



FCC PART 15, SUBPART C
TEST REPORT


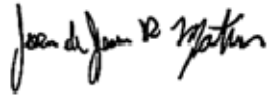
For

SunPower Corporation

1414 Harbour Way South, Ste 1901,

Richmond, CA 94804

FCC ID: YAW523917

| | |
|--|--|
| Report Type: Original Report | Model: SunPower STAC (523917) |
| Prepared By: Vincent Licata Test Engineer |  |
| Report Number: R1707273-247 | |
| Report Date: 2017-09-15 | |
| Reviewed By: Jose Martinez RF Engineer |  |
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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 " * " encl

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DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|-----------------|---------------|-------------------------|------------------|
| 0 | R1707273-247 | Original Report | - |

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *SunPower Corporation* and their product model: SunPower STAC, Serial number: 523917 FCC ID: YAW523917 or the “EUT” as referred to in this report

1.2 Objective

This report is prepared on behalf of *SunPower Corporation*, 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, 6 dB Bandwidth, Power Spectral Density, 100 kHz Bandwidth of Band Edges Measurement, Conducted and Radiated Spurious Emissions.

1.3 Related Submittal(s)/Grant(s)

N/A

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB 558074 D01 DTS Meas Guidance v04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

1.5 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.

| Parameter | Measurement uncertainty |
|-----------------------------------|-------------------------|
| Occupied Channel Bandwidth | ±5 % |
| RF output power, conducted | ±0.57 dB |
| Power Spectral Density, conducted | ±1.48dB |
| Unwanted Emissions, conducted | ±1.57dB |
| All emissions, radiated | ±4.0 dB |
| AC power line Conducted Emission | ±2.0 dB |
| Temperature | ±2 ° C |
| Humidity | ±5 % |
| DC and low frequency voltages | ±1.0 % |
| Time | ±2 % |
| Duty Cycle | ±3 % |

1.6 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3279.02), in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body

- - For the USA (Federal Communications Commission):

- 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
- 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
- 3- All Telephone Terminal Equipment within FCC Scope C.

- For the Canada (Industry Canada):

- 1- All Scope 1-Licence-Exempt Radio Frequency Devices;
- 2- All Scope 2-Licensed Personal Mobile Radio Services;
- 3- All Scope 3-Licensed General Mobile & Fixed Radio Services;
- 4- All Scope 4-Licensed Maritime & Aviation Radio Services;
- 5- All Scope 5-Licensed Fixed Microwave Radio Services
- 6- All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.

For Singapore (Info-Communications Development Authority (IDA)):

- 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2

- For the Hong Kong Special Administrative Region:

- 1 All Radio Equipment, per KHCA 10XX-series Specifications;
 - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
 - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
- 1 MIC Telecommunication Business Law (Terminal Equipment):
 - All Scope A1 - Terminal Equipment for the Purpose of Calls;
 - All Scope A2 - Other Terminal Equipment
 - 2 Radio Law (Radio Equipment):
 - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
 - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
 - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.01) to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

- 1 Electronics and Office Equipment:
 - for Telephony (ver. 3.0)
 - for Audio/Video (ver. 3.0)
 - for Battery Charging Systems (ver. 1.1)
 - for Set-top Boxes & Cable Boxes (ver. 4.1)
 - for Televisions (ver. 6.1)
 - for Computers (ver. 6.0)
 - for Displays (ver. 6.0)
 - for Imaging Equipment (ver. 2.0)
 - for Computer Servers (ver. 2.0)
- 2 Commercial Food Service Equipment
 - for Commercial Dishwashers (ver. 2.0)
 - for Commercial Ice Machines (ver. 2.0)
 - for Commercial Ovens (ver. 2.1)
 - for Commercial Refrigerators and Freezers
- 3 Lighting Products
 - For Decorative Light Strings (ver. 1.5)
 - For Luminaires (including sub-components) and Lamps (ver. 1.2)
 - For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
 - For Integral LED Lamps (ver. 1.4)
- 4 Heating, Ventilation, and AC Products
 - for Residential Ceiling Fans (ver. 3.0)
 - for Residential Ventilating Fans (ver. 3.2)
- 5 Other
 - For Water Coolers (ver. 3.0)

D. A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
 - o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
 - o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
 - o EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)

- Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC US -EU EMC & Telecom MRA CAB (NB)
- Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
- Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter
- USA:
 - ENERGY STAR Recognized Test Laboratory – US EPA
 - Telecommunications Certification Body (TCB) – US FCC;
 - Nationally Recognized Test Laboratory (NRTL) – US OSHA

Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v04.

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 firmware used was Putty provided by *SunPower Corporation*, the software is compliant with the standard requirements being tested against.

| Modulation | Frequency (MHz) | Power Setting |
|------------|-----------------|---------------|
| 802.11b | 2412 | 18 |
| | 2437 | 18 |
| | 2462 | 18 |
| 802.11g | 2412 | 11 |
| | 2437 | 11 |
| | 2462 | 11 |
| 802.11n20 | 2412 | 11 |
| | 2437 | 11 |
| | 2462 | 11 |
| 802.11n40 | 2422 | 10 |
| | 2437 | 10 |
| | 2452 | 10 |

Data Rates Tested:

802.11b mode: 1 Mbps

802.11g mode: 6 Mbps

802.11n HT20 mode: 6.5 Mbps

802.11n HT40 mode: 13.5 Mbps

2.3 Duty Cycle Correction Factor

According to KDB 558074 D01 DTS Meas Guidance v04 section 6.0:

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be utilized to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data is being acquired (i.e., no transmitter off-time is to be considered).

| Radio Mode | On Time (ms) | Period (ms) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) |
|------------|--------------|-------------|----------------|-----------------------------------|
| 802.11b | 18.91 | 19.24 | 98.28% | 0.08 |
| 802.11g | 3.13 | 10.01 | 31.27% | 5.05 |
| 802.11n20 | 2.93 | 10.05 | 29.15% | 5.35 |
| 802.11n40 | 1.442 | 10.05 | 14.35% | 8.43 |

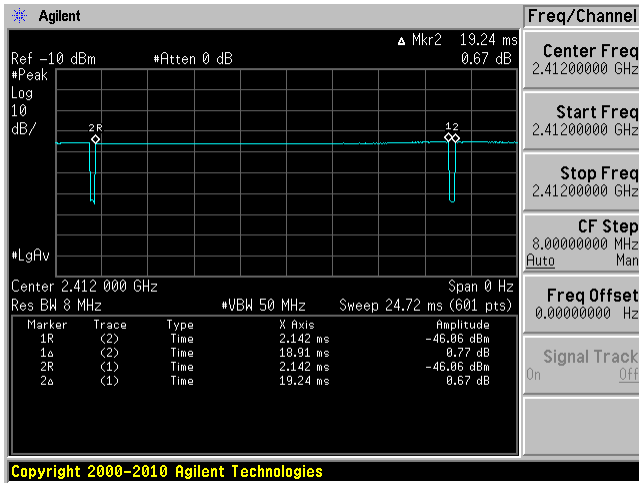
Duty Cycle = On Time (ms)/ Period (ms)

Duty Cycle Correction Factor (dB) = $10 \cdot \log(1/\text{Duty Cycle})$

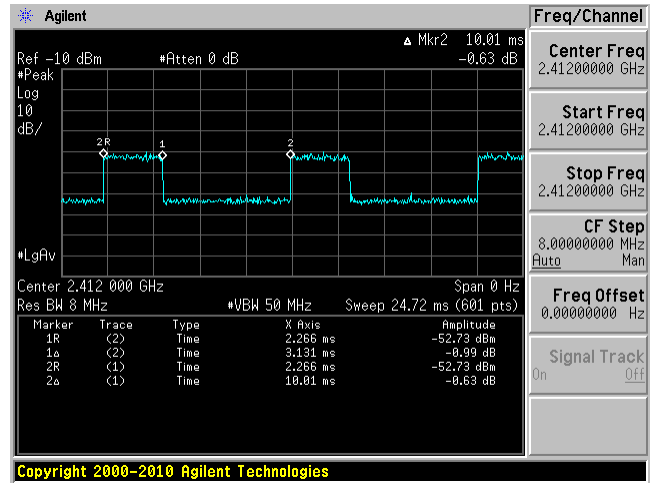
Please refer to the following plots.

Antenna Port J20

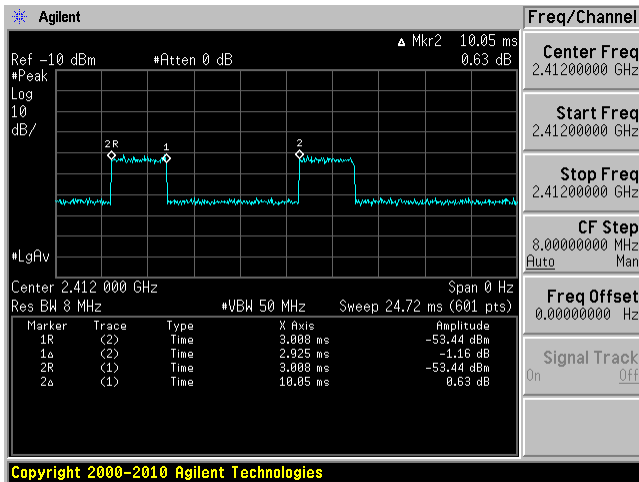
802.11b mode



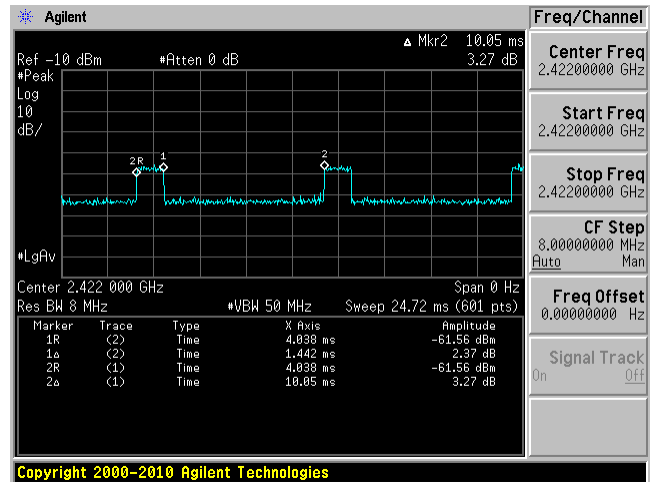
802.11g mode



802.11n20 mode



802.11 n40 mode



2.4 Equipment Modifications

No equipment modifications are made to the EUT

2.5 Local Support Equipment

| Manufacturer | Description | Model |
|--------------|-------------|----------------|
| Dell | Laptop | Latitude E6410 |

2.6 Support Equipment

| Manufacturer | Description | Model | Serial Number |
|--------------|-----------------|----------------------|---------------|
| AMETEK | DC Power Supply | Sorensen XHR 600-1.7 | 1118A03471 |

2.7 Interface Ports and Cabling

| Cable Description | Length (m) | To | From |
|---------------------|------------|--------|--------------|
| Micro USB to USB | < 1 m | Laptop | EUT |
| RF Cable | < 1 m | EUT | PSA |
| Power Supply Cables | 6.5 m | EUT | Power Supply |

3 Summary of Test Results

Results reported relate only to the product tested.

| FCC Rules | Description of Test | Results |
|---|--|-----------|
| FCC §15.203 | Antenna Requirement | Compliant |
| FCC §15.207 | AC Line Conducted Emissions | Compliant |
| FCC §2.1091, §15.247(i) | RF Exposure | Compliant |
| FCC §2.1051, §15.247 (d) | Spurious Emissions at Antenna Port | Compliant |
| FCC §2.1053, §15.205, §15.209, §15.247 (d) | Radiated Spurious Emissions | Compliant |
| FCC §15.247(a)(2) | 6 dB and 99% Emission Bandwidth | Compliant |
| FCC §15.247(b)(3) | Maximum Peak Output Power | Compliant |
| FCC §15.247(d) | 100 kHz Bandwidth of Frequency Band Edge | Compliant |
| FCC §15.247(e) | Power Spectral Density | Compliant |

4 FCC §15.203 - Antenna Requirements

4.1 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.

4.2 Antenna Description

The antennas used by the EUT apply unique reverse SMA connectors.

Note¹: See Annex C – EUT Photographs for visual of antenna attachment.

| Antenna usage | Frequency Range (MHz) | Maximum Antenna Gain (dBi) |
|---------------|-----------------------|----------------------------|
| Wi-Fi | 2400 | 0.8 |

5 FCC §2.1091, §15.247(i) – RF Exposure

5.1 Applicable Standards

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

Limits for General Population/Uncontrolled Exposure

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

f = frequency in MHz

* = Plane-wave equivalent power density

5.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

5.3 MPE Results

| | |
|---|---------------|
| <u>Maximum peak output power at antenna input terminal (dBm):</u> | <u>16.89</u> |
| <u>Maximum peak output power at antenna input terminal (mW):</u> | <u>48.865</u> |
| <u>Prediction distance (cm):</u> | <u>20</u> |
| <u>Prediction frequency (MHz):</u> | <u>2412</u> |
| <u>Maximum Antenna Gain, typical (dBi):</u> | <u>0.8</u> |
| <u>Maximum Antenna Gain (numeric):</u> | <u>1.202</u> |
| <u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u> | <u>0.0117</u> |
| <u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u> | <u>1.0</u> |

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0117 mW/cm². Limit is 1.0 mW/cm².

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 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 ^{Note1} | 56 to 46 ^{Note2} |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

Note1: Decreases with the logarithm of the frequency.

Note2: A linear average detector is required

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.10-2013 measurement procedure. The specification used were FCC §15.207 limits.

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

The AC/DC power adapter of the 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 cords of support equipment were connected to LISN-2.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data were recorded in the peak, quasi-peak, and average detection mode. Quasi-Peak readings are distinguished with a "QP." Average readings are distinguished with an "Ave".

6.4 Corrected Amplitude and 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:

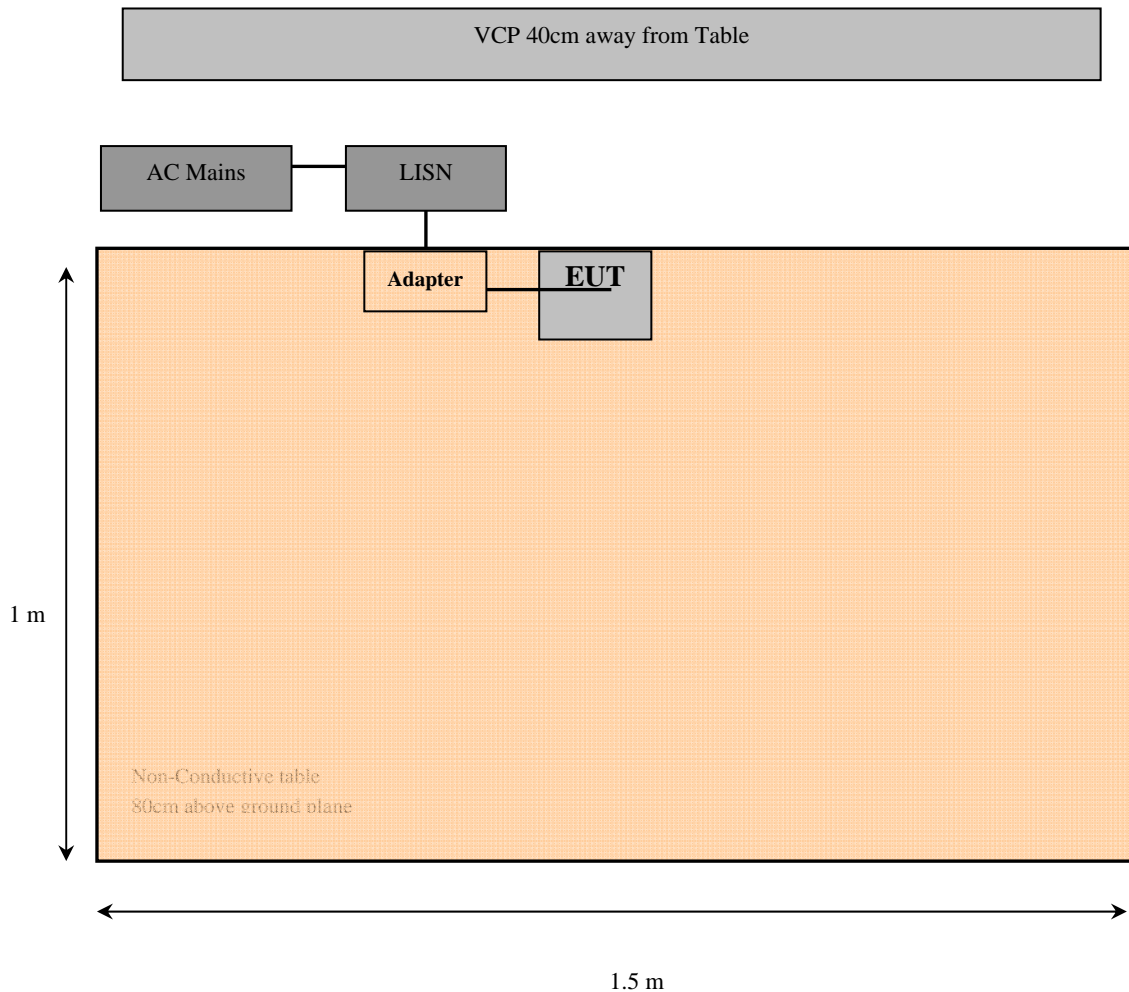
$$CA = A_i + CL + \text{Atten}$$

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:

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

6.5 Test Setup Block Diagram



6.6 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|---------------------------|---------------------------------|-----------------------------|------------|------------------|----------------------|
| Rohde and Schwarz | Receiver, EMI Test | ESCI 1166.5950K03 | 100338 | 2016-02-04 | 2 years |
| Rohde and Schwarz | Impulse Limiter | ESH3-Z2 | 101964 | 2017-07-25 | 1 year |
| Keysight Technologies | RF Limiter | 11867A | MY42242931 | 2017-01-12 | 1 year |
| Solar Electronics Company | High Pass Filter | Type 7930-100 | 7930150204 | 2017-03-13 | 1 year |
| Suirong | 30 ft conductive emission cable | LMR 400 | - | N/R | N/A |
| FCC | LISN | FCC-LISN-50-25-2-10-CISPR16 | 160129 | 2017-04-24 | 1 year |
| Vasona | Test software | V6.0 build 11 | 10400213 | N/R | N/R |

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: | 23° C |
| Relative Humidity: | 42 % |
| ATM Pressure: | 101.31 kPa |

The testing was performed by Vincent Licata on 2017-08-31 in 5 chamber 3.

