FCC TEST REPORT

For

Jiangmen Todaair Electronics Co.,Ltd

Wireless Router/Bridge/ Access Point/CPE

Model No.: DIP3226-H

Additional Model No.: Please Refer to page 6

Prepared for	:	Jiangmen Todaair Electronics Co.,Ltd
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Date of receipt of test sample	:	September 21, 2016
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	September 21, 2016~October 27, 2016
Date of Report	:	October 27, 2016

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FCC TEST REPORT
FCC CFR 47 PART 15 C(15.247): 2015

Report Reference No.	**:**	**LCS1609211622E**
Date of Issue	:	October 27, 2016
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	**:**	**Jiangmen Todaair Electronics Co.,Ltd**
Address	:	F6. Electronic Building No.1 Guangde Steet Peng Jiang District, Jiangmen, Guangdong, China
Test Specification		
Standard	:	FCC CFR 47 PART 15 C(15.247): 2015
Test Report Form No.	**:**	LCSEMC-1.0
TRF Originator	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	:	Dated 2011-03

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EUT Description.	**:**	**Wireless Router/Bridge/ Access Point/CPE**
Trade Mark	:	TODAAIR®
Model/ Type reference	:	DIP3226-H
Ratings	:	Input: DC 24.0V Adapter parameters: AC 100-240V, 50Hz/60Hz
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Jacky Li	Glin Lu	Gavin Liang
Jacky Li/ File administrators	Glin Lu/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS1609211622E	October 27, 2016 Date of issue

EUT.....	: Wireless Router/Bridge/ Access Point/CPE
Type / Model.....	: DIP3226-H
Applicant.....	**: Jiangmen Todaair Electronics Co.,Ltd**
Address.....	: F6. Electronic Building No.1 Guangde Steet Peng Jiang District, Jiangmen, Guangdong, China
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Fax.....	: 0750-3671877
Factory.....	**: Jiangmen Todaair Electronics Co.,Ltd**
Address.....	: F6. Electronic Building No.1 Guangde Steet Peng Jiang District, Jiangmen, Guangdong, China
Telephone.....	: 0750-3671877
Fax.....	: 0750-3671877

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
00	2016-10-27	Initial Issue	Gavin Liang

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1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	Wireless Router/Bridge/ Access Point/CPE
Model Number	:	DIP326-H, CN326-H, CN3210-H, DIP3210-H, CN3217-H-N, T123, T323-H, IN3212S-H-48, IN612S-H-48, T324, IN1214S-H-48, DIP3226-H, CN3226-H, IN3210S-48, IN3211, GW2, GW4, DIP3220, IN3223S-H-48
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Test Model	:	DIP3226-H
Power Supply	:	Input: DC 24.0V Adapter parameters: AC 100-240V, 50Hz/60Hz
Frequency Range	:	2412.00~2462.00MHz/2422.00~2452.00MHz；
Channel Number	:	11 Channels for WIFI 20MHz Bandwidth(802.11b/g/n-HT20) 7 Channels for WIFI 40MHz Bandwidth(802.11n-HT40)
Modulation Technology	:	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM,QPSK,BPSK)
Data Rates	:	IEEE 802.11b: 1-11Mbps IEEE 802.11g: 6-54Mbps IEEE 802.11n: MCS0-MCS15
Antenna Type And Gain	:	Integral antenna, 14dBi for chain0 Integral antenna, 14dBi for chain1

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
--	--	--	--	--

1.3. External I/O Cable

I/O Port Description	Quantity	Cable
RJ45	2	N/A

1.4. Description of Test Facility

CNAS Registration Number. is L4595.
FCC Registration Number. is 899208.
Industry Canada Registration Number. is 9642A-1.
VCCI Registration Number. is C-4260 and R-3804.
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

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 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(Chain0+Chain1-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(Chain0+Chain1-High Channel).

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case datarates 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: MCS8, 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	--	--

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 v03r05 and KDB 6622911 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

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3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmit condition. The duty cycle is 100% and the average correction factor is 0.

3.2. EUT Exercise Software

N/A

3.3. Special Accessories

N/A

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.

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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

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5. TEST RESULT

5.1. On Time and Duty Cycle

5.1.1. Standard Applicable

None; for reporting purpose only.

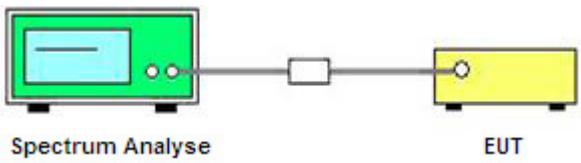
5.1.2. Measuring Instruments and Setting

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

5.1.3. Test Procedures

1. Set the centre frequency of the spectrum analyse to the transmiting 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

Mode	On Time B (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW(KHz)
Chain 0						
IEEE 802.11b	5	5	1	100	0	0.010
IEEE 802.11g	5	5	1	100	0	0.010
IEEE 802.11n-HT20	5	5	1	100	0	0.010
IEEE 802.11n-HT40	5	5	1	100	0	0.010
Chain1						
IEEE 802.11b	5	5	1	100	0	0.010
IEEE 802.11g	5	5	1	100	0	0.010
IEEE 802.11n-HT20	5	5	1	100	0	0.010
IEEE 802.11n-HT40	5	5	1	100	0	0.010

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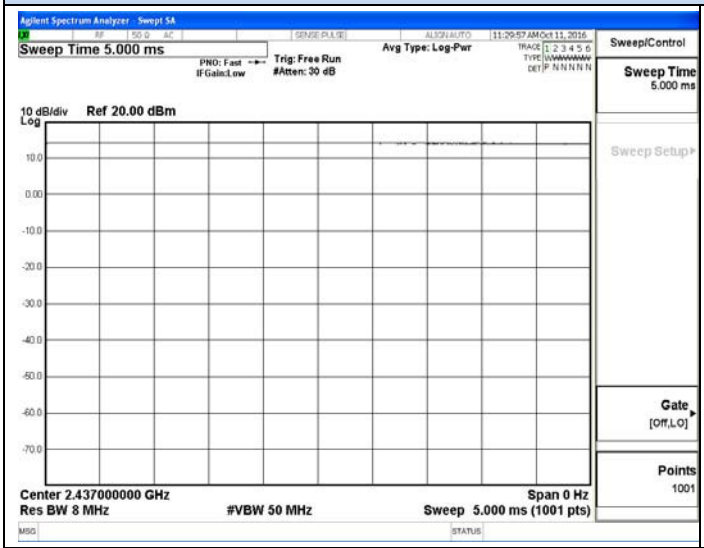
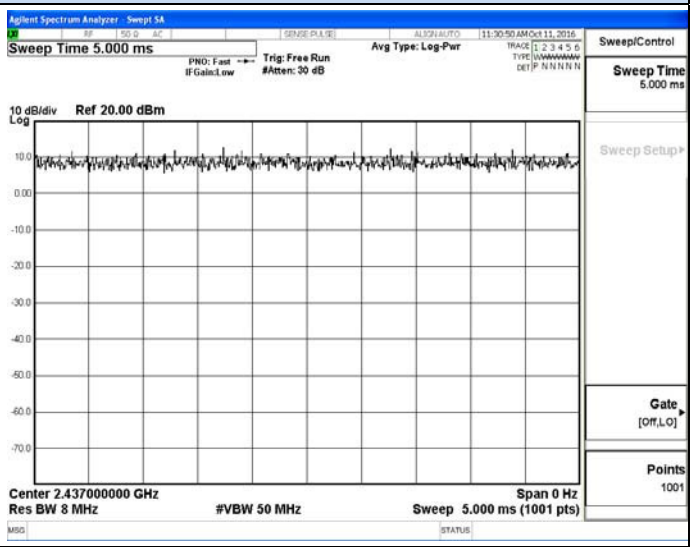
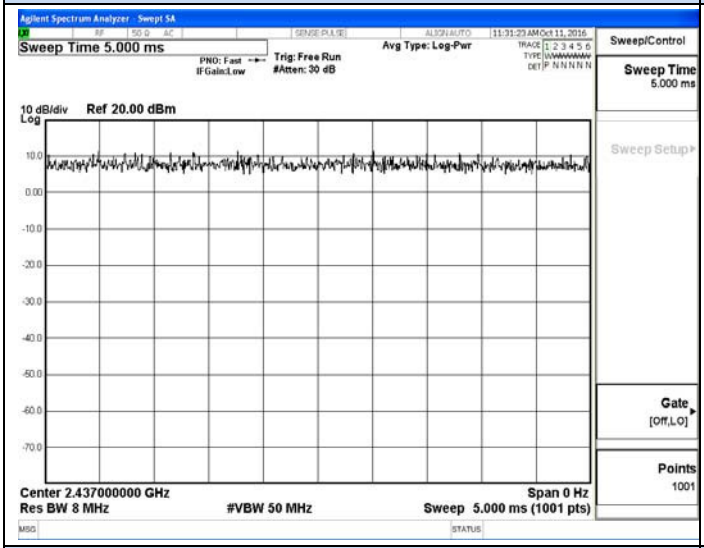
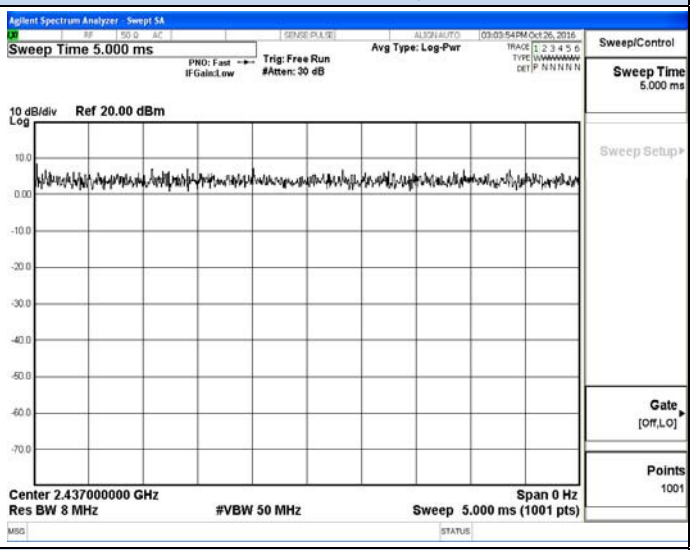
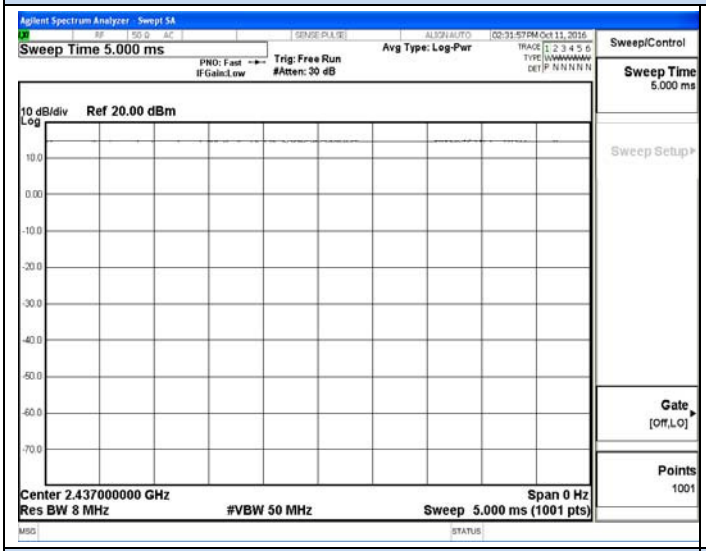
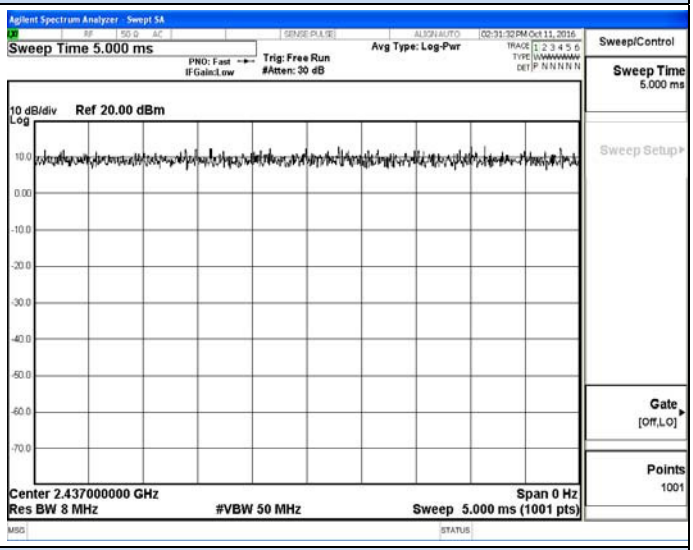
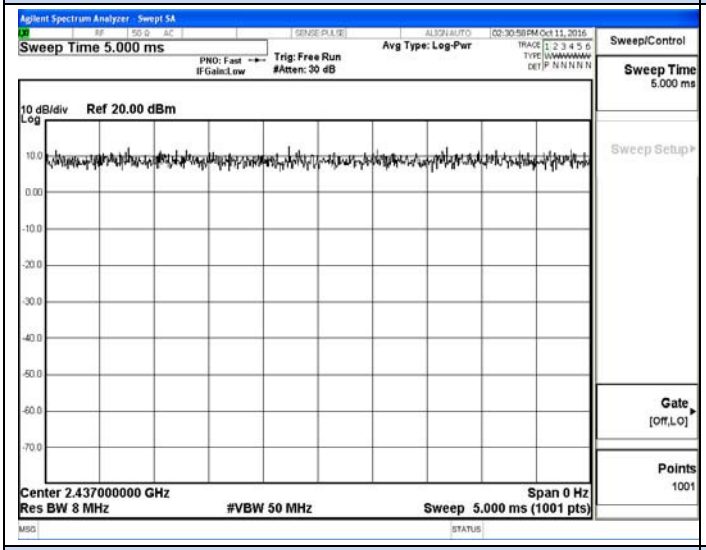
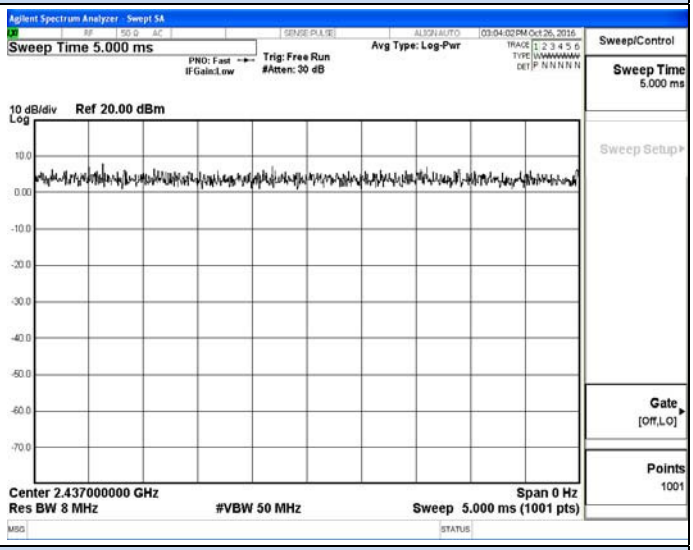
Test plot of On Time and Duty Cycle	
Chain 0	
	
