

MEASUREMENT REPORT

FCC PART 15.247 / RSS-247 Bluetooth-LE

FCC ID: HSW2832
IC: 4492A-2832
Application: Murata Electronics North America

Application Type: C2PC Certification
Product: Bluetooth Low Energy Module
Model No.: MBN52832
Brand Name: Murata
FCC Classification: Digital Transmission System (DTS)
FCC Rule Part(s): Part15 Subpart C (Section 15.247)
ISED Rule(s): RSS-247 Issue 2, RSS-GEN Issue 5
Test Procedure(s): ANSI C63.10-2013
Test Date: April 01~June 10, 2020

Reviewed By: oscar shi
(Oscar Shi)

Approved By: Robin Wu
(Robin Wu)



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2003RSU067-U1	Rev. 01	Initial Report	06-10-2020	Valid

Note: This C2PC certification is for adding additional antenna, the antenna type is PCB Flipper Antenna, antenna gain is 2.2dBi.

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General Information

Applicant:	Murata Electronics North America
Applicant Address:	2200 Lake Park Drive, Smyrna, GA 30080-7604
Manufacturer:	Murata Electronics North America
Manufacturer Address:	2200 Lake Park Drive, Smyrna, GA 30080-7604
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
Test Device Serial No.:	N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Designation No. CN1166) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications, Radio and SAR testing.



1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada and Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name:	Bluetooth Low Energy Module		
Model No.:	MBN52832		
Brand Name:	Muruta		
Bluetooth Specification:	V5.0		
Operating Temperature:	-40 ~ 85°C		
Power Type:	Coin Cell Battery:	3Vdc	
	External Power Supply:	5Vdc	
	Universal Serial Bus:	5Vdc	

2.2. Product Specification Subjective to this Report

Bluetooth Frequency:	2402~2480MHz
Channel Number:	40
Type of modulation:	GFSK
Data Rate:	1Mbps, 2Mbps

2.3. Description of Available Antennas

Antenna Type	Frequency Band (GHz)	Max Peak Gain (dBi)
Flipper Antenna	2.4 ~ 2.5	2.2

2.4. Working Frequencies for this Report

Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2404 MHz	02	2406 MHz
03	2408 MHz	04	2410 MHz	05	2412 MHz
06	2414 MHz	07	2416 MHz	08	2418 MHz
09	2420 MHz	10	2422 MHz	11	2424 MHz
12	2426 MHz	13	2428 MHz	14	2430 MHz
15	2432 MHz	16	2434 MHz	17	2436 MHz
18	2438 MHz	19	2440 MHz	20	2442 MHz
21	2444 MHz	22	2446 MHz	23	2448 MHz
24	2450 MHz	25	2452 MHz	26	2454 MHz
27	2456 MHz	28	2458 MHz	29	2460 MHz
30	2462 MHz	31	2464 MHz	32	2466 MHz
33	2468 MHz	34	2470 MHz	35	2472 MHz
36	2474 MHz	37	2476 MHz	38	2478 MHz
39	2480 MHz	--	--	--	--

2.5. Test Mode

Test Mode	Mode 1: Transmit by BLE 1Mbps
	Mode 2: Transmit by BLE 2Mbps

2.6. Test Configuration

The device was tested per the guidance of ANSI C63.10-2013, which is used as the reference of appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.7. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.8. Description of Test Software

The test utility software used during testing was "Tera Term", and the version was "4.99(SVN#7121)".

2.9. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase.

However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

RSS-GEN 4.1

In addition to complying with the applicable RSSs and RSP-100, each unit of a product model (i.e. of a radio apparatus) shall meet the labelling requirements set out in this section prior to being marketed in Canada or imported into Canada.

If the dimensions of the product are extremely small or it is not practical to place the label or marking on the product, and if electronic labelling cannot be implemented, the label shall be placed in a prominent location in the user manual supplied with the product, as agreed upon with ISED prior to the certification application. The user manual may be in an electronic format; if it is not supplied to the user, the user manual must be readily available.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013), and were used in the measurement.

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions were used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the Antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable. For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive Antenna height using a broadband Antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn Antennas were used. For frequencies below 30MHz, a calibrated loop Antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband Antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive Antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn Antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive Antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive Antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn Antenna, the horn Antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.”

- The antenna of the device is **permanently attached**.

Conclusion:

The unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2021/01/18
Two-Line V-Network	R&S	ENV 216	MRTSUE06002	1 year	2020/06/13
Two-Line V-Network	R&S	ENV 216	MRTSUE06003	1 year	2020/06/13
Thermohygrometer	Testo	608-H1	MRTSUE06404	1 year	2020/08/08
Shielding Room	MIX-BEP	Chamber-SR2	MRTSUE06215	N/A	N/A

Radiated Emissions - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2020/08/01
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2020/09/03
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/13
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2021/04/03
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2020/10/13
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2020/12/29
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2020/08/08
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2021/04/30

Radiated Emission - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2020/08/01
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/13
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2020/10/13
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2020/10/27
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2020/12/29
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2020/12/15
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2021/04/30

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2021/04/11
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06452	1 year	2020/07/11
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2021/04/14
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2020/11/17
USB wideband power sensor	Keysight	U2021XA	MRTSUE06446	1 year	2020/06/30
USB wideband power sensor	Keysight	U2021XA	MRTSUE06447	1 year	2020/06/30
Bluetooth Test Set	Anritsu	MT8852B-042	MRTSUE06389	1 year	2020/06/13
Audio Analyzer	Agilent	U8903B	MRTSUE06143	1 year	2020/06/13
Modulation Analyzer	HP	8901A	MRTSUE06098	1 year	2020/10/10
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2020/11/07
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2020/11/07
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2020/08/08

Software	Version	Function
EMI Software	V3	EMI Test Software

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

AC Conducted Emission Measurement - SR2
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 9kHz~150kHz: 3.84dB 150kHz~30MHz: 3.46dB
Radiated Emission Measurement - AC1
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): Horizontal: 30MHz~300MHz: 4.07dB 300MHz~1GHz: 3.63dB 1GHz~18GHz: 4.16dB Vertical: 30MHz~300MHz: 4.18dB 300MHz~1GHz: 3.60dB 1GHz~18GHz: 4.76dB
Radiated Emission Measurement - AC2
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): Horizontal: 30MHz~300MHz: 3.75dB 300MHz~1GHz: 3.53dB 1GHz~18GHz: 4.28dB Vertical: 30MHz~300MHz: 3.86dB 300MHz~1GHz: 3.53dB 1GHz~18GHz: 4.33dB

7. TEST RESULT

7.1. Summary

FCC Part Section(s)	ISED Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(b)(3)	RSS-247 [5.4(d)]	Output Power	$\leq 1\text{Watt}$ & EIRP $\leq 4\text{Watt}$	Conducted	Pass	Section 7.2
15.247(e)	RSS-247 [5.2]	Power Spectral Density	$\leq 8\text{dBm} / 3\text{kHz}$	Conducted	Pass	Section 7.3
15.205 15.209	RSS-247 [5.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	Pass	Section 7.4 Section 7.5

Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent worst case emissions.
- 3) This report is C2PC certification for adding additional antenna, so just Output Power, Radiated Spurious Emission and Radiated Restricted Band Edge are tested.

7.2. Output Power Measurement

7.2.1. Test Limit

The maximum out power shall be less 1 Watt (30dBm) and the E.I.R.P shall not exceed 4 Watt (36dBm).

The conducted output power limit specified in paragraph FCC Part 15.247(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs FCC Part 15.247(b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.2.2. Test Procedure Used

ANSI C63.10 - Section 11.9.1.3

ANSI C63.10 - Section 11.9.2.3.2

7.2.3. Test Setting

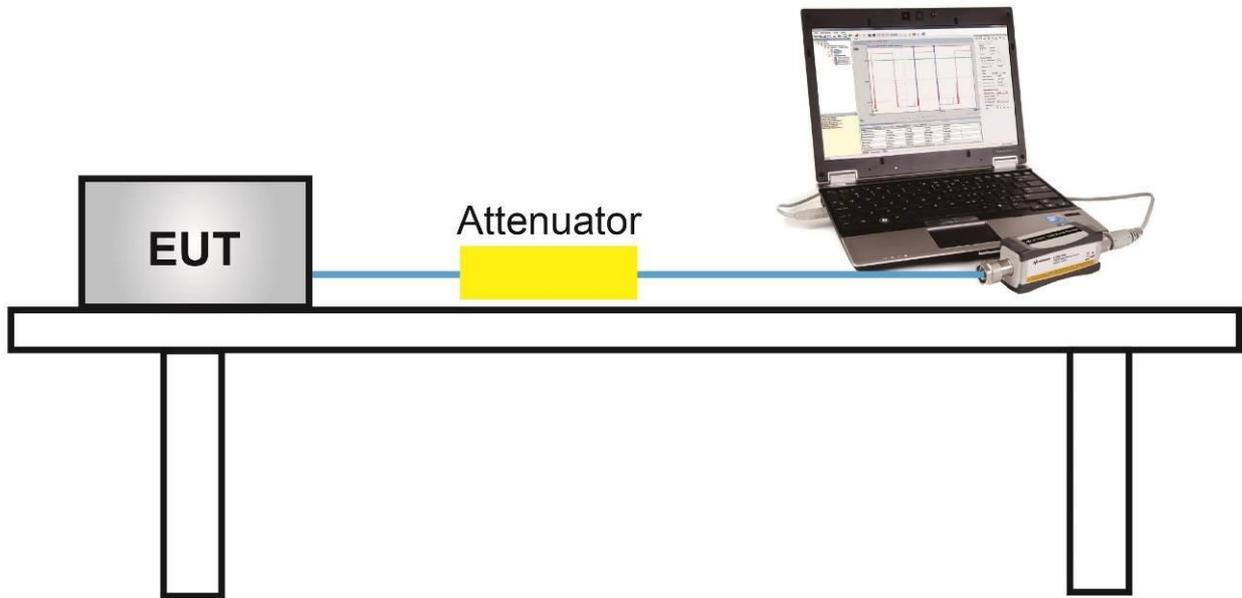
Method PKPM1 (Peak Power Measurement)

Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

Method AVGPM-G (Measurement using a gated RF average-reading power meter)

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

7.2.4. Test Setup



7.2.5. Test Result of Output Power

Product	Bluetooth Low Energy Module	Temperature	25°C
Test Engineer	Ternence Wang	Relative Humidity	52%
Test Site	TR3	Test Date	2020/04/01

Test Result of Peak Output Power

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	E.I.R.P (dBm)	E.I.R.P Limit (dBm)	Result
BLE	1	00	2402	2.88	≤ 30.00	5.08	≤ 36.00	Pass
BLE	1	19	2440	2.68	≤ 30.00	4.88	≤ 36.00	Pass
BLE	1	39	2480	2.58	≤ 30.00	4.78	≤ 36.00	Pass

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	E.I.R.P (dBm)	E.I.R.P Limit (dBm)	Result
BLE	2	00	2402	2.89	≤ 30.00	5.09	≤ 36.00	Pass
BLE	2	19	2440	2.69	≤ 30.00	4.89	≤ 36.00	Pass
BLE	2	39	2480	2.57	≤ 30.00	4.77	≤ 36.00	Pass

Note: EIRP (dBm) = Peak Power (dBm) + Antenna Gain (dBi), Antenna Gain = 2.20 dBi.

