



FCC PART 15, SUBPART C
IC RSS-210, ISSUE 8, DECEMBER 2010

TEST AND MEASUREMENT REPORT

For

GoPro, Inc.

3000 Clearview Way, San Mateo, CA 94402, USA

FCC ID: CNFHWPP1
IC: 10193A-HWPP1

Report Type: Original Report	Product Type: Portable Camera with 2.4 GHz WLAN and BLE
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* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “*” (Rev. 12)

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1406136-247	Original Report	2014-08-29

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: CNFHWPP1; IC: 10193A-HWPP1*, model number: *HWPP1*, which henceforth is referred to as the EUT (Equipment Under Test.) The EUT is a portable camera with 2.4 GHz WLAN and BLE.

1.2 Mechanical Description of EUT

The EUT measures approximately 59 mm (L) x 41.6 mm (W) x 28.7 mm (H) and weighs approximately 65 g (without battery) and 87g (with battery).

The data gathered are from a typical production sample provided by the manufacturer with serial number: PIDVT1614 (D1F) and D1E, assigned by client.

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 and IC RSS-210 Issue 8, Dec 2010.

The objective is to determine compliance with FCC Part 15.247 and IC RSS-210 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)

R1406136-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 ± 2.0 dB for Conducted Emissions tests and ± 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 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 Chaoran Chu to comply with the standard requirements being tested against.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Samsung	HD Screen	UN22D5003BF	23S13CRC00363D
DELL	Laptop	Latitude E6530	-

2.5 EUT Internal Configuration Details

Manufacturer	Description	Type	Serial Number
AT&S	Mother Board	MX3SH	4.2
AT&S	Camera Board	-	4.0
AT&S	USB Board	-	4.0
Lexar	Micro SD Memory Card 32GB	-	-
GoPro	Li-ion Battery Pack	-	-

2.6 Power Supply and Line Filters

Manufacturer	Description	Model	Part Number
GoPro	Power Adapter	Switching Power Adapter	SPA011AU5W2
DELL	AC Adapter	AA90PM111	

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	1M	Plug	EUT
HDMI Cable	1M	EUT	Monitor
RF Cable	<1M	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & IC Rules	Description of Test	Results
FCC §15.247(i), §2.1093 IC RSS-102	RF Exposure	Compliant
FCC §15.203 IC RSS-Gen §7.1.2	Antenna Requirement	Compliant
FCC §15.207(a) IC RSS-Gen §7.2.4	AC Line Conducted Emissions	Compliant
FCC §15.247 (d) IC RSS-210 §A8.5	Spurious Emissions at Antenna Port	Compliant
FCC §15.205 IC RSS-210 §2.2	Restricted Bands	Compliant
FCC §15.209, §15.247 (d) IC RSS-210 §A8.5	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) IC RSS-210 §A8.2	6 dB Emission Bandwidth	Compliant
FCC §15.247(b)(3) IC RSS-210 §A8.4	Maximum Peak Output Power	Compliant
FCC §15.247(d) IC RSS-210 §A8.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(e) IC RSS-210 §A8.2(b)	Power Spectral Density	Compliant

4 FCC §15.247(i), §2.1093 & IC RSS-102 – RF Exposure

4.1 Applicable Standards

FCC §2.1093, §15.247(i) and IC RSS-102

4.2 Test Result

Compliance, please refer to the SAR report: R1406136-SAR.

5 FCC §15.203 & IC RSS-Gen §7.1.2 – 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.

According to IC RSS-Gen §7.1.2: Transmitter Antenna

A transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 mW or less. For devices of output powers greater than 10 mW, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

5.2 Antenna Description

Antenna Location	Antenna Gain (dBi) @ 2.4 GHz
Internal	0

The Highest Gain is 0 dBi, and the antenna consists of non-standard (UFL) connectors; Antenna gain that exceeds 6 dBi was added to RF measurement therefore, it complies with the antenna requirement. Please refer to the internal photos.

6 FCC §15.207 & IC RSS-Gen §7.2.4 – AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 and IC RSS-Gen §7.2.4 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 μ H/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 and IC RSS-Gen §7.2.4 limits.

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

The AC/DC power adapter of the 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”.

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2013-09-28	1 year
Solar Electronics	LISN-1	9252-50-R-24-N	511205	2014-06-25	1 year
Solar Electronics	LISN-2	9252-50-R-24-N	511213	2014-06-25	1 year
TTE	Filter, High Pass	H962-150k-50-21378	K7133	2014-01-30	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:	22-24° C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 KPa

The testing was performed by Cipher Chu on 2014-07-14 to 2014-07-23 in 5m chamber3.

6.8 Summary of Test Results

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

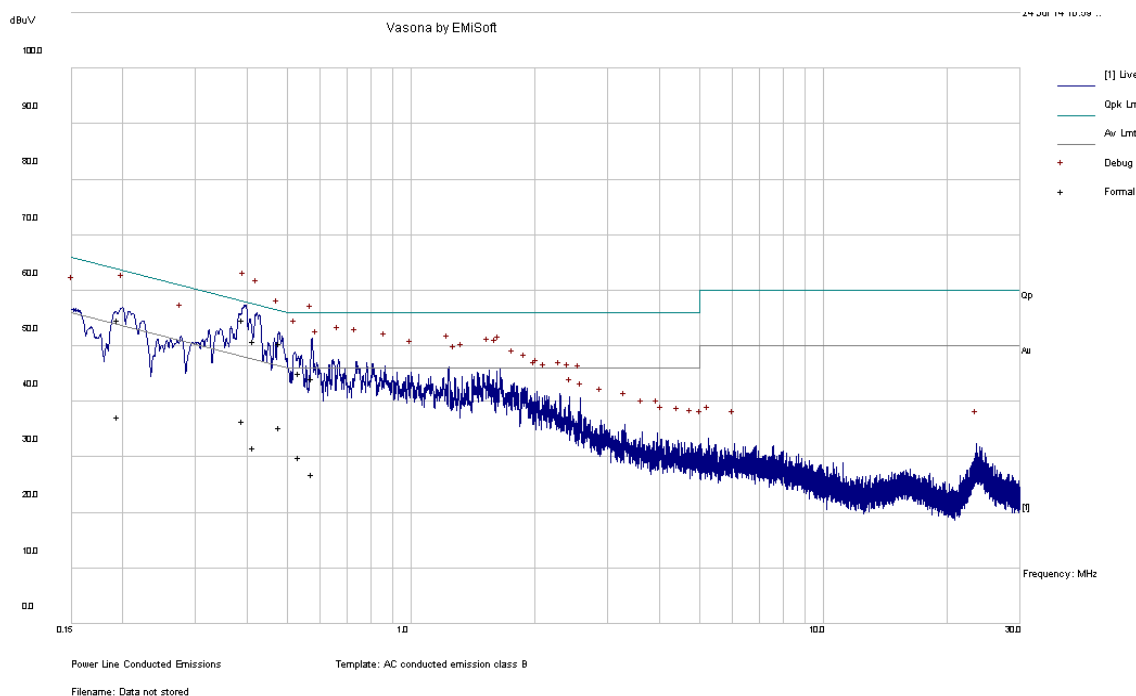
2.4 GHz Band

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	Frequency (MHz)	Conductor Mode (Line/Neutral)	Range (MHz)
-3.3	0.392229	Neutral	0.15-30

6.9 Conducted Emissions Test Plots and Data

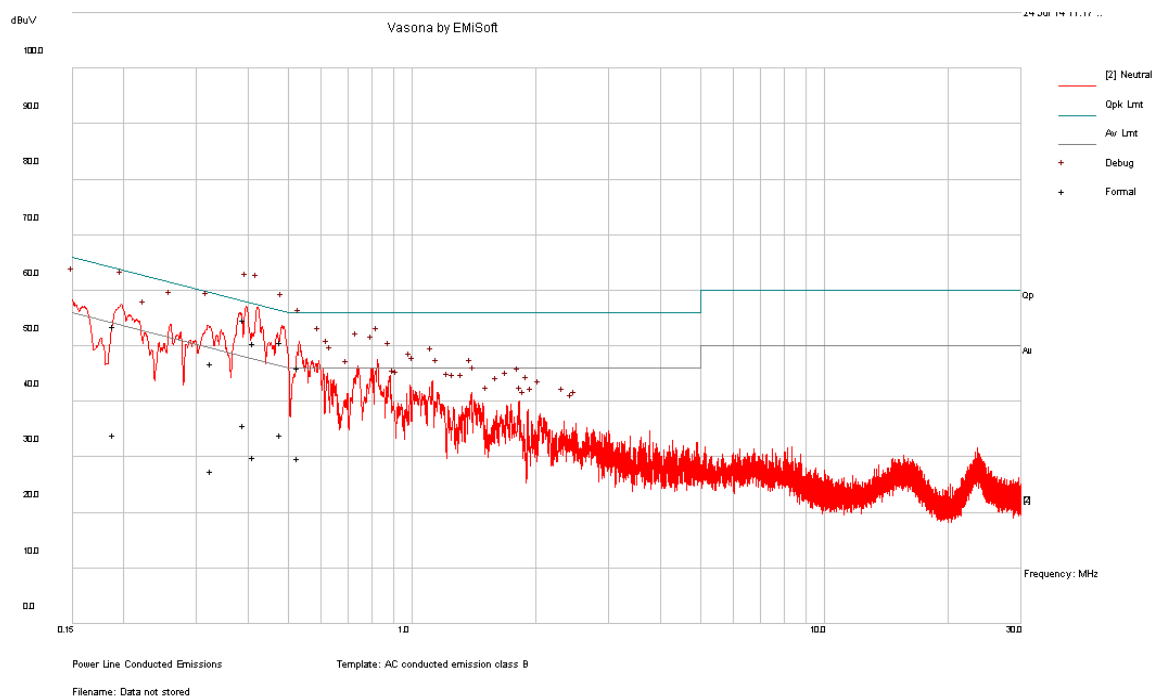
2.4 Wi-Fi Band and BLE Co-location

120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBμV)	Conductor (Line/Neutral)	Limit (dBμV)	Margin (dB)	Detector (QP/Ave.)
0.392666	54.63	Line	58.01	-3.38	QP
0.416261	50.89	Line	57.52	-6.64	QP
0.481356	50.42	Line	56.32	-5.89	QP
0.576281	44.18	Line	56	-11.82	QP
0.1952	54.7	Line	63.81	-9.11	QP
0.535496	45.22	Line	56	-10.78	QP

Frequency (MHz)	Corrected Amplitude (dBμV)	Conductor (Line/Neutral)	Limit (dBμV)	Margin (dB)	Detector (QP/Ave.)
0.392666	36.49	Line	48.01	-11.51	Ave.
0.416261	31.69	Line	47.52	-15.83	Ave.
0.481356	35.35	Line	46.32	-10.96	Ave.
0.576281	26.85	Line	46	-19.15	Ave.
0.1952	37.34	Line	53.81	-16.47	Ave.
0.535496	30	Line	46	-16	Ave.

120 V, 60 Hz – Neutral

Frequency (MHz)	Corrected Amplitude (dBμV)	Conductor (Line/Neutral)	Limit (dBμV)	Margin (dB)	Detector (QP/Ave.)
0.413565	50.46	Neutral	57.58	-7.12	QP
0.392229	54.71	Neutral	58.02	-3.3	QP
0.481766	50.61	Neutral	56.31	-5.7	QP
0.531686	46.12	Neutral	56	-9.88	QP
0.32609	46.92	Neutral	59.55	-12.64	QP
0.189375	53.47	Neutral	64.06	-10.6	QP

Frequency (MHz)	Corrected Amplitude (dBμV)	Conductor (Line/Neutral)	Limit (dBμV)	Margin (dB)	Detector (QP/Ave.)
0.413565	29.96	Neutral	47.58	-17.61	Ave.
0.392229	35.65	Neutral	48.02	-12.37	Ave.
0.481766	34.04	Neutral	46.31	-12.26	Ave.
0.531686	29.82	Neutral	46	-16.18	Ave.
0.32609	27.47	Neutral	49.55	-22.08	Ave.
0.189375	33.95	Neutral	54.06	-20.12	Ave.

7 FCC §2.1051, §15.247(d) & IC RSS-210 §A8.5 – Spurious Emissions at Antenna Terminals

7.1 Applicable Standards

For FCC §15.247(d) and IC RSS-210 §A8.5 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.

7.2 Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	MY44303352	2013-10-16	1 year

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

7.4 Test Environmental Conditions

Temperature:	22-24° C
Relative Humidity:	40-41%
ATM Pressure:	103.1-104.1 KPa

The testing was performed by Cipher Chu on 2014-07-14 to 2014-07-23 at RF site.

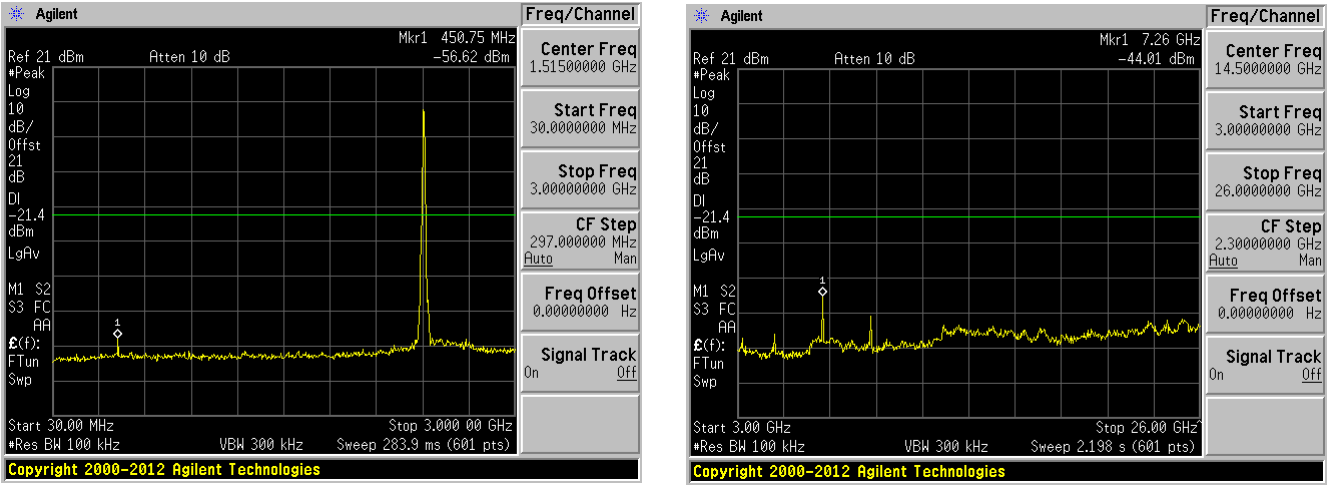
7.5 Test Results

Please refer to following plots of spurious emissions.

