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FCC RADIO TEST REPORT

Applicant's company	**Linksys LLC**
Applicant Address	121 Theory Drive, Irvine, CA 92617, USA
FCC ID	**Q87-EA9200**

Product Name	AC3200 Tri-Band Smart Wi-Fi Router
Brand Name	LINKSYS
Model No.	EA9200
Test Rule Part(s)	47 CFR FCC Part 15 Subpart E § 15.407
Test Freq. Range	5150 ~ 5250 MHz / 5725 ~ 5850 MHz
Received Date	Apr. 22, 2014
Final Test Date	May 19, 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.

TAF
Testing Laboratory
1190

Table of Contents

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR4N1172-26AC	Rev. 01	Initial issue of report	Jun. 21, 2016

1. VERIFICATION OF COMPLIANCE

Product Name	:	AC3200 Tri-Band Smart WI-FI Router
Brand Name	:	LINKSYS
Model No.	:	EA9200
Applicant	:	Linksys LLC
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 Apr. 22, 2014 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**	**Under Limit**
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	0.19 dB
4.4	15.407(a)	Power Spectral Density	Complies	16.44 dB
4.5	15.407(b)	Radiated Emissions	Complies	8.63 dB
4.6	15.407(b)	Band Edge Emissions	Complies	0.11 dB
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, 3RX) 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 ~ 5250 MHz / 5725 ~ 5850 MHz
Channel Number	9 for 20MHz bandwidth ; 4 for 40MHz bandwidth 2 for 80MHz bandwidth
Channel Band Width (99%)	**<For Non-Beamforming Mode>** IEEE 802.11a: 29.70 MHz **<For Beamforming Mode>** IEEE 802.11ac MCS0/Nss1 (VHT20): 30.13 MHz IEEE 802.11ac MCS0/Nss1 (VHT40): 37.77 MHz IEEE 802.11ac MCS0/Nss1 (VHT80): 76.12 MHz
Maximum Conducted Output Power	**<For Non-Beamforming Mode>** IEEE 802.11a: 23.82 dBm **<For Beamforming Mode>** IEEE 802.11ac MCS0/Nss1 (VHT20): 27.99 dBm IEEE 802.11ac MCS0/Nss1 (VHT40): 25.40 dBm IEEE 802.11ac MCS0/Nss1 (VHT80): 23.36 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

Items	Description	
Beamforming Function	☒ With beamforming for 802.11n/ac in 2.4GHz and 5GHz.	☐ Without beamforming

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	Remark
Adapter	APD	DA-48T12	Input: 100-240V ~ 50-60Hz, 1.4A Max Output: 12V, 4A	Cable (Non-shielded, 1.2m)
Other				
Power cable*1: Non-shielded, 1.8m				

3.3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)		
					2.4GHz	5GHz Band 1	5GHz Band 4
1	GALTRONICS	120300049200J	Dipole	Reversed-SMA	1.81	-	3.05
2	GALTRONICS	120300049200J	Dipole	Reversed-SMA	1.81	-	3.05
3	GALTRONICS	120300049200J	Dipole	Reversed-SMA	1.81	-	3.05
4	Dockon	DMA-300-5020	Printend	N/A	-	3.10	-
5	Dockon	DMA-300-5020	Printend	N/A	-	3.10	-
6	Dockon	DMA-300-5020	Printend	N/A	-	3.10	-

Note: The EUT has six antennas.

For 2.4 GHz WLAN function:

For IEEE 802.11b/g mode (1TX/3RX):

Only Chain 1 can be used as transmitting.

Chain 1, Chain 2 and Chain 3 could receive simultaneously.

For IEEE 802.11n/ac mode (3TX/3RX):

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

For 5GHz WLAN function:

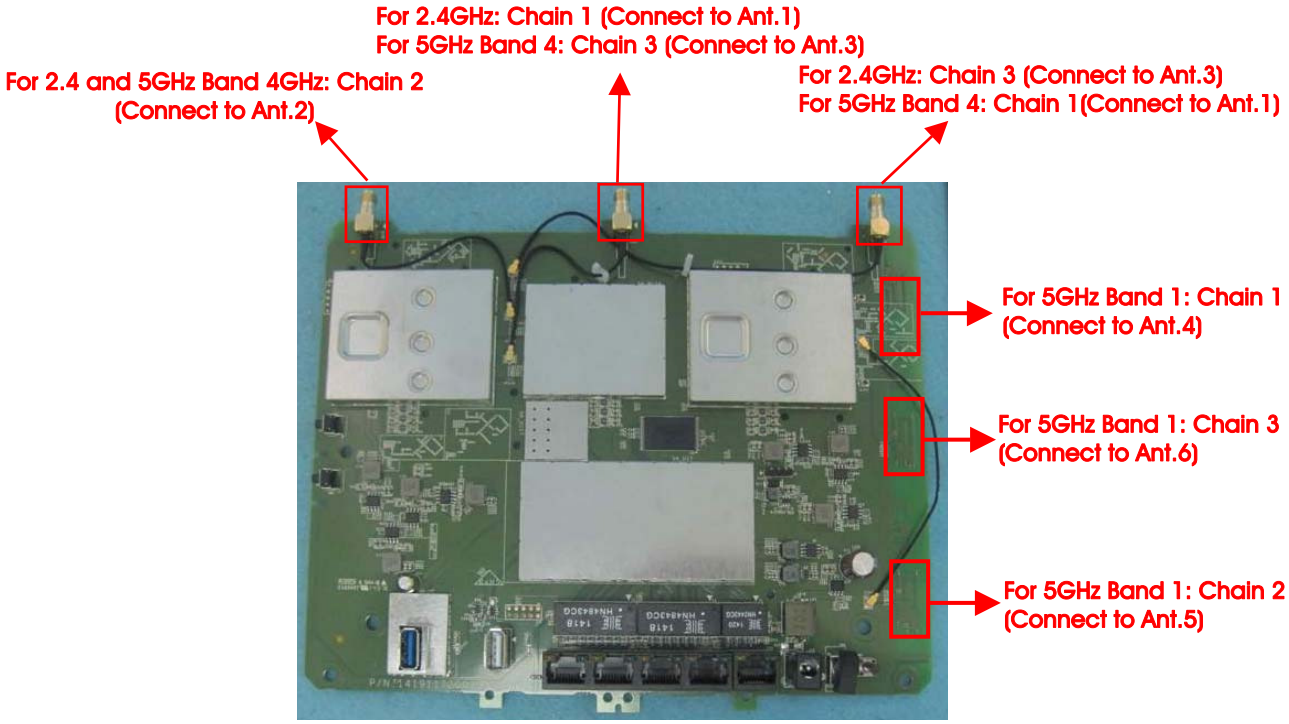
For IEEE 802.11a mode (1TX/3RX):

Only Chain 1 can be used as transmitting.

Chain 1, Chain 2 and Chain 3 could receive simultaneously.

For IEEE 802.11n/ac mode (3TX/3RX):

Chain 1, Chain 2 and Chain 3 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, 149, 153, 157, 161, 165.

For 40MHz bandwidth systems, use Channel 38, 46, 151, 159.

For 80MHz bandwidth systems, use Channel 42, 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	-	-
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 Carrier Frequencies

There are three bandwidth systems.

For 20MHz bandwidth systems, use Channel 149, 153, 157, 161, 165.

For 40MHz bandwidth systems, use Channel 151, 159.

For 80MHz bandwidth systems, use Channel 155.

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
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

3.6. 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. 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
AC Power Conducted Emission	Normal Link		-	-	-
Max. Conducted Output Power	<For Non-Beamforming Mode>				
	11a/BPSK	Band 4	6Mbps	149/157/165	1
	<For Beamforming Mode>				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
Power Spectral Density	<For Non-Beamforming Mode>				
	11a/BPSK	Band 4	6Mbps	149/157/165	1
	<For Beamforming Mode>				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
26dB Spectrum Bandwidth & 99% Occupied Bandwidth Measurement	<For Non-Beamforming Mode>				
	11a/BPSK	Band 4	6Mbps	149/157/165	1
	<For Beamforming Mode>				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
6dB Spectrum Bandwidth Measurement	<For Non-Beamforming Mode>				
	11a/BPSK	Band 4	6Mbps	149/157/165	1
	<For Beamforming Mode>				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
Radiated Emission Below 1GHz	Normal Link		-	-	-

Radiated Emission Above 1GHz	<For Non-Beamforming Mode>				
	11a/BPSK	Band 4	6Mbps	149/157/165	1
	<For Beamforming Mode>				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
Band Edge Emission	<For Non-Beamforming Mode>				
	11a/BPSK	Band 4	6Mbps	149/157/165	1
	<For Beamforming Mode>				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2+3
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2+3
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2+3
Frequency Stability	20 MHz	Band 4	-	157	1
	40 MHz	Band 4	-	151	1
	80 MHz	Band 4	-	155	1

Note: 1.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.

