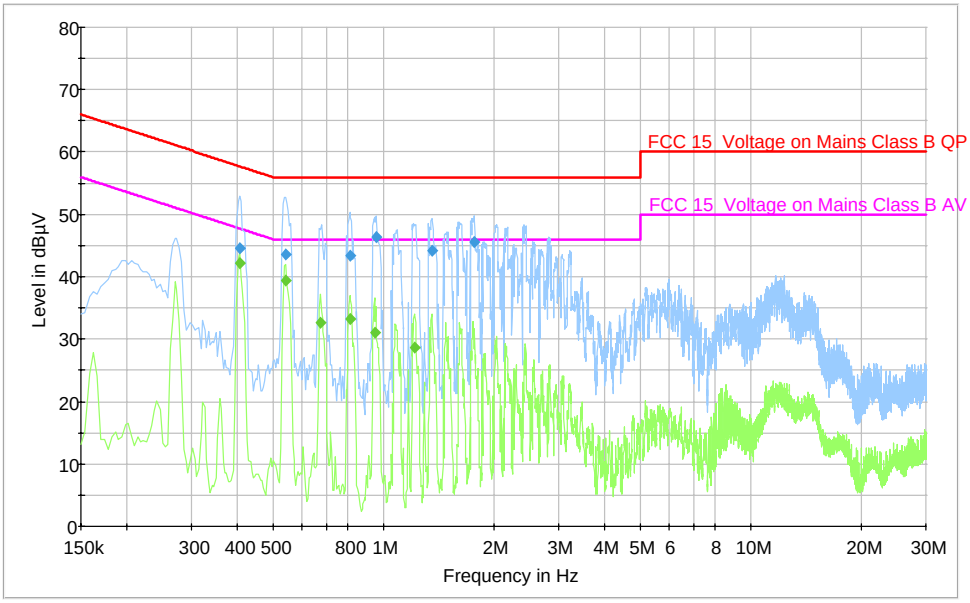
1.9 dB at **0.434 MHz** in the **Neutral** conductor mode for **(DVE) DSA-12W-10Fxx***
6.8 dB at **0.166 MHz** in the **Neutral** conductor mode for **(DVE) DSA-013 F12 US 12**
9.6 dB at **2.298 MHz** in the **Neutral** conductor mode for **(Leader Electronic) MU-12-2120100-A1**

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

Conducted Emissions Test plots and Data

For MM2225

120V 60HZ - Line for (DVE) DSA-12W-10Fxx.



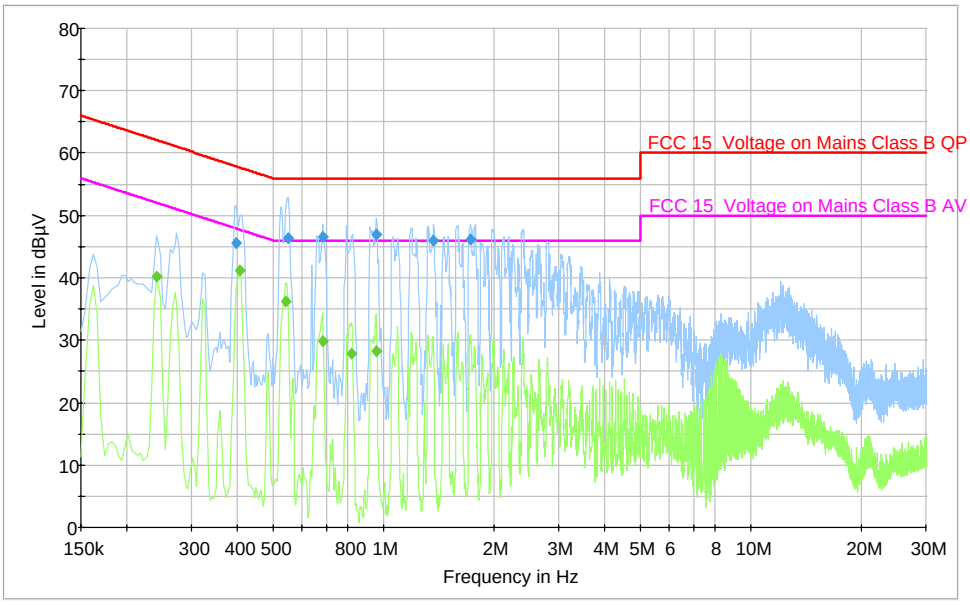
QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Margin (dB)	Limit (dBµV)
0.954000	46.4	L1	9.6	56.0
1.766000	45.5	L1	10.5	56.0
1.354000	44.2	L1	11.8	56.0
0.542000	43.5	L1	12.5	56.0
0.810000	43.3	L1	12.7	56.0
0.406000	44.5	L1	13.2	57.7

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Margin (dB)	Limit (dBµV)
0.406000	42.2	L1	5.6	47.7
0.542000	39.3	L1	6.7	46.0
0.810000	33.2	L1	12.8	46.0
0.674000	32.5	L1	13.5	46.0
0.946000	31.0	L1	15.0	46.0
1.214000	28.6	L1	17.4	46.0

120V 60HZ - Neutral for (DVE) DSA-12W-10Fxx.



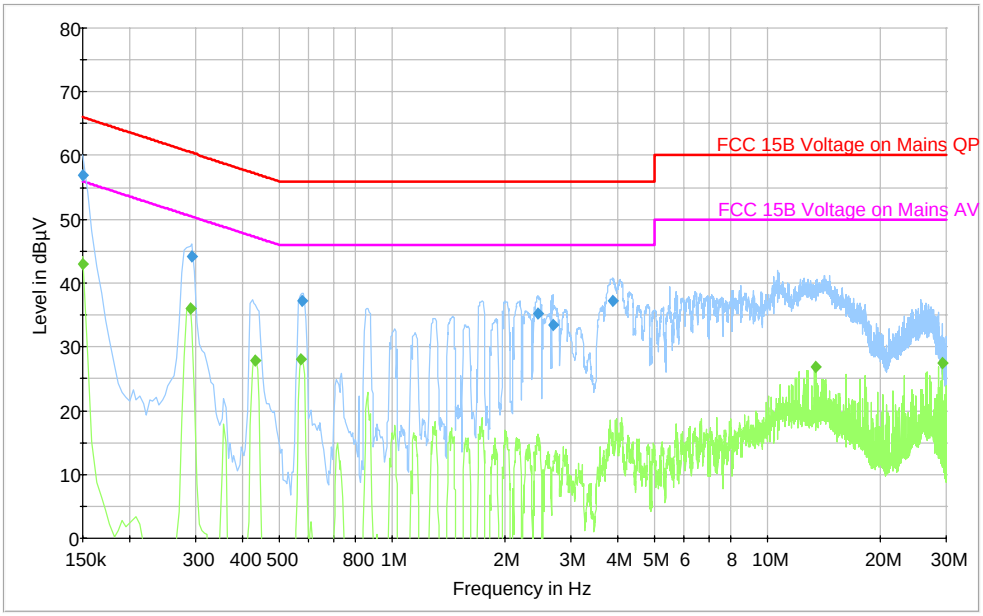
QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Margin (dB)	Limit (dBµV)
0.958000	47.1	N	8.9	56.0
0.682000	46.6	N	9.5	56.0
0.550000	46.4	N	9.6	56.0
1.730000	46.1	N	9.9	56.0
1.366000	46.0	N	10.0	56.0
0.398000	45.6	N	12.3	57.9

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Margin (dB)	Limit (dBµV)
0.406000	41.1	N	6.6	47.7
0.542000	36.2	N	9.8	46.0
0.242000	40.2	N	11.9	52.0
0.682000	29.8	N	16.2	46.0
0.954000	28.2	N	17.8	46.0
0.818000	27.9	N	18.2	46.0

120V 60HZ - Line for (DVE) DSA-013 F12 US 12



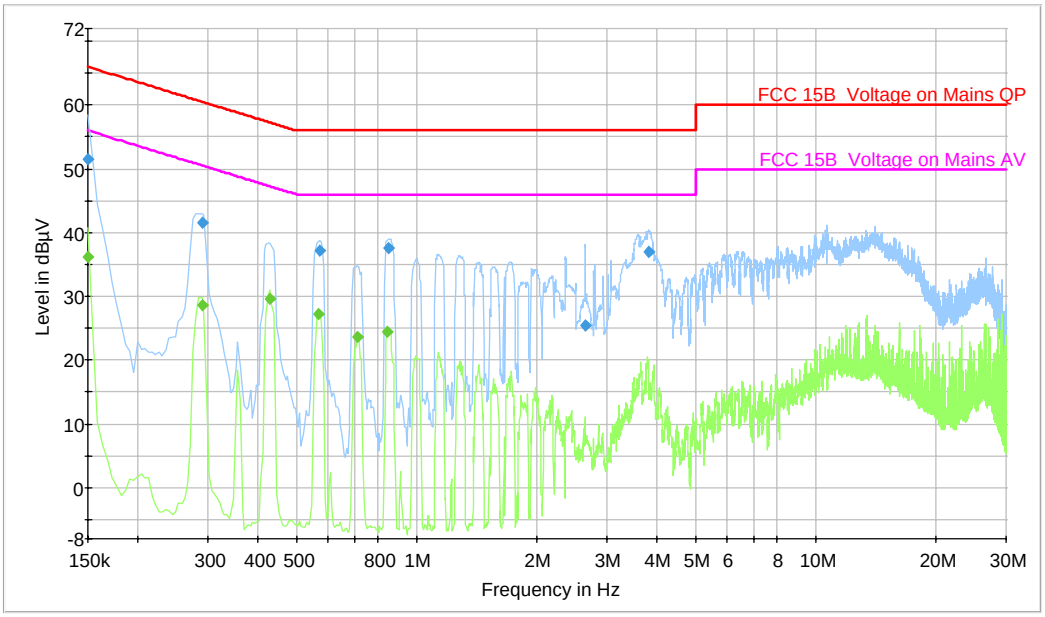
QP Measurements

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

Average Measurements

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

120V 60HZ - Neutral for (DVE) DSA-013 F12 US 12



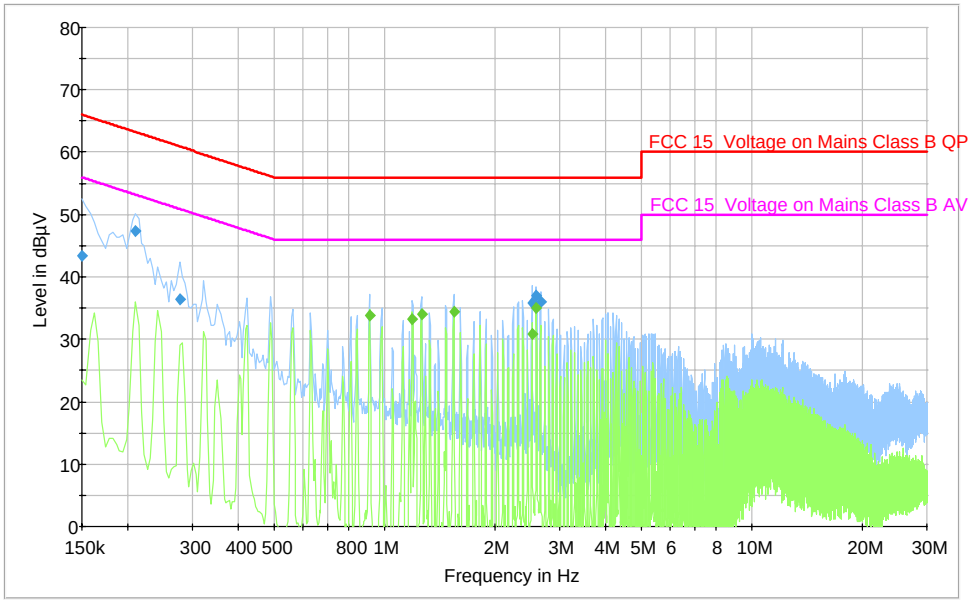
QP Measurements

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

Average Measurements

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

120V 60HZ - Line for (Leader Electronics) MU-12-2120100-A1



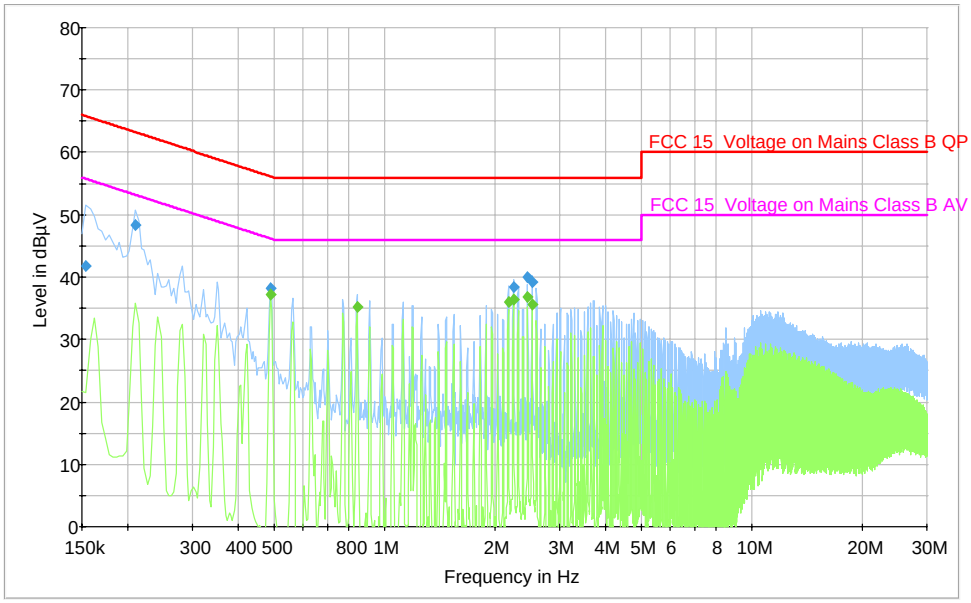
QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Margin (dB)	Limit (dBµV)
0.210000	47.3	L1	15.9	63.2
2.594000	37.0	L1	19.0	56.0
2.662000	36.1	L1	19.9	56.0
2.522000	35.9	L1	20.1	56.0
0.150000	43.4	L1	22.6	66.0
0.278000	36.3	L1	24.5	60.9

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Margin (dB)	Limit (dBµV)
2.594000	35.1	L1	10.9	46.0
1.542000	34.5	L1	11.5	46.0
1.262000	34.0	L1	12.0	46.0
0.910000	33.8	L1	12.2	46.0
1.190000	33.3	L1	12.7	46.0
2.522000	30.9	L1	15.1	46.0

120V 60HZ - Neutral for (Leader Electronics) MU-12-2120100-A1



QP Measurements

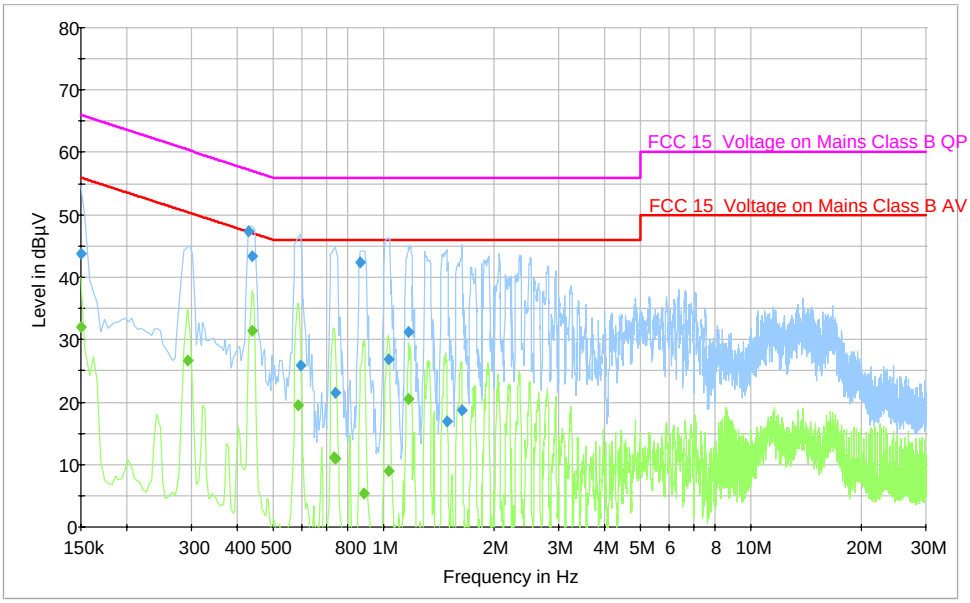
Frequency (MHz)	QuasiPeak (dBµV)	Line	Margin (dB)	Limit (dBµV)
0.210000	48.3	N	14.9	63.2
2.454000	40.0	N	16.0	56.0
2.526000	39.2	N	16.8	56.0
2.242000	38.5	N	17.5	56.0
0.490000	38.2	N	18.0	56.2
0.154000	41.8	N	24.0	65.8

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Margin (dB)	Limit (dBµV)
0.490000	37.2	N	9.0	46.2
2.454000	36.7	N	9.3	46.0
2.242000	36.5	N	9.5	46.0
2.174000	35.9	N	10.1	46.0
2.522000	35.7	N	10.3	46.0
0.842000	35.3	N	10.7	46.0

For MM22X1

120V 60HZ - Line for (DVE) DSA-12W-10Fxx



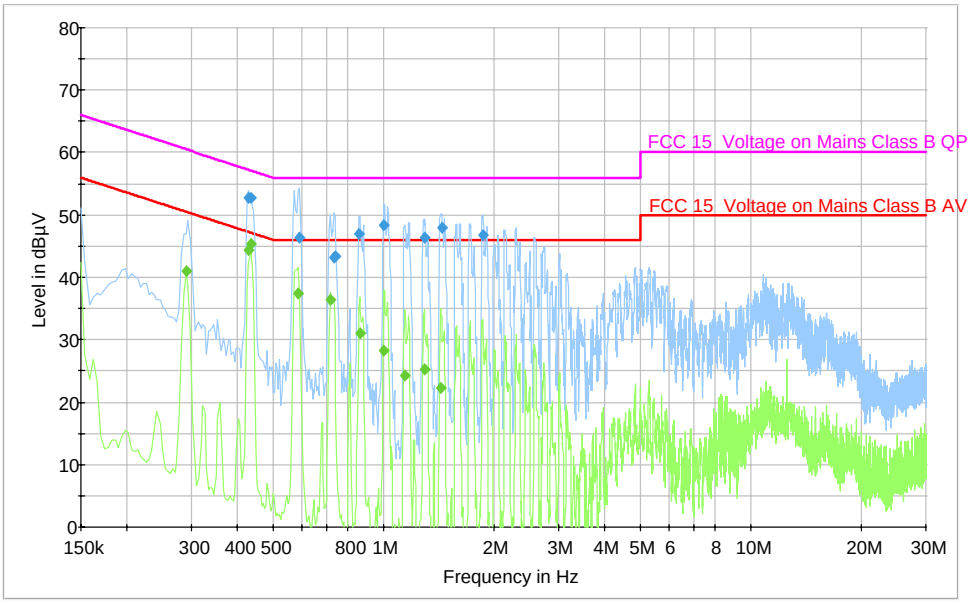
QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.438000	43.5	L1	0.4	13.6	57.1
0.866000	42.3	L1	0.3	13.7	56.0
0.430000	47.4	L1	0.4	19.9	67.3
0.150000	43.7	L1	0.1	22.3	66.0
1.170000	31.3	L1	0.3	24.7	56.0
1.030000	26.9	L1	0.3	29.1	56.0
0.594000	26.0	L1	0.3	30.0	56.0
0.742000	21.5	L1	0.3	34.5	56.0
1.634000	18.6	L1	0.3	37.4	56.0
1.490000	16.9	L1	0.3	39.1	56.0

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.438000	31.5	L1	0.4	15.6	47.1
0.294000	26.6	L1	0.2	23.8	50.4
0.150000	32.1	L1	0.1	23.9	56.0
1.170000	20.4	L1	0.3	25.6	46.0
0.586000	19.4	L1	0.3	26.6	46.0
0.734000	11.1	L1	0.3	34.9	46.0
0.738000	10.9	L1	0.3	35.1	46.0
1.030000	9.0	L1	0.3	37.0	46.0
0.886000	5.4	L1	0.3	40.6	46.0
1.478000	-1.4	L1	0.3	47.4	46.0

120V 60HZ - Neutral for (DVE) DSA-12W-10Fxx



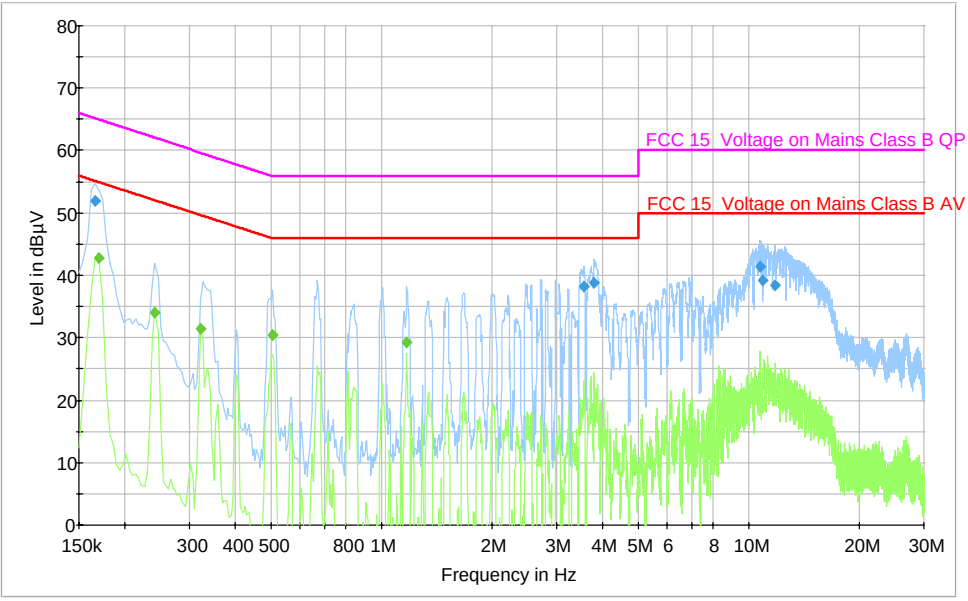
QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.738000	43.4	N	0.3	2.6	46.0
0.734000	43.3	N	0.3	2.8	46.0
0.430000	52.8	N	0.4	4.5	57.3
0.434000	52.7	N	0.4	4.5	57.2
1.002000	48.3	N	0.3	7.7	56.0
1.442000	48.1	N	0.2	7.9	56.0
0.858000	46.9	N	0.3	9.1	56.0
1.866000	46.8	N	0.2	9.2	56.0
0.590000	46.4	N	0.3	9.6	56.0
1.290000	46.3	N	0.3	9.7	56.0

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.434000	45.3	N	0.4	1.9*	47.2
0.430000	44.3	N	0.4	3.0	47.3
0.586000	37.4	N	0.3	8.6	46.0
0.290000	41.0	N	0.2	9.5	50.5
0.718000	36.5	N	0.3	9.5	46.0
0.862000	31.0	N	0.3	15.0	46.0
1.002000	28.3	N	0.3	17.7	46.0
1.290000	25.2	N	0.3	20.8	46.0
1.146000	24.2	N	0.3	21.8	46.0
1.430000	22.2	N	0.2	23.8	46.0

120V 60HZ - Line for (DVE) DSA-013F-12 US 12



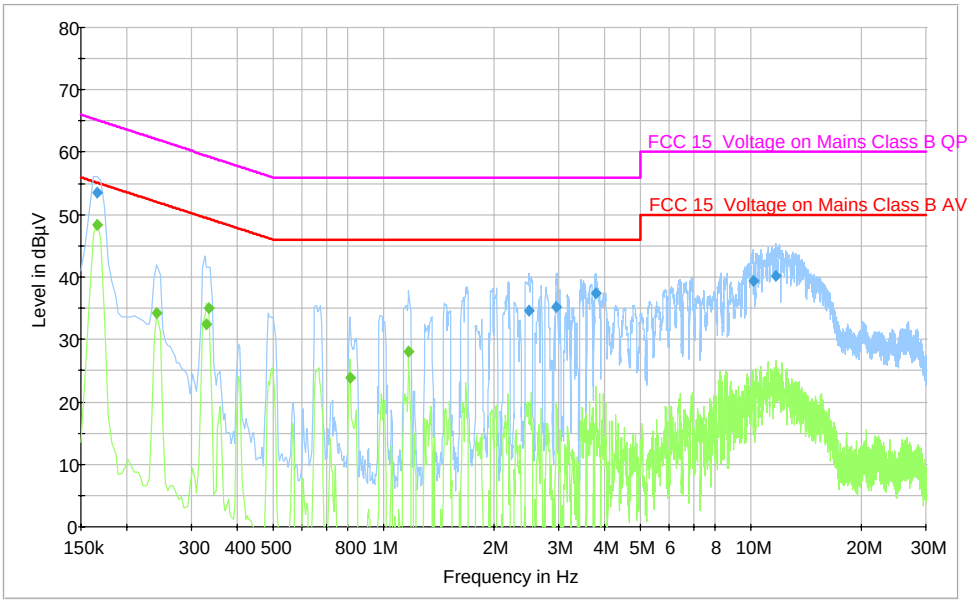
QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	51.9	L1	0.1	13.3	65.2
3.802000	38.8	L1	0.3	17.2	56.0
3.562000	38.2	L1	0.3	17.8	56.0
10.730000	41.4	L1	0.4	18.6	60.0
10.910000	39.3	L1	0.4	20.7	60.0
11.814000	38.5	L1	0.4	21.5	60.0

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.170000	42.8	L1	0.1	12.2	55.0
0.506000	30.4	L1	0.3	15.6	46.0
1.170000	29.3	L1	0.3	16.7	46.0
0.242000	34.1	L1	0.2	17.9	52.0
0.322000	31.4	L1	0.2	18.3	49.7

120V 60HZ - Neutral for (DVE) DSA-013F-12US 12



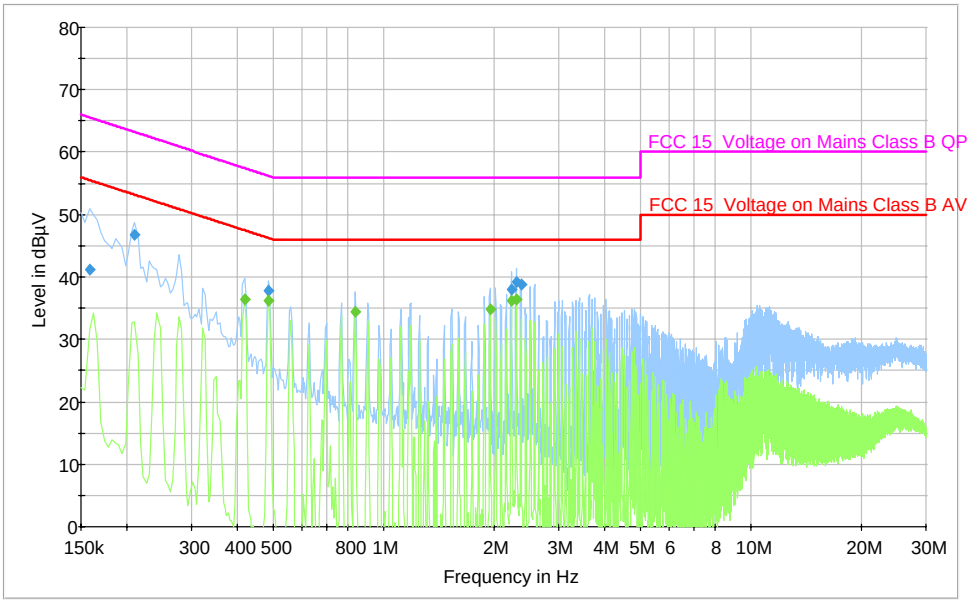
QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	53.5	N	0.1	11.7	65.2
3.798000	37.4	N	0.3	18.6	56.0
11.714000	40.2	N	0.4	19.8	60.0
10.138000	39.4	N	0.4	20.6	60.0
2.962000	35.1	N	0.3	20.9	56.0
2.490000	34.6	N	0.3	21.4	56.0

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	48.4	N	0.1	6.8	55.2
0.334000	34.9	N	0.3	14.5	49.4
0.330000	32.4	N	0.3	17.1	49.5
0.242000	34.3	N	0.2	17.7	52.0
1.170000	28.1	N	0.3	17.9	46.0
0.810000	23.8	N	0.3	22.2	46.0

120V 60HZ - Line for (Leader Electronic) MU-12-2120100-A1



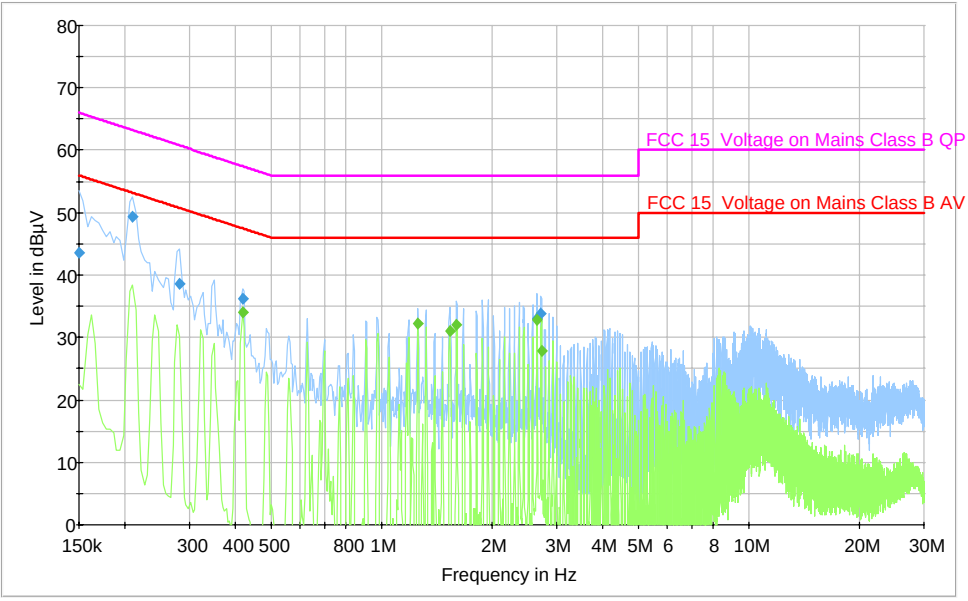
QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.210000	46.8	L1	0.2	16.4	63.2
2.302000	39.2	L1	0.2	16.8	56.0
2.366000	38.8	L1	0.3	17.2	56.0
2.230000	38.1	L1	0.3	17.9	56.0
0.486000	37.8	L1	0.3	18.4	56.2
0.158000	41.2	L1	0.1	24.4	65.6

