



MEASUREMENT REPORT

FCC PART 15.247 WLAN 802.11b/g/n

FCC ID: X3ZWFMOD1

APPLICANT: Amp'ed RF Technology, Inc.

Application Type: Certification

Product: Wi-Fi & BLE combo module

Model No.: ART6212

Brand Name: ART

FCC Classification: Digital Transmission System (DTS)

FCC Rule Part(s): Part15 Subpart C (Section 15.247)

Test Procedure(s): ANSI C63.10-2013
KDB 558074 D01v04

Test Date: March 20 ~ April 04, 2017

Reviewed By : Kevin Guo
(Kevin Guo)

Approved By : Marlin Chen
(Marlin Chen)



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 KDB 558074 D01v04. 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
1710WSU01001	Rev. 01	Initial Report	01-11-2018	Invalid
1710WSU01001	Rev. 02	Add antenna description	04-16-2018	Valid

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§2.1033 General Information

Applicant:	Amp'ed RF Technology, Inc.
Applicant Address:	1879 Lundy Ave, Suite 138, San Jose, CA, 95131
Manufacturer:	Amp'ed RF Technology, Inc.
Manufacturer Address:	1879 Lundy Ave, Suite 138, San Jose, CA, 95131
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
MRT Registration No.:	893164
FCC Rule Part(s):	Part15 Subpart C (Section 15.247)
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 893164) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-4179, G-814, C-4664, T-2206) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, EU and TELEC Rules.



1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.



2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name:	Wi-Fi & BLE combo module
Model No.:	ART6212
Brand Name:	ART
Work Voltage	DC 3.6V
Bluetooth Specification	
Frequency Range:	2402 ~ 2480MHz
Bluetooth Version:	V4.1
Modulation Type:	GFSK
Antenna Type:	PCB
Antenna Gain:	3 dBi
Wi-Fi Specification	
Frequency Range	<u>2.4GHz:</u> For 802.11b/g/n-HT20: 2412 ~ 2462 MHz <u>5GHz:</u> For 802.11a/n-HT20-VHT20: 5180~5240MHz, 5745~5825MHz
Type of Modulation	802.11b: DSSS 802.11a/g/n: OFDM
Antenna Type:	Chip
Antenna Gain:	0.5 dBi for 2.4GHz 2 dBi for 5GHz

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

2.2. Working Frequencies

Channel List for 802.11b/g/n-HT20

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	--	--

2.3. Description of Available Antenna

Antenna Specification				
Model Name	Type	Frequency Band	Connector	Max. Peak Gain
AT3216-B2R7HAA	Surface Mount	2.4G WiFi	Solder	0.2 dBi
AT3216-B5R5HAA	Surface Mount	5G WiFi	Solder	2 dBi
479501011	PCB Trace	Bluetooth	U.FL	3 dBi

2.4. Test Mode

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

2.5. Description of Test Software

The test utility software used during testing was “Wi-Fi Term”, and the version was “v4.11”.

2.6. Device Capabilities

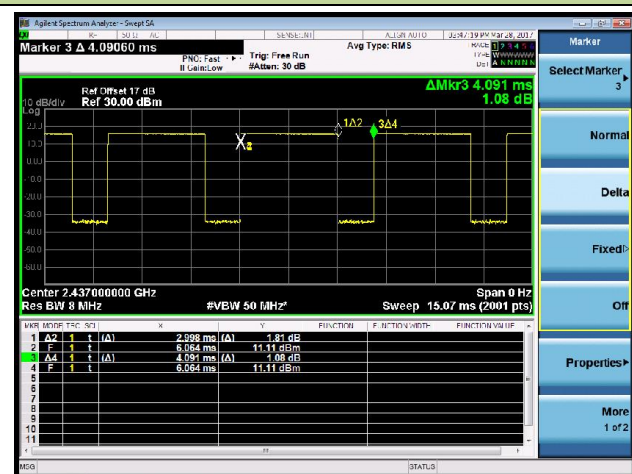
This device contains the following capabilities:

802.11a/b/g/n Wi-Fi and BLE Device.

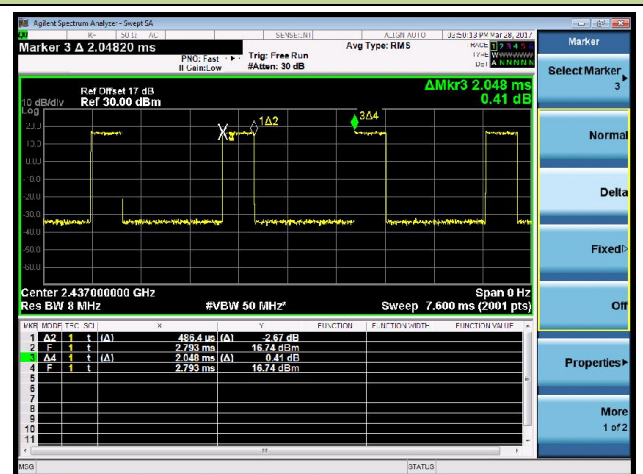
Note: 2.4GHz WLAN (DTS) operation is possible in 20MHz, and 40MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section 6.0 b) of KDB 558074 D01v04. 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 are as follows:

Test Mode	Duty Cycle
802.11b	73.28%
802.11g	23.75%
802.11n-HT20	21.99%

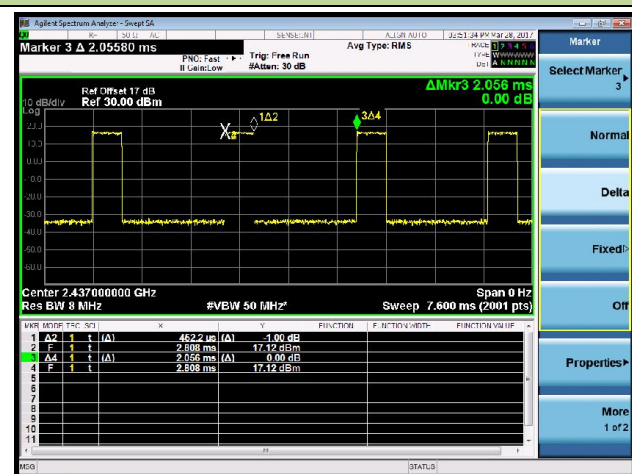
802.11b - Duty Cycle



802.11g - Duty Cycle



802.11n-HT20 - Duty Cycle



-

2.7. Test Configuration

The **Wi-Fi & BLE combo module** was tested per the guidance of KDB 558074 D01v04. 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. 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.

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 D01v04 were used in the measurement of the **Wi-Fi & BLE combo module**.

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. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

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

4. 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.”

Conclusion:

The **Wi-Fi & BLE combo module** unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2018/04/28
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2018/06/21
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2018/06/21
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06179	1 year	2017/12/22
Shielding Anechoic Chamber	Mikebang	Chamber-SR2	MRTSUE06215	1 year	2018/05/10

Radiated Disturbance – AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
MXE EMI Receiver	Agilent	N9038A	MRTSUE06125	1 year	2018/08/18
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2017/12/10
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2017/11/21
TRILOG Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2018/10/22
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2017/11/19
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2018/01/04
Digital Thermometer & Hygrometer	Minggao	ETH529	MRTSUE06170	1 year	2017/11/30
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2018/05/10

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2018/04/25
Power Meter	Boonton	55006	MRTSUE06109	1 year	2018/04/25
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06184	1 year	2017/12/22

Software	Version	Function
e3	V8.3.5	EMI Test Software

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 - SR2
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 150kHz~30MHz: $\pm 3.46\text{dB}$
Radiated Emission Measurement – AC2
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 9kHz ~ 1GHz: $\pm 3.86\text{dB}$ 1GHz ~ 25GHz: $\pm 4.32\text{dB}$

7. TEST RESULT

7.1. Summary

Product Name: Wi-Fi & BLE combo module
FCC ID: X3ZWFMOD1
FCC Classification: Digital Transmission System (DTS)
Data Rate(s) Tested: 1Mbps ~ 11Mbps (b); 6Mbps ~ 54Mbps (g);
MCS0 for 802.11n-HT20MHz;

FCC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	6dB Bandwidth	$\geq 500\text{kHz}$	Conducted	Pass	Section 7.2
15.247(b)(3)	Output Power	Refer to Section 7.3		Pass	Section 7.3
15.247(e)	Power Spectral Density	Refer to Section 7.4		Pass	Section 7.4
15.247(d)	Band Edge / Out-of-Band Emissions	$\geq 30\text{dBc(Average)}$		Pass	Section 7.5
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	Radiated	Pass	Section 7.6 & 7.7
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	N/A	Section 7.8

Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
- 3) Test Items "6dB Bandwidth" & "Band Edge / Out-of-Band Emissions" have been assessed single, and showed the worst test data in this report.

7.2. 6dB Bandwidth Measurement

7.2.1. Test Limit

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

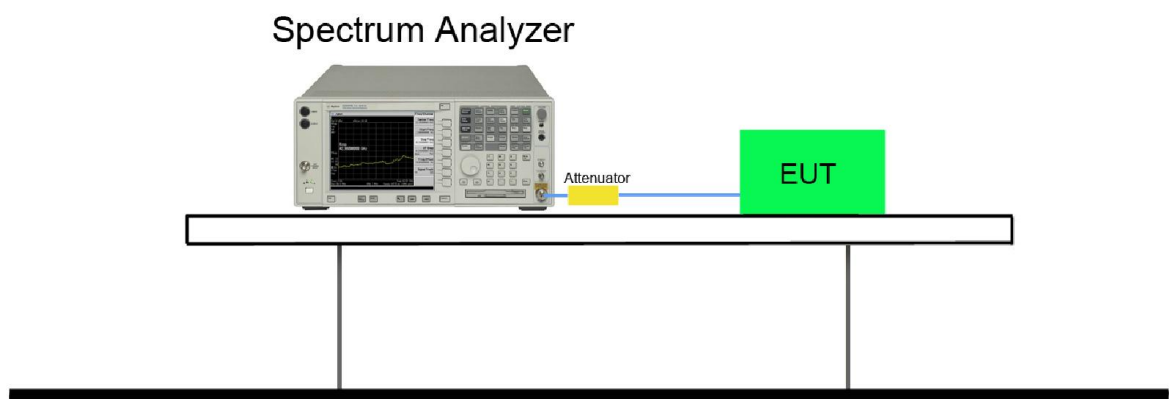
7.2.2. Test Procedure used

KDB 558074 D01v04 - Section 8.2 Option 2

7.2.3. Test Setting

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

7.2.4. Test Setup



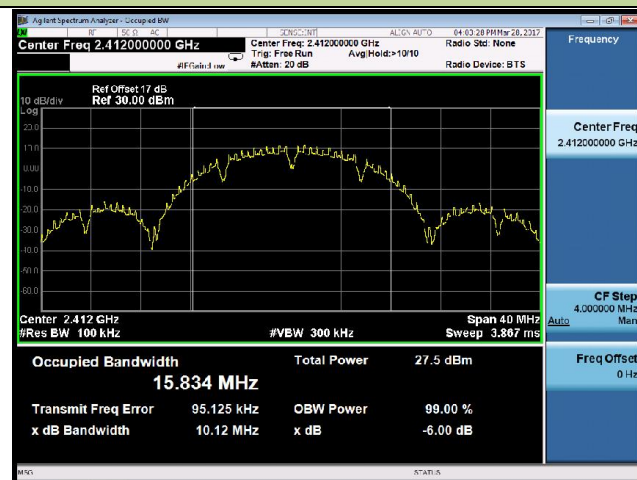
7.2.5. Test Result

Product	Wi-Fi & BLE combo module	Temperature	25°C
Test Engineer	Andy Zhu	Relative Humidity	58%
Test Site	TR3	Test Date	2017/03/28
Test Item	6dB Bandwidth		

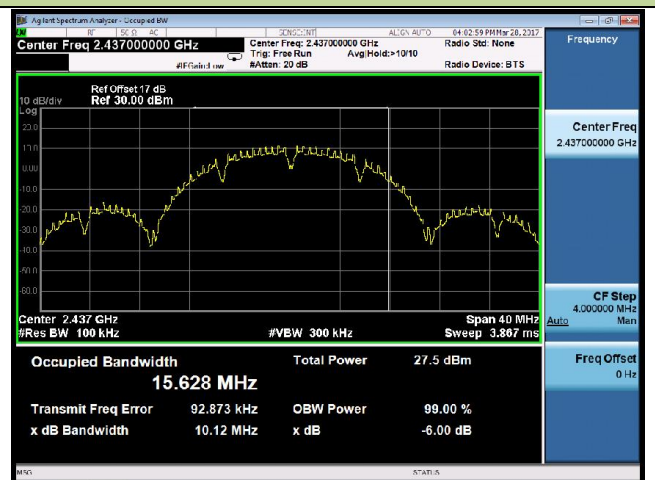
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
802.11b	1Mbps	01	2412	10.12	≥ 0.5	Pass
802.11b	1Mbps	06	2437	10.12	≥ 0.5	Pass
802.11b	1Mbps	11	2462	10.11	≥ 0.5	Pass
802.11g	6Mbps	01	2412	16.42	≥ 0.5	Pass
802.11g	6Mbps	06	2437	16.40	≥ 0.5	Pass
802.11g	6Mbps	11	2462	16.41	≥ 0.5	Pass
802.11n-HT20	MCS0	01	2412	17.62	≥ 0.5	Pass
802.11n-HT20	MCS0	06	2437	17.62	≥ 0.5	Pass
802.11n-HT20	MCS0	11	2462	17.63	≥ 0.5	Pass

802.11b 6dB Bandwidth

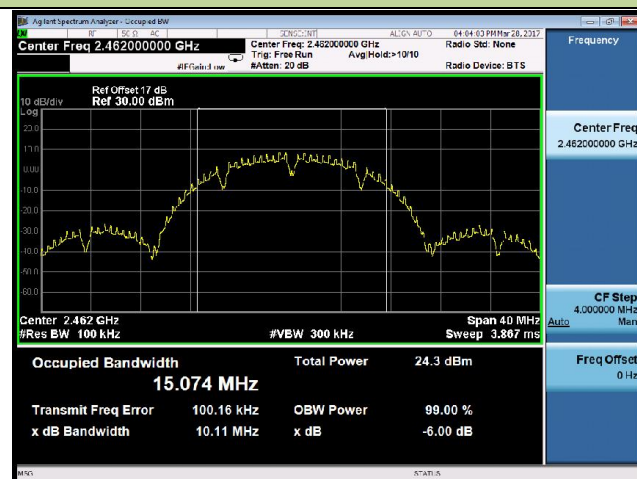
Channel 01 (2412MHz)



Channel 06 (2437MHz)

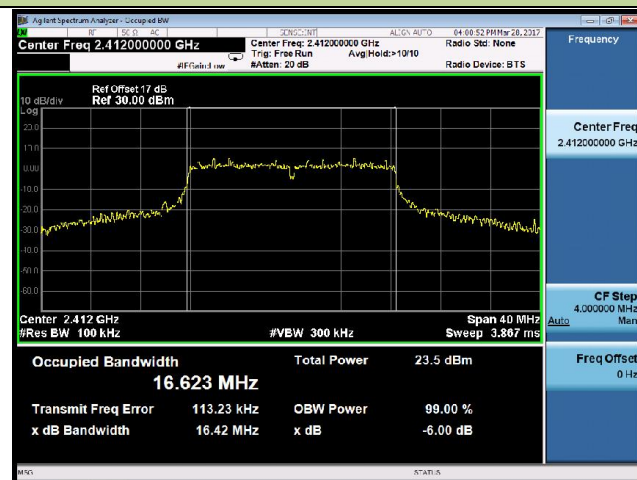


Channel 11 (2462MHz)

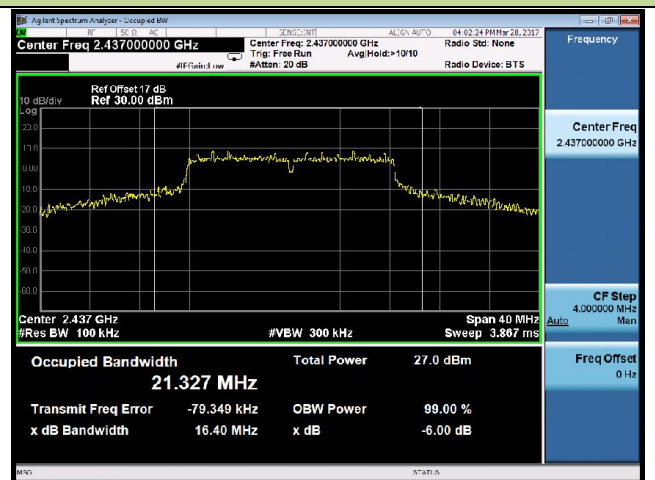


802.11g 6dB Bandwidth

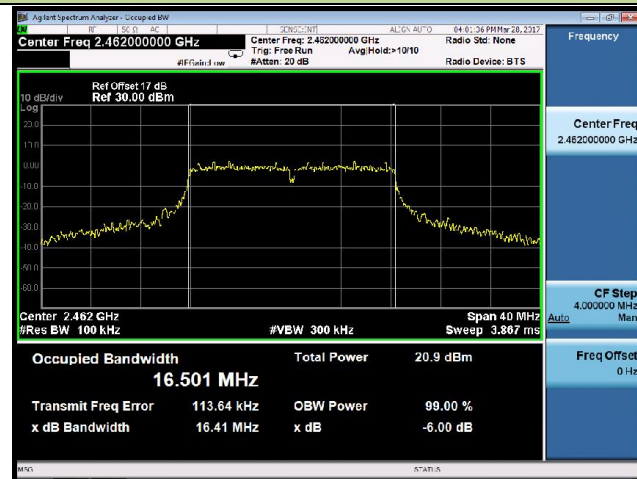
Channel 01 (2412MHz)



