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FCC RADIO TEST REPORT

Applicant's company	**Realtek Semiconductor Corp.**
Applicant Address	No. 2,Innovation Road II, Hsinchu Science Park, Hsinchu 300,Taiwan
FCC ID	**TX2RTL8812AENF**
Manufacturer's company	**Realtek Semiconductor Corp.**
Manufacturer Address	No. 2,Innovation Road II, Hsinchu Science Park, Hsinchu 300,Taiwan

Product Name	802.11a/b/g/n/ac RTL8812AENF Combo module
Brand Name	REALTEK
Model No.	RTL8812AENF
Test Rule Part(s)	47 CFR FCC Part 15 Subpart E § 15.407
Test Freq. Range	5250 ~ 5350MHz / 5470 ~ 5725MHz / 5725 ~ 5850 MHz
Received Date	Mar. 07, 2014
Final Test Date	Jan. 13, 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 v01r01, KDB662911 D01 v02r01, KDB644545 D03 v01.**

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

TAF
Testing Laboratory
1190

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR422118-06AC	Rev. 01	Initial issue of report	Jan. 21, 2016

1. VERIFICATION OF COMPLIANCE

Product Name	:	802.11a/b/g/n/ac RTL8812AENF Combo module
Brand Name	:	REALTEK
Model No.	:	RTL8812AENF
Applicant	:	Realtek Semiconductor Corp.
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 Mar. 07, 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	15.207	AC Power Line Conducted Emissions	Complies	14.29 dB
4.2	15.407(a)	26dB Spectrum Bandwidth and 99% Occupied Bandwidth	Complies	-
4.3	15.407(e)	6dB Spectrum Bandwidth	Complies	-
4.4	15.407(a)	Maximum Conducted Output Power	Complies	7.22 dB
4.5	15.407(a)	Power Spectral Density	Complies	23.41 dB
4.6	15.407(b)	Radiated Emissions	Complies	3.15 dB
4.7	15.407(b)	Band Edge Emissions	Complies	1.53 dB
4.8	15.407(g)	Frequency Stability	Complies	-
4.9	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Product Type	WLAN (1TX/2TX, 2RX)
Radio Type	Intentional Transceiver
Power Type	From host system
Modulation	IEEE 802.11a: OFDM IEEE 802.11n/ac: see the below table
Data Modulation	IEEE 802.11a/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) IEEE 802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
Data Rate (Mbps)	IEEE 802.11a: OFDM (6/9/12/18/24/36/48/54) IEEE 802.11n/ac: see the below table
Frequency Range	5250 ~ 5350MHz / 5470 ~ 5725MHz / 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 For 1TX: IEEE 802.11a: 17.11 MHz For 2TX: IEEE 802.11a: 18.58 MHz For beamforming mode IEEE 802.11ac MCS0/Nss1 (VHT20): 18.49 MHz IEEE 802.11ac MCS0/Nss1 (VHT40): 37.77 MHz IEEE 802.11ac MCS0/Nss1 (VHT80): 75.54 MHz
Maximum Conducted Output Power	For Non-beamforming mode For 1TX: IEEE 802.11a: 17.83 dBm For 2TX: IEEE 802.11a: 20.69 dBm For beamforming mode IEEE 802.11ac MCS0/Nss1 (VHT20): 20.77 dBm IEEE 802.11ac MCS0/Nss1 (VHT40): 20.73 dBm IEEE 802.11ac MCS0/Nss1 (VHT80): 16.41 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

Items	Description	
Beamforming Function	☒ With beamforming	☐ Without beamforming

Note: The product has beamforming function for 802.11n in 2.4G and 11n/ac in 5GHz.

Antenna and Band width

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

IEEE 11n/ac Spec.

Protocol	Number of Transmit Chains (NTX)	Data Rate / MCS
802.11n (HT20)	1 / 2	MCS 0-7 / 0-15
802.11n (HT40)	1 / 2	MCS 0-7 / 0-15
802.11ac (VHT20)	1 / 2	MCS 0-8/Nss1 / MCS 0-8/Nss1-2
802.11ac (VHT40)	1 / 2	MCS 0-9/Nss1 / MCS 0-9/Nss1-2
802.11ac (VHT80)	1 / 2	MCS 0-9/Nss1 / MCS 0-9/Nss1-2

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

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

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

3.2. Accessories

N/A

3.3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	
					2.4GHz	5GHz
1	LYNwave	ALA110-222050-300011	PIFA Antenna	IPEX MHF4	3.5	5

<For 2.4GHz Band>

For IEEE 802.11b mode (1TX, 1RX)

Only Chain 1 can be used as transmitting/receiving antenna.

For IEEE 802.11g mode (1TX/2TX, 2RX)

The EUT can support both 1TX and 2TX functions.

For 1TX

Only Chain 1 can be used as transmitting antenna.

Chain 1 and Chain 2 could receive simultaneously.

For 2TX

Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna.

Chain 1 and Chain 2 could both transmit/receive simultaneously.

