SPORTON International Inc.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
Ph: 886-3-327-3456 / FAX: 886-3-327-0973 / www.sporton.com.tw

FCC RADIO TEST REPORT

Applicant's company	**Ubiquiti Networks, Inc.**
Applicant Address	685 Third Avenue, 27th Floor New York, New York 10017 USA
FCC ID	**SWX-M445G**
Manufacturer's company	**Ubiquiti Networks, Inc.**
Manufacturer Address	685 Third Avenue, 27th Floor New York, New York 10017 USA

Product Name	WiFi 5G Module
Brand Name	UBIQUITI
Model No.	4x4-5G
Test Rule Part(s)	47 CFR FCC Part 15 Subpart E § 15.407
Test Freq. Range	5150 ~ 5350MHz / 5470 ~ 5725MHz / 5725 ~ 5850 MHz
Received Date	May 02, 2017
Final Test Date	May 19, 2017
Submission Type	Class II Change

Statement

Test result included is for the IEEE 802.11n and IEEE 802.11a/ac of the product.

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.10-2013**, **47 CFR FCC Part 15 Subpart E, KDB789033 D02 v01r04, KDB662911 D01 v02r01, KDB644545 D03 v01, ET Docket No. 13–49; FCC 16–24.**

The test equipment used to perform the test is calibrated and traceable to NML/ROC.

Testing Laboratory
1190

Table of Contents

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR661623-06	Rev. 01	Initial issue of report	Jul. 12, 2017

1. VERIFICATION OF COMPLIANCE

Product Name	:	WiFi 5G Module
Brand Name	:	UBIQUITI
Model No.	:	4x4-5G
Applicant	:	Ubiquiti Networks, Inc.
Test Rule Part(s)	:	47 CFR FCC Part 15 Subpart E § 15.407

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on May 02, 2017 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.

Cliff Chang

SPORTON INTERNATIONAL INC.

2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart E			
Part	**Rule Section**	**Description of Test**	**Result**
4.1	15.207	AC Power Line Conducted Emissions	Complies
4.2	15.407(b)	Radiated Emissions	Complies
4.3	15.407(b)	Band Edge Emissions	Complies
4.4	15.203	Antenna Requirements	Complies

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Product Type	WLAN (4TX, 4RX)
Radio Type	Intentional Transceiver
Power Type	From host system
Modulation	IEEE 802.11a: OFDM IEEE 802.11n/ac: see the below table
Data Modulation	IEEE 802.11a/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) IEEE 802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
Data Rate (Mbps)	IEEE 802.11a: OFDM (6/9/12/18/24/36/48/54) IEEE 802.11n/ac: see the below table
Frequency Range	5150 ~ 5350MHz / 5470 ~ 5725MHz / 5725 ~ 5850 MHz
Channel Number	25 for 20MHz bandwidth ; 12 for 40MHz bandwidth 6 for 80MHz bandwidth
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

Items	Description	
Communication Mode	☒ IP Based (Load Based)	☐ Frame Based
TPC Function	☒ With TPC	☐ Without TPC
Weather Band (5600~5650MHz)	☒ With 5600~5650MHz	☐ Without 5600~5650MHz
Beamforming Function	☒ With beamforming	☐ Without beamforming

Note: The EUT has beamforming function for 802.11n/ac.

Antenna and Bandwidth

Antenna	Four (TX)		
Bandwidth Mode	20 MHz	40 MHz	80 MHz
IEEE 802.11a	V	X	X
IEEE 802.11n	V	V	X
IEEE 802.11ac	V	V	V

IEEE 11n/ac Spec.

Protocol	Number of Transmit Chains (NTX)	Data Rate / MCS
802.11n (HT20)	4	MCS 0-31
802.11n (HT40)	4	MCS 0-31
802.11ac (VHT20)	4	MCS 0-9/Nss1-4
802.11ac (VHT40)	4	MCS 0-9/Nss1-4
802.11ac (VHT80)	4	MCS 0-9/Nss1-4

Note 1: IEEE Std. 802.11n modulation consists of HT20 and HT40 (HT: High Throughput). Then EUT supports HT20 and HT40.

Note 2: IEEE Std. 802.11ac modulation consists of VHT20, VHT40, VHT80 and VHT160 (VHT: Very High Throughput). Then EUT supports VHT20, VHT40 and VHT80.

Note 3: Modulation modes consist of below configuration:
HT20/HT40: IEEE 802.11n, VHT20/VHT40/VHT80: IEEE 802.11ac

3.2. Accessories

N/A

3.3. Table for Filed Antenna

EUT	Ant.	Chain	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	1	-	-	PIFA Antenna	N/A	6
	2	2	-	-	PIFA Antenna	N/A	6
	3	3	-	-	PIFA Antenna	N/A	6
	4	4	-	-	PIFA Antenna	N/A	6
2	5	1	-	-	PIFA Antenna	N/A	6
	6	2	-	-	PIFA Antenna	N/A	6
	7	3	-	-	PIFA Antenna	N/A	6
	8	4	-	-	PIFA Antenna	N/A	6

Note: Ant. 1~Ant. 4 Connect to chain 1~chain 4 for EUT 1, Ant. 5~Ant. 6 Connect to chain 1~chain 4 for EUT 2

For IEEE 802.11a/n/ac mode (4TX/4RX):

Chain 1, Chain 2, Chain 3 and Chain 4 can be used as transmitting/receiving antenna.

Chain 1, Chain 2, Chain 3 and Chain 4 could transmit/receive simultaneously.

3.4. Table for Carrier Frequencies

There are three bandwidth systems.

For 20MHz bandwidth systems, use Channel 36, 40, 44, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 144, 149, 153, 157, 161, 165.

For 40MHz bandwidth systems, use Channel 38, 46, 54, 62, 102, 110, 118, 126, 134, 142, 151, 159.

For 80MHz bandwidth systems, use Channel 42, 58, 106, 122, 138, 155.

