MEASUREMENT REPORT
FCC PART 15.247 WLAN 802.11b/g/n

Report No.: S20240511014701E02

Issue Date: 06-17-2024

Applicant:	Shanghai MXCHIP Information Technology Co., Ltd
Address:	Floor 9, Building B, Lane 2145, JinshaJiang Road, Putuo District, Shanghai
FCC ID:	P53-EMC5020
Product:	2.4GHz Wi-Fi/BLE Module
Model No.:	EMC5020-P
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01v05r02
Result:	Pass
Item Receipt Date:	May 11, 2024
Test Date:	May 13 ~ Jun 04, 2024

Compiled By: Stone Zhang
(Stone Zhang)
Senior Test Engineer

Approved By: Line Chen
(Line Chen)
Engineer Manager

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 C63.4-2014. Test results reported herein relate only to the item(s)
The test report shall not be reproduced except in full without the written approval of Fangguang Inspection & Testing Co., Ltd. Wuxi Branch
The test report must not be used by the client to claim product certifications, approval, or endorsement by NVLAP, NIST or any agency of U.S. Government.

Revision History

Report No.	Version	Description	Issue Date
S20240511014701E02	Rev. 01	/	06-17-2024

CONTENTS

Description Page

§2.1033 General Information ... 5

1. INTRODUCTION ... 6

1.1. Scope ... 6
1.2. Fangguang Test Location ... 6

2. PRODUCT INFORMATION ... 7

2.1. Equipment Description ... 7
2.2. Product Specification Subjective to this Report ... 7
2.3. Operation Frequency / Channel List ... 7
2.4. Device Capabilities ... 7
2.5. Description of Test Software ... 12
2.6. Test Mode ... 13
2.7. Test Configuration ... 13
2.8. EMI Suppression Device(s)/Modifications ... 13
2.9. EUT Photo ... 13
2.10. Labeling Requirements ... 13
2.11. Calculation with all conversion and correction factors used ... 13

3. DESCRIPTION OF TEST ... 14

3.1. Evaluation Procedure ... 14
3.2. AC Line Conducted Emissions ... 14
3.3. Radiated Emissions ... 15

4. ANTENNA REQUIREMENTS ... 16

5. TEST EQUIPMENT CALIBRATION DATE ... 17

6. MEASUREMENT UNCERTAINTY ... 18

7. TEST RESULT ... 19

7.1. Summary ... 19
7.2. 6dB Bandwidth Measurement ... 20
7.2.1. Test Limit ... 20
7.2.2. Test Procedure used ... 20
7.2.3. Test Setting ... 20
7.2.4. Test Setup ... 20
7.2.5. Test Result ... 21
7.3. Output Power Measurement ... 25

7.3.1. Test Limit 25
7.3.2. Test Procedure Used 25
7.3.3. Test Setting 25
7.3.4. Test Setup 26
7.3.5. Test Result of Output Power 26
7.4. Power Spectral Density Measurement 32
7.4.1. Test Limit 32
7.4.2. Test Procedure Used 32
7.4.3. Test Setting 32
7.4.4. Test Setup 33
7.4.5. Test Result 34
7.5. Conducted Band Edge and Out-of-Band Emissions 40
7.5.1. Test Limit 40
7.5.2. Test Procedure Used 40
7.5.3. Test Settitng 40
7.5.4. Test Setup 40
7.5.5. Test Result 41
7.6. Radiated Spurious Emission Measurement 52
7.6.1. Test Limit 52
7.6.2. Test Procedure Used 52
7.6.3. Test Setting 52
7.6.4. Test Setup 54
7.6.5. Test Result 56
7.7. Radiated Restricted Band Edge Measurement 67
7.7.1. Test Limit 67
7.7.2. Test Procedure Used 70
7.7.3. Test Setting 70
7.7.4. Test Setup 71
7.7.5. Test Result 72
7.8. AC Conducted Emissions Measurement 96
7.8.1. Test Limit 96
7.8.2. Test Setup 96
7.8.3. Test Result 97

8. CONCLUSION 98

§2.1033 General Information

Applicant:	Shanghai MXCHIP Information Technology Co., Ltd
Applicant Address:	Floor 9, Building B, Lane 2145, JinshaJiang Road, Putuo District, Shanghai
Manufacturer:	Chengdu Xuguang Technology Co., Ltd
Manufacturer Address:	No. 86, Section 2, Gongyuan Road, Longquanyi, Chengdu, Sichuan
Test Site:	Fangguang Inspection & Testing Co., Ltd.
LAB ID:	CN5037
Test Site Address:	G9 Building, China Sensor Network International Innovation Park No.200, Linghu Avenue Wuxi, Jiangsu 214000 China
FCC Rule Part(s):	Part 15 Subpart C (15.247)
FCC ID:	P53-EMC5020
Test Device Serial No.:	S/N.:/ ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	Digital Transmission System (DTS)

1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2. Fangguang Test Location

These measurement tests were performed at the Fangguang Inspection and testing Co.,LTD located at 200 Linghu Avenue, Xinwu District, Wuxi City. The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014.

2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	2.4GHz Wi-Fi/BLE Module
Model Name:	EMC5020-P
Trade Mark:	MXCHIP®
Input Voltage Range:	DC5.0V 300mA

2.2. Product Specification Subjective to this Report

Frequency Range:	802.11b/g/n20/ax20: 2412 ~ 2462MHz
Channel Number:	802.11b/g/n20/ax20: 11
Type of Modulation:	802.11b: DSSS 802.11g/n: OFDM
Data Rate:	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: MCS0~MCS7
Antenna Type:	PCB Antenna
Antenna Gain:	2dBi

2.3. Operation Frequency / Channel List

802.11b/g/n20

Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2412 MHz	02	2417 MHz	03	2422 MHz
04	2427 MHz	05	2432 MHz	06	2437 MHz
07	2442 MHz	08	2447 MHz	09	2452 MHz
10	2457 MHz	11	2462 MHz	--	--

EUT was tested with Channel 01, 06 and 11.

2.4. Device Capabilities

This device contains the following capabilities: 2.4GHz WLAN (DTS)

Note: 2.4GHz WLAN (DTS) operation is possible in 20MHz channel bandwidths. The maximum achievable duty cycle was determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles:

Test Mode	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
802.11b	2412	19.00	19.00	100.00
	2437	19.00	19.00	100.00
	2462	19.00	19.00	100.00
802.11g	2412	19.00	19.00	100.00
	2437	19.00	19.00	100.00
	2462	19.00	19.00	100.00
802.11n-HT20	2412	19.00	19.00	100.00
	2437	19.00	19.00	100.00
	2462	19.00	19.00	100.00

Test Graphs：

11B_2412

11B_2437

11B_2462


11G_2412

11G_2437


11G_2462

11N20SISO_2412


11N20SISO_2437

11N20SISO_2462

2.5. Description of Test Software

The test utility software used during testing was “AliGenieFlashTool.exe”, pre-scan with all the data rates, and the worst case was performed as below:

Test Mode	Data Rate	*Power Level Setting
802.11b	1 Mbps	15
802.11g	6 Mbps	13
802.11n-HT20	MCS0	13

2.6. Test Mode

Test Mode	Mode 1: Transmit by 802.11b
	Mode 2: Transmit by 802.11g
	Mode 3: Transmit by 802.11n-HT20

2.7. Test Configuration

The EUT was tested per the guidance of KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.8. EMI Suppression Device(s)/Modifications

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

2.9. EUT Photo

The EUT external photo, internal photo and test setup photo, please refer to the plots in the S20240511014701-A1/A2/A3.

2.10. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

2.11. Calculation with all conversion and correction factors used

For AC Line Conducted Emissions Test:

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

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

For Radiated Emissions Below 1GHz Test:

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

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

For Radiated Emissions Above 1GHz Test:

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

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

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

Deviation from measurement procedure…………………………......................................None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. The turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-25GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. 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.”

- Use a unique coupling to the intentional radiator**.**

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	FWXGJC-2016-181	1 year	2025/03/07
Two-Line V-Network	R&S	ENV 216	FWXGJC-2016-182	1 year	2025/04/28
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-385	1 year	2025/02/25

Radiated Emission

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Loop Antenna	Schwarzbeck	FMZB 1519B	FWXGJC-2018-015	3 year	2024/08/13
Bi-Log Antenna	R&S	HL562E	FWXGJC-2016-267-06	3 year	2025/03/02
Broadband Horn Antenna	R&S	HF907	FWXGJC-2016-267-07	1 year	2025/03/01
Broadband Horn Antenna	Schwarzbeck	BBHA9170	FWXGJC-2018-016	3 year	2024/06/04
EMI Receiver	R&S	ESR26	FWXGJC-2016-267-01	1 year	2024/11/05
Pre-Amplifier	R&S	SCU-18D	FWXGJC-2016-267-05	1 year	2024/11/05
Pre-Amplifier	R&S	EMC184055 SE	FWXGJC-2018-018	3 year	2025/04/13
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-387	1 year	2024/11/03
Anechoic Chamber	Aimuke	EMCCT-3	FWXGJC-2016-270	1 year	2025/06/07

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Keysight	N9010B	FWXGJC-2018-010	1 year	2025/03/02
RF Control Unit	Toncend	JS0806-2	FWXGJC-2018-013	1 year	2025/05/19
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-385	1 year	2025/02/25

Test Software	Manufacturer	Version	Asset No.	Function
EMI Test Software	tonscend	V3.3.10	/	/

6. 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
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.05dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 30MHz-1GHz: 3.06dB 1GHz-12.75GHz: 4.13dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 30MHz-1GHz: 1.00 dB 1GHz-26.5GHz: 1.30 dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.60dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.80dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.20MHz

7. TEST RESULT

7.1. Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	6dB Bandwidth	≥ 500kHz	Conducted	Pass	Section 7.2
15.247(b)(3)	Output Power	≤ 30dBm		Pass	Section 7.3
15.247(e)	Power Spectral Density	≤ 8dBm/3kHz		Pass	Section 7.4
15.247(d)	Band Edge	≥ 20dBc		Pass	Section 7.5
15.247(d)	Out-of-Band Emissions	≥ 20dBc		Pass	Section 7.6
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS GEN [8.9])	Radiated	Pass	Section 7.7
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits (RSS GEN [8.8])	Line Conducted	Not Applicable	Section 7.8

Notes:

1) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
2) 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.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

7.2. 6dB Bandwidth Measurement

7.2.1. Test Limit

The minimum permissible 6dB bandwidth is 500 kHz.

7.2.2. Test Procedure used

ANSI C63.10-2013 Section 11.8.2 Option 1

KDB 558074 D01 v05r02 – Section 8.2

7.2.3. Test Setting

1. Set RBW = 100 kHz
2. VBW ≥ 3 × RBW
3. Detector = peak
4. Trace mode = max hold
5. Sweep = auto couple
6. Allow the trace was allowed to stabilize
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.2.4. Test Setup

7.2.5. Test Result

Test Mode	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit [MHz]	99% BW[MHz]	Verdict
802.11b	2412	9.520	2407.000	2416.520	≥0.5	13.539	PASS
	2437	9.040	2432.480	2441.520	≥0.5	13.411	PASS
	2462	9.080	2457.440	2466.520	≥0.5	13.464	PASS
802.11g	2412	16.320	2403.840	2420.160	≥0.5	16.660	PASS
	2437	16.320	2428.840	2445.160	≥0.5	16.588	PASS
	2462	16.320	2453.840	2470.160	≥0.5	16.631	PASS
802.11n-HT20	2412	17.200	2403.360	2420.560	≥0.5	17.473	PASS
	2437	17.040	2428.480	2445.520	≥0.5	17.447	PASS
	2462	17.080	2453.440	2470.520	≥0.5	17.441	PASS

11B _2412

11B_2437

11B_2462

11G_2412

11G_2437

11G_2462

11N20SISO_2412

11N20SISO_2437

11N20SISO_2462
 

7.3. Output Power Measurement

7.3.1. Test Limit

The maximum permissible conducted output power is 1 Watt (30dBm). And for antenna gain greater than 6dBi the limit shall reduce by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.3.2. Test Procedure Used

ANSI C63.10-2013 – Section 11.9.2.2.4

KDB 558074 D01 v05r02 – Section 8.3.2.2

7.3.3. Test Setting

1. Set span to at least 1.5 times the OBW..

2. Set RBW = 1% to 5% of the OBW, not to exceed 1 MHz.

3. Set VBW ≥ [3 × RBW].

4. Number of points in sweep ≥ [2 × span / RBW]. (This gives bin-to-bin spacing RBW / 2, so that narrowband signals are not lost between frequency bins.)

5.Sweep time = auto.

6. Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

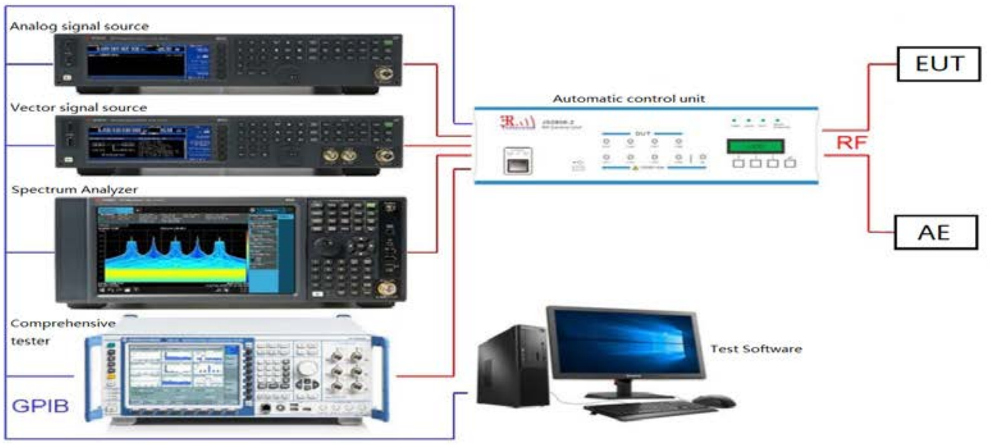
7. Do not use sweep triggering. Allow the sweep to “free run.”

8. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the ON and OFF periods of the transmitter.

9. Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

10Add [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the ON and OFF times of the transmission). For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is 25%.

7.3.4. Test Setup



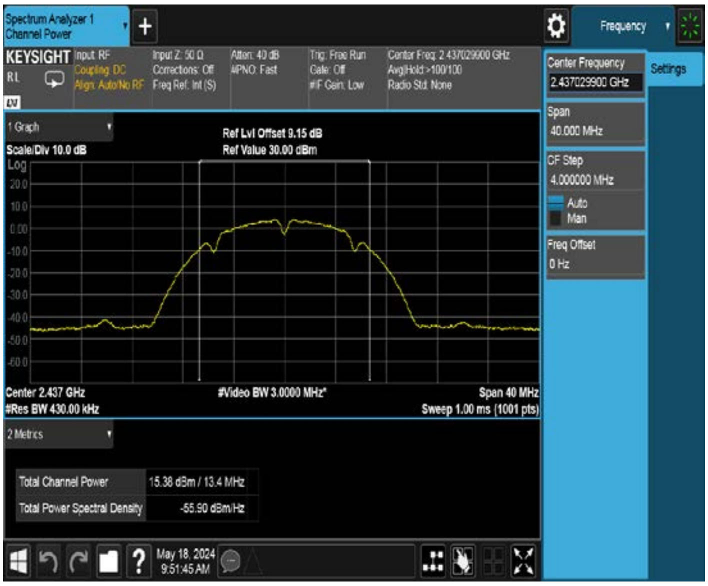
7.3.5. Test Result of Output Power

Test Mode	Channel	Average power [dBm]	Limit[dBm]	Verdict
802.11b	2412	14.77	≤30	PASS
	2437	15.38	≤30	PASS
	2462	15.18	≤30	PASS
802.11g	2412	12.65	≤30	PASS
	2437	13.30	≤30	PASS
	2462	12.97	≤30	PASS
802.11n-HT20	2412	12.55	≤30	PASS
	2437	13.21	≤30	PASS
	2462	13.06	≤30	PASS

The Duty Cycle Factor is compensated in the Offset of graph.

11B_2412

11B_2437



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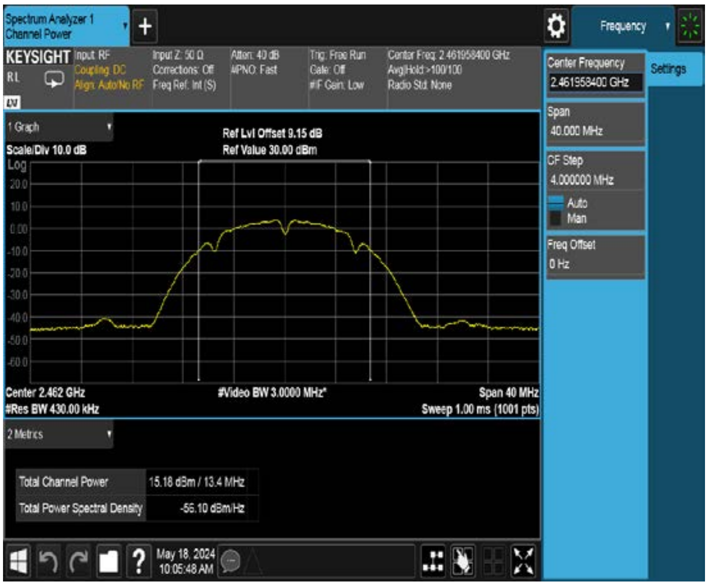
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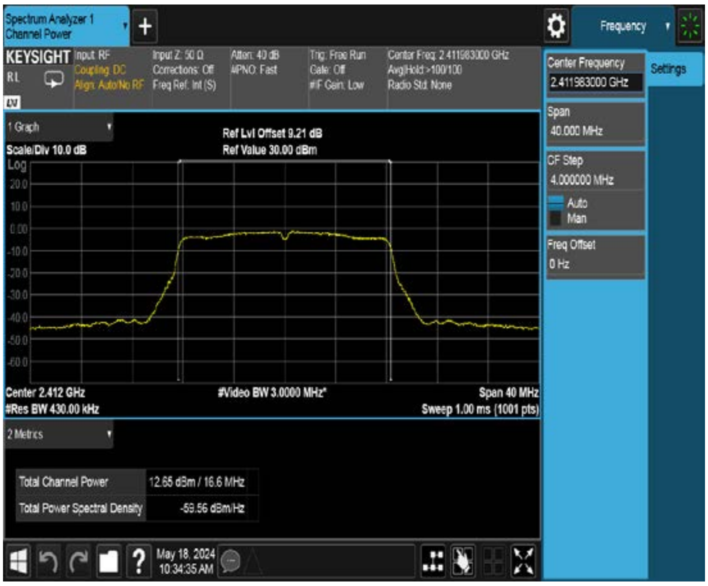

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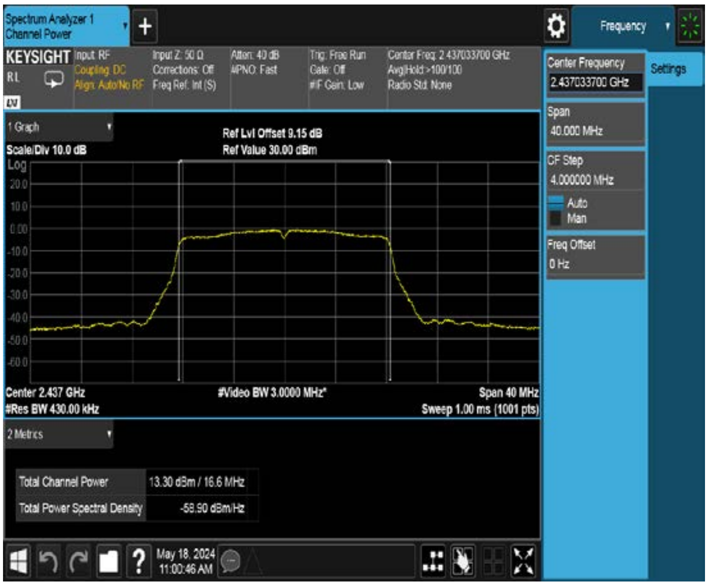
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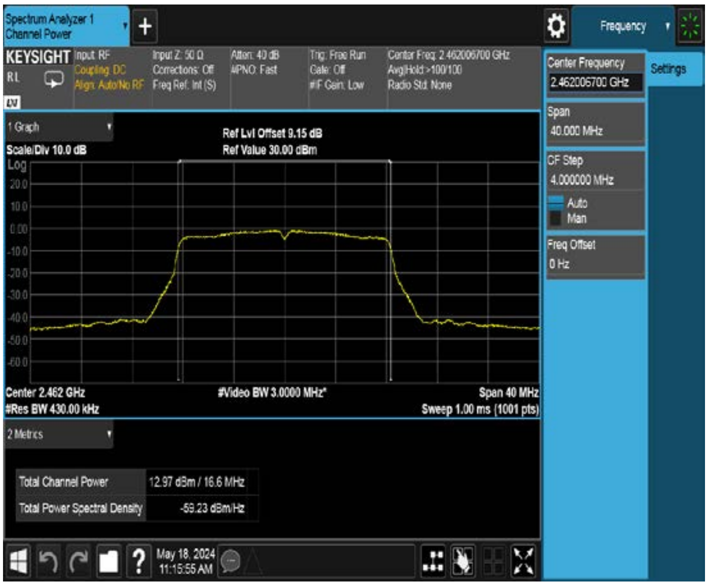
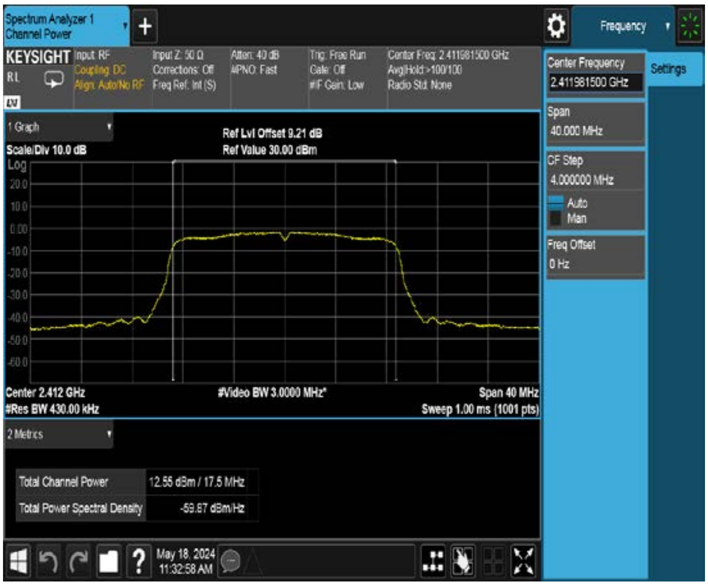
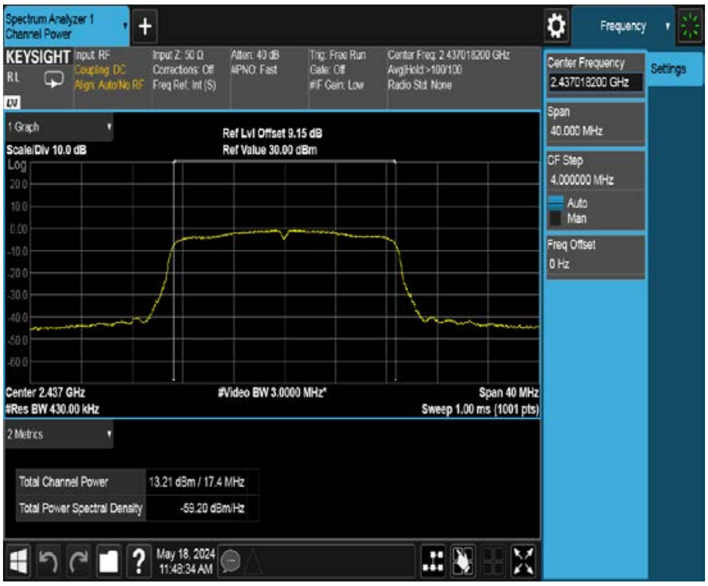
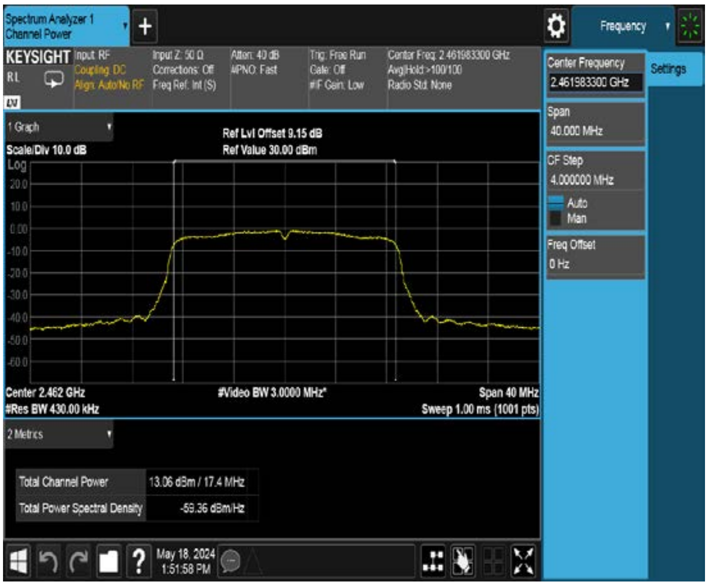


11N20SISO_2412

11N20SISO_2437


11N20SISO_2462


7.4. Power Spectral Density Measurement

7.4.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band. And for antenna gain greater than 6dBi the limit shall reduce by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.4.2. Test Procedure Used

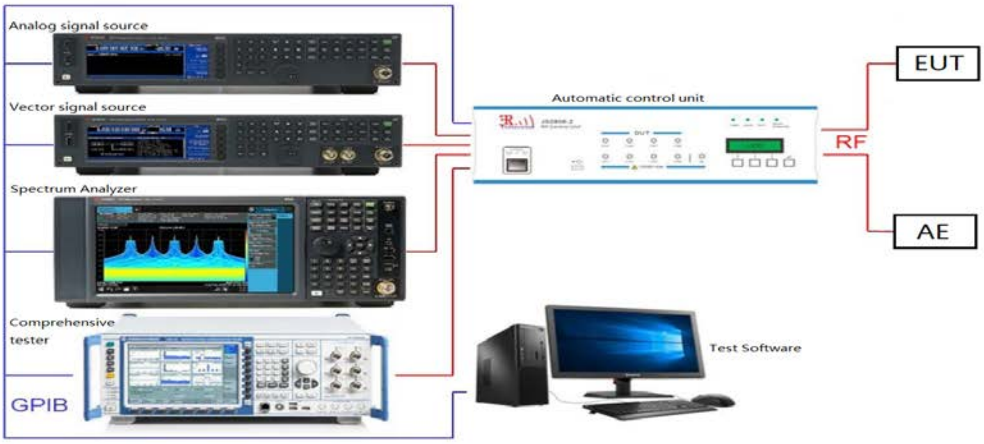
KDB 558074 D01 v05r02 - Section 8.4

ANSI C63.10 – Section 11.10.5

7.4.3. Test Setting

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the OBW.
3. Set the RBW to 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ [3 × RBW].
5. Detector = power averaging (rms) or sample detector (when rms not available).
6. Ensure that the number of measurement points in the sweep ≥ [2 × span / RBW].
7. Sweep time = auto couple.
8. Do not use sweep triggering; allow sweep to “free run.”
9. Employ trace averaging (rms) mode over a minimum of 100 traces.
10. Use the peak marker function to determine the maximum amplitude level.
11. Add [10 log (1 / D)], where D is the duty cycle measured in step a), to the measured PSD to If measured value exceeds requirement specified by regulatory agency, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).