6.8 Summary of Test Results

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

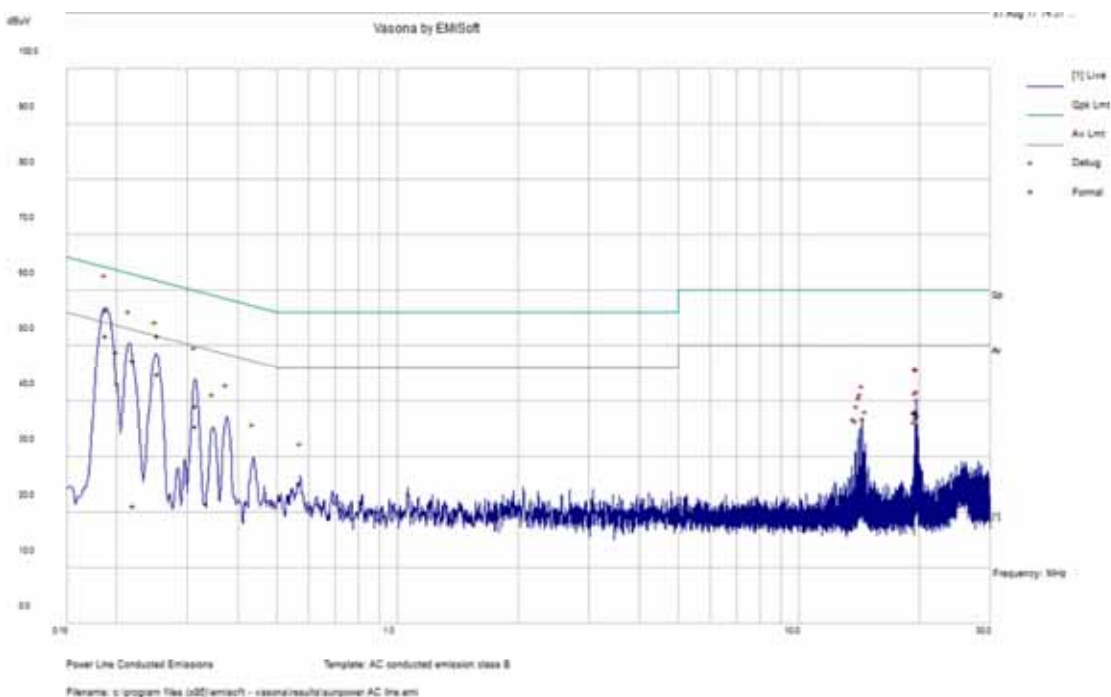
2.4 GHz Wi-Fi

| Connection: AC/DC adapter connected to 120 V/60 Hz, AC | | | |
|--|-----------------|-------------------------------|-------------|
| Margin (dB) | Frequency (MHz) | Conductor Mode (Line/Neutral) | Range (MHz) |
| -2.26 | 0.187832 | Line | 0.15-30 |

6.9 Conducted Emissions Test Plots and Data

2.4 GHz Wi-Fi

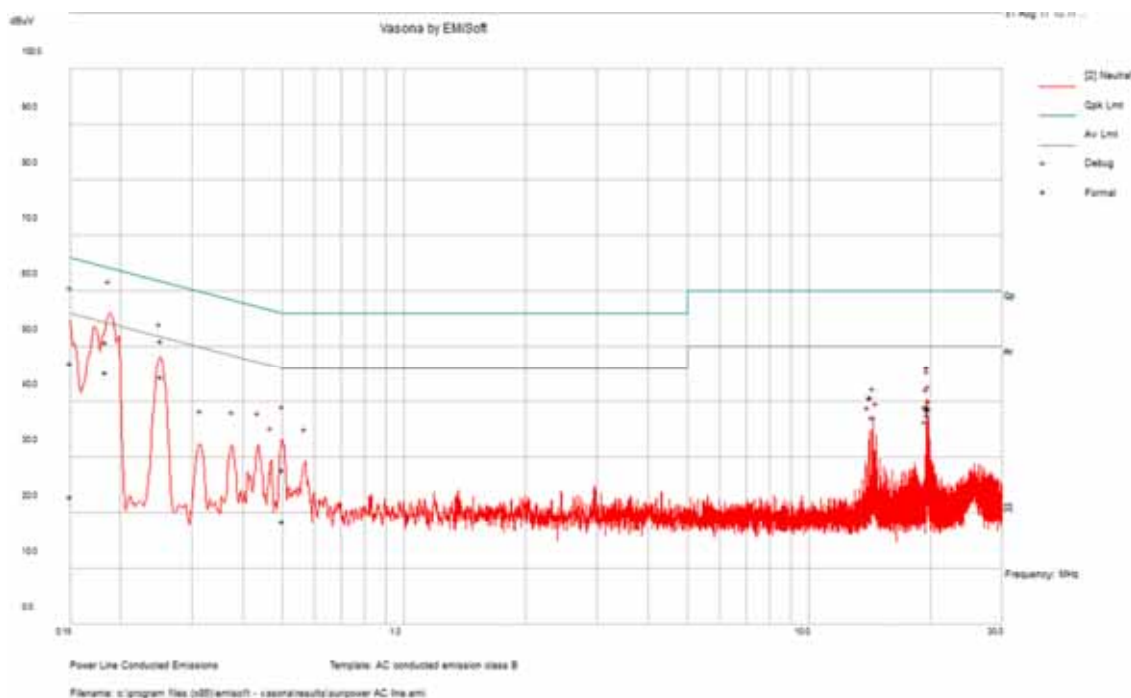
120 V, 60 Hz – Line



| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.187832 | 56.37 | Line | 64.13 | -7.77 | QP |
| 0.220297 | 47.34 | Line | 62.81 | -15.47 | QP |
| 0.252915 | 51.75 | Line | 61.66 | -9.91 | QP |
| 0.313901 | 39.07 | Line | 59.87 | -20.8 | QP |
| 19.63093 | 37.93 | Line | 60 | -22.07 | QP |
| 19.56867 | 38.23 | Line | 60 | -21.77 | QP |

| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.187832 | 51.87 | Line | 54.13 | -2.26 | Ave. |
| 0.220297 | 21.33 | Line | 52.81 | -31.48 | Ave. |
| 0.252915 | 44.88 | Line | 51.66 | -6.78 | Ave. |
| 0.313901 | 35.56 | Line | 49.87 | -14.3 | Ave. |
| 19.63093 | 37.09 | Line | 50 | -12.91 | Ave. |
| 19.56867 | 37.78 | Line | 50 | -12.22 | Ave. |

120 V, 60 Hz – Neutral



| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.18398 | 50.85 | Neutral | 64.3 | -13.45 | QP |
| 0.150182 | 47.11 | Neutral | 65.99 | -18.88 | QP |
| 0.252141 | 51.16 | Neutral | 61.69 | -10.53 | QP |
| 19.56973 | 39.23 | Neutral | 60 | -20.77 | QP |
| 19.63174 | 38.5 | Neutral | 60 | -21.5 | QP |
| 0.50156 | 27.75 | Neutral | 56 | -28.25 | QP |

| Frequency (MHz) | Corrected Amplitude (dBuV) | Conductor (Line/Neutral) | Limit (dBuV) | Margin (dB) | Detector (QP/Ave.) |
|-----------------|----------------------------|--------------------------|--------------|-------------|--------------------|
| 0.18398 | 45.37 | Neutral | 54.3 | -8.93 | Ave. |
| 0.150182 | 23.09 | Neutral | 55.99 | -32.9 | Ave. |
| 0.252141 | 44.64 | Neutral | 51.69 | -7.05 | Ave. |
| 19.56973 | 38.75 | Neutral | 50 | -11.25 | Ave. |
| 19.63174 | 37.62 | Neutral | 50 | -12.38 | Ave. |
| 0.50156 | 18.69 | Neutral | 46 | -27.31 | Ave. |

7 FCC §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 §15.205(a) and RSS-Gen 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 | 3332 – 3339 | 22.01 – 23.12 |
| 8.41425 – 8.41475 | 167.72 – 173.2 | 3345.8 – 3358 | 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 §15.209(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 §15.247 (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 C63.10-2013. The specification used was the FCC 15 Subpart C.

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 were 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 was set 3 meter away from the testing antenna, which was varied from 1-4 meter, and the EUT was placed on a turntable, which was 0.8 meter and 1.5 meter above the ground plane for below and above 1000 MHz measurements, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna's polarity should be changed between horizontal and vertical.

The spectrum analyzer or receiver was set as:

Below 1000 MHz:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000 MHz:

- (1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
- (2) Average: RBW = 1MHz / VBW = 1/Period / Sweep = Auto

7.4 Corrected Amplitude and 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:

$$\text{CA} = \text{Ai} + \text{AF} + \text{CL} + \text{Atten} - \text{Ga}$$

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:

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

7.5 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|-------------------|-----------------------------------|----------------------|--------------------------|------------------------|----------------------|
| Rohde and Schwarz | Receiver, EMI Test | ESCI 1166.5950K03 | 100338 | 2016-02-04 | 2 years |
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 2017-04-20 | 1 year |
| Sunol Sciences | System Controller | SC99V | 011003-1 | N/R | N/A |
| Sunol Sciences | Antenna, Biconi-Log | JB3 | A020106-2 | 2015-07-11 | 26 Months |
| EMCO | Antenna, Horn | 3115 | 9511-4627 | 2016-01-28 | 2 years |
| Agilent | Amplifier, Pre | 8447D | 2944A10187 | 2017-03-13 | 1 year |
| IW | AOBOR Hi frequency Co AX Cable | DC 1531 | KPS- 1501A3960K PS | 2016-08-05 | 1 year |
| - | SMA cable | - | C0002 | Each time ¹ | N/A |
| - | N-Type Cable | - | C00012 | Each time ¹ | N/A |
| - | N-Type Cable | - | C00014 | Each time ¹ | N/A |
| Agilent | Pre-Amplifier | 8449B | 3147A00400 | 2017-06-15 | 1 year |
| Sunol Sciences | Antenna, Horn | DRH-118 | A052704 | 2017-03-27 | 2 years |
| A.R.A. | Antenna, Horn | DRG-118/A | 1132 | 2015-09-21 | 2 years |
| Vasona | Test software | V6.0 build 11 | 10400213 | N/R | N/R |

Note¹: cable and attenuator included in the test set-up will be checked each time before testing.

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

7.6 Test Environmental Conditions

| | |
|---------------------------|-----------|
| Temperature: | 20-23 °C |
| Relative Humidity: | 42-50 % |
| ATM Pressure: | 102.7 kPa |

The testing was performed by Vincent Licata 2017-08-31 to 2017-09-11 in 5m chamber 3 and 10m chamber 1¹.

Note¹: Radiated emissions from 30 MHz to 1 GHz were performed in the 10m chamber 1 because the EUT needed to be grounded and the power supply put under ground in order to simulate normal conditions.

7.7 Summary of Test Results

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

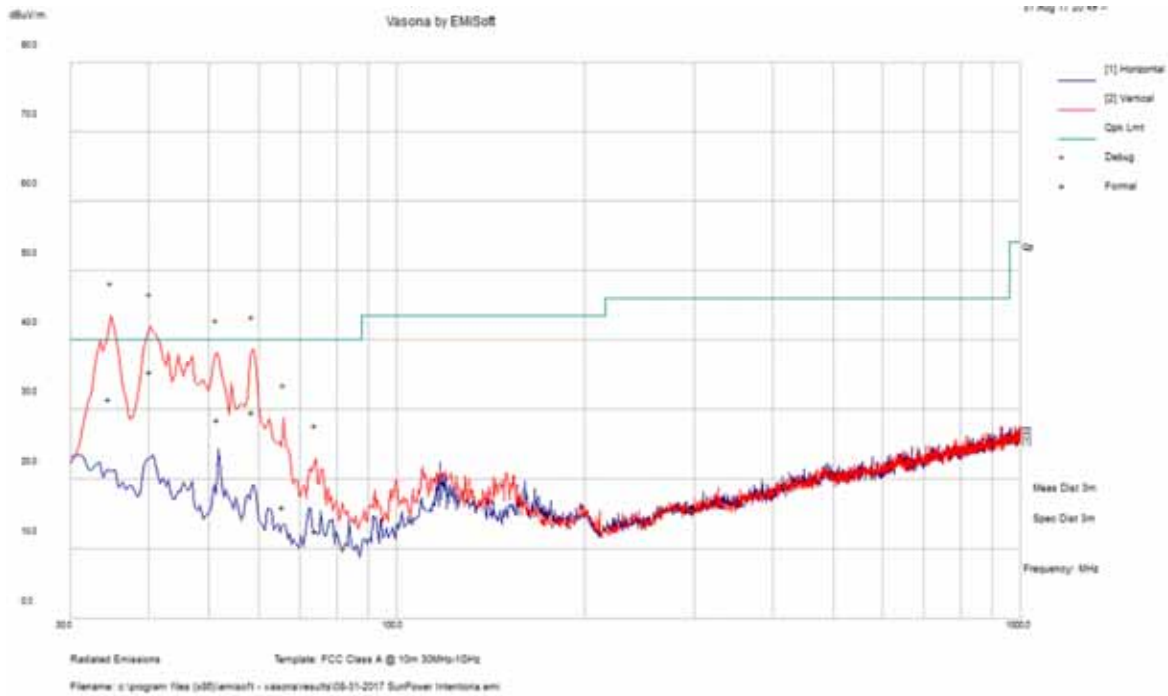
2.4 GHz Wi-Fi

| Mode: Transmitting | | | |
|--------------------|-----------------|------------------------------------|----------------|
| Margin (dB) | Frequency (MHz) | Polarization (Horizontal/Vertical) | Mode, channel |
| -0.67 | 2390 | Vertical | g, low channel |

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

7.8 Radiated Emissions Test Results

1) 30 MHz – 1 GHz Worst Case, Measured at 3 meters



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) | Comment |
|-----------------|------------------------------|---------------------|------------------------|-----------------------------|----------------|-------------|---------|
| 34.62725 | 31.42 | 102 | V | 79 | 40 | -8.58 | Pass |
| 40.2055 | 35.46 | 207 | V | 12 | 40 | -4.54 | Pass |
| 58.60025 | 29.66 | 120 | V | 318 | 40 | -10.34 | Pass |
| 51.54675 | 28.53 | 204 | V | 295 | 40 | -11.47 | Pass |
| 65.76675 | 15.92 | 323 | V | 166 | 40 | -24.08 | Pass |
| 74.17825 | 12.52 | 178 | V | 227 | 40 | -27.48 | Pass |

Note: Only 6 emissions were present because the other emissions were 20 dB below the limit.

2) 1–25 GHz Measured at 3 meters

Note: After the pre-scan, the worst case for each mode has been selected for the formal tested as below,

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 | 69.30 | 259 | 181 | H | 28.94 | 6.29 | 0 | 104.53 | - | - | PK |
| 2412 | 66.67 | 259 | 181 | H | 28.94 | 6.29 | 0 | 101.90 | - | - | AV |
| 2412 | 66.35 | 181 | 100 | V | 28.93 | 6.29 | 0 | 101.57 | - | - | PK |
| 2412 | 63.86 | 181 | 100 | V | 28.93 | 6.29 | 0 | 99.08 | - | - | AV |
| 2390 | 29.60 | 0 | 100 | H | 28.94 | 6.24 | 0 | 64.78 | 74.00 | -9.22 | PK |
| 2390 | 17.24 | 0 | 100 | H | 28.94 | 6.24 | 0 | 52.42 | 54.00 | -1.58 | AV |
| 2390 | 29.49 | 0 | 100 | V | 28.93 | 6.24 | 0 | 64.66 | 74.00 | -9.34 | PK |
| 2390 | 17.22 | 0 | 100 | V | 28.93 | 6.24 | 0 | 52.39 | 54.00 | -1.61 | AV |
| 4824 | 49.30 | 162 | 300 | H | 32.53 | 9.62 | 36.36 | 55.09 | 74.00 | -18.91 | PK |
| 4824 | 41.72 | 162 | 300 | H | 32.53 | 9.62 | 36.36 | 47.51 | 54.00 | -6.49 | AV |
| 4824 | 50.10 | 11 | 300 | V | 32.53 | 9.62 | 36.36 | 55.89 | 74.00 | -18.11 | PK |
| 4824 | 42.16 | 11 | 300 | V | 32.53 | 9.62 | 36.36 | 47.95 | 54.00 | -6.05 | AV |
| 7236 | 46.58 | 0 | 100 | H | 36.88 | 12.21 | 36.38 | 59.29 | 74.00 | -14.71 | PK |
| 7236 | 34.01 | 0 | 100 | H | 36.88 | 12.21 | 36.38 | 46.72 | 54.00 | -7.28 | AV |
| 9648 | 48.15 | 0 | 100 | H | 37.81 | 13.82 | 36.43 | 63.35 | 74.00 | -10.65 | PK |
| 9648 | 35.54 | 0 | 100 | H | 37.81 | 13.82 | 36.43 | 50.74 | 54.00 | -3.26 | AV |
| Middle Channel 2437 MHz | | | | | | | | | | | |
| 2437 | 69.73 | 65 | 100 | H | 29.19 | 6.29 | 0.00 | 105.21 | - | - | PK |
| 2437 | 67.09 | 65 | 100 | H | 29.19 | 6.29 | 0.00 | 102.57 | - | - | AV |
| 2437 | 69.93 | 186 | 100 | V | 29.19 | 6.29 | 0.00 | 105.41 | - | - | PK |
| 2437 | 67.34 | 186 | 100 | V | 29.19 | 6.29 | 0.00 | 102.82 | - | - | AV |
| 4874 | 49.31 | 272 | 300 | H | 32.70 | 9.42 | 36.327 | 55.09 | 74.00 | -18.91 | PK |
| 4874 | 40.34 | 272 | 300 | H | 32.70 | 9.42 | 36.327 | 46.12 | 54.00 | -7.88 | PK |
| 4874 | 50.19 | 12 | 300 | V | 32.70 | 9.42 | 36.327 | 55.97 | 74.00 | -18.03 | PK |
| 4874 | 43.55 | 12 | 300 | V | 32.70 | 9.42 | 36.327 | 49.33 | 54.00 | -4.67 | AV |
| 7311 | 44.76 | 0 | 100 | H | 36.99 | 11.68 | 36.40 | 57.03 | 74.00 | -16.97 | PK |
| 7311 | 33.52 | 0 | 100 | H | 36.99 | 11.68 | 36.40 | 45.79 | 54.00 | -8.21 | AV |
| 9748 | 47.55 | 0 | 100 | H | 37.82 | 13.21 | 36.45 | 62.12 | 74.00 | -11.88 | PK |
| 9748 | 35.27 | 0 | 100 | H | 37.82 | 13.21 | 36.45 | 49.84 | 54.00 | -4.16 | AV |

| Frequency (MHz) | S.A. Reading (dB μ V) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dB μ V/m) | FCC | | Comments |
|-----------------------|---------------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------------|----------------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dB μ V/m) | Margin (dB) | |
| High Channel 2462 MHz | | | | | | | | | | | |
| 2462 | 73.57 | 68 | 134 | H | 29.15 | 6.35 | 0.00 | 109.07 | - | - | PK |
| 2462 | 70.96 | 68 | 134 | H | 29.15 | 6.35 | 0.00 | 106.46 | - | - | AV |
| 2462 | 72.56 | 186 | 100 | V | 29.19 | 6.35 | 0.00 | 108.09 | - | - | PK |
| 2462 | 69.86 | 186 | 100 | V | 29.19 | 6.35 | 0.00 | 105.39 | - | - | AV |
| 2483.5 | 30.18 | 0 | 100 | H | 29.25 | 6.22 | 0.00 | 65.65 | 74.00 | -8.35 | PK |
| 2483.5 | 17.62 | 0 | 100 | H | 29.25 | 6.22 | 0.00 | 53.09 | 54.00 | -0.91 | AV |
| 2483.5 | 29.80 | 0 | 100 | V | 29.18 | 6.22 | 0.00 | 65.20 | 74.00 | -8.80 | PK |
| 2483.5 | 17.60 | 0 | 100 | V | 29.18 | 6.22 | 0.00 | 53.00 | 54.00 | -1.00 | AV |
| 4924 | 48.50 | 0 | 300 | H | 32.70 | 8.58 | 36.33 | 53.45 | 74.00 | -20.55 | PK |
| 4924 | 41.64 | 0 | 300 | H | 32.70 | 8.58 | 36.33 | 46.59 | 54.00 | -7.41 | AV |
| 4924 | 50.52 | 64 | 300 | V | 32.70 | 8.58 | 36.33 | 55.47 | 74.00 | -18.53 | PK |
| 4924 | 43.96 | 64 | 300 | V | 32.70 | 8.58 | 36.33 | 48.91 | 54.00 | -5.09 | AV |
| 7386 | 46.13 | 0 | 100 | H | 37.10 | 12.30 | 36.41 | 59.12 | 74.00 | -14.88 | PK |
| 7386 | 34.29 | 0 | 100 | H | 37.10 | 12.30 | 36.41 | 47.28 | 54.00 | -6.72 | AV |
| 9848 | 47.36 | 0 | 100 | H | 37.98 | 13.76 | 36.45 | 62.65 | 74.00 | -11.35 | PK |
| 9848 | 35.18 | 0 | 100 | H | 37.98 | 13.76 | 36.45 | 50.47 | 54.00 | -3.53 | AV |

Note: Emissions past the third harmonic are all noise floor.

