FCC PART 15, SUBPART C
ISED RSS-247, ISSUE 2, FEBRUARY 2017

TEST AND MEASUREMENT REPORT

For

Intel Corporation

2200 Mission College Blvd.,

Santa Clara, CA 95054, USA

FCC ID: 2AB8ZND26
IC: 1000X-ND26

Report Type:	**Product Type:**
Original Report	Smart Watch

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Report Number:	R1705182-247 (Wi-Fi + BLE)
Report Date:	2017-06-23
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* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*"

TABLE OF CONTENTS

1 General Description 5
1.1 Product Description for Equipment Under Test (EUT) 5
1.2 Mechanical Description of EUT 5
1.3 Objective 5
1.4 Related Submittal(s)/Grant(s) 5
1.5 Test Methodology 5
1.6 Measurement Uncertainty 6
1.7 Test Facility Registrations 6
1.8 Test Facility Accreditations 7
2 System Test Configuration 9
2.1 Justification 9
2.2 EUT Exercise Software 9
2.3 Duty Cycle Correction Factor 9
2.4 Equipment Modifications 11
2.5 Local Support Equipment 11
2.6 Support Equipment 11
2.7 Interface Ports and Cabling 11
3 Summary of Test Results 12
4 FCC §15.203 and ISED RSS-Gen §8.3 - Antenna Requirements 13
4.1 Applicable Standards 13
4.2 Antenna Description 13
5 FCC §2.1093, §15.247(i) and ISED RSS-102 - RF Exposure 14
5.1 Applicable Standards 14
5.2 Test Results 14
6 FCC §15.207 and ISED RSS-Gen §8.8 - AC Line Conducted Emissions 15
6.1 Applicable Standards 15
6.2 Test Setup 15
6.3 Test Procedure 15
6.4 Corrected Amplitude and Margin Calculation 16
6.5 Test Setup Block Diagram 16
6.6 Test Equipment List and Details 17
6.7 Test Environmental Conditions 17
6.8 Summary of Test Results 18
6.9 Conducted Emissions Test Plots and Data 19
7 FCC §15.209, §15.247(d) and ISED RSS-247 §5.5, RSS-Gen §8.9, §8.10 - Spurious Radiated Emissions 23
7.1 Applicable Standards 23
7.2 Test Setup 25
7.3 Test Procedure 25
7.4 Corrected Amplitude and Margin Calculation 25
7.5 Test Equipment List and Details 26
7.6 Test Environmental Conditions 26
7.7 Summary of Test Results 27
7.8 Radiated Emissions Test Results 28
8 FCC §15.247(a) (2) and ISED RSS-247 §5.2 - Emission Bandwidth 34
8.1 Applicable Standards 34
8.2 Measurement Procedure 34
8.3 Test Equipment List and Details 34
8.4 Test Environmental Conditions 34
8.5 Test Results 35
9 FCC §15.247(b) (3) and ISED RSS-247 §5.4 (4) - RF Output Power 40
9.1 Applicable Standards 40
9.2 Measurement Procedure 40
9.3 Test Equipment List and Details 40

9.4 Test Environmental Conditions 40
9.5 Test Results 41
10 FCC §15.247(d) and ISED RSS-247 §5.5 - 100 kHz Bandwidth of Band Edges 43
10.1 Applicable Standards 43
10.2 Measurement Procedure 43
10.3 Test Equipment List and Details 43
10.4 Test Environmental Conditions 43
10.5 Test Results 44
11 FCC §15.247(e) and ISED RSS-247 §5.2(2) – Power Spectral Density 46
11.1 Applicable Standards 46
11.2 Measurement Procedure 46
11.3 Test Equipment List and Details 46
11.4 Test Environmental Conditions 46
11.5 Test Results 47
12 FCC §15.247(d) and ISED RSS-247 §5.5, RSS-Gen §8.9 - Spurious Emissions at Antenna Terminals 52
12.1 Applicable Standards 52
12.2 Test Procedure 52
12.3 Test Equipment List and Details 52
12.4 Test Environmental Conditions 52
12.5 Test Results 53
13 Annex A (Normative) - FCC and ISED Equipment Labeling Requirements 61
13.1 FCC ID Label Requirements 61
13.2 ISED Label Requirements 62
13.3 FCC ID and ISED Label Contents and Location 63
14 Annex B (Normative) - Test Setup Photographs 64
14.1 Radiated Emission below 1 GHz Front View 64
14.2 Radiated Emission below 1 GHz Rear View 64
14.3 Radiated Emission above 1 GHz Front View 65
14.4 Radiated Emission above 1 GHz Rear View 65
14.5 AC Conducted Emissions Front View 66
14.6 AC Conducted Emissions Side View 66
14.7 Conducted Setup Photo 67
15 Annex C (Normative) - EUT Photographs 68
15.1 EUT Top View 68
15.2 EUT Bottom View 68
15.3 EUT Front View 69
15.4 EUT Rear View 69
15.5 EUT Right Side View 70
15.6 EUT Left Side View 70
15.7 EUT Open Case View 71
15.8 EUT Main Board Top View 71
15.9 EUT Main Board Bottom View w/o Battery 72
15.10 EUT Battery Top View 72
15.11 EUT Lid Bottom View 73
16 Annex D (Informative) - A2LA Electrical Testing Certificate 74

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1705182-247 (Wi-Fi + BLE)	Original Report	2017-06-23

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Intel Corporation*, and their product model: *SBF81*, FCC ID: 2AB8ZND26, IC: 1000X-ND26 or the "EUT" as referred to in this report. It is a smart watch with Wi-Fi, NFC, Bluetooth Classic, and Bluetooth Low Energy functions.

1.2 Mechanical Description of EUT

The EUT measures approximately 4.7625 cm (L) x 4.445 cm (W) x 1.5875 cm (H) and weight 0.052 kg.

The test data gathered are from typical production sample, serial number: SCDV15HR716000H and SCDV1EHR7160006 assigned by Intel Corporation.

1.3 Objective

This report is prepared on behalf of *Intel Corporation.*, in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commission's rules and ISEDC RSS-247 Issue 2, FEBRUARY 2017.

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

FCC Part 15, Subpart C, Equipment DSS with FCC ID: 2AB8ZND26, IC: 1000X-ND26
FCC Part 15, Subpart C, Equipment DXX with FCC ID: 2AB8ZND26, IC: 1000X-ND26

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 v04: 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 and Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime and 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 and 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 and 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 and Teleterminal Equipment (RandTTE) Directive 1995/5/EC
    US -EU EMC and Telecom MRA CAB
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA)
  APEC Tel MRA -Phase I and 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 and 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 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 the Android Debug Bridge program and the command lines were provided by *Intel Corporation.* The software is compliant with the standard requirements being tested against.

2.3 Duty Cycle Correction Factor

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

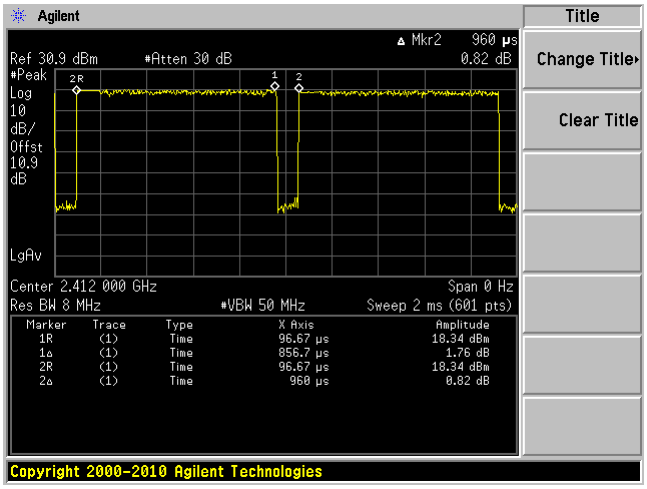
Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be utilized 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	0.8567	0.96	89.24	0.49
802.11g	0.179	0.281	63.70	1.96
802.11n20	0.166	0.268	61.94	2.08
BLE	0.3872	0.6248	61.97	2.08

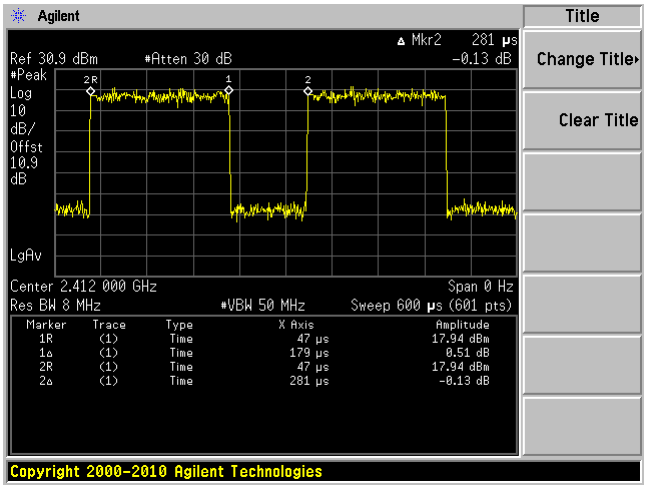
Duty Cycle = On Time (ms)/ Period (ms)
Duty Cycle Correction Factor (dB) = 10*log(1/Duty Cycle)

Please refer to the following plots.

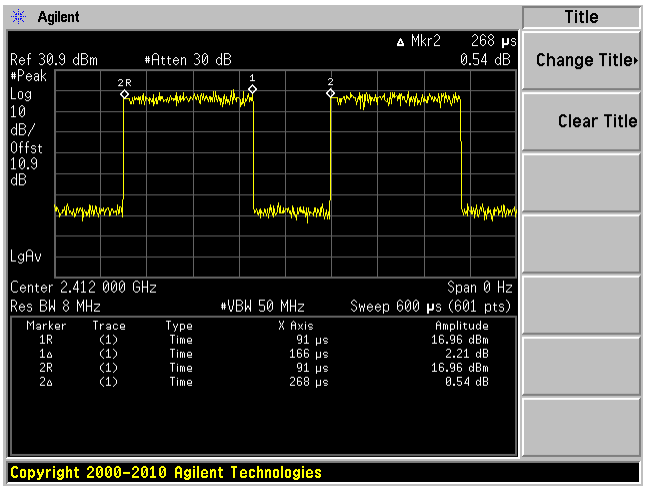
802.11b mode



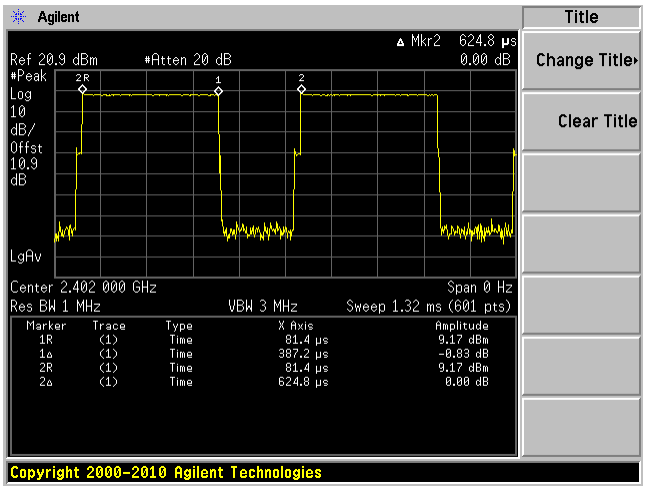
802.11g mode



802.11n20 mode



BLE



2.4 Equipment Modifications

N/A

2.5 Local Support Equipment

Manufacturer	Description	Model
Lenovo	Laptop	20332

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
Micro USB Cable	< 1 m	Laptop	EUT
RF Cable	< 1 m	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

FCC and ISED Rules	Description of Test	Results
FCC §15.203 ISED RSS-Gen §8.3	Antenna Requirement	Compliant
FCC §15.207 ISED RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §2.1093, §15.247(i) ISED RSS-102	RF Exposure	Compliant[1]
FCC §2.1051, §15.247 (d) ISED RSS-247 §5.5	Spurious Emissions at Antenna Port	Compliant
FCC §2.1053, §15.205, §15.209, §15.247 (d) ISED RSS-247 §5.5 RSS-Gen §8.9 and §8.10	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) ISED RSS-247 §5.2 (1)	6 dB and 99% Emission Bandwidth	Compliant
FCC §15.247(b)(3) ISED RSS-247 §5.4 (4)	RF Output Power	Compliant
FCC §15.247(d) ISED RSS-247 §5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(e) ISED RSS-247 §5.2 (2)	Power Spectral Density	Compliant

Note[1]: RF exposure analysis is covered in a separate report.

4 FCC §15.203 and ISED RSS-Gen §8.3 - 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.

According to ISED RSS-Gen §8.3: Transmitter Antenna

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the license-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

License-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the license-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. [9] When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

4.2 Antenna Description

The antennas used by the EUT are permanent attached antennas.

Radio Antenna	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
Wi-Fi/Bluetooth	2400-2483.5	-7.432

5 FCC §2.1093, §15.247(i) and ISED RSS-102 - RF Exposure

5.1 Applicable Standards

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

5.2 Test Results

Please refer to the SAR Report: R1705182-SAR.

6 FCC §15.207 and ISED RSS-Gen §8.8 - AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 and ISED RSS-Gen §8.8 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 and ISED RSS-Gen §8.8 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:

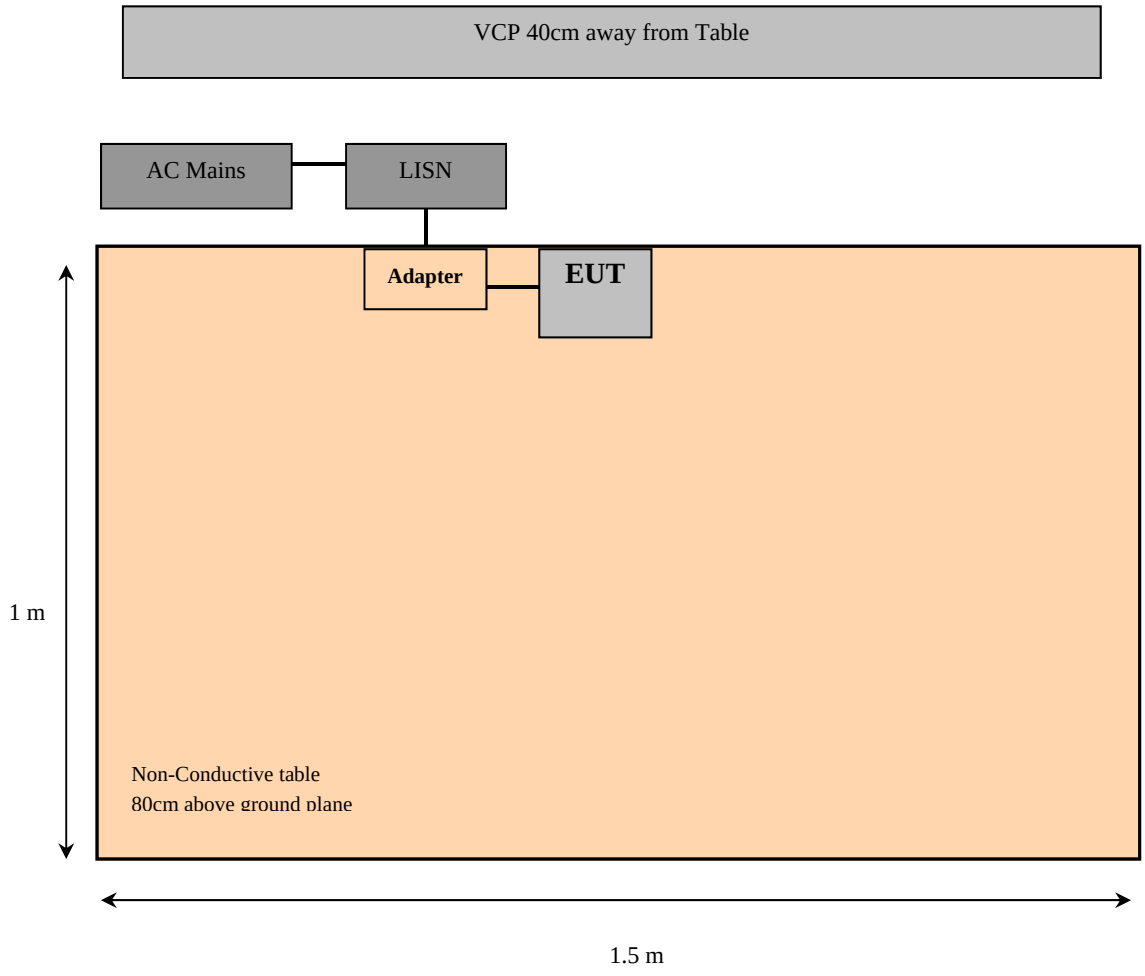
CA = Ai + CL + Atten

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 and Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2 years
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101964	2016-07-22	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2017-03-09	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	2017-03-05	1 year
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160131	2017-04-25	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:	22º C
Relative Humidity:	42 %
ATM Pressure:	102 kPa

The testing was performed by Frank Wang on 2017-05-29 in site.

