

# RF MEASUREMENT REPORT

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**FCC ID:** T68-TTBLE  
**Applicant:** Fluke Electronics  
**Product:** LE Bluetooth Module  
**Model No.:** TTBLE  
**FCC Classification:** Digital Transmission System (DTS)  
**FCC Rule Part(s):** Part 15 Subpart C (Section 15.247)  
**Result:** Complies  
**Received Date:** 2023-09-05  
**Test Date:** 2023-09-12 ~ 2023-09-15

**Reviewed By:**

\_\_\_\_\_  
Sunny Sun

**Approved By:**

\_\_\_\_\_  
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.

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### Revision History

Report No.	Version	Description	Issue Date	Note
2309RSU028-U1	V01	Initial Report	2023-10-16	Valid

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#### 1.4. Product Information

Product Name	LE Bluetooth Module
Model No.	TTBLE
EUT Identification No.	20230905Sample#04 (Conducted Test) 20230911Sample#06 (Radiated Test)
Bluetooth Specification	V4.2 Bluetooth-LE
Antenna Information	Refer to Section 1.5
Working Voltage	3.3 ~ 5Vdc
Operating Temperature	-20°C ~ 60°C
Note: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

#### 1.5. Radio Specification under Test

Bluetooth Frequency	2402 ~ 2480MHz
Channel Number	40
Type of modulation	GFSK
Data Rate	1Mbps
Antenna Type	Ceramic Chip Antenna
Antenna Gain	3.00dBi

**1.6. Working Frequencies**

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	--	--	--	--

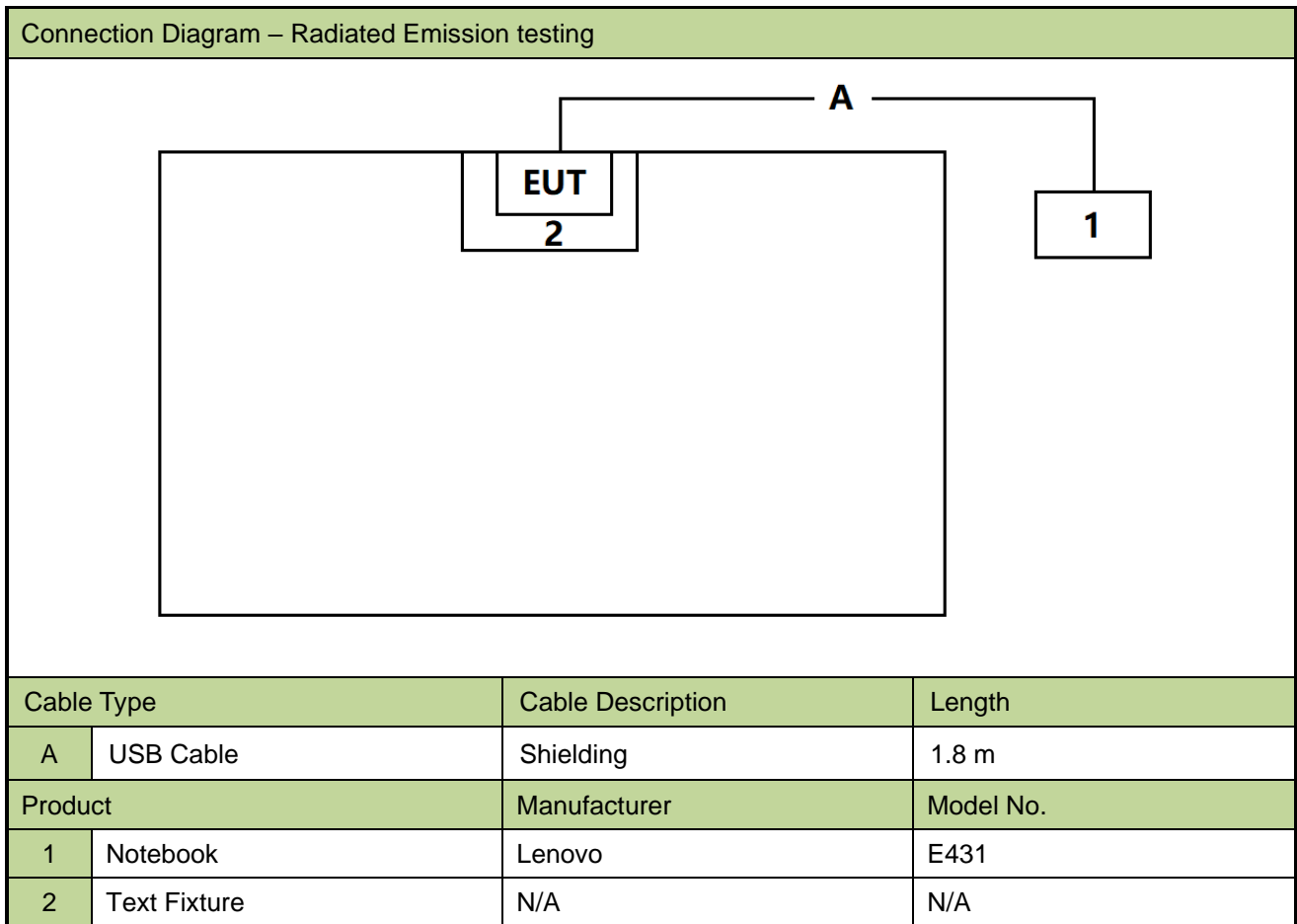
## 2. Test Configuration

### 2.1. Test Mode

Mode 1: Transmit by BLE-1Mbps

### 2.2. Test System Connection Diagram

The device was tested per the guidance ANSI C63.10: 2013 was used to reference the appropriate EUT setup for radiated emissions testing.



Note: The USB Cable and Text Fixture are provided by manufacturer.



### 2.3. Test Software

The test utility software used during testing was “RF Test”, and the version was 0421.

### 2.4. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15.247
- KDB 558074 D01v05r02
- ANSI C63.10-2013

### 2.5. Test Environment Condition

Ambient Temperature	15 ~ 35°C
Relative Humidity	20 ~75%RH

### 3. 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 antenna of the device is **permanently attached**.
- There are no provisions for connection to an external antenna.

**Conclusion:**

The unit complies with the requirement of §15.203.

#### 4. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2024-02-29	WZ-SR4
USB Power Sensor	Keysight	U2021XA	MRTSUE06447	1 year	2024-05-23	WZ-SR4
Thermohygrometer	testo	608-H1	MRTSUE06222	1 year	2023-10-11	WZ-SR4
Shielding Room	HUAMING	WZ-SR4	MRTSUE06441	N/A	N/A	WZ-SR4
EMI Test Receiver	Agilent	N9038A	MRTSUE06125	1 year	2024-05-23	WZ-AC2
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2023-09-29	WZ-AC2
TRILOG Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2024-05-15	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06171	1 year	2023-10-13	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2023-11-05	WZ-AC2
Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2024-05-07	WZ-AC2
Preamplifier	EMCI	EMC184045SE	MRTSUE06640	1 year	2024-01-12	WZ-AC2
Thermohygrometer	Mingle	ETH529	MRTSUE06170	1 year	2023-11-27	WZ-AC2
Thermohygrometer	testo	608-H1	MRTSUE11038	1 year	2023-11-01	WZ-AC2
Anechoic Chamber	RIKEN	WZ-AC2	MRTSUE06213	1 year	2024-04-20	WZ-AC2

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802	1.02	RE Antenna & Turntable
BenchVue Power Meter	2018.1	Power

## 5. Decision Rules and Measurement Uncertainty

### 5.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 5.2. 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  $k = 2$ .

Radiated Emission Measurement
The maximum measurement uncertainty is evaluated as: Coaxial: 9kHz~30MHz: 2.59dB Coplanar: 9kHz~30MHz: 2.60dB Horizontal: 30MHz~200MHz: 3.85dB 200MHz~1GHz: 4.36dB 1GHz~40GHz: 4.98dB Vertical: 30MHz~200MHz: 4.06dB 200MHz~1GHz: 5.28dB 1GHz~40GHz: 4.91dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 2.3dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 1.5dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 2.3dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 3.2%

## 6. Test Result

### 6.1. Summary

FCC Section(s)	Test Description	Test Condition	Verdict
15.247(a)(2)	6dB Bandwidth	Conducted	Pass
15.247(b)(3)	Output Power		Pass
15.247(e)	Power Spectral Density		Pass
15.247(d)	Band Edge / Out-of-Band Emissions		Pass
15.205 15.209	General Field Strength (Restricted Bands and Radiated Emission)	Radiated	Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	N/A

#### Notes:

- 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.
- For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
- "N/A" means that this item is not applicable, and the detail information refer to relevant section.

## 6.2. 6dB Bandwidth Measurement

### 6.2.1. Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

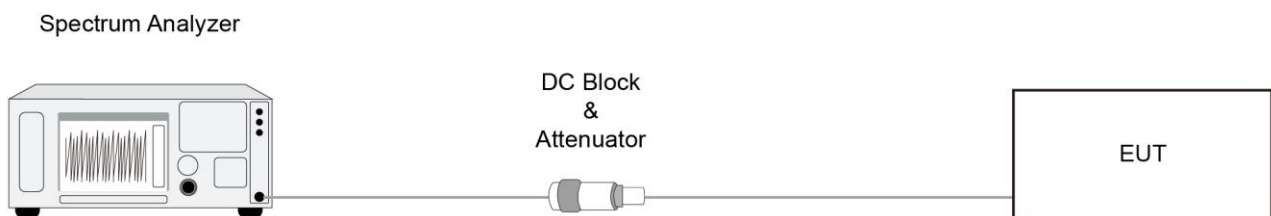
### 6.2.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.8

### 6.2.3. Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to  $X = 6$ . The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set RBW = 100 kHz
3. VBW  $\geq 3 \times$  RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize

### 6.2.4. Test Setup



### 6.2.5. Test Result

Refer to Appendix A.2.

### 6.3. Output Power Measurement

#### 6.3.1. Test Limit

The maximum output power shall be less 1 Watt (30dBm).

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.

#### 6.3.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.9.1.3

ANSI C63.10 - 2013 - Section 11.9.2.3.2

#### 6.3.3. Test Setting

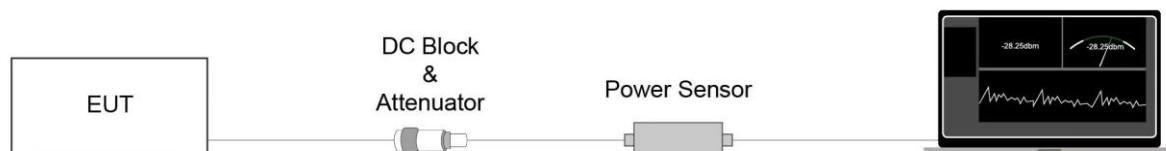
##### **Method PKPM1 (Peak Power Measurement of Signals with DTS BW $\leq$ 50MHz)**

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.

