FCC PART 15, SUBPART C

TEST AND MEASUREMENT REPORT

For

Venstar Inc.

9250 Owensmouth Ave.,

Chatsworth, CA 91311, USA

FCC ID: MUH-SKYPORT3

Report Type:	**Product Type:**
Original Report	Thermostat with Wi-Fi Module

Prepared By:	Cipher Chu Test Engineer
Report Number:	R1504163-247
Report Date:	2015-07-06
Reviewed By:	Bo Li RF Lead

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732-9164

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1504163-247	Original Report	2015-07-06

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report has been compiled on behalf of Venstar Inc., and their product, FCC ID: MUH-SKYPORT3, model number: *T4900*, which henceforth is referred to as the EUT (Equipment under Test.). The EUT was a Thermostat with 2.4 GHz Wi-Fi Module.

1.2 Mechanical Description of EUT

The EUT measures approximately 13.5 cm (L) x 13 cm (W) x 3 cm (H) and weighs approximately 300 g.

The data gathered are from a typical production sample provided by the manufacturer with serial number: R1504163-01, assigned by BACL.

1.3 Objective

This report is prepared on behalf of Venstar Inc. in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commission's rules.

The objective is to determine compliance with FCC Part 15.247, Antenna Requirements, AC Line Conducted Emissions, 6 dB Bandwidth, power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emissions, Conducted and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the 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 CISPR16-4-2:2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB 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 Corp.

1.7 Test Facility

Bay area compliance Laboratories Corp. (BACL) is:
1- An independent Commercial Test Laboratory accredited to **ISO 17025: 2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminaires and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65: 1996** by **A2LA** to certify:
2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.
3. Radio Communication Equipment for Singapore.
4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.
5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).
6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s),Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

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 site at BACL Corp. 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 have 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 test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. 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 Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.4-2009.

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

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

The software "RadioToolIGU v1.1.5540.33372" is provided by customer.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
DELL	Laptop	Inspiron 1545	25840163269

2.5 EUT Internal Configuration Details

Manufacturer	Description	Type	Serial Number
Venstar Inc.	WiFi module	T4900	9WL8DY

2.6 Power Supply and Line Filters

Manufacturer	Description	Model	Part Number
AC Adaptor	Power Adapter	MKA-412400200	050VPP

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	1	Laptop	EUT
RF Cable	1	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	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.247 (d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209, §15.247 (d)	Restricted Bands, Radiated Spurious Emissions	Compliant
§15.247(a)(2)	6 dB Emission 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

4.1 Applicable Standard

FCC §2.1091, §15.247(i)

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)
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

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

Maximum peak output power at antenna input terminal (dBm):	14.68
Maximum peak output power at antenna input terminal (mW):	29.38
Prediction distance (cm):	20
Prediction frequency (MHz):	2437
Maximum Antenna Gain, typical (dBi):	1.9
Maximum Antenna Gain (numeric):	1.55
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.00905
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device meets MPE requirement for uncontrolled exposure environment at 20 cm distance.

5 FCC §15.207 - AC Line Conducted Emissions

5.1 Applicable Standards

As per FCC §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 Note	56 to 46 Note
0.5-5	56	46
5-30	60	50

Note: Decreases with the logarithm of the frequency.

5.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4-2009 measurement procedure. The specification used was FCC §15.207 limits.

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

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

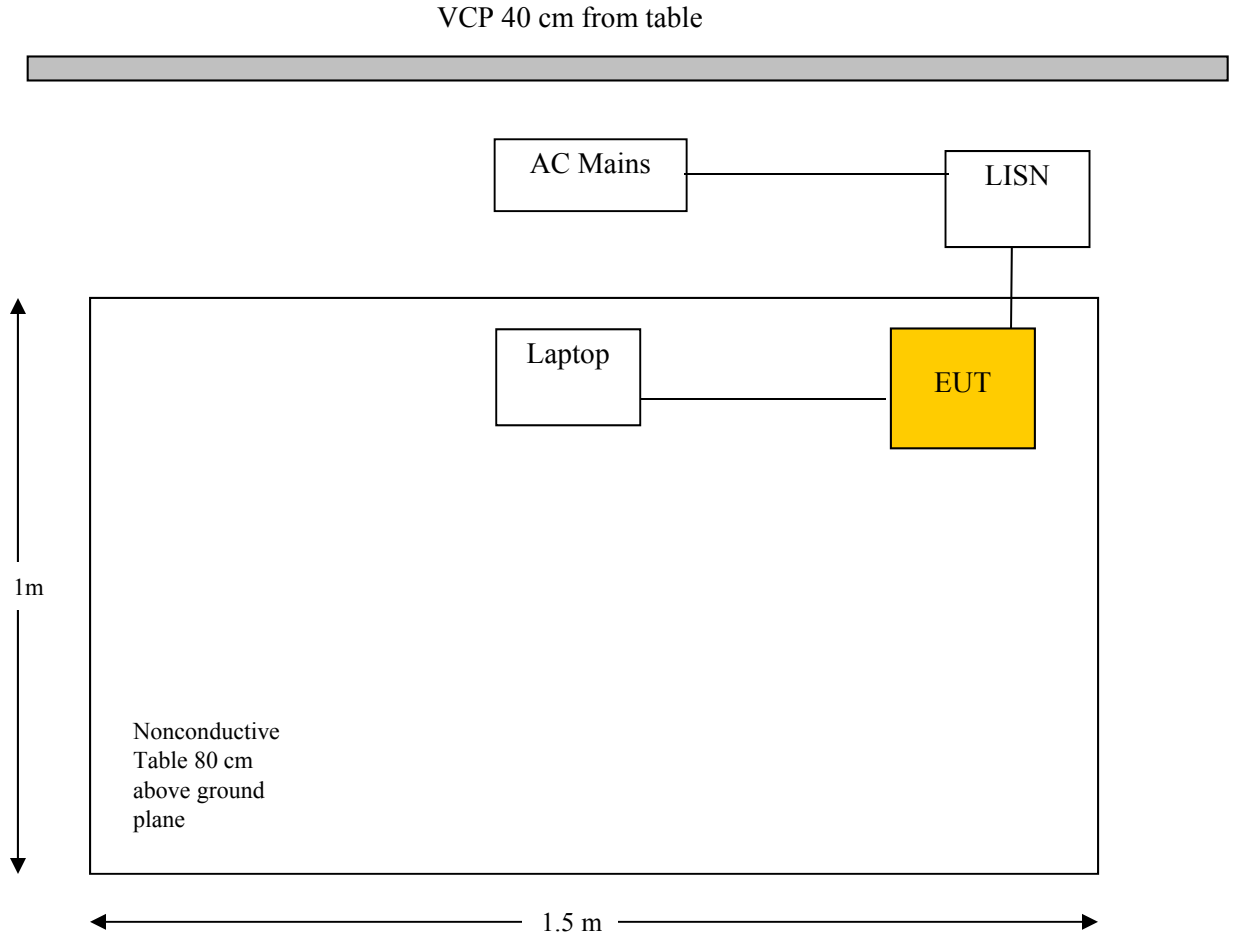
5.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cord of the support equipment was connected to LISN-2.

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”.

5.4 Test Setup Block Diagram



5.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL), the Attenuator Factor (Atten) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within 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 - Limit

5.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2014-09-28	1 year
Solar Electronics	LISN	9252-50-R-24-N	511205	2014-06-25	1 year
TTE	Filter, High Pass	H962-150k-50-21378	K7133	2015-01-30	1 year

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

5.7 Test Environmental Conditions

Temperature:	24º C
Relative Humidity:	43 %
ATM Pressure:	102.5 kPa

The testing was performed by Cipher Chu on 2015-05-19 in 5m chamber3.

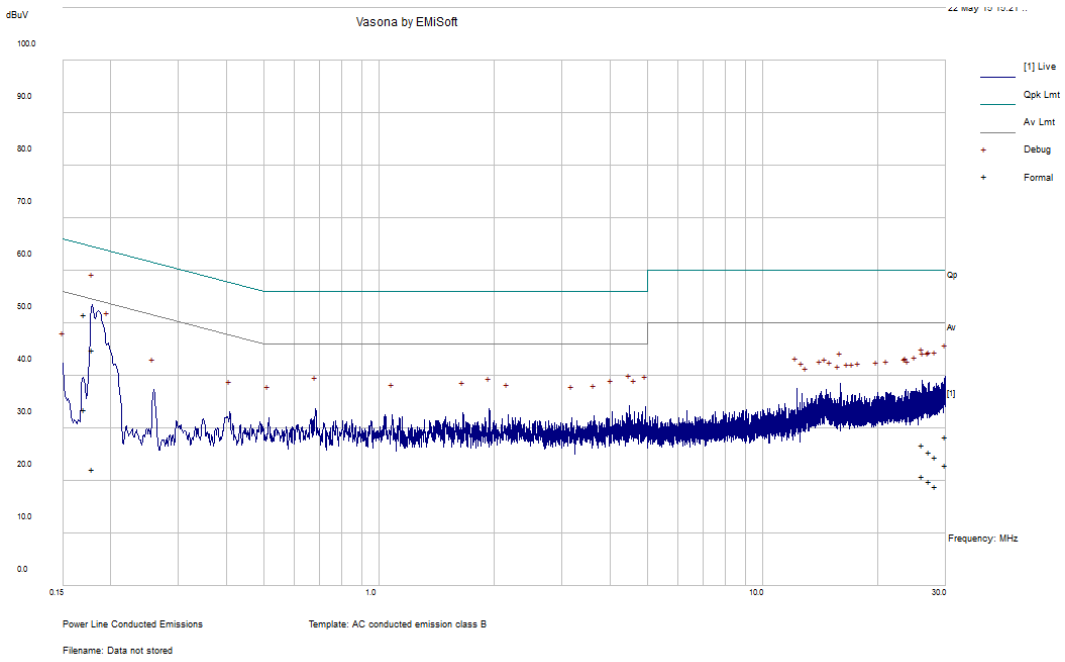
5.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15.207 standard's conducted emissions limits, with the margin reading of:

Connection: AC/AC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-12.66	0.150123	Neutral	30-1000

5.9 Conducted Emissions Test Plots and Data

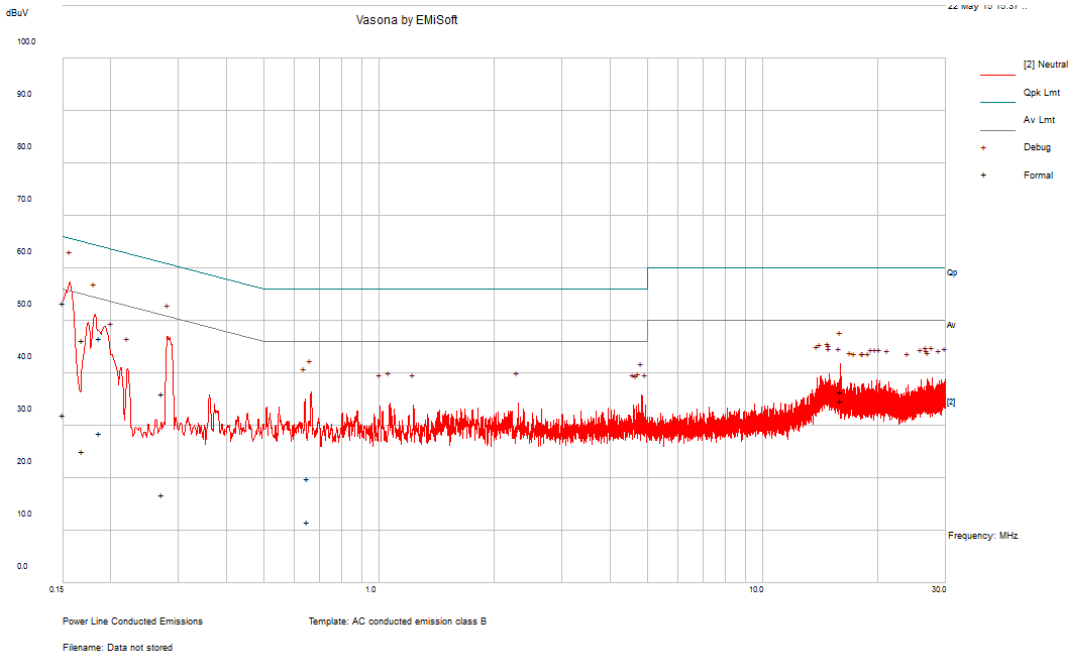
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.171165	51.61	Line	64.9	-13.30	QP
0.179568	44.95	Line	64.51	-19.55	QP
29.98967	28.50	Line	60	-31.50	QP
26.1006	26.85	Line	60	-33.15	QP
27.22691	25.52	Line	60	-34.48	QP
28.26426	24.51	Line	60	-35.49	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.171165	33.58	Line	54.9	-21.32	Ave.
0.179568	22.26	Line	54.51	-32.25	Ave.
29.98967	23.07	Line	50	-26.93	Ave.
26.1006	20.94	Line	50	-29.06	Ave.
27.22691	19.96	Line	50	-30.04	Ave.
28.26426	19.02	Line	50	-30.98	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.150123	53.33	Neutral	65.99	-12.66	QP
0.168834	46.35	Neutral	65.02	-18.67	QP
0.272103	36.08	Neutral	61.05	-24.97	QP
15.97789	36.51	Neutral	60	-23.49	QP
0.652182	19.88	Neutral	56	-36.12	QP
0.187167	46.62	Neutral	64.16	-17.54	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.150123	32.05	Neutral	55.99	-23.95	Ave.
0.168834	25.13	Neutral	55.02	-29.89	Ave.
0.272103	16.93	Neutral	51.05	-34.13	Ave.
15.97789	34.74	Neutral	50	-15.26	Ave.
0.652182	11.66	Neutral	46	-34.34	Ave.
0.187167	28.65	Neutral	54.16	-25.51	Ave.

6 FCC §2.1051 & §15.247(d) – Spurious Emissions at Antenna Terminals

6.1 Applicable Standards

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.

6.2 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.

6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2014-10-16	1 year

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

6.4 Test Environmental Conditions

Temperature:	24º C
Relative Humidity:	43 %
ATM Pressure:	102.5 kPa

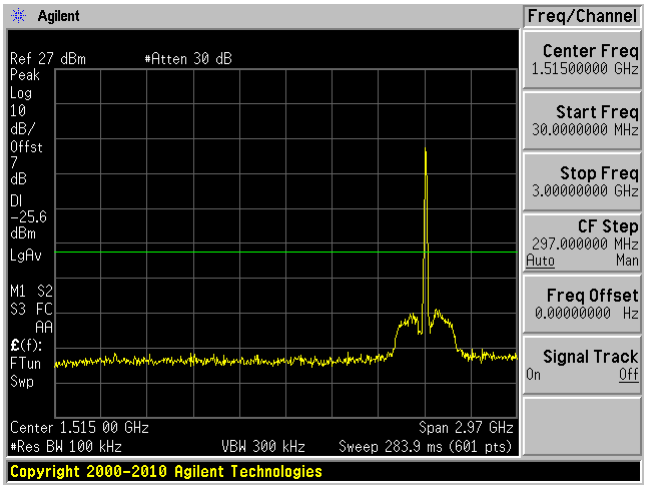
The testing was performed by Cipher Chu on 2015-05-19 at RF site.

6.5 Test Results

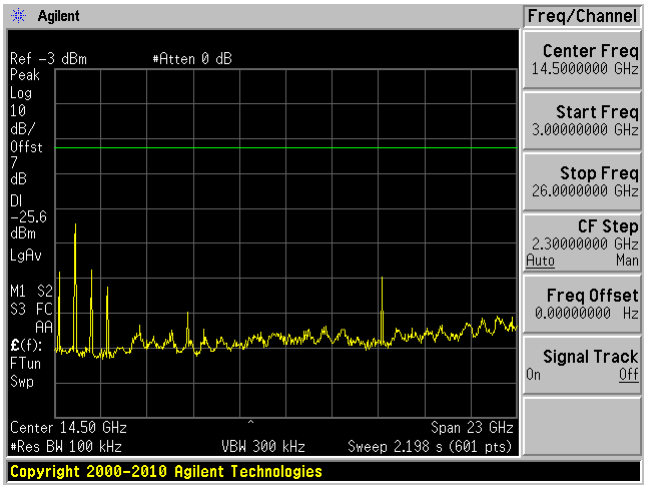
Please refer to following plots of spurious emissions.

