MEASUREMENT REPORT

FCC PART 15.247 & IC RSS-247 Bluetooth

FCC ID:	VPYLB1PJ
IC:	772C-LB1PJ
APPLICANT:	Murata Manufacturing Co., Ltd.

Application Type:	Certification
Product:	W-LAN + Bluetooth Module
Model No.:	LBEE5ZZ1PJ
FCC Classification:	FCC Part 15 Spread Spectrum Transmitter(DSS)
FCC Rule Part(s):	Part 15.247
IC Rule(s):	RSS-247 Issue 2, RSS-GEN Issue 4
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01v04
Test Date:	October 25 ~ November 28, 2017

Reviewed By : (Kevin Guo)

Approved By : (Marlin Chen)

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
1710WSU01601	Rev. 01	Initial report	12-11-2017	Valid

CONTENTS

Description Page

1. INTRODUCTION 7

1.1. Scope 7
1.2. MRT Test Location 7

2. PRODUCT INFORMATION 8

2.1. Equipment Description 8
2.2. Product Specification Subjective to this Standard 8
2.3. Operation Frequency / Channel List 9
2.4. Pseudorandom Frequency Hopping Sequence 10
2.5. Device Capabilities 10
2.6. Test Configuration 10
2.7. Test Software 10
2.8. EMI Suppression Device(s)/Modifications 11
2.9. Labeling Requirements 11

3. DESCRIPTION of TEST 12

3.1. Evaluation Procedure 12
3.2. AC Line Conducted Emissions 12
3.3. Radiated Emissions 13

4. ANTENNA REQUIREMENTS 14

5. TEST EQUIPMENT CALIBRATION DATE 15

6. MEASUREMENT UNCERTAINTY 16

7. TEST RESULT 17

7.1. Summary 17
7.2. 20dB Bandwidth Measurement 18
7.2.1. Test Limit 18
7.2.2. Test Procedure used 18
7.2.3. Test Setting 18
7.2.4. Test Setup 18
7.2.5. Test Result 19
7.3. Output Power Measurement 22
7.3.1. Test Limit 22
7.3.2. Test Procedure Used 22
7.3.3. Test Setting 22
7.3.4. Test Setup 22

7.3.5. Test Result 23
7.4. Carrier Frequency Separation Measurement 27
7.4.1. Test Limit 27
7.4.2. Test Procedure Used 27
7.4.3. Test Setting 27
7.4.4. Test Setup 27
7.4.5. Test Result 28
7.5. Number of Hopping Channels Measurement 31
7.5.1. Test Limit 31
7.5.2. Test Procedure Used 31
7.5.3. Test Settitng 31
7.5.4. Test Setup 31
7.5.5. Test Result 32
7.6. Time of Occupancy Measurement 35
7.6.1. Test Limit 35
7.6.2. Test Procedure Used 35
7.6.3. Test Settitng 35
7.6.4. Test Setup 36
7.6.5. Test Result 37
7.7. Band-edge Compliance Measurement 39
7.7.1. Test Limit 39
7.7.2. Test Procedure Used 39
7.7.3. Test Setting 39
7.7.4. Test Setup 40
7.7.5. Test Result 41
7.8. Conducted Spurious Emissions Measurement 44
7.8.1. Test Limit 44
7.8.2. Test Procedure Used 44
7.8.3. Test Setting 44
7.8.4. Test Setup 45
7.8.5. Test Result 46
7.9. Radiated Spurious Emission Measurement 49
7.9.1. Test Limit 49
7.9.2. Test Procedure Used 49
7.9.3. Test Setting 49
7.9.4. Test Setup 51
7.9.5. Test Result 53
7.10. Radiated Restricted Band Edge Measurement 62

7.10.1. Test Result 62
7.11. AC Conducted Emissions Measurement 86
7.11.1. Test Limit 86
7.11.2. Test Setup 86
7.11.3. Test Result 86
8. CONCLUSION 87

§2.1033 General Information

Applicant:	Murata Manufacturing Co., Ltd.
Applicant Address:	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan
Manufacturer:	Murata Manufacturing Co., Ltd.
Manufacturer Address:	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
FCC Registration No.:	893164
IC Registration No.:	11384A-1
FCC Rule Part(s):	Part 15.247
IC Rule(s):	RSS-247 Issue 2
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	Spread Spectrum Transmitter(DSS)

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. Equipment Description

Product Name:	W-LAN + Bluetooth Module
Model No.:	LBEE5ZZ1PJ
Brand Name:	Murata
Work Voltage	DC 3.3V
WiFi Specification	802.11 a/b/g/n/ac
Bluetooth Specification	v4.1 dual mode

2.2. Product Specification Subjective to this Standard

Operating Frequency	2402~2480MHz
Channel Number	79
Type of modulation	GFSK, Pi/4 DQPSK, 8DPSK
Data Rate	1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps (8DPSK)
Antenna type	PCB Antenna
Antenna Gain	3.1dBi

The equipment under test (EUT) is the **W-LAN + Bluetooth Module**. The test data contained in this report pertains only to the emissions due to the EUT's Bluetooth transmitter.

- 15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.

- 15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

- 15.247(h): The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

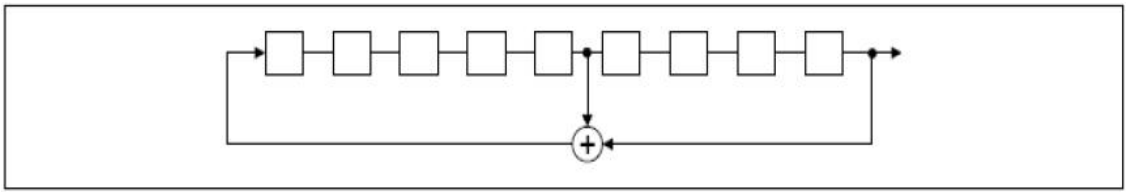
2.3. Operation Frequency / Channel List

Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2403 MHz	02	2404 MHz
03	2405 MHz	04	2406 MHz	05	2407 MHz
06	2408 MHz	07	2409 MHz	08	2410 MHz
09	2411 MHz	10	2412 MHz	11	2413 MHz
12	2414 MHz	13	2415 MHz	14	2416 MHz
15	2417 MHz	16	2418 MHz	17	2419 MHz
18	2420 MHz	19	2421 MHz	20	2422 MHz
21	2423 MHz	22	2424 MHz	23	2425 MHz
24	2426 MHz	25	2427 MHz	26	2428 MHz
27	2429 MHz	28	2430 MHz	29	2431 MHz
30	2432 MHz	31	2433 MHz	32	2434 MHz
33	2435 MHz	34	2436 MHz	35	2437 MHz
36	2438 MHz	37	2439 MHz	38	2440 MHz
39	2441 MHz	40	2442 MHz	41	2443 MHz
42	2444 MHz	43	2445 MHz	44	2446 MHz
45	2447 MHz	46	2448 MHz	47	2449 MHz
48	2450 MHz	49	2451 MHz	50	2452 MHz
51	2453 MHz	52	2454 MHz	53	2455 MHz
54	2456 MHz	55	2457 MHz	56	2458 MHz
57	2459 MHz	58	2460 MHz	59	2461 MHz
60	2462 MHz	61	2463 MHz	62	2464 MHz
63	2465 MHz	64	2466 MHz	65	2467 MHz
66	2468 MHz	67	2469 MHz	68	2470 MHz
69	2471 MHz	70	2472 MHz	71	2473 MHz
72	2474 MHz	73	2475 MHz	74	2476 MHz
75	2477 MHz	76	2478 MHz	77	2479 MHz
78	2480 MHz	-	-	-	-

2.4. Pseudorandom Frequency Hopping Sequence

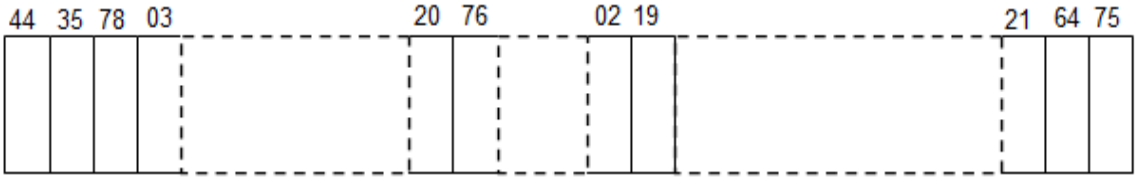
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 2^9 - 1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

2.5. Device Capabilities

This device contains the following capabilities:

5GHz WLAN (UNII), 2.4GHz WLAN (DTS), Bluetooth (v4.1 dual mode)

2.6. Test Configuration

The **W-LAN + Bluetooth Module** was tested per the guidance of ANSI C63.10-2013. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.7. Test Software

The test utility software used during testing was “QCARCT”, and the version was “v3.0.210.0”.

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.

RSP-100 Issue 11 Section 3

The manufacturer, importer or distributor shall meet the labelling requirements set out in this section for every unit:

(i) prior to marketing in Canada, for products manufactured in Canada

(ii) prior to importation into Canada, for imported products

For information regarding the e-labelling option, see Notice 2014–DRS1003. The label for the certified product represents the manufacturer's or importer's compliance with Innovation, Science and Economic Development Canada's (ISED) regulatory requirements.

Please see attachment for IC 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 “Filing were used in the measurement of the **W-LAN + Bluetooth 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 were 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.

Line conducted emissions test results are shown in Section 7.11.

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. An 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 Beamwidth 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 **W-LAN + Bluetooth 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	MRTSUE06001	1 year	2018/06/20
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2018/06/20
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2018/06/20
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06181	1 year	2017/12/20
Shielding Anechoic Chamber	Mikebang	Chamber-SR2	MRTSUE06214	1 year	2018/05/10

Radiated Disturbance – AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
MXE EMI Receiver	Agilent	N9038A	MRTSUE06125	1 year	2018/08/18
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2018/11/21
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2018/11/21
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2018/10/21
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2017/12/11
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2018/04/25
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06183	1 year	2017/12/22
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	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	Agilent	U2021XA	MRTSUE06030	1 year	2017/12/06
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06180	1 year	2017/12/22

Software	**Version**	**Function**
e3	V 8.3.5	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=2Uc(y)): 150kHz~30MHz: 3.46dB
Radiated Emission Measurement - AC1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: 4.18dB 1GHz ~ 25GHz: 4.76dB
Spurious Emissions, Conducted - TR3
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.78dB
Output Power - TR3
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.13dB
Power Spectrum Density - TR3
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.15dB
Occupied Bandwidth - TR3
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.28%

7. TEST RESULT

7.1. Summary

Company Name: **Murata Manufacturing Co., Ltd.**
FCC ID: **VPYLB1PJ**
IC: **772C-LB1PJ**
Method/System: **Frequency Hopping Spread Spectrum (FHSS)**
Number of Channels: **79**

FCC Part Section(s)	IC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(1)	RSS-247 [5.1]	20dB Bandwidth	N/A	Conducted	PASS	Section 7.2
15.247(b)(1)	RSS-247 [5.4(b)]	Peak Transmitter Output Power	<1 Watt if > 75 non-overlapping channels used		PASS	Section 7.3
15.247(a)(1)	RSS-247 [5.1]	Channel Separation	> 2/3 of 20 dB BW for systems with Output Power < 125mW		PASS	Section 7.4
15.247(a)(1)(iii)	RSS-247 [5.1]	Number of Channels	> 15 Channels		PASS	Section 7.5
15.247(a)(1)(iii)	RSS-247 [5.1]	Time of Occupancy	< 0.4 sec in 31.6 sec period		PASS	Section 7.6
15.247(d)	RSS-247 [5.5]	Band Edge / out-of-Band Emissions	Conducted ≥ 20dBc		PASS	Section 7.7 Section 7.8
15.205, 15.209	RSS-247 [5.5]	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 7.9 Section 7.10
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	N/A	Section 7.11

Notes: The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.

7.2. 20dB Bandwidth Measurement

7.2.1.Test Limit

N/A

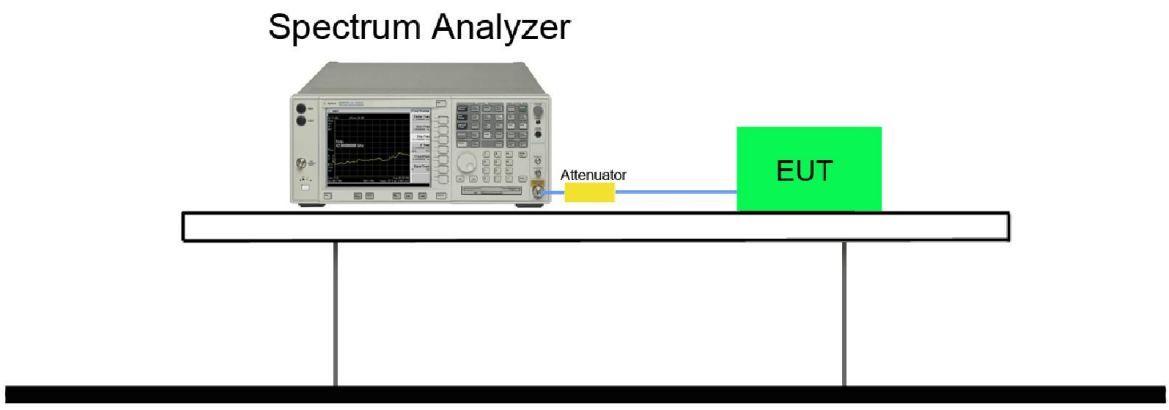
7.2.2.Test Procedure used

ANSI C63.10-2013 - Section 6.9.2

7.2.3.Test Setting

1. Set RBW ≥ 1% of the 20dB bandwidth
2. VBW ≥ 3 × RBW
3. Span = approximately 2 to 5 times the 20dB bandwidth, centered on a hopping channel
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize
8. 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 20 dB relative to the maximum level measured in the fundamental emission.

7.2.4.Test Setup



7.2.5.Test Result

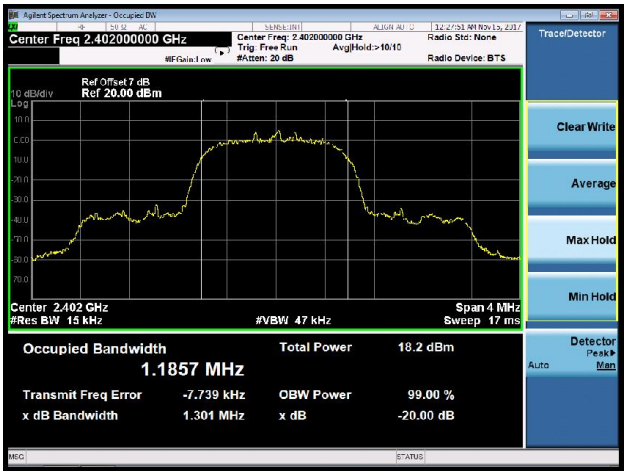
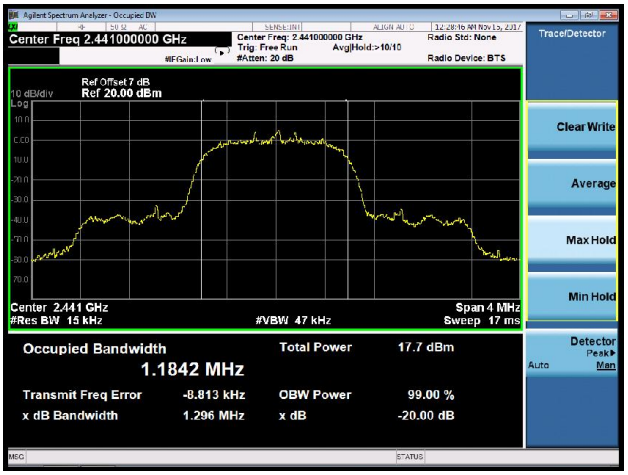
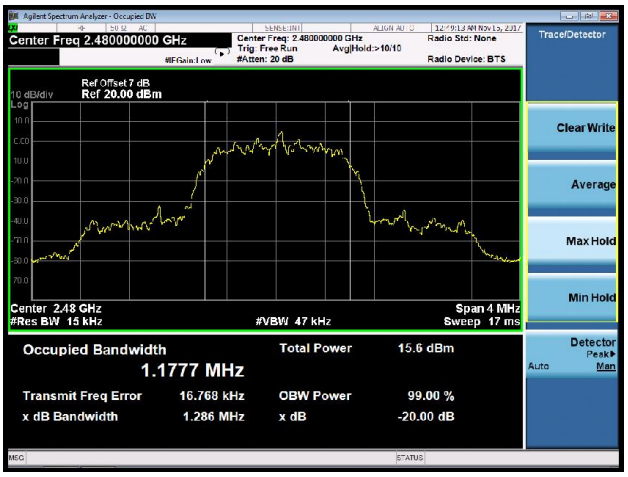
Test Mode	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)	Result
DH5	00	2402	998.6	918.2	Pass
DH5	39	2441	1022.0	914.9	Pass
DH5	78	2480	1020.0	921.5	Pass
2DH5	00	2402	1301.0	1185.7	Pass
2DH5	39	2441	1296.0	1184.2	Pass
2DH5	78	2480	1286.0	1177.7	Pass
3DH5	00	2402	1263.0	1179.5	Pass
3DH5	39	2441	1263.0	1178.6	Pass
3DH5	78	2480	1262.0	1177.7	Pass

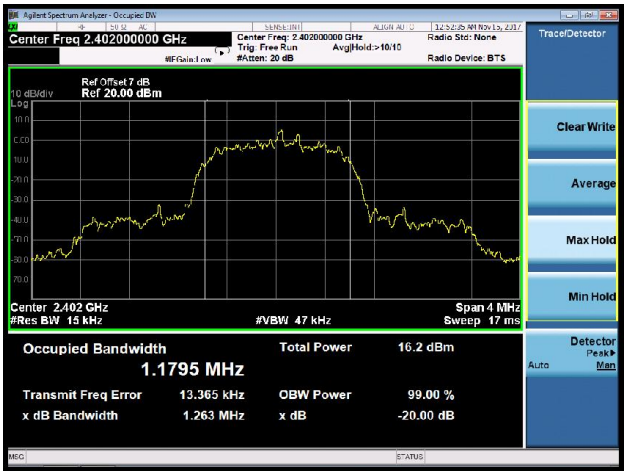
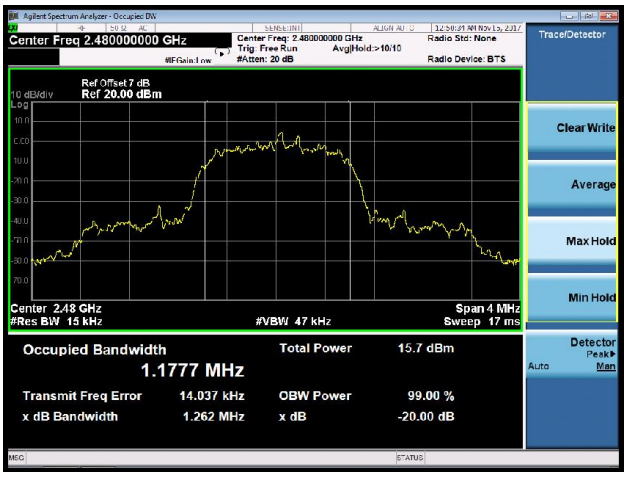
DH5 20dB Bandwidth

Channel 00 (2402MHz)

Channel 39 (2441MHz)

Channel 78 (2480MHz)

2DH5 20dB Bandwidth	
Channel 00 (2402MHz)	**Channel 39 (2441MHz)**
	
Channel 78 (2480MHz)	
	

3DH5 20dB Bandwidth	
Channel 00 (2402MHz)	**Channel 39 (2441MHz)**
	
Channel 78 (2480MHz)	
	

7.3. Output Power Measurement

7.3.1.Test Limit

The maximum out power permissible output power is 1 Watt for all other frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels.