2.There are two modes of EUT, one is beamforming mode, and the other is non-beamforming mode for 802.11ac 20/40/80, after evaluating, beamforming mode has been evaluated to be the worst case, so it was selected to test and record in this test report.

3.The EUT can only be used at standing position.

The following test modes were performed for all tests:

For Co-location MPE Test:

The EUT could be applied with 2.4GHz WLAN function, 5GHz Band 1 WLAN function and 5GHz Band 4 WLAN function; therefore Co-location Maximum Permissible Exposure (Please refer to FA4N1172-26AB) test is added for simultaneously transmit between 2.4GHz WLAN function, 5GHz Band 1 WLAN function and 5GHz Band 4 WLAN function.

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	-
TH01-CB	OVEN Room	Hsin Chu	-	-	-

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

3.8. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR4N11726-AB
Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1. Updating 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)".	2. 26dB Bandwidth and 99% Occupied Bandwidth 3. 6dB Spectrum Bandwidth 4. Maximum Conducted Output Power 5. Power Spectral Density 6. Radiated Emissions above 1GHz 7. Band Edge Emissions 8. Frequency Stability

3.9. Table for Supporting Units

For Test Site No: 03CH01-CB <Above 1GHz>

<For Non-Beamforming Mode>

Support Unit	Brand	Model	FCC ID
NB	DELL	E4300	DoC

<For Beamforming Mode>

Support Unit	Brand	Model	FCC ID
NB*2	DELL	E4300	DoC
WLAN ac Dongle	Broadcom	Bcm4366	DoC

For Test Site No: TH01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	E4300	DoC

3.10. 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.

Test Software Version	Mtool2.0.1.6					
Mode	Test Frequency (MHz)					
	5745 MHz	5785 MHz	5825 MHz	5755 MHz	5795 MHz	5775 MHz
802.11a	96	96	96	-	-	-
802.11ac MCS0/Nss1 VHT20	93	62	60	-	-	-
802.11ac MCS0/Nss1 VHT40	-	-	-	81	73	-
802.11ac MCS0/Nss1 VHT80	-	-	-	-	-	73

3.11. 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 DOS.
3. Executed "Lantest.exe " to link with the remote workstation to receive and transmit packet by WLAN ac Dongle and transmit duty cycle no less 98%

3.12. 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	2.060	2.090	98.56%	0.06	0.01

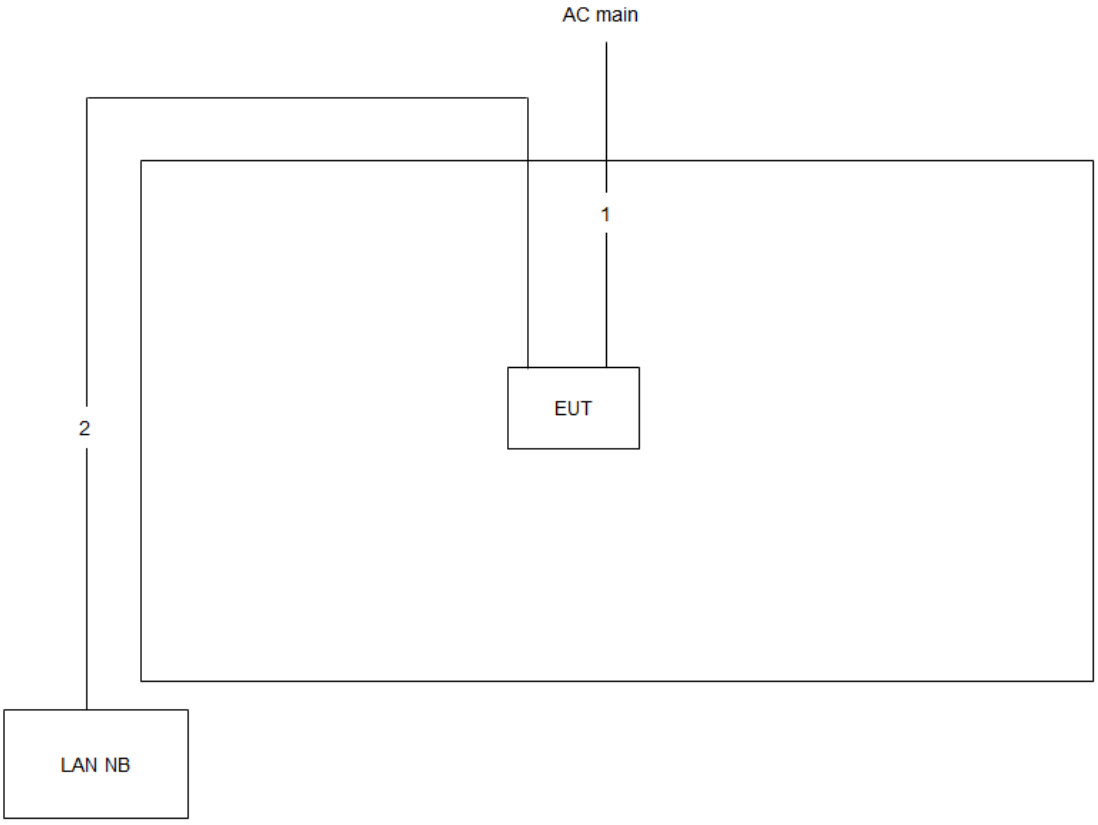
<For Beamforming Mode>

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
802.11ac MCS0/Nss1 VHT20	3.840	3.940	97.46%	0.11	0.26
802.11ac MCS0/Nss1 VHT40	4.580	4.700	97.45%	0.11	0.22
802.11ac MCS0/Nss1 VHT80	5.060	5.400	93.70%	0.28	0.20

3.13. Test Configurations

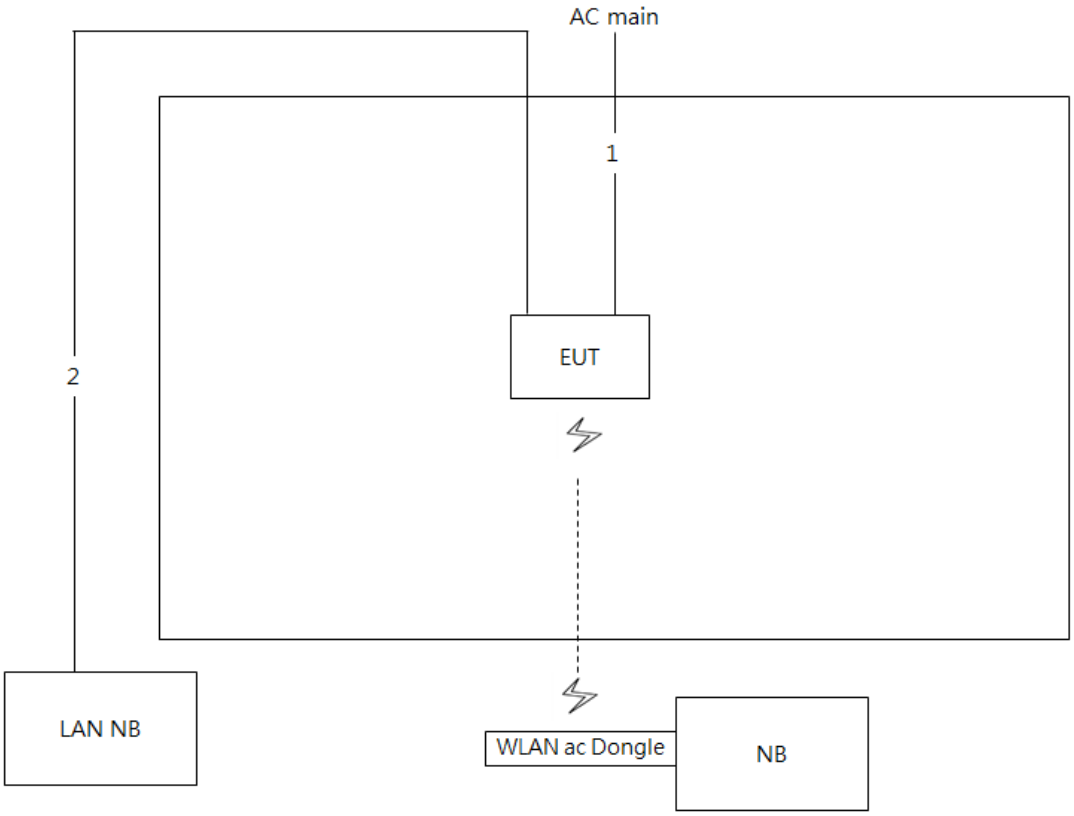
3.13.1. Radiation Emissions Test Configuration

<For Non-Beamforming Mode>



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

<For Beamforming Mode>



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

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	56%
Test Engineer	Serway Li		

