



RF MEASUREMENT REPORT

FCC ID: HD5-HONSR28PRT

Applicant: Honeywell International In
Honeywell Safety and Productivity Solutions

Product: Wireless Module

Model No.: HON-SR28-PRT, HON-SR28-BT

Brand Name: Honeywell

FCC Classification: Digital Transmission System (DTS)

FCC Rule Part(s): Part 15 Subpart C (Section 15.247)

Result: Complies

Received Date: 2023-08-04

Test Date: 2023-08-08 ~ 2023-08-13

Reviewed By:

Jame Yuan

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 (Shenzhen) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2305RSU049-U1	V01	Initial Report	2023-08-15	Invalid
2305RSU049-U1	V02	Update Bluetooth version	2023-08-25	Valid

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1. General Information

1.1. Applicant

Honeywell International In

Honeywell Safety and Productivity Solutions

9680 Old Bailes Rd. Fort Mill, SC 29707 United States

1.2. Manufacturer

Honeywell International In

Honeywell Safety and Productivity Solutions

9680 Old Bailes Rd. Fort Mill, SC 29707 United States

1.3. Testing Facility

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

1.4. Product Information

Product Name	Wireless Module
Model No.	HON-SR28-PRT, HON-SR28-BT
EUT Identification No.	20230804Sample#01 (for Conducted) 20230804Sample#03 (for Radiated)
Wi-Fi Specification	802.11a/b/g/n/ac
Bluetooth Specification	v5.0, dual mode
Note 1: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer. Note 2: HON-SR28-PRT and HON-SR28-BT are identical in hardware. The only difference is HON-SR28-BT disable Wi-Fi via software.	

1.5. Radio Specification under Test

Bluetooth Frequency	2402 ~ 2480MHz
Channel Number	40
Type of modulation	GFSK
Data Rate	1Mbps
Antenna Type	FPC Antenna
Antenna Gain	4.2dBi

1.6. Working Frequencies

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

2. Test Configuration

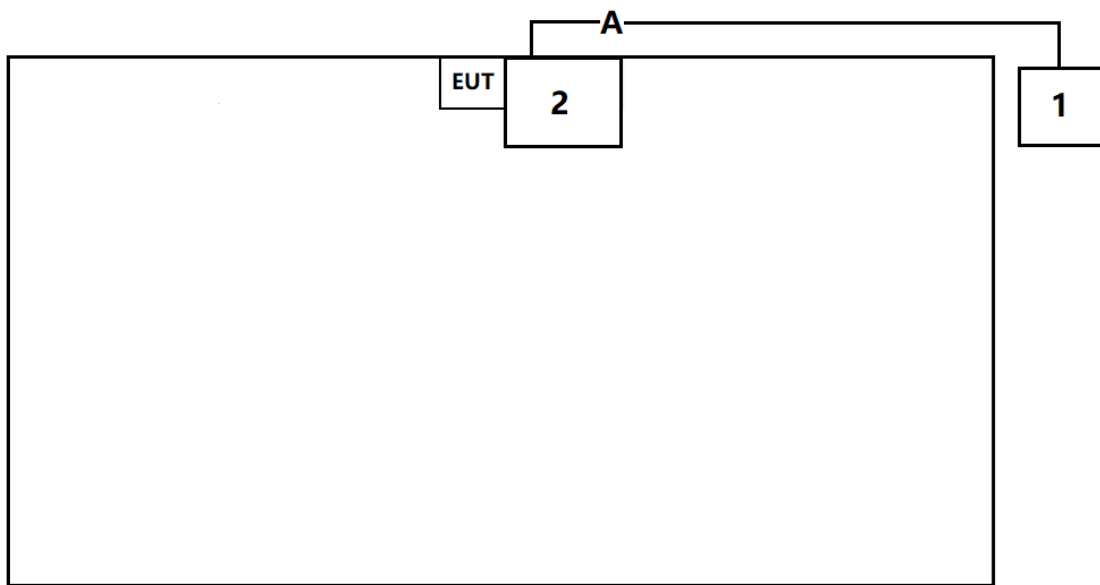
2.1. Test Mode

Mode 1: Transmit by BLE-1Mbps

2.2. Test System Connection Diagram

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

Connection Diagram



Cable Type		Cable Spec	Length
A	Power Cable	Non-Shielded	> 10.0m
No	Product	Manufacturer	Model No.
1	Notebook (for RF Test)	Hp	735G5
2	Test Fixture	Honeywell	N/A

2.3. Test Software

The test utility software used during testing was “Putty”, and the version was 0.78.

2.4. Applied Standards

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

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

2.5. Test Environment Condition

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

3. Antenna Requirements

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

The Bluetooth antenna of the device uses a unique IPEX connector.

Conclusion:

The unit complies with the requirement of §15.203.

4. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
TRILOG Antenna	Sunol Sciences Corp.	JB1	MRTSUE06021	1 year	2024-04-09	NS-AC1
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06292	1 year	2023-10-18	NS-AC1
Anechoic Chamber	BOOMWAVE	NS-AC1	MRTSUE06496	1 year	2024-07-12	NS-AC1
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06572	1 year	2024-03-31	NS-AC1
TRILOG Antenna	Schwarzbeck	VULB 9162	MRTSUE06573	1 year	2024-06-09	NS-AC1
Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06574	1 year	2024-07-07	NS-AC1
EMI Test Receiver	R&S	ESR3	MRTSUE06575	1 year	2024-06-18	NS-AC1
Preamplifier	EMCI	EMC184045SE	MRTSUE06641	1 year	2024-01-12	NS-AC1
Thermohygrometer	testo	608-H1	MRTSUE11020	1 year	2024-05-03	NS-AC1
Thermohygrometer	testo	608-H1	MRTSUE11104	1 year	2024-05-03	NS-AC1
Signal Analyzer	Agilent	N9010A	MRTSUE06195	1 year	2023-12-20	NS-AC1/NS-TR2
Signal Analyzer	Keysight	N9020A	MRTSUE10065	1 year	2023-12-20	NS-AC1/NS-TR2
Signal Generator	Agilent	E4438C	MRTSUE06026	1 year	2024-06-30	NS-SR2
Shielding Room	BOOMWAVE	NS-SR2	MRTSUE06551	5 years	2024-06-03	NS-SR2
EMI Test Receiver	R&S	ESL3	MRTSUE06576	1 year	2024-06-18	NS-SR2
Two-Line V-Network	R&S	ENV216	MRTSUE06577	1 year	2024-04-25	NS-SR2
Two-Line V-Network	R&S	ENV216	MRTSUE06578	1 year	2024-04-25	NS-SR2
ISN	R&S	ENY81	MRTSUE06579	1 year	2024-06-12	NS-SR2
ISN	R&S	ENY81-CA6	MRTSUE06580	1 year	2024-05-24	NS-SR2
Thermohygrometer	testo	608-H1	MRTSUE11106	1 year	2024-05-03	NS-SR2
USB Power Sensor	Keysight	U2021XA	MRTSUE06581	1 year	2024-06-30	NS-TR2
Thermohygrometer	DELI	NO.8813	MRTSUE06783	1 year	2023-12-28	NS-TR2
Temperature Chamber	OUKE	OK-TH-100C	MRTSUE06899	1 year	2024-04-25	NS-TR2
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2023-12-28	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11039	1 year	2023-11-01	WZ-AC1
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2023-09-29	WZ-AC1/WZ-AC2

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Agilent Power Panel	V 3.9	Power
Controller_T-E-TAC-2	1.02	RE Antenna & Turntable
Controller_MF 7802	2.03C	RE Antenna & Turntable

5. Decision Rules and Measurement Uncertainty

5.1. Decision Rules

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

5.2. Measurement Uncertainty

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

AC Conducted Emission Measurement
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 9kHz~150kHz: 3.58dB 150kHz~30MHz: 3.20dB
Radiated Disturbance
Measurement Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 9kHz~30MHz: 2.60dB 30MHz~200MHz: 4.06dB 200MHz~1GHz: 5.28dB 1GHz~40GHz: 4.98dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 2.3dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 1.5dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 2.3dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 3.2%

6. Test Result

6.1. Summary

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

Note:

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. 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.

6.2. 6dB Bandwidth Measurement

6.2.1. Test Limit

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

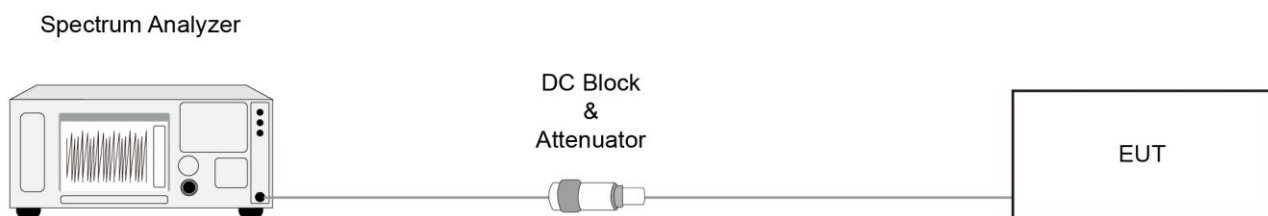
6.2.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.8

6.2.3. Test Setting

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

6.2.4. Test Setup



6.2.5. Test Result

Refer to Appendix A.2.

6.3. Output Power Measurement

6.3.1. Test Limit

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

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

6.3.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.9.1.3

ANSI C63.10 - 2013 - Section 11.9.2.3.2

6.3.3. Test Setting

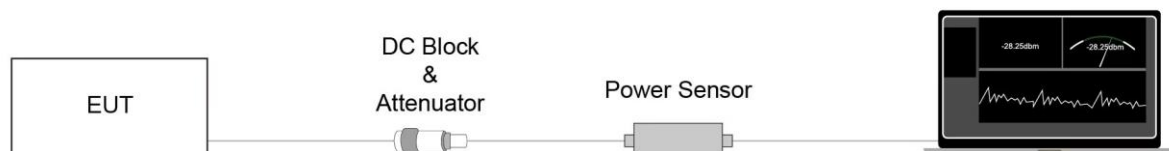
Method PKPM1 (Peak Power Measurement of Signals with DTS BW $\leq$ 50MHz)

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

Average Power Measurement

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

6.3.4. Test Setup



6.3.5. Test Result

Refer to Appendix A.3.