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 | 65.90 | 259 | 177 | H | 28.94 | 6.29 | 0 | 101.13 | - | - | PK |
| 2412 | 56.25 | 259 | 177 | H | 28.94 | 6.29 | 0 | 91.48 | - | - | AV |
| 2412 | 64.29 | 180 | 100 | V | 28.93 | 6.29 | 0 | 99.51 | - | - | PK |
| 2412 | 54.79 | 180 | 100 | V | 28.93 | 6.29 | 0 | 90.01 | - | - | AV |
| 2390 | 70.67 | 73 | 100 | H | 28.94 | 6.76 | 36.59 | 69.78 | 74.00 | -4.23 | PK |
| 2390 | 54.08 | 73 | 100 | H | 28.94 | 6.76 | 36.59 | 53.19 | 54.00 | -0.82 | AV |
| 2390 | 70.14 | 192 | 100 | V | 28.93 | 6.76 | 36.59 | 69.24 | 74.00 | -4.77 | PK |
| 2390 | 54.24 | 192 | 100 | V | 28.93 | 6.76 | 36.59 | 53.34 | 54.00 | -0.67 | AV |
| 4824 | 47.72 | 0 | 100 | H | 32.53 | 9.62 | 36.36 | 53.51 | 74.00 | -20.49 | PK |
| 4824 | 35.61 | 0 | 100 | H | 32.53 | 9.62 | 36.36 | 41.40 | 54.00 | -12.60 | AV |
| 4824 | 47.18 | 0 | 100 | V | 32.53 | 9.62 | 36.36 | 52.97 | 74.00 | -21.03 | PK |
| 4824 | 35.24 | 0 | 100 | V | 32.53 | 9.62 | 36.36 | 41.03 | 54.00 | -12.97 | AV |
| 7236 | 45.74 | 0 | 100 | H | 36.88 | 12.21 | 36.38 | 58.45 | 74.00 | -15.55 | PK |
| 7236 | 34.01 | 0 | 100 | H | 36.88 | 12.21 | 36.38 | 46.72 | 54.00 | -7.28 | AV |
| 9648 | 47.35 | 0 | 100 | H | 37.81 | 13.82 | 36.43 | 62.55 | 74.00 | -11.45 | PK |
| 9648 | 35.54 | 0 | 100 | H | 37.81 | 13.82 | 36.43 | 50.74 | 54.00 | -3.26 | AV |
| Low Channel 2437 MHz | | | | | | | | | | | |
| 2437 | 63.73 | 84 | 100 | H | 29.19 | 6.29 | 0.00 | 99.21 | - | - | PK |
| 2437 | 54.83 | 84 | 100 | H | 29.19 | 6.29 | 0.00 | 90.31 | - | - | AV |
| 2437 | 63.43 | 180 | 100 | V | 29.19 | 6.29 | 0.00 | 98.91 | - | - | PK |
| 2437 | 54.47 | 180 | 100 | V | 29.19 | 6.29 | 0.00 | 89.95 | - | - | AV |
| 4874 | 47.14 | 0 | 100 | H | 32.70 | 9.42 | 36.327 | 52.92 | 74.00 | -21.08 | PK |
| 4874 | 35.52 | 0 | 100 | H | 32.70 | 9.42 | 36.327 | 41.30 | 54.00 | -12.70 | PK |
| 4874 | 46.89 | 0 | 100 | V | 32.70 | 9.42 | 36.327 | 52.67 | 74.00 | -21.33 | PK |
| 4874 | 35.49 | 0 | 100 | V | 32.70 | 9.42 | 36.327 | 41.27 | 54.00 | -12.73 | AV |
| 7311 | 45.14 | 0 | 100 | H | 36.99 | 11.68 | 36.40 | 57.41 | 74.00 | -16.59 | PK |
| 7311 | 33.68 | 0 | 100 | H | 36.99 | 11.68 | 36.40 | 45.95 | 54.00 | -8.05 | AV |
| 9748 | 46.88 | 0 | 100 | H | 37.82 | 13.21 | 36.45 | 61.45 | 74.00 | -12.55 | PK |
| 9748 | 35.40 | 0 | 100 | H | 37.82 | 13.21 | 36.45 | 49.97 | 54.00 | -4.03 | AV |

| Frequency (MHz) | S.A. Reading (dB μ V) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dB μ V/m) | FCC | | Comments |
|-----------------------|---------------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------------|----------------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dB μ V/m) | Margin (dB) | |
| High Channel 2462 MHz | | | | | | | | | | | |
| 2462 | 67.40 | 81 | 179 | H | 29.15 | 6.35 | 0.00 | 102.9 | - | - | PK |
| 2462 | 57.87 | 81 | 179 | H | 29.15 | 6.35 | 0.00 | 93.37 | - | - | AV |
| 2462 | 67.02 | 178 | 100 | V | 29.19 | 6.35 | 0.00 | 102.5 | - | - | PK |
| 2462 | 57.38 | 178 | 100 | V | 29.19 | 6.35 | 0.00 | 92.91 | - | - | AV |
| 2483.5 | 70.87 | 74 | 100 | H | 29.25 | 6.84 | 36.59 | 70.37 | 74.00 | -3.63 | PK |
| 2483.5 | 53.24 | 74 | 100 | H | 29.25 | 6.84 | 36.59 | 52.74 | 54.00 | -1.26 | AV |
| 2483.5 | 68.55 | 171 | 100 | V | 29.18 | 6.84 | 36.59 | 67.98 | 74.00 | -6.02 | PK |
| 2483.5 | 50.94 | 171 | 100 | V | 29.18 | 6.84 | 36.59 | 50.37 | 54.00 | -3.63 | AV |
| 4924 | 47.02 | 0 | 100 | H | 32.70 | 8.58 | 36.33 | 51.97 | 74.00 | -22.03 | PK |
| 4924 | 35.25 | 0 | 100 | H | 32.70 | 8.58 | 36.33 | 40.20 | 54.00 | -13.80 | AV |
| 4924 | 47.25 | 0 | 100 | V | 32.70 | 8.58 | 36.33 | 52.20 | 74.00 | -21.80 | PK |
| 4924 | 35.27 | 0 | 100 | V | 32.70 | 8.58 | 36.33 | 40.22 | 54.00 | -13.78 | AV |
| 7386 | 45.63 | 0 | 100 | H | 37.10 | 12.30 | 36.41 | 58.62 | 74.00 | -15.38 | PK |
| 7386 | 34.19 | 0 | 100 | H | 37.10 | 12.30 | 36.41 | 47.18 | 54.00 | -6.82 | AV |
| 9848 | 46.80 | 0 | 100 | H | 37.98 | 13.76 | 36.45 | 62.09 | 74.00 | -11.91 | PK |
| 9848 | 35.24 | 0 | 100 | H | 37.98 | 13.76 | 36.45 | 50.53 | 54.00 | -3.47 | AV |

Note: Emissions past the third harmonic are all noise floor.

802.11n20 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 | 64.88 | 85 | 100 | H | 28.94 | 6.29 | 0 | 100.11 | - | - | PK |
| 2412 | 55.45 | 85 | 100 | H | 28.94 | 6.29 | 0 | 90.68 | - | - | AV |
| 2412 | 63.48 | 182 | 100 | V | 28.93 | 6.29 | 0 | 98.70 | - | - | PK |
| 2412 | 54.51 | 182 | 100 | V | 28.93 | 6.29 | 0 | 89.73 | - | - | AV |
| 2390 | 63.18 | 64 | 128 | H | 28.94 | 6.76 | 36.59 | 62.29 | 74.00 | -11.72 | PK |
| 2390 | 46.09 | 64 | 128 | H | 28.94 | 6.76 | 36.59 | 45.20 | 54.00 | -8.81 | AV |
| 2390 | 61.94 | 194 | 100 | V | 28.93 | 6.76 | 36.59 | 61.04 | 74.00 | -12.97 | PK |
| 2390 | 44.66 | 194 | 100 | V | 28.93 | 6.76 | 36.59 | 43.76 | 54.00 | -10.25 | AV |
| 4824 | 47.82 | 0 | 100 | H | 32.53 | 9.62 | 36.36 | 53.61 | 74.00 | -20.39 | PK |
| 4824 | 35.68 | 0 | 100 | H | 32.53 | 9.62 | 36.36 | 41.47 | 54.00 | -12.53 | AV |
| 4824 | 47.48 | 0 | 100 | V | 32.53 | 9.62 | 36.36 | 53.27 | 74.00 | -20.73 | PK |
| 4824 | 35.64 | 0 | 100 | V | 32.53 | 9.62 | 36.36 | 41.43 | 54.00 | -12.57 | AV |
| 7236 | 45.83 | 0 | 100 | H | 36.88 | 12.21 | 36.38 | 58.54 | 74.00 | -15.46 | PK |
| 7236 | 34.44 | 0 | 100 | H | 36.88 | 12.21 | 36.38 | 47.15 | 54.00 | -6.85 | AV |
| 9648 | 47.66 | 0 | 100 | H | 37.81 | 13.82 | 36.43 | 62.86 | 74.00 | -11.14 | PK |
| 9648 | 35.62 | 0 | 100 | H | 37.81 | 13.82 | 36.43 | 50.82 | 54.00 | -3.18 | AV |
| Middle Channel 2437 MHz | | | | | | | | | | | |
| 2437 | 64.32 | 85 | 100 | H | 29.19 | 6.29 | 0.00 | 99.80 | - | - | PK |
| 2437 | 55.18 | 85 | 100 | H | 29.19 | 6.29 | 0.00 | 90.66 | - | - | AV |
| 2437 | 64.16 | 186 | 100 | V | 29.19 | 6.29 | 0.00 | 99.64 | - | - | PK |
| 2437 | 55.07 | 186 | 100 | V | 29.19 | 6.29 | 0.00 | 90.55 | - | - | AV |
| 4874 | 48.14 | 0 | 100 | H | 32.70 | 9.42 | 36.327 | 53.92 | 74.00 | -20.08 | PK |
| 4874 | 35.67 | 0 | 100 | H | 32.70 | 9.42 | 36.327 | 41.45 | 54.00 | -12.55 | PK |
| 4874 | 48.61 | 0 | 100 | V | 32.70 | 9.42 | 36.327 | 54.39 | 74.00 | -19.61 | PK |
| 4874 | 35.71 | 0 | 100 | V | 32.70 | 9.42 | 36.327 | 41.49 | 54.00 | -12.51 | AV |
| 7311 | 45.39 | 0 | 100 | H | 36.99 | 11.68 | 36.40 | 57.66 | 74.00 | -16.34 | PK |
| 7311 | 34.17 | 0 | 100 | H | 36.99 | 11.68 | 36.40 | 46.44 | 54.00 | -7.56 | AV |
| 9748 | 47.24 | 0 | 100 | H | 37.82 | 13.21 | 36.45 | 61.81 | 74.00 | -12.19 | PK |
| 9748 | 35.56 | 0 | 100 | H | 37.82 | 13.21 | 36.45 | 50.13 | 54.00 | -3.87 | AV |

| Frequency (MHz) | S.A. Reading (dB μ V) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dB μ V/m) | FCC | | Comments |
|-----------------------|---------------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------------|----------------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dB μ V/m) | Margin (dB) | |
| High Channel 2462 MHz | | | | | | | | | | | |
| 2462 | 66.98 | 82 | 100 | H | 29.15 | 6.35 | 0.00 | 102.48 | - | - | PK |
| 2462 | 57.61 | 82 | 100 | H | 29.15 | 6.35 | 0.00 | 93.11 | - | - | AV |
| 2462 | 66.75 | 178 | 100 | V | 29.19 | 6.35 | 0.00 | 102.28 | - | - | PK |
| 2462 | 57.11 | 178 | 100 | V | 29.19 | 6.35 | 0.00 | 92.64 | - | - | AV |
| 2483.5 | 71.66 | 73 | 100 | H | 29.25 | 6.84 | 36.59 | 71.16 | 74.00 | -2.84 | PK |
| 2483.5 | 53.82 | 73 | 100 | H | 29.25 | 6.84 | 36.59 | 53.32 | 54.00 | -0.68 | AV |
| 2483.5 | 70.54 | 185 | 100 | V | 29.18 | 6.84 | 36.59 | 69.97 | 74.00 | -4.03 | PK |
| 2483.5 | 51.95 | 185 | 100 | V | 29.18 | 6.84 | 36.59 | 51.38 | 54.00 | -2.62 | AV |
| 4924 | 47.32 | 0 | 100 | H | 32.70 | 8.58 | 36.33 | 52.27 | 74.00 | -21.73 | PK |
| 4924 | 35.18 | 0 | 100 | H | 32.70 | 8.58 | 36.33 | 40.13 | 54.00 | -13.87 | AV |
| 4924 | 47.31 | 0 | 100 | V | 32.70 | 8.58 | 36.33 | 52.26 | 74.00 | -21.74 | PK |
| 4924 | 35.16 | 0 | 100 | V | 32.70 | 8.58 | 36.33 | 40.11 | 54.00 | -13.89 | AV |
| 7386 | 46.16 | 0 | 100 | H | 37.10 | 12.30 | 36.41 | 59.15 | 74.00 | -14.85 | PK |
| 7386 | 34.10 | 0 | 100 | H | 37.10 | 12.30 | 36.41 | 47.09 | 54.00 | -6.91 | AV |
| 9848 | 47.31 | 0 | 100 | H | 37.98 | 13.76 | 36.45 | 62.60 | 74.00 | -11.40 | PK |
| 9848 | 34.96 | 0 | 100 | H | 37.98 | 13.76 | 36.45 | 50.25 | 54.00 | -3.75 | AV |

Note: Emissions past the third harmonic are all noise floor.