7.3. Power Spectral Density Measurement

7.3.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band.

The same method of determining the conducted output power shall be used to determine the power spectral density.

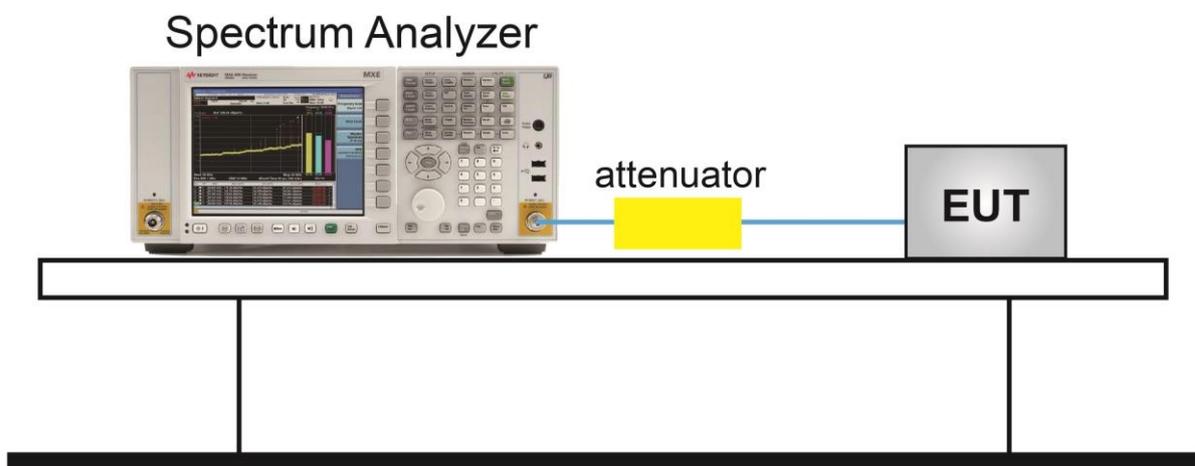
7.3.2. Test Procedure Used

ANSI C63.10 - Section 11.10.2

7.3.3. Test Setting

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 3kHz
4. VBW = 10kHz
5. Detector = Peak
6. Sweep time = Auto couple
7. Trace mode = Max hold
8. Trace was allowed to stabilize

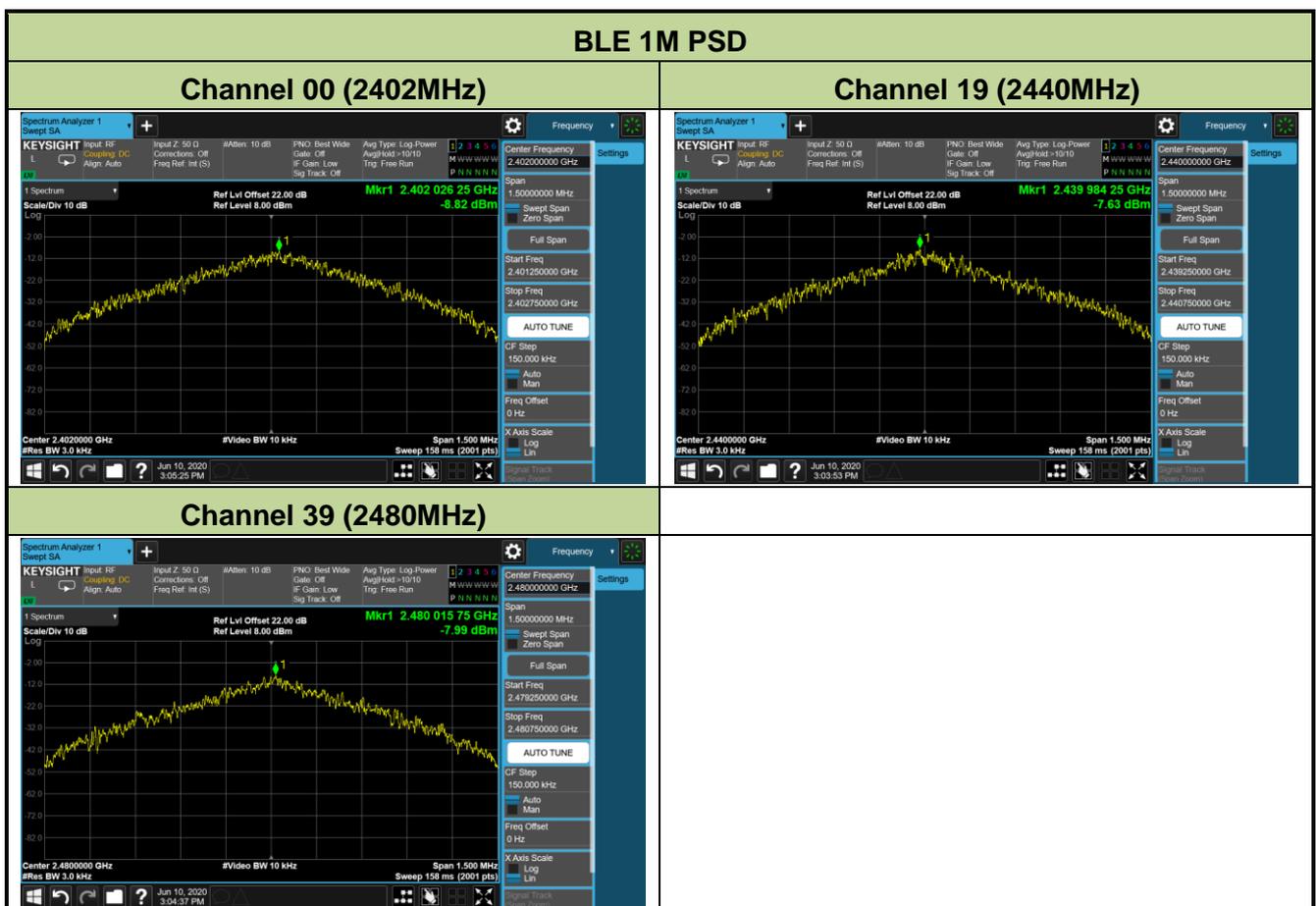
7.3.4. Test Setup

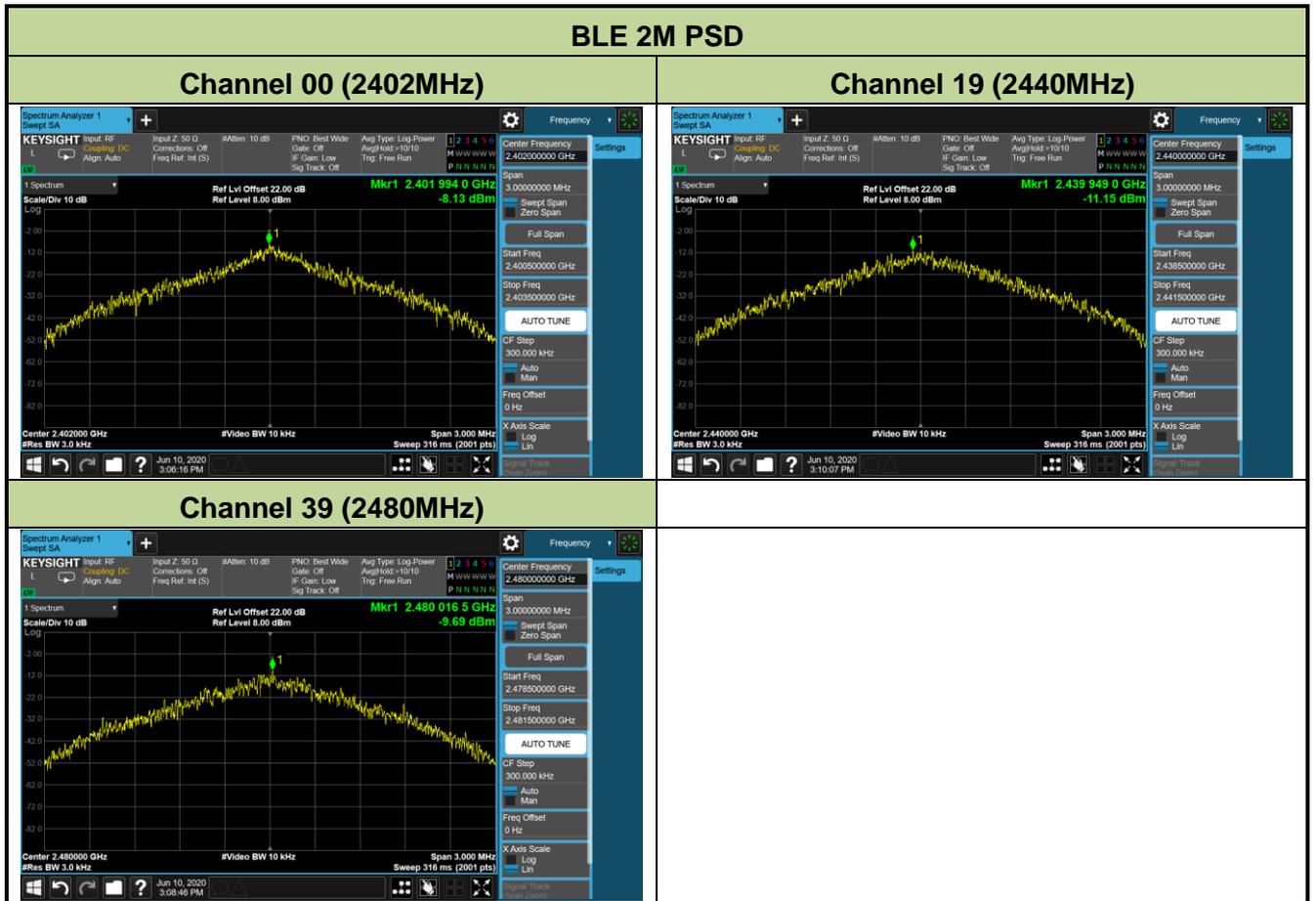


7.3.5. Test Result

Product	Bluetooth Low Energy Module	Temperature	25 °C
Test Engineer	Gordon Qi	Relative Humidity	52%
Test Site	TR3	Test Date	2020/06/10

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	PSD Result (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
BLE	1	00	2402	-8.82	≤ 8.00	Pass
BLE	1	19	2440	-7.63	≤ 8.00	Pass
BLE	1	39	2480	-7.99	≤ 8.00	Pass
BLE	2	00	2402	-8.13	≤ 8.00	Pass
BLE	2	19	2440	-11.15	≤ 8.00	Pass
BLE	2	39	2480	-9.69	≤ 8.00	Pass





7.4. Radiated Spurious Emission Measurement

7.4.1. Test Limit

All out of band emissions appearing in a restricted band as defined in Section 8.10 of RSS-Gen, must also comply with the radiated emission limits specified in Section 8.9.

