FCC TEST REPORT

For

Panda Wireless, Inc.

Panda Wireless N600 Dual Band Wireless N USB Adapter

Model No.: PAU09

Prepared for	:	Panda Wireless, Inc.
Address	:	15559 Union Ave, Suite 300, Los Gatos, California, United States 95032
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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Date of receipt of test sample	:	June 21, 2016
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	June 21, 2016~August 23, 2016
Date of Report	:	August 23, 2016

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

Report Reference No.	**:**	**LCS1606211684E**
Date of Issue	:	August 23, 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.....	**:**	**Panda Wireless, Inc.**
Address	:	15559 Union Ave, Suite 300, Los Gatos, California, United States 95032
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

EUT Description.	**:**	**Panda Wireless N600 Dual Band Wireless N USB Adapter**
Trade Mark	:	Panda Wireless
Model/ Type reference.....	:	PAU09
Ratings	:	DC 5V, 0.5A
Result	:	**Positive**

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

FCC -- TEST REPORT

Test Report No. : LCS1606211684E	August 23, 2016 Date of issue

EUT.....	: Panda Wireless N600 Dual Band Wireless N USB Adapter
Type / Model.....	: PAU09
Applicant.....	**: Panda Wireless, Inc.**
Address.....	: 15559 Union Ave, Suite 300, Los Gatos, California, United States 95032
Telephone.....	: 408 827 8106
Fax.....	: 408 827 8106
Manufacturer.....	**: Panda Wireless, Inc.**
Address.....	: 15559 Union Ave, Suite 300, Los Gatos, California, United States 95032
Telephone.....	: 408 827 8106
Fax.....	: 408 827 8106
Factory.....	**: Panda Wireless, Inc.**
Address.....	: 15559 Union Ave, Suite 300, Los Gatos, California, United States 95032
Telephone.....	: 408 827 8106
Fax.....	: 408 827 8106

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	2016-08-23	Initial Issue	Gavin Liang

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	Panda Wireless N600 Dual Band Wireless N USB Adapter
Model Number	:	PAU09
Power Supply	:	DC 5V, 0.5A from USB
Frequency Range	:	2412.00~2462.00MHz/2422.00~2452.00MHz; 5180.00-5240.00MHz/5745.00-5825.00MHz
Channel Number	:	11 Channels for WIFI 20MHz Bandwidth(802.11b/g/n-HT20) 7 Channels for WIFI 40MHz Bandwidth(802.11n-HT40) 4 Channels for 5180.00-5240.00MHz(802.11a/n-HT20) 5 Channels for 5745.00-5825.00MHz(802.11a/n-HT20) 2 Channels for 5190.00-5230.00MHz(802.11n-HT40) 2 Channels for 5755.00-5795.00MHz(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) IEEE 802.11a: OFDM (64QAM, 16QAM,QPSK,BPSK)
Data Rates	:	IEEE 802.11b: 1-11Mbps IEEE 802.11g: 6-54Mbps IEEE 802.11n: MCS0-MCS15 IEEE 802.11a: 6-54Mbps
Antenna Type And Gain	:	R-SMA antenna, 5.0 dBi (Max.)

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
Lenovo	PC	B470	--	DoC

1.3. External I/O Cable

I/O Port Description	Quantity	Cable
USB	1	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 150 kHz-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).

Pre-testing for AC conducted emission measurement, measured at both AC 120V/60Hz and AC 240V/60Hz for power adapter of PC;

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: MCS8, OFDM.

Channel List & Frequency

IEEE 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 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

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmits 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.

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 analyzer.

5.1.3. Test Procedures

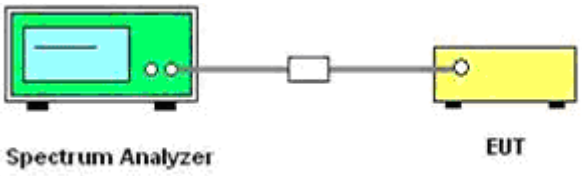
1. Set the centre frequency of the spectrum analyzer to the transmitting frequency;

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



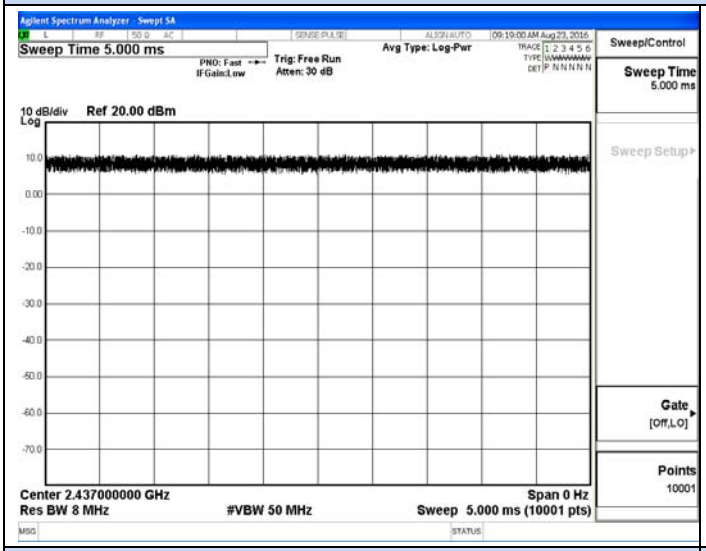
5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

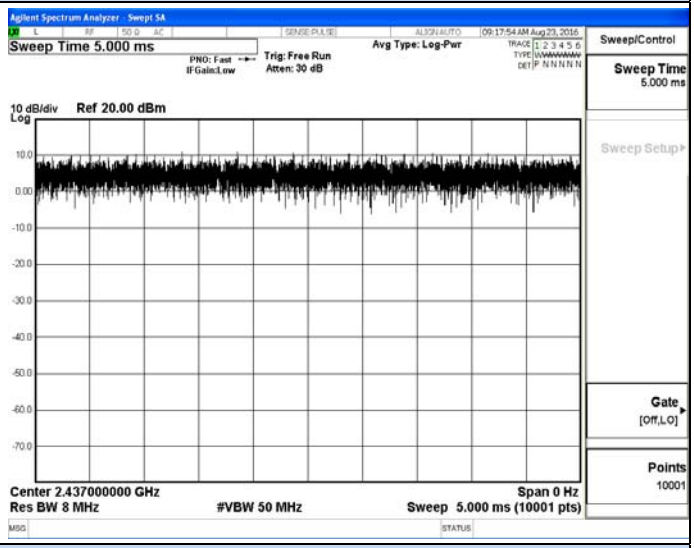
5.1.6. Test result

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

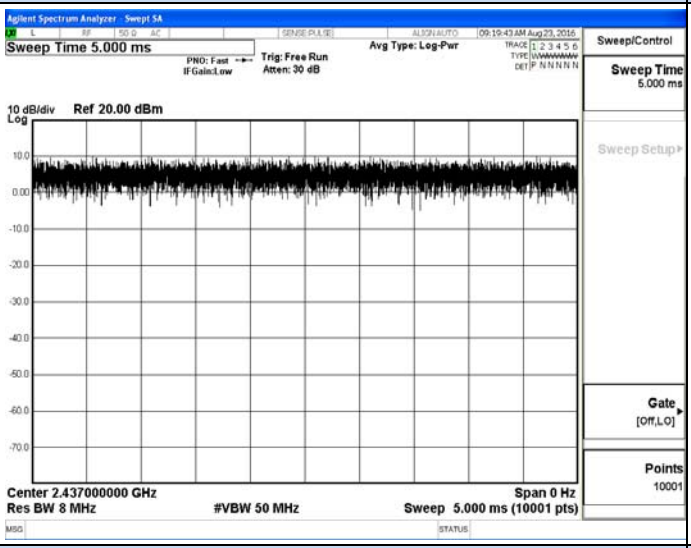
On Time and Duty Cycle



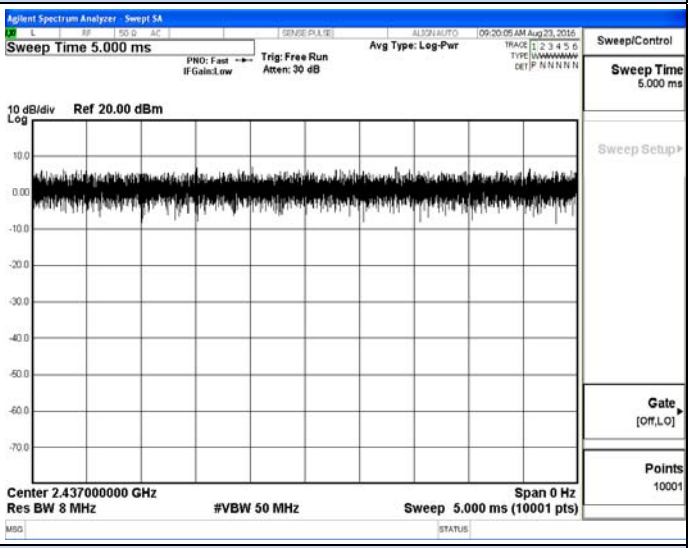
IEEE 802.11b



IEEE 802.11g



IEEE 802.11n HT20



IEEE 802.11n HT40

5.2. Maximum Peak 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 exceeds 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.

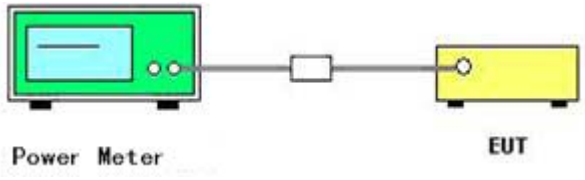
5.2.2. Measuring Instruments and Setting

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°C	Humidity	60%
Test Engineer	Jacky	Configurations	802.11b/g/n

Test Mode	Channel	Frequency (MHz)	Measured Output Peak Power (dBm)			Limits (dBm)	Verdict
			Antenna 0	Antenna 1	Sum		
IEEE 802.11 b	1	2412	14.49	16.01	/	30	PASS
	6	2437	14.44	15.53	/		
	11	2462	14.50	15.01	/		
IEEE 802.11 g	1	2412	13.63	14.64	/	30	PASS
	6	2437	13.92	14.57	/		
	11	2462	14.14	14.17	/		
IEEE 802.11 n HT20	1	2412	13.60	14.58	17.13	30	PASS
	6	2437	13.93	14.43	17.20		
	11	2462	14.09	14.09	17.10		
IEEE 802.11 n HT40	3	2422	13.53	14.14	16.86	30	PASS
	6	2437	13.44	14.14	16.81		
	9	2452	13.65	13.69	16.68		

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

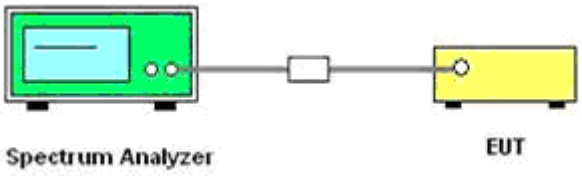
5.3.2. Measuring Instruments and Setting

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.