802.11b, Low Channel, 2412 MHz

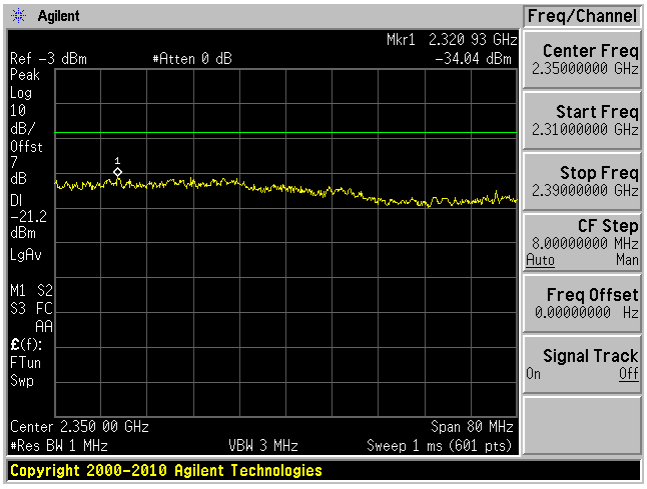
Plot: 30 MHz – 3 GHz



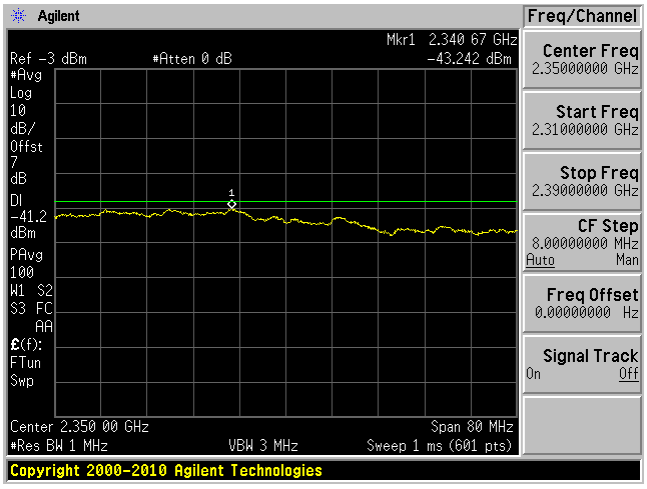
Plot: 3 GHz – 26 GHz



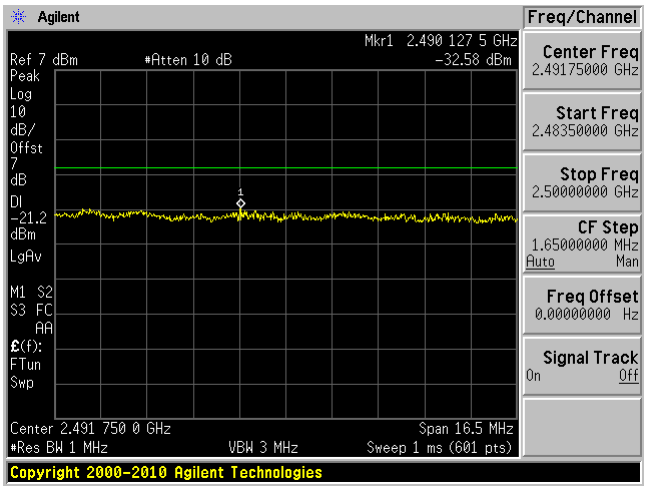
Plot: 2.31 GHz – 2.39 GHz (restrict Band) Peak



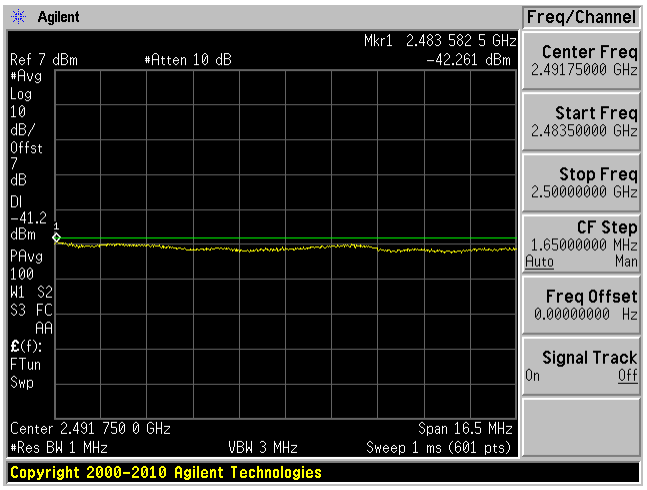
Plot: 2.31 GHz – 2.39 GHz (restrict band) Ave



Plot: 2.4835 GHz – 2.5 GHz (restrict Band)
Peak

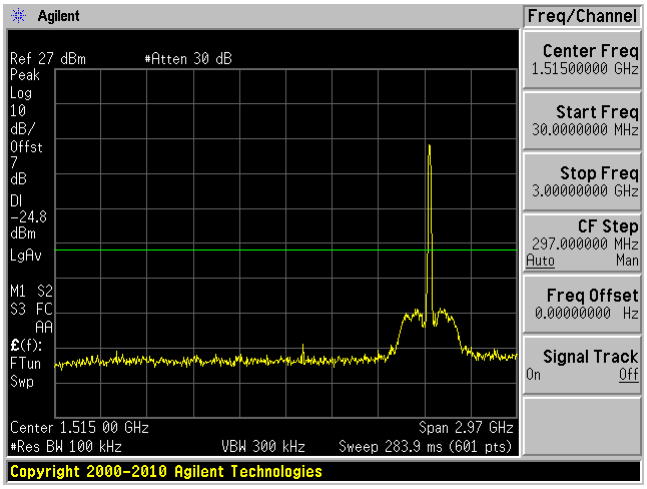


Plot: 2.4835 GHz – 2.5 GHz (restrict band)
Ave

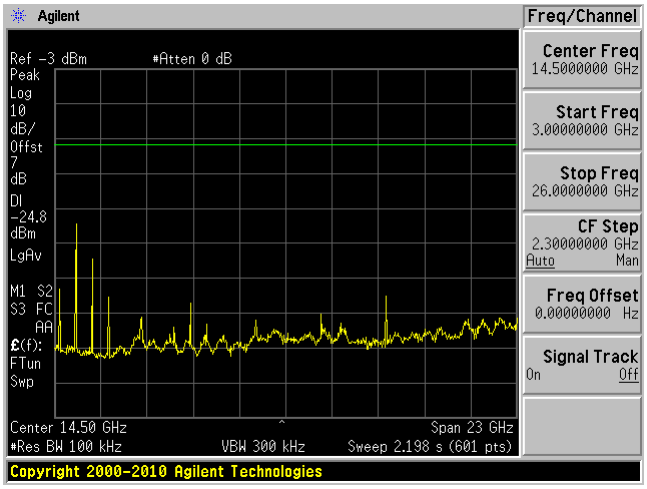


802.11b, Middle Channel, 2437 MHz

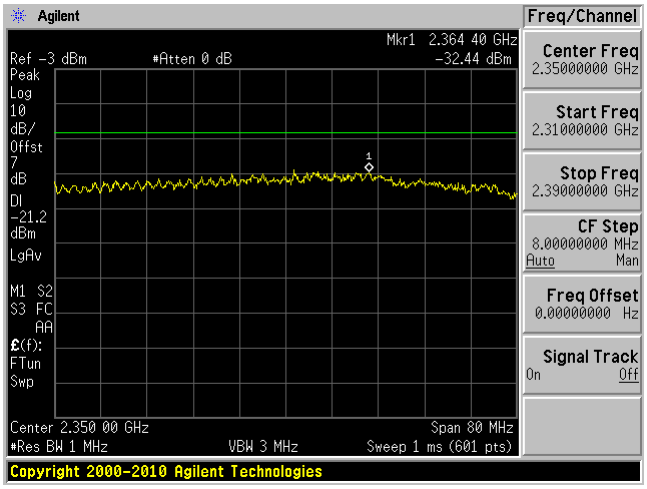
Plot: 30 MHz – 3 GHz



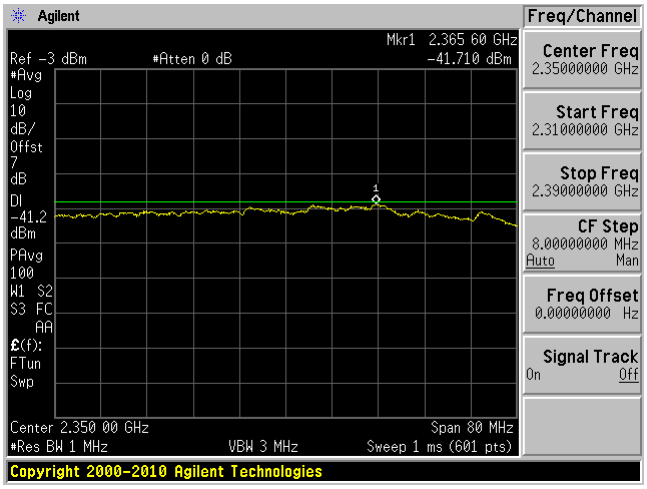
Plot: 3 GHz – 26 GHz



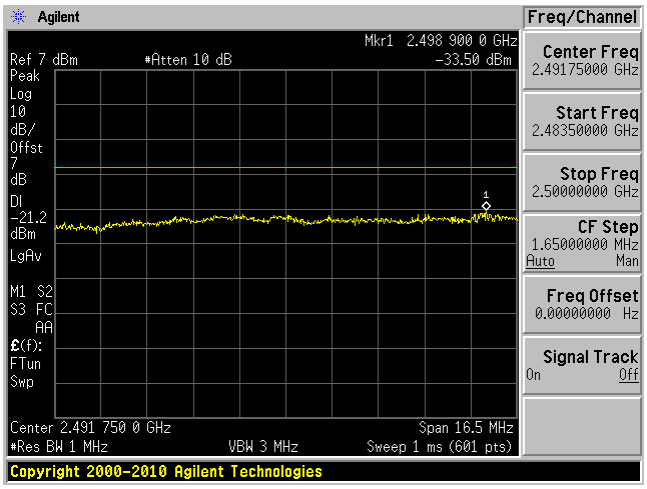
Plot: 2.31 GHz – 2.39 GHz (restrict Band) Peak



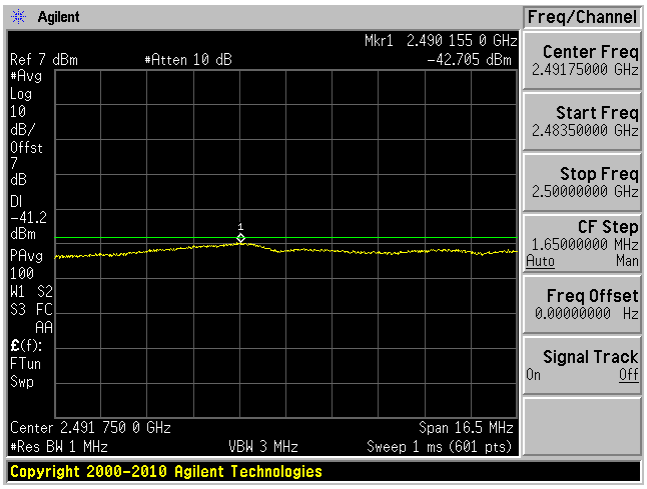
Plot: 2.31 GHz – 2.39 GHz (restrict band) Ave



Plot: 2.4835 GHz – 2.5 GHz (restrict Band)
Peak

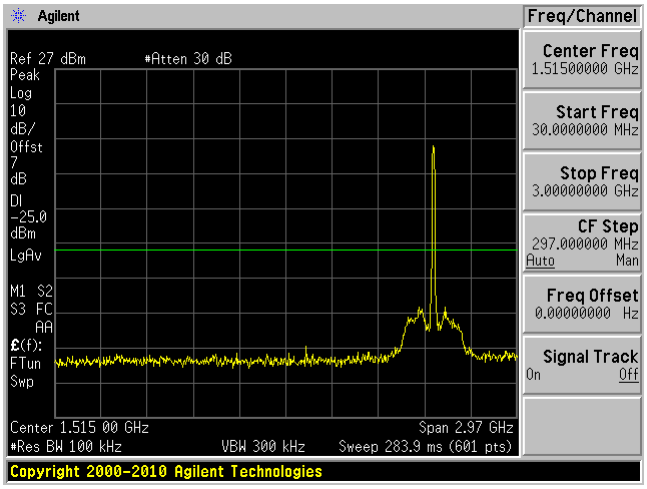


Plot: 2.4835 GHz – 2.5 GHz (restrict band)
Ave

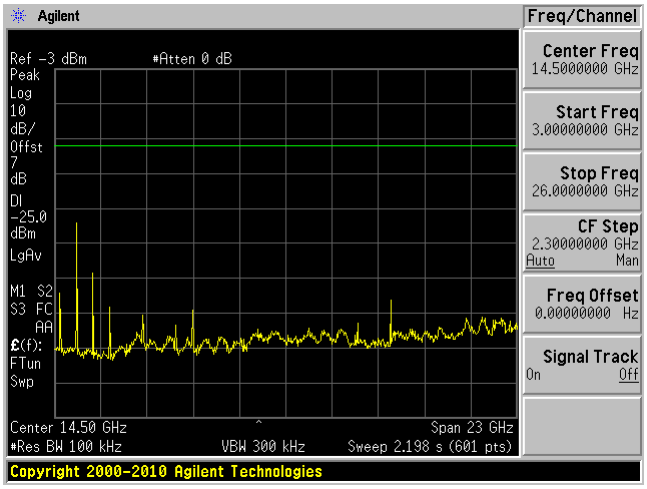


802.11b, High Channel, 2462 MHz

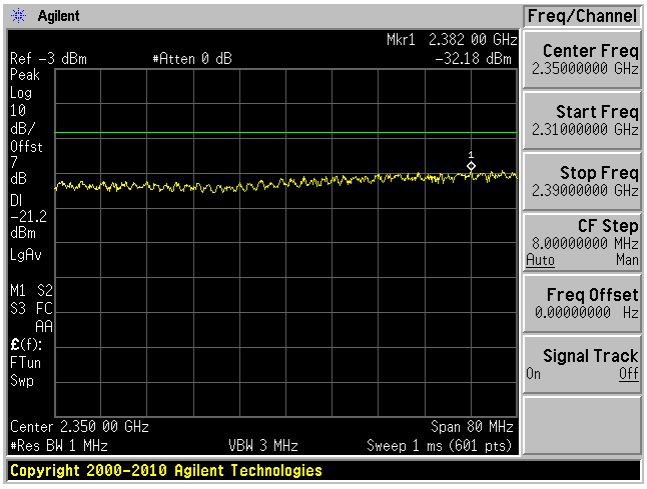
Plot: 30 MHz – 3 GHz



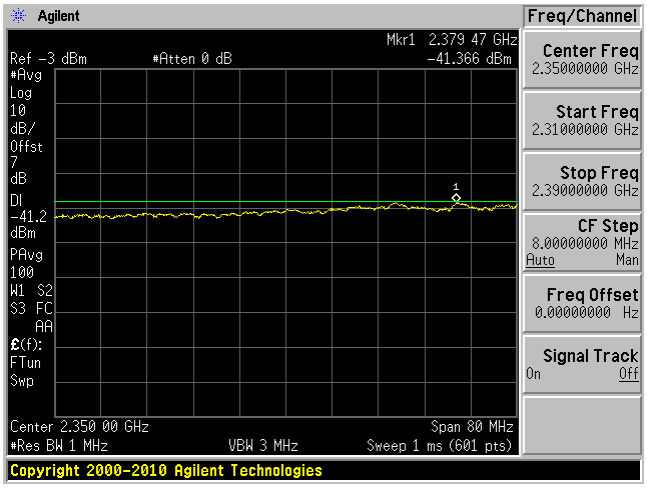
Plot: 3 GHz – 26 GHz



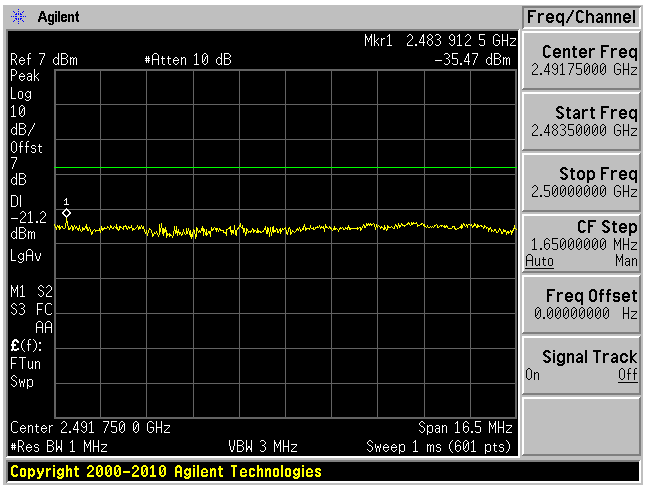
Plot: 2.31 GHz – 2.39 GHz (restrict Band)
Peak



