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	**AirTies Wireless Networks**
Applicant Address	Gülbahar Mah. Avni Dilligil Sok. Celik Is Merkezi No 5 mecidiyekoy ISTANBUL, 34394 Turkey
FCC ID	**Z3WAIR49200**
Manufacturer's company	**SHENZHEN GONGJIN ELECTRONICS CO.,LTD.**
Manufacturer Address	2F/3F/4F Baiying Building,1019#Naihai RD, Nanshan Dist., Shenzhen, Guangdong, CHINA

Product Name	2 Port Gigabit Ethernet 11ac/11n Wireless Router
Brand Name	AirTies
Model No.	Air 4920
Test Rule Part(s)	47 CFR FCC Part 15 Subpart E § 15.407
Test Freq. Range	5150 ~ 5350 MHz / 5470 ~ 5725 MHz / 5725 ~ 5850 MHz
Received Date	May 13, 2016
Final Test Date	May 28, 2016
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 v01r02, 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
FR552501-05	Rev. 01	Initial issue of report	Jun. 06, 2016

1. VERIFICATION OF COMPLIANCE

Product Name	:	2 Port Gigabit Ethernet 11ac/11n Wireless Router
Brand Name	:	AirTies
Model No.	:	Air 4920
Applicant	:	AirTies Wireless Networks
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 13, 2016 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.

Sam Chen

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	15.407(a)	26dB Spectrum Bandwidth and 99% Occupied Bandwidth	Complies
4.2	15.407(e)	6dB Spectrum Bandwidth	Complies
4.3	15.407(a)	Maximum Conducted Output Power	Complies
4.4	15.407(a)	Power Spectral Density	Complies
4.5	15.407(b)	Radiated Emissions	Complies
4.6	15.407(b)	Band Edge Emissions	Complies
4.7	15.407(g)	Frequency Stability	Complies
4.8	15.203	Antenna Requirements	Complies

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Product Type	IEEE 802.11a: WLAN (1TX, 1RX) IEEE 802.11n/ac: WLAN (3TX, 3RX)
Radio Type	Intentional Transceiver
Power Type	From power adapter
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 ~ 5350 MHz / 5470 ~ 5725 MHz / 5725 ~ 5850 MHz
Channel Number	21 for 20MHz bandwidth ; 9 for 40MHz bandwidth 4 for 80MHz bandwidth
Channel Band Width (99%)	**For non-beamforming mode** IEEE 802.11a: 25.01 MHz **For beamforming mode** IEEE 802.11ac MCS0/Nss1 (VHT20): 21.88 MHz IEEE 802.11ac MCS0/Nss1 (VHT40): 45.01 MHz IEEE 802.11ac MCS0/Nss1 (VHT80): 83.94 MHz
Maximum Conducted Output Power	**For non-beamforming mode** IEEE 802.11a: 22.77 dBm **For beamforming mode** IEEE 802.11ac MCS0/Nss1 (VHT20): 27.43 dBm IEEE 802.11ac MCS0/Nss1 (VHT40): 26.59 dBm IEEE 802.11ac MCS0/Nss1 (VHT80): 26.39 dBm
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
Weather Band (5600~5650MHz)	☐ With 5600~5650MHz	☒ Without 5600~5650MHz
Beamforming Function	☒ With beamforming	☐ Without beamforming
Operate Condition	☒ Indoor	☐ Outdoor

Note: The product has beamforming function for 802.11n/ac in 5GHz.

Antenna and Band width

Antenna	Single (TX)			Three (TX)		
Band width Mode	20 MHz	40 MHz	80 MHz	20 MHz	40 MHz	80 MHz
IEEE 802.11a	V	X	X	X	X	X
IEEE 802.11n	X	X	X	V	V	X
IEEE 802.11ac	X	X	X	V	V	V

IEEE 11n/ac Spec.

Protocol	Number of Transmit Chains (NTX)	Data Rate / MCS
802.11n (HT20)	3	MCS 0-23
802.11n (HT40)	3	MCS 0-23
802.11ac (VHT20)	3	MCS 0-9/Nss1-3
802.11ac (VHT40)	3	MCS 0-9/Nss1-3
802.11ac (VHT80)	3	MCS 0-9/Nss1-3

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

Power	Brand	Model	Rating
Adapter	MOSO	MSA-C1000IC12.0-12W-US	Input: 100-240Vac, 50/60Hz, 0.5A max. Output: 12.0Vdc, 1A

3.3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	
					2.4GHz	5GHz
1	-	-	PCB Antenna	N/A	2.5	-
2	Airgain	N2420S-T-G50U	PIFA Antenna	I-PEX	2.5	-
3	-	-	PCB Antenna	N/A	-	0
4	-	-	PCB Antenna	N/A	-	0
5	-	-	PCB Antenna	N/A	-	0

Note: The EUT has five antennas. There are two antennas for 2.4GHz and three antennas for 5GHz.

For 2.4GHz band:

For 802.11b/g mode:

Only Chain 1 could transmit/receive simultaneously.

For 802.11n mode:

Chain 1 and Chain 2 could transmit/receive simultaneously.

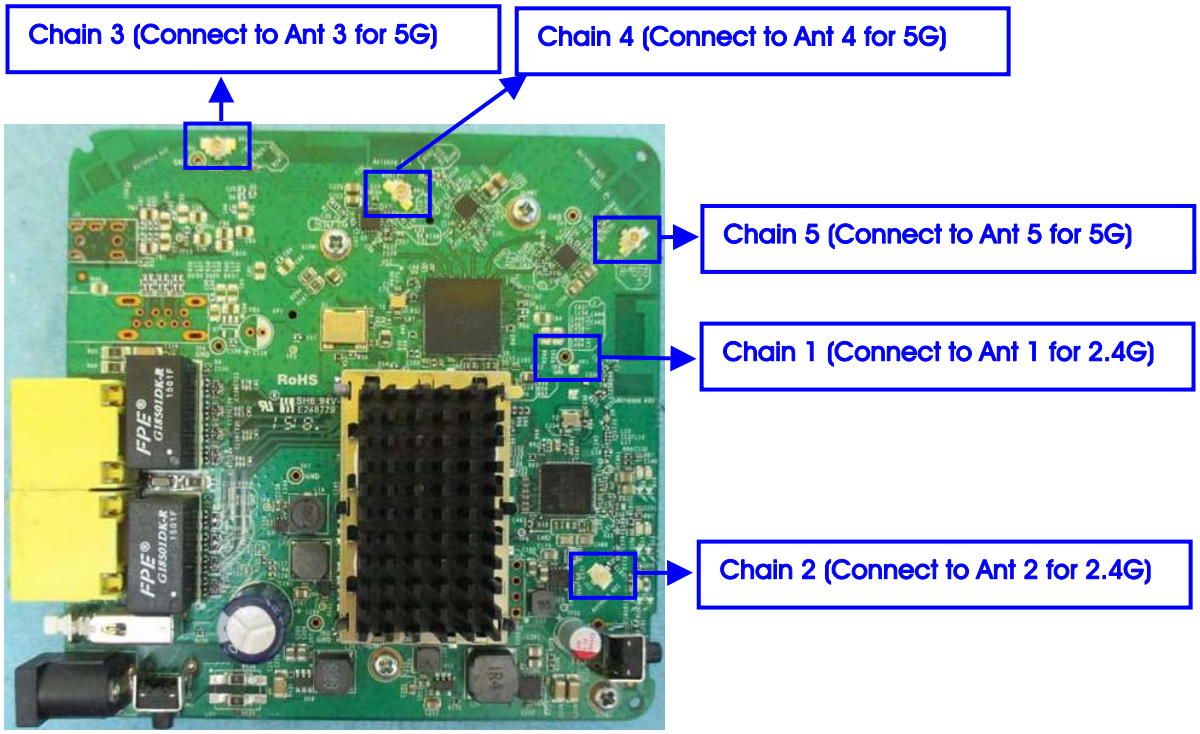
For 5GHz band:

For 802.11a mode:

Only Chain 3 could transmit/receive simultaneously.

For 802.11n/ac mode:

Chain 3, Chain 4 and Chain 5 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, 132, 136, 140, 149, 153, 157, 161, 165.

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

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

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
5150~5250 MHz Band 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 Band 2	52	5260 MHz	60	5300 MHz
	54	5270 MHz	62	5310 MHz
	56	5280 MHz	64	5320 MHz
	58	5290 MHz	-	-
5470~5725 MHz Band 3	100	5500 MHz	112	5560 MHz
	102	5510 MHz	116	5580 MHz
	104	5520 MHz	132	5660 MHz
	106	5530 MHz	134	5670 MHz
	108	5540 MHz	136	5680 MHz
	110	5550 MHz	140	5700 MHz
5725~5850 MHz Band 4	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 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. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode		Data Rate	Channel	Chain
Max. Conducted Output Power	**For non-beamforming mode**				
	11a/BPSK	Band 4	6Mbps	149/157/165	3
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	3+4+5
	11ac VHT40	Band 4	MCS0/Nss1	151/159	3+4+5
	11ac VHT80	Band 4	MCS0/Nss1	155	3+4+5
Power Spectral Density	**For non-beamforming mode**				
	11a/BPSK	Band 4	6Mbps	149/157/165	3
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	3+4+5
	11ac VHT40	Band 4	MCS0/Nss1	151/159	3+4+5
	11ac VHT80	Band 4	MCS0/Nss1	155	3+4+5
26dB Spectrum Bandwidth & 99% Occupied Bandwidth Measurement	**For non-beamforming mode**				
	11a/BPSK	Band 4	6Mbps	149/157/165	3
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	3+4+5
	11ac VHT40	Band 4	MCS0/Nss1	151/159	3+4+5
	11ac VHT80	Band 4	MCS0/Nss1	155	3+4+5
6dB Spectrum Bandwidth Measurement	**For non-beamforming mode**				
	11a/BPSK	Band 4	6Mbps	149/157/165	3
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	3+4+5
	11ac VHT40	Band 4	MCS0/Nss1	151/159	3+4+5
	11ac VHT80	Band 4	MCS0/Nss1	155	3+4+5
Radiated Emission Above 1GHz	**For non-beamforming mode**				
	11a/BPSK	Band 4	6Mbps	149/157/165	3
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	3+4+5
	11ac VHT40	Band 4	MCS0/Nss1	151/159	3+4+5
	11ac VHT80	Band 4	MCS0/Nss1	155	3+4+5

Band Edge Emission	For non-beamforming mode				
	11a/BPSK	Band 4	6Mbps	149/157/165	3
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	3+4+5
	11ac VHT40	Band 4	MCS0/Nss1	151/159	3+4+5
	11ac VHT80	Band 4	MCS0/Nss1	155	3+4+5
Frequency Stability	20 MHz	Band 4	-	157	3
	40 MHz	Band 4	-	151	3
	80 MHz	Band 4	-	155	3

Note1: VHT20/VHT40 covers HT20/HT40, due to same modulation. The power setting for 802.11n HT20 and HT40 are the same or lower than 802.11ac VHT20 and VHT40.

