RF MEASUREMENT REPORT

FCC ID:	VW3FAST5689E
Applicant:	SAGEMCOM BROADBAND SAS
Product:	Giga Hub
Model No.:	FAST 5689E
Brand Name:	SAGEMCOM
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15 Subpart C (Section 15.247)
Test Date:	January 12 ~ 27, 2022

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
2201RSU021-U1	Rev. 01	Initial Report	02-27-2022	Valid

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1. General Information

1.1. Applicant

SAGEMCOM BROADBAND SAS

250 Route de l'Empereur - 92848 RUEIL MALMAISON CEDEX- FRANCE

1.2. Manufacturer

SAGEMCOM BROADBAND SAS

250 Route de l'Empereur - 92848 RUEIL MALMAISON CEDEX- FRANCE

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		CNAS: L10551		
	FCC: CN1166		ISED: CN0001		
	VCCI:	☐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		CNAS: L10551		
	FCC: CN1284		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	Giga Hub
Model No.	FAST 5689E
EUT Identification No.	20220107Sample#17(Radiated) 20220107Sample#16(Conducted)
Wi-Fi Specification	802.11b/g/n/ac/ax
ZigBee Specification	802.15.4
Z-Wave Specification	800 ~ 900MHz radio frequency range
Antenna Information	Refer to Section 1.7
Power Type	AC Adapter
Operating Environment	Indoor Use
Accessories	
Adapter 1#	Model No.: NBS60E120500M2 Input: 100-127V, 50/60Hz, 1.5A Output: 12.0V⎓5.0A
Adapter 2#	Model No.: MS-Z5000R120-060C0-P Input: 100-127V, 50/60Hz, 1.5A Output: 12.0V⎓5.0A
Adapter 3#	Model No.: ADS-65HI-12A-2 12060E-L Input: 100-127V, 50/60Hz, 1.5A Output: 12.0V⎓5.0A
Remark: 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

ZigBee Specification	802.15.4
Frequency Range	2405 ~ 2480 MHz
Channel Number	16
Type of Modulation	O-QPSK

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

1.6. Working Frequencies

Channel	Frequency	Channel	Frequency	Channel	Frequency
11	2405 MHz	12	2410 MHz	13	2415 MHz
14	2420 MHz	15	2425 MHz	16	2430 MHz
17	2435 MHz	18	2440 MHz	19	2445 MHz
20	2450 MHz	21	2455 MHz	22	2460 MHz
23	2465 MHz	24	2470 MHz	25	2475 MHz
26	2480 MHz	--	--	--	--

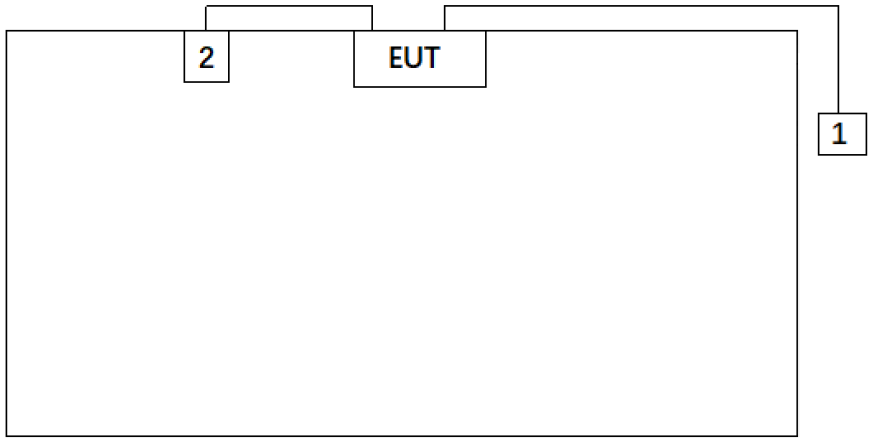
1.7. Description of Available Antennas

Antenna Type	Frequency Band (GHz)	Antenna Gain (dBi)				Directional Gain (dBi)	
		Ant 0	Ant 1	Ant 2	Ant 3	For Power	For PSD
Wi-Fi Antenna (4*4 MIMO)							
PIFA &	2.4 ~ 2.5	2.79	2.38	2.95	1.91	2.95	6.40
Dipole	5.15 ~ 5.85	4.89	4.53	3.51	3.88	4.89	6.90
ZigBee Antenna							
Dipole	2.4 ~ 2.5	2.85					
Z-Wave Antenna							
Dipole	0.9 ~ 1	-0.46					

2. Test Configuration

2.1. 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 – Radiated Emission testing & AC Conducted Emissions


Product		Manufacturer	Model No.
1	Notebook	DELL	Precision 3510
2	AC Adapter	Sagemcom	NBS60E120500M2

2.2. Test Software

The test utility software used during testing was “telnet”, and the commands are provided by manufacture.

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

3. Antenna Requirements

Excerpt from §15.203 of the FCC Rules/Regulations:

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

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

Conclusion:

The unit complies with the requirement of §15.203.

4. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2022/12/29	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2022/9/16	WZ-AC1
Preamplifier	Agilent	83017A	MRTSUE06076	1 year	2022/11/12	WZ-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2022/8/5	WZ-AC1
Anechoic Chamber	TDK	WZ-AC1	MRTSUE06212	1 year	2022/4/29	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE06403	1 year	2022/6/28	WZ-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06607	1 year	2022/12/29	WZ-AC1
Thermohygrometer	testo	Testo 608-H1	MRTSUE11039	1 year	2022/11/11	WZ-AC1
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2022/10/28	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2022/12/1	WZ-AC1
Preamplifier	EMCI	EMC184045SE	MRTSUE06640	1 year	2023/1/13	WZ-AC1
Temperature Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2022/10/10	WZ-TR3
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2022/6/28	WZ-TR3
Signal Analyzer	Keysight	N9010B	MRTSUE06558	1 year	2022/6/24	WZ-TR3
Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2022/4/13	WZ-TR3
USB Power Sensor	Keysight	U2021XA	MRTSUE06446	1 year	2022/6/8	WZ-TR3
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2022/6/8	WZ-SR2
Thermohygrometer	testo	608-H1	MRTSUE06404	1 year	2022/6/28	WZ-SR2
Four-Line V-Network	R&S	ENV432	MRTSUE06615	1 year	2022/10/13	WZ-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06909	1 year	2022/11/1	WZ-SR2

Software	Version	Function
EMI Software	V3	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.

AC Conducted Emission Measurement
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz~150kHz: 3.74dB 150kHz~30MHz: 3.44dB
Radiated Disturbance
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): Horizontal: 30MHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~40GHz: 6.40dB Vertical: 30MHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~40GHz: 6.40dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.78dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.13dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.15dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.28%

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

Remark:

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.

6.2. 6dB Bandwidth Measurement

6.2.1. Test Limit

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

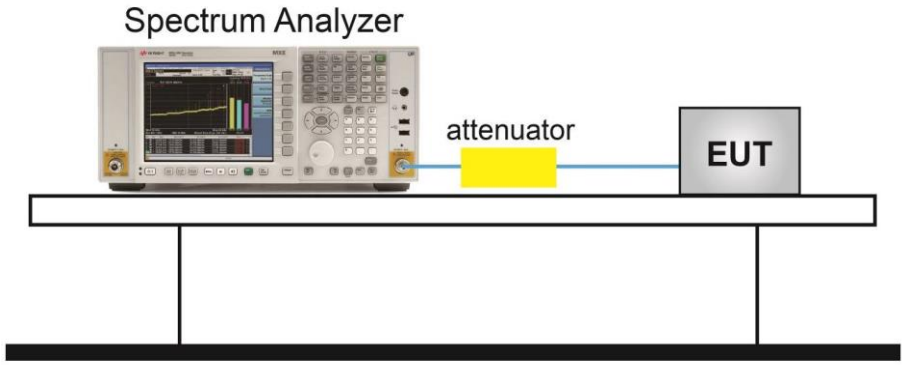
6.2.2. Test Procedure

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 ≥ 3 × 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

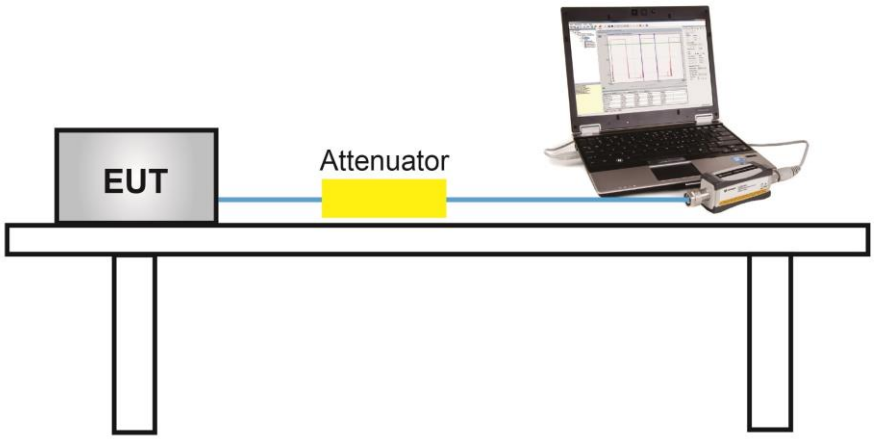
Method PKPM1 (Peak Power Measurement)

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.

