FCC PART 15.247
ISEDC RSS-247 ISSUE 2 FEBRUARY 2017

TEST AND MEASUREMENT REPORT

For

Zebra Technologies Corporation

3 Overlook Point,

Lincolnshire, IL 60069, USA

FCC ID: I28-ZBRZQ3BT
IC: 3798B-ZBRZQ3BT

Report Type:	**Product Type:**
Class II Permissive Change	Bluetooth Module

	Name of Test Engineer	Signature
Prepared By:	Zhao Zhao	
Report Number:	R1905134-247 DTS	
Report Date:	2019-05-20	
	Name of Reviewer	Signature
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ACCREDITED
CERTIFICATE #3297.02

Note: This test report was prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This test report **shall not** be used by the customer to claim product certification, approval, or endorsement by A2LA or any agency of the United States Government or any foreign government.

* 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 "*"

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1905134-247 DTS	Class II Permissive Change Report	2019-05-20

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Zebra Technologies Corporation*, and their product model: ZQ3BT (FCC ID: I28-ZBRZQ3BT, IC: 3798B-ZBRZQ3BT) or the "EUT" as referred to in this report. The model was installed in the host models: ZT411 and ZT421.

AC line conducted emissions tests were performed for both hosts because of the different power consumption. The radiated spurious emissions tests were performed only for ZT411 due to the similarity of the hosts. Please refer to the Annex C Declaration of Similarity for details.

Radio Type	ZQ3BT (Bluetooth Ver4.0+EDR)
Operating Frequency	2402-2480 MHz
Modulation	FHSS (BDR/EDR); GFSK (LE)
Channel Spacing	1MHz (BDR, EDR); 2MHz (LE)
Chip Type Antenna Gain	1.69 dBi
RF Output power	0.0052W (BDR/EDR); 0.0029 (LE)

1.2 Objective

This report is prepared on behalf of *Zebra Technologies Corp.,* in accordance with FCC CFR47 §15.247 and ISEDC RSS-247 Issue 2, February 2017.

The objective is to determine compliance with FCC Part 15.247 and ISEDC RSS-247 Issue 2 rules for AC line conducted emissions and Radiated Spurious Emission.

1.3 Related Submittal(s)/Grant(s)

N/A

1.4 Test Methodology

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

1.5 Measurement Uncertainty

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

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

1.6 Test Facility Registrations

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

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

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

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

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

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

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide

range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.03)*** to certify

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

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

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

- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

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

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

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

5 Other
- For Water Coolers (ver. 3.0)

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

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

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v05r02.

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

2.2 EUT Exercise Software

The software "Toolbox v1.83" was used to transmit signal for all the modules. The software was provided by *Zebra Technologies, Corp.* and verified by Zhao Zhao to comply with the standard requirements being tested against.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Local Support Equipment

None

2.5 Support Equipment

Manufacturer	Description	Model	Serial Number
HP	Laptop	ZBOOK 14u G5	5CG90125FX

2.6 Interface Ports and Cabling

Cable Descriptions	Length (m)	From	To
USB to USB-B	1.5	Laptop	EUT

3 Summary of Test Results

Results reported relate only to the product tested.

FCC and ISED Rules	Description of Test	Results
FCC §15.207 ISED RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §2.1053, §15.205, §15.209, §15.247 (d) ISED RSS-247 §5.5 RSS-Gen §8.9 and §8.10	Radiated Spurious Emissions	Compliant

4 FCC §15.207 & RSS-210 §8.8 - AC Line Conducted Emissions

4.1 Applicable Standards

As per FCC §15.207 and ISED RSS-Gen §8.8 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note1	56 to 46 Note2
0.5-5	56	46
5-30	60	50

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

4.2 Test Setup

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

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

The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

4.3 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”.

4.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL), the Attenuator Factor (Atten) to indicated Amplitude (Ai) reading. The basic equation is as follows:

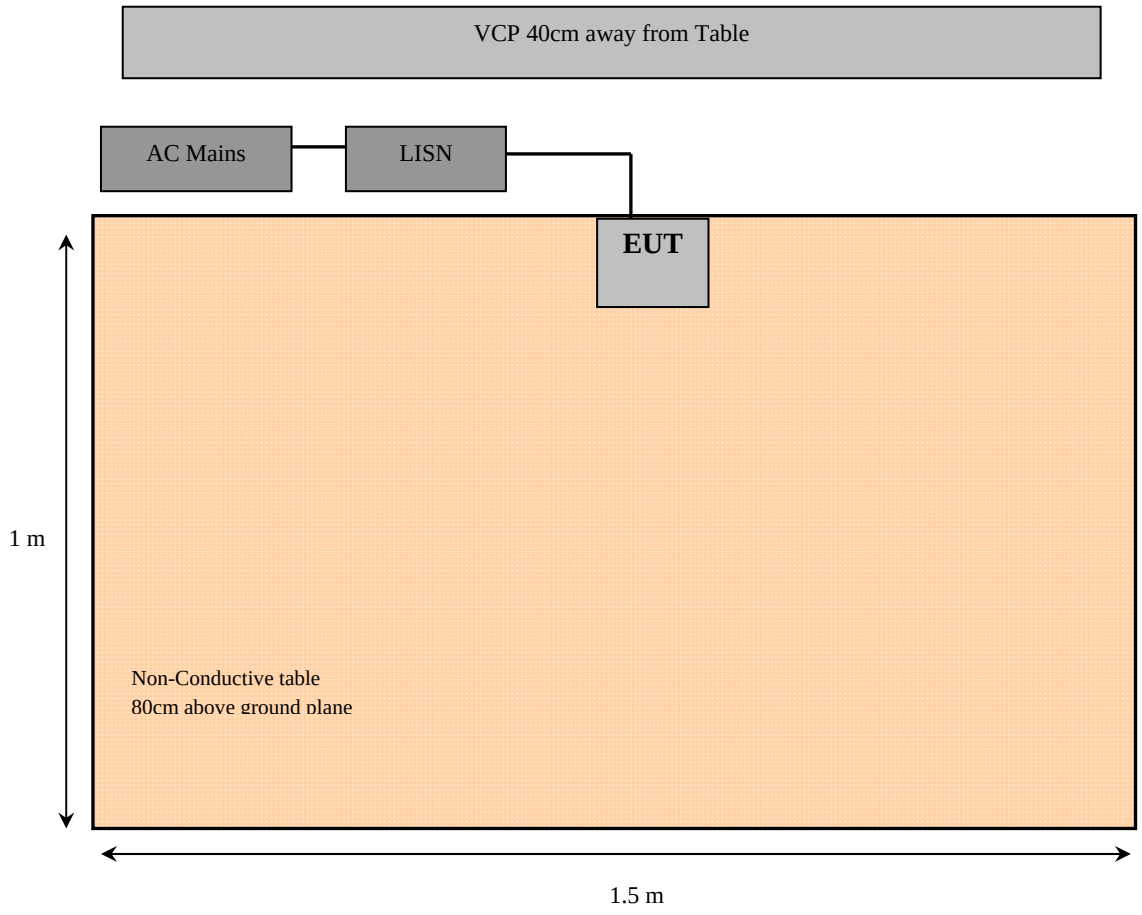
CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

4.5 Test Setup Block Diagram



4.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101963	2018-07-27	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150202	2019-02-25	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/A
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160132	2018-05-16	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2018-07-05	2 years

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

4.7 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	37 %
ATM Pressure:	101.6 kPa

The testing was performed by Zhao Zhao on 2019-05-02 in 5 meter chamber 3.