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
5150~5250 MHz U-NII-1	36	5180 MHz	44	5220 MHz
	38	5190 MHz	46	5230 MHz
	40	5200 MHz	48	5240 MHz
	42	5210 MHz	-	-
5250~5350 MHz U-NII-2A	52	5260 MHz	60	5300 MHz
	54	5270 MHz	62	5310 MHz
	56	5280 MHz	64	5320 MHz
	58	5290 MHz	-	-
5470~5725 MHz U-NII-2C	100	5500 MHz	124	5620 MHz
	102	5510 MHz	126	5630 MHz
	104	5520 MHz	128	5640 MHz
	106	5530 MHz	132	5660 MHz
	108	5540 MHz	134	5670 MHz
	110	5550 MHz	136	5680 MHz
	112	5560 MHz	138	5690 MHz
	116	5580 MHz	140	5700 MHz
	118	5590 MHz	142	5710 MHz
	120	5600 MHz	144	5720 MHz
	122	5610 MHz	-	-
5725~5850 MHz U-NII-3	149	5745 MHz	157	5785 MHz
	151	5755 MHz	159	5795 MHz
	153	5765 MHz	161	5805 MHz
	155	5775 MHz	165	5825 MHz

3.5. Table for 80+80 MHz Mode

Type	Channel No.	Frequency
9	106+138	5530+5690 MHz
10	106+155	5530+5775 MHz
11	122+155	5610+5775 MHz
12	138+155	5690+5775 MHz
13	42+58	5210+5290 MHz
14	106+122	5530+5610 MHz
15	122+138	5610+5690 MHz

Note: Non-beamforming mode supports type 9-15, beamforming mdoe supports type 9-14 only.

3.6. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. The following table is a list of the test modes shown in this test report.

Test Items	Mode		Data Rate	Channel	Chain
AC Power Conducted Emission	CTX		-	-	-
Radiated Emission Above 1GHz	**For non-beamforming mode**				
	11a/BPSK	U-NII-3	6Mbps	149	1+2+3+4
	11ac VHT40	U-NII-1 U-NII-2A	MCS0/Nss1	46/54	1+2+3+4
	11ac VHT80	U-NII-2C U-NII-3	MCS0/Nss1	138	1+2+3+4
Band Edge Emission	11a/BPSK	U-NII-3	6Mbps	149	1+2+3+4
	11ac VHT40	U-NII-1 U-NII-2A	MCS0/Nss1	46/54	1+2+3+4
	11ac VHT80	U-NII-2C U-NII-3	MCS0/Nss1	138	1+2+3+4

The following test modes were performed for all tests:

For Conducted Emission test:

Mode 1: CTX

For Radiated Emission test (Above 1GHz):

The EUT can be placed in Y-axis and Z-axis. After evaluating, The worst case was found at Z-axis, so it's recorded in this report.

Mode 1. CTX at Z-axis

3.7. Table for Testing Locations

Test Site Location					
Address:	No.8, Lane 724, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C.				
TEL:	886-3-656-9065				
FAX:	886-3-656-9085				
Test Site No.	**Site Category**	**Location**	**FCC Designation No.**	**IC File No.**	**VCCI Reg. No**
03CH01-CB	SAC	Hsin Chu	TW0006	IC 4086D	-
CO01-CB	Conduction	Hsin Chu	TW0006	IC 4086D	-

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC).

3.8. Table for EUT type

EUT type	Support Band
1	Band 1 and Band 2
2	Band 3 and Band 4

3.9. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR661623

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1. Changing filter 2. Changing antenna with the same type and same gain. 3. Original module supports B1～B4. It would become two type that one supports B1～B2 and another supports B3～B4. 4. Updating applicant address to “685 Third Avenue, 27th Floor New York, New York 10017 USA” from “2580 Orchard Parkway San Jose, CA 95131” 5. Updating manufacturer address to “685 Third Avenue, 27th Floor New York, New York 10017 USA” from “2580 Orchard Parkway San Jose, CA 95131” 6. Disable eight sets 80+80MHz mode (CH42+106, 42+122, 42+138, 42+155, 58+106, 58+122, 58+138, 58+155)	1. Conducted Emission test 2. Radiated Emission above 1GHz test 3. (After evaluating, the worst case is found at CH46, 54, 138, 149, and retest this channel only. The above test channel will be based on original output power to re-test.)

3.10. able for Supporting Units

For Test Site No: 03CH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC
Test Fixture	UBIQUITI	UAP-AC-HD_REV03	N/A
PoE	UBIQUITI	GP-D480-050G	DoC

For Test Site No: CO01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC
Test Fixture	UBIQUITI	UAP-AC-HD_REV03	N/A
PoE	UBIQUITI	GP-D480-050G	DoC

3.11. EUT Operation during Test

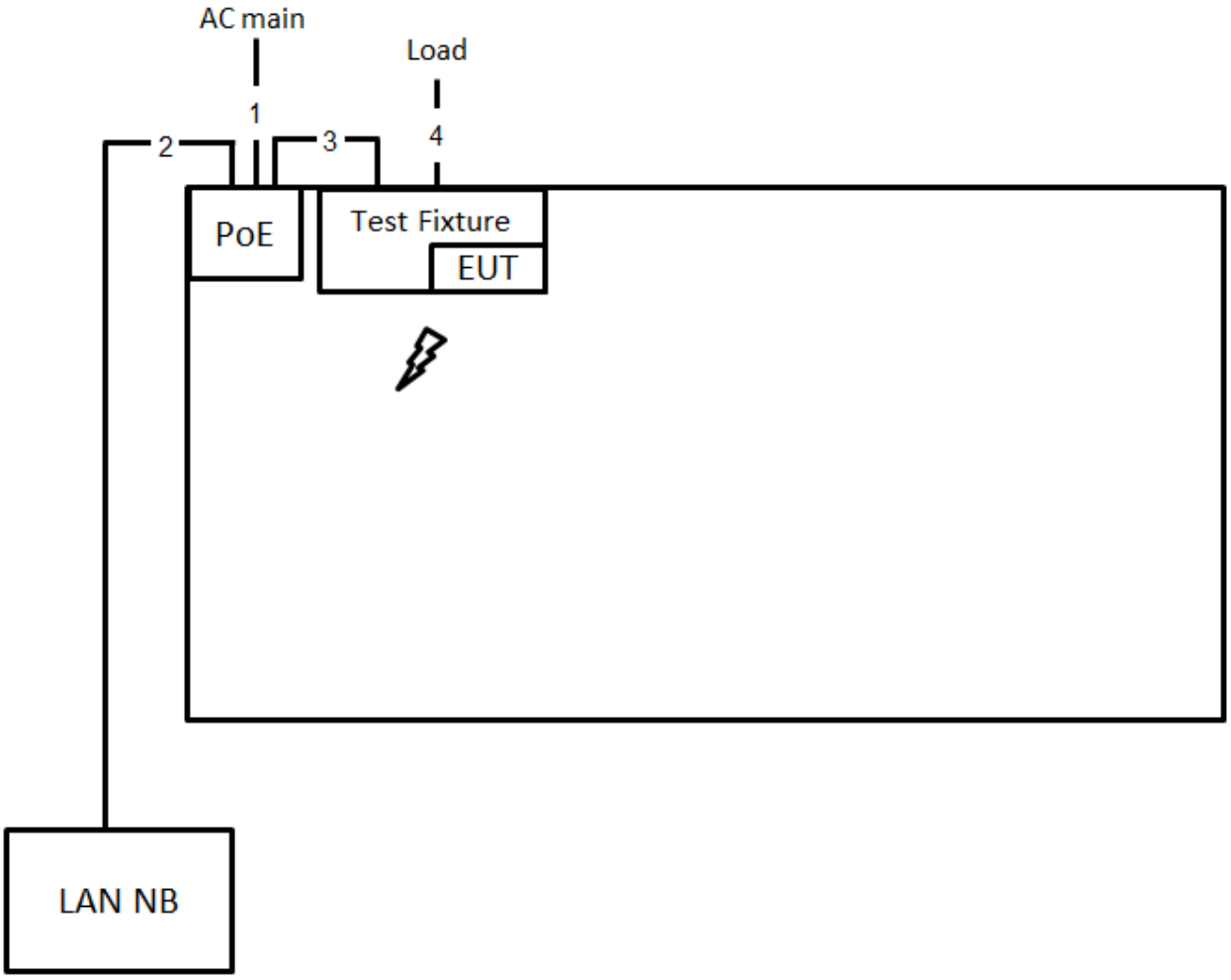
The EUT was programmed to be in continuously transmitting mode.