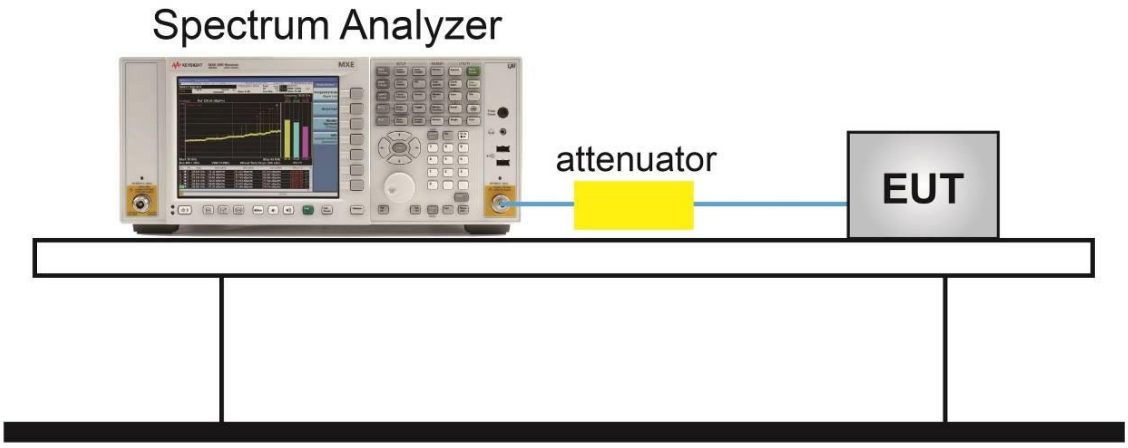
6.4.2. Test Procedure

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 Settitng

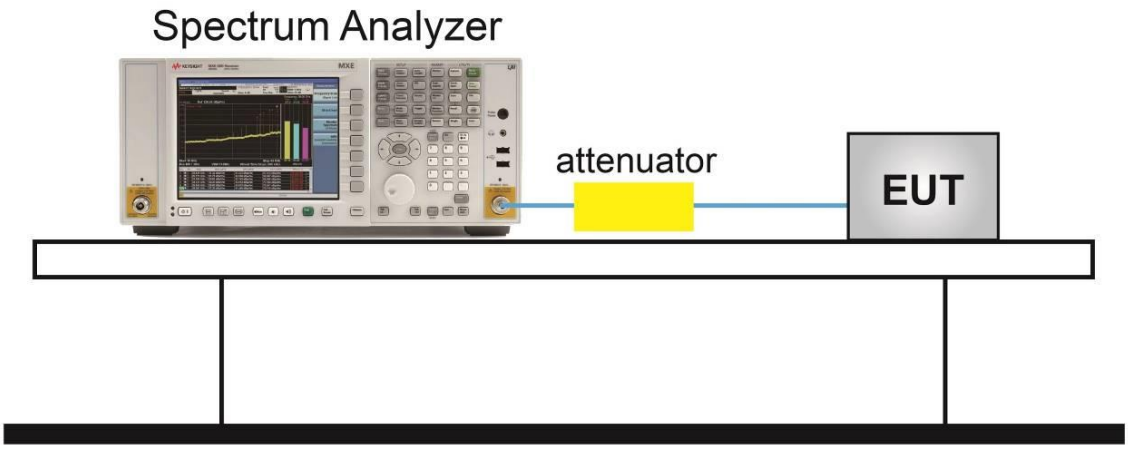
Reference level measurement

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 ≥ 3 x RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

Emission level measurement

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

6.5.4. Test Setup



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 ≥ 98%, set VBW = 10 Hz.

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

4. Detector = Peak

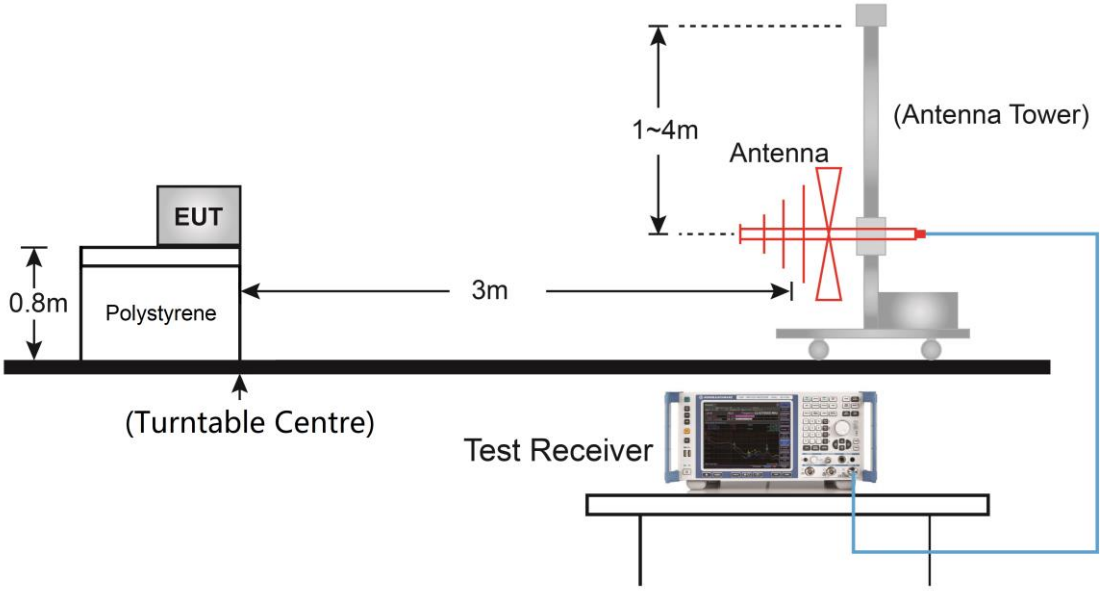
5. Sweep time = auto

6. Trace mode = max hold

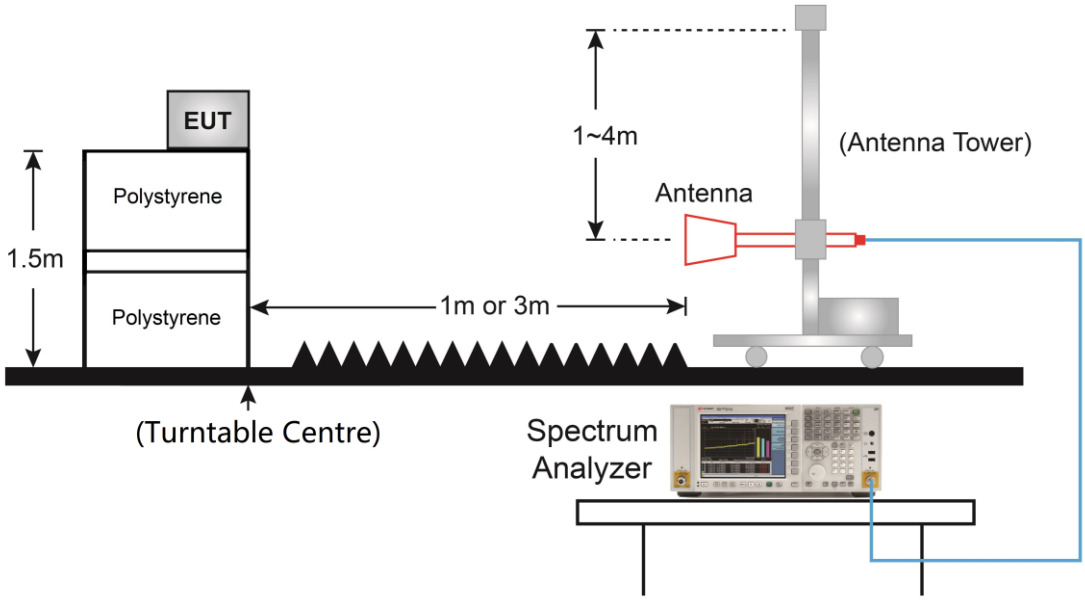
7. Trace was allowed to stabilize

6.6.4. Test Setup

Below 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

ANSI C63.10-2013 Section 6.6

ANSI C63.10-2013 Section 11.13

6.7.3. Test Setting

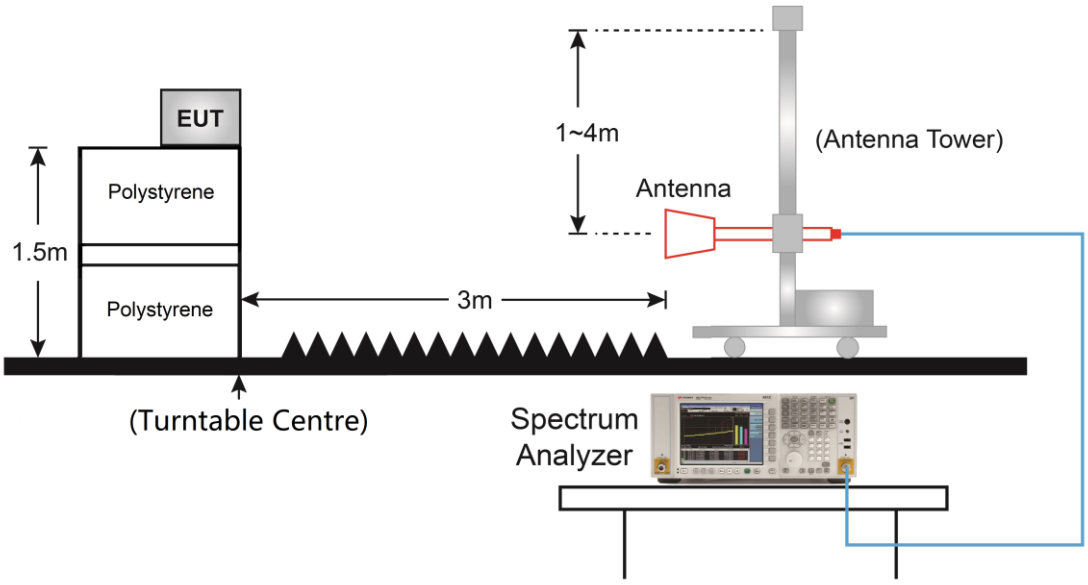
Peak Field Strength Measurements

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 ≥ 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

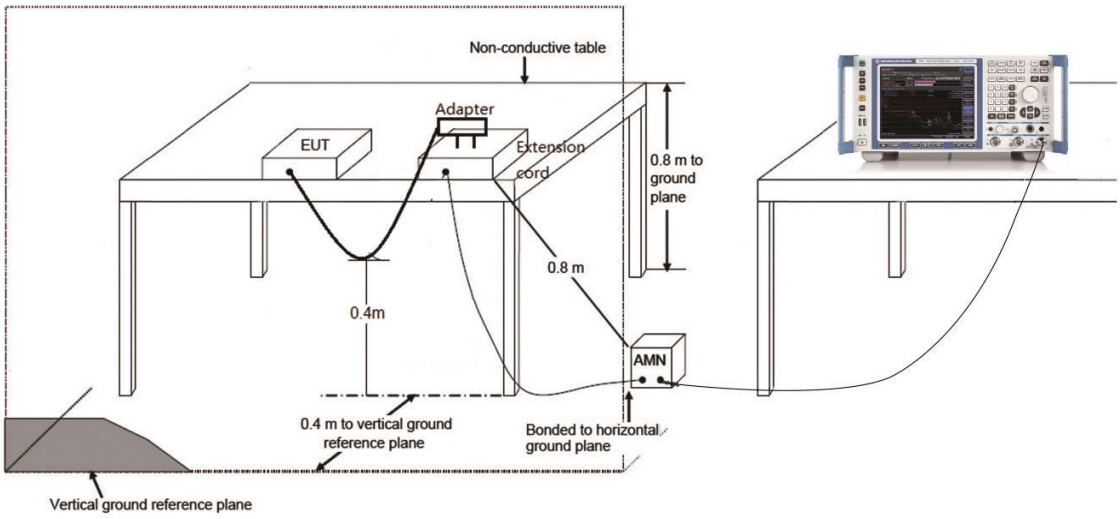
Refer to Appendix A.7.