For IEEE 802.11n mode (1TX/2TX, 2RX)

The EUT can support both 1TX and 2TX functions.

For 1TX

Only Chain 1 can be used as transmitting antenna.

Chain 1 and Chain 2 could receive simultaneously.

For 2TX

Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna.

Chain 1 and Chain 2 could both transmit/receive simultaneously.

Only 2TX function was selected to test and record in the report, the 1TX test results were covered by 2TX test results.

<For 5GHz Band>

For IEEE 802.11a mode (1TX/2TX, 2RX):

The EUT can support both 1TX and 2TX functions.

For 1TX

Only Chain 1 can be used as transmitting antenna.

Chain 1 and Chain 2 could receive simultaneously.

For 2TX

Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna.

Chain 1 and Chain 2 could both transmit/receive simultaneously.

For IEEE 802.11n/ac mode (1TX/2TX, 2RX):

The EUT can support both 1TX and 2TX functions.

For 1TX

Only Chain 1 can be used as transmitting antenna.

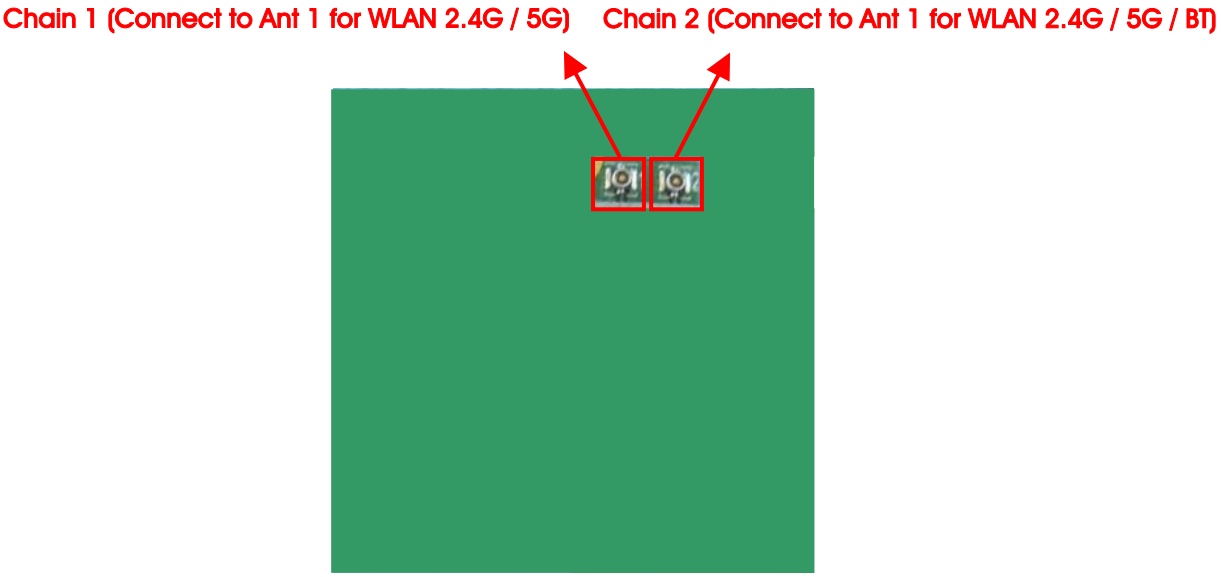
Chain 1 and Chain 2 could receive simultaneously.

For 2TX

Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna.

Chain 1 and Chain 2 could both transmit/receive simultaneously.

Only 2TX function was selected to test and record in the report, the 1TX test results were covered by 2TX test results.



3.4. Table for Carrier Frequencies

There are three bandwidth systems.

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

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

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

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
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	120	5600 MHz
	102	5510 MHz	122	5610 MHz
	104	5520 MHz	124	5620 MHz
	106	5530 MHz	126	5630 MHz
	108	5540 MHz	128	5640 MHz
	110	5550 MHz	132	5660 MHz
	112	5560 MHz	134	5670 MHz
	116	5580 MHz	136	5680 MHz
	118	5590 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
AC Power Conducted Emission	Normal Link		-	-	-
Max. Conducted Output Power	For non-beamforming mode				
	11a/BPSK	Band 4	6Mbps	149/157/165	1 1+2
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2
Power Spectral Density	For non-beamforming mode				
	11a/BPSK	Band 4	6Mbps	149/157/165	1 1+2
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2
26dB Spectrum Bandwidth & 99% Occupied Bandwidth Measurement	For non-beamforming mode				
	11a/BPSK	Band 4	6Mbps	149/157/165	1 1+2
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2
6dB Spectrum Bandwidth Measurement	For non-beamforming mode				
	11a/BPSK	Band 4	6Mbps	149/157/165	1 1+2
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2
Radiated Emission Below 1GHz	Normal Link		-	-	-

Radiated Emission Above 1GHz	For non-beamforming mode				
	11a/BPSK	Band 4	6Mbps	149/157/165	1 1+2
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2
Band Edge Emission	For non-beamforming mode				
	11a/BPSK	Band 4	6Mbps	149/157/165	1 1+2
	For beamforming mode				
	11ac VHT20	Band 4	MCS0/Nss1	149/157/165	1+2
	11ac VHT40	Band 4	MCS0/Nss1	151/159	1+2
	11ac VHT80	Band 4	MCS0/Nss1	155	1+2
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.

