FCC PART 15, SUBPART C
ISEDC RSS-247, ISSUE 3, AUGUST 2023

TEST REPORT

For

Brilliant Home Technology Inc.

155 Bovet Road Suite 500
San Mateo, CA 94402, USA

FCC ID: 2APQV-BCPUSMG
IC: 23875-BCPCAMG

Report Type:	**Product Type:**
Original Report	Control Panel

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Report Number:	R2310194-247 DTS	
Report Date:	2024-03-20	
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ACCREDITED
CERTIFICATE #3297.02

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2310194-247 DTS	Original Report	2024-03-20

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test was prepared on behalf of Brilliant Home Technology Inc., and their product model: 4-Switch BHA120US-WH4 F4.2, FCC ID: 2APQV-BCPUSMG, IC: 23875-BCPCAMG, the "EUT" as referred to in this report. The EUT has 2.4 GHz/5 GHz Wi-Fi and 2.4 GHz BLE capabilities.

Model Number	4-Switch BHA120US-WH4 F4.2
FCC ID	2APQV-BCPUSMG
IC	23875-BCPCAMG
Device Description	Control Panel
Operating Frequency	2400-2483.5 MHz
Modes supported	802.11a/b/g/n20/n40/ac80, GFSK(BLE)
Omnidirectional Antenna Gain	1.1 dBi (Wi-Fi Ant 1), 0 dBi (Wi-Fi Ant 2), 1.8 dBi (BLE Ant)

1.2 Objective

This report is prepared on behalf of *Brilliant Home Technology Inc.* in accordance with Part 2, Subpart J, and Part 15, Subpart C of the Federal Communication Commission's rules and ISEDC RSS-247 Issue 3, August 2023.

The objective was to determine compliance with FCC Part 15.247 and ISEDC RSS-247 for Antenna Requirement, RF Exposure, AC Line Conducted Emissions, Emission Bandwidth, and Radiated& Conducted Spurious Emissions, 100 kHz Band Edges, Maximum Output Power, and Peak Power Spectrum Density

In order to determine compliance, the manufacturer or a contracted laboratory makes measurements and takes the necessary steps to ensure that the equipment complies with the appropriate technical standards.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product maybe which result in lowering the immunity should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing and/or I/O cable changes, etc.).

1.3 Mechanical Description of EUT

Dimensions: 21 cm (Length) 13.2 cm (Width) 0.8 cm (Height).
Weight: 0.25 kg
Serial Number: FA4AMS20F2
EUT Photos: See Attachments Appendix B and Appendix C.

1.4 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment Class: NII with FCC ID: 2APQV-BCPUSMG, IC: 23875-BCPCAMG

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB 558074 D01 DTS Meas Guidance v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

1.6 Measurement Uncertainty

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

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

1.7 Test Facility Registrations

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

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

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

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

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2017 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.

2.2 EUT Exercise Software

The test utility used was "Tera Term", the software is compliant with the standard requirements being tested against.

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

Radio	Frequency (MHz)	Mode	Power Setting
2.4 GHz Wi-Fi	2412	802.11b	20
	2437		20
	2462		21
	2412	802.11g	17
	2437		17
	2462		17
	2412	802.11n20	17
	2437		16
	2462		16
	2422	802.11n40	16
	2437		16
	2452		16
2.4 GHz BLE	2402	1M PHY	7
	2440		7
	2480		7
	2402	2M PHY	7
	2440		7
	2480		7

Wi-Fi and BLE Data Rates Tested:
802.11b mode: 1Mbps
802.11g mode: 6Mbps
802.11n HT20 mode: MCS0
802.11n HT40 mode: MCS0
1M PHY: 1Mbps
2M PHY: 2Mbps

2.3 Duty Cycle Correction Factor

According to FCC KDB 558074 D01 DTS Meas Guidance v05r02 section 6:

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).

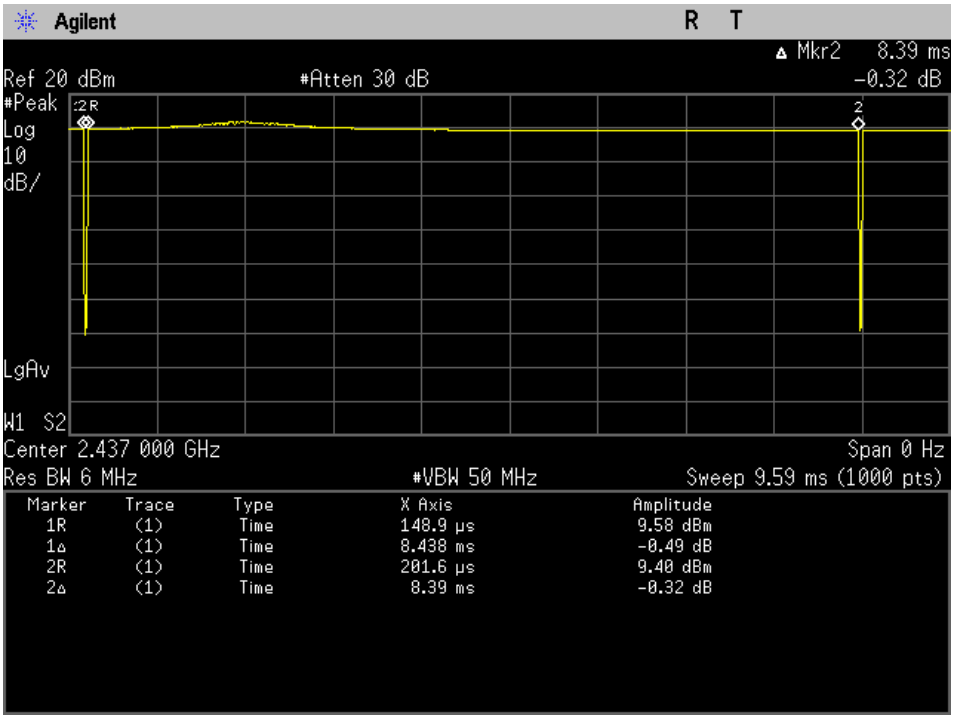
When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternate procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle. The duty cycle is considered to be constant if variations are less than ± 2%, otherwise the duty cycle is considered to be non-constant.

Radio	Radio Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
2.4 GHz Wi-Fi	802.11b	8.39	8.438	99.43	0.03
	802.11g	1.389	1.445	96.12	0.17
	802.11n20	1.298	1.352	96.01	0.18
	802.11n40	-	-	100	0
2.4 GHZ BLE	1Mbps	2.1324	2.4957	85.44	0.68
	2Mbps	1.0628	1.8658	56.96	2.44

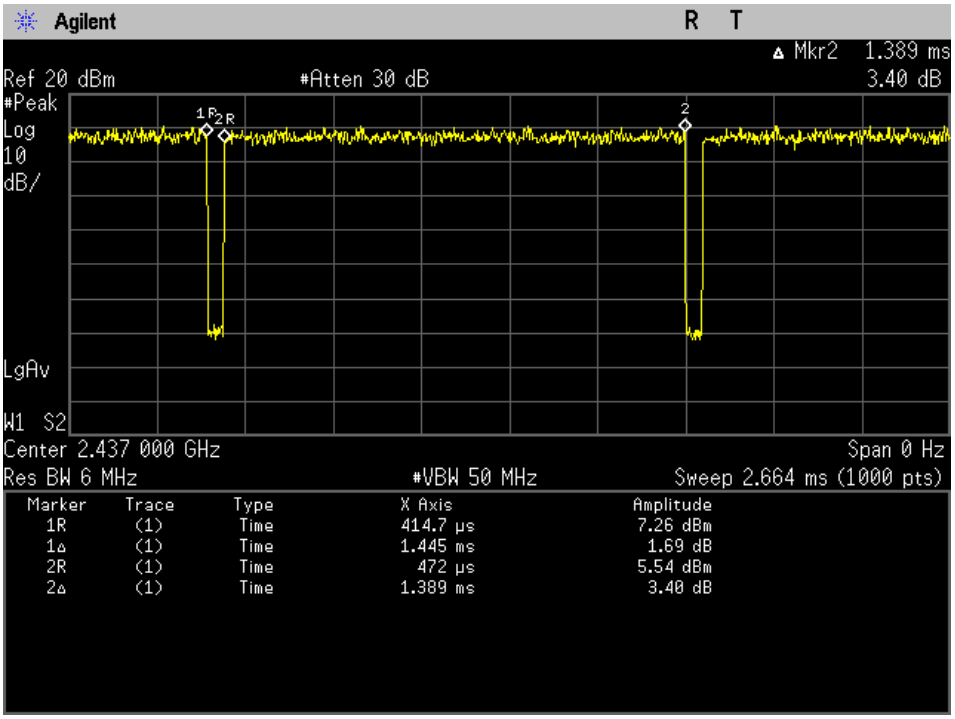
*Note: Duty Cycle Correction Factor = 10*log(1/duty cycle)*

Please refer to the following plots.

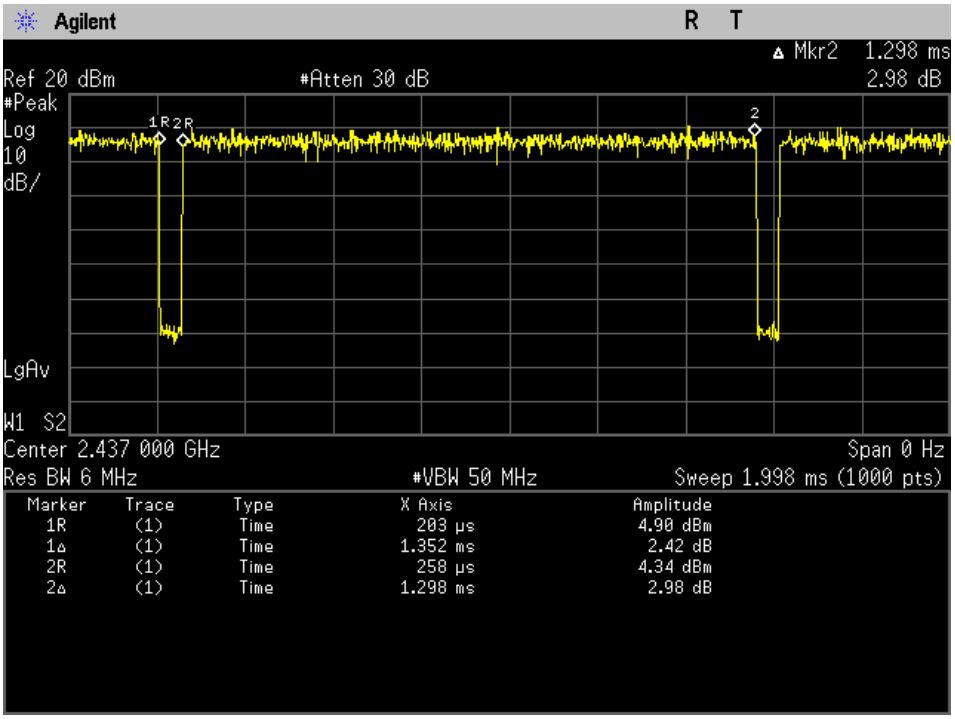
802.11b mode



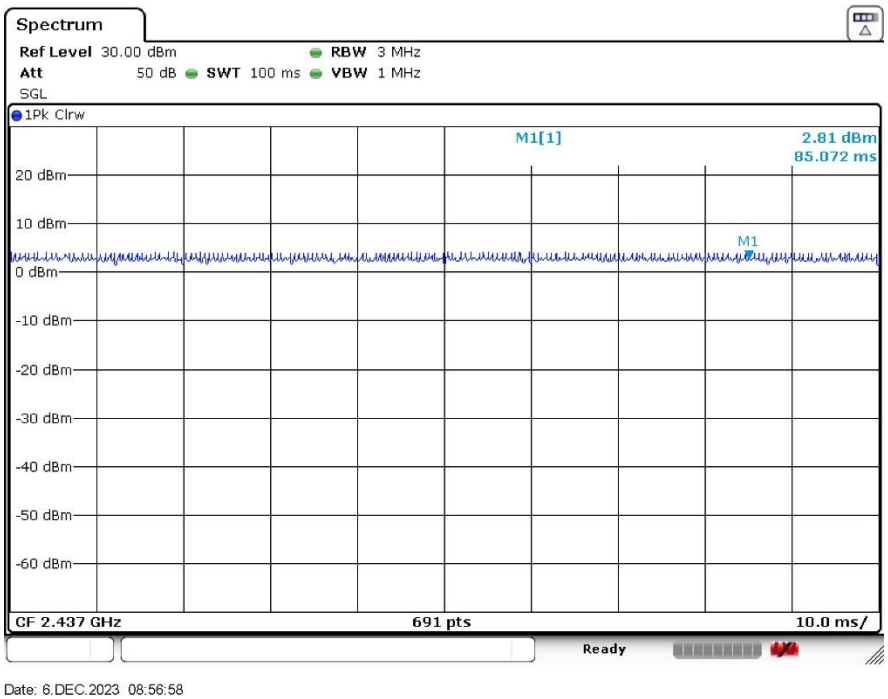
802.11g mode



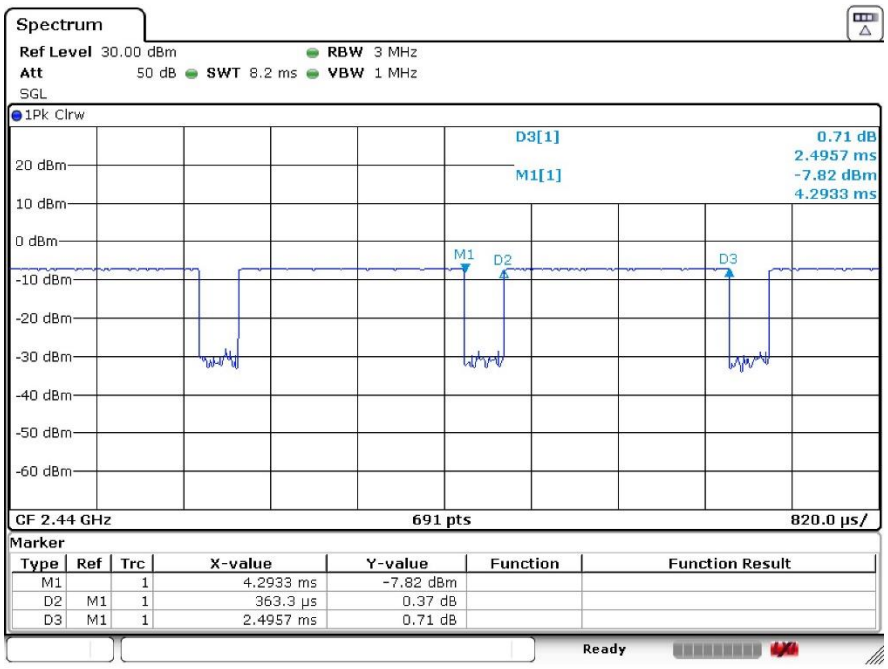
802.11n20 mode



802.11n40 mode



BLE 1Mbps



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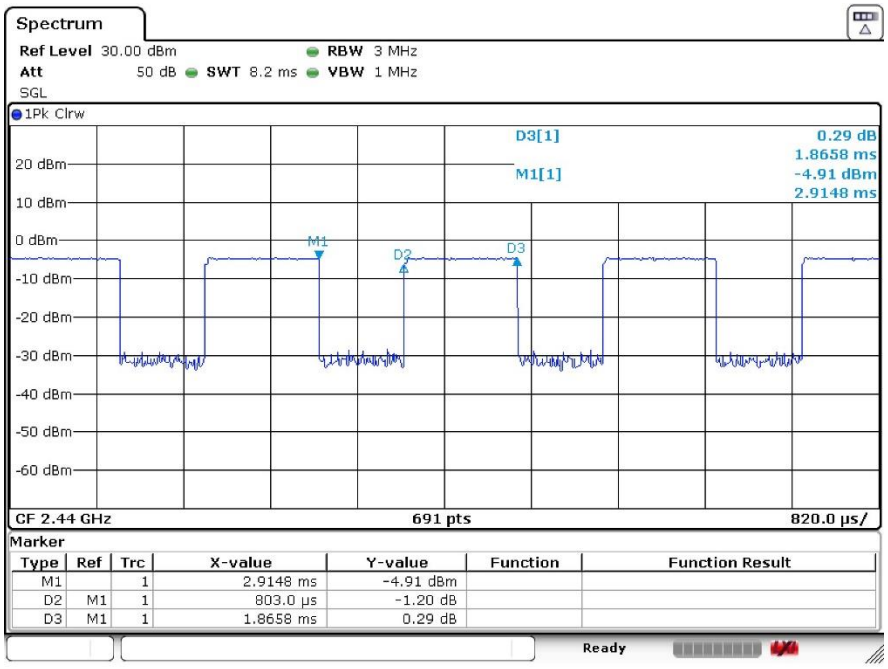
BLE 2Mbps



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2.4 Equipment Modification

None.

