FCC PART 15, SUBPART C

TEST AND MEASUREMENT REPORT

For

GoPro, Inc.

3000 Clearview Way, San Mateo, CA 94402, USA

FCC ID: CNFHWHM1

Report Type:	**Product Type:**
Original Report	Action Sports Camera

Prepared By:	Todd Moy Test Engineer
Report Number:	R1506014-247
Report Date:	2015-07-22
Reviewed By:	Simon Ma RF Lead

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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by A2LA*, NIST, or any agency of the Federal Government.
* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*"

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1506014-247	Initial	2015-07-22

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report has been compiled on behalf of *GoPro Inc*., and their product, *FCC ID: CNFHWHM1*, model number: *HWHM1*, which henceforth is referred to as the EUT (Equipment Under Test.) The EUT is an action sports camera with 2.4 GHz 802.11b/g/n and BLE capability.

1.2 Mechanical Description of EUT

The EUT measures approximately 8 cm (L) x 5.6 cm (W) x 3.6 cm (H) and weighs 0.05 kg.

The data gathered are from a production sample provided by the manufacturer, serial number: R1506014-01, assigned by BACL.

1.3 Objective

This report is prepared on behalf of *GoPro, 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 rules for Output Power, 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)

R1506014-FCC SAR

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 and FCC KDB 558074 D01 DTS Meas Guidance v03r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

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 Luminares 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 and FCC KDB 558074 D01 DTS Meas Guidance v03r02.

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 test utility used was *Tera Term*, provided by *GoPro, Inc.*, and was verified by Todd Moy to comply with the standard requirements being tested against.

2.3 Equipment Modifications

A SMA wire was attached to the output signal before the antenna of the EUT to perform conducted measurements.

2.4 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Lenovo	Laptop	0679	CB08585694

2.5 EUT Internal Configuration Details

Manufacturer	Description	Model/Rev.	Serial Number
GoPro	USB/SD Card Board	HD4-CB-03	4000942
GoPro	Li-ON Battery 3.8VDC	601-09135-000	CHDAB-101
GoPro	Mother Board	-	4000926

2.6 Power Supply and Line Filters

Manufacturer	Description	Model	Part Number
GoPro	AC/DC Adapter	AWALC-001(TSC-5D)	WALCD0213019965

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	1 m	EUT	Laptop
RF Cable	< 1 m	PSA	EUT

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§15.247(i), §2.1093	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

*: please refer to SAR report R1506014-FCC SAR

4 FCC §15.247(i) & §2.1093 - RF Exposure

4.1 Applicable Standards

FCC §2.1093, §15.247(i)

4.2 Test Result

Compliance, please refer to the SAR report: R1506014-FCC SAR.

5 FCC §15.203 - Antenna Requirements

5.1 Applicable Standards

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 FCC §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 Description

Antenna Type	Maximum Antenna Gain (dBi) @ 2.4 GHz
Internal PCB	2.6

6 FCC §15.207 - AC Line Conducted Emissions

6.1 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.

6.2 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.

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

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

6.3 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”.

6.4 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:

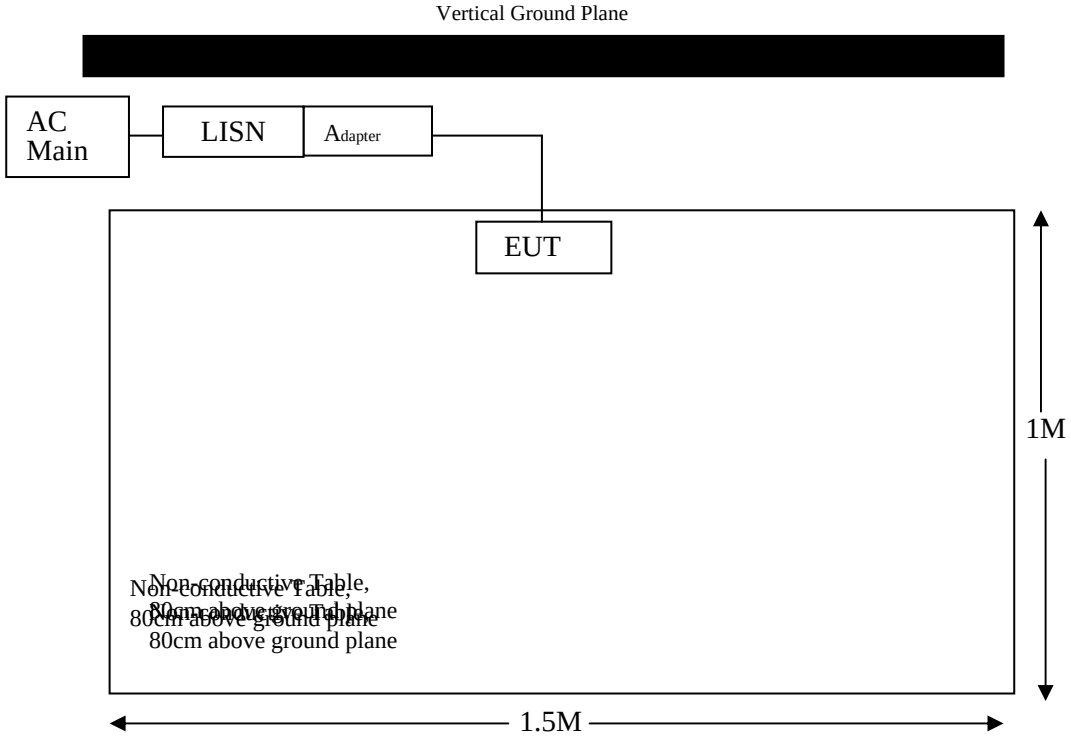
CA = Ai + CL + Atten

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

6.5 Test Setup Block Diagram



6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	9/28/2014	1 year
Solar Electronics	LISN	9252-50-R-24-N	511205	6/25/2014	1 year
Keysight Technologies	RF Limiter	11867A	MY42242931	12/17/2014	1year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	3/06/2015	1 Year

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

6.7 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	56 %
ATM Pressure:	101.2 kPa

The testing was performed by Todd Moy on 2015-06-11 in 5m chamber3.

6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15C standard's conducted emissions limits, with the margin reading of:

2.4 GHz Wi-Fi:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-9.95	0.481562	Neutral	0.15-30

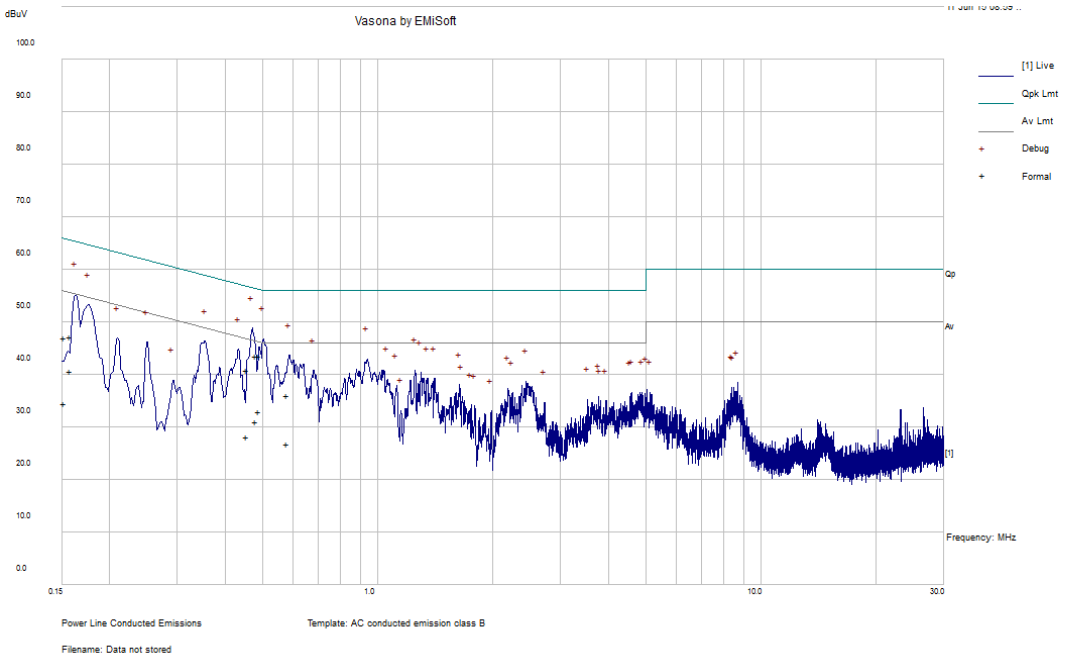
2.4 GHz BLE:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-14.4	0.5051	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

2.4 GHz Wi-Fi:

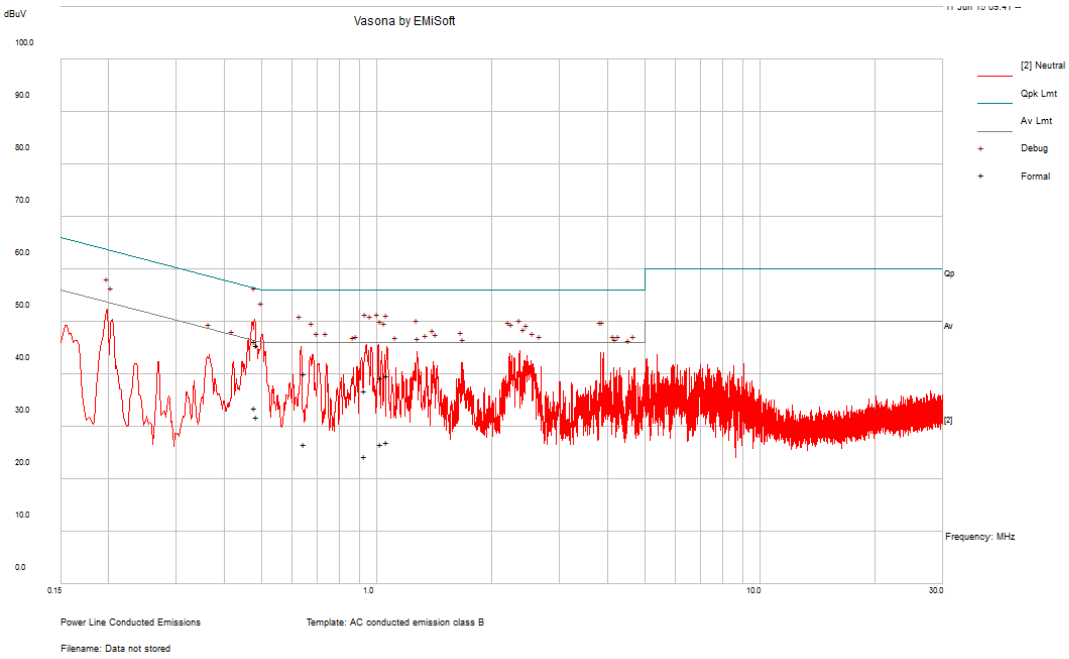
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.48175	43.57	Line	56.31	-12.74	QP
0.489408	43.51	Line	56.18	-12.67	QP
0.152143	47.01	Line	65.88	-18.87	QP
0.455956	40.93	Line	56.77	-15.83	QP
0.580111	36.02	Line	56	-19.98	QP
0.157382	47.21	Line	65.6	-18.39	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.48175	31.01	Line	46.31	-15.3	Ave
0.489408	33.06	Line	46.18	-13.12	Ave
0.152143	34.6	Line	55.88	-21.28	Ave
0.455956	28.22	Line	46.77	-18.55	Ave
0.580111	26.83	Line	46	-19.17	Ave
0.157382	40.73	Line	55.6	-14.88	Ave

120 V, 60 Hz – Neutral

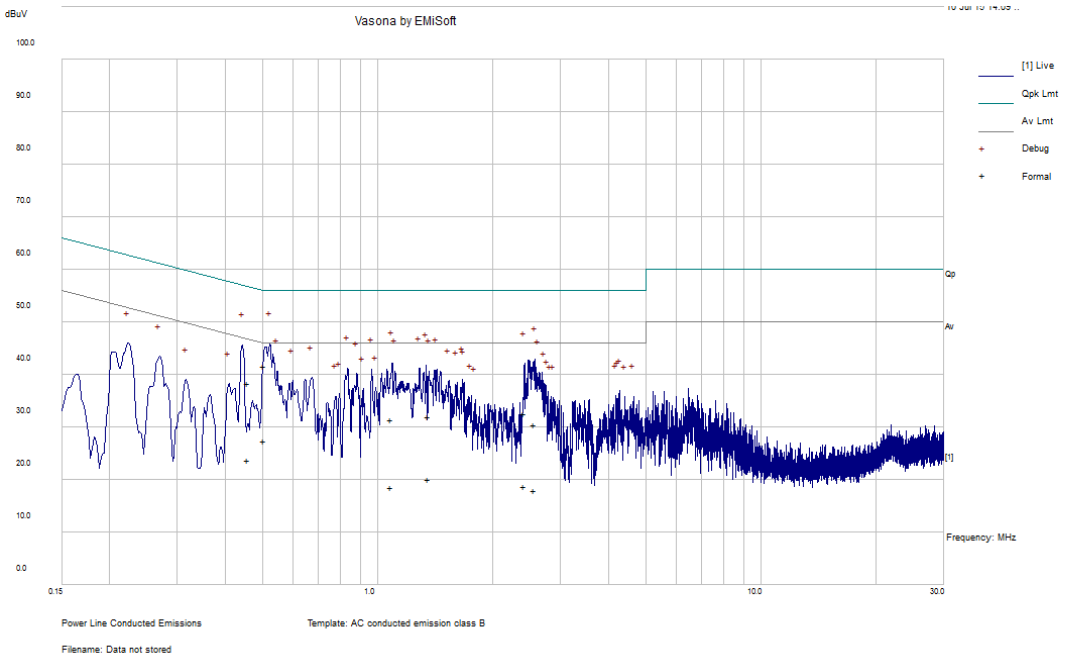


Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.481562	46.37	Neutral	56.31	-9.95	QP
0.487538	45.5	Neutral	56.21	-10.71	QP
0.930611	36.91	Neutral	56	-19.09	QP
1.027114	39.32	Neutral	56	-16.68	QP
1.065229	39.73	Neutral	56	-16.27	QP
0.648627	40.1	Neutral	56	-15.9	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.481562	33.59	Neutral	46.31	-12.72	Ave
0.487538	31.83	Neutral	46.21	-14.38	Ave
0.930611	24.37	Neutral	46	-21.63	Ave
1.027114	26.58	Neutral	46	-19.42	Ave
1.065229	26.96	Neutral	46	-19.04	Ave
0.648627	26.59	Neutral	46	-19.41	Ave

2.4 GHz BLE:

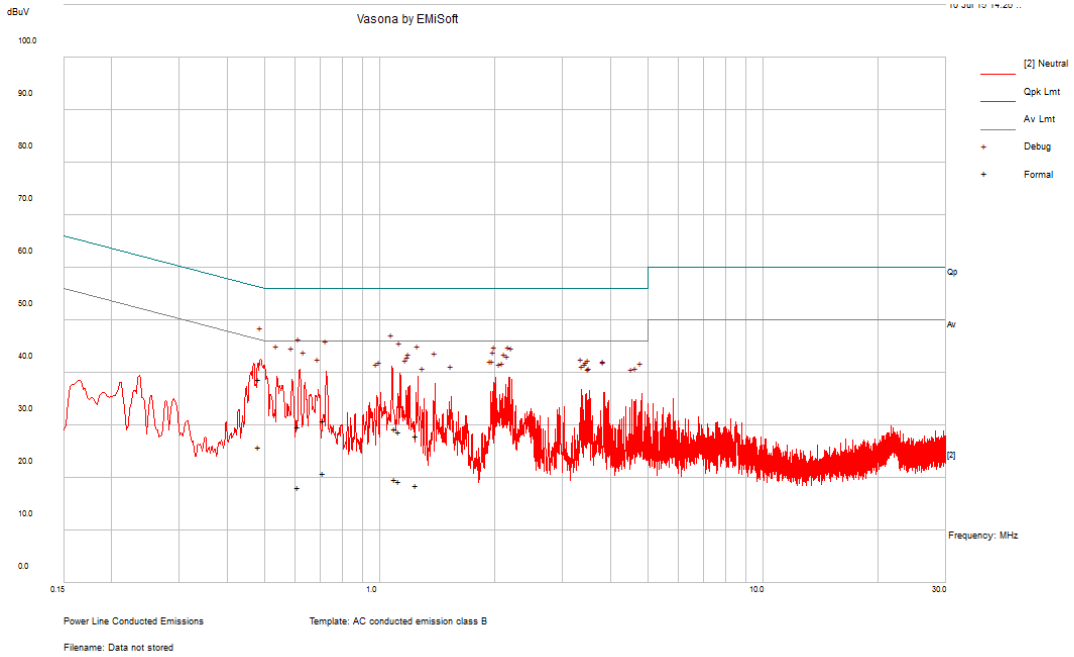
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.5051	41.6	Line	56	-14.4	QP
0.459401	38.49	Line	56.7	-18.22	QP
2.560259	30.47	Line	56	-25.53	QP
1.084902	31.4	Line	56	-24.6	QP
2.410541	32.58	Line	56	-23.42	QP
1.354434	31.97	Line	56	-24.03	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.5051	27.39	Line	46	-18.61	Ave.
0.459401	23.88	Line	46.7	-22.82	Ave.
2.560259	18.03	Line	46	-27.97	Ave.
1.084902	18.66	Line	46	-27.34	Ave.
2.410541	18.8	Line	46	-27.2	Ave.
1.354434	20.06	Line	46	-25.94	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.483023	38.86	Neutral	56.29	-17.43	QP
1.094596	29.36	Neutral	56	-26.64	QP
0.611419	29.66	Neutral	56	-26.34	QP
0.71264	30.97	Neutral	56	-25.03	QP
1.122631	28.74	Neutral	56	-27.26	QP
1.243455	28.08	Neutral	56	-27.92	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.483023	25.87	Neutral	46.29	-20.42	Ave.
1.094596	19.8	Neutral	46	-26.2	Ave.
0.611419	18.23	Neutral	46	-27.77	Ave.
0.71264	20.87	Neutral	46	-25.13	Ave.
1.122631	19.39	Neutral	46	-26.61	Ave.
1.243455	18.68	Neutral	46	-27.32	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 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

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 10 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
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2015-03-09	2year
HP/ Agilant	Pre-amplifier	8449B OPT HO2	3008A0113	2015-05-19	1year
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2014-08-08	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:	22-24º C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Todd Moy on 2015-06-10 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 MHz – 25 GHz:

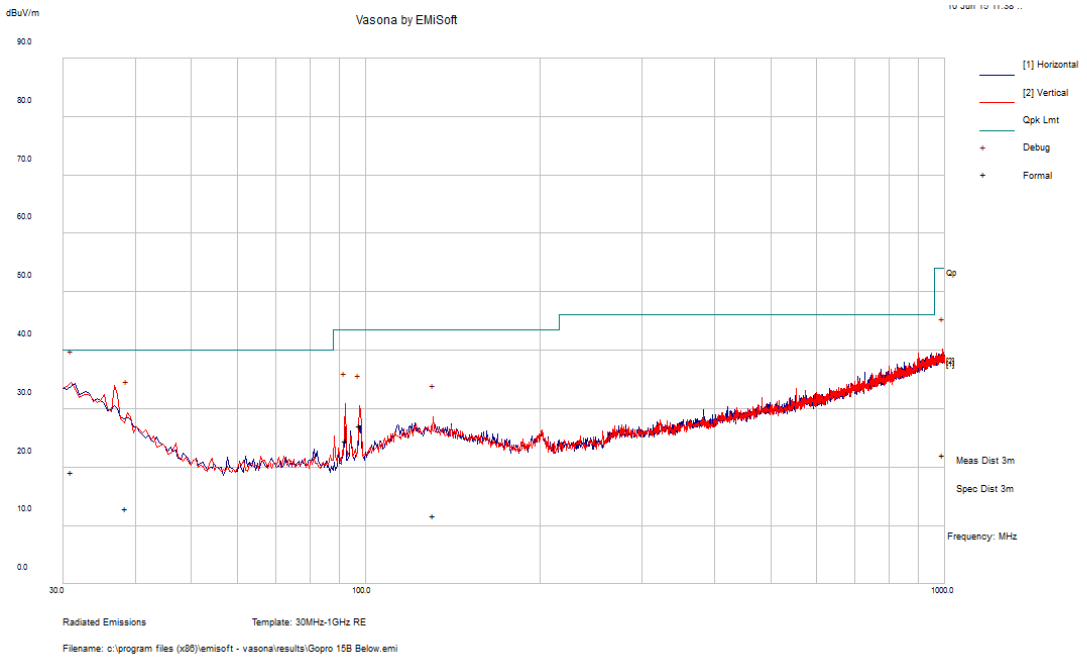
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-1.62	2390	Horizontal	g mode, low CH

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

7.8 Radiated Emissions Test Data and Plots

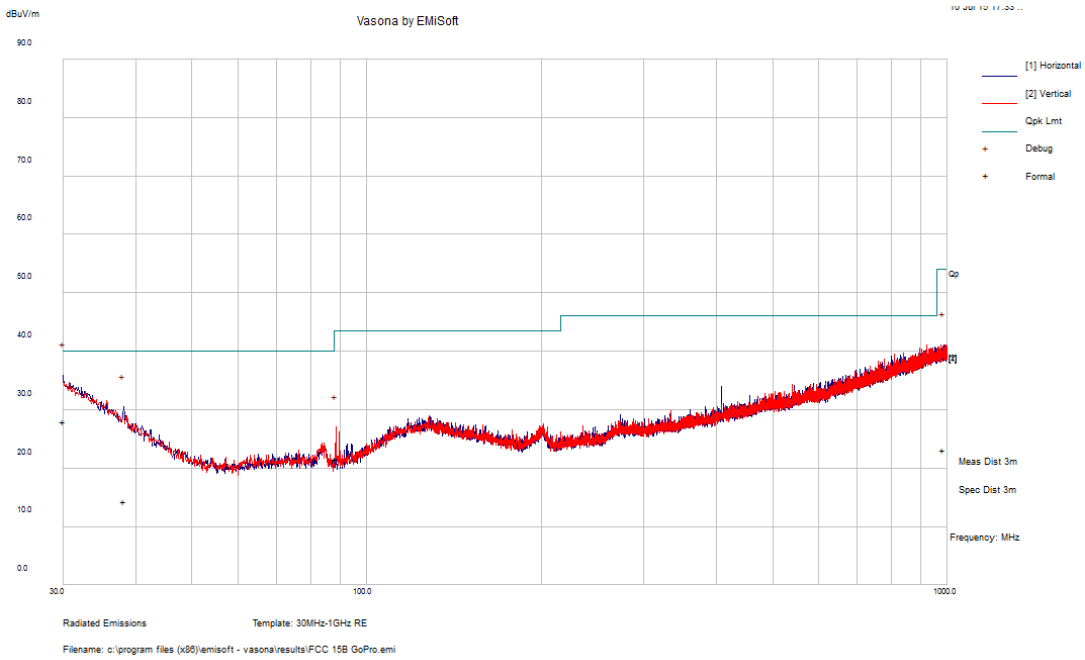
1) 30 MHz – 1 GHz

2.4 GHz Wi-Fi



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comments
31.0355	19.09	285	V	88	40	-20.91	QP
38.55425	12.98	258	V	207	40	-27.02	QP
92.27925	24.5	101	V	37	43.5	-19	QP
97.63925	27.14	299	V	255	43.5	-16.36	QP
992.0015	22.07	158	V	178	54	-31.93	QP
130.6875	11.71	115	V	78	43.5	-31.79	QP

2.4 GHz BLE



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comments
30	27.91	177	H	59	40	-12.09	QP
38.2195	14.35	194	H	13	40	-25.65	QP
984.9703	23.14	278	H	18	54	-30.86	QP
88.473	21.5	138	V	360	43.5	-22	QP