RSS-Gen Section 8.9			
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Magnetic Field Strength (H-Field) ($\mu\text{A/m}$)	Measured Distance (m)
0.009 - 0.490	--	6.37/F (F in kHz)	300
0.490 - 1.705	--	6.37/F (F in kHz)	30
1.705 - 30	--	0.08	30
30 - 88	100	--	3
88 - 216	150	--	3
216 - 960	200	--	3
Above 960	500	--	3

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measured Distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

7.4.2. Test Procedure Used

ANSI C63.10 - Section 6.3 (General Requirements)

ANSI C63.10 - Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 - Section 6.5 (Standard test method above 30MHz to 1GHz)

ANSI C63.10 - Section 6.6 (Standard test method above 1GHz)

7.4.3. Test Setting

Table 1 - RBW as a function of frequency

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Quasi-Peak Measurements below 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = as specified in Table 1
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

Peak Measurements above 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold

7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. RBW = 1MHz

3. VBW; If the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW = 10Hz

If the EUT duty cycle is $< 98\%$, set VBW $\geq 1/T$. T is the minimum transmission duration

4. Detector = Peak

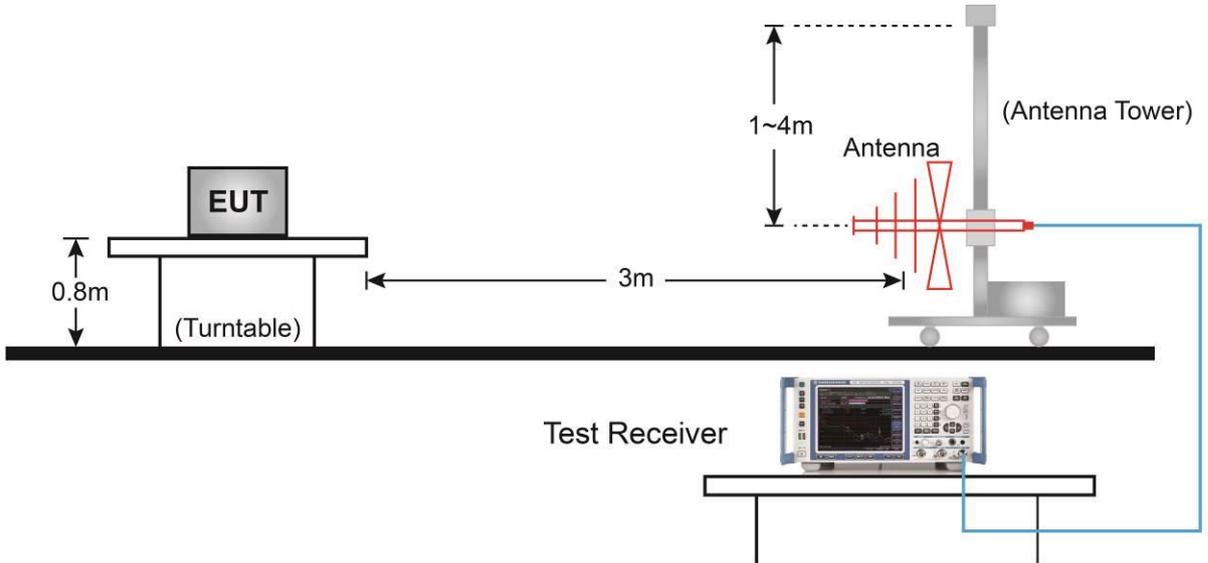
5. Sweep time = auto

6. Trace mode = max hold

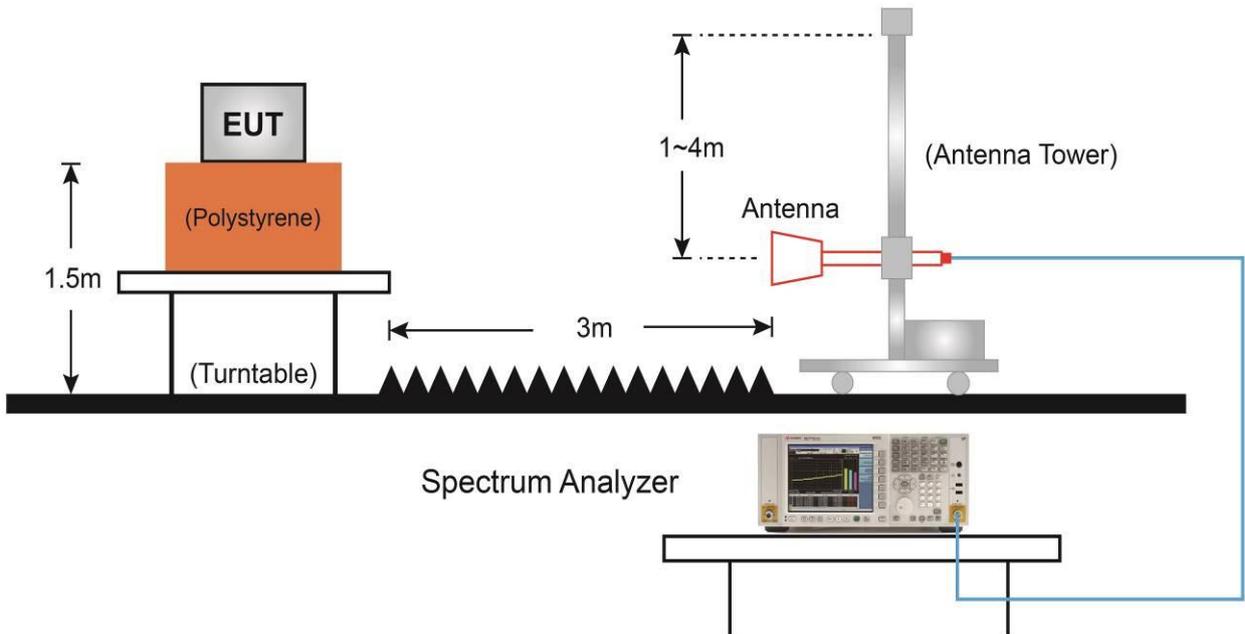
7. Trace was allowed to stabilize

7.4.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



7.4.5. Test Result

Product	Bluetooth Low Energy Module	Temperature	25°C
Test Engineer	White wang	Relative Humidity	54%
Test Site	AC2	Test Date	2020/04/02
Test Mode	Test Mode 1	Test Channel:	00
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-25GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4901.5	39.1	4.1	43.2	74.0	-30.8	Peak	Horizontal
*	6363.5	37.3	7.8	45.1	74.0	-28.9	Peak	Horizontal
*	7205.0	34.6	12.2	46.8	74.0	-27.2	Peak	Horizontal
	11871.5	27.3	20.2	47.5	74.0	-26.5	Peak	Horizontal
	4867.5	40.8	3.7	44.5	74.0	-29.5	Peak	Vertical
*	6465.5	36.6	8.4	45.0	74.0	-29.0	Peak	Vertical
*	7205.0	36.2	12.2	48.4	74.0	-25.6	Peak	Vertical
	11786.5	29.1	20.3	49.4	74.0	-24.6	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (93.8dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Product	Bluetooth Low Energy Module	Temperature	25°C
Test Engineer	White wang	Relative Humidity	54%
Test Site	AC2	Test Date	2020/04/02
Test Mode	Test Mode 1	Test Channel:	19
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-25GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4859.0	40.7	3.7	44.4	74.0	-29.6	Peak	Horizontal
*	6159.5	38.1	6.8	44.9	74.0	-29.1	Peak	Horizontal
*	7137.0	34.2	11.7	45.9	74.0	-28.1	Peak	Horizontal
	11897.0	27.9	20.1	48.0	74.0	-26.0	Peak	Horizontal
	4816.5	39.6	4.1	43.7	74.0	-30.3	Peak	Vertical
*	6253.0	37.7	7.2	44.9	74.0	-29.1	Peak	Vertical
*	6805.5	35.6	9.6	45.2	74.0	-28.8	Peak	Vertical
	11880.0	28.8	19.8	48.6	74.0	-25.4	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (92.5dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Product	Bluetooth Low Energy Module	Temperature	25°C
Test Engineer	White wang	Relative Humidity	54%
Test Site	AC2	Test Date	2020/04/02
Test Mode	Test Mode 1	Test Channel:	39
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-25GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4808.0	39.3	4.2	43.5	74.0	-30.5	Peak	Horizontal
*	6295.5	38.1	7.0	45.1	74.0	-28.9	Peak	Horizontal
*	7069.0	33.7	11.5	45.2	74.0	-28.8	Peak	Horizontal
	11897.0	28.5	20.1	48.6	74.0	-25.4	Peak	Horizontal
	4910.0	39.1	4.2	43.3	74.0	-30.7	Peak	Vertical
*	6465.5	36.9	8.4	45.3	74.0	-28.7	Peak	Vertical
*	6941.5	34.9	10.5	45.4	74.0	-28.6	Peak	Vertical
	10928.0	30.2	17.7	47.9	74.0	-26.1	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (90.3dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Product	Bluetooth Low Energy Module	Temperature	25°C
Test Engineer	White wang	Relative Humidity	54%
Test Site	AC2	Test Date	2020/04/02
Test Mode	Test Mode 2	Test Channel:	00
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-25GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	5063.0	39.2	4.7	43.9	74.0	-30.1	Peak	Horizontal
*	6627.0	36.1	9.1	45.2	74.0	-28.8	Peak	Horizontal
*	7043.5	35.5	11.2	46.7	74.0	-27.3	Peak	Horizontal
	11030.0	30.4	18.1	48.5	74.0	-25.5	Peak	Horizontal
	4816.5	39.0	4.1	43.1	74.0	-30.9	Peak	Vertical
*	6338.0	38.0	7.6	45.6	74.0	-28.4	Peak	Vertical
*	7205.0	36.0	12.2	48.2	74.0	-25.8	Peak	Vertical
	11965.0	28.0	20.3	48.3	74.0	-25.7	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (93.8dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Product	Bluetooth Low Energy Module	Temperature	25°C
Test Engineer	White wang	Relative Humidity	54%
Test Site	AC2	Test Date	2020/04/02
Test Mode	Test Mode 2	Test Channel:	19
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-25GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4884.5	39.7	3.9	43.6	74.0	-30.4	Peak	Horizontal
*	6550.5	36.9	8.7	45.6	74.0	-28.4	Peak	Horizontal
*	7137.0	34.8	11.7	46.5	74.0	-27.5	Peak	Horizontal
	12228.5	27.8	20.8	48.6	74.0	-25.4	Peak	Horizontal
	4884.5	40.0	3.9	43.9	74.0	-30.1	Peak	Vertical
*	6202.0	38.6	7.1	45.7	74.0	-28.3	Peak	Vertical
*	6652.5	36.2	8.8	45.0	74.0	-29.0	Peak	Vertical
	11880.0	28.5	19.8	48.3	74.0	-25.7	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (93.7dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Product	Bluetooth Low Energy Module	Temperature	25°C
Test Engineer	White wang	Relative Humidity	54%
Test Site	AC2	Test Date	2020/04/02
Test Mode	Test Mode 2	Test Channel:	39
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-25GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4961.0	39.9	3.9	43.8	74.0	-30.2	Peak	Horizontal
*	6193.5	37.5	7.0	44.5	74.0	-29.5	Peak	Horizontal
*	6661.0	36.5	8.9	45.4	74.0	-28.6	Peak	Horizontal
	11667.5	29.1	19.5	48.6	74.0	-25.4	Peak	Horizontal
	4961.0	40.1	3.9	44.0	74.0	-30.0	Peak	Vertical
*	6049.0	38.7	6.3	45.0	74.0	-29.0	Peak	Vertical
*	7137.0	34.2	11.7	45.9	74.0	-28.1	Peak	Vertical
	12177.5	28.6	20.0	48.6	74.0	-25.4	Peak	Vertical