6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15C and ISED RSS-Gen 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)**
-4.93	0.531758	Line	0.15-30

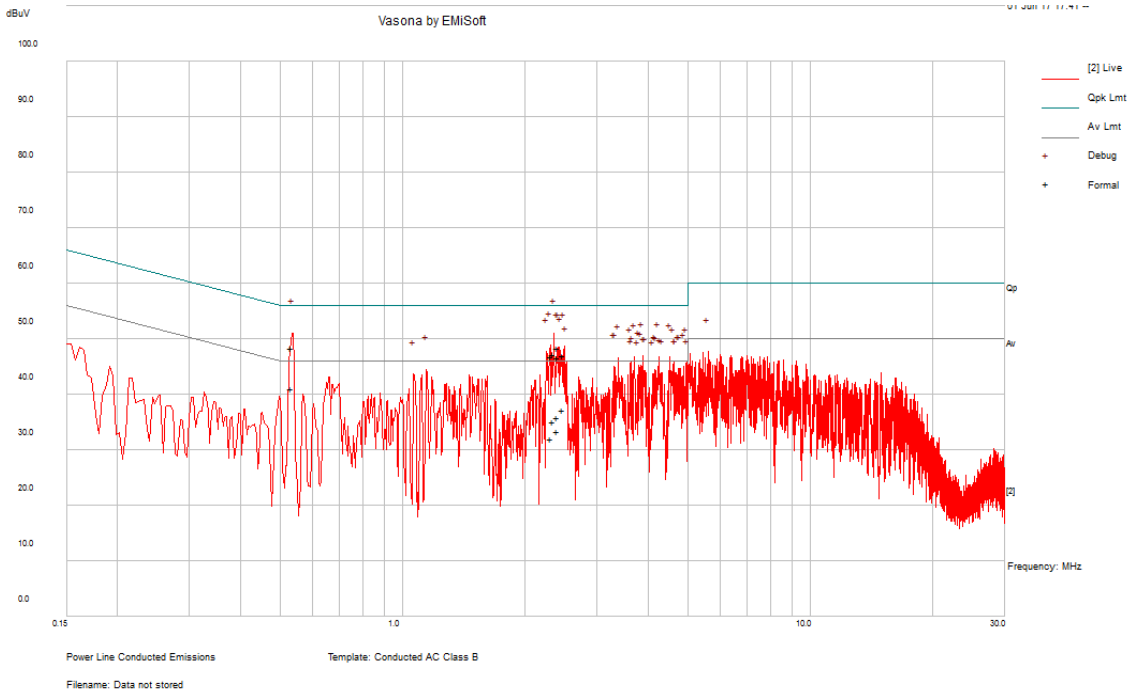
BLE

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-10.06	0.546979	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

2.4 GHz Wi-Fi

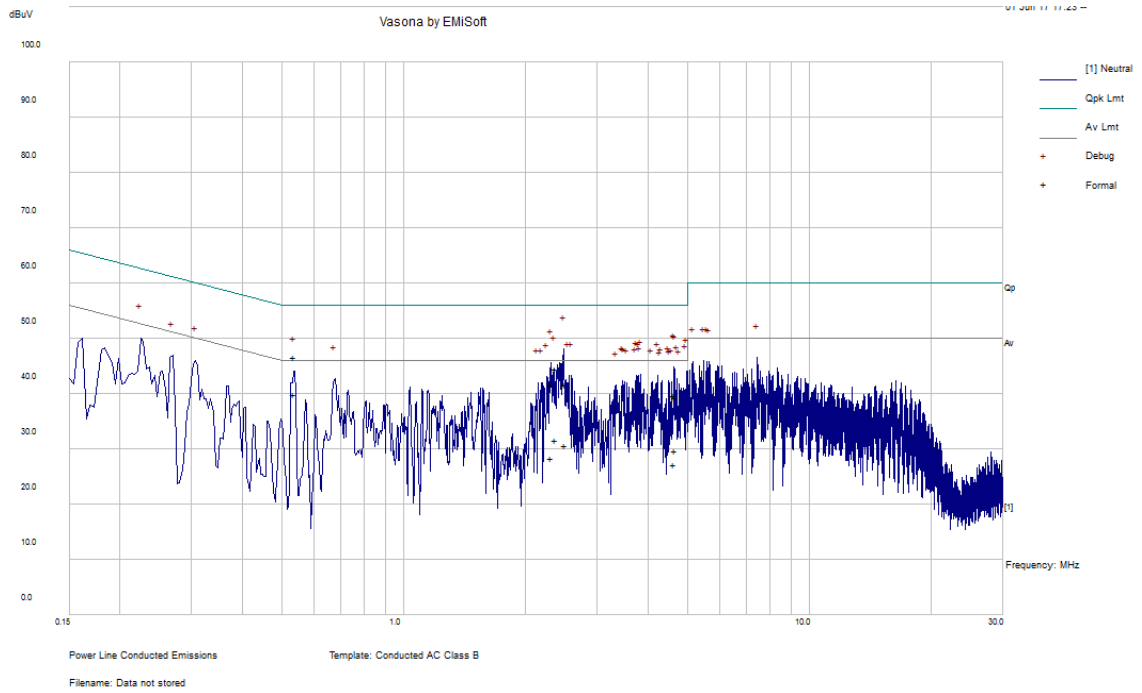
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
2.33736	47.28	Line	56	-8.72	QP
0.531758	48.39	Line	56	-7.61	QP
2.308002	46.91	Line	56	-9.09	QP
2.472695	47.05	Line	56	-8.95	QP
2.40374	46.67	Line	56	-9.33	QP
2.389727	48.42	Line	56	-7.58	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
2.33736	35.14	Line	46	-10.86	Ave.
0.531758	41.07	Line	46	**-4.93**	Ave.
2.308002	32.1	Line	46	-13.9	Ave.
2.472695	37.26	Line	46	-8.74	Ave.
2.40374	33.35	Line	46	-12.65	Ave.
2.389727	35.81	Line	46	-10.19	Ave.

120 V, 60 Hz – Neutral

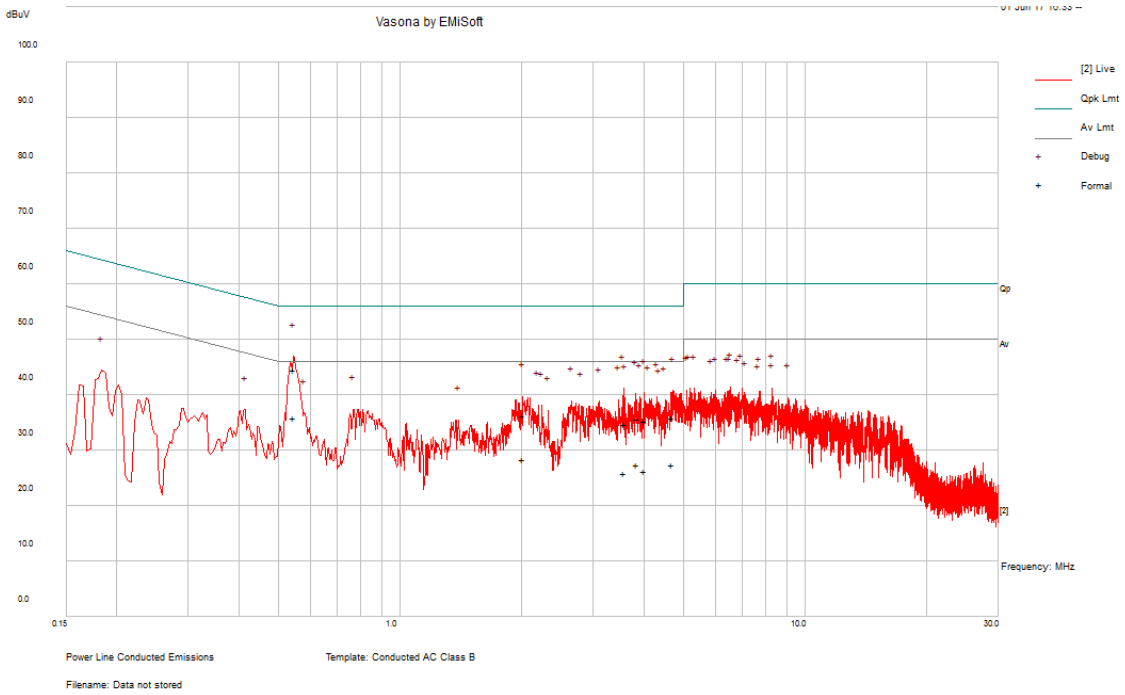


Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
2.49891	41.68	Neutral	56	-14.32	QP
2.313395	41.58	Neutral	56	-14.42	QP
4.626328	39.77	Neutral	56	-16.23	QP
4.662188	39.42	Neutral	56	-16.58	QP
2.368307	44.51	Neutral	56	-11.49	QP
0.537284	46.7	Neutral	56	-9.3	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
2.49891	30.69	Neutral	46	-15.31	Ave.
2.313395	28.42	Neutral	46	-17.58	Ave.
4.626328	27.32	Neutral	46	-18.68	Ave.
4.662188	29.67	Neutral	46	-16.33	Ave.
2.368307	31.69	Neutral	46	-14.31	Ave.
0.537284	39.88	Neutral	46	-6.12	Ave.

BLE

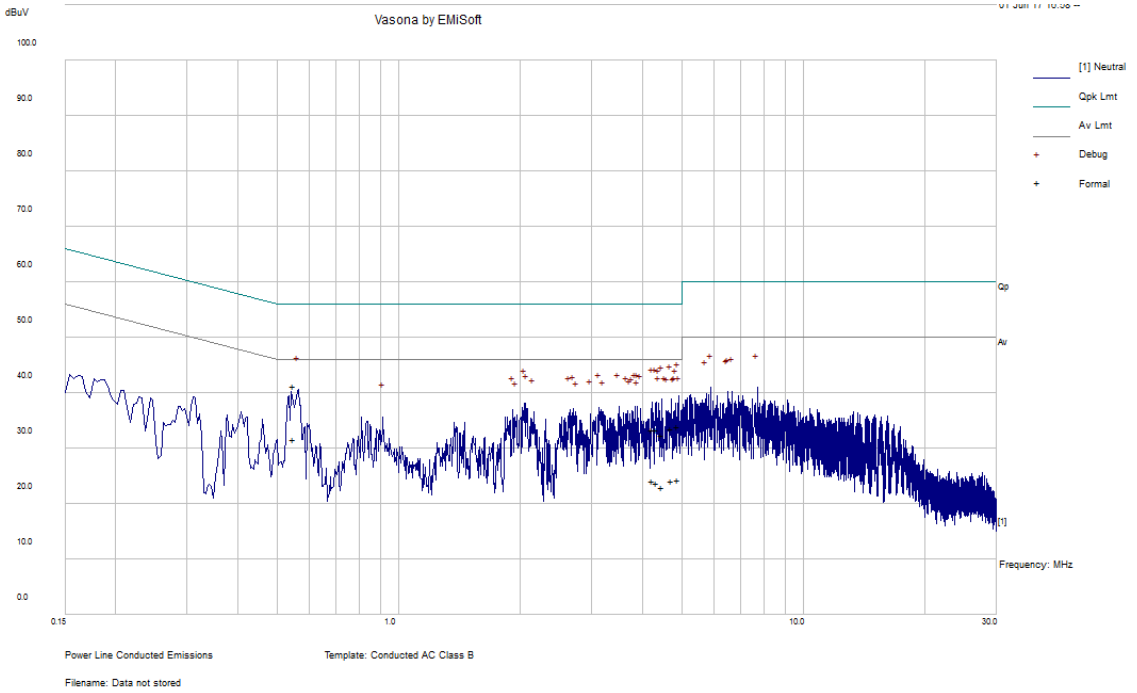
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.546979	44.59	Line	56	-11.41	QP
3.572435	34.68	Line	56	-21.32	QP
4.698073	35.86	Line	56	-20.14	QP
4.021812	35.29	Line	56	-20.71	QP
3.834378	35.61	Line	56	-20.39	QP
2.012121	36.28	Line	56	-19.72	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.546979	35.94	Line	46	**-10.06**	Ave.
3.572435	25.88	Line	46	-20.12	Ave.
4.698073	27.41	Line	46	-18.59	Ave.
4.021812	26.22	Line	46	-19.78	Ave.
3.834378	27.37	Line	46	-18.63	Ave.
2.012121	28.39	Line	46	-17.61	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.549005	41.2	Neutral	56	-14.8	QP
4.911131	33.91	Neutral	56	-22.09	QP
4.71419	33.65	Neutral	56	-22.35	QP
4.475829	32.35	Neutral	56	-23.65	QP
4.334106	33.32	Neutral	56	-22.68	QP
4.246685	33.33	Neutral	56	-22.67	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.549005	31.66	Neutral	46	-14.34	Ave.
4.911131	24.3	Neutral	46	-21.7	Ave.
4.71419	24.27	Neutral	46	-21.73	Ave.
4.475829	23.09	Neutral	46	-22.91	Ave.
4.334106	23.77	Neutral	46	-22.23	Ave.
4.246685	24.18	Neutral	46	-21.82	Ave.

7 FCC §15.209, §15.247(d) and ISED RSS-247 §5.5, RSS-Gen §8.9, §8.10 - 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		
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).