2)1–25 GHz

2.4 GHz Wi-Fi, 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											
2412	69.75	114	133	V	28.444	6.645	0	104.839	-	-	Peak
2412	74.78	326	163	H	28.461	6.645	0	109.886	-	-	Peak
2412	65.35	116	133	V	28.444	6.645	0	100.439	-	-	Ave
2412	69.17	321	166	H	28.461	6.645	0	104.276	-	-	Ave
2390	25.96	114	133	V	28.444	6.645	0	61.049	74	-12.951	Peak
2390	26.11	326	163	H	28.461	6.645	0	61.216	74	-12.784	Peak
2390	12.89	116	133	V	28.444	6.645	0	47.979	54	-6.021	Ave
2390	13.29	312	166	H	28.461	6.645	0	48.396	54	-5.604	Ave
4824	45.8	0	100	V	33.842	4.24155	35.858	48.025	74	-25.975	Peak
4824	46.05	0	100	H	33.795	4.24155	35.858	48.228	74	-25.772	Peak
4824	31.52	0	100	V	33.842	4.24155	35.858	33.745	54	-20.255	Ave
4824	31.5	0	100	H	33.795	4.24155	35.858	33.678	54	-20.322	Ave
7236	46.29	0	100	V	38.471	5.41965	36.011	54.170	84.839	-30.669	Peak
7236	46.68	0	100	H	38.523	5.41965	36.011	54.612	89.886	-35.274	Peak
7236	31.61	0	100	V	38.471	5.41965	36.011	39.490	80.439	-40.949	Ave
7236	31.63	0	100	H	38.523	5.41965	36.011	39.562	84.276	-44.714	Ave
9648	45.96	0	100	V	39.588	6.24145	36.044	55.745	84.839	-29.094	Peak
9648	45.83	0	100	H	39.730	6.24145	36.044	55.757	89.886	-34.129	Peak
9648	31.63	0	100	V	39.588	6.24145	36.044	41.415	80.439	-39.024	Ave
9648	31.62	0	100	H	39.730	6.24145	36.044	41.547	84.276	-42.729	Ave
Middle Channel 2437 MHz											
2437	65.63	52	172	V	28.444	6.645	0	100.719	-	-	Peak
2437	72.51	315	243	H	28.461	6.645	0	107.616	-	-	Peak
2437	63.37	300	137	V	28.444	6.645	0	98.459	-	-	Ave
2437	68.97	328	194	H	28.461	6.645	0	104.076	-	-	Ave
4874	45.36	0	100	V	33.873	4.2984	35.896	47.636	74	-26.365	Peak
4874	45.07	0	100	H	33.795	4.2984	35.896	47.268	74	-26.733	Peak
4874	30.74	0	100	V	33.873	4.2984	35.896	33.016	54	-20.985	Ave
4874	30.72	0	100	H	33.795	4.2984	35.896	32.918	54	-21.083	Ave
7311	46.22	0	100	V	38.299	5.49505	35.958	54.056	74	-19.944	Peak
7311	46.28	0	100	H	38.314	5.49505	35.958	54.131	74	-19.869	Peak
7311	31.71	0	100	V	38.299	5.49505	35.958	39.546	54	-14.454	Ave
7311	31.71	0	100	H	38.314	5.49505	35.958	39.561	54	-14.439	Ave
9748	45.66	0	100	V	39.739	6.26855	36.032	55.636	80.719	-25.083	Peak
9748	45.62	0	100	H	39.730	6.26855	36.032	55.587	87.616	-32.029	Peak
9748	31.7	0	100	V	39.739	6.26855	36.032	41.676	78.459	-36.783	Ave
9748	31.71	0	100	H	39.730	6.26855	36.032	41.677	84.076	-42.399	Ave

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)	
High Channel 2462 MHz											
2462	67.63	116	127	V	29.12	6.76	0.00	103.51	-	-	Peak
2462	73.06	332	153	H	29.04	6.76	0.00	108.87	-	-	Peak
2462	63.16	115	120	V	29.12	6.76	0.00	99.04	-	-	Ave
2462	67.9	314	232	H	29.04	6.76	0.00	103.71	-	-	Ave
2483.5	25.56	116	127	V	29.12	6.76	0.00	61.44	74.00	-12.56	Peak
2483.5	26.7	332	153	H	29.04	6.76	0.00	62.51	74.00	-11.49	Peak
2483.5	13	115	120	V	29.12	6.76	0.00	48.88	54.00	-5.12	Ave
2483.5	13.3	314	232	H	29.04	6.76	0.00	49.11	54.00	-4.89	Ave
4924	47.58	0	100	V	33.87	4.30	35.91	49.84	74.00	-24.16	Peak
4924	49.53	0	100	H	33.89	4.30	35.91	51.81	74.00	-22.19	Peak
4924	31.18	0	100	V	33.87	4.30	35.91	33.44	54.00	-20.56	Ave
4924	31.19	0	100	H	33.89	4.30	35.91	33.47	54.00	-20.53	Ave
7386	45.97	0	100	V	38.09	5.51	35.96	53.61	74.00	-20.39	Peak
7386	46.06	0	100	H	38.12	5.51	35.96	53.73	74.00	-20.27	Peak
7386	31.51	0	100	V	38.09	5.51	35.96	39.15	54.00	-14.85	Ave
7386	31.5	0	100	H	38.12	5.51	35.96	39.17	54.00	-14.83	Ave
9848	45.38	0	100	V	39.74	6.26	35.98	55.41	83.51	-28.11	Peak
9848	45.31	0	100	H	39.74	6.26	35.98	55.33	88.87	-33.53	Peak
9848	31.7	0	100	V	39.74	6.26	35.98	41.73	79.04	-37.32	Ave
9848	31.7	0	100	H	39.74	6.26	35.98	41.72	83.71	-41.98	Ave

2.4 GHz Wi-Fi, 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											
2412	68.06	144	132	V	28.44	6.64	0.00	103.15	-	-	Peak
2412	73.49	328	159	H	28.46	6.64	0.00	108.60	-	-	Peak
2412	57.02	113	133	V	28.44	6.64	0.00	92.11	-	-	Ave
2412	61.68	326	157	H	28.46	6.64	0.00	96.79	-	-	Ave
2390	35.86	223	244	V	28.44	3.14	0.00	67.44	74.00	-6.56	Peak
2390	35.54	319	207	H	28.46	3.14	0.00	67.14	74.00	-6.86	Peak
2390	19.77	209	218	V	28.44	3.14	0.00	51.35	54.00	-2.65	Ave
2390	20.78	326	232	H	28.46	3.14	0.00	52.38	54.00	-1.62	Ave
4824	47.35	0	100	V	33.84	4.24	35.86	49.58	74.00	-24.42	Peak
4824	46.83	0	100	H	33.80	4.24	35.86	49.01	74.00	-24.99	Peak
4824	32.45	0	100	V	33.84	4.24	35.86	34.68	54.00	-19.32	Ave
4824	32.72	0	100	H	33.80	4.24	35.86	34.90	54.00	-19.10	Ave
7236	46.18	0	100	V	38.47	5.42	36.01	54.06	83.15	-29.09	Peak
7236	45.93	0	100	H	38.52	5.42	36.01	53.86	88.60	-34.73	Peak
7236	32.38	0	100	V	38.47	5.42	36.01	40.26	72.11	-31.85	Ave
7236	32.84	0	100	H	38.52	5.42	36.01	40.77	76.79	-36.01	Ave
9648	44.27	0	100	V	39.59	6.24	36.04	54.06	83.15	-29.09	Peak
9648	44.48	0	100	H	39.73	6.24	36.04	54.41	88.60	-34.19	Peak
9648	30.57	0	100	V	39.59	6.24	36.04	40.36	72.11	-31.75	Ave
9648	30.53	0	100	H	39.73	6.24	36.04	40.46	76.79	-36.33	Ave
Middle Channel 2437 MHz											
2437	66.91	115	132	V	28.44	6.64	0.00	102.00	-	-	Peak
2437	70.11	307	242	H	28.46	6.64	0.00	105.22	-	-	Peak
2437	55.37	115	124	V	28.44	6.64	0.00	90.46	-	-	Ave
2437	59.73	341	183	H	28.46	6.64	0.00	94.84	-	-	Ave
4874	47.11	0	100	V	33.87	4.30	35.90	49.39	74.00	-24.61	Peak
4874	45.96	0	100	H	33.80	4.30	35.90	48.16	74.00	-25.84	Peak
4874	32.36	0	100	V	33.87	4.30	35.90	34.64	54.00	-19.36	Ave
4874	32.56	0	100	H	33.80	4.30	35.90	34.76	54.00	-19.24	Ave
7311	45.66	0	100	V	38.30	5.50	35.96	53.50	74.00	-20.50	Peak
7311	45.88	0	100	H	38.31	5.50	35.96	53.73	74.00	-20.27	Peak
7311	32.17	0	100	V	38.30	5.50	35.96	40.01	54.00	-13.99	Ave
7311	32.49	0	100	H	38.31	5.50	35.96	40.34	54.00	-13.66	Ave
9748	44.28	0	100	V	39.74	6.27	36.03	54.26	82.00	-27.74	Peak
9748	45.64	0	100	H	39.73	6.27	36.03	55.61	85.22	-29.61	Peak
9748	31.35	0	100	V	39.74	6.27	36.03	41.33	70.46	-29.13	Ave
9748	31.29	0	100	H	39.73	6.27	36.03	41.26	74.84	-33.58	Ave

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)	
High Channel 2462 MHz											
2462	65.68	208	184	V	29.12	3.24	0.00	98.04	-	-	Peak
2462	71.8	325	164	H	29.04	3.24	0.00	104.08	-	-	Peak
2462	54.87	212	190	V	29.12	3.24	0.00	87.23	-	-	Ave
2462	57.74	0	180	H	29.04	3.24	0.00	90.02	-	-	Ave
2483.5	28.82	208	184	V	29.12	3.24	0.00	61.18	74.00	-12.82	Peak
2483.5	34.9	253	127	H	29.04	3.24	0.00	67.18	74.00	-6.82	Peak
2483.5	16.49	286	300	V	29.12	3.24	0.00	48.85	54.00	-5.15	Ave
2483.5	15.74	0	180	H	29.04	3.24	0.00	48.02	54.00	-5.98	Ave
4924	46.17	0	100	V	33.87	4.30	35.91	48.43	74.00	-25.57	Peak
4924	46.1	0	100	H	33.89	4.30	35.91	48.38	74.00	-25.62	Peak
4924	35.83	0	100	V	33.87	4.30	35.91	38.09	54.00	-15.91	Ave
4924	31.71	0	100	H	33.89	4.30	35.91	33.99	54.00	-20.01	Ave
7386	45.25	0	100	V	38.09	5.51	35.96	52.89	74.00	-21.11	Peak
7386	46.43	0	100	H	38.12	5.51	35.96	54.10	74.00	-19.90	Peak
7386	31.71	0	100	V	38.09	5.51	35.96	39.35	54.00	-14.65	Ave
7386	31.52	0	100	H	38.12	5.51	35.96	39.19	54.00	-14.81	Ave
9848	45.77	0	100	V	39.74	6.26	35.98	55.80	78.04	-22.24	Peak
9848	45.12	0	100	H	39.74	6.26	35.98	55.14	84.08	-28.94	Peak
9848	31.4	0	100	V	39.74	6.26	35.98	41.43	67.23	-25.80	Ave
9848	31.36	0	100	H	39.74	6.26	35.98	41.38	70.02	-28.64	Ave

2.4 GHz Wi-Fi, 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											
2412	73.16	31	143	V	28.38	6.64	0.00	108.18	-	-	Peak
2412	75.38	152	169	H	28.39	6.64	0.00	110.41	-	-	Peak
2412	61.26	31	143	V	28.38	6.64	0.00	96.28	-	-	Ave
2412	63.78	152	169	H	28.39	6.64	0.00	98.81	-	-	Ave
2390	30.1	185	200	V	28.38	3.23	0.00	61.71	74.00	-12.29	Peak
2390	31.52	330	275	H	28.39	3.23	0.00	63.14	74.00	-10.86	Peak
2390	18	224	100	V	28.38	3.23	0.00	49.61	54.00	-4.39	Ave
2390	18.81	349	227	H	28.39	3.23	0.00	50.43	54.00	-3.57	Ave
4824	45.55	0	100	V	32.89	4.24	35.86	46.82	74.00	-27.18	Peak
4824	46.85	0	100	H	32.74	4.24	35.86	47.97	74.00	-26.03	Peak
4824	32.28	0	100	V	32.89	4.24	35.86	33.55	54.00	-20.45	Ave
4824	32.42	0	100	H	32.74	4.24	35.86	33.54	54.00	-20.46	Ave
7236	45.48	0	100	V	36.25	5.42	36.01	51.14	88.18	-37.04	Peak
7236	45.33	0	100	H	36.14	5.42	36.01	50.88	90.41	-39.53	Peak
7236	31.88	0	100	V	36.25	5.42	36.01	37.54	76.28	-38.74	Ave
7236	31.95	0	100	H	36.14	5.42	36.01	37.50	78.81	-41.31	Ave
9648	42.84	0	100	V	38.00	6.24	36.04	51.04	88.18	-37.15	Peak
9648	43.16	0	100	H	37.92	6.24	36.04	51.28	90.41	-39.14	Peak
9648	29.5	0	100	V	38.00	6.24	36.04	37.70	76.28	-38.59	Ave
9648	29.48	0	100	H	37.92	6.24	36.04	37.60	78.81	-41.22	Ave
Middle Channel 2437 MHz											
2437	72.85	238	164	V	28.38	6.64	0.00	107.87	-	-	Peak
2437	76.71	347	240	H	28.39	6.64	0.00	111.74	-	-	Peak
2437	61.28	234	161	V	28.38	6.64	0.00	96.30	-	-	Ave
2437	65.93	335	237	H	28.39	6.64	0.00	100.96	-	-	Ave
4874	49.35	0	100	V	33.30	4.30	35.90	51.05	74.00	-22.95	Peak
4874	47.35	0	100	H	32.93	4.30	35.90	48.68	74.00	-25.32	Peak
4874	33.74	0	100	V	33.30	4.30	35.90	35.44	54.00	-18.56	Ave
4874	33.9	0	100	H	32.93	4.30	35.90	35.23	54.00	-18.77	Ave
7311	46.45	0	100	V	36.69	5.50	35.96	52.68	74.00	-21.32	Peak
7311	46.84	0	100	H	36.58	5.50	35.96	52.95	74.00	-21.05	Peak
7311	32.33	0	100	V	36.69	5.50	35.96	38.56	54.00	-15.44	Ave
7311	32.3	0	100	H	36.58	5.50	35.96	38.41	54.00	-15.59	Ave
9748	46.26	0	100	V	38.13	6.27	36.03	54.63	87.87	-33.25	Peak
9748	47.29	0	100	H	37.90	6.27	36.03	55.42	91.74	-36.32	Peak
9748	32.7	0	100	V	38.13	6.27	36.03	41.07	76.30	-35.24	Ave
9748	32.75	0	100	H	37.90	6.27	36.03	40.88	80.96	-40.08	Ave

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)	
High Channel 2462 MHz											
2462	71.86	35	124	V	28.55	6.76	0.00	107.17	-	-	Peak
2462	76.8	155	166	H	28.60	6.76	0.00	112.16	-	-	Peak
2462	60.15	35	124	V	28.55	6.76	0.00	95.46	-	-	Ave
2462	64.39	155	166	H	28.60	6.76	0.00	99.75	-	-	Ave
2483.5	30.34	211	171	V	28.55	3.26	0.00	62.15	74.00	-11.85	Peak
2483.5	32.9	331	300	H	28.60	3.26	0.00	64.76	74.00	-9.25	Peak
2483.5	15.57	183	234	V	28.55	3.26	0.00	47.38	54.00	-6.62	Ave
2483.5	17.93	344	300	H	28.60	3.26	0.00	49.79	54.00	-4.22	Ave
4924	46.87	0	100	V	33.32	4.30	35.91	48.57	74.00	-25.43	Peak
4924	47.1	0	100	H	33.24	4.30	35.91	48.73	74.00	-25.27	Peak
4924	31.83	0	100	V	33.32	4.30	35.91	33.53	54.00	-20.47	Ave
4924	31.95	0	100	H	33.24	4.30	35.91	33.58	54.00	-20.42	Ave
7386	45.69	0	100	V	36.88	5.51	35.96	52.12	74.00	-21.88	Peak
7386	46.13	0	100	H	36.76	5.51	35.96	52.44	74.00	-21.56	Peak
7386	31.7	0	100	V	36.88	5.51	35.96	38.13	54.00	-15.87	Ave
7386	31.8	0	100	H	36.76	5.51	35.96	38.11	54.00	-15.89	Ave
9848	45.83	0	100	V	38.36	6.26	35.98	54.48	87.17	-32.69	Peak
9848	45.61	0	100	H	38.37	6.26	35.98	54.27	92.16	-37.89	Peak
9848	31.72	0	100	V	38.36	6.26	35.98	40.37	75.46	-35.09	Ave
9848	31.71	0	100	H	38.37	6.26	35.98	40.37	79.75	-39.38	Ave

2.4 GHz BLE

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 2402 MHz											
2402	68.5	247	134	V	28.35	2.86	0.00	99.71	-	-	Peak
2402	72.3	336	246	H	28.20	2.86	0.00	103.36	-	-	Peak
2402	67.85	268	213	V	28.35	2.86	0.00	99.06	-	-	Ave
2402	70.26	0	252	H	28.20	2.86	0.00	101.32	-	-	Ave
2390	27.2	95	257	V	28.35	2.86	0.00	58.41	74.00	-15.59	Peak
2390	29.04	326	243	H	28.20	2.86	0.00	60.10	74.00	-13.90	Peak
2390	12.23	309	251	V	28.35	2.86	0.00	43.44	54.00	-10.56	Ave
2390	14.47	326	243	H	28.20	2.86	0.00	45.53	54.00	-8.47	Ave
4804	45.41	0	100	V	32.89	8.88	35.86	51.32	74.00	-22.68	Peak
4804	45.66	0	100	H	32.74	8.88	35.86	51.42	74.00	-22.58	Peak
4804	30.82	0	100	V	32.89	8.88	35.86	36.73	54.00	-17.27	Ave
4804	30.8	0	100	H	32.74	8.88	35.86	36.56	54.00	-17.44	Ave
7206	43.64	0	100	V	36.25	10.62	36.01	54.50	79.71	-25.21	Peak
7206	43.05	0	100	H	36.14	10.62	36.01	53.80	83.36	-29.57	Peak
7206	29.38	0	100	V	36.25	10.62	36.01	40.24	79.06	-38.82	Ave
7206	29.35	0	100	H	36.14	10.62	36.01	40.10	81.32	-41.23	Ave
9608	42.45	0	100	V	38.00	12.85	36.04	57.25	79.71	-22.46	Peak
9608	43.03	0	100	H	37.92	12.85	36.04	57.75	83.36	-25.62	Peak
9608	28.68	0	100	V	38.00	12.85	36.04	43.48	79.06	-35.58	Ave
9608	28.69	0	100	H	37.92	12.85	36.04	43.41	81.32	-37.92	Ave
Middle Channel 2440 MHz											
2440	69.92	242	130	V	28.348	2.86	0.00	101.13	-	-	Peak
2440	73.8	337	231	H	28.200	2.86	0.00	104.86	-	-	Peak
2440	69.23	242	127	V	28.348	2.86	0.00	100.44	-	-	Ave
2440	72.28	344	288	H	28.200	2.86	0.00	103.34	-	-	Ave
4880	46.47	0	100	V	33.295	8.95	35.90	52.82	74.00	-21.18	Peak
4880	47.4	0	100	H	32.932	8.95	35.90	53.38	74.00	-20.62	Peak
4880	31.55	0	100	V	33.295	8.95	35.90	37.90	54.00	-16.10	Ave
4880	31.55	0	100	H	32.932	8.95	35.90	37.53	54.00	-16.47	Ave
7320	43.69	0	100	V	36.694	10.87	35.96	55.30	74.00	-18.70	Peak
7320	43.63	0	100	H	36.575	10.87	35.96	55.12	74.00	-18.88	Peak
7320	29.89	0	100	V	36.694	10.87	35.96	41.50	54.00	-12.50	Ave
7320	29.86	0	100	H	36.575	10.87	35.96	41.35	54.00	-12.65	Ave
9760	44.09	0	100	V	38.128	13.56	36.03	59.75	81.13	-21.38	Peak
9760	43.8	0	100	H	37.896	13.56	36.03	59.23	84.86	-25.64	Peak
9760	29.6	0	100	V	38.128	13.56	36.03	45.26	80.44	-35.18	Ave
9760	29.51	0	100	H	37.896	13.56	36.03	44.94	83.34	-38.41	Ave

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)	
High Channel 2480 MHz											
2480	70.74	231	176	V	28.61	2.95	0.00	102.30	-	-	Peak
2480	74.54	341	229	H	28.52	2.95	0.00	106.01	-	-	Peak
2480	69.89	198	165	V	28.61	2.95	0.00	101.45	-	-	Ave
2480	74.08	0	231	H	28.52	2.95	0.00	105.55	-	-	Ave
2483.5	27.36	235	159	V	28.61	2.95	0.00	58.92	74.00	-15.08	Peak
2483.5	28.51	341	279	H	28.52	2.95	0.00	59.98	74.00	-14.02	Peak
2483.5	13.05	226	158	V	28.61	2.95	0.00	44.61	54.00	-9.39	Ave
2483.5	13.26	333	277	H	28.52	2.95	0.00	44.73	54.00	-9.27	Ave
4960	44.95	0	100	V	33.32	9.38	35.91	51.73	74.00	-22.27	Peak
4960	45.27	0	100	H	33.24	10.38	35.91	52.98	74.00	-21.02	Peak
4960	30.4	0	100	V	33.32	11.38	35.91	39.18	54.00	-14.82	Ave
4960	30.41	0	100	H	33.24	12.38	35.91	40.12	54.00	-13.88	Ave
7440	44.15	0	100	V	36.88	11.26	35.96	56.33	74.00	-17.67	Peak
7440	43.97	0	100	H	36.76	11.26	35.96	56.02	74.00	-17.98	Peak
7440	30	0	100	V	36.88	11.26	35.96	42.18	54.00	-11.82	Ave
7440	29.98	0	100	H	36.76	11.26	35.96	42.03	54.00	-11.97	Ave
9920	44.46	0	100	V	38.36	14.58	35.98	61.43	82.30	-20.87	Peak
9920	43.63	0	100	H	38.37	14.58	35.98	60.61	86.01	-25.40	Peak
9920	29.19	0	100	V	38.36	14.58	35.98	46.16	81.45	-35.29	Ave
9920	29.09	0	100	H	38.37	14.58	35.98	46.07	85.55	-39.48	Ave

8 FCC §15.247(d) - Spurious Emissions at Antenna Terminals

8.1 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. 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 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.

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:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	101.8 kPa

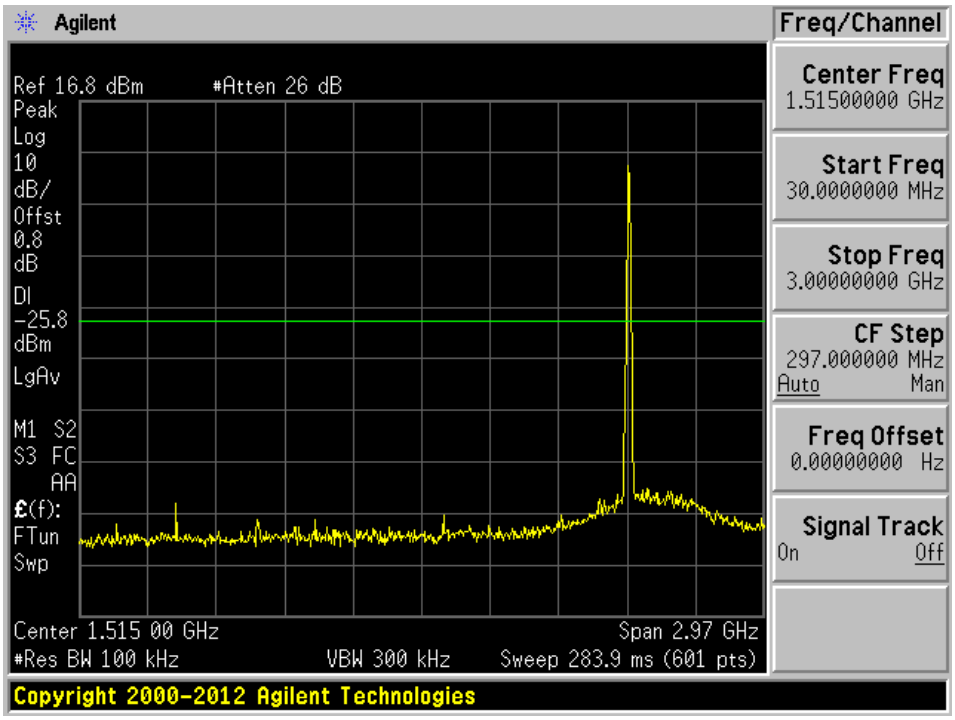
The testing was performed by Todd Moy on 2015-06-22 in RF site.

8.5 Test Results

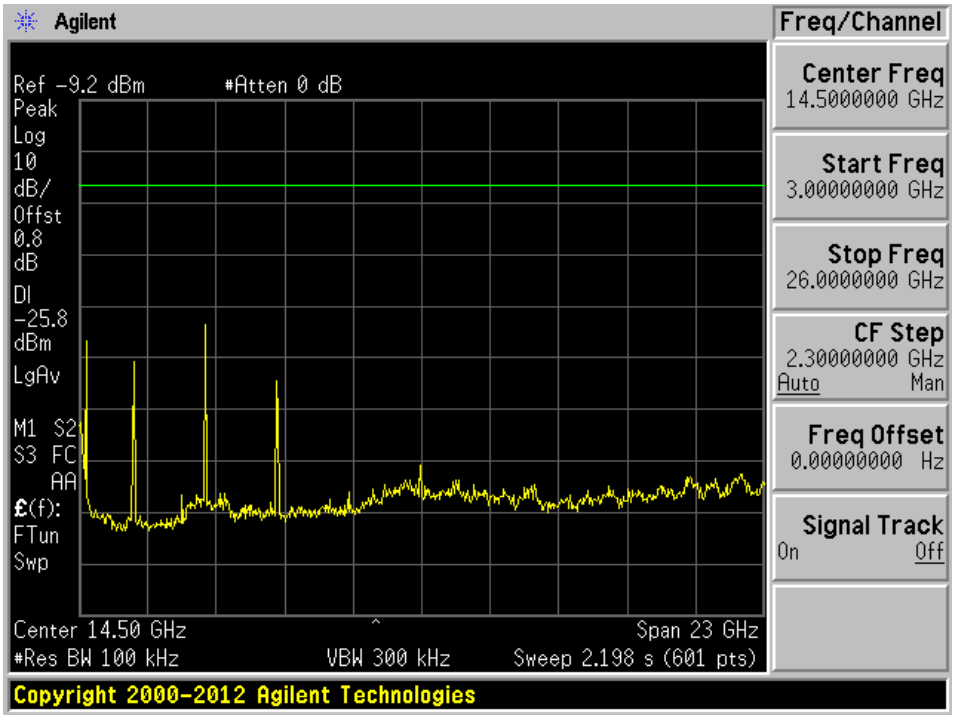
Please refer to following plots.

