FCC PART 15, SUBPART C

TEST AND MEASUREMENT REPORT

For

MS Magnet Solutions Ltd.

Agathonos 11, Kapsalos 3087
Limassol, Cyprus

FCC ID: 2AKJA-S1500W4

Report Type:	**Product Type:**
Original Report	PiXcell Smallcell Wi-Fi Router

Prepared By:	Rudy Sun Test Engineer
Report Number:	R16121418-247 DTS (Wi-Fi)
Report Date:	2017-02-20
Reviewed By:	Bo Li RF Supervisor
	Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732-9164

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R16121418-247 DTS (Wi-Fi)	Original Report	-

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *MS Magnet Solutions Ltd.*, and their product model: S1500 W4, FCC ID: 2AKJA-S1500W4 or the "EUT" as referred to in this report. It is a module with Wi-Fi function. It operates in the 2.4 GHz band.

1.2 Mechanical Description of EUT

The EUT measures approximately 217 mm (L) x 135 mm (W) x 36 mm (H).

The test data gathered are from typical production sample, serial number: S01-14060182 assigned by MS Magnet Solutions Ltd.

1.3 Objective

This report is prepared on behalf of *MS Magnet Solutions Ltd.*, 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.

1.4 Related Submittal(s)/Grant(s)

R16121418-27 (WCDMA band 4)

1.5 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 v03r05: 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.

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 %

1.7 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.

1.8 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 3297.02),*** 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 Accreditation Certificate Number 3297.03)*** to certify

- 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 3297.01)*** 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):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC
    US -EU EMC & Telecom MRA CAB
- 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;
- 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 v03r05.

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 SecureCRTPortable.exe, RT3050QA.exe and firmware files provided by MS Magnet Solutions Ltd., the software is comply with the standard requirements being tested against.

2.3 Duty Cycle Correction Factor

According to KDB 558074 D01 DTS Meas Guidance v03r05 section 6.0:

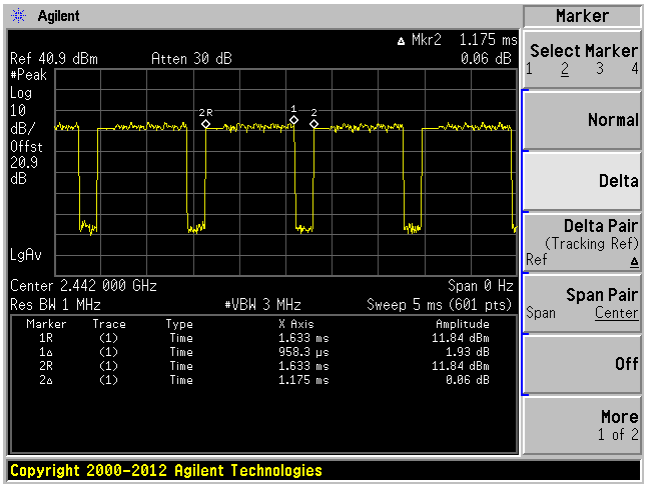
Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be utilized 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 (us)	Period (us)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.11b	958.3	1175	81.56	0.89
802.11g	170	386.7	43.96	3.57
802.11n20	156.7	373.3	41.98	3.77
802.11n40	98.33	300	32.78	4.84

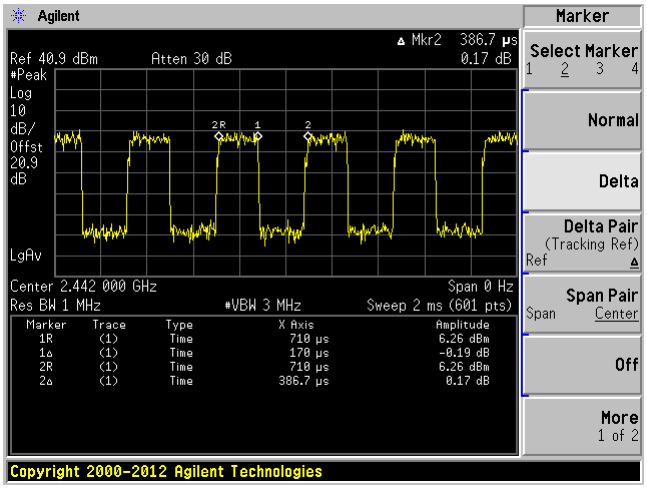
Duty Cycle = On Time (ms)/ Period (ms)
Duty Cycle Correction Factor (dB) = 10*log(1/Duty Cycle)

Please refer to the following plots.

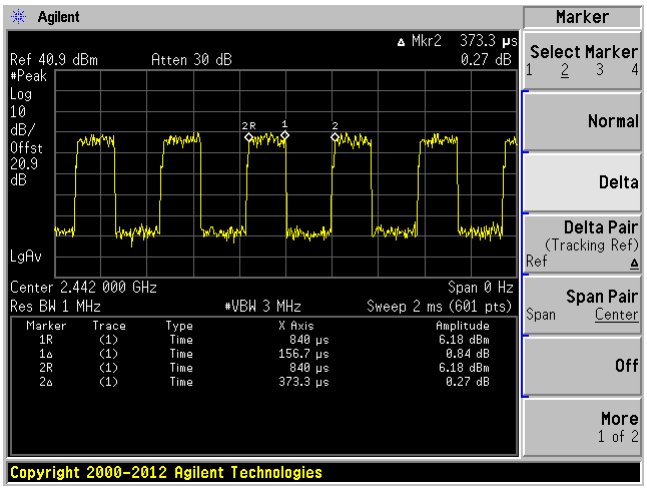
802.11b mode



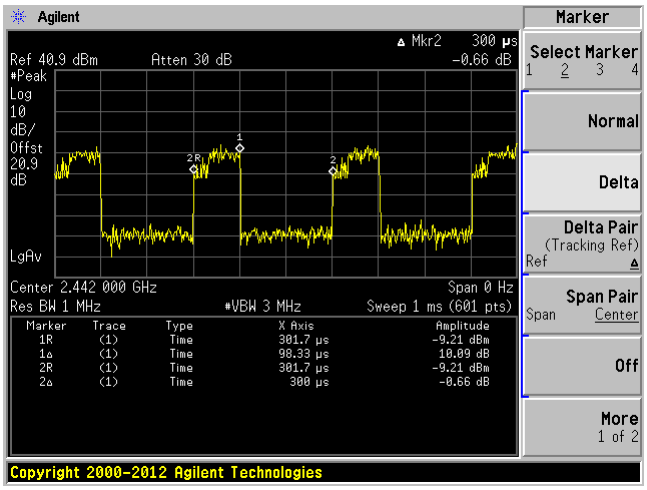
802.11g mode



802.11n20 mode



802.11n40 mode



2.4 Equipment Modifications

N/A

2.5 Local Support Equipment

Manufacturer/Product Type	Description	Model No.	Serial No.
Dell	Windows Laptop	E6410	-

2.6 Support Equipment

There was no support equipment included, or intended for use with EUT during these tests.

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
RJ45	< 1 m	Windows Laptop	EUT
RF Cable	< 1 m	PSA	EUT

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
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 & 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 are permanent attached antennas.

Antenna usage	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
Wi-Fi	2400-2500	5

5 FCC §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

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF field

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

Maximum peak output power at antenna input terminal (dBm):	18.59
Maximum peak output power at antenna input terminal (mW):	72.277
Prediction distance (cm):	20
Prediction frequency (MHz):	2412
Maximum Antenna Gain, typical (dBi):	5
Maximum Antenna Gain (numeric):	3.162
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0455
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0455 mW/cm^2. Limit is 1.0 mW/cm^2. The Percentage is 0.0455/1=4.55%. The total percentage is 29.76% (WWAN) + 4.55% (WLAN) = 34.31%.

6 FCC §15.207 - AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 Conducted limits:

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

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 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 & Margin Calculation

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

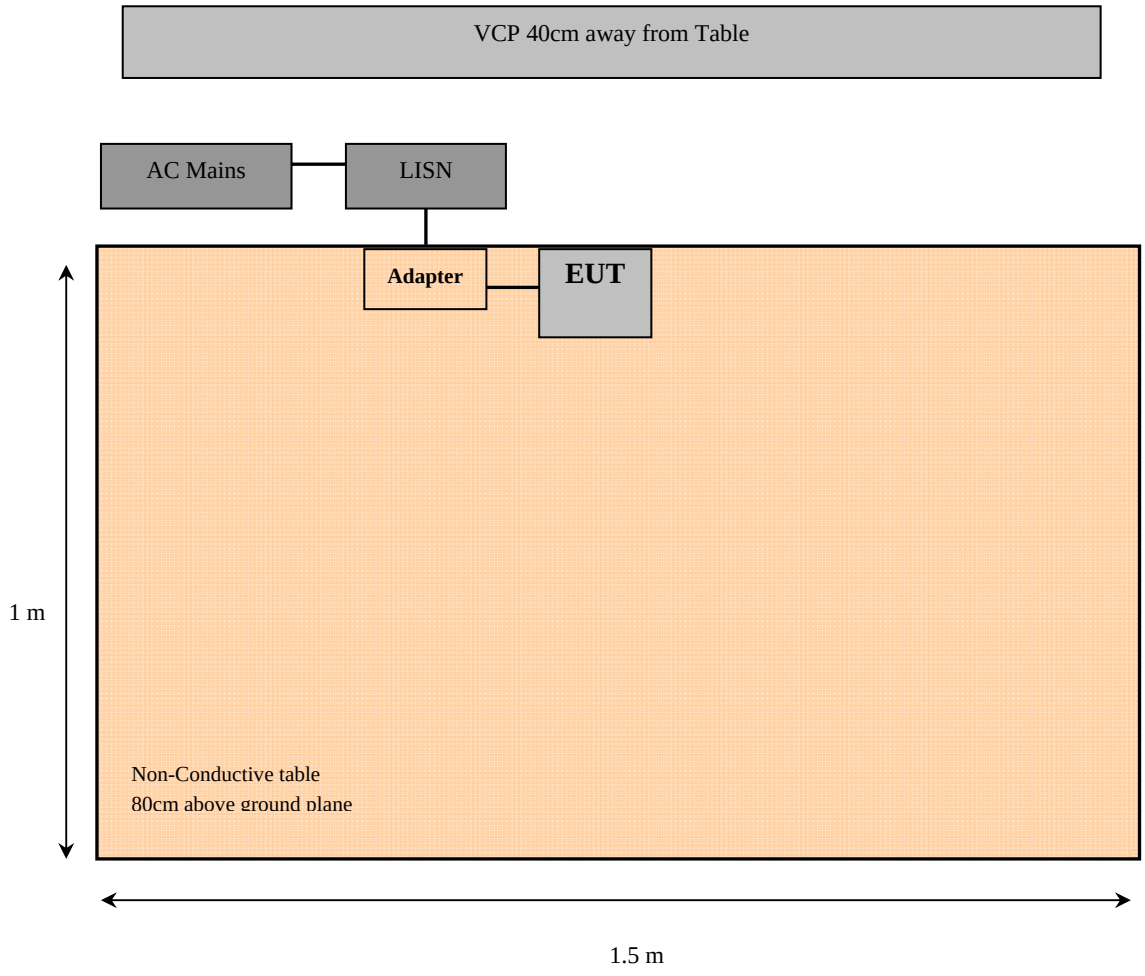
CA = Ai + CL + Atten

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

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

6.5 Test Setup Block Diagram



6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2 years
Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101964	2016-07-22	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2016-03-09	1 Year
Suirong	30 ft conductive emission cable	LMR 400	-	2016-03-05	1 year
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160131	2016-04-25	1year
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:	21º C
Relative Humidity:	38 %
ATM Pressure:	101 kPa

The testing was performed by Rudy Sun on 2017-01-20 in BACL Conducted test Site.