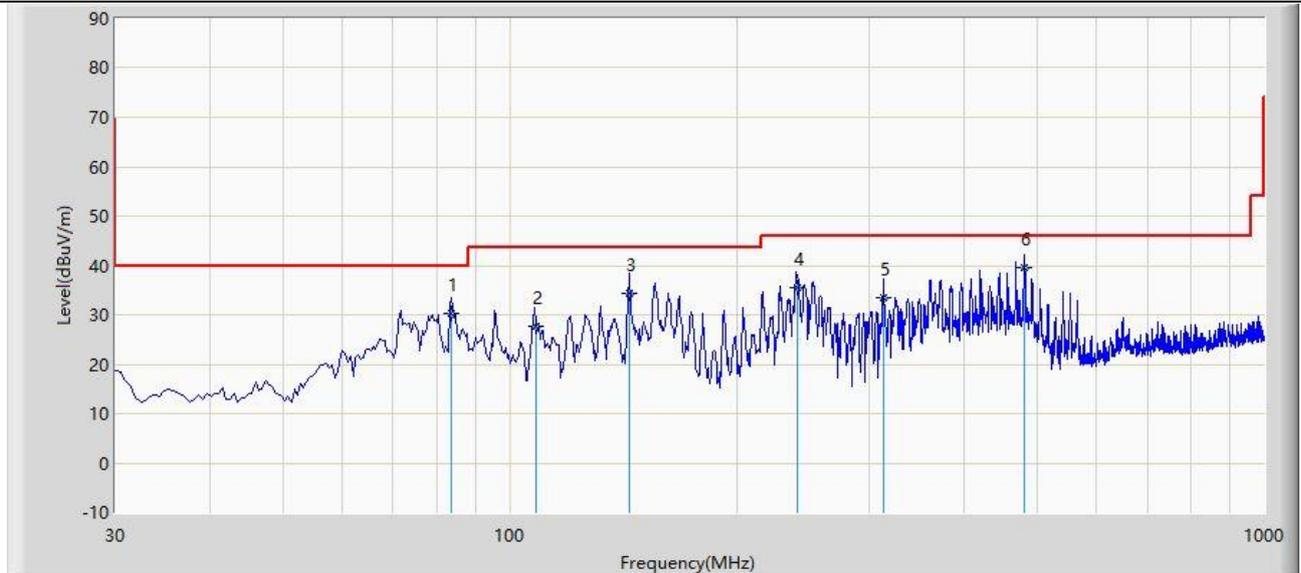
Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (93.5dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

The Worst Case of Radiated Emission below 1GHz:

Site: AC2	Time: 2020/04/03 - 15:15
Limit: FCC_Part15.209_RSE(3m)	Engineer: White Wang
Probe: AC2_VULB9162_0.03-7GHz	Polarity: Horizontal
EUT: Bluetooth Low Energy Module	Power: By USB 5VDC
Test Mode: Transmit at 2402MHz at BLE 1M	



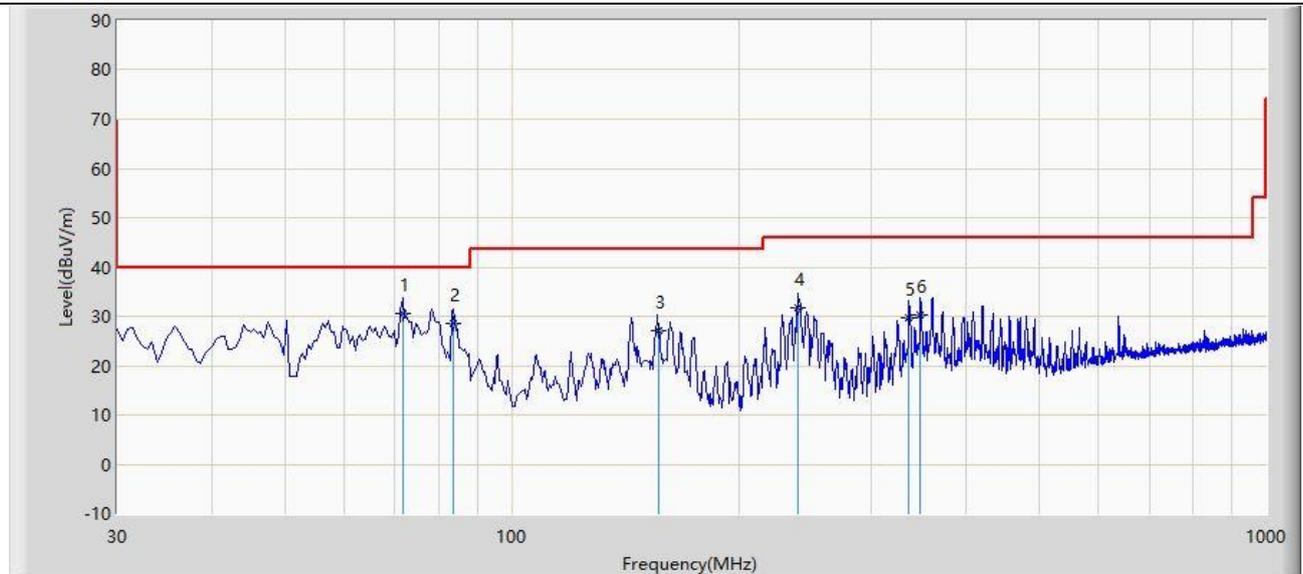
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			83.846	30.262	21.508	-9.738	40.000	8.755	QP
2			108.310	27.663	15.433	-15.837	43.500	12.230	QP
3			143.840	34.471	25.380	-9.029	43.500	9.091	QP
4			240.135	35.525	21.960	-10.475	46.000	13.566	QP
5			312.845	33.613	18.398	-12.387	46.000	15.216	QP
6		*	481.660	39.444	20.502	-6.556	46.000	18.942	QP

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The amplitude of Radiated emissions (the test frequency range: 9kHz ~ 30MHz), is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

Site: AC2	Time: 2020/04/11 - 15:50
Limit: FCC_Part15.209_RSE(3m)	Engineer: White Wang
Probe: AC2_VULB9162_0.03-7GHz	Polarity: Vertical
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: : Transmit at 2402MHz at BLE 1M	



No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1		*	71.820	30.610	20.886	-9.390	40.000	9.724	QP
2			83.841	28.582	19.829	-11.418	40.000	8.753	QP
3			156.337	27.147	17.661	-16.353	43.500	9.486	QP
4			239.807	31.786	18.234	-14.214	46.000	13.552	QP
5			336.157	29.822	13.652	-16.178	46.000	16.169	QP
6			348.015	30.170	13.400	-15.830	46.000	16.770	QP

Note 1: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The amplitude of Radiated emissions (the test frequency range: 9kHz ~ 30MHz),

is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

7.5. Radiated Restricted Band Edge Measurement

7.5.1. Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41	--	--	--

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

For RSS-Gen Section 8.10 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 8.10 of RSS-Gen, must also comply with the radiated emission limits specified in Section 8.9.

Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.009 - 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	* 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.
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		

All out of band emissions appearing in a restricted band as specified in Section 8.10 of the RSS-Gen must not exceed the limits shown in Table per Section 8.9.

RSS-Gen Section 8.9			
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Magnetic Field Strength (H-Field) ($\mu\text{A/m}$)	Measured Distance (m)
0.009 - 0.490 1	--	6.37/F (F in kHz)	300
0.490 - 1.705	--	6.37/F (F in kHz)	30
1.705 - 30	--	0.08	30
30 - 88	100	--	3
88 - 216	150	--	3
216 - 960	200	--	3
Above 960	500	--	3

7.5.2. Test Procedure Used

ANSI C63.10 - Section 6.3 (General Requirements)

ANSI C63.10 - Section 6.6 (Standard test method above 1GHz)

7.5.3. Test Setting

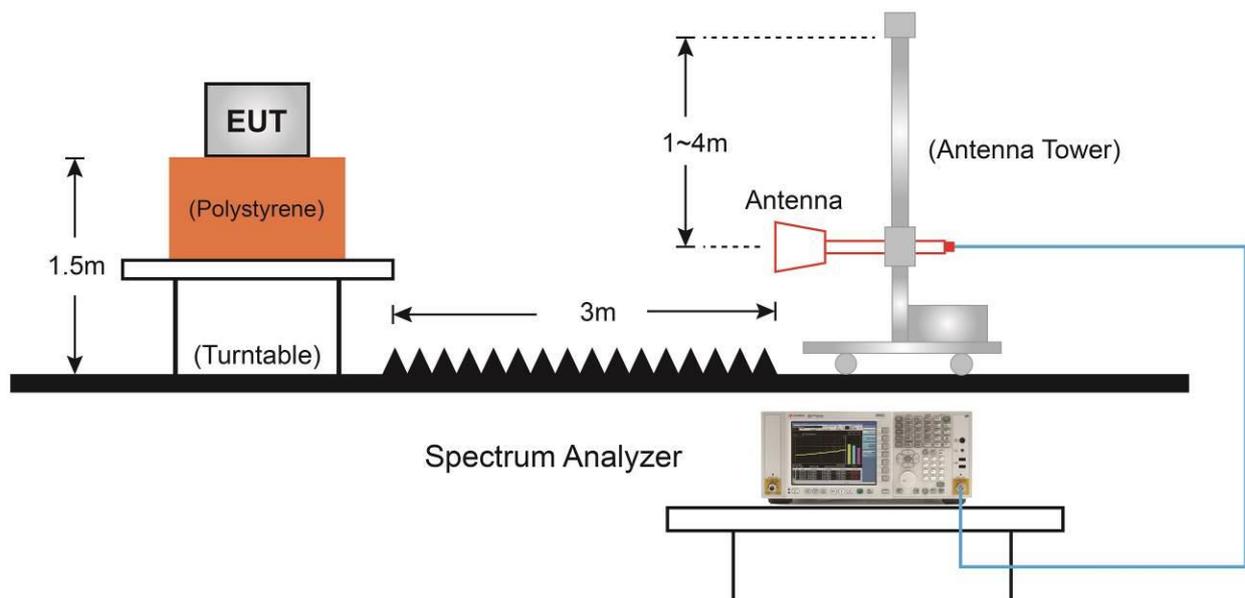
Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Field Strength Measurements

