FCC PART 15.407
ISEDC RSS-247, ISSUE 2, FEBRUARY 2017
TEST REPORT

For

Zebra Technologies Corporation

3 Overlook Point, Lincolnshire, IL 60069, USA

FCC ID: I28MD-FXLAN11AC
IC: 3798B-FXLAN11AC

Report Type:	**Product Type:**
Class II Permissive Change	Wireless 802.11ac + Bluetooth Module

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Report Number:	R1911192-247 NII
Report Date:	2020-01-23
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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	R1911192-407 NII	CIIPC Report	2020-01-23

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Zebra Technologies Corp.*, and their product model: WYSBHVGXG, FCC ID: I28MD-FXLAN11AC, IC: 3798B-FXLAN11AC, the "EUT" as referred to in this report. The EUT is a Wireless 802.11ac + Bluetooth Module. The EUT was installed in host device model number: ZQ511, ZQ521. The host devices were declared to be identical, and ZQ521 was selected for testing. Please refer to the manufacturer declaration of similarity letter in Annex C of this report.

1.2 Objective

This report is prepared on behalf of *Zebra Technologies Corp.* 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 for Radiated Spurious Emissions testing, AC Line Conducted Emission testing and to verify the Output Power.

This project is a Permissive Change II submission for the purpose of placing the module in new host (Model: ZQ511, ZQ521), lowering power, and enabling colocation with RFID (FCC ID: I28-RFIDM6EMTT, IC: 3798B-RFIDM6EMTT).

Model Number	WYSBHVGXG (EUT)
FCC ID	I28MD-FXLAN11AC
IC	3798B-FXLAN11AC
Radio Type	WLAN-ac/bt
Operating Frequency	2402MHz – 2480MHz, 2412MHz – 2462MHz 5180MHz – 5240MHz, 5260MHz – 5320MHz 5500MHz – 5700MHz, 5745MHz – 5825MHz
Modulation	GFSK, π/4-DQPSK, 8DPSK (BDR/EDR); GFSK (LE); DSSS, OFDM (WLAN)
Channel Spacing	1MHz (BDR, EDR); 2MHz (LE) 5MHz (2.4G); 20MHz (5G); 40MHz (5G) ; 80MHz (5G)
Omnidirectional Antenna Gain	3.66 dBi (2.4G), 3.19 dBi (5G);
Original RF Output Power	0.0081W (BDR/EDR); 0.0071W (LE) 0.0399W (2.4G WLAN); 0.0115W (UNII-1); 0.0086W (UNII-2); 0.0086W (UNII-2E); 0.0073W (UNII-3)

Model Number	M6E-NANO
FCC ID	I28- M6ENANO
IC	3798B-M6ENANO
Radio Type	UHF RFID
Operating Frequency	902MHz – 928MHz
Modulation	ASK
Channel Spacing	500 kHz
Loop Antenna Gain	-28 dBi
RF Output power	0.147 Watt

1.3 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz, and FCC KDB 789033 D02 General UNII Test Procedure New Rules v02r01.

1.4 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 %

1.5 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.

1.6 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report.

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

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03)*** to certify

- For the USA (Federal Communications Commission):
  - 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  - 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  - 3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
  - 1 All Scope 1-Licence-Exempt Radio Frequency Devices;
  - 2 All Scope 2-Licensed Personal Mobile Radio Services;
  - 3 All Scope 3-Licensed General Mobile & Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime & Aviation Radio Services;
  - 5 All Scope 5-Licensed Fixed Microwave Radio Services
  - 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
  - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
  - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  - 1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  - 2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

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

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

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

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

5 Other
- For Water Coolers (ver. 3.0)

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

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (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 789033 D02 General UNII Test Procedures New Rules v02r01.

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 by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

The test utility used was the "Toolbox v1.83", provided by *Zebra Technologies Corp.,* the software is compliant with the standard requirements being tested against.

2.3 Equipment Modifications

Installation in host device; lowering output power.

2.4 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Laptop	Latitude E6410	3CKRAQ1

2.5 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	< 1	Laptop	EUT

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & ISEDC Rules	Description of Test	Results
FCC §2.1053, §15.205, §15.209, 15.407(b) ISEDC RSS-247 §6.2	Radiated Spurious Emissions	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §407(a) ISEDC RSS-247 §6.2	Output Power	Compliant
FCC §2.1093 ISEDC RSS-102	RF Exposure	Note[1]

Note[1]: Please refer to Test Report R1911192-SAR for RF Exposure result.

