FCC PART 15, SUBPART C
ISED RSS-247, ISSUE 1, MAY 2015

TEST AND MEASUREMENT REPORT

For

Intel Corporation

2200 Mission College Blvd.,

Santa Clara, CA 95054, USA

FCC ID: 2AB8ZND24
IC: 1000X-ND24

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

Prepared By:	Jose Martinez Associate Test Engineer
Report Number:	R1610053-247 DTS
Report Date:	2016-11-09
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TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1610053-247 DTS	Original Report	2016-11-09

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: *SBF8A*, FCC ID: 2AB8ZND24, IC: 1000X-ND24 or the "EUT" as referred to in this report. It is a smart watch with Wi-Fi, Bluetooth and BLE functions. It operates in the 2.4 GHz band.

1.2 Mechanical Description of EUT

The EUT measures approximately 5 cm (L) x 5 cm (W) x 1.5 cm (H) and weight 0.05 kg.

The test data gathered are from typical production sample, serial number: AEDV05HR 6350010 and AEDV05HR 6350019 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 ISED RSS-247 Issue 1, MAY 2015.

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: 2AB8ZND24, IC: 1000X-ND24
FCC Part 15, Subpart C, Equipment DXX with FCC ID: 2AB8ZND24, IC: 1000X-ND24

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 Android Debug Bridge and command lines provided by *Intel Corporation*, 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:

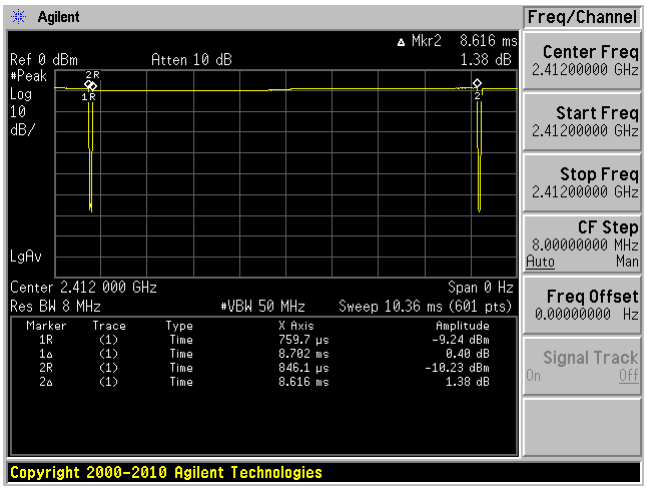
Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be utilized 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 (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.11b	8.616	8.702	99.01	NA
802.11g	1.426	1.527	93.39	0.30
802.11n20	1.337	1.437	93.04	0.34
BLE	0.3894	0.6248	62.32	2.05

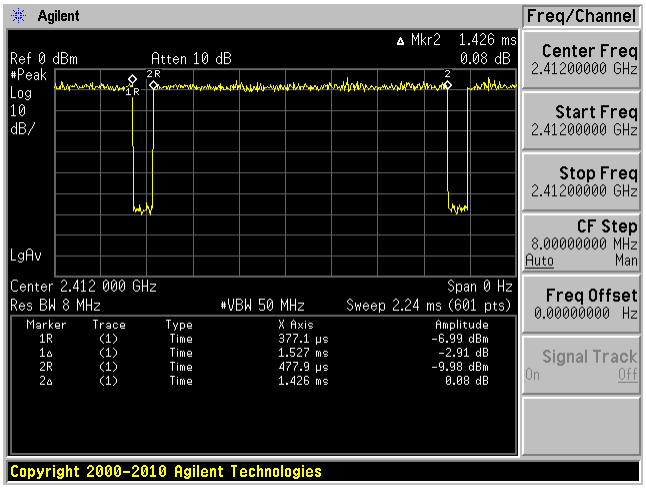
Duty Cycle = On Time (ms)/ Period (ms)
Duty Cycle Correction Factor (dB) = 10*log(1/Duty Cycle)

Please refer to the following plots.

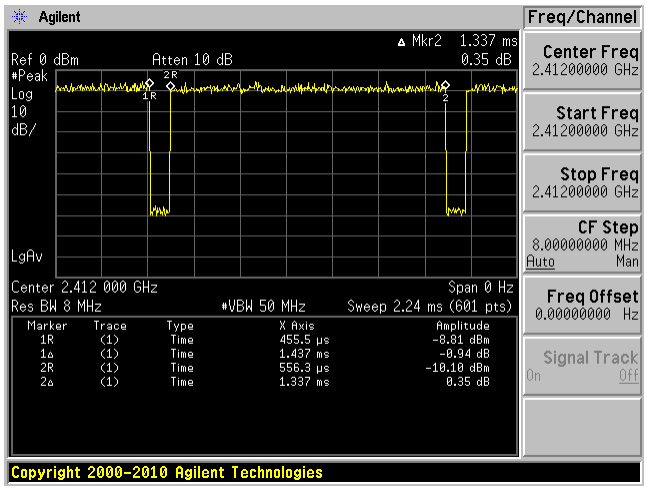
802.11b mode



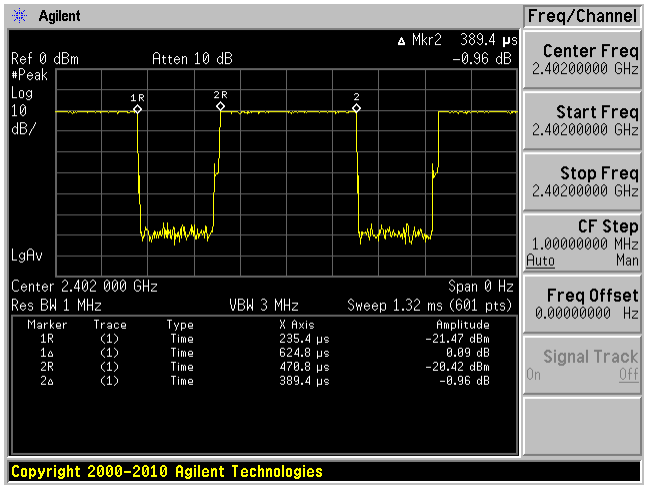
802.11g mode



802.11n20 mode



BLE



2.4 Equipment Modifications

N/A

Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Lenovo	Laptop	20332	YB04499042

2.5 Support Equipment

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

2.6 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 & 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 & §8.10	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) ISED RSS-247 §5.2 (1)	6 dB & 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 & 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	2400-2500	-5.5

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

5.1 Applicable Standards

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

5.2 Test Results

Please refer to the SAR Report: R1610053-SAR.

6 FCC §15.207 & 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 & 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:

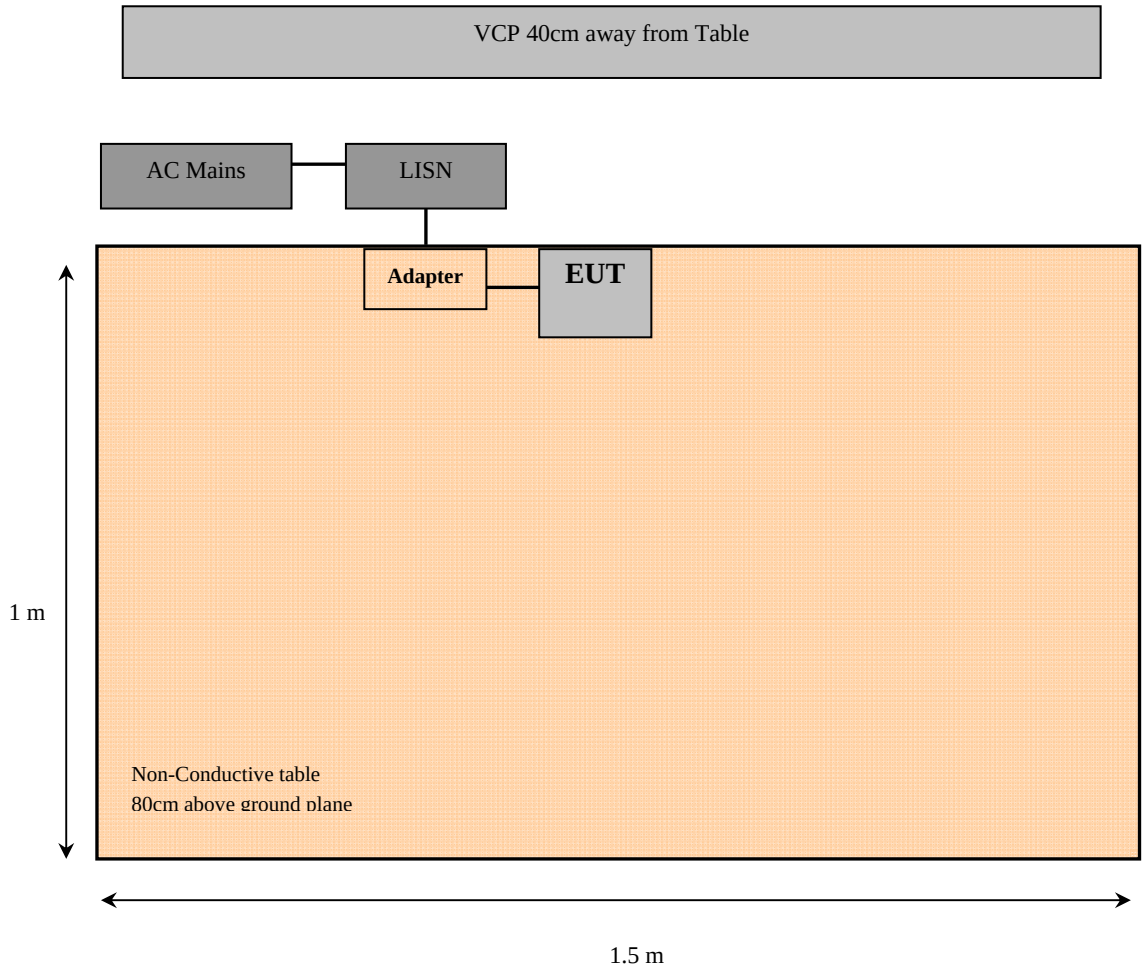
CA = Ai + CL + Atten

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:	22º C
Relative Humidity:	42 %
ATM Pressure:	102 kPa

The testing was performed by Jose Martinez on 2016-11-02 in 5 chamber 3.

6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC 15C 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)**
-13.94	0.733687	Neutral	0.15-30

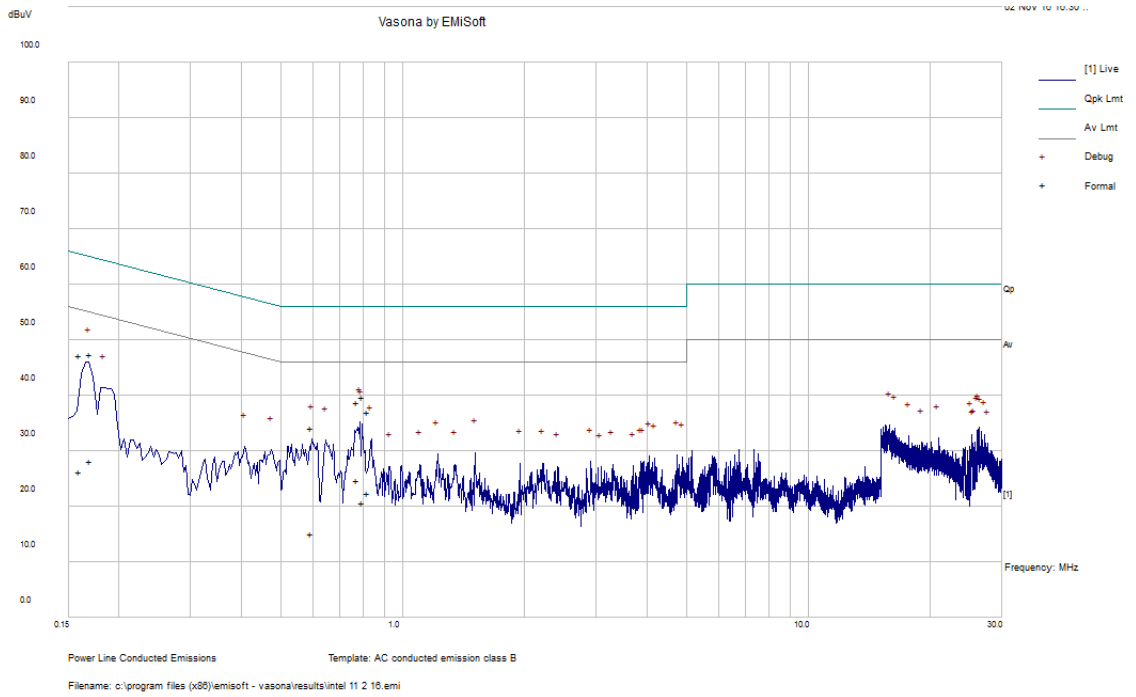
BLE

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-13.28	0.753797	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

2.4 GHz Wi-Fi

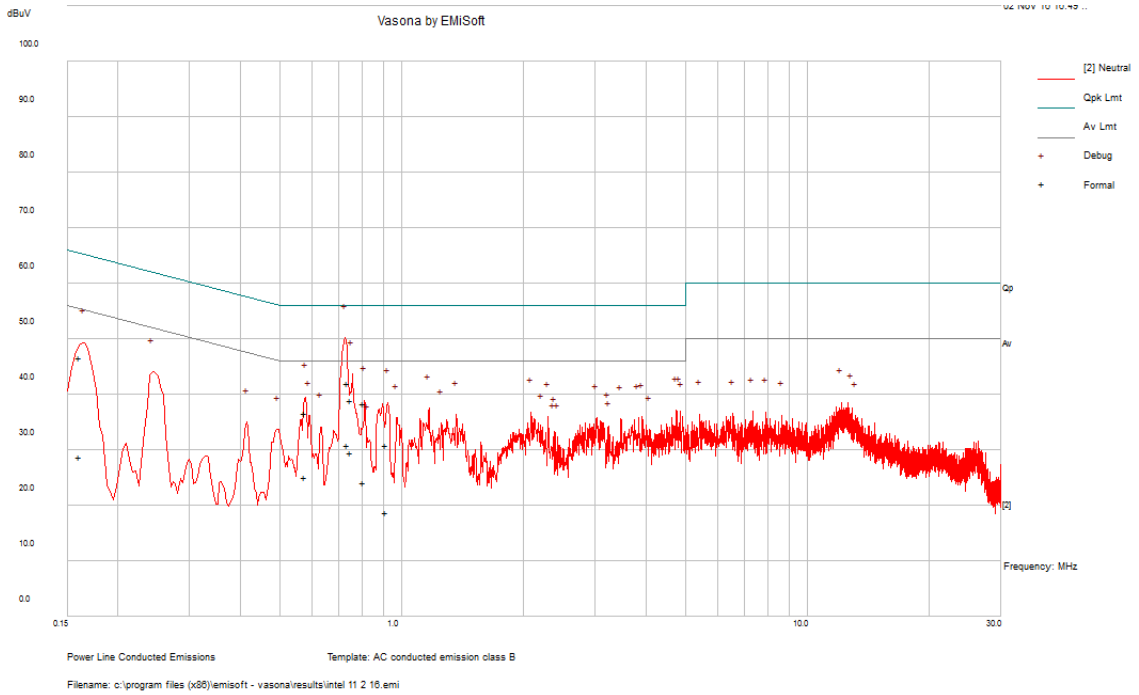
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.159766	47.33	Line	65.48	-18.15	QP
0.770351	38.8	Line	56	-17.2	QP
0.797092	39.78	Line	56	-16.22	QP
0.16931	47.38	Line	64.99	-17.61	QP
0.596196	34.26	Line	56	-21.74	QP
0.818776	37.02	Line	56	-18.98	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.159766	26.2	Line	55.48	-29.28	Ave.
0.770351	24.72	Line	46	-21.28	Ave.
0.797092	20.67	Line	46	-25.33	Ave.
0.16931	28.26	Line	54.99	-26.74	Ave.
0.596196	15.18	Line	46	-30.82	Ave.
0.818776	22.43	Line	46	-23.57	Ave.

