

FCC PART 15.247
EMI MEASUREMENT AND TEST REPORT

For

Actiontec Electronics, Inc.

760 N. Mary Avenue, Sunnyvale, CA 94085

FCC ID: LNQ802MIG3

This Report Concerns: ☒ Original Report	Equipment Type: 802.11b/g Wireless Mini PCI Module
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Report No.: R0507071	
Report Date: 2005-07-12	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Actiontec Electronics, Inc.* product, FCC ID: *LNQ802MIG3* or the "EUT" as referred to in this report is a 802.11b/g Wireless Mini PCI Module which is measured approximately 61mmL x 52mmW x 3mmH.

** The test data gathered are from production sample, serial number:00904BCA20E3, provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Actiontec Electronics, 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, 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.

Test Facility

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

Test site at Bay Area Compliance Laboratory Corporation 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 file 31040/SIT 1300F2 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 EUT was configured for testing according to ANSI C63.4-2003.

Schematics and Block Diagram

Please refer to Appendix A.

Equipment Modifications

No modifications were made to the EUT.

Local Support Equipment

Manufacturer	Description	Model	Serial Number	FCC ID
Matsonic	Main board	MS9087C	/	DOC
Seagate	Hard drive	ST340014A	5JX71GVN	DOC
Sony	CD-ROM Drive	CDU5211	10BD0239226	DOC
Tigerpro	Power supply	TP-300	D2B003696	DOC
Compaq	Monitor	HSTND-1L01	CNN4240LBU	DOC
Compaq	Keyboard with mouse	KPM3B34	404236261V6	DOC

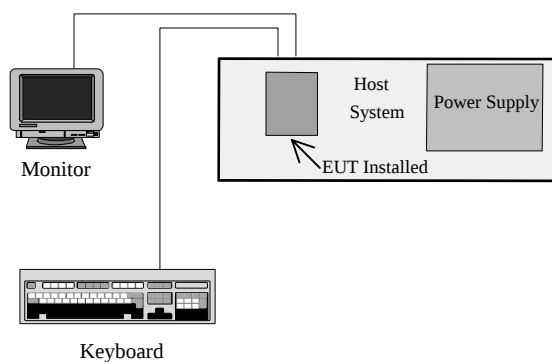
External I/O Cabling List and Details

Cable Description	Length (M)	From	To
Shielded Cable	1.5	Keyboard	Host
Shielded Video Cable	1.5	Monitor	Host

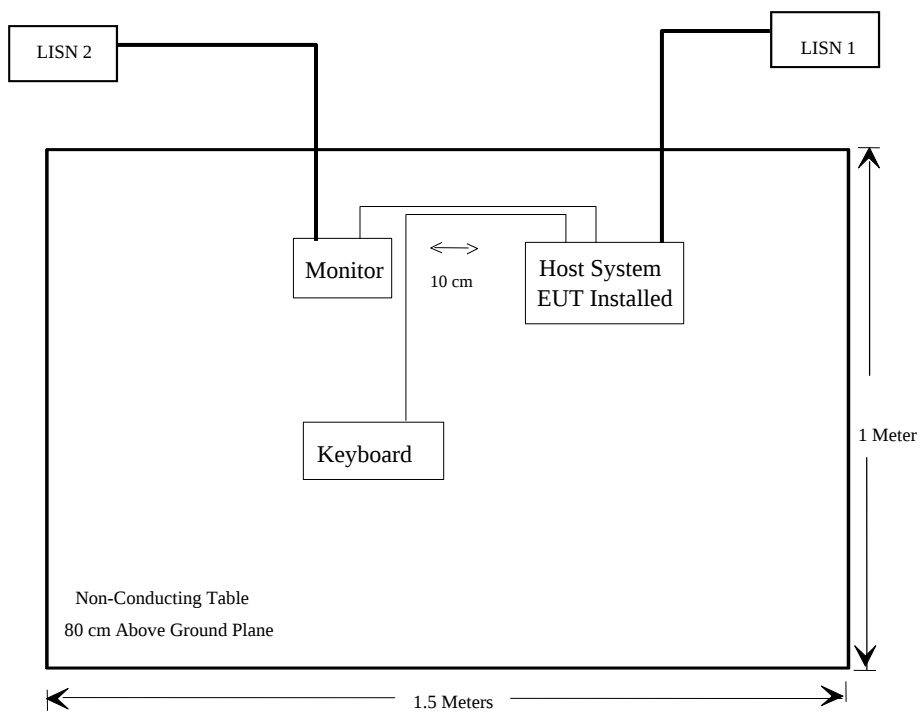
Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number	FCC ID
Tigerpro	Power supply	TP-300	D2B003696	DOC

Configuration of Test System



Test Setup Block Diagram



SUMMARY OF TEST RESULTS FOR FCC PART 15.247

Results reported relate only to the product tested.