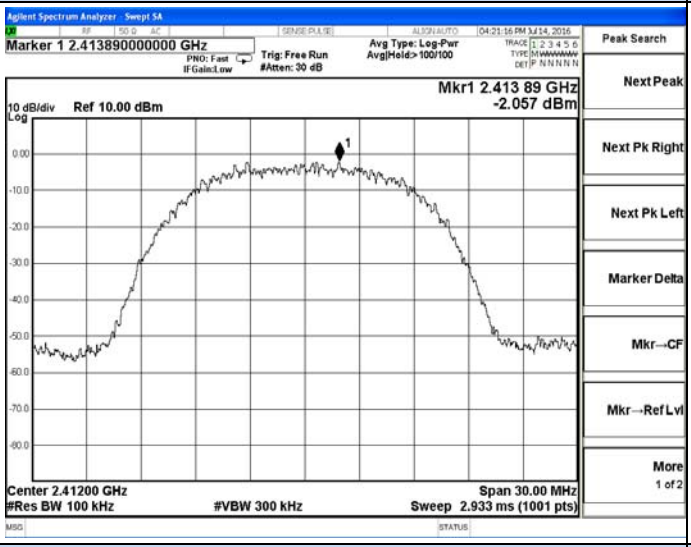
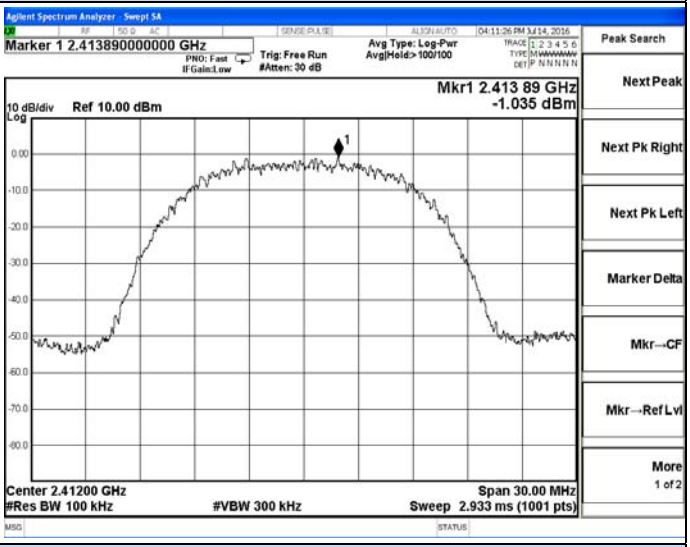
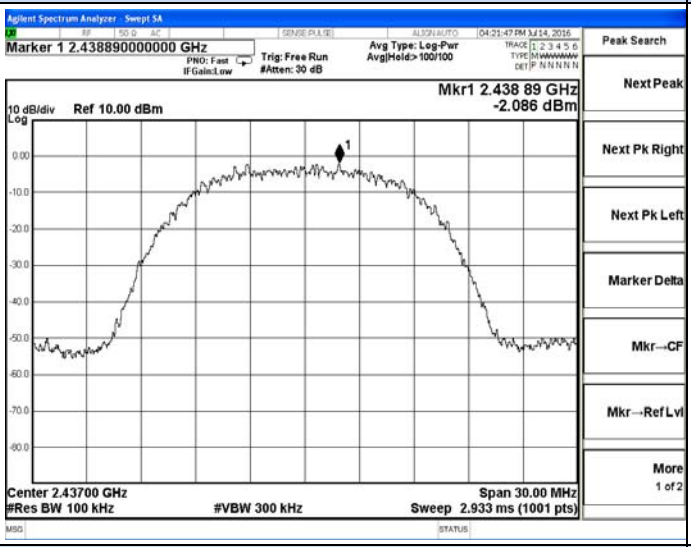
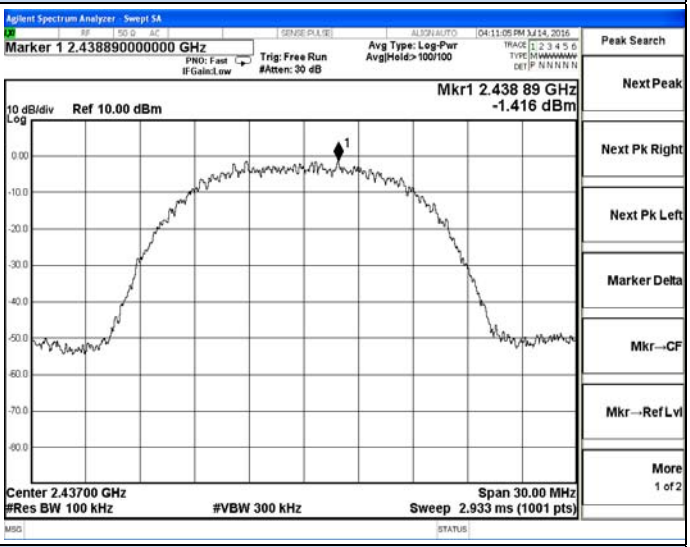
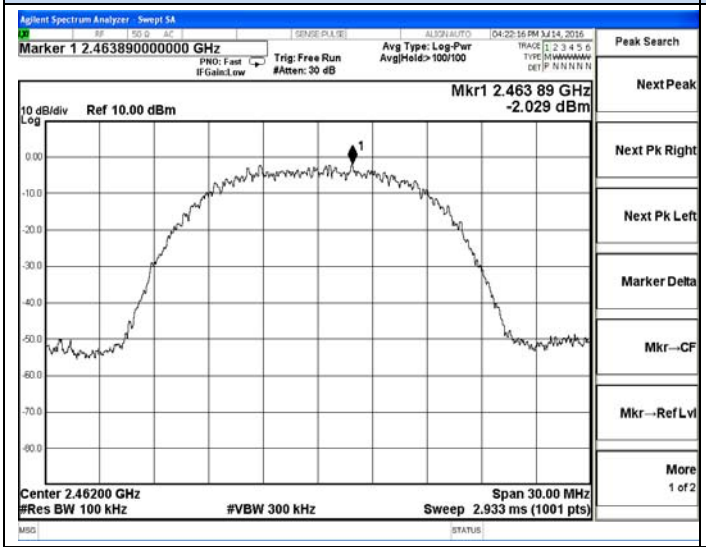
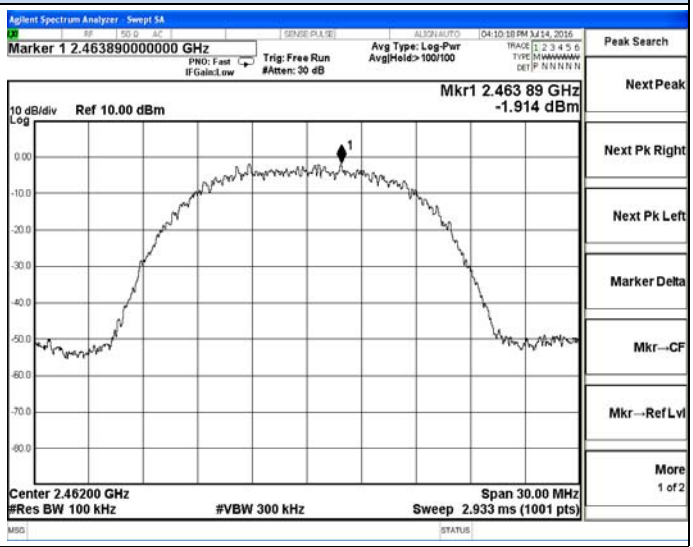
5.3.6. Test Result of Power Spectral Density

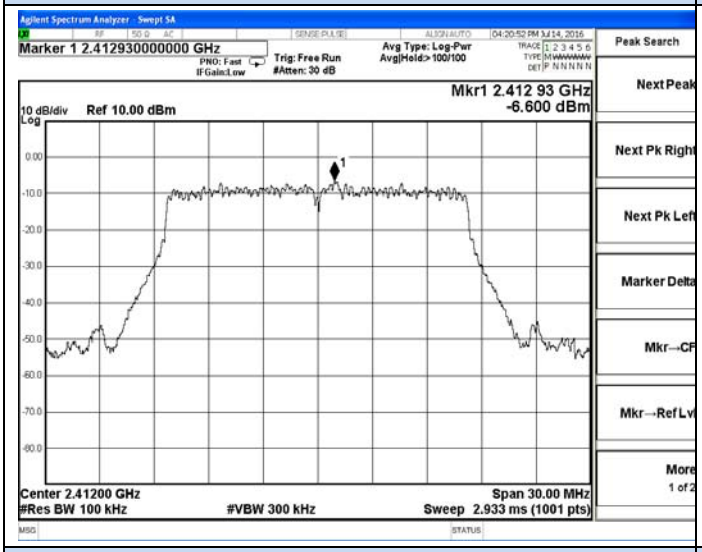
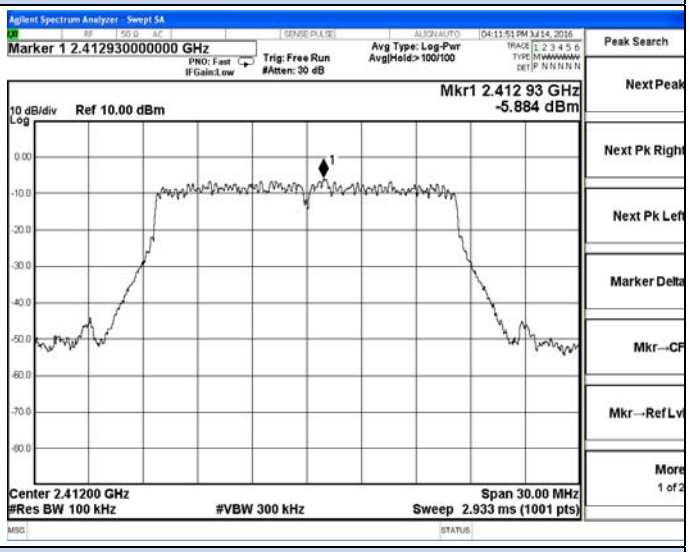
Temperature	25℃	Humidity	60%
Test Engineer	Jakcy	Configurations	802.11b/g/n

Test Mode	Channel	Frequency (MHz)	Measured Peak Power Spectral Density (dBm/3KHz)			Limits (dBm/3KHz)	Verdict
			Antenna 0	Antenna 1	Sum		
IEEE 802.11 b	1	2412	-2.057	-1.035	/	8	PASS
	6	2437	-2.086	-1.416	/		
	11	2462	-2.029	-1.914	/		
IEEE 802.11 g	1	2412	-6.600	-5.884	/	8	PASS
	6	2437	-6.632	-5.955	/		
	11	2462	-6.028	-6.515	/		
IEEE 802.11 n HT20	1	2412	-7.607	-6.341	-3.918	7	PASS
	6	2437	-6.877	-6.149	-3.487		
	11	2462	-6.526	-6.440	-3.472		
IEEE 802.11 n HT40	3	2422	-10.535	-10.359	-7.436	7	PASS
	6	2437	-10.157	-9.568	-6.842		
	9	2452	-10.428	-10.044	-7.221		