120 V, 60 Hz – Neutral

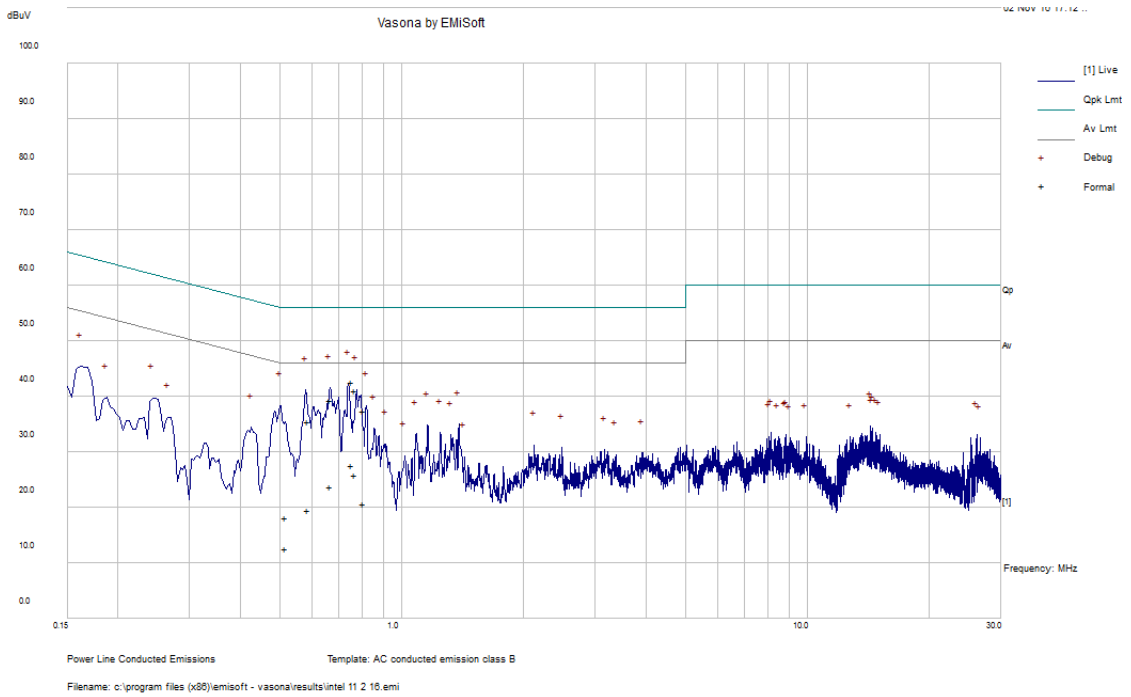


Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.733687	42.06	Neutral	56	-13.94	QP
0.750579	39.07	Neutral	56	-16.93	QP
0.160714	46.58	Neutral	65.43	-18.85	QP
0.576423	36.66	Neutral	56	-19.34	QP
0.804464	38.49	Neutral	56	-17.51	QP
0.912562	30.94	Neutral	56	-25.06	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.733687	30.92	Neutral	46	-15.08	Ave.
0.750579	29.5	Neutral	46	-16.5	Ave.
0.160714	28.86	Neutral	55.43	-26.56	Ave.
0.576423	25.07	Neutral	46	-20.93	Ave.
0.804464	24.25	Neutral	46	-21.75	Ave.
0.912562	18.85	Neutral	46	-27.15	Ave.

BLE

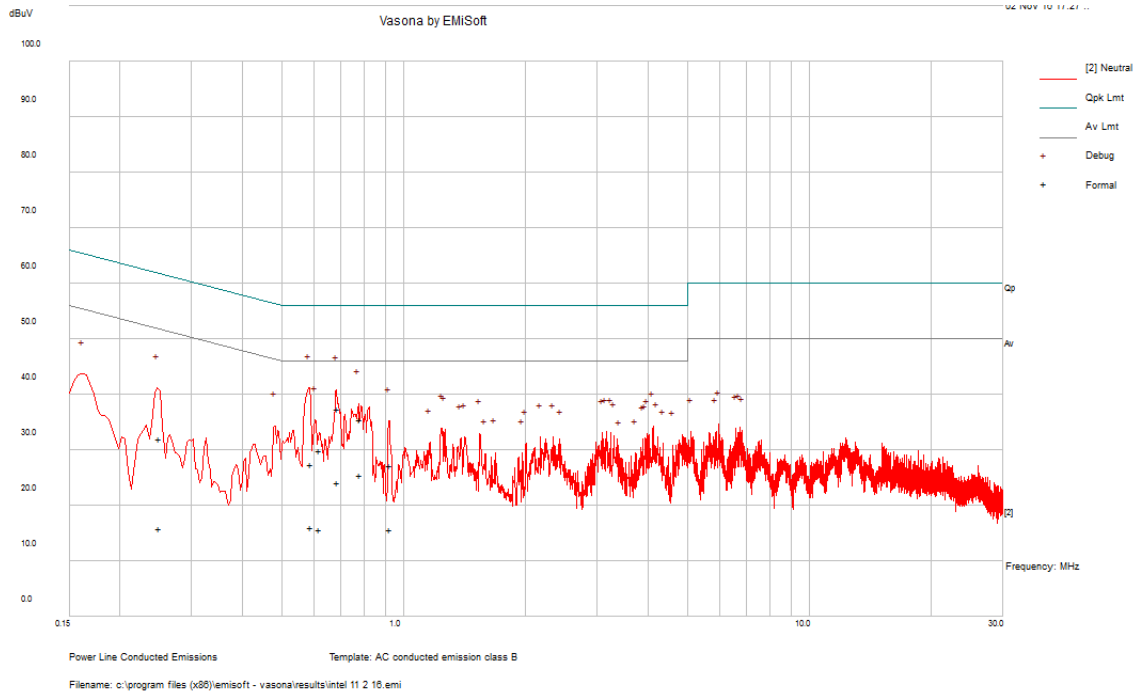
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.753797	42.72	Line	56	-13.28	QP
0.668475	39.32	Line	56	-16.68	QP
0.765547	41.12	Line	56	-14.88	QP
0.587133	35.55	Line	56	-20.45	QP
0.518113	18.26	Line	56	-37.74	QP
0.803845	37.51	Line	56	-18.49	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.753797	27.72	Line	46	-18.28	Ave.
0.668475	23.82	Line	46	-22.18	Ave.
0.765547	25.91	Line	46	-20.09	Ave.
0.587133	19.53	Line	46	-26.47	Ave.
0.518113	12.61	Line	46	-33.39	Ave.
0.803845	20.66	Line	46	-25.34	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.59198	27.35	Neutral	56	-28.65	QP
0.688501	37.35	Neutral	56	-18.65	QP
0.781459	35.47	Neutral	56	-20.53	QP
0.620579	29.93	Neutral	56	-26.07	QP
0.250493	31.98	Neutral	61.74	-29.76	QP
0.925247	27.2	Neutral	56	-28.8	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.59198	16.01	Neutral	46	-29.99	Ave.
0.688501	24.24	Neutral	46	-21.76	Ave.
0.781459	25.51	Neutral	46	-20.49	Ave.
0.620579	15.76	Neutral	46	-30.24	Ave.
0.250493	15.88	Neutral	51.74	-35.86	Ave.
0.925247	15.77	Neutral	46	-30.23	Ave.

7 FCC §15.209, §15.247(d) & 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 = 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	US45303156	2016-01-19	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
-	N-Type Cable	-	C00013	2016-04-28	1 year
-	N-Type Cable	-	C00014	2016-05-28	1 year
HP	Pre-Amplifier	8447D	2443A04374	2016-06-28	1year
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2015-10-22	2 years
Wisewave	Amplifier, Low Noise	ALN-22093530-01	12263-01	2016-05-16	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:	20-22 ºC
Relative Humidity:	42-46 %
ATM Pressure:	102 kPa

The testing was performed by Jin Yang 2016-10-11 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)**	**Mode, channel**
-1.72	2483.5	Vertical	n20 mode, high channel

BLE

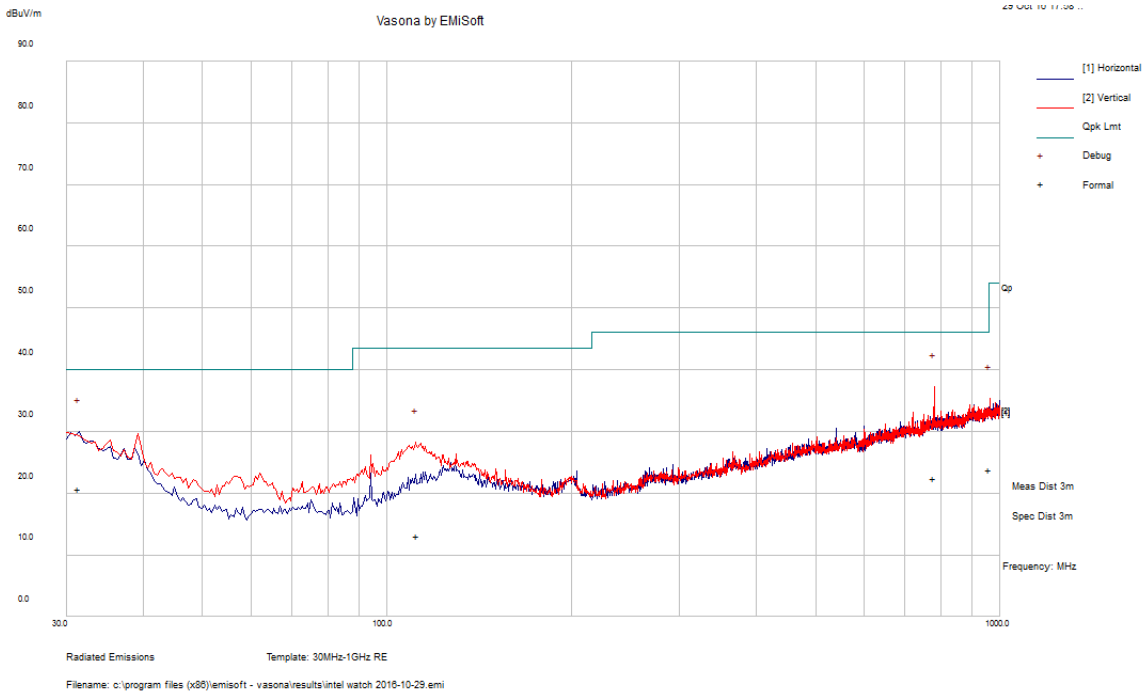
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**channel**
-2.64	2390	Vertical	Low channel

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

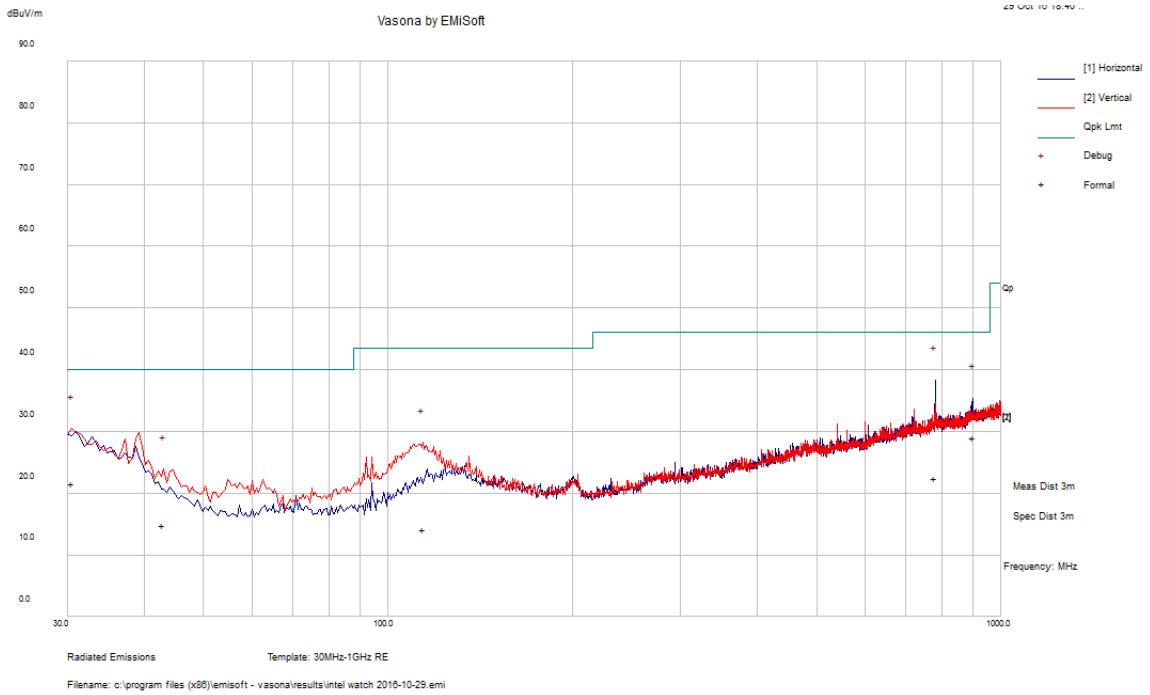
2.4 GHz Wi-Fi



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
780.0548	22.41	163	V	336	46	-23.59	QP
31.435	20.8	124	H	246	40	-19.2	QP
111.7245	13.12	101	V	181	43.5	-30.38	QP
961.7688	23.82	296	V	227	54	-30.18	QP

Note: Only 4 emissions were present because the other emissions were under the noise floor.