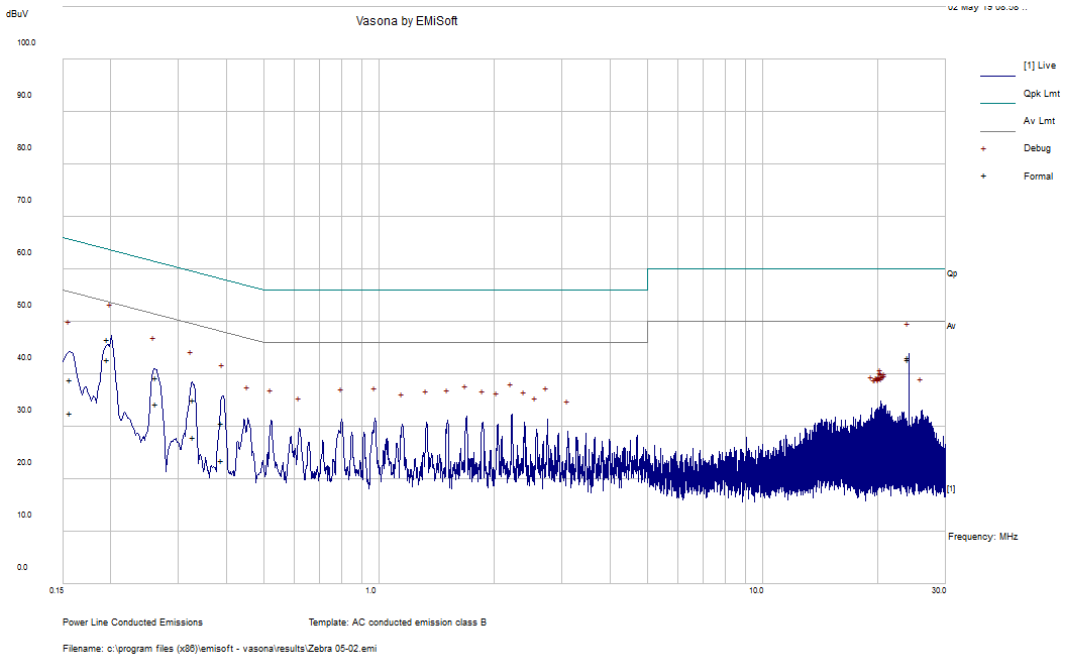
4.8 Summary of Test Results

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

Connection: AC/DC Adapter Connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-6.82	24.002166	Line	0.15-30

Worst Case Classic Bluetooth/BLE for Host ZT411

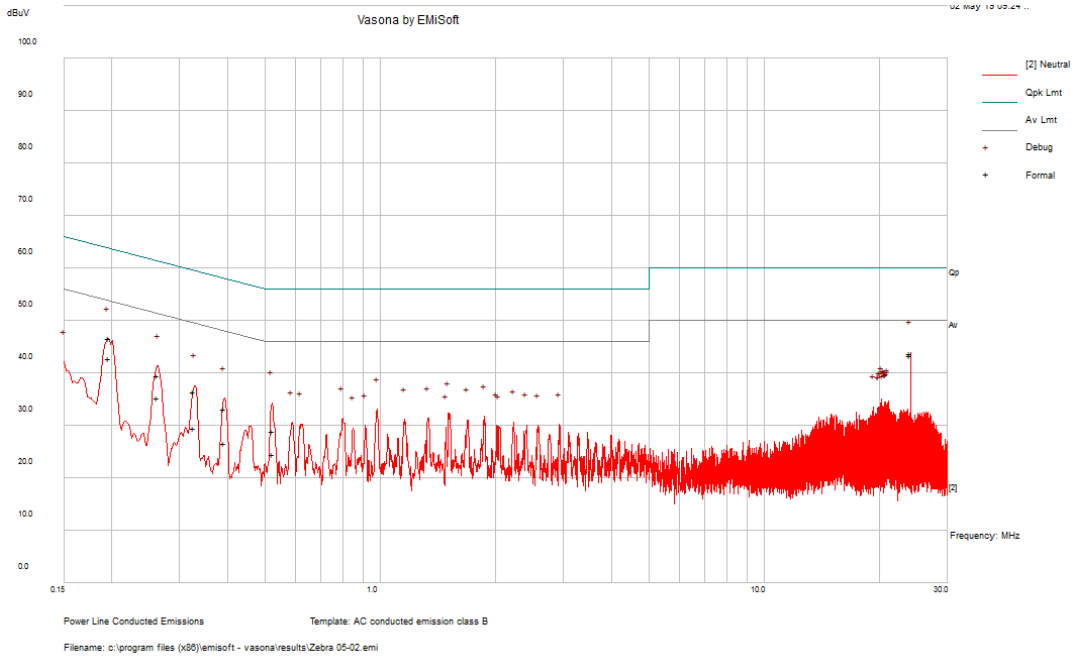
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
24.002166	42.87	Line	60	-17.13	QP
0.195887	46.69	Line	63.78	-17.09	QP
0.263251	39.43	Line	61.33	-21.9	QP
0.328867	35.19	Line	59.48	-24.29	QP
0.156875	38.88	Line	65.63	-26.75	QP
0.388303	30.67	Line	58.1	-27.43	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
24.002166	**43.18**	**Line**	**50**	**-6.82**	**Ave.**
0.195887	42.84	Line	53.78	-10.94	Ave.
0.263251	34.41	Line	51.33	-16.92	Ave.
0.328867	27.96	Line	49.48	-21.52	Ave.
0.156875	32.53	Line	55.63	-23.09	Ave.
0.388303	23.52	Line	48.1	-24.58	Ave.

