

# RF MEASUREMENT REPORT

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**FCC ID:** XIA-CTL2000  
**Applicant:** NetComm Wireless Pty Ltd  
**Product:** Smart Installation Tool  
**Model No.:** CTL-2000  
**Brand Name:** CASA SYSTEMS  
**FCC Classification:** Digital Transmission System (DTS)  
**FCC Rule Part(s):** Part 15 Subpart C (Section 15.247)  
**Result:** Complies  
**Received Date:** 2023-04-11  
**Test Date:** 2023-05-09 ~ 2023-05-20

**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.

**Revision History**

Report No.	Version	Description	Issue Date	Note
2304RSU026-U3	V01	Initial Report	2023-07-11	Valid

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## 1. General Information

### 1.1. Applicant

NetComm Wireless Pty Ltd

Level 5, 18-20 Orion Road, Lane Cove, NSW 2066, Sydney, Australia

### 1.2. Manufacturer

CASA SYSTEMS INC.

100 Old River Road Andover, MA 01810. USA

### 1.3. Testing Facility

<input checked="" type="checkbox"/>	<b>Test Site – MRT Suzhou Laboratory</b>
	<b>Laboratory Location (Suzhou - Wuzhong)</b> D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
	<b>Laboratory Location (Suzhou - SIP)</b> 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China
	<b>Laboratory Accreditations</b>
	A2LA: 3628.01 <span style="float: right;">CNAS: L10551</span> FCC: CN1166 <span style="float: right;">ISED: CN0001</span> VCCI: <input type="checkbox"/> R-20025 <input type="checkbox"/> G-20034 <input type="checkbox"/> C-20020 <input type="checkbox"/> T-20020 <input type="checkbox"/> R-20141 <input type="checkbox"/> G-20134 <input type="checkbox"/> C-20103 <input type="checkbox"/> T-20104
<input type="checkbox"/>	<b>Test Site – MRT Shenzhen Laboratory</b>
	<b>Laboratory Location (Shenzhen)</b> 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China
	<b>Laboratory Accreditations</b>
	A2LA: 3628.02 <span style="float: right;">CNAS: L10551</span> FCC: CN1284 <span style="float: right;">ISED: CN0105</span>
<input type="checkbox"/>	<b>Test Site – MRT Taiwan Laboratory</b>
	<b>Laboratory Location (Taiwan)</b> No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
	<b>Laboratory Accreditations</b>
	TAF: L3261-190725 FCC: 291082, TW3261 <span style="float: right;">ISED: TW3261</span>

#### 1.4. Product Information

Product Name	Smart Installation Tool
Model No.	CTL-2000
EUT Identification No. or Serial No.	20230411Sample#24
Wi-Fi Specification	802.11b/g/n
Bluetooth Specification	V5.0 Dual mode
Antenna Information	Refer to Clause 1.5
Working Voltage	By Battery
Accessories	
Rechargeable Li-ion Battery	Model No.: BAT-0007 Rated Capacity: 2000mAh, 24Wh Rated Voltage: 12V
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

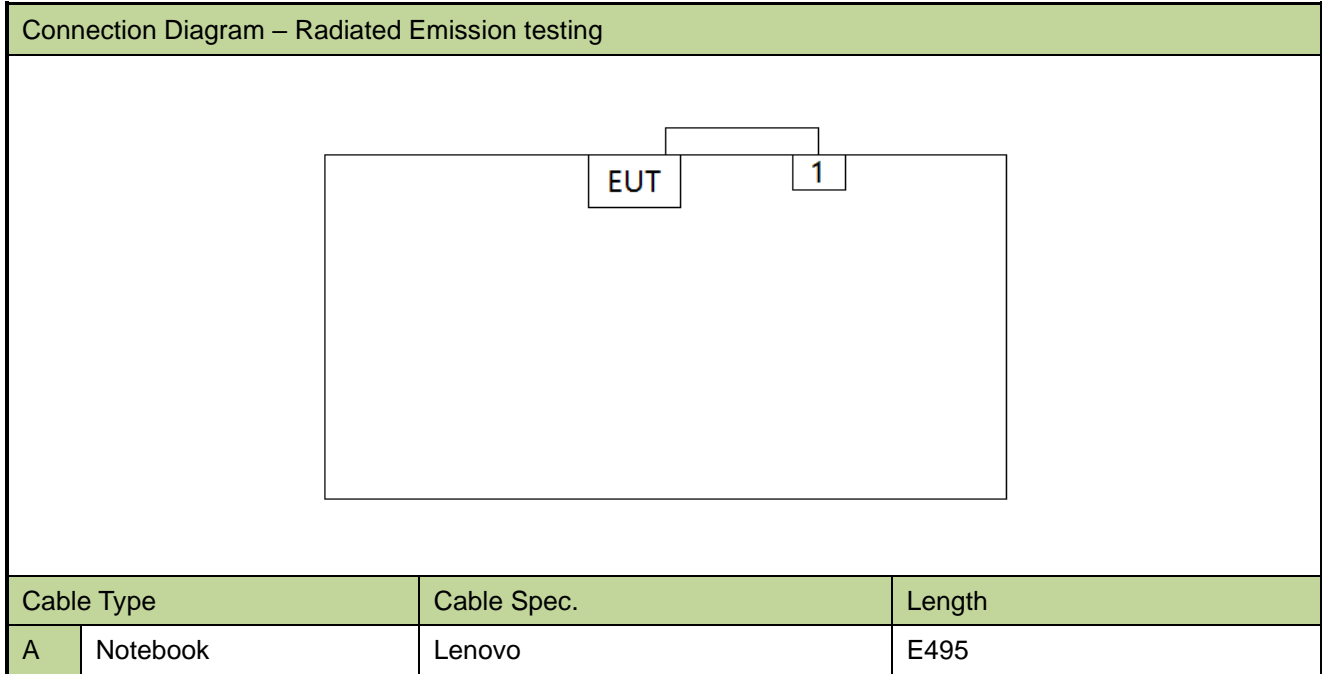
Bluetooth Frequency	2402 ~ 2480MHz
Channel Number	40
Type of modulation	GFSK
Data Rate	1Mbps
Antenna Type	PCB
Antenna Gain	3.3 dBi

**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 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 and AC line conducted testing.



### 2.2. Test Software

The test utility software used during testing was “EspRFTestTool\_v2.6\_Manual.exe”.

### 2.3. 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

### 2.4. Test Environment Condition

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



## 2. 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.

### 3. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
TRILOG Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2023-05-20	WZ-AC2
EMI Test Receiver	Agilent	N9038A	MRTSUE06125	1 year	2023-06-04	WZ-AC2
Thermohygrometer	Mingle	ETH529	MRTSUE06170	1 year	2023-11-27	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06171	1 year	2023-10-13	WZ-AC2
Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2024-05-07	WZ-AC2
Anechoic Chamber	RIKEN	WZ-AC2	MRTSUE06213	1 year	2024-04-20	WZ-AC2
Thermohygrometer	testo	608-H1	MRTSUE11038	1 year	2023-11-01	WZ-AC2
Signal Analyzer	Keysight	N9010B	MRTSUE06558	1 year	2023-06-01	SIP-TR1
Thermohygrometer	testo	608-H1	MRTSUE11022	1 year	2023-11-01	SIP-TR1
USB Power Sensor	Keysight	U2021XA	MRTSUE06596	1 year	2023-08-23	SIP-TR1

Software	Version	Function
EMI V3	V 3.0.0	EMI Test Software
Controller_MF 7802	2.03C	RE Antenna & Turntable
BenchVue Power Meter	2018.1	Power

## 4. Decision Rules and Measurement Uncertainty

### 4.1. 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.)

### 4.2. 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  $k = 2$ .

<b>AC Conducted Emission Measurement</b>
The maximum measurement uncertainty is evaluated as: 9kHz~150kHz: 3.58dB 150kHz~30MHz: 3.20dB
<b>Radiated Disturbance</b>
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
<b>Spurious Emissions, Conducted</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 2.3dB
<b>Output Power</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 1.5dB
<b>Power Spectrum Density</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 2.3dB
<b>Occupied Bandwidth</b>
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 3.2%

## 5. Test Result

### 5.1. 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	General Field Strength	Radiated	Pass
15.209	(Restricted Bands and Radiated Emission)		
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 the item is not applicable, and details refer to relevant section.

## 5.2. 6dB Bandwidth Measurement

### 5.2.1. Test Limit

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

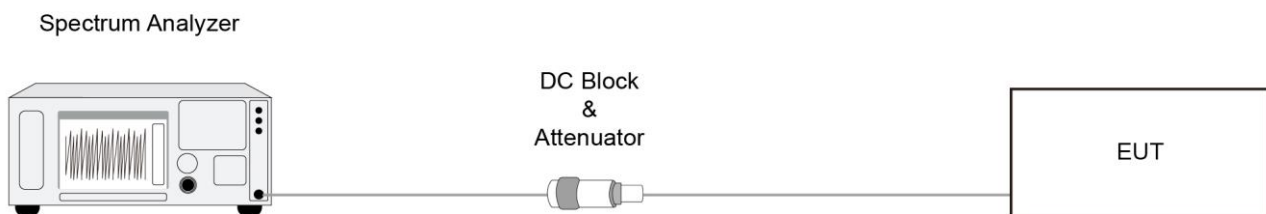
### 5.2.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.8

### 5.2.3. 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

### 5.2.4. Test Setup



### 5.2.5. Test Result

Refer to Appendix A.2.

