MEASUREMENT REPORT

FCC PART 15.247 & IC RSS-247 WLAN

FCC ID:	VPYLBEE5ZZ1PJ
IC:	772C-LBEE5ZZ1PJ
APPLICANT:	Murata Manufacturing Co., Ltd.
Application Type:	Certification
Product:	W-LAN + Bluetooth Module
Model No.:	1PJ
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Part 15 Subpart C (Section 15.247)
IC Rule(s):	RSS-247 Issue 2, RSS-GEN Issue 5
Test Procedure(s):	ANSI C63.10-2013, KDB 558074 D01v05
Test Date:	August 13 ~ September 26, 2018

Reviewed By: (Kevin Guo)

Approved By: (Robin Wu)

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.

Revision History

Report No.	Version	Description	Issue Date	Note
1808WSU011-U3	Rev. 01	Initial report	11-30-2018	Valid

CONTENTS

§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, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
FCC Registration No.:	893164
IC Registration No.:	11384A-1
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 ANSI C63.4-2014.**
- **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-20025, G-20034, C-20020, T-20020) 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, Radio and SAR testing.**

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 measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.

2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name:	W-LAN + Bluetooth Module
Model No.:	1PJ
Brand Name:	Murata
Work Voltage	DC 3.3V
WiFi Specification	802.11 a/b/g/n/ac
Bluetooth Specification	V5.0 dual mode

2.2. Product Specification Subjective to this Report

Frequency Range	802.11b/g/n-HT20/ac-VHT20: 2412 ~ 2462MHz 802.11n-HT40/ac-VHT40: 2422 ~ 2452MHz
Channel Number:	802.11b/g/n-HT20/ac-VHT20: 11 802.11n-HT40/ac-VHT40: 7
Type of Modulation	802.11b: DSSS 802.11g/n/ac: OFDM
Data Rate:	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 150Mbps 802.11ac: up to 200Mbps
Antenna type	PCB Antenna
Antenna Gain	2.0dBi

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

2.3. Operation Frequency / Channel List

802.11b/g/n-HT20/ac-VHT20

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	--	--

802.11n-HT40/ac-VHT40

Channel	Frequency	Channel	Frequency	Channel	Frequency
03	2422 MHz	04	2427 MHz	05	2432 MHz
06	2437 MHz	07	2442 MHz	08	2447 MHz
09	2452 MHz	--	--	--	--

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
	Mode 4: Transmit by 802.11n-HT40
	Mode 5: Transmit by 802.11ac-VHT20
	Mode 6: Transmit by 802.11ac-VHT40

2.5. Description of Test Software

The test utility software used during testing was “QCARCT”, and the version was “v3.0.268.0”.

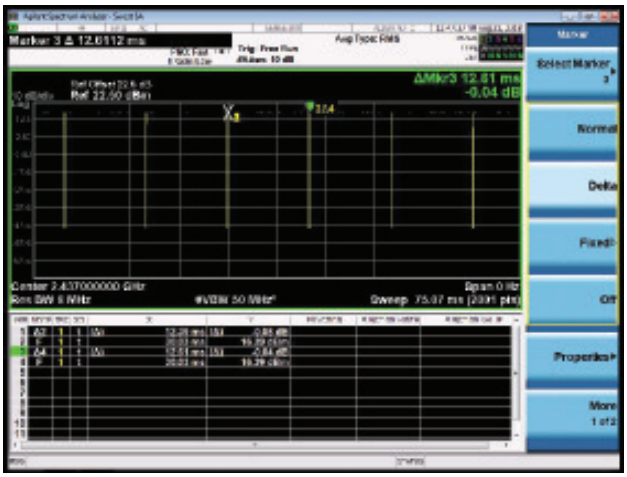
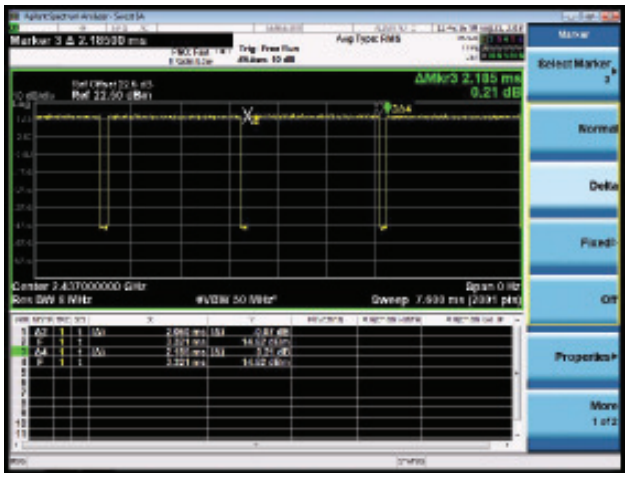
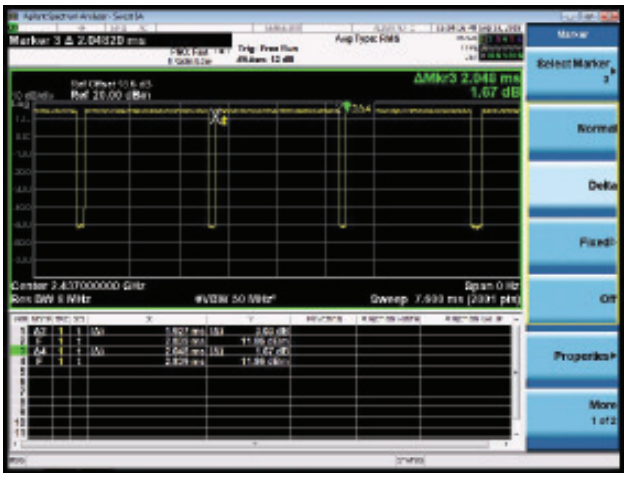
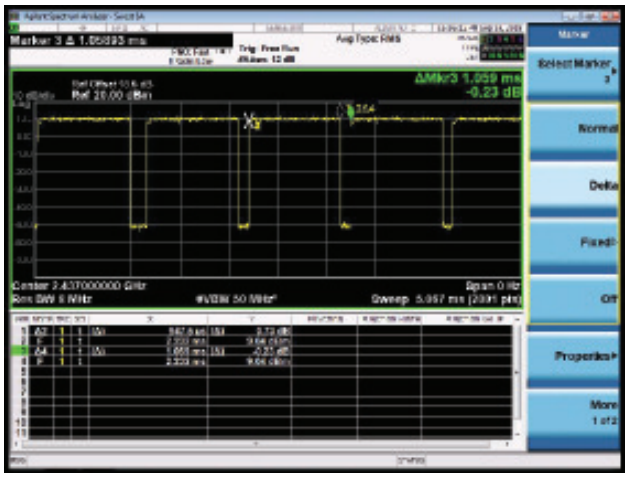
Power Parameter Value:

Test Mode	Test Frequency (MHz)	Power Parameter Value	Test Mode	Test Frequency (MHz)	Power Parameter Value
11b	2412	18.0	11n-HT40	2422	16.0
	2437	17.5		2437	16.5
	2462	17.5		2452	15.0
11g	2412	17.5	11ac-VHT20	2412	17.5
	2437	17.0		2437	17.5
	2462	17.0		2462	17.5
11n-HT20	2412	17.5	11ac-VHT40	2422	16.5
	2437	17.5		2437	16.5
	2462	17.5		2452	15.5

2.6. Duty Cycle

2.4GHz WLAN (DTS) operation is possible in 20MHz and 40MHz channel bandwidths. The maximum achievable duty cycle was determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Test Mode	Duty Cycle
802.11b	98.26%
802.11g	94.28%
802.11n-HT20	92.43%
802.11n-HT40	86.35%
802.11ac-VHT20	94.09%
802.11ac-VHT40	89.47%

802.11b (T = 12.39ms)	802.11g (T = 2.06ms)
	
802.11n-HT20 (T = 1.90ms)	**802.11n-HT40 (T = 938.60us)**
	
802.11ac-VHT20 (T = 1.93ms)	**802.11ac-VHT40 (T = 947.50us)**
	

2.7. 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.

2.8. 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 guidance provided in KDB 558074 D01v05 were used in the measurement of the device.

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 1-25GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.
Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. 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	2019/04/20
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2019/06/15
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2019/06/15
Thermohygrometer	Testo	608-H1	MRTSUE06404	1 year	2019/08/15
Shielding Anechoic Chamber	Mikebang	Chamber-SR2	MRTSUE06214	N/A	N/A

Radiated Disturbance – AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2019/08/14
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2019/09/14
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2018/11/17
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2019/06/13
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2018/11/21
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2019/04/12
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2019/10/20
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2018/12/14
Broadband CoaxialPreamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2018/11/17
Thermohygrometer	testo	608-H1	MRTSUE06403	1 year	2019/08/15
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2019/05/02

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2019/04/25
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06452	1 year	2019/07/20
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2018/12/06
Thermohygrometer	Testo	608-H1	MRTSUE06401	1 year	2019/08/15

Software	Version	Function
e3	V 8.3.5	EMI Test Software

5. MEASUREMENT UNCERTAINTY

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

AC Conducted Emission Measurement - 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%

6. TEST RESULT

6.1. Summary

Company Name: **Murata Manufacturing Co., Ltd.**
FCC ID: **VPYLBEE5ZZ1PJ**
IC: **772C-LBEE5ZZ1PJ**

FCC Section(s)	IC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	≥ 500kHz	Conducted	Pass	Section 6.2
15.247(b)(3)	RSS-247 [5.4(4)]	Output Power	≤ 30dBm		Pass	Section 6.3
15.247(e)	RSS-247 [5.2]	Power Spectral Density	≤ 8dBm/3kHz		Pass	Section 6.4
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	≤ 30dBc(Average)		Pass	Section 6.5
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 6.6 & 6.7
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	N/A	Section 6.8

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.