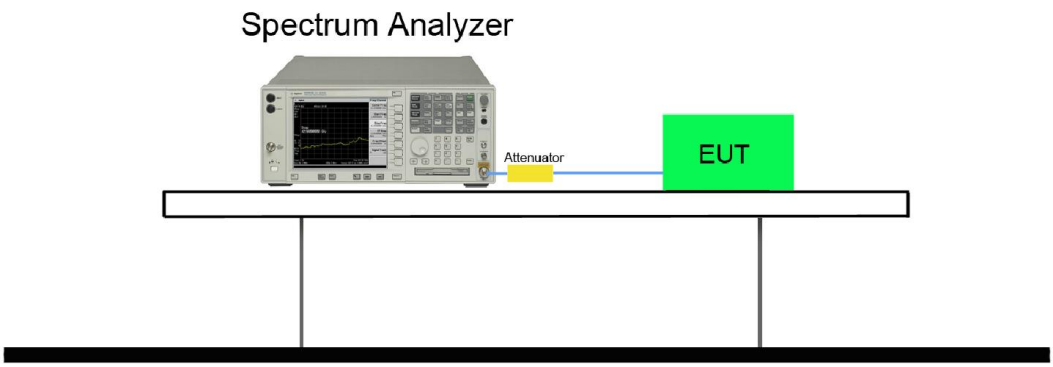
7.3.2.Test Procedure Used

ANSI C63.10-2013 - Section 7.8.5

7.3.3.Test Setting

1. Set RBW ≥ the 20 dB bandwidth of the emission being measured.
2. VBW ≥ 3 × RBW
3. Span = approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (don't forget added the external attenuation and cable loss)

7.3.4.Test Setup

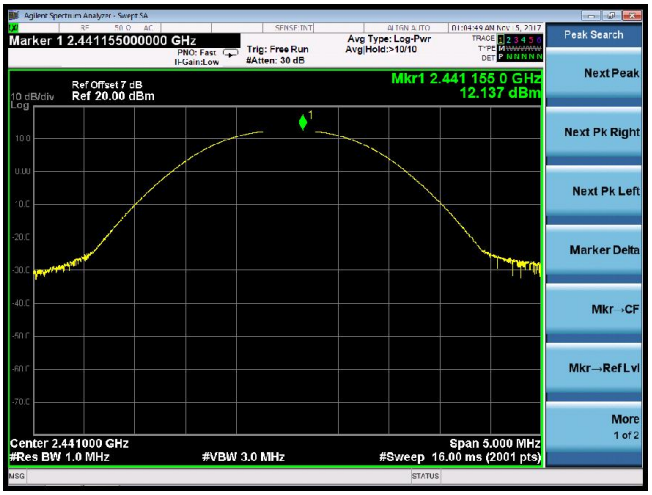


7.3.5.Test Result

Test Mode	Channel No.	Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)
DH5	00	2402	12.25	< 30
DH5	39	2441	12.14	< 30
DH5	78	2480	11.85	< 30
2DH5	00	2402	11.20	< 30
2DH5	39	2441	11.05	< 30
2DH5	78	2480	10.76	< 30
3DH5	00	2402	11.54	< 30
3DH5	39	2441	11.39	< 30
3DH5	78	2480	11.11	< 30

Note 1: EIRP (dBm) = Conducted Power (dBm) + Antenna Gain (dBi), Antenna Gain = 3.1dBi.

Note 2: Max EIRP (dBm) = 12.25 dBm + 3.1 dBi = 15.35 dBm < 30 dBm.

DH5 Output Power	
Channel 00 (2402MHz)	**Channel 39 (2441MHz)**
	
Channel 78 (2480MHz)	

2DH5 Output Power	
Channel 00 (2402MHz)	**Channel 39 (2441MHz)**
Channel 78 (2480MHz)	

3DH5 Output Power	
Channel 00 (2402MHz)	**Channel 39 (2441MHz)**
Channel 78 (2480MHz)	

7.4. Carrier Frequency Separation Measurement

7.4.1.Test Limit

The minimum permissible channel separation for this system is 2/3 the value of the 20dB BW.

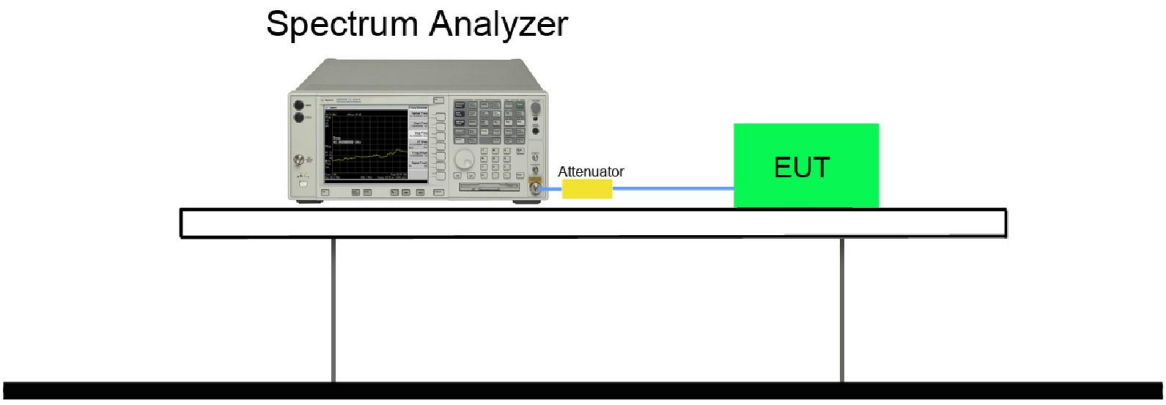
7.4.2.Test Procedure Used

ANSI C63.10-2013 - Section 7.8.2

7.4.3.Test Setting

1. Span = wide enough to capture the peaks of two adjacent channels.
2. RBW ≥ 1 % of the span
3. VBW ≥ RBW
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

7.4.4.Test Setup



7.4.5.Test Result

Test Mode	Channel No.	Frequency (MHz)	Limit (kHz)	Result
DH5	00	2402	≥ 612.13	Pass
DH5	39	2441	≥ 609.93	Pass
DH5	78	2480	≥ 614.33	Pass
2DH5	00	2402	≥ 790.47	Pass
2DH5	39	2441	≥ 789.47	Pass
2DH5	78	2480	≥ 785.13	Pass
3DH5	00	2402	≥ 786.33	Pass
3DH5	39	2441	≥ 785.73	Pass
3DH5	78	2480	≥ 785.13	Pass

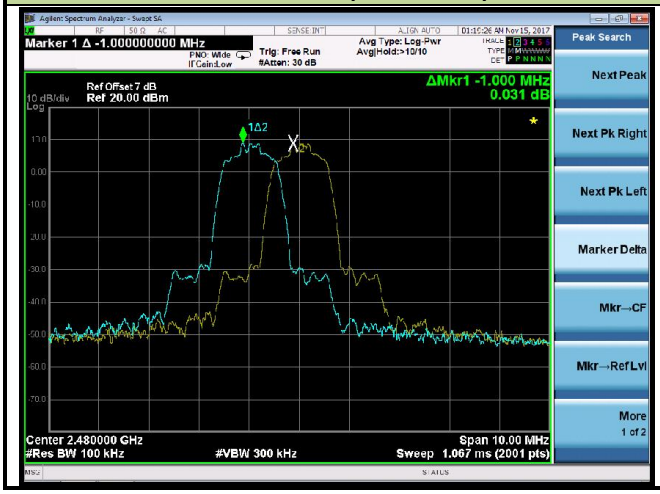
Note: The Limit is 2/3 the value of the 20dB BW.

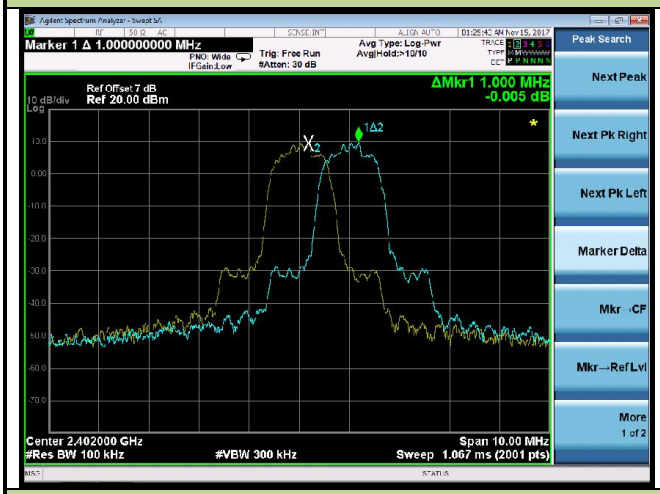
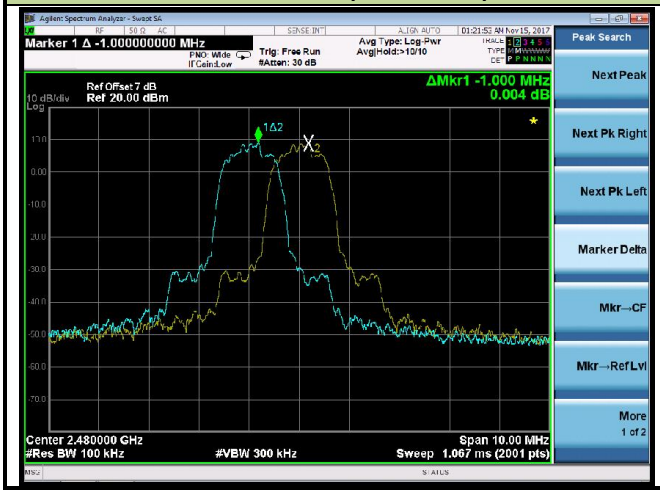
DH5 Carrier Frequency Separation

Channel 00 (2402MHz)

Channel 39 (2441MHz)

Channel 78 (2480MHz)

2DH5 Carrier Frequency Separation	
Channel 00 (2402MHz)	**Channel 39 (2441MHz)**
Channel 78 (2480MHz)	
	

3DH5 Carrier Frequency Separation	
Channel 00 (2402MHz)	**Channel 39 (2441MHz)**
	
Channel 78 (2480MHz)	
	

7.5. Number of Hopping Channels Measurement

7.5.1.Test Limit

This frequency hopping system must employ a minimum of 15 hopping channels.

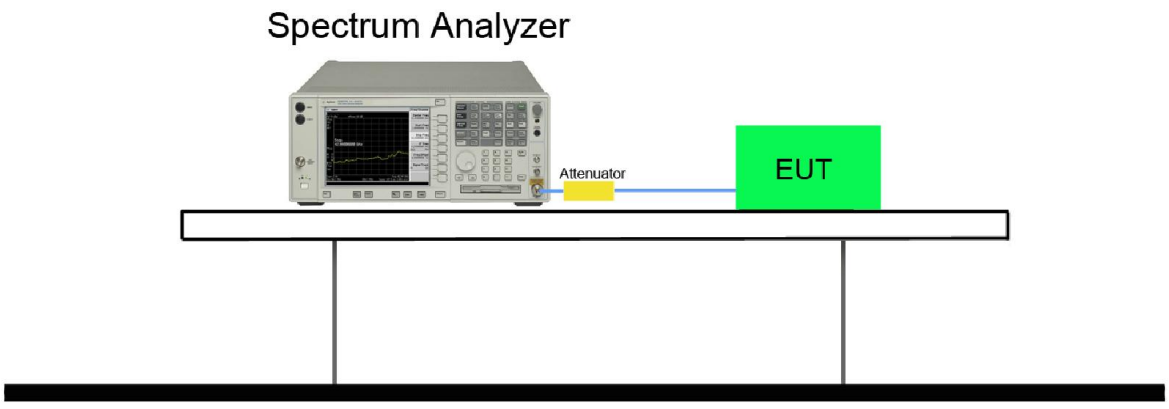
7.5.2.Test Procedure Used

ANSI C63.10-2013 - Section 7.8.3

7.5.3.Test Settitng

1. Span = the frequency band of operation.
2. RBW ≥ 1 % of the span
3. VBW ≥ RBW
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

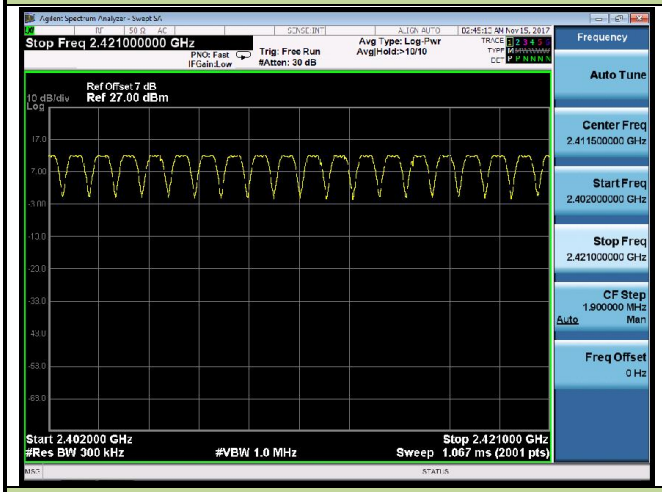


7.5.5.Test Result

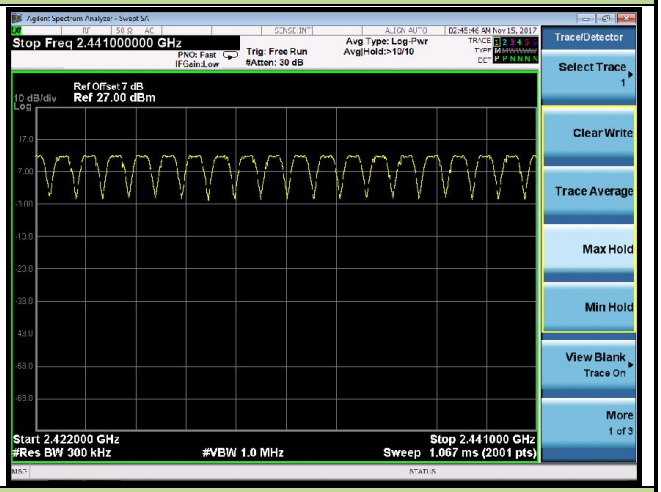
Test Mode (Hopping)	Channel Numbers	Frequency (MHz)	Limit (Hopping Channels)	Result
DH5	79	2402~2480	≥ 15	Pass
2DH5	79	2402~2480	≥ 15	Pass
3DH5	79	2402~2480	≥ 15	Pass

