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

TEST REPORT

For

hard&softWERK GmbH

Bahnhof Str. 10 D-78112 St.
Georgen im Schwarzwald, Germany

FCC ID: 2BBC6-BS222
IC: 30643-BS222

Report Type:	**Product Type:**
Original Report	Battery Powered BLE Beacon

Prepared By:	Kevin Chau RF Test Engineer
Report Number:	R2501315-247
Report Date:	2025-03-19
Reviewed By:	Steven Lianto EMC & RF Lead

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732-9164

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 "*"

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2501315-247	Original Report	2025-03-19

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test report is prepared on behalf of *hard&softWERK GmbH*, and their product model: blukii Small MKII 1201, FCC ID: 2BBC6-BS222, IC: 30643-BS222, the "EUT" as referred to in this report. The EUT is a Battery Powered BLE Beacon and has Bluetooth LE capability.

1.2 Mechanical Description of EUT

The UUT measures approximately 2.2 cm (L) x 2.2 cm (W) x 0.72 cm (H) and weighs approximately 0.005 kg.

The data gathered was from a production sample provided by hard&softWERK GmbH with with S/N: L000232 (Radiated sample) & L000233 (Conducted sample)

1.3 Objective

This report is prepared on behalf of *hard&softWERK GmbH* 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 is to determine compliance with FCC Part 15.247 and ISEDC RSS-247 for Antenna Requirement, RF Exposure, AC Line Conducted Emissions, Radiated Spurious Emissions, Emission Bandwidth, Maximum Output Power, Peak Power Spectral Density, and 100 kHz at Antenna Terminal (-20 dBc).

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.).

1.4 Related Submittal(s)/Grant(s)

N/A

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.

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-0428.

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 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

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

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

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

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

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

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

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

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

5 Other
- For Water Coolers (ver. 3.0)

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

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Innovation, Science and Economic development Canada - 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.

2.2 EUT Exercise Software

The exercising software used during testing was "RFTool v1.6.5", provided by hard&softWERK GmbH. The software is compliant with the standard requirements being tested against.

Radio	Mode	Channel	Frequency (MHz)	Power Setting
Bluetooth LE	1M PHY	Low	2402	8
		Middle	2440	8
		High	2480	8
	2M PHY	Low	2402	8
		Middle	2440	8
		High	2480	8

Data rates used:
1M PHY: 1Mbps
2M PHY: 2Mbps

2.3 Duty Cycle Correction Factor

According to KDB 558074 D01 DTS Meas Guidance v05r02 section 6.0:

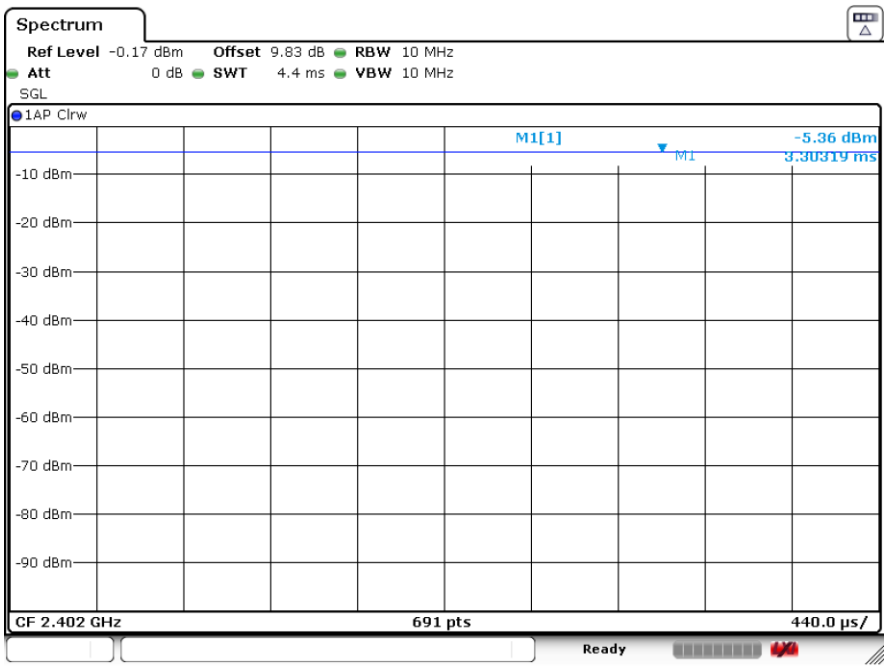
All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum-power transmission duration, T, are required for each tested mode of operation.

Radio Mode	On Time (µs)	Period (µs)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
1M PHY	100	100	100	0
2M PHY	100	100	100	0

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

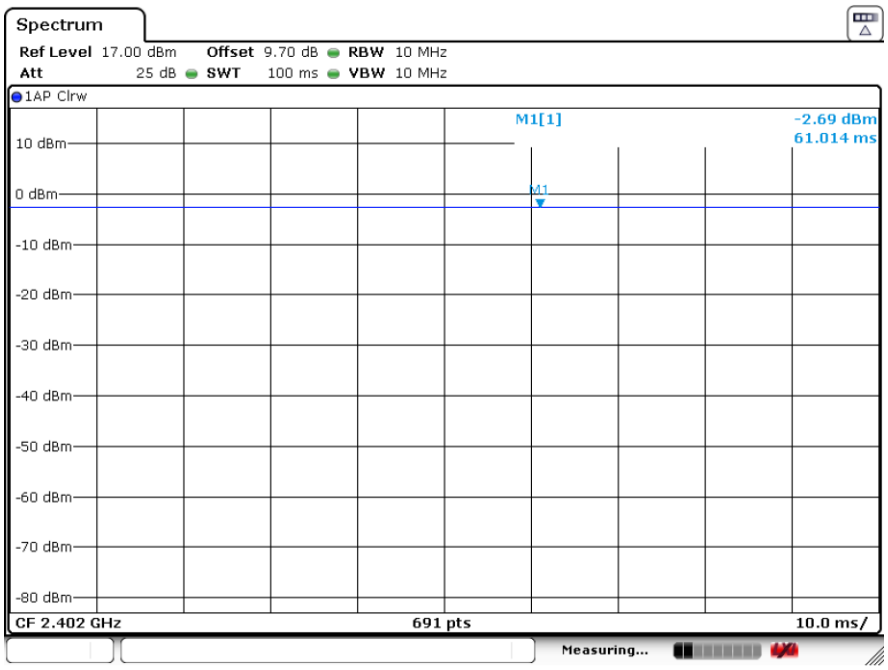
Please refer to plots below for detailed Duty Cycle measurements.

BLE, 1M PHY



Date: 26.FEB.2025 22:12:20

BLE, 2M PHY



Date: 27.FEB.2025 18:06:38

2.4 Equipment Modification

No modifications were made to the EUT during testing.

2.5 Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Laptop	Latitude E7440	C71SYZ1

2.6 Remote Support Equipment

None

2.7 Power Supply and Line Filters

None

2.8 Interface Ports and Cabling

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

3 Summary of Test Results

FCC & ISEDC Rules	Description of Test	Results
FCC §15.203 ISEDC RSS-Gen §6.8	Antenna Requirements	Compliant
FCC §2.1091, §15.247(i) ISEDC RSS-102	RF Exposure	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Line Conducted Emissions	N/A[1]
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(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 Terminal (dBc)	Compliant
FCC §2.1051, §15.247(d) ISEDC RSS-247 §5.5	100 kHz Bandwidth of Frequency Band Edges	Compliant

Note[1]: The EUT is battery powered.

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	1201-M1	Metal Antenna	2400-2480	2.0

Note: The antenna gain information was provided by the customer

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

5.1 Applicable Standards

According to FCC §15.247(i), Radio frequency devices operating under the provisions of this part are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307(b), 1.1310, 2.1091, and 2.1093 of this chapter, as appropriate. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements. Technical information showing the basis for this statement must be submitted to the Commission upon request.

According to FCC §2.1091 and §1.1310(e)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

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

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

According to ISEDC RSS-102 Issue 6 Section 6.6: Field reference level exposure exemption limits

Field reference level (FRL) 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 (i.e. mobile devices), except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum EIRP 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 EIRP of the device is equal to or less than $4.49/f0.5W4.49/f0.5W$ (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 EIRP 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 EIRP of the device is equal to or less than $1.31\times10-2f0.6834W1.31\times10-2f0.6834W$ (adjusted for tune-up tolerance), where f is in MHz
- at or above 6 GHz and the source-based, time-averaged maximum EIRP 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 EIRP was derived.

5.2 MPE Prediction

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

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

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

5.3 MPE Result

Bluetooth LE, 2M PHY

Maximum output power at antenna input terminal (dBm):	3.297
Maximum output power at antenna input terminal (mW):	2.136
Prediction distance (cm):	20
Prediction frequency (MHz):	2402
Maximum Directional Antenna Gain, typical (dBi):	2.0
Maximum Antenna Gain (numeric):	1.585
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.000674
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.000647 mW/cm^2. Limit is 1 mW/cm^2.

5.4 IC Exemption

Bluetooth LE, 2M PHY

The EIRP of this device is 5.297 dBm (3.386 mW) which is less than the exemption threshold, i.e., 1.31*10^(-2) * f^(0.6834) = 2.676 W.

Therefore, the SAR evaluation is exempt.

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

6.1 Applicable Standards

As per FCC §15.35(b): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d),

in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

As per ISEDC RSS-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.

As per ISEDC 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 ISEDC 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 licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

6.2 Test Setup

The radiated emissions tests were performed in the 5-meter chamber, using the setup in accordance with ANSI C63.10-2020. The specification used was the FCC §15.247 and ISEDC RSS-247 limits.

The spacing between the peripherals was 10 centimeters.

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

6.3 Test Procedure

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

6.4 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

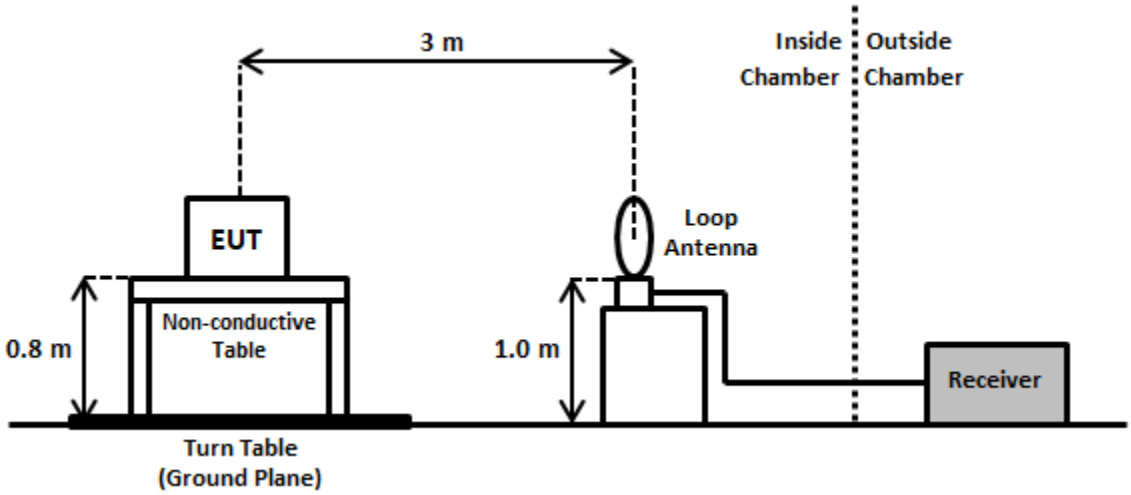
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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:

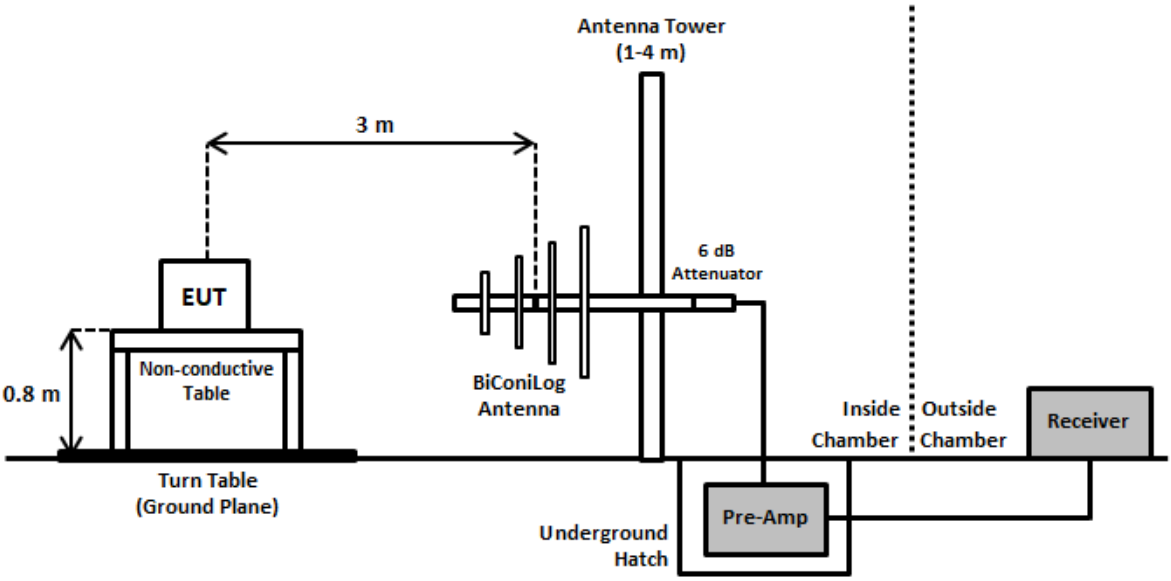
Margin = Corrected Amplitude – Limit

6.5 Test Setup Block Diagram

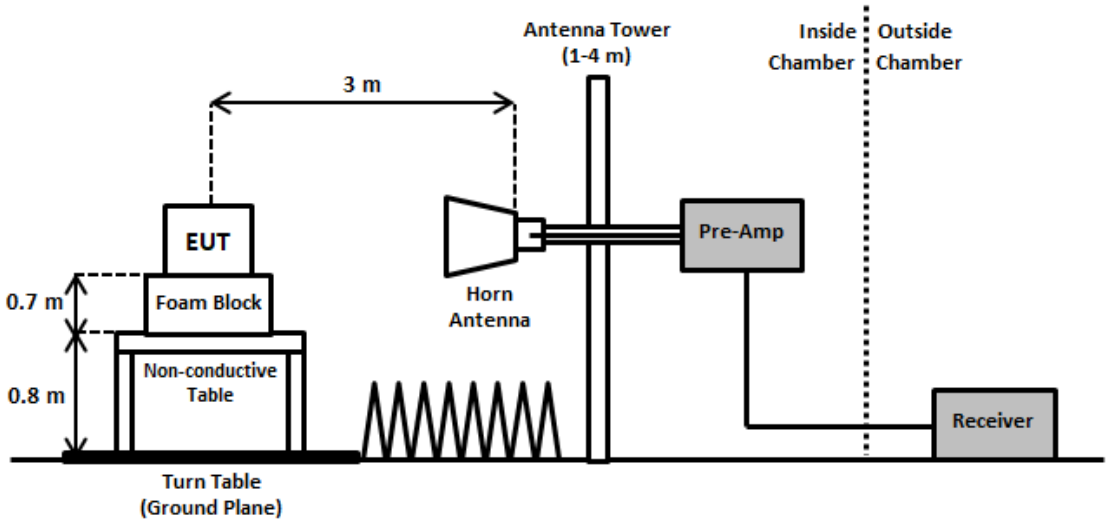
9 kHz to 30 MHz



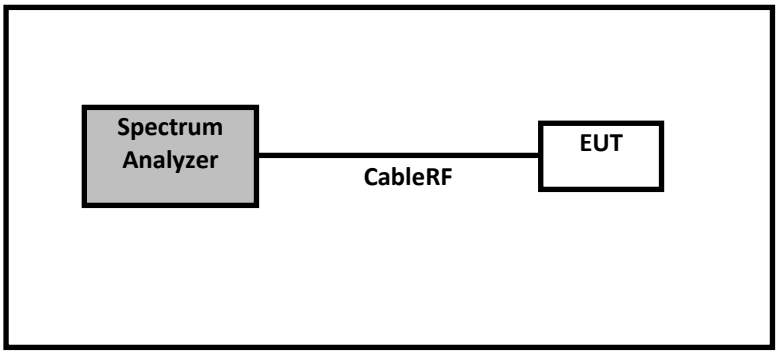
30 MHz to 1 GHz



1 GHz to 26.5 GHz



Band-Edges



6.6 Test Equipment List and Details

Radiated Spurious Emissions

BACL No	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
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
1432	Keysight Technologies	MXE EMI Receiver, Multi-touch	N9038B	MY60180008	2025-01-03	1 year
310	Rhode & Schwarz	EMI Test Receiver	ESCI 1166.5950.03	100338	2024-05-29	1 year
316	Sonoma Instruments	Preamplifier 10 kHz - 2.5 GHz	317	260406	2025-02-20	6 months
321	Sunol Sciences	Biconilog Antenna	JB3	A020106-2; 1504	2023-12-18	2 years
1245	-	6dB Attenuator	PE7390-6	01182018A	2023-12-18	2 years
1246	Hewlet Packard	RF Limiter	11867A	1734	2024-04-09	1 year
1248	Pasternack	RG214 COAX Cable	PE3062	-	2024-10-01	6 months
1249	Time microwave	LMR-400 Cable Dc-3 GHz	AE13684	2k80612-5 6fts	2024-04-09	1 year
1359	Pasternack	N 600in RF Cable	PE3496LF-600	-	2025-01-02	6 months
1192	ETS Lindgren	Horn Antenna	3117	218973	2024-10-23	2 years
1393	Mini Circuit	CBL ASSY 2.92MM PLUG TO PLUG 12"	FL086-12KM+	QN2318110-2318	2025-02-18	6 months
1449	BACL	Preamplifier	BACL1313-A100M18G	4052472	2025-02-19	6 months
90	Wisewave	Horn Antenna	ARH-4223-02	10555-01	2023-05-02	2 years
1394	Mini Circuit	CBL ASSY 2.92MM PLUG TO PLUG 12"	FL086-12KM+	QN2318110-2318	2025-02-18	6 months
1451	BACL	Preamplifier	BACL-1313-A1840	4052432	2025-02-19	6 months
1334	Micro-Tronics	Notch Filter 2.4GHz	BRM50702	G361	2024-12-31	1 year
393	Com-Power	Loop Antenna, Active	AL-130	17043	2023-05-26	2 years

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".*

Band-Edges

BACL No	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
1128	Agilent	EXA Signal Analyzer	N9010A	MY48030852	2024-05-23	1 year
-	-	RF Cable	-	-	Each Time[1]	N/A

Note[1]: cable included in the test set-up was 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".*

6.7 Test Environmental Conditions

Radiated Spurious Emissions

Temperature:	22.7 to 23.2 ºC
Relative Humidity:	38.8 to 42.1 %
ATM Pressure:	101.4 to 101.7

The testing was performed by Kevin Chau from 2025-03-04 to 2025-03-19 in 5m chamber 3.

Band-Edges

Temperature:	21.1 ºC
Relative Humidity:	44.7 %
ATM Pressure:	101.5 kPa

The testing was performed by Kevin Chau on 2025-03-14 at RF test site.

6.8 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:

Worst Case – Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Configuration**
-0.01	120.5025	Horizontal	2440 MHz, 1M PHY

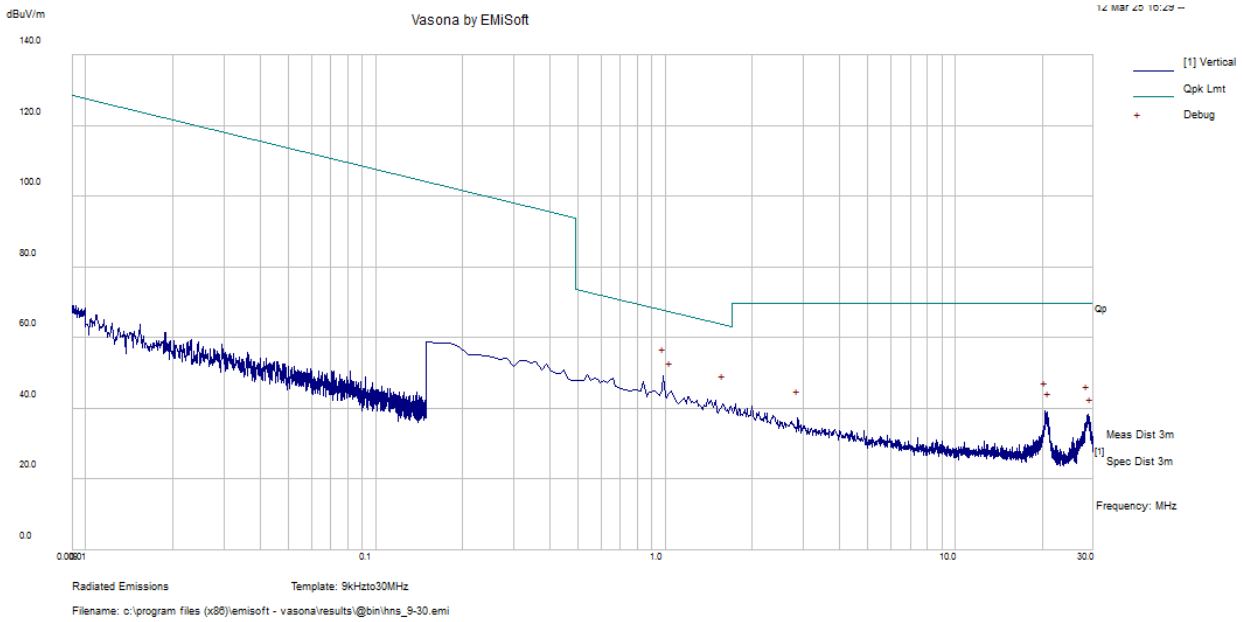
Please refer to the tables and plots in the next section for detailed test results.

6.9 Radiated Emissions Test Results

Please refer to Annex E for detailed FCC §15.209 band-edges test result.

