LP0002-2018

TEST REPORT
FOR
Cisco Systems, Inc.

Brand: Cisco
170 West Tasman Drive,
San Jose, CA 95134 USA

Report Type: Original Report	**Product Type:** Cisco Catalyst 9120AX Series Access Points

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ACCREDITED
CERTIFICATE #3297.02

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* This test report may contain data and test methods that are not covered by BACL's scope of accreditation as of the test report date shown above. These items are marked within the test report text with an asterisk "*"

TABLE OF CONTENTS

1 General Description 4
1.1 Product Description for Equipment Under Test (EUT) 4
1.2 Mechanical Description of EUT 4
1.3 Objective 4
1.4 Related Submittal(s)/Grant(s) 4
1.5 Test Methodology 4
1.6 Measurement Uncertainty 5
1.7 Test Facility Registrations 5
1.8 Test Facility Accreditations 5
2 System Test Configuration 8
2.1 Justification 8
2.2 EUT Exercise Software 8
2.3 Equipment Modifications 9
2.4 Local Support Equipment 9
2.5 Support Equipment 9
2.6 Interface Ports and Cabling 9
3 Summary of Test Results 10
4 FCC §15.207 & ISEDC RSS-Gen §8.8 - AC Power Line Conducted Emissions 11
4.1 Applicable Standards 11
4.2 Test Setup 11
4.3 Test Procedure 11
4.4 Corrected Amplitude and Margin Calculation 12
4.5 Test Equipment List and Details 12
4.6 Test Environmental Conditions 12
4.7 Summary of Test Results 13
4.8 Conducted Emissions Test Plots and Data 14
5 FCC §15.209, §15.247(d) & ISEDC RSS-247 §5.5, RSS-Gen §8.9, §8.10- Spurious Radiated Emissions 16
5.1 Applicable Standards 16
5.2 Test Setup 17
5.3 Test Procedure 17
5.4 Corrected Amplitude and Margin Calculation 18
5.5 Test Equipment List and Details 18
5.6 Test Environmental Conditions 19
5.7 Summary of Test Results 19
5.8 Spurious Emissions Test Results 20
6 Annex A – Test Setup Photographs 27
7 Annex B- EUT External Photographs 28
8 Annex C- EUT Internal Photographs 29
9 Annex D (Normative) - ISO/IEC 17025 Certificate and Scope of Accreditation 30

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1909242-247	Original Report	2019-10-07

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of Cisco Systems, Inc., and their product model: C9120AXE-T, as referred to as EUT in this report. The product is Cisco Catalyst 9120AX Series Access Points Brand: Cisco.

1.2 Mechanical Description of EUT

Length (cm)	Width (cm)	Height (cm)	Weight (g)
20	20	4	1150

1.3 Objective

This report is prepared on behalf of *Cisco Systems, 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 on February 2017, and LP0002-2018.

The objective is to determine compliance with FCC Part 15.247 and ISEDC RSS-247 rules and LP0002-2018 for AC Line Conducted Emissions and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

R1909242-407 Report FCC ID: LDKEDAC92157 IC: 2461N-EDAC92157

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 v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 and LP0002-2018.

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 ^{o} 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 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 according to ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v05r02, and LP0002-2018

The EUT was tested in a testinnonHT20 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 Tera Term and test commands, provided by *Cisco Systems, Inc.*, the software is compliant with the standard requirements being tested against.

Modulation	Frequency (MHz)	Power Setting
2.4GHz WiFi 802.11b/g/n/ac/ax	2412	17
	2437	17
	2462	17
	2462	17
2.4GHz AUX 802.11ax	2412	17
	2437	17
	2462	17
BLE	2402	5
	2426	5
	2480	5

Data Rates Tested:
802.11b mode: 1Mbps
802.11nonHT20 mode: 6Mbps
802.11n/ac mode: m0/m0x1
802.11ax mode: m0h1

2.3 Equipment Modifications

No equipment modifications are made to the EUT

2.4 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Laptop	Latitude E6410	3CKRAQ1

2.5 Support Equipment

Manufacturer	Description	Model
Cisco	Power supply	AIR-PWRINJ6 V01

2.6 Interface Ports and Cabling

Cable Description	Length	Brand	Model	To	From
Ethernet cable	2 m	BACL	BACL-LAN	PoE	EUT
Ethernet-serial-USB cable	2 m	Cisco	E to U Cable	EUT	Laptop

3 Summary of Test Results

Results reported relate only to the product tested.

