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.
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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 04, 2016
Date of Report	:	August 04, 2016

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FCC TEST REPORT
FCC CFR 47 PART 15 E(15.407): 2015

Report Reference No.	**:**	**LCS1608040280E**
Date of Issue	:	August 04, 2016
Testing Laboratory Name.....	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	:	1F., Xingyuan Industrial Park, Tongda Road, Bao'an Blvd., 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 E(15.407): 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.	**:**	**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/ File administrators	Glin Lu/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS1608040280E	August 04, 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	2016-08-04	Initial Issue	Gavin Liang

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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

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 Port

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.

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 150 kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be 802.11a mode (Low 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 802.11a mode(Low Channel).

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:
IEEE 802.11a Mode : 6 Mbps, OFDM.
IEEE 802.11n-HT20 Mode: MCS0, OFDM.
IEEE 802.11n-HT40 Mode: MCS8, OFDM.

Antenna & Bandwidth

Antenna	Single (Port.1)			Two (Port.1 + Port.2)		
Bandwidth Mode	20MHz	40MHz	80MHz	20MHz	40MHz	80MHz
802.11a	☐	☐	☐	☑	☐	☐
802.11n	☐	☐	☐	☑	☑	☐
802.11ac	☐	☐	☐	☐	☐	☐

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 789033 D02 General UNII Test Procedures New Rules v01r02 and KDB 6622911 are required to be used for this kind of FCC 15.407 UII device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E

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

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 E		
FCC Rules	**Description of Test**	**Result**
§15.407(a)	Maximum Conducted Output Power	Compliant
§15.407(a)	Power Spectral Density	Compliant
§15.407(e)	6dB Bandwidth	Compliant
§15.407(b)	Radiated Emissions	Compliant
§15.407(b)	Band edge Emissions	Compliant
§15.407(g)	Frequency Stability	Note
§15.207(a)	Line Conducted Emissions	Compliant
§15.203	Antenna Requirements	Compliant
§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.

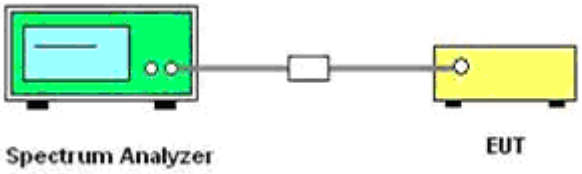
5.1.2. Measuring Instruments and Setting

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

5.1.3. Test Procedures

1. Set the centre frequency of the spectrum analyses 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 a	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

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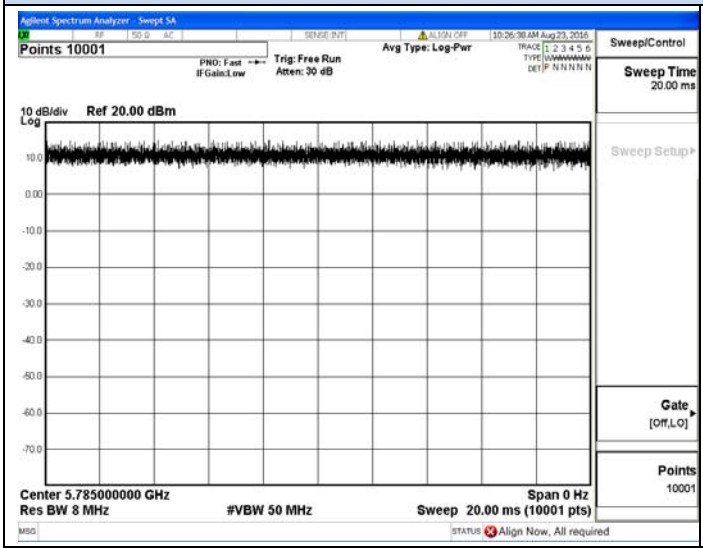
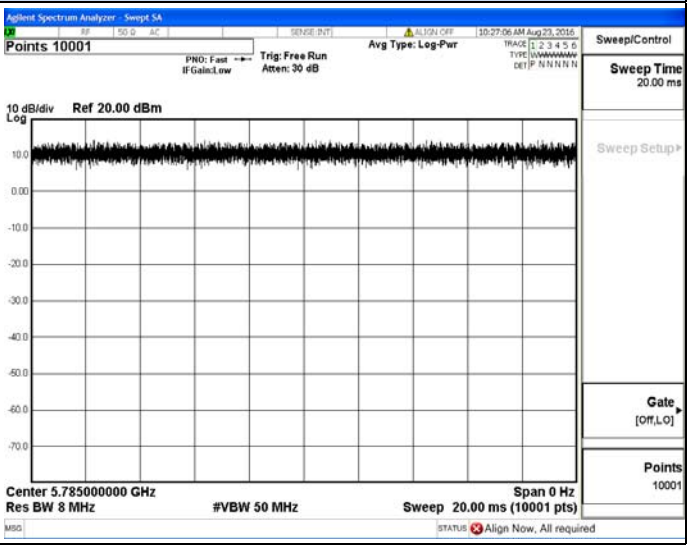
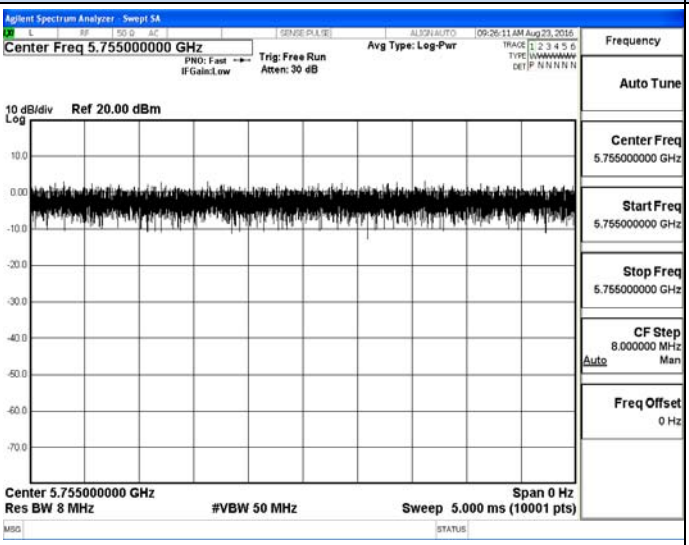
On Time and Duty Cycle



IEEE 802.11a



IEEE 802.11n HT20



IEEE 802.11n HT40

5.2. Maximum Conducted Output Power Measurement

5.2.1. Standard Applicable

For 5725~5850MHz

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

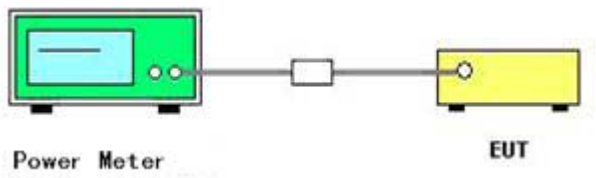
5.2.2. Measuring Instruments and Setting

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	802.11a/n

Test Mode	Channel	Frequency (MHz)	Measured Output Average Power (dBm)			Duty Cycle factor (dB)	Limits (dBm)	Verdict
			Antenna 0	Antenna 1	Sum			
IEEE 802.11 a	149	5745	14.62	14.33	/	0	30	PASS
	157	5785	13.89	13.43	/	0		
	165	5825	13.29	14.76	/	0		
IEEE 802.11 n HT20	149	5745	14.25	14.36	17.32	0	30	PASS
	157	5785	13.81	13.43	16.63	0		
	165	5825	14.18	14.62	17.42	0		
IEEE 802.11 n HT40	151	5755	14.85	14.52	17.70	0	30	PASS
	159	5795	14.59	14.82	17.72	0		

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 6Mbps at IEEE 802.11 a; 13Mbps at IEEE 802.11 n HT20; 27Mbps at IEEE 802.11 n HT40;*

5.3. Power Spectral Density Measurement

5.3.1. Standard Applicable

For 5725~5850MHz

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

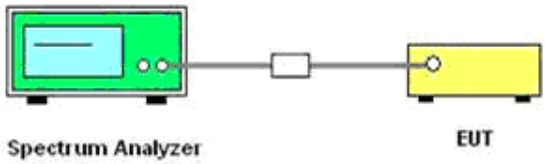
5.3.2. Measuring Instruments and Setting

Please refer to section 6 of equipment 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 = 300 kHz.
4. Set the VBW= 1000 kHz
5. Span=Encompass the entire emissions bandwidth (EBW) of the signal
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (<500KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

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

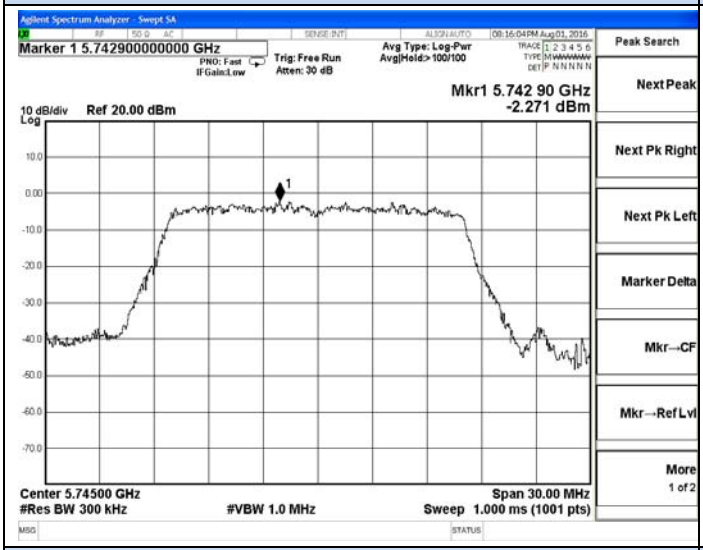
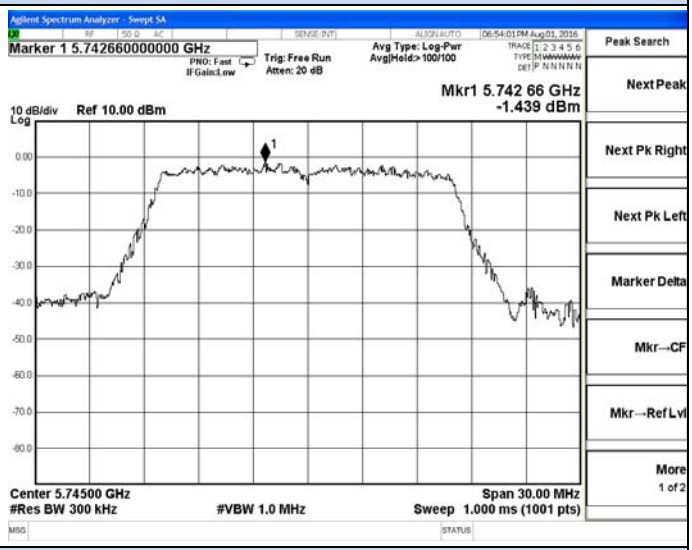
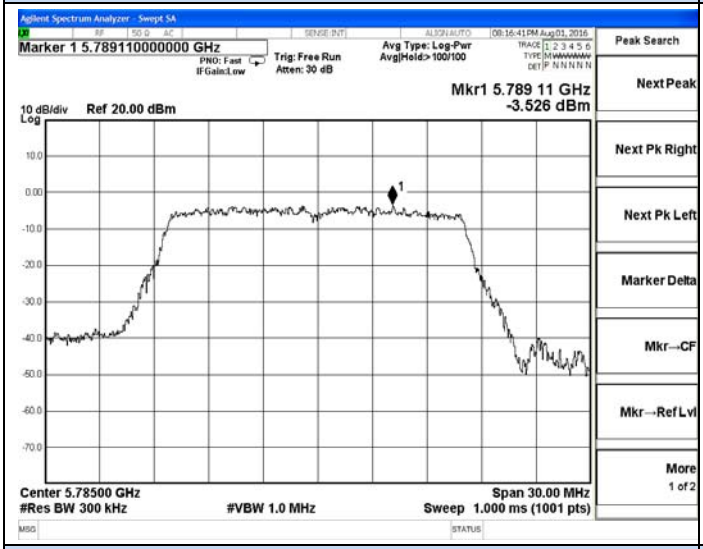
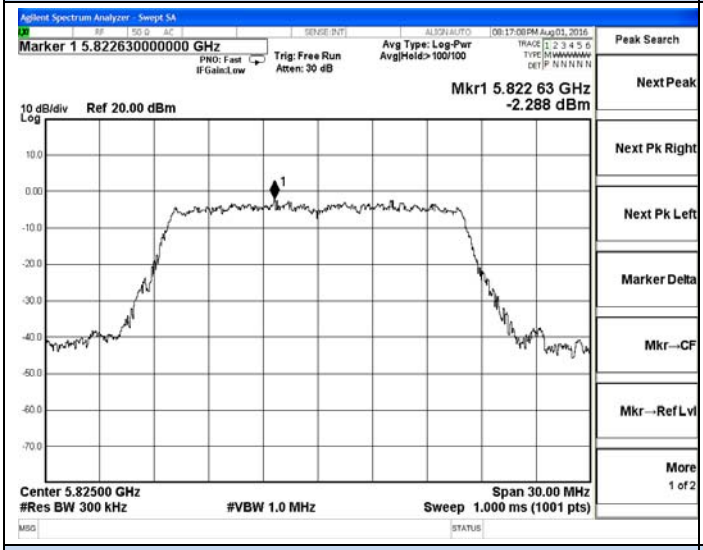
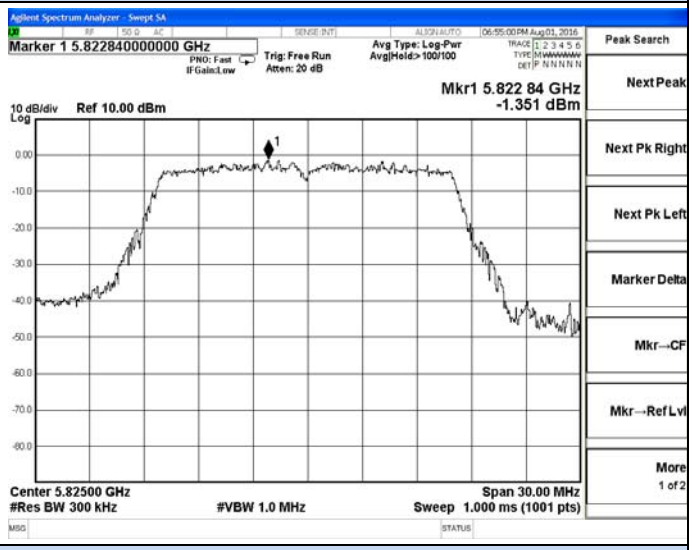
Test Mode	Channel	Frequency (MHz)	Report Peak Power Spectral Density (dBm/500KHz)			Duty Cycle factor (dB)	RBW factor (dB)	Limits (dBm/500KHz)	Verdict
			Antenna 0	Antenna 1	Sum				
IEEE 802.11 a	149	5745	-0.053	0.779	/	0	2.218	30	PASS
	157	5785	-1.308	-0.624	/	0	2.218		
	165	5825	-0.070	0.867	/	0	2.218		
IEEE 802.11 n HT20	149	5745	-0.893	-0.215	2.470	0	2.218	29	PASS
	157	5785	-0.371	-1.624	2.058	0	2.218		
	165	5825	-0.163	-0.073	2.893	0	2.218		
IEEE 802.11 n HT40	151	5755	-2.827	-3.013	0.091	0	2.218	29	PASS
	159	5795	-2.398	-4.015	-0.121	0	2.218		