Channel 06 (2437MHz)

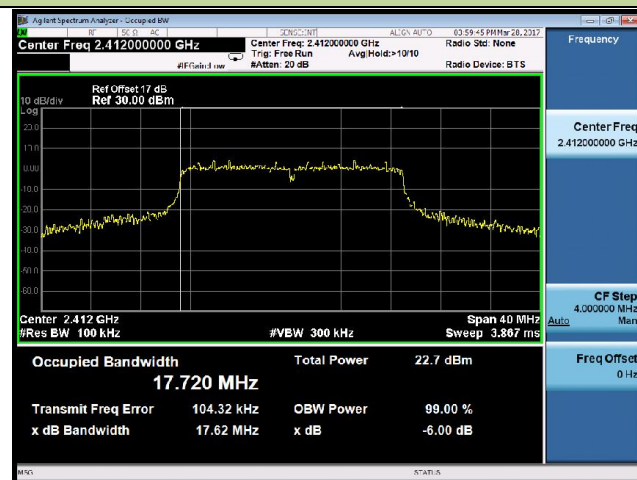


Channel 11 (2462MHz)

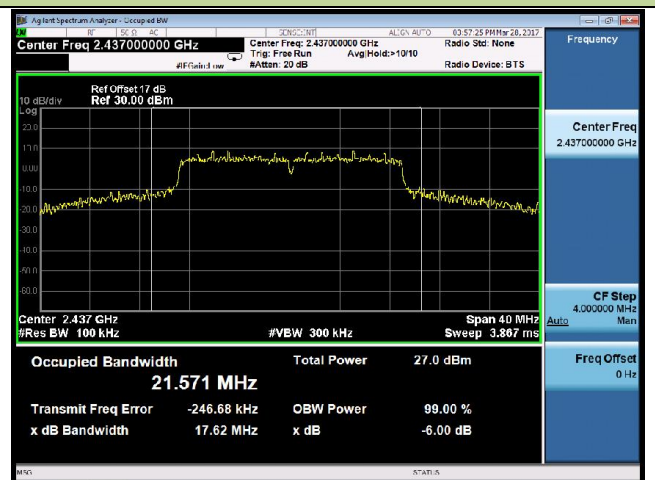


802.11n-HT20 6dB Bandwidth

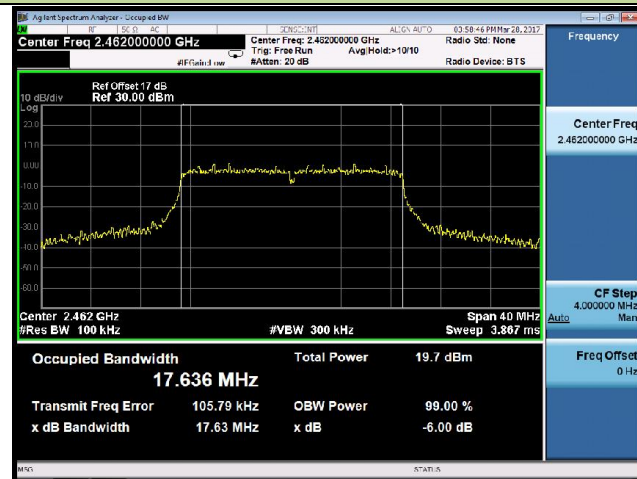
Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)



7.3. Output Power Measurement

7.3.1. Test Limit

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

7.3.2. Test Procedure Used

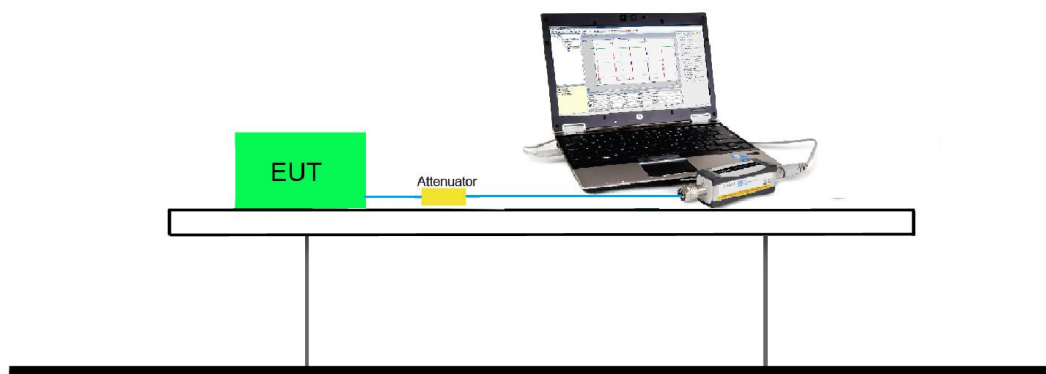
KDB 558074 D01v04 - Section 9.1.3 PKPM1 Peak-reading power meter method (for signals with $BW \leq 50\text{MHz}$)

7.3.3. Test Setting

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

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.

7.3.4. Test Setup



7.3.5. Test Result of Output Power

Power output test was verified over all data rates of each mode shown as below table, and then choose the maximum power output (yellow marker) for final test of each channel.

Test Mode	Bandwidth (MHz)	Channel No.	Frequency (MHz)	Data Rate/ MCS	Peak Power (dBm)
802.11b	20	6	2437	1Mbps	6.49
				5.5Mbps	6.27
				11Mbps	6.10
802.11g	20	6	2437	6Mbps	15.96
				24Mbps	15.53
				54Mbps	15.21
802.11n	20	6	2437	MCS0	15.85
				MCS3	15.55
				MCS7	15.13

Product	Wi-Fi & BLE combo module	Temperature	25°C
Test Engineer	Andy Zhu	Relative Humidity	50 ~ 58%
Test Site	TR3	Test Date	2017/03/28
Test Item	Output Power		

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Result
802.11b	1Mbps	01	2412	6.49	≤ 30	Pass
802.11b	1Mbps	06	2437	5.71	≤ 30	Pass
802.11b	1Mbps	11	2462	5.89	≤ 30	Pass
802.11g	6Mbps	01	2412	15.96	≤ 30	Pass
802.11g	6Mbps	06	2437	15.33	≤ 30	Pass
802.11g	6Mbps	11	2462	13.03	≤ 30	Pass
802.11n-HT20	MCS0	01	2412	15.28	≤ 30	Pass
802.11n-HT20	MCS0	06	2437	15.85	≤ 30	Pass
802.11n-HT20	MCS0	11	2462	11.08	≤ 30	Pass

7.4. Power Spectral Density Measurement

7.4.1. Test Limit

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

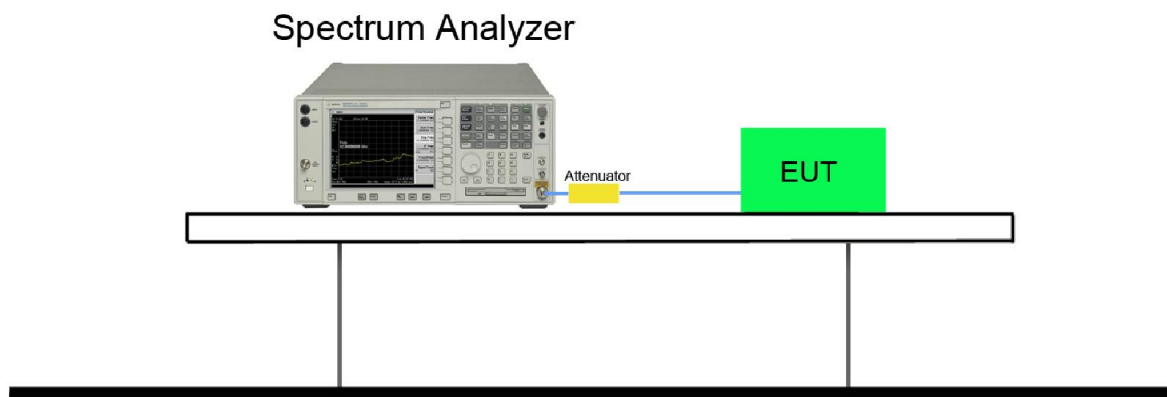
7.4.2. Test Procedure Used

KDB 558074 D01v04 - Section 10.2 Method PKPSD (peak PSD).

7.4.3. Test Setting

1. Set analyzer center frequency to DTS channel center frequency.
2. Set span to at least 1.5 times the OBW.
3. RBW = 3kHz
4. VBW = 10kHz
5. Detector = Peak
6. Sweep time = auto couple
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.

7.4.4. Test Setup



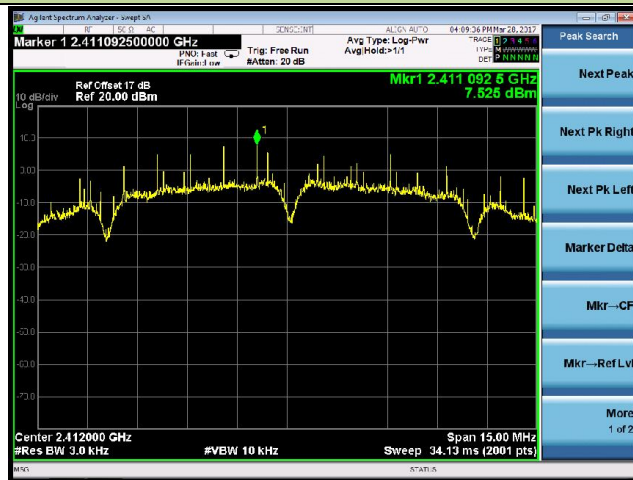
7.4.5. Test Result

Product	Wi-Fi & BLE combo module	Temperature	25°C
Test Engineer	Andy Zhu	Relative Humidity	50 ~ 58%
Test Site	TR3	Test Date	2017/03/28
Test Item	Power Spectral Density		

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	PSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
802.11b	1Mbps	01	2412	7.53	≤ 8	Pass
802.11b	1Mbps	06	2437	7.09	≤ 8	Pass
802.11b	1Mbps	11	2462	4.07	≤ 8	Pass
802.11g	6Mbps	01	2412	-8.81	≤ 8	Pass
802.11g	6Mbps	06	2437	-5.9	≤ 8	Pass
802.11g	6Mbps	11	2462	-11.26	≤ 8	Pass
802.11n-HT20	MCS0	01	2412	-9.65	≤ 8	Pass
802.11n-HT20	MCS0	06	2437	-5.57	≤ 8	Pass
802.11n-HT20	MCS0	11	2462	-12.51	≤ 8	Pass

802.11b PSD

Channel 01 (2412MHz)



Channel 06 (2437MHz)

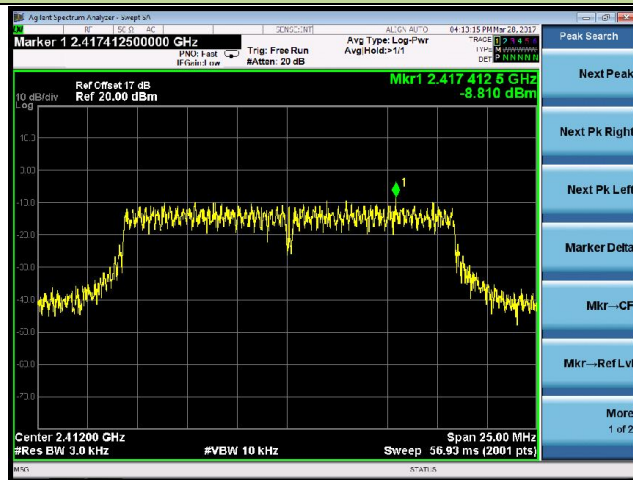


Channel 11 (2462MHz)

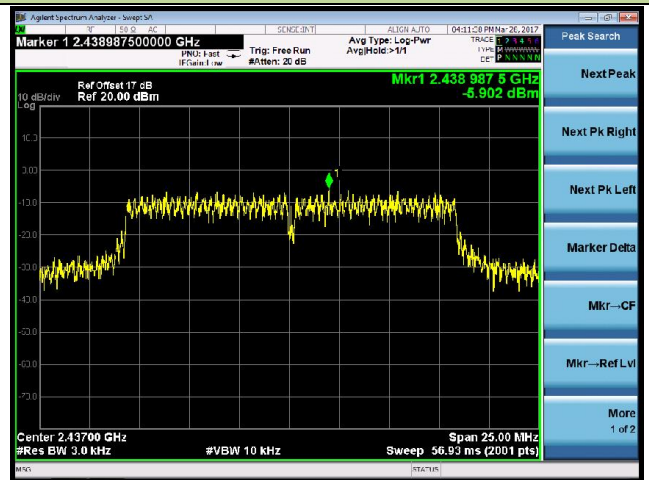


802.11g PSD

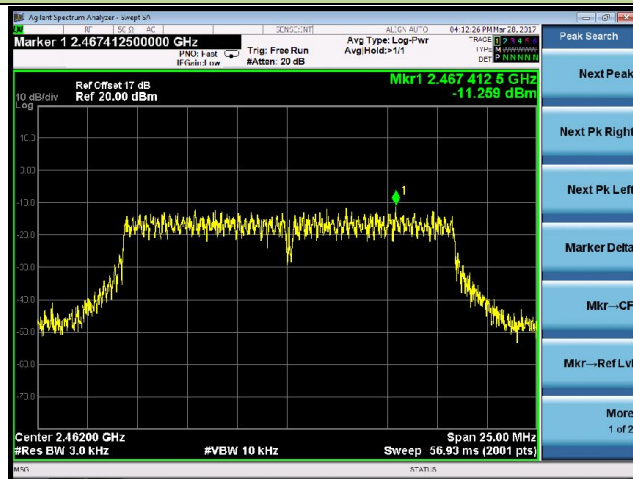
Channel 01 (2412MHz)



Channel 06 (2437MHz)

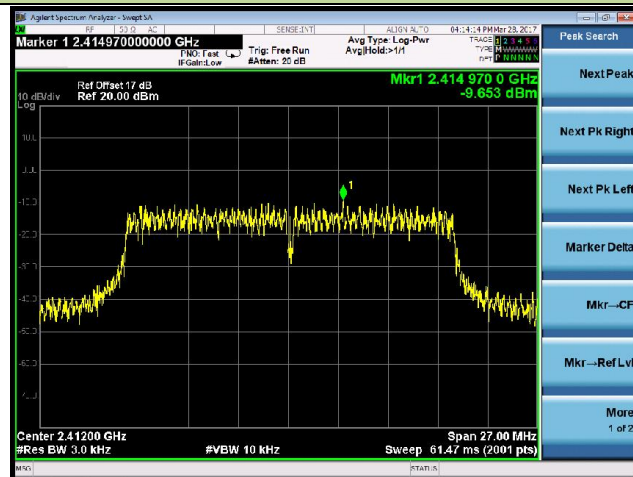


Channel 11 (2462MHz)

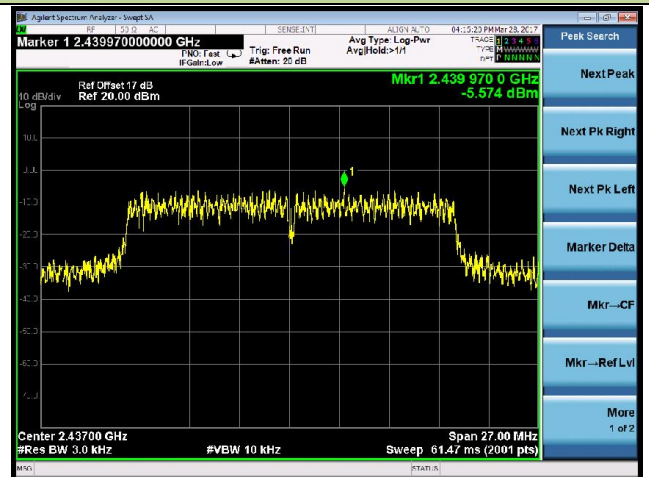


802.11n-HT20 PSD

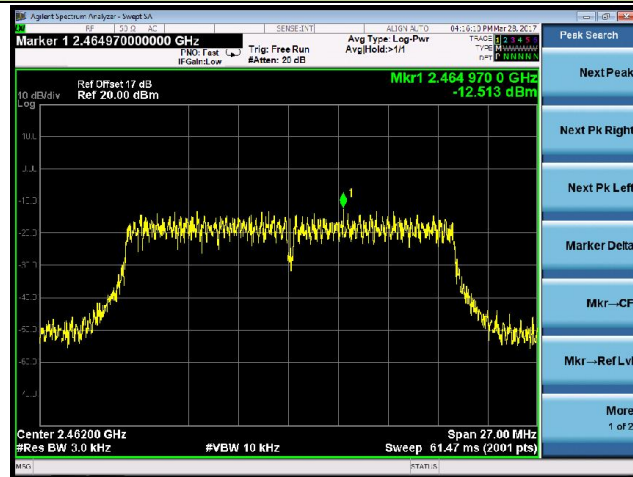
Channel 01 (2412MHz)