##### **Average Power Measurement**

Average 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 power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

#### 6.3.4. Test Setup



#### 6.3.5. Test Result

Refer to Appendix A.3.

## 6.4. Power Spectral Density Measurement

### 6.4.1. 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.

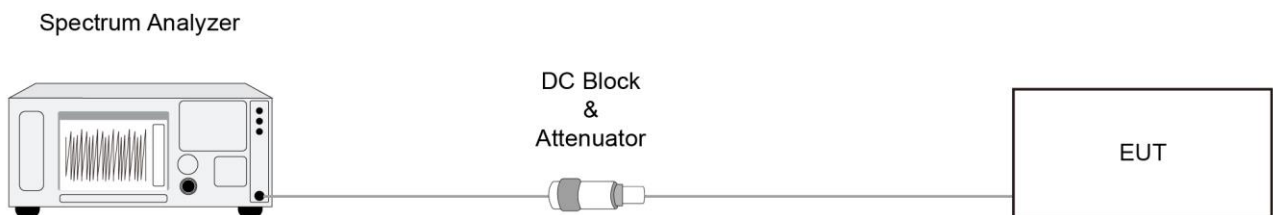
### 6.4.2. Test Procedure

ANSI C63.10-2013 Section 11.10.2

### 6.4.3. 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

### 6.4.4. Test Setup



### 6.4.5. Test Result

Refer to Appendix A.4.



## **6.5. Conducted Band Edge and Out-of-Band Emissions Measurement**

### **6.5.1. Test Limit**

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth per the PSD procedure.

### **6.5.2. Test Procedure**

ANSI C63.10-2013 - Section 11.11

### **6.5.3. Test Setting**

#### **Reference level measurement**

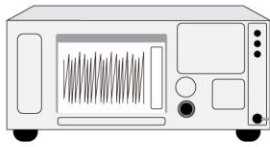
1. Set instrument center frequency to DTS channel center frequency
2. Set the span to  $\geq 1.5$  times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW  $\geq 3 \times$  RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

#### **Emission level measurement**

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

#### 6.5.4. Test Setup

Spectrum Analyzer



DC Block  
&  
Attenuator



#### 6.5.5. Test Result

Refer to Appendix A.5.

## 6.6. Radiated Spurious Emission Measurement

### 6.6.1. Test Limit

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 [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

### 6.6.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.11 & 11.12

ANSI C63.10 - 2013 - Section 6.3 (General Requirements)

ANSI C63.10 - 2013 - Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 - 2013 - Section 6.5 (Standard test method above 30MHz to 1GHz)

ANSI C63.10 - 2013 - Section 6.6 (Standard test method above 1GHz)

### 6.6.3. 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
> 1000MHz	1MHz

**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**

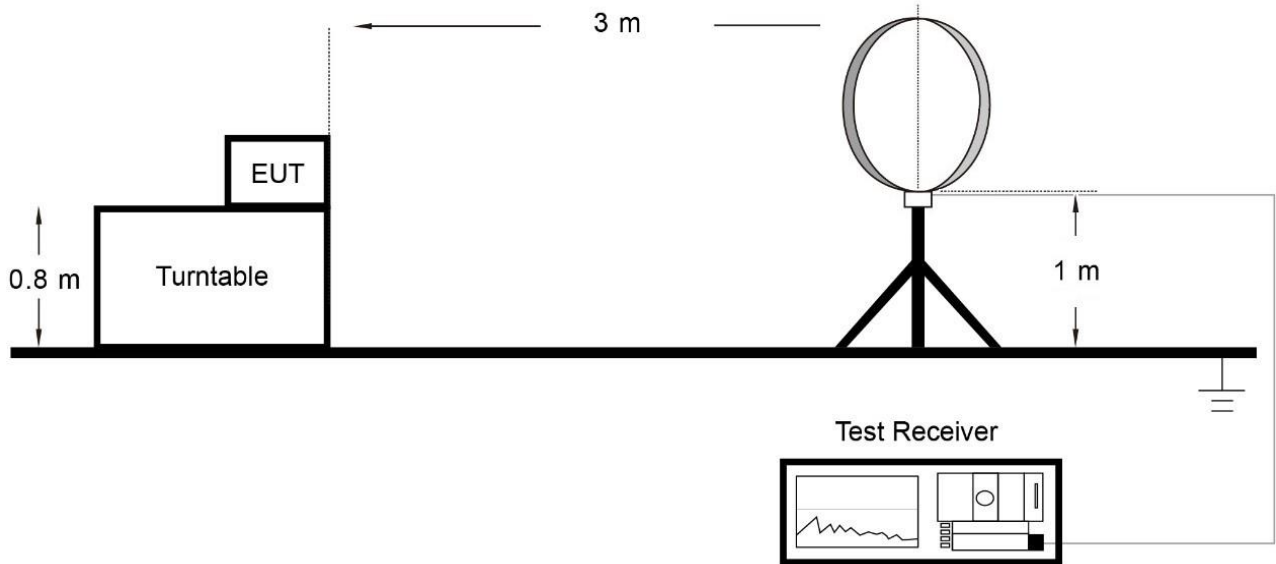
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

**Average Measurements above 1GHz (Method VB)**

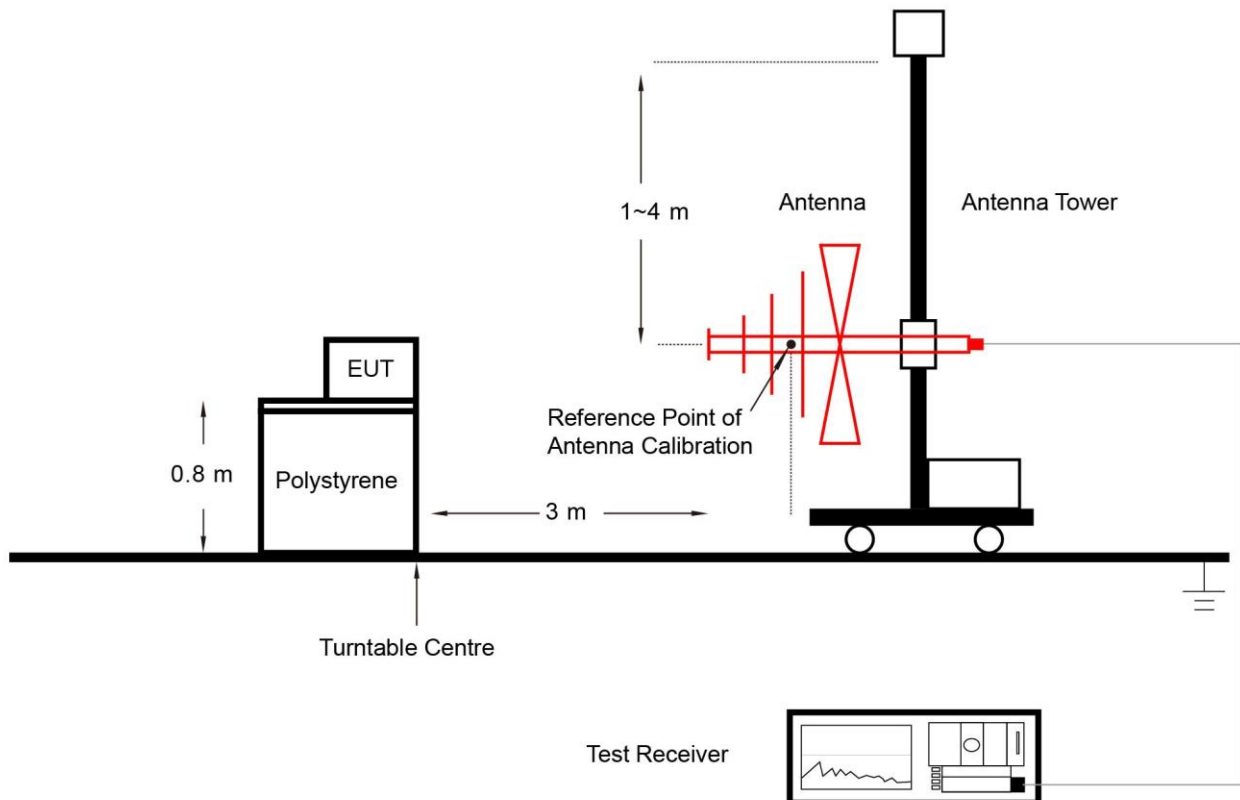
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle  $\geq 98\%$ , set VBW = 10 Hz.  
If the EUT duty cycle is  $< 98\%$ , set VBW  $\geq 1/T$ . T is the minimum transmission duration.
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