6.8 Summary of Test Results

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

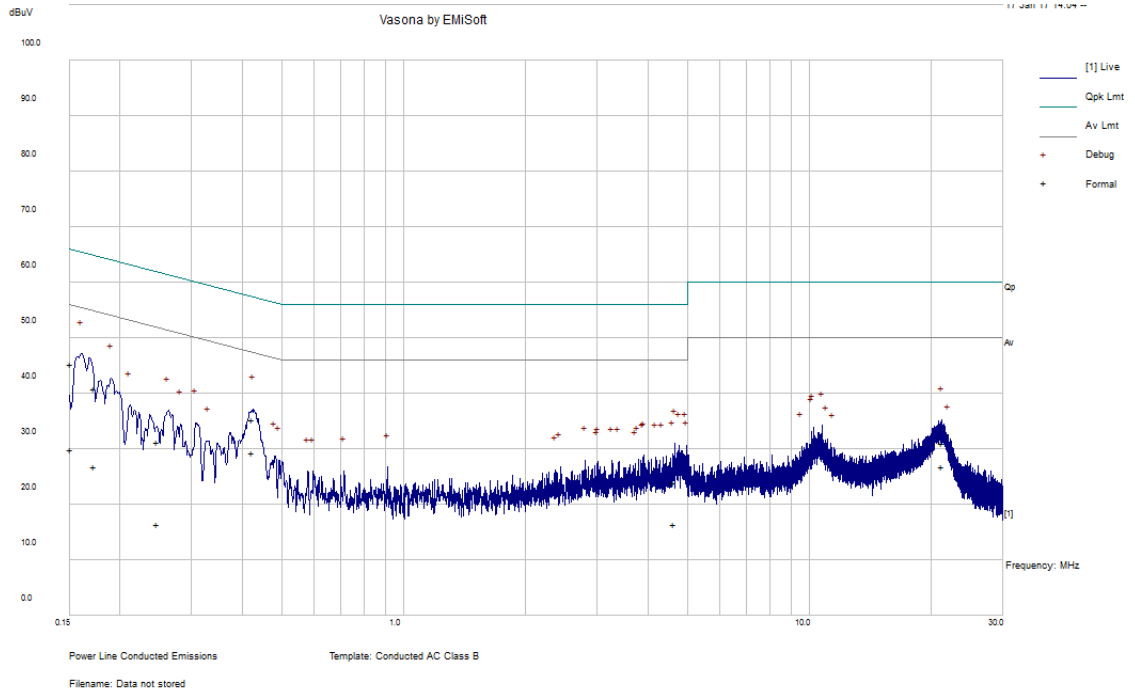
2.4 GHz Wi-Fi

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-18.03	0.422892	Live	0.15-30

6.9 Conducted Emissions Test Plots and Data

2.4 GHz Wi-Fi

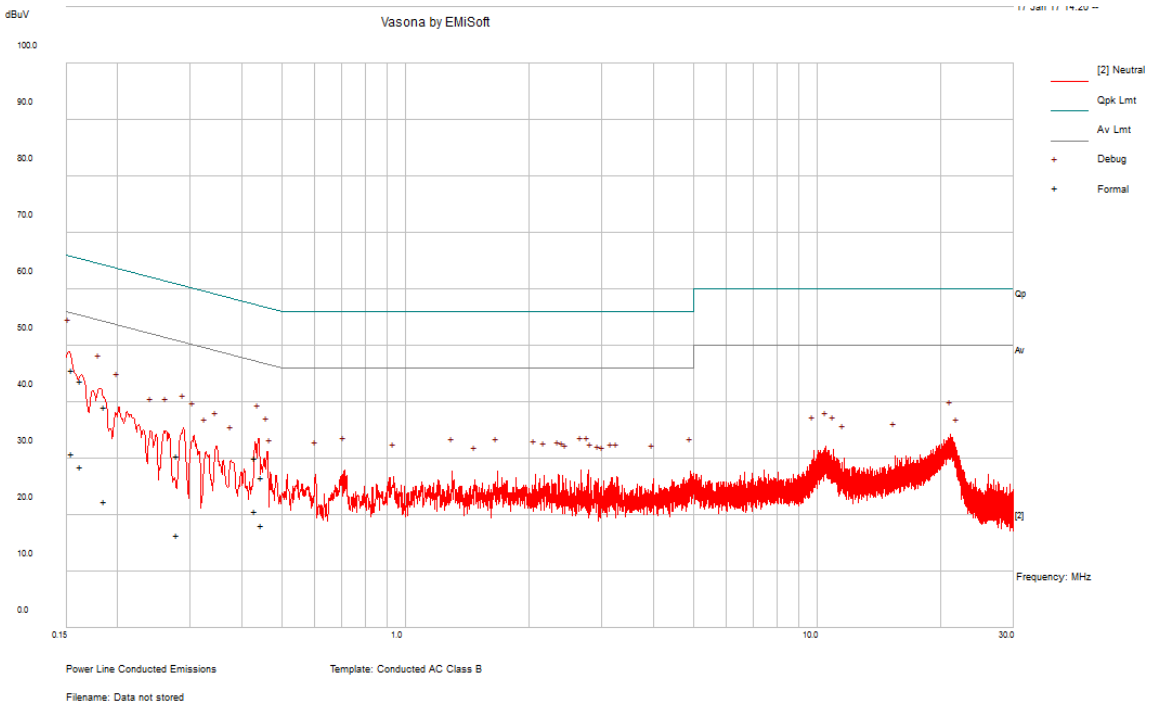
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.151515	45.24	Line	65.92	-20.68	QP
0.422892	35.41	Line	57.39	-21.98	QP
0.172857	40.96	Line	64.82	-23.86	QP
0.247647	31.33	Line	61.84	-30.5	QP
21.22161	31.03	Line	60	-28.97	QP
4.652204	23.95	Line	56	-32.05	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.151515	30.01	Line	55.92	-25.91	Ave.
0.422892	29.36	Line	47.39	**-18.03**	Ave.
0.172857	26.77	Line	54.82	-28.05	Ave.
0.247647	16.47	Line	51.84	-35.36	Ave.
21.22161	26.87	Line	50	-23.13	Ave.
4.652204	16.49	Line	46	-29.51	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.154926	45.73	Neutral	65.73	-20	QP
0.162789	43.74	Neutral	65.32	-21.58	QP
0.432369	30.21	Neutral	57.21	-26.99	QP
0.185964	39.21	Neutral	64.21	-25	QP
0.278793	30.47	Neutral	60.85	-30.38	QP
0.447369	26.62	Neutral	56.92	-30.31	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.154926	30.96	Neutral	55.73	-24.77	Ave.
0.162789	28.66	Neutral	55.32	-26.66	Ave.
0.432369	20.74	Neutral	47.21	-26.47	Ave.
0.185964	22.44	Neutral	54.21	-31.77	Ave.
0.278793	16.42	Neutral	50.85	-34.43	Ave.
0.447369	18.31	Neutral	46.92	-28.61	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) 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		
0.495 – 0.505	16.69475 – 16.69525	960 – 1240	4. 5 – 5. 15
2.1735 – 2.1905	25.5 – 25.67	1300 – 1427	5. 35 – 5. 46
4.125 – 4.128	37.5 – 38.25	1435 – 1626.5	7.25 – 7.75
4.17725 – 4.17775	73 – 74.6	1645.5 – 1646.5	8.025 – 8.5
4.20725 – 4.20775	74.8 – 75.2	1660 – 1710	9.0 – 9.2
6.215 – 6.218	108 – 121.94	1718.8 – 1722.2	9.3 – 9.5
6.26775 – 6.26825	123 – 138	2200 – 2300	10.6 – 12.7
6.31175 – 6.31225	149.9 – 150.05	2310 – 2390	13.25 – 13.4
8.291 – 8.294	156.52475 – 156.52525	2483.5 – 2500	14.47 – 14.5
8.362 – 8.366	156.7 – 156.9	2690 – 2900	15.35 – 16.2
8.37625 – 8.38675	162.0125 –167.17	3260 – 3267	17.7 – 21.4
8.41425 – 8.41475	167.72 – 173.2	3.332 – 3.339	22.01 – 23.12
12.29 – 12.293	240 – 285	3 3458 – 3 358	23.6 – 24.0
12.51975 – 12.52025	322 – 335.4	3.600 – 4.400	31.2 – 31.8
12.57675 – 12.57725	399.9 – 410		36.43 – 36.5
13.36 – 13.41	608 – 614		Above 38.6

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 limits.

The spacing between the peripherals was 10 centimeters.

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

7.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords 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:

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

Above 1000 MHz:

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

7.4 Corrected Amplitude & Margin Calculation

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

CA = Ai + AF + CL + Atten – Ga

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

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2 year
Agilent	Analyzer, Spectrum	E4440A	US 42221851	2016-06-10	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2015-07-11	2 Years
EMCO	Antenna, Horn	3115	9511-4627	2016-01-28	2 years
HP	Amplifier, Pre	8449B	3147A00400	2016-03-30	1 year
IW	Armored High Frequency Cable	DC 1531	KPS-1501A3960KPS	2016-08-05	1 Year
-	SMA cable	-	C0002	Each time[1]	N/A
HP	Pre-Amplifier	8447D	2443A04374	2016-06-28	1year
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2015-10-22	2 years
AH Systems	Amplifier, Low Noise	PAM-1840VH	153	2016-12-01	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note[1]: 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:	19-21 ºC
Relative Humidity:	38-42 %
ATM Pressure:	101 kPa

The testing was performed by Rudy Sun from 2017-01-20 in 5m chamber 3.

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

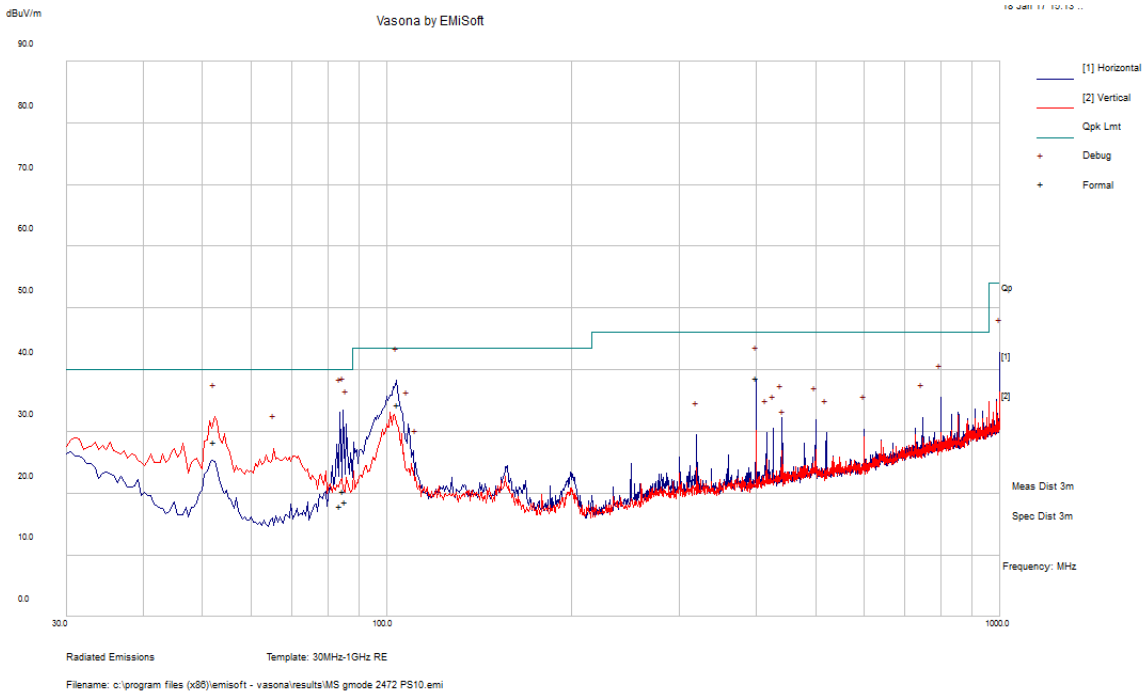
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, channel**
-0.19	2390	Horizontal	n20 mode, low channel

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
104.1088	34.45	287	H	39	43.5	-9.05	QP
84.99475	20.35	180	H	188	40	-19.65	QP
83.75575	17.96	192	H	205	40	-22.04	QP
52.20475	28.38	99	V	312	40	-11.62	QP
399.9888	38.77	101	H	178	46	-7.23	QP
85.7075	18.69	265	H	188	40	-21.31	QP