7.4.4. Test Setup



7.4.5. Test Result

Test Mode	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
802.11b	2412	-16.73	≤8.00	PASS
	2437	-16.20	≤8.00	PASS
	2462	-16.38	≤8.00	PASS
802.11g	2412	-20.39	≤8.00	PASS
	2437	-19.79	≤8.00	PASS
	2462	-20.50	≤8.00	PASS
802.11n-HT20	2412	-20.94	≤8.00	PASS
	2437	-20.13	≤8.00	PASS
	2462	-20.56	≤8.00	PASS

11B_2412

11B_2437

11B_2462

11G_2412


11G_2437

11G_2462


11N20SISO_2412

11N20SISO_2437


11N20SISO_2462


7.5. Conducted Band Edge and Out-of-Band Emissions

7.5.1. 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.

7.5.2. Test Procedure Used

KDB 558074 D01 v05r02 - Section 8.5 & Section 8.6

ANSI C63.10 – Section 11.11&11.12

7.5.3. Test Settitng

(a) Set the center frequency and span to encompass frequency range to be measured

(b) RBW = 100kHz

(c) VBW = 300kHz

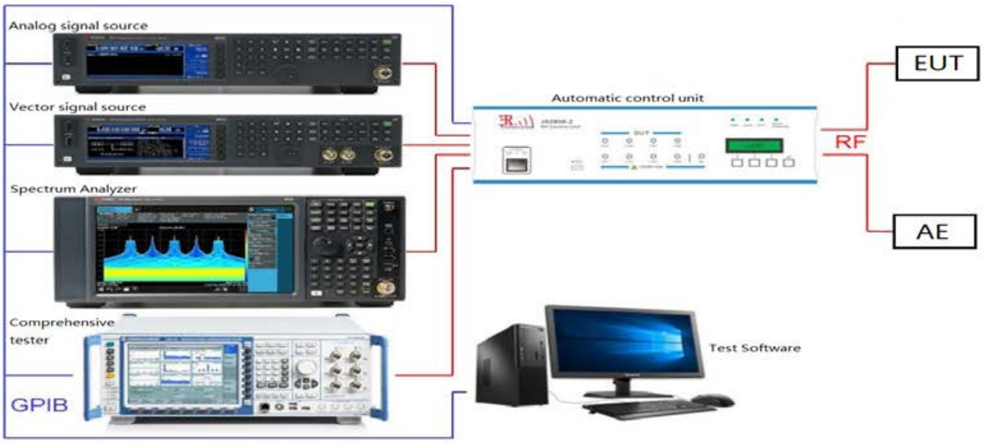
(d) Detector = RMS

(e) Trace mode = max hold

(f) Sweep time = auto couple

(g) The trace was allowed to stabilize

7.5.4. Test Setup



7.5.5. Test Result

Test Mode	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
802.11b	Low	2412	6.20	-38.35	≤-23.8	PASS
	High	2462	6.75	-48.76	≤-23.25	PASS
802.11g	Low	2412	-0.01	-39.80	≤-30.01	PASS
	High	2462	0.23	-49.07	≤-29.77	PASS
802.11n-HT20	Low	2412	-0.21	-40.40	≤-30.21	PASS
	High	2462	-0.51	-48.34	≤-30.51	PASS

Test Mode	ChName	Channel	Detector	Freq [MHz]	Result [dBm]	Limit [dBm]	Verdict
802.11b	Low	2412	AV	2310.000	-48.97	≤-41.20	PASS
			AV	2386.580	-48.03	≤-41.20	PASS
			AV	2390.000	-48.20	≤-41.20	PASS
			Peak	2310.000	-38.66	≤-21.20	PASS
			Peak	2387.100	-37.07	≤-21.20	PASS
			Peak	2390.000	-38.13	≤-21.20	PASS
	High	2462	AV	2483.500	-48.00	≤-41.20	PASS
			AV	2486.970	-47.87	≤-41.20	PASS
			AV	2500.000	-48.40	≤-41.20	PASS
			Peak	2483.500	-37.61	≤-21.20	PASS
			Peak	2487.520	-37.18	≤-21.20	PASS
			Peak	2500.000	-38.83	≤-21.20	PASS
802.11g	Low	2412	AV	2310.000	-49.13	≤-41.20	PASS
			AV	2389.960	-47.25	≤-41.20	PASS
			AV	2390.000	-47.25	≤-41.20	PASS
			Peak	2310.000	-38.45	≤-21.20	PASS
			Peak	2389.440	-32.34	≤-21.20	PASS
			Peak	2390.000	-35.03	≤-21.20	PASS
	High	2462	AV	2483.500	-46.88	≤-41.20	PASS
			AV	2483.560	-46.92	≤-41.20	PASS
			AV	2500.000	-48.40	≤-41.20	PASS
			Peak	2483.500	-33.93	≤-21.20	PASS
			Peak	2484.110	-31.25	≤-21.20	PASS
			Peak	2500.000	-38.41	≤-21.20	PASS

802.11n-HT20	Low	2412	AV	2310.000	-49.17	≤-41.20	PASS
			AV	2389.960	-47.06	≤-41.20	PASS
			AV	2390.000	-47.06	≤-41.20	PASS
			Peak	2310.000	-38.39	≤-21.20	PASS
			Peak	2388.790	-33.15	≤-21.20	PASS
			Peak	2390.000	-34.95	≤-21.20	PASS
	High	2462	AV	2483.500	-46.53	≤-41.20	PASS
			AV	2483.560	-46.59	≤-41.20	PASS
			AV	2500.000	-48.38	≤-41.20	PASS
			Peak	2483.500	-31.70	≤-21.20	PASS
			Peak	2484.660	-30.54	≤-21.20	PASS
			Peak	2500.000	-38.21	≤-21.20	PASS

11B_Low_2412


11B_High_2462


11G_Low_2412


11G_High_2462


11N20SISO_Low_2412


11N20SISO_High_2462


11B_Low_2412_AV


11B_Low_2412_Peak


11B_High_2462_AV

11B_High_2462_Peak


11G_Low_2412_AV

11G_Low_2412_Peak


11G_High_2462_AV

11G_High_2462_Peak


11N20SISO_Low_2412_AV


11N20SISO_Low_2412_Peak


11N20SISO_High_2462_AV

11N20SISO_High_2462_Peak


Note：

1. The Antenna Gain is compensated in the graph.
2. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.

7.6. Radiated Spurious Emission Measurement

7.6.1. 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

7.6.2. Test Procedure Used

ANSI C63.10-2013 – Section 6.6.4.3

7.6.3. Test Setting

Peak Field Strength Measurements

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

7. Trace was allowed to stabilize

Table 1 - RBW as a function of frequency

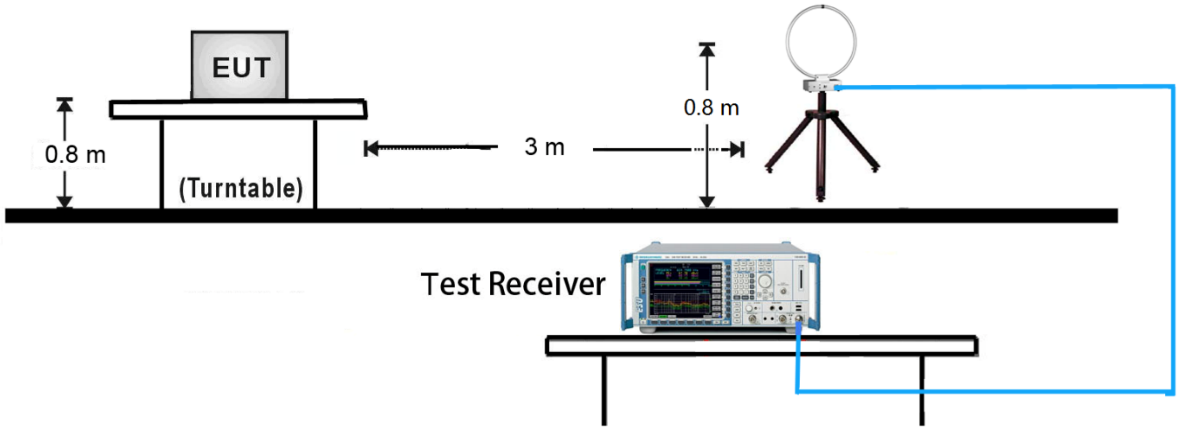
Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

<u>Average Field Strength Measurements</u>

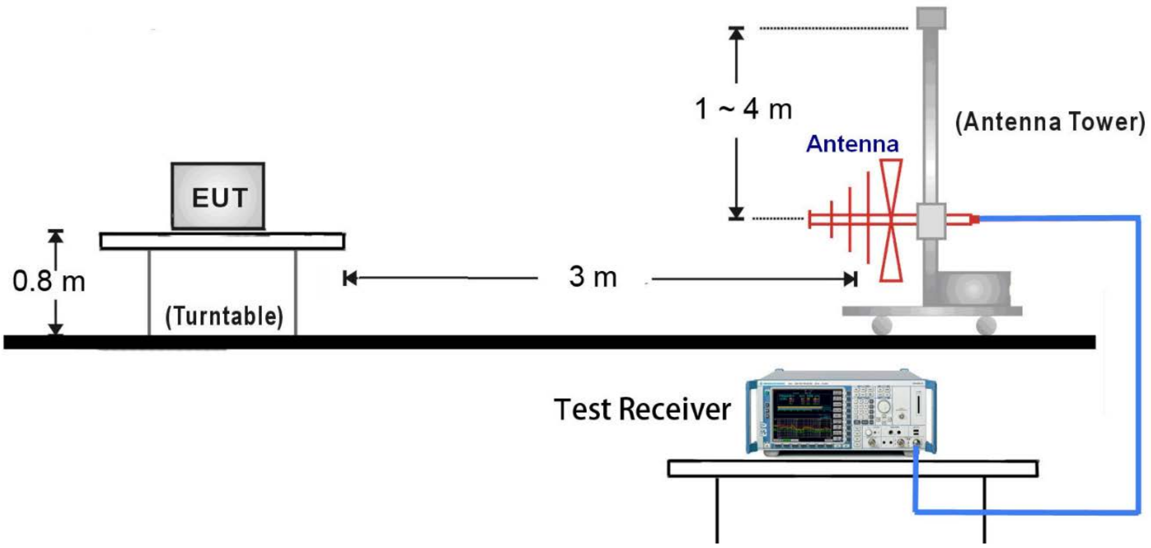
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = Power Average (RMS)
5. Number of sweep point = 2001 (Number of sweep points must be ≥ 2 x span / RBW)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces.

7.6.4. Test Setup

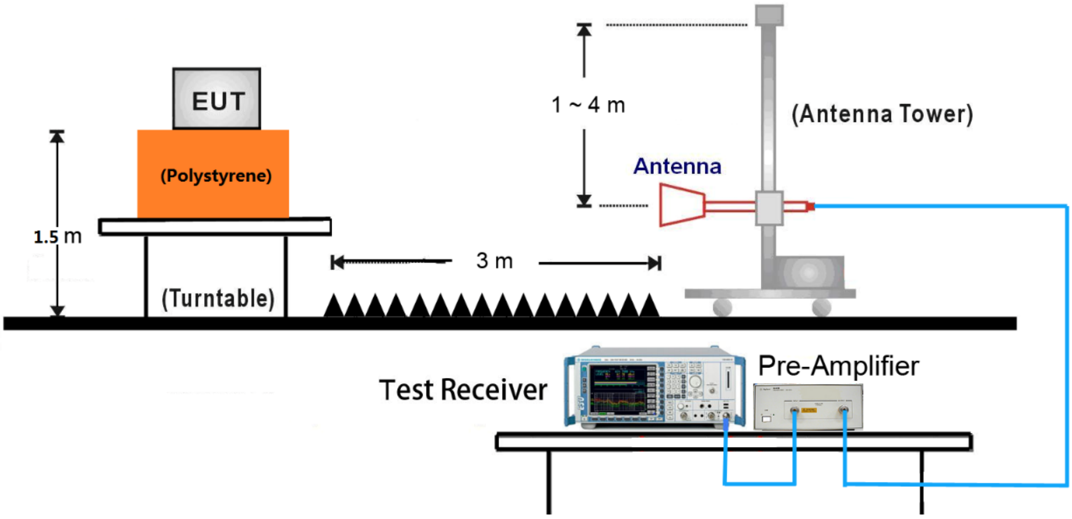
<u>9kHz ~ 30MHz Test Setup:</u>



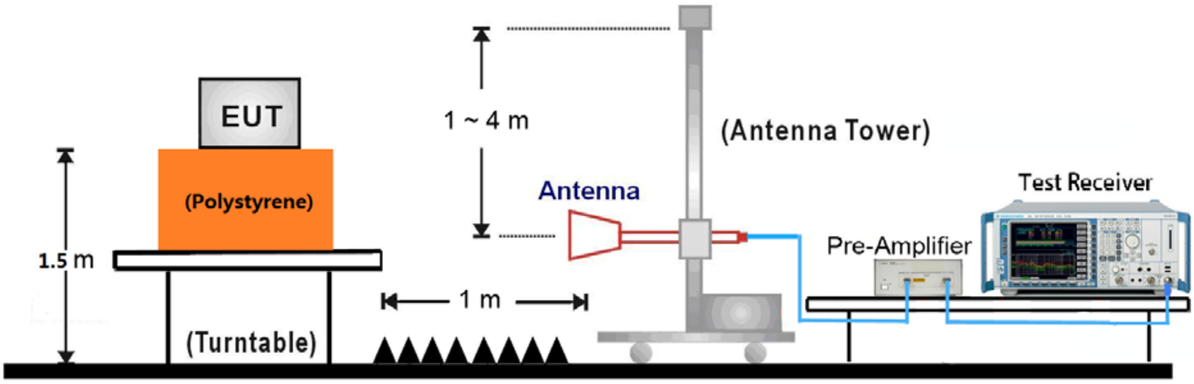
<u>30MHz ~ 1GHz Test Setup:</u>



1GHz ~ 18GHz Test Setup:



18GHz ~25GHz Test Setup:



7.6.5. Test Result

Test Mode:	802.11b	Test Date:	2024-05-23
Test Channel:	01-2412MHz	Test Engineer:	Stone Zhang
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. 3. This is the worst case of Radiated Emission for 1-18GHz.		