As per ISED RSS-Gen 8.9,

> Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µv/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for license-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

As per ISED RSS-247 §5.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

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 and ISED RSS-247 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 > 1/*T* Hz / Sweep = Auto

Where *T* is the period of the transmitting signal

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:

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 and Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2 year
Agilent	Analyzer, Spectrum	E4446A	US44300386	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
Agilent	Amplifier, Pre	8447D	2944A10187	2016-06-28	1 year
IW	Armored High Frequency Cable	DC 1531	KPS-1501A3960KPS	2016-08-05	1 year
-	SMA cable	-	C0002	Each time[1]	Each time[1]
-	N-Type Cable	-	C00014	2017-05-28	1 year
Agilent	Pre-Amplifier	8449B	3008A01978	2017-03-23	1 year
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2015-10-22	2 years
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:	20-22 ºC
Relative Humidity:	42-46 %
ATM Pressure:	102 kPa

The testing was performed by Frank Wang from 2017-05-29 to 2017-06-05 in 5m chamber 3.

7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with FCC Title 47, Part 15C and ISED RSS-247 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)**	Scan range
-0.02	959.9915	Horizontal	30 MHz – 25 GHz

BLE

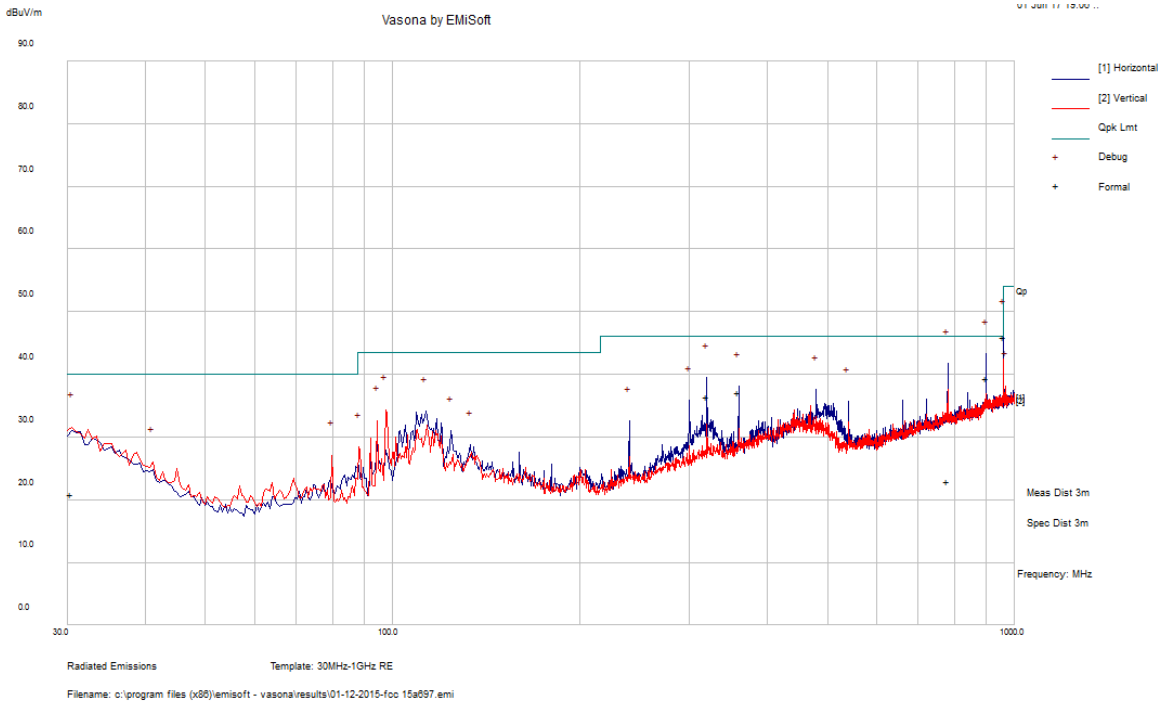
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Scan range**
-3.79	2483.5	Vertical	30 MHz – 25 GHz

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

7.8 Radiated Emissions Test Results

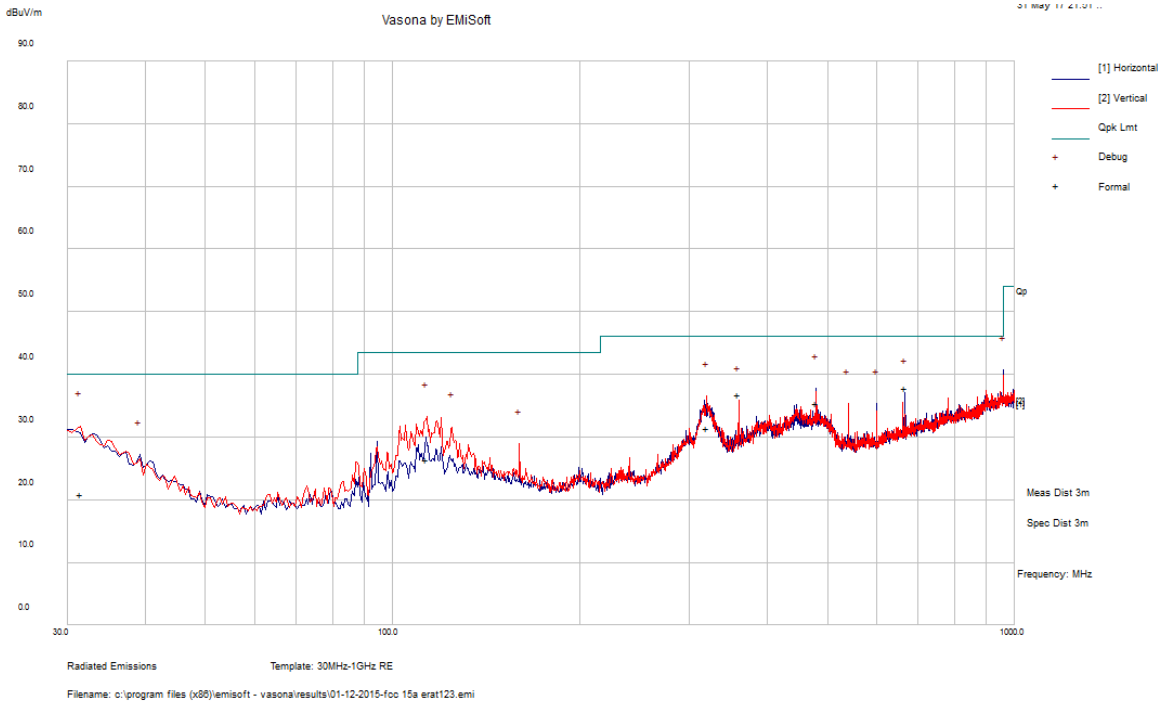
1) 30 MHz – 1 GHz Worst Case, Measured at 3 meters

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
899.9903	39.44	107	H	155	46	-6.56	QP
780.3713	22.91	182	H	16	46	-23.09	QP
319.968	36.44	101	H	286	46	-9.56	QP
959.9915	45.98	101	H	139	46	**-0.02**	QP
360.014	37.11	101	H	155	46	-8.89	QP
30.36125	20.88	154	V	100	40	-19.12	QP

BLE



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
479.968	35.44	101	H	227	46	-10.56	QP
31.54025	20.82	123	V	123	40	-19.18	QP
666.6485	37.91	131	H	259	46	-8.09	QP
319.9493	31.44	100	V	249	46	-14.56	QP
360.0105	36.89	101	V	275	46	-9.11	QP
113.199	26.38	296	V	0	43.5	-17.12	QP

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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/ISED		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	72.17	123	211	H	29.042	6.29	0	107.502	-	-	PK
2412	65.54	123	211	H	29.042	6.29	0	100.872	-	-	AV
2412	70.42	180	150	V	29.042	6.29	0	105.752	-	-	PK
2412	63.71	180	150	V	29.042	6.29	0	99.042	-	-	AV
2390	27.37	0	100	H	29.042	6.29	0	62.702	74	-11.298	PK
2390	16.52	0	100	H	29.042	6.29	0	51.852	54	-2.148	AV
2390	26.87	0	100	V	29.042	6.29	0	62.202	74	-11.798	PK
2390	17.21	0	100	V	29.042	6.29	0	52.542	54	-1.458	AV
4824	53.75	127	214	H	32.472	8.416	38.56	56.078	74	-17.922	PK
4824	42.26	127	214	H	32.472	8.416	38.56	44.588	54	-9.412	AV
7236	47.2	0	100	H	36.69	10.211	37.9	56.201	74	-17.799	PK
7236	32.8	0	100	H	36.39	10.211	37.9	41.501	54	-12.499	AV
9648	47.35	0	100	H	37.77	11.621	38.29	58.451	74	-15.549	PK
9648	33.38	0	100	H	37.77	11.621	38.29	44.481	54	-9.519	AV
Middle Channel 2437 MHz											
2437	69.57	123	300	H	29.042	6.29	0	104.902	-	-	PK
2437	61.98	123	300	H	29.042	6.29	0	97.312	-	-	AV
2437	69.94	184	253	V	29.042	6.29	0	105.272	-	-	PK
2437	61.28	184	253	V	29.042	6.29	0	96.612	-	-	AV
4874	58.56	174	165	V	32.64	8.416	38.54	61.076	74	-12.924	PK
4874	46.6	174	165	V	32.64	8.416	38.54	49.116	54	-4.884	AV
7311	47.51	0	100	V	37.148	10.211	37.9	56.969	74	-17.031	PK
7311	33	0	100	V	37.148	10.211	37.9	42.459	54	-11.541	AV
9748	47.82	0	100	V	37.92	11.621	38.29	59.071	74	-14.929	PK
9748	33.3	0	100	V	37.92	11.621	38.29	44.551	54	-9.449	AV
High Channel 2462 MHz											
2462	70.55	124	300	H	29.413	6.29	0	106.253	-	-	PK
2462	61.77	124	300	H	29.413	6.29	0	97.473	-	-	AV
2462	71.25	187	239	V	29.413	6.29	0	106.953	-	-	PK
2462	63.39	187	239	V	29.413	6.29	0	99.093	-	-	AV
2483.5	27.69	0	100	H	29.413	6.29	0	63.393	74	-10.607	PK
2483.5	13.4	0	100	H	29.413	6.29	0	49.103	54	-4.897	AV
2483.5	27.65	0	100	V	29.413	6.29	0	63.353	74	-10.647	PK
2483.5	13.56	0	100	V	29.413	6.29	0	49.263	54	-4.737	AV
4924	55.72	170	100	V	32.64	8.416	38.54	58.236	74	-15.764	PK
4924	44	170	100	V	32.64	8.416	38.54	46.516	54	-7.484	AV
7386	47.14	0	100	V	37.139	10.211	37.89	56.6	74	-17.4	PK
7386	33	0	100	V	37.139	10.211	37.89	42.46	54	-11.54	AV
9848	46.82	0	100	V	37.99	11.621	38.33	58.101	74	-15.899	PK
9848	33.19	0	100	V	37.99	11.621	38.33	44.471	54	-9.529	AV

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/ISED		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	69.48	119	300	H	29.042	6.29	0	104.812	-	-	PK
2412	57.67	119	300	H	29.042	6.29	0	93.002	-	-	AV
2412	69.54	186	280	V	29.042	6.29	0	104.872	-	-	PK
2412	60.118606	186	280	V	29.042	6.29	0	95.450	-	-	AV
2390	28.16	0	100	H	29.042	6.29	0	63.492	74	-10.508	PK
2390	13.95	0	100	H	29.042	6.29	0	49.282	54	-4.718	AV
2390	27.76	0	100	V	29.042	6.29	0	63.092	74	-10.908	PK
2390	14.4	0	100	V	29.042	6.29	0	49.732	54	-4.268	AV
4824	54.63	187	221	V	32.472	8.416	38.56	56.958	74	-17.042	PK
4824	40.45	187	221	V	32.472	8.416	38.56	42.778	54	-11.222	AV
7236	48.39	0	100	V	36.69	10.211	37.9	57.391	74	-16.609	PK
7236	33.86	0	100	V	36.39	10.211	37.9	42.561	54	-11.439	AV
9648	47.24	0	100	V	37.77	11.621	38.29	58.341	74	-15.659	PK
9648	34	0	100	V	37.77	11.621	38.29	45.101	54	-8.899	AV
Middle Channel 2437 MHz											
2437	66.03	306	141	H	29.042	6.29	0	101.362	-	-	PK
2437	54.61	306	141	H	29.042	6.29	0	89.942	-	-	AV
2437	68.21	51	149	V	29.042	6.29	0	103.542	-	-	PK
2437	56.64	51	149	V	29.042	6.29	0	91.972	-	-	AV
4874	55.47	38	247	V	32.64	8.416	38.54	57.986	74	-16.014	PK
4874	41.8	38	247	V	32.64	8.416	38.54	44.316	54	-9.684	AV
7311	47.32	0	100	V	37.148	10.211	37.9	56.779	74	-17.221	PK
7311	34.18	0	100	V	37.148	10.211	37.9	43.639	54	-10.361	AV
9748	47.25	0	100	V	37.92	11.621	38.29	58.501	74	-15.499	PK
9748	34.45	0	100	V	37.92	11.621	38.29	45.701	54	-8.299	AV
High Channel 2462 MHz											
2462	67.82	296	114	H	29.413	6.29	0	103.523	-	-	PK
2462	56.28	296	114	H	29.413	6.29	0	91.983	-	-	AV
2462	67.87	347	161	V	29.413	6.29	0	103.573	-	-	PK
2462	55.84	347	161	V	29.413	6.29	0	91.543	-	-	AV
2483.5	29.64	300	260	H	29.413	6.29	0	65.343	74	-8.657	PK
2483.5	14.47	300	260	H	29.413	6.29	0	50.173	54	-3.827	AV
2483.5	30.08	143	241	V	29.413	6.29	0	65.783	74	-8.217	PK
2483.5	14.7	143	241	V	29.413	6.29	0	50.403	54	-3.597	AV
4924	57.05	158	300	V	32.64	8.416	38.54	59.566	74	-14.434	PK
4924	42.56	158	300	V	32.64	8.416	38.54	45.076	54	-8.924	AV
7386	49.18	0	100	V	37.139	10.211	37.89	58.64	74	-15.36	PK
7386	33.88	0	100	V	37.139	10.211	37.89	43.34	54	-10.66	AV
9848	46.87	0	100	V	37.99	11.621	38.33	58.151	74	-15.849	PK
9848	34.03	0	10	V	37.99	11.621	38.33	45.311	54	-8.689	AV