<For Non-Beamforming Mode>

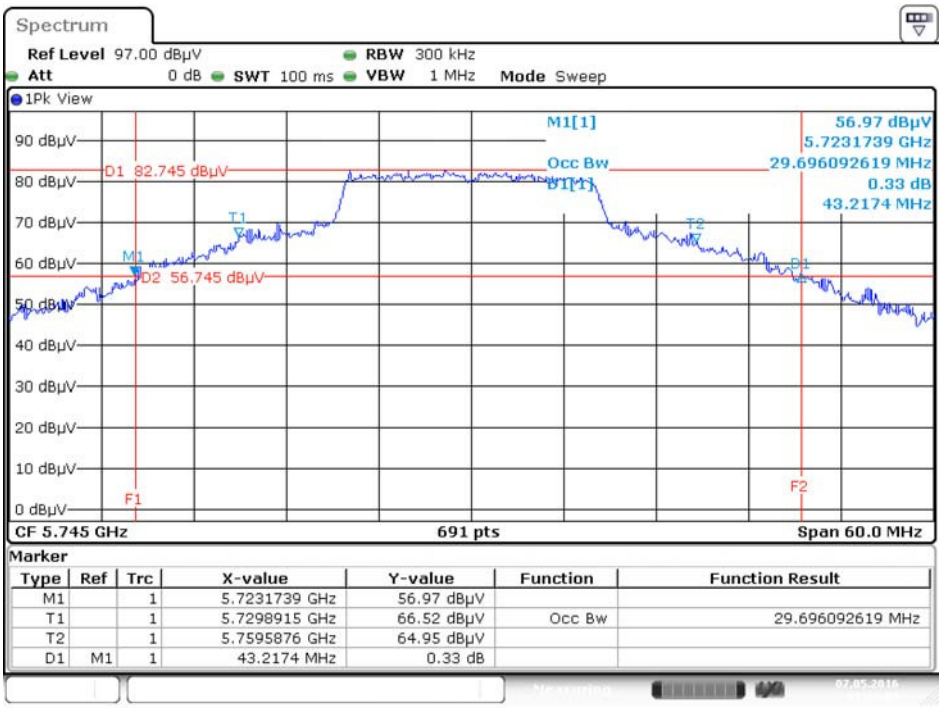
Mode	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a	5745 MHz	43.22	29.70
	5785 MHz	41.65	28.13
	5825 MHz	39.22	24.14

<For Beamforming Mode>

Mode	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11ac MCS0/Nss1 VHT20	5745 MHz	43.91	30.13
	5785 MHz	21.22	17.97
	5825 MHz	21.22	17.97
802.11ac MCS0/Nss1 VHT40	5755 MHz	64.06	37.77
	5795 MHz	57.97	37.19
802.11ac MCS0/Nss1 VHT80	5775 MHz	82.32	76.12

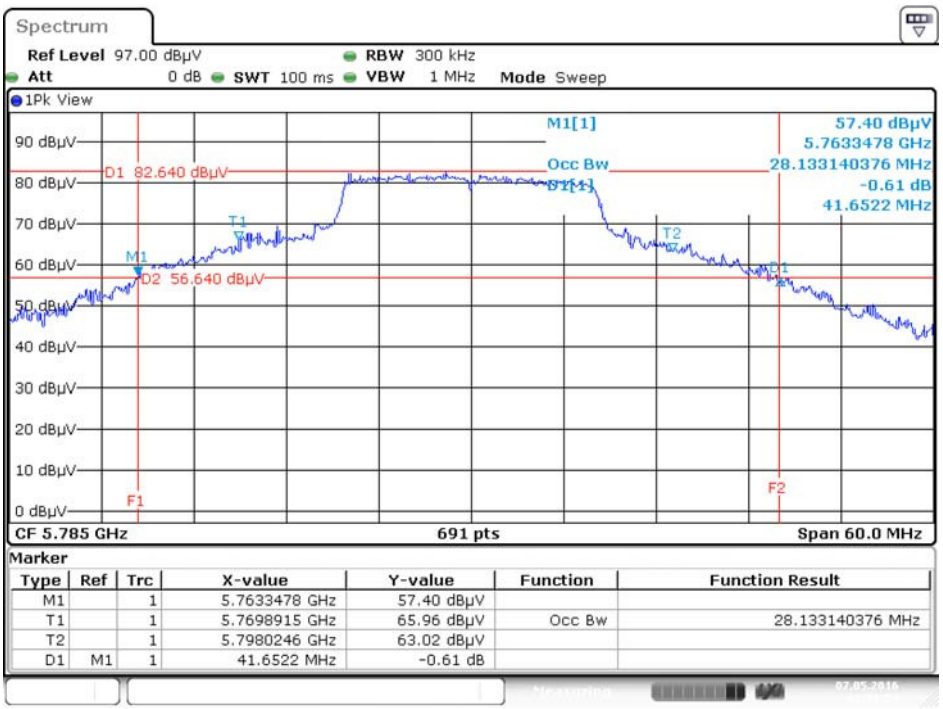
<For Non-Beamforming Mode>

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 / 5745 MHz



Date: 7.MAY.2016 03:44:04

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 / 5785 MHz



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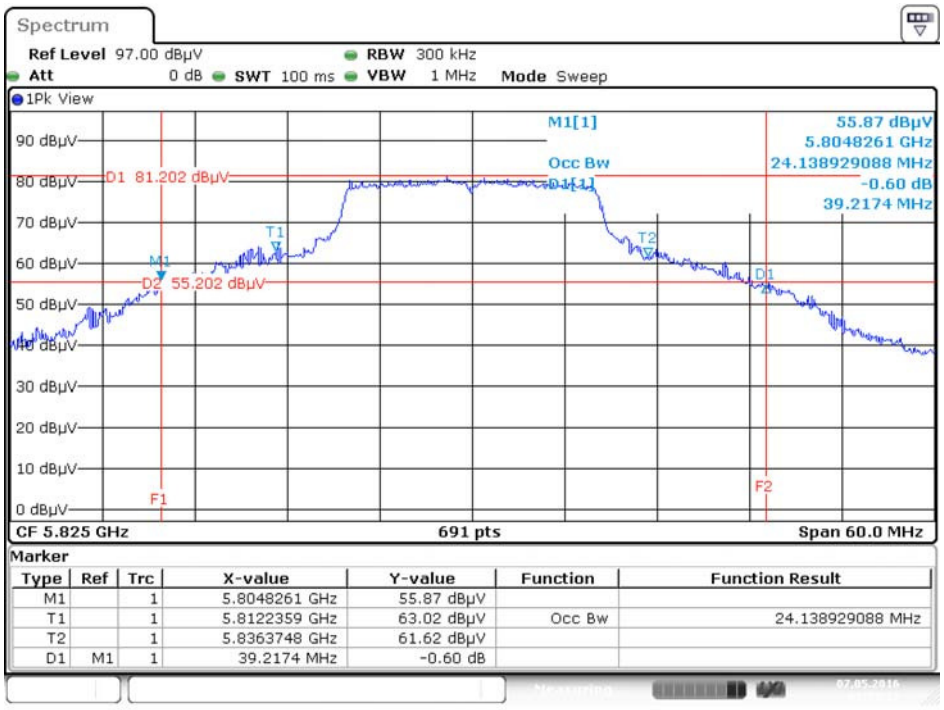
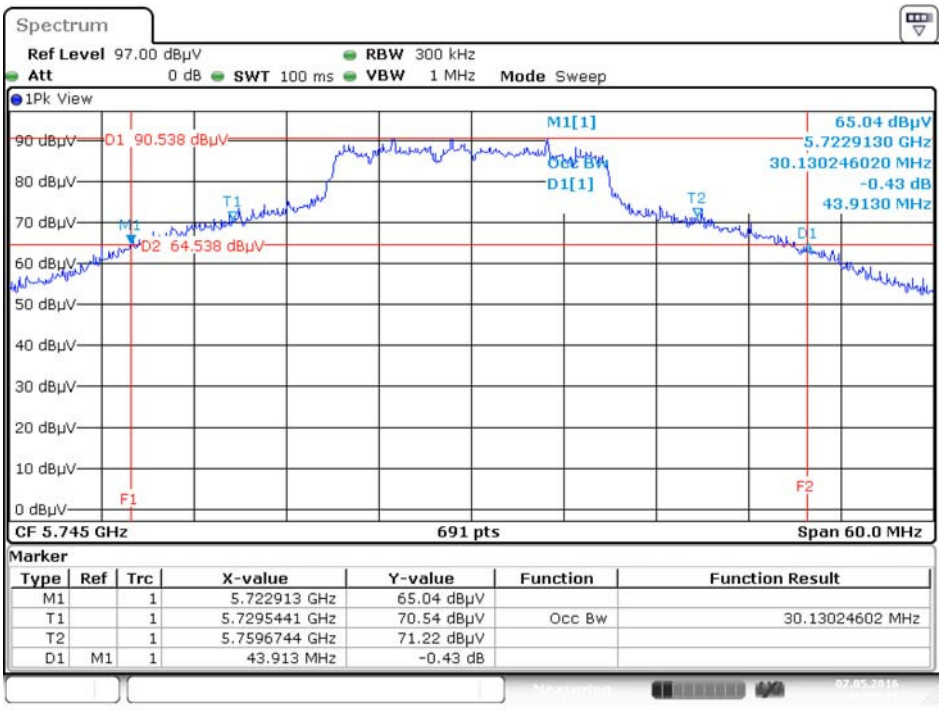
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 / 5825 MHz