Note2: There are two functions of EUT, one is beamforming function, and the other is non-beamforming function 802.11n/ac in 5GHz. After evaluating, beamforming function has been evaluated to be the worst case, so it was selected to test and record in this test report.

Note3: The EUT can only be used at Y axis position.

3.6. 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	-
TH01-CB	OVEN Room	Hsin Chu	-	-	-

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

3.7. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR552501-04AB

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

Modifications	Performance Checking
Updating test rule of 5GHz band 4 to "15.407 (b)(4)(i) of New Rules (ET Docket No. 13–49; FCC 16–24)" from "New Rules (ET Docket No. 13–49; FCC 14-30)".	1. 26dB Bandwidth and 99% Occupied Bandwidth 2. 6dB Spectrum Bandwidth 3. Maximum Conducted Output Power 4. Power Spectral Density 5. Radiated Emissions (above 1GHz) 6. Band Edge Emissions 7. Frequency Stability

3.8. Table for Supporting Units

For Test Site No: 03CH01-CB (For non-beamforming mode)

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC

For Test Site No: 03CH01-CB (For beamforming mode)

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC
Notebook	DELL	E4300	DoC
WLAN module (RX Device)	Boardcom	BCM943162ZP	QDS-BRCM1075

For Test Site No: TH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC

3.9. Table for Parameters of Test Software Setting

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

For non-beamforming mode

Test Software Version	Mtool 2.0.0.7		
Mode	Test Frequency (MHz)		
	NCB: 20MHz		
	5745 MHz	5785 MHz	5825 MHz
802.11a	85	85	85

For beamforming mode

Test Software Version	Mtool 2.0.0.7		
Mode	Test Frequency (MHz)		
	NCB: 20MHz		
	5745 MHz	5785 MHz	5825 MHz
802.11ac MCS0/Nss1 VHT20	85	85	83
Mode	NCB: 40MHz		
802.11ac MCS0/Nss1 VHT40	5755 MHz	5795 MHz	
	85	85	
Mode	NCB: 80MHz		
802.11ac MCS0/Nss1 VHT80	5775 MHz		
	85		

3.10. EUT Operation during Test

For non-beamforming mode:

The EUT was programmed to be in continuously transmitting mode.

For beamforming mode:

For Conducted Mode:

The EUT was programmed to be in continuously transmitting mode.

For Radiated Mode:

During the test, the following programs under WIN XP were executed.

The program was executed as follows:

1. During the test, the EUT operation to normal function.
2. Executed command fixed test channel under Telnet.
3. Executed "Lantest.exe" to link with the remote workstation to receive and transmit packet by RX Device and transmit duty cycle no less 98%

3.11. Duty Cycle

For non-beamforming mode

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
802.11a	2.070	2.100	98.57	0.06	0.01

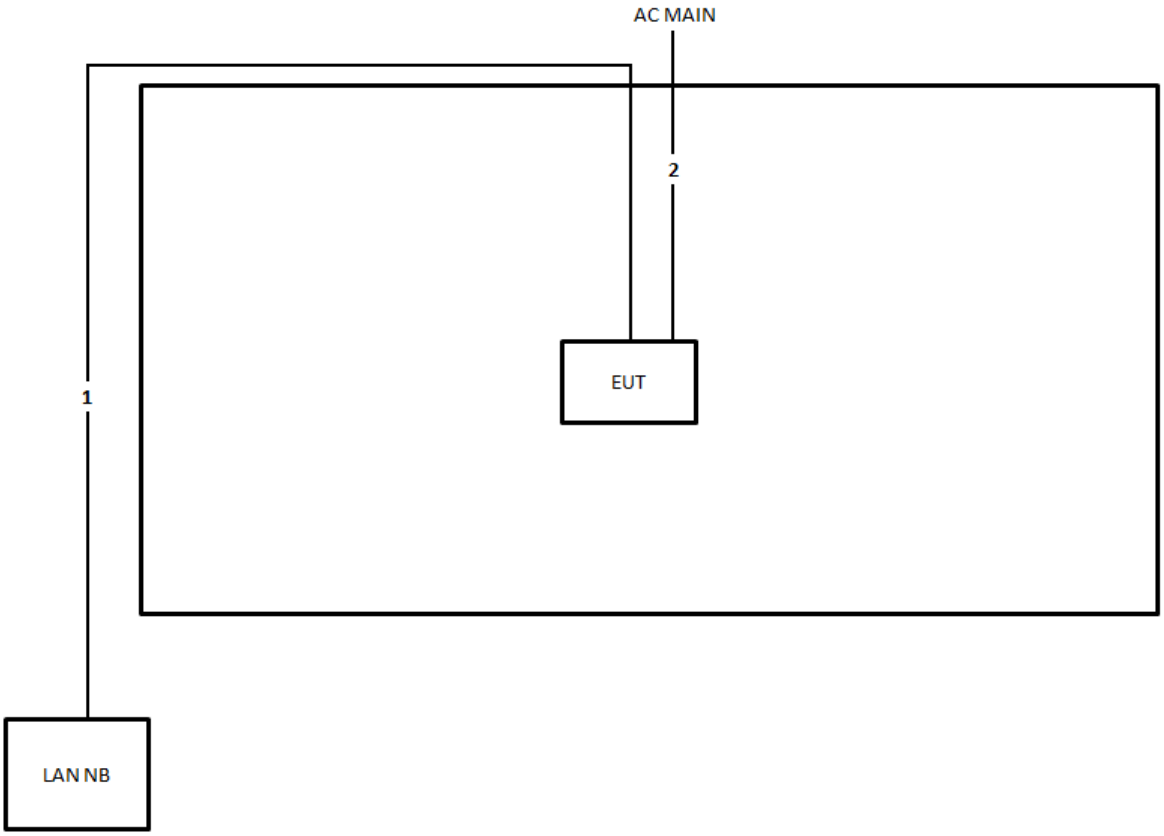
For beamforming mode

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
802.11ac MCS0/Nss1 VHT20	1.950	2.020	96.53	0.15	0.51
802.11ac MCS0/Nss1 VHT40	4.560	4.640	98.28	0.08	0.01
802.11ac MCS0/Nss1 VHT80	5.060	5.140	98.44	0.07	0.01

3.12. Test Configurations

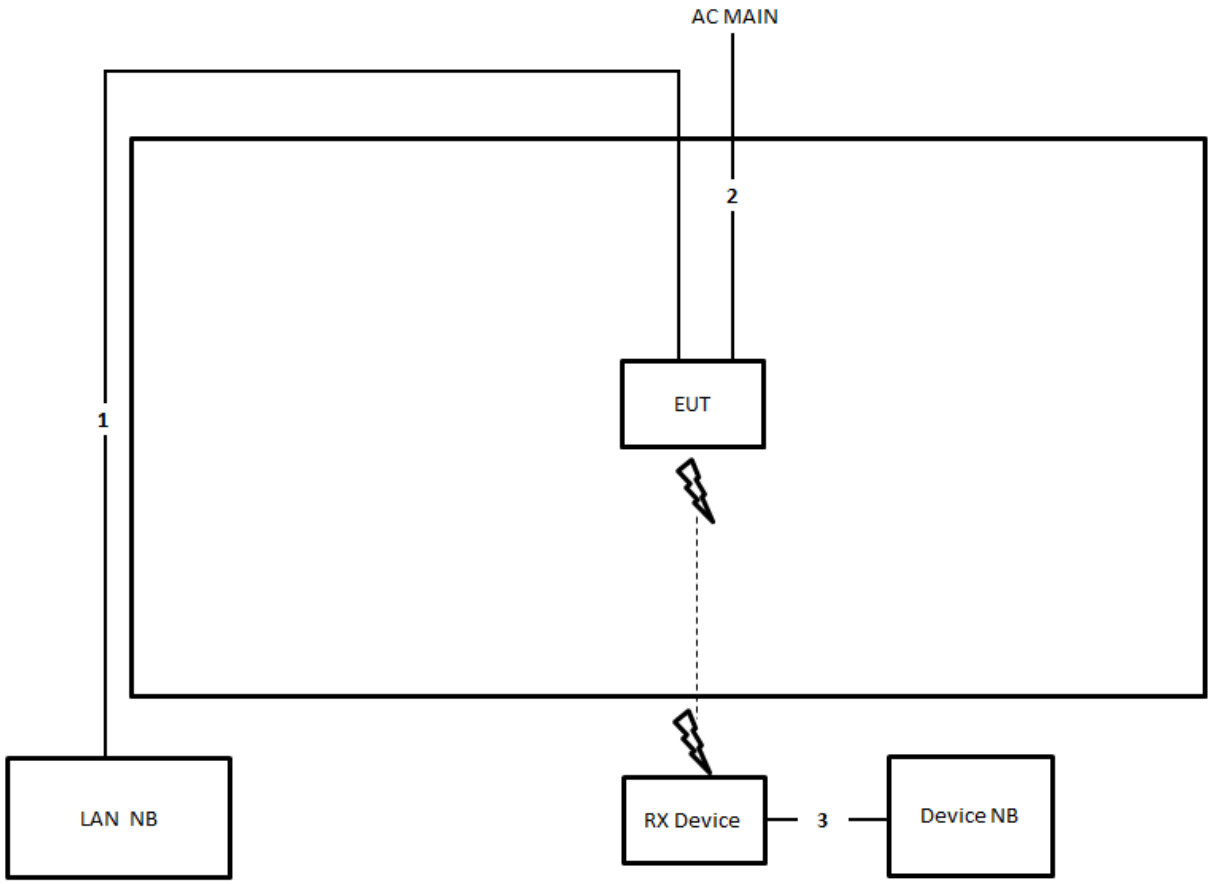
3.12.1. Radiation Emissions Test Configuration

For non-beamforming mode



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

For beamforming mode



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

4. TEST RESULT

4.1. 26dB Bandwidth and 99% Occupied Bandwidth Measurement

4.1.1. Limit

No restriction limits.

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 spectrum analyzer.