6.2. 6dB Bandwidth Measurement

6.2.1.Test Limit

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

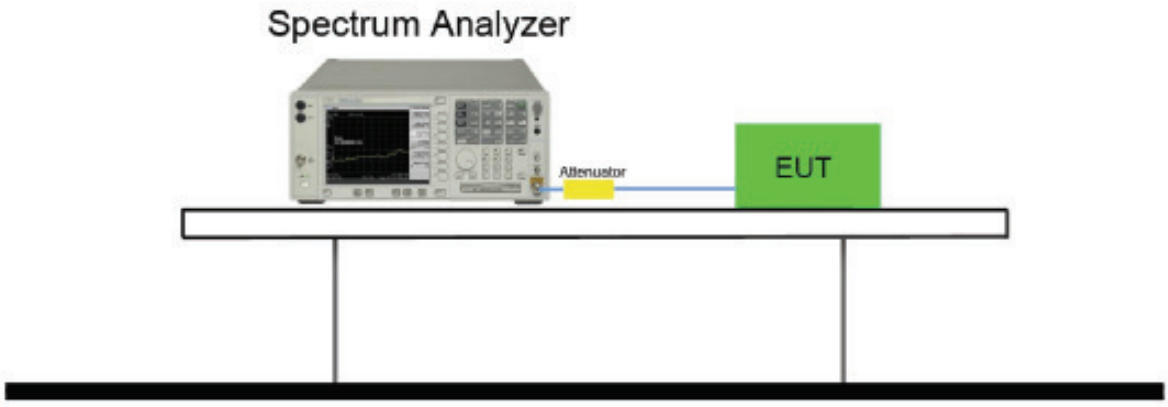
6.2.2.Test Procedure used

ANSI C63.10-2013 - Section 11.8.2 Option 2

6.2.3.Test Setting

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

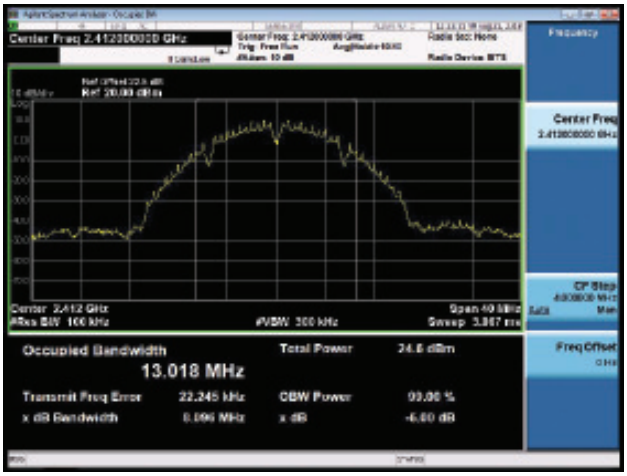
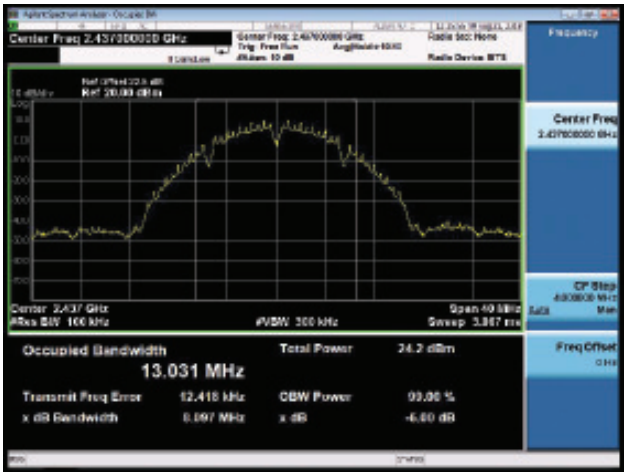
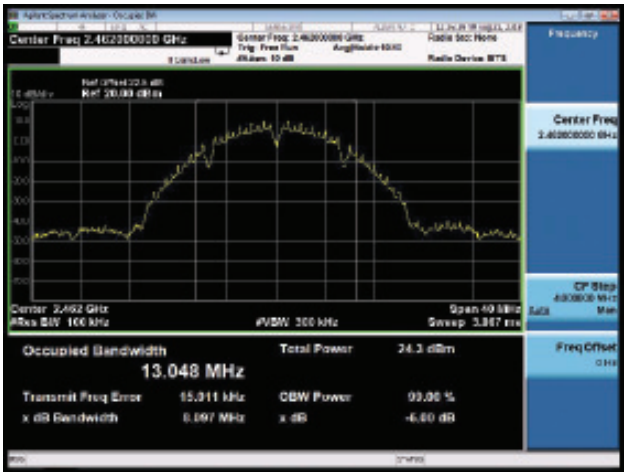
6.2.4.Test Setup

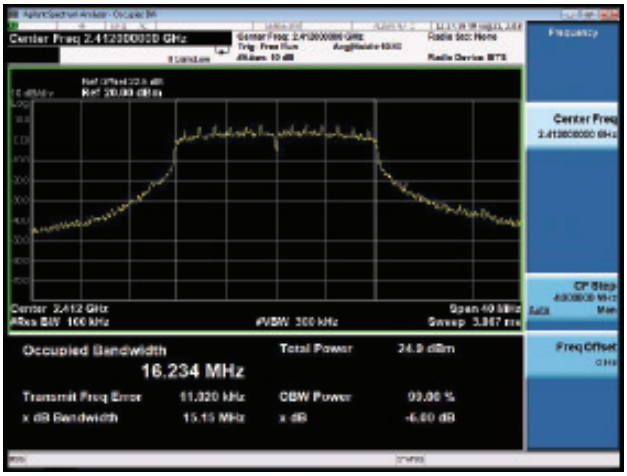
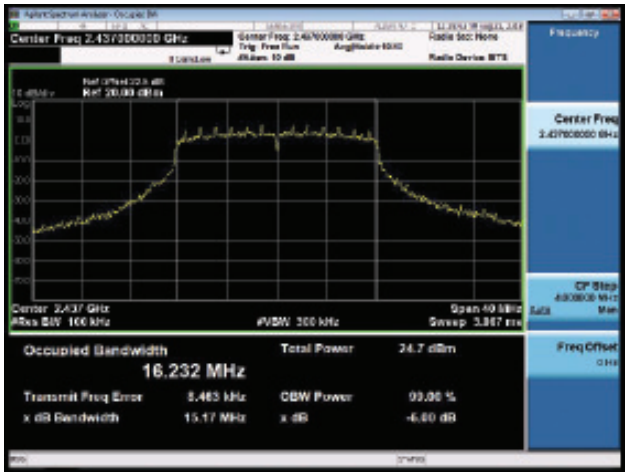
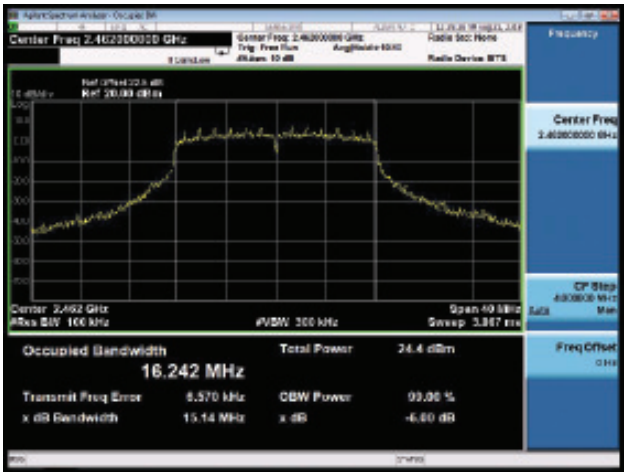


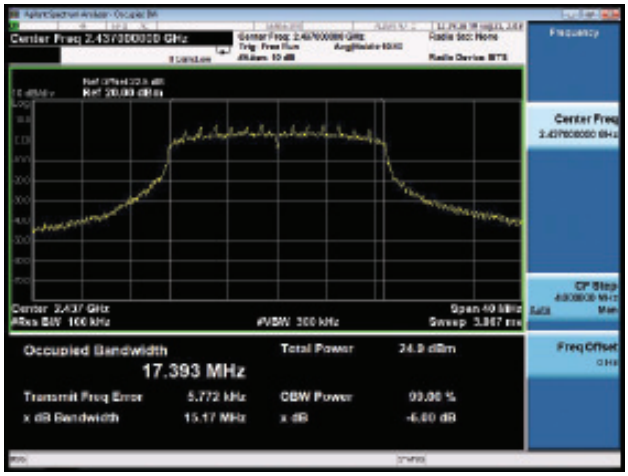
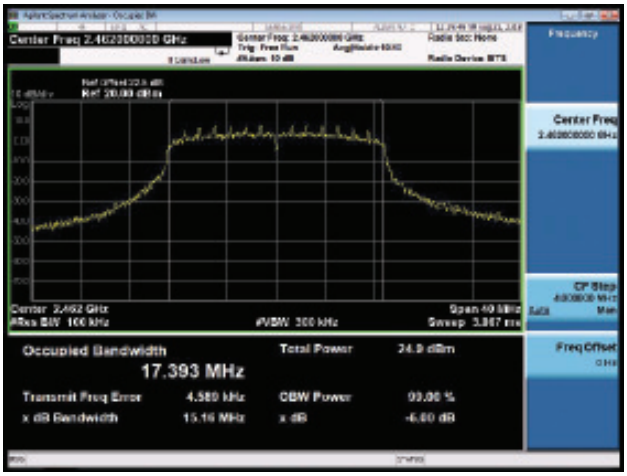
6.2.5.Test Result

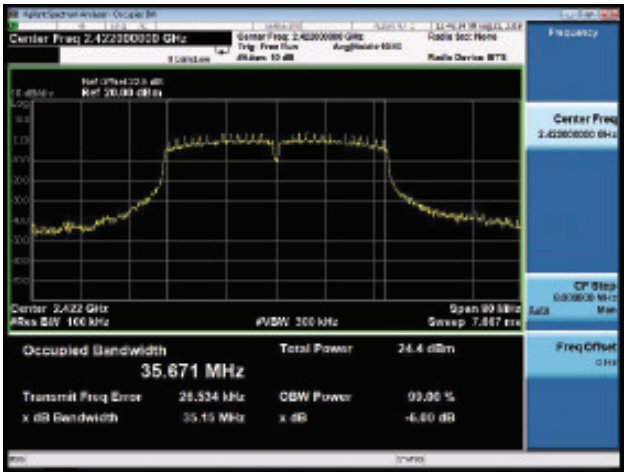
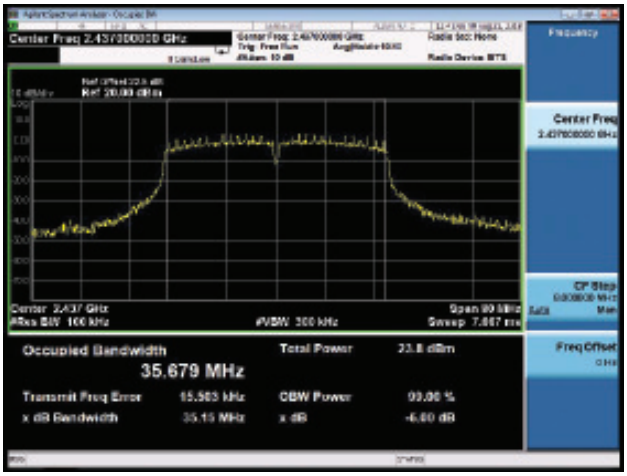
Product	W-LAN + Bluetooth Module	Temperature	23°C
Test Engineer	Dandy Li	Relative Humidity	54%
Test Site	TR3	Test Date	2018/08/21

