


# MEASUREMENT REPORT

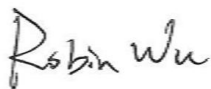
## FCC PART 15.247 & IC RSS-247 BLE

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**FCC ID:** VPYLBEE59B1LV  
**IC:** 772C-LBEE59B1LV  
**APPLICANT:** Murata Manufacturing Co., Ltd.

**Application Type:** Certification  
**Product:** Communication Module  
**Model No.:** Type1LV  
**FCC Classification:** Digital Transmission System (DTS)  
**FCC Rule Part(s):** Part 15 Subpart C (Section 15.247)  
**IC Rule(s):** RSS-247 Issue 2, RSS-GEN Issue 5  
**Test Procedure(s):** ANSI C63.10-2013, KDB 558074 D01v05r01  
**Test Date:** March 01 ~ March 07, 2019

Reviewed By:   
( Kevin Guo )

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
1901WSU002-U5	Rev. 01	Initial Report	03-28-2019	Valid

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## §2.1033 General Information

<b>Applicant:</b>	Murata Manufacturing Co., Ltd.
<b>Applicant Address:</b>	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan
<b>Manufacturer:</b>	Murata Manufacturing Co., Ltd.
<b>Manufacturer Address:</b>	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan
<b>Test Site:</b>	MRT Technology (Suzhou) Co., Ltd
<b>Test Site Address:</b>	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
<b>FCC Registration No.:</b>	893164
<b>IC Registration No.:</b>	11384A-1
<b>Test Device Serial No.:</b>	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 Reg. No. 893164) 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 Industry Canada 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:	Communication Module
Model No.:	Type1LV
Brand Name:	Murata
Work Voltage	DC 3.3V
WiFi Specification	802.11 a/b/g/n/ac
Bluetooth Specification	BR / EDR / LE 1Mbps / LE 2Mbps

Note: Work voltage of test fixture is DC 5V.

### 2.2. Product Specification Subjective to this Report

Bluetooth Frequency:	2402~2480MHz
Channel Number:	40
Data Rate:	1Mbps(GFSK), 2Mbps(GFSK)
Antenna Type:	PCB Antenna
Antenna Gain:	0.9dBi

Note: For other features of this EUT, test report will be issued separately.

### 2.3. Operation Frequency / Channel List

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	--	--	--	--

## 2.4. Test Configuration

The **Communication Module** was tested per the guidance of ANSI C63.10-2013. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

## 2.5. Description of Test Software

The test utility software used during testing was “Tera Term”, and the version was “v4.78”.

## 2.6. EMI Suppression Device(s)/Modifications

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

## 2.7. 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.

### RSP-100 Issue 11 Section 3

The manufacturer, importer or distributor shall meet the labelling requirements set out in this section for every unit:

- (i) prior to marketing in Canada, for products manufactured in Canada
- (ii) prior to importation into Canada, for imported products

For information regarding the e-labelling option, see Notice 2014–DRS1003. The label for the certified product represents the manufacturer’s or importer’s compliance with Innovation, Science and Economic Development Canada’s (ISED) regulatory requirements.

Please see attachment for IC label and label location.



### 3. DESCRIPTION OF TEST

#### 3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 558074 D01v05 were used in the measurement of the device.

**Deviation from measurement procedure.....None**

#### 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. 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	2019/04/20
Two-Line V-Network	R&S	ENV 216	MRTSUE06002	1 year	2019/06/15
Two-Line V-Network	R&S	ENV 216	MRTSUE06003	1 year	2019/06/15
Thermohygrometer	Testo	608-H1	MRTSUE06404	1 year	2019/08/15
Shielding Anechoic Chamber	Mikebang	Chamber-SR2	MRTSUE06214	N/A	N/A

##### Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTSUE06452	1 year	2019/07/20
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2019/04/20
USB wideband power sensor	KEYSIGHT	U2021XA	MRTSUE06446	1 year	2019/07/20
Attenuator	MVE	MVE2211-10	MRTSUE06800	1 year	2019/07/10
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2019/12/06
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2019/08/15

##### Radiated Emissions - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2019/08/14
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2019/09/14
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2019/11/20
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2019/04/12
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2019/10/20
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2019/12/17
Broadband Coaxial Preamp	Agilent	83017A	MRTSUE06076	1 year	2019/11/16
Preamp	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2019/06/12
Digital Thermometer & Hygrometer	Testo	608-H1	MRTSUE06403	1 year	2019/08/15
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06213	1 year	2019/05/02

## Radiated Emissions - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2019/08/14
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2019/11/09
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2019/10/20
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2019/11/09
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2019/12/17
Broadband Coaxial Preampfier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2019/11/16
Preampfier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2019/06/13
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2019/12/13
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2019/05/02

Software	Version	Function
e3	V 8.3.5	EMI Test Software

## 5. 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  $k = 2$ .

<b>AC Conducted Emission Measurement - SR2</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 150kHz~30MHz: 3.46dB
<b>Radiated Emission Measurement - AC1</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 9kHz ~ 1GHz: 4.18dB 1GHz ~ 25GHz: 4.76dB
<b>Radiated Emission Measurement - AC2</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 9kHz ~ 1GHz: 3.86dB 1GHz ~ 25GHz: 4.33dB
<b>Spurious Emissions, Conducted - TR3</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 0.78dB
<b>Output Power - TR3</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 1.13dB
<b>Power Spectrum Density - TR3</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 1.15dB
<b>Occupied Bandwidth - TR3</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 0.28%

## 6. TEST RESULT

### 6.1. Summary

**Company Name:** Murata Manufacturing Co., Ltd.

**FCC ID:** VPYLBEE59B1LV

**IC:** 772C-LBEE59B1LV

FCC Section(s)	IC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	$\geq 500\text{kHz}$	Conducted	Pass	Section 6.2
15.247(b)(3)	RSS-247 [5.4(4)]	Output Power	$\leq 30\text{dBm}$		Pass	Section 6.3
15.247(e)	RSS-247 [5.2]	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$		Pass	Section 6.4
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	$\leq 20\text{dBc(Peak)}$		Pass	Section 6.5
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 6.6 & 6.7
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	N/A	Section 6.8

#### 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 the worst case emissions.
- 3) N/A means Not Applicable.

## 6.2. 6dB Bandwidth Measurement

### 6.2.1. Test Limit

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

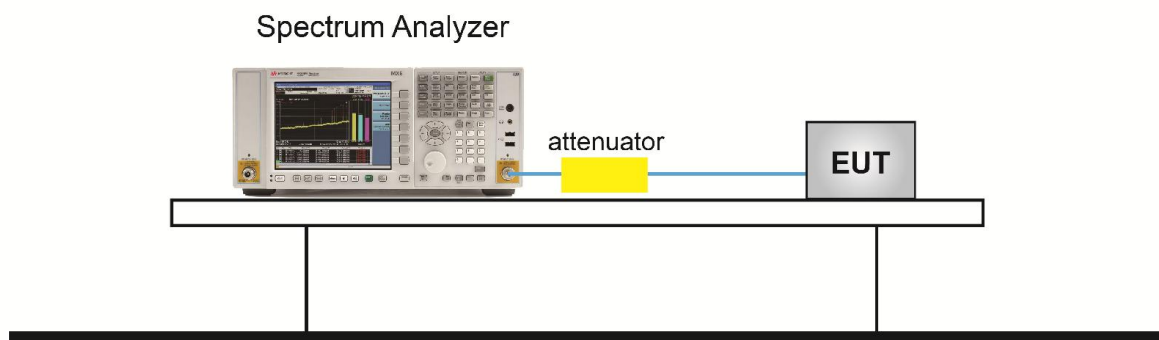
### 6.2.2. Test Procedure used

ANSI C63.10-2013 - Section 11.8.2 Option 2

### 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 was allowed to stabilize

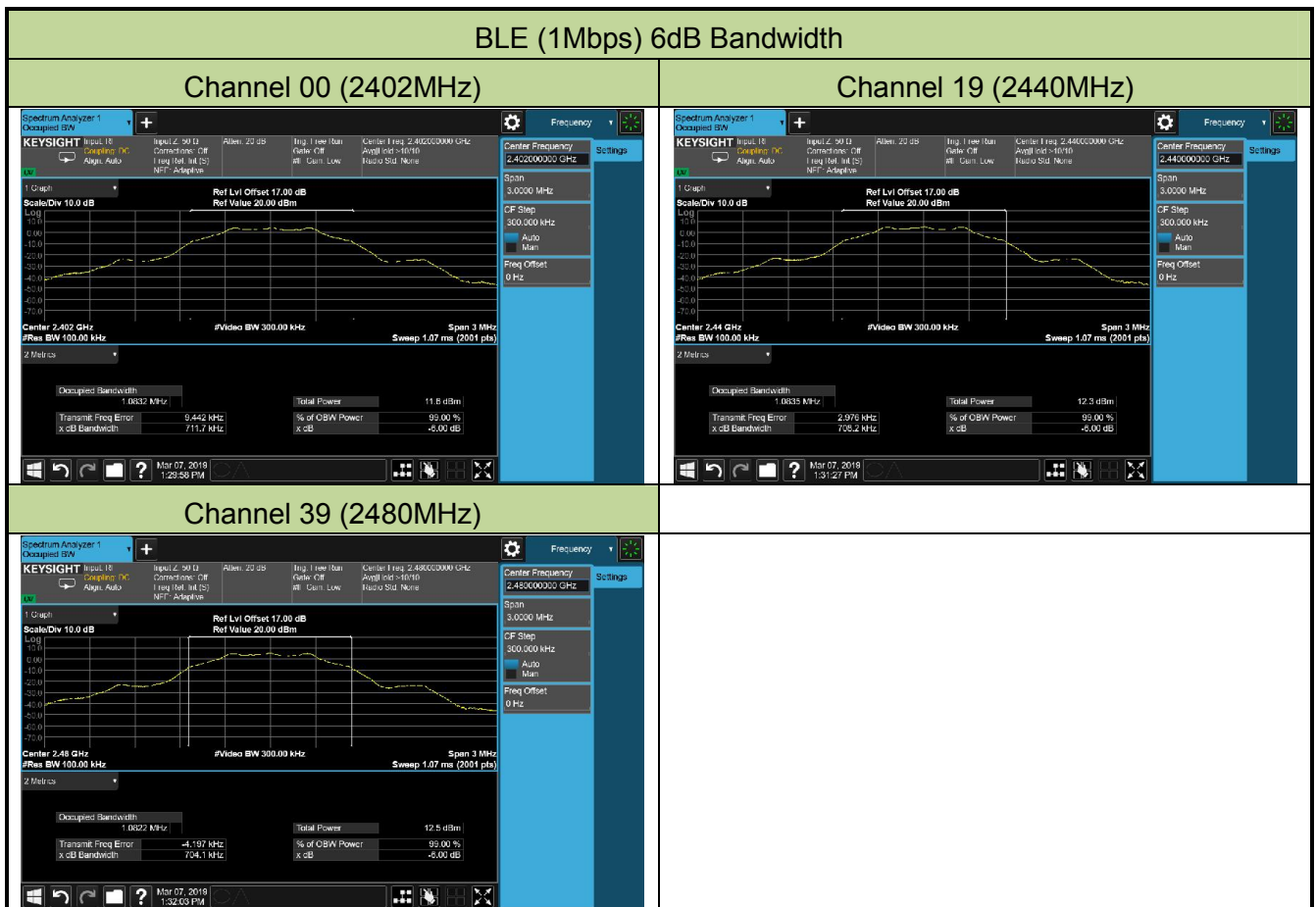
### 6.2.4. Test Setup



**6.2.5. Test Result**

Product	Communication Module	Temperature	25°C
Test Engineer	Dandy Li	Relative Humidity	52%
Test Site	TR3	Test Date	2019/03/07

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	99% Bandwidth (MHz)	Result
BLE	1	00	2402	0.71	≥ 0.5	1.08	Pass
BLE	1	19	2440	0.71	≥ 0.5	1.08	Pass
BLE	1	39	2480	0.70	≥ 0.5	1.08	Pass
BLE	2	00	2402	1.27	≥ 0.5	2.11	Pass
BLE	2	19	2440	1.27	≥ 0.5	2.11	Pass
BLE	2	39	2480	1.28	≥ 0.5	2.10	Pass





BLE (2Mbps) 6dB Bandwidth

Channel 00 (2402MHz)



Channel 19 (2440MHz)



Channel 39 (2480MHz)



### 6.3. Output Power Measurement

#### 6.3.1. Test Limit

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

#### 6.3.2. Test Procedure Used

ANSI C63.10-2013 - Section 11.9.1.3 PKPM1 Peak-reading power meter method

ANSI C63.10-2013 - Section 11.9.2.3.2 Method AVGPM-G

#### 6.3.3. Test Setting

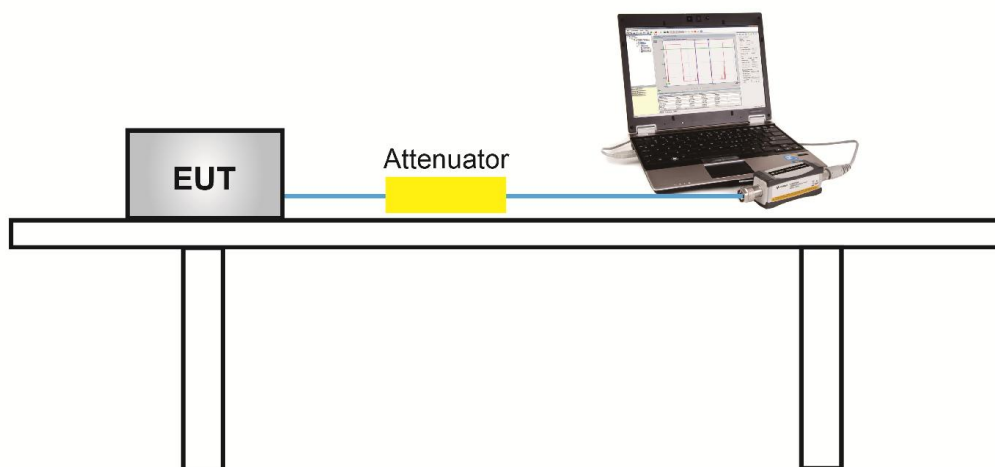
##### Method PKPM1 (Peak power measurement)

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.