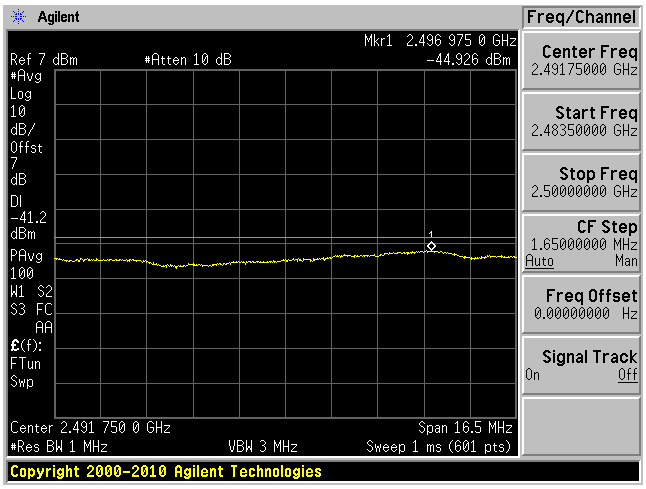
Plot: 2.31 GHz – 2.39 GHz (restrict band)
Ave



Plot: 2.4835 GHz – 2.5 GHz (restrict Band)
Peak

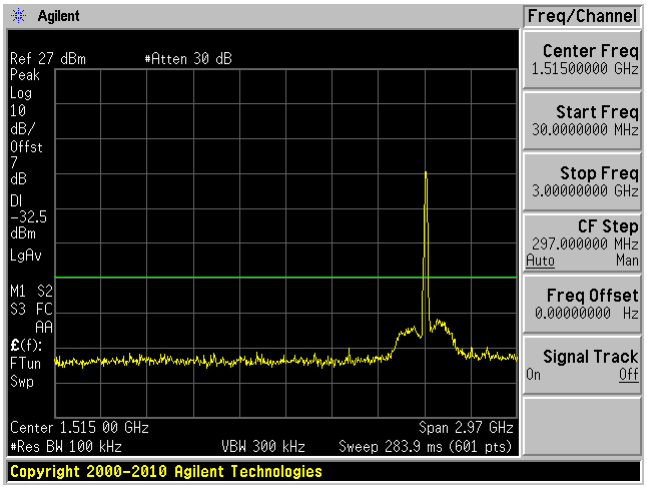


Plot: 2.4835 GHz – 2.5 GHz (restrict band)
Ave

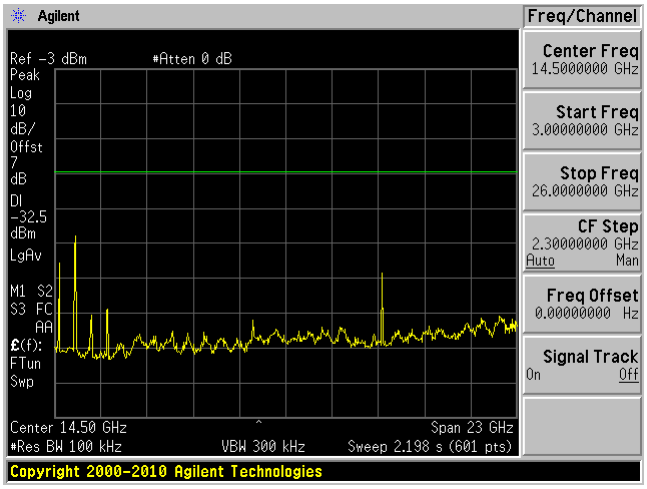


802.11g, Low Channel 2412 MHz

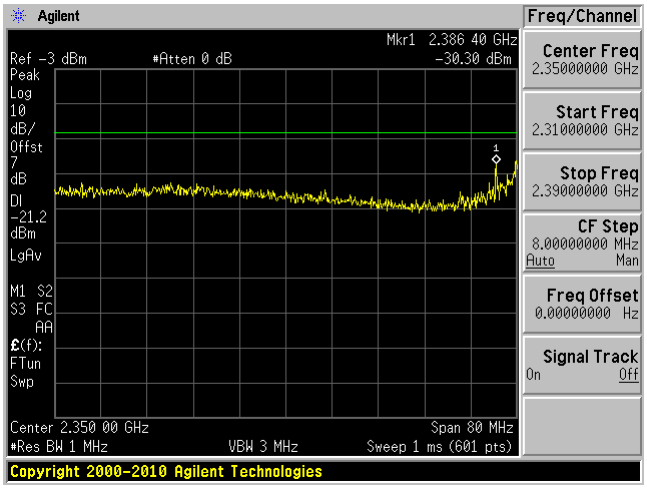
Plot: 30 MHz – 3 GHz



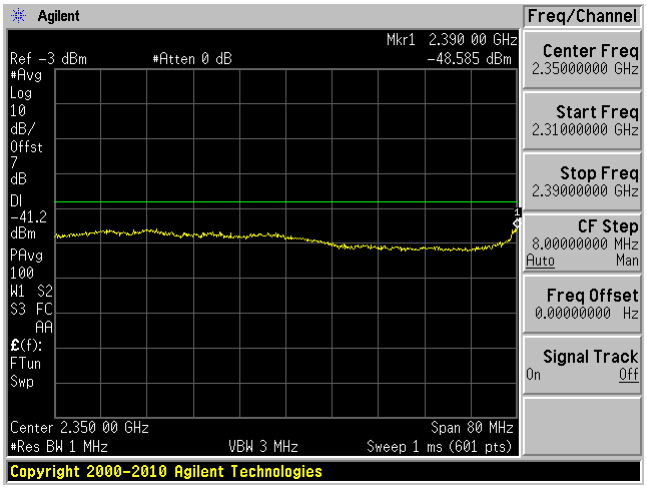
Plot: 3 GHz – 26 GHz



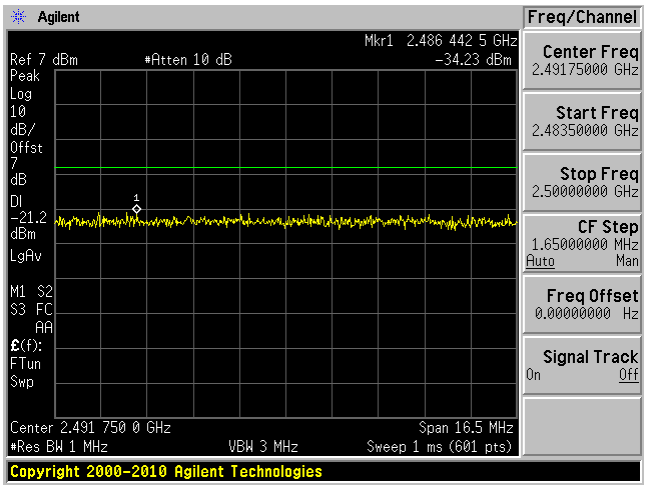
Plot: 2.31 GHz – 2.39 GHz (restrict Band)
Peak



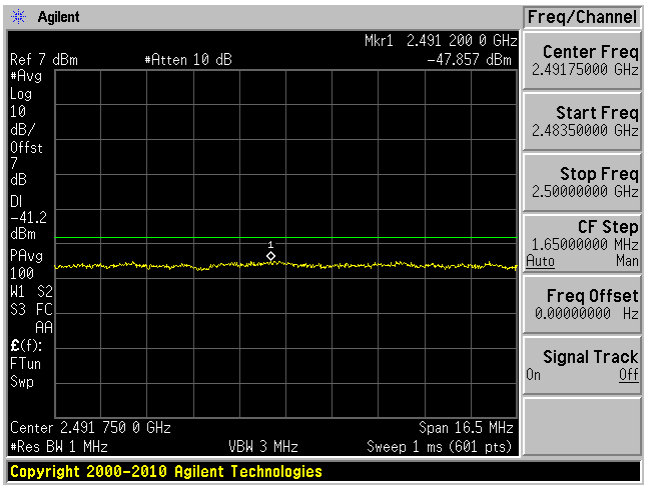
Plot: 2.31 GHz – 2.39 GHz (restrict band)
Ave



Plot: 2.4835 GHz – 2.5 GHz (restrict Band)
Peak

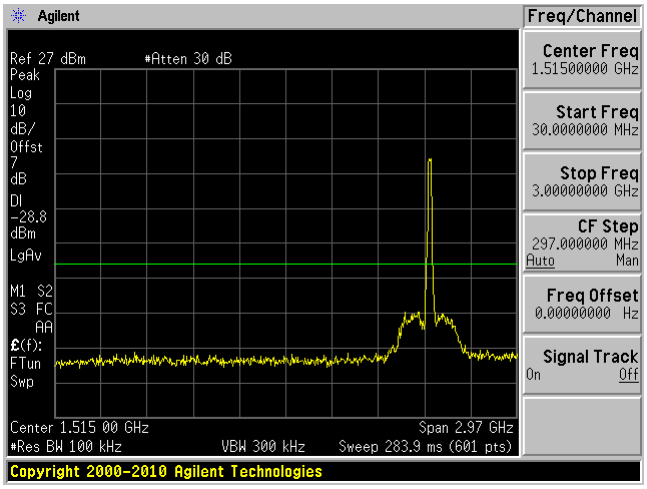


Plot: 2.4835 GHz – 2.5 GHz (restrict band)
Ave

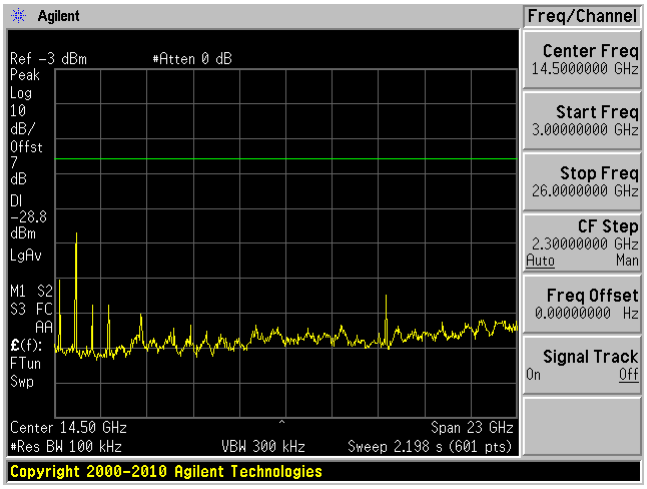


802.11g, Middle Channel 2437 MHz

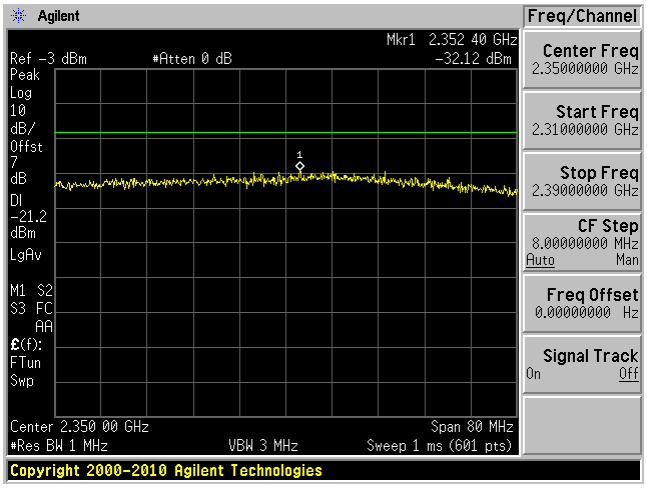
Plot: 30 MHz – 3 GHz



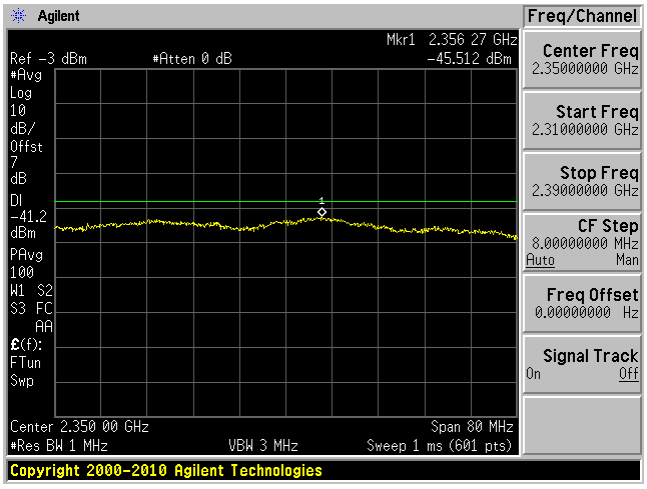
Plot: 3 GHz – 26 GHz



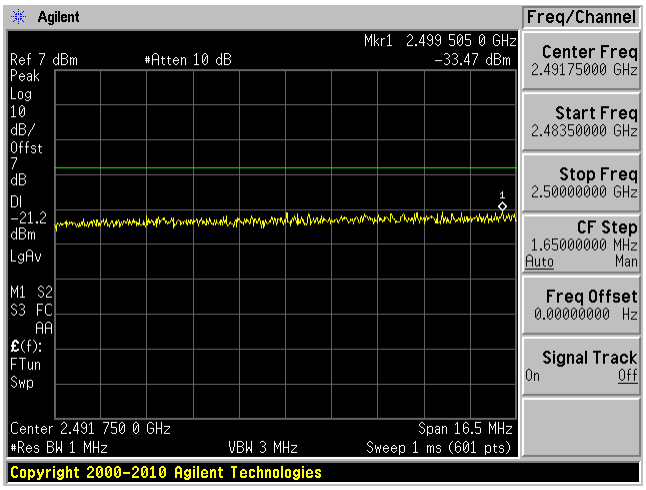
Plot: 2.31 GHz – 2.39 GHz (restrict Band)
Peak



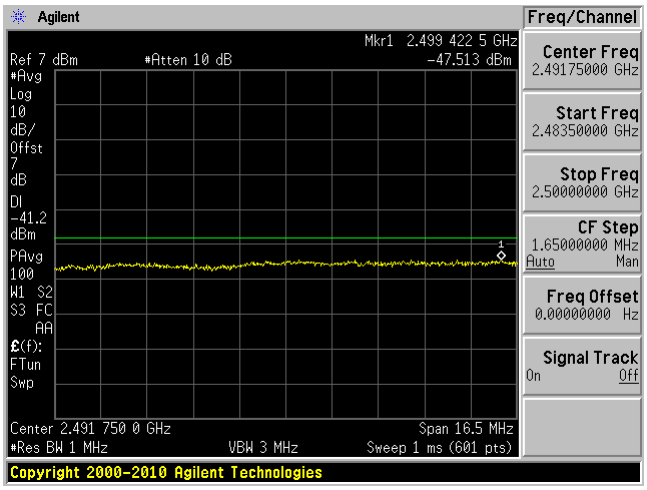
Plot: 2.31 GHz – 2.39 GHz (restrict band)
Ave



