Lab Code: 200167-0

FCC PART 15 SUBPART C

TEST AND MEASUREMENT REPORT

For

Actiontec Electronics, Inc.

760 N. Mary Avenue,

Sunnyvale, CA 94085, USA

FCC ID: LNQGT784WN
Model: GT784WN

Report Type:	**Product Type:**
CIIPC Report	Wireless 802.11n ADSL2 Modem Gateway

Test Engineers:	Dennis Huang
Report Number:	R1101131-247
Report Date:	2011-02-02
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1101131-247	CIIPC Report	2011-02-07

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Actiontec Electronics*, Inc., and their product model: *GT784WN*, FCC ID: *LNQGT784WN* which will henceforth be referred to as the EUT (Equipment Under Test). The EUT is a Wireless 11n ADSL2 Modem Gateway. It features 802.11b/g/n modes with n mode in 20MHz bandwidth and 40 MHz Bandwidth. The operating frequency is from 2.4 to 2.4835 GHz.

1.2 Mechanical Description of EUT

The "EUT" measures 16.5cm (L) x 13cm (W) x3.5cm (H), and weighs approximately 298 g.

The test data gathered are from typical production sample, serial number: CRCA0311900020*, provided by the manufacturer.*

1.3 Objective

This class II permissive changel measurement and test 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, and power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emissions, Conducted and Radiated Spurious Emissions for adding a 802.11n 40MHz Bandwidth mode to the EUT.

1.4 Related Submittal(s)/Grant(s)

FCC ID: LNQGT784WN, BACL Project Number: R10081714-247

1.5 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 and ANSI C63.10-2009, American National Standard for Testing Unlicensed Wireless Devices.

1.6 Measurement Uncertainty

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

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

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

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

1.7 Test Facility

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

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

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

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

2 System Test Configuration

2.1 Justification

The EUT and its host were configured for testing according to ANSI C63.4-2003 & ANSI C63.10-2009.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

Software: Turbo Cad V.14

The EUT had been tested with the following data rate settings:

Radio Mode	Band Width (MHz)	Frequency/Data rate		
		Low Channel (MHz/Mbps)	Middle Channel (MHz/Mbps)	High Channel (MHz)
802.11n	40	2422/6.5	2437/6.5	2452/6.5

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Special Accessories

N/A

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
IBM	Laptop	T41	99-P3NYB
Motion Computing	Tablet	T008	2311219800003

2.6 Internal Configuration

Manufacturer	Description	Model No.	Serial No.
Actiontec	PCB Board	06433A	CRCA0471700040

2.7 Power Supply and Line Filters

Manufacturer	Description	Model No.	Serial No.
Actiontec Electronics, Inc.	I.T.E Power Supply	MT12-Y120100-A1	-

2.8 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RJ45 Cable	< 2 m	EUT	Laptop
RJ45 Cable	< 2 m	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§15.247 (i) §2.1091	RF Exposure (MPE) Information	Compliant
§15.203	Antenna Requirement	Compliant
§ 15.207 (a)	AC Line Conducted Emissions	Compliant
§2.1051 §15.247 (d)	Spurious Emissions at Antenna Port	Compliant
§15.205	Restricted Bands	Compliant
§15.209 (a) §15.247 (d)	Radiated Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Bandwidth	Compliant
§15.247 (b)(3)	Maximum Peak Output Power	Compliant
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247 (e)	Power Spectral Density	Compliant

4 FCC §15.247 (i) & § 2.1091 - RF Exposure Information

4.1 Applicable Standard

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

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

Limits for General Population/Uncontrolled Exposure

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

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

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from 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

4.3 MPE Results

Mode	Frequency Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mw/cm^2)	Result
WLAN	2.4 GHz	20	19.44	2	0.027	Compliance

The predicted power density level at 20 cm is 0.027 mw/cm^2 which is below the uncontrolled exposure limit of 1.0 mW/cm^2. The EUT is used at least 20 cm away from user's body. It is determined as mobile equipment and complies with the MPE limit.

5 FCC §15.203 - Antenna Requirement

5.1 Applicable Standard

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

And according to § 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.

5.2 Antenna Connector Construction

EUT has two Transmitter/Receiver antennae which are both external antennae and features a permanent attachment to the EUT chassis as well as non-standard connector. The Transmitter antenna has a max gain of 2 dBi which fulfills the requirements of FCC rule 15.203.

Frequency Band	Antenna 0 Gain (dBi)	Antenna 1 Gain (dBi)	Maximum Effective Gain (dBi)
2.4 GHz	2.0	2.0	5.01

5.3 Antenna Photo

6 FCC §15.207 – AC Line Conducted Emissions

6.1 Applicable Standard

Section 15.207 Conducted limits:

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

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 (1)	56 to 46 (1)
0.5-5	56	46
5-30	60	50

(1) *Decreases with the logarithm of the frequency.*

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2003 measurement procedure. The specification used was FCC Part15.207 limits.

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

The AC/DC power adapter of the unit was connected with LISN-1 which provided 120 V / 60 Hz AC power.

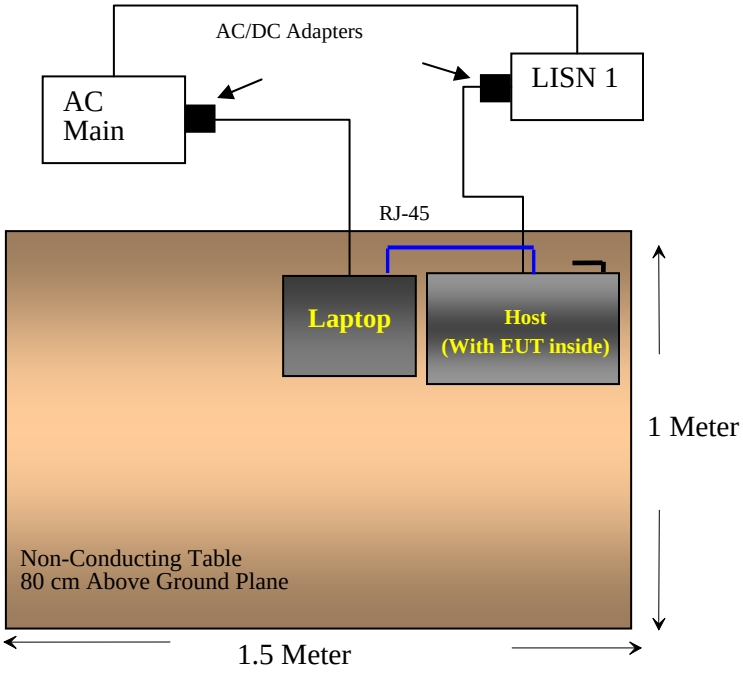
6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2010-03-24
Solar Electronics	LISN	9252-R-24-BNC	511205	2010-06-25

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

6.4 Test Setup Block Diagram

Conducted Emissions



6.5 Test Procedure

During the conducted emissions test, the power cord of the EUT host system 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".

6.6 Test Environmental Conditions

Temperature:	23-25 °C
Relative Humidity:	50-55 %
ATM Pressure:	99-103kPa

The testing was performed by Dennis Huang on 2011-02-01 at 5m Chamber 2.

6.7 Summary of Test Results

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

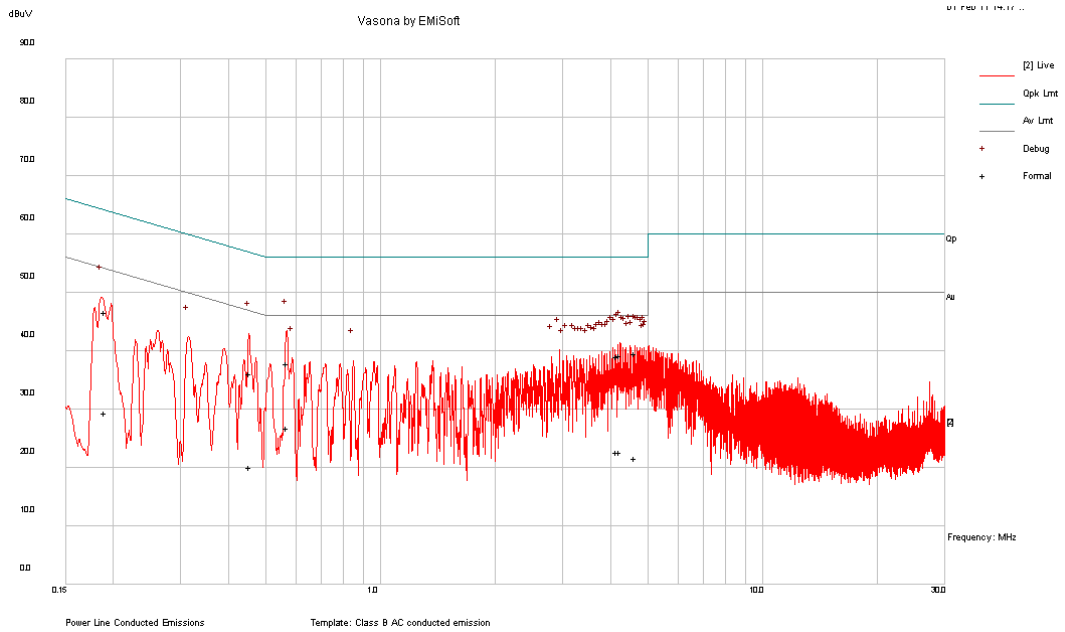
Worst Case: 802.11n 40 MHz BW Middle Channel (2437 MHz)

Connection: AC/DC adapter connected to 120 V/60 Hz AC Mode: 802.11 n 40MHz BW Middle Channel Transmitting			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-16.5	4.629743	Line	0.15 to 30
-15.81	4.772183	Neutral	0.15 to 30

6.8 Conducted Emissions Test Plots and Data

Please refer to the following plots and tables.

120 V, 60 Hz – Line



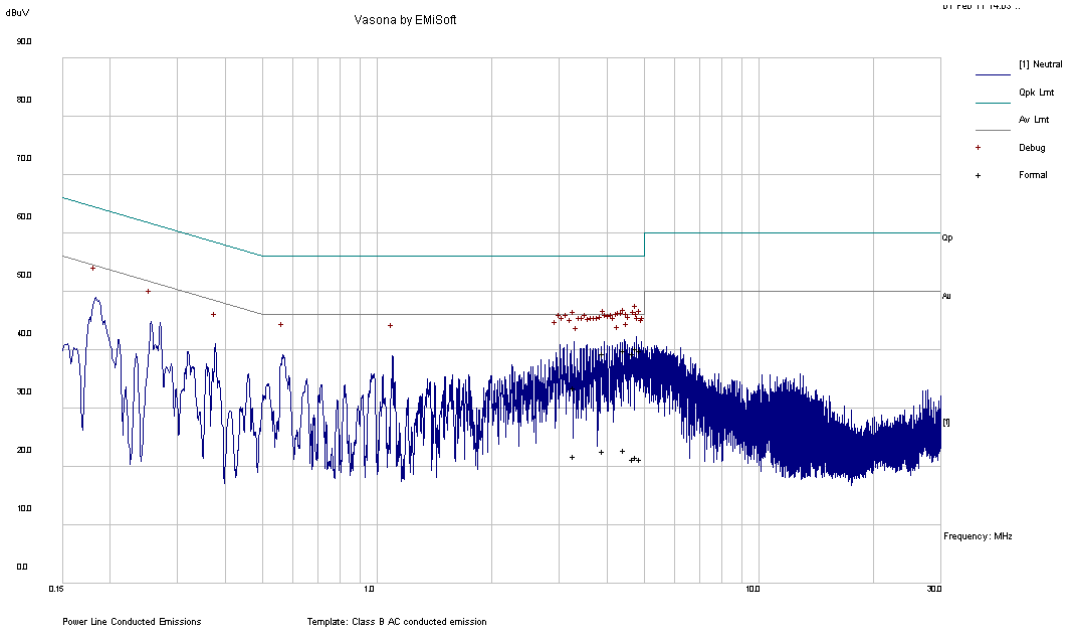
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.568524	37.84	Line	56	-18.16
0.455118	36.2	Line	56.78	-20.58
4.238318	39.26	Line	56	-16.74
4.17191	39.07	Line	56	-16.93
0.190185	46.66	Line	64.03	-17.36
4.629743	39.5	Line	56	-16.5

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.568524	26.82	Line	46	-19.18
0.455118	20.17	Line	46.78	-26.61
4.238318	22.6	Line	46	-23.4
4.17191	22.74	Line	46	-23.26
0.190185	29.4	Line	54.03	-24.63
4.629743	21.67	Line	46	-24.33

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
4.772183	40.19	Neutral	56	-15.81
4.442753	39.87	Neutral	56	-16.13
4.901018	39.96	Neutral	56	-16.04
3.918827	39.41	Neutral	56	-16.59
3.278799	33.53	Neutral	56	-22.47
4.701212	39.45	Neutral	56	-16.55

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
4.772183	21.65	Neutral	46	-24.35
4.442753	22.82	Neutral	46	-23.18
4.901018	21.3	Neutral	46	-24.7
3.918827	22.7	Neutral	46	-23.3
3.278799	21.77	Neutral	46	-24.23
4.701212	21.26	Neutral	46	-24.74

7 FCC §2.1051 & §15.247(d) - Spurious Emissions at Antenna Terminals

7.1 Applicable Standard

For FCC §15.247(d) in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Requirements: FCC §2.1051.