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 6Mbps at IEEE 802.11 a; 13Mbps at IEEE 802.11 n HT20; 27Mbps 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)/3=1dBi according to KDB662911D01;*
5. *RBW factor* = 10 log (500 *kHz/RBW) = 10*log (500KHz/300KHz) = 2.218 dB;*
6. *Report peak power spectral density = Measure peak power spectral density + RBW factor + Duty Cycle factor*
7. *please refer to following plots;*

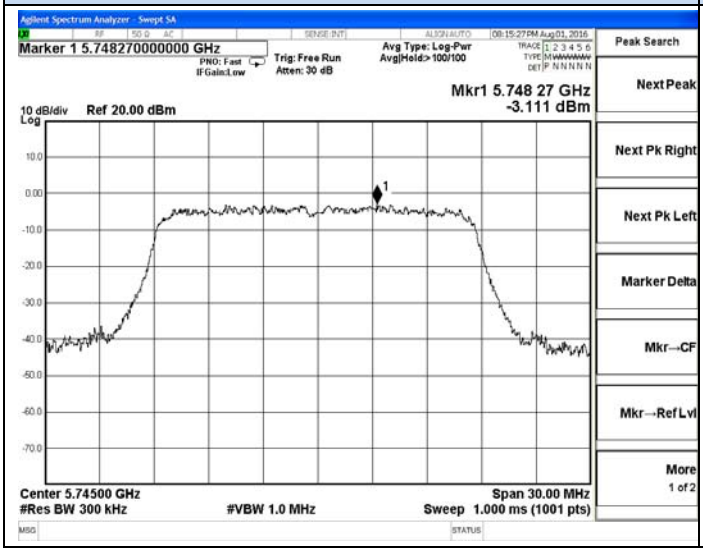
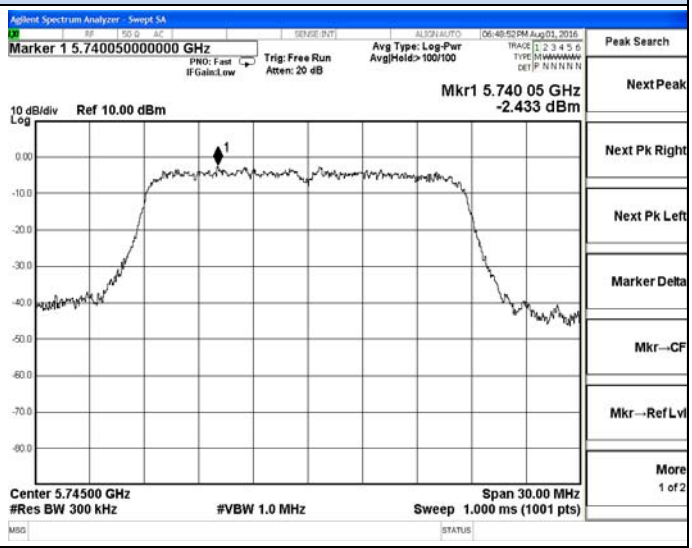
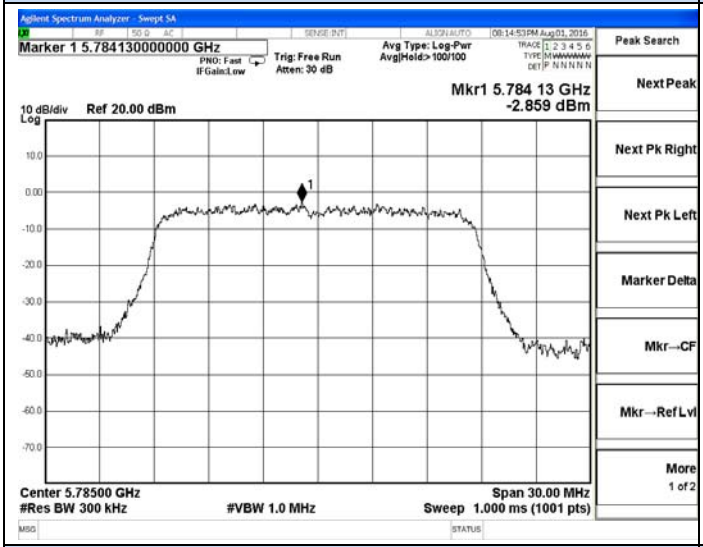
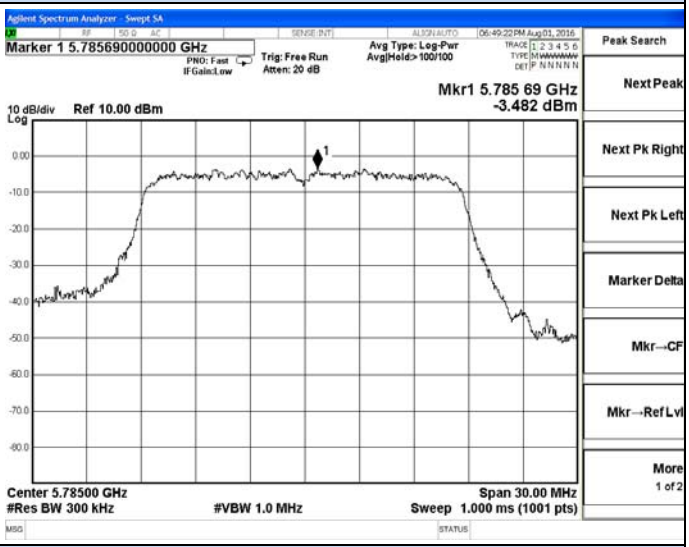
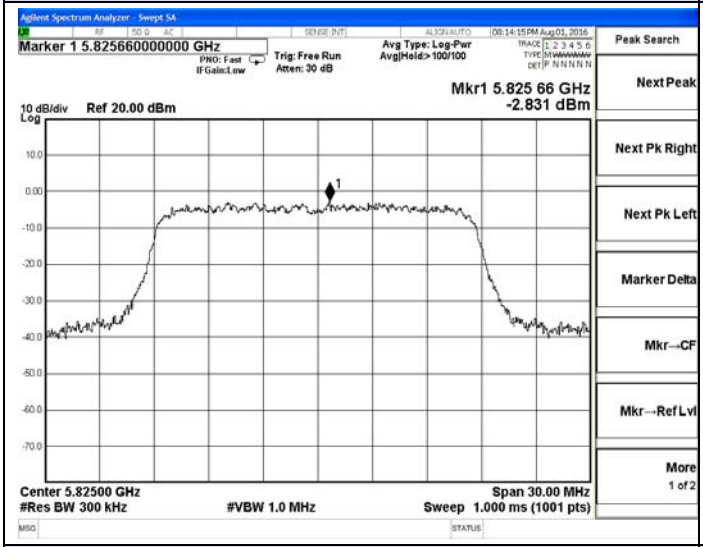
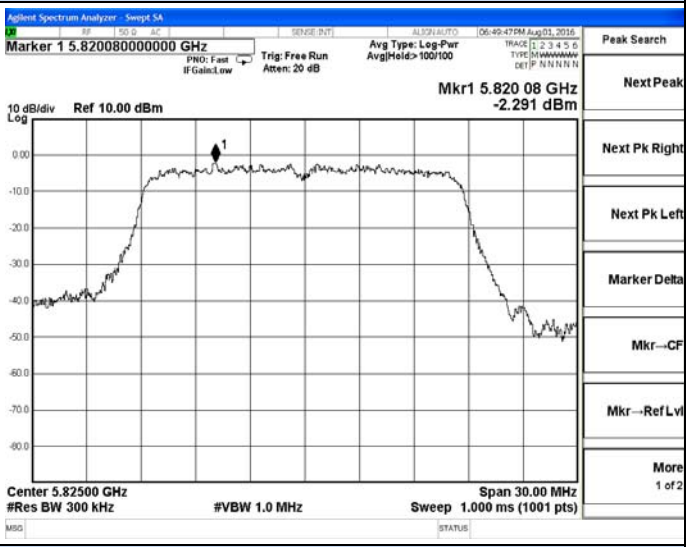
Peak Power Spectral Density

IEEE 802.11 a

Antenna 0	Antenna 1
	
5745 MHz	5745 MHz
	
5785 MHz	5785 MHz
	
5825 MHz	5825 MHz

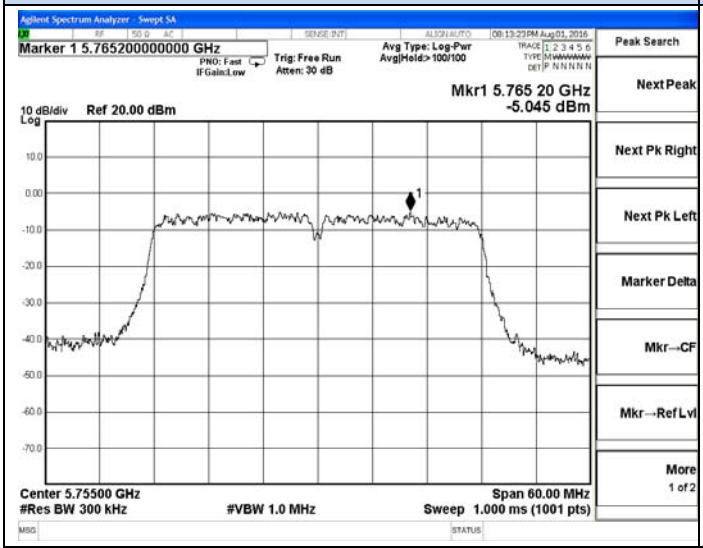
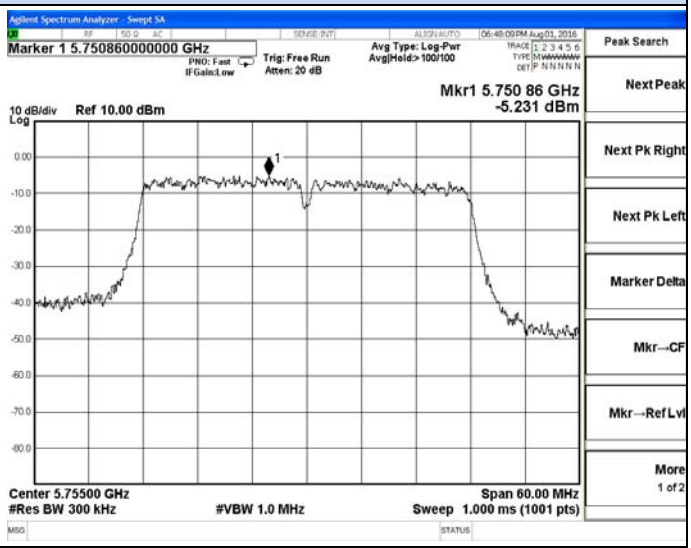
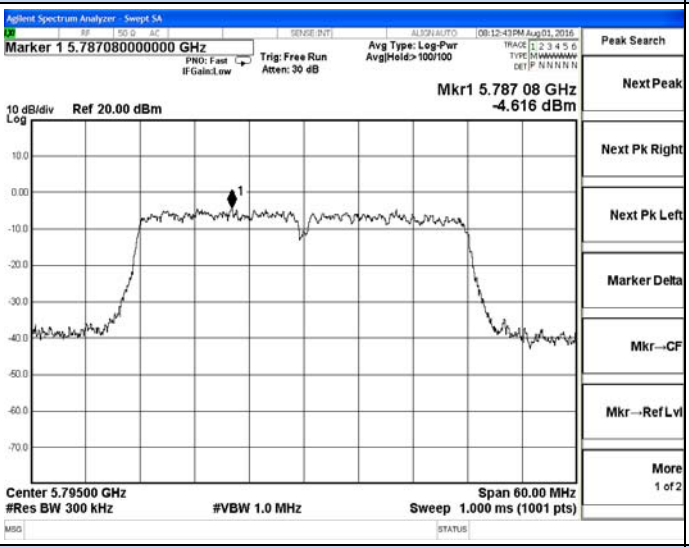
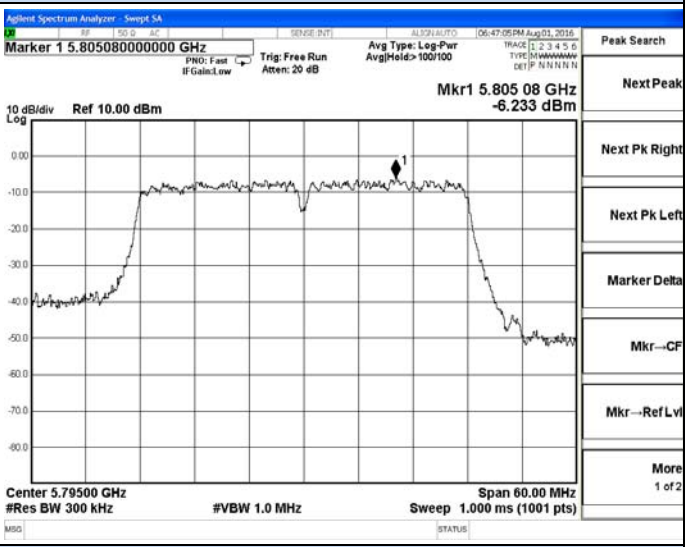
Peak Power Spectral Density

IEEE 802.11 n HT20

Antenna 0	Antenna 1
	
5745 MHz	5745 MHz
	
5785 MHz	5785 MHz
	
5825 MHz	5825 MHz

Peak Power Spectral Density

IEEE 802.11 n HT20

Antenna 0	Antenna 1
	
5755 MHz	5755 MHz
	
5795 MHz	5795 MHz

5.4. 6dB Occupied Bandwidth Measurement

5.4.1. Standard Applicable

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

5.4.2. Measuring Instruments and Setting

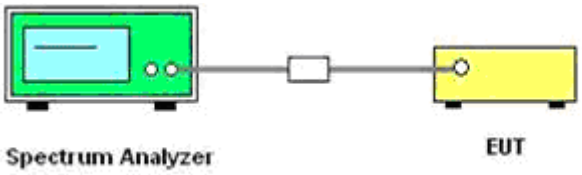
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the band 5.725-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple
f) Allow the trace to stabilize.
g) 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.