Date: 7.MAY.2016 03:53:22

<For Beamforming Mode>

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



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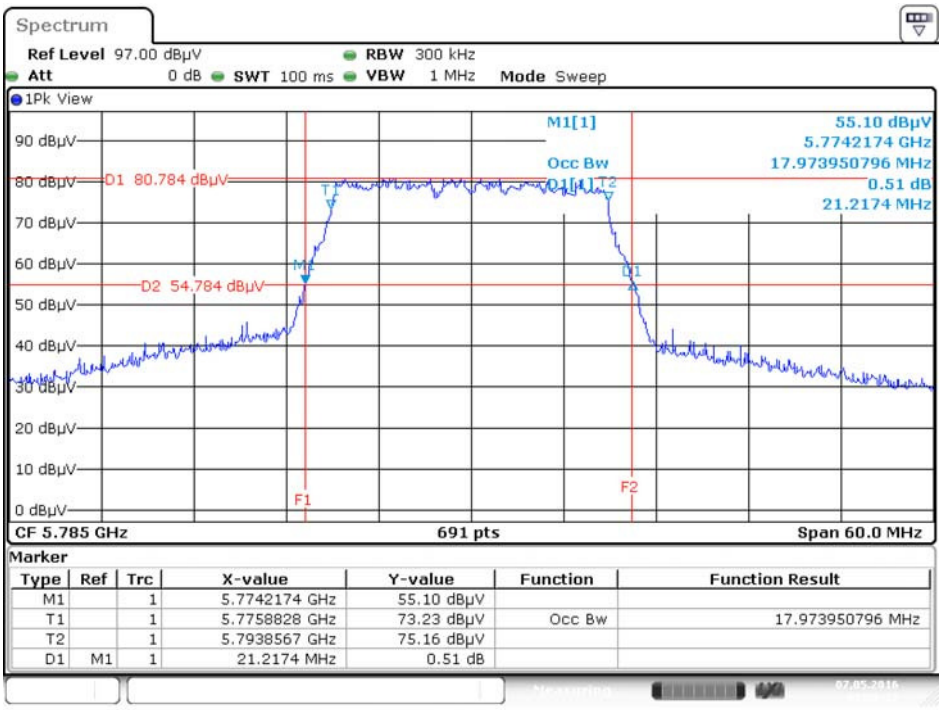
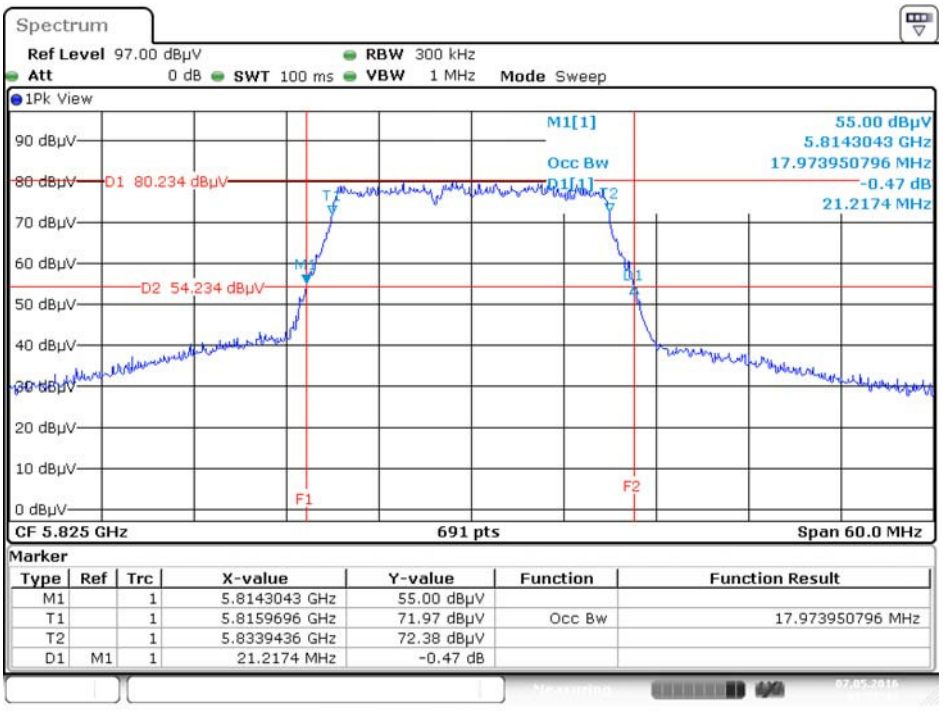