### 6.6.4. Test Setup

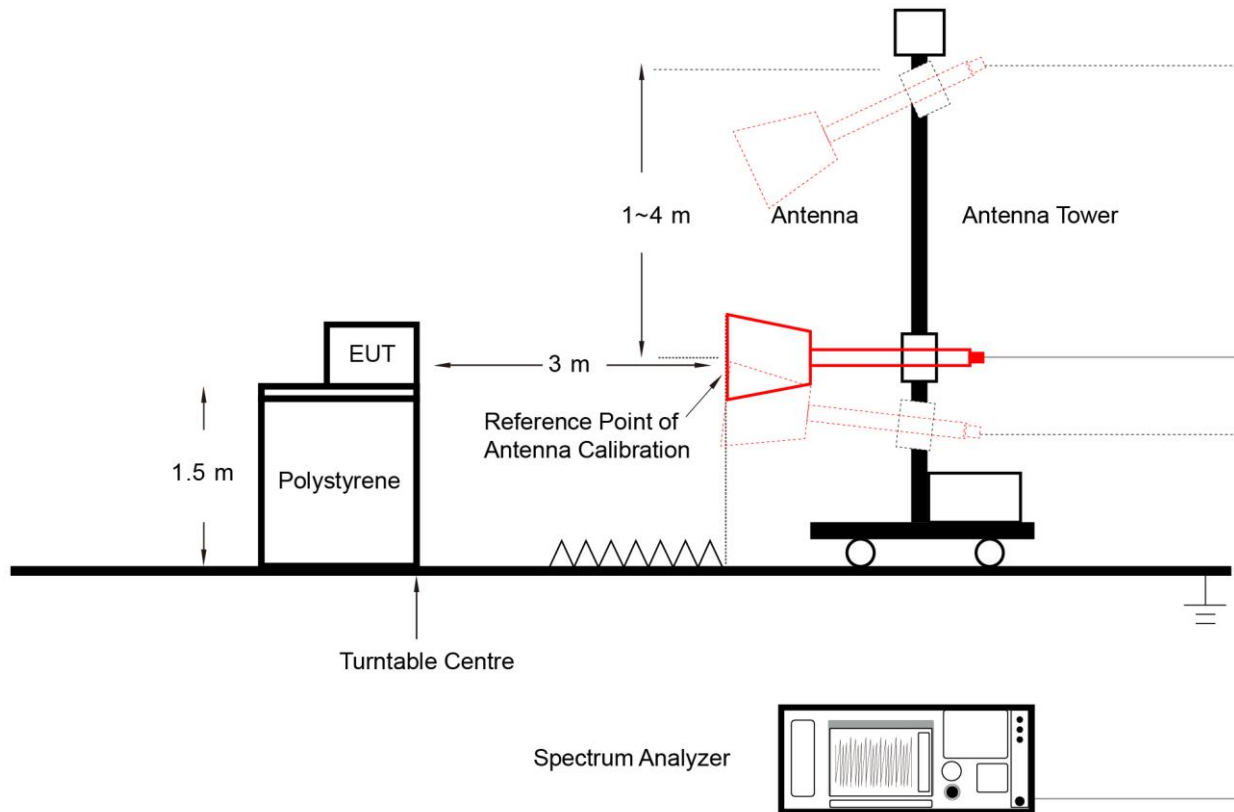
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



6.6.5. Test Result

Refer to Appendix A.6.

## 6.7. Radiated Restricted Band Edge Measurement

### 6.7.1. 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
<sup>1</sup> 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	( <sup>2</sup> )
13.36 - 13.41	--	--	--

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR 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 [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

### 6.7.2. Test Procedure

ANSI C63.10-2013 Section 6.3 & 6.6 & 11.13

### 6.7.3. 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

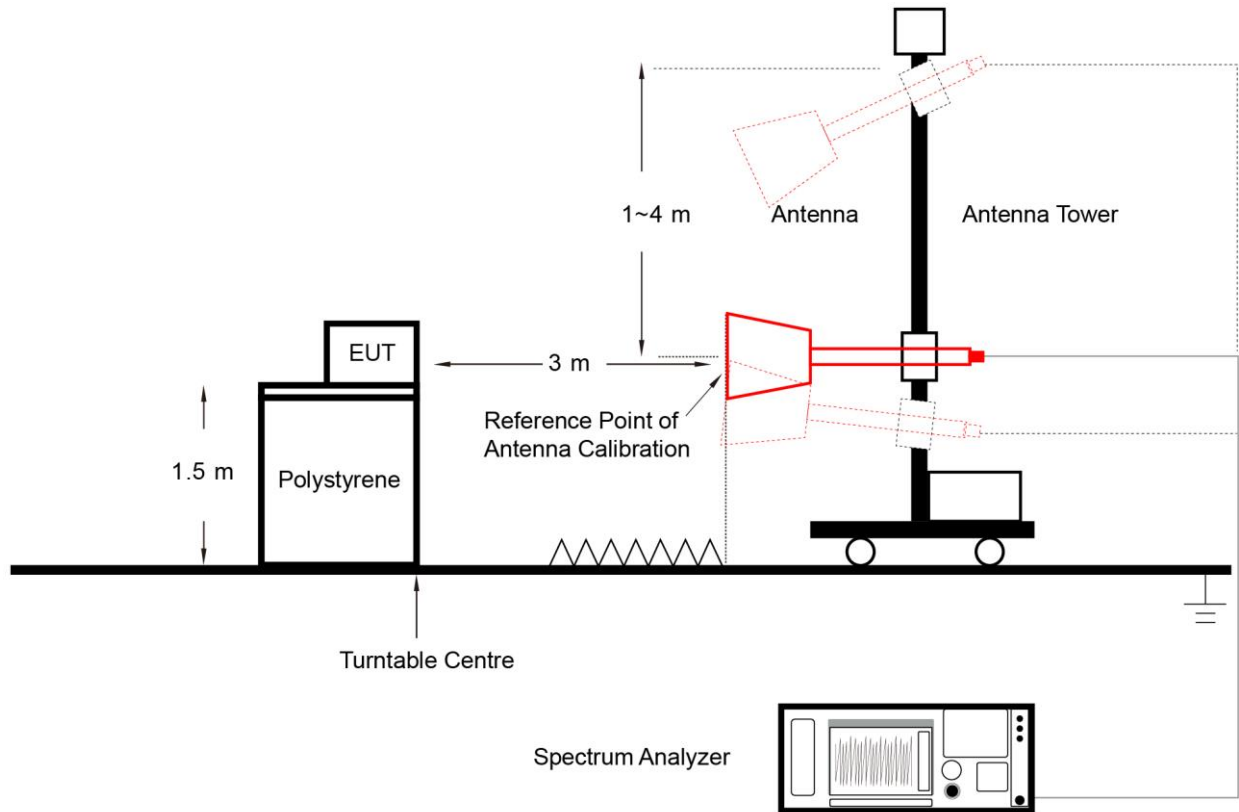
#### Average Field Strength Measurements

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. 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

#### 6.7.4. Test Setup



#### 6.7.5. Test Result

Refer to Appendix A.7.

## 6.8. AC Conducted Emissions Measurement

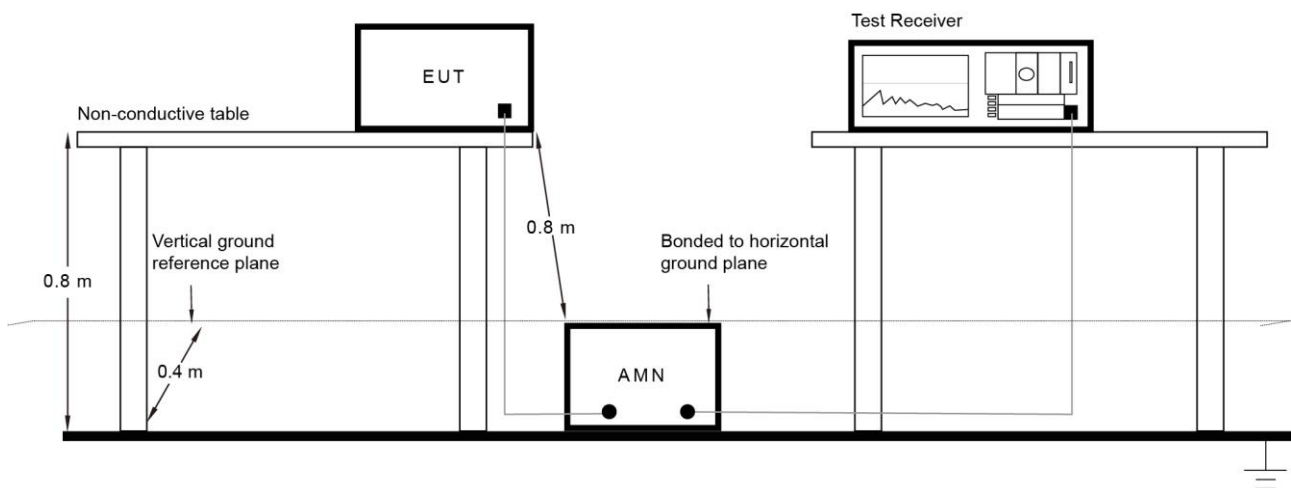
### 6.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dB $\mu$ V)	AV (dB $\mu$ V)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

### 6.8.2. Test Setup



### 6.8.3. Test Result

The EUT is powered by test fixture, so this item is not applicable.

## Appendix A - Test Result

### A.1 Duty Cycle Test Result

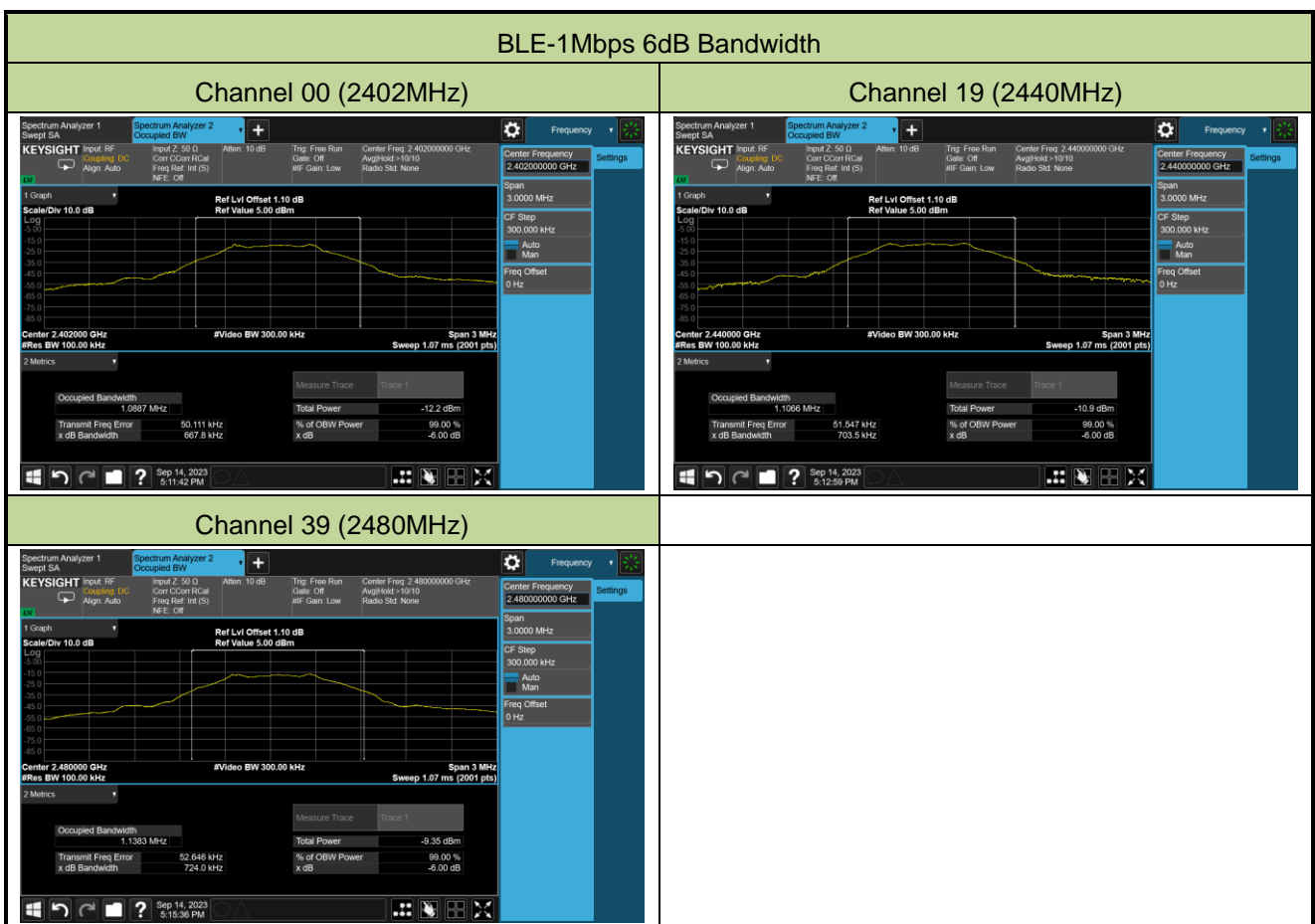
Test Site	WZ-SR4	Test Engineer	Jeff Yang
Test Date	2023-09-14		