DH5 Number of Hopping Channels

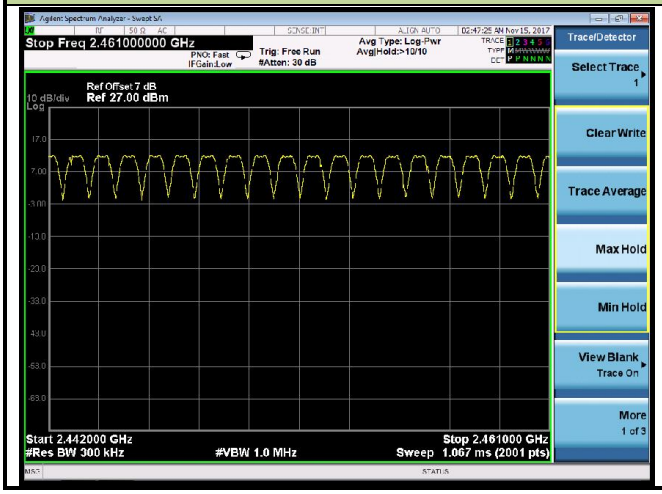
2402 ~ 2421MHz



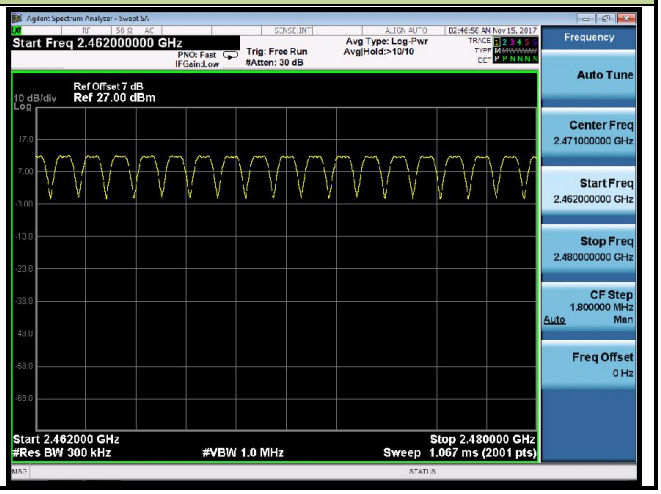
2422 ~ 2441MHz

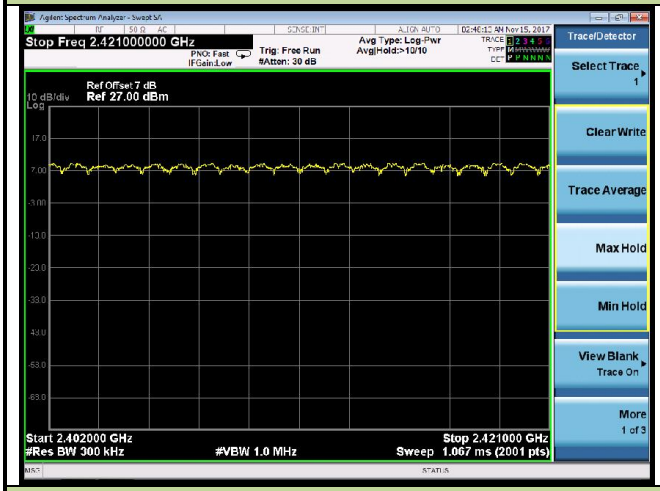
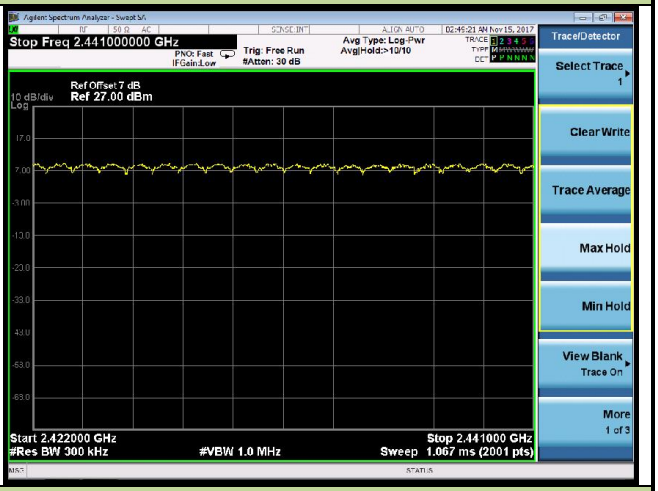
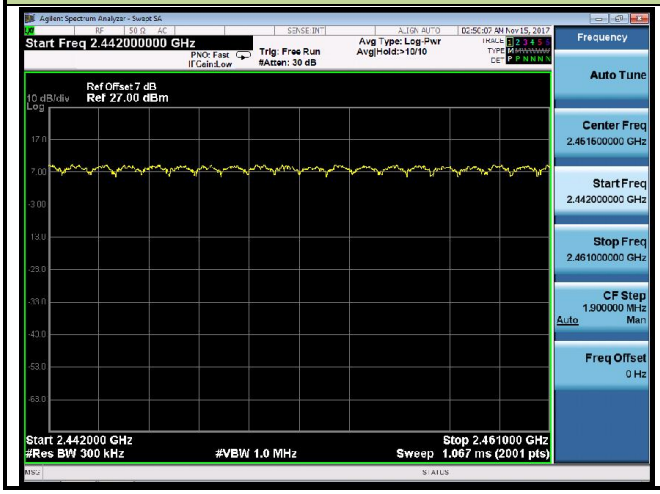
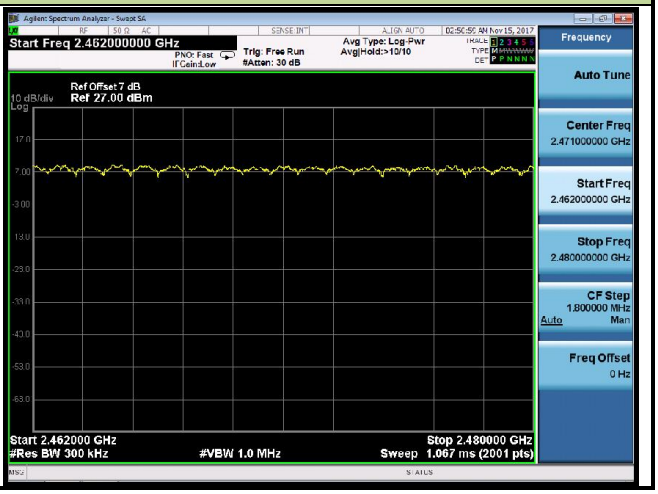


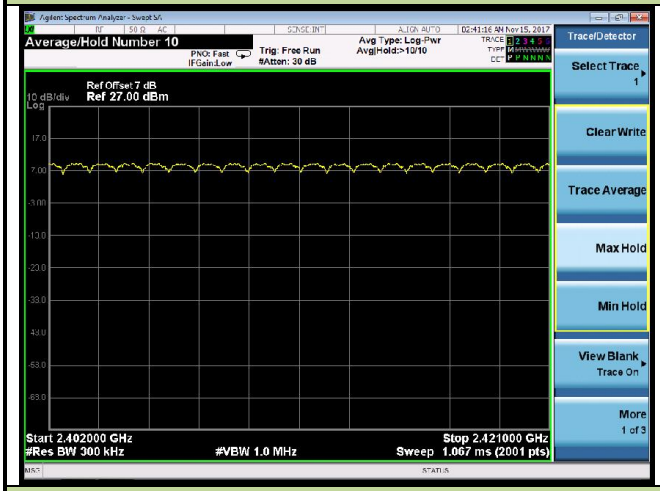
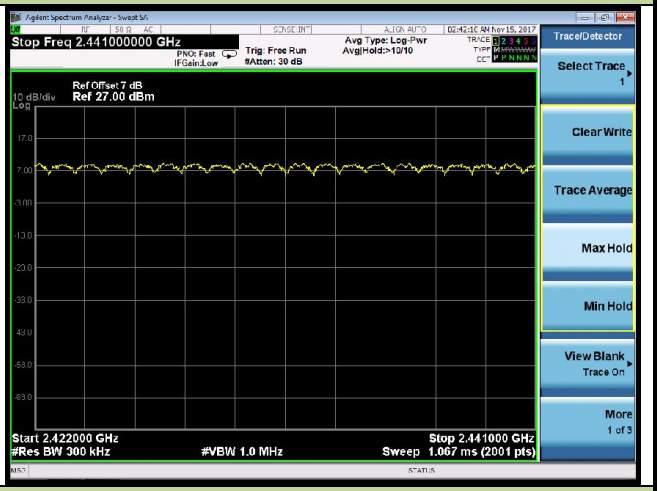
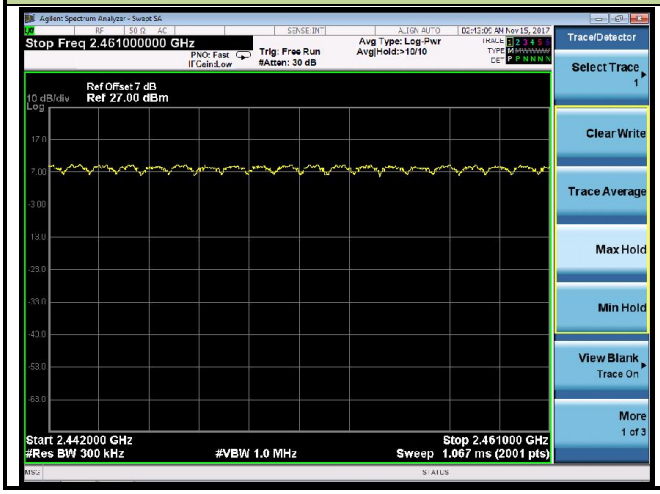
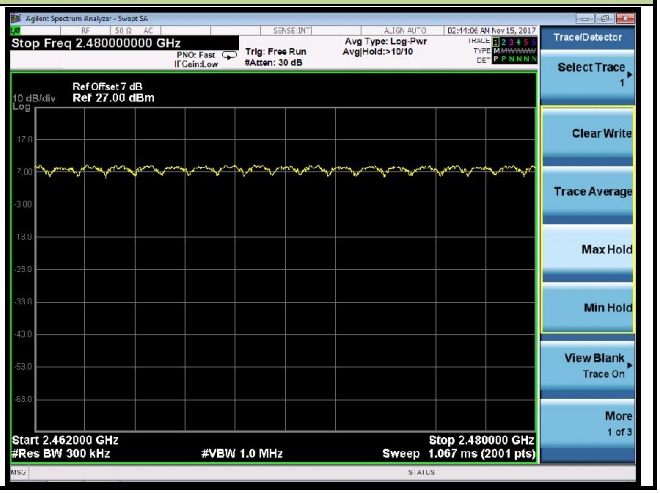
2442 ~ 2461MHz



2462 ~ 2480MHz



2DH5 Number of Hopping Channels	
2402 ~ 2421MHz	2422 ~ 2441MHz
	
2442 ~ 2461MHz	2462 ~ 2480MHz
	

3DH5 Number of Hopping Channels	
2402 ~ 2421MHz	**2422 ~ 2441MHz**
	
2442 ~ 2461MHz	**2462 ~ 2480MHz**
	

7.6. Time of Occupancy Measurement

7.6.1.Test Limit

The maximum permissible time of occupancy is 400ms within a period of 400ms multiplied by the number of hopping channels employed.

7.6.2.Test Procedure Used

ANSI C63.10-2013 - Section 7.8.4

7.6.3.Test Settitng

Span = zero span, centered on a hopping channel.

RBW = 1MHz

VBW ≥ RBW

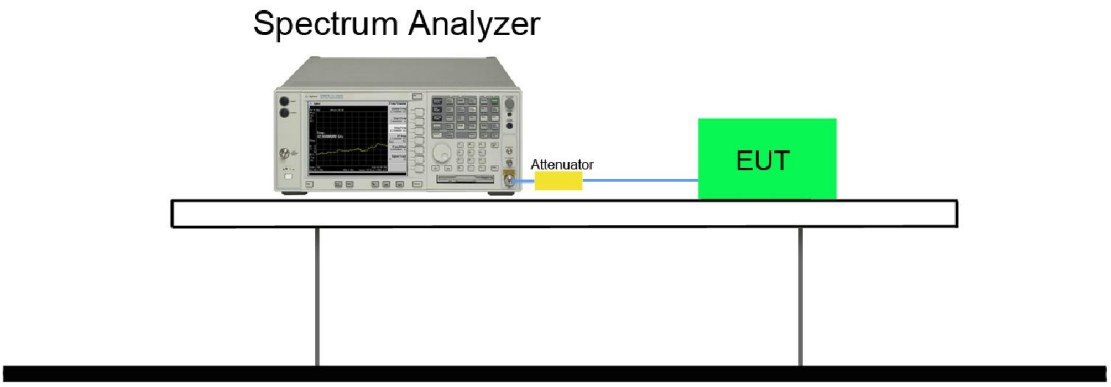
Sweep time = as necessary to capture the entire dwell time per hopping channel

Detector = Peak

Trace mode = max hold

If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (data rate, modulation format, etc.), repeat this test for each variation. An oscilloscope may be used instead of a spectrum analyzer. The EUT shall show compliance with the appropriate regulatory limit for the number of hopping channels. A plot of the data shall be included in the test report.

7.6.4.Test Setup

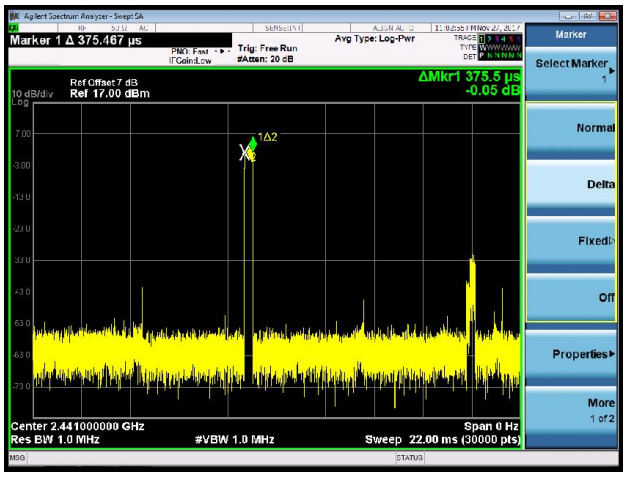


7.6.5.Test Result

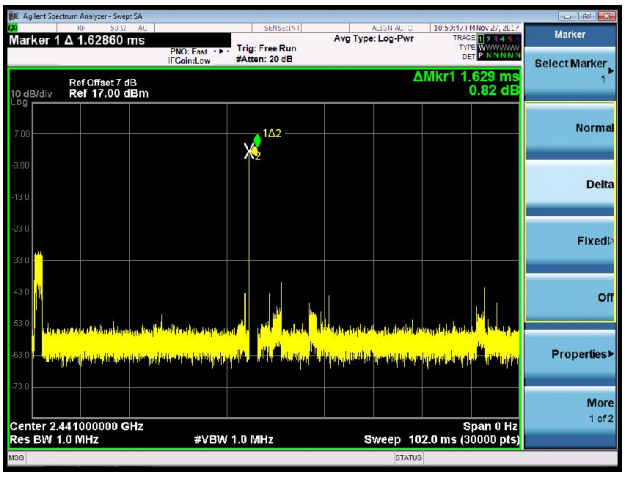
Test Mode	Channel No.	Frequency (MHz)	Hops Over Occupancy Time(Hops)	Packet Transfer Time (ms)	Time of Occupancy (ms)	Limit (ms)	Result
3DH1	39	2441	320	0.38	121.6	< 400	Pass
3DH3	39	2441	160	1.63	260.8	< 400	Pass
3DH5	39	2441	107	2.87	307.1	< 400	Pass

Packet Transfer Time

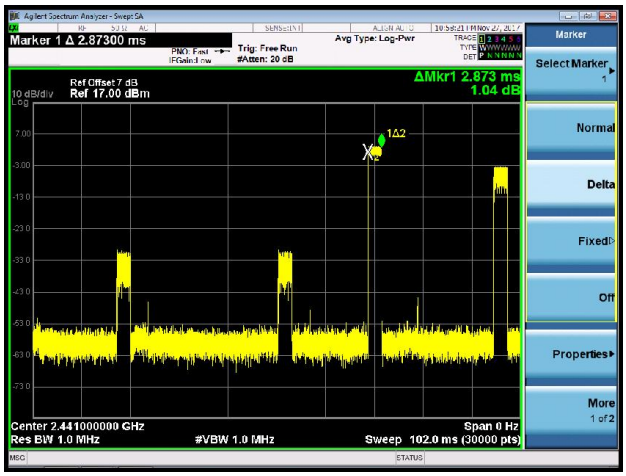
3DH1-Channel 39(2441MHz)



3DH3-Channel 39(2441MHz)



3DH5-Channel 39(2441MHz)



Note 1: According the Bluetooth Standard Specification, the nominal hop rate is 1600 hops/s. All Bluetooth unit participating in the piconet are time and hop synchronized to the channel.

Hops Over Occupancy Time in 31.6s for 3DH1 = 1600 / 2 / 79 * 31.6 = 320.

Hops Over Occupancy Time in 31.6s for 3DH3 = 1600 / 4 / 79 * 31.6 = 160.

Hops Over Occupancy Time in 31.6s for 3DH5 = 1600 / 6 / 79 * 31.6 = 107.

Note 2: Time of Occupancy = Packet Transfer Time * Hops Over Occupancy Time in 31.6s.

7.7. Band-edge Compliance Measurement

7.7.1.Test Limit

The maximum permissible emission level is 20dBc. Any emissions were lying outside of the emission bandwidth and in authorized band edges to a field strength limit specified in Section 15.209 of the Title 47 CFR.

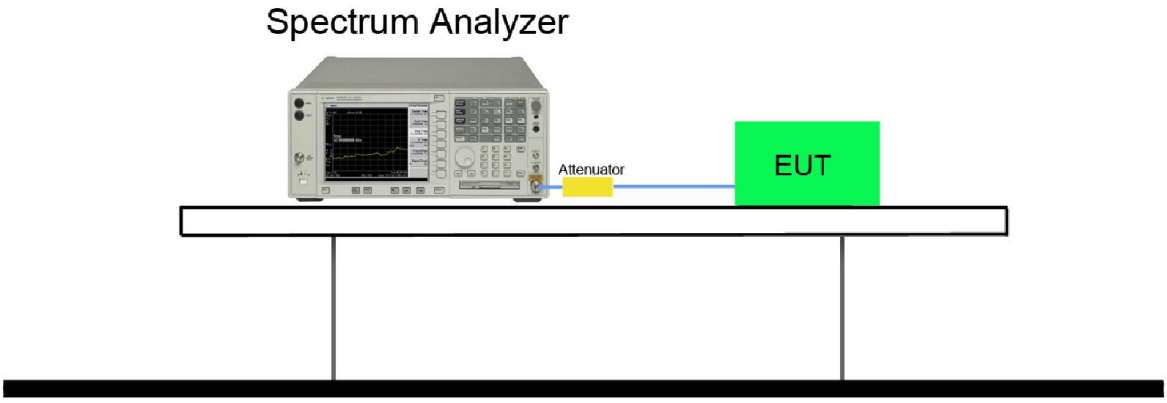
7.7.2.Test Procedure Used

ANSI C63.10-2013 - Section 6.10.4

7.7.3.Test Setting

1. Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
2. RBW ≥ 1% of spectrum analyzer display span
3. VBW ≥ RBW
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize
8. Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, than use the marker-to-peak function to move the marker to the peak of the in-band emission.