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/ISED		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	65.29	10	134	H	29.042	6.29	0	100.622	-	-	PK
2412	53.45	10	134	H	29.042	6.29	0	88.782	-	-	AV
2412	66.05	335	100	V	29.042	6.29	0	101.382	-	-	PK
2412	54.88	335	100	V	29.042	6.29	0	90.212	-	-	AV
2390	27.31	0	100	H	29.042	6.29	0	62.642	74	-11.358	PK
2390	13.68	0	100	H	29.042	6.29	0	49.012	54	-4.988	AV
2390	27.15	0	100	V	29.042	6.29	0	62.482	74	-11.518	PK
2390	14	0	100	V	29.042	6.29	0	49.332	54	-4.668	AV
4824	50.53	346	142	V	32.472	8.416	38.56	52.858	74	-21.142	PK
4824	36.73	346	142	V	32.472	8.416	38.56	39.058	54	-14.942	AV
7236	46.42	0	100	V	36.69	10.211	37.9	55.421	74	-18.579	PK
7236	33.64	0	100	V	36.39	10.211	37.9	42.341	54	-11.659	AV
9648	46.99	0	100	V	37.77	11.621	38.29	58.091	74	-15.909	PK
9648	34.28	0	100	V	37.77	11.621	38.29	45.381	54	-8.619	AV
Middle Channel 2437 MHz											
2437	69.76	230	300	H	29.042	6.29	0	105.092	-	-	PK
2437	60.45	230	300	H	29.042	6.29	0	95.782	-	-	AV
2437	69.96	123	170	V	29.042	6.29	0	105.292	-	-	PK
2437	60.69	123	170	V	29.042	6.29	0	96.022	-	-	AV
4874	57.59	176	300	V	32.64	8.416	38.54	60.106	74	-13.894	PK
4874	45.63	176	300	V	32.64	8.416	38.54	48.146	54	-5.854	AV
7311	46.36	0	100	V	37.148	10.211	37.9	55.819	74	-18.181	PK
7311	35.76	0	100	V	37.148	10.211	37.9	45.219	54	-8.781	AV
9748	47.38	0	100	V	37.92	11.621	38.29	58.631	74	-15.369	PK
9748	36.31	0	100	V	37.92	11.621	38.29	47.561	54	-6.439	AV
High Channel 2462 MHz											
2462	70.03	217	295	H	29.413	6.29	0	105.733	-	-	PK
2462	61.78	217	295	H	29.413	6.29	0	97.483	-	-	AV
2462	70.3	114	195	V	29.413	6.29	0	106.003	-	-	PK
2462	61.14	114	195	V	29.413	6.29	0	96.843	-	-	AV
2483.5	62.45	227	291	H	29.413	6.29	39.466	58.687	74	-15.313	PK
2483.5	45.91	227	291	H	29.413	6.29	39.466	42.147	54	-11.853	AV
2483.5	64.39	208	100	V	29.413	6.29	39.466	60.627	74	-13.373	PK
2483.5	48.4	208	100	V	29.413	6.29	39.466	44.637	54	-9.363	AV
4924	57.70	33	165	V	32.64	8.42	38.54	60.22	74.00	-13.78	PK
4924	45.36	33	165	V	32.64	8.42	38.54	47.88	54.00	-6.12	AV
7386	46.85	0	100	V	37.14	10.21	37.89	56.31	74.00	-17.69	PK
7386	36.06	0	100	V	37.14	10.21	37.89	45.52	54.00	-8.48	AV
9848	46.28	0	100	V	37.99	11.62	38.33	57.56	74.00	-16.44	PK
9848	35.98	0	100	V	37.99	11.62	38.33	47.26	54.00	-6.74	AV

BLE

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2402 MHz											
2402	68.33	284	278	H	29.04	5.19	0	102.56	-	-	PK
2402	66.34	284	278	H	29.04	5.19	0	100.57	-	-	AV
2402	63.02	0	300	V	29.04	5.19	0	97.25	-	-	PK
2402	60.91	0	300	V	29.04	5.19	0	95.14	-	-	AV
2390	27.17	0	100	H	29.04	5.19	0	61.40	74.00	-12.60	PK
2390	15.52	0	100	H	29.04	5.19	0	49.75	54.00	-4.25	AV
2390	27.07	0	100	V	29.04	5.19	0	61.30	74.00	-12.70	PK
2390	15.70	0	100	V	29.04	5.19	0	49.93	54.00	-4.07	AV
4804	47.98	0	100	H	32.47	8.71	38.56	50.60	74.00	-23.40	PK
4804	36.43	0	100	H	32.47	8.71	38.56	39.05	54.00	-14.95	AV
7206	47.20	0	100	H	36.69	11.17	37.9	57.16	74.00	-16.84	PK
7206	35.55	0	100	H	36.39	11.17	37.9	45.21	54.00	-8.79	AV
9608	47.08	0	100	H	37.77	13.41	38.29	59.97	74.00	-14.03	PK
9608	36.52	0	100	H	37.77	13.41	38.29	49.41	54.00	-4.59	AV
Middle Channel 2440 MHz											
2440	66.62	275	225	H	29.04	5.19	0.00	100.85	-	-	PK
2440	65.20	275	225	H	29.04	5.19	0.00	99.43	-	-	AV
2440	62.67	197	100	V	29.04	5.19	0.00	96.90	-	-	PK
2440	61.16	197	100	V	29.04	5.19	0.00	95.39	-	-	AV
4880	48.01	0	100	H	32.64	0.00	38.54	42.11	74.00	-31.89	PK
4880	35.87	0	100	H	32.64	0.00	38.54	29.97	54.00	-24.03	AV
7320	46.78	0	100	H	37.15	0.00	37.90	46.03	74.00	-27.97	PK
7320	34.77	0	100	H	37.15	0.00	37.90	34.02	54.00	-19.98	AV
9760	47.09	0	100	H	37.92	0.00	38.29	46.72	74.00	-27.28	PK
9760	35.48	0	100	H	37.92	0.00	38.29	35.11	54.00	-18.89	AV
High Channel 2480 MHz											
2480	65.66	302	201	H	29.41	5.19	0.00	100.26	-	-	PK
2480	63.97	302	201	H	29.41	5.19	0.00	98.57	-	-	AV
2480	59.03	159	216	V	29.41	5.19	0.00	93.63	-	-	PK
2480	56.76	159	216	V	29.41	5.19	0.00	91.36	-	-	AV
2483.5	27.16	0	100	H	29.41	5.19	0.00	61.76	74.00	-12.24	PK
2483.5	15.53	0	100	H	29.41	5.19	0.00	50.13	54.00	-3.87	AV
2483.5	27.32	0	100	V	29.41	5.19	0.00	61.92	74.00	-12.08	PK
2483.5	15.61	0	100	V	29.41	5.19	0.00	50.21	54.00	-3.79	AV
4960	49.64	0	100	H	32.64	0.00	38.54	43.74	74.00	-30.26	PK
4960	37.98	0	100	H	32.64	0.00	38.54	32.08	54.00	-21.92	AV
7440	47.45	0	100	H	37.14	0.00	37.89	46.70	74.00	-27.30	PK
7440	34.88	0	100	H	37.14	0.00	37.89	34.13	54.00	-19.87	AV
9920	46.40	0	100	H	37.99	0.00	38.33	46.06	74.00	-27.94	PK
9920	35.21	0	100	H	37.99	0.00	38.33	34.87	54.00	-19.13	AV

8 FCC §15.247(a) (2) and ISED RSS-247 §5.2 - Emission Bandwidth

8.1 Applicable Standards

According to FCC §15.247(a) (2) and ISED RSS-247 §5.2, 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	US44300386	2016-06-10	1 year
-	RF cable	-	-	Each time[1]	Each time[1]
-	10 dB attenuator	-	-	Each time[1]	Each time[1]

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:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

The testing was performed by Frank Wang on 2017-06-01 in RF site.

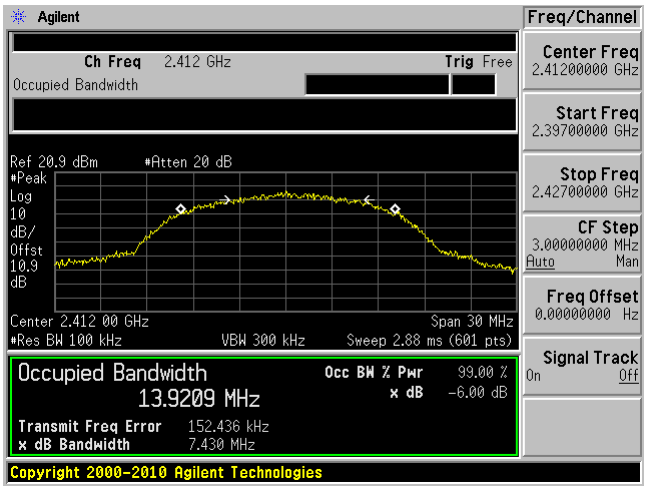
8.5 Test Results

Channel	Frequency (MHz)	99% OBW (kHz)	6 dB OBW (kHz)	Limit (kHz)
802.11b mode				
Low	2412	13920.9	7430	500
Middle	2437	13911.7	6419	500
High	2462	13896.5	9090	500
802.11g mode				
Low	2412	16223.7	15312	500
Middle	2437	16276.7	16231	500
High	2462	16274.7	15143	500
802.11n-HT20 mode				
Low	2412	17328.1	14821	500
Middle	2437	17476.9	16018	500
High	2462	17468.2	15314	500
BLE				
Low	2402	1088.4	737.050	500
Middle	2440	1102.2	685.062	500
High	2480	1092.3	668.944	500

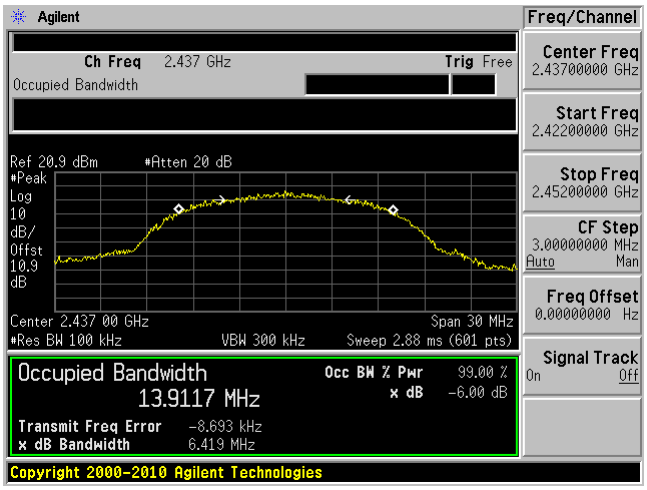
Please refer to the following plots for detailed test results.

