FCC PART 15, SUBPART C
ISEDC RSS-247, ISSUE 2, FEBRUARY 2017
LP0002-2018

TEST REPORT

For

Cisco Systems Inc.

125 West Tasman Drive,

San Jose, CA 95134 USA

FCC ID: LDKSLTSP1905
IC: 2461N-SLTSP1905

Report Type: Permissive II Change Report	**Product Type:** Cisco 802.11ax Access Point
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ACCREDITED
CERTIFICATE #3297.02

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1903188-247	Permissive II Change Report	2019-05-07

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: C9115AXE-B (US), C9115AXE-A (Canada), and C9115AXE-T (Taiwan) as referred to as EUT in this report. The product is an 802.11ax Dual Band Access Point.

1.2 Mechanical Description of EUT

Height (mm)	Width (mm)	Dimension (mm)	Weight (g)
77	77	44	100

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 NCC LP0002-2018.

The objective is to determine compliance with FCC Part 15.247, ISEDC RSS-247 and NCC LP-0002 rules for Antenna Requirements and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

R1903188-407

1.5 Test Methodology

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

1.6 Measurement Uncertainty

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

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

1.7 Test Facility Registrations

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

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

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

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

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 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 v04.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

The test firmware used was 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
802.11b	2412	17
	2442	17
	2462	17
802.11g	2412	17
	2442	17
	2462	17
802.11n	2412	17
	2442	17
	2462	17
802.11ax	2412	17
	2442	17
	2462	17
BLE	2402	5
	2440	5
	2480	5

Data Rates Tested:
802.11b mode: 1Mbps
802.11g 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	To	From
Ethernet cable	2 m	PoE	EUT
Ethernet-serial-USB cable	2 m	EUT	Laptop

3 Summary of Test Results

Results reported relate only to the product tested.

FCC, ISEDC, and LP0002 Rules	Description of Test	Results
FCC §2.1091, §15.247(i) & ISEDC RSS-102 & LP0002	RF Exposure	Compliant
FCC §2.1053, §15.35(b), §15.205, §15.209, §15.247 (d) ISEDC RSS-247 §5.5 ISEDC RSS-Gen §8.9 and §8.10 LP0002-2018 §3.10	Radiated Spurious Emissions	Compliant

4 FCC §2.1091, §15.247(i) & ISEDC RSS-102 & LP0002– RF Exposure

4.1 Applicable Standards

According to FCC §15.247(i), §1.1307(b)(1) and LP0002 5.20.2.2, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

According to ISED RSS-102 Issue 5:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
* Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

4.3 MPE Results for FCC

2.4 GHz Wi-Fi

Maximum output power at antenna input terminal (dBm):	23.8
Maximum output power at antenna input terminal (mW):	239.88
Prediction distance (cm):	30
Prediction frequency (MHz):	2437
Maximum Antenna Gain, typical (dBi):	12
Maximum Antenna Gain (numeric):	15.85
Power density of prediction frequency at 30.0 cm (mW/cm^2):	0.336
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 30 cm is 0.336 mW/cm^2. Limit is 1.0 mW/cm^2.

2.4 GHz BLE

Maximum peak output power at antenna input terminal (dBm):	4.47
Maximum peak output power at antenna input terminal (mW):	2.80
Prediction distance (cm):	30
Prediction frequency (MHz):	2426
Maximum Antenna Gain, typical (dBi):	6.0
Maximum Antenna Gain (numeric):	3.98
Power density of prediction frequency at 30.0 cm (mW/cm^2):	0.00099
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 30 cm is 0.00099 mW/cm^2. Limit is 1.0 mW/cm^2.

5 GHz Wi-Fi

Maximum peak output power at antenna input terminal (dBm):	23.29
Maximum peak output power at antenna input terminal (mW):	213.30
Prediction distance (cm):	30
Prediction frequency (MHz):	5785
Maximum Antenna Gain, typical (dBi):	12
Maximum Antenna Gain (numeric):	15.85
Power density of prediction frequency at 30.0 cm (mW/cm^2):	0.29907
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 30 cm is 0.29907 mW/cm^2. Limit is 1.0 mW/cm^2.