#### 6.3.4. Test Setup



### 6.3.5. Test Result

Product	Communication Module	Temperature	25°C
Test Engineer	Dandy Li	Relative Humidity	52%
Test Site	TR3	Test Date	2019/03/07

### Test Result of Peak Output Power

Test Mode	Data Rate / Mbps	Channel No.	Freq. (MHz)	Peak Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Result
BLE	1	00	2402	3.75	≤ 30.00	4.65	≤ 36.00	Pass
BLE	1	19	2440	4.71	≤ 30.00	5.61	≤ 36.00	Pass
BLE	1	39	2480	4.87	≤ 30.00	5.77	≤ 36.00	Pass
BLE	2	00	2402	3.86	≤ 30.00	4.76	≤ 36.00	Pass
BLE	2	19	2440	4.78	≤ 30.00	5.68	≤ 36.00	Pass
BLE	2	39	2480	4.97	≤ 30.00	5.87	≤ 36.00	Pass

Note: EIRP (dBm) = Peak Power (dBm) + Antenna Gain (dBi), Antenna Gain = 0.9 dBi.

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

Test Mode	Data Rate / Mbps	Channel No.	Freq. (MHz)	Average Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Result
BLE	1	00	2402	3.56	≤ 30.00	4.46	≤ 36.00	Pass
BLE	1	19	2440	4.51	≤ 30.00	5.41	≤ 36.00	Pass
BLE	1	39	2480	4.69	≤ 30.00	5.59	≤ 36.00	Pass
BLE	2	00	2402	3.48	≤ 30.00	4.38	≤ 36.00	Pass
BLE	2	19	2440	4.44	≤ 30.00	5.34	≤ 36.00	Pass
BLE	2	39	2480	4.63	≤ 30.00	5.53	≤ 36.00	Pass

Note: EIRP (dBm) = Average Power (dBm) + Antenna Gain (dBi), Antenna Gain = 0.9 dBi.

## 6.4. Power Spectral Density Measurement

### 6.4.1. Test Limit

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

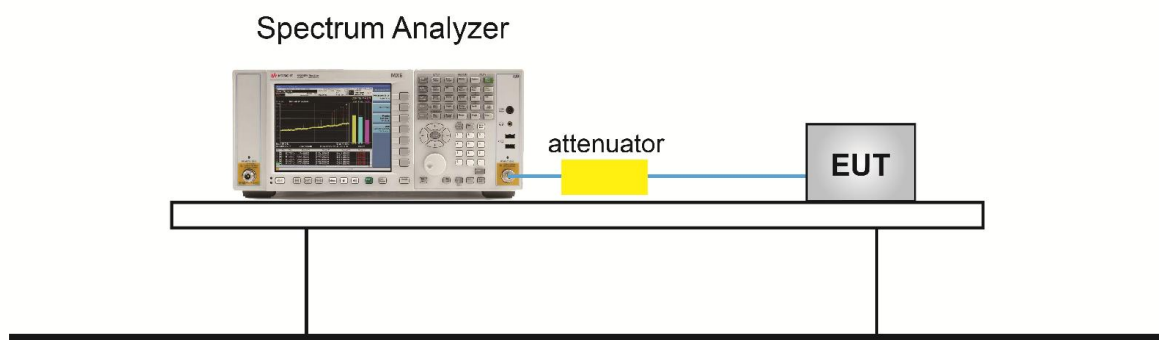
### 6.4.2. Test Procedure Used

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

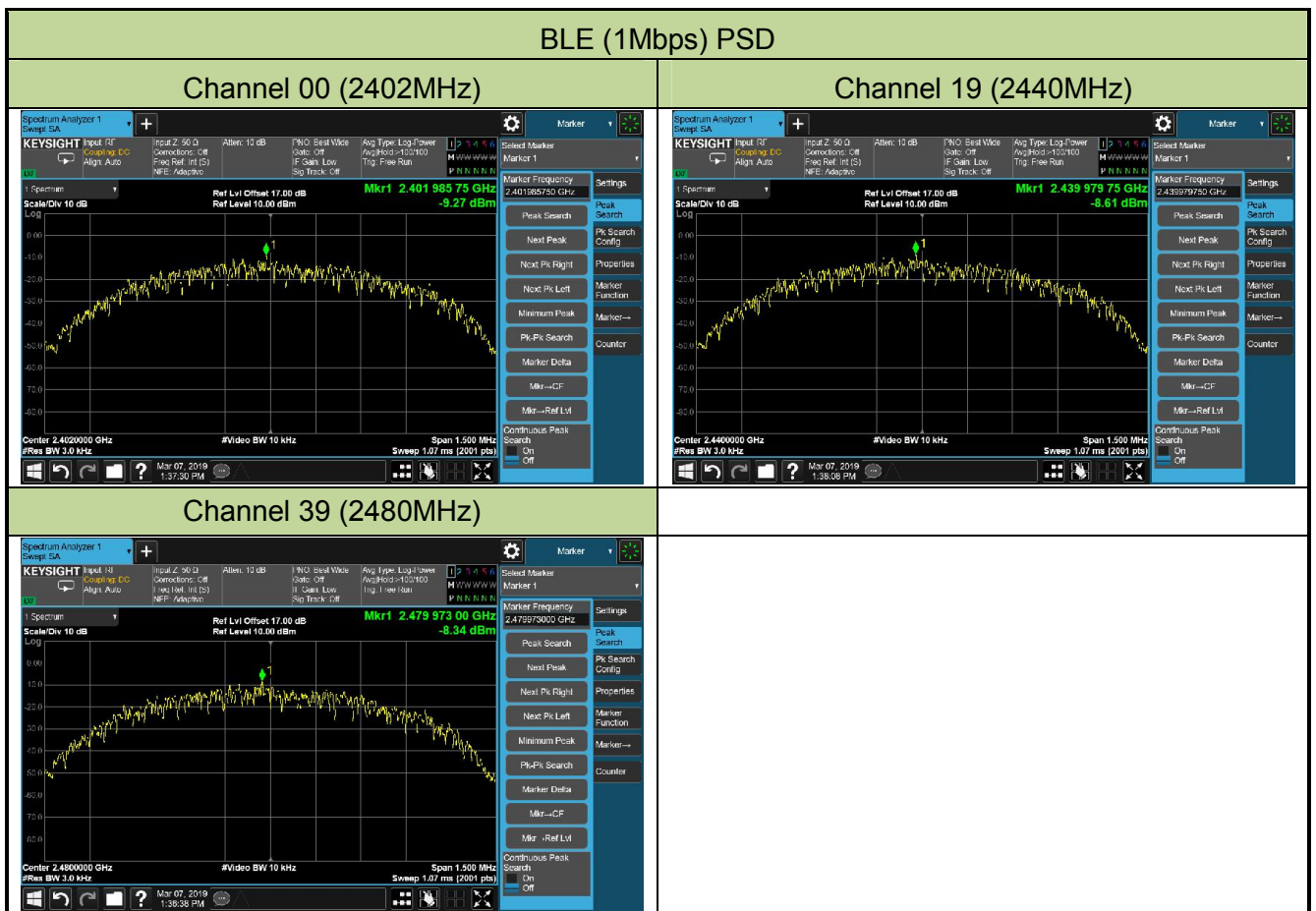
### 6.4.4. Test Setup

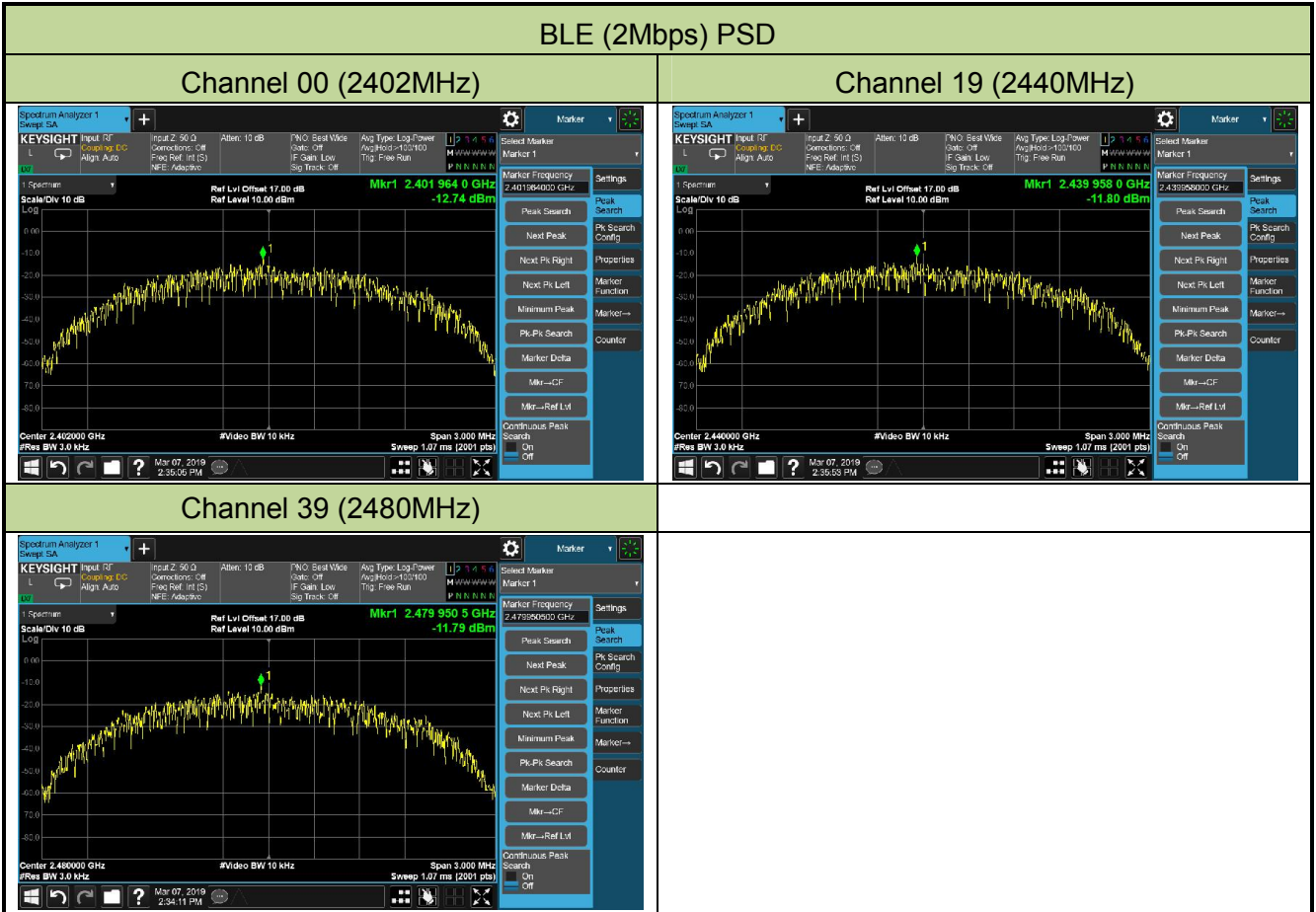


### 6.4.5. Test Result

Product	Communication Module	Temperature	25°C
Test Engineer	Amy Zhang	Relative Humidity	52%
Test Site	TR3	Test Date	2019/03/07

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	PSD Result (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
BLE	1	00	2402	-9.27	≤ 8.00	Pass
BLE	1	19	2440	-8.61	≤ 8.00	Pass
BLE	1	39	2480	-8.34	≤ 8.00	Pass
BLE	2	00	2402	-12.74	≤ 8.00	Pass
BLE	2	19	2440	-11.80	≤ 8.00	Pass
BLE	2	39	2480	-11.79	≤ 8.00	Pass





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

### **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 100kHz bandwidth per the PSD procedure.

### **6.5.2. Test Procedure Used**

ANSI C63.10-2013 - Section 11.11.2 & 11.11.3.