6.4. Power Spectral Density Measurement

6.4.1. Test Limit

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

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

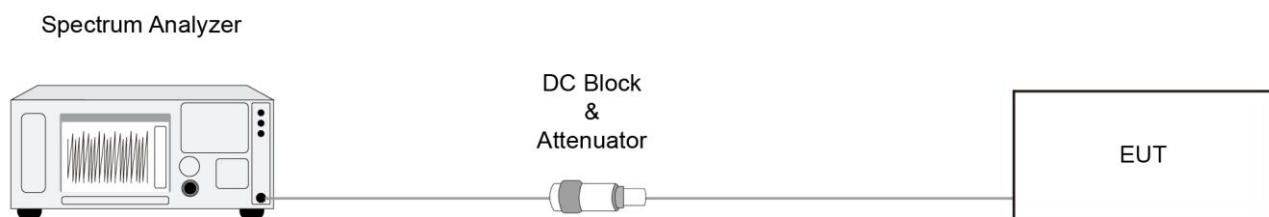
6.4.2. Test Procedure

ANSI C63.10-2013 Section 11.10.2

6.4.3. Test Setting

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

6.4.4. Test Setup



6.4.5. Test Result

Refer to Appendix A.4.

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

6.5.1. Test Limit

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

6.5.2. Test Procedure

ANSI C63.10-2013 - Section 11.11

6.5.3. Test Setting

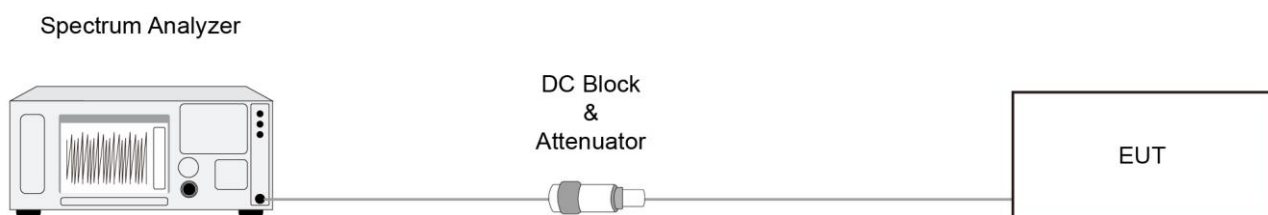
Reference level measurement

1. Set instrument center frequency to DTS channel center frequency
2. Set the span to ≥ 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 ≥ 300 kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

6.5.4. Test Setup



6.5.5. Test Result

Refer to Appendix A.5.

6.6. Radiated Spurious Emission Measurement

6.6.1. Test Limit

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

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [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

6.6.2. Test Procedure

ANSI C63.10 - 2013 - Section 11.11 & 11.12

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

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

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

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

6.6.3. Test Setting

Table 1 - RBW as a function of frequency

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

Quasi-Peak Measurements below 1GHz

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

Peak Measurements above 1GHz

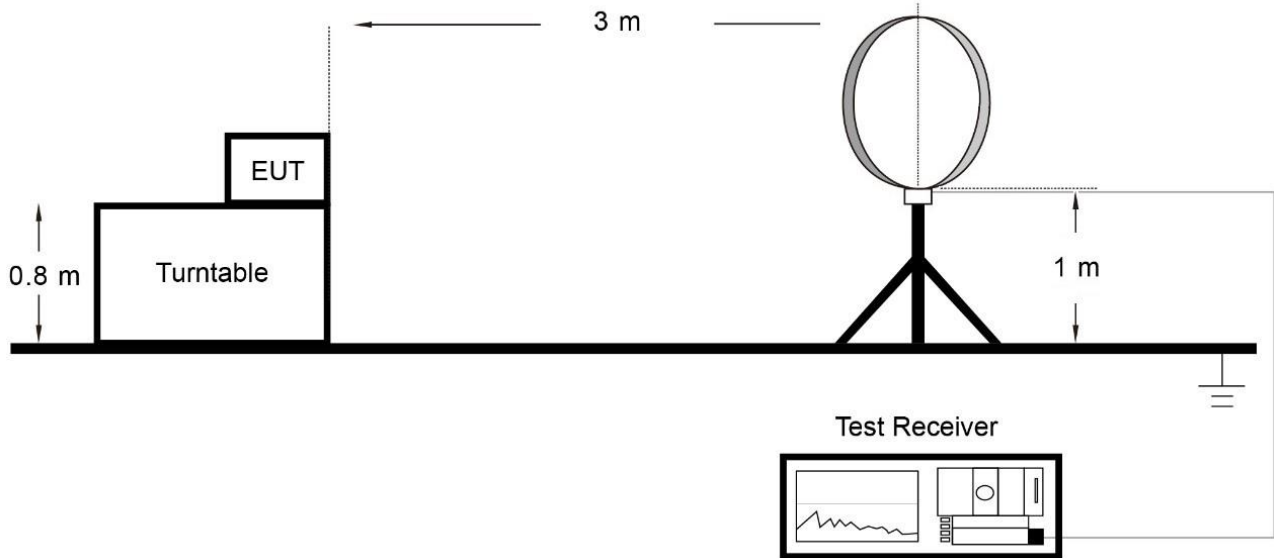
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

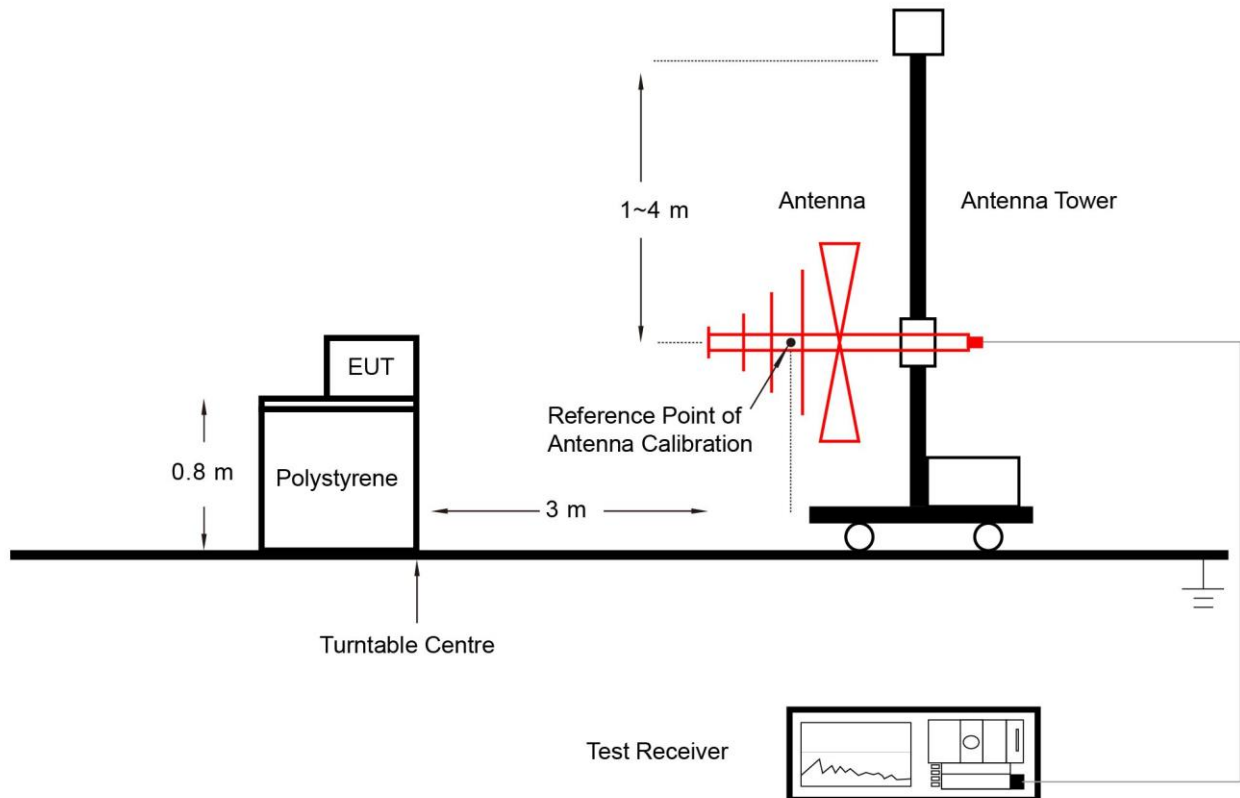
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW = 10 Hz.
If the EUT duty cycle is $< 98\%$, set VBW $\geq 1/T$. T is the minimum transmission duration.
4.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

6.6.4. Test Setup

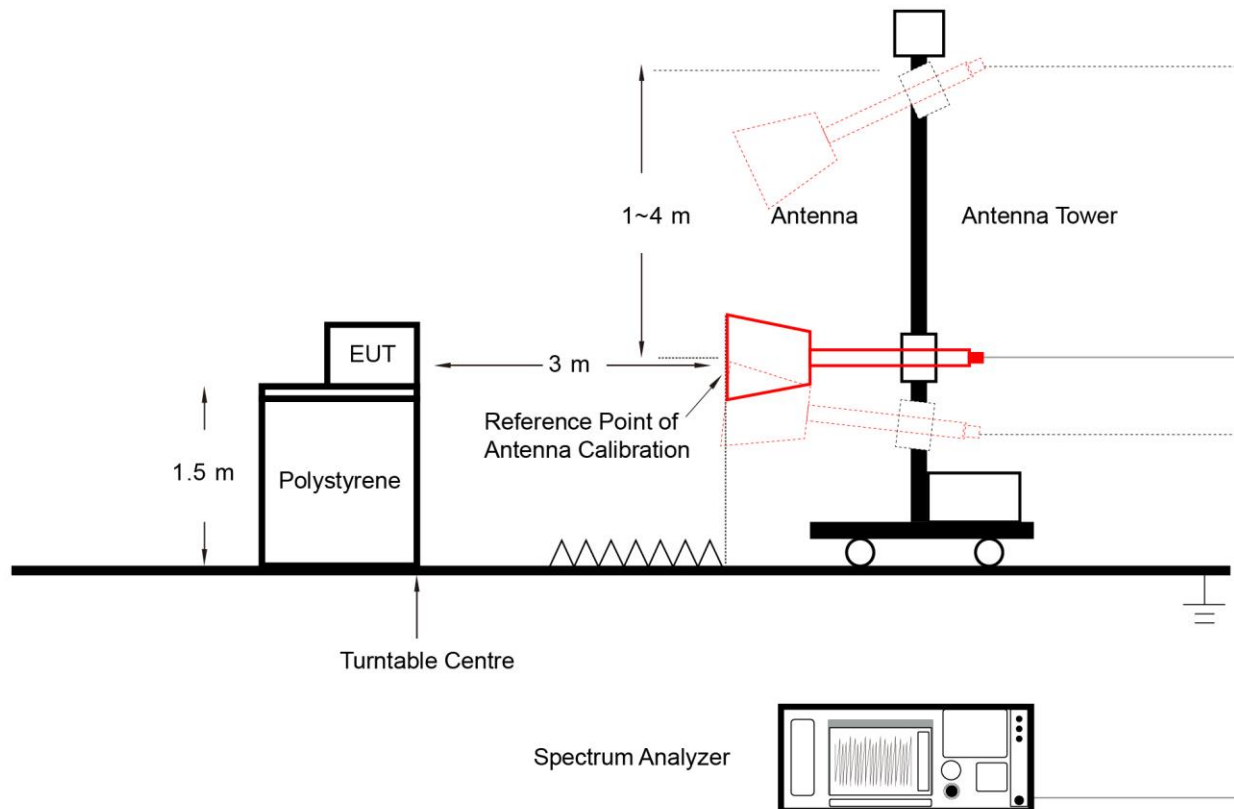
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



6.6.5. Test Result

Refer to Appendix A.6.