7.7.4.Test Setup

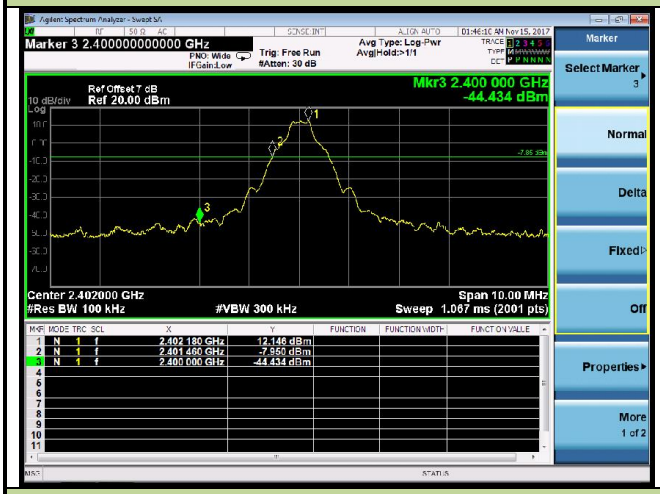


7.7.5.Test Result

Test Mode	Channel No.	Frequency (MHz)	Limit	Result
DH5	00	2402	20dBc	Pass
DH5	78	2480	20dBc	Pass
2DH5	00	2402	20dBc	Pass
2DH5	78	2480	20dBc	Pass
3DH5	00	2402	20dBc	Pass
3DH5	78	2480	20dBc	Pass

DH5 Band-edge Compliance

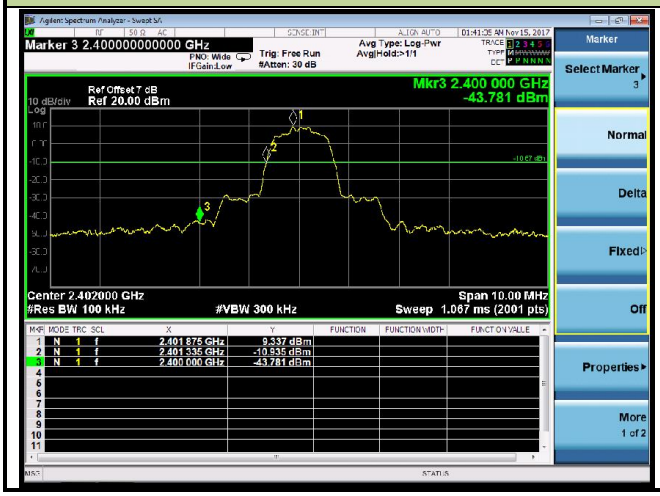
Channel 00 (2402MHz)



Channel 78 (2480MHz)

2DH5 Band-edge Compliance

Channel 00 (2402MHz)



Channel 78 (2480MHz)

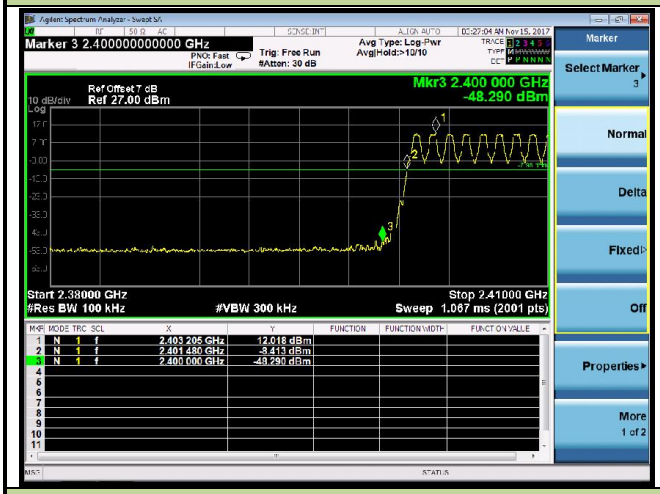
3DH5 Band-edge Compliance

Channel 00 (2402MHz)

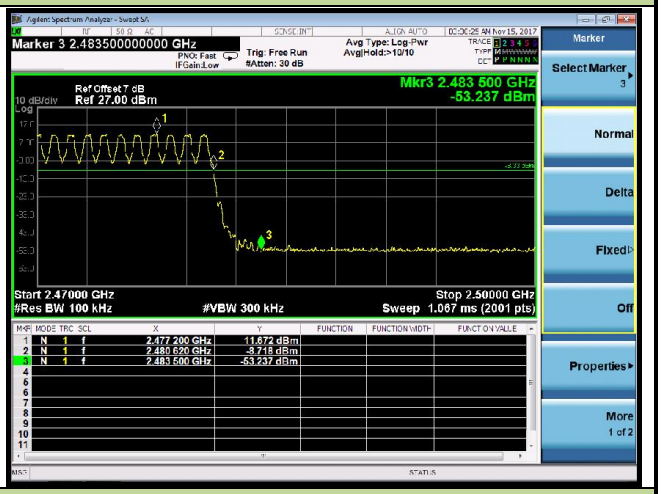
Channel 78 (2480MHz)

DH5 Operation Frequency Range of 20dB Bandwidth within Hopping Mode

Channel 00 (2402MHz)

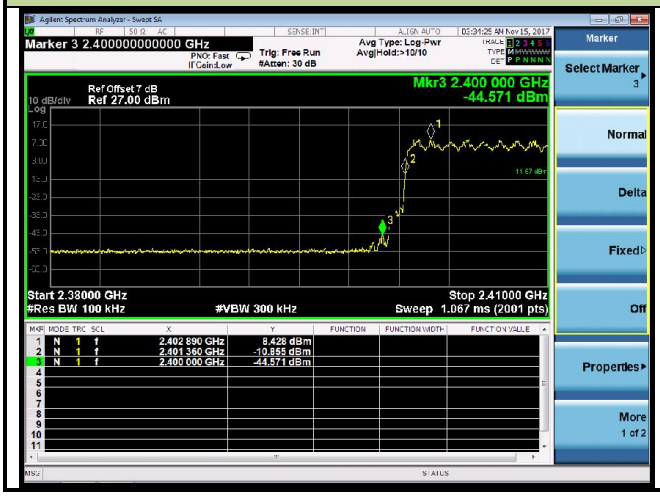


Channel 78 (2480MHz)

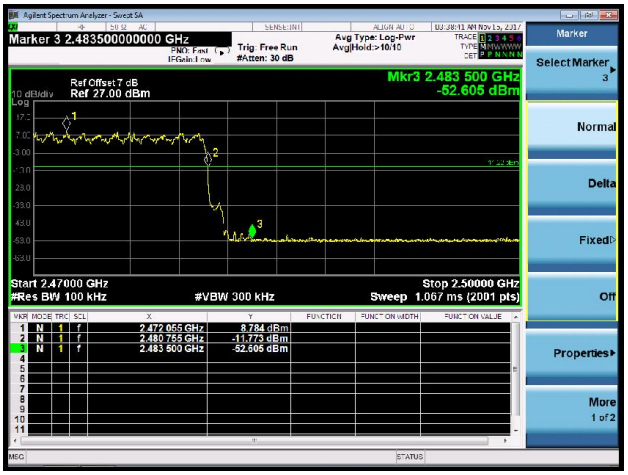


2DH5 Operation Frequency Range of 20dB Bandwidth within Hopping Mode

Channel 00 (2402MHz)



Channel 78 (2480MHz)

DH5 Operation Frequency Range of 20dB Bandwidth within Hopping Mode	
Channel 00 (2402MHz)	**Channel 78 (2480MHz)**
	

7.8. Conducted Spurious Emissions Measurement

7.8.1.Test Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

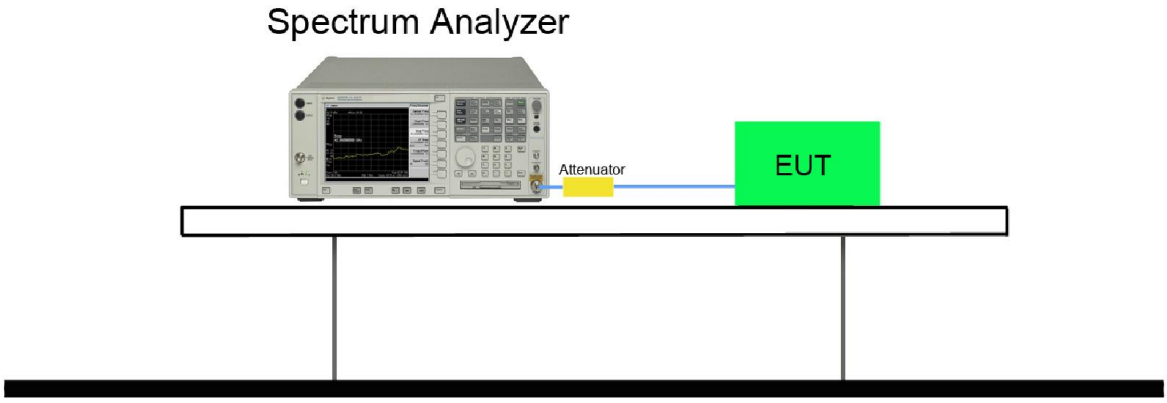
7.8.2.Test Procedure Used

ANSI C63.10-2013 - Section 7.8.8

7.8.3.Test Setting

1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
2. RBW = 100 KHz
3. VBW ≥ RBW
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize
8. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this section.

7.8.4.Test Setup



7.8.5.Test Result

Test Mode	Channel No.	Frequency (MHz)	Limit (MHz)	Result
DH5	00	2402	20dBc	Pass
DH5	39	2441	20dBc	Pass
DH5	78	2480	20dBc	Pass
2DH5	00	2402	20dBc	Pass
2DH5	39	2441	20dBc	Pass
2DH5	78	2480	20dBc	Pass
3DH5	00	2402	20dBc	Pass
3DH5	39	2441	20dBc	Pass
3DH5	78	2480	20dBc	Pass

DH5 Conducted Spurious Emissions

Channel 00 (2402MHz)

Channel 39 (2441MHz)

Channel 78 (2480MHz)

2DH5 Conducted Spurious Emissions

Channel 00 (2402MHz)

Channel 39 (2441MHz)

Channel 78 (2480MHz)

3DH5 Conducted Spurious Emissions	
Channel 00 (2402MHz)	**Channel 39 (2441MHz)**
Channel 78 (2480MHz)	

7.9. Radiated Spurious Emission Measurement

7.9.1.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

7.9.2.Test Procedure Used

ANSI C63.10-2013 - Section 11.12.1

7.9.3.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 = 3 * RBW
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

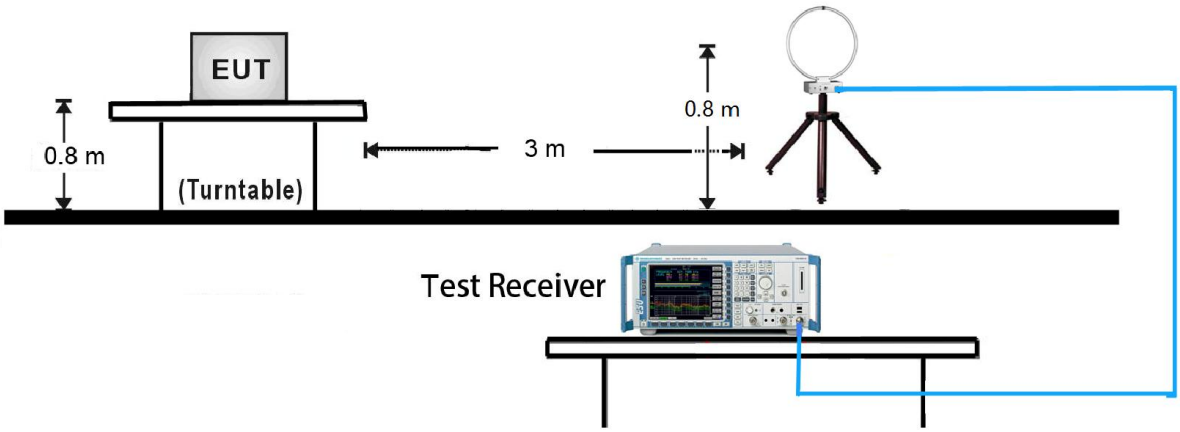
Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Average Field Strength Measurements

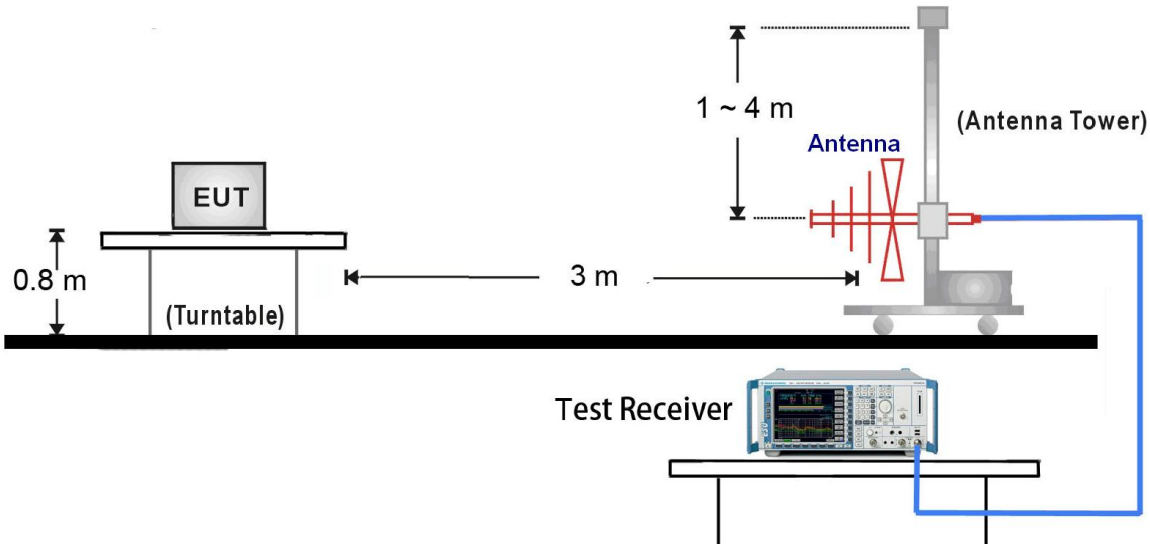
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW ≥ 1/T
4. De As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). 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
5. Detector = Peak
6. Sweep time = auto
7. Trace mode = max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

7.9.4.Test Setup

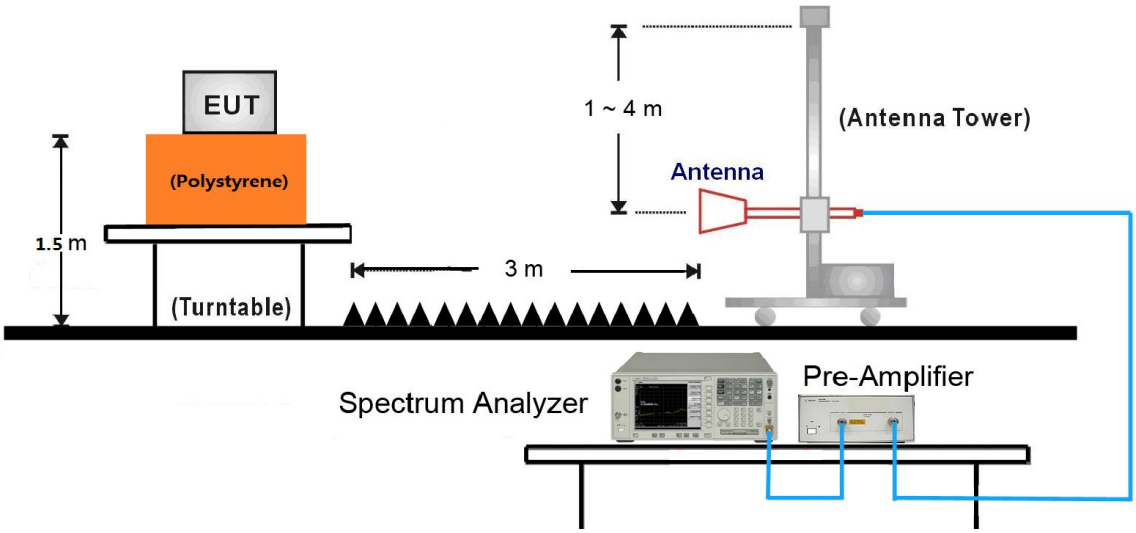
9kHz ~ 30MHz Test Setup:



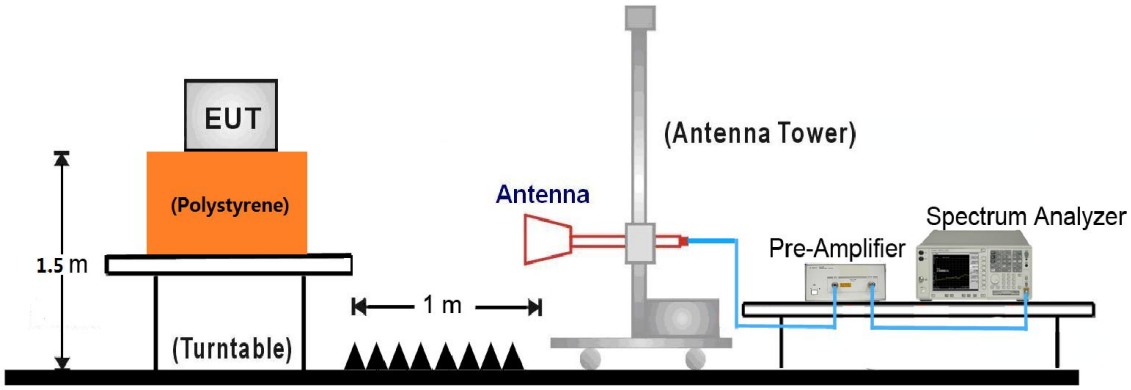
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



18GHz ~25GHz Test Setup:



7.9.5.Test Result

Test Mode:	DH5	Test Site:	AC1
Test Channel:	00	Test Engineer:	Will Yan
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
	7477.00	35.75	8.18	43.93	74	-30.07	Peak	Horizontal
	8199.50	35.24	8.31	43.55	74	-30.45	Peak	Horizontal
*	9780.50	33.31	11.44	44.75	85.1	-40.35	Peak	Horizontal
*	15076.00	33.70	14.29	47.99	85.1	-37.11	Peak	Horizontal
	7570.50	34.77	8.22	42.99	74	-31.01	Peak	Vertical
	8437.50	35.64	8.16	43.80	74	-30.20	Peak	Vertical
*	9857.00	33.37	11.59	44.96	85.1	-40.14	Peak	Vertical
*	14880.50	34.76	15.03	49.79	85.1	-35.31	Peak	Vertical

Note 1: “*” is not in restricted band, its limit is 20dBc of the fundamental emission level (105.1dBμV/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)

Test Mode:	DH5	Test Site:	AC1
Test channel:	39	Test Engineer:	Will Yan
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
	7468.50	34.67	8.14	42.81	74	-31.19	Peak	Horizontal
	8267.50	33.91	8.13	42.04	74	-31.96	Peak	Horizontal
*	9678.50	32.88	10.90	43.78	85.1	-41.32	Peak	Horizontal
*	15212.00	32.47	13.57	46.04	85.1	-39.06	Peak	Horizontal
	7579.00	34.45	8.21	42.66	74	-31.34	Peak	Vertical
	8352.50	34.31	8.03	42.34	74	-31.66	Peak	Vertical
*	9712.50	33.81	11.01	44.82	85.1	-40.28	Peak	Vertical
*	15016.50	31.69	14.62	46.31	85.1	-38.79	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (105.1dBμV/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)

Test Mode:	DH5	Test Site:	AC1
Test channel:	78	Test Engineer:	Will Yan
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
	7443.00	39.34	7.99	47.33	74	-26.67	Peak	Horizontal
	8310.00	33.94	8.01	41.95	74	-32.05	Peak	Horizontal
*	9772.00	34.38	11.44	45.82	85.1	-39.28	Peak	Horizontal
*	14804.00	33.02	15.28	48.30	85.1	-36.80	Peak	Horizontal
	7519.50	33.64	8.30	41.94	74	-32.06	Peak	Vertical
	8386.50	33.43	8.06	41.49	74	-32.51	Peak	Vertical
*	9687.00	32.59	10.90	43.49	85.1	-41.61	Peak	Vertical
*	15110.00	33.16	14.31	47.47	85.1	-37.63	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (105.1dBμV/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)

Test Mode:	2DH5	Test Site:	AC1
Test channel:	00	Test Engineer:	Will Yan
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
	7443.00	38.77	7.99	46.76	74	-27.24	Peak	Horizontal
	8267.50	34.69	8.13	42.82	74	-31.18	Peak	Horizontal
*	9670.00	32.92	10.91	43.83	83.9	-40.07	Peak	Horizontal
*	15050.50	33.70	14.52	48.22	83.9	-35.68	Peak	Horizontal
	7621.50	35.27	8.05	43.32	74	-30.68	Peak	Vertical
	8250.50	35.15	8.13	43.28	74	-30.72	Peak	Vertical
*	9636.00	33.47	10.96	44.43	83.9	-39.47	Peak	Vertical
*	14957.00	33.62	14.76	48.38	83.9	-35.52	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (103.9dBμV/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)