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



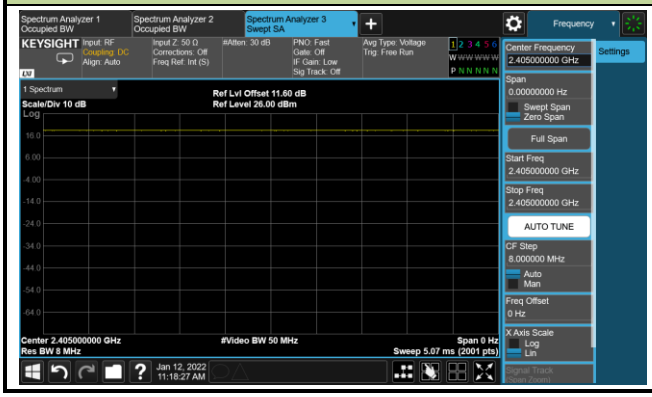
6.8.3. Test Result

Refer to Appendix A.8.

Appendix A - Test Result

A.1 Duty Cycle Test Result

Test Site	WZ-TR3	Test Engineer	Liz Yuan
Test Date	2022/01/12		

Test Mode	Duty Cycle
ZigBee	100%
Duty Cycle (T = Transmission Duration)	
ZigBee- 2405MHz	
	

A.2 6dB Bandwidth Test Result

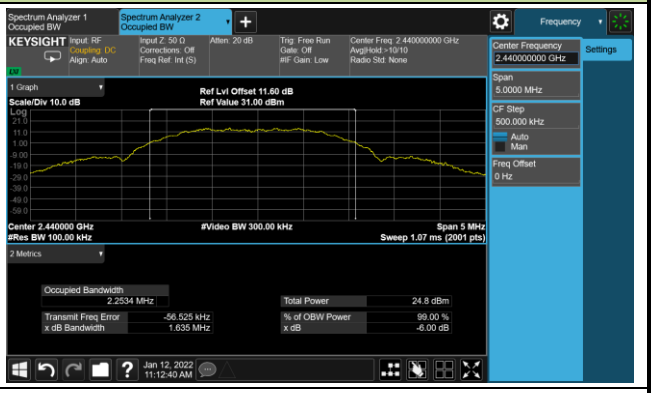
Test Site	WZ-TR3	Test Engineer	Liz Yuan
Test Date	2022/01/12 ~ 2022/01/14		

Test Mode	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)
ZigBee	11	2405	1.642	≥ 0.5
ZigBee	18	2440	1.635	≥ 0.5
ZigBee	26	2480	1.647	≥ 0.5

ZigBee 6dB Bandwidth

Channel 11 (2405MHz)

Channel 18 (2440MHz)



Channel 26 (2480MHz)

A.3 Output Power Test Result

Test Site	WZ-TR3	Test Engineer	Liz Yuan
Test Date	2022/01/14		

Test Mode	Channel No.	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Result
Peak Output Power					
ZigBee	11	2405	18.64	≤ 30.00	Pass
ZigBee	18	2440	18.45	≤ 30.00	Pass
Zigbee	25	2480	18.56	≤ 30.00	Pass
ZigBee	26	2480	8.55	≤ 30.00	Pass
Average Output Power (Reporting Only)					
ZigBee	11	2405	18.61	≤ 30.00	Pass
ZigBee	18	2440	18.41	≤ 30.00	Pass
Zigbee	25	2480	18.50	≤ 30.00	Pass
ZigBee	26	2480	8.49	≤ 30.00	Pass

A.4 Power Spectral Density Test Result

Test Site	WZ-TR3	Test Engineer	Liz Yuan
Test Date	2022/01/14		

Test Mode	Channel No.	Frequency (MHz)	PSD Result (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
ZigBee	11	2405	3.29	≤ 8.00	Pass
ZigBee	18	2440	3.16	≤ 8.00	Pass
ZigBee	26	2480	-6.34	≤ 8.00	Pass

ZigBee PSD

Channel 11 (2405MHz)

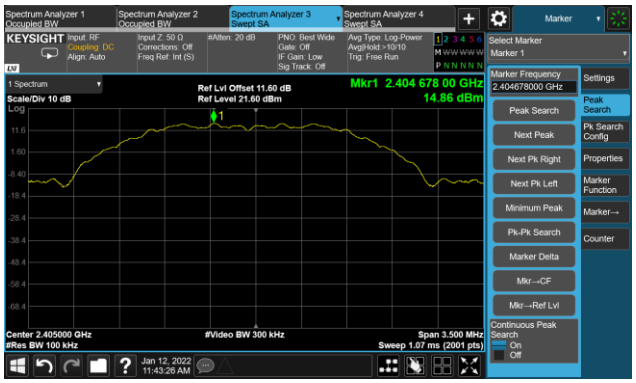
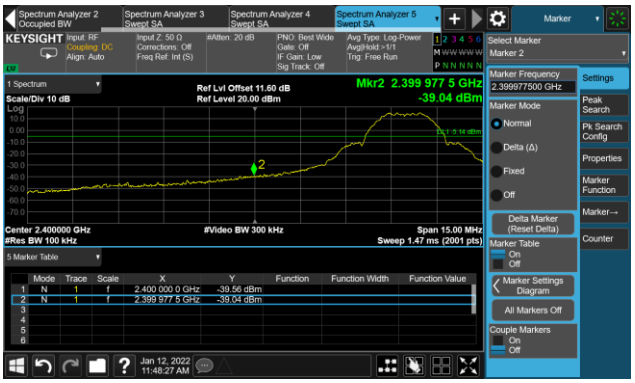
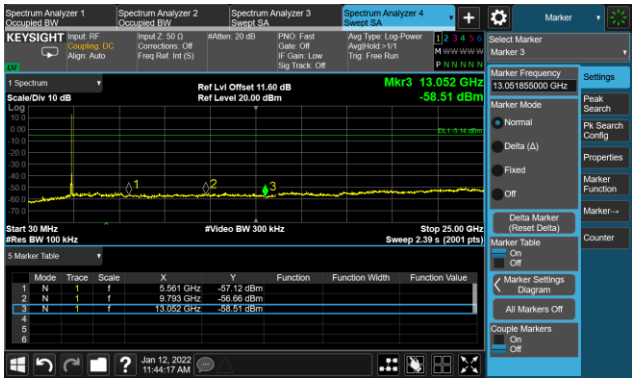
Channel 18 (2440MHz)

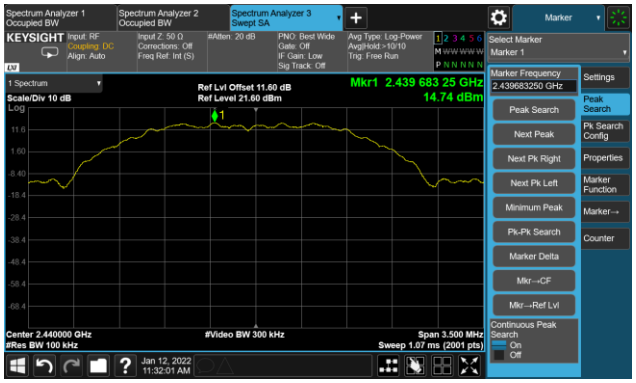
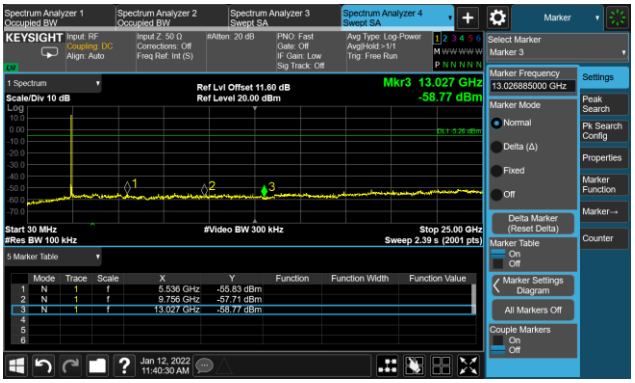
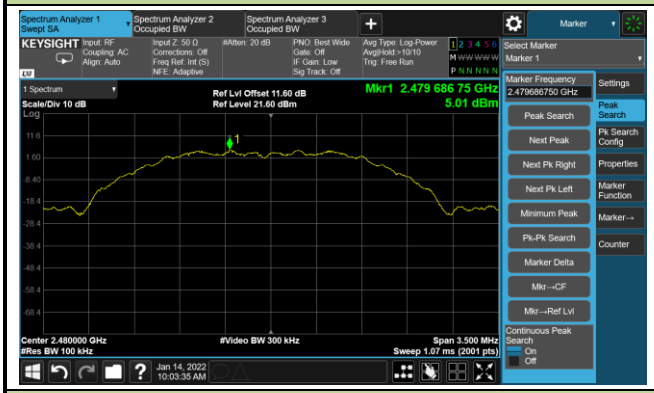
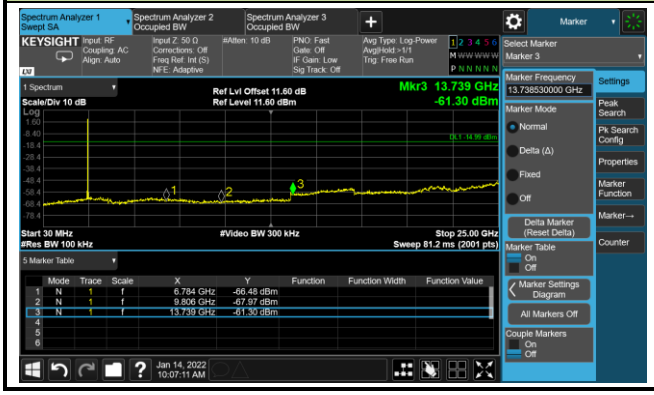
Channel 26 (2480MHz)

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

Test Site	WZ-TR3	Test Engineer	Liz Yuan
Test Date	2022/01/12 ~ 2022/01/14		

Test Mode	Channel No.	Frequency (MHz)	Limit (dBc)	Result
ZigBee	11	2405	20	Pass
ZigBee	18	2440	20	Pass
ZigBee	26	2480	20	Pass

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	
	

A.6 Radiated Spurious Emission Test Result

Test Site	WZ-AC1	Test Engineer	Kin Xia
Test Date	2022/01/14 ~ 2022/01/15	Test Mode:	ZigBee
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