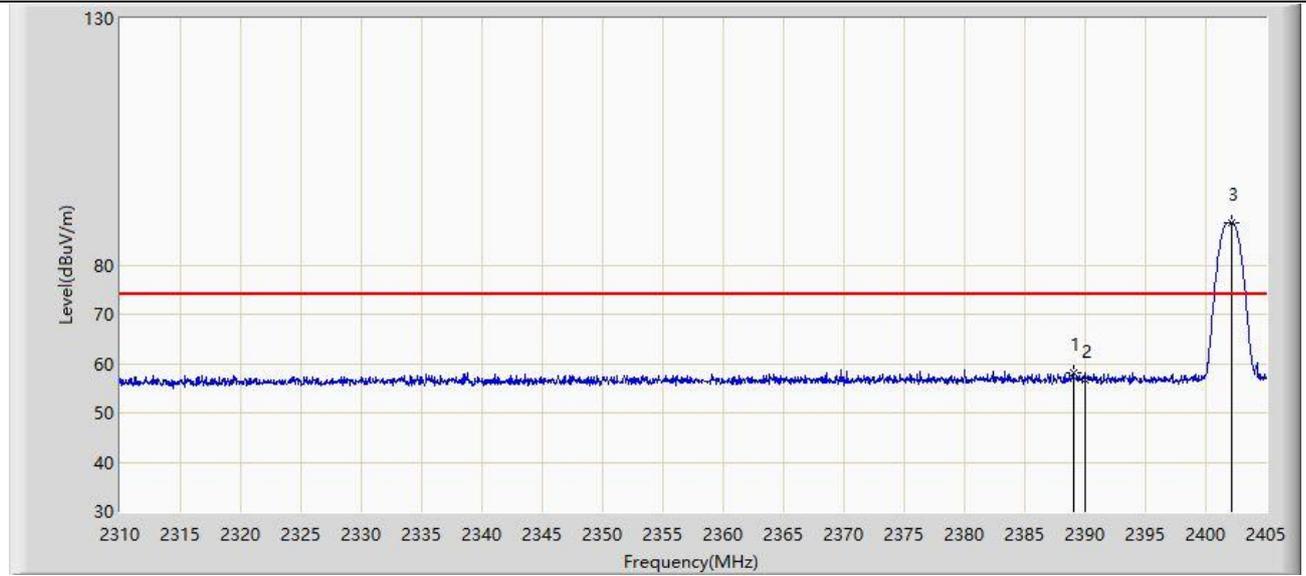
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW $\geq 1/T$
4. De As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
5. Detector = Peak
6. Sweep time = auto
7. Trace mode = max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

7.5.4. Test Setup



7.5.5. Test Result

Site: AC2	Time: 2020/04/01 - 20:01
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2402MHz 1M	

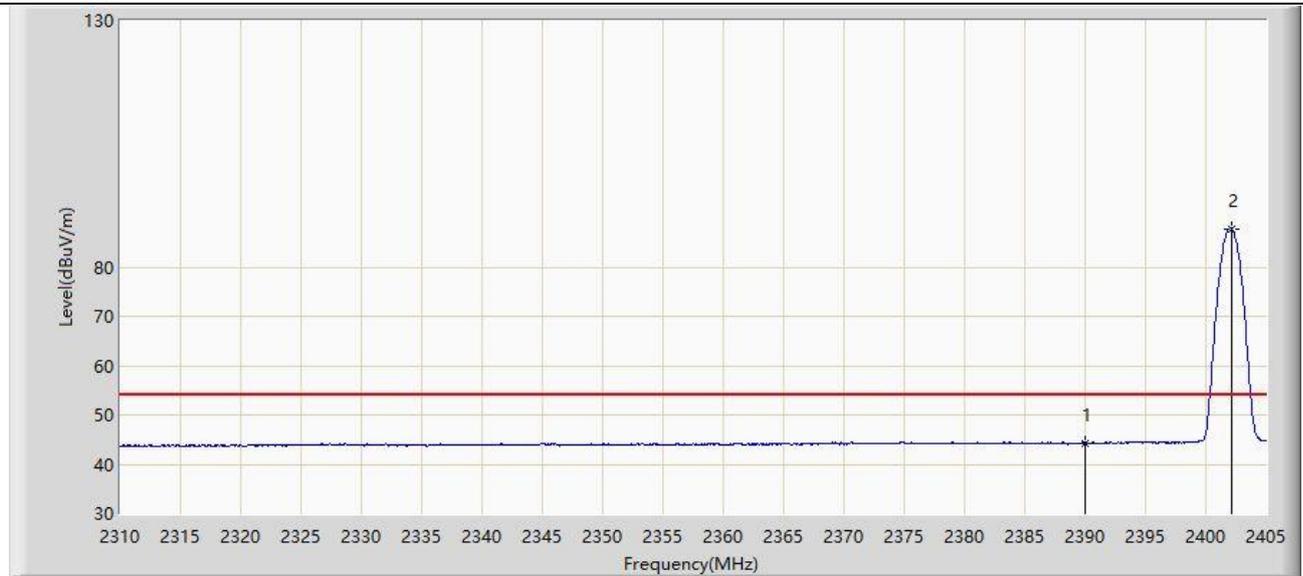


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1			2388.992	58.014	25.530	-15.986	74.000	32.484	PK
2			2390.000	56.661	24.176	-17.339	74.000	32.485	PK
3		*	2402.150	88.584	56.070	14.584	74.000	32.514	PK

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:04
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2402MHz 1M	

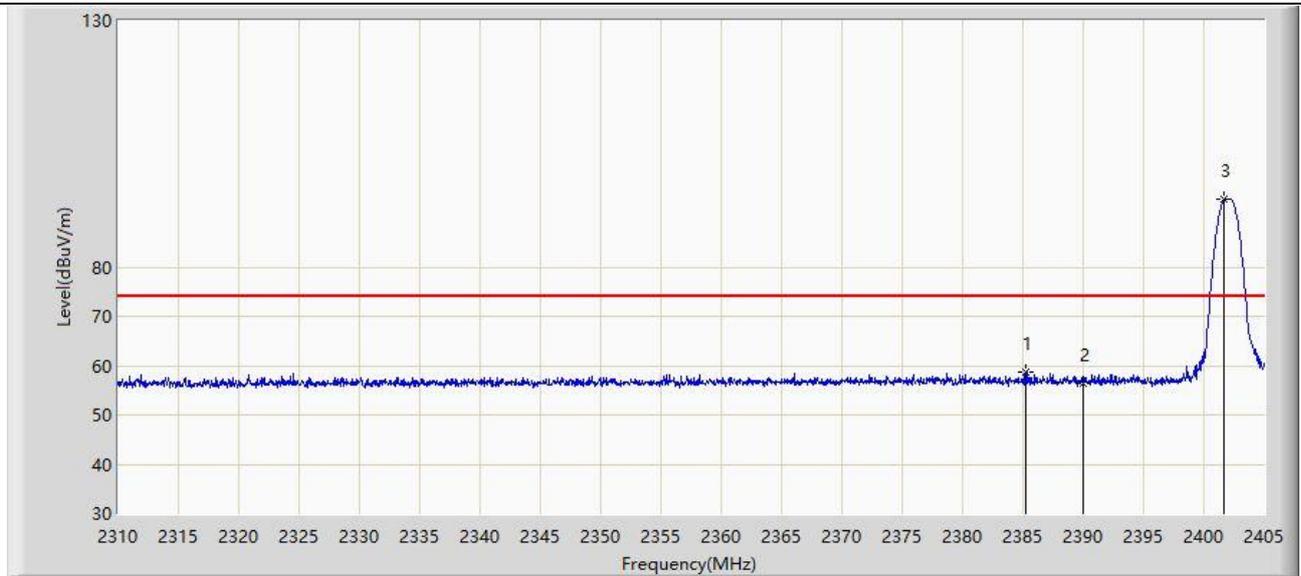


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1			2390.000	44.324	11.839	-9.676	54.000	32.485	AV
2		*	2402.150	87.727	55.213	33.727	54.000	32.514	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:11
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2402MHz 1M	

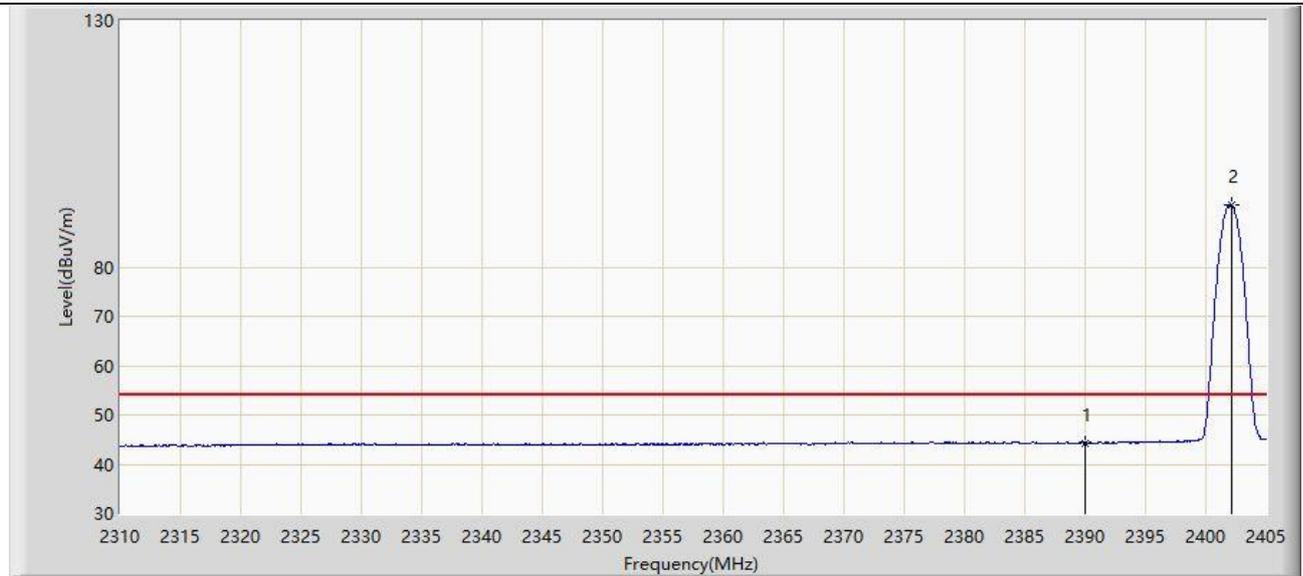


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1			2385.192	58.804	26.324	-15.196	74.000	32.480	PK
2			2390.000	56.503	24.018	-17.497	74.000	32.485	PK
3		*	2401.722	93.821	61.308	19.821	74.000	32.513	PK