FCC RULES	DESCRIPTION OF TEST	RESULT
§2.1091	RF Exposure	Pass
§15.203	Antenna Requirement	Pass
§15.205	Restricted Band	Pass
§ 15.207 (a)	Conducted Emissions	Pass*
§2.1051	Spurious Emission at Antenna Port	Pass
§15.209 (a)	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

*: Test data are within the measurement uncertainty.

§1.1307(b)(1) & §2.1091 - RF EXPOSURE

According to §15.247(b)(5) 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

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: 16.56 (dBm)

Maximum peak output power at antenna input terminal: 45.29 (mW)

Predication frequency: 2450 (MHz)

Antenna Gain (typical): 5 (dBi)

antenna gain: 3.16 (numeric)

Prediction distance: 20 (cm)

Power density at predication frequency at 20 cm: 0.028 (mW/cm²)

MPE limit for uncontrolled exposure at prediction frequency: 1.0 (mW/cm²)

Test Result

The EUT is a mobile device. The Power density at predication frequency at 20 cm is 0.028 mW/cm² within the limit of 1.0 mW/cm².

ANTENNA REQUIREMENT

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 (1), 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 gain of antenna is 5 dBi by default. Please see EUT photo for details.

§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 spectrum analyzer, 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 host was connected with LISN-1.

Spectrum Analyzer Setup

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
R&S	Receiver, EMI Test	ESCS30	100176	9/15/2004
R&S	LISN, Artificial Mains	ESH2-Z5	871884/039	8/16/2004

* **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 host system was connected to the mains outlet of the LISN-1.

Maximizing procedure were 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 an "QP". Average readings are distinguished with an "Ave".

Environmental Conditions

Temperature:	23° C
Relative Humidity:	42%
ATM Pressure:	1018 mbar

**The testing was performed by Daniel Deng on 2005-07-08.*

Summary of Test Results

According to the recorded data in following table, the EUT measured -3.7dB within the measurement uncertainty of ± 4.0 , and had the worst margin of:

-3.7 dB at 10.1 MHz in the Line conductor

Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dB μ V	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dB μ V	Margin dB
10.100	46.3	Ave	Line	50.0	-3.7
10.100	43.6	Ave	Neutral	50.0	-6.4
0.175	44.2	Ave	Line	54.7	-10.5
10.100	48.4	QP	Line	60.0	-11.6
10.100	47.9	QP	Neutral	60.0	-12.1
0.750	33.6	Ave	Line	46.0	-12.4
1.060	33.3	Ave	Neutral	46.0	-12.7
0.175	39.8	Ave	Neutral	54.7	-14.9
0.175	44.7	QP	Line	64.7	-20.0
0.175	43.8	QP	Neutral	64.7	-20.9
0.750	35.0	QP	Line	56.0	-21.0
1.060	33.8	QP	Neutral	56.0	-22.2

Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented in the following page as reference.