26dB Bandwidth	
Spectrum Parameters	**Setting**
Attenuation	Auto
Span Frequency	> 26dB Bandwidth
RBW	Approximately 1% of the emission bandwidth
VBW	VBW > RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto
99% Occupied Bandwidth	
Spectrum Parameters	**Setting**
Span	1.5 times to 5.0 times the OBW
RBW	1 % to 5 % of the OBW
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold

4.1.3. Test Procedures

For Radiated 26dB Bandwidth and 99% Occupied Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

4.1.4. Test Setup Layout

For Radiated 26dB Bandwidth and 99% Occupied Bandwidth Measurement:

This test setup layout is the same as that shown in section 4.5.4.

4.1.5. Test Deviation

There is no deviation with the original standard.

4.1.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.1.7. Test Result of 26dB Bandwidth and 99% Occupied Bandwidth

Temperature	24°C	Humidity	45%
Test Engineer	Serway Li		

For non-beamforming mode

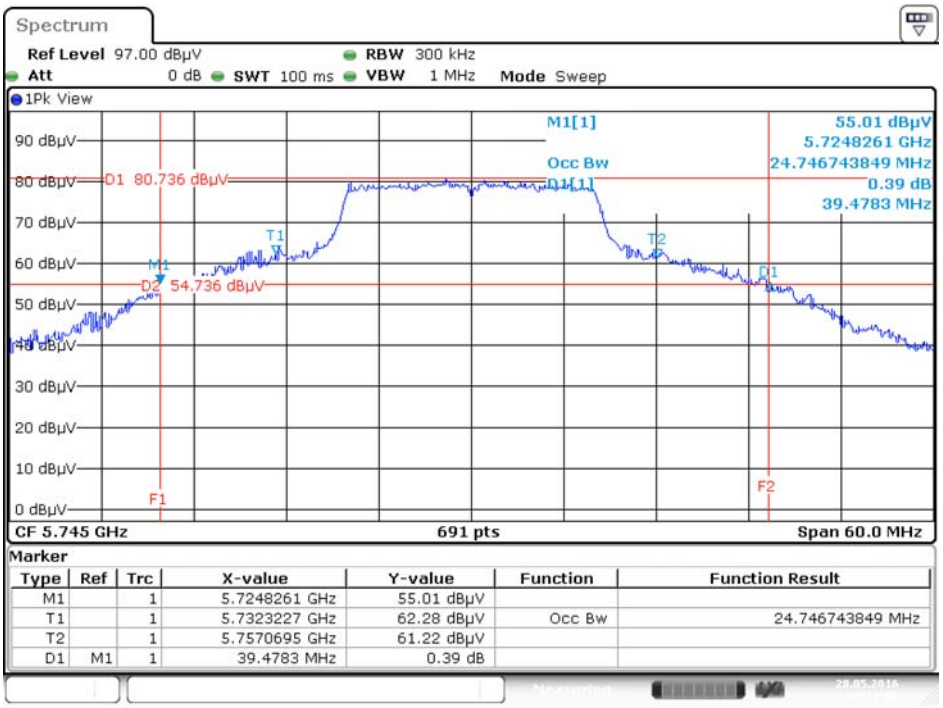
Mode	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a	5745 MHz	39.48	24.75
	5785 MHz	40.87	24.92
	5825 MHz	40.61	25.01

For beamforming mode

Mode	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11ac MCS0/Nss1 VHT20	5745 MHz	39.04	21.88
	5785 MHz	38.09	21.27
	5825 MHz	37.65	20.67
802.11ac MCS0/Nss1 VHT40	5755 MHz	80.73	45.01
	5795 MHz	79.28	42.11
802.11ac MCS0/Nss1 VHT80	5775 MHz	166.38	83.94

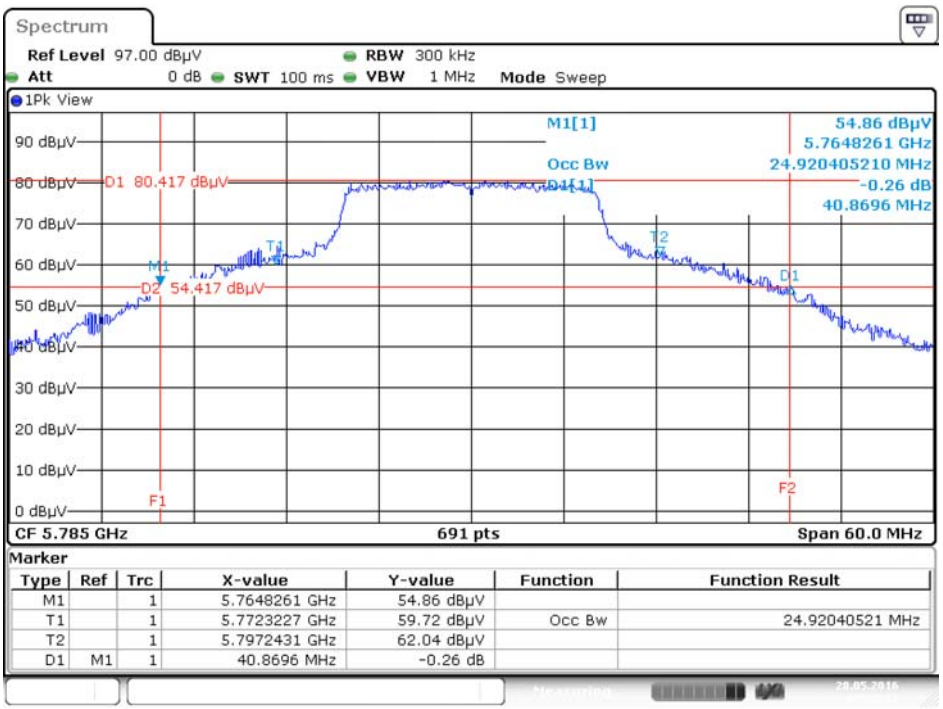
For non-beamforming mode

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 3 / 5745 MHz



Date: 28.MAY.2016 05:17:57

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 3 / 5785 MHz



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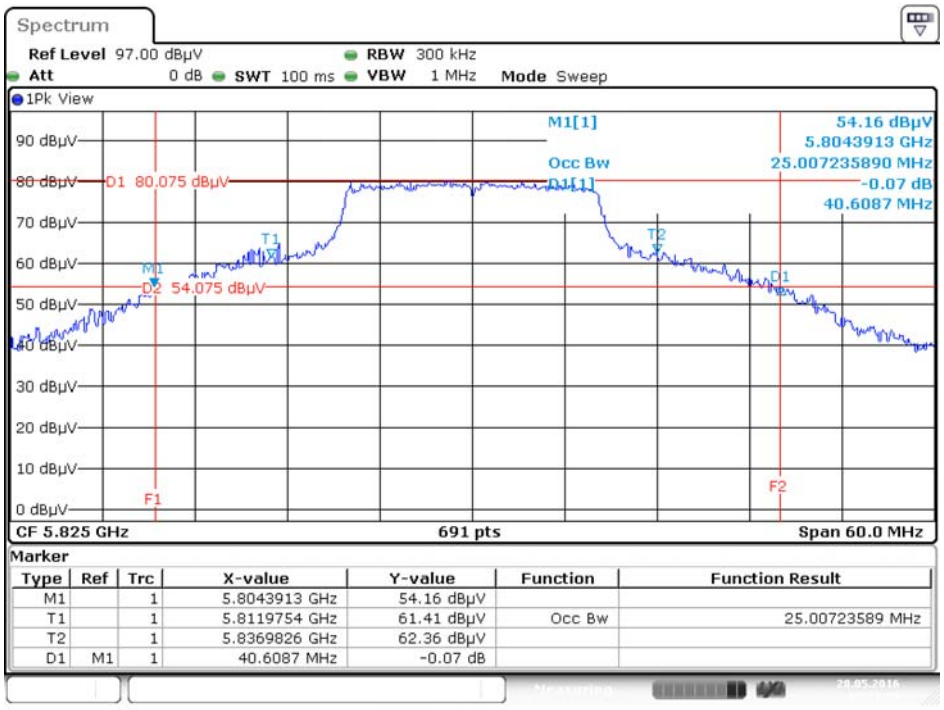
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 3 / 5825 MHz



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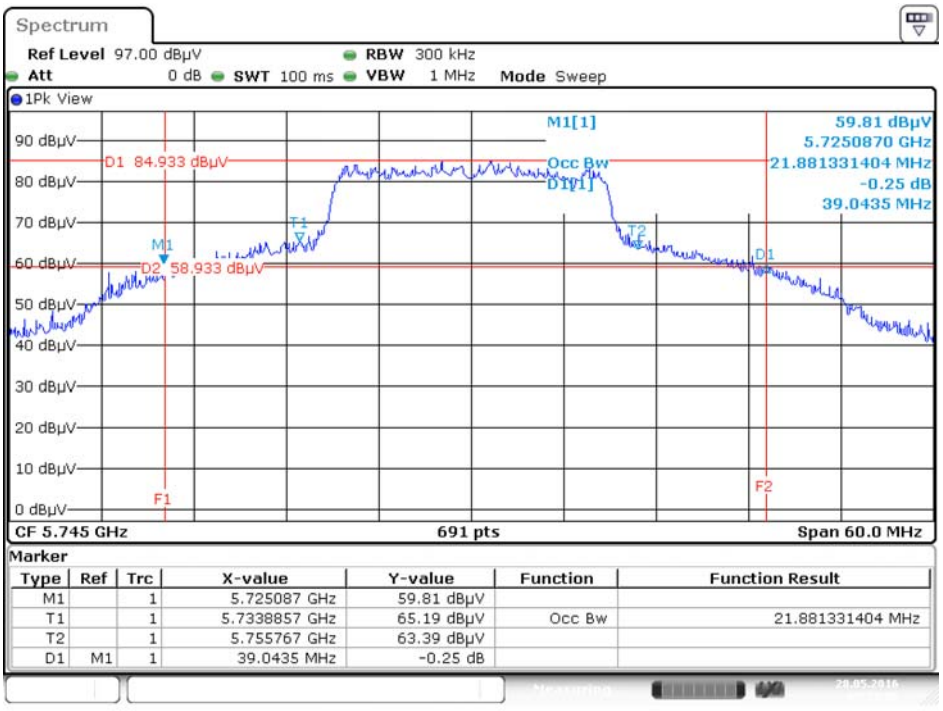
For beamforming mode

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 3 + Chain 4 + Chain 5 / 5745 MHz



