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

TEST REPORT

For

Axon Enterprise, Inc.

17800 N. 85th Street,

Scottsdale, Arizona, United States 85255

FCC ID: X4GS01166
IC: 8803A-S01166

Report Type: Original Report		**Product Type:** Wireless Microphone
Prepared By	Alexandrae Duran Test Engineer	
Report Number	R1902278-DSS	
Report Date	2019-04-04	
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ACCREDITED
CERTIFICATE #3297.02

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1902278-DSS	Original Report	2019-04-04

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

Manufacturer:	Axon Enterprise, Inc.
EUT Name:	Axon Fleet 2 Wireless Microphone
EUT Model(s):	AX1018
FCC ID:	X4GS01166
IC:	8803A-S01166
Serial Number(s):	X58000502

This test and measurement report was prepared on behalf of *Axon Enterprise, Inc.,* and their product model: *AX1018*, FCC ID: X4GS01166 IC: 8803A-S01166, and will be referred to as the "EUT" in this report. The EUT is a wireless microphone for *Axon Fleet 2* vehicle system.

The RF chipset utilized in this system is a 2.4GHz transceiver pair – the "PurePath Wireless" Chipset (CC8520 IC), and range extender (CC2592). One transceiver is located in the Wireless Mic and it is used to transmit digitized audio over the air to the receiving end. This receiver is called the Junction Box, and it is where the other transceiver is located.

1.2 Objective

This report is prepared on behalf of *Axon Enterprise. Inc,* 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 ISEDC RSS-247 rules for Output Power, Antenna Requirements, 20 dB Bandwidth, 100 kHz Bandwidth of Band Edges Measurement, Hopping Channel Separation, Number of Frequencies Used, Dwell Time, as well as Conducted and Radiated Spurious Emissions.

1.3 Related Submittal(s)/Grant(s)

SAR Report: R1902278-SAR.

1.4 Test Methodology

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

1.5 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

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

1.6 Test Facility Registrations

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

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

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

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

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

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

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

Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.03)*** 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 3279.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes & Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products

- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

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

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Innovation, Science and Economic development Canada - ISEDC) 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:
  - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
  - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
  - Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Media Development Authority - IMDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
  - Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was configured for testing in accordance to ANSI C63.10-2013

The worst-case data rates are determined by measuring the peak power across all data rates.

2.2 EUT Exercise Software

The test firmware used for fixed channel measurement was *WirelessMic_rftest_2-18.bin*. And the test firmware used for hopping channel measurement was *WirelessMic_v2.2.4._radiopwr_0db.bin.* The test software used was *PuTTY* version*: Release 0.70,* and *adm_too* version: *build 3.7.170929.1603-48-gf379999.* Both were supplied by *Axon Enterprise, Inc*. The software complies with the standard requirements being tested against

Modulation	Frequency (MHz)	Power Setting
2FSK	2406	0
	2442	0
	2474	0

2.3 Duty Cycle Correction Factor

According to ANSI C63.10-2013 section 7.5:

Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 s (100 ms). In cases where the pulse train exceeds 0.1 s, the measured field strength shall be determined during a 0.1 s interval. The following procedure is an example of how the average value may be determined. The average field strength may be found by measuring the peak pulse amplitude (in log equivalent units) and determining the duty cycle correction factor (in dB) associated with the pulse modulation as shown in following equation:

$\delta(dB) = 20\log(\Delta)$

where: δ is the duty cycle correction factor (dB)
Δ is the duty cycle (dimensionless)

Frequency (MHz)	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
2406	4.880	100	4.88	-26.23
2442	5.3016	100	5.31	-25.511
2474	5.0736	100	5.07	-25.89

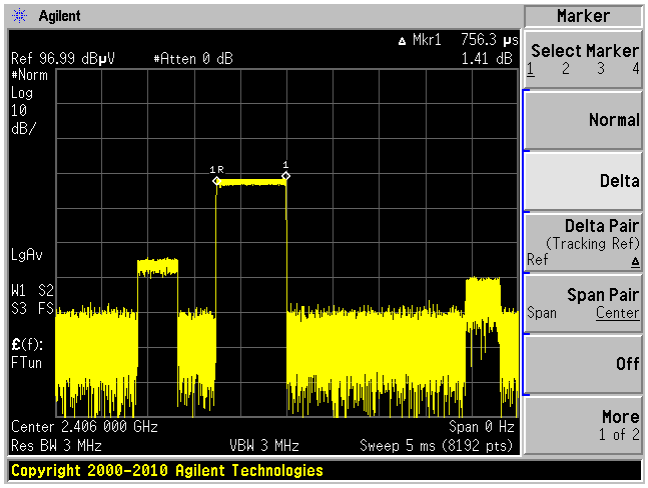
Duty Cycle = On Time (ms)/ Period (ms)

Note: The testing and calculation is performed on the normal frequency hopping mode. The wide pulse widths are observed after the Wireless Mic connects to the Junction Box's network. And per observation, there is maximum 1 wide pulse and 7 regular pulses in 100 ms period of individual channel. The calculation is the worst case.

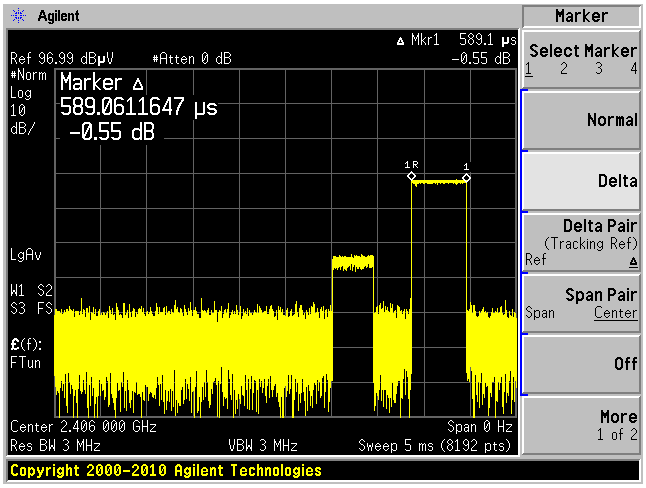
Please refer to the following plots.

2406 MHz

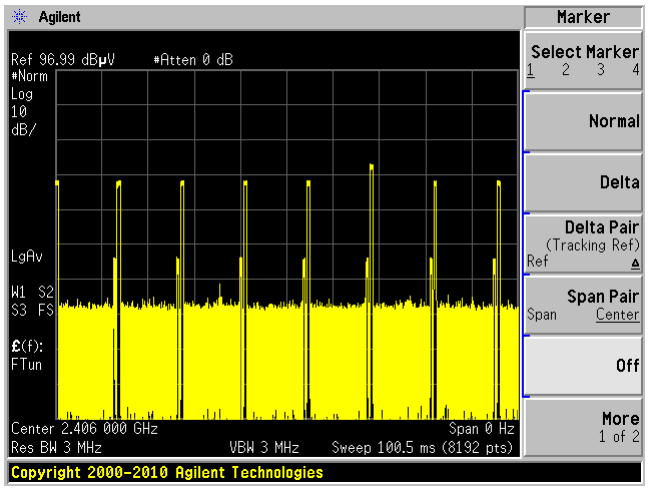
Wide Pulse Width



Regular Pulse Width

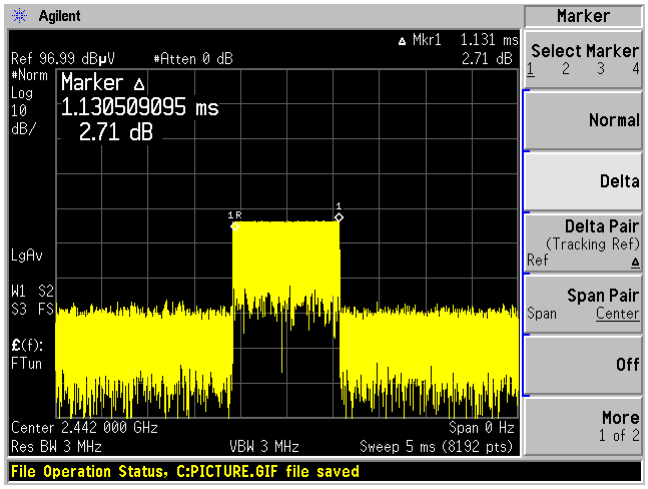


Pulses in 100 ms

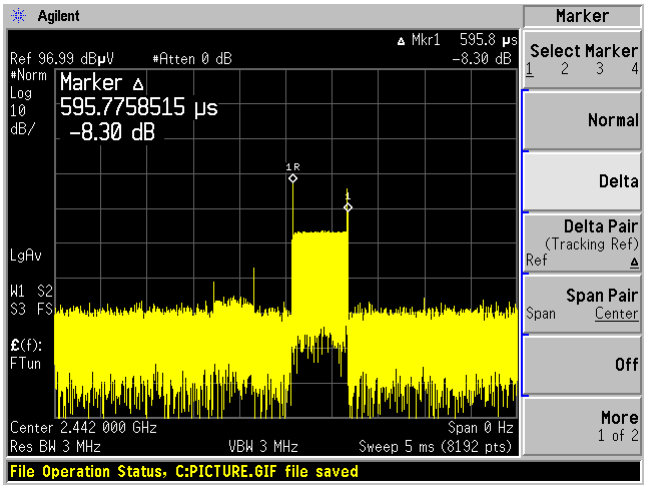


2442 MHz

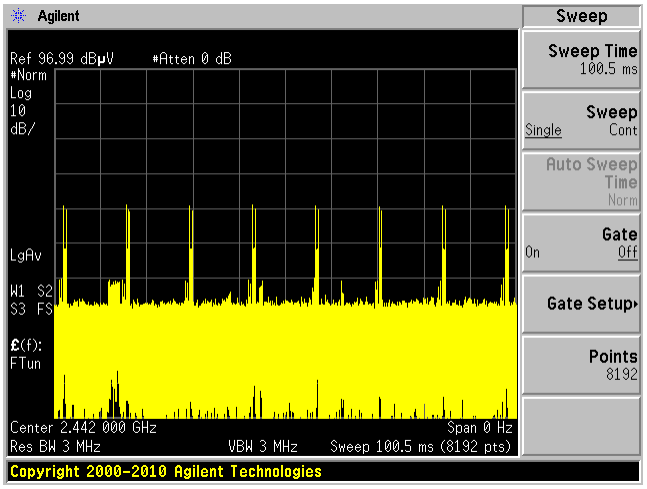
Wide Pulse Width



Regular Pulse Width

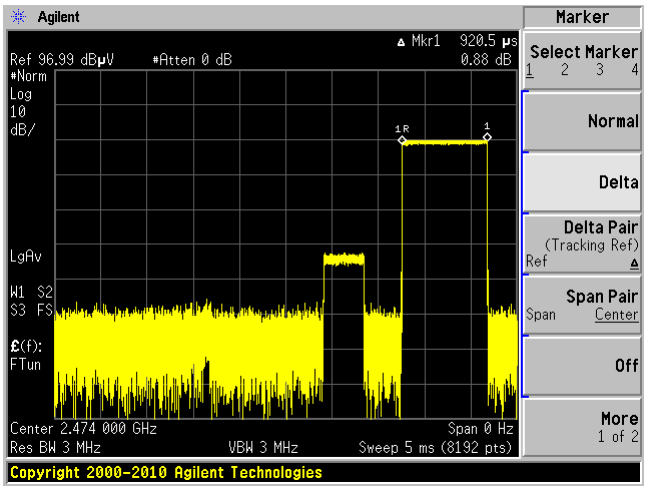


Pulses in 100 ms

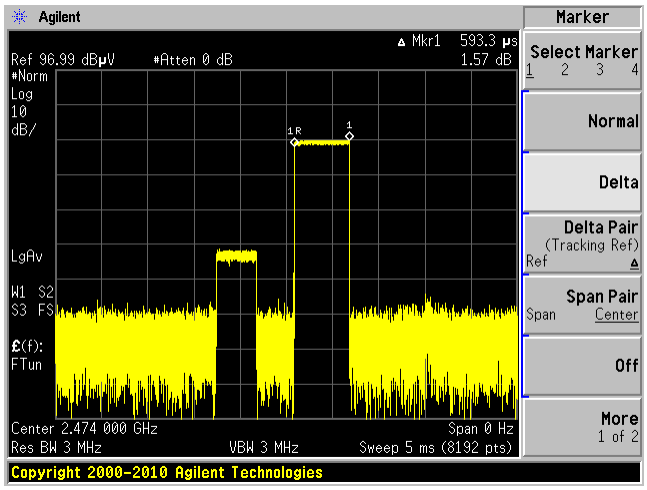


2474 MHz

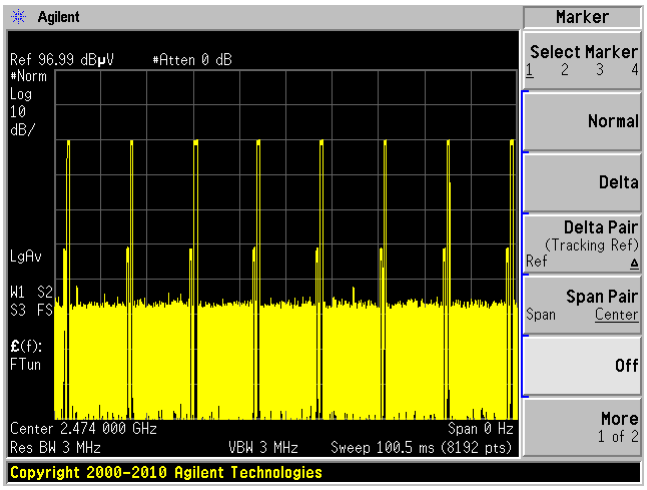
Wide Pulse Width



Regular Pulse Width



Pulses in 100 ms



2.4 Equipment Modifications

A 3mm hole was drilled into the EUT for the purpose of accessing RF ports for conducted measurements, as well as debug ports to allow configuration of the EUT for testing.