802.11b mode

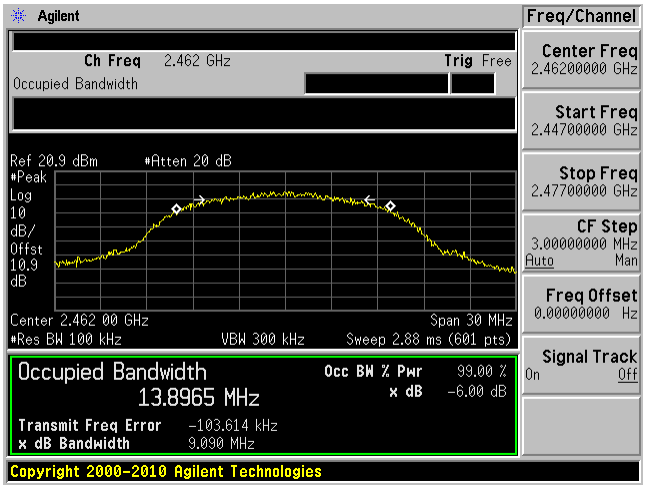
Low Channel 2412 MHz



Middle Channel 2437 MHz

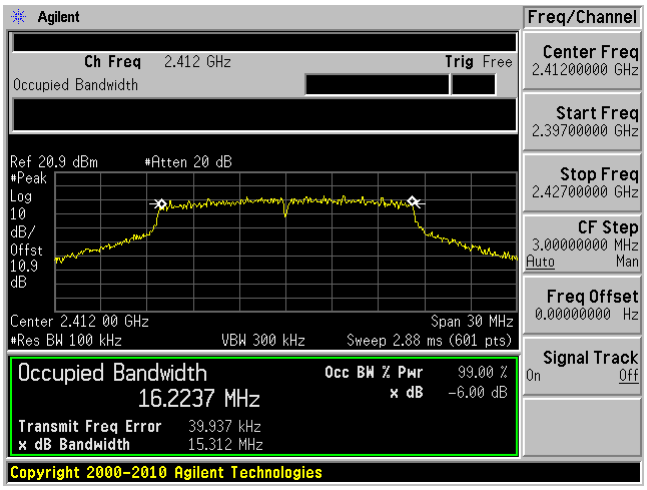


High Channel 2462 MHz

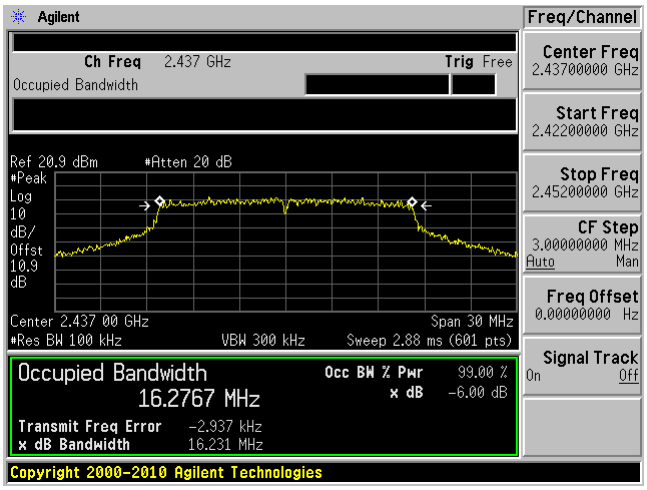


802.11g mode

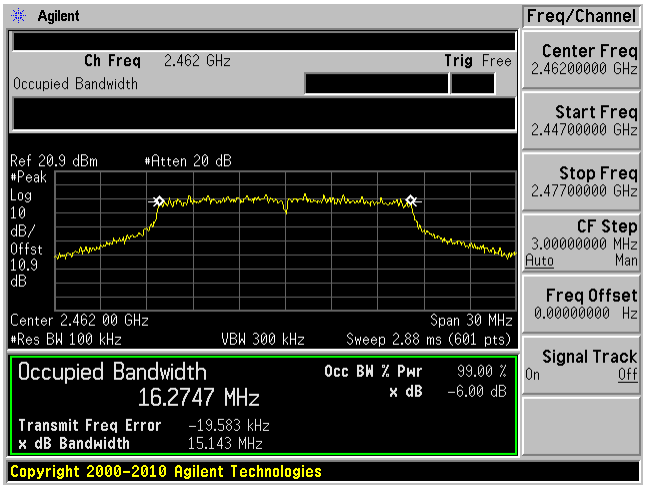
Low Channel 2412 MHz



Middle Channel 2437 MHz

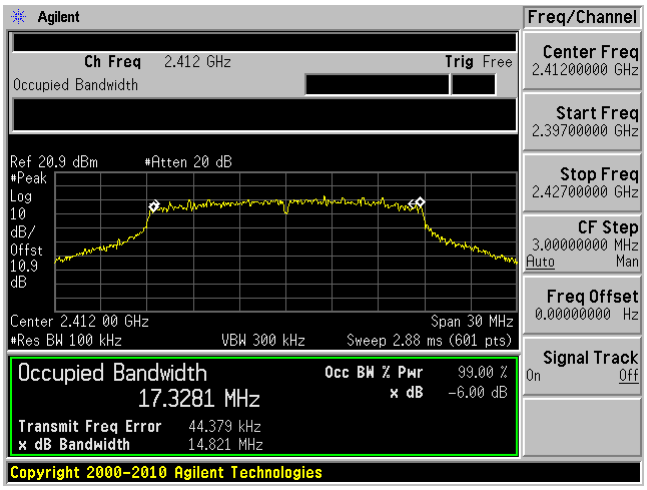


High Channel 2462 MHz

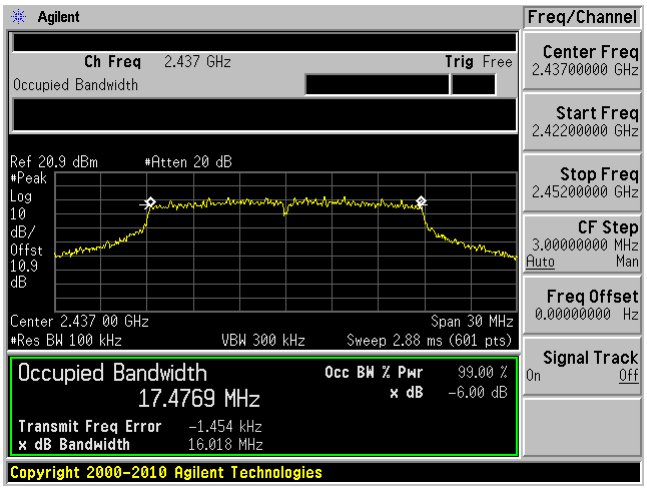


802.11n20 mode

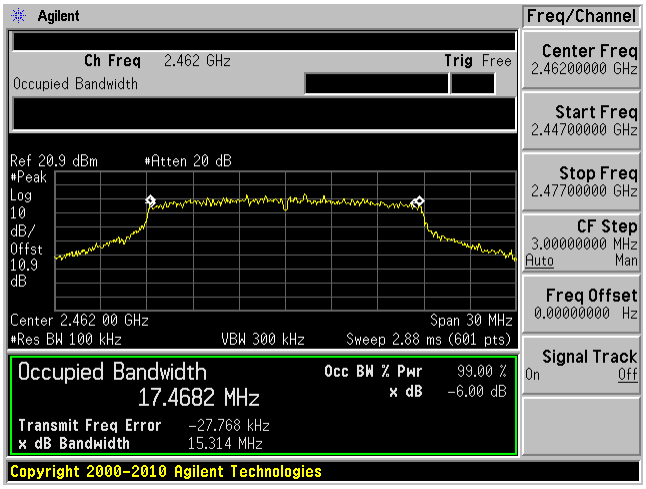
Low Channel 2412 MHz



Middle Channel 2437 MHz

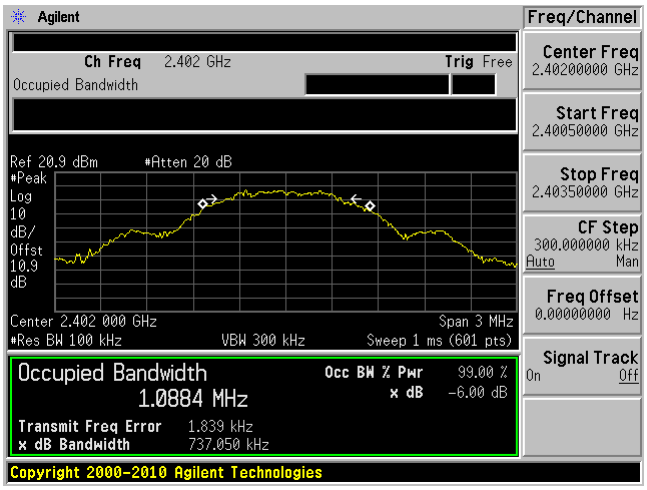


High Channel 2462 MHz

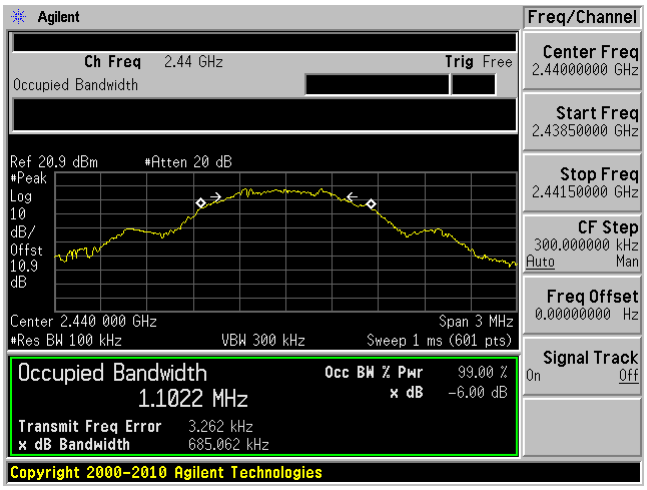


BLE

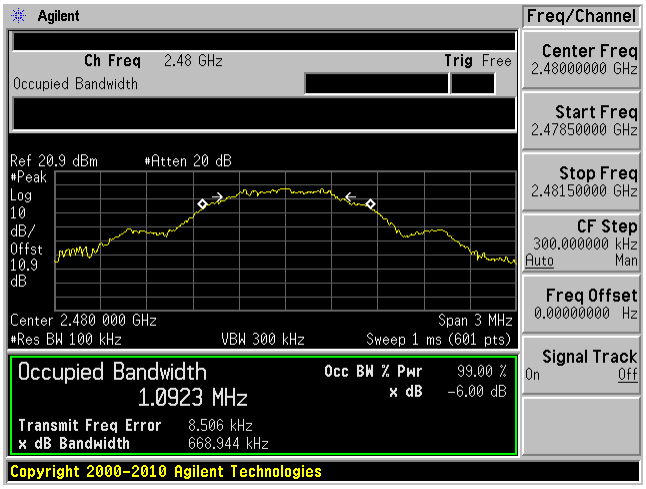
Low Channel 2402 MHz



Middle Channel 2440 MHz



High Channel 2480 MHz



9 FCC §15.247(b) (3) and ISED RSS-247 §5.4 (4) - RF Output Power

9.1 Applicable Standards

According to FCC §15.247(b) (3) and ISED RSS-247 §5.4 (4) 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
Agilent	Analyzer, Spectrum	E4446A	US44300386	2016-06-10	1 year
-	RF cable	-	-	Each time[1]	Each time[1]
-	10 dB attenuator	-	-	Each time[1]	Each time[1]
ETS- Lingerin	Power Sensor	7002-006	160097	2016-12-05	2 years

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:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

The testing was performed by Frank Wang on 2017-06-01 in RF site.

9.5 Test Results

Average Output Power

Channel	Frequency (MHz)	Conducted Average Output Power (dBm)	Limit (dBm)
802.11b mode			
1	2412	16.43	30
6	2437	15.86	30
11	2462	15.85	30
802.11g mode			
1	2412	15.69	30
6	2437	15.58	30
11	2462	15.98	30
802.11n-HT20 mode			
1	2412	14.92	30
6	2437	15	30
11	2462	15.37	30

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

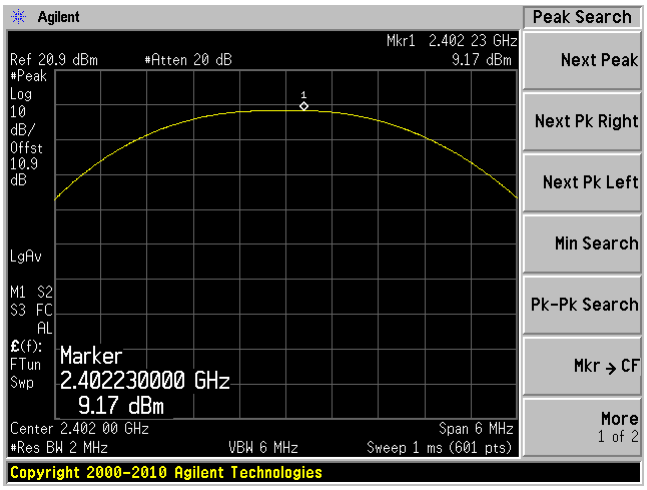
Peak Output Power

Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)	Limit (dBm)
BLE			
Low	2402	9.17	30
Middle	2440	10.23	30
High	2480	9.19	30

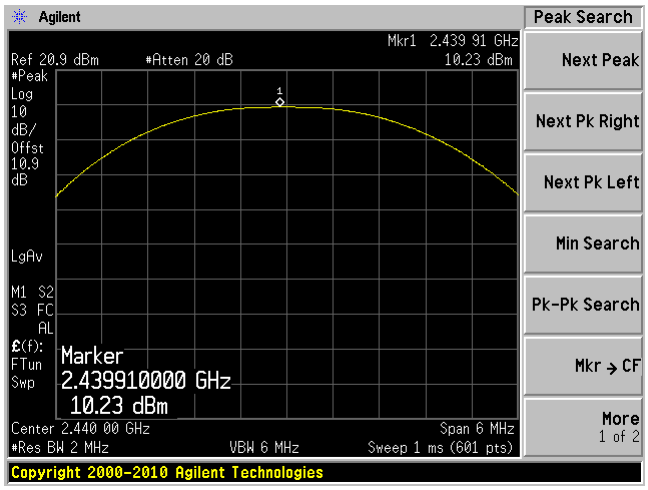
Please refer to the following plots for detailed test results.

BLE

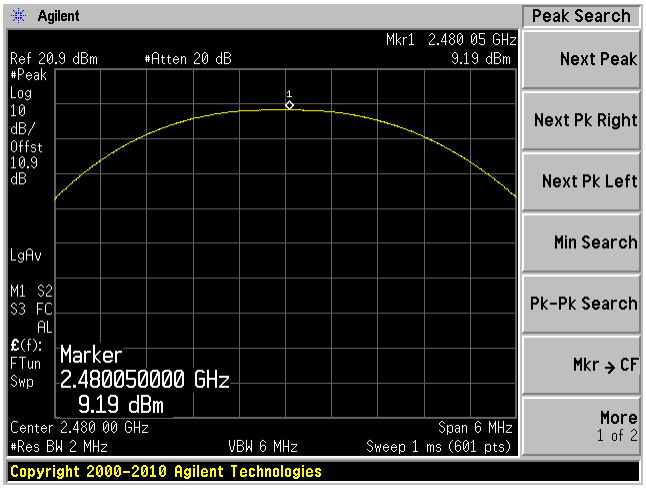
Low Channel 2402 MHz



Middle Channel 2440 MHz



High Channel 2480 MHz



10 FCC §15.247(d) and ISED RSS-247 §5.5 - 100 kHz Bandwidth of Band Edges

10.1 Applicable Standards

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

According to ISED RSS-247 §5.5.In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

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	E4446A	MY48250238	2016-06-10	1 year
-	RF cable	-	-	Each time[1]	Each time[1]
-	10 dB attenuator	-	-	Each time[1]	Each time[1]

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:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

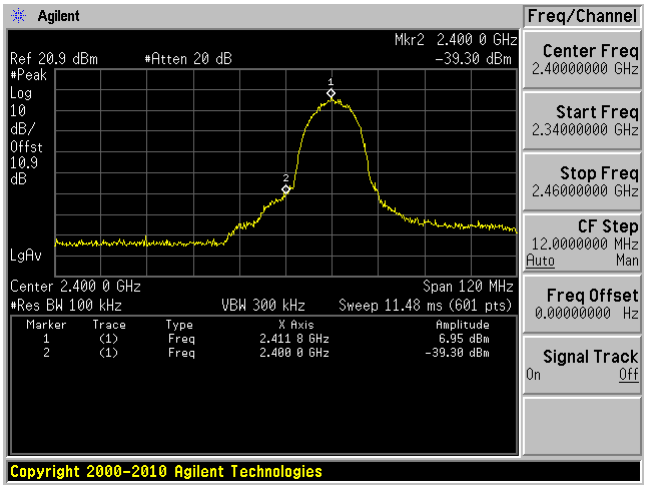
The testing was performed by Frank Wang on 2017-06-01 in RF site.

10.5 Test Results

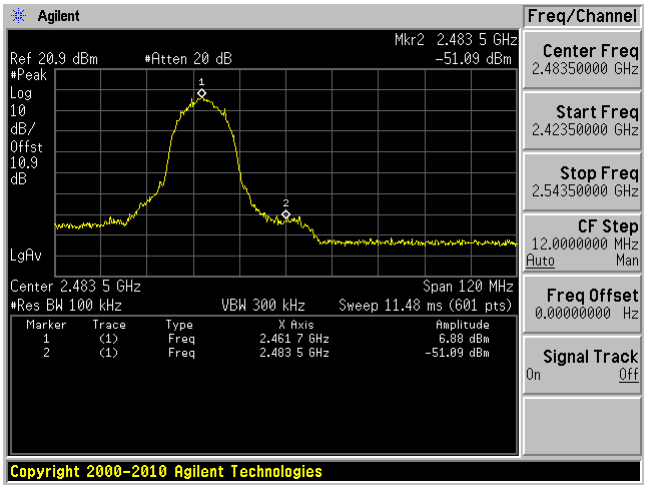
Please refer to the following plots.