2.5 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude 5410

2.6 Remote Support Equipment

Manufacturer	Description	Model
-	USB/Serial Breakout	213-00068 Rev 1

2.7 Interface Ports and Cabling

Cable Descriptions	Length (m)	From	To
USB to TTL UART Serial Cable	1.5	EUT	Laptop

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
FCC §15.247(a)(2) ISEDC RSS-247 §5.2 RSS-Gen §6.7	6 dB & 99% Emission Bandwidth	Compliant
FCC §15.247(b)(3) ISEDC RSS-247 §5.4	Maximum Output Power	Compliant
FCC §15.247(d) ISEDC RSS-247 §5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(e) ISEDC RSS-247 §5.2(2)	Peak Power Spectral Density	Compliant
FCC §2.1051, §15.247 (d) ISEDC RSS-247 §5.5	Spurious Emissions at Antenna Port	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

Antenna	External/Internal/ Integral	Antenna Type	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
Wi-Fi Ant 1	Internal	PCB	2400-2483.5	1.1
Wi-Fi Ant 2	Internal	PCB	2400-2483.5	0
BLE Ant	Internal	PCB	2400-2483.5	1.8

Note: Antenna gain was provided by the *Brilliant Home Technology Inc*.
For MIMO configs (i.e. 802.11n): MIMO antenna gain is 3.60 dBi.

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

5.1 Applicable Standards

As per FCC §1.1310(d) (3), At operating frequencies above 6 GHz, the MPE limits listed in Table 1 in paragraph (e)(1) of this section shall be used in all cases to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part.

TABLE 1 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*($900/f^2$)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*($180/f^2$)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

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

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 Footnote6 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 x 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 MPE Prediction

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

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

Where: S = power density
EIRP = Effective Isotropic Radiated Power
R = distance to the center of radiation of the antenna

5.3 MPE Results for FCC

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)
2.4 GHz Wi-Fi	2462	1.1	20.73	21.83	152.41	0.03	1.0
5 GHz Wi-Fi	5825	4.77	17.78	22.55	179.89	0.04	1.0
BLE	2402	1.8	12.56	14.36	27.29	0.01	1.0

5.4 RF exposure evaluation exemption for IC

2.4 GHz Wi-Fi

The EIRP of this device is 21.83 dBm (152.41 mW) which is less than the exemption threshold, i.e., 1.31*10^(-2) * f^(0.6834)=2.72W. Therefore, the RF exposure evaluation is exempt.

5 GHz Wi-Fi

The EIRP of this device is 22.55 dBm (179.89 mW) which is less than the exemption threshold, i.e., 1.31*10^(-2) * f^(0.6834)=4.9W. Therefore, the RF exposure evaluation is exempt.

BLE

The EIRP of this device is 14.36 dBm (27.29mW) which is less than the exemption threshold, i.e., 1.31*10^(-2) * f^(0.6834)=2.68W. Therefore, the RF exposure evaluation is exempt.

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:

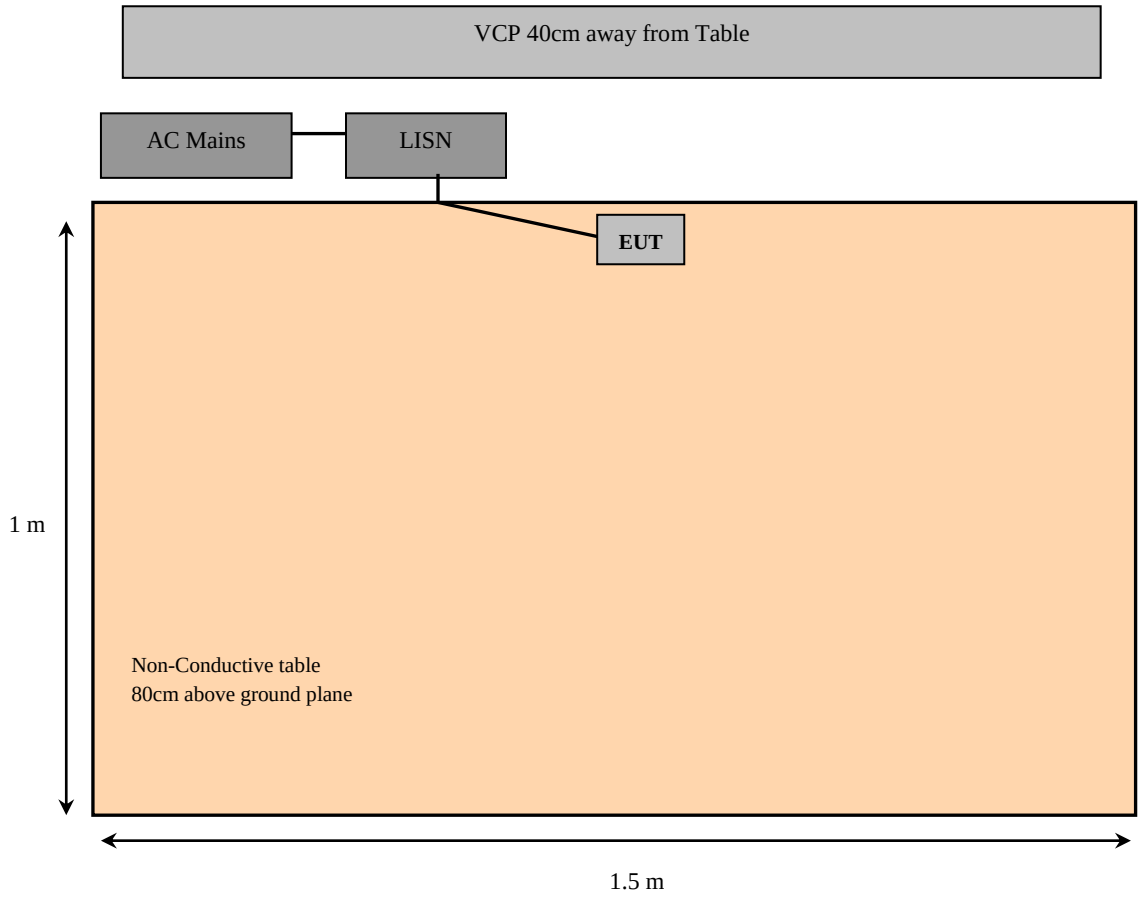
CA = Ai + CL + Atten

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 & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2023-06-16	1 year
681	Rohde & Schwarz	Impulse Limiter	ESH3-Z2	101962	2024-01-04	6 months
726	Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2024-01-08	6 months
732	FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2023-09-12	1 year
1241	Pasternack	RG223 Coaxial cable 1500cm	PE3447-1500cm	N/A	2024-01-02	6 months

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:	22ºC
Relative Humidity:	49%
ATM Pressure:	102.6 kPa

The testing was performed by Steven Lianto on 2024-02-04 in 5m chamber 3

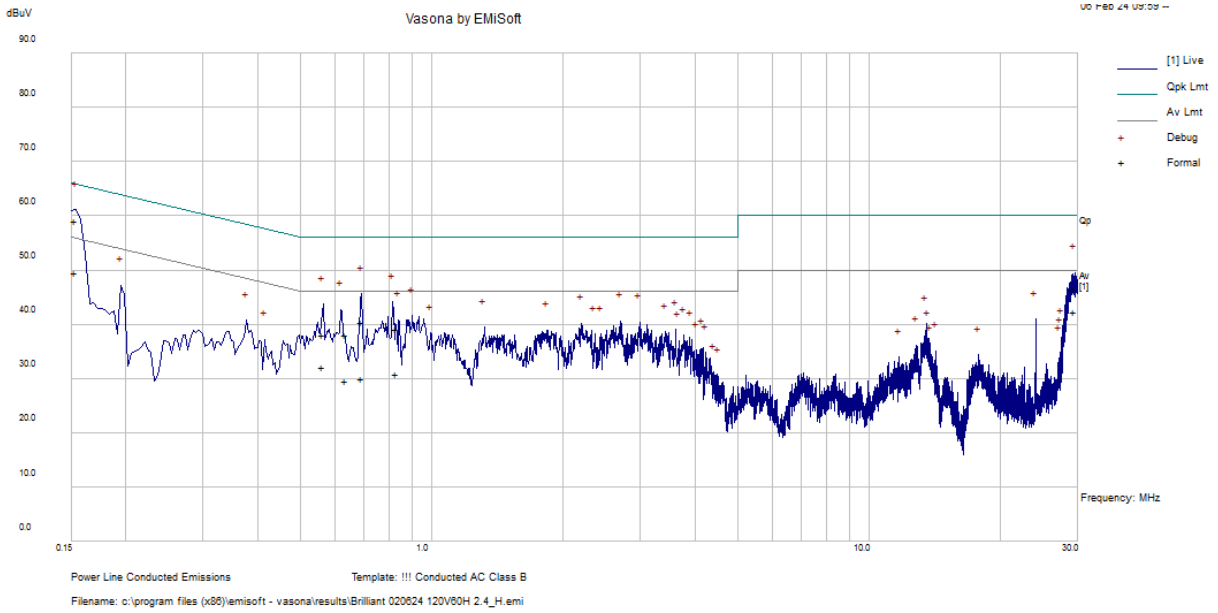
6.8 Summary of Test Results

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/Mode	**Margin (dB)**	**Frequency (MHz)**	**Conductor Mode (Live/Neutral)**	**Range (MHz)**
GFSK	-6.15	28.82335	Neutral	0.15-30
802.11b	-5.51	0.150284	Neutral	0.15-30

6.9 Conducted Emissions Test Plots and Data

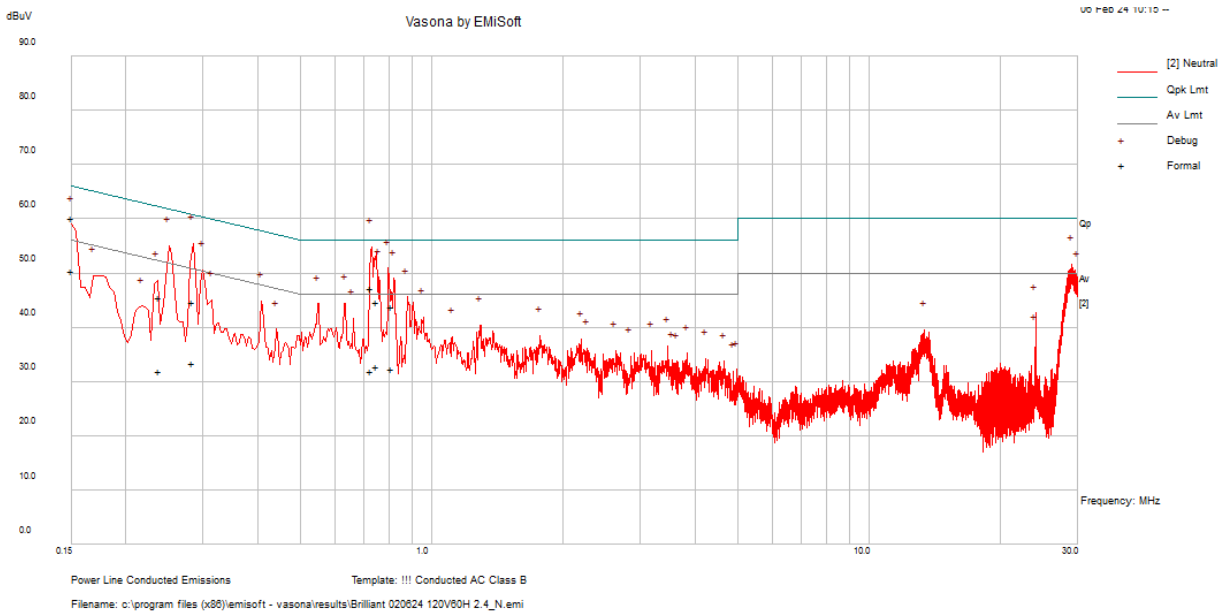
2.4G WIFI
120 V, 60 Hz – Live



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.153156	59.08	Live	65.83	-6.75	QP
0.690402	40.32	Live	56	-15.68	QP
29.50665	46.28	Live	60	-13.72	QP
0.827617	39.19	Live	56	-16.81	QP
0.564125	37.98	Live	56	-18.02	QP
0.633975	38.13	Live	56	-17.87	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.153156	49.64	Live	55.83	-6.18	Ave.
0.690402	29.96	Live	46	-16.04	Ave.
29.50665	42.24	Live	50	-7.76	Ave.
0.827617	30.79	Live	46	-15.21	Ave.
0.564125	32.1	Live	46	-13.9	Ave.
0.633975	29.53	Live	46	-16.47	Ave.

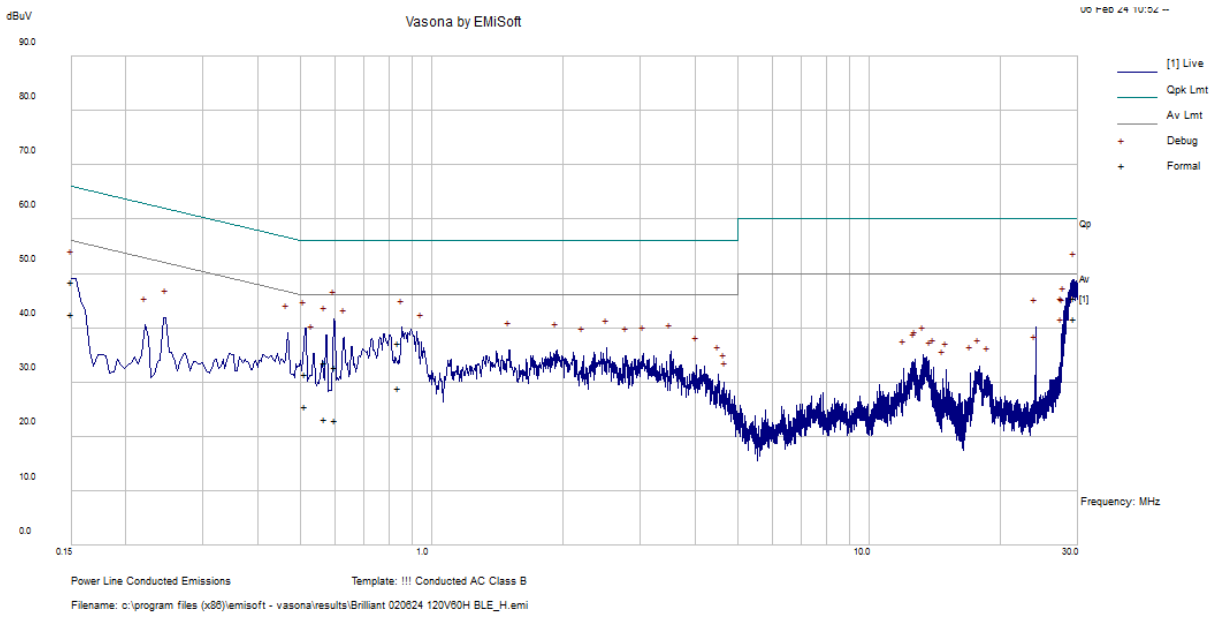
2.4G WIFI
120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.725143	47.26	Neutral	31.93	-8.74	QP
0.80941	43.88	Neutral	32.3	-12.12	QP
0.283812	44.57	Neutral	33.35	-16.13	QP
0.237863	45.52	Neutral	31.84	-16.65	QP
0.748227	44.68	Neutral	32.66	-11.32	QP
0.150284	60.19	Neutral	50.47	-5.8	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.725143	31.93	Neutral	46	-14.07	Ave.
0.80941	32.3	Neutral	46	-13.7	Ave.
0.283812	33.35	Neutral	50.7	-17.35	Ave.
0.237863	31.84	Neutral	52.17	-20.33	Ave.
0.748227	32.66	Neutral	46	-13.34	Ave.
0.150284	50.47	Neutral	55.98	-5.51	Ave.

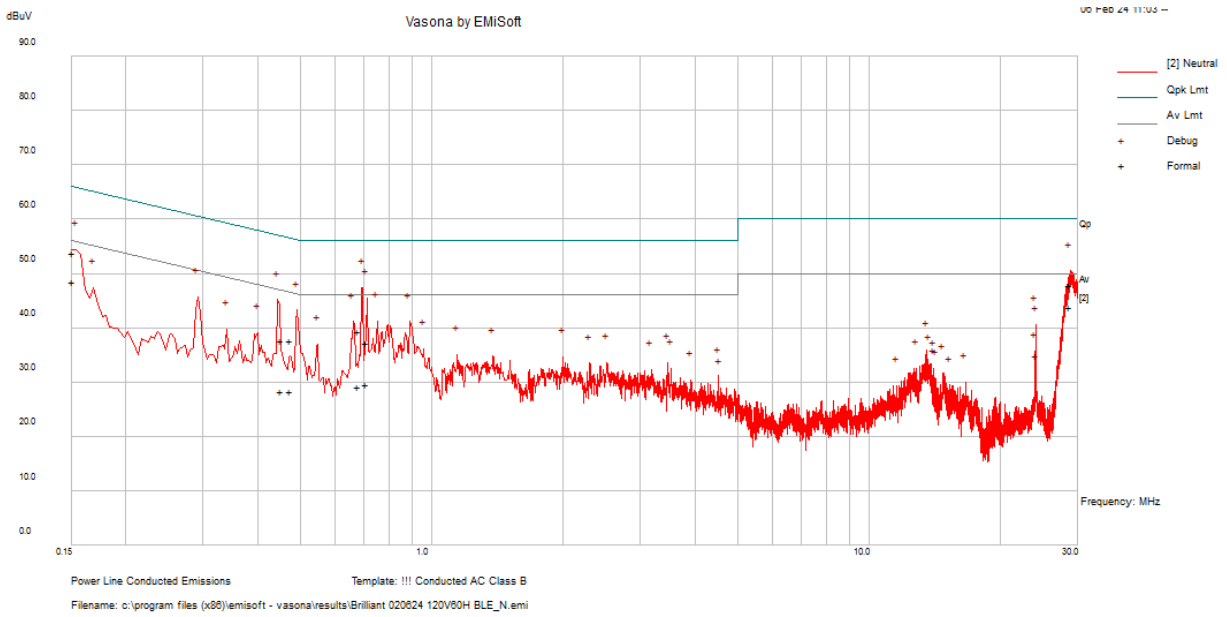
BLE
120 V, 60 Hz – Live



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
29.38612	45.54	Live	60	-14.46	QP
0.602442	32.75	Live	56	-23.25	QP
0.838712	37.13	Live	56	-18.87	QP
0.515376	31.55	Live	56	-24.45	QP
0.150064	48.49	Live	66	-17.51	QP
0.569806	33.56	Live	56	-22.44	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
29.38612	41.7	**Live**	50	-8.3	**Ave.**
0.602442	22.97	Live	46	-23.03	Ave.
0.838712	28.95	Live	46	-17.05	Ave.
0.515376	25.53	Live	46	-20.47	Ave.
0.150064	42.5	Live	56	-13.5	Ave.
0.569806	23.09	Live	46	-22.91	Ave.