IEEE 802.11b	IEEE 802.11g
	
IEEE 802.11n-HT20	IEEE 802.11n-HT40

Test plot of On Time and Duty Cycle	
Chain 1	
	
IEEE 802.11b	IEEE 802.11g
	
IEEE 802.11n-HT20	IEEE 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.

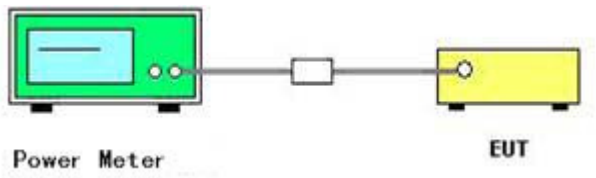
5.2.2. Measuring Instruments and Setting

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	25℃	Humidty	60%
Test Engineer	Jacky	Configurations	802.11b/g/n

Peak Power							
Test Mode	Channel	Frequency (MHz)	Peak Conducted Power(dBm)		Sum Power (dBm)	Max. Limit (dBm)	Result
			Chain0	Chain1			
IEEE 802.11b	1	2412	15.04	15.10	/	27	Complies
	6	2437	15.12	15.21	/	27	Complies
	11	2462	15.08	15.11	/	27	Complies
IEEE 802.11g	1	2412	14.11	14.15	/	27	Complies
	6	2437	14.13	14.14	/	27	Complies
	11	2462	14.21	14.20	/	27	Complies
IEEE 802.11n (HT20)	1	2412	14.05	14.07	17.07	27	Complies
	6	2437	14.02	14.05	17.05	27	Complies
	11	2462	14.06	14.04	17.06	27	Complies
IEEE 802.11n (HT40)	3	2422	13.27	13.33	16.31	27	Complies
	6	2437	12.91	13.16	16.05	27	Complies
	9	2452	13.07	12.93	16.01	27	Complies

Average Power(for report purpose only)						
Test Mode	Channel	Frequency (MHz)	AV Conducted Power(dBm)		Duty cycle factor (dB)	Sum Power (dBm)
			Chain0	Chain1		
IEEE 802.11b	1	2412	9.25	9.31	0	/
	6	2437	9.34	9.42	0	/
	11	2462	9.29	9.18	0	/
IEEE 802.11g	1	2412	7.07	7.11	0	/
	6	2437	7.13	7.24	0	/
	11	2462	7.17	7.23	0	/
IEEE 802.11n (HT20)	1	2412	7.09	7.14	0	10.13
	6	2437	7.12	7.02	0	10.08
	11	2462	7.03	7.08	0	10.07
IEEE 802.11n (HT40)	3	2422	6.58	6.62	0	9.61
	6	2437	6.34	6.45	0	9.41
	9	2452	6.51	6.39	0	9.46

Note:
Directional gain = GANT; Directional gain=14dBi > 6 dBi, so the limit=30-INT((14-6)/3)=27
Sum Power= Conducted Power+ Duty Cycle Correction Factor

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.

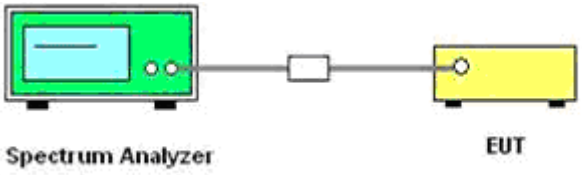
5.3.2. Measuring Instruments and Setting

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~100kHz.
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