6.7. Radiated Restricted Band Edge Measurement

6.7.1. Test Limit

For 15.205 requirement:

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

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

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

6.7.2. Test Procedure

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

6.7.3. Test Setting

Peak Field Strength Measurements

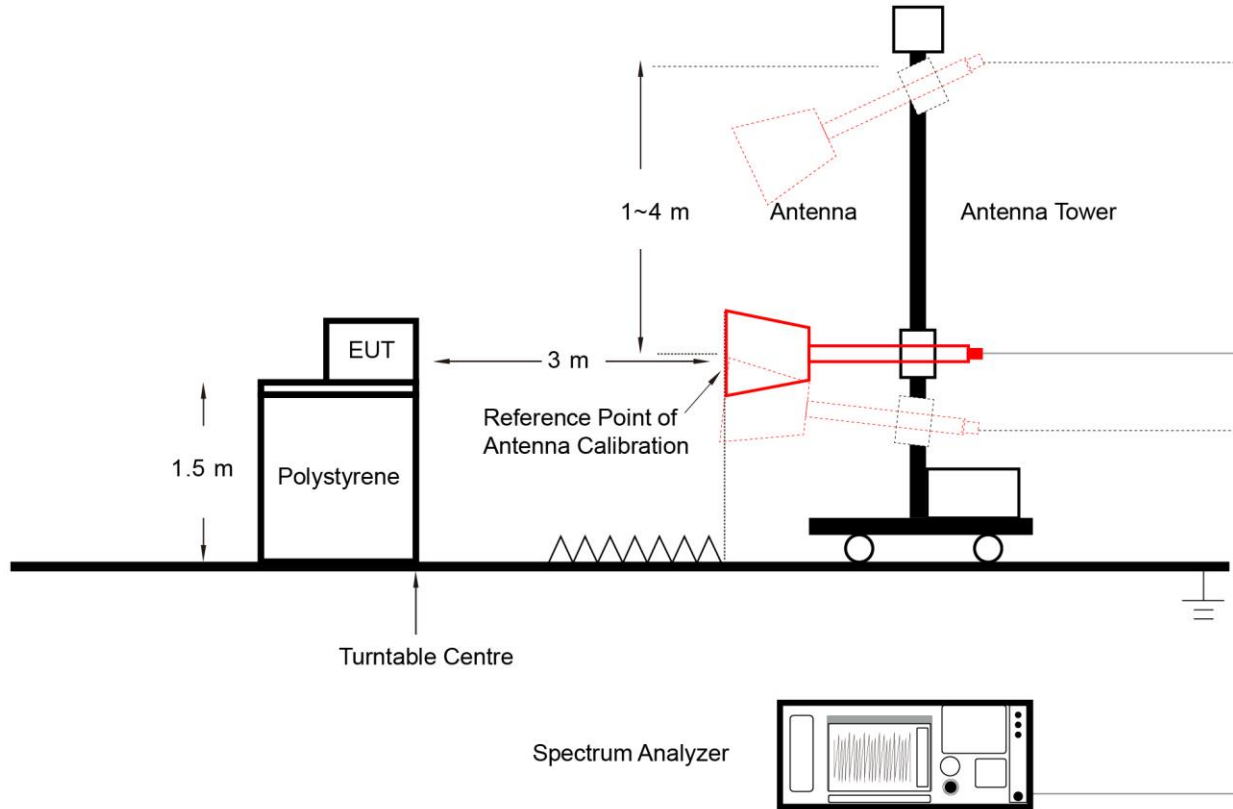
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW $\geq 1/T$
4. As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
5. Detector = Peak

6. Sweep time = auto
7. Trace mode = max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

6.7.4. Test Setup



6.7.5. Test Result

Refer to Appendix A.7.

6.8. AC Conducted Emissions Measurement

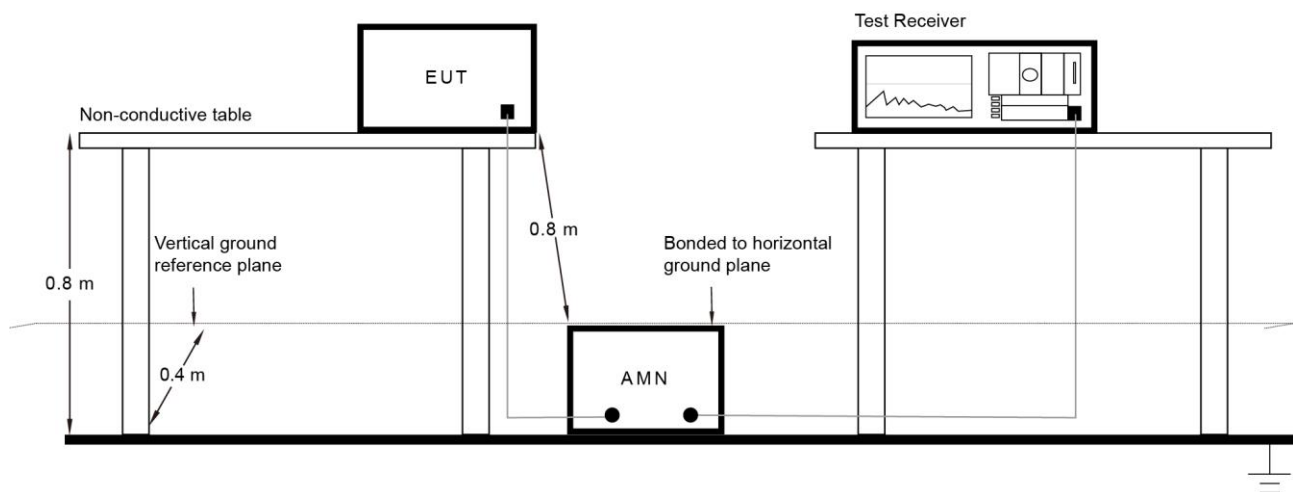
6.8.1. Test Limit

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



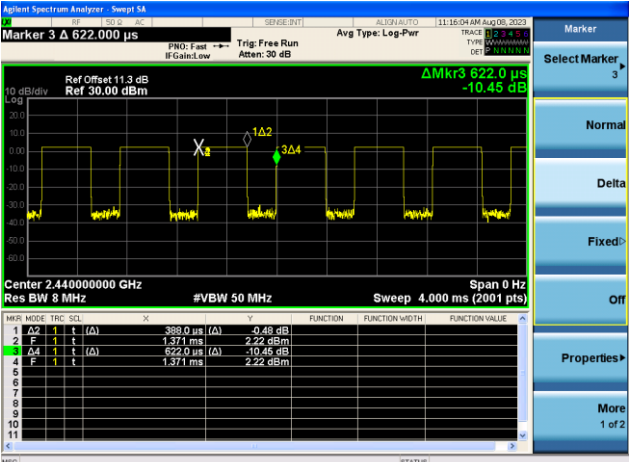
6.8.3. Test Result

Refer to Appendix A.8.

Appendix A - Test Result

A.1 Duty Cycle Test Result

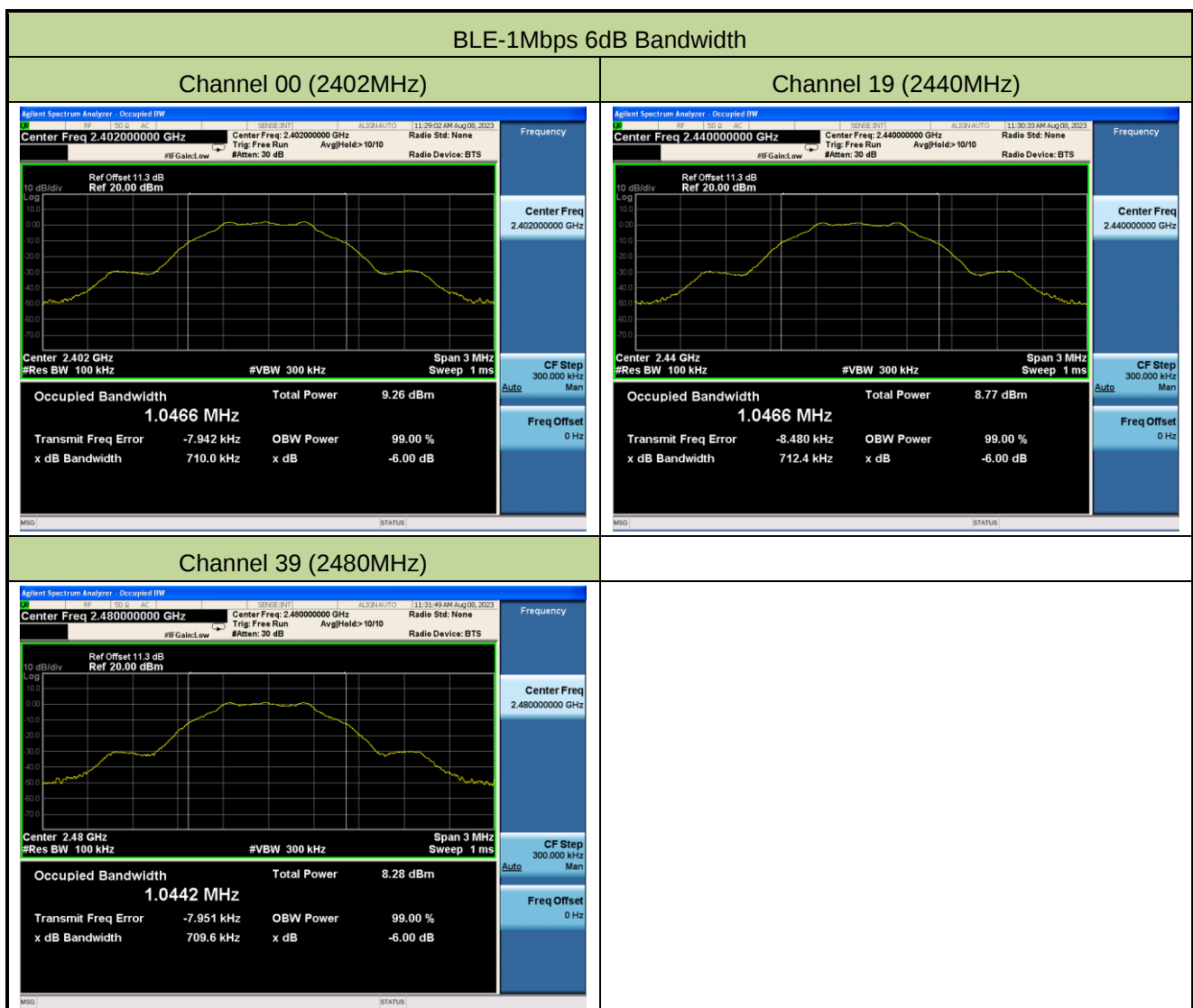
Test Site	NS-TR2	Test Engineer	Summer Tang
Test Date	2023-08-08		