BLE



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
780.2463	22.43	149	H	146	46	-23.57	QP
30.5205	21.51	196	V	207	40	-18.49	QP
900.0095	28.94	296	H	213	46	-17.06	QP
114.002	14.14	114	V	137	43.5	-29.36	QP
42.98175	14.77	175	V	235	40	-25.23	QP

Note: Only 5 emissions were present because the other emissions were under the noise floor.

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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	59.41	150	231	H	29.09	5.22	0.00	93.72	N/A	N/A	PK
2412	56.86	150	231	H	29.09	5.22	0.00	91.17	N/A	N/A	AV
2412	63.63	23	104	V	29.09	5.22	0.00	97.94	N/A	N/A	PK
2412	61.08	23	104	V	29.09	5.22	0.00	95.39	N/A	N/A	AV
2390	28.61	23	104	V	28.98	5.22	0.00	62.81	74.00	-11.19	PK
2390	17.01	23	104	V	28.98	5.22	0.00	51.21	54.00	-2.79	AV
4824	47.58	0	100	V	32.51	7.89	36.63	51.35	74.00	-22.65	PK
4824	35.78	0	100	V	32.51	7.89	36.63	39.55	54.00	-14.45	AV
7236	47.04	0	100	V	36.86	10.51	36.42	57.99	74.00	-16.01	PK
7236	35.08	0	100	V	36.86	10.51	36.42	46.03	54.00	-7.97	AV
9648	47.71	0	100	V	37.80	11.39	36.67	60.23	74.00	-13.77	PK
9648	36.11	0	100	V	37.80	11.39	36.67	48.63	54.00	-5.37	AV
Middle Channel 2437 MHz											
2437	61.76	51	291	H	29.18	5.22	0.00	96.16	N/A	N/A	PK
2437	59.19	51	291	H	29.18	5.22	0.00	93.59	N/A	N/A	AV
2437	63.43	42	104	V	29.18	5.22	0.00	97.83	N/A	N/A	PK
2437	60.94	42	104	V	29.18	5.22	0.00	95.34	N/A	N/A	AV
4874	47.82	0	100	V	32.59	7.92	36.63	51.70	74.00	-22.30	PK
4874	35.81	0	100	V	32.59	7.92	36.63	39.69	54.00	-14.31	AV
7311	46.63	0	100	V	37.15	10.65	36.43	58.00	74.00	-16.00	PK
7311	34.32	0	100	V	37.15	10.65	36.43	45.69	54.00	-8.31	AV
9748	47.5	0	100	V	37.88	11.45	36.69	60.14	74.00	-13.86	PK
9748	35.48	0	100	V	37.88	11.45	36.69	48.12	54.00	-5.88	AV
High Channel 2462 MHz											
2462	61.3	55	294	H	29.27	5.22	0.00	95.79	N/A	N/A	PK
2462	58.82	55	294	H	29.27	5.22	0.00	93.31	N/A	N/A	AV
2462	63.05	41	145	V	29.27	5.22	0.00	97.54	N/A	N/A	PK
2462	60.23	41	145	V	29.27	5.22	0.00	94.72	N/A	N/A	AV
2483.5	27.94	41	145	V	29.35	5.35	0.00	62.64	74.00	-11.36	PK
2483.5	16.77	41	145	V	29.35	5.35	0.00	51.47	54.00	-2.53	AV
4924	47.49	0	100	V	32.72	7.95	36.61	51.55	74.00	-22.45	PK
4924	35.65	0	100	V	32.72	7.95	36.61	39.71	54.00	-14.29	AV
7386	46.26	0	100	V	37.14	10.80	36.44	57.76	74.00	-16.24	PK
7386	34.28	0	100	V	37.14	10.80	36.44	45.78	54.00	-8.22	AV
9848	47.36	0	100	V	37.95	11.51	36.70	60.12	74.00	-13.88	PK
9848	35.31	0	100	V	37.95	11.51	36.70	48.07	54.00	-5.93	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	66.82	52	291	H	29.09	5.22	0.00	101.13	N/A	N/A	PK
2412	56.9	52	291	H	29.09	5.22	0.00	91.21	N/A	N/A	AV
2412	68.66	38	101	V	29.09	5.22	0.00	102.97	N/A	N/A	PK
2412	59.11	38	101	V	29.09	5.22	0.00	93.42	N/A	N/A	AV
2390	28.32	38	101	V	28.98	5.22	0.00	62.52	74.00	-11.48	PK
2390	17.09	38	101	V	28.98	5.22	0.00	51.29	54.00	-2.71	AV
4824	47.13	0	100	V	32.51	7.89	36.63	50.90	74.00	-23.10	PK
4824	35.75	0	100	V	32.51	7.89	36.63	39.52	54.00	-14.48	AV
7236	47.3	0	100	V	36.86	10.51	36.42	58.25	74.00	-15.75	PK
7236	35.04	0	100	V	36.86	10.51	36.42	45.99	54.00	-8.01	AV
9648	47.88	0	100	V	37.80	11.39	36.67	60.40	74.00	-13.60	PK
9648	36.16	0	100	V	37.80	11.39	36.67	48.68	54.00	-5.32	AV
Middle Channel 2437 MHz											
2437	66.18	54	294	H	29.18	5.22	0.00	100.58	N/A	N/A	PK
2437	56.17	54	294	H	29.18	5.22	0.00	90.57	N/A	N/A	AV
2437	68.03	39	100	V	29.18	5.22	0.00	102.43	N/A	N/A	PK
2437	58.95	39	100	V	29.18	5.22	0.00	93.35	N/A	N/A	AV
4874	47.72	0	100	V	32.59	7.92	36.63	51.60	74.00	-22.40	PK
4874	35.77	0	100	V	32.59	7.92	36.63	39.65	54.00	-14.35	AV
7311	47.01	0	100	V	37.15	10.65	36.43	58.38	74.00	-15.62	PK
7311	34.42	0	100	V	37.15	10.65	36.43	45.79	54.00	-8.21	AV
9748	47.56	0	100	V	37.88	11.45	36.69	60.20	74.00	-13.80	PK
9748	35.55	0	100	V	37.88	11.45	36.69	48.19	54.00	-5.81	AV
High Channel 2462 MHz											
2462	65.37	56	291	H	29.27	5.22	0.00	99.86	N/A	N/A	PK
2462	56.47	56	291	H	29.27	5.22	0.00	90.96	N/A	N/A	AV
2462	67.65	40	100	V	29.27	5.22	0.00	102.14	N/A	N/A	PK
2462	58.09	40	100	V	29.27	5.22	0.00	92.58	N/A	N/A	AV
2483.5	29.09	40	100	V	29.35	5.35	0.00	63.79	74.00	-10.21	PK
2483.5	17.3	40	100	V	29.35	5.35	0.00	52.00	54.00	-2.00	AV
4924	47.81	0	100	V	32.72	7.95	36.61	51.87	74.00	-22.13	PK
4924	35.8	0	100	V	32.72	7.95	36.61	39.86	54.00	-14.14	AV
7386	46.42	0	100	V	37.14	10.80	36.44	57.92	74.00	-16.08	PK
7386	34.33	0	100	V	37.14	10.80	36.44	45.83	54.00	-8.17	AV
9848	47.46	0	100	V	37.95	11.51	36.70	60.22	74.00	-13.78	PK
9848	35.42	0	100	V	37.95	11.51	36.70	48.18	54.00	-5.82	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	65.91	52	300	H	29.09	5.22	0.00	100.22	N/A	N/A	PK
2412	56.93	52	300	H	29.09	5.22	0.00	91.24	N/A	N/A	AV
2412	68.36	36	100	V	29.09	5.22	0.00	102.67	N/A	N/A	PK
2412	58.98	36	100	V	29.09	5.22	0.00	93.29	N/A	N/A	AV
2390	28.77	36	100	V	28.98	5.22	0.00	62.97	74.00	-11.03	PK
2390	17.16	36	100	V	28.98	5.22	0.00	51.36	54.00	-2.64	AV
4824	47.63	0.00	100	V	32.51	7.89	36.63	51.40	74.00	-22.60	PK
4824	35.74	0.00	100	V	32.51	7.89	36.63	39.51	54.00	-14.49	AV
7236	46.93	0.00	100	V	36.86	10.51	36.42	57.88	74.00	-16.12	PK
7236	34.94	0.00	100	V	36.86	10.51	36.42	45.89	54.00	-8.11	AV
9648	47.47	0.00	100	V	37.80	11.39	36.67	59.99	74.00	-14.01	PK
9648	36.22	0.00	100	V	37.80	11.39	36.67	48.74	54.00	-5.26	AV
Middle Channel 2437 MHz											
2437	66.11	53	290	H	29.18	5.22	0.00	100.51	N/A	N/A	PK
2437	56.38	53	290	H	29.18	5.22	0.00	90.78	N/A	N/A	AV
2437	67.51	41	101	V	29.18	5.22	0.00	101.91	N/A	N/A	PK
2437	57.87	41	101	V	29.18	5.22	0.00	92.27	N/A	N/A	AV
4874	46.94	41	101	V	32.59	7.92	36.63	50.82	74.00	-23.18	PK
4874	35.84	41	101	V	32.59	7.92	36.63	39.72	54.00	-14.28	AV
7311	45.85	0	100	V	37.15	10.65	36.43	57.22	74.00	-16.78	PK
7311	34.43	0	100	V	37.15	10.65	36.43	45.80	54.00	-8.20	AV
9748	47.53	0	100	V	37.88	11.45	36.69	60.17	74.00	-13.83	PK
9748	35.6	0	100	V	37.88	11.45	36.69	48.24	54.00	-5.76	AV
High Channel 2462 MHz											
2462	65.57	59	294	H	29.27	5.22	0.00	100.06	N/A	N/A	PK
2462	56.46	59	294	H	29.27	5.22	0.00	90.95	N/A	N/A	AV
2462	67.72	43	100	V	29.27	5.22	0.00	102.21	N/A	N/A	PK
2462	57.73	43	100	V	29.27	5.22	0.00	92.22	N/A	N/A	AV
2483.5	32.13	43	100	V	29.35	5.35	0.00	66.83	74.00	-7.17	PK
2483.5	17.58	43	100	V	29.35	5.35	0.00	52.28	54.00	-1.72	AV
4924	47.19	0	100	V	32.72	7.95	36.61	51.25	74.00	-22.75	PK
4924	35.49	0	100	V	32.72	7.95	36.61	39.55	54.00	-14.45	AV
7386	46.45	0	100	V	37.14	10.80	36.44	57.95	74.00	-16.05	PK
7386	34.3	0	100	V	37.14	10.80	36.44	45.80	54.00	-8.20	AV
9848	47.49	0	100	V	37.95	11.51	36.70	60.25	74.00	-13.75	PK
9848	35.31	0	100	V	37.95	11.51	36.70	48.07	54.00	-5.93	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											
2412	65.91	52	300	H	29.09	5.22	0.00	100.22	N/A	N/A	PK
2412	56.93	52	300	H	29.09	5.22	0.00	91.24	N/A	N/A	AV
2412	68.36	36	100	V	29.09	5.22	0.00	102.67	N/A	N/A	PK
2412	58.98	36	100	V	29.09	5.22	0.00	93.29	N/A	N/A	AV
2390	28.77	36	100	V	28.98	5.22	0.00	62.97	74.00	-11.03	PK
2390	17.16	36	100	V	28.98	5.22	0.00	51.36	54.00	-2.64	AV
4824	47.63	0	100	V	32.51	7.89	36.63	51.40	74.00	-22.60	PK
4824	35.74	0	100	V	32.51	7.89	36.63	39.51	54.00	-14.49	AV
7236	46.93	0	100	V	36.86	10.51	36.42	57.88	74.00	-16.12	PK
7236	34.94	0	100	V	36.86	10.51	36.42	45.89	54.00	-8.11	AV
9648	47.47	0	100	V	37.80	11.39	36.67	59.99	74.00	-14.01	PK
9648	36.22	0	100	V	37.80	11.39	36.67	48.74	54.00	-5.26	AV
Middle Channel 2440 MHz											
2440	61.61	52	293	H	29.19	5.22	0.00	96.02	N/A	N/A	PK
2440	58.81	52	293	H	29.19	5.22	0.00	93.22	N/A	N/A	AV
2440	63.22	39	104	V	29.19	5.22	0.00	97.63	N/A	N/A	PK
2440	60.32	39	104	V	29.19	5.22	0.00	94.73	N/A	N/A	AV
4880	47.38	0	100	V	32.60	7.93	36.63	51.28	74.00	-22.72	PK
4880	36.72	0	100	V	32.60	7.93	36.63	40.62	54.00	-13.38	AV
7320	46.21	0	100	V	37.15	10.67	36.43	57.60	74.00	-16.40	PK
7320	34.55	0	100	V	37.15	10.67	36.43	45.94	54.00	-8.06	AV
9760	48.18	0	100	V	37.89	11.46	36.69	60.84	74.00	-13.16	PK
9760	36.48	0	100	V	37.89	11.46	36.69	49.14	54.00	-4.86	AV
High Channel 2480 MHz											
2480	59.11	57	295	H	29.34	5.22	0.00	93.67	N/A	N/A	H
2480	55.82	57	295	H	29.34	5.22	0.00	90.38	N/A	N/A	H
2480	59.83	44	100	V	29.34	5.22	0.00	94.39	N/A	N/A	V
2480	56.73	44	100	V	29.34	5.22	0.00	91.29	N/A	N/A	V
2483.5	28.09	44	100	V	29.35	5.35	0.00	62.79	74.00	-11.21	V
2483.5	16.65	44	100	V	29.35	5.35	0.00	51.36	54.00	-2.65	V
4960	47.29	0	100	V	32.85	7.97	36.59	51.52	74.00	-22.48	V
4960	36.67	0	100	V	32.85	7.97	36.59	40.90	54.00	-13.10	V
7440	46.88	0	100	V	37.04	10.82	36.45	58.29	74.00	-15.71	V
7440	35.44	0	100	V	37.04	10.82	36.45	46.85	54.00	-7.15	V
9920	47.52	0	100	V	38.00	11.54	36.70	60.36	74.00	-13.64	V
9920	36.56	0	100	V	38.00	11.54	36.70	49.40	54.00	-4.60	V

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

8.1 Applicable Standards

According to ECFR §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 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	US45303156	2016-01-19	1 year
-	RF cable	-	-	Each time[1]	N/A
-	10 dB 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:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

The testing was performed by Jose Martinez on 2016-10-28 in RF site.