### **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

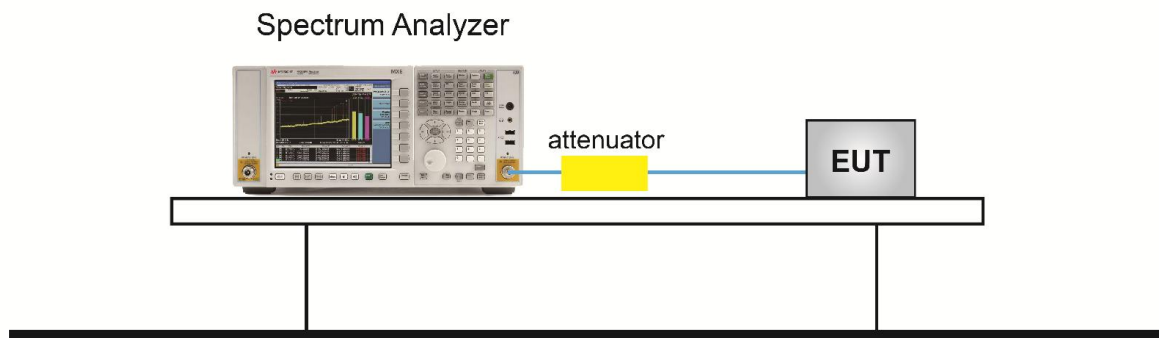
#### **Emission level measurement**

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 1.3MHz
3. VBW = 4MHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

### Test Notes

1. RBW was set to 1.3MHz rather than 100 kHz in order to increase the measurement speed.
2. The display line shown in the following plots denotes the limit at 20dB below the fundamental emission level measured in a 100 kHz bandwidth. However, since the traces in the following plots are measured with a 1.3MHz RBW, the display line may not necessarily appear to be 30dB below the level of the fundamental in a 1.3MHz bandwidth.
3. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present.

### 6.5.4. Test Setup





### 6.5.5. Test Result

Product	Communication Module	Temperature	25°C
Test Engineer	Amy Zhang	Relative Humidity	52%
Test Site	TR3	Test Date	2019/03/07

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Limit	Result
BLE	1	00	2402	20dBc	Pass
BLE	1	19	2440	20dBc	Pass
BLE	1	39	2480	20dBc	Pass
BLE	2	00	2402	20dBc	Pass
BLE	2	19	2440	20dBc	Pass
BLE	2	39	2480	20dBc	Pass

#### BLE (1Mbps) Out-of-Band Emissions

##### Channel 00 (2402MHz)

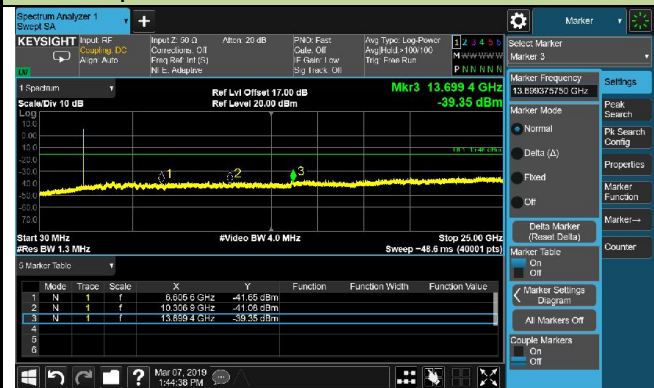
###### 100kHz PSD Reference Level



###### Low Band Edge



#### Spurious Emission 30MHz ~ 25GHz



### Channel 19 (2440MHz)

#### 100kHz PSD Reference Level



#### Spurious Emission 30MHz ~ 25GHz



### Channel 39 (2480MHz)

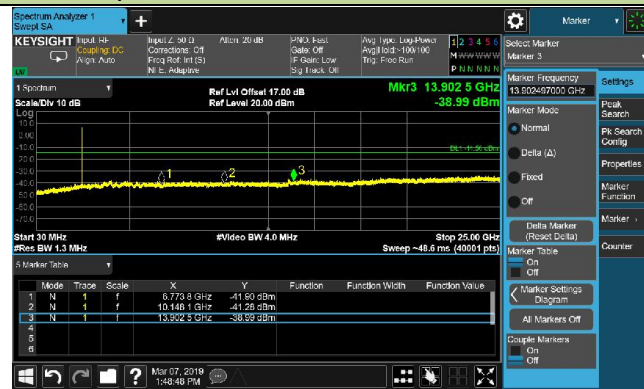
#### 100kHz PSD Reference Level



#### High Band Edge



#### Spurious Emission 30MHz ~ 25GHz



## BLE (2Mbps) Out-of-Band Emissions

### Channel 00 (2402MHz)

#### 100kHz PSD Reference Level



#### Low Band Edge



#### Spurious Emission 30MHz ~ 25GHz



Channel 19 (2440MHz)

100kHz PSD Reference Level



Spurious Emission 30MHz ~ 25GHz



Channel 39 (2480MHz)

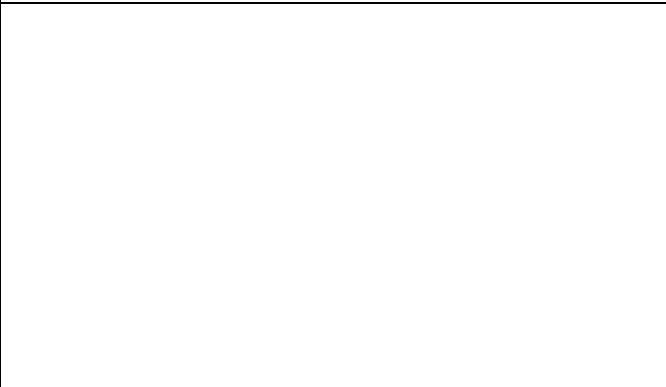
100kHz PSD Reference Level



High Band Edge



Spurious Emission 30MHz ~ 25GHz



## 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 [ $\mu\text{V}/\text{m}$ ]	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 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)

### 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
> 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**

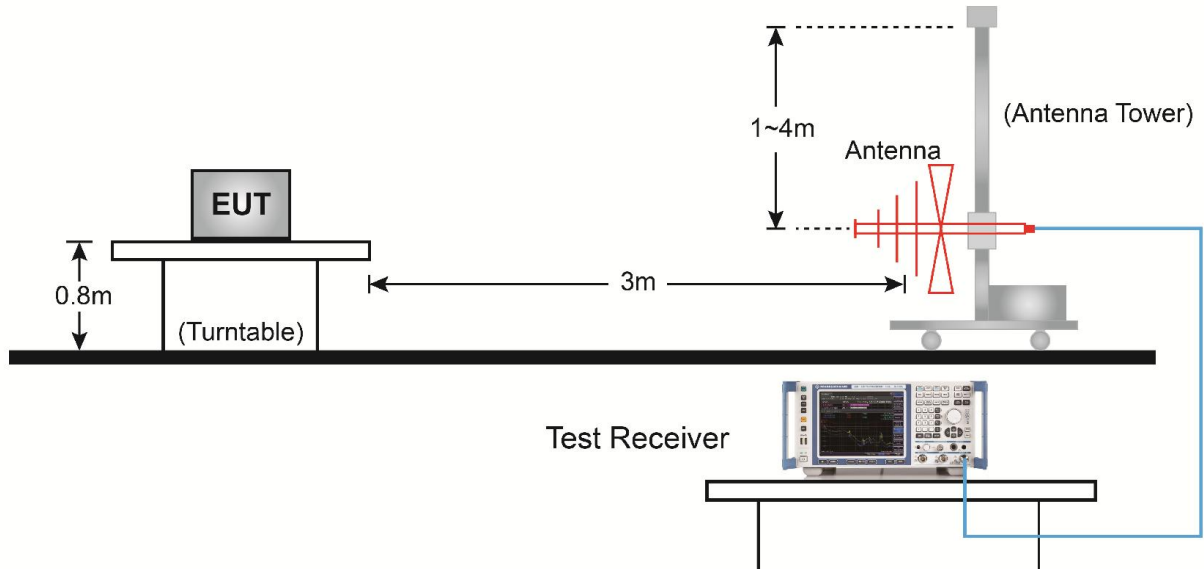
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

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

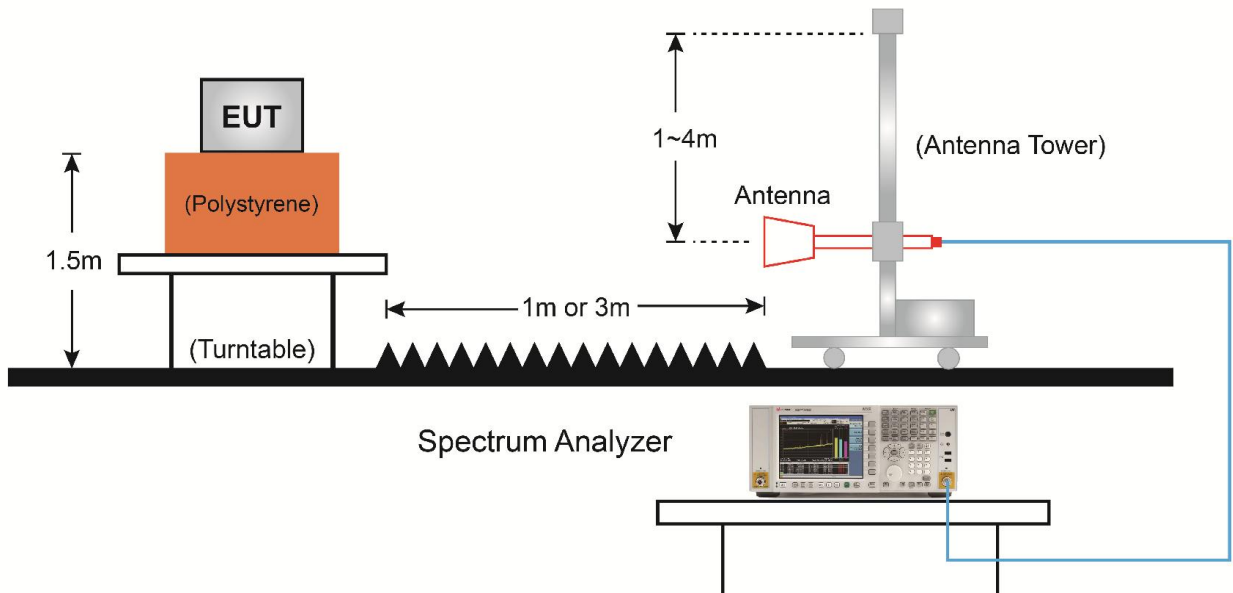
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle  $\geq 98\%$ , set VBW = 10 Hz.
4. If the EUT duty cycle is  $< 98\%$ , set VBW  $\geq 1/T$ . T is the minimum transmission duration.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

### 6.6.4. Test Setup

#### Below 1GHz Test Setup:



#### Above 1GHz Test Setup:



**6.6.5. Test Result**

Product	Communication Module	Temperature	26°C
Test Engineer	Bruce Wang	Relative Humidity	56%
Test Site	AC1	Test Date	2019/03/02
Test Mode:	BLE (1Mbps)	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 1-18GHz, 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
	4085.5	37.3	3.5	40.8	74.0	-33.2	Peak	Horizontal
	4876.0	36.5	6.0	42.5	74.0	-31.5	Peak	Horizontal
*	6465.5	35.3	9.8	45.1	78.5	-33.4	Peak	Horizontal
*	9806.0	34.5	16.3	50.8	78.5	-27.7	Peak	Horizontal
	4009.0	38.0	3.4	41.4	74.0	-32.6	Peak	Vertical
	4867.5	36.6	6.0	42.6	74.0	-31.4	Peak	Vertical
*	6593.0	35.4	10.2	45.6	78.5	-32.9	Peak	Vertical
*	10282.0	35.0	17.1	52.1	78.5	-26.4	Peak	Vertical

Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (98.5dBμV/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	Communication Module	Temperature	26°C
Test Engineer	Bruce Wang	Relative Humidity	56%
Test Site	AC1	Test Date	2019/03/02
Test Mode:	BLE (1Mbps)	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 1-18GHz, 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
	3975.0	38.1	3.1	41.2	74.0	-32.8	Peak	Horizontal
	5003.5	35.7	6.3	42.0	74.0	-32.0	Peak	Horizontal
*	6253.0	36.6	8.7	45.3	78.0	-32.7	Peak	Horizontal
*	9993.0	34.8	16.7	51.5	78.0	-26.5	Peak	Horizontal
	3975.0	37.3	3.1	40.4	74.0	-33.6	Peak	Vertical
	4833.5	36.3	5.9	42.2	74.0	-31.8	Peak	Vertical
*	6865.0	35.5	10.6	46.1	78.0	-31.9	Peak	Vertical
*	10299.0	34.3	17.3	51.6	78.0	-26.4	Peak	Vertical

Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (98.0dBμV/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	Communication Module	Temperature	26°C
Test Engineer	Bruce Wang	Relative Humidity	56%
Test Site	AC1	Test Date	2019/03/02
Test Mode:	BLE (1Mbps)	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 1-18GHz, 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
	3966.5	37.9	3.1	41.0	74.0	-33.0	Peak	Horizontal
	4782.5	36.6	5.7	42.3	74.0	-31.7	Peak	Horizontal
*	6567.5	36.2	10.2	46.4	77.8	-31.4	Peak	Horizontal
*	9942.0	34.7	16.8	51.5	77.8	-26.3	Peak	Horizontal
	4077.0	37.3	3.5	40.8	74.0	-33.2	Peak	Vertical
	4816.5	36.2	5.9	42.1	74.0	-31.9	Peak	Vertical
*	6550.5	36.1	10.2	46.3	77.8	-31.5	Peak	Vertical
*	9899.5	34.3	16.6	50.9	77.8	-26.9	Peak	Vertical

Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (97.8dBμV/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	Communication Module	Temperature	26°C
Test Engineer	Bruce Wang	Relative Humidity	56%
Test Site	AC1	Test Date	2019/03/02
Test Mode:	BLE (2Mbps)	Test Channel:	00
Remark:	3. Average measurement was not performed if peak level lower than average limit. 4. Other frequency was 20dB below limit line within 1-18GHz, 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
	4060.0	37.8	3.5	41.3	74.0	-32.7	Peak	Horizontal
	4672.0	37.0	5.4	42.4	74.0	-31.6	Peak	Horizontal
*	6601.5	35.3	10.2	45.5	78.9	-33.4	Peak	Horizontal
*	10205.5	34.8	17.1	51.9	78.9	-27.0	Peak	Horizontal
	4034.5	37.1	3.4	40.5	74.0	-33.5	Peak	Vertical
	5063.0	36.6	6.5	43.1	74.0	-30.9	Peak	Vertical
*	6635.5	35.7	10.1	45.8	78.9	-33.1	Peak	Vertical
*	10239.5	33.6	17.2	50.8	78.9	-28.1	Peak	Vertical

Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (98.9dBμV/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	Communication Module	Temperature	26°C
Test Engineer	Bruce Wang	Relative Humidity	56%
Test Site	AC1	Test Date	2019/03/02
Test Mode:	BLE (2Mbps)	Test Channel:	19
Remark:	3. Average measurement was not performed if peak level lower than average limit. 4. Other frequency was 20dB below limit line within 1-18GHz, 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
	3983.5	37.0	3.2	40.2	74.0	-33.8	Peak	Horizontal
	5122.5	35.8	6.6	42.4	74.0	-31.6	Peak	Horizontal
*	6397.5	35.3	9.2	44.5	78.5	-34.0	Peak	Horizontal
*	10231.0	34.3	17.1	51.4	78.5	-27.1	Peak	Horizontal
	4196.0	37.3	3.9	41.2	74.0	-32.8	Peak	Vertical
	4808.0	36.5	5.9	42.4	74.0	-31.6	Peak	Vertical
*	6610.0	35.7	10.2	45.9	78.5	-32.6	Peak	Vertical
*	9959.0	34.4	16.7	51.1	78.5	-27.4	Peak	Vertical

Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (98.5dBμV/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	Communication Module	Temperature	26°C
Test Engineer	Bruce Wang	Relative Humidity	56%
Test Site	AC1	Test Date	2019/03/02
Test Mode:	BLE (2Mbps)	Test Channel:	39
Remark:	3. Average measurement was not performed if peak level lower than average limit. 4. Other frequency was 20dB below limit line within 1-18GHz, 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
	4026.0	38.2	3.4	41.6	74.0	-32.4	Peak	Horizontal
	5020.5	36.4	6.4	42.8	74.0	-31.2	Peak	Horizontal
*	6100.0	36.4	8.1	44.5	77.8	-33.3	Peak	Horizontal
*	9933.5	35.1	16.7	51.8	77.8	-26.0	Peak	Horizontal
	4153.5	36.5	3.8	40.3	74.0	-33.7	Peak	Vertical
	4825.0	35.9	5.9	41.8	74.0	-32.2	Peak	Vertical
*	6491.0	35.5	9.9	45.4	77.8	-32.4	Peak	Vertical
*	10214.0	33.8	17.1	50.9	77.8	-26.9	Peak	Vertical

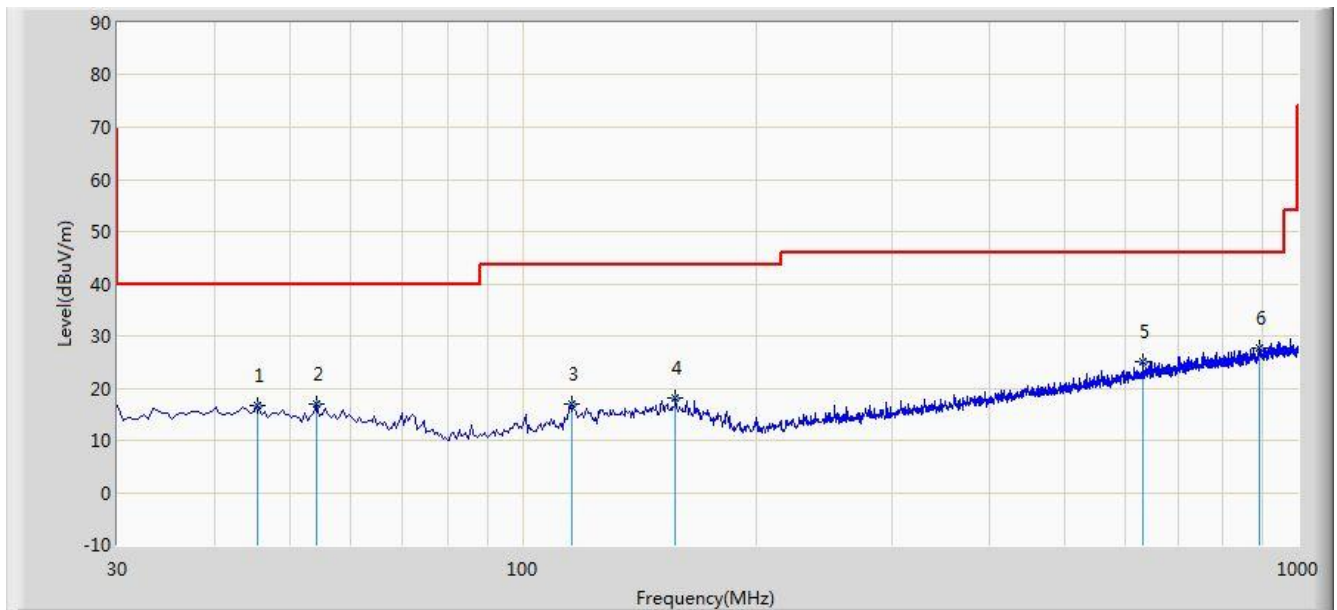
Note 1: "\*" is not in restricted band, its limit is 20dBc of the fundamental emission level (97.8dBμV/m) or 15.209 which is higher.

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

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

**The Worst Case of Radiated Emission below 1GHz:**

Site: AC1	Time: 2019/03/06 - 01:16
Limit: FCC_Part15.209_RSE(3m)	Engineer: Messiah Li
Probe: VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: Communication Module	Power: DC 3.3V
<b>Test Mode: Worst case</b>	



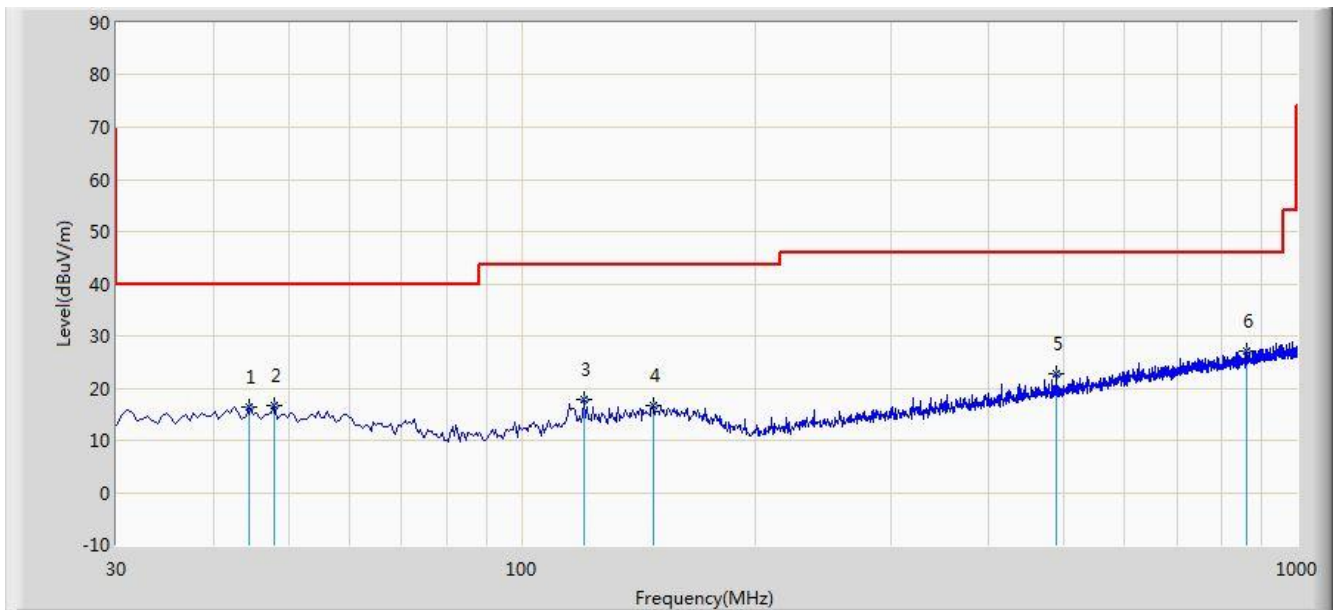
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			45.520	16.612	2.337	-23.388	40.000	14.274	QP
2			54.250	16.903	3.021	-23.097	40.000	13.882	QP
3			115.845	16.943	4.178	-26.557	43.500	12.764	QP
4			157.555	18.067	2.770	-25.433	43.500	15.297	QP
5			631.400	25.054	3.862	-20.946	46.000	21.192	QP
6		*	892.330	27.791	3.471	-18.209	46.000	24.320	QP

Note 1: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

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

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

Site: AC1	Time: 2019/03/06 - 01:16
Limit: FCC_Part15.209_RSE(3m)	Engineer: Messiah Li
Probe: VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: Communication Module	Power: DC 3.3V
<b>Test Mode: Worst case</b>	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			44.550	16.300	1.972	-23.700	40.000	14.328	QP
2			47.945	16.672	2.446	-23.328	40.000	14.226	QP
3			120.210	17.933	4.701	-25.567	43.500	13.233	QP
4			147.855	16.598	1.462	-26.902	43.500	15.136	QP
5			489.780	22.877	4.458	-23.123	46.000	18.418	QP
6		*	861.290	26.989	3.103	-19.011	46.000	23.886	QP

Note 1: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB)

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

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

## 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 - 156.525	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.

<b>FCC Part 15 Subpart C Paragraph 15.209</b>		
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)
0.090 - 0.110	149.9 -150.5	9.0 - 9.2
0.495 -0.505	156.52475 - 156.525225	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	334.5 - 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]	Magnetic field strength (H-Field) [uA/m]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	6.37/F(F in kHz)	N/A	300
0.490 - 1.705	63.7/F(F in kHz)	N/A	30
1.705 - 30	0.08	N/A	30
30 - 88	N/A	100	3
88 - 216	N/A	150	3
216 - 960	N/A	200	3
Above 960	N/A	500	3

### 6.7.2. Test Procedure Used

ANSI C63.10 Section 6.3 (General Requirements)

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

### 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

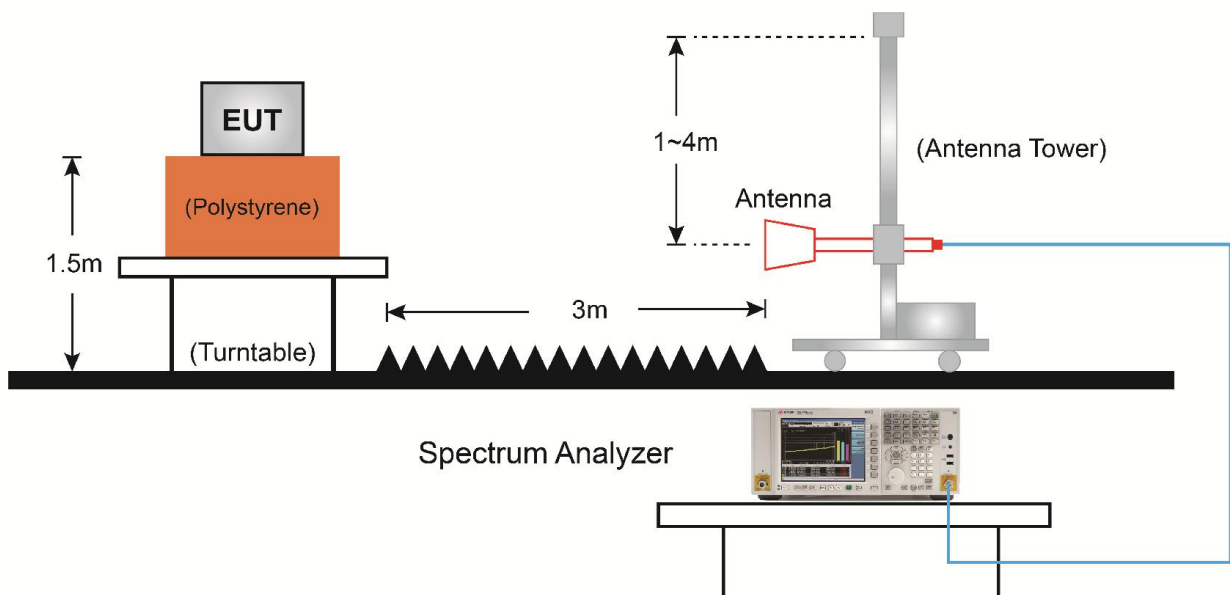
### Average Measurements above 1GHz (Method VB)

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.