1) 9 kHz – 30 MHz, Measured at 3 meters

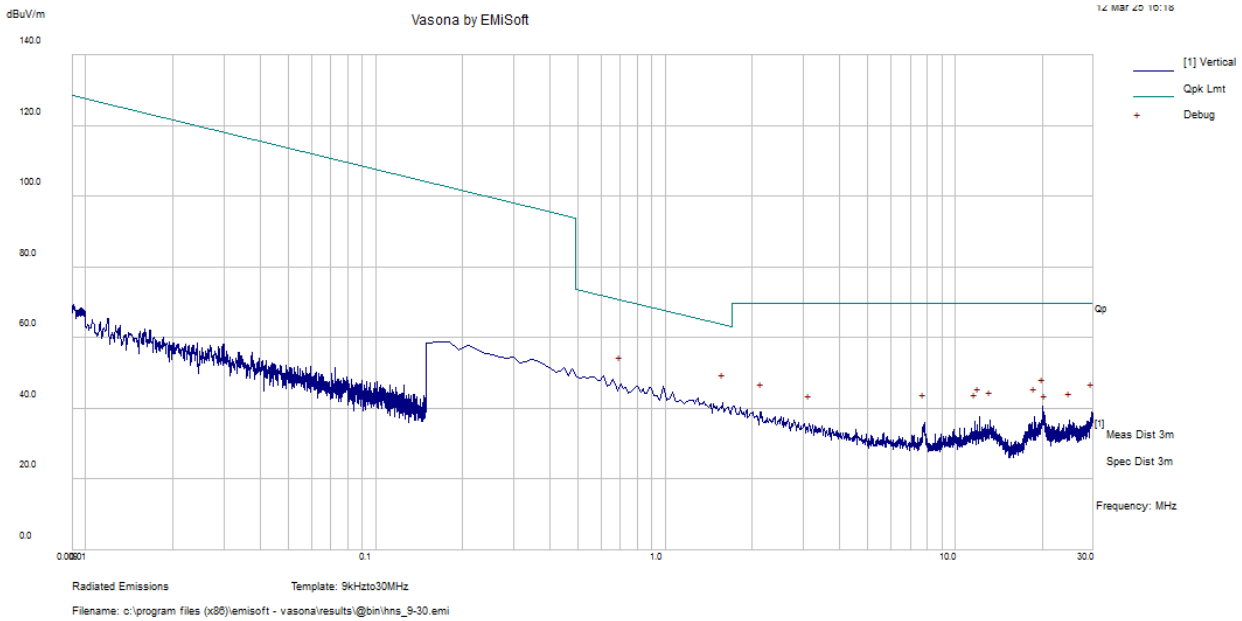
BLE, 1M PHY, 2440 MHz, Parallel



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
0.9858	39.02	10.05	49.07	67.73	-18.66	Peak
1.5828	31.01	10.25	41.25	63.62	-22.36	Peak
1.0455	34.78	10.07	44.85	67.22	-22.37	Peak
20.52263	30.01	9.36	39.37	69.54	-30.17	Peak
28.71645	30.66	7.64	38.3	69.54	-31.24	Peak
2.86635	26.76	10.4	37.16	69.54	-32.38	Peak

Note 1: Radiated Spurious Emissions at 9kHz-30MHz was only evaluated at worst case configuration.
Note 2: Peak measurement was evaluated against the Quasi-Peak limit to show worst-case compliance.

BLE, 1M PHY, 2440 MHz, Perpendicular

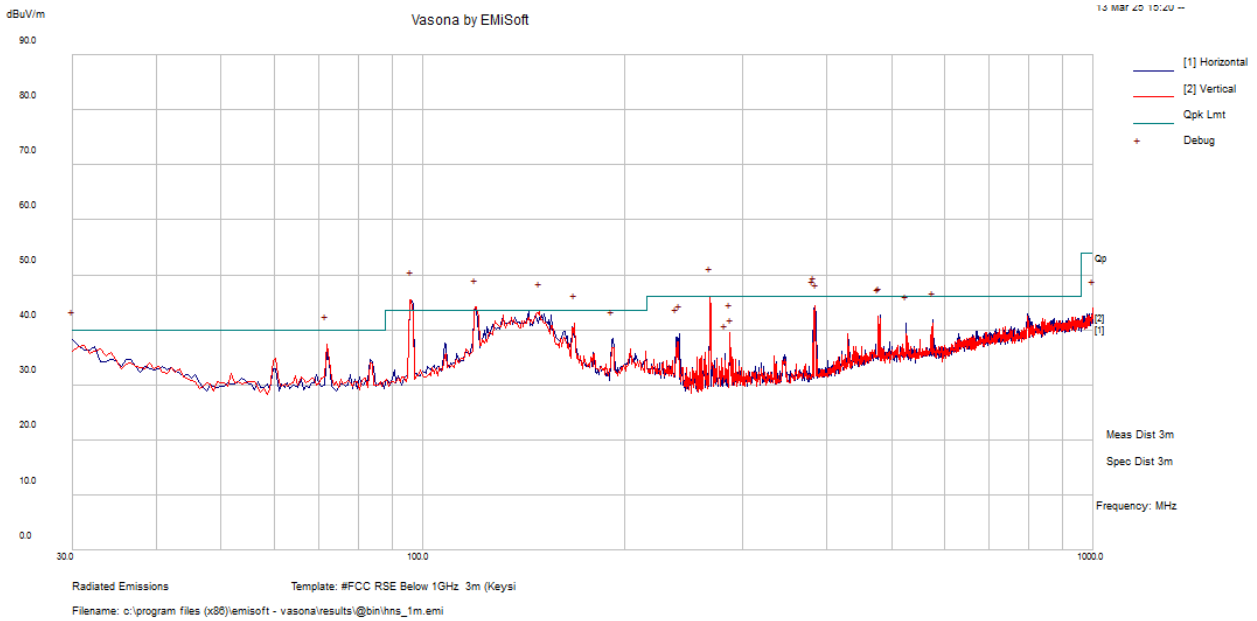


Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1.5828	31.42	10.25	41.66	63.62	-21.96	Peak
0.702225	36.65	10.14	46.79	70.68	-23.89	Peak
20.10473	31	9.51	40.51	69.54	-29.03	Peak
2.14995	28.75	10.35	39.1	69.54	-30.44	Peak
29.71643	31.42	7.51	38.94	69.54	-30.6	Peak
18.82118	27.87	9.9	37.77	69.54	-31.77	Peak

Note 1: Radiated Spurious Emissions at 9kHz-30MHz was only evaluated at worst case configuration.
Note 2: Peak measurement was evaluated against the Quasi-Peak limit to show worst-case compliance.

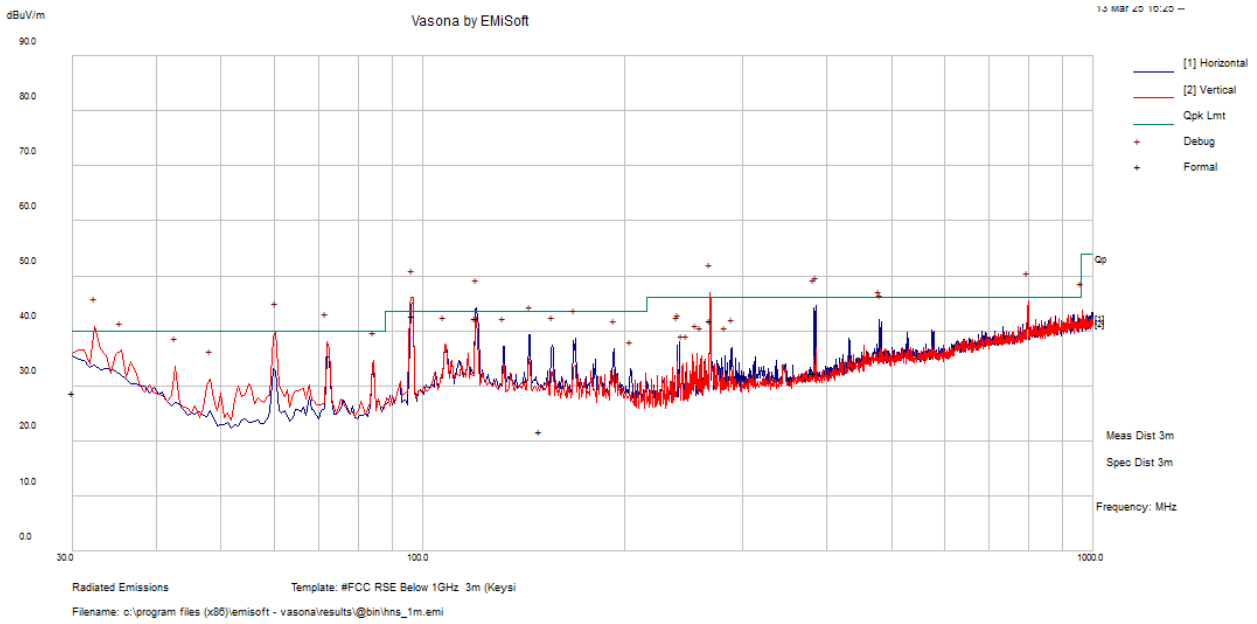
2) 30 MHz – 1 GHz, Measured at 3 meters

BLE, 1M PHY, 2402 MHz



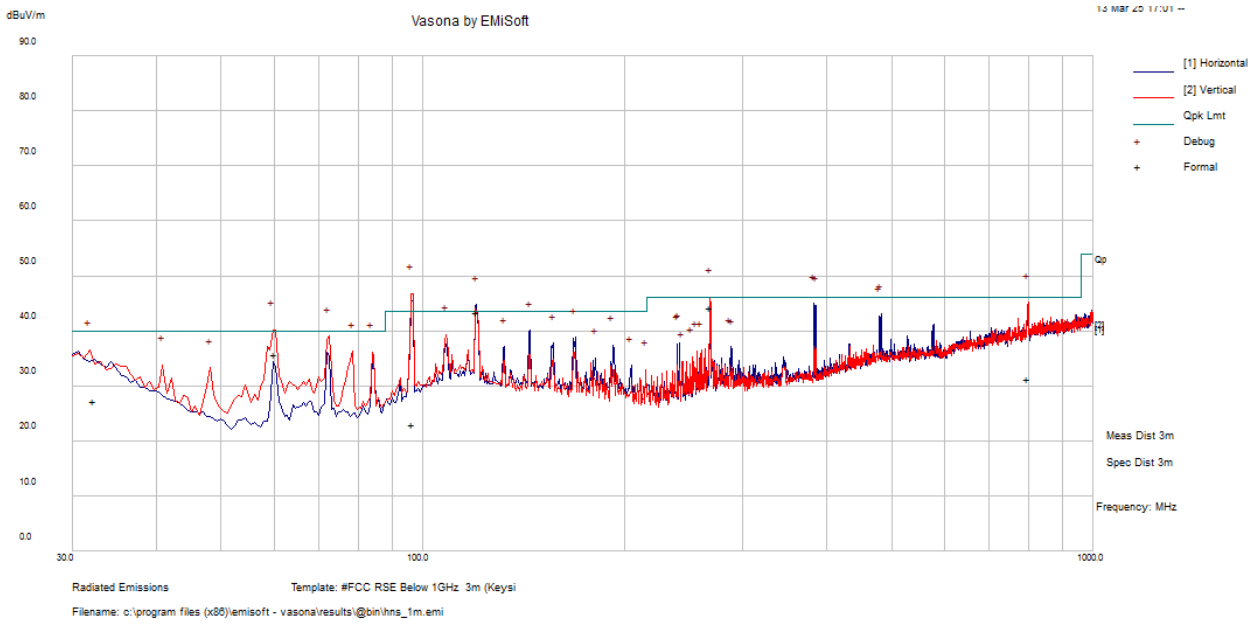
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
96.325	53.52	-10.86	42.67	190	H	118	43.5	-0.83	QP
119.9378	48.96	-6.72	42.24	119	H	265	43.5	-1.26	QP
268.2547	49.1	-7.21	41.89	123	V	66	46	-4.11	QP
149.3359	29.59	-7.94	21.65	173	V	14	43.5	-21.85	QP
383.8188	37.03	-4.71	32.33	274	V	311	46	-13.67	QP
30.00052	29.25	-0.58	28.66	173	H	35	40	-11.34	QP