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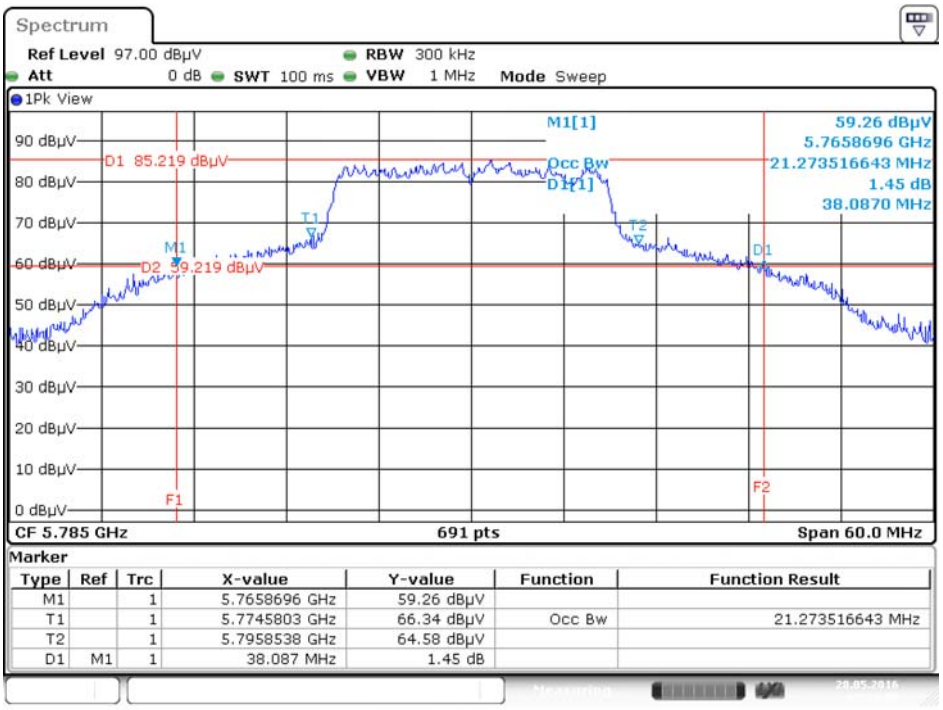
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 3 + Chain 4 + Chain 5 / 5785 MHz



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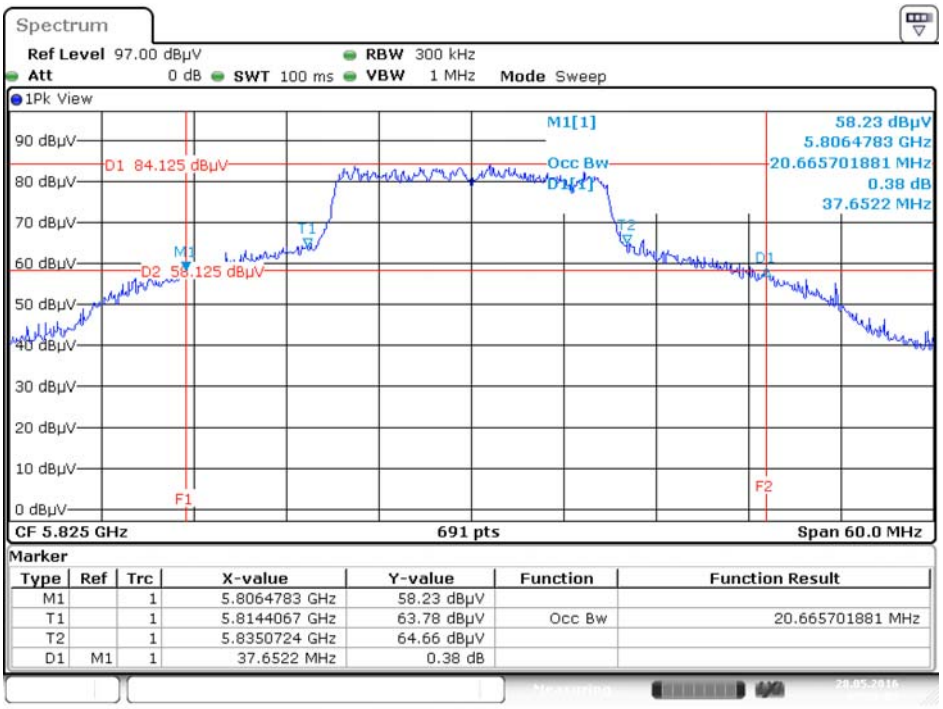
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 3 + Chain 4 + Chain 5 / 5825 MHz



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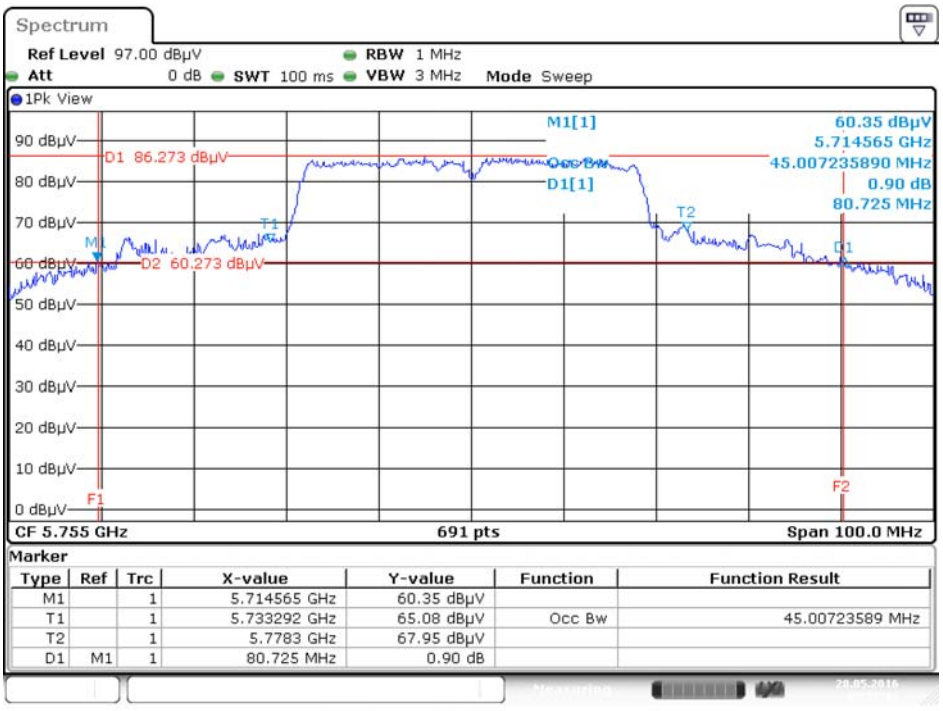
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 3 + Chain 4 + Chain 5 / 5755 MHz



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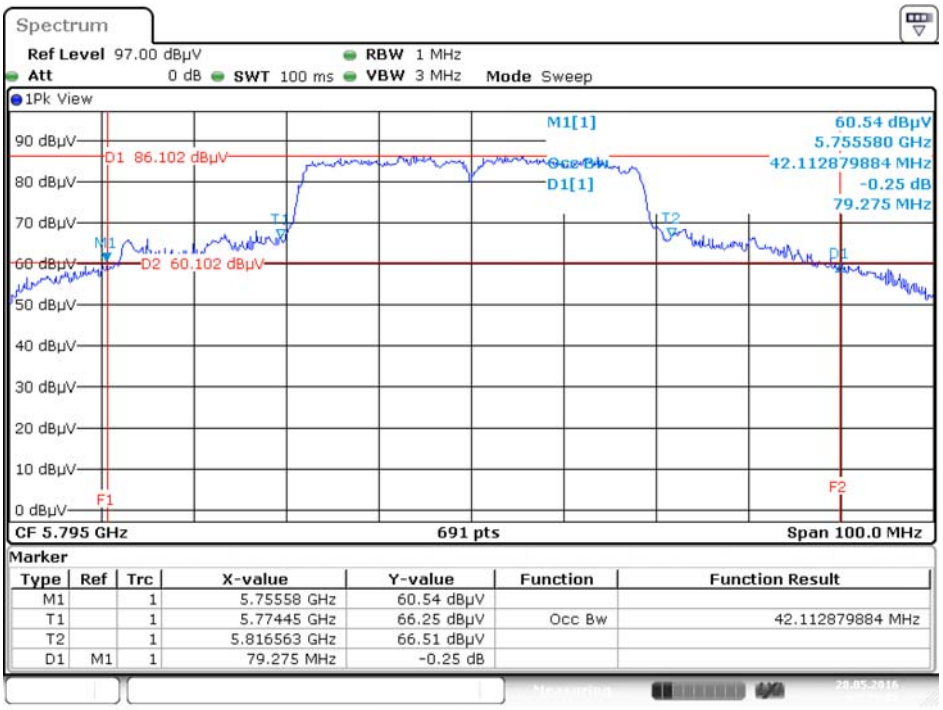
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 3 + Chain 4 + Chain 5 / 5795 MHz



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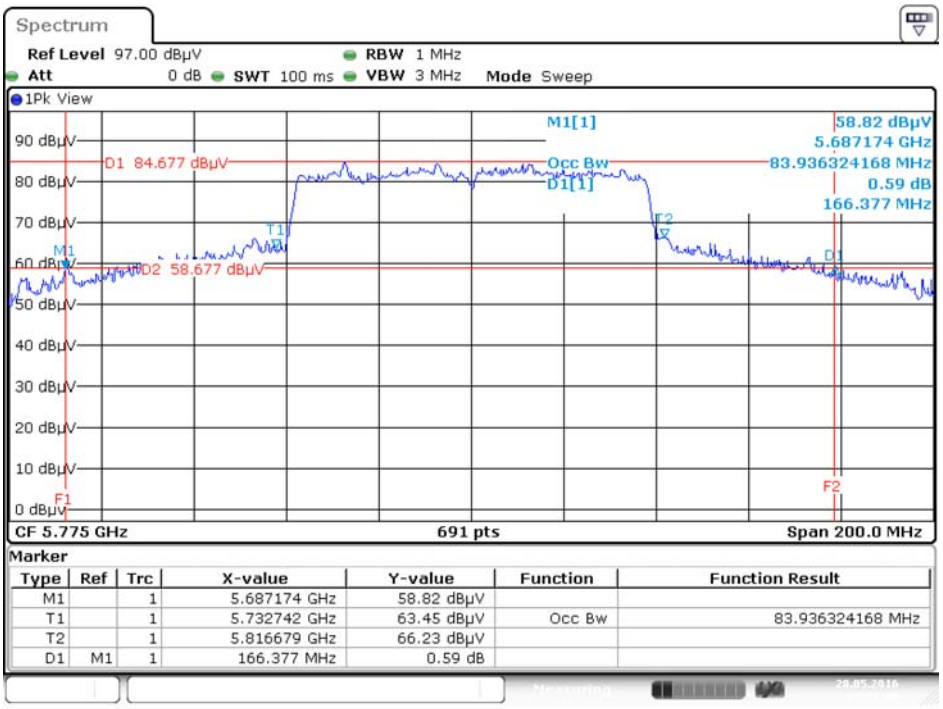
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 3 + Chain 4 + Chain 5 / 5775 MHz



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4.2. 6dB Spectrum Bandwidth Measurement

4.2.1. Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz.