Test Mode:	2DH5	Test Site:	AC1
Test channel:	39	Test Engineer:	Will Yan
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
	7324.00	35.73	8.04	43.77	74	-30.23	Peak	Horizontal
	8318.50	35.52	8.02	43.54	74	-30.46	Peak	Horizontal
*	9823.00	32.88	11.63	44.51	83.7	-39.19	Peak	Horizontal
*	14974.00	32.92	14.75	47.67	83.7	-36.03	Peak	Horizontal
	7604.50	33.53	8.09	41.62	74	-32.38	Peak	Vertical
	8335.50	34.21	8.04	42.25	74	-31.75	Peak	Vertical
*	9721.00	32.10	11.07	43.17	83.7	-40.53	Peak	Vertical
*	15025.00	31.75	14.58	46.33	83.7	-37.37	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (103.7dBμV/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)

Test Mode:	2DH5	Test Site:	AC1
Test channel:	78	Test Engineer:	Will Yan
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
	7536.50	34.12	8.30	42.42	74	-31.58	Peak	Horizontal
	8352.50	34.20	8.03	42.23	74	-31.77	Peak	Horizontal
*	9687.00	33.88	10.90	44.78	83.5	-38.72	Peak	Horizontal
*	15016.50	33.44	14.62	48.06	83.5	-35.44	Peak	Horizontal
	7511.00	35.02	8.29	43.31	74	-30.69	Peak	Vertical
	8276.00	35.34	8.12	43.46	74	-30.54	Peak	Vertical
*	9806.00	34.03	11.52	45.55	83.5	-37.95	Peak	Vertical
*	14948.50	34.51	14.82	49.33	83.5	-34.17	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (103.5dBμV/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)

Test Mode:	3DH5	Test Site:	AC1
Test channel:	00	Test Engineer:	Will Yan
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
	7638.50	34.97	8.04	43.01	74	-30.99	Peak	Horizontal
	8352.50	35.24	8.03	43.27	74	-30.73	Peak	Horizontal
*	9755.00	32.00	11.39	43.39	83.5	-40.11	Peak	Horizontal
*	14906.00	32.62	14.93	47.55	83.5	-35.95	Peak	Horizontal
	7519.50	33.95	8.30	42.25	74	-31.75	Peak	Vertical
	8174.00	33.74	8.36	42.10	74	-31.90	Peak	Vertical
*	9678.50	34.27	10.90	45.17	83.5	-38.33	Peak	Vertical
*	15016.50	32.84	14.62	47.46	83.5	-36.04	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (103.5dBμV/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)

Test Mode:	3DH5	Test Site:	AC1
Test channel:	39	Test Engineer:	Will Yan
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
	7621.50	35.10	8.05	43.15	74	-30.85	Peak	Horizontal
	8267.50	34.53	8.13	42.66	74	-31.34	Peak	Horizontal
*	9789.00	33.34	11.44	44.78	83.4	-38.62	Peak	Horizontal
*	14889.00	32.60	15.00	47.60	83.4	-35.80	Peak	Horizontal
	7800.00	35.93	8.37	44.30	74	-29.70	Peak	Vertical
	8242.00	32.45	8.13	40.58	74	-33.42	Peak	Vertical
*	9729.50	31.24	11.14	42.38	83.4	-41.02	Peak	Vertical
*	15203.50	31.70	13.62	45.32	83.4	-38.08	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 20dBc of the fundamental emission level (103.4dBμV/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)

Test Mode:	3DH5	Test Site:	AC1
Test channel:	78	Test Engineer:	Will Yan
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
	7596.00	34.58	8.11	42.69	74	-31.31	Peak	Horizontal
	8208.00	33.94	8.31	42.25	74	-31.75	Peak	Horizontal
*	9772.00	33.04	11.44	44.48	83.8	-39.32	Peak	Horizontal
*	15076.00	32.94	14.29	47.23	83.8	-36.57	Peak	Horizontal
	7570.50	34.38	8.22	42.60	74	-31.40	Peak	Vertical
	8259.00	34.60	8.14	42.74	74	-31.26	Peak	Vertical
*	9738.00	33.35	11.21	44.56	83.8	-39.24	Peak	Vertical
*	15203.50	32.76	13.62	46.38	83.8	-37.42	Peak	Vertical

Note 1: “*” is not in restricted band, its limit is 20dBc of the fundamental emission level (103.8dBμV/m) or 15.209 which is higher.

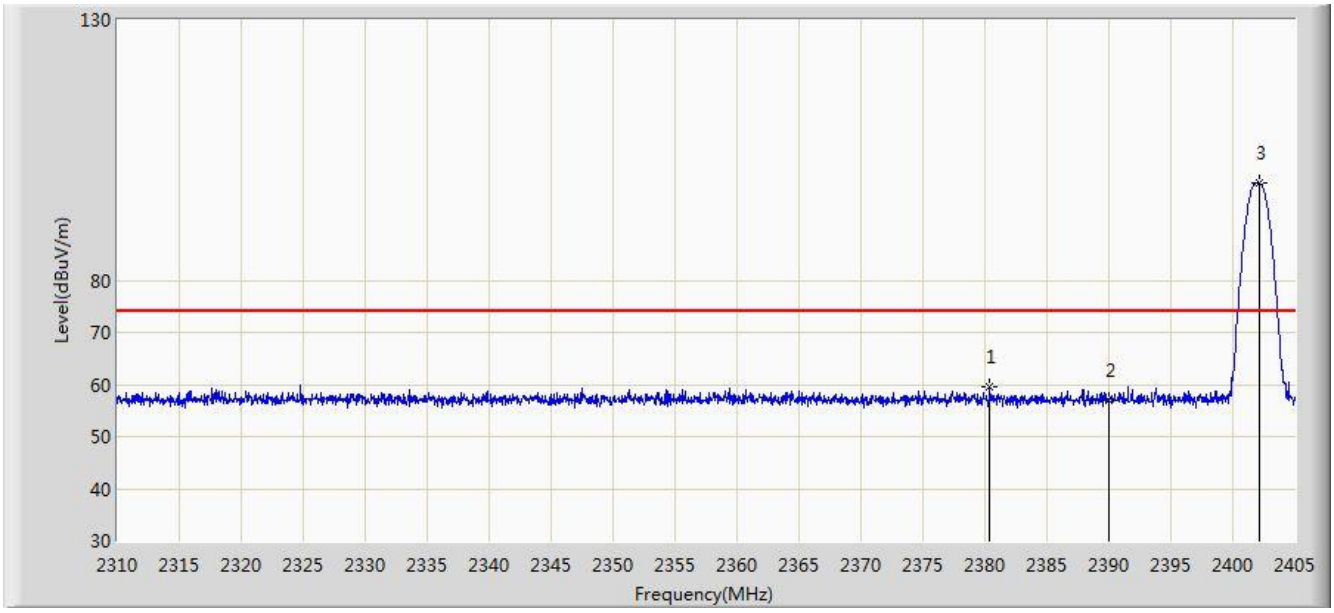
Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

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

7.10. Radiated Restricted Band Edge Measurement

7.10.1. Test Result

Site: AC1	Time: 2017/11/09 - 19:13
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by DH5 at channel 2402MHz	

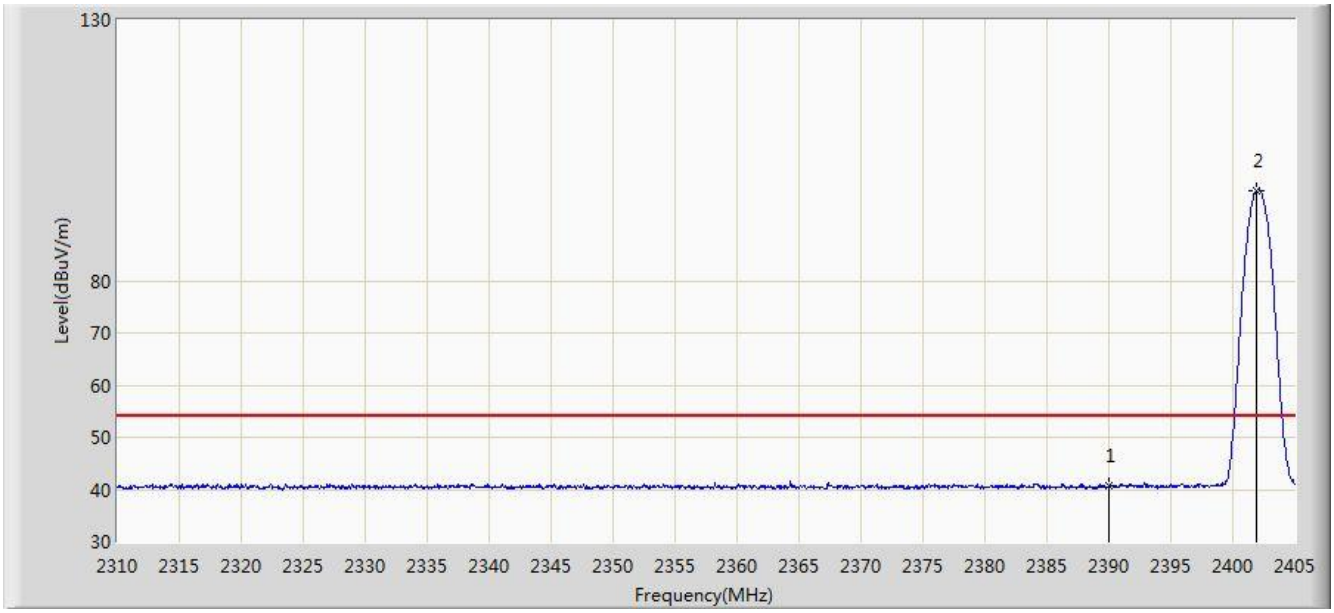


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2380.395	59.457	28.237	-14.543	74.000	31.221	PK
2			2390.000	57.079	25.876	-16.921	74.000	31.203	PK
3			2402.150	98.616	67.432	N/A	N/A	31.184	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:18
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by DH5 at channel 2402MHz	

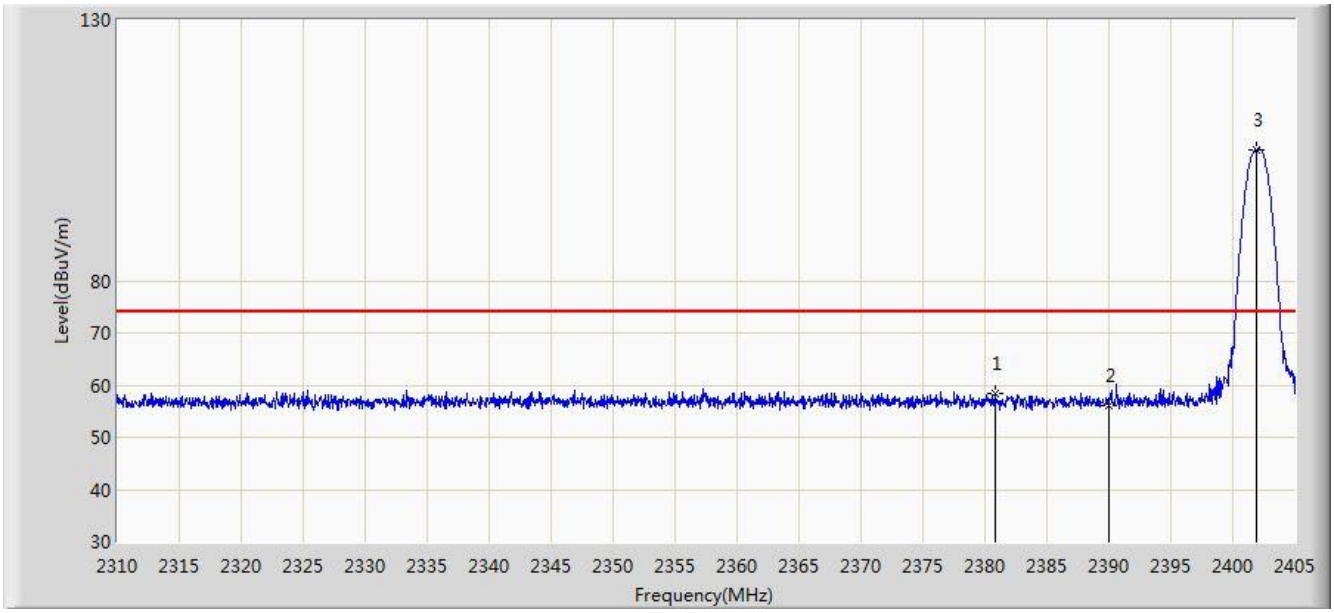


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	40.595	9.392	-13.405	54.000	31.203	AV
2			2401.913	97.281	66.097	N/A	N/A	31.184	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:25
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by DH5 at channel 2402MHz	

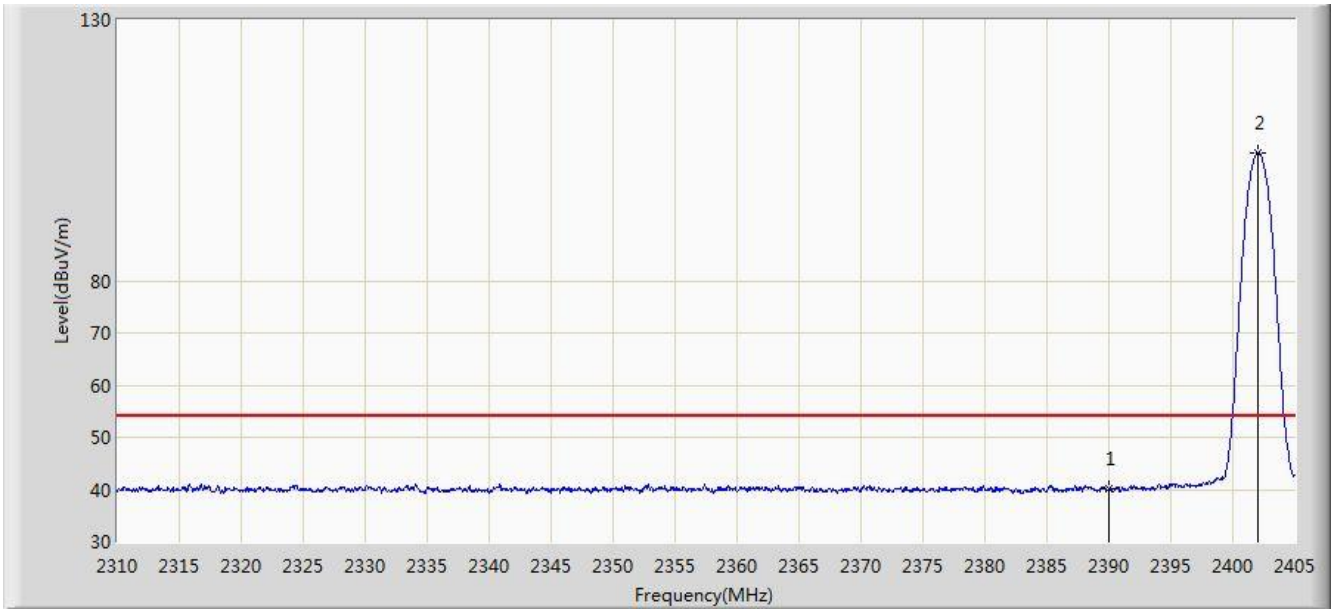


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2380.775	58.335	27.115	-15.665	74.000	31.220	PK
2			2390.000	56.188	24.985	-17.812	74.000	31.203	PK
3			2401.865	105.182	73.998	N/A	N/A	31.184	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:26
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by DH5 at channel 2402MHz	

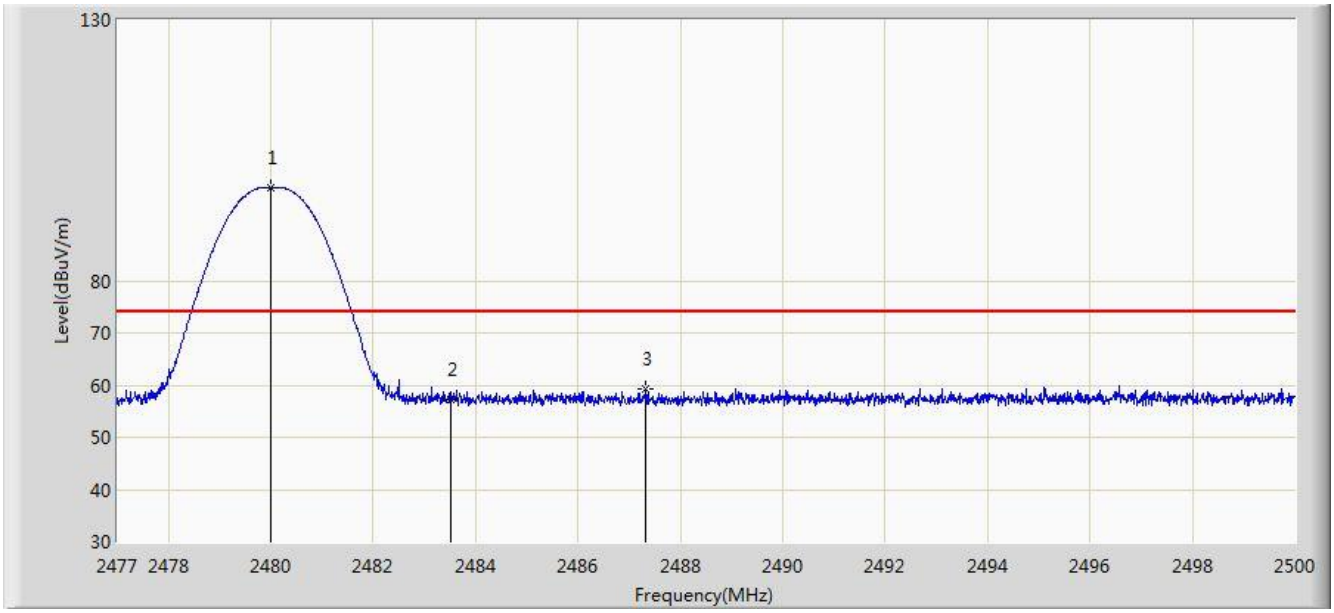


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	40.108	8.905	-13.892	54.000	31.203	AV
2			2402.008	104.423	73.239	N/A	N/A	31.184	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:27
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by DH5 at channel 2480MHz	