802.11b mode, Low Channel

30 MHz to 3 GHz

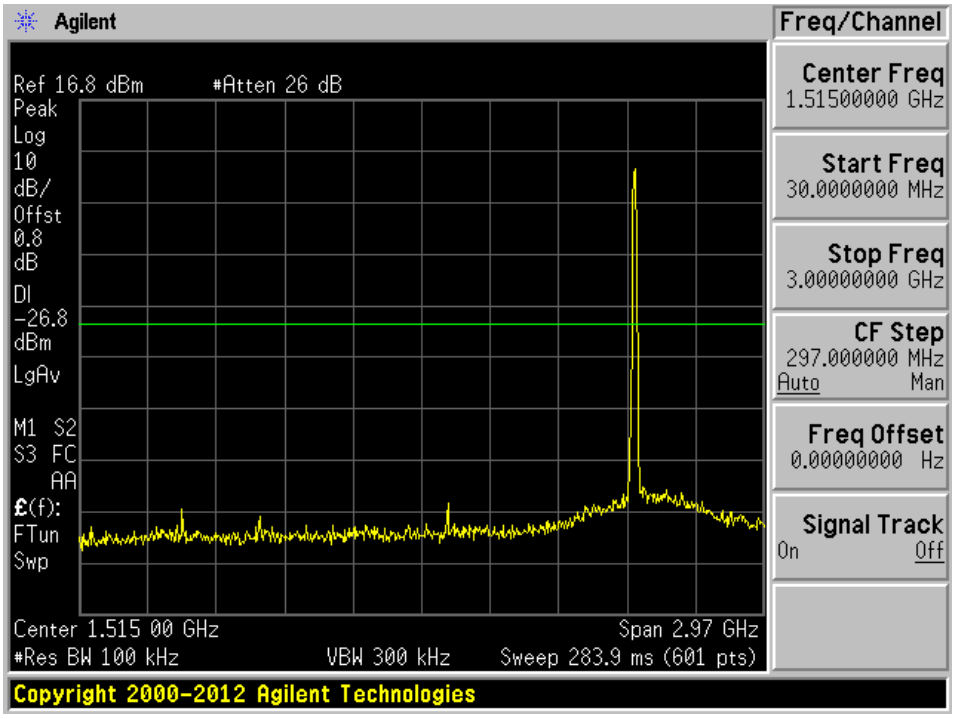


3 GHz to 26 GHz

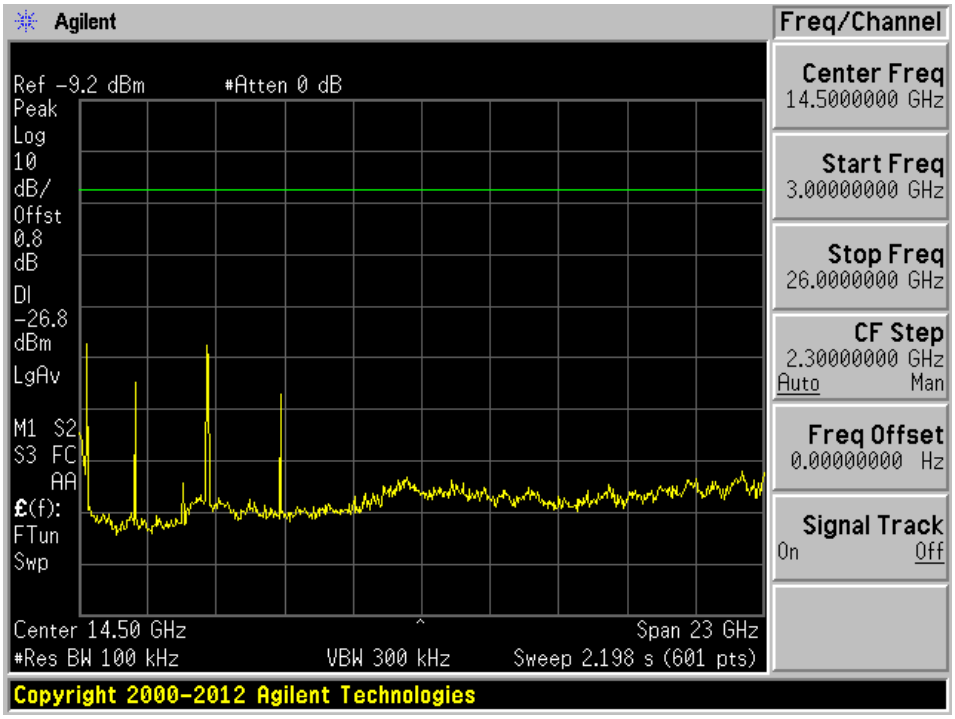


802.11b mode, Middle Channel

30 MHz to 3 GHz

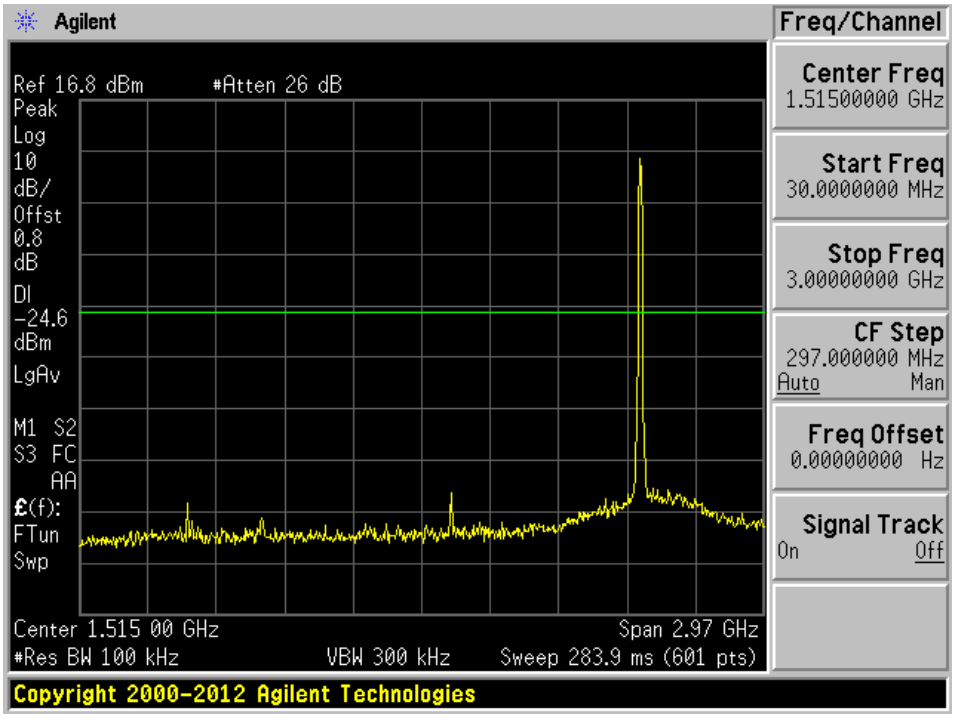


3 GHz to 26 GHz

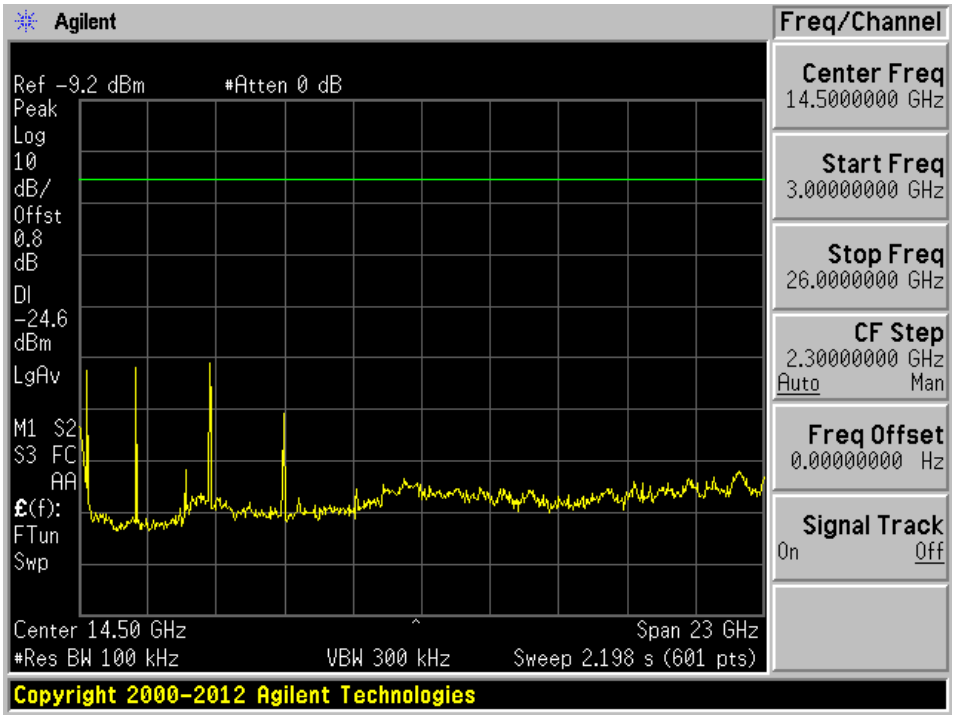


802.11b mode, High Channel

30 MHz to 3 GHz

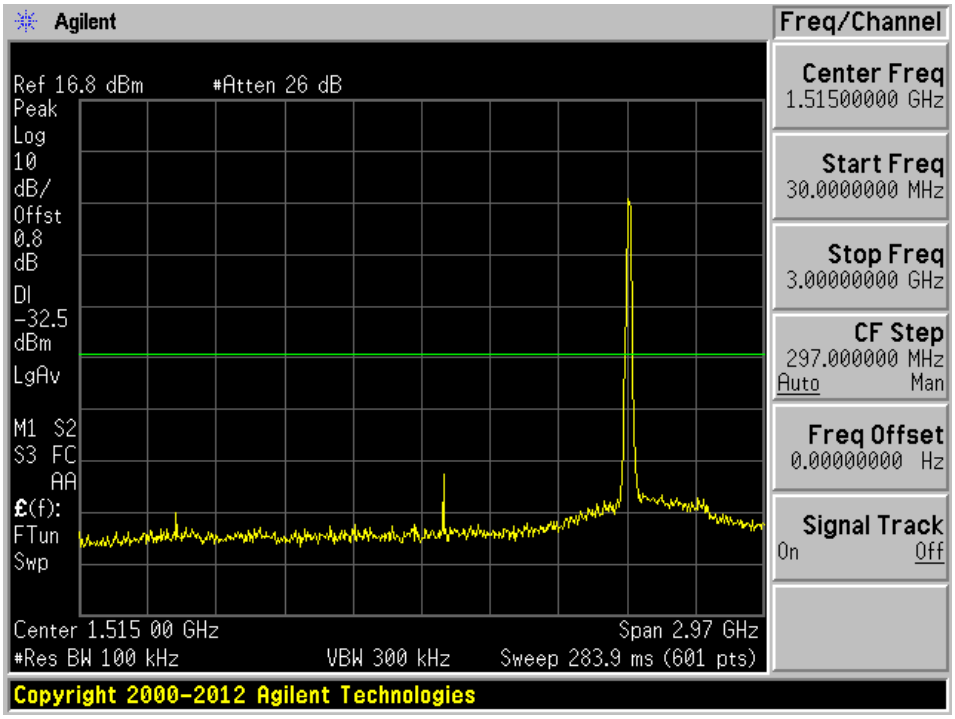


3 GHz to 26 GHz

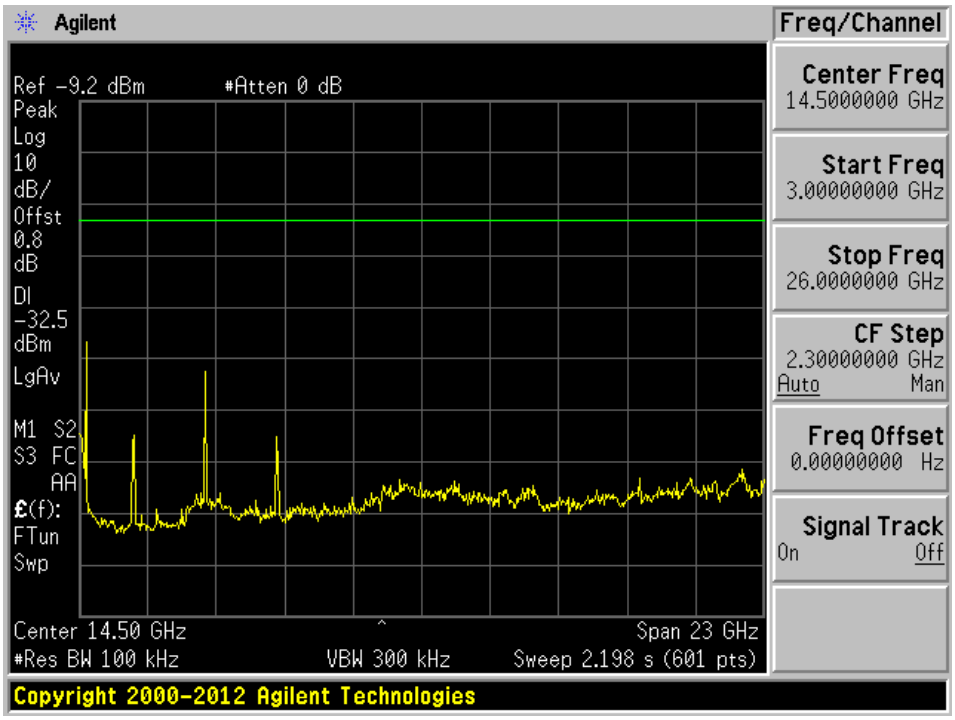


802.11g mode, Low Channel

30 MHz to 3 GHz

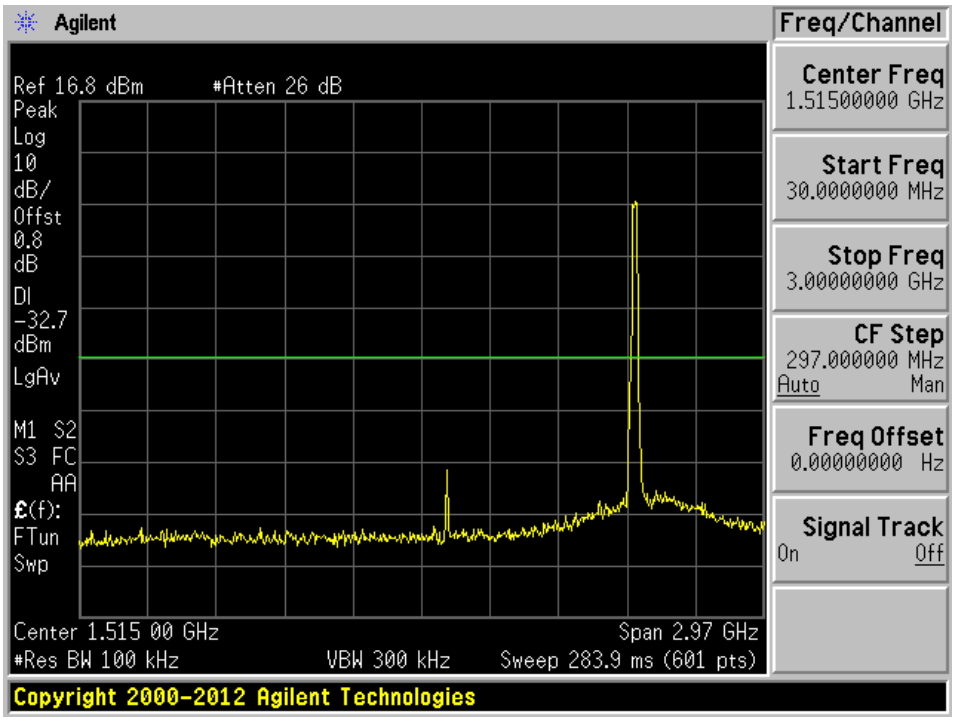


3 GHz to 26 GHz

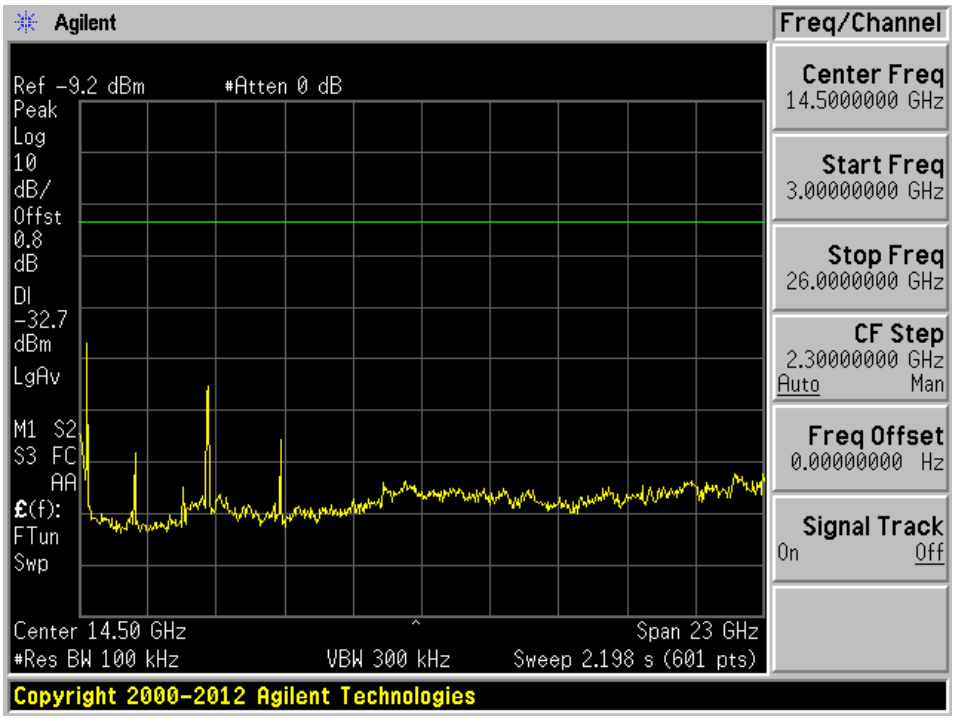


802.11g mode, Middle Channel

30 MHz to 3 GHz

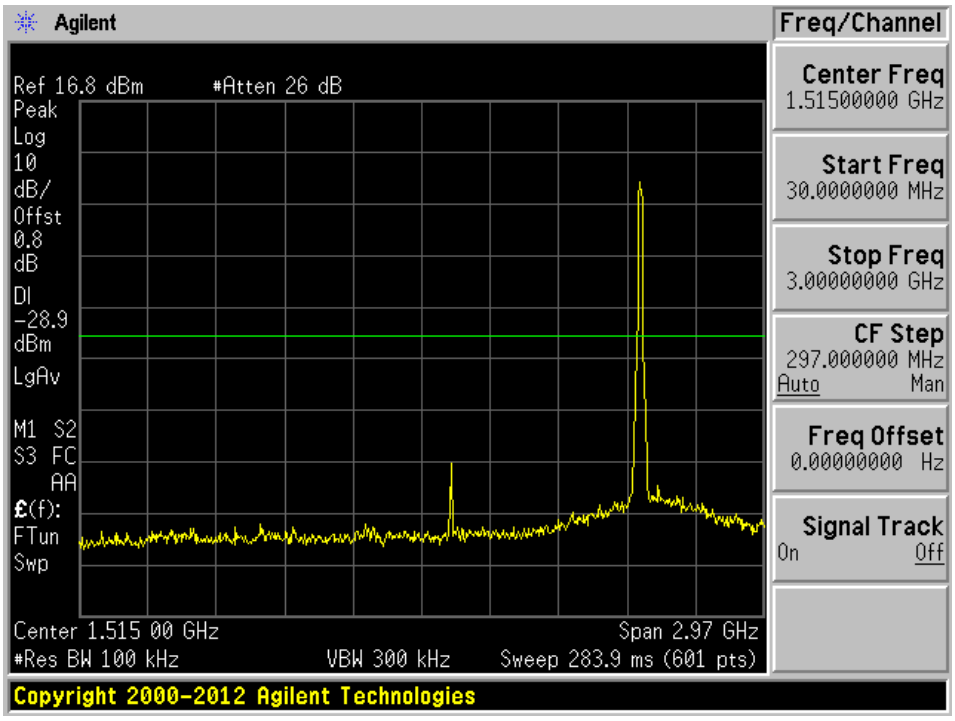


3 GHz to 26 GHz

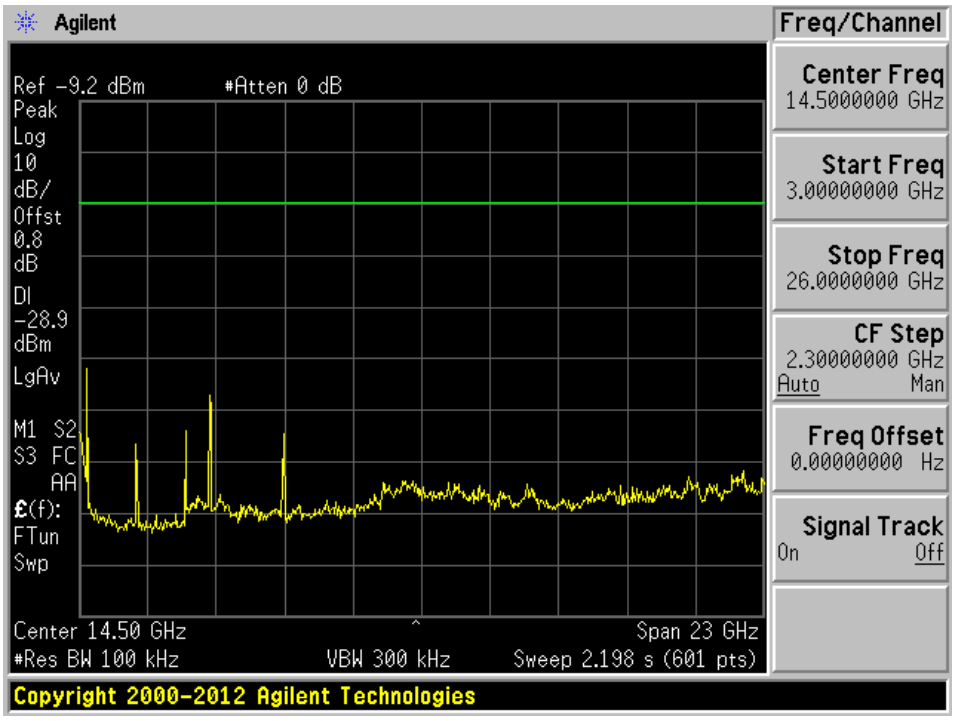


802.11g mode, High Channel

30 MHz to 3 GHz

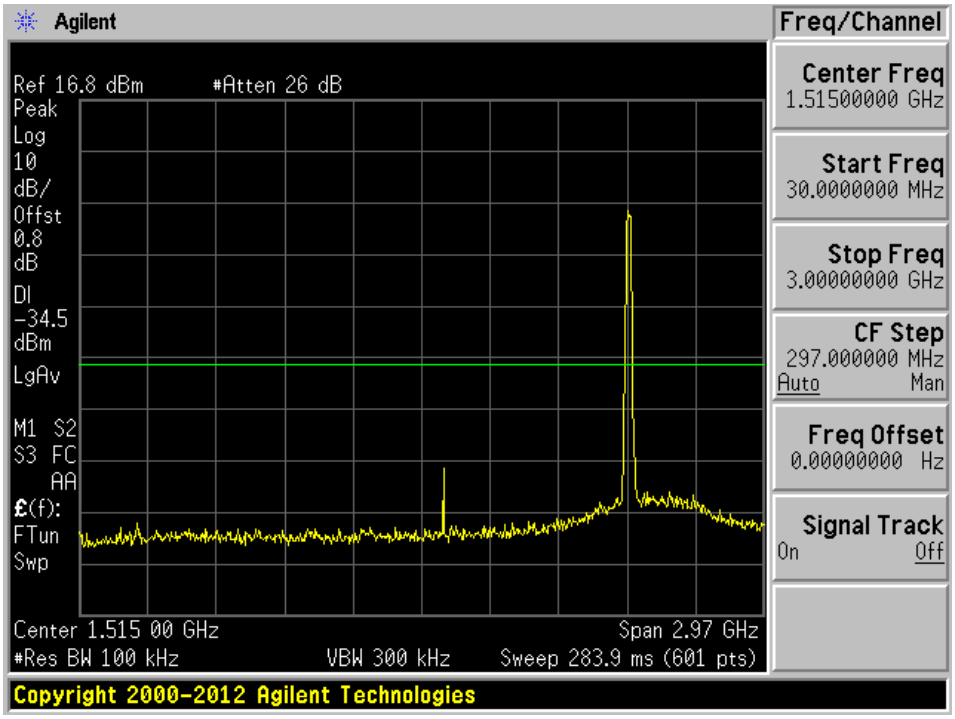


3 GHz to 26 GHz

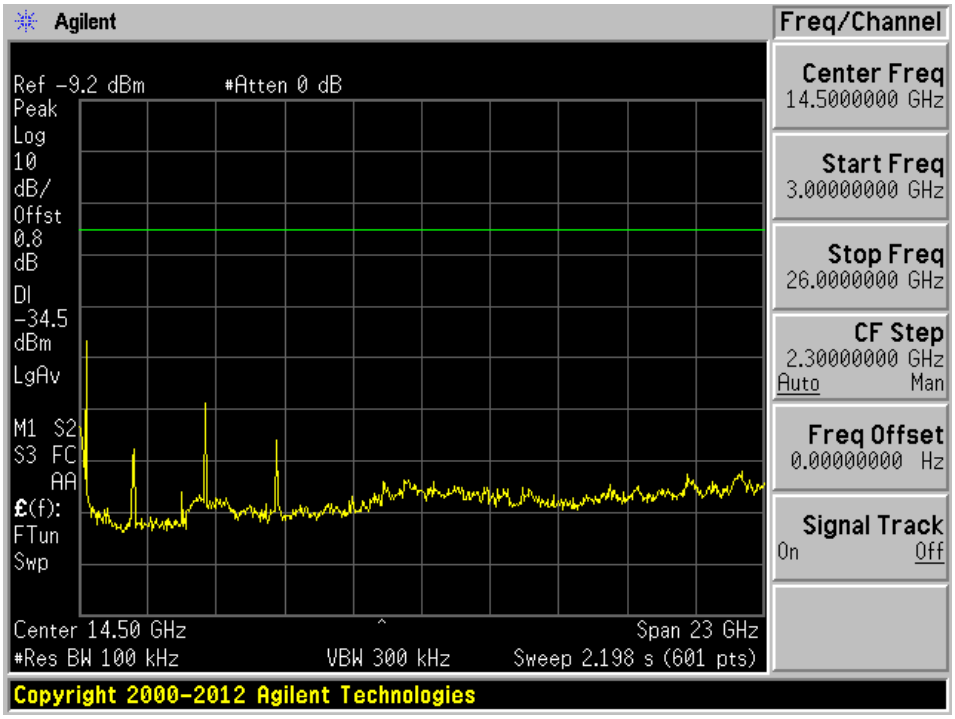


802.11n-HT20 mode, Low Channel

30 MHz to 3 GHz

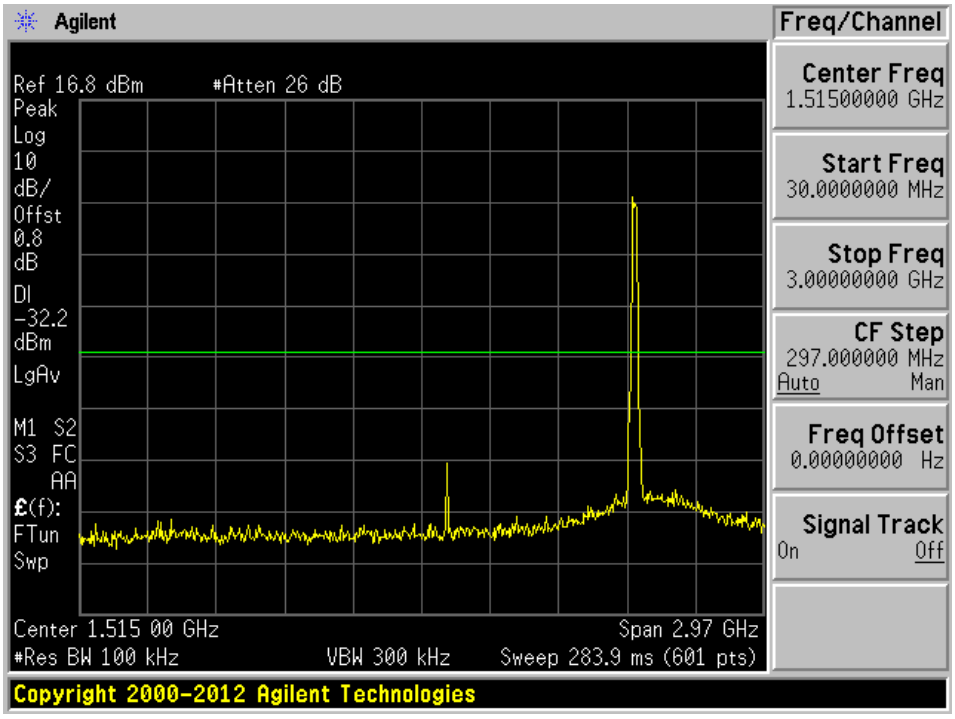


3 GHz to 26 GHz

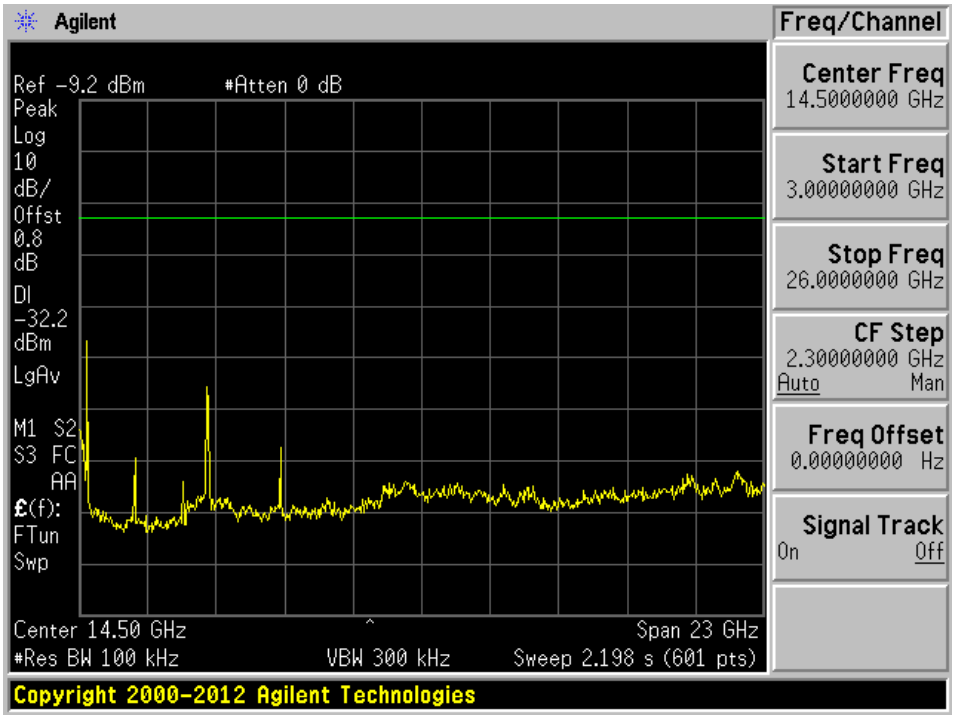


802.11n-HT20 mode, Middle Channel