### 5.3. Output Power Measurement

#### 5.3.1. 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.

#### 5.3.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.9.1.3

ANSI C63.10 - 2013 - Section 11.9.2.3.2

#### 5.3.3. Test Setting

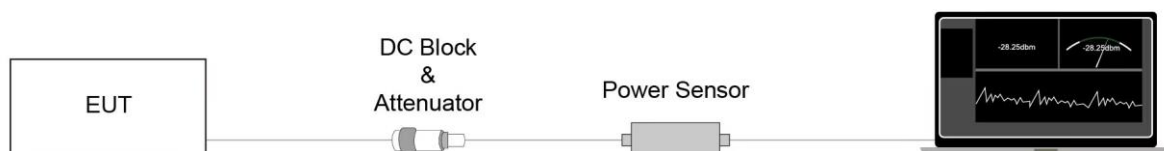
##### **Method PKPM1 (Peak Power Measurement of Signals with DTS BW $\leq$ 50MHz)**

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.

#### 5.3.4. Test Setup



#### 5.3.5. Test Result

Refer to Appendix A.3.

## 5.4. Power Spectral Density Measurement

### 5.4.1. 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.

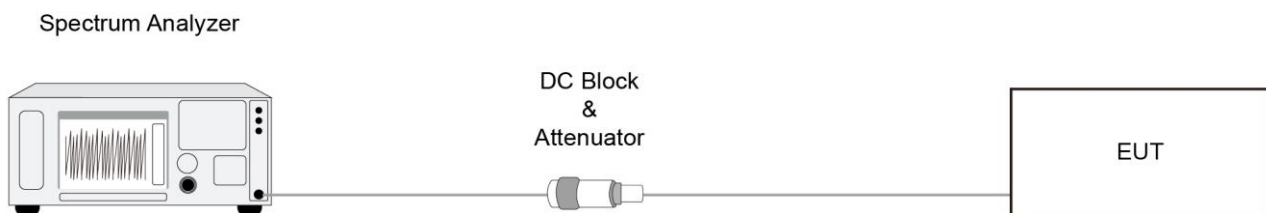
### 5.4.2. Test Procedure

ANSI C63.10-2013 Section 11.10.2

### 5.4.3. 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

### 5.4.4. Test Setup



### 5.4.5. Test Result

Refer to Appendix A.4.

## 5.5. Conducted Band Edge and Out-of-Band Emissions Measurement

### 5.5.1. 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.

### 5.5.2. Test Procedure

ANSI C63.10-2013 - Section 11.11

### 5.5.3. Test Setting

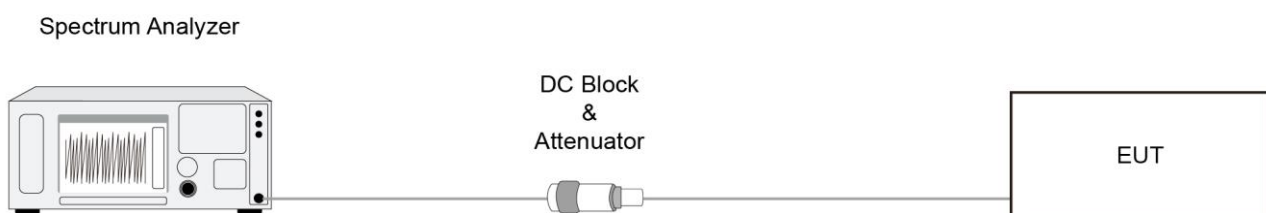
#### Reference level measurement

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

### 5.5.4. Test Setup





### **5.5.5. Test Result**

Refer to Appendix A.5.

## 5.6. Radiated Spurious Emission Measurement

### 5.6.1. 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 [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

### 5.6.2. 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)

### 5.6.3. 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**

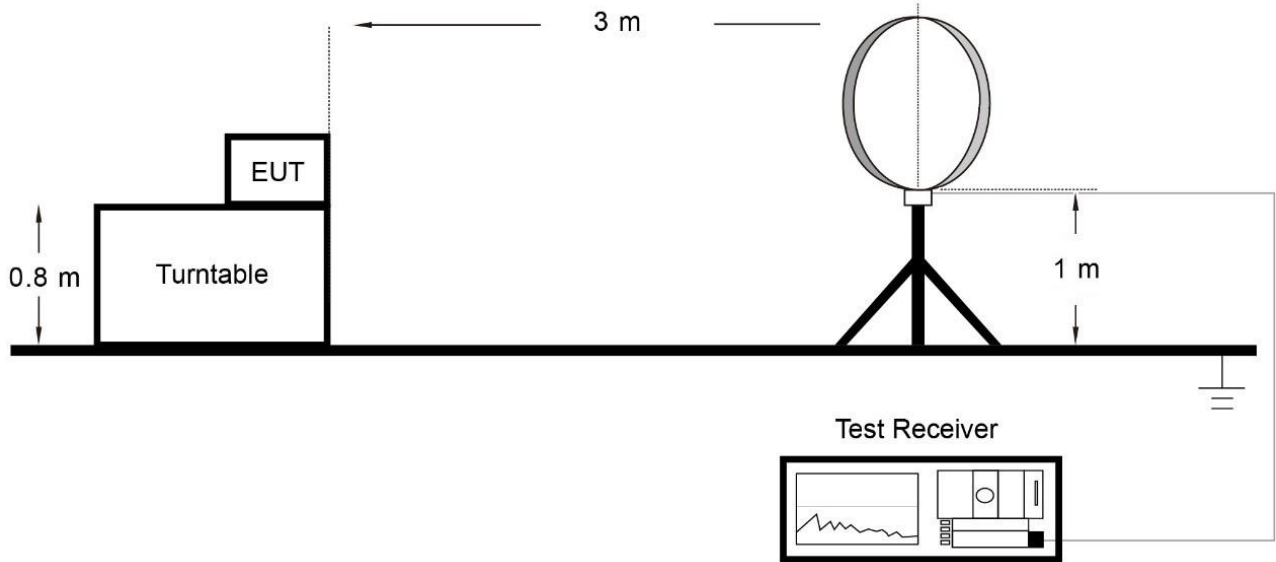
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

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

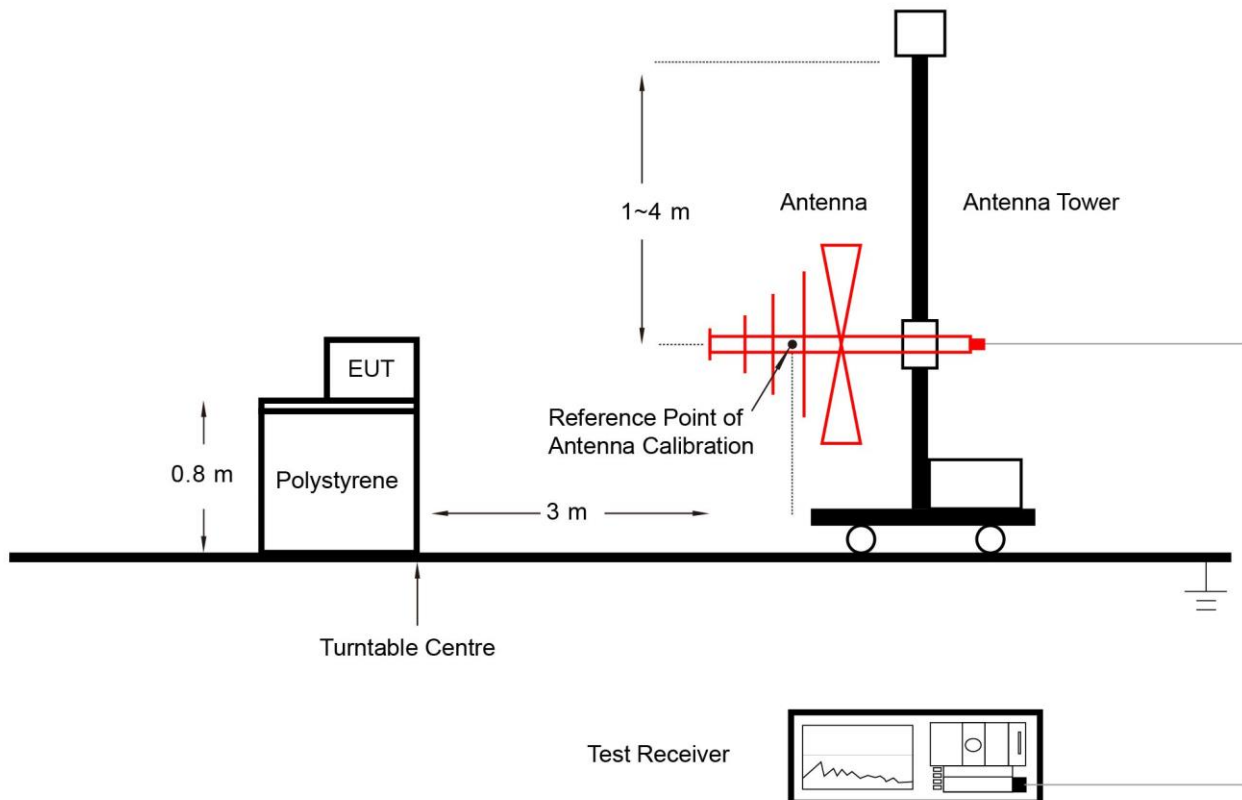
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle  $\geq 98\%$ , set VBW = 10 Hz.  
If the EUT duty cycle is  $< 98\%$ , set VBW  $\geq 1/T$ . T is the minimum transmission duration.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