BLE
120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.680813	39.32	Neutral	56	-16.68	QP
28.82335	47.78	Neutral	60	-12.22	QP
0.709653	37.25	Neutral	56	-18.75	QP
0.1515	53.9	Neutral	65.92	-12.02	QP
0.451935	37.55	Neutral	56.84	-19.29	QP
0.475802	37.56	Neutral	56.41	-18.86	QP

Frequency (MHz)	Corrected Amplitude (dBuV)	Conductor (Live/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.680813	29.24	Neutral	46	-16.76	Ave.
28.82335	43.85	Neutral	50	-6.15	Ave.
0.709653	29.59	Neutral	46	-16.41	Ave.
0.1515	48.46	Neutral	55.92	-7.46	Ave.
0.451935	28.37	Neutral	46.84	-18.47	Ave.
0.475802	28.25	Neutral	46.41	-18.16	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 where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 – General field strength limits at frequencies above 30 MHz

Frequency (MHz)	Field Strength (µV/m at 3 m)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Table 6 – General field strength limits at frequencies below 30 MHz

Frequency	Field Strength (micro volts/meter)	Measurement Distance (meters)
9 – 490 kHz[Note 1]	6.37/F (F in kHz)	300
490 – 1705 kHz	63.7/F (F in kHz)	30
1.705 – 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

As per ISED RSS-Gen 8.10(c),

Unwanted emissions that do not fall within the restricted frequency bands listed in table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

Table 7 – Restricted frequency bands[Note 1]

MHz	MHz	GHz
0.090 – 0.110	149.9 – 150.05	9.0 – 9.2
0.495 – 0.505	156.52475 – 156.52525	9.3 – 9.5
2.1735 – 2.1905	156.7 – 156.9	10.6 – 12.7
3.020 – 3.026	162.0125 –167.17	13.25 – 13.4
4.125 – 4.128	167.72 – 173.2	14.47 – 14.5
4.17725 – 4.17775	240 – 285	15.35 – 16.2
4.20725 – 4.20775	322 – 335.4	17.7 – 21.4
5.677 – 5.683	399.9 – 410	22.01 – 23.12
6.215 – 6.218	608 – 614	23.6 – 24.0
6.26775 – 6.26825	960 – 1427	31.2 – 31.8
6.31175 – 6.31225	1435 – 1626.5	36.43 – 36.5
8.291 – 8.294	1645.5 – 1646.5	Above 38.6
8.362 – 8.366	1660 – 1710	
8.37625 – 8.38675	1718.8 – 1722.2	
8.41425 – 8.41475	2200 – 2300	
12.29 – 12.293	2310 – 2390	
12.51975 – 12.52025	2483.5 – 2500	
12.57675 – 12.57725	2655 – 2900	
13.36 – 13.41	3260 – 3267	
16.42 – 16.423	3332 – 3339	
16.69475 – 16.69525	3345.8 – 3358	
16.80425 – 16.80475	3500 – 4400	
25.5 – 25.67	4500 – 5150	
37.5 – 38.25	5350 – 5460	
73 – 74.6	7250 – 7750	
74.8 – 75.2	8025 – 8500	
108 – 138		

Note 1: Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for license-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

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

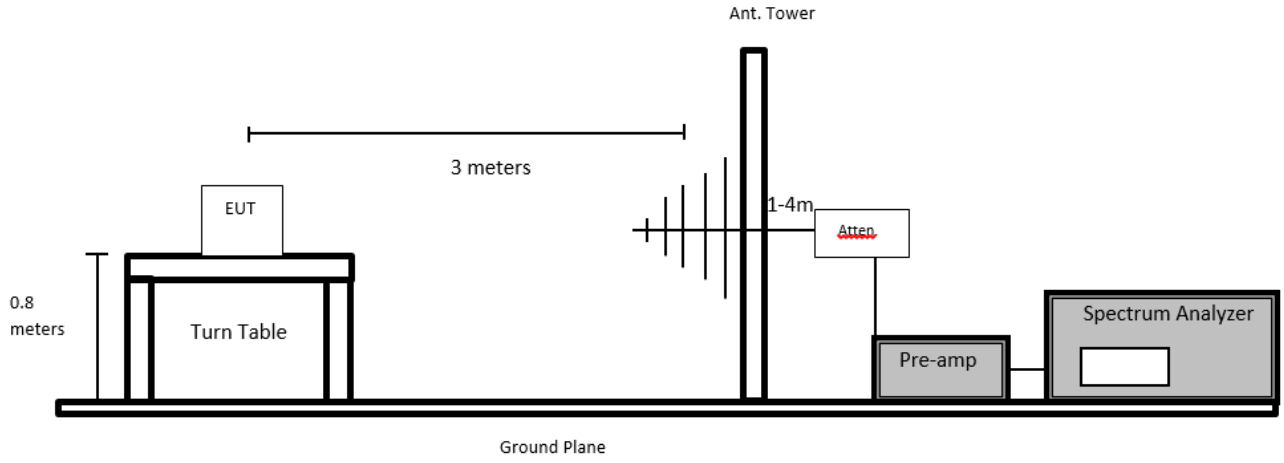
The radiated emissions tests were performed in the 5-meter chamber and 10-meter chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart C and ISEDC RSS-247.

The spacing between the peripherals was 10 centimeters.

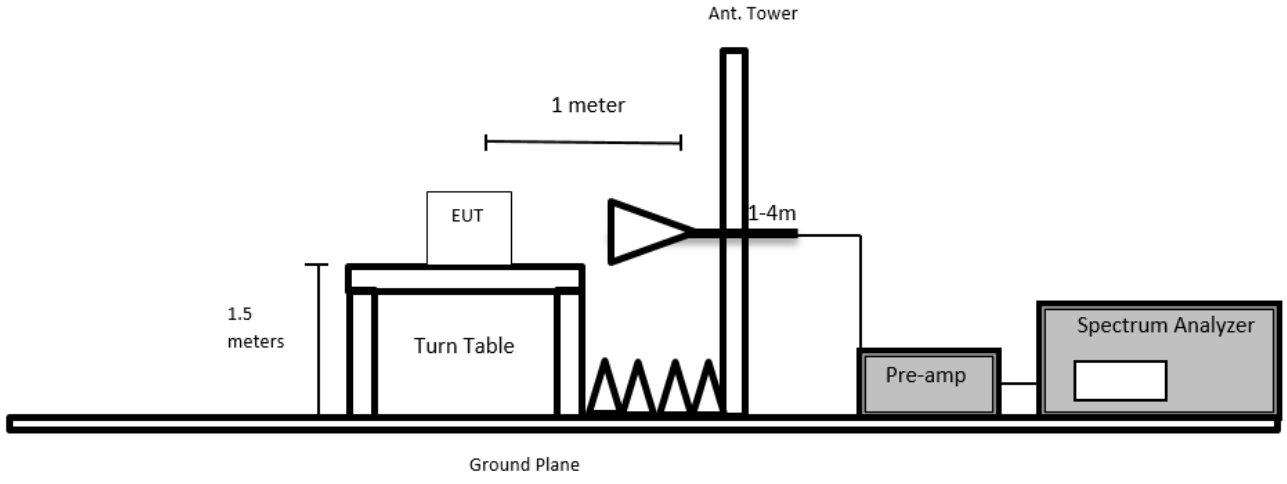
External I/O cables were draped along the edge of the test table and bundled when necessary.

7.3 Test Setup Diagrams

Below 1 GHz



Above 1 GHz



7.4 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

7.5 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

7.6 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
310	Rohde & Schwarz	EMI Test Receiver 9 KHZ to 3 GHZ	ESCI 1166.5950.03	100338	2023-05-11	1 year
424	Agilent	Spectrum Analyzer	E4440A	US45303156	2022-12-19	15 months
624	Agilent	Spectrum Analyzer	E4446A	MY48250238	2023-05-12	1 year
327	Sunol Sciences	System Controller	SC110V	122303-1	N/R	N/R
1075	Sunol Sciences	Boresight Tower	TLT3	050119-7	N/R	N/R
1388	Sunol Sciences	Flush Mount Turntable	FM	112005-2	N/R	N/R
316	Sonoma Instruments	Preamplifier	317	260406	2023-09-26	6 months
321	Sunol Sciences	Biconilog Antenna	JB3	A020106-2; 1504	2023-12-18	2 years
1186	Pasternack	Coaxial Cable, RG214	PE3062-1050CM	N/A	2023-10-03	6 months
1245	-	6dB Attenuator	PE7390-6	01182018A	2023-12-18	2 years
1246	Hewlet Packard	RF Limiter	11867A	01734	2023-04-13	1 year
1248	Pasternack	RG214 COAX Cable	PE3062	N/A	2023-10-04	6 months
1249	Time Microwave	LMR-400 Cable Dc-3 GHz	AE13684	2k80612-5 6fts	2023-10-09	6 months
658	HP/ Agilant	Pre Amplifier	8449B OPT HO2	3008A01103	2023-12-01	6 months
1192	ETS Lindgren	Horn Antenna	3117	00218973	2022-09-29	2 years
1247	Uti flex	Micro - Coax	N/A	N/A	2023-12-01	6 months
1354	RFMW	2.92 mm 10ft RF Cable DC to 40 GHz	P1CA-29M29M-F150-120	N/A	2023-07-24	1 year
672	Micro-Tronics	2.4-2.6 GHz Notch Filter	BRM50701	160	2023-03-09	1 year
91	Wisewave	Horn Antenna	ARH-4223-02	10555-02	2022-03-08	2 years
827	AH Systems	Preamplifier	PAM 1840 VH	170	2023-11-08	6 months
1329	Pasternack	2.92 mm short coaxial cable	PE360-12	N/A	2023-11-28	6 months

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° – 22.5°C
Relative Humidity:	55%
Barometric Pressure:	101.85 kPa

The testing was performed by Arturo Reyes from 2024-01-18 to 2024-02-21 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**
-1.0	17883.125	Horizontal	BLE, 2402 MHz

Note: the device does not produce emissions below 30 MHz thus testing was not performed below 30 MHz

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

7.9 Radiated Emissions Test Results

Note: Below test data are the radiated cabinet emissions, for conducted in-lieu of radiated measurements performed at the antenna port please refer to ANNEX F and ANNEX E.

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

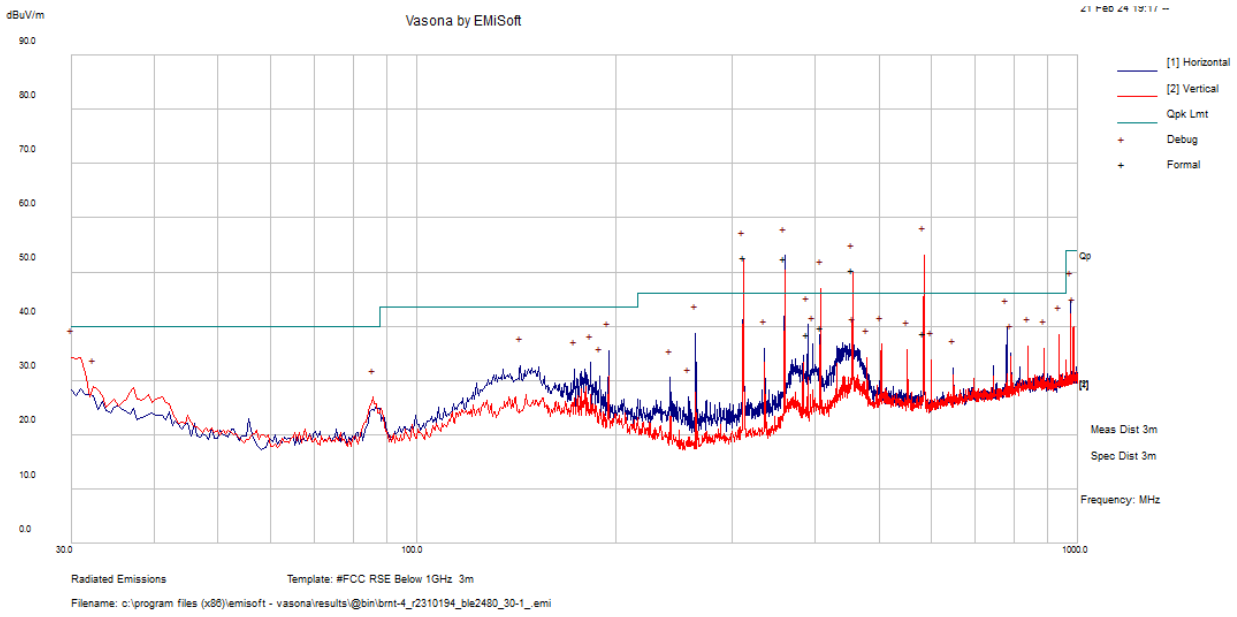
Note[1]: *All peaks exceeding the limit line in the graph fall out of restricted bands and thus 30dBc limit (FCC 15.247(d)/RSS-247 5.5) was instead applied.*

Fundamental measured for Bluetooth LE low channel: (111.31dBuV/m @3m) – 30dB = 81.31 dBuV/m @3m)

Fundamental measured for 802.11b low channel: (118.55dBuV/m @3m) – 30dB = 88.55dBuV/m @3m)

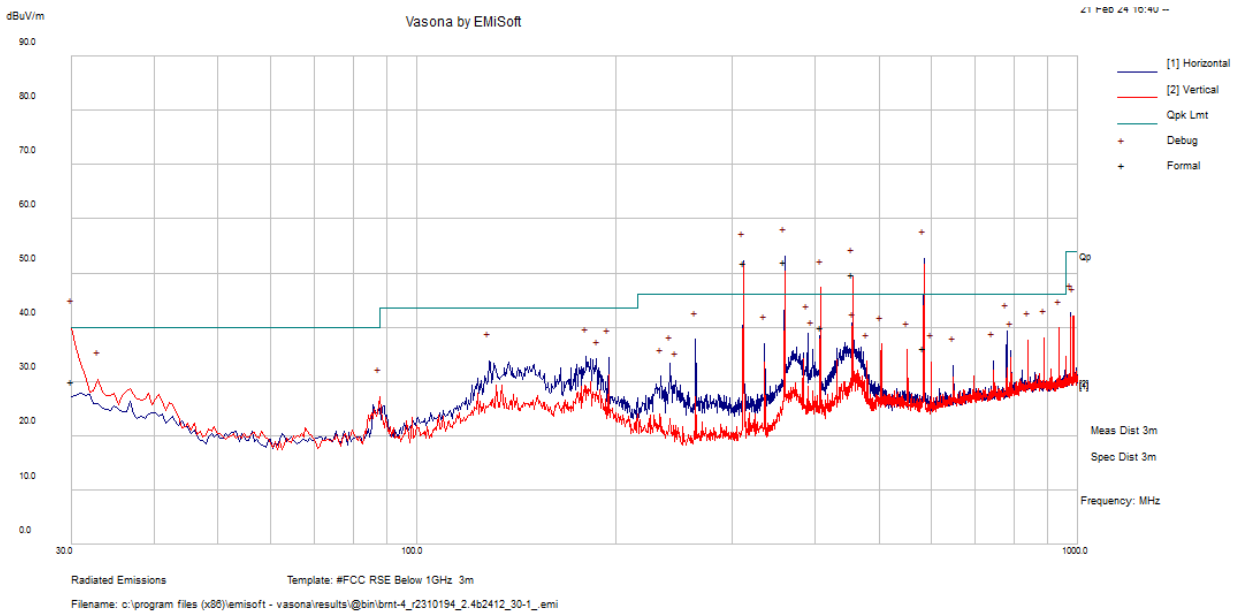
Note: *Pre-scans were performed on all shown configurations in order to determine worst-case results. Following this, a formal scan was performed on the worst-case detailed below*