Worst case colocation 2.4 GHz Wi-Fi, BLE and 5 GHz Wi-Fi.

Frequency Band	Max Conducted Power(dBm)	Evaluated Distance (cm)	Worst-Case MPE (mW/cm^2)	MPE Limit (mW/cm^2)	Worst-Case MPE Ratios	Sum of MPE Ratios	Limit
Worst Case							
2.4 GHz WiFi	23.8	30	0.336	1.0	33.6 %	63.606 %	100%
2.4 GHz BLE	4.47	30	0.00099	1.0	0.099 %		
5 GHz WiFi	23.29	30	0.29907	1.0	29.907 %		

4.4 RF exposure evaluation for ISEDC

2.4 GHz Wi-Fi

Maximum output power at antenna input terminal (dBm):	23.8
Maximum output power at antenna input terminal (W):	0.2399
Prediction distance (m):	0.3
Prediction frequency (MHz):	2437
Maximum Antenna Gain, typical (dBi):	12
Maximum Antenna Gain (numeric):	15.85
Power density of prediction frequency at 30.0 cm (W/m^2):	3.362
ISEDC MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	5.404

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 0.3 m is 3.362 W/m^2. Limit is 5.404 W/m^2.

2.4 GHz BLE

Maximum peak output power at antenna input terminal (dBm):	4.47
Maximum peak output power at antenna input terminal (W):	0.0028
Prediction distance (m):	0.3
Prediction frequency (MHz):	2426
Maximum Antenna Gain, typical (dBi):	6.0
Maximum Antenna Gain (numeric):	3.98
Power density of prediction frequency at 30.0 cm (W/cm^2):	0.0099
FCC MPE limit for uncontrolled exposure at prediction frequency (W/cm^2):	5.387

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 0.3 m is 0.0099 W/m^2. Limit is 5.387 W/m^2.

5 GHz Wi-Fi

Maximum peak output power at antenna input terminal (dBm):	23.3
Maximum peak output power at antenna input terminal (W):	0.21380
Prediction distance (m):	0.3
Prediction frequency (MHz):	5785
Maximum Antenna Gain, typical (dBi):	12
Maximum Antenna Gain (numeric):	15.85
Power density of prediction frequency at 30.0 cm (W/m^2):	2.99756
FCC MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	9.756

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 0.3 m is 2.99756 W/m^2. Limit is 9.756 W/m^2.

Worst case colocation 2.4 GHz Wi-Fi, BLE and 5 GHz Wi-Fi.

Frequency Band	Max Conducted Power(dBm)	Evaluated Distance (m)	Worst-Case MPE (W/m^2)	MPE Limit (W/m^2)	Worst-Case MPE Ratios	Sum of MPE Ratios	Limit
Worst Case							
2.4 GHz WiFi	23.8	0.3	3.362	5.404	62.21 %	93.12 %	100%
2.4 GHz BLE	4.47	0.3	0.0099	5.387	0.18 %		
5 GHz WiFi	23.3	0.3	2.99756	9.756	30.73 %		

5 FCC §15.209, §15.247(d) & ISEDC RSS-247 §5.5, RSS-Gen §8.9, §8.10 AND LP0002-2018 §3.10- 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 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 1166.5950.03	100338	2018-07-05	2 years
Agilent	Analyzer, Spectrum	E4446A	MY48250238	2018-05-08	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
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2018-02-14	2 years
Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2018-02-14	2 years
Agilent	Amplifier, Pre	8447D	2443A04374	2018-08-09	1 year
Insulated Wire INC	2.92mm (M) X2, 1501 Armor Neoprene, 396	KPS-1501AN-3960-KPS	DC 1807	2018-03-13	2 years
-	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
A.H. Systems	Pre-Amplifier	PAM 1840V	170	2018-09-10	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2019-04-02	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".