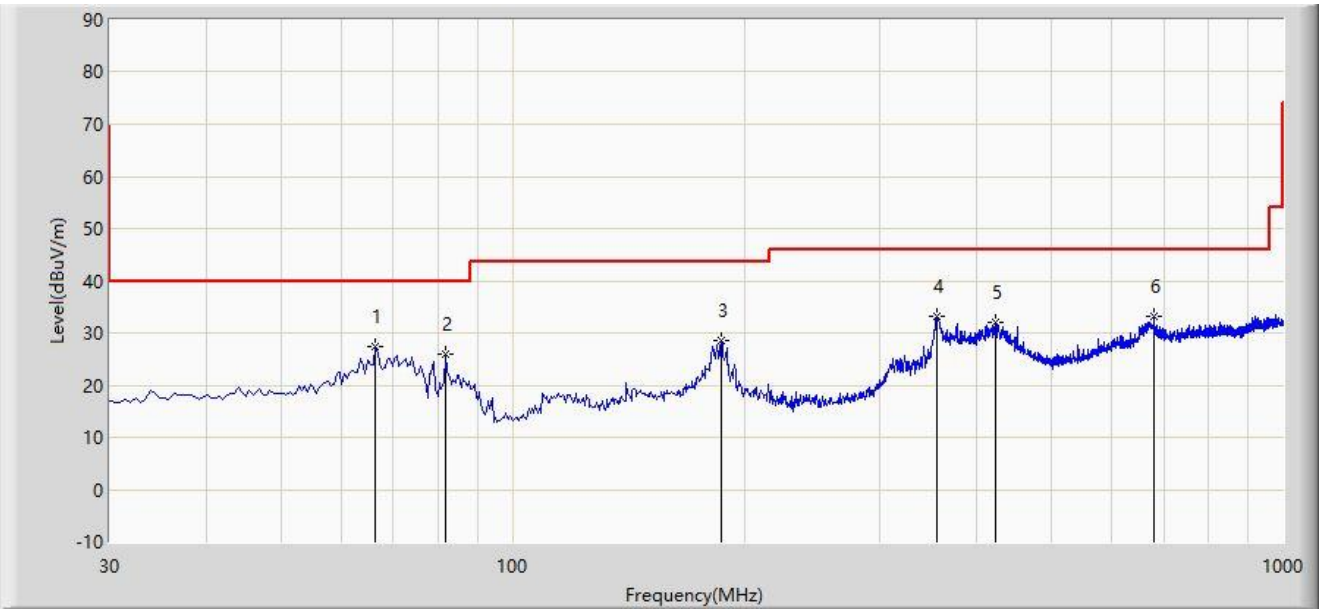
Test Channel	Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
11	7536.5	37.3	8.7	46.0	74.0	-28.0	Peak	Horizontal
	9466.0	35.6	12.4	48.0	74.0	-26.0	Peak	Horizontal
	11319.0	36.7	13.4	50.1	74.0	-23.9	Peak	Horizontal
	8182.5	40.4	9.5	49.9	74.0	-24.1	Peak	Vertical
	9440.5	35.9	12.4	48.3	74.0	-25.7	Peak	Vertical
	10783.5	36.4	13.8	50.2	74.0	-23.8	Peak	Vertical
18	7315.5	38.4	9.2	47.6	74.0	-26.4	Peak	Horizontal
	8182.5	40.1	9.5	49.6	74.0	-24.4	Peak	Horizontal
	10732.5	35.9	13.7	49.6	74.0	-24.4	Peak	Horizontal
	7324.0	39.2	9.2	48.4	74.0	-25.6	Peak	Vertical
	8182.5	40.3	9.5	49.8	74.0	-24.2	Peak	Vertical
	10936.5	35.7	13.9	49.6	74.0	-24.4	Peak	Vertical
26	7358.0	37.1	8.9	46.0	74.0	-28.0	Peak	Horizontal
	8182.5	39.1	9.5	48.6	74.0	-25.4	Peak	Horizontal
	11123.5	36.3	13.4	49.7	74.0	-24.3	Peak	Horizontal
	7298.5	37.0	9.1	46.1	74.0	-27.9	Peak	Vertical
	8182.5	40.2	9.5	49.7	74.0	-24.3	Peak	Vertical
	11081.0	36.3	13.7	50.0	74.0	-24.0	Peak	Vertical

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

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

The Result of Radiated Emission below 1GHz:

Site: WZ-AC1	Time: 2022/01/27 - 20:18
Temperature: 18.1°C	Humidity: 44%
Limit: FCC_Part15.209_RSE(3m)	Engineer: Lucas Wang
Probe: WZ-AC1_VULB 9168 _30-1000MHz	Polarity: Horizontal
EUT: HOME HUB 4000	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at Channel 2402MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1		*	66.375	27.526	10.872	-12.474	40.000	16.654	PK
2			81.895	25.973	12.979	-14.027	40.000	12.994	PK
3			186.655	28.432	13.056	-15.068	43.500	15.376	PK
4			355.920	33.271	13.788	-12.729	46.000	19.483	PK
5			422.850	32.169	10.791	-13.831	46.000	21.378	PK
6			679.415	33.112	6.551	-12.888	46.000	26.561	PK

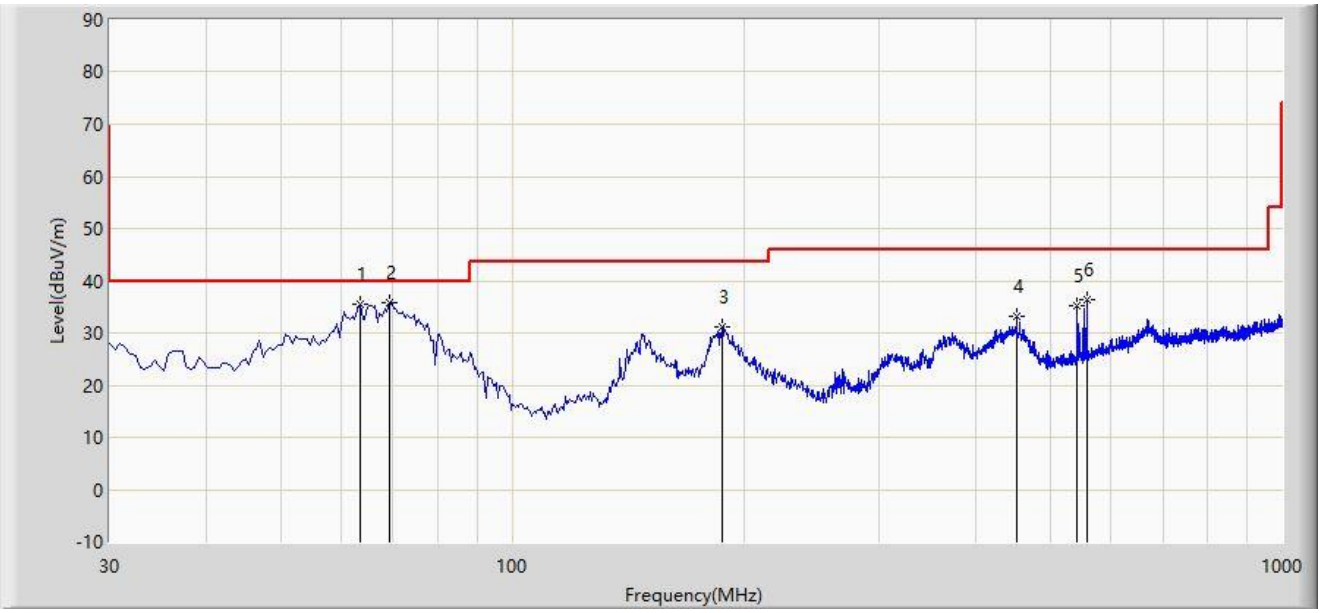
Note 1: Measure Level (dBµV/m) = Reading Level (dBµV) + Factor (dB)

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

Note 2: QP measurement was not performed when peak measure level was lower than the QP limit.

Note 3: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz and 18GHz to 25GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

Site: WZ-AC1	Time: 2022/01/27 - 20:23
Temperature: 18.1°C	Humidity: 44%
Limit: FCC_Part15.209_RSE(3m)	Engineer: Lucas Wang
Probe: WZ-AC1_VULB 9168 _30-1000MHz	Polarity: Vertical
EUT: HOME HUB 4000	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at Channel 2402MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1			63.465	35.432	18.245	-4.568	40.000	17.187	PK
2		*	69.285	35.868	19.821	-4.132	40.000	16.047	PK
3			187.625	31.079	15.827	-12.421	43.500	15.252	PK
4			451.950	33.105	10.836	-12.895	46.000	22.269	PK
5			541.190	35.099	11.200	-10.901	46.000	23.899	PK
6			558.650	36.518	12.351	-9.482	46.000	24.167	PK

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

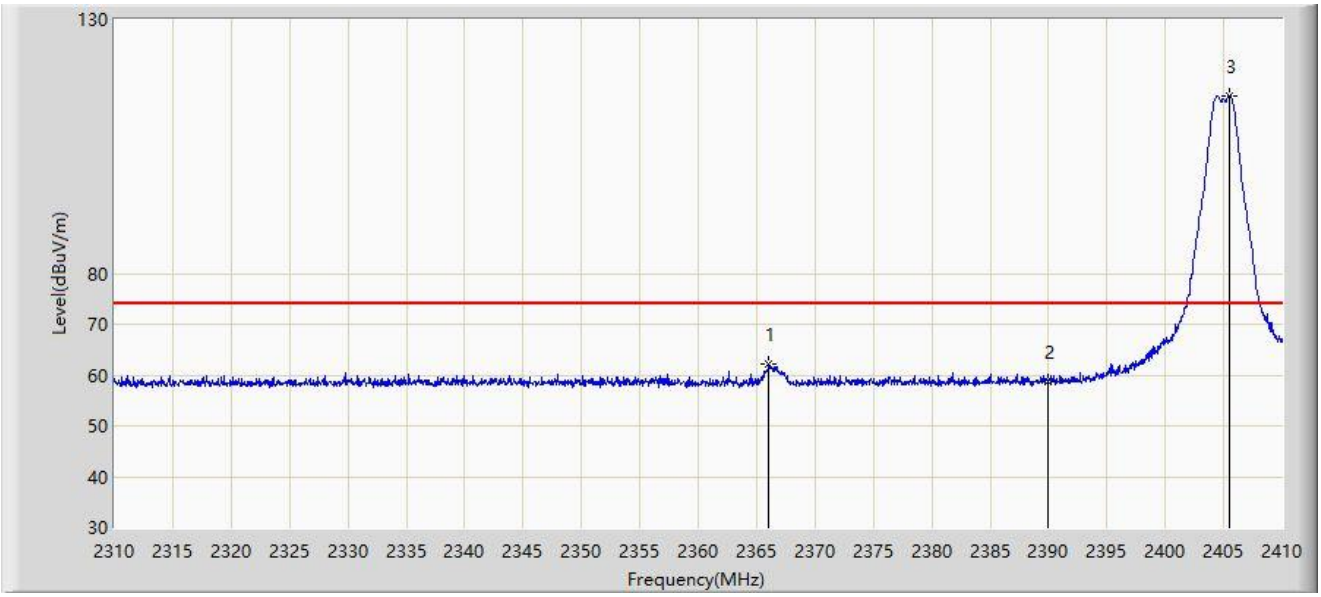
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: QP measurement was not performed when peak measure level was lower than the QP limit.