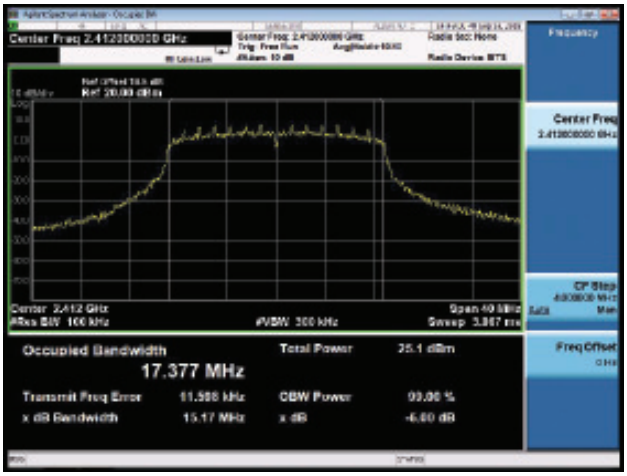
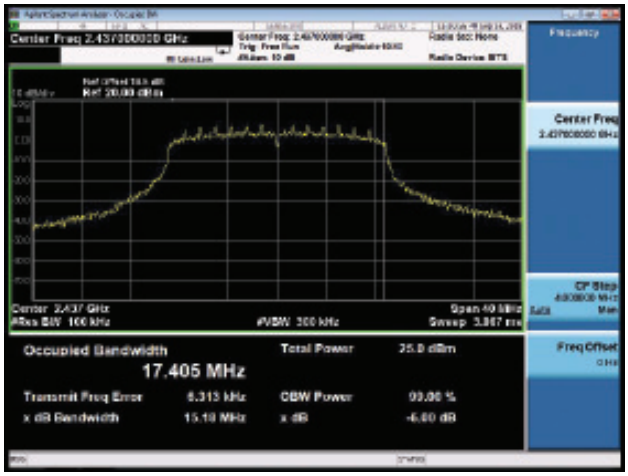
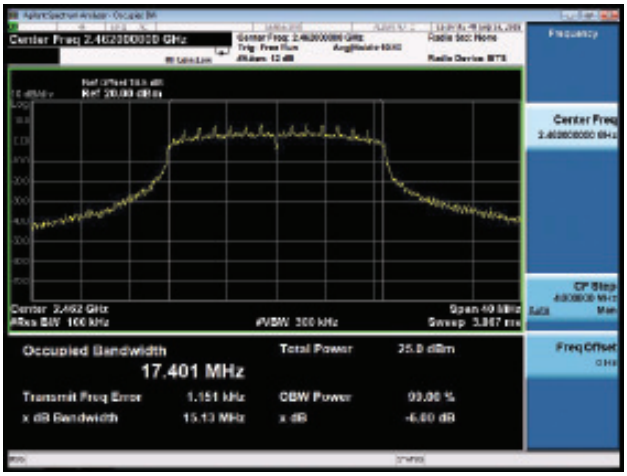
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
802.11b	1Mbps	01	2412	8.10	≥0.5	Pass
802.11b	1Mbps	06	2437	8.10	≥0.5	Pass
802.11b	1Mbps	11	2462	8.10	≥0.5	Pass
802.11g	6Mbps	01	2412	15.15	≥0.5	Pass
802.11g	6Mbps	06	2437	15.17	≥0.5	Pass
802.11g	6Mbps	11	2462	15.14	≥0.5	Pass
802.11n-HT20	MCS0	01	2412	15.17	≥0.5	Pass
802.11n-HT20	MCS0	06	2437	15.17	≥0.5	Pass
802.11n-HT20	MCS0	11	2462	15.16	≥0.5	Pass
802.11n-HT40	MCS0	03	2422	35.15	≥0.5	Pass
802.11n-HT40	MCS0	06	2437	35.15	≥0.5	Pass
802.11n-HT40	MCS0	09	2452	35.13	≥0.5	Pass
802.11ac-VHT20	MCS0	01	2412	15.17	≥0.5	Pass
802.11ac-VHT20	MCS0	06	2437	15.18	≥0.5	Pass
802.11ac-VHT20	MCS0	11	2462	15.13	≥0.5	Pass
802.11ac-VHT40	MCS0	03	2422	35.15	≥0.5	Pass
802.11ac-VHT40	MCS0	06	2437	35.15	≥0.5	Pass
802.11ac-VHT40	MCS0	09	2452	35.16	≥0.5	Pass

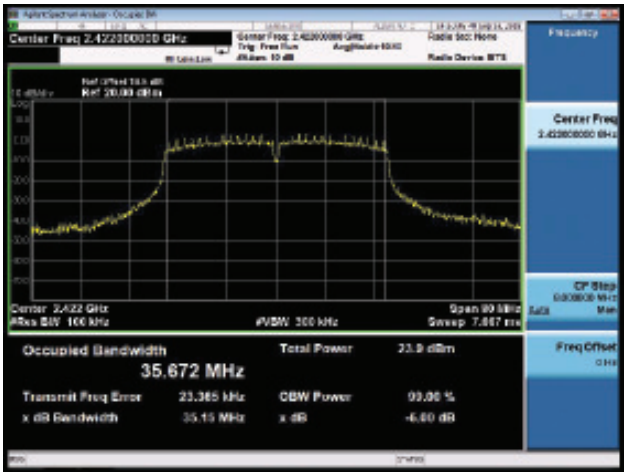
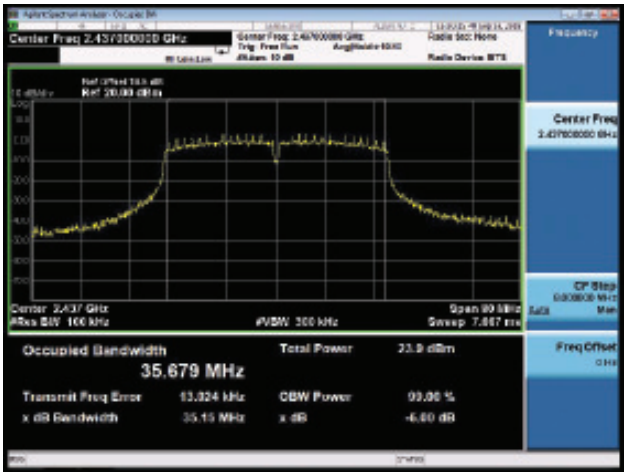
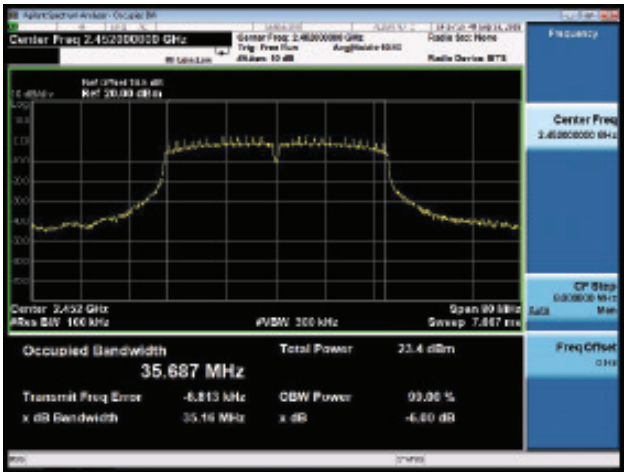
802.11b 6dB Bandwidth	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

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)	
	

802.11n-HT40 6dB Bandwidth	
Channel 03 (2422MHz)	Channel 06 (2437MHz)
	
Channel 09 (2452MHz)	
	

802.11ac-VHT20 6dB Bandwidth	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

802.11ac-VHT40 6dB Bandwidth	
Channel 03 (2422MHz)	Channel 06 (2437MHz)
	
Channel 09 (2452MHz)	
	

6.3. Output Power Measurement

6.3.1.Test Limit

The maximum conducted output power shall be exceed 1 Watt (30dBm) and the E.I.R.P shall not exceed 4 Watt (36dBm).

The total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6dBi.

6.3.2.Test Procedure Used

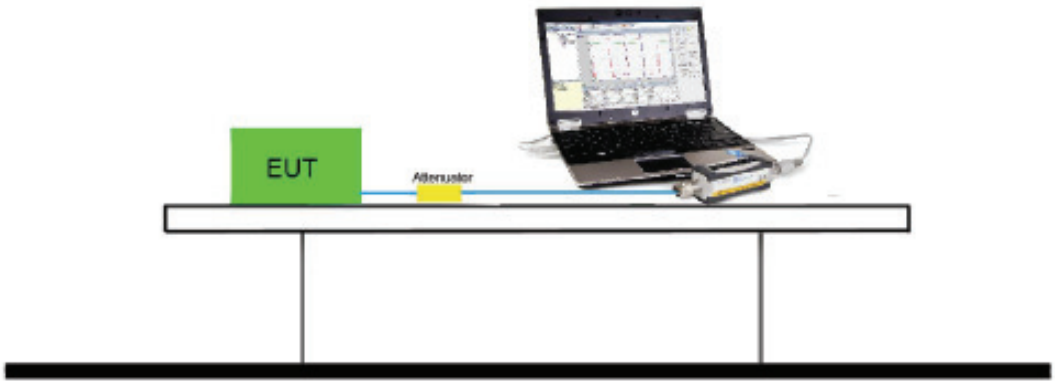
ANSI C63.10-2013 - Section 11.9.2.3.2

6.3.3.Test Setting

Average Power Measurement

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

6.3.4.Test Setup



6.3.5.Test Result

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

Output power at various data rates:

Test Mode	Bandwidth (MHz)	Channel No.	Frequency (MHz)	Data Rate / MCS	Average Power (dBm)
802.11b	20	06	2437	1Mbps	18.57
				5.5Mbps	18.33
				11Mbps	18.06
802.11g	20	06	2437	6Mbps	18.01
				24Mbps	17.74
				54Mbps	17.45
802.11n	20	06	2437	MCS0	17.62
				MCS3	17.33
				MCS7	17.09
802.11n	40	06	2437	MCS0	16.67
				MCS3	16.26
				MCS7	16.01
802.11ac	20	06	2437	MCS0	17.75
				MCS4	17.04
				MCS8	16.58
802.11ac	40	06	2437	MCS0	16.52
				MCS4	16.00
				MCS9	15.51

Product	W-LAN + Bluetooth Module	Temperature	23°C
Test Engineer	Dandy Li	Relative Humidity	54%
Test Site	TR3	Test Date	2018/08/19

Test Mode	Data Rate / MCS	Channel No.	Freq. (MHz)	Average Power (dBm)	Power Limit (dBm)	Result
11b	1Mbps	01	2412	18.92	≤ 30.00	Pass
11b	1Mbps	06	2437	18.57	≤ 30.00	Pass
11b	1Mbps	11	2462	18.55	≤ 30.00	Pass
11g	6Mbps	01	2412	17.82	≤ 30.00	Pass
11g	6Mbps	06	2437	18.01	≤ 30.00	Pass
11g	6Mbps	11	2462	17.62	≤ 30.00	Pass
11n-HT20	MCS0	01	2412	17.62	≤ 30.00	Pass
11n-HT20	MCS0	06	2437	17.83	≤ 30.00	Pass
11n-HT20	MCS0	11	2462	17.80	≤ 30.00	Pass
11n-HT40	MCS0	03	2422	16.98	≤ 30.00	Pass
11n-HT40	MCS0	06	2437	16.67	≤ 30.00	Pass
11n-HT40	MCS0	09	2452	16.73	≤ 30.00	Pass
11ac-VHT20	MCS0	01	2412	17.57	≤ 30.00	Pass
11ac-VHT20	MCS0	06	2437	17.75	≤ 30.00	Pass
11ac-VHT20	MCS0	11	2462	17.71	≤ 30.00	Pass
11ac-VHT40	MCS0	03	2422	16.53	≤ 30.00	Pass
11ac-VHT40	MCS0	06	2437	16.52	≤ 30.00	Pass
11ac-VHT40	MCS0	09	2452	15.58	≤ 30.00	Pass

Note 1: EIRP (dBm) = Average Power (dBm) + Antenna Gain (dBi), Antenna Gain (dBi) = 2.0dBi.