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
2.298000	36.4	L1	0.2	9.6	46.0
2.230000	36.2	L1	0.3	9.8	46.0
0.486000	36.3	L1	0.3	9.9	46.2
0.418000	36.4	L1	0.4	11.1	47.5
1.950000	34.9	L1	0.2	11.1	46.0
0.838000	34.4	L1	0.3	11.6	46.0

120V 60HZ - Neutral for (Leader Electronic) MU-12-2120100-A1



QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.210000	49.4	N	0.2	13.8	63.2
0.418000	36.2	N	0.4	21.3	57.5
2.718000	33.9	N	0.2	22.1	56.0
0.282000	38.6	N	0.2	22.2	60.8
0.150000	43.6	N	0.1	22.4	66.0
2.654000	33.1	N	0.2	22.9	56.0

Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
2.650000	32.8	N	0.2	13.2	46.0
0.418000	34.0	N	0.4	13.5	47.5
1.254000	32.2	N	0.3	13.8	46.0
1.602000	32.0	N	0.3	14.0	46.0
1.534000	31.1	N	0.3	14.9	46.0
2.722000	27.9	N	0.2	18.1	46.0

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

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

Applicable Standard

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	2006-01-11

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	65%
ATM Pressure:	1027 mbar

**The testing was performed by Snell Leong on 2006-03-08*

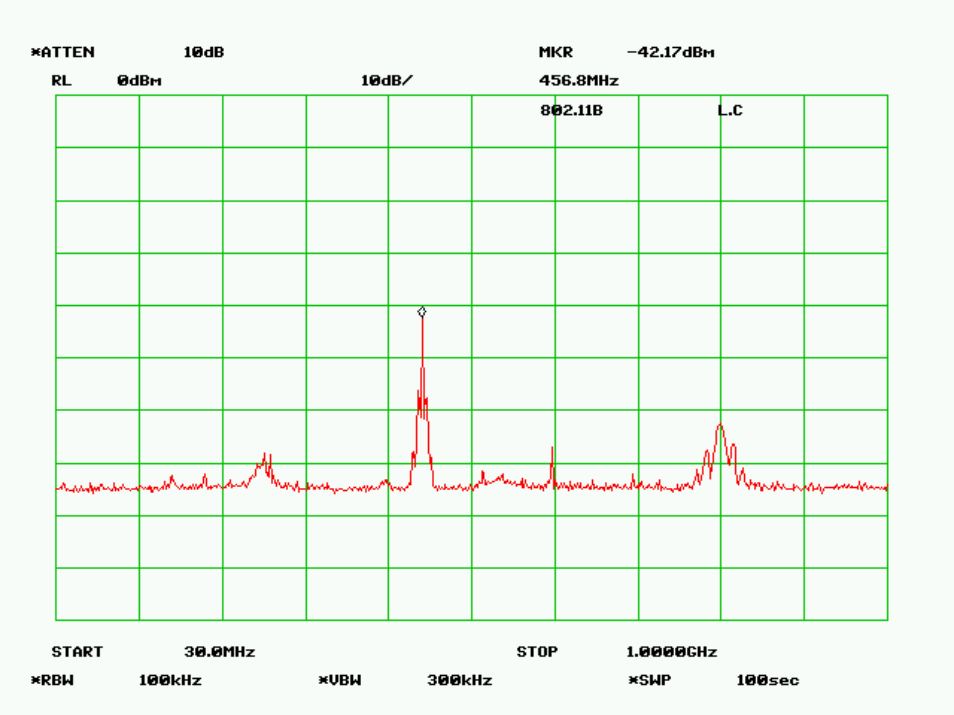
Measurement Result

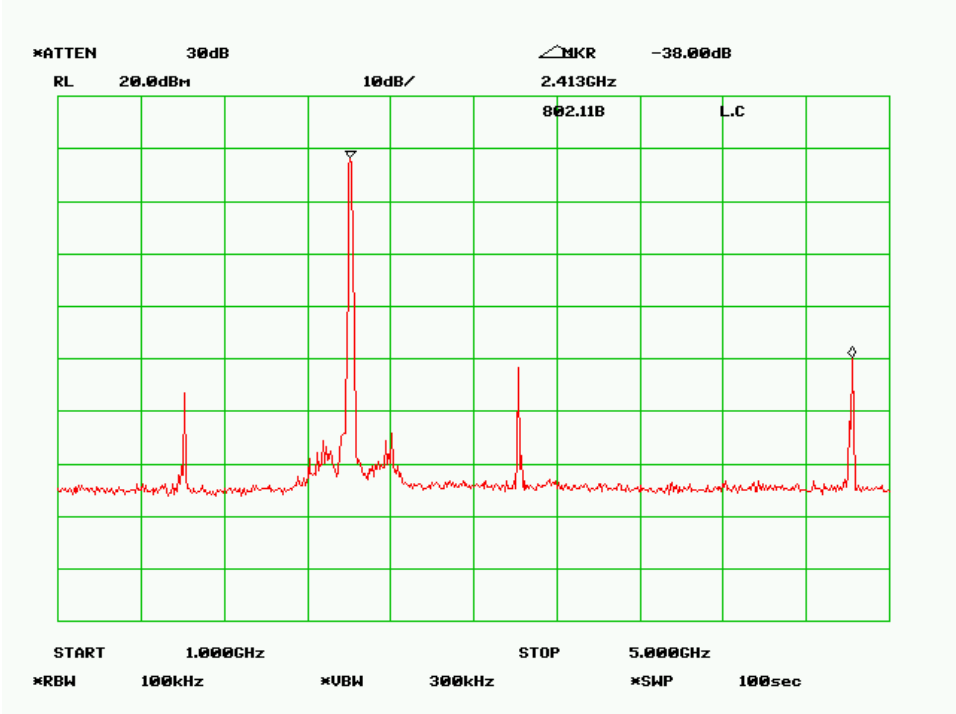
Please refer to following pages for plots of spurious emissions.

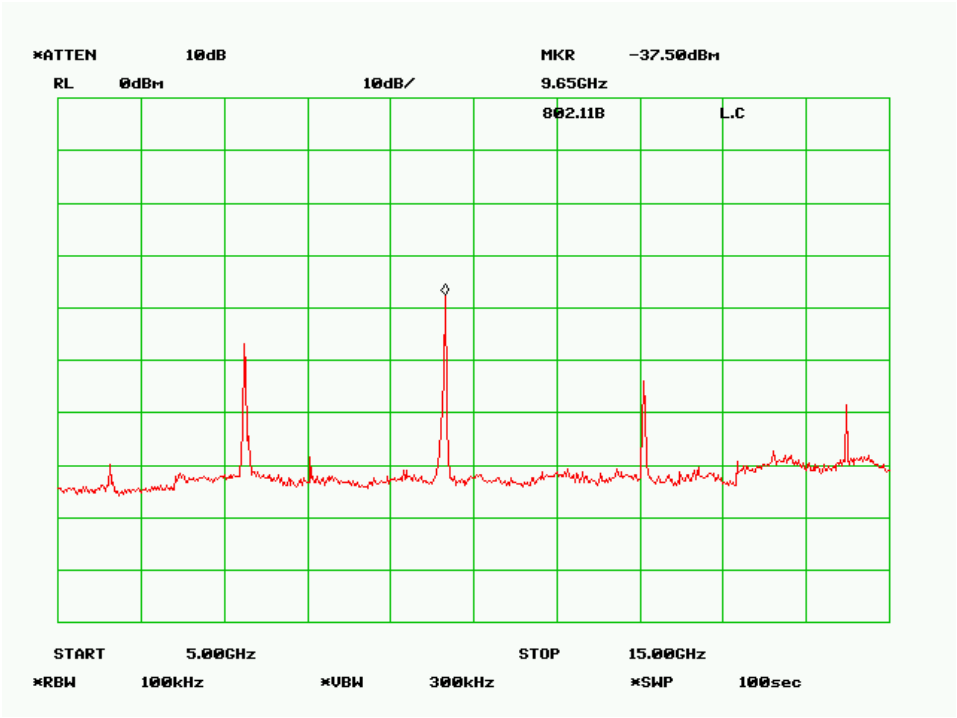
For MM2225:

802.11b:

Low Channel



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RL 0dBm
10dB/
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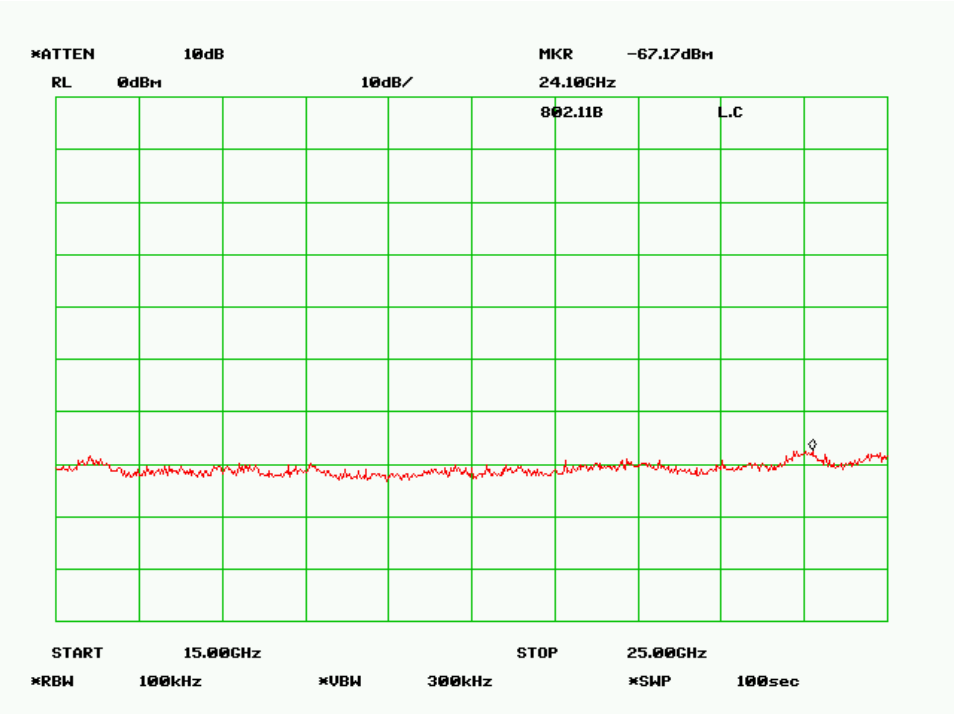
802.11B
L.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec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10dB/
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802.11B
L.C
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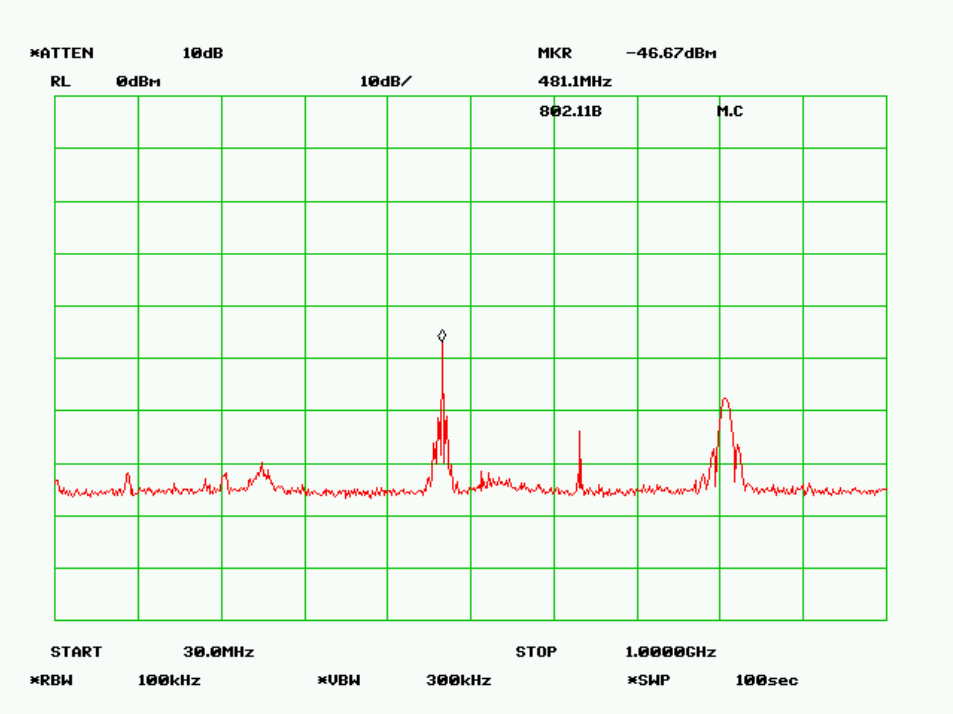
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

Mid Channel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RL 0dBm
10dB/
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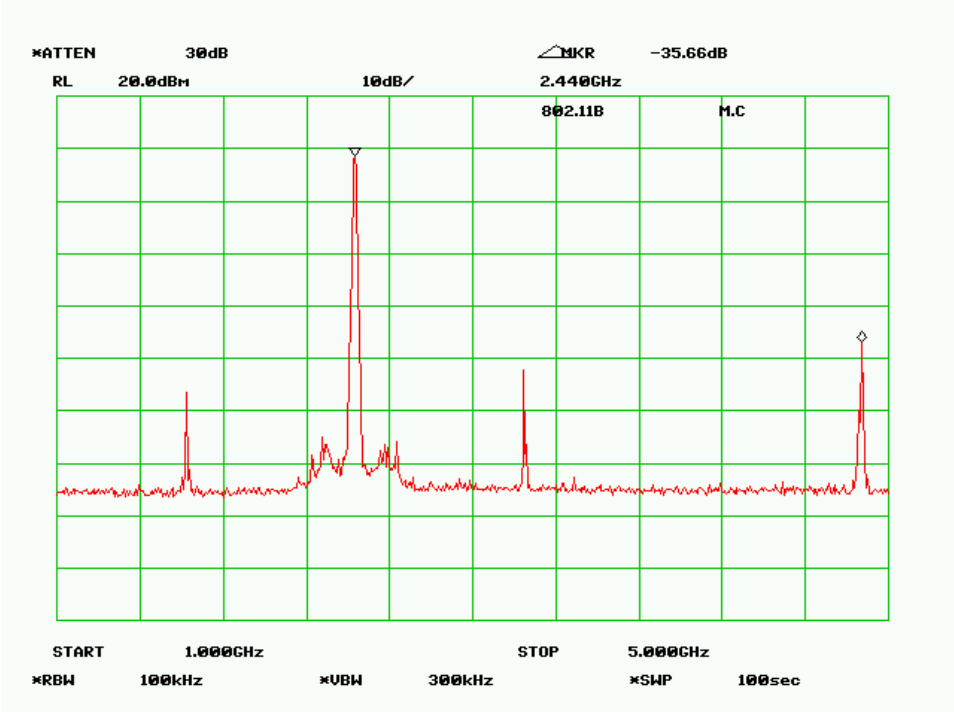
802.11B
M.C
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec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RL 20.0dBm
10dB/
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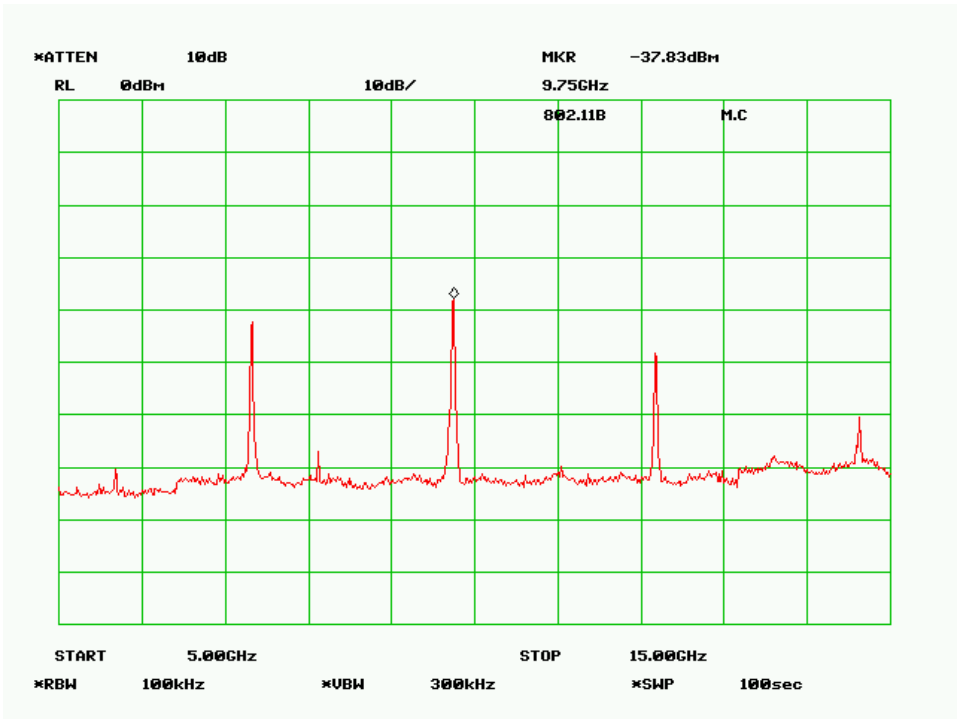
802.11B
M.C
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec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RL 0dBm
10dB/
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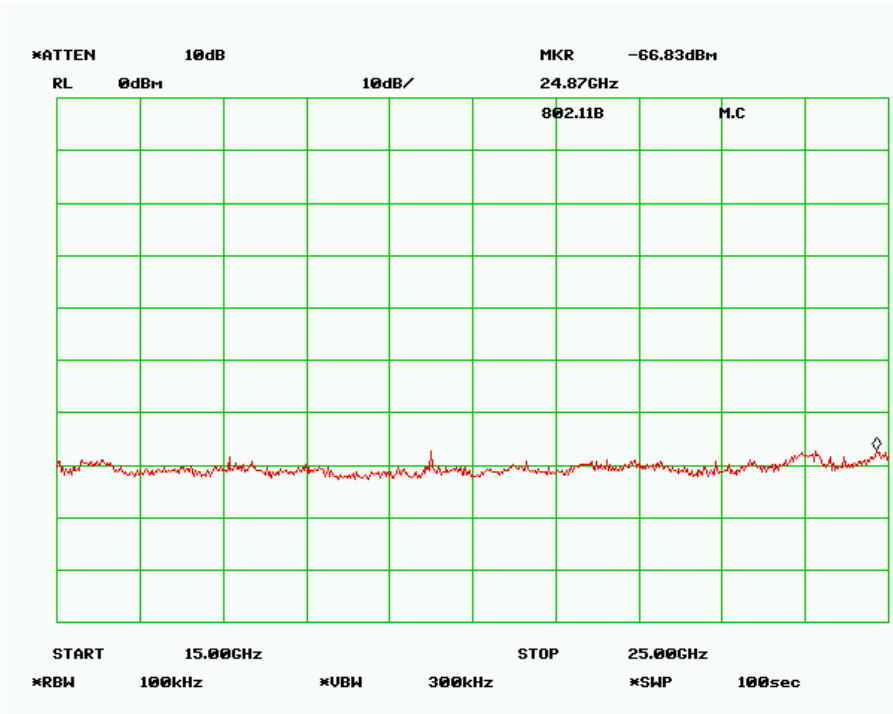
802.11B
M.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec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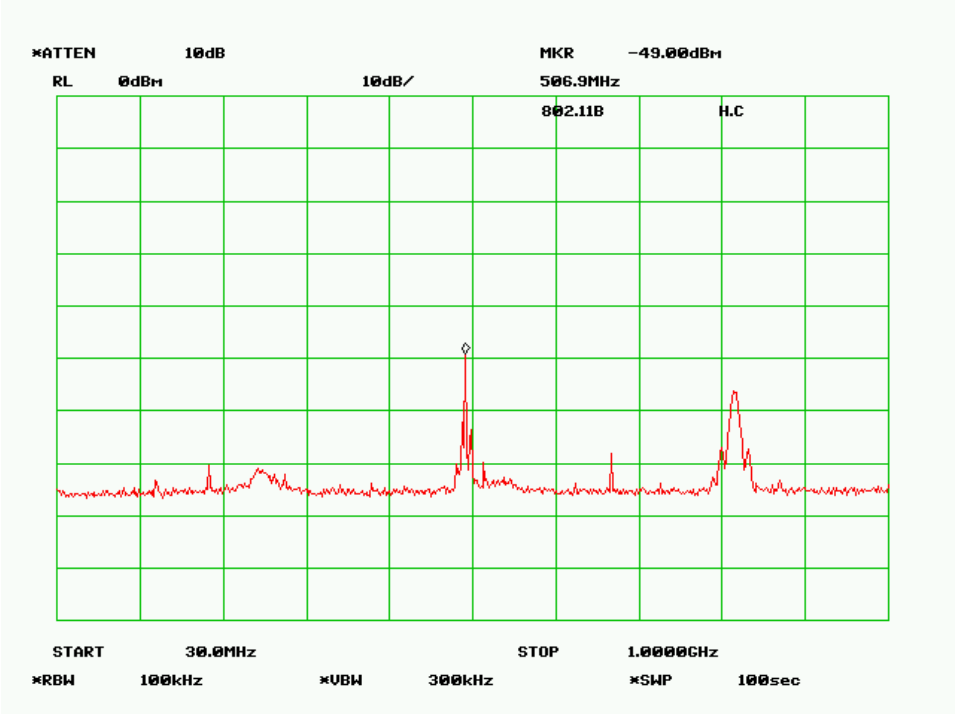
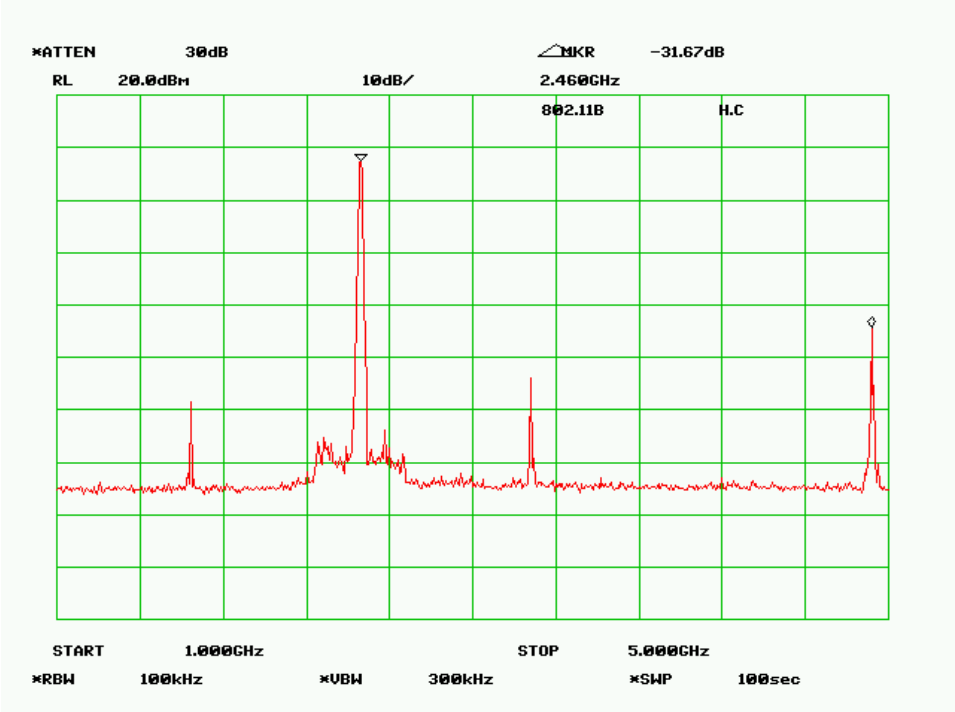
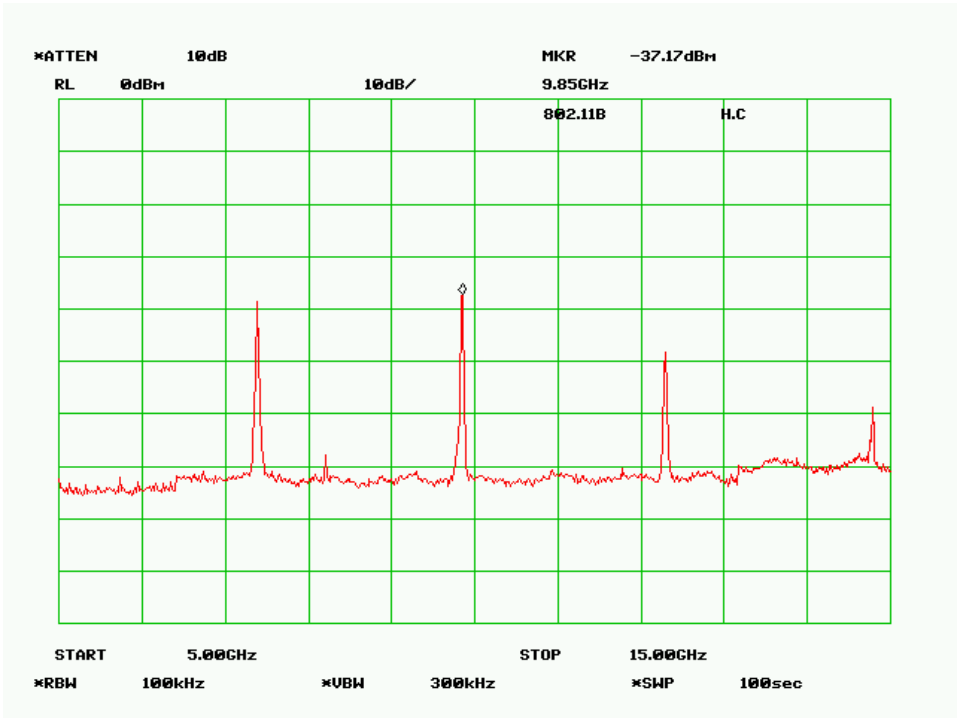
RL 0dBm
10dB/
24.87GHz
802.11B
M.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

High Channel



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802.11B
H.C
START 5.00GHz
STOP 15.00GHz
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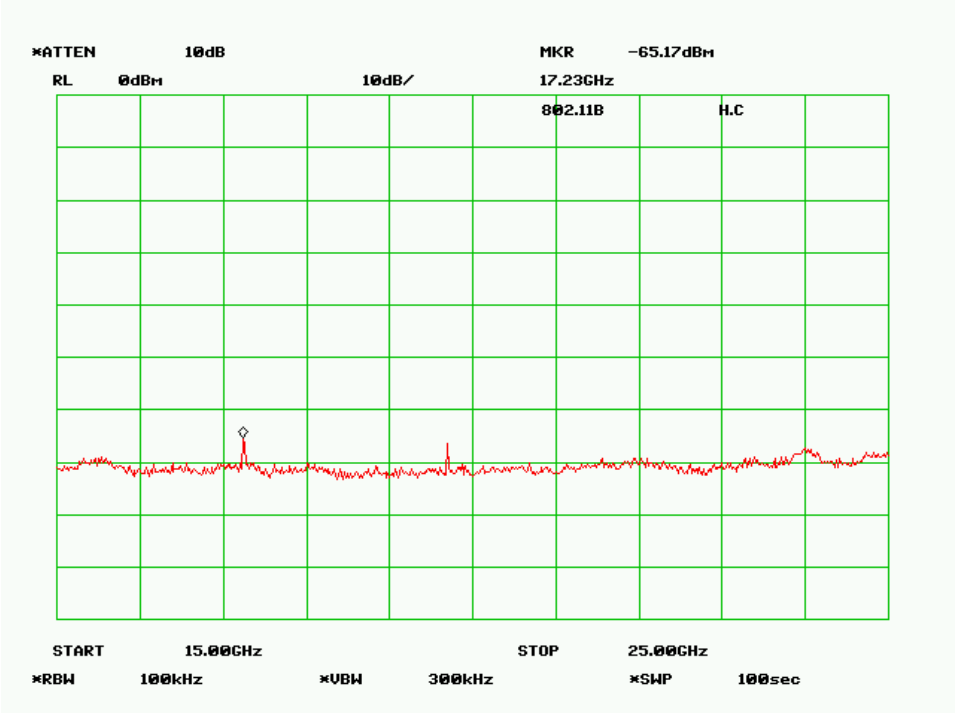
*VBW 300kHz
*SWP 100sec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10dB/
17.23GHz
802.11B
H.C
START 15.00GHz
STOP 25.00GHz
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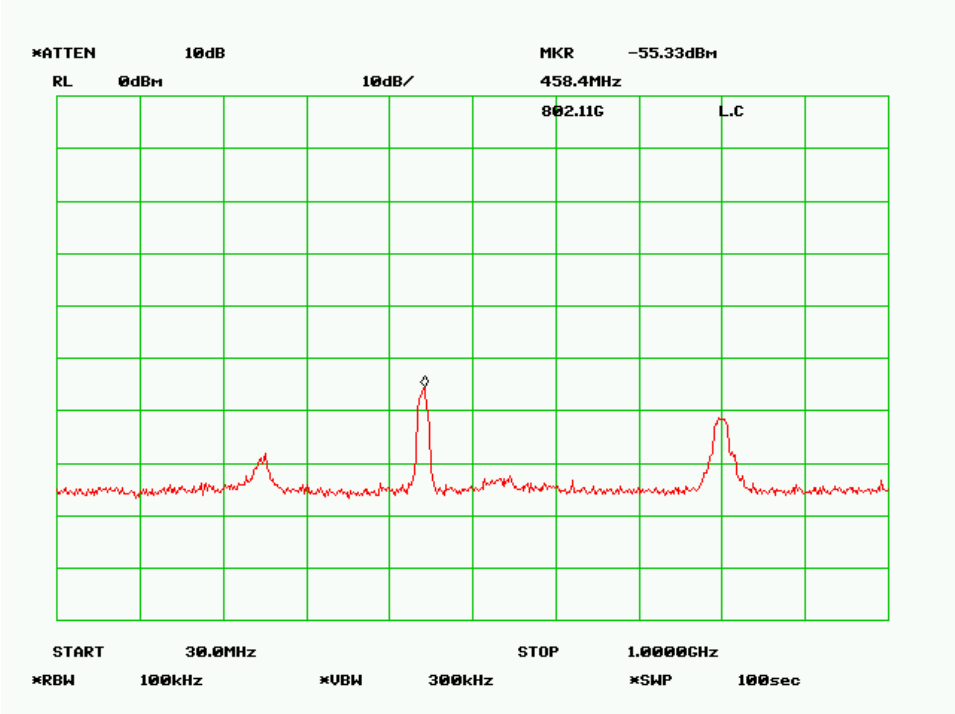
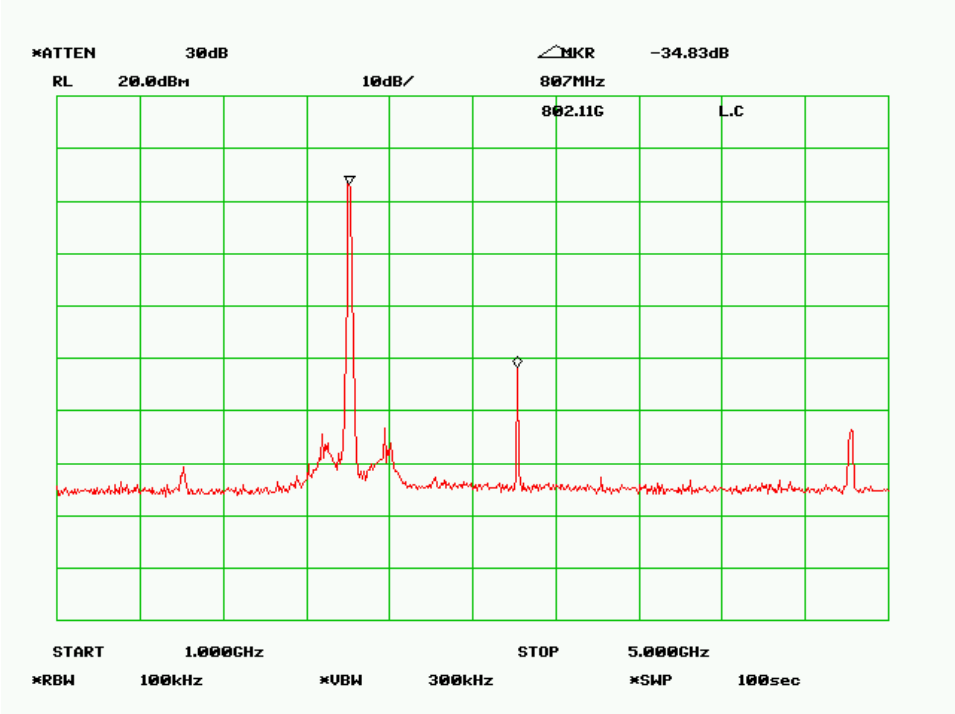
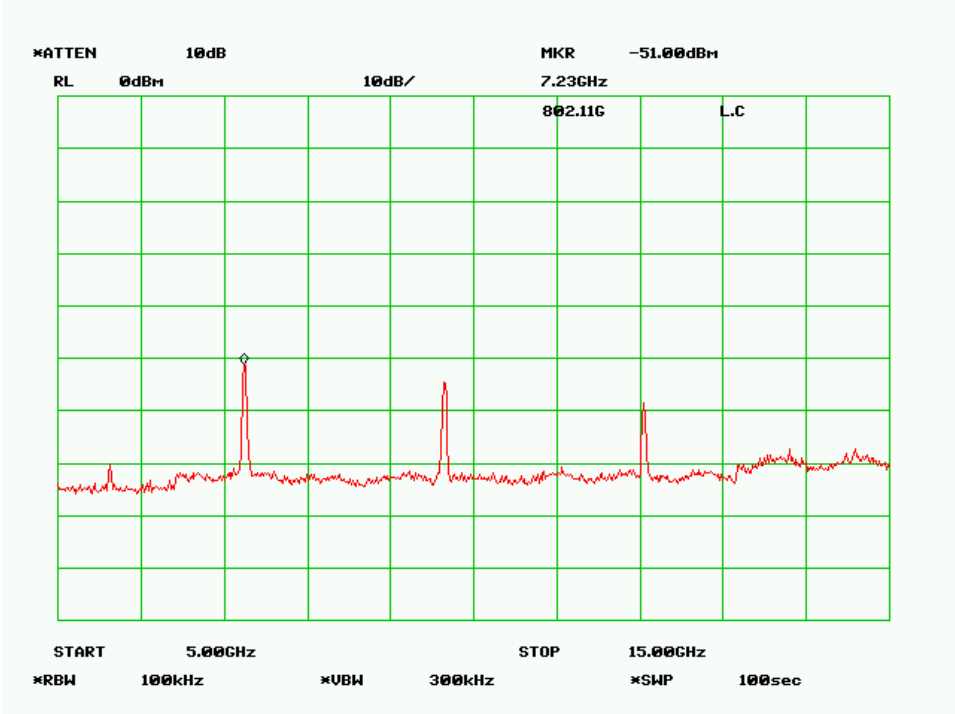
*VBW 300kHz
*SWP 100sec