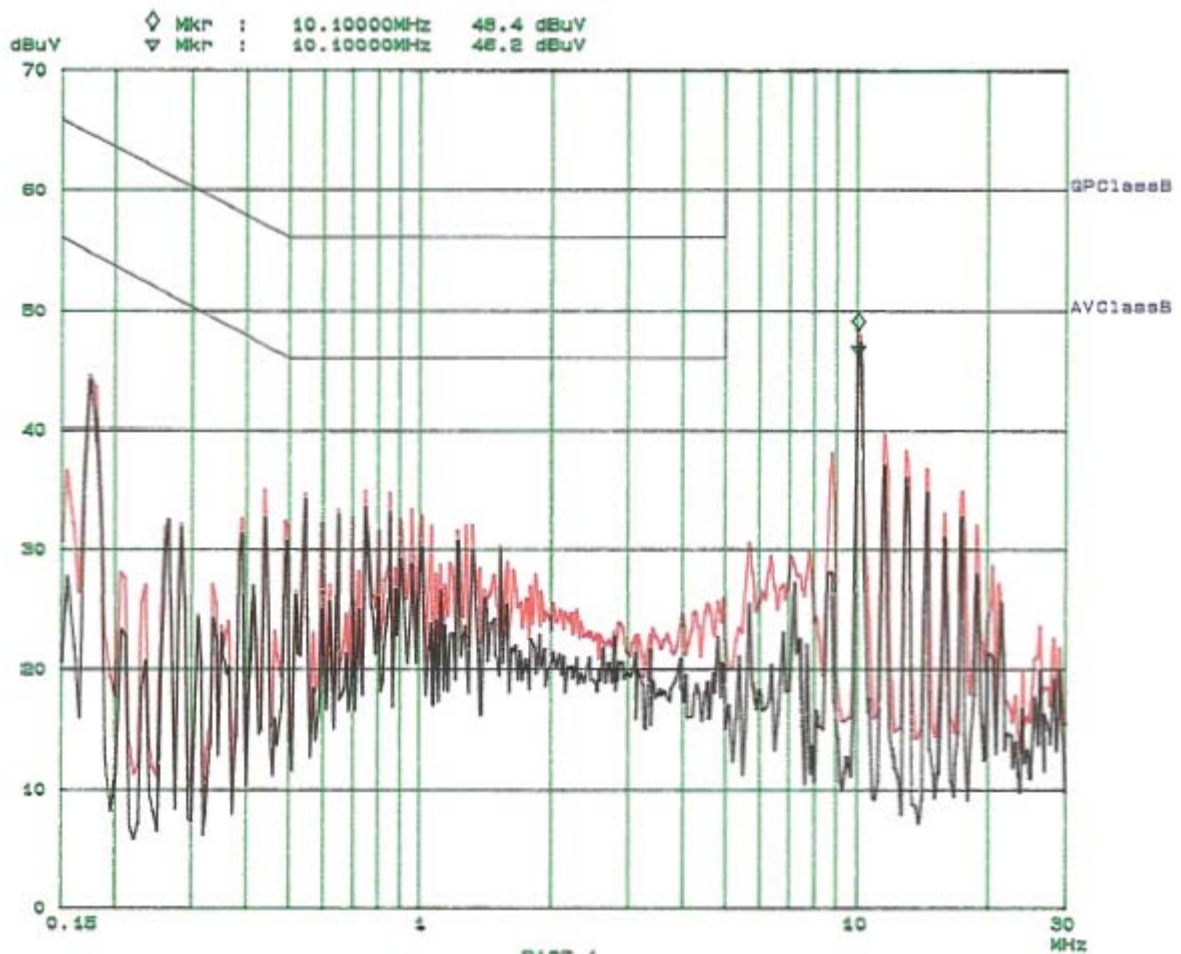
Bay Area Compliance Laboratory Corp
Class B

08. Jul 08 16:25

EUT: 8902MIG3
Manuf: Actiontec
Op Cond: Normal
Operator: DANIEL
Comment: L
120VAC

Scan Settings (3 Ranges)

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	15dB LN	OFF
1M	5M	10k	9k	QP+AV	1ms	15dB LN	OFF
5M	30M	100k	9k	QP+AV	1ms	15dB LN	OFF