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

7.2 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.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09

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

7.4 Test Environmental Conditions

Temperature:	23-25 °C
Relative Humidity:	50-55 %
ATM Pressure:	99-103kPa

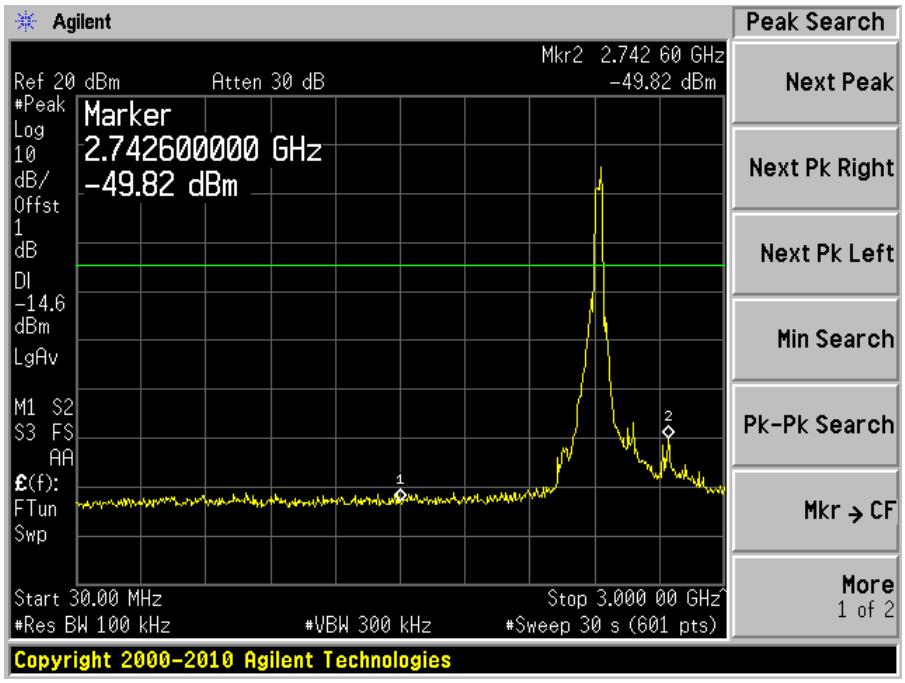
The testing was performed by Dennis Huang on 2011-01-28 at RF Site.

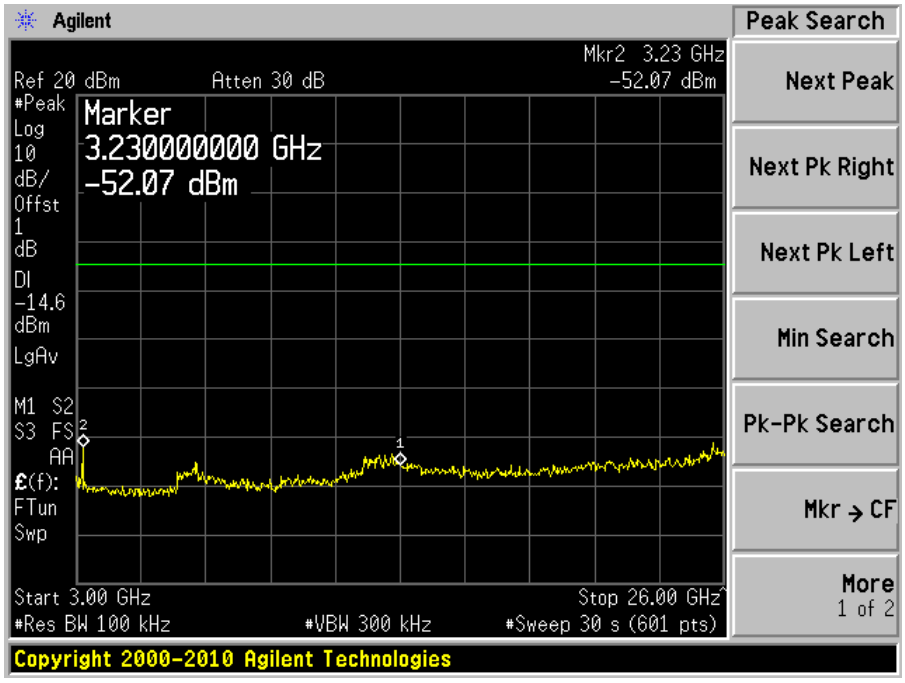
7.5 Measurement Result

Please refer to following plots of spurious emissions.

802.11 n 40 MHz BW (Antenna #0)

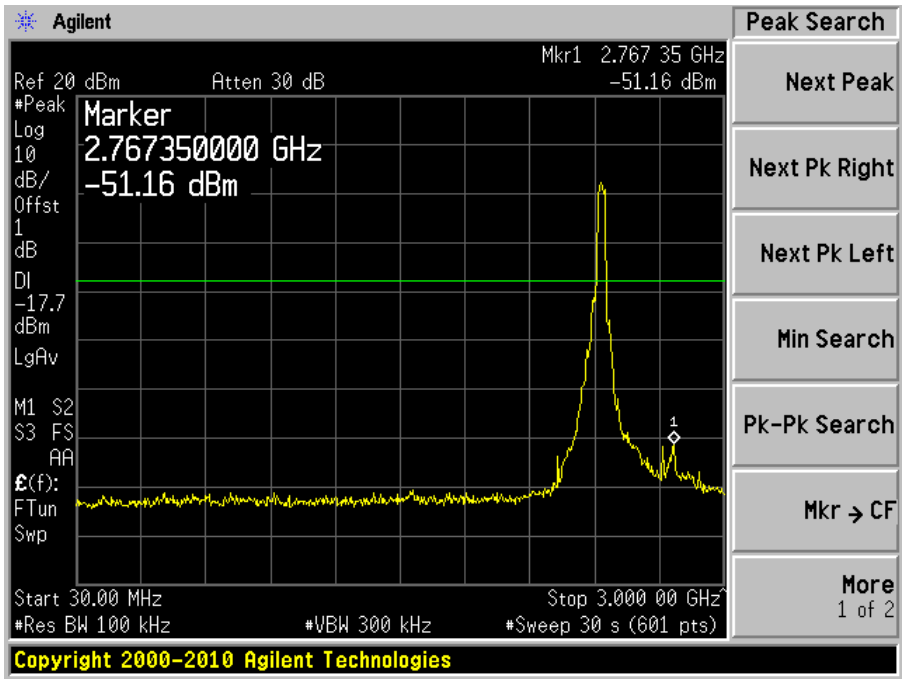
Low Channel 2422 MHz

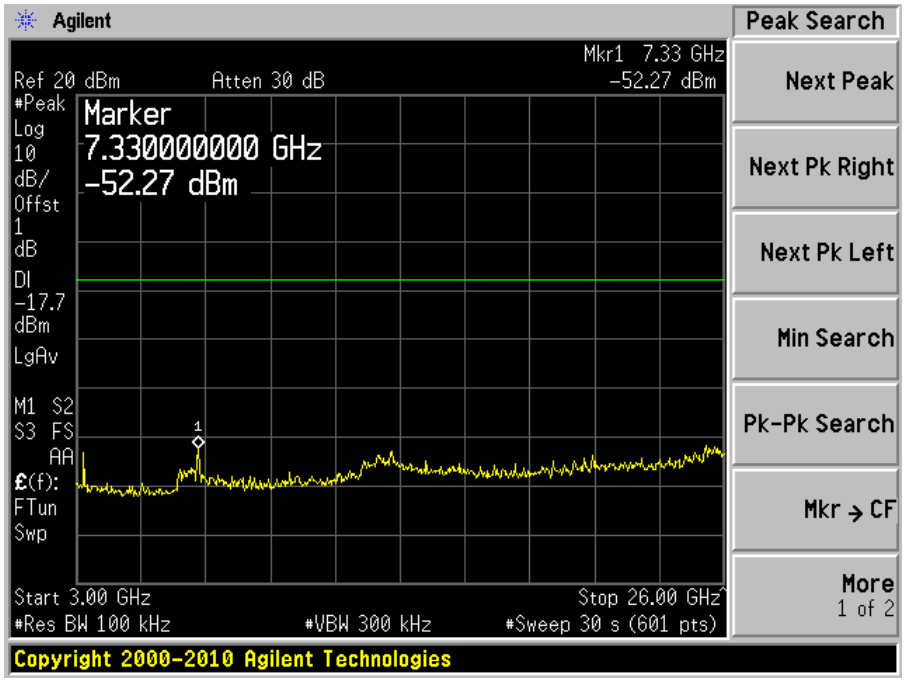




802.11 n 40 MHz BW (Antenna #0)

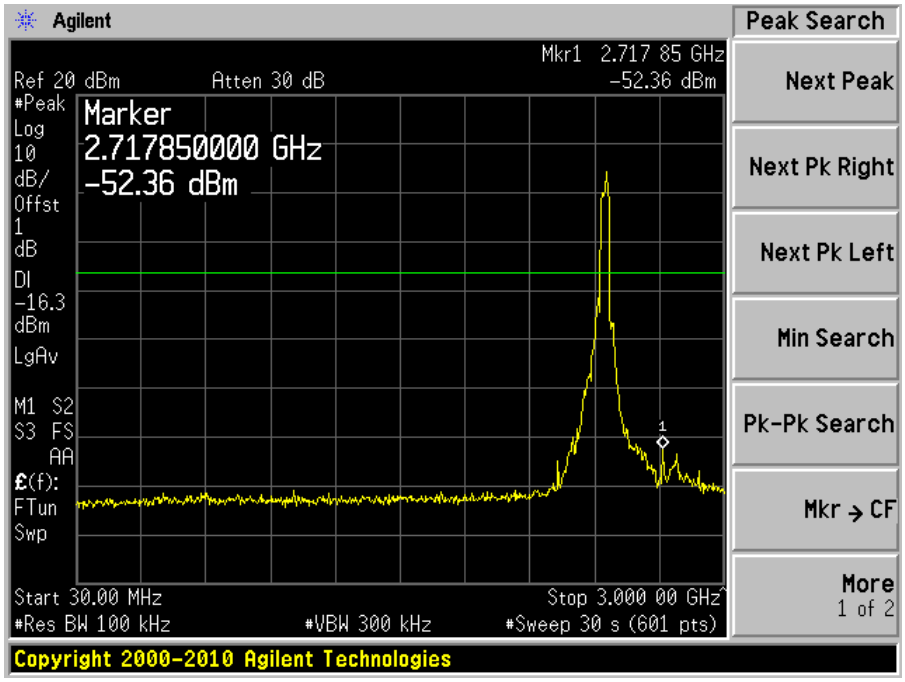
Middle Channel 2437 MHz

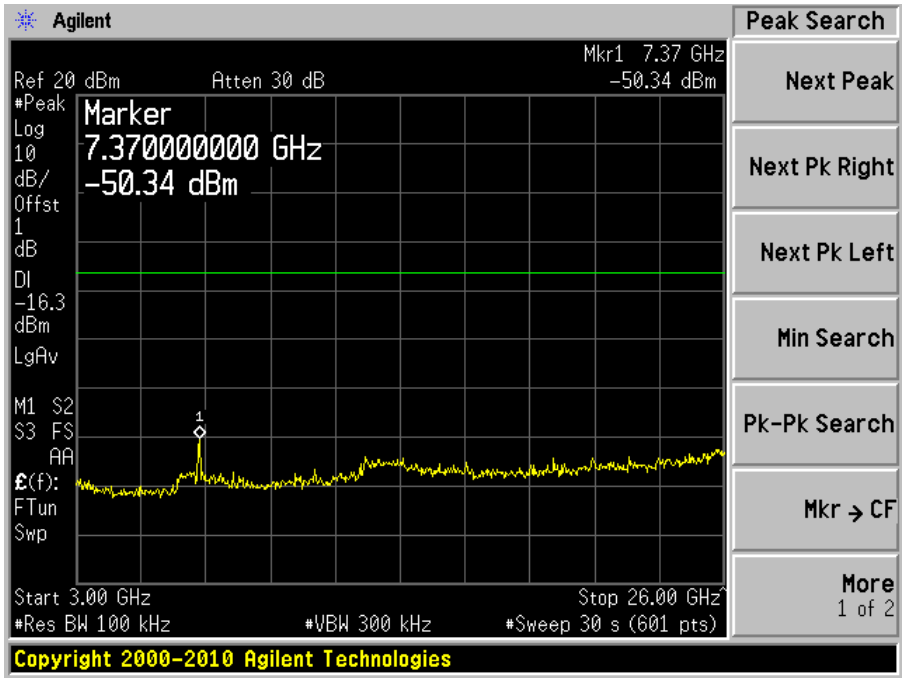




802.11 n 40 MHz BW (Antenna #0)