5.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were used.
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 Occupied Bandwidth

Temperature	25°C	Humidity	60%
Test Engineer	Jacky	Configurations	802.11a/n

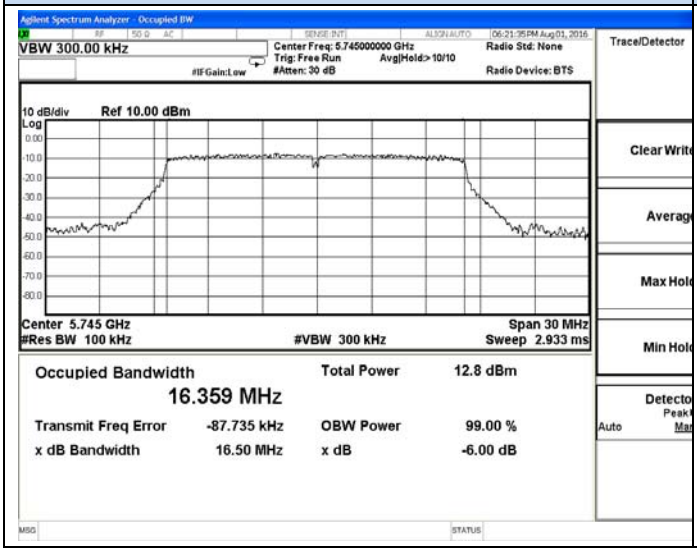
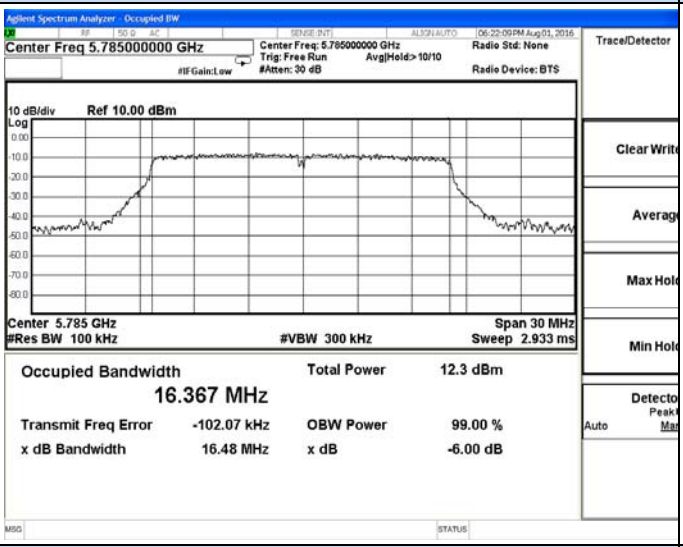
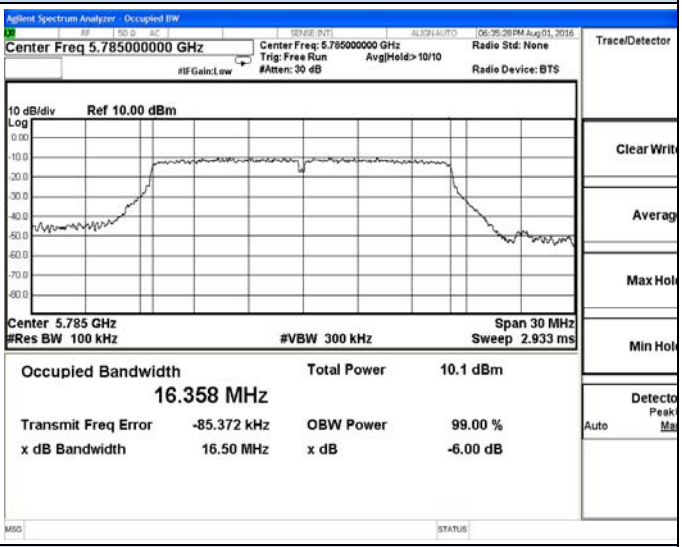
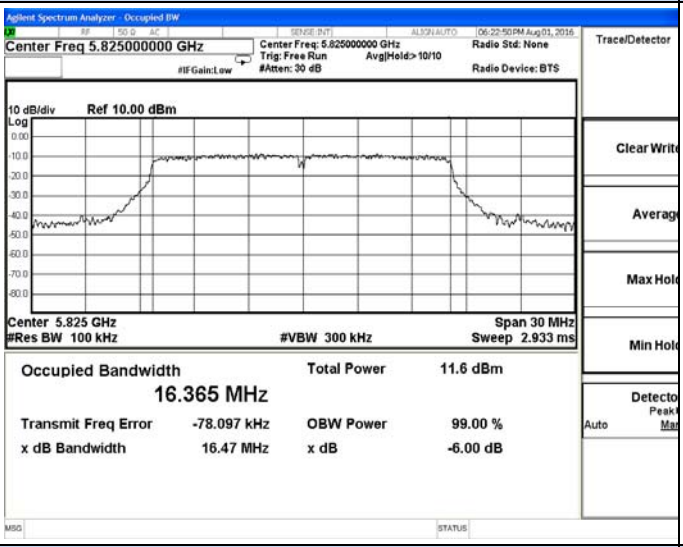
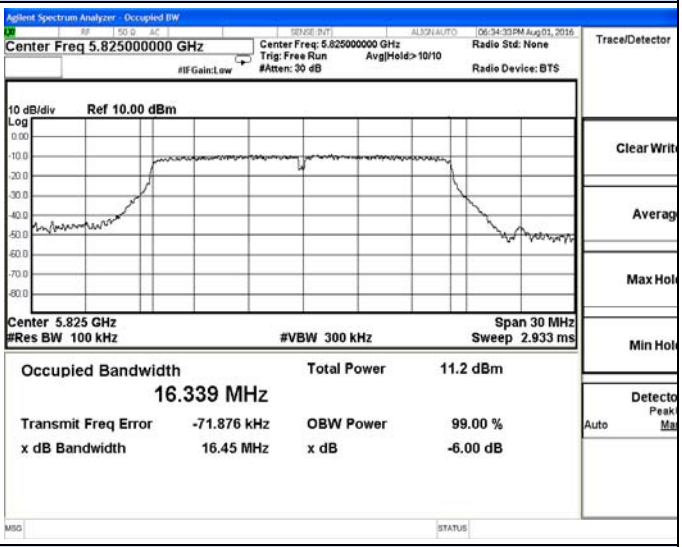
Test Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Limits (MHz)	Verdict
			Antenna 0	Antenna 1		
IEEE 802.11a	149	5745	16.50	16.49	0.500	PASS
	157	5785	16.48	16.50		
	165	5825	16.47	16.45		
IEEE 802.11n HT20	149	5745	17.34	17.33	0.500	PASS
	157	5785	17.32	17.56		
	165	5825	17.52	17.59		
IEEE 802.11n HT40	151	5755	36.37	36.38	0.500	PASS
	159	5795	36.41	36.41		

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 6Mbps at IEEE 802.11 a; 13Mbps at IEEE 802.11 n HT20; 27Mbps at IEEE 802.11 n HT40*
4. *please refer to following plots;*