Note 3: 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-AC1	Time: 2022/01/14 - 01:03
Temperature: 22°C	Humidity: 41.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Kin Xia
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Giga Hub	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at Channel 2402MHz	

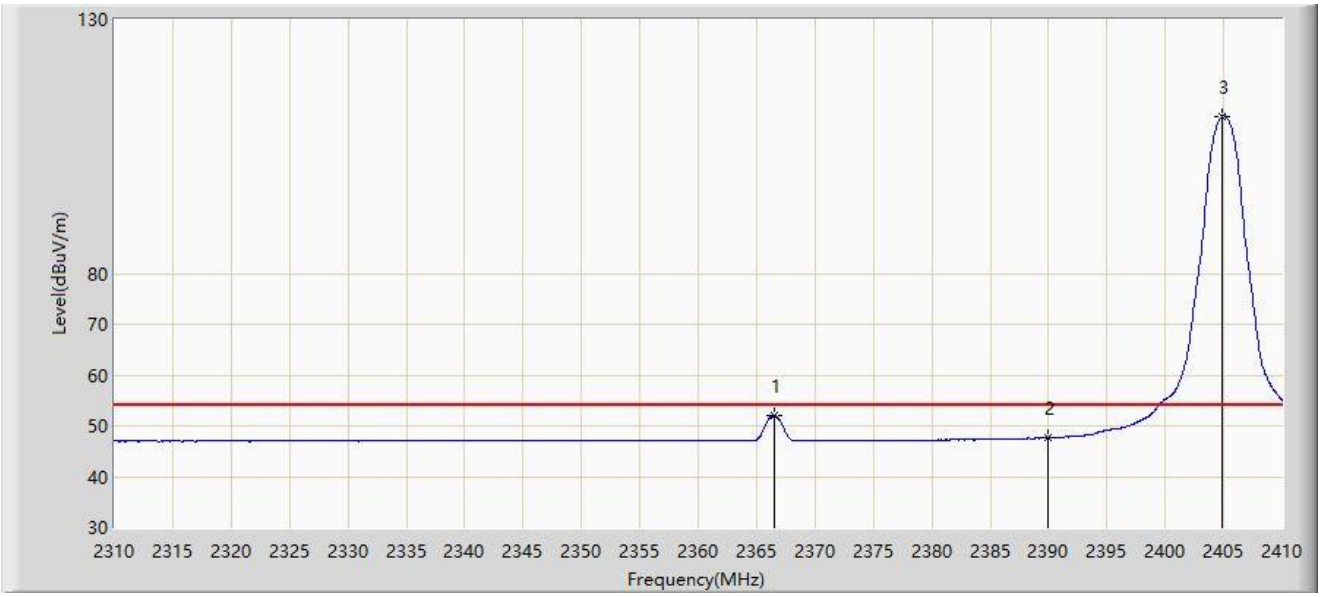


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1			2366.050	62.120	31.335	-11.880	74.000	30.785	PK
2			2390.000	58.692	27.876	-15.308	74.000	30.816	PK
3		*	2405.500	114.962	84.124	N/A	N/A	30.837	PK

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

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

Site: WZ-AC1	Time: 2022/01/14 - 01:05
Temperature: 22°C	Humidity: 41.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Kin Xia
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Giga Hub	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at Channel 2402MHz	

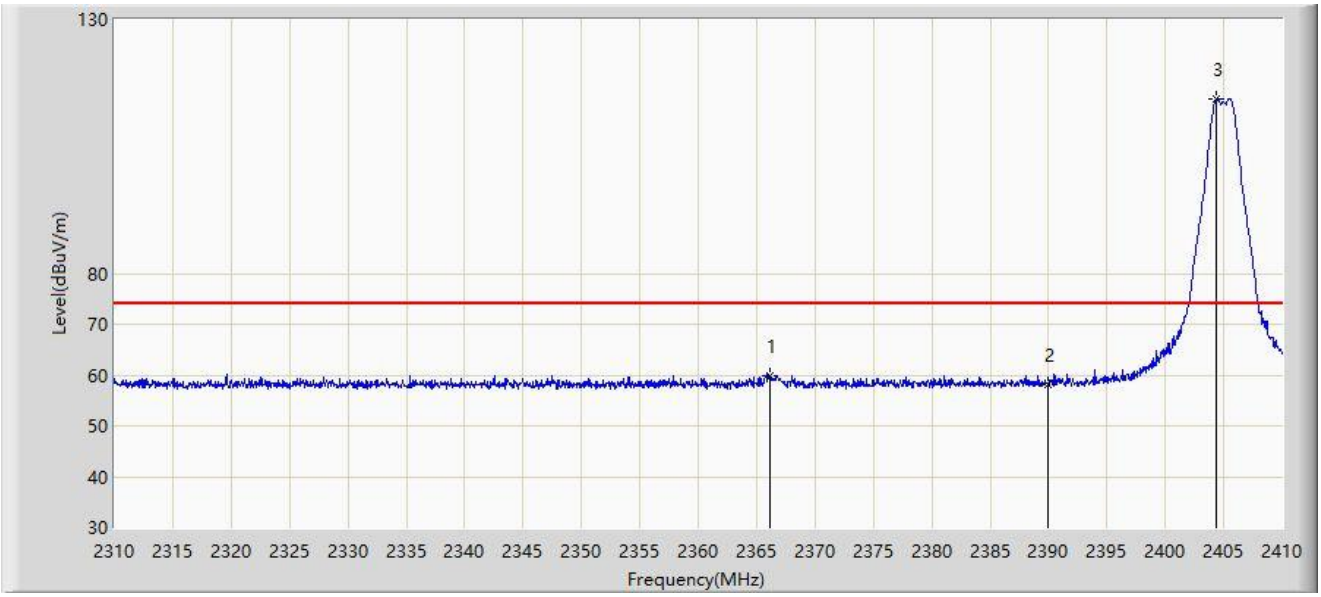


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1			2366.550	51.932	21.147	-2.068	54.000	30.785	AV
2			2390.000	47.624	16.808	-6.376	54.000	30.816	AV
3	X	*	2404.850	110.964	80.126	N/A	N/A	30.838	AV

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

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

Site: WZ-AC1	Time: 2022/01/14 - 01:06
Temperature: 22°C	Humidity: 41.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Kin Xia
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Giga Hub	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at Channel 2402MHz	

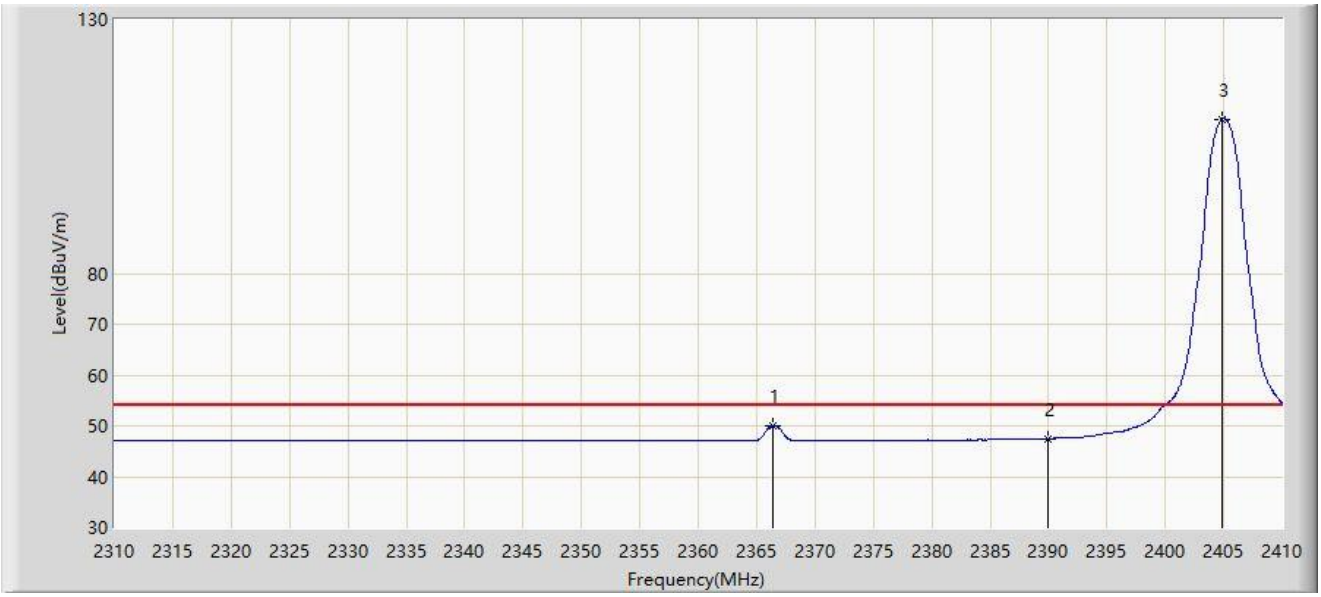


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1			2366.150	59.935	29.150	-14.065	74.000	30.784	PK
2			2390.000	58.209	27.393	-15.791	74.000	30.816	PK
3		*	2404.400	114.356	83.518	N/A	N/A	30.838	PK

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

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

Site: WZ-AC1	Time: 2022/01/14 - 00:56
Temperature: 22°C	Humidity: 41.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Kin Xia
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Giga Hub	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at Channel 2402MHz	