120 V, 60 Hz – Neutral

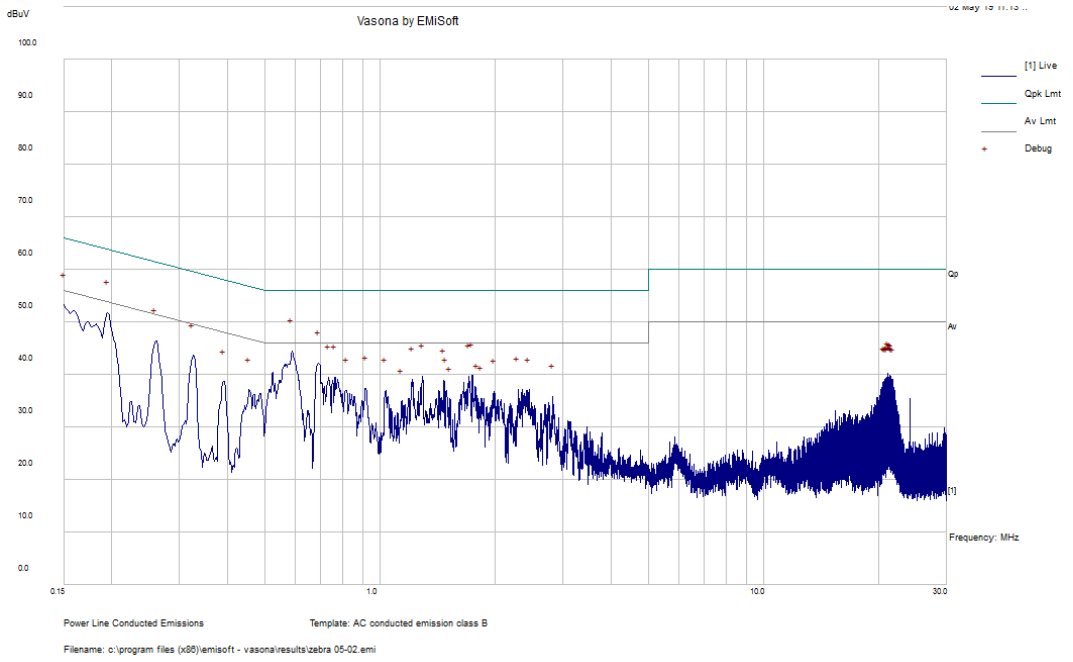


Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
24.001068	43.47	Neutral	60	-16.53	QP
0.196176	46.66	Neutral	63.77	-17.11	QP
0.261762	39.47	Neutral	61.38	-21.91	QP
0.524853	28.96	Neutral	56	-27.04	QP
0.326082	36.41	Neutral	59.55	-23.14	QP
0.390787	33.26	Neutral	58.05	-24.79	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
24.001068	43.79	Neutral	50	-6.21	Ave.
0.196176	42.9	Neutral	53.77	-10.87	Ave.
0.261762	35.27	Neutral	51.38	-16.11	Ave.
0.524853	24.63	Neutral	46	-21.37	Ave.
0.326082	29.46	Neutral	49.55	-20.09	Ave.
0.390787	26.66	Neutral	48.05	-21.39	Ave.