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Laptop	Latitude E6410	3CKRAQ1

2.6 Support Equipment

Manufacturer	Description	Model	Serial Number
SparkFun	USB to Serial UART I/O Expander	FT232RL	N/A

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2.7 Power Supply/Adapter

No external power supply was required to power the EUT. The EUT uses an internal battery to operate.

2.8 Interface Ports and Cabling

Description	Length (m)	To	From
U.F.L to SMA	< 1 m	PSA	EUT
USB 2.0 Type A to Micro USB Cable	<1m	Laptop	EUT

3 Summary of Test Results

Results reported relate only to the product tested.

FCC and ISEDC Rules	Description of Test	Results
FCC §15.203 ISEDC RSS-Gen §6.8	Antenna Requirement	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §2.1093, §15.247(i) ISEDC RSS-102	RF Exposure	Compliant
FCC §2.1051, §15.247(d) ISEDC RSS-247 §5.5	Spurious Emissions at Antenna Port	Compliant
FCC §2.1053, §15.205, §15.209, §15.247(d) ISEDC RSS-247 §5.5 ISEDC RSS-Gen §8.9, §8.10	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(1) ISEDC RSS-247 §5.1(1) ISEDC RSS-Gen §6.6	20 dB and 99% Emission Bandwidth	Compliant
FCC §15.247(b)(1) ISEDC RSS-247 §5.4	Maximum Peak Output Power	Compliant
FCC §15.247(d) ISEDC RSS-247 §5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(a)(1)(iii) ISEDC RSS-247 §5.1(4)	Number of Hopping Channels	Compliant
FCC §15.247(a)(1) ISEDC RSS-247 §5.1(2)	Hopping Channel Separation	Compliant
FCC §15.247(a)(1)(iii) ISEDC RSS-247 §5.1 (4)	Dwell Time	Compliant

4 FCC §15.203 & ISEDC RSS-Gen §6.8 - 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.

According to ISEDC RSS-Gen §6.8: Transmitter Antenna

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For license-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

4.2 Antenna Description

The antenna used by the EUT is a permanently attached antenna.

Ant Number	Antenna type	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
ANT 1	Metal Stapled PIFA	2406-2474	2.0
ANT 2	FPC	2406-2474	2.0

Note: There is an RF switch that switches between both antennas and each antenna performs identical SISO operation.

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

5.1 Applicable Standards

FCC §2.1093, §15.247(i), & IC RSS-102

5.2 Test Results

Please refer to the SAR Report: R1902278-SAR.

6 FCC §15.207 & ISEDC RSS-Gen §8.8 - AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 and ISEDC 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 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.
Note 2: 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 was FCC §15.207 and ISEDC 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 detection mode, 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 Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100337	2018-10-26	2 years
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101963	2018-07-27	1 year
Keysight Technologies	RF Limiter	11867A	MY42242932	2019-01-18	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150202	2019-02-25	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/A
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2018-04-04	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

6.6 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	101.31 kPa

The testing was performed by Alexandrae Duran on 2019-03-14 in 5 chamber 3.

6.7 Summary of Test Results

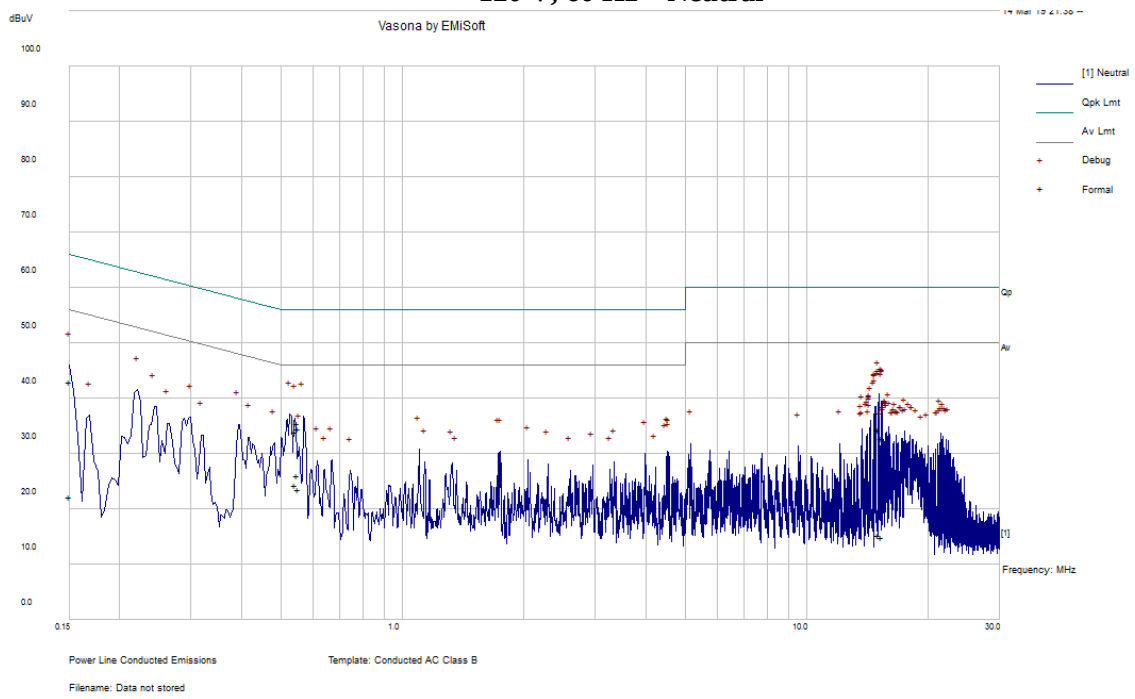
According to the recorded data in following table, the EUT complied with the FCC 15C and ISEDC RSS-Gen standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-9.3	0.548425	Line	0.15-30

6.1 Conducted Emissions Test Plots and Data

2.4 GHz PurePath Wireless

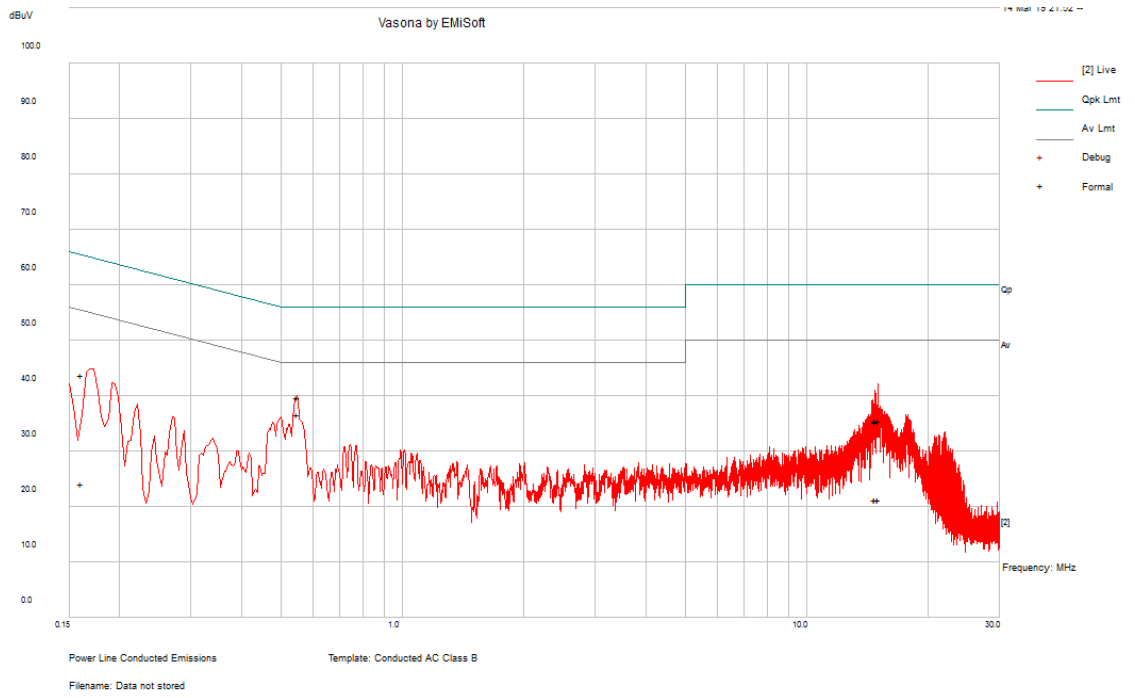
120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.542218	33.96	Neutral	56	-22.04	QP
0.55378	34.63	Neutral	56	-21.37	QP
15.05601	34.42	Neutral	60	-25.58	QP
0.551168	35.54	Neutral	56	-20.46	QP
0.150036	43.09	Neutral	66	-22.91	QP
15.29243	32.9	Neutral	60	-27.1	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.542218	24.42	Neutral	46	-21.58	Ave.
0.55378	23.61	Neutral	46	-22.39	Ave.
15.05601	15.25	Neutral	50	-34.75	Ave.
0.551168	26.08	Neutral	46	-19.92	Ave.
0.150036	22.22	Neutral	56	-33.77	Ave.
15.29243	14.9	Neutral	50	-35.1	Ave.

120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.548425	39.66	Line	56	-16.34	QP
15.00435	35.5	Line	60	-24.5	QP
14.9896	35.57	Line	60	-24.43	QP
14.72026	35.59	Line	60	-24.41	QP
14.78692	35.25	Line	60	-24.75	QP
0.160234	43.8	Line	65.45	-21.65	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.548425	36.7	Line	46	-9.3	Ave.
15.00435	21.21	Line	50	-28.79	Ave.
14.9896	21.28	Line	50	-28.72	Ave.
14.72026	21.29	Line	50	-28.71	Ave.
14.78692	21.25	Line	50	-28.75	Ave.
0.160234	24.11	Line	55.45	-31.34	Ave.

7 FCC §15.209, §15.247(d) & ISEDC 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 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

ISED RSS-Gen §8.10 Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110 2.1.35 - 2.1905 3.020 - 3.026 4.125 - 4.128 4.17725 - 4.17775 4.20725 - 4.20775 5.677 - 5.683 6.215 - 6.218 6.26775 - 6.26825 6.31175 - 6.31225 8.291 - 8.294 8.362 - 8.366 8.37625 - 8.38675 8.41425 - 8.41475 12.29 - 12.293 12.57675 - 12.57725	12.36 - 13.41 16.42-16.432 6.42-16.432 16.69475 - 16.69525 16.80425 - 12.80475 25.5 - 25.67 37 - 38.25 73 - 74.6 74-75.2 108 - 138 156.52475 - 156.52525 156.7 - 156.9 240 - 285 322 - 335.4 399.9 - 410	608 - 614 960 - 1427 1435 - 1626.5 1660 - 1710 1718.8-1722.22 2200 - 2300 2310 - 2390 2655 - 2900 3260 - 3267 3332 - 3339 3345.8 - 3358 3500 - 4400 4500 - 5150 5350 - 5460 7250 - 7750 8025 -8500	9.0 - 9.2 9.3 - 9.5 10.6 - 12.7 13.25 - 13.4 14.47 - 14.5 15.36 - 16.2 17.7 - 21.4 22.01 -23.12 23.6 - 24.0 31.2 - 36.5 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 ISEDC RSS-Gen 8.9,

Except when the requirements applicable to a given device state otherwise, emission from license-exempt transmitters shall company with the field strength limits shown in the table below. Additional, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

General Field Strength Limits for License-Exemption Transmitters at Frequencies above 30 Mhz

Frequency (MHz)	Field Strength (µv/m at 3 meters)
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 licence-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 ISEDC 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 ISEDC RSS-247 limits.

