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

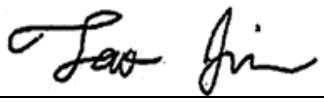
For

Zebra Technologies Corporation

3 Overlook Point, Lincolnshire, IL 60069, USA

FCC ID: UZ7RE40
IC: 109AN-RE40

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

Prepared By:	Tao Jin Test Engineer	
Report Number:	R2203311-247	
Report Date:	2022-12-28	
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ACCREDITED
CERTIFICATE #3297.02

* 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	R2203311-247	Class II Permissive Change	2022-12-28

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test was prepared on behalf of *Zebra Technologies Corporation*, and their product model: RE40, FCC ID: UZ7RE40, IC: 109AN-RE40, the "EUT" as referred to in this report. The EUT is a RFID Module. The EUT was installed in host device model number: ZD621 (similar model: ZD611). After pre-testing, ZD621 was determined to reflect worst-case results and thus chosen for formal testing.

1.2 Objective

This report is prepared on behalf of *Zebra Technologies Corporation* 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 15C and ISEDC RSS-247 for Radiated Spurious Emissions testing and AC Line Conducted Emission testing for multiple transmitters' co-location configuration.

This project is a Permissive Change II submission for the purpose of placing the module in new host (Model: ZD621,ZD611), and enabling colocation with Wi-Fi and Bluetooth Module (FCC ID: I28-WYSBHVDXP, IC: 3798B-WYSBHVDXP).

Model Number	WYSBHVDXP
FCC ID	I28-WYSBHVDXP
IC	3798B-WYSBHVDXP
Radio Type	WLAN-AX/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	1 dBi (BT), 0.3 dBi (2.4G), 4.4 dBi (5G)
EIRP	0.016W (BDR/EDR); 0.008W (LE) 0.0525W (2.4G WLAN); 0.0813W (5G WLAN)

Model Number	RE40
FCC ID	UZ7RE40
IC	109AN-RE40
Radio Type	UHF RFID
Operating Frequency	902.75MHz – 927.25MHz
Modulation	ASK
Channel Spacing	500 kHz
Loop Antenna Gain	-30 dBi
EIRP	0.0005 W

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 v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

1.5 Measurement Uncertainty

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

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Power Spectral Density, conducted	±1.48dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 ° 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 17025:2017 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 17025:2017 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 17025:2017 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 - ISED) 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.

The worst-case configuration was selected based on the original test report, and verified consistent by measuring the conducted output power or PSD.

Radio	Frequency	Modulation	Power Setting
2.4GHz Wi-Fi	2412	b	Default
Bluetooth	2402	BLE	"C"
	2402	BTC	"C"
RFID	902.75 MHz	-	Default

2.2 EUT Exercise Software

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

2.3 Equipment Modification

None.

2.4 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude E6410

2.5 Remote Support Equipment

None.

2.6 Interface Ports and Cabling

Cable Descriptions	Length (m)	From	To
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 §15.203 ISEDC RSS-Gen §6.8	Antenna Requirements	Compliant
FCC §2.1091, §15.247(i) ISED RSS-102	RF Exposure	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §2.1053, §15.35(b), §15.205, §15.209, §15.247(d) ISEDC RSS-247 §5.5 ISEDC RSS-Gen §8.9, §8.10	Radiated Spurious Emissions	Compliant

BACL is responsible for all the information provided in this report, except when information is provided by the customer as identified in this report. Information provided by the customer, e.g., antenna gain, can affect the validity of results.

4 FCC §15.203 & ISEDC RSS-Gen §6.8 - Antenna Requirements

4.1 Applicable Standards

According to FCC §15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to ISEDC RSS-Gen §6.8: Transmitter Antenna

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

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

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

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

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

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

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

4.2 Antenna Description

External/Internal/ Integral	Part Number	Antenna Type	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
Internal	P1110774-01	Patch Antenna	2412-2472	0.3
			5150-5850	4.4
Internal	RE40	Loop Antenna	902.75-927.25	-30
Integral	2450AT07A0100	Monopole Antenna	2402-2480	1

5 FCC §15.247(i) §2.1091 & ISED RSS-102 - RF Exposure

5.1 Applicable Standards

According to FCC KDB 447498 D04 Interim General RF Exposure Guidance v01, Section 2.1 RF Exposure Test Exemptions for Single Source,

2.1.1 General RF Exposure Test Exemption Considerations

RF exposure test exemptions provide means to obtain certification without the need of showing data (measurements, or analytical/numerical modeling) to demonstrate compliance. Hereafter, in this context, an RF source is referred to as "exempt RF device" in the sense that it is not required to show data demonstrating compliance to RF exposure limits.

Test exemptions apply for devices used in general population/uncontrolled exposure environments, according to the SAR-based, or MPE-based exemption thresholds.8 However, it is always possible, especially when the potential for exposure cannot be easily determined, that an RF exposure evaluation may become required according §§ 1.1307(c) and (d).

As detailed in Section 2.1.2, the 1 mW and SAR-based test exemption conditions are in terms of source-based available maximum time-averaged (matched conducted) output power for all operating configurations, adjusted for tune-up tolerance, and at the minimum test separation distance required for the particular RF exposure scenario under consideration. This minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander.
To qualify for SAR test exemption, the test separation distances applied must be fully explained and justified (typically in the SAR measurement, or SAR analysis report, according to KDB Pub. 865664) by showing the actual operating configurations and exposure conditions of the transmitter, and applicable host platform requirements (e.g., KDB Pubs. 648474, 616217, 941225)

When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for SAR test exemption.

If RF exposure testing requirements for a specific device are covered in a KDB Publication, those requirements must be satisfied before applying any SAR test exemption provisions. For example, this is the case for handheld PTT two-way radios, handsets, laptops, and tablets, etc.9

Finally, when 10-g extremity SAR applies, SAR test exemption may be considered by applying a factor of 2.5 to the SAR-based exemption thresholds.

2.1.2 1-mW Test Exemption

Per §1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance.

This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

2.1.3 SAR-Based Exemption

A more comprehensive exemption, considering a variable power threshold that depends on both the separation distance and power, is provided in §1.1307(b)(3)(ii)(B). This exemption is applicable to the frequency range between 300 MHz and 6 GHz, with test separation distances between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions.

Accordingly, a RF source is considered an RF exempt device if its available maximum time-averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold. This exemption threshold was derived based on general population 1-g SAR requirements and is detailed in Appendix C.

2.1.4 MPE-Based Exemption

An alternative to the SAR-based exemption is provided in §1.1307(b)(3)(ii)(C), for a much wider frequency range, from 300 kHz to 100 GHz, applicable for separation distances greater or equal to $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. The MPE-based test exemption condition is in terms of ERP, defined as the

[8] Specific test exemption thresholds for operations under occupational/controlled limits are not established.
[9] When SAR evaluation is required by the hotspot mode or UMPC mini-tablet procedures, that is, where an antenna is ≤ 2.5 cm from a surface or edge, the *test separation distance* from the phantom to the antenna or device enclosure, as appropriate, should be applied to determine SAR test exemption for such configurations, according to the criteria in this document. For that case, the *test separation distance* cannot be determined from the distance of the antenna to the device surface or edge.

According to ISED RSS-102 Issue 5 Section 2.5.1 Exemption Limits for Routine Evaluation-SAR Evaluation:

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in table below,

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71	101	132	162	193
450	52	70	88	106	123
835	17	30	42	55	67
1900	7	10	18	34	60
2450	4	7	15	30	52
3500	2	6	16	32	55
5800	1	6	15	27	41

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223	254	284	315	345
450	141	159	177	195	213
835	80	92	105	117	130
1900	99	153	225	316	431
2450	83	123	173	235	309
3500	86	124	170	225	290
5800	56	71	85	97	106

3.1 FCC RF Exposure Exemption Evaluation Procedures

According to FCC KDB 447498 D04 Interim General RF Exposure Guidance v01, Annex B Exemptions for Single Source,

B.1 General

This appendix provides the exemption criteria and summarizes relevant parameters and usage considerations based on descriptions in FCC 19-126.

B.2 Blanket 1 mW Blanket Exemption

The 1 mW Blanket Exemption of § 1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance. The 1 mW blanket exemption applies at separation distances less than 0.5 cm, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph § 1.1307(b)(3)(ii)(A). The 1 mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

B.3 MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table B.1 – THRESHOLD FOR SINGLE RF SOURCE SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source			**Minimum Distance**			**Threshold ERP**
f_L MHz		f_H MHz	$\lambda_L/2\pi$		$\lambda_H/2\pi$	W
0.3	-	1.34	159 m	-	35.6 m	1,920 R^2
1.34	-	30	35.6 m	-	1.6 m	3,450 R^2/f^2
30	-	300	1.6 m	-	159 mm	3.83 R^2
300	-	1,500	159 mm	-	31.8 mm	0.0128 $R^2 f$
1,500	-	100,000	31.8 mm	-	0.5 mm	19.2 R^2
Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

The table applies to any RF source (i.e., single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least $\lambda/2\pi$. The thresholds are based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.

For mobile devices that are not exempt per Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP20cm in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{th}\,(\text{mW}) = ERP_{20\,cm}\,(\text{mW}) = 2040f \quad 0.3\ \text{GHz} \le f < 1.5\ \text{GHz}$$
$$P_{th}\,(\text{mW}) = ERP_{20\,cm}\,(\text{mW}) = 3060 \quad 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \qquad \text{(B.1)}$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

B.4 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

As for devices with antennas of length greater than $\lambda/4$ where the gain is not well defined, but always less than that of a half-wave dipole (length $\lambda/2$), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th}\,(\text{mW}) = ERP_{20\,\text{cm}}\,(d/20\,\text{cm})^{x} \quad d \le 20\,\text{cm}$$
$$P_{th}\,(\text{mW}) = ERP_{20\,\text{cm}} \quad 20\,\text{cm} < d \le 40\,\text{cm} \qquad \text{(B.2)}$$

Where

$$x = -\log_{10}\,(60/(ERP_{20\,\text{cm}}\sqrt{f}))$$

and f is in GHz, d is the separation distance (cm), and EPR20cm is per Formula (B.1).

The example values shown in Table B.2 are for illustration only.

Table B.2 – Example Power Thresholds (mW)

Frequency (MHz)	**Distance (mm)**										
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

According to ISED RSS-102 Issue 5:

2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz[6] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2}\, f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

5.2 RF exposure evaluation exemption for FCC

BT 2.4 GHz Radio (FCC ID: I28-WYSBHVDXP)

Prediction frequency (GHz)	2.402
Maximum output power (dBm)	11.72
Maximum ERP (dBm)	10.57
Maximum Output Power (mW)	14.86
Prediction distance (cm)	20
Maximum antenna gain (dBi)	1
1500 MHz ≤ f < 10000 MHz	Option C (MPE based) Exemption Threshold
	P_{th} (W)
	$19.2R^2 = 0.768$

WLAN 2.4 GHz Radio (FCC ID: I28-WYSBHVDXP)

Prediction frequency (GHz)	2.412
Maximum output power (dBm)	16.90
Maximum ERP (dBm)	15.05
Maximum Output Power (mW)	48.98
Prediction distance (cm)	20
Maximum antenna gain (dBi)	0.3
1500 MHz ≤ f < 10000 MHz	Option C (MPE based) Exemption Threshold
	P_{th} (W)
	$19.2R^2 = 0.768$

WLAN 5 GHz Radio (FCC ID: I28-WYSBHVDXP)

Prediction frequency (GHz)	5.180
Maximum output power (dBm)	14.7
Maximum ERP (dBm)	16.95
Maximum ERP (mW)	49.55
Prediction distance (cm)	20
Maximum antenna gain (dBi)	4.4
1500 MHz ≤ *f* < 10000 MHz	Option C (MPE based) Exemption Threshold
	P_{th} (W)
	$19.2R^2 = 0.768$

RFID 900 MHz Radio (FCC ID: UZ7RE40)

Prediction frequency[f] (MHz)	902.75
Maximum output power (dBm)	27.20
Maximum ERP (dBm)	-4.95
Maximum output power (W)	0.524807
Prediction distance[R] (m)	0.20
Maximum allowed antenna gain (dBi)	-30
300 MHz ≤ *f* < 1500 MHz	Option C (MPE based) Exemption Threshold
	P_{th} (W)
	$0.0128\ R^2f = 0.462$

Radio Co-location

Frequency Band	Max Conducted Power (dBm)	Antenna Gain (dBi)	Evaluated Distance (cm)	Max ERP (W)	Option C Exemption Threhsold (W)	Worst-Case Ratios	Sum of Ratios	Limit
Worst Case								
900 MHz Radio	27.20	-30	20	0.00032	0.462	0.069%	6.6%	100%
WLAN/BT Radio	14.7	4.4	20	0.0496	0.768	6.5%		

Results

For the different combination of transmitters, a separation distance of 20 cm complies with the SAR simultaneous transmission limit of ≤ 1.0.