Rules	Description of Test	Results
FCC §15.207 ISEDC RSS-Gen §8.8 LP0002-2018	AC Power Line Conducted Emissions	Compliant
FCC §2.1053, §15.35(b), §15.205, §15.209, §15.247 (d) ISEDC RSS-247 §5.5 ISEDC RSS-Gen §8.9 & §8.10 LP0002-2018	Radiated Spurious Emissions	Compliant

4 FCC §15.207 & ISEDC RSS-Gen §8.8 & LP0002 - AC Power Line Conducted Emissions

4.1 Applicable Standards

As per FCC §15.207, LP0002 and ISEDC RSS GEN §8.8

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 [1]	56 to 46 [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.

4.2 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 limits and ISEDC RSS GEN §8.8 and LP0002

External I/O cables were draped along the edge of the test table and bundled when necessary.
The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

4.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the main 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 was recorded in the peak, quasi-peak, and average detection mode. Quasi-Peak readings are distinguished with “QP.” Average readings are distinguished with “Ave”.

4.4 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

4.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2018-07-05	2 years
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101964	2019-07-31	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	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	2019-04-11	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 09 June 2016) "A2LA Policy on Metrological Traceability".*

4.6 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	44 %
ATM Pressure:	101.31 kPa

The testing was performed by Tri Pham on 2019-10-08 in Ground Test Site.

4.7 Summary of Test Results

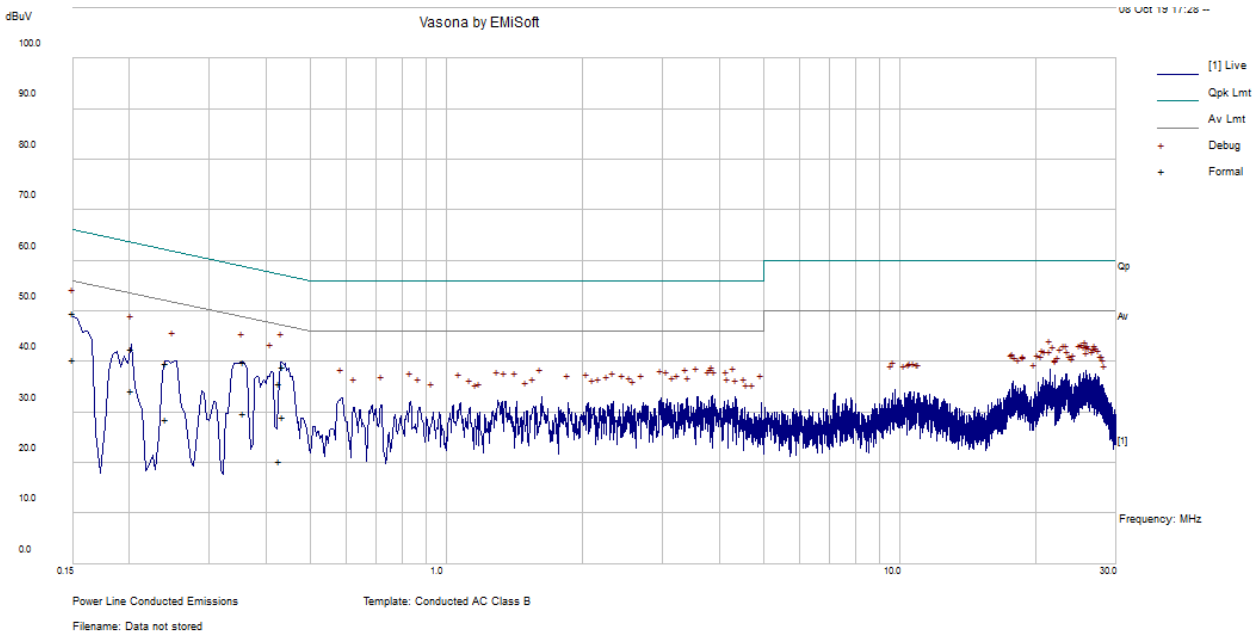
According to the recorded data in following table, the EUT complied with the FCC Part 15 and RSS-Gen standards and LP0002' conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Live/Neutral)**	**Range (MHz)**
-15.47	0.150373	Line	0.15-30

4.8 Conducted Emissions Test Plots and Data

Worst Case Colocation: BLE 2426 MHz, 2.4 GHz Wi-Fi HT20 mode 2462 MHz, 2.4GHz Wifi Aux nonHT20 mode 2412 MHz and 5 GHz Wi-Fi VHT160 mode 5250 MHz