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.

6dB Spectrum Bandwidth	
Spectrum Parameters	**Setting**
Attenuation	Auto
Span Frequency	> 6dB Bandwidth
RBW	100kHz
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.2.3. Test Procedures

For Radiated 6dB Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Test was performed in accordance with KDB789033 D02 v01r02 for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - section (C) Emission Bandwidth.
3. Multiple antenna system was performed in accordance with KDB662911 D01 v02r01 Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
4. Measured the spectrum width with power higher than 6dB below carrier.

4.2.4. Test Setup Layout

For Radiated 6dB Bandwidth Measurement:

This test setup layout is the same as that shown in section 4.5.4.

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. Test Result of 6dB Spectrum Bandwidth

Temperature	24°C	Humidity	45%
Test Engineer	Serway Li		

For non-beamforming mode

Mode	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
802.11a	5745 MHz	16.35	500	Complies
	5785 MHz	16.35	500	Complies
	5825 MHz	16.29	500	Complies

For beamforming mode

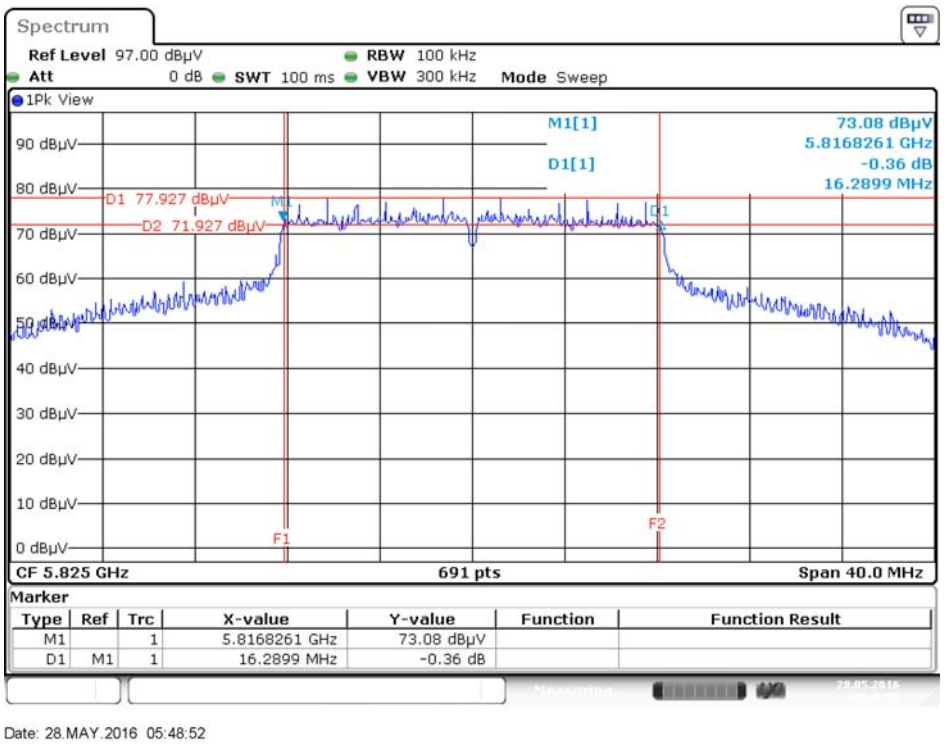
Mode	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
802.11ac MCS0/Nss1 VHT20	5745 MHz	15.65	500	Complies
	5785 MHz	16.29	500	Complies
	5825 MHz	16.29	500	Complies
802.11ac MCS0/Nss1 VHT40	5755 MHz	36.41	500	Complies
	5795 MHz	35.71	500	Complies
802.11ac MCS0/Nss1 VHT80	5775 MHz	75.36	500	Complies

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

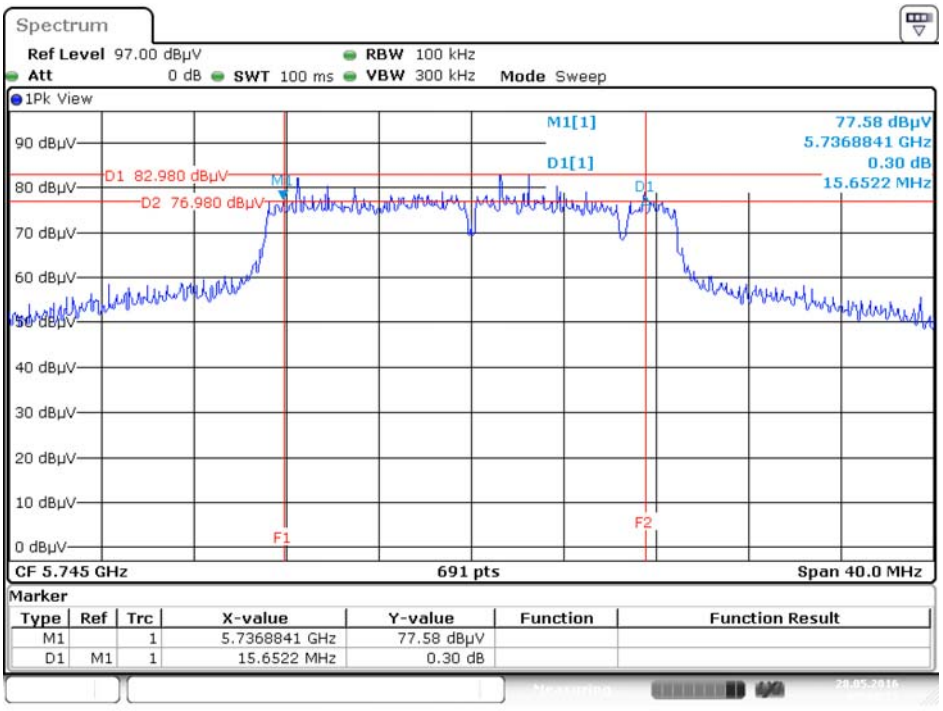
For non-beamforming mode

6 dB Bandwidth Plot on Configuration IEEE 802.11a / Chain 3 / 5825 MHz



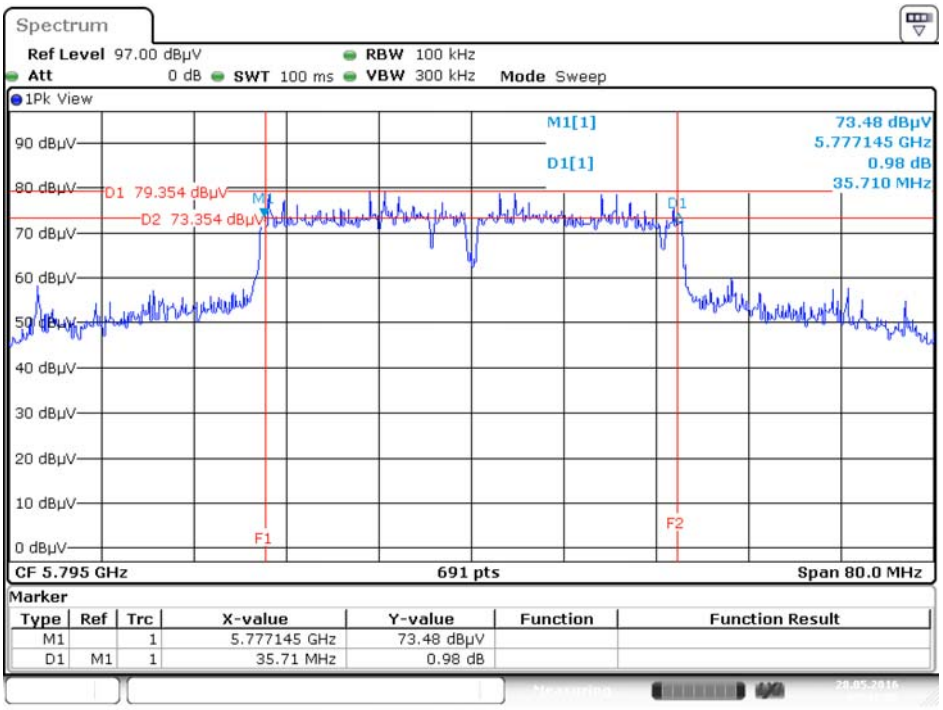
For beamforming mode

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 3 + Chain 4 + Chain 5 / 5745 MHz



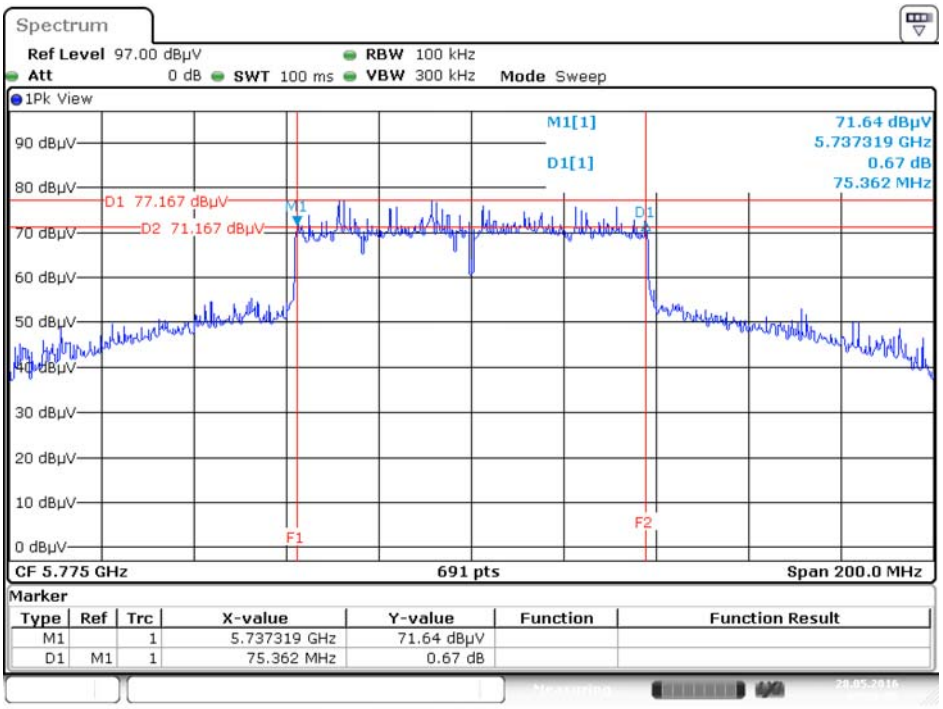
Date: 28.MAY.2016 05:43:22

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 3 + Chain 4 + Chain 5 / 5795 MHz



Date: 28.MAY.2016 05:41:26

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 3 + Chain 4 + Chain 5 / 5775 MHz



4.3. Maximum Conducted Output Power Measurement

4.3.1. Limit

Frequency Band		Limit
☒	5.725~5.85 GHz	The maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm). 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.