Plot: 2.4835 GHz – 2.5 GHz (restrict Band)
Peak

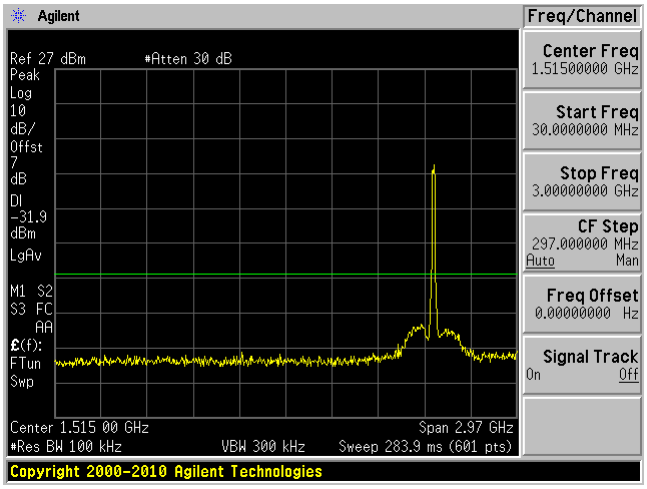


Plot: 2.4835 GHz – 2.5 GHz (restrict band)
Ave

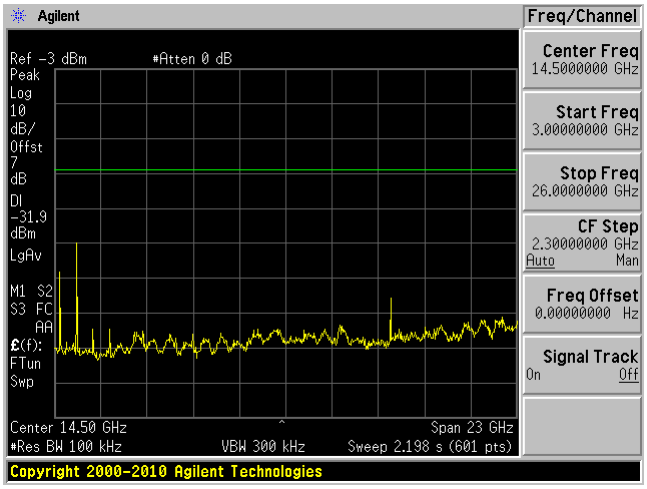


802.11g, High Channel 2462 MHz

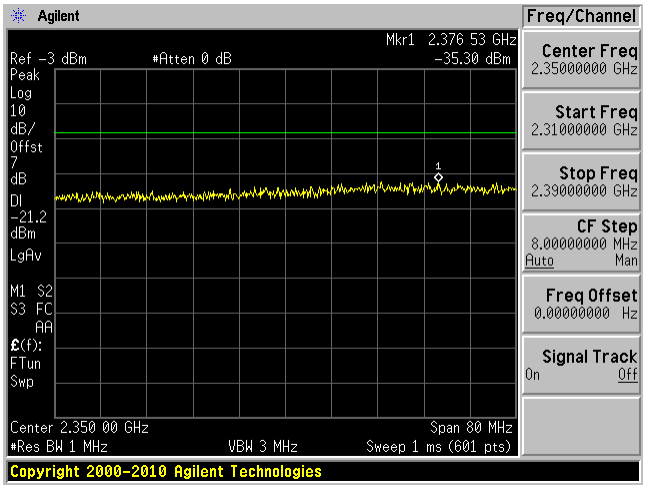
Plot: 30 MHz – 3 GHz



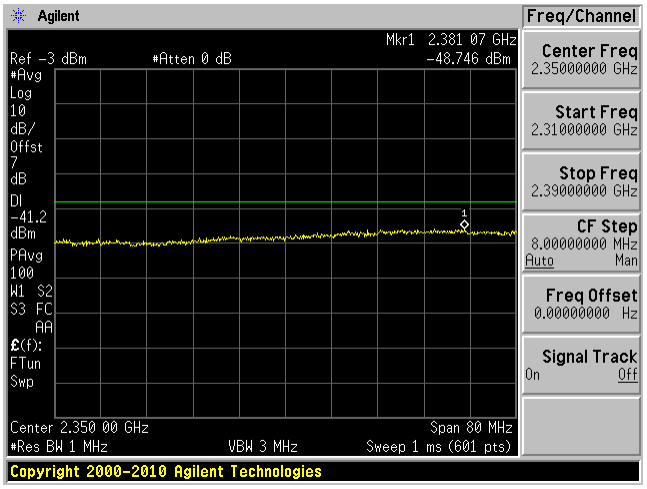
Plot: 3 GHz – 26 GHz



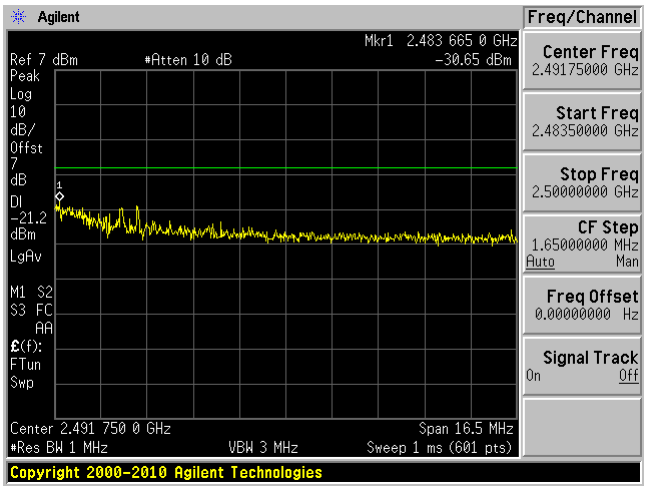
Plot: 2.31 GHz – 2.39 GHz (restrict Band) Peak



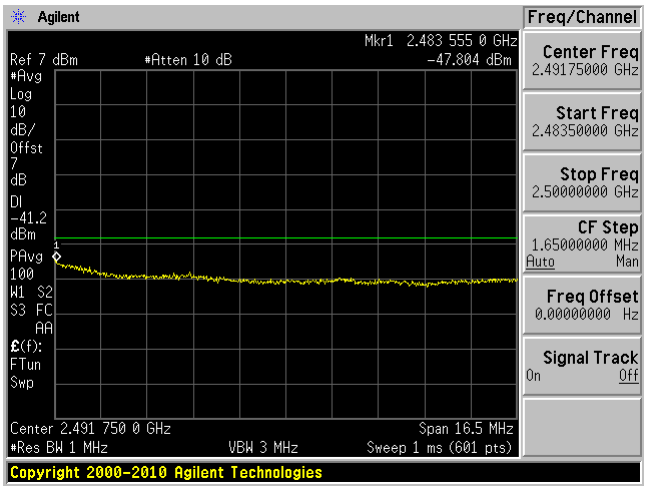
Plot: 2.31 GHz – 2.39 GHz (restrict band) Ave



Plot: 2.4835 GHz – 2.5 GHz (restrict Band)
Peak

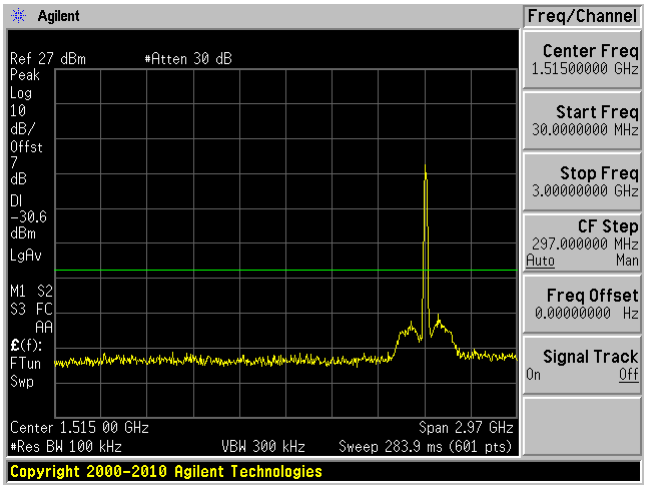


Plot: 2.4835 GHz – 2.5 GHz (restrict band)
Ave

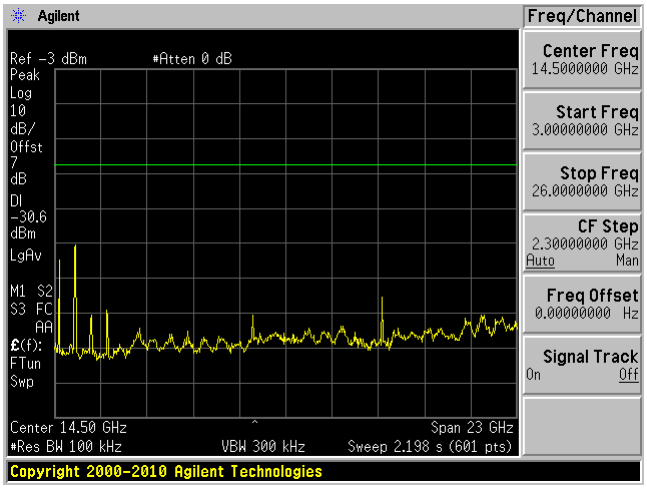


802.11n-HT20, Low Channel 2412 MHz

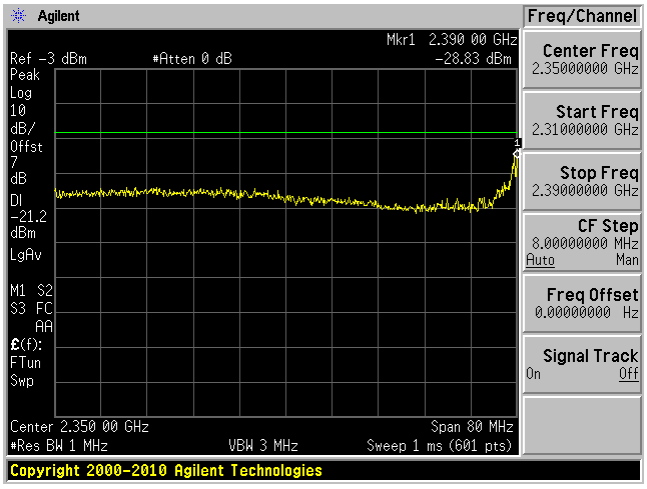
Plot: 30 MHz – 3 GHz



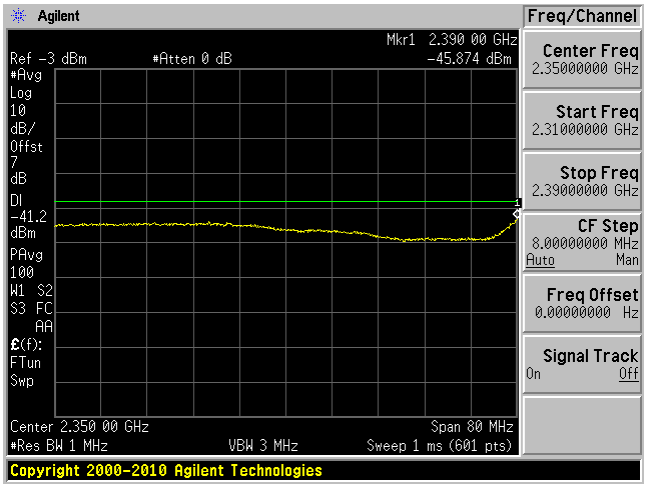
Plot: 3 GHz – 26 GHz



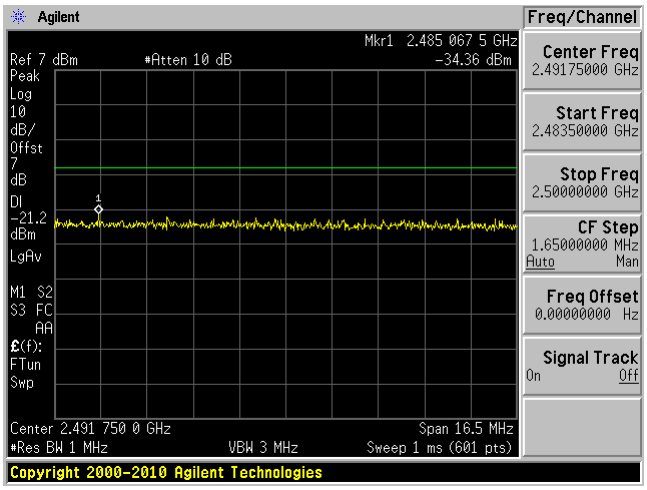
Plot: 2.31 GHz – 2.39 GHz (restrict Band) Peak



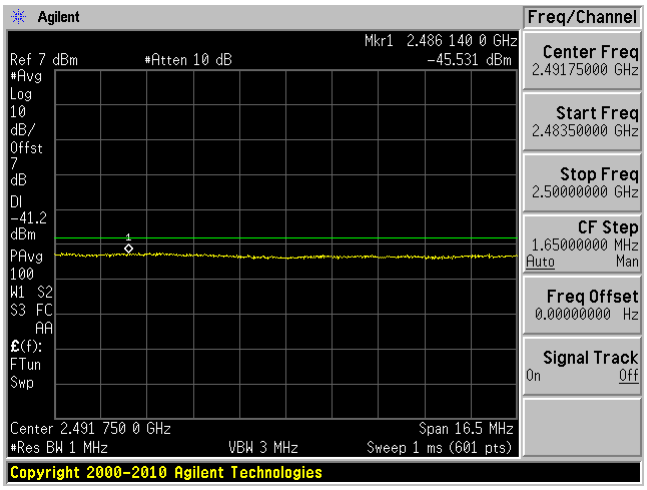
Plot: 2.31 GHz – 2.39 GHz (restrict band) Ave