802.11b mode

Low Channel 2412 MHz

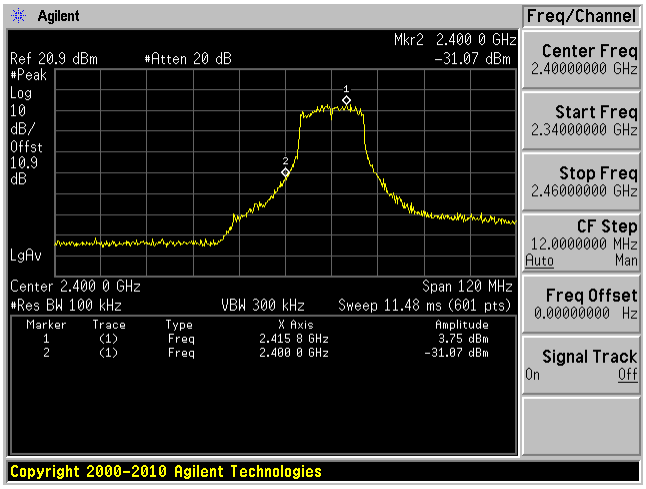


High Channel 2462 MHz

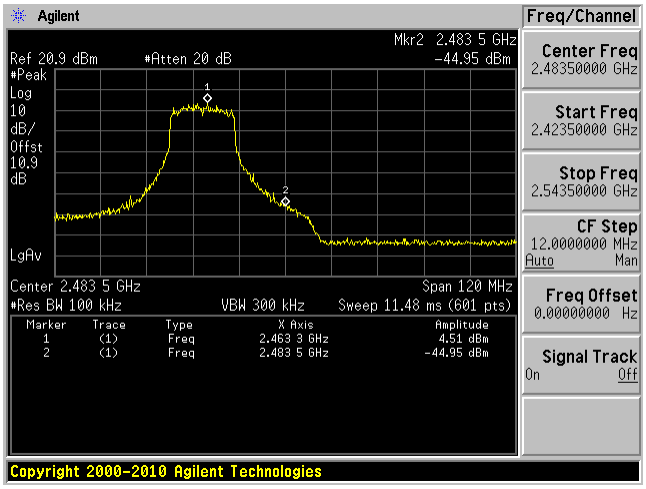


802.11g mode

Low Channel 2412 MHz

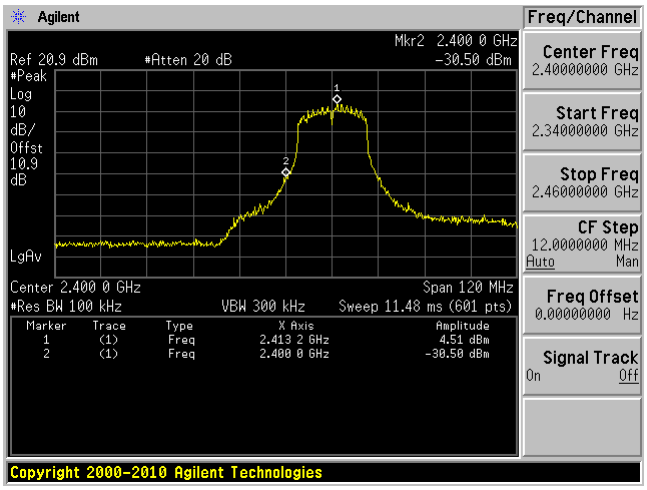


High Channel 2462 MHz

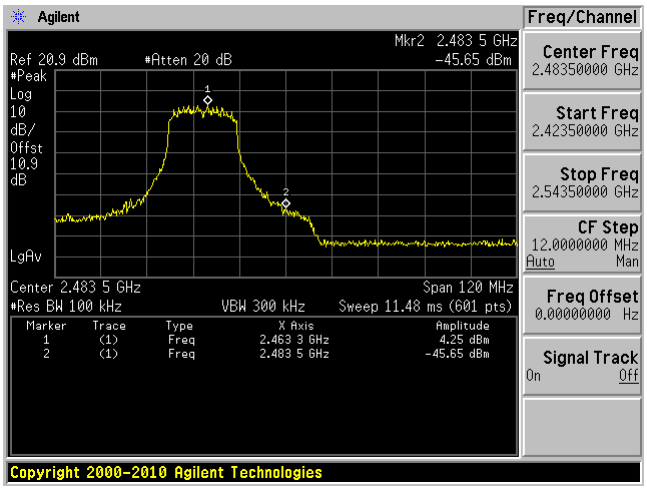


802.11n20 mode

Low Channel 2412 MHz

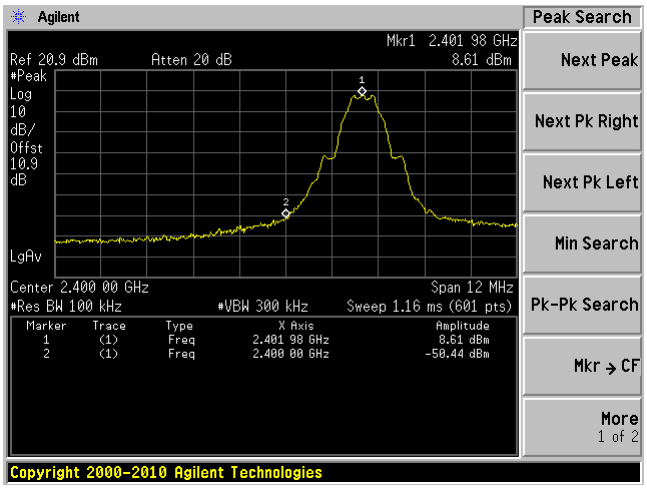


High Channel 2462 MHz

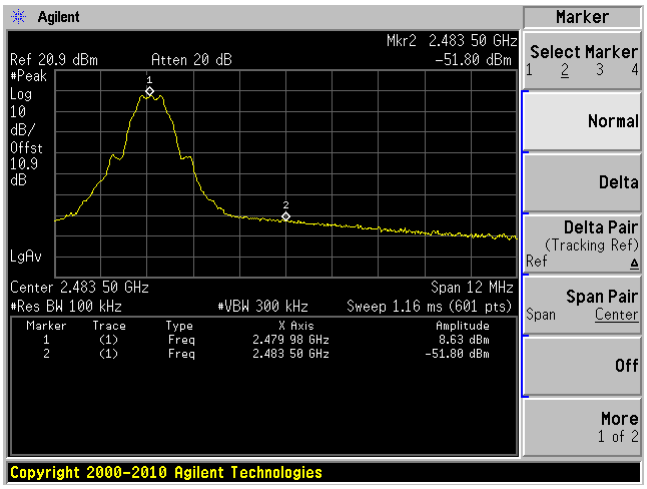


BLE

Low Channel 2402 MHz



High Channel 2480 MHz



11 FCC §15.247(e) and ISED RSS-247 §5.2(2) – Power Spectral Density

11.1 Applicable Standards

According to FCC §15.247(e) and ISED RSS-247 §5.2 (2) , 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	2016-06-10	1 year
-	RF cable	-	-	Each time[1]	Each time[1]
-	10 dB attenuator	-	-	Each time[1]	Each time[1]

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:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

The testing was performed by Frank Wang on 2017-06-01 in RF site.

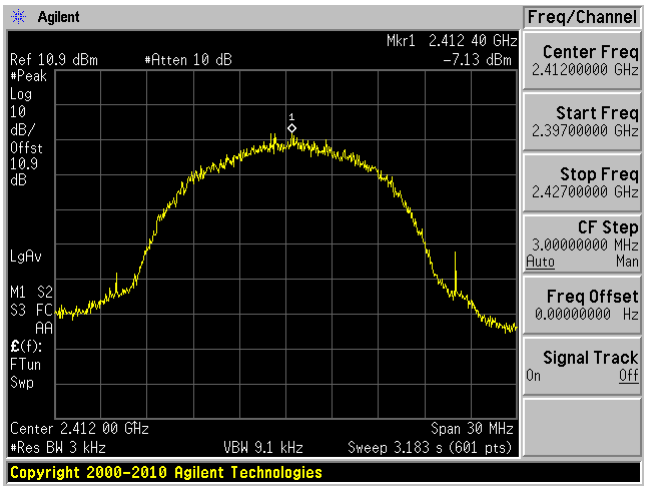
11.5 Test Results

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)
802.11b mode			
Low	2412	-7.13	8
Middle	2437	-7.94	8
High	2462	-8.08	8
802.11g mode			
Low	2412	-10.22	8
Middle	2437	-11.42	8
High	2462	-10.59	8
802.11n-HT20 mode			
Low	2412	-11.95	8
Middle	2437	-12.39	8
High	2462	-12.40	8
BLE			
Low	2402	-5.10	8
Middle	2440	-3.95	8
High	2480	-4.88	8

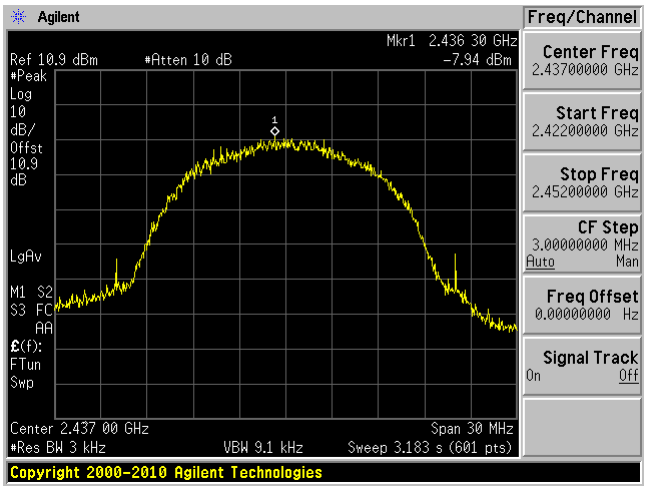
Please refer to the following plots for detailed test results