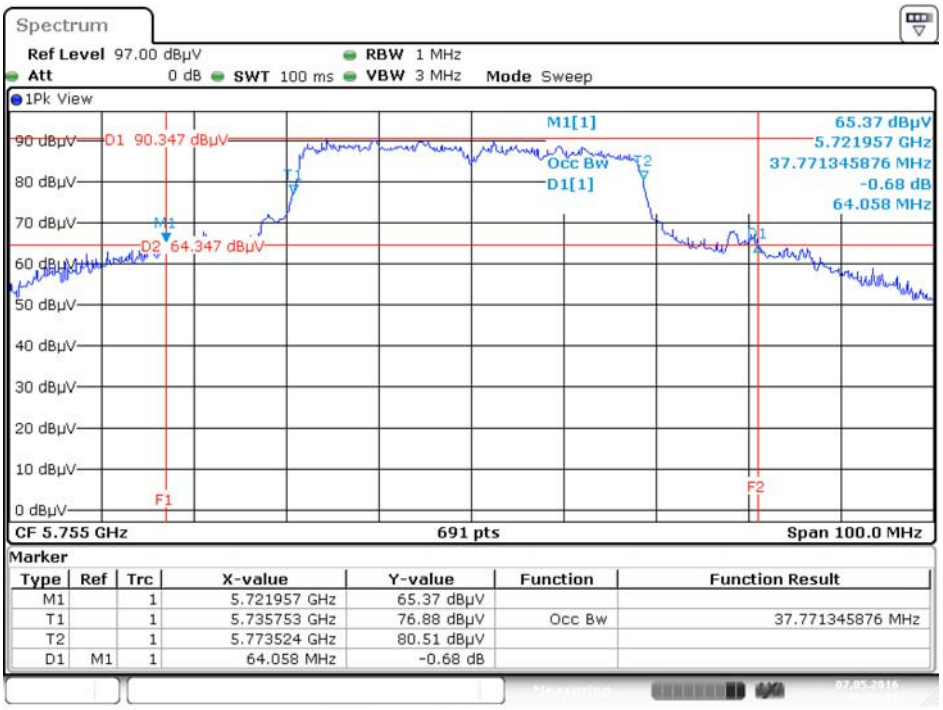
Date: 7.MAY.2016 03:56:31

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5825 MHz



Date: 7.MAY.2016 03:57:41

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5755 MHz



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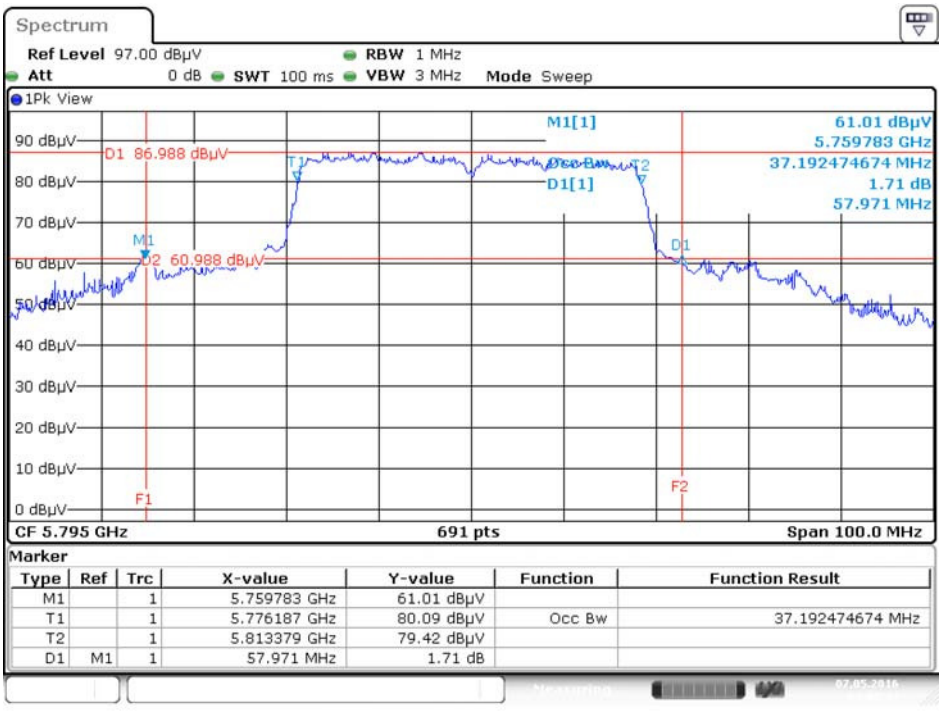
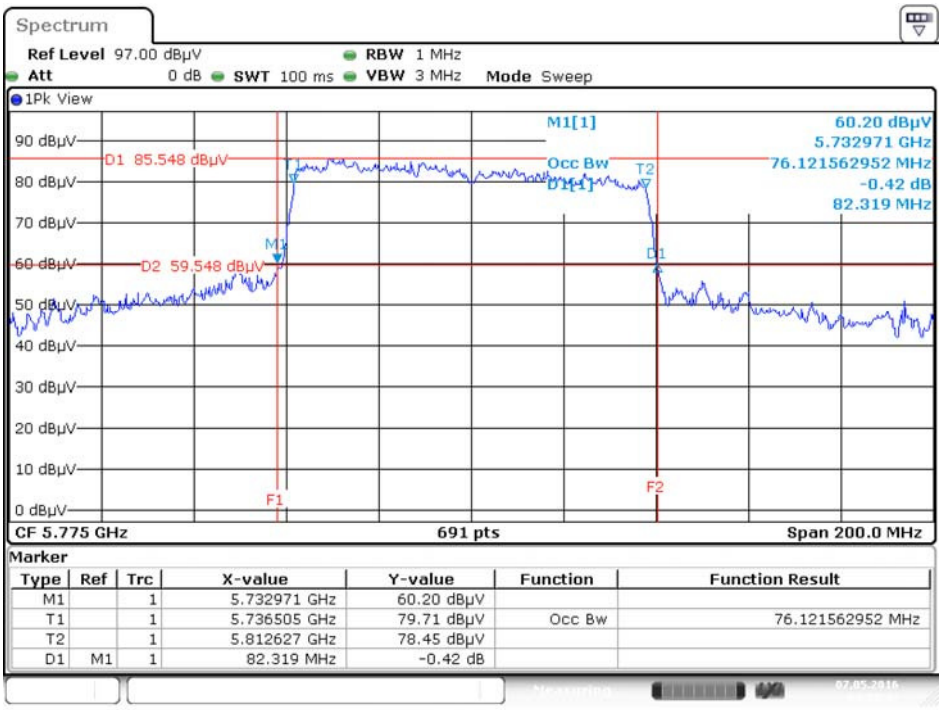
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5795 MHz



Date: 7.MAY.2016 04:00:45

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5775 MHz



Date: 7.MAY.2016 04:03:41

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	56%
Test Engineer	Serway Lai		

<For Non-Beamforming Mode>

Mode	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
802.11a	5745 MHz	16.35	500	Complies
	5785 MHz	16.12	500	Complies
	5825 MHz	16.35	500	Complies

<For Beamforming Mode>

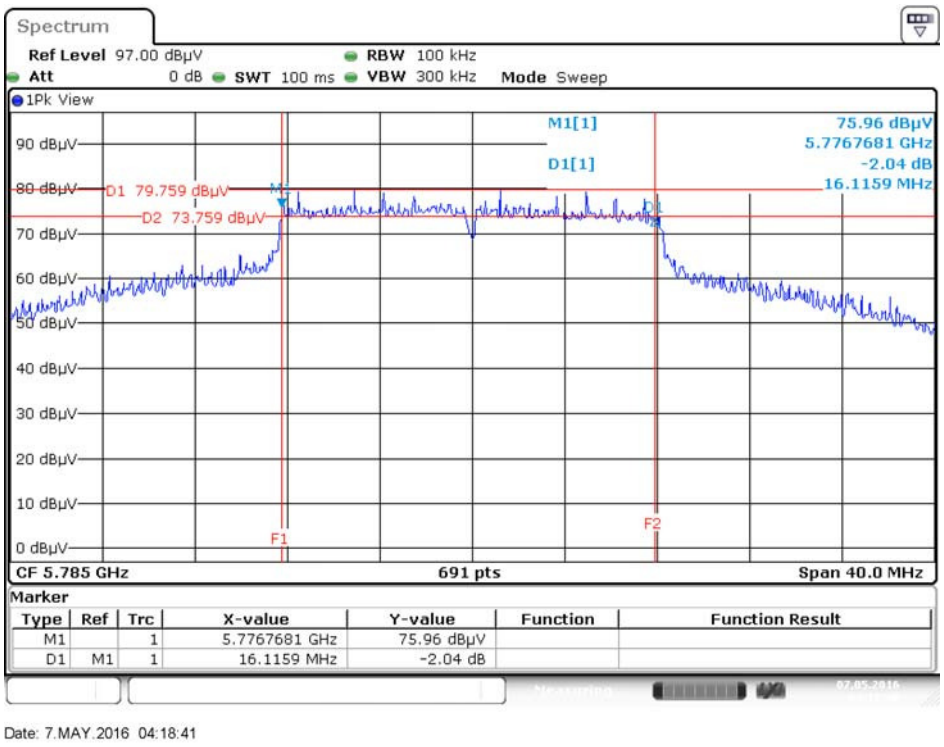
Mode	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
802.11ac MCS0/Nss1 VHT20	5745 MHz	15.42	500	Complies
	5785 MHz	16.93	500	Complies
	5825 MHz	17.62	500	Complies
802.11ac MCS0/Nss1 VHT40	5755 MHz	35.01	500	Complies
	5795 MHz	35.25	500	Complies
802.11ac MCS0/Nss1 VHT80	5775 MHz	69.57	500	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>

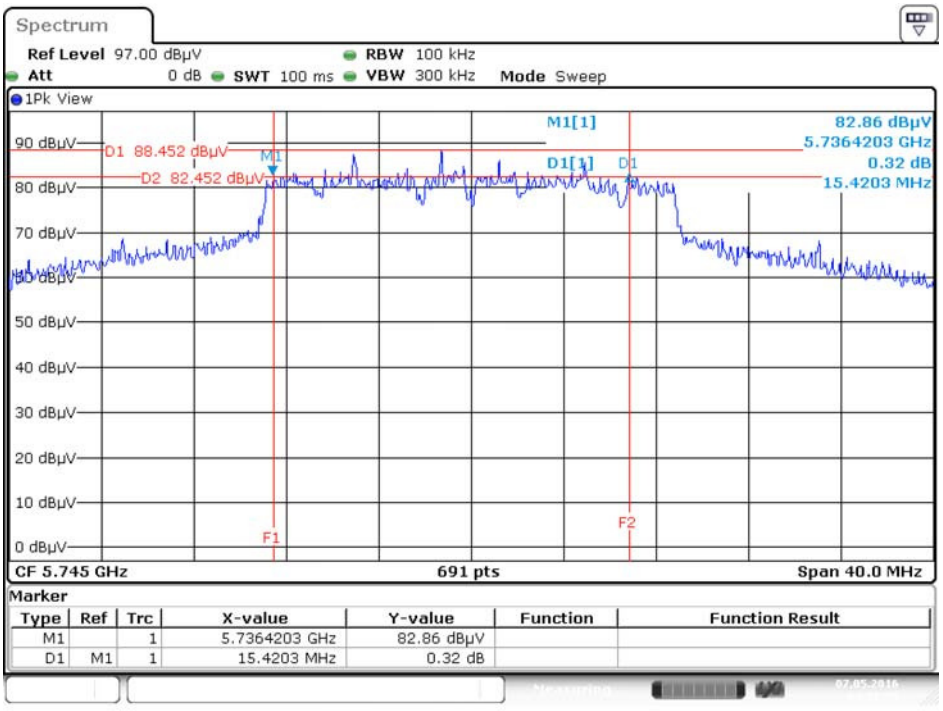
6 dB Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 / 5785 MHz