### 5.6.4. Test Setup

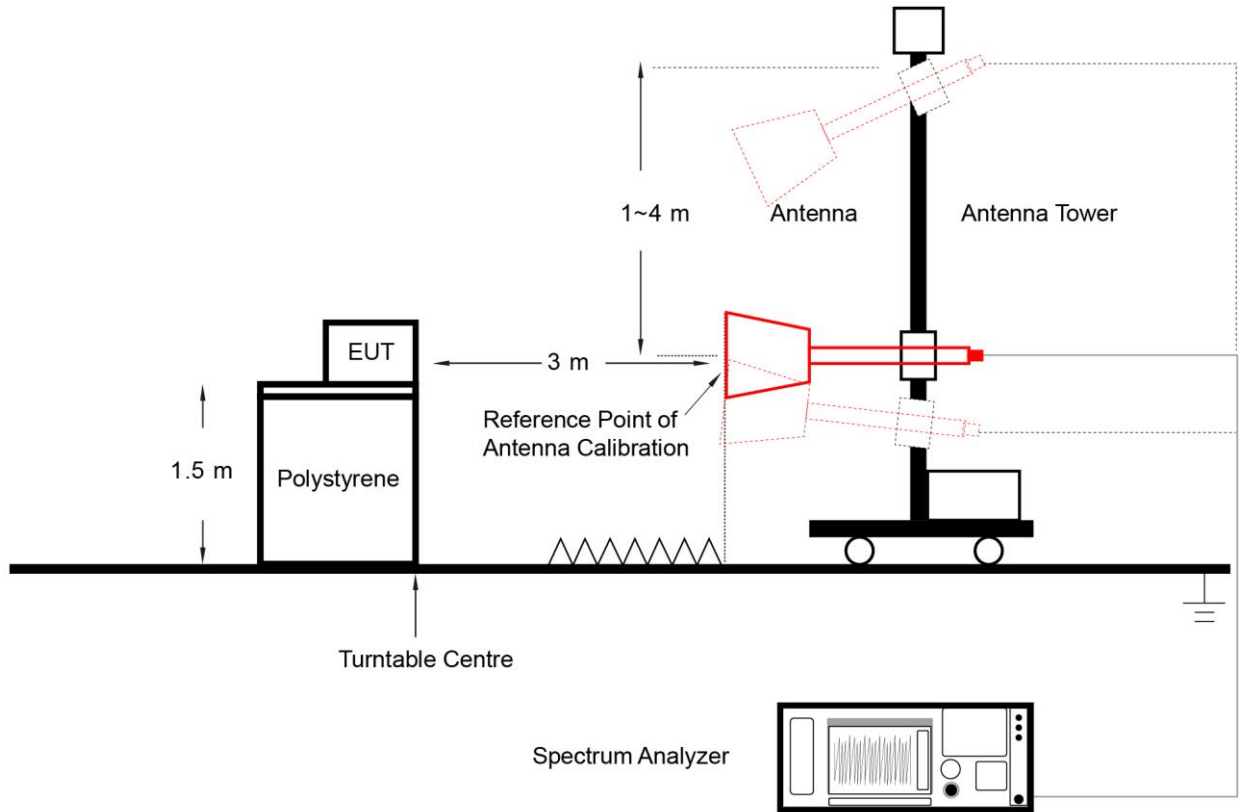
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



5.6.5. Test Result

Refer to Appendix A.6.

## 5.7. Radiated Restricted Band Edge Measurement

### 5.7.1. 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 [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

### 5.7.2. Test Procedure

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

### 5.7.3. Test Setting

#### Peak Field Strength Measurements

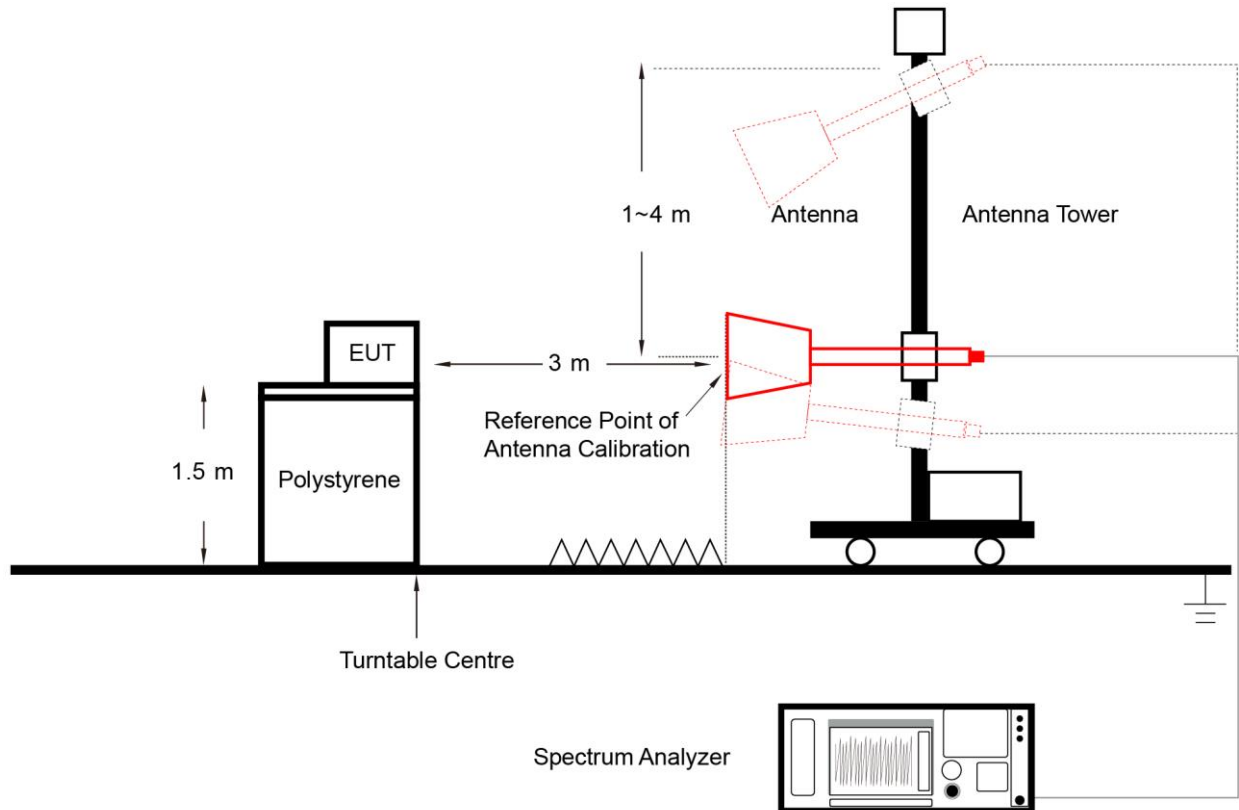
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

#### 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

#### 5.7.4. Test Setup



#### 5.7.5. Test Result

Refer to Appendix A.7.



## 5.8. AC Conducted Emissions Measurement

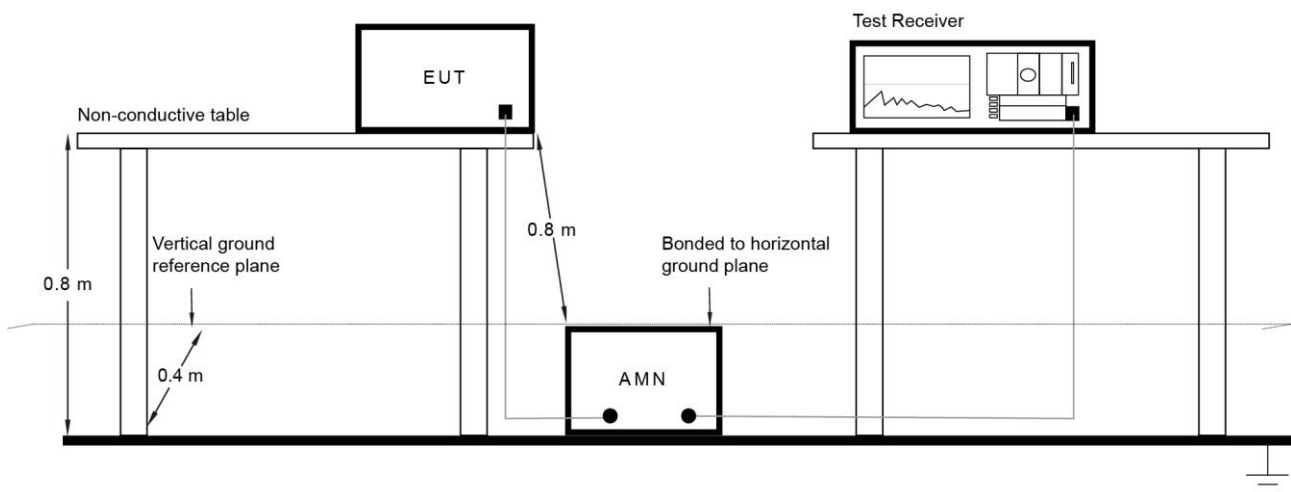
### 5.8.1. Test Limit

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.

### 5.8.2. Test Setup



### 5.8.3. Test Result

This device is powered by battery in actual use. Therefore, this requirement is not applicable.