4 FCC §15.209, §15.407(b) & ISEDC RSS-247 §6.2 - Spurious Radiated Emissions

4.1 Applicable Standard

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

As per FCC §15.209: 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 Note 1	3
88 - 216	150 Note 1	3
216 - 960	200 Note 1	3
Above 960	500	3

Note 1: 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 Part 15.407 (b)

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall noet exceed an e.i.r.p. of -27 dBm/MHz.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

As per ISEDC RSS-247 §6.2

For transmitters operating in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, any unwanted emissions that fall into the band 5250- 5350 MHz must be 26 dBc, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth, above 5.25 GHz. Otherwise, the transmission is considered as intentional and the devices shall implement dynamic frequency selection (DFS) and transmitter power control (TPC) as per the requirements for the band 5250-5350 MHz

For devices with both operating frequencies and channel bandwidths contained within the band 5250-5350 MHz, the device shall comply with the following:

1. All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. if the equipment is intended for outdoor use; or
2. All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and any emissions within the band 5150-5250 MHz shall meet the power spectral density limits of Section 6.2.1. The device shall be labelled “for indoor use only.”

For devices with operating frequencies in the band 5250-5350 MHz but having a channel bandwidth that overlaps the band 5150-5250 MHz, the devices’ unwanted emission shall not exceed -27 dBm/MHz e.i.r.p. outside the band 5150-5350 MHz and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device shall be labelled “for indoor use only.”

For transmitters operating in the band 5470-5725 MHz, emissions outside the band shall not exceed -27 dBm/MHz e.i.r.p.

For the band 5725-5850 MHz, emissions at frequencies from the band edges to 10 MHz above or below the band edges shall not exceed -17 dBm/MHz e.i.r.p. For emissions at frequencies more than 10 MHz above or below the band edges, the emissions power shall not exceed -27 dBm/MHz.

4.2 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 15.407 and ISEDC RSS-247 limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

4.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords were connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter or 1.5 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

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 = 3MHz / Sweep = 100ms
(2) Average: RBW = 1MHz / VBW = 10Hz or 1/T / Sweep = Auto

4.4 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 for Class A. 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 1166.5950K03	100044	2018-10-26	2 years
Agilent	Analyzer, Spectrum	E4446A	US44300386	2019-06-26	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	Pre-Amplifier	8447D	2944A10187	2019-04-10	1 year
A.H. Systems	Horn Antenna	SAS-200/571	261	2019-06-07	2 years
WiseWave	Horn Antenna	ARH-4223-02	10555-1	2018-02-04	2 years
WiseWave	Horn Antenna	ARH-2823-02	10555-02	2017-12-15	2 years
HP	Pre-Amplifier	8449B	3008A01978	2019-09-27	1 year
A.H. Systems	Pre-Amplifier	PAM 1840V	18091112	2019-09-24	1 year
Insulated Wire Corp.	157 Series 2.92 SM (x2) Armored 33 ft. Cable	KPS-1571AN-3960-KPS	DC 1917	2019-05-08	1 year
-	SMA cable	-	C0002	Each time[1]	N/A
-	N-Type Cable	-	C00013	Each time[1]	N/A
-	N-Type Cable	-	C00014	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 calibrations have been performed per the A2LA requirements, traceable to the NIST.*

4.6 Test Environmental Conditions

Temperature:	20-22 ºC
Relative Humidity:	42-50 %
ATM Pressure:	102.7 kPa

The testing was performed by Christian McCaig from 2019-11-22 to 2019-12-12 in 5m chamber 3 and by Matthew Riego from 2019-12-06 to 2019-12-07 in 10m chamber 1.