2) 1–25 GHz Measured at 3 meters

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	72.98	35	191	H	29.042	3.53	0	105.552	-	-	Peak
2412	79.83	350	229	V	29.042	3.53	0	112.402	-	-	Peak
2412	65.51	35	191	H	29.042	3.53	0	98.082	-	-	Ave
2412	71.96	350	229	V	29.042	3.53	0	104.532	-	-	Ave
2390	28.06	0	100	H	29.042	3.53	0	60.632	74	-13.368	Peak
2390	30.13	0	100	V	29.042	3.53	0	62.702	74	-11.298	Peak
2390	18.7	0	100	H	29.042	3.53	0	51.272	54	-2.728	Ave
2390	21.03	0	100	V	29.042	3.53	0	53.602	54	-0.398	Ave
4824	70.13	190	100	H	32.472	5.2	38.54	69.262	74	-4.738	Peak
4824	71.11	223	100	V	32.472	5.2	38.54	70.242	74	-3.758	Peak
4824	53.23	190	100	H	32.472	5.2	38.54	52.362	54	-1.638	Ave
4824	54.48	223	100	V	32.472	5.2	38.54	53.612	54	-0.388	Ave
7326	50.17	0	100	H	36.692	6.8	37.9	55.762	74	-18.238	Peak
7326	63.91	0	150	V	36.692	6.8	37.9	69.502	74	-4.498	Peak
7326	36.15	0	100	H	36.692	6.8	37.9	41.742	54	-12.258	Ave
7326	45.65	0	150	V	36.692	6.8	37.9	51.242	54	-2.758	Ave
Middle Channel 2442 MHz											
2442	71.76	180	220	V	29.413	3.53	0	104.703	-	-	Peak
2442	71.24	329	168	H	29.413	3.53	0	104.183	-	-	Peak
2442	55.75	180	220	V	29.413	3.53	0	88.693	-	-	Ave
2442	55.27	329	168	H	29.413	3.53	0	88.213	-	-	Ave
4884	71.38	0	155	V	32.638	5.2	38.54	70.678	74	-3.322	Peak
4884	66.48	330	180	H	32.638	5.2	38.54	65.778	74	-8.222	Peak
4884	54.50	0	155	V	32.638	5.2	38.54	53.798	54	-0.202	Ave
4884	46.88	330	180	H	32.638	5.2	38.54	46.178	54	-7.822	Ave
High Channel 2472 MHz											
2472	67.53	201	132	V	29.3	3.53	0	100.36	-	-	Peak
2472	65.99	226	213	H	29.3	3.53	0	98.82	-	-	Peak
2472	61.28	201	132	V	29.3	3.53	0	94.11	-	-	Ave
2472	59.67	226	213	H	29.3	3.53	0	92.5	-	-	Ave
2483.5	31.95	201	132	V	29.34	3.53	0	64.82	74	-9.18	Peak
2483.5	31.16	226	213	H	29.34	3.53	0	64.03	74	-9.97	Peak
2483.5	20.27	201	132	V	29.34	3.53	0	53.14	54	-0.86	Ave
2483.5	20.91	226	213	H	29.34	3.53	0	53.78	54	-0.22	Ave
4944	50.72	201	132	V	32.638	5.2	38.54	50.018	74	-23.982	Peak
4944	47.06	226	213	H	32.638	5.2	38.54	46.358	74	-27.642	Peak
4944	37.89	201	132	V	32.638	5.2	38.54	37.188	54	-16.812	Ave
4944	34.60	226	213	H	32.638	5.2	38.54	33.898	54	-20.102	Ave

802.11g mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	73.6	317	243	H	29.042	3.53	0	106.172	-	-	Peak
2412	72.38	324	254	V	29.042	3.53	0	104.952	-	-	Peak
2412	61.88	317	243	H	29.042	3.53	0	94.452	-	-	Ave
2412	60.71	324	254	V	29.042	3.53	0	93.282	-	-	Ave
2390	26.77	0	100	H	29.042	3.53	0	59.342	74	-14.658	Peak
2390	28.19	0	250	V	29.042	3.53	0	60.762	74	-13.238	Peak
2390	15.66	0	100	H	29.042	3.53	0	48.232	54	-5.768	Ave
2390	15.82	0	250	V	29.042	3.53	0	48.392	54	-5.608	Ave
4824	67.56	190	100	H	32.472	5.2	38.54	66.692	74	-7.308	Peak
4824	69.07	223	100	V	32.472	5.2	38.54	68.202	74	-5.798	Peak
4824	54.28	190	100	H	32.472	5.2	38.54	53.412	54	-0.588	Ave
4824	54.01	223	100	V	32.472	5.2	38.54	53.142	54	-0.858	Ave
7236	51.47	0	284	H	36.692	6.8	38	56.962	74	-17.038	Peak
7236	64.72	340	237	V	36.692	6.8	38	70.212	74	-3.788	Peak
7236	37.03	0	284	H	36.692	6.8	38	42.522	54	-11.478	Ave
7236	46.65	340	237	V	36.692	6.8	38	52.142	54	-1.858	Ave
Middle Channel 2442 MHz											
2442	69.07	178	130	V	29.413	3.53	0	102.013	-	-	Peak
2442	70.24	316	236	H	29.413	3.53	0	103.183	-	-	Peak
2442	56.29	178	130	V	29.413	3.53	0	89.233	-	-	Ave
2442	58.97	316	236	H	29.413	3.53	0	91.913	-	-	Ave
4884	64.22	344	250	V	32.638	5.2	38.54	63.518	74	-10.482	Peak
4884	55.33	338	263	H	32.638	5.2	38.54	54.628	74	-19.372	Peak
4884	49.65	344	250	V	32.638	5.2	38.54	48.948	54	-5.052	Ave
4884	41.13	338	263	H	32.638	5.2	38.54	40.428	54	-13.572	Ave
High Channel 2472 MHz											
2472	67.78	191	221	V	29.413	3.53	0	100.723	-	-	Peak
2472	64.14	195	131	H	29.413	3.53	0	97.083	-	-	Peak
2472	55.79	191	221	V	29.413	3.53	0	88.733	-	-	Ave
2472	52.38	195	131	H	29.413	3.53	0	85.323	-	-	Ave
2483.5	32.24	191	221	V	29.413	3.53	0	65.183	74	-8.817	Peak
2483.5	29.17	195	131	H	29.413	3.53	0	62.113	74	-11.887	Peak
2483.5	20.59	191	221	V	29.413	3.53	0	53.533	54	-0.467	Ave
2483.5	18.37	195	131	H	29.413	3.53	0	51.313	54	-2.687	Ave
4944	51.68	265	270	V	32.638	5.2	38.54	50.978	74	-23.022	Peak
4944	46.56	245	120	H	32.638	5.2	38.54	45.858	74	-28.142	Peak
4944	38.99	265	270	V	32.638	5.2	38.54	38.288	54	-15.712	Ave
4944	35.70	245	120	H	32.638	5.2	38.54	34.998	54	-19.002	Ave

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	71.37	165	126	V	29.042	3.53	0	103.94	-	-	Peak
2412	70.69	330	238	H	29.042	3.53	0	103.26	-	-	Peak
2412	59.8	165	126	V	29.042	3.53	0	92.37	-	-	Ave
2412	59.42	330	238	H	29.042	3.53	0	91.99	-	-	Ave
2390	35.48	225	180	V	29.042	3.53	0	68.05	74	-5.95	Peak
2390	38.34	339	254	H	29.042	3.53	0	70.91	74	-3.09	Peak
2390	19.39	225	180	V	29.042	3.53	0	51.96	54	-2.04	Ave
2390	21.24	339	254	H	29.042	3.53	0	53.81	54	-0.19	Ave
4824	60.26	180	150	V	32.472	5.2	38.54	59.39	74	-14.61	Peak
4824	59.47	323	280	H	32.472	5.2	38.54	58.60	74	-15.40	Peak
4824	47.43	180	150	V	32.472	5.2	38.54	46.56	54	-7.44	Ave
4824	47.98	323	280	H	32.472	5.2	38.54	47.11	54	-6.89	Ave
Middle Channel 2442 MHz											
2442	72.38	187	137	V	29.413	3.53	0	105.32	-	-	Peak
2442	72.82	310	296	H	29.413	3.53	0	105.76	-	-	Peak
2442	60.17	187	137	V	29.413	3.53	0	93.11	-	-	Ave
2442	60.46	310	296	H	29.413	3.53	0	93.40	-	-	Ave
4884	64.39	168	120	V	32.638	5.2	38.54	63.69	74	-10.31	Peak
4884	64.58	316	230	H	32.638	5.2	38.54	63.88	74	-10.12	Peak
4884	50.76	168	120	V	32.638	5.2	38.54	50.06	54	-3.94	Ave
4884	50.07	316	230	H	32.638	5.2	38.54	49.37	54	-4.63	Ave
7326	59.28	180	100	V	37.148	6.8	33.99	69.24	74	-4.76	Peak
7326	59.31	314	300	H	37.148	6.8	33.99	69.27	74	-4.73	Peak
7326	42.16	180	100	V	37.148	6.8	33.99	52.12	54	-1.88	Ave
7326	42.99	314	300	H	37.148	6.8	33.99	52.95	54	-1.05	Ave
High Channel 2472 MHz											
2472	66.14	206	101	V	29.413	3.43	0	98.98	-	-	Peak
2472	65.04	225	159	H	29.413	3.43	0	97.88	-	-	Peak
2472	54.98	206	101	V	29.413	3.43	0	87.82	-	-	Ave
2472	53.95	225	159	H	29.413	3.43	0	86.79	-	-	Ave
2483.5	32.26	206	101	V	29.413	3.43	0	65.10	74	-8.90	Peak
2483.5	30.11	225	159	H	29.413	3.43	0	62.95	74	-11.05	Peak
2483.5	20.97	206	101	V	29.413	3.43	0	53.81	54	-0.19	Ave
2483.5	20.26	225	159	H	29.413	3.43	0	53.10	54	-0.90	Ave
4944	54.47	341	205	V	32.638	5.20	38.54	53.77	74	-20.23	Peak
4944	46.97	220	100	H	32.638	5.20	38.54	46.27	74	-27.73	Peak
4944	41.37	341	205	V	32.638	5.20	38.54	40.67	54	-13.33	Ave
4944	35.34	220	100	H	32.638	5.20	38.54	34.64	54	-19.36	Ave

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	69.28	160	153	V	29.042	3.43	0	101.75	-	-	Peak
2422	69.05	350	260	H	29.042	3.43	0	101.52	-	-	Peak
2422	56.58	160	153	V	29.042	3.43	0	89.05	-	-	Ave
2422	54.55	350	260	H	29.042	3.43	0	87.02	-	-	Ave
2390	40.65	83	282	V	29.042	3.43	0	73.12	74	-0.88	Peak
2390	36.23	313	242	H	29.042	3.43	0	68.70	74	-5.30	Peak
2390	20.95	83	282	V	29.042	3.43	0	53.42	54	-0.58	Ave
2390	21.05	313	242	H	29.042	3.43	0	53.52	54	-0.48	Ave
4844	46.11	159	210	V	32.472	5.17	38.54	45.21	74	-28.79	Peak
4844	45.77	207	202	H	32.472	5.17	38.54	44.87	74	-29.13	Peak
4844	35.25	159	210	V	32.472	5.17	38.54	34.35	54	-19.65	Ave
4844	35.31	207	202	H	32.472	5.17	38.54	34.41	54	-19.59	Ave
Middle Channel 2442 MHz											
2442	70.92	330	175	V	29.413	3.53	0	103.86	-	-	Peak
2442	70.23	313	298	H	29.413	3.53	0	103.17	-	-	Peak
2442	58.72	330	175	V	29.413	3.53	0	91.66	-	-	Ave
2442	57.43	313	298	H	29.413	3.53	0	90.37	-	-	Ave
4884	53.02	223	272	V	32.638	5.2	38.54	52.32	74	-21.68	Peak
4884	48.30	316	105	H	32.638	5.2	38.54	47.60	74	-26.40	Peak
4884	40.69	223	272	V	32.638	5.2	38.54	39.99	54	-14.01	Ave
4884	36.61	316	105	H	32.638	5.2	38.54	35.91	54	-18.09	Ave
High Channel 2462 MHz											
2462	61.93	200	136	V	29.413	3.43	0	94.77	-	-	Peak
2462	61.51	224	225	H	29.413	3.43	0	94.35	-	-	Peak
2462	49.84	200	136	V	29.413	3.43	0	82.68	-	-	Ave
2462	49.49	224	225	H	29.413	3.43	0	82.33	-	-	Ave
2483.5	35.31	200	136	V	29.413	3.43	0	68.15	74	-5.85	Peak
2483.5	33.93	224	225	H	29.413	3.43	0	66.77	74	-7.23	Peak
2483.5	20.62	200	136	V	29.413	3.43	0	53.96	54	-0.54	Ave
2483.5	19.94	224	225	H	29.413	3.43	0	52.78	54	-1.22	Ave
4924	46.13	0	100	V	32.638	5.20	38.54	45.43	74	-28.57	Peak
4924	45.89	120	140	H	32.638	5.20	38.54	45.19	74	-28.81	Peak
4924	35.12	0	100	V	32.638	5.20	38.54	34.42	54	-19.58	Ave
4924	35.15	120	140	H	32.638	5.20	38.54	34.45	54	-19.55	Ave

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 v03r05: 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	E4440A	US 42221851	2016-06-10	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: 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:	22º C
Relative Humidity:	39 %
ATM Pressure:	101.5 KPa

The testing was performed by Rudy Sun on 2017-01-19 in RF site.