## Appendix A - Test Result

### A.1 Duty Cycle Test Result

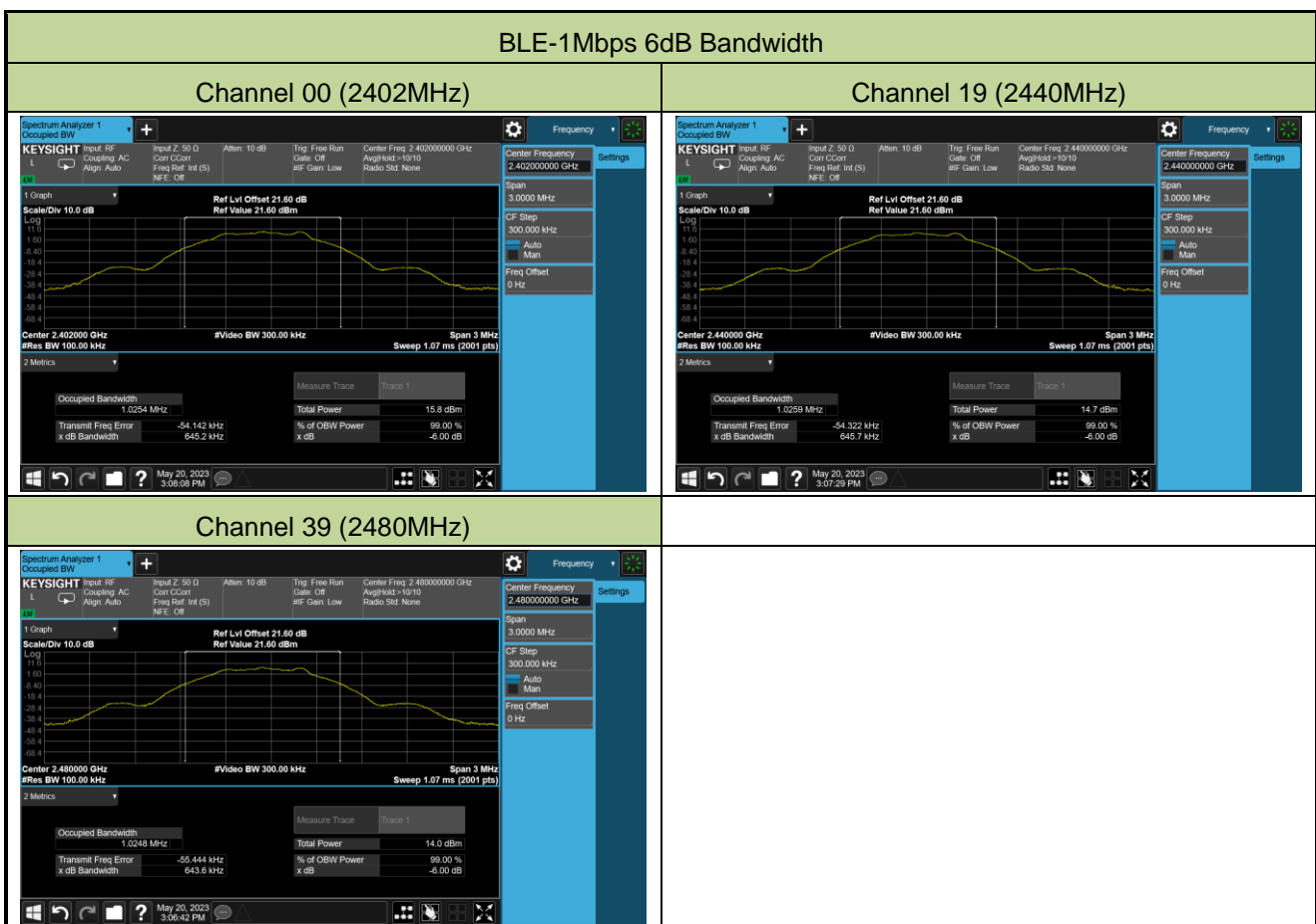
Test Site	SIP-TR1	Test Engineer	Chase Zhu
Test Date	2023-05-20		

Test Mode	Duty Cycle																																								
BLE-1Mbps	83.28%																																								
Duty Cycle (T = Transmission Duration)																																									
BLE-1Mbps (T = 2.082ms)																																									
<table border="1" style="margin-top: 10px;"> <thead> <tr> <th>Mode</th> <th>Trace</th> <th>Scale</th> <th>X</th> <th>Y</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>2.082 ms (Δ)</td> <td>-23.80 dBm</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>F</td> <td>1</td> <td>1.474 ms</td> <td>0.201 dBm</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>Δ</td> <td>1</td> <td>2.500 ms (Δ)</td> <td>-0.062 dBm</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>F</td> <td>1</td> <td>1.474 ms</td> <td>9.201 dBm</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Mode	Trace	Scale	X	Y	Function	Function Width	Function Value	1	Δ	1	2.082 ms (Δ)	-23.80 dBm				2	F	1	1.474 ms	0.201 dBm				3	Δ	1	2.500 ms (Δ)	-0.062 dBm				4	F	1	1.474 ms	9.201 dBm			
Mode	Trace	Scale	X	Y	Function	Function Width	Function Value																																		
1	Δ	1	2.082 ms (Δ)	-23.80 dBm																																					
2	F	1	1.474 ms	0.201 dBm																																					
3	Δ	1	2.500 ms (Δ)	-0.062 dBm																																					
4	F	1	1.474 ms	9.201 dBm																																					

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

Test Site	SIP-TR1	Test Engineer	Chase Zhu
Test Date	2023-05-20		

Test Mode	Data Rate	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
BLE	1Mbps	00	2402	0.6452	≥ 0.5
BLE	1Mbps	19	2440	0.6457	≥ 0.5
BLE	1Mbps	39	2480	0.6436	≥ 0.5



**A.3 Output Power Test Result**

Test Site	SIP-TR1	Test Engineer	Chase Zhu
Test Date	2023-05-20		

**Test Result of Peak Output Power**

Test Mode	Data Rate	Channel No.	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Result
BLE	1Mbps	00	2402	9.77	≤ 30.00	Pass
BLE	1Mbps	19	2440	8.57	≤ 30.00	Pass
BLE	1Mbps	39	2480	7.72	≤ 30.00	Pass

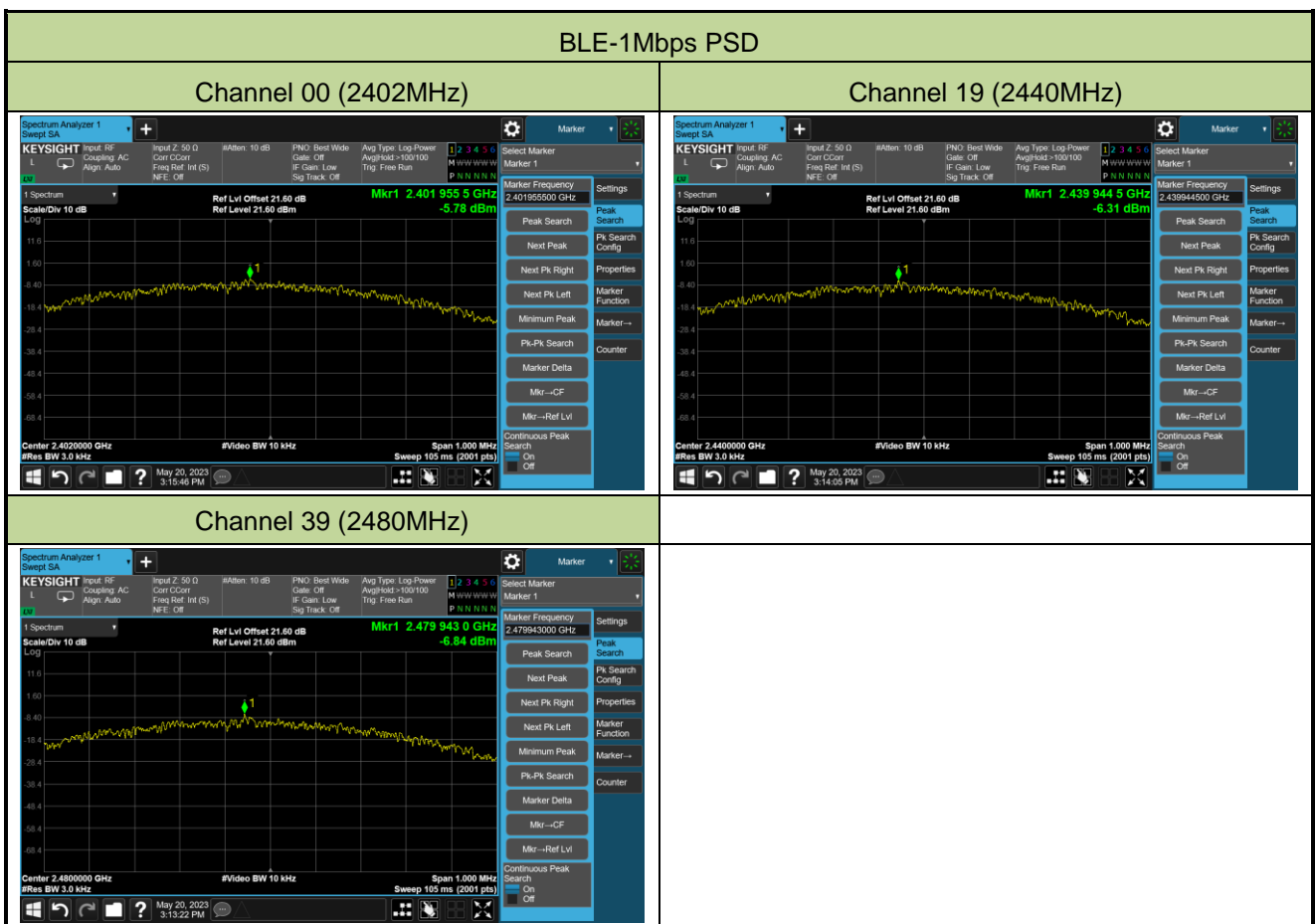
**Test Result of Average Output Power (Reporting Only)**

Test Mode	Data Rate	Channel No.	Frequency (MHz)	Average Power (dBm)	Limit (dBm)	Result
BLE	1Mbps	00	2402	8.43	≤ 30.00	Pass
BLE	1Mbps	19	2440	7.82	≤ 30.00	Pass
BLE	1Mbps	39	2480	6.87	≤ 30.00	Pass