3.12. Duty Cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Min. VBW (kHz)
802.11a	2.020	2.140	94.39	0.25	0.50
802.11ac MCS0/Nss1 VHT40	2.320	2.540	91.34	0.39	0.43
802.11ac MCS0/Nss1 VHT80	1.136	1.224	92.81	0.32	0.88

3.13. Test Configurations

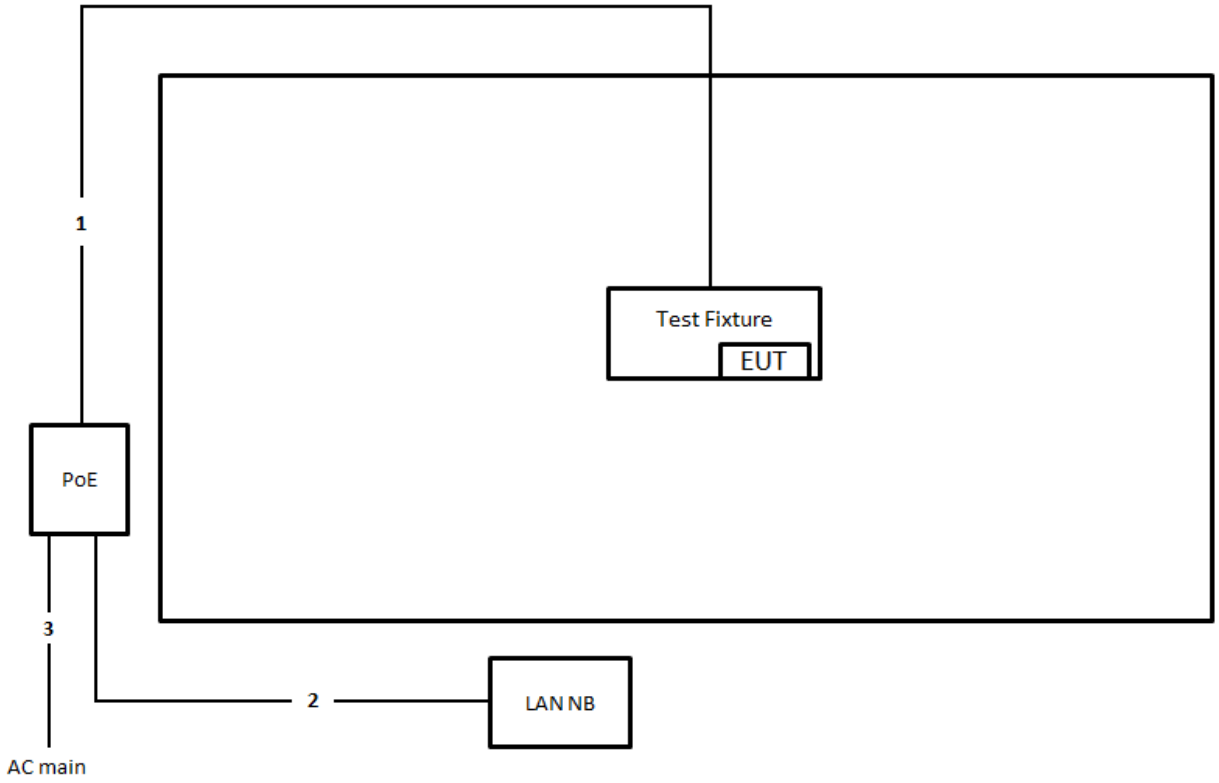
3.13.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	0.5m
2	RJ-45 cable	No	10m
3	RJ-45 cable	No	1m
4	RJ-45 cable	No	1m

3.13.2. Radiation Emissions Test Configuration

Test Configuration: above 1GHz test for non-beamforming mode



Item	Connection	Shielded	Length
1	RJ-45 cable	No	10m
2	RJ-45 cable	No	1.5m
3	Power cable	No	0.5m

4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For this product that is designed to connect to the 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 below limits table.