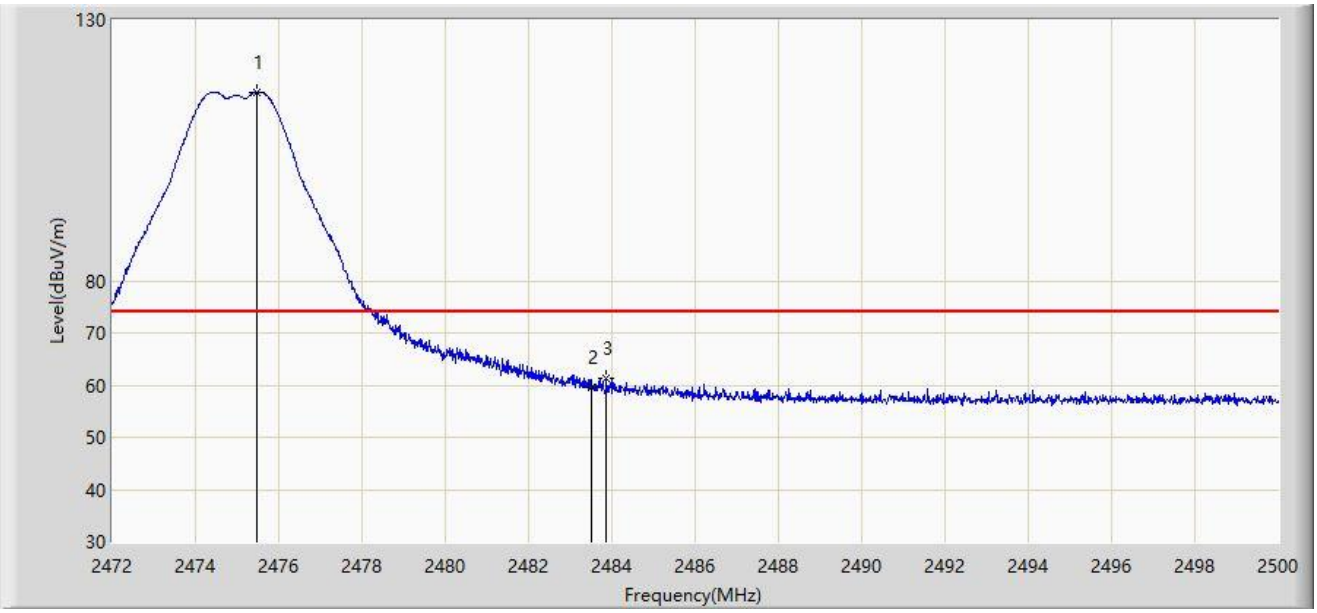


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1			2366.450	50.042	19.257	-3.958	54.000	30.785	AV
2			2390.000	47.505	16.689	-6.495	54.000	30.816	AV
3	X	*	2404.800	110.309	79.471	N/A	N/A	30.838	AV

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

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

Site: WZ-AC1	Time: 2022/02/17 - 10:00
Temperature: 16.1°C	Humidity: 38.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Charles Zhang
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Home Hub 4000	Power: AC 120V/60Hz
Test Mode: Transmit by Zigbee at Channel 2475MHz	

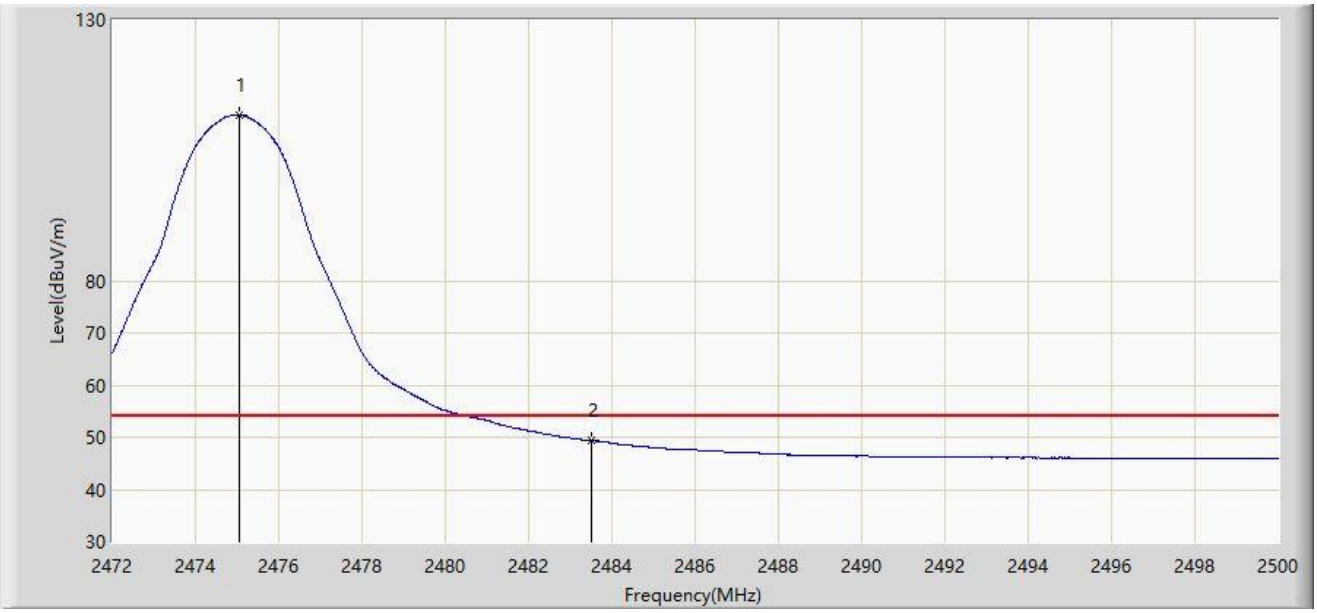


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1		*	2475.472	116.166	85.180	N/A	N/A	30.986	PK
2			2483.500	59.656	28.635	-14.344	74.000	31.021	PK
3			2483.858	61.396	30.374	-12.604	74.000	31.022	PK

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

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

Site: WZ-AC1	Time: 2022/02/17 - 10:06
Temperature: 16.1°C	Humidity: 38.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Charles Zhang
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Home Hub 4000	Power: AC 120V/60Hz
Test Mode: Transmit by Zigbee at Channel 2475MHz	

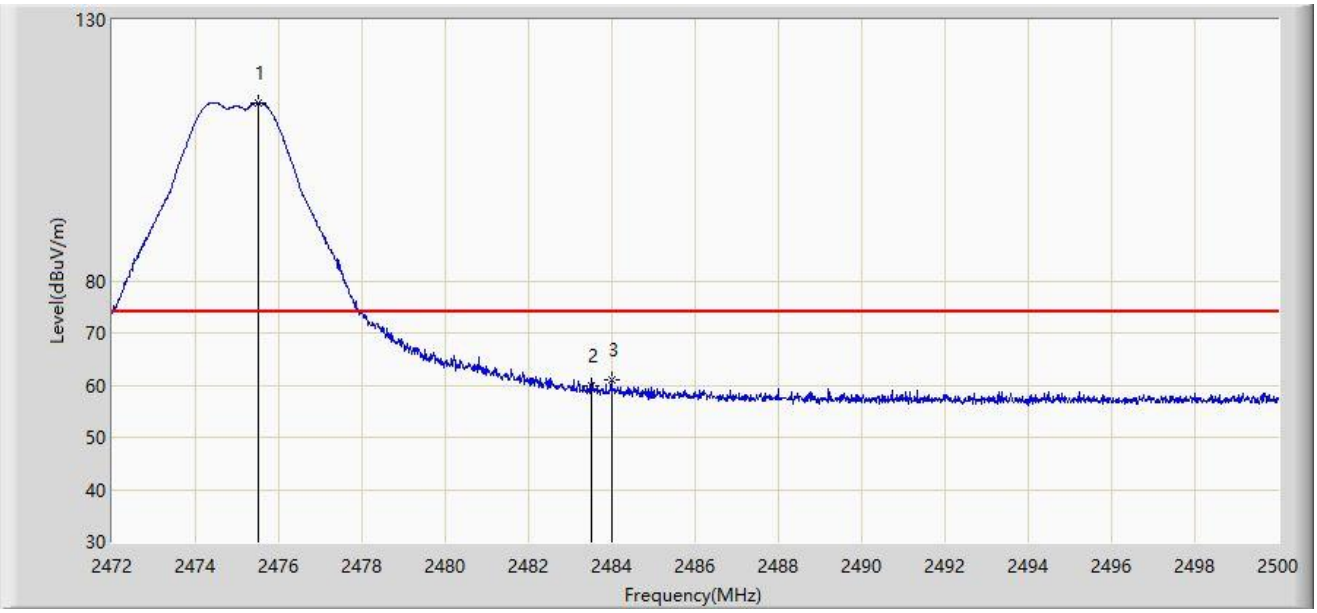


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1	X	*	2475.038	111.760	80.776	N/A	N/A	30.984	AV
2			2483.500	49.351	18.330	-4.649	54.000	31.021	AV

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

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

Site: WZ-AC1	Time: 2022/02/17 - 10:09
Temperature: 16.1°C	Humidity: 38.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Charles Zhang
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Home Hub 4000	Power: AC 120V/60Hz
Test Mode: Transmit by Zigbee at Channel 2475MHz	

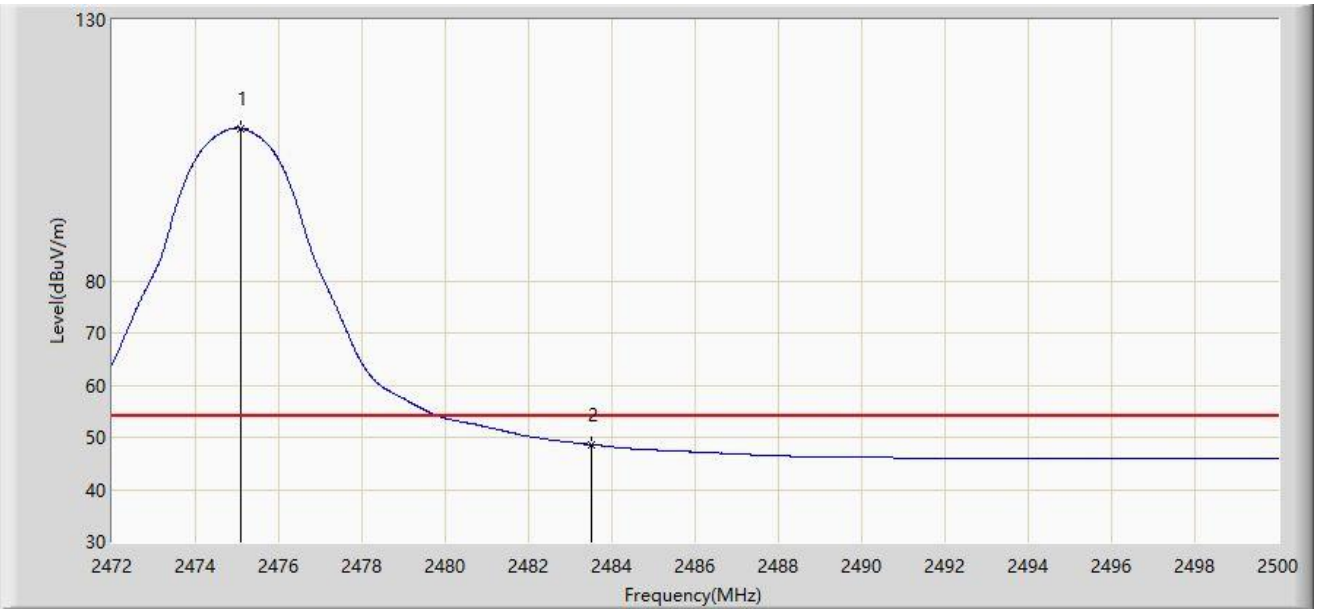


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1		*	2475.514	114.020	83.034	N/A	N/A	30.986	PK
2			2483.500	59.986	28.965	-14.014	74.000	31.021	PK
3			2483.984	61.039	30.016	-12.961	74.000	31.023	PK