5.6 Test Environmental Conditions

Temperature:	22-25 ºC
Relative Humidity:	29-30 %
ATM Pressure:	102.1 kPa

The testing was performed by Giovanni Velazquez Munoz 2019-04-02 to 2019-04-12 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

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, channel**
-0.16	96.0435	Horizontal	2412 MHz, HT/VHT20

BLE

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, channel**
-0.16	96.0435	Horizontal	2480 MHz, BLE

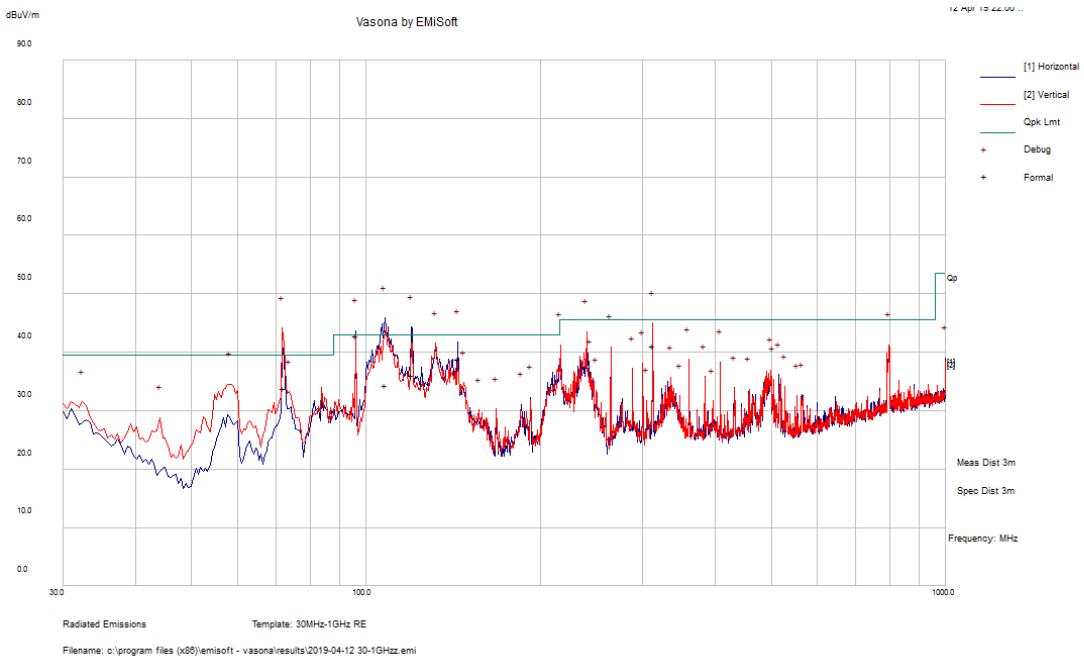
Please refer to the following table and plots for specific test result details

5.8 Spurious Emissions Test Results

Testing was done in 4TX MIMO configuration and 50Ohm Terminators have been used instead of external antennas

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

Worst Case Colocation, BLE 2480MHz, 2.4 GHz Wi-Fi HT/VHT20 mode 2412MHz 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
71.95775	33.78	285	V	286	39.5	-5.72	Pass
107.7985	34.48	157	H	216	43	-8.62	Pass
119.9378	36.15	127	H	61	43	-6.85	Pass
96.0435	42.84	201	H	79	43	-0.16	Pass
312.1723	41.1	101	V	50	45.5	-4.4	Pass
144.0825	38.82	194	H	74	43	-4.18	Pass