BLE, 1M PHY, 2440 MHz



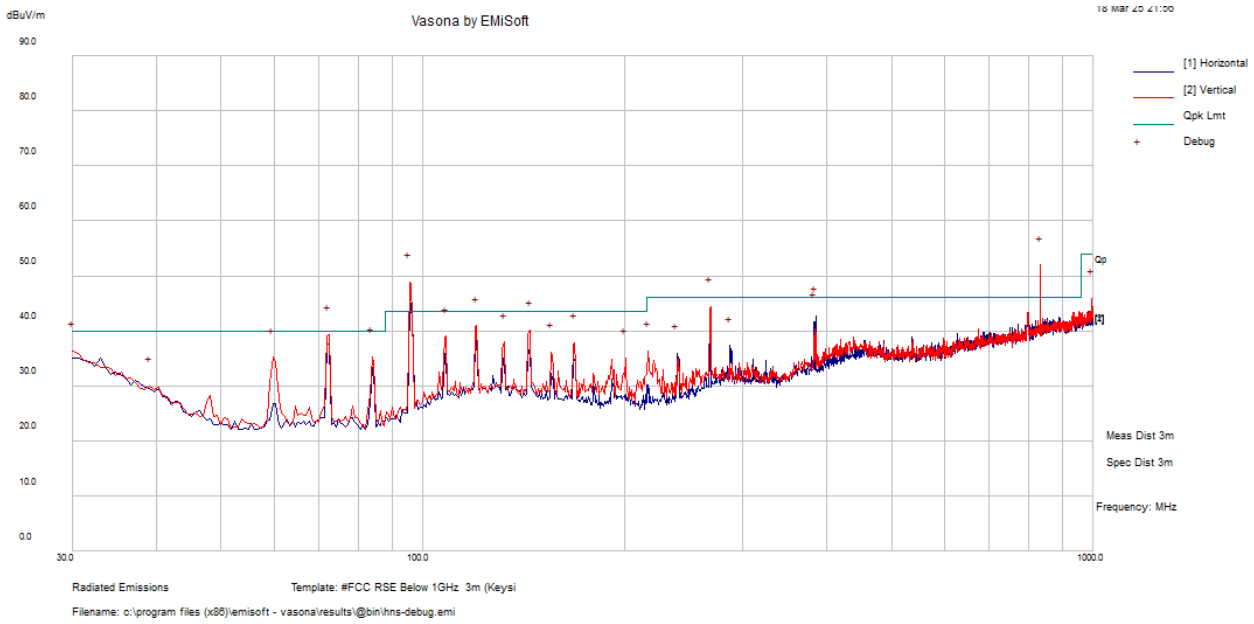
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
96.66031	33.66	-10.77	22.89	197	V	246	43.5	-20.61	QP
268.2547	51.53	-7.21	44.32	108	V	24	46	-1.68	QP
32.25	29.57	-2.33	27.24	252	V	136	40	-12.76	QP
120.5025	**50.18**	**-6.69**	**43.49**	**258**	**H**	**113**	**43.5**	**-0.01**	**QP**
60.205	49.38	-13.56	35.81	165	V	14	40	-4.19	QP
800.0356	28.37	2.86	31.23	183	V	86	46	-14.77	QP

BLE, 1M PHY, 2480 MHz



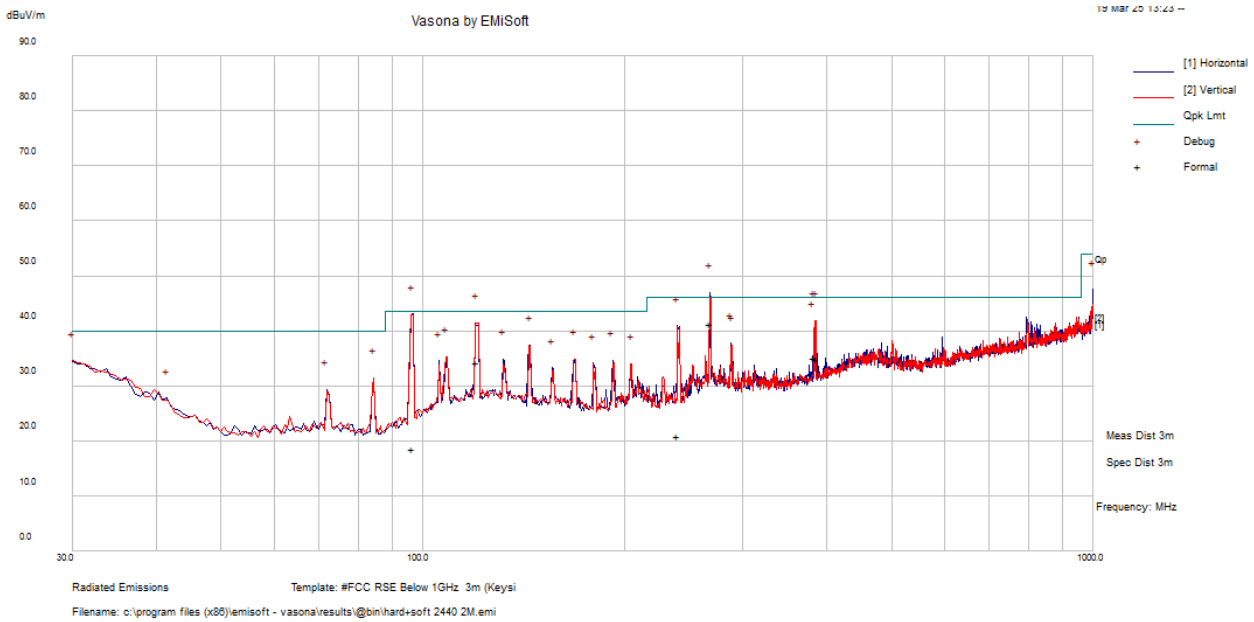
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
95.935	53.89	-10.96	42.93	181	V	181	43.5	-0.57	QP
59.91563	45.43	-13.6	31.84	135	V	35	40	-8.16	QP
268.285	51.06	-7.21	43.86	100	V	41	46	-2.14	QP
799.125	30.23	2.85	33.07	149	V	219	46	-12.93	QP
72.31563	44.73	-12.93	31.8	153	V	8	40	-8.2	QP
120.5831	48.06	-6.69	41.37	220	H	115	43.5	-2.13	QP

BLE, 2M PHY, 2402 MHz



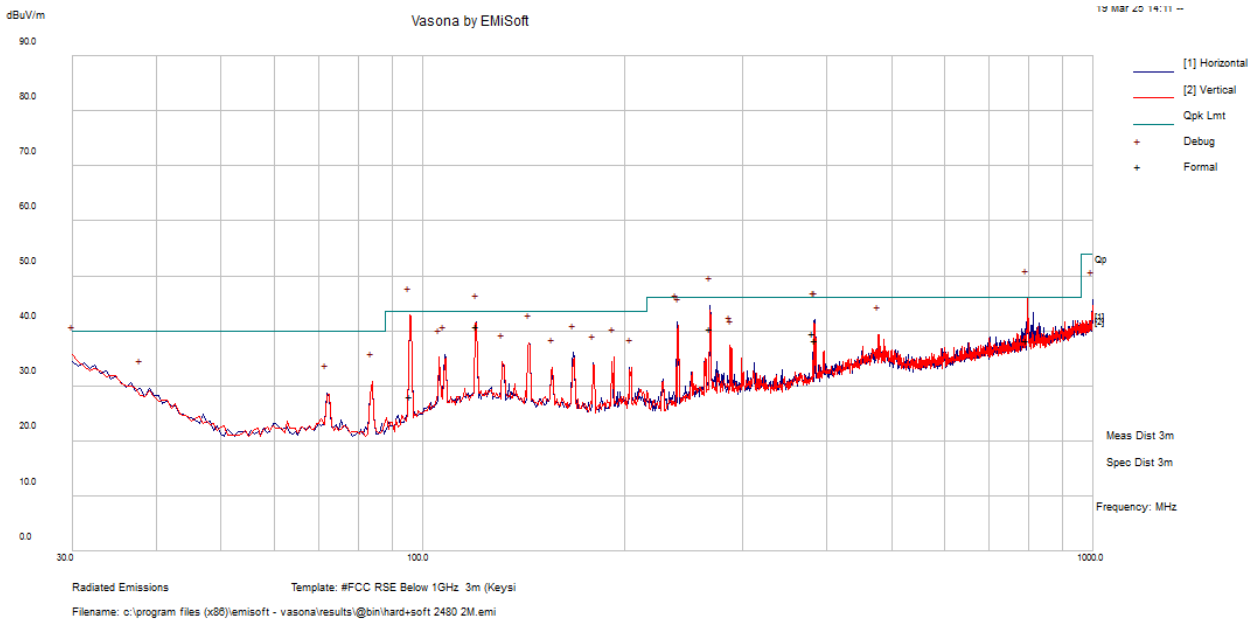
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
95.74063	35.41	-11.03	24.39	100	V	236	43.5	-19.12	QP
120.2453	39.56	-6.7	32.86	123	V	23	43.5	-10.65	QP
72.10188	34.19	-12.93	21.26	151	V	15	40	-18.74	QP
833.2847	28.4	3.39	31.79	151	V	183	46	-14.21	QP
268.5459	47.33	-7.19	40.15	107	V	125	46	-5.85	QP
385.3222	30.34	-4.67	25.66	112	H	69	46	-20.34	QP

BLE, 2M PHY, 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)	Detector
96.5175	29.33	-10.81	18.52	120	H	221	43.5	-24.98	QP
120.3331	40.85	-6.7	34.15	193	V	228	43.5	-9.35	QP
386.1159	39.58	-4.65	34.93	100	V	137	46	-11.07	QP
383.8844	39.83	-4.69	35.13	126	V	170	46	-10.87	QP
239.8294	29.58	-8.7	20.87	185	H	246	46	-25.13	QP
268.5928	48.5	-7.18	41.32	100	H	117	46	-4.68	QP

BLE, 2M PHY, 2480 MHz



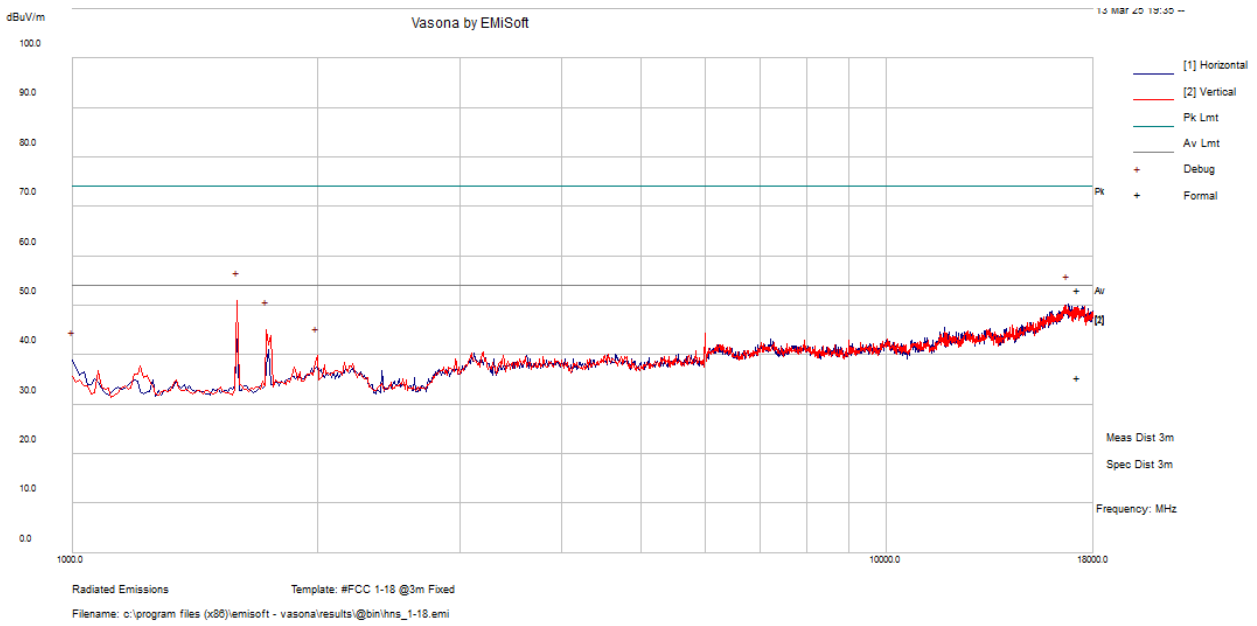
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
796.8363	35.45	2.8	38.26	137	V	95	46	-7.74	QP
95.665	39.09	-11.05	28.05	202	V	14	43.5	-15.46	QP
268.1134	47.63	-7.22	40.42	122	H	161	46	-5.58	QP
120.1975	47.49	-6.71	40.78	131	H	167	43.5	-2.72	QP
384.6988	43.06	-4.69	38.38	197	H	64	46	-7.62	QP
382.6506	44.21	-4.72	39.49	106	H	61	46	-6.51	QP