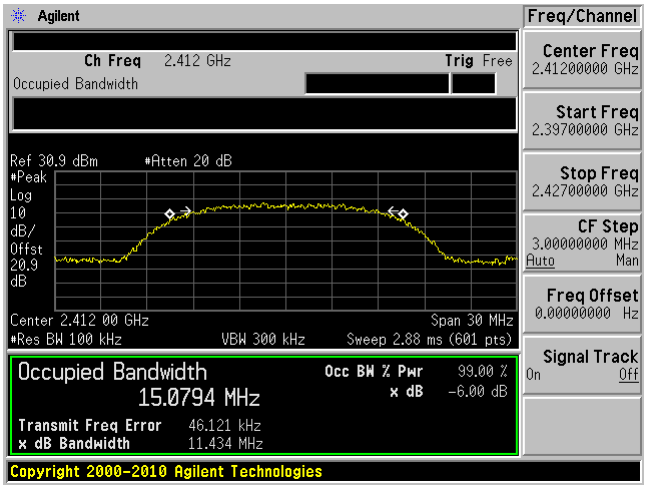
8.5 Test Results

Channel	Frequency (MHz)	99% OBW (kHz)	6 dB BW (kHz)	6 dB OBW limit (kHz)
802.11b mode				
Low	2412	15079.4	11434	500
Middle	2442	14987.8	10519	500
High	2472	15058.9	12065	500
802.11g mode				
Low	2412	16419.3	16499	500
Middle	2442	16439.9	16525	500
High	2472	16435.8	16508	500
802.11n-HT20 mode				
Low	2412	17566.2	17703	500
Middle	2442	17566.2	17662	500
High	2472	17570.5	17685	500
802.11n-HT40 mode				
Low	2422	36065.0	36458	500
Middle	2442	35984.6	36403	500
High	2462	36060.9	36434	500

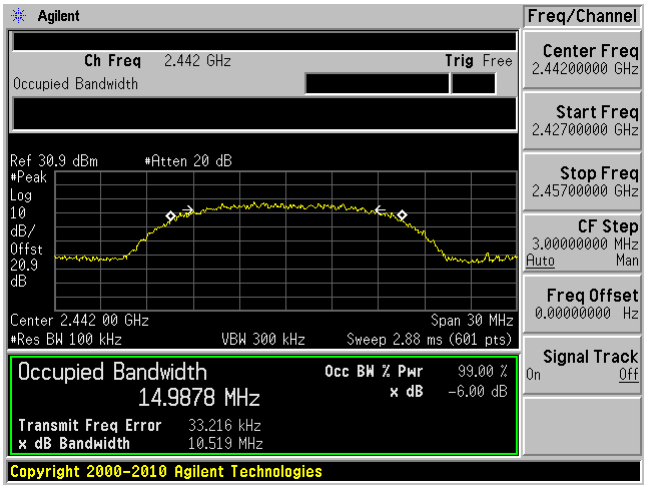
Please refer to the following plots for detailed test results.

802.11b mode

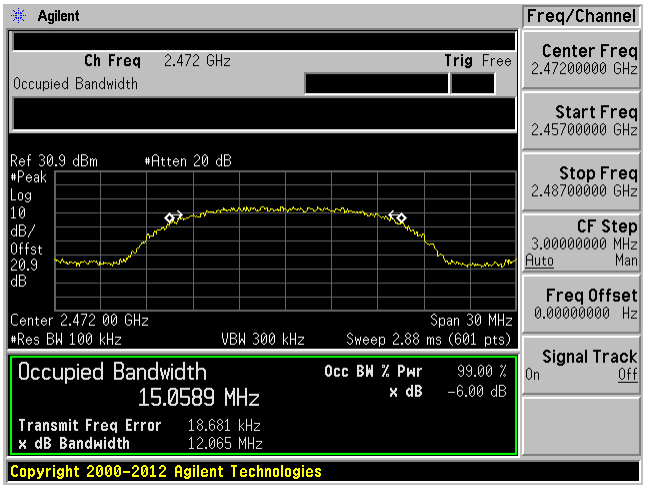
Low Channel 2412 MHz



Middle Channel 2442 MHz

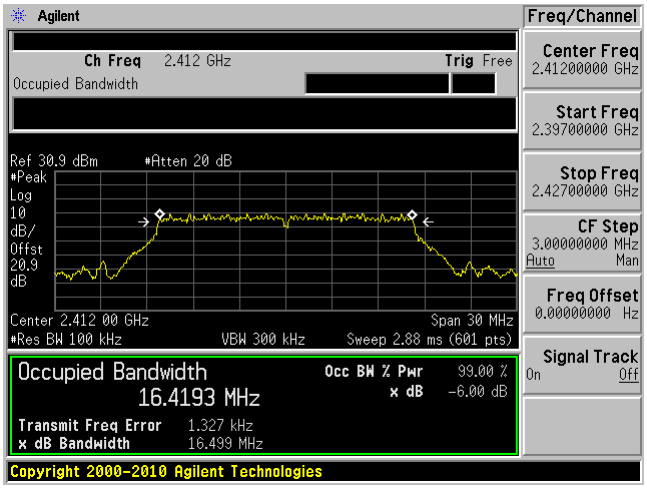


High Channel 2472 MHz

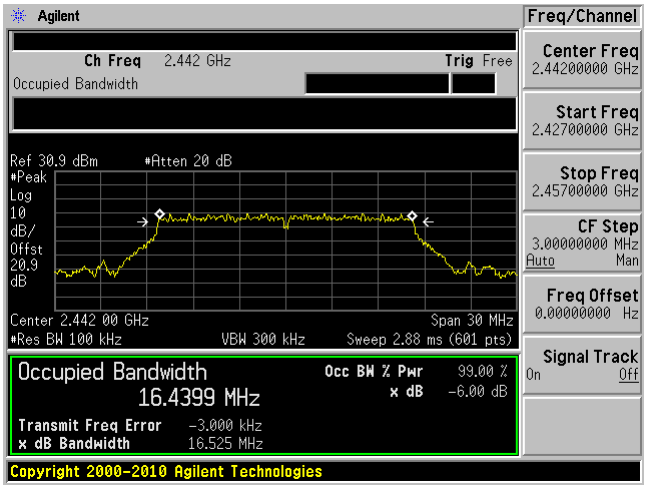


802.11g mode

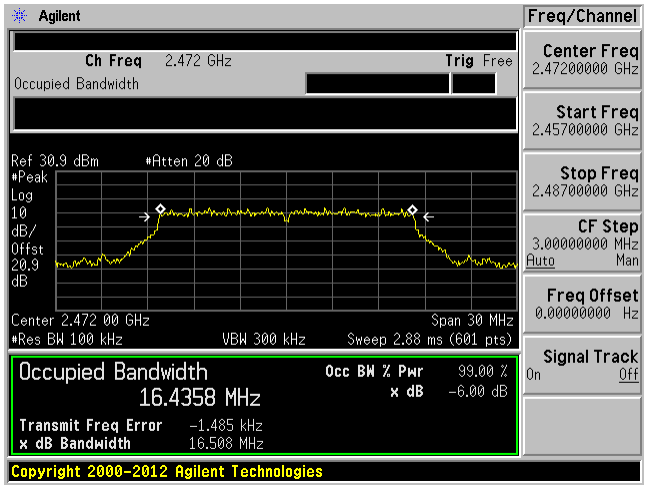
Low Channel 2412 MHz



Middle Channel 2442 MHz

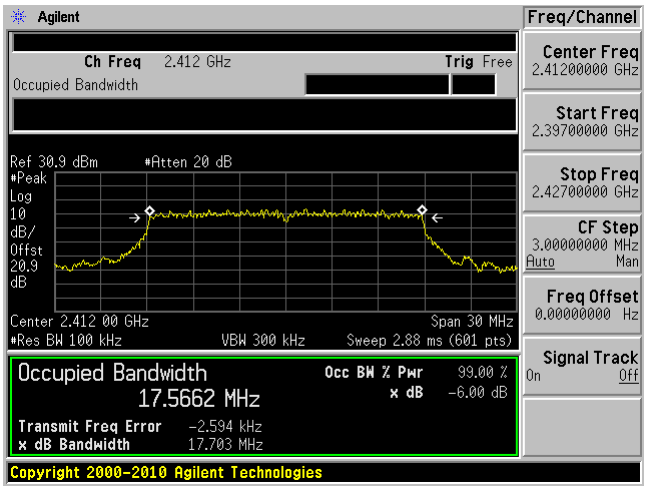


High Channel 2472 MHz

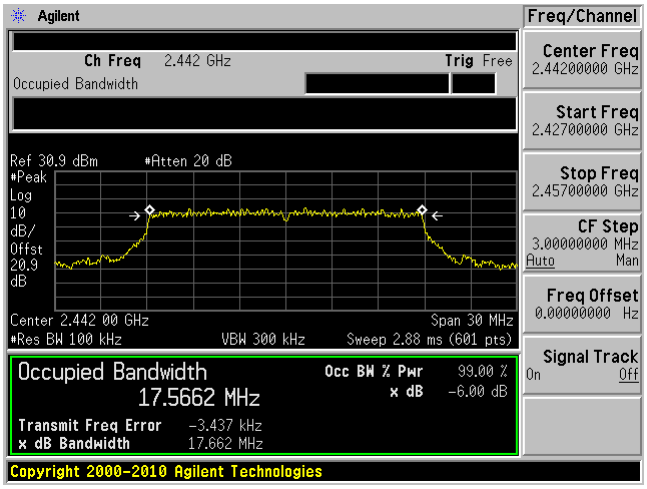


802.11n20 mode

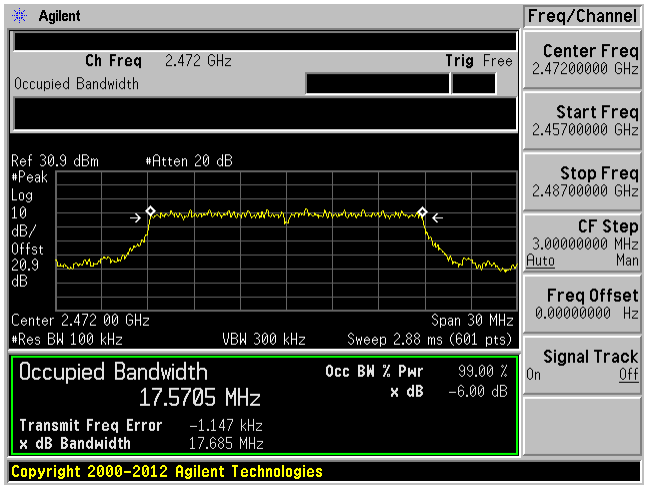
Low Channel 2412 MHz



Middle Channel 2442 MHz

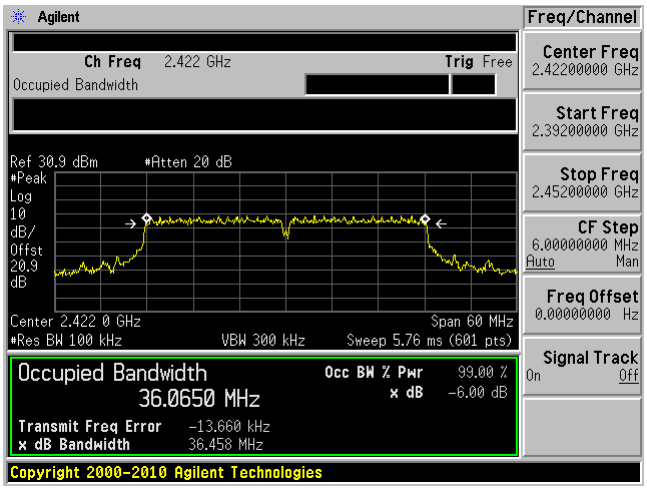


High Channel 2472 MHz

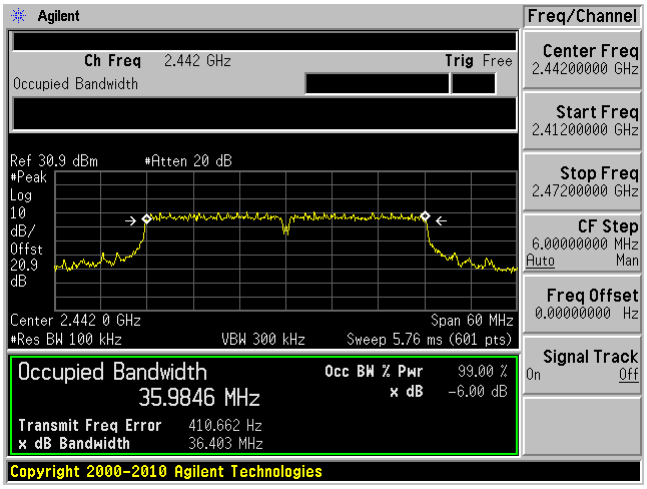


802.11n40 mode

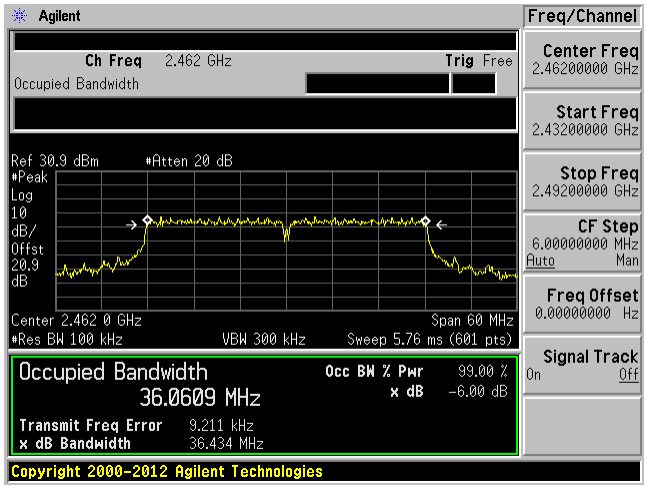
Low Channel 2422 MHz



Middle Channel 2442 MHz



High Channel 2462 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 v03r05: 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-Lindgren	Power Sensor	7002-006	160097	2016-12-05	2 year
-	RF Cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: 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:	22º C
Relative Humidity:	40 %
ATM Pressure:	101.6 KPa

The testing was performed by Rudy Sun on 2017-01-20 in RF site.