802.11n40 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 2422 MHz | | | | | | | | | | | |
| 2422 | 61.25 | 85 | 100 | H | 28.94 | 6.29 | 0 | 96.48 | - | - | PK |
| 2422 | 50.37 | 85 | 100 | H | 28.94 | 6.29 | 0 | 85.60 | - | - | AV |
| 2422 | 60.66 | 176 | 100 | V | 28.93 | 6.29 | 0 | 95.88 | - | - | PK |
| 2422 | 49.68 | 176 | 100 | V | 28.93 | 6.29 | 0 | 84.90 | - | - | AV |
| 2390 | 69.07 | 67 | 100 | H | 28.94 | 6.76 | 36.59 | 68.18 | 74.00 | -5.83 | PK |
| 2390 | 52.76 | 67 | 100 | H | 28.94 | 6.76 | 36.59 | 51.87 | 54.00 | -2.14 | AV |
| 2390 | 68.70 | 195 | 100 | V | 28.93 | 6.76 | 36.59 | 67.80 | 74.00 | -6.21 | PK |
| 2390 | 53.03 | 195 | 100 | V | 28.93 | 6.76 | 36.59 | 52.13 | 54.00 | -1.88 | AV |
| 4844 | 47.66 | 0 | 100 | H | 32.53 | 9.62 | 36.36 | 53.45 | 74.00 | -20.55 | PK |
| 4844 | 35.38 | 0 | 100 | H | 32.53 | 9.62 | 36.36 | 41.17 | 54.00 | -12.83 | AV |
| 4844 | 47.61 | 0 | 100 | V | 32.53 | 9.62 | 36.36 | 53.40 | 74.00 | -20.60 | PK |
| 4844 | 35.34 | 0 | 100 | V | 32.53 | 9.62 | 36.36 | 41.13 | 54.00 | -12.87 | AV |
| 7266 | 46.48 | 0 | 100 | H | 36.88 | 12.21 | 36.38 | 59.19 | 74.00 | -14.81 | PK |
| 7266 | 34.27 | 0 | 100 | H | 36.88 | 12.21 | 36.38 | 46.98 | 54.00 | -7.02 | AV |
| 9688 | 47.93 | 0 | 100 | H | 37.81 | 13.82 | 36.43 | 63.13 | 74.00 | -10.87 | PK |
| 9688 | 35.61 | 0 | 100 | H | 37.81 | 13.82 | 36.43 | 50.81 | 54.00 | -3.19 | AV |
| Middle Channel 2437 MHz | | | | | | | | | | | |
| 2437 | 61.33 | 86 | 100 | H | 29.19 | 6.29 | 0.00 | 96.81 | - | - | PK |
| 2437 | 50.46 | 86 | 100 | H | 29.19 | 6.29 | 0.00 | 85.94 | - | - | AV |
| 2437 | 60.83 | 179 | 100 | V | 29.19 | 6.29 | 0.00 | 96.31 | - | - | PK |
| 2437 | 49.81 | 179 | 100 | V | 29.19 | 6.29 | 0.00 | 85.29 | - | - | AV |
| 4874 | 47.79 | 0 | 100 | H | 32.70 | 9.42 | 36.327 | 53.57 | 74.00 | -20.43 | PK |
| 4874 | 35.61 | 0 | 100 | H | 32.70 | 9.42 | 36.327 | 41.39 | 54.00 | -12.61 | PK |
| 4874 | 47.62 | 0 | 100 | V | 32.70 | 9.42 | 36.327 | 53.40 | 74.00 | -20.60 | PK |
| 4874 | 35.57 | 0 | 100 | V | 32.70 | 9.42 | 36.327 | 41.35 | 54.00 | -12.65 | AV |
| 7311 | 45.14 | 0 | 100 | H | 36.99 | 11.68 | 36.40 | 57.41 | 74.00 | -16.59 | PK |
| 7311 | 33.49 | 0 | 100 | H | 36.99 | 11.68 | 36.40 | 45.76 | 54.00 | -8.24 | AV |
| 9748 | 47.16 | 0 | 100 | H | 37.82 | 13.21 | 36.45 | 61.73 | 74.00 | -12.27 | PK |
| 9748 | 34.66 | 0 | 100 | H | 37.82 | 13.21 | 36.45 | 49.23 | 54.00 | -4.77 | AV |

| Frequency (MHz) | S.A. Reading (dB μ V) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dB μ V/m) | FCC | | Comments |
|-----------------------|---------------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------------|----------------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dB μ V/m) | Margin (dB) | |
| High Channel 2452 MHz | | | | | | | | | | | |
| 2452 | 61.89 | 85 | 100 | H | 29.15 | 6.35 | 0.00 | 97.39 | - | - | PK |
| 2452 | 50.81 | 85 | 100 | H | 29.15 | 6.35 | 0.00 | 86.31 | - | - | AV |
| 2452 | 61.22 | 177 | 100 | V | 29.19 | 6.35 | 0.00 | 96.75 | - | - | PK |
| 2452 | 50.42 | 177 | 100 | V | 29.19 | 6.35 | 0.00 | 85.95 | - | - | AV |
| 2483.5 | 68.99 | 75 | 100 | H | 29.25 | 6.84 | 36.59 | 68.49 | 74.00 | -5.51 | PK |
| 2483.5 | 52.84 | 75 | 100 | H | 29.25 | 6.84 | 36.59 | 52.34 | 54.00 | -1.66 | AV |
| 2483.5 | 68.37 | 184 | 100 | V | 29.18 | 6.84 | 36.59 | 67.80 | 74.00 | -6.20 | PK |
| 2483.5 | 51.90 | 184 | 100 | V | 29.18 | 6.84 | 36.59 | 51.33 | 54.00 | -2.67 | AV |
| 4904 | 47.35 | 0 | 100 | H | 32.70 | 8.58 | 36.33 | 52.30 | 74.00 | -21.70 | PK |
| 4904 | 35.40 | 0 | 100 | H | 32.70 | 8.58 | 36.33 | 40.35 | 54.00 | -13.65 | AV |
| 4904 | 47.46 | 0 | 100 | V | 32.70 | 8.58 | 36.33 | 52.41 | 74.00 | -21.59 | PK |
| 4904 | 35.62 | 0 | 100 | V | 32.70 | 8.58 | 36.33 | 40.57 | 54.00 | -13.43 | AV |
| 7356 | 45.53 | 0 | 100 | H | 37.10 | 12.30 | 36.41 | 58.52 | 74.00 | -15.48 | PK |
| 7356 | 33.43 | 0 | 100 | H | 37.10 | 12.30 | 36.41 | 46.42 | 54.00 | -7.58 | AV |
| 9808 | 46.45 | 0 | 100 | H | 37.98 | 13.76 | 36.45 | 61.74 | 74.00 | -12.26 | PK |
| 9808 | 34.68 | 0 | 100 | H | 37.98 | 13.76 | 36.45 | 49.97 | 54.00 | -4.03 | AV |

Note: Emissions past the third harmonic are all noise floor.

8 FCC §15.247(a) (2) -Emission Bandwidth

8.1 Applicable Standards

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

8.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8: DTS bandwidth

8.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|--------------|--------------------|-----------|------------|------------------------|----------------------|
| Agilent | Analyzer, Spectrum | E4446A | MY48250238 | 2017-02-24 | 1 year |
| - | RF cable | - | - | Each time ¹ | N/A |
| - | 20dB attenuator | - | - | Each time ¹ | N/A |

Note¹: cable and attenuator included in the test set-up will be checked each time before testing.

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° C |
| Relative Humidity: | 42 % |
| ATM Pressure: | 102.7 KPa |

The testing was performed by Vincent Licata on 2017-09-1 in RF site.

8.5 Test Results**6dB Bandwidth****Antenna Port J20**

| Channel | Frequency (MHz) | 99% OBW (kHz) | 6 dB BW (kHz) | 6 dB OBW limit (kHz) |
|-----------------|-----------------|---------------|---------------|----------------------|
| 802.11b mode | | | | |
| Low | 2412 | 13687 | 7586 | 500 |
| Middle | 2437 | 13562 | 8053 | 500 |
| High | 2462 | 13352 | 6599 | 500 |
| 802.11g mode | | | | |
| Low | 2412 | 16486 | 16362 | 500 |
| Middle | 2437 | 16497 | 16384 | 500 |
| High | 2462 | 16463 | 16494 | 500 |
| 802.11n-20 mode | | | | |
| Low | 2412 | 17664 | 17623 | 500 |
| Middle | 2437 | 17632 | 17022 | 500 |
| High | 2462 | 17617 | 17764 | 500 |
| 802.11n-40 mode | | | | |
| Low | 2422 | 35963 | 31443 | 500 |
| Middle | 2437 | 35942 | 34046 | 500 |
| High | 2452 | 35937 | 34363 | 500 |

Note: Worst case antenna data is shown.

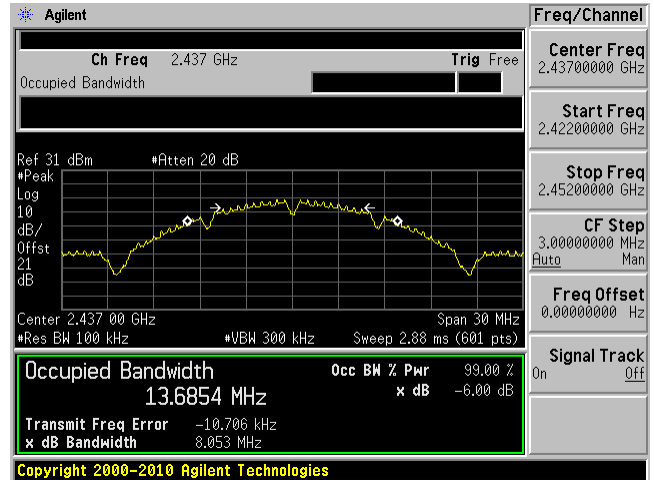
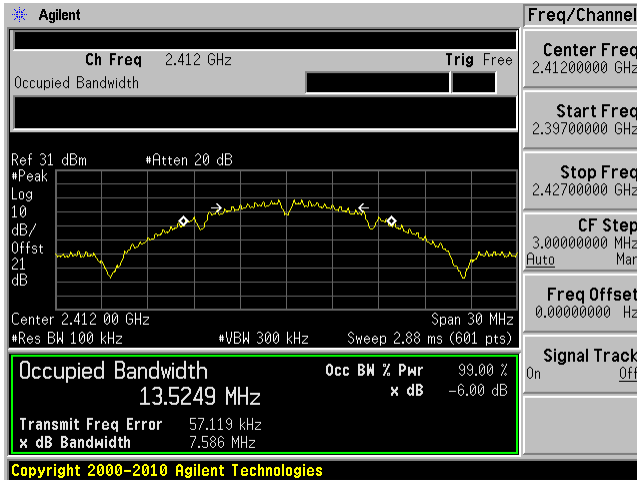
Please refer to the following plots for detailed test results.

6dB Bandwidth

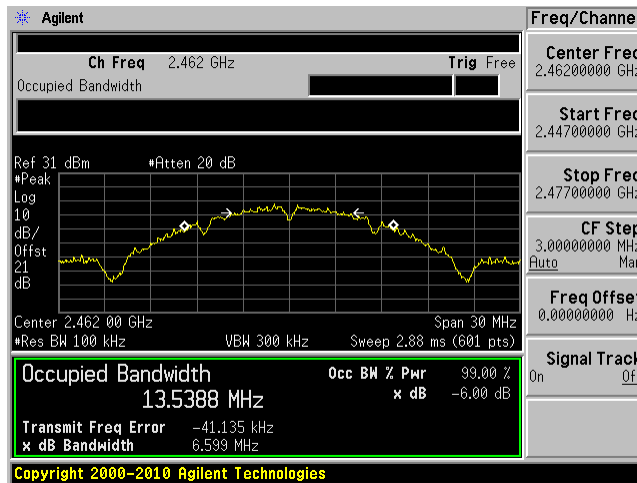
802.11b mode (Port J20)

Low Channel 2412 MHz

Middle Channel 2437 MHz

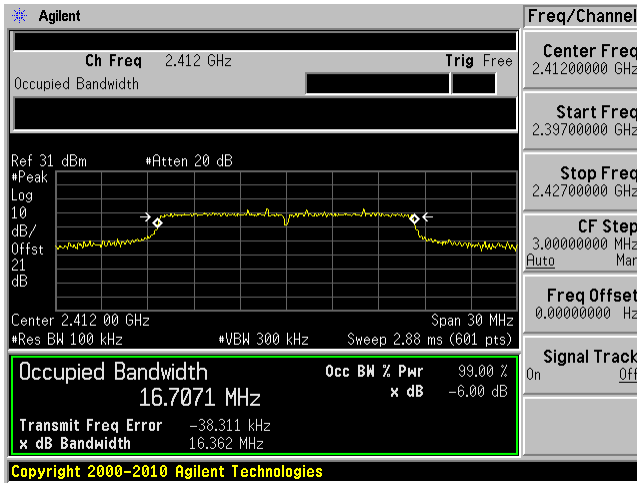


High Channel 2462 MHz

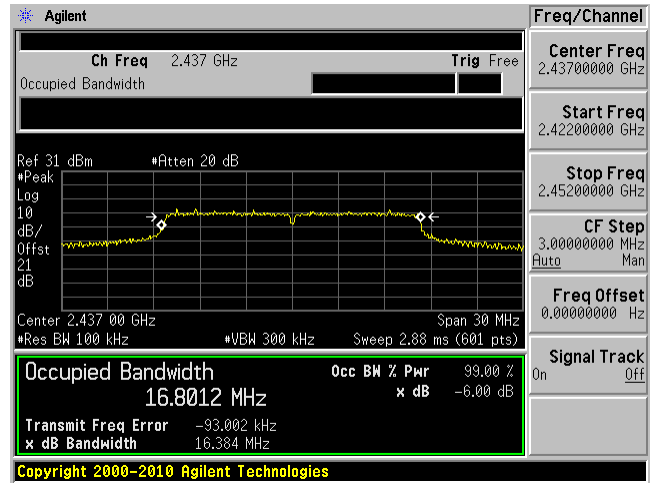


802.11g mode (Port J20)

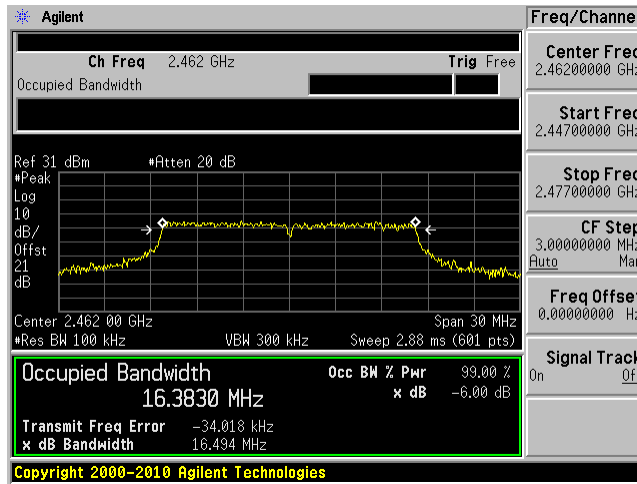
Low Channel 2412 MHz



Middle Channel 2437 MHz

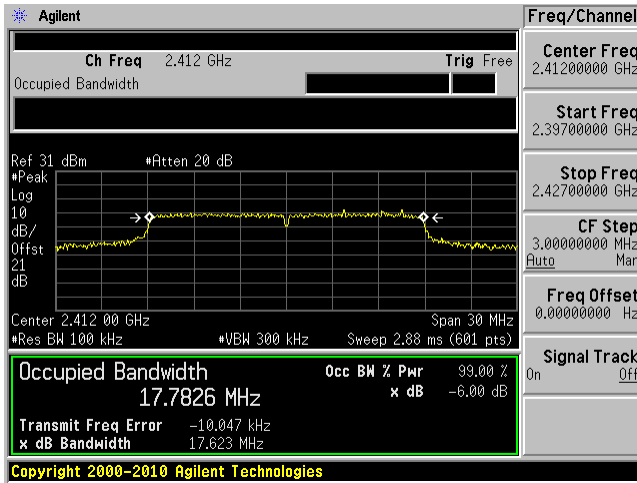


High Channel 2462 MHz

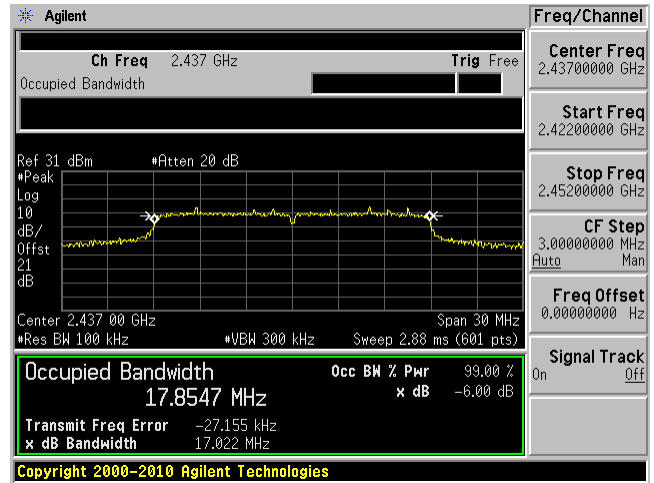


802.11n20 mode (Port J20)

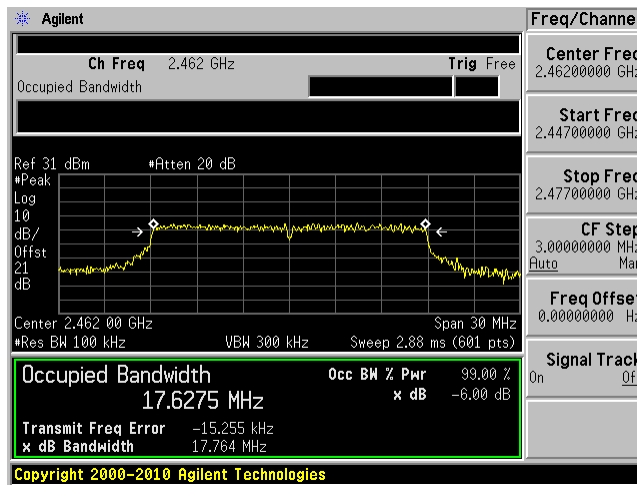
Low Channel 2412 MHz



Middle Channel 2437 MHz

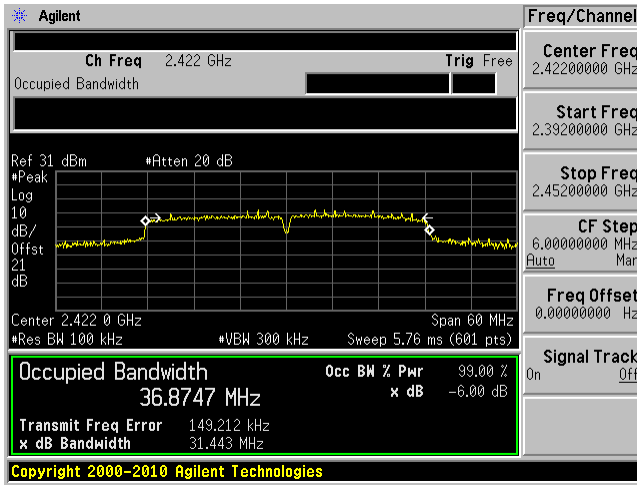


High Channel 2462 MHz

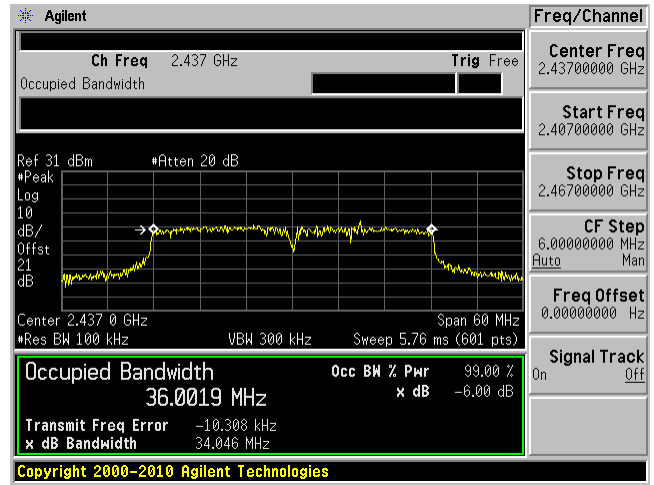


802.11n40 mode (Port J20)