FCC/IC Limits for 1 GHz to 26.5 GHz			
Applicability	**(dBm)**	**(uV/m at 3meters)**	**(dBuV/m at 3meters)**
Restricted Band Average Limit	-	500	54[2]
Restricted Band Peak Limit[1]	-	-	74

Note 1: Restricted Band Peak Limit is defined to be 20dB higher than Average Limit.
Note 2: Above 1GHz limit calculation:
dBuV/m = 20*log(V/m) + 120 = 20*log((500 [uV/m]/1000000)) + 120 = 54 [dBuV/m]

3) 1 GHz – 18 GHz, Measured at 3 meters

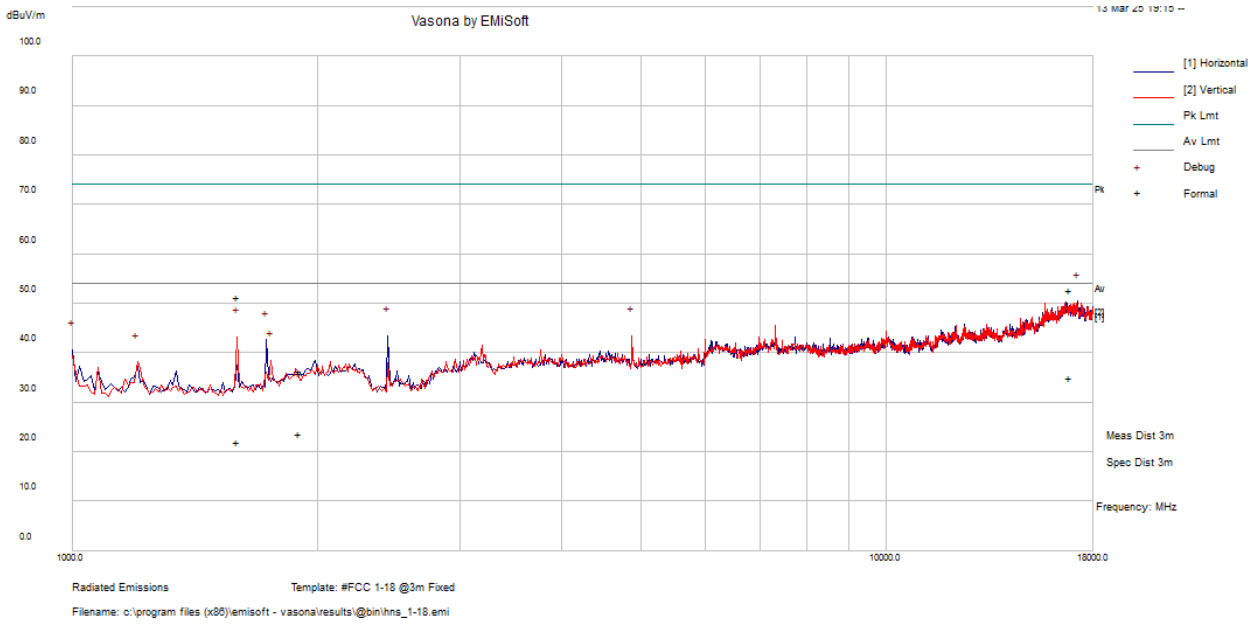
BLE, 1M PHY, 2402 MHz



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)	Detector
1594.8	56.88	-8.5	48.38	259	V	172	74	-25.62	Peak
16756.38	35.25	17.05	52.3	157	H	96	74	-21.7	Peak
1594.8	30.05	-8.5	21.54	259	V	172	54	-32.46	Average
16756.38	17.22	17.05	34.27	157	H	96	54	-19.73	Average

Note: All other peak emissions in the plot above are shown to be below the Average limit.

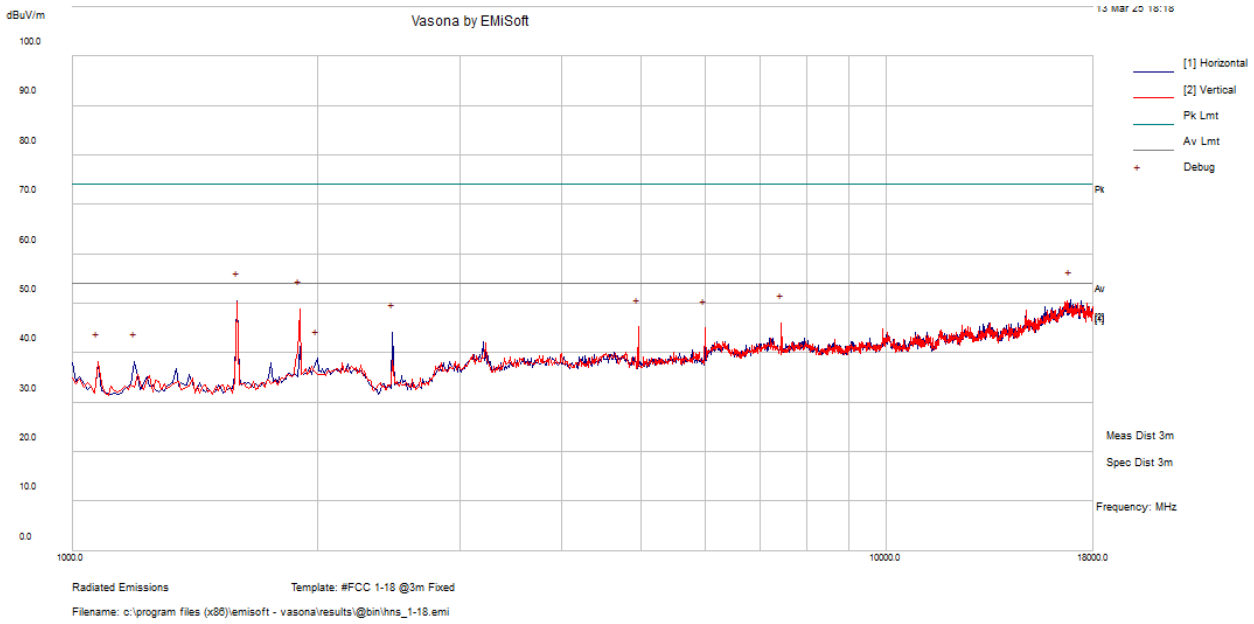
BLE, 1M PHY, 2440 MHz



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)	Detector
17213.92	35.93	17.2	53.13	226	H	159	74	-20.88	Peak
17213.92	18.17	17.2	35.37	226	H	159	54	-18.63	Average

Note: All other peak emissions in the plot above are shown to be below the Average limit.

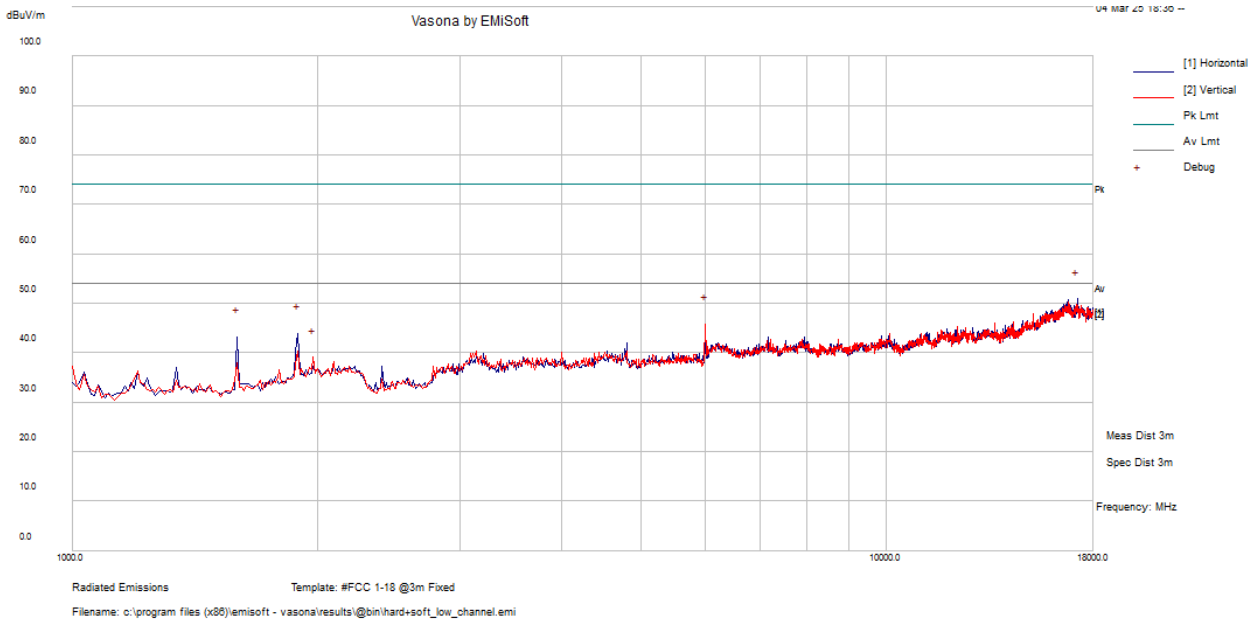
BLE, 1M PHY, 2480 MHz



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)	Detector
16872.95	35.65	17.03	52.68	272	H	335	74	-21.32	Peak
1596.76	59.88	-8.49	51.39	122	H	347	74	-22.61	Peak
1903.095	40.87	-4.84	36.03	292	V	274	74	-37.97	Peak
16872.95	17.92	17.03	34.96	272	H	335	54	-19.04	Average
1596.76	30.53	-8.49	22.04	122	H	347	54	-31.96	Average
1903.095	28.57	-4.84	23.73	292	V	274	54	-30.27	Average

Note: All other peak emissions in the plot above are shown to be below the Average limit.