6dB Occupied Bandwidth

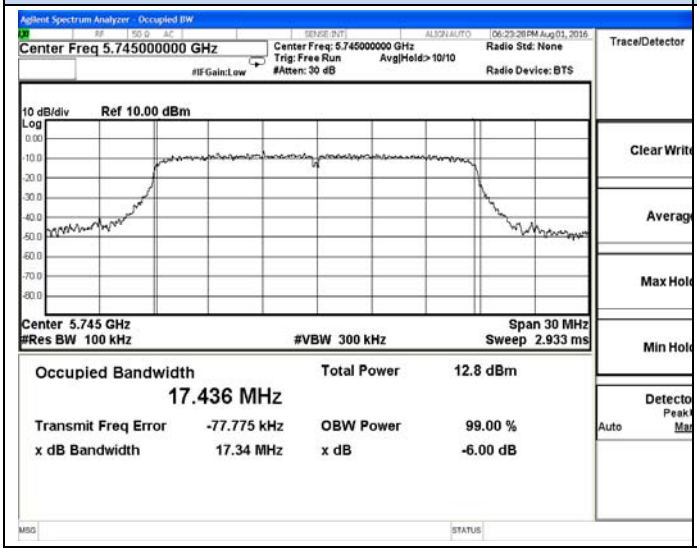
IEEE 802.11 a

Antenna 0	Antenna 1
	
5745 MHz	5745 MHz
	
5785 MHz	5785 MHz
	
5825 MHz	5825 MHz

6dB Occupied Bandwidth

IEEE 802.11 n HT20

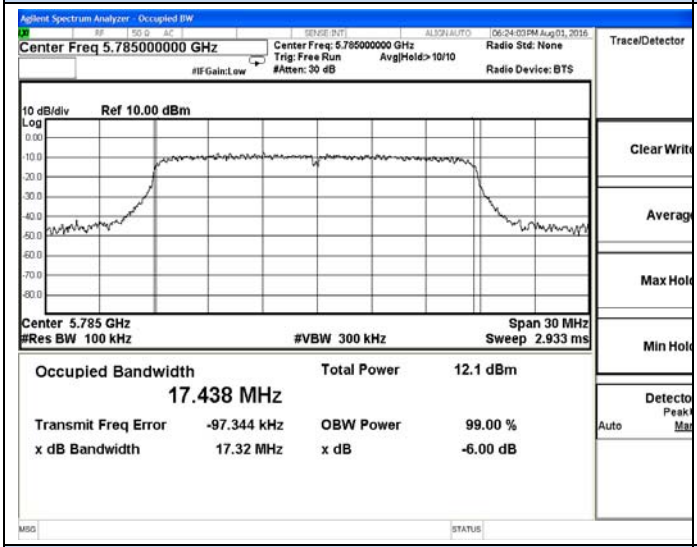
Antenna 0



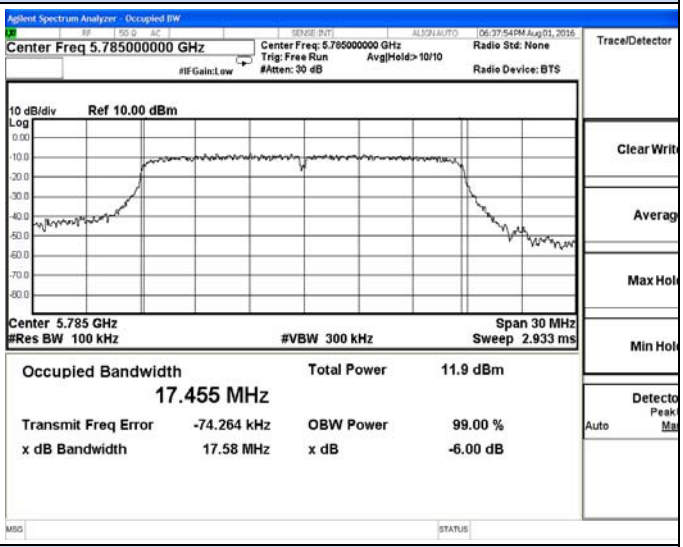
5745 MHz

Antenna 1

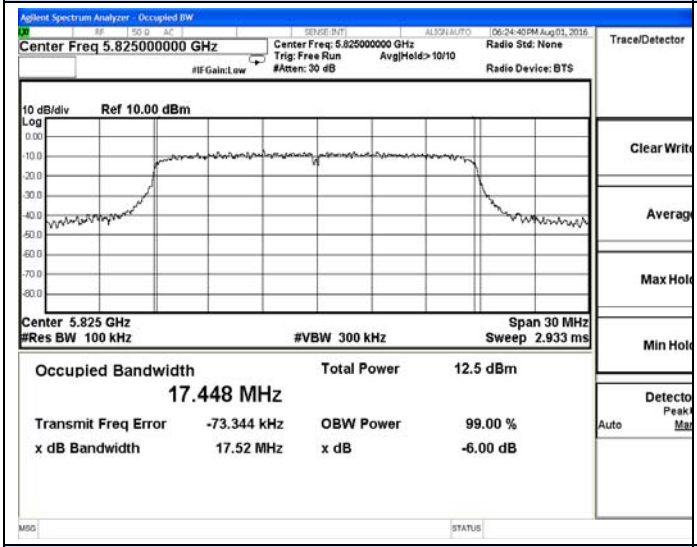
5745 MHz



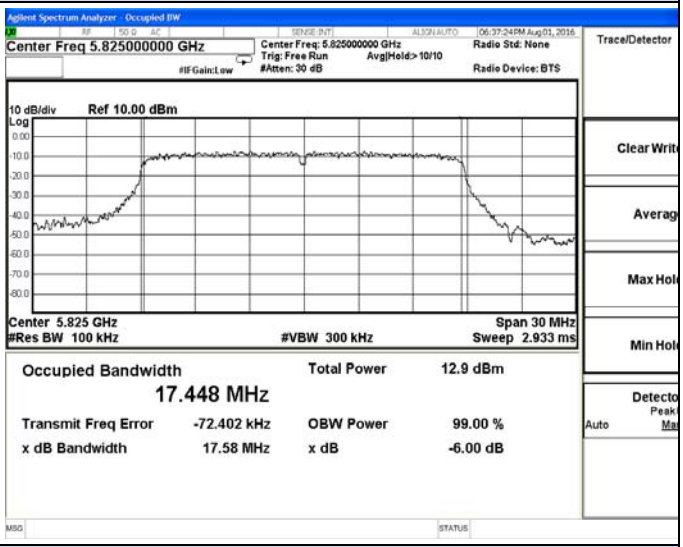
5785 MHz



5785 MHz



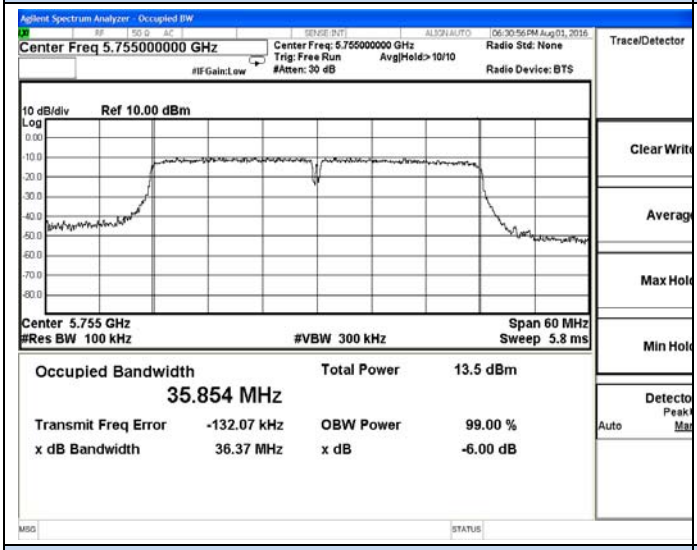
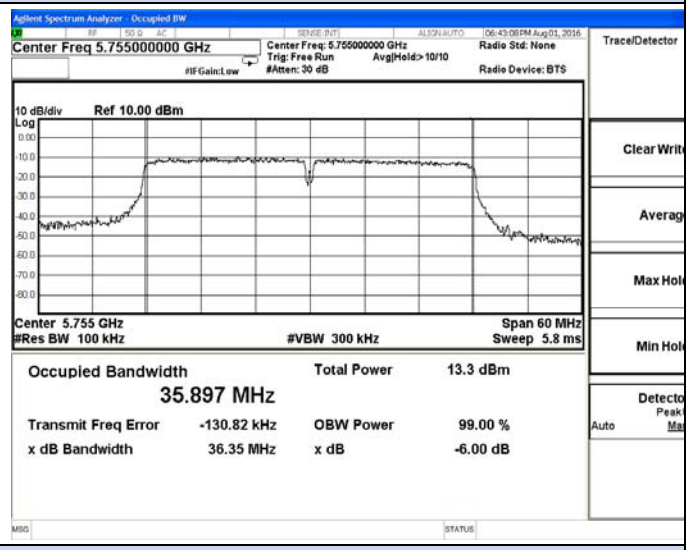
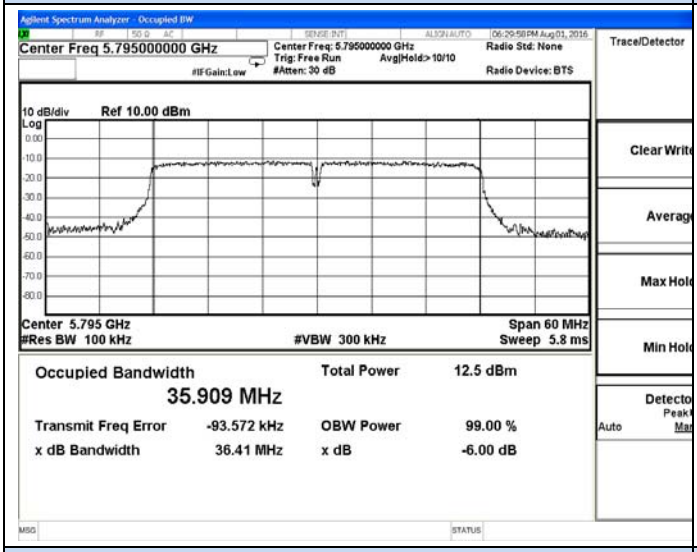
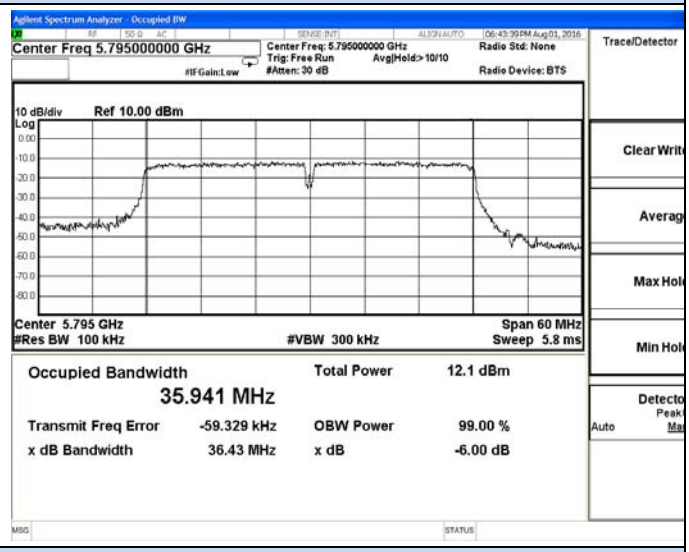
5825 MHz



5825 MHz

6dB Occupied Bandwidth

IEEE 802.11 n HT40

Antenna 0	*Antenna 1*
	
5755 MHz	*5755 MHz*
	
5795 MHz	*5795 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

In addition, 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.

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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 polarisations of the antenna.

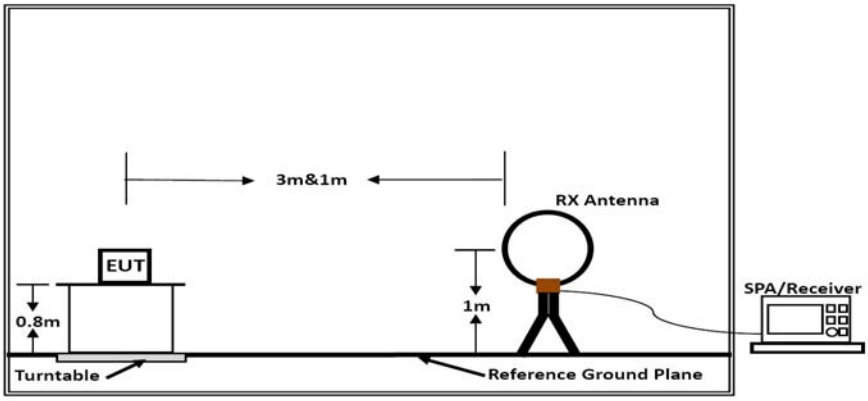
Final measurement:

--- 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.

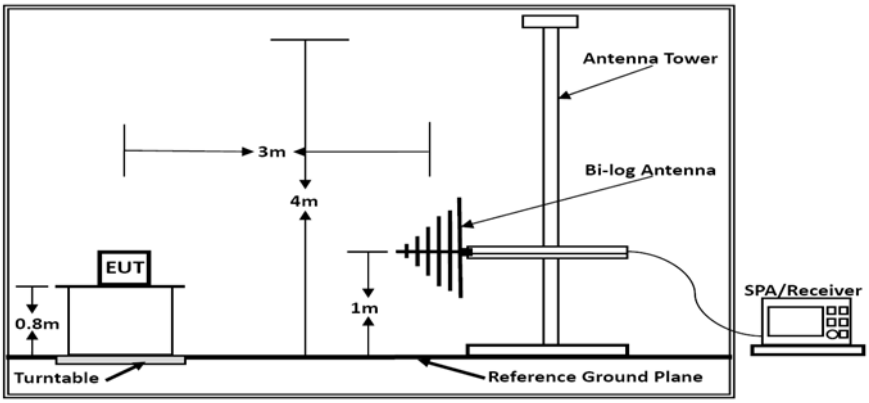
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

5.5.4. Test Setup Layout

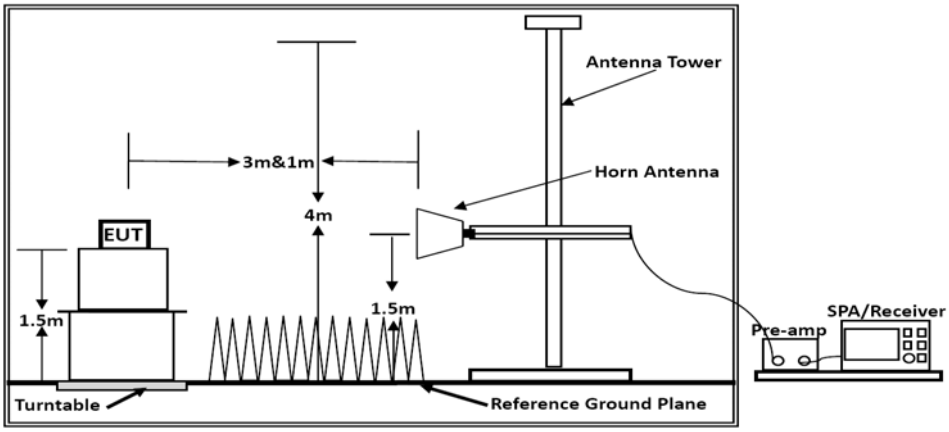
For radiated emissions below 30MHz



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.

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

Temperature	25˚C	Humidity	60%
Test Engineer	Jacky	Configurations	802.11a/n

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

Note:

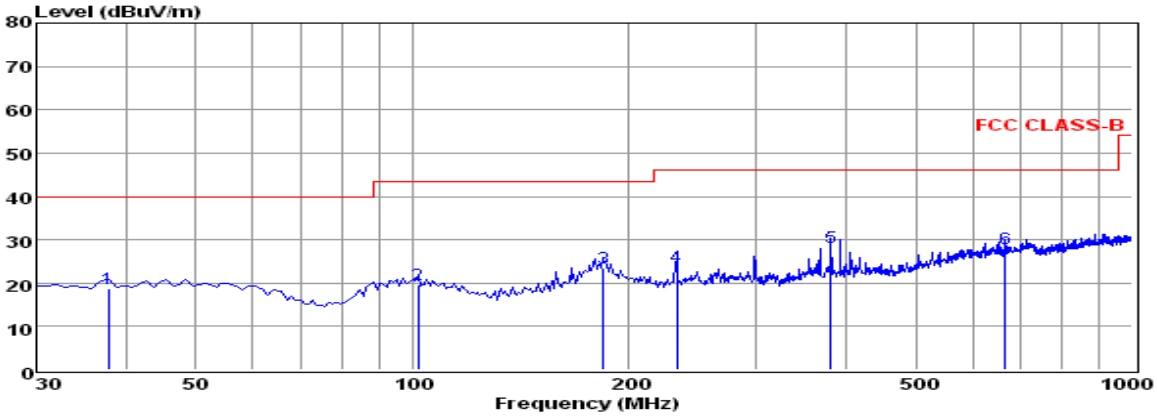
The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

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

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

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

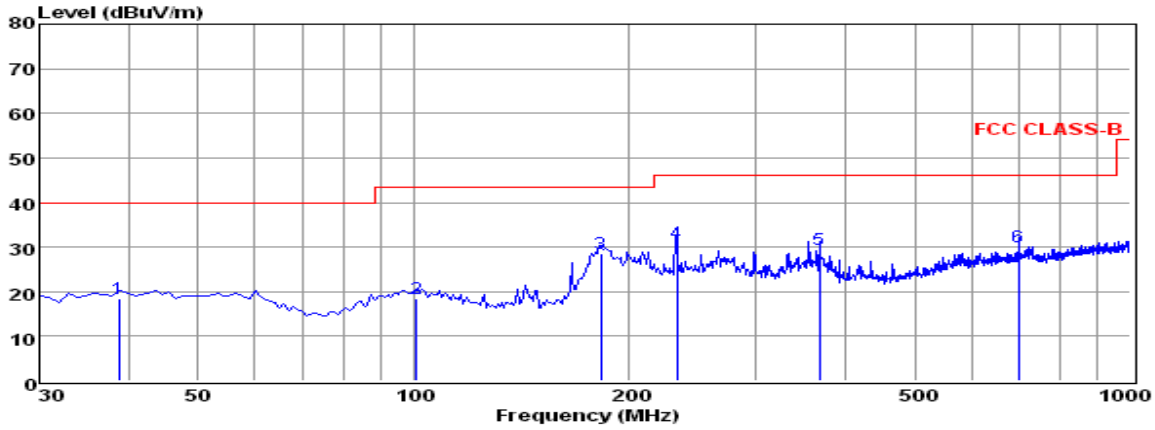
Temperature	25˚C	Humidity	60%
Test Engineer	Jacky	Configurations	802.11a, 5825MHz



Env./Ins: 24℃/56%
pol: VERTICAL

	Freq MHz	Reading dBuV	CabLos dB	Antfac dB/m	Measured dBuV/m	Limit dBuV/m	Over dB	Remark
1	37.76	5.46	0.38	13.01	18.85	40.00	-21.15	QP
2	101.78	6.03	0.60	13.00	19.63	43.50	-23.87	QP
3	184.23	12.73	0.70	10.05	23.48	43.50	-20.02	QP
4	232.73	10.97	0.98	11.77	23.72	46.00	-22.28	QP
5	381.14	12.47	1.18	14.62	28.27	46.00	-17.73	QP
6	666.32	7.71	1.55	18.69	27.95	46.00	-18.05	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 MHz	Reading dBuV	CabLos dB	Antfac dB/m	Measured dBuV/m	Limit dBuV/m	Over dB	Remark
1	38.73	4.71	0.38	13.25	18.34	40.00	-21.66	QP
2	100.81	4.88	0.60	13.09	18.57	43.50	-24.93	QP
3	182.29	17.71	0.89	9.88	28.48	43.50	-15.02	QP
4	232.73	18.22	0.98	11.77	30.97	46.00	-15.03	QP
5	368.53	13.63	1.22	14.50	29.35	46.00	-16.65	QP
6	699.30	9.60	1.59	18.81	30.00	46.00	-16.00	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:

Pre-scan all modes and recorded the worst case results in this report (802.11a-5825MHz).

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

5.5.8. Results for Radiated Emissions (Above 1GHz)

IEEE 802.11a (Antenna 0 was worst case)

Channel 149

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.235	59.15	33.23	35.04	3.91	61.25	68.2	-6.95	Peak	Horizontal
17.235	41.33	33.23	35.04	3.91	43.43	54.0	-10.57	Average	Horizontal
17.235	57.01	33.23	35.04	3.91	59.11	68.2	-9.09	Peak	Vertical
17.235	40.04	33.23	35.04	3.91	42.14	54.0	-11.86	Average	Vertical

Channel 157

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.355	58.57	33.27	35.15	3.93	60.62	68.2	-7.58	Peak	Horizontal
17.355	40.96	33.27	35.15	3.93	43.01	54.0	-10.99	Average	Horizontal
17.355	58.20	33.27	35.15	3.93	60.25	68.2	-7.95	Peak	Vertical
17.355	41.72	33.27	35.15	3.93	43.77	54.0	-10.23	Average	Vertical

Channel 163

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.475	57.87	33.32	35.14	3.97	60.02	68.2	-8.18	Peak	Horizontal
17.475	41.31	33.32	35.14	3.97	43.46	54.0	-10.54	Average	Horizontal
17.475	56.95	33.32	35.14	3.97	59.10	68.2	-9.10	Peak	Vertical
17.475	41.63	33.32	35.14	3.97	43.78	54.0	-10.22	Average	Vertical

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

Channel 149

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.235	60.46	33.23	35.04	3.91	62.56	68.2	-5.64	Peak	Horizontal
17.235	43.01	33.23	35.04	3.91	45.11	54.0	-8.89	Average	Horizontal
17.235	57.91	33.23	35.04	3.91	60.01	68.2	-8.19	Peak	Vertical
17.235	41.68	33.23	35.04	3.91	43.78	54.0	-10.22	Average	Vertical

Channel 157

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.355	60.02	33.27	35.15	3.93	62.07	68.2	-6.13	Peak	Horizontal
17.355	43.90	33.27	35.15	3.93	45.95	54.0	-8.05	Average	Horizontal
17.355	59.53	33.27	35.15	3.93	61.58	68.2	-6.62	Peak	Vertical
17.355	41.96	33.27	35.15	3.93	44.01	54.0	-9.99	Average	Vertical

Channel 163

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.475	59.79	33.32	35.14	3.97	61.94	68.2	-6.26	Peak	Horizontal
17.475	42.09	33.32	35.14	3.97	44.24	54.0	-9.76	Average	Horizontal
17.475	58.58	33.32	35.14	3.97	60.73	68.2	-7.47	Peak	Vertical
17.475	40.96	33.32	35.14	3.97	43.11	54.0	-10.89	Average	Vertical