Worst Case: BLE, 2480 MHz



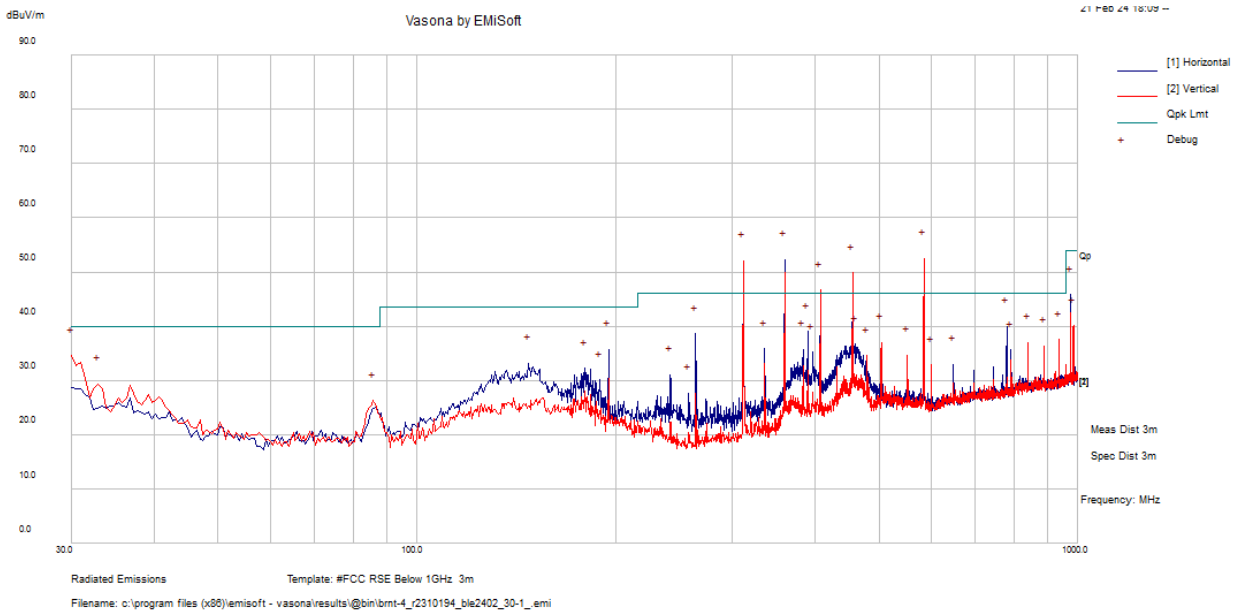
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
585.0755	47.71	-8.99	38.72	100	V	32	46	-7.28	QP
359.98625	66.03	-13.51	52.52	105	H	232	81.31	-28.79	QP
311.9905	67.73	-14.93	52.8	170	V	314	81.31	-28.51	QP
455.9845	61.26	-10.91	50.35	105	V	331	81.31	-30.96	QP
408.05025	52.32	-12.63	39.69	133	V	292	46	-6.31	QP
389.9805	51.72	-13.28	38.44	101	H	136	46	-7.56	QP

Worst Case: 802.11b, 2412 MHz



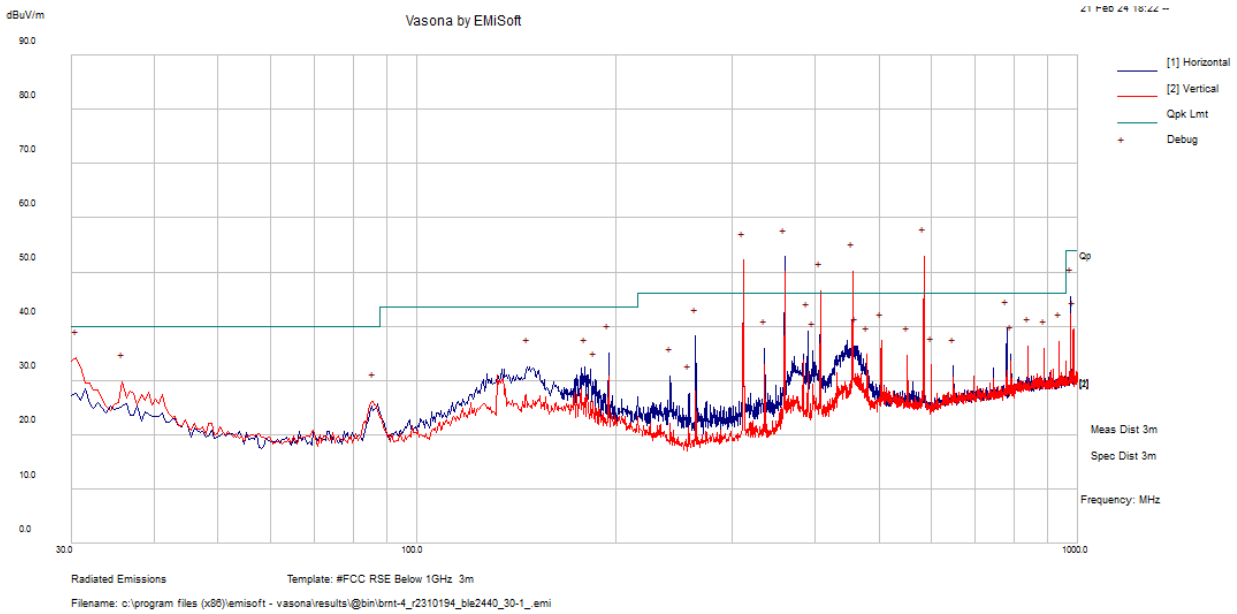
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
359.98675	65.54	-13.51	52.03	103	H	199	88.55	-36.52	QP
585.08725	45.22	-8.99	36.23	205	H	21	46	-9.77	QP
311.99425	66.92	-14.93	51.99	103	H	163	88.55	-36.56	QP
455.98375	60.58	-10.91	49.67	125	V	352	88.55	-38.88	QP
408.05125	52.62	-12.63	39.99	123	V	311	46	-6.01	QP
30	39.6	-9.5	30.1	103	V	206	40	-9.9	QP

BLE, 2402 MHz



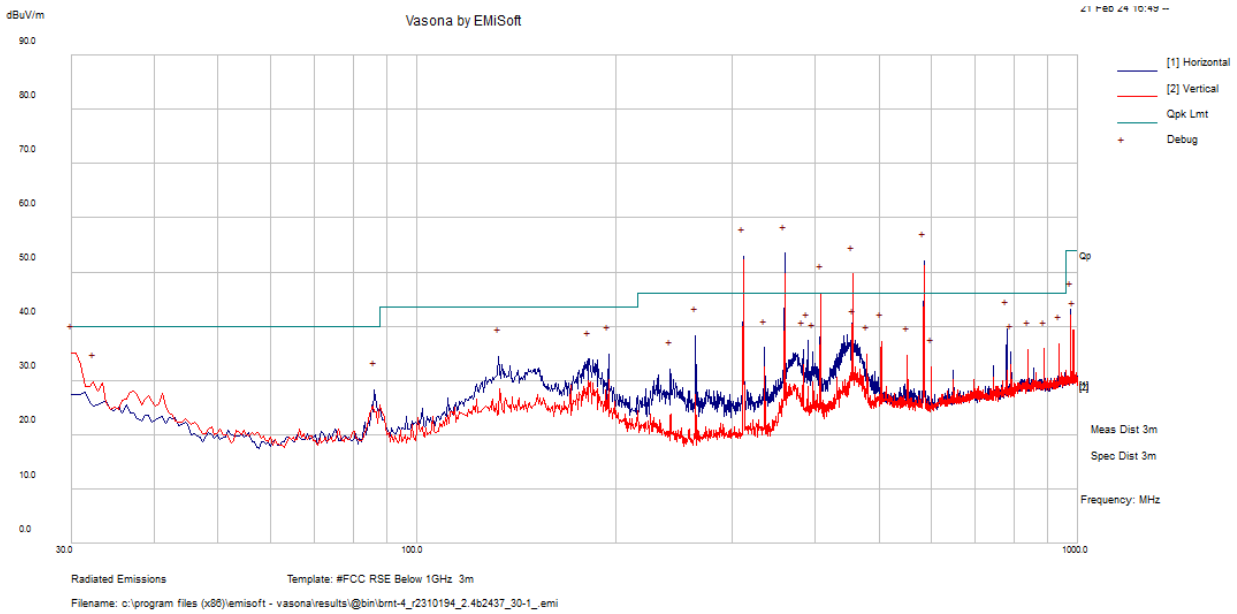
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
585.325	61.5	-9	52.5	100	V	360	81.51	-29.01	Peak
359.8	65.78	-13.52	52.26	100	H	360	81.51	-29.25	Peak
311.785	67.05	-14.94	52.11	200	V	360	81.51	-29.4	Peak
455.83	60.75	-10.92	49.83	100	V	360	81.51	-31.68	Peak
407.815	59.28	-12.64	46.64	100	V	360	81.51	-34.87	Peak
30	44	-9.5	34.5	100	V	360	40	-5.5	Peak

BLE, 2440 MHz



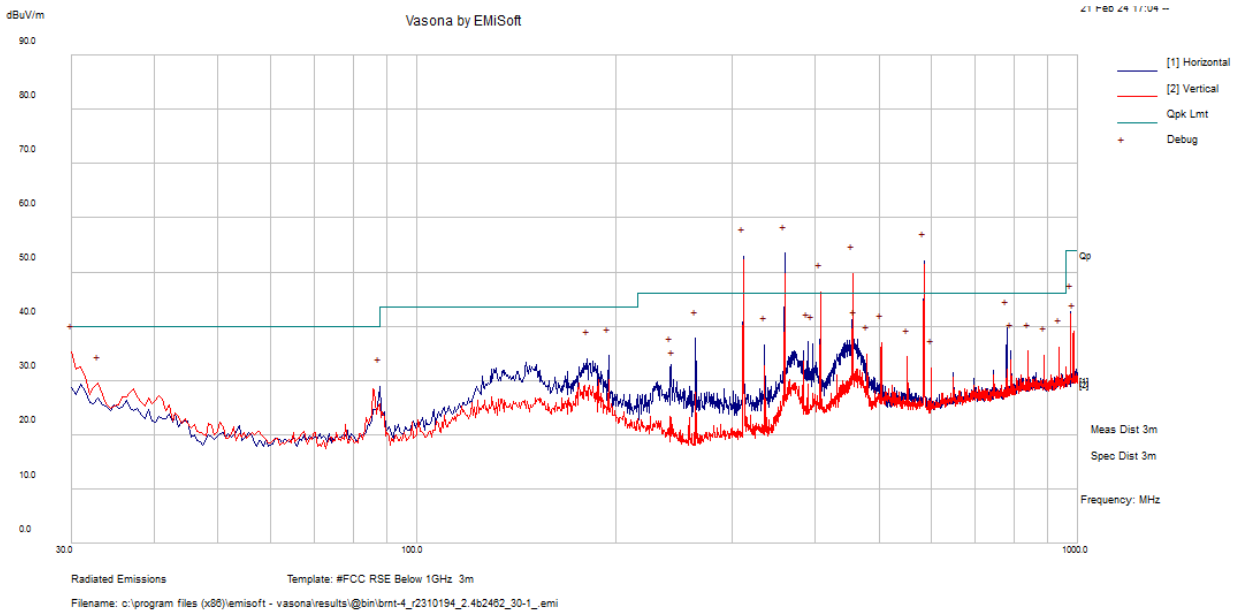
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
585.325	61.92	-9	52.92	100	V	360	81.15	-28.23	Peak
359.8	66.33	-13.52	52.81	100	H	360	81.15	-28.34	Peak
311.785	67.08	-14.94	52.14	100	H	360	81.15	-29.01	Peak
455.83	61.06	-10.92	50.14	100	V	360	81.15	-31.01	Peak
407.815	59.2	-12.64	46.56	100	V	360	81.15	-34.59	Peak
30.485	44.01	-9.93	34.08	200	V	360	40	-5.92	Peak

802.11b, 2437 MHz



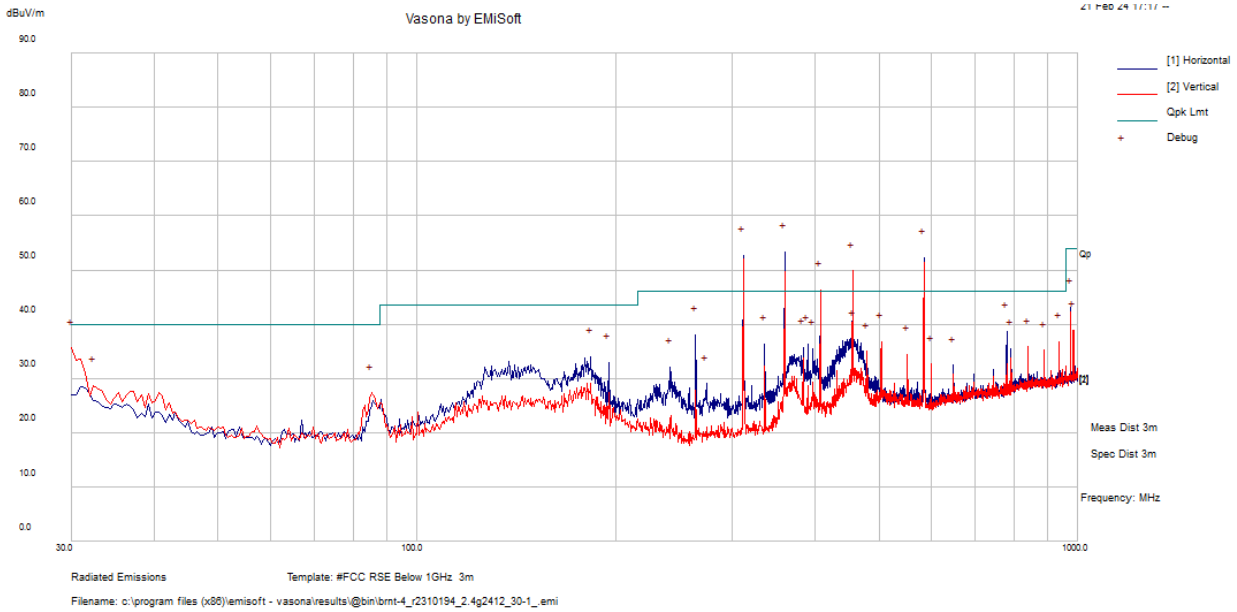
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
359.8	66.97	-13.52	53.45	100	H	360	88.83	-35.38	Peak
311.785	67.8	-14.94	52.86	100	H	360	88.83	-35.97	Peak
584.84	61	-8.99	52.01	200	H	360	88.83	-36.82	Peak
455.83	60.57	-10.92	49.65	100	V	360	88.83	-39.18	Peak
408.3	58.71	-12.61	46.1	100	V	360	88.83	-42.73	Peak
30	44.5	-9.5	35	100	V	360	40	-5	Peak

802.11b, 2462 MHz



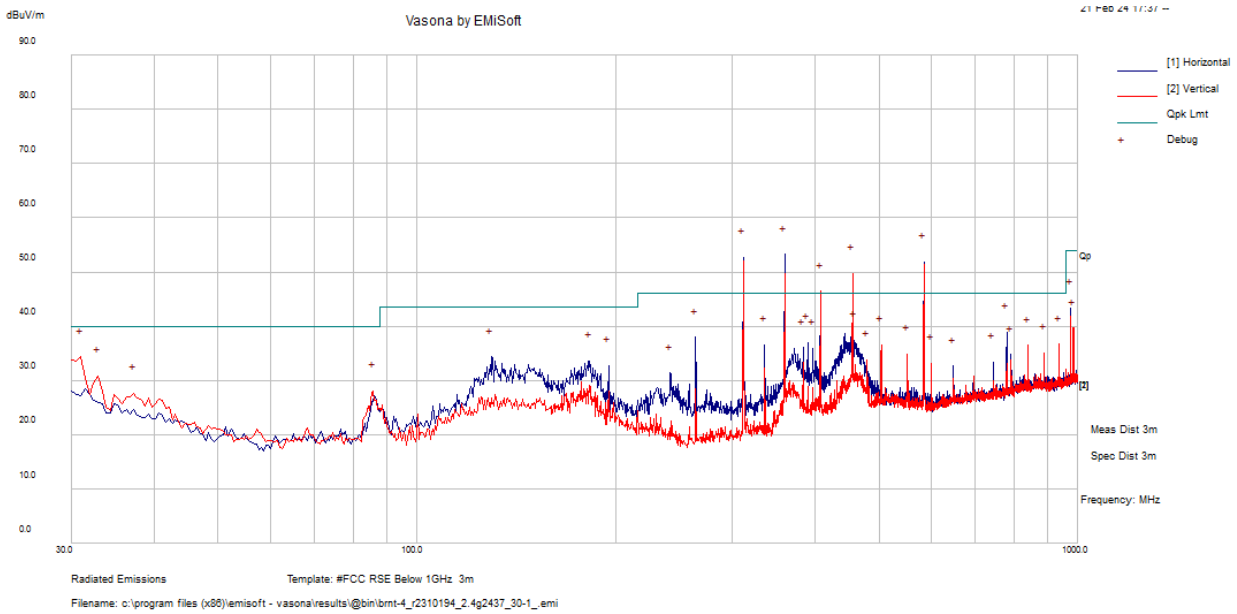
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
359.8	67	-13.52	53.48	100	H	360	89.78	-36.3	Peak
311.785	67.8	-14.94	52.86	100	H	360	89.78	-36.92	Peak
585.325	61.07	-9	52.07	200	H	360	89.78	-37.71	Peak
455.83	60.69	-10.92	49.77	100	V	360	89.78	-40.01	Peak
407.815	58.91	-12.64	46.27	100	V	360	89.78	-43.51	Peak
30	44.63	-9.5	35.13	100	V	360	40	-4.87	Peak