7.3 Test Procedure

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, 1.5 meter above the ground plane for above 1000 MHz measurements, the table shall be rotated for 360 degrees to ascertain the highest emission. The receiving antenna will be oriented by the polarizations of horizontal and vertical positions.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

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

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = 100 ms
(2) Average: Peak+DCCF

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	100044	2017-09-19	2 years
Agilent	Analyzer, Spectrum	E4446A	US44300386	2018-06-01	1 year
Rohde & Schwarz	Analyzer, Spectrum	FSQ26	200749	2017-06-08	2 years
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2018-02-26	2 years
Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2017-12-15	2 years
Agilent	Amplifier, Pre	8447D	2944A10187	2018-04-02	1 year
IW	AOBOR Hi frequency Co AX Cable	DC 1531	KPS-1501A3960KPS	2018-01-11	1 year
-	SMA cable	-	C00011	Each time[1]	N/A
-	N-Type Cable	-	C00012	Each time[1]	N/A
-	N-Type Cable	-	C00014	Each time[1]	N/A
HP	Pre-Amplifier	8449B	3008A01978	2018-08-10	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	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 Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

7.6 Test Environmental Conditions

Temperature:	22-24 ºC
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Zhao Zhao, and Alexandrae Duran between 2019-03-05 and 2019-03-14 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 ISEDC RSS-247 standard's radiated emissions limits, and had the worst margin of:

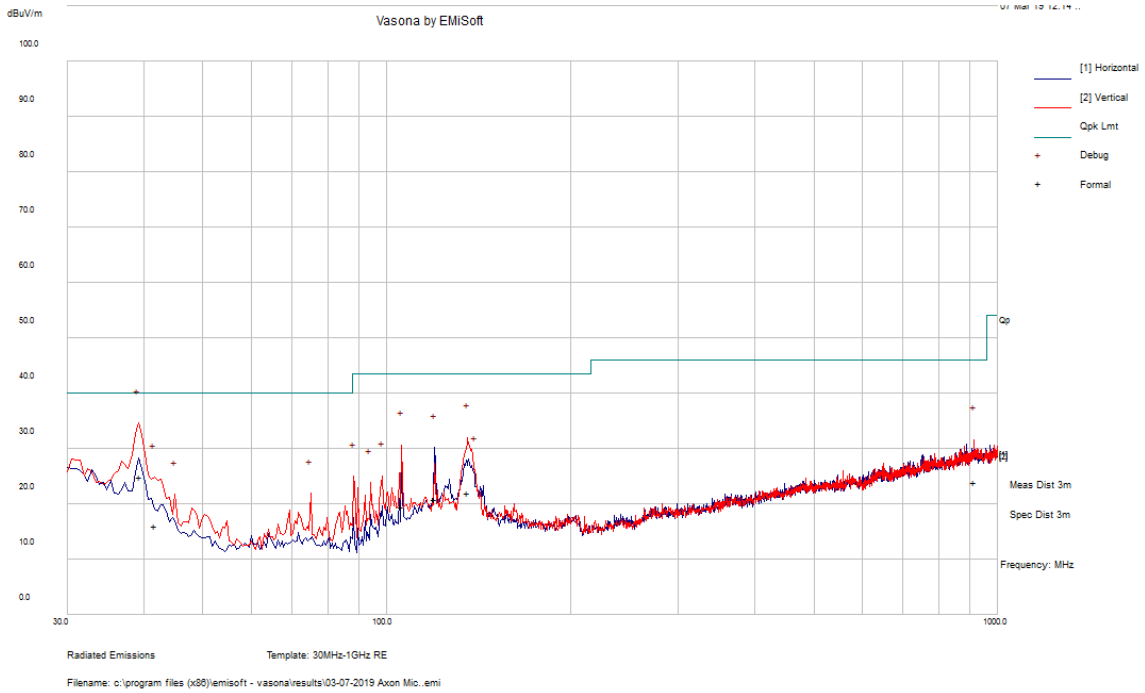
Mode: Transmitting				
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode**	**Fundamental Channel**
-6.88	2483.5	Horizontal	2FSK	Low Channel 2406 MHz

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

7.8 Radiated Emissions Test Result Data

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

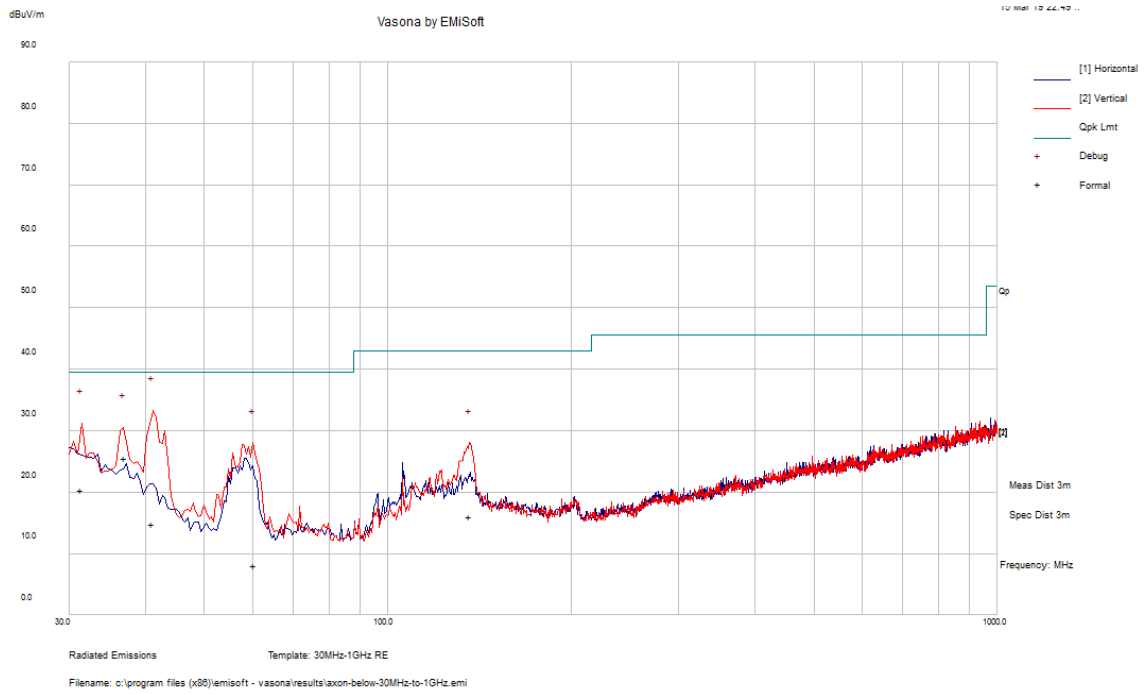
Low Channel (2406 MHz) Antenna 1



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
39.4475	25.01	122	V	0	40	-14.99	QP
135.743	22.04	167	V	218	43.5	-21.46	QP
915.0018	23.97	264	V	73	46	-22.03	QP
119.9693	20.87	277	H	248	43.5	-22.63	QP
41.677	16.12	140	V	243	40	-23.88	QP
105.7235	19.59	119	V	253	43.5	-23.91	QP

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

Low Channel (2406 MHz) Antenna 2



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
36.94925	25.52	217	V	64	39.5	-13.98	QP
31.43675	20.43	227	V	77	39.5	-19.07	QP
41.0025	14.9	293	V	51	39.5	-24.6	QP
41.0025	14.9	293	V	51	39.5	-24.6	QP
136.418	16	110	V	360	43	-27	QP
60.2965	8.09	187	V	158	39.5	-31.41	QP

1 GHz – 18 GHz Measured at 3 meters

Antenna 1

Peak Measurement

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2406 MHz (power setting: 0)											
2406	73.11	360	280	H	28.94	5.76	0.00	107.81	-	-	PK
2406	64.90	83	282	V	28.93	5.76	0.00	99.59	-	-	PK
2390	30.47	0	100	H	28.94	5.76	0.00	65.17	74	-8.83	PK
2390	28.04	0	100	V	28.93	5.76	0.00	62.73	74	-11.27	PK
4812	48.02	0	100	V	32.56	8.52	35.66	53.44	74	-20.56	PK
7218	45.37	0	100	V	36.73	10.92	35.67	57.34	74	-16.66	PK
Middle Channel 2442 MHz (power setting: 0)											
2440	68.14	223	211	H	29.15	5.76	0.00	103.05	-	-	PK
2440	64.62	235	300	V	29.19	5.76	0.00	99.56	-	-	PK
4880	48.10	0	100	H	32.81	8.52	35.66	53.77	74	-20.23	PK
7320	44.63	0	100	H	37.06	10.92	35.67	56.93	74	-17.07	
High Channel 2474 MHz (power setting: 0)											
2474	69.16	85	231	H	29.25	5.76	0.00	104.17	-	-	PK
2474	65.29	337	276	V	29.18	5.76	0.00	100.23	-	-	PK
2483.5	32.11	85	231	H	29.25	5.76	0.00	67.12	74	-6.88	PK
2483.5	62.11	337	276	V	29.18	5.76	0.00	97.05	74	23.05	PK
4948	46.11	0	100	H	32.79	8.52	35.66	51.76	74	-22.24	PK
7422	45.35	0	100	H	37.02	11.05	35.67	57.75	74	-16.25	PK

Average Measurement

Frequency (MHz)	Peak Value (dBµV/m)	Duty Cycle Factor (dB)	Test Antenna Polarity (H/V)	Average Value (dBµV/m)	FCC/ISEDC		Comments
					Limit (dBµV/m)	Margin (dB)	
Low Channel 2406 MHz (power setting: 0)							
2406	107.81	-26.23	H	81.58	-	-	AVE
2406	99.59	-26.23	V	73.36	-	-	AVE
2390	65.17	-26.23	H	38.94	54	-15.06	AVE
2390	62.73	-26.23	V	36.5	54	-17.5	AVE
4812	53.44	-26.23	V	27.21	54	-26.79	AVE
7218	57.34	-26.23	V	31.11	54	-22.89	AVE
Middle Channel 2442 MHz (power setting: 0)							
2442	103.05	-25.51	H	77.54	-	-	AVE
2442	99.56	-25.51	V	74.05	-	-	AVE
4884	53.77	-25.51	H	28.26	54	-25.74	AVE
7326	56.93	-25.51	H	31.42	54	-22.58	AVE
High Channel 2474 MHz (power setting: 0)							
2474	104.17	-25.89	H	78.28	-	-	AVE
2474	100.23	-25.89	V	74.34	-	-	AVE
2483.5	67.12	-25.89	H	41.23	54	-12.77	AVE
2483.5	97.05	-25.89	V	71.16	54	17.16	AVE
4948	51.76	-25.89	H	25.87	54	-28.13	AVE
7422	57.75	-25.89	H	31.86	54	-22.14	AVE

Antenna 2

Peak Measurement

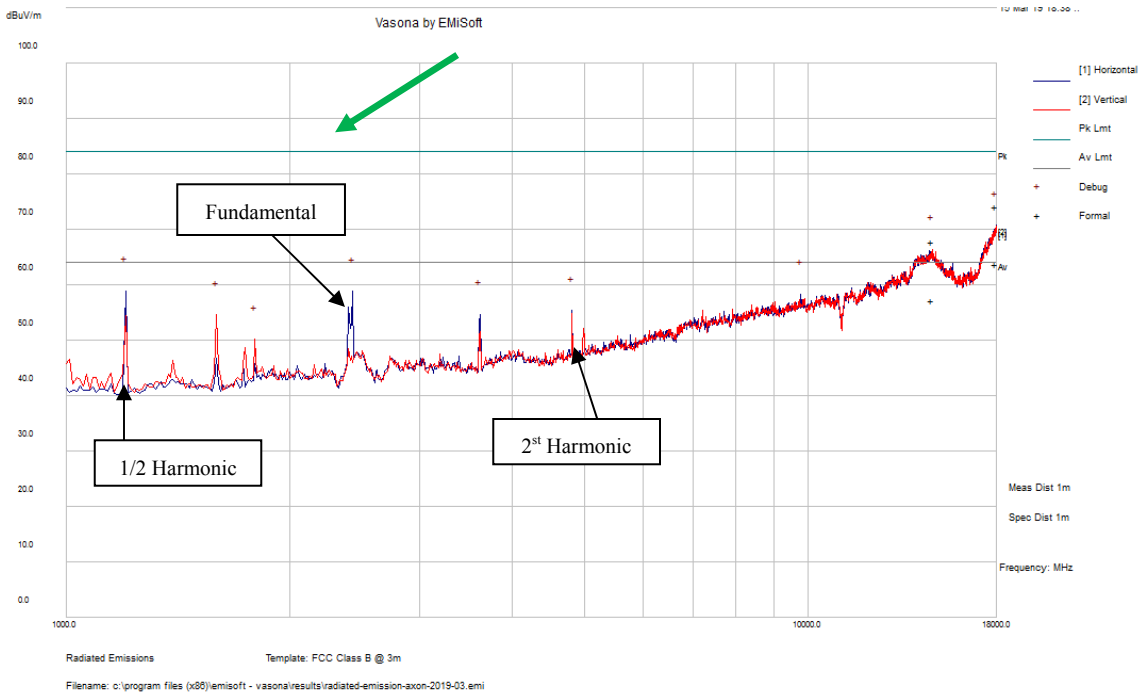
Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2406 MHz (power setting: 0)											
2406	69.16	72	172	H	28.94	5.76	0.00	103.86	-	-	PK
2406	69.16	80	271	V	28.93	5.76	0.00	103.85	-	-	PK
2390	27.61	0	100	H	28.94	5.76	0.00	62.31	74	-11.69	PK
2390	28.55	0	100	V	28.93	5.76	0.00	63.24	74	-10.76	PK
4812	49.30	33	98	V	32.56	8.52	35.66	54.72	74	-19.28	PK
7218	45.00	0	100	V	36.73	10.92	35.67	56.97	74	-17.03	PK
Middle Channel 2442 MHz (power setting: 0)											
2440	67.18	70	183	H	29.15	5.76	0.00	102.09	-	-	PK
2440	64.62	250	287	V	29.19	5.76	0.00	99.56	-	-	PK
4880	47.86	92	286	H	32.81	8.52	35.66	53.53	74	-20.47	PK
7320	44.02	0	100	H	37.06	10.92	35.67	56.32	74	-17.68	PK
High Channel 2474 MHz (power setting: 0)											
2474	72.46	105	271	H	29.25	5.76	0.00	107.47	-	-	PK
2474	64.56	300	221	V	29.18	5.76	0.00	99.50	-	-	PK
2483.5	28.27	123	208	H	29.25	5.76	0.00	63.28	74	-10.72	PK
2483.5	30.62	220	300	V	29.18	5.76	0.00	65.56	74	-8.44	PK
4948	46.46	0	100	H	32.79	8.52	35.66	52.11	74	-21.89	PK
7422	45.14	0	100	H	37.02	11.05	35.67	57.54	74	-16.46	PK