4.3.2. Measuring Instruments and Setting

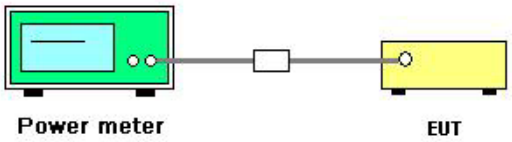
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Detector	AVERAGE

4.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the power meter.
2. Test was performed in accordance with KDB789033 D02 v01r02 for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - section (E) Maximum conducted output power =>3. Measurement using a Power Meter (PM) =>b) Method PM-G (Measurement using a gated RF average power meter).
3. Multiple antenna systems was performed in accordance with KDB662911 D01 v02r01 Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
4. When measuring maximum conducted output power with multiple antenna systems, add every result of the values by mathematic formula.

4.3.4. Test Setup Layout



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 Maximum Conducted Output Power

Temperature	24°C	Humidity	45%
Test Engineer	Serway Li	Test Date	May 28, 2016

For non-beamforming mode

Mode	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
		Chain 3		
802.11a	5745 MHz	22.77	30.00	Complies
	5785 MHz	22.11	30.00	Complies
	5825 MHz	22.02	30.00	Complies

For beamforming mode

Mode	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Chain 3	Chain 4	Chain 5	Total		
802.11ac MCS0/Nss1 VHT20	5745 MHz	22.52	22.88	22.56	27.43	30.00	Complies
	5785 MHz	22.17	21.77	21.14	26.49	30.00	Complies
	5825 MHz	21.48	20.43	21.63	25.98	30.00	Complies
802.11ac MCS0/Nss1 VHT40	5755 MHz	21.61	22.08	21.74	26.59	30.00	Complies
	5795 MHz	21.32	21.47	21.36	26.16	30.00	Complies
802.11ac MCS0/Nss1 VHT80	5775 MHz	21.53	21.86	21.46	26.39	30.00	Complies

4.4. Power Spectral Density Measurement

4.4.1. Limit

The following table is power spectral density limits and decrease power density limit rule refer to section 4.3.1.

Frequency Band		Limit
☒	5.725~5.85 GHz	30 dBm/500kHz

4.4.2. Measuring Instruments and Setting

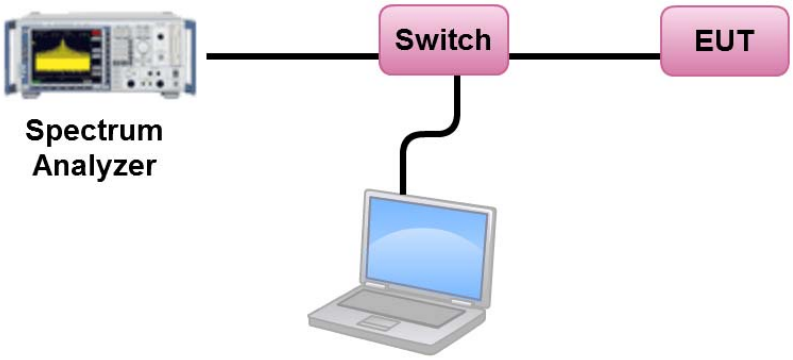
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Encompass the entire emissions bandwidth (EBW) of the signal
RBW	1000 kHz
VBW	3000 kHz
Detector	RMS
Trace	AVERAGE
Sweep Time	Auto
Trace Average	100 times
Note: If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.	

4.4.3. Test Procedures

1. The transmitter output (antenna port) was connected RF switch to the spectrum analyzer.
2. Test was performed in accordance with KDB789033 D02 v01r02 for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - section (F) Maximum Power Spectral Density (PSD).
3. Multiple antenna systems was performed in accordance KDB662911 D01 v02r01 in-Band Power Spectral Density (PSD) Measurements and sum the spectra across the outputs.
4. For 5.725~5.85 GHz, the measured result of PSD level must add 10log(500kHz/RBW) and the final result should ≤ 30 dBm.

4.4.4. Test Setup Layout



4.4.5. Test Deviation

There is no deviation with the original standard.

4.4.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.4.7. Test Result of Power Spectral Density

Temperature	24°C	Humidity	45%
Test Engineer	Serway Li		

For non-beamforming mode

Configuration IEEE 802.11a / Chain 3

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
149	5745 MHz	9.58	-3.01	6.57	30.00	Complies
157	5785 MHz	8.89	-3.01	5.88	30.00	Complies
165	5825 MHz	8.78	-3.01	5.77	30.00	Complies

For beamforming mode

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 3 + Chain 4 + Chain 5

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
149	5745 MHz	14.30	-3.01	11.29	30.00	Complies
157	5785 MHz	13.21	-3.01	10.20	30.00	Complies
165	5825 MHz	12.86	-3.01	9.85	30.00	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =4.77dBi < 6dBi, so the limit doesn't reduce.

Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 3 + Chain 4 + Chain 5

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
151	5755 MHz	10.48	-3.01	7.47	30.00	Complies
159	5795 MHz	9.96	-3.01	6.95	30.00	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =4.77dBi < 6dBi, so the limit doesn't reduce.

Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 3 + Chain 4 + Chain 5

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
155	5775 MHz	7.27	-3.01	4.26	30.00	Complies

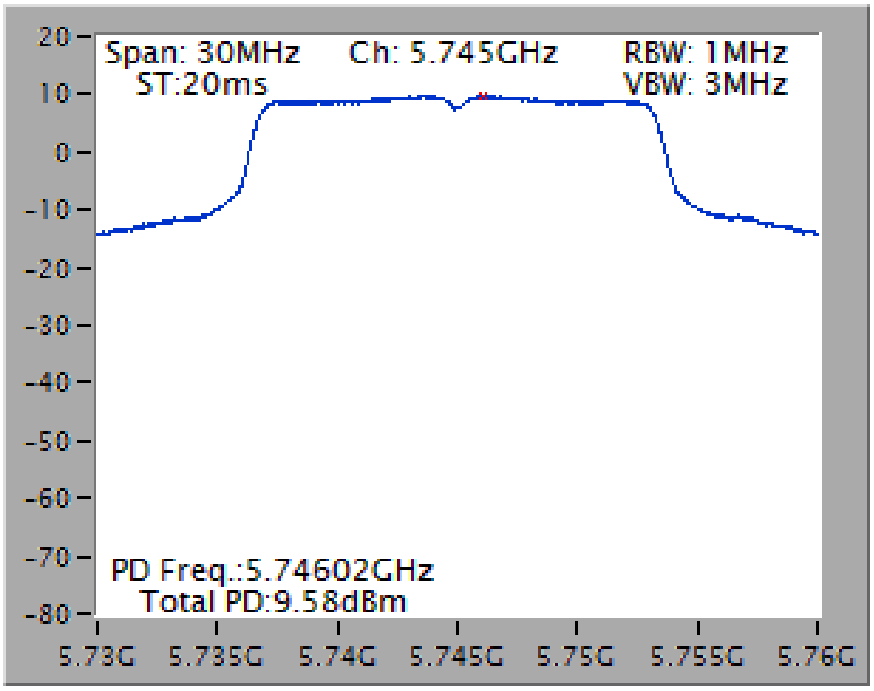
Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =4.77dBi < 6dBi, so the limit doesn't reduce.