5.3 RF exposure evaluation exemption for IC

RFID 902.75 MHz (IC: 109AN-RE40)

27.20 dBm + (-30.0) dBi = -2.8 dBm < $1.31\times10^{-2}f^{0.6834}$ = 1.371 W = 31.370 dBm

BT BR, 2402 MHz (IC: 3798B-WYSBHVDXP)

11.72 dBm + 1 dBi = 12.72 dBm < $1.31\times10^{-2}f^{0.6834}$ = 2.676 W = 34.275 dBm

WLAN 802.11b, 2412 MHz (IC: 3798B-WYSBHVDXP)

16.90 dBm + 0.3 dBi = 17.20 dBm < $1.31\times10^{-2}f^{0.6834}$ = 2.684 W = 34.288 dBm

WLAN 802.11a, 5180 MHz (IC: 3798B-WYSBHVDXP)

12.86 dBm + 4.4 dBi = 17.26 dBm < $1.31\times10^{-2}f^{0.6834}$ = 4.761 W = 36.777 dBm

Therefore, RF exposure is not required.

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

6.1 Applicable Standards

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

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

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 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

6.2 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.

6.3 Test Procedure

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

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

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

6.4 Corrected Amplitude & Margin Calculation

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

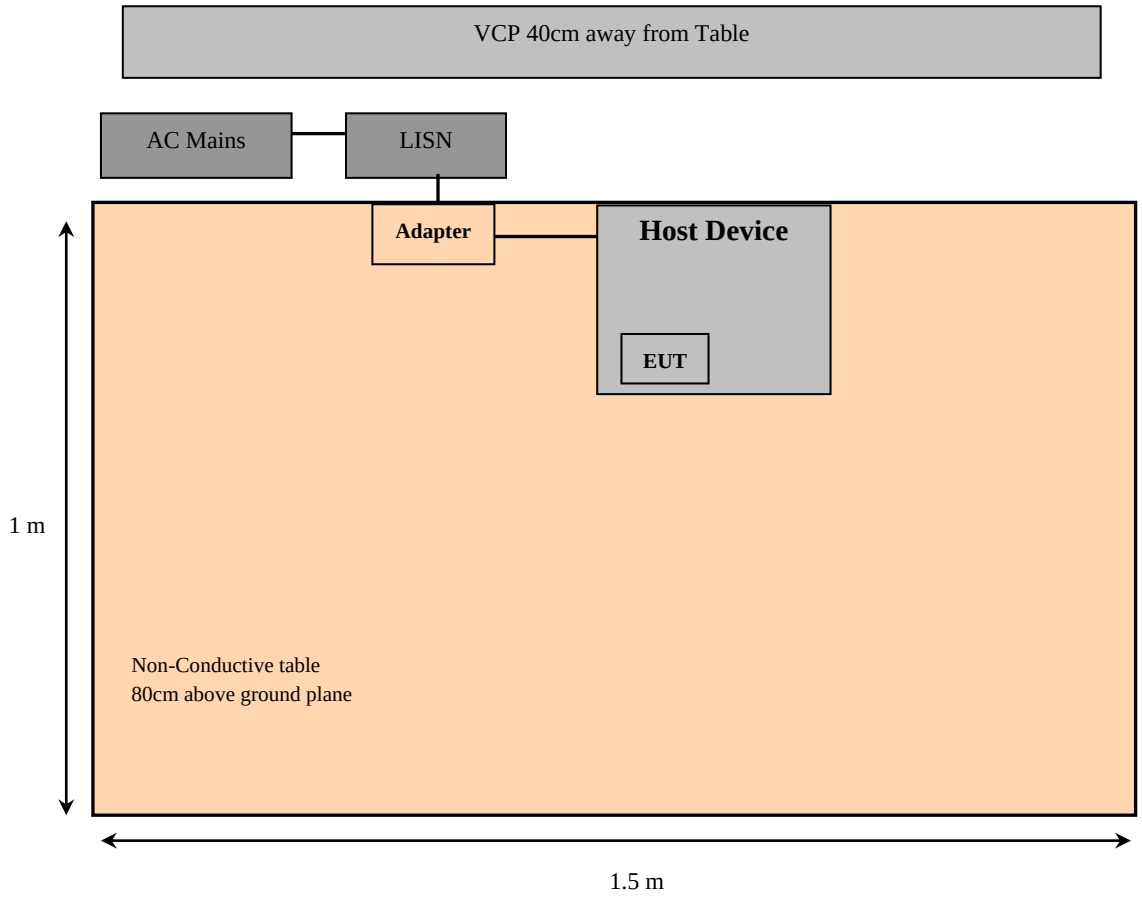
CA = Ai + CL + Atten

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

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

Margin = Corrected Amplitude – Limit

6.5 Test Setup Block Diagram



6.6 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
124	Rohde and Schwarz	EMI Test Receiver	ESCI 1166.5950K 03	100044	2021-05-14	2 years
681	Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101962	2022-09-12	1 year
726	Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2022-09-16	1 year
-	Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/A
734	FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160131	2021-12-22	1 year
-	Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

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

6.7 Test Environmental Conditions

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

The testing was performed by Tyler Dorsey on 2022-12-14 in 5m chamber 3

6.8 Summary of Test Results

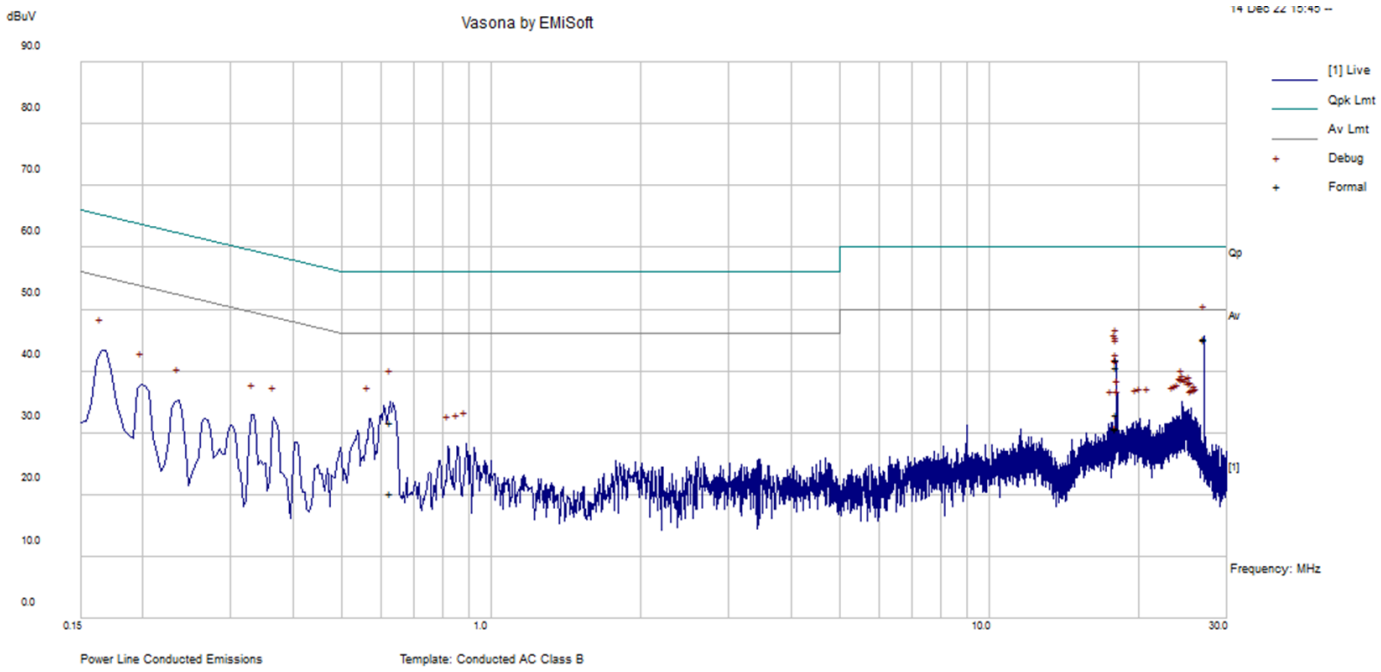
According to the recorded data in following table, the EUT complied with the FCC 15C and ISEDC RSS-Gen standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC Adapter Connected to 120 V/60 Hz, AC				
Modulation	**Margin (dB)**	**Frequency (MHz)**	**Conductor Mode (Live/Neutral)**	**Range (MHz)**
2.4 Wi-Fi + RFID	-4.76	26.999376	Live	0.15-30
5 Wi-Fi + RFID	-4.55	26.99961	Live	0.15-30
BDR + RFID	-4.86	27.00066	Live	0.15-30
BLE + RFID	-4.74	26.99941	Live	0.15-30