9.5 Test Results

Wi-Fi Output Power

Channel	Frequency (MHz)	Ave Power (dBm)	Limit (dBm)
802.11 b mode			
1	2412	18.59	30
7	2442	18.39	30
13	2472	13.20	30
802.11 g mode			
1	2412	15.09	30
7	2442	15.13	30
13	2472	12.04	30
802.11 n20 mode			
1	2412	16.18	30
7	2442	16.06	30
13	2472	12.14	30
802.11 n40 mode			
3	2422	14.25	30
7	2442	15.92	30
11	2462	10.44	30

Note: 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 v03r05: 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	US 42221851	2016-06-10	1 year
-	RF Cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: 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:	21º C
Relative Humidity:	40 %
ATM Pressure:	101.6 KPa

The testing was performed by Rudy Sun on 2017-01-20 in RF site.

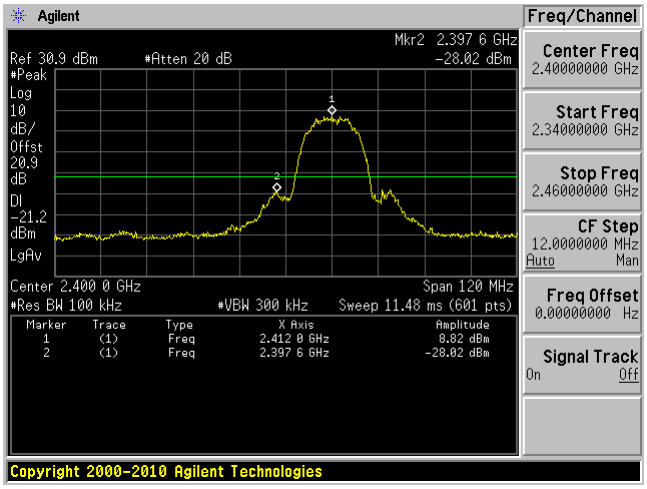
10.5 Test Results

Channel	Frequency (MHz)	Delta Between the 2 Marks (dB)	Limit (dB)
802.11 b mode			
1	2412	36.84	>30
13	2472	37.33	>30
802.11 g mode			
1	2412	34.18	>30
13	2472	32.93	>30
802.11 n20 mode			
1	2412	33.49	>30
13	2472	33.64	>30
802.11 n40 mode			
3	2422	30.42	>30
11	2462	30.06	>30

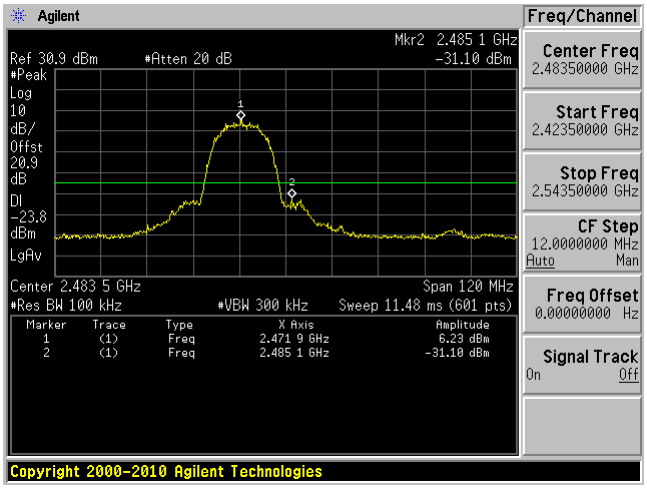
Please refer to the following plots for detailed test results.

802.11b mode

Low Channel 2412 MHz

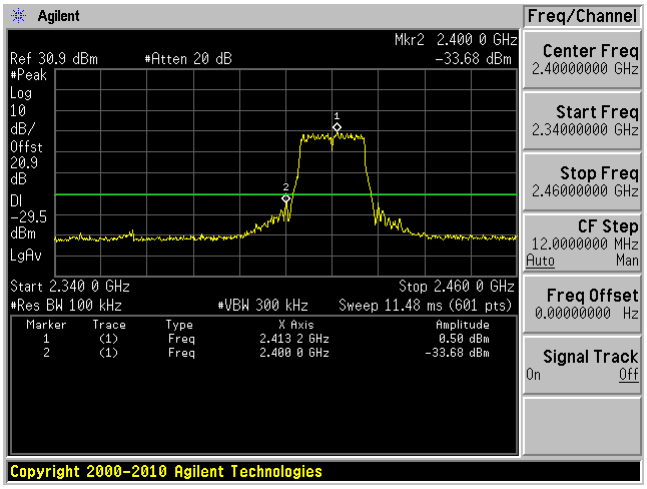


High Channel 2472 MHz

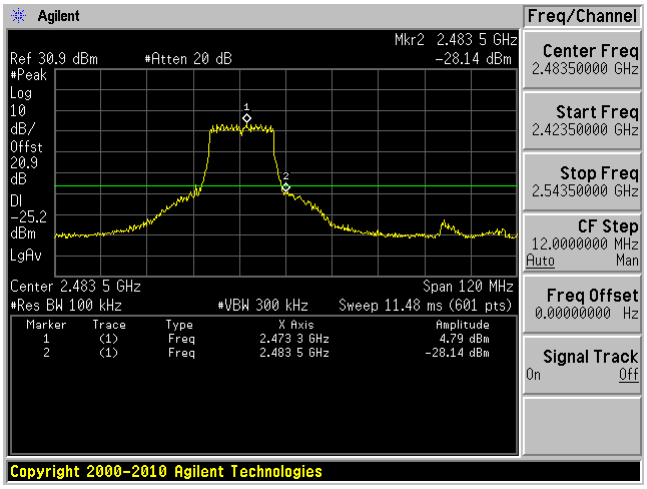


802.11g mode

Low Channel 2412 MHz

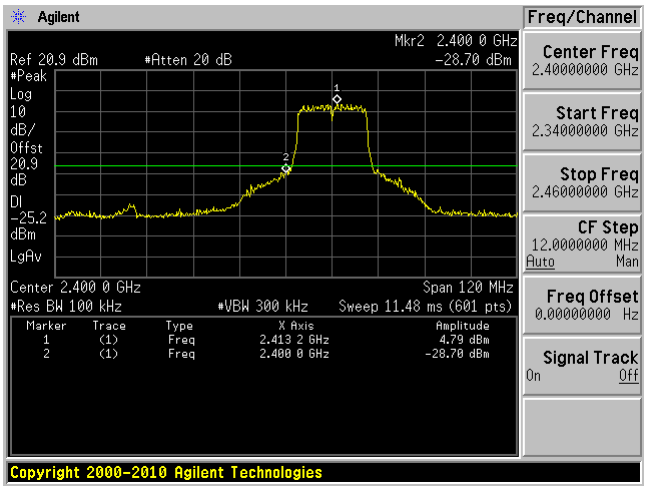


High Channel 2472 MHz

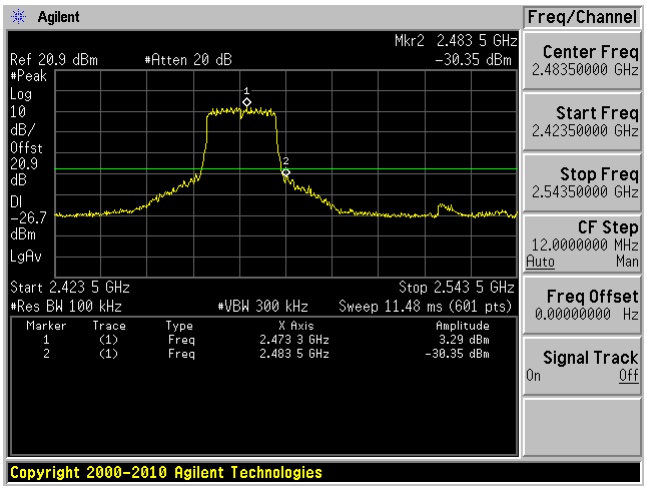


802.11n20 mode

Low Channel 2412 MHz

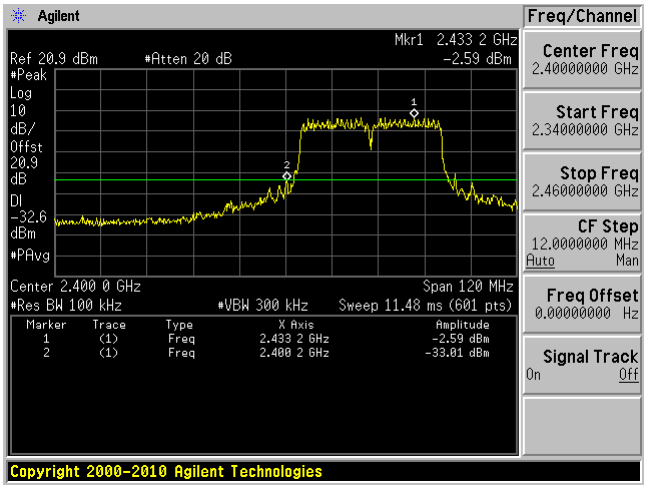


High Channel 2472 MHz

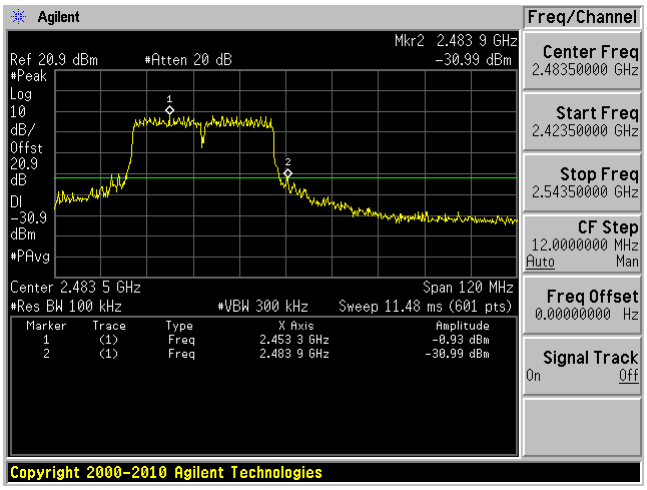


802.11n40 mode

Low Channel 2422 MHz



High Channel 2462 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 v03r05: 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	E4440A	US 42221851	2016-06-10	1 year
-	RF Cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: 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:	21º C
Relative Humidity:	40 %
ATM Pressure:	101.6 KPa

The testing was performed by Rudy Sun on 2017-01-20 in RF site.