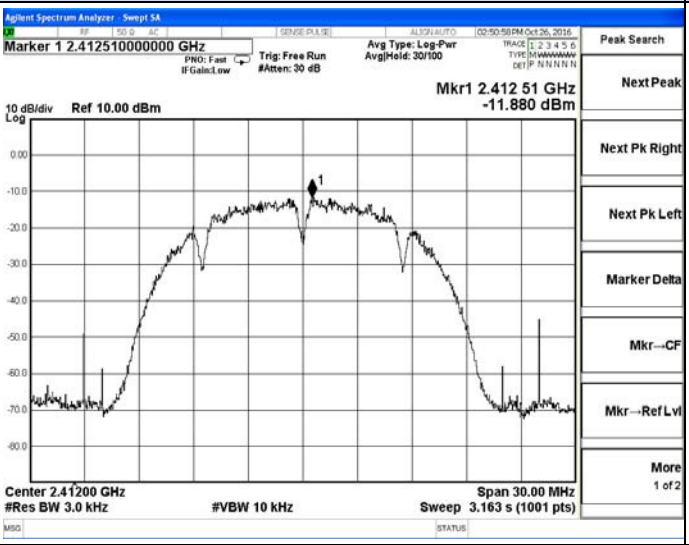
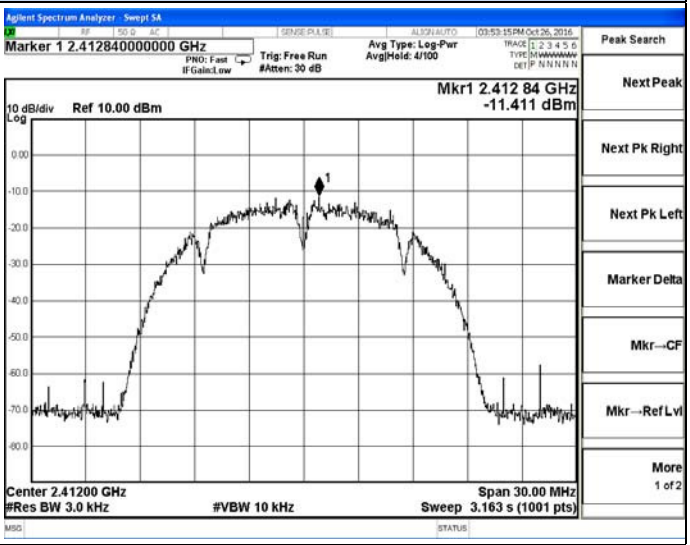
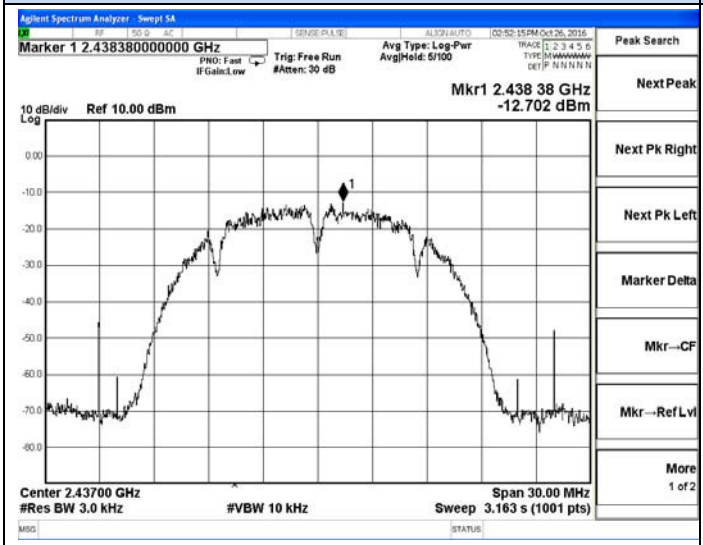
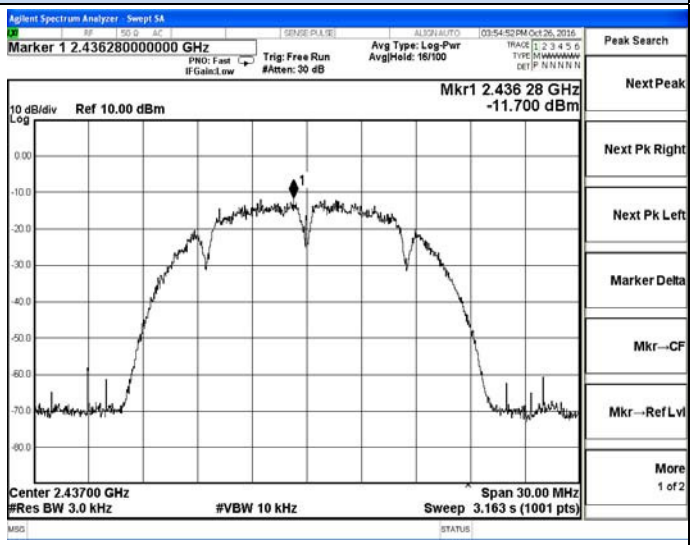
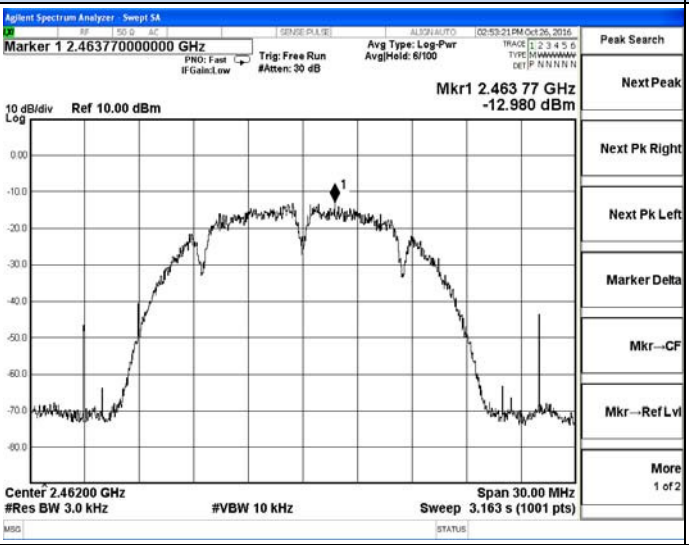
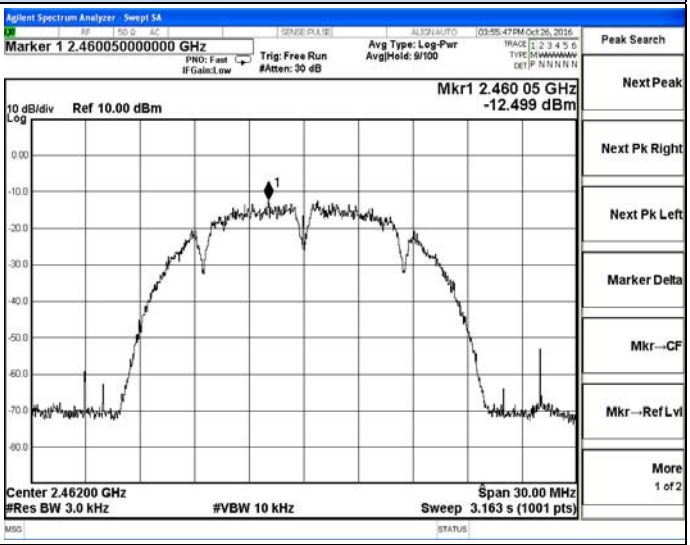
Temperature	25℃	Humidity	60%
Test Engineer	Jakcy	Configurations	802.11b/g/n

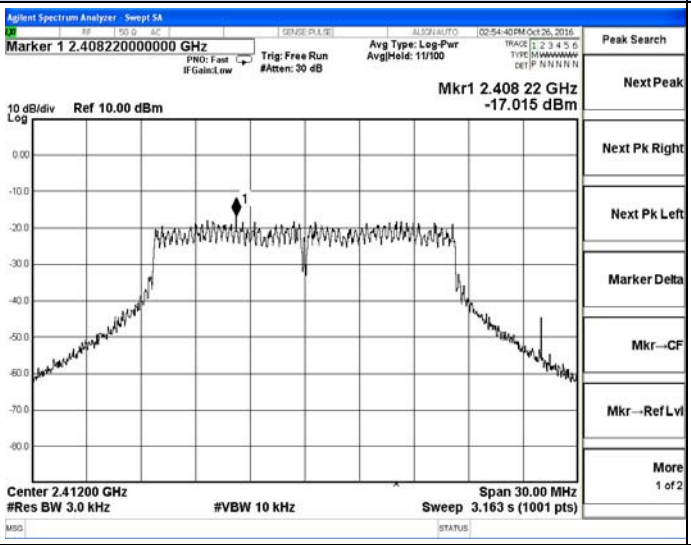
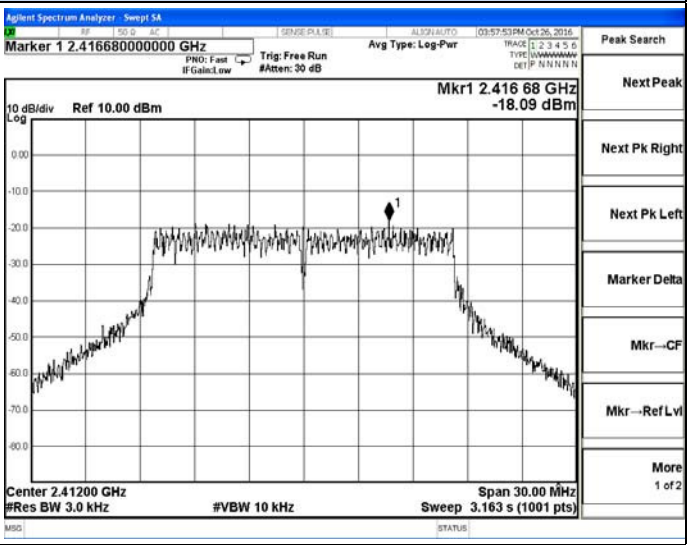
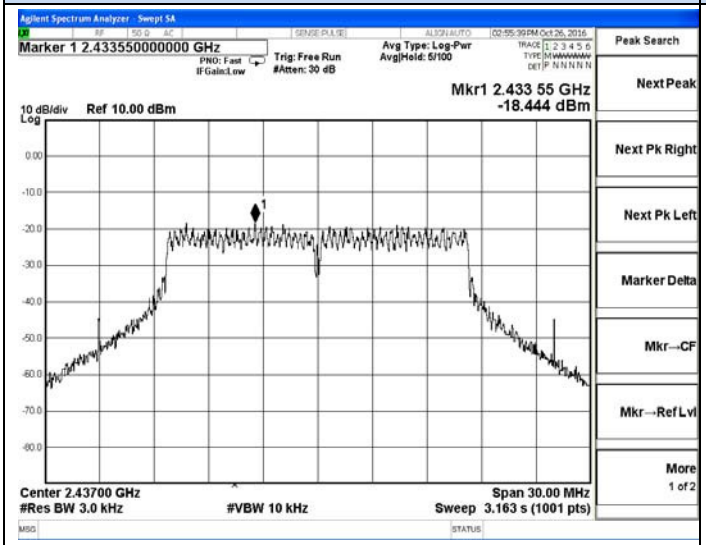
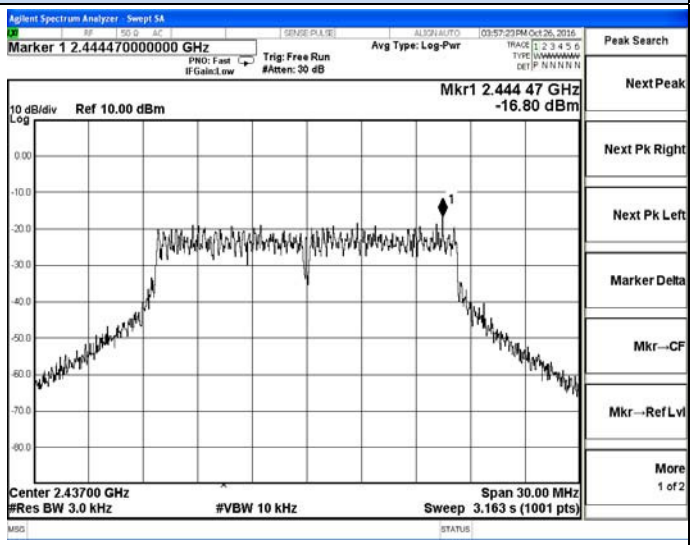
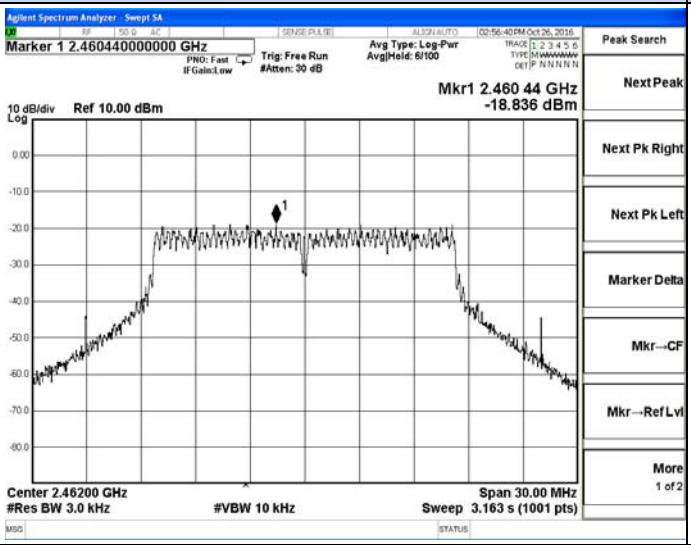
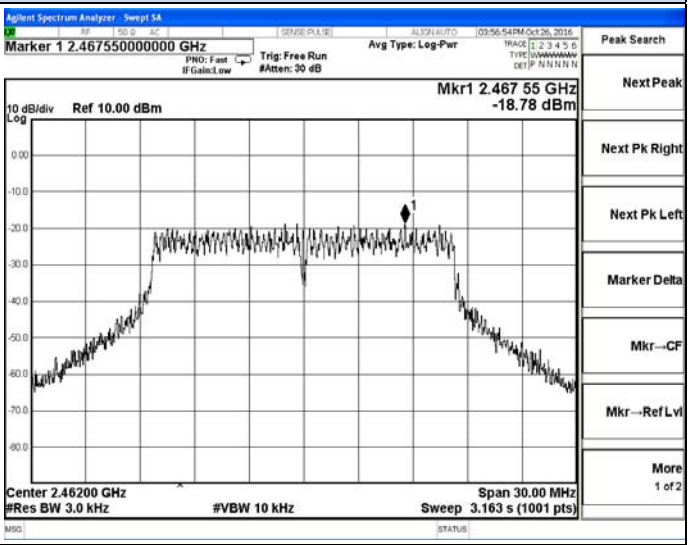
Test Mode	Channel	Frequency (MHz)	Power Density (dBm/3KHz)		Duty cycle factor (dB)	Sum PSD (dBm/3KHz)	Max. Limit (dBm/3KHz)	Result
			Chain0	Chain1				
IEEE 802.11b	1	2412	-11.880	-11.411	0	/	5	Complies
	6	2437	-12.702	-11.700	0	/	5	Complies
	11	2462	-12.980	-12.499	0	/	5	Complies
IEEE 802.11g	1	2412	-17.015	-18.090	0	/	5	Complies
	6	2437	-18.444	-16.800	0	/	5	Complies
	11	2462	-18.836	-18.780	0	/	5	Complies
IEEE 802.11n (HT20)	1	2412	-18.025	-17.550	0	-14.771	4	Complies
	6	2437	-18.299	-19.450	0	-15.826	4	Complies
	11	2462	-18.905	-18.400	0	-15.635	4	Complies
IEEE 802.11n (HT40)	3	2422	-23.968	-22.644	0	-20.245	4	Complies
	6	2437	-23.700	-22.298	0	-19.932	4	Complies
	9	2452	-24.610	-22.175	0	-20.214	4	Complies