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

Channel 151

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.265	59.31	33.23	35.04	3.91	61.41	68.2	-6.79	Peak	Horizontal
17.265	42.26	33.23	35.04	3.91	44.36	54.0	-9.64	Average	Horizontal
17.265	58.01	33.23	35.04	3.91	60.11	68.2	-8.09	Peak	Vertical
17.265	40.74	33.23	35.04	3.91	42.84	54.0	-11.16	Average	Vertical

Channel 159

Freq GHz	Read Level dBuV	Ant. Fac dB/m	Pre. Fac dB	Cab.Los dB	Measured Level dBuV	Limit Line dBuV/m	Over limit dB	Remark	Pol/Phase
17.385	58.97	33.27	35.15	3.93	61.02	68.2	-7.18	Peak	Horizontal
17.385	42.66	33.27	35.15	3.93	44.71	54.0	-9.29	Average	Horizontal
17.385	59.37	33.27	35.15	3.93	61.42	68.2	-6.78	Peak	Vertical
17.385	42.58	33.27	35.15	3.93	44.63	54.0	-9.37	Average	Vertical

Notes:

1. *Measuring frequencies from 9k~40GHz, No emission found between lowest internal used/generated frequencies to 30MHz.*
2. *Radiated emissions measured in frequency range from 9k~40GHz 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.*

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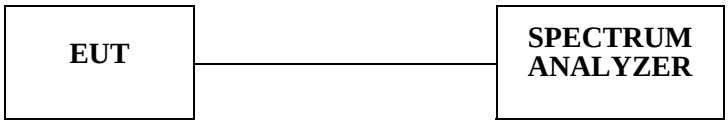
5.6. Undesirable Emissions Measurement

5.6.1 Test Requirements

According to§15.407 (b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band:
(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
(ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.
(7) The provisions of §15.205 apply to intentional radiators operating under this section.
(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

5.6.2 Test Configuration



5.6.3 Test Procedure

According to KDB789033 D02 General UNII Test Procedures New Rules v01 Section G: Unwanted Emission Measurement

1. Unwanted Emissions in the Restricted Bands

   a) For all measurements, follow the requirements in section II.G.3. “General Requirements for Unwanted Emissions Measurements.”

   b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. “Procedure for Unwanted Emissions Measurements below 1000 MHz.”

   c) At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in sections II.G.5. and II.G.6, respectively, must satisfy the respective peak and average limits. If all peak measurements satisfy the average limit, then average measurements are not required.

d)) For conducted measurements above 1000 MHz, EIRP shall be computed as specified in section II.G.3.b) and then field strength shall be computed as follows (see KDB Publication 412172):

(i) E[dBμV/m] = EIRP[dBm] - 20 log (d[meters]) + 104.77, where E = field strength and d = distance at which field strength limit is specified in the rules;

(ii) (ii) E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters

e) For conducted measurements below 1000 MHz, the field strength shall be computed as specified in d), above, and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1000 MHz, or an additional 6 dB shall be added for frequencies below 30 MHz.

2. Unwanted Emissions that fall Outside of the Restricted Bands

a) For all measurements, follow the requirements in section II.G.3. "General Requirements for Unwanted Emissions Measurements."

b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. "Procedure for Unwanted Emissions Measurements below 1000 MHz."

c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in section II.G.5., "Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1000 MHz."

(i) Section 15.407(b) (1-3) specifies the unwanted emissions limit for the U-NII-1 and 2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz dBm/MHz peak emission limit.

(ii) Section 15.407(b) (4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b) (4)(i). An alternative to the band emissions mask is specified in Section 15.407(b) (4) (ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the alternative limit.

d) If radiated measurements are performed, field strength is then converted to EIRP as follows:

(i) EIRP = ((E×d)^2) / 30

Where:

- E is the field strength in V/m;
- d is the measurement distance in meters;
- EIRP is the equivalent isotopically radiated power in watts;

(ii) Working in dB units, the above equation is equivalent to:

EIRP [dBm] = E [dBμV/m] + 20 log (d [meters]) - 104.77

(iii) Or, if d is 3 meters:

EIRP [dBm] = E [dBμV/m] - 95.2

5.6.4. Test Results

IEEE 802.11 a											
Frequency (MHz)		Conducted Power (dBm)		Antenna Gain (dBi)		Ground Reflection Factor	Covert Radiated E Level At 3m (dBuV/m)		Detector	Limit (dBuV/m)	Verdict
Antenna 0	Antenna 1	Antenna 0	Antenna 1	Antenna 0	Antenna 1		Antenna 0	Antenna 1			
5650.000	5650.000	-50.049	-49.727	5.0	5.0	0	50.211	50.533	Peak	74.00	PASS
5650.000	5650.000	-52.237	-52.143	5.0	5.0	0	48.023	48.117	Average	54.00	PASS
5700.000	5700.000	-50.944	-50.989	5.0	5.0	0	49.316	49.271	Peak	74.00	PASS
5700.000	5700.000	-61.961	-62.087	5.0	5.0	0	38.299	38.173	Average	54.00	PASS
5720.000	5720.000	-48.179	-46.561	5.0	5.0	0	52.081	53.699	Peak	74.00	PASS
5720.000	5720.000	-60.794	-60.462	5.0	5.0	0	39.466	39.798	Average	54.00	PASS
5725.000	5725.000	-38.070	-39.873	5.0	5.0	0	62.190	60.387	Peak	74.00	PASS
5725.000	5725.000	-56.299	-57.162	5.0	5.0	0	43.961	43.098	Average	54.00	PASS
5750.000	5746.690	1.594	0.787	5.0	5.0	0	101.854	101.047	Peak	---	PASS
5750.000	5746.690	-9.407	-9.294	5.0	5.0	0	90.853	90.966	Average	---	PASS
5830.180	5830.010	1.730	2.862	5.0	5.0	0	101.990	103.122	Peak	---	PASS
5826.880	5826.910	-9.130	-8.353	5.0	5.0	0	91.130	91.907	Average	---	PASS
5850.000	5850.000	-48.612	-47.233	5.0	5.0	0	51.648	53.027	Peak	74.00	PASS
5850.000	5850.000	-60.360	-59.633	5.0	5.0	0	39.900	40.627	Average	54.00	PASS
5855.000	5855.000	-48.718	-50.055	5.0	5.0	0	51.542	50.205	Peak	74.00	PASS
5855.000	5855.000	-61.157	-60.688	5.0	5.0	0	39.103	39.572	Average	54.00	PASS
5875.000	5877.050	-51.352	-43.931	5.0	5.0	0	48.908	56.329	Peak	74.00	PASS
5875.000	5877.050	-61.802	-55.072	5.0	5.0	0	38.458	45.188	Average	54.00	PASS
5925.000	5925.000	-51.194	-51.486	5.0	5.0	0	49.066	48.774	Peak	74.00	PASS
5925.000	5925.000	-62.307	-62.136	5.0	5.0	0	37.953	38.124	Average	54.00	PASS

IEEE 802.11 n HT20											
Frequency (MHz)		Conducted Power (dBm)			Antenna Gain (dBi)		Ground Reflection Factor	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
Antenna 0	Antenna 1	Antenna 0	Antenna 1	Sum	Antenna 0	Antenna 1					
5650.000	5650.000	-51.301	-50.783	-48.024	5.0	5.0	0	52.236	Peak	74.00	PASS
5650.000	5650.000	-62.257	-62.418	-59.326	5.0	5.0	0	40.934	Average	54.00	PASS
5700.000	5700.000	-50.184	-49.914	-47.037	5.0	5.0	0	53.223	Peak	74.00	PASS
5700.000	5700.000	-61.962	-62.059	-59.000	5.0	5.0	0	41.260	Average	54.00	PASS
5720.000	5720.000	-49.328	-46.416	-44.622	5.0	5.0	0	55.638	Peak	74.00	PASS
5720.000	5720.000	-60.563	-60.296	-57.417	5.0	5.0	0	42.843	Average	54.00	PASS
5725.000	5725.000	-39.628	-42.343	-37.766	5.0	5.0	0	62.494	Peak	74.00	PASS
5725.000	5725.000	-55.388	-56.531	-52.912	5.0	5.0	0	47.348	Average	54.00	PASS
5746.470	5746.580	1.215	1.399	4.318	5.0	5.0	0	104.578	Peak	---	PASS
5743.610	5743.610	-9.737	-9.570	-6.642	5.0	5.0	0	88.618	Average	---	PASS
5826.440	5828.980	1.336	2.376	4.897	5.0	5.0	0	105.157	Peak	---	PASS
5823.580	5823.570	-9.387	-8.551	-5.939	5.0	5.0	0	94.321	Average	---	PASS
5850.000	5850.000	-47.605	-48.049	-44.811	5.0	5.0	0	55.449	Peak	74.00	PASS
5850.000	5850.000	-59.927	-59.269	-56.575	5.0	5.0	0	43.685	Average	54.00	PASS
5855.000	5855.000	-51.026	-50.333	-47.655	5.0	5.0	0	52.605	Peak	74.00	PASS
5855.000	5855.000	-61.131	-60.655	-57.876	5.0	5.0	0	42.384	Average	54.00	PASS
5875.000	5875.000	-51.570	-49.113	-47.160	5.0	5.0	0	53.100	Peak	74.00	PASS
5875.000	5875.000	-61.804	-61.255	-58.511	5.0	5.0	0	41.749	Average	54.00	PASS
5925.000	5877.050	-51.815	-44.207	-43.512	5.0	5.0	0	56.748	Peak	74.00	PASS
5925.000	5877.050	-62.335	-54.381	-53.736	5.0	5.0	0	46.524	Average	54.00	PASS

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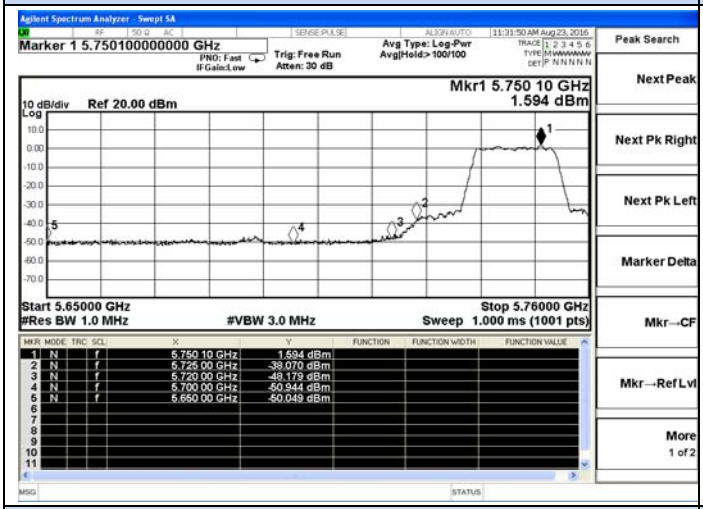
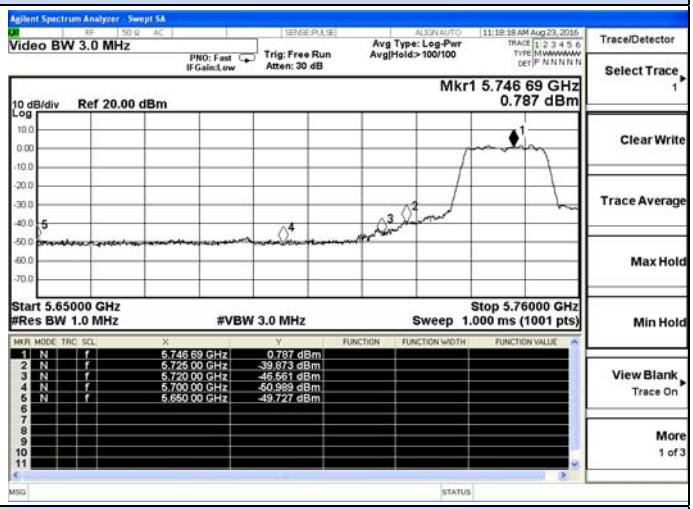
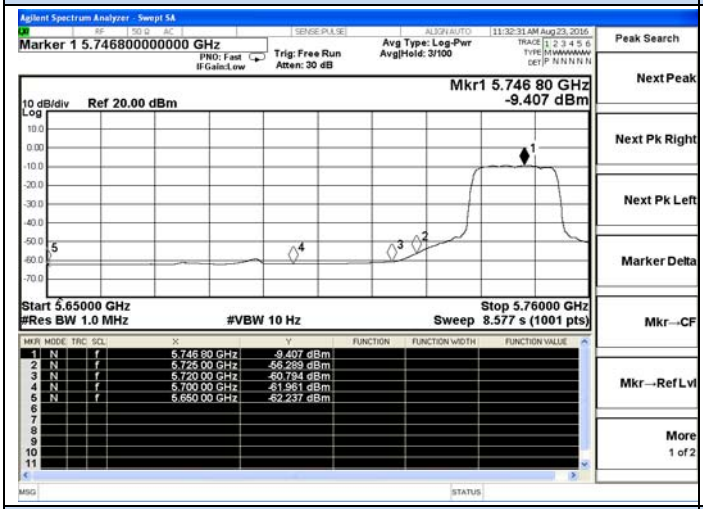
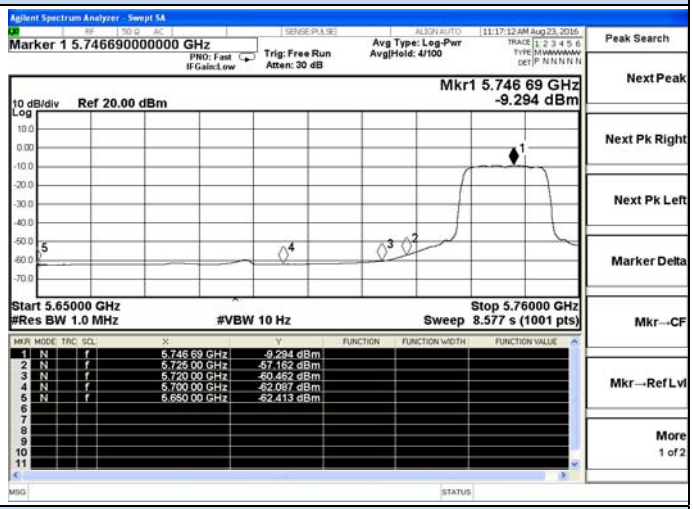
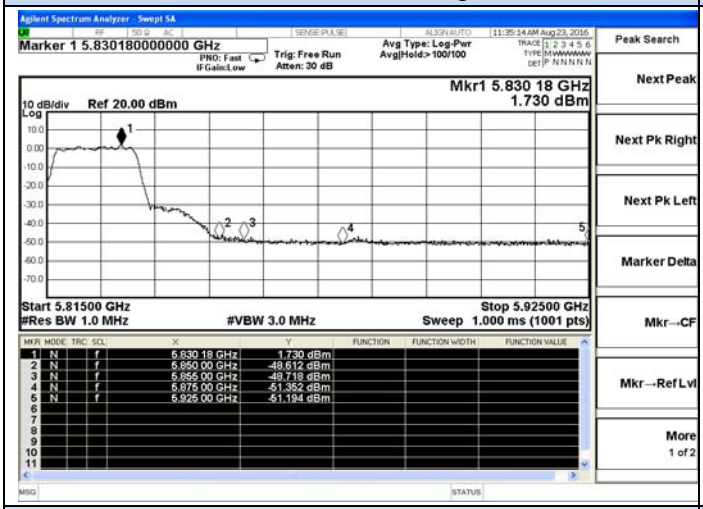
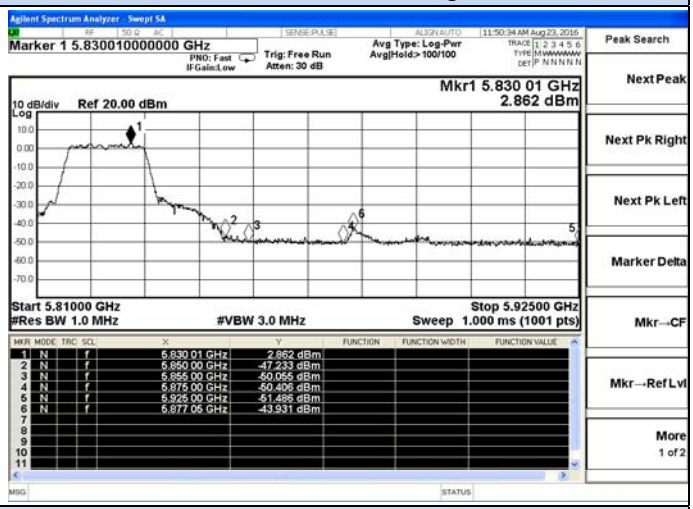
IEEE 802.11 n HT40											
Frequency (MHz)		Conducted Power (dBm)			Antenna Gain (dBi)		Ground Reflection Factor	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
Antenna 0	Antenna 1	Antenna 0	Antenna 1	Sum	Antenna 0	Antenna 1					
5650.000	5650.000	-49.115	-49.249	-46.171	5.0	5.0	0	54.089	Peak	74.00	PASS
5650.000	5650.000	-60.339	-60.778	-57.543	5.0	5.0	0	42.717	Average	54.00	PASS
5700.000	5700.000	-49.799	-48.302	-45.976	5.0	5.0	0	54.284	Peak	74.00	PASS
5700.000	5700.000	-60.906	-60.501	-57.688	5.0	5.0	0	42.572	Average	54.00	PASS
5720.000	5720.000	-38.915	-41.132	-36.873	5.0	5.0	0	63.387	Peak	74.00	PASS
5720.000	5720.000	-52.202	-53.327	-49.718	5.0	5.0	0	50.542	Average	54.00	PASS
5725.000	5725.000	-37.879	-38.704	-35.262	5.0	5.0	0	64.998	Peak	74.00	PASS
5725.000	5725.000	-50.592	-52.108	-48.274	5.0	5.0	0	51.986	Average	54.00	PASS
5744.625	5744.625	-1.061	-0.975	1.993	5.0	5.0	0	102.253	Peak	---	PASS
5749.000	5749.000	-12.042	-11.802	-8.910	5.0	5.0	0	91.350	Average	---	PASS
5784.450	5784.600	-0.020	0.822	3.432	5.0	5.0	0	103.692	Peak	---	PASS
5785.200	5789.100	-10.837	-10.321	-7.561	5.0	5.0	0	92.699	Average	---	PASS
5850.000	5850.000	-47.932	-46.251	-44.000	5.0	5.0	0	56.260	Peak	74.00	PASS
5850.000	5850.000	-60.020	-59.930	-56.964	5.0	5.0	0	43.296	Average	54.00	PASS
5855.000	5855.000	-49.460	-48.949	-46.187	5.0	5.0	0	54.073	Peak	74.00	PASS
5855.000	5855.000	-60.614	-60.685	-57.639	5.0	5.0	0	42.621	Average	54.00	PASS
5875.000	5875.000	-49.283	-48.965	-46.111	5.0	5.0	0	54.149	Peak	74.00	PASS
5875.000	5875.000	-61.517	-61.270	-58.381	5.0	5.0	0	41.879	Average	54.00	PASS
5925.000	5925.000	-50.225	-50.418	-47.310	5.0	5.0	0	52.950	Peak	74.00	PASS
5925.000	5925.000	-61.950	-61.715	-58.821	5.0	5.0	0	41.439	Average	54.00	PASS