Test Mode	Duty Cycle
BLE-1Mbps	62.38%
Duty Cycle (T = Transmission Duration)	
BLE-1Mbps (T = 388.0µs)	
	

A.2 6dB Bandwidth Test Result

Test Site	NS-TR2	Test Engineer	Summer Tang
Test Date	2023-08-08		

Test Mode	Data Rate	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
BLE	1Mbps	00	2402	0.7100	≥ 0.5
BLE	1Mbps	19	2440	0.7124	≥ 0.5
BLE	1Mbps	39	2480	0.7096	≥ 0.5



A.3 Output Power Test Result

Test Site	NS-TR2	Test Engineer	Summer Tang
Test Date	2023-08-08		

Test Result of Peak Output Power

Test Mode	Data Rate	Channel No.	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Result
BLE	1Mbps	00	2402	3.05	≤ 30.00	Pass
BLE	1Mbps	19	2440	2.61	≤ 30.00	Pass
BLE	1Mbps	39	2480	2.21	≤ 30.00	Pass

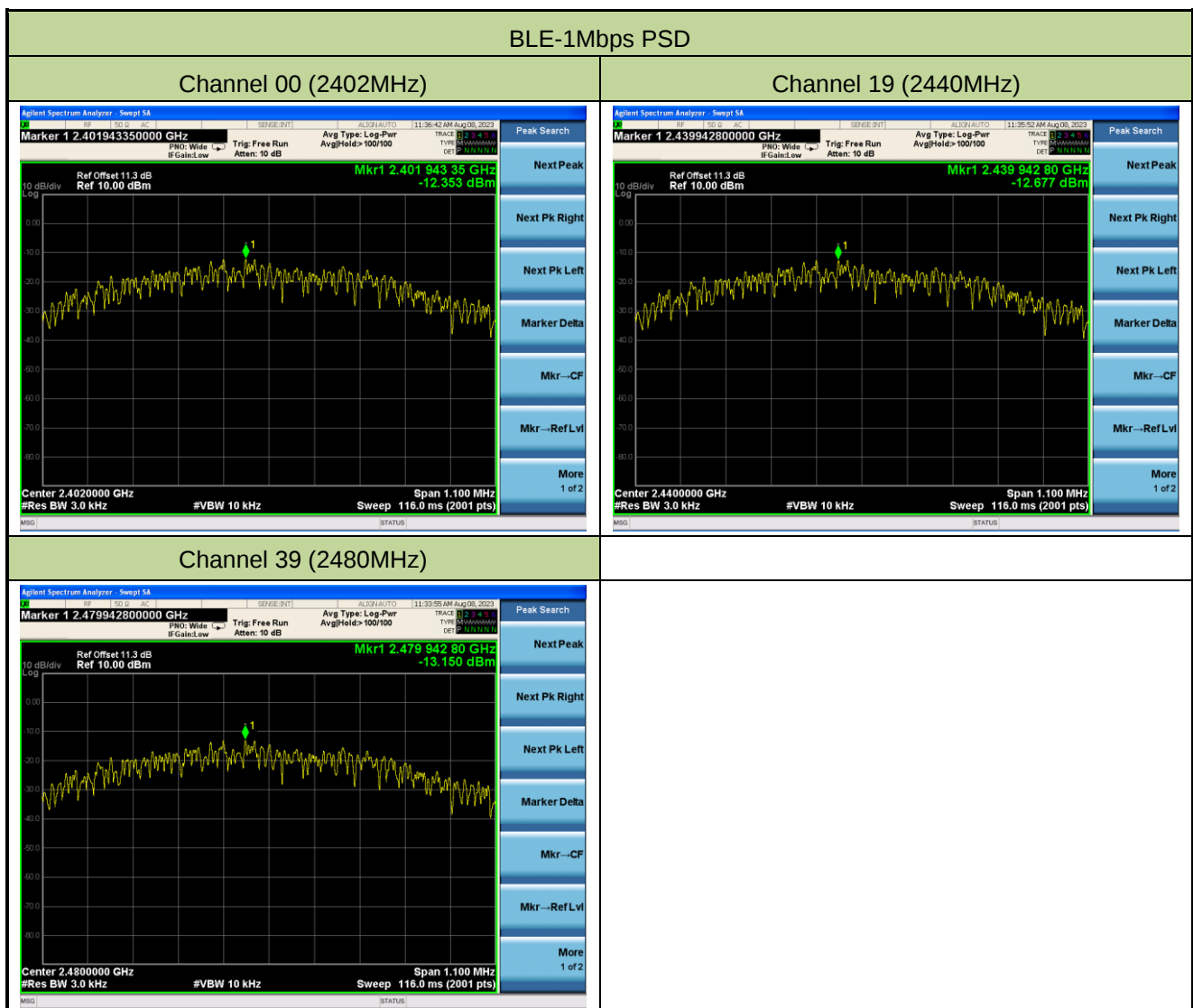
Test Result of Average Output Power (Reporting Only)

Test Mode	Data Rate	Channel No.	Frequency (MHz)	Average Power (dBm)	Limit (dBm)	Result
BLE	1Mbps	00	2402	2.88	≤ 30.00	Pass
BLE	1Mbps	19	2440	2.45	≤ 30.00	Pass
BLE	1Mbps	39	2480	1.99	≤ 30.00	Pass

A.4 Power Spectral Density Test Result

Test Site	NS-TR2	Test Engineer	Summer Tang
Test Date	2023-08-08		

Test Mode	Data Rate	Channel No.	Frequency (MHz)	PSD Result (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
BLE	1Mbps	00	2402	-12.353	≤ 8.00	Pass
BLE	1Mbps	19	2440	-12.677	≤ 8.00	Pass
BLE	1Mbps	39	2480	-13.150	≤ 8.00	Pass



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

Test Site	NS-TR2	Test Engineer	Summer Tang
Test Date	2023-08-08		

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

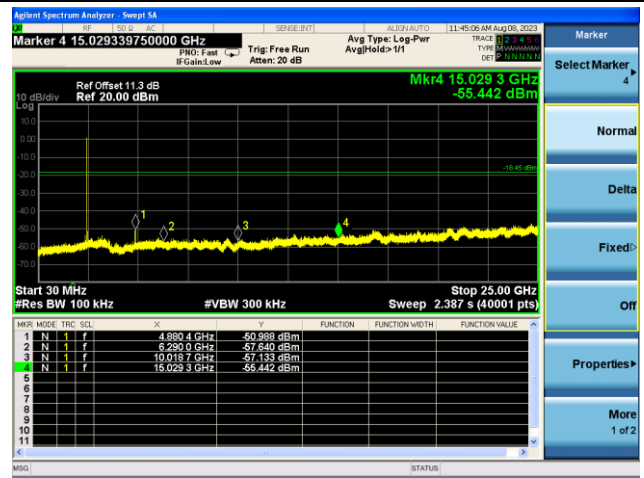


Channel 19 (2440MHz)

100kHz PSD Reference Level



Spurious Emission 30MHz ~ 25GHz

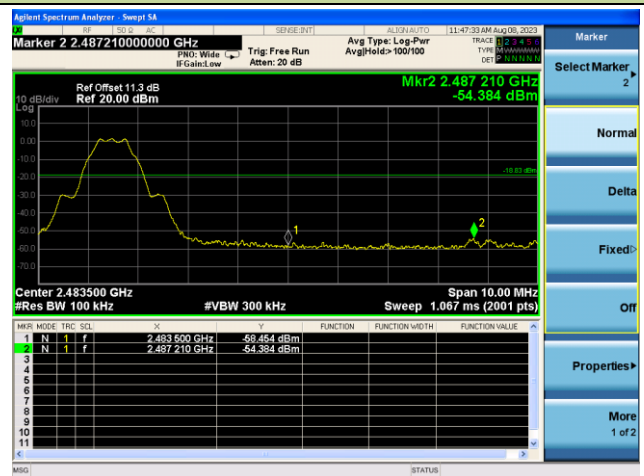


Channel 39 (2480MHz)

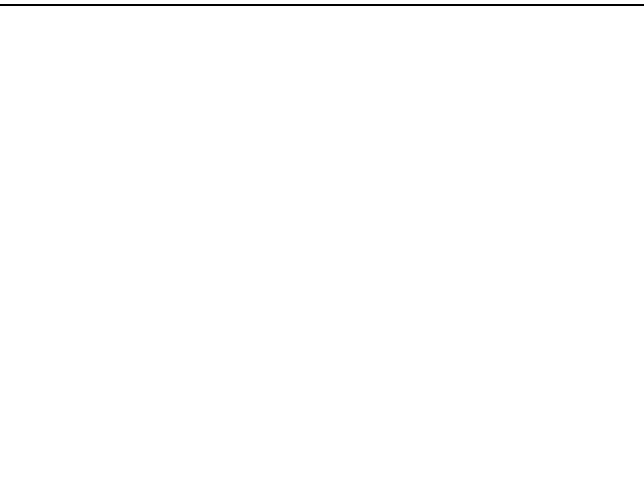
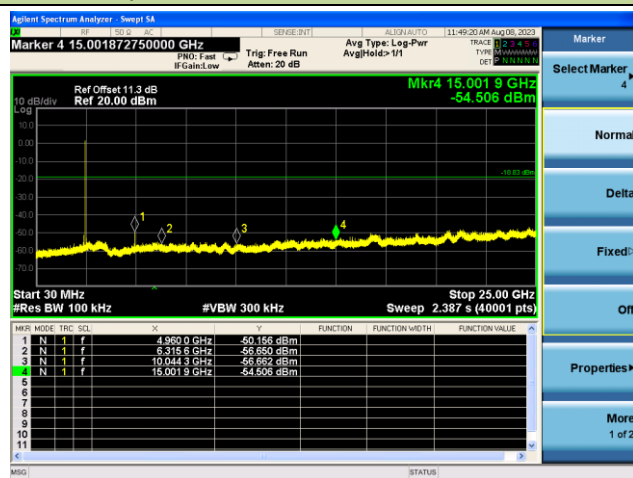
100kHz PSD Reference Level