Channel 06 (2437MHz)



Channel 11 (2462MHz)



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 30dB 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 D01v04 - Section 11.2 & Section 11.3

7.5.3. Test Setting

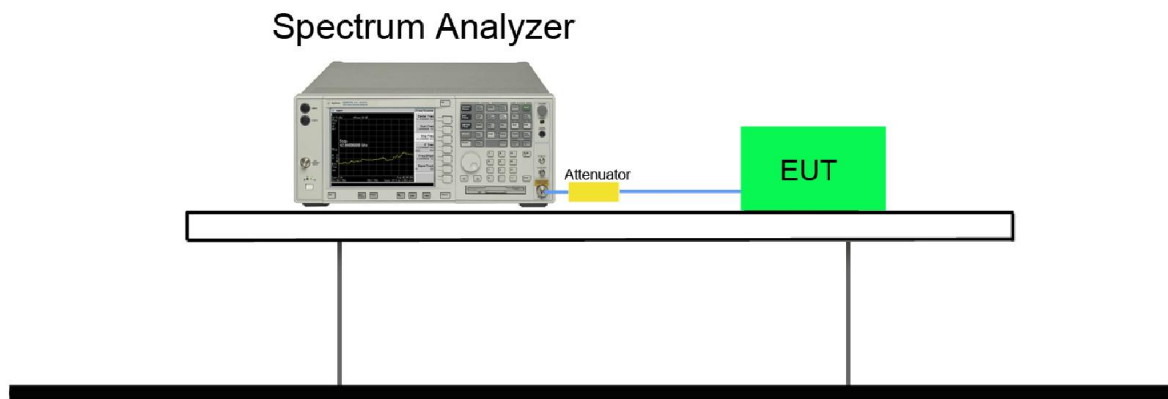
Reference level measurement

1. Set instrument center frequency to DTS channel center frequency
2. Set the span to ≥ 1.5 times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW $\geq 3 \times$ RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

Emission level measurement

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

7.5.4.Test Setup



7.5.5.Test Result

Product	Wi-Fi & BLE combo module	Temperature	25°C
Test Engineer	Lewis Huang	Relative Humidity	50 ~ 58%
Test Site	TR3	Test Date	2017/03/28
Test Item	Conducted Band Edge and Out-of-Band Emissions		

Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	Limit	Result
802.11b	1Mbps	01	2412	30dBc	Pass
802.11b	1Mbps	06	2437	30dBc	Pass
802.11b	1Mbps	11	2462	30dBc	Pass
802.11g	6Mbps	01	2412	30dBc	Pass
802.11g	6Mbps	06	2437	30dBc	Pass
802.11g	6Mbps	11	2462	30dBc	Pass
802.11n-HT20	MCS0	01	2412	30dBc	Pass
802.11n-HT20	MCS0	06	2437	30dBc	Pass
802.11n-HT20	MCS0	11	2462	30dBc	Pass

802.11b Out-of-Band Emissions

Channel 01 (2412MHz)

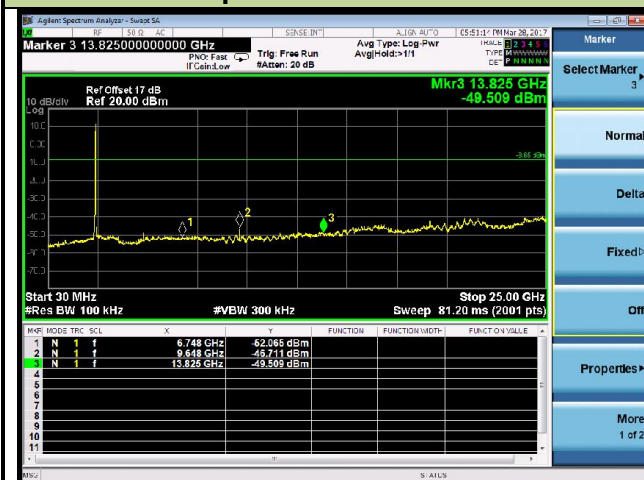
100kHz PSD reference Level



Low Band Edge



Spurious Emission

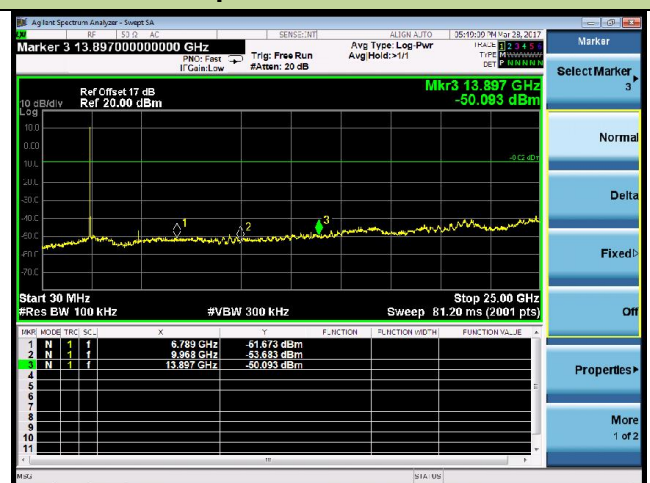


Channel 06 (2437MHz)

100kHz PSD reference Level

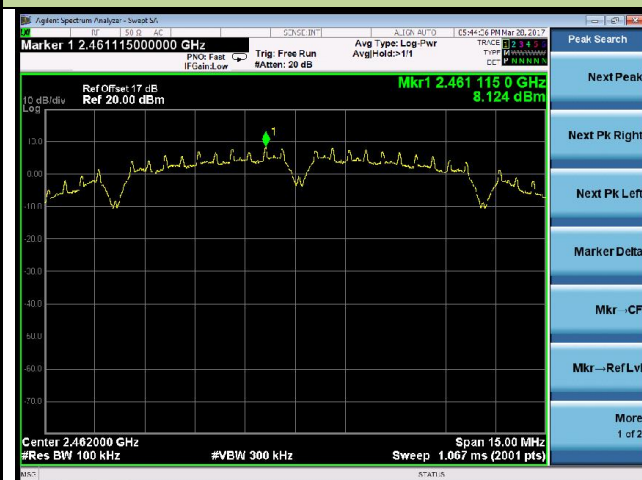


Spurious Emission



Channel 11 (2462MHz)

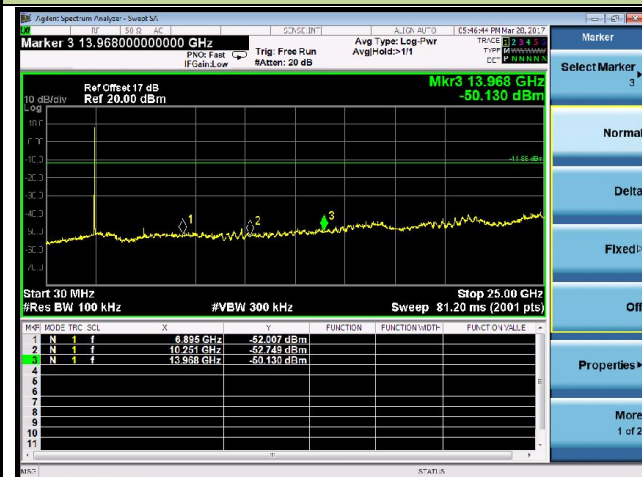
100kHz PSD reference Level



High Band Edge



Spurious Emission



802.11g Out-of-Band Emissions

Channel 01 (2412MHz)

100kHz PSD reference Level



Low Band Edge

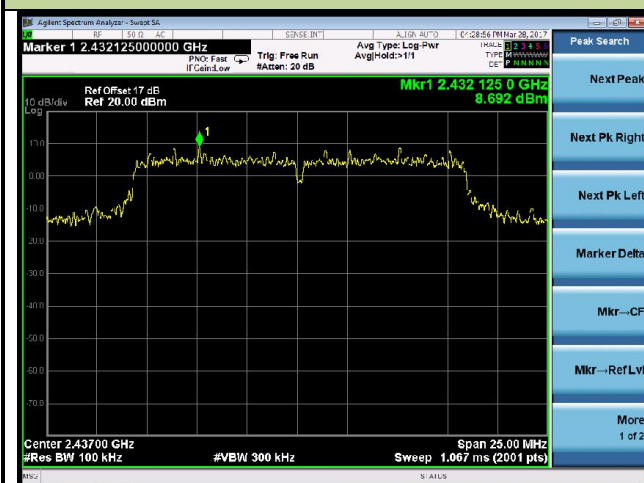


Spurious Emission

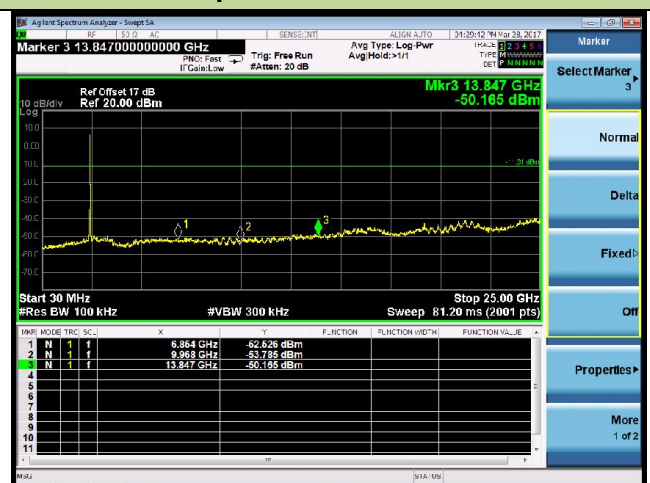


Channel 06 (2437MHz)

100kHz PSD reference Level



Spurious Emission

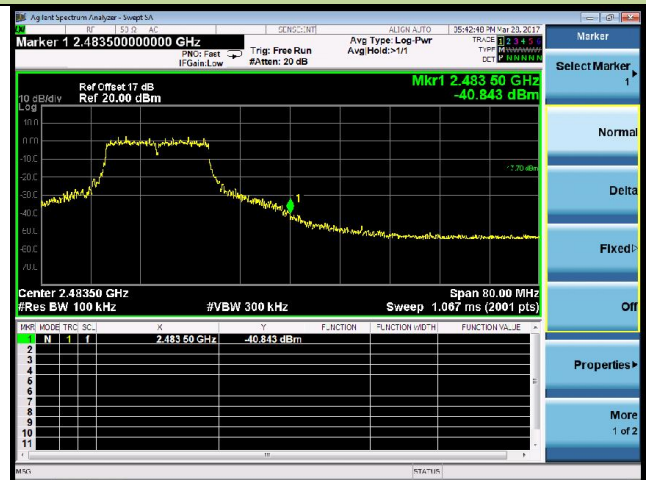


Channel 11 (2462MHz)

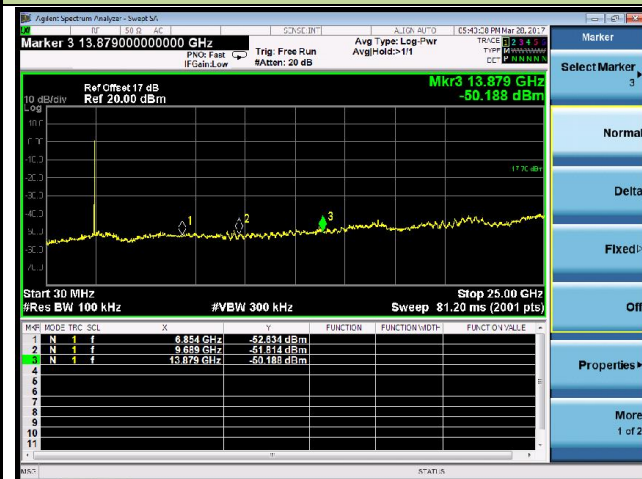
100kHz PSD reference Level



High Band Edge



Spurious Emission



802.11n-HT20 Out-of-Band Emissions

Channel 01 (2412MHz)

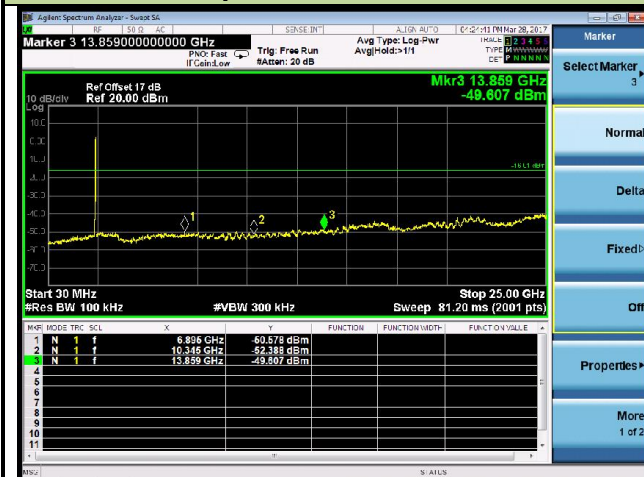
100kHz PSD reference Level



Low Band Edge

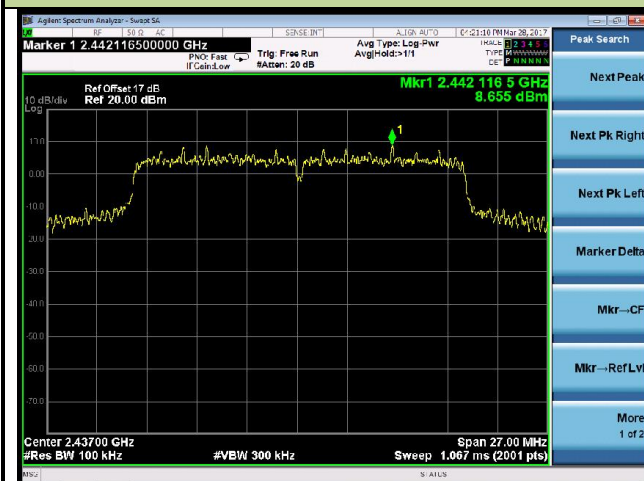


Spurious Emission

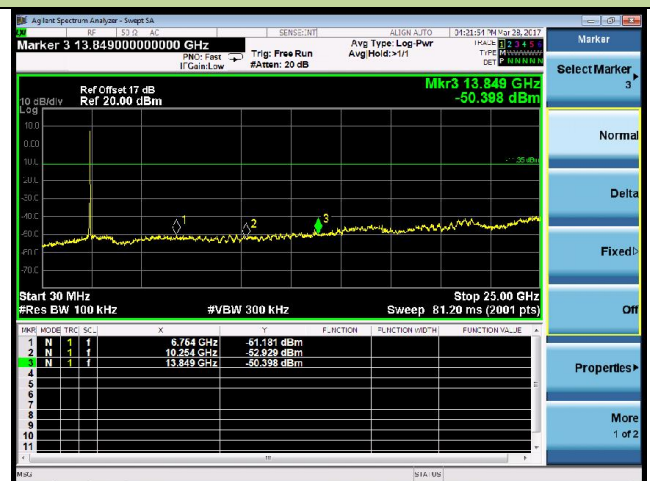


Channel 06 (2437MHz)

100kHz PSD reference Level



Spurious Emission

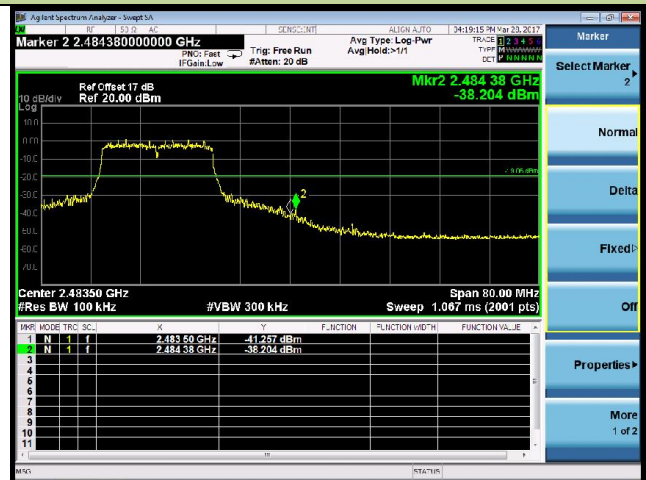


Channel 11 (2462MHz)

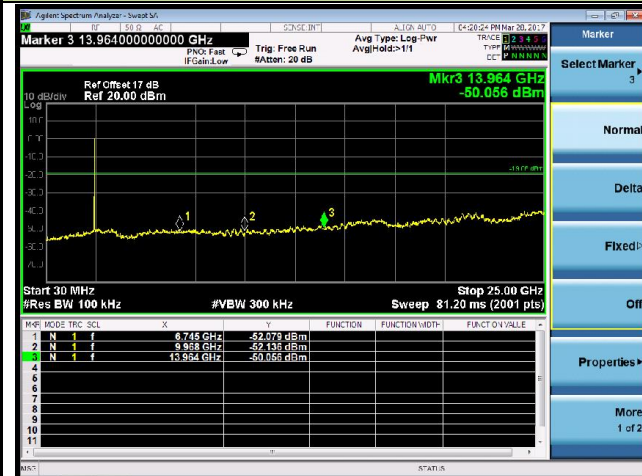
100kHz PSD reference Level



High Band Edge



Spurious Emission



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 [V/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