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:13
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2402MHz 1M	

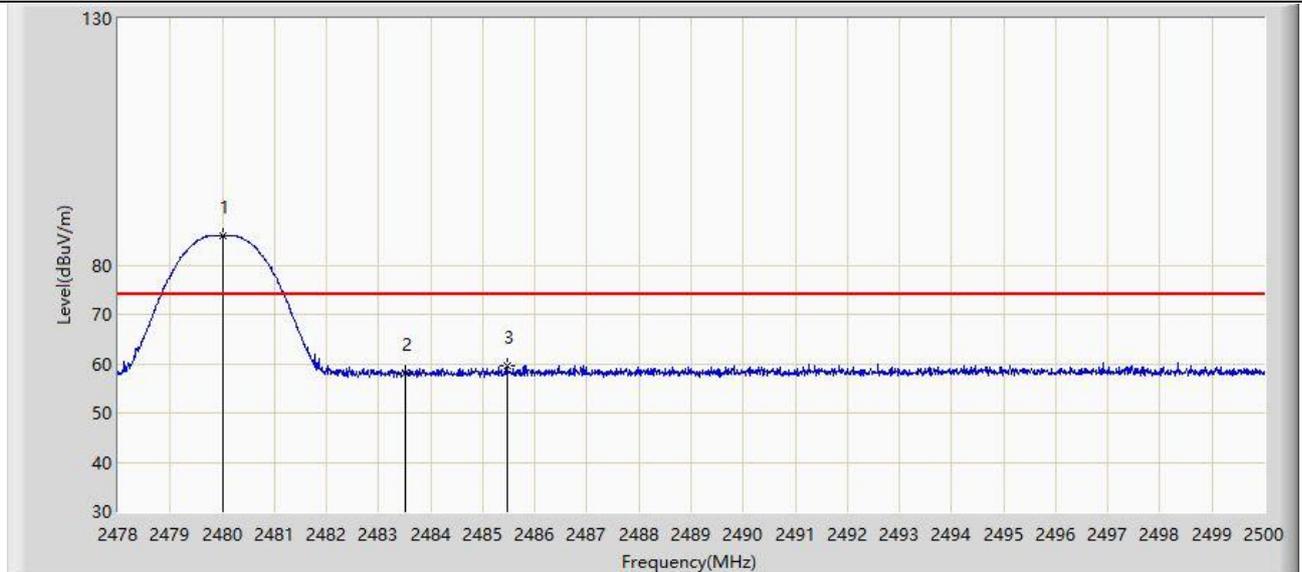


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1			2390.000	44.334	11.849	-9.666	54.000	32.485	AV
2		*	2402.150	92.592	60.078	38.592	54.000	32.514	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:17
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2480MHz 1M	

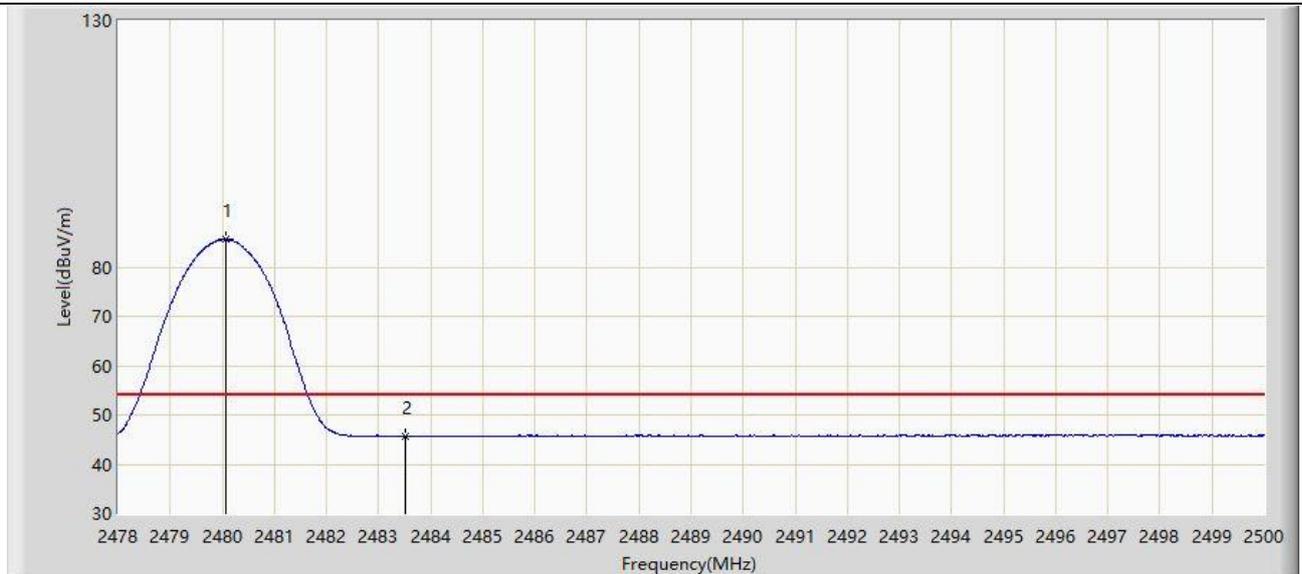


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.002	85.866	53.483	11.866	74.000	32.383	PK
2			2483.500	58.077	25.702	-15.923	74.000	32.375	PK
3			2485.458	59.622	27.252	-14.378	74.000	32.370	PK

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:34
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2480MHz 1M	

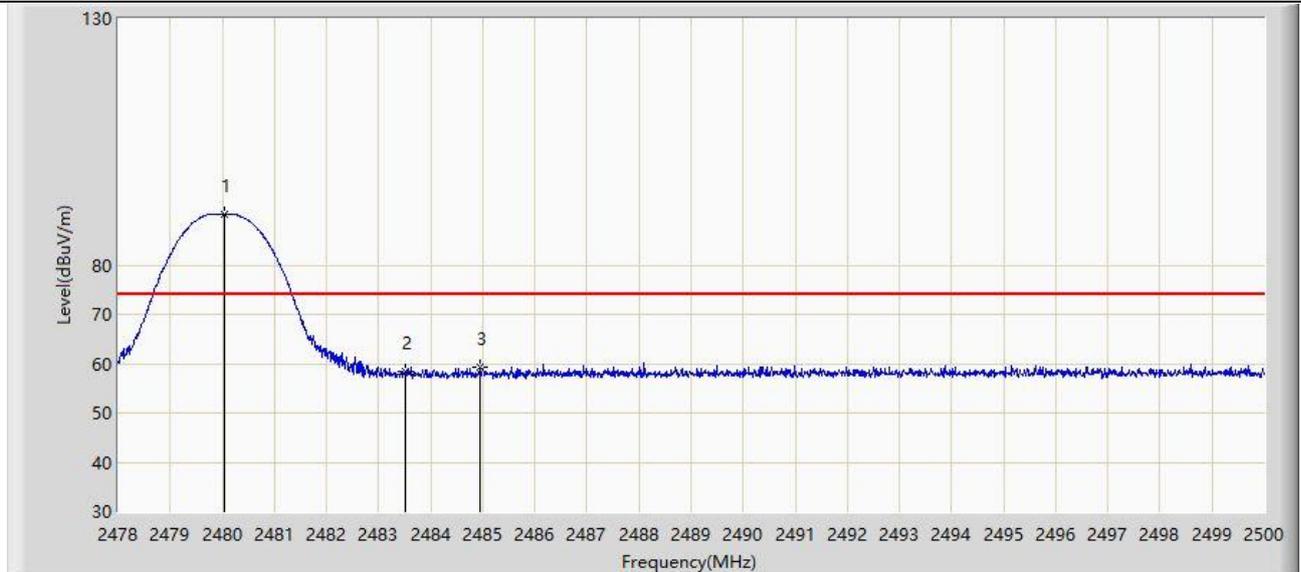


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1		*	2480.079	85.538	53.155	31.538	54.000	32.383	AV
2			2483.500	45.758	13.383	-8.242	54.000	32.375	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:38
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2480MHz 1M	

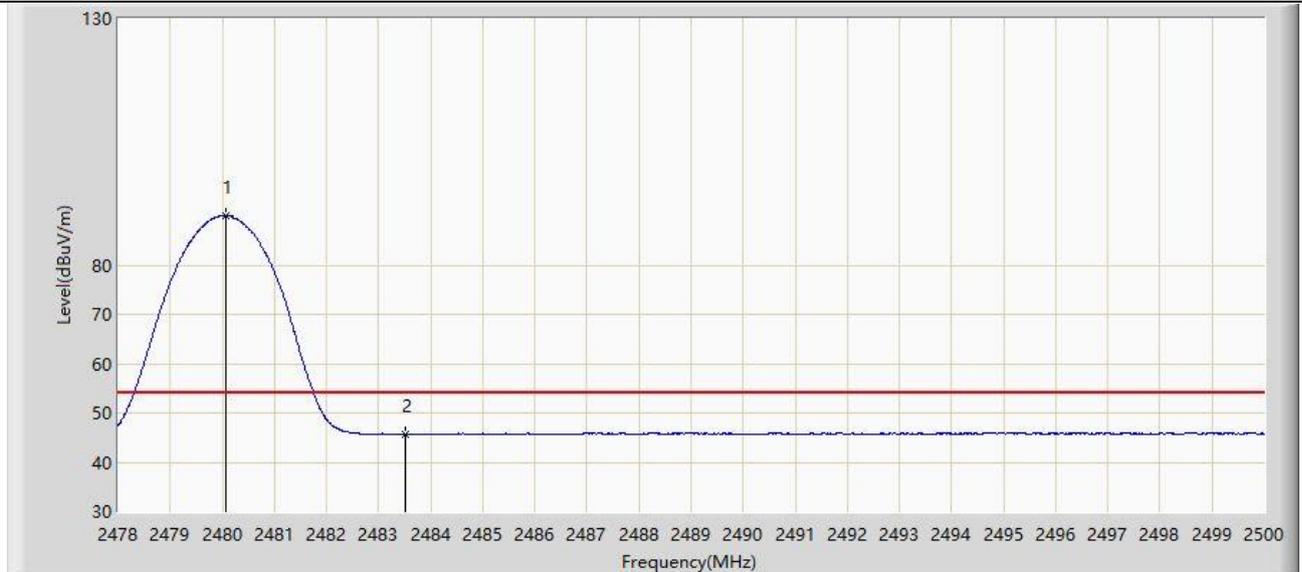


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.046	90.269	57.886	16.269	74.000	32.383	PK
2			2483.500	58.411	26.036	-15.589	74.000	32.375	PK
3			2484.952	59.207	26.836	-14.793	74.000	32.371	PK

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:40
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2480MHz 1M	