4.7 Summary of Test Results

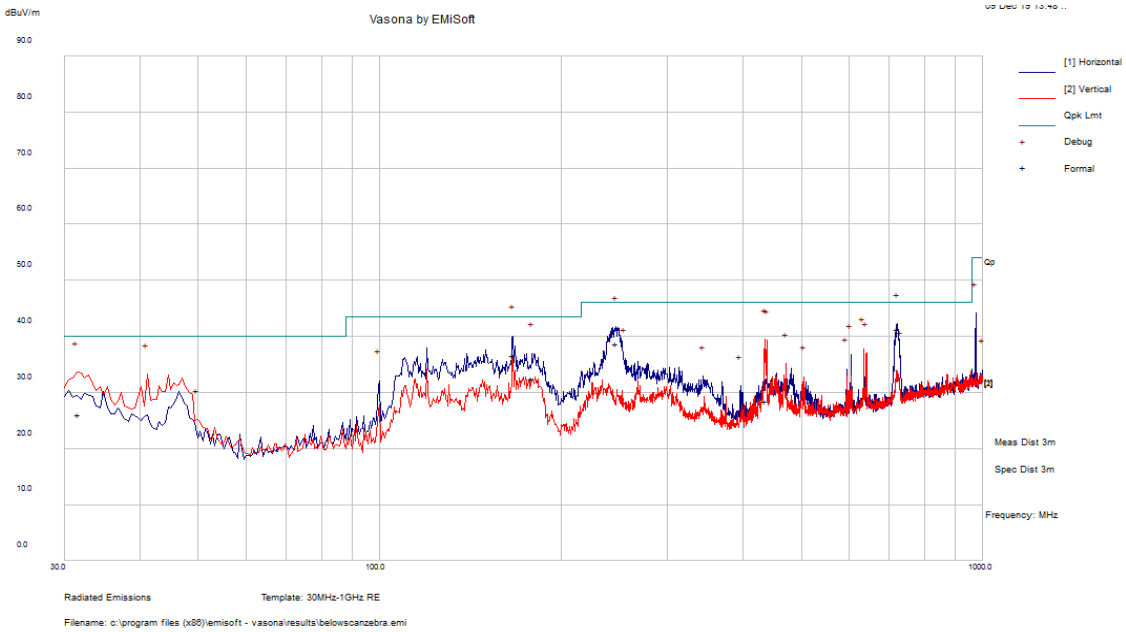
According to the data hereinafter, the EUT complied with the FCC Part 15.407 and ISEDC RSS-247 standards' radiated emissions limits, and had the worst margin of:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-1.12	17932	Horizontal	802.11a mode, 5180 MHz +927.2 MHz RFID

4.8 Radiated Emissions Test Result Data

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

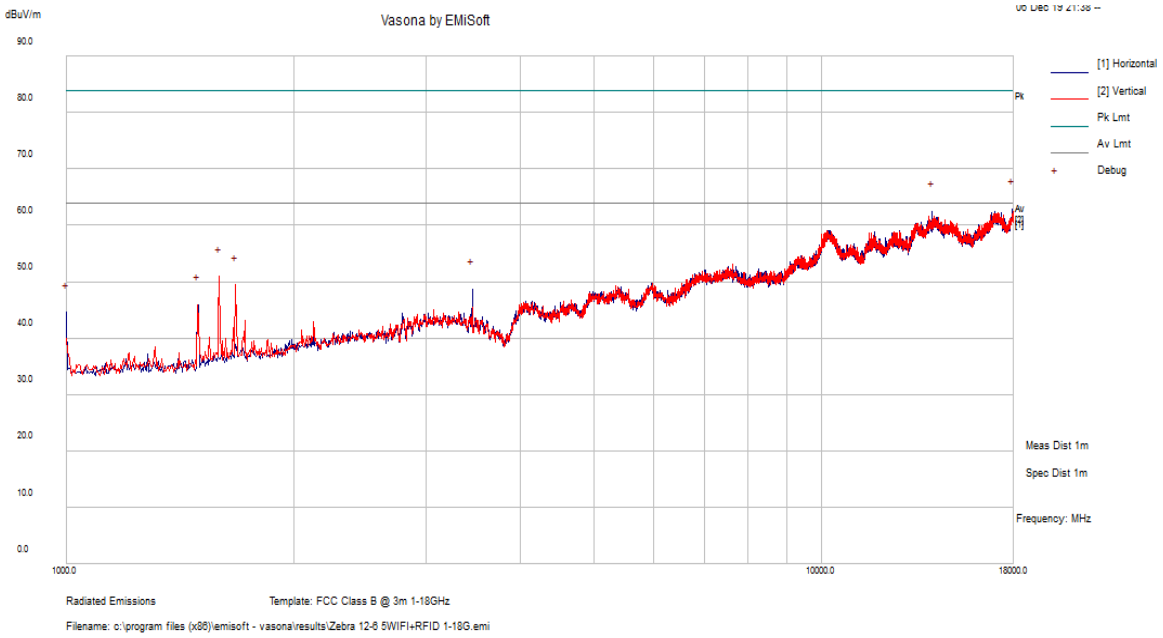
5 GHz Wi-Fi + RFID Colocation



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comments (PK/QP/Ave.)
166.173	36.69	215	H	310	43.5	-6.81	QP
721.11975	41.24	108	H	146	46	-4.76	QP
246.21225	38.78	126	H	123	46	-7.22	QP
31.7005	26.04	163	V	34	40	-13.96	QP
178.87925	32.46	203	H	320	43.5	-11.04	QP
436.068	28.43	118	V	128	46	-17.57	QP