Test Mode	Duty Cycle																														
BLE-1Mbps	26.78%																														
Duty Cycle (T = Transmission Duration)																															
BLE-1Mbps (T = 399.0μs)																															
<p>The screenshot shows a Keysight Spectrum Analyzer interface. The main display shows a pulse train waveform. A marker 'X' is placed on the period of the pulse train, showing a value of 1.490 ms. Another marker 'Δ' is placed on the pulse width, showing a value of 0.05 dB. The marker table at the bottom shows the following data:</p> <table border="1"> <thead> <tr> <th>Marker</th> <th>Trace</th> <th>Scale</th> <th>Function</th> <th>Function Width</th> <th>Function Value</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Δ</td> <td>1</td> <td>(A)</td> <td>399.0 μs</td> <td>0.7585 dB</td> </tr> <tr> <td>2</td> <td>F</td> <td>1</td> <td>(A)</td> <td>3.245 ms</td> <td>-19.41 dBm</td> </tr> <tr> <td>3</td> <td>Δ</td> <td>1</td> <td>(Δ)</td> <td>1.490 ms</td> <td>0.04997 dB</td> </tr> <tr> <td>4</td> <td>F</td> <td>1</td> <td>(A)</td> <td>3.245 ms</td> <td>-19.41 dBm</td> </tr> </tbody> </table>		Marker	Trace	Scale	Function	Function Width	Function Value	1	Δ	1	(A)	399.0 μs	0.7585 dB	2	F	1	(A)	3.245 ms	-19.41 dBm	3	Δ	1	(Δ)	1.490 ms	0.04997 dB	4	F	1	(A)	3.245 ms	-19.41 dBm
Marker	Trace	Scale	Function	Function Width	Function Value																										
1	Δ	1	(A)	399.0 μs	0.7585 dB																										
2	F	1	(A)	3.245 ms	-19.41 dBm																										
3	Δ	1	(Δ)	1.490 ms	0.04997 dB																										
4	F	1	(A)	3.245 ms	-19.41 dBm																										

**A.2 6dB Bandwidth Test Result**

Test Site	WZ-SR4	Test Engineer	Jeff Yang
Test Date	2023-09-14		

Test Mode	Data Rate	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
BLE	1Mbps	00	2402	0.6678	≥ 0.5
BLE	1Mbps	19	2440	0.7035	≥ 0.5
BLE	1Mbps	39	2480	0.7240	≥ 0.5



### A.3 Output Power Test Result

Test Site	WZ-SR4	Test Engineer	Jeff Yang
Test Date	2023-09-14		

#### Test Result of Peak Output Power

Test Mode	Data Rate	Channel No.	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Result
BLE	1Mbps	00	2402	-17.69	≤ 30.00	Pass
BLE	1Mbps	19	2440	-17.05	≤ 30.00	Pass
BLE	1Mbps	39	2480	-15.52	≤ 30.00	Pass

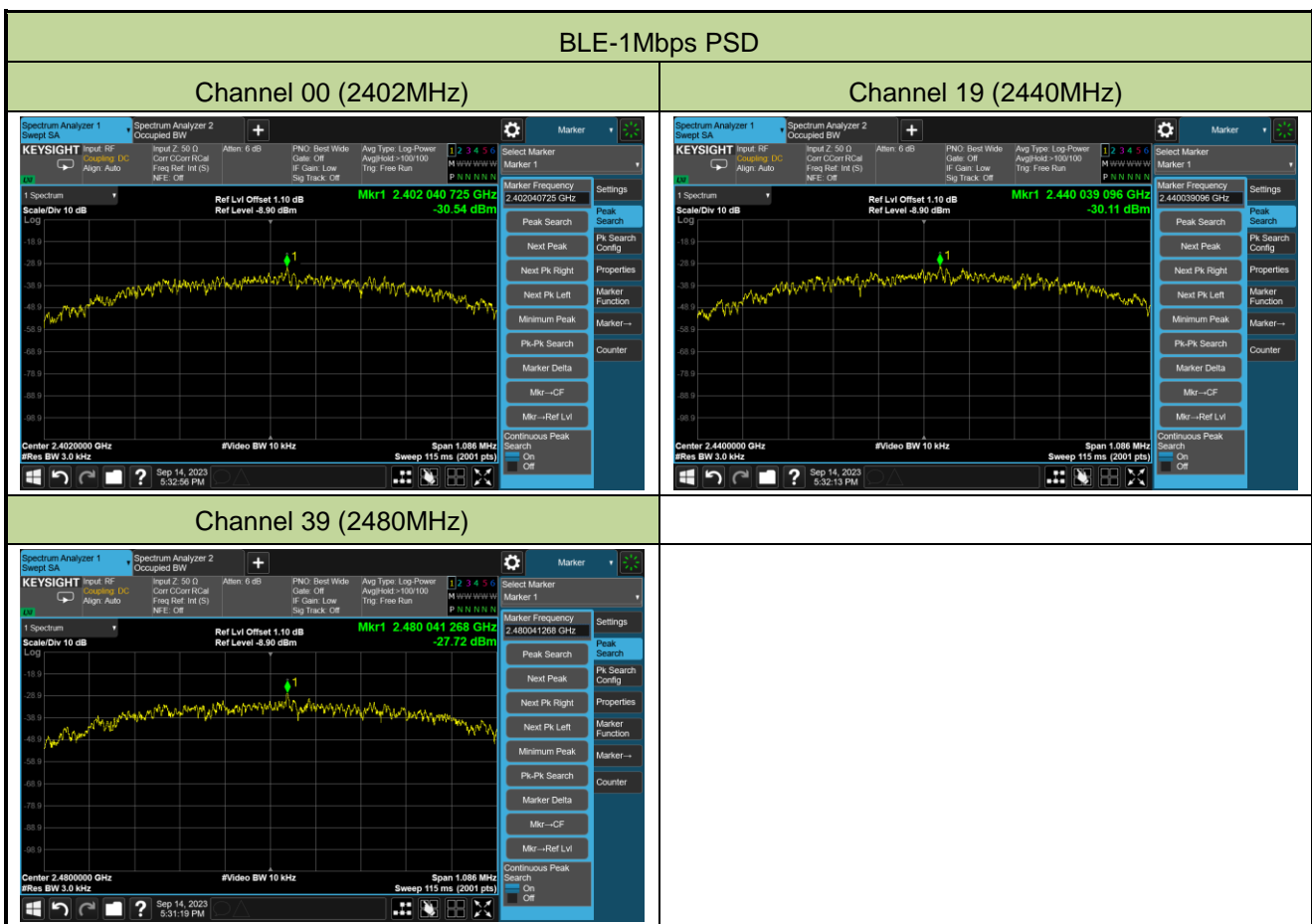
#### Test Result of Average Output Power (Reporting Only)

Test Mode	Data Rate	Channel No.	Frequency (MHz)	Average Power (dBm)	Limit (dBm)	Result
BLE	1Mbps	00	2402	-19.63	≤ 30.00	Pass
BLE	1Mbps	19	2440	-18.37	≤ 30.00	Pass
BLE	1Mbps	39	2480	-17.38	≤ 30.00	Pass