802.11b mode

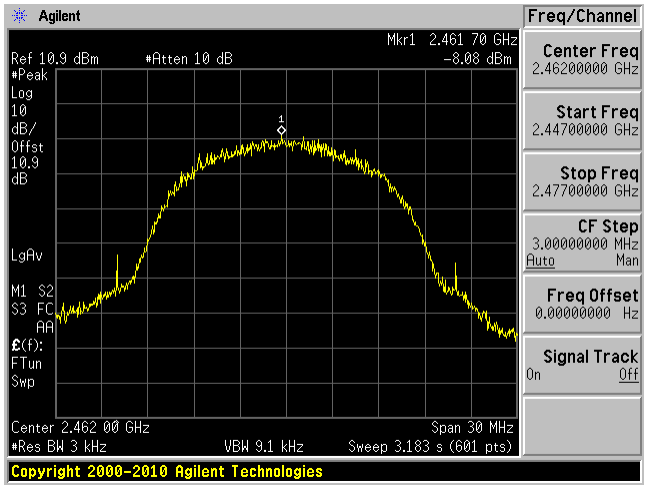
Low Channel 2412 MHz



Middle Channel 2437 MHz

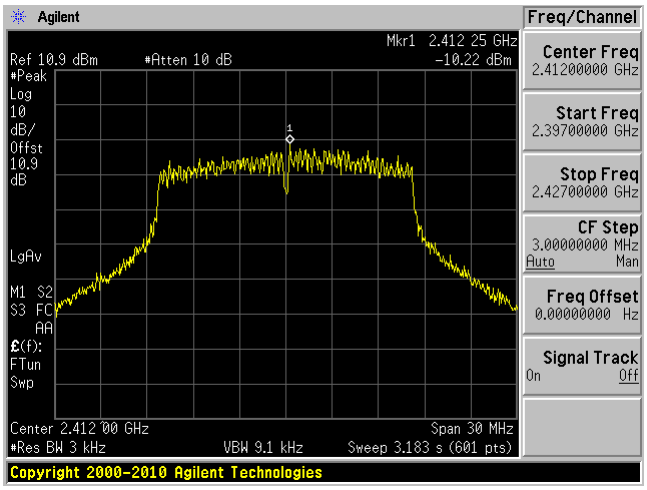


High Channel 2462 MHz

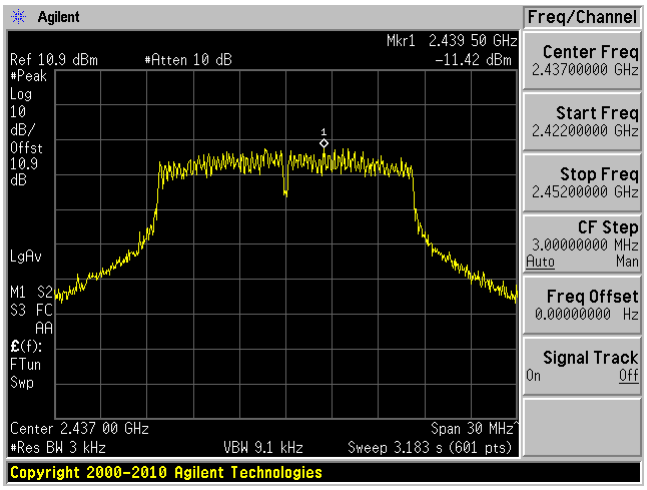


802.11g mode

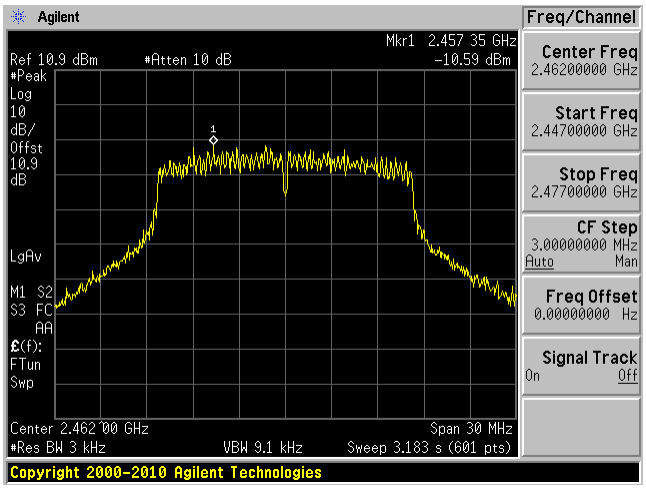
Low Channel 2412 MHz



Middle Channel 2437 MHz

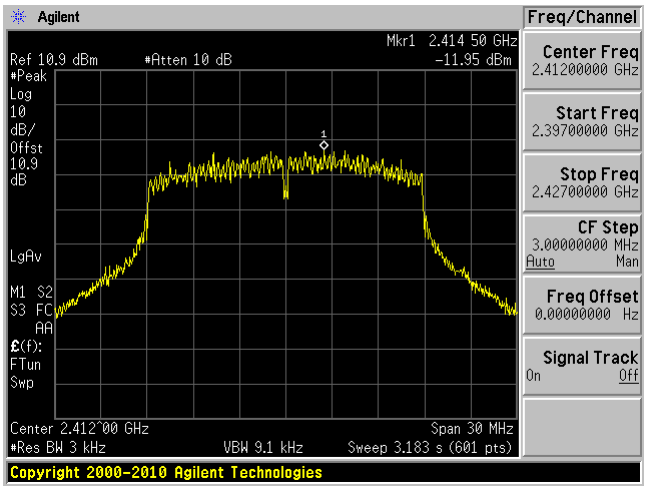


High Channel 2462 MHz

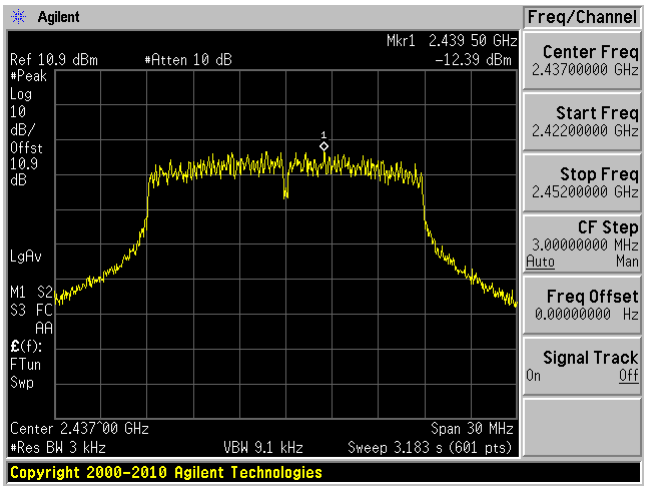


802.11n20 mode

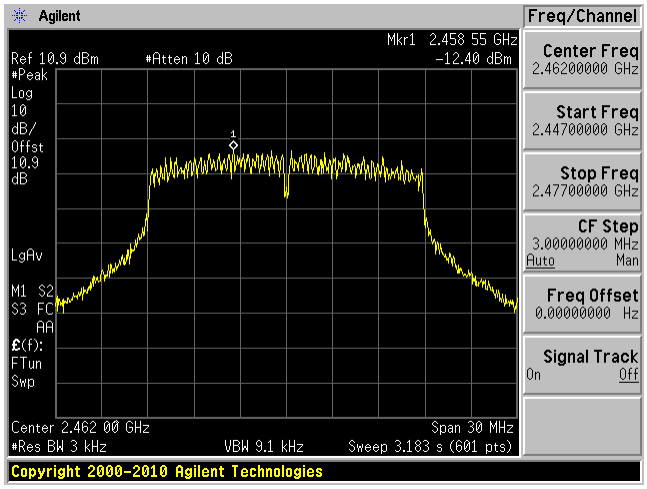
Low Channel 2412 MHz



Middle Channel 2437 MHz

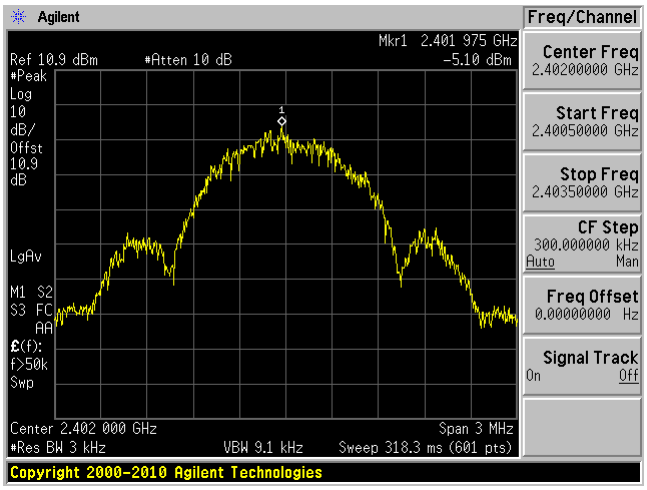


High Channel 2462 MHz

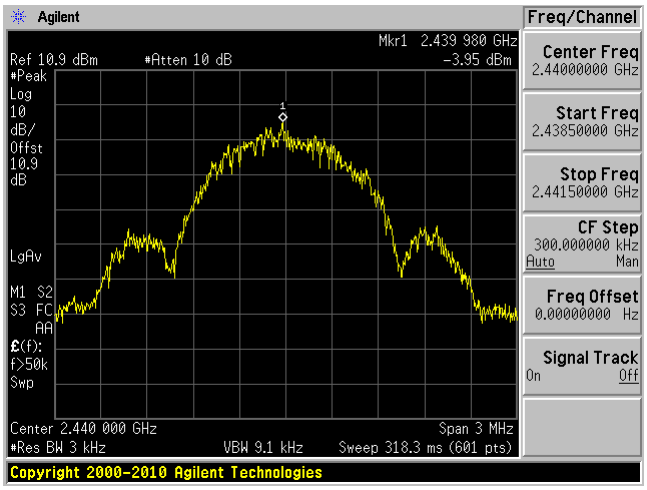


BLE

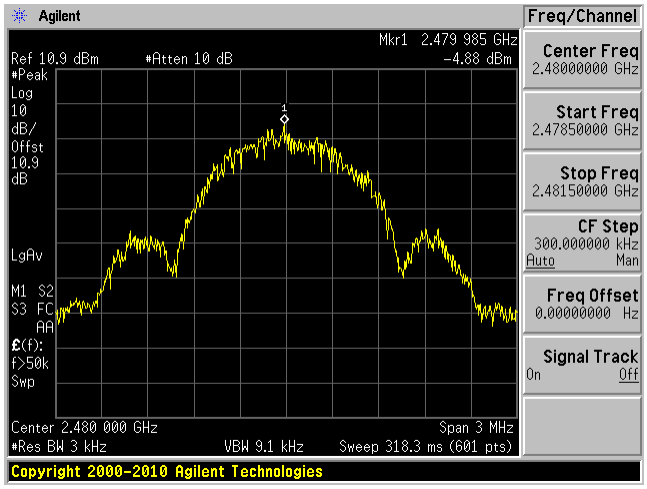
Low Channel 2402 MHz



Middle Channel 2440 MHz



High Channel 2480 MHz



12 FCC §15.247(d) and ISED RSS-247 §5.5, RSS-Gen §8.9 - Spurious Emissions at Antenna Terminals

12.1 Applicable Standards

For FCC §15.247(d) in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

As per ISED RSS-247 §5.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

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	E4446A	MY48250238	2016-06-10	1 year
-	RF cable	-	-	Each time[1]	Each time[1]
-	10 dB attenuator	-	-	Each time[1]	Each time[1]

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:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

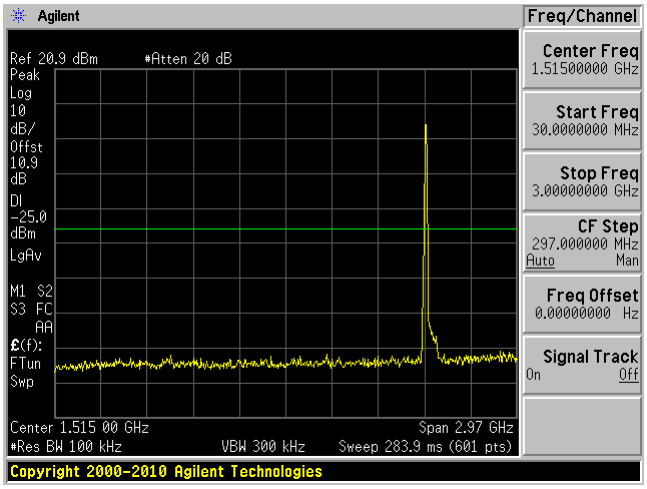
The testing was performed by Frank Wang on 2017-06-02 in RF site.

12.5 Test Results

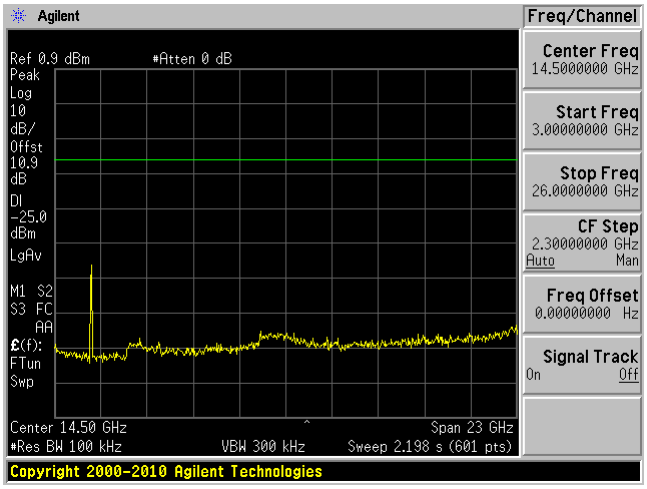
Please refer to following plots.

802.11b mode

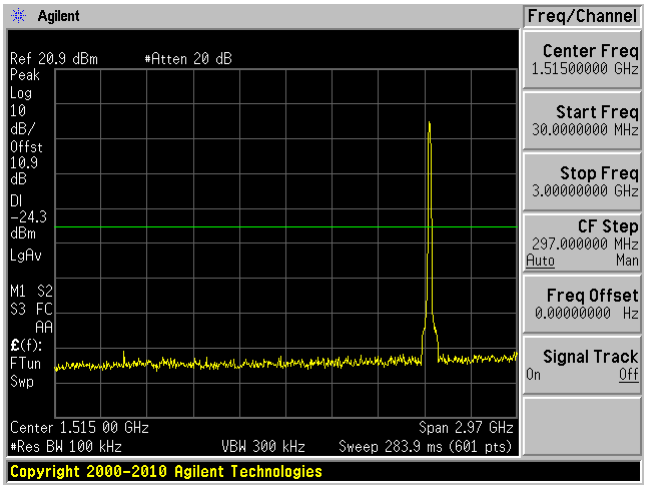
Low Channel 30MHz – 3 GHz



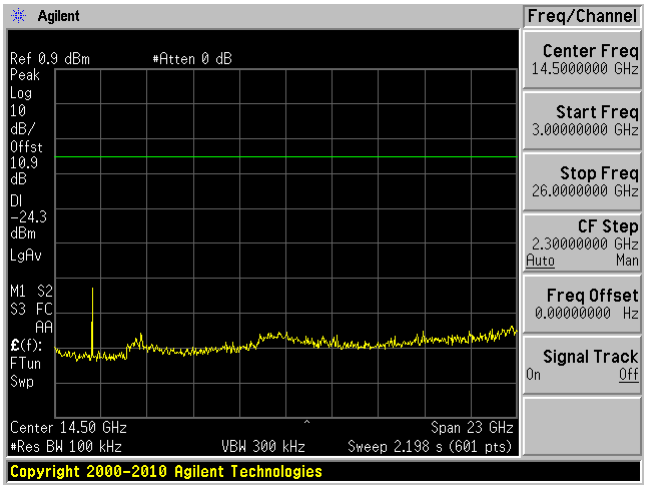
Low Channel 3 GHz – 26 GHz



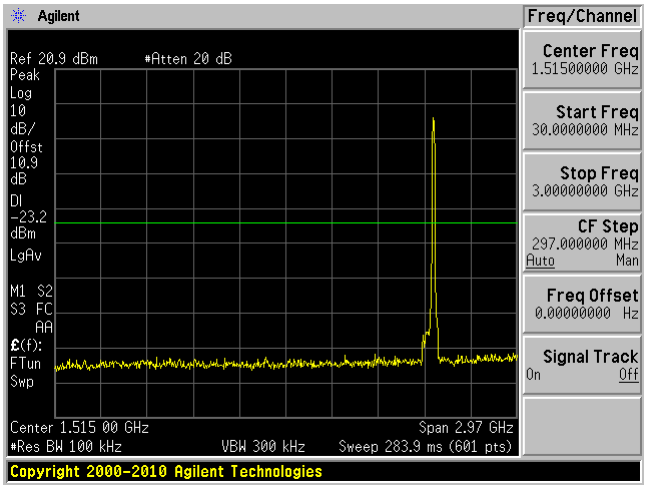
Middle Channel 30 MHz – 3 GHz



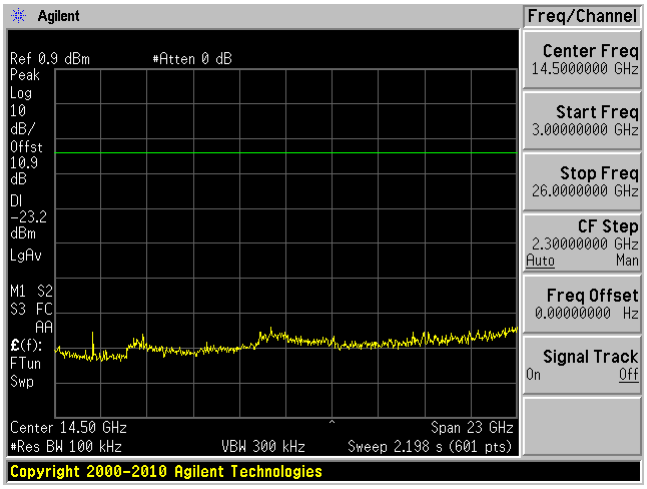
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

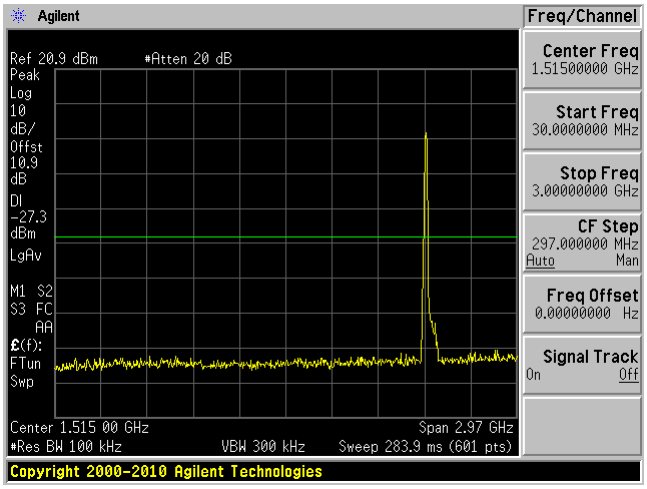


High Channel 3 GHz – 26 GHz

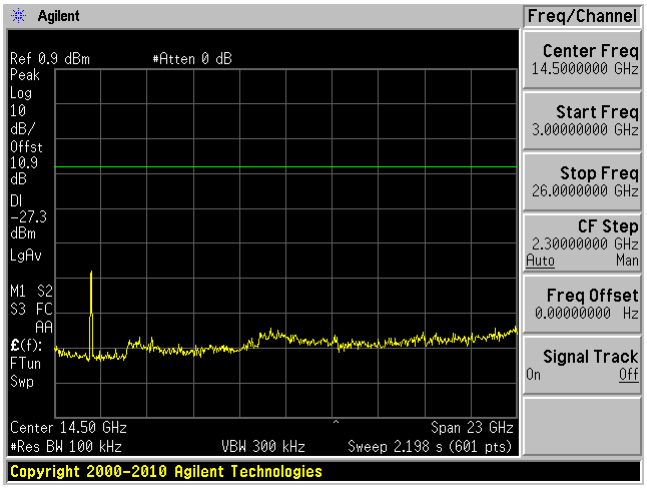


802.11g mode

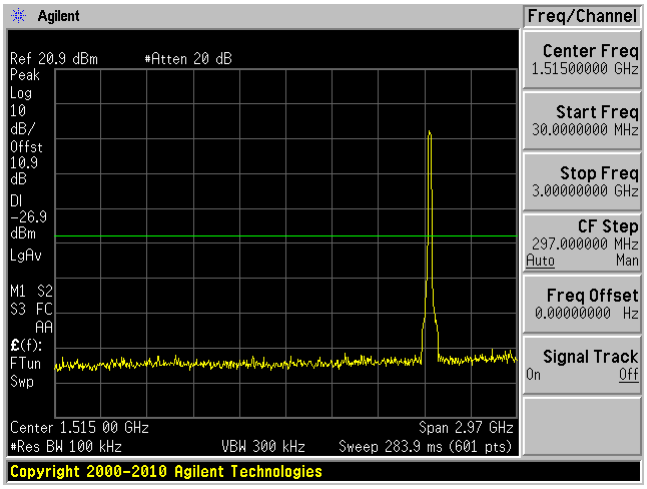
Low Channel 30 MHz – 3 GHz



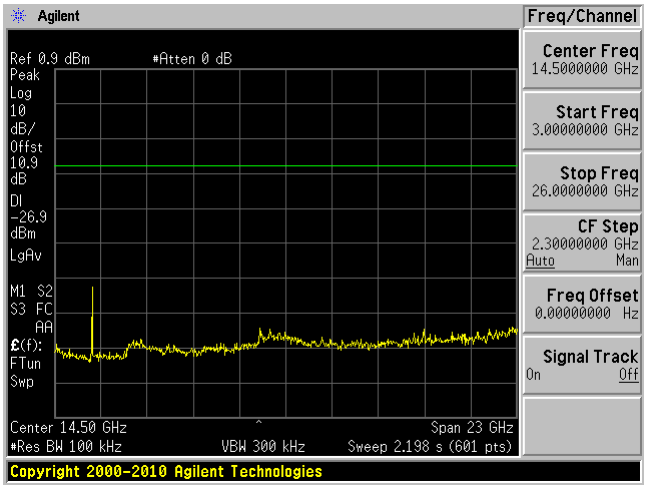
Low Channel 3 GHz – 26 GHz



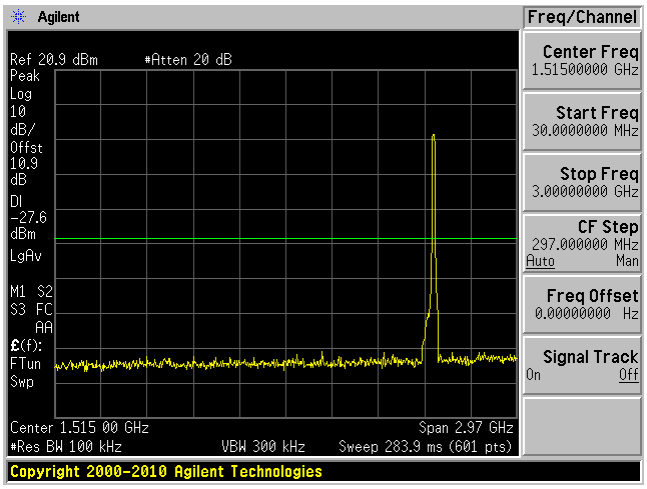
Middle Channel 30 MHz – 3 GHz



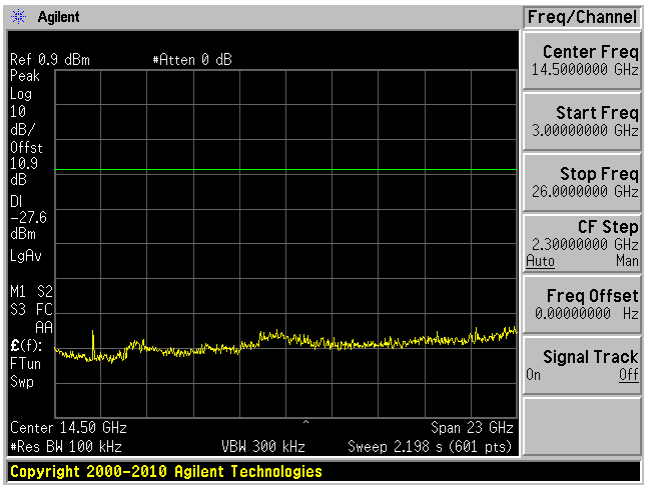
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