Note 2: EIRP Limit (dBm) = 4 (W) = 36 (dBm)

Note 3: Max EIRP (dBm) = Max Average Power(dBm) + Antenna Gain (dBi) = 18.92 dBm + 2 dBi = 20.92 dBm < 36 dBm

6.4. Power Spectral Density Measurement

6.4.1.Test Limit

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

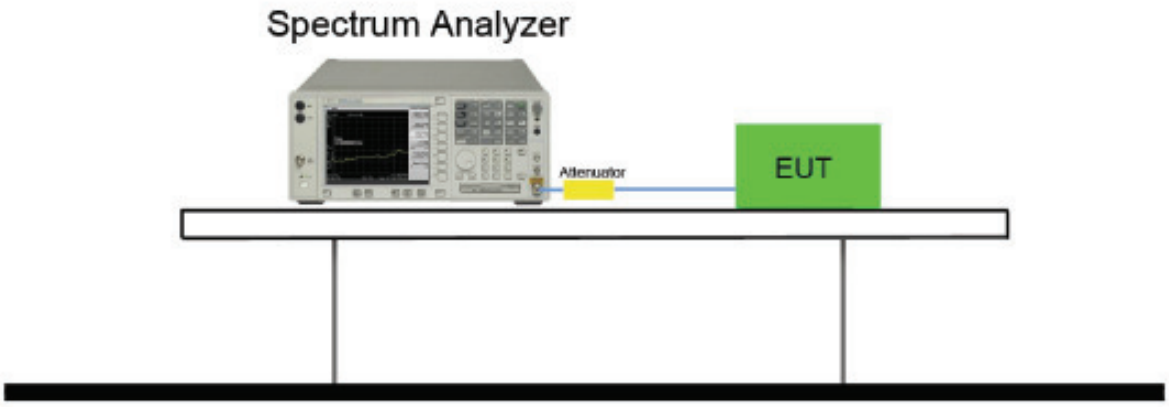
6.4.2.Test Procedure Used

ANSI C63.10 Section 11.10.5

6.4.3.Test Setting

1. Measure the duty cycle (x) of the transmitter output signal.
2. Set instrument center frequency to DTS channel center frequency.
3. Set span to at least 1.5 times the OBW.
4. RBW = 10 kHz.
5. VBW = 30 kHz.
6. Detector = RMS.
7. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
8. Sweep time = auto couple.
9. Don’t use sweep triggering. Allow sweep to “free run”.
10. Employ trace averaging (RMS) mode over a minimum of 100 traces.
11. Use the peak marker function to determine the maximum amplitude level.
12. Add 10 log (1/x), where x is the duty cycle measured in step (a, to the measured PSD to compute the average PSD during the actual transmission time.
13. Add Constant Factor = 10*log (3kHz / 10kHz) = -5.23.

6.4.4.Test Setup



6.4.5.Test Result

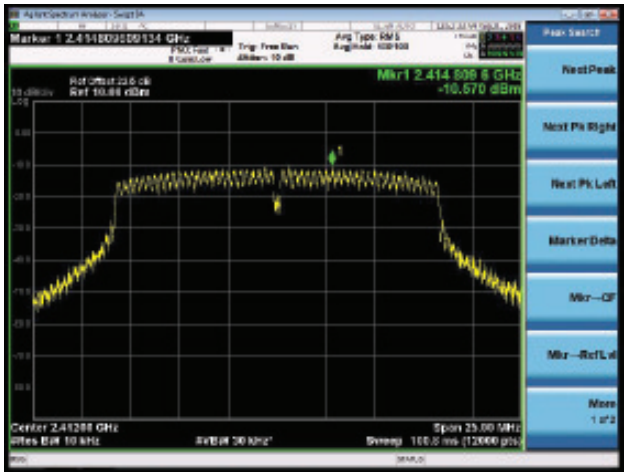
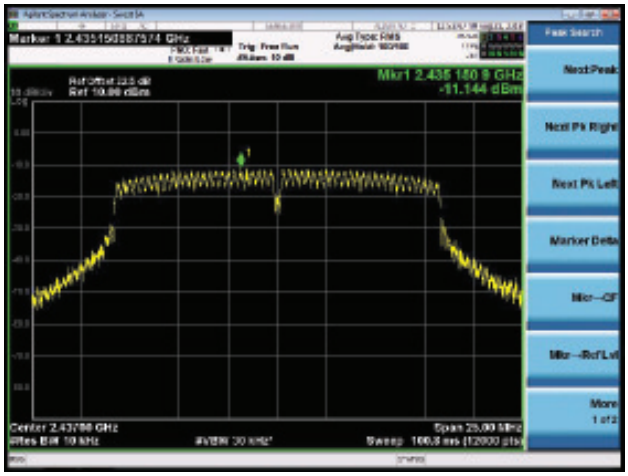
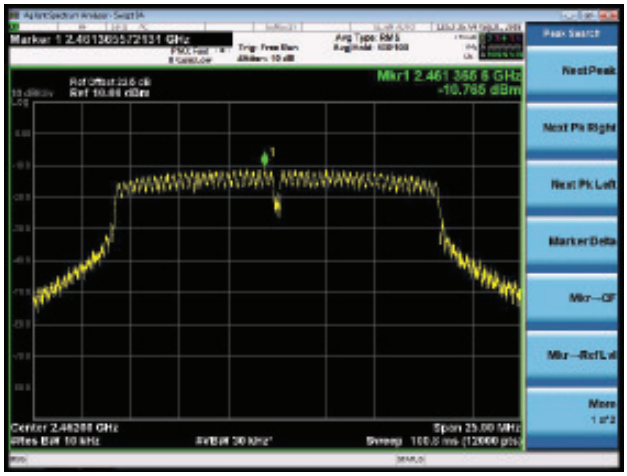
Product	W-LAN + Bluetooth Module	Temperature	23°C
Test Engineer	Dandy Li	Relative Humidity	54%
Test Site	TR3	Test Date	2018/08/21

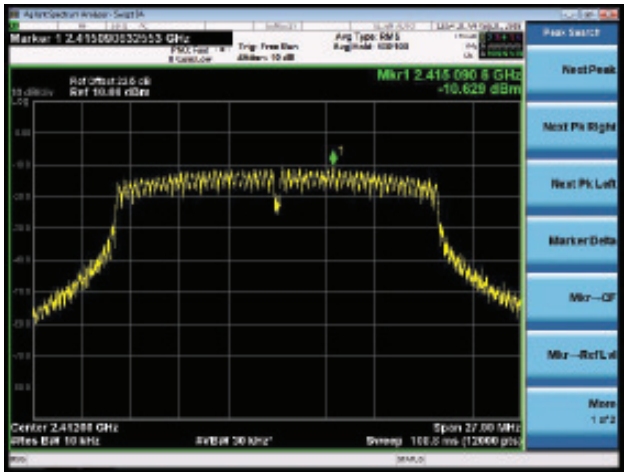
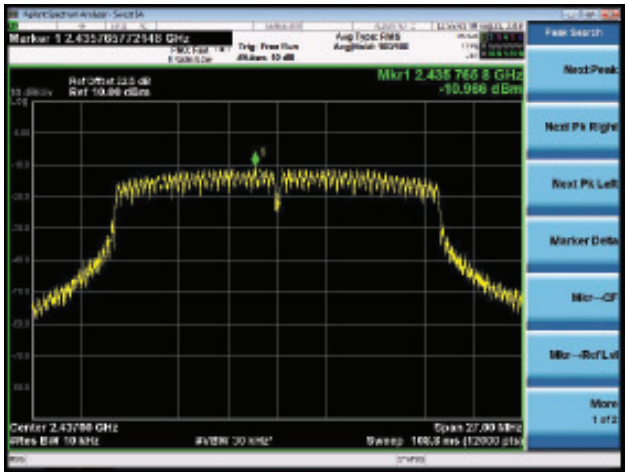
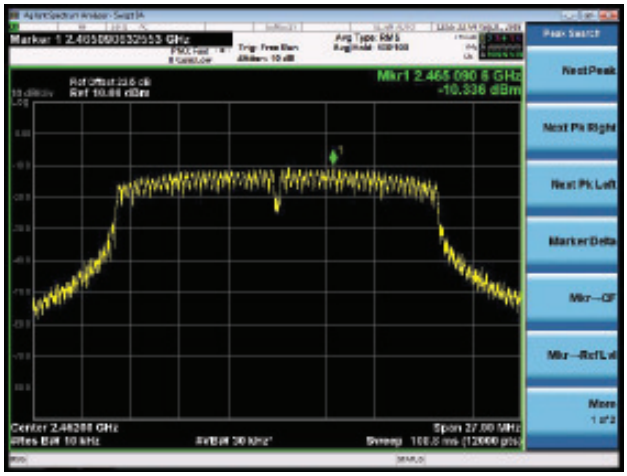
Test Mode	Data Rate / MCS	Channel No.	Freq. (MHz)	AVGPSD (dBm/ 10kHz)	Duty Cycle (%)	Constant Factor	Final AVGPSD (dBm/3kHz)	Limit (dBm/ 3kHz)	Result
11b	1Mbps	01	2412	-8.20	98.26	-5.23	-13.43	≤ 8.0	Pass
11b	1Mbps	06	2437	-7.80	98.26	-5.23	-13.03	≤ 8.0	Pass
11b	1Mbps	11	2462	-8.09	98.26	-5.23	-13.32	≤ 8.0	Pass
11g	6Mbps	01	2412	-10.57	94.28	-5.23	-15.54	≤ 8.0	Pass
11g	6Mbps	06	2437	-11.14	94.28	-5.23	-16.12	≤ 8.0	Pass
11g	6Mbps	11	2462	-10.77	94.28	-5.23	-15.74	≤ 8.0	Pass
11n-HT20	MCS0	01	2412	-10.63	92.43	-5.23	-15.52	≤ 8.0	Pass
11n-HT20	MCS0	06	2437	-10.97	92.43	-5.23	-15.85	≤ 8.0	Pass
11n-HT20	MCS0	11	2462	-10.34	92.43	-5.23	-15.22	≤ 8.0	Pass
11n-HT40	MCS0	03	2422	-15.03	86.35	-5.23	-19.63	≤ 8.0	Pass
11n-HT40	MCS0	06	2437	-15.16	86.35	-5.23	-19.76	≤ 8.0	Pass
11n-HT40	MCS0	09	2452	-14.51	86.35	-5.23	-19.10	≤ 8.0	Pass
11ac-VHT20	MCS0	01	2412	-11.17	94.09	-5.23	-16.14	≤ 8.0	Pass
11ac-VHT20	MCS0	06	2437	-10.62	94.09	-5.23	-15.59	≤ 8.0	Pass
11ac-VHT20	MCS0	11	2462	-10.57	94.09	-5.23	-15.54	≤ 8.0	Pass
11ac-VHT40	MCS0	03	2422	-15.21	89.47	-5.23	-19.96	≤ 8.0	Pass
11ac-VHT40	MCS0	06	2437	-14.86	89.47	-5.23	-19.61	≤ 8.0	Pass
11ac-VHT40	MCS0	09	2452	-15.87	89.47	-5.23	-20.62	≤ 8.0	Pass

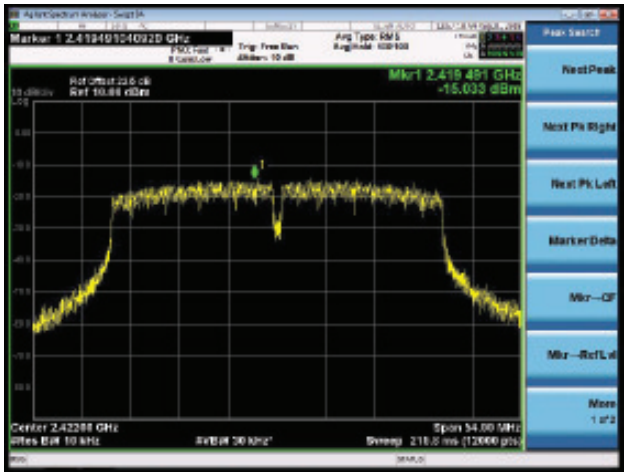
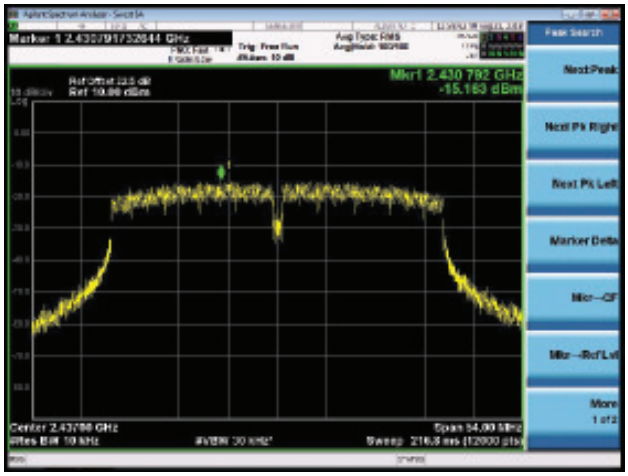
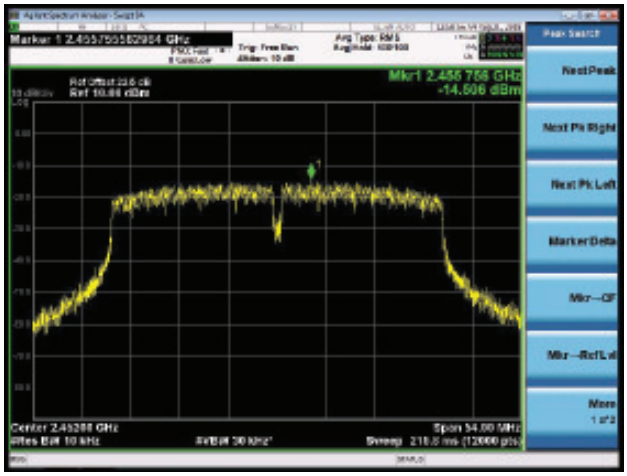
Note 1: When EUT duty cycle ≥ 98%, Final AVGPSD (dBm/3kHz) = AVGPSD (dBm/10kHz) + Constant Factor.