30 MHz to 3 GHz

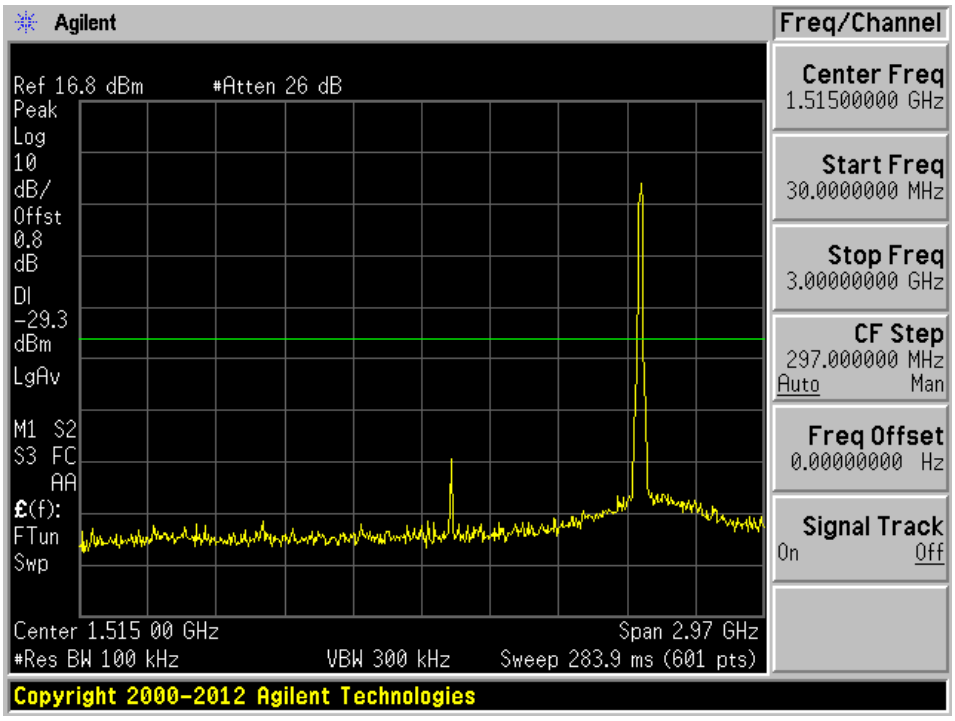


3 GHz to 26 GHz

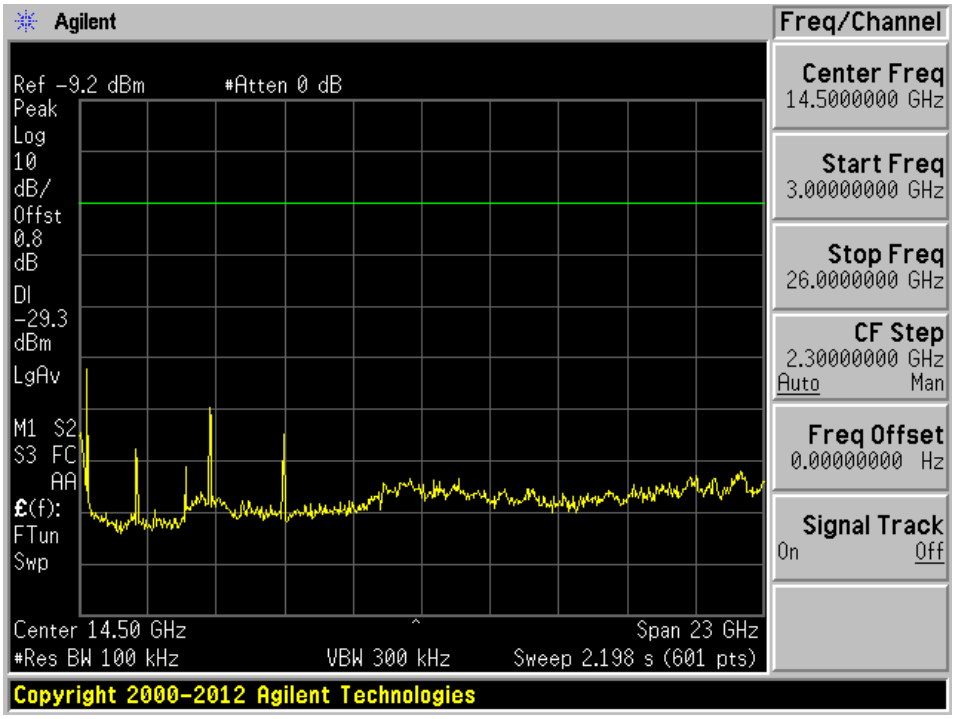


802.11n-HT20 mode, High Channel

30 MHz to 3 GHz

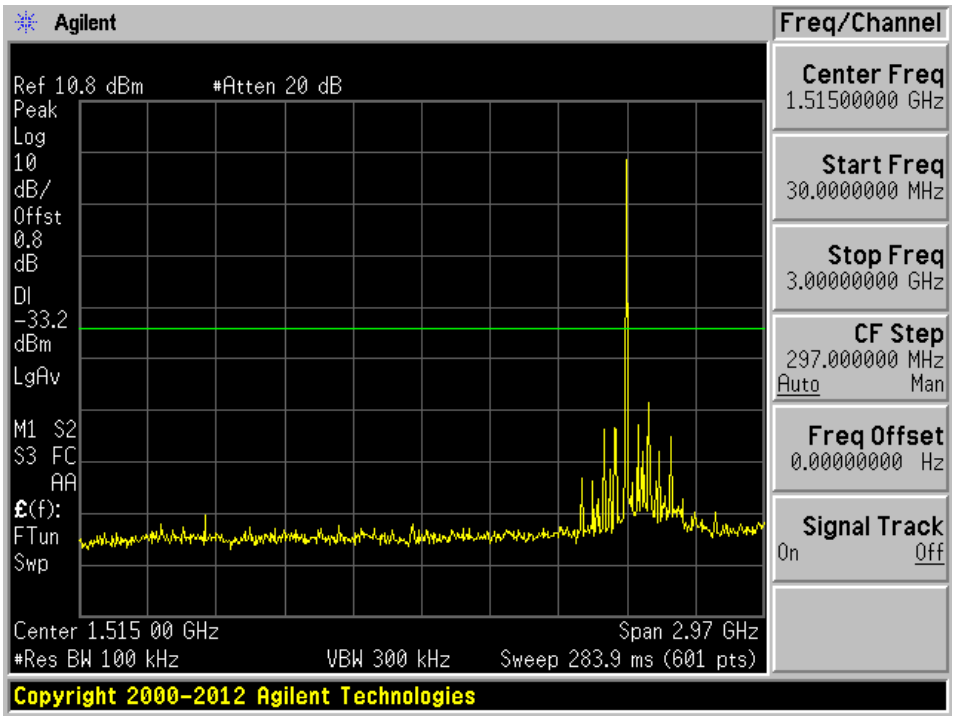


3 GHz to 26 GHz

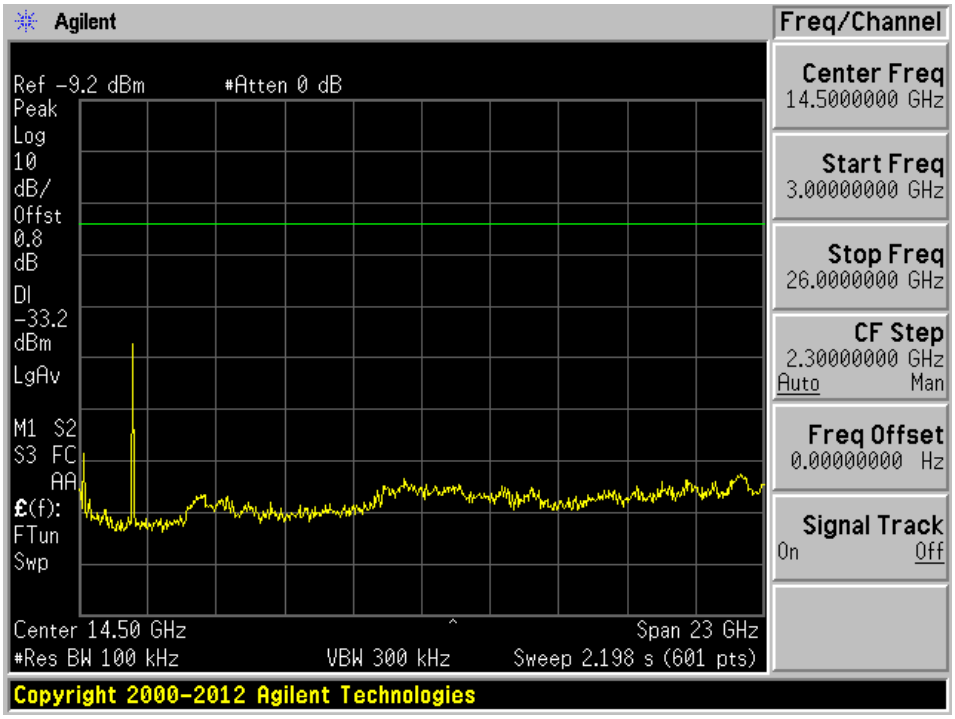


2.4 GHz BLE mode, Low Channel

30 MHz to 3 GHz

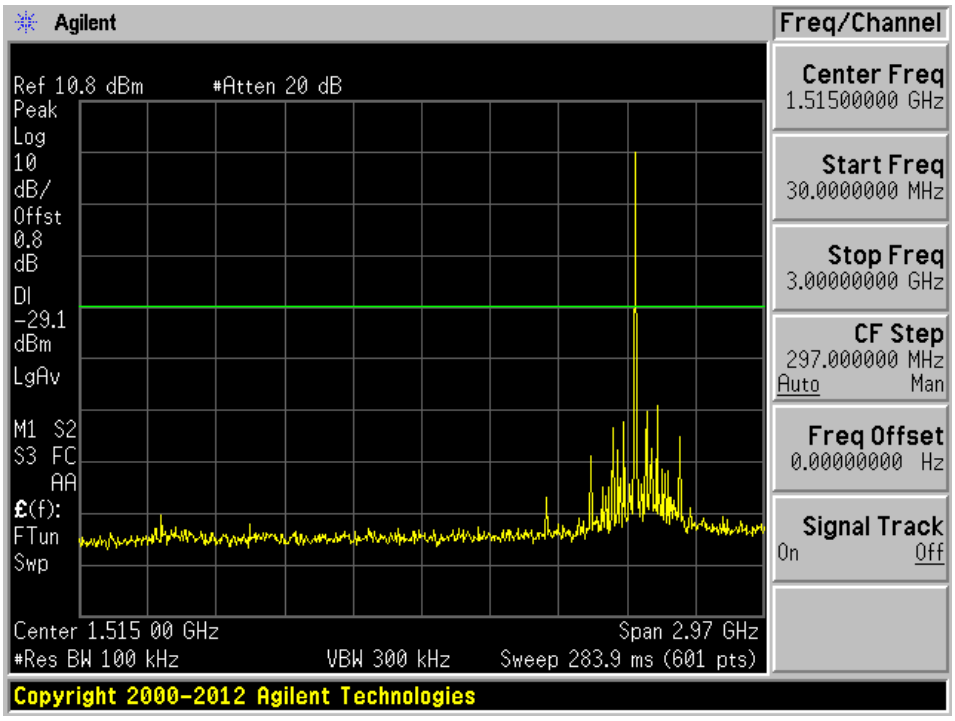


3 GHz to 26 GHz

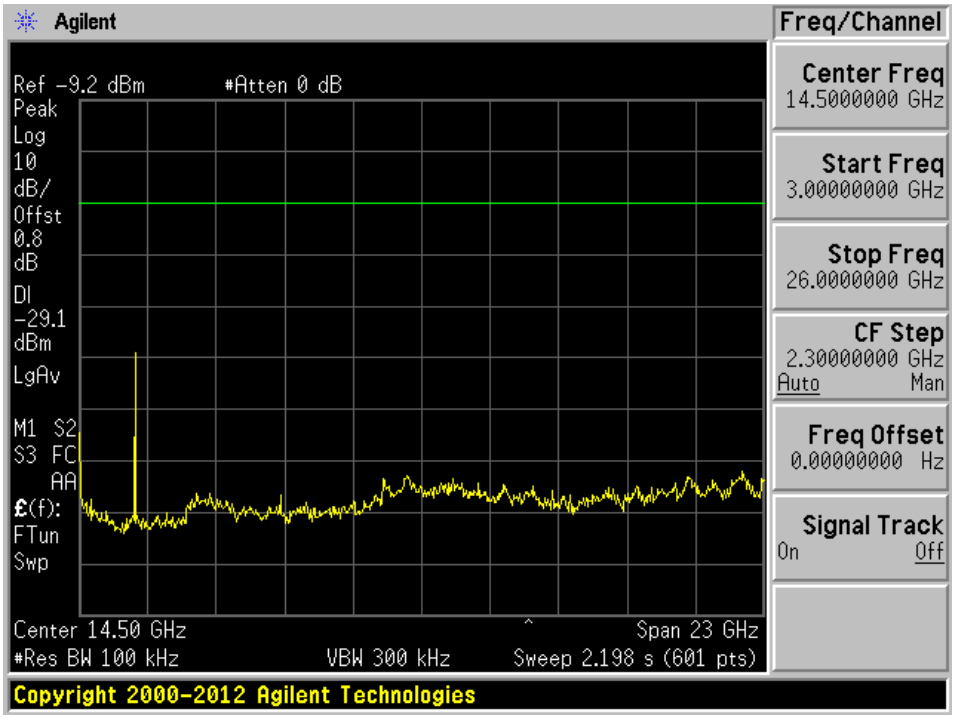


2.4 GHz BLE mode, Middle Channel

30 MHz to 3 GHz

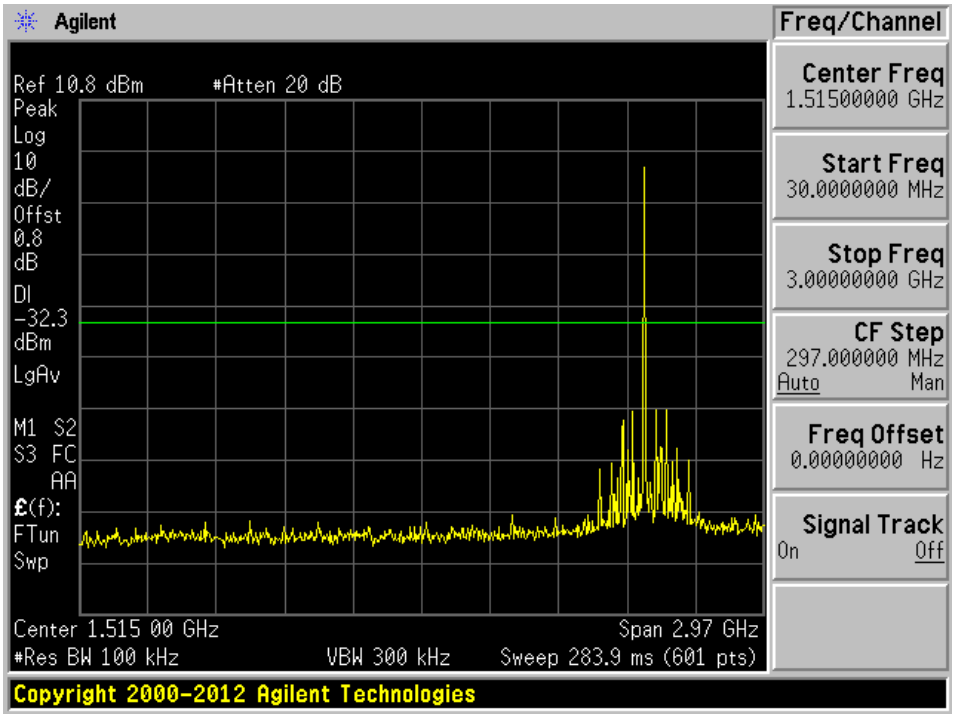


3 GHz to 26 GHz

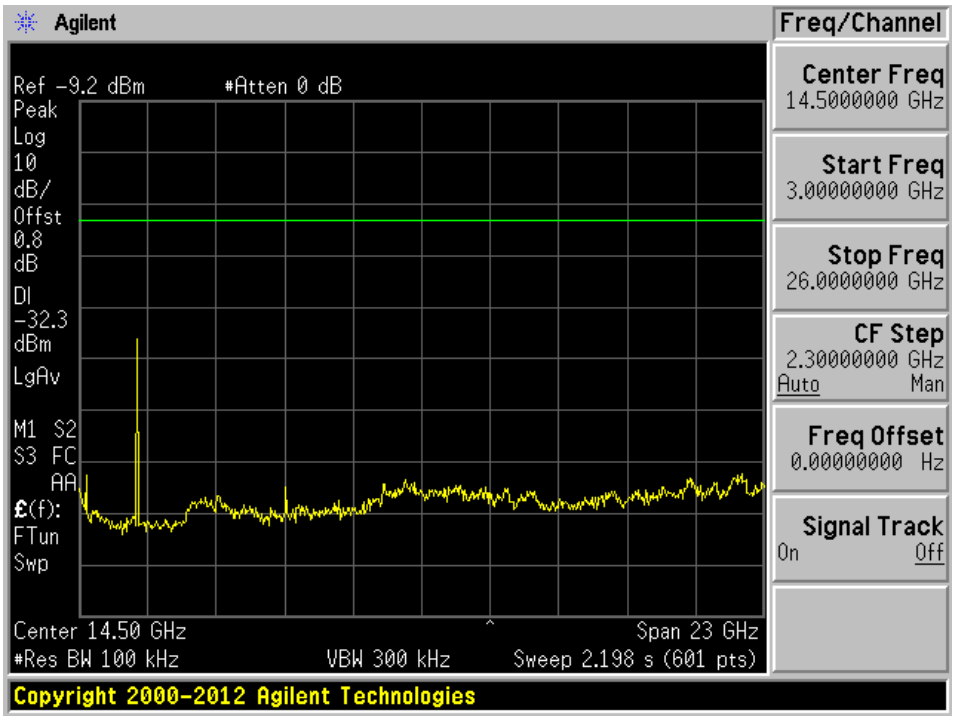


2.4 GHz BLE mode, High Channel

30 MHz to 3 GHz



3 GHz to 26 GHz



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

9.1 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

9.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v03r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8: DTS bandwidth

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:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	101.8 kPa

The testing was performed by Todd Moy on 2015-06-22 in RF site.