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;*
3. *Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT20; 13.5Mbps at IEEE 802.11 n HT40;*
4. *The PSD limits of IEEE 802.11n HT20 and IEEE 802.11 n HT40 for MIMO device should be reduce (10*long(2)+5-6)/3=1dBi according to KDB662911D01;*
5. *please refer to following plots;*

Peak Power Spectral Density	
IEEE 802.11 b	
Antenna 0	Antenna 1
	
2412 MHz	2412 MHz
	
2437 MHz	2437 MHz
	
2462 MHz	2462 MHz

Peak Power Spectral Density	
IEEE 802.11 g	
Antenna 0	Antenna 1
	
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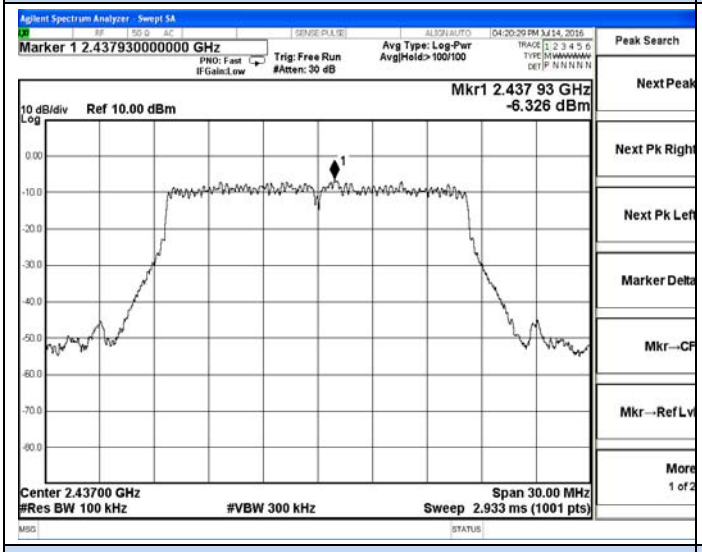