Date: 7.MAY.2016 04:18:41

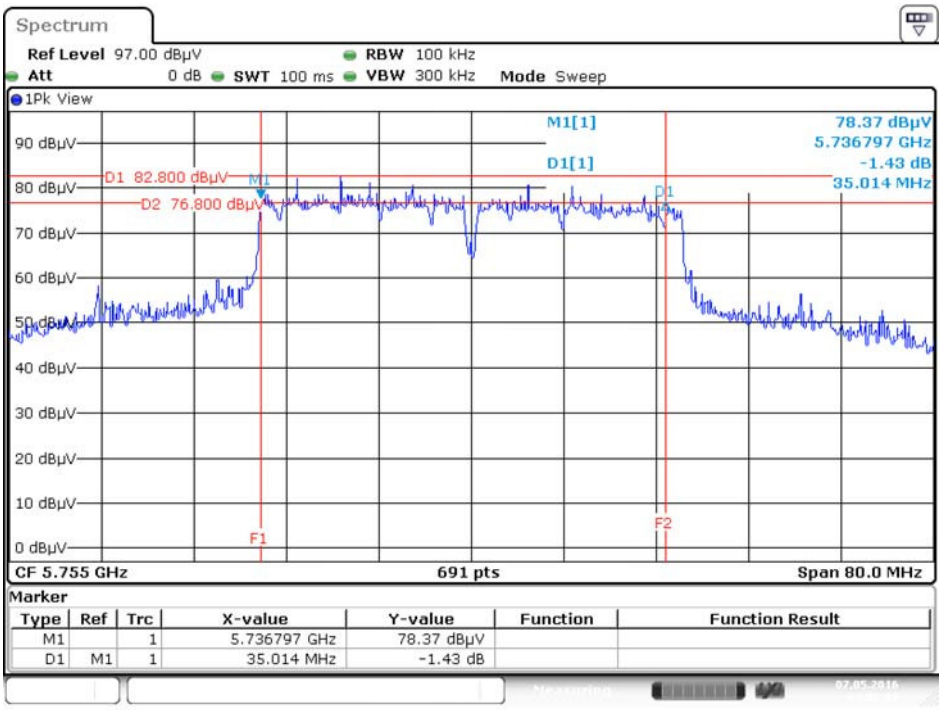
<ForBeamforming Mode>

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



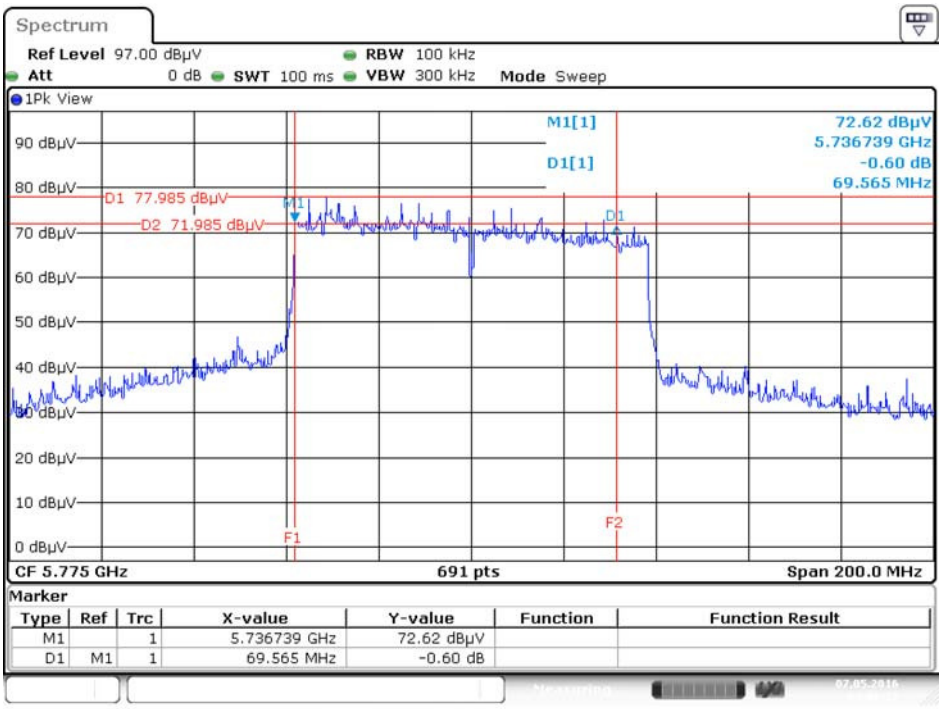
Date: 7.MAY.2016 04:11:35

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5755MHz



Date: 7.MAY.2016 04:08:38

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5775 MHz



Date: 7.MAY.2016 04:06:22

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

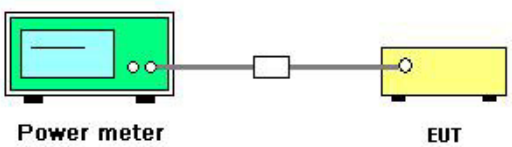
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

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	56%
Test Engineer	Serway Li	Test Date	May 7, 2016 ~ May 19, 2016

<For Non-Beamforming Mode>

Mode	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
802.11a	5745 MHz	23.82	30.00	Complies
	5785 MHz	23.45	30.00	Complies
	5825 MHz	23.16	30.00	Complies

<For Beamforming Mode>

Mode	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Chain 1	Chain 2	Chain 3	Total		
802.11ac MCS0/Nss1 VHT20	5745 MHz	23.10	23.19	23.36	27.99	28.18	Complies
	5785 MHz	16.48	15.58	16.15	20.86	28.18	Complies
	5825 MHz	15.99	15.23	15.62	20.40	28.18	Complies
802.11ac MCS0/Nss1 VHT40	5755 MHz	21.09	20.34	20.42	25.40	28.18	Complies
	5795 MHz	18.62	18.87	18.57	23.46	28.18	Complies
802.11ac MCS0/Nss1 VHT80	5775 MHz	18.30	18.81	18.65	23.36	28.18	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =7.82dBi, So limit=30-(7.82-6)=28.18 dBm.

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

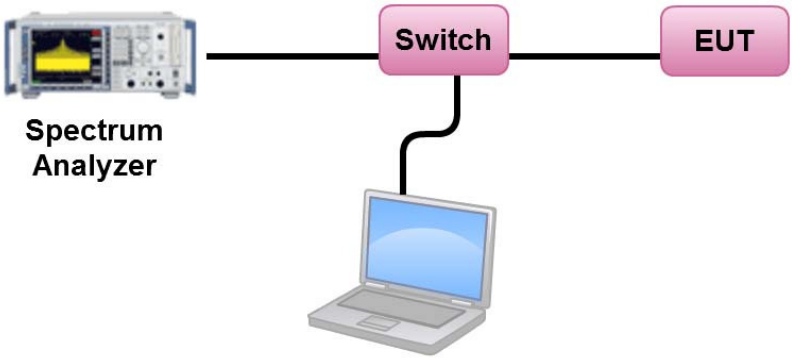
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

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	56%
Test Engineer	Serway Li		

<For Non-Beamforming Mode>

Configuration IEEE 802.11a / Chain 1

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
149	5745 MHz	10.65	-3.01	7.64	30.00	Complies
157	5785 MHz	10.17	-3.01	7.16	30.00	Complies
165	5825 MHz	9.90	-3.01	6.89	30.00	Complies

<For Beamforming Mode>

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + 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	14.75	-3.01	11.74	28.18	Complies
157	5785 MHz	7.58	-3.01	4.57	28.18	Complies
165	5825 MHz	7.22	-3.01	4.21	28.18	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =7.82dBi, So limit=30-(7.82-6)=28.18 dBm/500kHz.

Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
151	5755 MHz	9.22	-3.01	6.21	28.18	Complies
159	5795 MHz	7.33	-3.01	4.32	28.18	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =7.82dBi, So limit=30-(7.82-6)=28.18 dBm/500kHz.

Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
155	5775 MHz	3.94	-3.01	0.93	28.18	Complies

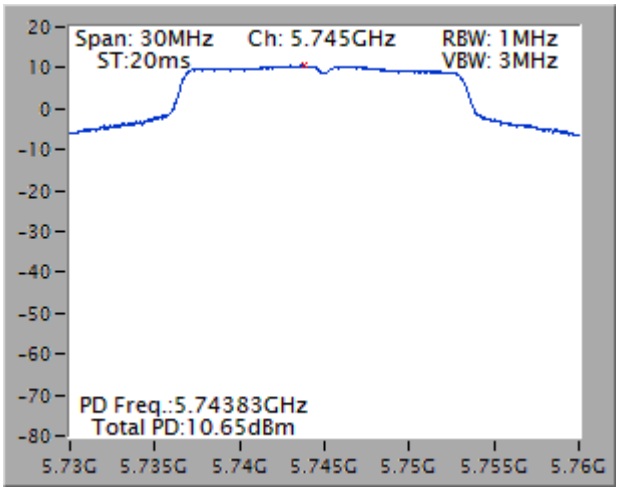
Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =7.82dBi, So limit=30-(7.82-6)=28.18 dBm/500kHz.