High Band Edge



Spurious Emission 30MHz ~ 25GHz



A.6 Radiated Spurious Emission Test Result

Test Site	NS-AC1	Test Engineer	Flag Yang
Test Date	2023-08-09	Test Mode:	BLE-1Mbps
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

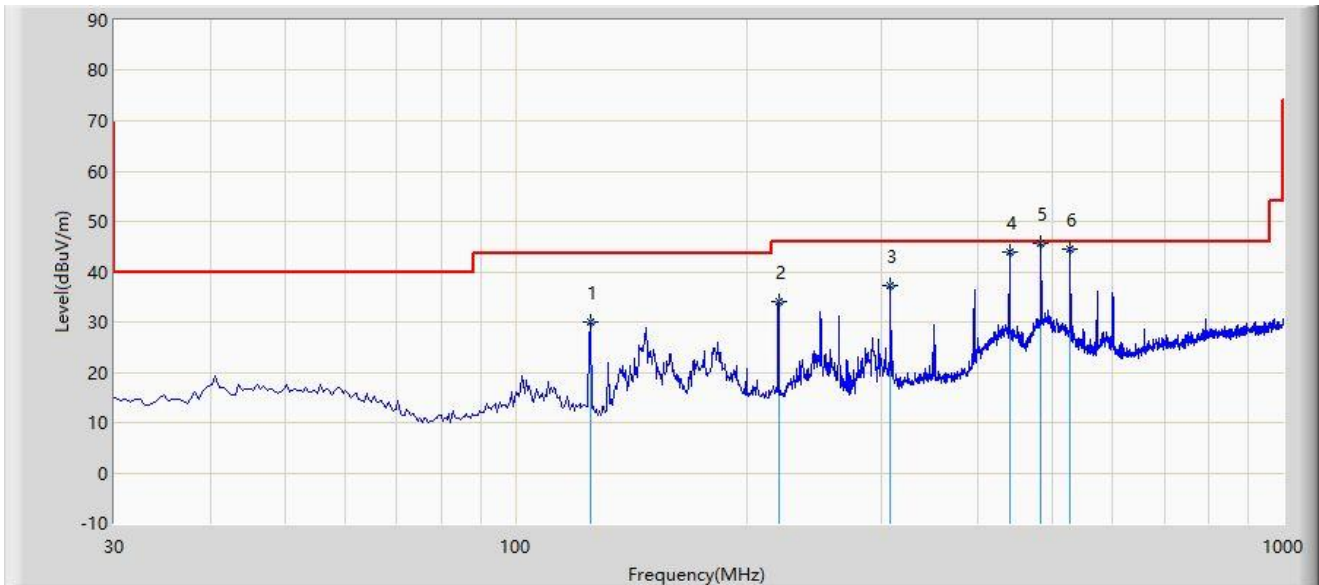
Test Channel	Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detect or	Polarization
00	4799.5	39.7	1.5	41.2	74.0	-32.8	Peak	Horizontal
	7570.5	33.2	9.7	42.9	74.0	-31.1	Peak	Horizontal
	11472.0	34.1	15.8	49.9	74.0	-24.1	Peak	Horizontal
	4808.0	37.7	1.4	39.1	74.0	-34.9	Peak	Vertical
	11489.0	33.2	15.7	48.9	74.0	-25.1	Peak	Vertical
	15773.0	31.6	16.1	47.7	74.0	-26.3	Peak	Vertical
19	4782.5	36.3	1.7	38.0	74.0	-36.0	Peak	Horizontal
	7519.5	32.3	10.0	42.3	74.0	-31.7	Peak	Horizontal
	11123.5	31.8	15.3	47.1	74.0	-26.9	Peak	Horizontal
	4663.5	35.3	1.5	36.8	74.0	-37.2	Peak	Vertical
	7579.0	32.2	9.5	41.7	74.0	-32.3	Peak	Vertical
	11540.0	30.8	15.5	46.3	74.0	-27.7	Peak	Vertical
39	4961.0	36.9	1.8	38.7	74.0	-35.3	Peak	Horizontal
	7460.0	32.8	10.3	43.1	74.0	-30.9	Peak	Horizontal
	11387.0	31.5	15.2	46.7	74.0	-27.3	Peak	Horizontal
	4604.0	34.9	1.6	36.5	74.0	-37.5	Peak	Vertical
	7519.5	33.3	10.0	43.3	74.0	-30.7	Peak	Vertical
	11021.5	31.7	15.0	46.7	74.0	-27.3	Peak	Vertical

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

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

The Result of Radiated Emission below 1GHz:

Site: NS-AC1	Test Date: 2023-08-13
Limit: FCC_Part15.209_RSE(3m)	Engineer: Flag Yang
Probe: NS-AC1_VULB9162	Polarity: Horizontal
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmitter 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		125.006	30.109	16.200	-13.391	43.500	13.909	QP
2		220.010	34.079	17.900	-11.921	46.000	16.179	QP
3		308.010	37.113	18.500	-8.887	46.000	18.613	QP
4		440.015	43.940	22.500	-2.060	46.000	21.440	QP
5	*	484.006	45.698	23.500	-0.302	46.000	22.199	QP
6		528.018	44.577	21.600	-1.423	46.000	22.977	QP

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

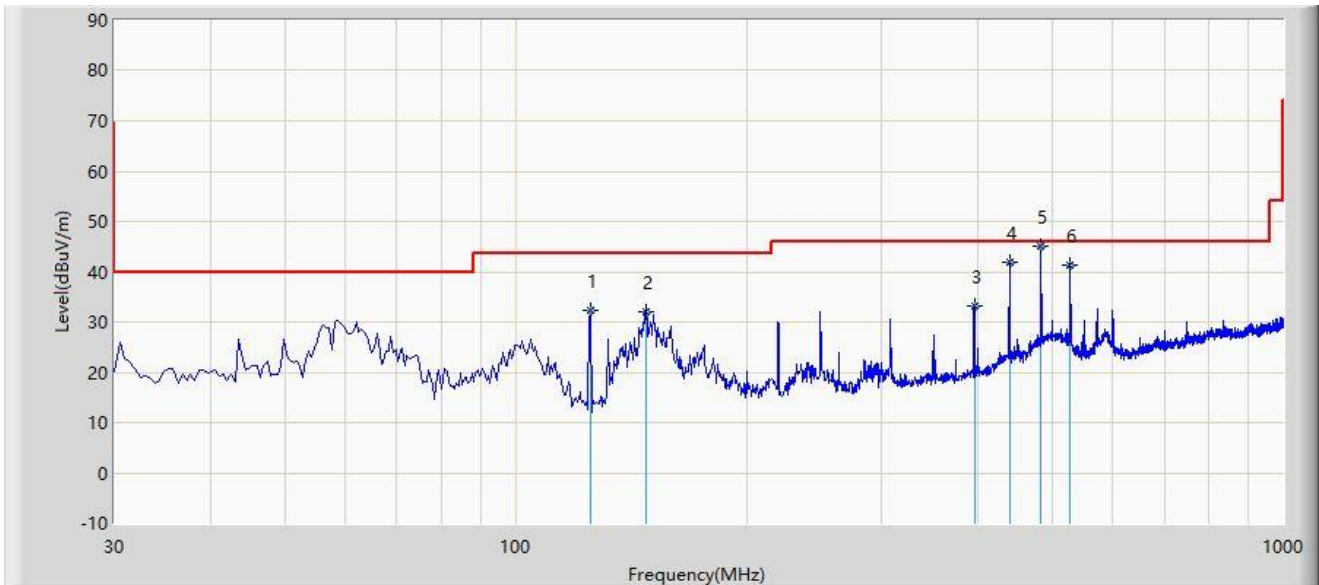
Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

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

Note 4: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz and 18GHz to 25GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value.

Therefore, the data is not presented in the report.

Site: NS-AC1	Test Date: 2023-08-13
Limit: FCC_Part15.209_RSE(3m)	Engineer: Flag Yang
Probe: NS-AC1_VULB9162	Polarity: Vertical
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmitter by BLE 1M at 2402MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB/m)	Type
1		125.010	32.209	18.300	-11.291	43.500	13.909	QP
2		148.133	32.052	19.500	-11.448	43.500	12.553	QP
3		396.002	33.063	12.000	-12.937	46.000	21.063	QP
4		440.019	41.741	20.300	-4.259	46.000	21.441	QP
5	*	484.015	45.199	23.000	-0.801	46.000	22.199	QP
6		528.016	41.177	18.200	-4.823	46.000	22.977	QP

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

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

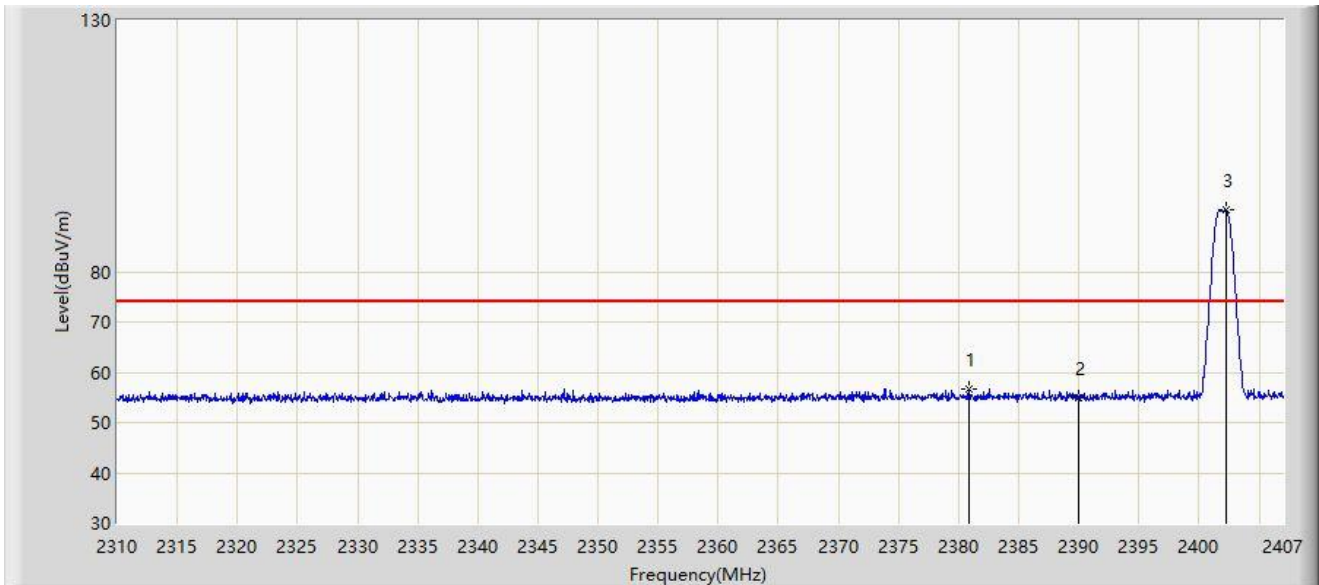
Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz and 18GHz to 25GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value.