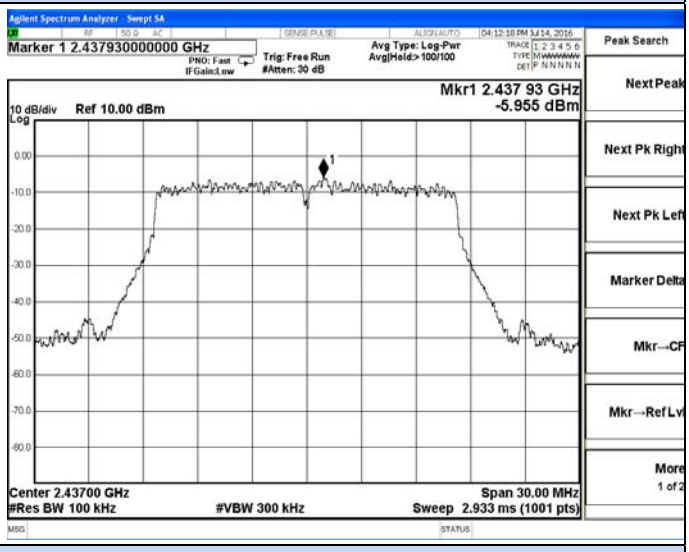
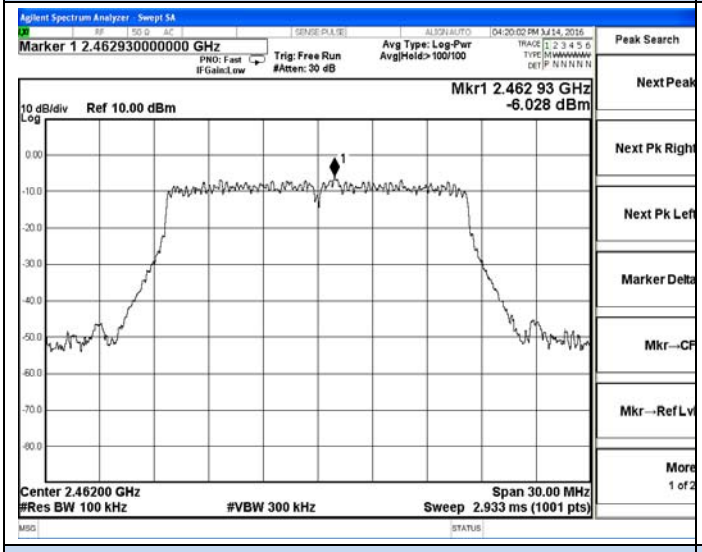
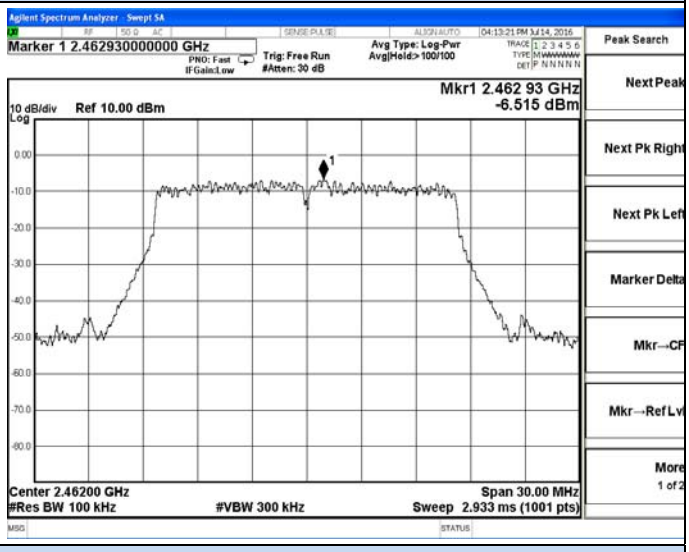
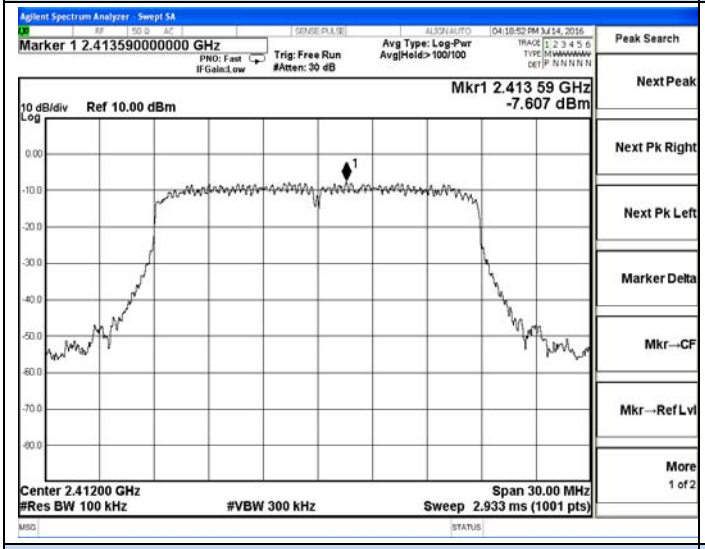
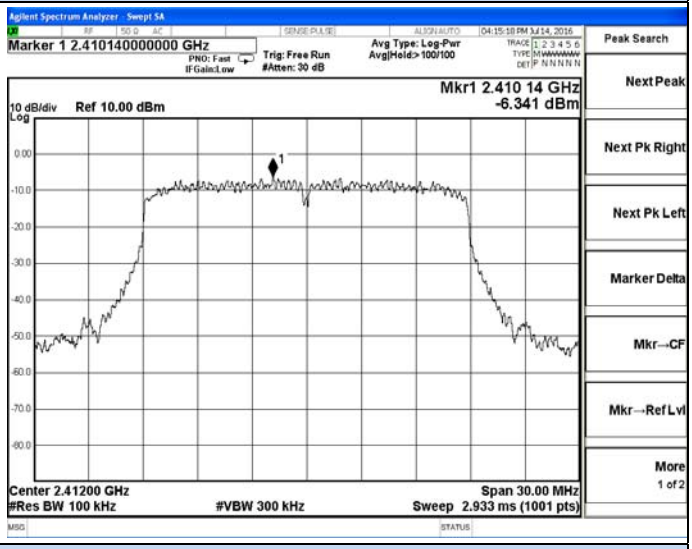
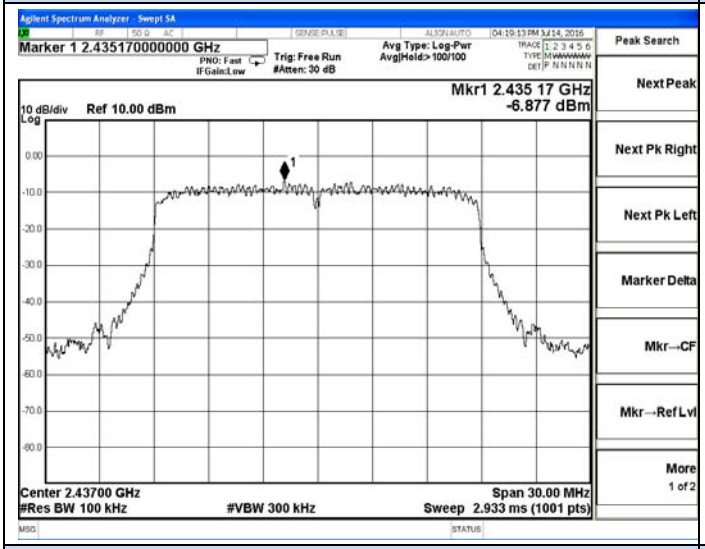
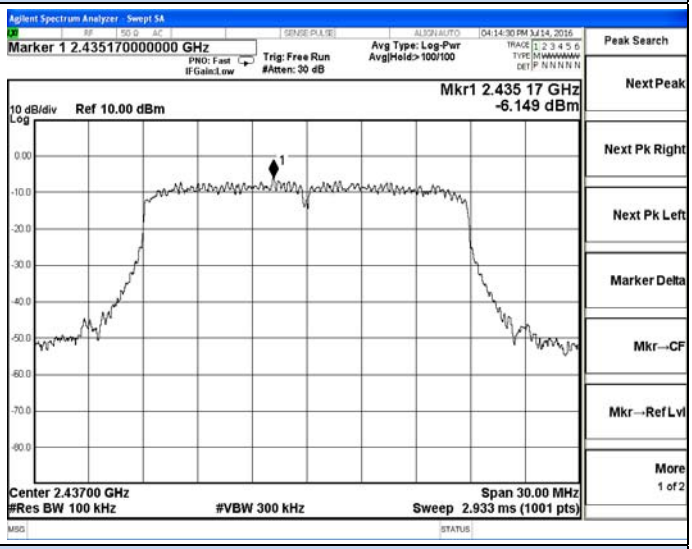
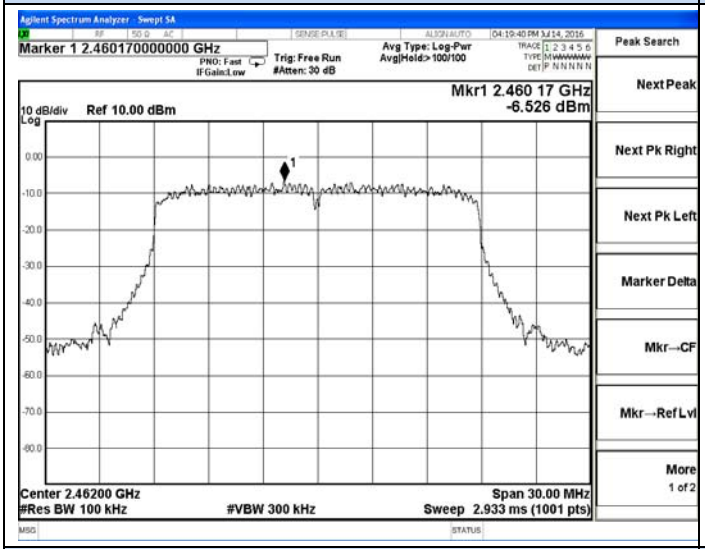
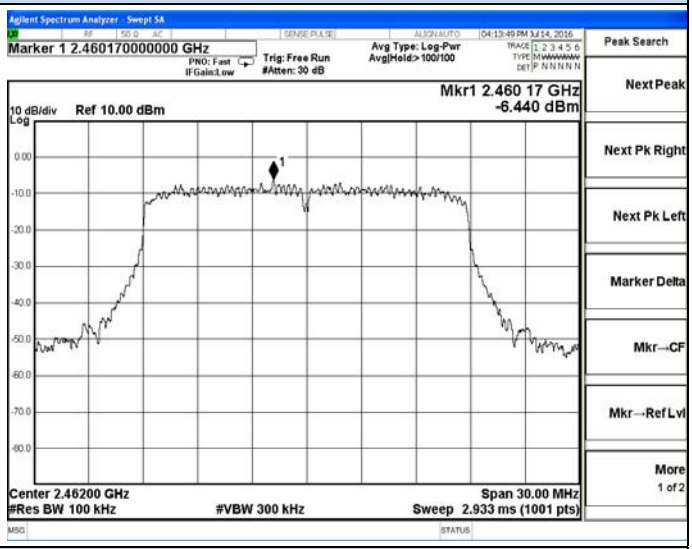
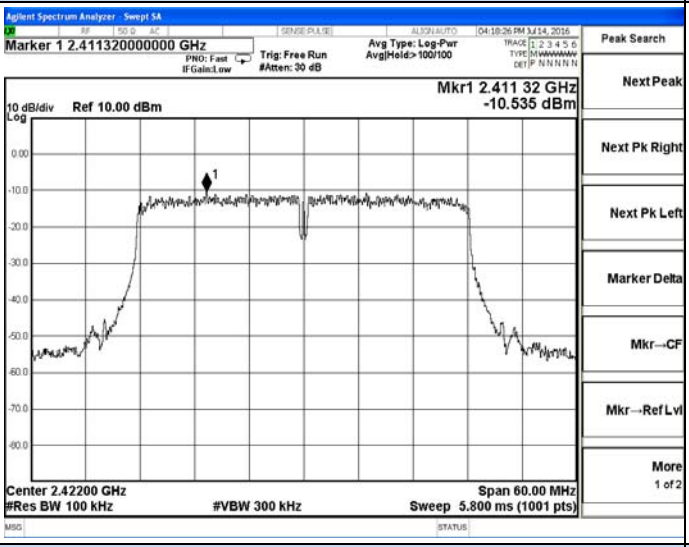
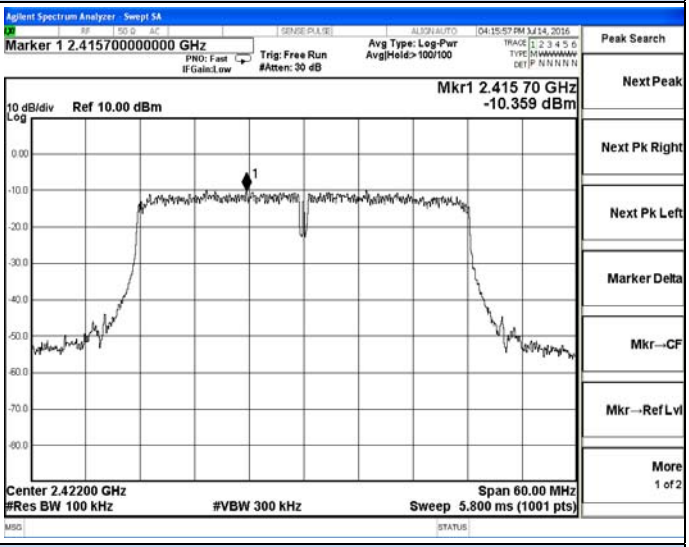
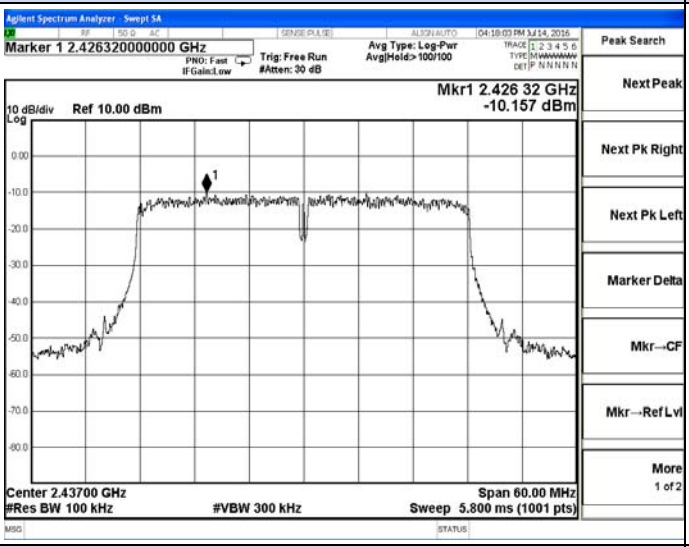
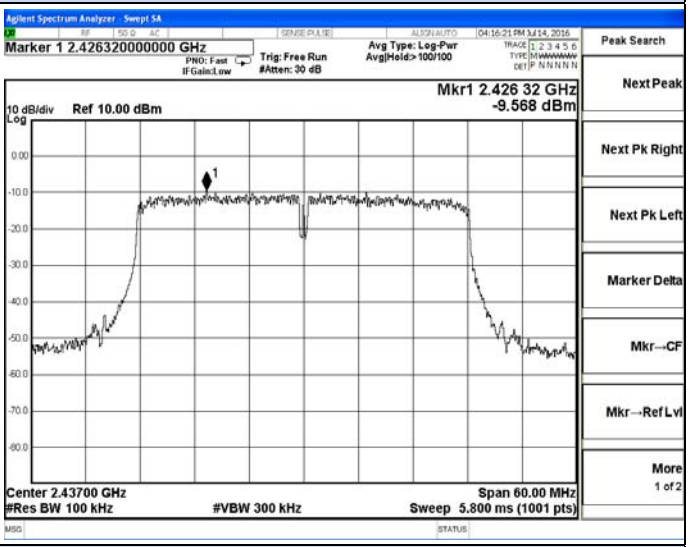
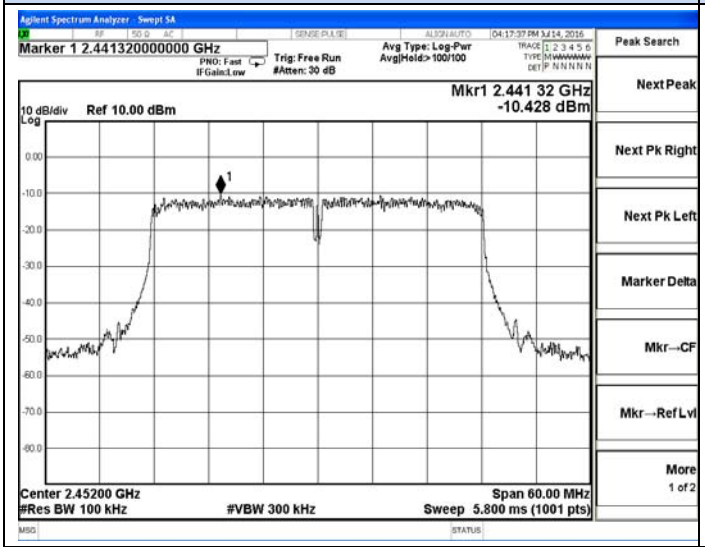
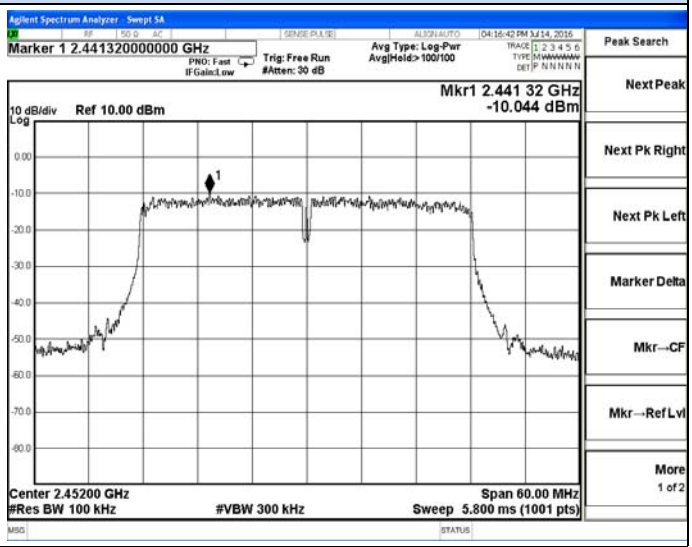
	