2) Above 1 GHz, measured at 3 meters

2.4GHz 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	46.84	0	100	H	33.07	12.46	38.00	54.37	74	-19.63	PK
4824	35.94	0	100	H	33.07	12.46	38.00	43.47	54	-10.53	AV
4824	47.21	0	100	V	33.07	12.46	38.00	54.74	74	-19.26	PK
4824	32.66	0	100	V	33.07	12.46	38.00	40.19	54	-13.81	AV
7236	46.12	0	100	H	35.78	16.23	37.74	60.39	74	-13.61	PK
7236	34.96	0	100	H	35.78	16.23	37.74	49.22	54	-4.78	AV
Mid Channel 2442 MHz CCK mode power setting: 17											
4884	44.20	0	100	H	33.07	12.46	38.00	51.73	74	-22.27	PK
4884	35.06	0	100	H	33.07	12.46	38.00	42.59	54	-11.41	AV
4884	44.42	0	100	V	33.07	12.46	38.00	51.95	74	-22.05	PK
4884	34.96	0	100	V	33.07	12.46	38.00	42.49	54	-11.51	AV
7326	42.92	0	100	V	35.78	16.23	37.74	57.19	74	-16.81	PK
7326	33.96	0	100	V	35.78	16.23	37.74	48.22	54	-5.78	AV
High Channel 2462 MHz CCK mode power setting: 17											
4924	45.24	0	100	H	33.07	12.46	38.00	52.77	74	-21.23	PK
4924	35.16	0	100	H	33.07	12.46	38.00	42.69	54	-11.31	AV
4924	46.24	0	100	V	33.07	12.46	38.00	53.77	74	-20.23	PK
4924	34.96	0	100	V	33.07	12.46	38.00	42.49	54	-11.51	AV
7386	44.03	0	100	H	35.78	16.23	37.74	58.30	74	-15.70	PK
7386	34.06	0	100	H	35.78	16.23	37.74	48.32	54	-5.68	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	43.40	0	100	H	33.07	12.46	38.00	51.00	74	-23.07	PK
4824	34.20	0	100	H	33.07	12.46	38.00	41.53	54	-12.27	AV
4824	44.27	0	100	V	33.07	12.46	38.00	52.02	74	-22.20	PK
4824	34.50	0	100	V	33.07	12.46	38.00	42.13	54	-11.97	AV
7236	43.40	0	100	H	35.78	16.23	37.74	56.69	74	-16.03	PK
7236	34.10	0	100	H	35.78	16.23	37.74	46.97	54	-5.63	AV
Mid Channel 2442 MHz Non HT20 mode power setting: 17											
4884	43.47	0	100	H	33.07	12.46	38.00	51.00	74	-23.00	PK
4884	34.00	0	100	H	33.07	12.46	38.00	41.53	54	-12.47	AV
4884	44.49	0	100	V	33.07	12.46	38.00	52.02	74	-21.98	PK
4884	34.60	0	100	V	33.07	12.46	38.00	42.13	54	-11.87	AV
7326	42.42	0	100	H	35.78	16.23	37.74	56.69	74	-17.31	PK
7326	32.70	0	100	H	35.78	16.23	37.74	46.97	54	-7.03	AV
High Channel 2462 MHz Non HT20 mode power setting: 17											
4924	44.80	0	100	H	33.07	12.46	38.00	52.33	74	-21.67	PK
4924	34.20	0	100	H	33.07	12.46	38.00	41.73	54	-12.27	AV
4924	44.37	0	100	V	33.07	12.46	38.00	51.90	74	-22.10	PK