Plot: 2.4835 GHz – 2.5 GHz (restrict Band)
Peak

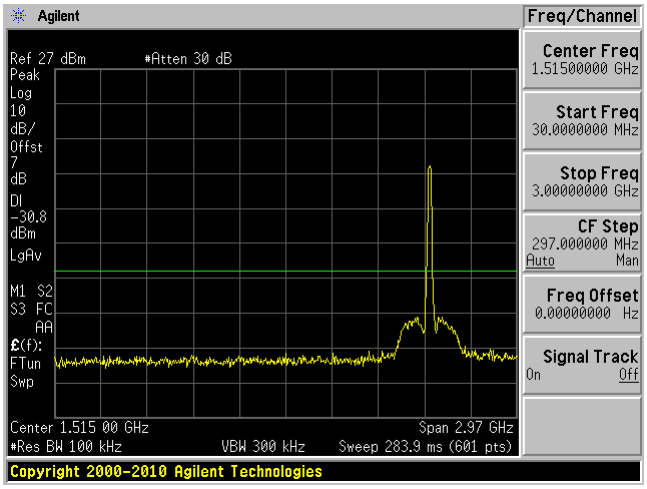


Plot: 2.4835 GHz – 2.5 GHz (restrict band)
Ave

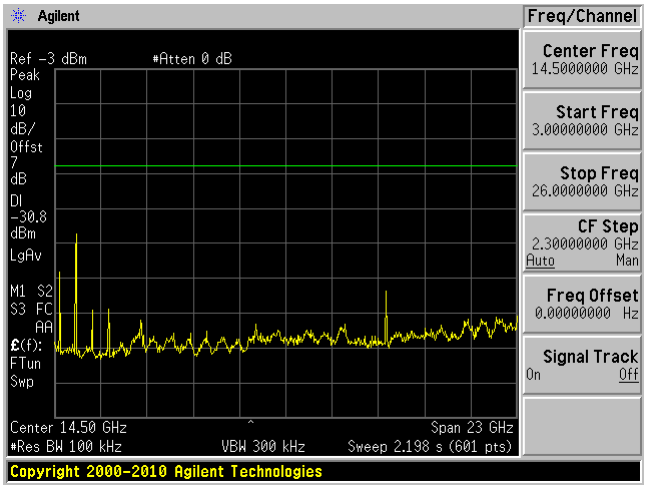


802.11n-HT20, Middle Channel 2437 MHz

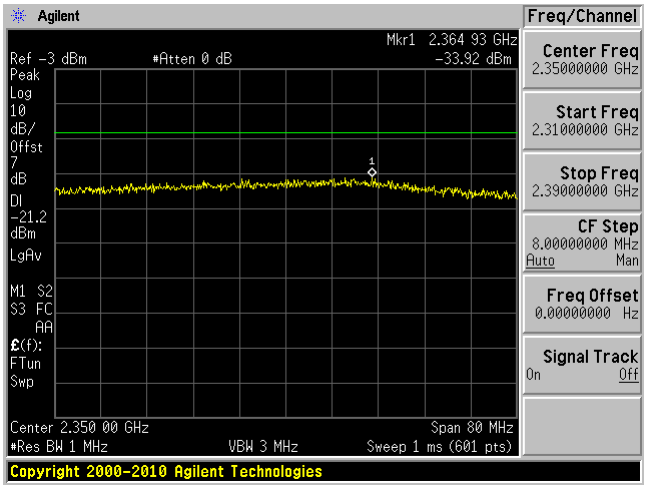
Plot: 30 MHz – 3 GHz



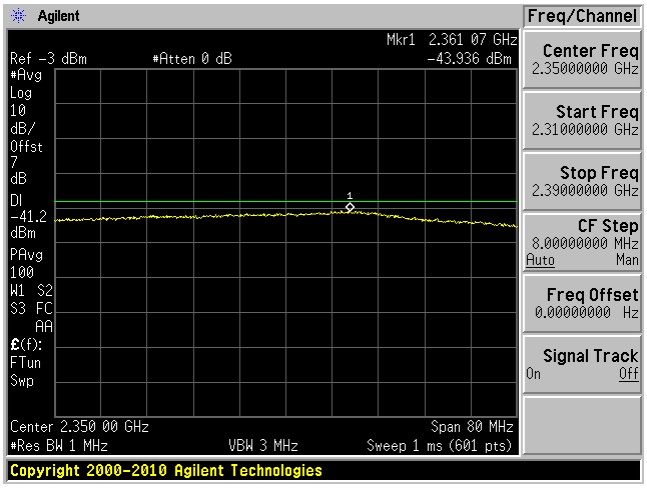
Plot: 3 GHz – 26 GHz



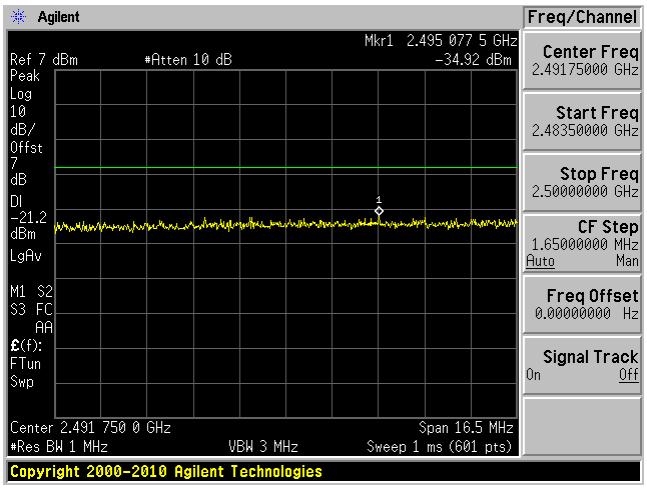
Plot: 2.31 GHz – 2.39 GHz (restrict Band) Peak



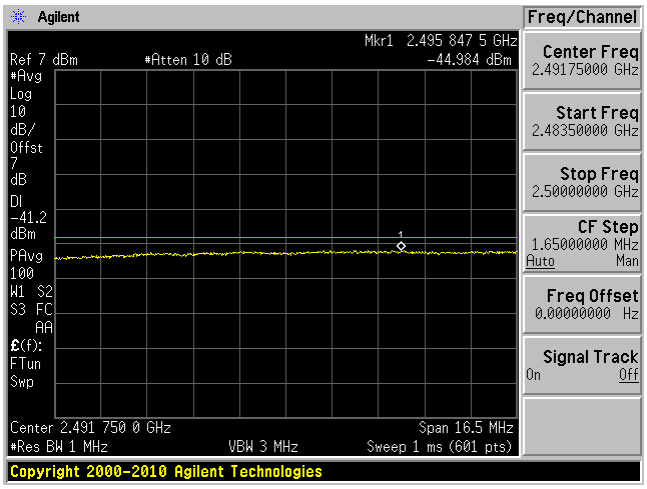
Plot: 2.31 GHz – 2.39 GHz (restrict band) Ave



Plot: 2.4835 GHz – 2.5 GHz (restrict Band)
Peak

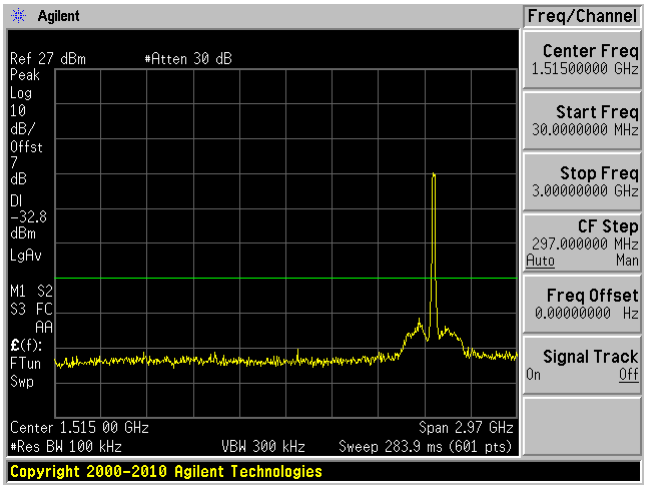


Plot: 2.4835 GHz – 2.5 GHz (restrict band)
Ave

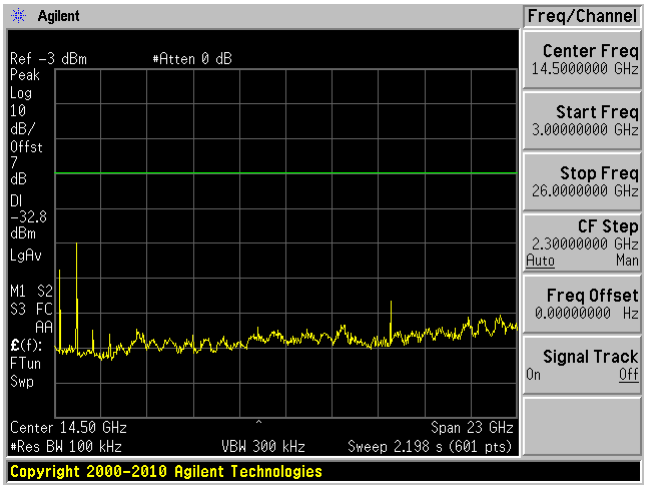


802.11n-HT20, High Channel 2462 MHz

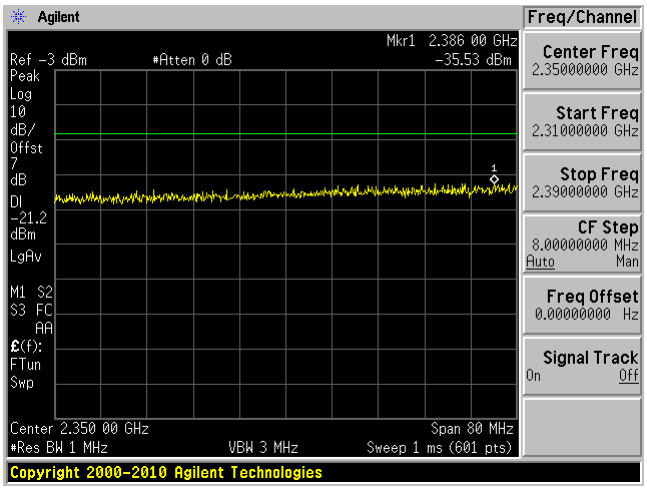
Plot: 30 MHz – 3 GHz



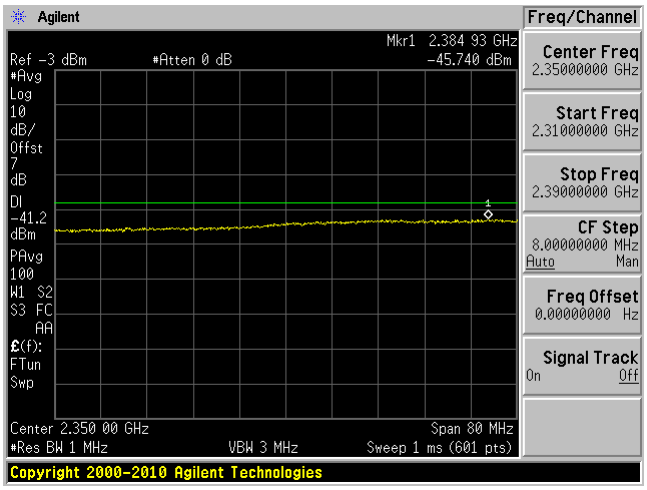
Plot: 3 GHz – 26 GHz



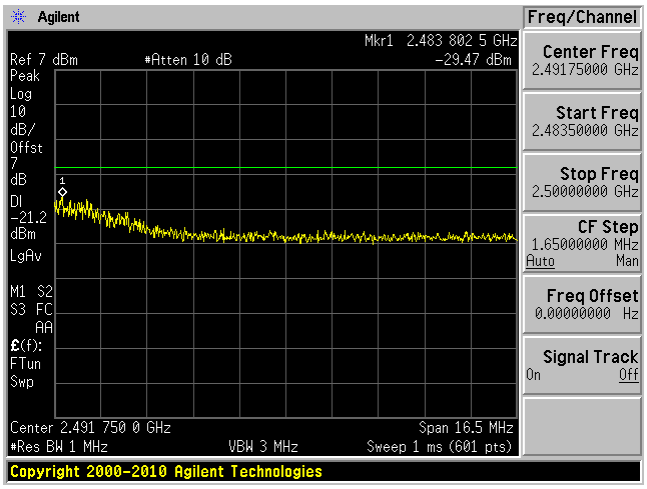
Plot: 2.31 GHz – 2.39 GHz (restrict Band) Peak



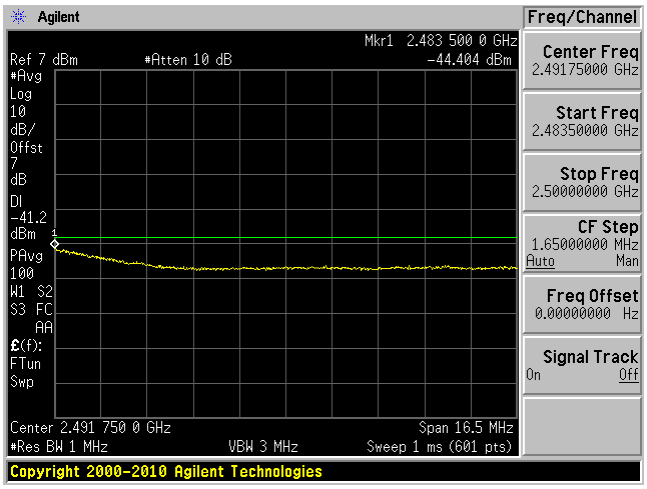
Plot: 2.31 GHz – 2.39 GHz (restrict band) Ave



Plot: 2.4835 GHz – 2.5 GHz (restrict Band)
Peak



Plot: 2.4835 GHz – 2.5 GHz (restrict band)
Ave



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

7.1 Applicable Standards

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

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

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

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

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

MHz	MHz	MHz	GHz
0.090 – 0.110	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 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	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).

7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2009. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 3 centimeters.

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

7.3 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

7.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within 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 - Limit

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2014-09-28	1 year
Agilent	Spectrum Analyzer	E4440A	MY44303352	2014-10-16	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2014-09-18	1 year
EMCO	Horn Antenna	3115	9511-4627	2014-10-17	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2014-08-08	1 year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2014-07-09	1 year

Statement of Traceability: BACL *attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.*

7.6 Test Environmental Conditions

Temperature:	24º C
Relative Humidity:	43 %
ATM Pressure:	102.5 kPa

The testing was performed by Cipher Chu on 2015-05-19 in 5m chamber3.

7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-9.22	37.1135	Horizontal	802.11g mode middle Channel

1 – 25 GHz:

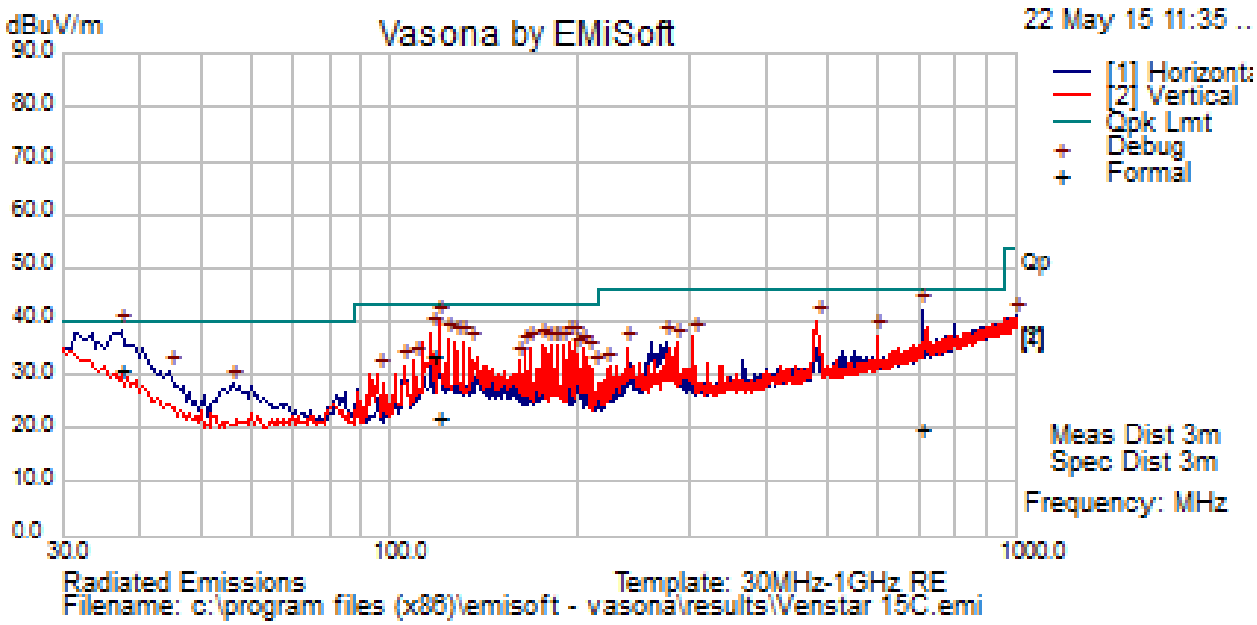
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-5.84	9748	Vertical	802.11b mode middle Channel

Note: Termination method was used.