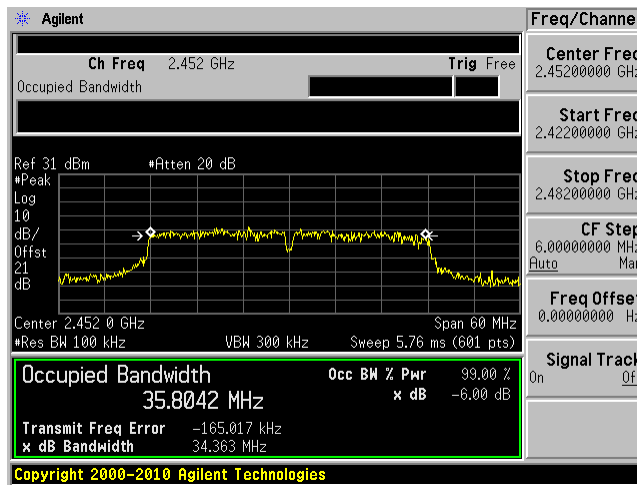
Low Channel 2422 MHz



Middle Channel 2437 MHz



High Channel 2452 MHz

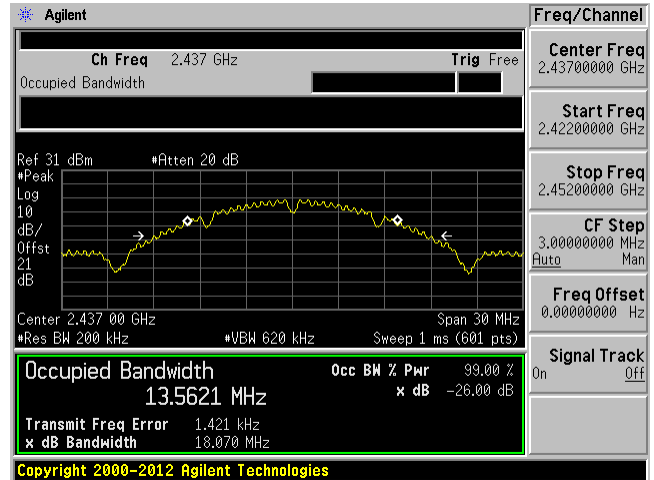
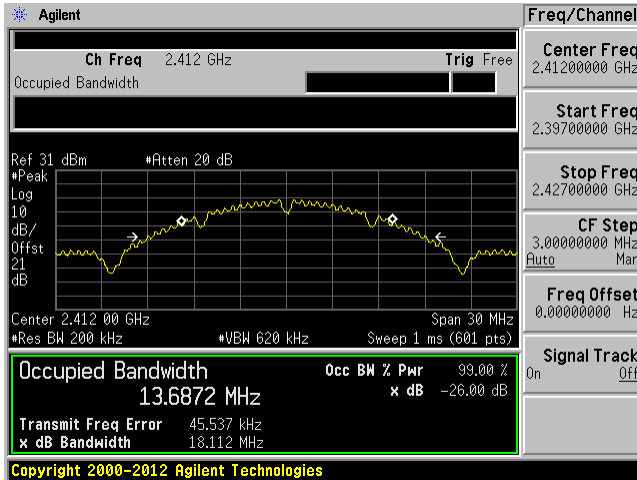


99% OBW

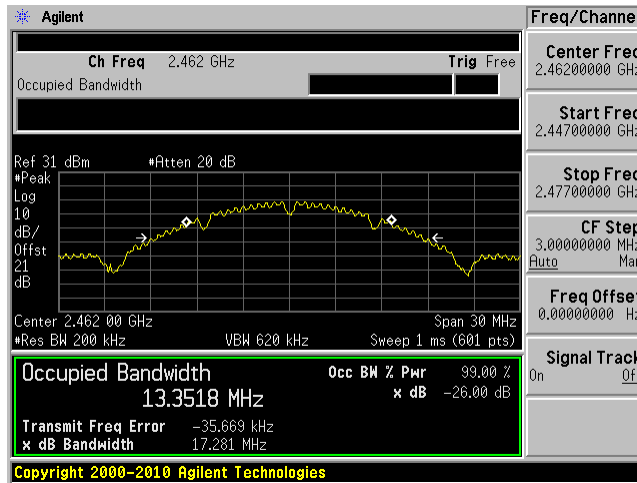
802.11b mode (Port J20)

Low Channel 2412 MHz

Middle Channel 2437 MHz

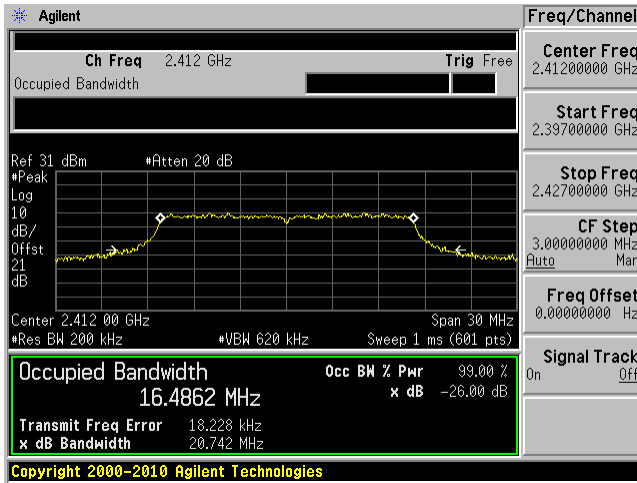


High Channel 2462 MHz

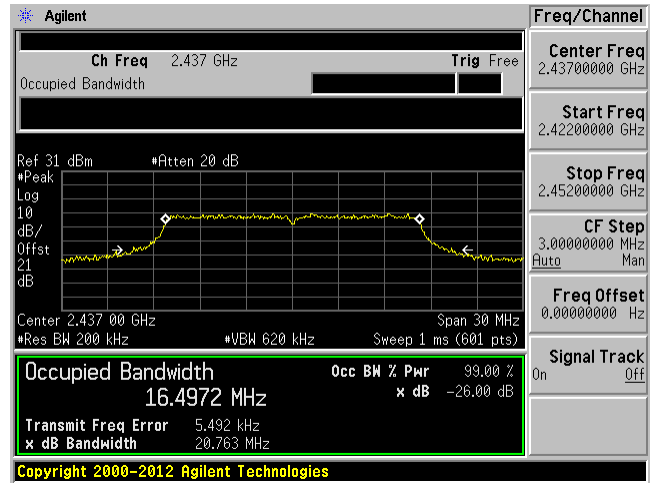


802.11g mode (Port J20)

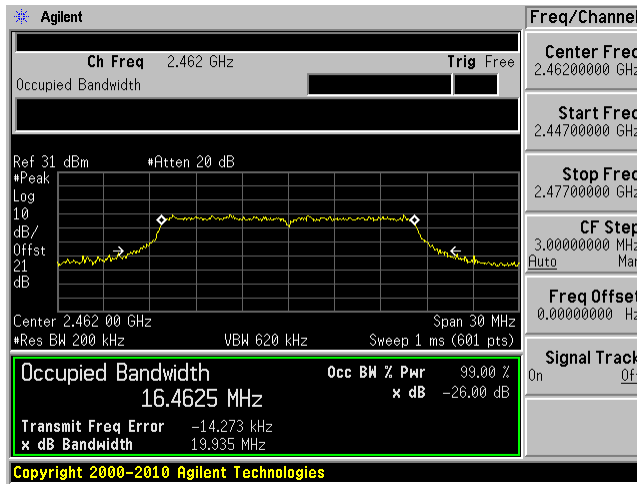
Low Channel 2412 MHz



Middle Channel 2437 MHz

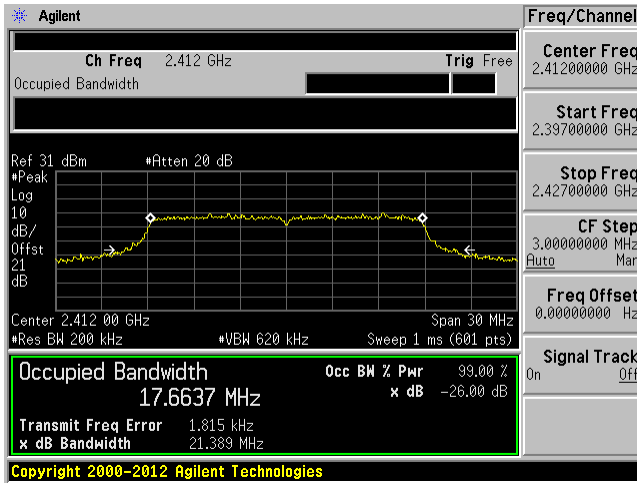


High Channel 2462 MHz

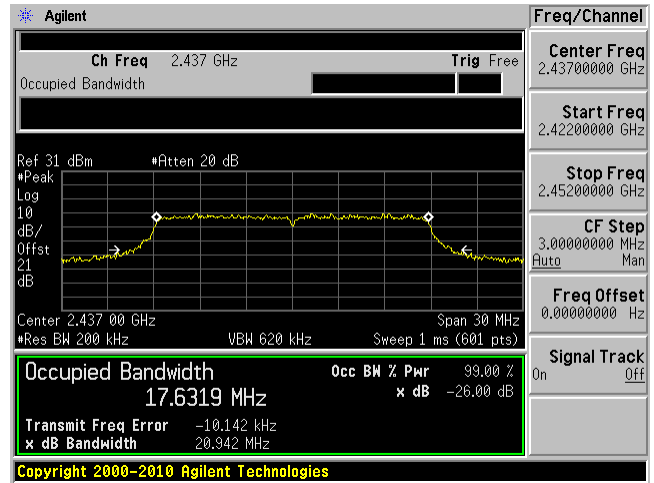


802.11n20 mode (Port J20)

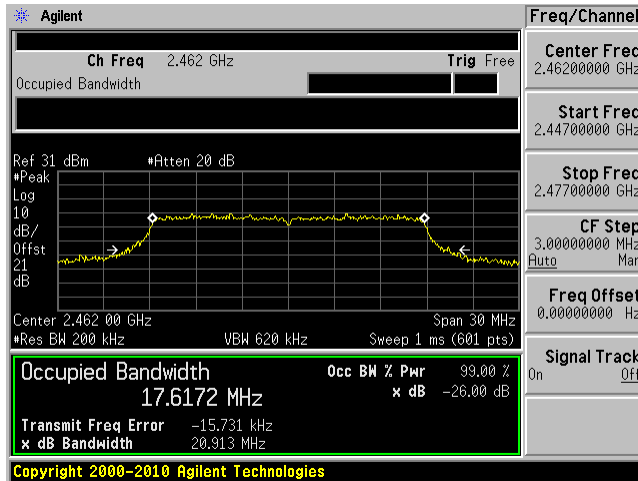
Low Channel 2412 MHz



Middle Channel 2437 MHz

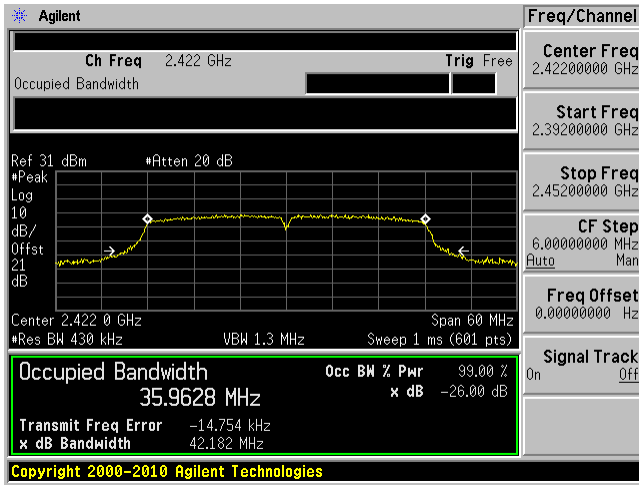


High Channel 2462 MHz

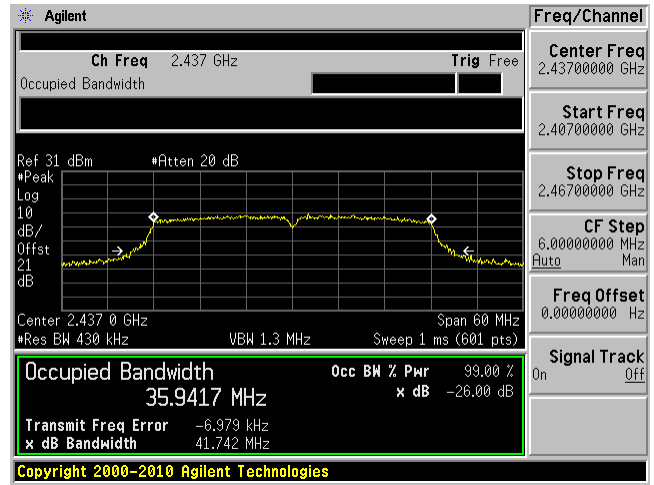


802.11n40 mode (Port J20)

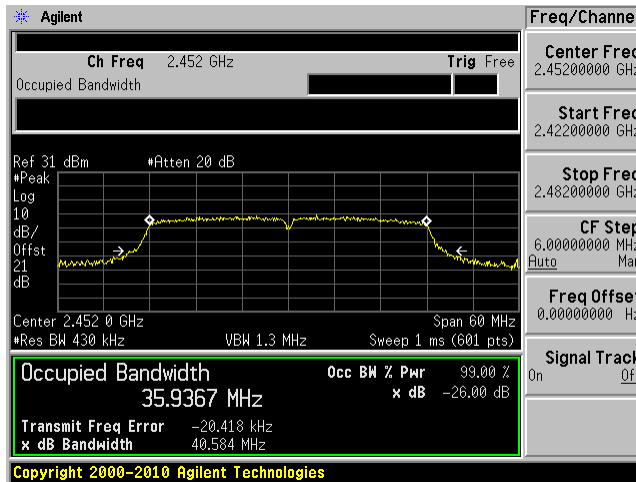
Low Channel 2422 MHz



Middle Channel 2437 MHz



High Channel 2452 MHz



9 FCC §15.247(b) (3) - Output Power Measurement

9.1 Applicable Standards

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

9.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 9: Fundamental emission output power

9.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|---------------|-----------------|-----------|------------|------------------------|----------------------|
| ETS- Lingerin | Power Sensor | 7002-006 | 160097 | 2016-12-05 | 2 years |
| - | RF Cable | - | - | Each time ¹ | N/A |
| - | 20dB attenuator | - | - | Each time ¹ | N/A |

Note¹: cable and attenuator included in the test set-up will be checked each time before testing.

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° C |
| Relative Humidity: | 42 % |
| ATM Pressure: | 102.7 KPa |

The testing was performed by Vincent Licata on 2017-09-1 in RF site.

9.5 Test Results

Average Output Power

| Antenna Port | Channel | Frequency (MHz) | Average Power (dBm) | Limit (dBm) |
|----------------|---------|-----------------|---------------------|-------------|
| 802.11b mode | | | | |
| J19 | 1 | 2412 | 14.02 | 30 |
| | 6 | 2437 | 14.19 | 30 |
| | 11 | 2462 | 14.54 | 30 |
| J20 | 1 | 2412 | 16.89 | 30 |
| | 6 | 2437 | 16.50 | 30 |
| | 11 | 2462 | 16.28 | 30 |
| 802.11g mode | | | | |
| J19 | 1 | 2412 | 7.37 | 30 |
| | 6 | 2437 | 7.68 | 30 |
| | 11 | 2462 | 7.33 | 30 |
| J20 | 1 | 2412 | 10.93 | 30 |
| | 6 | 2437 | 10.78 | 30 |
| | 11 | 2462 | 10.99 | 30 |
| 802.11n20 mode | | | | |
| J19 | 1 | 2412 | 7.23 | 30 |
| | 6 | 2437 | 7.31 | 30 |
| | 11 | 2462 | 7.34 | 30 |
| J20 | 1 | 2412 | 11.05 | 30 |
| | 6 | 2437 | 10.79 | 30 |
| | 11 | 2462 | 10.39 | 30 |
| 802.11n40 mode | | | | |
| J19 | 3 | 2422 | 6.14 | 30 |
| | 6 | 2437 | 6.27 | 30 |
| | 9 | 2452 | 6.44 | 30 |
| J20 | 3 | 2422 | 9.96 | 30 |
| | 6 | 2437 | 9.87 | 30 |
| | 9 | 2452 | 9.72 | 30 |

Note 1: Duty Cycle correction factor has already been added to the measurement.

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

10.1 Applicable Standards

According to ECFR §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

10.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 13: Band-edge measurements

10.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|--------------|--------------------|-----------|------------|------------------------|----------------------|
| Agilent | Analyzer, Spectrum | E4440A | US45303156 | 2017-02-24 | 1 year |
| - | RF Cable | - | - | Each time ¹ | N/A |
| - | 20dB attenuator | - | - | Each time ¹ | N/A |

Note¹: cable and attenuator included in the test set-up will be checked each time before testing.

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

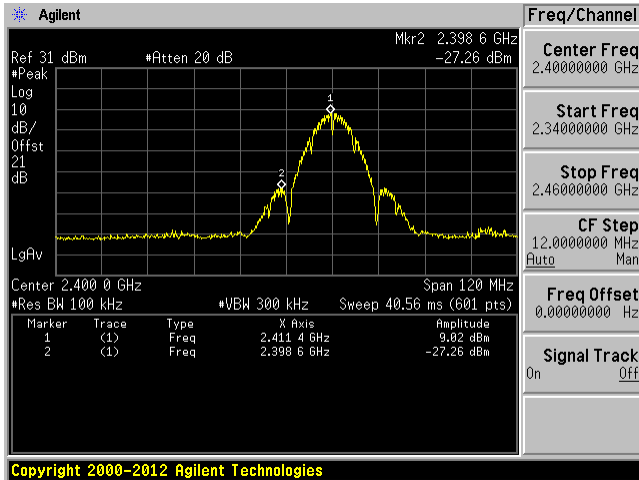
| | |
|---------------------------|-----------|
| Temperature: | 23° C |
| Relative Humidity: | 42 % |
| ATM Pressure: | 102.7 KPa |

The testing was performed by Vincent Licata on 2017-09-1 in RF site.