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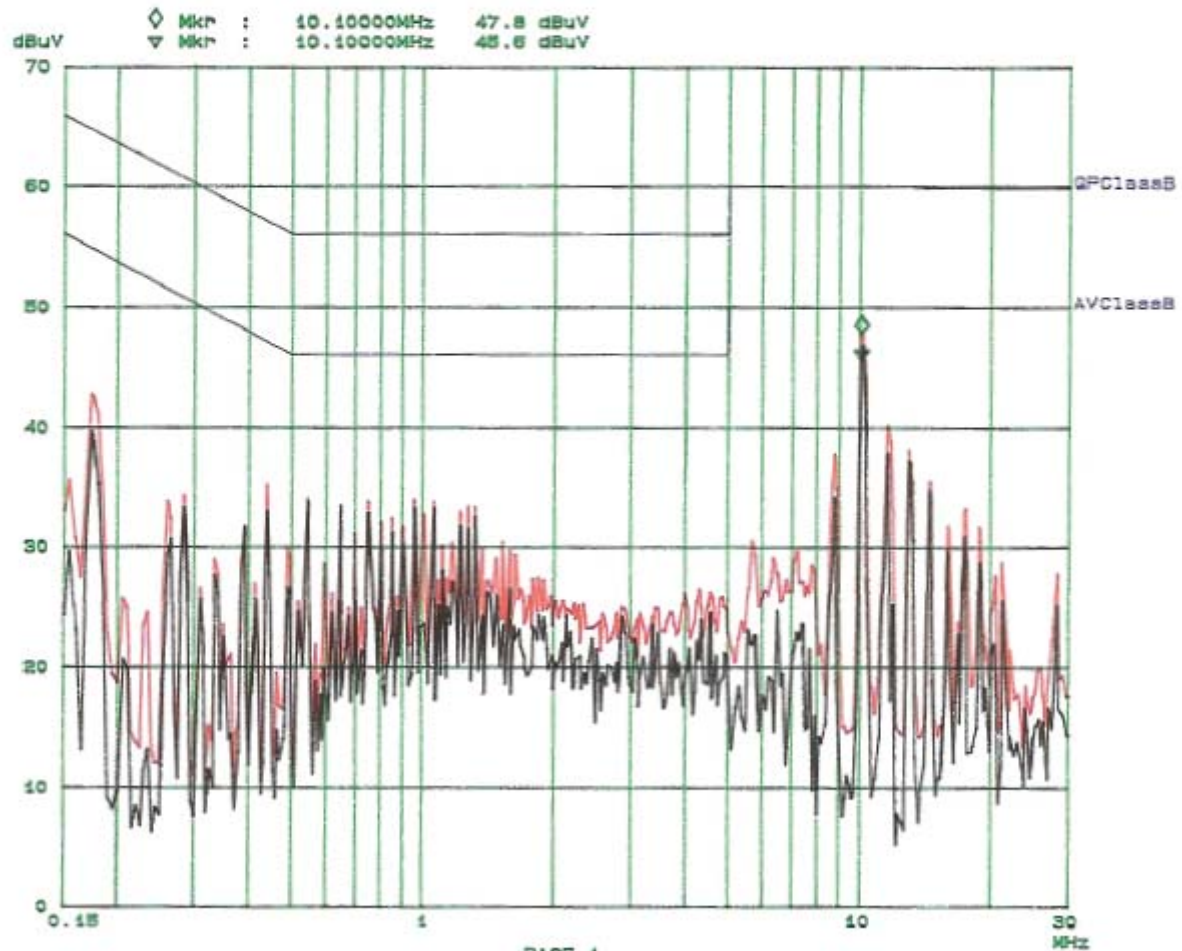
Bay Area Compliance Laboratory Corp
Class B

08. Jul 05 15:57

EUT: 8802MIG3
Manuf: Actiontec
Op Cond: Normal
Operator: DANIEL
Comment: N
120VAC

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	GP+AV	20ms	15dB LN	OFF
1M	5M	10k	9k	GP+AV	1ms	15dB LN	OFF
5M	30M	100k	9k	GP+AV	1ms	15dB LN	OFF



PAGE 1

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§2.1051 - 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 10th harmonic.

Equipment Lists

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Analyzer, Spectrum	8565EC	3946A00131	06/08/2004

* **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.