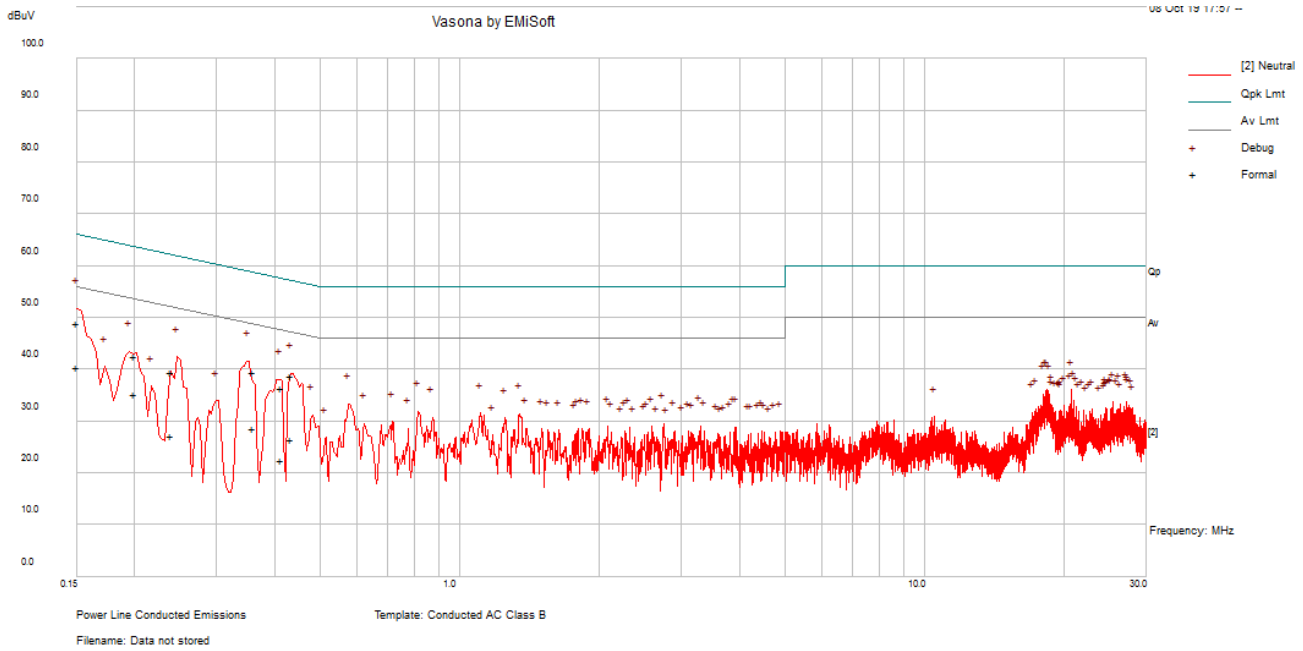
110 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.150373	49.67	Line	65.98	-16.31	QP
0.202259	42.56	Line	63.52	-20.96	QP
0.241355	39.79	Line	62.05	-22.26	QP
0.357915	39.92	Line	58.78	-18.85	QP
0.428647	35.77	Line	57.28	-21.51	QP
0.435772	39.02	Line	57.14	-18.13	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.150373	40.51	Line	55.98	-15.47	Ave.
0.202259	34.3	Line	53.52	-19.22	Ave.
0.241355	28.61	Line	52.05	-23.44	Ave.
0.357915	29.9	Line	48.78	-18.88	Ave.
0.428647	20.28	Line	47.28	-27	Ave.
0.435772	29	Line	47.14	-18.14	Ave.

110 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.150329	48.84	Neutral	65.98	-17.14	QP
0.359817	39.43	Neutral	58.73	-19.3	QP
0.433108	38.74	Neutral	57.19	-18.45	QP
0.239999	39.55	Neutral	62.1	-22.54	QP
0.414121	36.39	Neutral	57.57	-21.17	QP
0.199584	42.49	Neutral	63.63	-21.14	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.150329	40.38	Neutral	55.98	-15.6	Ave.
0.359817	28.58	Neutral	48.73	-20.15	Ave.
0.433108	26.43	Neutral	47.19	-20.77	Ave.
0.239999	27.12	Neutral	52.1	-24.98	Ave.
0.414121	22.44	Neutral	47.57	-25.12	Ave.
0.199584	35.2	Neutral	53.63	-18.43	Ave.

5 FCC §15.209, §15.247(d) & ISEDC RSS-247 §5.5, RSS-Gen §8.9, §8.10- and LP0002 Spurious Radiated Emissions

5.1 Applicable Standards

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 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