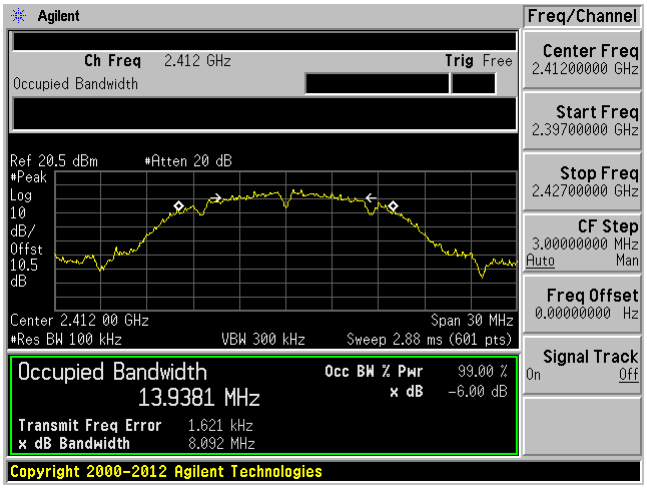
8.5 Test Results

Channel	Frequency (MHz)	99% OBW (kHz)	6 dB OBW (kHz)	6 dB OBW Lmit (kHz)
802.11b mode				
Low	2412	13938.1	8092	500
Middle	2437	13720.9	8958	500
High	2462	13981.4	8588	500
802.11g mode				
Low	2412	16296.4	16055	500
Middle	2437	16303.5	15961	500
High	2462	16296.6	15597	500
802.11n-HT20 mode				
Low	2412	17424.8	15975	500
Middle	2437	17478.9	16758	500
High	2462	17479.4	15223	500
BLE				
Low	2402	1086.1	698.008	500
Middle	2440	1086.0	697.715	500
High	2480	1088.3	710.867	500

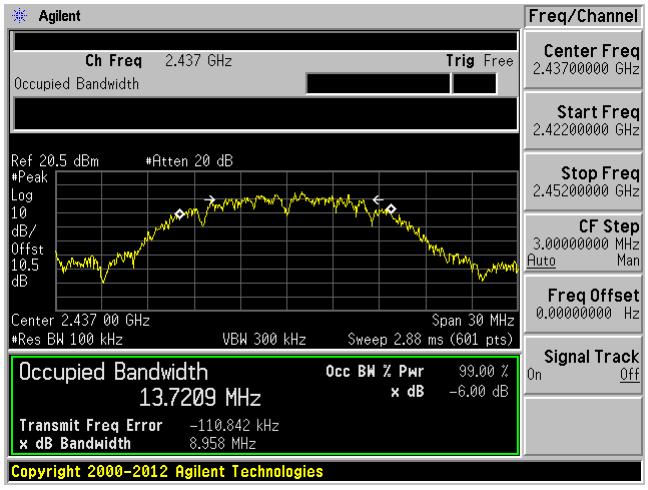
Please refer to the following plots for detailed test results.