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

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

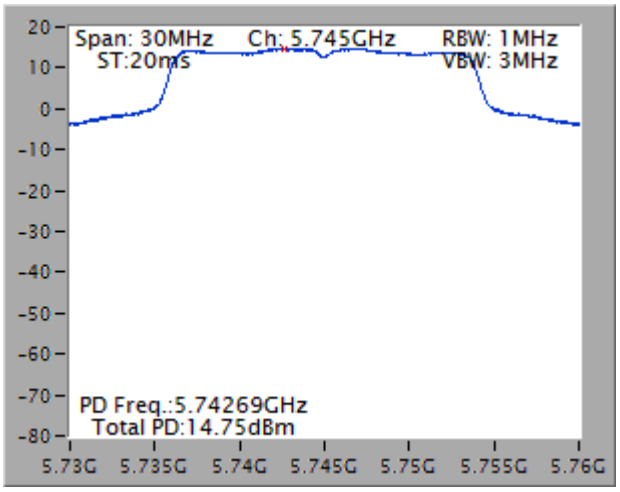
<For Non-Beamforming Mode>

Power Density Plot on Configuration IEEE 802.11a / Chain 1 / 5745 MHz

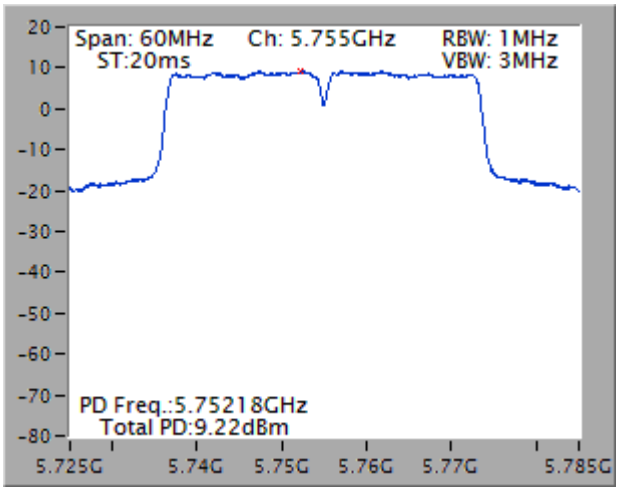


<For Beamforming Mode>

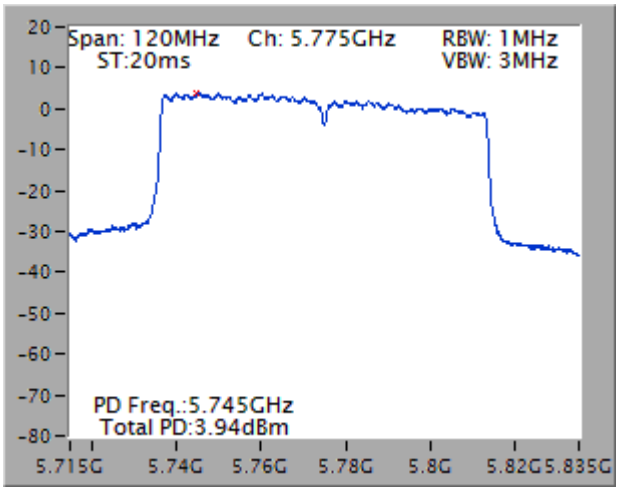
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5755 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 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.

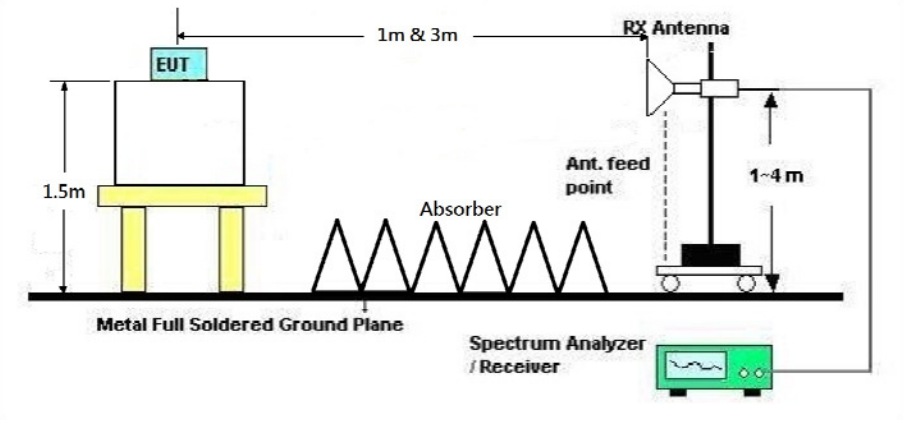
Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	40 GHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	1MHz / 3MHz for peak

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	22°C	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11a CH 149 / Chain 1
Test Date	Mar. 15, 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	11493.92	45.28	54.00	-8.72	31.07	10.94	39.20	35.93	150	283	Average	HORIZONTAL
2	11495.44	58.05	74.00	-15.95	43.84	10.94	39.20	35.93	150	283	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	11489.20	58.43	74.00	-15.57	44.22	10.94	39.20	35.93	150	228	Peak	VERTICAL
2	11494.52	44.92	54.00	-9.08	30.71	10.94	39.20	35.93	150	228	Average	VERTICAL

Temperature	22℃	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11a CH 157 / Chain 1
Test Date	Mar. 15, 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	11568.85	44.85	54.00	-9.15	30.64	10.98	39.15	35.92	150	198	Average	HORIZONTAL
2	11570.54	57.59	74.00	-16.41	43.38	10.98	39.15	35.92	150	198	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	11568.82	59.66	74.00	-14.34	45.45	10.98	39.15	35.92	150	256	Peak	VERTICAL
2	11572.16	44.69	54.00	-9.31	30.48	10.98	39.15	35.92	150	256	Average	VERTICAL

Temperature	22℃	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11a CH 165 / Chain 1
Test Date	Mar. 15, 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	11649.71	44.50	54.00	-9.50	30.31	11.01	39.09	35.91	150	229	Average	HORIZONTAL
2	11650.86	57.83	74.00	-16.17	43.64	11.03	39.07	35.91	150	229	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	11647.86	44.64	54.00	-9.36	30.45	11.01	39.09	35.91	150	173	Average	VERTICAL
2	11650.89	58.16	74.00	-15.84	43.97	11.03	39.07	35.91	150	173	Peak	VERTICAL

<For Beamforming Mode>

Temperature	22℃	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149 / Chain 1 + Chain 2 + Chain 3
Test Date	Mar. 15, 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	11488.01	44.75	54.00	-9.25	30.54	10.94	39.20	35.93	150	162	Average	HORIZONTAL
2	11488.14	58.14	74.00	-15.86	43.93	10.94	39.20	35.93	150	162	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	11490.40	57.92	74.00	-16.08	43.71	10.94	39.20	35.93	150	140	Peak	VERTICAL
2	11498.16	45.05	54.00	-8.95	30.84	10.94	39.20	35.93	150	140	Average	VERTICAL

Temperature	22°C	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 157 / Chain 1 + Chain 2 + Chain 3
Test Date	Mar. 15, 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	11571.03	57.90	74.00	-16.10	43.69	10.98	39.15	35.92	150	128	Peak	HORIZONTAL
2	11571.05	44.72	54.00	-9.28	30.51	10.98	39.15	35.92	150	128	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	11567.70	57.83	74.00	-16.17	43.62	10.98	39.15	35.92	150	182	Peak	VERTICAL
2	11568.90	44.80	54.00	-9.20	30.59	10.98	39.15	35.92	150	182	Average	VERTICAL

Temperature	22℃	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 165 / Chain 1 + Chain 2 + Chain 3
Test Date	Mar. 15, 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	11648.00	44.47	54.00	-9.53	30.28	11.01	39.09	35.91	150	134	Average	HORIZONTAL
2	11649.39	57.76	74.00	-16.24	43.57	11.01	39.09	35.91	150	134	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	11648.05	44.61	54.00	-9.39	30.42	11.01	39.09	35.91	150	181	Average	VERTICAL
2	11648.78	58.09	74.00	-15.91	43.90	11.01	39.09	35.91	150	181	Peak	VERTICAL

Temperature	22℃	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151 / Chain 1 + Chain 2 + Chain 3
Test Date	Mar. 15, 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	11510.50	58.41	74.00	-15.59	44.19	10.94	39.20	35.92	150	163	Peak	HORIZONTAL
2	11512.36	45.33	54.00	-8.67	31.11	10.94	39.20	35.92	150	163	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	11507.97	57.94	74.00	-16.06	43.73	10.94	39.20	35.93	150	147	Peak	VERTICAL
2	11512.21	45.37	54.00	-8.63	31.15	10.94	39.20	35.92	150	147	Average	VERTICAL

Temperature	22℃	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 159 / Chain 1 + Chain 2 + Chain 3
Test Date	Mar. 15, 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	11589.47	44.74	54.00	-9.26	30.54	10.99	39.12	35.91	150	153	Average	HORIZONTAL
2	11591.06	58.53	74.00	-15.47	44.33	10.99	39.12	35.91	150	153	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	11588.78	44.75	54.00	-9.25	30.55	10.99	39.12	35.91	150	181	Average	VERTICAL
2	11591.46	58.15	74.00	-15.85	43.95	10.99	39.12	35.91	150	181	Peak	VERTICAL

Temperature	22℃	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 155 / Chain 1 + Chain 2 + Chain 3
Test Date	Mar. 15, 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	11548.05	44.11	54.00	-9.89	29.90	10.96	39.17	35.92	150	170	Average	HORIZONTAL
2	11550.28	57.20	74.00	-16.80	42.99	10.98	39.15	35.92	150	170	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	11548.10	57.82	74.00	-16.18	43.61	10.96	39.17	35.92	150	186	Peak	VERTICAL
2	11550.22	44.05	54.00	-9.95	29.84	10.98	39.15	35.92	150	186	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.