As per NCC Section 2.7,

MHz	MHz	MHz
0.090 - 0.110	167.72 - 173.20	3260.0 - 3267.0
0.490 - 0.510	240.00 - 285.00	3332.0 - 3339.0
2.172 - 2.198	322.00 - 335.40	3345.8 - 3358.0
3.013 - 3.033	399.90 - 410.00	3500.0 - 4400.0
4.115 - 4.198	608.00 - 614.00	4500.0 - 5250.0
5.670 - 5.690	703.00 - 748.00	5350.0 - 5460.0
6.200 - 6.300	758.00 - 803.00	7250.0 - 7750.0
8.230 - 8.400	825.00 - 915.00	8025.0 - 8500.0
12.265 - 12.600	930.00 - 1240.0	9000.0 - 9200.0
13.340 - 13.430	1300.0 - 1427.0	9300.0 - 9500.0
14.965 - 15.020	1435.0 - 1626.5	10600 - 12700
16.700 - 16.755	1660.0 - 1785.0	13250 - 13400
19.965 - 20.020	1805.0 - 1880.0	14470 - 14500
25.500 - 25.700	1885.0 - 1900.0	15350 - 16200
37.475 - 38.275	1905.0 - 1985.0	17700 - 21400
73.500 - 75.400	2010.0 - 2025.0	22010 - 23120
108.00 - 138.00	2110.0 - 2170.0	23600 - 24000
149.90 - 150.05	2200.0 - 2300.0	31200 - 31800
156.70 - 156.90	2310.0 - 2390.0	36430 - 36500
162.01 - 167.17	2483.5 - 2900.0	Above 38600

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).

5.2 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 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.

5.3 Test Procedure

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.

For radiated testing 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 = 3MHz / Sweep = 100 ms
(2) Average: RBW = 1MHz / VBW = 3MHz / Sweep = Auto

5.4 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

5.5 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	2018-10-26	2 years
Rohde and Schwarz	Analyzer, Spectrum	FSV40	1321.3008K39-101203-UW	2019-08-06	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2018-02-26	2 years
Agilent	Amplifier, Pre	8447D	2944A10187	2019-04-11	1 year
HP	Pre-Amplifier	8449B	3008A01978	2019-09-27	1 year
Rohde & Schwarz	EMI Test Receiver	ESU-40	100433	2019-02-06	1 year
MDP DIgital	Times Microwave LMR 400 UltraFex Coaxial Cable 35\'	LMR400UF	BACL1904161	2019-04-16	1 year
-	SMA cable	-	C0002	Each time[1]	N/A
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".

5.6 Test Environmental Conditions

Temperature:	22-25 ºC
Relative Humidity:	42-48 %
ATM Pressure:	102.1 kPa

The testing was performed by Christian McCaig and Matthew Riego de Dios from 2019-09-20 to 2019-10-09 in 5m chamber 3.

5.7 Summary of Test Results

According to the data hereinafter, the EUT complied with FCC Title 47, Part 15C and RSS-247 standard's radiated emissions limits, and had the worst margin of:

2.4GHz Wi-Fi/BLE

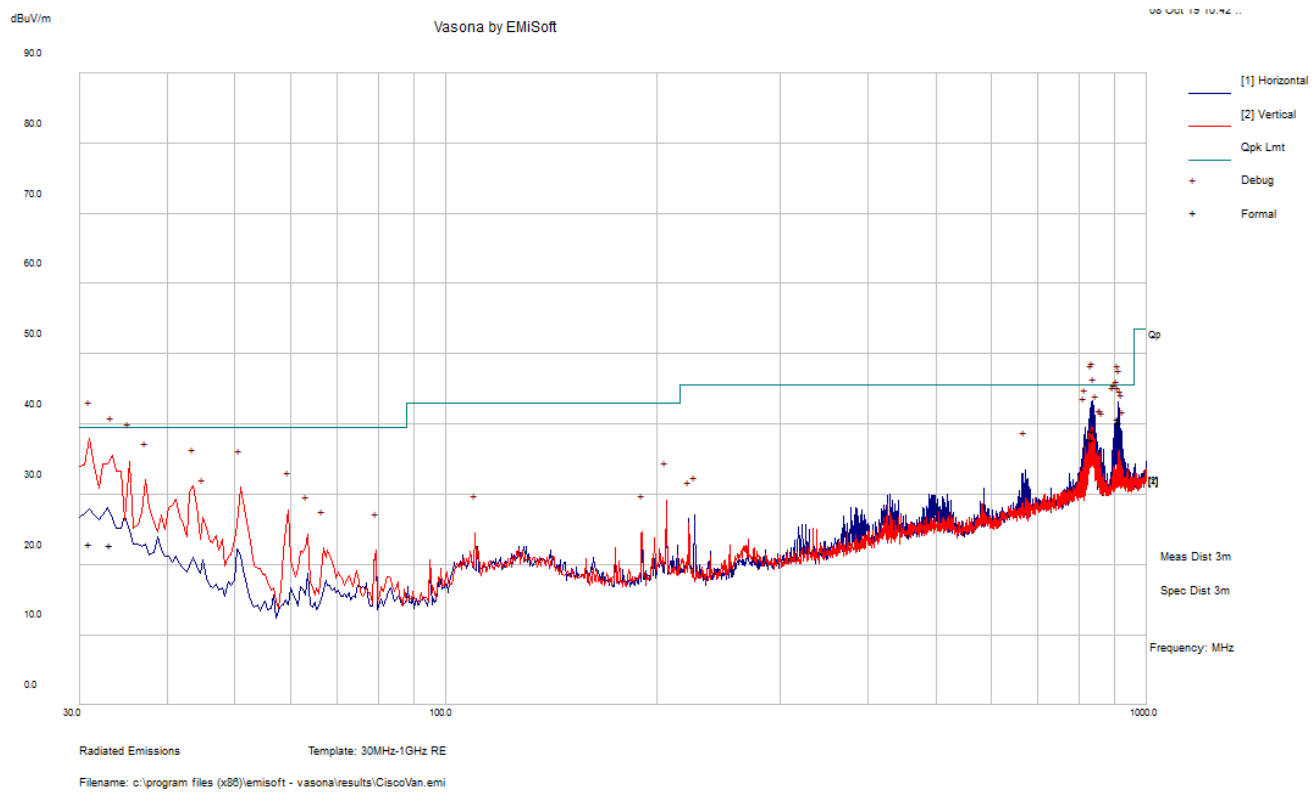
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, channel**
-4.58	7236	Vertical	Co-location