KDB 558074 D01v04 - Section 12.2.3 (quasi-peak measurements)

KDB 558074 D01v04 - Section 12.2.4 (peak power measurements)

KDB 558074 D01v04 - Section 12.2.5 (average power measurements)

7.6.3. Test Setting

Peak Field Strength Measurements

Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

RBW = as specified in Table 1

VBW = 3MHz

Detector = peak

Sweep time = auto couple

Trace mode = max hold

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

Average Field Strength Measurements

Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

RBW = 1MHz

VBW $\geq 1/T$

De 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

Detector = Peak

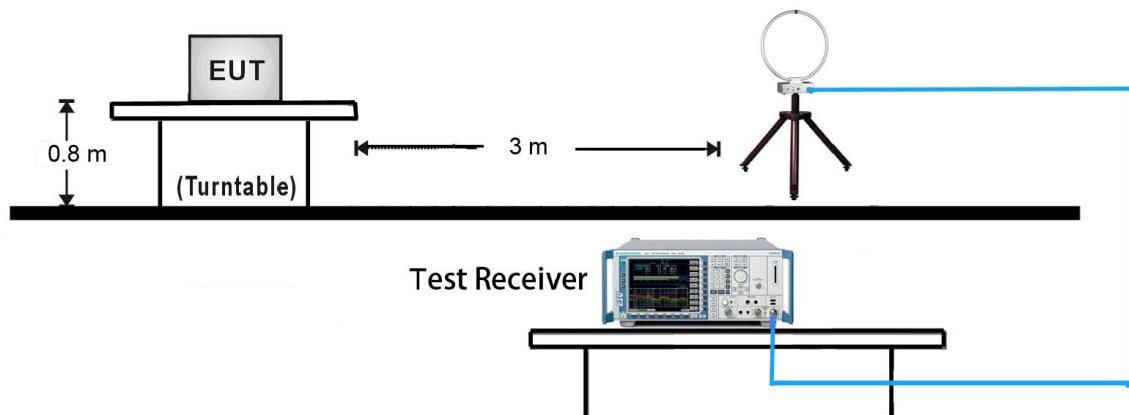
Sweep time = auto

Trace mode = max hold

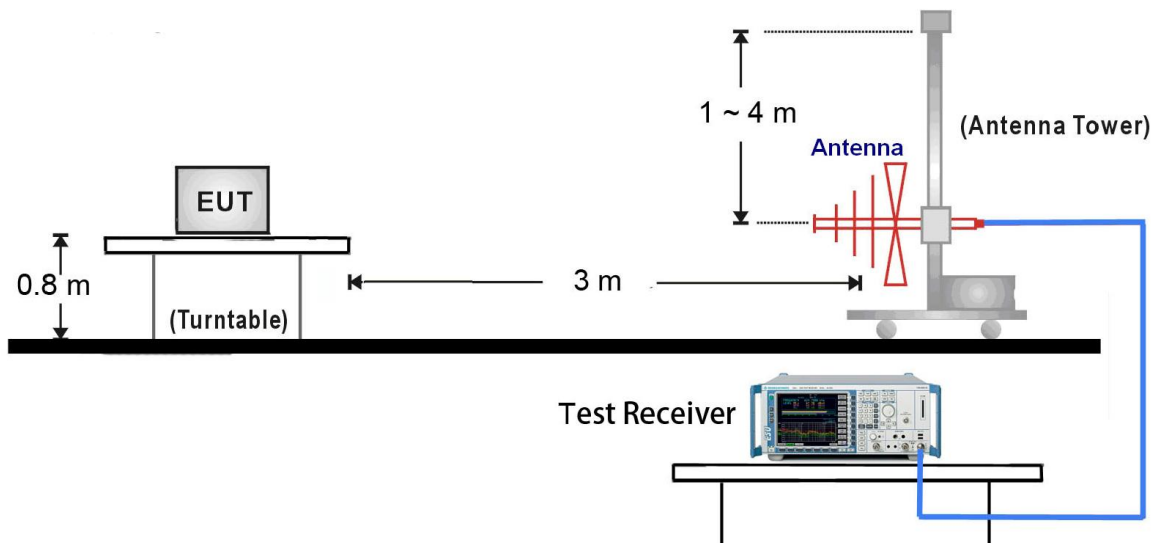
Allow max hold to run for at least 50 times (1/duty cycle) traces

7.6.4.Test Setup

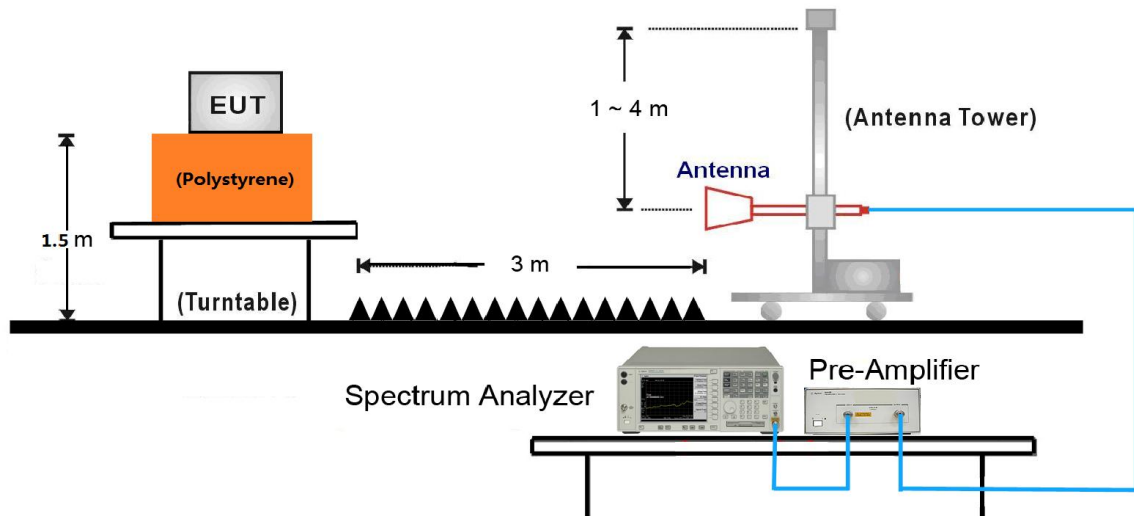
9kHz ~ 30MHz Test Setup:



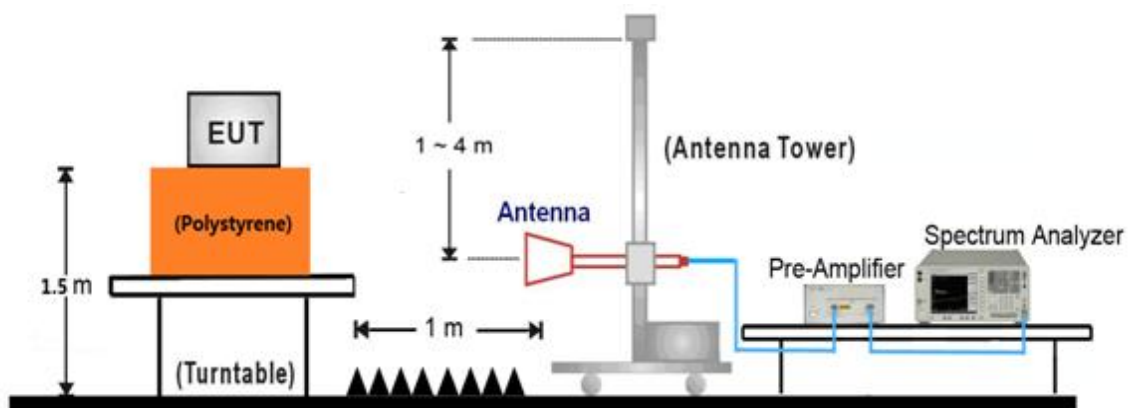
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



18GHz ~25GHz Test Setup:



7.6.5. Test Result

Product	Wi-Fi & BLE combo module	Temperature	27°C
Test Engineer	Snake Ni	Relative Humidity	49%
Test Site	AC1	Test Date	2017/03/25
Test Mode:	802.11b	Test Channel:	01
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4825.0	51.0	2.7	53.7	74	-20.3	Peak	Horizontal
*	6032.0	42.9	5.2	48.1	74	-25.9	Peak	Horizontal
	7587.5	6.8	36.6	43.4	74	-30.6	Peak	Horizontal
*	9661.5	7.4	38.1	45.5	74	-28.5	Peak	Horizontal
	4825.0	50.6	2.7	53.3	74	-20.7	Peak	Vertical
*	6032.0	43.7	5.2	48.9	74	-25.1	Peak	Vertical
	7502.5	8.4	36.7	45.1	74	-28.9	Peak	Vertical
*	10324.5	7.5	39.2	46.7	74	-27.3	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (101.2dBμV/m) or 15.209 which is higher.

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

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

Product	Wi-Fi & BLE combo module	Temperature	27°C
Test Engineer	Snake Ni	Relative Humidity	49%
Test Site	AC1	Test Date	2017/03/25
Test Mode:	802.11b	Test Channel:	06
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4876.0	49.1	2.6	51.7	74	-22.3	Peak	Horizontal
*	6091.5	42.0	5.6	47.6	80.4	-32.8	Peak	Horizontal
	7417.5	7.4	36.6	44.0	74	-30.0	Peak	Horizontal
*	9602.0	7.5	38.1	45.6	80.4	-34.8	Peak	Horizontal
	4876.0	51.2	2.6	53.8	74	-20.2	Peak	Vertical
*	6091.5	44.0	5.6	49.6	80.4	-30.8	Peak	Vertical
	7332.5	7.8	36.5	44.3	74	-29.7	Peak	Vertical
*	10520.0	8.4	39.6	48.0	80.4	-32.4	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (100.4dBμV/m) or 15.209 which is higher.

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

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

Product	Wi-Fi & BLE combo module	Temperature	27°C
Test Engineer	Snake Ni	Relative Humidity	49%
Test Site	AC1	Test Date	2017/03/25
Test Mode:	802.11b	Test Channel:	11
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4927.0	48.4	2.6	51.0	74	-23.0	Peak	Horizontal
*	6151.0	40.4	5.8	46.2	81.3	-35.1	Peak	Horizontal
	7655.5	7.5	36.5	44.0	74	-30.0	Peak	Horizontal
*	9704.0	7.5	38.1	45.6	81.3	-35.7	Peak	Horizontal
	4927.0	51.0	2.6	53.6	74	-20.4	Peak	Vertical
*	6159.5	44.4	5.8	50.2	81.3	-31.1	Peak	Vertical
	7392.0	7.6	36.5	44.1	74	-29.9	Peak	Vertical
*	9687.0	8.6	38.1	46.7	81.3	-34.6	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (101.3dBμV/m) or 15.209 which is higher.

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

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

Product	Wi-Fi & BLE combo module	Temperature	27°C
Test Engineer	Snake Ni	Relative Humidity	49%
Test Site	AC1	Test Date	2017/03/25
Test Mode:	802.11g	Test Channel:	01
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4822.2	50.6	2.6	53.2	54	-0.8	Average	Horizontal
	4825.0	61.2	2.7	63.9	74	-10.1	Peak	Horizontal
*	6032.0	42.6	5.2	47.8	81.4	-33.6	Peak	Horizontal
	7230.5	37.8	10.7	48.5	74	-25.5	Peak	Horizontal
*	9398.0	7.0	37.9	44.9	81.4	-36.5	Peak	Horizontal
	4822.6	47.5	2.6	50.1	54	-3.9	Average	Vertical
	4825.0	60.7	2.7	63.4	74	-10.6	Peak	Vertical
*	6032.0	43.7	5.2	48.9	81.4	-32.5	Peak	Vertical
	7230.5	41.4	10.7	52.1	74	-21.9	Peak	Vertical
*	9372.5	8.1	37.9	46.0	81.4	-35.4	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (101.4dBμV/m) or 15.209 which is higher.

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

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

Product	Wi-Fi & BLE combo module	Temperature	27°C
Test Engineer	Snake Ni	Relative Humidity	49%
Test Site	AC1	Test Date	2017/03/25
Test Mode:	802.11g	Test Channel:	06
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4867.5	59.7	2.6	62.3	74	-11.7	Peak	Horizontal
	4872.5	49.9	2.6	52.5	54	-1.5	Average	Horizontal
*	6091.5	42.6	5.6	48.2	81	-32.8	Peak	Horizontal
	7315.5	8.2	36.5	44.7	74	-29.3	Peak	Horizontal
*	9610.5	7.4	38.1	45.5	81	-35.5	Peak	Horizontal
	4872.5	49.5	2.6	52.1	54	-1.9	Average	Vertical
	4876.0	61.2	2.6	63.8	74	-10.2	Peak	Vertical
*	6091.5	17.2	32.9	50.1	81	-30.9	Peak	Vertical
	7315.5	13.6	36.5	50.1	74	-23.9	Peak	Vertical
*	9916.5	7.5	38.7	46.2	81	-34.8	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (101.0dBμV/m) or 15.209 which is higher.

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

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

Product	Wi-Fi & BLE combo module	Temperature	27°C
Test Engineer	Snake Ni	Relative Humidity	49%
Test Site	AC1	Test Date	2017/03/25
Test Mode:	802.11g	Test Channel:	11
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4922.4	45.5	2.6	48.1	54	-5.9	Average	Horizontal
	4927.0	57.6	2.6	60.2	74	-13.8	Peak	Horizontal
*	6151.0	40.1	5.8	45.9	81.5	-35.6	Peak	Horizontal
	7528.0	7.3	36.7	44.0	74	-30.0	Peak	Horizontal
*	9585.0	8.0	38.1	46.1	81.5	-35.4	Peak	Horizontal
	4918.5	56.9	2.6	59.5	74	-14.5	Peak	Vertical
	4922.9	44.0	2.6	46.6	54	-7.4	Average	Vertical
*	6151.0	44.6	5.8	50.4	81.5	-31.1	Peak	Vertical
	7392.0	11.7	36.5	48.2	74	-25.8	Peak	Vertical
*	9670.0	7.9	38.1	46.0	81.5	-35.5	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (101.5dBμV/m) or 15.209 which is higher.

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

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

Product	Wi-Fi & BLE combo module	Temperature	27°C
Test Engineer	Snake Ni	Relative Humidity	49%
Test Site	AC1	Test Date	2017/03/25
Test Mode:	802.11n-HT20	Test Channel:	01
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4821.2	49.3	2.6	51.9	54	-2.1	Average	Horizontal
	4825.0	61.8	2.7	64.5	74	-9.5	Peak	Horizontal
*	6032.0	42.6	5.2	47.8	80.1	-32.3	Peak	Horizontal
	7222.0	8.8	36.5	45.3	74	-28.7	Peak	Horizontal
*	9143.0	7.1	37.4	44.5	80.1	-35.6	Peak	Horizontal
	4825.0	59.6	2.7	62.3	74	-11.7	Peak	Vertical
	4826.2	46.8	2.7	49.5	54	-4.5	Average	Vertical
*	6032.0	43.3	5.2	48.5	80.1	-31.6	Peak	Vertical
	7247.5	38.3	10.7	49.0	74	-25.0	Peak	Vertical
*	9151.5	7.1	37.5	44.6	80.1	-35.5	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (100.1dBμV/m) or 15.209 which is higher.

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

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

Product	Wi-Fi & BLE combo module	Temperature	27°C
Test Engineer	Snake Ni	Relative Humidity	49%
Test Site	AC1	Test Date	2017/03/25
Test Mode:	802.11n-HT20	Test Channel:	06
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4875.4	50.1	2.6	52.7	54	-1.3	Average	Horizontal
	4876.0	61.1	2.6	63.7	74	-10.3	Peak	Horizontal
*	6091.5	43.0	5.6	48.6	84.2	-35.6	Peak	Horizontal
	7307.0	8.7	36.5	45.2	74	-28.8	Peak	Horizontal
*	9602.0	7.6	38.1	45.7	84.2	-38.5	Peak	Horizontal
	4875.4	48.0	2.6	50.6	54	-3.4	Average	Vertical
	4876.0	59.8	2.6	62.4	74	-11.6	Peak	Vertical
*	6091.5	44.4	5.6	50.0	84.2	-34.2	Peak	Vertical
	7315.5	40.8	10.7	51.5	74	-22.5	Peak	Vertical
*	9746.5	7.7	38.4	46.1	84.2	-38.1	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (104.2dBμV/m) or 15.209 which is higher.