Average Measurement

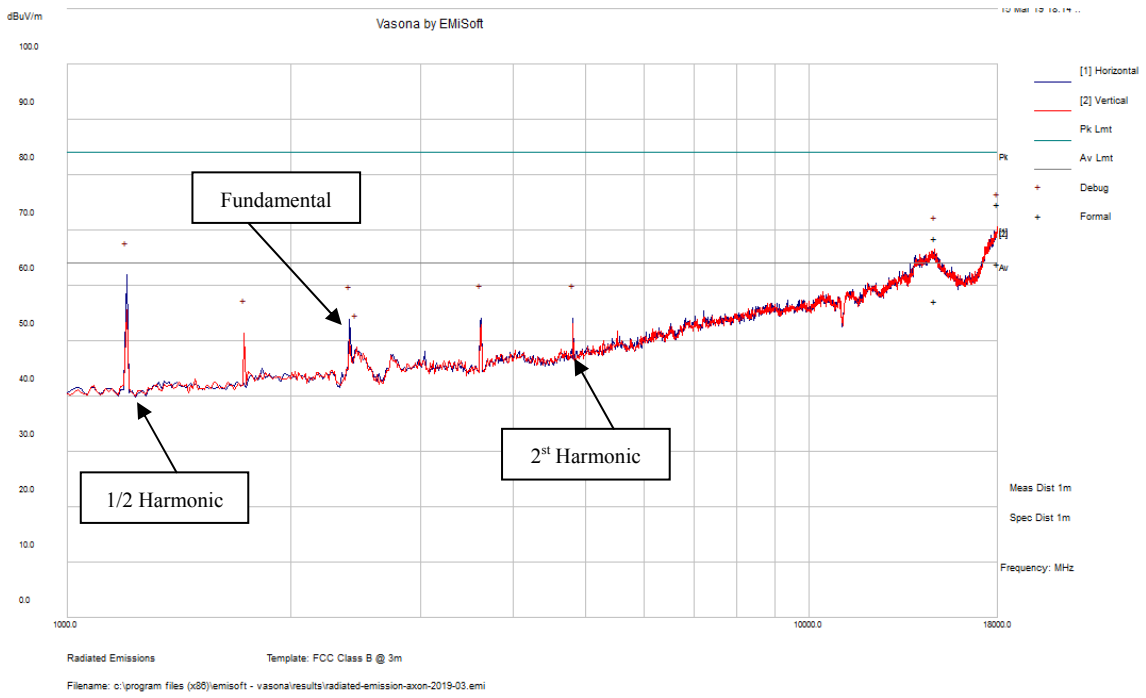
Frequency (MHz)	Peak Value (dBµV/m)	Duty Cycle Factor (dB)	Test Antenna Polarity (H/V)	Average Value (dBµV/m)	FCC/ISEDC		Comments
					Limit (dBµV/m)	Margin (dB)	
Low Channel 2406 MHz (power setting: 0)							
2406	103.86	-26.23	H	77.63	-	-	AVE
2406	103.85	-26.23	V	77.62	-	-	AVE
2390	62.31	-26.23	H	36.08	54	-17.92	AVE
2390	63.24	-26.23	V	37.01	54	-16.99	AVE
4812	54.72	-26.23	V	28.49	54	-25.51	AVE
7218	56.97	-26.23	V	30.74	54	-23.26	AVE
Middle Channel 2442 MHz (power setting: 0)							
2440	102.09	-25.51	H	76.58	-	-	AVE
2440	99.56	-25.51	V	74.05	-	-	AVE
4880	53.53	-25.51	H	28.02	54	-25.98	AVE
7320	56.32	-25.51	H	30.81	54	-23.19	AVE
High Channel 2474 MHz (power setting: 0)							
2474	107.47	-25.89	H	81.58	-	-	AVE
2474	99.5	-25.89	V	73.61	-	-	AVE
2483.5	63.28	-25.89	H	37.39	54	-16.61	AVE
2483.5	65.56	-25.89	V	39.67	54	-14.33	AVE
4948	52.11	-25.89	H	26.22	54	-27.78	AVE
7422	57.54	-25.89	H	31.65	54	-22.35	AVE

1 GHz – 18 GHz Worst Case, Measured at 1 Meter

Low Channel Antenna 1

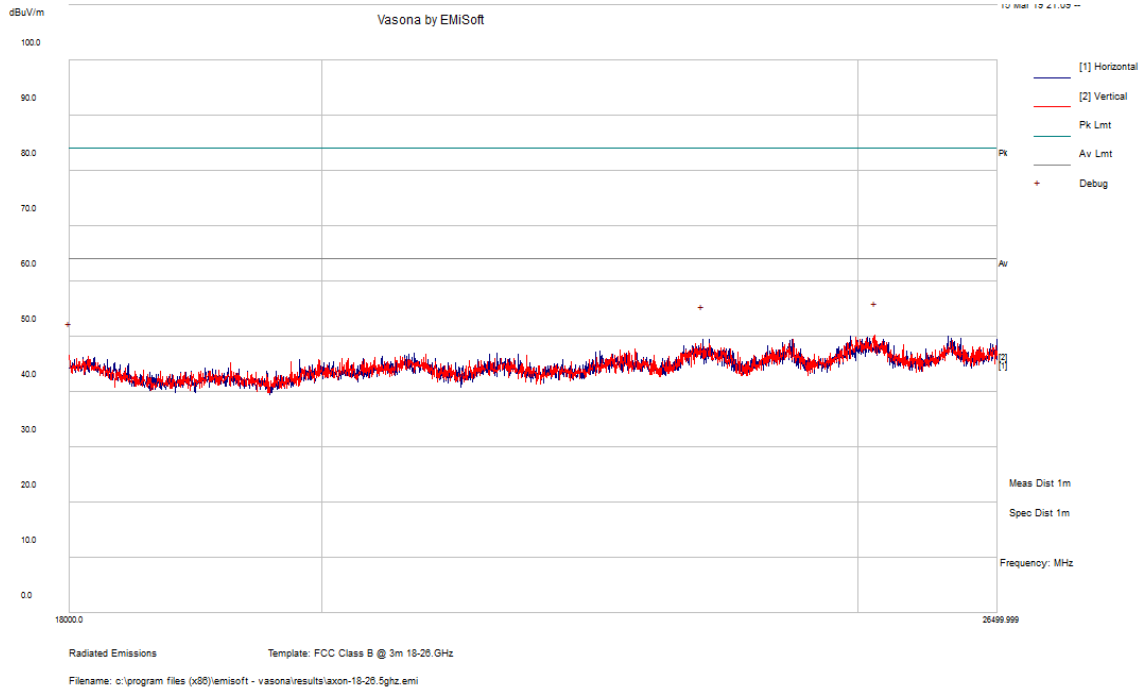


Low Channel Antenna 2

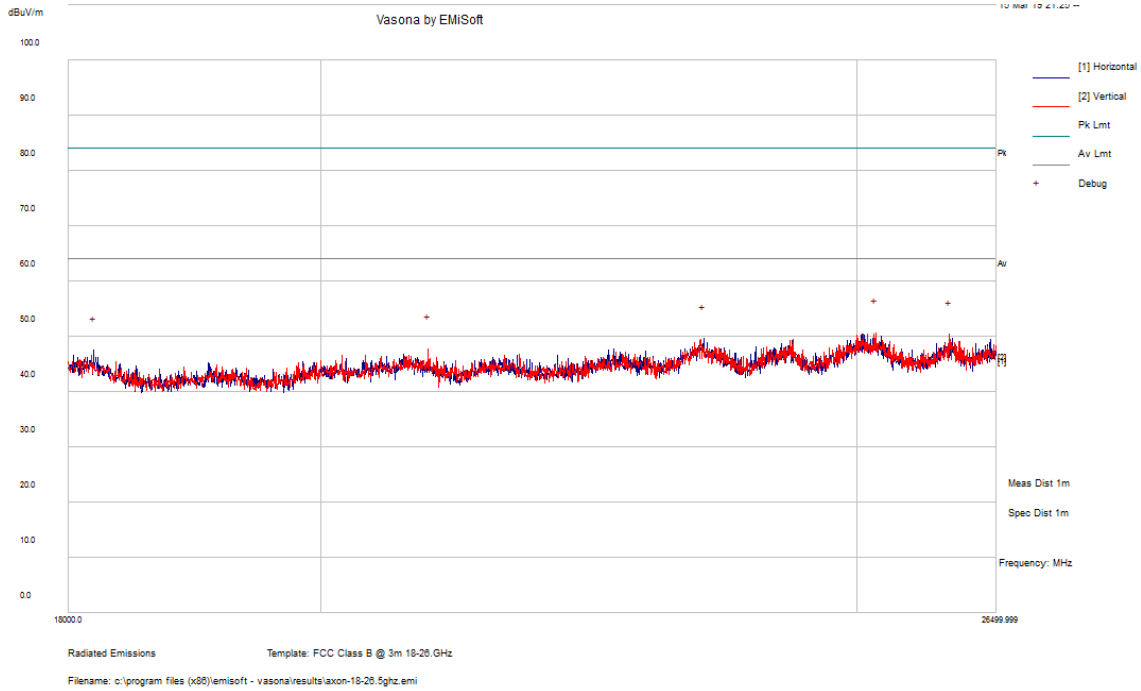


18 GHz – 26.5 GHz Worst Case, Measured at 1 meters

Low Channel Antenna 1



Low Channel Antenna 2



8 FCC §15.247(a) (1) & ISEDC RSS-247 §5.1, RSS-Gen §6.6 - Emission Bandwidth

8.1 Applicable Standards

According to FCC §15.247(a) (1) and ISEDC RSS-247 §5.1: the maximum 20 dB bandwidth of the hopping channel shall be presented.

8.2 Measurement Procedure

Span = approximately 2 to 5 times the 99% occupied bandwidth, centered on a hopping channel

RBW = 1% to 5 % of the 99% occupied bandwidth

VBW = 3RBW

Sweep = auto

Detector function = peak

Trace = max hold

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2018-06-01	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

8.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Alexandrae Duran from 2018-03-04 in RF site.

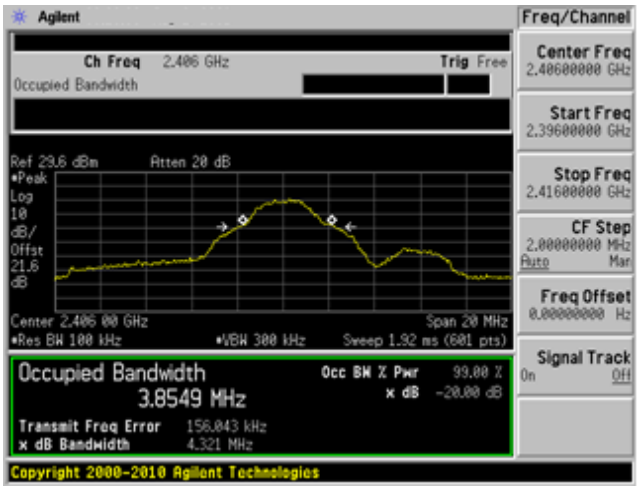
8.5 Test Results

Channel	Frequency (MHz)	99% OBW (MHz)	20 dB OBW (MHz)
Antenna 1			
Low	2406	3.8549	4.321
Middle	2442	4.0022	4.427
High	2474	4.1046	4.462
Antenna 2			
Low	2406	3.9427	4.481
Middle	2442	4.0313	4.532
High	2474	4.0607	4.365

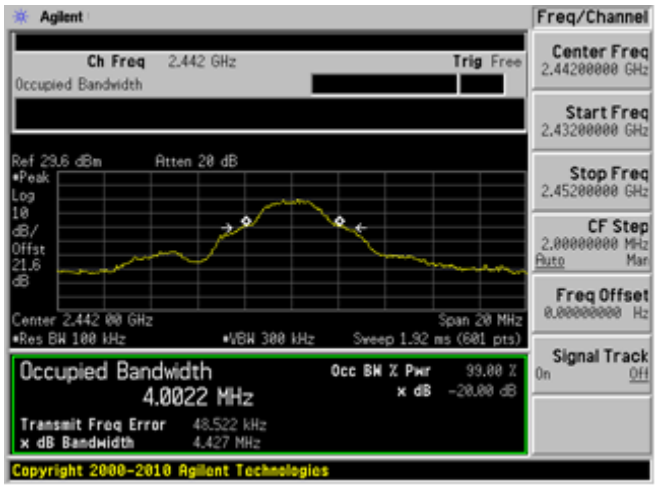
Please refer to the following plots for detailed test results.