Frequency (MHz)	Level (dBµV/m)	Factor (dB)	Limit (dBµV/m)	Margin (dB)	Detector	Polarization
1117.3333	38.05	-19.03	74.00	35.95	Peak	Horizontal
1246.6667	39.93	-18.26	74.00	34.07	Peak	Horizontal
5145.0000	45.76	-1.15	74.00	28.24	Peak	Horizontal
7935.0000	49.37	2.31	74.00	24.63	Peak	Horizontal
1150.6667	38.80	-17.74	74.00	35.20	Peak	Vertical
3995.0000	43.88	-4.21	74.00	30.12	Peak	Vertical
5460.0000	46.06	-0.62	74.00	27.94	Peak	Vertical
8635.0000	50.07	2.55	74.00	23.93	Peak	Vertical

Test Mode:	802.11b	Test Date:	2024-05-23
Test Channel:	06-2437MHz	Test Engineer:	Stone Zhang
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. 3. This is the worst case of Radiated Emission for 1-18GHz.		

Frequency (MHz)	Level (dBμV/m)	Factor (dB)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1124.0000	36.52	-18.99	74.00	37.48	Peak	Horizontal
4190.0000	44.51	-4.20	74.00	29.49	Peak	Horizontal
6105.0000	47.93	0.10	74.00	26.07	Peak	Horizontal
9080.0000	50.71	3.96	74.00	23.29	Peak	Horizontal
1066.6667	37.77	-18.19	74.00	36.23	Peak	Vertical
1249.3333	42.37	-17.24	74.00	31.63	Peak	Vertical
4875.0000	45.21	-2.30	74.00	28.79	Peak	Vertical
7035.0000	48.19	0.19	74.00	25.81	Peak	Vertical

Test Mode:	802.11b	Test Date:	2024-05-23
Test Channel:	11-2462MHz	Test Engineer:	Stone Zhang
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. 3. This is the worst case of Radiated Emission for 1-18GHz.		

Frequency (MHz)	Level (dBμV/m)	Factor (dB)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1062.6667	40.23	-19.36	74.00	33.77	Peak	Horizontal
1773.3333	41.07	-14.75	74.00	32.93	Peak	Horizontal
5985.0000	47.59	0.03	74.00	26.41	Peak	Horizontal
7970.0000	49.98	2.46	74.00	24.02	Peak	Horizontal
1246.6667	38.48	-17.26	74.00	35.52	Peak	Vertical
3835.0000	44.46	-4.94	74.00	29.54	Peak	Vertical
7375.0000	48.28	0.62	74.00	25.72	Peak	Vertical
8765.0000	50.37	3.27	74.00	23.63	Peak	Vertical

Test Mode:	802.11g	Test Date:	2024-05-23
Test Channel:	01-2412MHz	Test Engineer:	Stone Zhang
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. 3. This is the worst case of Radiated Emission for 1-18GHz.		

Frequency (MHz)	Level (dBμV/m)	Factor (dB)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1244.0000	40.19	-18.28	74.00	33.81	Peak	Horizontal
3200.0000	42.42	-7.68	74.00	31.58	Peak	Horizontal
5005.0000	45.92	-0.90	74.00	28.08	Peak	Horizontal
7375.0000	49.51	0.67	74.00	24.49	Peak	Horizontal
1246.6667	40.21	-17.26	74.00	33.79	Peak	Vertical
1729.3333	40.17	-14.39	74.00	33.83	Peak	Vertical
5355.0000	45.67	-1.18	74.00	28.33	Peak	Vertical
7460.0000	48.83	0.58	74.00	25.17	Peak	Vertical

Test Mode:	802.11g	Test Date:	2024-05-23
Test Channel:	06-2437MHz	Test Engineer:	Stone Zhang
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. 3. This is the worst case of Radiated Emission for 1-18GHz.		

Frequency (MHz)	Level (dBµV/m)	Factor (dB)	Limit (dBµV/m)	Margin (dB)	Detector	Polarization
1064.0000	38.23	-19.35	74.00	35.77	Peak	Horizontal
1772.0000	39.06	-14.76	74.00	34.94	Peak	Horizontal
6005.0000	48.07	0.08	74.00	25.93	Peak	Horizontal
9775.0000	51.56	5.24	74.00	22.44	Peak	Horizontal
1224.0000	40.37	-17.38	74.00	33.63	Peak	Vertical
3435.0000	43.15	-6.53	74.00	30.85	Peak	Vertical
5235.0000	46.71	-1.20	74.00	27.29	Peak	Vertical
10065.0000	52.04	5.96	74.00	21.96	Peak	Vertical

Test Mode:	802.11g	Test Date:	2024-05-23
Test Channel:	11-2462MHz	Test Engineer:	Stone Zhang
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. 3. This is the worst case of Radiated Emission for 1-18GHz.		

Frequency (MHz)	Level (dBμV/m)	Factor (dB)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1077.3333	37.56	-19.27	74.00	36.44	Peak	Horizontal
4520.0000	44.93	-3.04	74.00	29.07	Peak	Horizontal
6375.0000	47.56	0.43	74.00	26.44	Peak	Horizontal
8625.0000	50.13	2.55	74.00	23.87	Peak	Horizontal
1066.6667	39.37	-18.19	74.00	34.63	Peak	Vertical
2042.6667	41.97	-12.52	74.00	32.03	Peak	Vertical
6030.0000	47.89	0.03	74.00	26.11	Peak	Vertical
8990.0000	50.33	3.62	74.00	23.67	Peak	Vertical

Test Mode:	802.11n-HT20	Test Date:	2024-05-23
Test Channel:	01-2412MHz	Test Engineer:	Stone Zhang
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. 3. This is the worst case of Radiated Emission for 1-18GHz.		

Frequency (MHz)	Level (dBμV/m)	Factor (dB)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1248.0000	39.84	-18.25	74.00	34.16	Peak	Horizontal
5040.0000	45.86	-1.11	74.00	28.14	Peak	Horizontal
6035.0000	47.22	0.12	74.00	26.78	Peak	Horizontal
8330.0000	50.81	2.70	74.00	23.19	Peak	Horizontal
1186.6667	38.33	-17.57	74.00	35.67	Peak	Vertical
1774.6667	39.54	-14.05	74.00	34.46	Peak	Vertical
5875.0000	47.53	-0.43	74.00	26.47	Peak	Vertical
8305.0000	49.78	2.06	74.00	24.22	Peak	Vertical

Test Mode:	802.11n-HT20	Test Date:	2024-05-23
Test Channel:	06-2437MHz	Test Engineer:	Stone Zhang
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. 3. This is the worst case of Radiated Emission for 1-18GHz.		

Frequency (MHz)	Level (dBμV/m)	Factor (dB)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1064.0000	38.33	-19.35	74.00	35.67	Peak	Horizontal
1120.0000	38.95	-19.02	74.00	35.05	Peak	Horizontal
5075.0000	46.17	-1.18	74.00	27.83	Peak	Horizontal
7775.0000	50.12	1.72	74.00	23.88	Peak	Horizontal
1064.0000	38.63	-18.20	74.00	35.37	Peak	Vertical
1729.3333	41.97	-14.39	74.00	32.03	Peak	Vertical
3630.0000	43.79	-5.78	74.00	30.21	Peak	Vertical
5000.0000	46.15	-1.57	74.00	27.85	Peak	Vertical

Test Mode:	802.11n-HT20	Test Date:	2024-05-23
Test Channel:	11-2462MHz	Test Engineer:	Stone Zhang
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. 3. This is the worst case of Radiated Emission for 1-18GHz.		

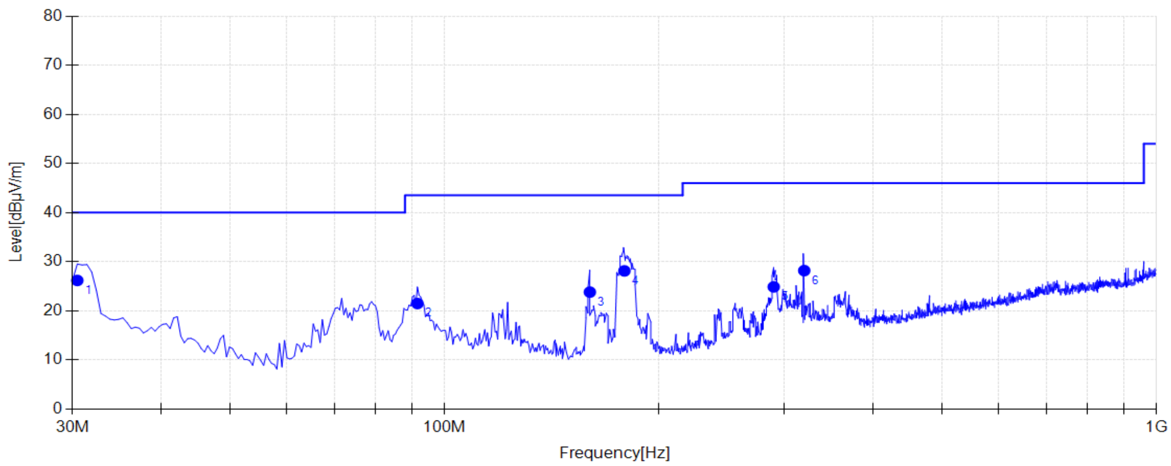
Frequency (MHz)	Level (dBμV/m)	Factor (dB)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1062.6667	37.23	-19.36	74.00	36.77	Peak	Horizontal
1393.3333	37.95	-17.37	74.00	36.05	Peak	Horizontal
4635.0000	44.77	-2.82	74.00	29.23	Peak	Horizontal
6695.0000	47.59	0.18	74.00	26.41	Peak	Horizontal
1198.6667	40.15	-17.52	74.00	33.85	Peak	Vertical
1749.3333	43.62	-14.28	74.00	30.38	Peak	Vertical
6565.0000	47.70	0.41	74.00	26.30	Peak	Vertical
8785.0000	51.09	3.46	74.00	22.91	Peak	Vertical

The worst case of Radiated Emission below 1GHz:

30MHz – 1GHz Test Data

EUT:	2.4GHz Wi-Fi/BLE Module	Polarity:	Horizontal
Model:	EMC5020-P	SN:	N/A
Mode:	Transmit at 802.11b Channel 2412MHz	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang

Test Graph

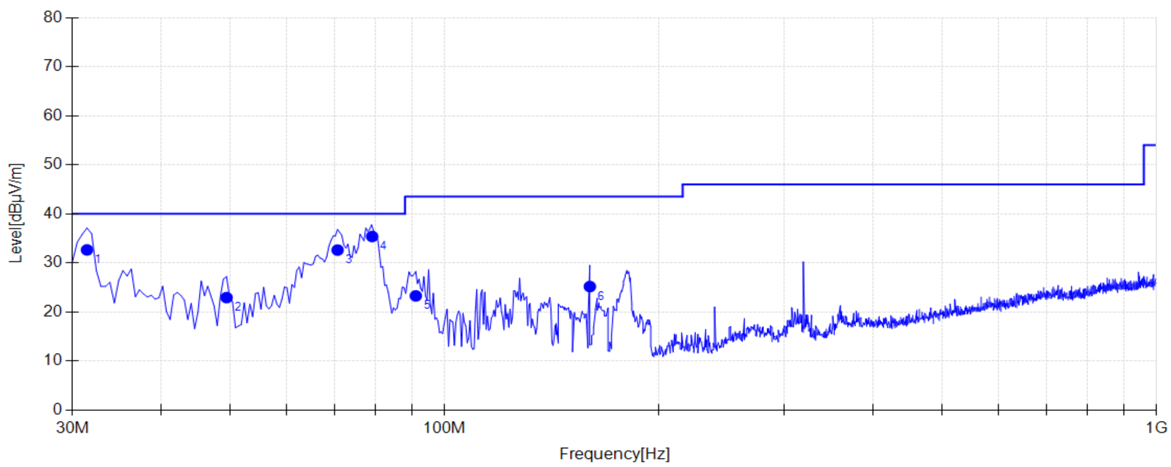


Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	30.4850	18.64	26.19	40.00	13.81	200	79	Horizontal
2	91.5950	10.48	21.50	43.50	22.00	200	30	Horizontal
3	159.980	10.04	23.82	43.50	19.68	200	30	Horizontal
4	178.895	10.46	28.14	43.50	15.36	200	357	Horizontal
5	289.960	12.67	24.88	46.00	21.12	100	359	Horizontal
6	320.030	13.44	28.20	46.00	17.80	100	193	Horizontal

Note 1: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

EUT:	2.4GHz Wi-Fi/BLE Module	Polarity:	Horizontal
Model:	EMC5020-P	SN:	N/A
Mode:	Transmit at 802.11b Channel 2412MHz	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang

Test Graph



Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	31.4550	17.53	32.66	40.00	7.34	100	232	Vertical
2	49.4000	9.70	22.94	40.00	17.06	100	149	Vertical
3	70.7400	7.84	32.63	40.00	7.37	100	47	Vertical
4	79.1108	8.71	35.40	40.00	4.60	100	336.5	Vertical
5	91.1100	10.07	23.29	43.50	20.21	100	6	Vertical
6	159.980	9.74	25.19	43.50	18.31	100	66	Vertical

Note 1: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

7.7. Radiated Restricted Band Edge Measurement

7.7.1. 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	8.25 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([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

For RSS-Gen Section 8.10 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 8.10 of RSS-Gen, must also comply with the radiated emission limits specified in Section 8.9.

Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.009 - 0.110	240 - 285	9.0 - 9.2
2.1735 - 2.1905	322 - 335.4	9.3 - 9.5
3.020 - 3.026	399.9 - 410	10.6 - 12.7
4.125 - 4.128	608 - 614	13.25 - 13.4
4.17725 - 4.17775	960 - 1427	14.47 - 14.5
4.20725 - 4.20775	1435 - 1626.5	15.35 - 16.2
5.677 - 5.683	1645.5 - 1646.5	17.7 - 21.4
6.215 - 6.218	1660 - 1710	22.01 - 23.12
6.26775 - 6.26825	1718.8 -1722.2	23.6 - 24.0
6.31175 - 6.31225	2200 - 2300	31.2 - 31.8
8.291 - 8.294	2310 -2390	36.43 - 36.5
8.362 - 8.366	2655 - 2900	Above 38.6
8.37625 - 8.38675	3260 - 3267	--
8.41425 - 8.41475	3332 -3339	
12.29 - 12.293	334.5 - 3358	
12.51975 - 12.52025	3500 - 4400	
12.57675 - 12.57725	4500 - 5150	
13.36 -13.41	5350 - 5460	
16.42 - 16.423	7250 - 7750	
16.69475 - 16.69525	8025 - 8500	
16.80425 - 16.80475	--	
25.5 - 25.67		
37.5 - 38.25		
73 - 74.6		
74.8 - 75.2		
108 - 138		
156.52475 - 156.525225		
156.7 - 156.9		

All out of band emissions appearing in a restricted band as specified in Section 8.10 of the RSS-

Gen must not exceed the limits shown in Table per Section 8.9.

RSS-Gen Section 8.9		
Frequency [MHz]	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

7.7.2. Test Procedure Used

ANSI C63.10 Section 6.3 (General Requirements)

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

7.7.3. Test Setting

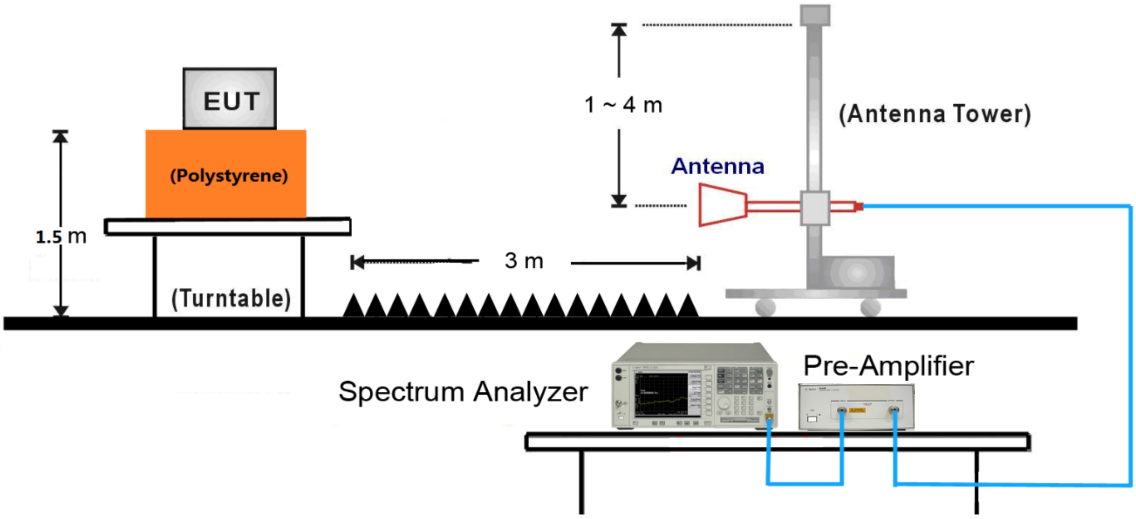
Peak Field Strength Measurements

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 = 3MHz
4. Detector = Power Average (RMS)
5. Number of sweep point = 2001 (Number of sweep points must be ≥ 2 x span / RBW)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces.

7.7.4. Test Setup

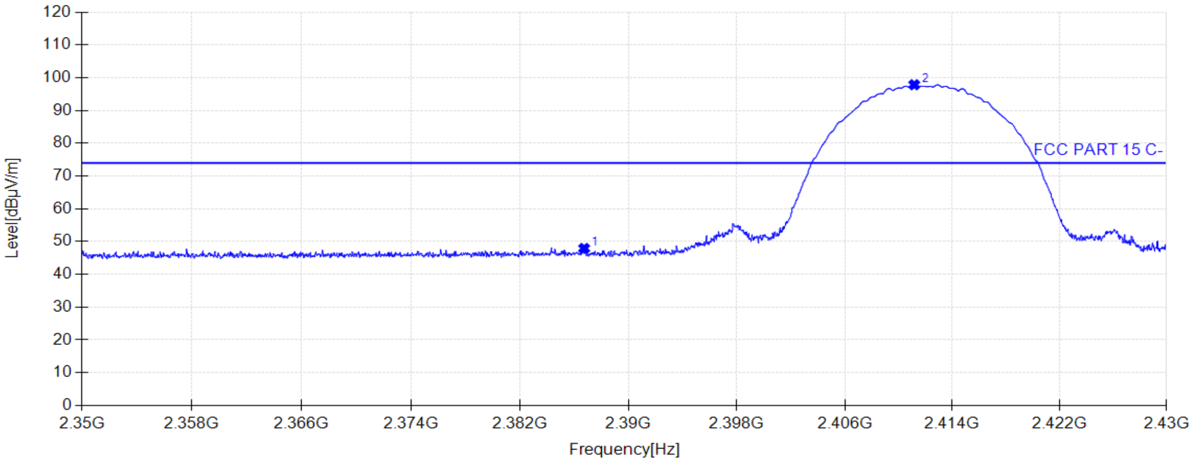


Note: This item was performed with the WIFI antenna connected.

7.7.5. Test Result

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11b Channel 2412MHz		

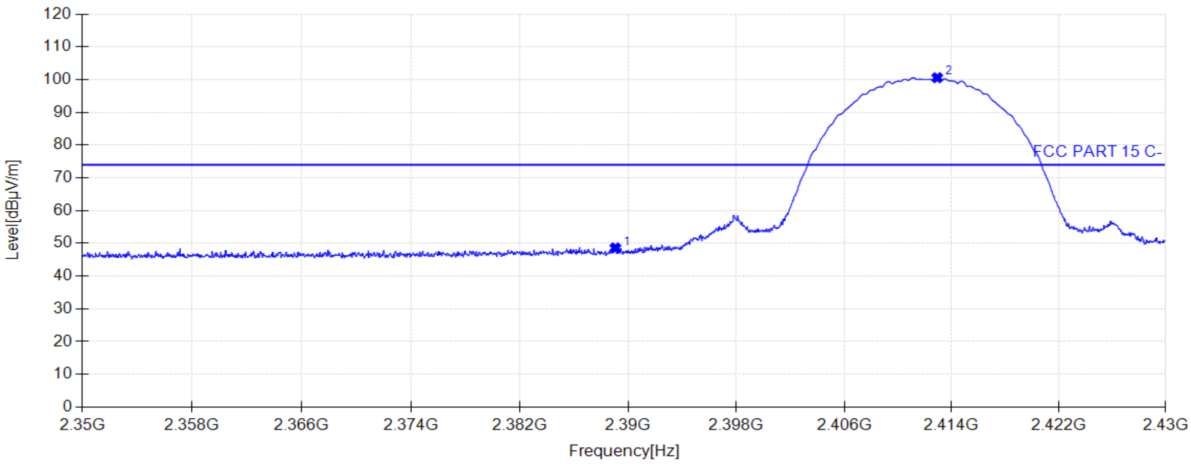
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2386.7200	47.92	33.20	74.00	26.08	160	124	Horizontal
2	2411.1600	97.84	33.27	/	/	160	82	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11b Channel 2412MHz		

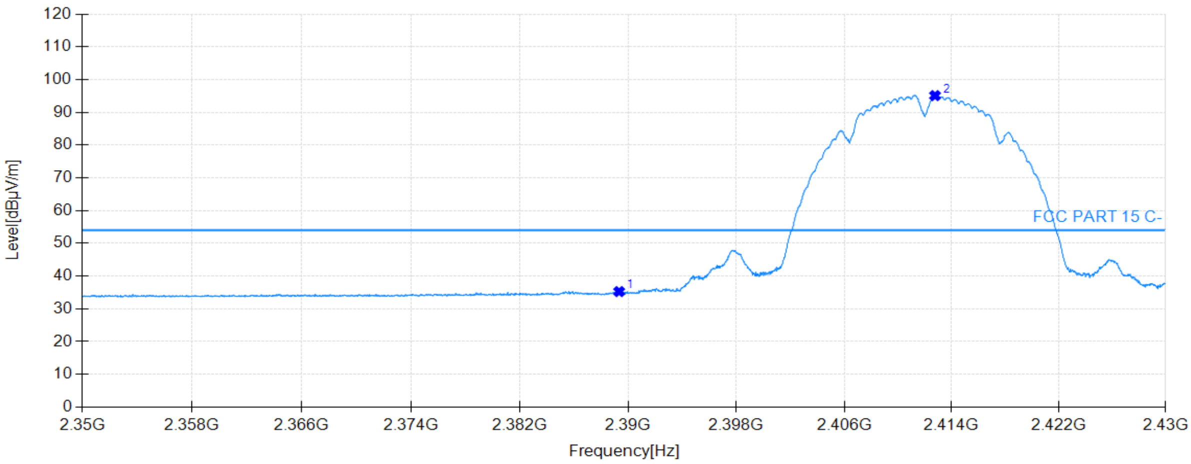
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.0400	48.59	33.10	74.00	25.41	160	38	Vertical
2	2412.9200	100.57	33.13	/	/	160	75	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11b Channel 2412MHz		

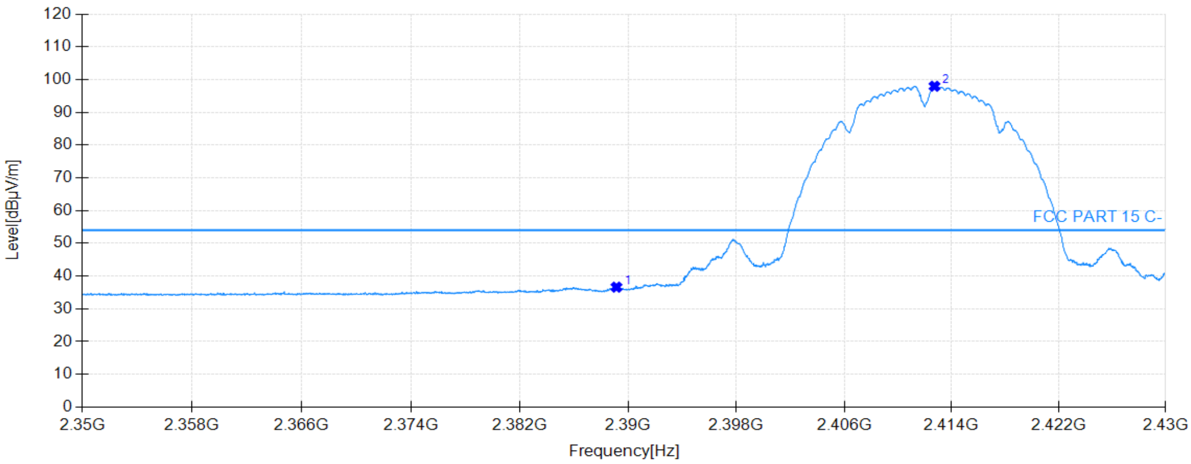
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.3200	35.27	33.20	54.00	18.73	160	83	Horizontal
2	2412.7600	95.10	33.27	/	/	160	83	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11b Channel 2412MHz		

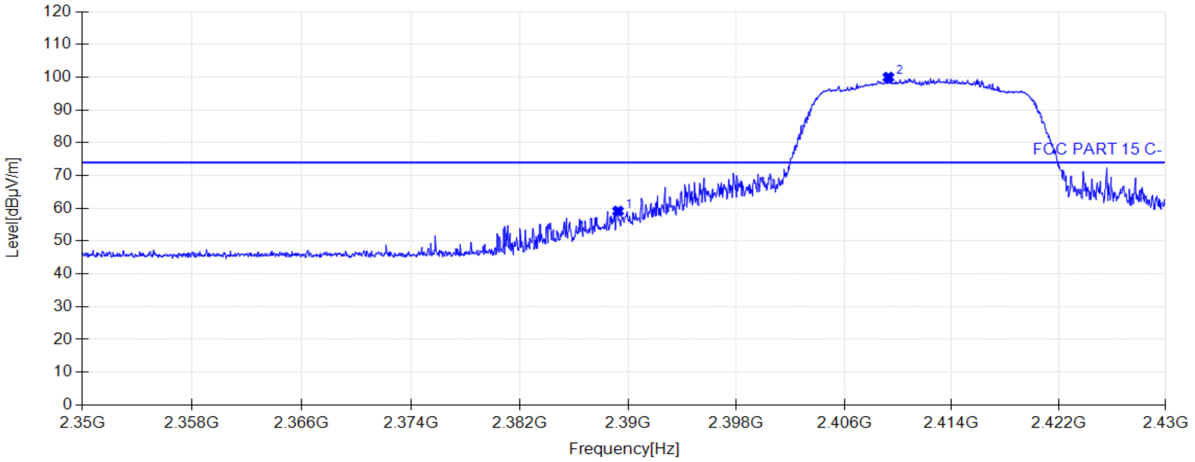
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.1200	36.62	33.10	54.00	17.38	160	123	Vertical
2	2412.7200	97.97	33.13	/	/	160	72	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11g Channel 2412MHz		