4924	34.70	0	100	V	33.07	12.46	38.00	42.23	54	-11.77	AV
7386	43.90	0	100	H	35.78	16.23	37.74	58.17	74	-15.83	PK
7386	34.30	0	100	H	35.78	16.23	37.74	48.57	54	-5.43	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	44.61	192	255	H	33.07	12.46	38.00	50.03	74	-23.97	PK
4824	33.04	192	255	H	33.07	12.46	38.00	38.46	54	-15.54	AV
4824	44.18	0	100	V	33.07	12.46	38.00	49.60	74	-24.40	PK
4824	35.35	0	100	V	33.07	12.46	38.00	40.77	54	-13.23	AV
7236	45.62	0	100	H	35.78	16.23	37.74	57.59	74	-16.41	PK
7236	35.48	0	100	H	35.78	16.23	37.74	47.45	54	-6.55	AV
Mid Channel 2442 MHz HT/VHT20 mode power setting: 17											
4884	45.34	0	100	H	33.07	12.46	38.00	51.01	74	-22.99	PK
4884	33.98	0	100	H	33.07	12.46	38.00	39.65	54	-14.35	AV
4884	45.54	0	100	V	33.07	12.46	38.00	51.21	74	-22.79	PK
4884	34.22	0	100	V	33.07	12.46	38.00	39.89	54	-14.11	AV
7326	43.64	0	100	H	35.78	16.23	37.74	55.94	74	-18.06	PK
7326	33.13	0	100	H	35.78	16.23	37.74	45.43	54	-8.57	AV
High Channel 2462 MHz HT/VHT20 mode power setting: 17											
4924	43.75	0	100	H	33.07	12.46	38.00	27.36	74	-22.72	PK
4924	34.30	0	100	H	33.07	12.46	38.00	15.71	54	-12.17	AV
4924	44.41	0	100	V	33.07	12.46	38.00	50.78	74	-22.06	PK
4924	34.80	0	100	V	33.07	12.46	38.00	39.73	54	-11.67	AV
7386	44.92	0	100	H	35.78	16.23	37.74	59.55	74	-14.81	PK
7386	34.50	0	100	H	35.78	16.23	37.74	45.96	54	-5.23	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	45.04	0	100	H	33.07	12.46	38.00	52.57	74	-21.43	4824
4824	33.49	0	100	H	33.07	12.46	38.00	41.02	54	-12.98	4824
4824	44.96	0	100	V	33.07	12.46	38.00	52.49	74	-21.51	4824
4824	33.92	0	100	V	33.07	12.46	38.00	41.45	54	-12.55	4824
Mid Channel 2442 MHz HE20 mode power setting: 17											
4884	44.77	0	100	H	33.07	12.46	38.00	52.30	74	-21.70	PK
4884	33.88	0	100	H	33.07	12.46	38.00	41.41	54	-12.59	AV
4884	44.60	0	100	V	33.07	12.46	38.00	52.13	74	-21.87	PK
4884	33.26	0	100	V	33.07	12.46	38.00	40.79	54	-13.21	AV
High Channel 2462 MHz HE20 mode power setting: 17											
4924	44.24	0	100	H	33.07	12.46	38.00	51.77	74	-22.23	PK
4924	33.15	0	100	H	33.07	12.46	38.00	40.68	54	-13.32	AV
4924	44.82	0	100	V	33.07	12.46	38.00	52.35	74	-21.65	PK
4924	33.73	0	100	V	33.07	12.46	38.00	41.26	54	-12.74	AV