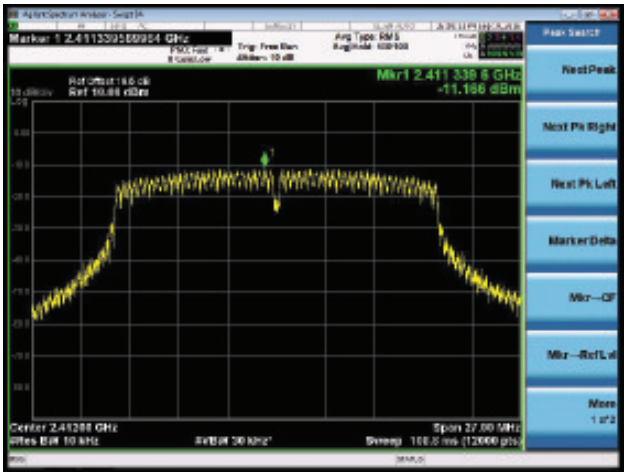
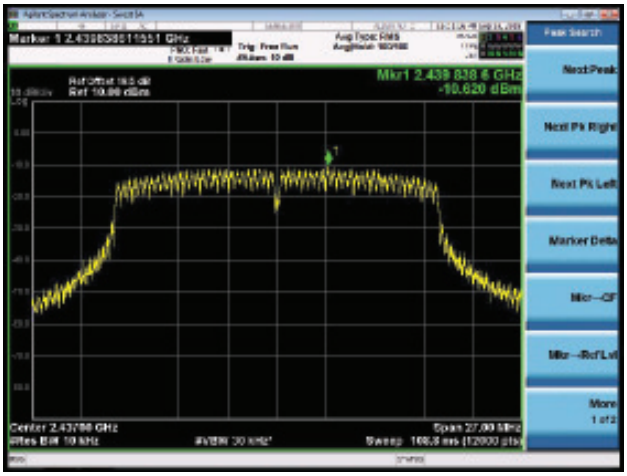
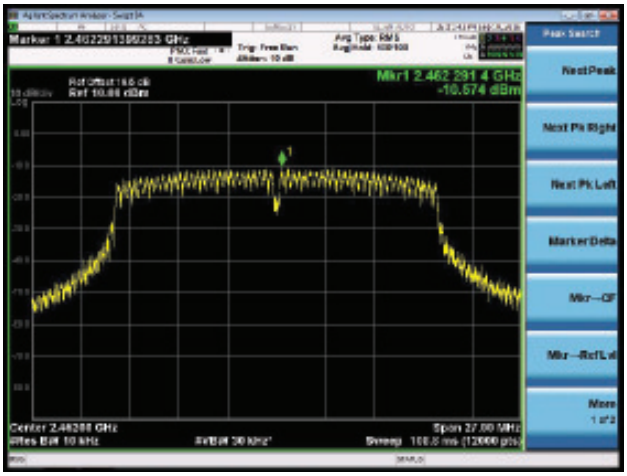
Note 2: When EUT duty cycle < 98%, Final AVGPSD (dBm/3kHz) = AVGPSD (dBm/10kHz) + 10*log (1/Duty cycle) + Constant Factor.

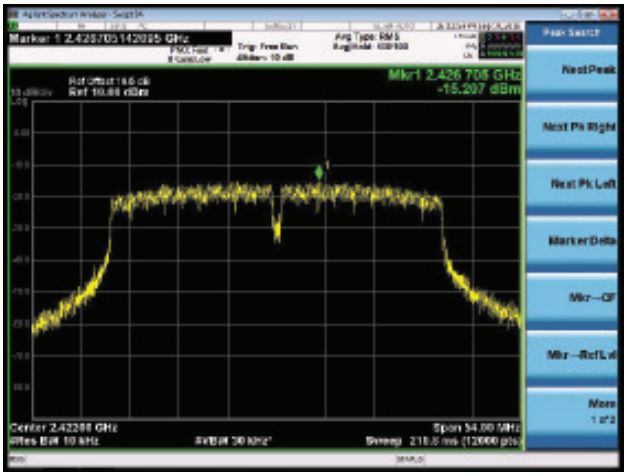
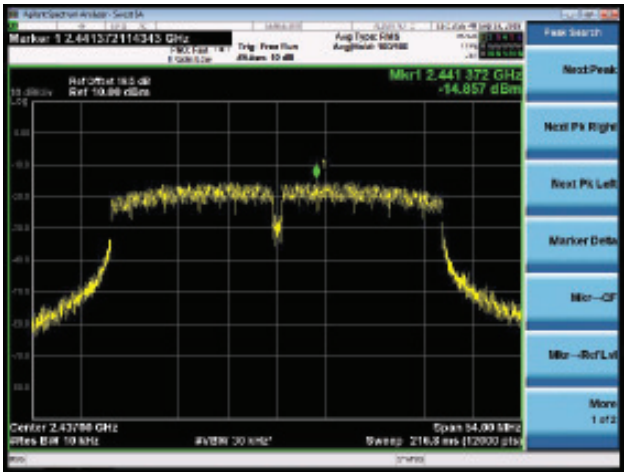
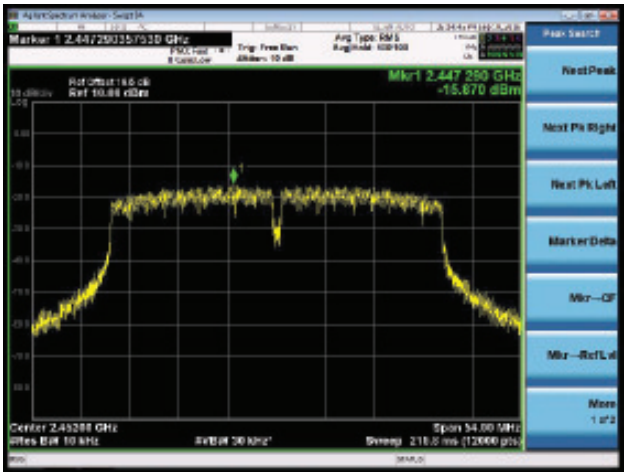
802.11b AVGPSD	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

802.11g AVGPSD	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

802.11n-HT20 AVGPSD	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

802.11n-HT40 AVGPSD	
Channel 03 (2422MHz)	Channel 06 (2437MHz)
	
Channel 09 (2452MHz)	
	

802.11ac-VHT20 AVGPSD	
Channel 01 (2412MHz)	Channel 06 (2437MHz)
	
Channel 11 (2462MHz)	
	

802.11ac-VHT40 AVGPSD	
Channel 03 (2422MHz)	Channel 06 (2437MHz)
	
Channel 09 (2452MHz)	
	

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

6.5.1.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.

6.5.2.Test Procedure Used

ANSI C63.10 Section 11.11

6.5.3.Test Settitng

Reference level measurement

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

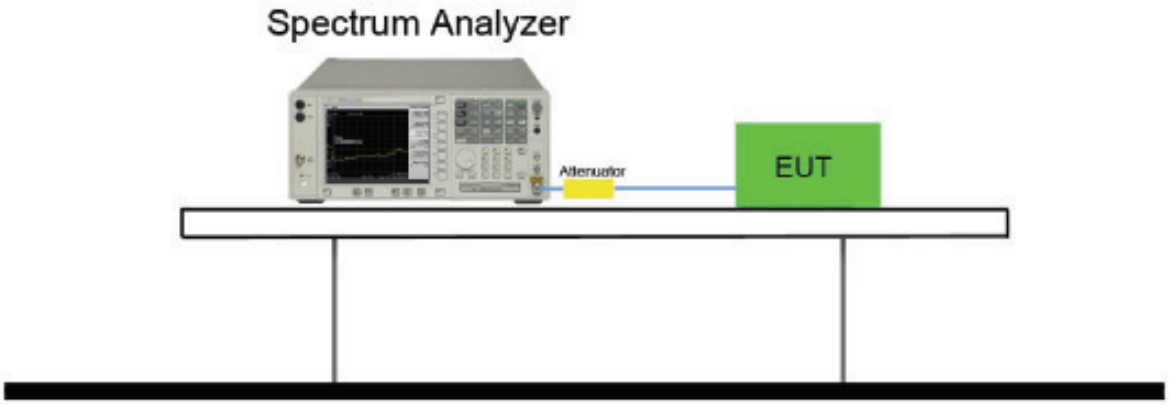
Emission level measurement

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 1.3MHz
3. VBW = 4MHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Notes

1. RBW was set to 1.3MHz rather than 100 kHz in order to increase the measurement speed.
2. The display line shown in the following plots denotes the limit at 30dB below the fundamental emission level measured in a 100 kHz bandwidth. However, since the traces in the following plots are measured with a 1.3MHz RBW, the display line may not necessarily appear to be 30dB below the level of the fundamental in a 1.3MHz bandwidth.
3. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present.