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 6Mbps at IEEE 802.11 a; 13Mbps at IEEE 802.11 n HT20; 27Mbps at IEEE 802.11 n HT40*
4. *please refer to following plots;*
5. *"---"means that the fundamental frequency not for 15.209 limits requirement.*

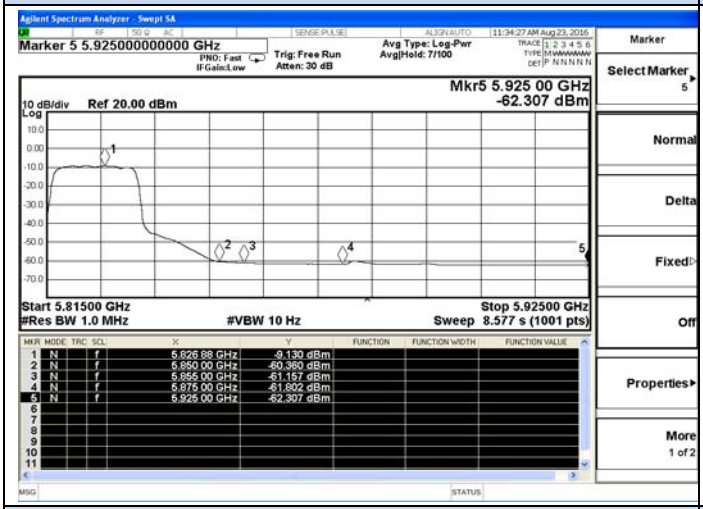
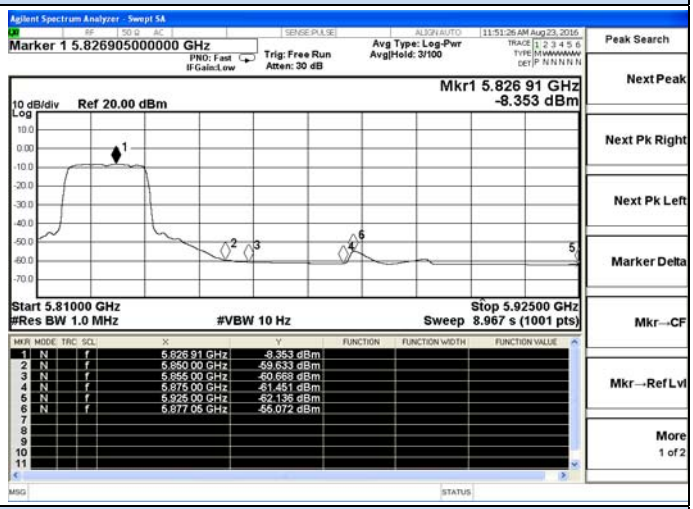
Band-edge Measurements for Radiated Emissions

IEEE 802.11 a

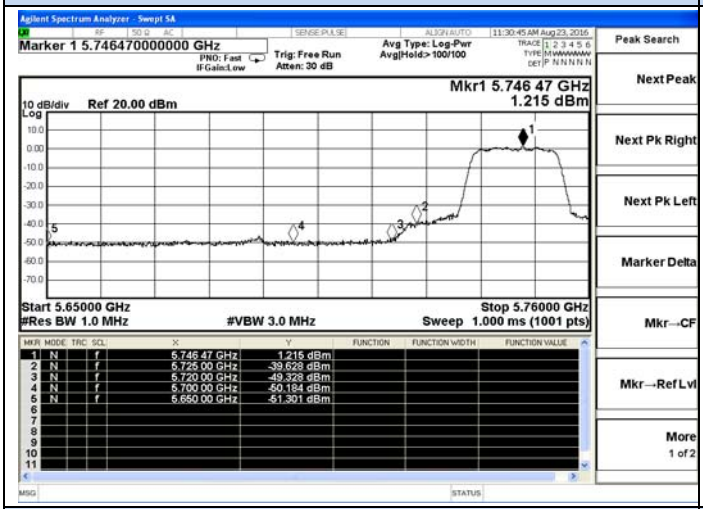
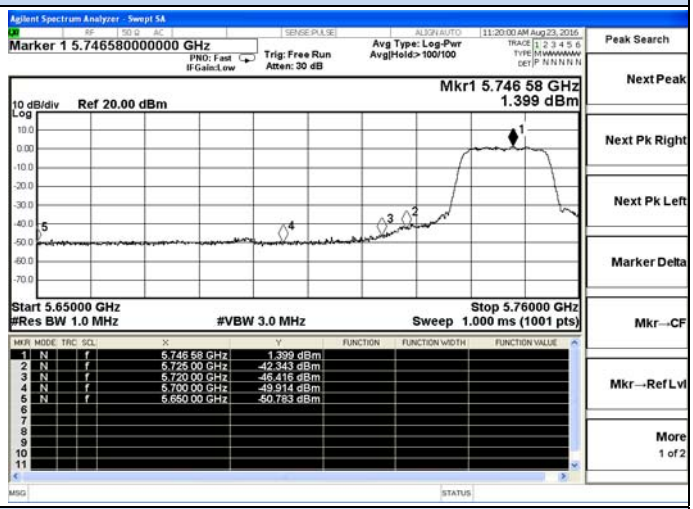
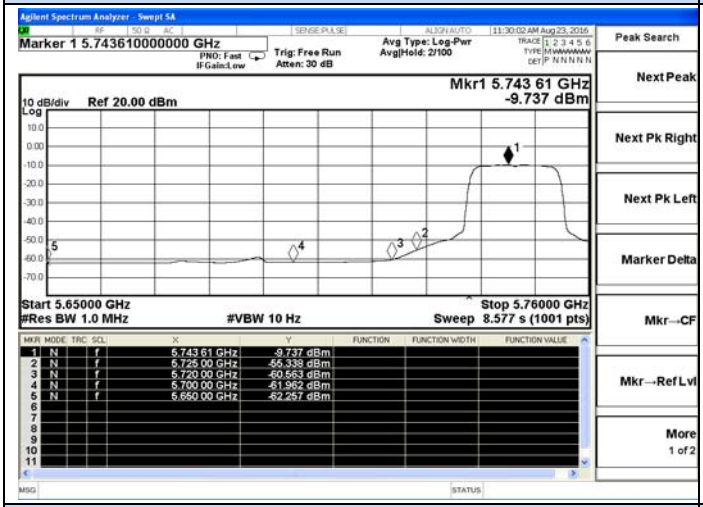
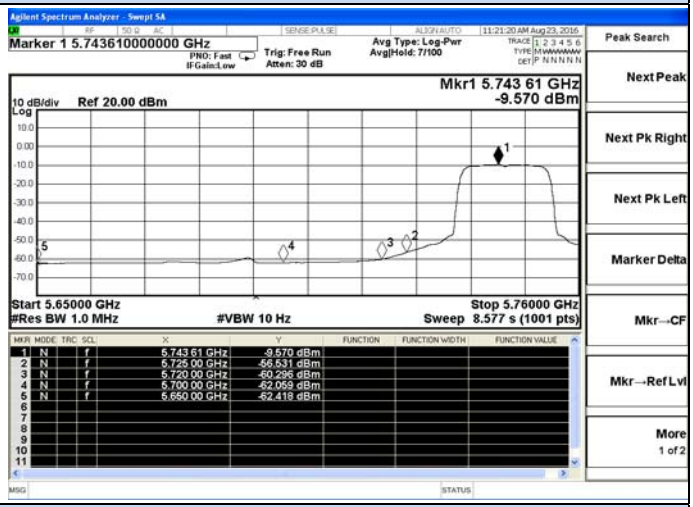
Antenna 0	Antenna 1
	
5745 MHz – Peak	5745 MHz – Peak
	
5745 MHz – Average	5745 MHz – Average
	
5825MHz – Peak	5825MHz – Peak

Band-edge Measurements for Radiated Emissions

IEEE 802.11 a

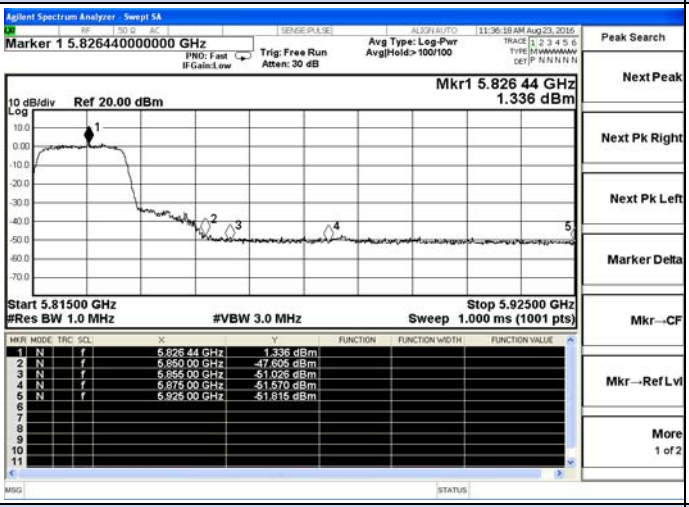
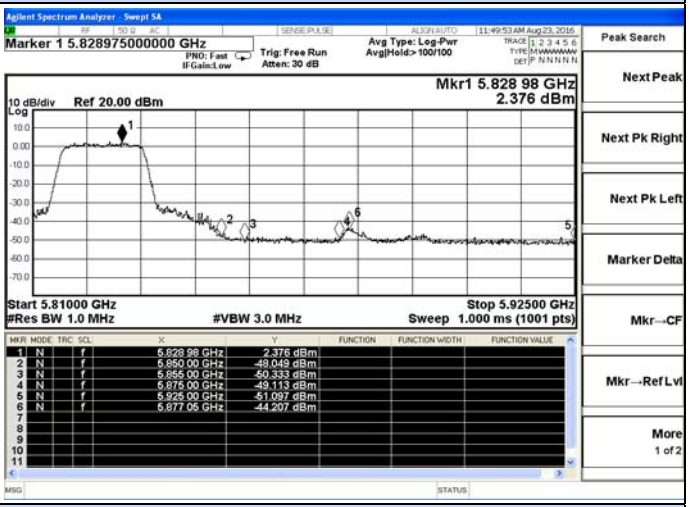
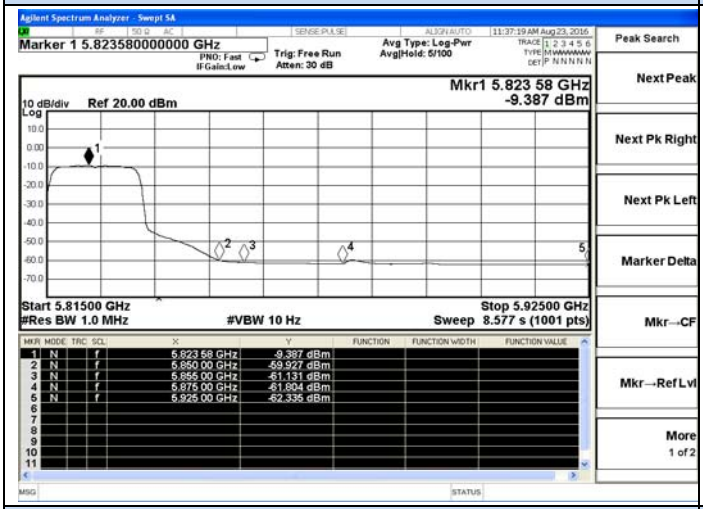
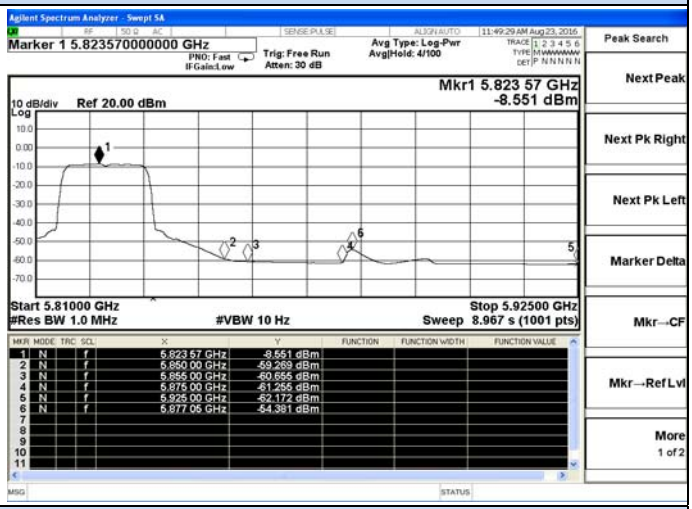
Antenna 0	Antenna 1
	