6.9 Conducted Emissions Test Plots and Data

2.4 GHz Wi-Fi + RFID Colocation

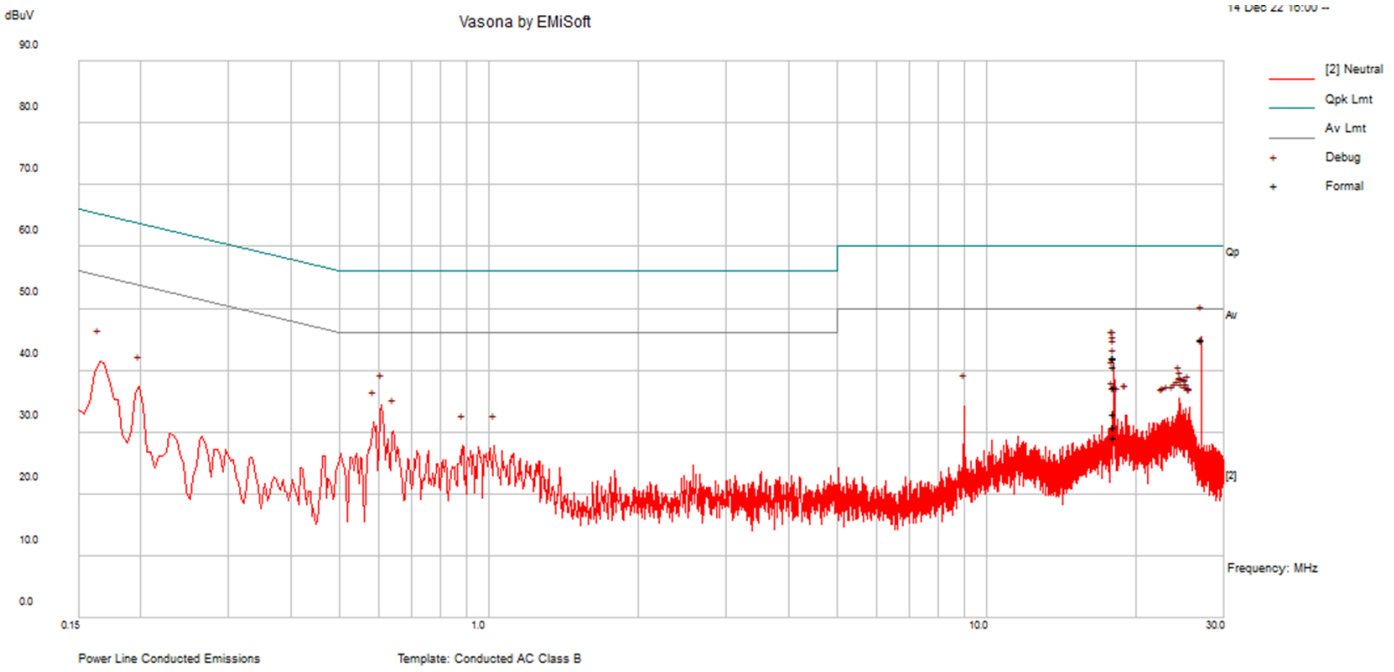
120 V, 60 Hz – Live



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.999376	45.07	Live	60	-14.93	QP
17.982496	41.88	Live	60	-18.12	QP
17.980767	41.89	Live	60	-18.11	QP
17.980849	41.91	Live	60	-18.09	QP
18.001154	40.56	Live	60	-19.44	QP
0.630044	31.77	Live	56	-24.23	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.999376	45.24	Live	50	-4.76	Ave.
17.982496	30.75	Live	50	-19.25	Ave.
17.980767	30.74	Live	50	-19.26	Ave.
17.980849	30.85	Live	50	-19.15	Ave.
18.001154	32.95	Live	50	-17.05	Ave.
0.630044	20.16	Live	46	-25.84	Ave.

120 V, 60 Hz – Neutral

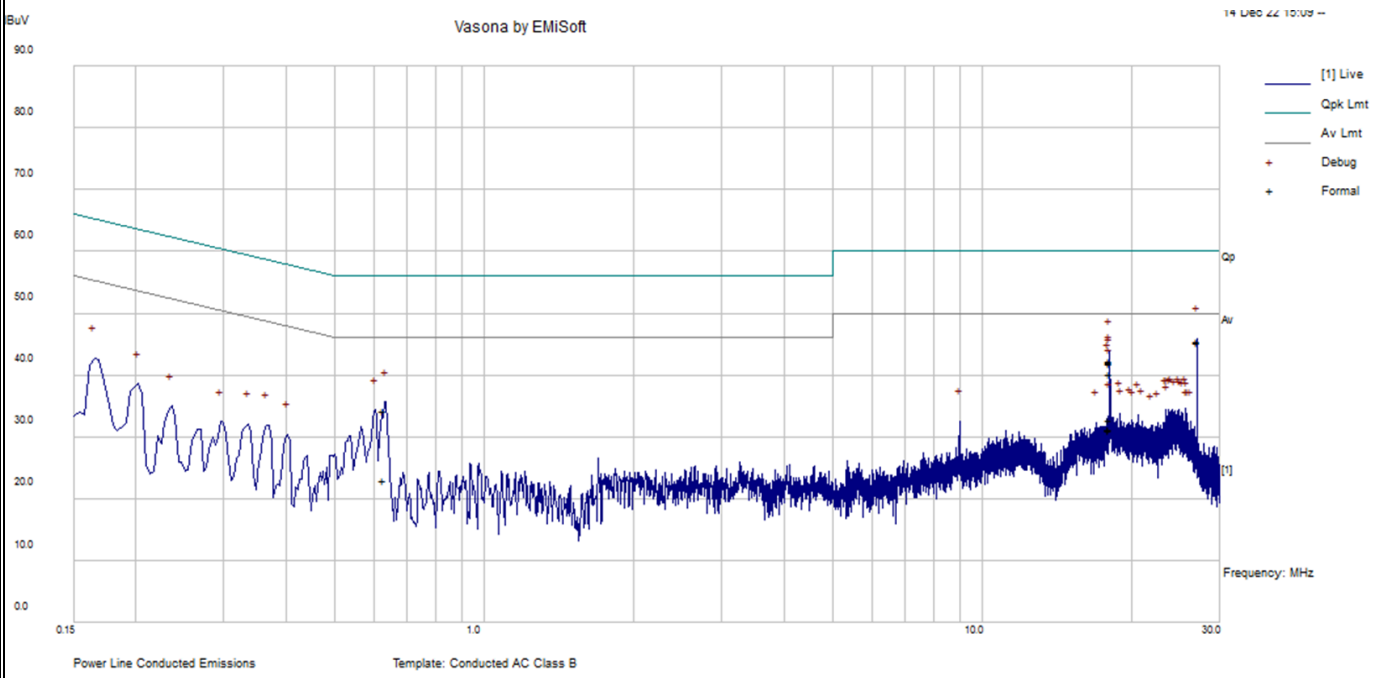


Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.999754	44.84	Neutral	60	-15.16	QP
18.001154	40.67	Neutral	60	-19.33	QP
17.981001	42.09	Neutral	60	-17.91	QP
17.982505	42.04	Neutral	60	-17.96	QP
17.982496	42	Neutral	60	-18	QP
18.055155	37.24	Neutral	60	-22.76	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.999754	45.01	Neutral	50	-4.99	Ave.
18.001154	33.07	Neutral	50	-16.93	Ave.
17.981001	30.86	Neutral	50	-19.14	Ave.
17.982505	30.76	Neutral	50	-19.24	Ave.
17.982496	30.77	Neutral	50	-19.23	Ave.
18.055155	29.17	Neutral	50	-20.83	Ave.

5 GHz Wi-Fi + RFID Colocation

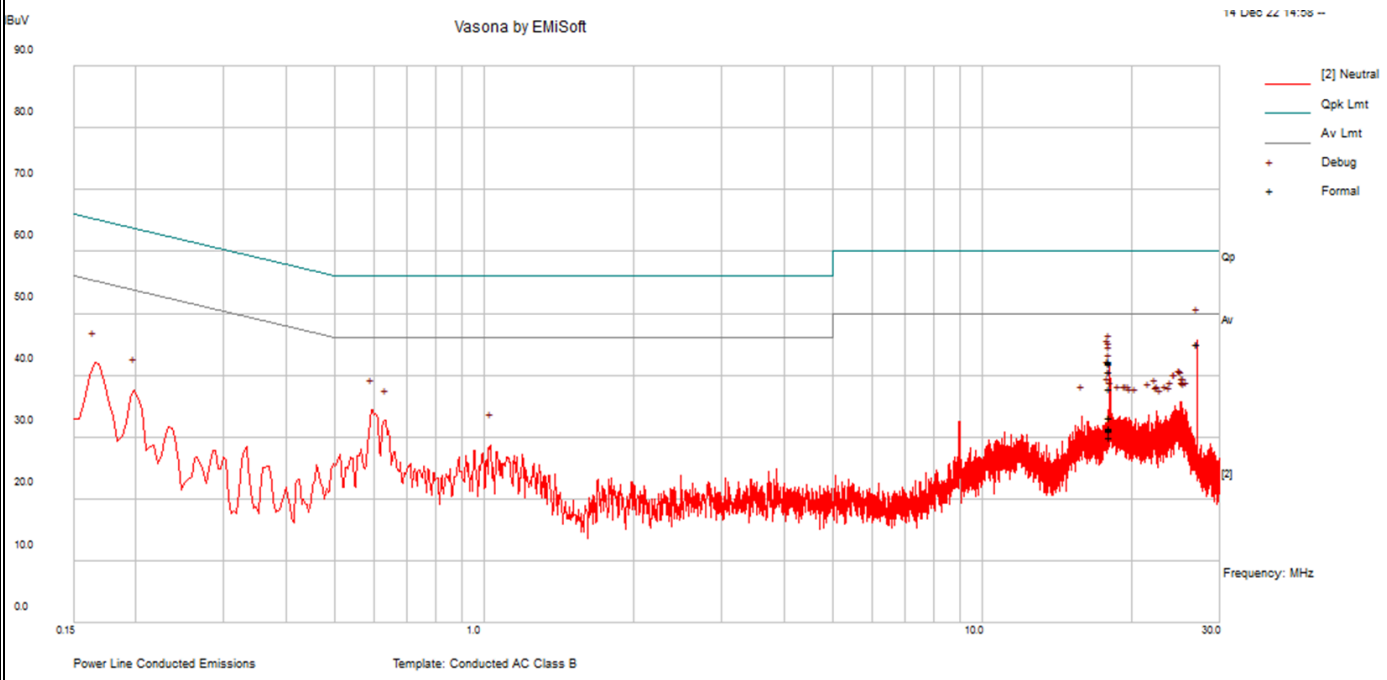
120 V, 60 Hz – Live



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.99961	45.31	Live	60	-14.69	QP
17.981587	42.23	Live	60	-17.77	QP
17.982766	41.83	Live	60	-18.17	QP
18.001568	40.22	Live	60	-19.78	QP
17.980911	42.06	Live	60	-17.94	QP
0.630019	34.16	Live	56	-21.84	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.99961	45.45	Live	50	-4.55	Ave.
17.981587	31.27	Live	50	-18.73	Ave.
17.982766	31	Live	50	-19	Ave.
18.001568	32.84	Live	50	-17.16	Ave.
17.980911	31.18	Live	50	-18.82	Ave.
0.630019	22.93	Live	46	-23.07	Ave.

120 V, 60 Hz – Neutral

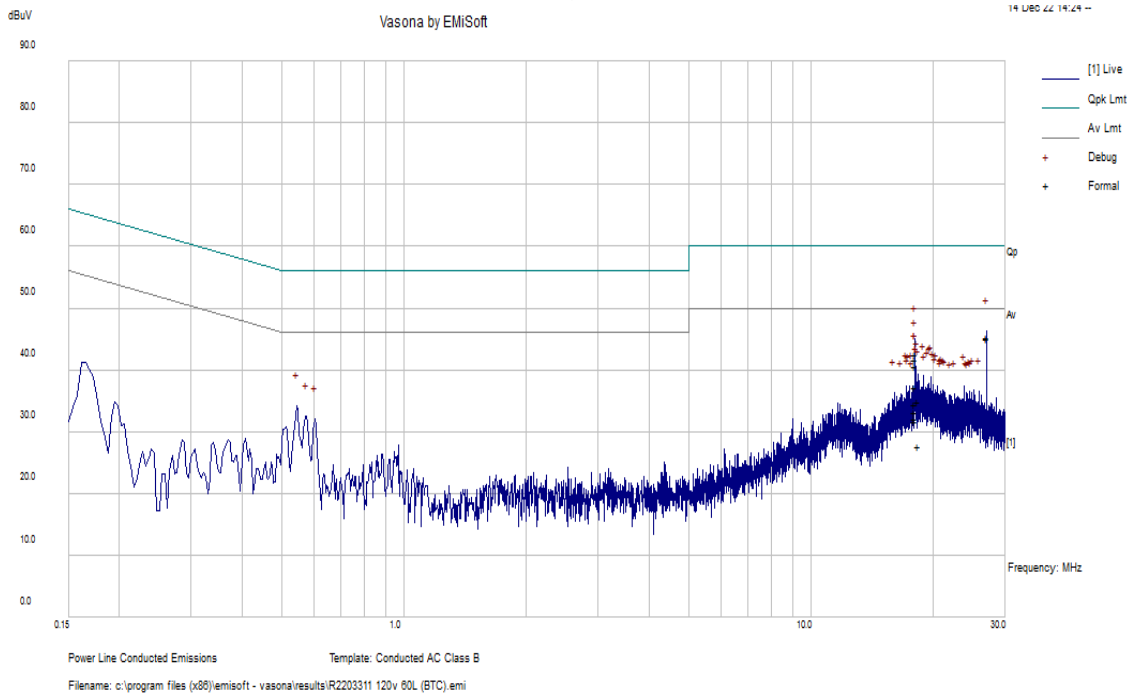


Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.999052	45	Neutral	60	-15	QP
17.982631	42.04	Neutral	60	-17.96	QP
17.981127	42.23	Neutral	60	-17.77	QP
18.001262	40.59	Neutral	60	-19.41	QP
18.054327	37.88	Neutral	60	-22.12	QP
17.98291	41.82	Neutral	60	-18.18	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.999052	45.12	Neutral	50	-4.88	Ave.
17.982631	31.3	Neutral	50	-18.7	Ave.
17.981127	31.46	Neutral	50	-18.54	Ave.
18.001262	33.19	Neutral	50	-16.81	Ave.
18.054327	29.94	Neutral	50	-20.06	Ave.
17.98291	31.02	Neutral	50	-18.98	Ave.