Antenna 1

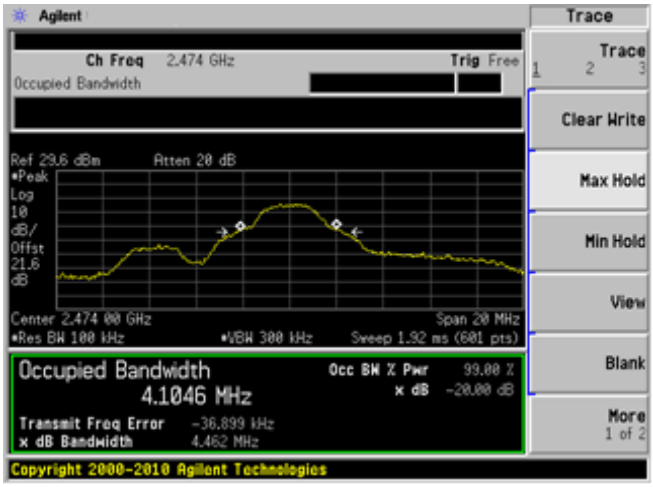
Low Channel 2406 MHz



Middle Channel 2442 MHz

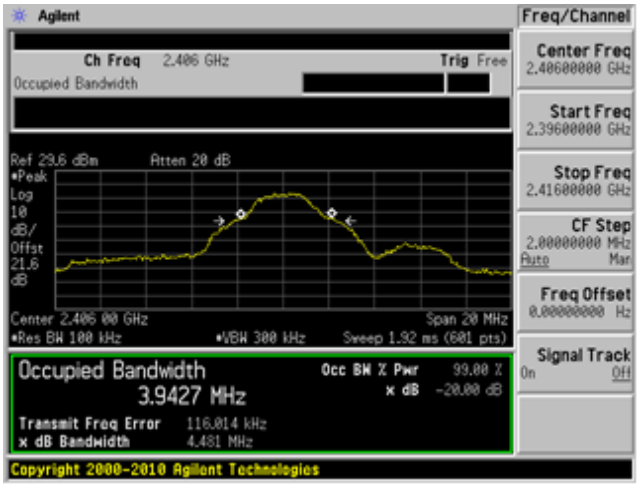


High Channel 2474 MHz

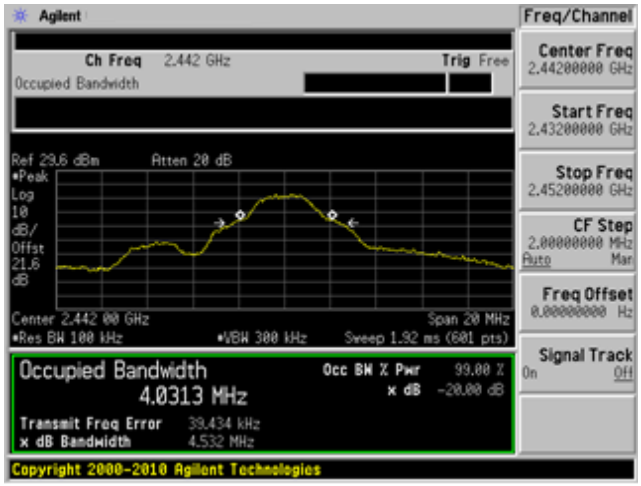


Antenna 2

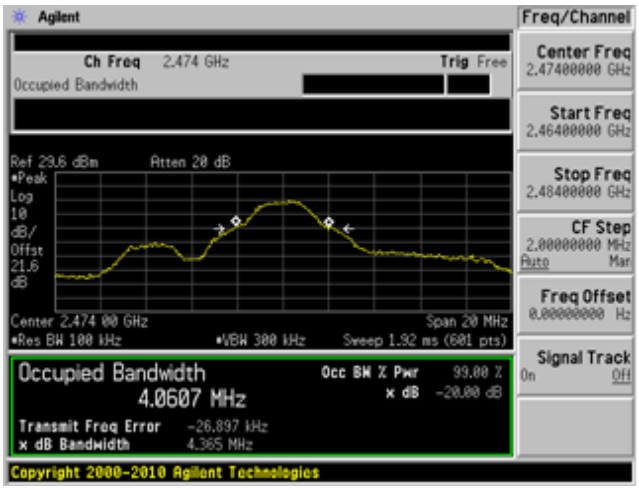
Low Channel 2406 MHz



Middle Channel 2442 MHz



High Channel 2474 MHz



9 FCC §15.247(b)(1) & ISEDC RSS-247 §5.4 - Output Power

9.1 Applicable Standards

According to FCC §15.247(b) (1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

According to RSS-247 §5.4: For frequency hopping systems operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels.

9.2 Measurement Procedure

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2018-06-01	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

9.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Alexandrae Duran from 2019-03-04 in RF site.

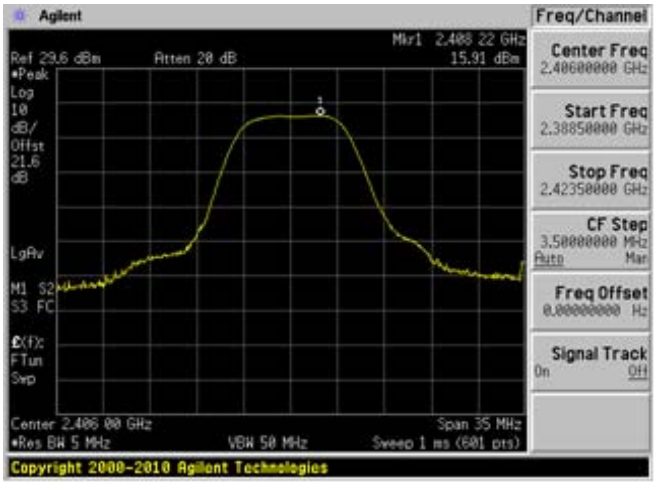
9.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)
Antenna 1			
Low	2406	15.91	20.97
Middle	2442	11.92	20.97
High	2474	12.83	20.97
Antenna 2			
Low	2406	16.83	20.97
Middle	2442	15.32	20.97
High	2474	12.85	20.97

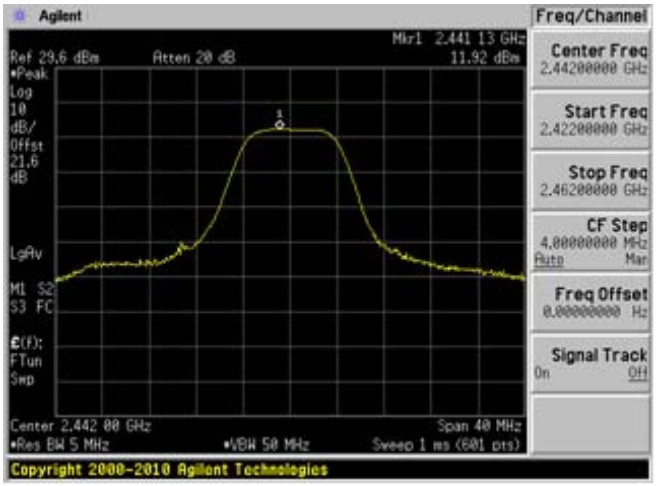
Please refer to the following plots for detailed test results.

Antenna 1

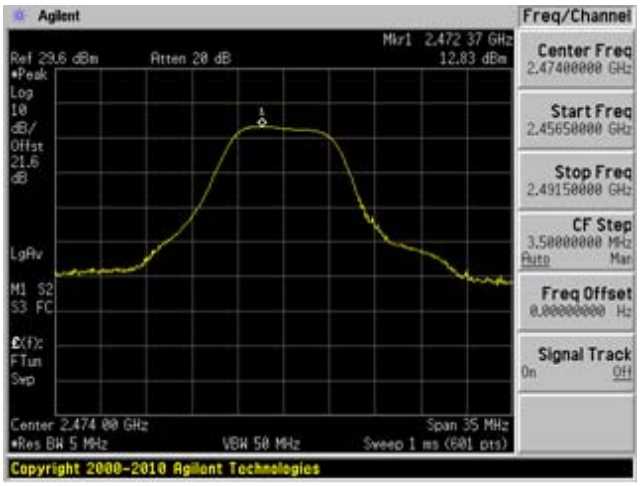
Low Channel 2406 MHz



Middle Channel 2442 MHz

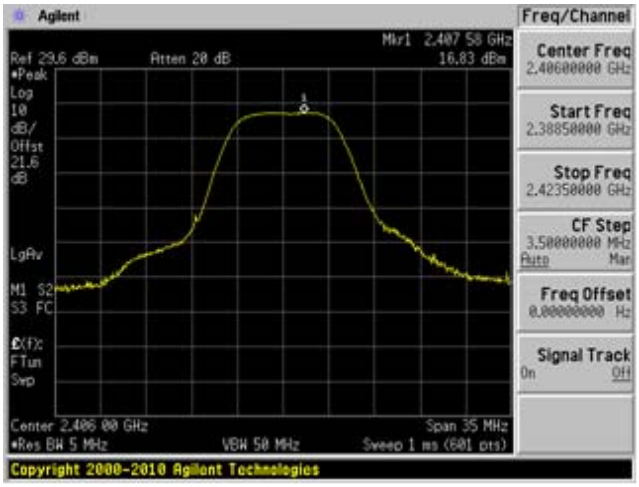


High Channel 2474

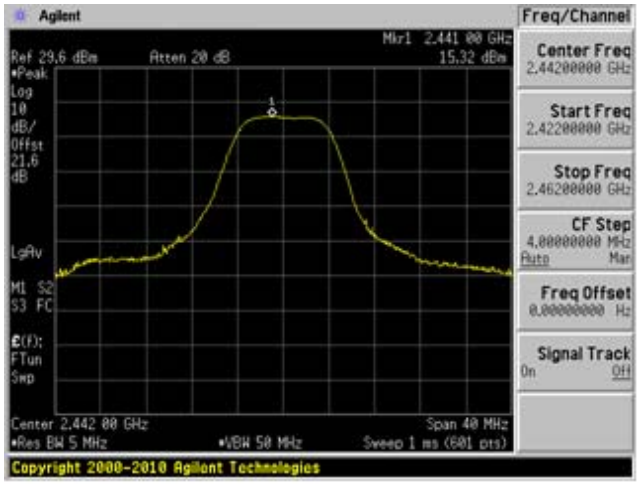


Antenna 2

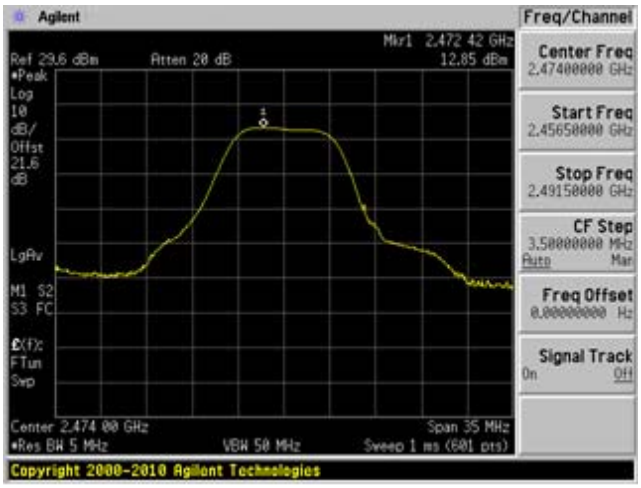
Low Channel 2406 MHz



Middle Channel 2442 MHz



High Channel 2474



10 FCC §15.247(d) & ISEDC 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 ISEDC 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

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW = 100 kHz
VBW = 300 kHz
Sweep = coupled
Detector function = peak
Trace = max hold

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2018-06-01	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

10.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

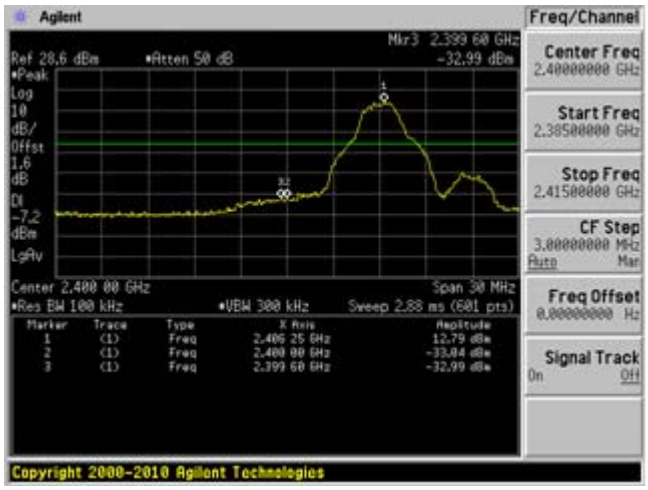
The testing was performed by Alexandrae Duran on 2019-03-05 and 2019-03-25in the RF site.