802.11b mode

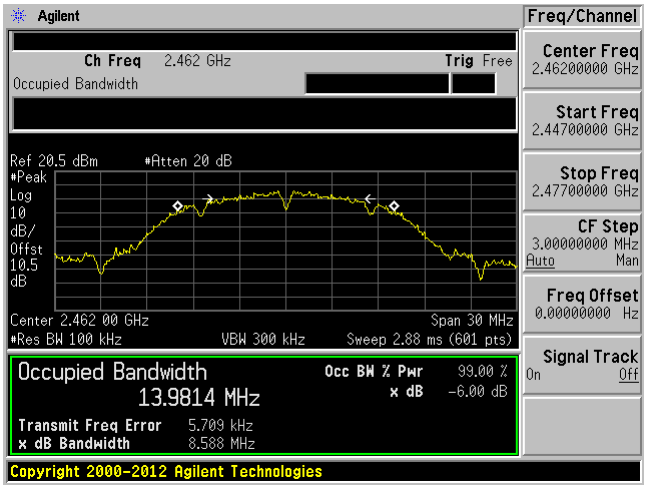
Low Channel 2412 MHz



Middle Channel 2437 MHz

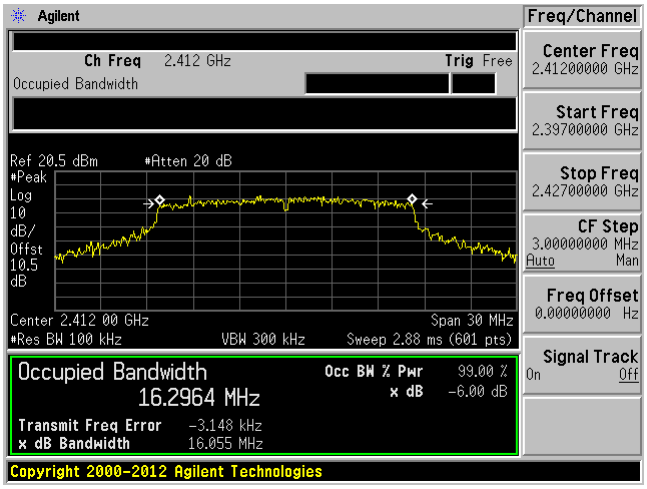


High Channel 2462 MHz

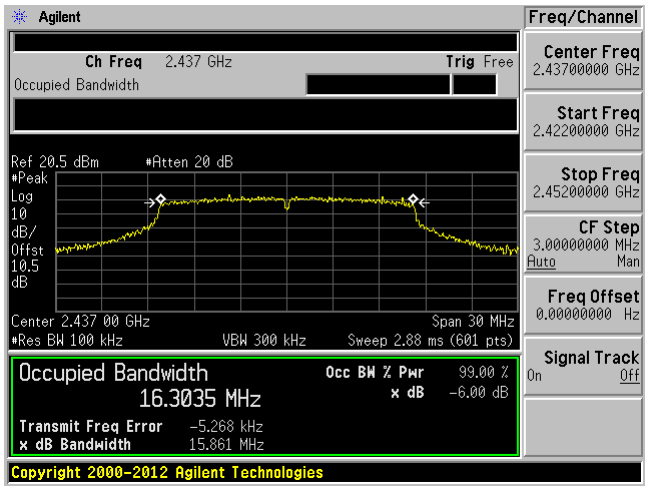


802.11g mode

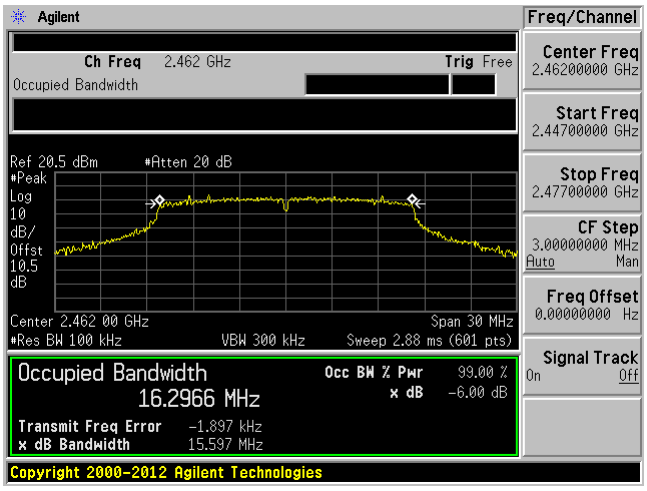
Low Channel 2412 MHz



Middle Channel 2437 MHz

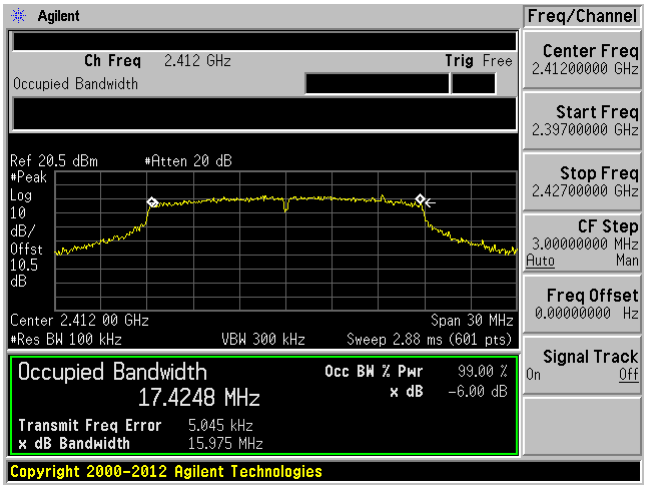


High Channel 2462 MHz

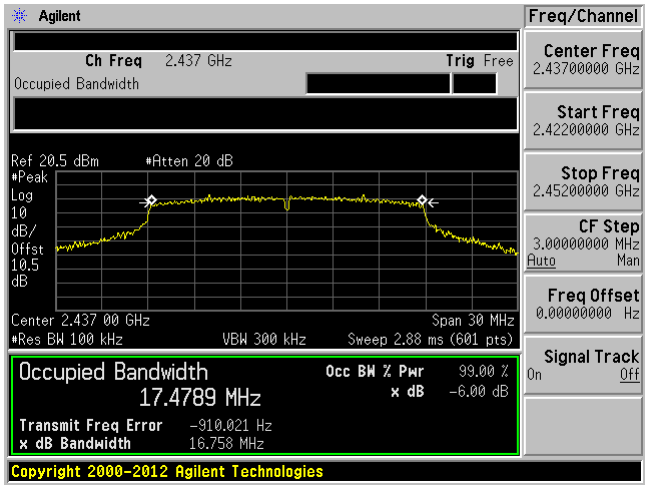


802.11n20 mode

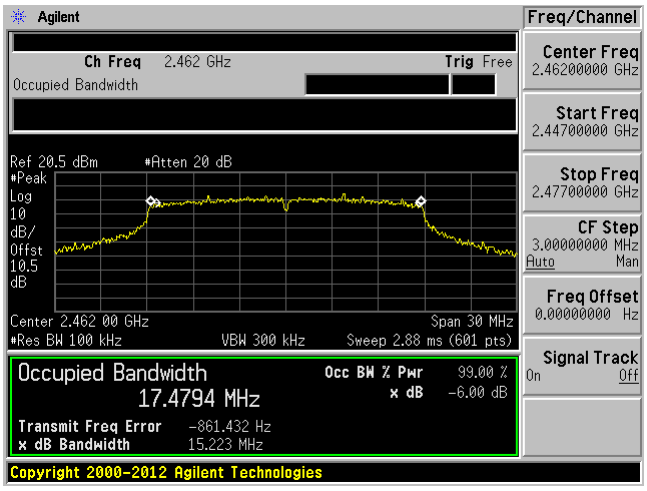
Low Channel 2412 MHz



Middle Channel 2437 MHz

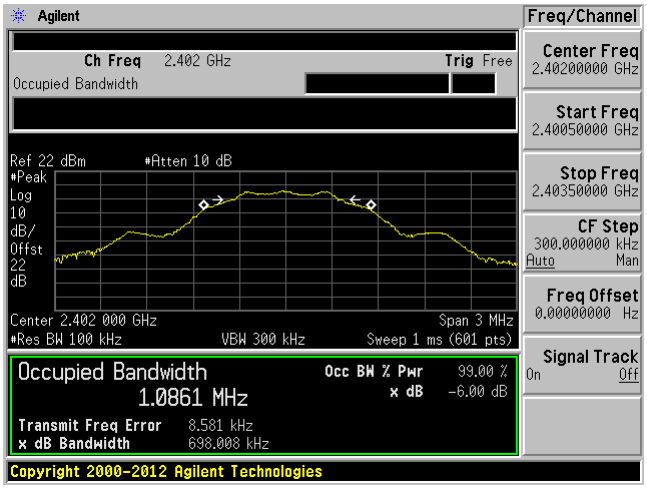


High Channel 2462 MHz

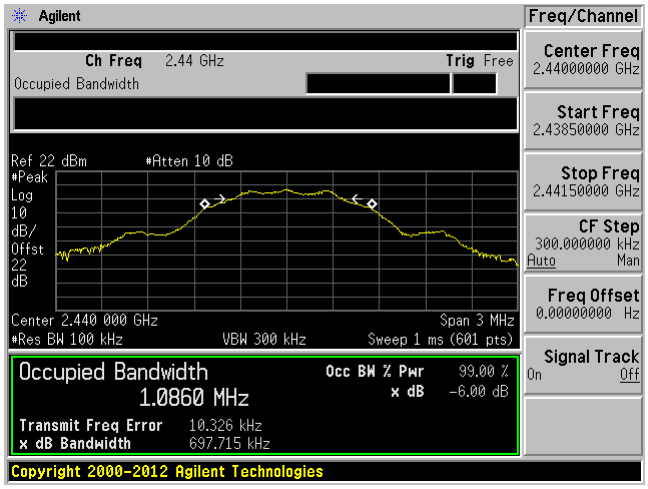


BLE

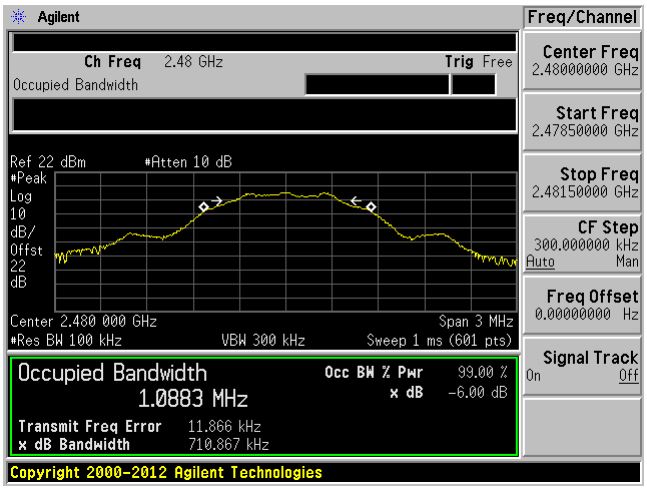
Low Channel 2402 MHz



Middle Channel 2440 MHz



High Channel 2480 MHz



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

9.1 Applicable Standards

According to ECFR §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 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
Agilent	Analyzer, Spectrum	E4440A	US45303156	2016-01-19	1 year
ETS- Lingerin	Power Sensor	7002-006	160097	2014-10-21	25 months
-	RF Cable	-	-	Each time[1]	N/A
-	10 dB 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:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

The testing was performed by Jose Martinez on 2016-10-28 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	15.78	30
6	2437	16.18	30
11	2462	16.11	30
802.11g mode			
1	2412	16.4	30
6	2437	16.72	30
11	2462	16.52	30
802.11n-HT20 mode			
1	2412	16.28	30
6	2437	16.55	30
11	2462	16.35	30

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

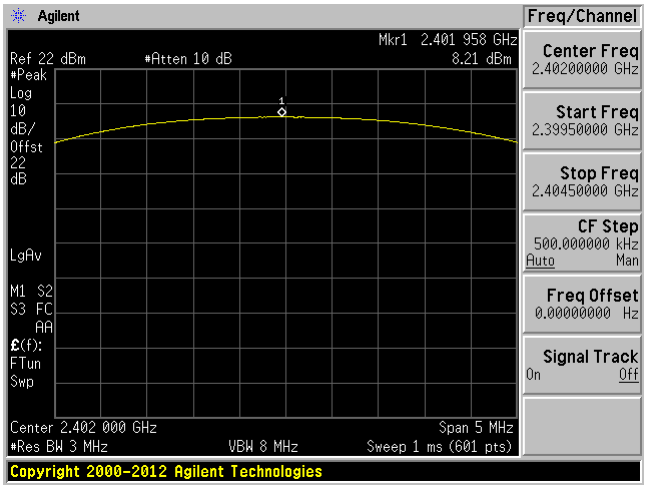
Peak Output Power

Channel	Frequency (MHz)	Conducted Peak Output Power (dBm)	Limit (dBm)
BLE			
Low	2402	8.21	30
Middle	2440	9.06	30
High	2480	8.13	30

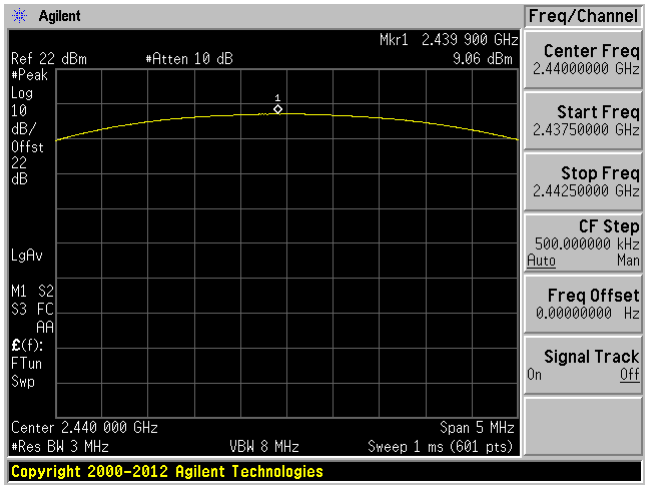
Please refer to the following plots for detailed test results.

BLE

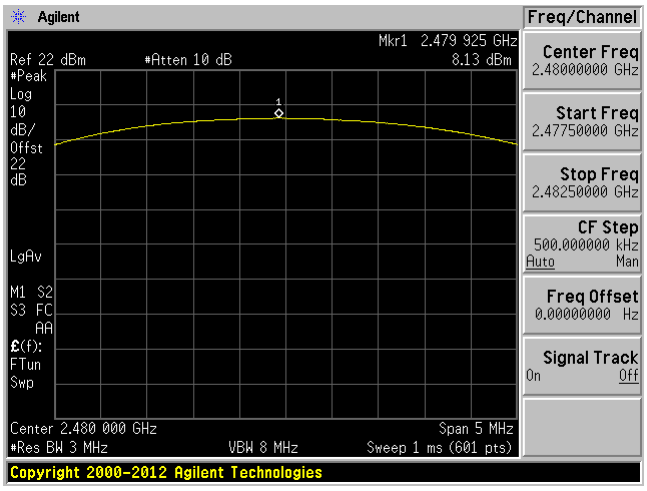
Low Channel 2402 MHz



Middle Channel 2440 MHz



High Channel 2480 MHz



10 FCC §15.247(d) & ISED RSS-247 §5.5 - 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).

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 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	US45303156	2016-01-19	1 year
-	RF Cable	-	-	Each time[1]	N/A
-	10 dB 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:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

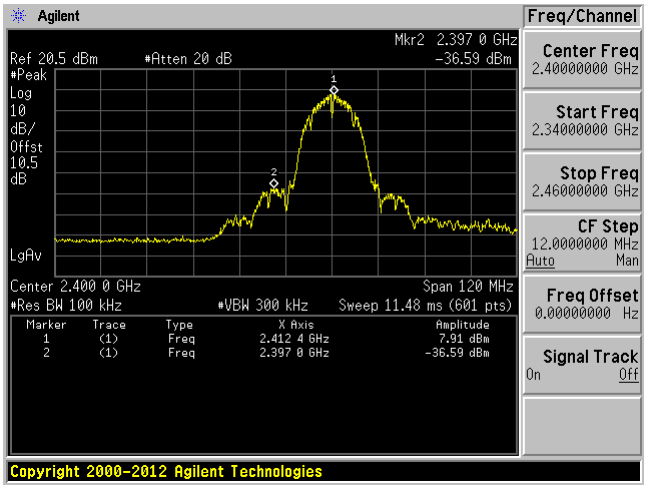
The testing was performed by Jose Martinez on 2016-10-28 in RF site.

10.5 Test Results

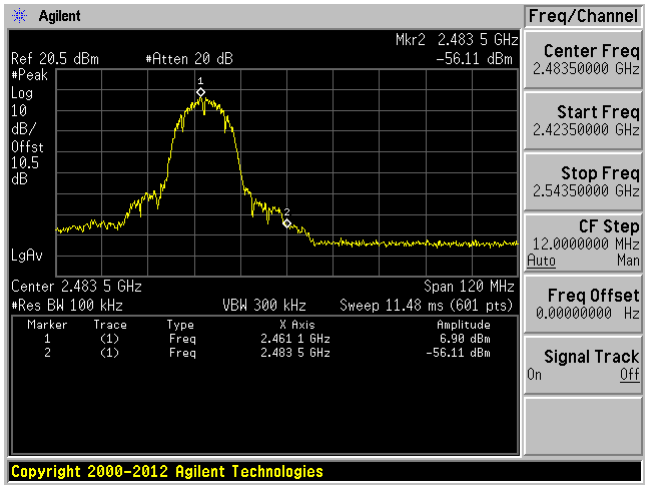
Please refer to the following plots.

802.11b mode

Low Channel 2412 MHz

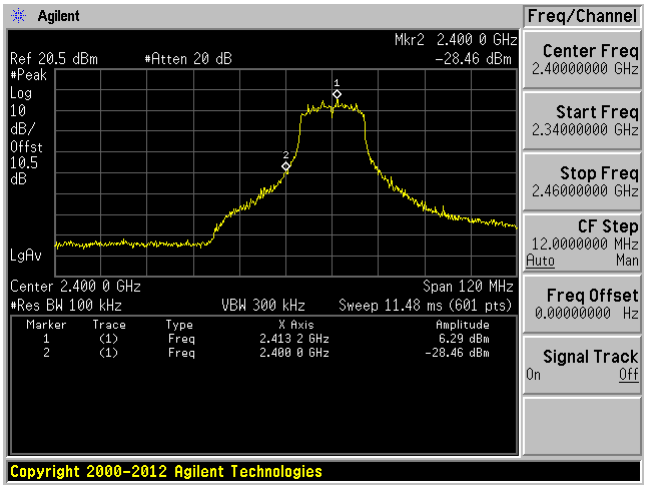


High Channel 2462 MHz

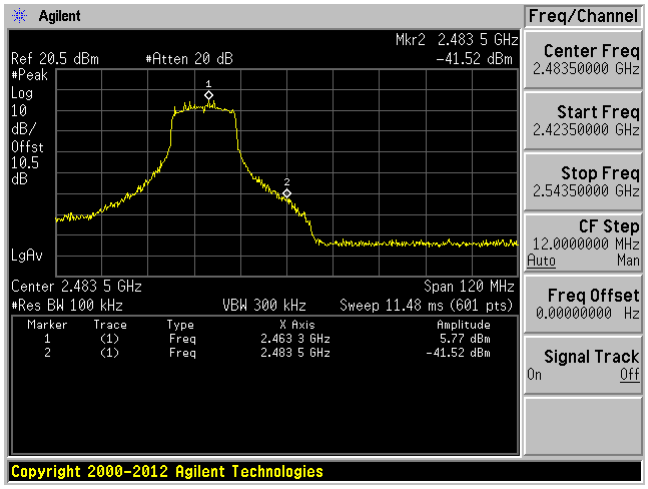


802.11g mode

Low Channel 2412 MHz

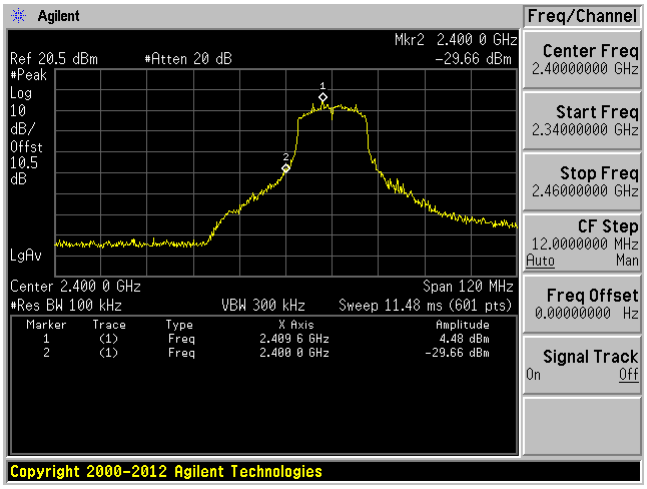


High Channel 2462 MHz

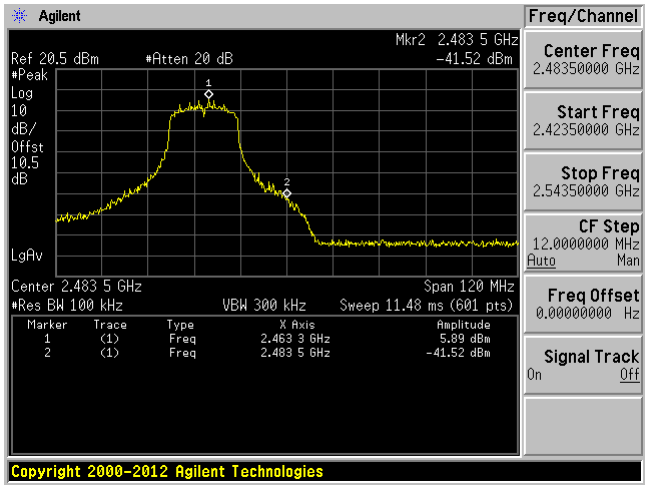


802.11n20 mode

Low Channel 2412 MHz

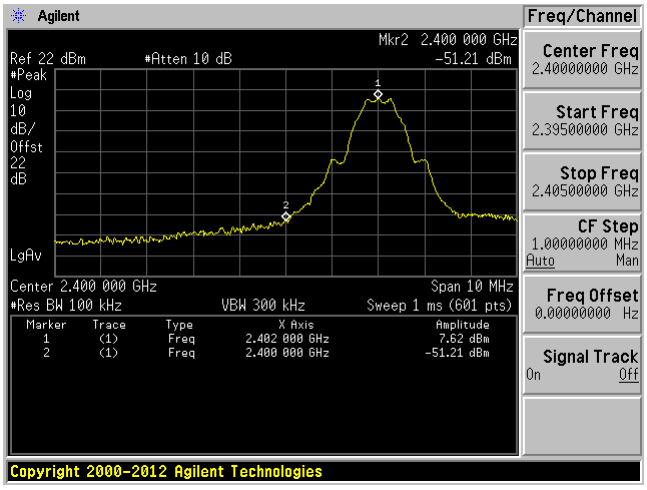


High Channel 2462 MHz

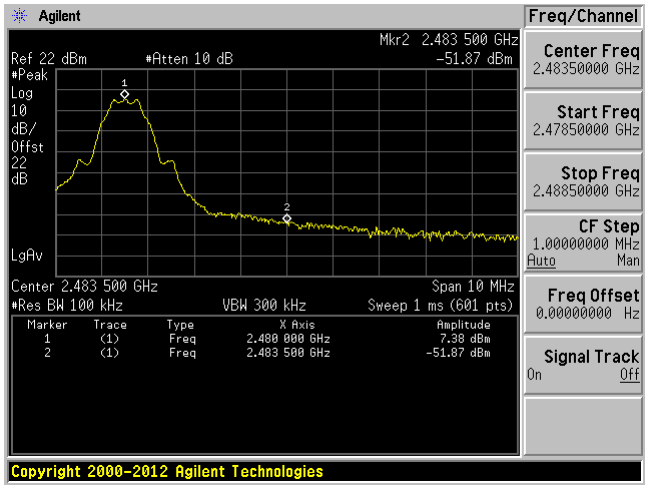


BLE

Low Channel 2402 MHz



High Channel 2480 MHz



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

11.1 Applicable Standards

According to ECFR §15.247(e) and 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 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	US45303156	2016-01-19	1 year
-	RF Cable	-	-	Each time[1]	N/A
-	10dB 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:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

The testing was performed by Jose Martinez on 2016-10-28 in RF site.