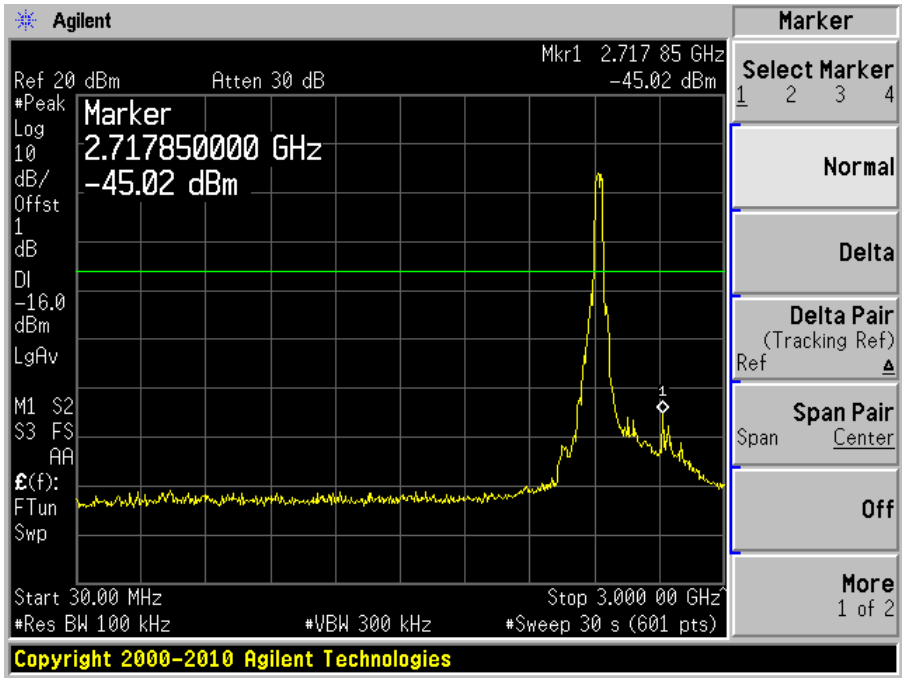
High Channel 2452 MHz

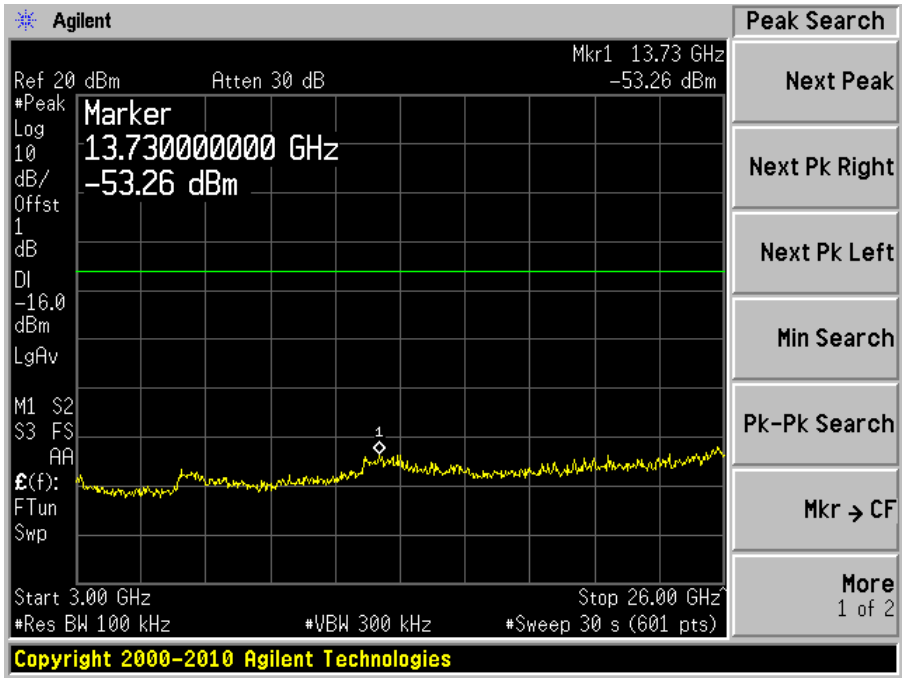




802.11 n 40 MHz BW (Antenna #1)

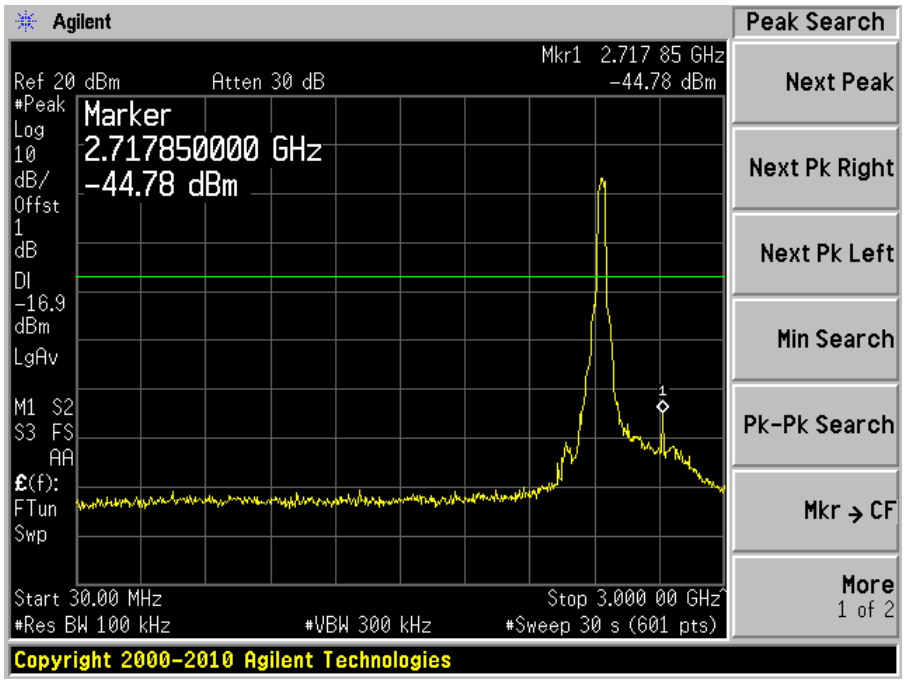
Low Channel 2422 MHz

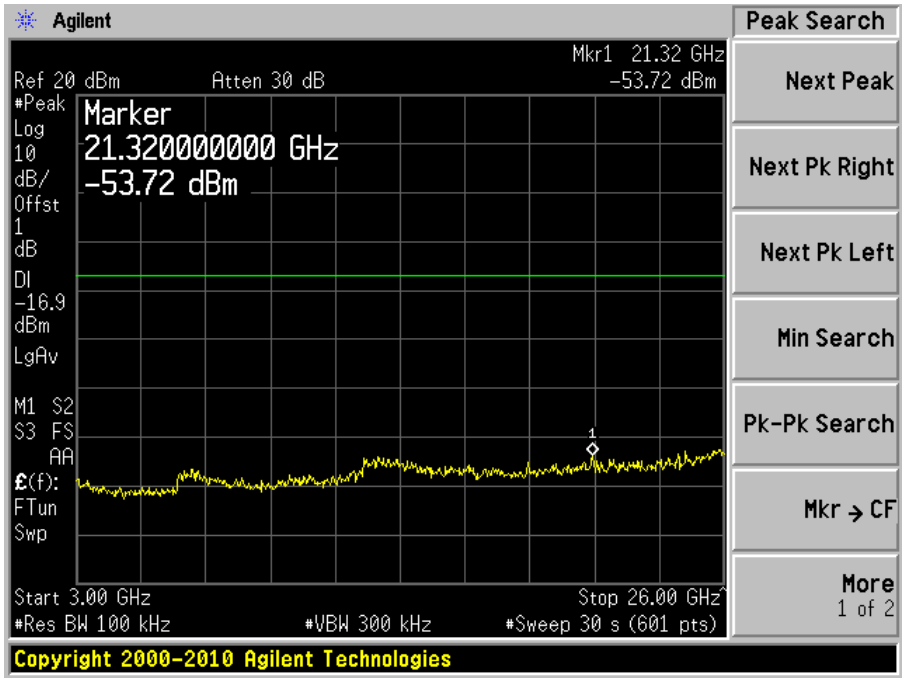




802.11 n 40 MHz BW (Antenna #1)

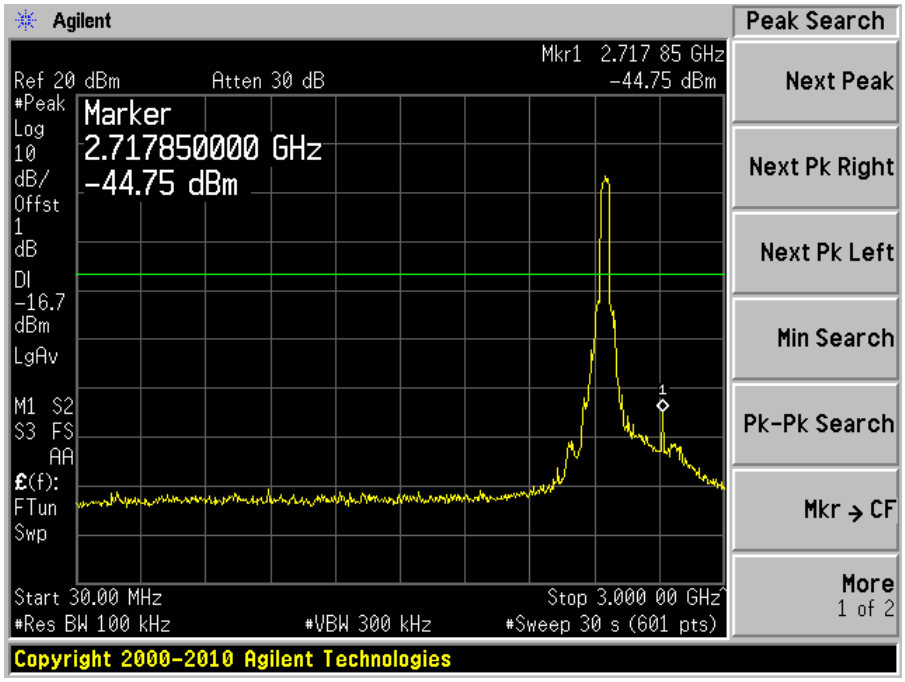
Middle Channel 2437 MHz

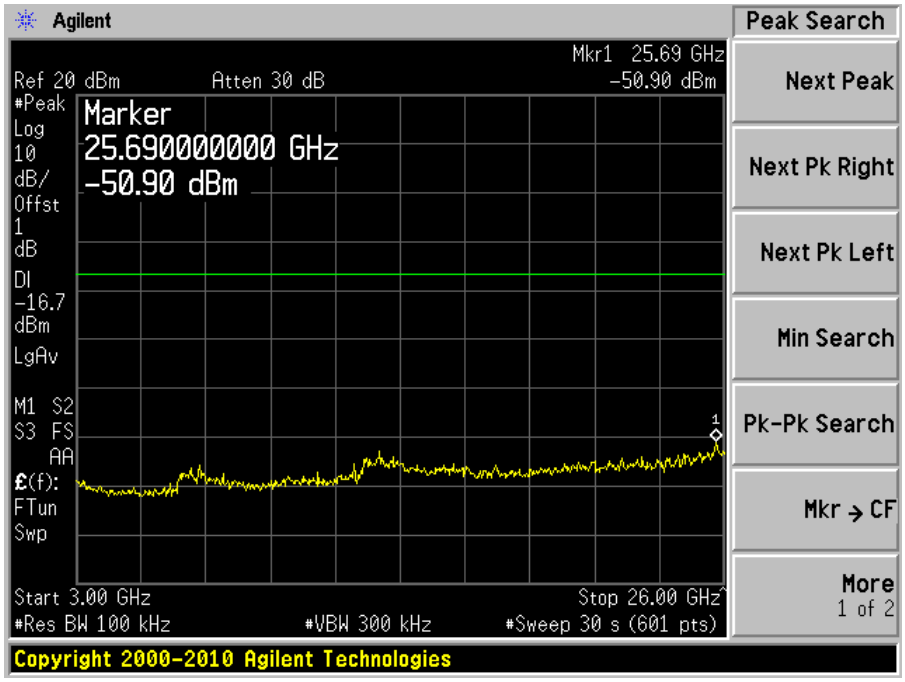




802.11 n 40 MHz BW (Antenna #1)