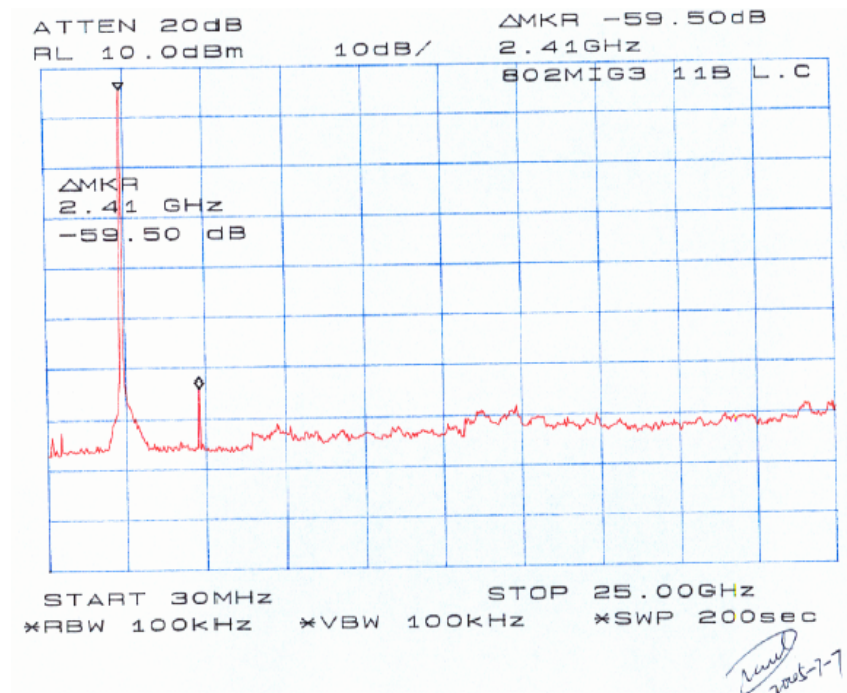
Environmental Conditions

Temperature:	23° C
Relative Humidity:	45%
ATM Pressure:	1015 mbar

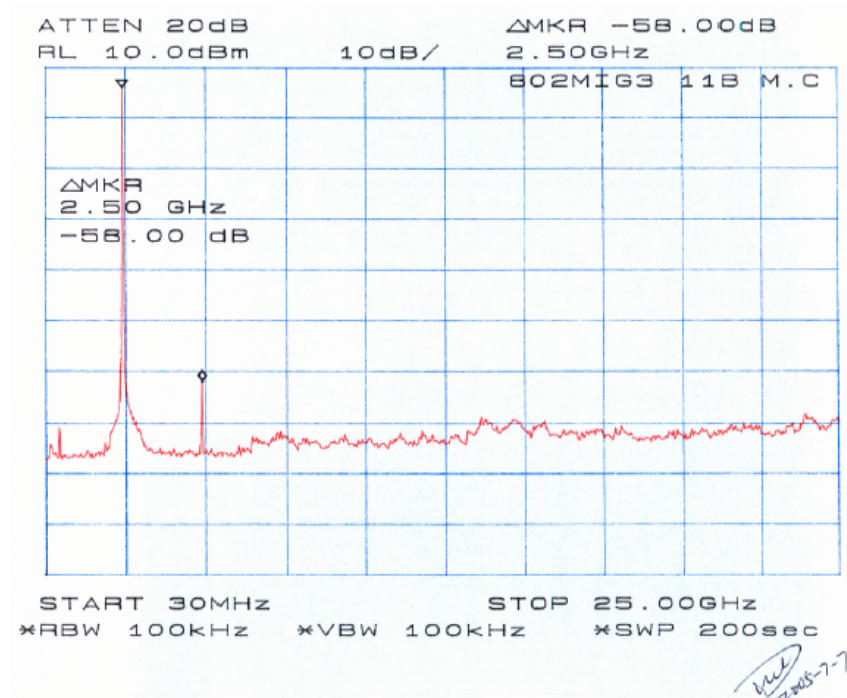
The testing was performed by Daniel Deng on 2005-07-07.