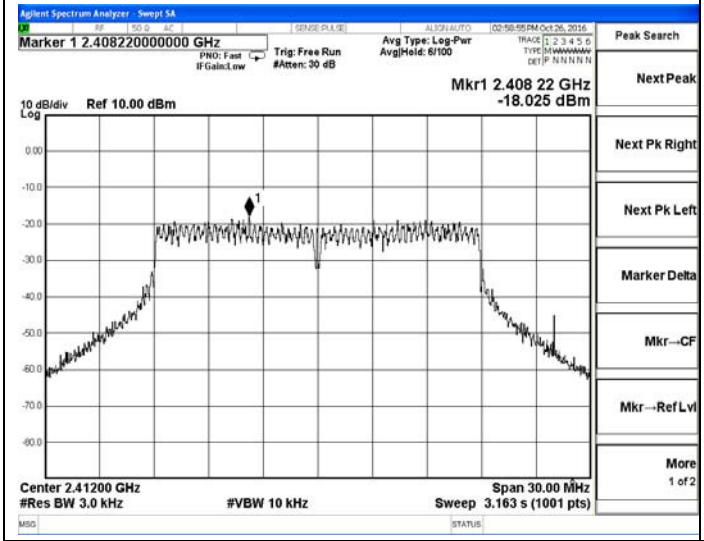
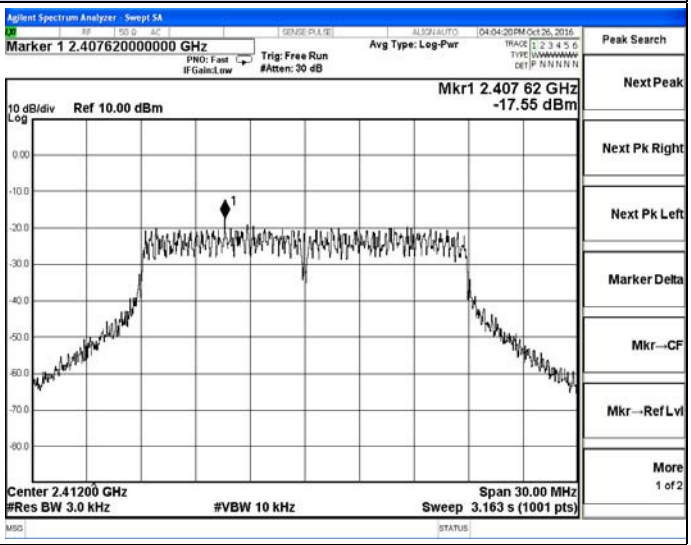
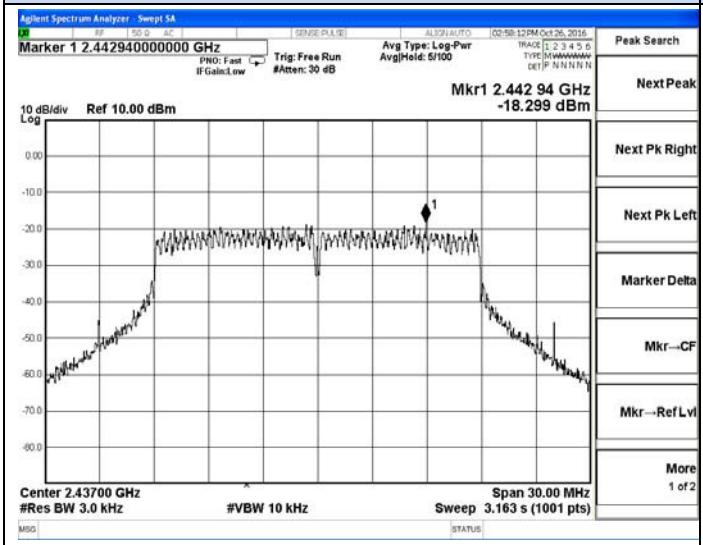
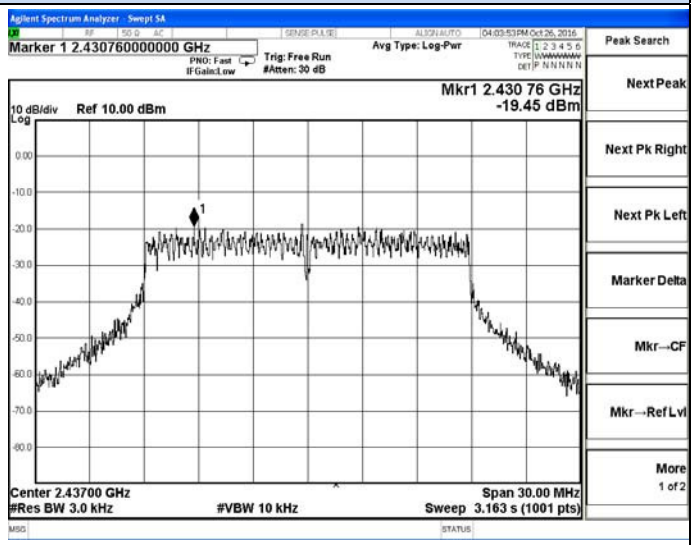
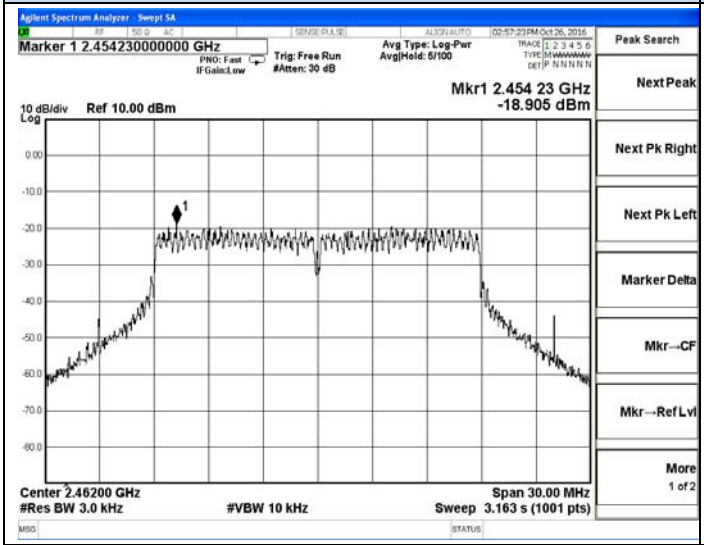
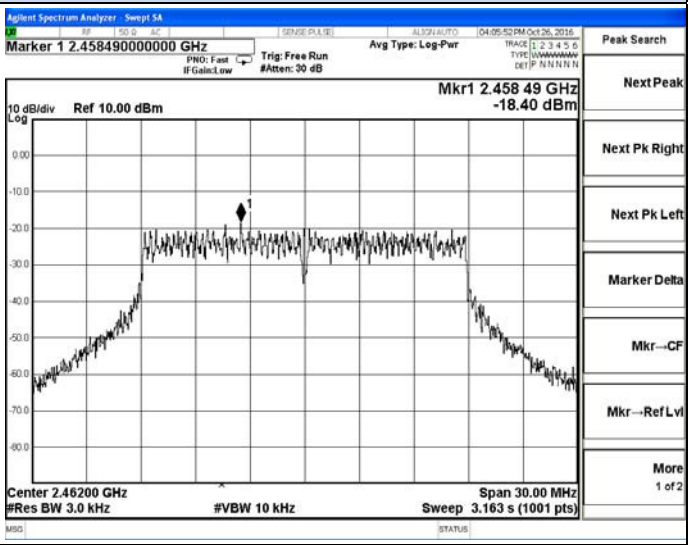
Note:
For IEEE 802.11b/g, Directional gain=$G_{ANT;}$ Directional gain=14dBi > 6 dBi, so the limit=8-INT((14-6)/3)=5
For IEEE 802.11n-HT20/HT40, Directional gain= Log(N)+G_{ANT}; Directional gain=17.01dBi > 6 dBi, so the limit=8-INT((17.01 -6)/3)=4
Sum PSD= Power Density + Duty Cycle Correction Factor