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

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

Product	Wi-Fi & BLE combo module	Temperature	27°C
Test Engineer	Snake Ni	Relative Humidity	49%
Test Site	AC1	Test Date	2017/03/25
Test Mode:	802.11n-HT20	Test Channel:	11
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4925.4	43.6	2.6	46.2	54	-7.8	Average	Horizontal
	4927.0	55.7	2.6	58.3	74	-15.7	Peak	Horizontal
*	6159.5	40.7	5.8	46.5	79.8	-33.3	Peak	Horizontal
	7519.5	7.4	36.7	44.1	74	-29.9	Peak	Horizontal
*	10596.5	7.7	39.7	47.4	79.8	-32.4	Peak	Horizontal
	4925.3	43.1	2.6	45.7	54	-8.3	Average	Vertical
	4927.0	56.5	2.6	59.1	74	-14.9	Peak	Vertical
*	6159.5	45.1	5.8	50.9	79.8	-28.9	Peak	Vertical
	7383.5	11.2	36.5	47.7	74	-26.3	Peak	Vertical
*	10562.5	8.8	39.7	48.5	79.8	-31.3	Peak	Vertical

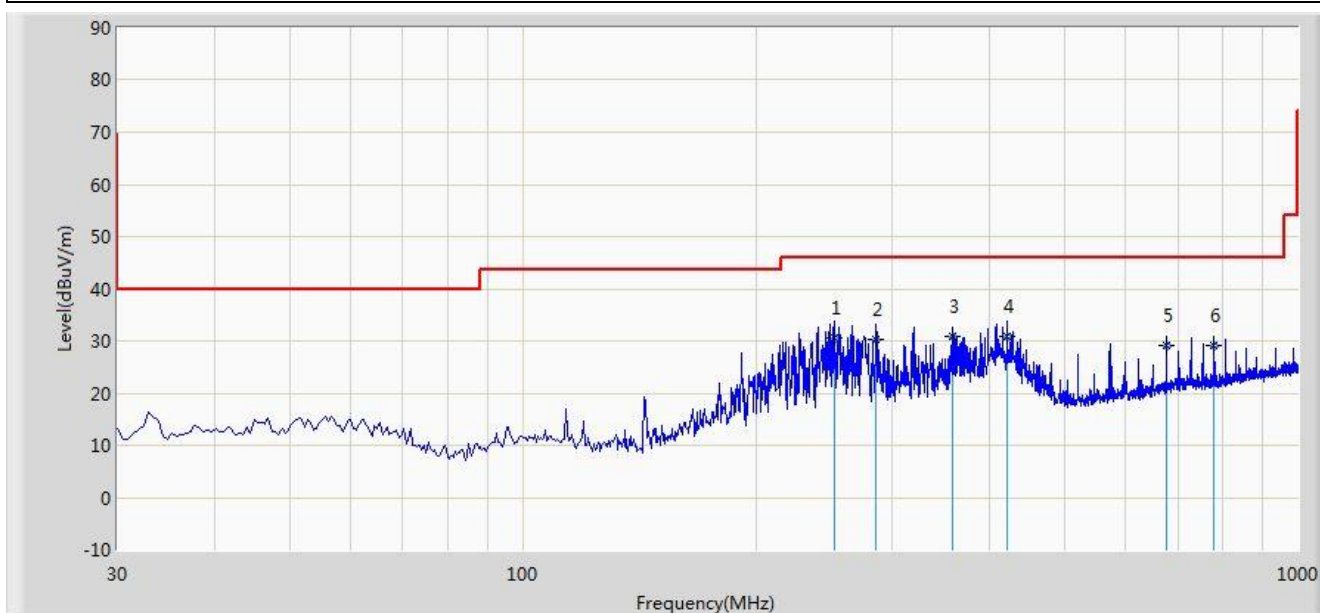
Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (99.8dBμV/m) or 15.209 which is higher.

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

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

The worst case of Radiated Emission below 1GHz:

Site: AC2	Time: 2017/04/05 - 11:03
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: VULB9162_0.03-8GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: There is the worst case within frequency range 30MHz~1GHz.	



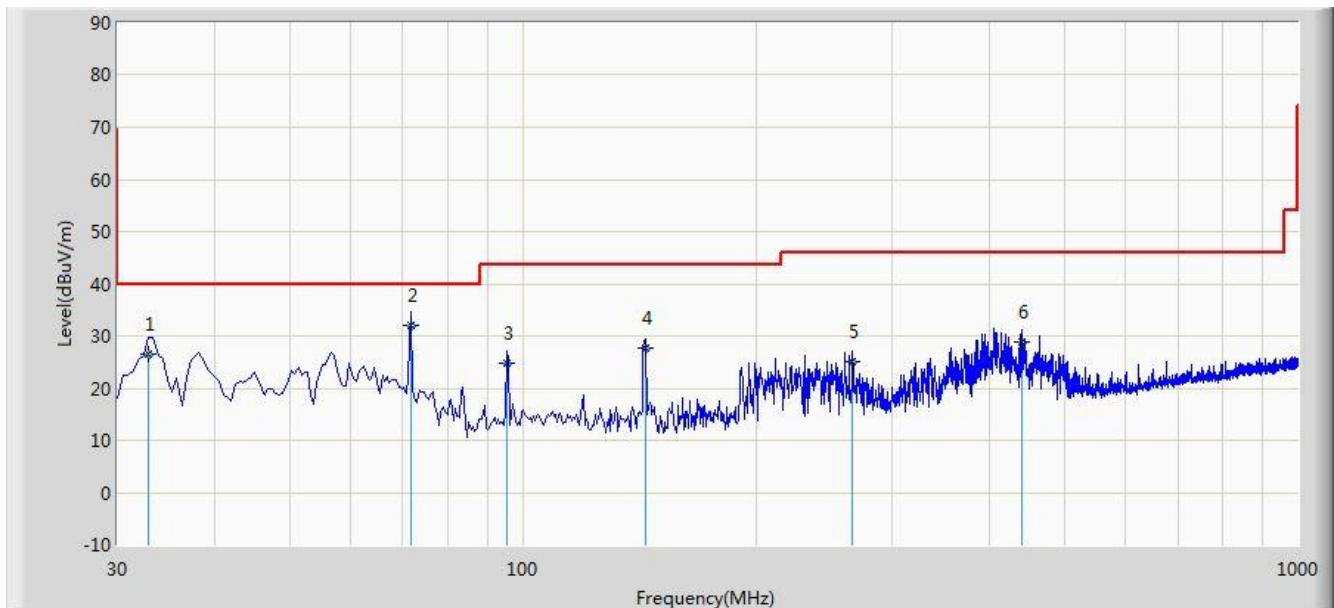
No	Flag	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Over Limit (dB)	Limit (dBμV/m)	Factor (dB)	Type
1			252.130	30.665	18.313	-15.335	46.000	12.352	QP
2			286.080	30.278	17.462	-15.722	46.000	12.816	QP
3			359.315	30.814	16.476	-15.186	46.000	14.338	QP
4		*	421.880	30.925	15.677	-15.075	46.000	15.248	QP
5			676.020	29.036	10.172	-16.964	46.000	18.864	QP
6			780.295	29.079	8.947	-16.921	46.000	20.132	QP

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

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

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

Site: AC2	Time: 2017/04/05 - 11:05
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: VULB9162_0.03-8GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: There is the worst case within frequency range 30MHz~1GHz.	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			32.910	26.649	14.585	-13.351	40.000	12.064	QP
2		*	71.710	32.120	22.354	-7.880	40.000	9.766	QP
3			95.475	24.871	13.325	-18.629	43.500	11.546	QP
4			143.975	27.643	19.234	-15.857	43.500	8.409	QP
5			266.680	24.930	12.347	-21.070	46.000	12.583	QP
6			441.280	28.863	13.418	-17.137	46.000	15.445	QP

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

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

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

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).

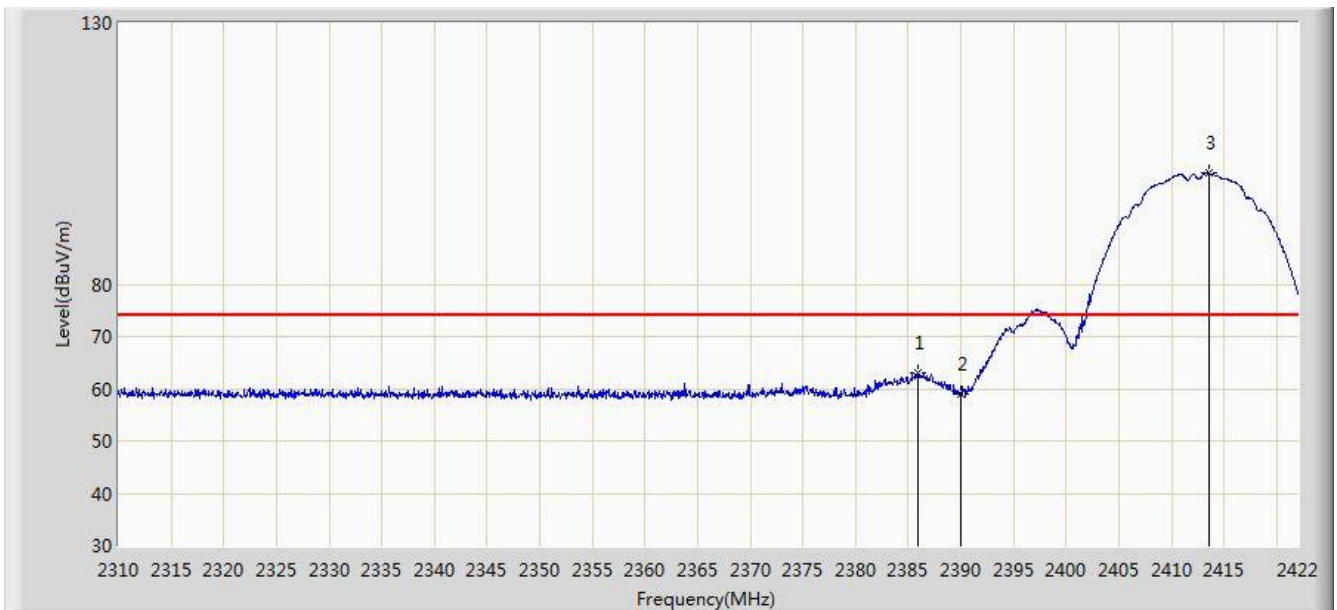
Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42-16.423	399.9 - 410	4.5-5.15
¹ 0.495 - 0.505	16.69475-16.69525	608 - 614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960 - 1240	7.25-7.75
4.125-4.128	25.5 -25.67	1300 - 1427	8.25 - 8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	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

7.7.2.Test Result

Site: AC2	Time: 2017/03/23 - 22:27
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11b at channel 2412MHz	

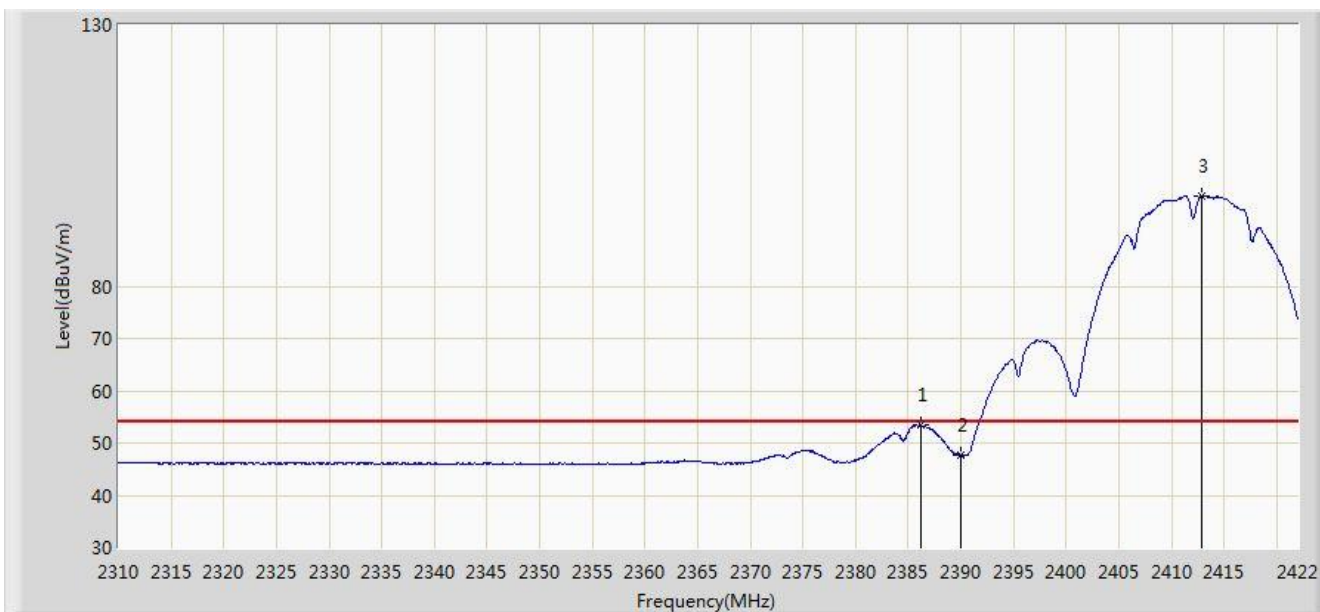


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2385.992	63.174	30.918	-10.826	74.000	32.256	PK
2			2390.000	59.034	26.756	-14.966	74.000	32.278	PK
3		*	2413.544	101.186	68.953	N/A	N/A	32.233	PK

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

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

Site: AC2	Time: 2017/03/23 - 22:31
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11b at channel 2412MHz	

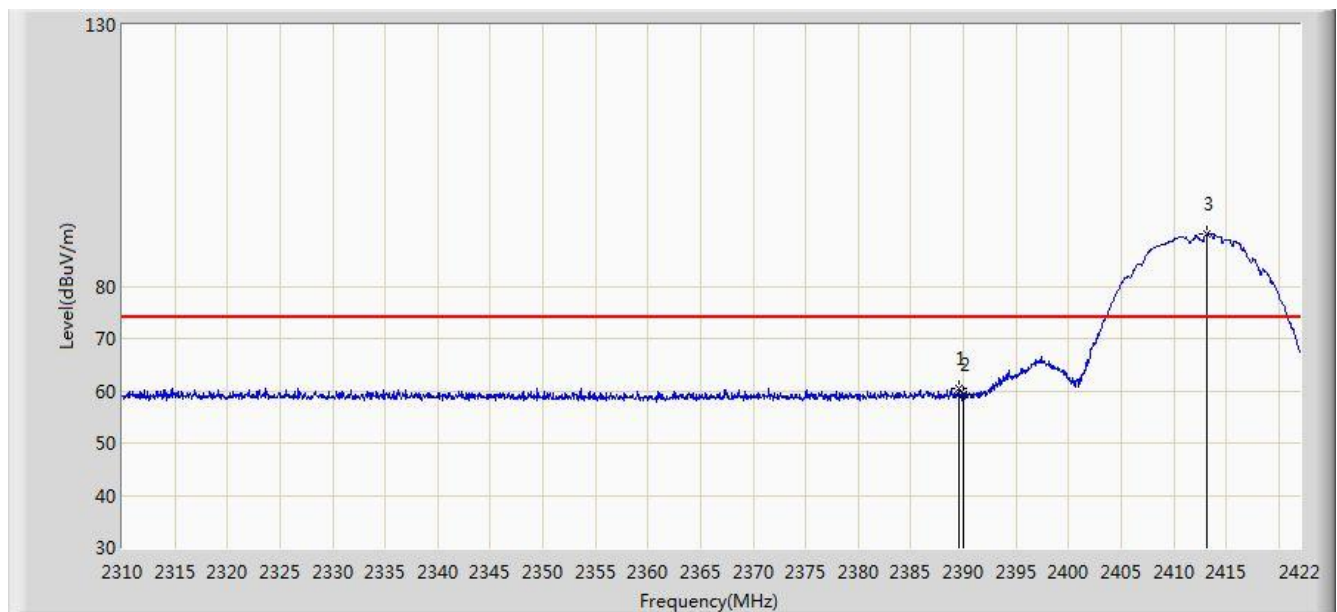


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2386.160	53.369	21.112	-0.631	54.000	32.257	AV
2			2390.000	47.605	15.327	-6.395	54.000	32.278	AV
3		*	2412.872	97.330	65.094	N/A	N/A	32.236	AV

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

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

Site: AC2	Time: 2017/03/23 - 22:31
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11b at channel 2412MHz	