Therefore, the data is not presented in the report.

A.7 Radiated Restricted Band Edge Test Result

Site: NS-AC1	Test Date: 2023-08-10
Limit: FCC_2.4G_RE(3m)	Engineer: Flag Yang
Probe: NS-AC1_BBHA9120D_2111_1-18GHz	Polarity: Horizontal
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmit by BLE 1M at 2402MHz	



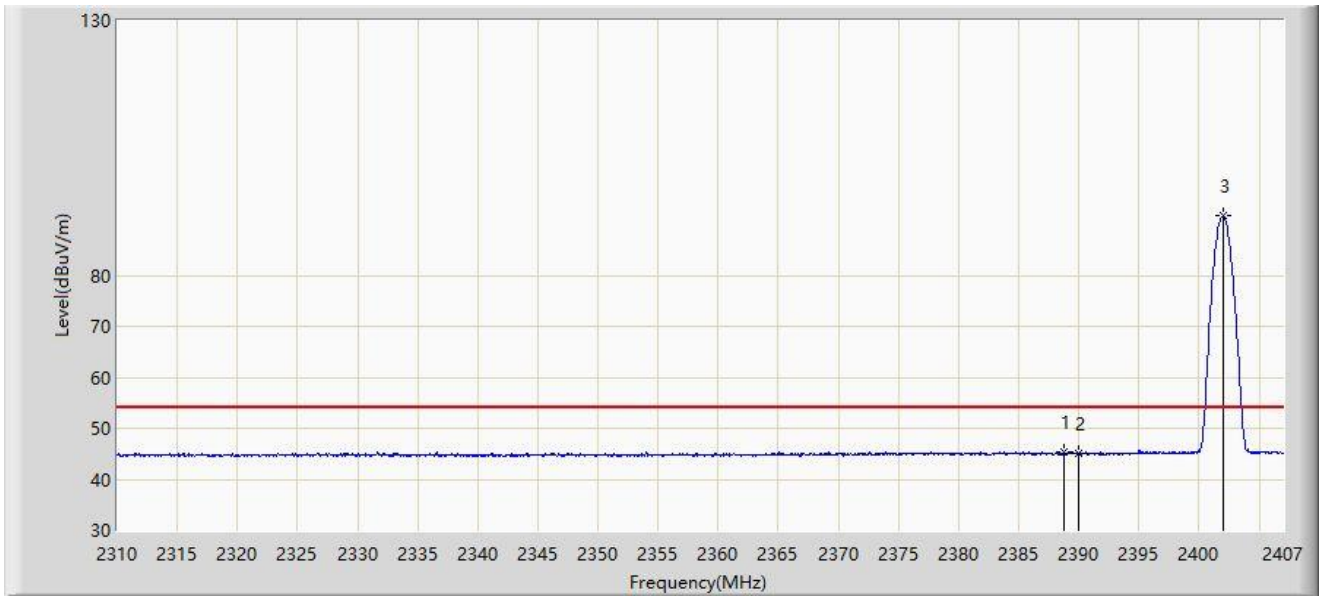
No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1	*	2380.810	56.746	25.815	-17.254	74.000	30.931	PK
2		2390.000	54.851	24.000	-19.149	74.000	30.850	PK
3		2402.247	92.272	61.433	N/A	N/A	30.839	PK

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).

Site: NS-AC1	Test Date: 2023-08-10
Limit: FCC_2.4G_RE(3m)	Engineer: Flag Yang
Probe: NS-AC1_BBHA9120D_2111_1-18GHz	Polarity: Horizontal
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmit by BLE 1M at 2402MHz	



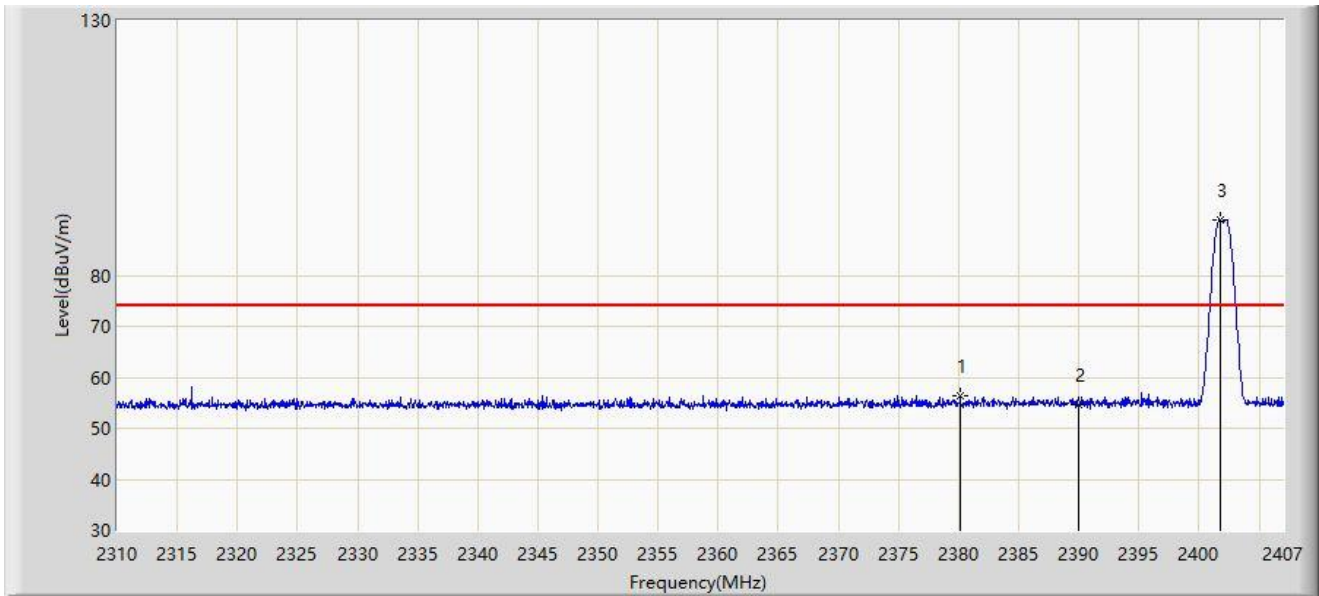
No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1	*	2388.764	45.482	14.620	-8.518	54.000	30.861	AV
2		2390.000	44.983	14.132	-9.017	54.000	30.850	AV
3		2401.956	91.611	60.773	N/A	N/A	30.839	AV

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: NS-AC1	Test Date: 2023-08-10
Limit: FCC_2.4G_RE(3m)	Engineer: Flag Yang
Probe: NS-AC1_BBHA9120D_2111_1-18GHz	Polarity: Vertical
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmit by BLE 1M at 2402MHz	



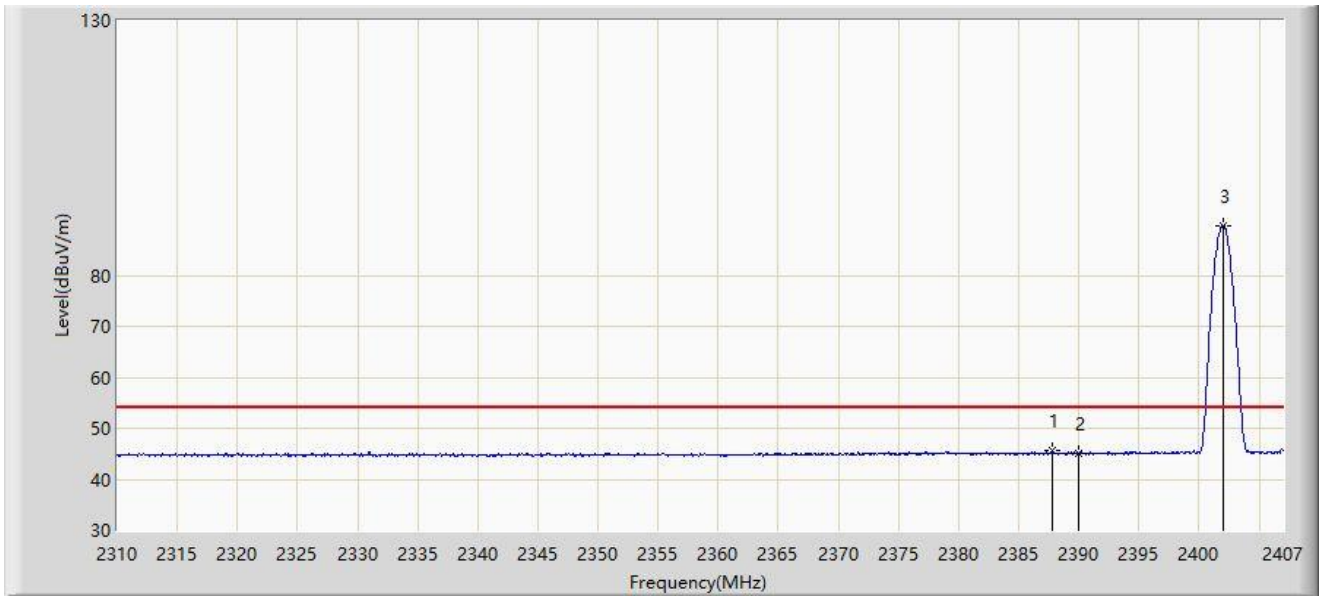
No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1	*	2380.131	56.301	25.364	-17.699	74.000	30.936	PK
2		2390.000	54.579	23.728	-19.421	74.000	30.850	PK
3		2401.713	90.892	60.054	N/A	N/A	30.837	PK

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).