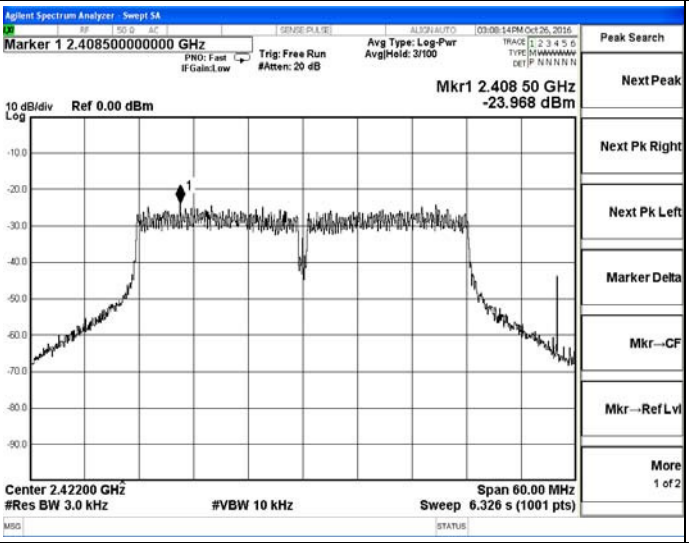
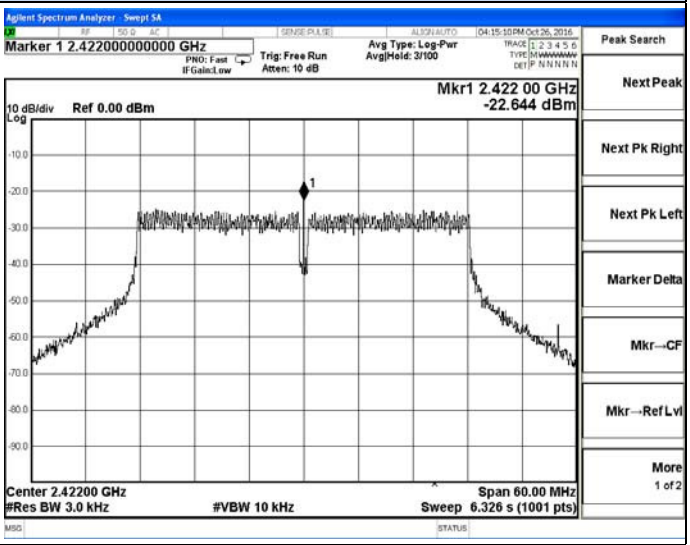
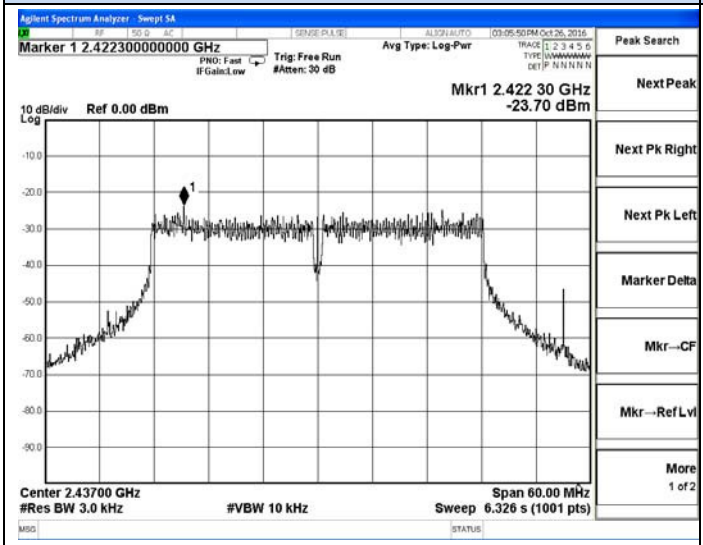
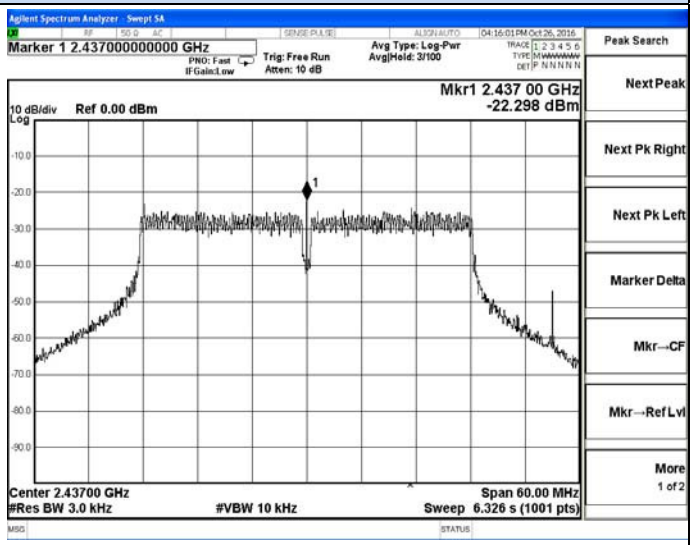
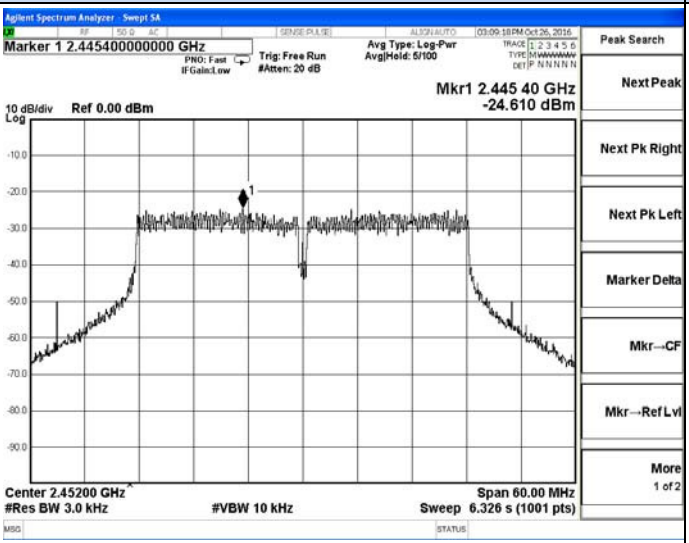
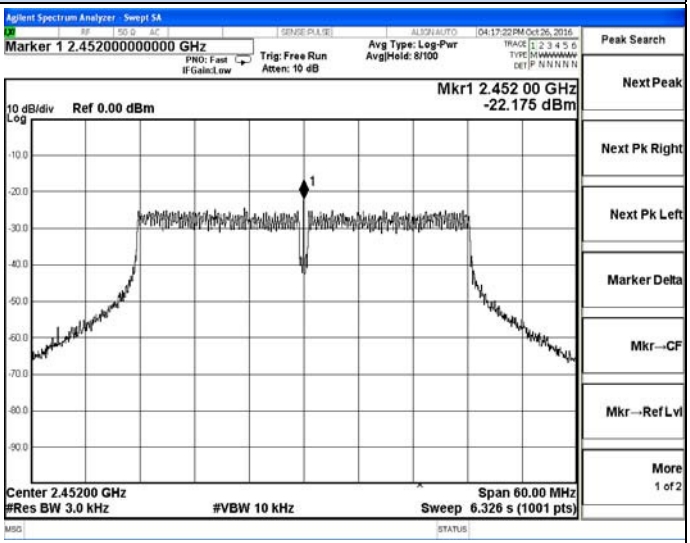
Test plot of Power Spectral Density

IEEE 802.11b

Chain0	Chain1
	
Low channel	Low channel
	
Middle channel	Middle channel
	
High channel	High channel

Test plot of Power Spectral Density	
IEEE 802.11g	
Chain0	***Chain1***
	
Low channel	Low channel
	
Middle channel	Middle channel
	
High channel	High channel

Test plot of Power Spectral Density	
IEEE 802.11n(HT20)	
Chain0	***Chain1***
	
Low channel	Low channel
	
Middle channel	Middle channel
	
High channel	High channel

Test plot of Power Spectral Density	
IEEE 802.11n(HT40)	
Chain0	***Chain1***
	
Low channel	Low channel
	
Middle channel	Middle channel
	
High channel	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

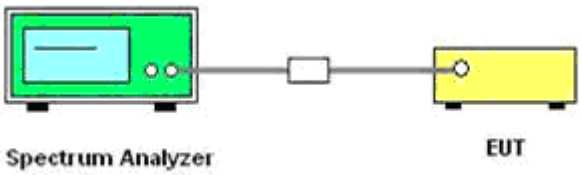
Please refer to section 6 of equipments list in this report. The following table is the setting of the Spectrum Analyzer.