Please refer to the following table and plots for specific test result details

7.8 Radiated Emissions Test Data and Plots

1) 30 MHz – 1 GHz



802.11g mode, Middle Channel

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
37.1135	30.78	150	H	291	40	-9.22
116.3643	33.83	185	V	150	43.5	-9.67
119.8113	22.32	121	V	337	43.5	-21.18
706.9285	20.04	162	H	121	46	-25.96

2) 1–25 GHz

802.11b Mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel, 2412 MHz											
4824	35.85	0	100	V	37.651	6.14	36.3	43.341	74	-30.659	Peak
4824	35.7	0	100	H	37.651	6.14	36.3	43.191	74	-30.809	Peak
4824	25.83	0	100	V	37.651	6.14	36.3	33.321	54	-20.679	Ave
4824	25.71	0	100	H	37.651	6.14	36.3	33.201	54	-20.799	Ave
7236	34.82	0	100	V	34.568	7.47	34	42.858	74	-31.142	Peak
7236	35.32	0	100	H	34.568	7.47	34	43.358	74	-30.642	Peak
7236	21.25	0	100	V	34.568	7.47	34	29.288	54	-24.712	Ave
7236	21.21	0	100	H	34.568	7.47	34	29.248	54	-24.752	Ave
9648	34.81	0	100	V	49.9	9.28	32.5	61.49	74	-12.51	Peak
9648	34.83	0	100	H	49.9	9.28	32.5	61.51	74	-12.49	Peak
9648	20.6	0	100	V	49.9	9.28	32.5	47.28	54	-6.72	Ave
9648	20.58	0	100	H	49.9	9.28	32.5	47.26	54	-6.74	Ave
Middle Channel, 2437 MHz											
4874	36.77	0	100	V	37.651	6.14	36.3	44.261	74	-29.739	Peak
4874	36.69	0	100	H	37.651	6.14	36.3	44.181	74	-29.819	Peak
4874	26.63	0	100	V	37.651	6.14	36.3	34.121	54	-19.879	Ave
4874	26.54	0	100	H	37.651	6.14	36.3	34.031	54	-19.969	Ave
7311	36.17	0	100	V	34.568	7.47	34	44.208	74	-29.792	Peak
7311	36.28	0	100	H	34.568	7.47	34	44.318	74	-29.682	Peak
7311	22.08	0	100	V	34.568	7.47	34	30.118	54	-23.882	Ave
7311	22.09	0	100	H	34.568	7.47	34	30.128	54	-23.872	Ave
9748	35.65	0	100	V	49.9	9.28	32.5	62.33	74	-11.67	Peak
9748	35.71	0	100	H	49.9	9.28	32.5	62.39	74	-11.61	Peak
9748	21.48	0	100	V	49.9	9.28	32.5	48.16	54	-5.84	Ave
9748	21.47	0	100	H	49.9	9.28	32.5	48.15	54	-5.85	Ave
High Channel, 2462 MHz											
4924	36.58	0	100	V	37.651	6.14	36.3	44.071	74	-29.929	Peak
4924	36.65	0	100	H	37.651	6.14	36.3	44.141	74	-29.859	Peak
4924	26.43	0	100	V	37.651	6.14	36.3	33.921	54	-20.079	Ave
4924	26.62	0	100	H	37.651	6.14	36.3	34.111	54	-19.889	Ave
7386	36.29	0	100	V	34.568	7.47	34	44.328	74	-29.672	Peak
7386	36.22	0	100	H	34.568	7.47	34	44.258	74	-29.742	Peak
7386	22.1	0	100	V	34.568	7.47	34	30.138	54	-23.862	Ave
7386	22.09	0	100	H	34.568	7.47	34	30.128	54	-23.872	Ave
9848	35.65	0	100	V	49.9	9.28	32.5	62.33	74	-11.67	Peak
9848	35.51	0	100	H	49.9	9.28	32.5	62.19	74	-11.81	Peak
9848	21.48	0	100	V	49.9	9.28	32.5	48.16	54	-5.84	Ave
9848	21.47	0	100	H	49.9	9.28	32.5	48.15	54	-5.85	Ave

802.11g Mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel, 2412 MHz											
4824	35.21	0	100	V	37.651	6.14	36.3	42.701	74	-31.299	Peak
4824	35.46	0	100	H	37.651	6.14	36.3	42.951	74	-31.049	Peak
4824	25.83	0	100	V	37.651	6.14	36.3	33.321	54	-20.679	Ave
4824	25.71	0	100	H	37.651	6.14	36.3	33.201	54	-20.799	Ave
7236	35.4	0	100	V	34.568	7.47	34	43.438	74	-30.562	Peak
7236	35.33	0	100	H	34.568	7.47	34	43.368	74	-30.632	Peak
7236	21.16	0	100	V	34.568	7.47	34	29.198	54	-24.802	Ave
7236	21.12	0	100	H	34.568	7.47	34	29.158	54	-24.842	Ave
9648	34.8	0	100	V	49.9	9.28	32.5	61.48	74	-12.52	Peak
9648	34.4	0	100	H	49.9	9.28	32.5	61.08	74	-12.92	Peak
9648	20.49	0	100	V	49.9	9.28	32.5	47.17	54	-6.83	Ave
9648	20.46	0	100	H	49.9	9.28	32.5	47.14	54	-6.86	Ave
Middle Channel, 2437 MHz											
4874	36.07	0	100	V	37.651	6.14	36.3	43.561	74	-30.439	Peak
4874	35.97	0	100	H	37.651	6.14	36.3	43.461	74	-30.539	Peak
4874	26.63	0	100	V	37.651	6.14	36.3	34.121	54	-19.879	Ave
4874	26.54	0	100	H	37.651	6.14	36.3	34.031	54	-19.969	Ave
7311	34.75	0	100	V	34.568	7.47	34	42.788	74	-31.212	Peak
7311	35.71	0	100	H	34.568	7.47	34	43.748	74	-30.252	Peak
7311	21.47	0	100	V	34.568	7.47	34	29.508	54	-24.492	Ave
7311	21.46	0	100	H	34.568	7.47	34	29.498	54	-24.502	Ave
9748	34.99	0	100	V	49.9	9.28	32.5	61.67	74	-12.33	Peak
9748	35.06	0	100	H	49.9	9.28	32.5	61.74	74	-12.26	Peak
9748	20.84	0	100	V	49.9	9.28	32.5	47.52	54	-6.48	Ave
9748	20.82	0	100	H	49.9	9.28	32.5	47.5	54	-6.5	Ave
High Channel, 2462 MHz											
4924	36.29	0	100	V	37.651	6.14	36.3	43.781	74	-30.219	Peak
4924	36.06	0	100	H	37.651	6.14	36.3	43.551	74	-30.449	Peak
4924	26.43	0	100	V	37.651	6.14	36.3	33.921	54	-20.079	Ave
4924	26.62	0	100	H	37.651	6.14	36.3	34.111	54	-19.889	Ave
7386	34.88	0	100	V	34.568	7.47	34	42.918	74	-31.082	Peak
7386	35.74	0	100	H	34.568	7.47	34	43.778	74	-30.222	Peak
7386	21.54	0	100	V	34.568	7.47	34	29.578	54	-24.422	Ave
7386	21.58	0	100	H	34.568	7.47	34	29.618	54	-24.382	Ave
9848	35.1	0	100	V	49.9	9.28	32.5	61.78	74	-12.22	Peak
9848	35.17	0	100	H	49.9	9.28	32.5	61.85	74	-12.15	Peak
9848	20.95	0	100	V	49.9	9.28	32.5	47.63	54	-6.37	Ave
9848	20.93	0	100	H	49.9	9.28	32.5	47.61	54	-6.39	Ave

802.11n-HT20 Mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel, 2412 MHz											
4824	35.85	0	100	V	37.651	6.14	36.3	43.341	74	-30.659	Peak
4824	35.83	0	100	H	37.651	6.14	36.3	43.321	74	-30.679	Peak
4824	25.83	0	100	V	37.651	6.14	36.3	33.321	54	-20.679	Ave
4824	25.71	0	100	H	37.651	6.14	36.3	33.201	54	-20.799	Ave
7236	35.35	0	100	V	34.568	7.47	34	43.388	74	-30.612	Peak
7236	35.33	0	100	H	34.568	7.47	34	43.368	74	-30.632	Peak
7236	21.28	0	100	V	34.568	7.47	34	29.318	54	-24.682	Ave
7236	21.27	0	100	H	34.568	7.47	34	29.308	54	-24.692	Ave
9648	34.93	0	100	V	49.9	9.28	32.5	61.61	74	-12.39	Peak
9648	34.61	0	100	H	49.9	9.28	32.5	61.29	74	-12.71	Peak
9648	20.71	0	100	V	49.9	9.28	32.5	47.39	54	-6.61	Ave
9648	20.7	0	100	H	49.9	9.28	32.5	47.38	54	-6.62	Ave
Middle Channel, 2437 MHz											
4874	36.48	0	100	V	37.651	6.14	36.3	43.971	74	-30.029	Peak
4874	36.12	0	100	H	37.651	6.14	36.3	43.611	74	-30.389	Peak
4874	26.43	0	100	V	37.651	6.14	36.3	33.921	54	-20.079	Ave
4874	26.62	0	100	H	37.651	6.14	36.3	34.111	54	-19.889	Ave
7311	35.92	0	100	V	34.568	7.47	34	43.958	74	-30.042	Peak
7311	35.83	0	100	H	34.568	7.47	34	43.868	74	-30.132	Peak
7311	21.69	0	100	V	34.568	7.47	34	29.728	54	-24.272	Ave
7311	21.67	0	100	H	34.568	7.47	34	29.708	54	-24.292	Ave
9748	35.3	0	100	V	49.9	9.28	32.5	61.98	74	-12.02	Peak
9748	34.98	0	100	H	49.9	9.28	32.5	61.66	74	-12.34	Peak
9748	21.08	0	100	V	49.9	9.28	32.5	47.76	54	-6.24	Ave
9748	21.07	0	100	H	49.9	9.28	32.5	47.75	54	-6.25	Ave
High Channel, 2462 MHz											
4924	36.37	0	100	V	37.651	6.14	36.3	43.861	74	-30.139	Peak
4924	36.45	0	100	H	37.651	6.14	36.3	43.941	74	-30.059	Peak
4924	26.12	0	100	V	37.651	6.14	36.3	33.611	54	-20.389	Ave
4924	26.67	0	100	H	37.651	6.14	36.3	34.161	54	-19.839	Ave
7386	35.88	0	100	V	34.568	7.47	34	43.918	74	-30.082	Peak
7386	35.3	0	100	H	34.568	7.47	34	43.338	74	-30.662	Peak
7386	21.59	0	100	V	34.568	7.47	34	29.628	54	-24.372	Ave
7386	21.16	0	100	H	34.568	7.47	34	29.198	54	-24.802	Ave
9848	35.6	0	100	V	49.9	9.28	32.5	62.28	74	-11.72	Peak
9848	34.58	0	100	H	49.9	9.28	32.5	61.26	74	-12.74	Peak
9848	21.11	0	100	V	49.9	9.28	32.5	47.79	54	-6.21	Ave
9848	21.24	0	100	H	49.9	9.28	32.5	47.92	54	-6.08	Ave

8 FCC §15.247(a)(2) - 6 dB & 99% Emission Bandwidth

8.1 Applicable Standards

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

8.2 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.

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2014-09-29	1 year

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

8.4 Test Environmental Conditions

Temperature:	24º C
Relative Humidity:	43 %
ATM Pressure:	102.5 kPa

The testing was performed by Cipher Chu on 2015-05-19 at RF site.

8.5 Test Results

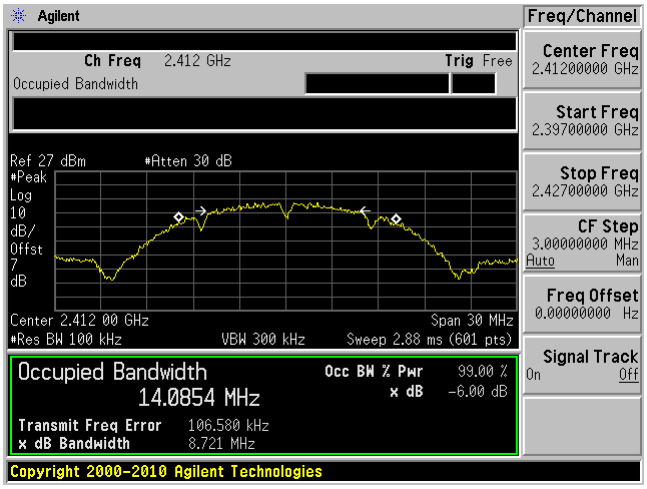
802.11 b mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	6 dB OBW Limit (MHz)	Results
802.11b Mode					
Low	2412	8.721	14.0854	> 0.5	Compliant
Middle	2437	9.041	14.3027	> 0.5	Compliant
High	2462	8.581	14.0356	> 0.5	Compliant
802.11g Mode					
Low	2412	15.777	16.3263	> 0.5	Compliant
Middle	2437	14.614	17.1438	> 0.5	Compliant
High	2462	12.922	16.2926	> 0.5	Compliant
802.11n-HT20 Mode					
Low	2412	15.108	17.4309	> 0.5	Compliant
Middle	2437	15.117	17.598	> 0.5	Compliant
High	2462	15.166	17.4457	> 0.5	Compliant

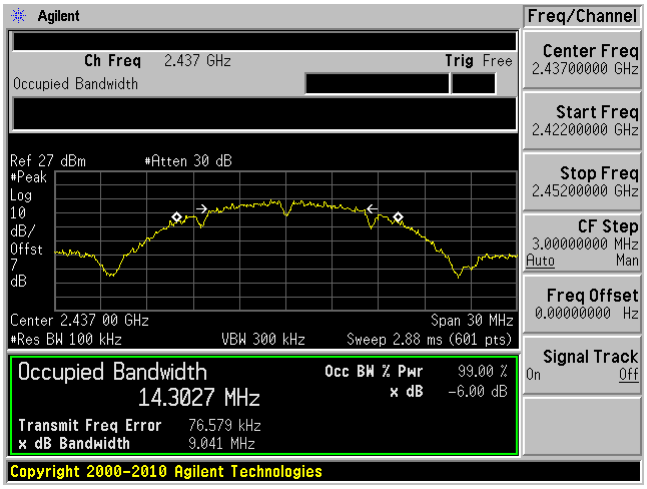
Please refer to the following plots for detailed test results