**A.4 Power Spectral Density Test Result**

Test Site	WZ-SR4	Test Engineer	Jeff Yang
Test Date	2023-09-14		

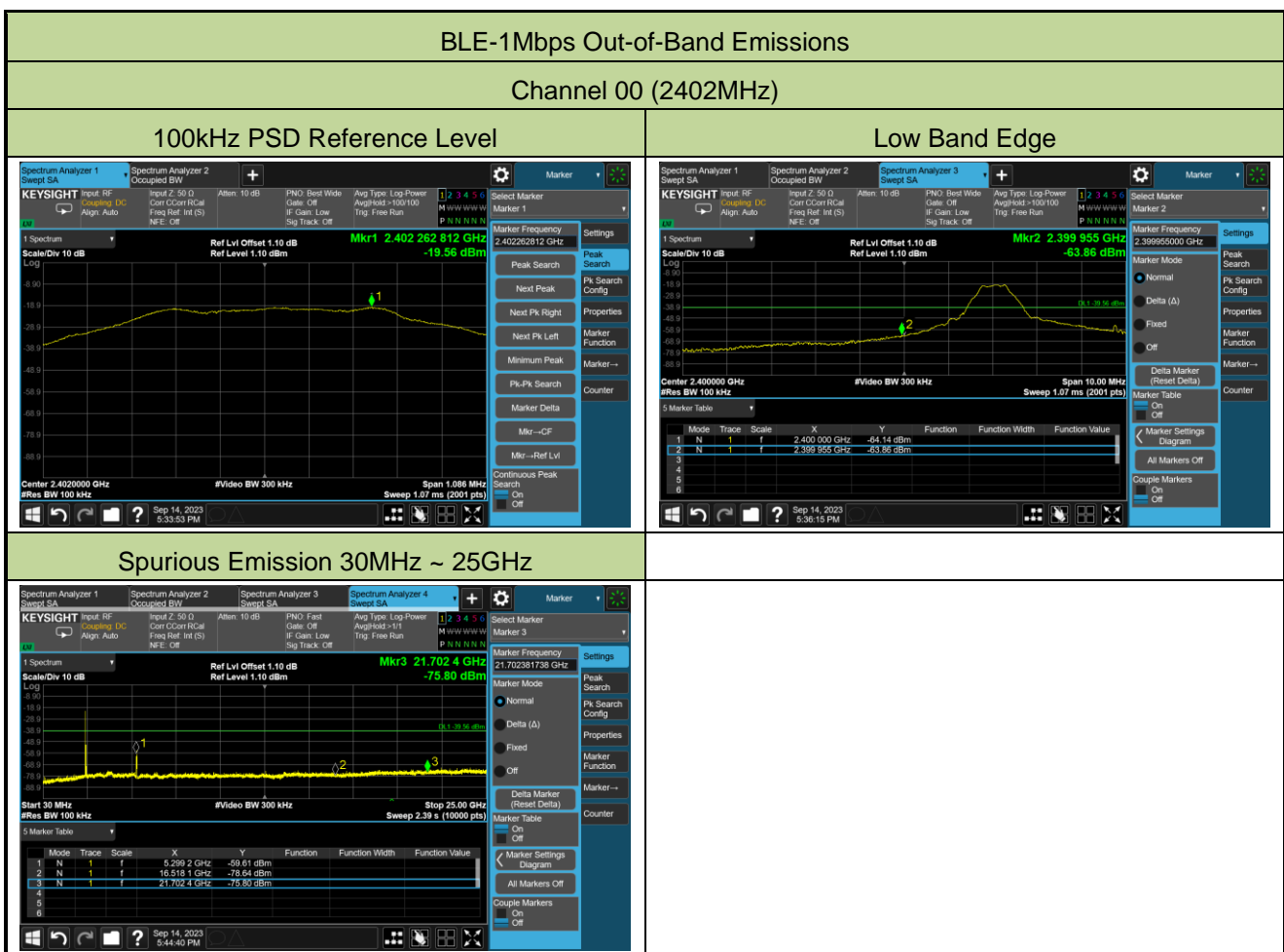
Test Mode	Data Rate	Channel No.	Frequency (MHz)	PSD Result (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
BLE	1Mbps	00	2402	-30.54	≤ 8.00	Pass
BLE	1Mbps	19	2440	-30.11	≤ 8.00	Pass
BLE	1Mbps	39	2480	-27.72	≤ 8.00	Pass



### A.5 Conducted Band Edge and Out-of-Band Emissions Test Result

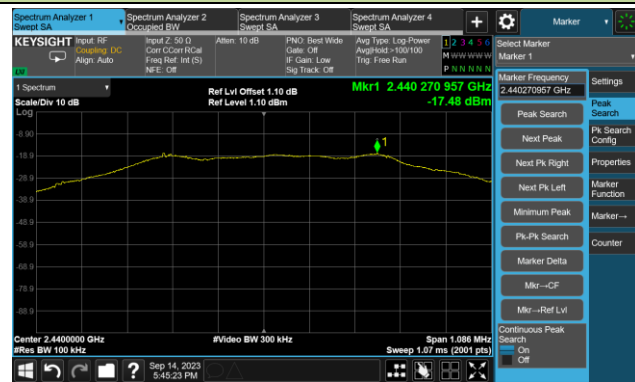
Test Site	WZ-SR4	Test Engineer	Jeff Yang
Test Date	2023-09-14		

Test Mode	Data Rate / Mbps	Channel No.	Frequency (MHz)	Limit (dBc)	Result
BLE	1	00	2402	20	Pass
BLE	1	19	2440	20	Pass
BLE	1	39	2480	20	Pass



## Channel 19 (2440MHz)

## 100kHz PSD Reference Level

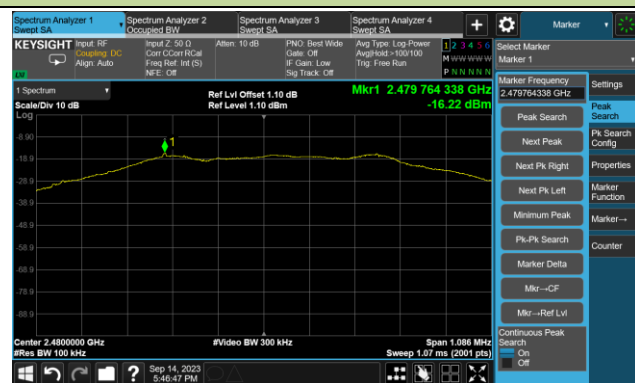


## Spurious Emission 30MHz ~ 25GHz

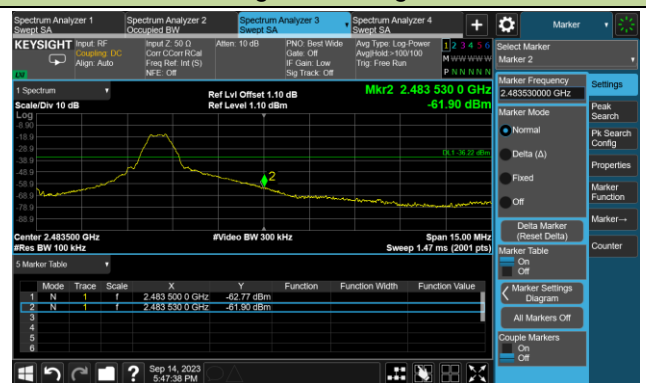


## Channel 39 (2480MHz)

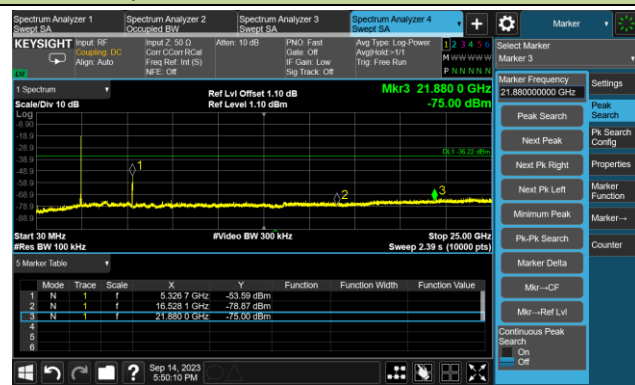
## 100kHz PSD Reference Level



## High Band Edge



## Spurious Emission 30MHz ~ 25GHz





**A.6 Radiated Spurious Emission Test Result**

Test Site	WZ-AC2	Test Engineer	Bob Zhang
Test Date	2023-09-12	Test Mode:	BLE-1Mbps
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

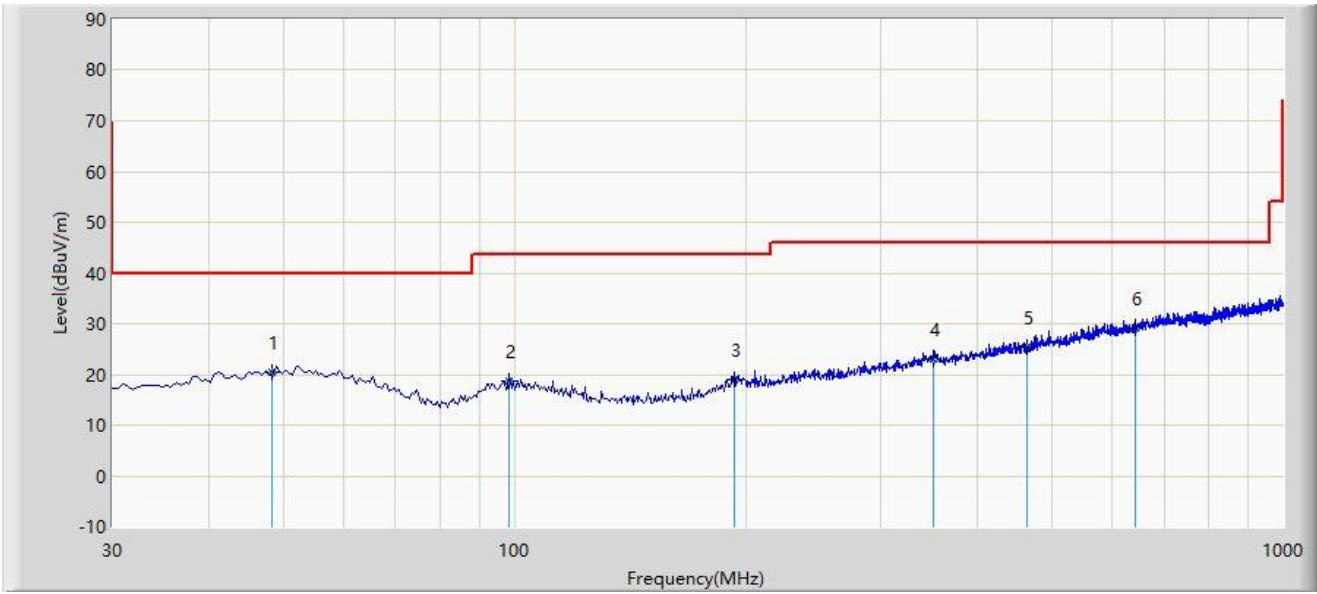
Test Channel	Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
00	4119.5	35.4	0.7	36.1	74.0	-37.9	Peak	Horizontal
	10894.0	30.1	16.2	46.3	74.0	-27.7	Peak	Horizontal
	11948.0	27.8	16.8	44.6	74.0	-29.4	Peak	Horizontal
	4119.5	35.2	0.7	35.9	74.0	-38.1	Peak	Vertical
	4638.0	35.5	3.5	39.0	74.0	-35.0	Peak	Vertical
	11684.5	29.7	17.3	47.0	74.0	-27.0	Peak	Vertical
19	4587.0	34.3	3.1	37.4	74.0	-36.6	Peak	Horizontal
	7324.0	35.0	11.4	46.4	74.0	-27.6	Peak	Horizontal
	11557.0	29.5	17.8	47.3	74.0	-26.7	Peak	Horizontal
	4918.5	34.5	3.2	37.7	74.0	-36.3	Peak	Vertical
	7315.5	40.4	11.4	51.8	74.0	-22.2	Peak	Vertical
	7315.5	35.1	11.4	46.5	54.0	-7.5	AV	Vertical
	11531.5	29.6	17.3	46.9	74.0	-27.1	Peak	Vertical
39	5046.0	34.5	3.3	37.8	74.0	-36.2	Peak	Horizontal
	7443.0	32.6	12.0	44.6	74.0	-29.4	Peak	Horizontal
	11642.0	29.0	17.9	46.9	74.0	-27.1	Peak	Horizontal
	4187.5	35.4	0.9	36.3	74.0	-37.7	Peak	Vertical
	7443.0	39.8	12.0	51.8	74.0	-22.2	Peak	Vertical
	7443.0	34.2	12.0	46.2	54.0	-7.8	AV	Vertical
	11914.0	29.8	17.2	47.0	74.0	-27.0	Peak	Vertical

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

Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre\_Amplifier Gain (dB)

**The Result of Radiated Emission below 1GHz:**

Site: WZ-AC2	Test Date: 2023-09-14
Limit: FCC_Part15.209_RSE(3m)	Engineer: Bob Zhang
Probe: VULB9162_30-7000MHz	Polarity: Horizontal
EUT: LE Bluetooth Module	Power: By Computer
Test Mode: Transmit by BLE 1Mbps at 2480MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		48.400	20.473	0.100	-19.527	40.000	20.373	QP
2		98.300	18.555	0.200	-24.945	43.500	18.356	QP
3		193.400	19.077	0.500	-24.423	43.500	18.578	QP
4		350.400	23.075	0.200	-22.925	46.000	22.875	QP
5		465.300	25.387	1.100	-20.613	46.000	24.287	QP
6	*	641.200	29.032	1.600	-16.968	46.000	27.432	QP

Note 1: " \* ", means this data is the worst emission level.