Worst Case Classic Bluetooth/BLE for Host ZT421

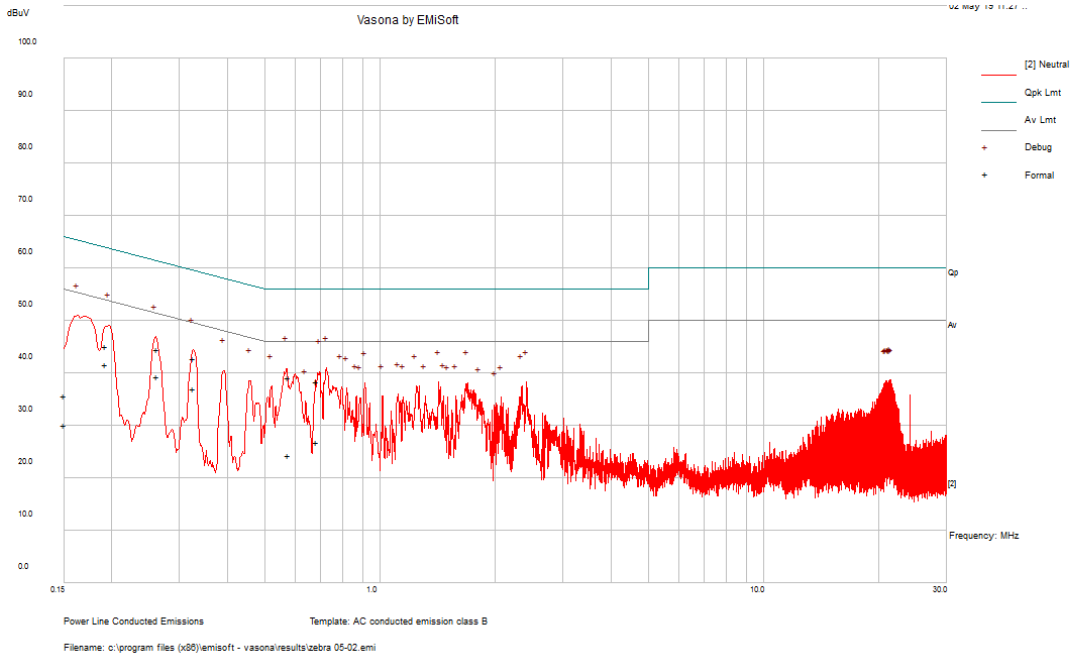
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.576837	39.21	Line	56	-16.79	QP
0.192306	45.1	Line	63.94	-18.84	QP
0.150322	35.79	Line	65.98	-30.19	QP
0.682931	38.47	Line	56	-17.53	QP
0.262063	44.51	Line	61.37	-16.85	QP
0.326113	42.86	Line	59.55	-16.69	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.576837	24.33	Line	46	-21.67	Ave.
0.192306	41.71	Line	53.94	-12.22	Ave.
0.150322	30.2	Line	55.98	-25.78	Ave.
0.682931	26.78	Line	46	-19.22	Ave.
0.262063	39.27	Line	51.37	-12.1	Ave.
0.326113	37.08	Line	49.55	-12.47	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.158199	50.2	Neutral	65.56	-15.35	QP
0.261739	44.72	Neutral	61.38	-16.65	QP
0.195828	47.38	Neutral	63.79	-16.4	QP
0.720956	38.88	Neutral	56	-17.12	QP
0.326617	42.62	Neutral	59.54	-16.92	QP
0.566732	40.87	Neutral	56	-15.13	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.158199	36.72	Neutral	55.56	-18.84	Ave.
0.261739	39.45	Neutral	51.38	-11.93	Ave.
0.195828	44.18	Neutral	53.79	-9.6	Ave.
0.720956	27.12	Neutral	46	-18.88	Ave.
0.326617	36.81	Neutral	49.54	-12.73	Ave.
0.566732	27.67	Neutral	46	-18.33	Ave.

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

5.1 Applicable Standards

As per FCC §15.35(b): 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).

As per ISEDC RSS-Gen 8.9,

> Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µv/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for license-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

As per ISEDC RSS-247 §5.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

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 15.209, FCC 15.247, FCC 15.407 limits.

The spacing between the peripherals was 10 centimeters.

5.3 Test Procedure

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

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

The EUT was set 3 meter away from the testing antenna, which was varied from 1-4 meter, and the EUT was placed on a turntable, which was 1.5 meter above the ground plane, the table was rotated for 360 degrees to find out the highest emission. The receiving antenna's polarity changed between horizontal and vertical.

The spectrum analyzer or receiver was set as:

Below 1000 MHz:

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

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz or 1/T / 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 & Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2018-07-05	2 year
Agilent	Analyzer, Spectrum	E4446A	US44300386	2018-06-01	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2018-02-26	2 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2019-04-02	2 years
Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2017-12-15	2 years
Agilent	Amplifier, Pre	8447D	2944A10187	2019-04-11	1 year
HP	Pre-Amplifier	8449B	3008A01978	2018-08-10	1year
A.H. Systems	Pre-Amplifer	PAM 1840V	170	2018-09-10	1 year
Insulted 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]: cables included in the test set-up will be checked each time before testing.
***Statement of Traceability: BACL** attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.*

5.6 Test Location, Date, Personnel and Environmental Conditions

Temperature:	23-25° C
Relative Humidity:	37 %
Barometric Pressure:	101.4 kPa

The testing was performed by Zhao Zhao from 2019-05-13 and 2019-05-14 in 5m3 chamber.