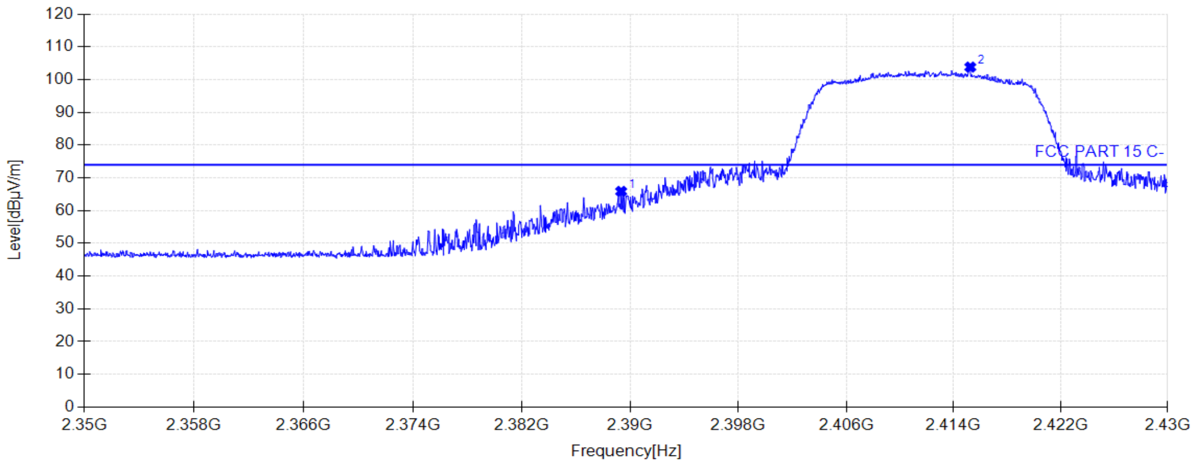
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.2400	59.14	33.20	74.00	14.86	160	174	Horizontal
2	2409.2800	99.96	33.26	/	/	160	87	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11g Channel 2412MHz		

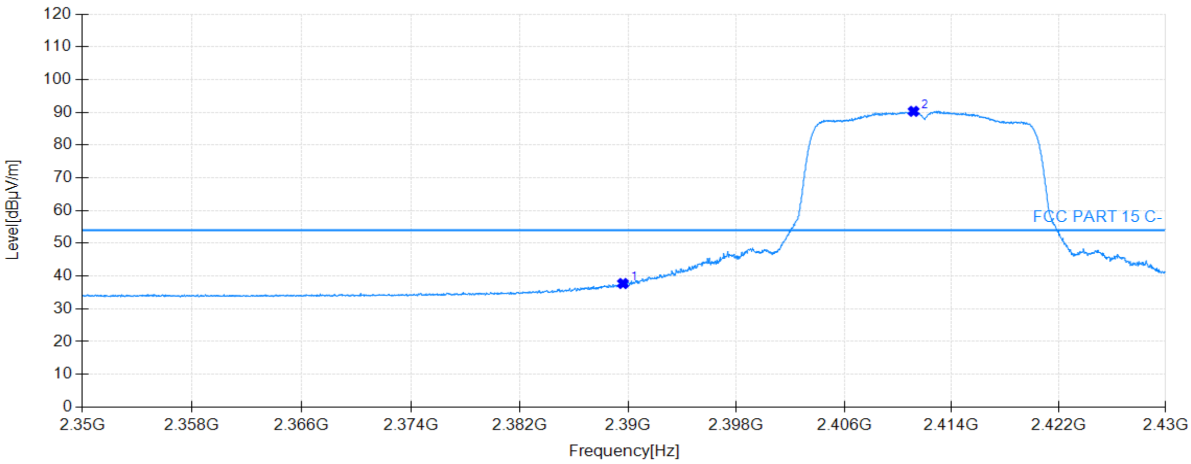
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.3200	65.86	33.10	74.00	8.14	160	19	Vertical
2	2415.2400	103.82	33.13	/	/	160	75	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11g Channel 2412MHz		

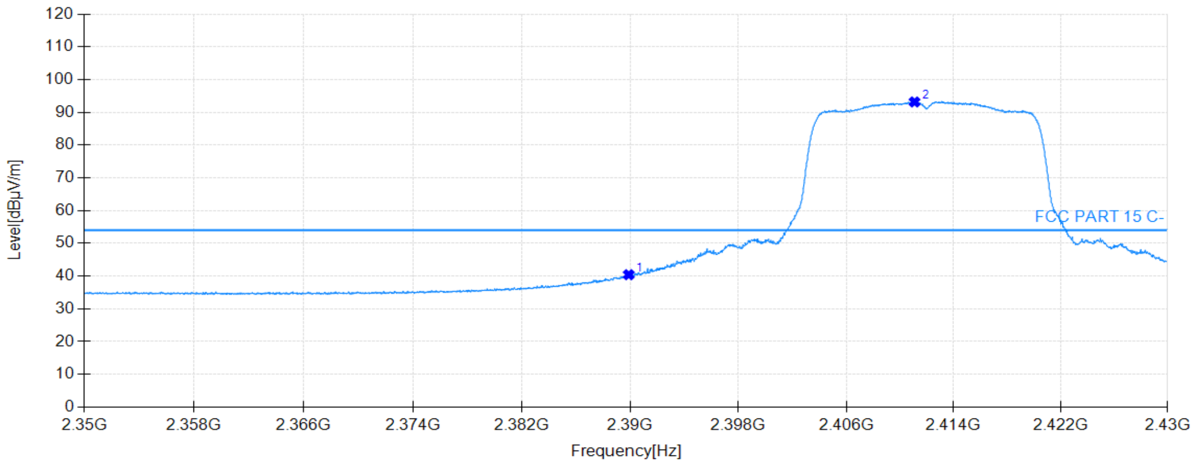
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.6000	37.73	33.20	54.00	16.27	160	87	Horizontal
2	2411.1600	90.30	33.27	/	/	160	82	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11g Channel 2412MHz		

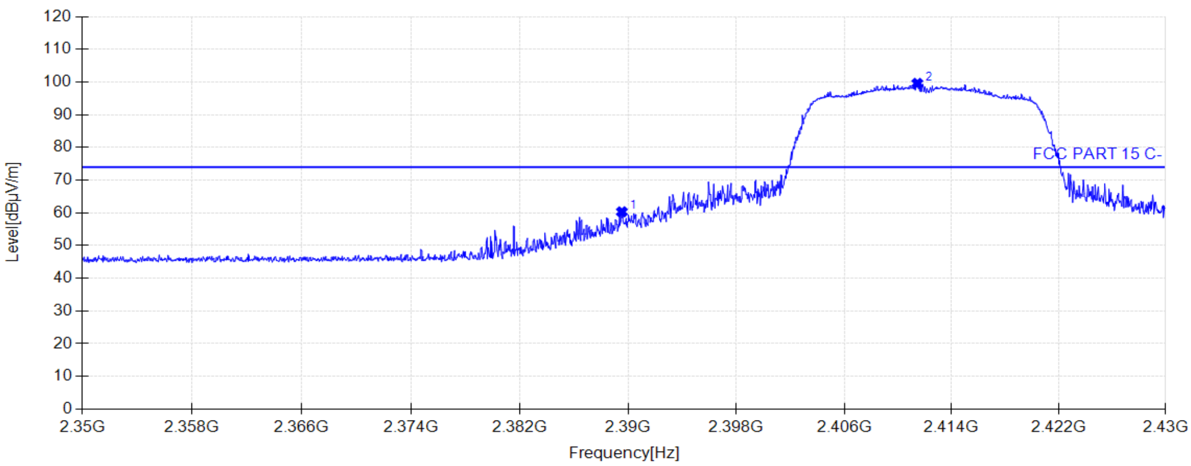
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.8800	40.42	33.10	54.00	13.58	160	20	Vertical
2	2411.0800	93.17	33.13	/	/	160	76	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11n-HT20 Channel 2412MHz		

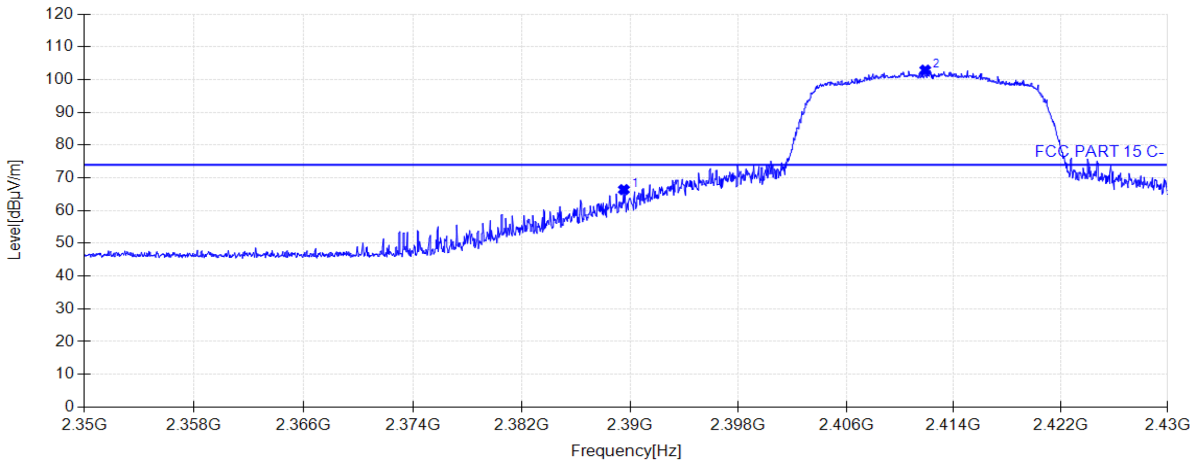
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.5200	60.32	33.20	74.00	13.68	160	86	Horizontal
2	2411.4400	99.58	33.27	/	/	160	82	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11n-HT20 Channel 2412MHz		

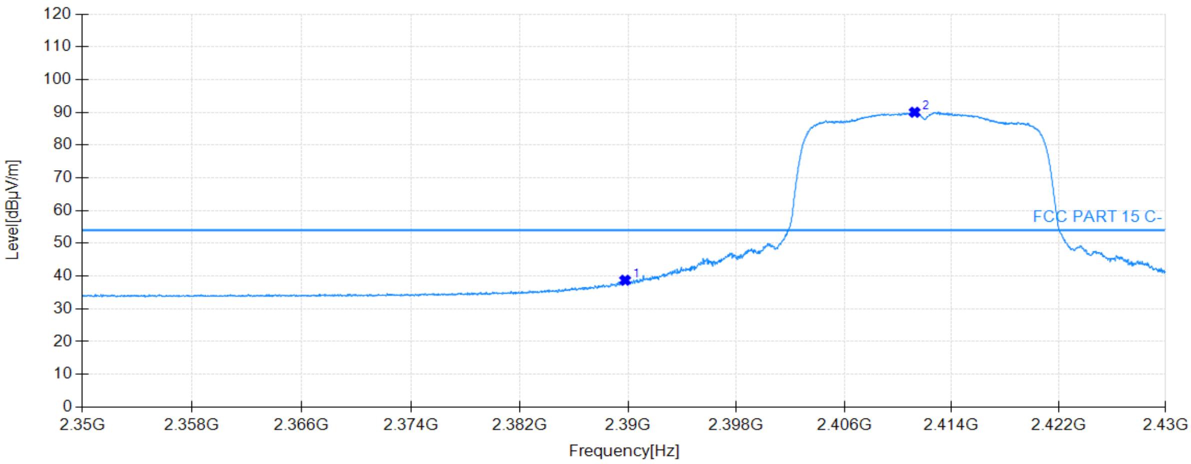
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.5200	66.40	33.10	74.00	7.60	160	255	Vertical
2	2411.8800	102.89	33.13	/	/	160	71	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11n-HT20 Channel 2412MHz		

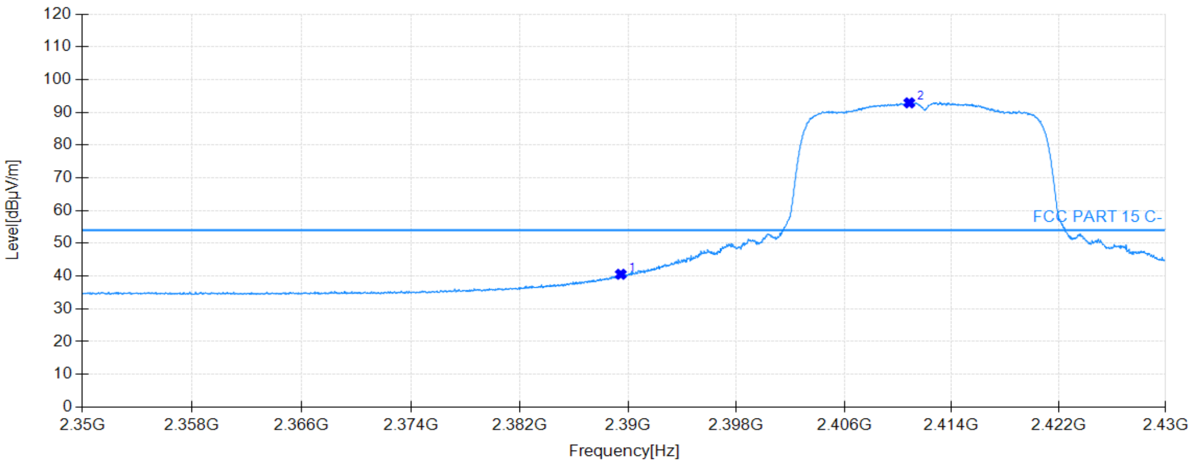
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.7600	38.73	33.20	54.00	15.27	160	81	Horizontal
2	2411.2400	90.02	33.27	/	/	160	81	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11n-HT20 Channel 2412MHz		