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

5.8 Spurious Emissions Test Results

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

Worst Case Colocation: BLE 2426 MHz, 2.4 GHz Wi-Fi HT20 mode 2462 MHz, 2.4GHz Wifi Aux nonHT20 mode 2412 MHz and 5 GHz Wi-Fi VHT160 mode 5250 MHz



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
31.04325	22.95	168	V	106	39.5	-16.55	Pass
837.8205	39.04	105	H	206	45.5	-6.46	Pass
833.57425	37.9	159	H	193	45.5	-7.6	Pass
910.027	40.81	156	H	198	45.5	-4.69	Pass
913.91675	40.25	152	H	194	45.5	-5.25	Pass
33.18375	22.83	117	V	165	39.5	-16.67	Pass

2) Above 1 GHz, measured at 1 meter in 4X4 MIMO configuration

2.4 GHz Wi-Fi

Freq. (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 CCK mode power setting: 17											
4824	46.66	0	183	H	32.46	8.40	35.90	51.61	84	-32.39	PK
4824	37.99	0	183	H	32.46	8.40	35.90	42.94	64	-21.06	AV
4824	49.13	42	150	V	32.45	8.40	35.90	54.08	84	-29.92	PK
4824	43.49	42	150	V	32.45	8.40	35.90	48.44	64	-15.56	AV
7236	50.73	172	139	H	37.94	9.97	35.25	63.39	84	-20.61	PK
7236	43.22	172	139	H	37.94	9.97	35.25	55.88	64	-8.12	AV
7236	52.30	217	134	V	38.02	9.97	35.25	65.04	84	-18.96	PK
7236	46.68	217	134	V	38.02	9.97	35.25	59.42	64	-4.58	AV
Mid Channel 2437 MHz CCK mode power setting: 17											
4884	48.47	341	247	H	32.46	8.40	35.90	53.42	84	-30.58	PK
4884	42.11	341	247	H	32.46	8.40	35.90	47.06	64	-16.94	AV
4884	50.64	316	123	V	32.45	8.40	35.90	55.59	84	-28.41	PK
4884	45.75	316	123	V	32.45	8.40	35.90	50.70	64	-13.30	AV
7326	49.68	189	143	H	37.98	10.16	35.27	62.55	84	-21.45	PK
7326	41.60	189	143	H	37.98	10.16	35.27	54.47	64	-9.53	AV
7326	51.27	190	147	V	38.00	10.16	35.27	64.16	84	-19.84	PK
7326	44.35	190	147	V	38.00	10.16	35.27	57.24	64	-6.76	AV
High Channel 2462 MHz CCK mode power setting: 17											
4924	47.46	186	339	H	32.46	8.40	35.90	52.41	84	-31.59	PK
4924	40.51	186	339	H	32.46	8.40	35.90	45.46	64	-18.54	AV
4924	50.26	323	171	V	32.45	8.40	35.90	55.21	84	-28.79	PK
4924	44.89	323	171	V	32.45	8.40	35.90	49.84	64	-14.16	AV
7386	48.43	212	117	H	37.98	10.34	35.32	61.43	84	-22.57	PK
7386	39.89	212	117	H	37.98	10.34	35.32	52.89	64	-11.11	AV
7386	50.52	216	108	V	38.00	10.34	35.32	63.54	84	-20.46	PK
7386	43.72	216	108	V	38.00	10.34	35.32	56.74	64	-7.26	AV