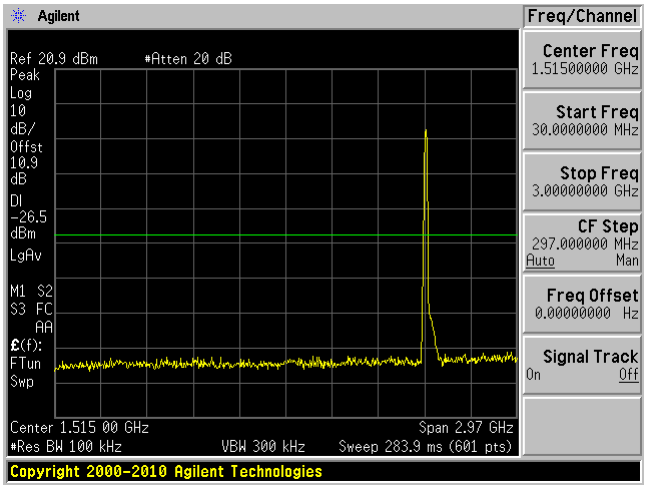


High Channel 3 GHz – 26 GHz

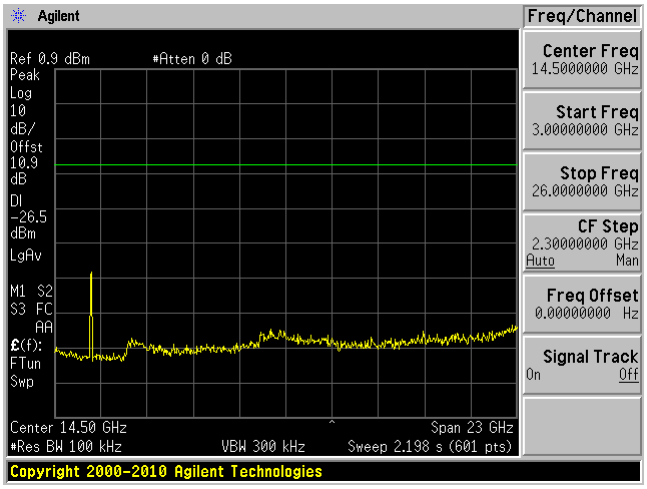


802.11n20 mode

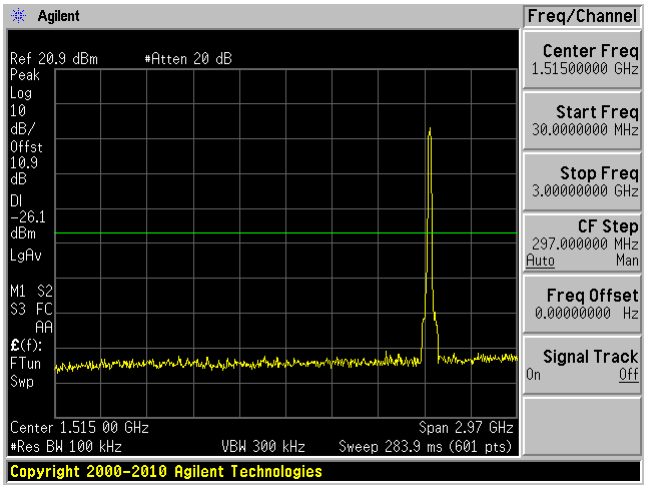
Low Channel 30 MHz – 3 GHz



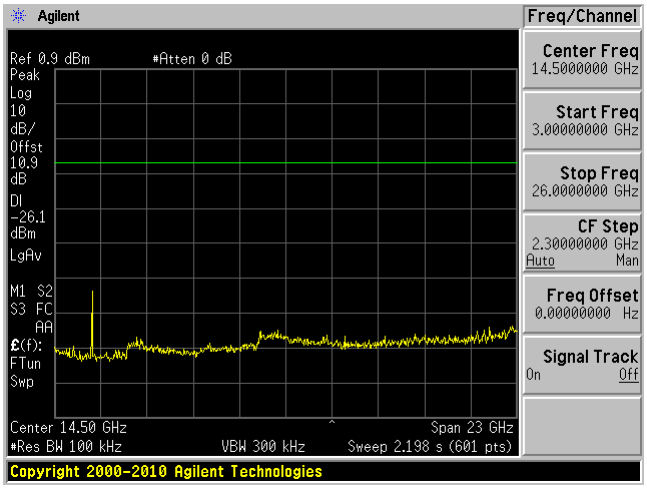
Low Channel 3 GHz – 26 GHz



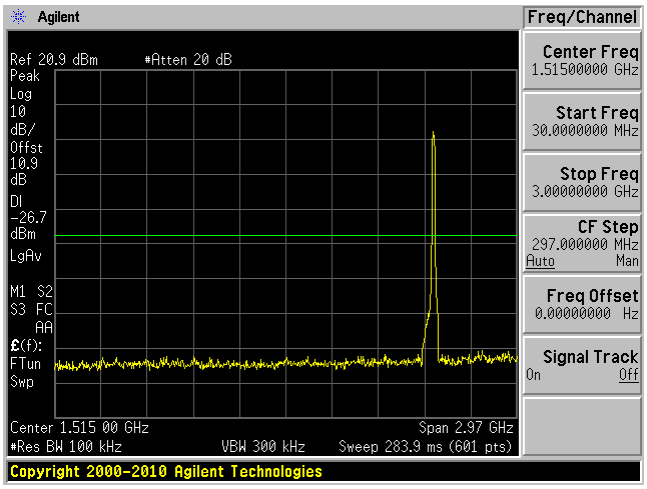
Middle Channel 30 MHz – 3 GHz



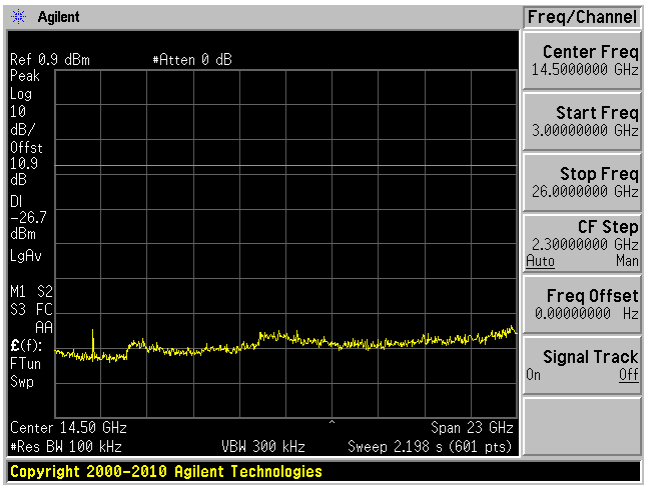
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

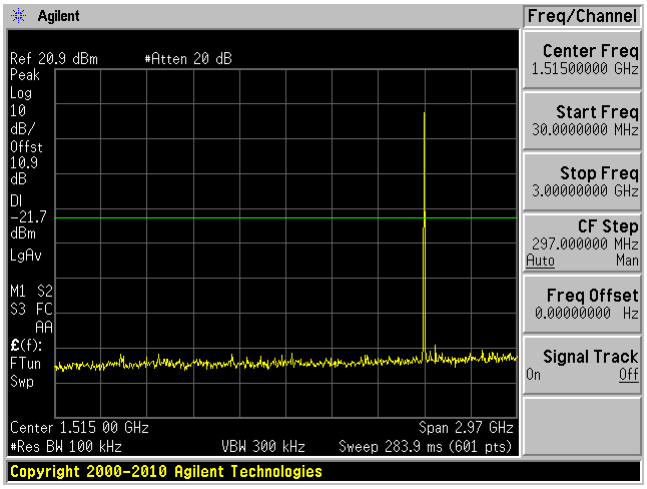


High Channel 3 GHz – 26 GHz

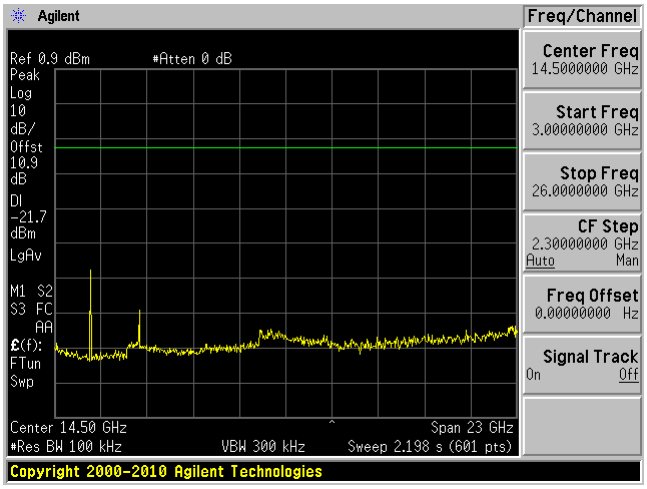


BLE

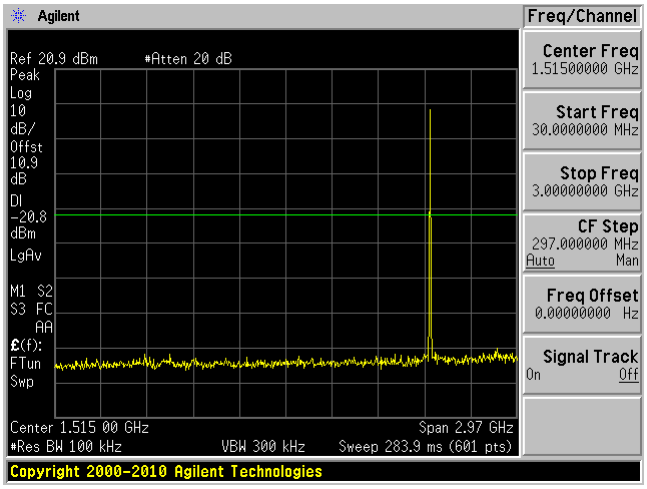
Low Channel 30 MHz – 3 GHz



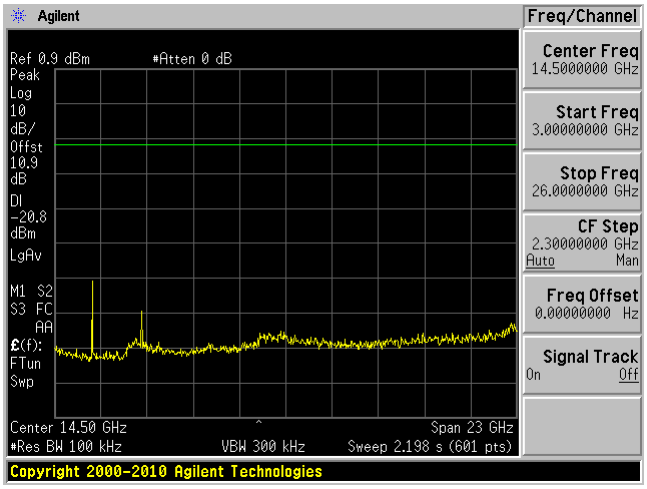
Low Channel 3 GHz – 26 GHz



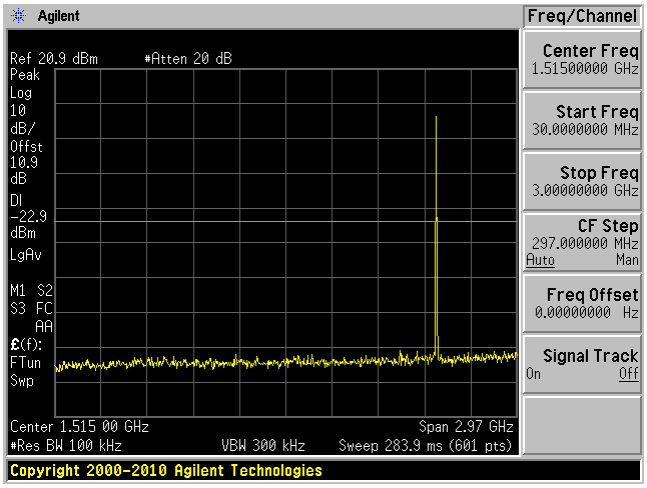
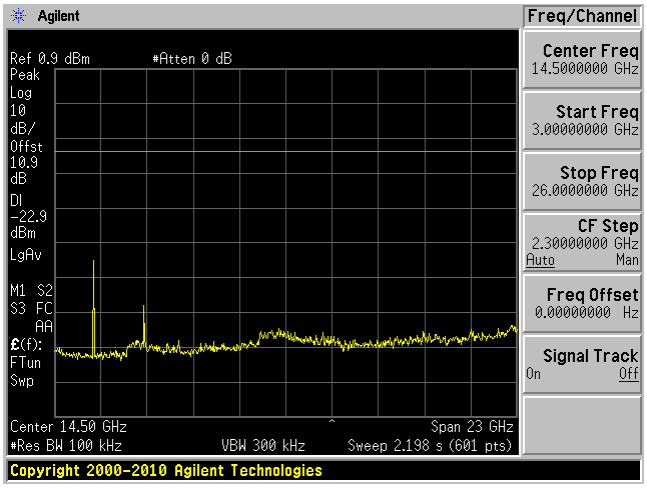
Middle Channel 30 MHz – 3 GHz



Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz



High Channel 3 GHz – 26 GHz