BLE, Measured at 3 Meter

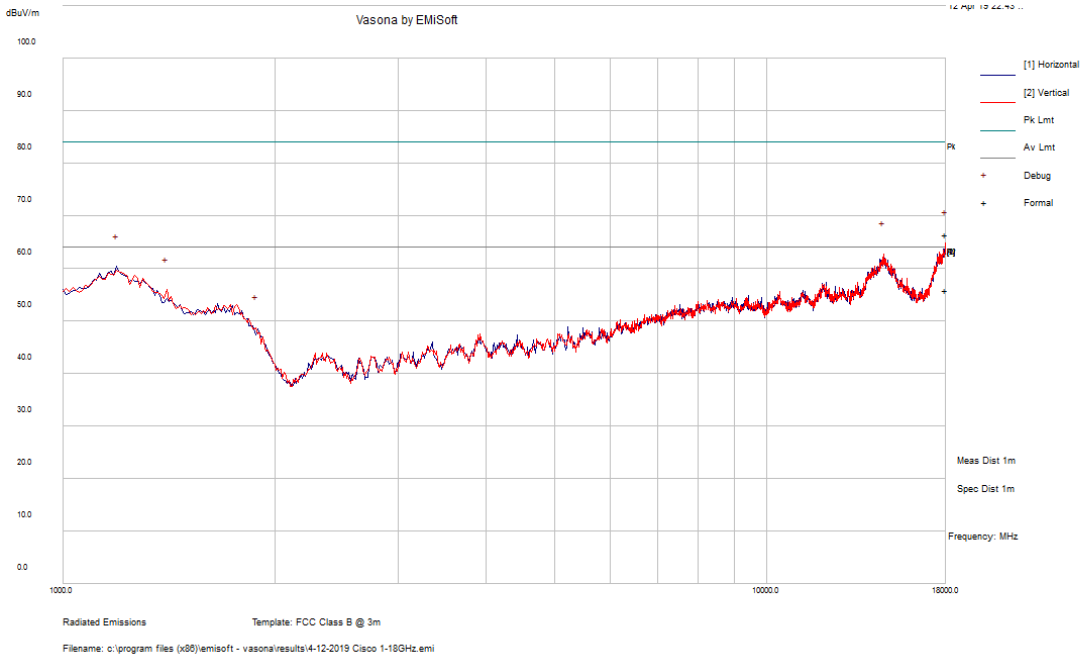
Freq. (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2402 MHz											
4804	43.22	0	100	H	33.14	11.34	38.17	49.52	74	-24.48	PK
4804	32.41	0	100	H	33.14	11.34	38.17	38.71	54	-15.29	AV
4804	43.59	0	100	V	33.14	11.34	38.17	49.89	74	-24.11	PK
4804	32.02	0	100	V	33.14	11.34	38.17	38.32	54	-15.68	AV
7206	47.19	0	100	H	37.50	15.78	36.47	64.00	74	-10.00	PK
7206	36.12	0	100	H	37.50	15.78	36.47	52.93	54	-1.07	AV
7206	46.77	0	100	V	37.50	15.78	36.47	63.58	74	-10.42	PK
7206	35.94	0	100	V	37.50	15.78	36.47	52.75	54	-1.25	AV
Mid Channel 2440 MHz											
4880	44.20	0	100	V	33.29	11.99	38.17	51.31	74	-22.70	PK
4880	31.77	0	100	V	33.29	11.99	38.17	38.87	54	-15.13	AV
4880	43.02	0	100	H	33.29	11.99	38.17	50.13	74	-23.88	PK
4880	31.31	0	100	H	33.29	11.99	38.17	38.41	54	-15.59	AV
7320	46.07	0	100	V	37.53	16.44	37.41	62.62	74	-11.38	PK
7320	35.04	0	100	V	37.53	16.44	37.41	51.59	54	-2.41	AV
7320	46.01	0	100	H	37.53	16.44	37.41	62.56	74	-11.44	PK
7320	34.74	0	100	H	37.53	16.44	37.41	51.30	54	-2.70	AV
High Channel 2480 MHz											
4960	42.04	0	100	V	33.37	11.99	38.09	49.31	74	-24.69	PK
4960	31.03	0	100	V	33.37	11.99	38.09	38.30	54	-15.70	AV
4960	42.51	0	100	H	33.37	11.99	38.09	49.78	74	-24.22	PK
4960	31.21	0	100	H	33.37	11.99	38.09	38.48	54	-15.52	AV
7440	46.17	0	100	V	37.41	17.00	37.62	62.96	74	-11.04	PK
7440	34.36	0	100	V	37.41	17.00	37.62	51.15	54	-2.85	AV
7440	45.37	0	100	H	37.41	17.00	37.62	62.16	74	-11.84	PK
7440	34.30	0	100	H	37.41	17.00	37.62	51.09	54	-2.91	AV

Note: Spurious emission above 7.5 GHz is the noise floor.