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

The following test modes were performed for all tests:

For Conducted Emission test:

Mode 1. Normal Link

For Radiated Emission below 1GHz test:

Mode 1. Normal Link

For Radiated Emission above 1GHz test:

Mode 1. CTX

For Radiated Emission Co-location Test:

Mode 1. EUT- 2.4G WLAN + Bluetooth

Mode 2. EUT- 5G WLAN + Bluetooth

For Co-location MPE:

The EUT could be applied with 2.4GHz WLAN+Bluetooth function and 5GHz WLAN+Bluetooth functiontherefore; Co-location Maximum Permissible Exposure (Please refer to FA422118-06) and Radiated Emission Co-location (please refer to Appendix B) tests are added for simultaneously transmit among 2.4GHz WLAN+Bluetooth function and 5GHz WLAN+Bluetooth function.

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 Reg. No.**	**IC File No.**	**VCCI Reg. No**
03CH01-CB	SAC	Hsin Chu	262045	IC 4086D	-
CO01-CB	Conduction	Hsin Chu	262045	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: FR422118AA

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

1.

Detail / Report No.	Gist	Modifications
FR422118-06AC	The total antennas amounted to 27 sets.	There is no hardware or electrical modification made to the applying modular transmitter itself. Adding 26 sets of PIFA antenna with lower gain than the original Certificate, after evaluating, it is not necessary to re-test all test items. Please refer to the Appendix C for detail.

2.

Modifications	Performance Checking
Changing 5GHz Band 2 and Band 3 to “New Rules” from “Old Rules”.	It is not necessary to re-test all test items.
Changing 5GHz Band 4 to “New Rules” from “Old Rules”.	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

Note: Test results of AC Power Line Conducted Emissions Measurement and Radiated Emissions below 1GHz are based on original report FR422118AA.

3.8. Table for Supporting Units

For Test Site No: CO01-CB

Support Unit	Brand	Model	FCC ID
Notebook*2	DELL	E6430	DoC
AP Router	Planex	GW-AP54SGX	KA220030603014-1
Mouse	Logitech	M-U0026	DoC
Earphone	SHYARO CHI	MIC-04	N/A
Device	REALTEK	RTL8812AENF	TX2RTL8812AENF
Test Fixture*2	Realtek	NGFF Adapter	N/A

For Test Site No: TH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC
Test Fixture	Realtek	NGFF Adapter	N/A

For Test Site No: 03CH01-CB <Above 1GHz test / For non-beamforming mode>

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC
Test Fixture	Realtek	NGFF Adapter	N/A

For Test Site No: 03CH01-CB <Above 1GHz test / For beamforming mode>

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC
Notebook	DELL	E4300	DoC
Wireless AP	Realtek	GW-AP54SGX	KA220030603014-1
Test Fixture	Realtek	NGFF Adapter	N/A

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.

Test Software Version	Realtek 11ac 8812A PCIE WLAN MP Diagnostic Program 0.0057.02.20140110		
Mode	Test Frequency (MHz)		
	NCB: 20MHz		
	5745 MHz	5785 MHz	5825 MHz
802.11a / 1TX	45	45	45
802.11a / 2TX	45/47	47/51	44/50
802.11ac MCS0/Nss1 VHT20	40/43	49/51	44/49
Mode	NCB: 40MHz		
802.11ac MCS0/Nss1 VHT40	5755 MHz	5795 MHz	
	41/42	47/52	
Mode	NCB: 80MHz		
802.11ac MCS0/Nss1 VHT80	5775 MHz		
	38/39		

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

3.11. Duty Cycle

For non-beamforming mode:

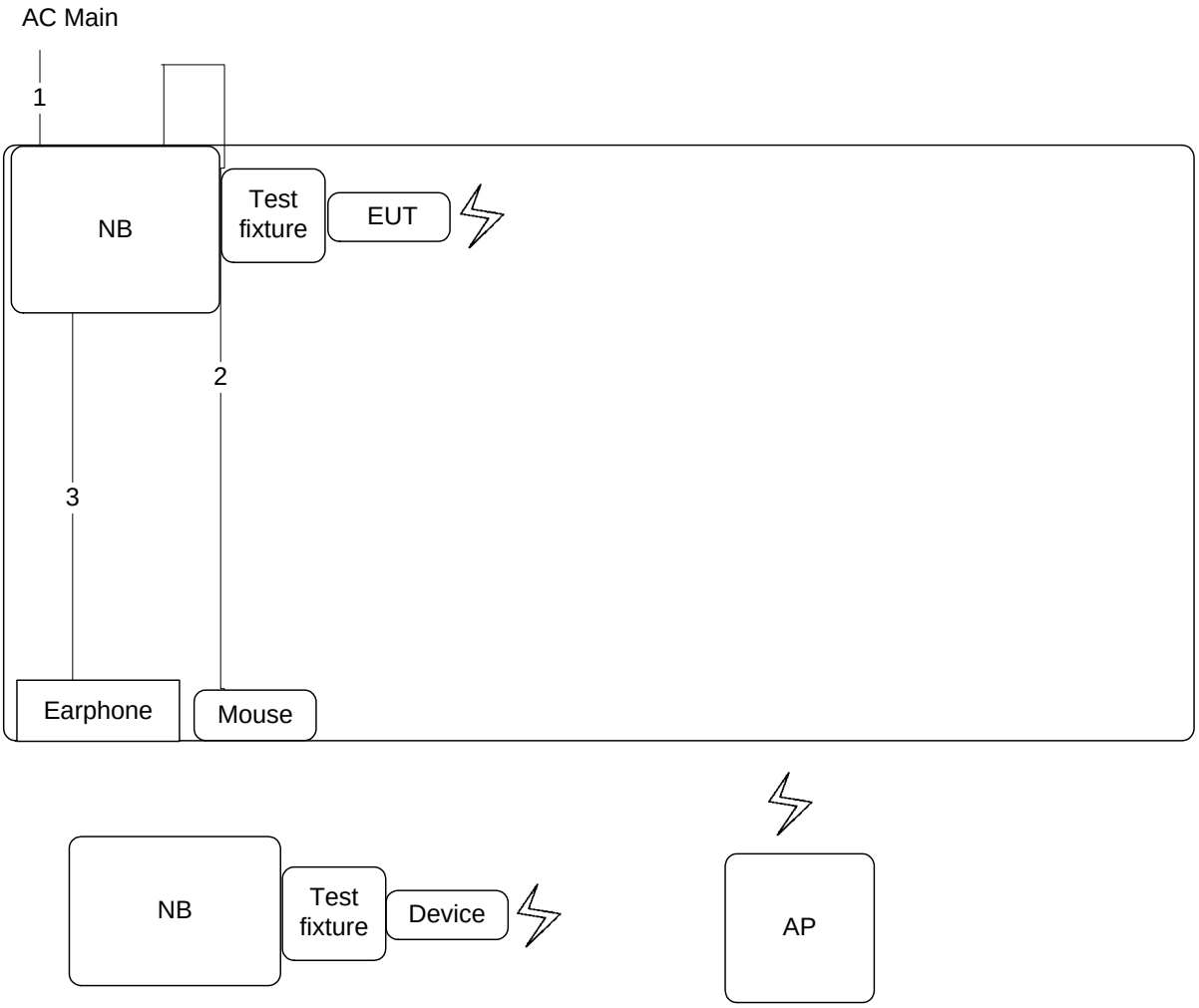
Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
802.11a	1.000	1.000	100.00%	0.00	0.01

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	1.939	2.075	93.44%	0.29	0.52
802.11ac MCS0/Nss1 VHT40	0.958	1.067	89.79%	0.47	1.04
802.11ac MCS0/Nss1 VHT80	0.862	0.994	86.77%	0.62	1.16