Freq. (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 Non HT20 mode power setting: 17											
4824	45.91	0	100	H	32.46	8.40	35.90	50.86	84	-33.14	PK
4824	32.26	0	100	H	32.46	8.40	35.90	37.21	64	-26.79	AV
4824	46.29	0	100	V	32.45	8.40	35.90	51.24	84	-32.76	PK
4824	32.25	0	100	V	32.45	8.40	35.90	37.20	64	-26.80	AV
Mid Channel 2437 MHz Non HT20 mode power setting: 17											
4884	46.26	0	100	H	32.46	8.40	35.90	51.21	84	-32.79	PK
4884	33.35	0	100	H	32.46	8.40	35.90	38.30	64	-25.70	AV
4884	46.53	0	100	V	32.45	8.40	35.90	51.48	84	-32.52	PK
4884	32.37	0	100	V	32.45	8.40	35.90	37.32	64	-26.68	AV
7326	48.07	194	156	H	37.98	10.16	35.27	60.94	84	-23.06	PK
7326	34.91	194	156	H	37.98	10.16	35.27	47.78	64	-16.22	AV
7326	49.63	346	104	V	38.00	10.16	35.27	62.52	84	-21.48	PK
7326	34.46	346	104	V	38.00	10.16	35.27	47.35	64	-16.65	AV
High Channel 2462 MHz Non HT20 mode power setting: 17											
4924	46.25	0	100	H	32.46	8.40	35.90	51.20	84	-32.80	PK
4924	33.01	0	100	H	32.46	8.40	35.90	37.96	64	-26.04	AV
4924	48.26	0	100	V	32.45	8.40	35.90	53.21	84	-30.79	PK
4924	36.17	0	100	V	32.45	8.40	35.90	41.12	64	-22.88	AV
7386	49.18	212	117	H	37.98	10.34	35.32	62.18	84	-21.82	PK
7386	37.84	212	117	H	37.98	10.34	35.32	50.84	64	-13.16	AV
7386	50.83	180	125	V	38.00	10.34	35.32	63.85	84	-20.15	PK
7386	39.46	180	125	V	38.00	10.34	35.32	52.48	64	-11.52	AV

Freq. (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 HT/VHT20 mode power setting: 17											
4824	45.42	0	100	H	32.46	8.40	35.90	50.37	84	-33.63	PK
4824	32.52	0	100	H	32.46	8.40	35.90	37.47	64	-26.53	AV
4824	46.03	0	100	V	32.45	8.40	35.90	50.98	84	-33.02	PK
4824	32.23	0	100	V	32.45	8.40	35.90	37.18	64	-26.82	AV
Mid Channel 2437 MHz HT/VHT20 mode power setting: 17											
4884	46.35	0	100	H	32.46	8.40	35.90	51.30	84	-32.70	PK
4884	32.95	0	100	H	32.46	8.40	35.90	37.90	64	-26.10	AV
4884	47.14	0	100	V	32.45	8.40	35.90	52.09	84	-31.91	PK
4884	32.19	0	100	V	32.45	8.40	35.90	37.14	64	-26.86	AV
High Channel 2462 MHz HT/VHT20 mode power setting: 17											
4924	44.75	0	100	H	32.46	8.40	35.90	49.70	84	-34.30	PK
4924	32.04	0	100	H	32.46	8.40	35.90	36.99	64	-27.01	AV
4924	44.80	0	100	V	32.45	8.40	35.90	49.75	84	-34.25	PK
4924	32.06	0	100	V	32.45	8.40	35.90	37.01	64	-26.99	AV

Freq. (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 HE20 mode power setting: 17											
4824	45.72	0	100	H	32.46	8.40	35.90	50.67	84	-33.33	PK
4824	32.06	0	100	H	32.46	8.40	35.90	37.01	64	-26.99	AV
4824	46.73	0	100	V	32.45	8.40	35.90	51.68	84	-32.32	PK
4824	32.17	0	100	V	32.45	8.40	35.90	37.12	64	-26.88	AV
Mid Channel 2437 MHz HE20 mode power setting: 17											
4874	46.09	0	100	H	32.46	8.40	35.90	51.04	84	-32.96	PK
4874	32.10	0	100	H	32.46	8.40	35.90	37.05	64	-26.95	AV
4874	46.14	0	100	V	32.45	8.40	35.90	51.09	84	-32.91	PK
4874	32.40	0	100	V	32.45	8.40	35.90	37.35	64	-26.65	AV
High Channel 2462 MHz HE20 mode power setting: 17											
4924	45.63	0	100	H	32.46	8.40	35.90	50.58	84	-33.42	PK
4924	32.21	0	100	H	32.46	8.40	35.90	37.16	64	-26.84	AV
4924	47.48	0	100	V	32.45	8.40	35.90	52.43	84	-31.57	PK
4924	32.61	0	100	V	32.45	8.40	35.90	37.56	64	-26.44	AV