802.11g, 2412 MHz



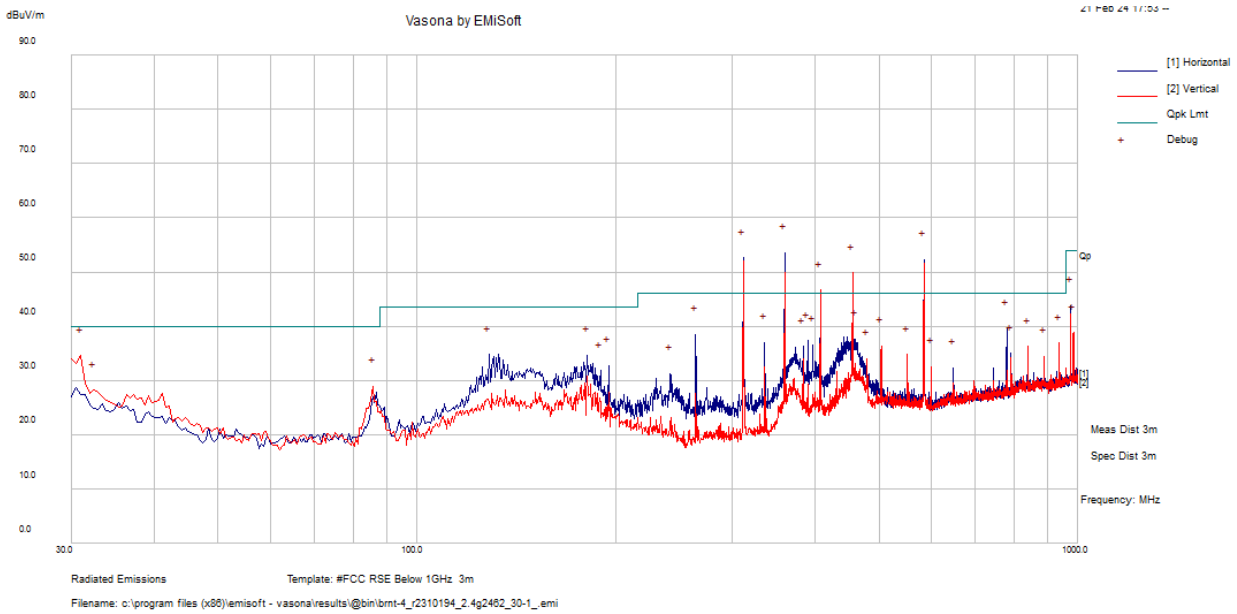
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
359.8	66.83	-13.52	53.31	100	H	360	84.89	-31.58	Peak
311.785	67.66	-14.94	52.72	100	H	360	84.89	-32.17	Peak
585.325	61.31	-9	52.31	200	H	360	84.89	-32.58	Peak
455.83	60.72	-10.92	49.8	100	V	360	84.89	-35.09	Peak
407.815	58.92	-12.64	46.28	100	V	360	84.89	-38.61	Peak
30	45.07	-9.5	35.57	100	V	360	40	-4.43	Peak

802.11g, 2437 MHz



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
359.8	66.79	-13.52	53.27	100	H	360	85.05	-31.78	Peak
311.785	67.59	-14.94	52.65	100	H	360	85.05	-32.4	Peak
584.84	60.79	-8.99	51.8	200	H	360	85.05	-33.25	Peak
455.83	60.59	-10.92	49.67	100	V	360	85.05	-35.38	Peak
408.3	59.03	-12.61	46.42	100	V	360	85.05	-38.63	Peak
30.97	44.67	-10.37	34.3	200	V	360	40	-5.7	Peak

802.11g, 2462 MHz



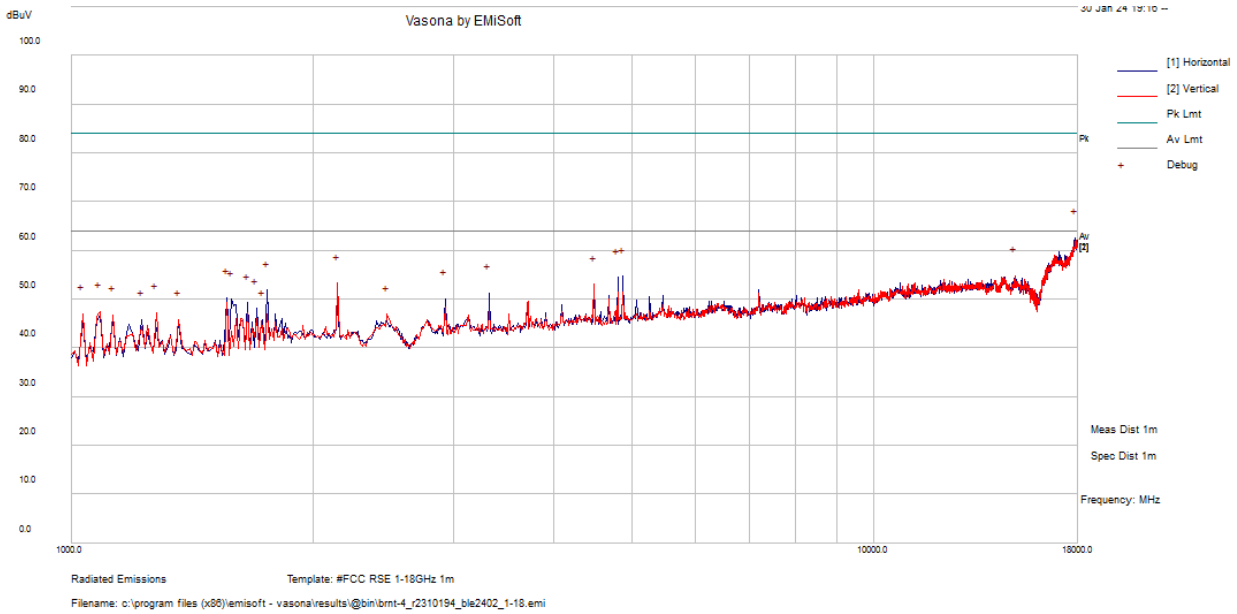
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
359.8	67.1	-13.52	53.58	100	H	360	85.29	-31.71	Peak
311.785	67.52	-14.94	52.58	100	H	360	85.29	-32.71	Peak
585.325	61.29	-9	52.29	200	H	360	85.29	-33	Peak
455.83	60.77	-10.92	49.85	100	V	360	85.29	-35.44	Peak
407.815	59.31	-12.64	46.67	100	V	360	85.29	-38.62	Peak
30.97	44.91	-10.37	34.54	200	V	360	40	-5.46	Peak

2) 1 – 18 GHz, Measured at 1 meter

FCC/IC Limits for 1 GHz to 40 GHz				
Applicability	**(dBm)**	**(uV/m at 3meters)**	**(dBuV/m at 3meters)**	**(dBuV/m at 1meter)[2]**
Restricted Band Average Limit	-	500	54	63.54
Restricted Band Peak Limit[1]	-	-	74	83.54
FCC §15.407(b) & ISEDC RSS-247 §6.2 Defined Unwanted Emissions Limit	-27	-	68.2	77.74

Note[1]: Restricted Band Peak Limit is defined to be 20dB higher than Average Limit.
*Note[2]: Limits at 1 meter are determined by applying a Distance correction factor accounts for extrapolation from 1 meters to 3 meters. Formula used is as follows: 20*log(3meters/1meter) = 9.54 (According to ANSI C63.10-2013 Section 9.4). i.e. 54[dBuV/m at 3m] + 9.54dB = 63.54[dBuV/m at 1m]*
Note[3]: Where Restricted Band Peak Limit is replaced with stricter 78 dBµV/m at 1 meter, compliance is being shown for unwmated emissions per FCC §15.407(b) & ISEDC RSS-247 §6.2
*Note: dBuV/m = 20*log(V/m) + 120. Thus 20*log((500[uV/m]/1000000))+120=54[dBuV/m]*
Note: Per ANSI C63.10-2013 Section 12.7.2: E[dBuV/m] = EIRP[dBm] + 95.2, for d = 3meters. Thus -27dBm + 95.2dB = 68.2dBuV/m at 3meters.

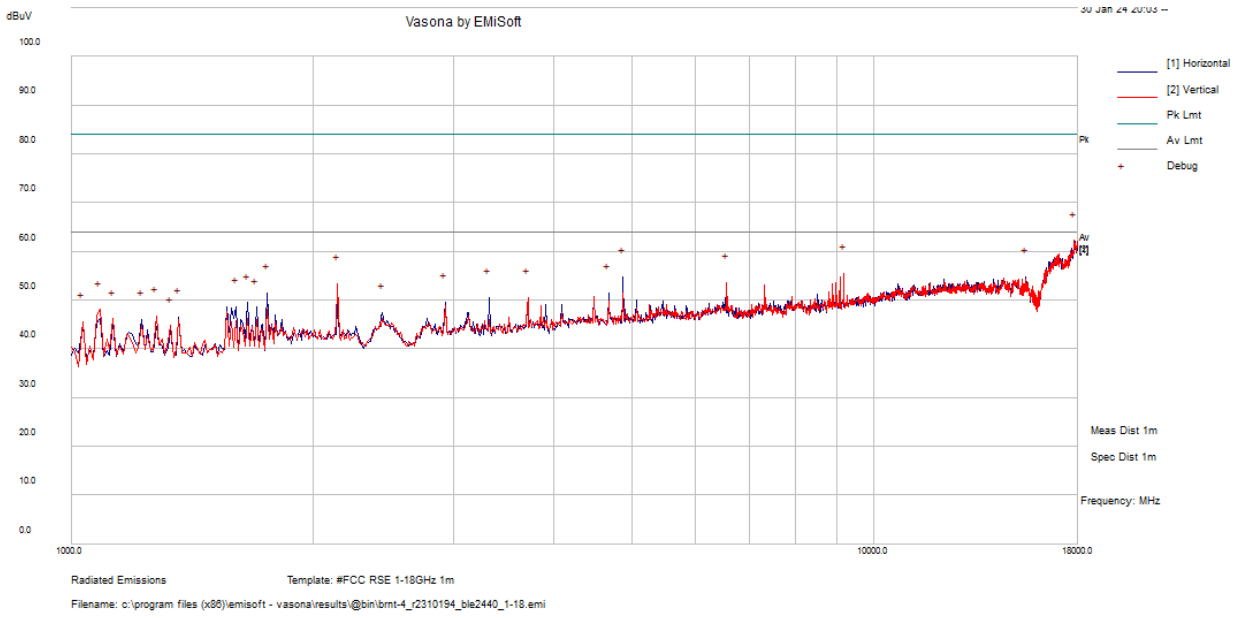
BLE, 2402 MHz



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
17883.125	47.93	14.61	62.54	100	H	360	63.54	-1.00	Peak

Note: Peak measurement is compared to the average limit.

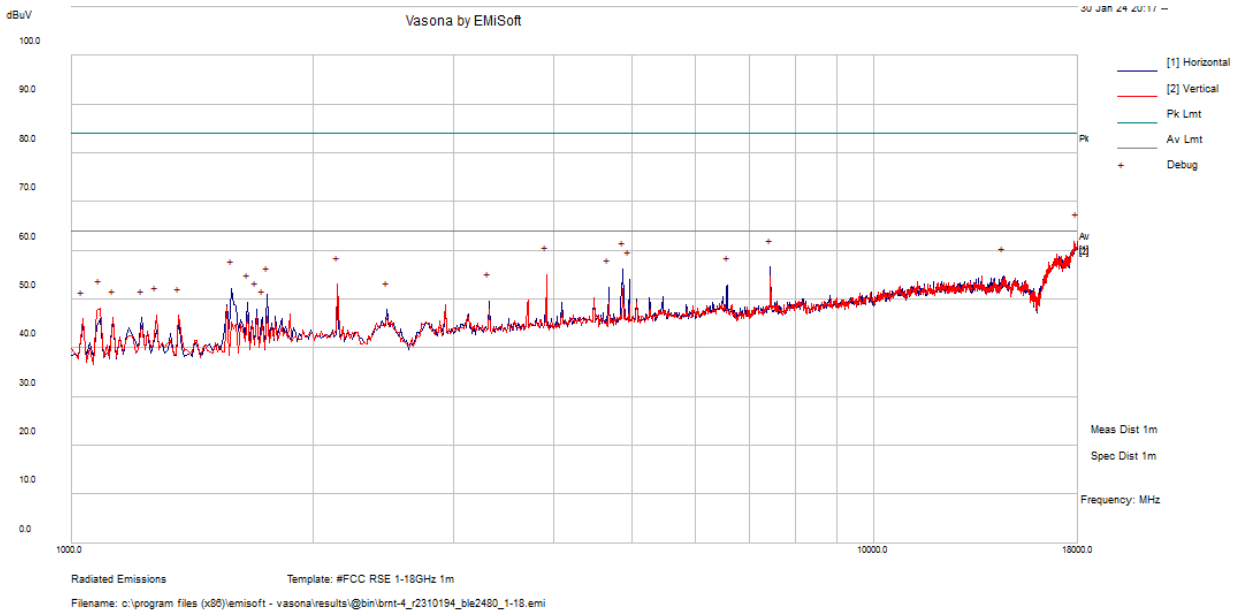
BLE, 2440 MHz



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
17808.75	48.19	14.02	62.21	300	V	360	63.54	-1.33	Peak

Note: Peak measurement is compared to the average limit.

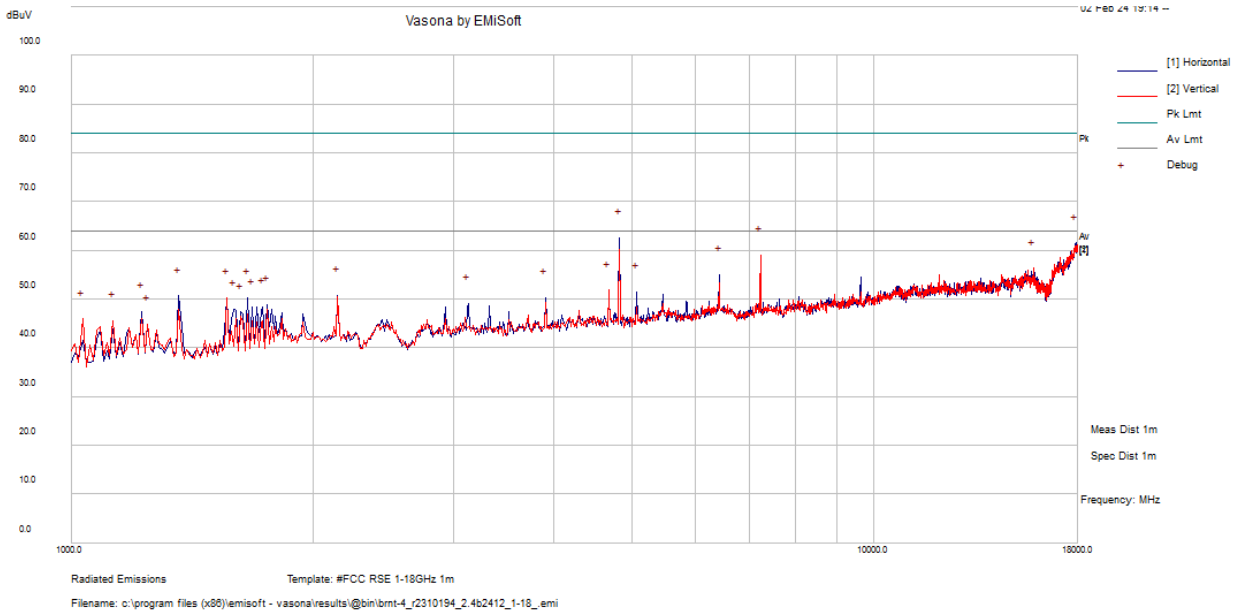
BLE, 2480 MHz



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
17957.5	46.76	15.09	61.85	300	V	360	63.54	-1.69	Peak

Note: Peak measurement is compared to the average limit.