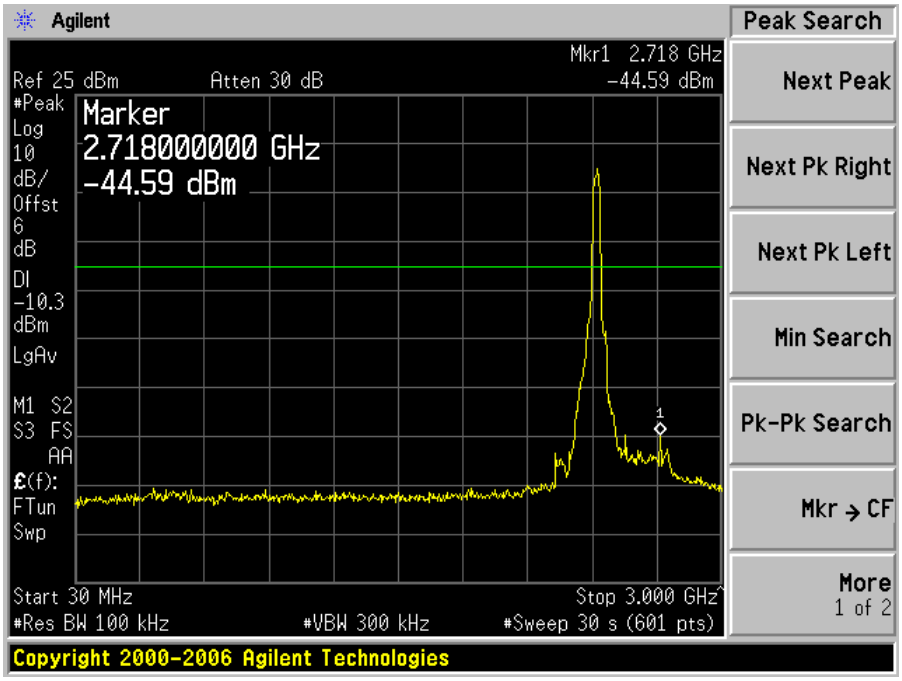
High Channel 2452 MHz

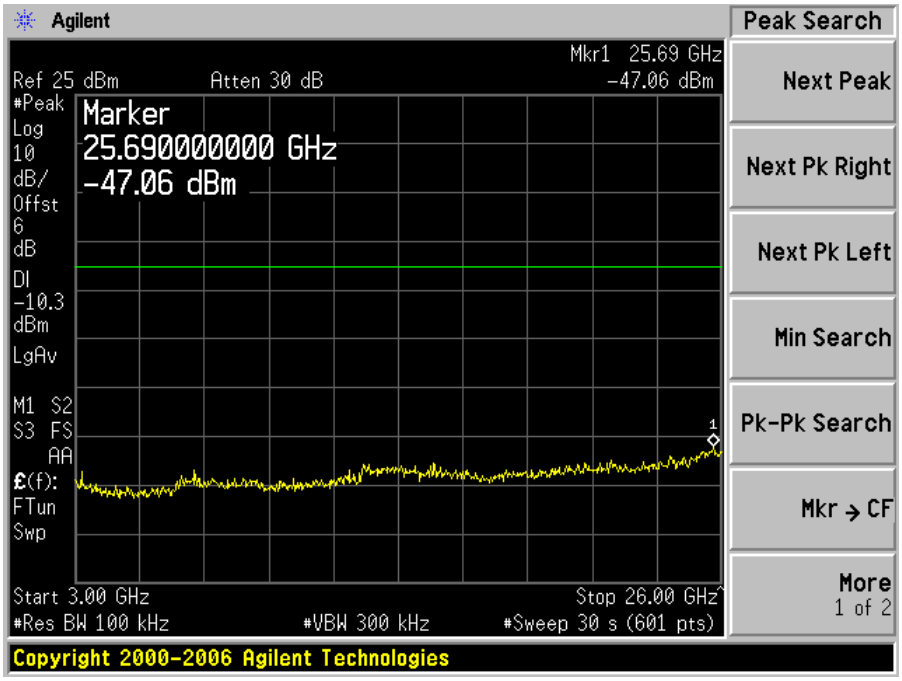




802.11 n 40MHz BW (Antenna #0 + Antenna #1)

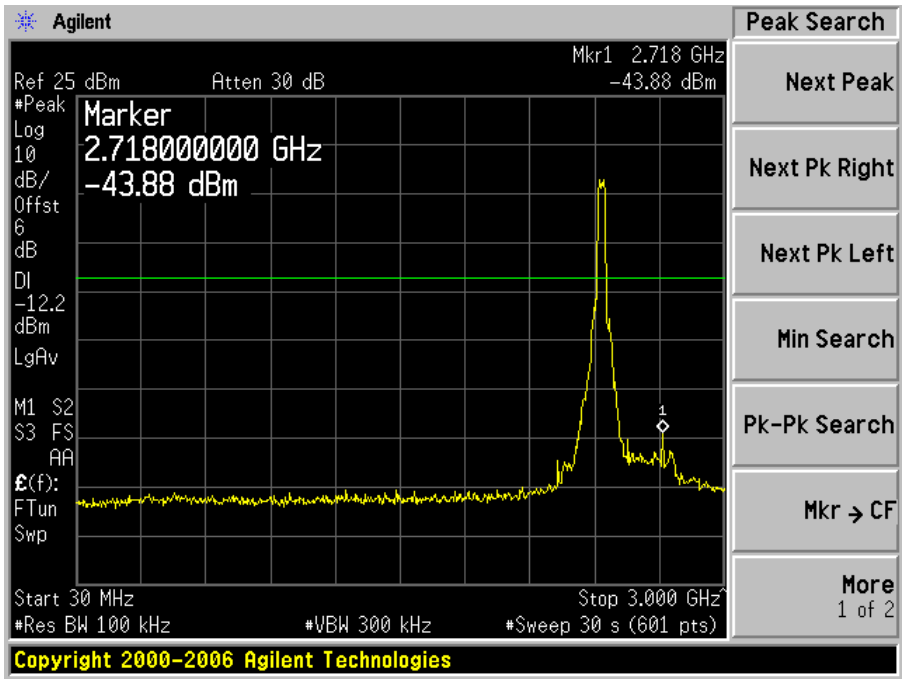
Low Channel 2422 MHz

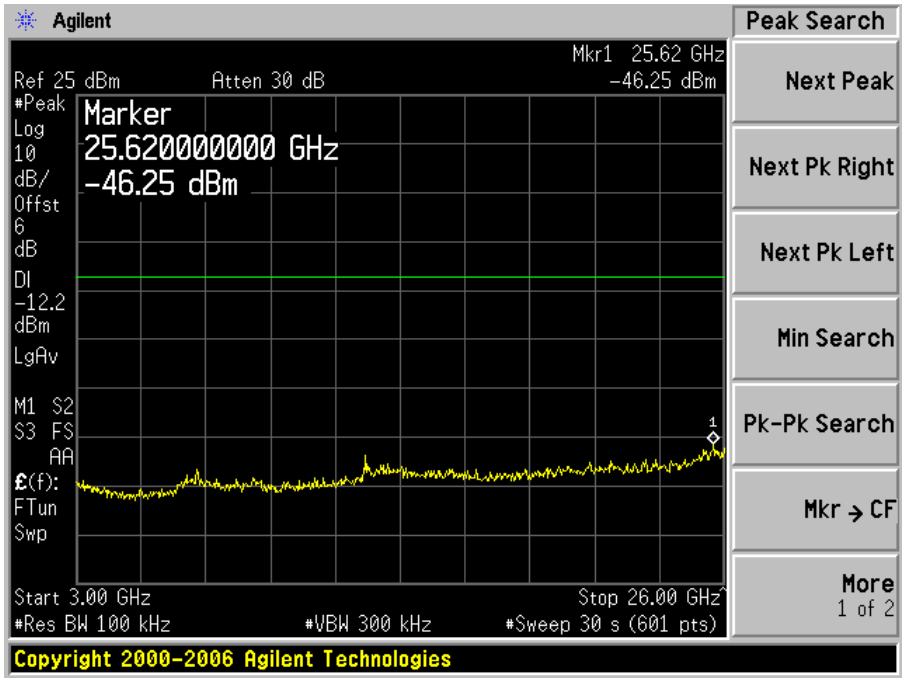




802.11 n 40 MHz BW (Antenna #0 + Antenna #1)

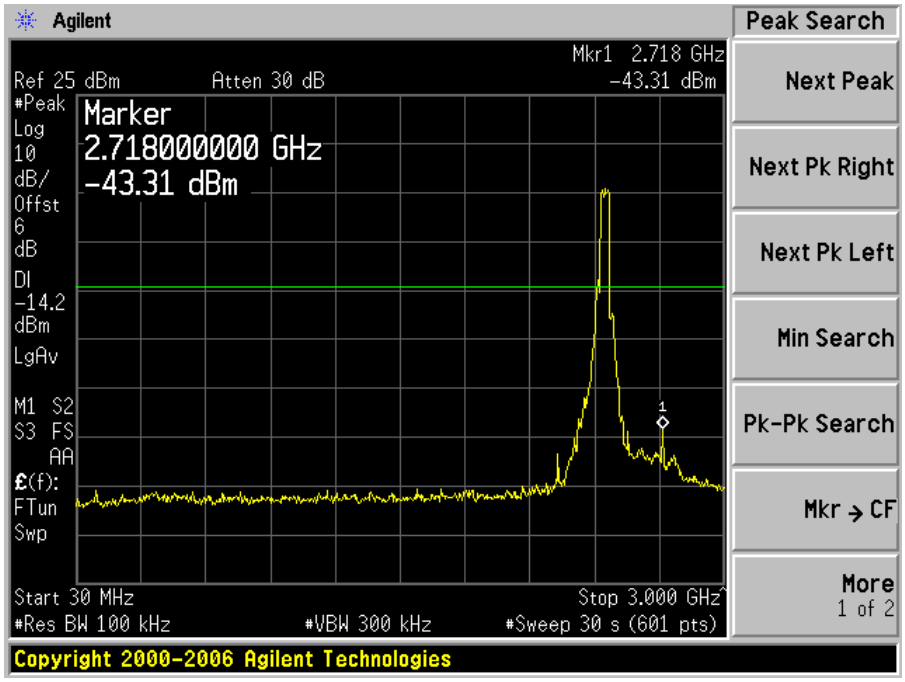
Middle Channel 2437 MHz

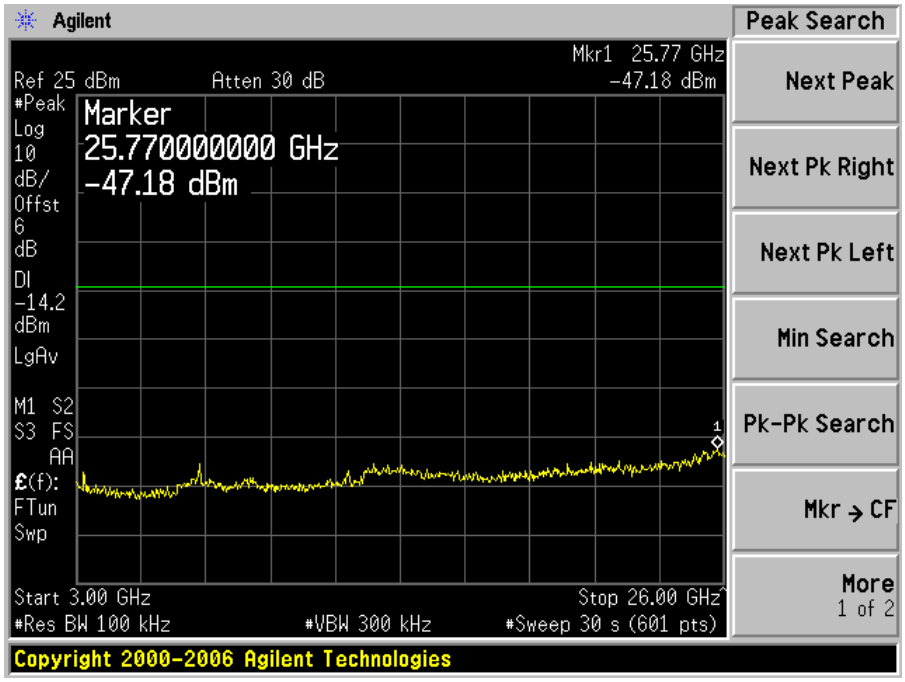




802.11 n 40 MHz BW (Antenna #0 + Antenna #1)

High Channel 2452 MHz





8 FCC §15.205, §15.209 & §15.247(d) - Spurious Radiated Emissions

8.1 Applicable Standard

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

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

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 (1)	3
88 - 216	150 (1)	3
216 - 960	200 (1)	3
Above 960	500	3

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

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

f (MHz)	f (MHz)	f (MHz)	f (GHz)
0.090 – 0.110	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	33458 – 3358	23.6 – 24.0
12.29 – 12.293	240 – 285	3600 – 4400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

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

8.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

8.3 EUT Setup

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

The spacing between the peripherals was 10 centimeters.