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

4.1.2. Measuring Instruments and Setting

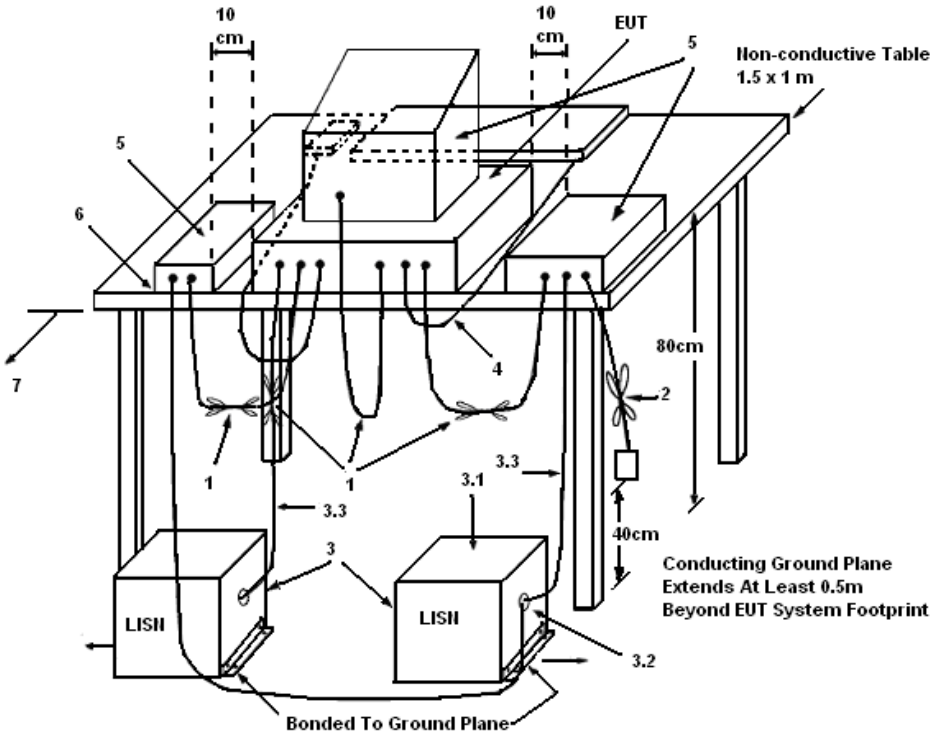
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

4.1.4. Test Setup Layout



LEGEND:

(1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

(2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

(3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, reference ground plane.

(3.1) All other equipment powered from additional LISN(s).

(3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.

(3.3) LISN at least 80 cm from nearest part of EUT chassis.

(4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.

(5) Non-EUT components of EUT system being tested.

(6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.

(7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

4.1.5. Test Deviation

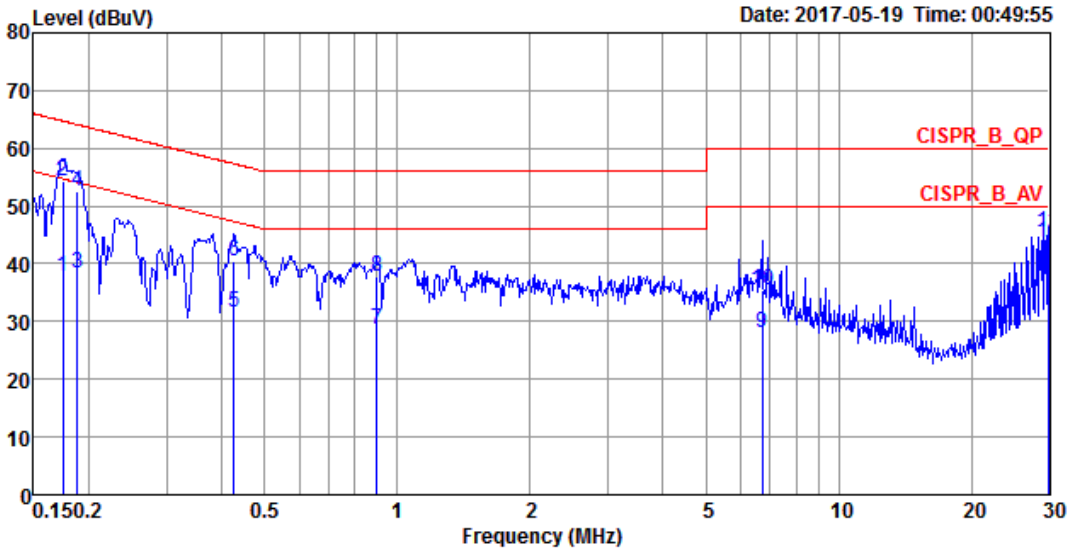
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

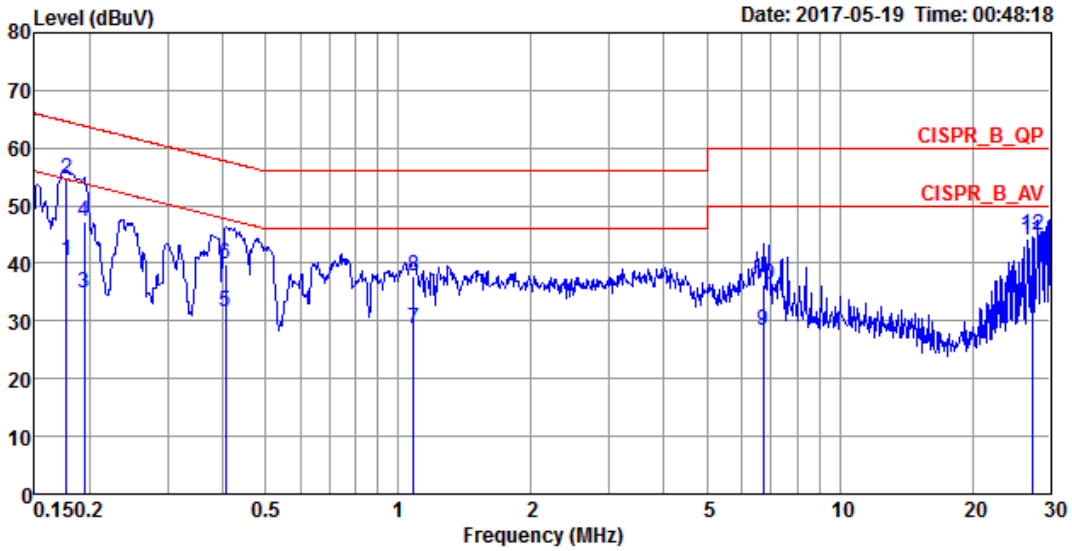
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	22°C	Humidity	57%
Test Engineer	Da Deng	Phase	Line
Configuration	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1749	37.83	-16.89	54.72	27.84	9.94	0.05	Average	LINE
2	0.1749	54.21	-10.51	64.72	44.22	9.94	0.05	QP	LINE
3	0.1884	38.45	-15.66	54.11	28.47	9.93	0.05	Average	LINE
4	0.1884	52.55	-11.56	64.11	42.57	9.93	0.05	QP	LINE
5	0.4260	31.69	-15.64	47.33	21.75	9.90	0.04	Average	LINE
6	0.4260	40.57	-16.76	57.33	30.63	9.90	0.04	QP	LINE
7	0.8992	28.65	-17.35	46.00	18.63	9.96	0.06	Average	LINE
8	0.8992	37.64	-18.36	56.00	27.62	9.96	0.06	QP	LINE
9	6.6978	27.95	-22.05	50.00	17.78	10.01	0.16	Average	LINE
10	6.6978	35.50	-24.50	60.00	25.33	10.01	0.16	QP	LINE
11	29.8415	43.82	-6.18	50.00	33.14	10.38	0.30	Average	LINE
12	29.8415	45.35	-14.65	60.00	34.67	10.38	0.30	QP	LINE