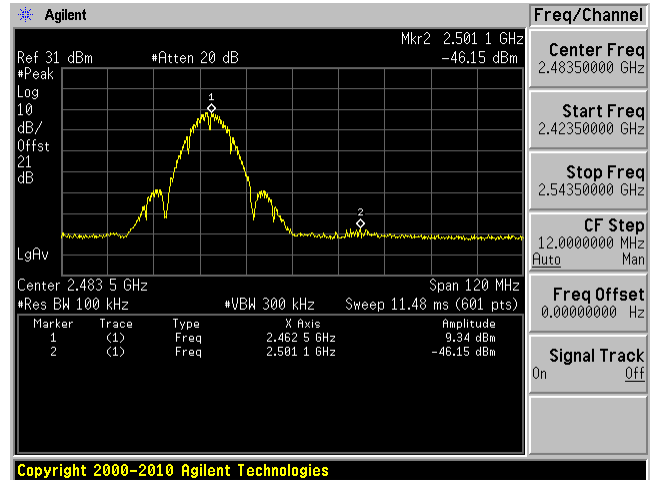
10.5 Test Results

802.11b mode (Port J20)

Low Channel 2412 MHz

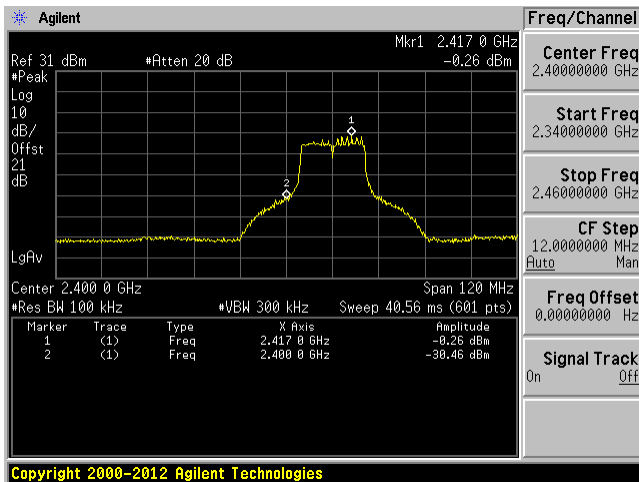


High Channel 2462 MHz

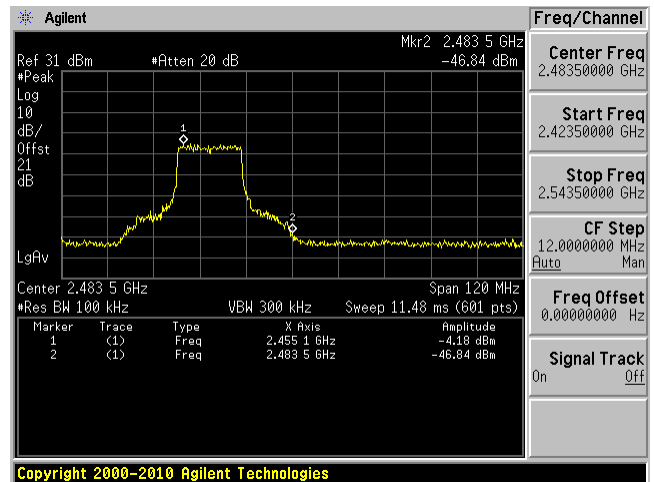


802.11g mode (Port J20)

Low Channel 2412 MHz

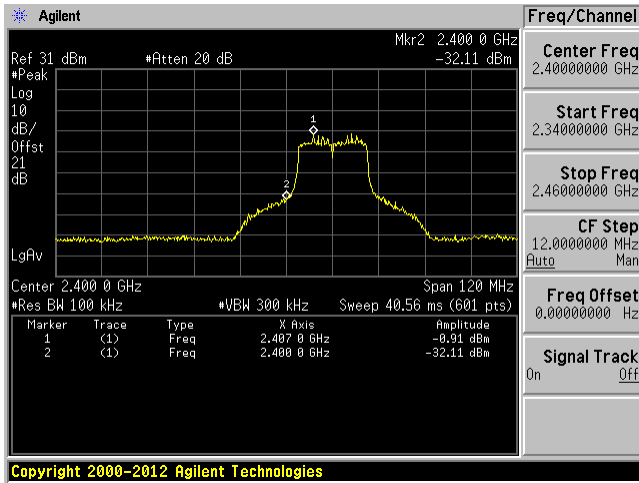


High Channel 2462 MHz

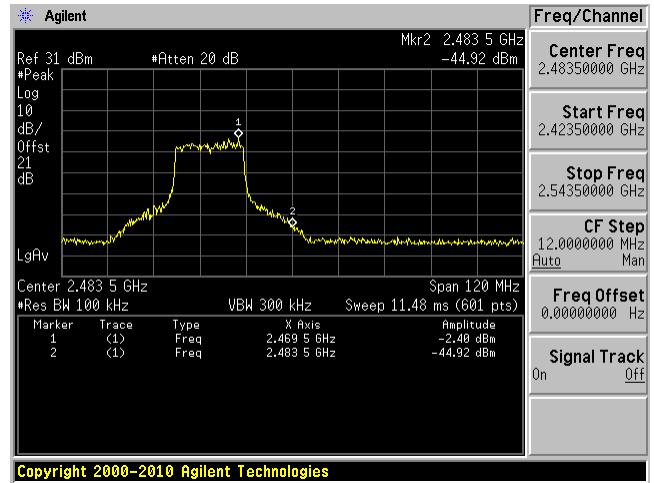


802.11n20 mode (Port J20)

Low Channel 2412 MHz

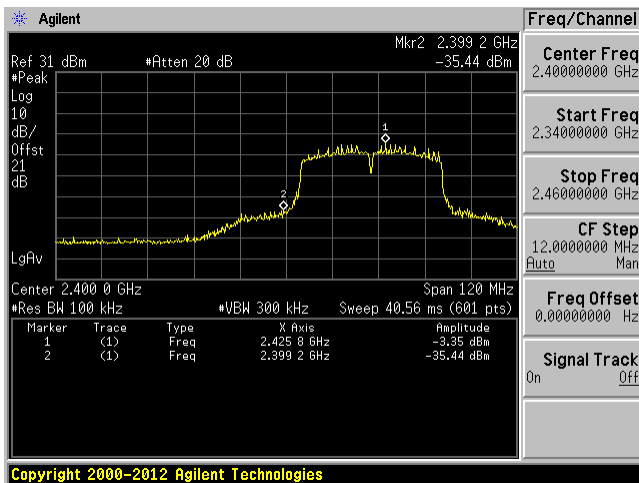


High Channel 2462 MHz

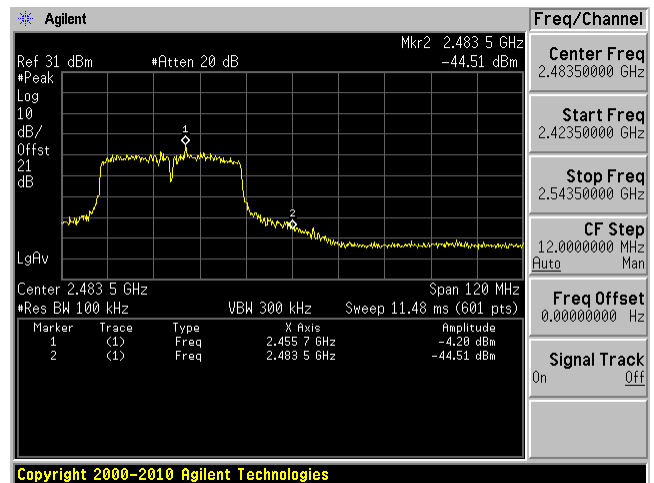


802.11n40 mode (Port J20)

Low Channel 2422 MHz

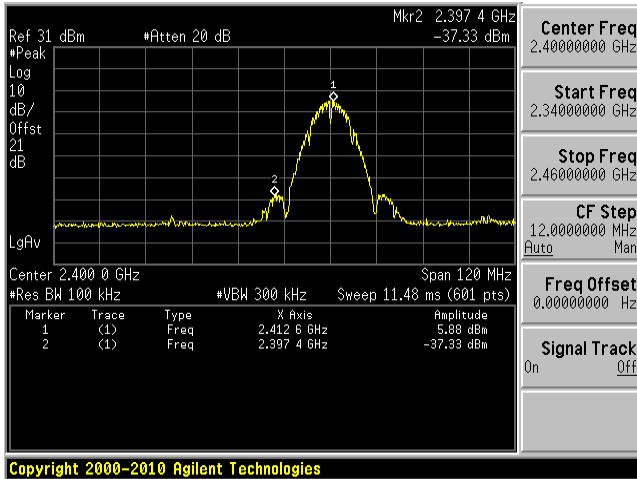


High Channel 2452 MHz

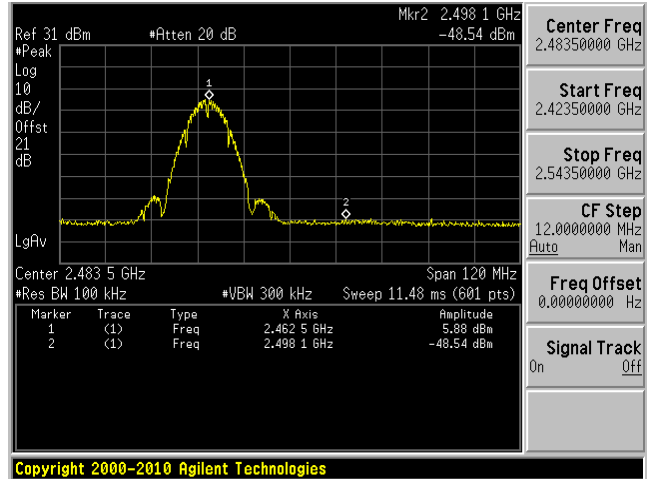


802.11b mode (Port J19)

Low Channel 2412 MHz

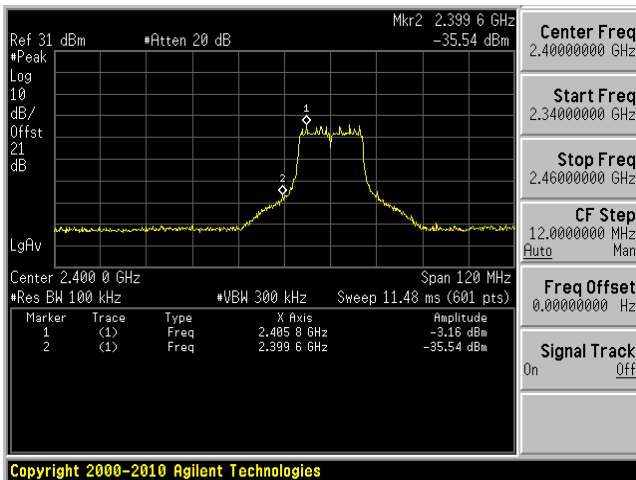


High Channel 2462 MHz

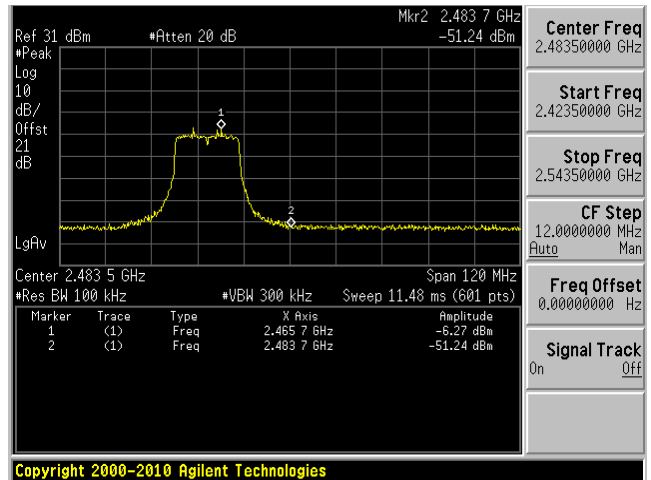


802.11g mode (Port J19)

Low Channel 2412 MHz

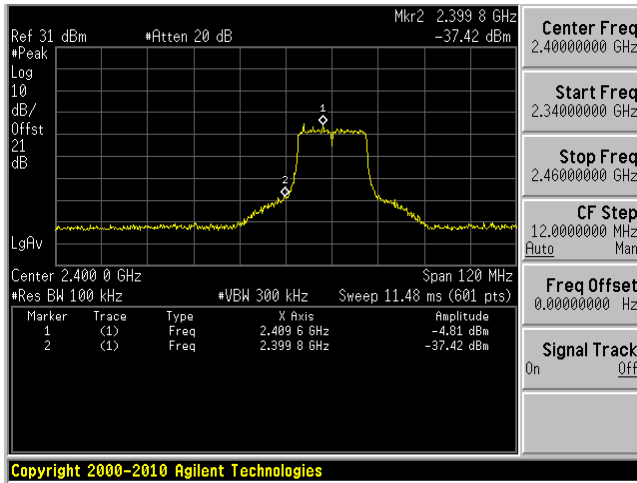


High Channel 2462 MHz

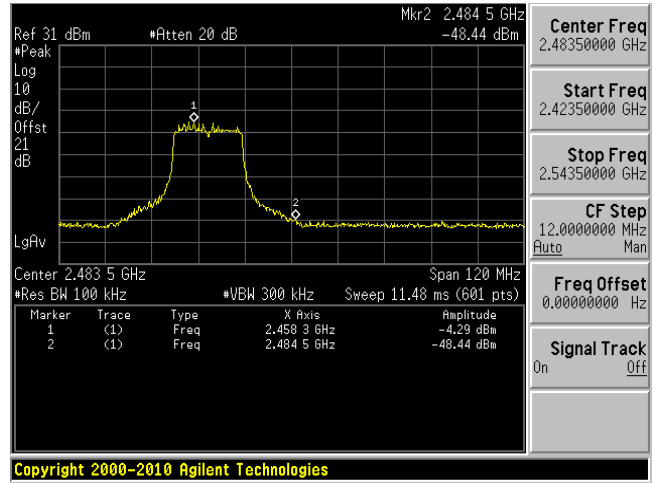


802.11n20 mode (Port J19)

Low Channel 2412 MHz

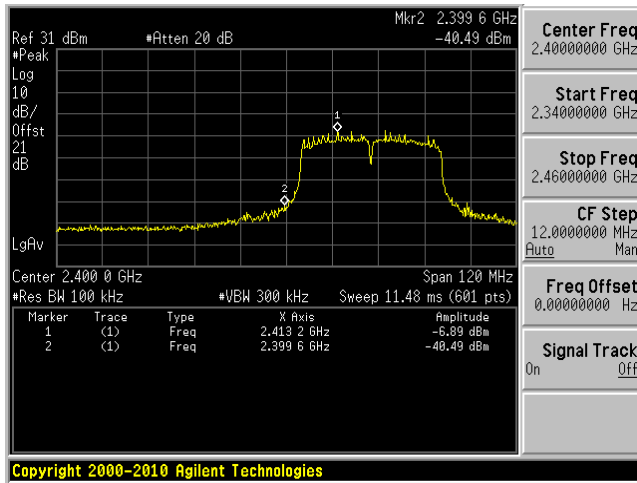


High Channel 2462 MHz

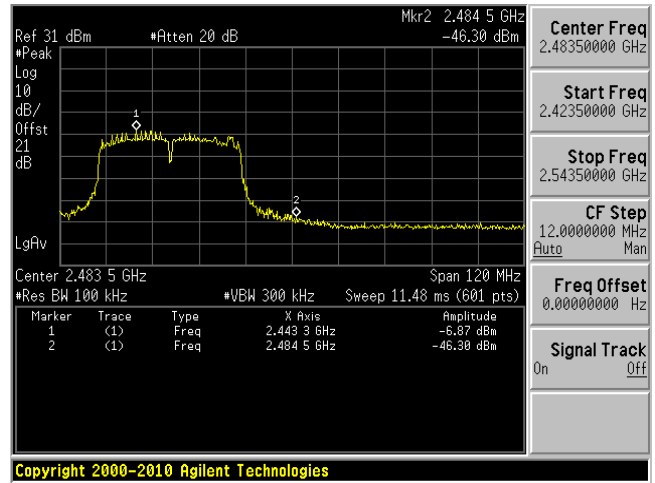


802.11n40 mode (Port J19)

Low Channel 2422 MHz



High Channel 2452 MHz



11 FCC §15.247(e) – Power Spectral Density

11.1 Applicable Standards

According to ECFR §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

11.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v04: 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.

11.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|--------------|--------------------|-----------|------------|------------------------|----------------------|
| Agilent | Analyzer, Spectrum | E4446A | MY48250238 | 2017-02-24 | 1 year |
| - | RF Cable | - | - | Each time ¹ | N/A |
| - | 20dB attenuator | - | - | Each time ¹ | N/A |

Note¹: cable and attenuator included in the test set-up will be checked each time before testing.

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° C |
| Relative Humidity: | 42 % |
| ATM Pressure: | 102.7 KPa |

The testing was performed by Vincent Licata on 2017-09-1 in RF site.

11.5 Test Results

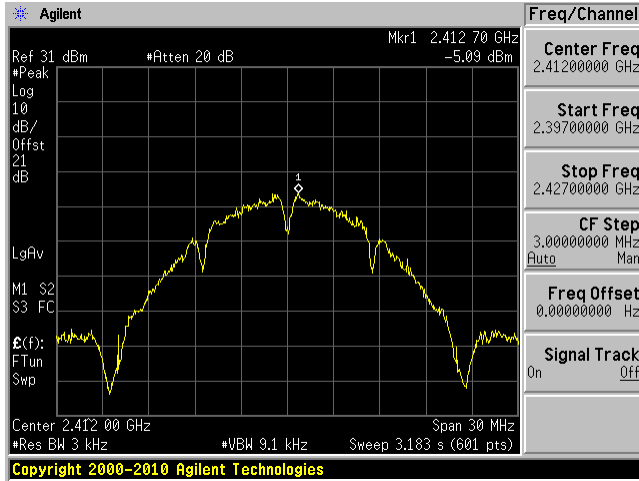
| Antenna Port | Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) |
|----------------|---------|-----------------|----------------|------------------|
| 802.11b mode | | | | |
| J20 | Low | 2412 | -5.09 | 8 |
| | Middle | 2437 | -5.55 | 8 |
| | High | 2462 | -5.08 | 8 |
| 802.11g mode | | | | |
| J20 | Low | 2412 | -14.83 | 8 |
| | Middle | 2437 | -15.36 | 8 |
| | High | 2462 | -14.99 | 8 |
| 802.11n20 mode | | | | |
| J20 | Low | 2412 | -14.47 | 8 |
| | Middle | 2437 | -14.93 | 8 |
| | High | 2462 | -16.30 | 8 |
| 802.11n40 mode | | | | |
| J20 | Low | 2422 | -18.02 | 8 |
| | Middle | 2437 | -19.32 | 8 |
| | High | 2452 | -18.96 | 8 |

Note: Worst case antenna data is shown.