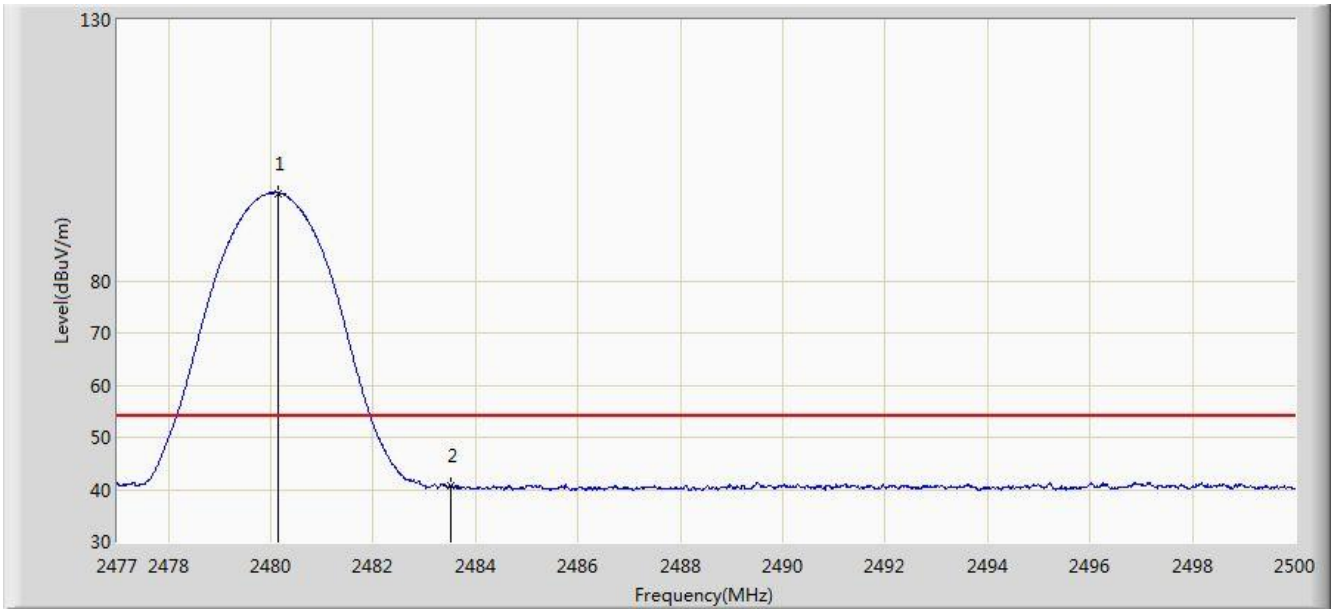


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2479.990	97.794	66.610	N/A	N/A	31.184	PK
2			2483.500	57.329	26.136	-16.671	74.000	31.194	PK
3			2487.327	59.331	28.128	-14.669	74.000	31.204	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:30
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by DH5 at channel 2480MHz	

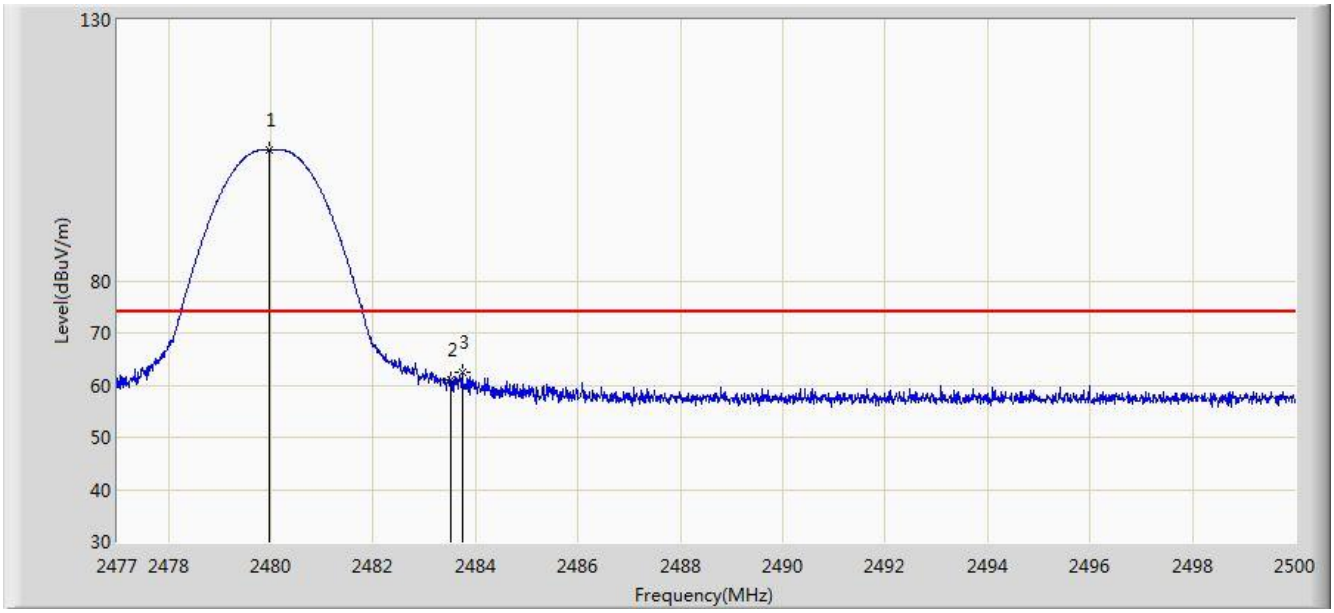


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2480.139	96.808	65.624	N/A	N/A	31.185	AV
2			2483.500	40.622	9.429	-13.378	54.000	31.194	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:30
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by DH5 at channel 2480MHz	

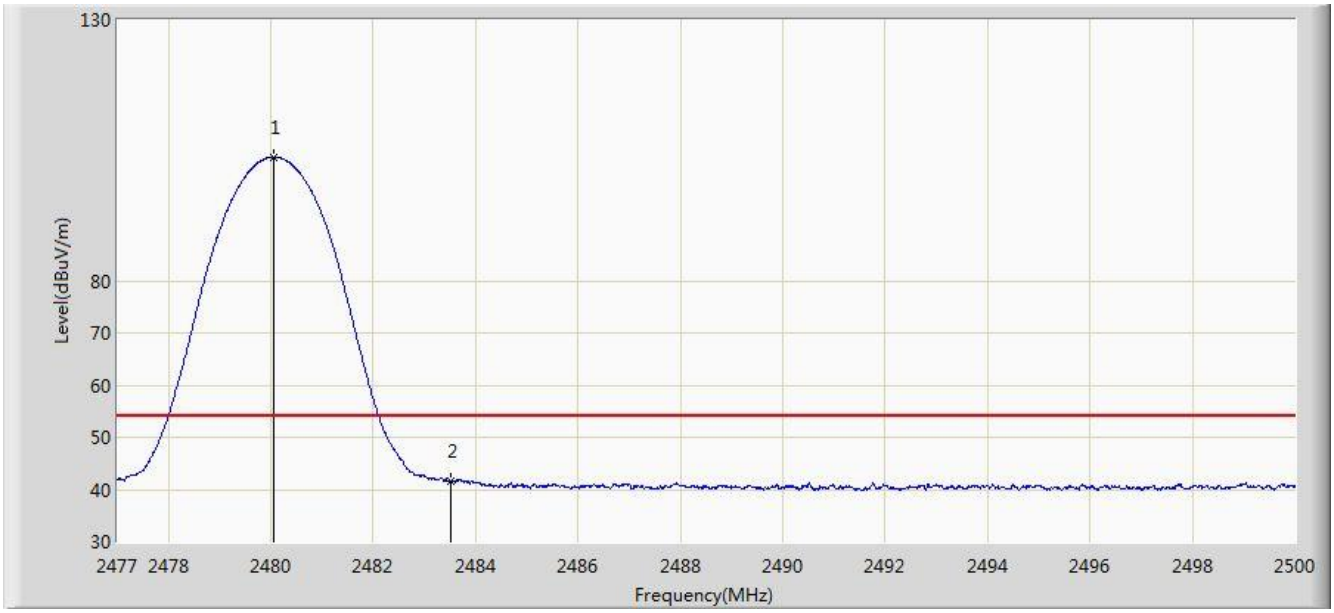


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2479.956	105.081	73.897	N/A	N/A	31.184	PK
2			2483.500	60.928	29.735	-13.072	74.000	31.194	PK
3			2483.739	62.319	31.125	-11.681	74.000	31.194	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:32
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by DH5 at channel 2480MHz	

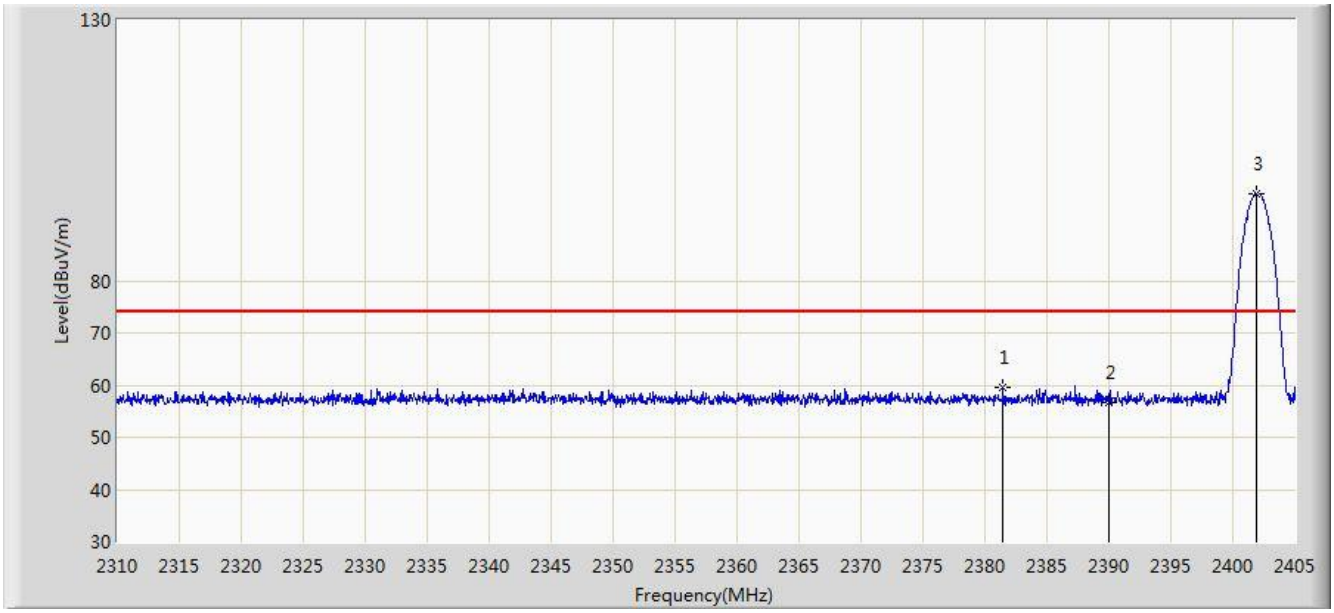


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2480.059	103.717	72.533	N/A	N/A	31.184	AV
2			2483.500	41.682	10.489	-12.318	54.000	31.194	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:33
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 2DH5 at channel 2402MHz	

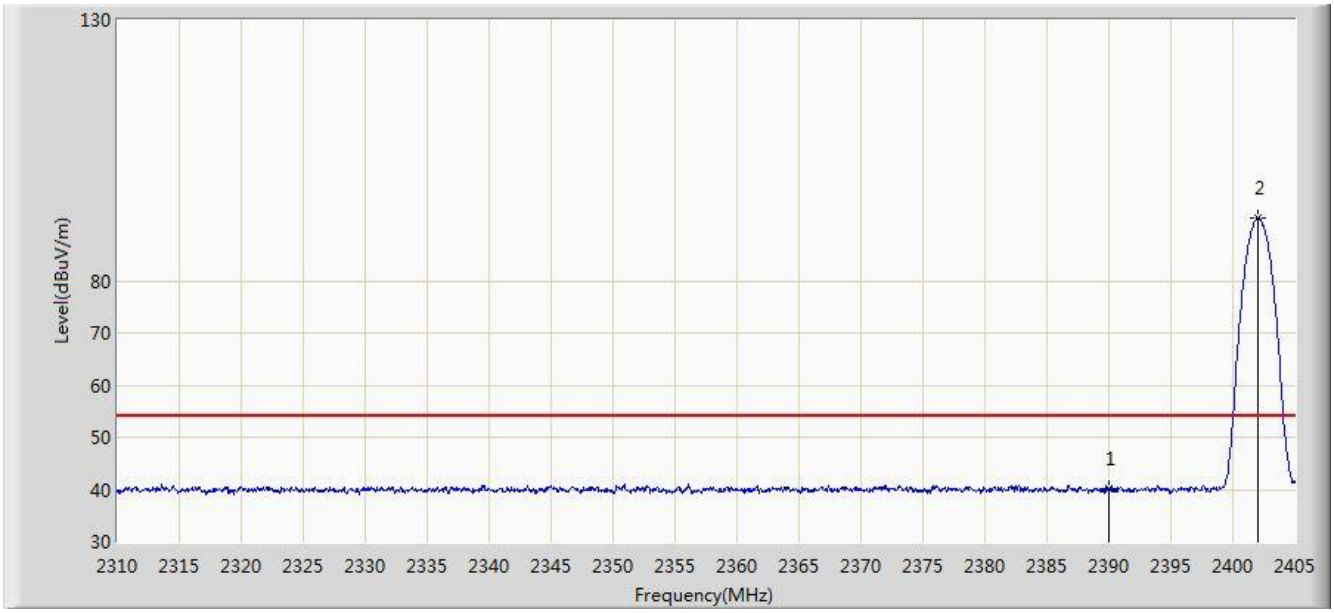


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2381.488	59.636	28.418	-14.364	74.000	31.218	PK
2			2390.000	56.668	25.465	-17.332	74.000	31.203	PK
3			2401.865	96.735	65.551	N/A	N/A	31.184	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:35
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 2DH5 at channel 2402MHz	

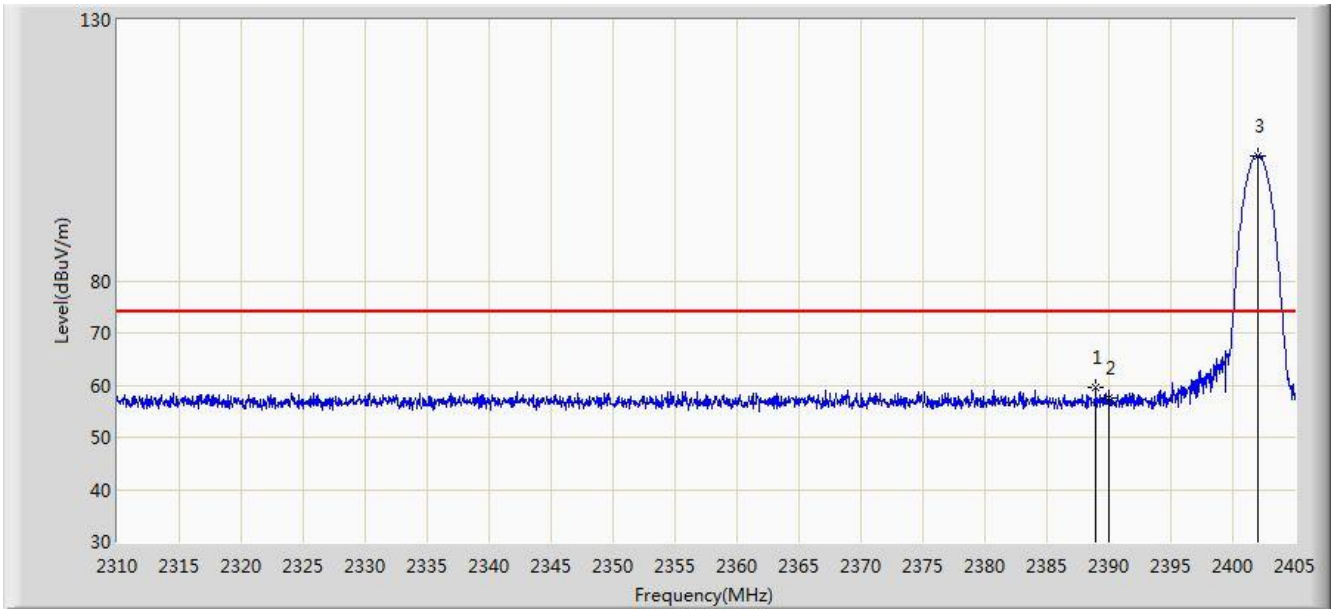


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	40.108	8.905	-13.892	54.000	31.203	AV
2			2402.008	92.008	60.824	N/A	N/A	31.184	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:36
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 2DH5 at channel 2402MHz	

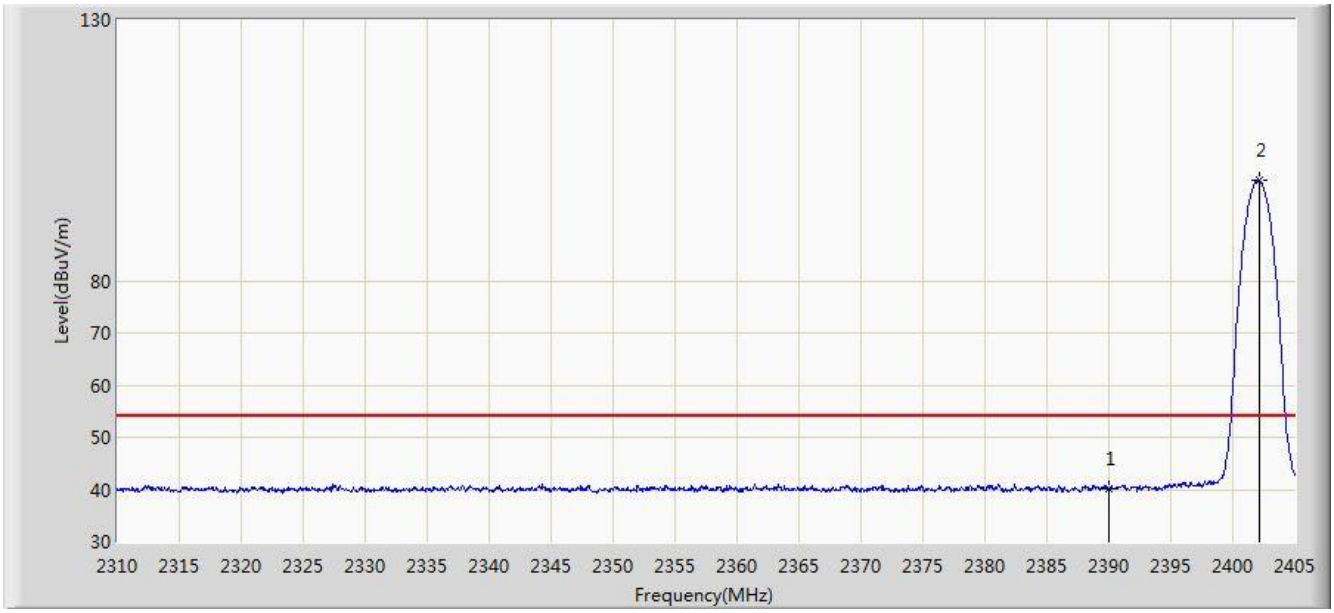


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2388.945	59.481	28.276	-14.519	74.000	31.205	PK
2			2390.000	57.618	26.415	-16.382	74.000	31.203	PK
3			2402.055	103.902	72.718	N/A	N/A	31.184	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:37
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 2DH5 at channel 2402MHz	