Bluetooth BDR + RFID Colocation

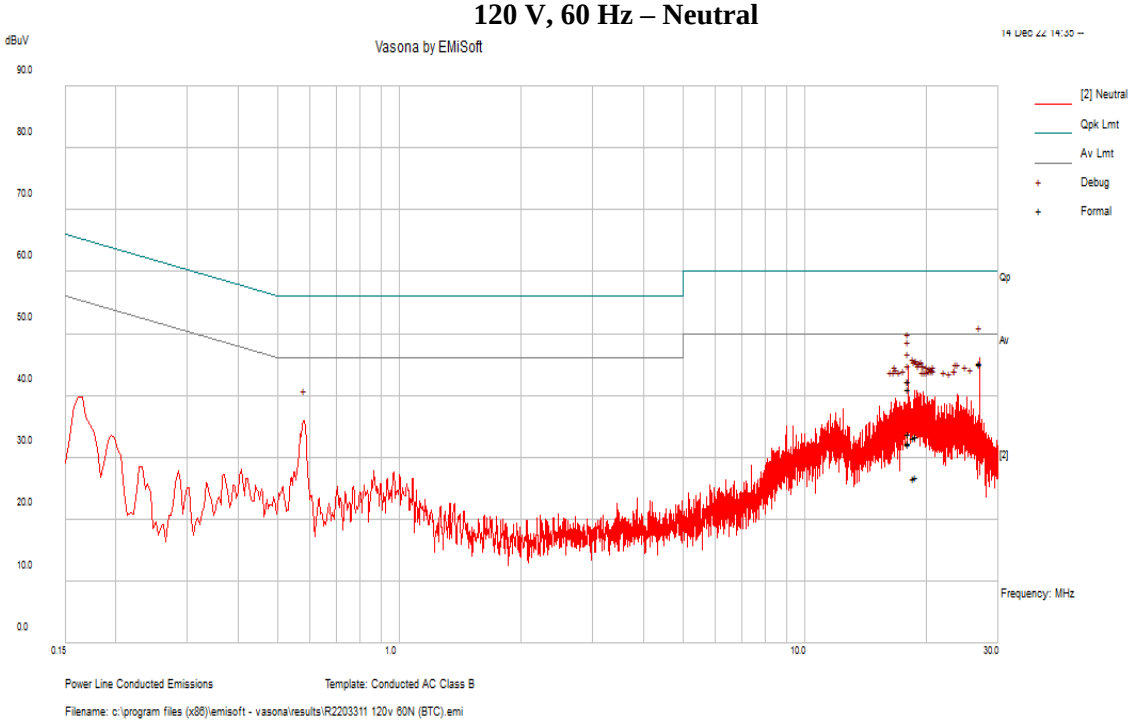
120 V, 60 Hz – Live



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
27.000659	45.31	Live	60	-14.69	QP
17.981767	42.62	Live	60	-17.38	QP
17.999182	41.69	Live	60	-18.31	QP
18.017516	40.68	Live	60	-19.32	QP
18.037671	37.17	Live	60	-22.83	QP
18.308682	34.88	Live	60	-25.12	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
27.000659	**45.14**	**Live**	**50**	**-4.86**	**Ave.**
17.981767	33.1	Live	50	-16.9	Ave.
17.999182	34.55	Live	50	-15.45	Ave.
18.017516	32.08	Live	50	-17.92	Ave.
18.037671	31.63	Live	50	-18.37	Ave.
18.308682	27.67	Live	50	-22.33	Ave.

120 V, 60 Hz – Neutral

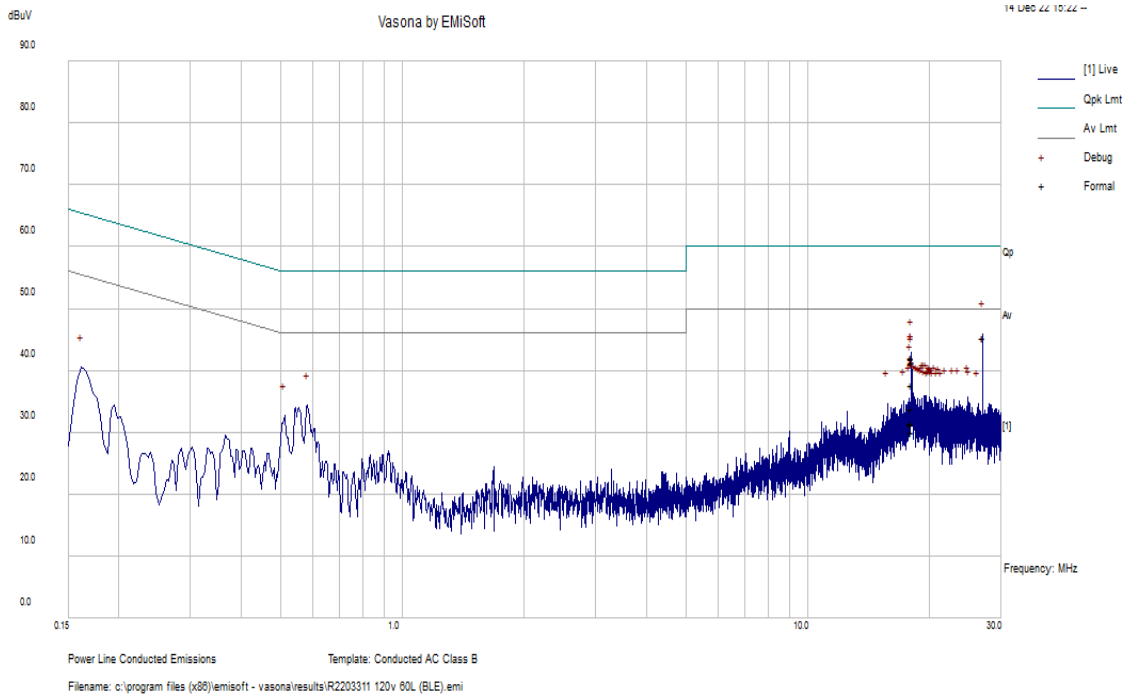


Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
17.999542	50.7	Neutral	60	-9.3	QP
18.001154	49.99	Neutral	60	-10.01	QP
26.99925	43.21	Neutral	60	-16.79	QP
18.035075	41.97	Neutral	60	-18.03	QP
17.963307	41.68	Neutral	60	-18.32	QP
18.034791	41.85	Neutral	60	-18.15	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
17.999542	42.78	Neutral	50	-7.22	Ave.
18.001154	42.07	Neutral	50	-7.93	Ave.
26.99925	43.54	Neutral	50	-6.46	Ave.
18.035075	35.29	Neutral	50	-14.71	Ave.
17.963307	34.69	Neutral	50	-15.31	Ave.
18.034791	35.13	Neutral	50	-14.87	Ave.

Bluetooth BLE + RFID Colocation

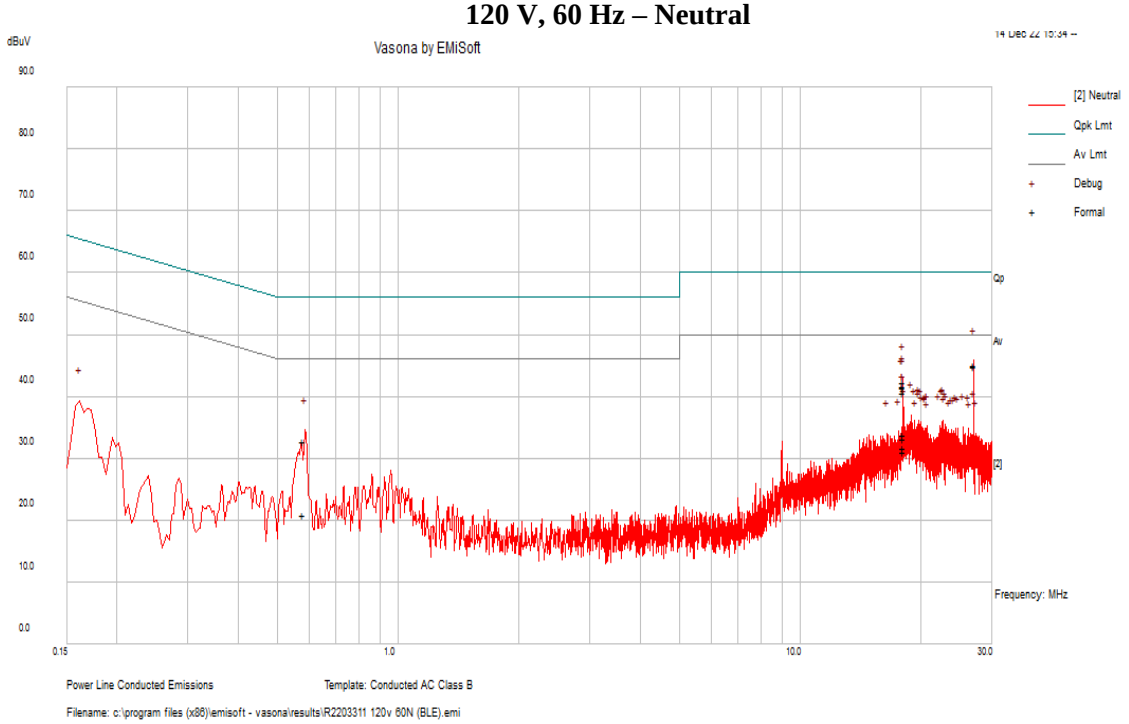
120 V, 60 Hz – Live



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.999412	45.31	Live	60	-14.69	QP
17.982091	42.17	Live	60	-17.83	QP
18.000032	41.27	Live	60	-18.73	QP
17.98255	42.05	Live	60	-17.95	QP
18.053013	37.67	Live	60	-22.33	QP
17.980731	41.94	Live	60	-18.06	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.999412	**45.26**	**Live**	**50**	**-4.74**	**Ave.**
17.982091	31.58	Live	50	-18.42	Ave.
18.000032	33.8	Live	50	-16.2	Ave.
17.98255	31.38	Live	50	-18.62	Ave.
18.053013	29.92	Live	50	-20.08	Ave.
17.980731	31.38	Live	50	-18.62	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.998908	45.02	Neutral	60	-14.98	QP
17.981299	42.33	Neutral	60	-17.67	QP
18.001352	40.66	Neutral	60	-19.34	QP
18.0001	41.41	Neutral	60	-18.59	QP
17.980047	41.65	Neutral	60	-18.35	QP
0.581636	32.74	Neutral	56	-23.26	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
26.998908	44.89	Neutral	50	-5.11	Ave.
17.981299	31.66	Neutral	50	-18.34	Ave.
18.001352	33.21	Neutral	50	-16.79	Ave.
18.0001	33.87	Neutral	50	-16.13	Ave.
17.980047	31.14	Neutral	50	-18.86	Ave.
0.581636	20.78	Neutral	46	-25.22	Ave.