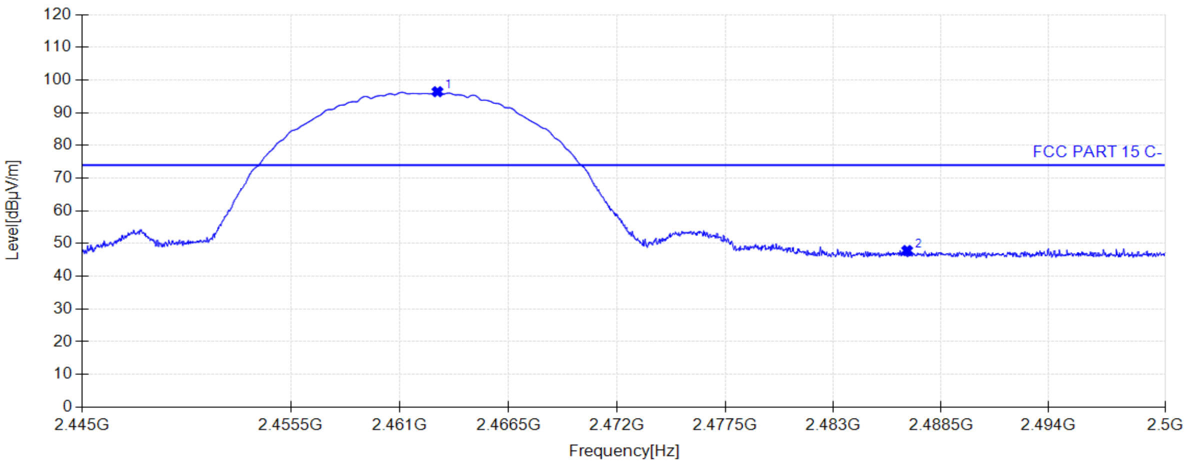
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2389.4400	40.55	33.10	54.00	13.45	160	76	Vertical
2	2410.8400	92.89	33.13	/	/	160	76	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11b Channel 2462MHz		

Test Graph

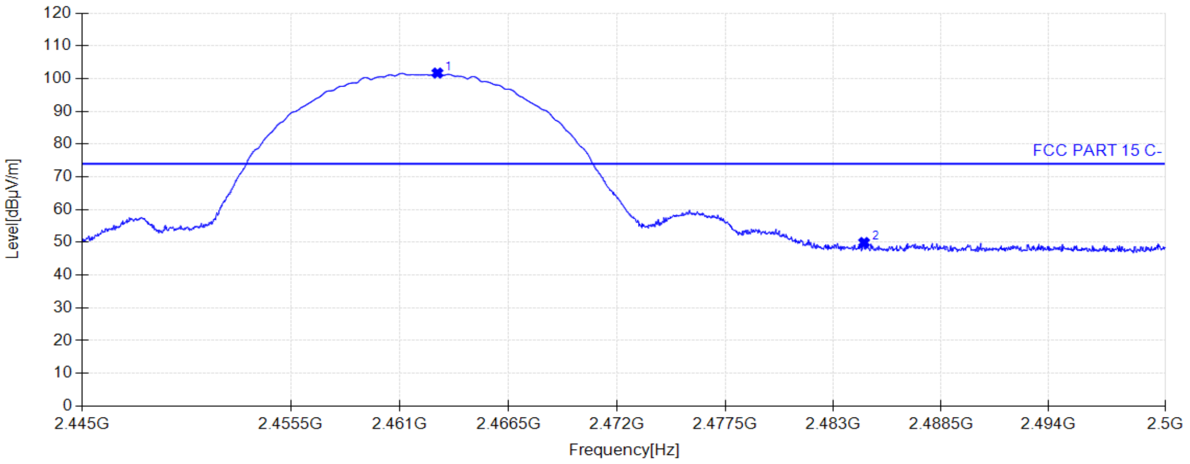


Suspected Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.9025	96.42	33.41	/	/	160	82	Horizontal
2	2486.7725	47.87	33.48	74.00	26.13	160	122	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11b Channel 2462MHz		

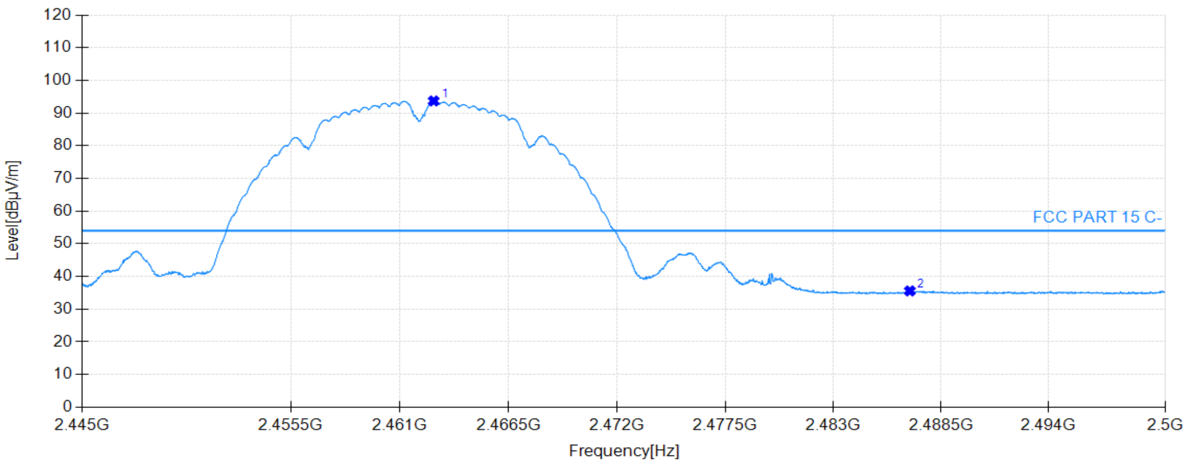
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.9025	101.68	33.18	/	/	160	347	Vertical
2	2484.5725	49.94	33.20	74.00	24.06	160	348	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11b Channel 2462MHz		

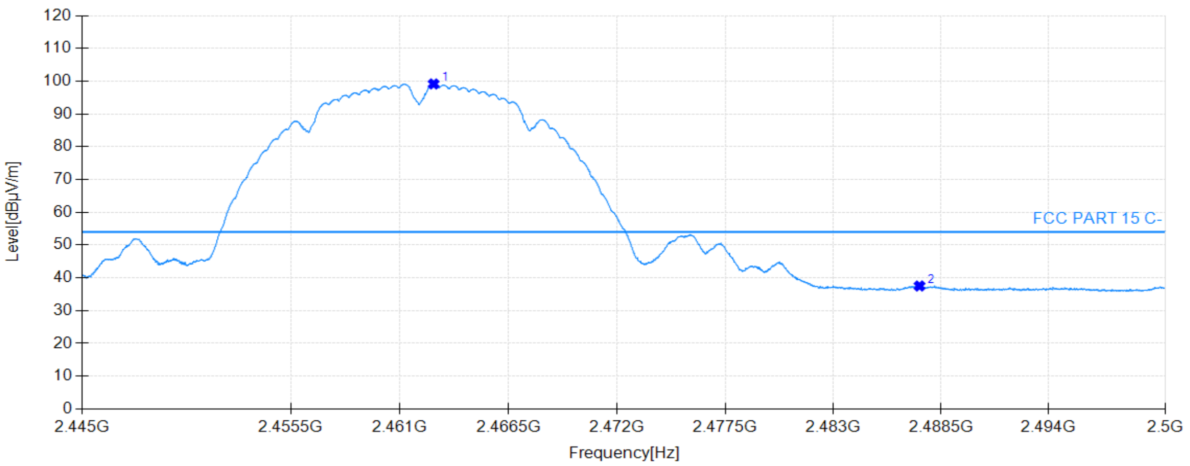
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.7100	93.71	33.41	/	/	160	81	Horizontal
2	2486.9100	35.58	33.48	54.00	18.42	160	127	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11b Channel 2462MHz		

Test Graph

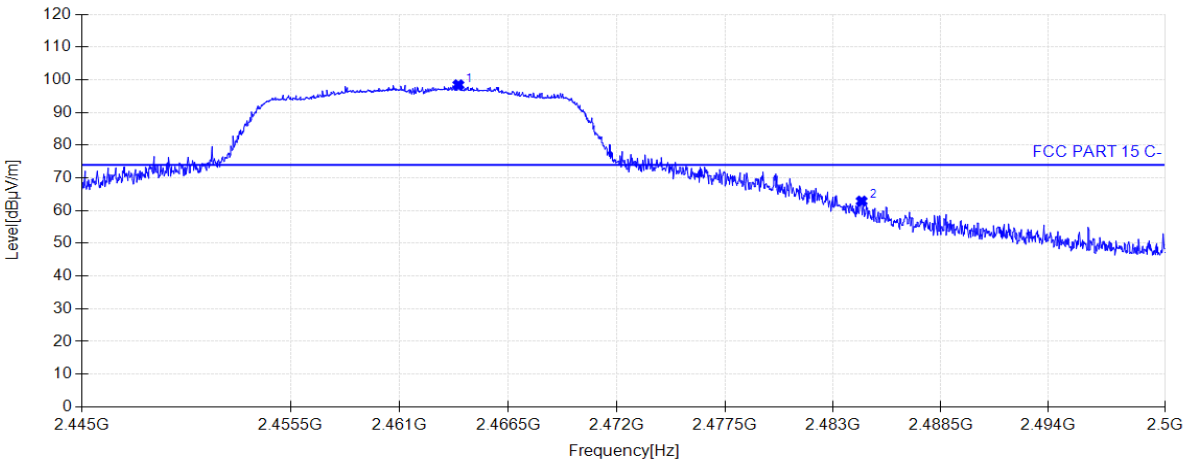


Suspected Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.7100	99.15	33.18	/	/	160	78	Vertical
2	2487.4050	37.52	33.21	54.00	16.48	160	352	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11g Channel 2462MHz		

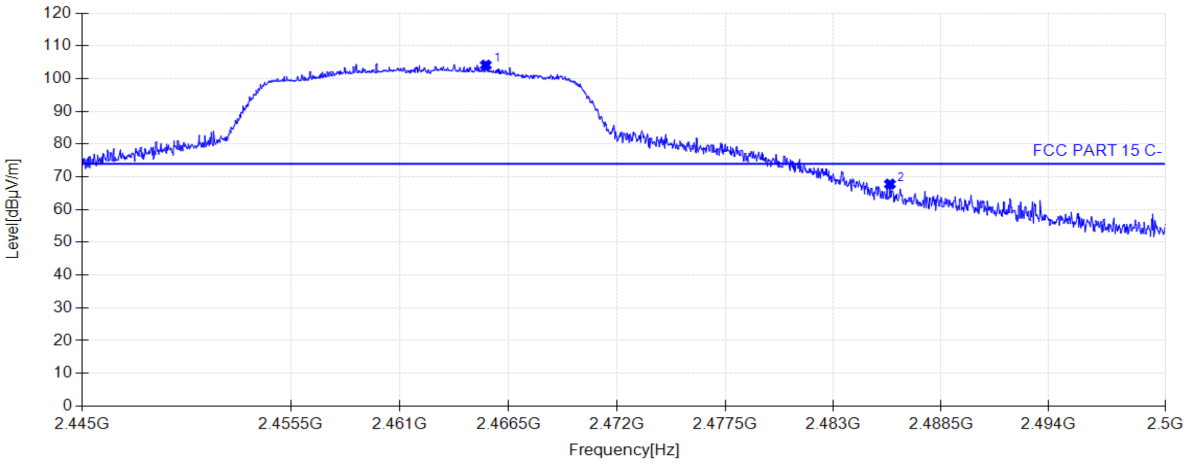
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2463.9750	98.43	33.42	/	/	160	85	Horizontal
2	2484.4625	62.90	33.48	74.00	11.10	160	90	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11g Channel 2462MHz		

Test Graph

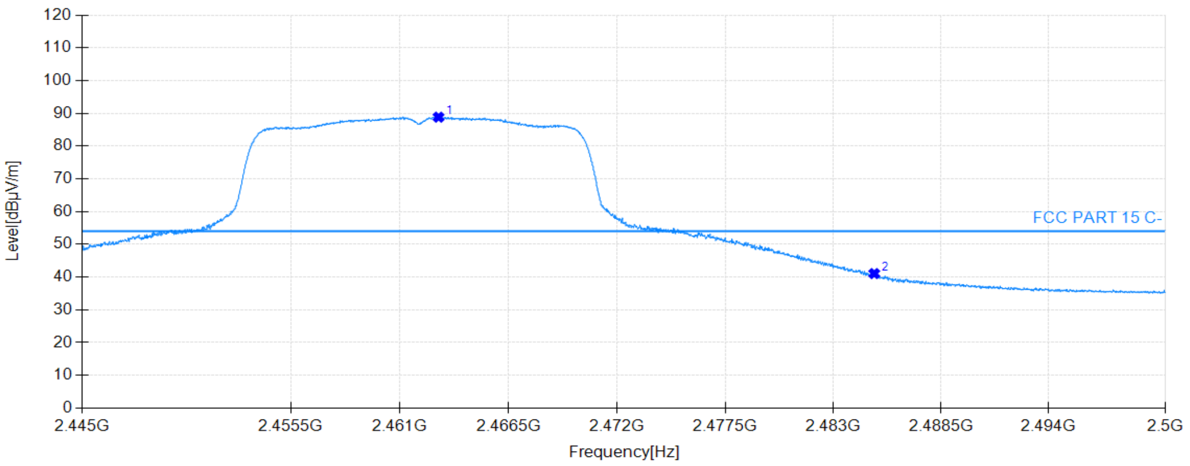


Suspected Data List

NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2465.3500	104.11	33.18	/	/	160	63	Vertical
2	2485.8925	67.78	33.21	74.00	6.22	160	13	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11g Channel 2462MHz		