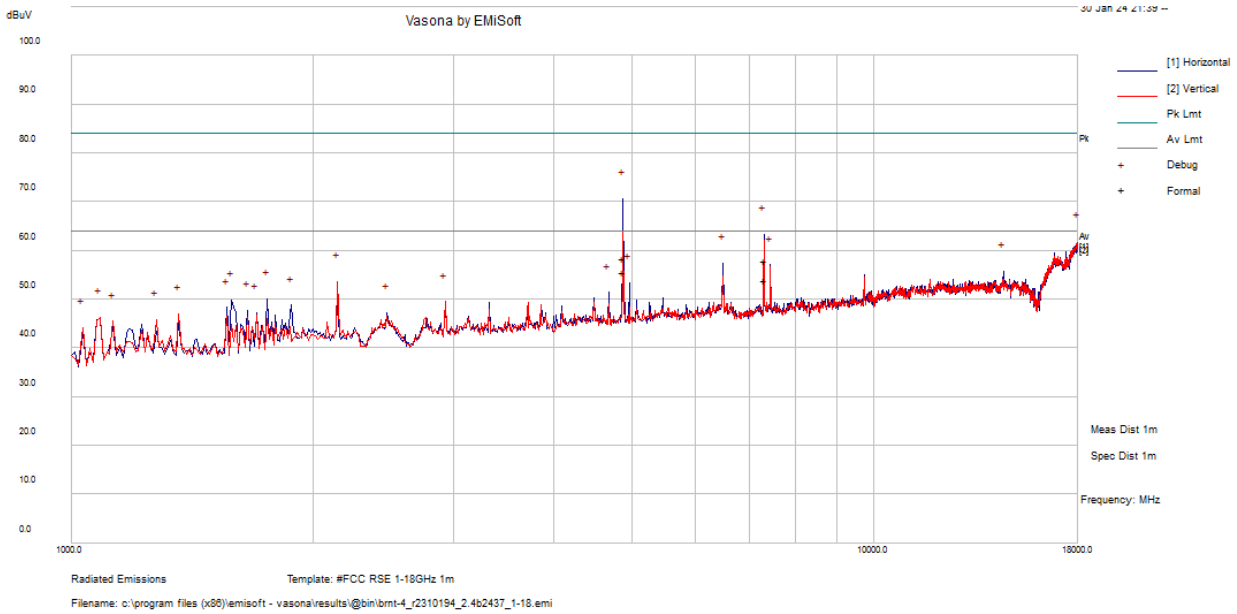
802.11b, 2412 MHz



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
4825	62.59	-0.09	62.5	200	H	360	63.54	-1.04	Peak

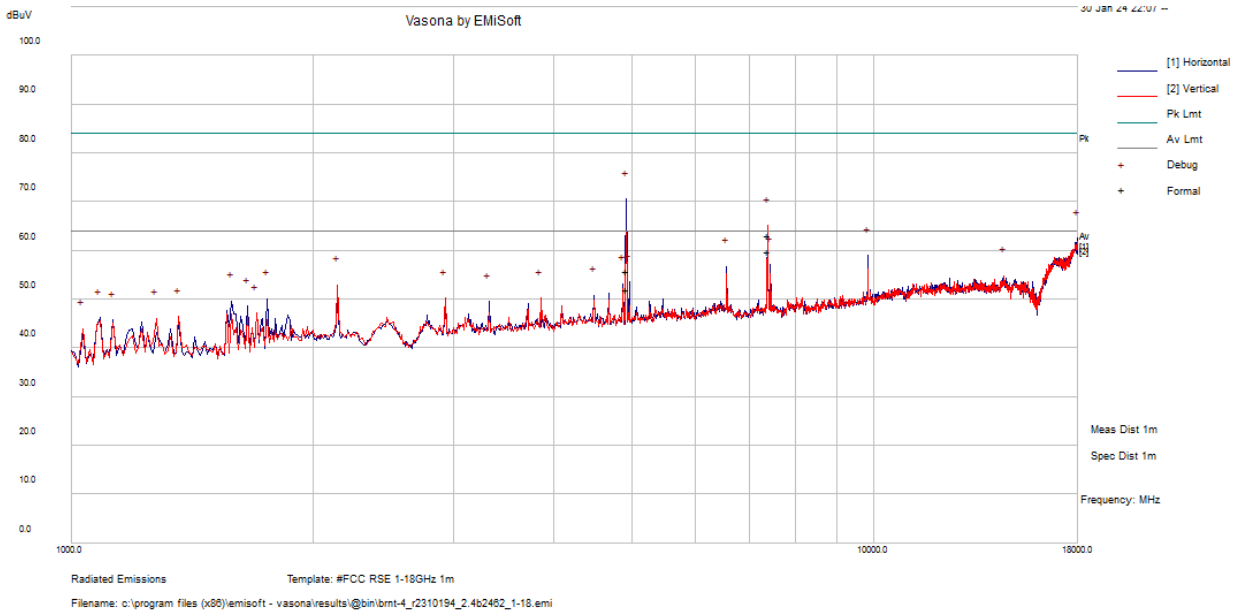
Note: Peak measurement is compared to the average limit.

802.11b, 2437 MHz



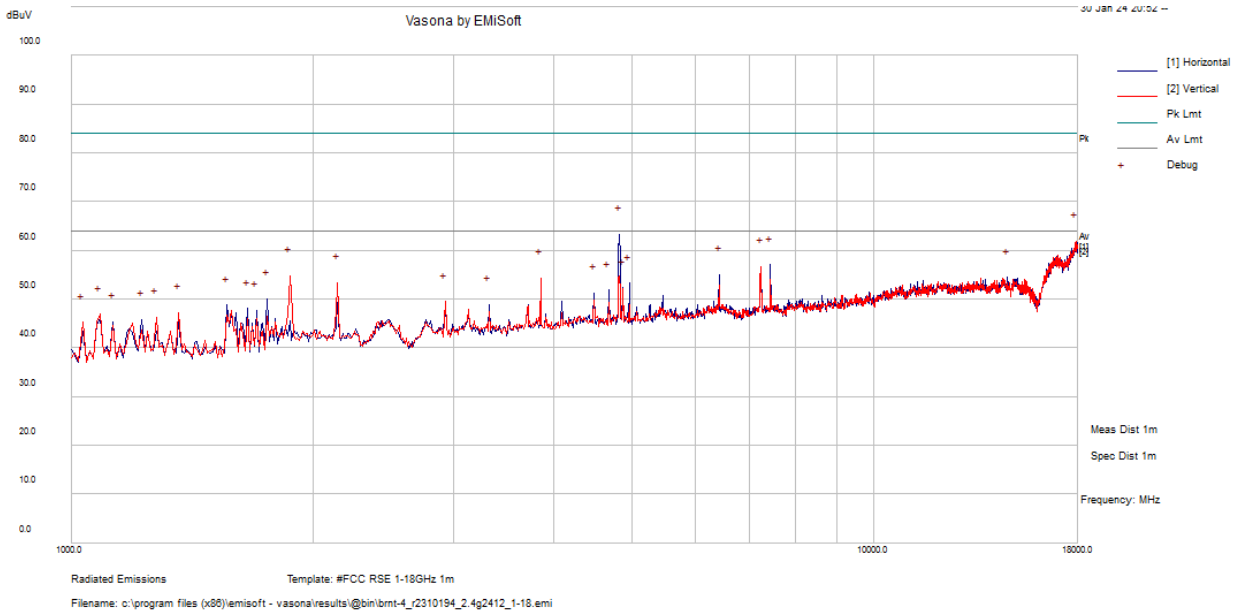
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Avg.)
4876.8475	58.42	-0.06	58.36	H	210	291	83.54	-25.18	Peak
4876.8475	55.62	-0.06	55.56	H	210	291	63.54	-7.98	Avg.

802.11b, 2462 MHz



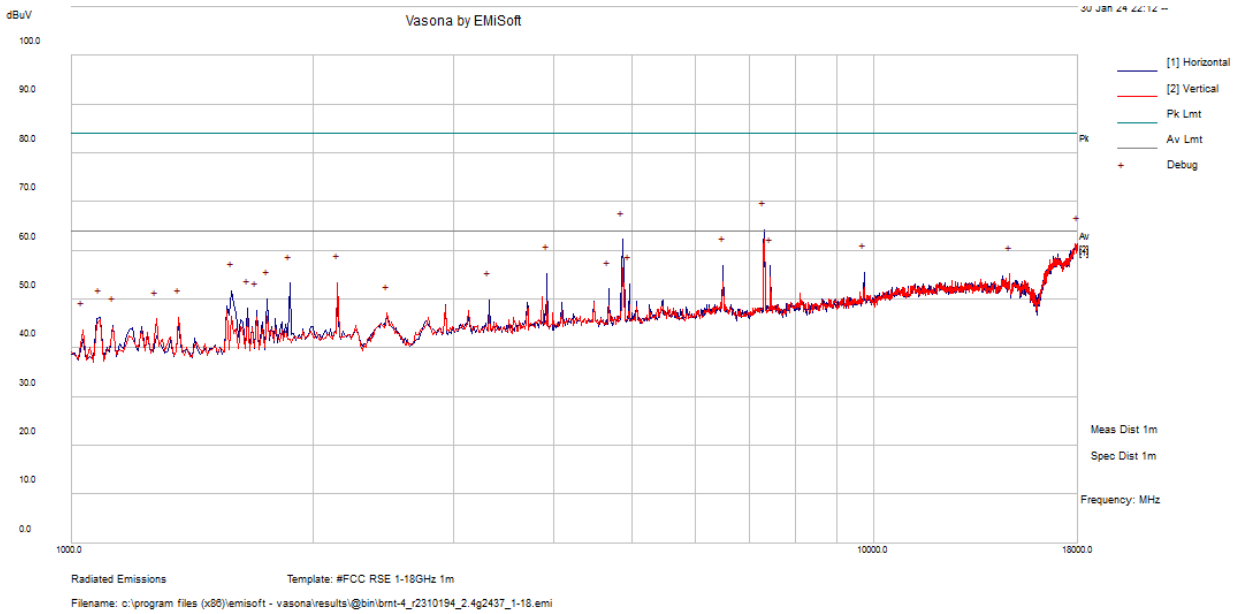
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Avg.)
4920.6875	55.84	-0.04	55.8	H	211	291	83.54	-27.74	Peak
4920.6875	52.1	-0.04	52.06	H	211	291	63.54	-11.48	Avg.
7386.9025	60.22	2.84	63.06	H	219	344	83.54	-20.48	Peak
7386.9025	56.96	2.84	59.8	H	219	344	63.54	-3.74	Avg.

802.11g, 2412 MHz



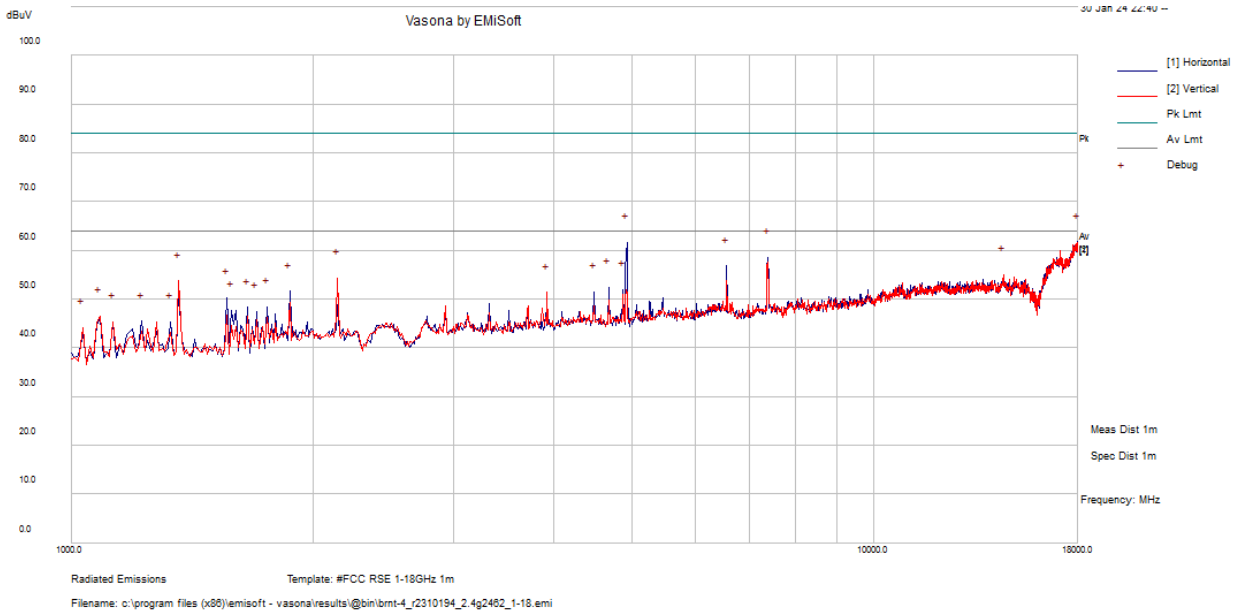
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector (Peak /Avg.)
4825.5825	62.81	-0.09	62.72	H	214	292	83.54	-20.82	Peak
4825.5825	51.55	-0.09	51.46	H	214	292	63.54	-12.08	Avg.

802.11g, 2437 MHz



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.)
7310.31	58.32	2.92	61.24	H	222	344	83.54	-22.3	Peak
7310.31	47.41	2.92	50.33	H	222	344	63.54	-13.21	Avg.

802.11g, 2462 MHz

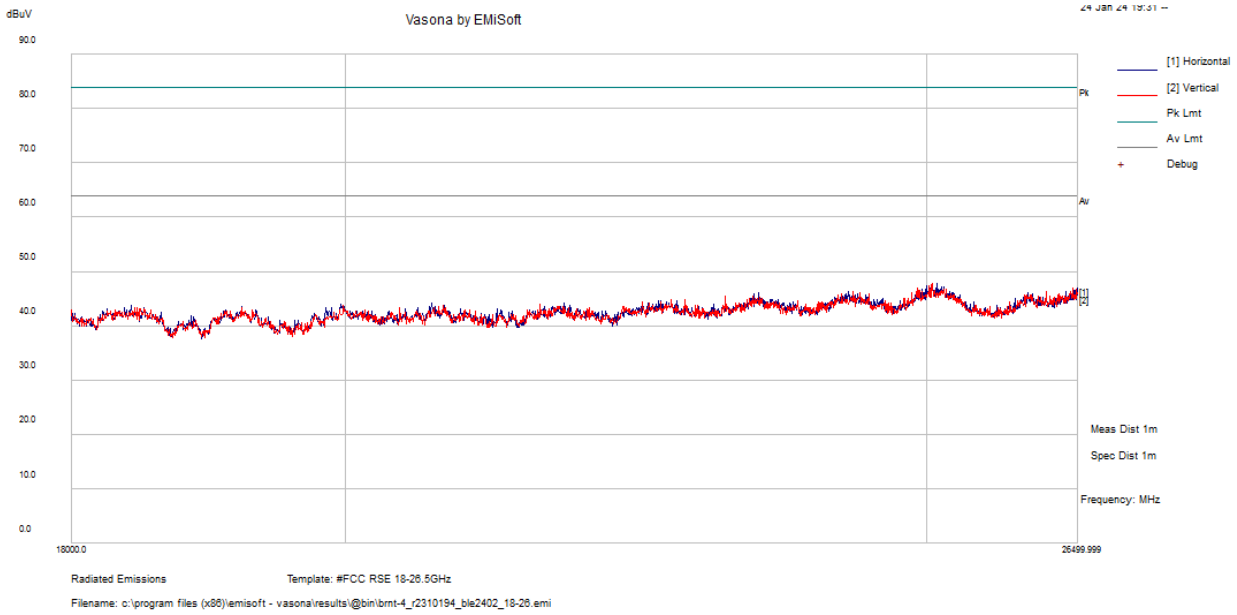


Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
17978.75	46.58	15.2	61.78	H	300	360	63.54	-1.76	Peak

Note: Peak measurement is compared to the average limit.

3) 18 - 26.5 GHz, Measured at 1 meter

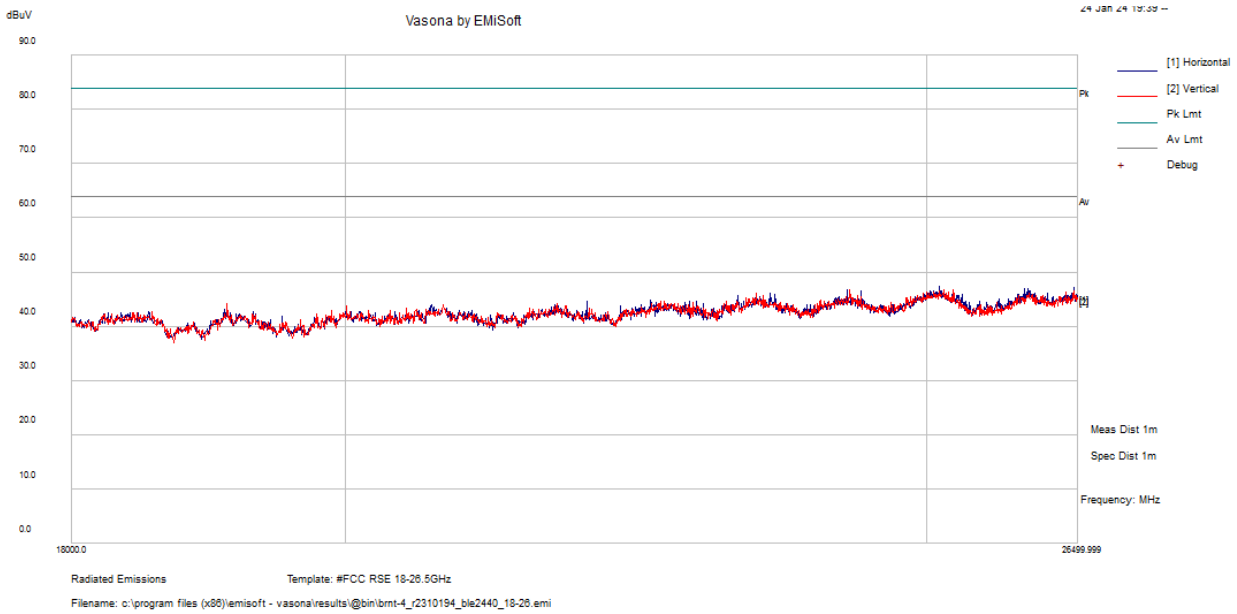
BLE, 2402 MHz



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.)
25108.488	39.64	8.08	47.72	H	200	360	63.54	-15.82	Peak

Note: Peak measurement is compared to the average limit.