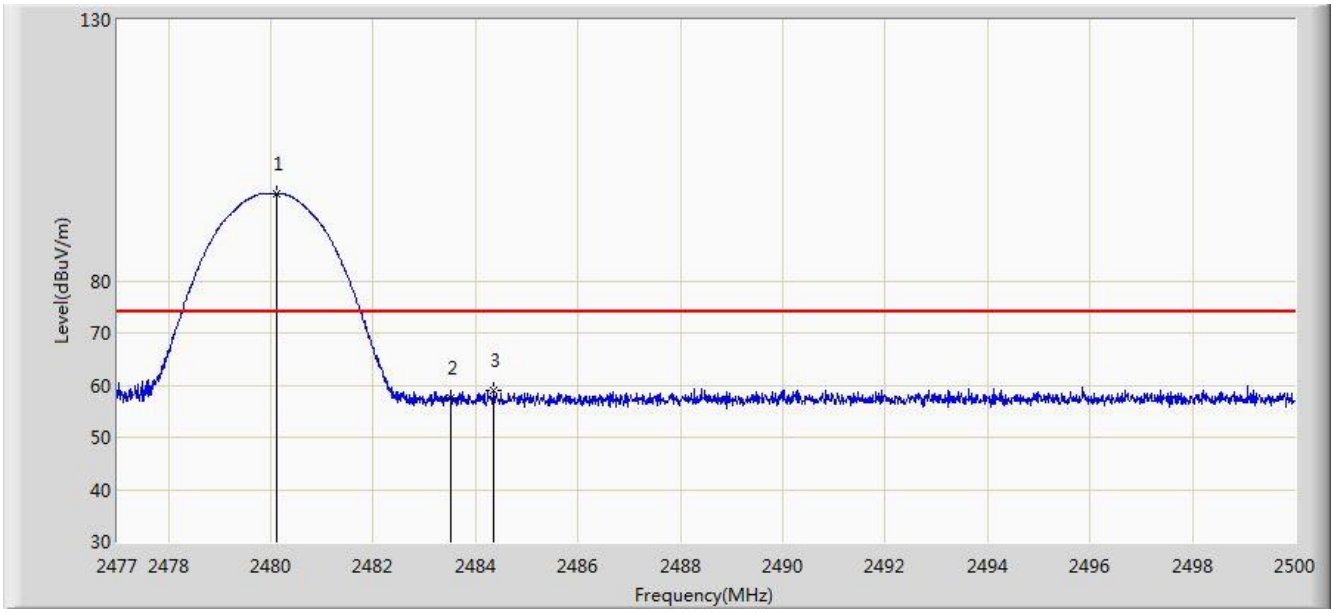


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	40.233	9.030	-13.767	54.000	31.203	AV
2			2402.150	99.299	68.115	N/A	N/A	31.184	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:38
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 2DH5 at channel 2480MHz	

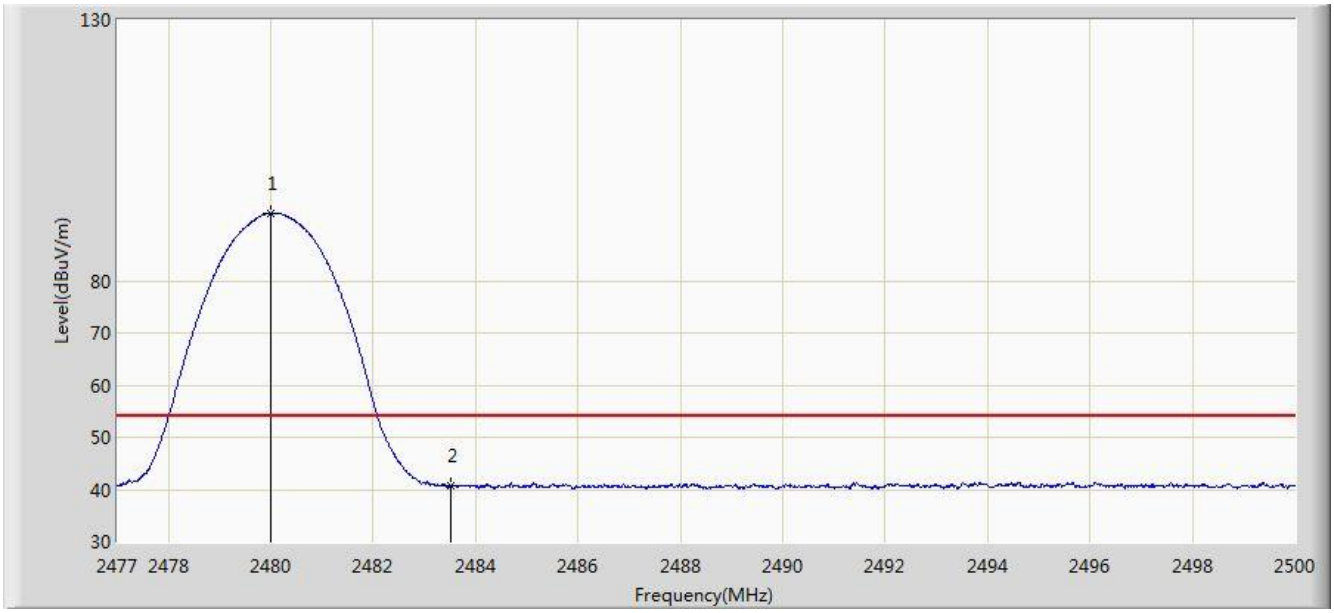


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2480.105	96.710	65.526	N/A	N/A	31.184	PK
2			2483.500	57.518	26.325	-16.482	74.000	31.194	PK
3			2484.337	58.903	27.707	-15.097	74.000	31.195	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:40
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 2DH5 at channel 2480MHz	

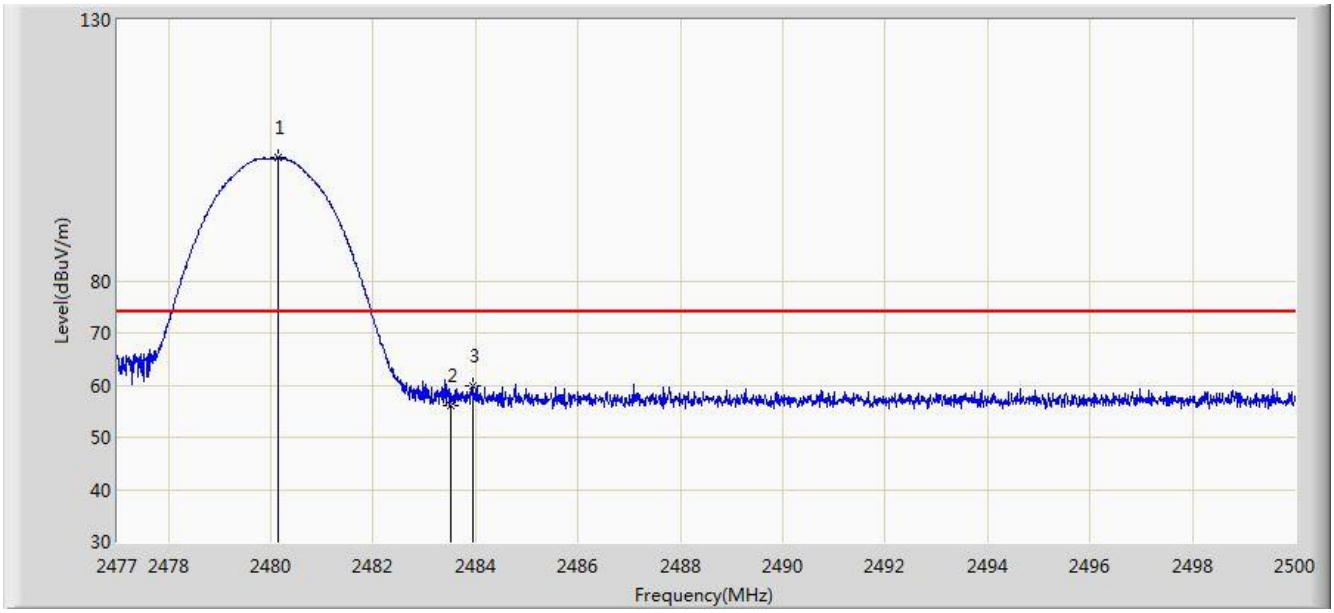


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2479.990	93.002	61.818	N/A	N/A	31.184	AV
2			2483.500	40.582	9.389	-13.418	54.000	31.194	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:41
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 2DH5 at channel 2480MHz	

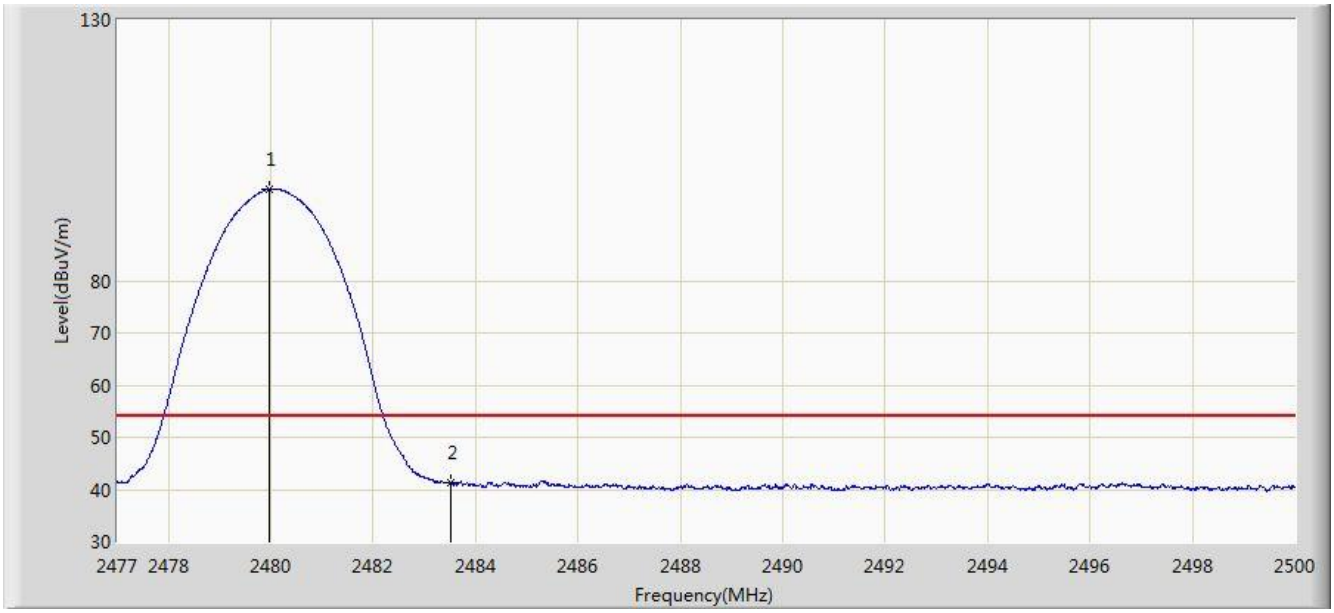


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2480.139	103.492	72.308	N/A	N/A	31.185	PK
2			2483.500	56.139	24.946	-17.861	74.000	31.194	PK
3			2483.958	59.988	28.793	-14.012	74.000	31.194	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:42
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 2DH5 at channel 2480MHz	

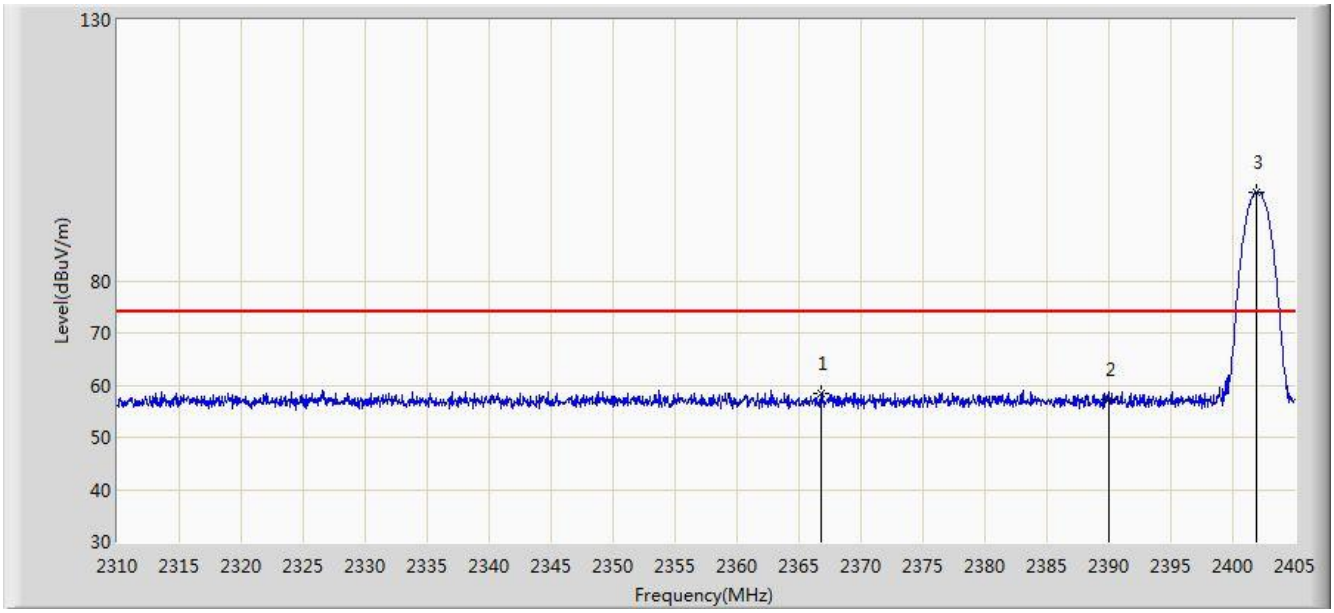


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2479.956	97.567	66.383	N/A	N/A	31.184	AV
2			2483.500	41.337	10.144	-12.663	54.000	31.194	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:43
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 3DH5 at channel 2402MHz	

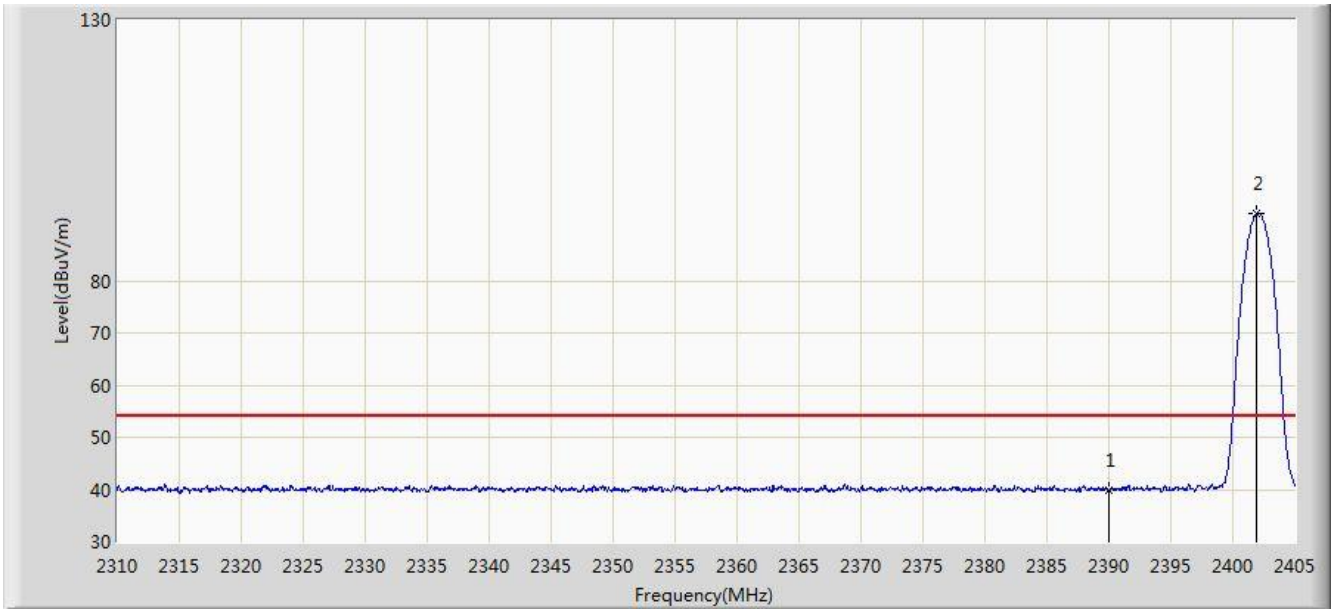


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2366.762	58.332	27.086	-15.668	74.000	31.246	PK
2			2390.000	57.296	26.093	-16.704	74.000	31.203	PK
3			2401.913	96.930	65.746	N/A	N/A	31.184	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:44
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 3DH5 at channel 2402MHz	