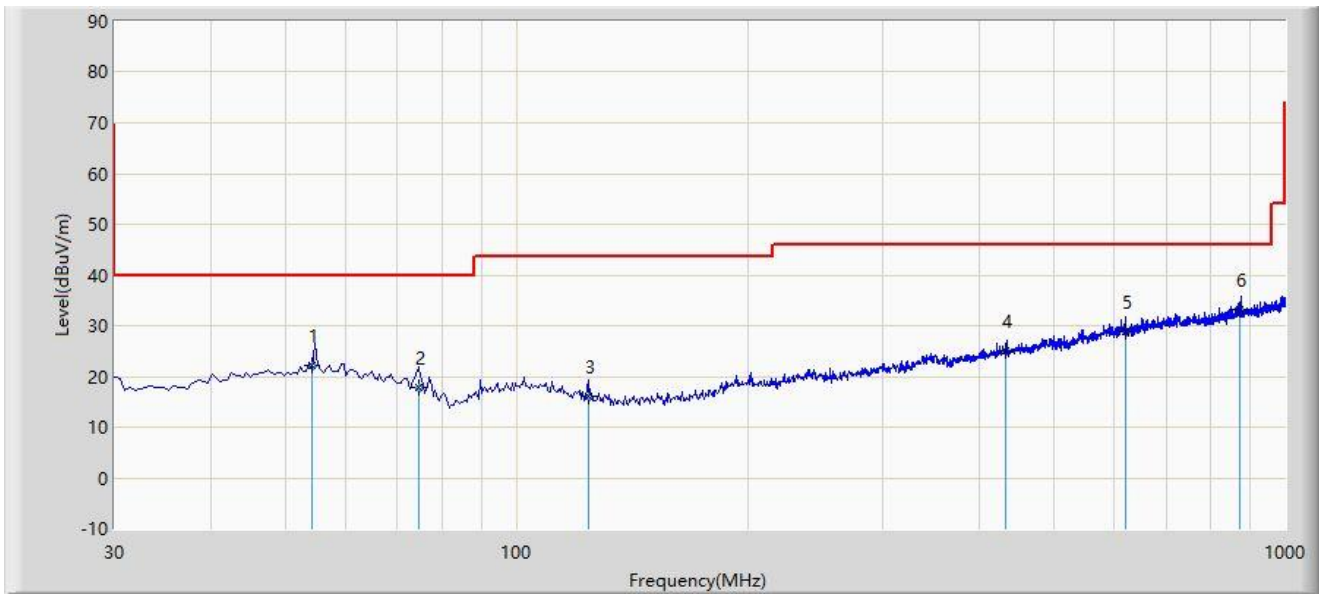
Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz and 18GHz to 25GHz) 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: WZ-AC2	Test Date: 2023-09-14
Limit: FCC_Part15.209_RSE(3m)	Engineer: Bob Zhang
Probe: VULB9162_30-7000MHz	Polarity: Vertical
EUT: LE Bluetooth Module	Power: By Computer
Test Mode: Transmit by BLE 1Mbps at 2480MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		54.200	22.263	1.900	-17.737	40.000	20.363	QP
2		74.500	17.701	2.400	-22.299	40.000	15.301	QP
3		124.090	16.223	0.200	-27.277	43.500	16.023	QP
4		432.100	25.133	1.200	-20.867	46.000	23.932	QP
5		619.600	28.784	1.600	-17.216	46.000	27.184	QP
6	*	874.200	33.064	2.300	-12.936	46.000	30.764	QP

Note 1: " \* ", means this data is the worst emission level.

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

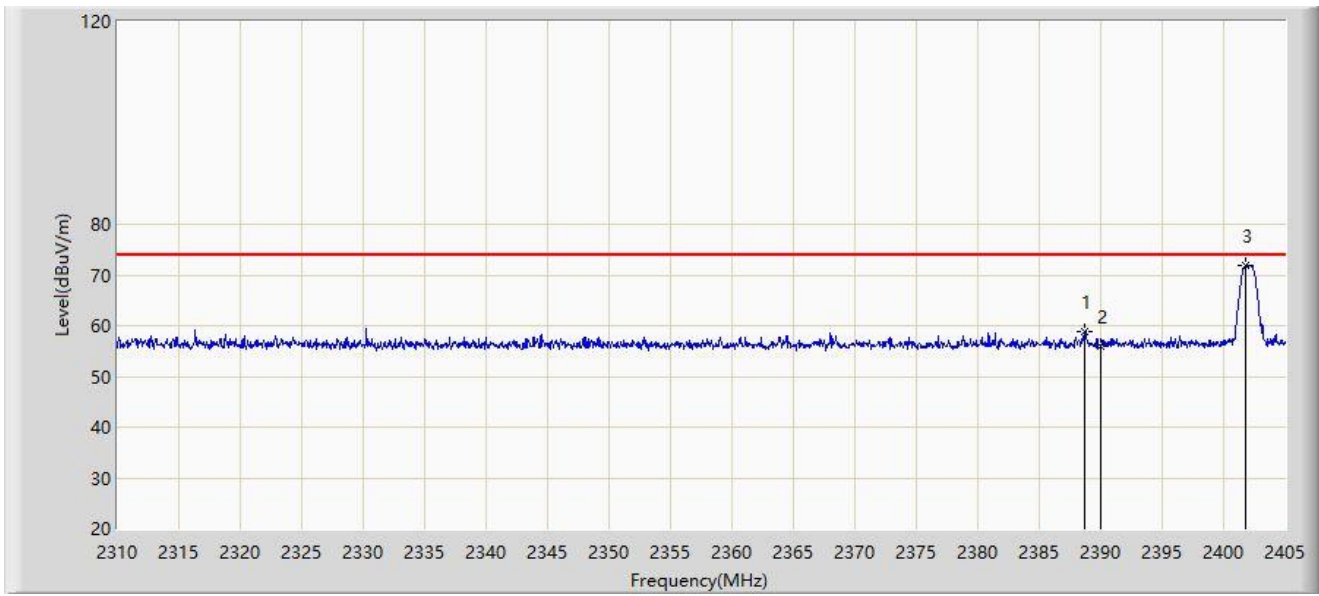
Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz and 18GHz to 25GHz) 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.

### A.7 Radiated Restricted Band Edge Test Result

Site: WZ-AC2	Test Date: 2023-09-15
Limit: FCC_2.4G_RE(3m)	Engineer: Bob Zhang
Probe: BBHA9120D_1457_1-18GHz	Polarity: Horizontal
EUT: LE Bluetooth Module	Power: By Computer
Test Mode: Transmit by BLE 1Mbps at 2402MHz	



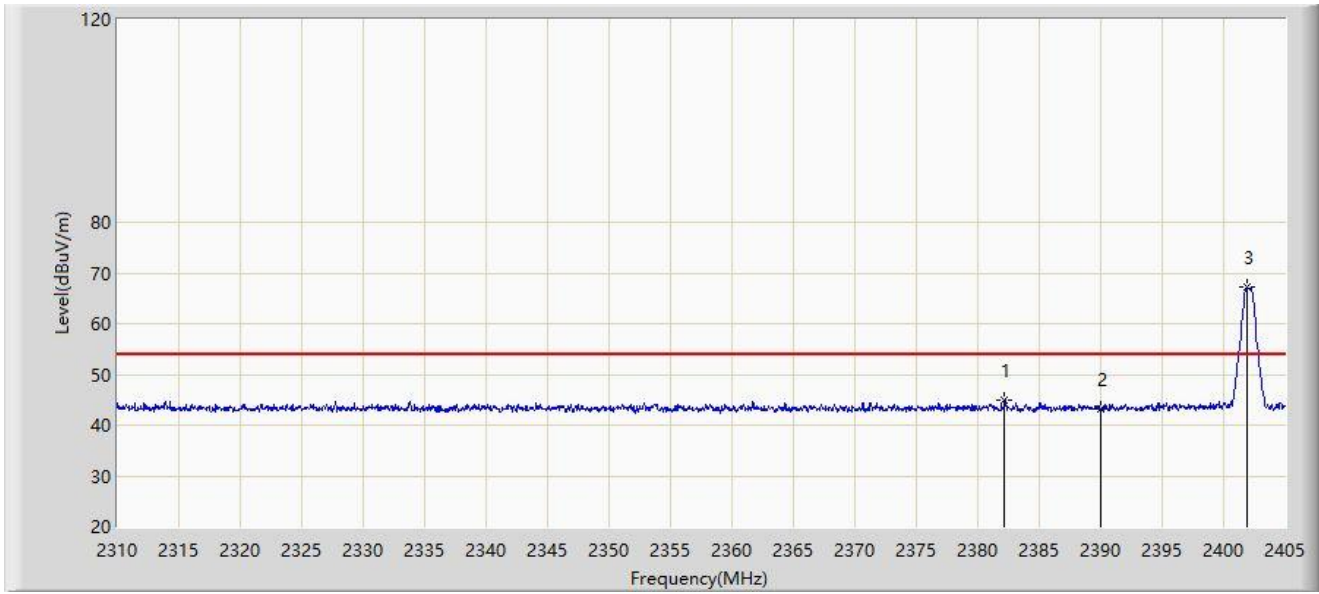
No	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Margin (dB)	Limit (dB $\mu$ V/m)	Factor (dB/m)	Type
1	*	2388.708	58.880	27.257	-15.120	74.000	31.623	PK
2		2390.000	55.910	24.295	-18.090	74.000	31.615	PK
3		2401.770	71.811	40.260	N/A	N/A	31.551	PK

Note 1: " \* ", means this data is the worst emission level.