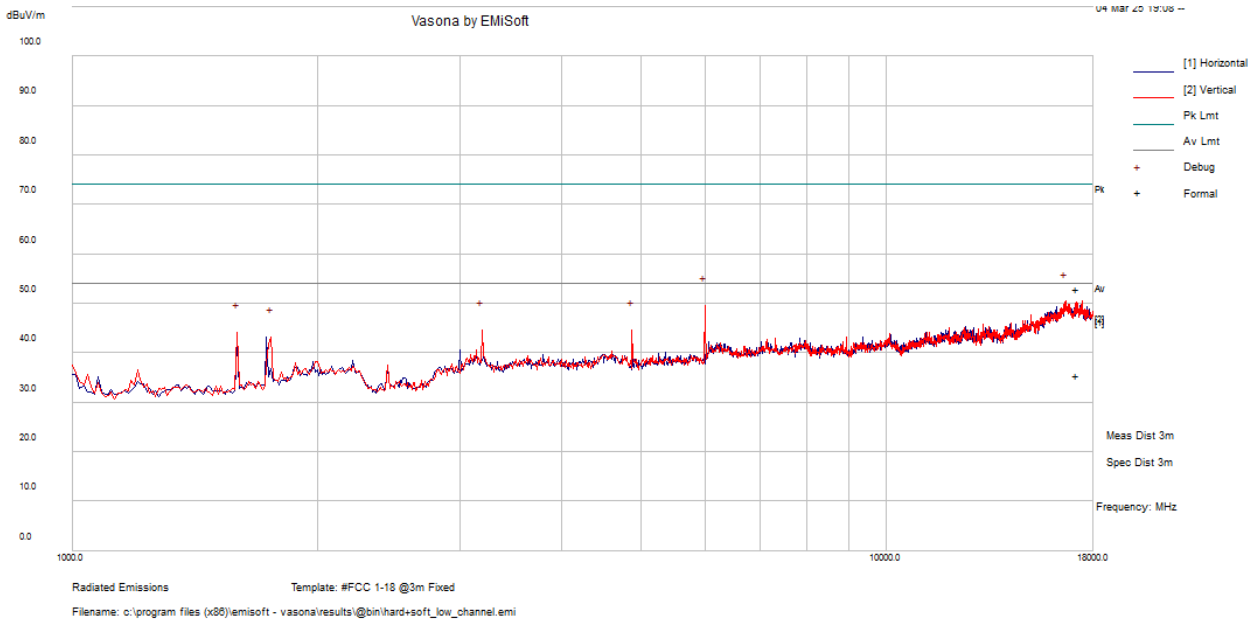
BLE, 2M PHY, 2402 MHz



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)	Detector
17202.27	35.49	17.35	52.84	117	H	160	74	-21.16	Peak
17202.27	18.05	17.35	35.4	117	H	160	54	-18.6	Average

Note: All other peak emissions in the plot above are shown to be below the Average limit.

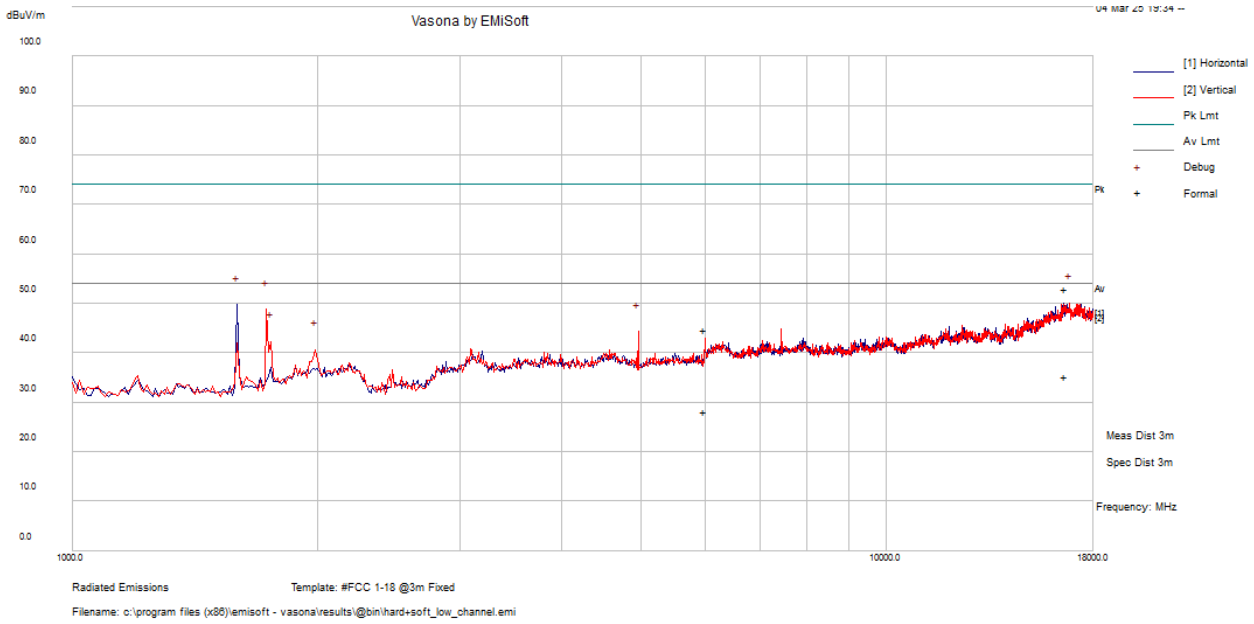
BLE, 2M PHY, 2440 MHz



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)	Detector
16638.64	35.63	17.27	52.9	195	V	224	74	-21.11	Peak
5995.283	44.4	0.29	44.7	174	V	336	74	-29.3	Peak
16638.64	17.91	17.27	35.17	195	V	224	54	-18.83	Average
5995.283	27.94	0.29	28.24	174	V	336	54	-25.76	Average

Note: All other peak emissions in the plot above are shown to be below the Average limit.

BLE, 2M PHY, 2480 MHz

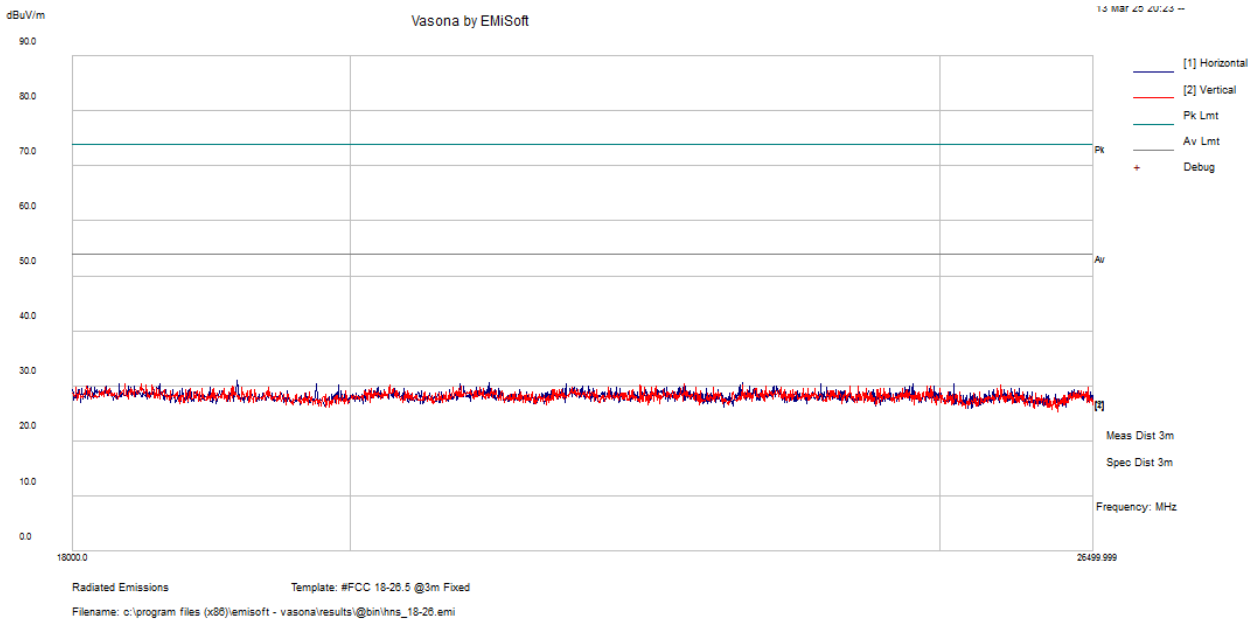


Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
16830.58	34.97	17	51.97	159	V	352	74	-22.04	Peak
1593.205	60.58	-8.51	52.07	239	H	175	74	-21.93	Peak
1733.268	40.99	-7.01	33.98	145	V	92	74	-40.02	Peak
16830.58	17.91	17	34.9	159	V	352	54	-19.1	Average
1593.205	30.82	-8.51	22.3	239	H	175	54	-31.7	Average
1733.268	29.3	-7.01	22.29	145	V	92	54	-31.71	Average

Note: All other peak emissions in the plot above are shown to be below the Average limit.

4) 18 GHz – 26.5 GHz, Measured at 3 meters

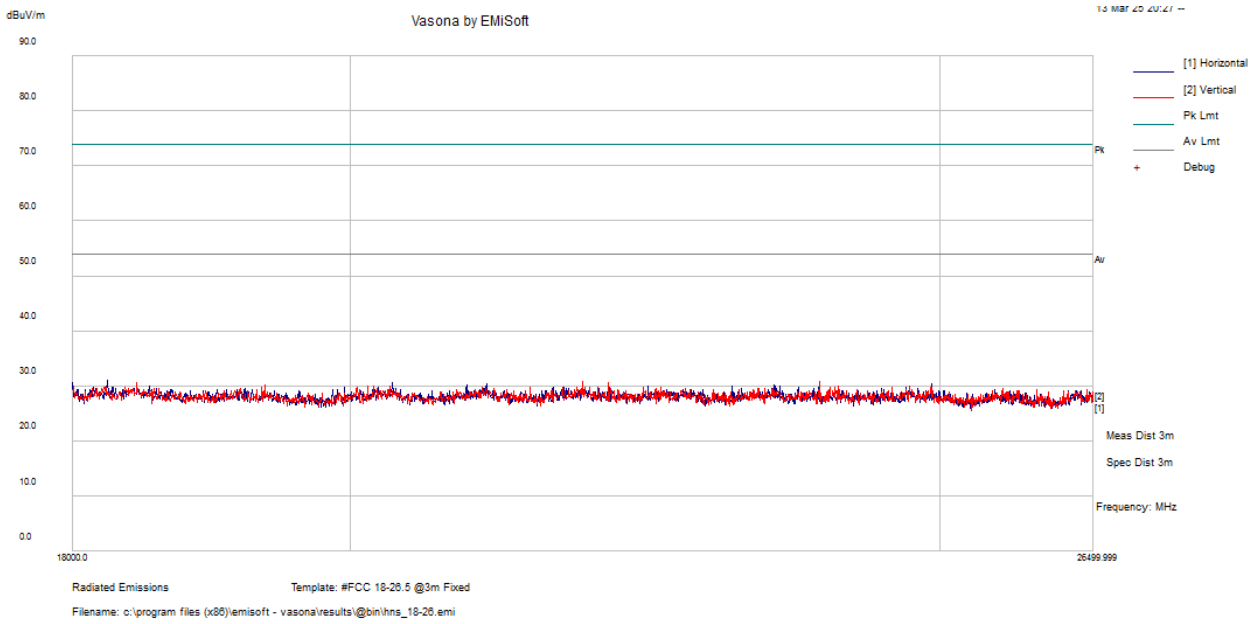
BLE, 1M PHY, 2402 MHz



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Limit (dBµV/m)	Margin (dB)	Detector
21089.08	40.63	-11.96	28.67	V	54	-25.33	Peak

Note 1: Peak measurement was evaluated against the Average limit to show worst-case compliance.
Note 2: All peak emissions in the plot above are shown to be below the Average limit.