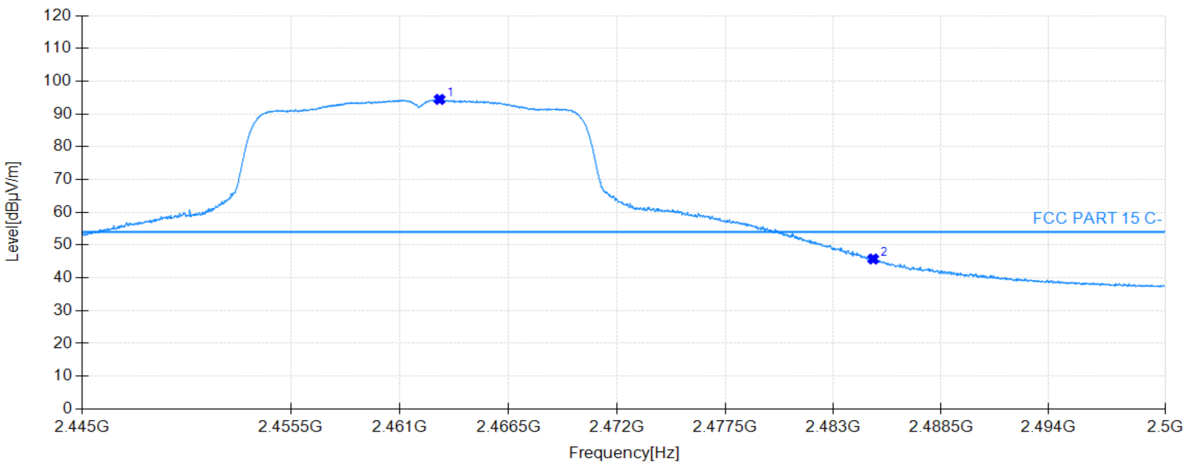
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.9575	88.83	33.41	/	/	160	82	Horizontal
2	2485.0950	41.07	33.48	54.00	12.93	160	129	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11g Channel 2462MHz		

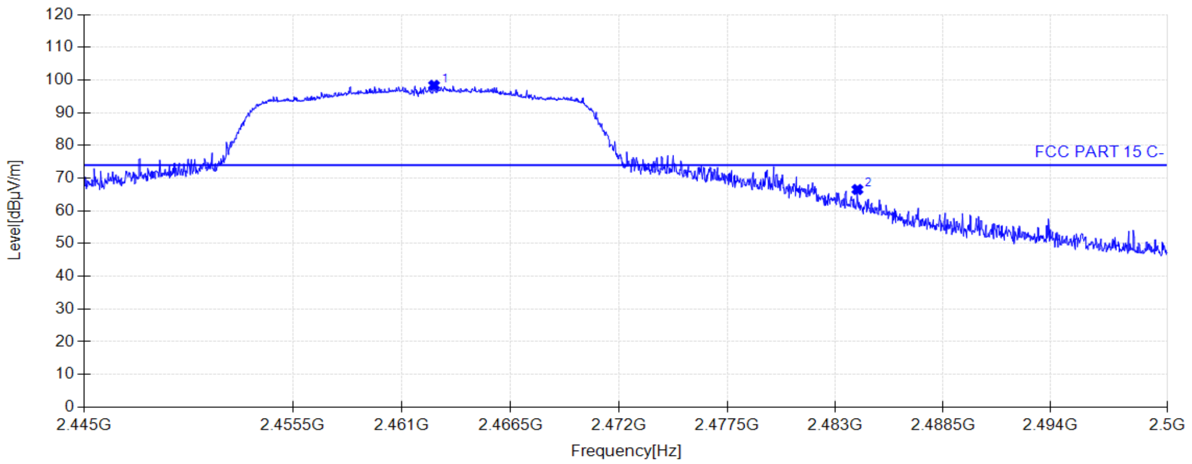
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2463.0125	94.45	33.18	/	/	160	76	Vertical
2	2485.0400	45.76	33.20	54.00	8.24	160	348	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11n-HT20 Channel 2462MHz		

Test Graph

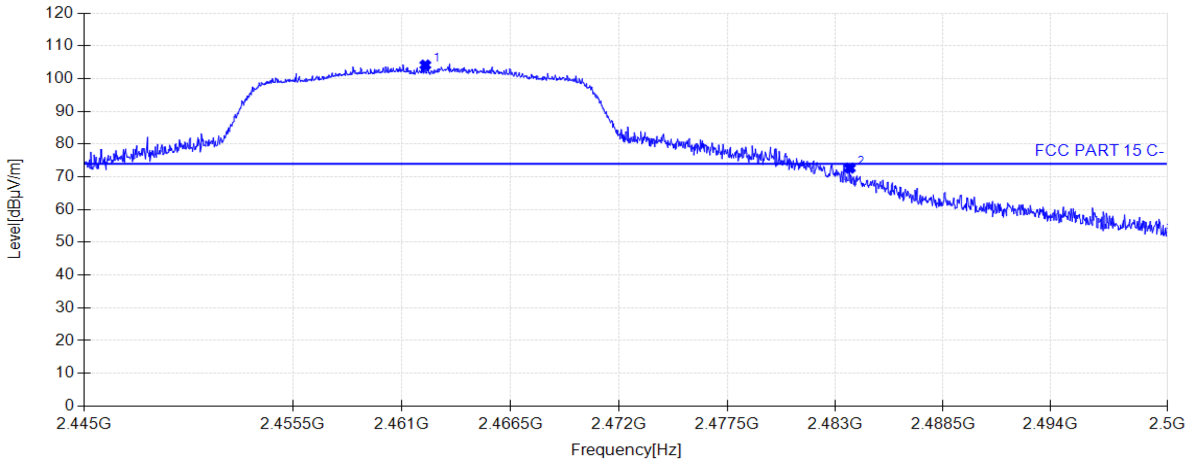


Suspected Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.6275	98.37	33.41	/	/	160	82	Horizontal
2	2484.1325	66.52	33.47	74.00	7.48	160	86	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11n-HT20 Channel 2462MHz		

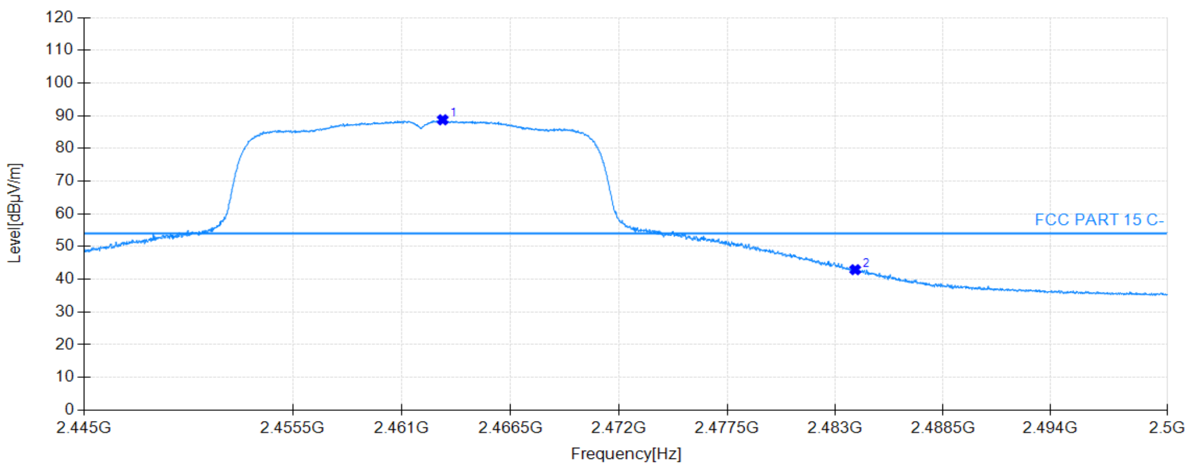
Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.1875	104.14	33.18	/	/	160	80	Vertical
2	2483.7475	72.67	33.20	74.00	1.33	160	196	Vertical

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11n-HT20 Channel 2462MHz		

Test Graph

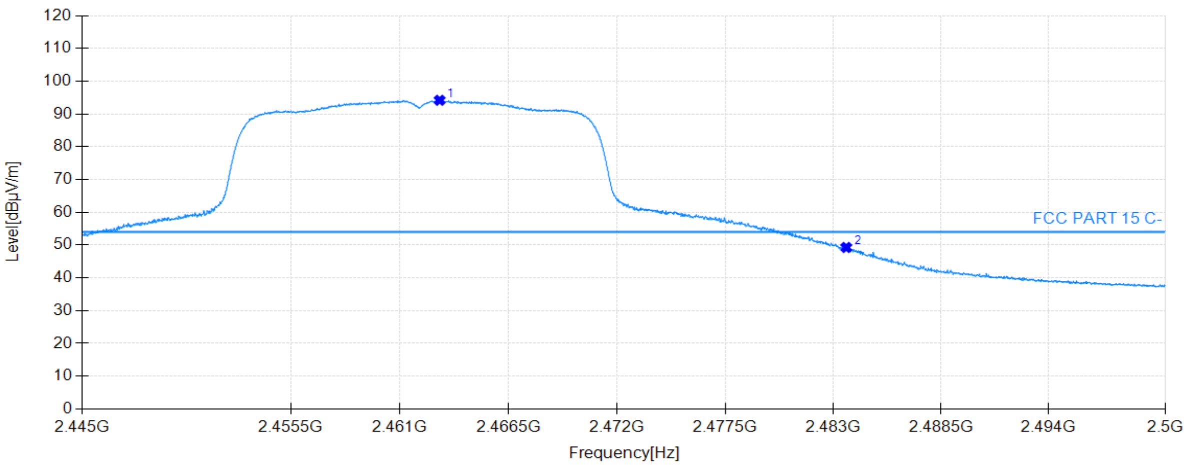


Suspected Data List

NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2463.0675	88.75	33.41	/	/	160	82	Horizontal
2	2484.0225	42.93	33.47	54.00	11.07	160	128	Horizontal

Project Information			
EUT:	2.4GHz Wi-Fi/BLE Module	Model:	EMC5020-P
SN:	N/A	Voltage:	DC 5V
Environment:	Temp: 23℃; Humi:56%	Engineer:	Stone Zhang
Remark:	Transmit at 802.11n-HT20 Channel 2462MHz		

Test Graph



Suspected Data List								
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2463.0125	94.17	33.18	/	/	160	76	Vertical
2	2483.6650	49.28	33.20	54.00	4.72	160	347	Vertical

7.8. AC Conducted Emissions Measurement

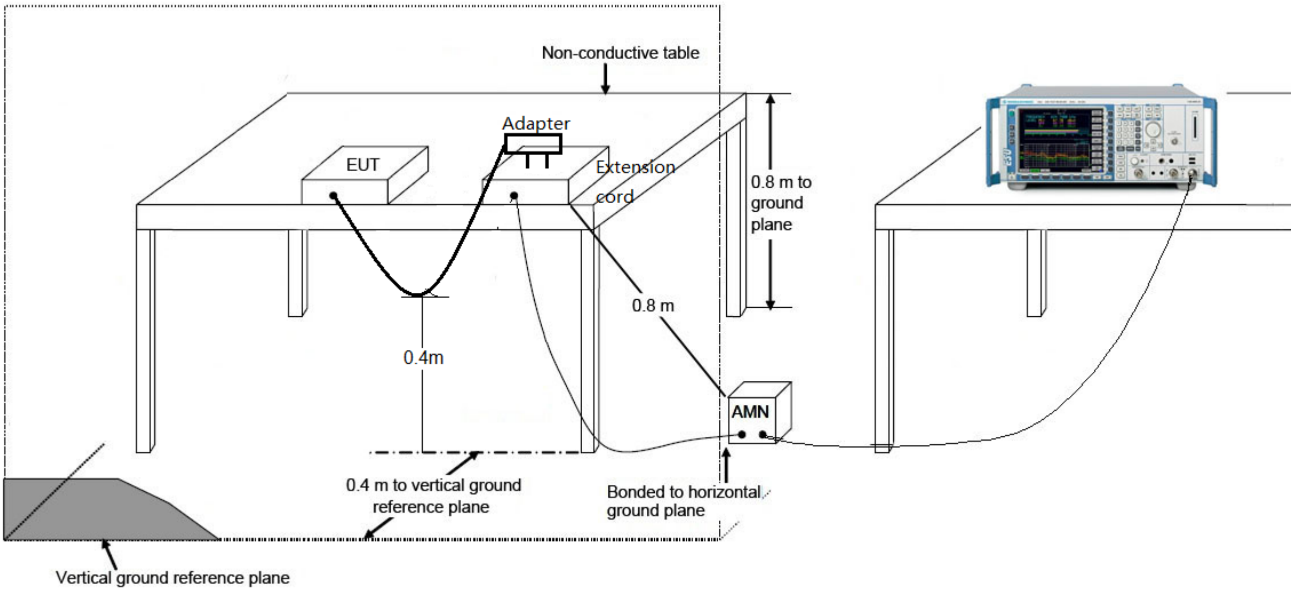
7.8.1. Test Limit

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.

7.8.2. Test Setup



7.8.3. Test Result

The EUT is DC supply, this item only for the EUT is designed to be connected to the public utility (AC) power line. Not applicable.

8. CONCLUSION

The data collected relate only the item(s) tested and show that the **2.4GHz Wi-Fi/BLE Module** is compliance with Part 15C of the FCC Rules.

The End