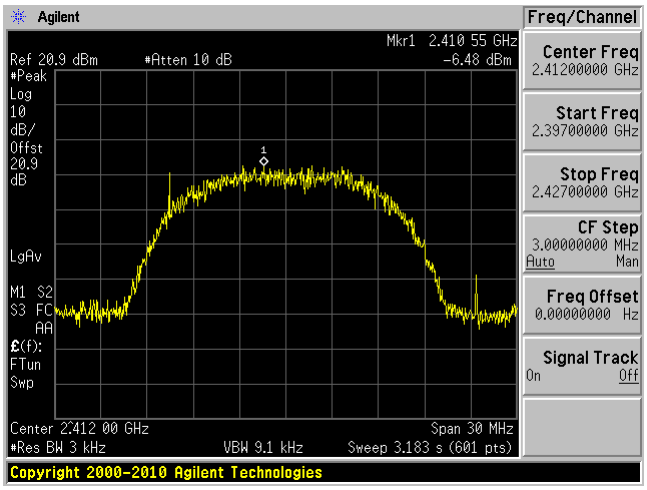
11.5 Test Results

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b mode			
Low	2412	-6.48	8
Middle	2442	-5.68	8
High	2472	-7.84	8
802.11g mode			
Low	2412	-15.59	8
Middle	2442	-15.38	8
High	2472	-12.25	8
802.11n-HT20 mode			
Low	2412	-11.43	8
Middle	2442	-12.30	8
High	2472	-12.63	8
802.11n-HT40 mode			
Low	2422	-17.84	8
Middle	2442	-15.52	8
High	2462	-19.08	8

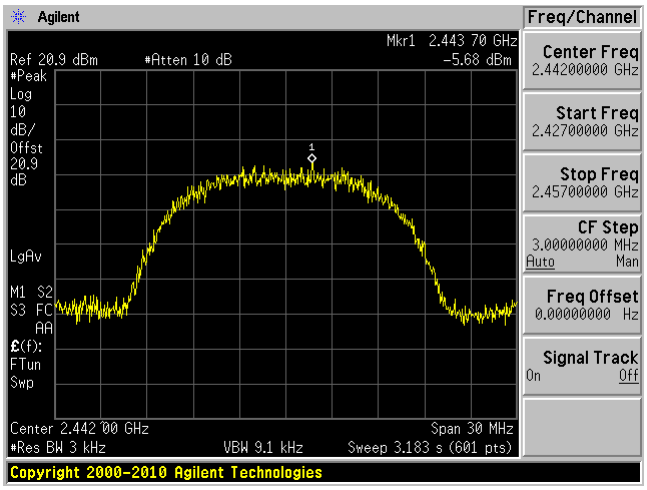
Please refer to the following plots for detailed test results

802.11b mode

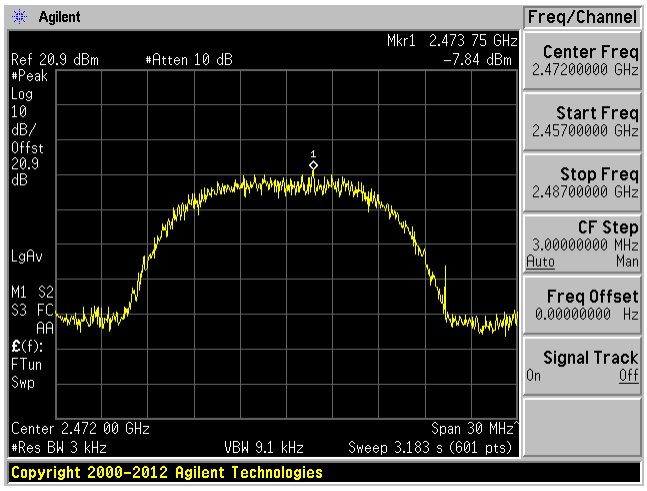
Low Channel 2412 MHz



Middle Channel 2442 MHz

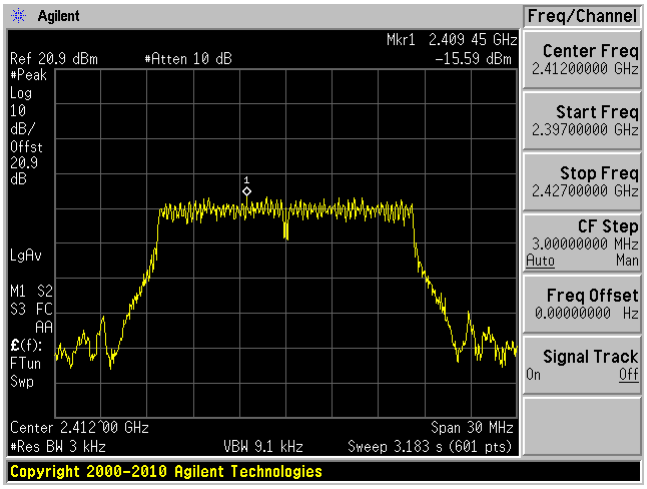


High Channel 2472 MHz

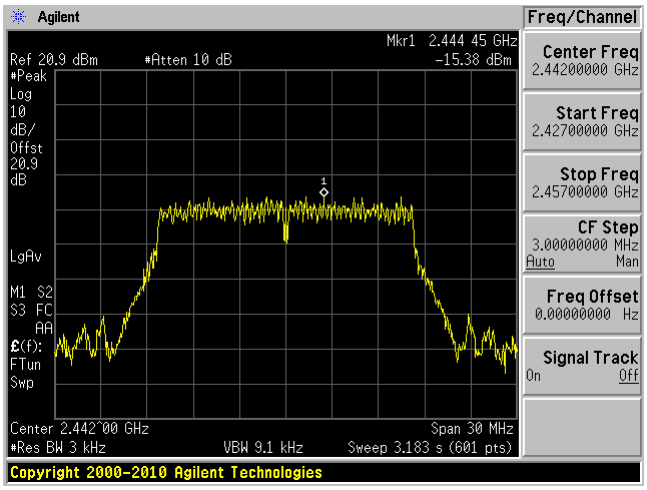


802.11g mode

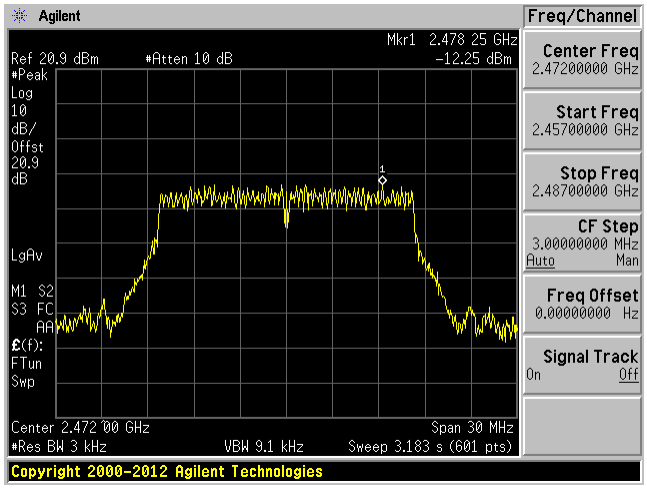
Low Channel 2412 MHz



Middle Channel 2442 MHz

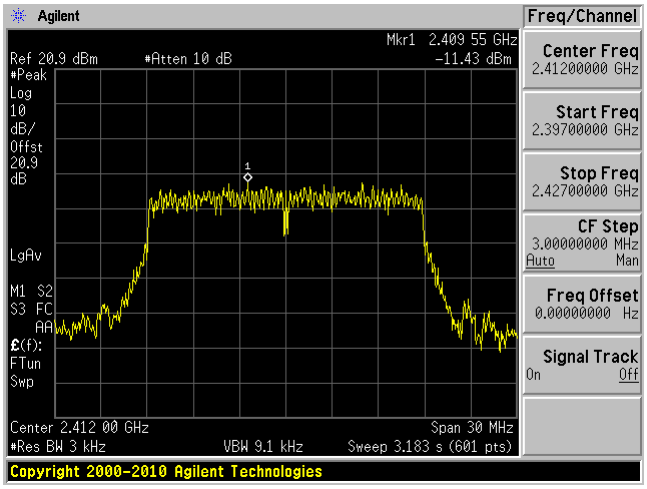


High Channel 2472 MHz

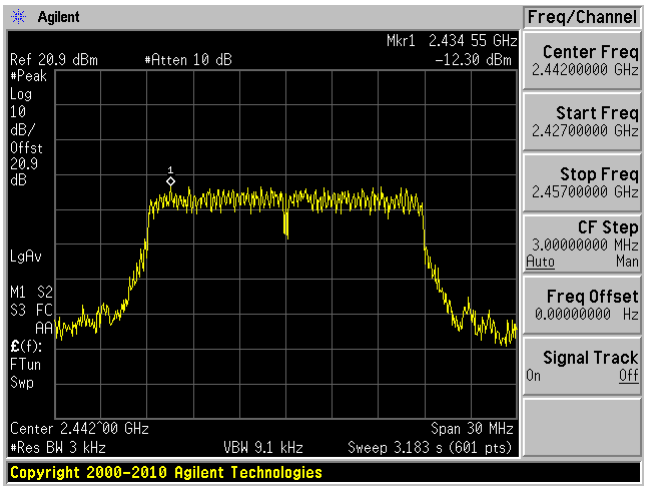


802.11n20 mode

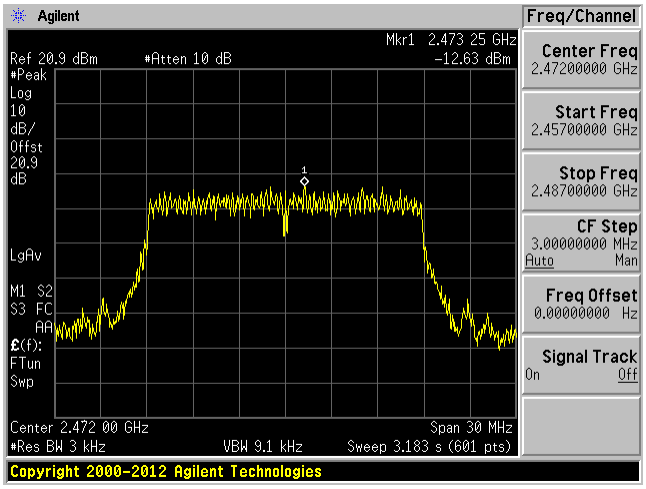
Low Channel 2412 MHz



Middle Channel 2442 MHz

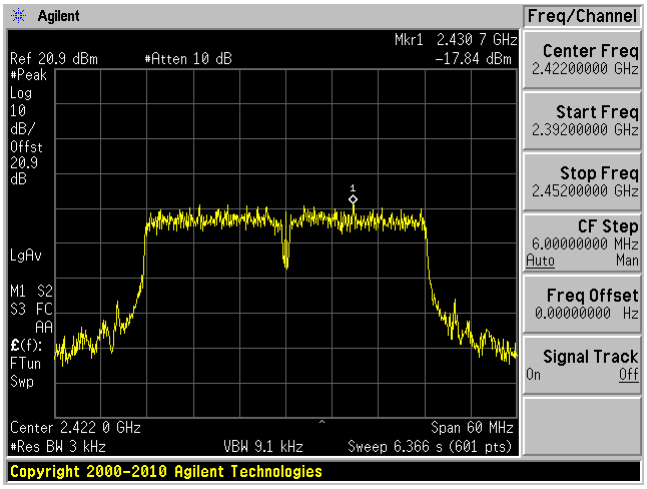


High Channel 2472 MHz

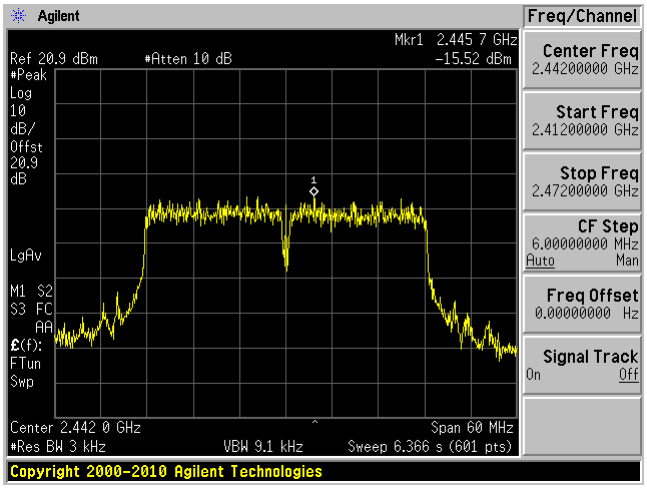


802.11n40 mode

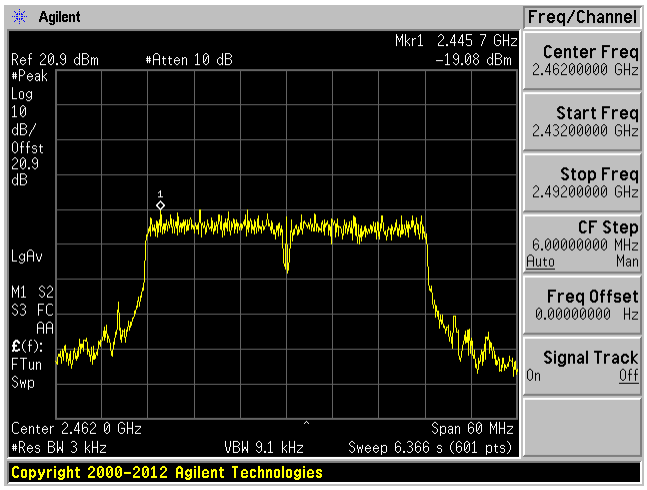
Low Channel 2422 MHz



Middle Channel 2442 MHz



High Channel 2462 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	US 42221851	2016-06-10	1 year
-	RF Cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: 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:	22º C
Relative Humidity:	40 %
ATM Pressure:	101.8 KPa

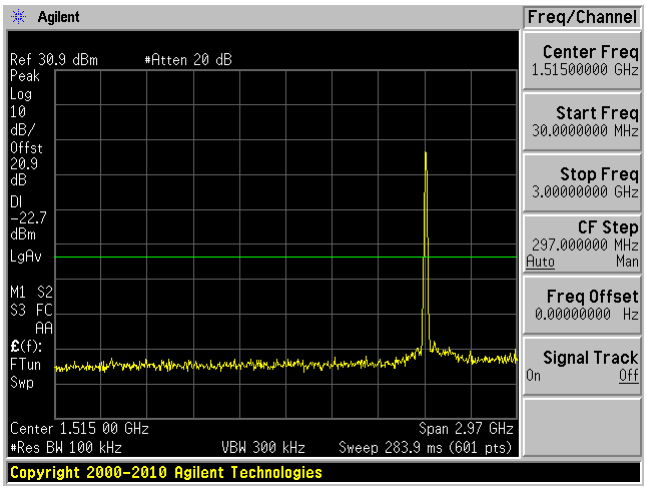
The testing was performed by Rudy Sun on 2017-01-20 in RF site.