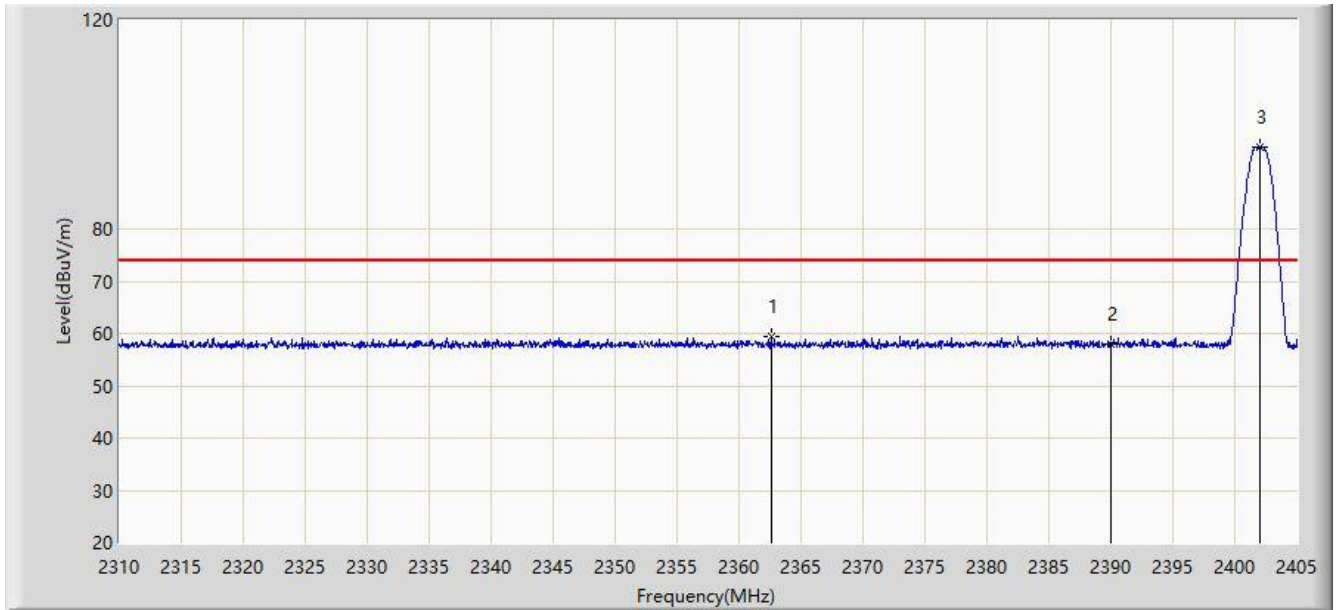
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

#### 6.7.4. Test Setup



### 6.7.5. Test Result

Site: AC1	Time: 2019/03/02 - 03:42
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(1Mbps) at channel 2402MHz	

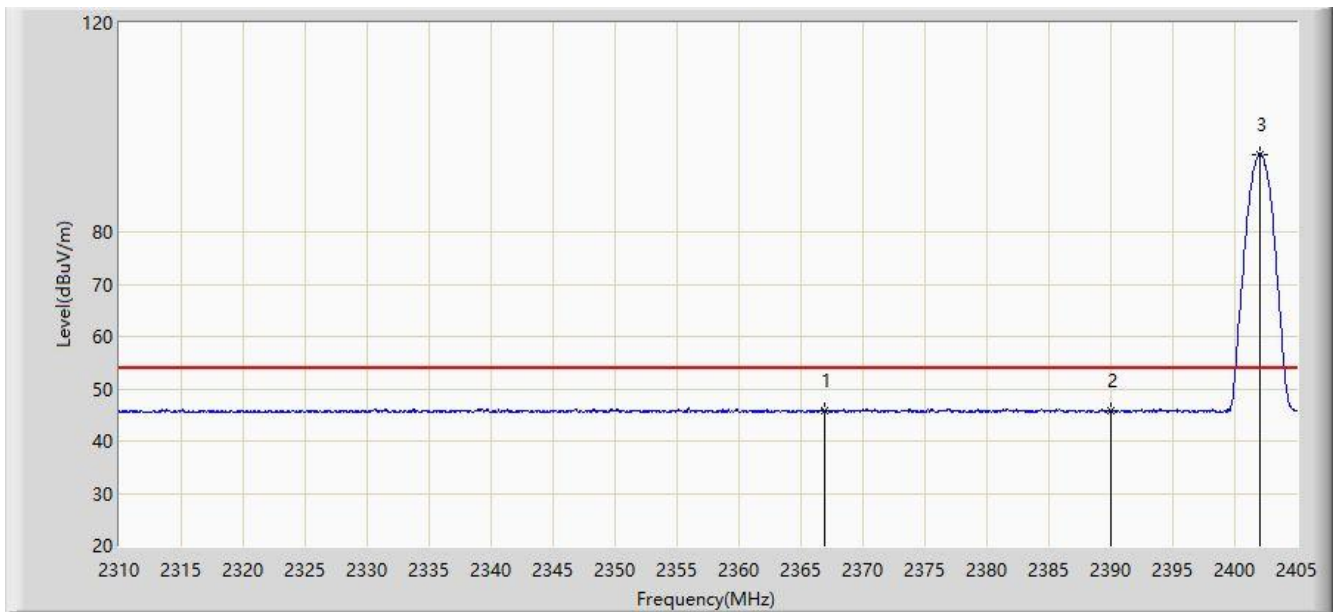


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2362.630	59.472	27.100	-14.528	74.000	32.372	PK
2			2390.000	58.101	25.774	-15.899	74.000	32.327	PK
3		*	2402.055	95.623	63.319	N/A	N/A	32.304	PK

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

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

Site: AC1	Time: 2019/03/02 - 03:52
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(1Mbps) at channel 2402MHz	

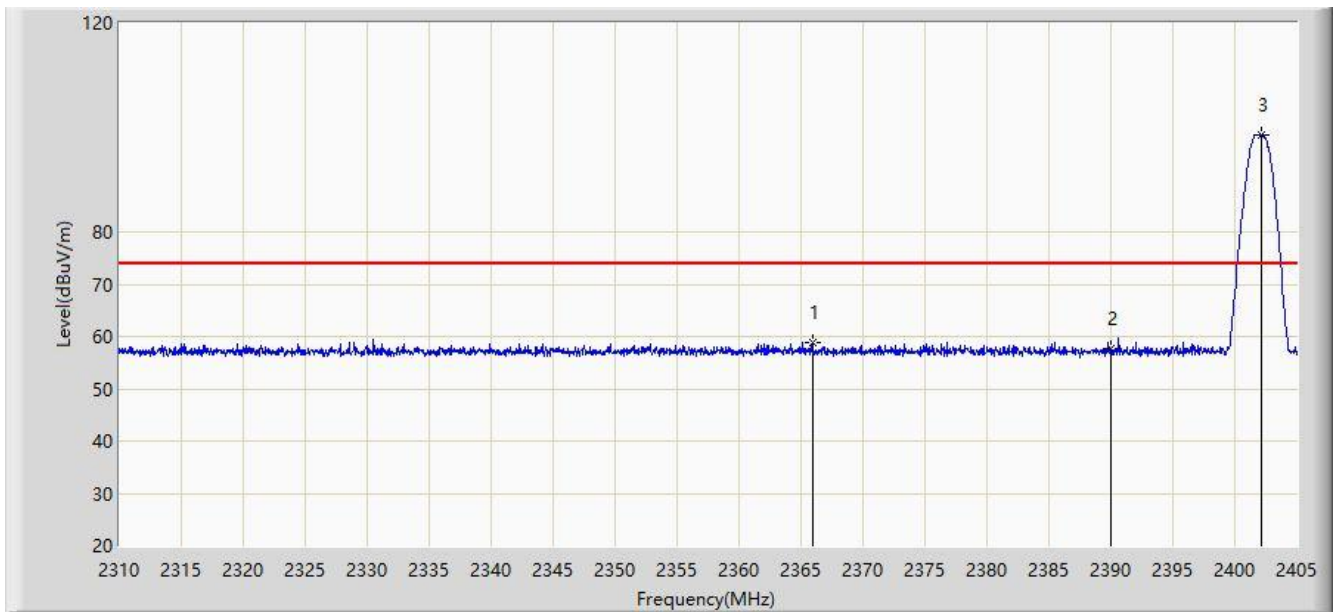


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2366.857	45.934	13.570	-8.066	54.000	32.364	AV
2			2390.000	45.777	13.450	-8.223	54.000	32.327	AV
3		*	2402.008	94.843	62.539	N/A	N/A	32.305	AV

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

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

Site: AC1	Time: 2019/03/02 - 03:54
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(1Mbps) at channel 2402MHz	

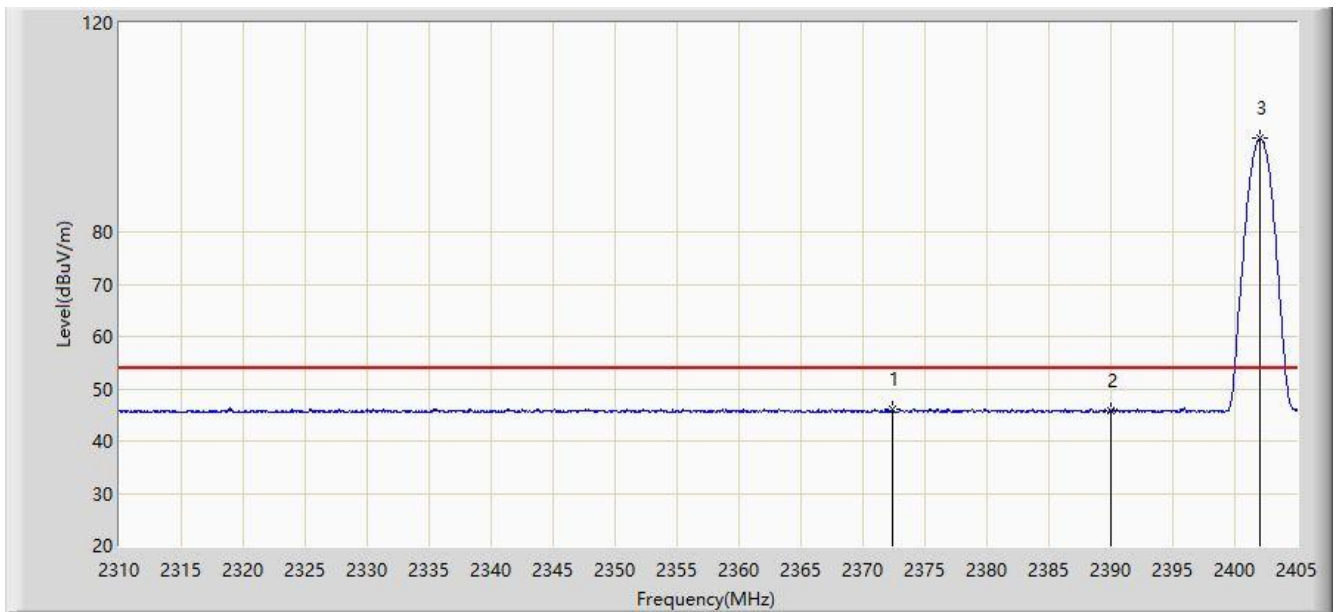


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2365.907	58.895	26.529	-15.105	74.000	32.365	PK
2			2390.000	57.592	25.265	-16.408	74.000	32.327	PK
3		*	2402.150	98.513	66.209	N/A	N/A	32.304	PK