9.5 Test Results

2.4 GHz Wi-Fi

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)	Results
802.11b mode					
low	2412	7.109	12.1803	> 0.5	Compliant
middle	2437	7.036	12.1677	> 0.5	Compliant
high	2462	7.09	12.1245	> 0.5	Compliant
802.11g mode					
low	2412	16.579	16.4427	> 0.5	Compliant
middle	2437	16.519	16.4158	> 0.5	Compliant
high	2462	17.67	17.6283	> 0.5	Compliant
802.11n-HT20 mode					
low	2412	17.67	17.6283	> 0.5	Compliant
middle	2437	17.665	17.6205	> 0.5	Compliant
high	2462	17.19	17.6232	> 0.5	Compliant

2.4 GHz BLE

Channel	Frequency (MHz)	6 dB Emission Bandwidth (kHz)	99% Occupied Bandwidth (kHz)	Limit (kHz)	Results
Low	2402	610.451	1063.9	> 500	Compliant
Middle	2440	634.722	1080.2	> 500	Compliant
High	2480	604.732	1051.2	> 500	Compliant

Please refer to the following plots for detailed test results

802.11b mode

Low channel: 2412 MHz

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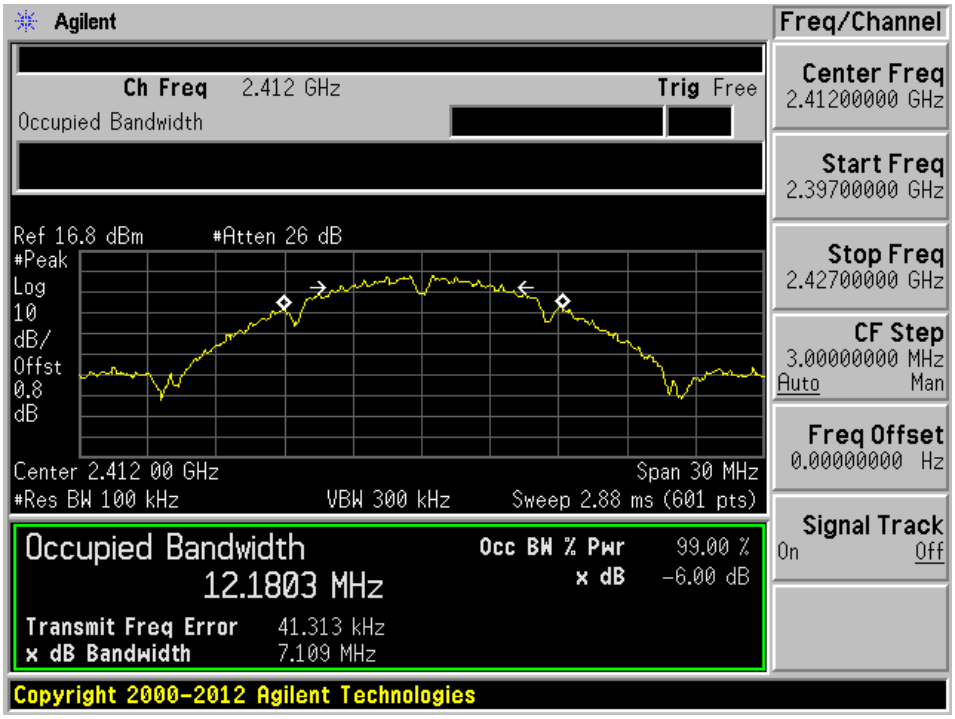
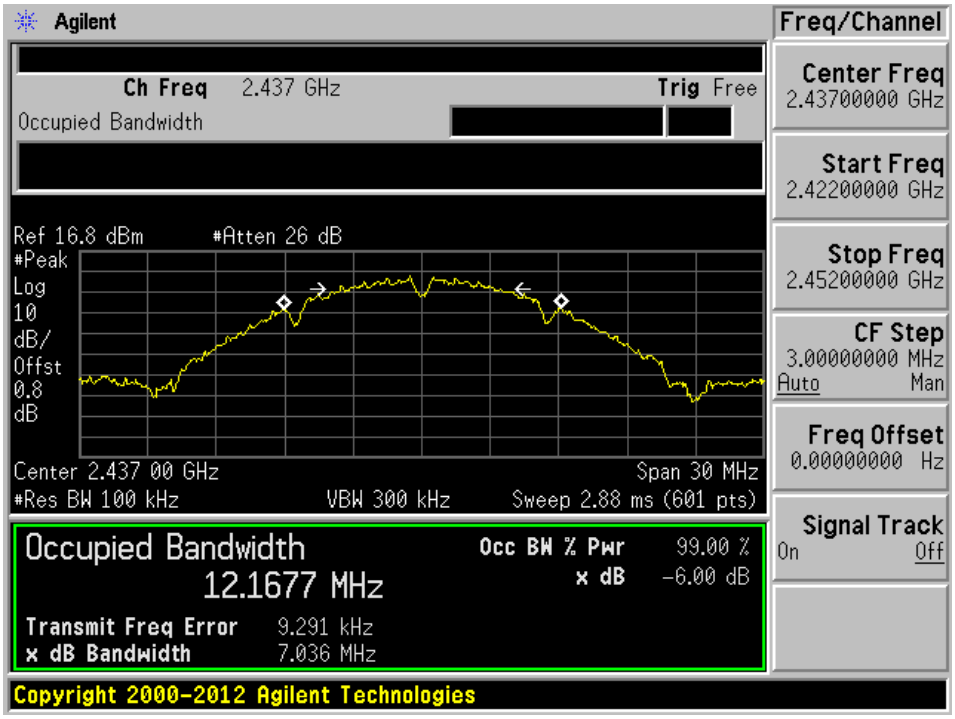
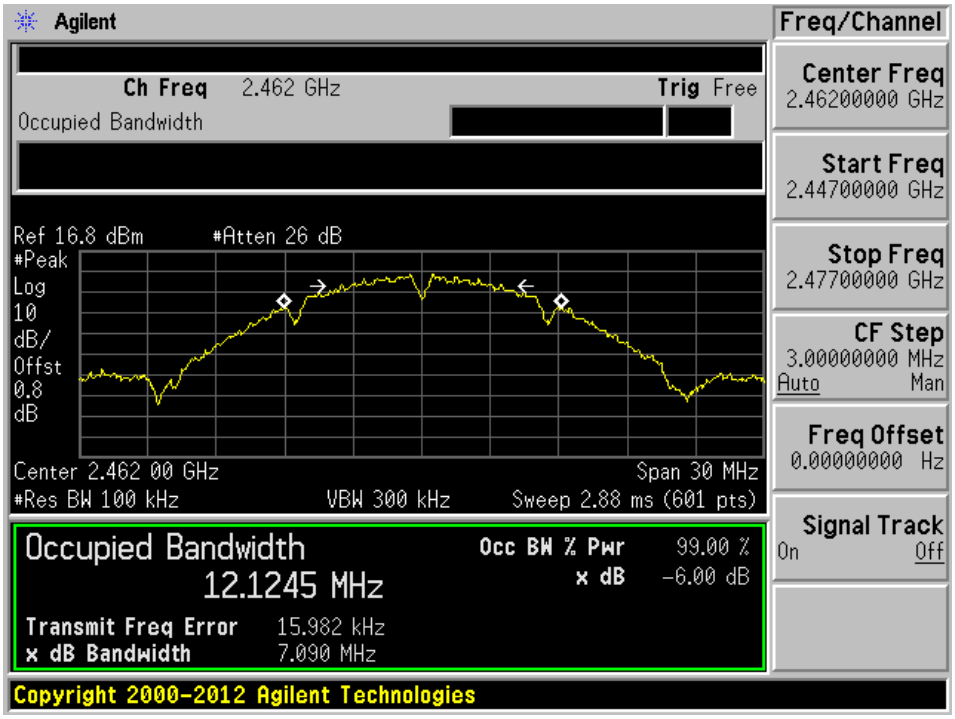