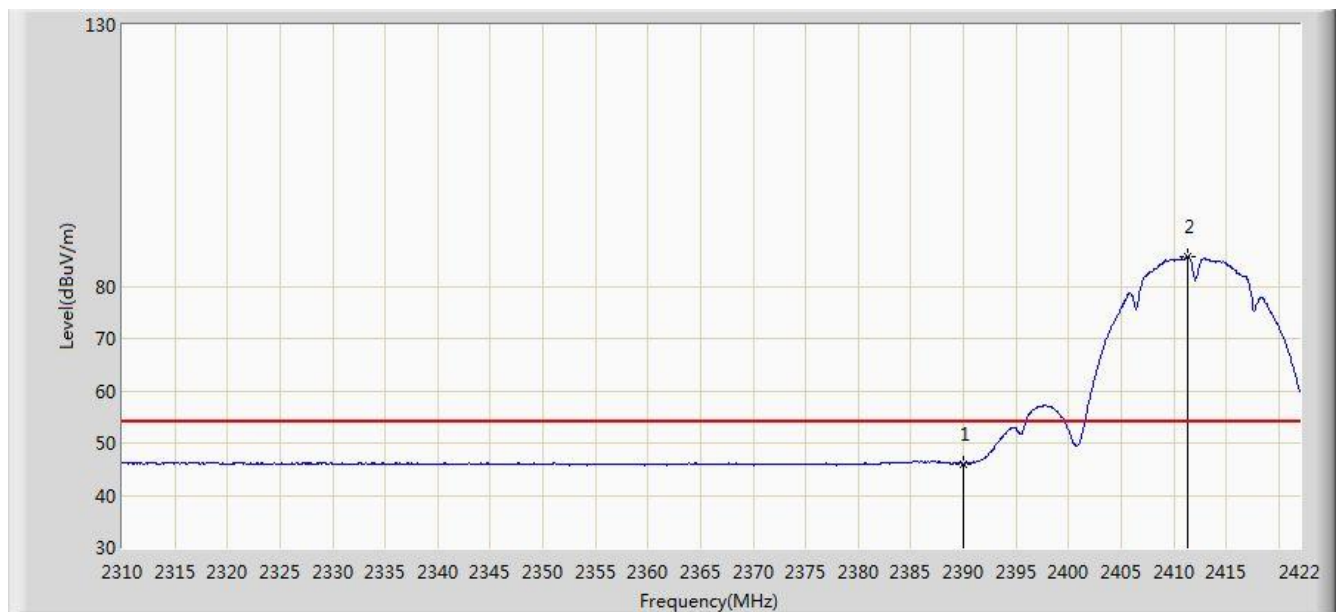


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2389.520	60.473	28.198	-13.527	74.000	32.275	PK
2			2390.000	59.404	27.126	-14.596	74.000	32.278	PK
3		*	2413.208	89.955	57.720	N/A	N/A	32.235	PK

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

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

Site: AC2	Time: 2017/03/23 - 23:18
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11b at channel 2412MHz	

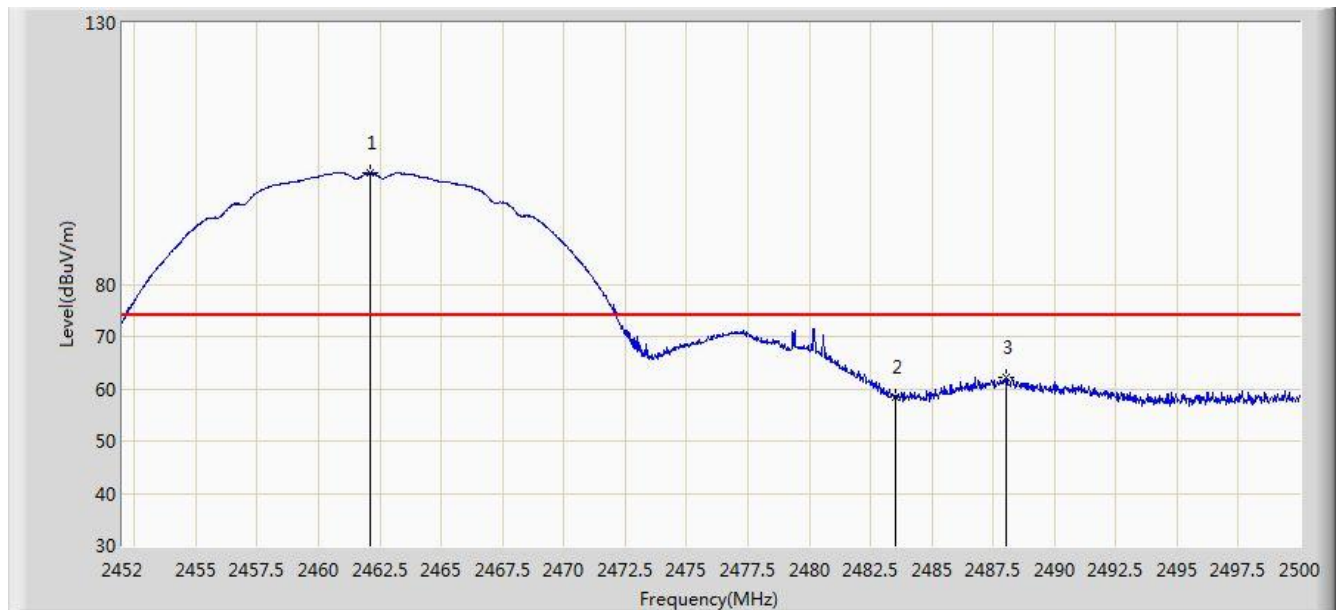


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	46.072	13.794	-7.928	54.000	32.278	AV
2		*	2411.304	85.642	53.399	N/A	N/A	32.243	AV

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

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

Site: AC2	Time: 2017/03/24 - 22:11
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11b at channel 2462MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2462.104	101.279	69.041	N/A	N/A	32.238	PK
2			2483.500	58.339	26.058	-15.661	74.000	32.282	PK
3			2488.024	62.158	29.861	-11.842	74.000	32.297	PK

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

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

Site: AC2	Time: 2017/03/24 - 22:10
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11b at channel 2462MHz	

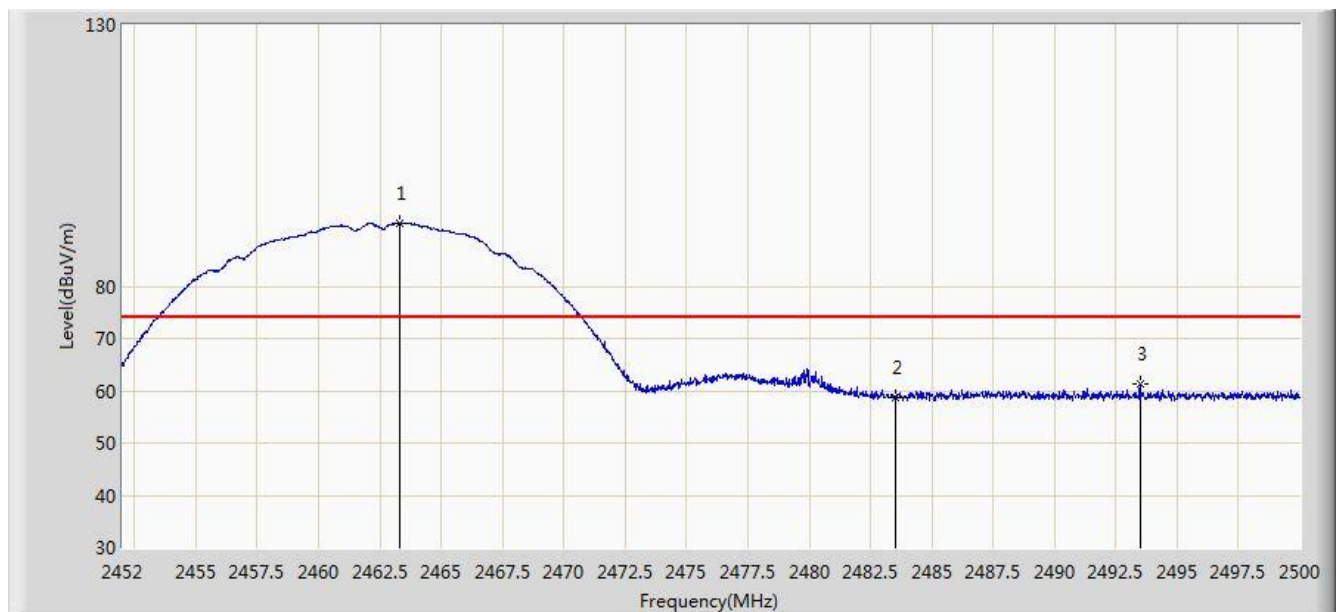


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2461.312	97.905	65.670	N/A	N/A	32.235	AV
2			2483.500	47.707	15.426	-6.293	54.000	32.282	AV
3			2487.952	51.735	19.438	-2.265	54.000	32.297	AV

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

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

Site: AC2	Time: 2017/03/24 - 22:12
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11b at channel 2462MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2463.328	92.100	59.861	18.100	74.000	32.240	PK
2			2483.500	58.560	26.279	-15.440	74.000	32.282	PK
3			2493.496	61.275	28.959	-12.725	74.000	32.316	PK

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

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

Site: AC2	Time: 2017/03/24 - 22:15
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11b at channel 2462MHz	

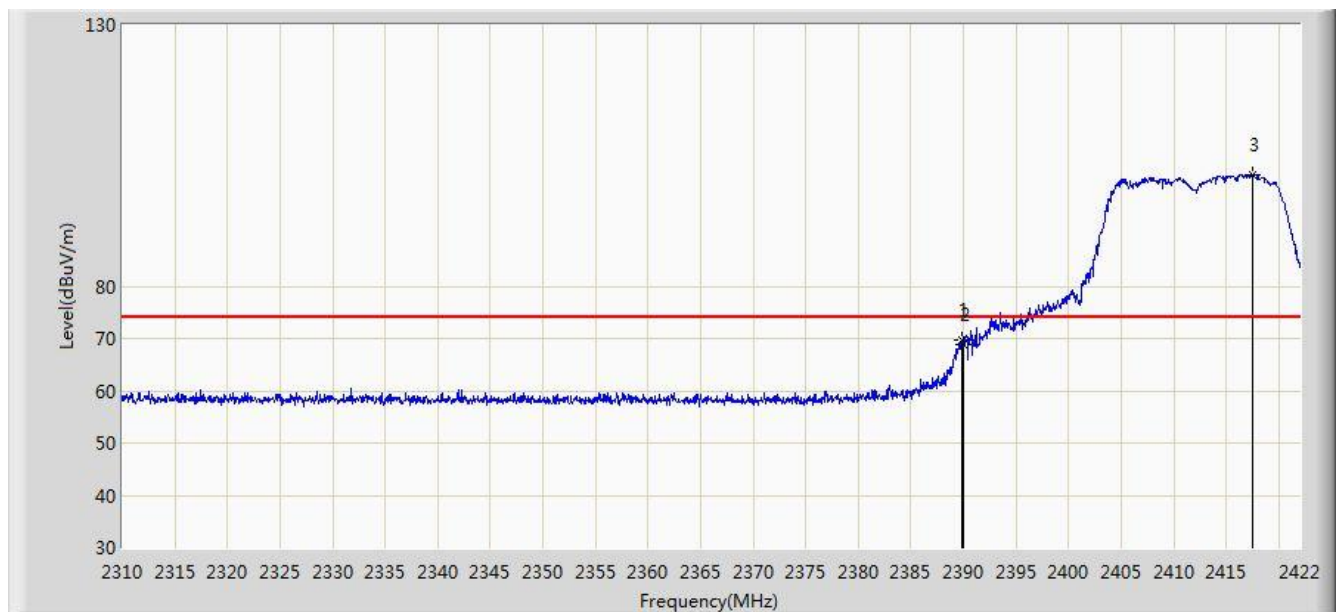


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2463.184	88.029	55.790	N/A	N/A	32.239	AV
2			2483.500	46.316	14.035	-7.684	54.000	32.282	AV

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

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

Site: AC2	Time: 2017/03/24 - 22:24
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11g at channel 2412MHz	

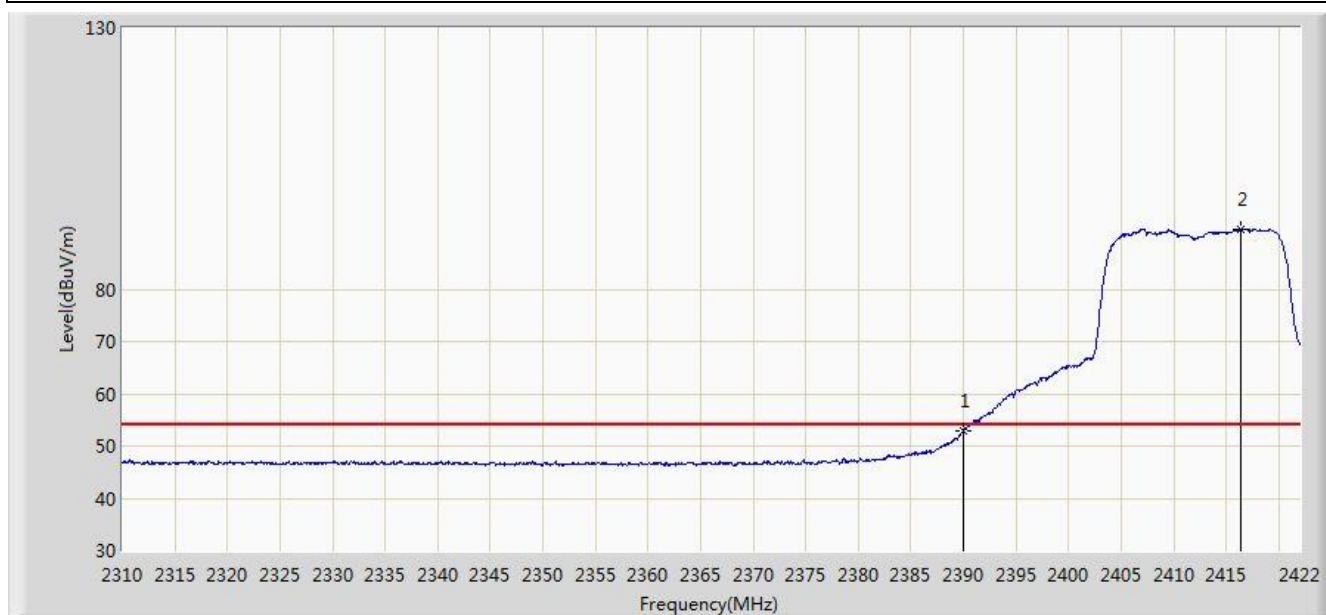


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2389.800	69.747	37.470	-4.253	74.000	32.277	PK
2			2390.000	68.748	36.470	-5.252	74.000	32.278	PK
3		*	2417.576	101.445	N/A	N/A	74.000	32.217	PK

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

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

Site: AC2	Time: 2017/03/24 - 22:21
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11g at channel 2412MHz	

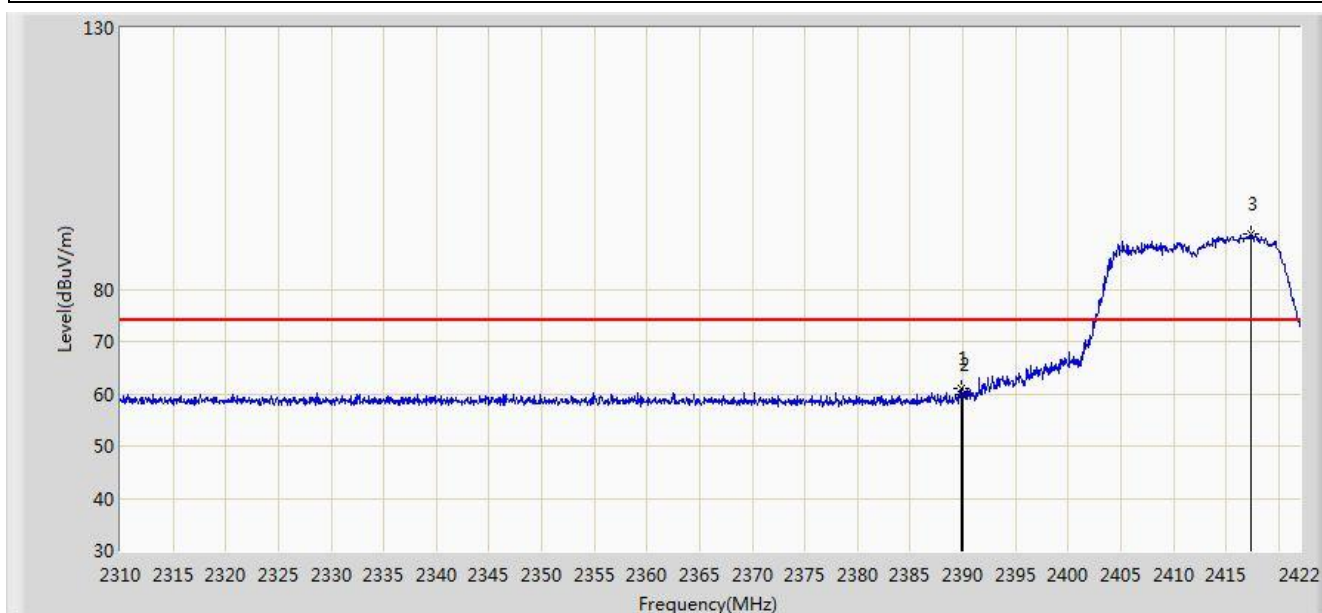


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	52.938	20.660	-1.062	54.000	32.278	AV
2		*	2416.344	91.466	N/A	N/A	54.000	32.222	AV

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

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

Site: AC2	Time: 2017/03/24 - 22:22
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11g at channel 2412MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2389.800	61.040	28.763	-12.960	74.000	32.277	PK
2			2390.000	59.749	27.471	-14.251	74.000	32.278	PK
3		*	2417.408	90.526	58.309	N/A	N/A	32.217	PK

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

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

Site: AC2	Time: 2017/03/24 - 22:24
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11g at channel 2412MHz	