12.5 Test Results

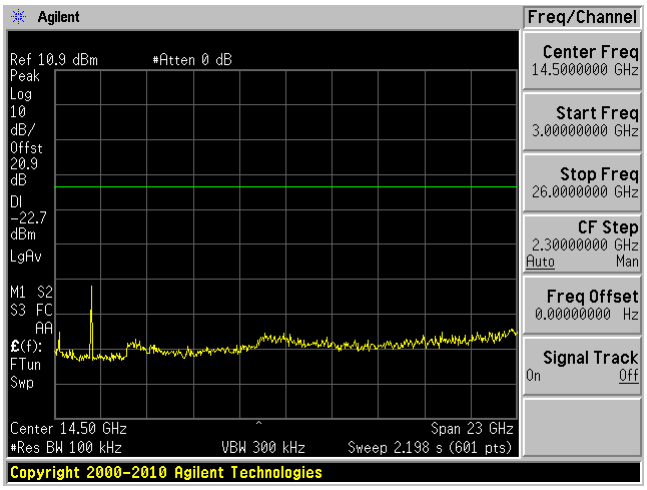
Please refer to following plots.

802.11b mode

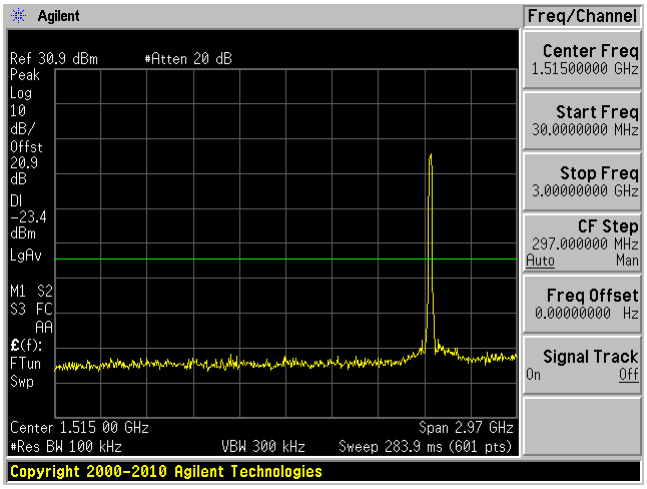
Low Channel 30MHz – 3 GHz



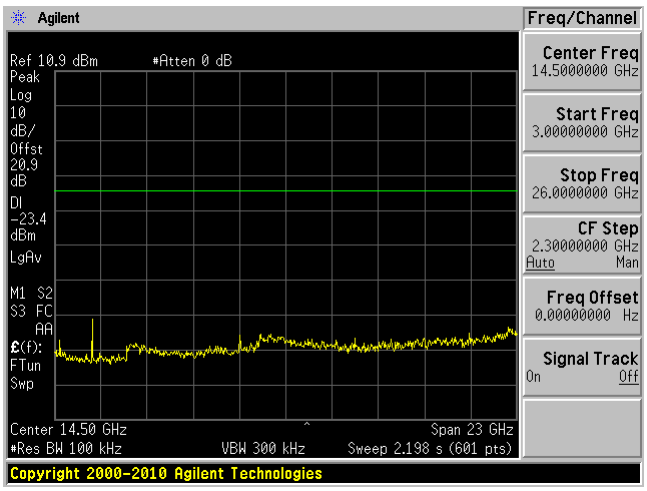
Low Channel 3 GHz – 26 GHz



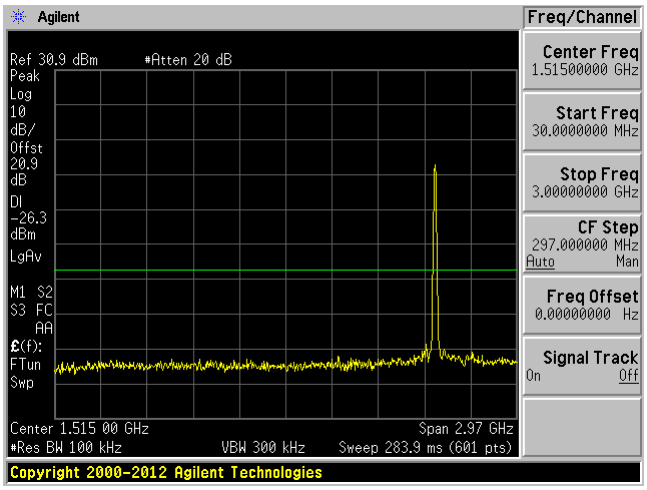
Middle Channel 30 MHz – 3 GHz



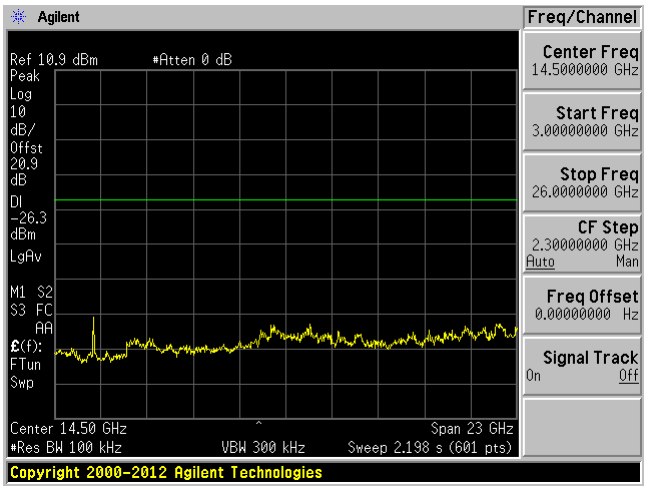
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

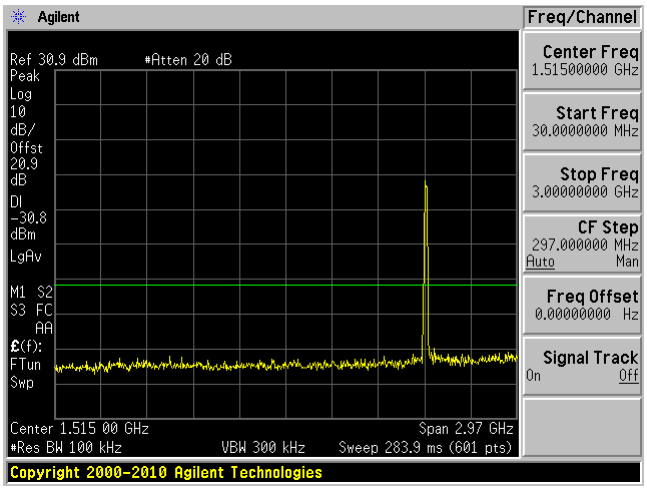


High Channel 3 GHz – 26 GHz

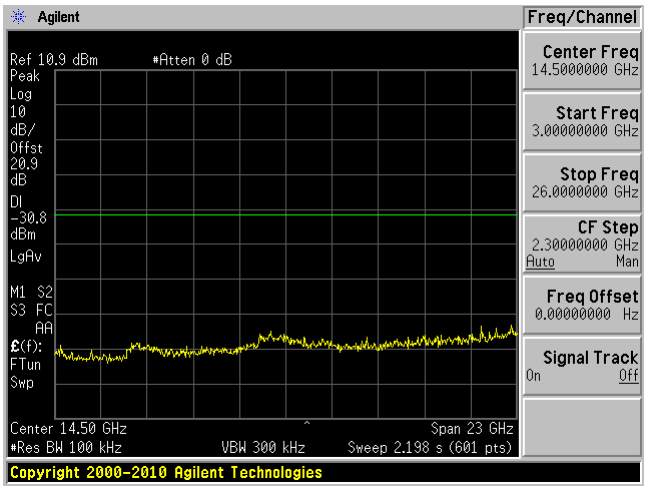


802.11g mode

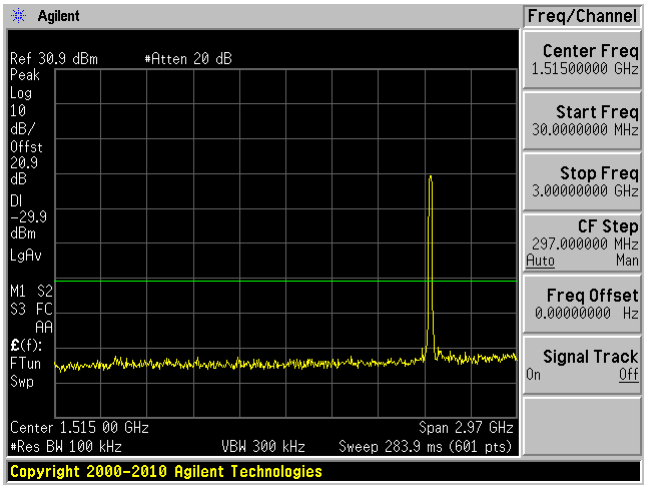
Low Channel 30 MHz – 3 GHz



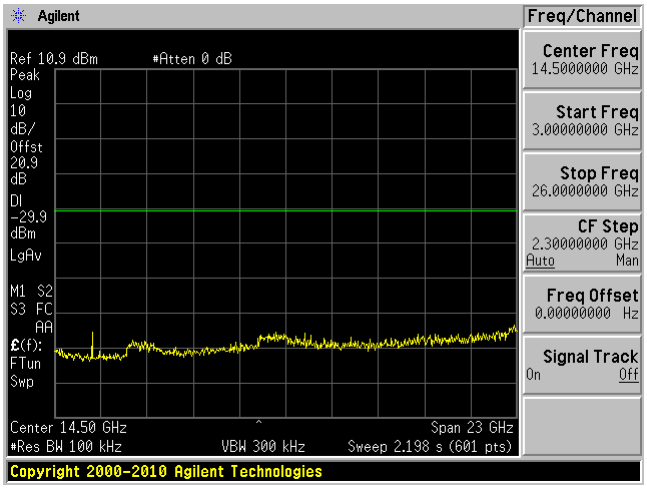
Low Channel 3 GHz – 26 GHz



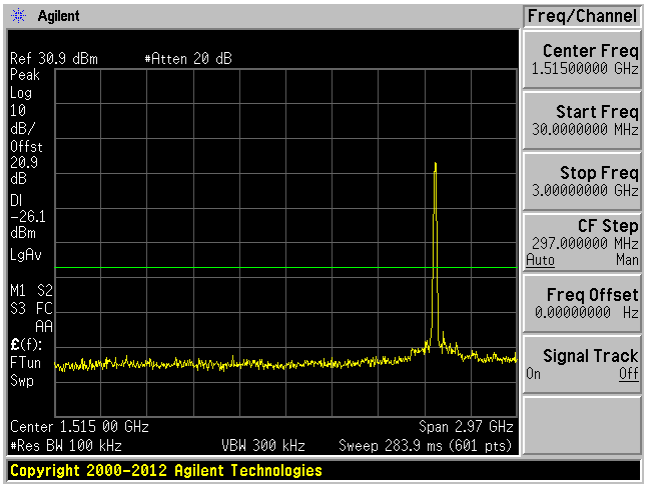
Middle Channel 30 MHz – 3 GHz



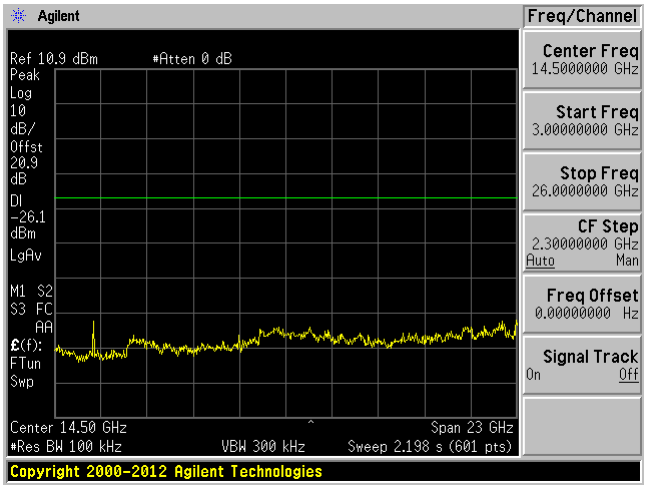
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