### A.4 Power Spectral Density Test Result

Test Site	SIP-TR1	Test Engineer	Chase Zhu
Test Date	2023-05-20		

Test Mode	Data Rate	Channel No.	Frequency (MHz)	PSD Result (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
BLE	1Mbps	00	2402	-5.78	≤ 8.00	Pass
BLE	1Mbps	19	2440	-6.31	≤ 8.00	Pass
BLE	1Mbps	39	2480	-6.84	≤ 8.00	Pass



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

Test Site	SIP-TR1	Test Engineer	Chase Zhu
Test Date	2023-05-20		

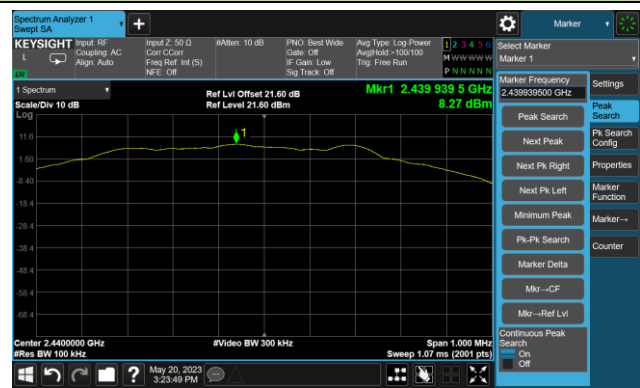
Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Limit (dBc)	Result
BLE	1	00	2402	20	Pass
BLE	1	19	2440	20	Pass
BLE	1	39	2480	20	Pass



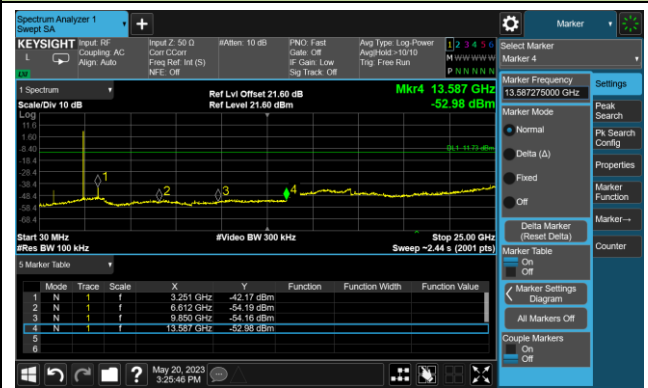
### BLE-1Mbps Out-of-Band Emissions

#### Channel 19 (2440MHz)

##### 100kHz PSD Reference Level



##### Spurious Emission



#### Channel 39 (2480MHz)

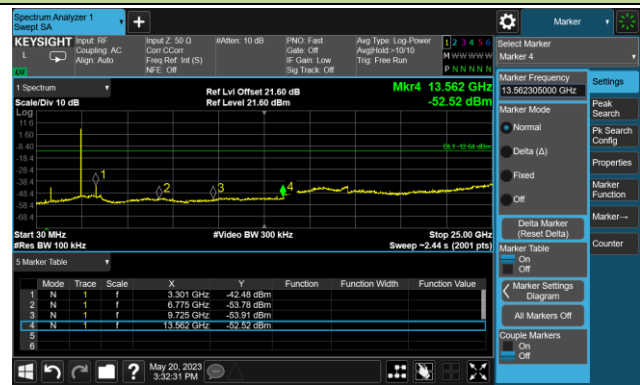
##### 100kHz PSD Reference Level



##### High Band Edge



##### Spurious Emission



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

Test Site	WZ-AC2	Test Engineer	Ajin Fan
Test Date	2023-05-20	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 (dB $\mu$ V)	Factor (dB/m)	Measure Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Detector	Polarization
00	4808.0	47.5	3.3	50.8	74.0	-23.2	Peak	Horizontal
	7468.5	30.8	12.1	42.9	74.0	-31.1	Peak	Horizontal
	11820.5	32.2	17.5	49.7	74.0	-24.3	Peak	Horizontal
	4808.0	45.0	3.3	48.3	74.0	-25.7	Peak	Vertical
	8140.0	32.4	11.7	44.1	74.0	-29.9	Peak	Vertical
	11897.0	31.2	17.3	48.5	74.0	-25.5	Peak	Vertical
19	4876.0	52.0	3.0	55.0	74.0	-19.0	Peak	Horizontal
	4876.0	49.3	3.0	52.3	54.0	-1.7	Peak	Horizontal
	7434.5	31.5	11.9	43.4	74.0	-30.6	Peak	Horizontal
	11574.0	31.0	17.6	48.6	74.0	-25.4	Peak	Vertical
	4876.0	47.8	3.0	50.8	74.0	-23.2	Peak	Vertical
	8089.0	32.2	11.8	44.0	74.0	-30.0	Peak	Vertical
39	4961.0	53.1	3.0	56.1	74.0	-17.9	Peak	Horizontal
	4961.0	49.4	3.0	52.4	54.0	-1.6	Peak	Horizontal
	8454.5	32.4	11.6	44.0	74.0	-30.0	Peak	Horizontal
	11642.0	31.1	17.9	49.0	74.0	-25.0	Peak	Vertical
	4961.0	47.7	3.0	50.7	74.0	-23.3	Peak	Vertical
	7426.0	31.6	11.7	43.3	74.0	-30.7	Peak	Vertical

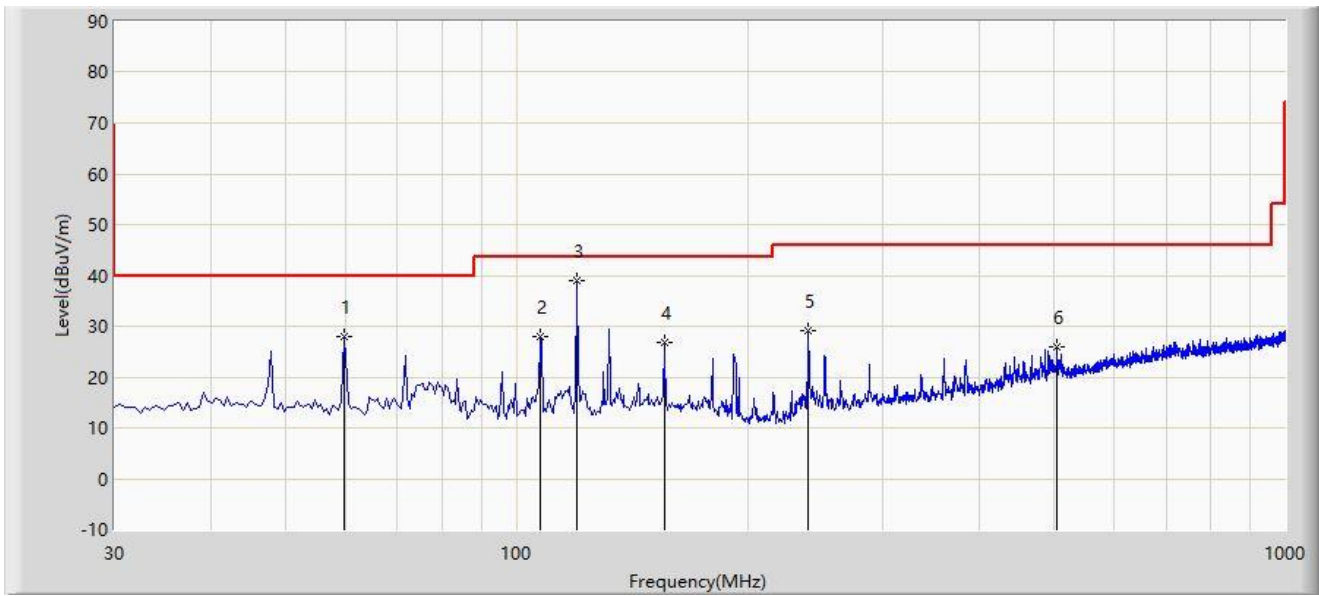
Note: Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB/m)

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



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

Site: SIP-AC3	Test Date: 2023-05-09
Limit: FCC_Part15.209_RSE(3m)	Engineer: Mero Zhou
Probe: VULB 9168_00997_25-2000MHz	Polarity: Horizontal
EUT: Smart Installation Tool	Power: By Battery
<b>Test Mode:</b> Transmit by DH5 at 2402MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		59.585	27.884	10.756	-12.116	40.000	17.128	PK
2		107.600	27.837	13.270	-15.663	43.500	14.567	PK
3	*	119.725	39.090	23.430	-4.410	43.500	15.660	PK
4		155.615	26.794	8.740	-16.706	43.500	18.055	PK
5		240.005	29.251	12.841	-16.749	46.000	16.411	PK
6		504.815	25.980	2.706	-20.020	46.000	23.274	PK