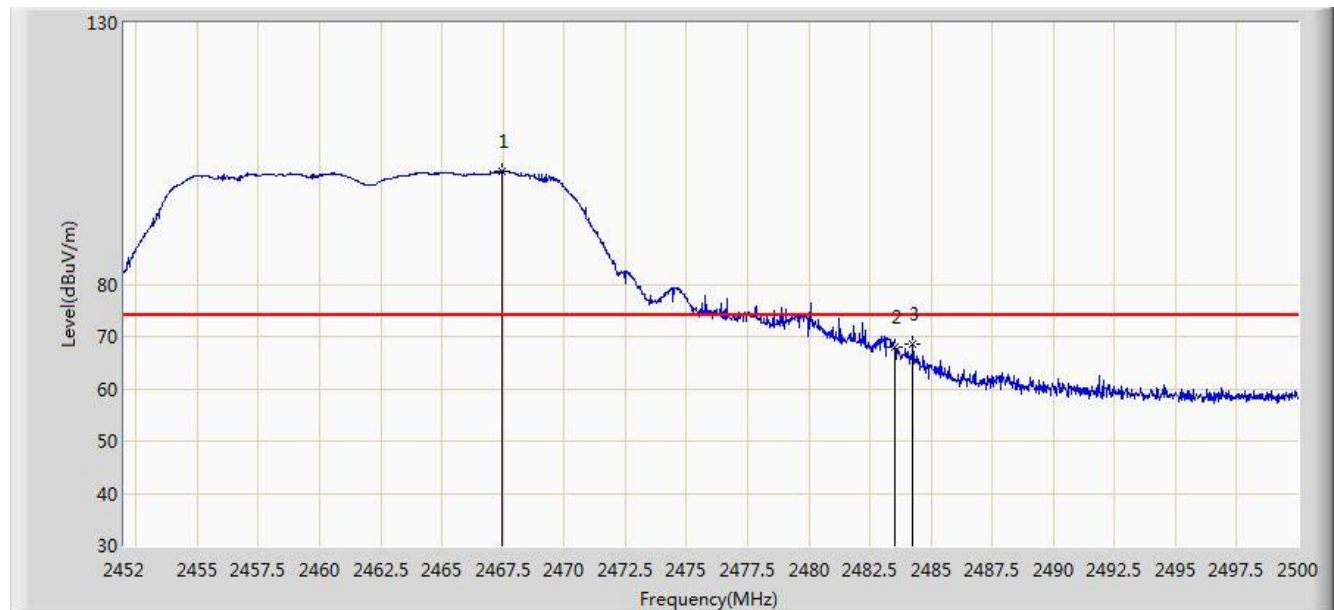


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	47.232	14.954	-6.768	54.000	32.278	AV
2		*	2416.904	80.169	47.950	N/A	N/A	32.219	AV

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

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

Site: AC2	Time: 2017/03/24 - 22:28
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11g at channel 2462MHz	

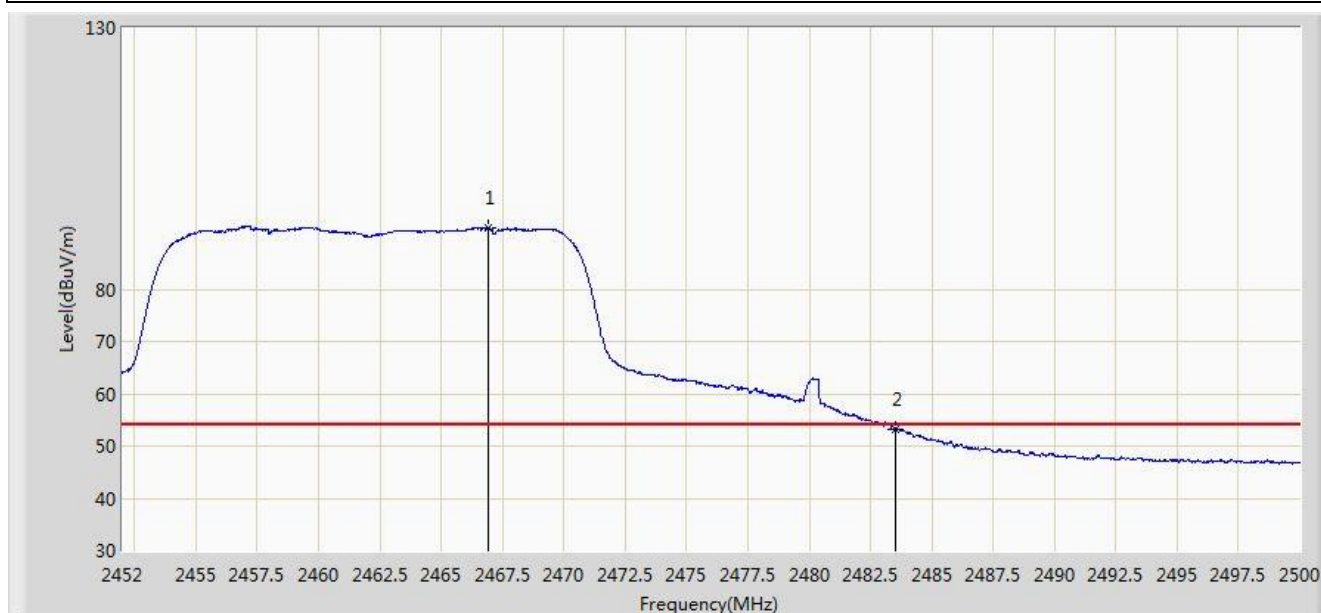


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2467.432	101.502	69.256	N/A	N/A	32.246	PK
2			2483.500	68.062	35.781	-5.938	74.000	32.282	PK
3			2484.256	68.510	36.226	-5.490	74.000	32.284	PK

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

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

Site: AC2	Time: 2017/03/24 - 22:27
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11g at channel 2462MHz	

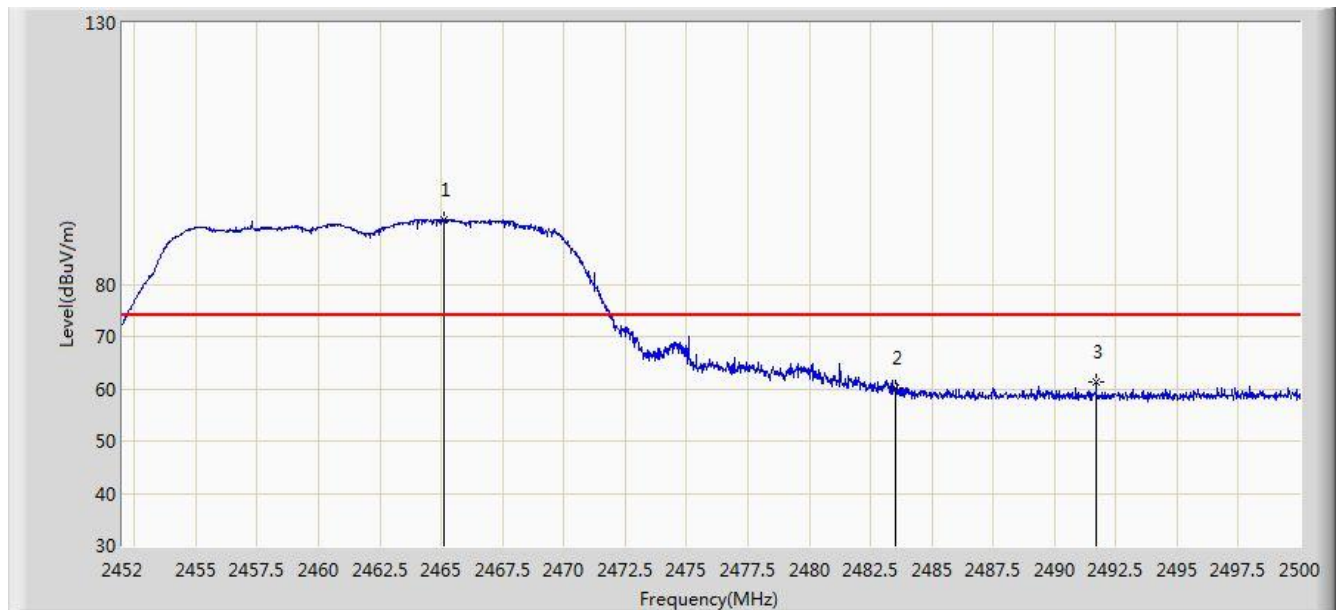


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2466.904	91.656	59.411	N/A	N/A	32.245	AV
2			2483.500	53.294	21.013	-0.706	54.000	32.282	AV

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

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

Site: AC2	Time: 2017/03/24 - 22:28
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11g at channel 2462MHz	

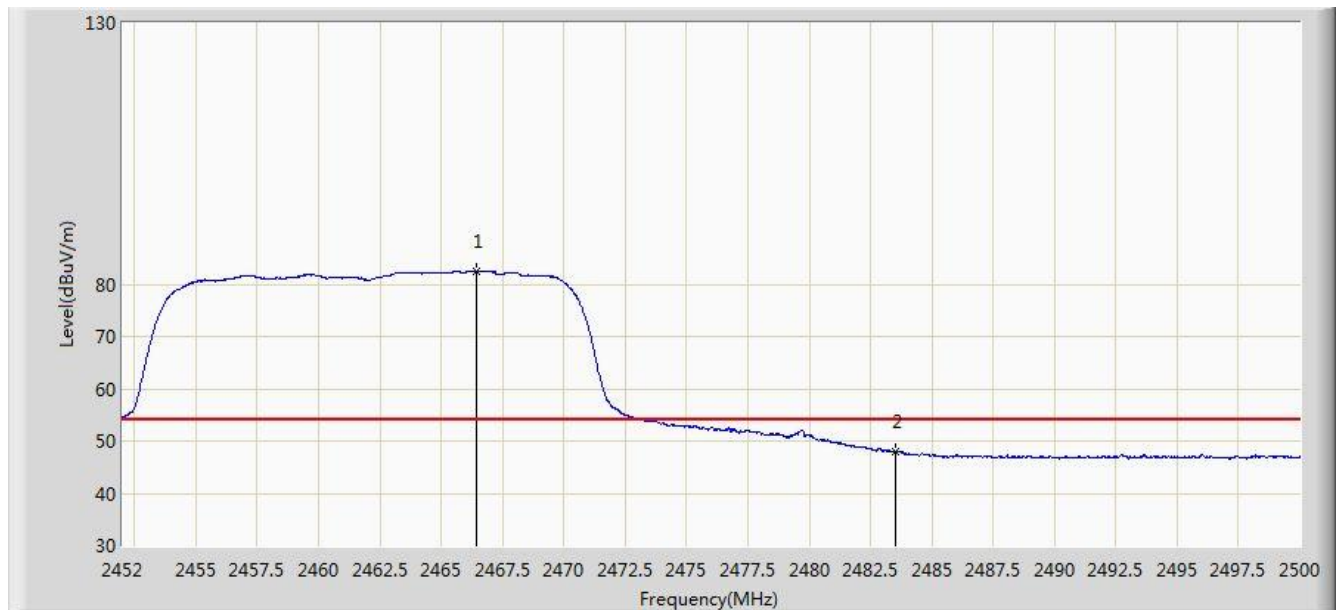


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2465.128	92.335	60.093	N/A	N/A	32.242	PK
2			2483.500	60.110	27.829	-13.890	74.000	32.282	PK
3			2491.696	61.361	29.051	-12.639	74.000	32.309	PK

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

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

Site: AC2	Time: 2017/03/24 - 22:30
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11g at channel 2462MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2466.448	82.601	50.357	N/A	N/A	32.244	AV
2			2483.500	47.994	15.713	-6.006	54.000	32.282	AV

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

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

Site: AC2	Time: 2017/03/24 - 22:33
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11n-HT20 at channel 2412MHz	

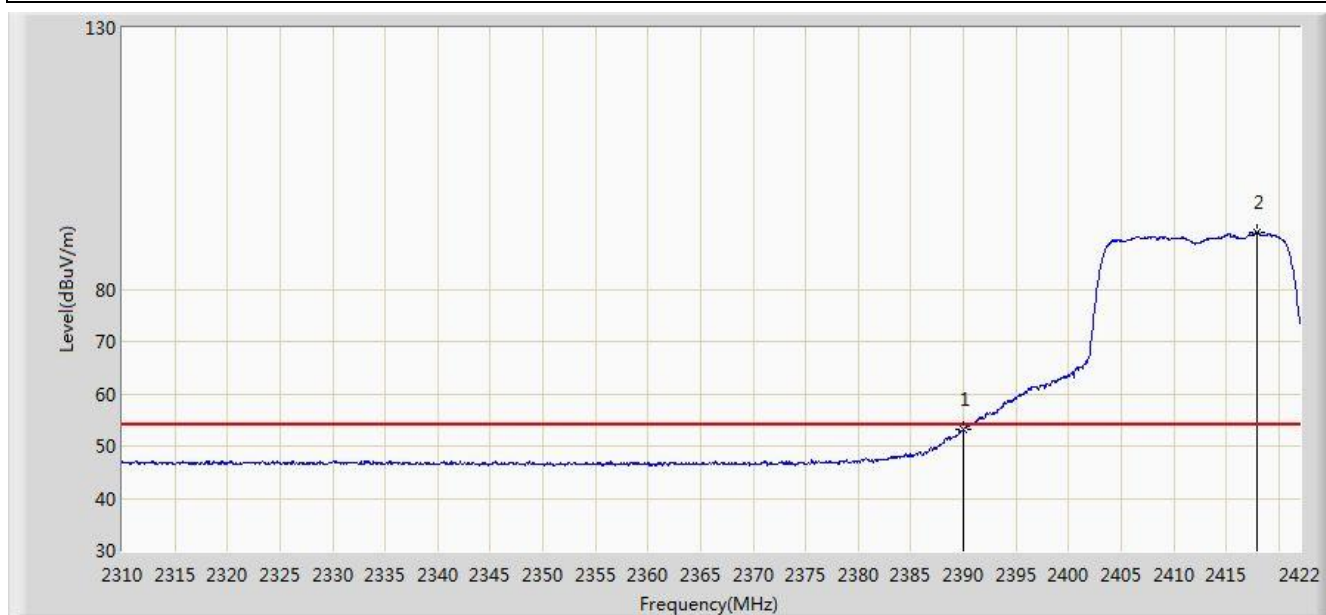


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2387.952	67.614	35.347	-6.386	74.000	32.267	PK
2			2390.000	67.610	35.332	-6.390	74.000	32.278	PK
3		*	2417.968	100.114	67.899	N/A	N/A	32.215	PK

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

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

Site: AC2	Time: 2017/03/24 - 22:33
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11n-HT20 at channel 2412MHz	

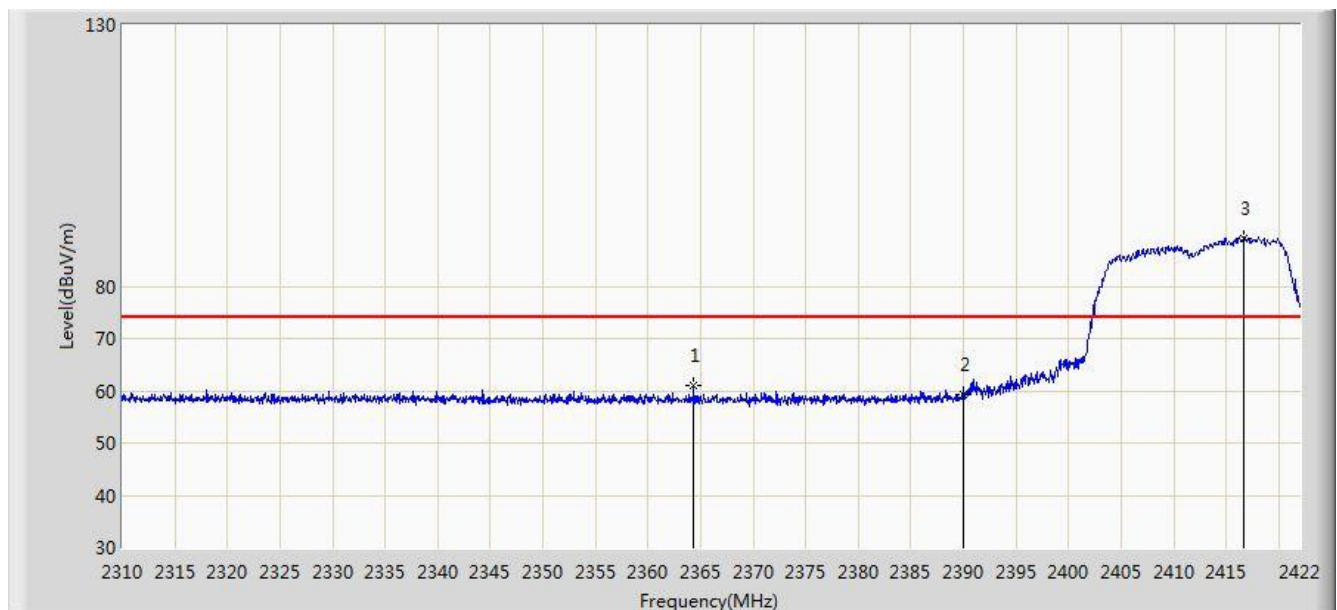


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	53.056	20.778	-0.944	54.000	32.278	AV
2		*	2417.912	90.811	58.596	N/A	N/A	32.215	AV

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

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

Site: AC2	Time: 2017/03/24 - 22:34
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11n-HT20 at channel 2412MHz	