7 FCC §15.35(b), §15.205, §15.209, §15.247(d) & ISEDC RSS-247 §5.5, RSS-Gen §8.9, §8.10- Spurious Radiated Emissions

7.1 Applicable Standards

As per FCC §15.35(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 ISED 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 ISED RSS-247 §5.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

7.2 Test Setup

The radiated emissions tests were performed in the 5-meter chamber and 10-meter chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart C and ISEDC RSS-247.

The spacing between the peripherals was 10 centimeters.

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

7.3 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 meters, and the EUT was placed on a turntable, which was 0.8 meters and 1.5 meters 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 = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz or 1/T / Sweep = Auto

7.4 Corrected Amplitude and Margin Calculation

For emissions below 1 GHz,

The Corrected Amplitude (CA) is calculated by adding the Correction Factor to the S.A. Reading. The basic equation is as follows:

CA = S.A. Reading + Correction Factor

For example, a corrected amplitude of 40.3 dBuV/m = S.A. Reading (32.5 dBuV) + Correction Factor (7.8 dB/m)

The Correction Factor is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) together. This calculation is done in the measurement software, and reported in the test result section. The basic equation is as follows:

Correction Factor = AF + CL + Atten – Ga

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

For emission above 1 GHz,

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

CA = Ai + AF + CL + Atten – Ga

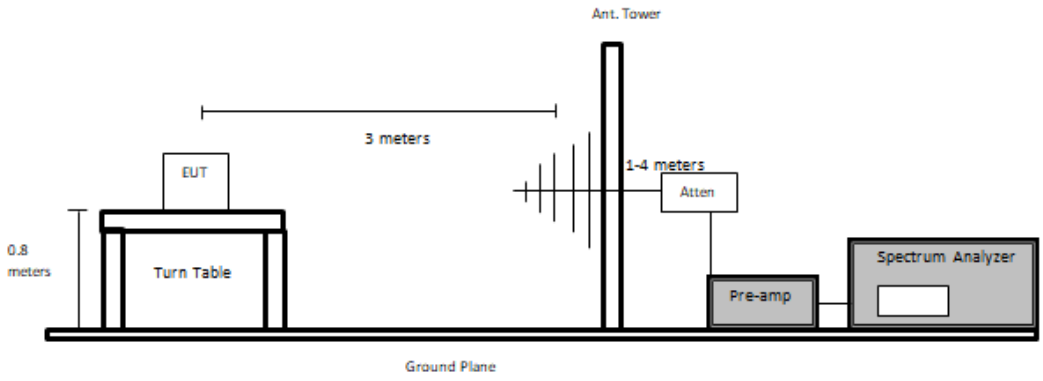
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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

Margin = Corrected Amplitude – Limit

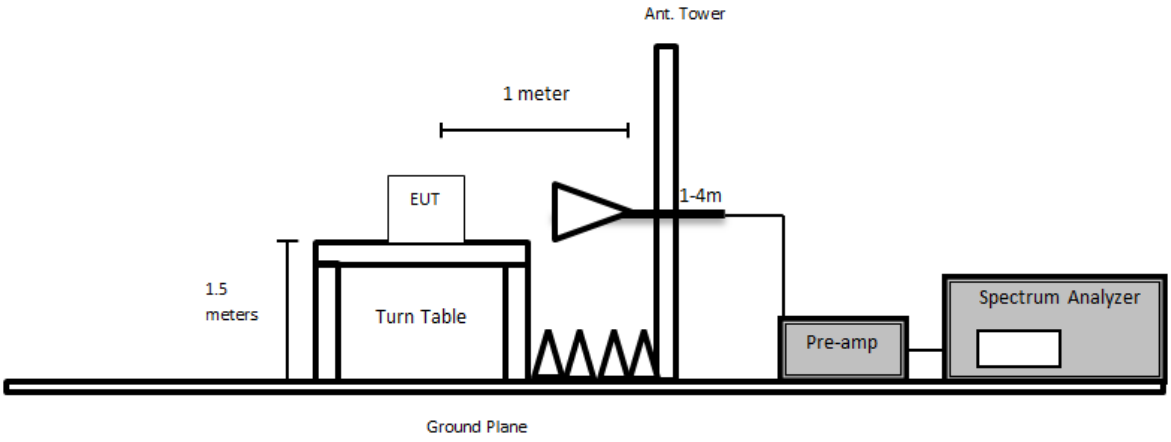
7.5 Test Setup Block Diagram

Below 1GHz:

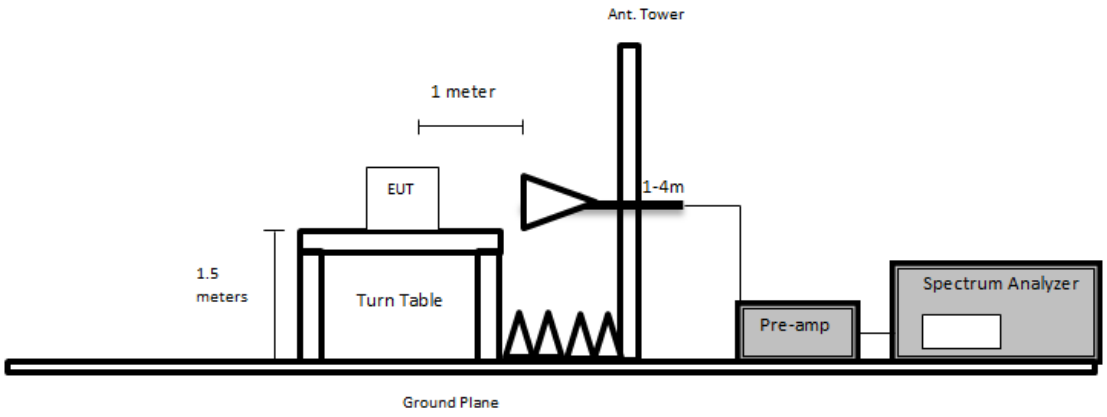


Above 1GHz:

Using Asset #1192



Using Asset #91,#230



7.6 Test Equipment List and Details

BACL No	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
124	Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K 03	100044	2021-05-14	2 years
655	Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2022-02-07	2 years
323	Sunol Science Corp	System Controller	SC104V	011003-1	N/R	N/R
658	HP/Agilant	Pre-Amplifier	8449B OPT HO2	3008A01 103	2022-07-22	1 year
827	A.H. Systems, Inc.	Pre-Amplifier	PAM-1840VH	170	2022-11-01	1 year
316	Sonoma Instruments	Preamplifier 10 kHz - 2.5 GHz	317	260406	2022-05-12	1 year
321	Sunol Science Corp	Biconilog Antenna	JB3	A020106-2; 1504	2021-11-22	2 years
1192	ETS Lindgren	Antenna, Horn	3117	00218973	2022-09-29	2 years
91	Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2022-03-08	2 years
230	Wisewave	Antenna, Horn	ARH-2823-02	10555-02	2022-03-08	2 years
1247	Uti flex	Micro - Coax	-	-	2022-07-22	1 year
1228	Pasternack	Coaxial Cable, RG213	PE3496-800CM	2111301	2021-11-30	1 year
1248	Pasternack	RG214 COAX Cable	PE3062	-	Each time[1]	N/A
1249	time microwave	LMR-400 Cable Dc-3 Ghz	AE13684	2k80612-5 6fts	Each time[1]	N/A
1295	Carlisle	10m Ultra Low Loss Coaxial Cable	UFB142A-1-3937-200200	64639890 912-001	2022-10-28	1 year
-	-	RF cable	-	-	Each time[1]	N/A
388	-	Notch filters	-	-	Each time[1]	N/A
811	Keysight Technologies	RF Limiter	11867A	MY42243 052	2022-07-27	1 year
1245	-	6dB Attenuator	PE7390-6	01182018 A	Each time[1]	N/A
-	Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note[1]: cable and notch filters 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 the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

7.7 Test Environmental Conditions

Temperature:	20 ºC
Relative Humidity:	28-30 %
Barometric Pressure:	101.8 kPa

The testing was performed by Arturo Reyes from 2022-11-25 to 2022-11-29 in 5m chamber 3.

7.8 Summary of Test Results

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

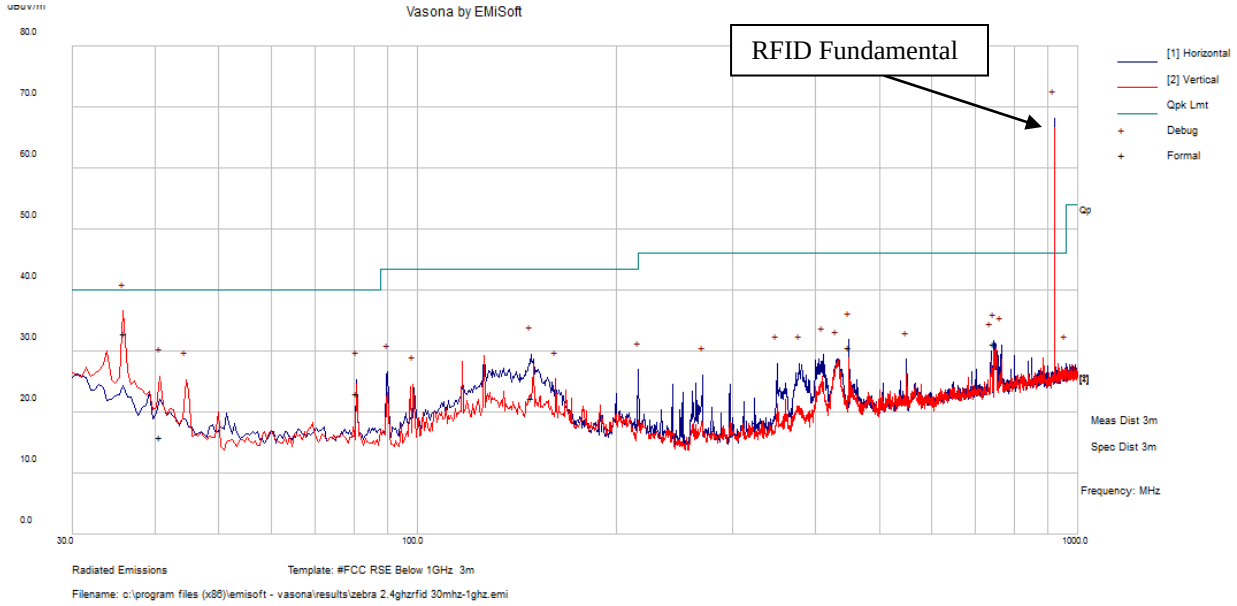
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Configuration**
-0.09	35.82	Horizontal	BTC + 902.75 MHz RFID Colocation