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

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

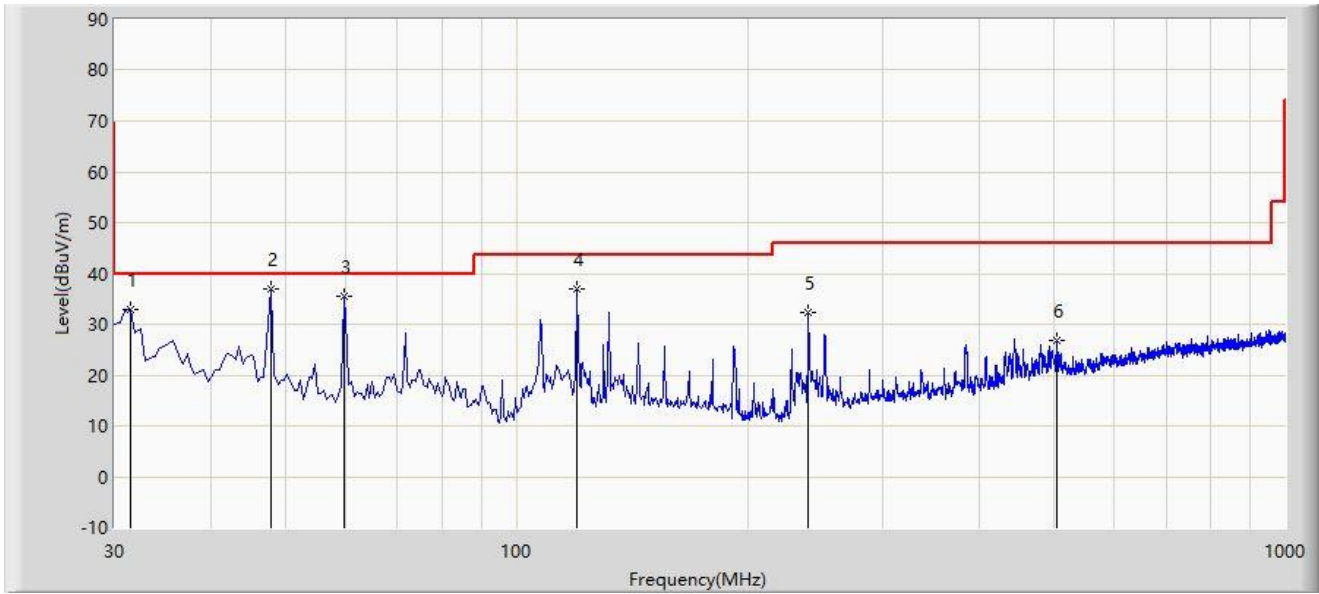
Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: Quasi-Peak measurement was not performed when peak measure level was lower than the quasi-peak limit.

Note 5: 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: SIP-AC3	Test Date: 2023-05-09
Limit: FCC_Part15.209_RSE(3m)	Engineer: Mero Zhou
Probe: VULB 9168_00997_25-2000MHz	Polarity: Vertical
EUT: Smart Installation Tool	Power: By Battery
<b>Test Mode:</b> Transmit by DH5 at 2402MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		31.455	33.007	16.567	-6.993	40.000	16.439	PK
2	*	47.945	36.999	19.014	-3.001	40.000	17.985	PK
3		59.585	35.488	18.360	-4.512	40.000	17.128	PK
4		119.725	37.038	21.378	-6.462	43.500	15.660	PK
5		240.005	32.178	15.768	-13.822	46.000	16.411	PK
6		504.330	26.775	3.515	-19.225	46.000	23.260	PK

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).

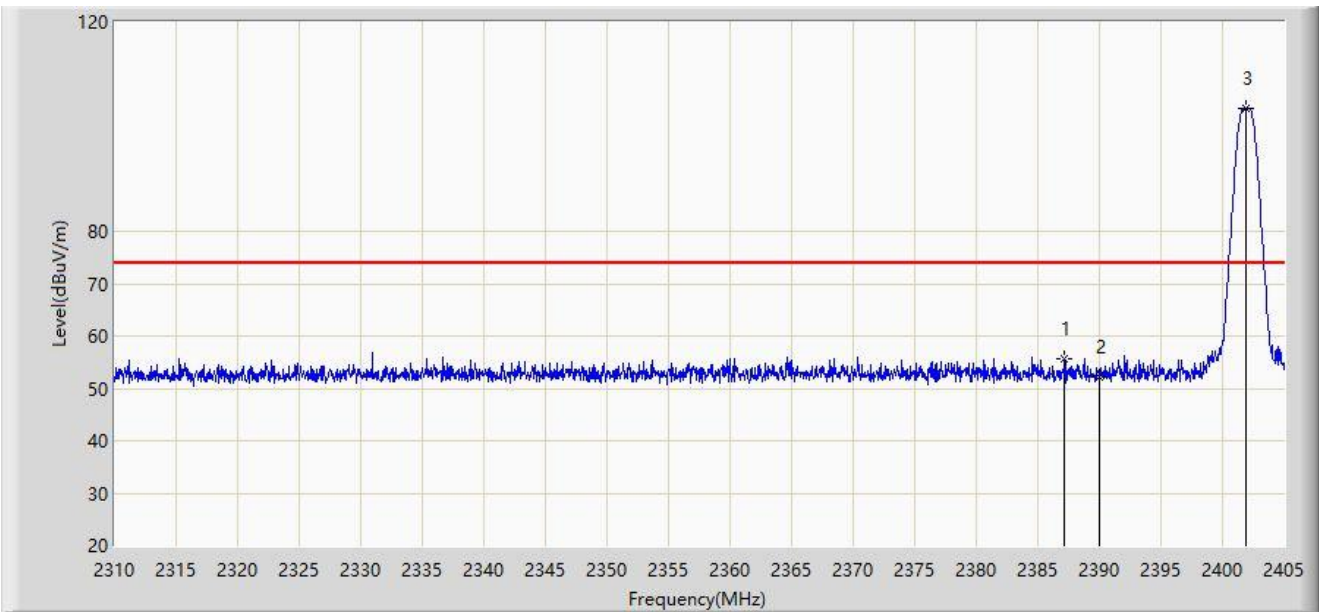
Note 4: Quasi-Peak measurement was not performed when peak measure level was lower than the quasi-peak limit.

Note 5: 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	Time: 2023/05/20 - 12:47
Limit: FCC_2.4G_RE(3m)	Engineer: Ajin Fan
Probe: BBHA9120D_1457_1-18GHz	Polarity: Horizontal
EUT: Smart Installation Tool	Power: By Battery
Test Mode: Transmit by BLE 1M at 2402MHz	



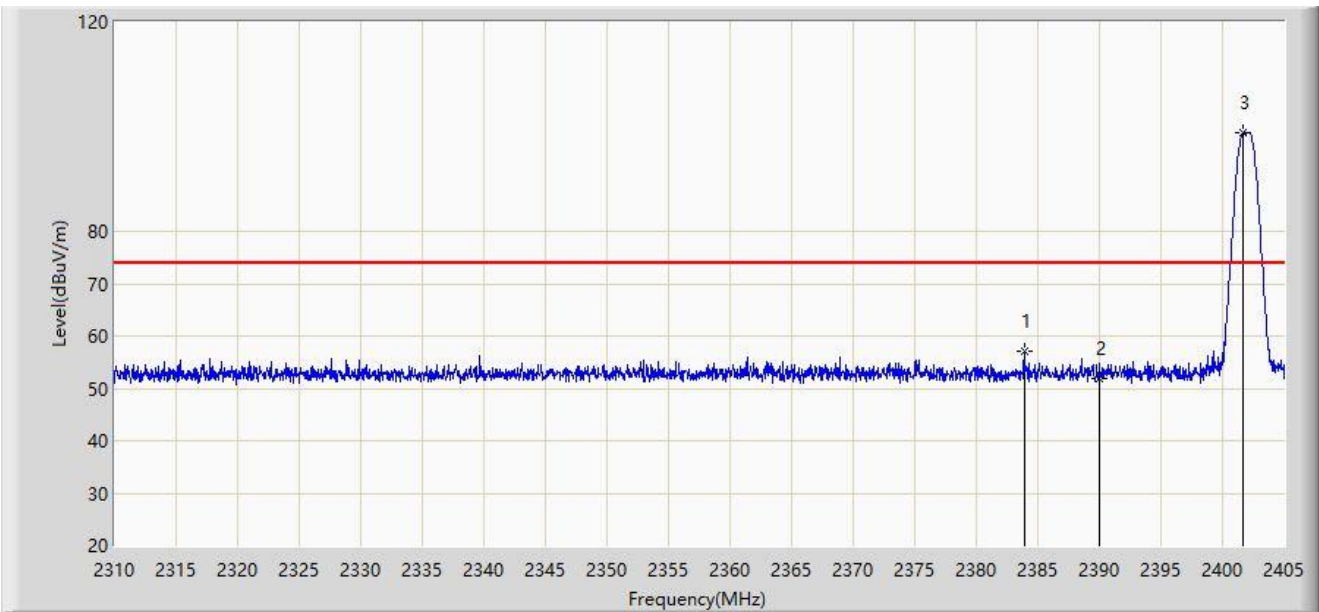
No	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Margin (dB)	Limit (dB $\mu$ V/m)	Factor (dB/m)	Type
1	*	2387.140	55.712	24.079	-18.288	74.000	31.633	PK
2		2390.000	52.216	20.601	-21.784	74.000	31.615	PK
3		2401.913	103.466	71.916	N/A	N/A	31.550	PK

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	Time: 2023/05/20 - 12:50
Limit: FCC_2.4G_RE(3m)	Engineer: Ajin Fan
Probe: BBHA9120D_1457_1-18GHz	Polarity: Vertical
EUT: Smart Installation Tool	Power: By Battery
Test Mode: Transmit by BLE 1M at 2402MHz	