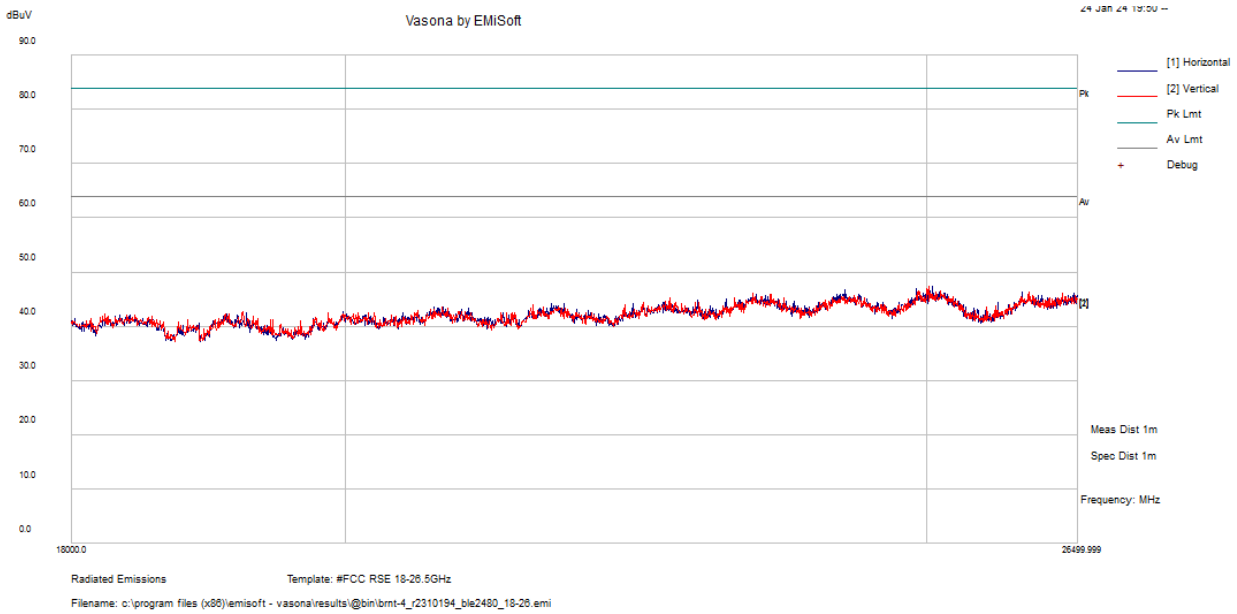
BLE, 2440 MHz



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.)
25997.475	37.98	8.31	46.29	H	200	360	63.54	-17.25	Peak

Note: Peak measurement is compared to the average limit.

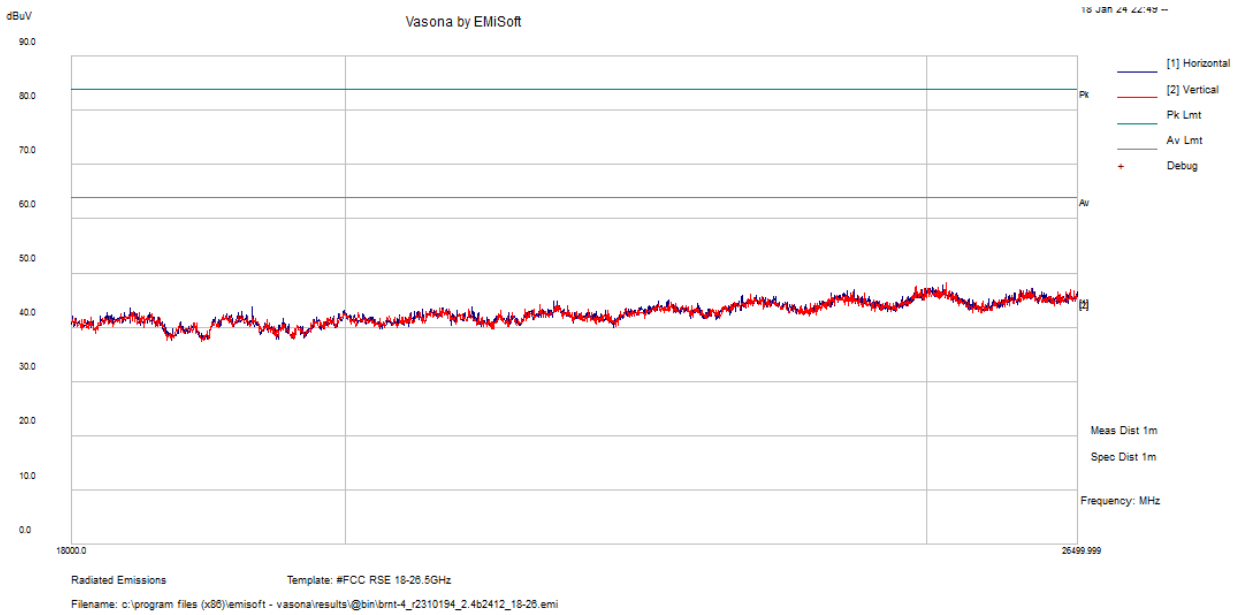
BLE, 2480 MHz



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.)
25025.675	38.06	7.95	46.01	H	0	360	63.54	-17.53	Peak

Note: Peak measurement is compared to the average limit.

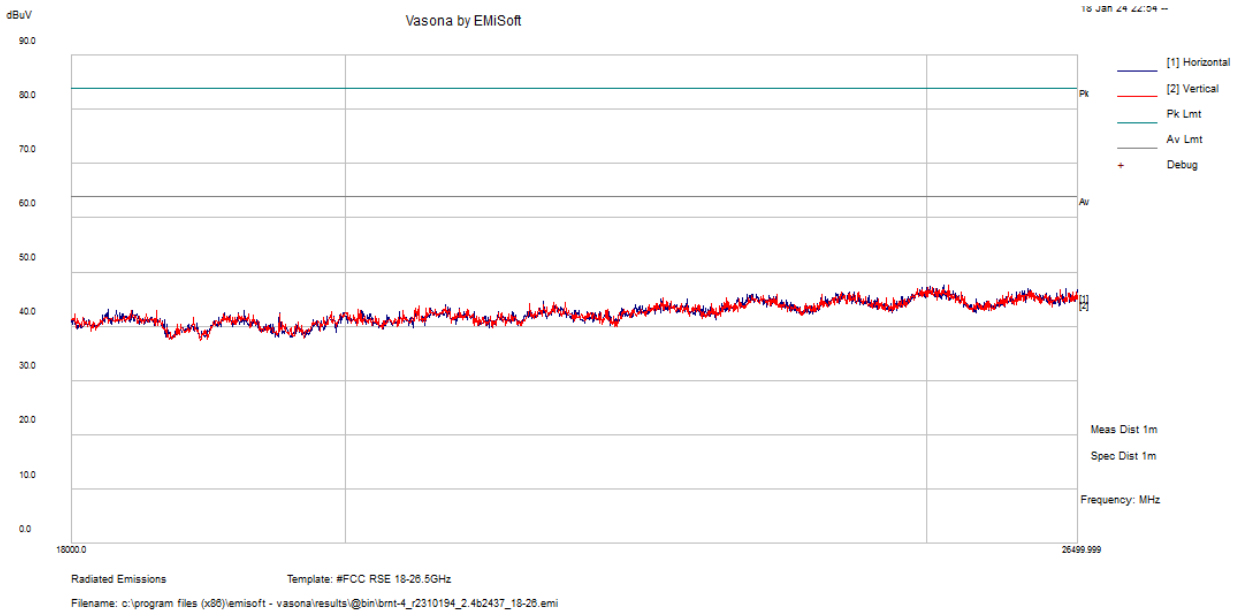
802.11b, 2412 MHz



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.)
25156.687	38.04	8.08	46.12	H	200	360	63.54	-17.42	Peak

Note: Peak measurement is compared to the average limit.

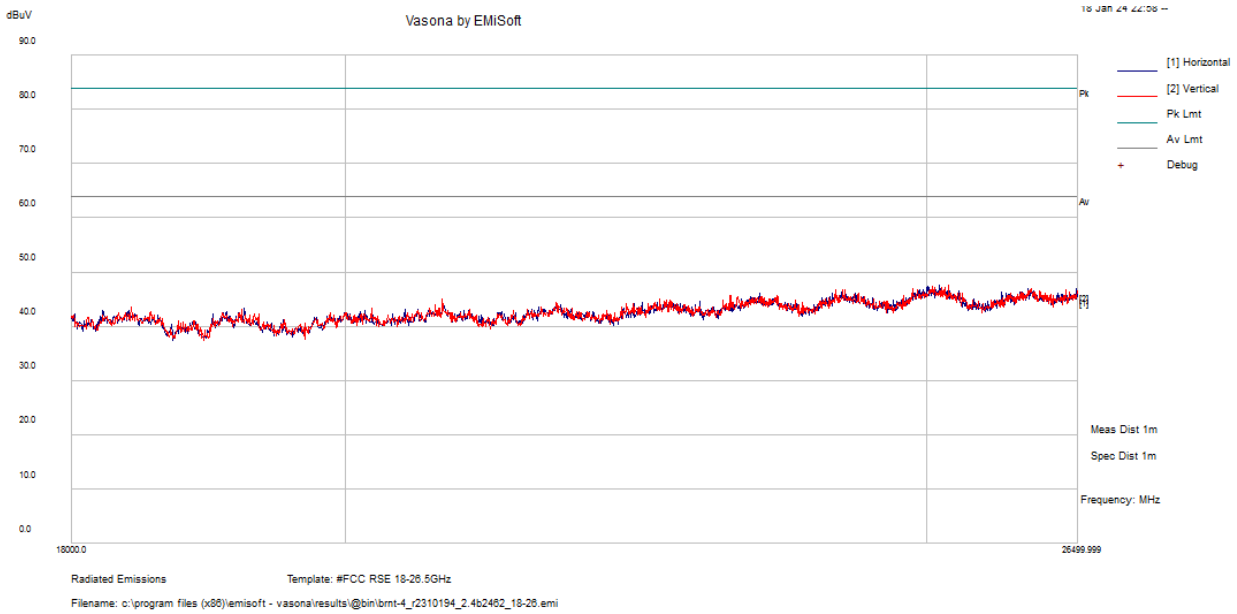
802.11b, 2437 MHz



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.)
25181.023	38.48	7.85	46.33	H	200	360	63.54	-17.21	Peak

Note: Peak measurement is compared to the average limit.

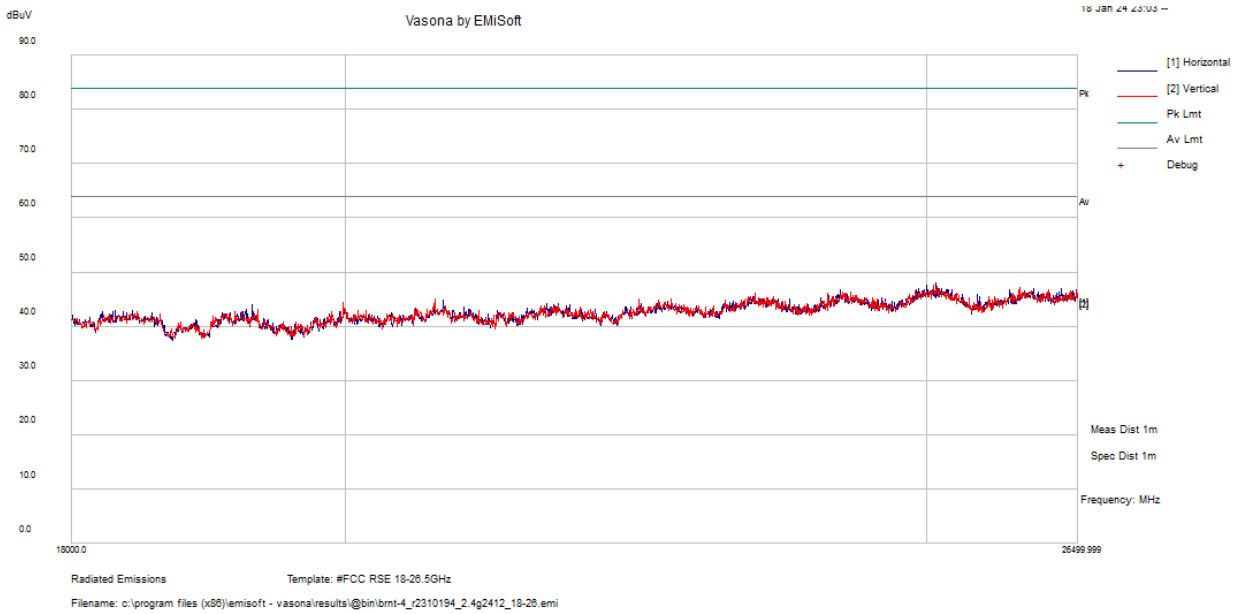
802.11b, 2462 MHz



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.)
25127.514	39.04	8.08	47.12	H	200	360	63.54	-16.42	Peak

Note: Peak measurement is compared to the average limit.

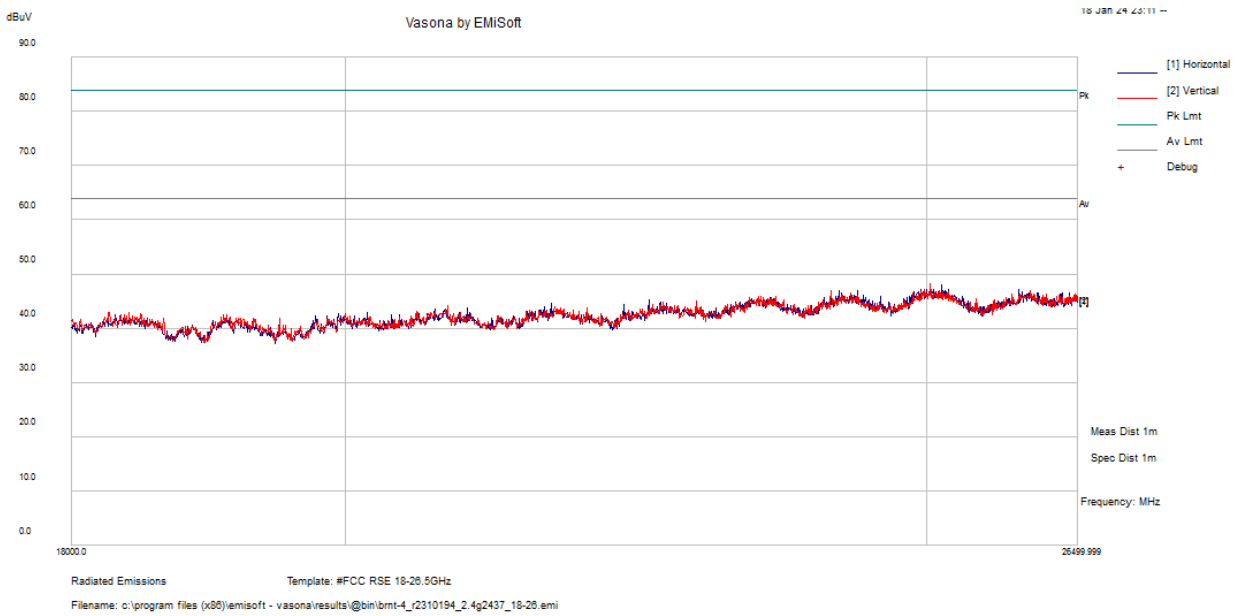
802.11g, 2412 MHz



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.)
25146.959	38.75	8.08	46.83	H	200	360	63.54	-16.71	Peak

Note: Peak measurement is compared to the average limit.