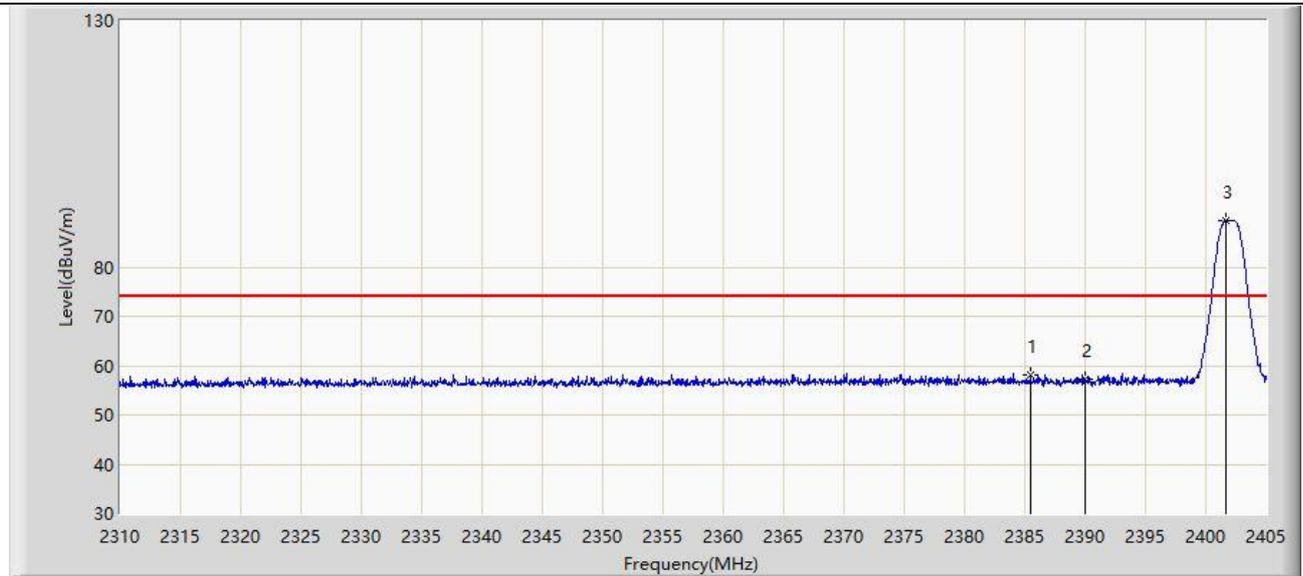


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1		*	2480.079	90.005	57.622	36.005	54.000	32.383	AV
2			2483.500	45.658	13.283	-8.342	54.000	32.375	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:43
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2402MHz 2M	

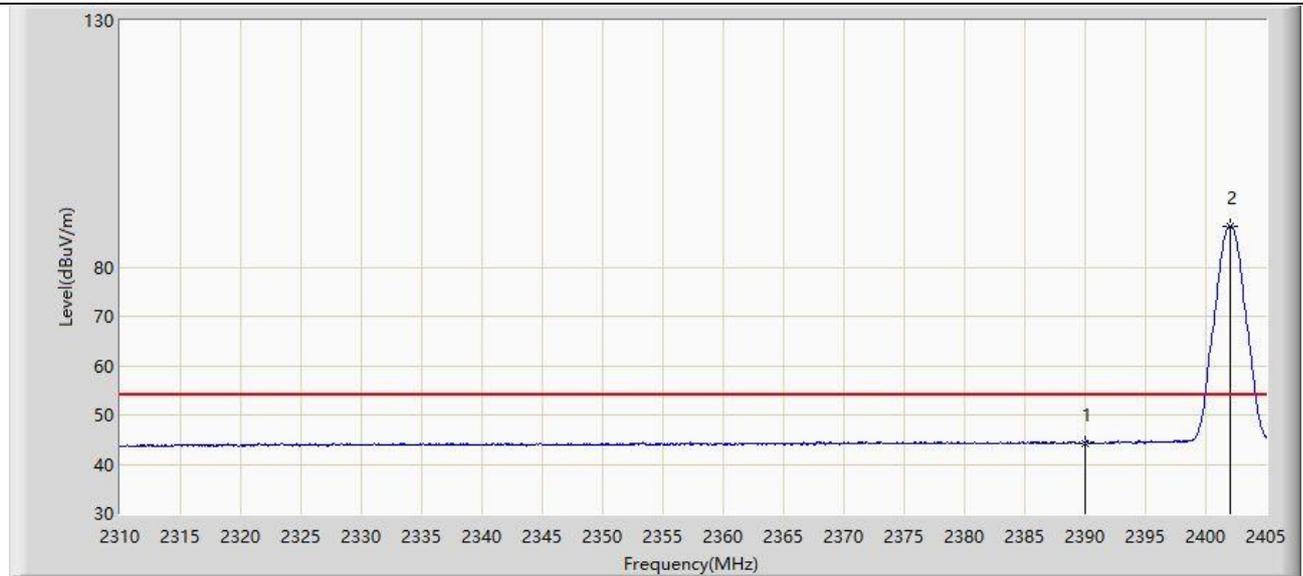


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2385.478	58.120	25.640	-15.880	74.000	32.481	PK
2			2390.000	57.133	24.648	-16.867	74.000	32.485	PK
3		*	2401.675	89.488	56.976	15.488	74.000	32.512	PK

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:45
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2402MHz 2M	

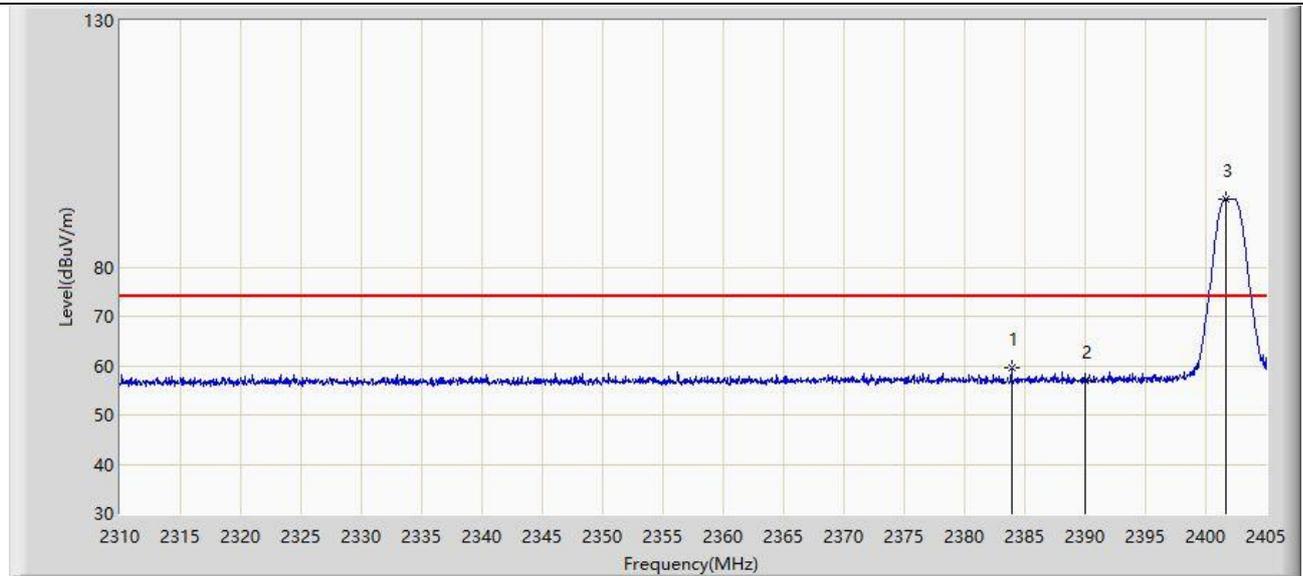


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1			2390.000	44.332	11.847	-9.668	54.000	32.485	AV
2		*	2402.008	88.322	55.809	34.322	54.000	32.513	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:51
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2402MHz 2M	

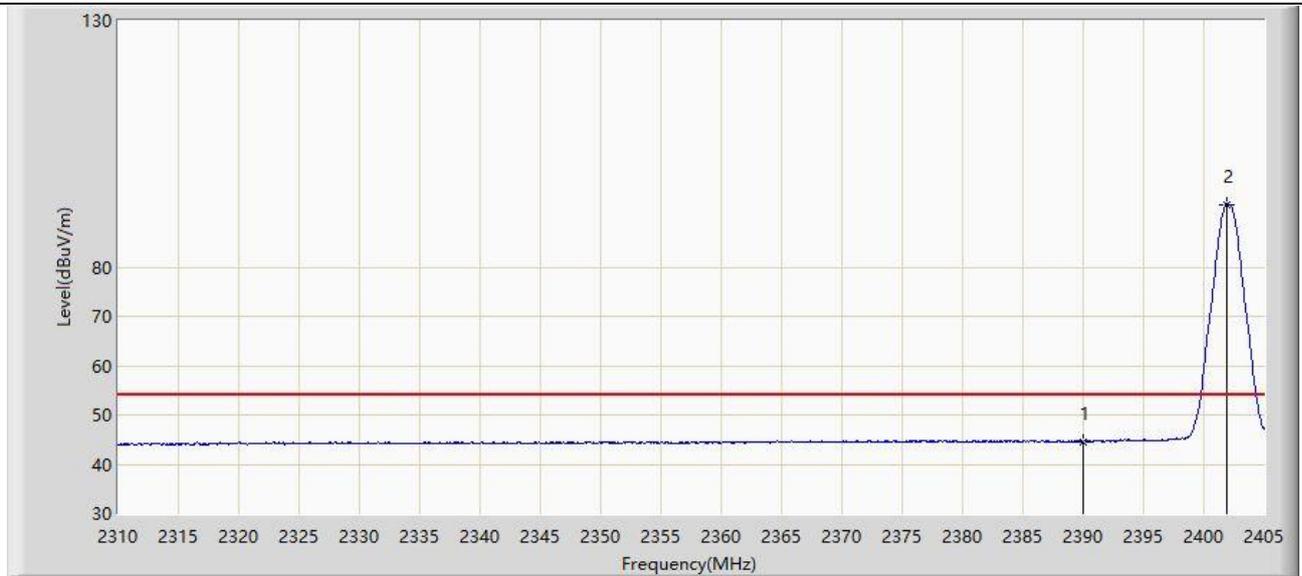


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1			2383.910	59.434	26.955	-14.566	74.000	32.479	PK
2			2390.000	56.936	24.451	-17.064	74.000	32.485	PK
3		*	2401.627	93.842	61.330	19.842	74.000	32.512	PK

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:54
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2402MHz 2M	