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

8.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2010-03-24
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A0020106-3	2010-06-16
Hewlett Packard	Pre amplifier	8447D	2944A06639	2010-06-18
Mini-Circuits	Pre Amplifier	ZVA-183-S	570400946	2010-05-10
A.R.A Inc	Horn antenna	DRG-1181A	1132	2010-12-15

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

8.5 Test Procedure

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

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

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

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

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

Above 1000 MHz:

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

8.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna 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 -7 dB means the emission is 7 dB below the maximum limit.
The equation for margin calculation is as follows:

Margin = Corrected Amplitude - FCC Limit

8.7 Test Environmental Conditions

Temperature:	23-25 °C
Relative Humidity:	50-55 %
ATM Pressure:	99-103kPa

The testing was performed by Dennis Huang on 2011-01-28 at 5m Chamber 3.

8.8 Summary of Test Results

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

802.11 n 40 MHz mode:

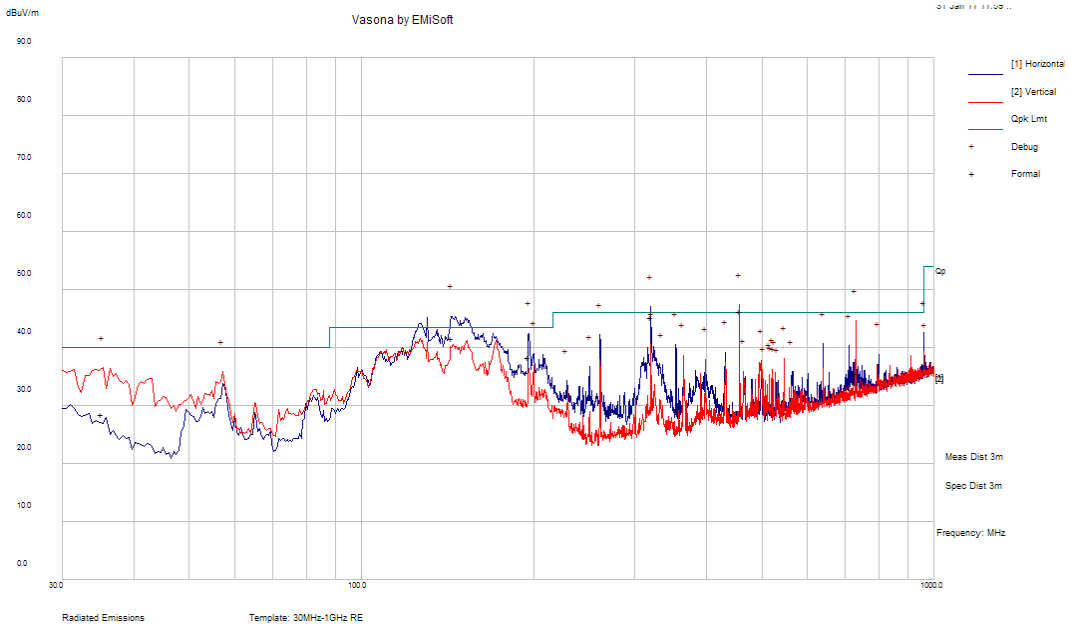
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
30-1000 MHz			
-0.72	319.9978	Horizontal	Middle, 30 MHz – 1 GHz
Above 1 GHz			
-1.235	7311	Vertical	Mid, 1 GHz – 25 GHz

8.9 Radiated Emissions Test plot & data

802.11n 40 MHz BW

1) 30 – 1000 MHz Measured at 3 meters:

(Worst Case, Middle Channel 2437 MHz, measured at 3 meters)



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
143.3205	41.72	302	H	51	43.5	-1.78
261.0188	39.6	127	H	94	46	-6.4
319.9978	45.28	98	H	335	46	-0.72
195.735	38.43	134	H	59	43.5	-5.07
729.1353	35.62	128	V	103	46	-10.38
35.09075	28.49	162	V	85	40	-11.51

2) Above 1 GHz Measured at 3 meters:

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
802.11 n 40 MHz BW, Low Channel 2422 MHz, measured at 3 meters											
7266	48.85	250	192	V	37.8	5.49	26.8	65.336	74	-8.67	peak
7266	39.84	360	100	H	37.8	5.49	26.8	56.326	74	-17.67	peak
7266	33.71	250	192	V	37.8	5.49	26.8	50.196	54	-3.80	Ave
7266	24.98	360	100	H	37.8	5.49	26.8	41.466	54	-12.53	Ave
802.11 n 40 MHz BW, Middle Channel 2437 MHz, measured at 3 meters											
7311	52.8	149	136	V	37.8	5.57	26.9	69.275	74	-4.73	peak
7311	46.95	249	144	H	37.8	5.57	26.9	63.425	74	-10.58	peak
7311	36.29	149	136	V	37.8	5.57	26.9	52.765	54	-1.24	Ave
7311	29.81	249	144	H	37.8	5.57	26.9	46.285	54	-7.72	Ave
802.11 n 40 MHz BW, High Channel 2452 MHz, measured at 3 meters											
7356	51.55	218	133	V	37.7	5.62	26.9	67.995	74	-6.01	peak
7356	38.74	360	100	H	37.7	5.62	26.9	55.185	74	-18.82	peak
7356	28.55	218	133	V	37.7	5.62	26.9	44.995	54	-9.01	Ave
7356	25.41	360	100	H	37.7	5.62	26.9	41.855	54	-12.15	Ave

Restricted Band Edge:

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBµV/m)	Part 15C		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
802.11 n 40 MHz BW, Lowest Channel											
2390	41.2	360	100	V	27.8	3.12	27.8	44.32	74	-29.68	peak
2390	39.8	360	100	H	27.8	3.12	27.8	42.92	74	-31.08	peak
2390	27.5	360	100	V	27.8	3.12	27.8	30.62	54	-23.38	Ave
2390	29.2	360	100	H	27.8	3.12	27.8	32.32	54	-21.68	Ave
802.11 n 40 MHz BW, Highest Channel											
2483.5	67.43	220	133	V	28.5	3.35	27.8	71.48	74	-2.52	peak
2483.5	66.65	251	142	H	28.5	3.35	27.8	70.7	74	-3.3	peak
2483.5	46.98	220	133	V	28.5	3.35	27.8	51.03	54	-2.97	Ave
2483.5	44.58	251	142	H	28.5	3.35	27.8	48.63	54	-5.37	Ave

9 FCC §15.247(a) (2) – 6 dB & 99% Emission Bandwidth

9.1 Applicable Standard

According to FCC §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

9.2 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.
4. Repeat above procedures until all frequencies measured were complete.

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09

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

9.4 Test Environmental Conditions

Temperature:	23-25 °C
Relative Humidity:	50-55 %
ATM Pressure:	99-103kPa

The testing was performed by Dennis Huang on 2011-01-28 at RF Site.

9.5 Summary of Test Results

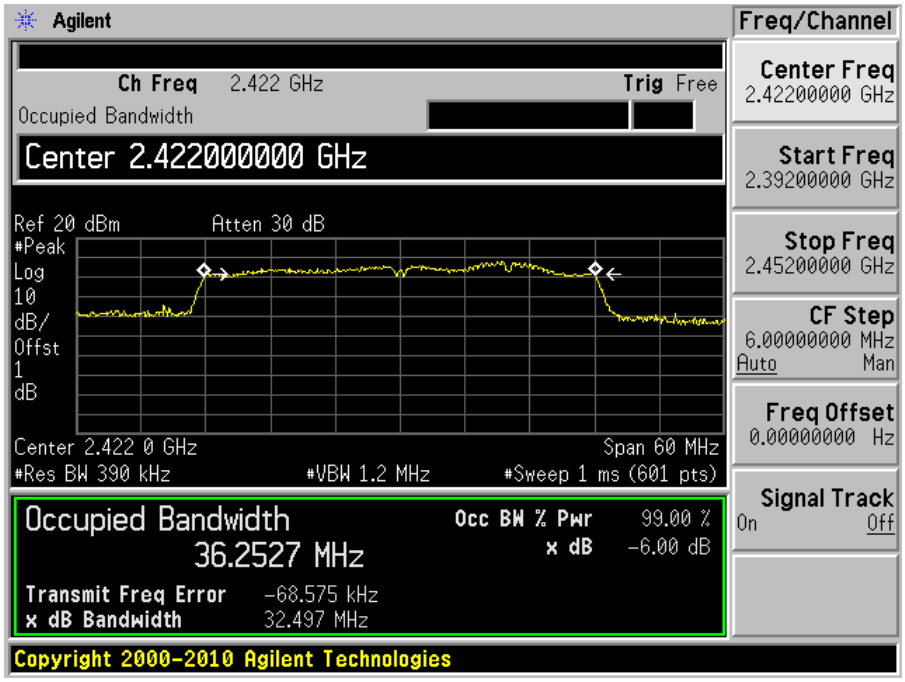
802.11 n 40 MHz Mode:

Antenna	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)	Results
#0	Low	2422	36.2527	32.497	> 500	Compliant
	Middle	2437	36.2870	35.278	> 500	Compliant
	High	2452	36.3432	32.567	> 500	Compliant
#1	Low	2422	36.3126	35.880	> 500	Compliant
	Middle	2437	36.2149	36.270	> 500	Compliant
	High	2452	36.2866	36.196	> 500	Compliant

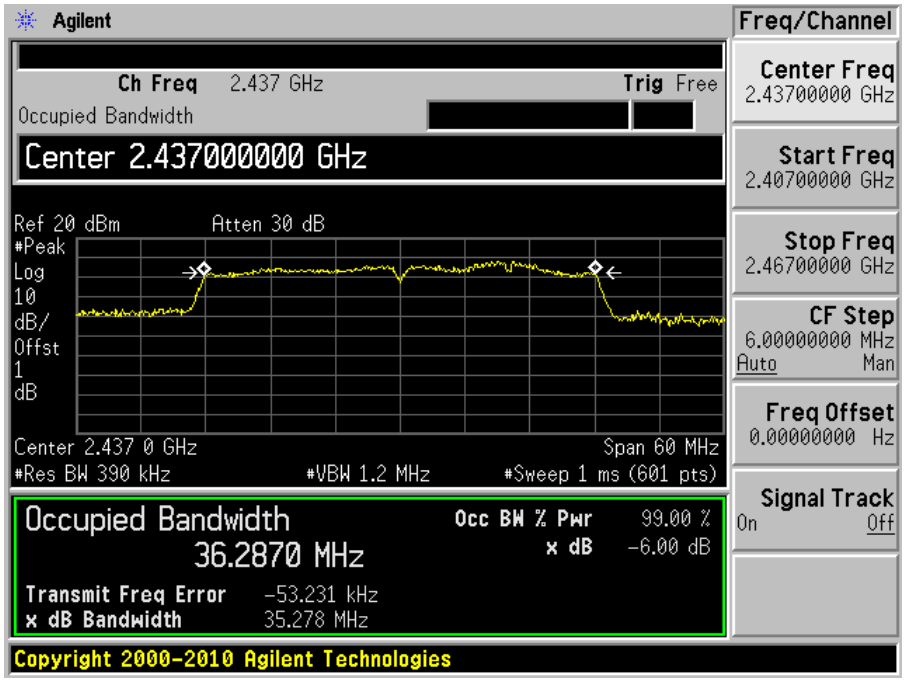
Please refer to the following plots for detailed test results

802.11 n 40 MHz (Antenna #0)