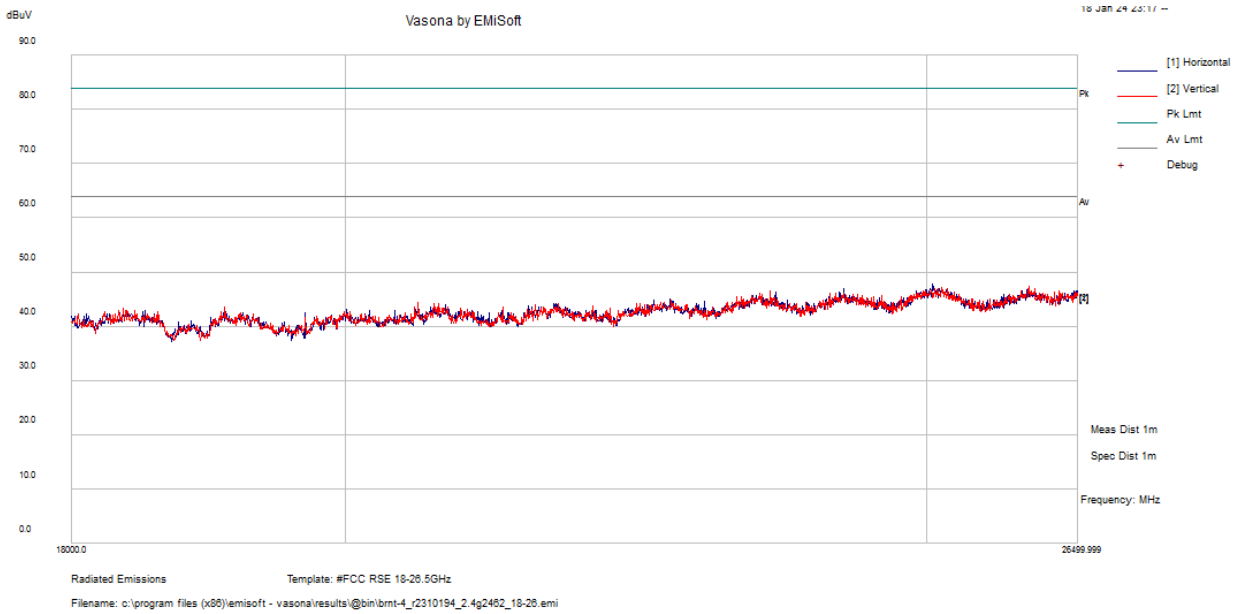
802.11g, 2437 MHz



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.)
25069.27	38.90	8.08	46.98	H	200	360	63.54	-16.56	Peak

Note: Peak measurement is compared to the average limit.

802.11b, 2462 MHz



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.)
25069.27	39.09	8.08	47.17	H	200	360	63.54	-16.37	Peak

Note: Peak measurement is compared to the average limit.

8 FCC §15. 247(a) (2) & ISEDC RSS-247 §5.2, RSS-Gen §6.7 - Emission Bandwidth

8.1 Applicable Standards

According to FCC §15.247(a) (2) and ISEDC RSS-247 §5.2: the minimum 6 dB bandwidth shall be 500 kHz.

8.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8: DTS bandwidth.

As per ANSI C63.10 Clause 11.8: DTS bandwidth

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described in 11.8.1 (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, and peak detector with maximum hold) is implemented by the instrumentation function.
When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥6 dB.

As per the ANSI 63.10 Clause 6.9.3: Occupied Bandwidth

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

a. The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.

b. The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.

c. Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.

d. Step a) through step c) might require iteration to adjust within the specified range.

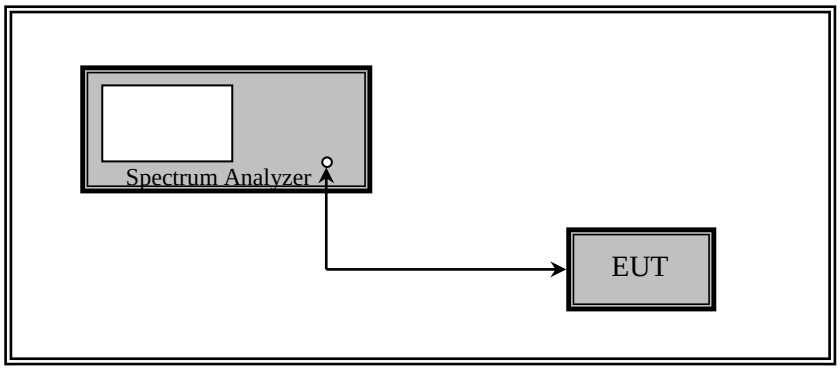
e. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

f. Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

g. If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.

h. The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

8.3 Test Setup Block Diagram



8.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
00424	Agilent	Spectrum Analyzer	E4440A	US45303 156	2022-12-19	12 Months

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".*

8.5 Test Environmental Conditions

Temperature:	20.8°C
Relative Humidity:	34%
ATM Pressure:	102.9 kPa

The testing was performed by Michael Papa from 2023-10-31 to 2023-11-28 at RF site.

8.6 Test Results

2.4 GHz Wi-Fi:

Channel	Frequency (MHz)	6 dB OBW (MHz)		99% OBW (MHz)		6 dB OBW Limit (kHz)	Result
		Antenna A	Antenna B	Antenna A	Antenna B		
802.11b							
Low	2412	9.15	9.13	13.97	13.83	≥ 500	Pass
Middle	2437	9.14	8.86	14.12	13.99	≥ 500	Pass
High	2462	9.25	9.34	14.64	14.44	≥ 500	Pass
802.11g							
Low	2412	14.93	13.60	16.83	16.61	≥ 500	Pass
Middle	2437	14.05	14.69	16.90	16.65	≥ 500	Pass
High	2462	15.17	15.07	16.82	16.72	≥ 500	Pass
802.11n20							
Low	2412	14.29	15.79	17.87	17.69	≥ 500	Pass
Middle	2437	15.19	14.55	17.97	17.69	≥ 500	Pass
High	2462	15.23	16.42	17.94	17.68	≥ 500	Pass
802.11n40							
Low	2422	35.42	35.37	36.10	36.29	≥ 500	Pass
Middle	2437	33.97	35.15	36.01	36.22	≥ 500	Pass
High	2452	34.07	35.26	36.07	36.44	≥ 500	Pass

2.4 GHz BLE:

Channel	Frequency (MHz)	6 dB OBW (MHz)		99% OBW (MHz)		6 dB OBW Limit (kHz)	Result
		1 Mbps	2 Mbps	1 Mbps	2 Mbps		
Low	2402	0.67	1.40	1.04	2.08	≥ 500	Pass
Middle	2440	0.66	1.16	1.04	2.09	≥ 500	Pass
High	2480	0.67	1.20	1.04	2.07	≥ 500	Pass

Note: See Annex A for 6dB OBW and 99OBW test results.

9 FCC §15.247(b)(3) & ISEDC RSS-247 §5.4 - Maximum Output Power

9.1 Applicable Standards

According to FCC §15.247(b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to RSS-247 §5.4: For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

9.2 Measurement Procedure

The BLE measurements are based on ANSI C63.10-2013, Section 11.9.1.1

11.9.1.1 RBW ≥ DTS bandwidth

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a. Set the RBW ≥ DTS bandwidth.
b. Set VBW ≥ [3 × RBW].
c. Set span ≥ [3 × RBW].
d. Sweep time = auto couple. Sweep time = auto.
e. Detector = peak.
f. Trace mode = max hold.
g. Allow trace to fully stabilize.
h. Use peak marker function to determine the peak amplitude level.

The Wi-Fi measurements are based on ANSI C63.10-2013, Section 11.9.2.2.2.

11.9.2.2.2 Method AVGSA-1

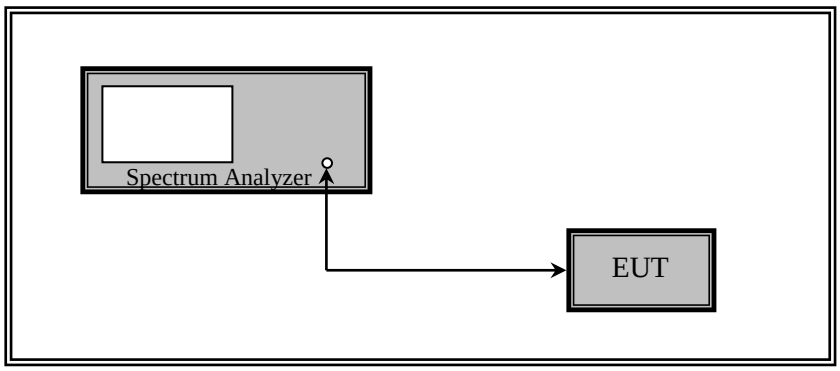
Method AVGSA-1 uses trace averaging with the EUT transmitting at full power throughout each sweep. The procedure for this method is as follows:

i. Set span to at least 1.5 times the OBW.
j. Set RBW = 1% to 5% of the OBW, not to exceed 1 MHz.
k. Set VBW ≥ [3 × RBW].
l. Number of points in sweep ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)
m. Sweep time = auto.
n. Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
o. If transmit duty cycle < 98%, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at the maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no OFF intervals) or at duty cycle ≥ 98%,

and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run."

p. Trace average at least 100 traces in power averaging (rms) mode.
q. Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

9.3 Test Setup Block Diagram



9.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
00424	Agilent	Spectrum Analyzer	E4440A	US45303156	2022-12-19	12 Months

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".*

9.5 Test Environmental Conditions

Temperature:	20.8°C
Relative Humidity:	34%
ATM Pressure:	102.9 kPa

The testing was performed by Michael Papa from 2023-10-31 to 2023-11-28 at RF site.

9.6 Test Results

2.4 GHz Wi-Fi:

Channel	Frequency (MHz)	Highest Applicable Antenna Gain (dBi)	Conducted Output Power (dBm)		Total Power (dBm)	FCC/IC Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
			ANT A	ANT B				
802.11b								
Low	2412	1.1	19.50	17.31	-	<30	20.60	<36
Middle	2437	1.1	19.78	17.80	-	<30	20.88	<36
High	2462	1.1	20.73	18.61	-	<30	21.83	<36
802.11g								
Low	2412	1.1	15.84	13.73	-	<30	16.94	<36
Middle	2437	1.1	16.00	13.86	-	<30	17.10	<36
High	2462	1.1	16.24	14.15	-	<30	17.34	<36
802.11n20								
Low	2412	3.6	14.66	12.84	16.85	<30	20.45	<36
Middle	2437	3.6	13.78	11.99	15.99	<30	19.59	<36
High	2462	3.6	14.06	12.29	16.27	<30	19.87	<36
802.11n40								
Low	2422	3.6	13.55	11.72	15.74	<30	19.34	<36
Middle	2437	3.6	13.85	11.91	16.00	<30	19.6	<36
High	2452	3.6	13.91	11.96	16.05	<30	19.65	<36

Note: EIRP [dBm] = Conducted Output Power [dBm]+Antenna Gain [dBi]
Note: For eirp limit, dBm=10log(Power[mW]/1mW)=10log(4000mW/1mW)=36dBm
Note: Duty Cycle correction factor has already been added to the measurement.

2.4 GHz BLE:

Channel	Frequency (MHz)	Antenna Gain (dBi)	Conducted Output Power (dBm)		Output Power Limit (dBm)	Highest EIRP (dBm)	EIRP Limit (dBm)	Result
			1 Mbps	2 Mbps				
Low	2402	1.8	12.53	12.56	30	14.36	<36	Pass
Middle	2440	1.8	12.05	12.10	30	13.9	<36	Pass
High	2480	1.8	11.95	12.26	30	14.06	<36	Pass

Note: The EIRP evaluated in the BLE table above uses the highest conducted output power to calculate EIRP
Note: EIRP [dBm] = Conducted Output Power [dBm]+Antenna Gain [dBi]
Note: For eirp limit, dBm=10log(Power[mW]/1mW)=10log(4000mW/1mW)=36dBm

Note: See Annex B for Output Power test results.

10 FCC §15.247(d) & ISEDC RSS-247 §5.5 - 100 kHz Spurious Emissions at Antenna Terminal

10.1 Applicable Standards

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

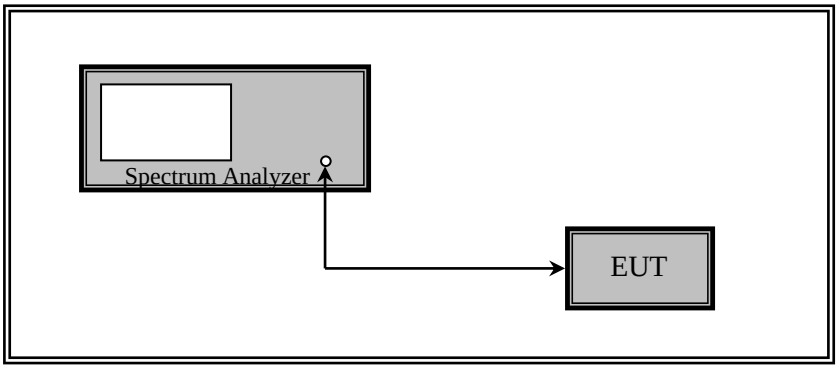
According to ISEDC RSS-247 §5.5.In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the 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.

10.2 Measurement Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.

RBW = 100 kHz
VBW = 300 kHz
Sweep = coupled
Detector function = peak
Trace = max hold

10.3 Test Setup Block Diagram



10.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
00424	Agilent	Spectrum Analyzer	E4440A	US45303156	2022-12-19	12 Months

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".*

10.5 Test Environmental Conditions

Temperature:	20.8°C
Relative Humidity:	34%
ATM Pressure:	102.9 kPa

The testing was performed by Michael Papa from 2023-10-31 to 2023-11-28 at RF site.

10.6 Test Results

Please refer to Annex D for detailed test results.

11 FCC §15.247(e) & ISEDC RSS-247 §5.2(2) – Peak Power Spectral Density

10.1 Applicable Standards

According to ECFR §15.247(e) and RSS-247 §5.2 (2) , for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

10.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8.4: Maximum power spectral density level in the fundamental emission.

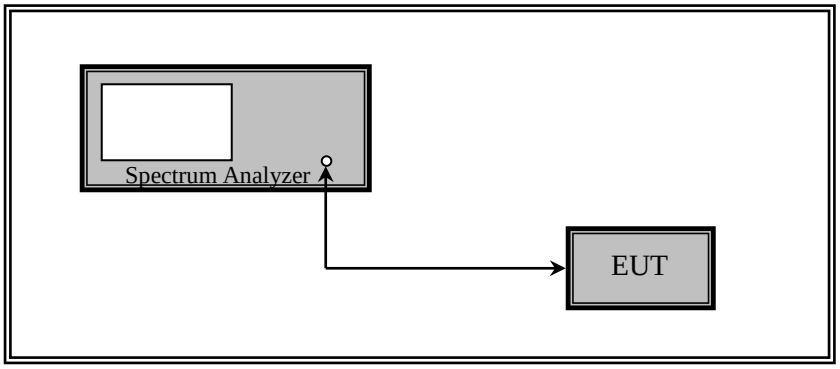
As per ANSI C63.10 Clause 11.10: Maximum power spectral density level in the fundamental emission.

Some regulatory requirements specify a conducted PSD limit within the DTS bandwidth during any time interval of continuous transmission.88 Such specifications require that the same method as used to determine the conducted output power shall be used to determine the power spectral density. If maximum peak conducted output power was measured, then the peak PSD procedure 11.10.2 (method PKPSD) shall be used. If maximum conducted output power was measured, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option):

Method PKPSD (peak PSD): The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

a. Set analyzer center frequency to DTS channel center frequency.
b. Set the span to 1.5 times the DTS bandwidth.
c. Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ [3 × RBW].
e. Detector = peak.
f. Sweep time = auto couple.
g. Trace mode = max hold.
h. Allow trace to fully stabilize.
i. Use the peak marker function to determine the maximum amplitude level within the RBW.
j. If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

10.3 Test Setup Block Diagram



10.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
00424	Agilent	Spectrum Analyzer	E4440A	US45303156	2022-12-19	12 Months

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".*

10.5 Test Environmental Conditions

Temperature:	20.8°C
Relative Humidity:	34%
ATM Pressure:	102.9 kPa

The testing was performed by Michael Papa from 2023-10-31 to 2023-11-28 at RF site.

10.6 Test Results

2.4 GHz Wi-Fi:

Channel	Frequency (MHz)	PSD (dBm/10kHz)		Limit (dBm/3kHz)
		Antenna A	Antenna B	
802.11b				
Low	2412	0.00	-1.89	8
Middle	2437	7.09[1]	3.52	8
High	2462	6.60	5.88	8
802.11g				
Low	2412	-4.90	-6.58	8
Middle	2437	-5.10	-6.61	8
High	2462	-4.84	-6.46	8
802.11n20				
Low	2412	-5.36	-5.55	8
Middle	2437	-6.33	-6.89	8
High	2462	-5.97	-6.30	8
802.11n40				
Low	2422	-9.17	-10.88	8
Middle	2437	-8.98	-10.79	8
High	2452	-8.43	-11.30	8

Note: PSD measurements were taken with wider RBW of 10 kHz, complying with FCC and IC RBW requirement of 3 kHz

[1]Note: PSD measurement taken with reduced RBW 3 kHz

2.4 GHz BLE:

Channel	Frequency (MHz)	PSD (dBm/10kHz)		Limit (dBm/3kHz)
		1 Mbps	2 Mbps	
Low	2402	2.30	-0.71	<8
Middle	2440	1.92	-1.10	<8
High	2480	1.75	-0.83	<8

Note: The EUT passed with wider RBW of 10 kHz, thus complied with FCC and IC RBW requirement of 3 kHz

Note: See Annex C for Power Spectrum Density test result.

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12 Appendix A (Normative) – EUT Test Setup Photographs

Please refer to the attachment.

13 Appendix B (Normative) – EUT External Photographs

Please refer to the attachment.

14 Appendix C – EUT Internal Photographs

Please refer to the attachment.

15 Appendix D (Normative) - A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIACE 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 ---