Note 2: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: WZ-AC2	Test Date: 2023-09-15
Limit: FCC_2.4G_RE(3m)	Engineer: Bob Zhang
Probe: BBHA9120D_1457_1-18GHz	Polarity: Horizontal
EUT: LE Bluetooth Module	Power: By Computer
Test Mode: Transmit by BLE 1Mbps at 2402MHz	



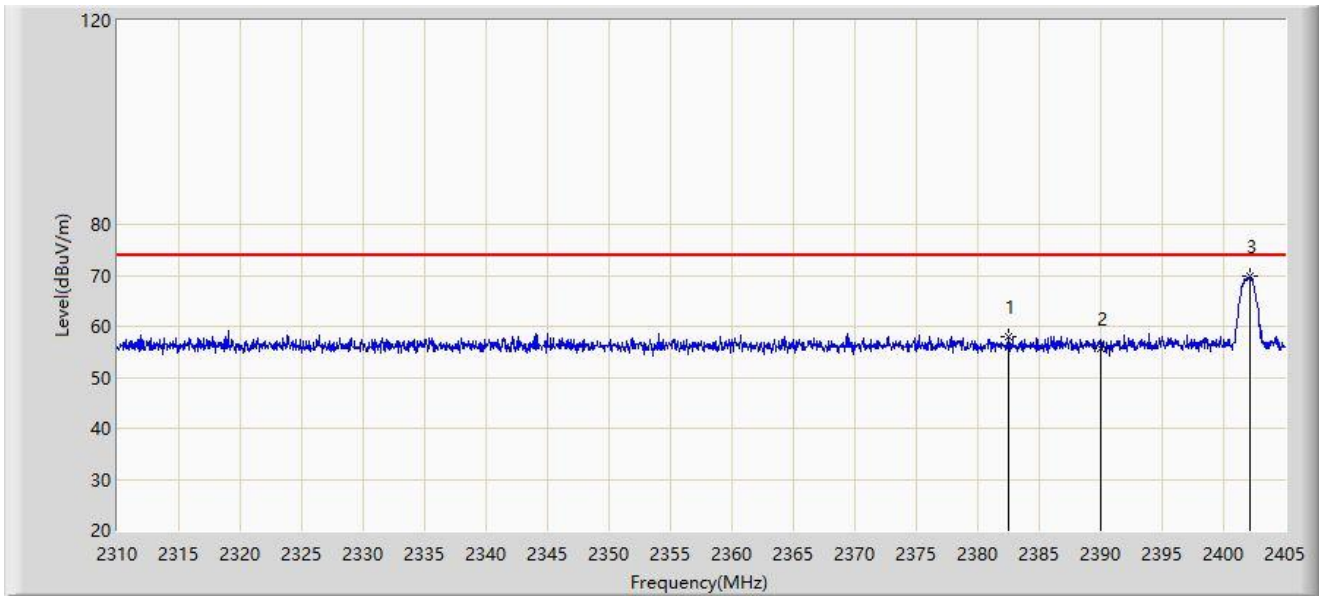
No	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Margin (dB)	Limit (dB $\mu$ V/m)	Factor (dB/m)	Type
1	*	2382.200	44.976	13.320	-9.024	54.000	31.656	AV
2		2390.000	43.191	11.576	-10.809	54.000	31.615	AV
3		2401.865	67.387	35.837	N/A	N/A	31.550	AV

Note 1: " \* ", means this data is the worst emission level.

Note 2: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: WZ-AC2	Test Date: 2023-09-15
Limit: FCC_2.4G_RE(3m)	Engineer: Bob Zhang
Probe: BBHA9120D_1457_1-18GHz	Polarity: Vertical
EUT: LE Bluetooth Module	Power: By Computer
Test Mode: Transmit by BLE 1Mbps at 2402MHz	



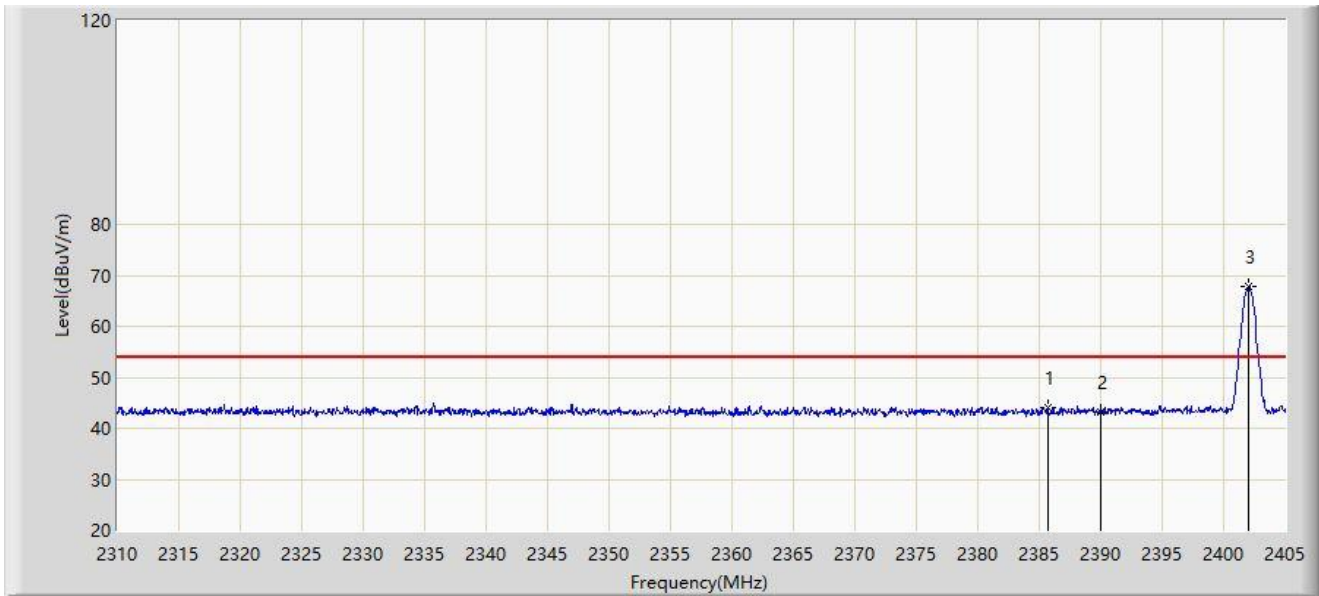
No	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Margin (dB)	Limit (dB $\mu$ V/m)	Factor (dB/m)	Type
1	*	2382.532	58.048	26.392	-15.952	74.000	31.656	PK
2		2390.000	55.727	24.112	-18.273	74.000	31.615	PK
3		2402.198	69.743	38.194	N/A	N/A	31.549	PK

Note 1: " \* ", means this data is the worst emission level.

Note 2: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: WZ-AC2	Test Date: 2023-09-15
Limit: FCC_2.4G_RE(3m)	Engineer: Bob Zhang
Probe: BBHA9120D_1457_1-18GHz	Polarity: Vertical
EUT: LE Bluetooth Module	Power: By Computer
Test Mode: Transmit by BLE 1Mbps at 2402MHz	



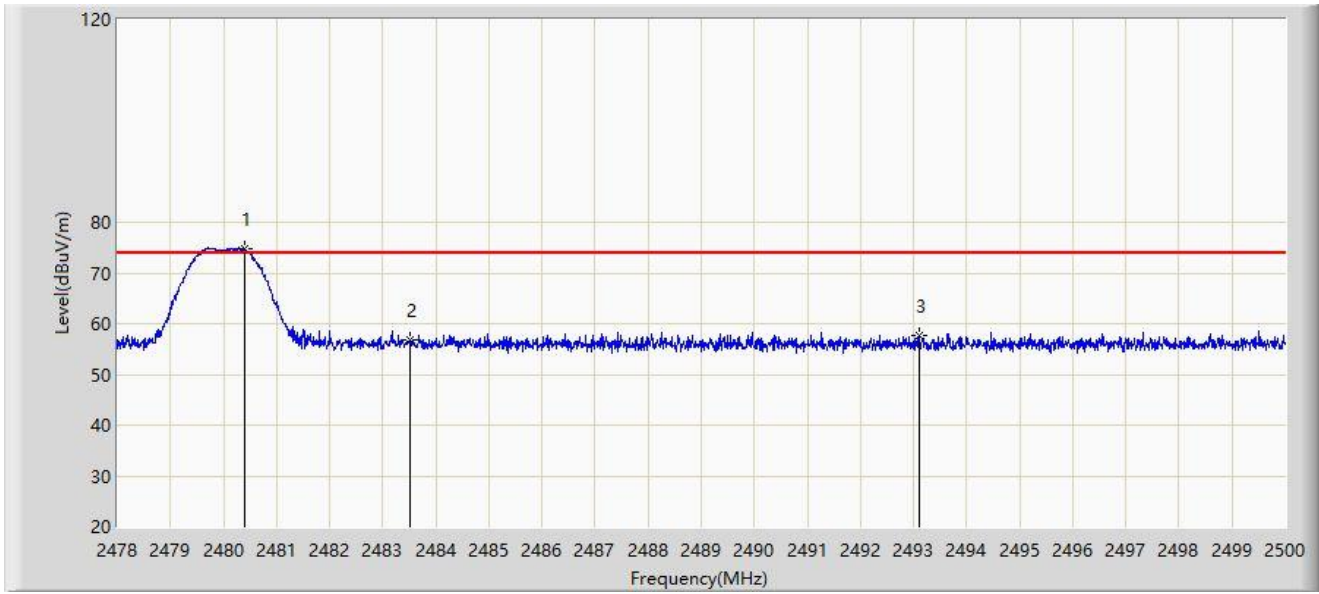
No	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Margin (dB)	Limit (dB $\mu$ V/m)	Factor (dB/m)	Type
1	*	2385.667	44.152	12.510	-9.848	54.000	31.642	AV
2		2390.000	43.178	11.563	-10.822	54.000	31.615	AV
3		2402.008	67.770	36.220	N/A	N/A	31.550	AV

Note 1: " \* ", means this data is the worst emission level.