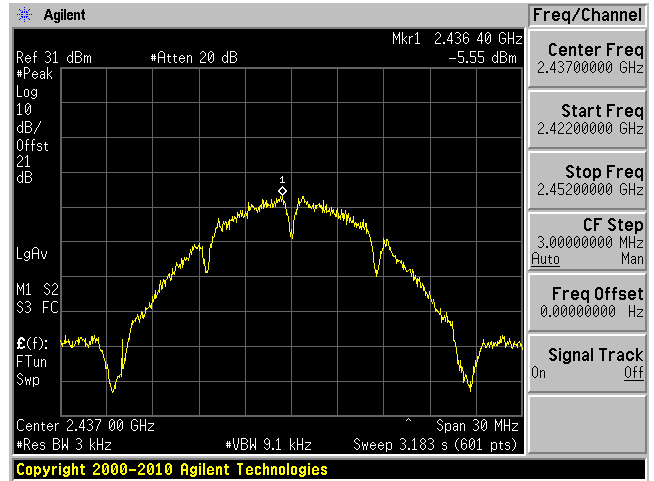
Please refer to the following plots for detailed test results

802.11b mode (Port J20)

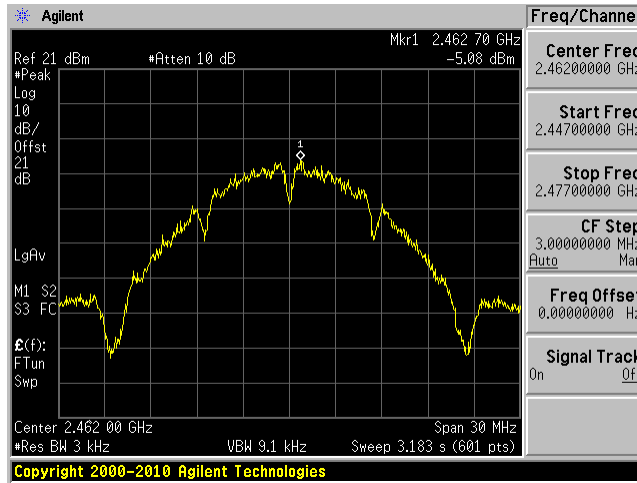
Low Channel 2412 MHz



Middle Channel 2437 MHz

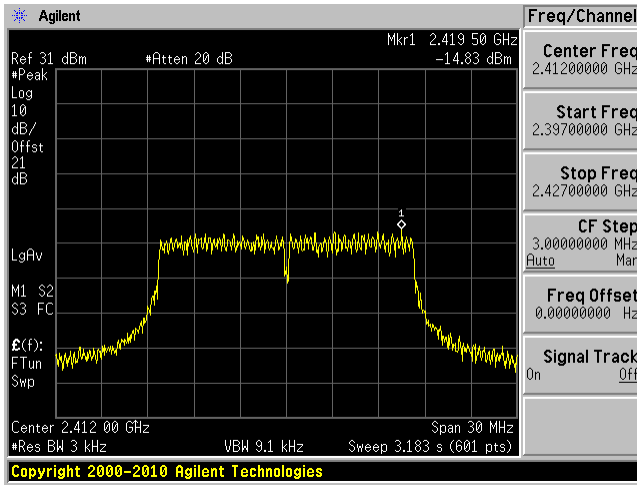


High Channel 2462 MHz

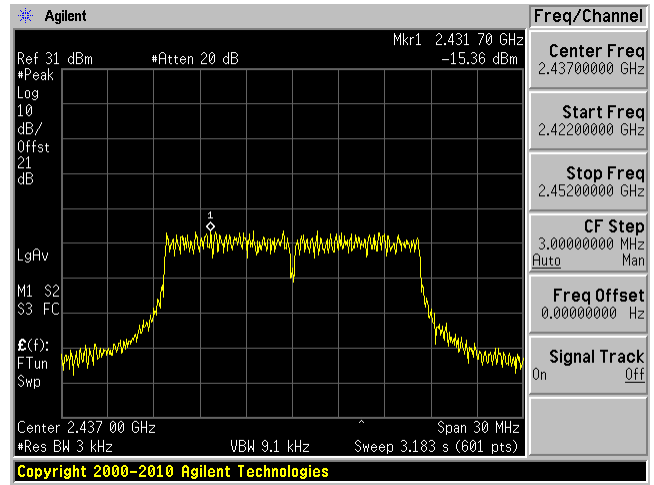


802.11g mode (Port J20)

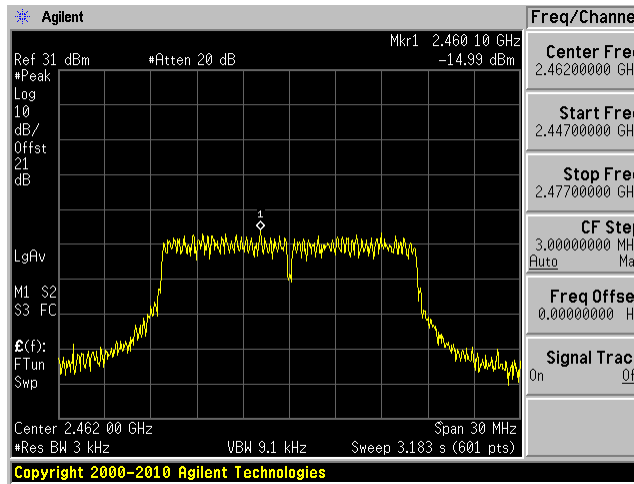
Low Channel 2412 MHz



Middle Channel 2437 MHz

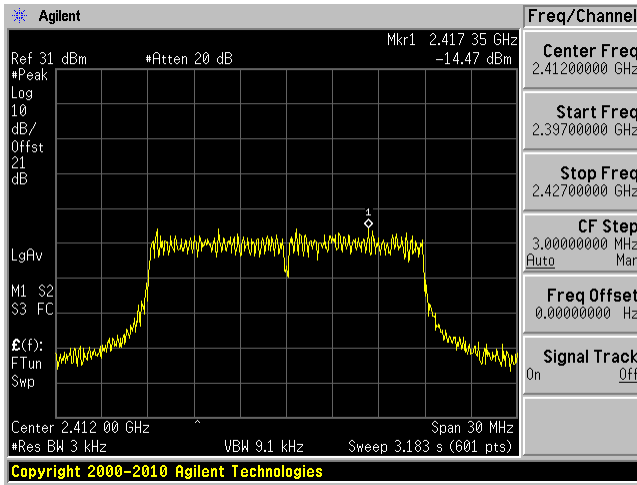


High Channel 2462 MHz

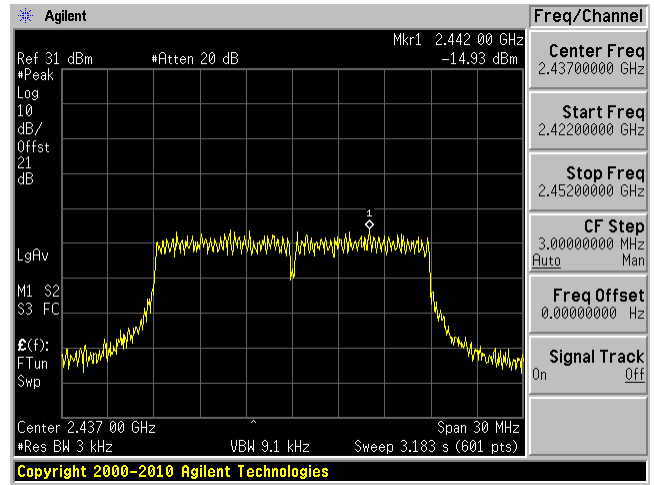


802.11n20 mode (Port J20)

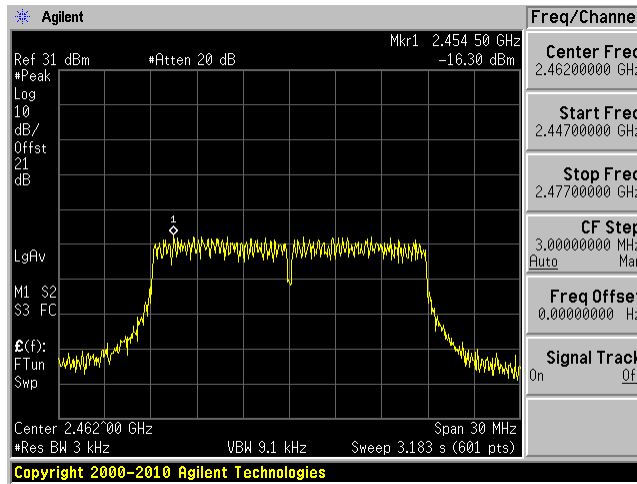
Low Channel 2412 MHz



Middle Channel 2437 MHz

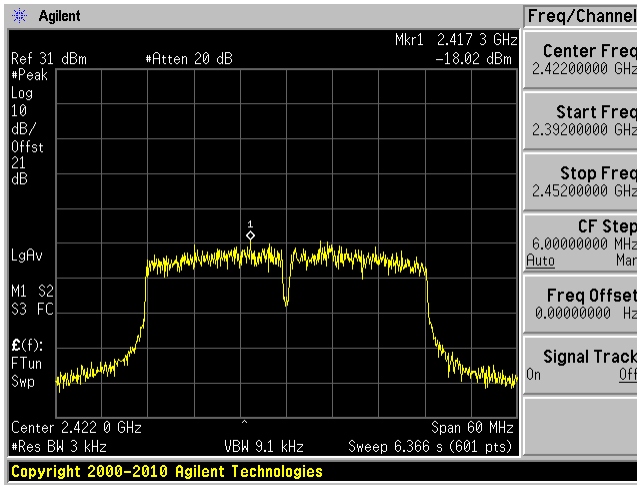


High Channel 2462 MHz

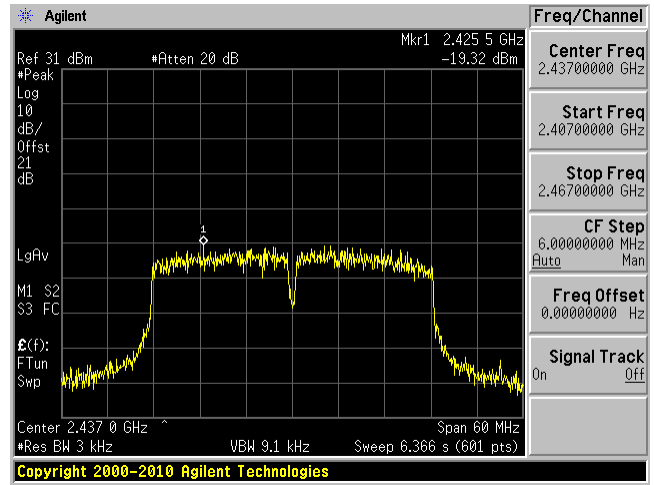


802.11n40 mode (Port J20)

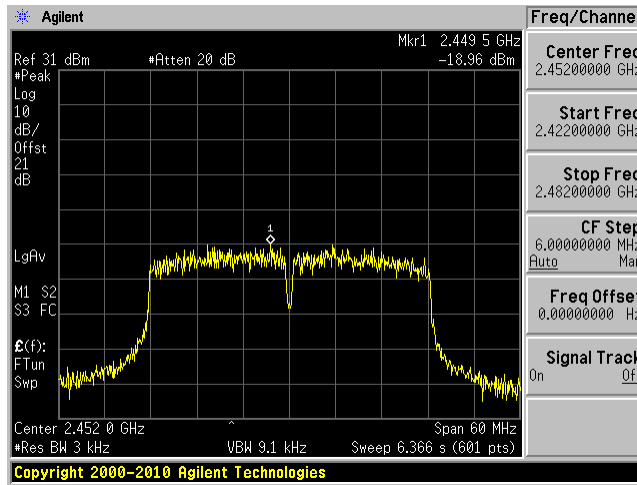
Low Channel 2422 MHz



Middle Channel 2437 MHz



High Channel 2452 MHz



12 FCC §15.247(d)– Spurious Emissions at Antenna Terminals

12.1 Applicable Standards

For ECFR §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)).

12.2 Test 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.

12.3 Test Equipment List and Details

| Manufacturer | Description | Model No. | Serial No. | Calibration Date | Calibration Interval |
|--------------|--------------------|-----------|------------|------------------------|----------------------|
| Agilent | Analyzer, Spectrum | E4440A | US45303156 | 2017-02-24 | 1 year |
| - | RF cable | - | - | Each time ¹ | N/A |
| - | 20dB attenuator | - | - | Each time ¹ | N/A |

Note¹: cable and attenuator included in the test set-up will be checked each time before testing.

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° C |
| Relative Humidity: | 42 % |
| ATM Pressure: | 102.7 KPa |

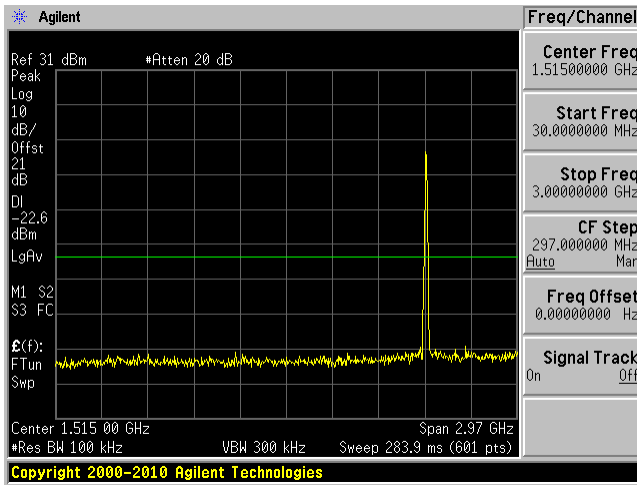
The testing was performed by Chin Ming Lui on 2017-09-1 in RF site.

12.5 Test Results

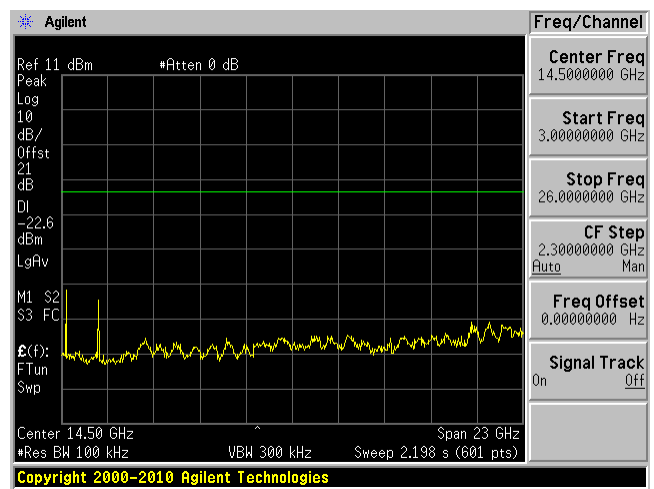
Please refer to following plots.

802.11b mode (Port J20)

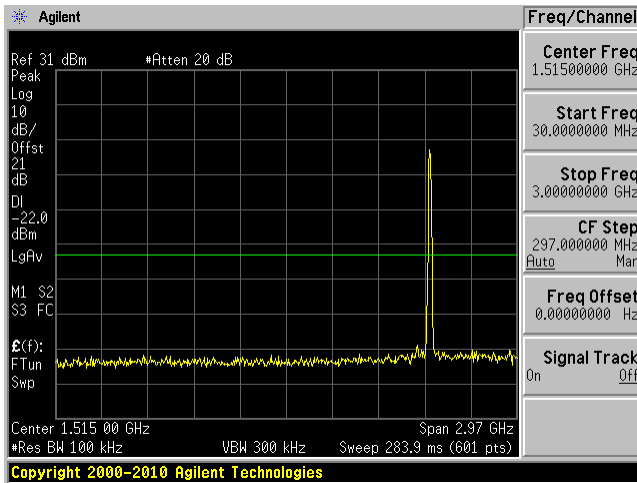
Low Channel 30MHz – 3 GHz



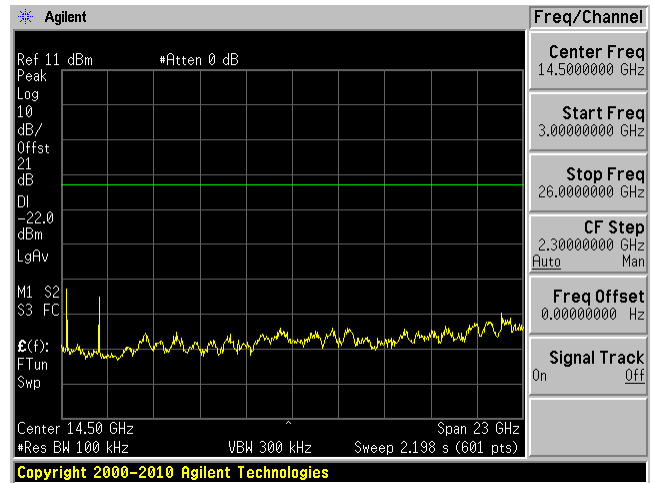
Low Channel 3 GHz – 26 GHz



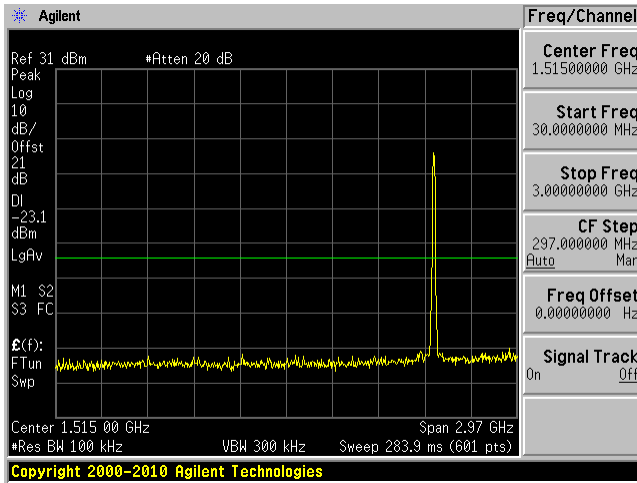
Middle Channel 30 MHz – 3 GHz



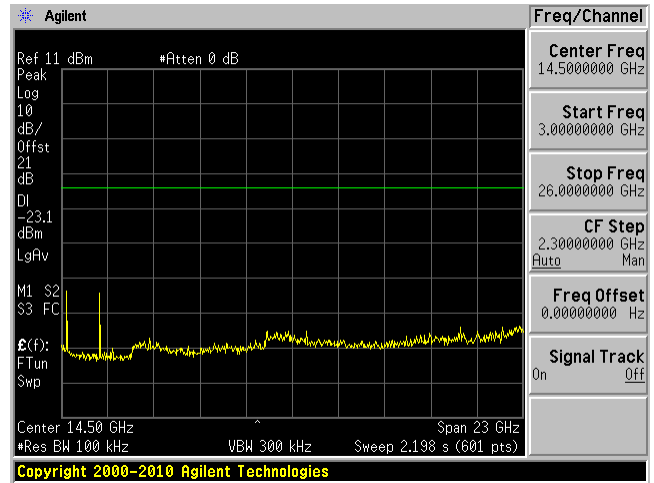
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