2437 MHz	2437 MHz
	
2462 MHz	2462 MHz

Peak Power Spectral Density	
IEEE 802.11 n HT20	
Antenna 0	Antenna 1
	
2412 MHz	2412 MHz
	
2437 MHz	2437 MHz
	
2462 MHz	2462 MHz

Peak Power Spectral Density	
IEEE 802.11 n HT40	
Antenna 0	Antenna 1
	
2422 MHz	2422 MHz
	
2437 MHz	2437 MHz
	
2462 MHz	2462 MHz

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

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300 KHz.

The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

According to KDB558074 D01 V03 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.

1. Set RBW = 100 kHz.

2. Set the video bandwidth (VBW) ≥ 3 RBW.

3. Detector = Peak.

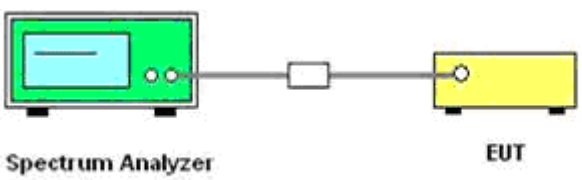
4. Trace mode = max hold.

5. Sweep = auto couple.

6. Allow the trace to stabilize.

7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

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

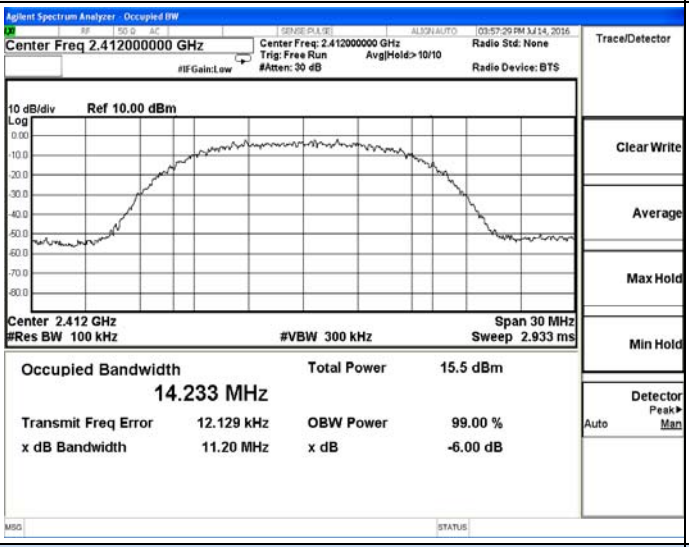
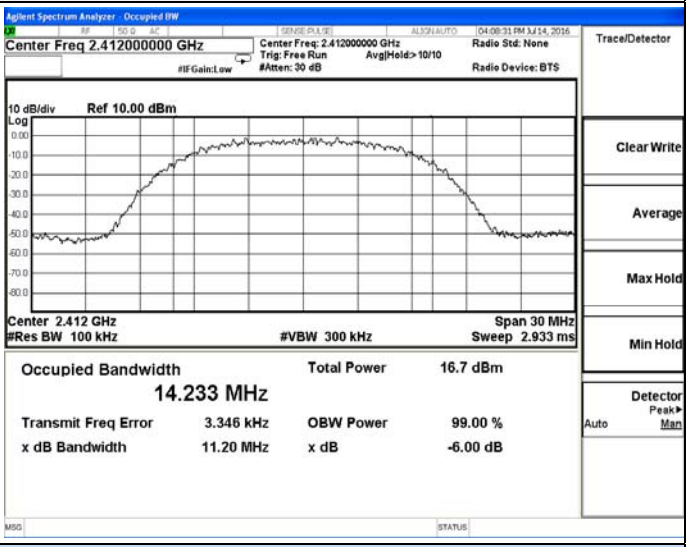
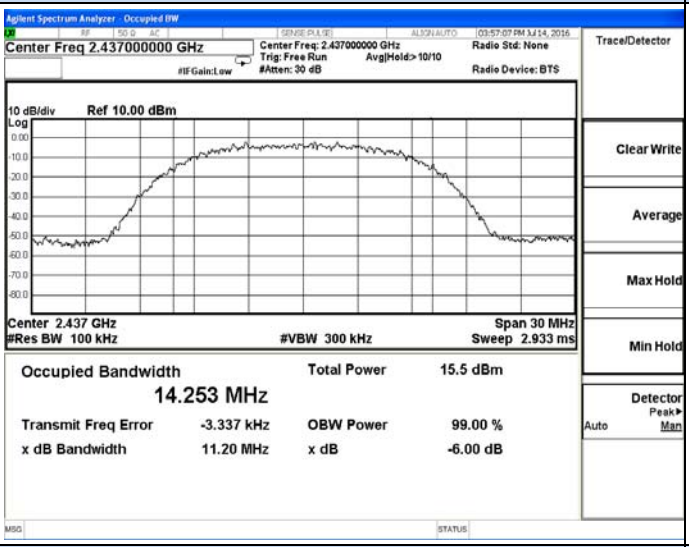
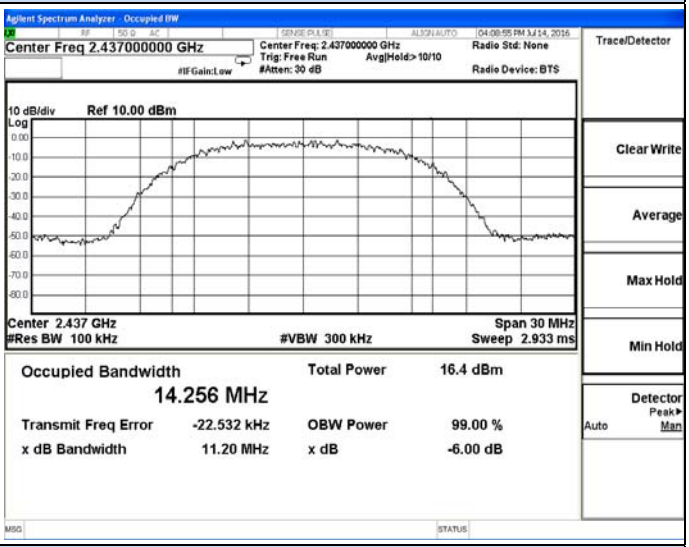
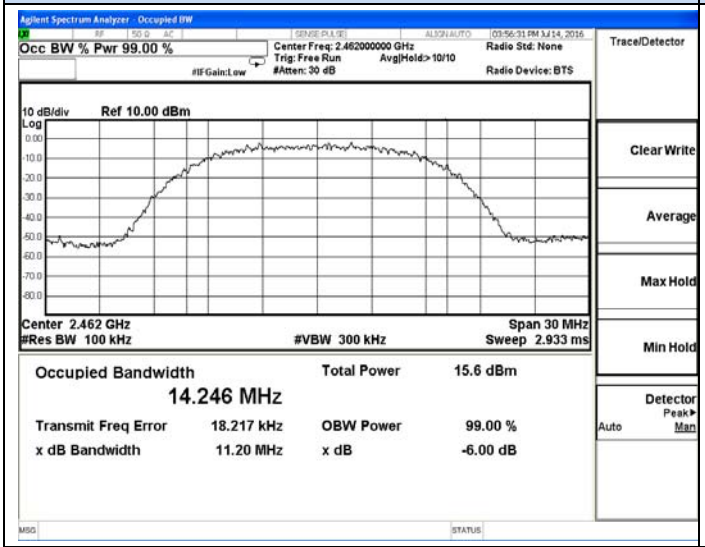
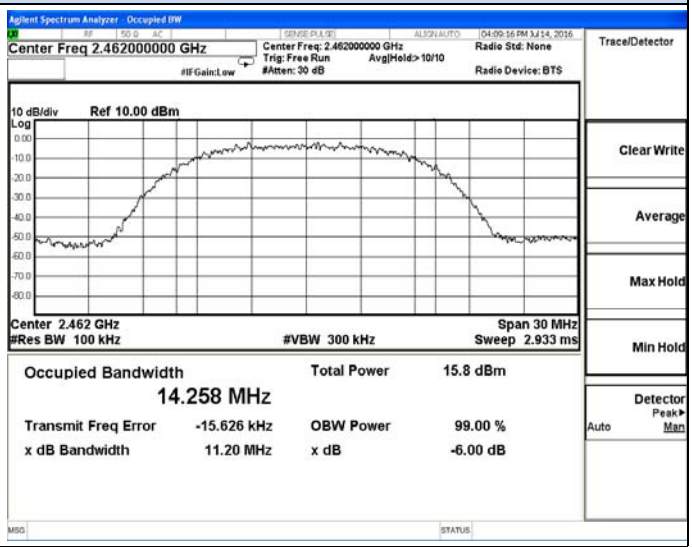
Test Mode	Channel	Frequency (MHz)	Measured 6 dB Bandwidth (MHz)		Limits (MHz)	Verdict
			Antenna 0	Antenna 1		
IEEE 802.11 b	1	2412	11.20	11.20	≥0.5000	PASS
	6	2437	11.20	11.20		
	11	2462	11.20	11.20		
IEEE 802.11 g	1	2412	16.46	16.45	≥0.5000	PASS
	6	2437	16.47	16.46		
	11	2462	16.47	16.47		
IEEE 802.11 n HT20	1	2412	17.50	17.60	≥0.5000	PASS
	6	2437	17.59	17.27		
	11	2462	17.59	17.57		
IEEE 802.11 n HT40	3	2422	36.43	36.42	≥0.5000	PASS
	6	2437	36.42	36.40		
	9	2452	36.42	36.43		