Temperature	22°C	Humidity	57%
Test Engineer	Da Deng	Phase	Neutral
Configuration	CTX		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1768	40.51	-14.13	54.64	30.50	9.96	0.05	Average	NEUTRAL
2	0.1768	54.48	-10.16	64.64	44.47	9.96	0.05	QP	NEUTRAL
3	0.1945	34.94	-18.90	53.84	24.91	9.98	0.05	Average	NEUTRAL
4	0.1945	47.17	-16.67	63.84	37.14	9.98	0.05	QP	NEUTRAL
5	0.4061	31.47	-16.26	47.73	21.47	9.96	0.04	Average	NEUTRAL
6	0.4061	39.98	-17.75	57.73	29.98	9.96	0.04	QP	NEUTRAL
7	1.0824	28.62	-17.38	46.00	18.57	9.99	0.06	Average	NEUTRAL
8	1.0824	37.89	-18.11	56.00	27.84	9.99	0.06	QP	NEUTRAL
9	6.6978	28.40	-21.60	50.00	18.12	10.12	0.16	Average	NEUTRAL
10	6.6978	36.41	-23.59	60.00	26.13	10.12	0.16	QP	NEUTRAL
11	27.2711	43.85	-6.15	50.00	33.24	10.33	0.28	Average	NEUTRAL
12	27.2711	44.73	-15.27	60.00	34.12	10.33	0.28	QP	NEUTRAL

Note:

Level = Read Level + LISN Factor + Cable Loss.

4.2. Radiated Emissions Measurement

4.2.1. Limit

For transmitters operating in the 5.15-5.35 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.

For transmitters operating in the 5.470-5.725 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.

For transmitters operating in the 5.725-5.85 GHz band: 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.

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 (micorvolts/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

4.2.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

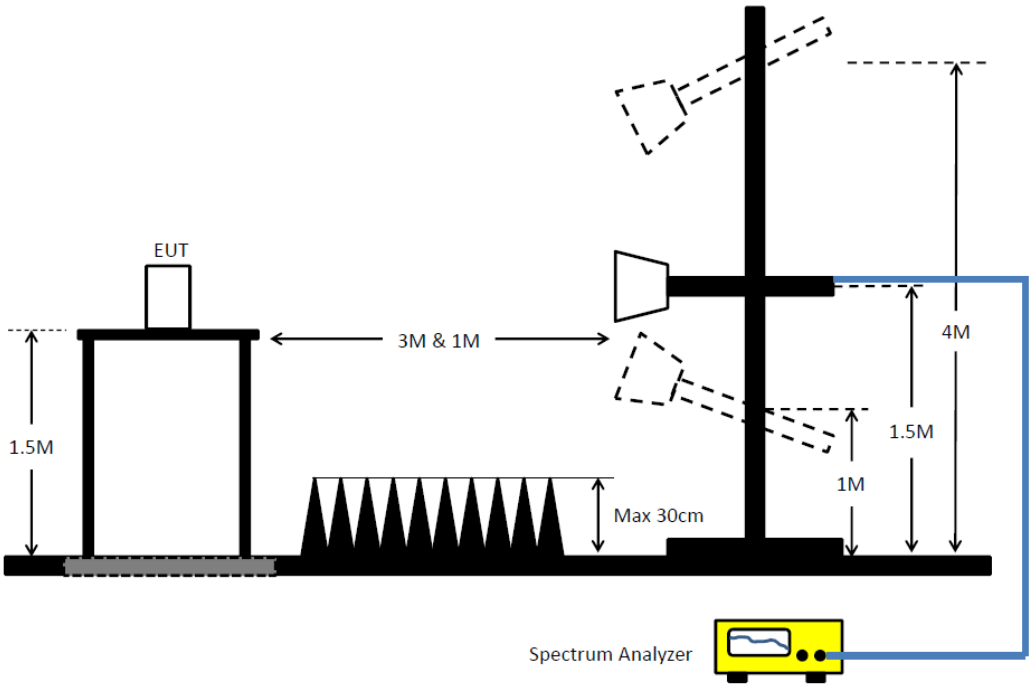
Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	40 GHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	1MHz / 3MHz for peak

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.2.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 1/T VBW for average reading in spectrum analyzer.
7. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
8. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
9. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

4.2.4. Test Setup Layout



4.2.5. Test Deviation

There is no deviation with the original standard.

4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.2.7. Results for Radiated Emissions (1GHz~40GHz)

For non-beamforming mode

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	IEEE 802.11a CH 149 / Chain 1 + Chain 2 + Chain 3 + Chain 4
Test Date	May 15, 2017		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11488.56	62.55	74.00	-11.45	48.79	9.49	39.00	34.73	220	154	Peak	HORIZONTAL
2	11488.88	50.37	54.00	-3.63	36.61	9.49	39.00	34.73	220	154	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11495.84	66.33	74.00	-7.67	52.57	9.49	39.00	34.73	248	342	Peak	VERTICAL
2	11495.92	53.13	54.00	-0.87	39.37	9.49	39.00	34.73	248	342	Average	VERTICAL

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 46 / Chain 1 + Chain 2 + Chain 3 + Chain 4
Test Date	May 16, 2017		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	15681.20	57.85	74.00	-16.15	40.61	12.03	37.93	32.72	162	260	Peak	HORIZONTAL
2	15695.60	44.07	54.00	-9.93	26.81	12.05	37.93	32.72	162	260	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	15684.32	44.18	54.00	-9.82	26.94	12.03	37.93	32.72	159	221	Average	VERTICAL
2	15693.12	57.14	74.00	-16.86	39.88	12.05	37.93	32.72	159	221	Peak	VERTICAL

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 54 / Chain 1 + Chain 2 + Chain 3 + Chain 4
Test Date	May 15, 2017		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	15823.76	58.93	74.00	-15.07	43.81	12.47	37.93	35.28	131	220	Peak	HORIZONTAL
2	15827.44	45.92	54.00	-8.08	30.80	12.47	37.93	35.28	131	220	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	15816.40	58.25	74.00	-15.75	43.13	12.47	37.93	35.28	145	241	Peak	VERTICAL
2	15824.24	45.47	54.00	-8.53	30.35	12.47	37.93	35.28	145	241	Average	VERTICAL