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

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

Site: WZ-AC1	Time: 2022/02/17 - 10:11
Temperature: 16.1°C	Humidity: 38.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Charles Zhang
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Home Hub 4000	Power: AC 120V/60Hz
Test Mode: Transmit by Zigbee at Channel 2475MHz	

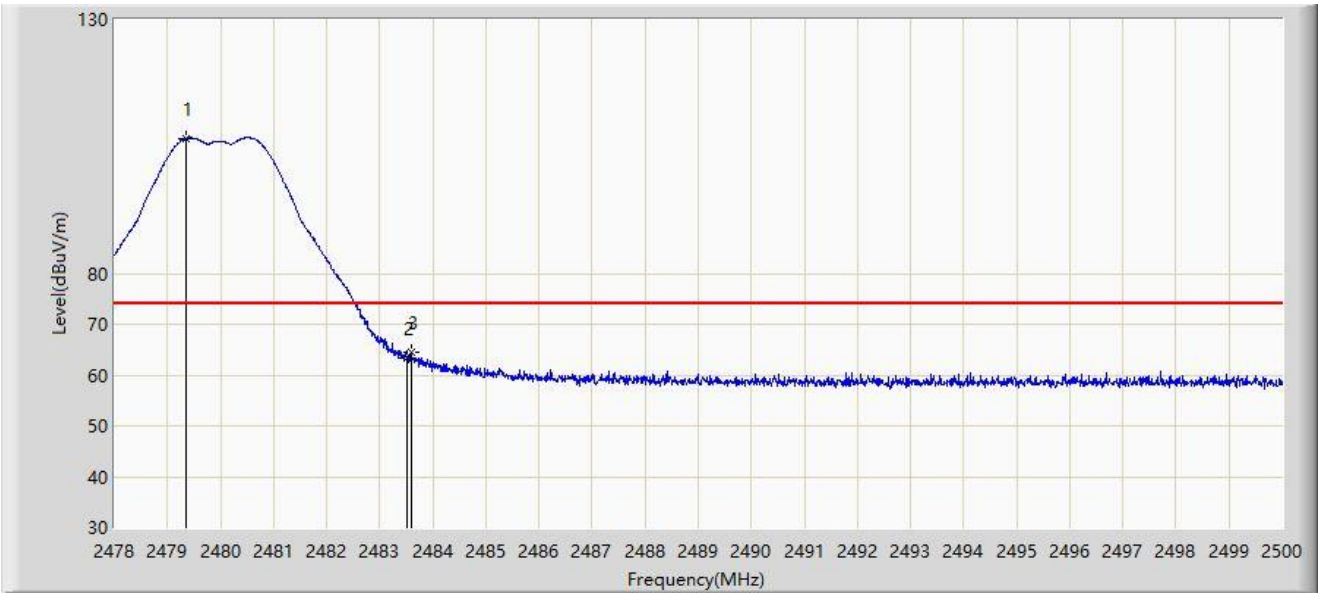


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1	X	*	2475.080	109.236	78.251	N/A	N/A	30.984	AV
2			2483.500	48.634	17.613	-5.366	54.000	31.021	AV

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

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

Site: WZ-AC1	Time: 2022/01/14 - 01:26
Temperature: 22°C	Humidity: 41.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Kin Xia
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Giga Hub	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at Channel 2480MHz	

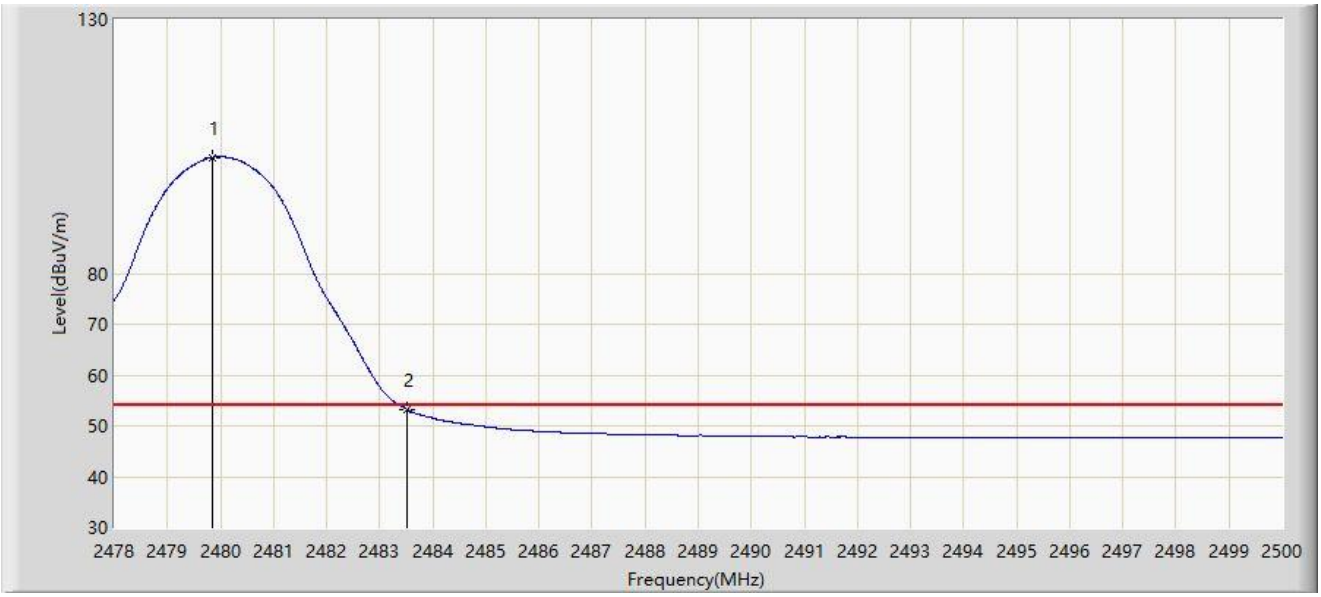


No	Flag	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		*	2479.353	106.563	75.560	N/A	N/A	31.003	PK
2			2483.500	63.356	32.335	-10.644	74.000	31.021	PK
3			2483.588	64.354	33.333	-9.646	74.000	31.021	PK

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

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

Site: WZ-AC1	Time: 2022/01/14 - 01:27
Temperature: 22°C	Humidity: 41.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Kin Xia
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Giga Hub	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at Channel 2480MHz	

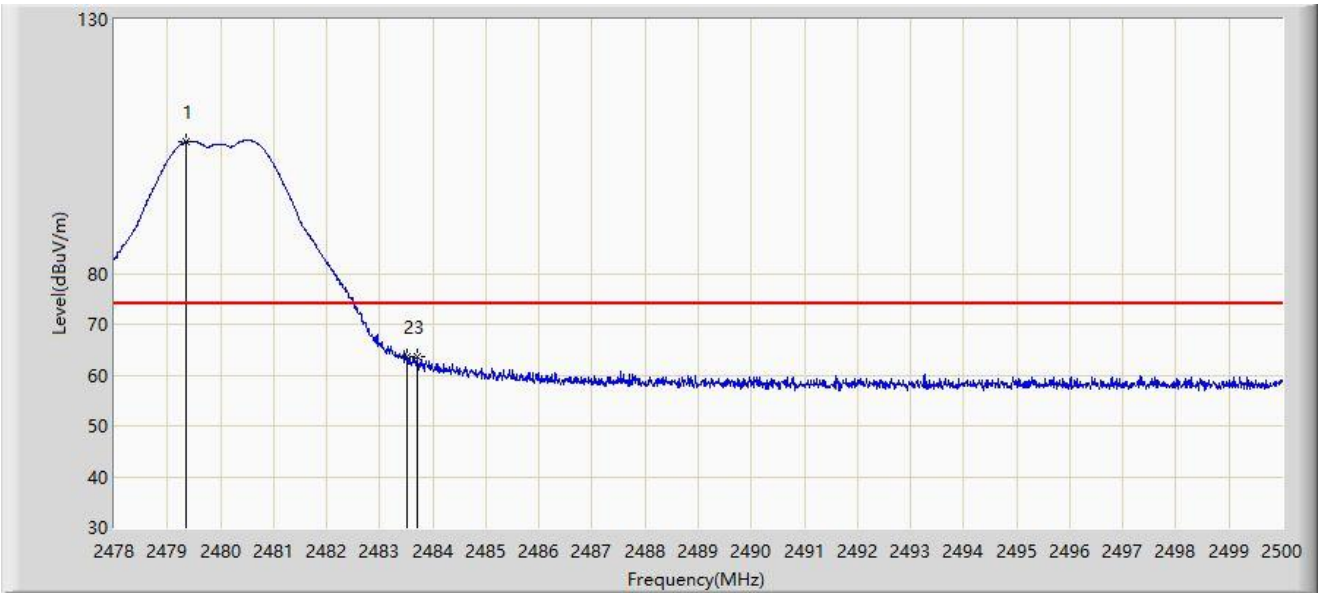


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1		*	2479.848	102.830	71.825	N/A	N/A	31.005	AV
2			2483.500	53.276	22.255	-0.724	54.000	31.021	AV

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

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

Site: WZ-AC1	Time: 2022/01/14 - 01:25
Temperature: 22°C	Humidity: 41.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Kin Xia
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Giga Hub	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at Channel 2480MHz	