Site: NS-AC1	Test Date: 2023-08-10
Limit: FCC_2.4G_RE(3m)	Engineer: Flag Yang
Probe: NS-AC1_BBHA9120D_2111_1-18GHz	Polarity: Vertical
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmit by BLE 1M at 2402MHz	



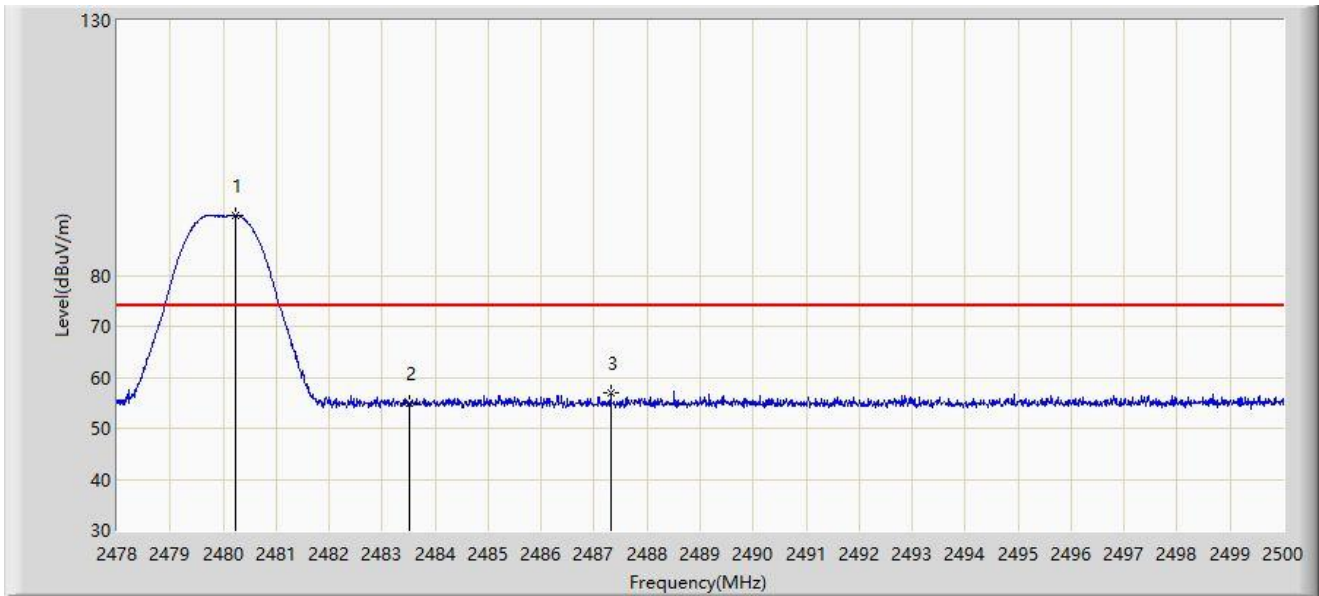
No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1	*	2387.794	45.518	14.648	-8.482	54.000	30.870	AV
2		2390.000	44.979	14.128	-9.021	54.000	30.850	AV
3		2402.053	89.825	58.986	N/A	N/A	30.839	AV

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: NS-AC1	Test Date: 2023-08-10
Limit: FCC_2.4G_RE(3m)	Engineer: Flag Yang
Probe: NS-AC1_BBHA9120D_2111_1-18GHz	Polarity: Horizontal
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmit by BLE 1M at 2480MHz	



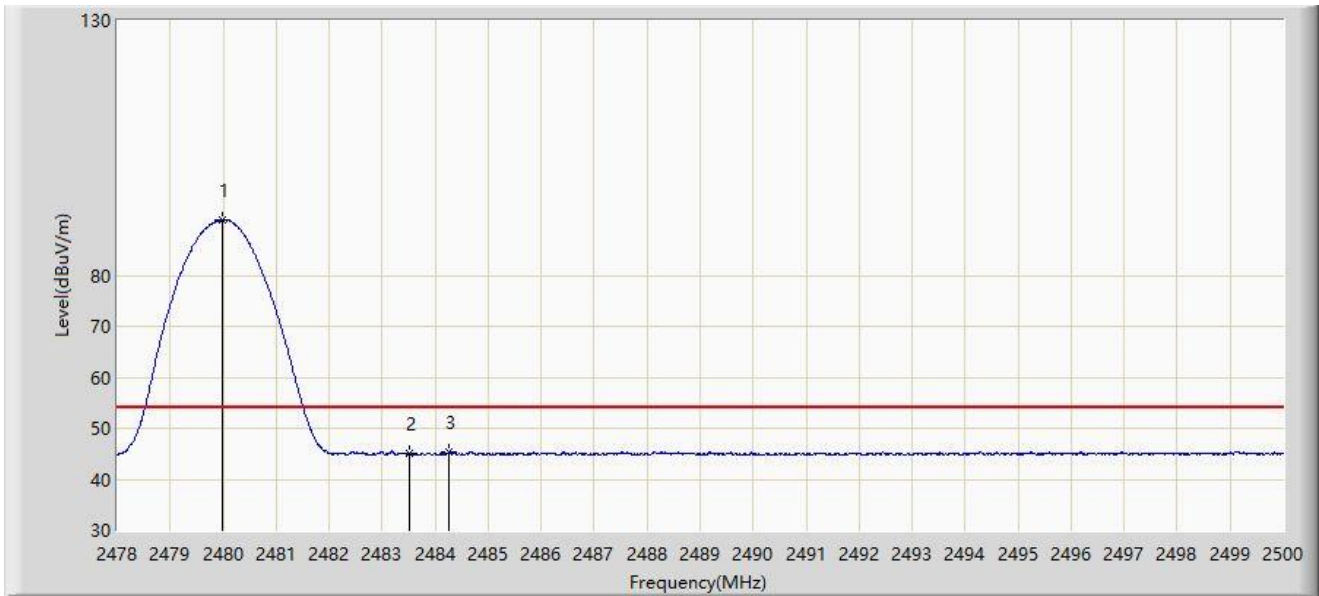
No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		2480.233	91.784	61.023	N/A	N/A	30.760	PK
2		2483.500	54.858	24.096	-19.142	74.000	30.761	PK
3	*	2487.306	56.943	26.180	-17.057	74.000	30.763	PK

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).

Site: NS-AC1	Test Date: 2023-08-10
Limit: FCC_2.4G_RE(3m)	Engineer: Flag Yang
Probe: NS-AC1_BBHA9120D_2111_1-18GHz	Polarity: Horizontal
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmit by BLE 1M at 2480MHz	



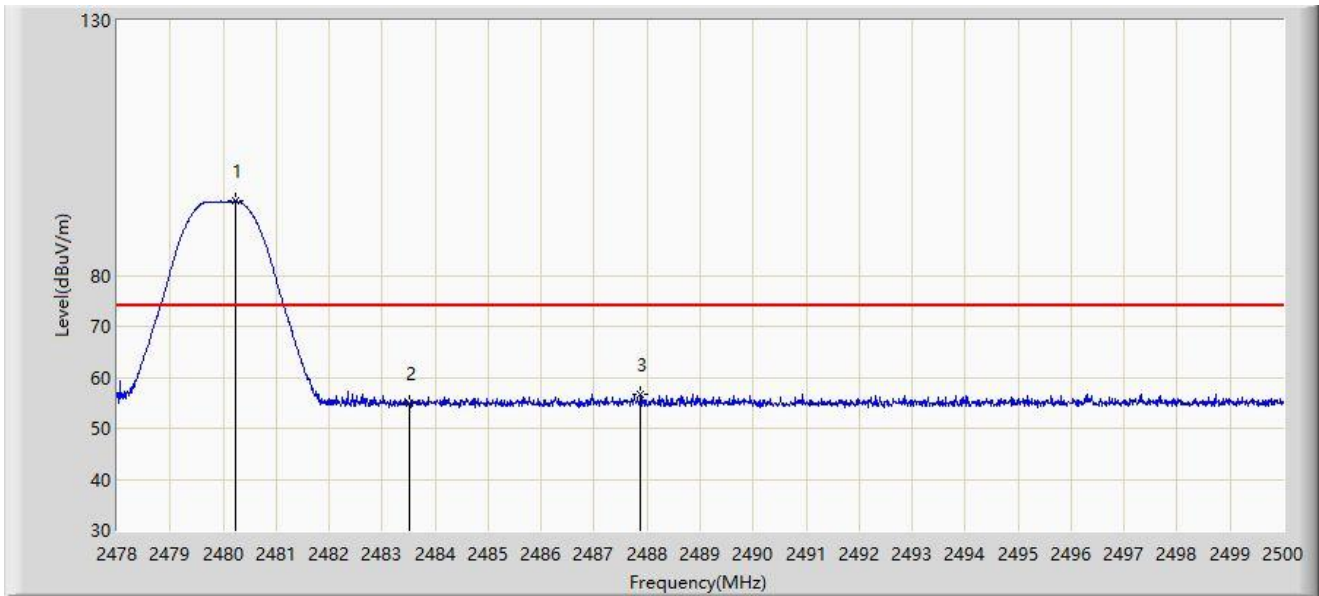
No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		2479.991	90.833	60.073	N/A	N/A	30.760	AV
2		2483.500	45.051	14.289	-8.949	54.000	30.761	AV
3	*	2484.270	45.456	14.694	-8.544	54.000	30.762	AV

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: NS-AC1	Test Date: 2023-08-10
Limit: FCC_2.4G_RE(3m)	Engineer: Flag Yang
Probe: NS-AC1_BBHA9120D_2111_1-18GHz	Polarity: Vertical
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmit by BLE 1M at 2480MHz	