802.11b, Low Channel, 2412 MHz

Plot: 30 MHz – 3 GHz

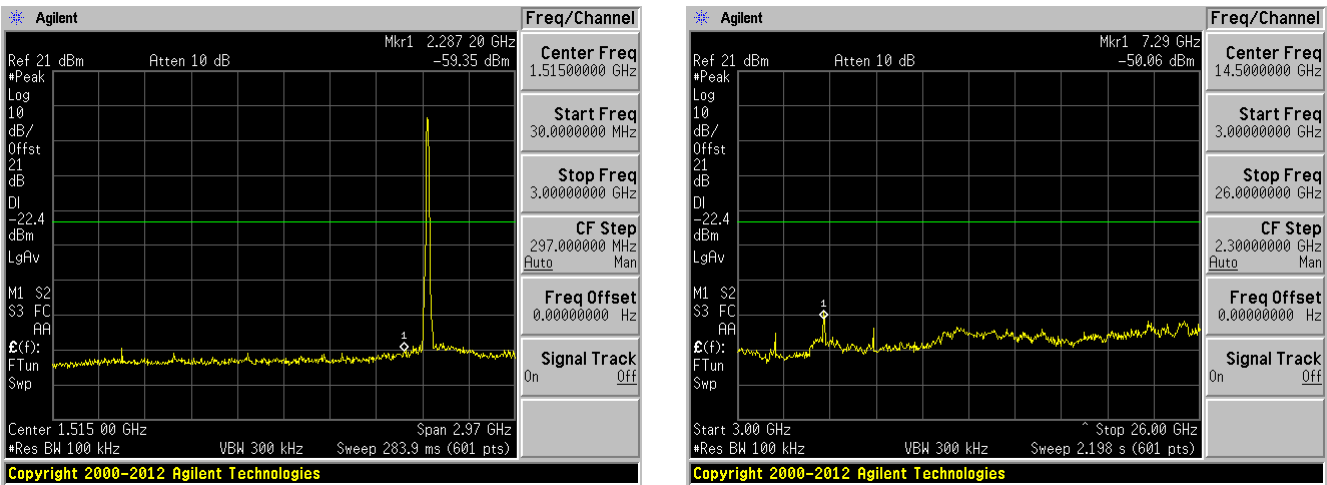
Plot: 3 GHz – 26 GHz



802.11b, Middle Channel, 2437 MHz

Plot: 30 MHz – 3 GHz

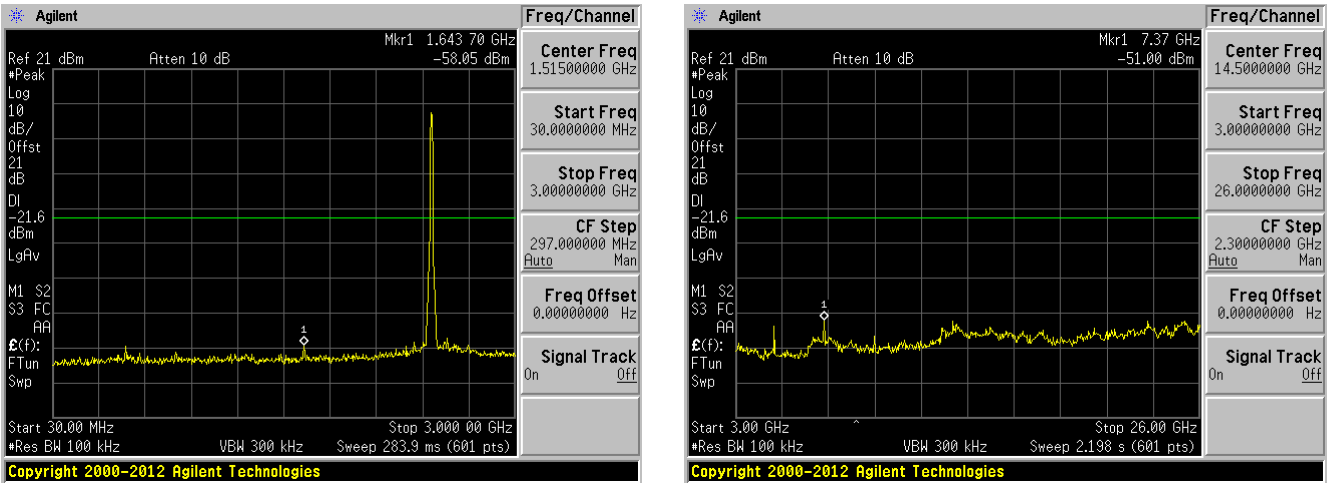
Plot: 3 GHz – 26 GHz



802.11b, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz

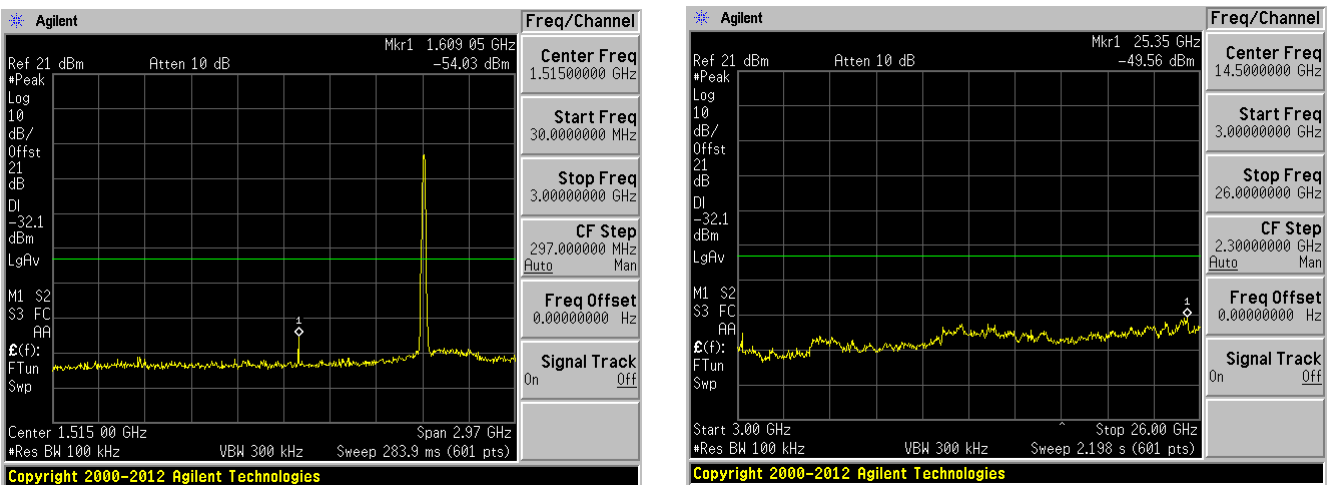
Plot: 3 GHz – 26 GHz



802.11g, Low Channel 2412 MHz

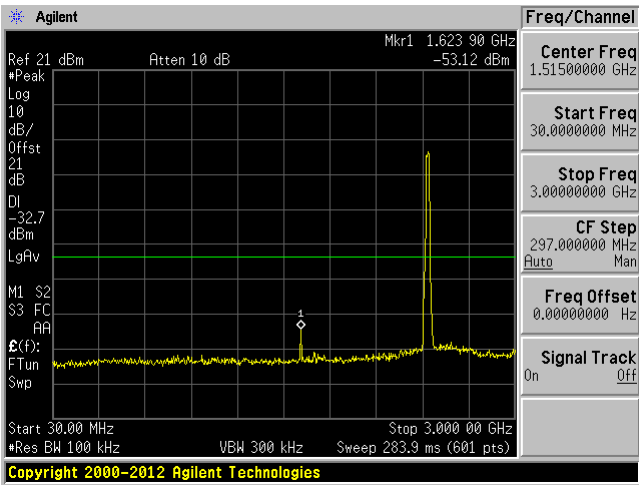
Plot: 30 MHz – 3 GHz

Plot: 3 GHz – 26 GHz

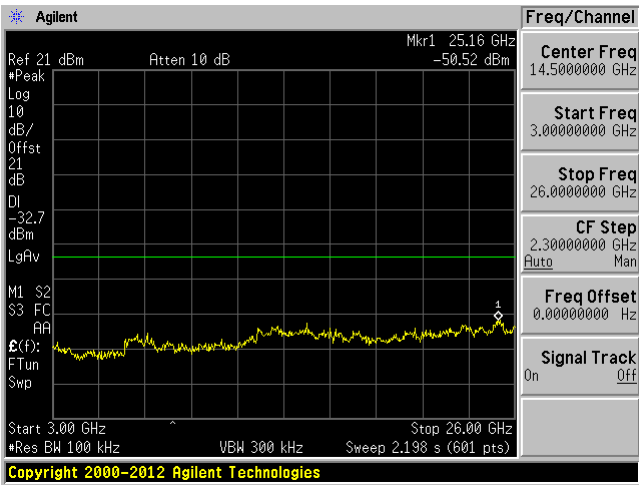


802.11g, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz

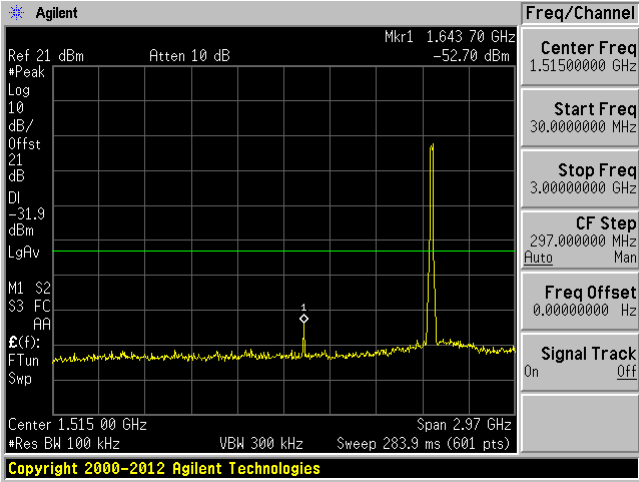


Plot: 3 GHz – 26 GHz

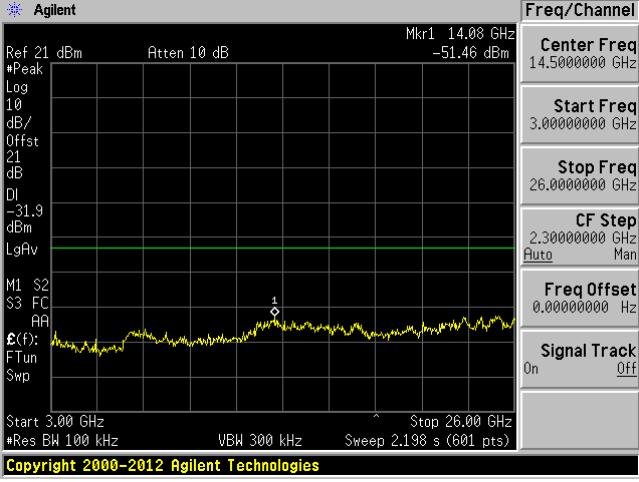


802.11g, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz

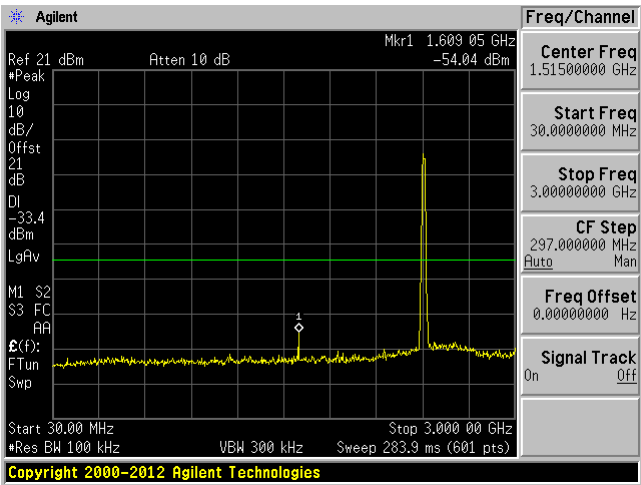


Plot: 3 GHz – 26 GHz

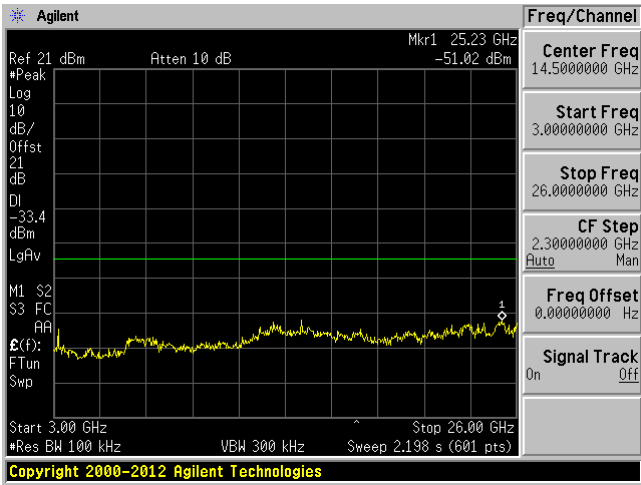


802.11n-HT20, Low Channel 2412 MHz

Plot: 30 MHz – 3 GHz

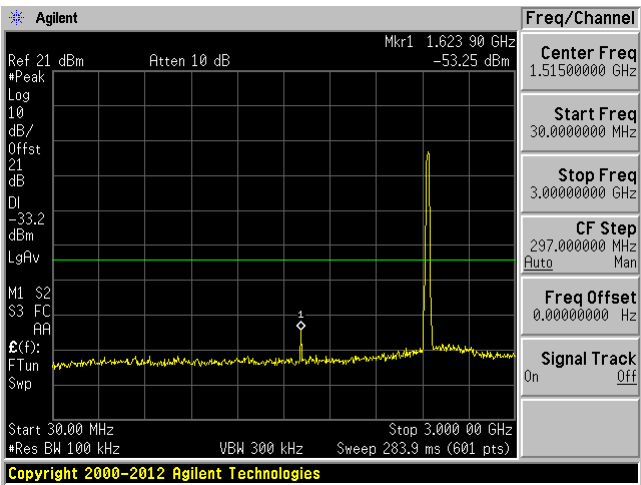


Plot: 3 GHz – 26 GHz

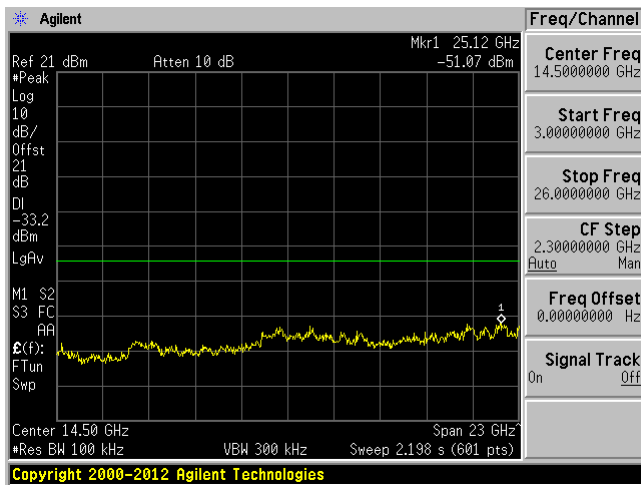


802.11n-HT20, Middle Channel 2437 MHz

Plot: 30 MHz – 3 GHz



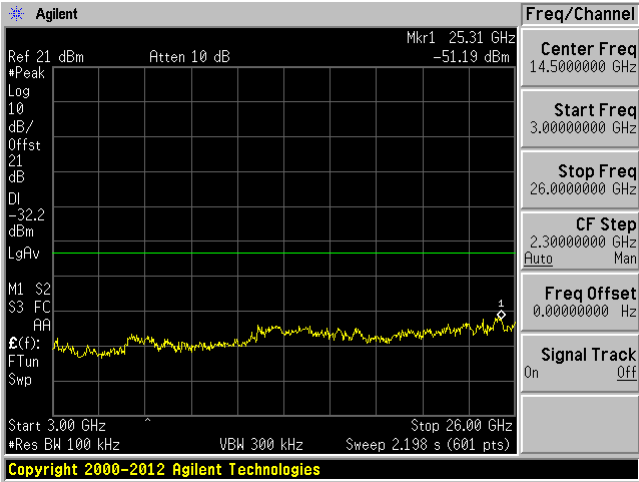
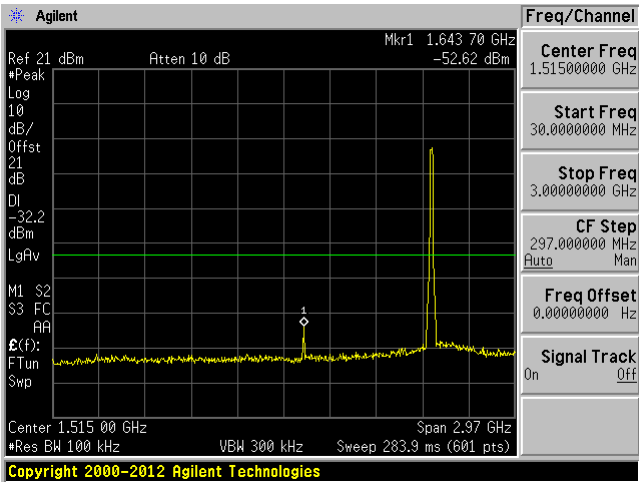
Plot: 3 GHz – 26 GHz