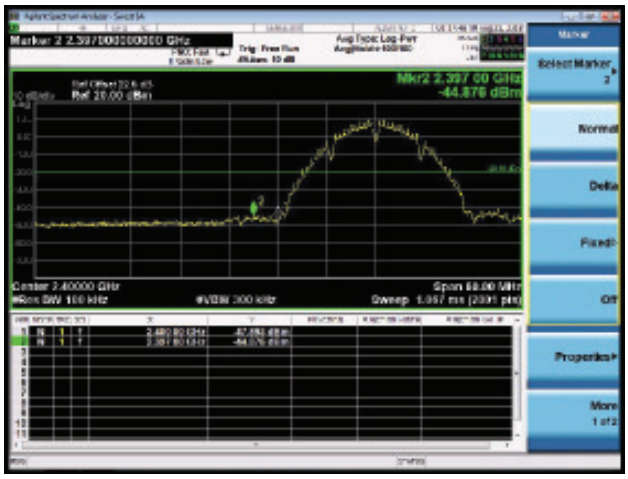
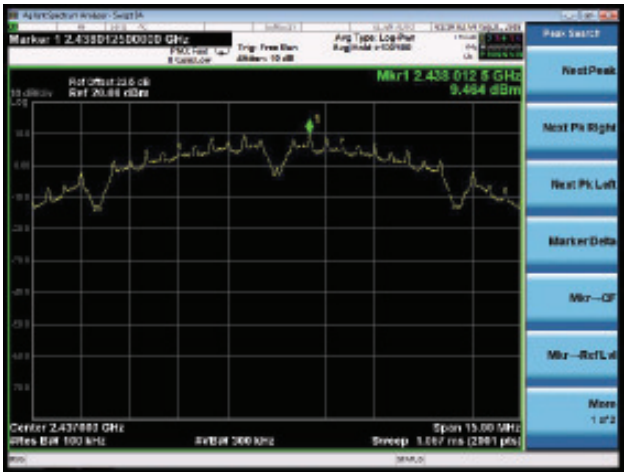
6.5.4.Test Setup

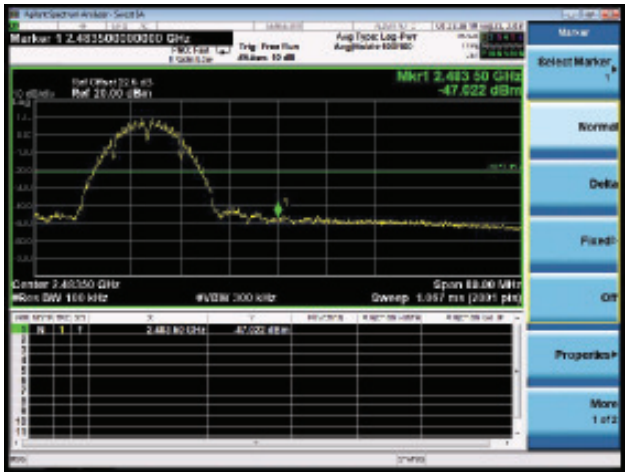


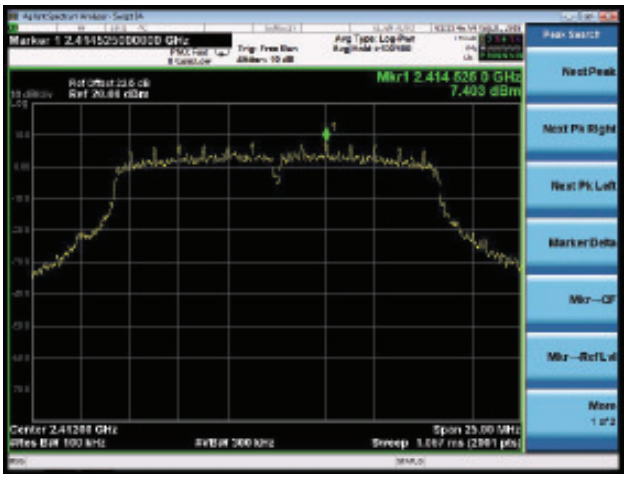
6.5.5.Test Result

Product	W-LAN + Bluetooth Module	Temperature	23°C
Test Engineer	Dandy Li	Relative Humidity	54%
Test Site	TR3	Test Date	2018/08/21

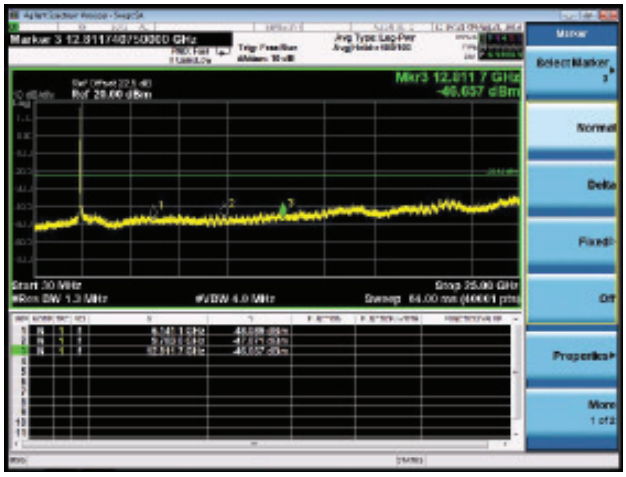
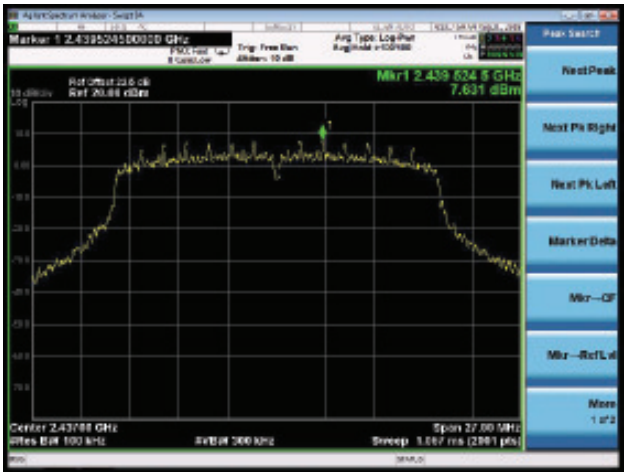
Test Mode	Data Rate / MCS	Channel No.	Frequency (MHz)	Limit	Result
11b	1Mbps	01	2412	30dBc	Pass
11b	1Mbps	06	2437	30dBc	Pass
11b	1Mbps	11	2462	30dBc	Pass
11g	6Mbps	01	2412	30dBc	Pass
11g	6Mbps	06	2437	30dBc	Pass
11g	6Mbps	11	2462	30dBc	Pass
11n-HT20	MCS0	01	2412	30dBc	Pass
11n-HT20	MCS0	06	2437	30dBc	Pass
11n-HT20	MCS0	11	2462	30dBc	Pass
11n-HT40	MCS0	03	2422	30dBc	Pass
11n-HT40	MCS0	06	2437	30dBc	Pass
11n-HT40	MCS0	09	2452	30dBc	Pass
11ac-VHT20	MCS0	01	2412	30dBc	Pass
11ac-VHT20	MCS0	06	2437	30dBc	Pass
11ac-VHT20	MCS0	11	2462	30dBc	Pass
11ac-VHT40	MCS0	03	2422	30dBc	Pass
11ac-VHT40	MCS0	06	2437	30dBc	Pass
11ac-VHT40	MCS0	09	2452	30dBc	Pass

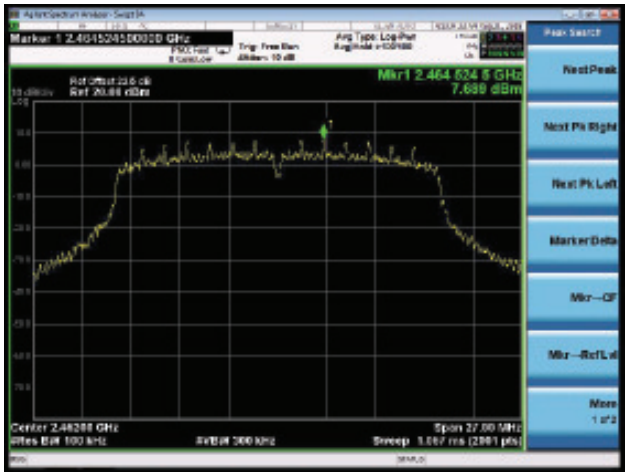
802.11b Out-of-Band Emissions	
Channel 01 (2412MHz)	
100kHz PSD Reference Level	Low Band Edge
	
Spurious Emission	
	
Channel 06 (2437MHz)	
100kHz PSD Reference Level	Spurious Emission
	

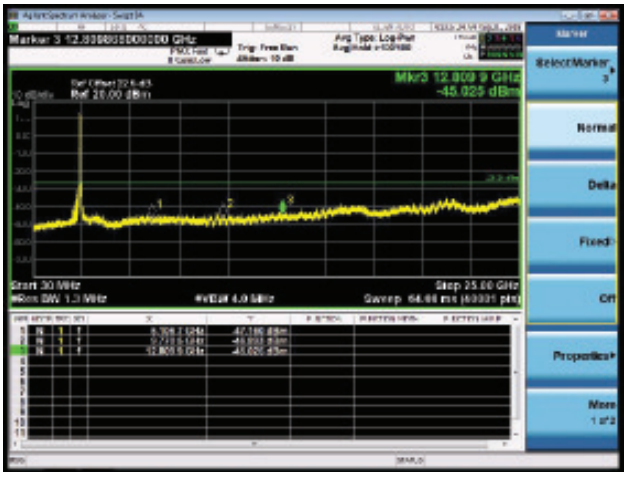
Channel 11 (2462MHz)	
100kHz PSD Reference Level	High Band Edge
	
Spurious Emission	
	

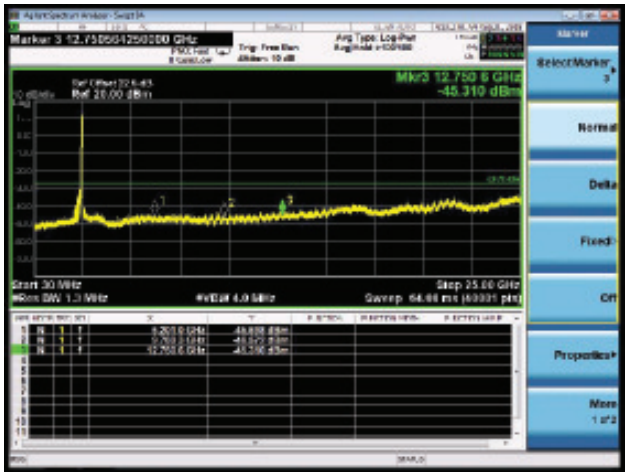
802.11g Out-of-Band Emissions	
Channel 01 (2412MHz)	
100kHz PSD Reference Level	Low Band Edge
	
Spurious Emission	
	
Channel 06 (2437MHz)	
100kHz PSD Reference Level	Spurious Emission
	

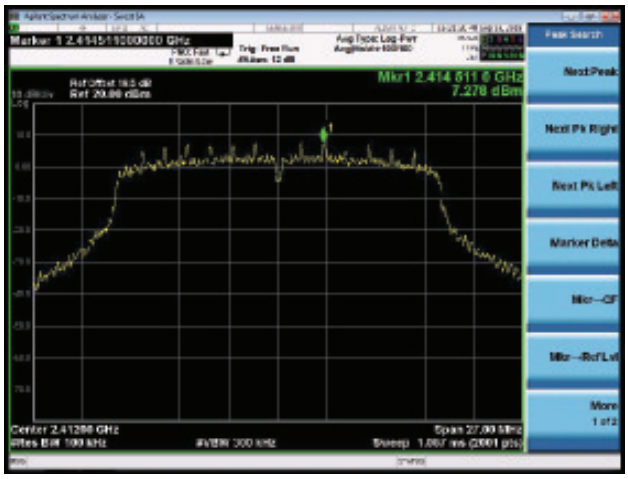
Channel 11 (2462MHz)	
100kHz PSD Reference Level	High Band Edge
	