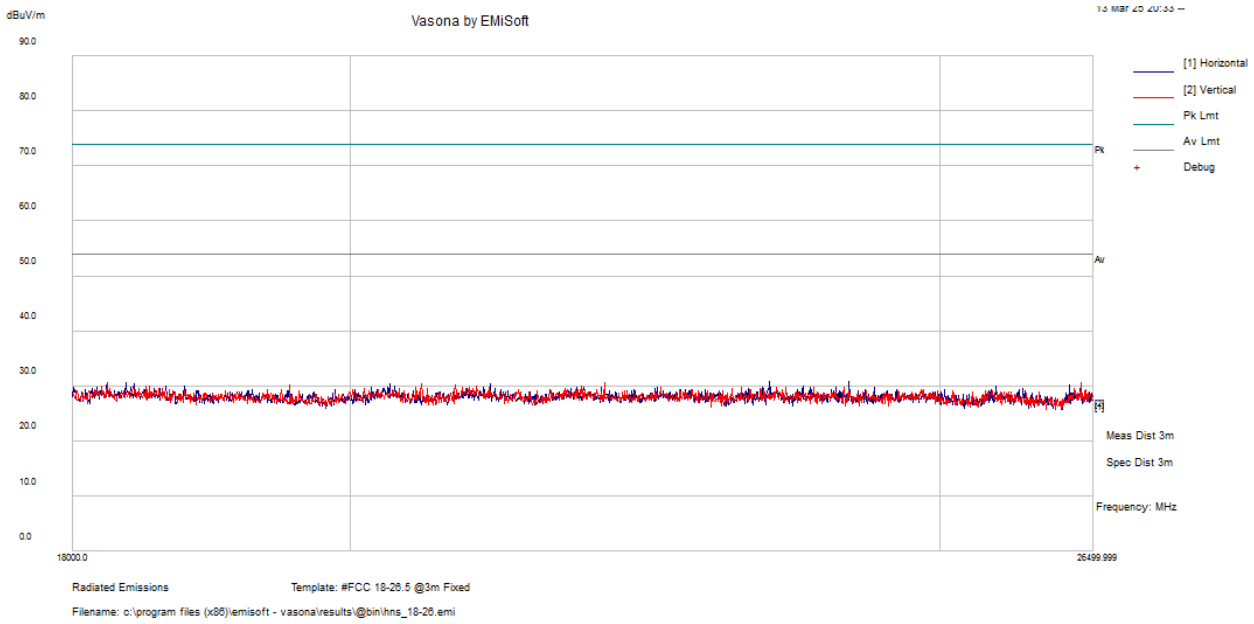
BLE, 1M PHY, 2440 MHz



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Limit (dBµV/m)	Margin (dB)	Detector
23909.2	36.99	-9.97	27.02	V	54	-26.98	Peak

Note 1: Peak measurement was evaluated against the Average limit to show worst-case compliance.
Note 2: All peak emissions in the plot above are shown to be below the Average limit.

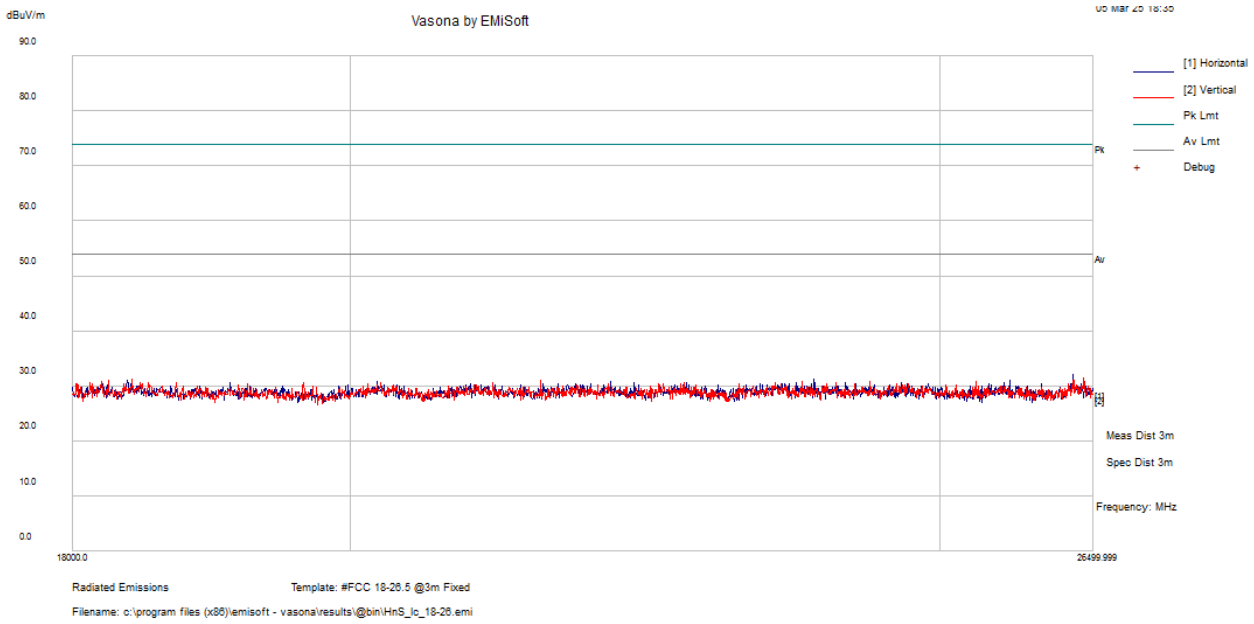
BLE, 1M PHY, 2480 MHz



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Limit (dBµV/m)	Margin (dB)	Detector
24164.86	38.35	-9.74	28.61	V	54	-25.39	Peak

Note 1: Peak measurement was evaluated against the Average limit to show worst-case compliance.
Note 2: All peak emissions in the plot above are shown to be below the Average limit.

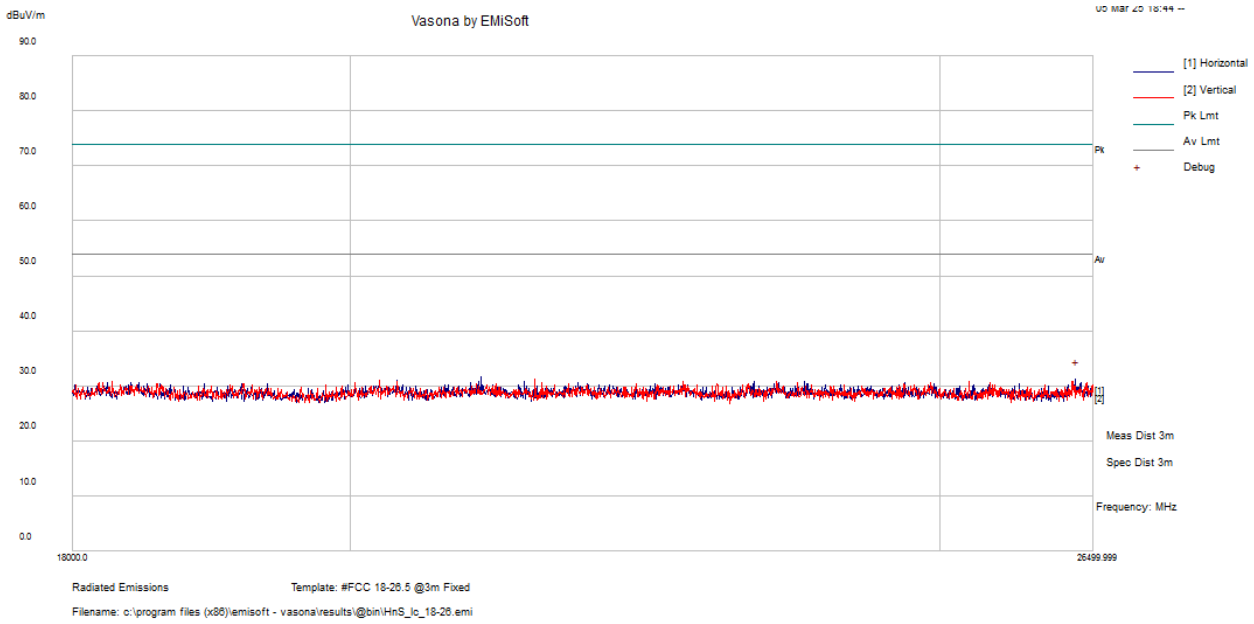
BLE, 2M PHY, 2402 MHz



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Limit (dBµV/m)	Margin (dB)	Detector
26321.24	37.74	-8.39	29.35	V	54	-24.65	Peak

Note 1: Peak measurement was evaluated against the Average limit to show worst-case compliance.
Note 2: All peak emissions in the plot above are shown to be below the Average limit.

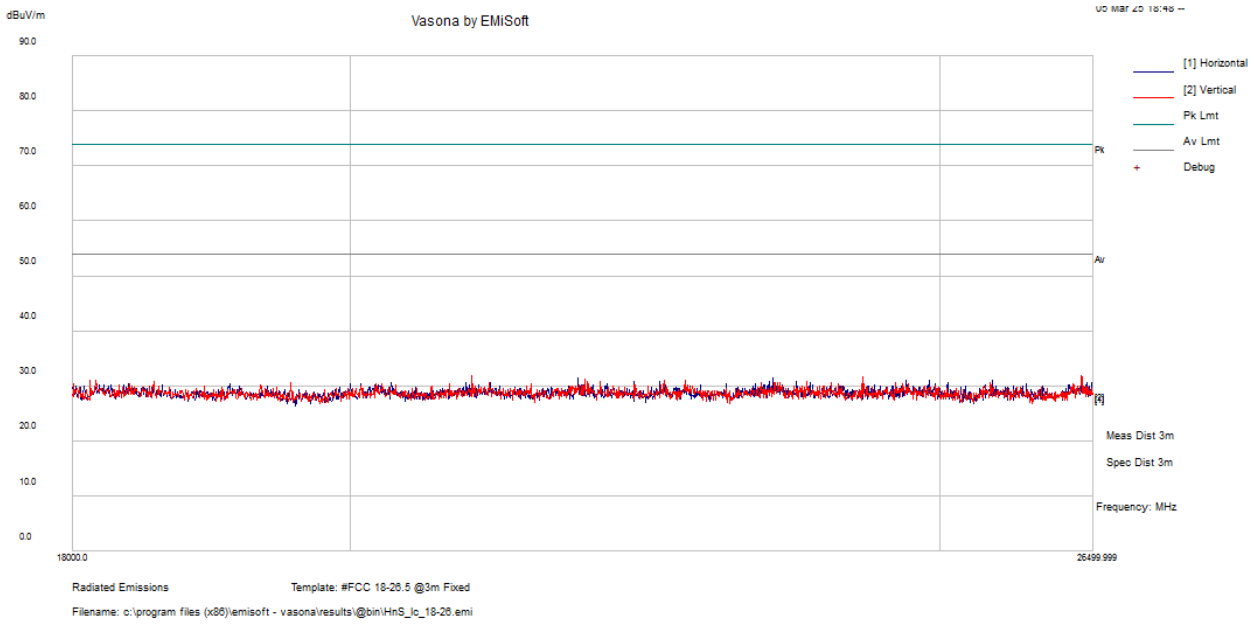
BLE, 2M PHY, 2440 MHz



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Limit (dBµV/m)	Margin (dB)	Detector
26331.42	37.75	-8.38	29.37	V	54	-24.63	Peak

Note 1: Peak measurement was evaluated against the Average limit to show worst-case compliance.
Note 2: All peak emissions in the plot above are shown to be below the Average limit.

BLE, 2M PHY, 2480 MHz



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Limit (dBµV/m)	Margin (dB)	Detector
26413.02	37.48	-8.26	29.22	V	54	-24.78	Peak

Note 1: Peak measurement was evaluated against the Average limit to show worst-case compliance.
Note 2: All peak emissions in the plot above are shown to be below the Average limit.

7 FCC §15.247(a) (2) & ISEDC RSS-247 §5.2, RSS-Gen §6.7 – Emission Bandwidth

7.1 Applicable Standards

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

7.2 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 6.9.3: Occupied bandwidth—power bandwidth (99%) measurement procedure

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).

As per ANSI C63.10 Clause 11.8: DTS bandwidth

One of the following procedures may be used to determine the modulated DTS bandwidth.