802.11n-HT20, High Channel 2462 MHz

Plot: 30 MHz – 3 GHz

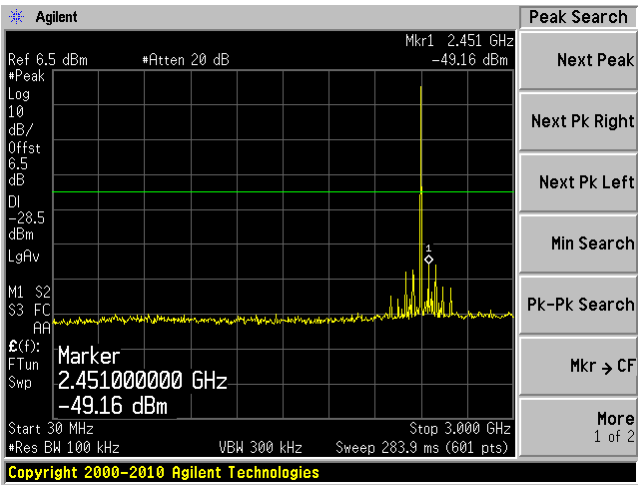
Plot: 3 GHz – 26 GHz



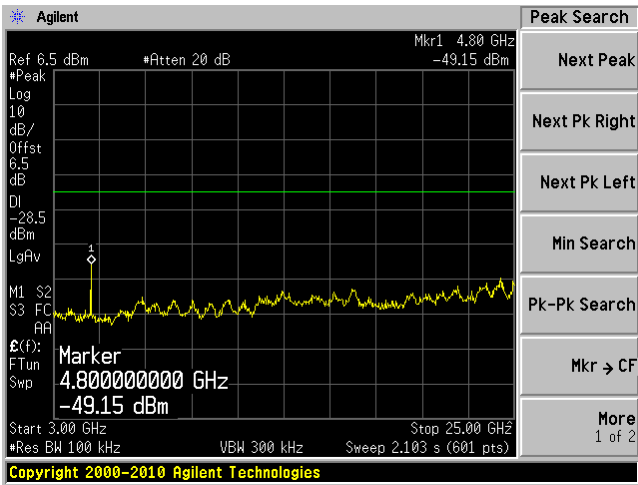
2.4 GHz BLE

Low Channel, 2402 MHz

Plot: 30 MHz – 3 GHz

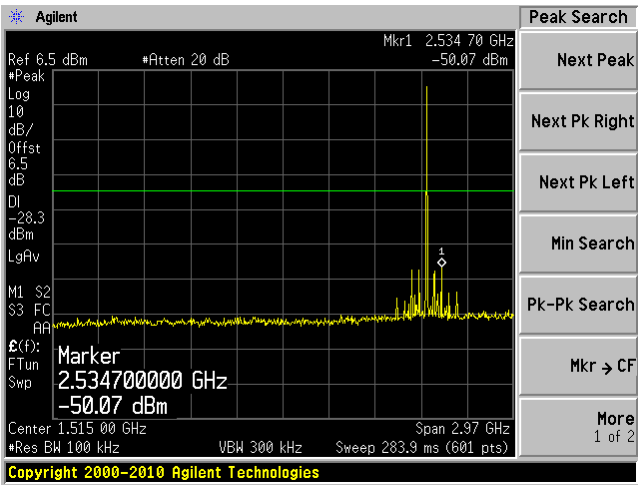


Plot: 3 GHz – 25 GHz

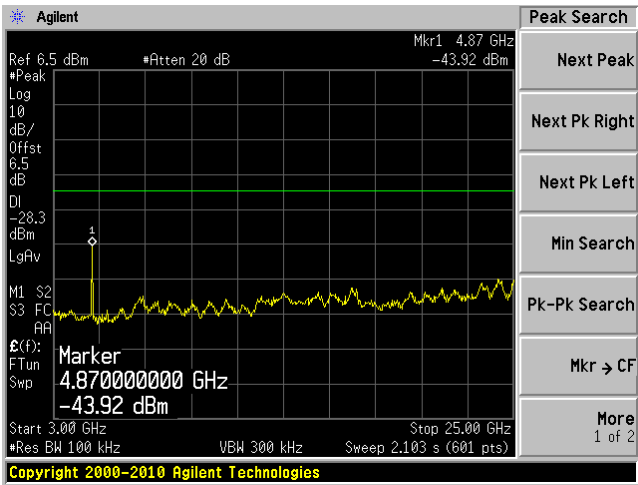


Middle Channel, 2440 MHz

Plot: 30 MHz – 3 GHz

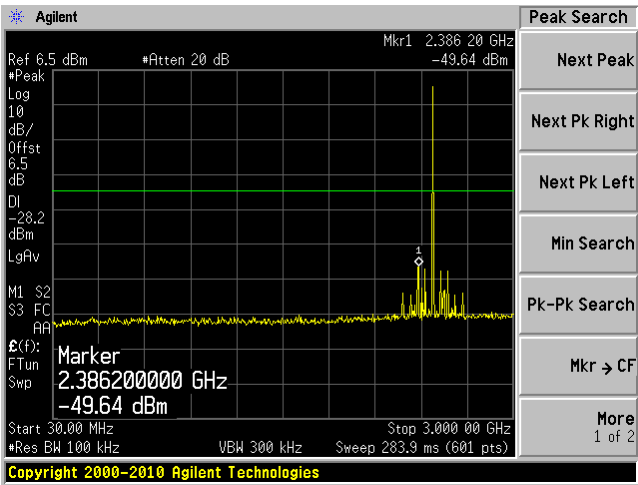


Plot: 3 GHz – 25 GHz

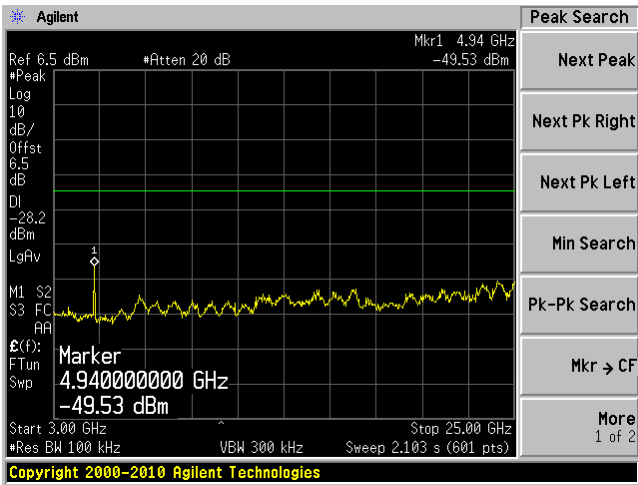


High Channel 2480 MHz

Plot: 30 MHz – 3 GHz



Plot: 3 GHz – 25 GHz



8 FCC §15.205, §15.209 & §15.247(d) & IC RSS-210 §A8.5 – Spurious Radiated Emissions

8.1 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) and RSS-210: 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)).

As per IC RSS-210 A8.5 Out-of-band Emissions, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

8.2 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 and IC RSS-210 limits.

The spacing between the peripherals was 10 centimeters.

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

8.3 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

8.4 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:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

8.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2013-09-28	1 year
Agilent	Spectrum Analyzer	E4440A	MY4430335 2	2013-10-16	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Science Corp	Combination Antenna	JB3	A020106-3	2013-09-18	1 year
EMCO	Horn Antenna	3115	9511-4627	2013-10-17	1 year
Hewlett Packard	Pre-amplifier	8447D	2944A10187	2013-08-08	1 year
WiseWave	Horn Antenna	ARH-4223-02	10555-01	2012-08-09	3 Years
Hewlett Packard	Pre-amplifier	8449B	3147A00400	2014-03-10	1 year

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

8.6 Test Environmental Conditions

Temperature:	22-24° C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 KPa

The testing was performed by Cipher Chu on 2014-07-14 to 2014-07-23 in 5m chamber3.

8.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C and IC RSS-210 standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Mode
-2.7	288.0125	Horizontal	Co-location

1 – 25 GHz:

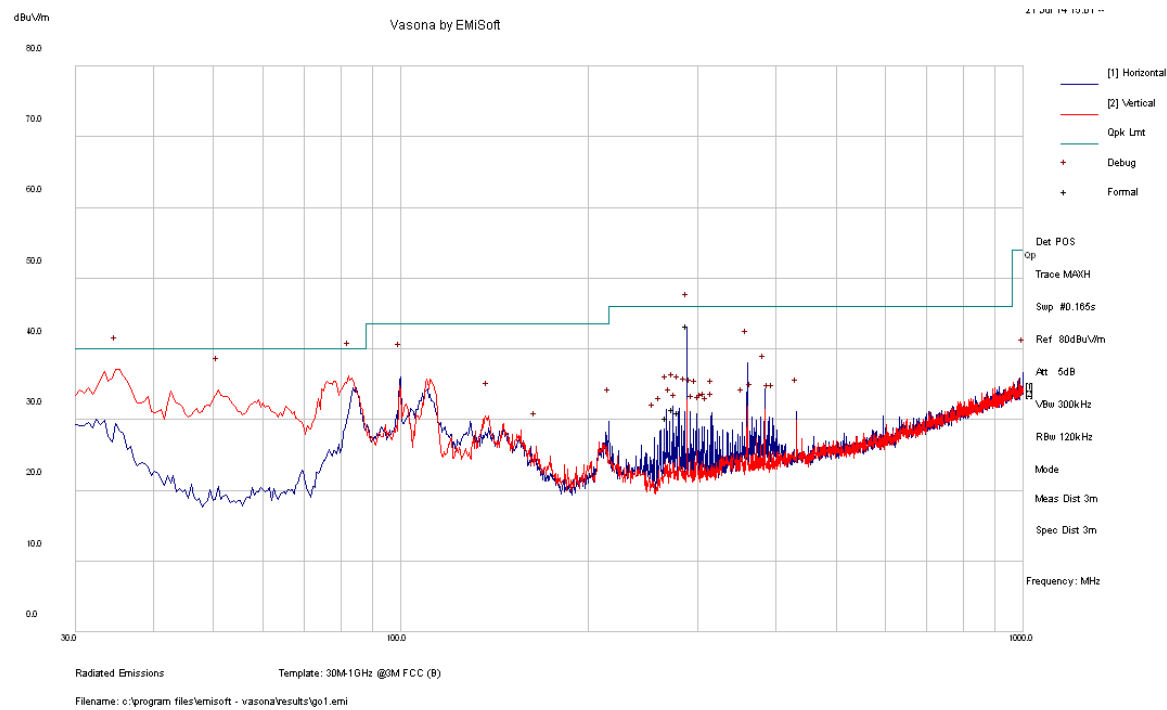
Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Mode, Channel
-1.244	2390	Horizontal	802.11g mode Low Channel

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

8.8 Radiated Emissions Test Data and Plots

1) 30 MHz – 1 GHz

2.4 Wi-Fi Band and BLE Co-location



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)	Comments
288.0125	43.3	98	H	146	46	-2.7	QP
273.4263	31.54	102	H	158	46	-14.46	QP
279.5575	31.07	100	H	138	46	-14.93	QP
267.296	30.31	113	H	146	46	-15.69	QP

2) 1-25 GHz

2.4 GHz Wi-Fi Band, 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/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	77.21	22	100	V	28.956	3.12	0	109.286	-	-	Peak
2412	79.64	175	121	H	28.956	3.12	0	111.716	-	-	Peak
2412	74.02	22	100	V	28.956	3.12	0	106.096	-	-	Ave
2412	76.33	175	121	H	28.956	3.12	0	108.406	-	-	Ave
2390	29.7	22	100	V	28.956	3.12	0	61.776	74	-12.224	Peak
2390	30.56	175	121	H	28.956	3.12	0	62.636	74	-11.364	Peak
2390	18.83	22	100	V	28.956	3.12	0	50.906	54	-3.094	Ave
2390	19.96	175	121	H	28.956	3.12	0	52.036	54	-1.964	Ave
4824	44.32	21	100	V	33.097	4.56	36.5	45.477	74	-28.523	Peak
4824	45.44	173	100	H	33.097	4.56	36.5	46.597	74	-27.403	Peak
4824	36.12	21	100	V	33.097	4.56	36.5	37.277	54	-16.723	Ave
4824	35.34	173	100	H	33.097	4.56	36.5	36.497	54	-17.503	Ave
7236	43.56	0	100	V	35.928	5.49	36.7	48.278	89.286	-41.008	Peak
7236	43.63	0	100	H	35.928	5.49	36.7	48.348	91.716	-43.368	Peak
7236	29.12	0	100	V	35.928	5.49	36.7	33.838	86.096	-52.258	Ave
7236	28.96	0	100	H	35.928	5.49	36.7	33.678	88.406	-54.728	Ave
9648	42.34	0	100	V	37.954	6.54	36.9	49.934	89.286	-39.352	Peak
9648	42.22	0	100	H	37.954	6.54	36.9	49.814	91.716	-41.902	Peak
9648	28.34	0	100	V	37.954	6.54	36.9	35.934	86.096	-50.162	Ave
9648	28.33	0	100	H	37.954	6.54	36.9	35.924	88.406	-52.482	Ave
Middle Channel 2437 MHz											
2437	77.45	25	100	V	28.956	3.12	0	109.526	-	-	Peak
2437	79.61	177	121	H	28.956	3.12	0	111.686	-	-	Peak
2437	74.11	25	100	V	28.956	3.12	0	106.186	-	-	Ave
2437	76.43	177	121	H	28.956	3.12	0	108.506	-	-	Ave
4874	44.11	25	100	V	33.327	4.54	36.5	45.477	74	-28.523	Peak
4874	45.23	177	100	H	33.327	4.54	36.5	46.597	74	-27.403	Peak
4874	35.91	25	100	V	33.327	4.54	36.5	37.277	54	-16.723	Ave
4874	35.13	177	100	H	33.327	4.54	36.5	36.497	54	-17.503	Ave
7311	43.35	0	100	V	36.369	5.57	36.7	48.589	74	-25.411	Peak
7311	43.42	0	100	H	36.369	5.57	36.7	48.659	74	-25.341	Peak
7311	28.91	0	100	V	36.369	5.57	36.7	34.149	54	-19.851	Ave
7311	28.75	0	100	H	36.369	5.57	36.7	33.989	54	-20.011	Ave
9748	42.13	0	100	V	38.087	6.62	36.9	49.937	89.526	-39.589	Peak
9748	42.01	0	100	H	38.087	6.62	36.9	49.817	91.686	-41.869	Peak
9748	28.13	0	100	V	38.087	6.62	36.9	35.937	86.186	-50.249	Ave
9748	28.12	0	100	H	38.087	6.62	36.9	35.927	88.506	-52.579	Ave

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
High Channel 2462 MHz											
2462	77.97	25	100	V	29.155	3.25	0	110.375	-	-	Peak
2462	79.81	177	120	H	29.155	3.25	0	112.215	-	-	Peak
2462	74.74	25	100	V	29.155	3.25	0	107.145	-	-	Ave
2462	76.27	177	120	H	29.155	3.25	0	108.675	-	-	Ave
2483.5	31.04	25	100	V	29.155	3.25	0	63.445	74	-10.555	Peak
2483.5	30.93	177	120	H	29.155	3.25	0	63.335	74	-10.665	Peak
2483.5	18.6	25	100	V	29.155	3.25	0	51.005	54	-2.995	Ave
2483.5	19.34	177	120	H	29.155	3.25	0	51.745	54	-2.255	Ave
4924	44.49	28	100	V	33.327	4.52	36.5	45.837	74	-28.163	Peak
4924	45.61	178	100	H	33.327	4.52	36.5	46.957	74	-27.043	Peak
4924	36.29	28	100	V	33.327	4.52	36.5	37.637	54	-16.363	Ave
4924	35.51	178	100	H	33.327	4.52	36.5	36.857	54	-17.143	Ave
7386	43.73	0	100	V	36.565	5.62	36.7	49.215	74	-24.785	Peak
7386	43.8	0	100	H	36.565	5.62	36.7	49.285	74	-24.715	Peak
7386	29.29	0	100	V	36.565	5.62	36.7	34.775	54	-19.225	Ave
7386	29.13	0	100	H	36.565	5.62	36.7	34.615	54	-19.385	Ave
9848	42.51	0	100	V	38.287	6.55	36.9	50.447	88.225	-37.778	Peak
9848	42.39	0	100	H	38.287	6.55	36.9	50.327	90.605	-40.278	Peak
9848	28.51	0	100	V	38.287	6.55	36.9	36.447	85.235	-48.788	Ave
9848	28.5	0	100	H	38.287	6.55	36.9	36.437	87.905	-51.468	Ave

2.4 GHz Wi-Fi Band, 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/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	72.8	28	100	V	28.956	3.12	0	104.876	-	-	Peak
2412	75.03	175	122	H	28.956	3.12	0	107.106	-	-	Peak
2412	60.31	28	100	V	28.956	3.12	0	92.386	-	-	Ave
2412	62.17	175	122	H	28.956	3.12	0	94.246	-	-	Ave
2390	35.57	28	100	V	28.956	3.12	0	67.646	74	-6.354	Peak
2390	37.34	175	122	H	28.956	3.12	0	69.416	74	-4.584	Peak
2390	18.73	28	100	V	28.956	3.12	0	50.806	54	-3.194	Ave
2390	20.68	175	122	H	28.956	3.12	0	52.756	54	-1.244	Ave
4824	44.15	28	100	V	33.097	4.56	36.5	45.307	74	-28.693	Peak
4824	45.27	175	100	H	33.097	4.56	36.5	46.427	74	-27.573	Peak
4824	35.95	28	100	V	33.097	4.56	36.5	37.107	54	-16.893	Ave
4824	35.17	175	100	H	33.097	4.56	36.5	36.327	54	-17.673	Ave
7236	43.39	0	100	V	35.928	5.49	36.7	48.108	84.876	-36.768	Peak
7236	43.46	0	100	H	35.928	5.49	36.7	48.178	87.106	-38.928	Peak
7236	28.95	0	100	V	35.928	5.49	36.7	33.668	72.386	-38.718	Ave
7236	28.79	0	100	H	35.928	5.49	36.7	33.508	74.246	-40.738	Ave
9648	42.17	0	100	V	37.954	6.54	36.9	49.764	84.876	-35.112	Peak
9648	42.05	0	100	H	37.954	6.54	36.9	49.644	87.106	-37.462	Peak
9648	28.17	0	100	V	37.954	6.54	36.9	35.764	72.386	-36.622	Ave
9648	28.16	0	100	H	37.954	6.54	36.9	35.754	74.246	-38.492	Ave
Middle Channel 2437 MHz											
2437	73.04	28	100	V	28.956	3.12	0	105.116	-	-	Peak
2437	74.87	178	120	H	28.956	3.12	0	106.946	-	-	Peak
2437	60.3	28	100	V	28.956	3.12	0	92.376	-	-	Ave
2437	61.26	178	120	H	28.956	3.12	0	93.336	-	-	Ave
4874	43.98	28	100	V	33.327	4.54	36.5	45.347	74	-28.653	Peak
4874	45.1	178	100	H	33.327	4.54	36.5	46.467	74	-27.533	Peak
4874	35.78	28	100	V	33.327	4.54	36.5	37.147	54	-16.853	Ave
4874	35.01	178	100	H	33.327	4.54	36.5	36.377	54	-17.623	Ave
7311	43.22	0	100	V	36.369	5.57	36.7	48.459	74	-25.541	Peak
7311	43.29	0	100	H	36.369	5.57	36.7	48.529	74	-25.471	Peak
7311	28.78	0	100	V	36.369	5.57	36.7	34.019	54	-19.981	Ave
7311	28.62	0	100	H	36.369	5.57	36.7	33.859	54	-20.141	Ave
9748	42.2	0	100	V	38.087	6.62	36.9	50.007	85.116	-35.109	Peak
9748	41.88	0	100	H	38.087	6.62	36.9	49.687	86.946	-37.259	Peak
9748	28	0	100	V	38.087	6.62	36.9	35.807	72.376	-36.569	Ave
9748	27.99	0	100	H	38.087	6.62	36.9	35.797	73.336	-37.539	Ave