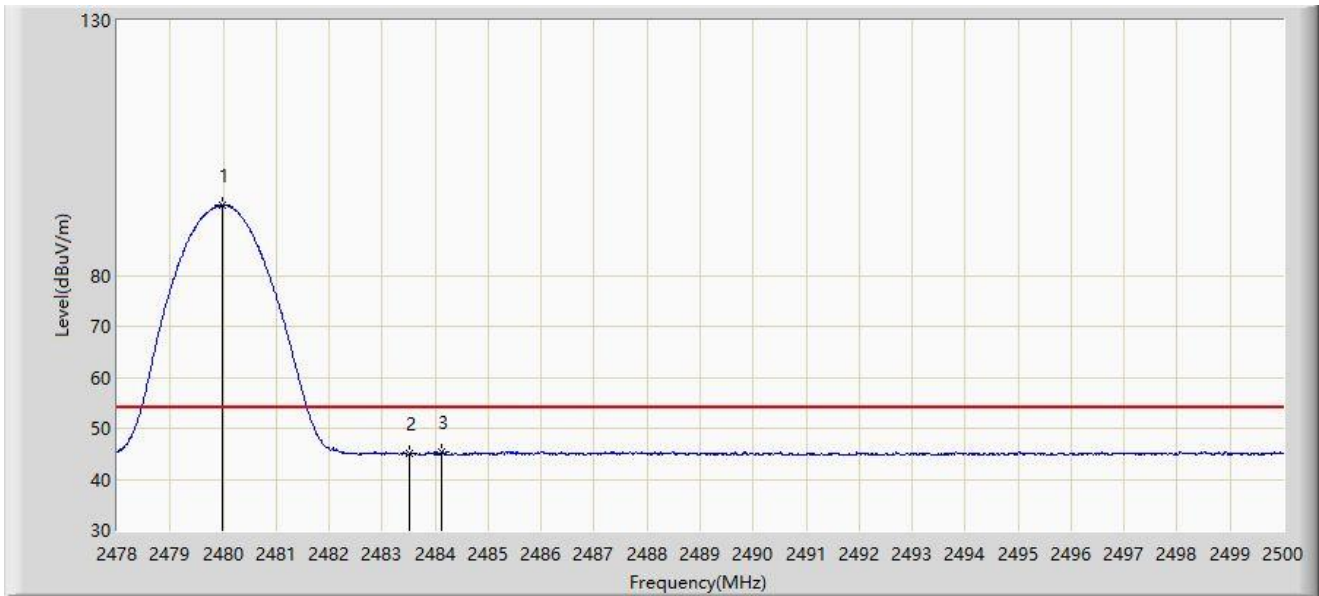
No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		2480.233	94.521	63.760	N/A	N/A	30.760	PK
2		2483.500	54.922	24.160	-19.078	74.000	30.761	PK
3	*	2487.878	56.753	25.989	-17.247	74.000	30.764	PK

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).

Site: NS-AC1	Test Date: 2023-08-10
Limit: FCC_2.4G_RE(3m)	Engineer: Flag Yang
Probe: NS-AC1_BBHA9120D_2111_1-18GHz	Polarity: Vertical
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmit by BLE 1M at 2480MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		2479.991	93.796	63.036	N/A	N/A	30.760	AV
2		2483.500	45.043	14.281	-8.957	54.000	30.761	AV
3	*	2484.127	45.351	14.589	-8.649	54.000	30.762	AV

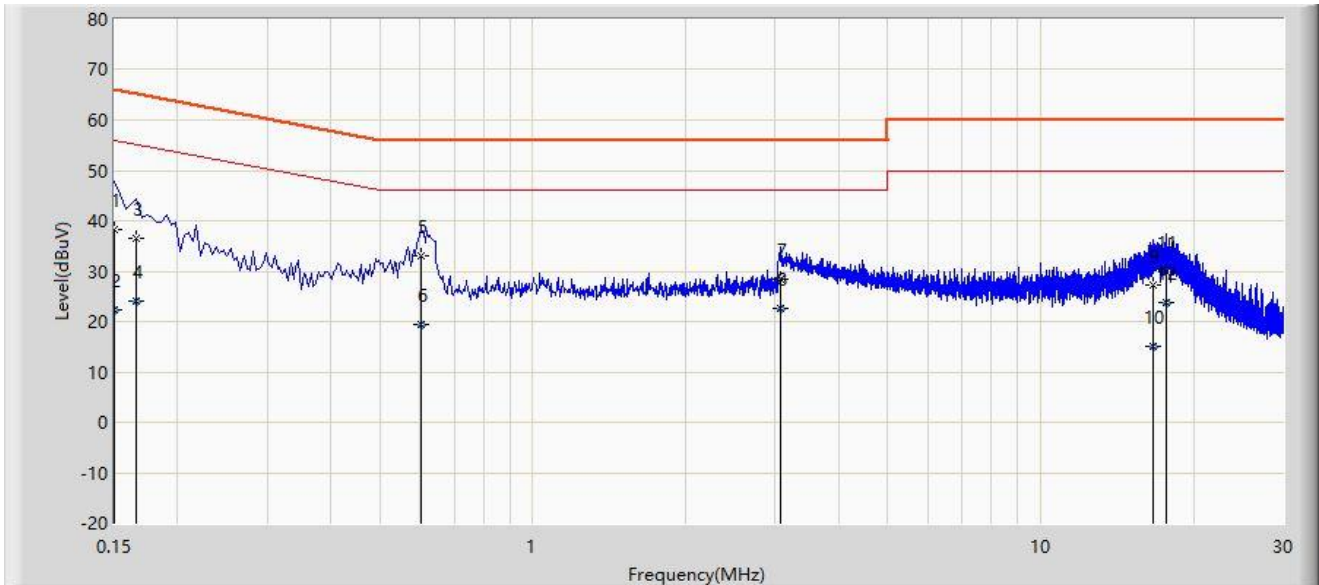
Note 1: " * ", means this data is the worst emission level.

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

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

A.8 AC Conducted Emissions Test Result

Site: NS-SR2	Test Date: 2023-08-09
Temperature: 25.1°C	Humidity: 48%
Limit: FCC_Part15.207_CE_AC Power	Engineer: Flag Yang
Probe: ENV216_102493_0.15MHz~30MHz-C	Polarity: Line
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmitter by BLE 1M at 2402MHz	



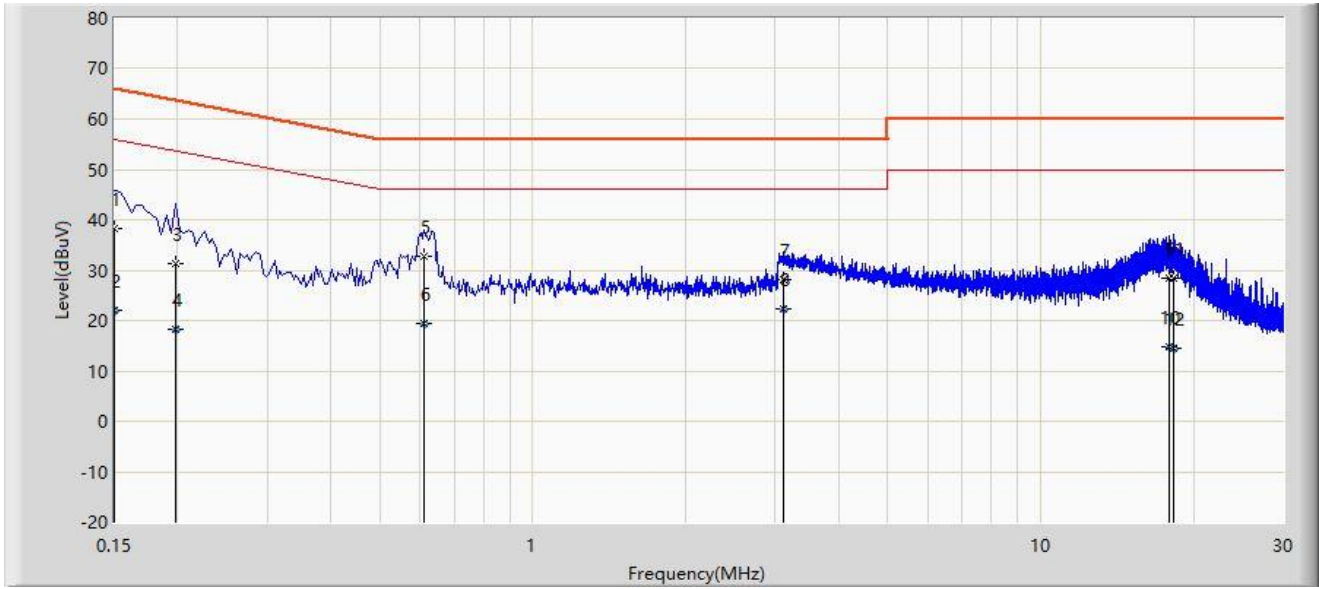
No	Mark	Frequency (MHz)	Measure Level (dBμV)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV)	Factor (dB)	Type
1		0.150	38.396	28.709	-27.604	66.000	9.687	QP
2		0.150	22.197	12.510	-33.803	56.000	9.687	AV
3		0.166	36.459	26.770	-28.699	65.158	9.690	QP
4		0.166	24.065	14.375	-31.093	55.158	9.690	AV
5	*	0.602	33.046	23.321	-22.954	56.000	9.725	QP
6		0.602	19.499	9.775	-26.501	46.000	9.725	AV
7		3.066	28.494	18.698	-27.506	56.000	9.796	QP
8		3.066	22.556	12.760	-23.444	46.000	9.796	AV
9		16.650	27.139	17.052	-32.861	60.000	10.087	QP
10		16.650	14.957	4.870	-35.043	50.000	10.087	AV
11		17.694	29.923	19.814	-30.077	60.000	10.109	QP
12		17.694	23.899	13.789	-26.101	50.000	10.109	AV

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

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

Note 3: Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

Site: NS-SR2	Test Date: 2023-08-09
Temperature: 25.1°C	Humidity: 48%
Limit: FCC_Part15.207_CE_AC Power	Engineer: Flag Yang
Probe: ENV216_102493_0.15MHz~30MHz-C	Polarity: Neutral
EUT: Wireless Module	Power: Powered by Test Fixture
Test Mode: Transmitter by BLE 1M at 2402MHz	



No	Mark	Frequency (MHz)	Measure Level (dBμV)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV)	Factor (dB)	Type
1		0.150	38.327	28.680	-27.673	66.000	9.647	QP
2		0.150	22.118	12.471	-33.882	56.000	9.647	AV
3		0.198	31.240	21.589	-32.454	63.694	9.651	QP
4		0.198	18.274	8.623	-35.420	53.694	9.651	AV
5	*	0.610	32.889	23.216	-23.111	56.000	9.673	QP
6		0.610	19.376	9.703	-26.624	46.000	9.673	AV
7		3.110	28.148	18.378	-27.852	56.000	9.770	QP
8		3.110	22.459	12.689	-23.541	46.000	9.770	AV
9		17.894	28.362	18.055	-31.638	60.000	10.307	QP
10		17.894	14.740	4.433	-35.260	50.000	10.307	AV
11		18.230	28.369	18.045	-31.631	60.000	10.325	QP
12		18.230	14.533	4.209	-35.467	50.000	10.325	AV

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

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

Note 3: Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

Appendix B - Test Setup Photograph

Refer to “2305RSU049-UT” file.

Appendix C - EUT Photograph

Refer to “2305RSU049-UE” file.

The End