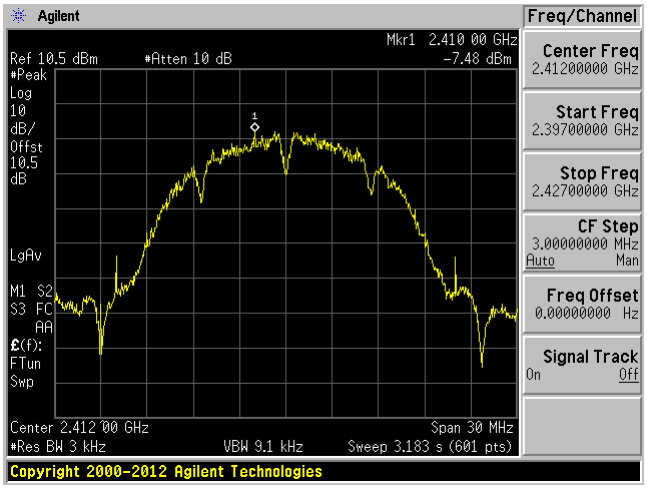
11.5 Test Results

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)
802.11b mode			
Low	2412	-7.48	8
Middle	2437	-7.17	8
High	2462	-7.43	8
802.11g mode			
Low	2412	-8.33	8
Middle	2437	-9.14	8
High	2462	-8.87	8
802.11n-HT20 mode			
Low	2412	-8.82	8
Middle	2437	-8.94	8
High	2462	-8.71	8
BLE			
Low	2402	-5.84	8
Middle	2440	-5.18	8
High	2480	-6.03	8

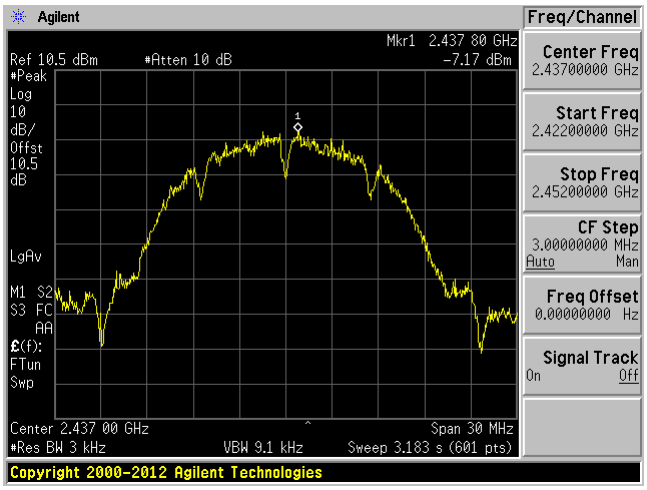
Please refer to the following plots for detailed test results

802.11b mode

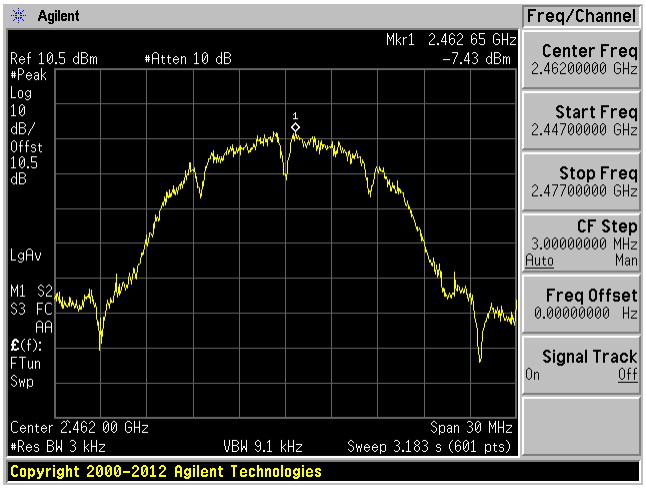
Low Channel 2412 MHz



Middle Channel 2437 MHz

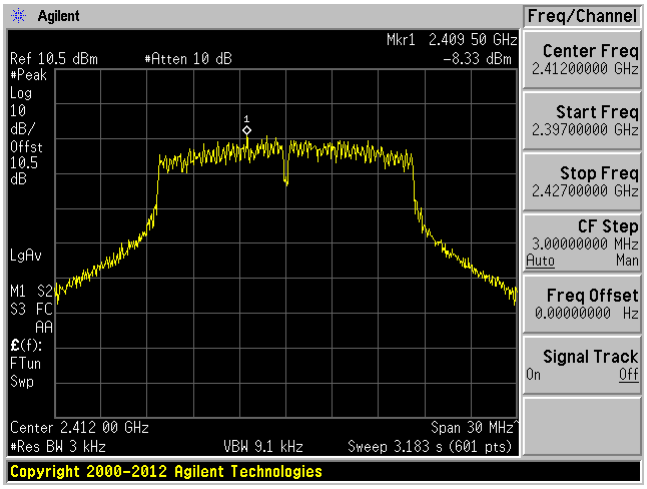


High Channel 2462 MHz

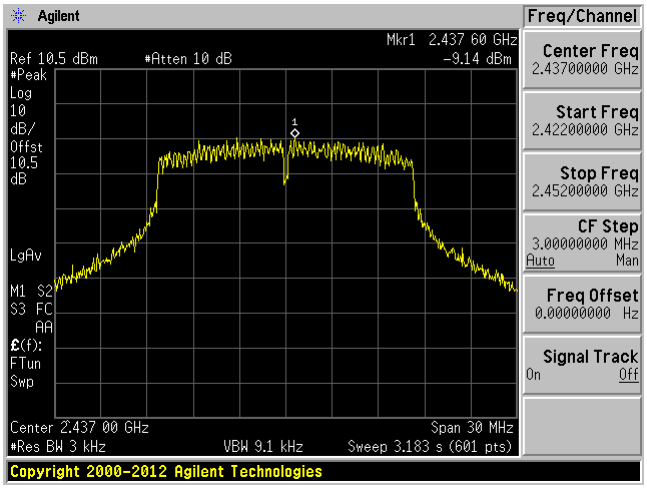


802.11g mode

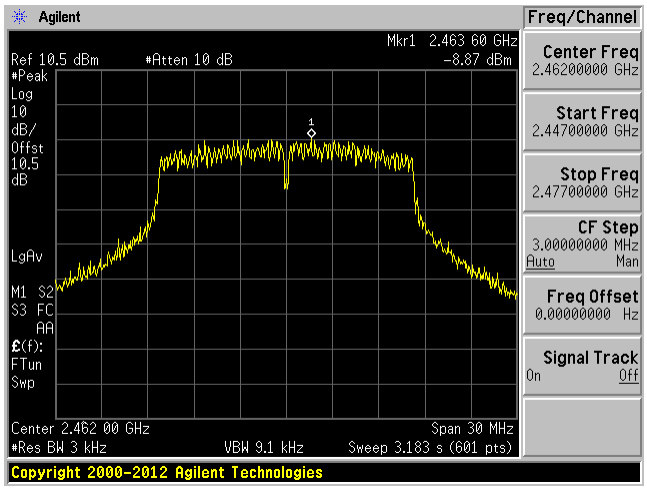
Low Channel 2412 MHz



Middle Channel 2437 MHz

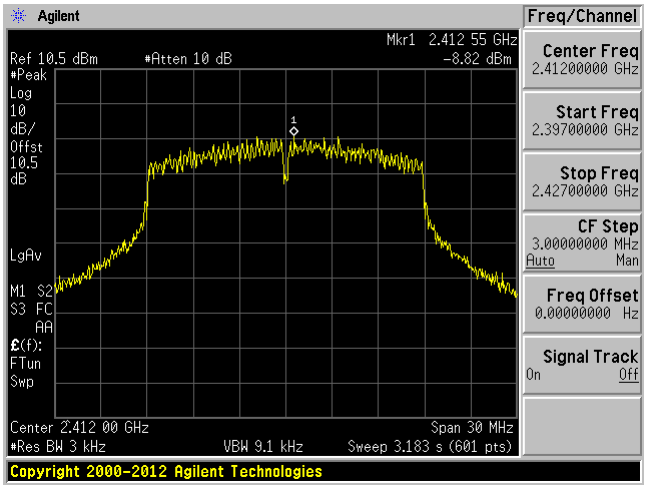


High Channel 2462 MHz

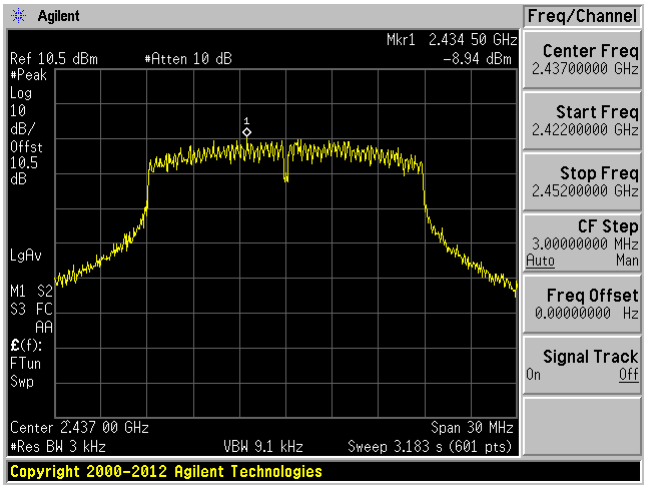


802.11n20 mode

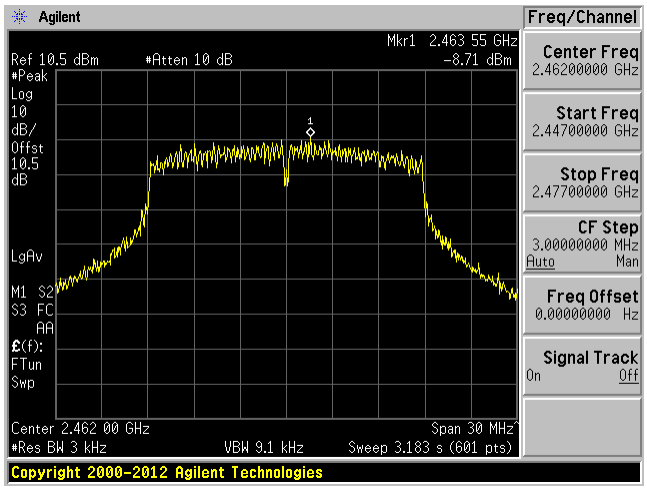
Low Channel 2412 MHz



Middle Channel 2437 MHz

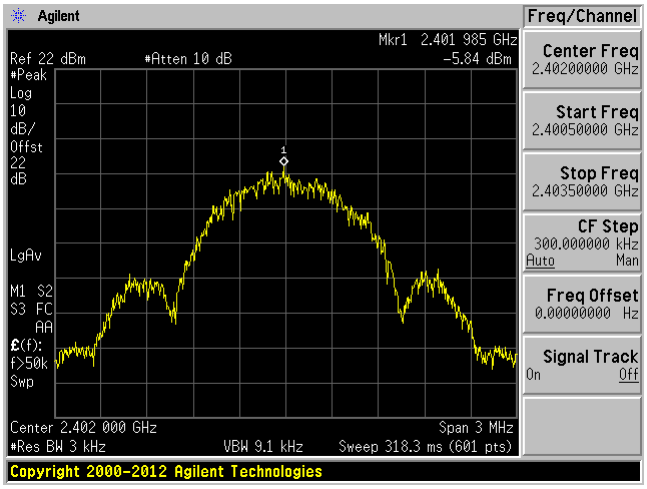


High Channel 2462 MHz

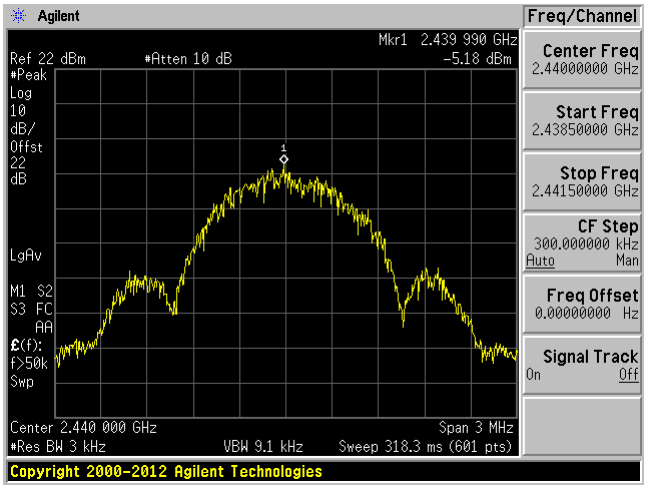


BLE

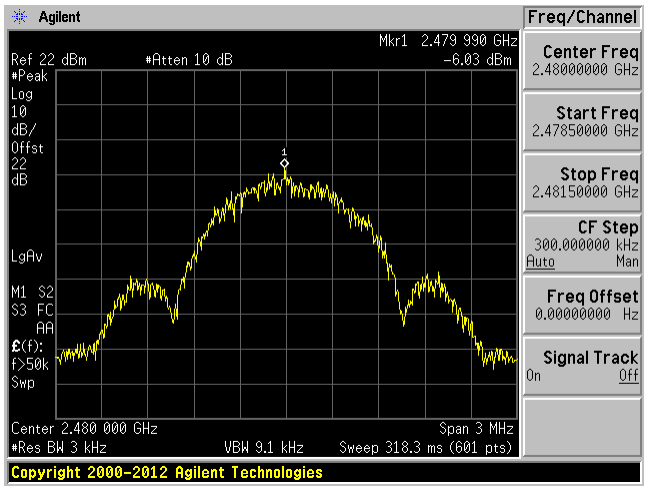
Low Channel 2402 MHz



Middle Channel 2440 MHz



High Channel 2480 MHz



12 FCC §15.247(d) & 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	E4440A	US45303156	2016-01-19	1 year
-	U. FL to SMA pigtail	-	-	Each time[1]	N/A
-	10 dB 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:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.5 KPa