2.4 GHz AUX Wi-Fi

Freq. (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 Non HT20 mode power setting: 17											
4824	43.75	0	100	H	32.46	8.40	35.90	48.70	84	-35.30	PK
4824	32.25	0	100	H	32.46	8.40	35.90	37.20	64	-26.80	AV
4824	42.81	0	100	V	32.45	8.40	35.90	47.76	84	-36.24	PK
4824	32.22	0	100	V	32.45	8.40	35.90	37.17	64	-26.83	AV
7236	47.95	332	290	H	36.75	16.23	37.74	63.19	78	-14.81	PK
7236	34.05	332	290	H	36.75	16.23	37.74	49.29	64	-14.71	AV
7236	51.20	186	145	V	36.75	16.23	37.74	66.44	78	-11.56	PK
7236	36.64	186	145	V	36.75	16.23	37.74	51.88	64	-12.12	AV
Mid Channel 2437 MHz Non HT20 mode power setting: 17											
4874	45.49	0	100	H	32.46	8.40	35.90	50.44	84	-33.56	PK
4874	32.45	0	100	H	32.46	8.40	35.90	37.40	64	-26.60	AV
4874	44.62	0	100	V	32.45	8.40	35.90	49.57	84	-34.43	PK
4874	32.23	0	100	V	32.45	8.40	35.90	37.18	64	-26.82	AV
7311	48.01	196	100	H	37.08	16.23	37.74	63.57	84	-20.43	PK
7311	34.10	196	100	H	37.08	16.23	37.74	49.66	64	-14.34	AV
7311	49.88	150	138	V	37.08	16.23	37.74	65.44	84	-18.56	PK
7311	36.39	150	138	V	37.08	16.23	37.74	51.95	64	-12.05	AV
High Channel 2462 MHz Non HT20 mode power setting: 17											
4924	44.18	0	100	H	32.46	8.40	35.90	49.13	84	-34.87	PK
4924	31.93	0	100	H	32.46	8.40	35.90	36.88	64	-27.12	AV
4924	44.41	0	100	V	32.45	8.40	35.90	49.36	84	-34.64	PK
4924	31.99	0	100	V	32.45	8.40	35.90	36.94	64	-27.06	AV
7386	46.00	0	290	H	37.19	16.23	37.74	61.68	84	-22.32	PK
7386	32.80	0	290	H	37.19	16.23	37.74	48.48	64	-15.52	AV
7386	46.94	0	139	V	37.19	16.23	37.74	62.62	84	-21.38	PK
7386	34.01	0	139	V	37.19	16.23	37.74	49.69	64	-14.31	AV