2) 1–18 GHz Worst Case, Measured at 1 meter

5 GHz Wi-Fi + RFID Colocation

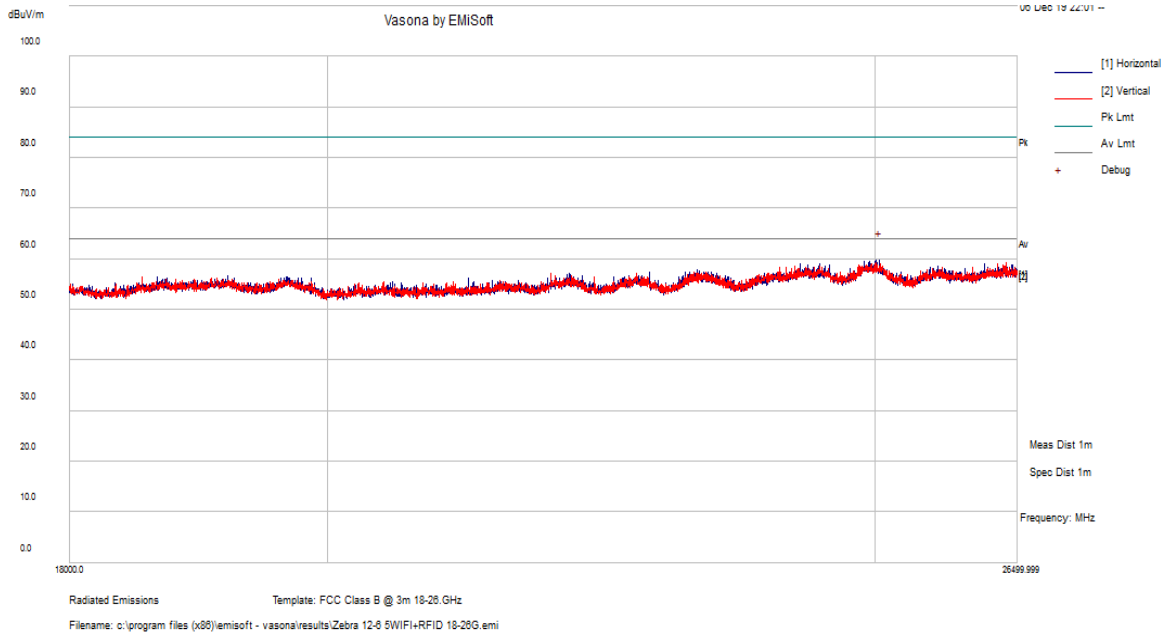


Frequency (MHz)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
17932	62.88	H	100	0	64	-1.12	Peak*
14039	62.45	H	100	0	64	-1.55	Peak*
1595	50.86	V	100	0	64	-13.14	Peak*
1675.75	49.38	V	100	0	64	-14.62	Peak*
3452.25	48.7	H	200	0	64	-15.3	Peak*
1493	45.86	V	100	0	64	-18.14	Peak*
1000	44.55	H	100	0	64	-19.45	Peak*

Note*: Due to the testing value by using peak detector is within the average limit, no average detector testing is needed.