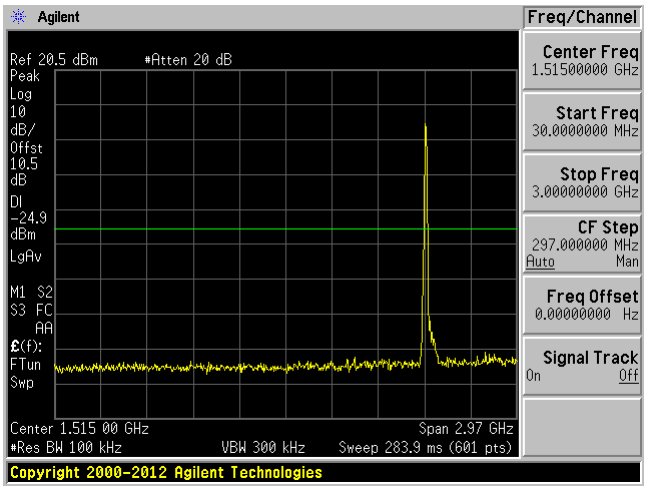
The testing was performed by Jose Martinez on 2016-10-28 in RF site.

12.5 Test Results

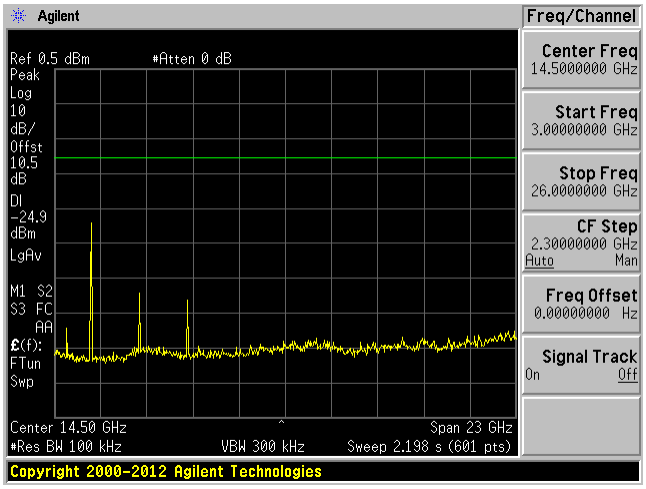
Please refer to following plots.

802.11b mode

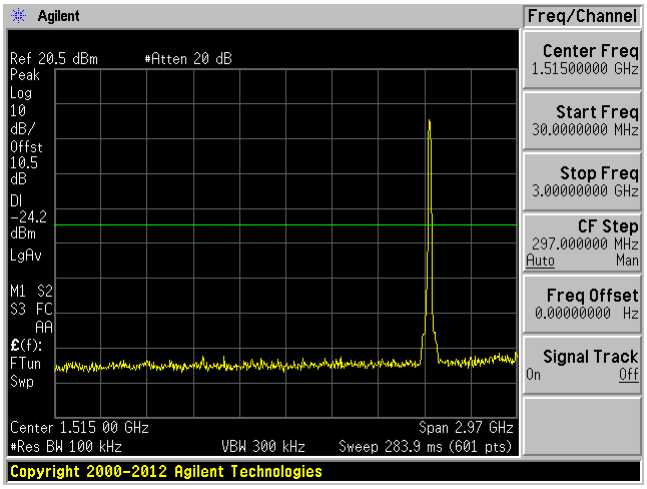
Low Channel 30MHz – 3 GHz



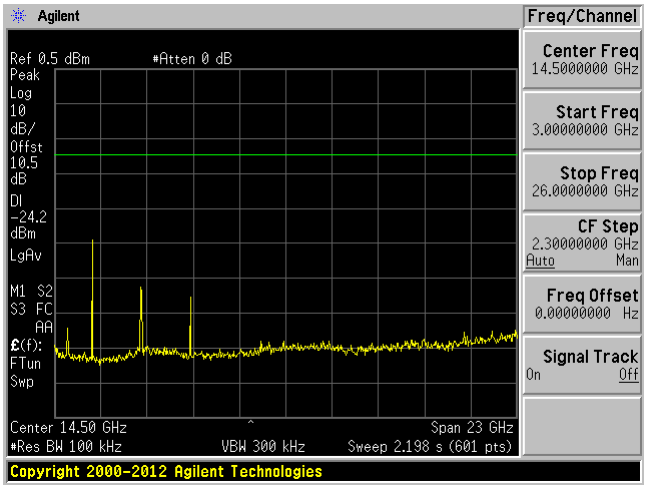
Low Channel 3 GHz – 26 GHz



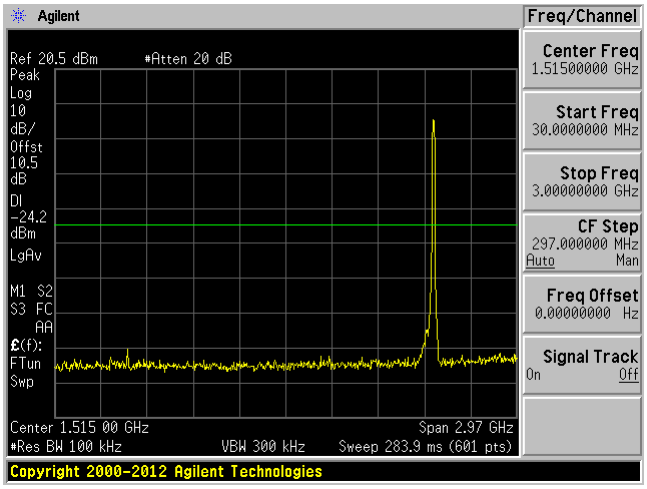
Middle Channel 30 MHz – 3 GHz



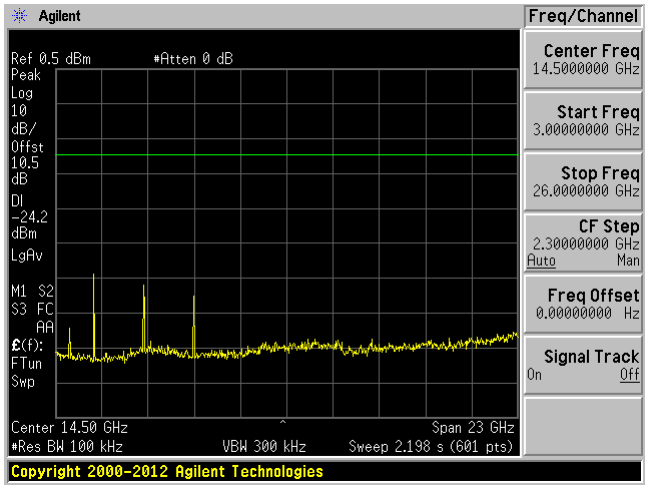
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

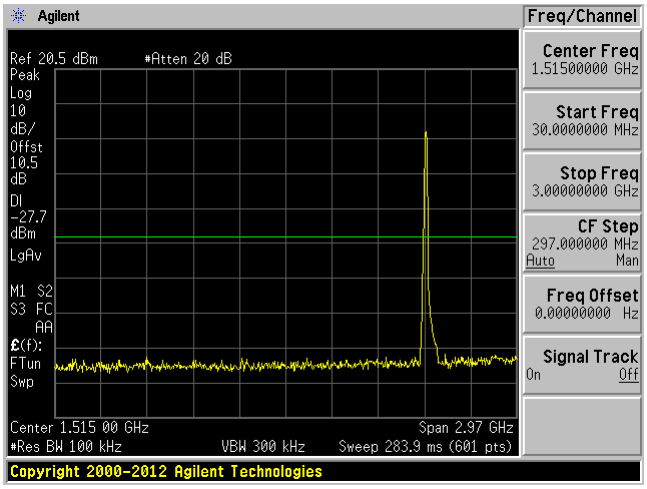


High Channel 3 GHz – 26 GHz

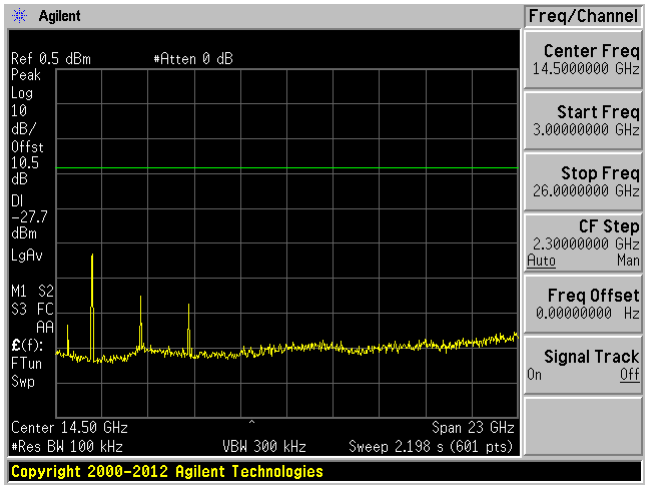


802.11g mode

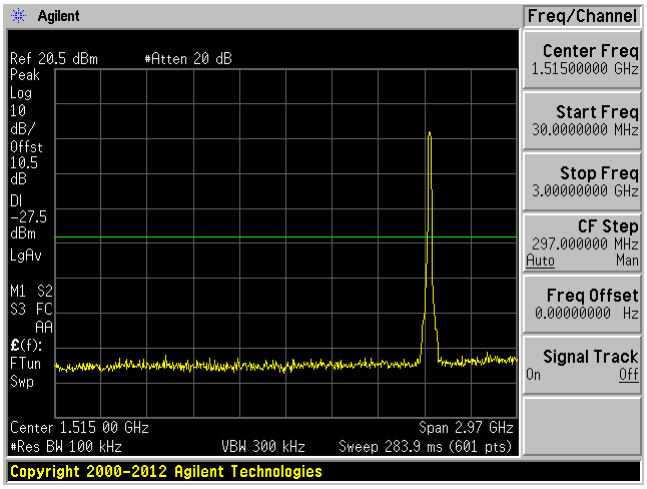
Low Channel 30 MHz – 3 GHz



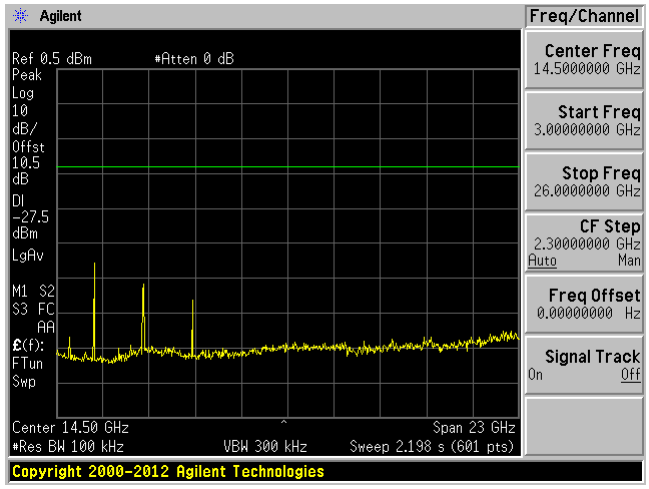
Low Channel 3 GHz – 26 GHz



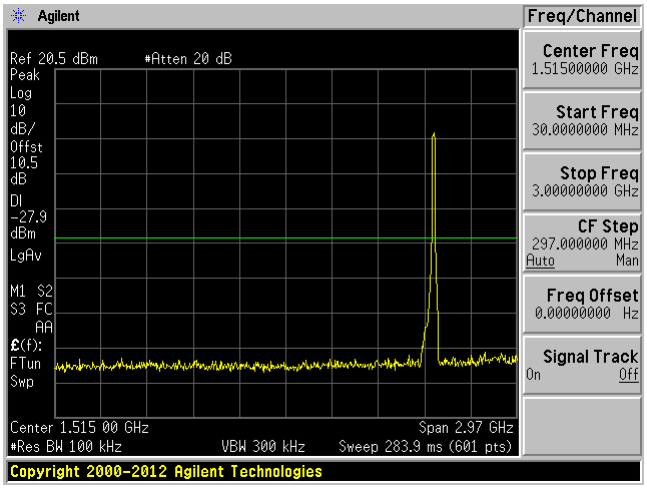
Middle Channel 30 MHz – 3 GHz



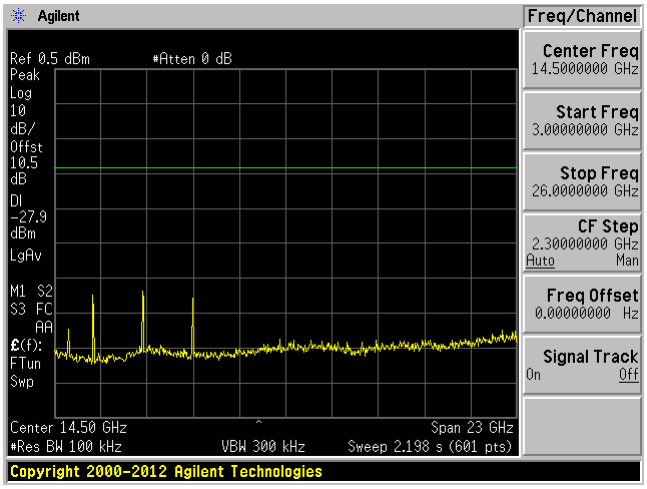
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

