FCC TEST REPORT

For

Wapeul Co.

WyPLUG

Test Model: WP0015

Prepared for	:	Wapeul Co.
Address	:	G-849 (8F), 815, Daewangpangyo-ro Sujeong-gu, Seongnam-si, Gyeonggi-do,Republic of Korea(south korea)
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
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Web	:	www.LCS-cert.com
Mail	:	webmaster@LCS-cert.com
Date of receipt of test sample	:	November 28, 2017
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	December 25, 2017~January 12, 2018
Date of Report	:	January 12, 2018

FCC TEST REPORT
FCC CFR 47 PART 15 C(15.247)

Report Reference No.	**:**	**LCS171128003AEA**
Date of Issue	:	January 12, 2018
Testing Laboratory Name.....	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
**Applicant's Name ..... **	**:**	**Wapeul Co.**
Address	:	G-849 (8F), 815, Daewangpangyo-ro Sujeong-gu, Seongnam-si, Gyeonggi-do,Republic of Korea(south korea)
Test Specification		
Standard	:	FCC CFR 47 PART 15 C(15.247)
Test Report Form No.	:	LCSEMC-1.0
TRF Originator.....	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	:	Dated 2011-03

**EUT Description. ..... **	**:**	**WyPLUG**
Trade Mark	:	WyPLUG
Test Model.....	:	WP0015
Ratings	:	INPUT: AC 110/220V, 50/60Hz, 1.5 A MAX OUTPUT: DC 5V/1.5A
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Linda He	Dick Su	Gavin Liang
Linda He/ File administrators	Dick Su/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS171128003AEA	January 12, 2018 Date of issue

EUT.....	: WP0015
Test Model.....	: WyPLUG
Applicant.....	**: Wapeul Co.**
Address.....	: G-849 (8F), 815, Daewangpangyo-ro Sujeong-gu, Seongnam-si, Gyeonggi-do,Republic of Korea(south korea)
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Wapeul Co.**
Address.....	: G-849 (8F), 815, Daewangpangyo-ro Sujeong-gu, Seongnam-si, Gyeonggi-do,Republic of Korea(south korea)
Telephone.....	: /
Fax.....	: /
Factory.....	**: Wapeul Co.**
Address.....	: G-849 (8F), 815, Daewangpangyo-ro Sujeong-gu, Seongnam-si, Gyeonggi-do,Republic of Korea(south korea)
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	January 12, 2018	Initial Issue	Gavin Liang

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	: WyPLUG
Additional Model No.	: /
Model Declaration	: /
Test Model	: WyPLUG
Power Supply	: INPUT: AC 110/220V, 50/60Hz, 1.5 A MAX OUTPUT: DC 5V/1.5A
Hardware version	: 1.5
Software version	: 1.5
WLAN	: Supported 802.11b/g/n20(HT20)/n40(HT40)
WLAN FCC Operation Frequency	: IEEE 802.11b/g/n20(HT20):2412-2462MHz IEEE 802.11n40(HT40):2422-2452MHz
WLAN Channel Number	: 11 Channels for WIFI 20MHz Bandwidth(802.11b/g/n-HT20) 9 Channels for WIFI 40MHz Bandwidth(802.11n-HT40)
WLAN Modulation Technology	IEEE 802.11b/g/n20(HT20): DSSS(CCK,DQPSK,DBPSK) IIEEE 802.11n(HT40): OFDM (64QAM, 16QAM,QPSK,BPSK)
Antenna Type And Gain	: Chain 0: Internal Antenna 1.0dBi(Max.) Chain 1: Internal Antenna 1.0dBi(Max.)

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
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1.3. External I/O Cable

I/O Port Description	Quantity	Cable
LAN Port	1	N/A

1.4. Description of Test Facility

FCC Registration Number. is 254912.
Industry Canada Registration Number. is 9642A-1.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001
NVLAP Registration Code is 600167-0

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7. Description of Test Modes

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
Worst-case mode and channel used for 150kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power, that was determined to be 802.11b mode(High Channel).
Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be 802.11b mode(High Channel).
Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:
802.11b Mode: 1 Mbps, DSSS.
802.11g Mode: 6 Mbps, OFDM.
802.11n Mode HT20: MCS0, OFDM.
802.11n Mode HT40: MCS0, OFDM.

Channel List & Frequency

802.11b/g/n(HT20)

Frequency Band	Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)
2412~2462MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437	--	--

IEEE 802.11n HT40

Frequency Band	Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)
2422~2452MHz	1	--	7	2442
	2	--	8	2447
	3	2422	9	2452
	4	2427	10	--
	5	2432	11	--
	6	2437	--	--

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd..

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure KDB558074 D01 DTS Meas. Guidance v04 are required to be used for this kind of FCC 15.247 digital modulation device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmits condition.

3.2. EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software (MT7620QA) provided by application.

3.3. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
Lenovo	PC	B470	--	DOC
Lenovo	AC/DC ADAPTER	ADP-90DDB	--	DOC

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C		
FCC Rules	**Description of Test**	**Result**
§15.247(b)	Maximum Conducted Output Power	Compliant
§15.247(e)	Power Spectral Density	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.247(a)	Occupied Bandwidth	Compliant
§15.209, §15.247(d)	Radiated and Conducted Spurious Emissions	Compliant
§15.205	Emissions at Restricted Band	Compliant
§15.207(a)	Conducted Emissions	Compliant
§15.203	Antenna Requirements	Compliant
§15.247(i)§2.1093	RF Exposure	Compliant

5. TEST RESULT

5.1. On Time and Duty Cycle

5.1.1. Standard Applicable

None; for reporting purpose only.

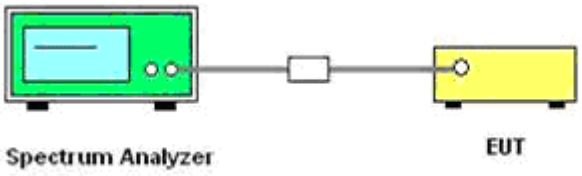
5.1.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the spectrum analyser.

5.1.3. Test Procedures

1. Set the centre frequency of the spectrum analyser to the transmitting frequency;
2. Set the span=0MHz, RBW=8MHz, VBW=50MHz, Sweep time=5ms;
3. Detector = peak;
4. Trace mode = Single hold.