3.12. Test Configurations

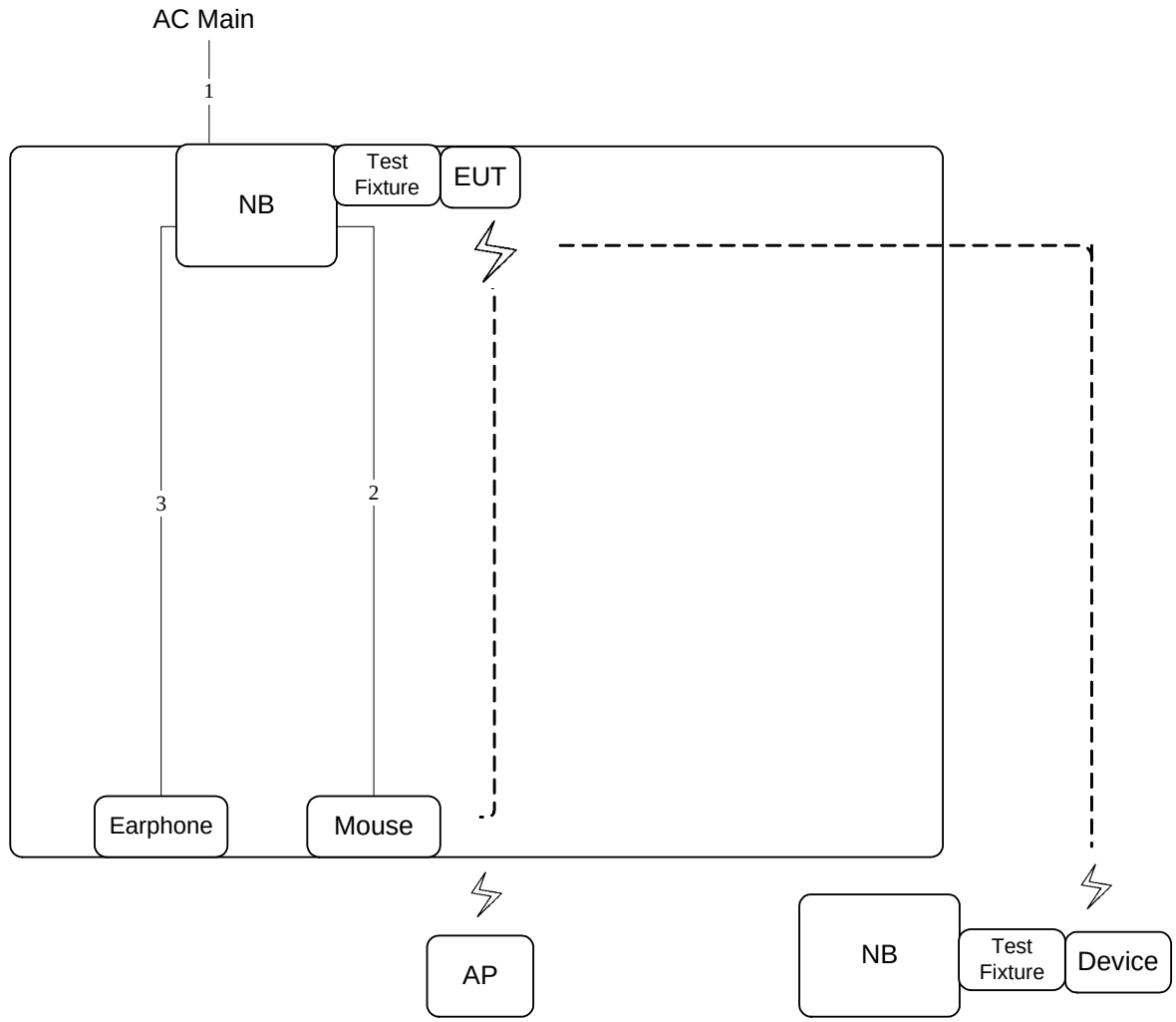
3.12.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	2.6m
2	USB cable	Yes	1.8m
3	Audio cable	No	1.5m

3.12.2. Radiation Emissions Test Configuration

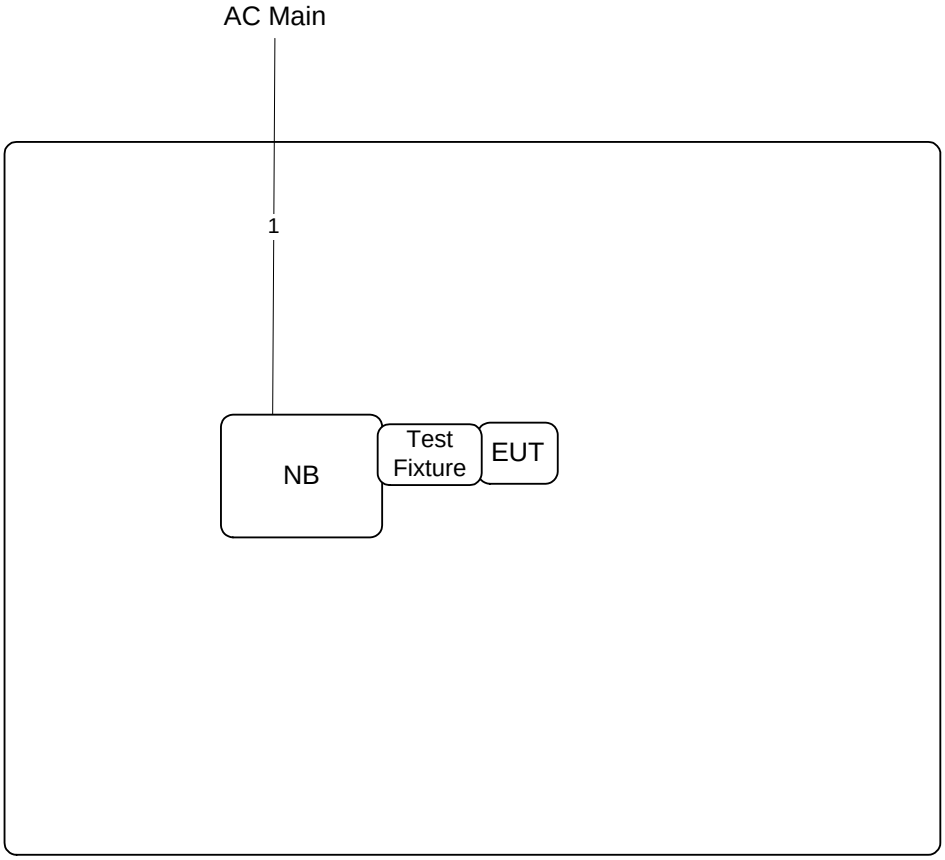
Test Configuration: 30MHz ~1GHz



Item	Connection	Shielded	Length
1	Power cable	No	2.6m
2	USB cable	Yes	1.8m
3	Audio cable	No	1.5m