Middle channel: 2437 MHz

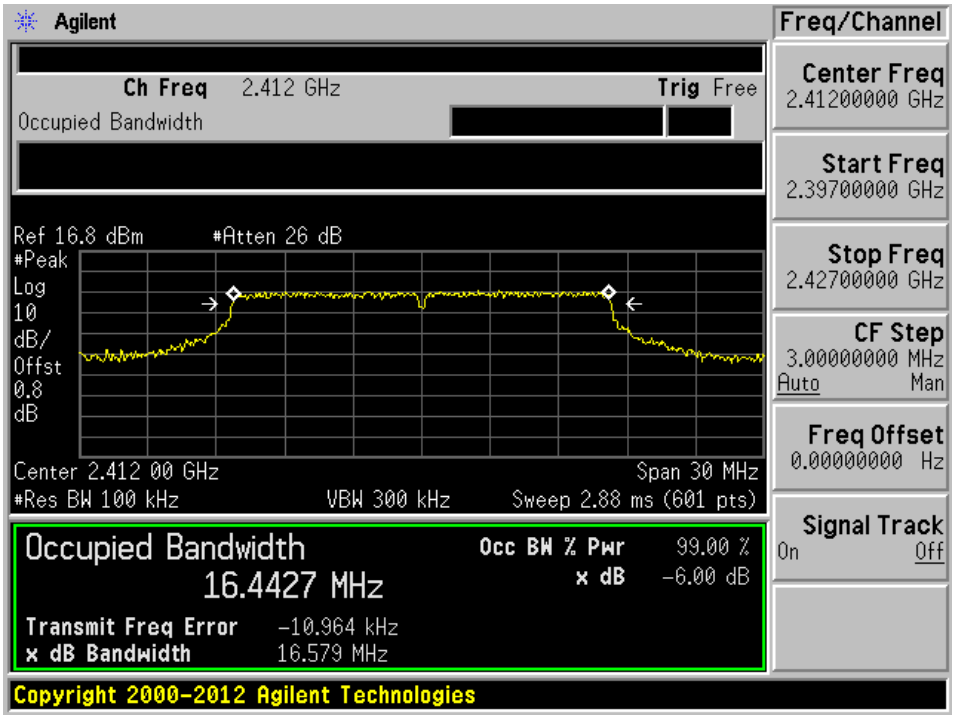


High channel: 2462 MHz

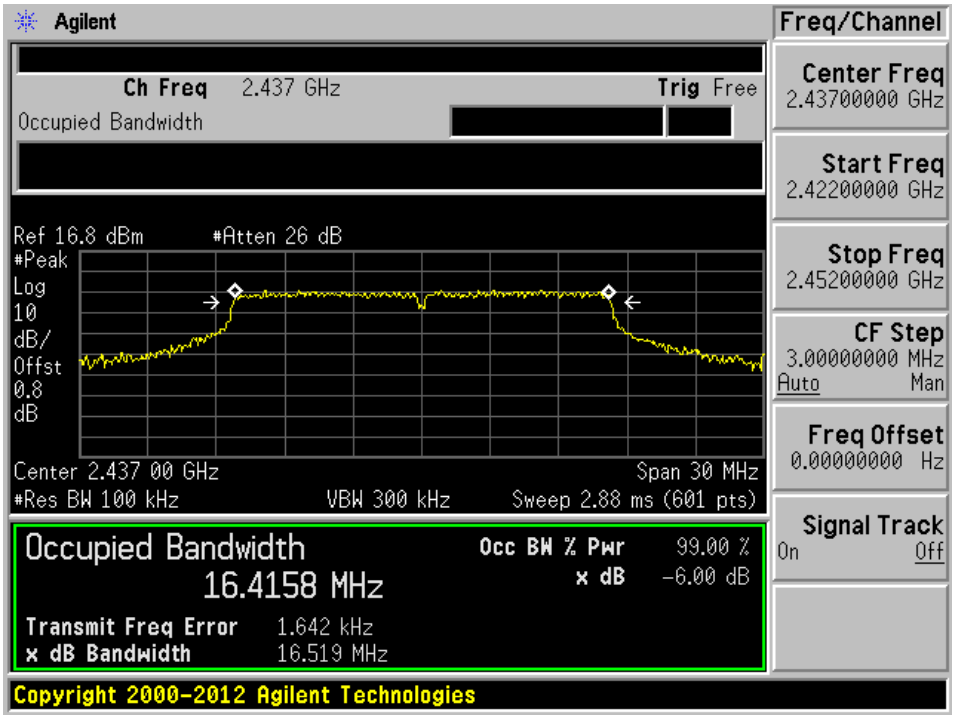


802.11g mode

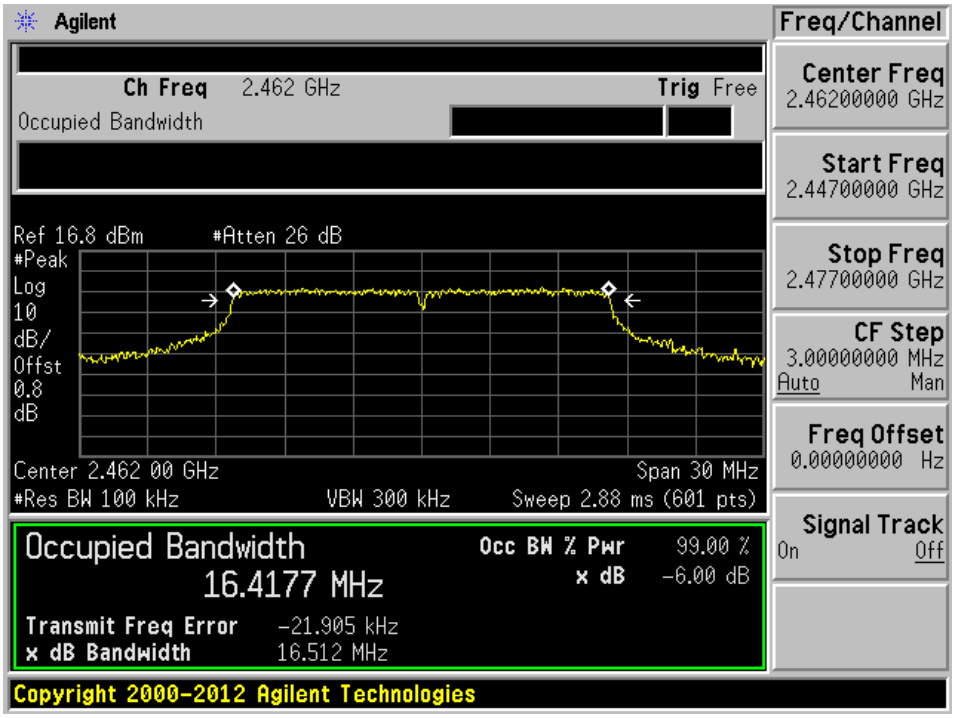
Low channel: 2412 MHz



Middle channel: 2437 MHz

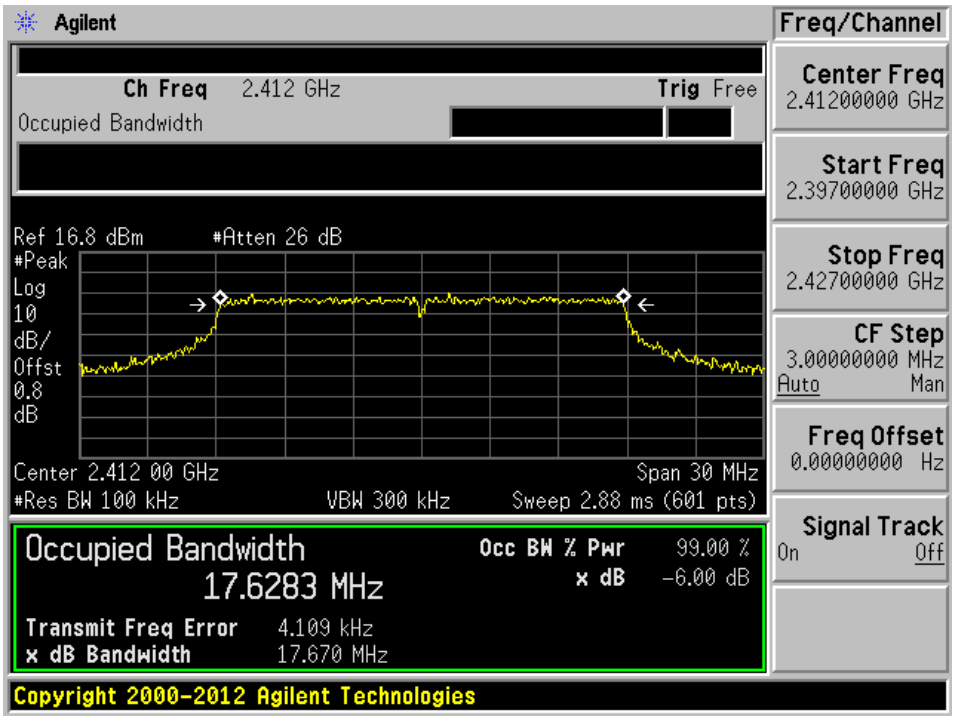


High channel: 2462 MHz

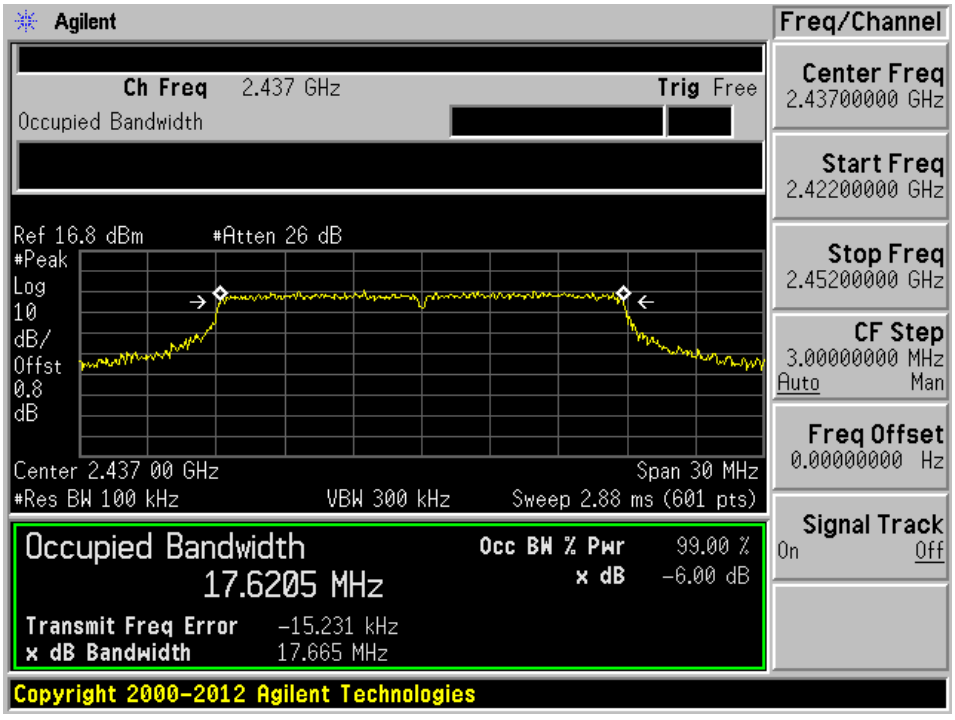


802.11n-HT20 mode

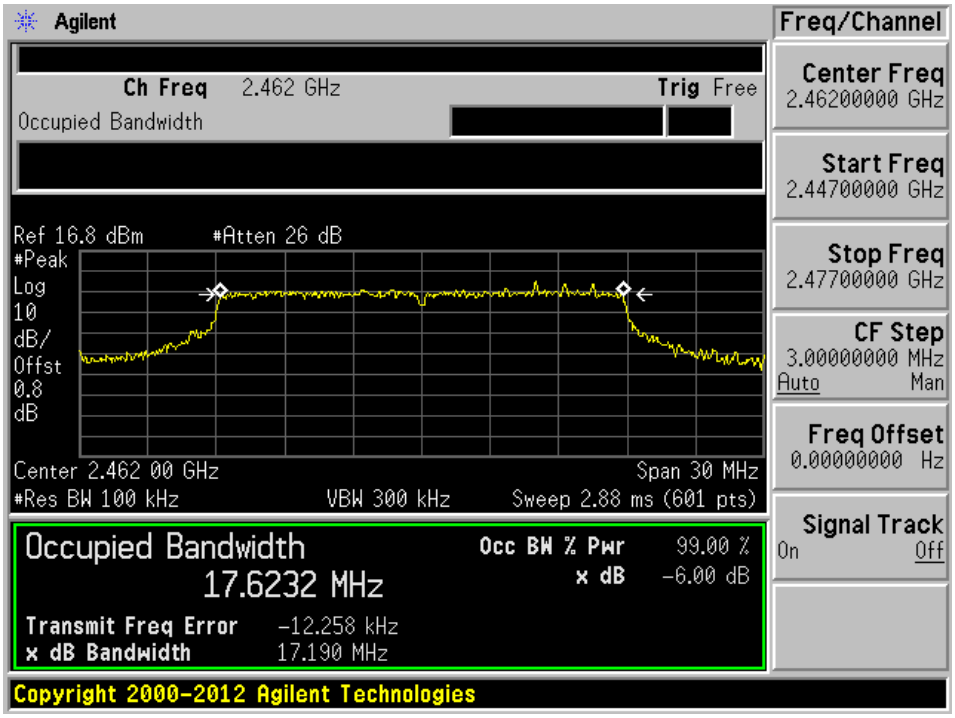
Low channel: 2412 MHz



Middle channel: 2437 MHz

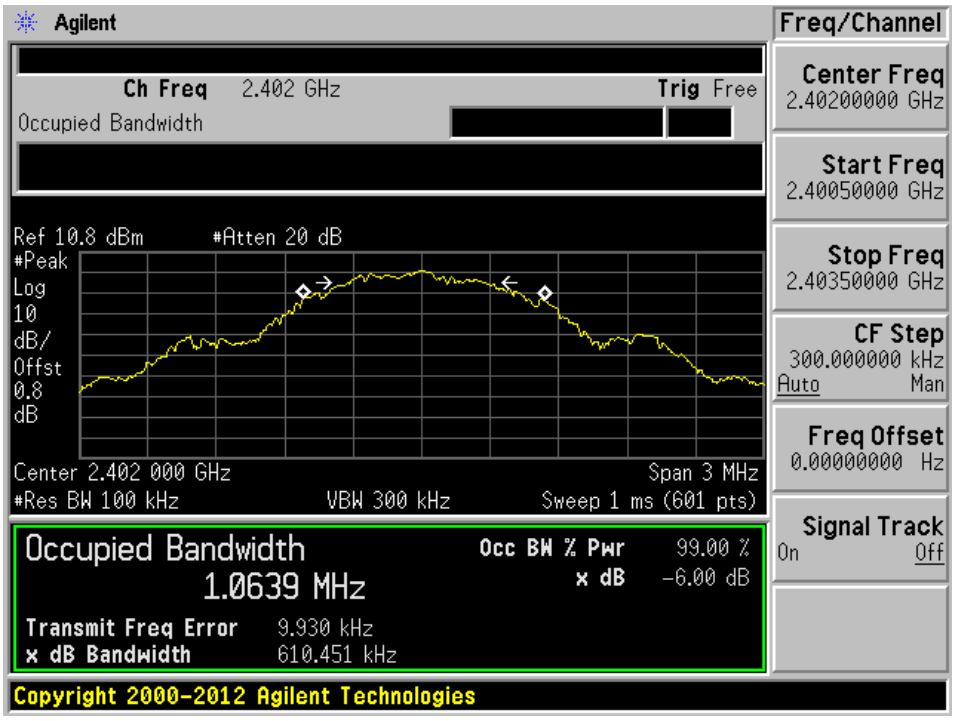


High channel: 2462 MHz

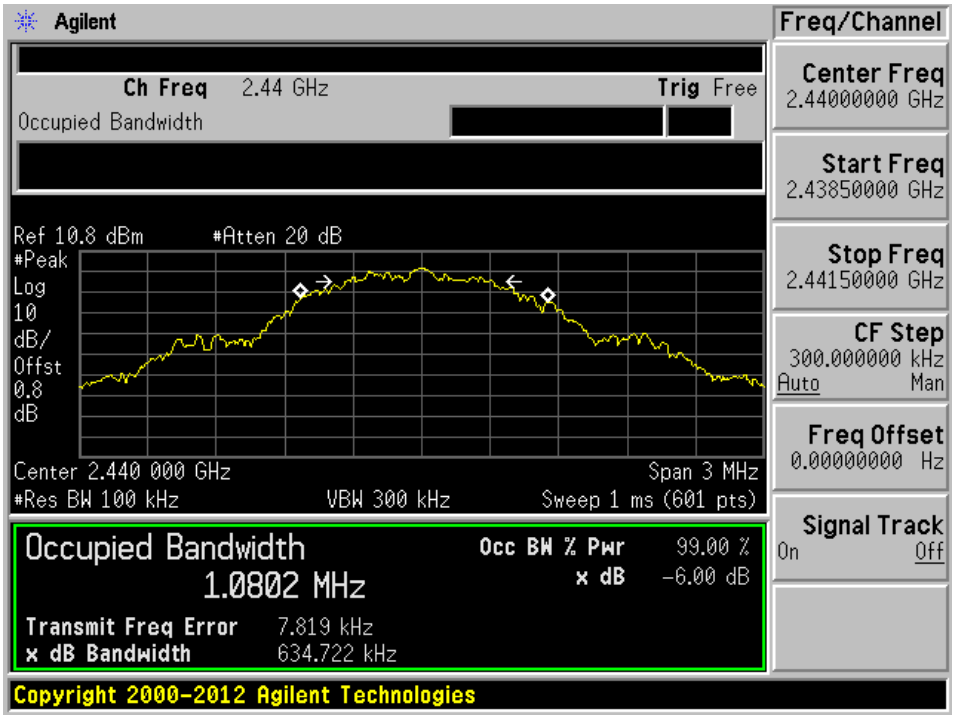


2.4 GHz BLE

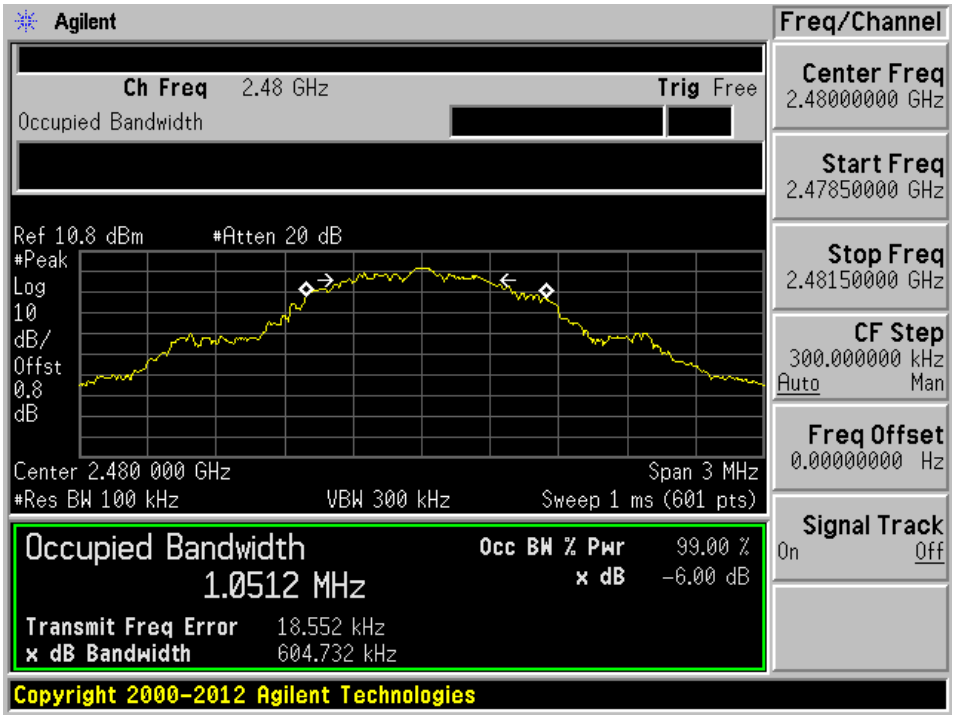
Low channel: 2402 MHz



Middle channel: 2440 MHz



High channel: 2480 MHz



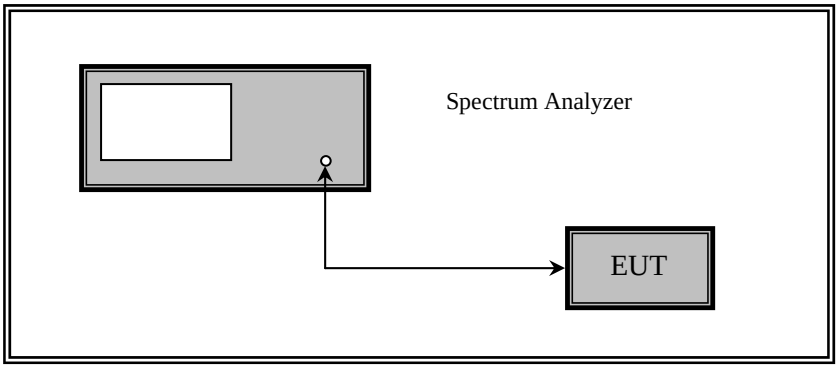
10 FCC §15.247(b) - Output Power Measurement

10.1 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.

10.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v03r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 9: Fundamental emission output power



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:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	101.8 kPa

The testing was performed by Todd Moy on 2015-06-22 in RF site.

10.5 Test Results

2.4 GHz Wi-Fi

Channel	Frequency (MHz)	Conducted Output Power (Average) (dBm)	Conducted Output Power (Peak) (dBm)	Limit (dBm)
802.11b mode				
Low	2412	13.62	17.56	30
Middle	2437	13.19	17.02	30
High	2462	14.27	17.67	30
802.11g mode				
Low	2412	11.45	19.90	30
Middle	2437	11.53	19.80	30
High	2462	12.43	20.60	30
802.11n-HT20 mode				
Low	2412	9.38	18.06	30
Middle	2437	10.75	19.39	30
High	2462	11.99	20.28	30

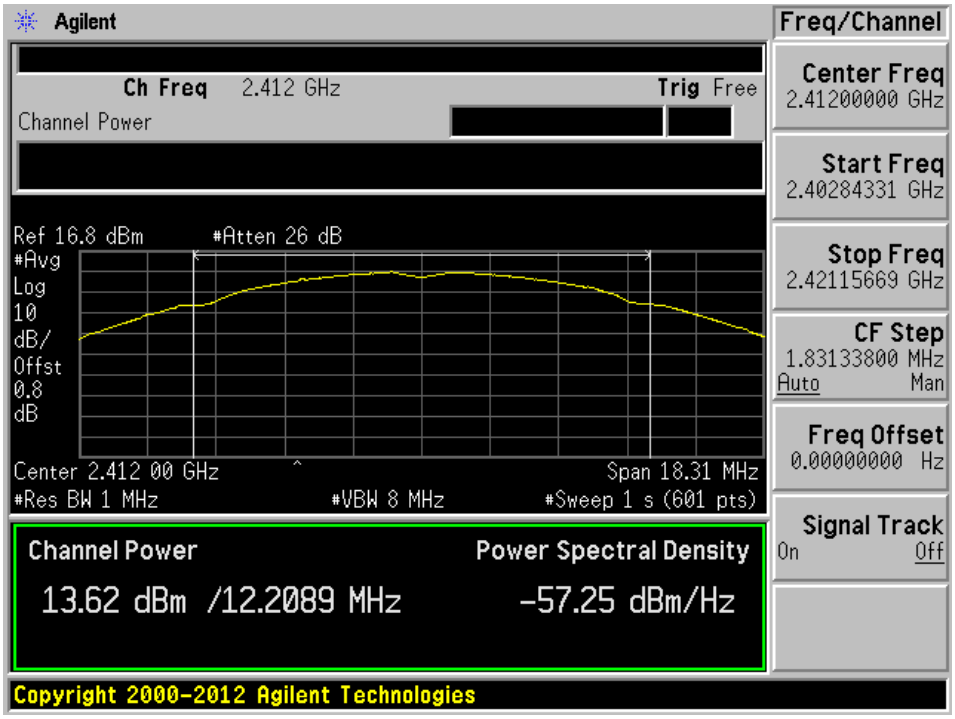
2.4 GHz BLE (Peak)

Channel	Frequency (MHz)	Conducted Output Power (Peak) (dBm)	Limit (dBm)
Low	2402	2.00	30
Middle	2440	2.43	30
High	2480	2.56	30

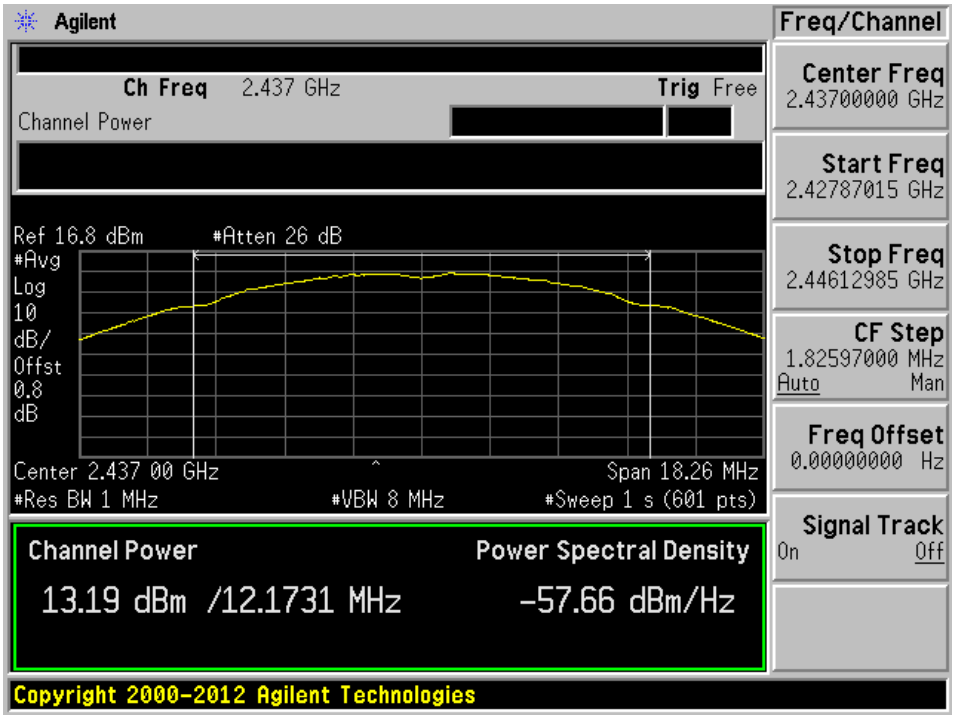
Please refer to following plots.