5.1.4. Test Setup Layout



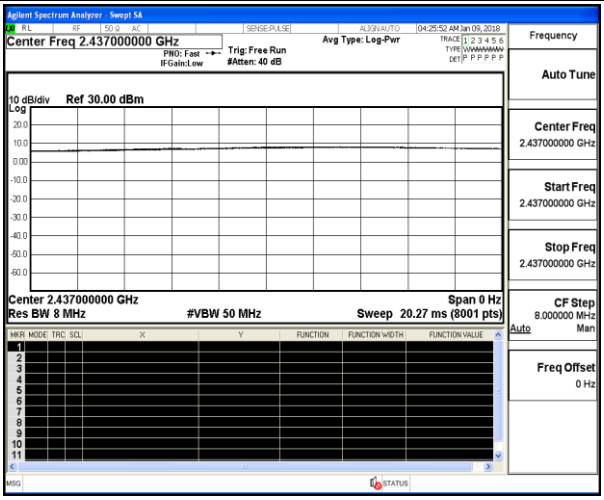
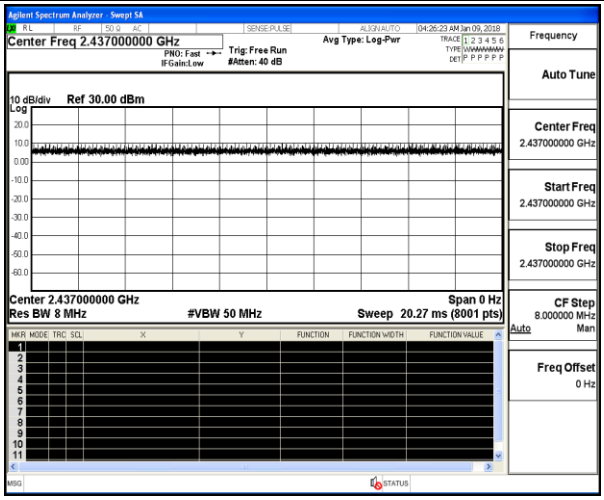
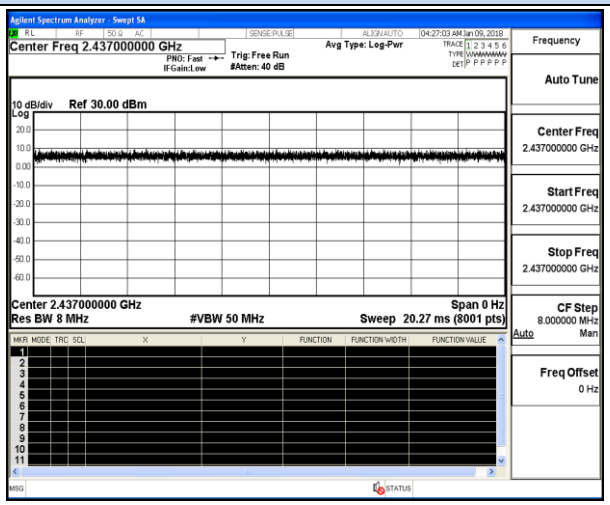
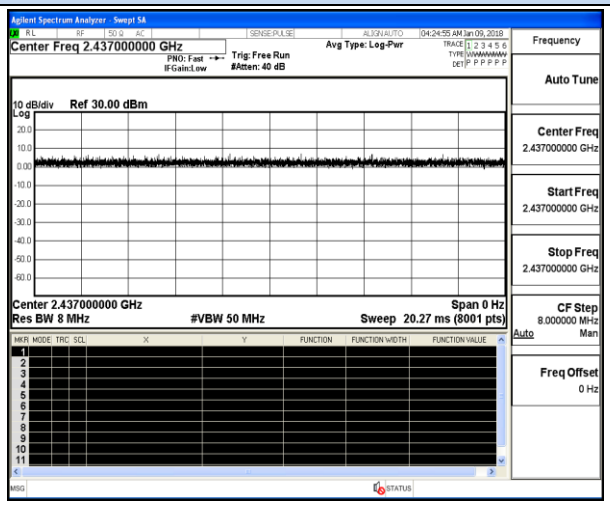
5.1.5. EUT Operation during Test

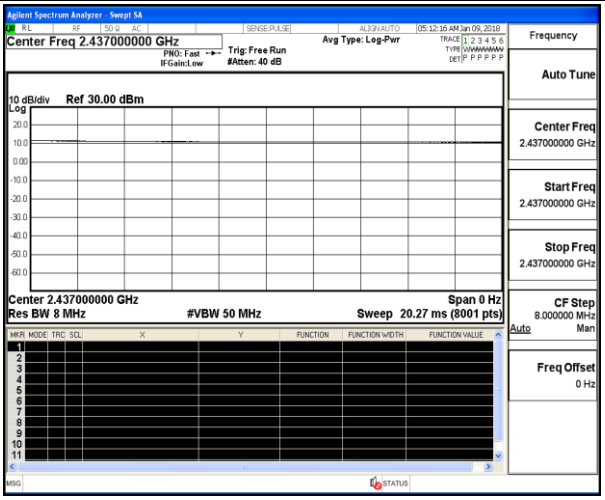
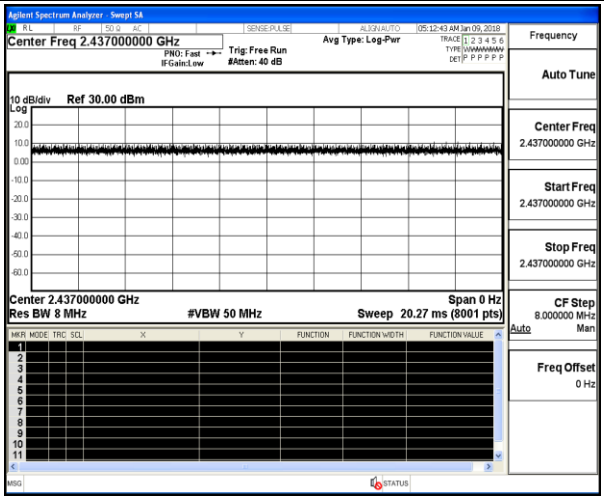
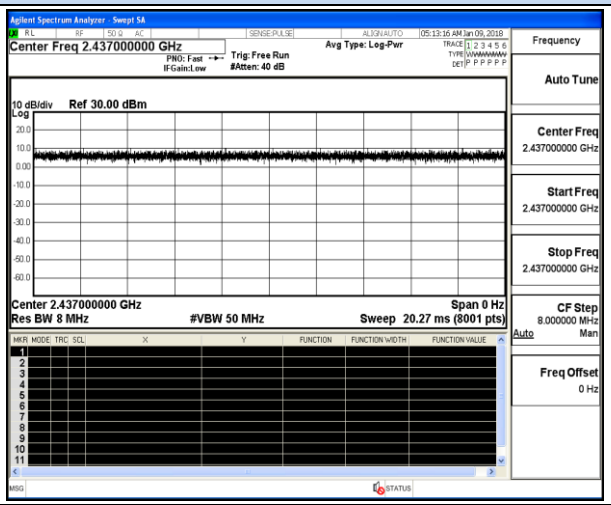
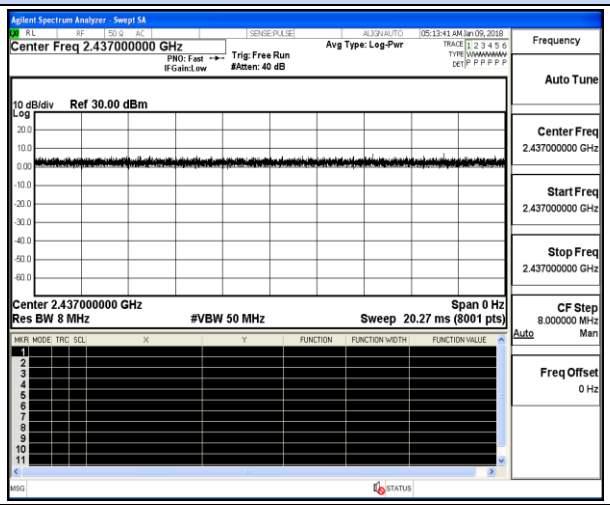
The EUT was programmed to be in continuously transmitting mode.

5.1.6. Test result

(Note: Chain 0 and Chain 1 are the same result.)