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

7.9 Radiated Emissions Test Results

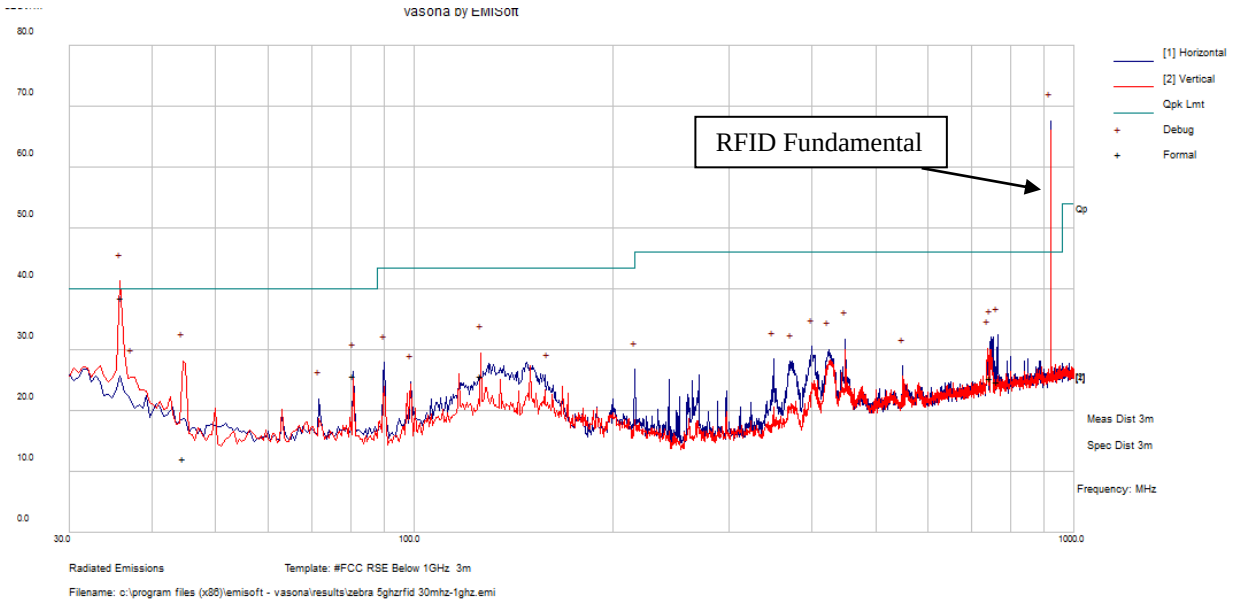
1) 30 MHz – 1 GHz Worst Case, Measured at 3 meters

Wi-Fi 802.11b 2412 MHz + RFID 902.75 MHz Colocation



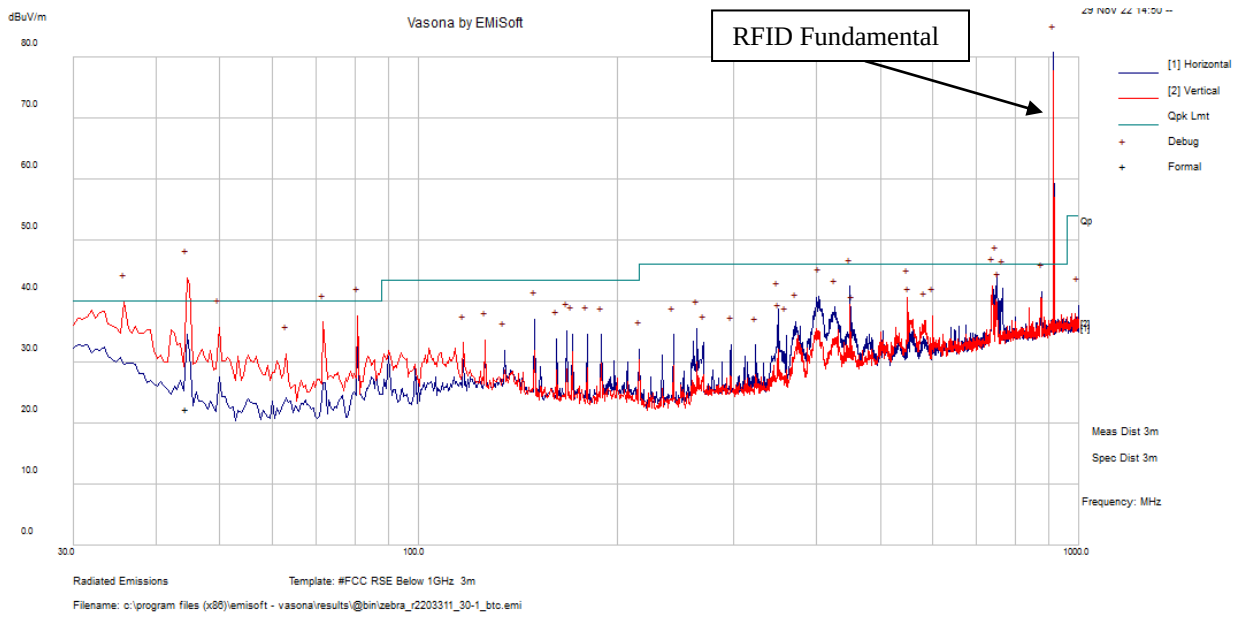
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
36.00425	35.61	-2.62	32.99	109	V	352	40	-7.01	QP
35.82	44.50	-4.65	39.85	100	H	349	40	-0.15	QP
749.74	42.49	1.87	44.36	100	V	329	46	-1.64	QP
80.925	50.65	-13.11	37.54	100	V	34	40	-2.46	QP
71.71	49.58	-13.02	36.56	300	V	45	40	-3.44	QP
740.04	40.84	1.63	42.47	100	V	103	46	-3.53	QP

Wi-Fi 802.11a 5260 MHz + RFID 902.75 MHz Colocation



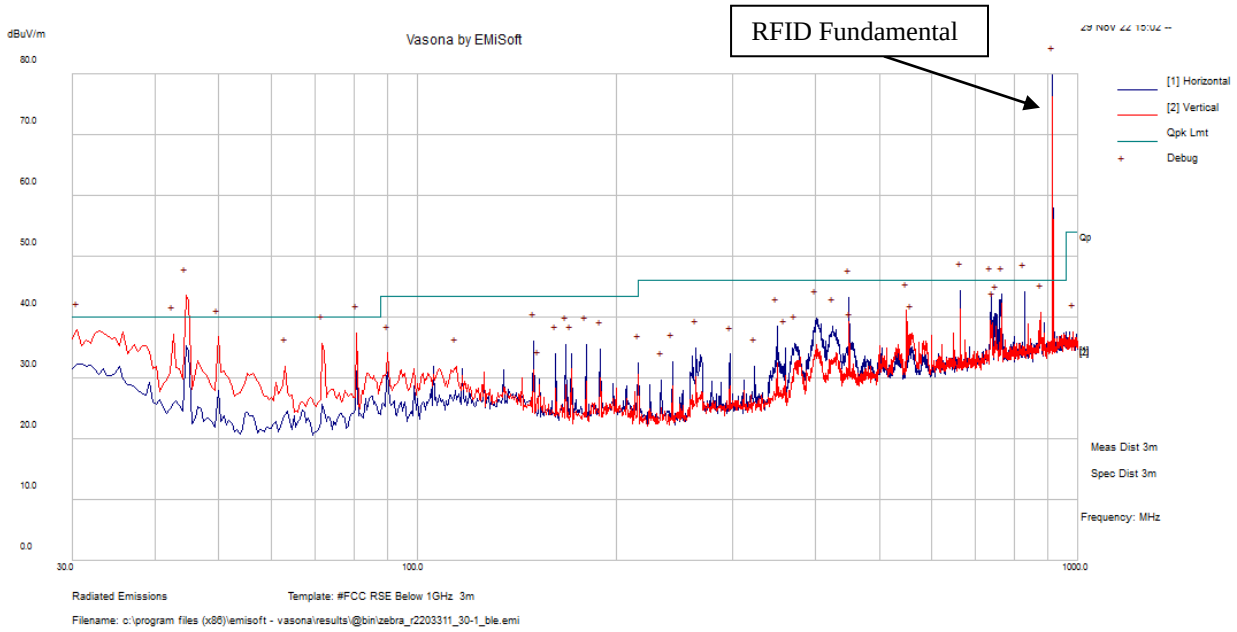
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comments (PK/QP/Ave.)
36.01325	41.24	-2.63	38.61	110	V	106	40	-1.39	QP
44.6185	21.01	-8.88	12.13	190	V	93	40	-27.87	QP
80.99825	37.26	-11.62	25.64	186	H	247	40	-14.36	QP
764.65	21.7	3.05	24.75	286	H	144	46	-21.25	QP
746.9068	22.61	2.73	25.34	291	H	116	46	-20.66	QP
126.0045	30.57	-4.82	25.75	157	V	188	43.5	-17.75	QP

Bluetooth Classic 2402 MHz + RFID 902.75 MHz Colocation



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
44.4535	32.27	-10.01	22.26	100	V	103	40	-17.74	QP
35.82	**44.56**	**-4.65**	**39.91**	**100**	**H**	**349**	**40**	**-0.09**	**QP**
749.74	42.49	1.87	44.36	100	V	329	46	-1.64	QP
80.925	50.65	-13.11	37.54	100	V	34	40	-2.46	QP
71.71	49.58	-13.02	36.56	300	V	45	40	-3.44	QP
740.04	40.84	1.63	42.47	100	V	103	46	-3.53	QP

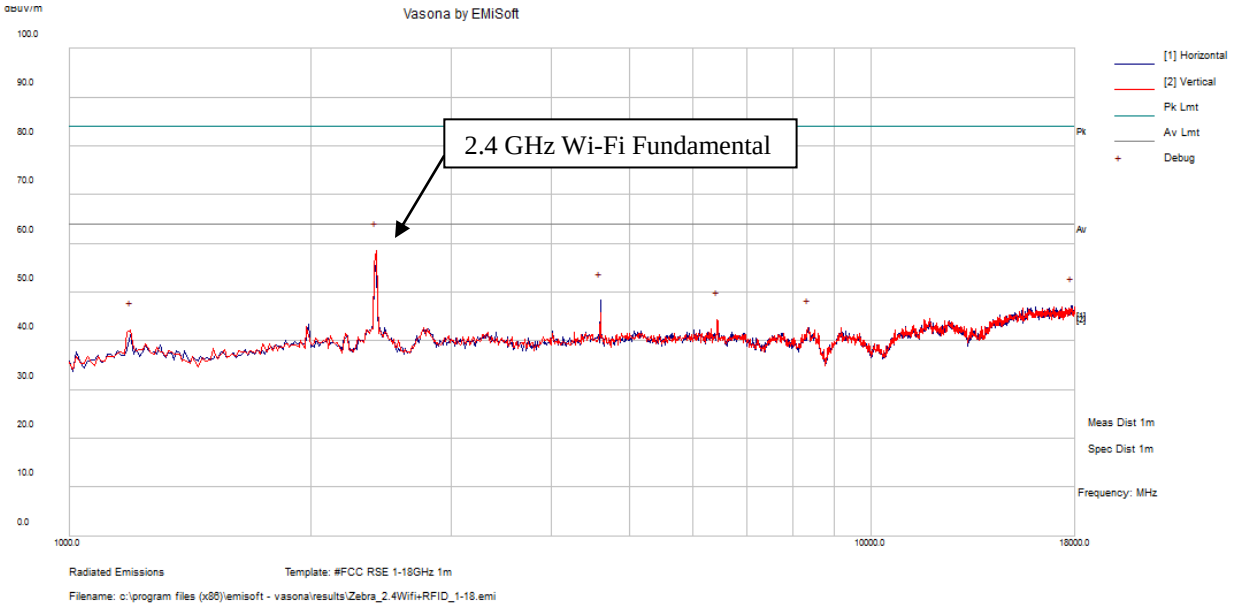
Bluetooth Low Energy 2402 MHz + RFID 902.75 MHz Colocation