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

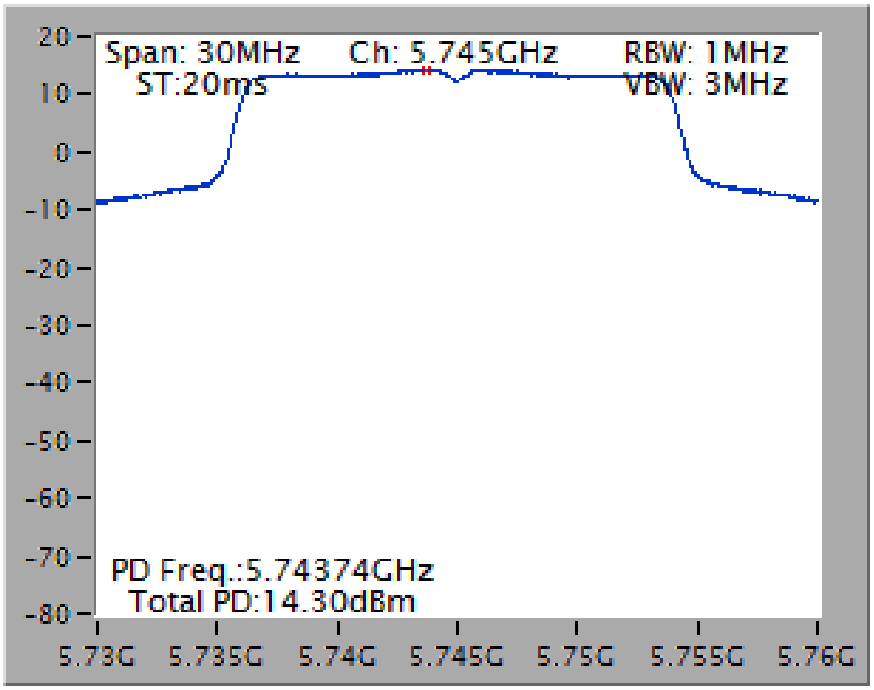
For non-beamforming mode

Power Density Plot on Configuration IEEE 802.11a / Chain 3 / 5745 MHz

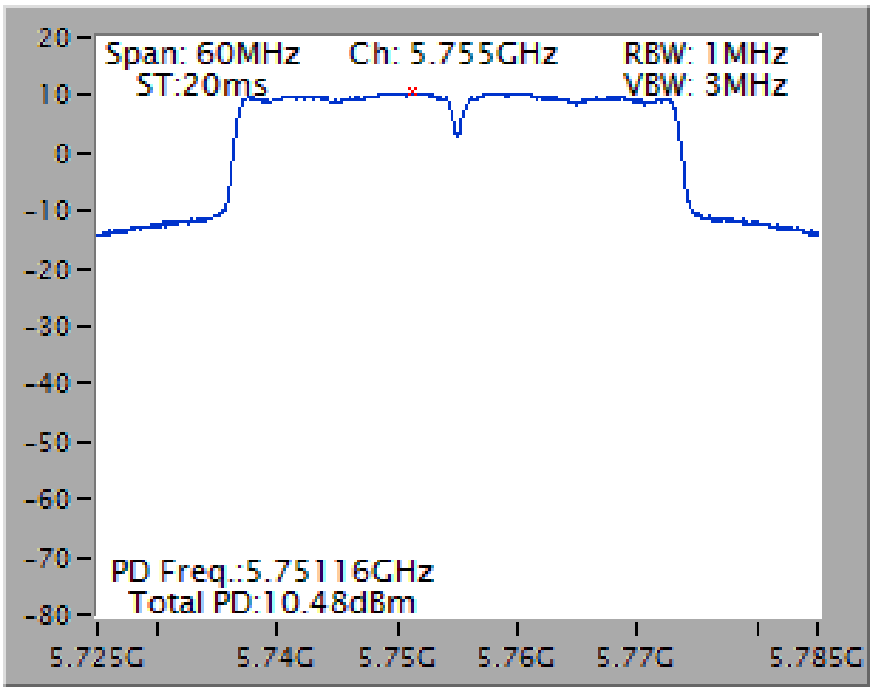


For beamforming mode

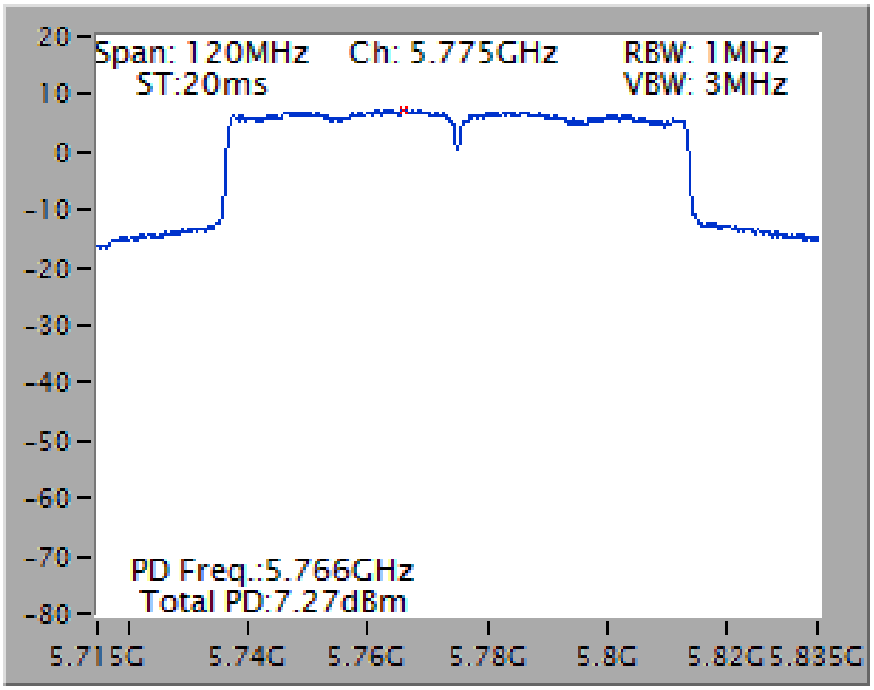
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 3 + Chain 4 + Chain 5 / 5745 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 3 + Chain 4 + Chain 5 / 5755 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 3 + Chain 4 + Chain 5 / 5775 MHz



4.5. Radiated Emissions Measurement

4.5.1. Limit

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

4.5.2. 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.

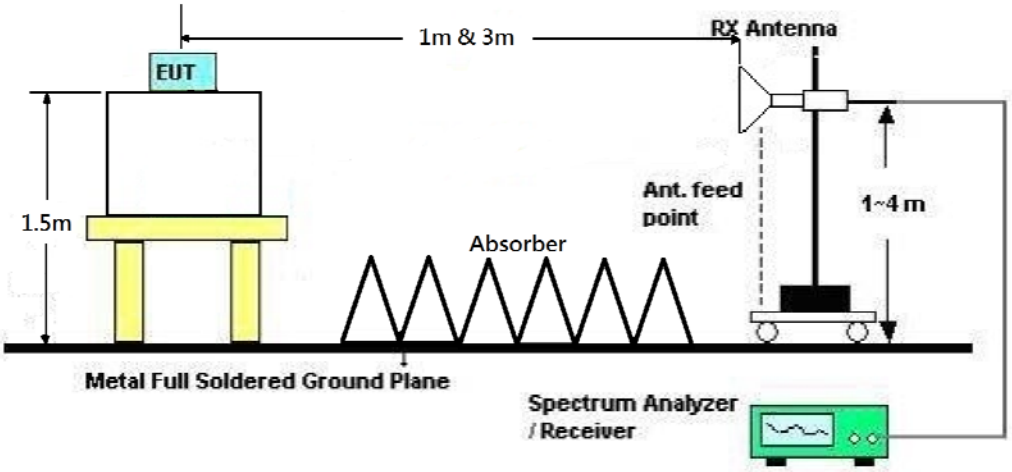
Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	40 GHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	1MHz / 3MHz for peak

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

4.5.3. 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.

4.5.4. Test Setup Layout



4.5.5. Test Deviation

There is no deviation with the original standard.

4.5.6. EUT Operation during Test

For Non-beamforming mode:

The EUT was programmed to be in continuously transmitting mode.

For beamforming mode:

The EUT was programmed to be in beamforming transmitting mode.

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

For non-beamforming mode

Temperature	23°C	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11a CH 149 / Chain 3
Test Date	May 16, 2016		

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	11488.33	44.99	54.00	-9.01	28.62	11.60	40.00	35.23	100	304	Average	HORIZONTAL
2	11489.87	57.97	74.00	-16.03	41.60	11.60	40.00	35.23	100	304	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	11488.04	44.90	54.00	-9.10	28.53	11.60	40.00	35.23	100	37	Average	VERTICAL
2	11489.92	57.80	74.00	-16.20	41.43	11.60	40.00	35.23	100	37	Peak	VERTICAL

Temperature	23℃	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11a CH 157 / Chain 3
Test Date	May 23, 2016		

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	11566.40	61.02	74.00	-12.98	44.74	11.64	39.87	35.23	155	79	Peak	HORIZONTAL
2	11576.12	48.27	54.00	-5.73	31.99	11.64	39.87	35.23	155	79	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	11570.40	61.67	74.00	-12.33	45.39	11.64	39.87	35.23	162	258	Peak	VERTICAL
2	11576.28	48.25	54.00	-5.75	31.97	11.64	39.87	35.23	162	258	Average	VERTICAL

Temperature	23℃	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11a CH 165 / Chain 3
Test Date	May 23, 2016		

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	11651.80	48.64	54.00	-5.36	32.48	11.71	39.67	35.22	206	298	Average	HORIZONTAL
2	11654.00	61.98	74.00	-12.02	45.82	11.71	39.67	35.22	206	298	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	11649.04	48.89	54.00	-5.11	32.69	11.69	39.73	35.22	137	242	Average	VERTICAL
2	11654.64	61.41	74.00	-12.59	45.25	11.71	39.67	35.22	137	242	Peak	VERTICAL

For beamforming mode

Temperature	23°C	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149 / Chain 3 + Chain 4 + Chain 5
Test Date	May 16, 2016		

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	11481.80	50.91	54.00	-3.09	34.56	11.57	40.01	35.23	162	232	Average	HORIZONTAL
2	11482.50	64.03	74.00	-9.97	47.68	11.57	40.01	35.23	162	232	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	11500.70	60.08	74.00	-13.92	43.71	11.60	40.00	35.23	104	302	Peak	VERTICAL
2	11501.70	46.76	54.00	-7.24	30.39	11.60	40.00	35.23	104	302	Average	VERTICAL

Temperature	23°C	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 157 / Chain 3 + Chain 4 + Chain 5
Test Date	May 24, 2016		

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	11570.00	52.60	54.00	-1.40	36.32	11.64	39.87	35.23	173	207	Average	HORIZONTAL
2	11572.44	68.79	74.00	-5.21	52.51	11.64	39.87	35.23	173	207	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	11565.56	50.76	54.00	-3.24	34.48	11.64	39.87	35.23	166	1	Average	VERTICAL
2	11568.64	64.39	74.00	-9.61	48.11	11.64	39.87	35.23	166	1	Peak	VERTICAL

Temperature	23°C	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 165 / Chain 3 + Chain 4 + Chain 5
Test Date	May 24, 2016		

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	11648.56	53.83	54.00	-0.17	37.63	11.69	39.73	35.22	168	207	Average	HORIZONTAL
2	11651.16	68.55	74.00	-5.45	52.39	11.71	39.67	35.22	168	207	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	11646.20	51.34	54.00	-2.66	35.14	11.69	39.73	35.22	207	1	Average	VERTICAL
2	11648.24	65.33	74.00	-8.67	49.13	11.69	39.73	35.22	207	1	Peak	VERTICAL

Temperature	23°C	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151 / Chain 3 + Chain 4 + Chain 5
Test Date	May 16, 2016		

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	11490.90	46.89	54.00	-7.11	30.52	11.60	40.00	35.23	100	230	Average	HORIZONTAL
2	11510.10	60.23	74.00	-13.77	43.86	11.60	40.00	35.23	100	230	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	11497.90	46.06	54.00	-7.94	29.69	11.60	40.00	35.23	100	340	Average	VERTICAL
2	11524.90	57.88	74.00	-16.12	41.56	11.62	39.93	35.23	100	340	Peak	VERTICAL

Temperature	23°C	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 159 / Chain 3 + Chain 4 + Chain 5
Test Date	May 24, 2016		

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	11589.92	49.42	54.00	-4.58	33.17	11.67	39.80	35.22	132	352	Average	HORIZONTAL
2	11599.84	61.58	74.00	-12.42	45.33	11.67	39.80	35.22	132	352	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	11584.16	61.21	74.00	-12.79	44.97	11.67	39.80	35.23	181	127	Peak	VERTICAL
2	11590.16	49.23	54.00	-4.77	32.98	11.67	39.80	35.22	181	127	Average	VERTICAL

Temperature	23°C	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 155 / Chain 3 + Chain 4 + Chain 5
Test Date	May 16, 2016		

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	11558.70	58.97	74.00	-15.03	42.69	11.64	39.87	35.23	100	171	Peak	HORIZONTAL
2	11572.00	46.11	54.00	-7.89	29.83	11.64	39.87	35.23	100	171	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	11566.90	46.03	54.00	-7.97	29.75	11.64	39.87	35.23	100	122	Average	VERTICAL
2	11569.70	58.57	74.00	-15.43	42.29	11.64	39.87	35.23	100	122	Peak	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.