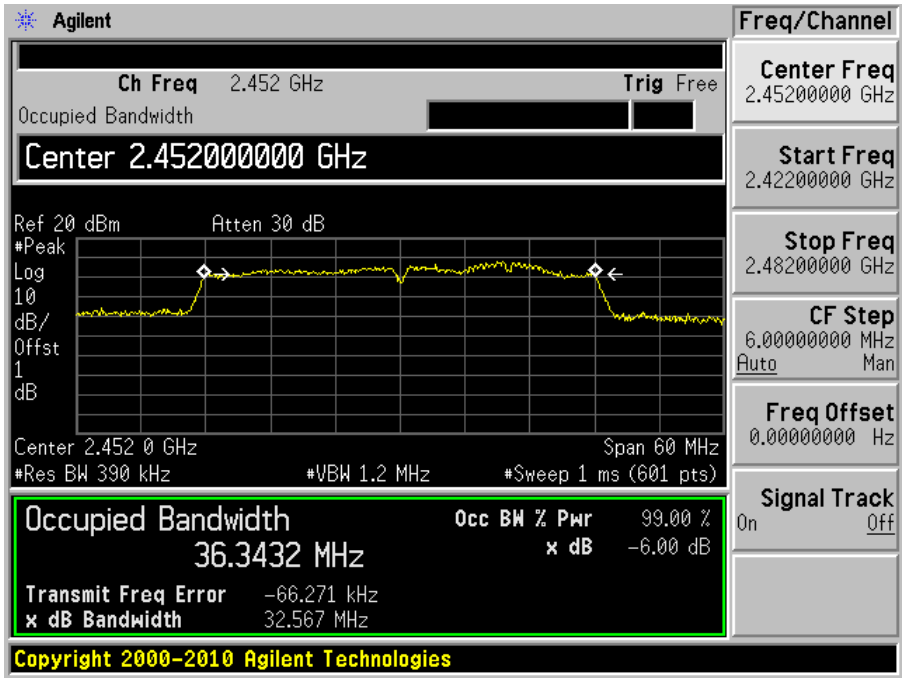
Low Channel 2422 MHz



Middle Channel 2437 MHz

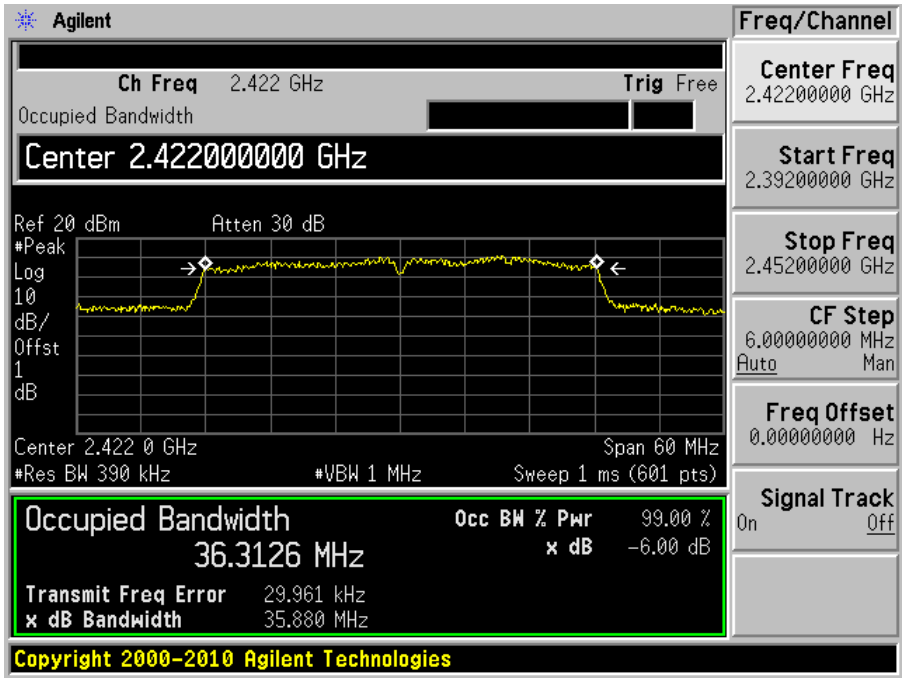


High Channel 2452 MHz

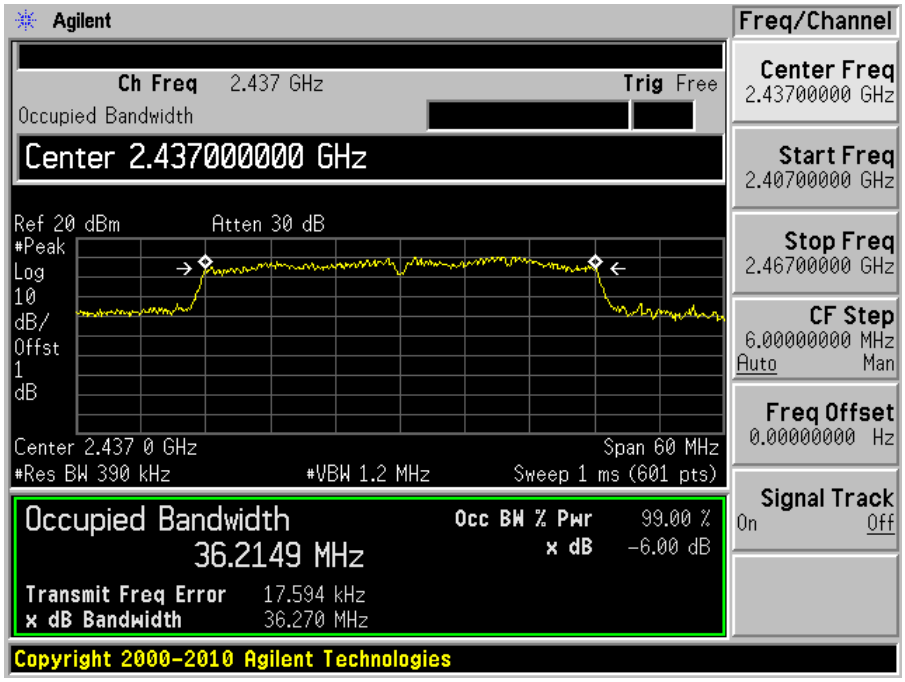


802.11 n 40 MHz (Antenna #1)

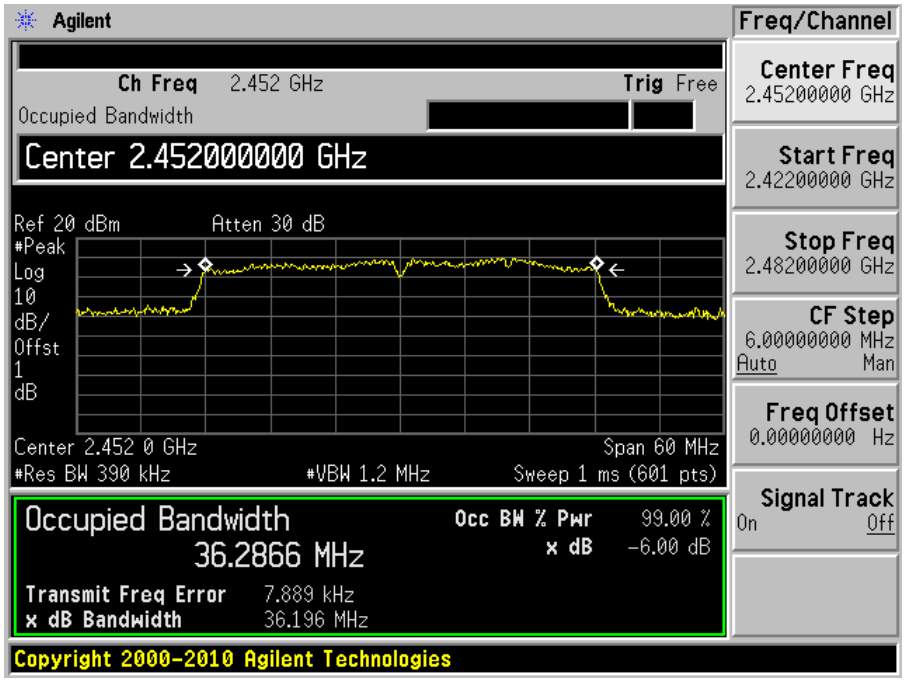
Low Channel 2422 MHz



Middle Channel 2437 MHz



High Channel 2452 MHz



10 FCC §15.247(b) - Peak Output Power Measurement

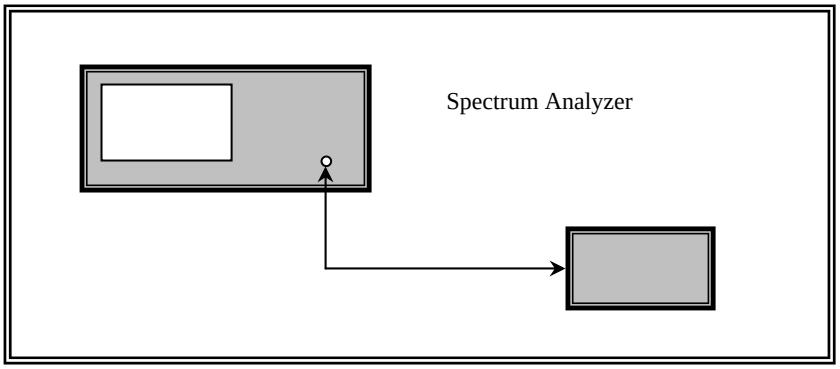
10.1 Applicable Standard

FCC §15.247(b) the maximum peak output power of the intentional radiator shall not exceed the following:

FCC §15.247(b) (3) for systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

10.2 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.



10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09

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

10.4 Test Environmental Conditions

Temperature:	23-25 °C
Relative Humidity:	50-55 %
ATM Pressure:	99-103kPa

The testing was performed by Dennis Huang on 2011-01-28 at RF Site.

10.5 Test Results

802.11 n 40 MHz:

Channel	Frequency (MHz)	Output Power @ Chain 0 (dBm)	Output Power @ Chain 1 (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2422	14.87	17.26	19.24	30	-10.06
Mid	2437	15.24	17.37	19.44	30	-9.58
High	2452	14.54	16.13	18.41	30	-9.93

11 FCC §15.247(d) - 100 kHz Bandwidth of Band Edges

11.1 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)).

11.2 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.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09

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

11.4 Test Environmental Conditions

Temperature:	23-25 °C
Relative Humidity:	50-55 %
ATM Pressure:	99-103kPa

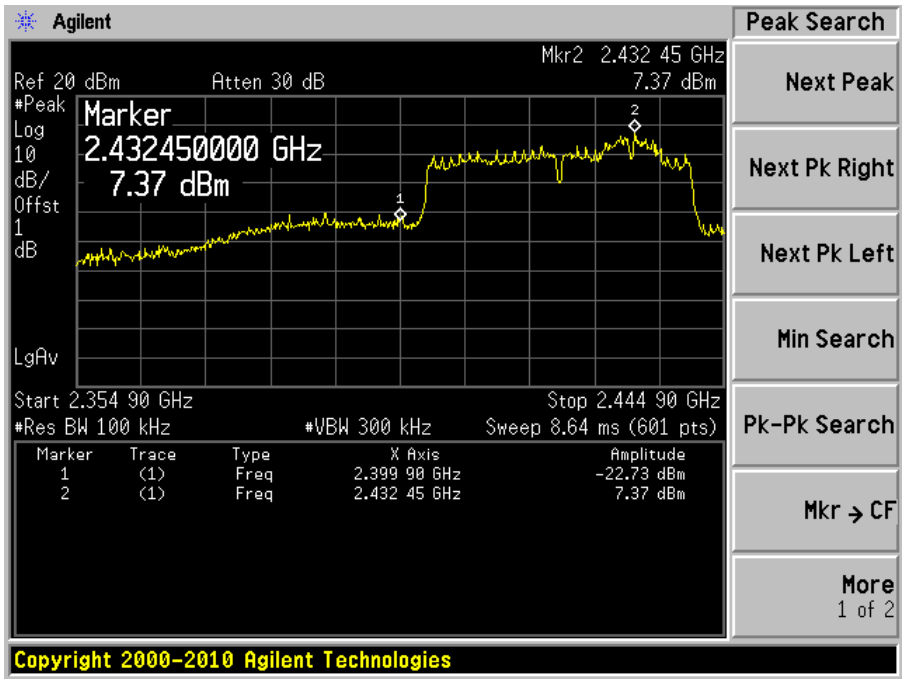
The testing was performed by Dennis Huang on 2011-01-28 at RF Site.

11.5 Measurement Results

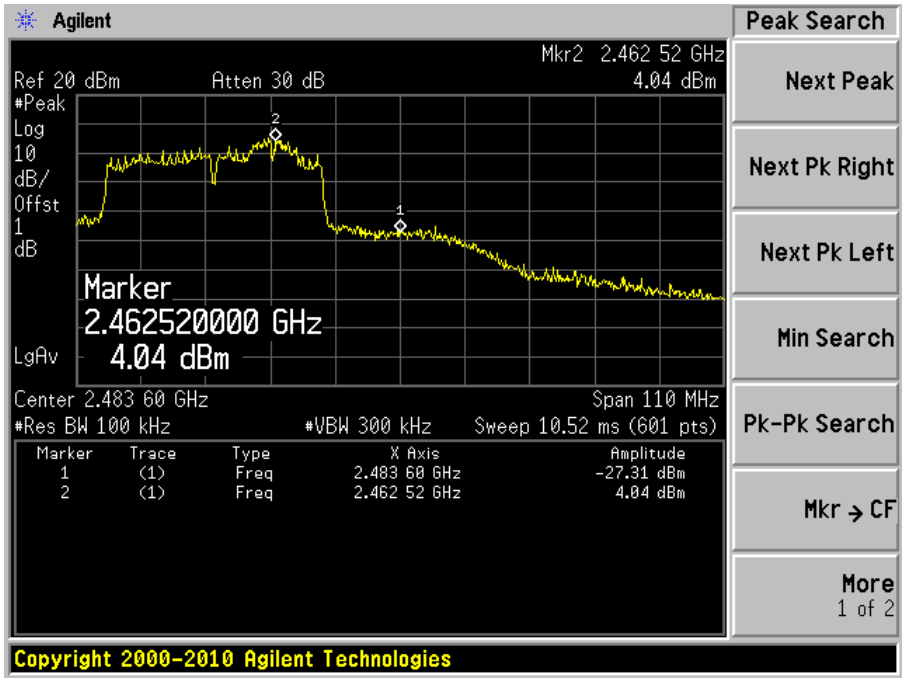
Please refer to following pages for plots of band edge.