Mode	On Time B (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW(KHz)
802.11b	5	5	1	100	0	0.010
802.11g	5	5	1	100	0	0.010
802.11n -HT20	5	5	1	100	0	0.010
802.11n -HT40	5	5	1	100	0	0.010

Test plot of On Time and Duty Cycle(Chain 0)	
	
802.11b	802.11g
	
802.11n-HT20	802.11n-HT40

Test plot of On Time and Duty Cycle (Chain 1)	
	
802.11b	802.11g
	
802.11n-HT20	802.11n-HT40

5.2. Maximum Conducted Output Power Measurement

5.2.1. Standard Applicable

According to §15.247(b): For systems using digital modulation in the 2400-2483.5 MHz and 5725-5850 MHz band, the limit for maximum peak conducted output power is 30dBm. The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi without any corresponding reduction in transmitter peak output power.

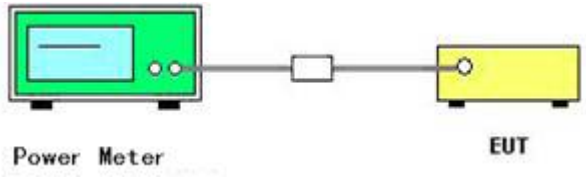
5.2.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the power meter.

5.2.3. Test Procedures

The transmitter output (antenna port) was connected to the power meter.

5.2.4. Test Setup Layout



5.2.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.2.6. Test Result of Maximum Conducted Output Power

Temperature	24.6℃	Humidity	48.4%
Test Engineer	Wilson Hong	Configurations	802.11b/g/n

Test Mode	Channel	Frequency (MHz)	Measured Peak Output Power (dBm)			Limits (dBm)	Verdict
			Chain0	Chain1	Sum		
IEEE 802.11b	1	2412	16.37	16.56	/	30	PASS
	6	2437	16.52	16.46	/		
	11	2462	16.31	16.27	/		
IEEE 802.11g	1	2412	18.05	17.97	/	30	PASS
	6	2437	17.07	17.22	/		
	11	2462	16.79	17.00	/		
IEEE 802.11n HT20	1	2412	17.72	17.75	20.75	30	PASS
	6	2437	17.19	17.43	20.32		
	11	2462	17.17	16.98	20.09		
IEEE 802.11n HT40	3	2422	16.99	18.09	20.59	30	PASS
	6	2437	17.34	17.54	20.45		
	9	2452	17.65	17.66	20.67		

Remark:

1. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*

Worst case data at 1Mbps at IEEE 802.11b; 6Mbps at IEEE 802.11g; 6.5Mbps at IEEE 802.11n HT20; 13.5Mbps at IEEE 802.11n HT40;

5.3. Power Spectral Density Measurement

5.3.1. Standard Applicable

According to §15.247(e): For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

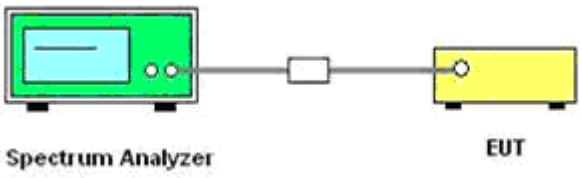
5.3.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

5.3.3. Test Procedures

1. The transmitter was connected directly to a Spectrum Analyzer through a directional couple.
2. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3. Set the RBW = 3 kHz~100 kHz.
4. Set the VBW ≥ 3*RBW
5. Set the span to 1.5 times the DTS channel bandwidth.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum power level in any 3 kHz band segment within the fundamental EBW.

5.3.4. Test Setup Layout



5.3.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

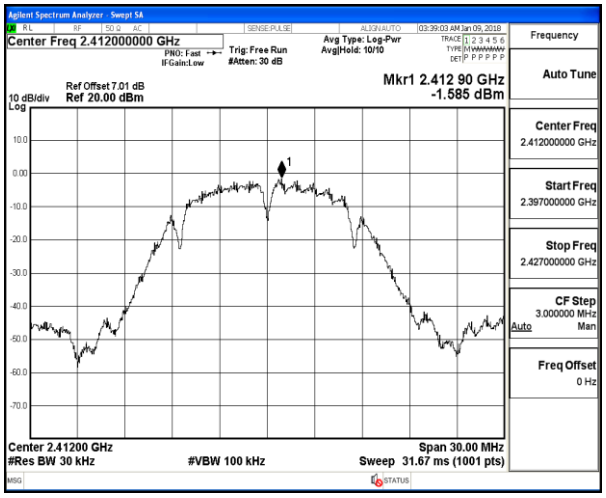
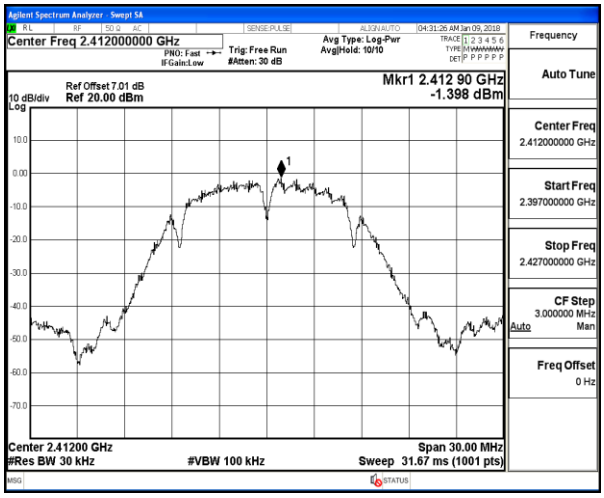
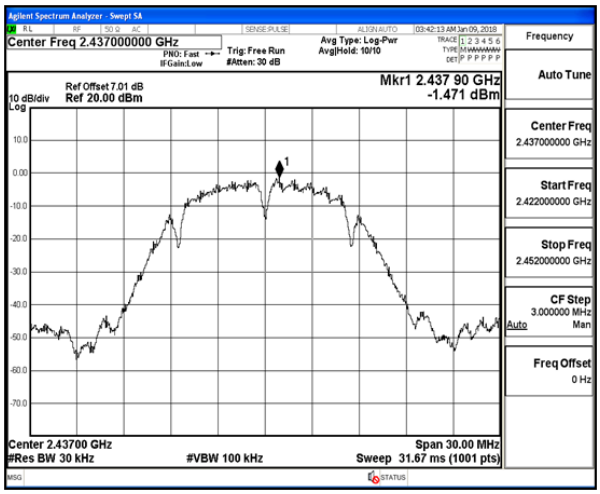
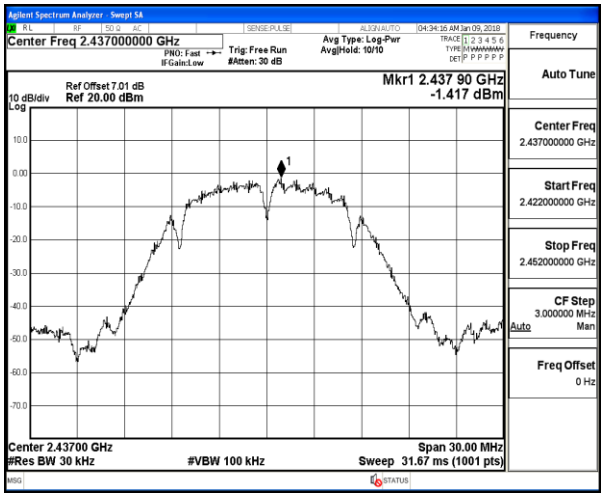
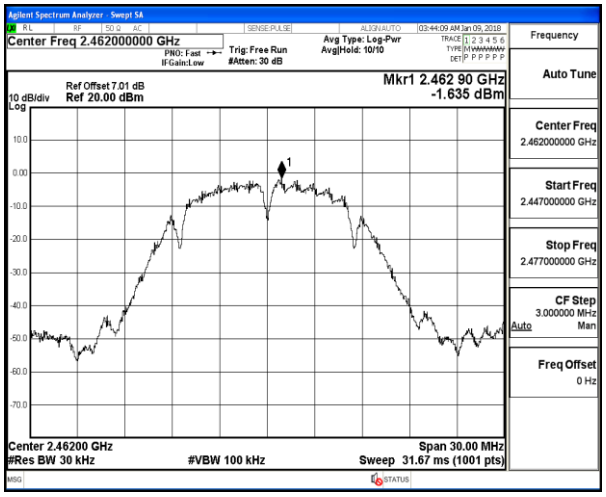
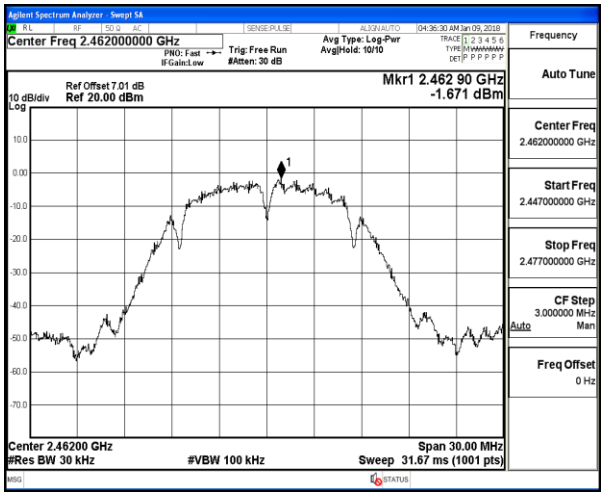
5.3.6. Test Result of Power Spectral Density