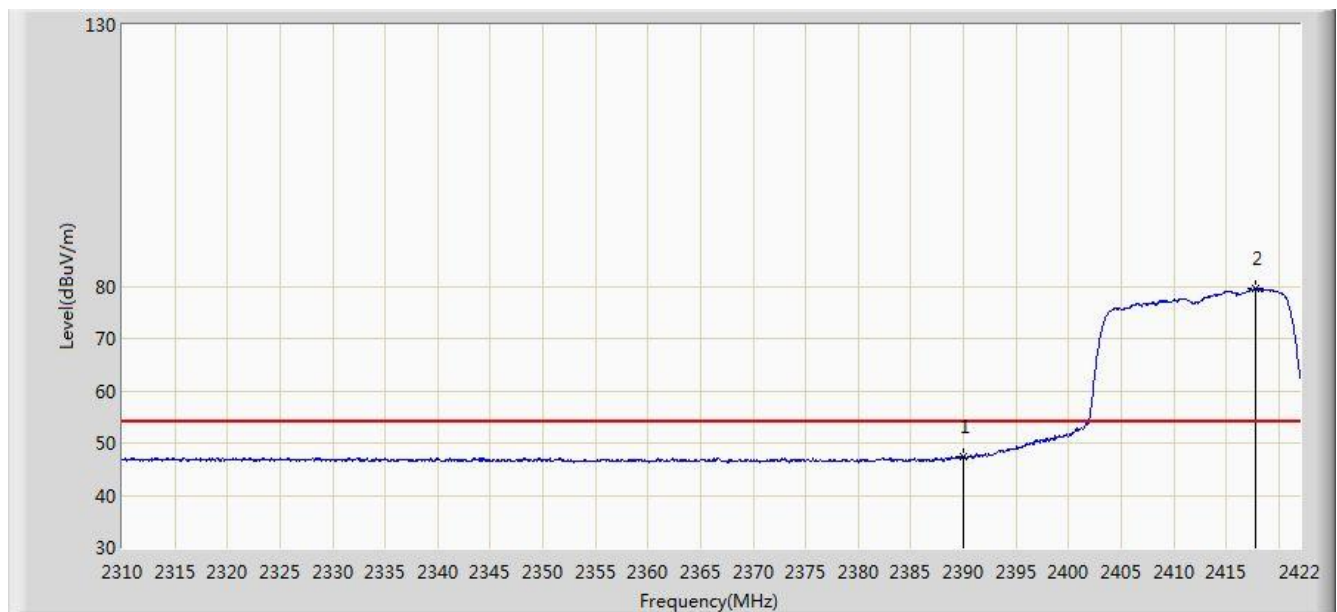


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2364.376	60.898	28.659	-13.102	74.000	32.238	PK
2			2390.000	59.357	27.079	-14.643	74.000	32.278	PK
3		*	2416.624	89.239	57.019	N/A	N/A	32.221	PK

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

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

Site: AC2	Time: 2017/03/24 - 22:35
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11n-HT20 at channel 2412MHz	

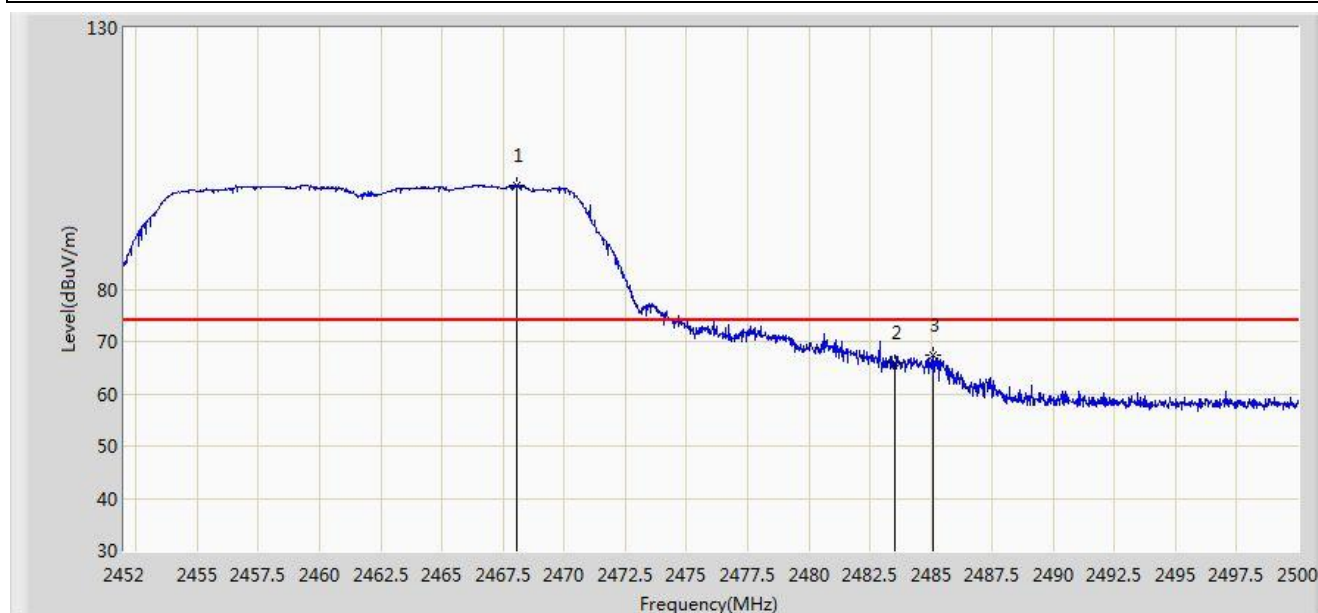


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	47.460	15.182	-6.540	54.000	32.278	AV
2		*	2417.800	79.601	47.385	N/A	N/A	32.215	AV

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

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

Site: AC2	Time: 2017/03/24 - 22:38
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11n-HT20 at channel 2462MHz	

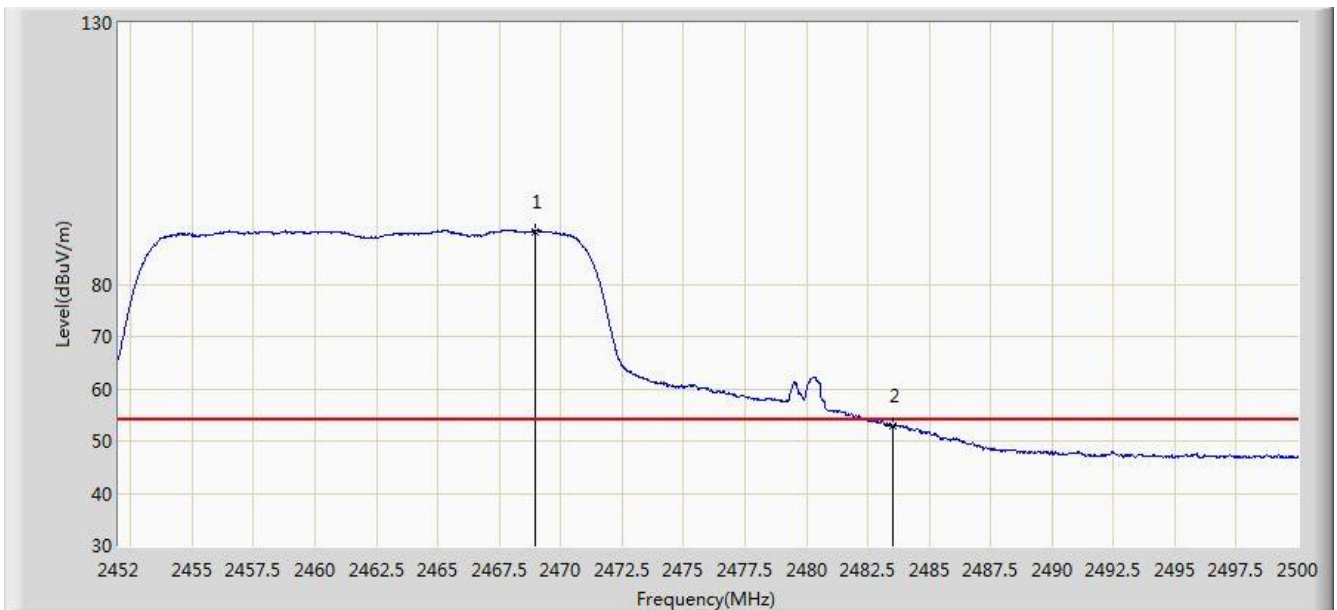


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2468.032	99.757	67.510	N/A	N/A	32.247	PK
2			2483.500	65.872	33.591	-8.128	74.000	32.282	PK
3			2485.096	67.362	35.075	-6.638	74.000	32.287	PK

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

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

Site: AC2	Time: 2017/03/24 - 22:37
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11n-HT20 at channel 2462MHz	

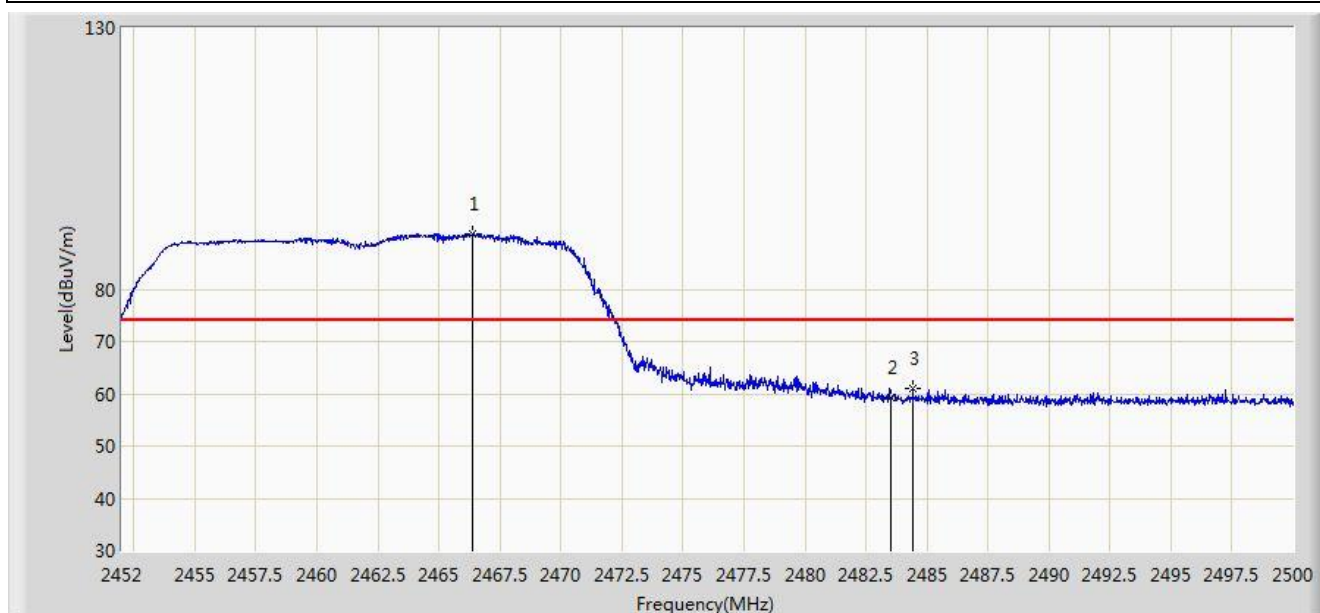


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2468.944	90.108	57.860	N/A	N/A	32.248	AV
2			2483.500	52.923	20.642	-1.077	54.000	32.282	AV

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

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

Site: AC2	Time: 2017/03/24 - 22:39
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11n-HT20 at channel 2462MHz	

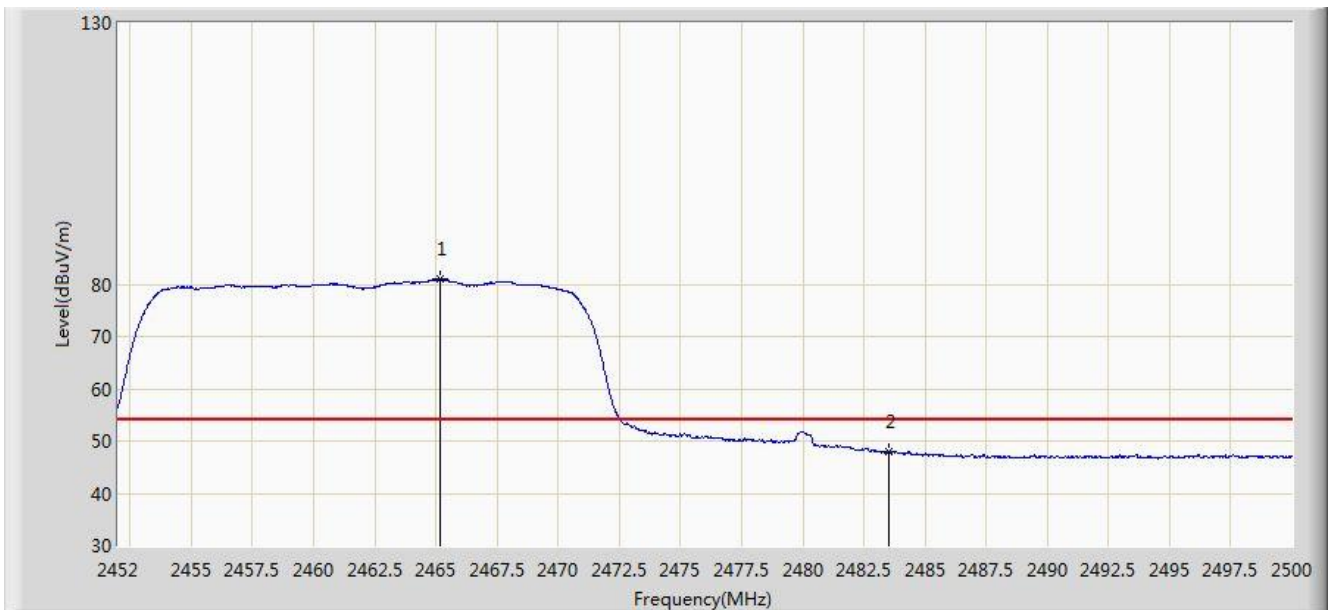


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2466.376	90.539	58.295	N/A	N/A	32.244	PK
2			2483.500	59.163	26.882	-14.837	74.000	32.282	PK
3			2484.424	61.052	28.768	-12.948	74.000	32.284	PK

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

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

Site: AC2	Time: 2017/03/24 - 22:40
Limit: FCC_Part15.209_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Wi-Fi & BLE combo module	Power: DC 3.6V
Note: Transmit by 802.11n-HT20 at channel 2462MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2465.176	80.893	48.651	N/A	N/A	32.242	AV
2			2483.500	47.951	15.670	-6.049	54.000	32.282	AV

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

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

7.8. AC Conducted Emissions Measurement

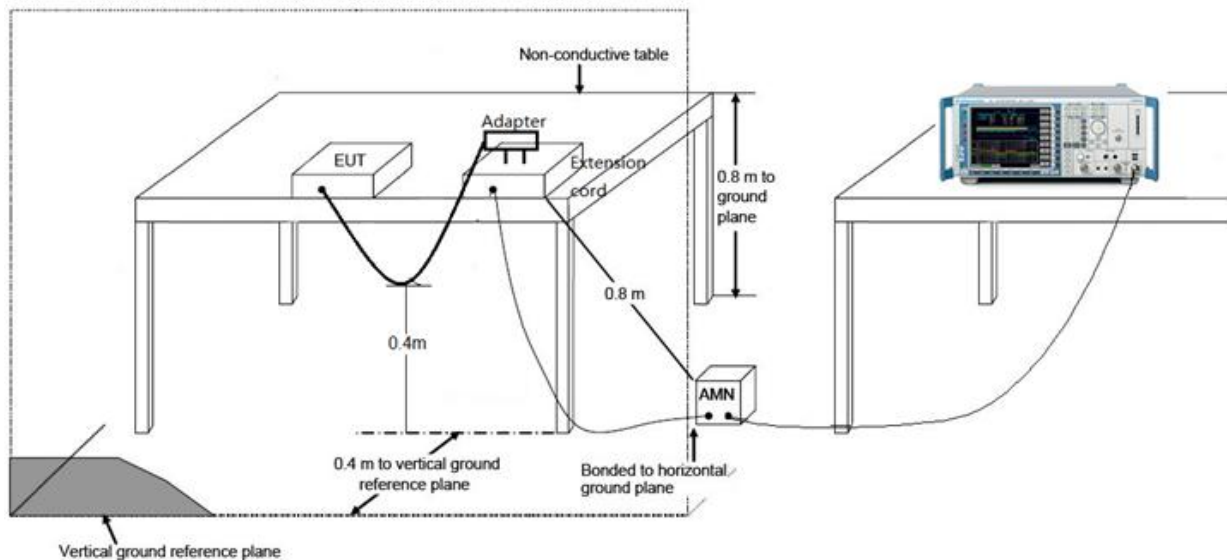
7.8.1. Test Limit

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

This test was not performed since the EUT is a build-in module which will be powered by the host equipment.

8. CONCLUSION

The data collected relate only the item(s) tested and show that the **Wi-Fi & BLE combo module** **FCC ID: X3ZWFMOD1** is in compliance with Part 15C of the FCC Rules.

The End