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	25℃	Humidity	60%
Test Engineer	Jacky	Configurations	802.11b/g/n

IEEE 802.11b					
Channel	Frequency	6dB Bandwidth (MHz)		Min. Limit (kHz)	Result
		Chain0	Chain1		
1	2412	10.09	10.11	500	Complies
6	2437	10.06	10.12	500	Complies
11	2462	10.10	10.12	500	Complies

IEEE 802.11g					
Channel	Frequency	6dB Bandwidth (MHz)		Min. Limit (kHz)	Result
		Chain0	Chain1		
1	2412	16.52	16.53	500	Complies
6	2437	16.56	16.59	500	Complies
11	2462	16.56	16.59	500	Complies

IEEE 802.11n HT20					
Channel	Frequency	6dB Bandwidth (MHz)		Min. Limit (kHz)	Result
		Chain0	Chain1		
1	2412	17.75	17.79	500	Complies
6	2437	17.70	17.77	500	Complies
11	2462	17.83	17.82	500	Complies

IEEE 802.11n HT40					
Channel	Frequency	6dB Bandwidth (MHz)		Min. Limit (kHz)	Result
		Chain0	Chain1		
3	2422	36.55	36.61	500	Complies
6	2437	36.58	36.58	500	Complies
9	2452	36.56	36.60	500	Complies

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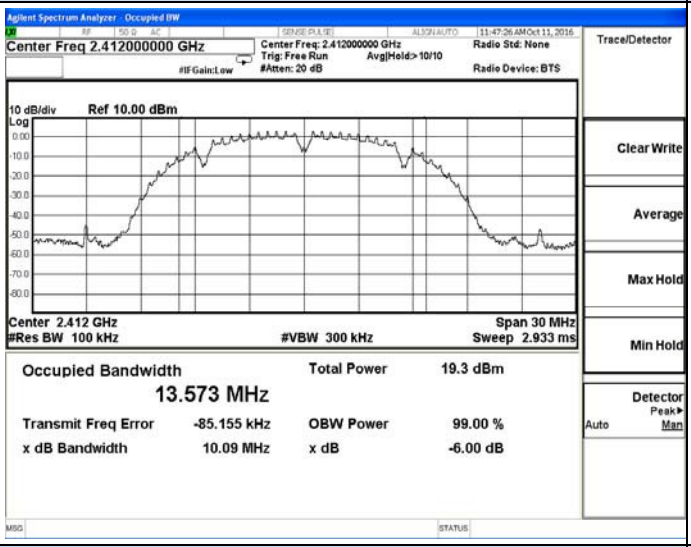
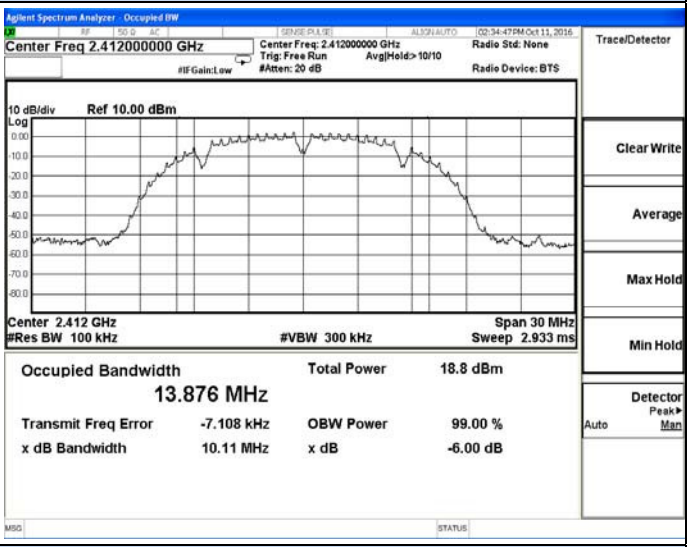
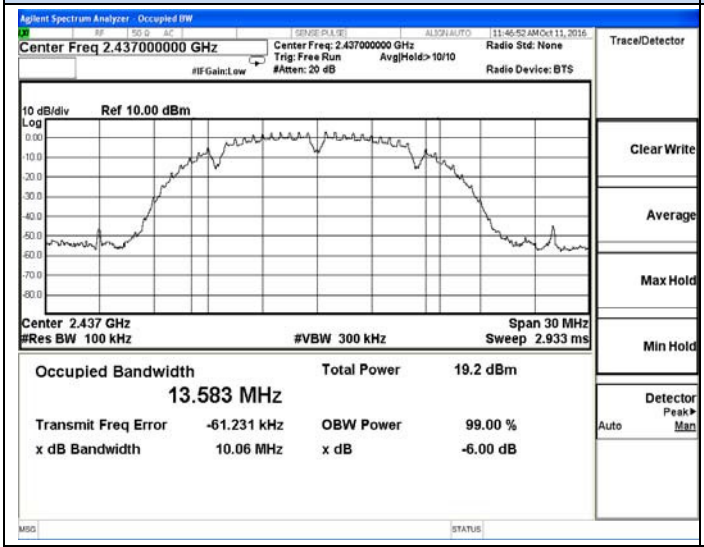
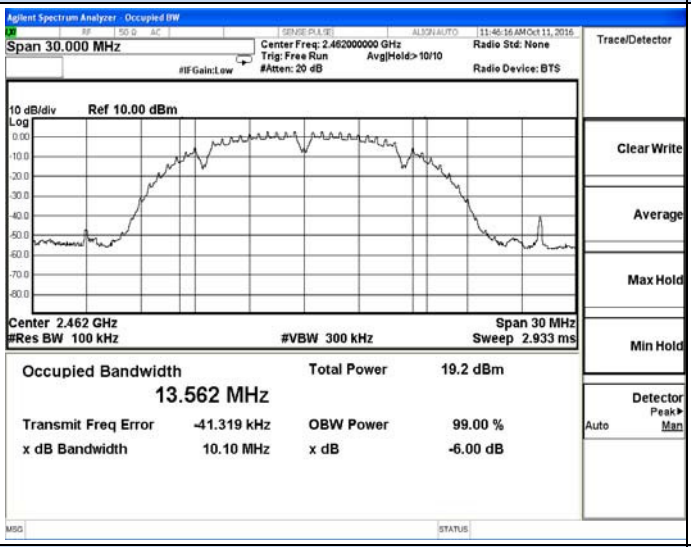
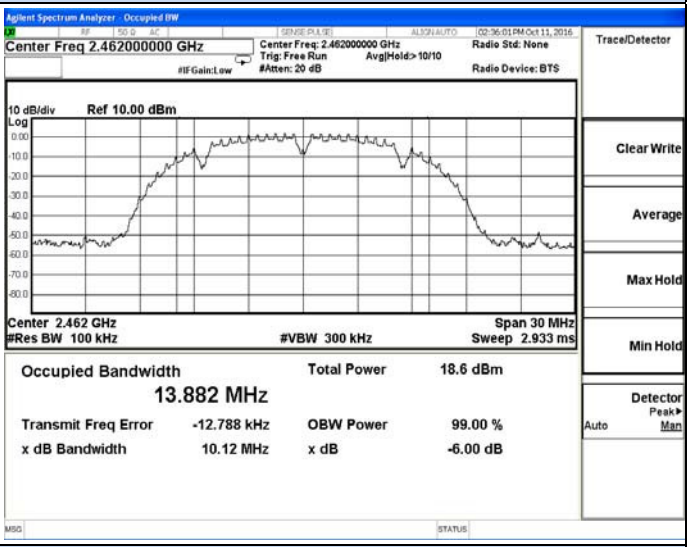
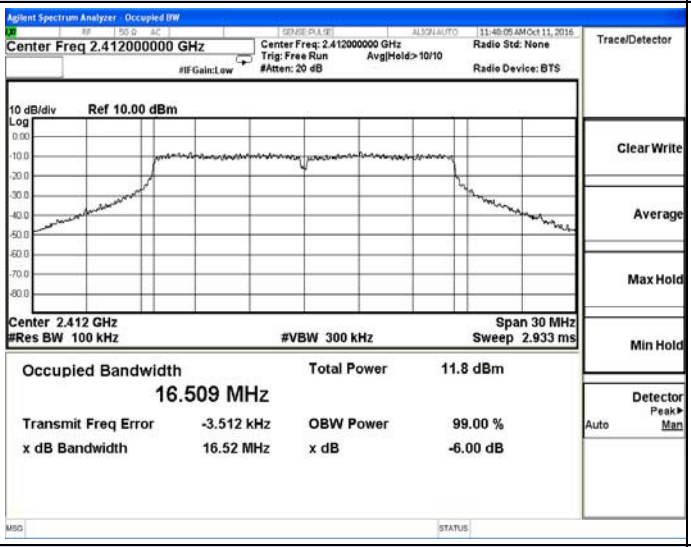
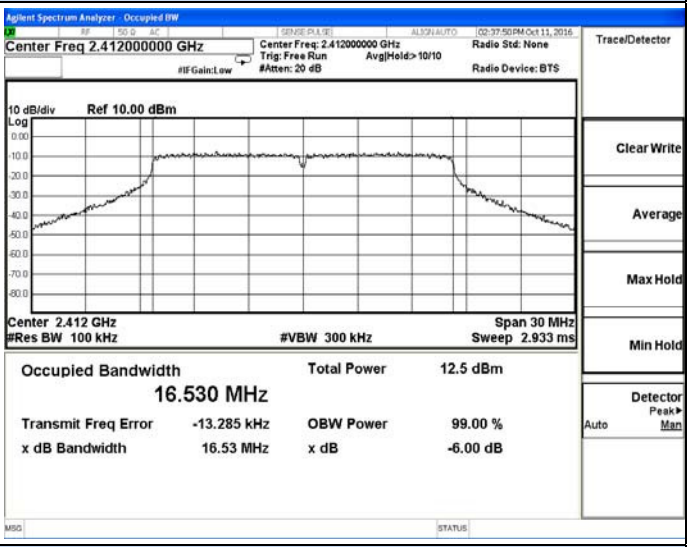
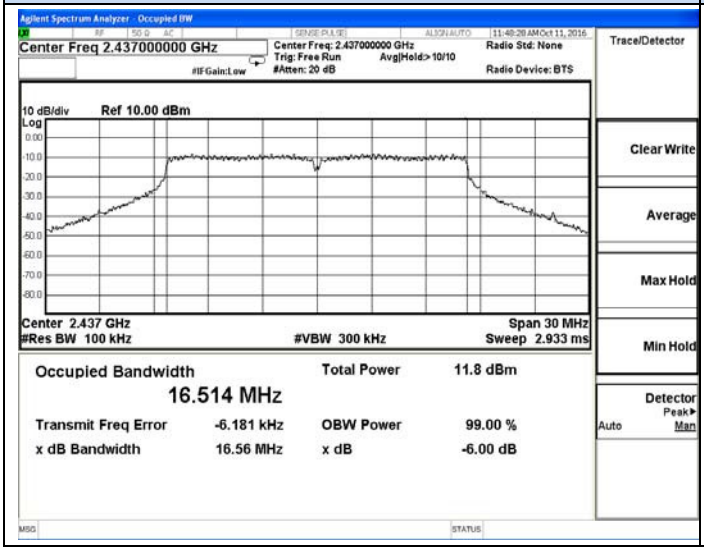
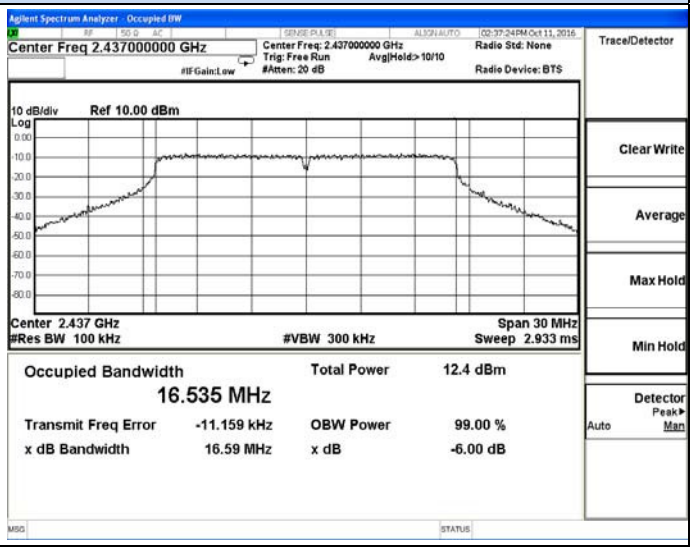
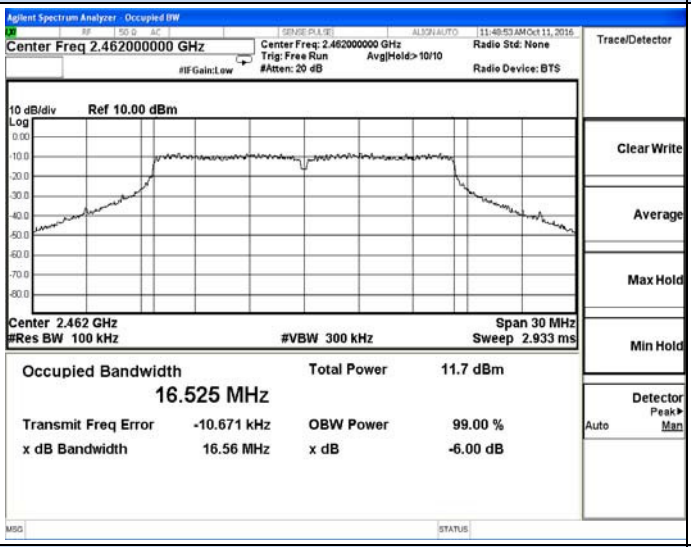
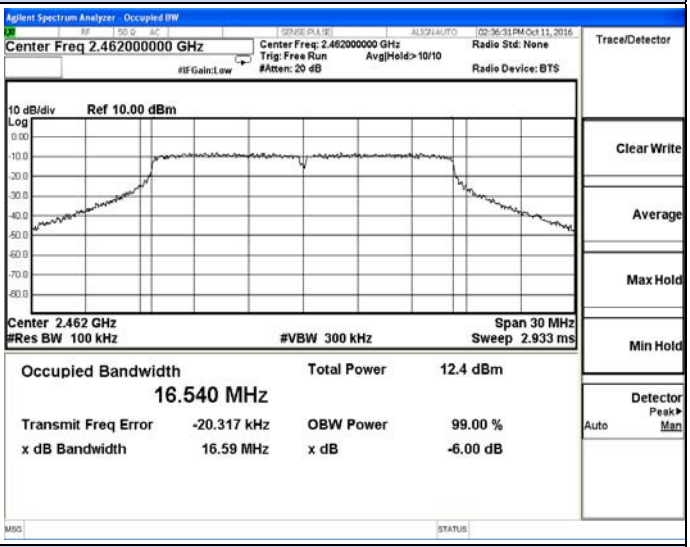
Test plot of 6dB Bandwidth