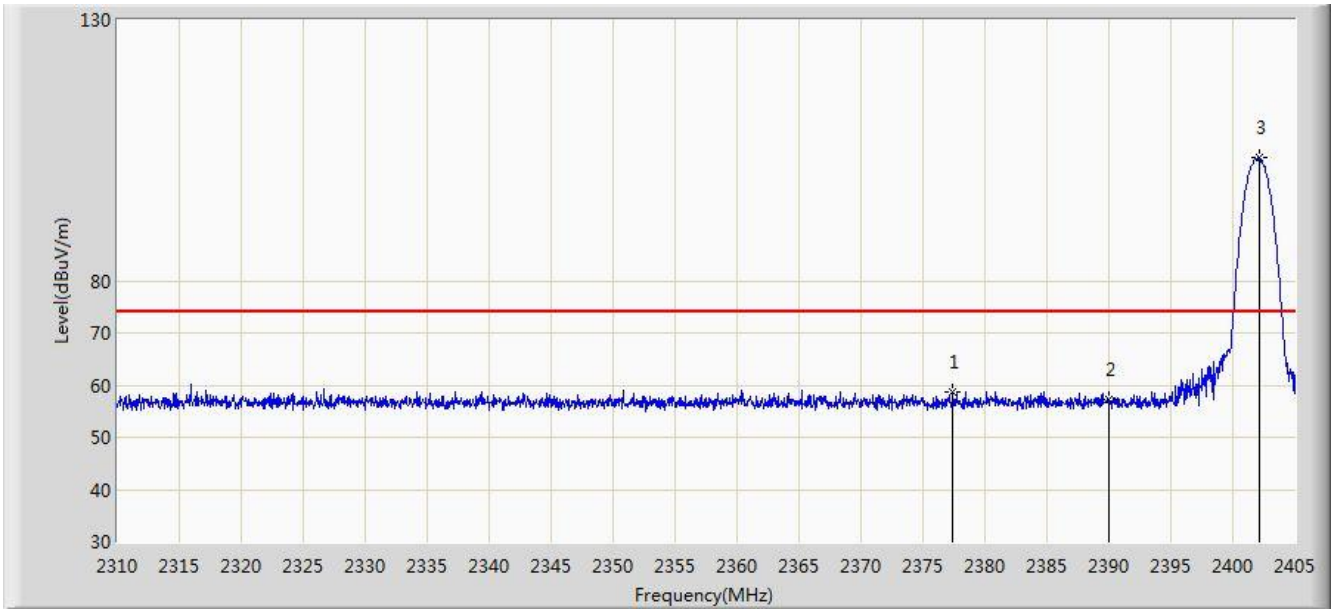


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	39.822	8.619	-14.178	54.000	31.203	AV
2			2401.960	92.924	61.740	N/A	N/A	31.184	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:45
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 3DH5 at channel 2402MHz	

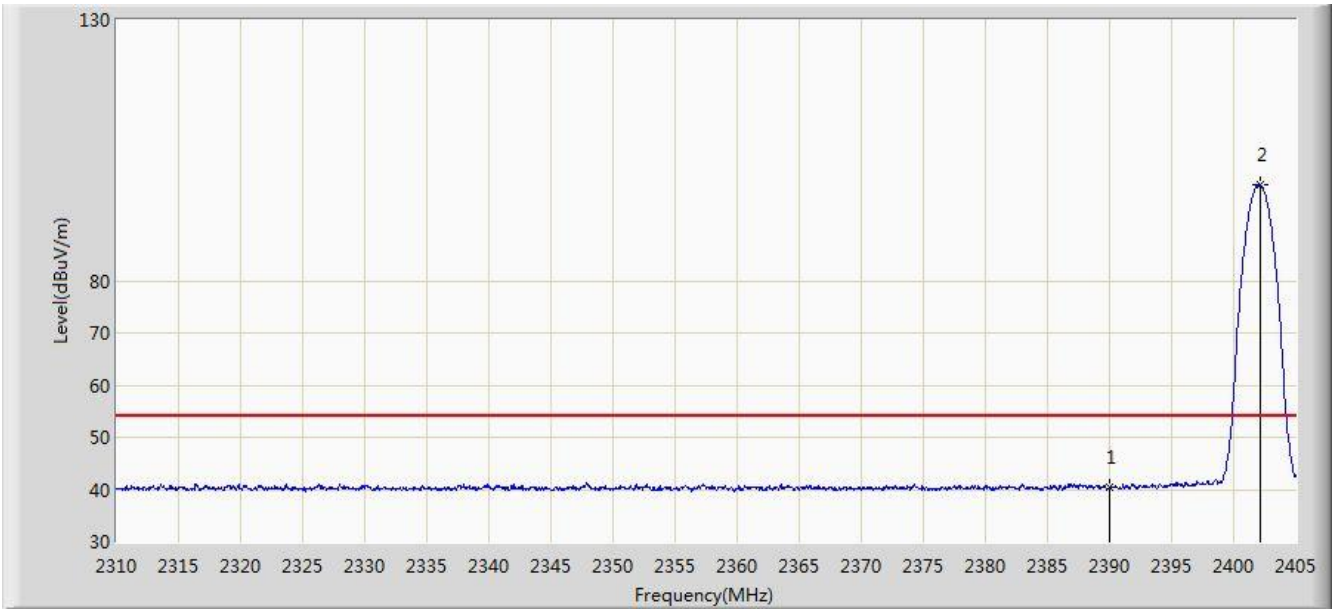


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2377.403	58.570	27.344	-15.430	74.000	31.226	PK
2			2390.000	57.138	25.935	-16.862	74.000	31.203	PK
3			2402.150	103.535	72.351	N/A	N/A	31.184	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:46
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 3DH5 at channel 2402MHz	

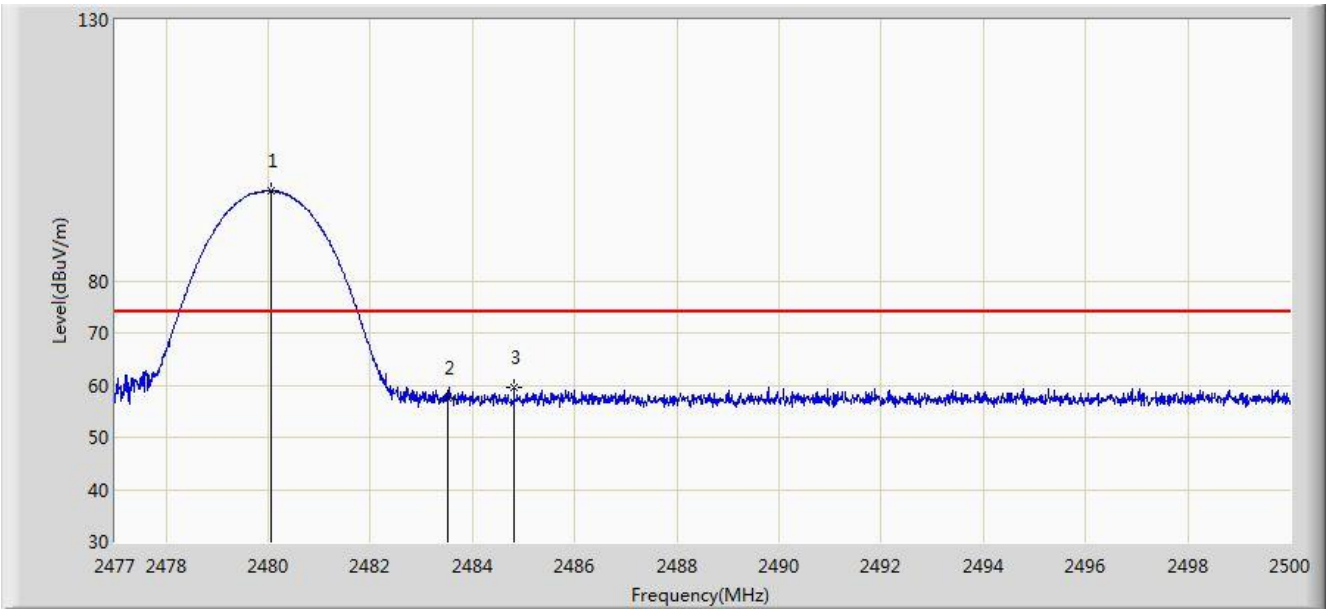


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2390.000	40.298	9.095	-13.702	54.000	31.203	AV
2			2402.150	98.338	67.154	N/A	N/A	31.184	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:47
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 3DH5 at channel 2480MHz	

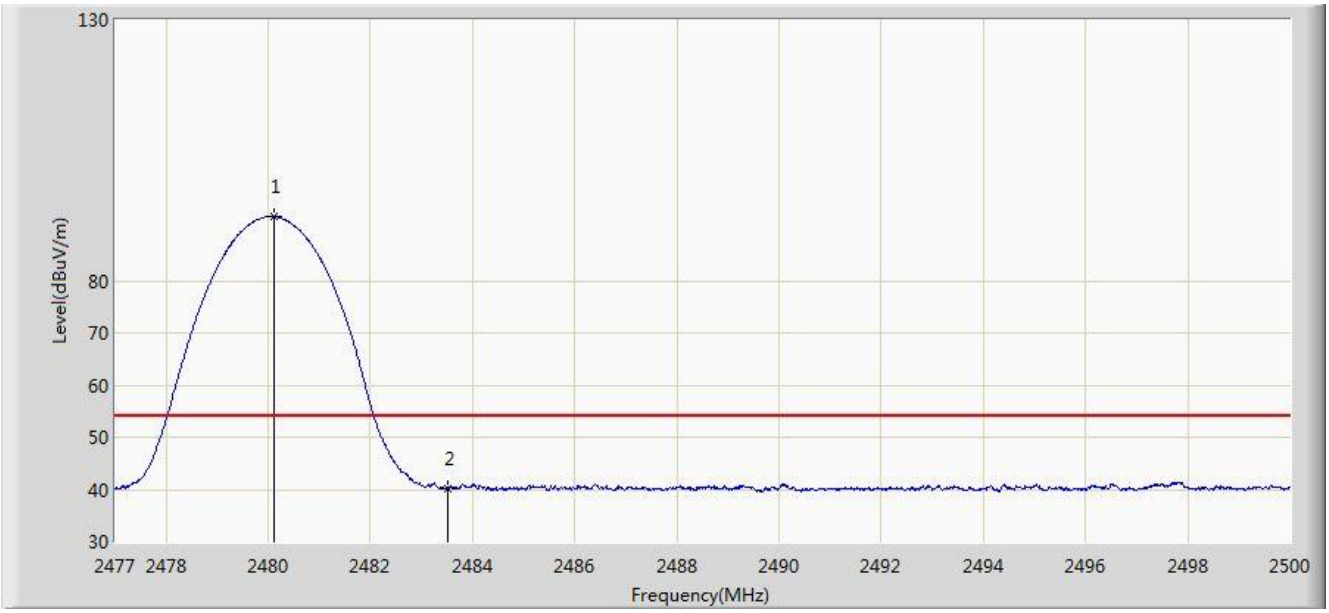


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2480.059	97.362	66.178	N/A	N/A	31.184	PK
2			2483.500	57.636	26.443	-16.364	74.000	31.194	PK
3			2484.809	59.472	28.275	-14.528	74.000	31.197	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:50
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 3DH5 at channel 2480MHz	

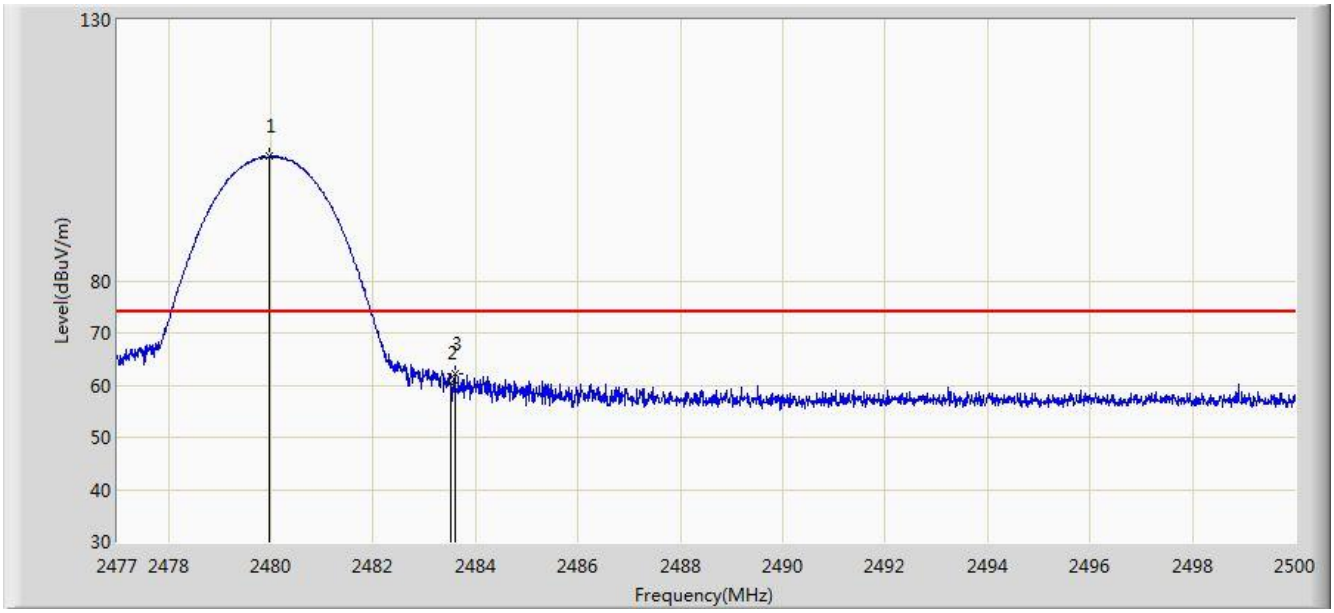


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2480.105	92.278	61.094	N/A	N/A	31.184	AV
2			2483.500	40.203	9.010	-13.797	54.000	31.194	AV

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

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

Site: AC1	Time: 2017/11/09 - 19:50
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 3DH5 at channel 2480MHz	

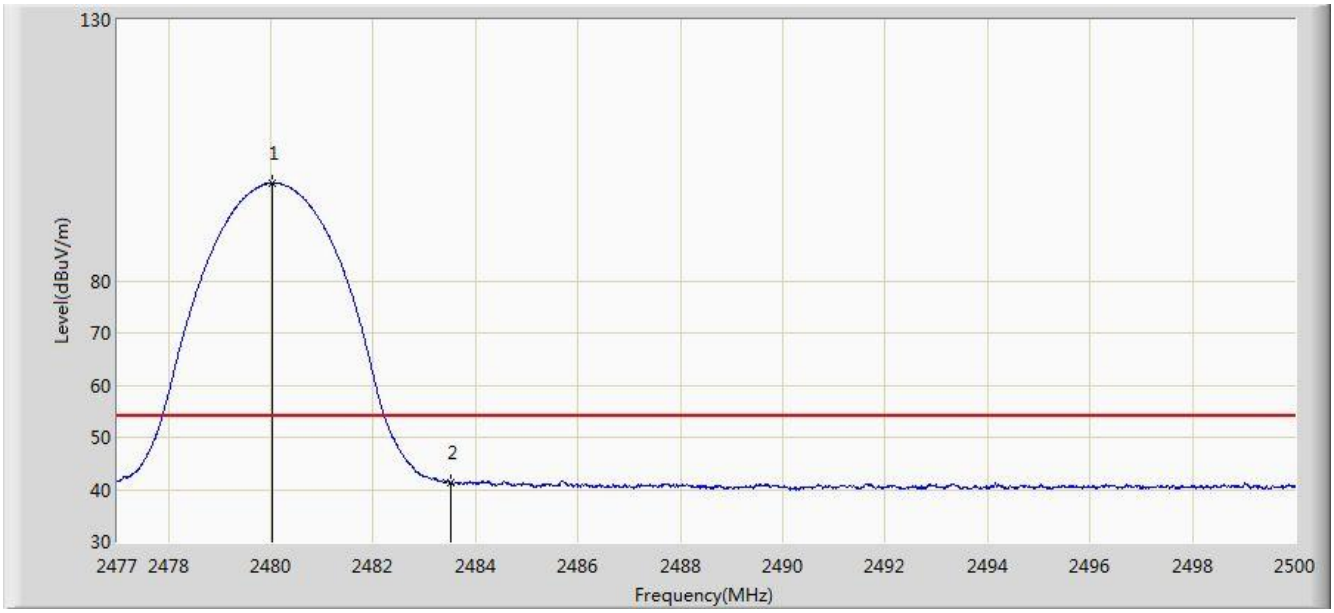


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2479.956	103.800	72.616	N/A	N/A	31.184	PK
2			2483.500	60.494	29.301	-13.506	74.000	31.194	PK
3			2483.601	62.221	31.027	-11.779	74.000	31.194	PK

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

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

Site: AC1	Time: 2017/11/09 - 19:52
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: W-LAN + Bluetooth Module	Power: DC 3.3V
Note: Transmit by 3DH5 at channel 2480MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2480.024	98.674	67.490	N/A	N/A	31.184	AV
2			2483.500	41.431	10.238	-12.569	54.000	31.194	AV

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

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

7.11. AC Conducted Emissions Measurement

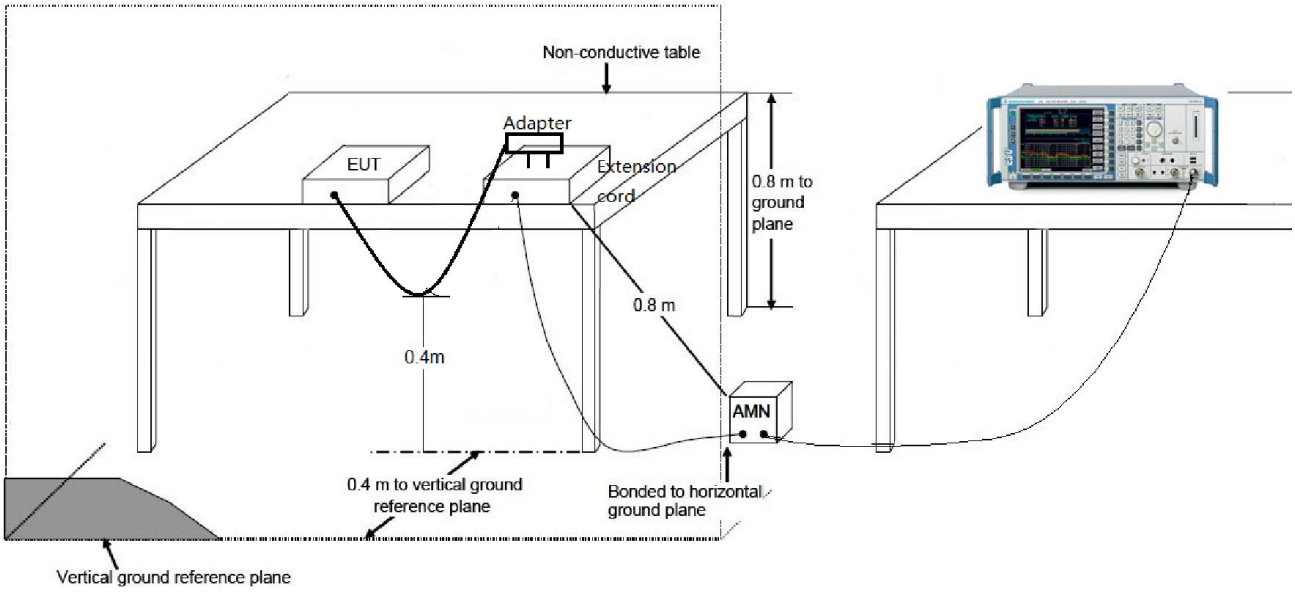
7.11.1. Test Limit

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

7.11.2. Test Setup



7.11.3. Test Result

Power supply of this device is by DC Source, so this item is not assessed.

8. CONCLUSION

The data collected relate only the item(s) tested and show that the **W-LAN + Bluetooth Module** is in compliance with Part 15C of the FCC Rules and IC Rules.

The End