Spurious Emission	
	

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
	

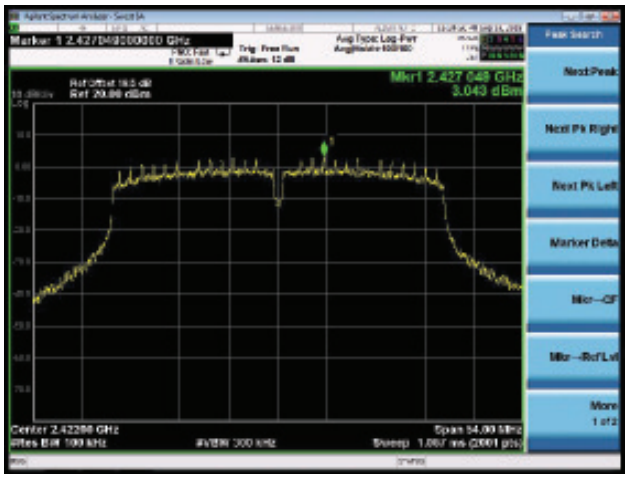
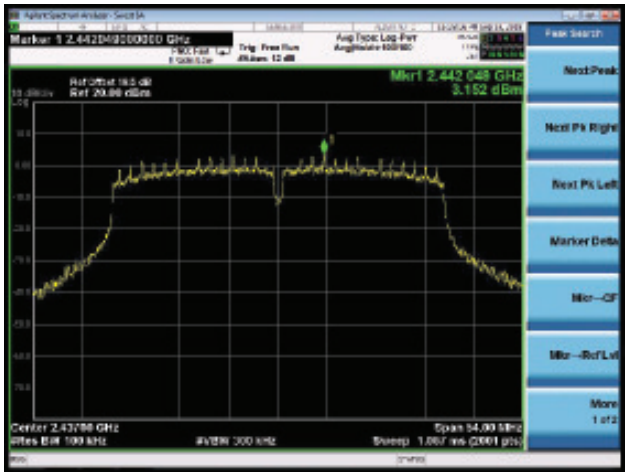
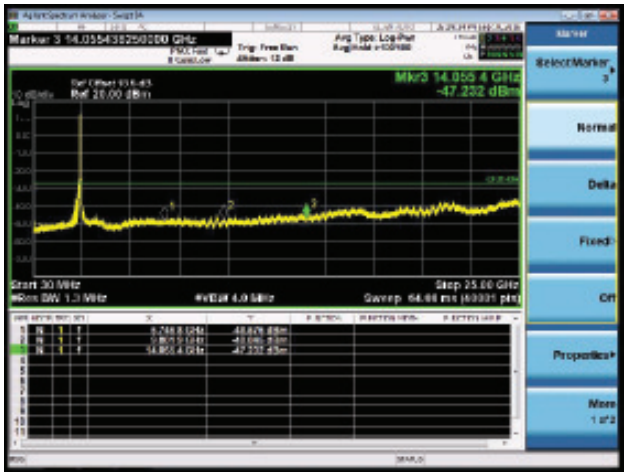
Channel 11 (2462MHz)	
100kHz PSD Reference Level	High Band Edge
	
Spurious Emission	
	

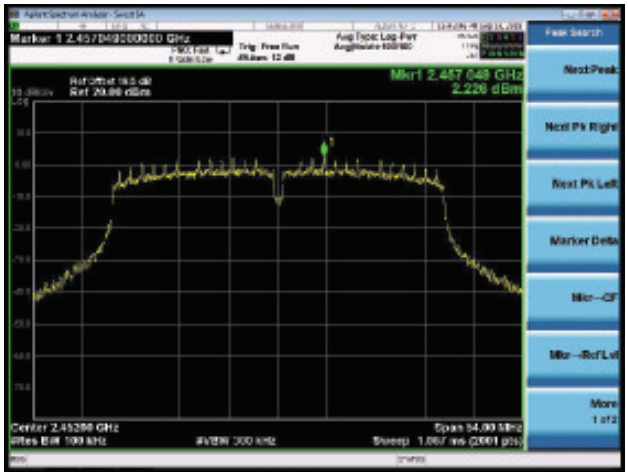
802.11n-HT40 Out-of-Band Emissions	
Channel 03 (2422MHz)	
100kHz PSD Reference Level	Low Band Edge
	
Spurious Emission	
	
Channel 06 (2437MHz)	
100kHz PSD Reference Level	Spurious Emission
	

Channel 09 (2452MHz)	
100kHz PSD Reference Level	High Band Edge
	
Spurious Emission	
	

802.11ac-VHT20 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	
	

802.11ac-VHT40 Out-of-Band Emissions	
Channel 03 (2422MHz)	
100kHz PSD Reference Level	Low Band Edge
	
Spurious Emission	
	
Channel 06 (2437MHz)	
100kHz PSD Reference Level	Spurious Emission
	

Channel 09 (2452MHz)	
100kHz PSD Reference Level	High Band Edge
	
Spurious Emission	
	

6.6. Radiated Spurious Emission Measurement

6.6.1.Test Limit

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

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.6.2.Test Procedure Used

ANSI C63.10 Section 6.3 (General Requirements)

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

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

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

6.6.3.Test Setting

Table 1 - RBW as a function of frequency

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

Quasi-Peak Measurements below 1GHz

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

Peak Measurements above 1GHz

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

Average Measurements above 1GHz (Method VB)

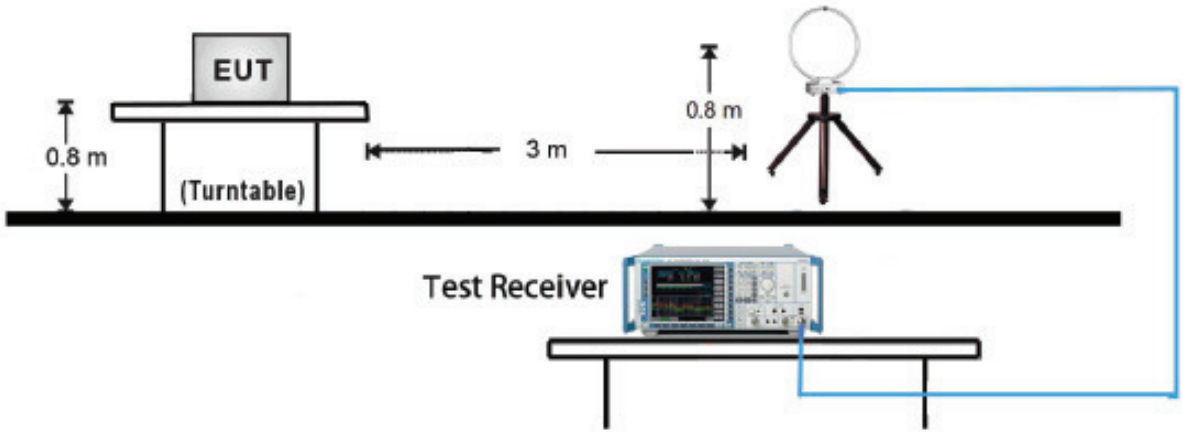
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.

   If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

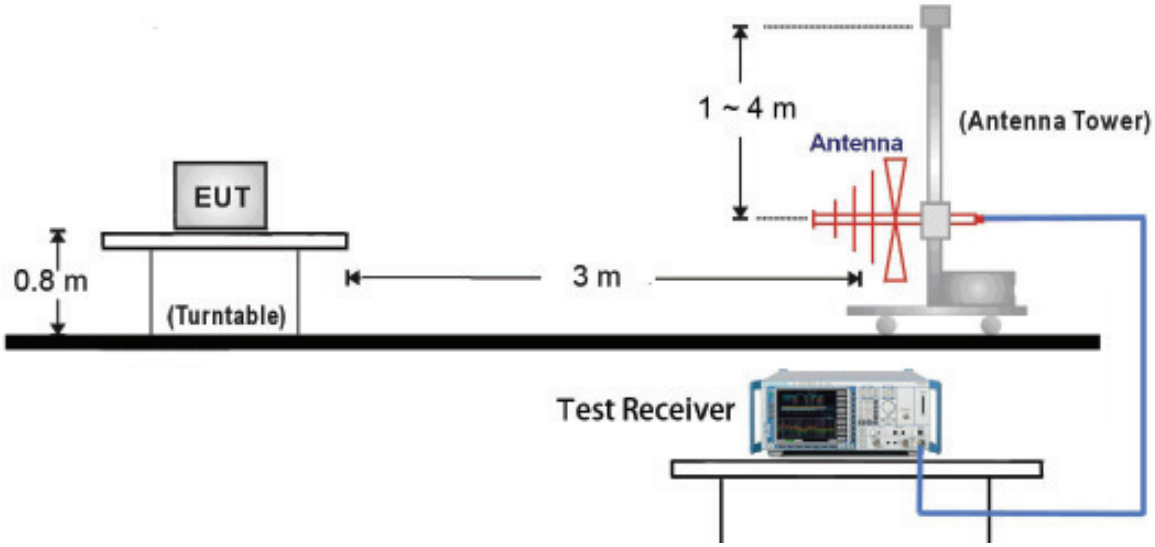
Simultaneously transmitting have been considered.

6.6.4.Test Setup

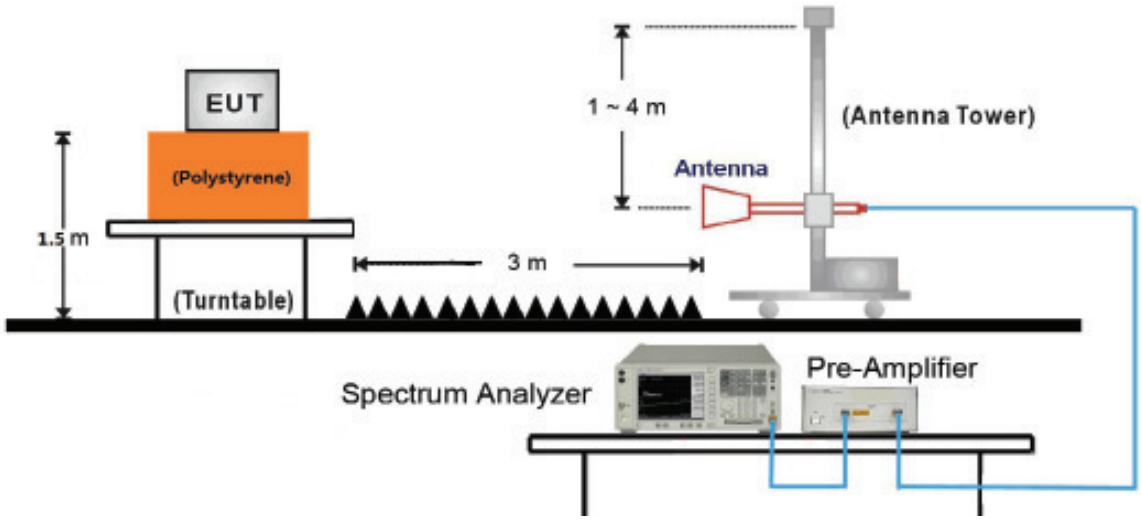
9kHz ~ 30MHz Test Setup:



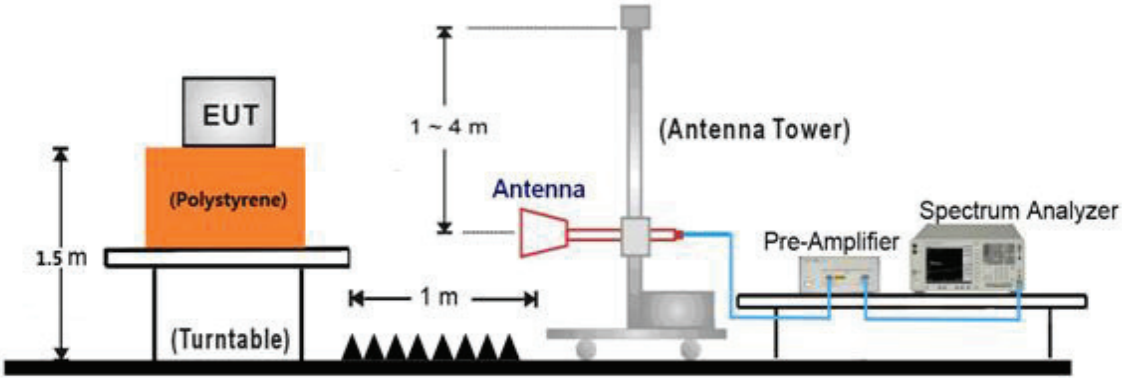
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



18GHz ~25GHz Test Setup:



6.6.5.Test Result

Product	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
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
	4094.0	37.9	3.6	41.5	74.0	-32.5	Peak	Horizontal
	4825.0	37.8	5.9	43.7	74.0	-30.3	Peak	Horizontal
*	6678.0	36.4	10.1	46.5	77.7	-31.2	Peak	Horizontal
*	8701.0	34.5	13.0	47.5	77.7	-30.2	Peak	Horizontal
	4009.0	38.0	3.4	41.4	74.0	-32.6	Peak	Vertical
	4825.0	36.7	5.9	42.6	74.0	-31.4	Peak	Vertical
*	6227.5	34.5	8.6	43.1	77.7	-34.6	Peak	Vertical
*	8718.0	33.7	13.0	46.7	77.7	-31.0	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (107.7dBμV/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)

Product	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
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
	4119.5	36.9	3.7	40.6	74.0	-33.4	Peak	Horizontal
	4944.0	34.9	6.1	41.0	74.0	-33.0	Peak	Horizontal
*	6695.0	33.7	10.1	43.8	77.3	-33.5	Peak	Horizontal
*	8760.5	33.1	13.2	46.3	77.3	-31.0	Peak	Horizontal
	4051.5	38.6	3.5	42.1	74.0	-31.9	Peak	Vertical
	4986.5	37.3	6.2	43.5	74.0	-30.5	Peak	Vertical
*	6397.5	35.9	9.2	45.1	77.3	-32.2	Peak	Vertical
*	8769.0	34.4	13.2	47.6	77.3	-29.7	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (107.3dBμV/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	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
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
	4051.5	38.2	3.5	41.7	74.0	-32.3	Peak	Horizontal
	4927.0	37.8	6.1	43.9	74.0	-30.1	Peak	Horizontal
*	6933.0	34.0	11.1	45.1	76.8	-31.7	Peak	Horizontal
*	9593.5	33.0	15.2	48.2	76.8	-28.6	Peak	Horizontal
	4119.5	38.1	3.7	41.8	74.0	-32.2	Peak	Vertical
	4731.5	38.2	5.7	43.9	74.0	-30.1	Peak	Vertical
*	6202.0	36.0	8.4	44.4	76.8	-32.4	Peak	Vertical
*	8760.5	33.5	13.2	46.7	76.8	-30.1	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (106.8dBμV/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)

Product	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
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
	3822.0	38.6	2.8	41.4	74.0	-32.6	Peak	Horizontal
	4825.0	37.3	5.9	43.2	74.0	-30.8	Peak	Horizontal
*	6593.0	36.5	10.2	46.7	80.5	-33.8	Peak	Horizontal
*	8735.0	34.1	13.0	47.1	80.5	-33.4	Peak	Horizontal
	4060.0	38.2	3.5	41.7	74.0	-32.3	Peak	Vertical
	4833.5	36.5	5.9	42.4	74.0	-31.6	Peak	Vertical
*	6329.5	36.3	9.0	45.3	80.5	-35.2	Peak	Vertical
*	8667.0	36.2	12.9	49.1	80.5	-31.4	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (110.5dBμV/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	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
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
	3779.5	38.5	2.6	41.1	74.0	-32.9	Peak	Horizontal
	4901.5	37.2	6.0	43.2	74.0	-30.8	Peak	Horizontal
*	6185.0	34.3	8.3	42.6	80.8	-38.2	Peak	Horizontal
*	7834.0	34.1	13.2	47.3	80.8	-33.5	Peak	Horizontal
	4000.5	38.1	3.3	41.4	74.0	-32.6	Peak	Vertical
	4893.0	36.7	6.0	42.7	74.0	-31.3	Peak	Vertical
*	5768.5	36.9	7.4	44.3	80.8	-36.5	Peak	Vertical
*	7936.0	35.8	13.5	49.3	80.8	-31.5	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (110.8dBμV/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)

Product	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
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
	4077.0	39.4	3.5	42.9	74.0	-31.1	Peak	Horizontal
	5046.0	36.3	6.5	42.8	74.0	-31.2	Peak	Horizontal
*	6567.5	35.7	10.2	45.9	79.1	-33.2	Peak	Horizontal
*	8735.0	33.5	13.0	46.5	79.1	-32.6	Peak	Horizontal
	4034.5	38.0	3.4	41.4	74.0	-32.6	Peak	Vertical
	4884.5	36.4	6.0	42.4	74.0	-31.6	Peak	Vertical
*	6049.0	36.5	7.9	44.4	79.1	-34.7	Peak	Vertical
*	8854.0	35.0	13.4	48.4	79.1	-30.7	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (109.1dBμV/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	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
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
	4204.5	37.2	4.0	41.2	74.0	-32.8	Peak	Horizontal
	5114.0	37.0	6.6	43.6	74.0	-30.4	Peak	Horizontal
*	6142.5	36.6	8.2	44.8	80.1	-35.3	Peak	Horizontal
*	9772.0	32.6	16.2	48.8	80.1	-31.3	Peak	Horizontal
	4119.5	37.9	3.7	41.6	74.0	-32.4	Peak	Vertical
	4927.0	36.8	6.1	42.9	74.0	-31.1	Peak	Vertical
*	6244.5	36.5	8.6	45.1	80.1	-35.0	Peak	Vertical
*	8743.5	33.9	13.1	47.0	80.1	-33.1	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (110.1dBμV/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	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
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
	4068.5	37.9	3.5	41.4	74.0	-32.6	Peak	Horizontal
	5029.0	36.8	6.4	43.2	74.0	-30.8	Peak	Horizontal
*	6550.5	36.6	10.2	46.8	80.4	-33.6	Peak	Horizontal
*	8667.0	35.7	12.9	48.6	80.4	-31.8	Peak	Horizontal
	3907.0	38.2	3.1	41.3	74.0	-32.7	Peak	Vertical
	4867.5	37.6	6.0	43.6	74.0	-30.4	Peak	Vertical
*	6576.0	36.0	10.2	46.2	80.4	-34.2	Peak	Vertical
*	10231.0	34.6	17.1	51.7	80.4	-28.7	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (110.4dBμV/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	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
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
	4094.0	38.3	3.6	41.9	74.0	-32.1	Peak	Horizontal
	4893.0	37.0	6.0	43.0	74.0	-31.0	Peak	Horizontal
*	6066.0	36.7	8.0	44.7	78.8	-34.1	Peak	Horizontal
*	9976.0	35.0	16.7	51.7	78.8	-27.1	Peak	Horizontal
	4102.5	37.5	3.6	41.1	74.0	-32.9	Peak	Vertical
	5037.5	36.6	6.5	43.1	74.0	-30.9	Peak	Vertical
*	6542.0	36.3	10.1	46.4	78.8	-32.4	Peak	Vertical
*	9746.5	35.4	16.1	51.5	78.8	-27.3	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (108.8dBμV/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)

Product	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
Test Mode:	802.11n-HT40	Test Channel:	03
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
	4060.0	38.0	3.5	41.5	74.0	-32.5	Peak	Horizontal
	4842.0	37.3	5.9	43.2	74.0	-30.8	Peak	Horizontal
*	6542.0	35.9	10.1	46.0	75.5	-29.5	Peak	Horizontal
*	9925.0	34.4	16.6	51.0	75.5	-24.5	Peak	Horizontal
	4289.5	36.9	4.3	41.2	74.0	-32.8	Peak	Vertical
	4944.0	36.8	6.1	42.9	74.0	-31.1	Peak	Vertical
*	6644.0	35.9	10.1	46.0	75.5	-29.5	Peak	Vertical
*	10307.5	34.4	17.3	51.7	75.5	-23.8	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (105.5dBμV/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	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
Test Mode:	802.11n-HT40	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
	4077.0	38.1	3.5	41.6	74.0	-32.4	Peak	Horizontal
	5071.5	37.0	6.5	43.5	74.0	-30.5	Peak	Horizontal
*	7086.0	36.2	11.9	48.1	75.2	-27.1	Peak	Horizontal
*	10350.0	35.5	17.3	52.8	75.2	-22.4	Peak	Horizontal
	4255.5	37.7	4.2	41.9	74.0	-32.1	Peak	Vertical
	5054.5	36.3	6.5	42.8	74.0	-31.2	Peak	Vertical
*	6550.5	36.4	10.2	46.6	75.2	-28.6	Peak	Vertical
*	10163.0	35.0	17.0	52.0	75.2	-23.2	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (105.2dBμV/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	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/08/23
Test Mode:	802.11n-HT40	Test Channel:	09
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
	4034.5	37.7	3.4	41.1	74.0	-32.9	Peak	Horizontal
	4893.0	36.4	6.0	42.4	74.0	-31.6	Peak	Horizontal
*	6584.5	36.4	10.2	46.6	74.2	-27.6	Peak	Horizontal
*	9857.0	34.7	16.7	51.4	74.2	-22.8	Peak	Horizontal
	4051.5	38.4	3.5	41.9	74.0	-32.1	Peak	Vertical
	5012.0	36.3	6.3	42.6	74.0	-31.4	Peak	Vertical
*	6899.0	36.0	10.8	46.8	74.2	-27.4	Peak	Vertical
*	10180.0	34.9	17.1	52.0	74.2	-22.2	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc 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	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/09/16
Test Mode:	802.11ac-VHT20	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
	4842.0	36.7	5.9	42.7	74.0	-31.3	Peak	Horizontal
	7443.0	35.7	12.9	48.6	74.0	-25.4	Peak	Horizontal
*	8828.5	35.7	13.3	49.0	80.0	-31.0	Peak	Horizontal
*	10035.5	33.9	16.7	50.6	80.0	-29.4	Peak	Horizontal
	4060.0	39.4	3.5	42.9	74.0	-31.1	Peak	Vertical
	4935.5	37.0	6.1	43.1	74.0	-30.9	Peak	Vertical
*	7919.0	35.9	13.4	49.3	80.0	-30.7	Peak	Vertical
*	9840.0	35.9	16.7	52.6	80.0	-27.4	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (110.0dBμV/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	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/09/16
Test Mode:	802.11ac-VHT20	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
	4051.5	38.3	3.5	41.8	74.0	-32.2	Peak	Horizontal
	4748.5	36.0	5.7	41.7	74.0	-32.3	Peak	Horizontal
*	6134.0	34.4	8.2	42.6	80.0	-37.4	Peak	Horizontal
*	9840.0	35.9	16.7	52.6	80.0	-27.4	Peak	Horizontal
	4068.5	38.4	3.5	41.9	74.0	-32.1	Peak	Vertical
	5097.0	36.7	6.6	43.3	74.0	-30.7	Peak	Vertical
*	6916.0	35.5	10.9	46.5	80.0	-33.5	Peak	Vertical
*	9721.0	34.7	15.7	50.4	80.0	-29.6	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (110.0dBμV/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	W-LAN + Bluetooth Module	Temperature	26°C
Test Engineer	Dandy Li	Relative Humidity	56%
Test Site	AC1	Test Date	2018/09/16
Test Mode:	802.11ac-VHT20	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
	3720.0	38.4	2.4	40.8	74.0	-33.2	Peak	Horizontal
	4918.5	36.6	6.1	42.7	74.0	-31.3	Peak	Horizontal
*	7842.5	35.1	13.3	48.4	80.0	-31.6	Peak	Horizontal
*	9925.0	34.8	16.6	51.4	80.0	-28.6	Peak	Horizontal
	3932.5	37.9	3.2	41.1	74.0	-32.9	Peak	Vertical
	5105.5	37.0	6.6	43.6	74.0	-30.4	Peak	Vertical
*	8650.0	36.2	13.0	49.1	80.0	-30.9	Peak	Vertical
*	10222.5	32.5	17.1	49.6	80.0	-30.4	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (110.0dBμV/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)