Note 2: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: WZ-AC2	Test Date: 2023-09-15
Limit: FCC_2.4G_RE(3m)	Engineer: Bob Zhang
Probe: BBHA9120D_1457_1-18GHz	Polarity: Horizontal
EUT: LE Bluetooth Module	Power: By Computer
Test Mode: Transmit by BLE 1Mbps at 2480MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		2480.387	74.891	43.392	N/A	N/A	31.499	PK
2		2483.500	56.825	25.325	-17.175	74.000	31.500	PK
3	*	2493.103	57.824	26.318	-16.176	74.000	31.506	PK

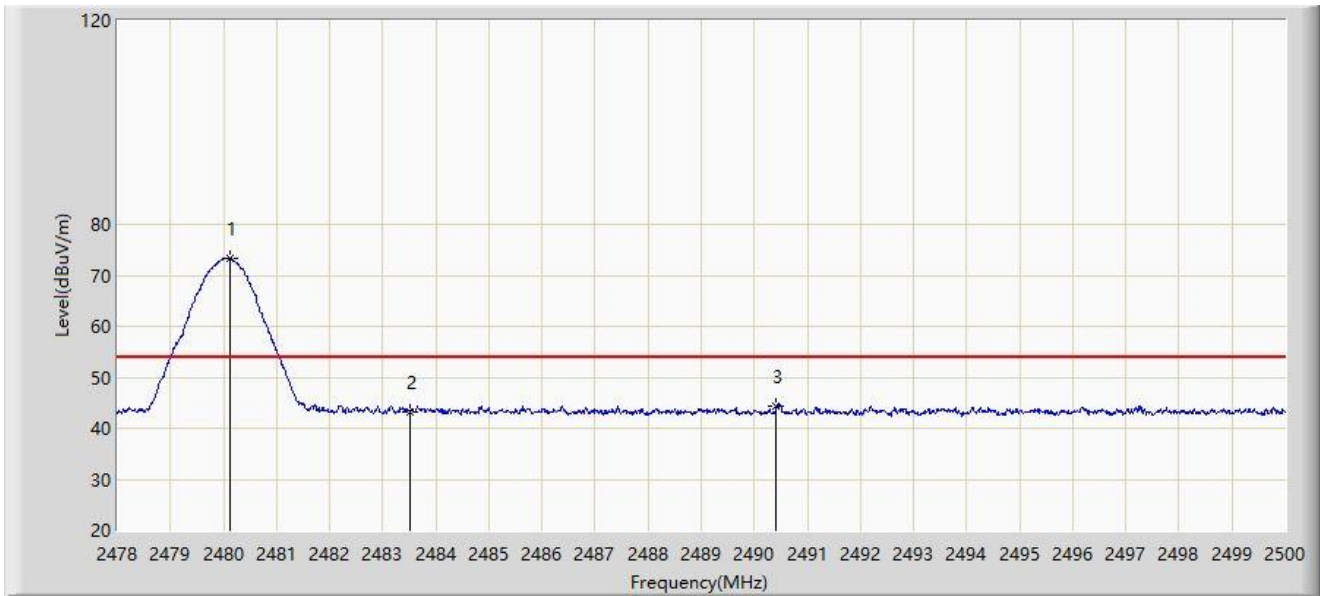
Note 1: " \* ", means this data is the worst emission level.

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

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).



Site: WZ-AC2	Test Date: 2023-09-15
Limit: FCC_2.4G_RE(3m)	Engineer: Bob Zhang
Probe: BBHA9120D_1457_1-18GHz	Polarity: Horizontal
EUT: LE Bluetooth Module	Power: By Computer
Test Mode: Transmit by BLE 1Mbps at 2480MHz	



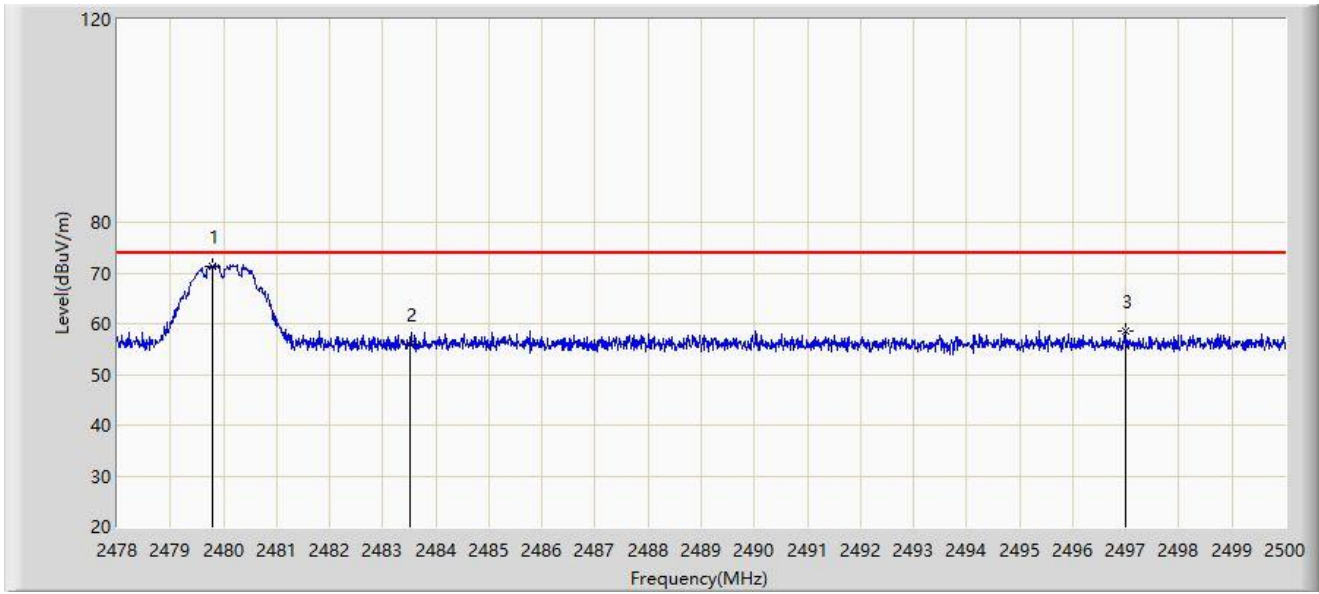
No	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Margin (dB)	Limit (dB $\mu$ V/m)	Factor (dB/m)	Type
1		2480.123	73.271	41.772	N/A	N/A	31.499	AV
2		2483.500	43.089	11.589	-10.911	54.000	31.500	AV
3	*	2490.419	44.467	12.964	-9.533	54.000	31.503	AV

Note 1: " \* ", means this data is the worst emission level.

Note 2: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: WZ-AC2	Test Date: 2023-09-15
Limit: FCC_2.4G_RE(3m)	Engineer: Bob Zhang
Probe: BBHA9120D_1457_1-18GHz	Polarity: Vertical
EUT: LE Bluetooth Module	Power: By Computer
Test Mode: Transmit by BLE 1Mbps at 2480MHz	



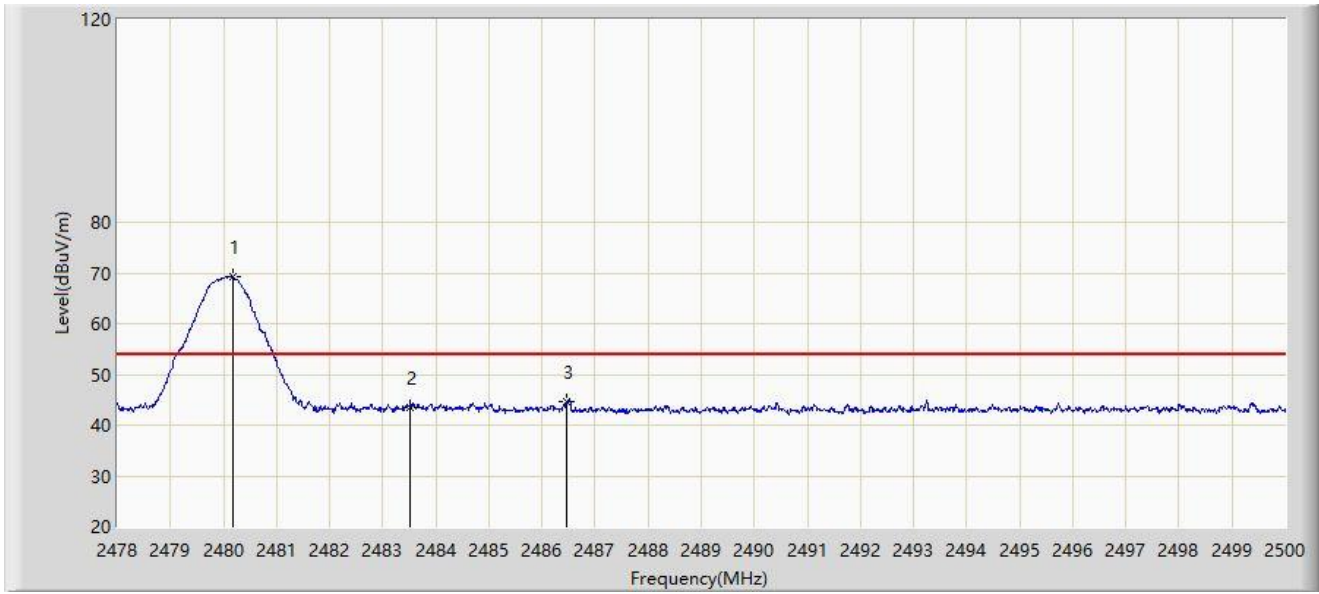
No	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Margin (dB)	Limit (dB $\mu$ V/m)	Factor (dB/m)	Type
1		2479.804	71.444	39.945	N/A	N/A	31.499	PK
2		2483.500	56.014	24.514	-17.986	74.000	31.500	PK
3	*	2497.008	58.502	26.988	-15.498	74.000	31.514	PK

Note 1: " \* ", means this data is the worst emission level.

Note 2: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: WZ-AC2	Test Date: 2023-09-15
Limit: FCC_2.4G_RE(3m)	Engineer: Bob Zhang
Probe: BBHA9120D_1457_1-18GHz	Polarity: Vertical
EUT: LE Bluetooth Module	Power: By Computer
Test Mode: Transmit by BLE 1Mbps at 2480MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		2480.178	69.235	37.736	N/A	N/A	31.499	AV
2		2483.500	43.382	11.882	-10.618	54.000	31.500	AV
3	*	2486.470	44.731	13.229	-9.269	54.000	31.502	AV

Note 1: " \* ", means this data is the worst emission level.

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

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

## **Appendix B - Test Setup Photograph**

Refer to "2309RSU028-UT" file.

## Appendix C - EUT Photograph

Refer to "2309RSU028-UE" file.

\_\_\_\_\_ The End \_\_\_\_\_