4.6. 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

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	22℃	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11a CH 149, 157, 165 / Chain 1
Test Date	Mar. 15, 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	5654.00	65.86	71.17	-5.31	60.14	7.89	34.22	36.39	156	326	Peak	VERTICAL
2	5742.00	106.45			100.46	7.86	34.50	36.37	156	326	Average	VERTICAL
3	5742.00	116.86			110.87	7.86	34.50	36.37	156	326	Peak	VERTICAL
4	5929.00	59.89	68.20	-8.31	53.39	7.82	35.01	36.33	156	326	Peak	VERTICAL

Item 3, 4 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	5600.00	59.72	68.20	-8.48	54.13	7.91	34.08	36.40	176	109	Peak	VERTICAL
2	5783.00	105.42			99.32	7.86	34.59	36.35	176	109	Average	VERTICAL
3	5788.00	115.17			109.07	7.86	34.59	36.35	176	109	Peak	VERTICAL
4	5945.00	65.72	68.20	-2.48	59.17	7.81	35.06	36.32	176	109	Peak	VERTICAL

Item 3, 4 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	59.57	68.20	-8.63	54.07	7.88	34.03	36.41	174	109	Peak	VERTICAL
2	5829.00	115.26			109.03	7.84	34.73	36.34	174	109	Peak	VERTICAL
3	5832.00	105.21			98.98	7.84	34.73	36.34	174	109	Average	VERTICAL
4	5978.00	65.67	68.20	-2.53	59.03	7.80	35.15	36.31	174	109	Peak	VERTICAL

Item 1, 2 are the fundamental frequency at 5825 MHz.

<For Beamforming Mode>

Temperature	22℃	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149, 157, 165 / Chain 1 + Chain 2 + Chain 3
Test Date	Mar. 15, 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	5643.00	63.32	68.20	-4.88	57.60	7.89	34.22	36.39	157	98	Peak	VERTICAL
2	5740.00	125.02			119.03	7.86	34.50	36.37	157	98	Peak	VERTICAL
3	5743.00	114.97			108.98	7.86	34.50	36.37	157	98	Average	VERTICAL
4	5985.00	61.49	68.20	-6.71	54.85	7.80	35.15	36.31	157	98	Peak	VERTICAL

Item 3, 4 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	5566.00	60.03	68.20	-8.17	54.60	7.85	33.99	36.41	177	102	Peak	VERTICAL
2	5784.00	107.04			100.94	7.86	34.59	36.35	177	102	Average	VERTICAL
3	5784.00	115.85			109.75	7.86	34.59	36.35	177	102	Peak	VERTICAL
4	5937.00	68.03	68.20	-0.17	61.52	7.82	35.01	36.32	177	102	Peak	VERTICAL

Item 3, 4 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	5602.00	59.59	68.20	-8.61	54.00	7.91	34.08	36.40	187	91	Peak	VERTICAL
2	5822.00	115.99			109.79	7.85	34.69	36.34	187	91	Peak	VERTICAL
3	5833.00	106.39			100.16	7.84	34.73	36.34	187	91	Average	VERTICAL
4	5978.00	67.96	68.20	-0.24	61.32	7.80	35.15	36.31	187	91	Peak	VERTICAL

Item 1, 2 are the fundamental frequency at 5825 MHz.

Temperature	22°C	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151, 159 / Chain 1 + Chain 2 + Chain 3
Test Date	Mar. 15, 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	5647.00	61.16	68.20	-7.04	55.44	7.89	34.22	36.39	164	95	Peak	VERTICAL
2	5740.00	119.08			113.09	7.86	34.50	36.37	164	95	Peak	VERTICAL
3	5741.00	110.08			104.09	7.86	34.50	36.37	164	95	Average	VERTICAL
4	5926.00	67.99	68.20	-0.21	61.49	7.82	35.01	36.33	164	95	Peak	VERTICAL

Item 3, 4 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	5648.00	61.06	68.20	-7.14	55.34	7.89	34.22	36.39	195	90	Peak	VERTICAL
2	5787.00	107.27			101.17	7.86	34.59	36.35	195	90	Average	VERTICAL
3	5809.00	116.96			110.77	7.85	34.69	36.35	195	90	Peak	VERTICAL
4	5953.00	68.09	68.20	-0.11	61.54	7.81	35.06	36.32	195	90	Peak	VERTICAL

Item 3, 4 are the fundamental frequency at 5795 MHz.

Temperature	22°C	Humidity	55%
Test Engineer	Charlie Cheng, Gary Chu, Wen Chao, Akina Chiu	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 155 / Chain 1 + Chain 2 + Chain 3
Test Date	Mar. 15, 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	64.26	68.20	-3.94	58.54	7.89	34.22	36.39	185	97	Peak	VERTICAL
2	5737.00	105.04			99.09	7.87	34.45	36.37	185	97	Average	VERTICAL
3	5745.00	118.48			112.49	7.86	34.50	36.37	185	97	Peak	VERTICAL
4	5927.00	68.07	68.20	-0.13	61.57	7.82	35.01	36.33	185	97	Peak	VERTICAL

Item 3, 4 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

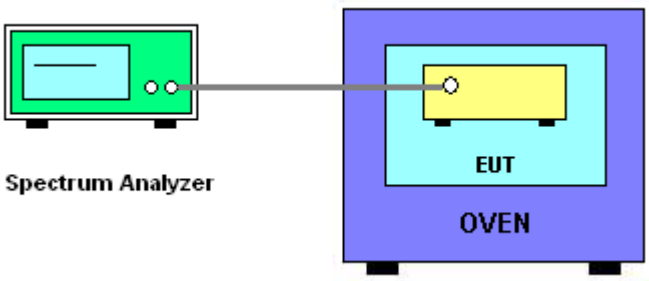
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

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
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	56%
Test Engineer	Serway Li	Test Date	May 07, 2016

Mode: 20 MHz / Chain 1

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5785 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5784.9924	5784.9921	5784.9917	5784.9910
110.00	5784.9922	5784.9921	5784.9913	5784.9909
93.50	5784.9917	5784.9907	5784.9902	5784.9893
Max. Deviation (MHz)	**0.0083**	**0.0093**	**0.0098**	**0.0107**
Max. Deviation (ppm)	**1.43**	**1.61**	**1.69**	**1.85**
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5785 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
0	5785.0022	5785.0010	5784.9994	5784.9975
10	5785.0008	5784.9996	5784.9977	5784.9955
20	5784.9995	5784.9982	5784.9967	5784.9949
30	5784.9983	5784.9970	5784.9954	5784.9935
40	5784.9969	5784.9958	5784.9944	5784.9928
Max. Deviation (MHz)	**0.0064**	**0.0076**	**0.0091**	**0.0118**
Max. Deviation (ppm)	**1.11**	**1.31**	**1.57**	**2.04**
Result	Complies			

Mode: 40 MHz / Chain 1

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5755 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5754.9932	5754.9923	5754.9913	5754.9904
110.00	5754.9929	5754.9924	5754.9922	5754.9920
93.50	5754.9922	5754.9916	5754.9914	5754.9909
Max. Deviation (MHz)	**0.0078**	**0.0084**	**0.0087**	**0.0096**
Max. Deviation (ppm)	**1.36**	**1.46**	**1.51**	**1.67**
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5755 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
0	5755.0036	5755.0024	5755.0008	5754.9989
10	5755.0022	5755.0010	5754.9991	5754.9969
20	5755.0009	5754.9996	5754.9981	5754.9963
30	5754.9997	5754.9984	5754.9968	5754.9949
40	5754.9983	5754.9972	5754.9958	5754.9942
Max. Deviation (MHz)	**0.0067**	**0.0062**	**0.0077**	**0.0104**
Max. Deviation (ppm)	**1.16**	**1.08**	**1.34**	**1.81**
Result	Complies			

Mode: 80 MHz / Chain 1

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5775 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5774.9941	5774.9931	5774.9927	5774.9923
110.00	5774.9936	5774.9928	5774.9926	5774.9916
93.50	5774.9933	5774.9929	5774.9924	5774.9916
Max. Deviation (MHz)	**0.0067**	**0.0072**	**0.0076**	**0.0084**
Max. Deviation (ppm)	**1.16**	**1.25**	**1.32**	**1.45**
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5775 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
0	5775.0004	5774.9992	5774.9976	5774.9957
10	5774.9990	5774.9978	5774.9959	5774.9937
20	5774.9977	5774.9964	5774.9949	5774.9931
30	5774.9965	5774.9952	5774.9936	5774.9917
40	5774.9951	5774.9940	5774.9926	5774.9910
Max. Deviation (MHz)	**0.0082**	**0.0094**	**0.0109**	**0.0136**
Max. Deviation (ppm)	**1.42**	**1.63**	**1.89**	**2.35**
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-I0-7	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.

"*" Calibration Interval of instruments listed above is two years.

N.C.R means Non-Calibration required.

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%