802.11b mode

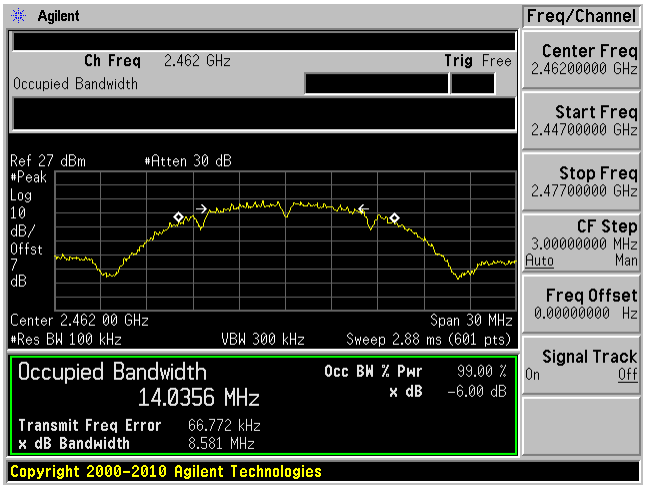
Low channel: 2412 MHz



Middle channel: 2437 MHz

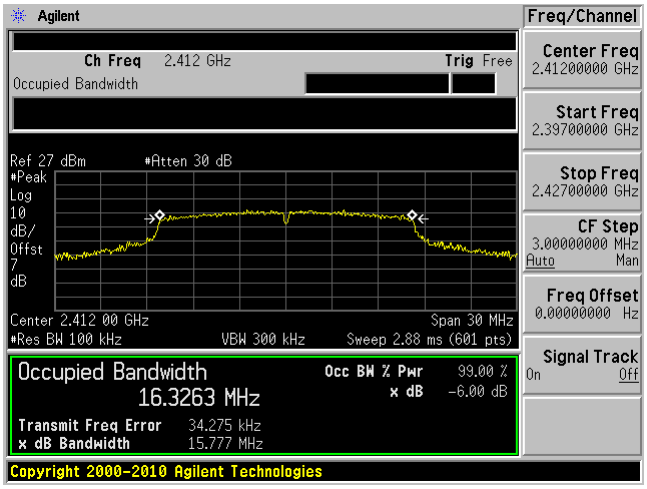


High channel: 2462 MHz

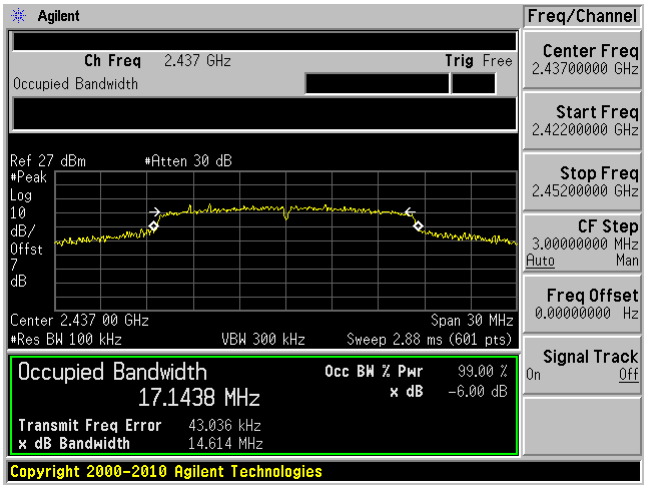


802.11g mode

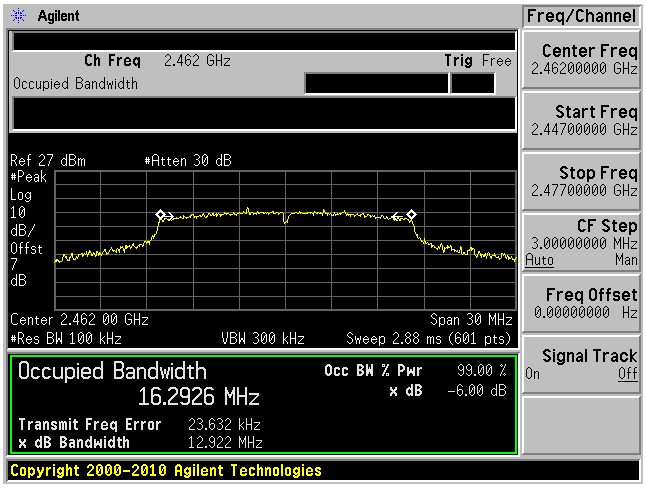
Low channel: 2412 MHz



Middle channel: 2437 MHz

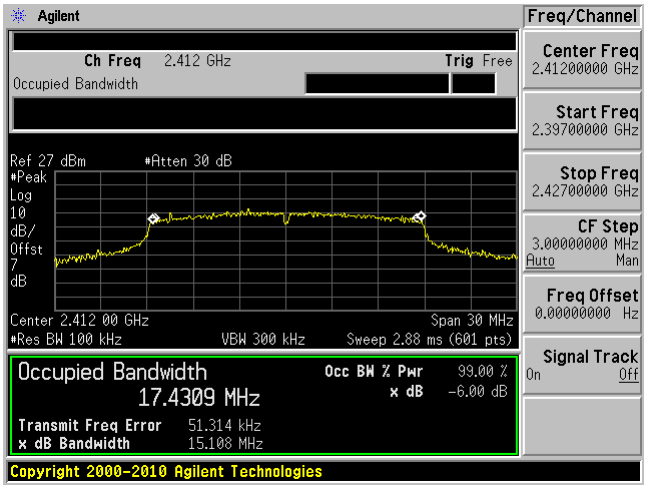


High channel: 2462 MHz

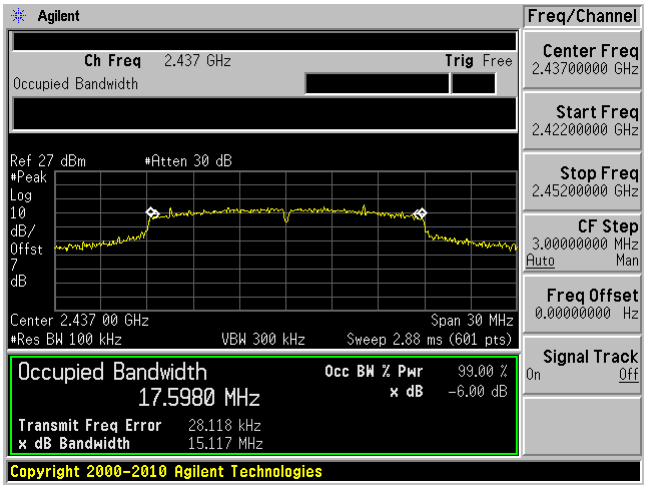


802.11n-HT20 mode

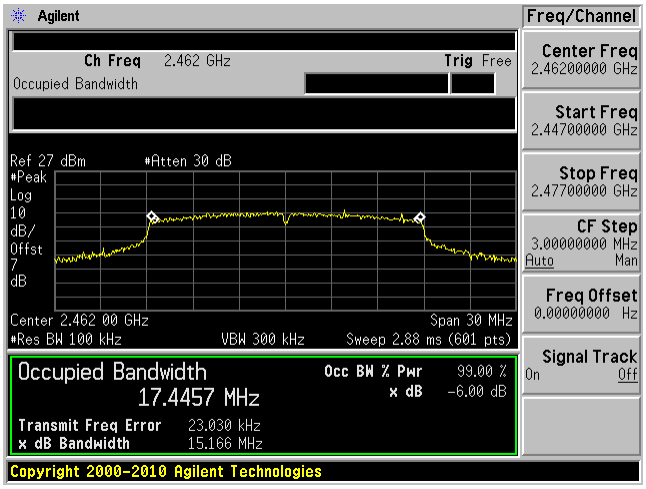
Low channel: 2412 MHz



Middle channel: 2437 MHz



High channel: 2462 MHz



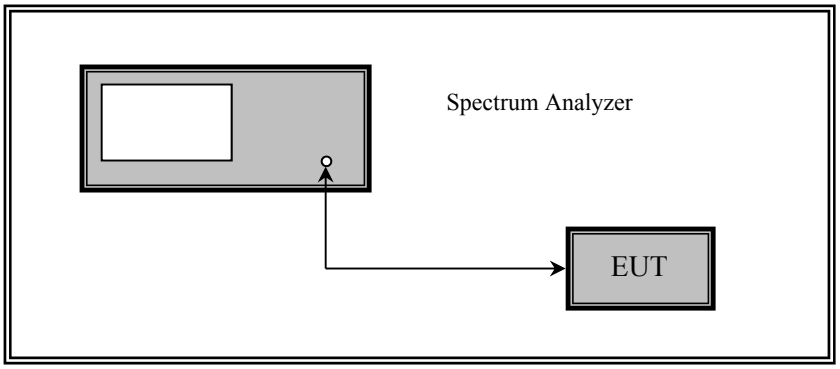
9 FCC §15.247(b) - Peak Output Power Measurement

9.1 Applicable Standards

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

9.2 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.



9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2014-09-29	1 year

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

9.4 Test Environmental Conditions

Temperature:	24º C
Relative Humidity:	43 %
ATM Pressure:	102.5 kPa

The testing was performed by Cipher Chu on 2015-05-19 at RF site.

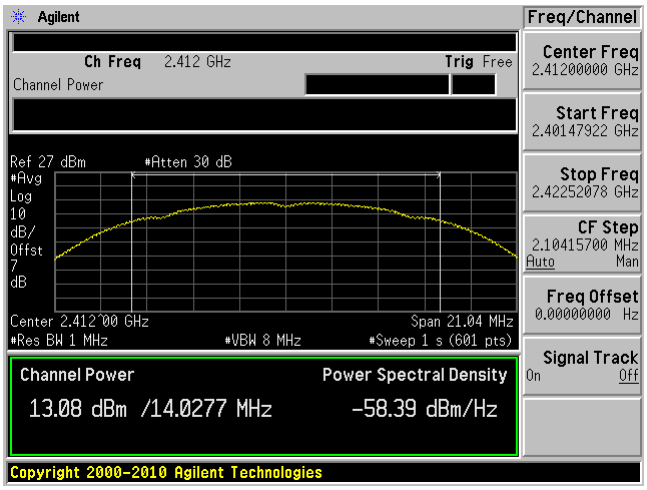
9.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power		Limit (dBm)	Results
		(dBm)	(mW)		
802.11b Mode					
Low	2412	13.08	20.32	30	Compliant
Middle	2437	14.25	26.61	30	Compliant
High	2462	13.52	22.49	30	Compliant
802.11g Mode					
Low	2412	11.62	14.52	30	Compliant
Middle	2437	14.68	29.38	30	Compliant
High	2462	11	12.59	30	Compliant
802.11n-HT20 Mode					
Low	2412	10.85	12.16	30	Compliant
Middle	2437	13.52	22.49	30	Compliant
High	2462	10.74	11.86	30	Compliant

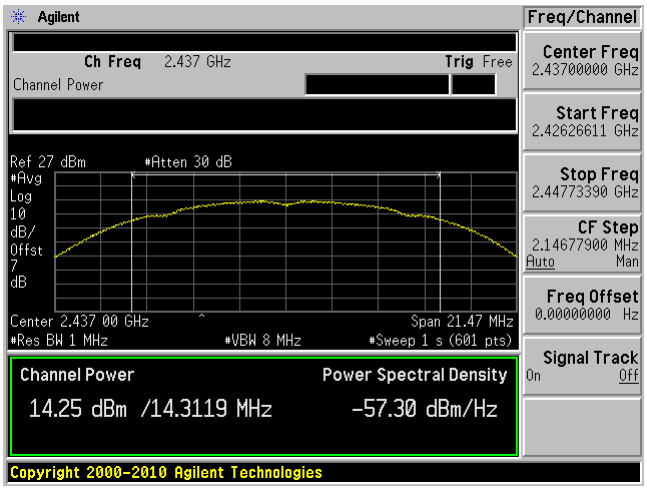
Please refer to the following plots for detailed test results

802.11b mode

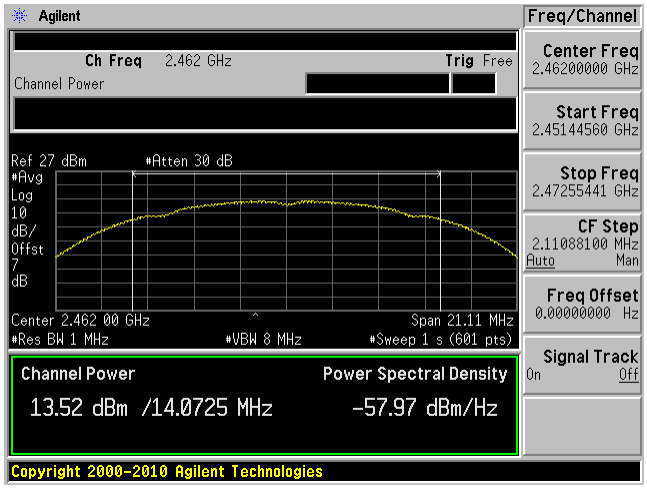
Low channel: 2412 MHz



Middle channel: 2437 MHz

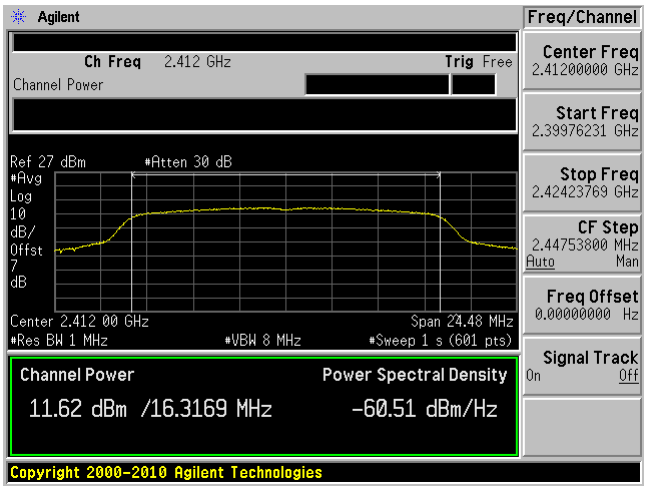


High channel: 2462 MHz

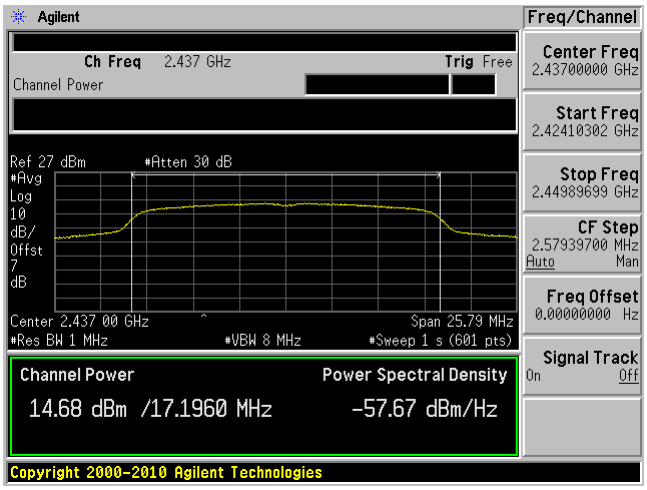


802.11g mode

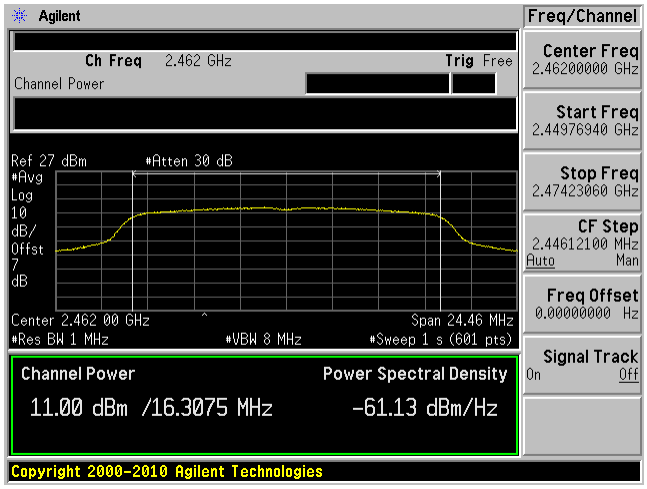
Low channel: 2412 MHz



Middle channel: 2437 MHz

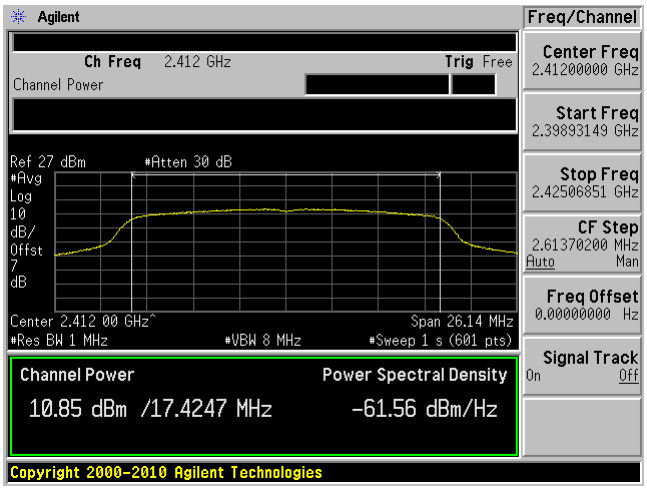


High channel: 2462 MHz

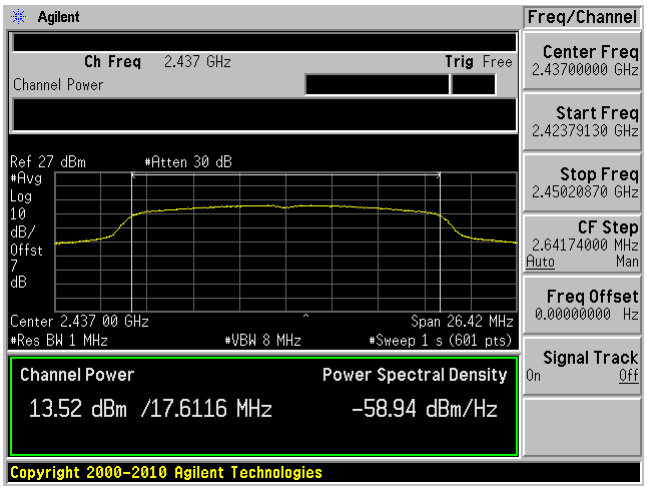


802.11n-HT20 mode

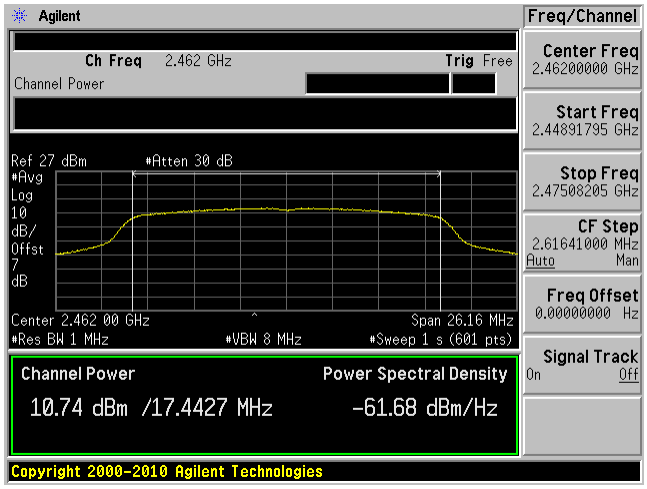
Low channel: 2412 MHz



Middle channel: 2437 MHz



High channel: 2462 MHz



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

10.1 Applicable Standards

According to FCC §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).

10.2 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.