802.11b mode

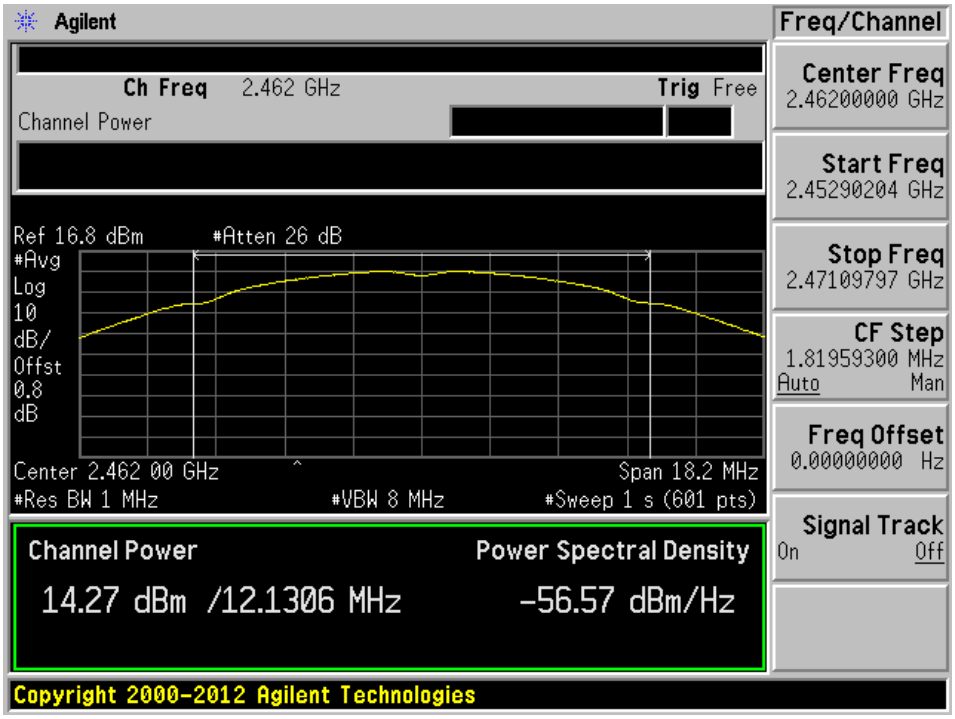
Low Channel



Middle Channel

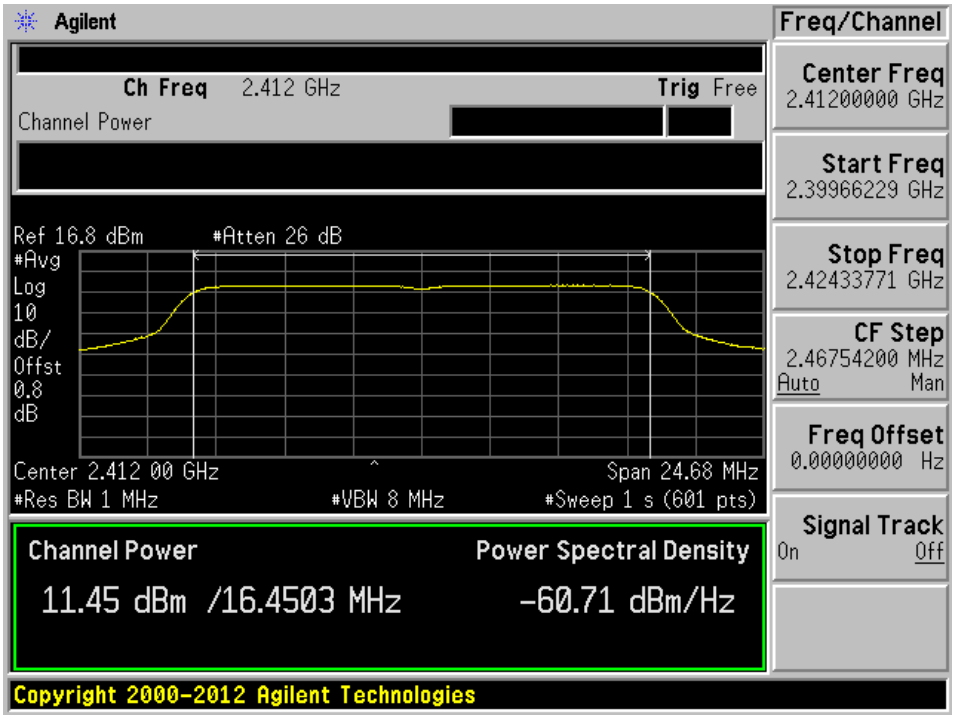


High Channel

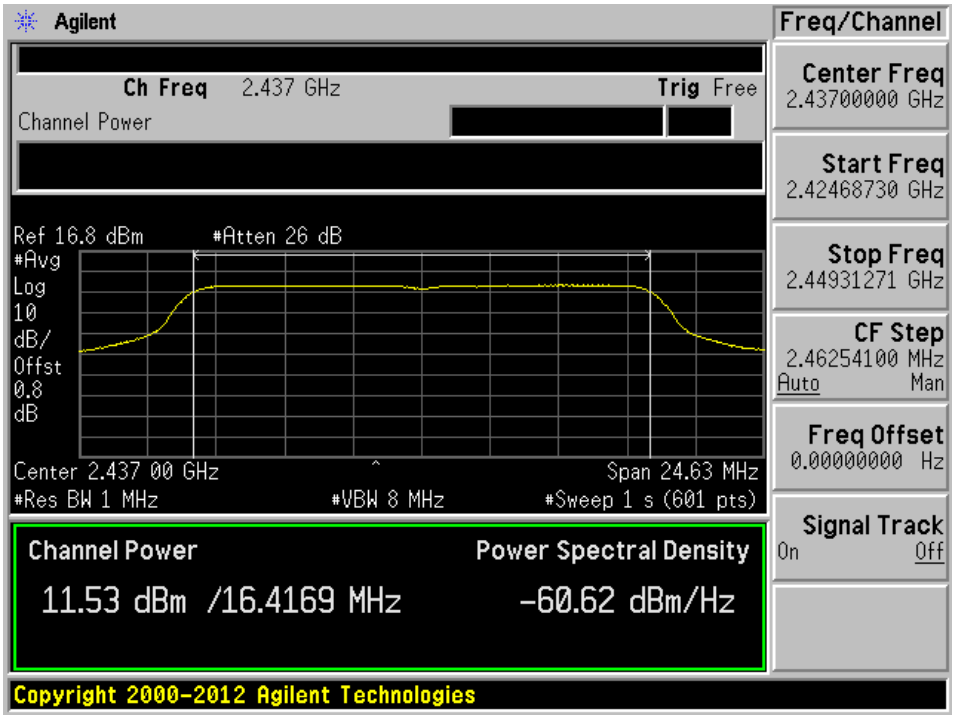


802.11g mode

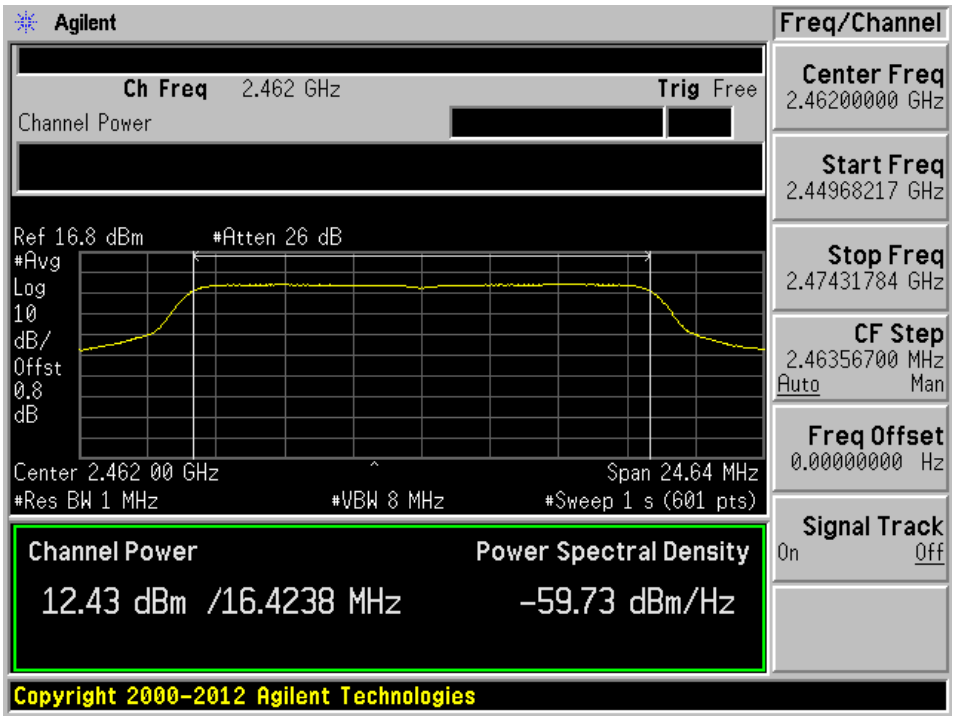
Low Channel



Middle Channel

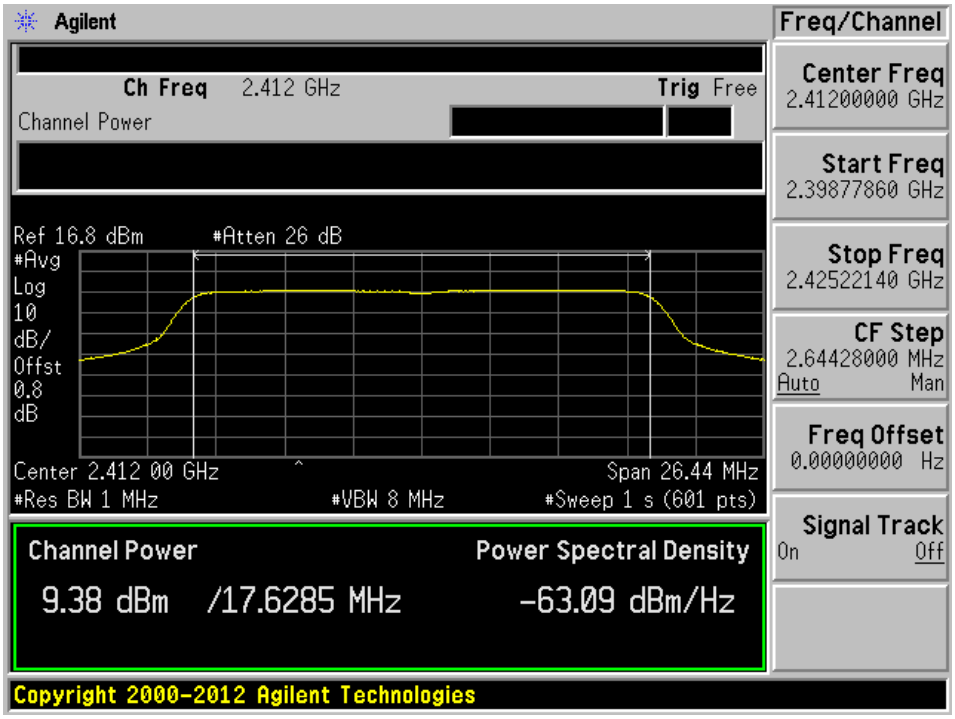


High channel

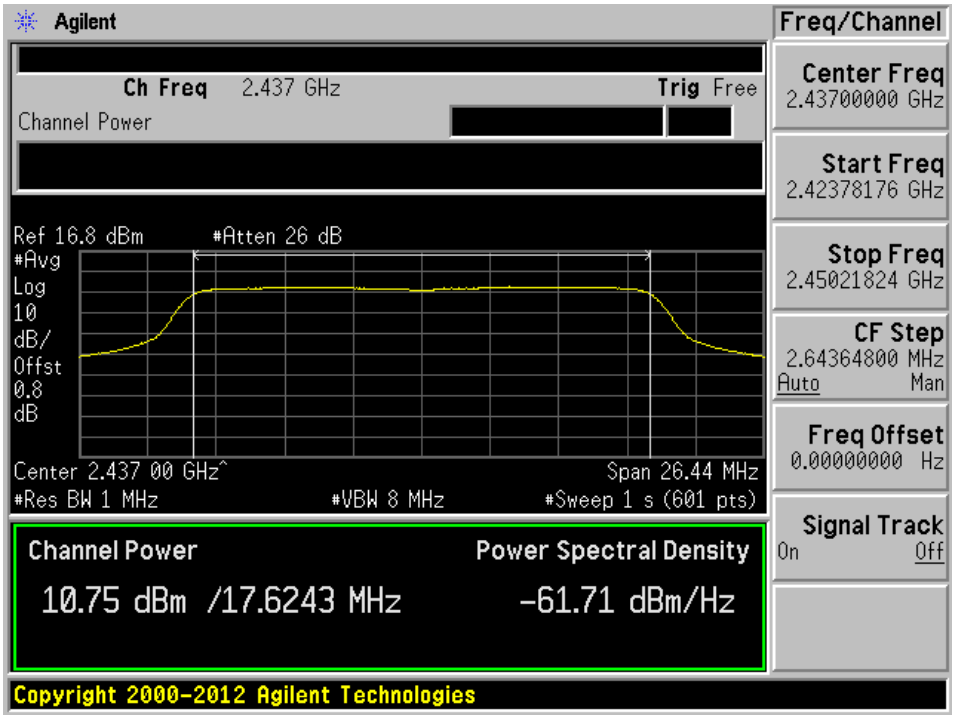


802.11n-HT20 mode

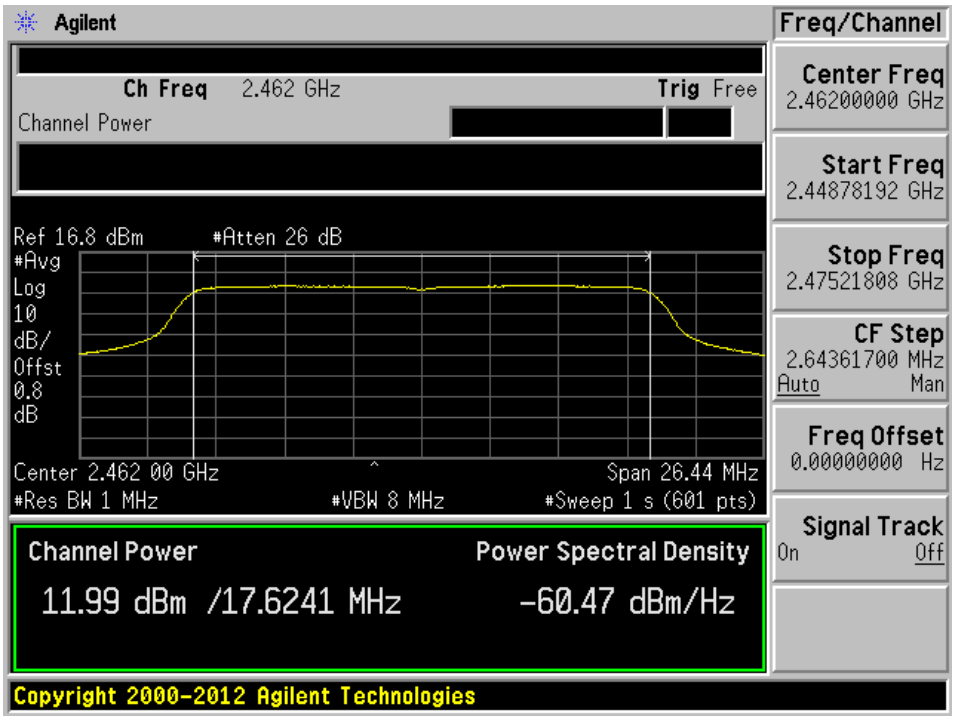
Low Channel



Middle Channel

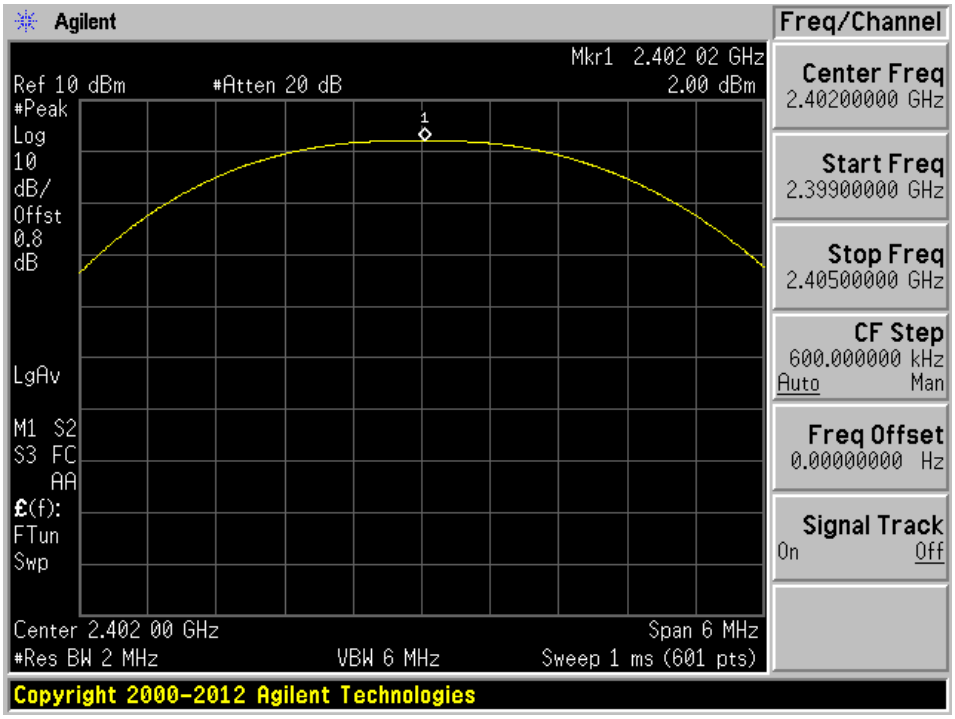


High Channel

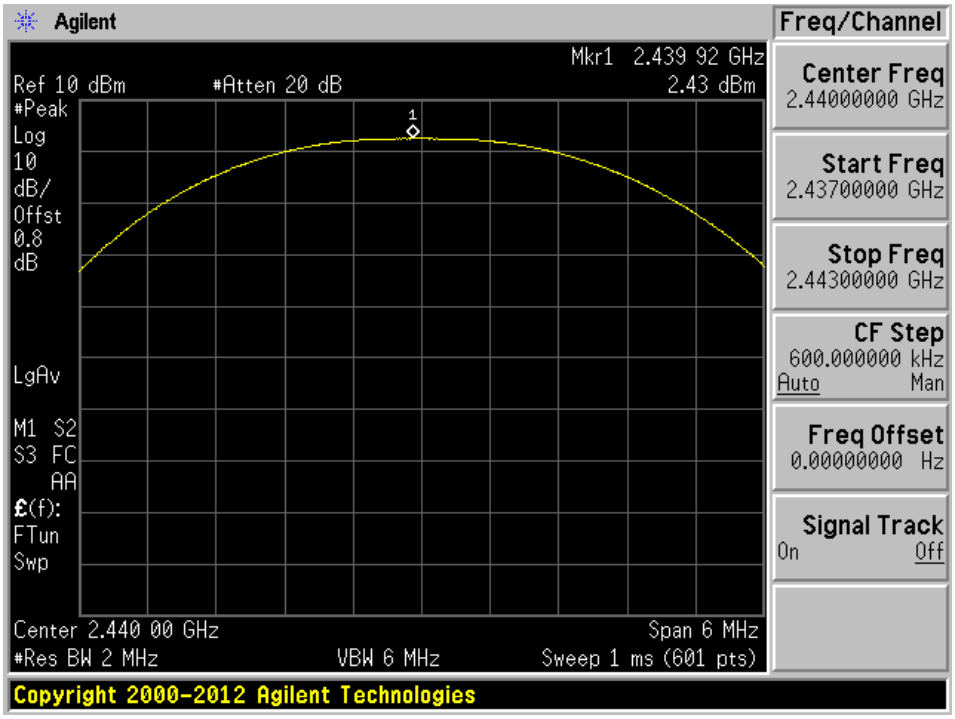


BLE mode

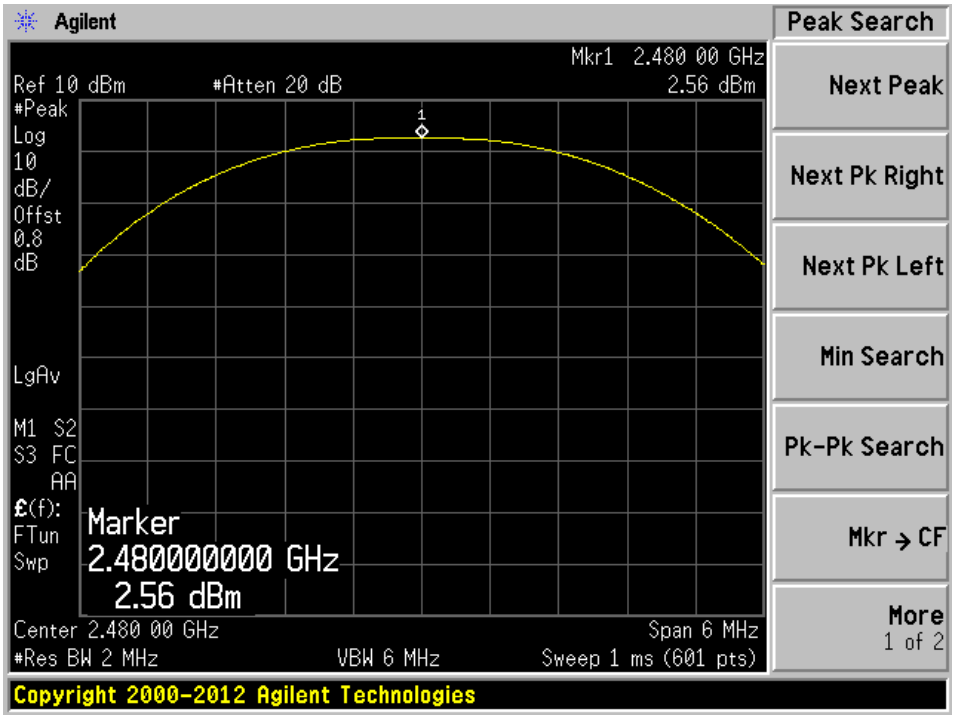
Low Channel



Middle Channel



High Channel



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

11.1 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).

11.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v03r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 13: Band-edge measurements

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:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	101.8 kPa

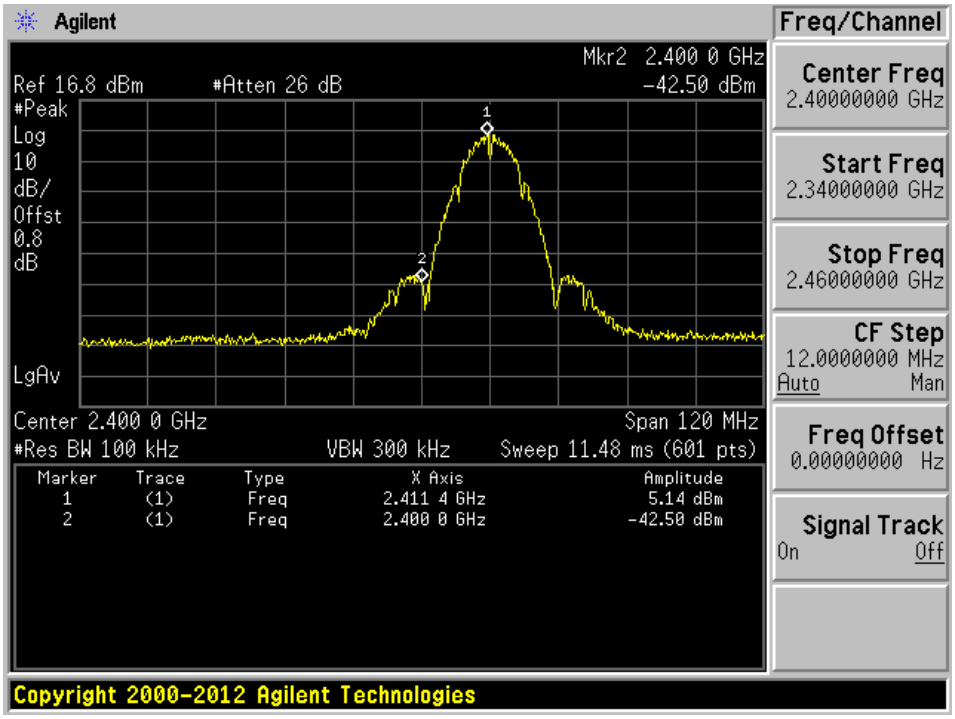
The testing was performed by Todd Moy on 2015-06-22 in RF site.

11.5 Test Results

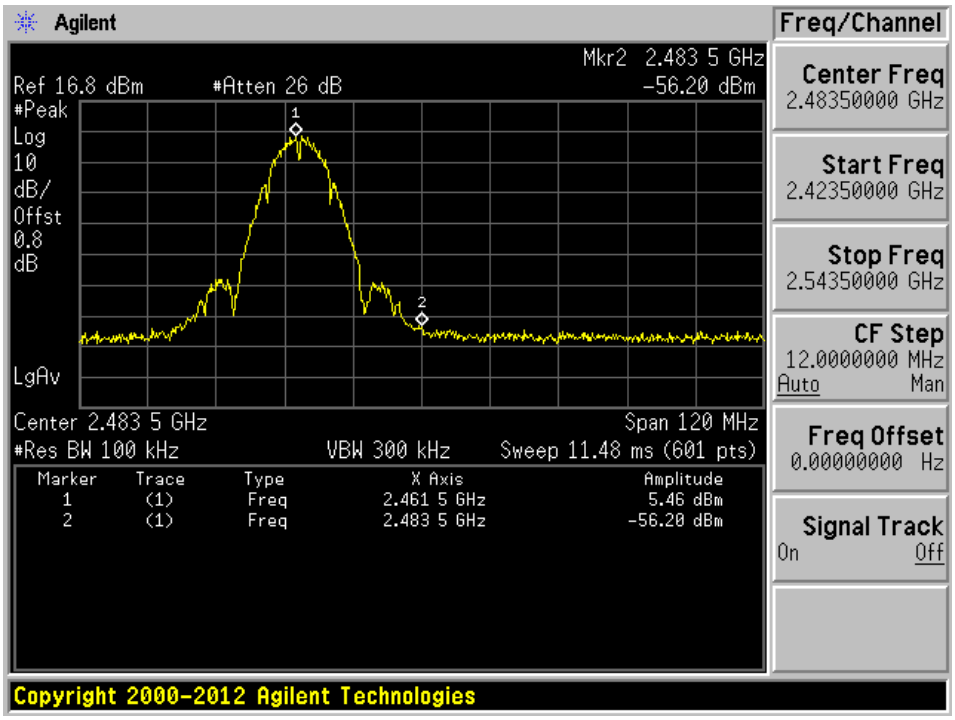
Please refer to following pages for plots of band edge.

802.11b mode

Low Band Edge

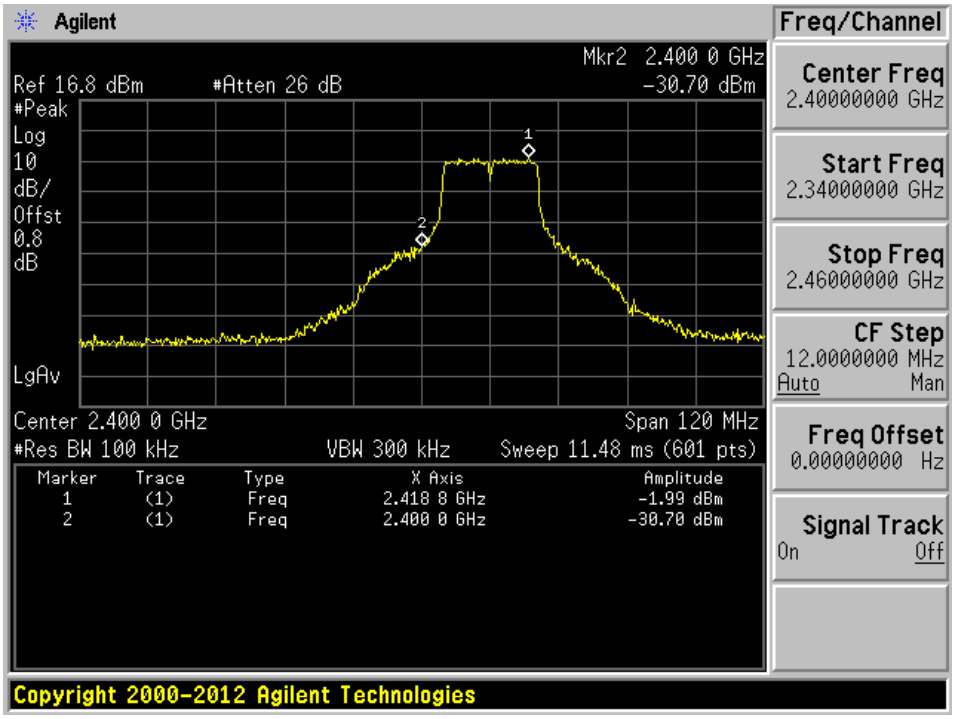


High Band Edge

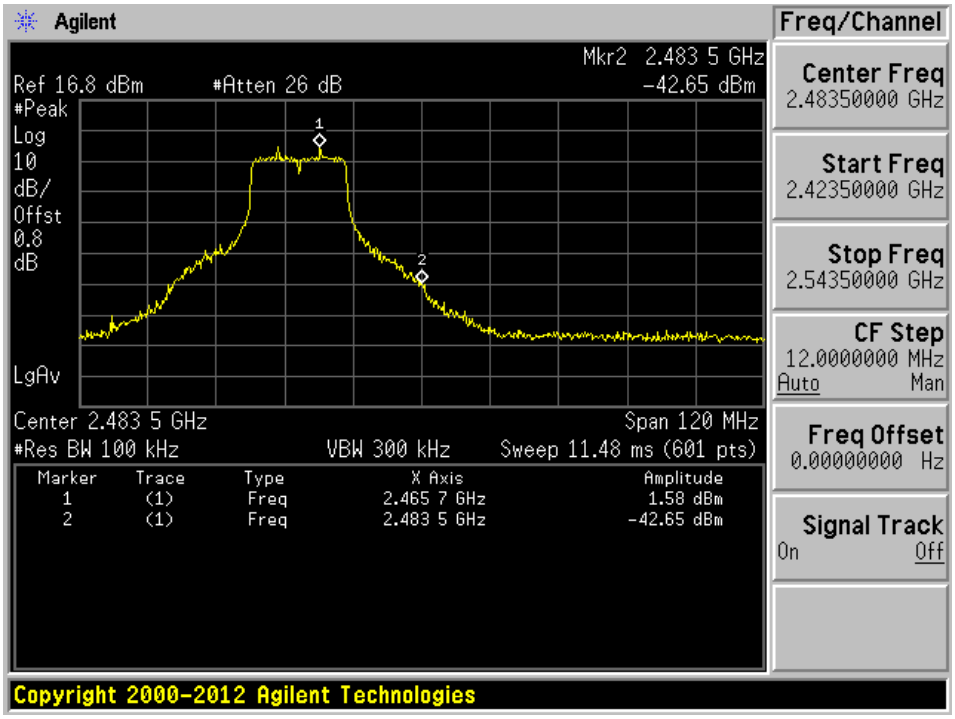


802.11g mode

Low Band Edge

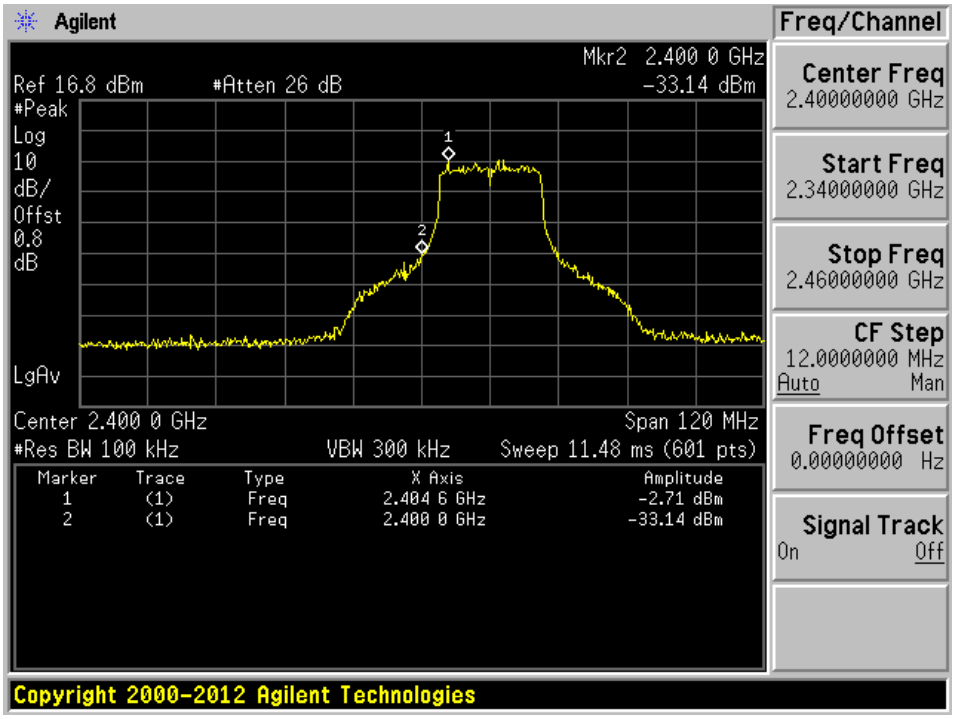


High Band Edge

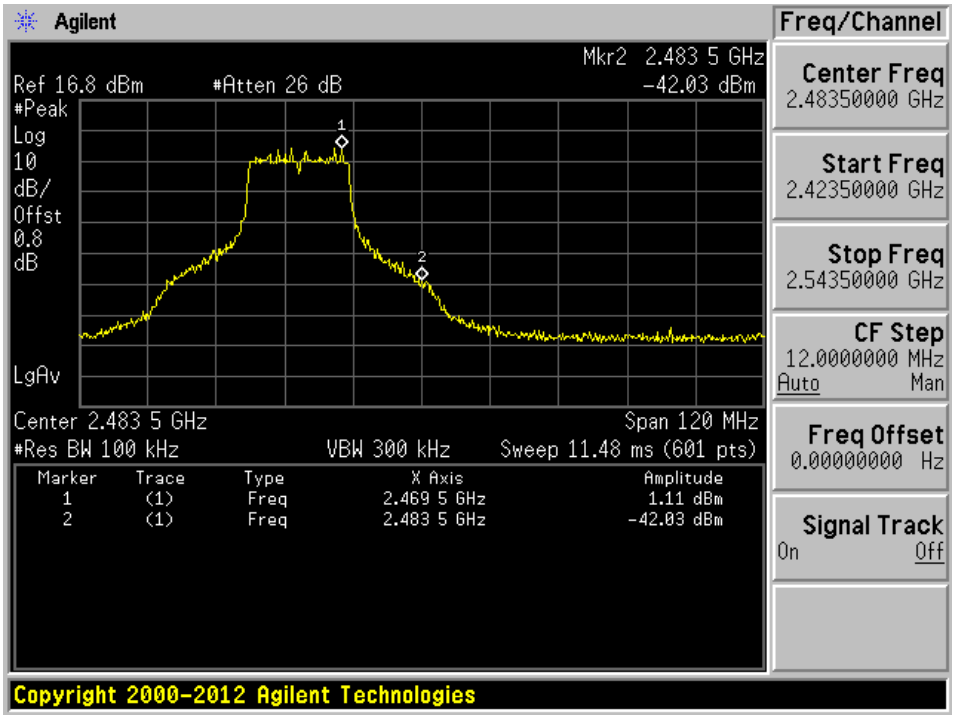


802.11n-HT20 mode

Low Band Edge

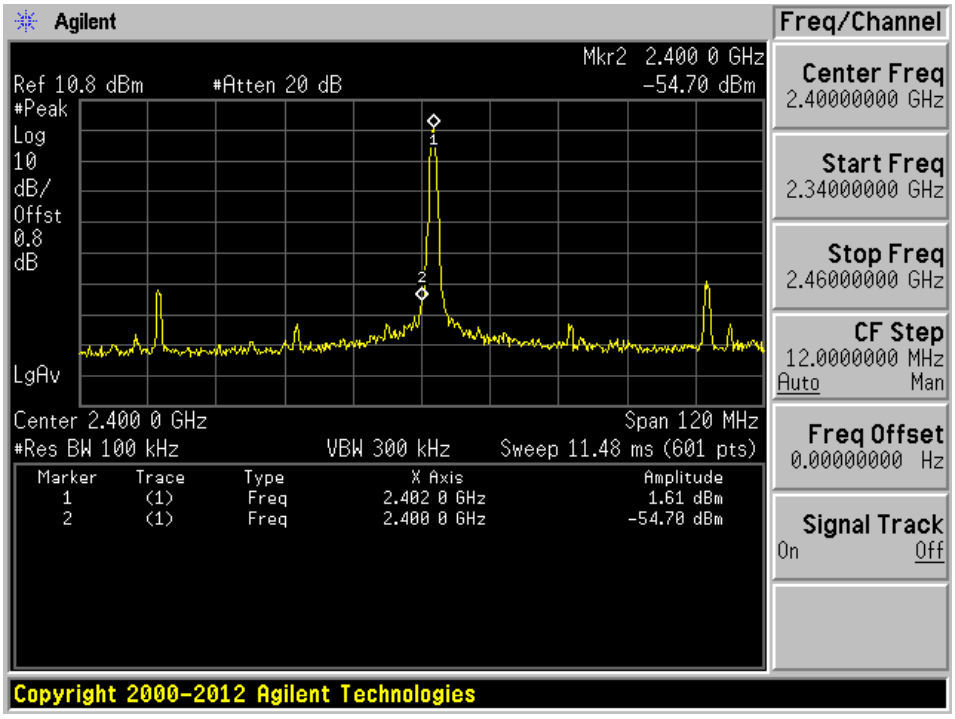


High Band Edge

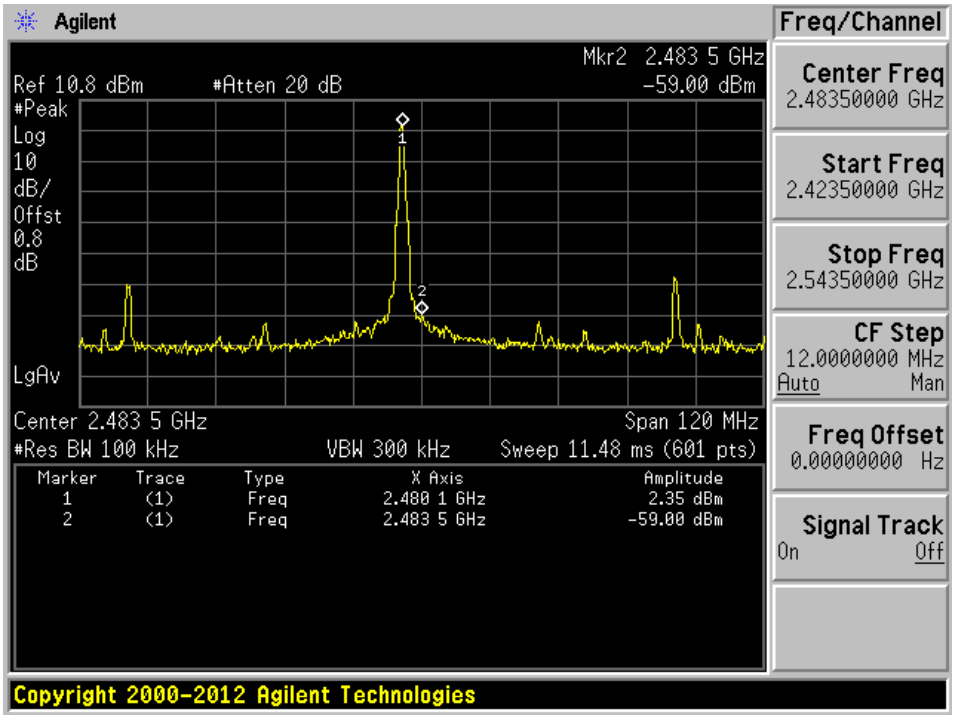


BLE mode

Low Band Edge



High Band Edge



12 FCC §15.247(e) - Power Spectral Density

12.1 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.

12.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v03r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 10: Maximum power spectral density level in the fundamental emission

12.3 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.*

12.4 Test Environmental Conditions

Temperature:	23 ºC
Relative Humidity:	42 %
ATM Pressure:	101.8 kPa

The testing was performed by Todd Moy on 2015-06-22 in RF site.