802.11 n 40 MHz – Antenna #0

Low Band Edge

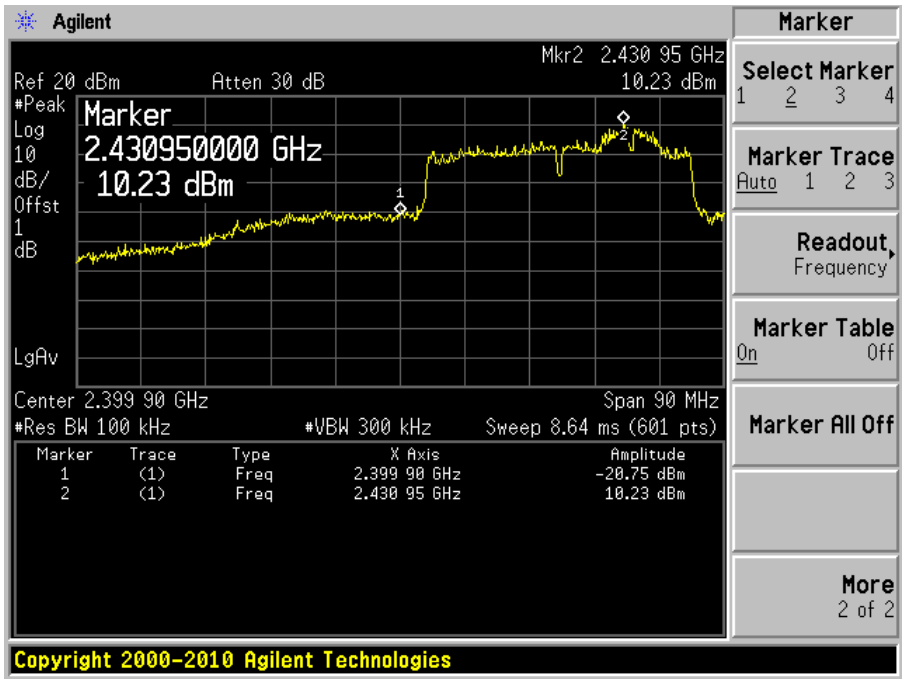


High Band Edge

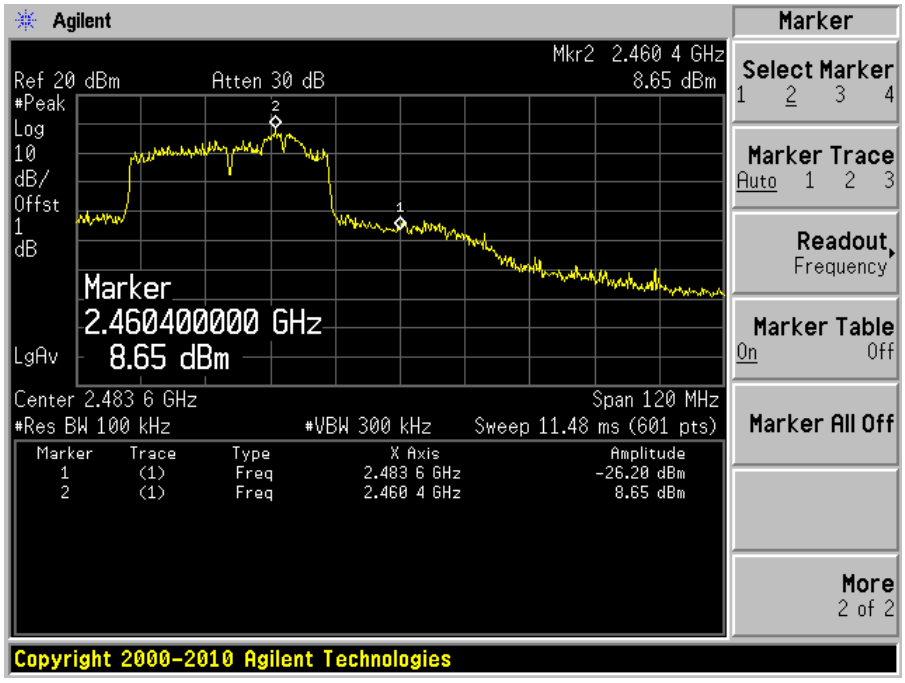


802.11 n 40 MHz – Antenna #1

Low Band Edge

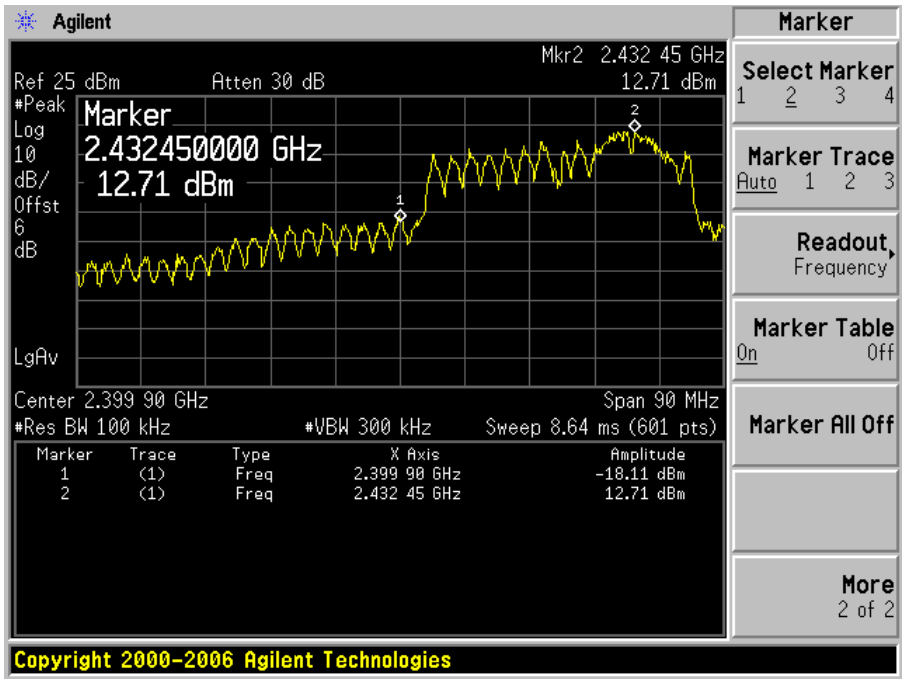


High Band Edge

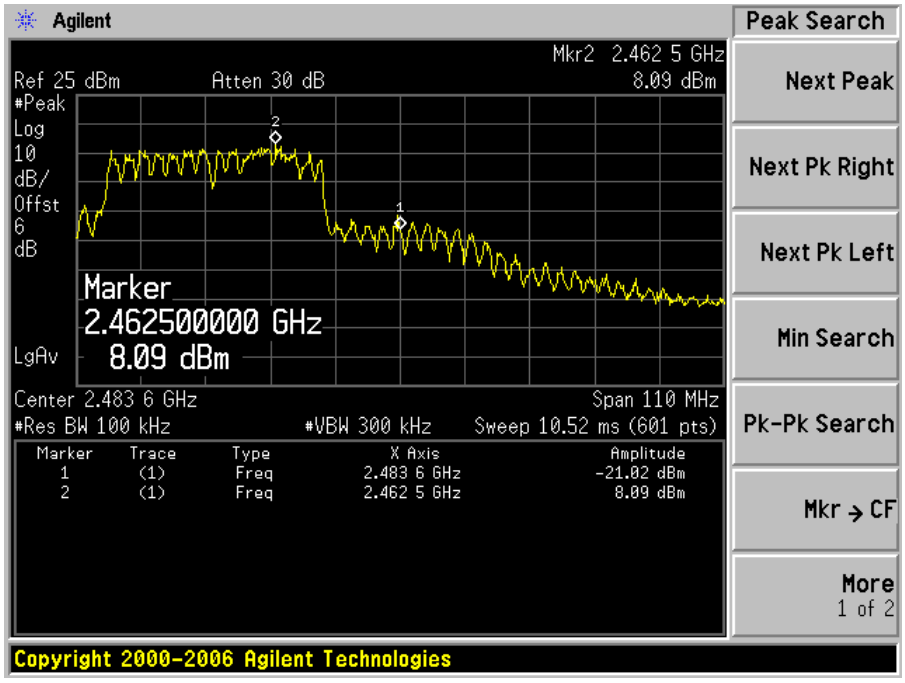


802.11 n 40 MHz BW (Antenna #0 + Antenna #1)

Low Band Edge



High Band Edge



12 FCC §15.247(e) - Power Spectral Density

12.1 Applicable Standard

According to §15.247 (e), for digitally modulated systems, the 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.

12.2 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.
4. Repeat above procedures until all frequencies measured were complete.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2010-05-09

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

12.4 Test Environmental Conditions

Temperature:	23-25 °C
Relative Humidity:	50-55 %
ATM Pressure:	99-103kPa

The testing was performed by Dennis Huang on 2011-01-28 at RF Site.

12.5 Summary of Test Results

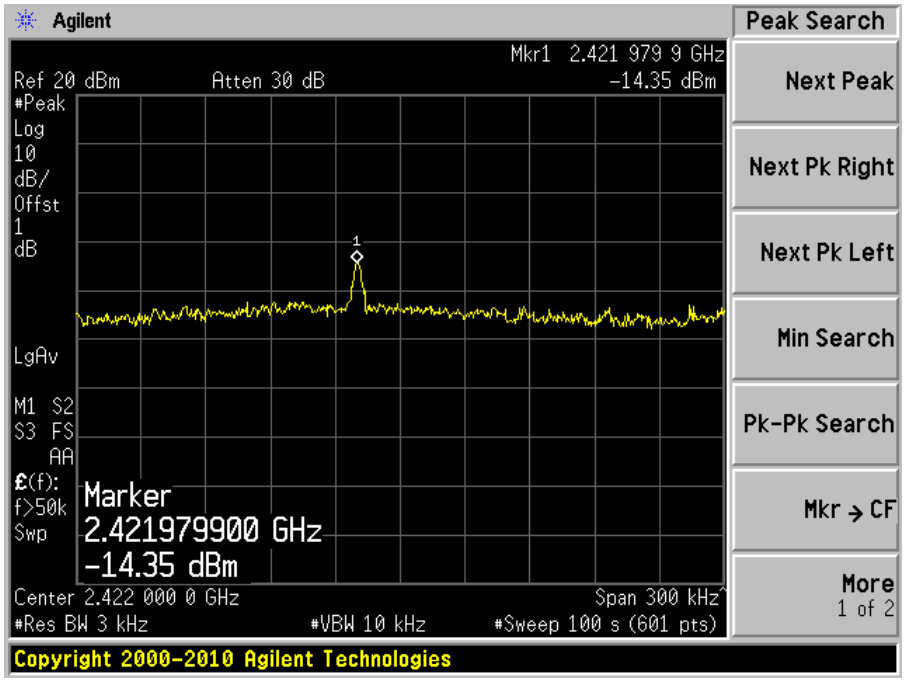
802.11 n 20 MHz mode:

Antenna	Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Results
#0	Low	2422	-14.35	8	Compliant
	Mid	2437	-12.61	8	Compliant
	High	2452	-10.42	8	Compliant
#1	Low	2422	-9.66	8	Compliant
	Mid	2437	-9.65	8	Compliant
	High	2452	-10.53	8	Compliant
#0 + #1	Low	2422	-6.68	8	Compliant
	Mid	2437	-7.17	8	Compliant
	High	2452	-5.58	8	Compliant

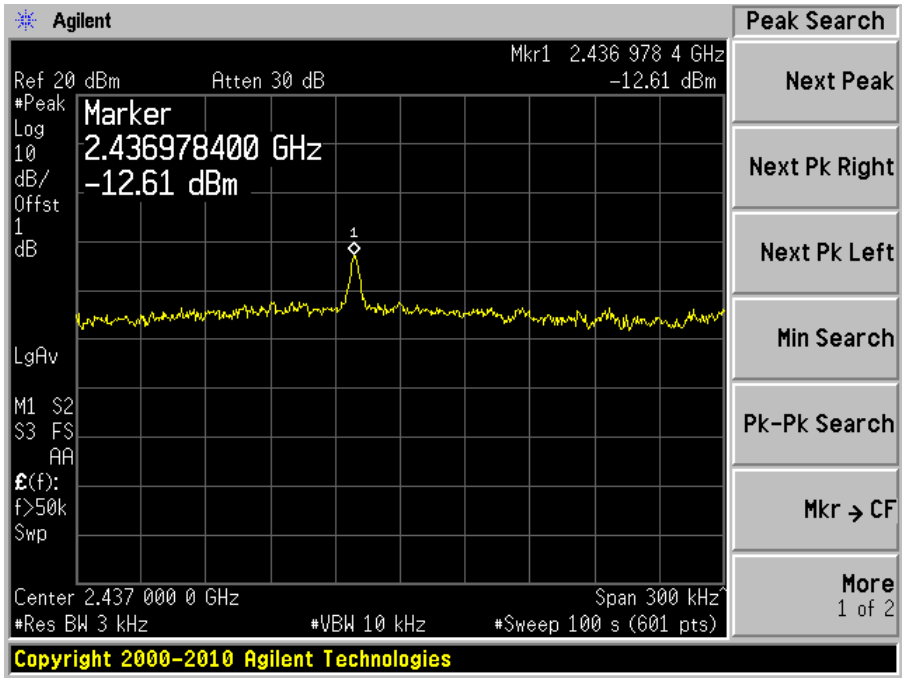
Please refer to the following plots for detailed test results:

802.11 n 40 MHz (Antenna #0)

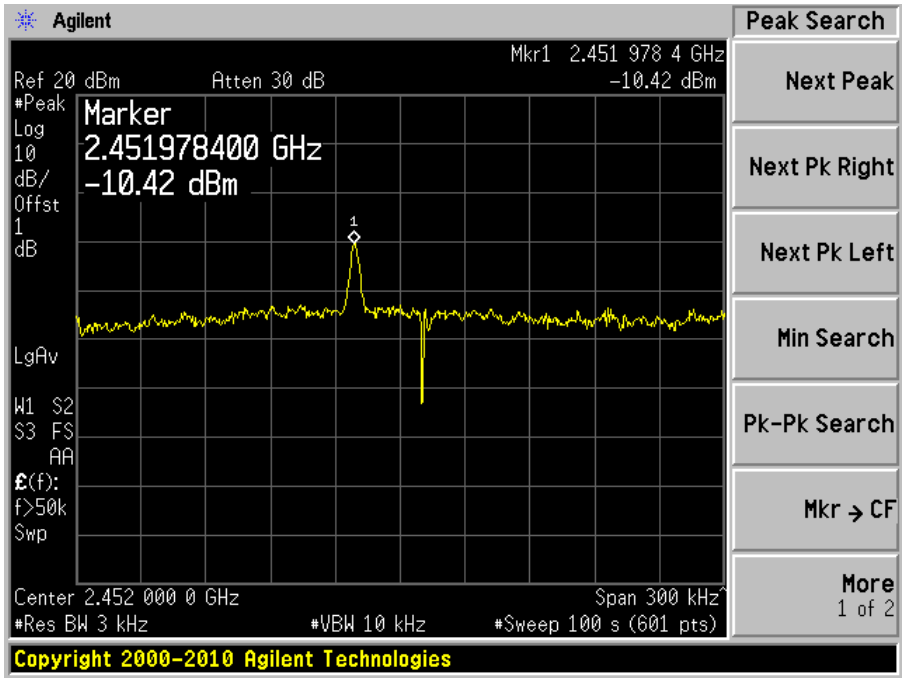
Low Channel 2422 MHz



Middle Channel 2437 MHz

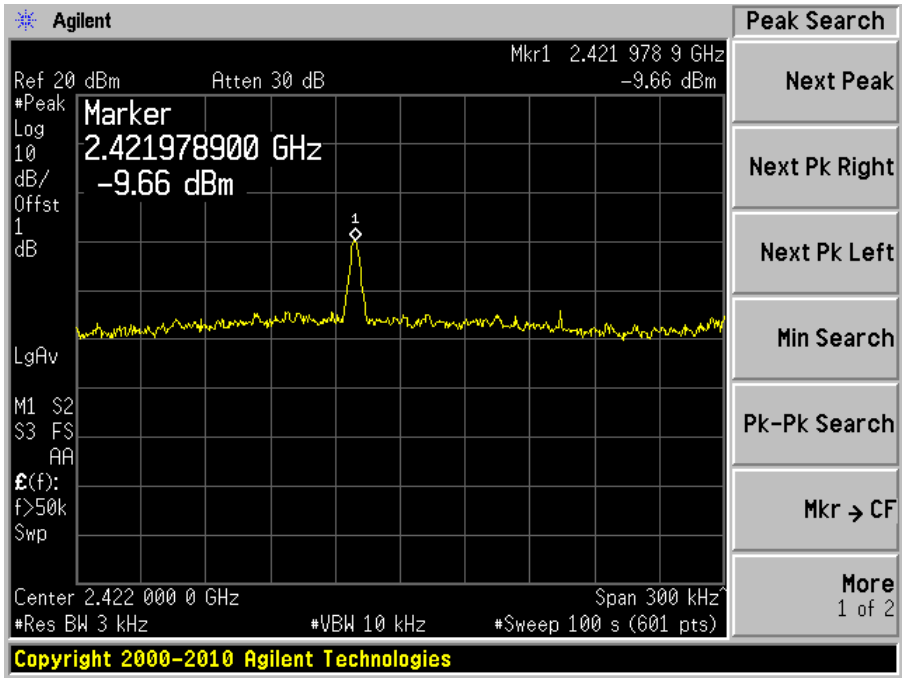


High Channel 2452 MHz

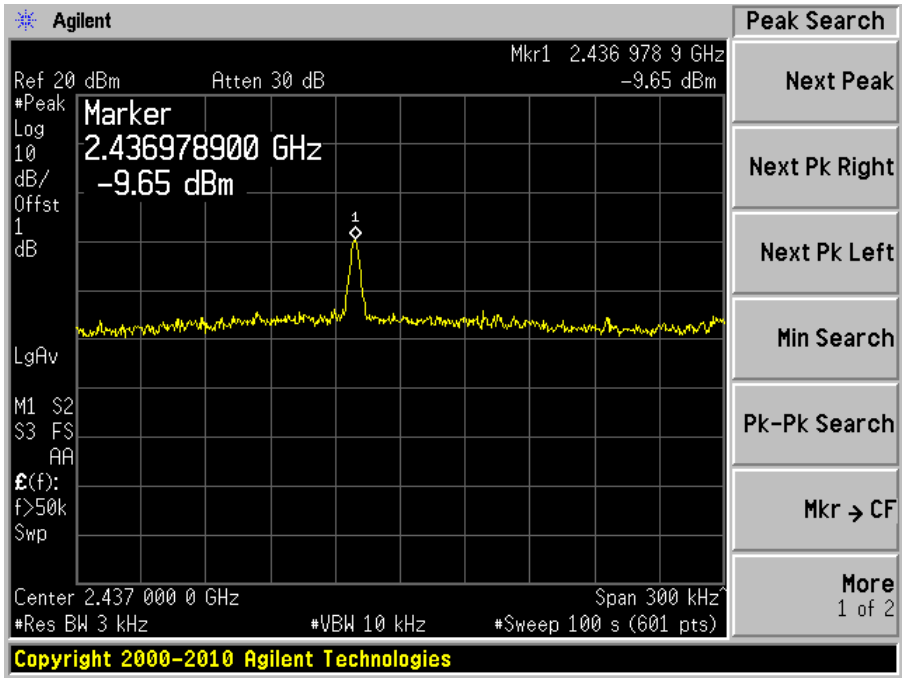


802.11 n 40 MHz (Antenna #1)

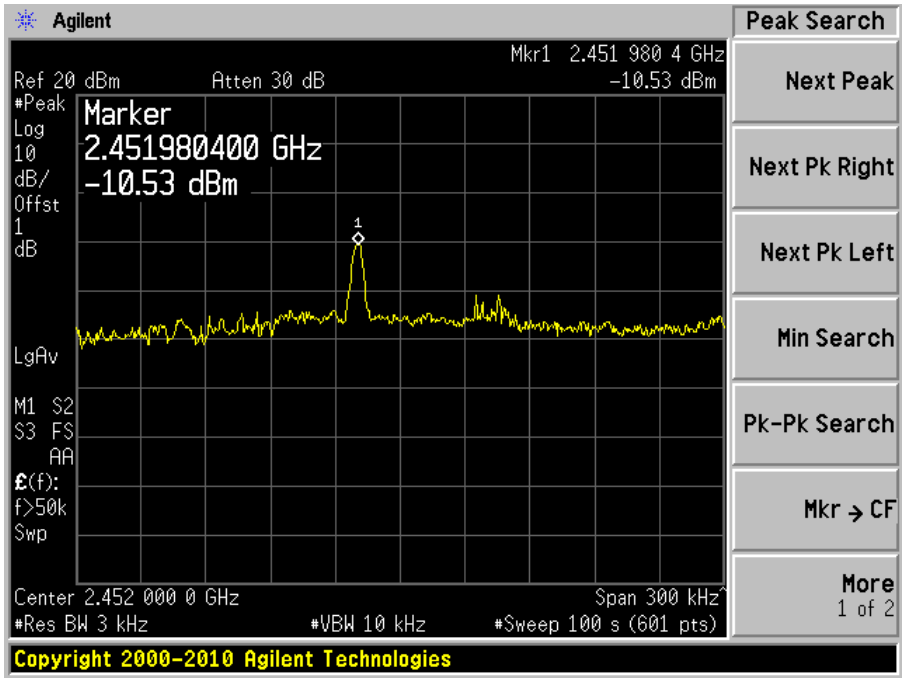
Low Channel 2422 MHz



Middle Channel 2437 MHz

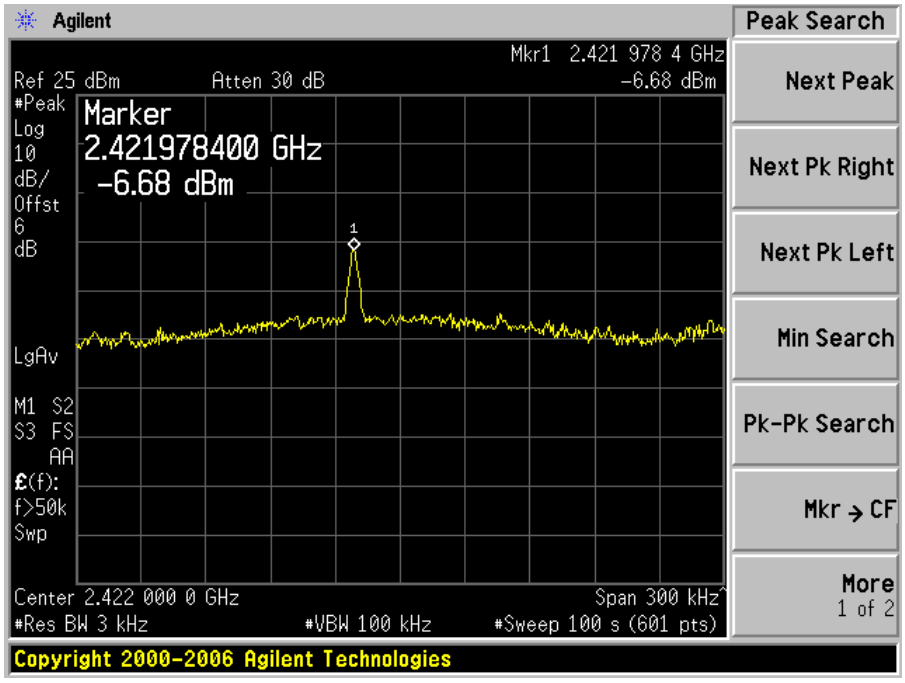


High Channel 2462 MHz

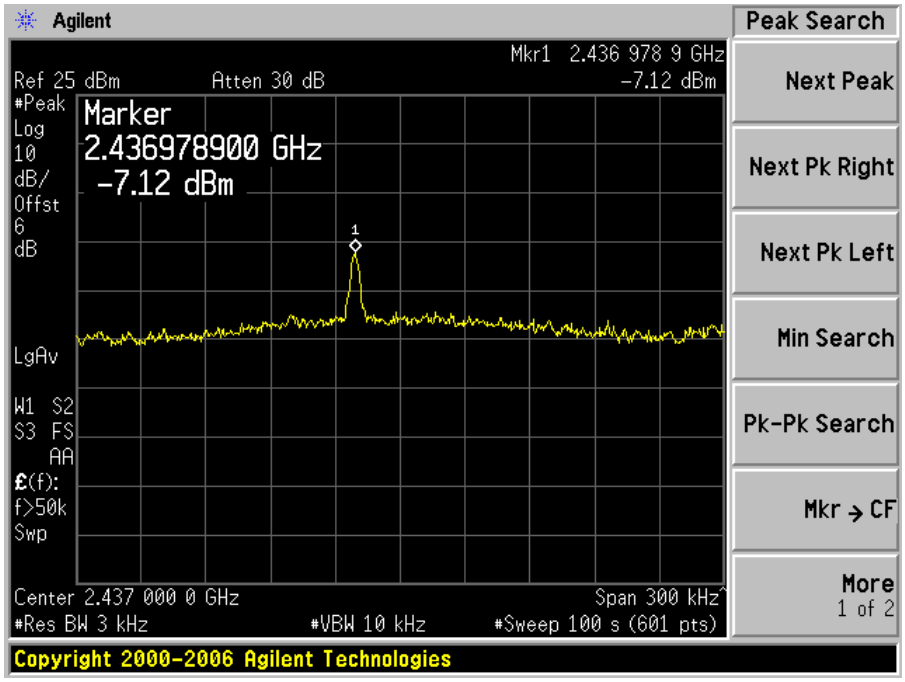


802.11 n 40 MHz BW (Antenna #0 + Antenna #1)

Low Channel 2422 MHz



Middle Channel 2437 MHz



High Channel 2452 MHz