3) 18-26.5 GHz Worst Case, Measured at 1 meter

5 GHz Wi-Fi + RFID Colocation

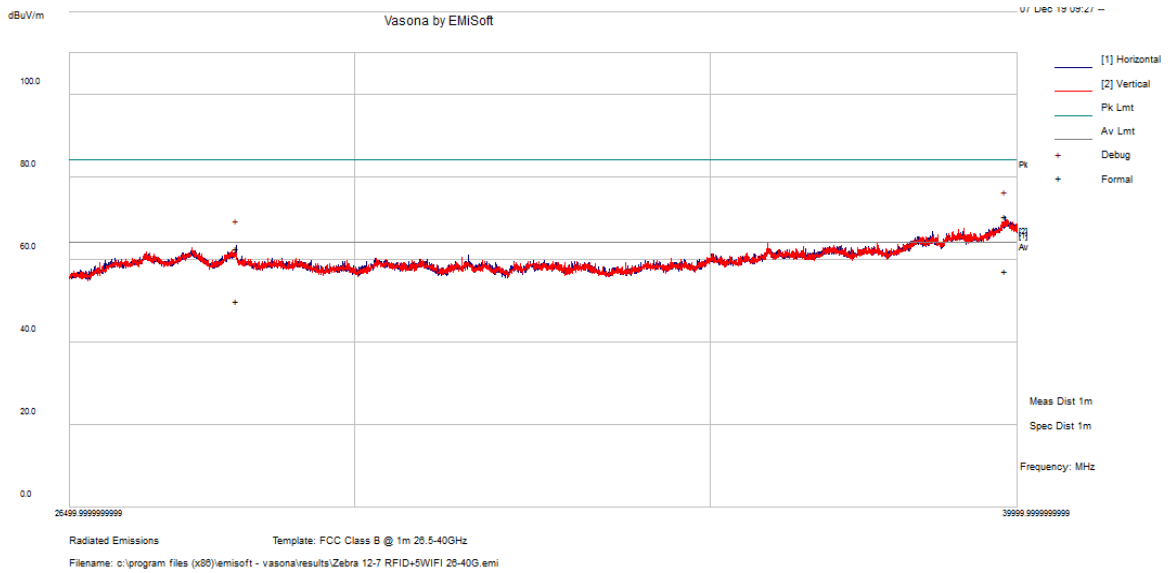


Frequency (MHz)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
25046.499	59.63	H	300	0	64	-4.37	Peak*

Note*: Due to the testing value by using peak detector is within the average limit, no average detector testing is needed.

4) 26.5-40 GHz Worst Case, Measured at 1 meter

5 GHz Wi-Fi + RFID Colocation



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
39786.555	70.45	H	110	124	84	-13.55	Peak
28491.376	62.68	H	114	361	84	-21.32	Peak
39786.555	57.13	H	110	124	64	-6.87	Ave
28491.376	49.79	H	114	361	64	-14.21	Ave

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

5.1 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 Note1	56 to 46 Note2
0.5-5	56	46
5-30	60	50

Note1: Decreases with the logarithm of the frequency.
Note2: A linear average detector is required

5.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.10-2013 measurement procedure. The specification used were FCC §15.207 and ISEDC RSS GEN §8.8 .

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.

5.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cords of support equipment were connected to LISN-2.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data were recorded in the peak, quasi-peak, and average detection mode. Quasi-Peak readings are distinguished with a “QP.” Average readings are distinguished with an “Ave”.

5.4 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:

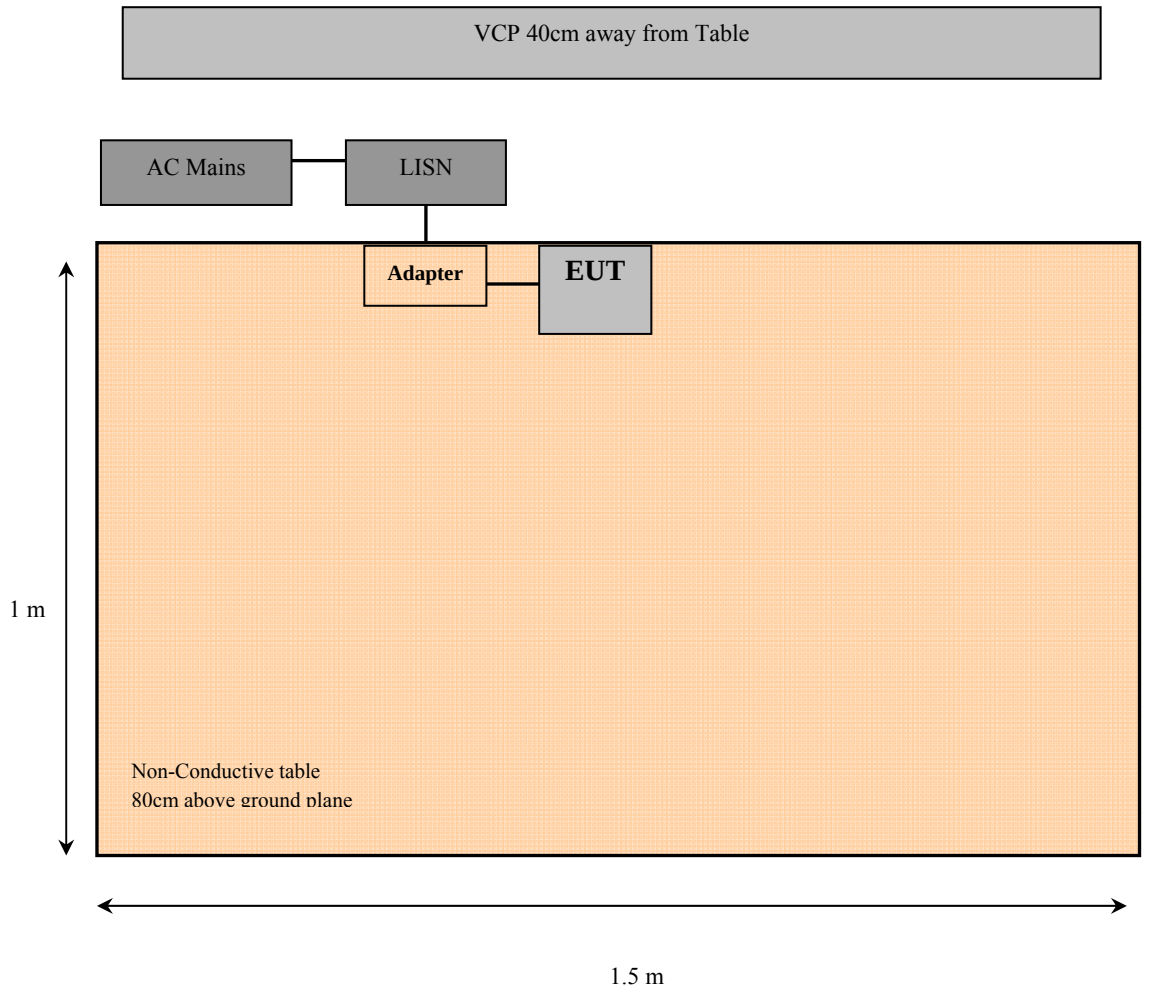
CA = Ai + CL + Atten

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

5.5 Test Setup Block Diagram



5.6 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
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150202	2019-02-25	1 year
Fairview Microwave	Micro-Coaxial Cable	FMC0101223-360	102515	2019-07-18	1 year
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160130	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 calibrations have been performed per the A2LA requirements, traceable to the NIST.*

5.7 Test Environmental Conditions

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

The testing was performed by Christian McCaig on 2019-12-04 in 5m chamber 3

5.8 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:

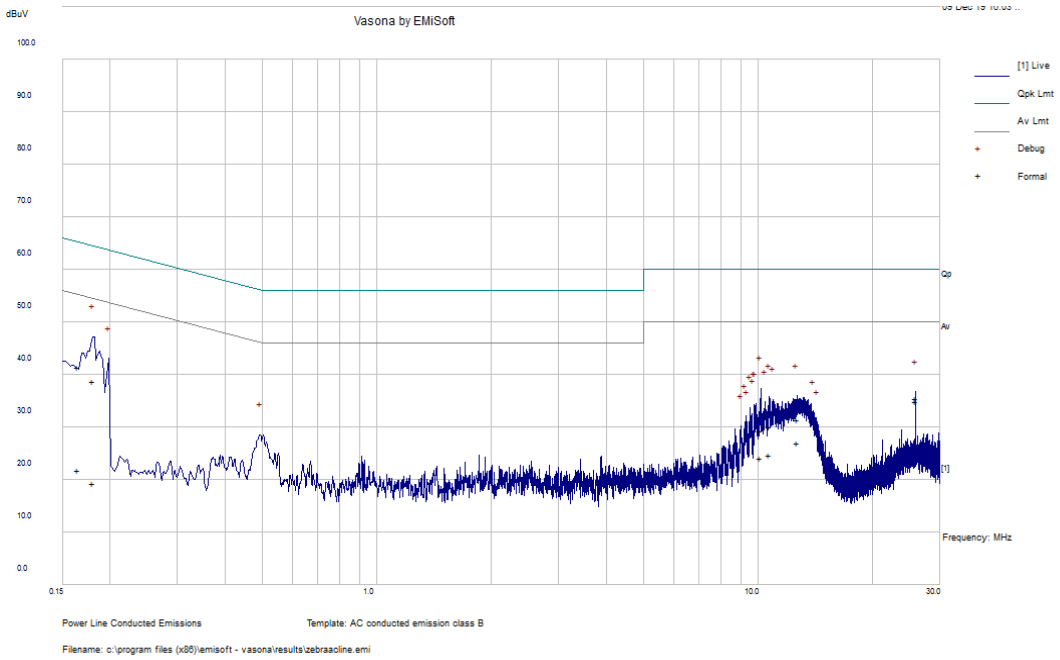
5 GHz Wi-Fi + RFID

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-15	25.87184	Line	0.15-30

5.9 Conducted Emissions Test Plots and Data

5 GHz Wi-Fi +RFID Colocation

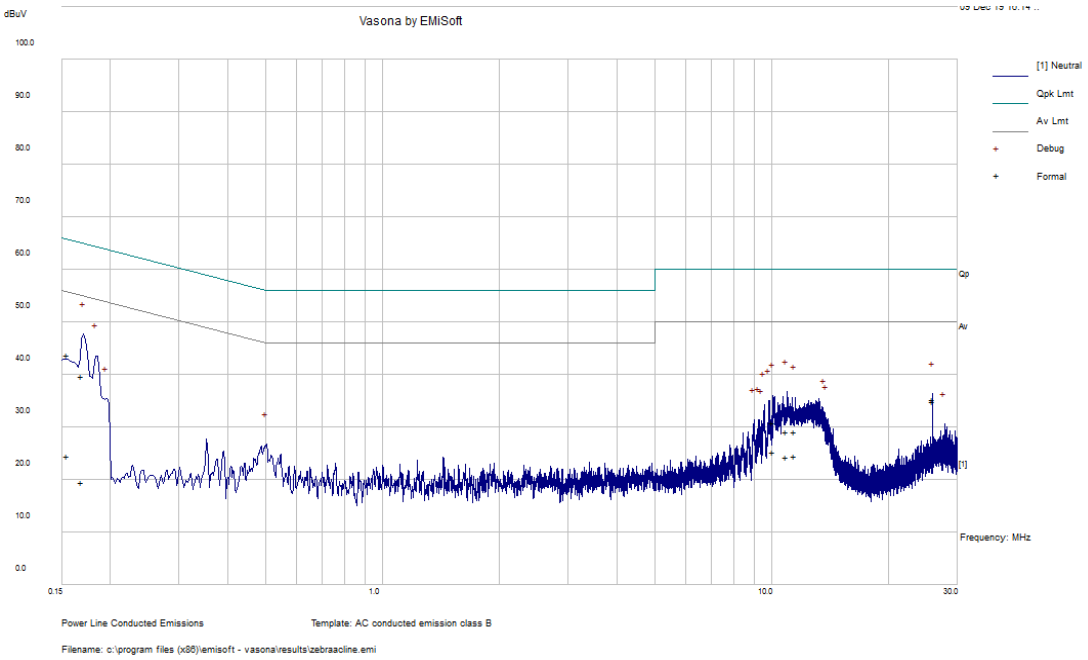
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.164926	41.4	Line	65.21	-23.81	QP
0.180647	38.79	Line	64.46	-25.66	QP
10.147335	29.35	Line	60	-30.65	QP
25.87184	35.54	Line	60	-24.46	QP
12.649006	31.39	Line	60	-28.61	QP
10.69651	30.07	Line	60	-29.93	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.164926	21.88	Line	55.21	-33.33	Ave.
0.180647	19.31	Line	54.46	-35.14	Ave.
10.147335	24.25	Line	50	-25.75	Ave.
25.87184	35	Line	50	-15	Ave.
12.649006	27.14	Line	50	-22.86	Ave.
10.69651	24.83	Line	50	-25.17	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.154645	43.71	Neutral	65.75	-22.04	QP
0.169107	39.69	Neutral	65	-25.31	QP
10.922155	29.16	Neutral	60	-30.84	QP
25.871456	35.39	Neutral	60	-24.61	QP
10.094742	30.9	Neutral	60	-29.1	QP
11.46705	29.15	Neutral	60	-30.85	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.154645	24.55	Neutral	55.75	-31.19	Ave.
0.169107	19.63	Neutral	55	-35.37	Ave.
10.922155	24.41	Neutral	50	-25.59	Ave.
25.871456	34.86	Neutral	50	-15.14	Ave.
10.094742	25.4	Neutral	50	-24.6	Ave.
11.46705	24.53	Neutral	50	-25.47	Ave.

6 FCC §407(a) & ISEDC RSS-247 §6.2 - Output Power

6.1 Applicable Standards

According to FCC §15.407(a):

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

According to ISEDC RSS-247 §6.2.1 for frequency band 5150-5250 MHz:

The maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

According to ISEDC RSS-247 §6.2.2 for frequency band 5250-5350 MHz:

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to ISEDC RSS-247 §6.2.3 for frequency band 5470-5600 MHz and 5650-5725 MHz:

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to ISEDC RSS-247 §6.2.4 for frequency band 5725-5850 MHz:

The maximum conducted output power shall not exceed 1 W. The power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

6.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a power meter.

6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
-	10dB attenuator	-	-	Each time[1]	N/A
-	RF cable	-	-	Each time[1]	N/A
ETS- Lindgren	Power Sensor	7002-006	160097	2018-12-31	2 years

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

6.4 Test Environmental Conditions

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

The testing was performed by Zhao Zhao on 2019-12-06 in RF site.