5825 MHz – Average	5825 MHz – Average

IEEE 802.11 n HT20

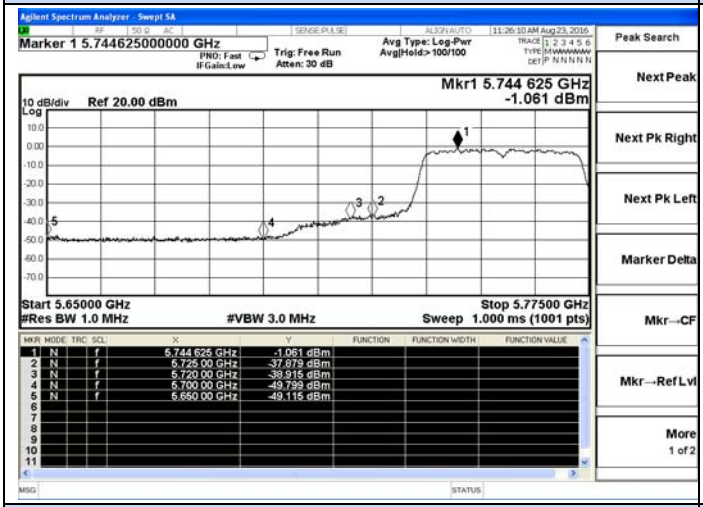
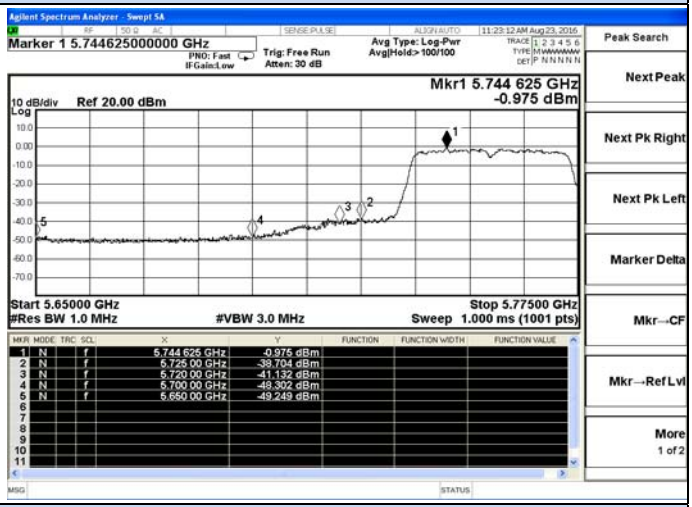
Antenna 0	Antenna 1
	
5745 MHz – Peak	5745 MHz – Peak
	
5745 MHz – Average	5745 MHz – Average

Band-edge Measurements for Radiated Emissions

IEEE 802.11 n HT20

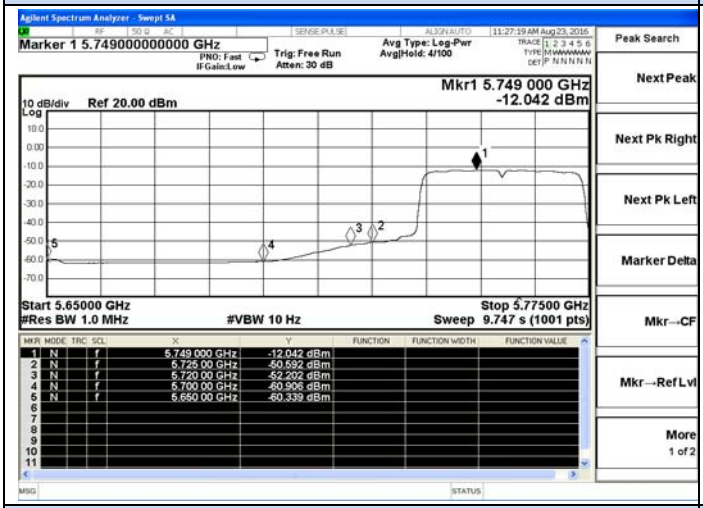
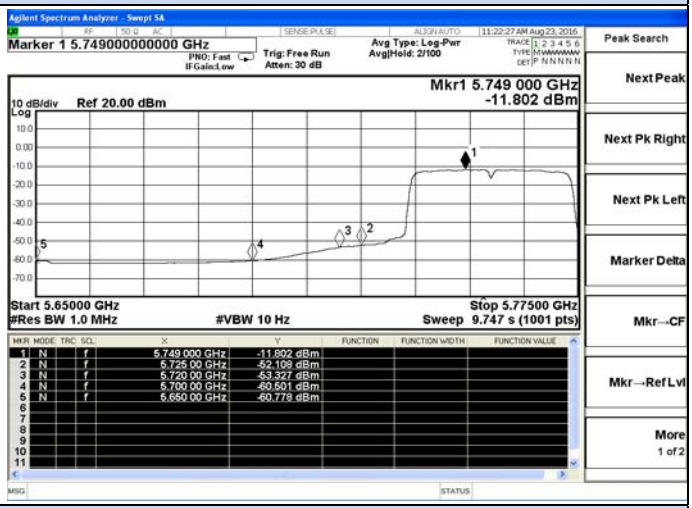
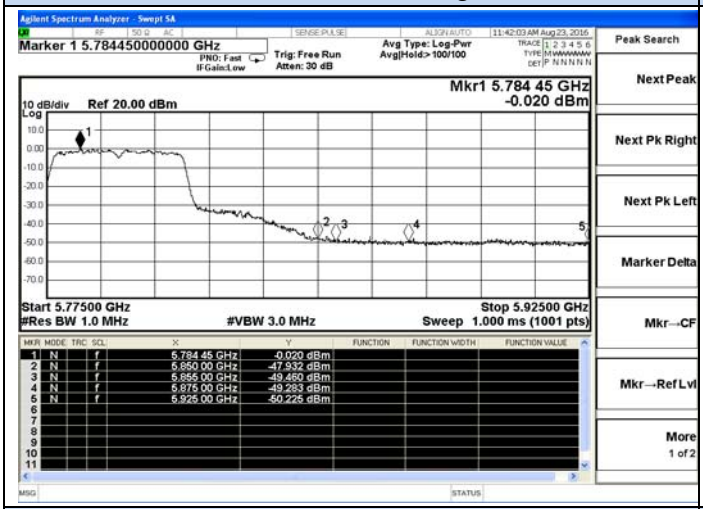
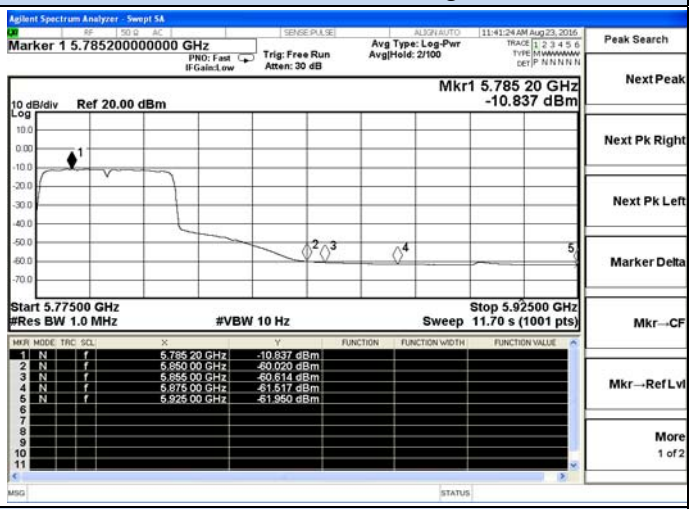
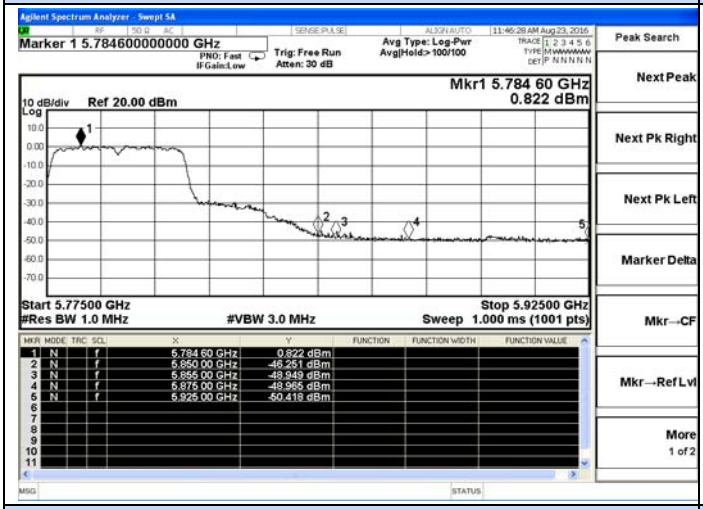
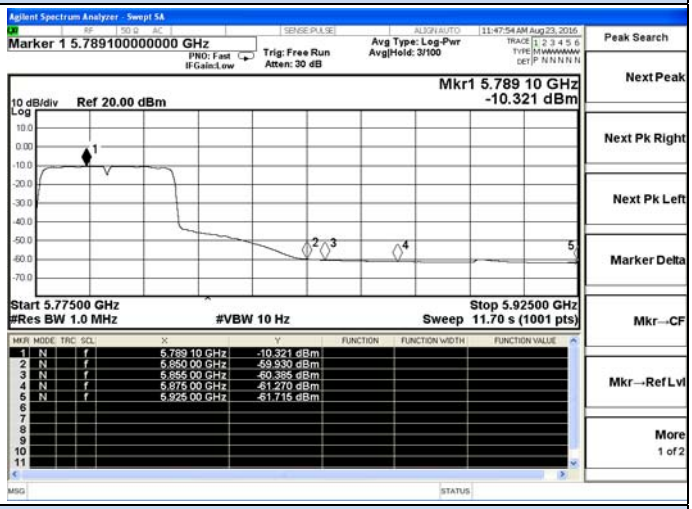
Antenna 0	Antenna 1
	
5825 MHz – Peak	5825 MHz – Peak
	
5825 MHz – Average	5825 MHz – Average

IEEE 802.11 n HT40

Antenna 0	Antenna 1
	
5755 MHz – Peak	5755 MHz – Peak

Band-edge Measurements for Radiated Emissions

IEEE 802.11 n HT40

Antenna 0	Antenna 1
	
5755 MHz – Average	5755 MHz – Average
	
5795 MHz – Peak	5795 MHz – Peak
	
5795 MHz – Average	5795 MHz – Average

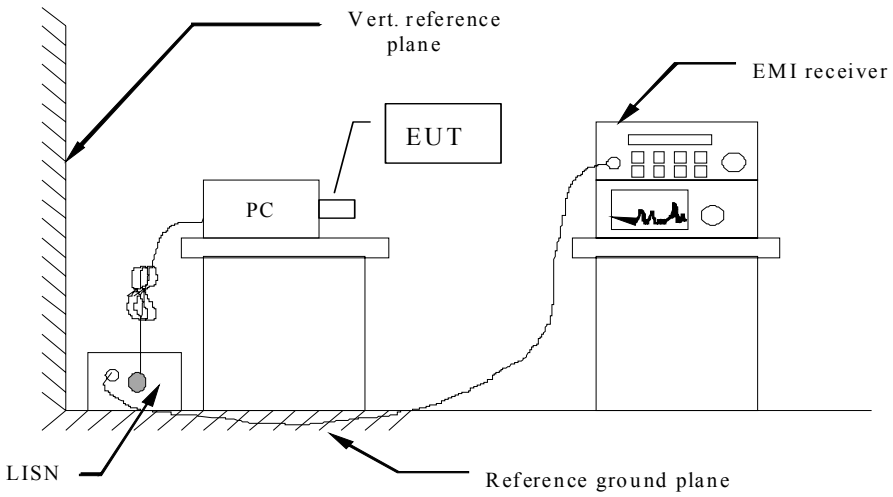
5.7. Power line conducted emissions

5.7.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

5.7.2 Block Diagram of Test Setup

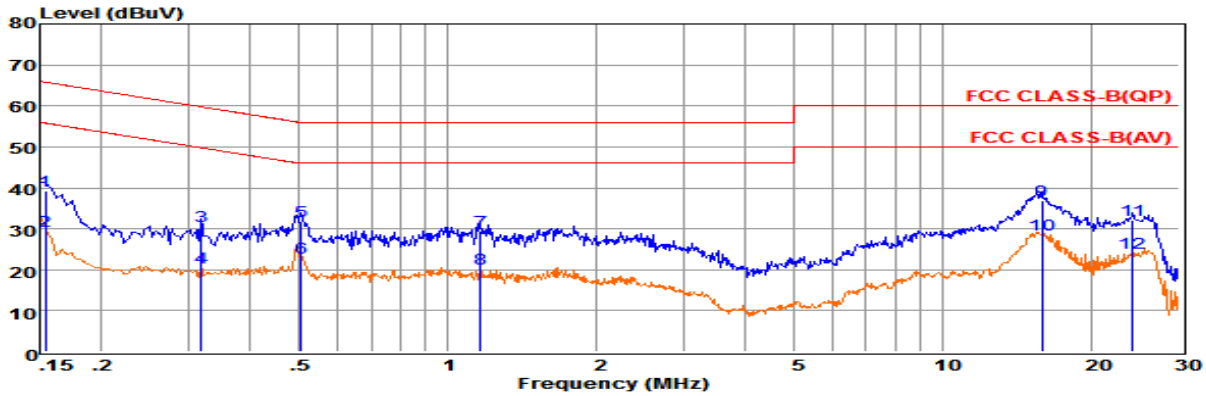


5.7.3 Test Results

PASS.