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2014-09-29	1 year

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

10.4 Test Environmental Conditions

Temperature:	24º C
Relative Humidity:	43 %
ATM Pressure:	102.5 kPa

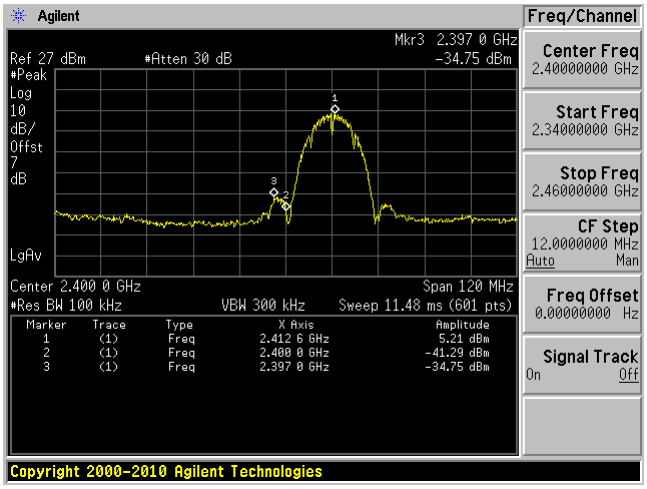
The testing was performed by Cipher Chu on 2015-05-19 at RF site.

10.5 Test Results

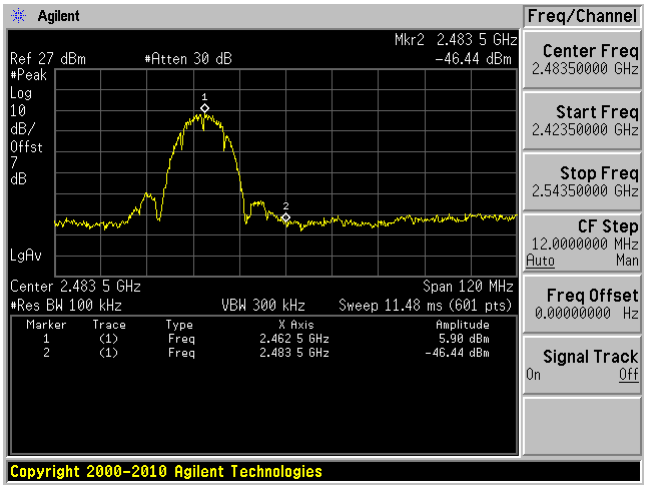
Please refer to following pages for plots of band edge.

802.11b mode

802.11b, Low Band Edge

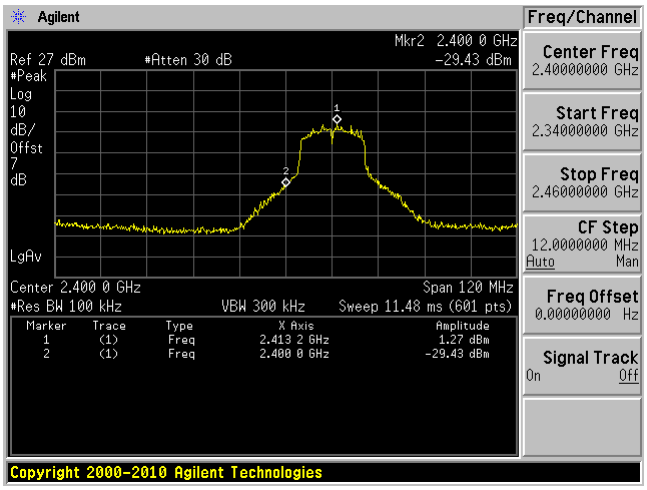


802.11b, High Band Edge

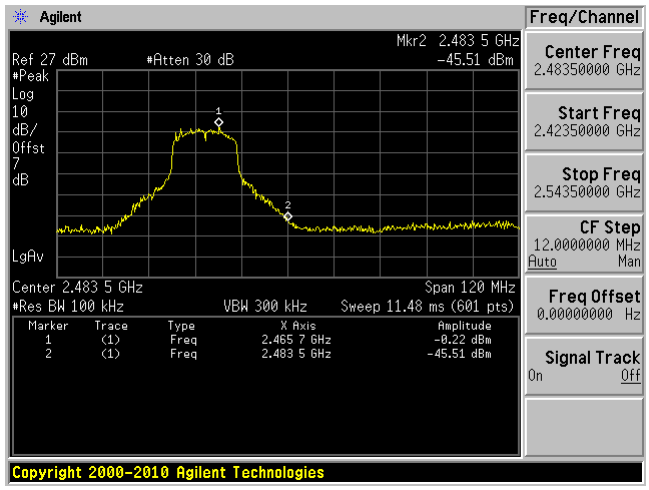


802.11g mode

802.11g, Low Band Edge

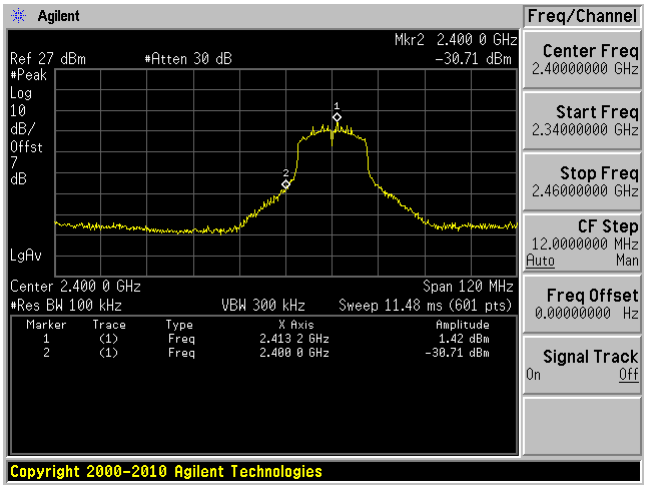


802.11g, High Band Edge

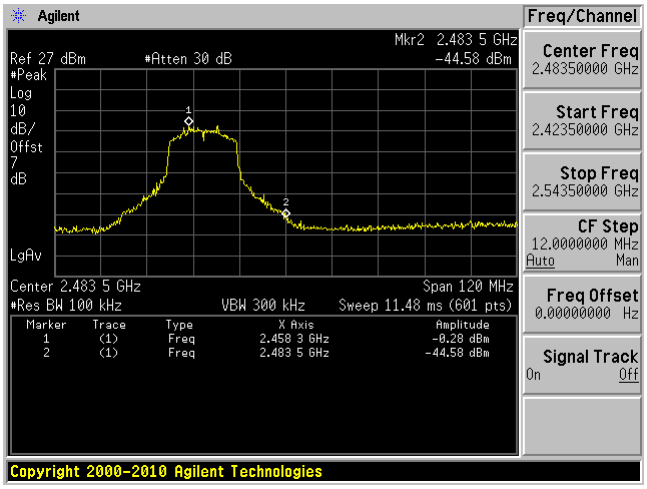


802.11n-HT20 mode

802.11n-HT20, Low Band Edge



802.11n-HT20, High Band Edge



11 FCC §15.247(e) - Power Spectral Density

11.1 Applicable Standards

According to FCC §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.

11.2 Measurement Procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2014-09-29	1 year

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

11.4 Test Environmental Conditions

Temperature:	24º C
Relative Humidity:	43 %
ATM Pressure:	102.5 kPa

The testing was performed by Cipher Chu on 2015-05-19 at RF site.

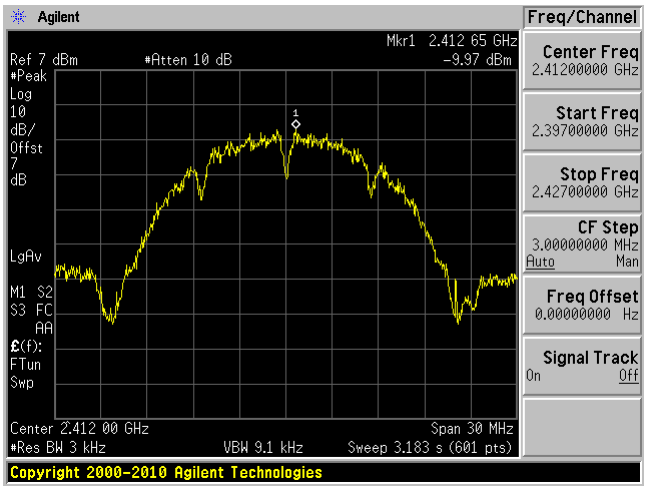
11.5 Test Results

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Results
802.11b Mode				
Low	2412	-9.97	8	Compliant
Middle	2437	-9.07	8	Compliant
High	2462	-9.88	8	Compliant
802.11g Mode				
Low	2412	-14.6	8	Compliant
Middle	2437	-11.73	8	Compliant
High	2462	-15.66	8	Compliant
802.11n-HT20 Mode				
Low	2412	-15.95	8	Compliant
Middle	2437	-12.7	8	Compliant
High	2462	-16.03	8	Compliant

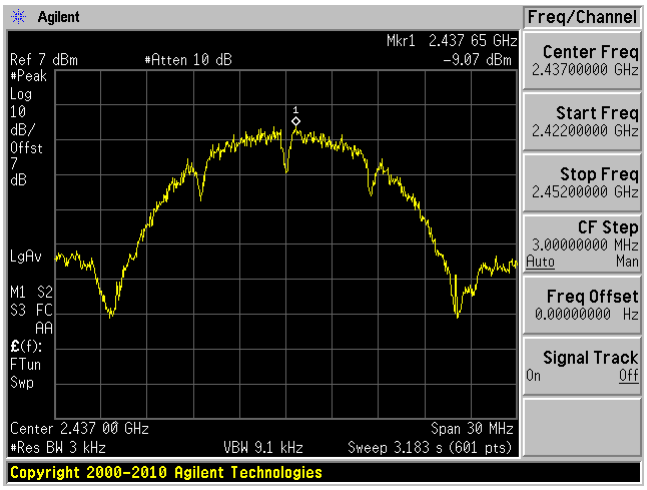
Please refer to the following plots for detailed test results

802.11b mode

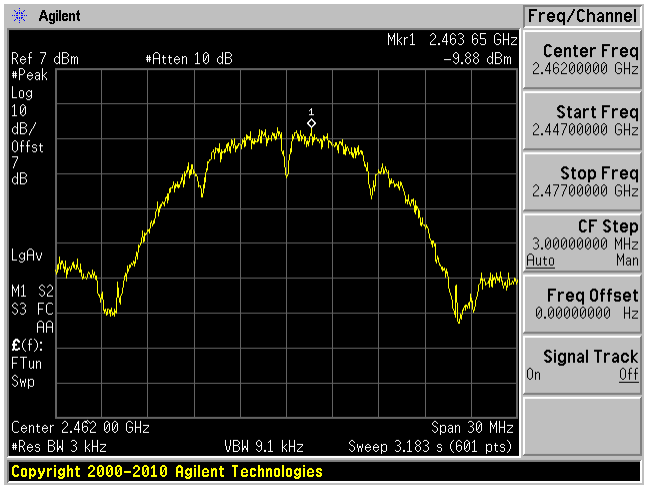
Low channel: 2412 MHz



Middle channel: 2437 MHz

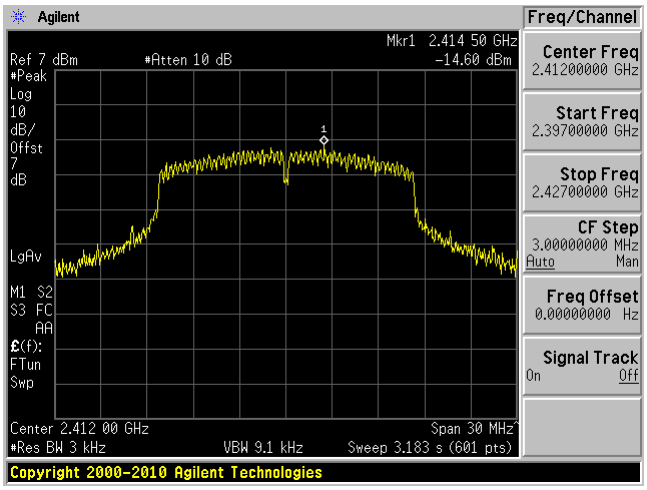


High channel: 2462 MHz

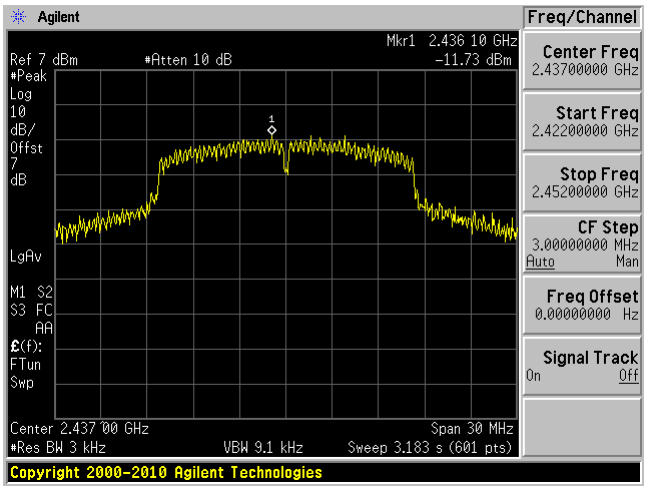


802.11g mode

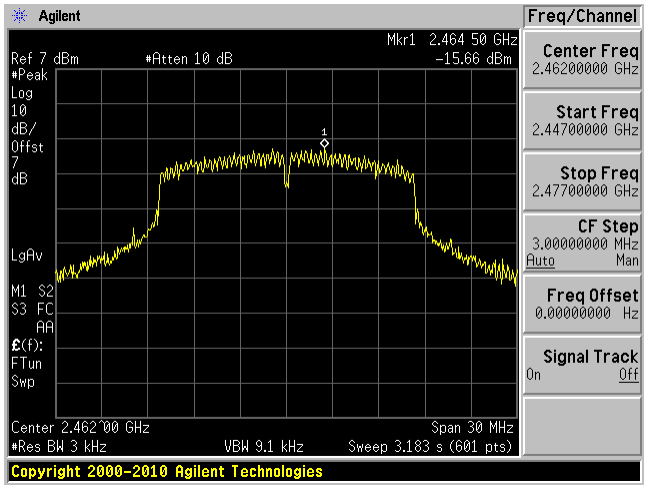
Low channel: 2412 MHz



Middle channel: 2437 MHz

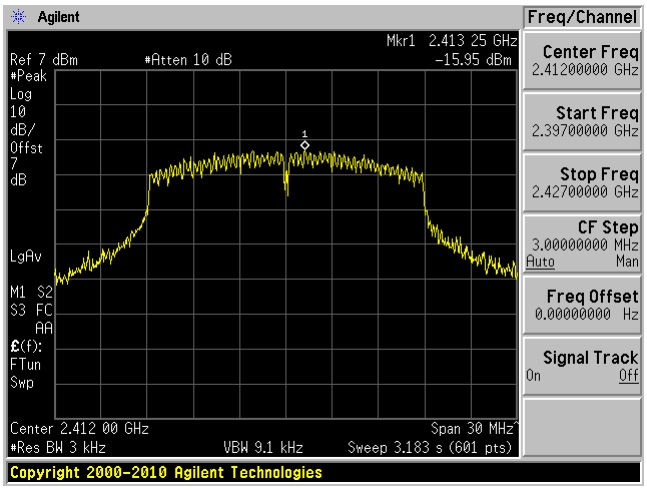


High channel: 2462 MHz

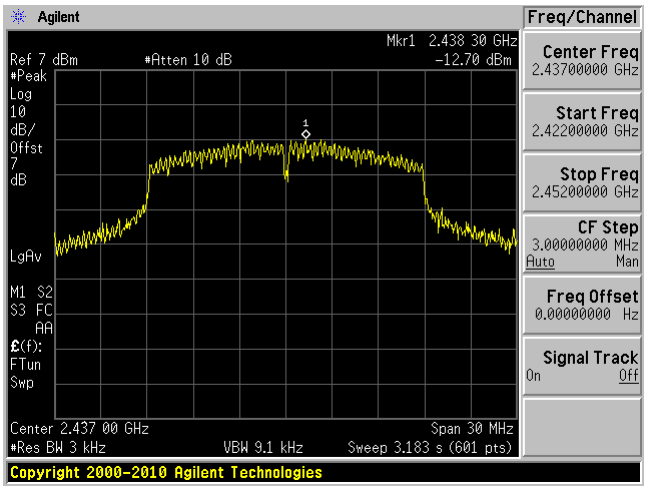


802.11n-HT20 mode

Low channel: 2412 MHz



Middle channel: 2437 MHz



High channel: 2462 MHz