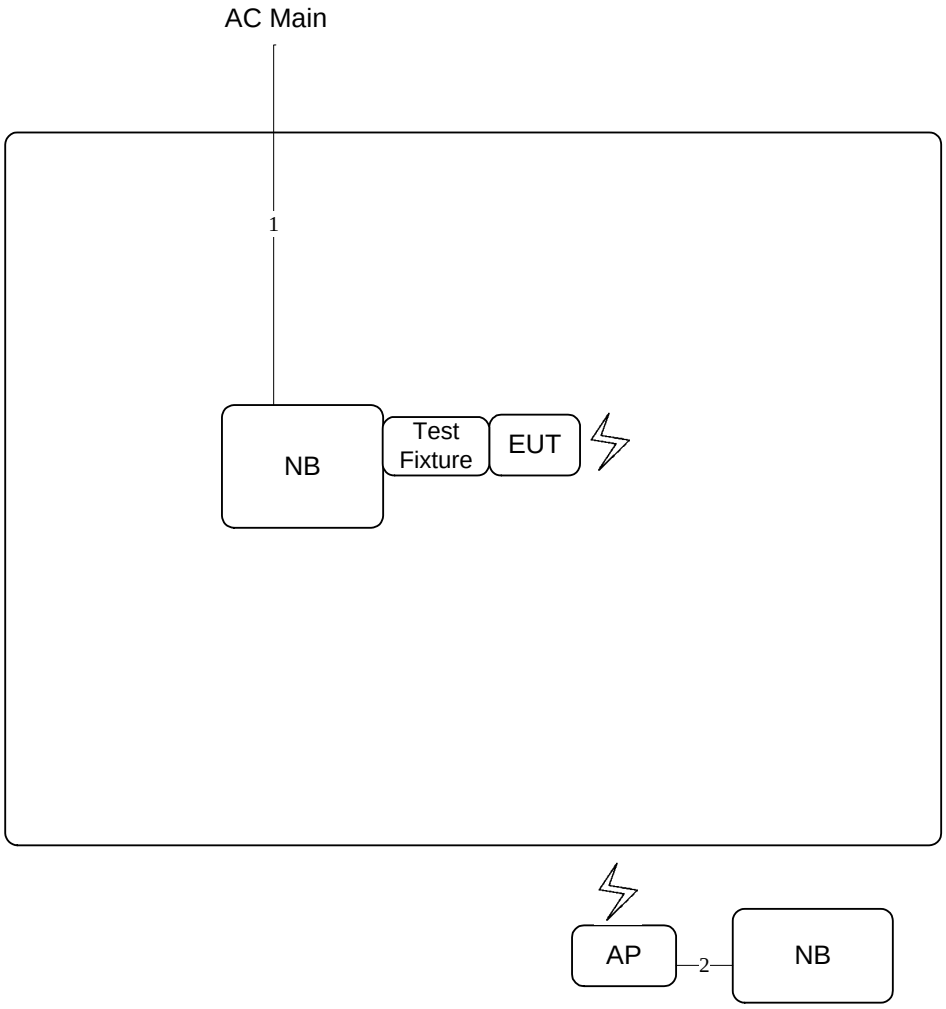
Test Configuration: above 1GHz

For non-beamforming mode



Item	Connection	Shielded	Length
1	Power cable	No	2.6m

For beamforming mode



Item	Connection	Shielded	Length
1	Power cable	No	2.6m
2	RJ-45 cable	No	1.5m

4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For this product that is designed to connect to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