10.5 Test Results

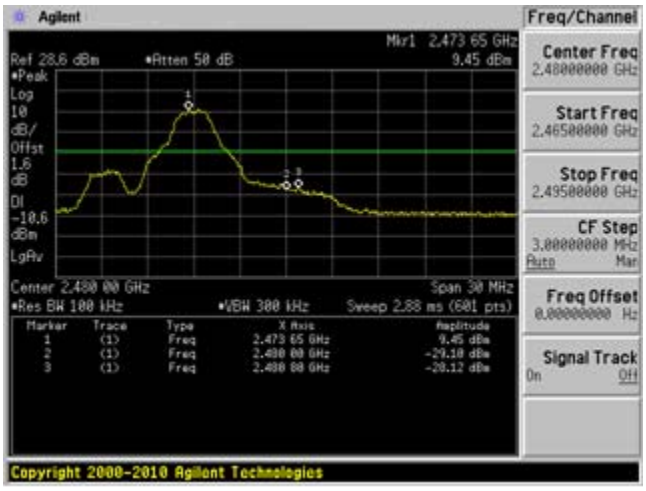
Antenna 1

Fixed Channel

Low Channel 2406 MHz



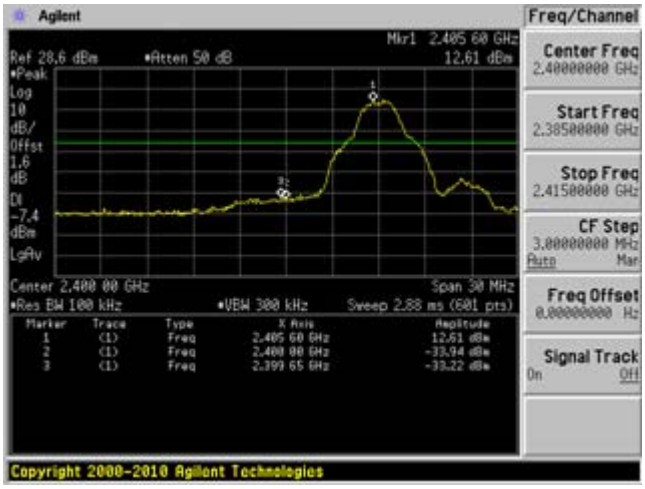
High Channel 2474 MHz



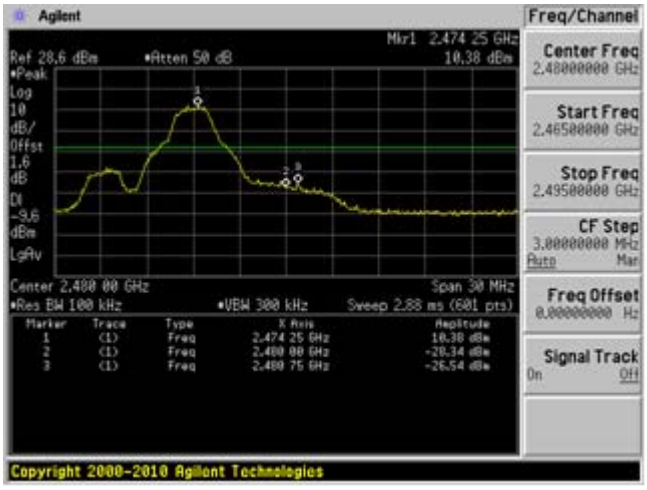
Antenna 2

Fixed Channel

Low Channel 2406 MHz



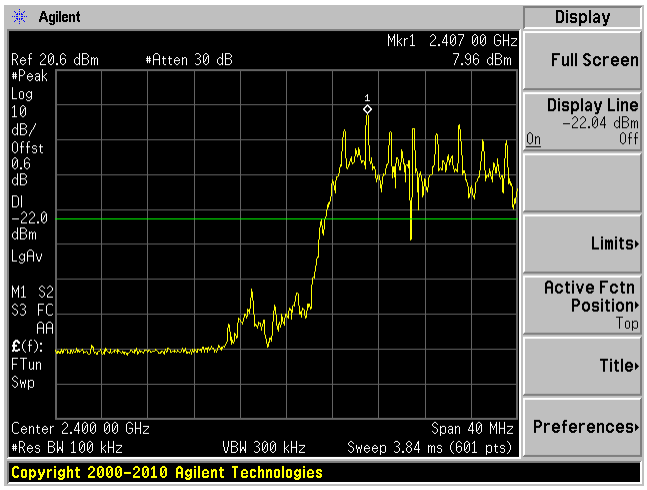
High Channel 2474 MHz



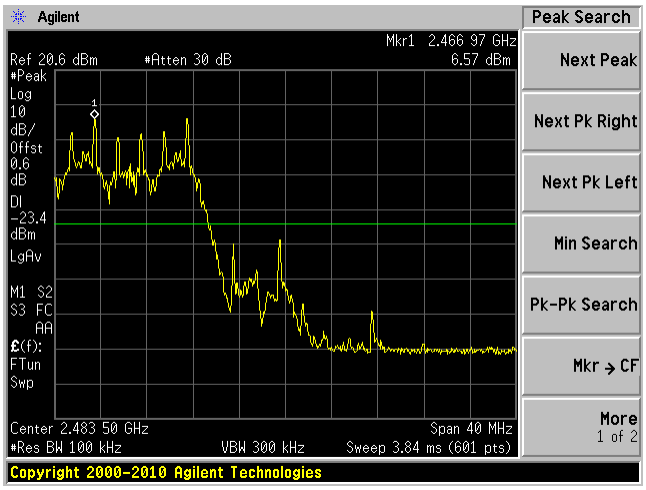
Antenna 1

Hopping Channel

Low Edge



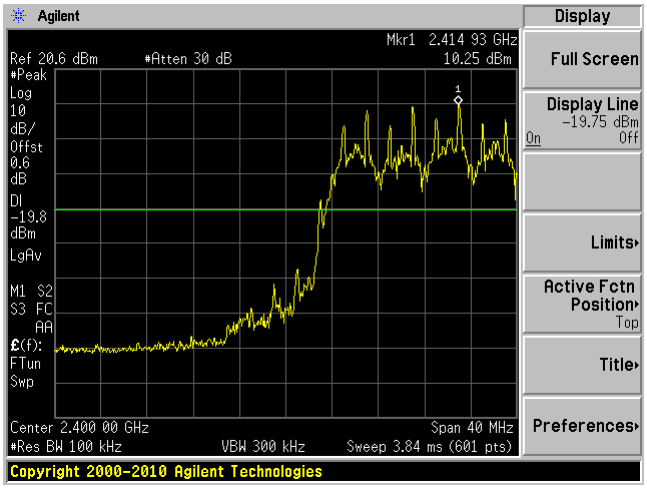
High Edge



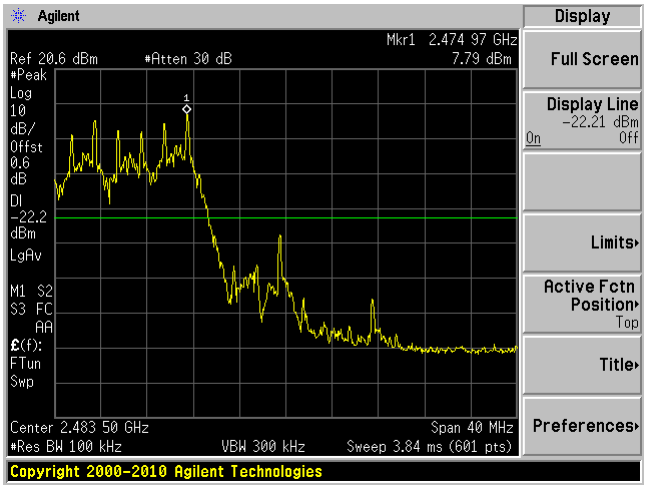
Antenna 2

Hopping Channel

Low Edge



High Edge



11 FCC §15.247(a)(1)(iii) & ISEDC RSS-247 §5.1(4) - Dwell Time

11.1 Applicable Standards

According to FCC §15.247(a)(1)(iii) and RSS-247 §5.1(4), Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

11.2 Measurement Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel
RBW ≤ channel spacing and where possible RBW should be set >> 1/*T*, where *T* is the expected dwell time per channel
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace = max hold

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) =
(Number of hops on spectrum analyzer) x (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2018-06-01	1 year
-	RF cable	-	-	Each time[1]	N/A
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	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 of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

11.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Frank Wang on 2019-03-05 in the RF site.

11.5 Test Results

Channel	Total on time in 100 ms (ms)	Number of 100 ms Period for Specified Period in the Requirements	Average Time of Occupancy (s)	Limit (sec)	Results
Low	4.88	72	0.351	0.4	compliant
Middle	5.30	72	0.382	0.4	compliant
High	5.07	72	0.365	0.4	compliant

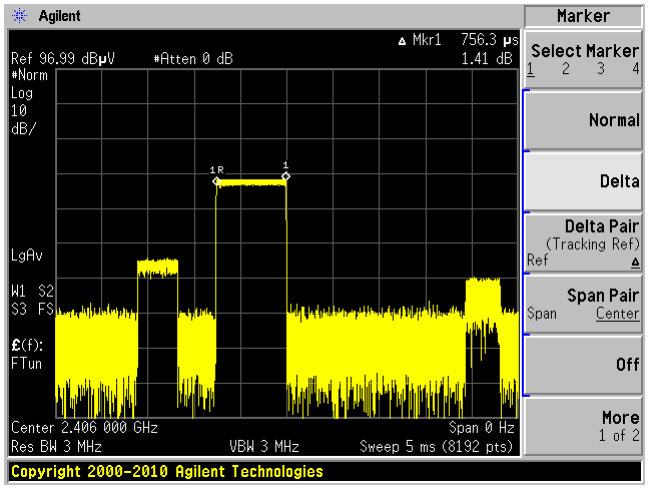
Please refer to the following plots for detailed test results.

Frequency (MHz)	On Time (ms)	Period (ms)
2406	4.880	100
2442	5.30	100
2474	5.07	100

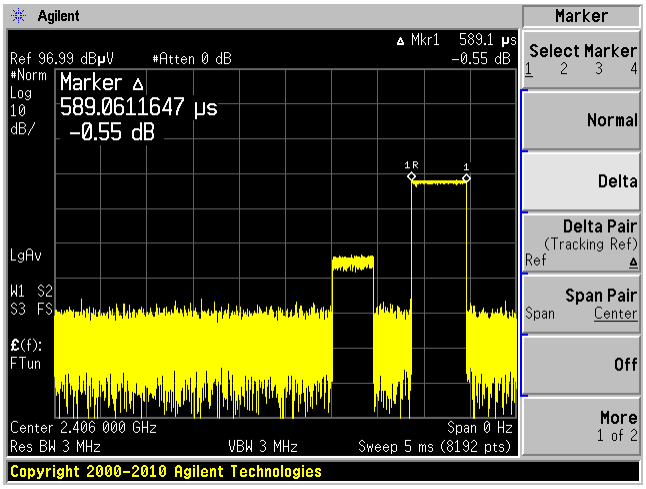
Note: The testing and calculation is performed on the normal frequency hopping mode. The wide pulse widths are observed after the Wireless Mic connects to the Junction Box's network. And per observation, there is maximum 1 wide pulse and 7 regular pulses in 100 ms period of individual channel. The calculation is the worst case.