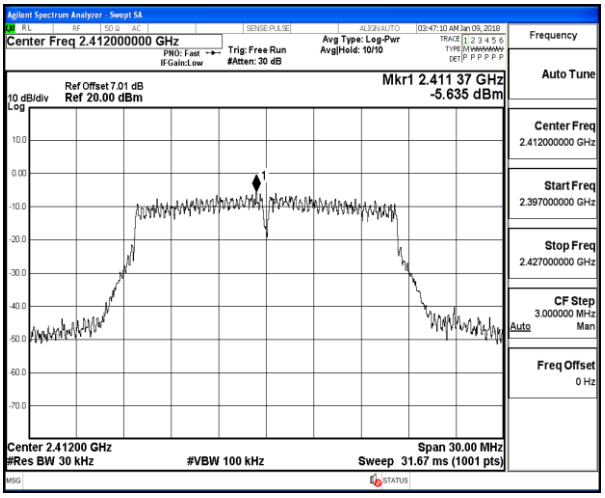
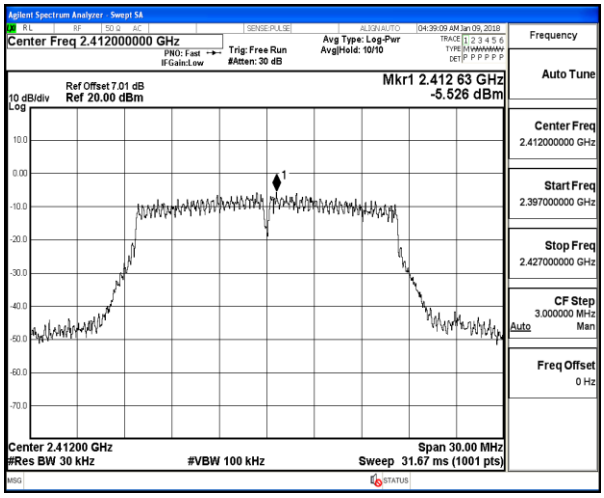
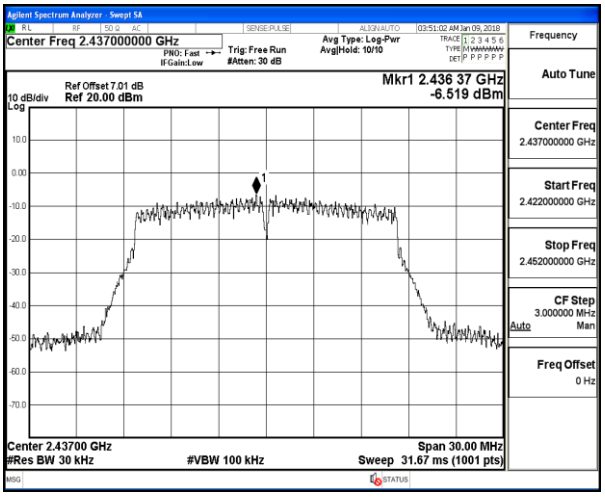
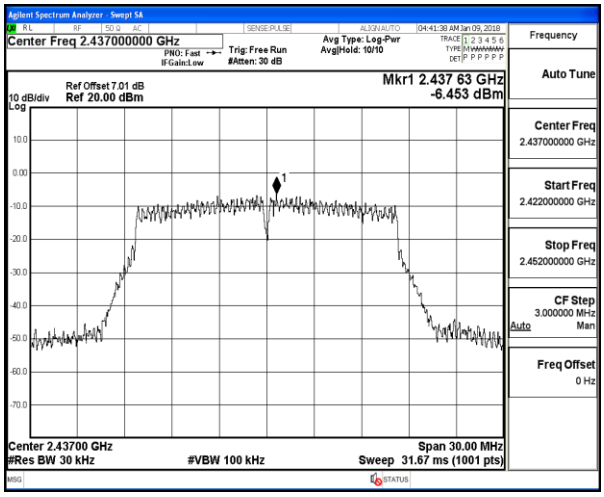
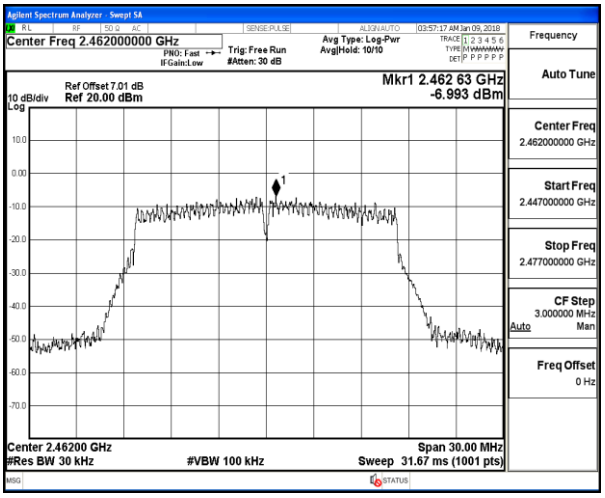
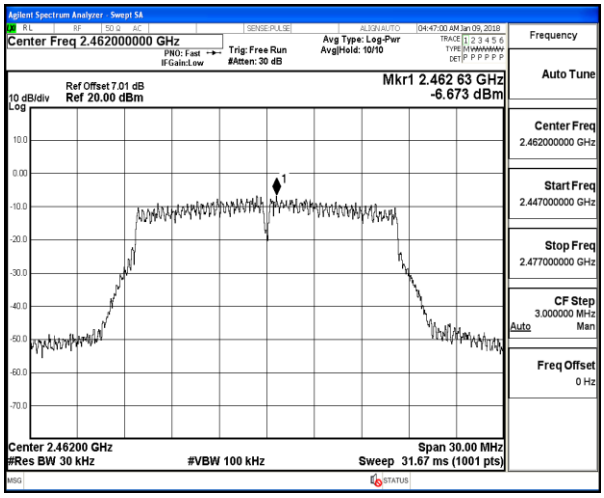
Temperature	24.6℃	Humidity	48.4%
Test Engineer	Wilson Hong	Configurations	802.11b/g/n