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

4.1.2. Measuring Instruments and Setting

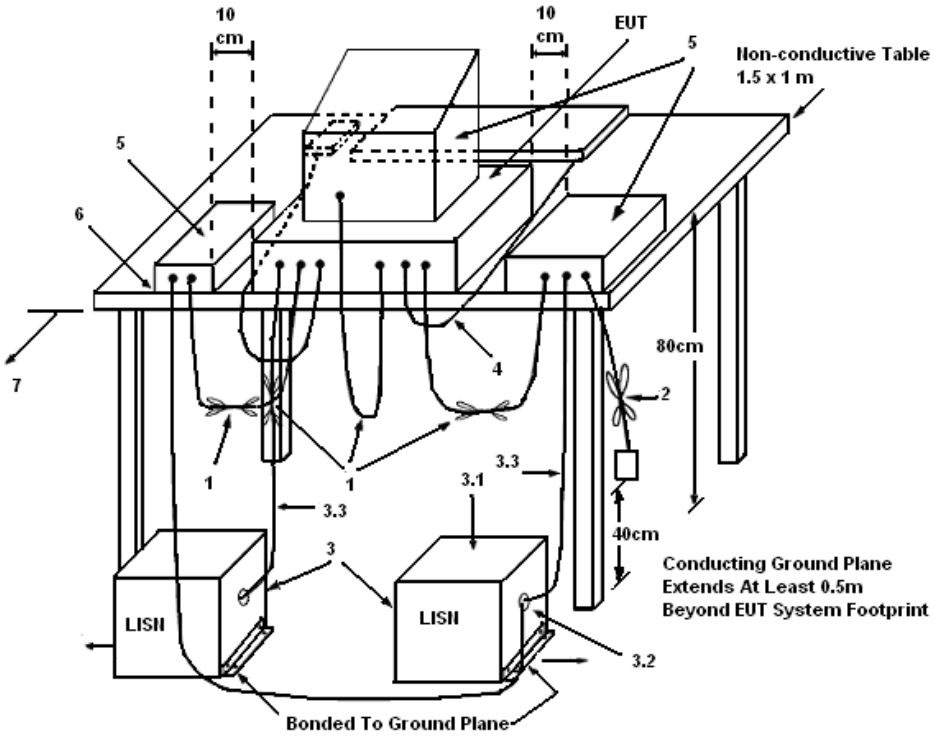
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

4.1.3. Test Procedures

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

4.1.4. Test Setup Layout



LEGEND:

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

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

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

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

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

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

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

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

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

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

4.1.5. Test Deviation

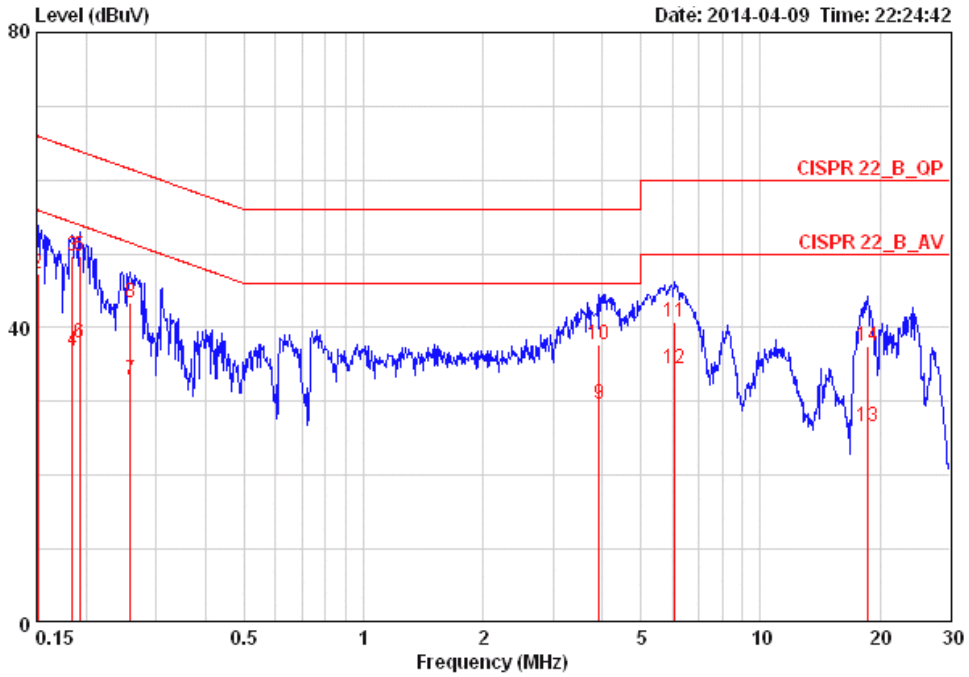
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