Straddle Channel

Temperature	22℃	Humidity	54%
Test Engineer	Eason Chen	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 138 / Chain 1 + Chain 2 + Chain 3 + Chain 4
Test Date	May 15, 2017 ~ May 16, 2017		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11378.56	41.77	54.00	-12.23	28.24	9.44	38.81	34.72	188	222	Average	HORIZONTAL
2	11399.36	54.33	74.00	-19.67	40.74	9.45	38.86	34.72	188	222	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	11409.44	56.87	74.00	-17.13	43.28	9.45	38.86	34.72	205	0	Peak	VERTICAL
2	11410.24	44.08	54.00	-9.92	30.49	9.45	38.86	34.72	205	0	Average	VERTICAL

Note:

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

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

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

4.3. Band Edge Emissions Measurement

4.3.1. Limit

For transmitters operating in the 5.15-5.35 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.

For transmitters operating in the 5.470-5.725 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.

For transmitters operating in the 5.725-5.85 GHz band: 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.

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 (micorvolts/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

4.3.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	1MHz / 3MHz for Peak

4.3.3. Test Procedures

The test procedure is the same as section 4.2.3.

4.3.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.2.4.

4.3.5. Test Deviation

There is no deviation with the original standard.

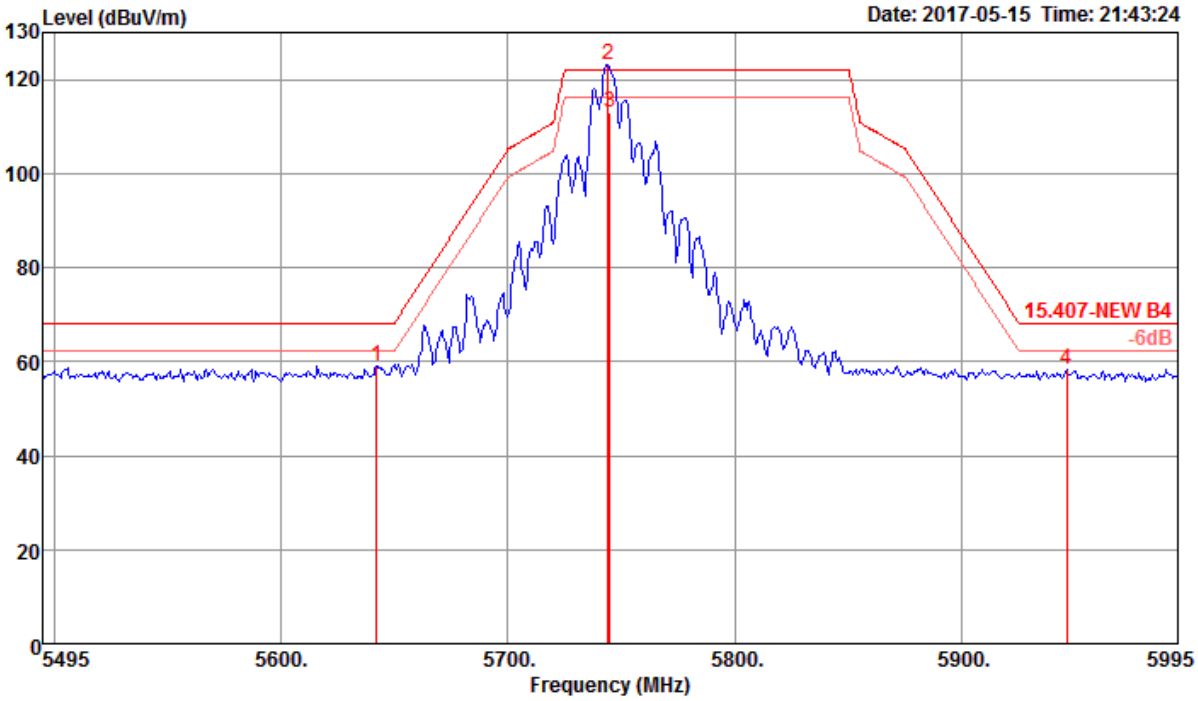
4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of Band Edge and Fundamental Emissions

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	IEEE 802.11a CH 149 / Chain 1 + Chain 2 + Chain 3 + Chain 4