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

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

Site: AC1	Time: 2019/03/02 - 03:55
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(1Mbps) at channel 2402MHz	



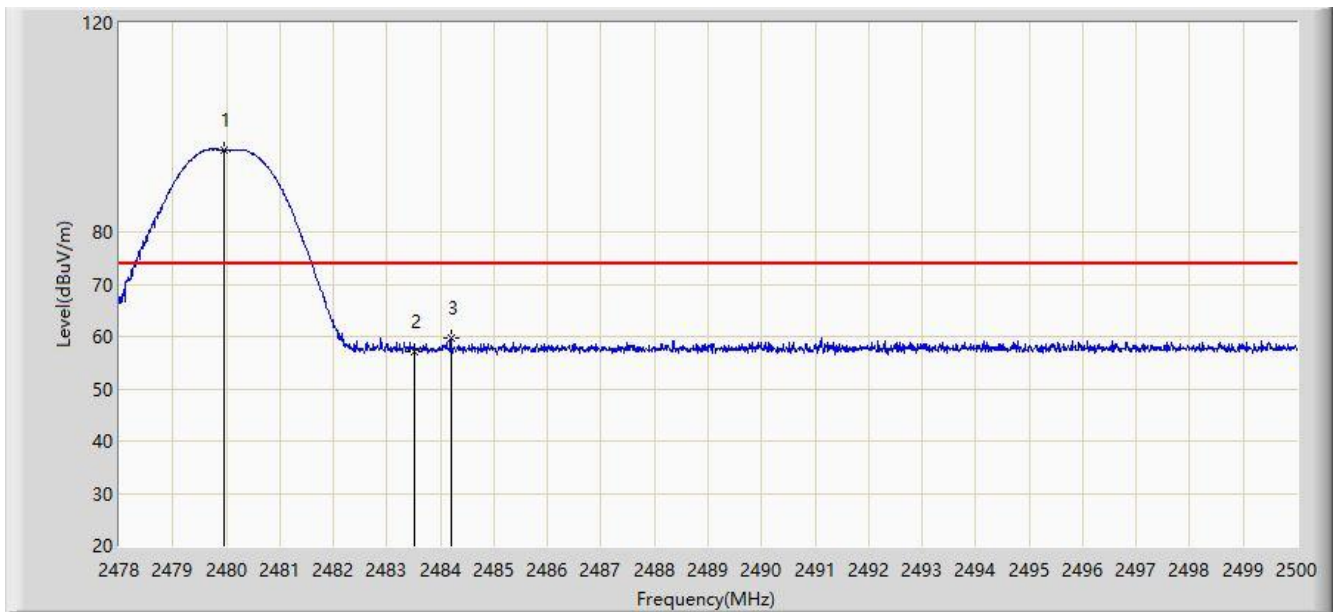
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2372.367	45.972	13.619	-8.028	54.000	32.354	AV
2			2390.000	45.683	13.356	-8.317	54.000	32.327	AV
3		*	2402.008	97.835	65.531	N/A	N/A	32.305	AV

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

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



Site: AC1	Time: 2019/03/02 - 03:56
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(1Mbps) at channel 2480MHz	

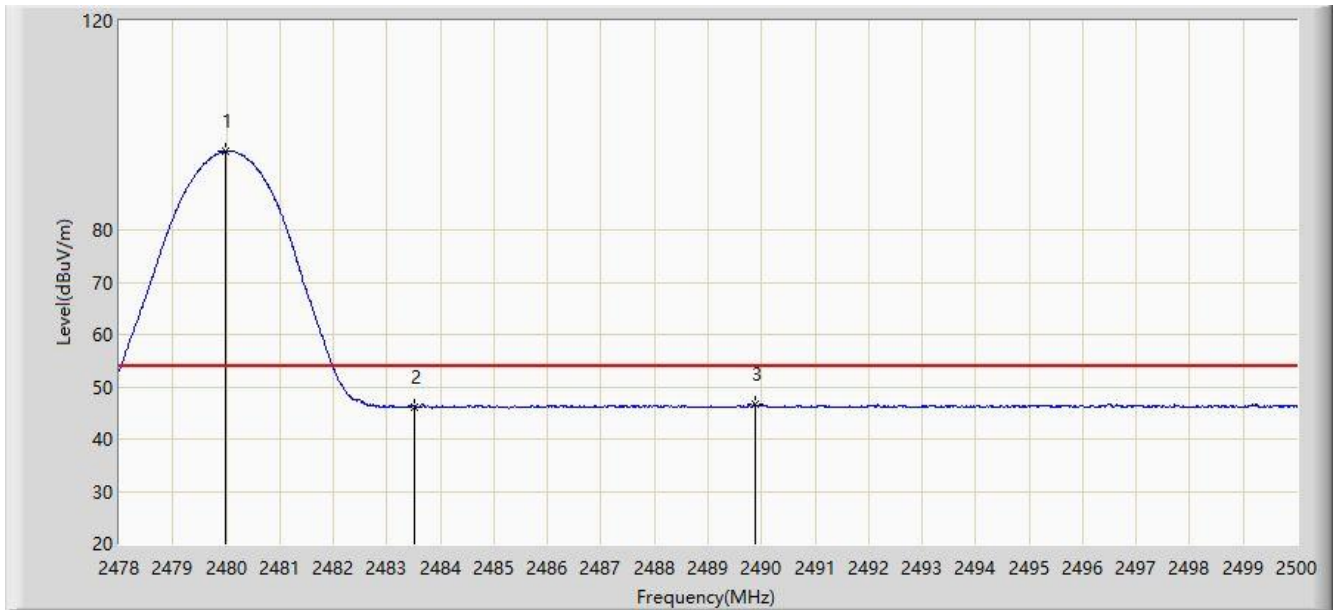


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.969	95.686	63.361	N/A	N/A	32.325	PK
2			2483.500	57.030	24.691	-16.970	74.000	32.340	PK
3			2484.204	59.669	27.327	-14.331	74.000	32.342	PK

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

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

Site: AC1	Time: 2019/03/02 - 03:58
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(1Mbps) at channel 2480MHz	

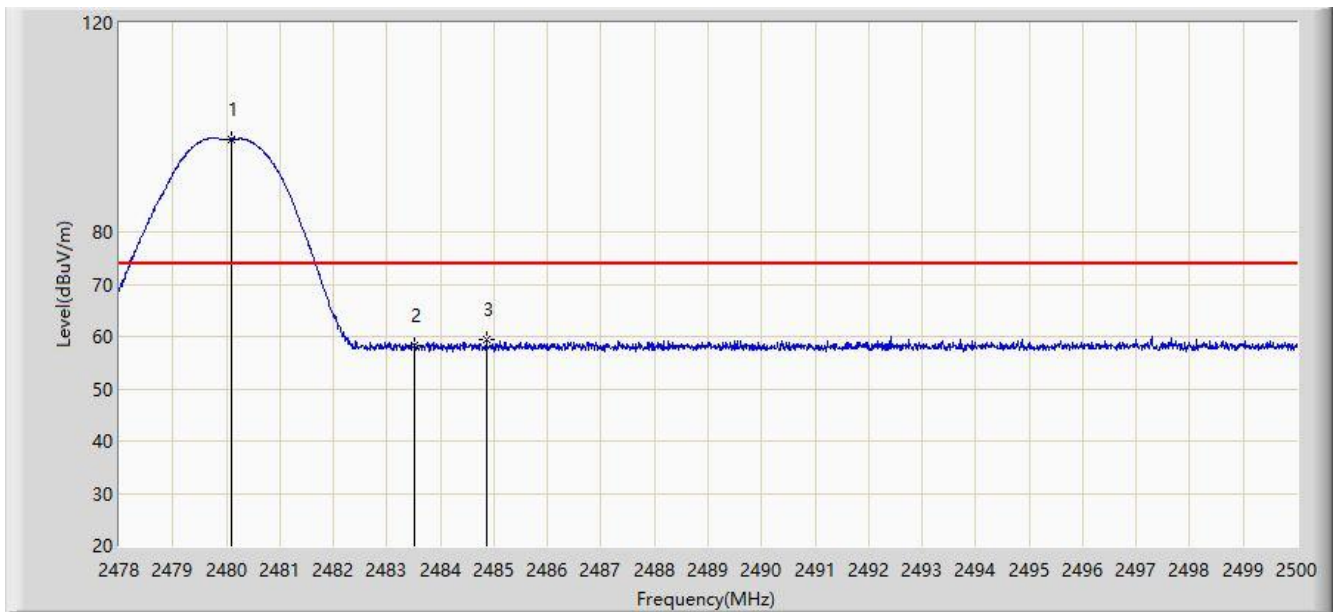


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.991	95.050	62.725	N/A	N/A	32.325	AV
2			2483.500	46.203	13.864	-7.797	54.000	32.340	AV
3			2489.891	46.604	14.240	-7.396	54.000	32.364	AV

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

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

Site: AC1	Time: 2019/03/02 - 03:59
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(1Mbps) at channel 2480MHz	

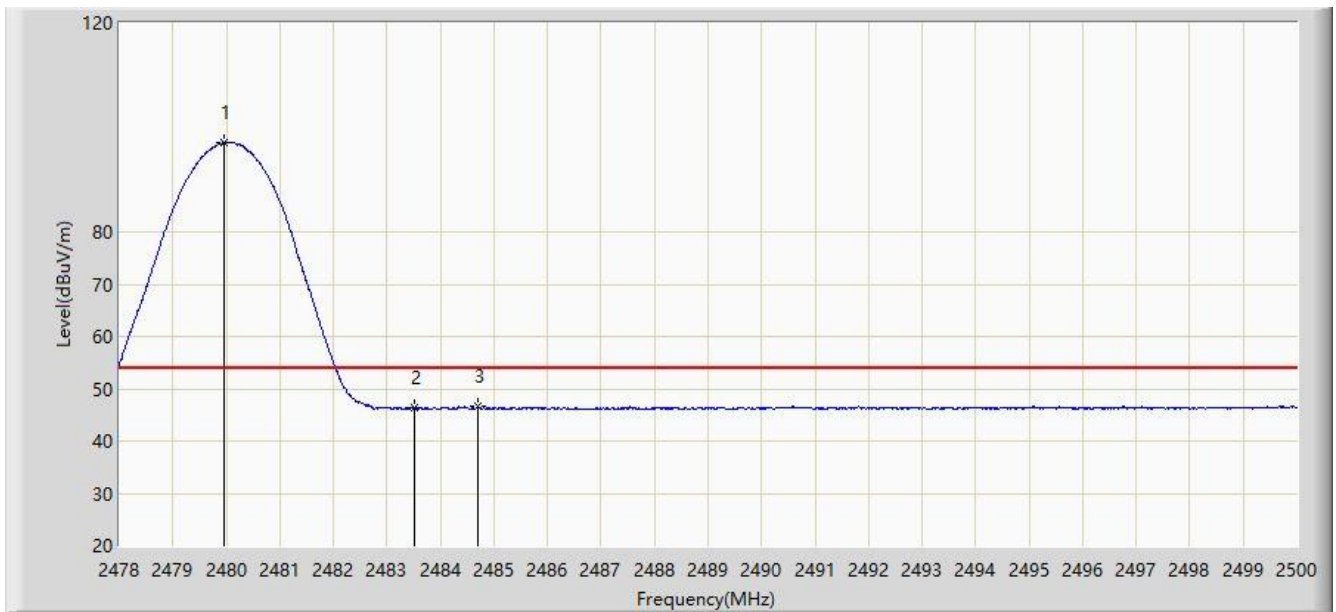


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.090	97.823	65.497	N/A	N/A	32.325	PK
2			2483.500	58.404	26.065	-15.596	74.000	32.340	PK
3			2484.864	59.440	27.096	-14.560	74.000	32.344	PK

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

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

Site: AC1	Time: 2019/03/02 - 04:01
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(1Mbps) at channel 2480MHz	