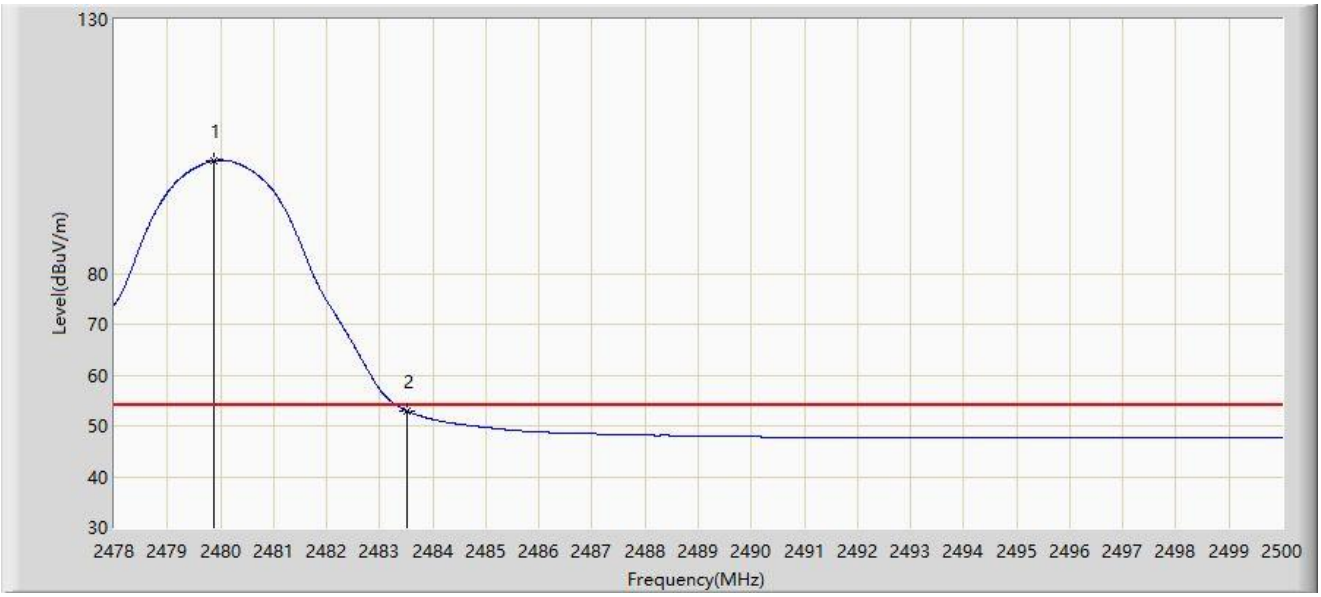


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1		*	2479.364	105.946	74.943	N/A	N/A	31.003	PK
2			2483.500	63.532	32.511	-10.468	74.000	31.021	PK
3			2483.720	63.716	32.694	-10.284	74.000	31.022	PK

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

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

Site: WZ-AC1	Time: 2022/01/14 - 01:25
Temperature: 22°C	Humidity: 41.2%
Limit: FCC_Part15_Band Edge(3m)	Engineer: Kin Xia
Probe: WZ-AC1_BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Giga Hub	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at Channel 2480MHz	



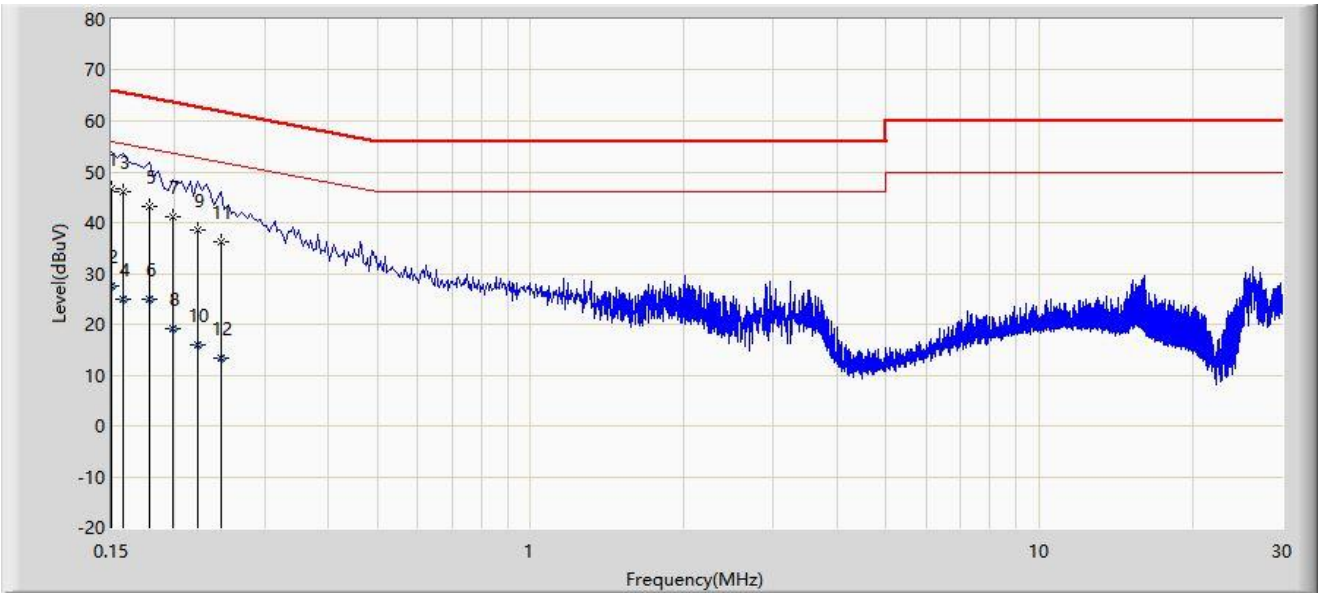
No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV/m)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV/m)	Factor (dB/m)	Type
1		*	2479.870	102.224	71.219	N/A	N/A	31.005	AV
2			2483.500	52.962	21.941	-1.038	54.000	31.021	AV

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

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

A.8 AC Conducted Emissions Test Result

Site: WZ-SR2	Time: 2022/01/19
Temperature: 24.0˚C	Humidity: 33.8%
Limit: FCC_Part15.207_CE_AC Power	Engineer: Helen Han
Probe: ENV216_101683_Filter Off_C	Polarity: Line
EUT: Giga Hub	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at channel 2405MHz	

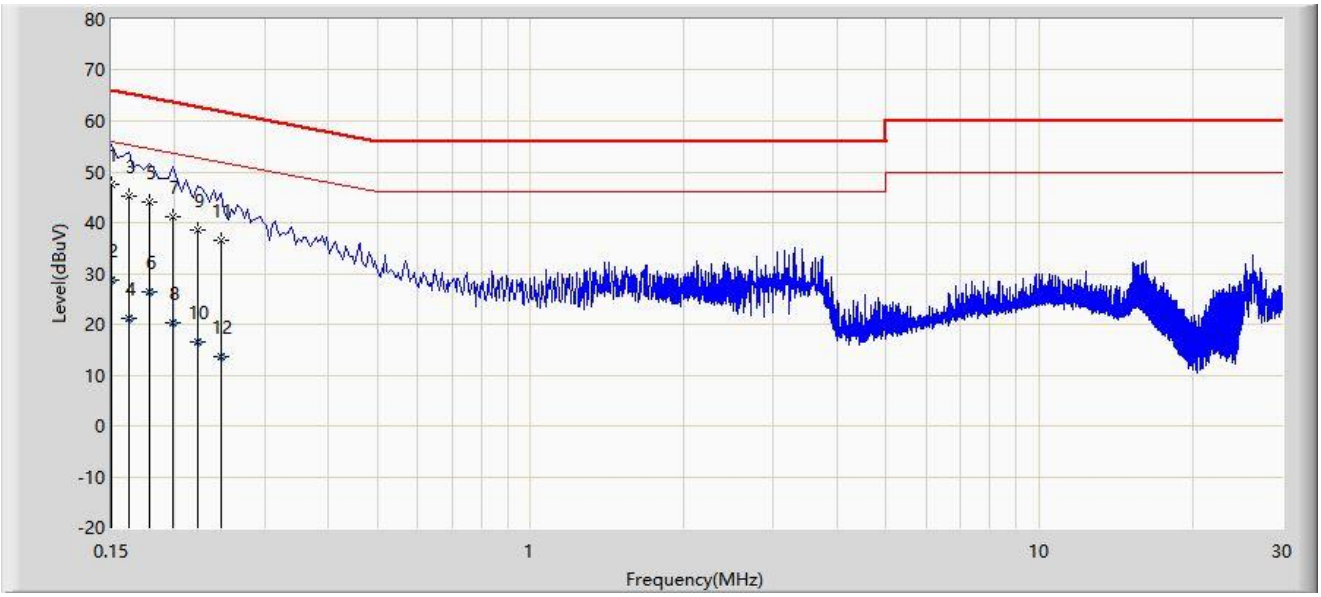


No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV)	Factor (dB)	Type
1		*	0.150	46.809	36.759	-19.191	66.000	10.050	QP
2			0.150	27.493	17.444	-28.507	56.000	10.050	AV
3			0.158	45.995	35.947	-19.574	65.568	10.048	QP
4			0.158	25.040	14.992	-30.528	55.568	10.048	AV
5			0.178	43.307	33.263	-21.272	64.578	10.044	QP
6			0.178	24.803	14.759	-29.776	54.578	10.044	AV
7			0.198	41.107	31.065	-22.587	63.694	10.043	QP
8			0.198	19.116	9.073	-34.578	53.694	10.043	AV
9			0.222	38.457	28.411	-24.287	62.744	10.046	QP
10			0.222	15.910	5.865	-36.833	52.744	10.046	AV
11			0.246	36.113	26.060	-25.778	61.891	10.052	QP
12			0.246	13.245	3.193	-38.646	51.891	10.052	AV

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

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

Site: WZ-SR2	Time: 2022/01/19
Temperature: 24.0˚C	Humidity: 33.8%
Limit: FCC_Part15.207_CE_AC Power	Engineer: Helen Han
Probe: ENV216_101683_Filter Off_C	Polarity: Neutral
EUT: Giga Hub	Power: AC 120V/60Hz
Test Mode: Transmit by ZigBee at channel 2405MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBµV)	Reading Level (dBµV)	Margin (dB)	Limit (dBµV)	Factor (dB)	Type
1		*	0.150	47.515	37.138	-18.485	66.000	10.377	QP
2			0.150	28.625	18.249	-27.375	56.000	10.377	AV
3			0.162	45.295	34.934	-20.066	65.361	10.361	QP
4			0.162	21.266	10.906	-34.095	55.361	10.361	AV
5			0.178	43.939	33.591	-20.640	64.578	10.348	QP
6			0.178	26.296	15.948	-28.283	54.578	10.348	AV
7			0.198	41.052	30.715	-22.642	63.694	10.337	QP
8			0.198	20.414	10.077	-33.280	53.694	10.337	AV
9			0.222	38.679	28.345	-24.065	62.744	10.333	QP
10			0.222	16.637	6.304	-36.107	52.744	10.333	AV
11			0.246	36.502	26.164	-25.389	61.891	10.338	QP
12			0.246	13.616	3.278	-38.275	51.891	10.338	AV

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

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

Appendix B - Test Setup Photograph

Refer to “2201RSU021-UT” file.

Appendix C - EUT Photograph

Refer to “2201RSU021-UE” file.

The End