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
High Channel 2462 MHz											
2462	72.38	21	100	V	29.155	3.25	0	104.785	-	-	Peak
2462	74.31	179	148	H	29.155	3.25	0	106.715	-	-	Peak
2462	60.66	21	100	V	29.155	3.25	0	93.065	-	-	Ave
2462	61.52	179	148	H	29.155	3.25	0	93.925	-	-	Ave
2483.5	37.34	21	100	V	29.155	3.25	0	69.745	74	-4.255	Peak
2483.5	38.77	179	148	H	29.155	3.25	0	71.175	74	-2.825	Peak
2483.5	19.36	21	100	V	29.155	3.25	0	51.765	54	-2.235	Ave
2483.5	19.87	179	148	H	29.155	3.25	0	52.275	54	-1.725	Ave
4924	44.36	21	100	V	33.327	4.52	36.5	45.707	74	-28.293	Peak
4924	45.48	179	100	H	33.327	4.52	36.5	46.827	74	-27.173	Peak
4924	36.16	21	100	V	33.327	4.52	36.5	37.507	54	-16.493	Ave
4924	35.38	179	100	H	33.327	4.52	36.5	36.727	54	-17.273	Ave
7386	43.6	0	100	V	36.565	5.62	36.7	49.085	74	-24.915	Peak
7386	43.67	0	100	H	36.565	5.62	36.7	49.155	74	-24.845	Peak
7386	29.16	0	100	V	36.565	5.62	36.7	34.645	54	-19.355	Ave
7386	29	0	100	H	36.565	5.62	36.7	34.485	54	-19.515	Ave
9848	42.38	0	100	V	38.287	6.55	36.9	50.317	84.785	-34.468	Peak
9848	42.26	0	100	H	38.287	6.55	36.9	50.197	86.715	-36.518	Peak
9848	28.38	0	100	V	38.287	6.55	36.9	36.317	73.065	-36.748	Ave
9848	28.37	0	100	H	38.287	6.55	36.9	36.307	73.925	-37.618	Ave

2.4 GHz Wi-Fi Band, 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/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	72.15	25	100	V	28.956	3.12	0	104.226	-	-	Peak
2412	73.31	175	122	H	28.956	3.12	0	105.386	-	-	Peak
2412	60.24	25	100	V	28.956	3.12	0	92.316	-	-	Ave
2412	61.08	175	122	H	28.956	3.12	0	93.156	-	-	Ave
2390	35.4	25	100	V	28.956	3.12	0	67.476	74	-6.524	Peak
2390	35.71	175	122	H	28.956	3.12	0	67.786	74	-6.214	Peak
2390	19.58	25	100	V	28.956	3.12	0	51.656	54	-2.344	Ave
2390	20.67	175	122	H	28.956	3.12	0	52.746	54	-1.254	Ave
4824	43.91	28	100	V	33.097	4.56	36.5	45.067	74	-28.933	Peak
4824	45.03	179	100	H	33.097	4.56	36.5	46.187	74	-27.813	Peak
4824	35.71	28	100	V	33.097	4.56	36.5	36.867	54	-17.133	Ave
4824	34.93	179	100	H	33.097	4.56	36.5	36.087	54	-17.913	Ave
7236	43.15	0	100	V	35.928	5.49	36.7	47.868	84.226	-36.358	Peak
7236	43.22	0	100	H	35.928	5.49	36.7	47.938	85.386	-37.448	Peak
7236	28.71	0	100	V	35.928	5.49	36.7	33.428	72.316	-38.888	Ave
7236	28.55	0	100	H	35.928	5.49	36.7	33.268	73.156	-39.888	Ave
9648	41.93	0	100	V	37.954	6.54	36.9	49.524	84.226	-34.702	Peak
9648	41.81	0	100	H	37.954	6.54	36.9	49.404	85.386	-35.982	Peak
9648	27.93	0	100	V	37.954	6.54	36.9	35.524	72.316	-36.792	Ave
9648	27.92	0	100	H	37.954	6.54	36.9	35.514	73.156	-37.642	Ave
Middle Channel 2437 MHz											
2437	72.31	28	100	V	28.956	3.12	0	104.386	-	-	Peak
2437	73.65	177	121	H	28.956	3.12	0	105.726	-	-	Peak
2437	60.04	28	100	V	28.956	3.12	0	92.116	-	-	Ave
2437	61.33	177	121	H	28.956	3.12	0	93.406	-	-	Ave
4874	43.92	28	100	V	33.327	4.54	36.5	45.287	74	-28.713	Peak
4874	45.04	177	100	H	33.327	4.54	36.5	46.407	74	-27.593	Peak
4874	35.72	28	100	V	33.327	4.54	36.5	37.087	54	-16.913	Ave
4874	34.94	177	100	H	33.327	4.54	36.5	36.307	54	-17.693	Ave
7311	43.16	0	100	V	36.369	5.57	36.7	48.399	74	-25.601	Peak
7311	43.23	0	100	H	36.369	5.57	36.7	48.469	74	-25.531	Peak
7311	28.72	0	100	V	36.369	5.57	36.7	33.959	54	-20.041	Ave
7311	28.56	0	100	H	36.369	5.57	36.7	33.799	54	-20.201	Ave
9748	41.94	0	100	V	38.087	6.62	36.9	49.747	84.386	-34.639	Peak
9748	41.82	0	100	H	38.087	6.62	36.9	49.627	85.726	-36.099	Peak
9748	27.94	0	100	V	38.087	6.62	36.9	35.747	72.116	-36.369	Ave
9748	27.93	0	100	H	38.087	6.62	36.9	35.737	73.406	-37.669	Ave

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
High Channel 2462 MHz											
2462	72.43	23	100	V	29.155	3.25	0	104.835	-	-	Peak
2462	74.88	176	118	H	29.155	3.25	0	107.285	-	-	Peak
2462	60.12	23	100	V	29.155	3.25	0	92.525	-	-	Ave
2462	62.57	176	118	H	29.155	3.25	0	94.975	-	-	Ave
2483.5	32.86	23	100	V	29.155	3.25	0	65.265	74	-8.735	Peak
2483.5	34.78	176	118	H	29.155	3.25	0	67.185	74	-6.815	Peak
2483.5	18.6	23	100	V	29.155	3.25	0	51.005	54	-2.995	Ave
2483.5	19.85	176	118	H	29.155	3.25	0	52.255	54	-1.745	Ave
4924	43.95	25	100	V	33.327	4.52	36.5	45.297	74	-28.703	Peak
4924	45.07	177	100	H	33.327	4.52	36.5	46.417	74	-27.583	Peak
4924	35.75	25	100	V	33.327	4.52	36.5	37.097	54	-16.903	Ave
4924	34.97	177	100	H	33.327	4.52	36.5	36.317	54	-17.683	Ave
7386	43.19	0	100	V	36.565	5.62	36.7	48.675	74	-25.325	Peak
7386	43.26	0	100	H	36.565	5.62	36.7	48.745	74	-25.255	Peak
7386	28.75	0	100	V	36.565	5.62	36.7	34.235	54	-19.765	Ave
7386	28.59	0	100	H	36.565	5.62	36.7	34.075	54	-19.925	Ave
9848	41.97	0	100	V	38.287	6.55	36.9	49.907	84.835	-34.928	Peak
9848	41.85	0	100	H	38.287	6.55	36.9	49.787	87.285	-37.498	Peak
9848	27.97	0	100	V	38.287	6.55	36.9	35.907	72.525	-36.618	Ave
9848	27.96	0	100	H	38.287	6.55	36.9	35.897	74.975	-39.078	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/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 2402 MHz											
2402	63.83	47	100	V	28.956	3.12	0	95.906	-	-	Peak
2402	64.62	181	126	H	28.956	3.12	0	96.696	-	-	Peak
2402	59.25	47	100	V	28.956	3.12	0	91.326	-	-	Ave
2402	60.22	181	126	H	28.956	3.12	0	92.296	-	-	Ave
2390	26.5	47	100	V	28.956	3.12	0	58.576	74	-15.424	Peak
2390	26.19	181	126	H	28.956	3.12	0	58.266	74	-15.734	Peak
2390	15.26	47	100	V	28.956	3.12	0	47.336	54	-6.664	Ave
2390	15.47	181	126	H	28.956	3.12	0	47.546	54	-6.454	Ave
4804	54.42	305	115	V	33.097	4.56	36.5	55.577	74	-18.423	Peak
4804	57.15	69	117	H	33.097	4.56	36.5	58.307	74	-15.693	Peak
4804	45.74	305	115	V	33.097	4.56	36.5	46.897	54	-7.103	Ave
4804	49.47	69	117	H	33.097	4.56	36.5	50.627	54	-3.373	Ave
7206	46.43	0	100	V	35.928	5.49	36.7	51.148	75.906	-24.758	Peak
7206	46.99	0	100	H	35.928	5.49	36.7	51.708	76.696	-24.988	Peak
7206	34.67	0	100	V	35.928	5.49	36.7	39.388	71.326	-31.938	Ave
7206	34.61	0	100	H	35.928	5.49	36.7	39.328	72.296	-32.968	Ave
9608	45.91	0	100	V	37.954	6.54	36.9	53.504	75.906	-22.402	Peak
9608	45.67	0	100	H	37.954	6.54	36.9	53.264	76.696	-23.432	Peak
9608	34.37	0	100	V	37.954	6.54	36.9	41.964	71.326	-29.362	Ave
9608	34.31	0	100	H	37.954	6.54	36.9	41.904	72.296	-30.392	Ave
Middle Channel 2440 MHz											
2440	63.43	28	100	V	28.956	3.12	0	95.506	-	-	Peak
2440	65.92	174	123	H	28.956	3.12	0	97.996	-	-	Peak
2440	58.41	28	100	V	28.956	3.12	0	90.486	-	-	Ave
2440	61.51	174	123	H	28.956	3.12	0	93.586	-	-	Ave
4880	53.41	304	110	V	33.327	4.54	36.5	54.777	74	-19.223	Peak
4880	55.31	66	100	H	33.327	4.54	36.5	56.677	74	-17.323	Peak
4880	45.16	304	110	V	33.327	4.54	36.5	46.527	54	-7.473	Ave
4880	46.64	66	100	H	33.327	4.54	36.5	48.007	54	-5.993	Ave
7320	46.57	0	100	V	36.369	5.57	36.7	51.809	74	-22.191	Peak
7320	46.84	0	100	H	36.369	5.57	36.7	52.079	74	-21.921	Peak
7320	34.7	0	100	V	36.369	5.57	36.7	39.939	54	-14.061	Ave
7320	34.71	0	100	H	36.369	5.57	36.7	39.949	54	-14.051	Ave
9760	45.51	0	100	V	38.087	6.62	36.9	53.317	75.506	-22.189	Peak
9760	45.55	0	100	H	38.087	6.62	36.9	53.357	77.996	-24.639	Peak
9760	34.38	0	100	V	38.087	6.62	36.9	42.187	70.486	-28.299	Ave
9760	34.34	0	100	H	38.087	6.62	36.9	42.147	73.586	-31.439	Ave

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
High Channel 2480 MHz											
2480	62.36	77	100	V	29.155	3.25	0	94.765	-	-	Peak
2480	61.43	287	100	H	29.155	3.25	0	93.835	-	-	Peak
2480	57.87	77	100	V	29.155	3.25	0	90.275	-	-	Ave
2480	57.25	287	100	H	29.155	3.25	0	89.655	-	-	Ave
2483.5	26.36	77	100	V	29.155	3.25	0	58.765	74	-15.235	Peak
2483.5	26.09	287	100	H	29.155	3.25	0	58.495	74	-15.505	Peak
2483.5	15.5	77	100	V	29.155	3.25	0	47.905	54	-6.095	Ave
2483.5	15.17	287	100	H	29.155	3.25	0	47.575	54	-6.425	Ave
4960	50.14	317	100	V	33.327	4.52	36.5	51.487	74	-22.513	Peak
4960	53.24	65	110	H	33.327	4.52	36.5	54.587	74	-19.413	Peak
4960	39.96	317	100	V	33.327	4.52	36.5	41.307	54	-12.693	Ave
4960	44.76	65	110	H	33.327	4.52	36.5	46.107	54	-7.893	Ave
7440	46.76	0	100	V	36.565	5.62	36.7	52.245	74	-21.755	Peak
7440	47.2	0	100	H	36.565	5.62	36.7	52.685	74	-21.315	Peak
7440	34.71	0	100	V	36.565	5.62	36.7	40.195	54	-13.805	Ave
7440	34.68	0	100	H	36.565	5.62	36.7	40.165	54	-13.835	Ave
9920	45.43	0	100	V	38.287	6.55	36.9	53.367	74.765	-21.398	Peak
9920	45.54	0	100	H	38.287	6.55	36.9	53.477	73.835	-20.358	Peak
9920	34.37	0	100	V	38.287	6.55	36.9	42.307	70.275	-27.968	Ave
9920	34.35	0	100	H	38.287	6.55	36.9	42.287	69.655	-27.368	Ave

9 FCC§15.247(a)(2) & IC RSS-210 §A8.2 – 6 dB & 99% Emission Bandwidth

9.1 Applicable Standards

According to FCC §15.247(a)(2) and IC RSS-210 A8.2 (a), 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 base 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	2013-09-29	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:	22-24° C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 KPa

The testing was performed by CIPHER Chu on 2014-07-14 to 2014-07-23 at RF site.

9.5 Test Results

2.4 GHz Wi-Fi Bands

802.11 b mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	7.150	12.4418	> 0.5	Compliant
Middle	2437	7.147	12.3609	> 0.5	Compliant
High	2462	7.147	12.6305	> 0.5	Compliant

802.11 g mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	16.342	16.4325	> 0.5	Compliant
Middle	2437	16.335	16.4235	> 0.5	Compliant
High	2462	16.343	16.4109	> 0.5	Compliant

802.11n HT20 mode:

Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)	Results
Low	2412	17.287	17.6120	> 0.5	Compliant
Middle	2437	16.982	17.6180	> 0.5	Compliant
High	2462	17.575	17.6165	> 0.5	Compliant

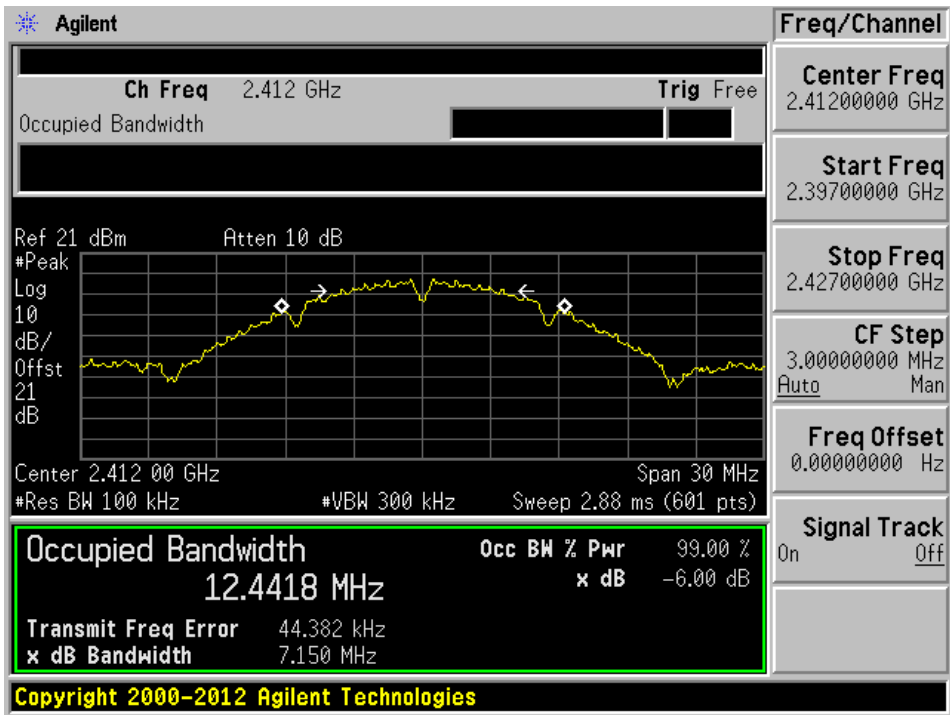
2.4 GHz BLE Band

Channel	Frequency (MHz)	6 dB Emission Bandwidth (kHz)	99% Occupied Bandwidth (kHz)	Limit (kHz)	Results
Low	2402	635.173	1073.4	> 500	Compliant
Middle	2440	638.401	1073.1	> 500	Compliant
High	2480	626.871	1076	> 500	Compliant

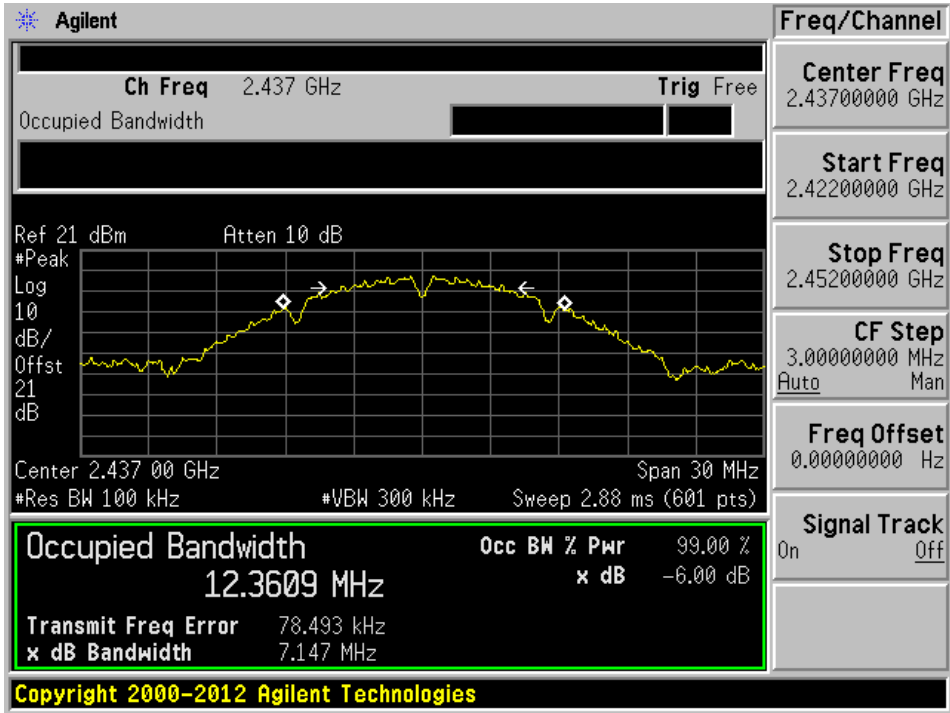
Please refer to the following plots for detailed test results