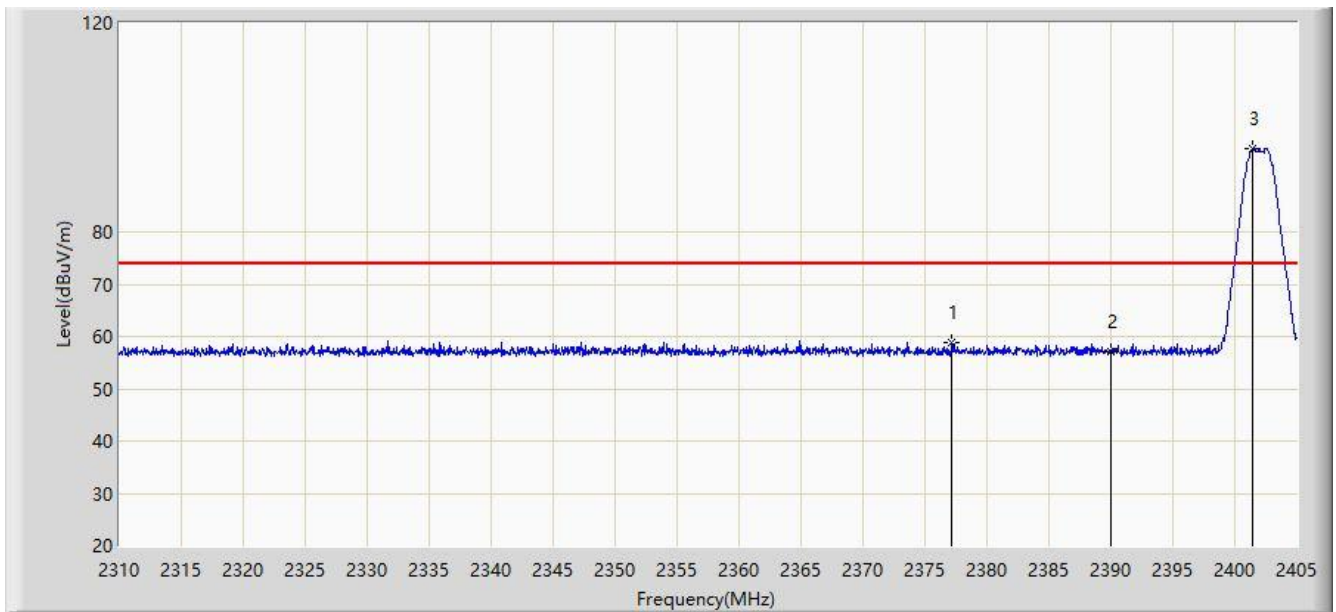


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.969	97.030	64.705	N/A	N/A	32.325	AV
2			2483.500	46.301	13.962	-7.699	54.000	32.340	AV
3			2484.688	46.583	14.239	-7.417	54.000	32.344	AV

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

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

Site: AC1	Time: 2019/03/02 - 04:03
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(2Mbps) at channel 2402MHz	

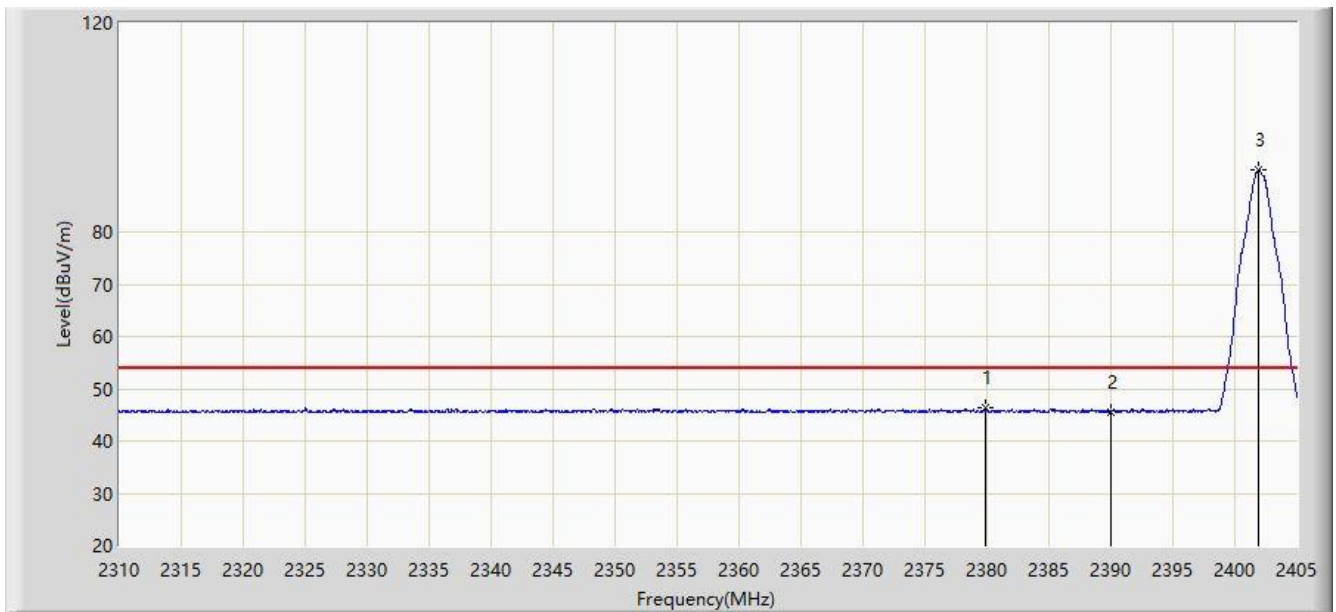


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2377.165	58.738	26.394	-15.262	74.000	32.344	PK
2			2390.000	57.216	24.889	-16.784	74.000	32.327	PK
3		*	2401.390	95.947	63.641	N/A	N/A	32.306	PK

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

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

Site: AC1	Time: 2019/03/02 - 04:04
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(2Mbps) at channel 2402MHz	

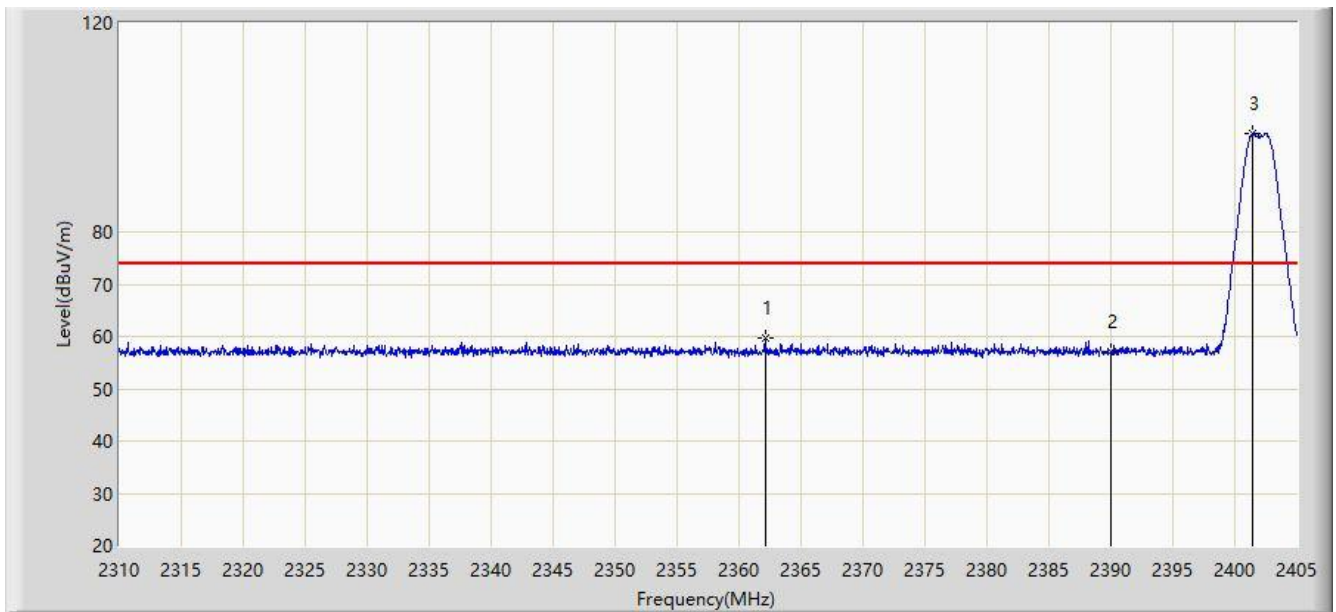


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2379.920	46.368	14.027	-7.632	54.000	32.341	AV
2			2390.000	45.596	13.269	-8.404	54.000	32.327	AV
3		*	2401.865	91.962	59.657	N/A	N/A	32.305	AV

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

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

Site: AC1	Time: 2019/03/02 - 04:05
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(2Mbps) at channel 2402MHz	

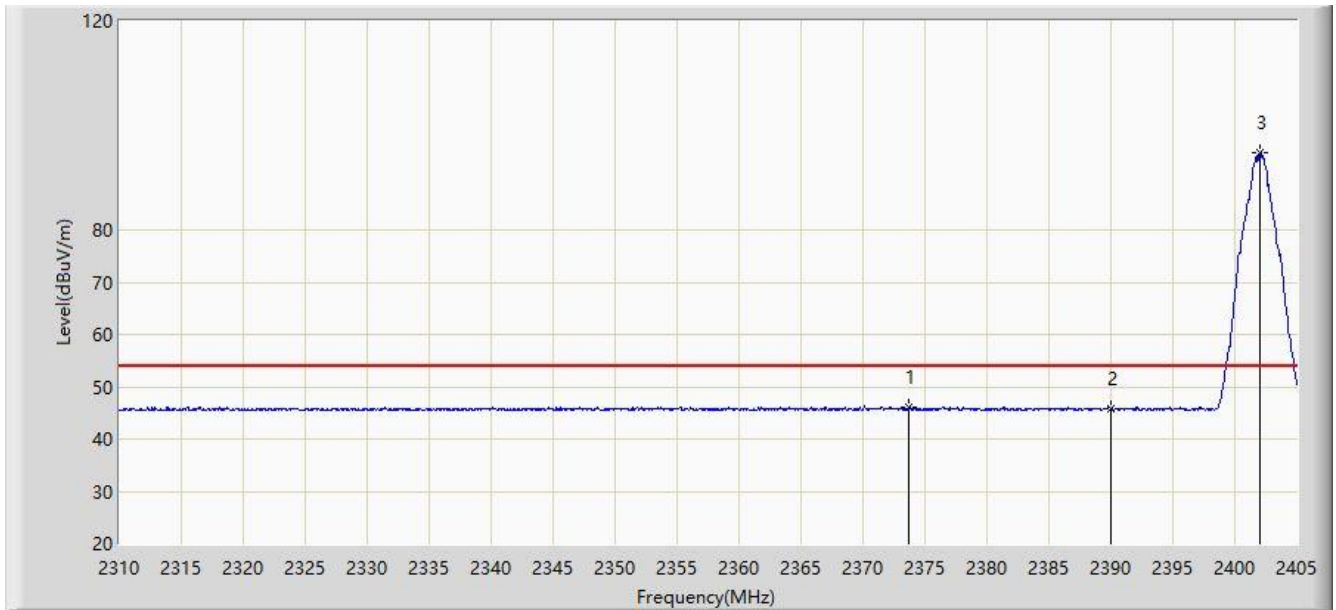


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2362.107	59.572	27.199	-14.428	74.000	32.372	PK
2			2390.000	57.098	24.771	-16.902	74.000	32.327	PK
3		*	2401.485	98.858	66.552	N/A	N/A	32.306	PK

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

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

Site: AC1	Time: 2019/03/02 - 04:06
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(2Mbps) at channel 2402MHz	



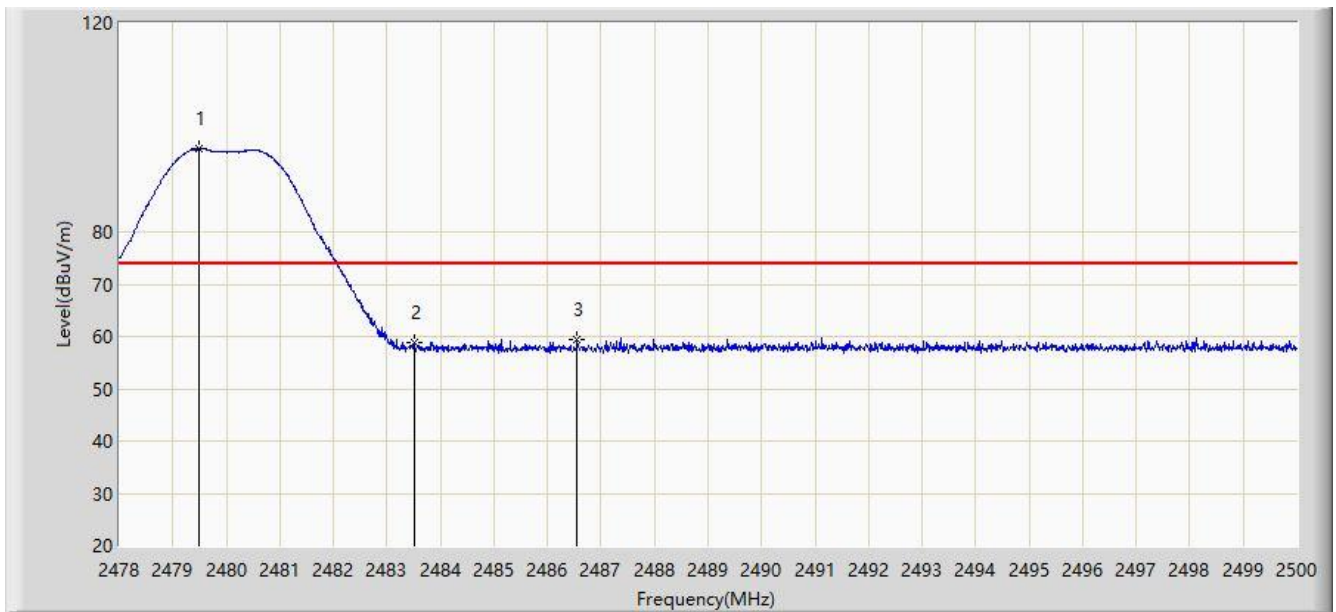
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2373.745	46.041	13.690	-7.959	54.000	32.351	AV
2			2390.000	45.761	13.434	-8.239	54.000	32.327	AV
3		*	2402.055	94.732	62.428	N/A	N/A	32.304	AV