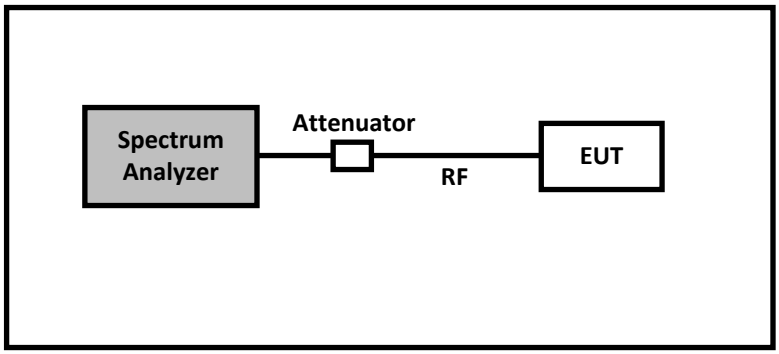
Option 1:

a. Set RBW = 100 kHz.
b. Set the VBW $\geqslant$ [3 $\times$ RBW].
c. Detector = peak.
d. Trace mode = max hold.
e. Sweep = auto couple.
f. Allow the trace to stabilize.
g. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Option 2:

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 $\geqslant$ 3 $\times$ 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 $\geqslant$6 dB.

7.3 Test Setup Block Diagram



7.4 Test Equipment List and Details

BACL No	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
912	Rhode & Schwarz	Spectrum Analyzer	FSV40	1321.3008k39-101203-UW	2024-07-25	1 year
-	-	10dB Attenuator	-	-	Each Time[1]	N/A
-	-	RF Cable	-	-	Each Time[1]	N/A

Note[1]: cable and attenuator included in the test set-up were 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".*

7.5 Test Environmental Conditions

Temperature:	20.8 to 21.5 ºC
Relative Humidity:	42.1 to 44.8 %
ATM Pressure:	101.3 to 101.5 kPa

The testing was performed by Kevin Chau from 2025-02-26 to 2025-02-27 at RF test site.

7.6 Test Results

Channel	Frequency (MHz)	99% OBW (MHz)	6 dB OBW (MHz)	6 dB OBW Limit (kHz)	Result
BLE, 1M PHY					
Low	2402	1.064	738.1	≥ 500	Pass
Middle	2440	1.064	746.7	≥ 500	Pass
High	2480	1.081	751.1	≥ 500	Pass
BLE, 2M PHY					
Low	2402	2.084	1398.0	≥ 500	Pass
Middle	2440	2.093	1406.7	≥ 500	Pass
High	2480	2.106	1419.7	≥ 500	Pass

Please refer to Annex A for detailed Emissions Bandwidth test results.

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

8.1 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 DTS 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).

8.2 Measurement Procedure

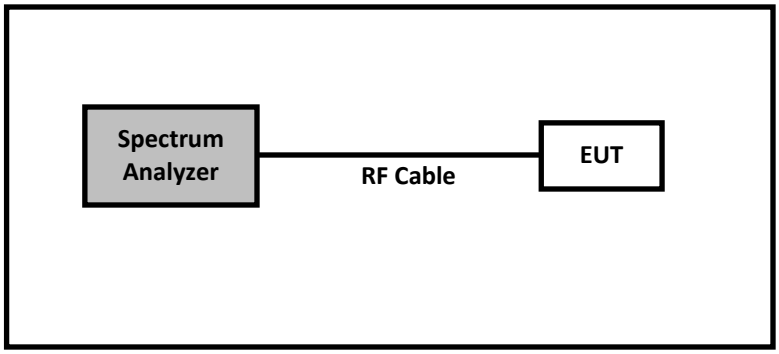
The measurements are based on ANSI C63.10-2013, Section 11.9.1.1.

11.9.1.1 RBW $\geqslant$ 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 $\geqslant$ DTS bandwidth.
b. Set VBW $\geqslant$ [3 $\times$ RBW].
c. Set span $\geqslant$ [3 $\times$ RBW].
d. Sweep time = No faster than coupled (auto) time.
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.

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
1128	Agilent	EXA Signal Analyzer	N9010A	MY48030852	2024-05-23	1 year
-	-	RF Cable	-	-	Each Time[1]	N/A

Note[1]: cable included in the test set-up was 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".*

8.5 Test Environmental Conditions

Temperature:	20.9 ºC
Relative Humidity:	45.9 %
ATM Pressure:	101.3 kPa

The testing was performed by Kevin Chau on 2025-02-28 at RF test site.

8.6 Test Results

Channel	Frequency (MHz)	Antenna Gain (dBi)	Conducted Output Power (dBm)	Conducted Output Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Result
BLE, 1M PHY							
Low	2402	2.0	3.282	≤ 30	5.282	≤ 36	Pass
Middle	2440	2.0	3.028	≤ 30	5.028	≤ 36	Pass
High	2480	2.0	2.978	≤ 30	4.978	≤ 36	Pass
BLE, 2M PHY							
Low	2402	2.0	3.297	≤ 30	5.297	≤ 36	Pass
Middle	2440	2.0	3.016	≤ 30	5.016	≤ 36	Pass
High	2480	2.0	3.009	≤ 30	5.009	≤ 36	Pass

Note 1: EIRP [dBm] = Conducted Output Power [dBm] + Antenna Gain [dBi].
Note 2: Conducted Output Power Limit [dBm] = 10*log(Power[mW]/1mW) = 10*log(1000mW/1mW) = 30 dBm
Note 3: EIRP Limit [dBm] = 10*log(Power[mW]/1mW) = 10*log(4000mW/1mW) = 36 dBm
Note 4: Antenna gain information was provided by the customer.

Please refer to Annex B for detailed Maximum Output Power test results.

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

9.1 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.

9.2 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.

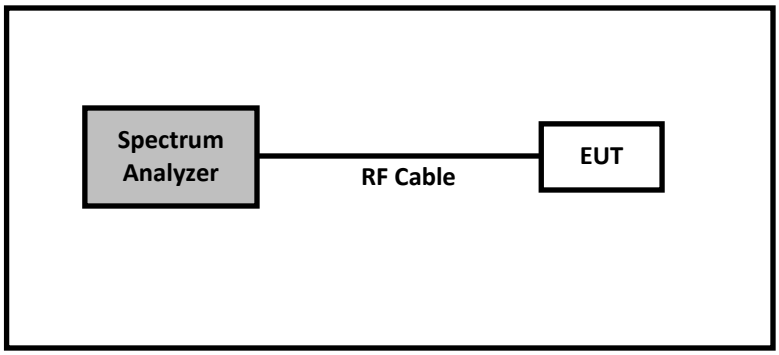
As per ANSI C63.10 Clause 11.10: Maximum power spectral density level in the fundamental emission

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 $\leqslant$ RBW $\leqslant$ 100 kHz.
d. Set the VBW $\geqslant$ [3 $\times$ 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.

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
1128	Agilent	EXA Signal Analyzer	N9010A	MY48030852	2024-05-23	1 year
-	-	RF Cable	-	-	Each Time[1]	N/A

Note[1]: cable included in the test set-up was 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".*

9.5 Test Environmental Conditions

Temperature:	20.9 to 22.1 ºC
Relative Humidity:	42.3 to 45.9 %
ATM Pressure:	101.3 to 101.5

The testing was performed by Kevin Chau from 2025-02-27 to 2025-02-28 at RF test site.

9.6 Test Results

Channel	Frequency (MHz)	PSD[1] [dBm/10kHz]	Limit (dBm/3kHz)	Result
BLE, 1M PHY				
Low	2402	-5.805	≤ 8	Pass
Middle	2440	-7.142	≤ 8	Pass
High	2480	-7.291	≤ 8	Pass
BLE, 2M PHY				
Low	2402	-9.537	≤ 8	Pass
Middle	2440	-9.785	≤ 8	Pass
High	2480	-9.749	≤ 8	Pass

Note: The EUT passed with wider RBW of 10kHz, thus it complies with FCC/IC RBW requirement of 3kHz as compliance is shown under a worse-case circumstance

Please refer to Annex C for detailed Peak Power Spectral Density test results.

10 FCC §15.247(d) & ISEDC RSS-247 §5.5 – 100 kHz Spurious Emissions at Antenna Terminal (-20 dBc)

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).

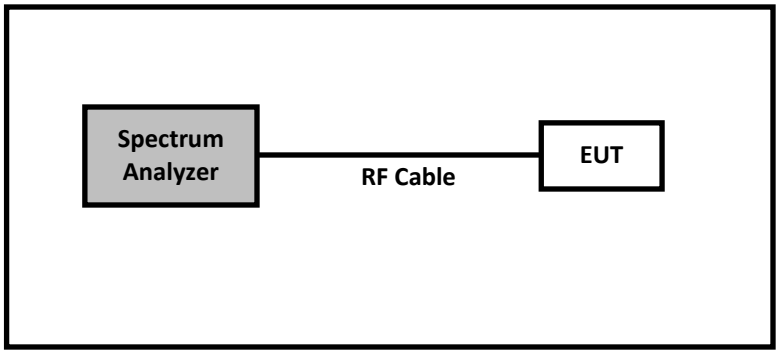
According to ISEDC RSS-247 §5.5.In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the 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
1128	Agilent	EXA Signal Analyzer	N9010A	MY48030852	2024-05-23	1 year
-	-	RF Cable	-	-	Each Time[1]	N/A

Note[1]: cable included in the test set-up was 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".*

10.5 Test Environmental Conditions

Temperature:	21.1 ºC
Relative Humidity:	44.7 %
ATM Pressure:	101.5 kPa

The testing was performed by Kevin Chau from 2025-03-14 at RF test site.

10.6 Test Results

Test Result: Pass

Please refer to Annex D for detailed 100 kHz Spurious Emissions and Band Edges at Antenna Terminal (-20 dBc) test results.

11 Annex A – Emission Bandwidth

Please refer to the attachment.

12 Annex B – Maximum Output Power

Please refer to the attachment.

13 Annex C – Peak Power Spectral Density

Please refer to the attachment.

14 Annex D – 100 kHz Spurious Emissions at Antenna Terminal (-20 dBc)

Please refer to the attachment.

15 Annex E – FCC §15.209 Band Edges

Please refer to the attachment.

16 Appendix A (Normative) – EUT Test Setup Photographs

Please refer to the attachment.

17 Appendix B (Normative) – EUT External Photographs

Please refer to the attachment

18 Appendix C (Normative) – EUT Internal Photographs

Please refer to the attachment

19 Appendix D (Informative) – Declaration of Similarity (DoS)

hard&softWERK

blukii Small MKII 1201 - Manufacturers Declaration of Similarity

03/13/2025

With this document, the company

hard&softWERK GmbH
Bahnhofstraße 10
78112 St. Georgen, Germany

confirms that the following product types:

Blukii Small MKII 1201 – Variant 1	Main Cirucit + Battery + Housing
Blukii Small MKII 1201 – Variant 2	Variant 1 + additional Holder
Blukii Small MKII 1201 – Variant 3	Variant 1 + additional Holder
Blukii Small MKII 1201 – Variant 4	Variant 1 in a different housing shape

differ only in labeling and housing size and shape.
The hard- and software functions are equal, and all tests were conducted on the worst-case model.

Model Name: **blukii Small MKII 1201**
HVIN: **1201-003**
FCC ID: **2BBC6-BS222**
IC ID: **30643-BS222**

Signature:

Matthias Schneider/CEO
+497724 918506 620
mschneider@hard-softwerk.com
hard & softWERK GmbH
Bahnhof Str. 10 D-78112 St.
Georgen im Schwarzwald, Germany

20 Appendix E (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 13th day of September 2024.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2026

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 ---