The test data please refer to following page.

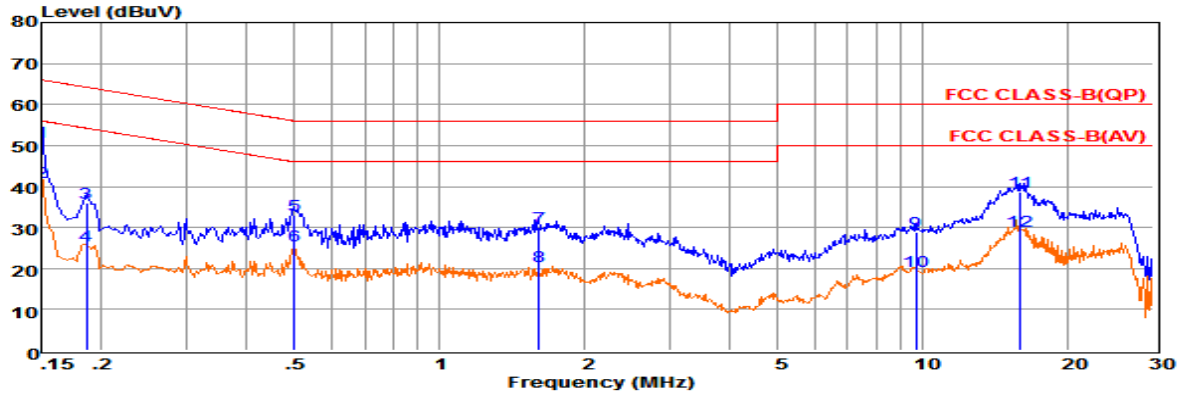
Test result for IEEE 802.11a (AC 120V/60Hz)



Env. Ins: 24*/56%
Pol: LINE

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15403	19.78	9.58	0.02	10.00	39.38	65.78	-26.40	QP
2	0.15413	9.72	9.58	0.02	10.00	29.32	55.77	-26.45	Average
3	0.31830	10.89	9.62	0.03	10.00	30.54	59.75	-29.21	QP
4	0.31840	0.74	9.62	0.03	10.00	20.39	49.75	-29.36	Average
5	0.50469	12.24	9.62	0.04	10.00	31.90	56.00	-24.10	QP
6	0.50479	3.34	9.62	0.04	10.00	23.00	46.00	-23.00	Average
7	1.16571	9.81	9.63	0.05	10.00	29.49	56.00	-26.51	QP
8	1.16671	0.48	9.63	0.05	10.00	20.16	46.00	-25.84	Average
	915.88538	17.15	9.72	0.11	10.00	36.98	60.00	-23.02	QP
	1015.88638	8.86	9.72	0.11	10.00	28.69	50.00	-21.31	Average
	1124.14232	12.19	9.71	0.13	10.00	32.03	60.00	-27.97	QP
	1224.14332	4.27	9.71	0.13	10.00	24.11	50.00	-25.89	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.

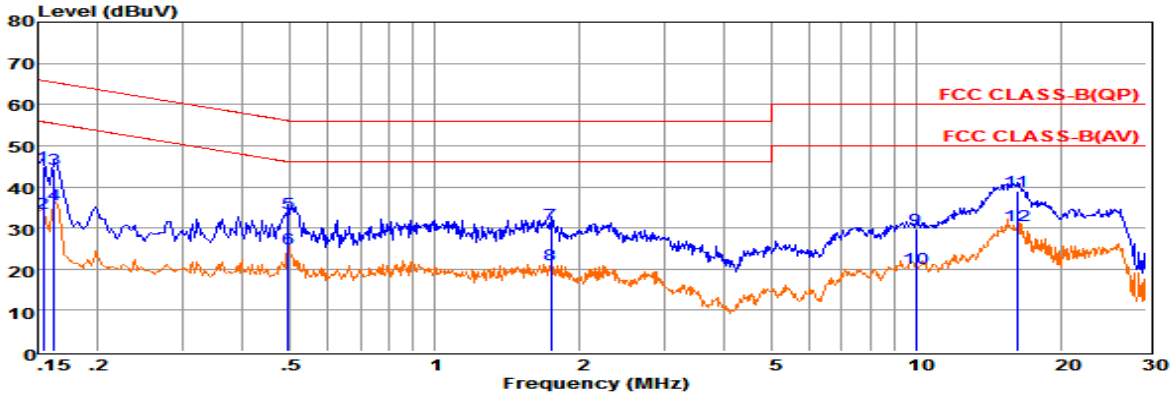


Env. Ins: 24*/56%
Pol: NEUTRAL

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15000	31.07	9.70	0.02	10.00	50.79	66.00	-15.21	QP
2	0.15010	21.44	9.70	0.02	10.00	41.16	55.99	-14.83	Average
3	0.18639	16.34	9.62	0.02	10.00	35.98	64.20	-28.22	QP
4	0.18649	5.82	9.62	0.02	10.00	25.46	54.19	-28.73	Average
5	0.50203	13.42	9.62	0.04	10.00	33.08	56.00	-22.92	QP
6	0.50213	6.01	9.62	0.04	10.00	25.67	46.00	-20.33	Average
7	1.61047	10.33	9.63	0.05	10.00	30.01	56.00	-25.99	QP
8	1.61147	0.75	9.63	0.05	10.00	20.43	46.00	-25.57	Average
9	9.70514	8.99	9.72	0.08	10.00	28.79	60.00	-31.21	QP
10	9.70614	-0.41	9.72	0.08	10.00	19.39	50.00	-30.61	Average
	1115.96977	18.90	9.75	0.11	10.00	38.76	60.00	-21.24	QP
	1215.97077	9.20	9.75	0.11	10.00	29.06	50.00	-20.94	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.

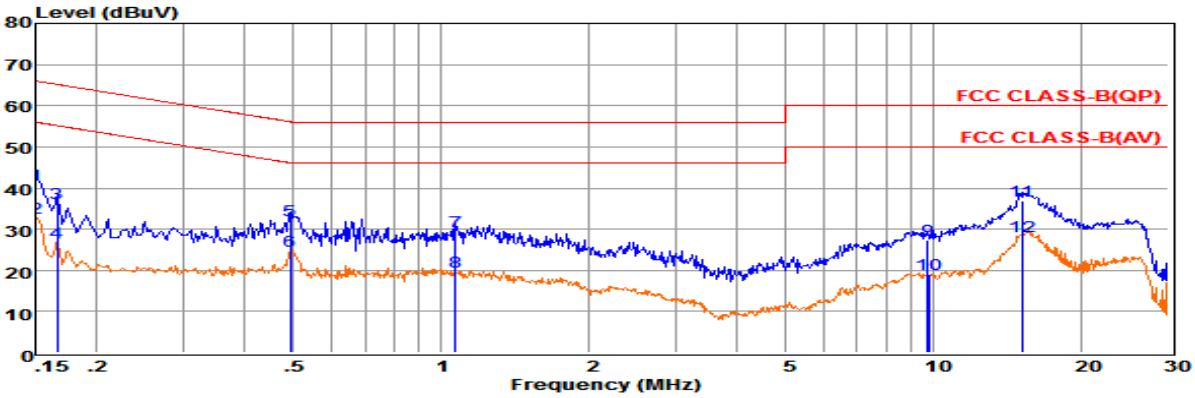
Test result for IEEE 802.11a (AC 240V/60Hz)



Env. Ins: 24*/56%
Pol: NEUTRAL

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15403	25.23	9.69	0.02	10.00	44.94	65.78	-20.84	QP
2	0.15413	13.95	9.69	0.02	10.00	33.66	55.77	-22.11	Average
3	0.16241	24.75	9.67	0.02	10.00	44.44	65.34	-20.90	QP
4	0.16251	16.14	9.67	0.02	10.00	35.83	55.33	-19.50	Average
5	0.49673	14.00	9.62	0.04	10.00	33.66	56.05	-22.39	QP
6	0.49683	5.26	9.62	0.04	10.00	24.92	46.05	-21.13	Average
7	1.74369	11.17	9.63	0.05	10.00	30.85	56.00	-25.15	QP
8	1.74469	1.57	9.63	0.05	10.00	21.25	46.00	-24.75	Average
9	9.96568	9.86	9.72	0.08	10.00	29.66	60.00	-30.34	QP
10	9.96668	0.38	9.72	0.08	10.00	20.18	50.00	-29.82	Average
11	16.13990	19.24	9.75	0.11	10.00	39.10	60.00	-20.90	QP
12	16.14090	10.71	9.75	0.11	10.00	30.57	50.00	-19.43	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.



Env. Ins: 24*/56%
Pol: LINE

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15000	21.15	9.57	0.02	10.00	40.74	66.00	-25.26	QP
2	0.15010	13.17	9.57	0.02	10.00	32.76	55.99	-23.23	Average
3	0.16589	16.78	9.59	0.02	10.00	36.39	65.16	-28.77	QP
4	0.16599	7.07	9.59	0.02	10.00	26.68	55.16	-28.48	Average
5	0.49411	12.47	9.62	0.04	10.00	32.13	56.10	-23.97	QP
6	0.49421	5.11	9.62	0.04	10.00	24.77	46.10	-21.33	Average
7	1.07096	9.81	9.63	0.05	10.00	29.49	56.00	-26.51	QP
8	1.07196	-0.12	9.63	0.05	10.00	19.56	46.00	-26.44	Average
9	9.75670	7.68	9.69	0.08	10.00	27.45	60.00	-32.55	QP
10	9.75770	-0.63	9.69	0.08	10.00	19.14	50.00	-30.86	Average
11	15.14567	17.16	9.71	0.10	10.00	36.97	60.00	-23.03	QP
12	15.14667	8.49	9.71	0.10	10.00	28.30	50.00	-21.70	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.

****Note: Pre-scan all modes and recorded the worst case results in this report (IEEE 802.11a).*

5.8. Antenna Requirements

5.8.1. Standard Applicable

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

5.8.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 5.0dBi which is an R-SMA antenna and no consideration of replacement. Please see EUT photo for details.

5.8.3. Results: Compliance.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Conducted power refers ANSI C63.10:2013 Output power test procedure for UNI devices.

Radiated power refers to ANSI C63.10:2013 Radiated emissions tests.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep Time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Limits

FCC	IC
Antenna Gain	
6 dBi	

Note: The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For WLAN devices, the OFDM (IEEE 802.11a) mode is used;

Antenna 0

T_{nom}	V_{nom}	Lowest Channel 5745 MHz	Middle Channel 5785 MHz	Highest Channel 5825 MHz
Conducted power [dBm] Measured with OFDM modulation		3.245	2.909	3.588
Radiated power [dBm] Measured with OFDM modulation		7.460	7.288	7.891
Gain [dBi] Calculated		4.215	4.379	4.303
Measurement uncertainty			± 1.6 dB (cond.) / ± 3.8 dB (rad.)	

Antenna 1

T_{nom}	V_{nom}	Lowest Channel 5745 MHz	Middle Channel 5785 MHz	Highest Channel 5825 MHz
Conducted power [dBm] Measured with OFDM modulation		4.983	3.121	5.016
Radiated power [dBm] Measured with OFDM modulation		9.160	8.535	9.307
Gain [dBi] Calculated		4.177	4.358	4.291
Measurement uncertainty			± 1.6 dB (cond.) / ± 3.8 dB (rad.)	

Result: -/-

6. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Cal Date	Due Date
EMC Receiver	R&S	ESCS 30	100174	9kHz – 2.75GHz	June 18, 2016	June 17, 2017
Signal analyzer	Agilent	E4448A(External mixers to 40GHz)	US44300469	9kHz~40GHz	July 16, 2016	July 15, 2017
Signal analyzer	Agilent	N9020A	MY50510140	9kHz~26.5GHz	October 27, 2015	October 27, 2016
LISN	MESS Tec	NNB-2/16Z	99079	9KHz-30MHz	June 18, 2016	June 17, 2017
LISN (Support Unit)	EMCO	3819/2NM	9703-1839	9KHz-30MHz	June 18, 2016	June 17, 2017
RF Cable-CON	UTIFLEX	3102-26886-4	CB049	9KHz-30MHz	June 18, 2016	June 17, 2017
ISN	SCHAFFNER	ISN ST08	21653	9KHz-30MHz	June 18, 2016	June 17, 2017
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30M-18GHz 3m	June 18, 2016	June 17, 2017
Amplifier	SCHAFFNER	COA9231A	18667	9kHz-2GHzz	June 18, 2016	June 17, 2017
Amplifier	Agilent	8449B	3008A02120	1GHz-26.5GHz	July 16, 2016	July 15, 2017
Amplifier	MITEQ	AMF-6F-260400	9121372	26.5GHz-40GHz	July 16, 2016	July 15, 2017
Loop Antenna	R&S	HFH2-Z2	860004/001	9k-30MHz	June 18, 2016	June 17, 2017
By-log Antenna	SCHWARZBECK	VULB9163	9163-470	30MHz-1GHz	June 10, 2016	June 09, 2017
Horn Antenna	EMCO	3115	6741	1GHz-18GHz	June 10, 2016	June 09, 2017
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz-40GHz	June 10, 2016	June 09, 2017
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz-1GHz	June 18, 2016	June 17, 2017
RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz-40GHz	June 18, 2016	June 17, 2017
Power Meter	R&S	NRVS	100444	DC-40GHz	June 18, 2016	June 17, 2017
Power Sensor	R&S	NRV-Z51	100458	DC-30GHz	June 18, 2016	June 17, 2017
Power Sensor	R&S	NRV-Z32	10057	30MHz-6GHz	June 18, 2016	June 17, 2017
AC Power Source	HPC	HPA-500E	HPA-9100024	AC 0~300V	June 18, 2016	June 17, 2017
DC power Soure	GW	GPC-6030D	C671845	DC 1V-60V	June 18, 2016	June 17, 2017
Temp. and Humidigy	Giant Force	GTH-225-20-S	MAB0103-00	N/A	June 18, 2016	June 17, 2017
RF CABLE-1m	JYE Bao	RG142	CB034-1m	20MHz-7GHz	June 18, 2016	June 17, 2017
RF CABLE-2m	JYE Bao	RG142	CB)35-2m	20MHz-1GHz	June 18, 2016	June 17, 2017
Note: All equipment through GRGT EST calibration						

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