IEEE 802.11b

Chain0	*Chain1*
	
Low channel	Low channel
	
Middle channel	Middle channel
	
High channel	High channel

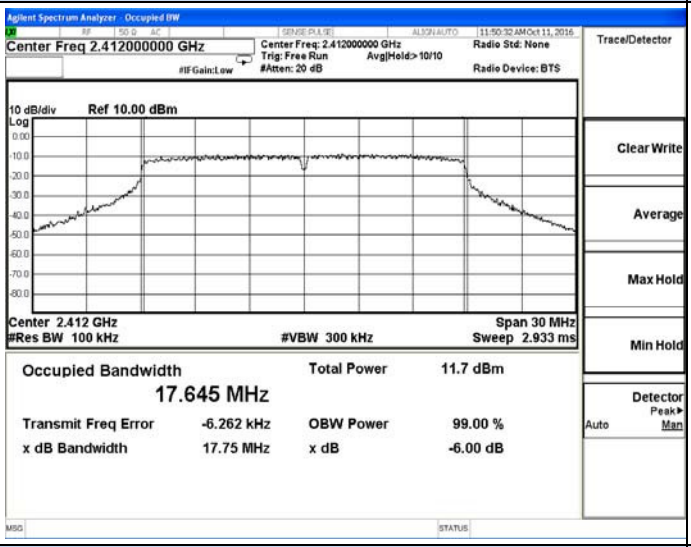
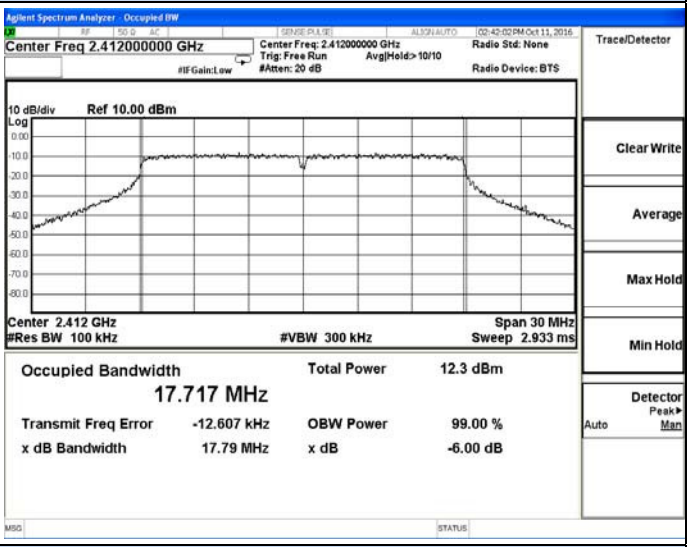
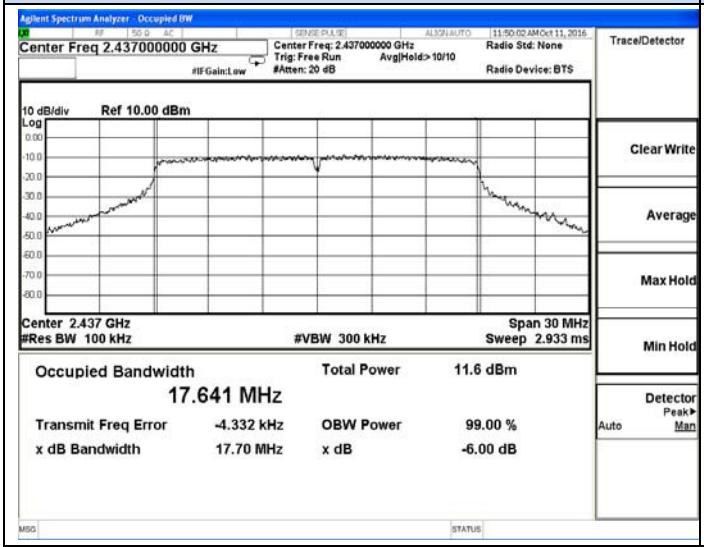
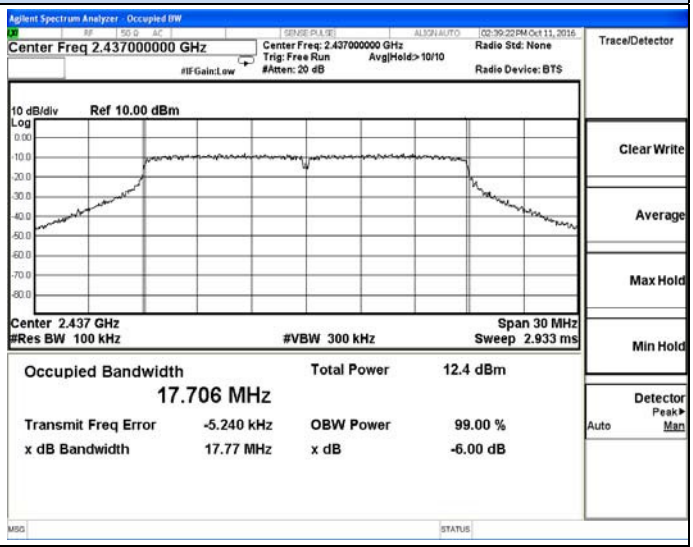
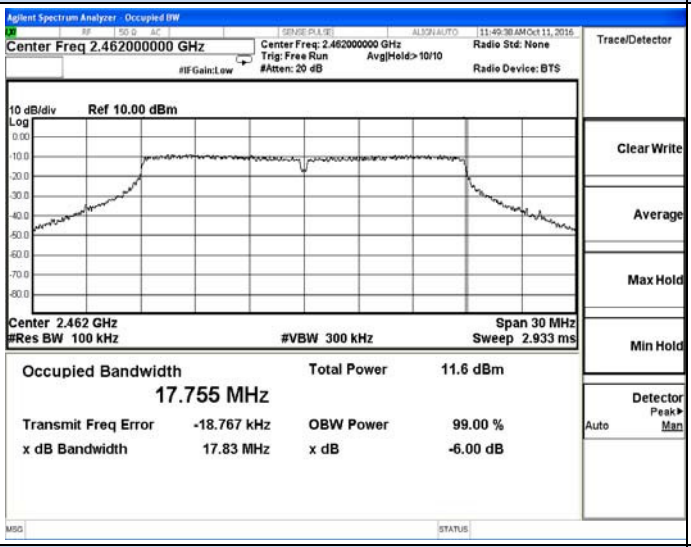
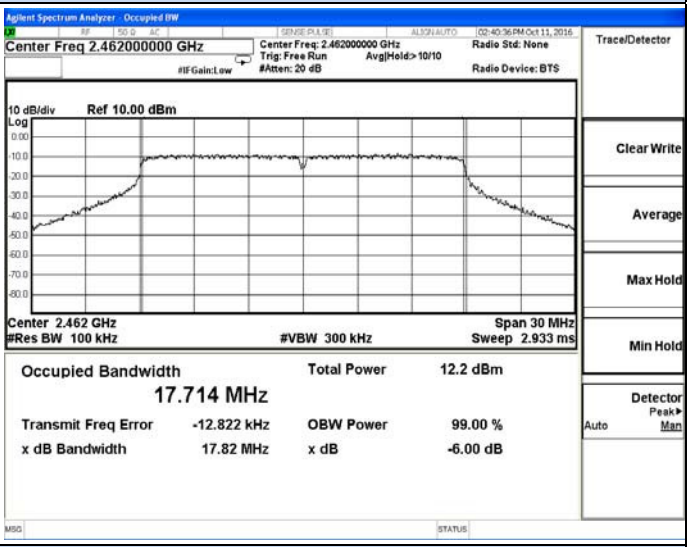
Test plot of 6dB Bandwidth