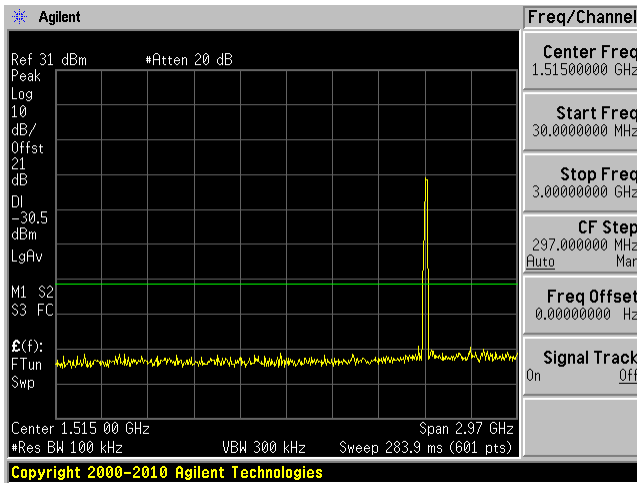


High Channel 3 GHz – 26 GHz

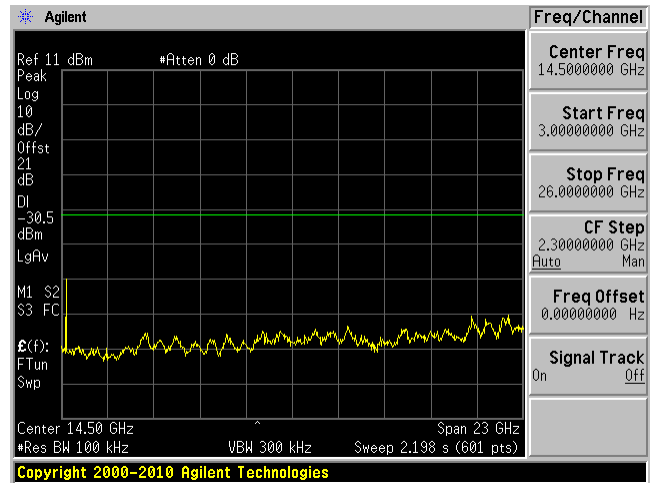


802.11g mode (Port J20)

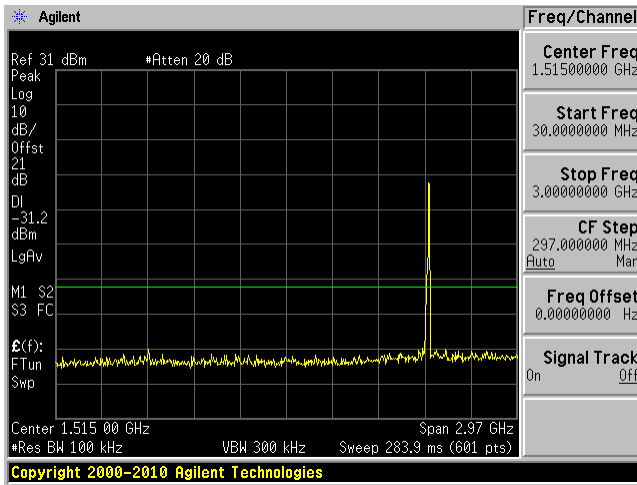
Low Channel 30 MHz – 3 GHz



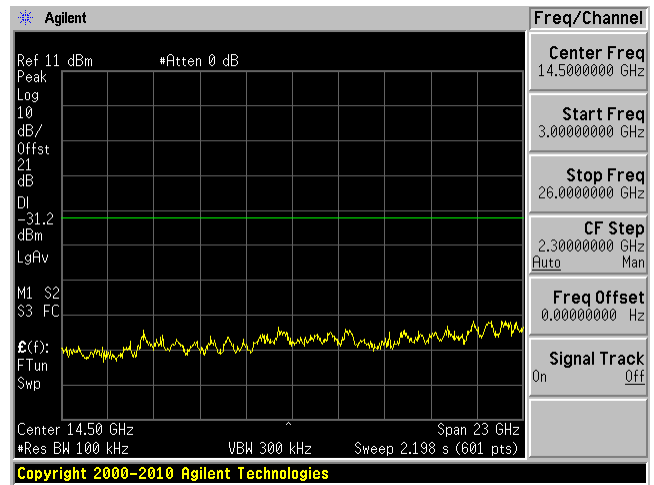
Low Channel 3 GHz – 26 GHz



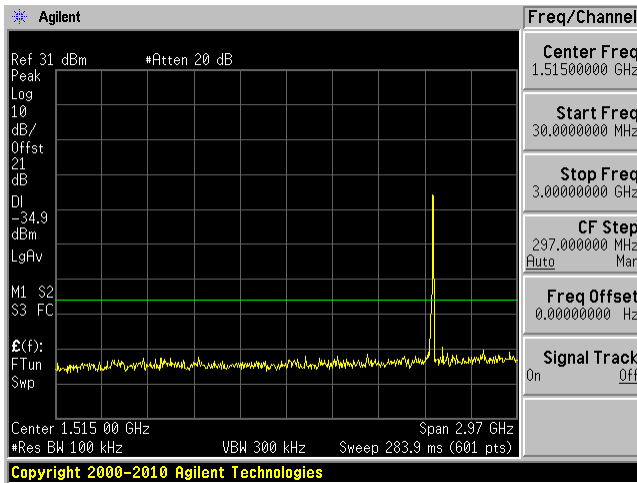
Middle Channel 30 MHz – 3 GHz



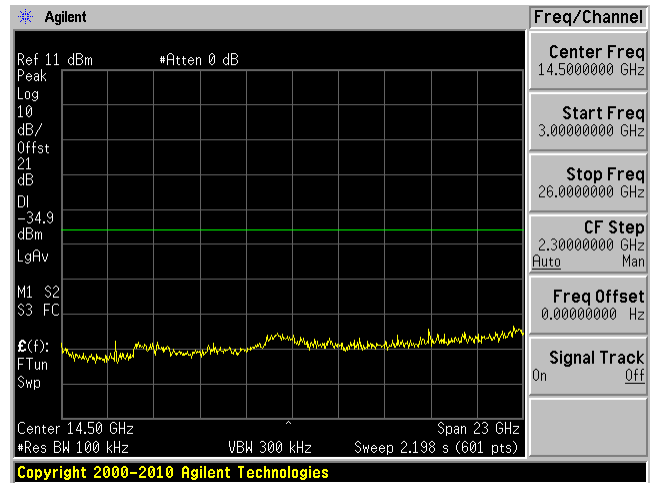
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

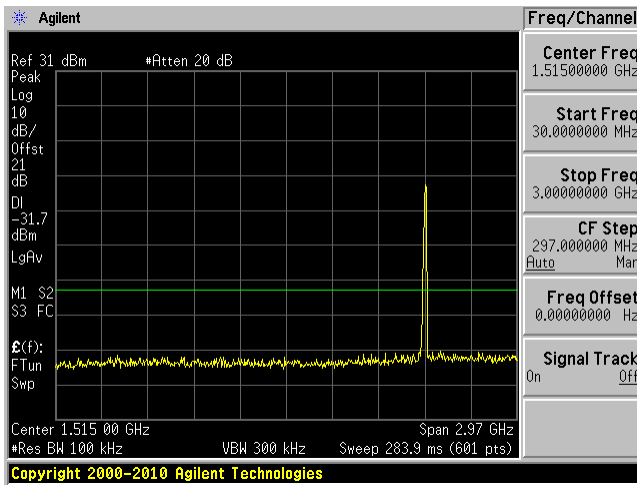


High Channel 3 GHz – 26 GHz

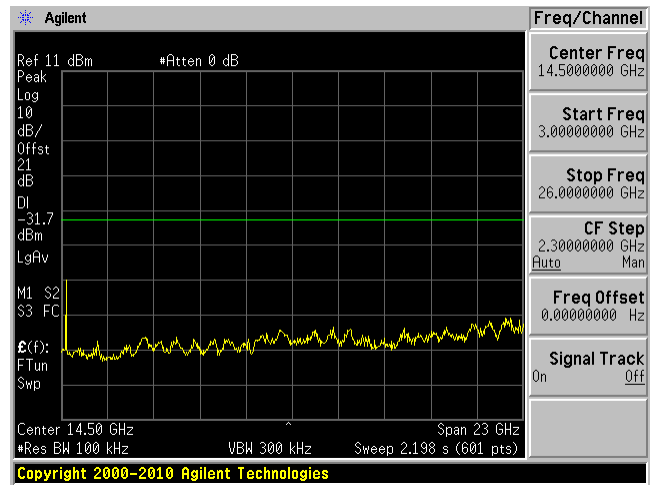


802.11n20 mode (Port J20)

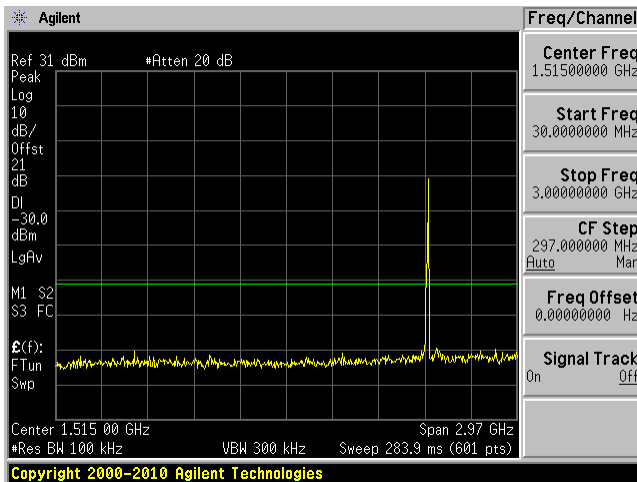
Low Channel 30 MHz – 3 GHz



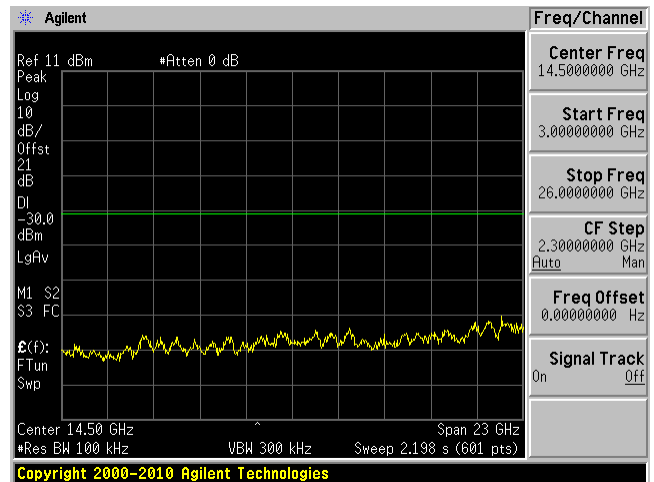
Low Channel 3 GHz – 26 GHz



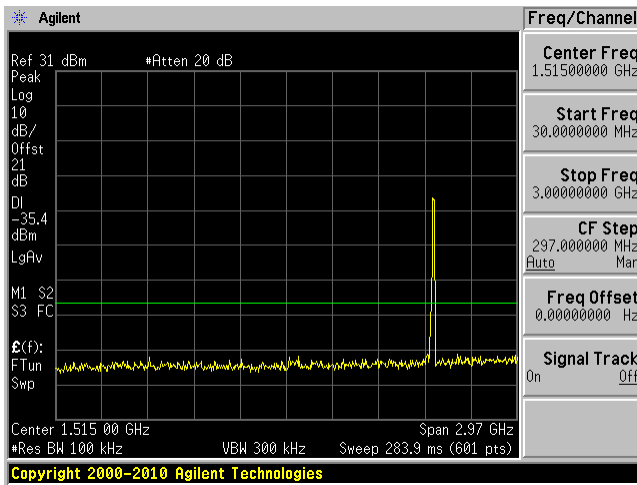
Middle Channel 30 MHz – 3 GHz



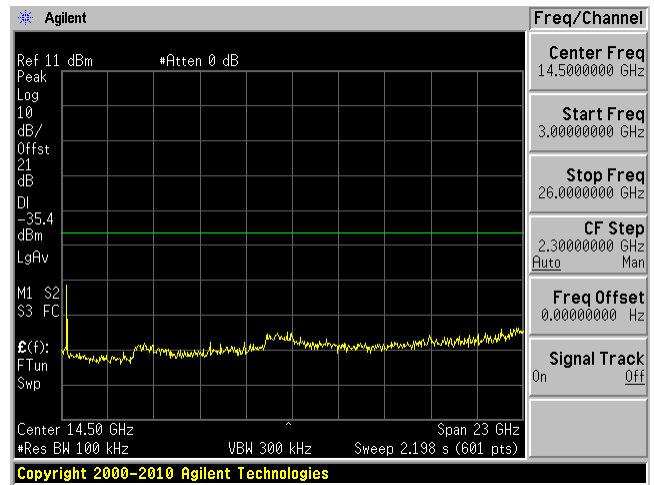
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

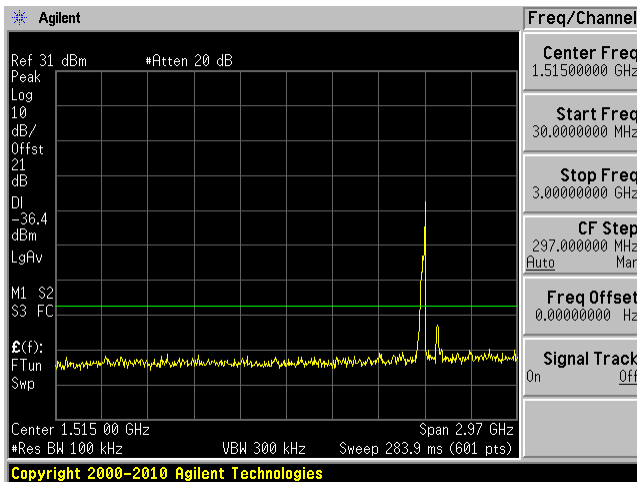


High Channel 3 GHz – 26 GHz

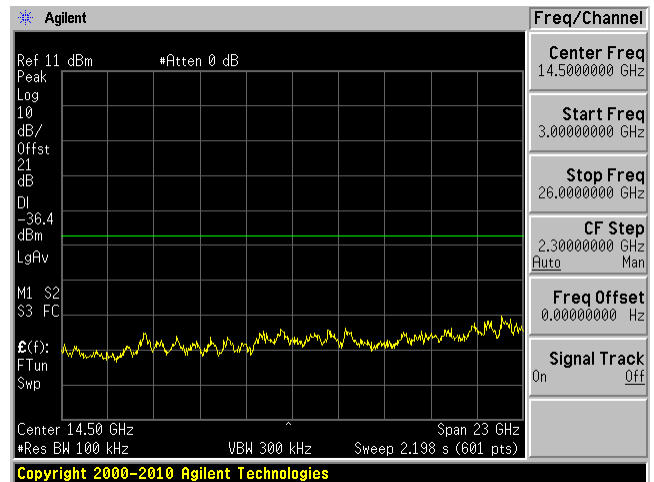


802.11n40 mode (Port J20)

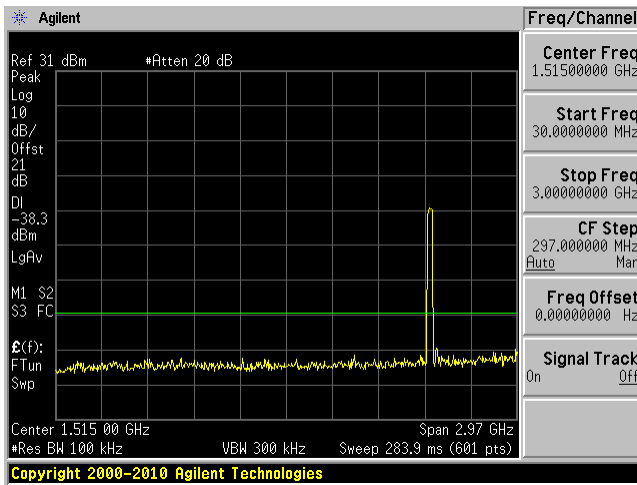
Low Channel 30 MHz – 3 GHz



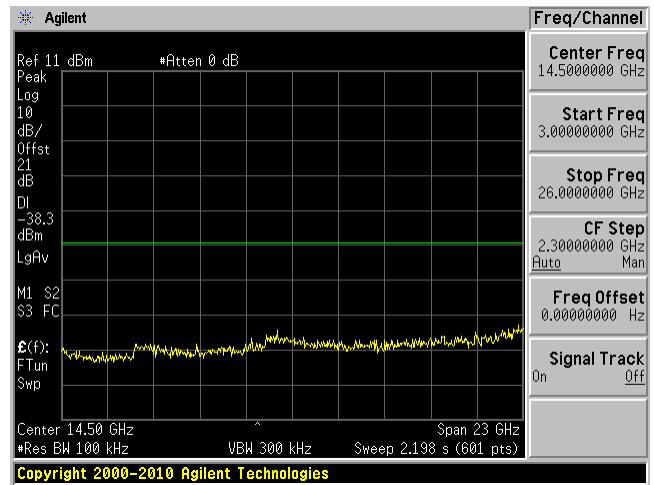
Low Channel 3 GHz – 26 GHz



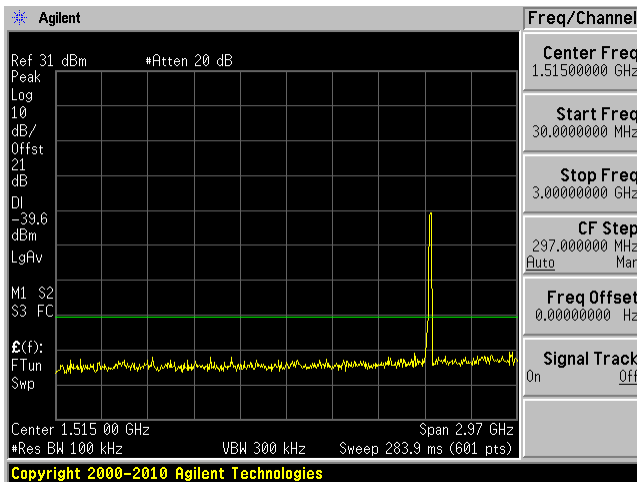
Middle Channel 30 MHz – 3 GHz



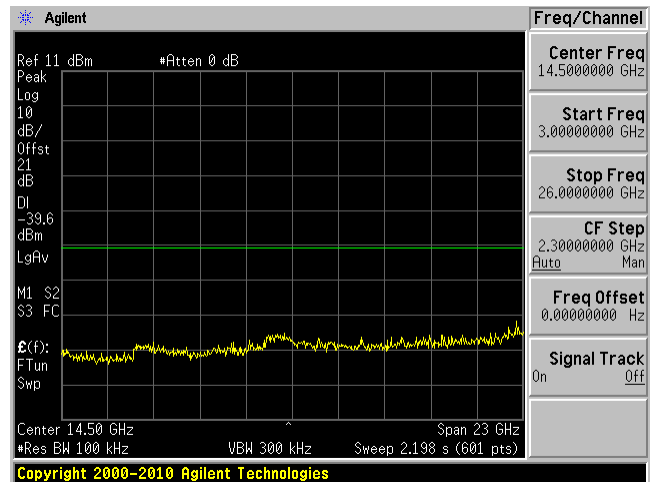
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz



High Channel 3 GHz – 26 GHz



13 Annex D (Informative) - A2LA Electrical Testing Certificate



Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of A2LA R222 - *Specific Requirements - EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 30th day of August 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2018

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

---END OF REPORT ---