Channel 149

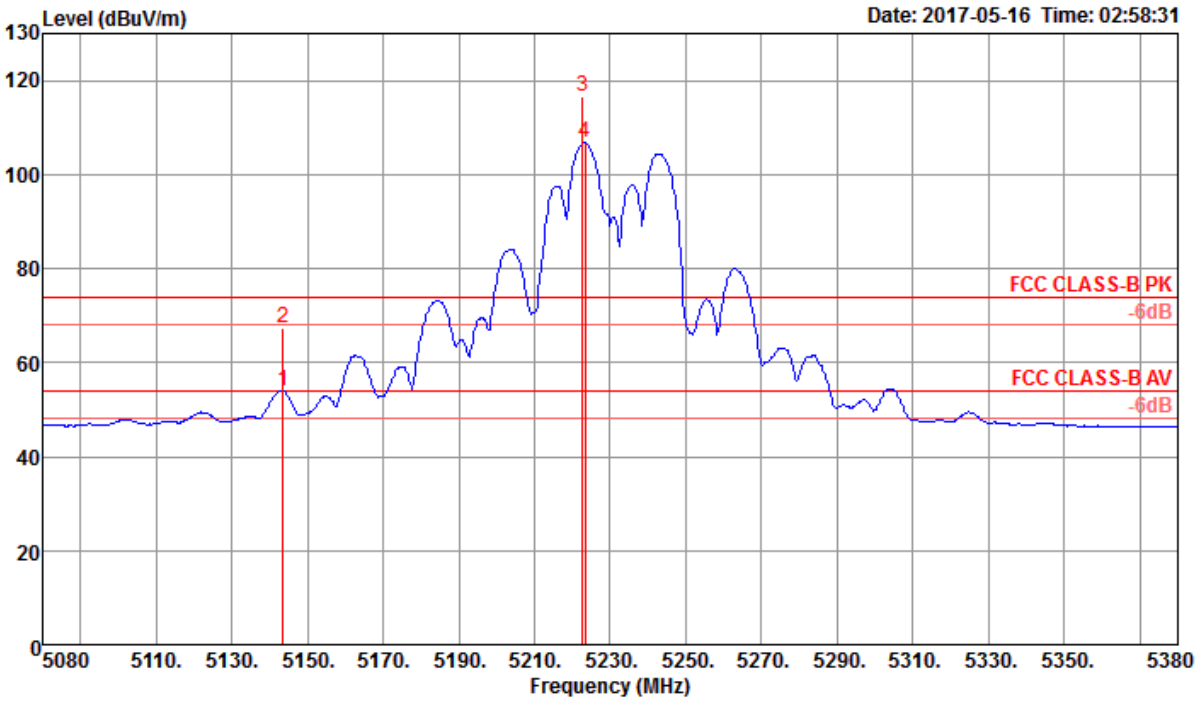


	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	5642.00	59.19	68.20	-9.01	52.94	6.68	34.53	34.96	242	301	Peak	VERTICAL
2 @	5744.00	123.16			116.90	6.68	34.55	34.97	242	301	Peak	VERTICAL
3	5745.00	113.16			106.90	6.68	34.55	34.97	242	301	Average	VERTICAL
4	5946.00	58.16	68.20	-10.04	51.98	6.59	34.59	35.00	242	301	Peak	VERTICAL

Item 2, 3 are the fundamental frequency at 5745 MHz.

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH46, 54 / Chain 1 + Chain 2 + Chain 3 + Chain 4

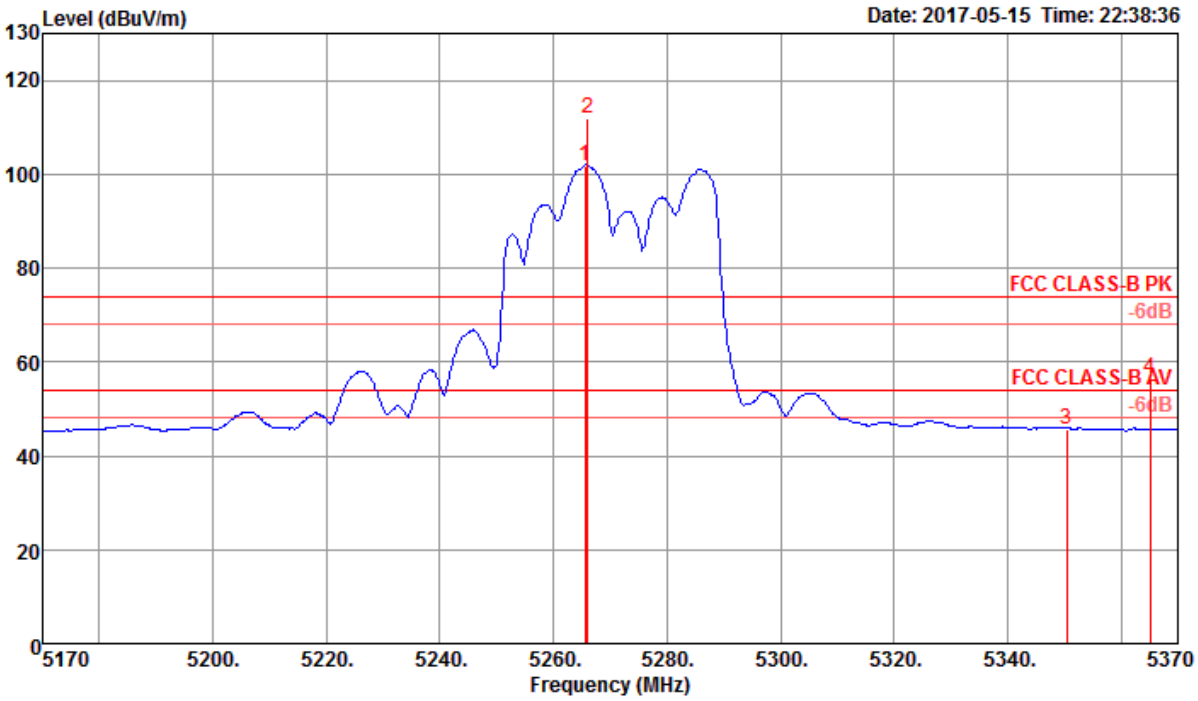
Channel 46



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	5143.60	53.89	54.00	-0.11	44.95	6.48	33.51	31.05	237	90	Average	VERTICAL
2	5143.60	67.51	74.00	-6.49	58.57	6.48	33.51	31.05	237	90	Peak	VERTICAL
3 @	5222.80	116.78			107.69	6.54	33.60	31.05	237	90	Peak	VERTICAL
4 @	5223.40	106.77			97.68	6.54	33.60	31.05	237	90	Average	VERTICAL

Item 3, 4 are the fundamental frequency at 5230 MHz.

Channel 54



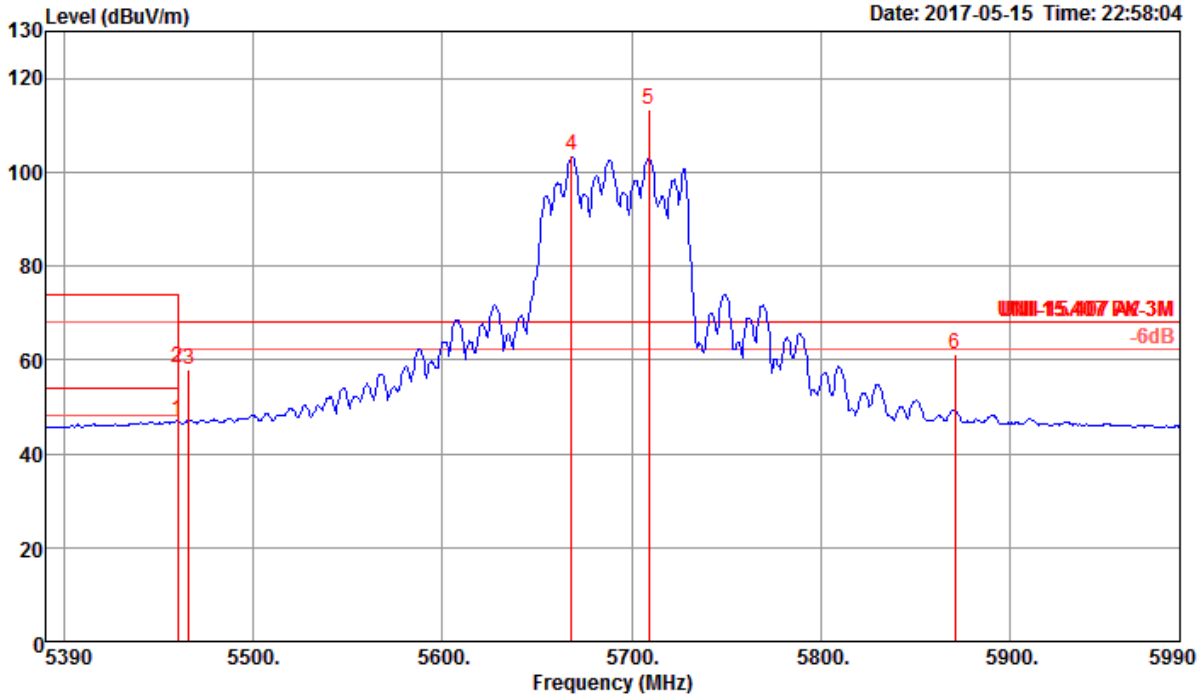
	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1 @	5265.60	101.90			96.21	6.44	34.18	34.93	280	105	Average	VERTICAL
2 @	5266.00	111.72			106.03	6.44	34.18	34.93	280	105	Peak	VERTICAL
3	5350.40	45.78	54.00	-8.22	39.95	6.47	34.29	34.93	280	105	Average	VERTICAL
4	5365.20	56.52	74.00	-17.48	50.67	6.48	34.31	34.94	280	105	Peak	VERTICAL