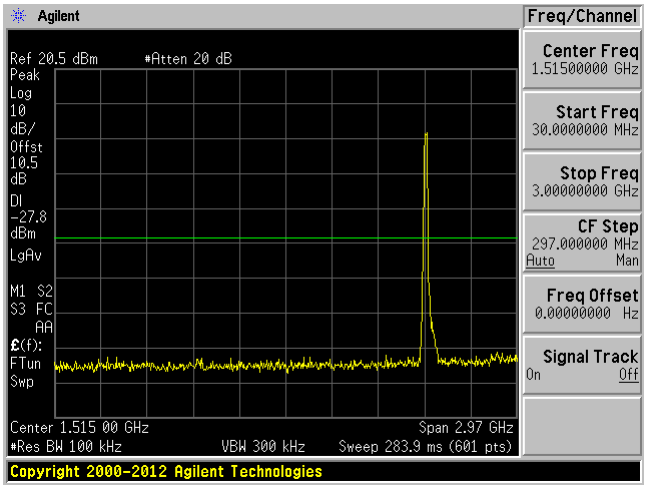


High Channel 3 GHz – 26 GHz

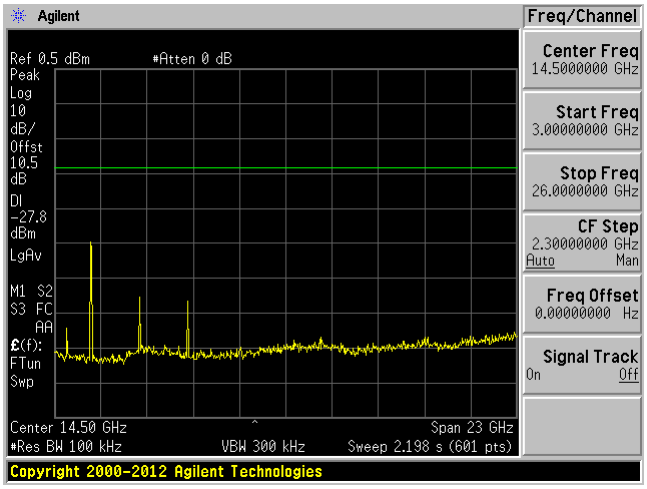


802.11n20 mode

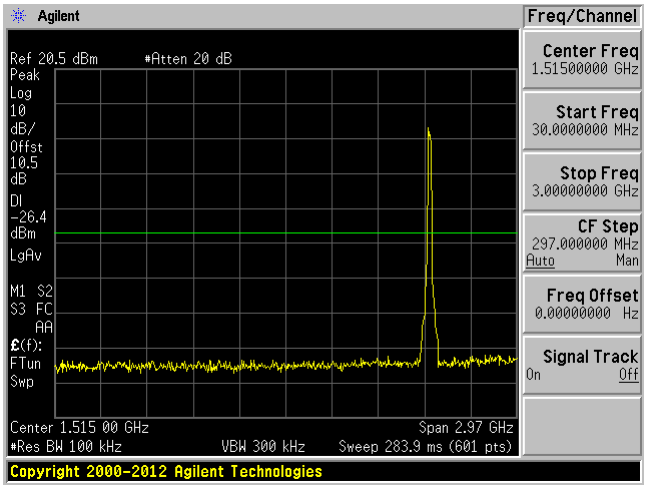
Low Channel 30 MHz – 3 GHz



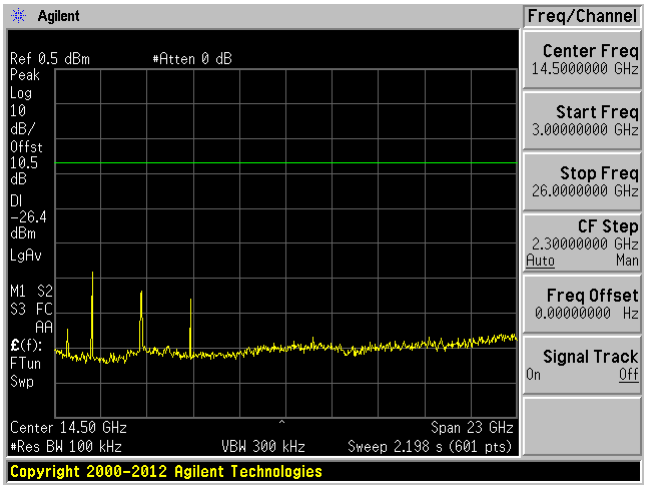
Low Channel 3 GHz – 26 GHz



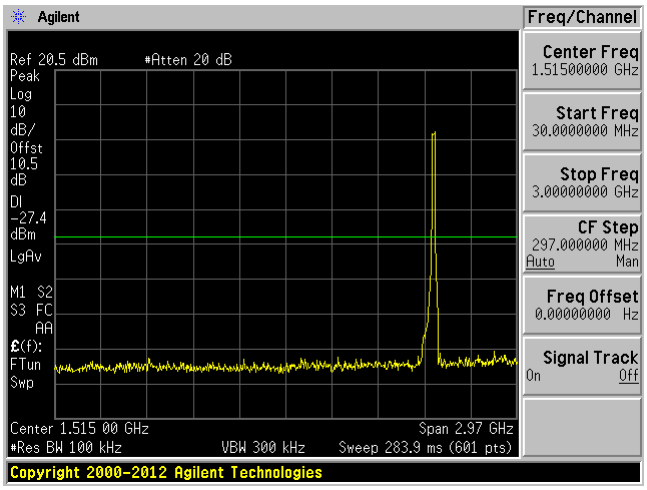
Middle Channel 30 MHz – 3 GHz



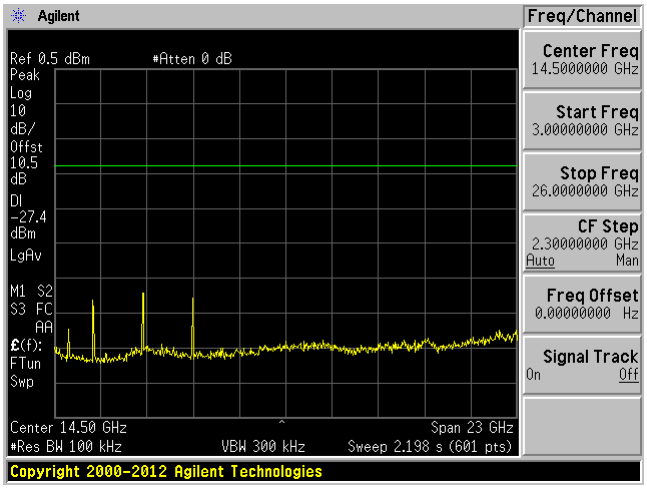
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

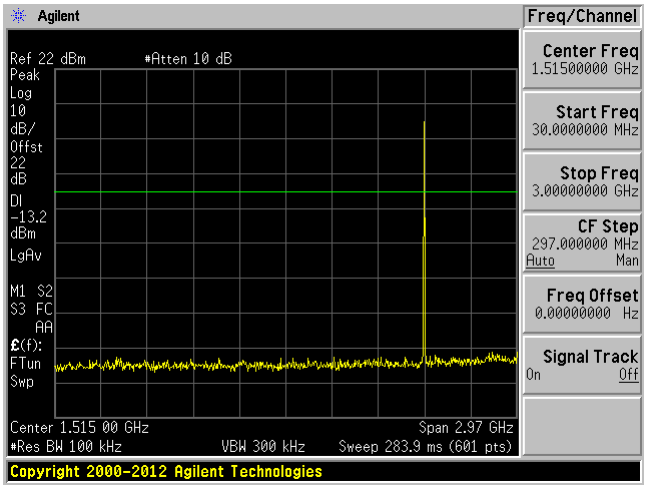


High Channel 3 GHz – 26 GHz

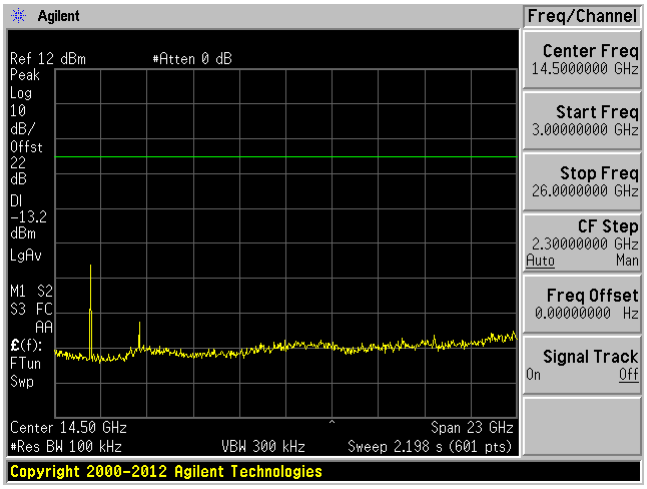


BLE

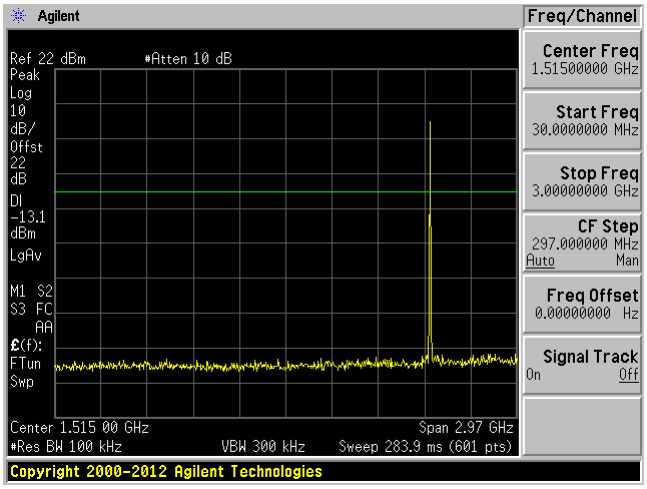
Low Channel 30 MHz – 3 GHz



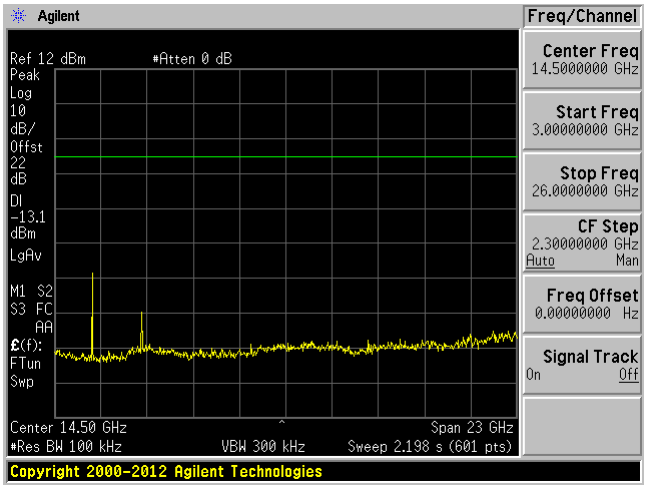
Low Channel 3 GHz – 26 GHz



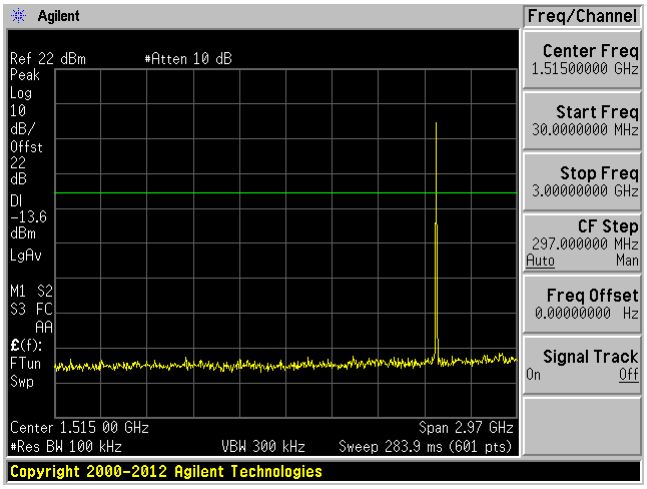
Middle Channel 30 MHz – 3 GHz



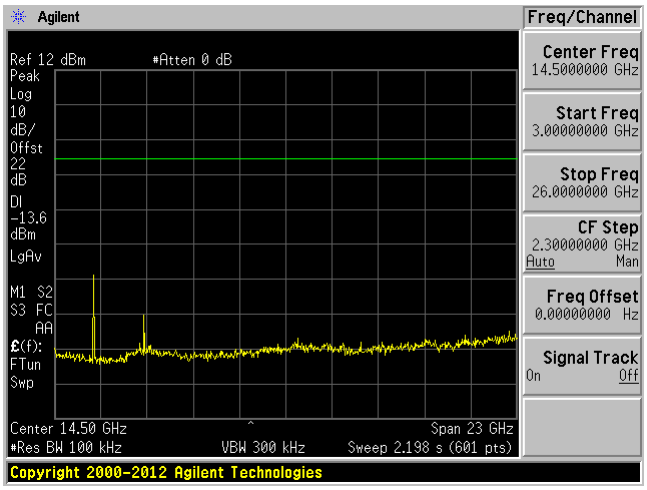
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz



High Channel 3 GHz – 26 GHz



13 Annex A (Informative) - A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

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

Presented this 30th day of August 2016.

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

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