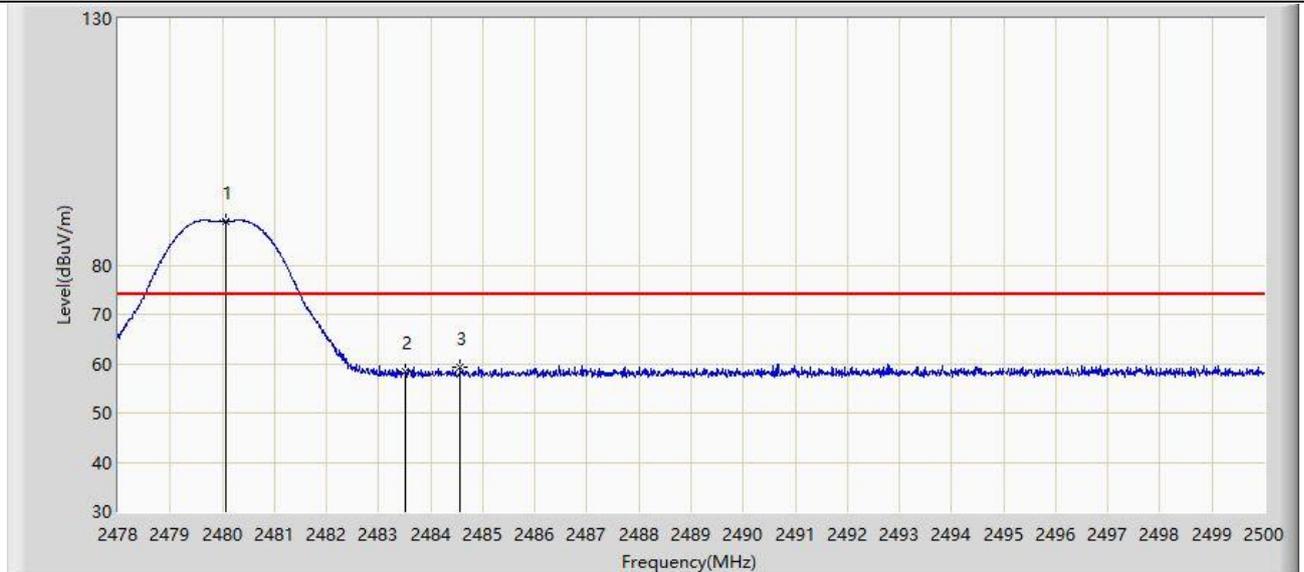


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1			2390.000	44.530	12.045	-9.470	54.000	32.485	AV
2		*	2401.865	92.659	60.146	38.659	54.000	32.514	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:55
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2480MHz 2M	

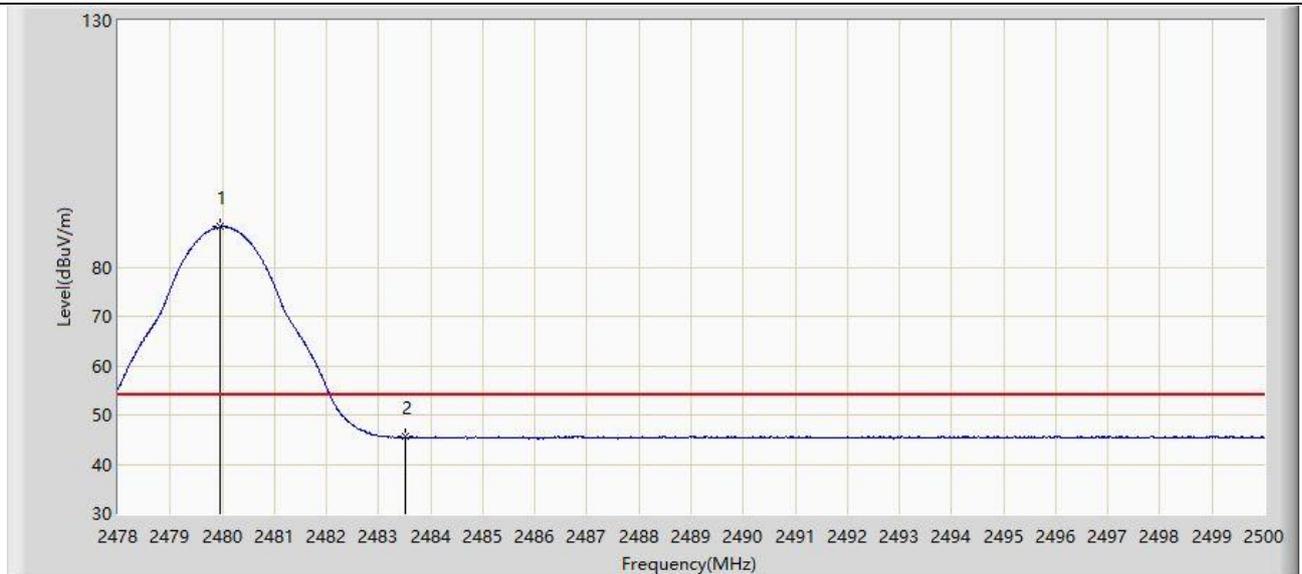


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.079	88.880	56.497	14.880	74.000	32.383	PK
2			2483.500	58.371	25.996	-15.629	74.000	32.375	PK
3			2484.567	59.319	26.947	-14.681	74.000	32.372	PK

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 20:57
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2480MHz 2M	

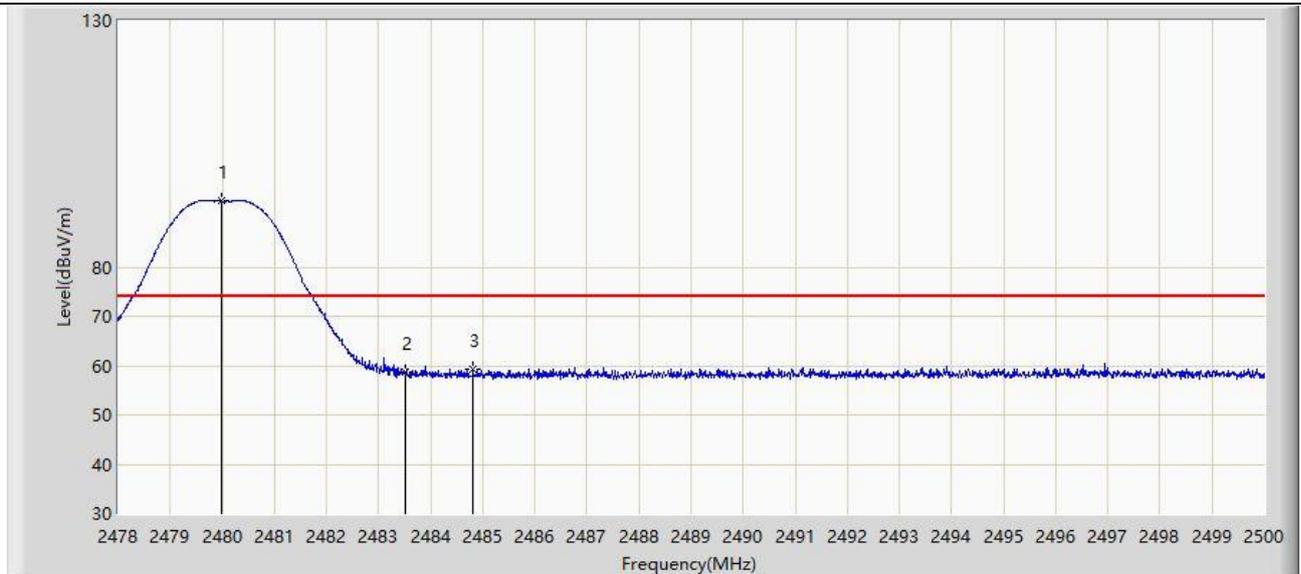


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.969	88.119	55.736	34.119	54.000	32.383	AV
2			2483.500	45.515	13.140	-8.485	54.000	32.375	AV

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 21:00
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2480MHz 2M	

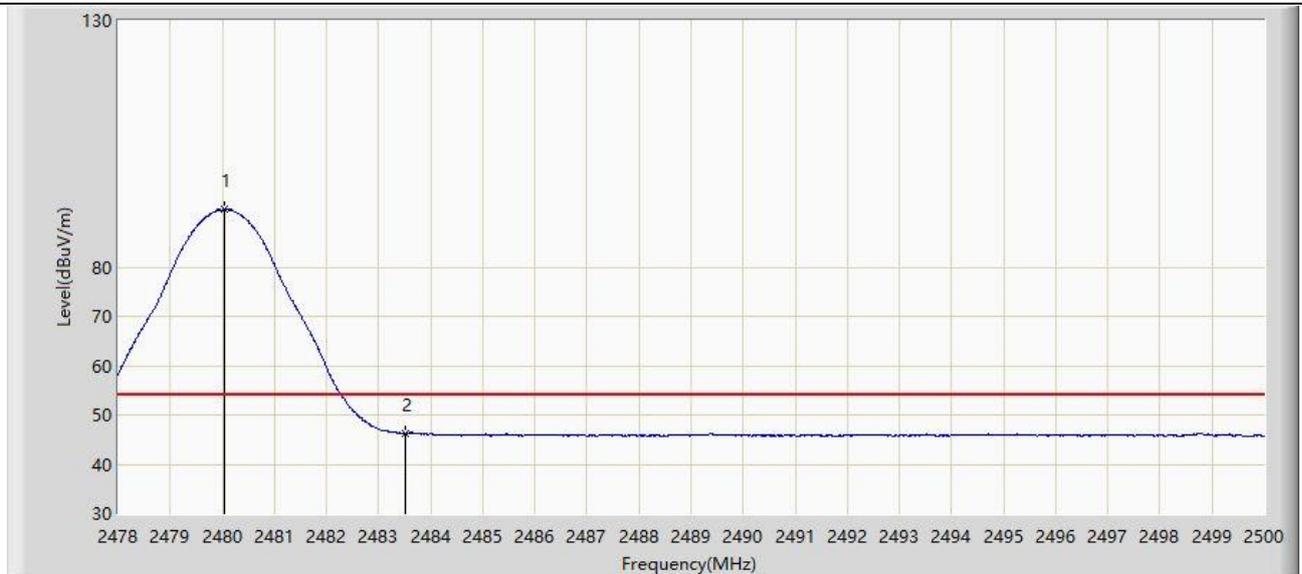


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB)	Type
1		*	2479.980	93.516	61.133	19.516	74.000	32.383	PK
2			2483.500	58.745	26.370	-15.255	74.000	32.375	PK
3			2484.809	59.317	26.945	-14.683	74.000	32.372	PK

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Site: AC2	Time: 2020/04/01 - 21:02
Limit: FCC_Part15_Band Edge(3m)	Engineer: White Wang
Probe: AC2_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Bluetooth Low Energy Module	Power: By USB
Test Mode: Transmit by BLE at channel 2480MHz 2M	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.046	91.614	59.231	37.614	54.000	32.383	AV
2			2483.500	46.178	13.803	-7.822	54.000	32.375	AV

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

8. CONCLUSION

The data collected relate only the item(s) tested and show that the device is in compliance with Part 15C of the FCC rules and ISED rules.

————— The End —————

Appendix A - Test Setup Photograph

Refer to "2003RSU067-UT" file.

Appendix B - EUT Photograph

Refer to "2003RSU067-UE" file.