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

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



Site: AC1	Time: 2019/03/02 - 04:08
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(2Mbps) at channel 2480MHz	

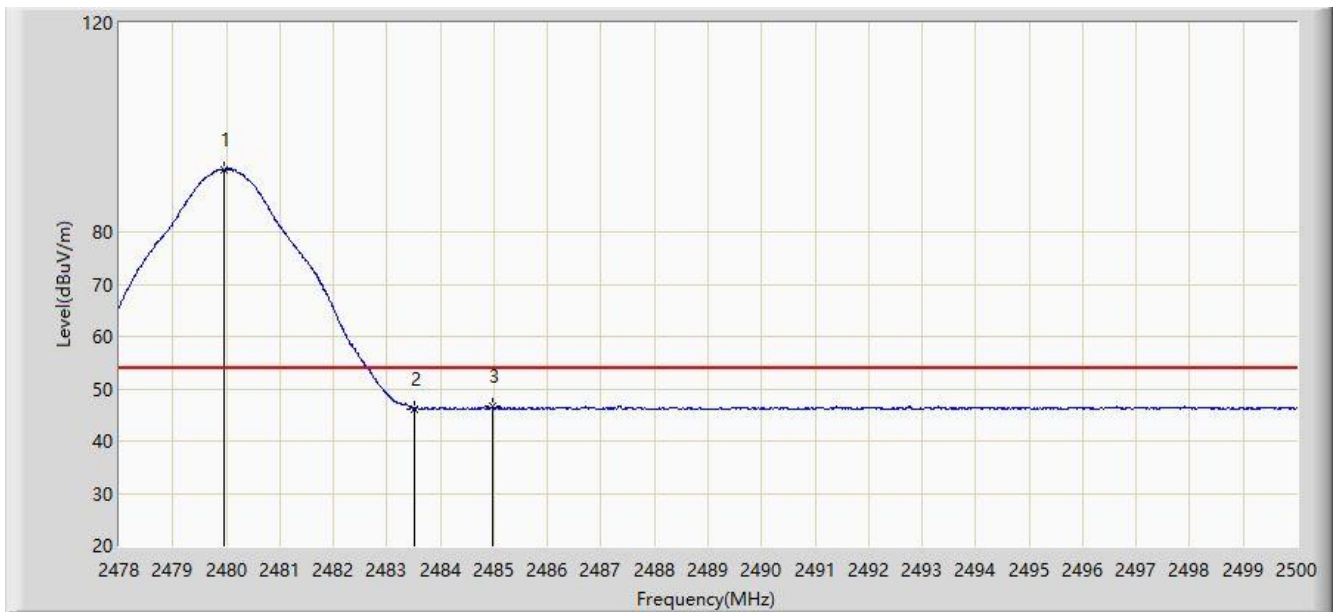


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.485	95.968	63.645	N/A	N/A	32.323	PK
2			2483.500	58.917	26.578	-15.083	74.000	32.340	PK
3			2486.547	59.560	27.209	-14.440	74.000	32.351	PK

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

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

Site: AC1	Time: 2019/03/02 - 04:10
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(2Mbps) at channel 2480MHz	

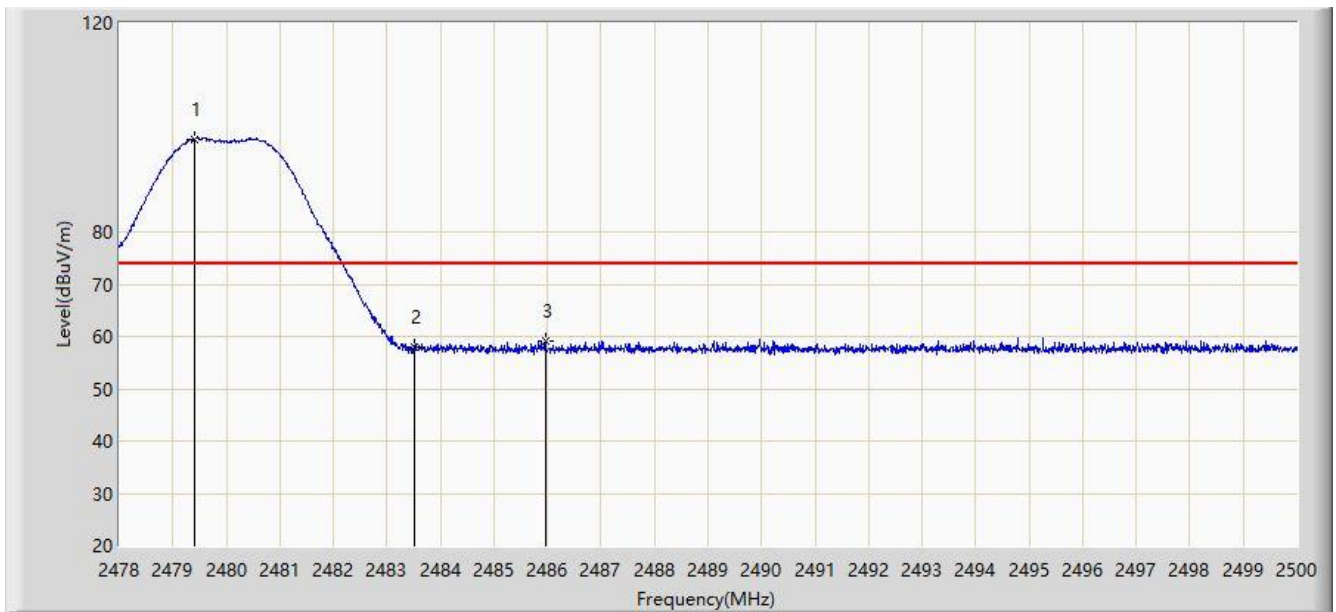


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.969	92.009	59.684	N/A	N/A	32.325	AV
2			2483.500	46.207	13.868	-7.793	54.000	32.340	AV
3			2484.963	46.583	14.238	-7.417	54.000	32.345	AV

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

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

Site: AC1	Time: 2019/03/02 - 04:11
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(2Mbps) at channel 2480MHz	

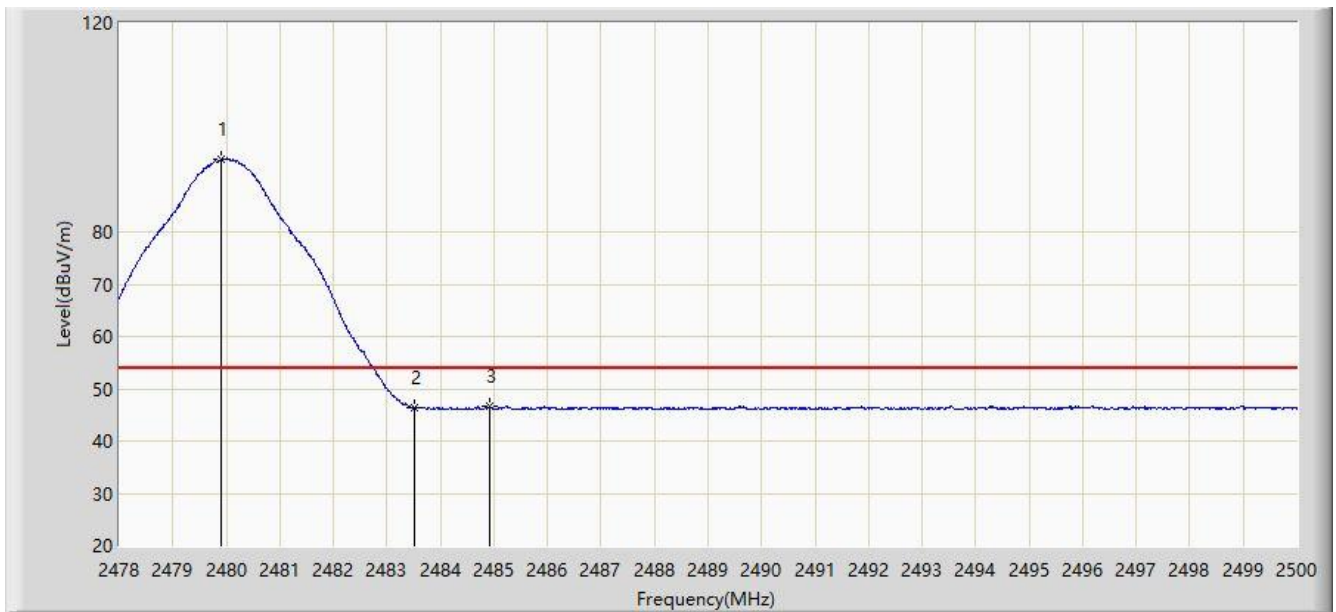


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.419	97.804	65.481	N/A	N/A	32.323	PK
2			2483.500	57.857	25.518	-16.143	74.000	32.340	PK
3			2485.964	59.134	26.785	-14.866	74.000	32.349	PK

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

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

Site: AC1	Time: 2019/03/02 - 04:12
Limit: FCC_Part15_Band Edge(3m)	Engineer: Messiah Li
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Communication Module	Power: DC 3.3V
Note: Transmit by BLE(2Mbps) at channel 2480MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.892	93.900	61.575	N/A	N/A	32.325	AV
2			2483.500	46.340	14.001	-7.660	54.000	32.340	AV
3			2484.908	46.642	14.297	-7.358	54.000	32.345	AV

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

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

## 6.8. AC Conducted Emissions Measurement

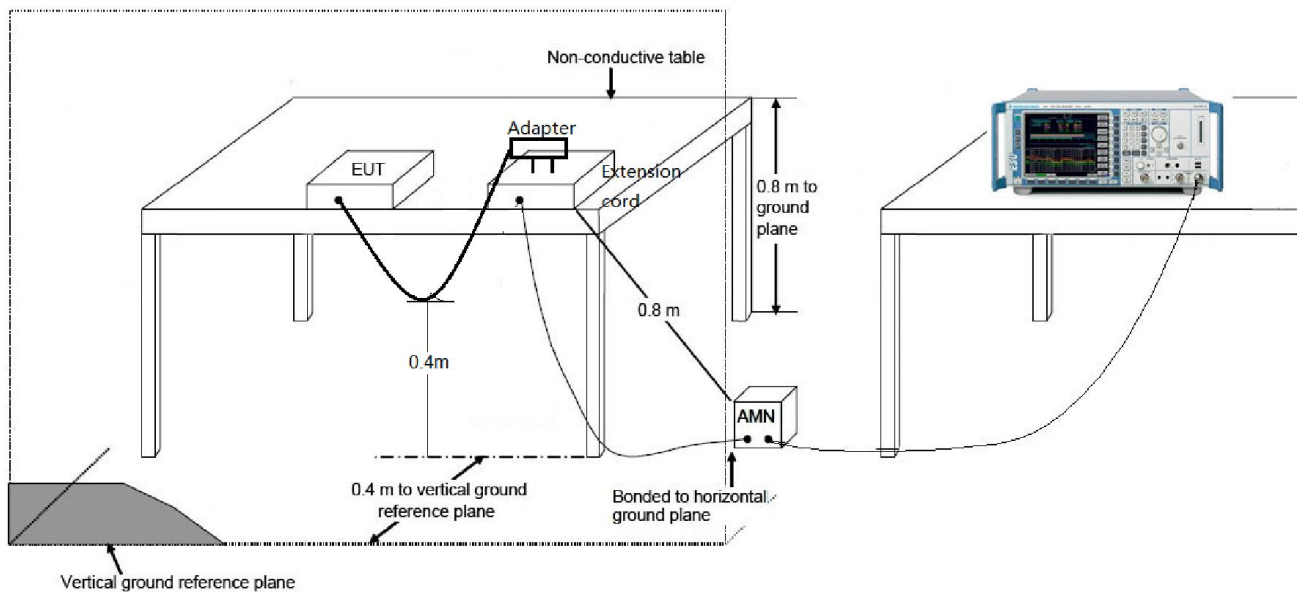
### 6.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
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

Power supply of this device is by DC Source, so this item is not assessed.

## 7. CONCLUSION

The data collected relate only the item(s) tested and show that the **Communication Module** is in compliance with Part 15C of the FCC Rules & RSS-247 Issue 2 of ISED Rules.

---

The End

## **Appendix A – Test Setup Photograph**

Refer to “19091WSU002-UT” file.

## **Appendix B – EUT Photograph**

Refer to “1901WSU002-UE” file.