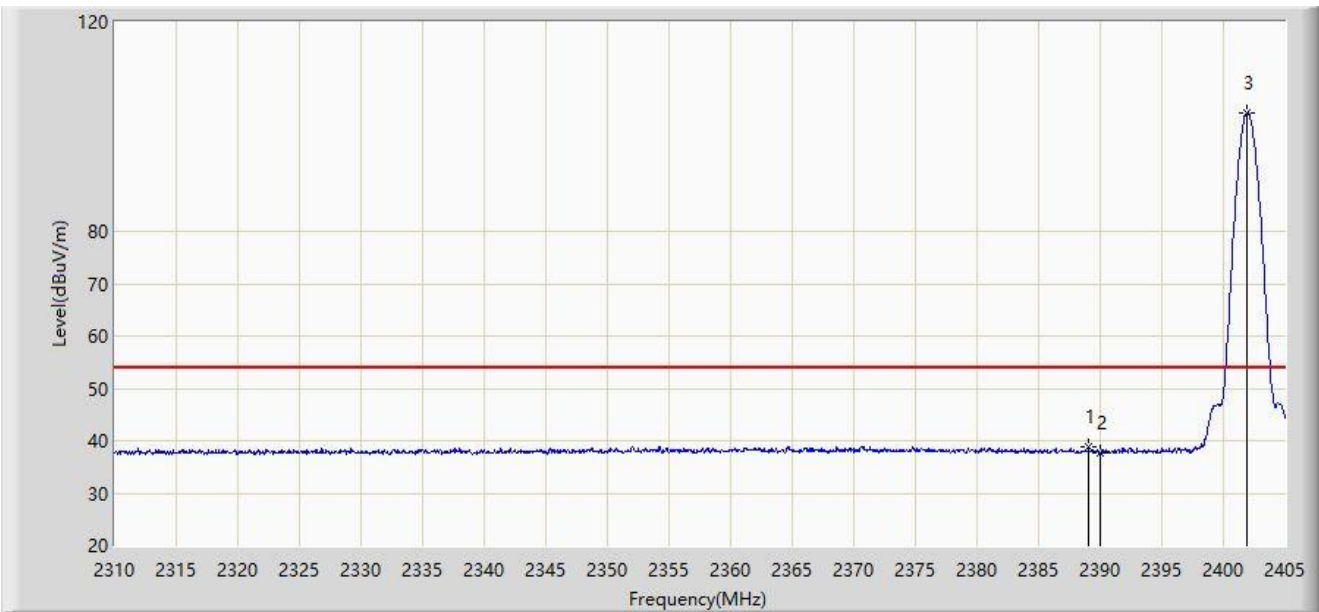
No	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Margin (dB)	Limit (dB $\mu$ V/m)	Factor (dB/m)	Type
1	*	2383.910	56.964	25.311	-17.036	74.000	31.652	PK
2		2390.000	51.774	20.159	-22.226	74.000	31.615	PK
3		2401.675	98.822	67.271	N/A	N/A	31.551	PK

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	Time: 2023/05/20 - 12:52
Limit: FCC_2.4G_RE(3m)	Engineer: Ajin Fan
Probe: BBHA9120D_1457_1-18GHz	Polarity: Horizontal
EUT: Smart Installation Tool	Power: By Battery
Test Mode: Transmit by BLE 1M at 2402MHz	



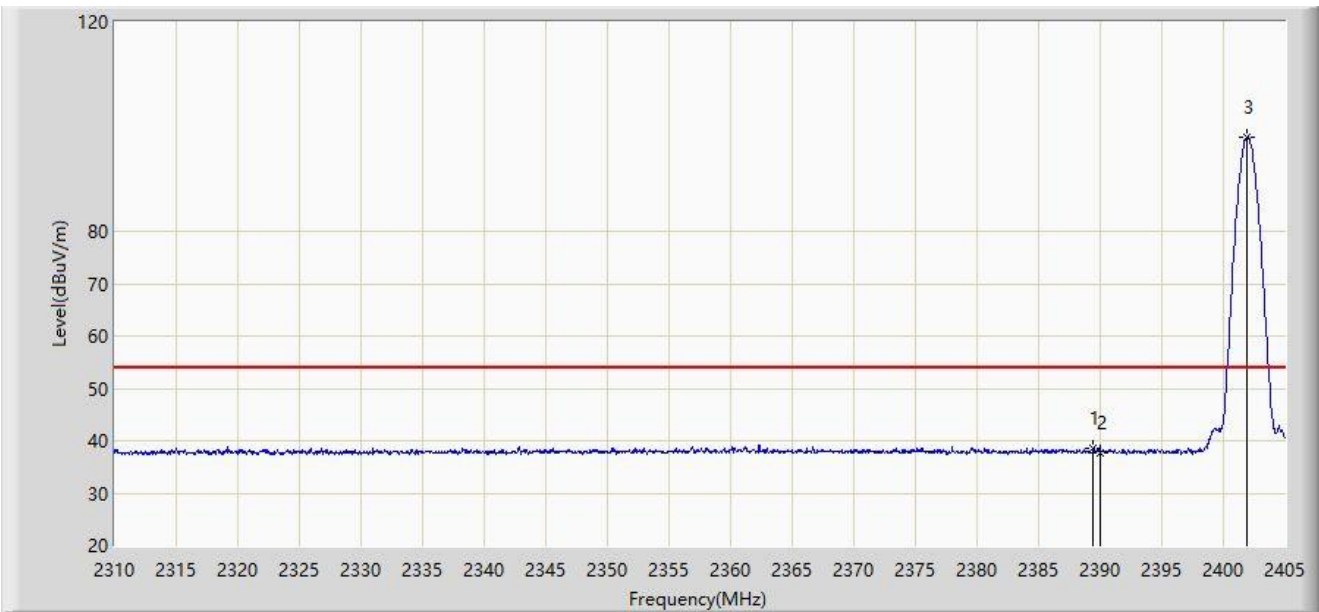
No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1	*	2389.040	38.818	7.197	-15.182	54.000	31.621	AV
2		2390.000	37.735	6.120	-16.265	54.000	31.615	AV
3		2401.913	102.553	71.003	N/A	N/A	31.550	AV

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).

Site: WZ-AC2	Time: 2023/05/20 - 12:56
Limit: FCC_2.4G_RE(3m)	Engineer: Ajin Fan
Probe: BBHA9120D_1457_1-18GHz	Polarity: Vertical
EUT: Smart Installation Tool	Power: By Battery
Test Mode: Transmit by BLE 1M at 2402MHz	



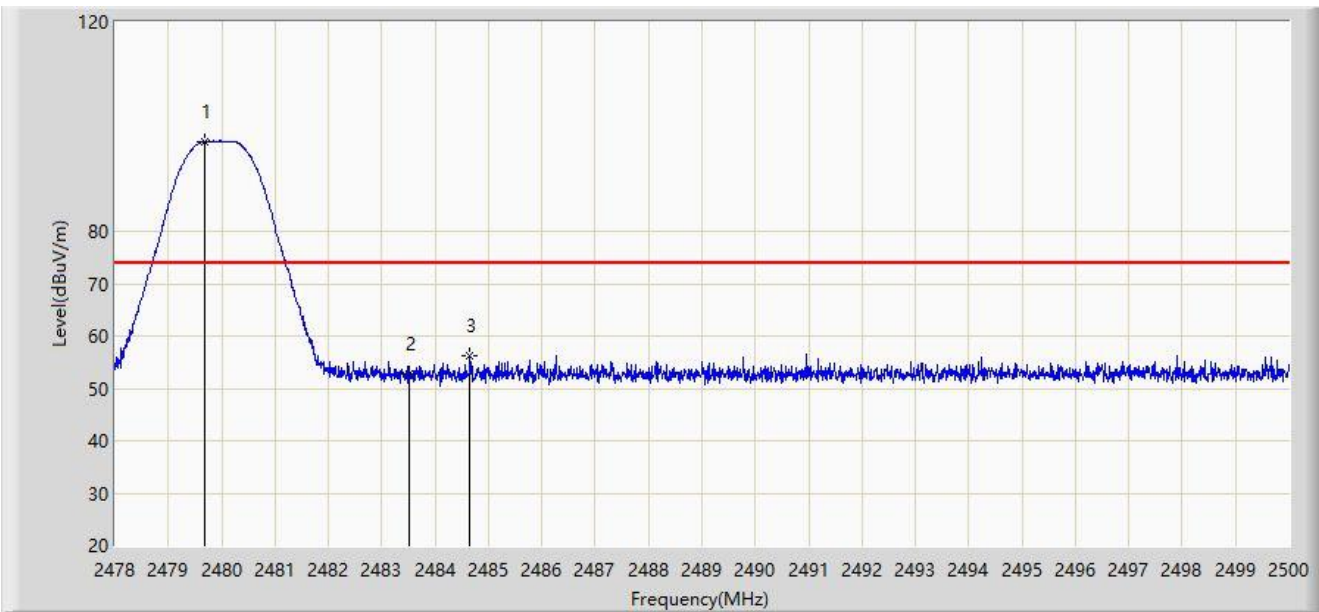
No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1	*	2389.420	38.437	6.818	-15.563	54.000	31.618	AV
2		2390.000	37.668	6.053	-16.332	54.000	31.615	AV
3		2401.865	97.921	66.371	N/A	N/A	31.550	AV

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).