802.11b mode

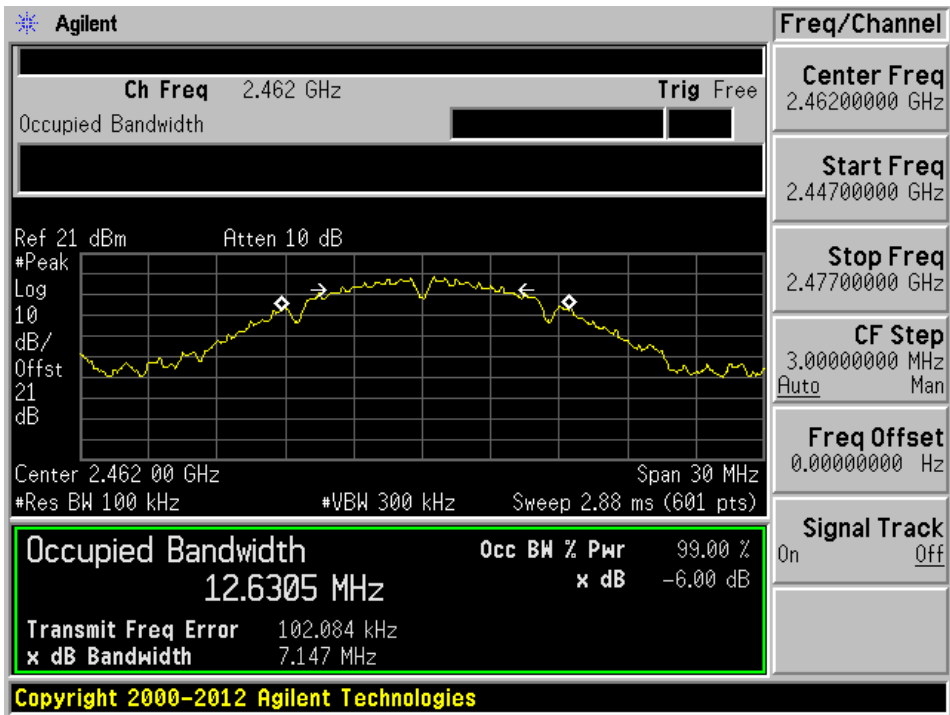
Low channel: 2412 MHz



Middle channel: 2437 MHz

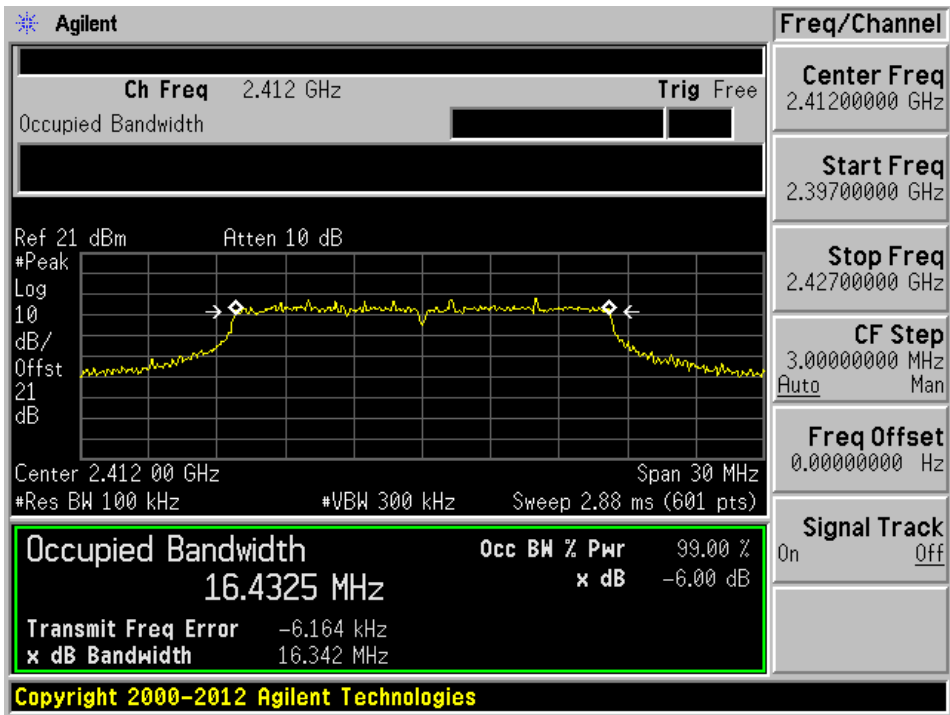


High channel: 2462 MHz

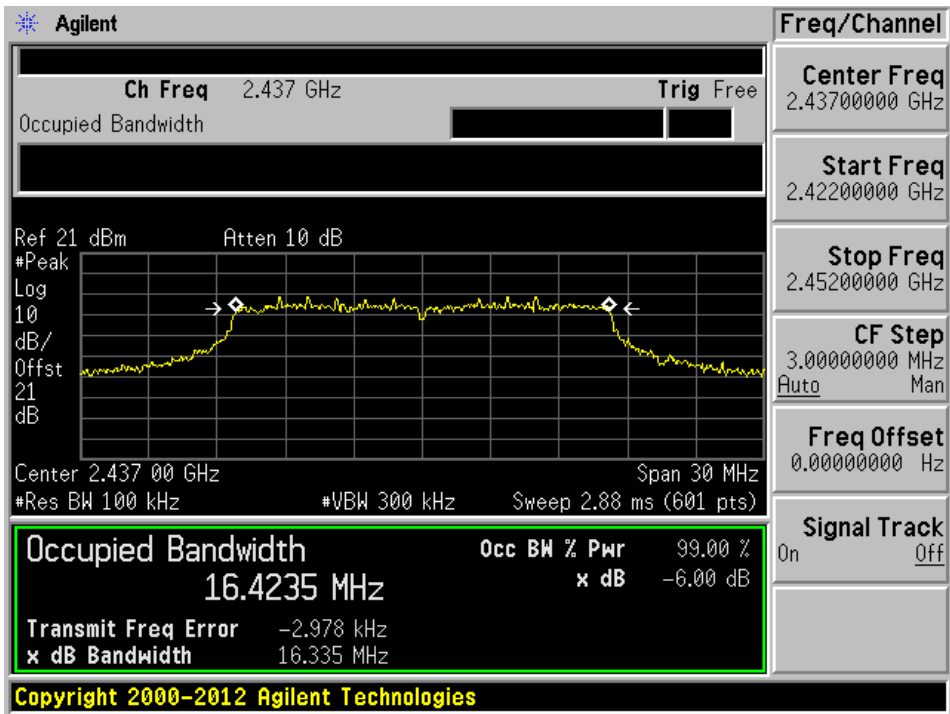


802.11g mode

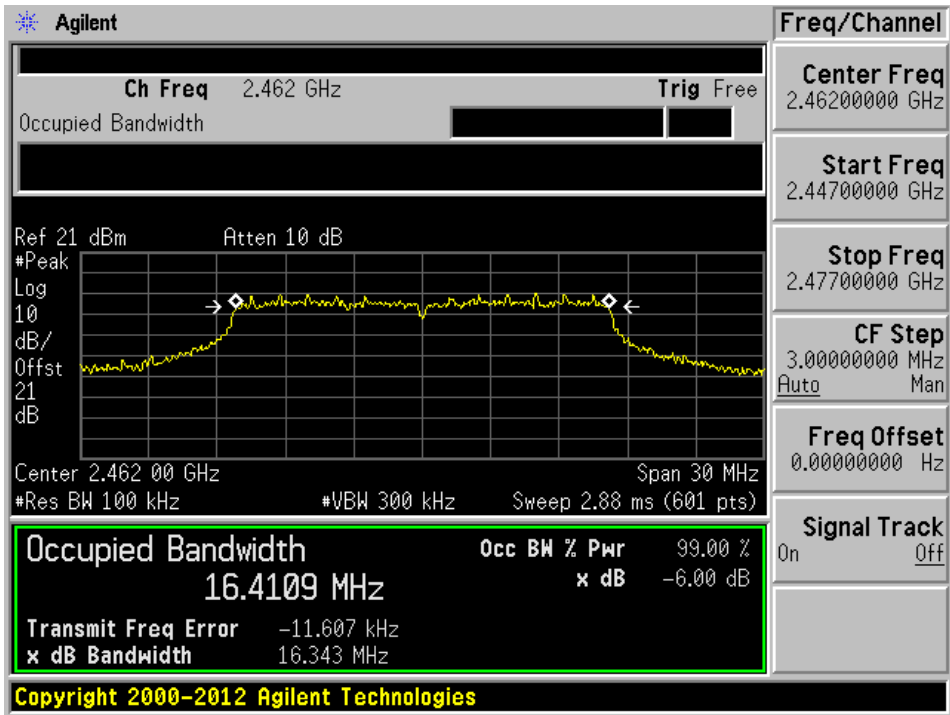
Low channel: 2412 MHz



Middle channel: 2437 MHz

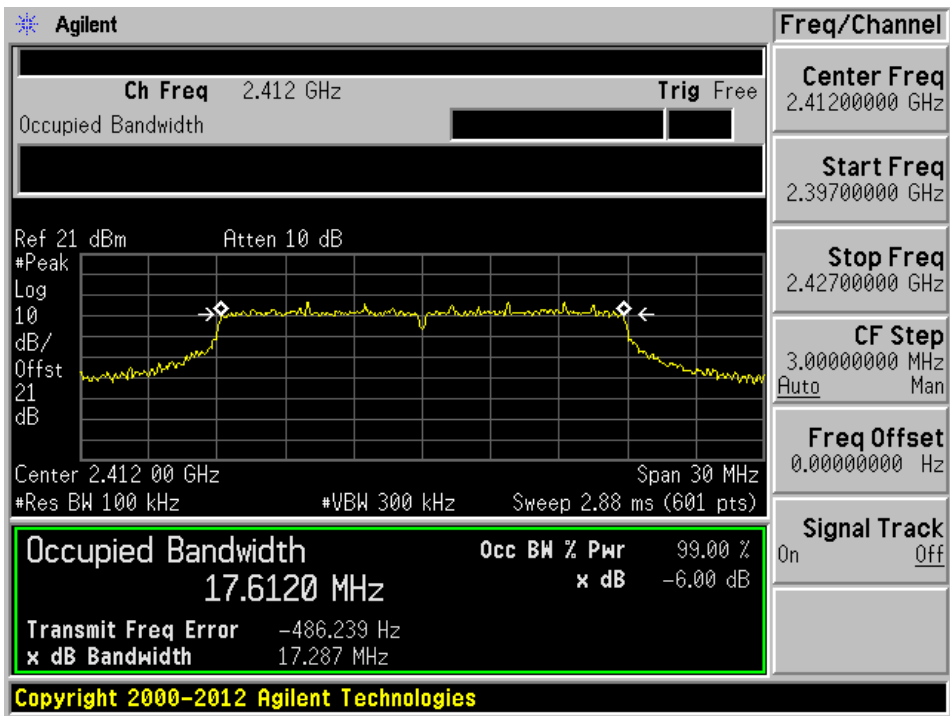


High channel: 2462 MHz

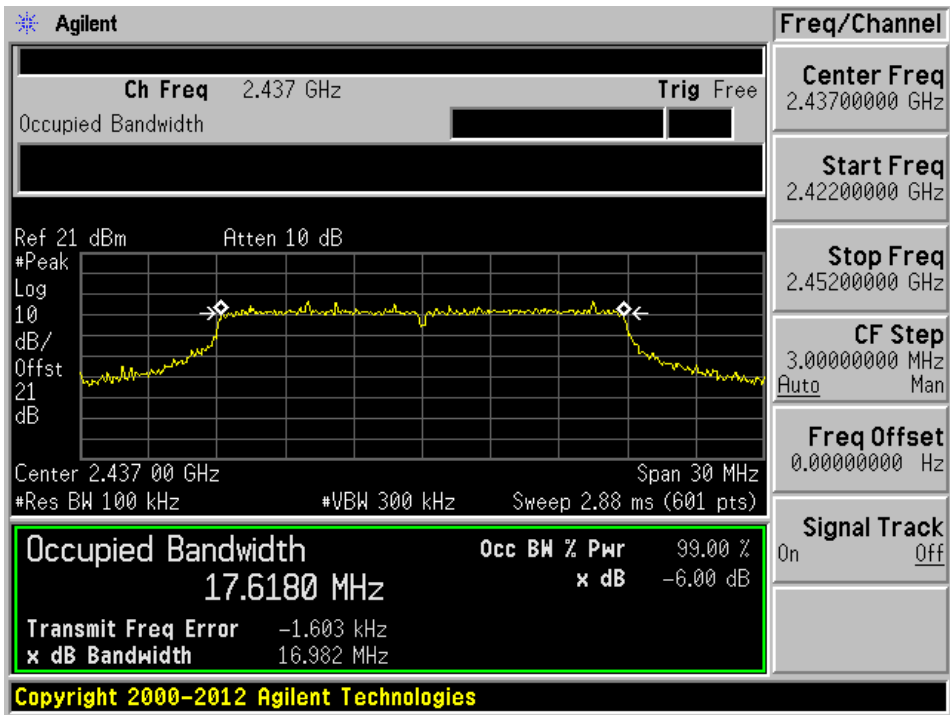


802.11n-HT20 mode

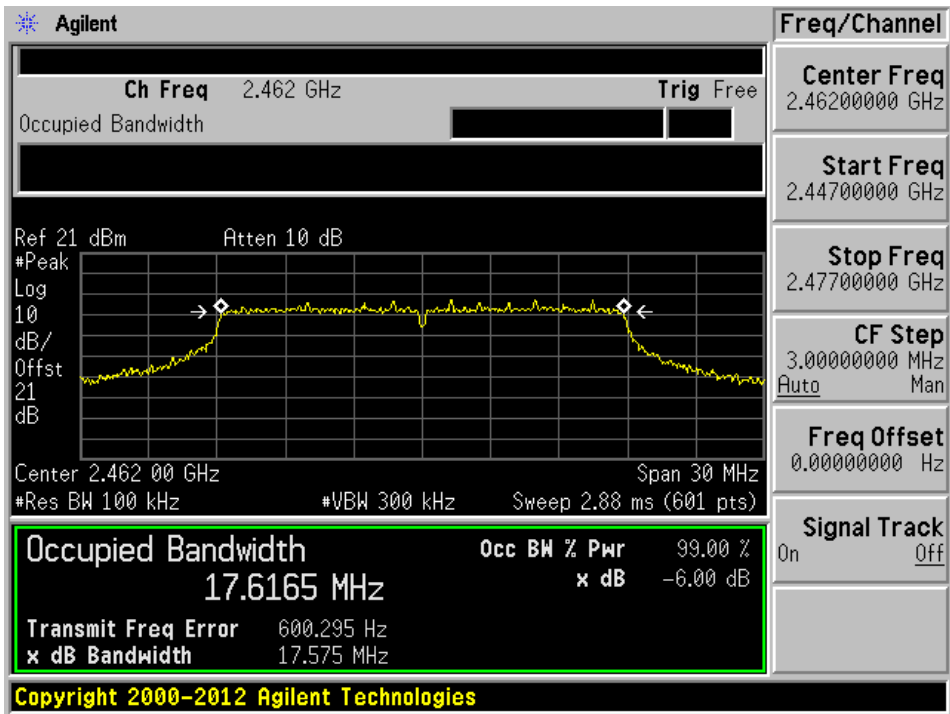
Low channel: 2412 MHz



Middle channel: 2437 MHz

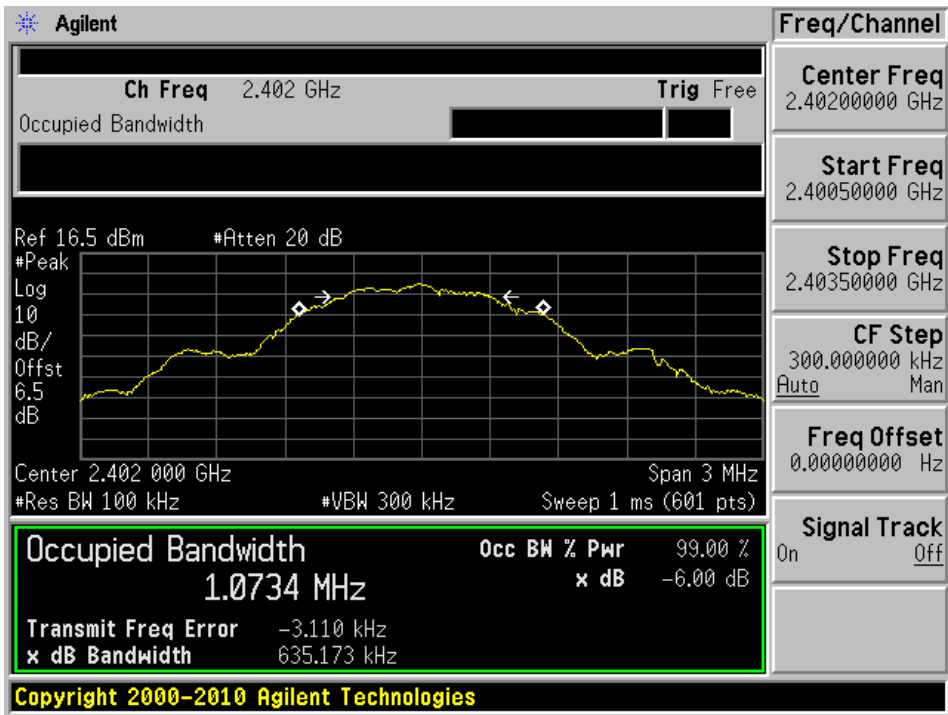


High channel: 2462 MHz

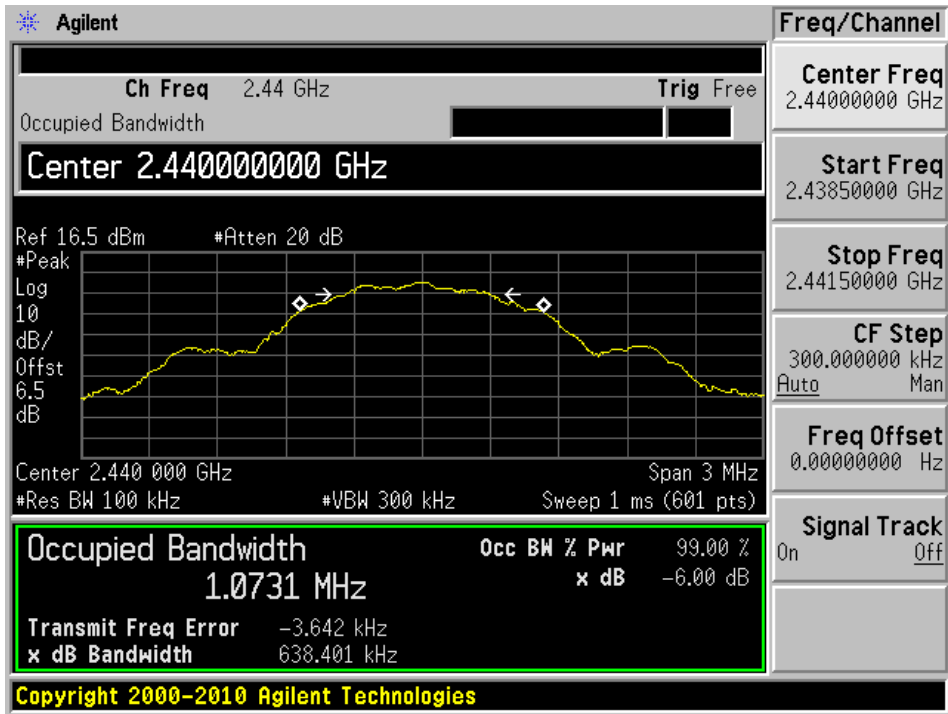


2.4 GHz, BLE

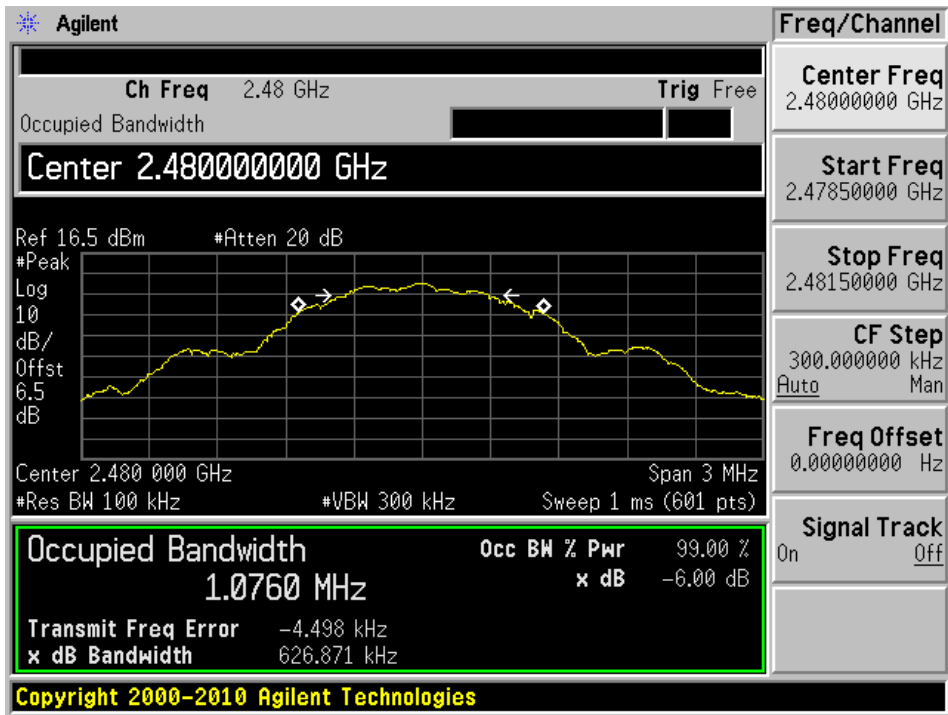
Low channel: 2402 MHz



Middle channel: 2440 MHz



High channel: 2480 MHz



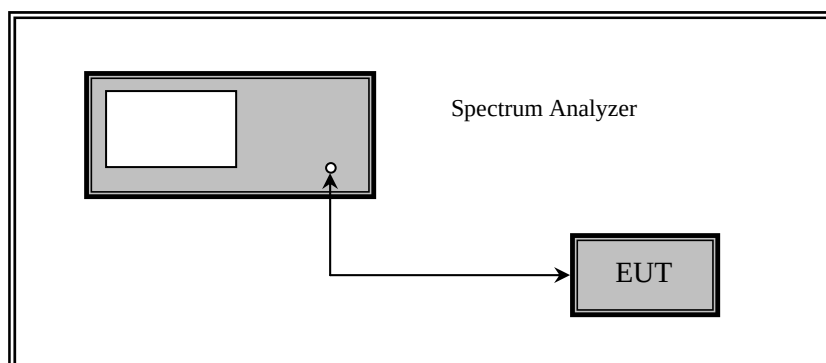
10 FCC §15.247(b) & IC RSS-210 §A8.4 – Peak Output Power Measurement

10.1 Applicable Standards

According to FCC §15.247(b) and IC RSS-210 §A8.4 (4) 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 base 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	2013-09-29	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:	22-24° C
Relative Humidity:	40-41%
ATM Pressure:	103.1-104.1 KPa

The testing was performed by Cipher Chu on 2014-07-14 to 2014-07-23 at RF site.

10.5 Test Results

2.4 GHz, Wi-Fi

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Power Setting
802.11b mode				
Low	2412	19.14	30	20