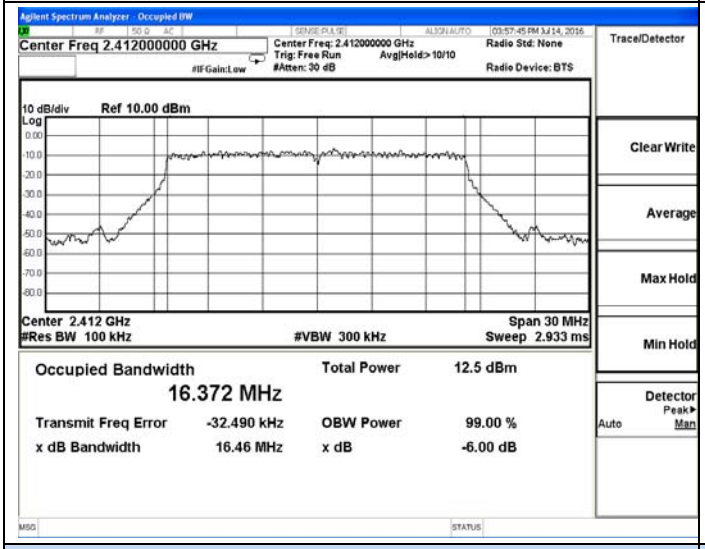
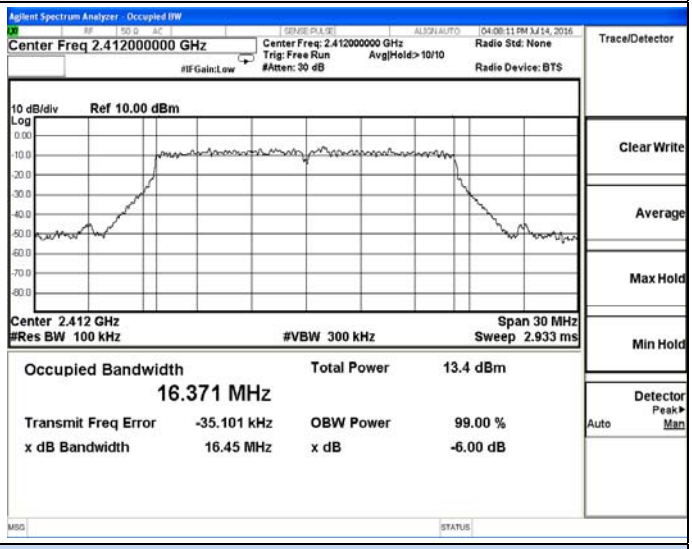
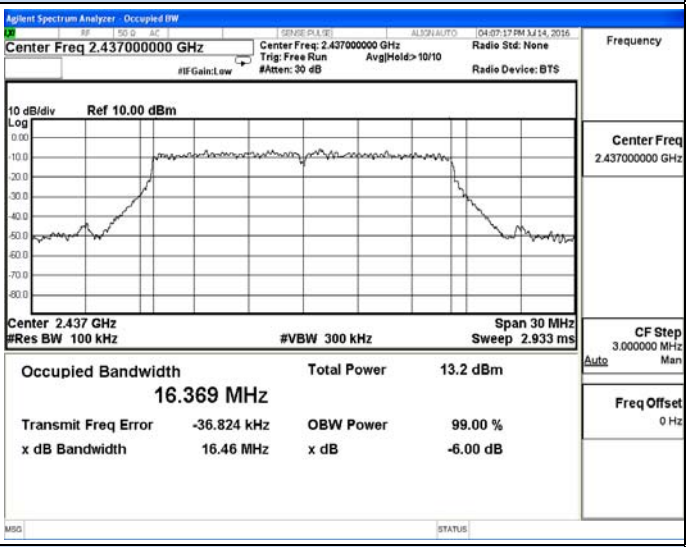
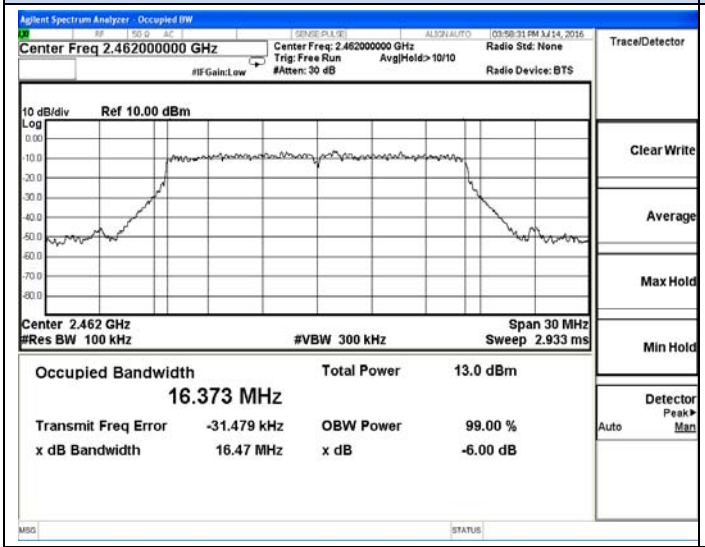
Remark:

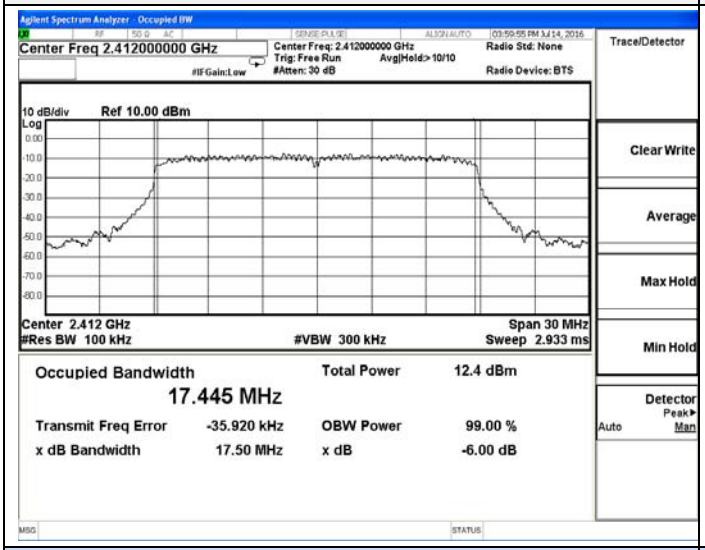
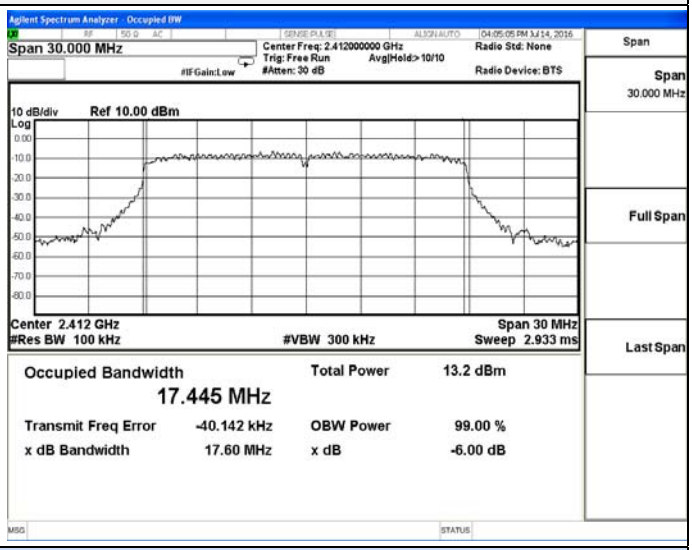
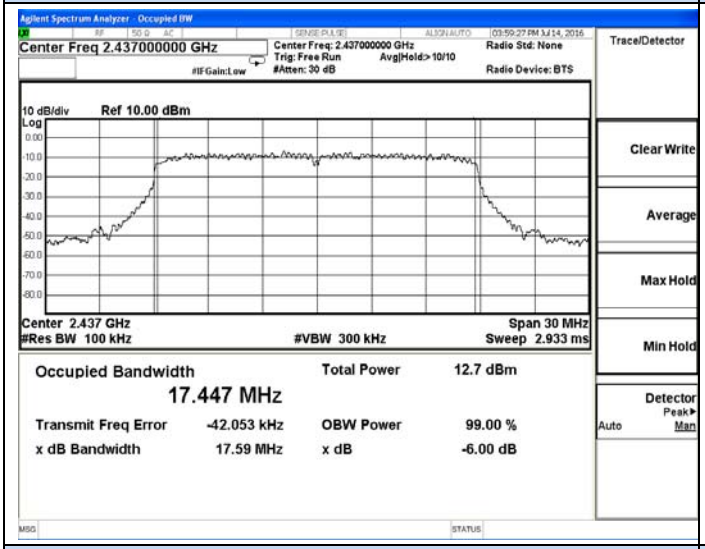
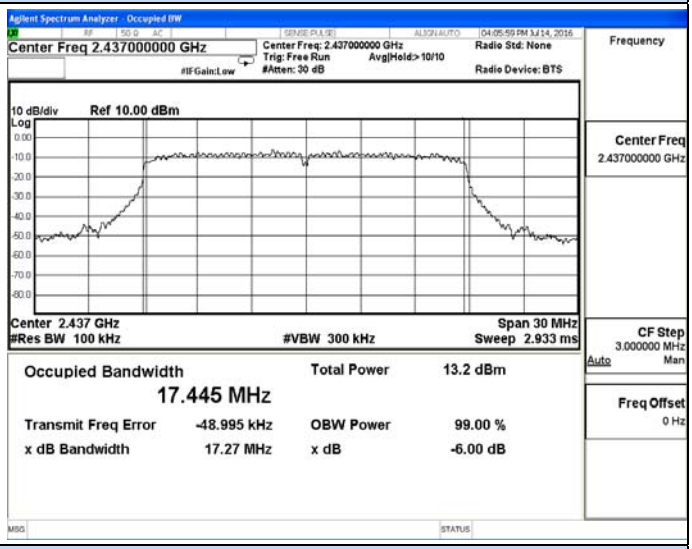
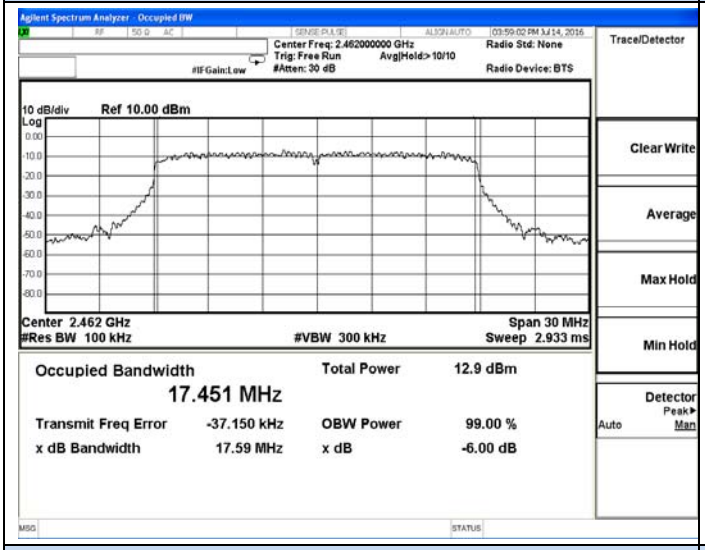
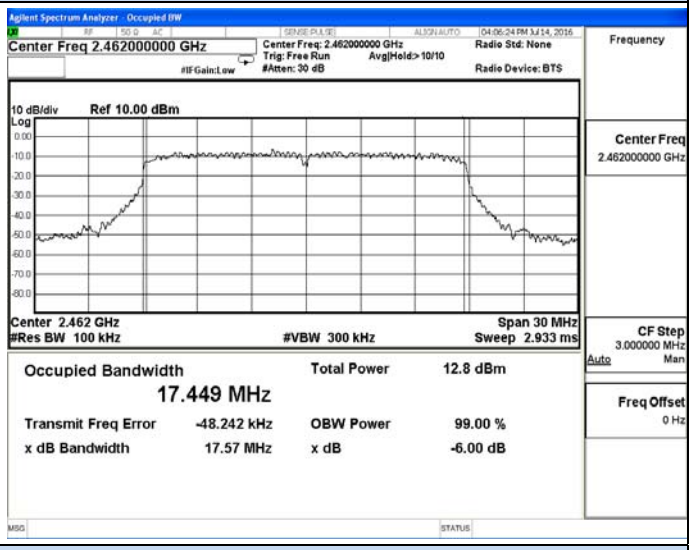
1. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 1Mbps at IEEE 802.11 b; 6Mbps at IEEE 802.11 g; 6.5Mbps at IEEE 802.11 n HT10; 13.5Mbps at IEEE 802.11 n HT40*
4. *please refer to following plots;*