Site: WZ-AC2	Time: 2023/05/20 - 12:57
Limit: FCC_2.4G_RE(3m)	Engineer: Ajin Fan
Probe: BBHA9120D_1457_1-18GHz	Polarity: Horizontal
EUT: Smart Installation Tool	Power: By Battery
Test Mode: Transmit by BLE 1M at 2480MHz	



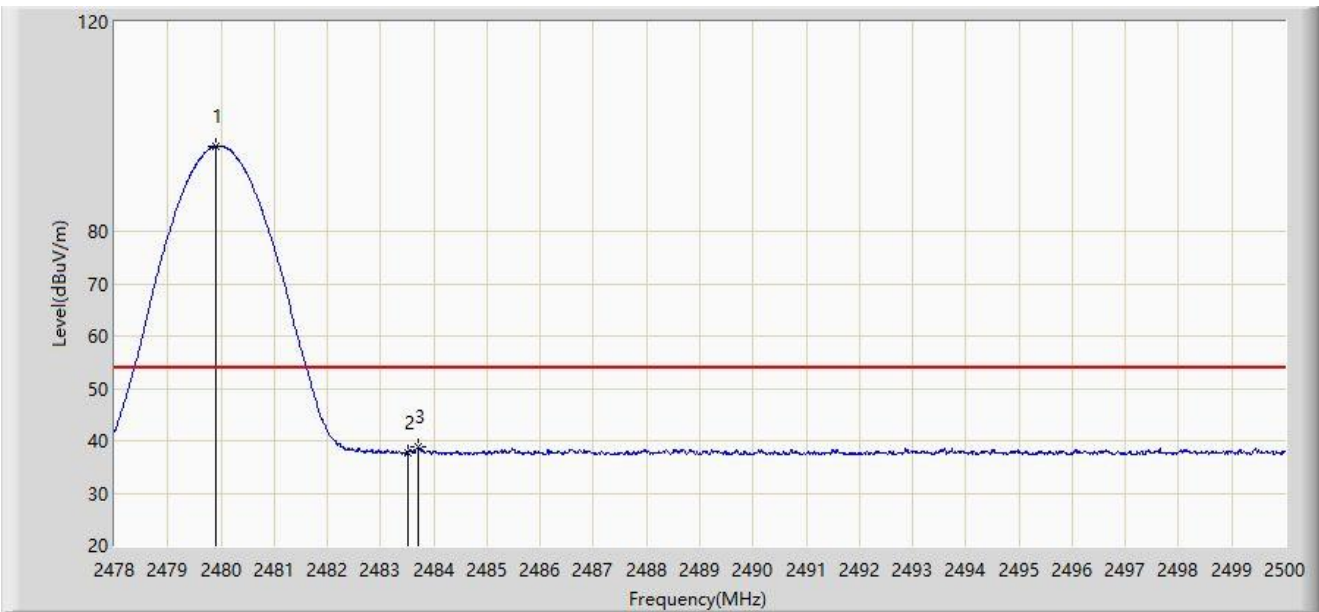
No	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Margin (dB)	Limit (dB $\mu$ V/m)	Factor (dB/m)	Type
1		2479.672	97.189	65.690	N/A	N/A	31.499	PK
2		2483.500	52.777	21.277	-21.223	74.000	31.500	PK
3	*	2484.655	56.341	24.840	-17.659	74.000	31.501	PK

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	Time: 2023/05/20 - 13:10
Limit: FCC_2.4G_RE(3m)	Engineer: Ajin Fan
Probe: BBHA9120D_1457_1-18GHz	Polarity: Horizontal
EUT: Smart Installation Tool	Power: By Battery
Test Mode: Transmit by BLE 1M 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		2479.914	96.252	64.753	N/A	N/A	31.499	AV
2		2483.500	37.812	6.312	-16.188	54.000	31.500	AV
3	*	2483.709	38.817	7.316	-15.183	54.000	31.501	AV

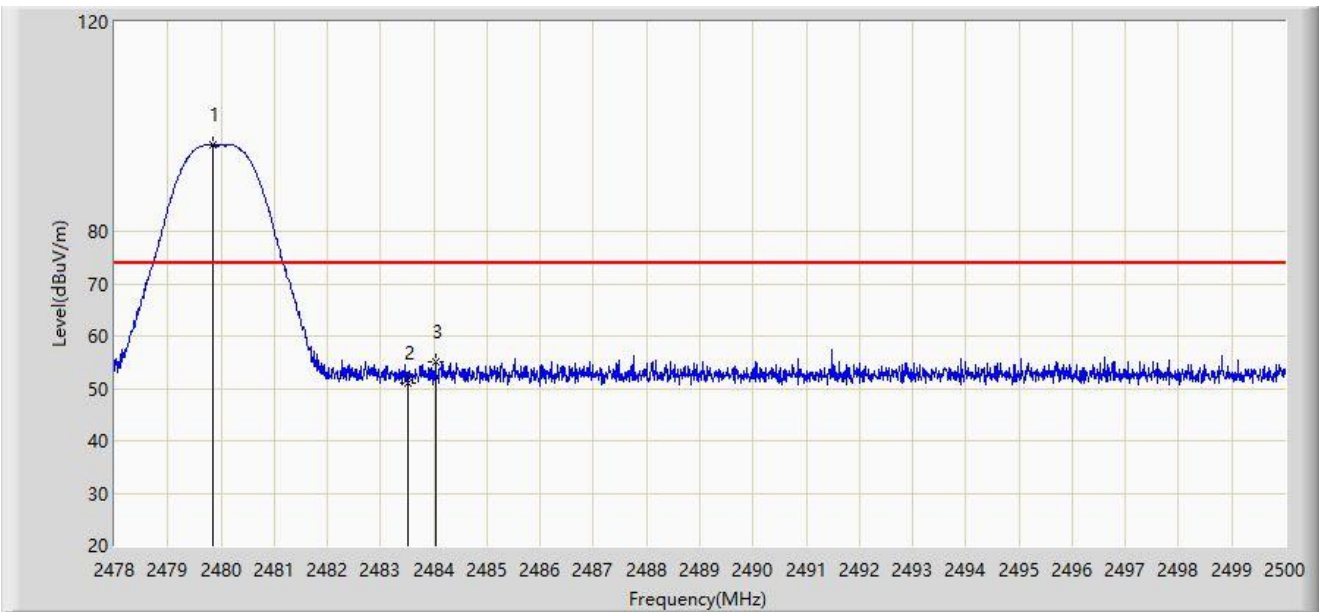
Note 1: " \* ", means this data is the worst emission level.

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	Time: 2023/05/20 - 13:09
Limit: FCC_2.4G_RE(3m)	Engineer: Ajin Fan
Probe: BBHA9120D_1457_1-18GHz	Polarity: Vertical
EUT: Smart Installation Tool	Power: By Battery
Test Mode: Transmit by BLE 1M at 2480MHz	



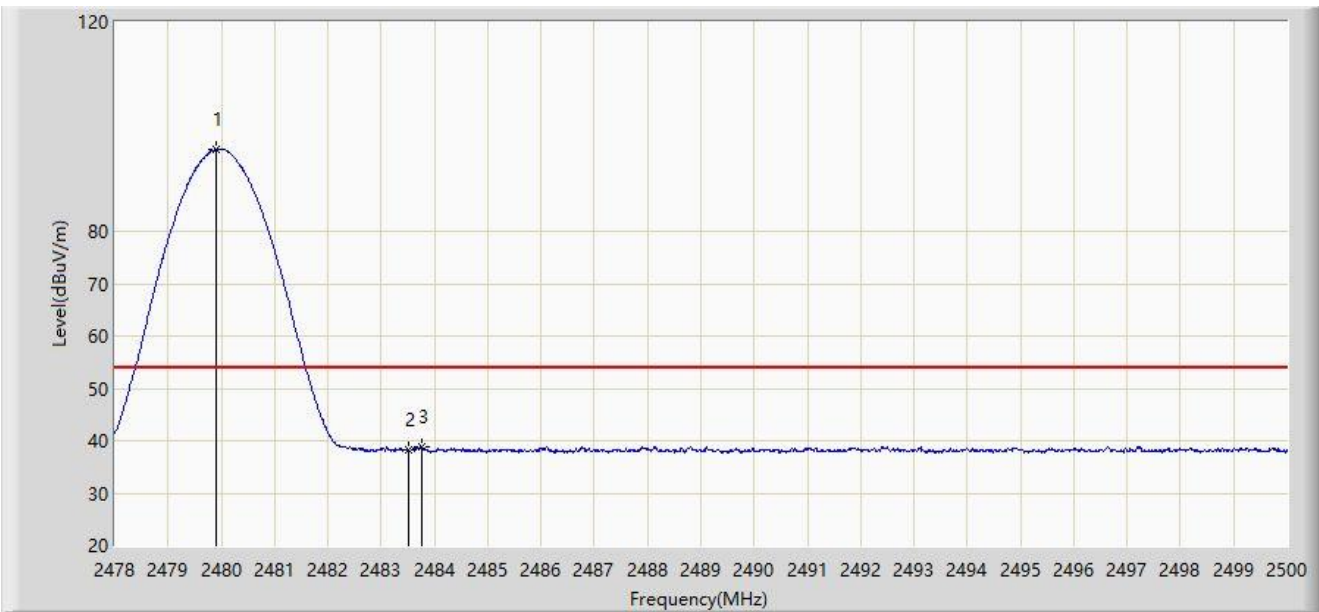
No	Mark	Frequency (MHz)	Measure Level (dB $\mu$ V/m)	Reading Level (dB $\mu$ V)	Margin (dB)	Limit (dB $\mu$ V/m)	Factor (dB/m)	Type
1		2479.848	96.567	65.068	N/A	N/A	31.499	PK
2		2483.500	51.044	19.544	-22.956	74.000	31.500	PK
3	*	2484.039	55.097	23.596	-18.903	74.000	31.501	PK

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	Time: 2023/05/20 - 13:12
Limit: FCC_2.4G_RE(3m)	Engineer: Ajin Fan
Probe: BBHA9120D_1457_1-18GHz	Polarity: Vertical
EUT: Smart Installation Tool	Power: By Battery
Test Mode: Transmit by BLE 1M 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		2479.914	95.628	64.129	N/A	N/A	31.499	AV
2		2483.500	38.254	6.754	-15.746	54.000	31.500	AV
3	*	2483.753	38.841	7.340	-15.159	54.000	31.501	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).

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

Refer to "2304RSU026-UT" file.

## Appendix C - EUT Photograph

Refer to "2304RSU026-UE" file.

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