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
36.00425	35.61	-2.62	32.99	109	V	352	40	-7.01	QP
148.5318	28.73	-6.34	22.39	298	H	213	43.5	-21.11	QP
44.514	33.58	-10.05	23.53	155	V	331	40	-16.47	QP
449.9728	32.52	-1.80	30.72	189	H	236	46	-15.28	QP
746.43	28.43	2.73	31.15	102	H	323	46	-14.85	QP
81.02025	34.78	-11.62	23.16	185	H	231	40	-16.84	QP

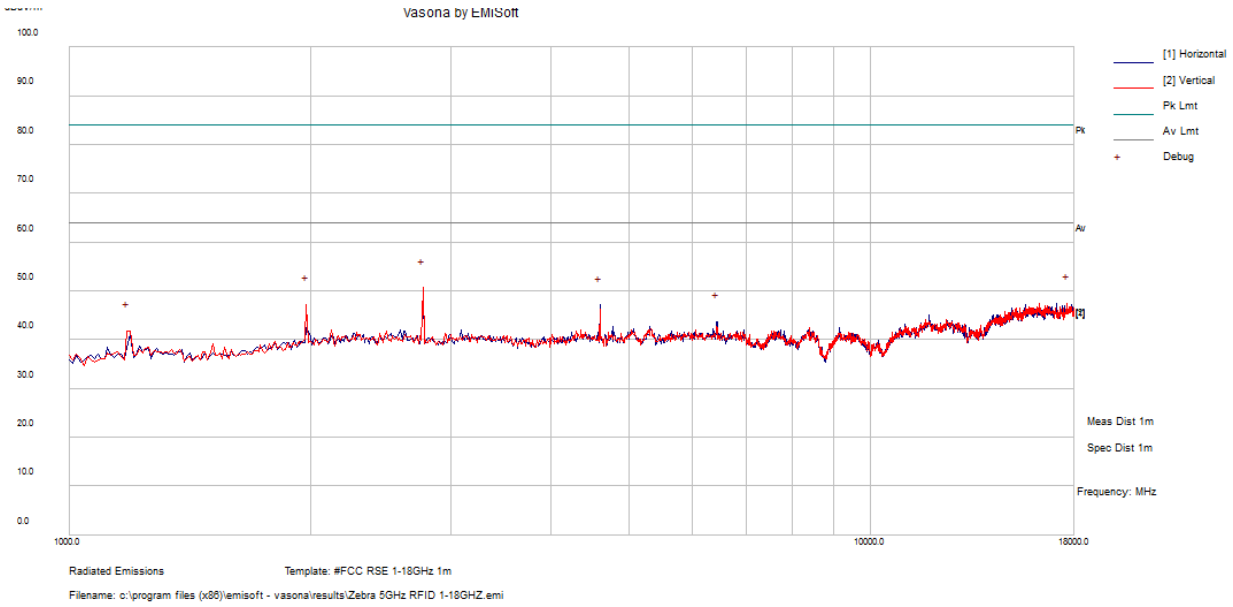
2) 1 – 18 GHz Worst Case, Measured at 1 meter

Wi-Fi 802.11b 2412 MHz + RFID 902.75 MHz Colocation



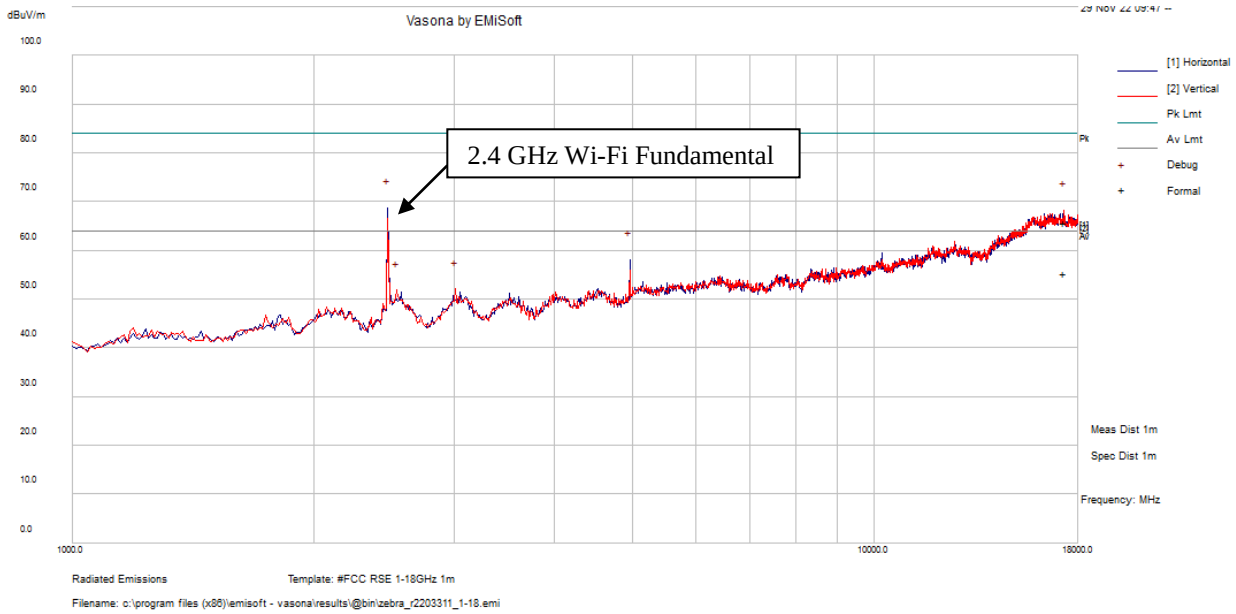
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Avg.)
2413.125	67.07	-8.46	58.62	V	100	0	64	-5.38	Peak
4601.875	54.6	-6.33	48.27	H	200	0	64	-15.73	Peak
17798.13	48.78	-1.57	47.22	H	100	0	64	-16.78	Peak
6440	49.95	-5.58	44.37	V	100	0	64	-19.63	Peak
8352.5	48.73	-5.97	42.76	V	300	0	64	-21.24	Peak
1191.25	55.66	-13.36	42.3	V	200	0	64	-21.7	Peak

Wi-Fi 802.11a 5260 MHz + RFID 902.75 MHz Colocation



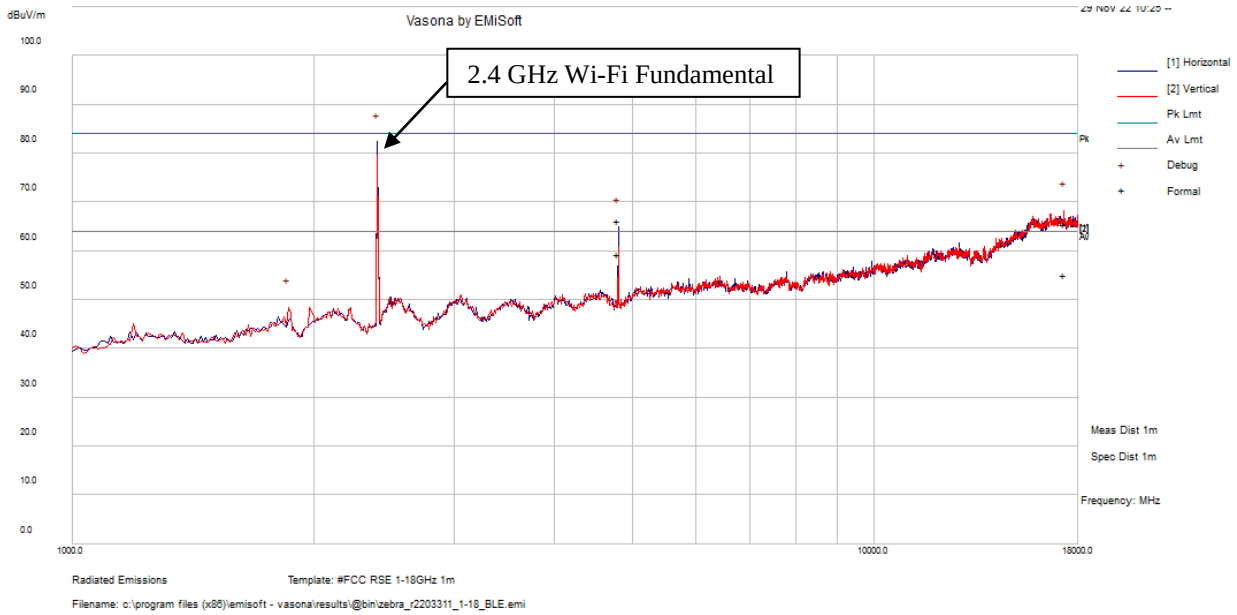
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
1180.625	55.29	-13.48	41.81	V	300	0	64	-22.19	Peak
1977.5	57.1	-9.82	47.28	V	200	0	64	-16.72	Peak
2763.75	58.98	-8.33	50.65	V	100	0	64	-13.35	Peak
4601.875	53.43	-6.33	47.1	H	200	0	64	-16.9	Peak
6440	49.28	-6.00	43.69	H	200	0	64	-20.31	Peak
17617.5	49.11	-1.62	47.49	V	200	0	64	-16.51	Peak

Bluetooth Classic 2402 MHz + RFID 902.75 MHz Colocation



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Avg.)
17300.58	47.6	18.13	65.73	V	249	18	84	-18.27	Peak
17300.58	37.05	17.68	55.18	V	249	18	64	-8.82	Average

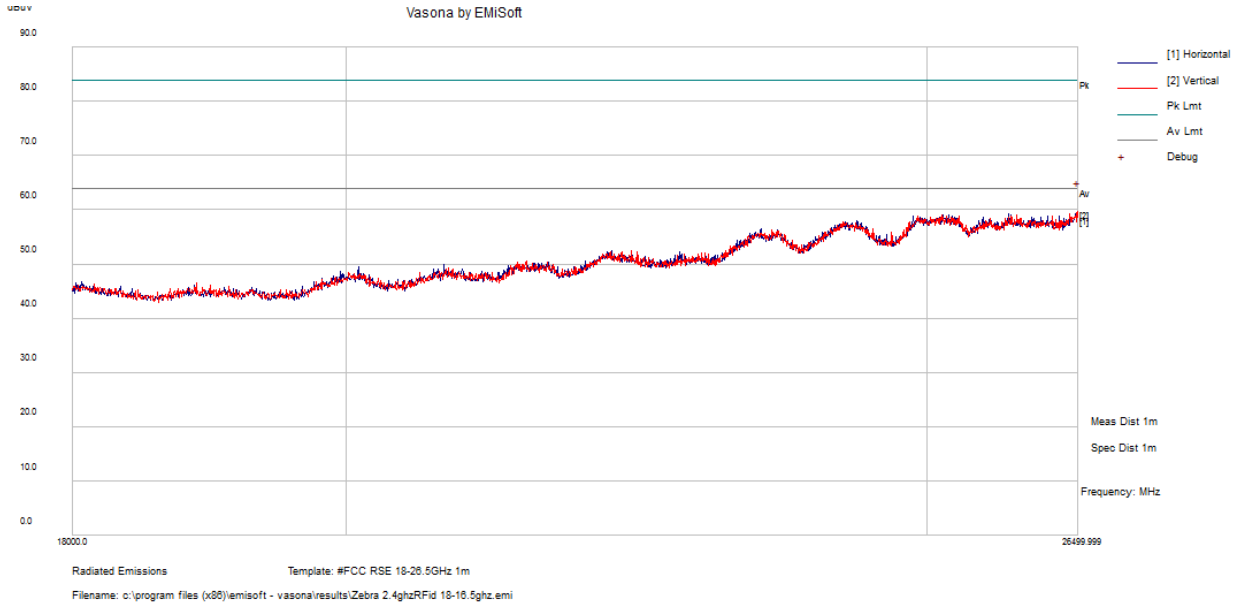
Bluetooth Low Energy 2402 MHz + RFID 902.75 MHz Colocation