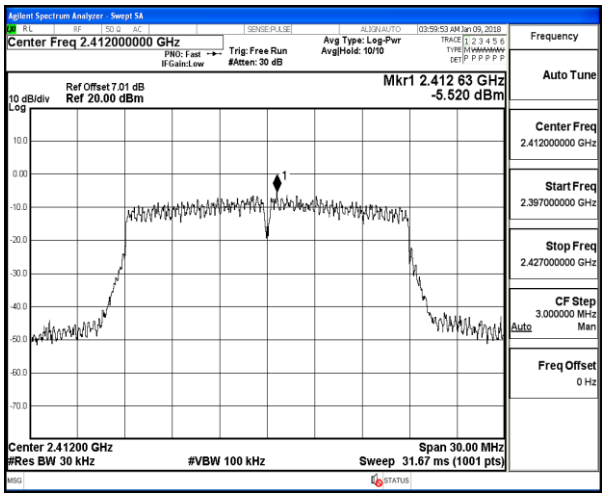
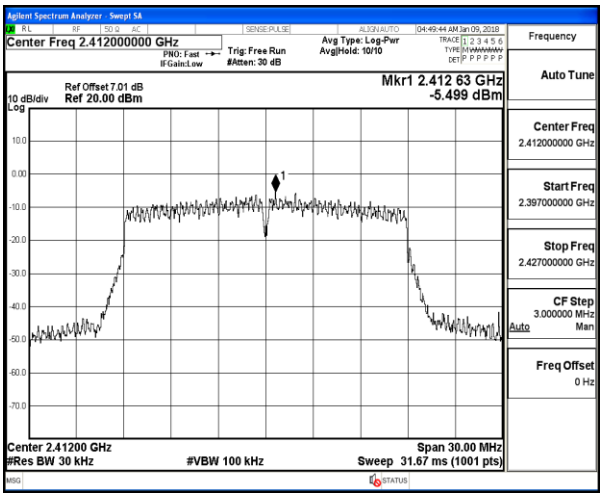
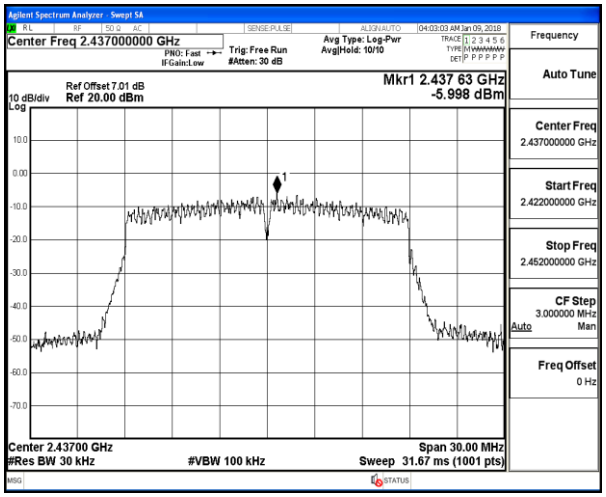
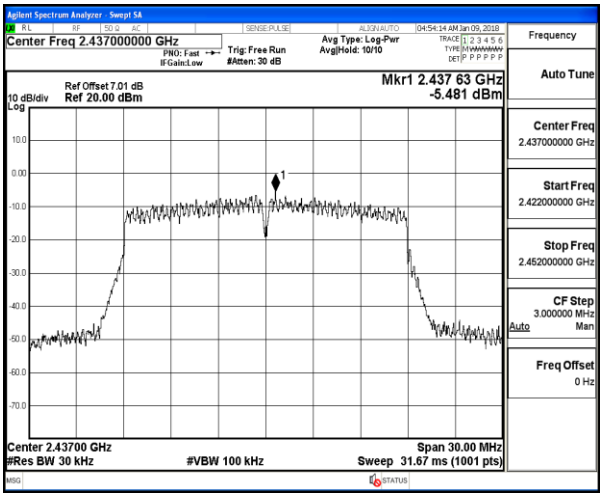
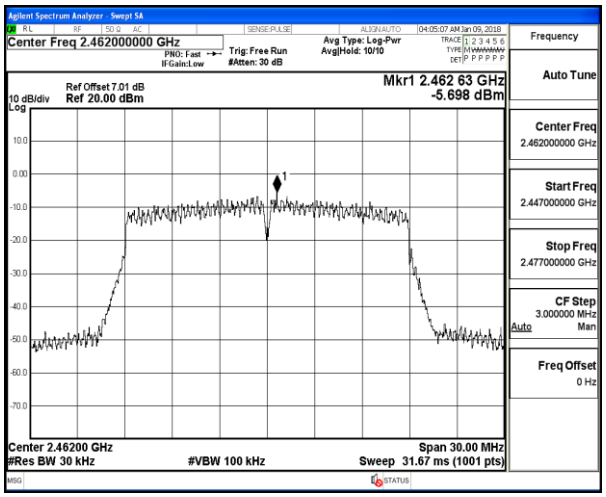
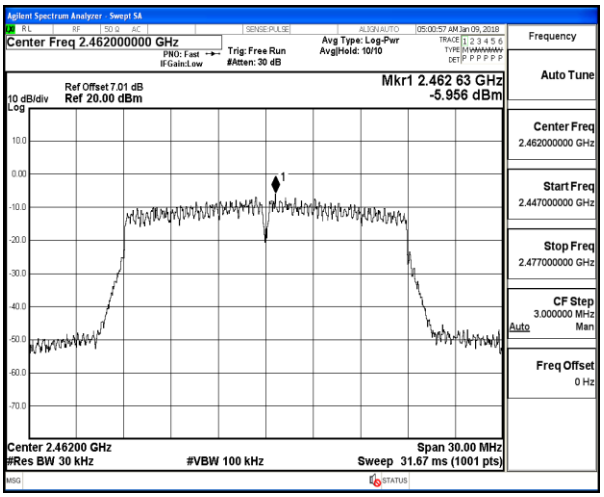
Test Mode	Channel	Frequency (MHz)	Measured Peak Power Spectrum Density (dBm/30KHz)			Limits (dBm/30KHz)	Verdict
			Chain0	Chain1	Sum		
IEEE 802.11b	1	2412	-1.585	-1.398	/	8	PASS
	6	2437	-1.471	-1.417	/		
	11	2462	-1.635	-1.671	/		
IEEE 802.11g	1	2412	-5.635	-5.526	/	8	PASS
	6	2437	-6.519	-6.453	/		
	11	2462	-6.993	-6.673	/		
IEEE 802.11n HT20	1	2412	-5.52	-5.499	-2.50	4.990*	PASS
	6	2437	-5.998	-5.481	-2.72		
	11	2462	-5.698	-5.956	-2.81		
IEEE 802.11n HT40	3	2422	-10.422	-9.498	-6.93	4.990*	PASS
	6	2437	-10.29	-9.479	-6.86		
	9	2452	-9.99	-9.616	-6.79		

Remark:

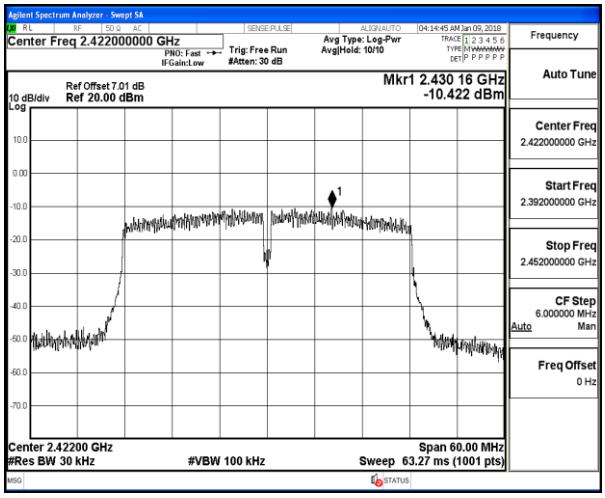
1. *Measured peak power spectrum density at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 1Mbps at IEEE 802.11b; 6Mbps at IEEE 802.11g; 6.5Mbps at IEEE 802.11n HT20; 13.5Mbps at IEEE 802.11n HT40;*
   Please refer to following plots;
4. *The PSD limits of IEEE 802.11n HT20 for MIMO with CDD technology should be reduce (10*log(2) =3.010dBi according to KDB662911D01;*
5. *For MIMO with CCD technology device, The Directional Gain= Gain of individual transmit antennas (dBi) + Array gain;*
   Array gain = 10 log (N_{ant}), where N_{ant} is the number of transmit antennas.

Test plot of Power Spectral Density	
	
802.11b Chain 0-Low channel	802.11b Chain 1-Low channel
	
802.11b Chain 0-Middle channel	802.11b Chain 1-Middle channel
	
802.11b Chain 0-High channel	802.11b Chain 1-High channel

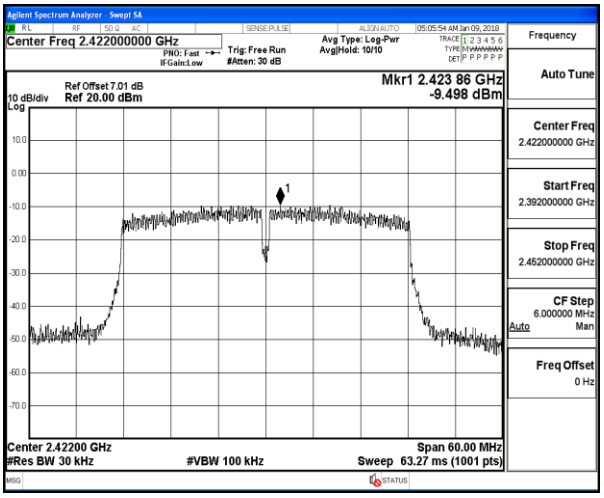
Test plot of Power Spectral Density	
	
802.11g Chain 0-Low channel	802.11g Chain 1-Low channel
	
802.11g Chain 0-Middle channel	802.11g Chain 1-Middle channel
	
802.11g Chain 0-High channel	802.11g Chain 1-High channel

Test plot of Power Spectral Density	
	
802.11n-HT20 Chain 0-Low channel	802.11n-HT20 Chain 1-Low channel
	
802.11n-HT20 Chain 0-Middle channel	802.11n-HT20 Chain 1-Middle channel
	
802.11n-HT20 Chain 0-High channel	802.11n-HT20 Chain 1-High channel

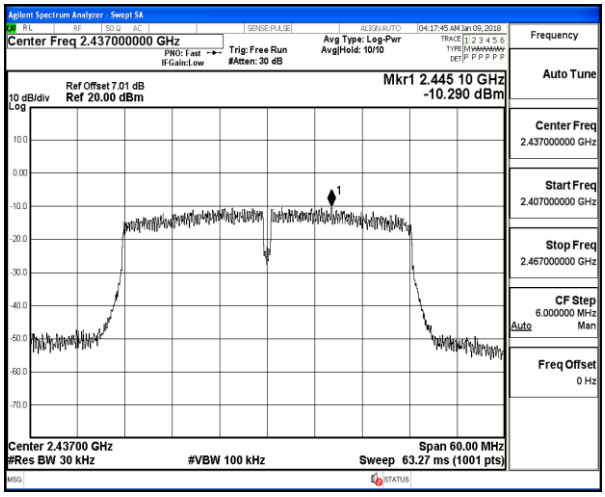
Test plot of Power Spectral Density



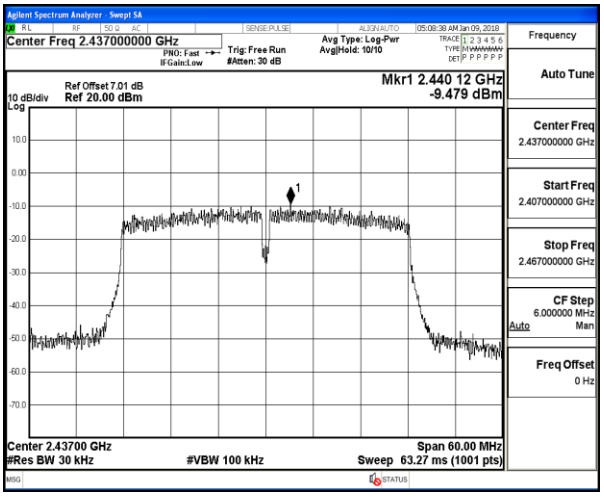
802.11n-HT40 Chain 0-Low channel



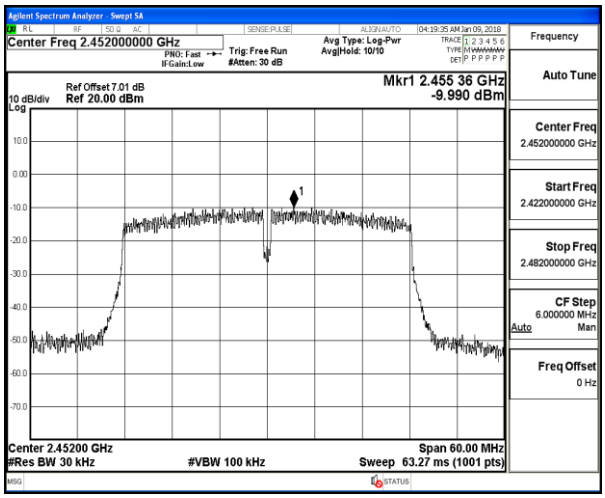
802.11n-HT40 Chain 1-Low channel



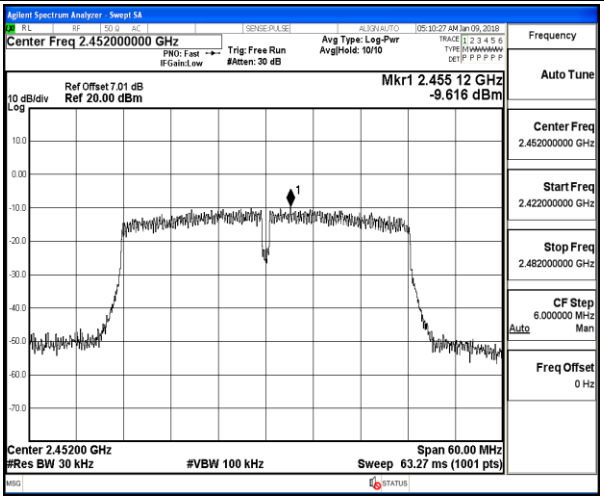
802.11n-HT40 Chain 0-Middle channel



802.11n-HT40 Chain 1-Middle channel



802.11n-HT40 Chain 0-High channel



802.11n-HT40 Chain 1-High channel

5.4. 6 dB Spectrum Bandwidth Measurement

5.4.1. Standard Applicable

According to §15.247(a)(2): For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

5.4.2. Measuring Instruments and Setting

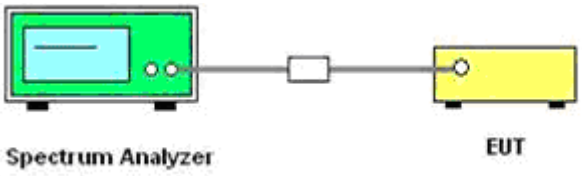
Please refer to section 6 of equipments list in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> RBW
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

5.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth and the video bandwidth were set according to KDB558074.
3. Measured the spectrum width with power higher than 6dB below carrier.