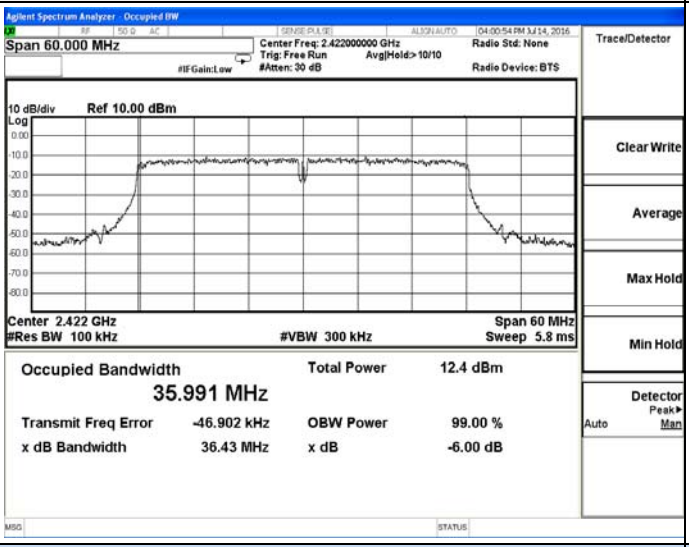
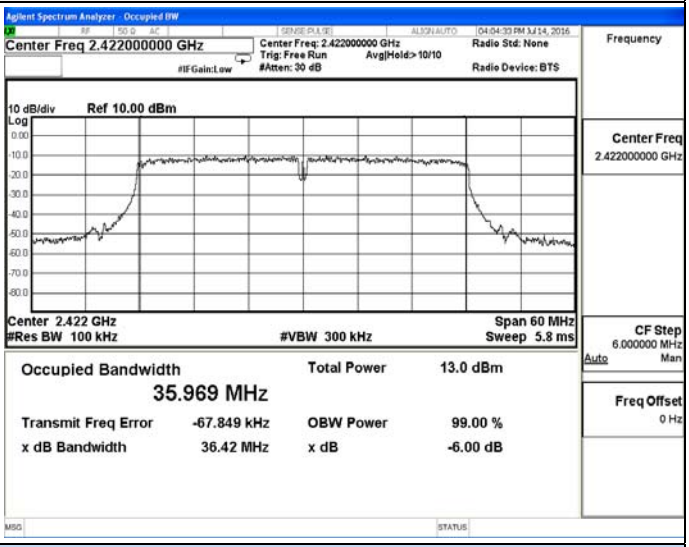
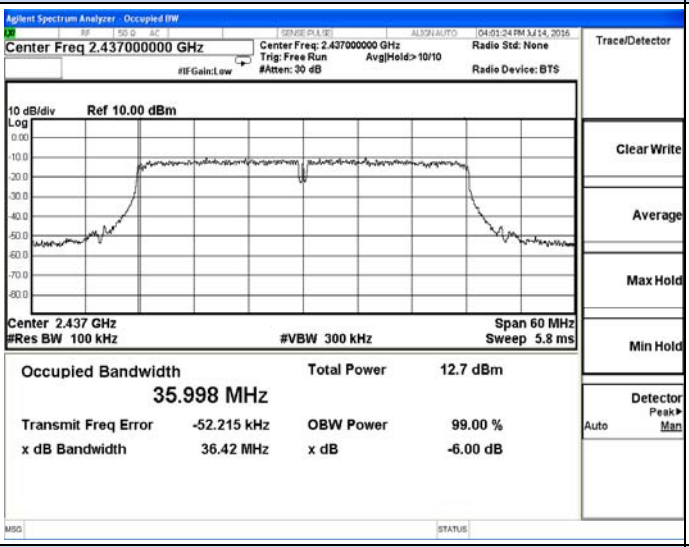
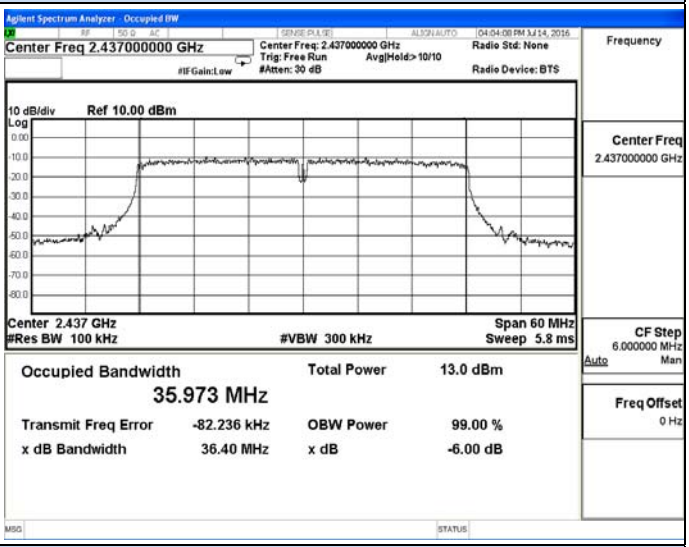
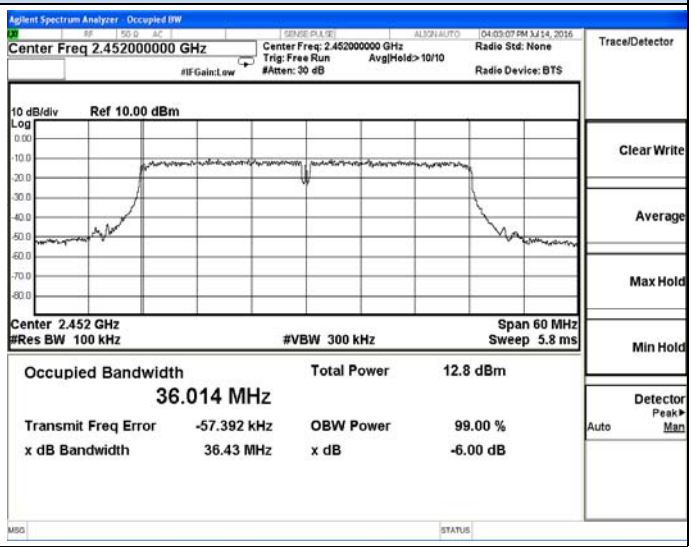
6 dB Bandwidth

IEEE 802.11 b

Antenna 0	*Antenna 1*
	
2412 MHz	*2412 MHz*
	
2437 MHz	*2437 MHz*
	
2462 MHz	*2462 MHz*

6 dB Bandwidth	
IEEE 802.11 g	
Antenna 0	*Antenna 1*
	
2412 MHz	*2412 MHz*
	
2437 MHz	*2437MHz*
	
2462 MHz	*2462 MHz*

6 dB Bandwidth	
IEEE 802.11 n HT20	
Antenna 0	*Antenna 1*
	
2412 MHz	*2412 MHz*
	
2437 MHz	*2437MHz*
	
2462 MHz	*2462 MHz*

6 dB Bandwidth	
IEEE 802.11 n HT40	
Antenna 0	*Antenna 1*
	
2422 MHz	*2422 MHz*
	
2437 MHz	*2437 MHz*
	
2452 MHz	*2452 MHz*

5.5. Radiated Emissions Measurement

5.5.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
\2\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

5.5.2. Measuring Instruments and Setting

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

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB 100kHz for QP/AVG

5.5.3. Test Procedures

1) **Sequence of testing 9 kHz to 30 MHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.5 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) **Sequence of testing 30 MHz to 1 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) **Sequence of testing 1 GHz to 18 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) **Sequence of testing above 18 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

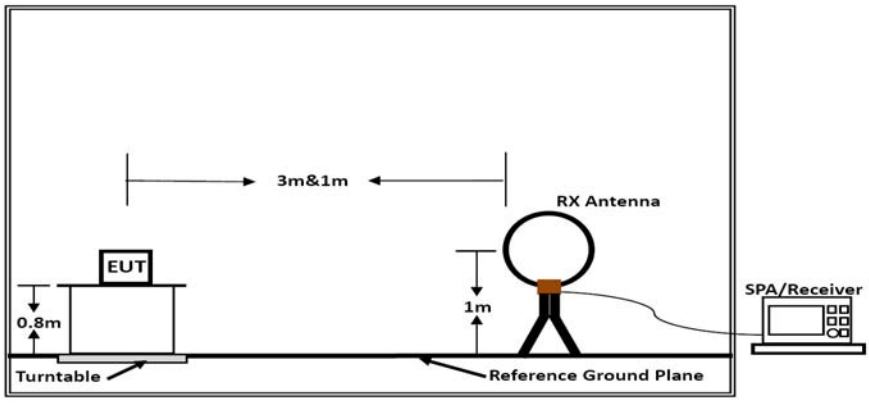
Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

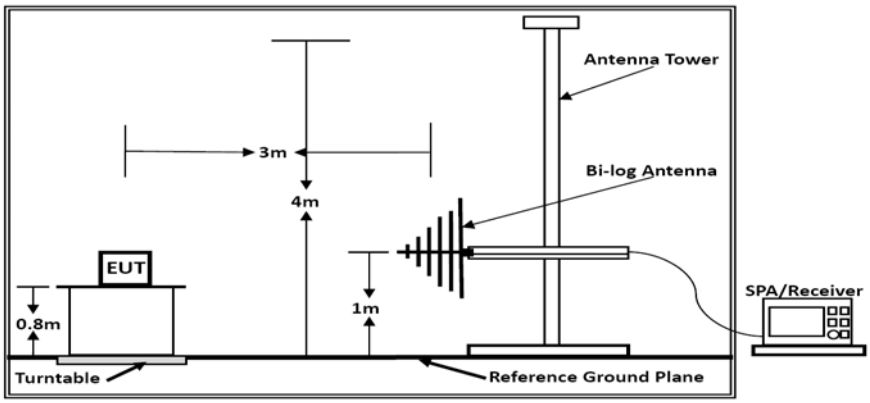
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

5.5.4. Test Setup Layout

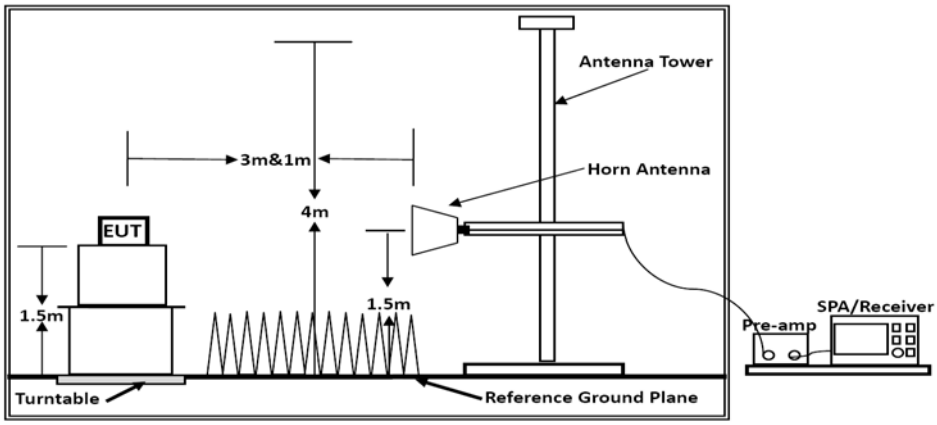
For radiated emissions below 30MHz



Below 30MHz



Below 1GHz



Above 1GHz

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1.5m.

Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1.5m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.5.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

1.5.6. Results of Radiated Emissions (9 kHz~30MHz)

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

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

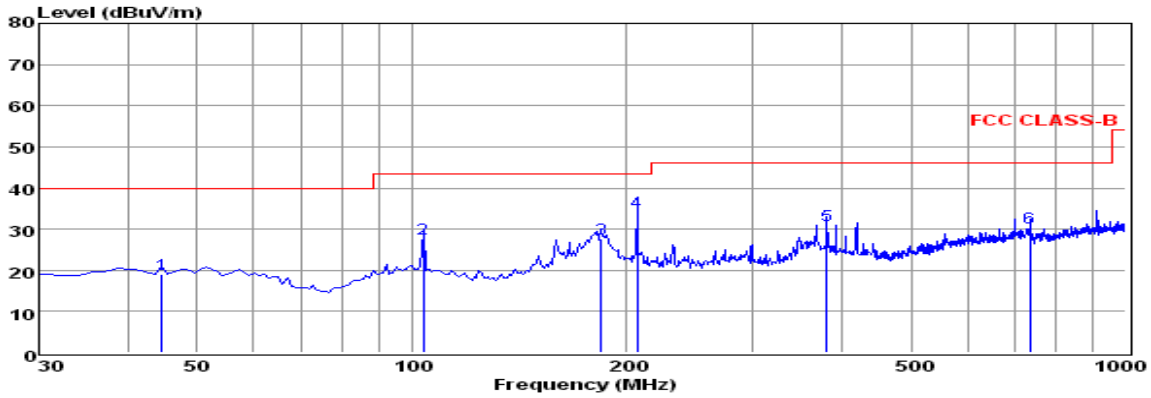
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

1.5.7. Results of Radiated Emissions (30MHz~1GHz)

Temperature	25℃	humidity	60%
Test Engineer	Jacky	Configurations	802.11b (High CH)

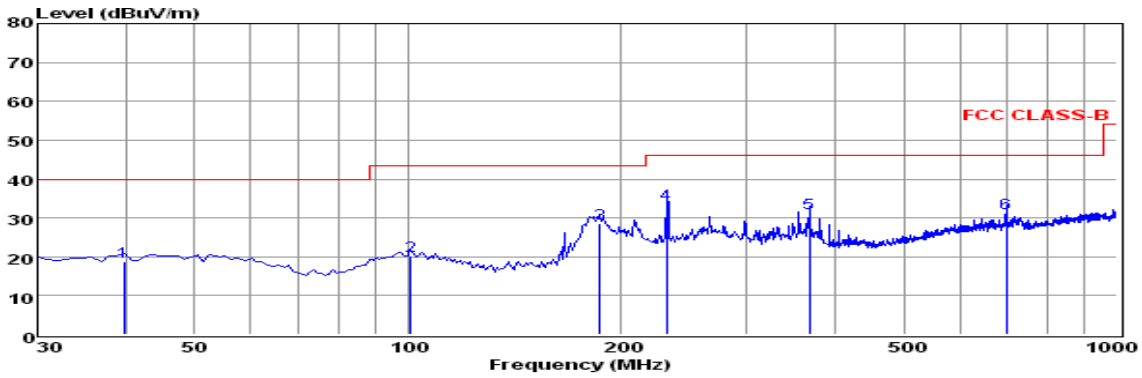
Test result for IEEE 802.11b (High Channel)



Env./Ins: 24℃/56%
pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	44.55	5.05	0.41	13.55	19.01	40.00	-20.99	QP
2	103.72	14.20	0.61	12.82	27.63	43.50	-15.87	QP
3	184.23	17.00	0.70	10.05	27.75	43.50	-15.75	QP
4	206.54	22.43	0.99	10.78	34.20	43.50	-9.30	QP
5	381.14	15.14	1.18	14.62	30.94	46.00	-15.06	QP
6	735.19	9.47	1.74	19.25	30.46	46.00	-15.54	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported



Env./Ins: 24℃/56%
pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	39.70	4.89	0.38	13.50	18.77	40.00	-21.23	QP
2	100.81	6.40	0.60	13.09	20.09	43.50	-23.41	QP
3	186.17	17.29	0.98	10.22	28.49	43.50	-15.01	QP
4	231.76	20.81	0.98	11.72	33.51	46.00	-12.49	QP
5	368.53	15.38	1.22	14.50	31.10	46.00	-14.90	QP
6	697.36	10.77	1.59	18.80	31.16	46.00	-14.84	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported

Note:

1. *Pre-scan all modes and recorded the worst case results in this report (802.11b (High Channel)).*
2. *Emission level (dBuV/m) = 20 log Emission level (uV/m).*
3. *Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.*

5.5.8. Results for Radiated Emissions (Above 1GHz)

IEEE 802.11b (Antenna 1 was worst case)

Channel 1

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4824.00	60.67	33.06	35.04	3.94	62.63	74	-11.37	Peak	Horizontal
4824.00	42.24	33.06	35.04	3.94	44.20	54	-9.80	Average	Horizontal
4824.00	60.45	33.06	35.04	3.94	62.41	74	-11.59	Peak	Vertical
4824.00	42.61	33.06	35.04	3.94	44.57	54	-9.43	Average	Vertical

Channel 6

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	61.59	33.16	35.15	3.96	63.56	74	-10.44	Peak	Horizontal
4874.00	43.05	33.16	35.15	3.96	45.02	54	-8.98	Average	Horizontal
4874.00	60.14	33.16	35.15	3.96	62.11	74	-11.89	Peak	Vertical
4874.00	42.77	33.16	35.15	3.96	44.74	54	-9.26	Average	Vertical

Channel 11

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4924.00	61.82	33.26	35.14	3.98	63.92	74	-10.08	Peak	Horizontal
4924.00	42.96	33.26	35.14	3.98	45.06	54	-8.94	Average	Horizontal
4924.00	60.48	33.26	35.14	3.98	62.58	74	-11.42	Peak	Vertical
4924.00	42.02	33.26	35.14	3.98	44.12	54	-9.88	Average	Vertical

IEEE 802.11g (Antenna 1 was worst case)

Channel 1

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4824.00	59.25	33.06	35.04	3.94	61.21	74	-12.79	Peak	Horizontal
4824.00	42.67	33.06	35.04	3.94	44.63	54	-9.37	Average	Horizontal
4824.00	58.15	33.06	35.04	3.94	60.11	74	-13.89	Peak	Vertical
4824.00	41.82	33.06	35.04	3.94	43.78	54	-10.22	Average	Vertical

Channel 6

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	59.27	33.16	35.15	3.96	61.24	74	-12.76	Peak	Horizontal
4874.00	42.58	33.16	35.15	3.96	44.55	54	-9.45	Average	Horizontal
4874.00	59.39	33.16	35.15	3.96	61.36	74	-12.64	Peak	Vertical
4874.00	42.30	33.16	35.15	3.96	44.27	54	-9.73	Average	Vertical

Channel 11

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4924.00	60.12	33.26	35.14	3.98	62.22	74	-11.78	Peak	Horizontal
4924.00	42.93	33.26	35.14	3.98	45.03	54	-8.97	Average	Horizontal
4924.00	59.52	33.26	35.14	3.98	61.62	74	-12.38	Peak	Vertical
4924.00	41.44	33.26	35.14	3.98	43.54	54	-10.46	Average	Vertical

IEEE 802.11n HT20 (Combine Antenna 0 and Antenna 1)

Channel 1

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4824.00	63.66	33.06	35.04	3.94	65.62	74	-8.38	Peak	Horizontal
4824.00	46.07	33.06	35.04	3.94	48.03	54	-5.97	Average	Horizontal
4824.00	62.15	33.06	35.04	3.94	64.11	74	-9.89	Peak	Vertical
4824.00	45.78	33.06	35.04	3.94	47.74	54	-6.26	Average	Vertical

Channel 6

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	64.25	33.16	35.15	3.96	66.22	74	-7.78	Peak	Horizontal
4874.00	47.06	33.16	35.15	3.96	49.03	54	-4.97	Average	Horizontal
4874.00	62.44	33.16	35.15	3.96	64.41	74	-9.59	Peak	Vertical
4874.00	44.78	33.16	35.15	3.96	46.75	54	-7.25	Average	Vertical

Channel 11

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4924.00	64.46	33.26	35.14	3.98	66.56	74	-7.44	Peak	Horizontal
4924.00	46.95	33.26	35.14	3.98	49.05	54	-4.95	Average	Horizontal
4924.00	63.51	33.26	35.14	3.98	65.61	74	-8.39	Peak	Vertical
4924.00	45.13	33.26	35.14	3.98	47.23	54	-6.77	Average	Vertical

IEEE 802.11n HT40 (Combine Antenna 0 and Antenna 1)

Channel 3

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4844.00	62.89	33.06	35.04	3.94	64.85	74	-9.15	Peak	Horizontal
4844.00	46.15	33.06	35.04	3.94	48.11	54	-5.89	Average	Horizontal
4844.00	61.06	33.06	35.04	3.94	63.02	74	-10.98	Peak	Vertical
4844.00	44.83	33.06	35.04	3.94	46.79	54	-7.21	Average	Vertical

Channel 6

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	62.81	33.16	35.15	3.96	64.78	74	-9.22	Peak	Horizontal
4874.00	46.26	33.16	35.15	3.96	48.23	54	-5.77	Average	Horizontal
4874.00	61.17	33.16	35.15	3.96	63.14	74	-10.86	Peak	Vertical
4874.00	44.48	33.16	35.15	3.96	46.45	54	-7.55	Average	Vertical

Channel 9

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4904.00	63.02	33.26	35.14	3.98	65.12	74	-8.88	Peak	Horizontal
4904.00	46.26	33.26	35.14	3.98	48.36	54	-5.64	Average	Horizontal
4904.00	62.10	33.26	35.14	3.98	64.20	74	-9.8	Peak	Vertical
4904.00	44.31	33.26	35.14	3.98	46.41	54	-7.59	Average	Vertical

Notes:

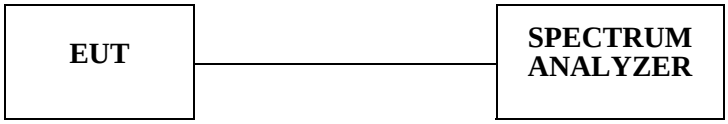
1. *Measuring frequencies from 9k~10th harmonic or 26.5GHz (which is less), No emission found between lowest internal used/generated frequency to 30MHz.*
2. *Radiated emissions measured in frequency range from 9k~10th harmonic or 26.5GHz (which is less) were made with an instrument using Peak detector mode.*
3. *Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*

5.6 Band-edge Measurements for Radiated Emissions

5.6.1 Test Requirements

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

5.6.2 Test Configuration



5.6.3 Test Procedure

According to KDB 558074 D01 V03 for Antenna-port conducted measurement.
Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=10Hz for Peak detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

$E = EIRP - 20\log D + 104.8$
Where:
E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

11. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.
12. Compare the resultant electric field strength level to the applicable regulatory limit.
13. Perform radiated spurious emission test duress until all measured frequencies were complete.

5.6.4 Limit

Below -20dB of the highest emission level in operating band.

Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)