Low Channel 2406 MHz

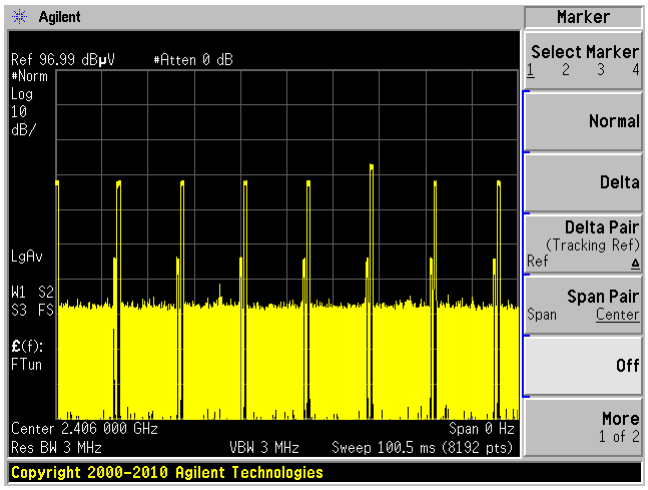
Wide Pulse Width



Regular Pulse Width

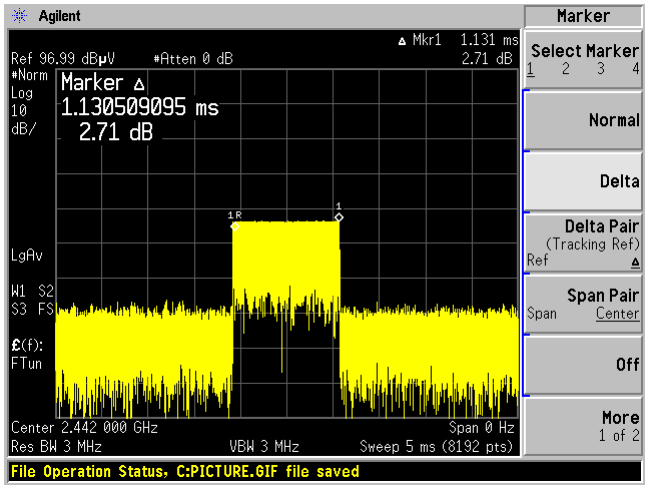


Pulses in 100 ms

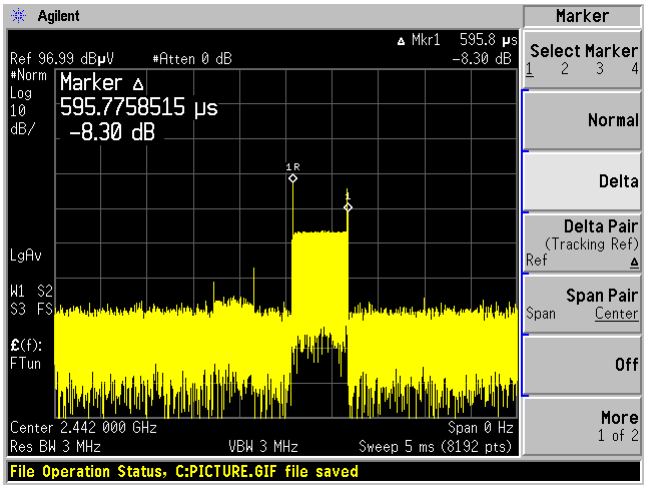


Middle Channel 2442 MHz

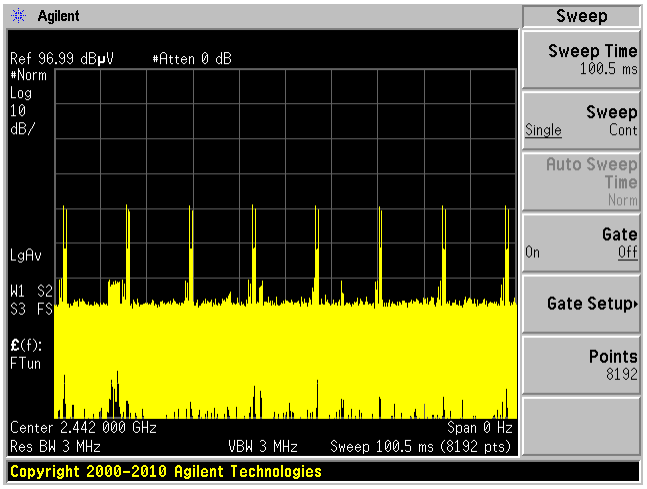
Wide Pulse Width



Regular Pulse Width

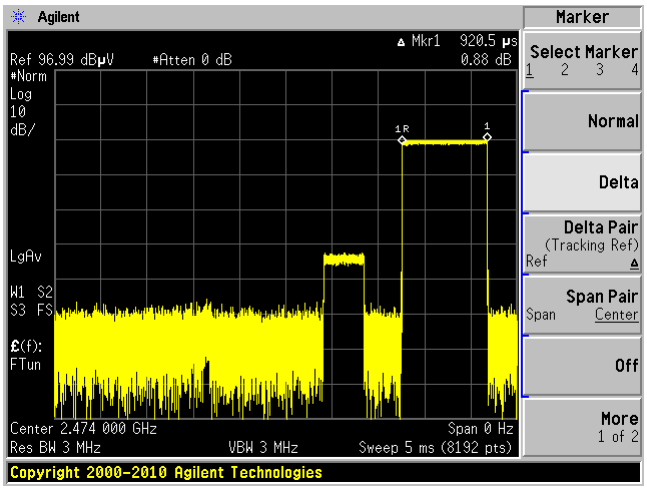


Pulses in 100 ms

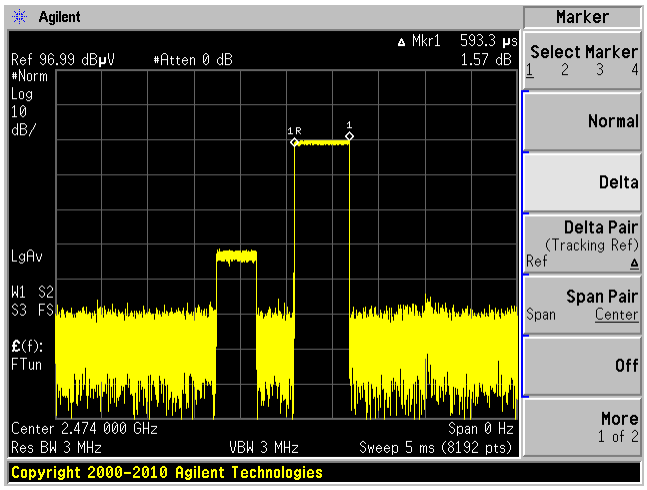


High Channel 2474 MHz

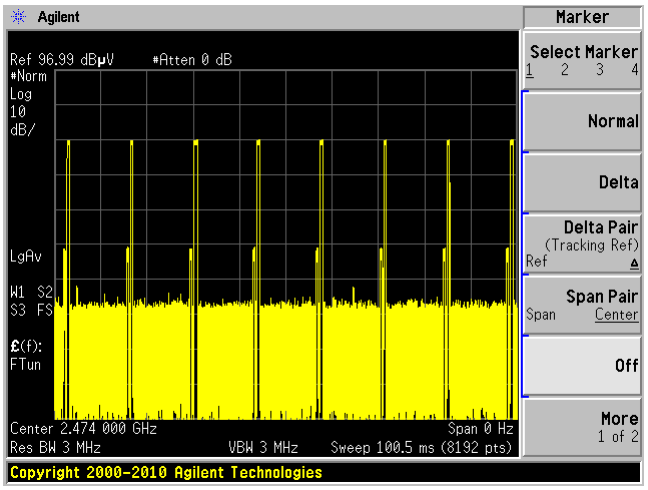
Wide Pulse Width



Regular Pulse Width



Pulses in 100 ms



12 FCC §15.247(a)(1)(iii) & ISEDC RSS-247 §5.1(4) - Number of Hopping Channels

12.1 Applicable Standards

According to FCC §15.247(a) (1) (iii) and RSS-247 §5.1(4): Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

12.2 Test Procedure

Span = the frequency band of operation
RBW = < 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller
VBW = ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2018-06-01	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

12.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

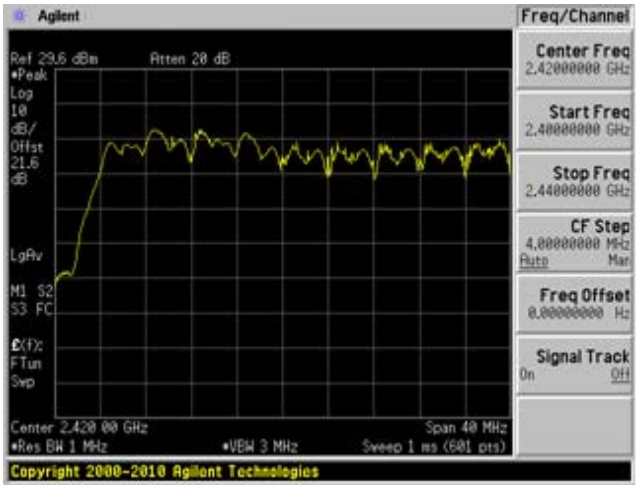
The testing was performed by Alexandrae Duran from 2019-03-05 in RF site.

12.5 Test Results

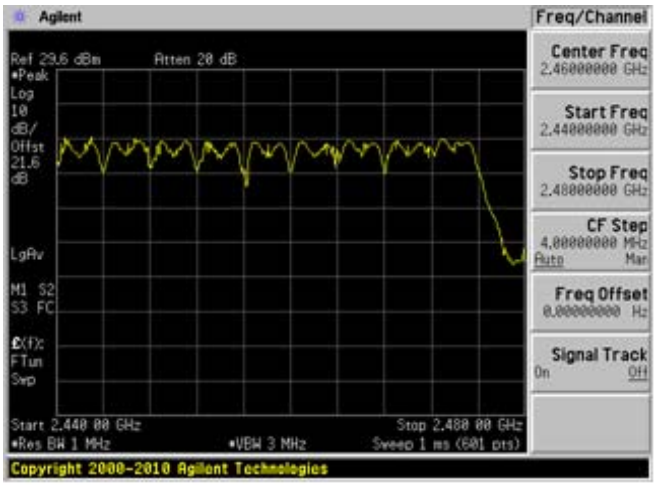
Total 18 channels; please refer to the plots hereinafter.

Antenna 1

9 Channels between 2400 to 2440 MHz

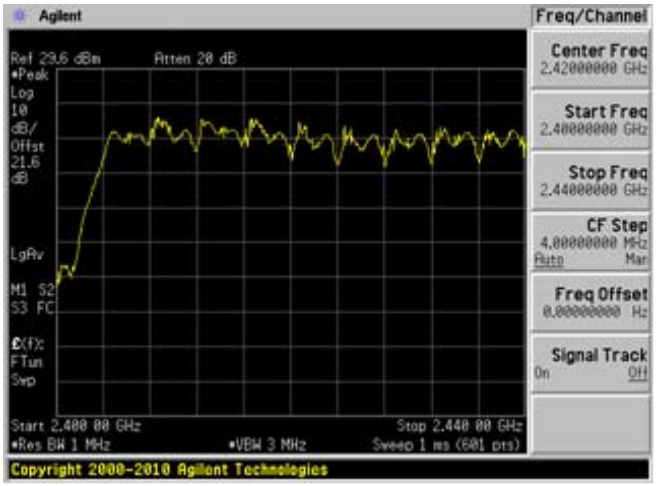


9 Channels Between 2440 to 2480 MHz

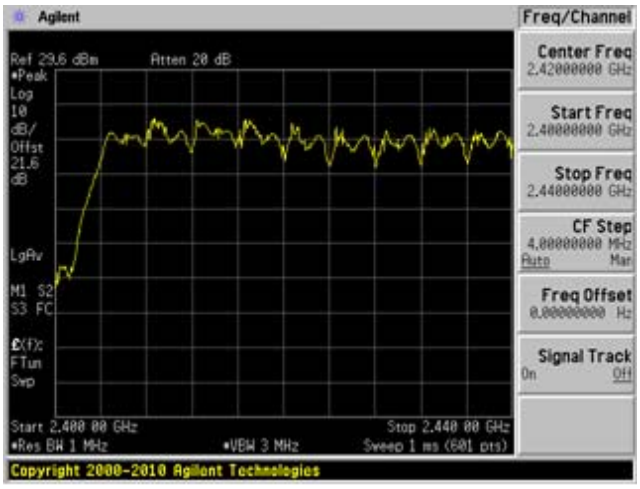


Antenna 2

9 Channels between 2400 to 2440 MHz



9 Channels Between 2440 to 2480 MHz



13 FCC §15.247(a)(1) & ISEDC RSS-247 §5.1(2) - Hopping Channel Separation

13.1 Applicable Standards

According to FCC §15.247(a) (1) and RSS-247 §5.1(2): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

13.2 Test Procedure

Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≈ 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel.
Video (or Average) Bandwidth = (VBW) ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold

13.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2018-06-01	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.

***Statement of Traceability*:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

13.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Alexandrae Duran from 2019-03-29 in RF site.

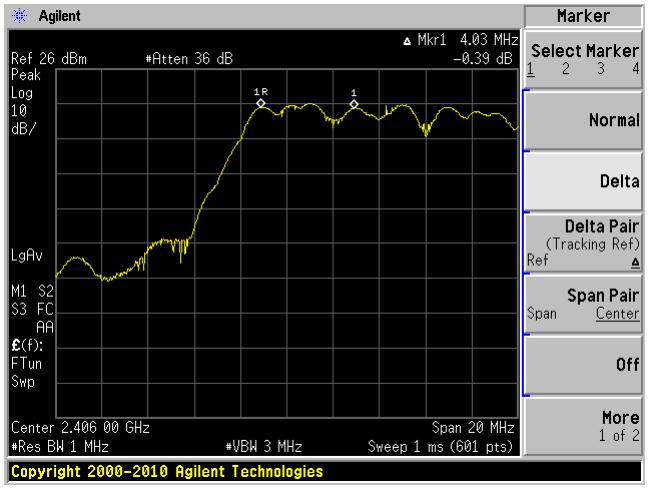
13.5 Test Results

Channel	Frequency (MHz)	Channel Separation (MHz)	Limit > 2/3 20 dB OBW (MHz)
Antenna 1			
Low	2406	4.03	2.881
Middle	2442	4.03	2.951
High	2474	4.03	2.975
Antenna 2			
Low	2406	4.03	2.987
Middle	2442	4.03	3.021
High	2474	4.03	2.91

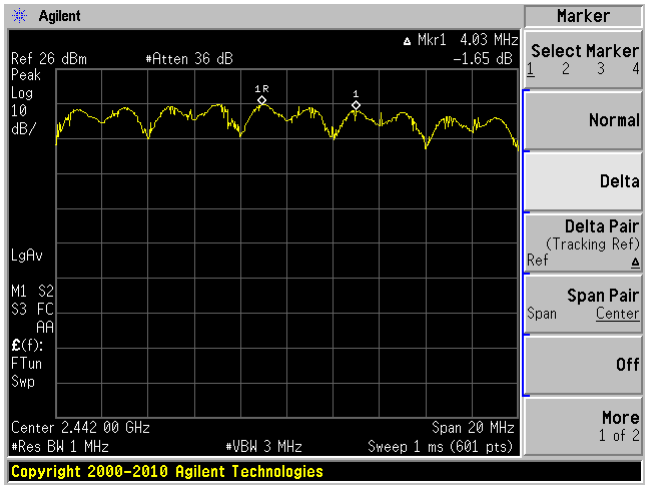
Please refer to following plots.