5.4.4. Test Setup Layout



5.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

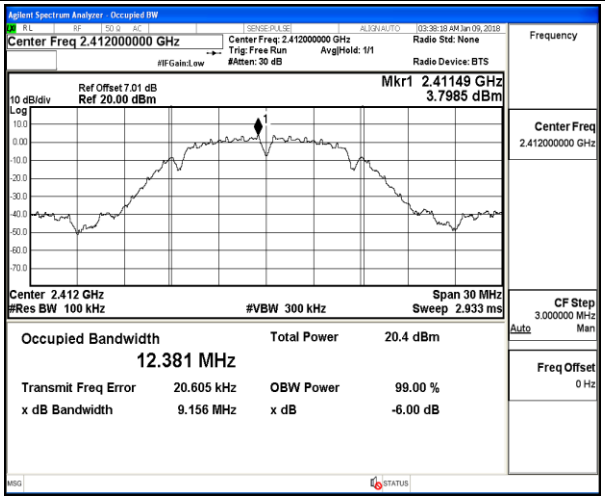
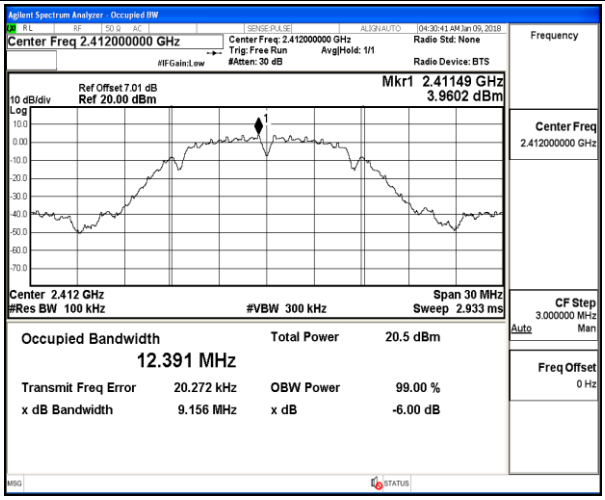
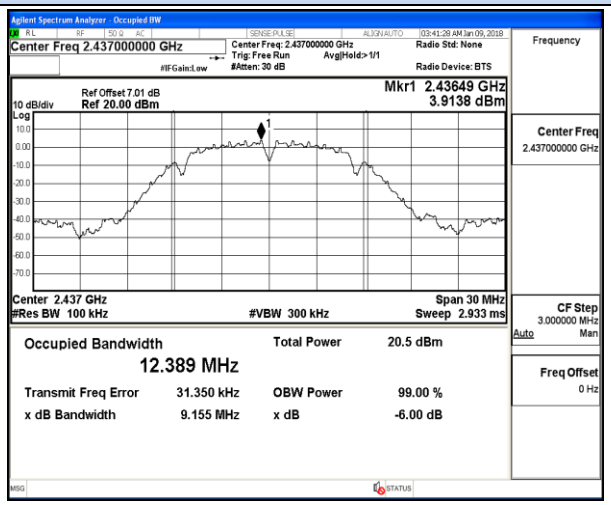
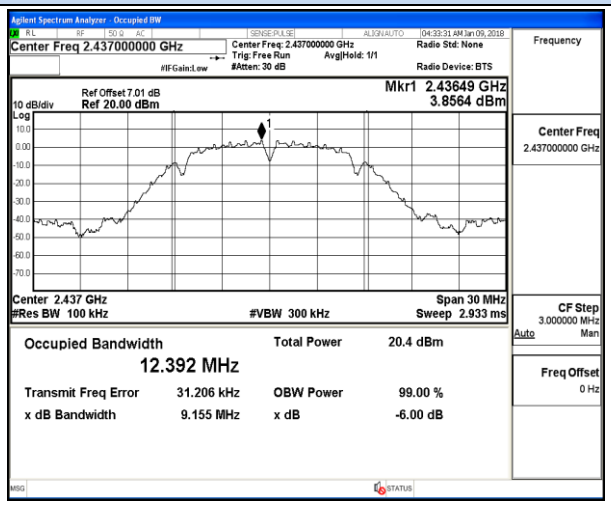
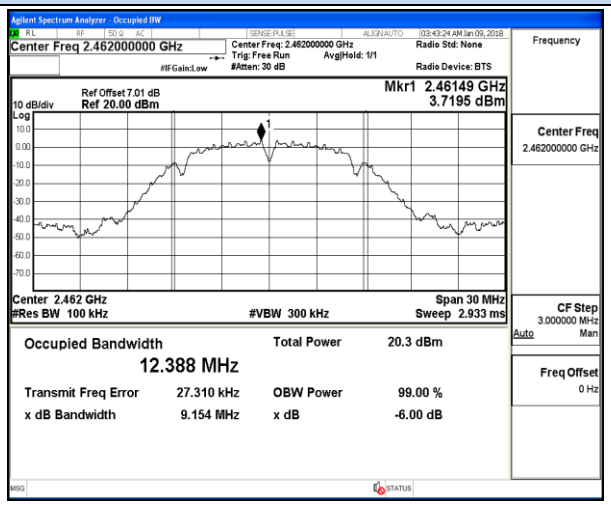
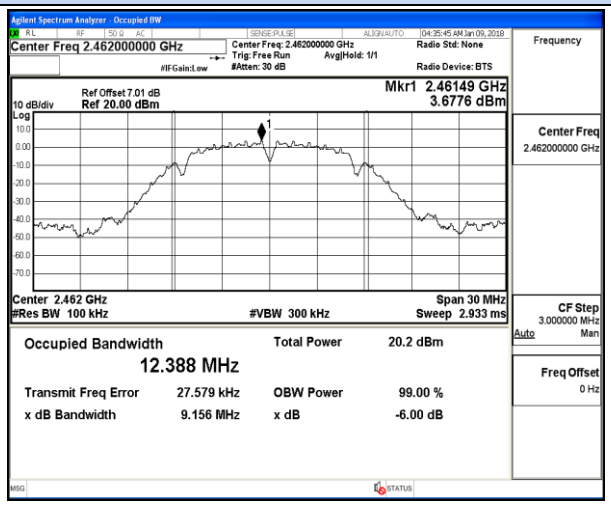
5.4.6. Test Result of 6dB Spectrum Bandwidth

Temperature	24.6℃	Humidity	48.4%
Test Engineer	Wilson Hong	Configurations	802.11b/g/n