Middle	2437	19.03	30	20
High	2462	20.16	30	20
802.11g mode				
Low	2412	13.27	30	15
Middle	2437	14.76	30	17
High	2462	12.93	30	14
802.11n-HT20 mode				
Low	2412	12.27	30	14
Middle	2437	13.64	30	16
High	2462	12.94	30	14

2.4 GHz, BLE

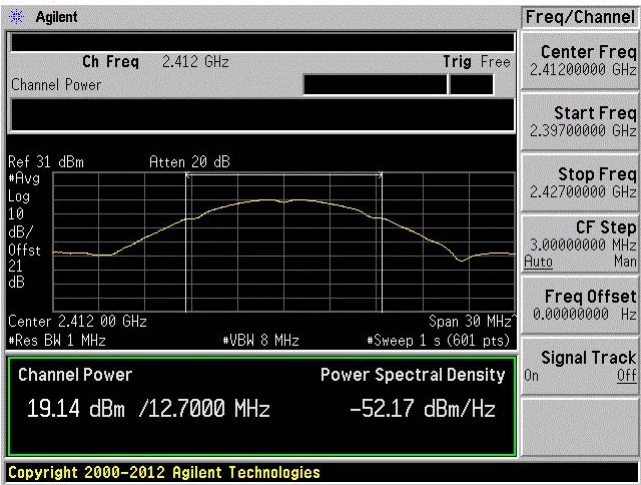
Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)
Low	2402	1.45	30
Middle	2440	1.68	30
High	2480	2.06	30

Please refer to following plots.

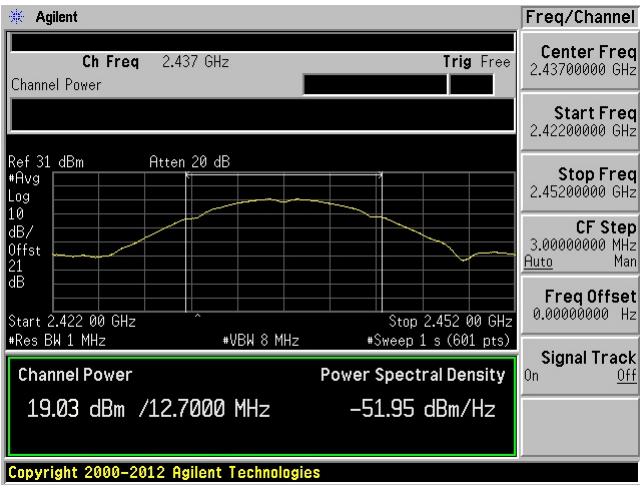
2.4 GHz, Wi-Fi

802.11b mode

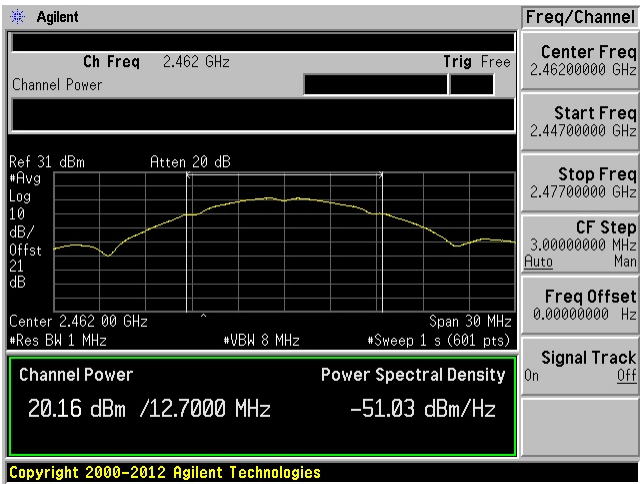
Low Channel



Middle Channel

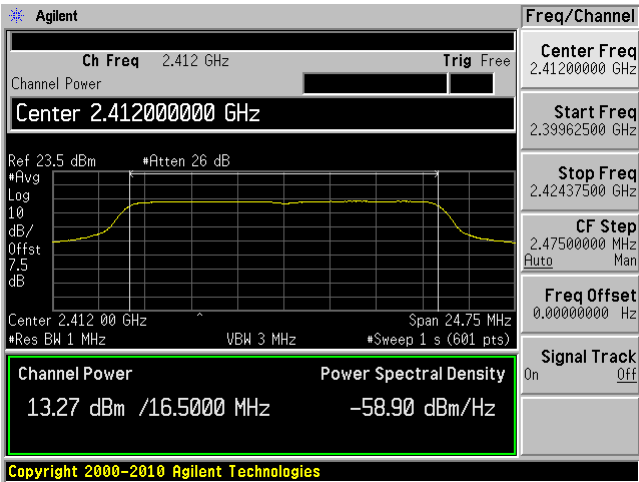


High Channel

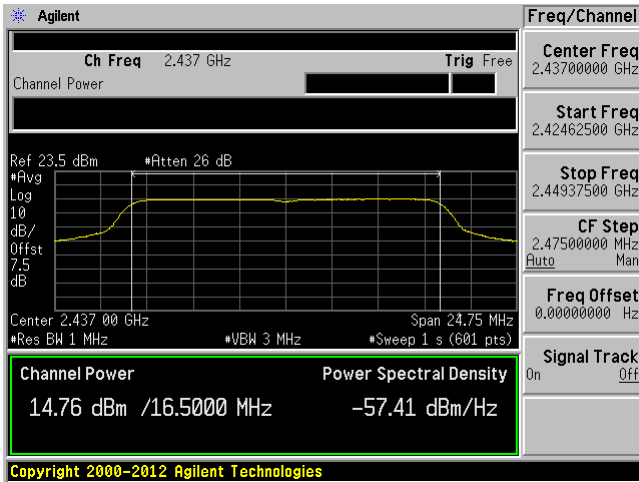


802.11g mode

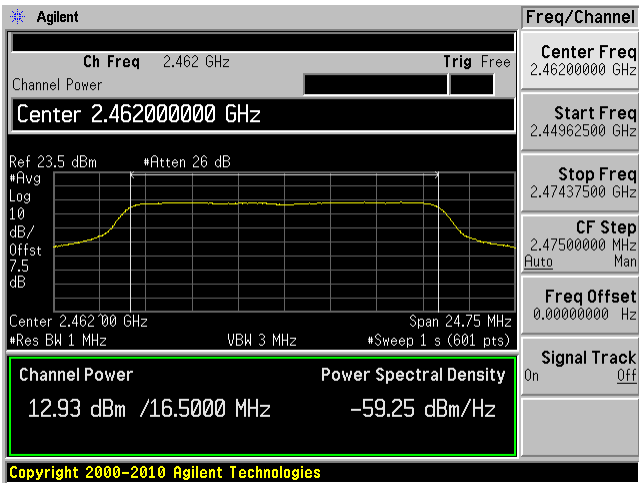
Low Channel



Middle Channel

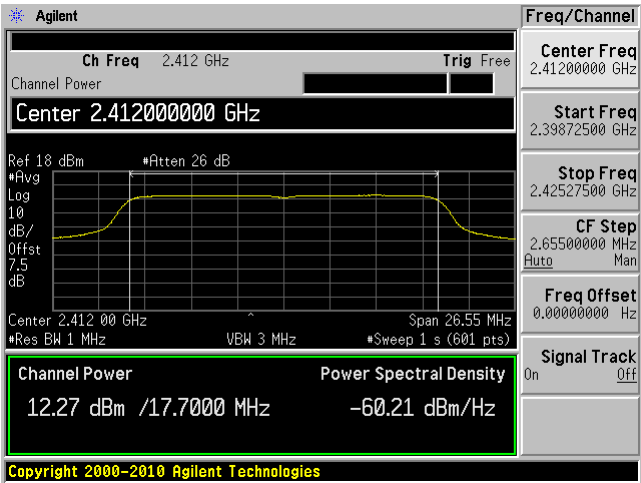


High channel

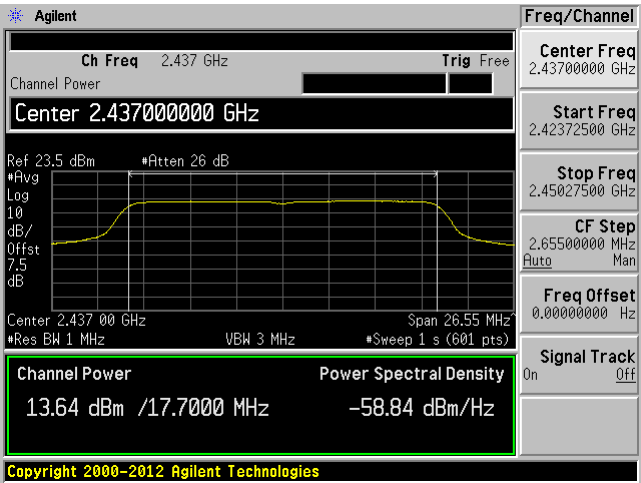


802.11n-HT20 mode

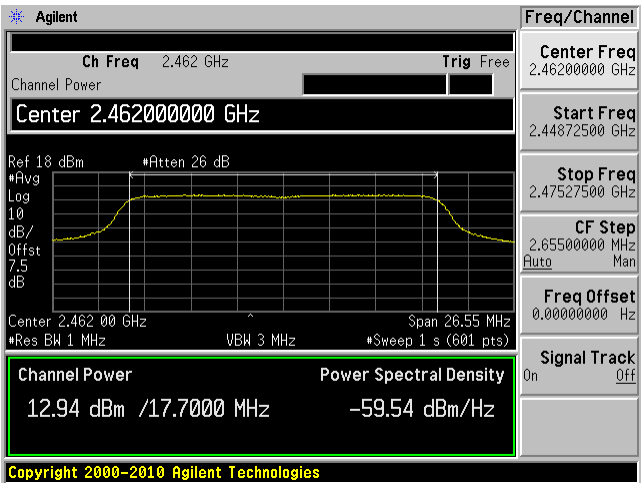
Low Channel



Middle Channel

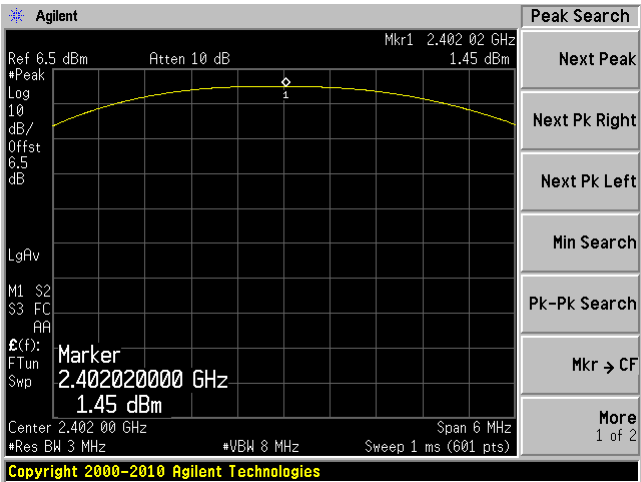


High Channel

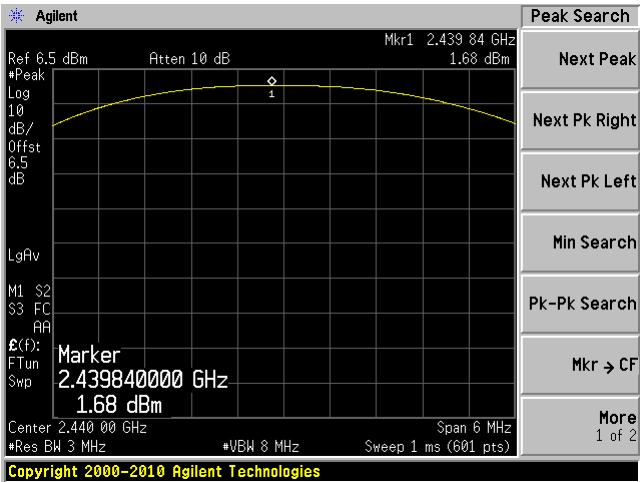


2.4 GHz, BLE

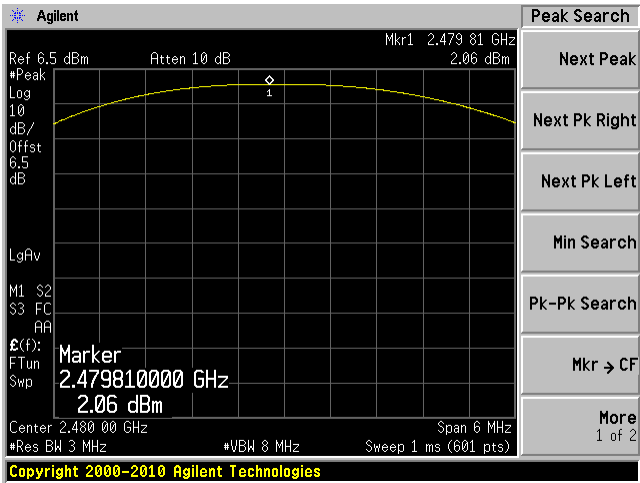
Low Channel



Middle Channel



High Channel



11 FCC §15.247(d) & IC RSS-210 §A8.5 – 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).

According to IC Rss-210 §A8.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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 section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required.