Antenna 1

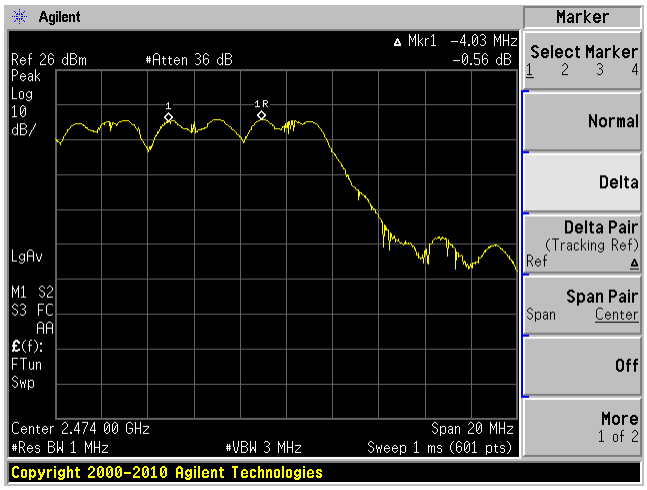
Low Channel 2406 MHz



Middle Channel 2442 MHz

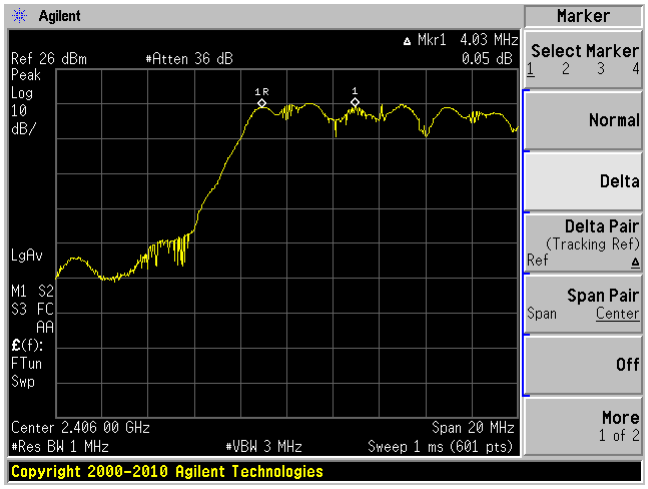


High Channel 2474 MHz

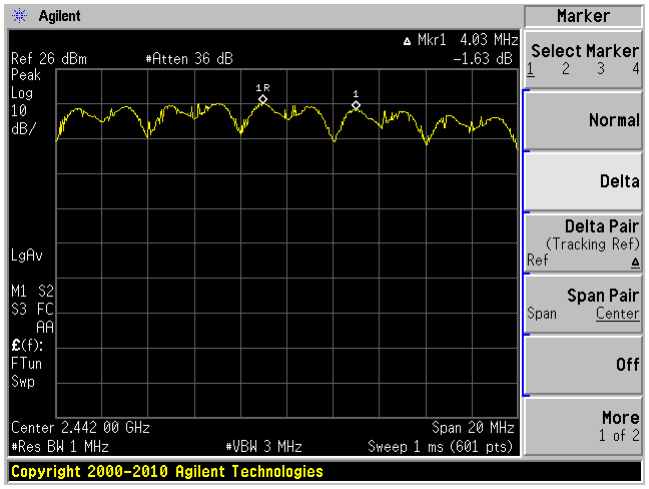


Antenna 2

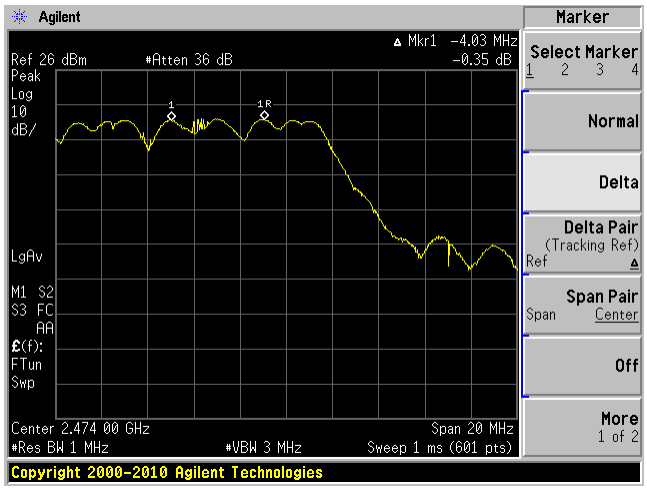
Low Channel 2406 MHz



Middle Channel 2442 MHz



High Channel 2474 MHz



14 FCC §15.247(d) & ISEDC RSS-247 §5.5 - Spurious Emissions at Antenna Terminals

14.1 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 ISEDC 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.

14.2 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.

14.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2018-06-01	1 year
-	RF cable	-	-	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 of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 9 June 2016) "A2LA Policy on Metrological Traceability".

14.4 Test Environmental Conditions

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

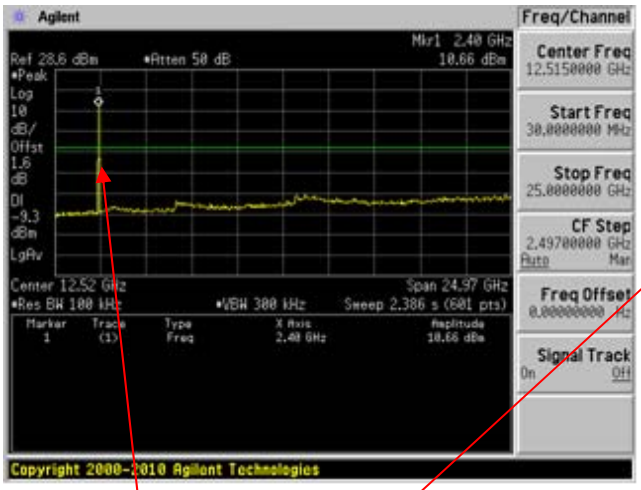
The testing was performed by Alexandrae Duran from 2019-03-05 in RF site.

14.5 Test Results

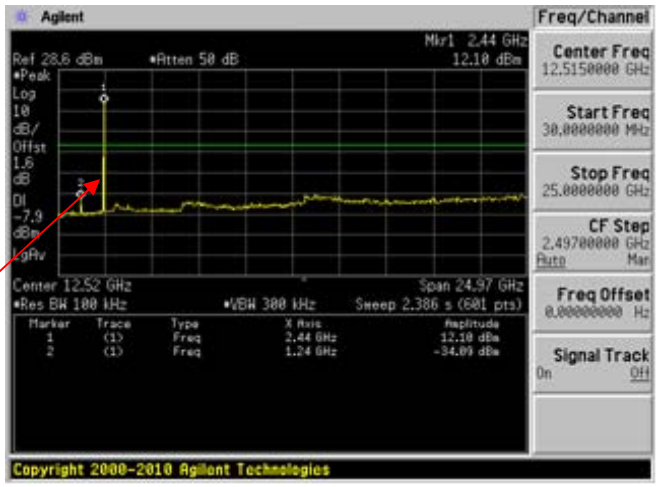
Please refer to following plots.

Antenna 1

Low Channel 30 MHz – 25 GHz

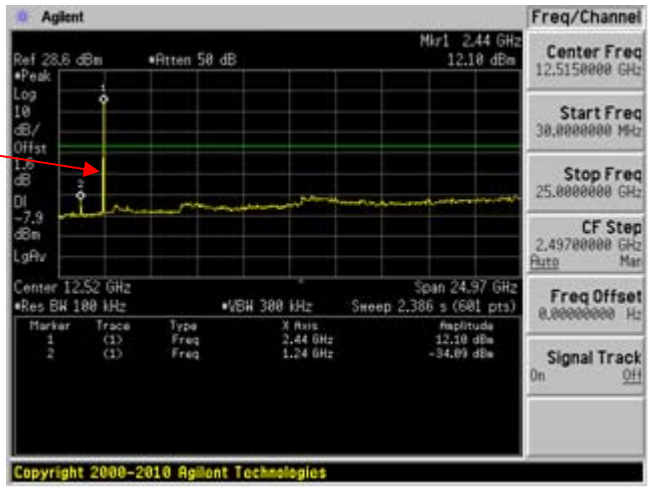


Middle Channel 30 MHz – 25 GHz



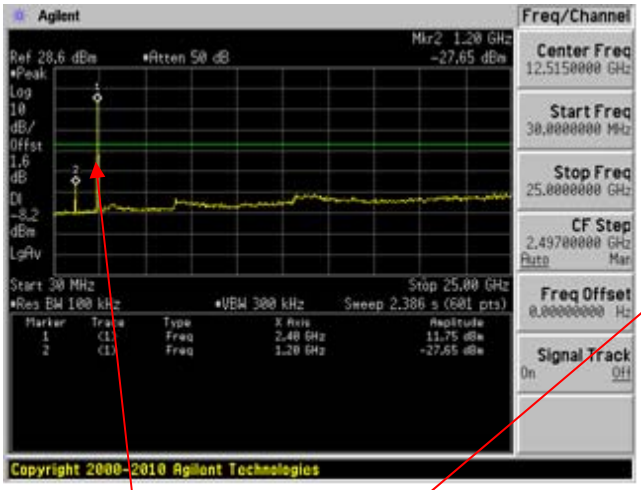
High Channel 30 MHz to 25 GHz

Fundamental Signal

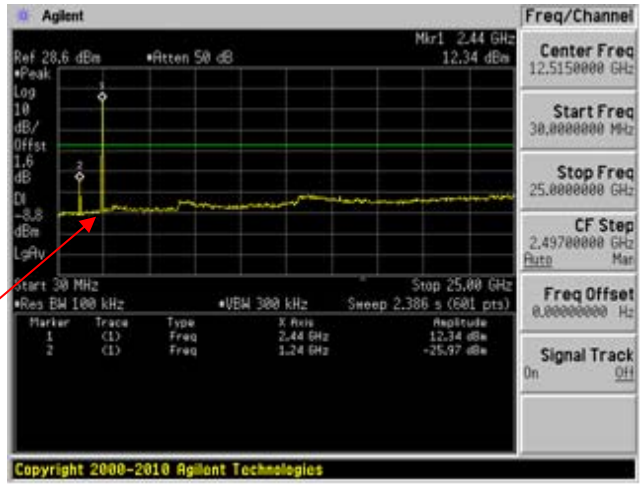


Antenna 2

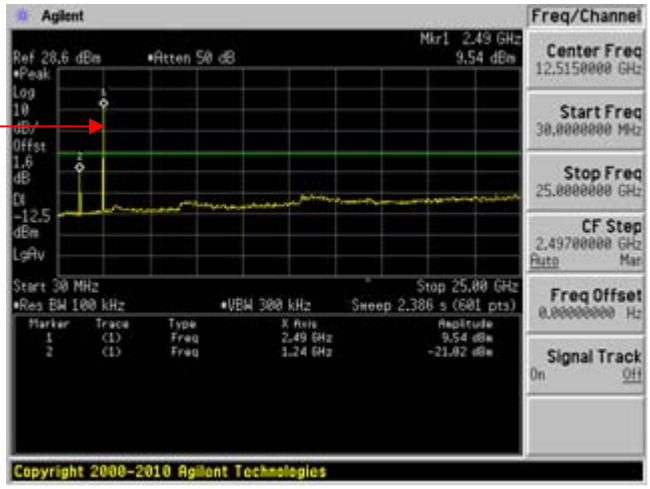
Low Channel 30 MHz – 25 GHz



Middle Channel 30 MHz – 25 GHz



High Channel 30 MHz to 25 GHz



Fundamental Signal

15 Exhibit A - FCC & ISED Equipment Labeling Requirements

15.1 FCC ID Label Requirements

As per FCC §2.925,

(a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in §2.926. The FCC Identifier shall be preceded by the term FCC ID in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID: XXX123

Where: XXX—Grantee Code, 123—Equipment Product Code

As per FCC §15.19,

(a) In addition to the requirements in part 2 of this chapter, a device subject to certification, or verification shall be labeled as follows:

(3) All other devices shall bear the following statement in a conspicuous location on the device:
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified above is required to be affixed only to the main control unit. If the EUT is integrated within another device then a label affixed to the host shall also state, "Contains FCC ID: XXXXXX"

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

15.2 IC Label Requirements

As per IC RSP-100 Section 3.1, the certification number shall appear as follows:

IC: XXXXXX-YYYYYYYY

Where:

- The letters "IC:" indicate that this is an Innovation, Science and Economic Development Canada's certification number, but they are not part of the certification number. XXXXXXYYYYYYYYYY is the ISED certification number.
- XXXXXX is the CN assigned by Innovation, Science and Economic Development Canada. Newly assigned CNs will be made up of five numeric characters (e.g. "20001") whereas existing CNs may consist of up to five numeric characters followed by an alphabetic character (e.g. "21A" or "15589J").
- YYYYYYYYYY is the Unique Product Number (UPN) assigned by the applicant, made up of a maximum of 11 alphanumeric characters.
- The CN and UPN are limited to capital alphabetic characters (A-Z) and numerals (0-9) only. The use of punctuation marks or other symbols, including "wildcard" characters, is not permitted.

- The HVIN may contain punctuation marks or symbols but they shall not represent any indeterminate (“wildcard”) characters.

As per RSS-Gen §2.1 Equipment Labeling:

The application for equipment certification shall be submitted in accordance with Industry Canada’s Radio Standards Procedure RSP-100, Radio Equipment Certification Procedure which sets out the requirements for certification and labelling of radio apparatus. RSP-100 shall be used in conjunction with RSS-Gen and other Radio Standards Specifications (RSSs) specifically applicable to the type of radio apparatus for which certification is sought.

12.3 Recommended Label Contents and Location

16 Appendix A- EUT Test Setup Photographs

Please refer to the attachment

17 Appendix B- EUT External Photographs

Please refer to the attachment

18 Appendix C- EUT Internal Photographs

Please refer to the attachment

19 Appendix E (Normative) - 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 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 April 2017*).

Presented this 2nd day of October 2018.

President and CEO
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2020

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

Please follow the web link below for a full ISO 17025 scope
https://www.a2la.org/scopepdf/3297-02.pdf

--- END OF REPORT ---