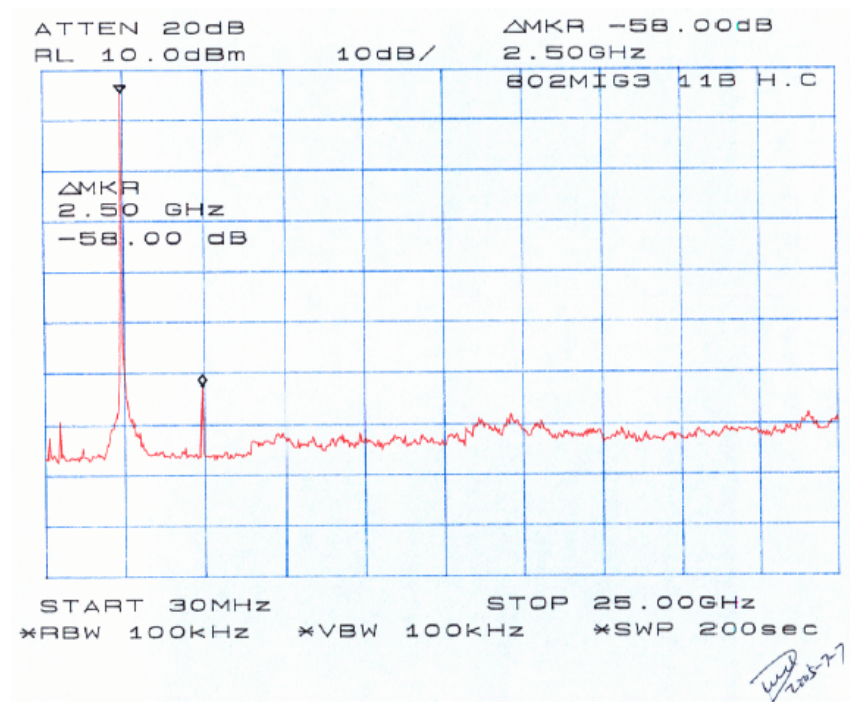
802.11b

Low Channel

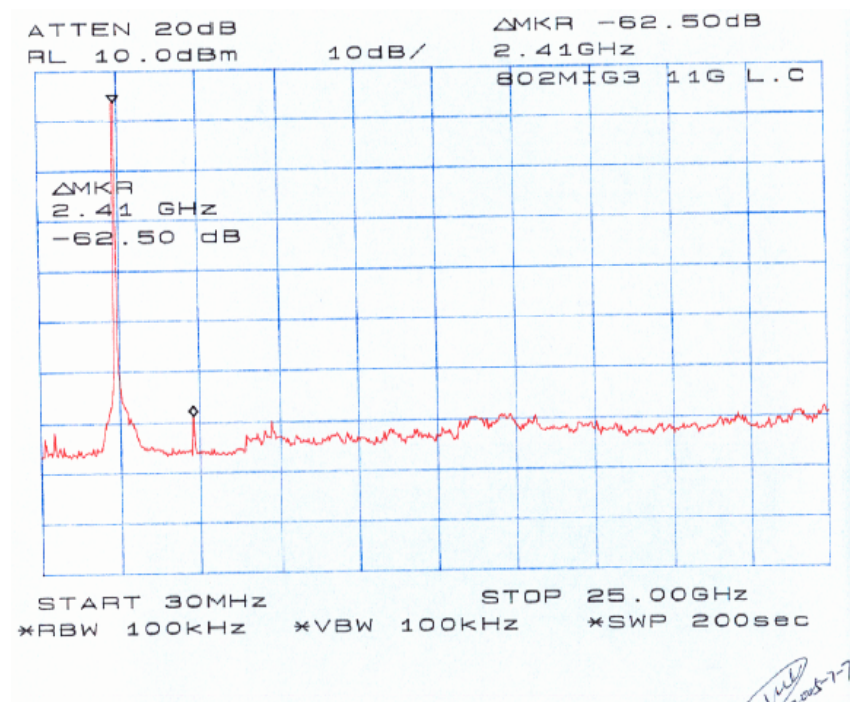


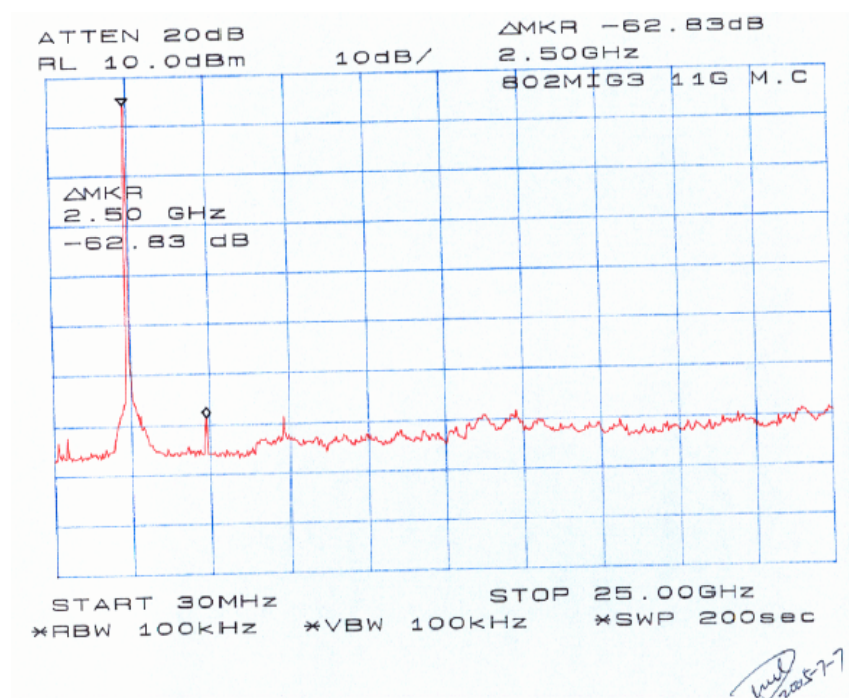
Mid Channel



High Channel

802.11g

Low Channel

Mid Channel*High Channel*