802.11g:

Low Channel



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10dB/
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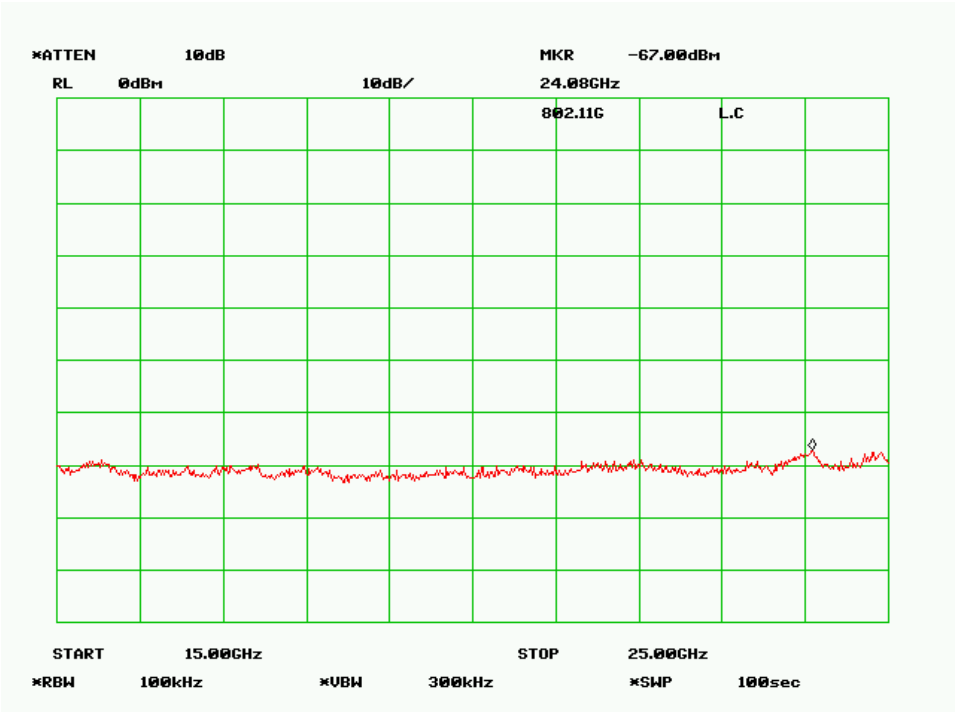
802.11G
L.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec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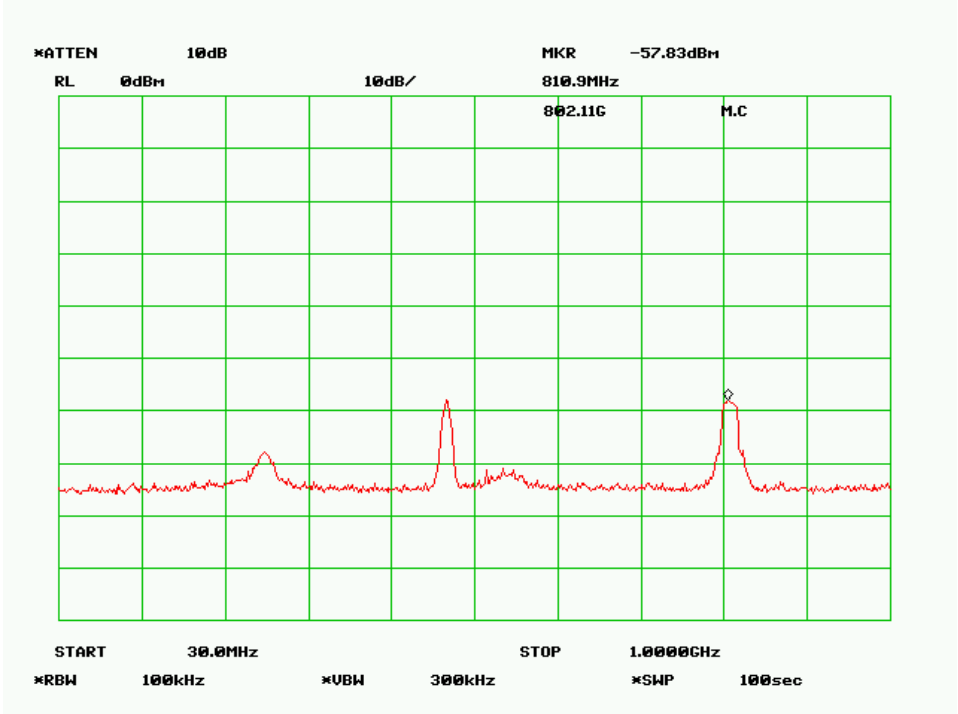
RL 0dBm
10dB/
24.08GHz
802.11G
L.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

Mid Channel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802.11G
M.C
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STOP 1.0000GHz
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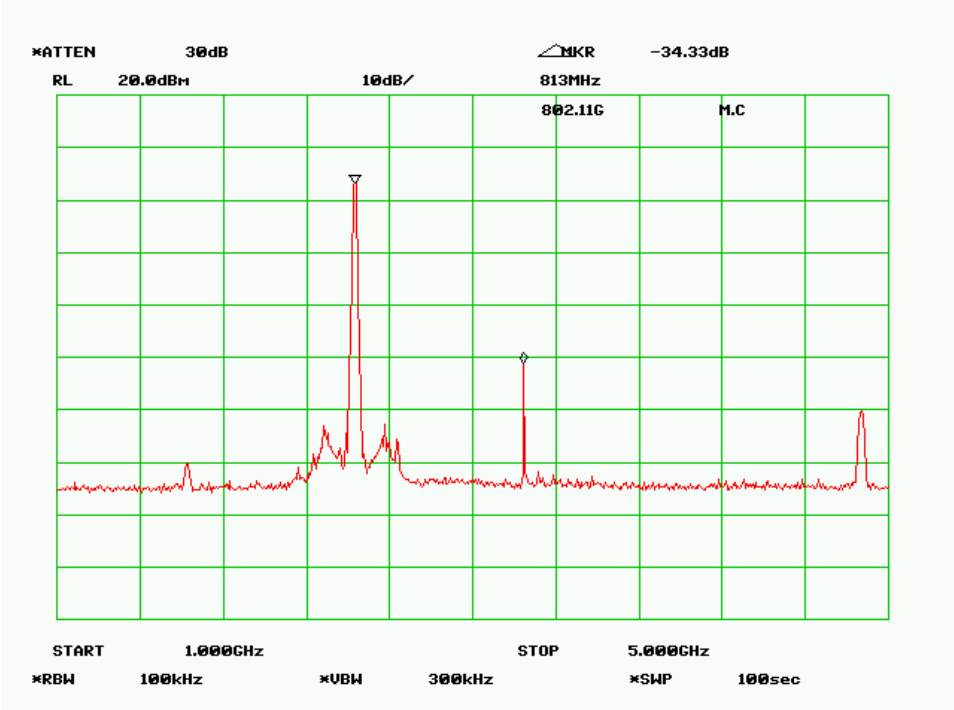
*VBW 300kHz
*SWP 100sec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10dB/
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802.11G
M.C
START 1.000GHz
STOP 5.000GHz
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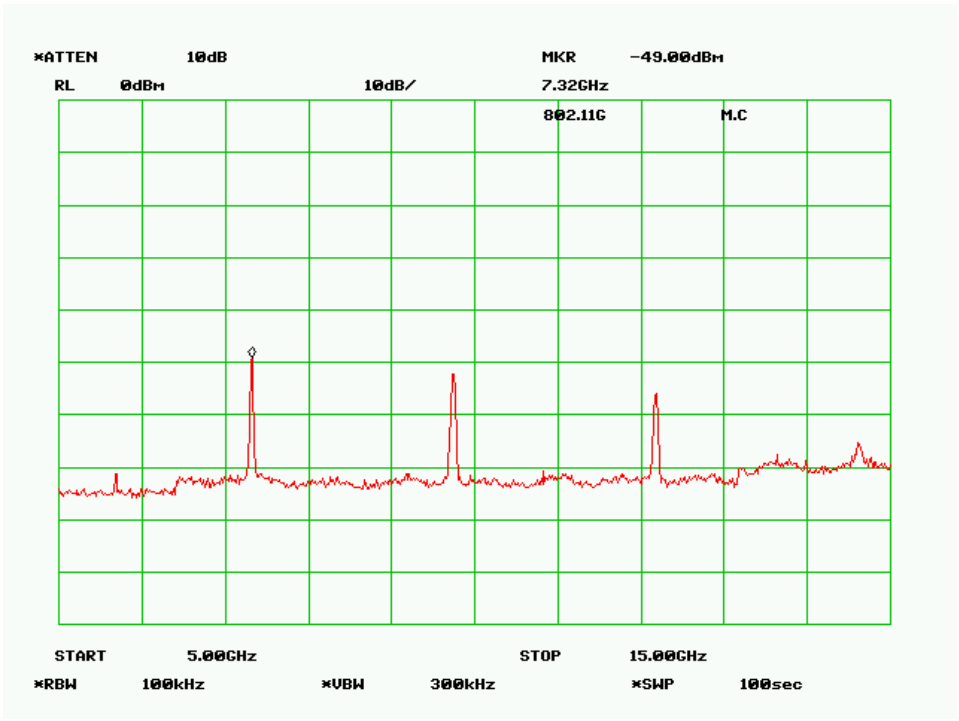
*VBW 300kHz
*SWP 100sec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802.11G
M.C
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STOP 15.00GHz
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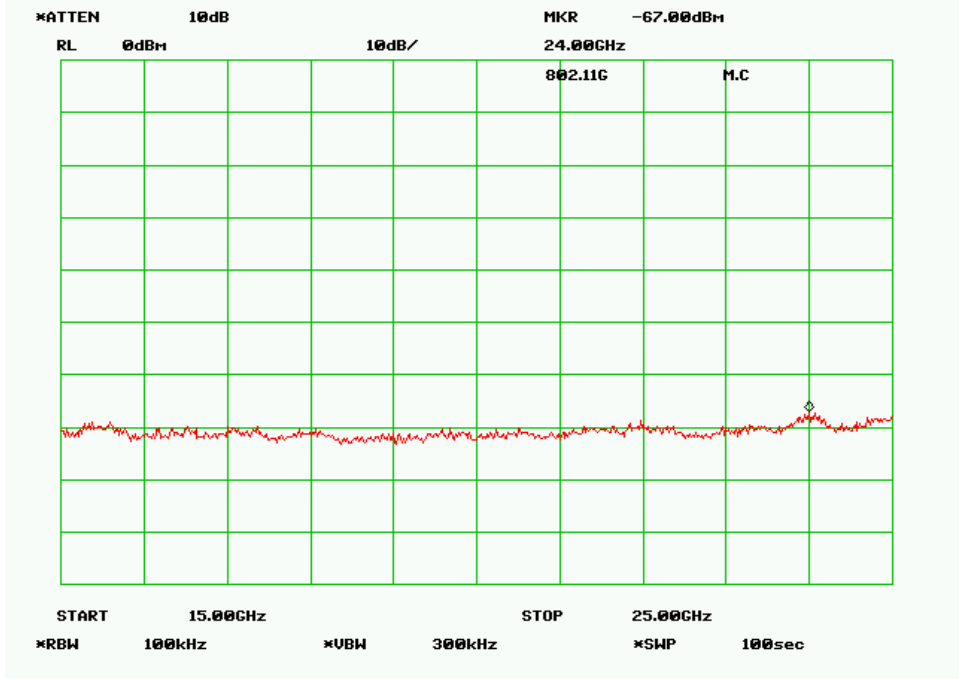
*VBW 300kHz
*SWP 100sec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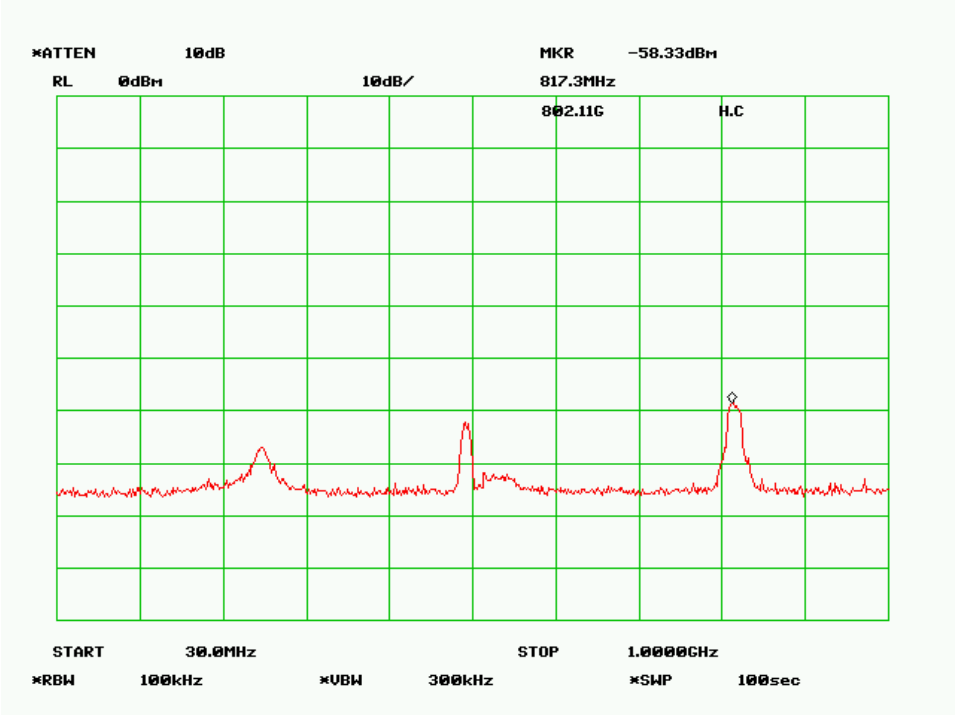
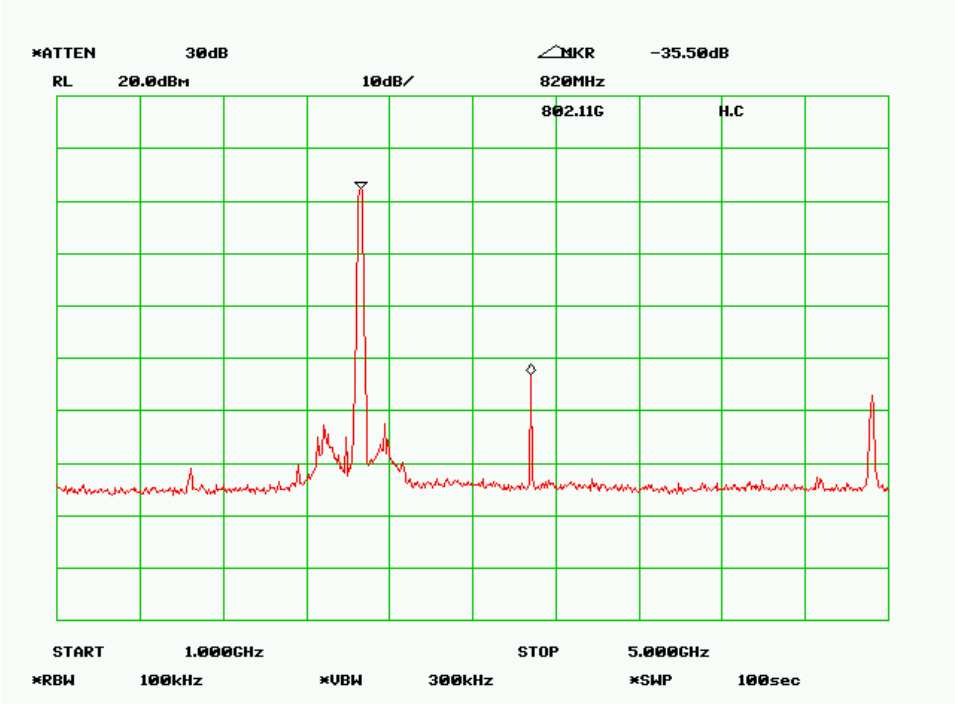
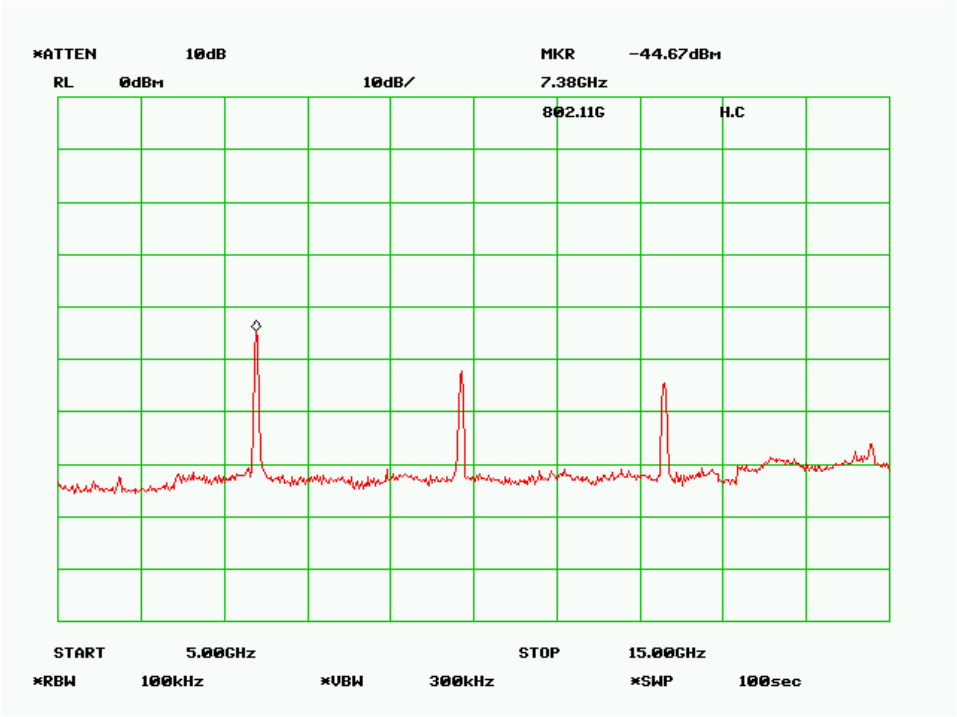
RL 0dBm
10dB/
24.00GHz
802.11G
M.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

High Channel



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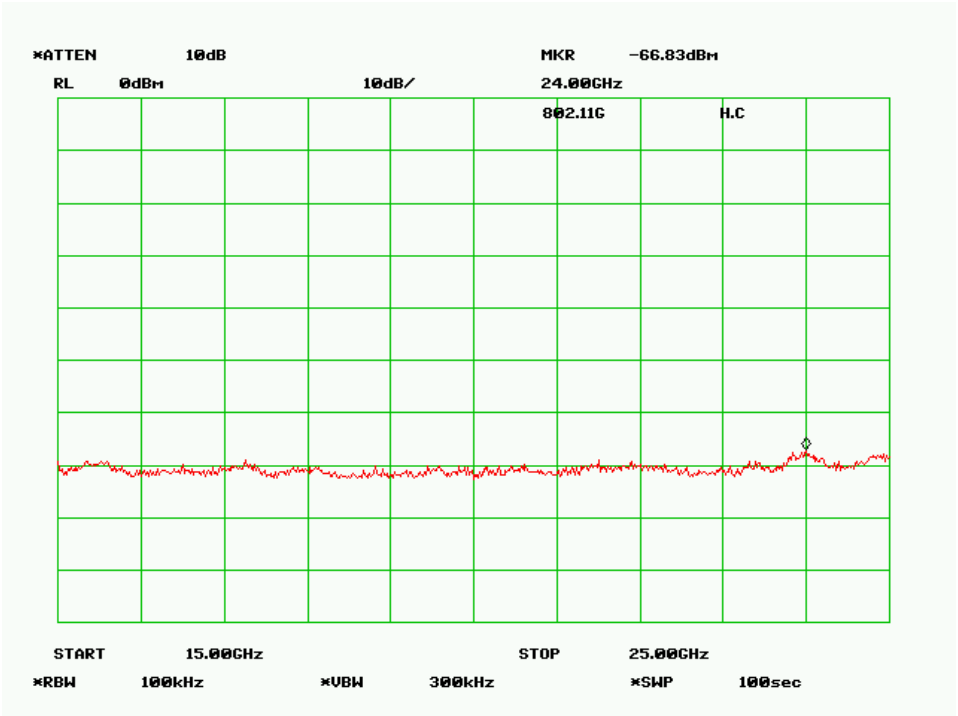
*VBW 300kHz
*SWP 100sec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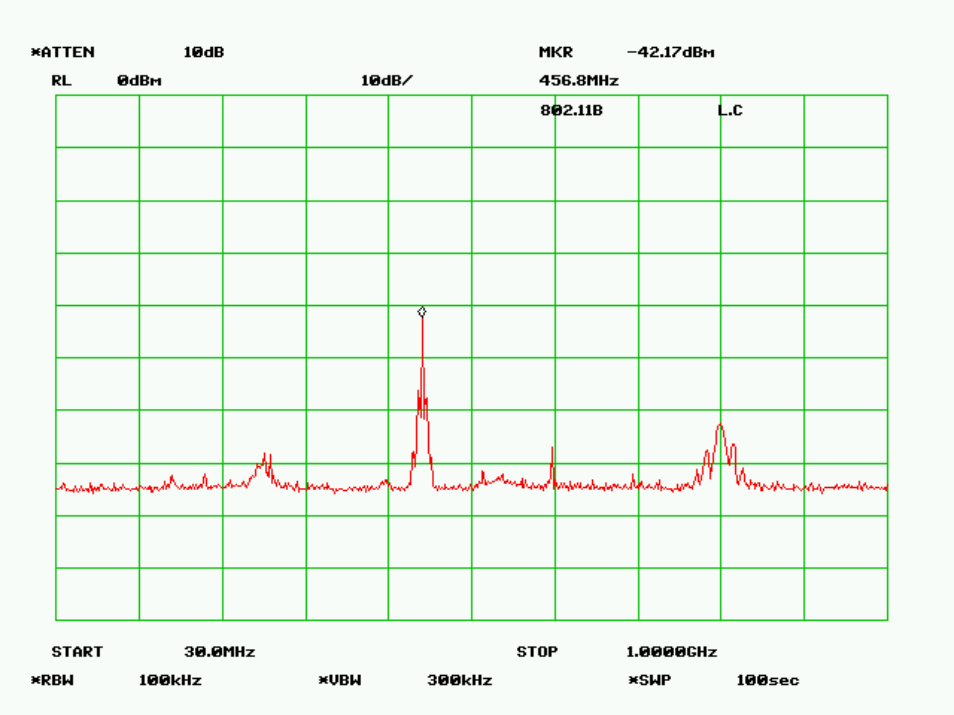
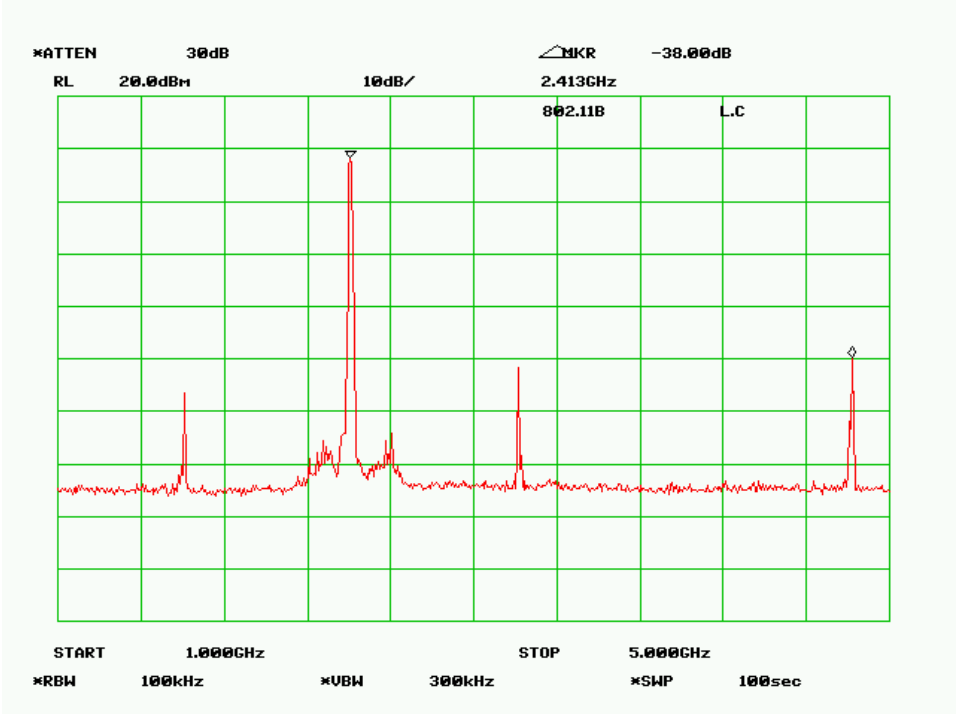
RL 0dBm
10dB/
24.00GHz
802.11G
H.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

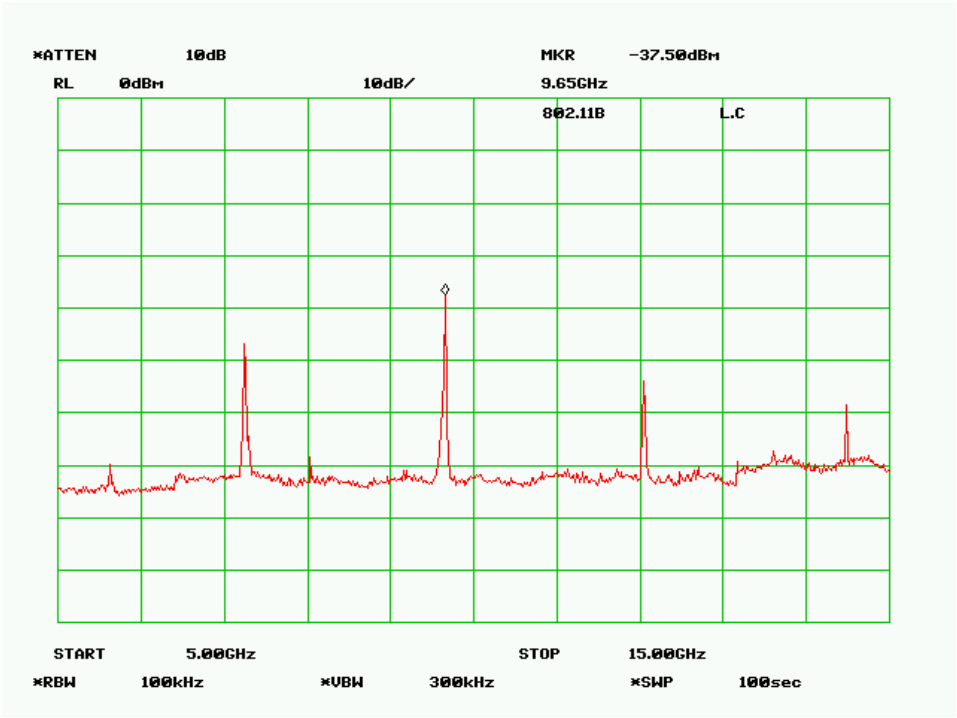
For MM22X1:

802.11b:

Low Channel



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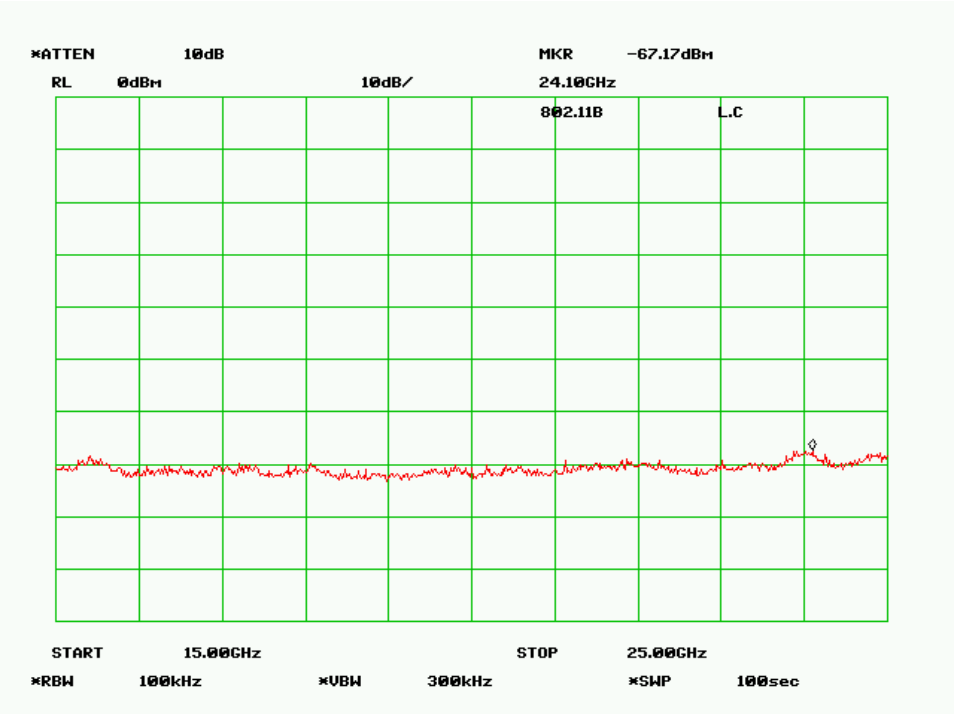
10dB/
9.65GHz
802.11B
L.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec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10dB/
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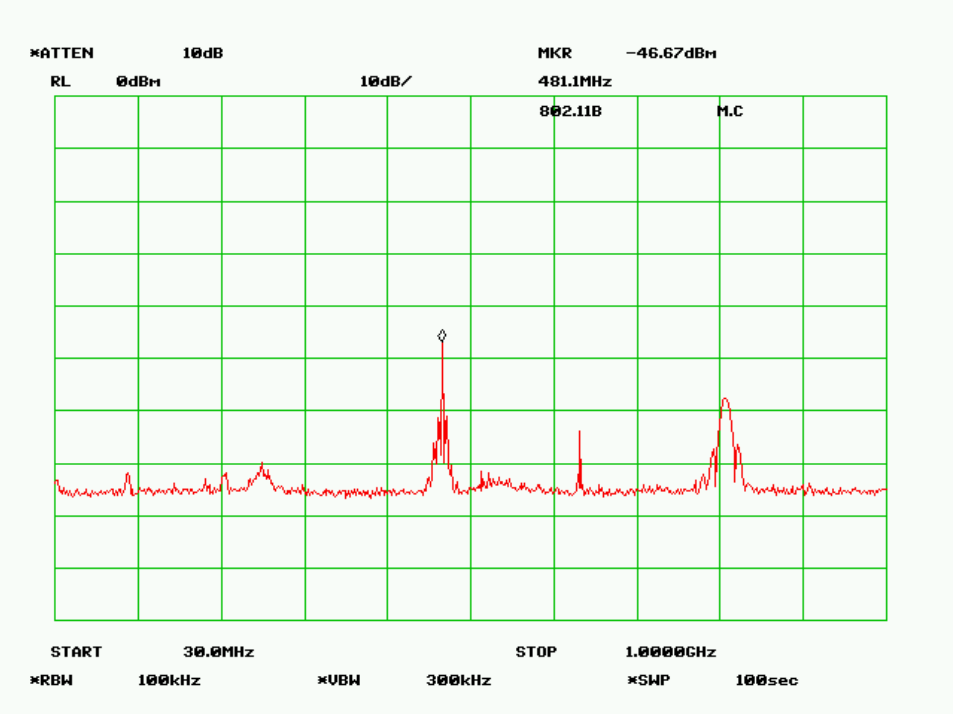
802.11B
L.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

Mid Channel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10dB/
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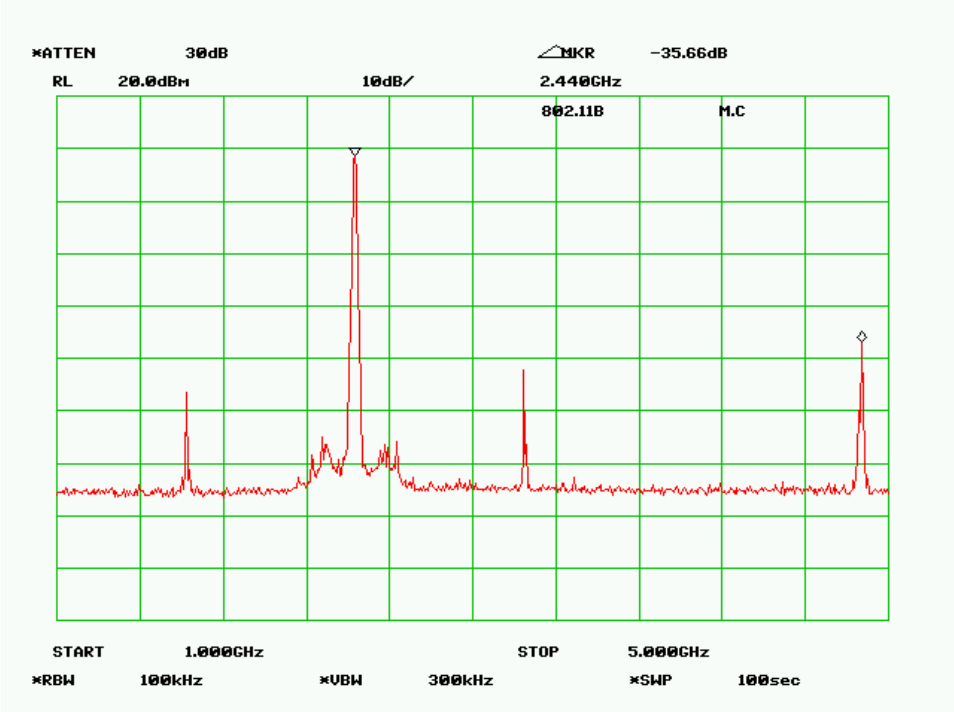
802.11B
M.C
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec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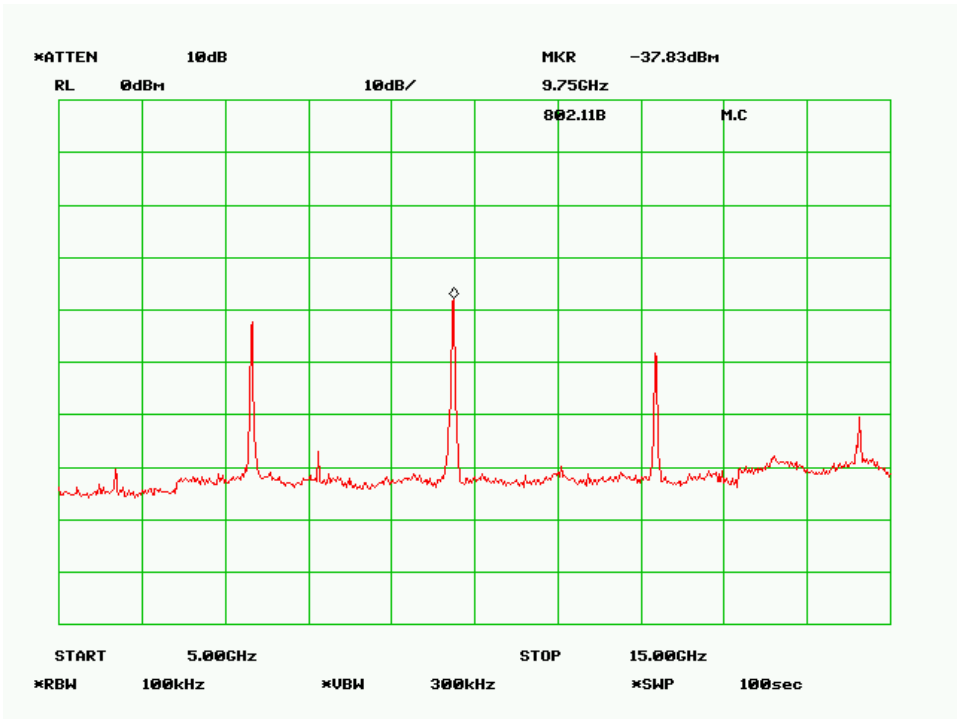
802.11B
M.C
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec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802.11B
M.C
START 5.00GHz
STOP 15.00GHz
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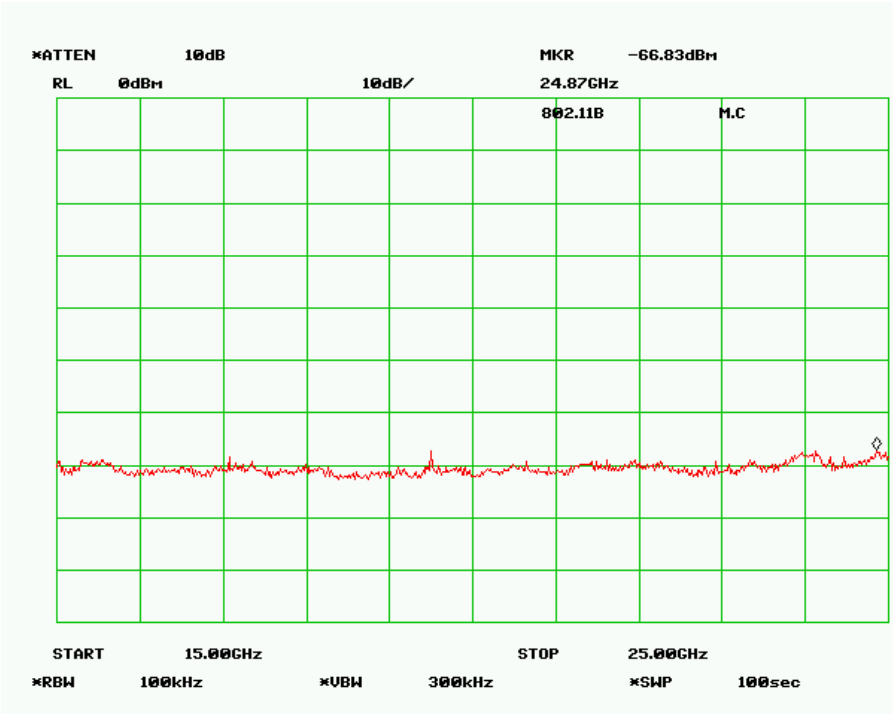
*VBW 300kHz
*SWP 100sec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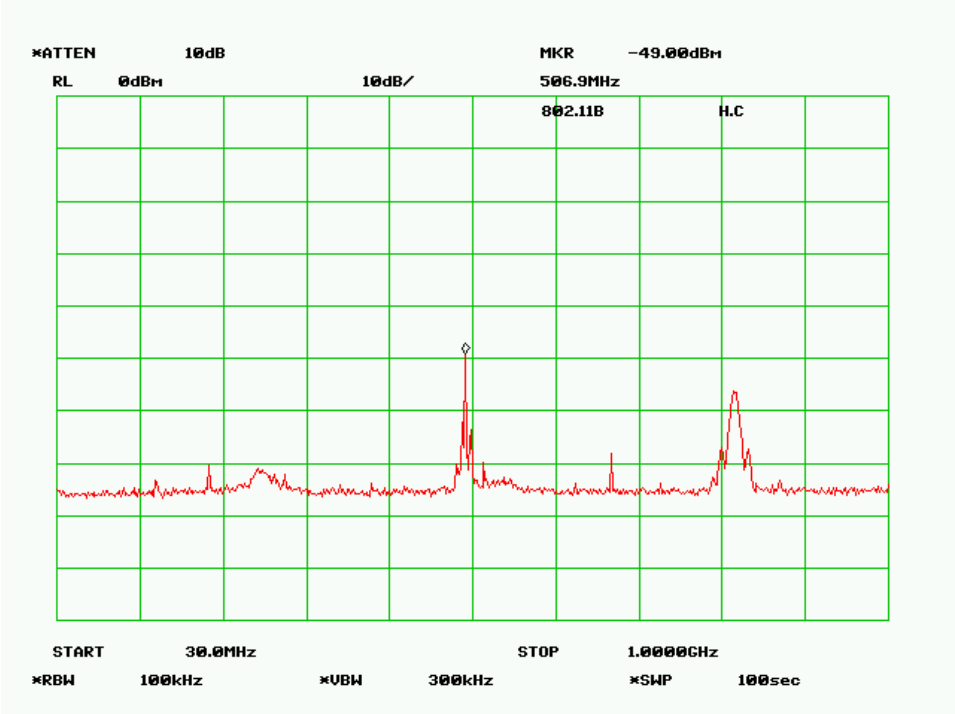
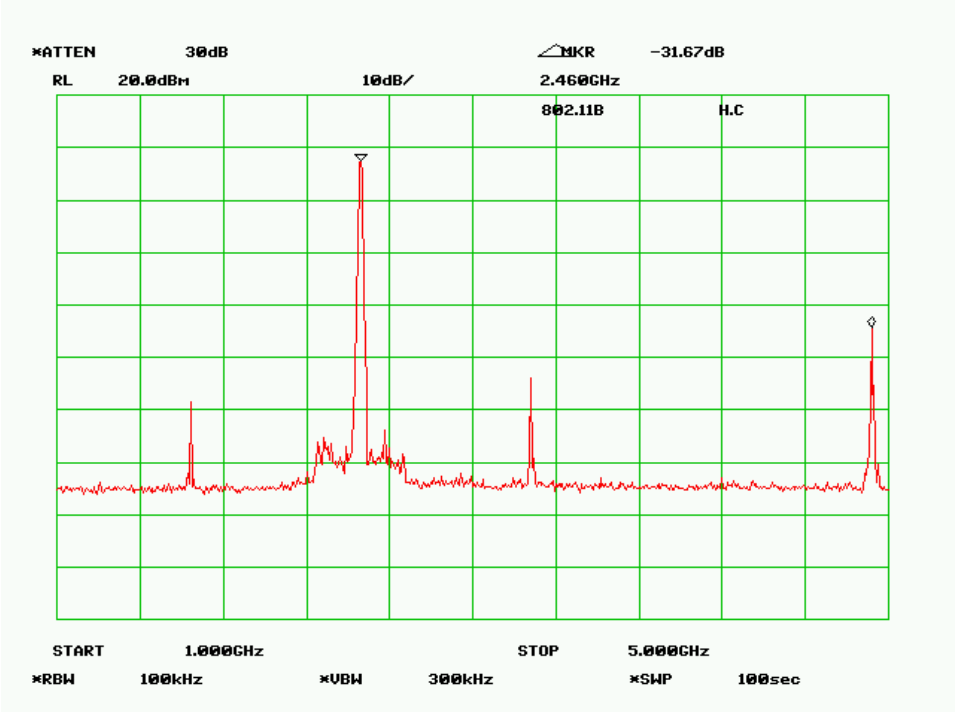
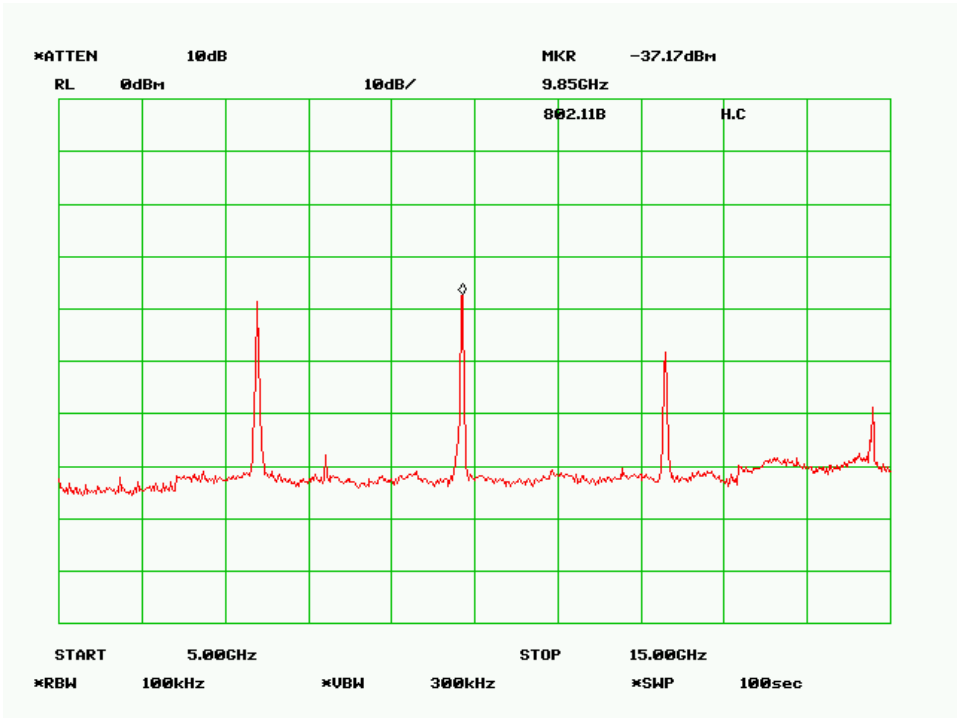
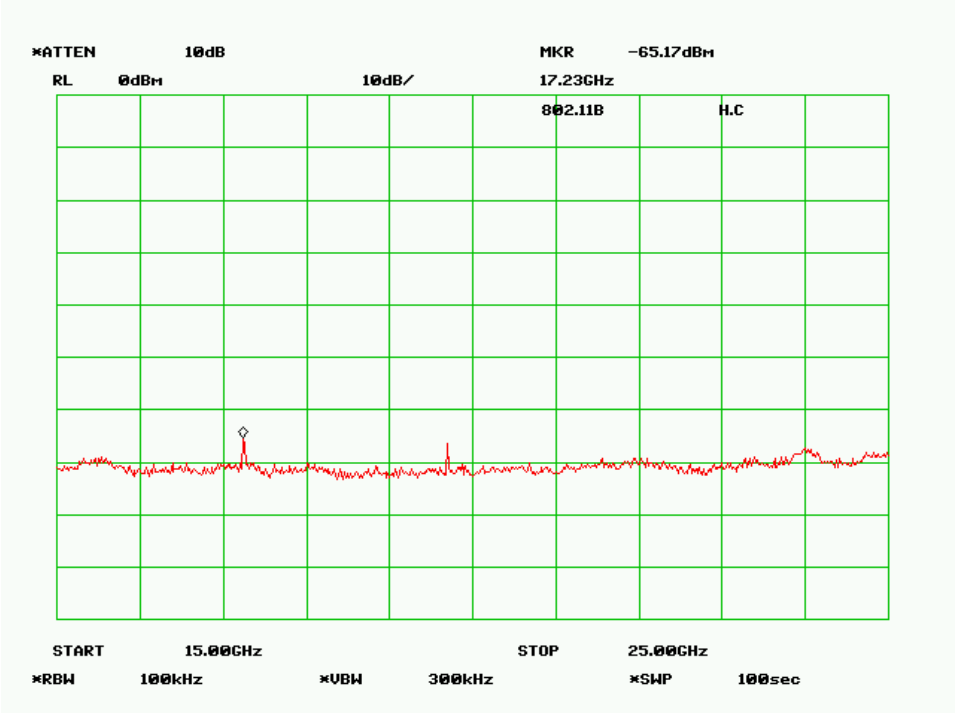
RL 0dBm
10dB/
24.87GHz
802.11B
M.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

High Channel



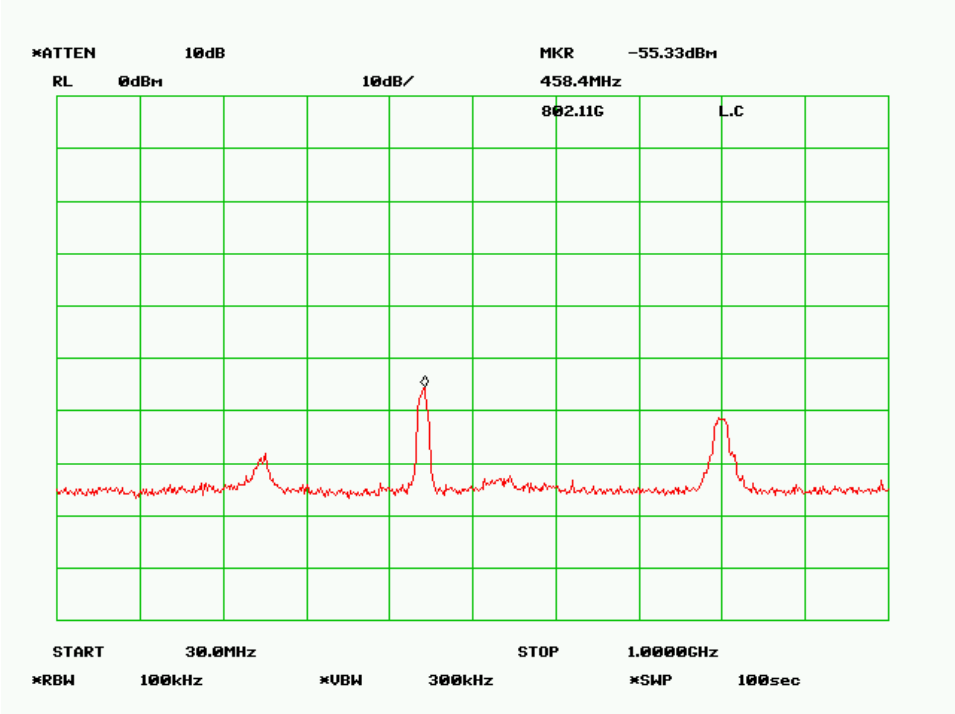


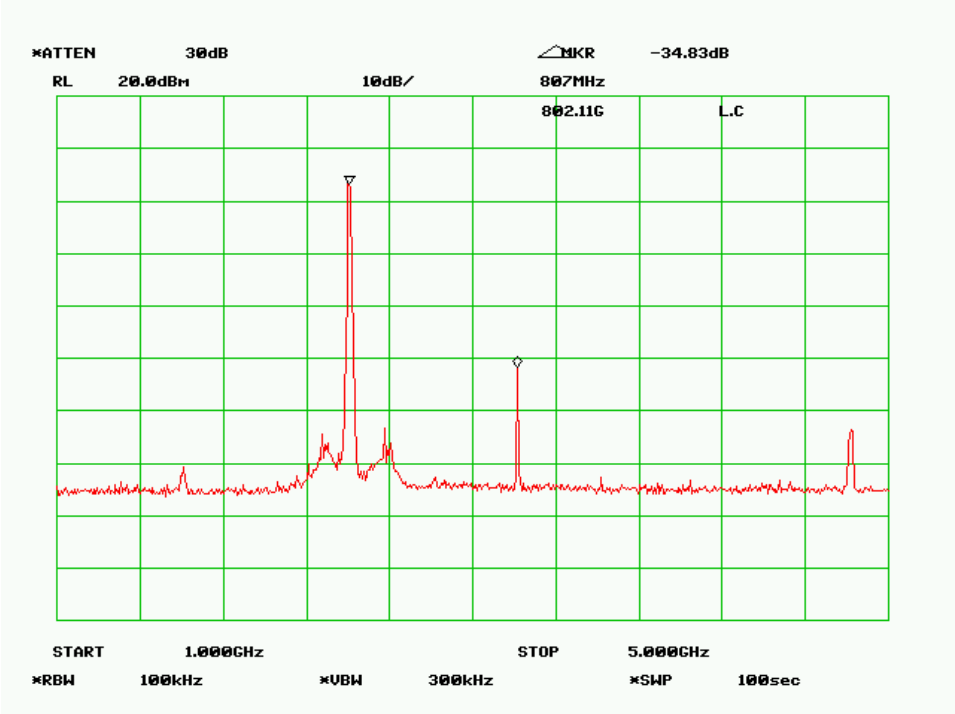

*ATTEN 10dB
MKR -37.17dBm
RL 0dBm
10dB/
9.85GHz
802.11B
H.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

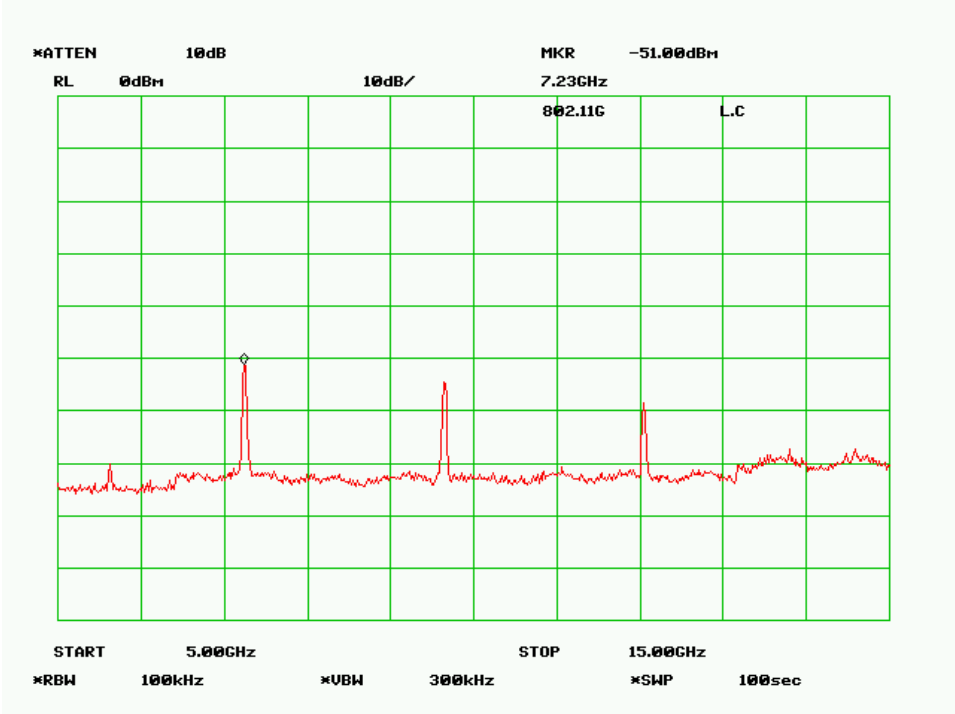

*ATTEN 10dB
MKR -65.17dBm
RL 0dBm
10dB/
17.23GHz
802.11B
H.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

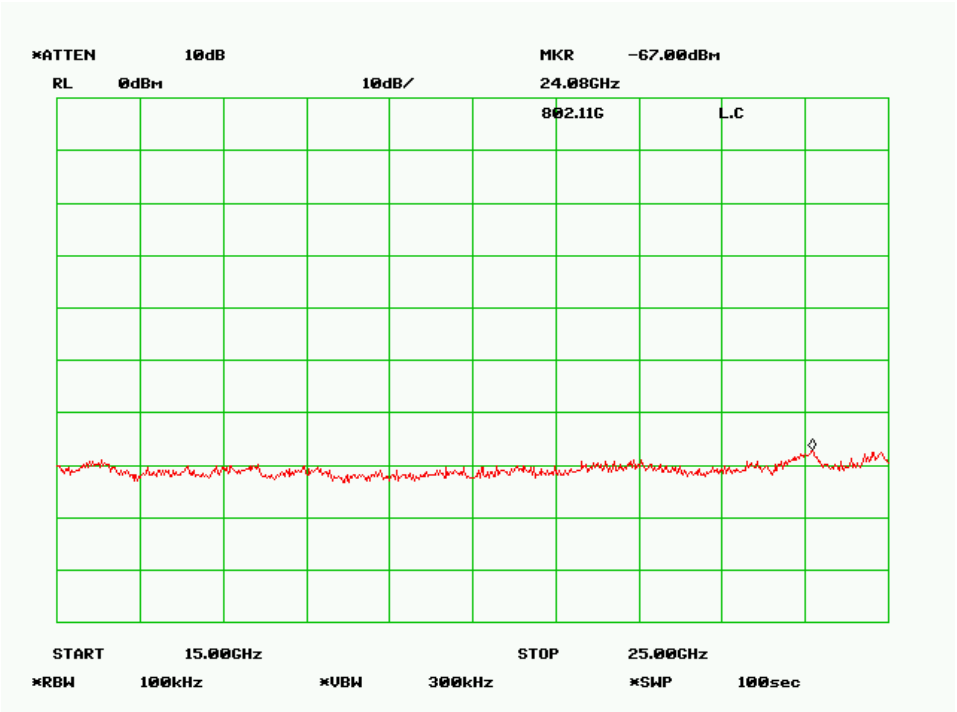
802.11g:

Low Channel

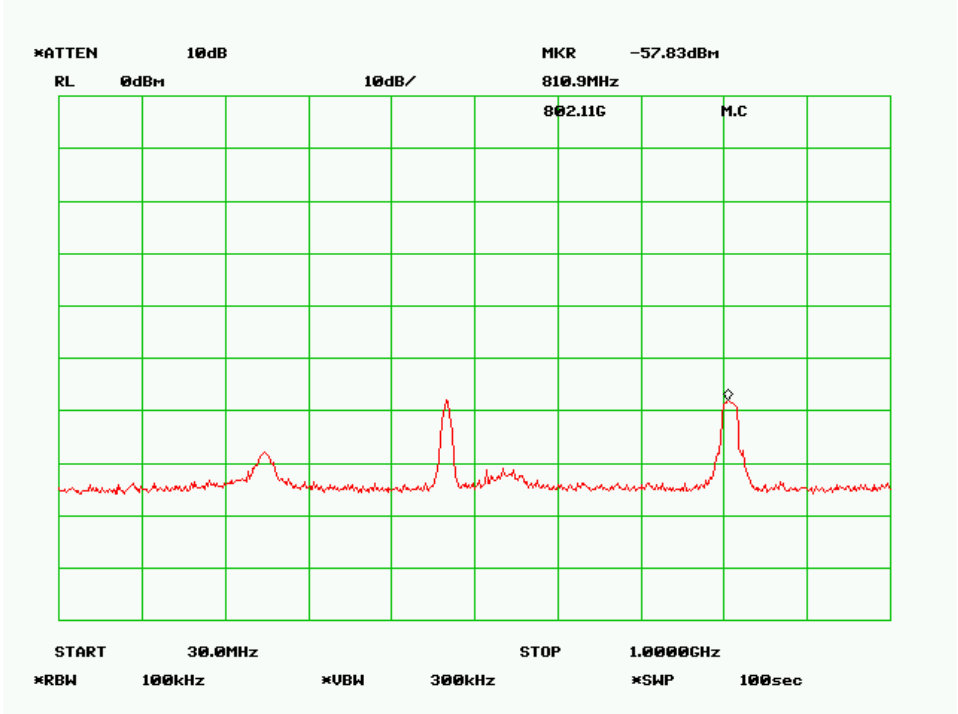


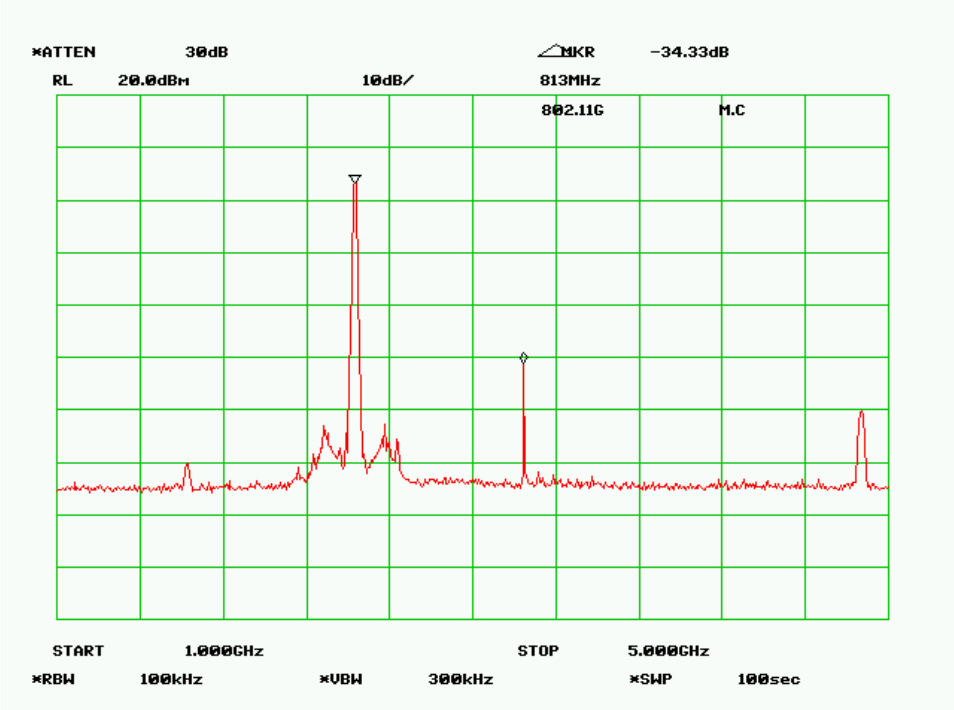


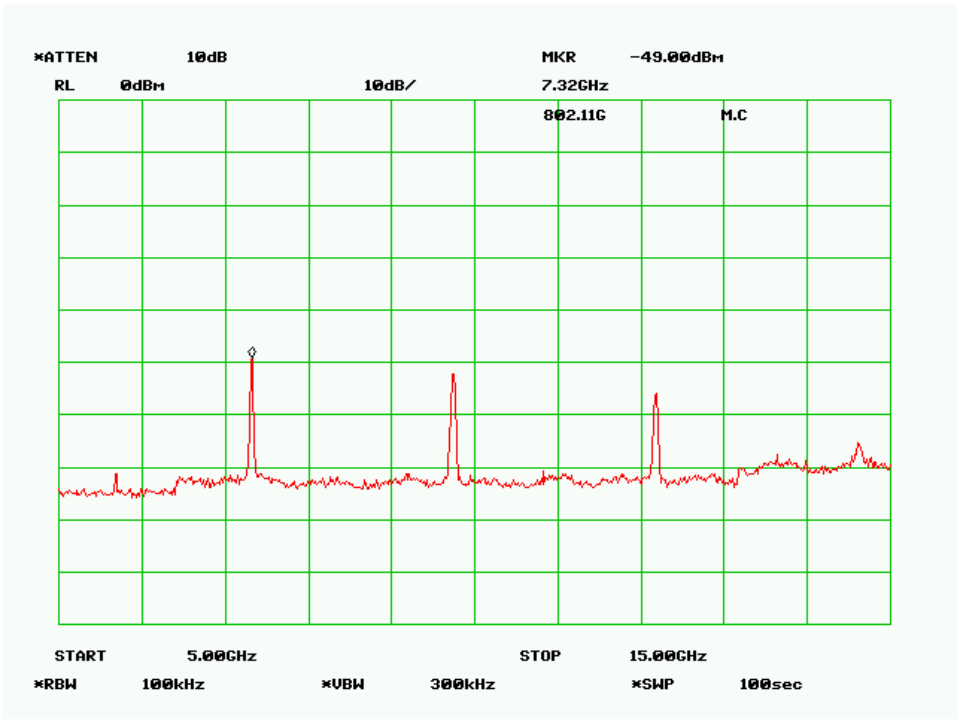

*ATTEN 10dB
MKR -51.00dBm
RL 0dBm
10dB/
7.23GHz
802.11G
L.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

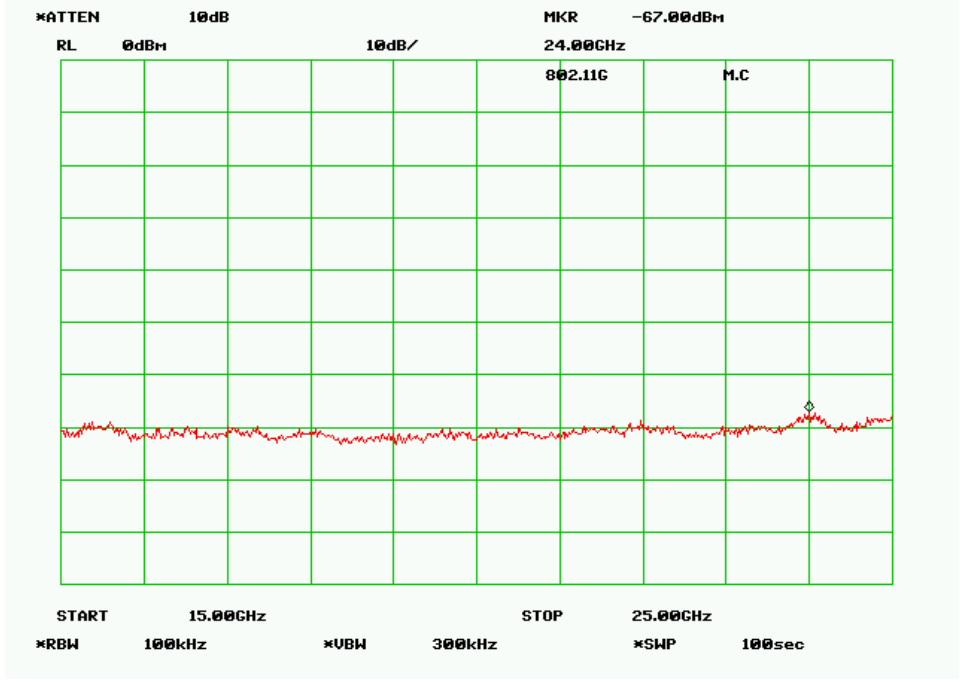

*ATTEN 10dB
MKR -67.00dBm
RL 0dBm
10dB/
24.08GHz
802.11G
L.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

Mid Channel

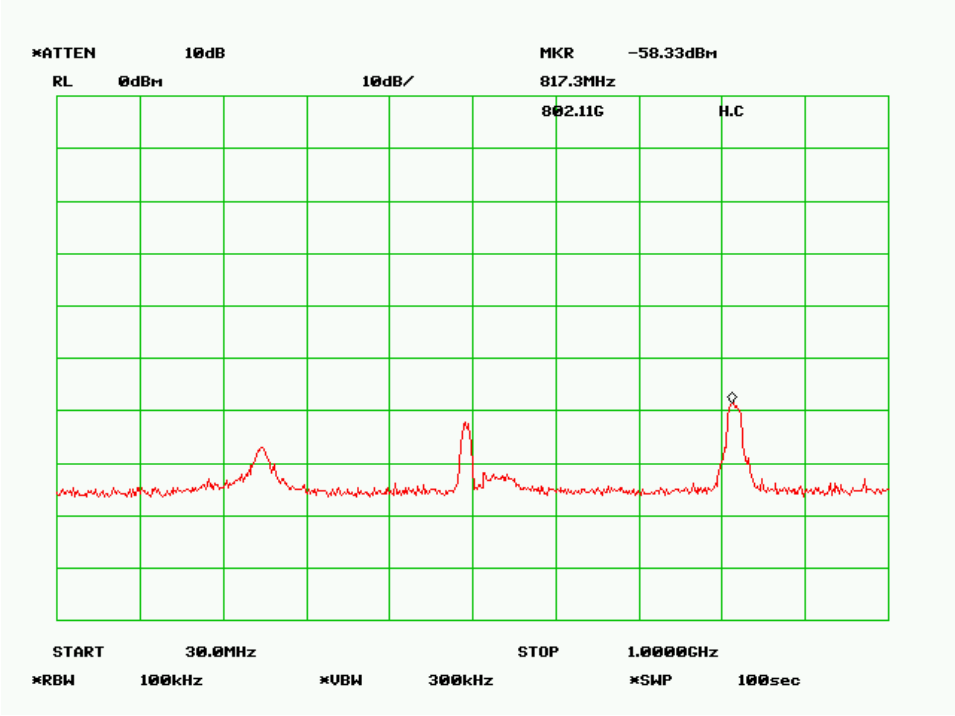

*ATTEN 10dB
MKR -57.83dBm
RL 0dBm
10dB/
810.9MHz
802.11G
M.C
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

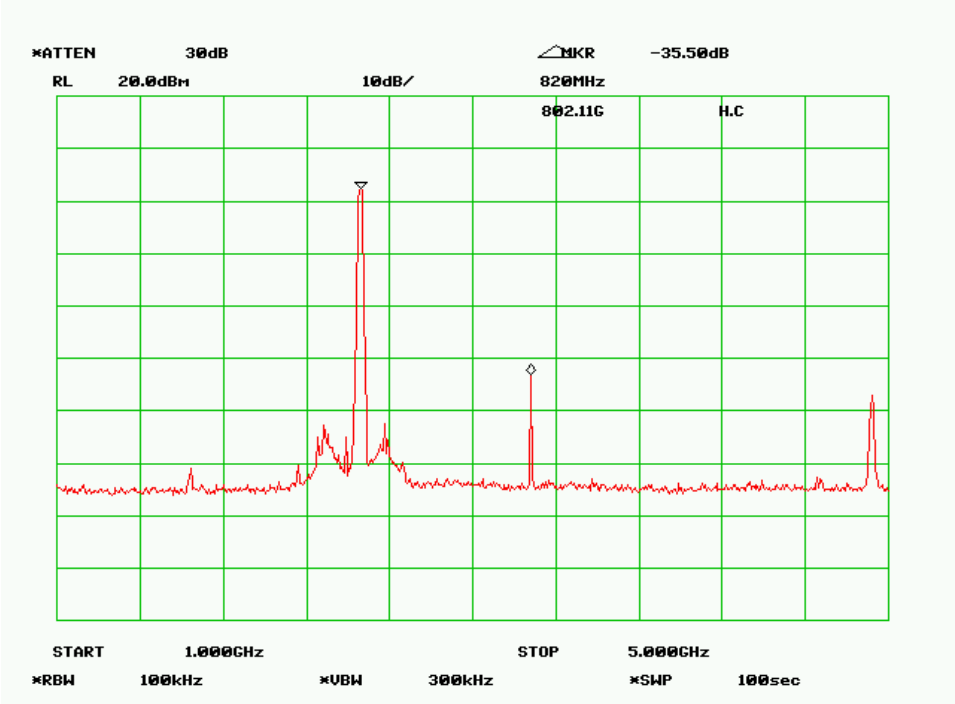

*ATTEN 30dB
MKR -34.33dB
RL 20.0dBm
10dB/
813MHz
802.11G
M.C
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

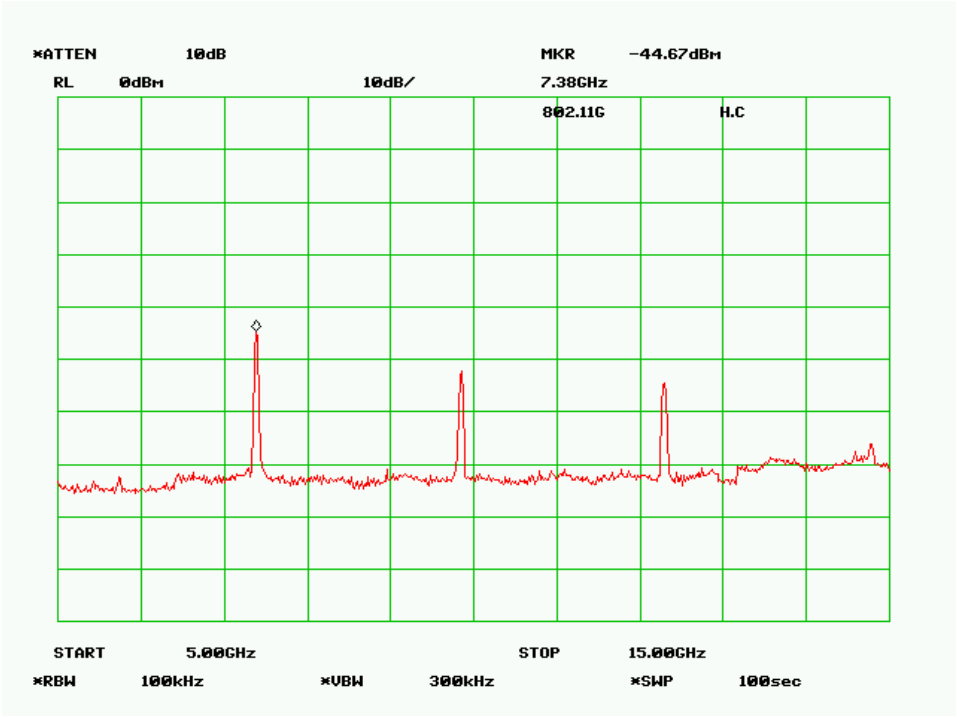

*ATTEN 10dB
MKR -49.00dBm
RL 0dBm
10dB/
7.32GHz
802.11G
M.C
START 5.00GHz
STOP 15.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

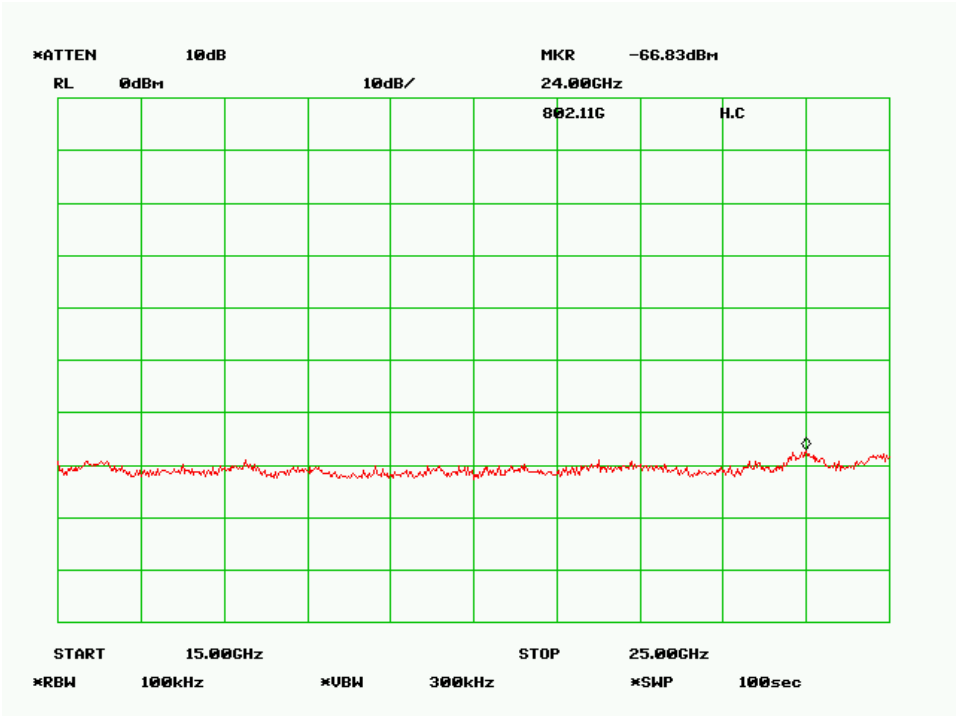

*ATTEN 10dB
MKR -67.00dBm
RL 0dBm
10dB/
24.00GHz
802.11G
M.C
START 15.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 300kHz
*SWP 100sec

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 EMISSIONS

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 emissions 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 emissions 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 Emissions (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 emissions 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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal Date
Sonoma Instrument	Pre-Amplifier	317	260407	2006-02-03
Sunol Science	Combination Antenna	JB3 Antenna	A013105	2006-02-11
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10
HP	Pre, Amplifier (1 ~ 26.5 GHz)	8449B	3147A00400	2005-10-05
Sunol Science	Antenna, Horn, Std	DRH-118	A052704	2005-06-02

* **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 emissions
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:

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 - FCC 15.247 Limit

Environmental Conditions

Temperature:	20° C
Relative Humidity:	65%
ATM Pressure:	1027 mbar

**The testing was performed by Snell Leong on 2006-03-08*

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 **3217.00 MHz** in the **Horizontal** polarization for Low Channel.*
-3.6 dB at **3250.00 MHz** in the **Horizontal** polarization for Middle Channel.*
-5.2 dB at **3285.00 MHz** in the **Horizontal** polarization for High Channel.

802.11g:

-4.0 dB at **3217.00 MHz** in the **Horizontal** polarization for Low Channel.
-0.4 dB at **3250.00 MHz** in the **Vertical** polarization for Middle Channel.*
-1.0 dB at **3285.00 MHz** in the **Horizontal** polarization for Low Channel.*
** The test data was within the measurement of uncertainty.*

Radiated Emissions Test plot & data@ 10 Meters

802.11b

Primary scan 1GHz -25GHz, (Low channel 2412 MHz)

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Factor dB	Cable loss dB	Amplifier dB	Distance factor dB	Corrected Reading dBuV/m	EN55022 Limit (dBuV/m)	EN55022 Margin	Comments	Testing Condition Mode/ Distance
3217.0000	57.8	66	1.3	H	29.8	1.4	35.2	0.0	53.9	54	-0.1*	Ave	CW / 3
3217.0000	55.5	250	1.3	V	29.8	1.4	35.2	0.0	51.6	54	-2.4*	Ave	CW / 3
4824.0000	40.1	250	1.1	H	32.5	1.9	34.8	0.0	39.7	54	-14.3	Ave	CW / 3
3217.0000	61.4	66	1.3	H	29.8	1.4	35.2	0.0	57.5	74	-16.5	Peak	CW / 3
4824.0000	37.7	223	1.3	V	32.5	1.9	34.8	0.0	37.3	54	-16.7	Ave	CW / 3
4824.0000	53.9	250	1.1	H	32.5	1.9	34.8	0.0	53.5	74	-20.5	Peak	CW / 3
4824.0000	52.3	223	1.3	V	32.5	1.9	34.8	0.0	51.9	74	-22.1	Peak	CW / 3
3217.0000	51.9	250	1.3	V	29.8	1.4	35.2	0.0	48.0	74	-26.0	Peak	CW / 3

Primary scan 1GHz -25GHz, (Middle channel 2437MHz)

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Factor dB	Cable loss dB	Amplifier dB	Distance factor dB	Corrected Reading dBuV/m	EN55022 Limit (dBuV/m)	EN55022 Margin	Comments	Testing Condition Mode/ Distance
3250.0000	54.3	225	1.0	H	29.8	1.4	35.2	0.0	50.4	54	-3.6*	Ave	CW / 3
3250.0000	50.6	180	1.0	V	29.8	1.4	35.2	0.0	46.7	54	-7.3	Ave	CW / 3
4874.0000	38.8	247	1.0	H	32.5	1.9	34.8	0.0	38.4	54	-15.6	Ave	CW / 3
4874.0000	37.9	137	1.1	V	32.5	1.9	34.8	0.0	37.5	54	-16.5	Ave	CW / 3
3250.0000	58.2	225	1.0	H	29.8	1.4	35.2	0.0	54.3	74	-19.7	Peak	CW / 3
4874.0000	52.7	247	1.0	H	32.5	1.9	34.8	0.0	52.3	74	-21.7	Peak	CW / 3
4874.0000	52.3	137	1.1	V	32.5	1.9	34.8	0.0	51.9	74	-22.1	Peak	CW / 3
3250.0000	55.2	180	1.0	V	29.8	1.4	35.2	0.0	51.3	74	-22.7	Peak	CW / 3

Primary scan 1GHz -25GHz, (High Channel 2462 MHz)

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Factor dB	Cable loss dB	Amplifier dB	Distance factor dB	Corrected Reading dBuV/m	EN55022 Limit (dBuV/m)	EN55022 Margin	Comments	Testing Condition Mode/ Distance
3285.0000	52.7	215	1.0	H	29.8	1.4	35.2	0.0	48.8	54	-5.2	Ave	CW / 3
3285.0000	50.9	186	1.0	V	29.8	1.4	35.2	0.0	47.0	54	-7.0	Ave	CW / 3
4924.0000	38.0	231	1.1	H	32.5	1.9	34.8	0.0	37.6	54	-16.4	Ave	CW / 3
4924.0000	37.7	138	1.1	V	32.5	1.9	34.8	0.0	37.3	54	-16.7	Ave	CW / 3
3285.0000	56.3	215	1.0	H	29.8	1.4	35.2	0.0	52.4	74	-21.6	Peak	CW / 3
3285.0000	55.1	186	1.0	V	29.8	1.4	35.2	0.0	51.2	74	-22.8	Peak	CW / 3
4924.0000	51.4	138	1.1	V	32.5	1.9	34.8	0.0	51.0	74	-23.0	Peak	CW / 3
4924.0000	51.3	231	1.1	H	32.5	1.9	34.8	0.0	50.9	74	-23.1	Peak	CW / 3

802.11g

Primary scan 1GHz -25GHz, (Low channel 2412 MHz)

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Factor dB	Cable loss dB	Amplifier dB	Distance factor dB	Corrected Reading dBuV/m	EN55022 Limit (dBuV/m)	EN55022 Margin	Comments	Testing Condition Mode/ Distance
3217.0000	53.9	67	1.2	H	29.8	1.4	35.2	0.0	50.0	54	-4.0	Ave	Throughput mode
3217.0000	52.5	139	1.4	V	29.8	1.4	35.2	0.0	48.6	54	-5.4	Ave	Throughput mode
3217.0000	62.8	67	1.2	H	29.8	1.4	35.2	0.0	58.9	74	-15.1	Peak	CW / 3
3217.0000	60.8	139	1.4	V	29.8	1.4	35.2	0.0	56.9	74	-17.1	Peak	CW / 3
4824.0000	32.6	227	1.5	V	32.5	1.9	34.8	0.0	32.2	54	-21.8	Ave	CW / 3
4824.0000	32.4	256	1.3	H	32.5	1.9	34.8	0.0	32.0	54	-22.0	Ave	CW / 3
4824.0000	46.3	227	1.5	V	32.5	1.9	34.8	0.0	45.9	74	-28.1	Peak	CW / 3
4824.0000	46.1	256	1.3	H	32.5	1.9	34.8	0.0	45.7	74	-28.3	Peak	CW / 3

Primary scan 1GHz -25GHz, (Middle channel 2437MHz)

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Factor dB	Cable loss dB	Amplifier dB	Distance factor dB	Corrected Reading dBuV/m	EN55022 Limit (dBuV/m)	EN55022 Margin	Comments	Testing Condition Mode/ Distance
3250.0000	57.5	252	1.5	V	29.8	1.4	35.2	0.0	53.6	54	-0.4*	Ave	CW / 3
3250.0000	51.8	68	1.2	H	32.5	1.4	35.2	0.0	50.6	54	-3.4*	Ave	CW / 3
3250.0000	61.2	68	1.2	H	29.8	1.4	35.2	0.0	57.3	74	-16.7	Peak	CW / 3
3250.0000	58.4	252	1.5	V	29.8	1.4	35.2	0.0	54.5	74	-19.5	Peak	CW / 3
4874.0000	31.5	247	1.1	H	32.5	1.9	34.8	0.0	31.1	54	-22.9	Ave	CW / 3
4874.0000	30.5	211	1.3	V	32.5	1.9	34.8	0.0	30.1	54	-23.9	Ave	CW / 3
4874.0000	46.5	247	1.1	H	32.5	1.9	34.8	0.0	46.1	74	-27.9	Peak	CW / 3
4874.0000	45.5	211	1.3	V	32.5	1.9	34.8	0.0	45.1	74	-28.9	Peak	CW / 3

Primary scan 1GHz -25GHz, (High Channel 2462 MHz)

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Factor dB	Cable loss dB	Amplifier dB	Distance factor dB	Corrected Reading dBuV/m	EN55022 Limit (dBuV/m)	EN55022 Margin	Comments	Testing Condition Mode/ Distance
3285.0000	54.2	71	1.1	H	32.5	1.4	35.2	0.0	53.0	54	-1.0*	Ave	CW / 3
3285.0000	55.1	248	1.3	V	29.8	1.4	35.2	0.0	51.2	54	-2.8*	Ave	CW / 3
3285.0000	56.9	71	1.1	H	29.8	1.4	35.2	0.0	53.0	74	-21.0	Peak	CW / 3
3285.0000	56.8	248	1.3	V	29.8	1.4	35.2	0.0	52.9	74	-21.1	Peak	CW / 3
4924.0000	32.1	138	1.1	V	32.5	1.9	34.8	0.0	31.7	54	-22.3	Ave	CW / 3
4924.0000	31.2	248	1.2	H	32.5	1.9	34.8	0.0	30.8	54	-23.2	Ave	CW / 3
4924.0000	46.3	138	1.1	V	32.5	1.9	34.8	0.0	45.9	74	-28.1	Peak	CW / 3
4924.0000	45.2	248	1.2	H	32.5	1.9	34.8	0.0	44.8	74	-29.2	Peak	CW / 3

§15.247(a)(2) – 6 dB BANDWIDTH

Applicable Standard

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 emissions 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	2006-01-11

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	65%
ATM Pressure:	1027 mbar

**The testing was performed by Snell Leong on 2006-03-08*

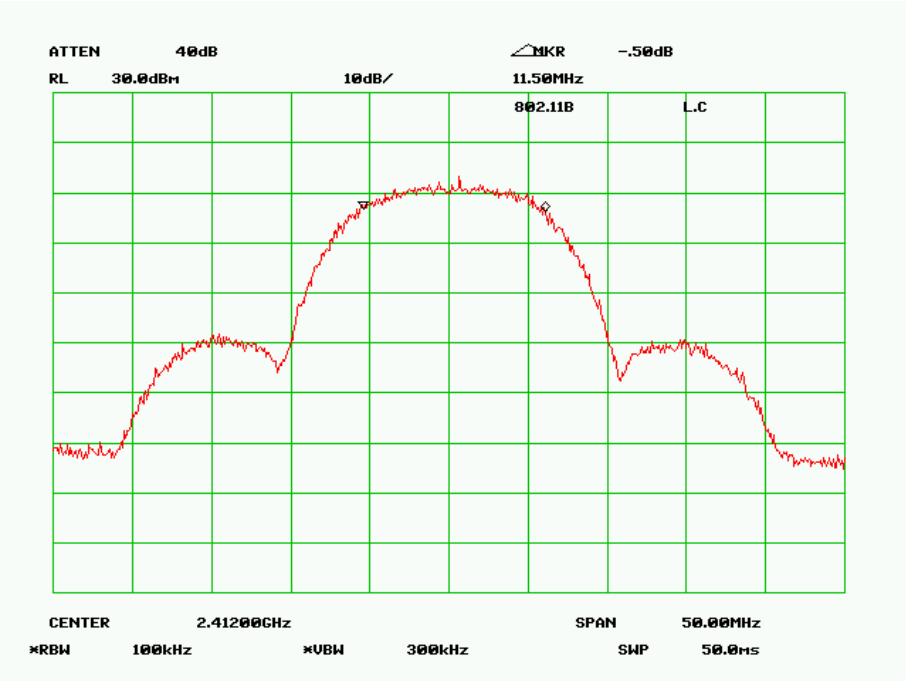
Measurement Result

For MM2225:

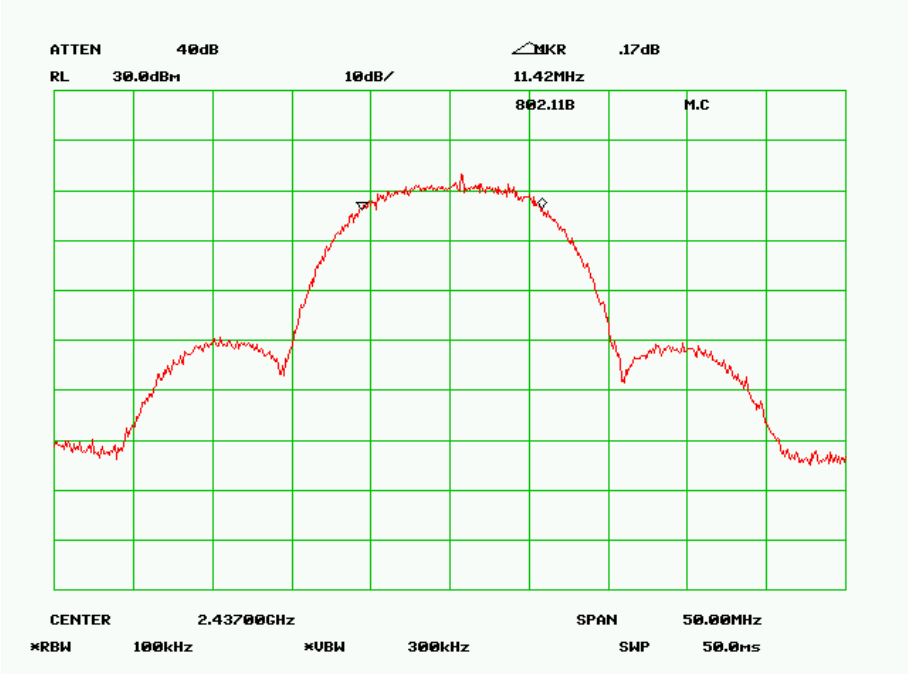
Test Result

802.11b:

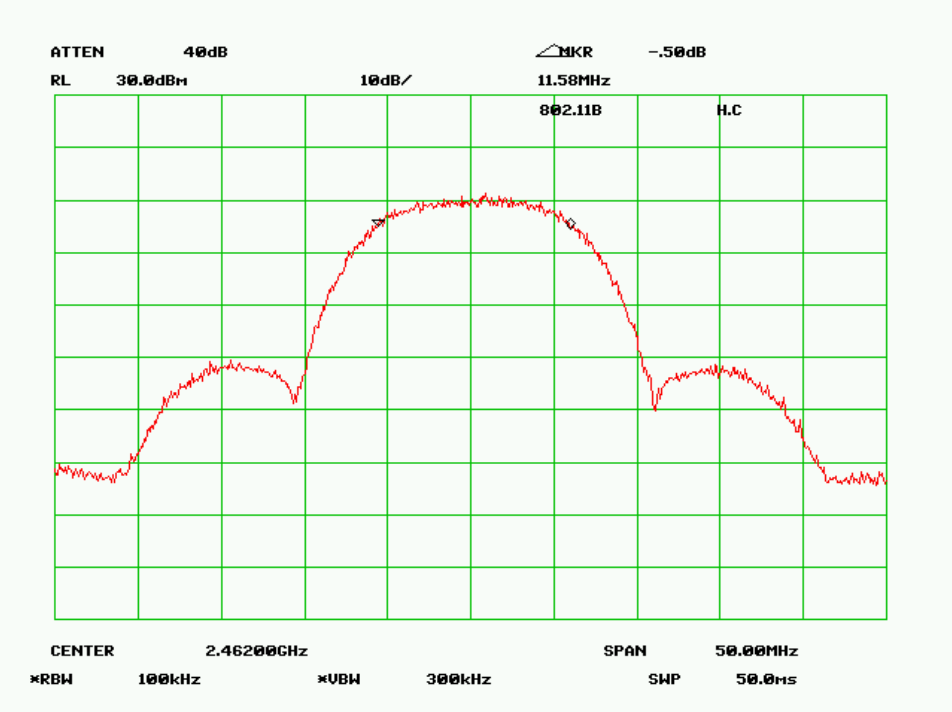
Low Channel



Middle Channel

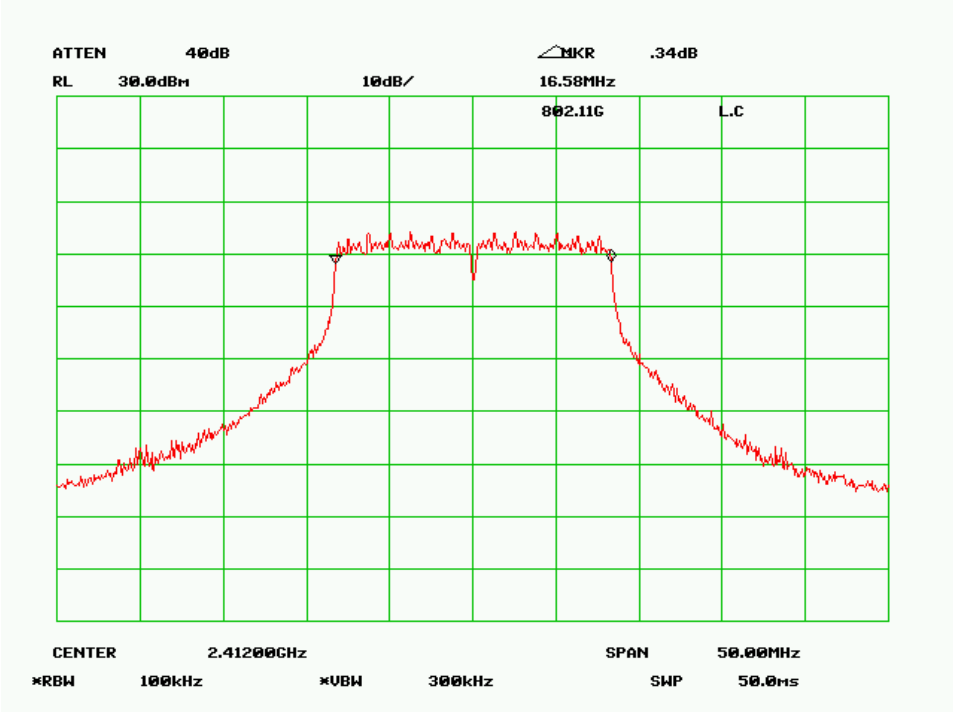


High Channel

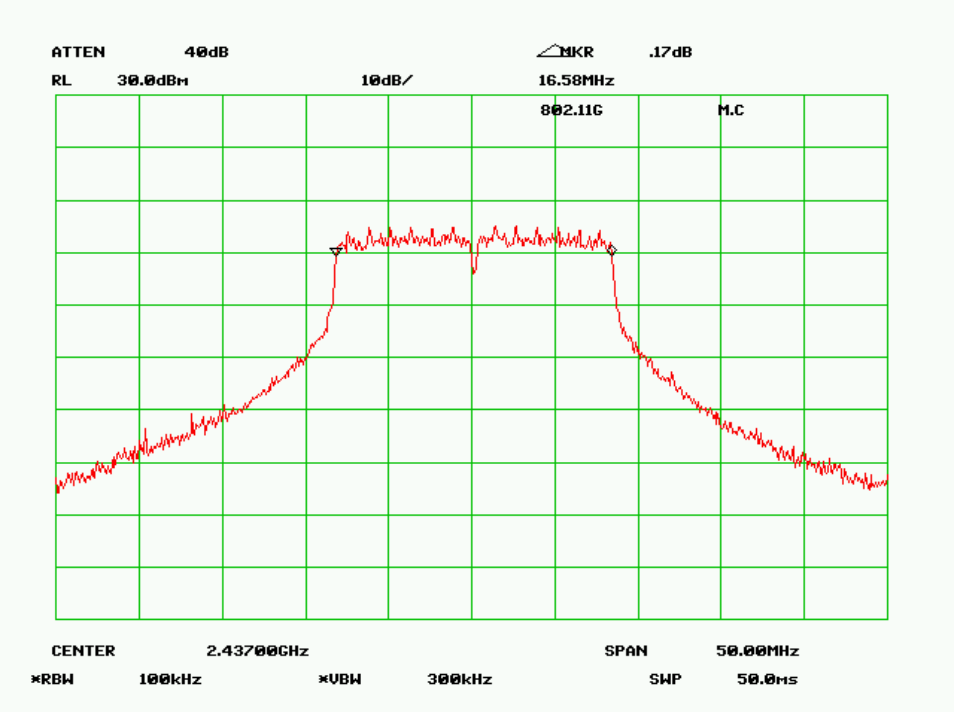


802.11g:

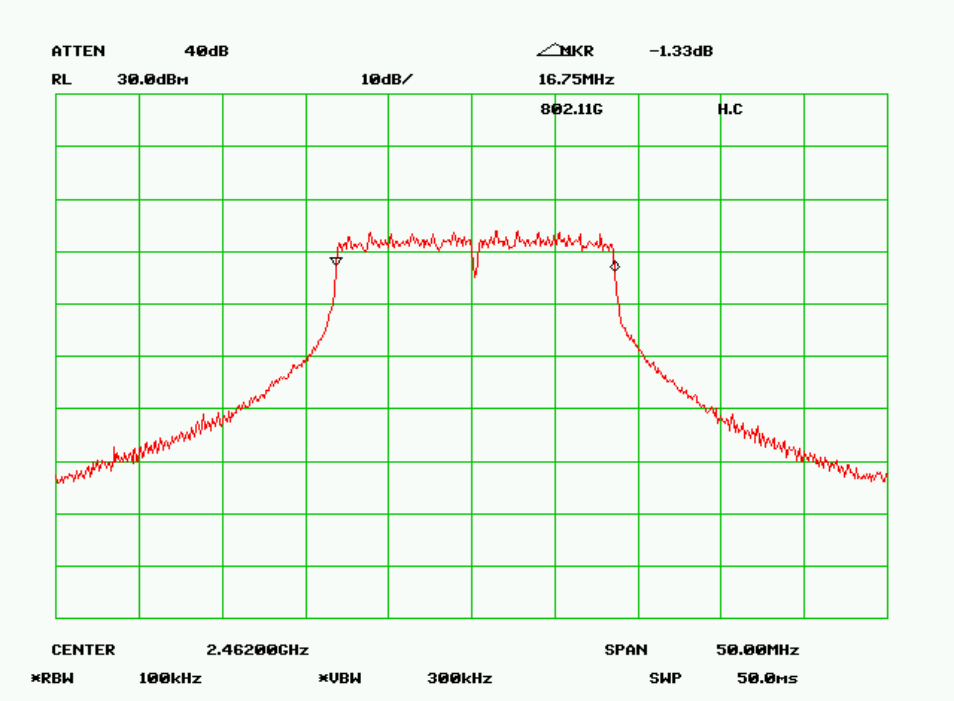
Low Channel



Mid. Channel



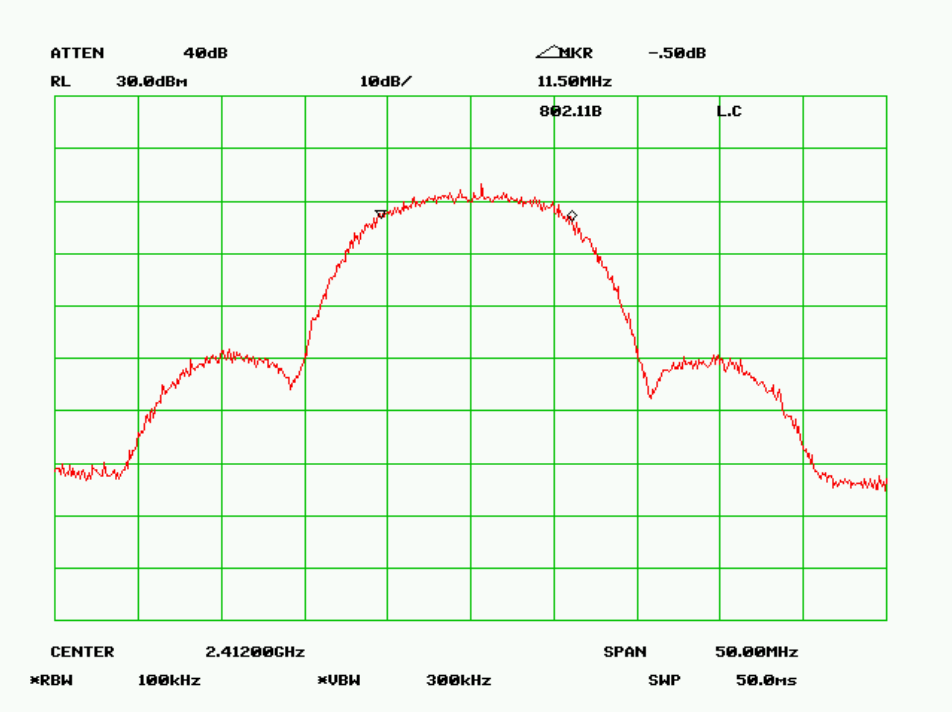
High Channel



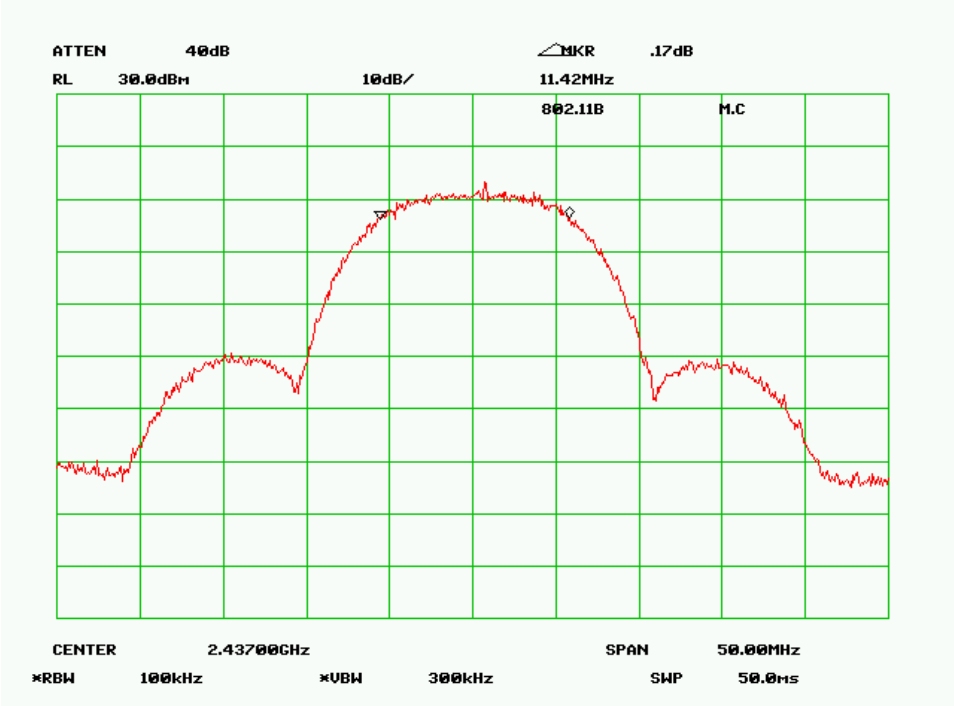
For MM22X1:

802.11b:

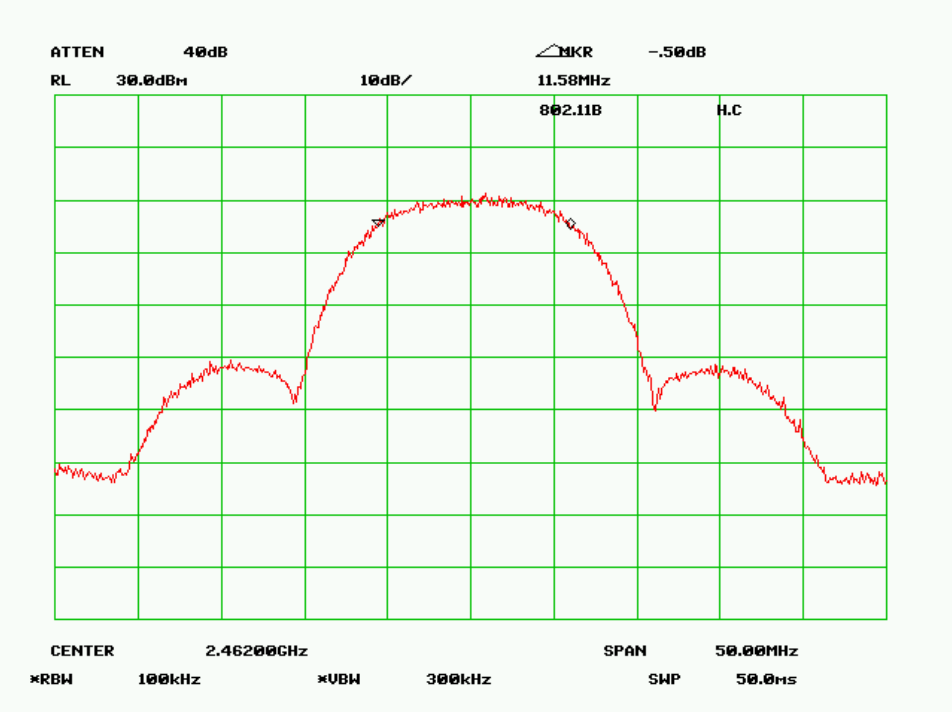
Low Channel



Middle Channel

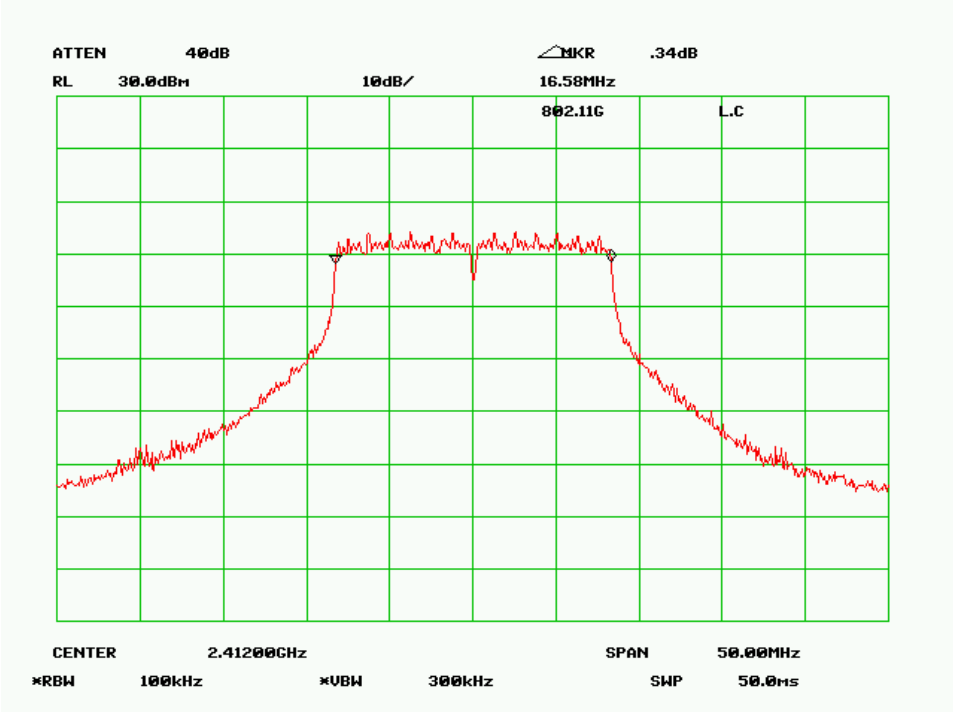


High Channel

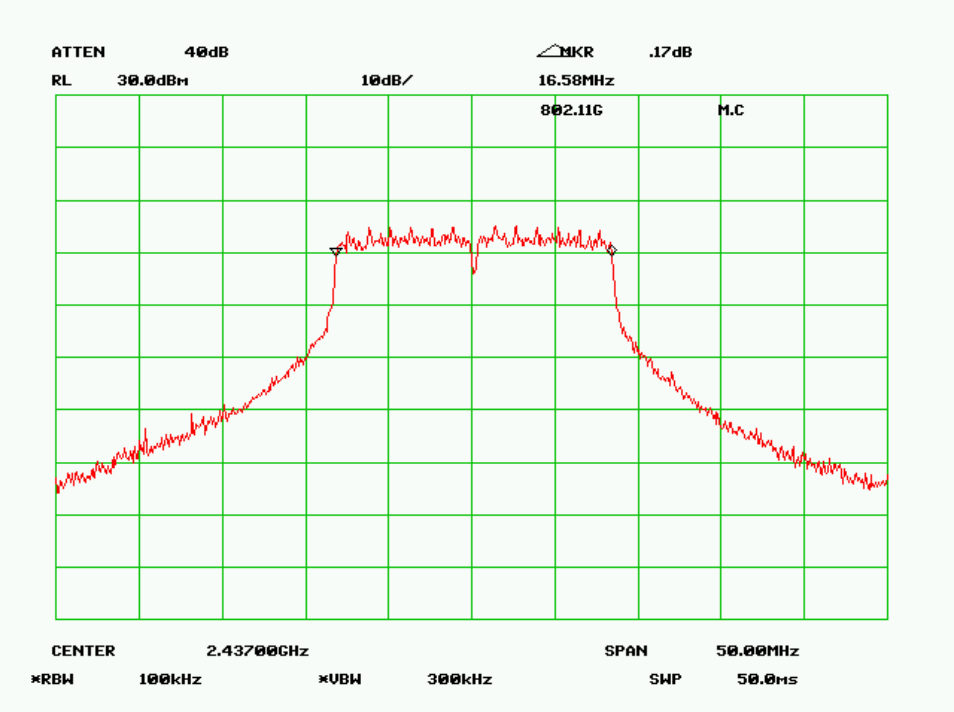


802.11g:

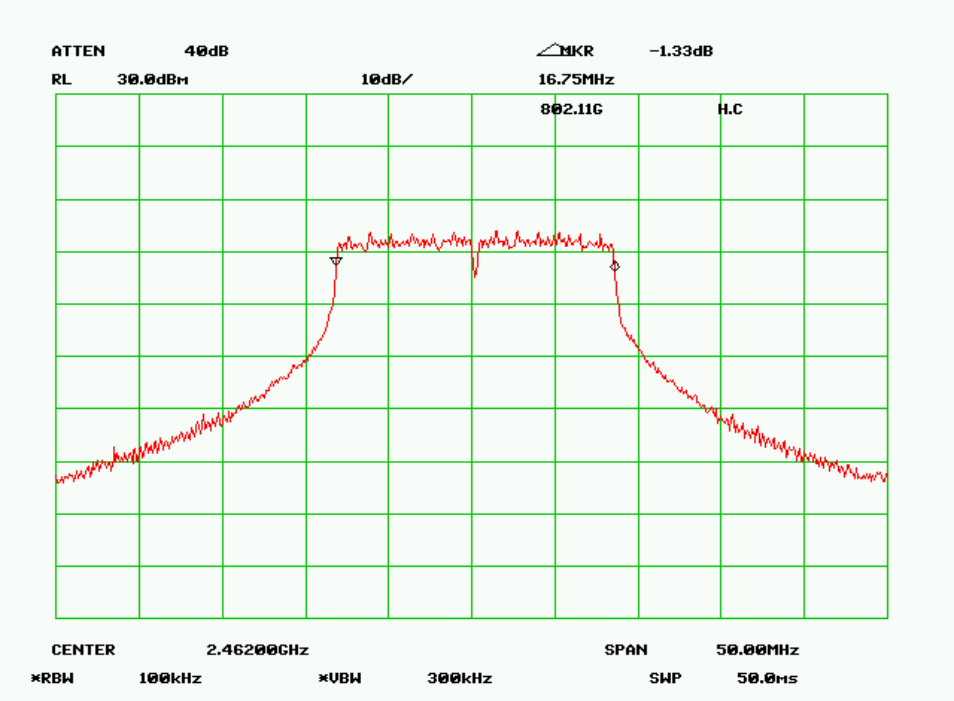
Low Channel



Mid. Channel



High Channel



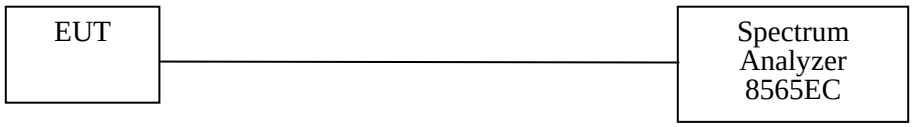
§15.247(b)(3) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

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	2006-01-11

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	65%
ATM Pressure:	1027 mbar

**The testing was performed by Snell Leong on 2006-03-08*

Measurement Result

For MM2225:

RF Output Power

802.11b:

802.11b @ 11Mbps

Frequency MHz	Reading dBm	Output in Watt	FCC 15.247 Limit (dBm)	FCC 15.247 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 MHz	Reading dBm	Output in Watt	FCC 15.247 Limit (dBm)	FCC 15.247 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 MHz	Reading dBm	Output in Watt	FCC 15.247 Limit (dBm)	FCC 15.247 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 MHz	Reading dBm	Output in Watt	FCC 15.247 Limit (dBm)	FCC 15.247 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 MHz	Reading dBm	Output in Watt	FCC 15.247 Limit (dBm)	FCC 15.247 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

For MM22X1:

RF Output Power

802.11b:

802.11b @ 11Mbps

Frequency MHz	Reading dBm	Output in Watt	FCC 15.247 Limit (dBm)	FCC 15.247 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 MHz	Reading dBm	Output in Watt	FCC 15.247 Limit (dBm)	FCC 15.247 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 MHz	Reading dBm	Output in Watt	FCC 15.247 Limit (dBm)	FCC 15.247 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 MHz	Reading dBm	Output in Watt	FCC 15.247 Limit (dBm)	FCC 15.247 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 MHz	Reading dBm	Output in Watt	FCC 15.247 Limit (dBm)	FCC 15.247 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

Applicable Standard

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 emissions 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	2006-01-11

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	65%
ATM Pressure:	1027 mbar

**The testing was performed by Snell Leong on 2006-03-08*

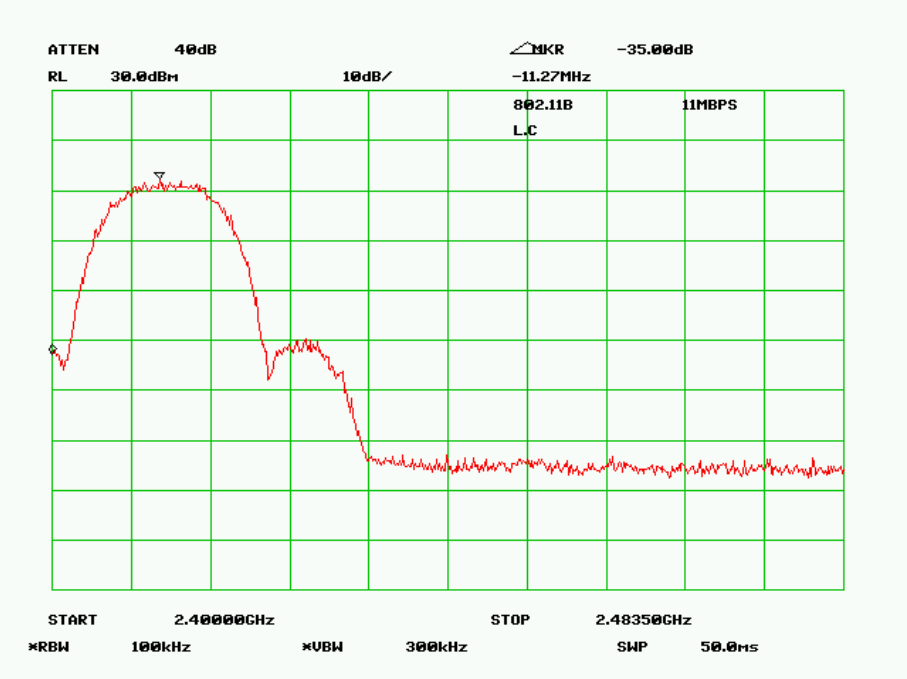
Measurement Result

Please refer to following pages for plots of band edge.

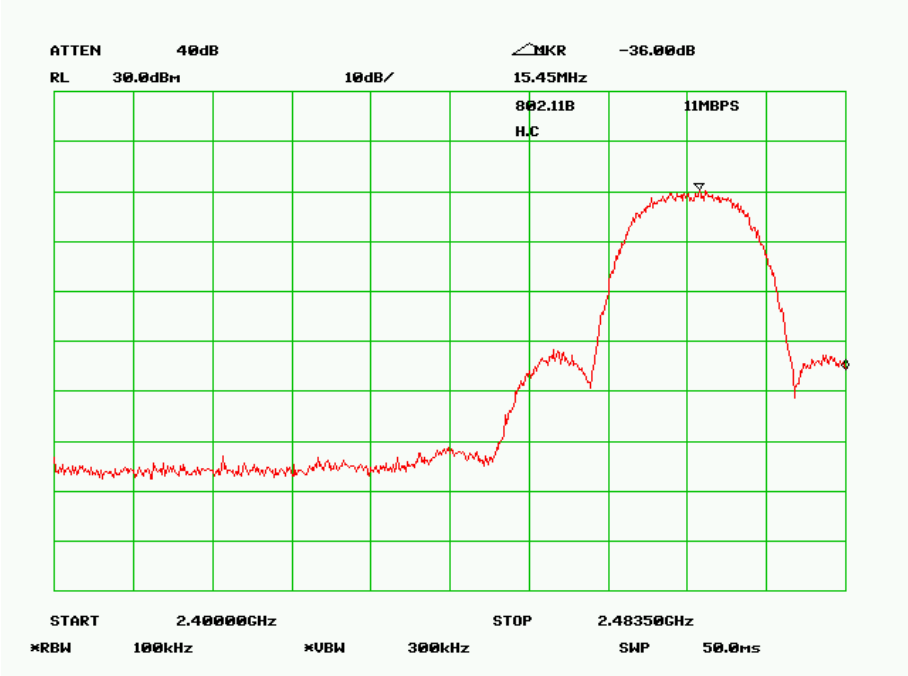
For MM2225:

802.11b:

Low Channel

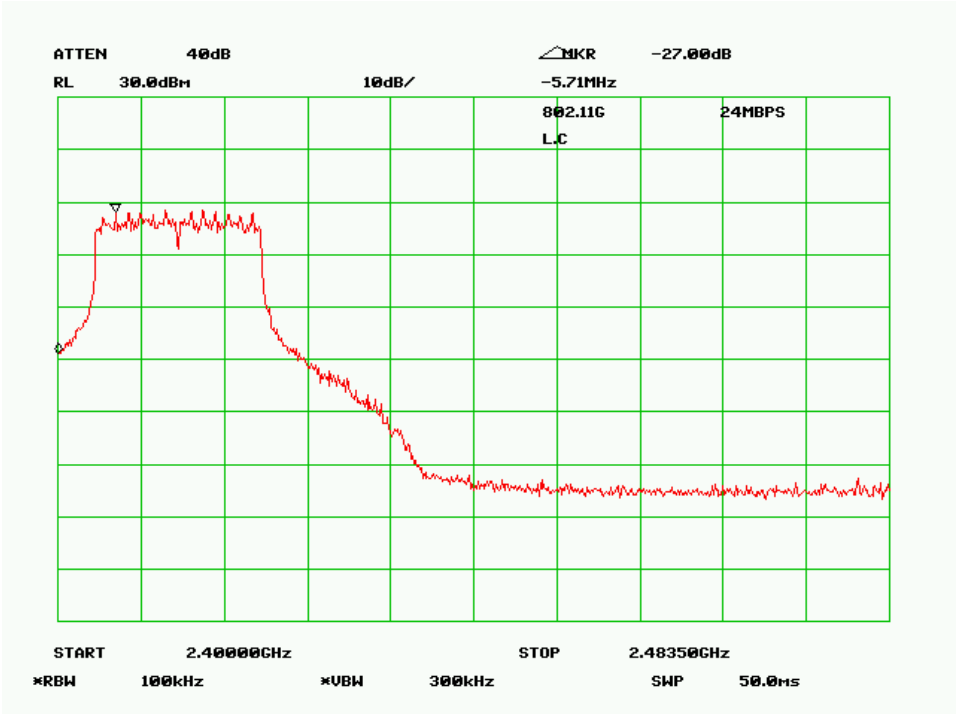


High Channel

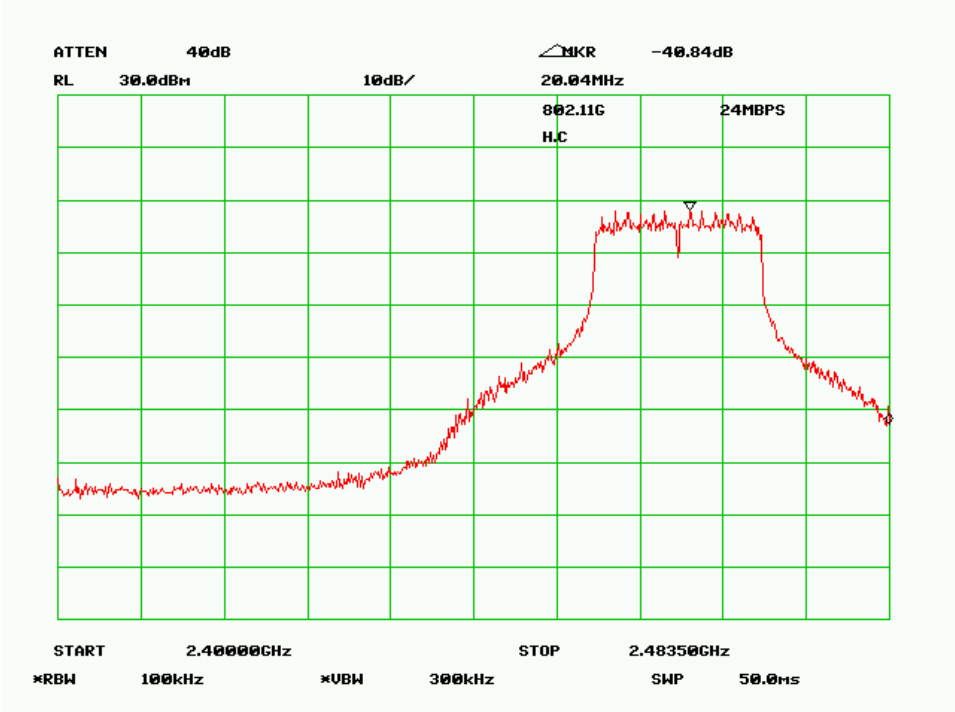


802.11g:

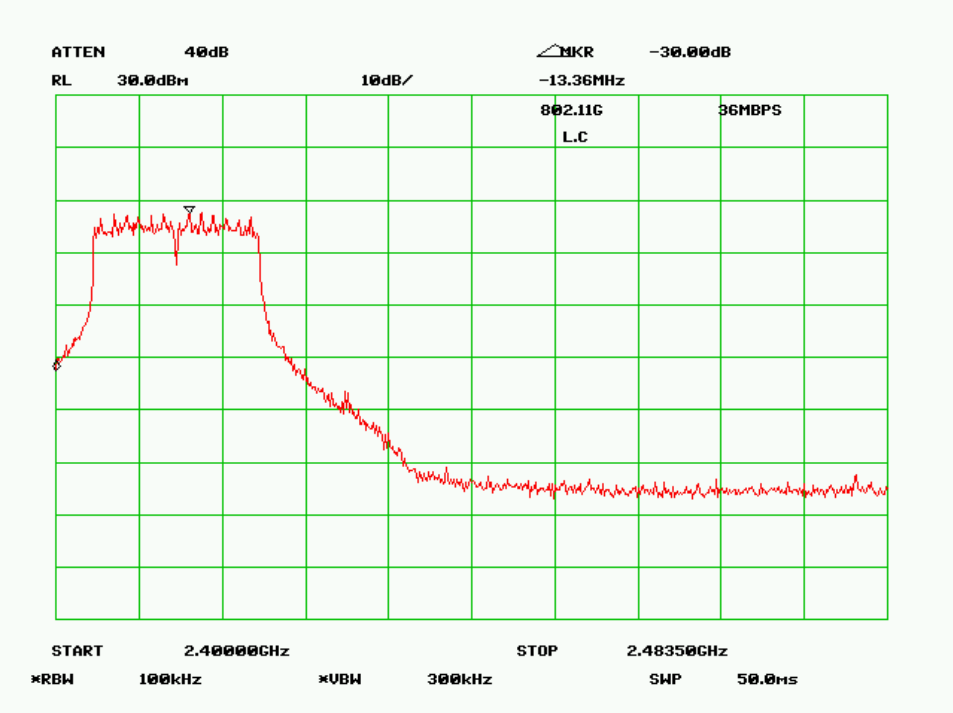
Low Channel, 24Mbps



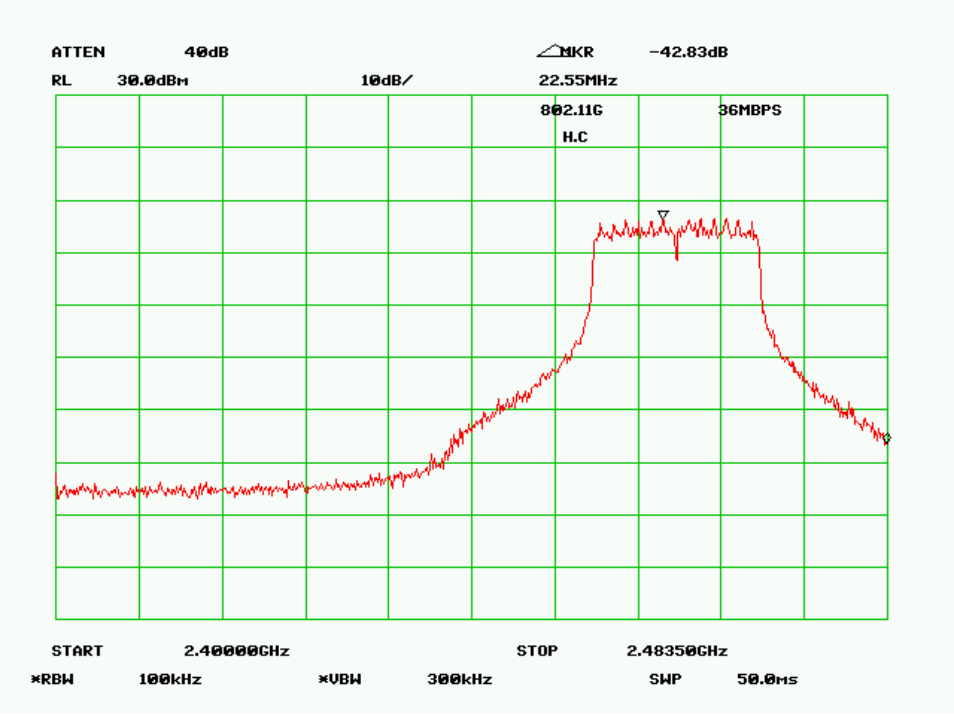
High Channel, 24Mbps



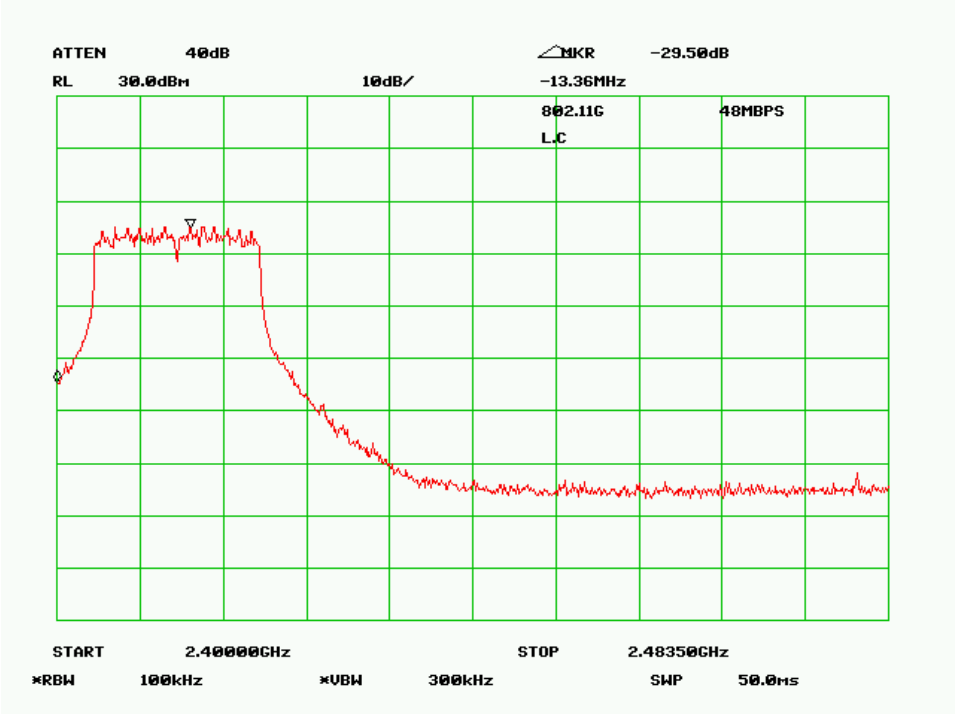
Low Channel, 36Mbps



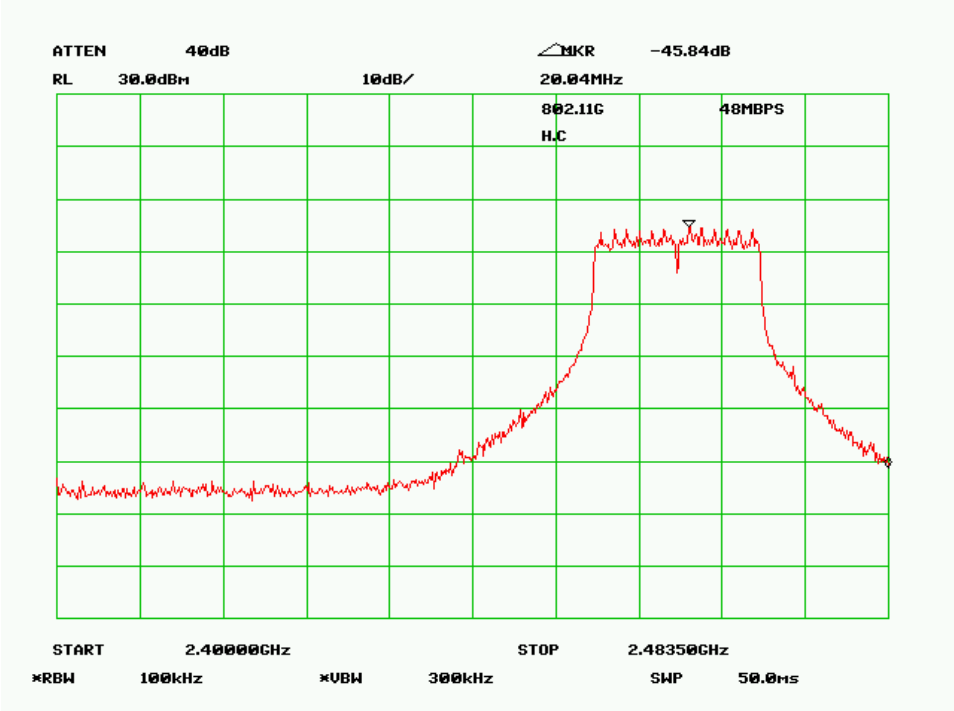
High Channel, 36Mbps



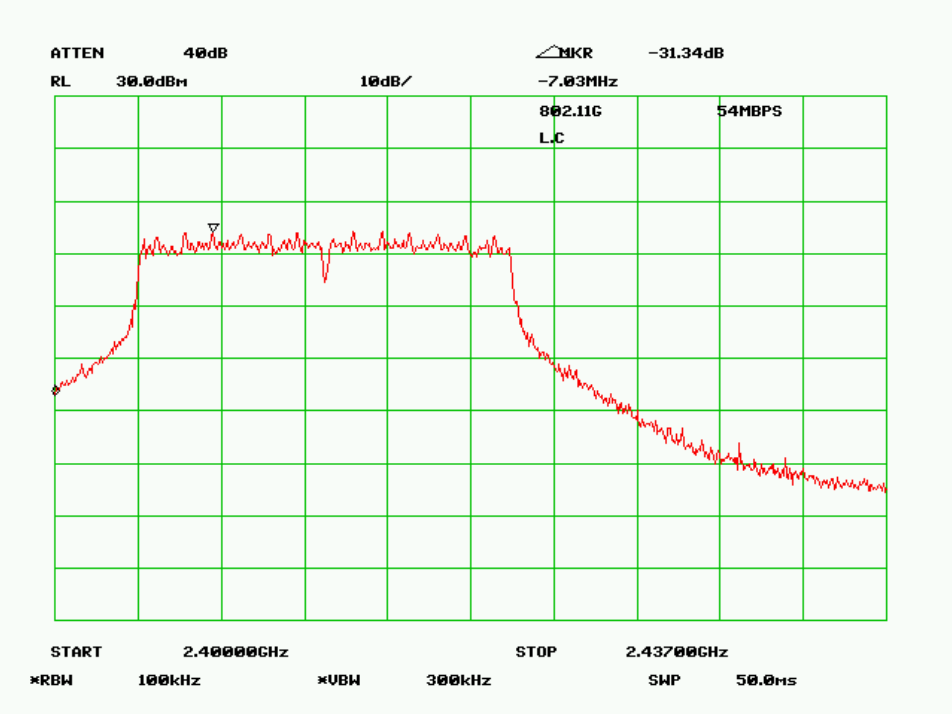
Low Channel, 48Mbps



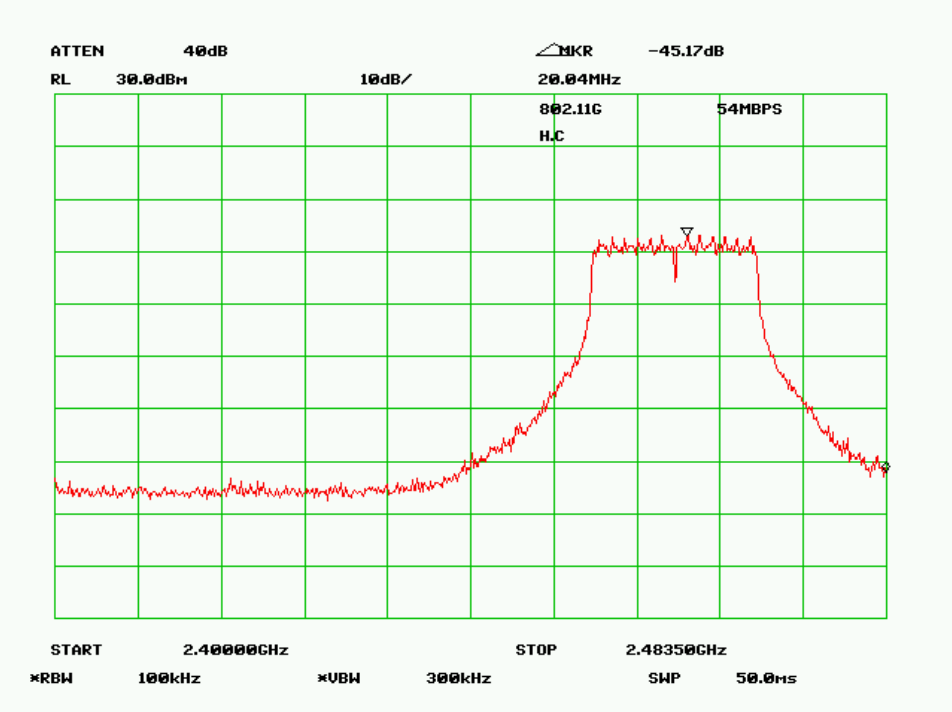
High Channel, 48Mbps



Low Channel, 54Mbps



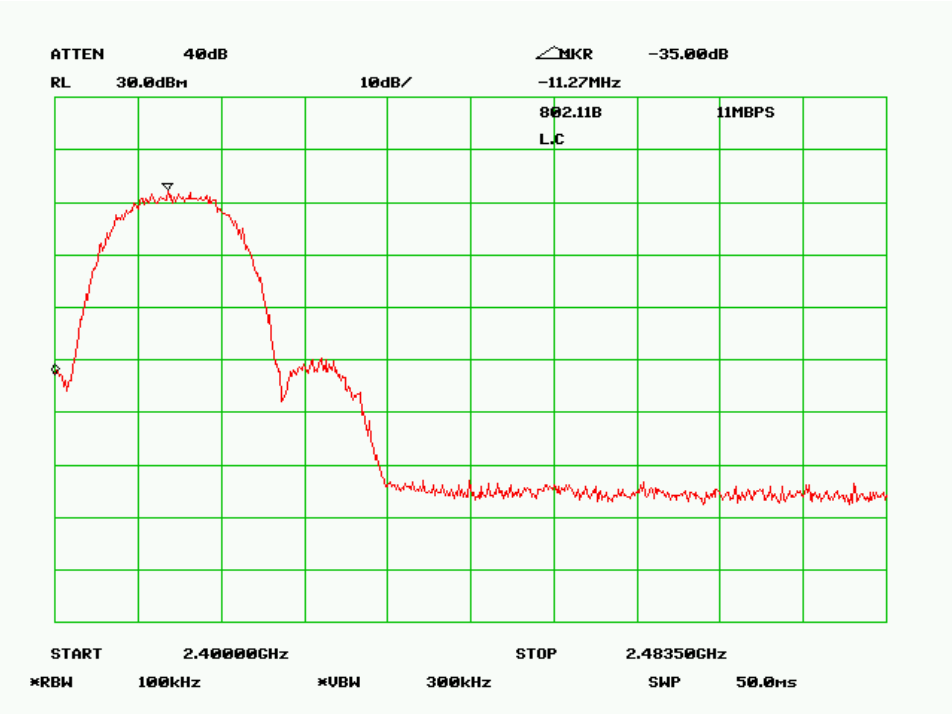
High Channel, 54Mbps



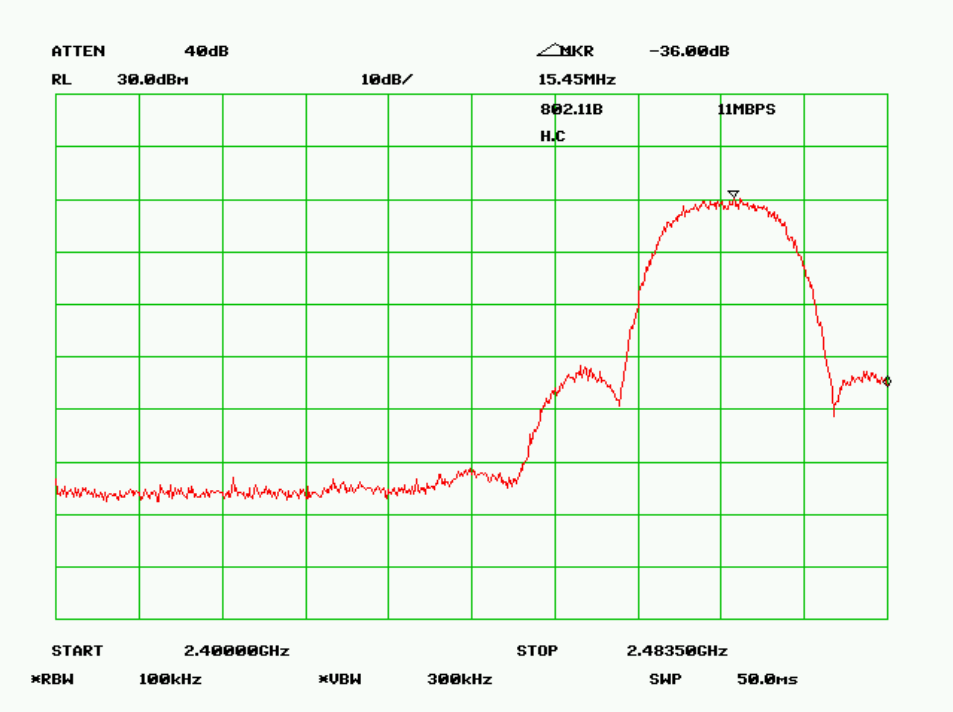
For MM22X1:

802.11b:

Low Channel

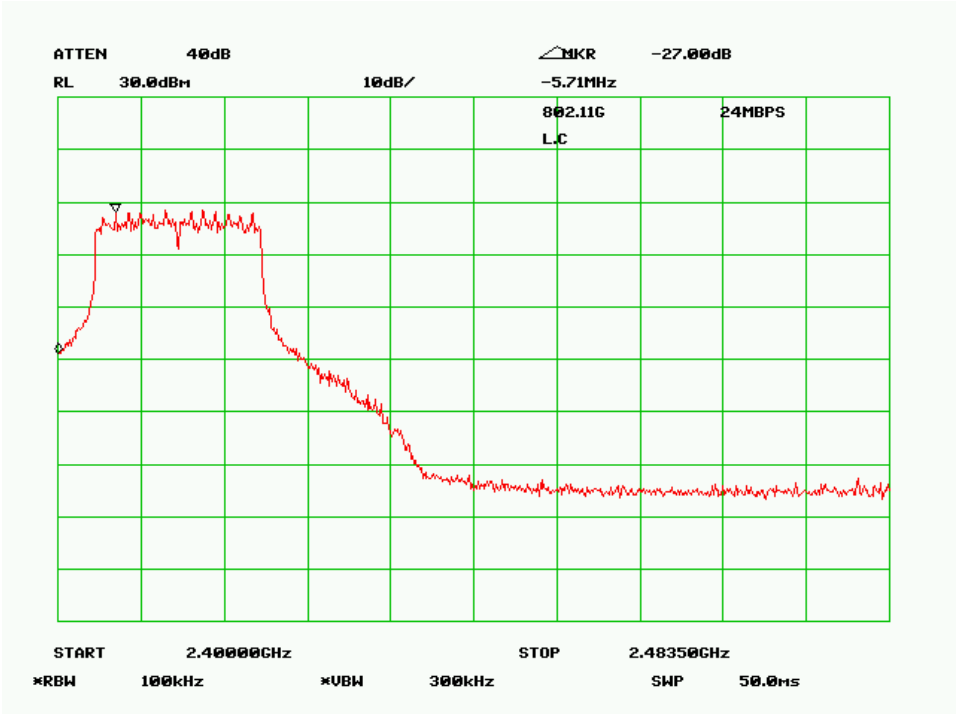


High Channel

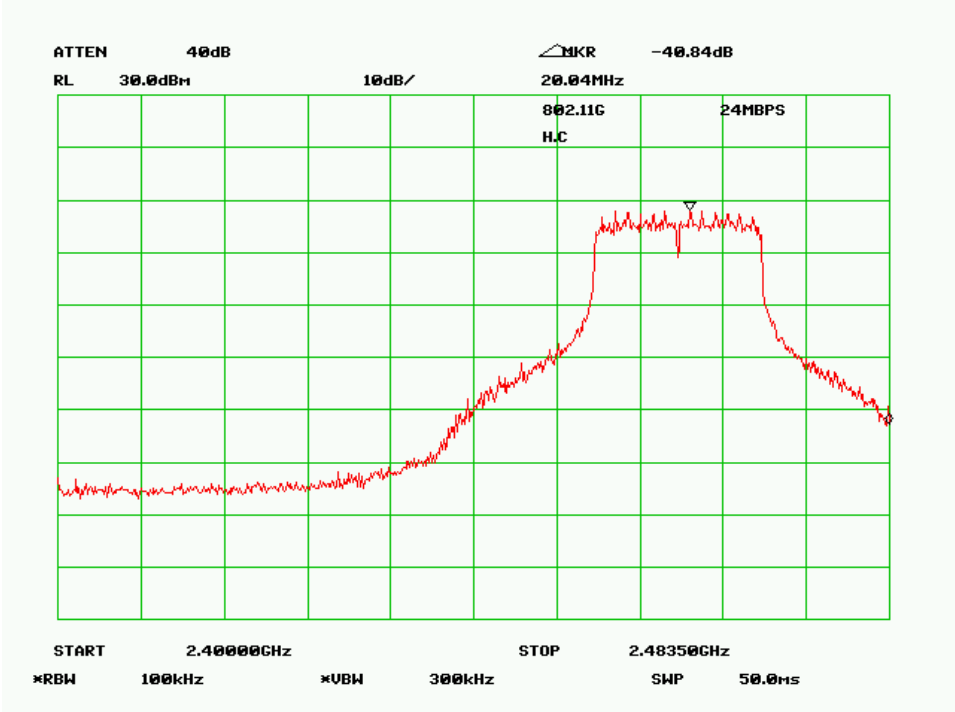


802.11g:

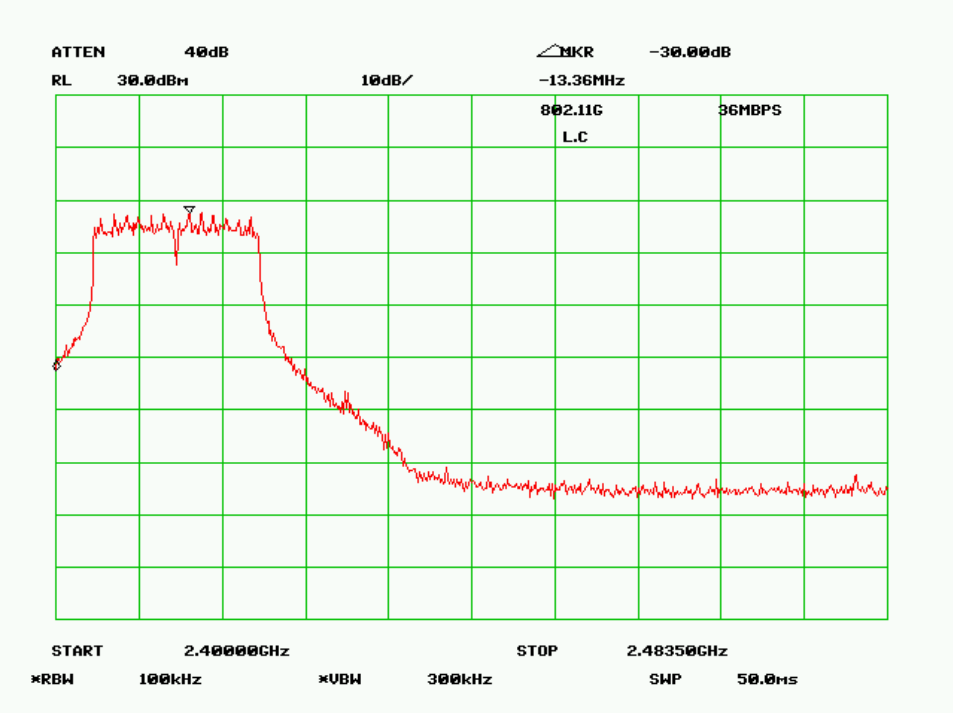
Low Channel, 24Mbps



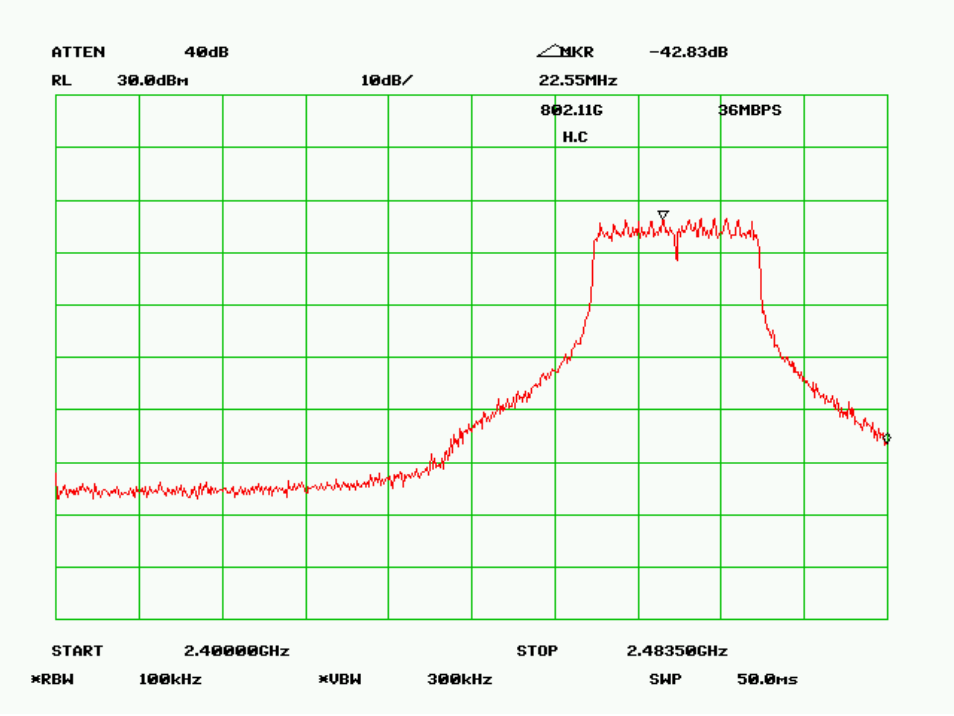
High Channel, 24Mbps



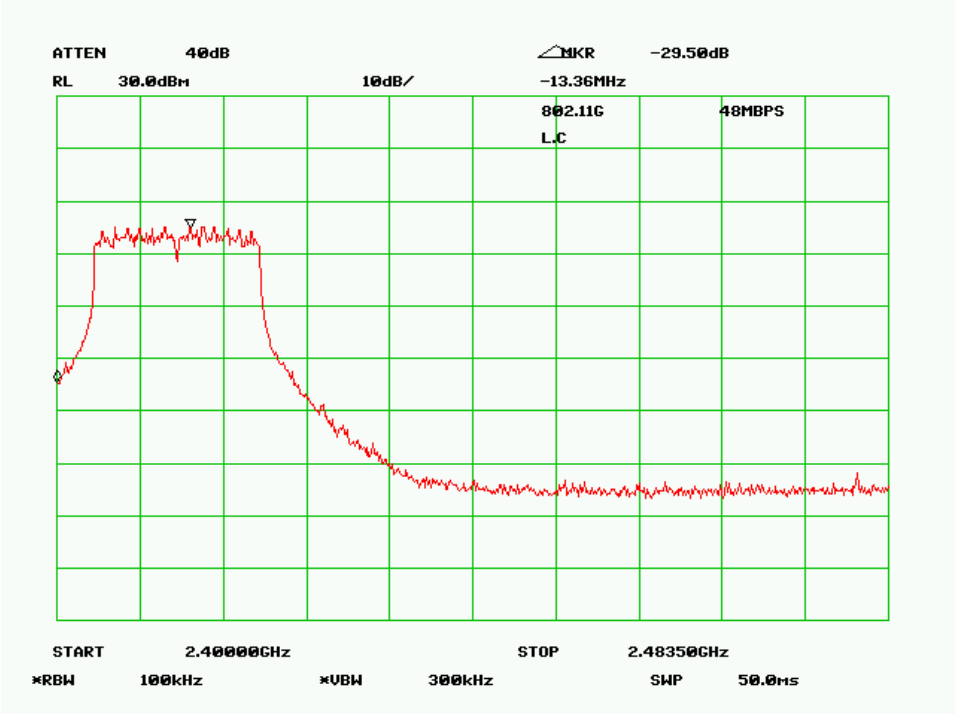
Low Channel, 36Mbps



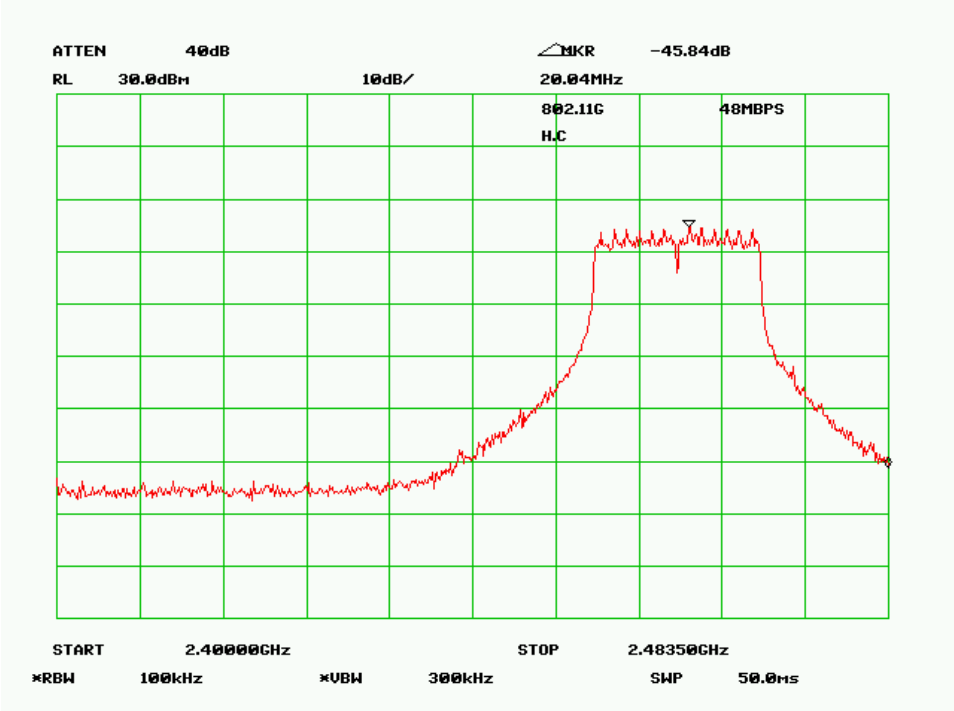
High Channel, 36Mbps



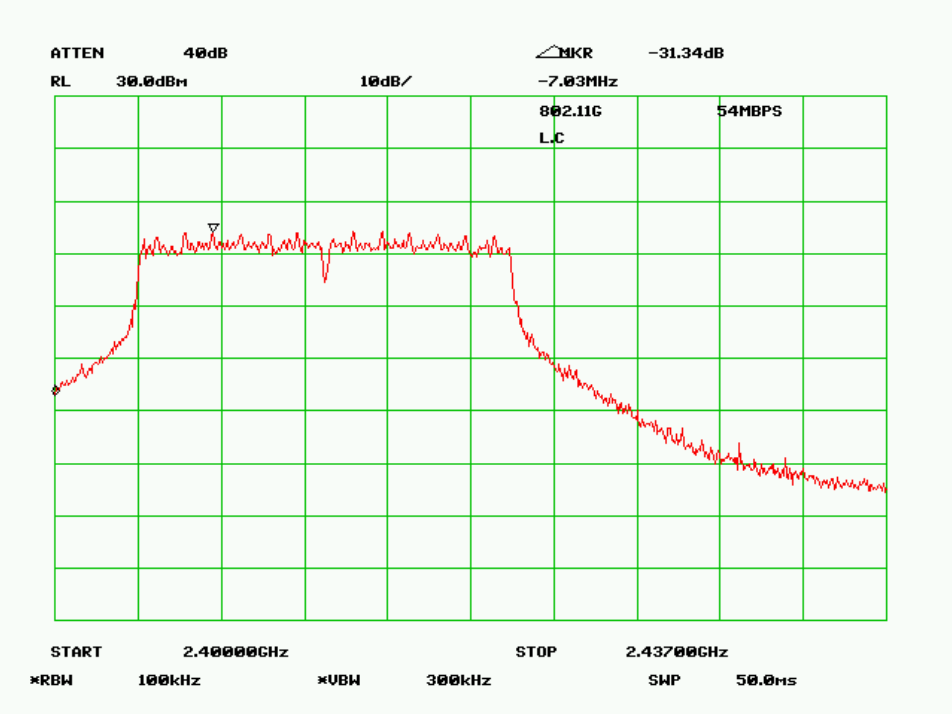
Low Channel, 48Mbps



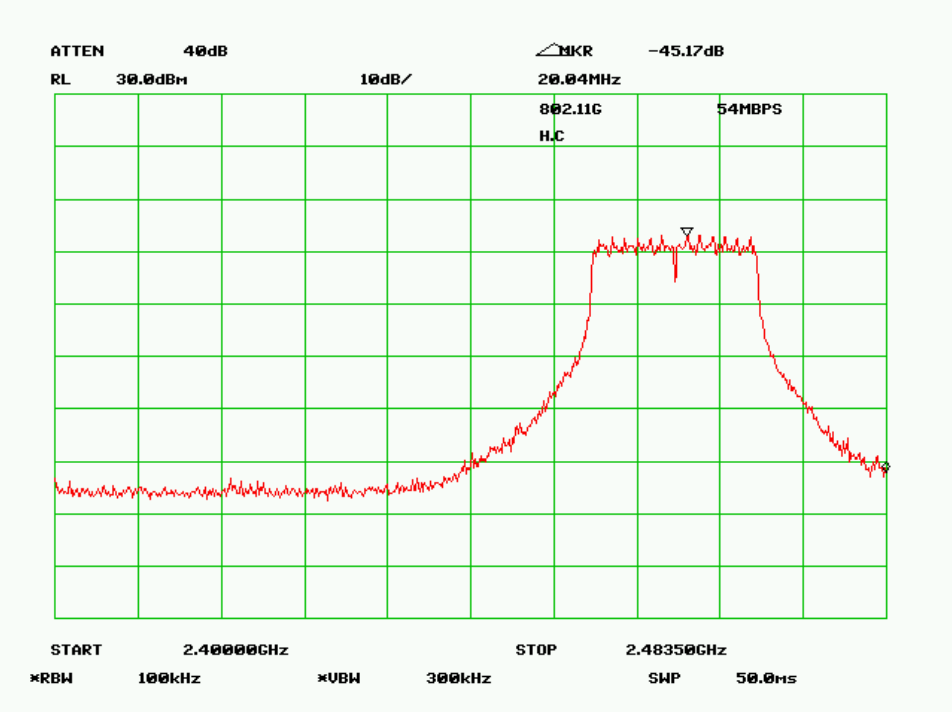
High Channel, 48Mbps



Low Channel, 54Mbps



High Channel, 54Mbps



§15.247(d) - POWER SPECTRAL DENSITY

Applicable Standard

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.

Environmental Conditions

Temperature:	20° C
Relative Humidity:	65%
ATM Pressure:	1027 mbar

**The testing was performed by Snell Leong on 2006-03-08*

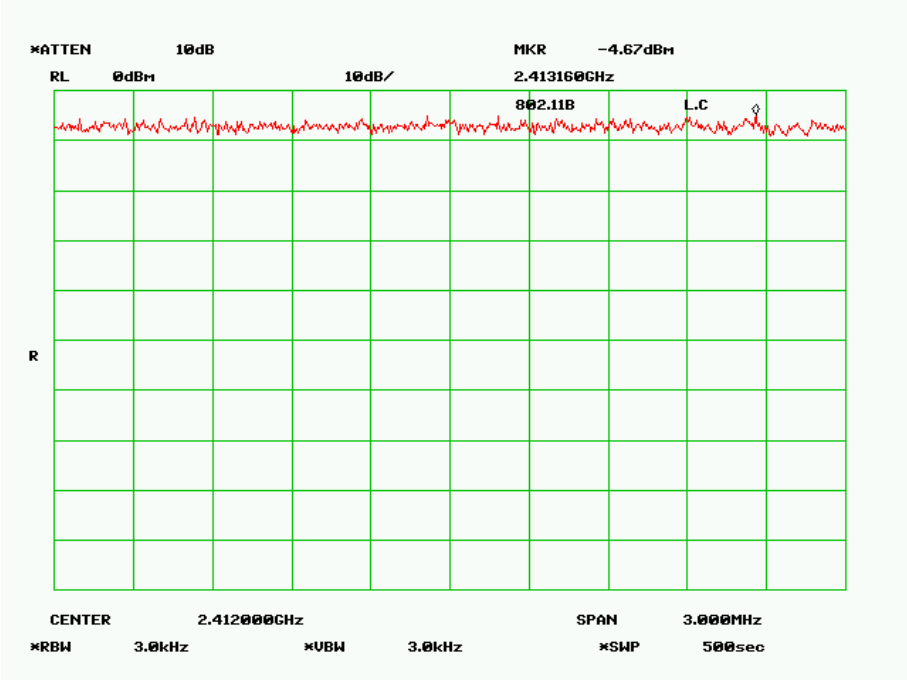
Measurement Result

For MM2225:

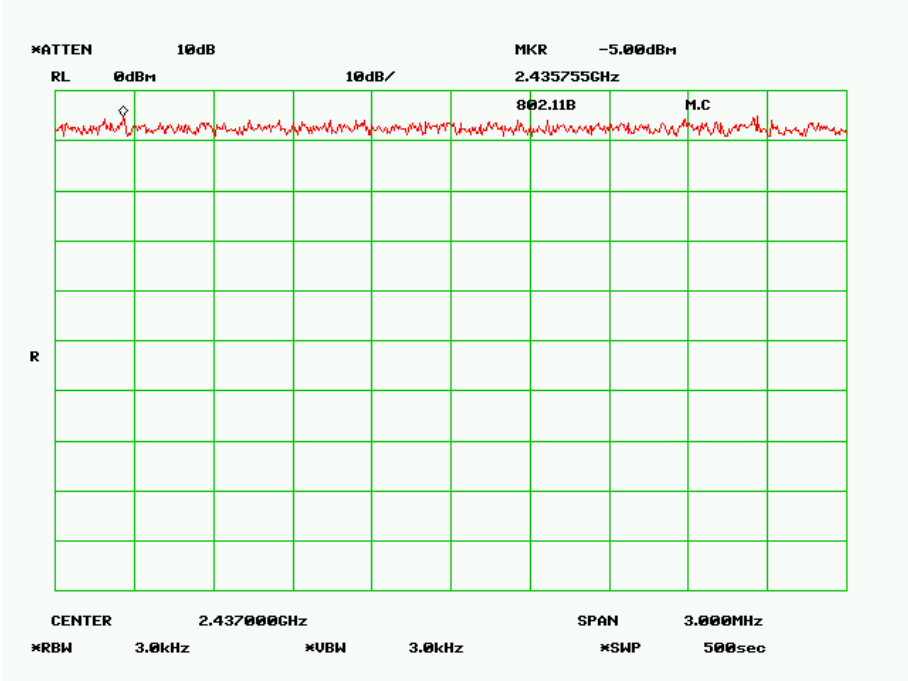
Test Result

802.11b:

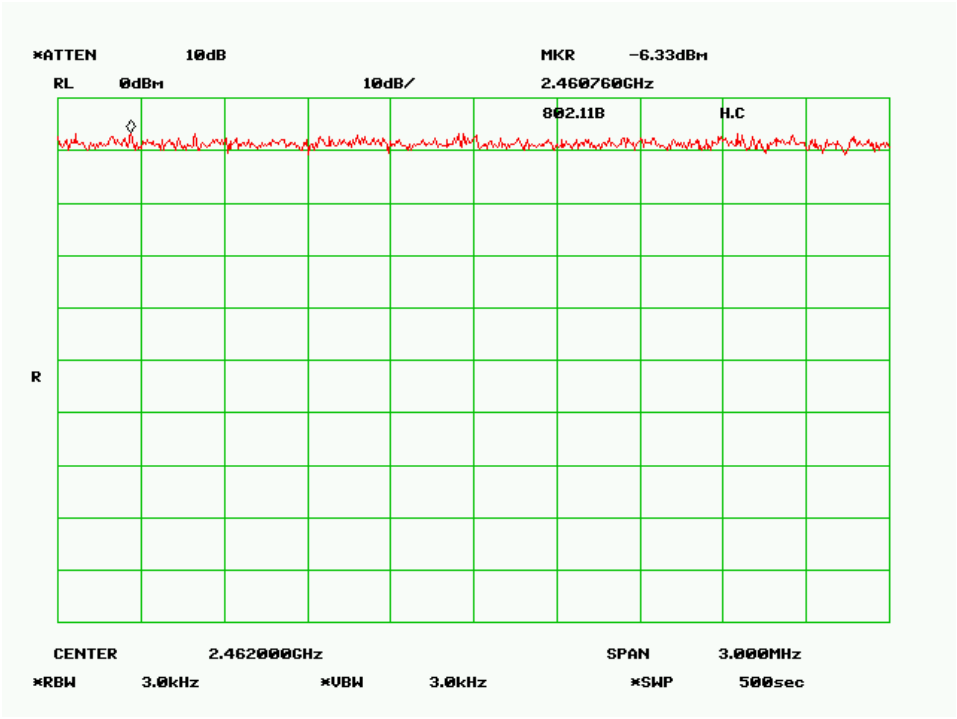
Low Channel



Mid. Channel

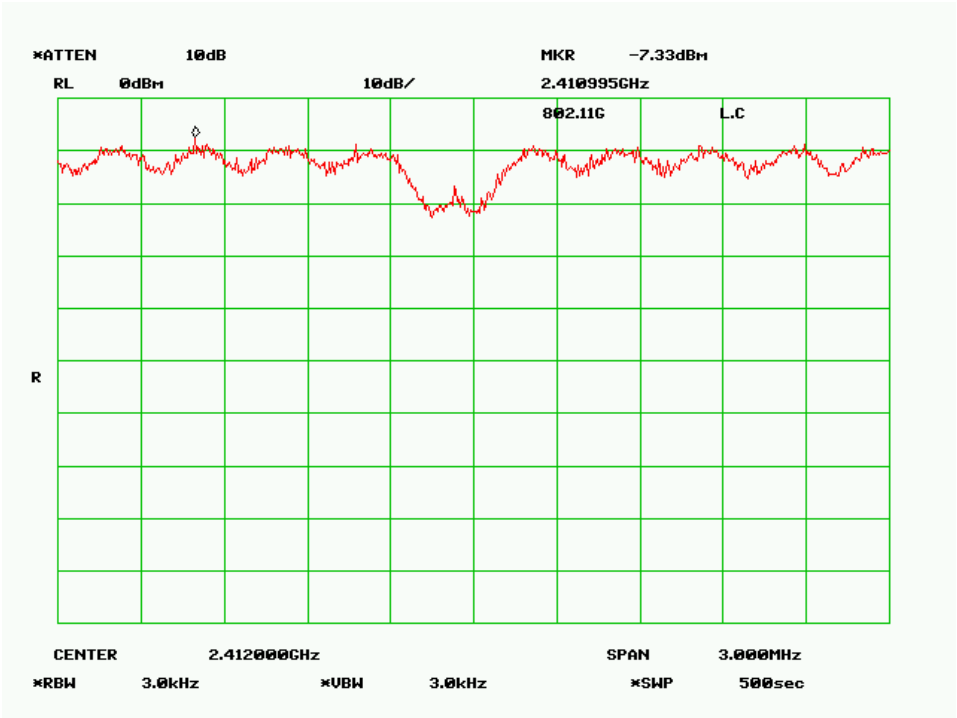


High Channel

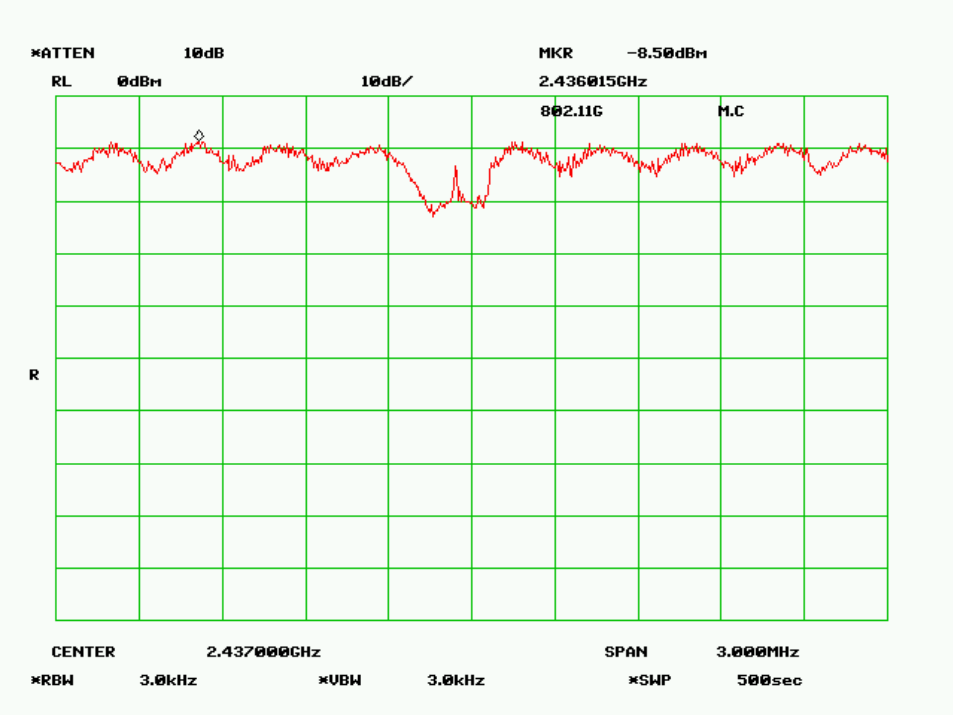


802.11g:

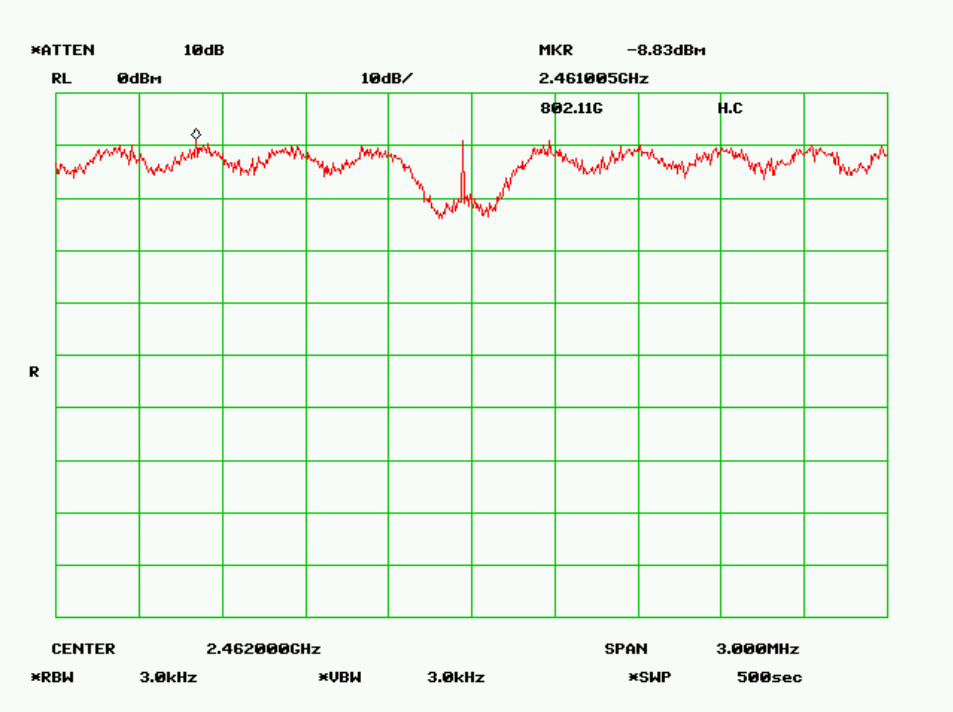
Low Channel



Mid Channel



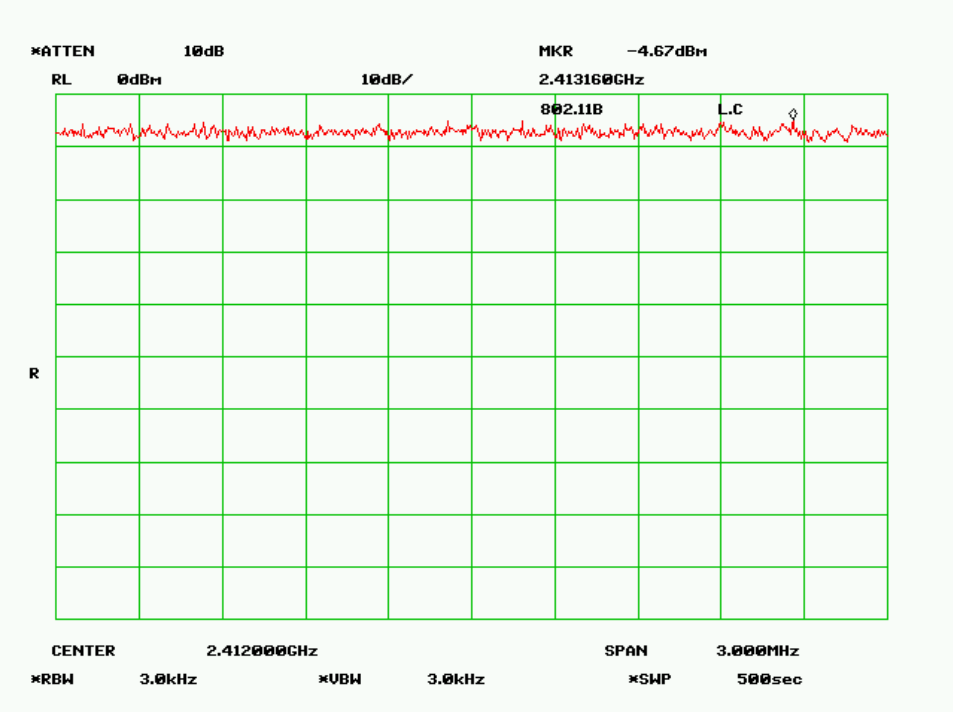
High Channel



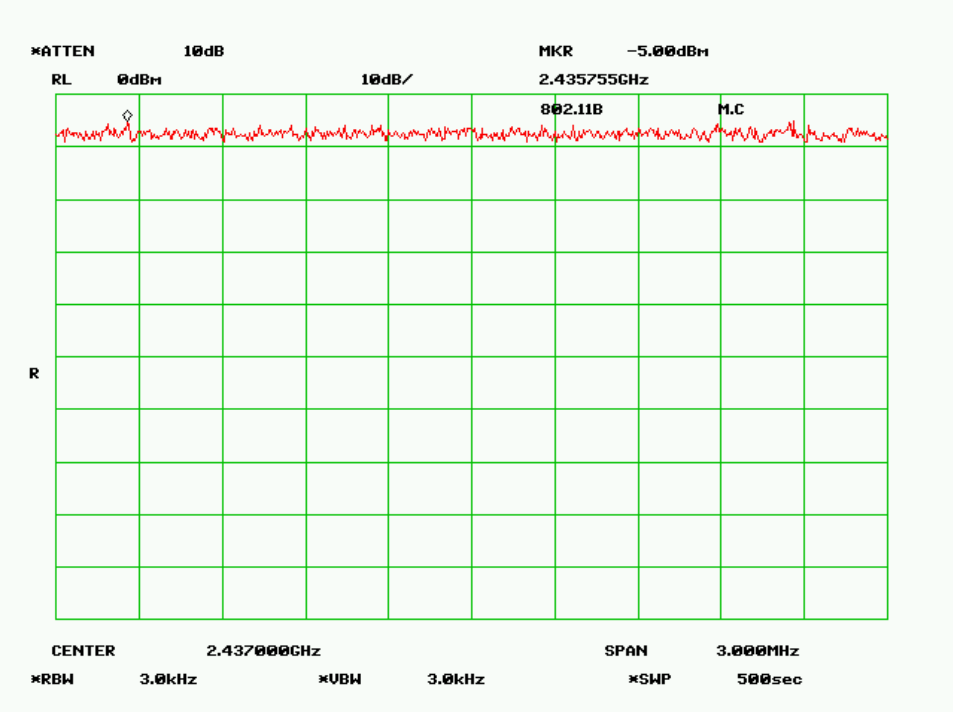
For MM22X1:

802.11b:

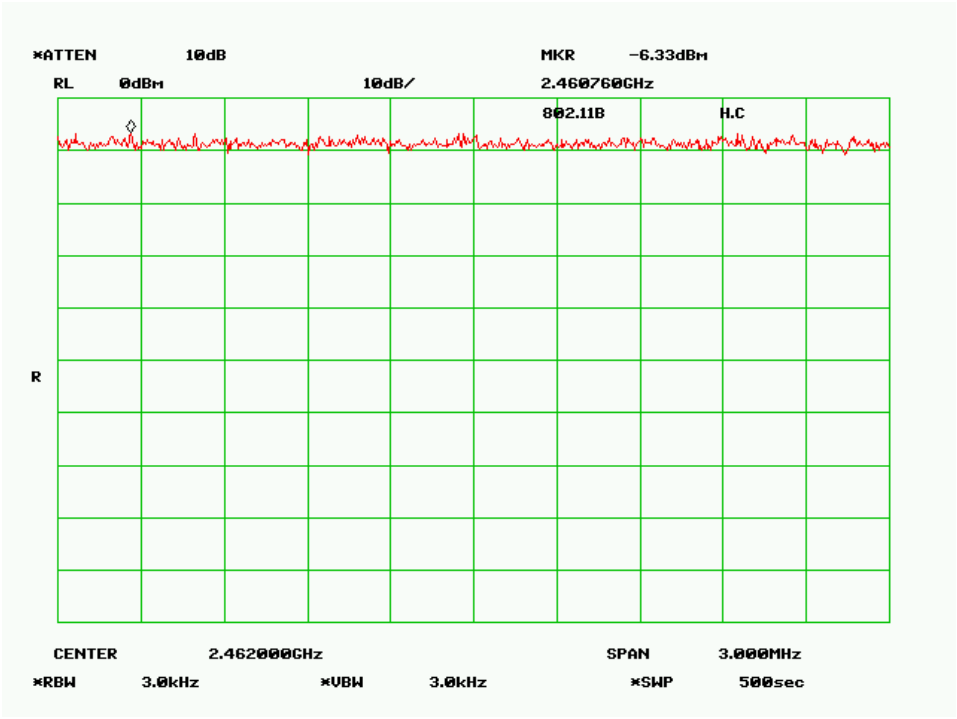
Low Channel



Mid. Channel

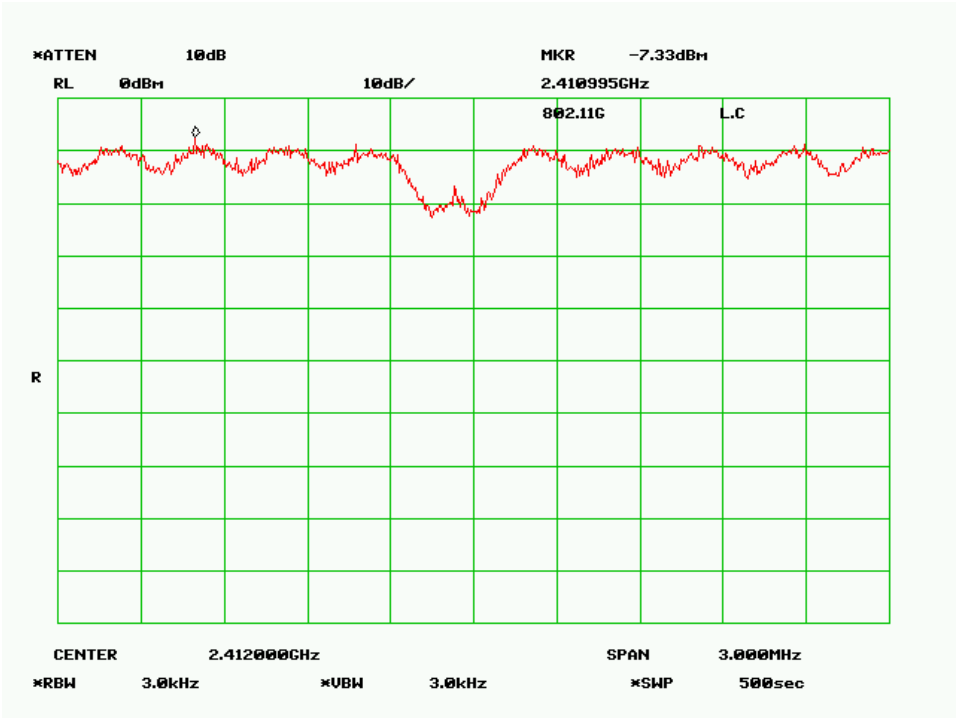


High Channel

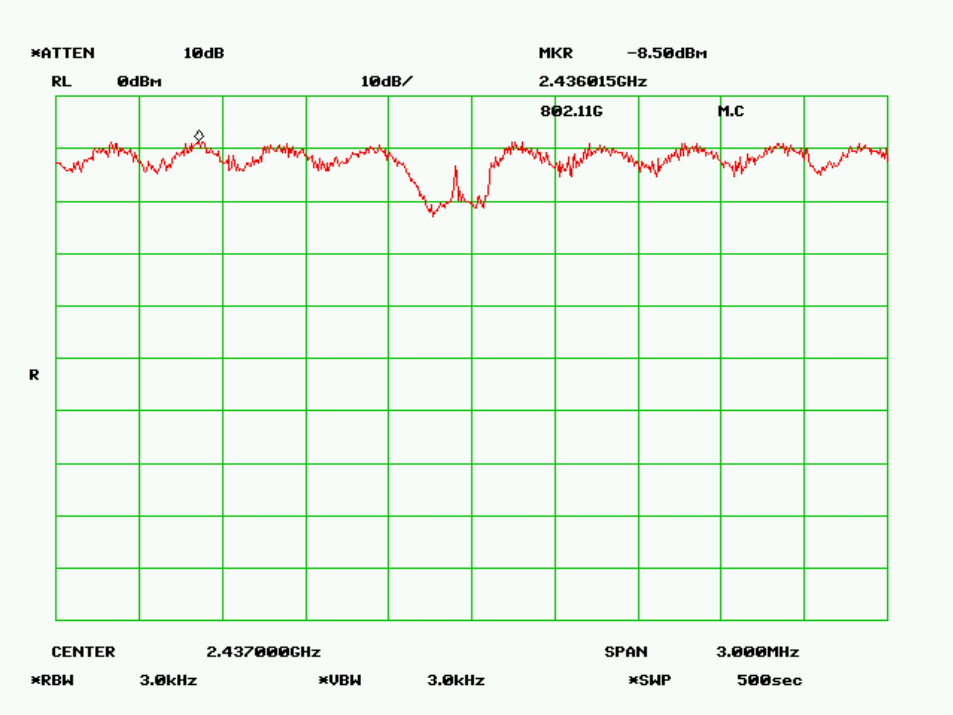


802.11g:

Low Channel



Mid Channel



High Channel