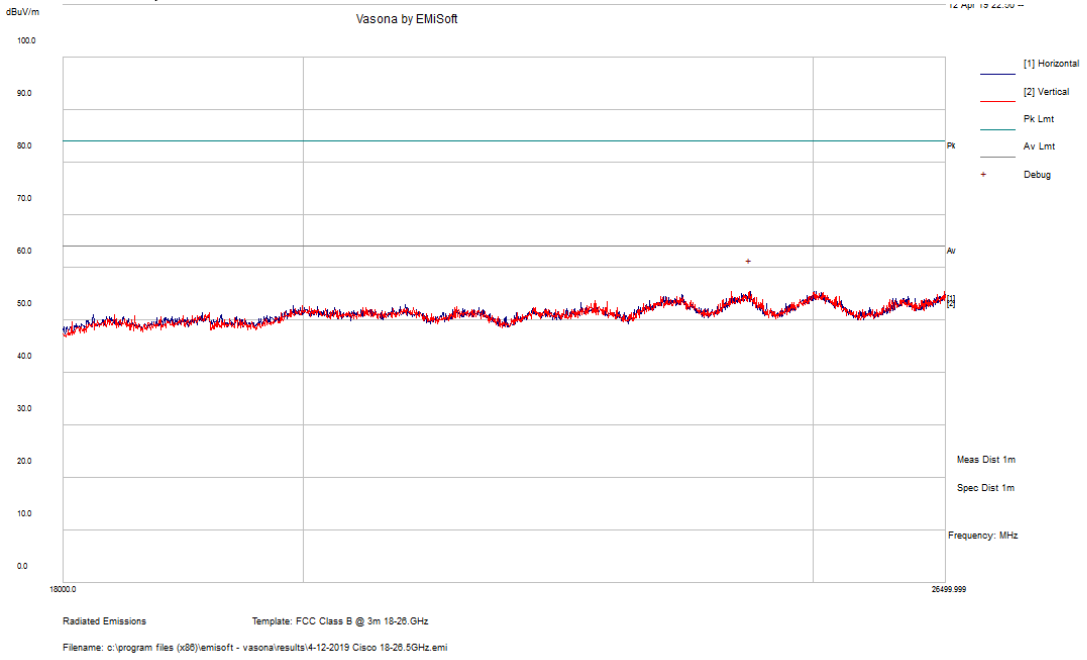
3) Co-location

EUT configuration: worst Case Colocation, BLE 2480MHz, 2.4 GHz Wi-Fi HT/VHT20 mode 2412MHz and 5 GHz Wi-Fi VHT160 mode 5250 MHz

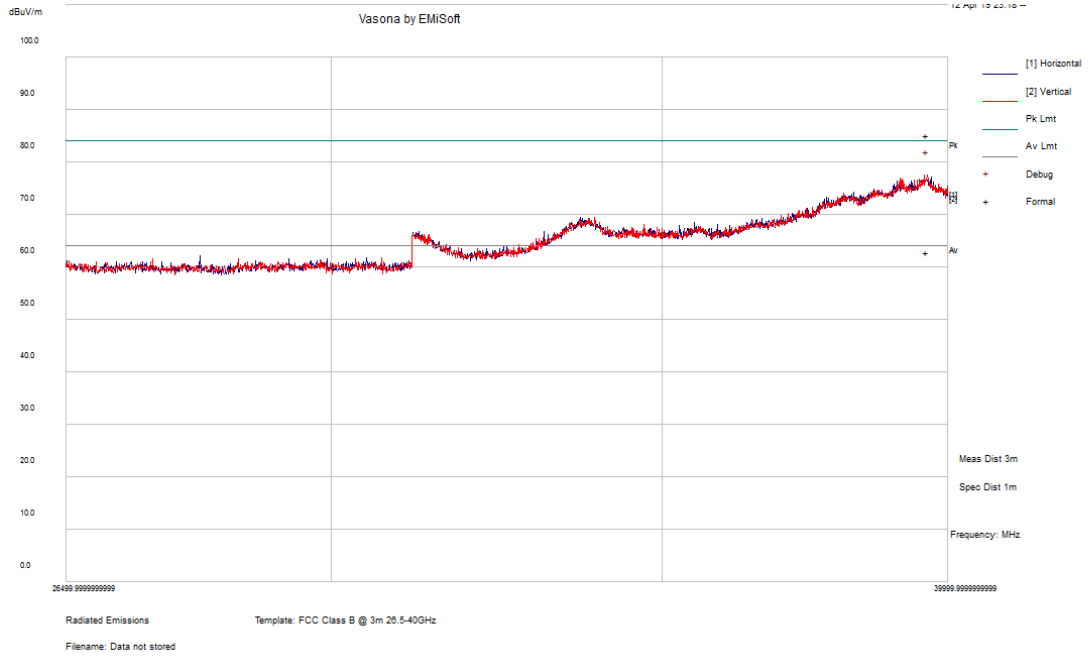
1 - 18 GHz, measured at 1 meter



18 GHz-26.5 GHz, measured at 1 meter



26.5 GHz-40 GHz, measured at 1 meter



6 Appendix A – Test Setup Photographs

Please refer to the attachment

7 Appendix B- EUT External Photographs

Please refer to the attachment

8 Appendix C- EUT Internal Photographs

Please refer to the attachment

9 Appendix 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 February 21, 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 ---