5.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15.209, 15.247 and RSS-247 standards' radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Detector Mode**
-18.41	31.86975	Vertical	Quasi Peak

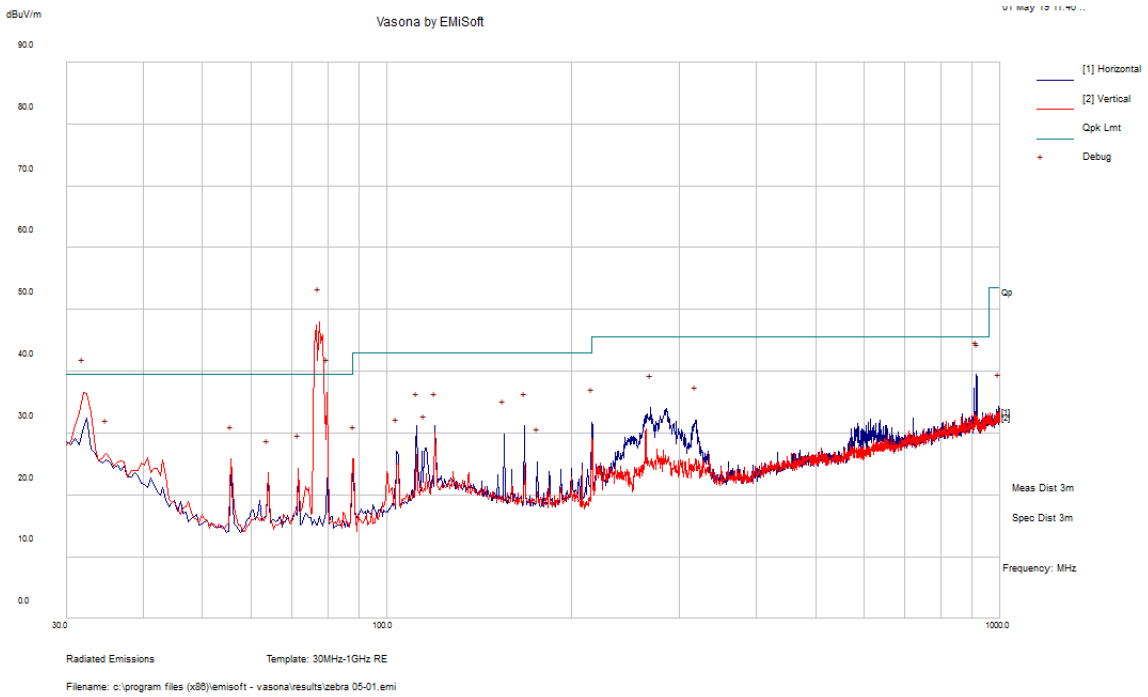
1-26.5 GHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Detector Mode**
-4.25	17978.983	Horizontal	Average

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

5.8 Radiated Emissions Test Results Data

30 MHz – 1 GHz:



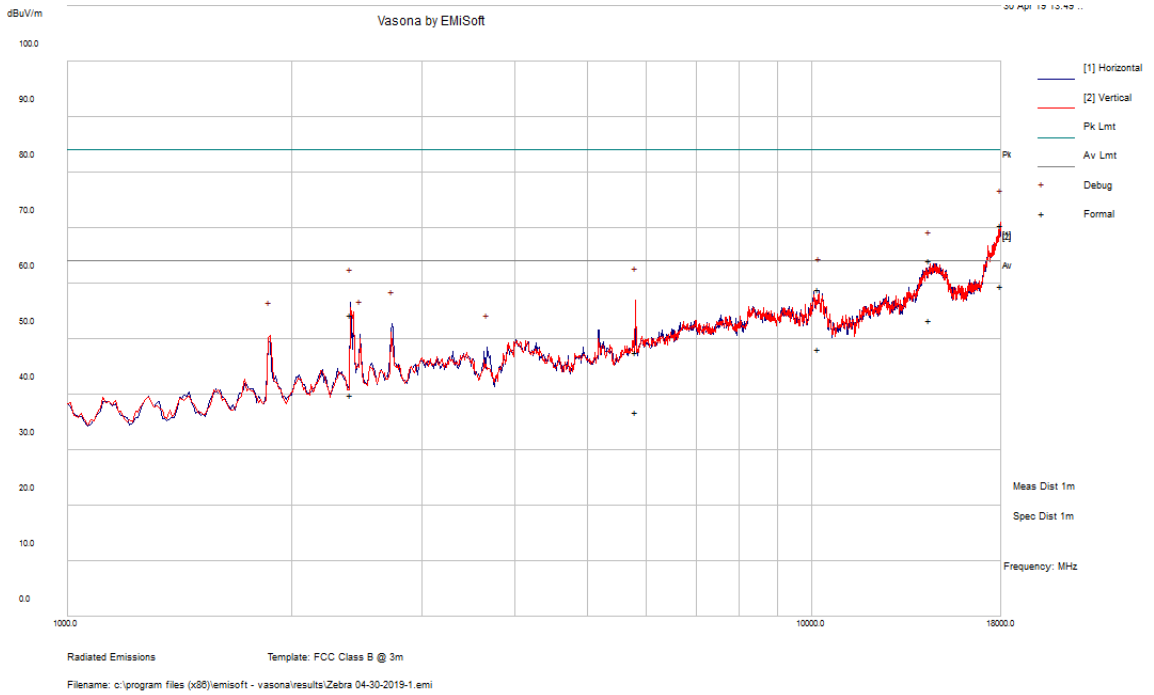
Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
77.531	9.64	229	V	306	39.5	-29.86	QP
77.39225	10.28	272	V	23	39.5	-29.22	QP
32.1335	20.89	204	V	323	39.5	-18.61	QP
31.86975	21.09	299	V	198	39.5	-18.41	QP
80.019	19.49	127	V	183	39.5	-20.01	QP
79.98025	18.36	210	V	30	39.5	-21.14	QP