Item 1, 2 are the fundamental frequency at 5270 MHz.

Straddle Channel

Temperature	22°C	Humidity	54%
Test Engineer	Eason Chen	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 138 (UNII 2C) / Chain 1 + Chain 2 + Chain 3 + Chain 4

Channel 138

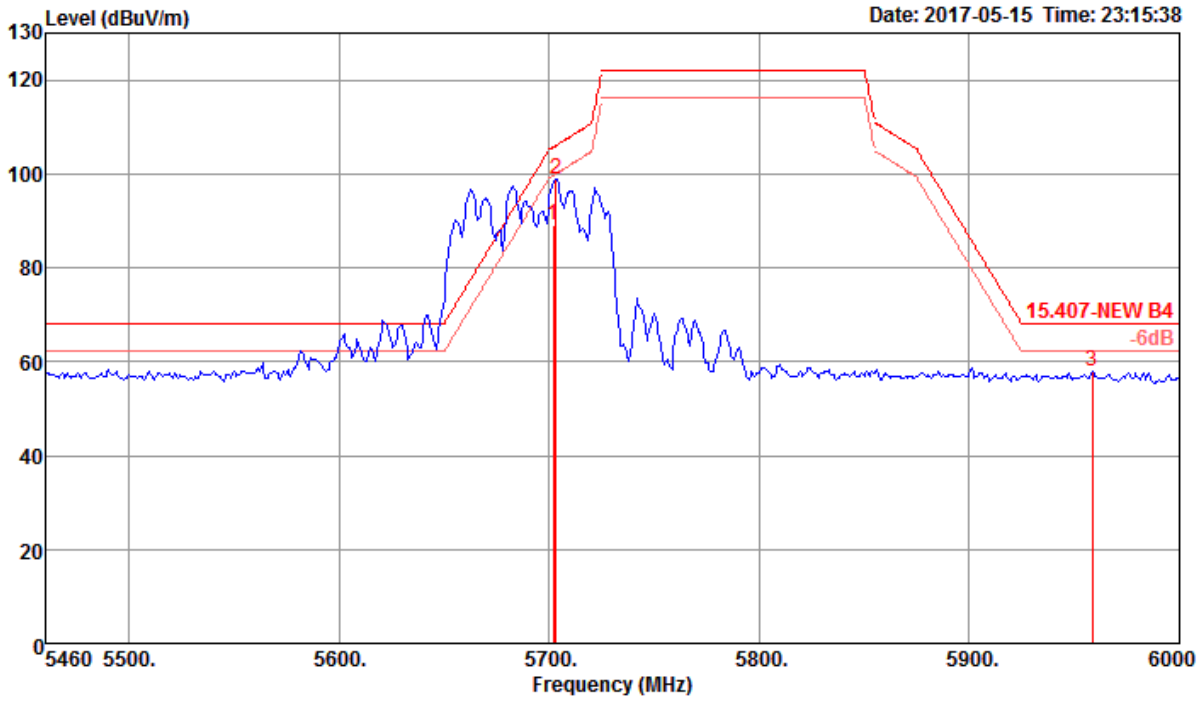


	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	5460.00	47.03	54.00	-6.97	40.98	6.55	34.44	34.94	229	302	Average	VERTICAL
2	5460.00	58.37	74.00	-15.63	52.32	6.55	34.44	34.94	229	302	Peak	VERTICAL
3	5465.60	57.88	68.20	-10.32	51.79	6.57	34.46	34.94	229	302	Peak	VERTICAL
4 @	5668.40	103.43			97.18	6.68	34.53	34.96	229	302	Average	VERTICAL
5 @	5709.20	113.17			106.92	6.68	34.54	34.97	229	302	Peak	VERTICAL
6	5871.20	61.32	68.20	-6.88	55.10	6.64	34.57	34.99	229	302	Peak	VERTICAL

Item 4, 5 are the fundamental frequency at 5690 MHz.

Temperature	22℃	Humidity	54%
Test Engineer	Eason Chen	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 138 (UNII 3) / Chain 1 + Chain 2 + Chain 3 + Chain 4

Channel 138



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	5702.00	89.11			82.86	6.68	34.54	34.97	210	293	Average	HORIZONTAL
2	5703.20	98.98			92.73	6.68	34.54	34.97	210	293	Peak	HORIZONTAL
3	5958.52	57.92	68.20	-10.28	51.75	6.58	34.59	35.00	210	293	Peak	HORIZONTAL

Item 1, 2 are the fundamental frequency at 5690 MHz.

Note:

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

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

4.4. Antenna Requirements

4.4.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

4.4.2. Antenna Connector Construction

Please refer to section 3.3 in this test report; antenna connector complied with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 23, 2017	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 14, 2016	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 21, 2016	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	May 24, 2016	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	Conduction (CO01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 10, 2016	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 25, 2016	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 16, 2017	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jun. 28, 2016	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 22, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
Test Software	Audix	E3	6.2009-I0-7	N/A	N/A	Radiation (03CH01-CB)

Note: Calibration Interval of instruments listed above is one year.

N.C.R. means Non-Calibration required.

6. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.2 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%