6.5 Test Results

5150 - 5250 MHz

FCC Results

Frequency (MHz)	Conducted Average Power (dBm)	FCC Limit (dBm)	Margin (dB)
802.11a mode			
5180	10.61	24	-13.39
5200	9.98	24	-14.02
5240	9.55	24	-14.45
802.11n/ac20 mode			
5180	9.19	24	-14.81
5200	9.33	24	-14.67
5240	9.29	24	-14.71
802.11n/ac40 mode			
5190	10.08	24	-13.92
5230	9.25	24	-14.75
802.11ac80 mode			
5210	6.74	24	-17.26

ISEDC Results

Frequency (MHz)	Conducted Average Power (dBm)	EIRP (dBm)	ISEDC Limit (dBm)	Margin (dB)
802.11a mode				
5180	10.61	13.8	23	-9.2
5200	9.98	13.17	23	-9.83
5240	9.55	12.74	23	-10.26
802.11n/ac20 mode				
5180	9.19	12.38	23	-10.62
5200	9.33	12.52	23	-10.48
5240	9.29	12.48	23	-10.52
802.11n/ac40 mode				
5190	10.08	13.27	23	-9.73
5230	9.25	12.44	23	-10.56
802.11ac80 mode				
5210	6.74	9.93	23	-13.07

Note: W5.2 is not allowed for outdoor use in Canada

5250 - 5350 MHz

Frequency (MHz)	Conducted Average Power (dBm)	FCC/ISEDC Limit (dBm)	Margin (dB)
802.11a mode			
5260	9.36	24	-14.64
5280	9.03	24	-14.97
5320	8.41	24	-15.59
802.11n/ac20 mode			
5260	9.07	24	-14.93
5280	8.81	24	-15.19
5320	8.01	24	-15.99
802.11n/ac40 mode			
5270	8.69	24	-15.31
5310	8.01	24	-15.99
802.11ac80 mode			
5290	7.04	24	-16.96

5470 - 5725 MHz

Frequency (MHz)	Conducted Average Power (dBm)	FCC/ISEDC Limit (dBm)	Margin (dB)
802.11a mode			
5500	9.36	24	-14.64
5600	8.86	24	-15.14
5700	7.53	24	-16.47
802.11n/ac20 mode			
5500	9.19	24	-14.81
5600	8.72	24	-15.28
5700	7.22	24	-16.78
802.11n/ac40 mode			
5510	8.78	24	-15.22
5550	5.48	24	-18.52
5670	7.10	24	-16.9
802.11ac80 mode			
5530	7.63	24	-16.37
5610	6.83	24	-17.17

Note: 5600-5650 MHz is not allowed for outdoor use in Canada

5725 - 5850 MHz

Frequency (MHz)	Conducted Average Power (dBm)	FCC/ ISEDC Limit (dBm)	Margin (dB)
802.11a mode			
5745	8.14	30	-21.86
5785	8.39	30	-21.61
5825	7.97	30	-22.03
802.11n/ac20 mode			
5745	8.12	30	-21.88
5785	8.39	30	-21.61
5825	8.64	30	-21.36
802.11n/ac40 mode			
5755	7.65	30	-22.35
5795	7.78	30	-22.22
802.11ac80 mode			
5775	6.74	30	-23.26

Note: Duty cycle correction factor has already been added to the measurements.

7 Annex A – EUT Test Setup Photographs

Please refer to the attachment.

8 Annex B – Host Device External Photographs

Please refer to the attachment.

9 Annex C (Informative) – Manufacturer Declaration of Similarity

ZEBRA

Zebra Technologies Corporation
3 Overlook Point
Lincolnshire, IL 60069

p 847-634-6700
f 847-913-8766
zebra.com

January 20, 2020

Declaration of Similarity

To:

FEDERAL COMMUNICATIONS COMMISSIONS
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046, USA

Innovation, Science and Economic Development Canada
Certification and Engineering Bureau
P.O. Box 11490, Station 'H'
3701 Carling Ave., Building 94
Ottawa, Ontario K2H 8S2, Canada

Dear Sir or Madam:

We Zebra Technologies Corp. hereby declare that product: printer, models: ZQ521 and ZQ511 are electrically similar with the same electromagnetic emissions and electromagnetic compatibility characteristics. Both models were tested by BACL with some reductions of duplicated testing, based on the similarity.

A description of the differences between those two models is as follow:
The print heads are different sizes.

Please contact me should there be need for any additional clarification or information.

Best Regards,

Charles A. Derrow
Director of Compliance Engineering
3 Overlook Point, Lincolnshire, IL 60069 USA

10 Annex D (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.

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 ---