1 – 18 GHz

BLE Mode

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 2402MHz											
2402	63.17	27	143	H	28.87	5.05	0.00	97.09	-	-	PK
2402	57.62	27	143	H	28.87	5.05	0.00	91.54	-	-	AV
2402	64.36	49	144	V	28.89	5.05	0.00	98.30	-	-	PK
2402	57.40	49	144	V	28.89	5.05	0.00	91.34	-	-	AV
2390	27.45	27	143	H	28.87	5.05	0.00	61.37	74	-12.64	PK
2390	15.39	27	143	H	28.87	5.05	0.00	49.31	54	-4.70	AV
2390	24.62	49	144	V	28.89	5.05	0.00	58.56	74	-15.44	PK
2390	15.75	49	144	V	28.89	5.05	0.00	49.69	54	-4.31	AV
4804	45.92	24	132	H	32.46	8.40	35.75	51.03	74	-22.98	PK
4804	33.11	24	132	H	32.46	8.40	35.75	38.22	54	-15.79	AV
4804	46.66	50	136	V	32.86	8.40	35.75	52.17	74	-21.83	PK
4804	32.82	50	136	V	32.86	8.40	35.75	38.33	54	-15.67	AV
Mid channel 2440MHz											
2440	64.18	22	136	H	29.12	5.11	0.00	98.41	-	-	PK
2440	51.26	22	136	H	29.12	5.11	0.00	85.49	-	-	AV
2440	64.30	52	148	V	29.05	5.11	0.00	98.46	-	-	PK
2440	51.50	52	148	V	29.05	5.11	0.00	85.66	-	-	AV
4880	46.13	32	130	H	32.56	8.62	38.09	49.22	74	-24.78	PK
4880	32.05	32	130	H	32.56	8.62	38.09	35.14	54	-18.86	AV
4880	45.72	33	132	V	32.56	8.62	38.09	48.81	74	-25.19	PK
4880	32.27	33	132	V	32.56	8.62	38.09	35.36	54	-18.64	AV
High channel 2480MHz											
2480	67.81	26	136	H	29.17	5.17	0.00	102.15	-	-	PK
2480	54.13	26	136	H	29.17	5.17	0.00	88.47	-	-	AV
2480	66.99	28	145	V	29.10	5.17	0.00	101.26	-	-	PK
2480	53.09	28	145	V	29.10	5.17	0.00	87.36	-	-	AV
2483.5	28.39	26	136	H	29.17	5.17	0.00	62.73	74	-11.27	PK
2483.5	15.06	26	136	H	29.17	5.17	0.00	49.40	54	-4.60	AV
2483.5	28.48	28	145	V	29.10	5.17	0.00	62.75	74	-11.26	PK
2483.5	14.83	28	145	V	29.10	5.17	0.00	49.10	54	-4.91	AV
4960	46.27	0	100	H	32.56	8.81	35.66	51.98	74	-22.02	PK
4960	32.35	0	100	H	32.56	8.81	35.66	38.06	54	-15.94	AV
4960	45.98	0	100	V	32.56	8.81	35.66	51.69	74	-22.31	PK
4960	32.26	0	100	V	32.56	8.81	35.66	37.97	54	-16.03	AV

Worst case Classic Bluetooth/BLE above 1 GHz:

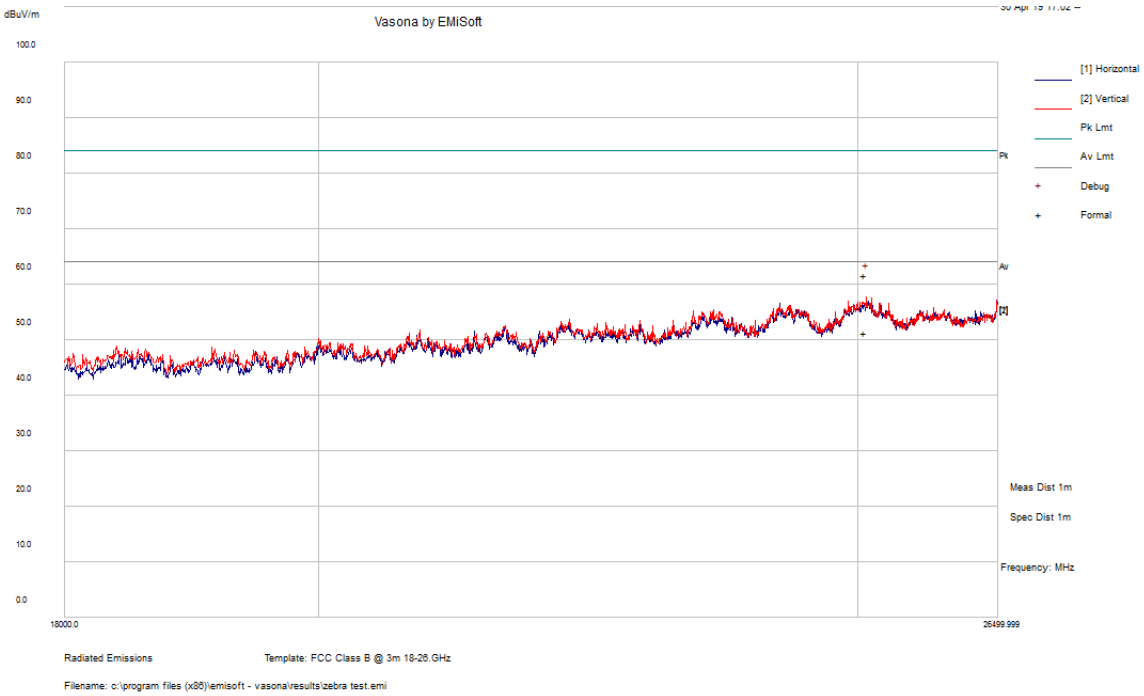


Frequency (MHz)	Corrected Amplitude (dBµV/m)	Polarity (H/V)	Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
17978.983	71.01	H	272	101	84	-12.99	Peak
14240.028	63.98	H	179	334	84	-20.02	Peak
5175.2075	48.16	V	273	304	84	-35.84	Peak
2722.64	43.91	H	174	32	84	-40.09	Peak
10223.878	59.47	H	272	9	84	-24.53	Peak
5238.0175	54.49	H	225	216	84	-29.51	Peak

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Polarity (H/V)	Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
17978.983	59.75	H	272	101	64	-4.25	**Ave**
14240.028	53.57	H	179	334	64	-10.43	Ave
5175.2075	39.52	V	273	304	64	-24.48	Ave
2722.64	33.15	H	174	32	64	-30.85	Ave
10223.878	48.99	H	272	9	64	-15.01	Ave
5238.0175	37.55	H	225	216	64	-26.45	Ave

Note: All scans above 1GHz used notch filter.

Worst Case of Classic Bluetooth/BLE



Note: No emission found above 18 GHz

6 Annex A (Normative) - EUT Test Setup Photographs

Please refer to the attachment.

7 Annex B (Normative) – EUT and Hosts Photographs

Please refer to the attachment.

8 Annex C (Normative) – Declaration of Similarity

ZEBRA

Zebra Technologies Corporation
3 Overlook Point
Lincolnshire, IL 60069

May 20, 2019

Declaration of Similarity

Zebra Technologies Corporation declares printer models ZT411 and ZT421 are similar such that both models:

- Have the same main control board, stepper motor, electronics enclosure, and user interface control panel.
- Have the same printing modes of thermal transfer or direct thermal.
- Have the same standard Bluetooth 4.x on the front panel, optional WLAN-ac/bt, and optional RFID radio modules.
- Have the same standard USB device port, ethernet 10/100, and RS-232, and dual USB host communication ports.
- Have Energy Star certification.
- Have similar power supplies with the same input ratings (100-240VAC, 50-60Hz), and same output voltages 22-, 5-, and40- VDC. The ZT411 uses a 200W power supply, and the ZT421 uses a 250W.

The main difference is the ZT411 is a 4-inch wide printer, and ZT421 is 6-inch wide.

Sincerely,

Jay Cadiz

Principal Compliance Engineer

Zebra Technologies Corporation

11 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.

--- END OF REPORT ---