11.2 Measurement Procedure

The measurements are base 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	2013-09-29	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:	22-24° C
Relative Humidity:	40-41%
ATM Pressure:	103.1-104.1 KPa

The testing was performed by Cipher Chu on 2014-07-14 to 2014-07-23 at RF site.

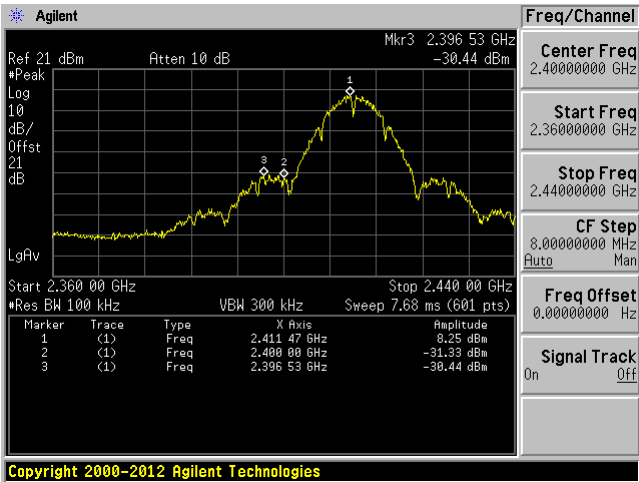
11.5 Test Results

Please refer to following pages for plots of band edge.

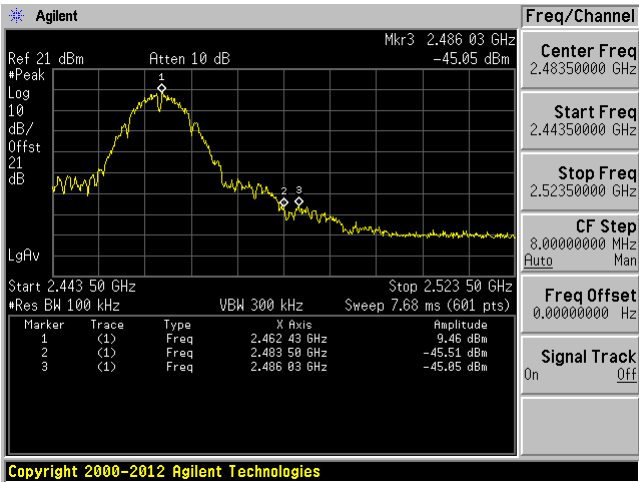
2.4 GHz, Wi-Fi

802.11b mode

Low Band Edge

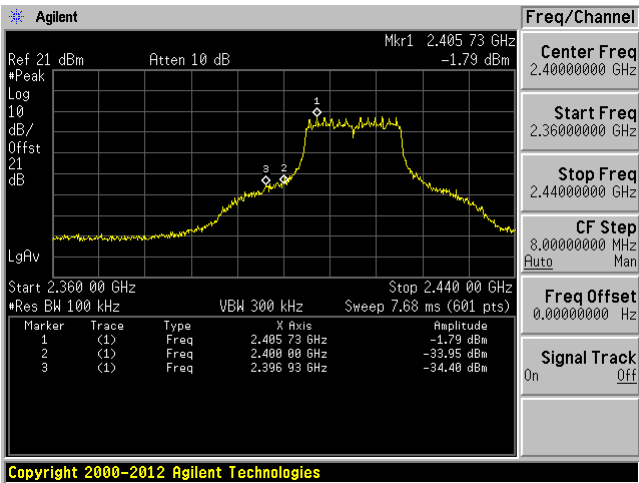


High Band Edge

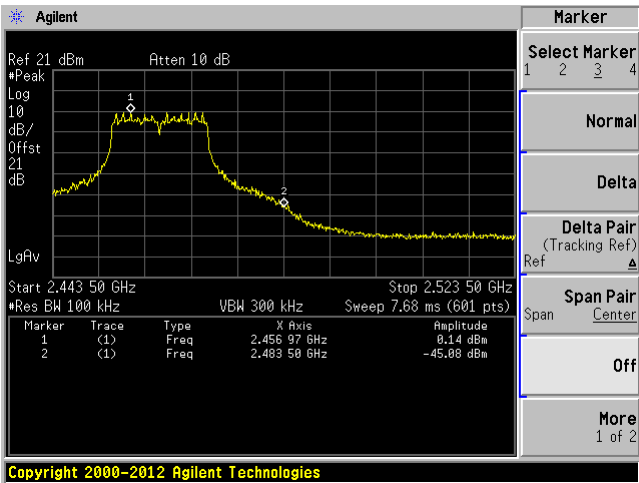


802.11g mode

Low Band Edge

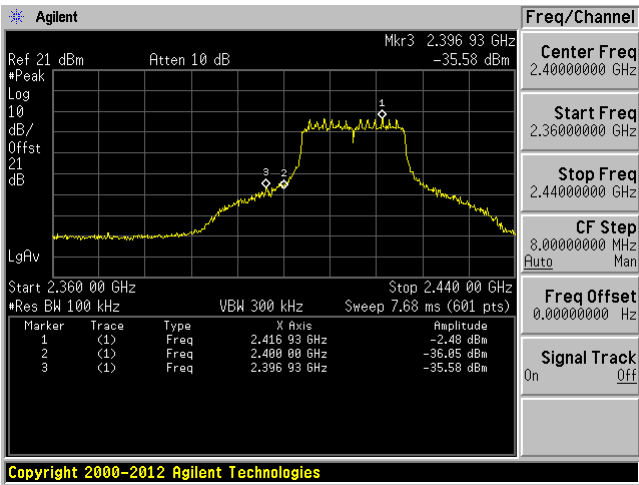


High Band Edge

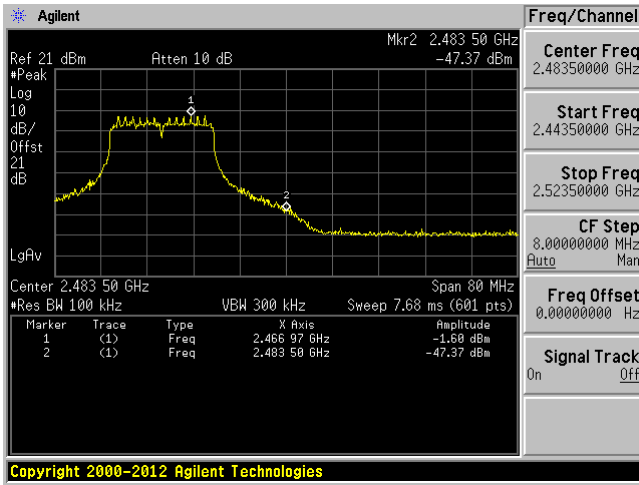


802.11n-HT20 mode

Low Band Edge

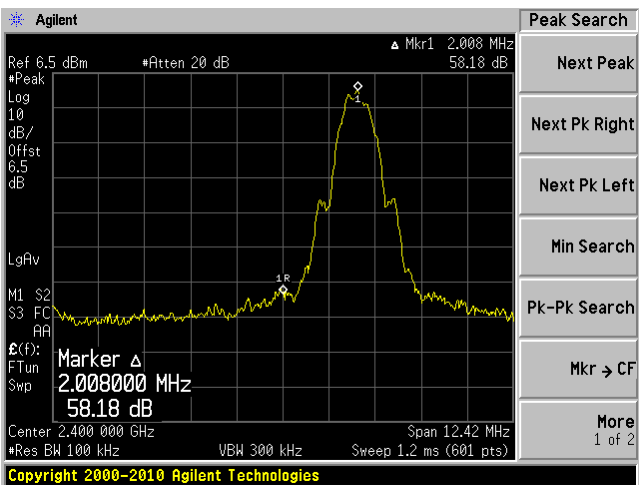


High Band Edge

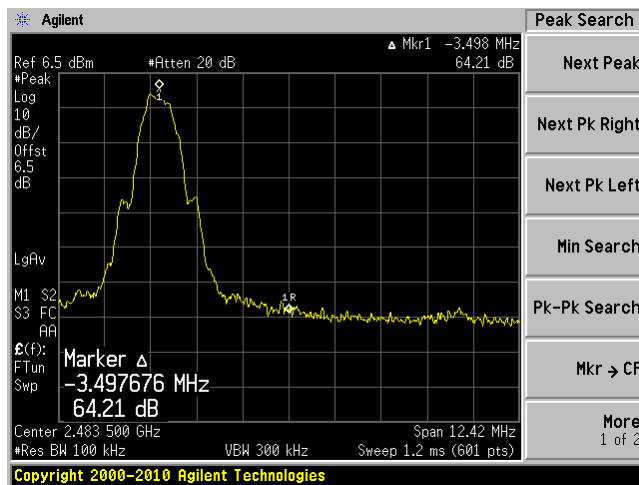


2.4 GHz, BLE

Low Band Edge



High Band Edge



12 FCC §15.247(e) & IC RSS-210 §A8.2 (b) – Power Spectral Density

12.1 Applicable Standards

According to FCC §15.247(e) and RSS-210 §A8.2 (b) , 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 base 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	2013-09-29	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:	22-24° C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 KPa

The testing was performed by Cipher Chu on 2014-07-14 to 2014-07-23 at 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	-7.36	8
Middle	2437	-8.88	8
High	2462	-7.75	8
802.11g mode			
Low	2412	-14.26	8
Middle	2437	-11.43	8
High	2462	-13.08	8
802.11n-HT20 mode			
Low	2412	-14.85	8
Middle	2437	-13.26	8
High	2462	-12.95	8

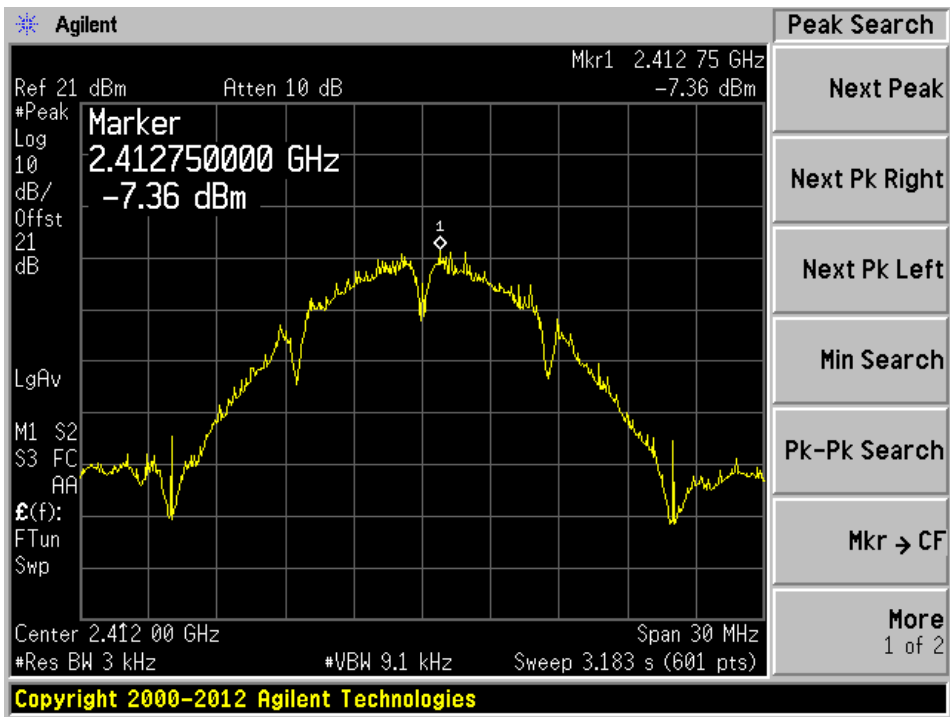
2.4 GHz, BLE

Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Low	2402	-10	8
Middle	2440	-9.43	8
High	2480	-9.53	8

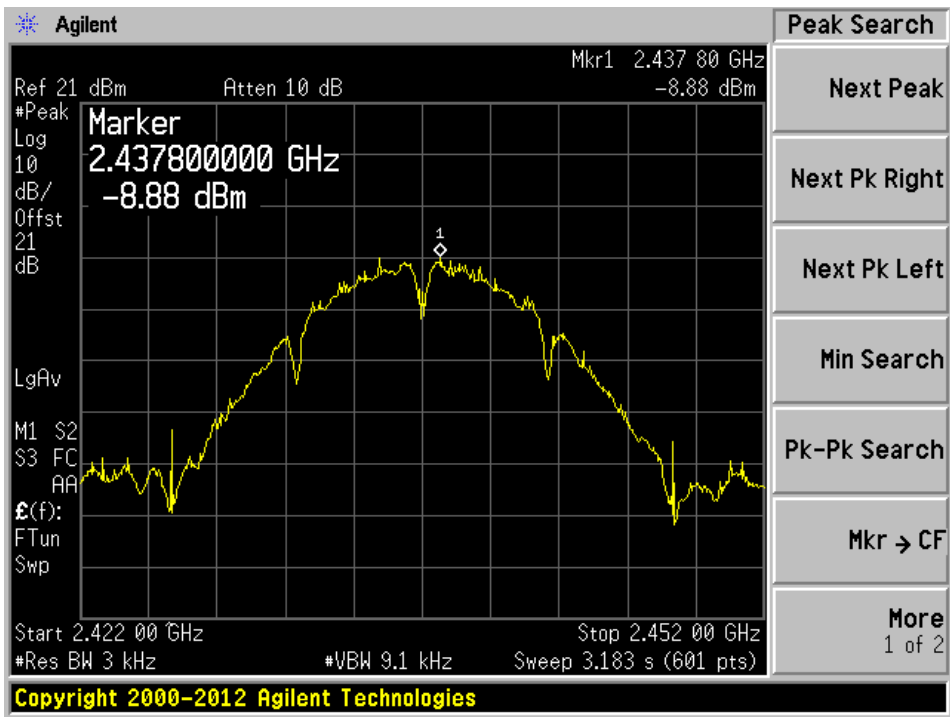
Please refer to the following plots for detailed test results:

802.11b mode

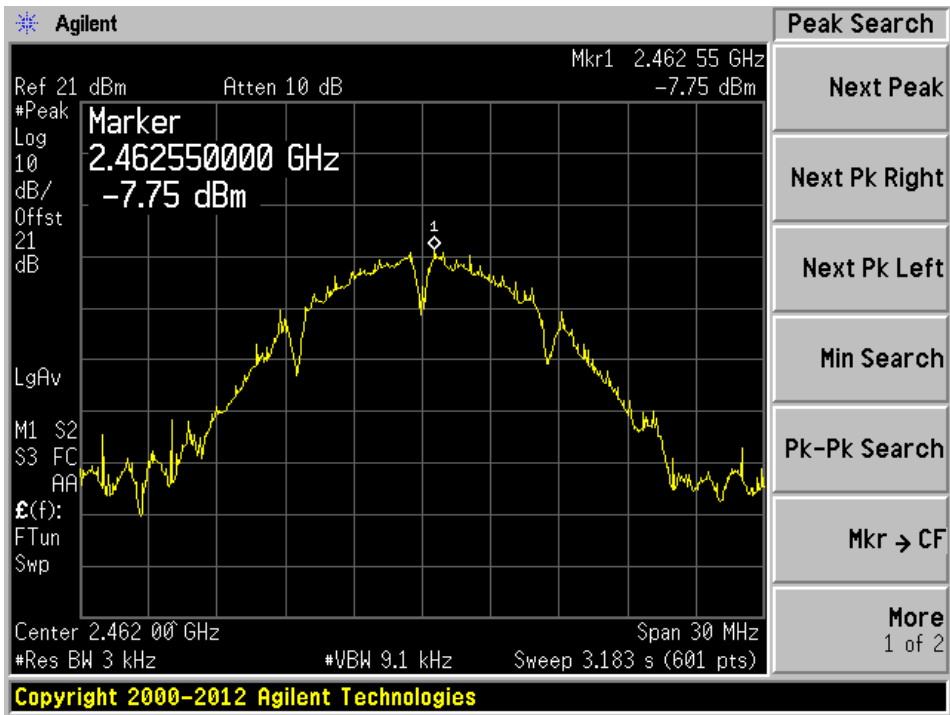
Low channel: 2412 MHz



Middle channel: 2437 MHz

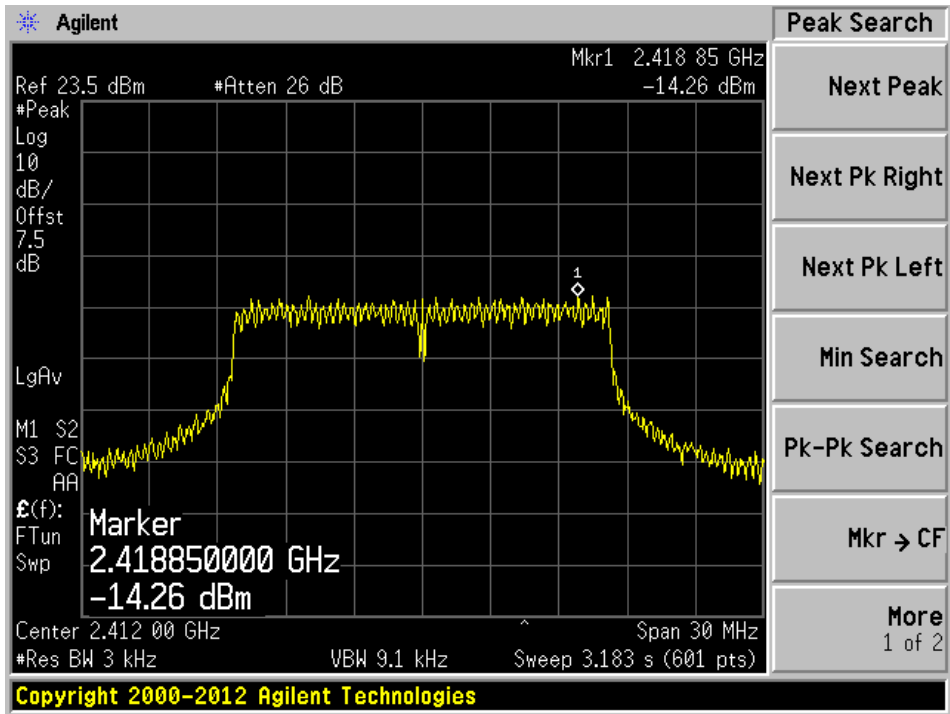


High channel: 2462 MHz

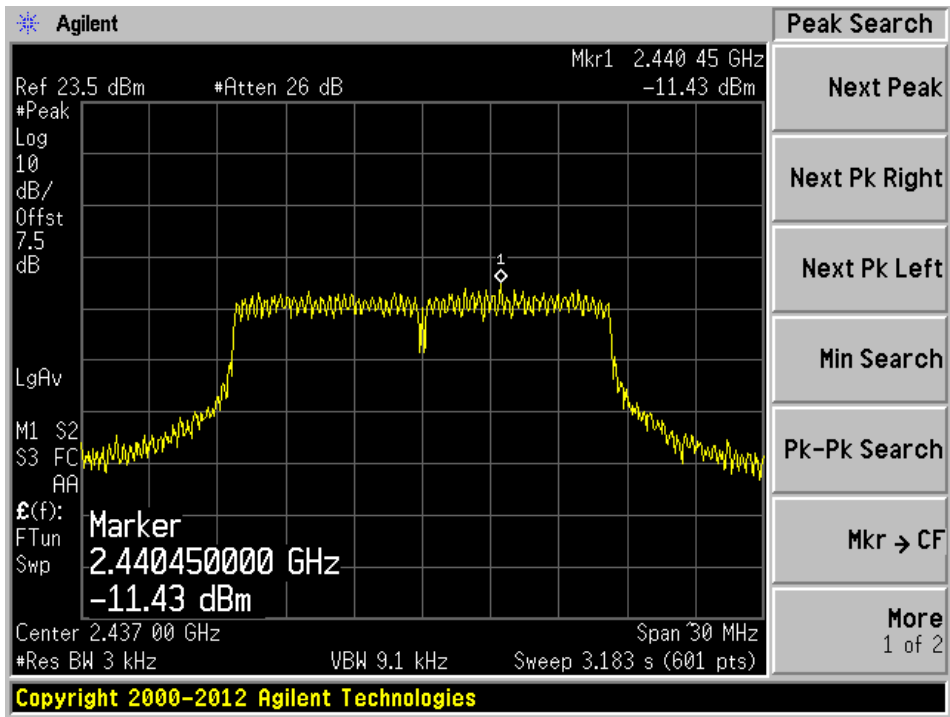


802.11g mode

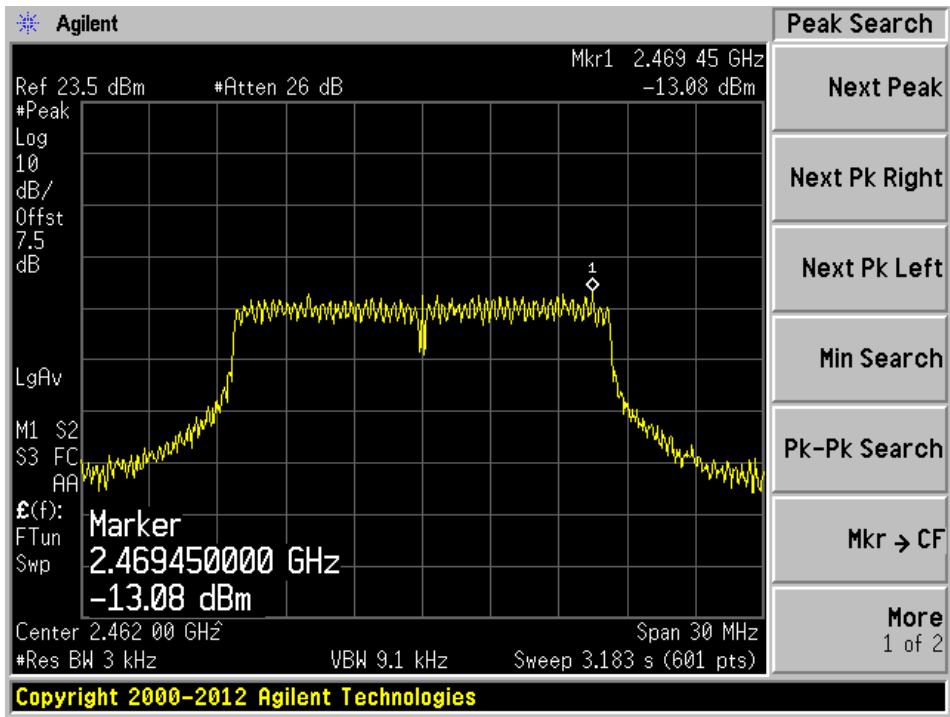
Low channel: 2412 MHz



Middle channel: 2437 MHz

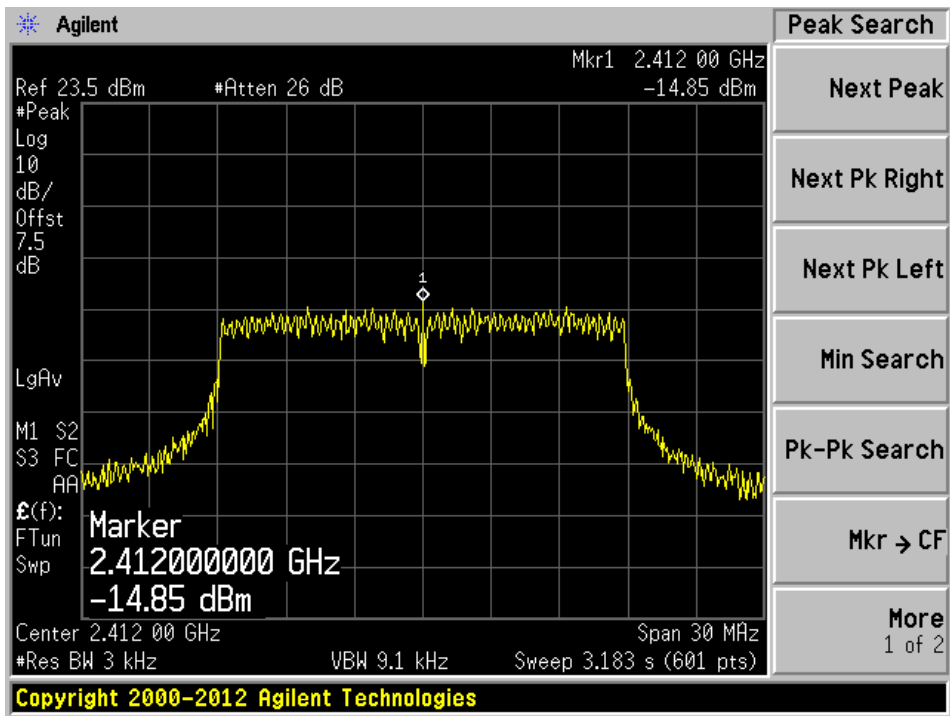


High channel: 2462 MHz

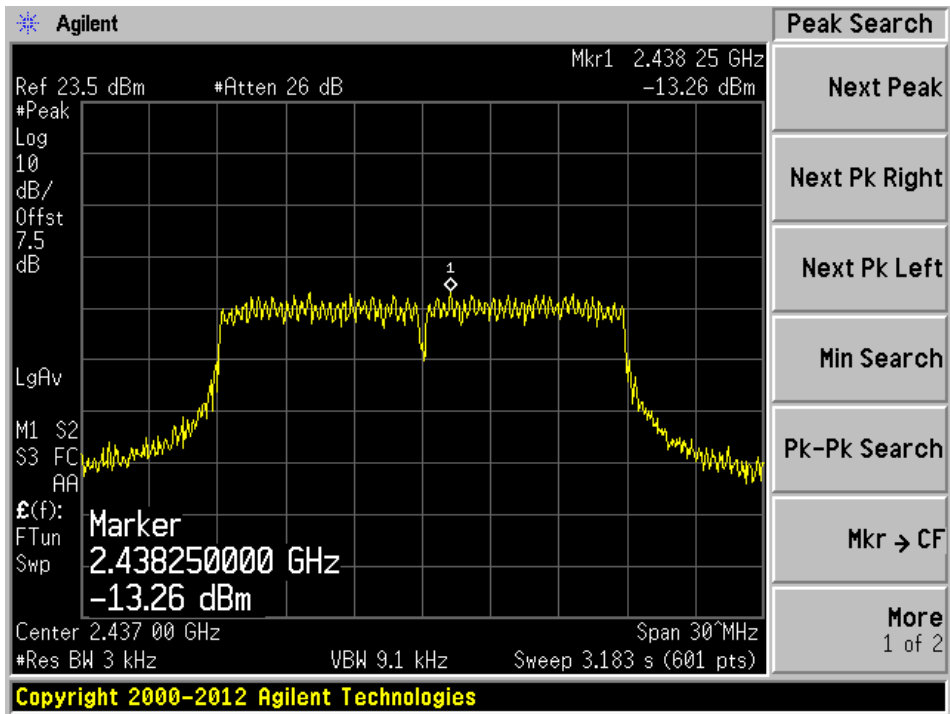


802.11n-HT20 mode

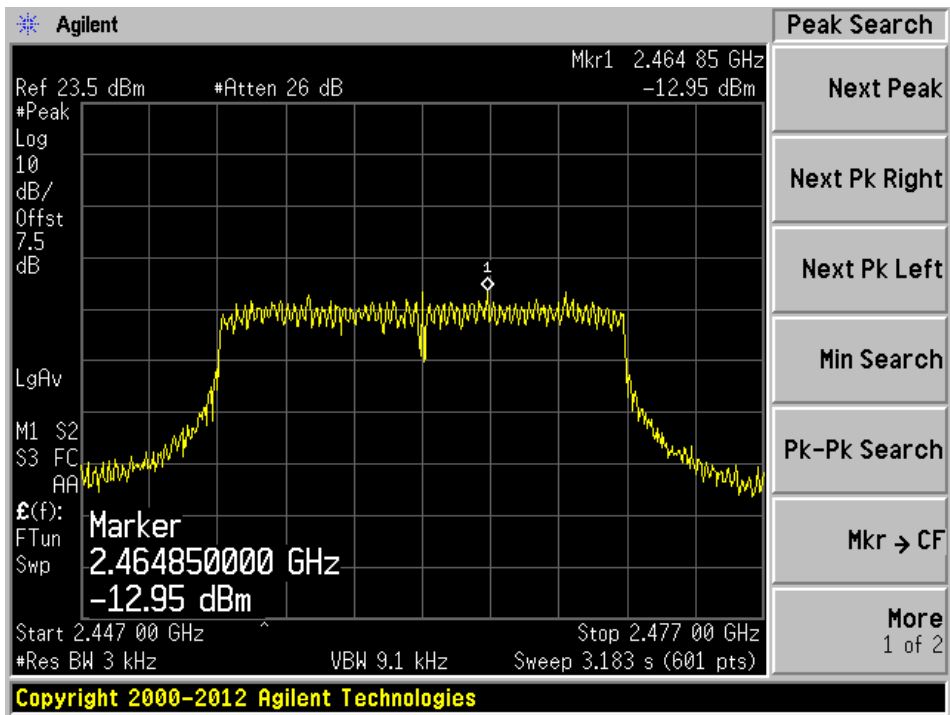
Low channel: 2412 MHz



Middle channel: 2437 MHz

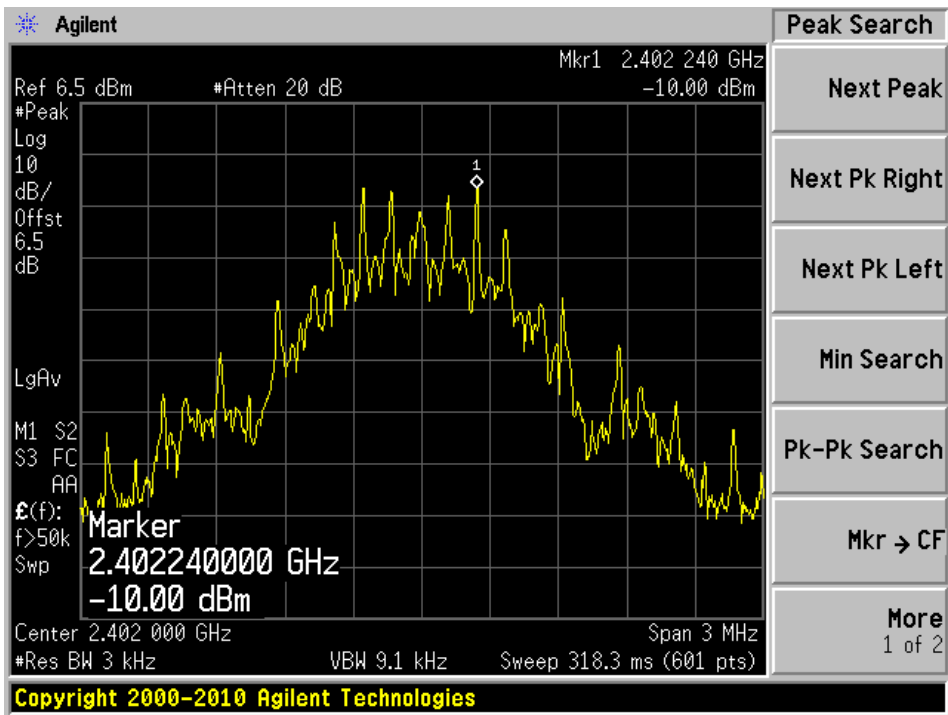


High channel: 2462 MHz

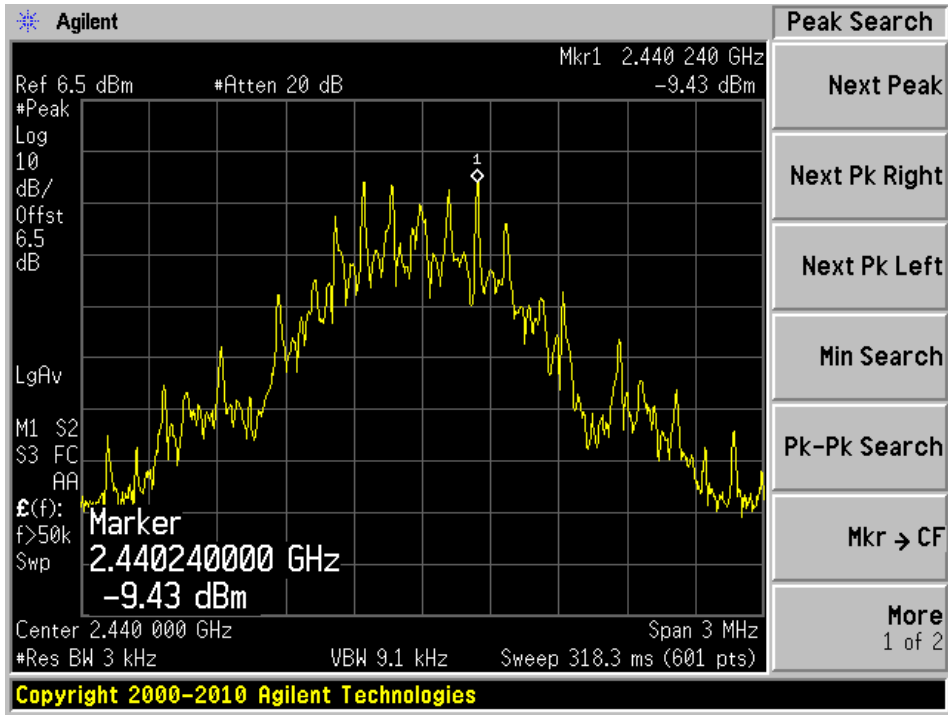


2.4 GHz, BLE

Low channel: 2402 MHz



Middle channel: 2440 MHz



High channel: 2480 MHz