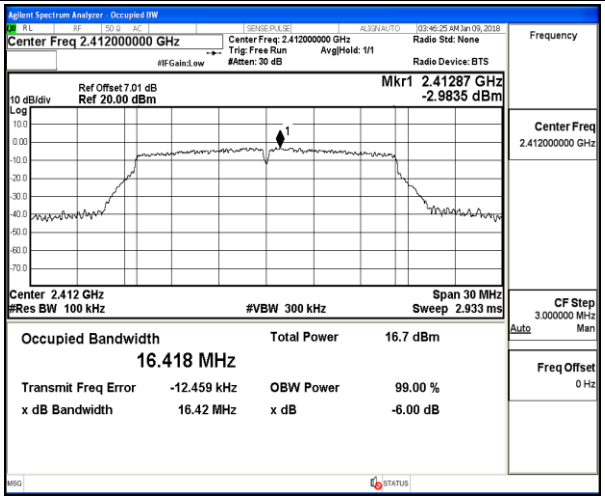
Test Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Limits (MHz)	Verdict
			Chain 0	Chain 1		
IEEE 802.11b	1	2412	9.156	9.156	0.500	PASS
	6	2437	9.155	9.155		
	11	2462	9.154	9.156		
IEEE 802.11g	1	2412	16.42	16.41	0.500	PASS
	6	2437	16.41	16.41		
	11	2462	16.41	16.42		
IEEE 802.11n HT20	1	2412	17.62	17.64	0.500	PASS
	6	2437	17.63	17.61		
	11	2462	17.62	17.63		
IEEE 802.11n HT40	3	2422	36.38	36.36	0.500	PASS
	6	2437	36.38	36.37		
	9	2452	36.34	36.34		

Remark:

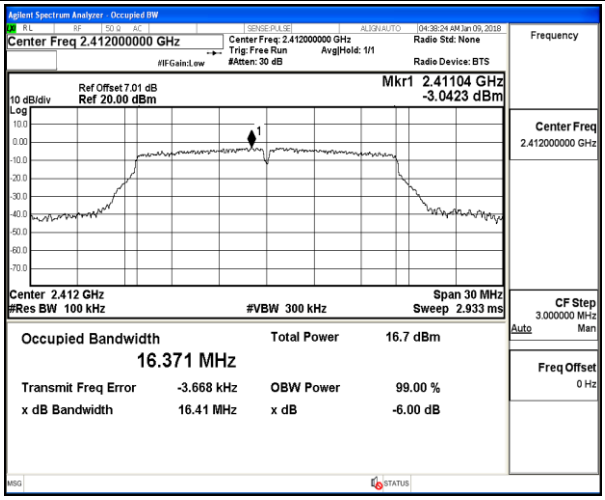
1. *Measured 6dB Bandwidth at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 1Mbps at IEEE 802.11b; 6Mbps at IEEE 802.11g; 6.5Mbps at IEEE 802.11n HT20; 13.5Mbps at IEEE 802.11n HT40;*

Test plot of 6 dB Bandwidth	
	
802.11b Chain 0-Low channel	802.11b Chain 1-Low channel
	
802.11b Chain 0-Middle channel	802.11b Chain 1-Middle channel
	
802.11b Chain 0-High channel	802.11b Chain 1-High channel

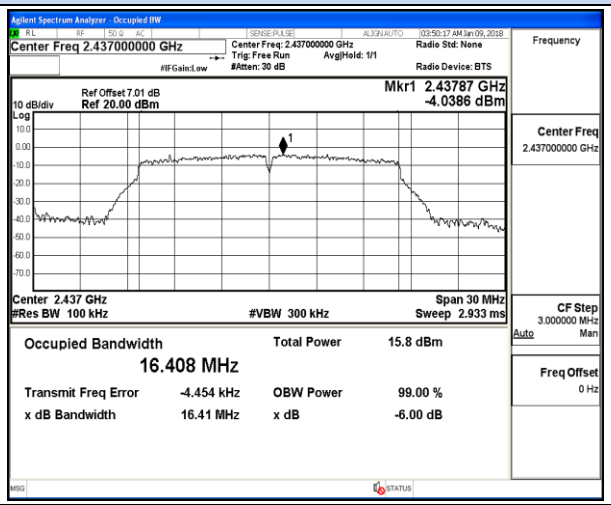
Test plot of 6 dB Bandwidth



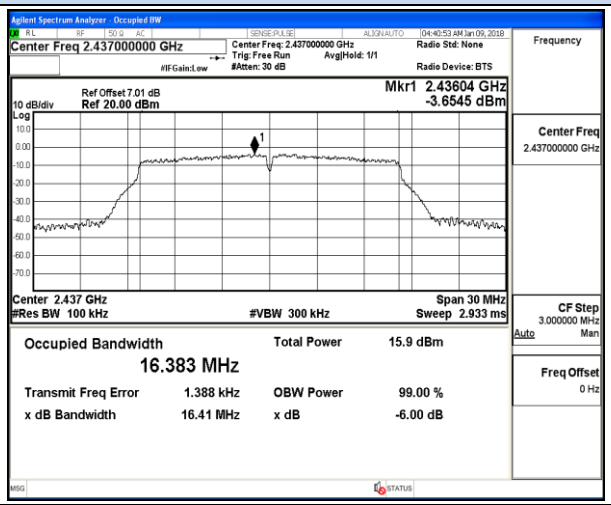
802.11g Chain 0-Low channel



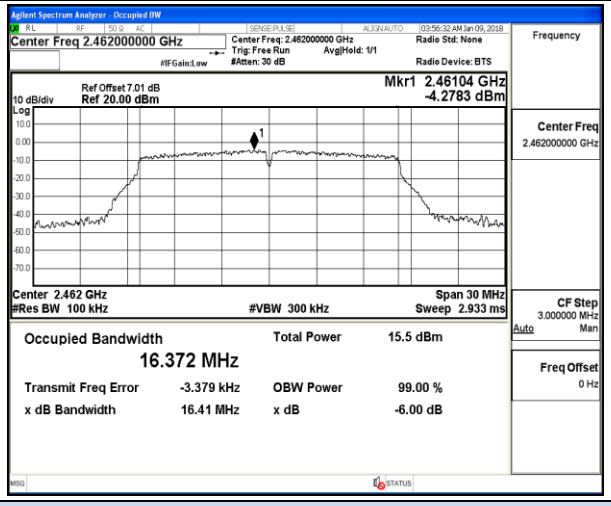
802.11g Chain 1-Low channel



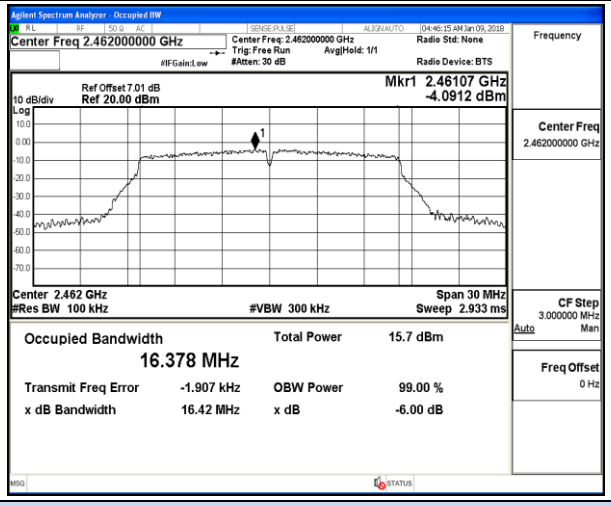
802.11g Chain 0-Middle channel



802.11g Chain 1-Middle channel



802.11g Chain 0-High channel



802.11g Chain 1-High channel