12.5 Test Results

2.4 GHz Wi-Fi

Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
802.11b mode			
Low	2412	-11.33	8
Middle	2437	-12.09	8
High	2462	-10.10	8
802.11g mode			
Low	2412	-14.21	8
Middle	2437	-15.71	8
High	2462	-14.02	8
802.11n-HT20 mode			
Low	2412	-16.48	8
Middle	2437	-16.83	8
High	2462	-15.29	8

2.4 GHz BLE

Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Low	2402	-9.36	8
Middle	2440	-8.93	8
High	2480	-8.94	8

Please refer to the following plots for detailed test results:

802.11b mode

Low channel: 2412 MHz

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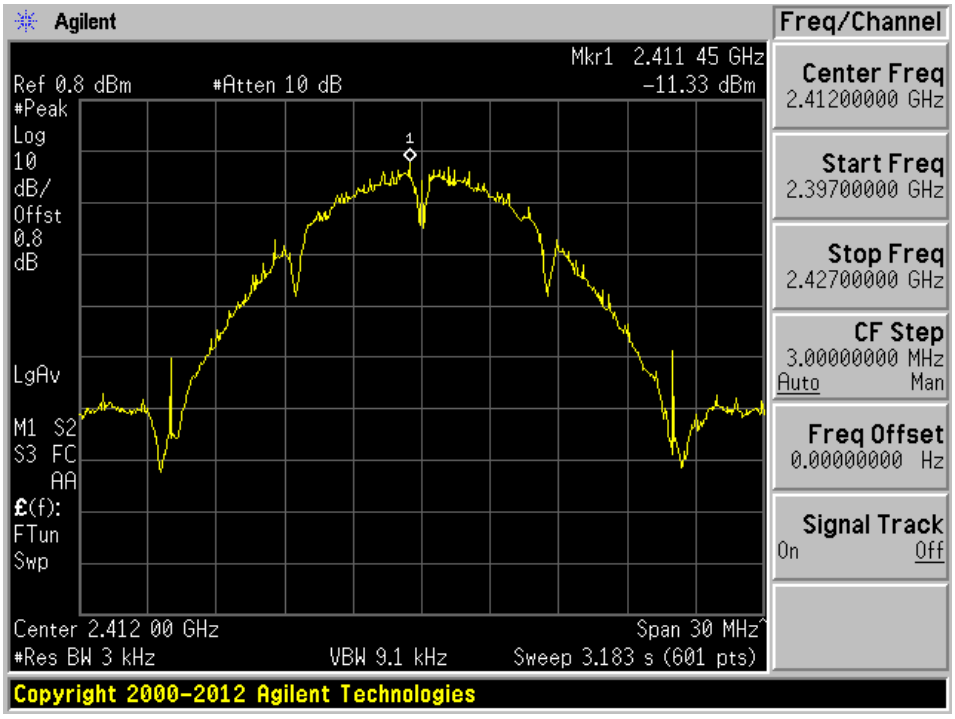
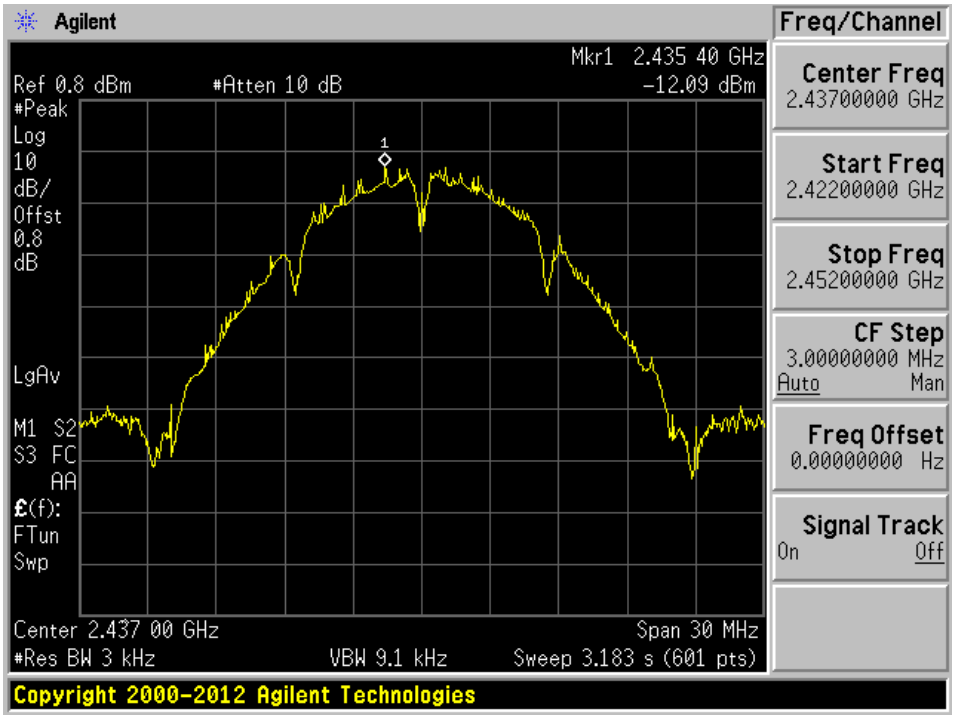
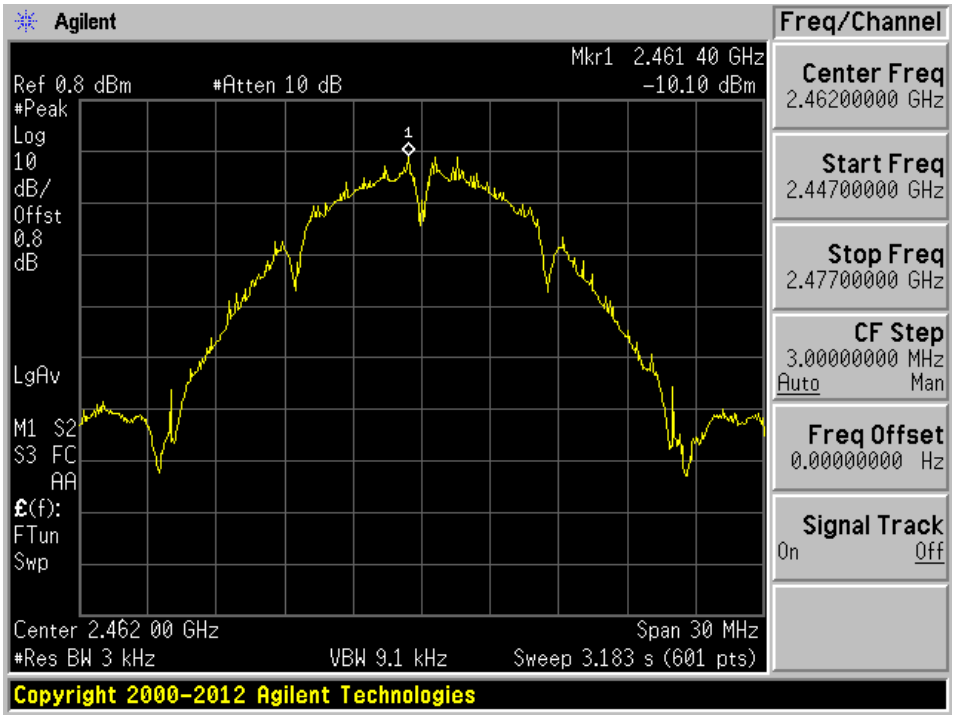


Middle channel: 2437 MHz

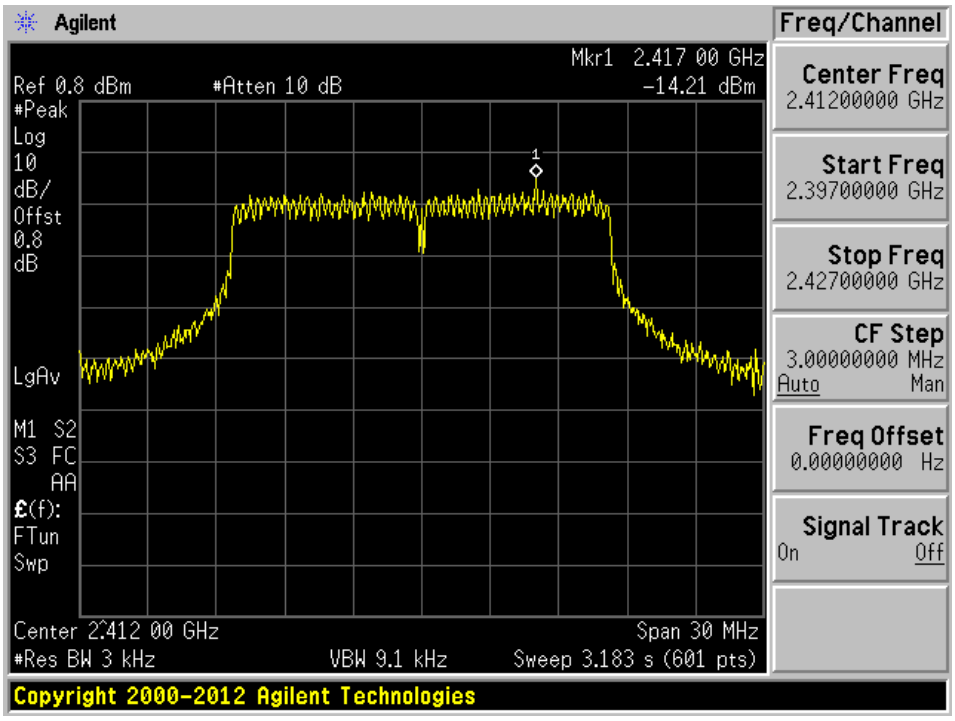


High channel: 2462 MHz

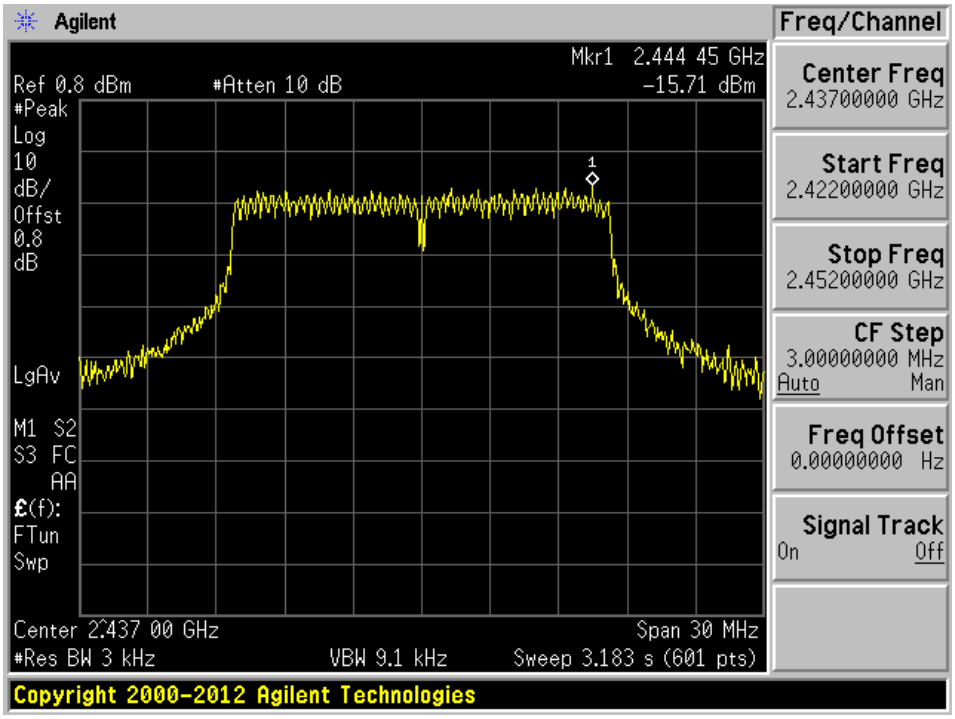


802.11g mode

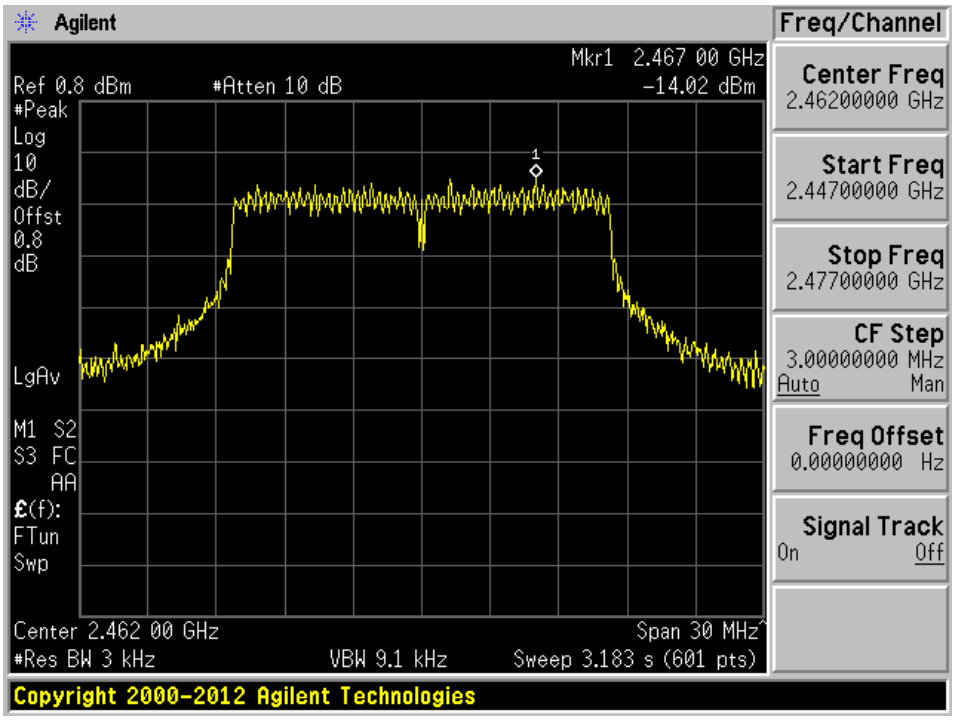
Low channel: 2412 MHz



Middle channel: 2437 MHz

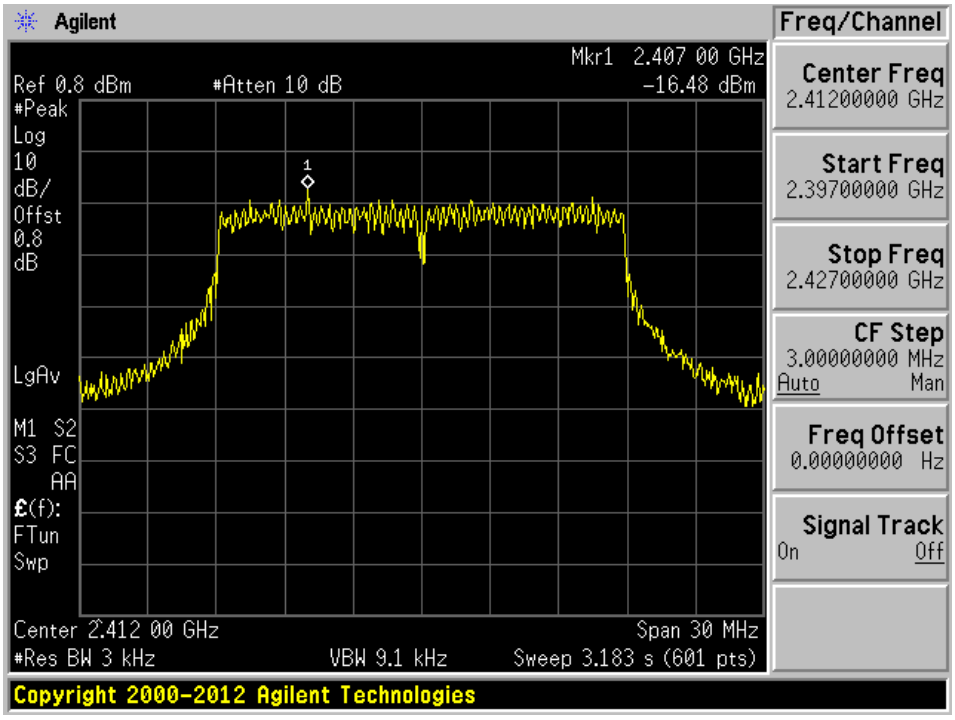


High channel: 2462 MHz

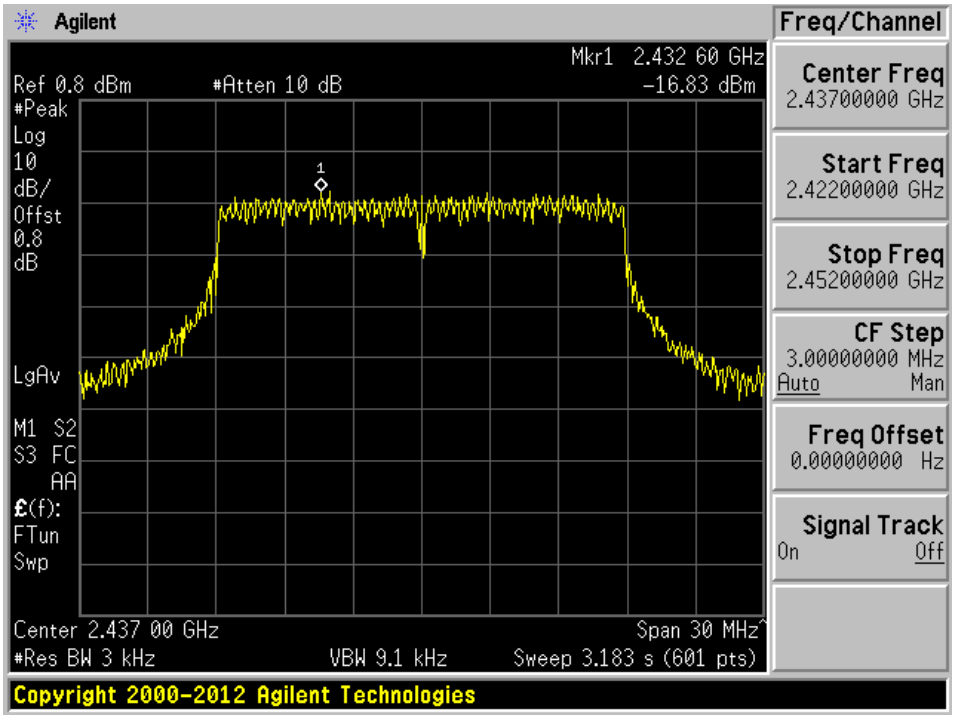


802.11n-HT20 mode

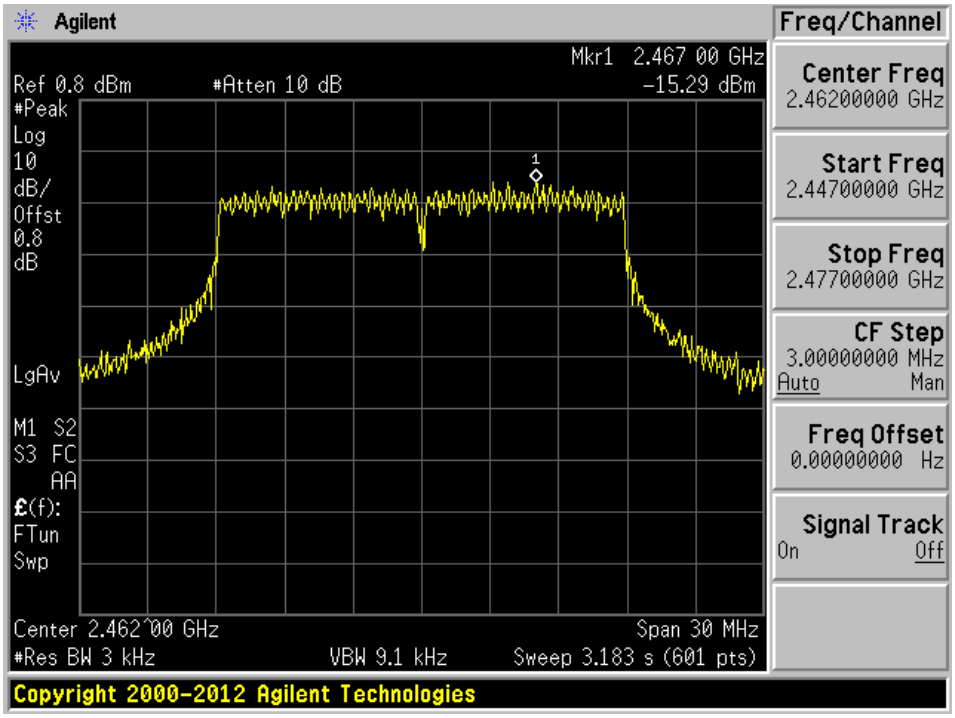
Low channel: 2412 MHz



Middle channel: 2437 MHz

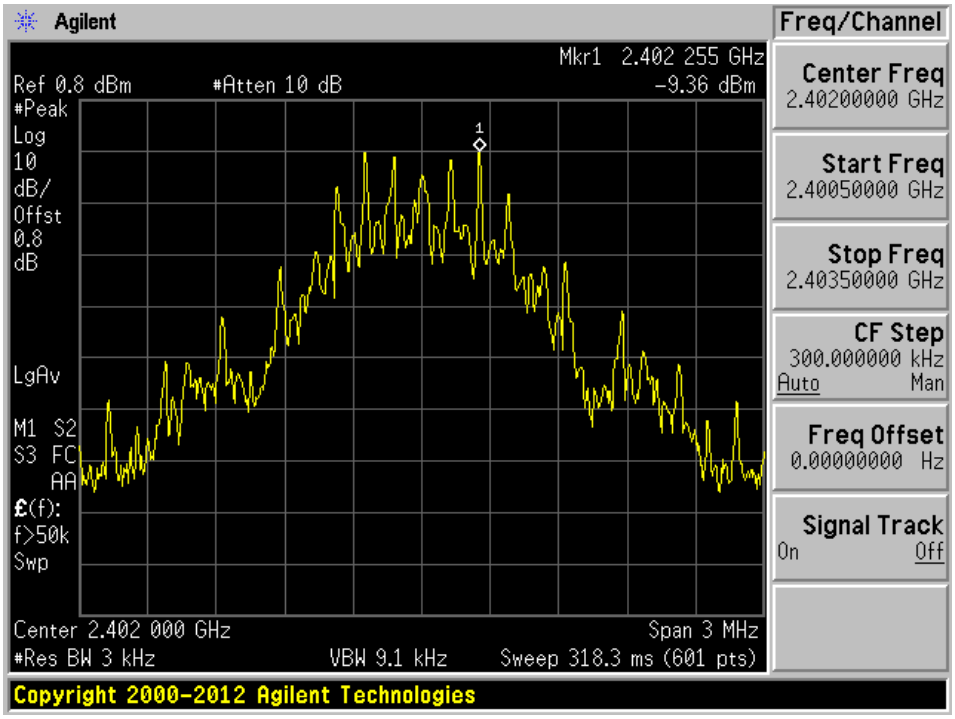


High channel: 2462 MHz

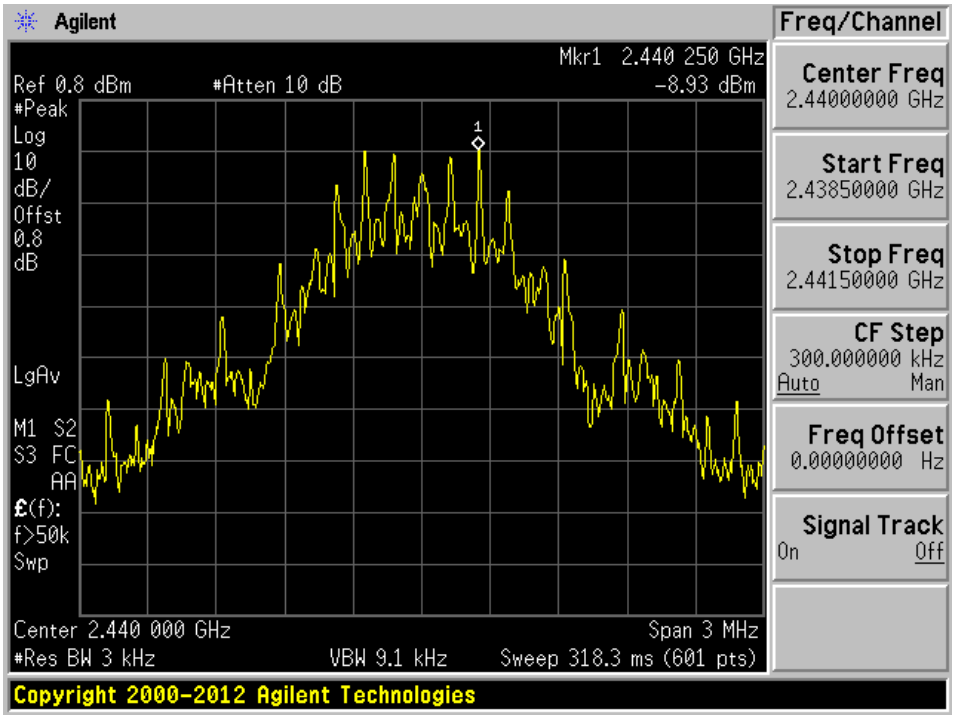


BLE mode

Low channel: 2402 MHz



Middle channel: 2440 MHz



High channel: 2480 MHz