IEEE 802.11g

Chain0	Chain1
	
Low channel	Low channel
	
Middle channel	Middle channel
	
High channel	High channel

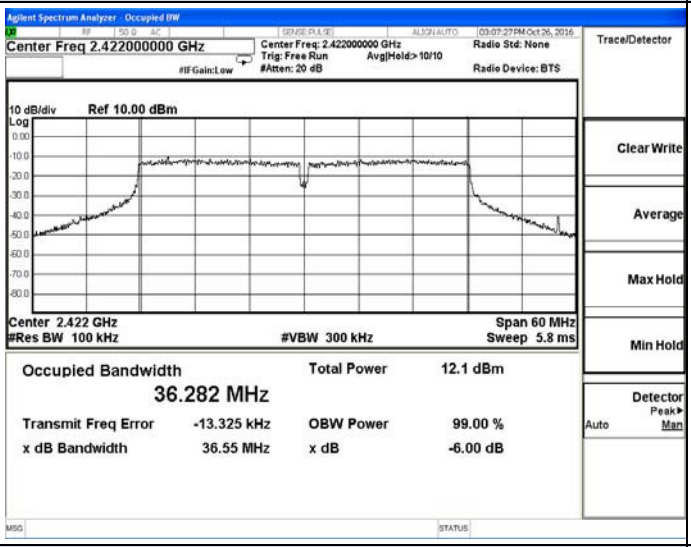
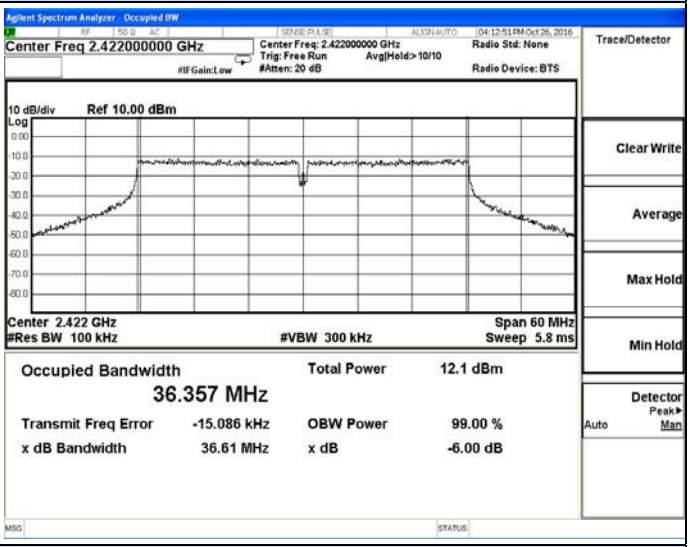
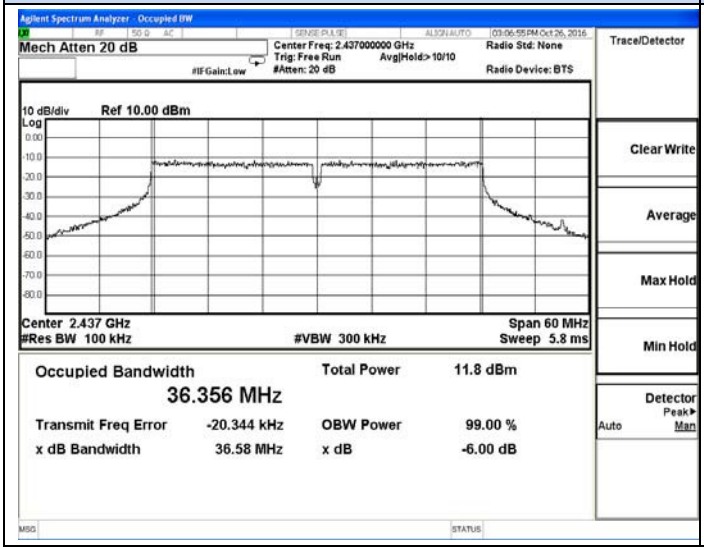
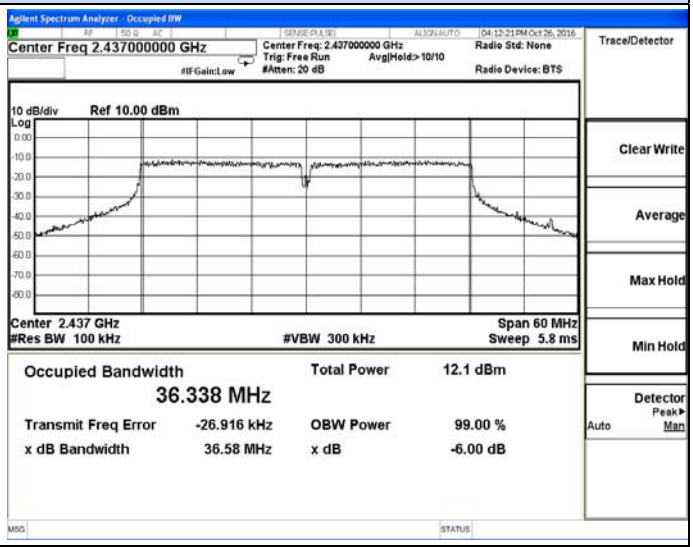
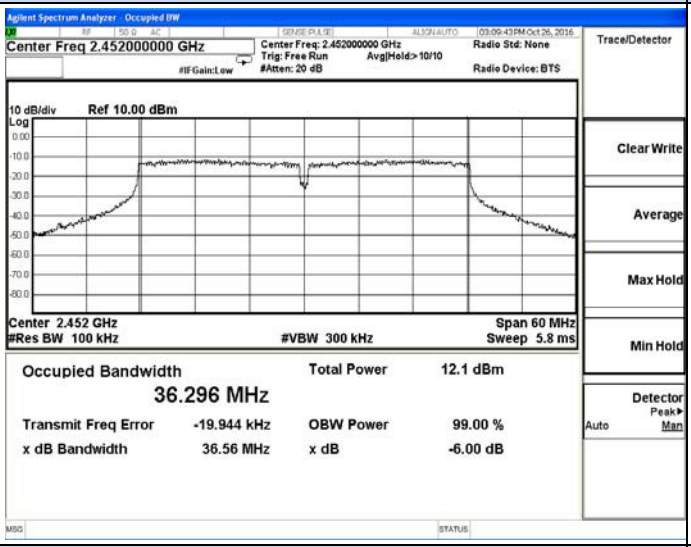
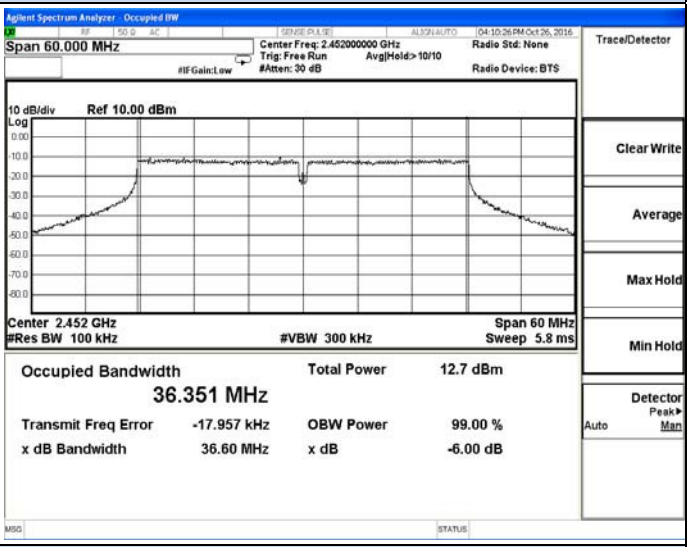
Test plot of 6dB Bandwidth

IEEE 802.11n(HT20)

Chain0	Chain1
	
Low channel	Low channel
	
Middle channel	Middle channel
	
High channel	High channel

Test plot of 6dB Bandwidth

IEEE 802.11n(HT40)

Chain0	Chain1
	
Low channel	Low channel
	
Middle channel	Middle channel
	
High channel	High channel