4.6. Band Edge Emissions Measurement

4.6.1. Limit

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

4.6.2. 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

4.6.3. Test Procedures

1. The test procedure is the same as section 4.5.3.

4.6.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.5.4.

4.6.5. Test Deviation

There is no deviation with the original standard.

4.6.6. EUT Operation during Test

For Non-beamforming mode:

The EUT was programmed to be in continuously transmitting mode.

For beamforming mode:

The EUT was programmed to be in beamforming transmitting mode.

4.6.7. Test Result of Band Edge and Fundamental Emissions

For non-beamforming mode

Temperature	23°C	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11a CH 149, 157, 165 / Chain 3
Test Date	May 16, 2016 ~ May 23, 2016		

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	5620.00	59.43	68.20	-8.77	52.85	7.61	31.94	32.97	209	330	Peak	HORIZONTAL
2	5743.00	109.15			102.33	7.73	32.10	33.01	209	330	Peak	HORIZONTAL
3	5744.00	99.45			92.63	7.73	32.10	33.01	209	330	Average	HORIZONTAL
4	5977.00	59.66	68.20	-8.54	52.55	7.83	32.38	33.10	209	330	Peak	HORIZONTAL

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

Channel 157

	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	5616.00	62.67	68.20	-5.53	56.09	7.61	31.94	32.97	248	178	Peak	HORIZONTAL
2	5784.00	114.22			107.35	7.76	32.14	33.03	248	178	Peak	HORIZONTAL
3	5787.00	103.77			96.90	7.76	32.14	33.03	248	178	Average	HORIZONTAL
4	5933.00	62.23	68.20	-5.97	55.17	7.82	32.32	33.08	248	178	Peak	HORIZONTAL

Item 2, 3 are the fundamental frequency at 5785 MHz.

Channel 165

	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	5621.00	61.25	68.20	-6.95	54.67	7.61	31.94	32.97	255	130	Peak	HORIZONTAL
2	5826.00	110.10			103.17	7.78	32.20	33.05	255	130	Peak	HORIZONTAL
3	5827.00	99.73			92.80	7.78	32.20	33.05	255	130	Average	HORIZONTAL
4	6003.00	62.98	68.20	-5.22	55.85	7.84	32.40	33.11	255	130	Peak	HORIZONTAL

Item 2, 3 are the fundamental frequency at 5825 MHz.

For beamforming mode

Temperature	23℃	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149, 157, 165 / Chain 3 + Chain 4 + Chain 5
Test Date	May 16, 2016 ~ May 24, 2016		

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	5657.00	68.03	73.40	-5.37	61.35	7.66	32.00	32.98	239	127	Peak	VERTICAL
2	5737.00	108.50			101.72	7.71	32.08	33.01	239	127	Average	VERTICAL
3	5737.00	116.90			110.12	7.71	32.08	33.01	239	127	Peak	VERTICAL
4	5978.00	60.10	68.20	-8.10	52.99	7.83	32.38	33.10	239	127	Peak	VERTICAL

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

Channel 157

	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	5636.00	62.46	68.20	-5.74	55.85	7.63	31.96	32.98	268	68	Peak	VERTICAL
2	5792.00	115.58			108.68	7.77	32.16	33.03	268	68	Peak	VERTICAL
3	5793.00	106.20			99.30	7.77	32.16	33.03	268	68	Average	VERTICAL
4	5943.00	62.44	68.20	-5.76	55.37	7.82	32.34	33.09	268	68	Peak	VERTICAL

Item 2, 3 are the fundamental frequency at 5785 MHz.

Channel 165

	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	5580.00	63.50	68.20	-4.70	56.98	7.58	31.90	32.96	251	184	Peak	VERTICAL
2	5820.00	120.97			114.05	7.78	32.18	33.04	251	184	Peak	VERTICAL
3	5824.00	110.59			103.66	7.78	32.20	33.05	251	184	Average	VERTICAL
4	5938.00	65.28	68.20	-2.92	58.23	7.82	32.32	33.09	251	184	Peak	VERTICAL

Item 2, 3 are the fundamental frequency at 5825 MHz.

Temperature	23℃	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151, 159 / Chain 3 + Chain 4 + Chain 5
Test Date	May 16, 2016 ~ May 23, 2016		

Channel 151

	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	5636.00	60.84	68.20	-7.36	54.23	7.63	31.96	32.98	213	172	Peak	VERTICAL
2	5761.00	113.95			107.11	7.74	32.12	33.02	213	172	Peak	VERTICAL
3	5768.00	103.81			96.98	7.74	32.12	33.03	213	172	Average	VERTICAL
4	5956.00	59.97	68.20	-8.23	52.90	7.82	32.34	33.09	213	172	Peak	VERTICAL

Item 2, 3 are the fundamental frequency at 5755 MHz.

Channel 159

	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	5614.00	62.87	68.20	-5.33	56.28	7.61	31.94	32.96	245	175	Peak	VERTICAL
2	5799.00	117.79			110.89	7.77	32.16	33.03	245	175	Peak	VERTICAL
3	5800.00	107.89			100.99	7.77	32.16	33.03	245	175	Average	VERTICAL
4	5926.00	63.77	68.20	-4.43	56.71	7.82	32.32	33.08	245	175	Peak	VERTICAL

Item 2, 3 are the fundamental frequency at 5795 MHz.

Temperature	23°C	Humidity	52%
Test Engineer	Lucke Hsieh / DK Chang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 155 / Chain 3 + Chain 4 + Chain 5
Test Date	May 16, 2016		

Channel 155

	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	5648.00	66.75	68.20	-1.45	60.11	7.64	31.98	32.98	220	177	Peak	VERTICAL
2	5760.00	111.67			104.83	7.74	32.12	33.02	220	177	Peak	VERTICAL
3	5785.00	101.51			94.64	7.76	32.14	33.03	220	177	Average	VERTICAL
4	5925.00	62.51	68.20	-5.69	55.45	7.82	32.32	33.08	220	177	Peak	VERTICAL

Item 2, 3 are the fundamental frequency at 5775 MHz.

Note:

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

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

4.7. Frequency Stability Measurement

4.7.1. Limit

In-band emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band (IEEE 802.11n specification).

4.7.2. Measuring Instruments and Setting

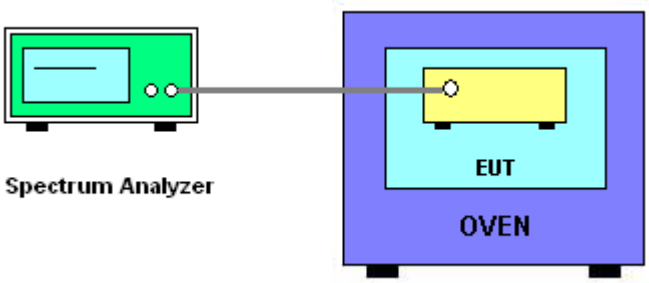
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Entire absence of modulation emissions bandwidth
RBW	10 kHz
VBW	10 kHz
Sweep Time	Auto

4.7.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 10^6 ppm and the limit is less than ±20ppm (IEEE 802.11nspecification).
6. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
7. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
8. Extreme temperature is 0°C~40°C.

4.7.4. Test Setup Layout



4.7.5. Test Deviation

There is no deviation with the original standard.

4.7.6. EUT Operation during Test

The EUT was programmed to be in continuously un-modulation transmitting mode.

4.7.7. Test Result of Frequency Stability

Temperature	24°C	Humidity	45%
Test Engineer	Serway Li	Test Date	May 28, 2016

Mode: 20 MHz / Chain 3

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5785 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5784.9900	5784.9897	5784.9892	5784.9886
110.00	5784.9891	5784.9882	5784.9873	5784.9867
93.50	5784.9890	5784.9881	5784.9878	5784.9872
Max. Deviation (MHz)	0.0110	0.0119	0.0127	0.0133
Max. Deviation (ppm)	1.91	2.06	2.20	2.30
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5785 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
0	5784.9918	5784.9914	5784.9907	5784.9906
10	5784.9910	5784.9903	5784.9899	5784.9892
20	5784.9891	5784.9881	5784.9875	5784.9869
30	5784.9874	5784.9867	5784.9858	5784.9855
40	5784.9855	5784.9847	5784.9842	5784.9840
Max. Deviation (MHz)	0.0145	0.0153	0.0158	0.0160
Max. Deviation (ppm)	2.50	2.64	2.73	2.76
Result	Complies			

Mode: 40 MHz / Chain 3

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5755 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5754.9899	5754.9889	5754.9888	5754.9880
110.00	5754.9892	5754.9882	5754.9872	5754.9865
93.50	5754.9886	5754.9883	5754.9875	5754.9873
Max. Deviation (MHz)	0.0114	0.0118	0.0129	0.0135
Max. Deviation (ppm)	1.99	2.06	2.23	2.35
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5755 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
0	5754.9915	5754.9906	5754.9905	5754.9904
10	5754.9903	5754.9901	5754.9895	5754.9888
20	5754.9892	5754.9891	5754.9887	5754.9885
30	5754.9874	5754.9867	5754.9858	5754.9851
40	5754.9866	5754.9864	5754.9858	5754.9855
Max. Deviation (MHz)	0.0134	0.0136	0.0142	0.0149
Max. Deviation (ppm)	2.33	2.36	2.47	2.59
Result	Complies			

Mode: 80 MHz / Chain 3

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5775 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5774.9902	5774.9894	5774.9892	5774.9887
110.00	5774.9892	5774.9882	5774.9872	5774.9869
93.50	5774.9882	5774.9880	5774.9879	5774.9876
Max. Deviation (MHz)	0.0118	0.0121	0.0129	0.0131
Max. Deviation (ppm)	2.05	2.09	2.23	2.28
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5775 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
0	5774.9911	5774.9902	5774.9896	5774.9891
10	5774.9902	5774.9893	5774.9885	5774.9880
20	5774.9892	5774.9884	5774.9876	5774.9871
30	5774.9874	5774.9871	5774.9868	5774.9858
40	5774.9855	5774.9846	5774.9845	5774.9844
Max. Deviation (MHz)	0.0145	0.0154	0.0155	0.0156
Max. Deviation (ppm)	2.51	2.66	2.68	2.70
Result	Complies			

4.8. Antenna Requirements

4.8.1. 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.

4.8.2. 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
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 22, 2015	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 18, 2016	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Nov. 13, 2015	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Oct. 27, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-17	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-1	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-2	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
Test Software	Audix	E3	6.2009-l0-7	N/A	N/A	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 09, 2015	Conducted (TH01-CB)
Temp. and Humidity Chamber	Ten Billion	TTH-D3SP	TBN-931011	-30~100 degree	Jun. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 02, 2015	Conducted (TH01-CB)

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

6. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	Remark
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%