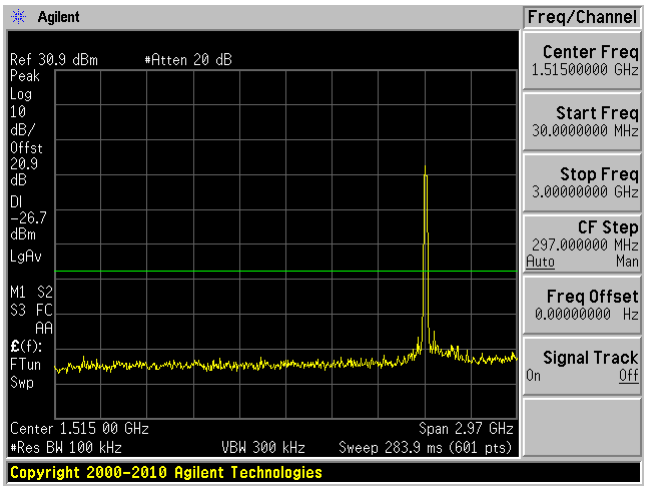


High Channel 3 GHz – 26 GHz

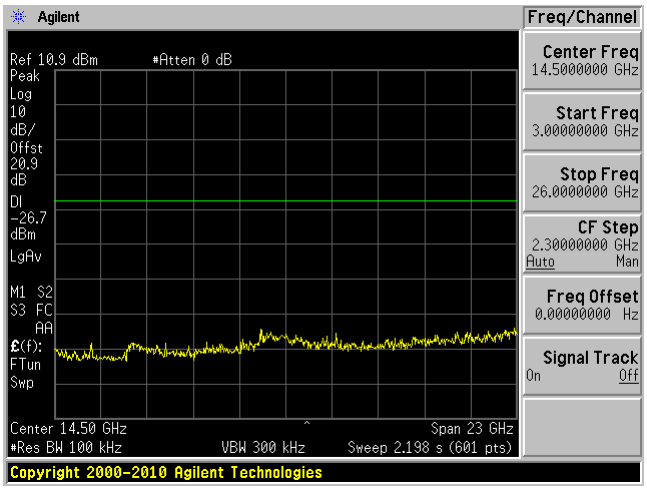


802.11n20 mode

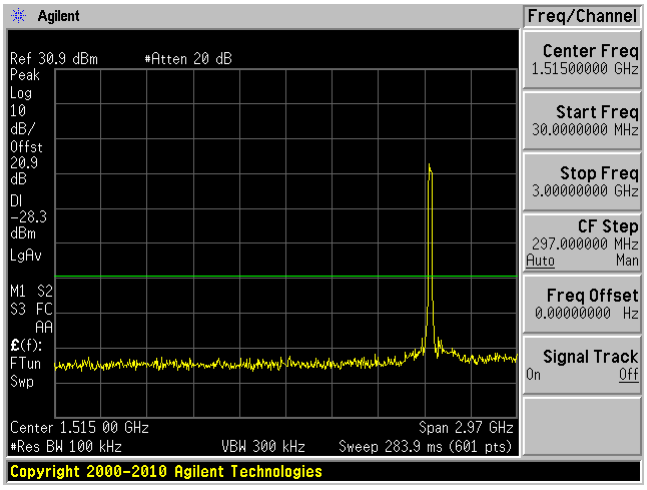
Low Channel 30 MHz – 3 GHz



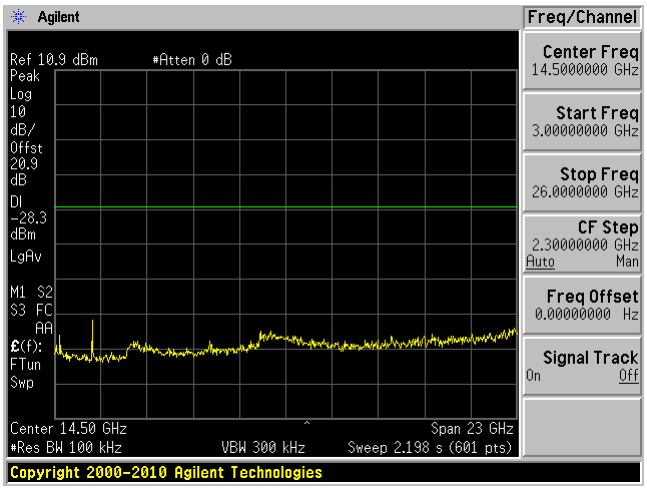
Low Channel 3 GHz – 26 GHz



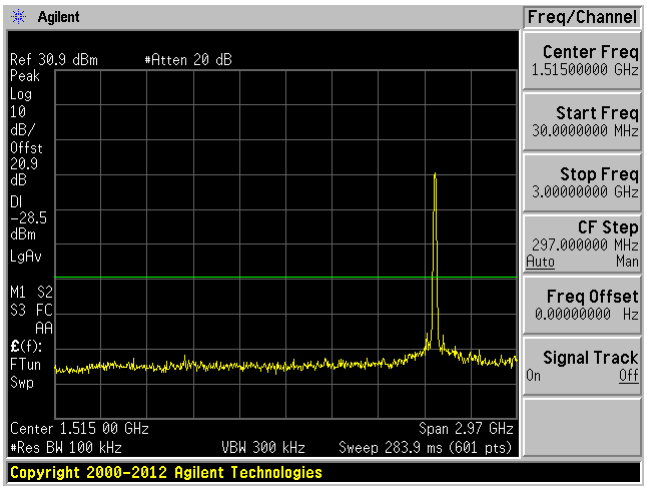
Middle Channel 30 MHz – 3 GHz



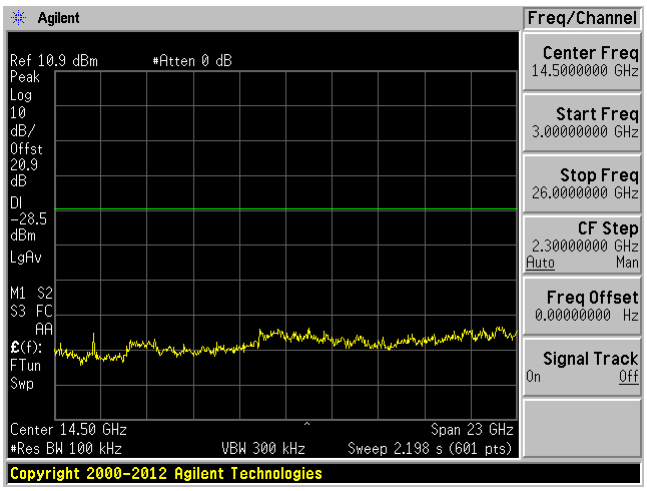
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

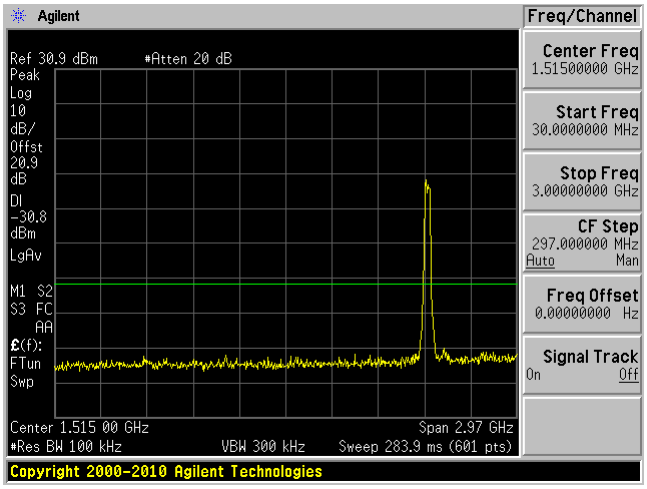


High Channel 3 GHz – 26 GHz

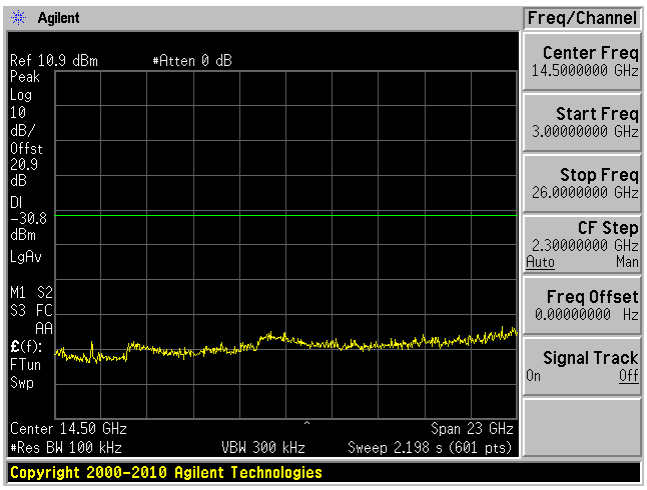


802.11n40 mode

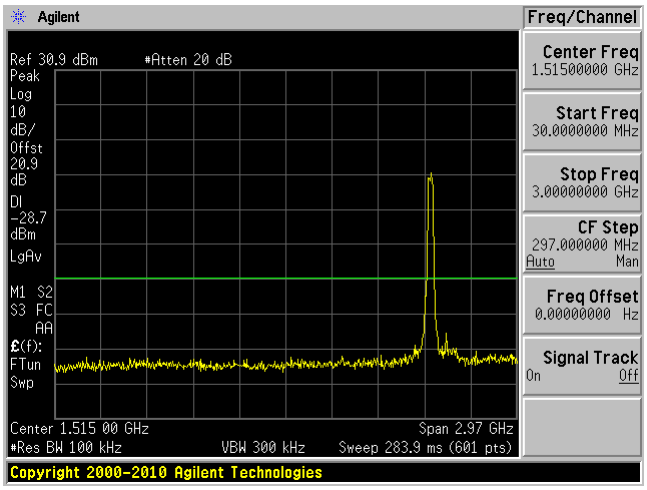
Low Channel 30 MHz – 3 GHz



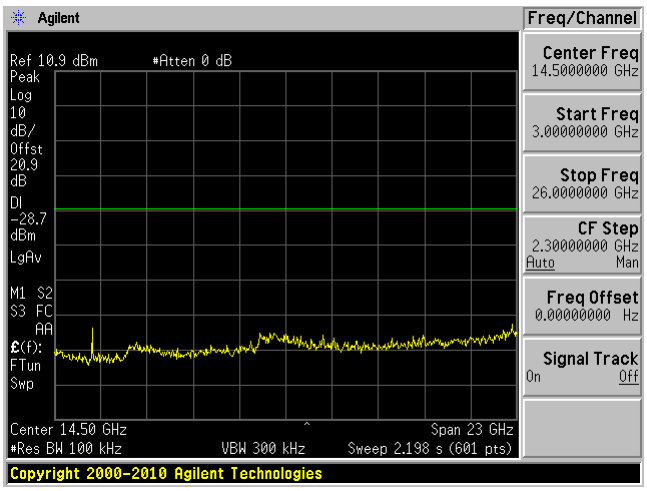
Low Channel 3 GHz – 26 GHz



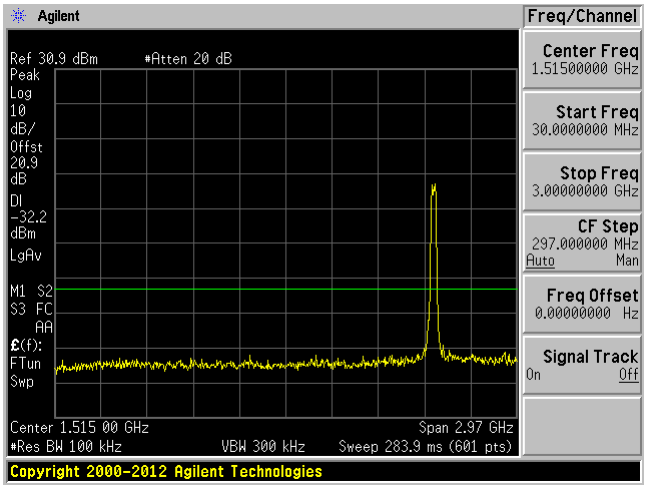
Middle Channel 30 MHz – 3 GHz



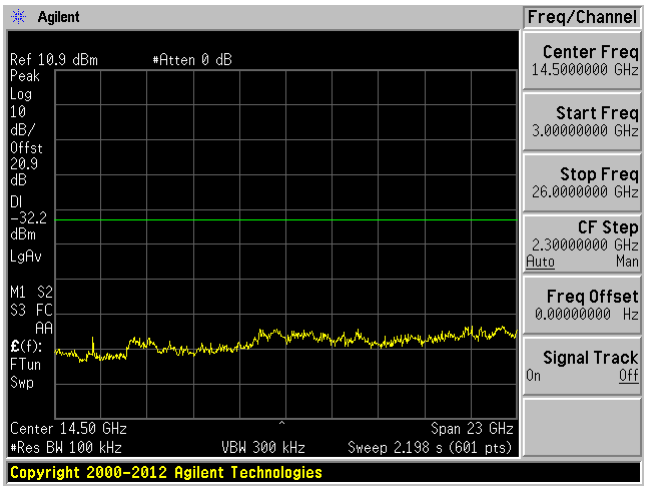
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz



High Channel 3 GHz – 26 GHz



--- END OF REPORT ---