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Avg.)
17290.03	47.39	18.12	65.51	V	156	88	84	-18.49	Peak
4803.958	62.86	3.23	66.09	H	114	216	84	-17.91	Peak
17290.03	36.96	18.12	55.08	V	156	88	64	-8.92	Average
4803.958	56.11	3.22	59.33	H	216	216	64	-4.67	Average

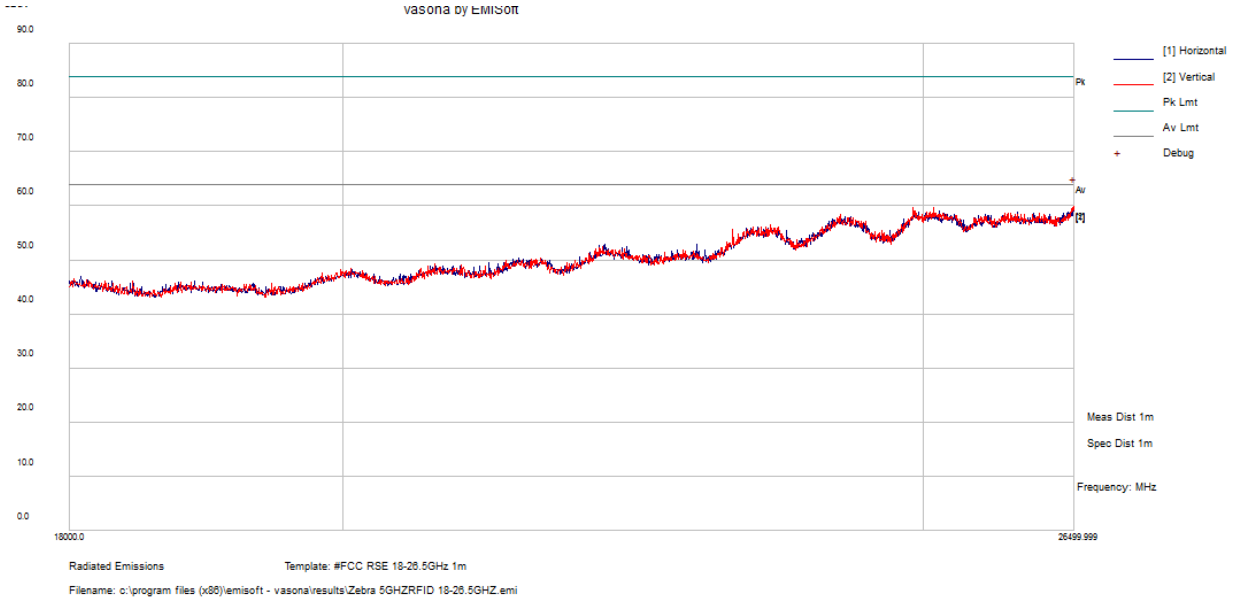
3) 18 - 26.5 GHz Worst Case, Measured at 1 meter

Wi-Fi 802.11b 2412 MHz + RFID 902.75 MHz Colocation



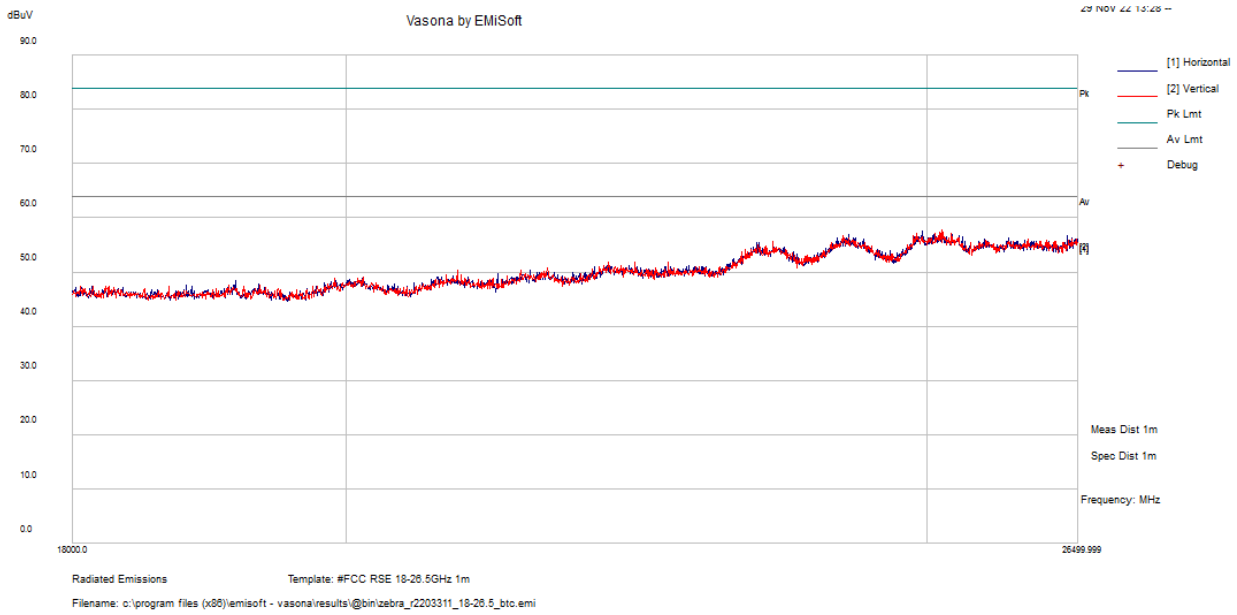
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Avg.)
26500	36.63	3.22	59.91	V	100	0	64	-4.09	Peak

Wi-Fi 802.11a 5260 MHz + RFID 902.75 MHz Colocation



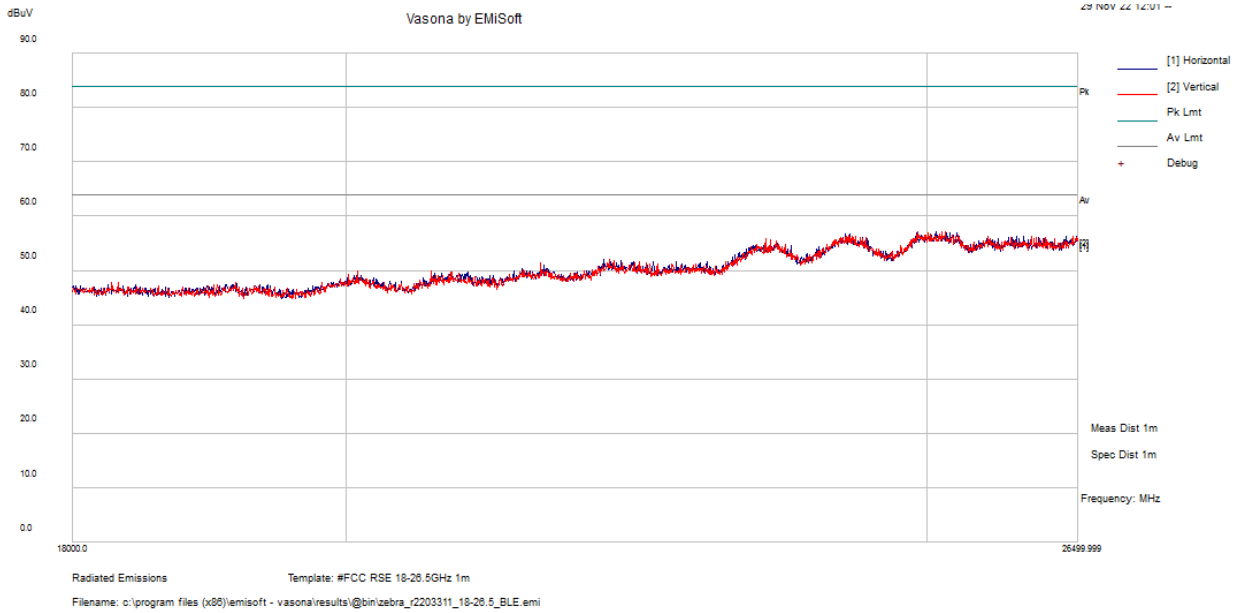
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
26494.69	36.71	23.23	59.94	V	100	0	64	-4.06	Peak

Bluetooth Classic 2402 MHz + RFID 902.75 MHz Colocation



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Avg.)
25146.96	37.59	18.49	56.08	V	101	352	64	-7.92	Peak

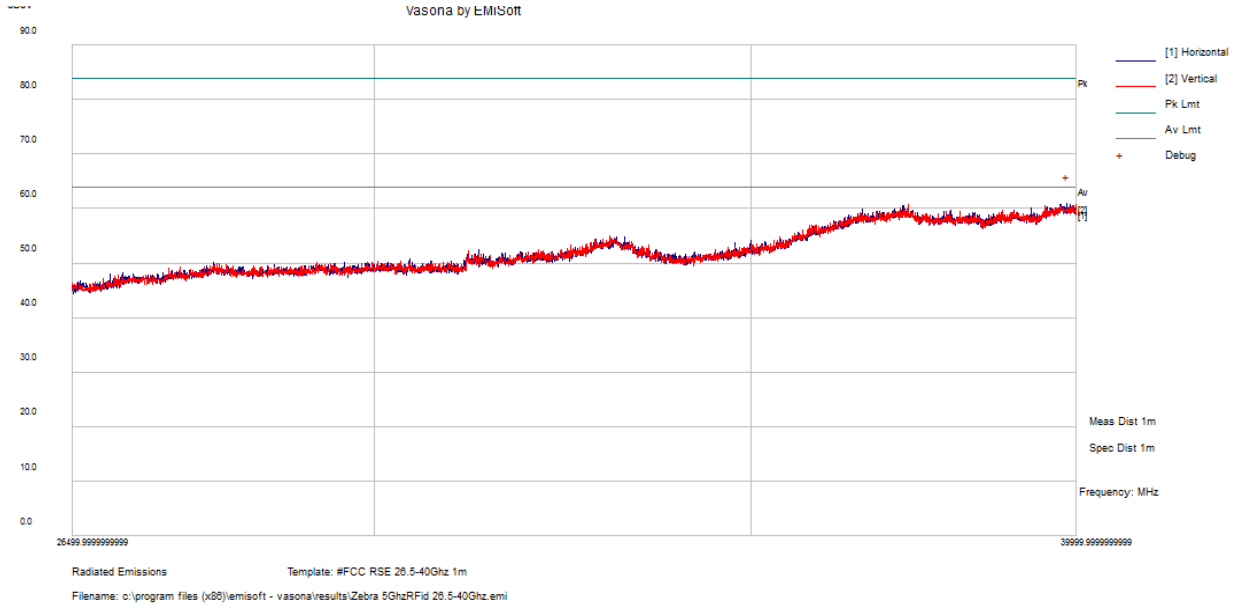
Bluetooth Low Energy 2402 MHz + RFID 902.75 MHz Colocation



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Avg.)
24948.36	37.62	18.47	56.09	H	150	0	64	-7.91	Peak

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

Wi-Fi 802.11a 5260 MHz + RFID 902.75 MHz Colocation



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Ave.)
39843.91	44.93	15.96	60.89	H	64	0	64	-3.11	Peak

8 Annex A (Normative) – EUT Test Setup Photographs

Please refer to the attachment.

9 Annex B (Normative) – Host Device External Photographs

Please refer to the attachment

10 Annex C (Normative) – Host Device Internal Photographs

Please refer to the attachment

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 17025:2017 *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 21st day of December 2022.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2024

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 ---