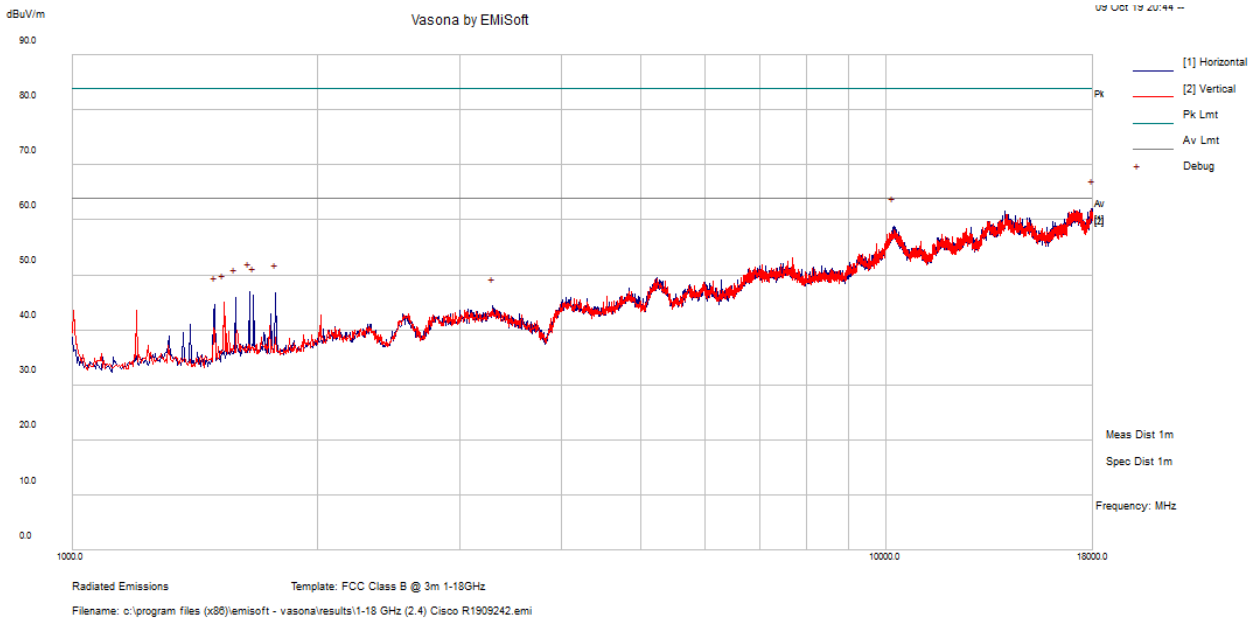
Measured at 1 meter

BLE

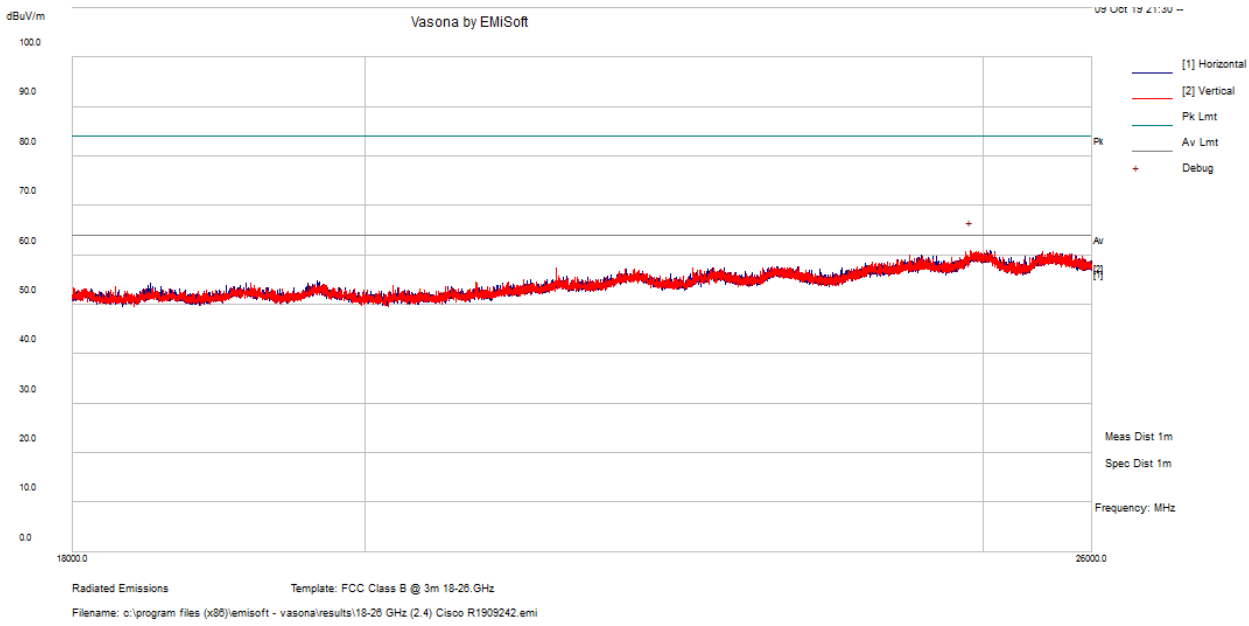
Freq. (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2402 MHz											
4804	44.95	0	100	H	32.46	8.40	35.90	49.90	84	-34.10	PK
4804	32.30	0	100	H	32.46	8.40	35.90	37.25	64	-26.75	AV
4804	45.17	0	100	V	32.45	8.40	35.90	50.12	84	-33.88	PK
4804	32.28	0	100	V	32.45	8.40	35.90	37.23	64	-26.77	AV
Mid Channel 2426 MHz											
4852	45.37	0	100	H	32.46	8.40	35.90	50.32	84	-33.68	PK
4852	32.18	0	100	H	32.46	8.40	35.90	37.13	64	-26.87	AV
4852	45.47	0	100	V	32.45	8.40	35.90	50.42	84	-33.58	PK
4852	32.20	0	100	V	32.45	8.40	35.90	37.15	64	-26.85	AV
High Channel 2480 MHz											
4960	49.58	0	100	H	32.46	8.40	35.90	54.53	84	-29.47	PK
4960	36.19	0	100	H	32.46	8.40	35.90	41.14	64	-22.86	AV
4960	48.95	0	100	V	32.45	8.40	35.90	53.90	84	-30.10	PK
4960	36.19	0	100	V	32.45	8.40	35.90	41.14	64	-22.86	AV

Worst Case Colocation: BLE 2426 MHz, 2.4 GHz Wi-Fi HT20 mode 2462 MHz, 2.4GHz Wifi Aux nonHT20 mode 2412 MHz and 5 GHz Wi-Fi VHT160 mode 5250 MHz

1 GHz – 18 GHz Worst Case Scan at 1 meter



18 GHz – 26.5 GHz Worst Case Scan at 1 meter



6 Annex A – Test Setup Photographs

Please refer to the attachment

7 Annex B- EUT External Photographs

Please refer to the attachment

8 Annex C- EUT Internal Photographs

Please refer to the attachment

9 Annex D (Normative) - ISO/IEC 17025 Certificate and Scope of Accreditation

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.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2020
Revised June 5, 2019

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 ---