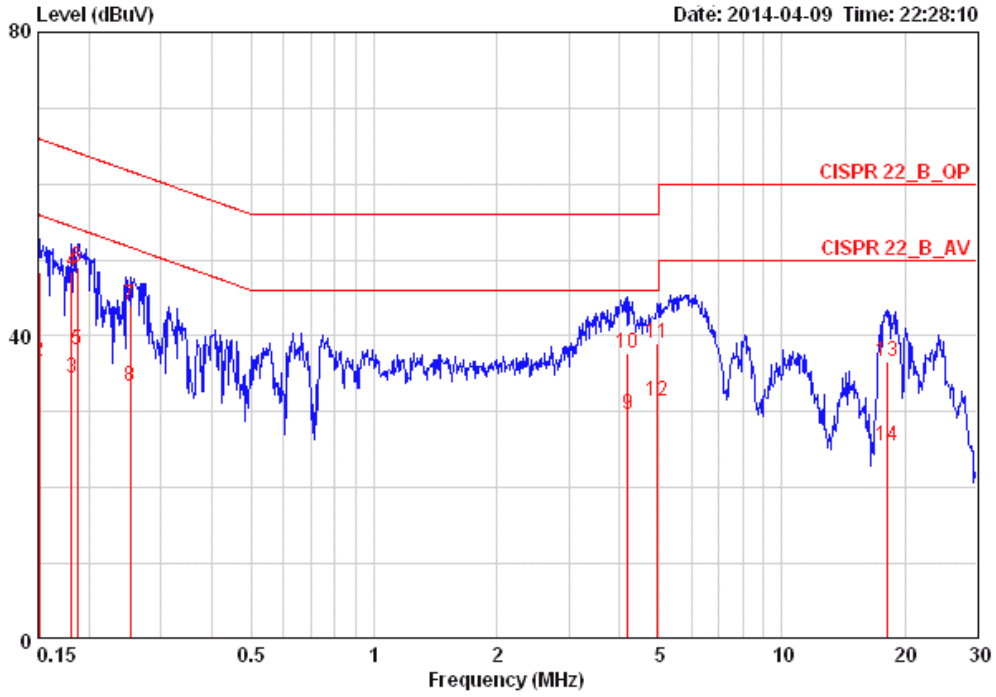
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	25°C	Humidity	52%
Test Engineer	Parody Lin	Phase	Line
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	LISN Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1	0.15080	34.93	-21.03	55.96	0.15	34.60	0.18	LINE	AVERAGE
2	0.15080	47.41	-18.55	65.96	0.15	47.08	0.18	LINE	QP
3 @	0.18443	49.79	-14.49	64.28	0.15	49.45	0.19	LINE	QP
4	0.18443	36.73	-17.55	54.28	0.15	36.39	0.19	LINE	AVERAGE
5 @	0.19242	49.64	-14.29	63.93	0.15	49.29	0.20	LINE	QP
6	0.19242	37.91	-16.02	53.93	0.15	37.56	0.20	LINE	AVERAGE
7	0.25888	32.88	-18.59	51.47	0.15	32.53	0.20	LINE	AVERAGE
8	0.25888	43.47	-18.00	61.47	0.15	43.12	0.20	LINE	QP
9	3.922	29.68	-16.32	46.00	0.28	29.11	0.30	LINE	AVERAGE
10	3.922	37.68	-18.32	56.00	0.28	37.11	0.30	LINE	QP
11	6.056	40.86	-19.14	60.00	0.31	40.22	0.33	LINE	QP
12	6.056	34.40	-15.60	50.00	0.31	33.76	0.33	LINE	AVERAGE
13	18.622	26.57	-23.43	50.00	0.57	25.51	0.49	LINE	AVERAGE
14	18.622	37.44	-22.56	60.00	0.57	36.38	0.49	LINE	QP

Temperature	25°C	Humidity	52%
Test Engineer	Parody Lin	Phase	Neutral
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	LISN Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1	0.15080	48.43	-17.53	65.96	0.07	48.18	0.18	NEUTRAL	QP
2	0.15080	36.52	-19.44	55.96	0.07	36.27	0.18	NEUTRAL	AVERAGE
3	0.18152	34.34	-20.07	54.42	0.07	34.08	0.19	NEUTRAL	AVERAGE
4	0.18152	48.39	-16.02	64.42	0.07	48.13	0.19	NEUTRAL	QP
5	0.18739	38.26	-15.90	54.15	0.07	37.99	0.20	NEUTRAL	AVERAGE
6	0.18739	48.98	-15.18	64.15	0.07	48.71	0.20	NEUTRAL	QP
7	0.25211	44.06	-17.63	61.69	0.07	43.79	0.20	NEUTRAL	QP
8	0.25211	33.45	-18.24	51.69	0.07	33.18	0.20	NEUTRAL	AVERAGE
9	4.180	29.73	-16.27	46.00	0.13	29.29	0.30	NEUTRAL	AVERAGE
10	4.180	37.82	-18.18	56.00	0.13	37.38	0.30	NEUTRAL	QP
11	4.952	38.97	-17.03	56.00	0.15	38.50	0.32	NEUTRAL	QP
12 @	4.952	31.34	-14.66	46.00	0.15	30.87	0.32	NEUTRAL	AVERAGE
13	18.039	36.63	-23.37	60.00	0.41	35.73	0.48	NEUTRAL	QP
14	18.039	25.46	-24.54	50.00	0.41	24.56	0.48	NEUTRAL	AVERAGE

Note:

Level = Read Level + LISN Factor + Cable Loss.

4.2. 26dB Bandwidth and 99% Occupied Bandwidth Measurement

4.2.1. Limit

No restriction limits.

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 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

4.2.3. 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%.

4.2.4. Test Setup Layout

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

This test setup layout is the same as that shown in section 4.6.4.

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 26dB Bandwidth and 99% Occupied Bandwidth

Temperature	24°C	Humidity	60%
Test Engineer	Clemens Fang		

<For non-beamforming mode>

For 1TX: Chain 1

Mode	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a	5745 MHz	24.17	16.93
	5785 MHz	25.39	17.11
	5825 MHz	25.22	16.93

For 2TX: Chain 1 + Chain 2

Mode	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a	5745 MHz	25.30	17.63
	5785 MHz	27.13	18.58
	5825 MHz	26.09	17.71

<For beamforming mode>

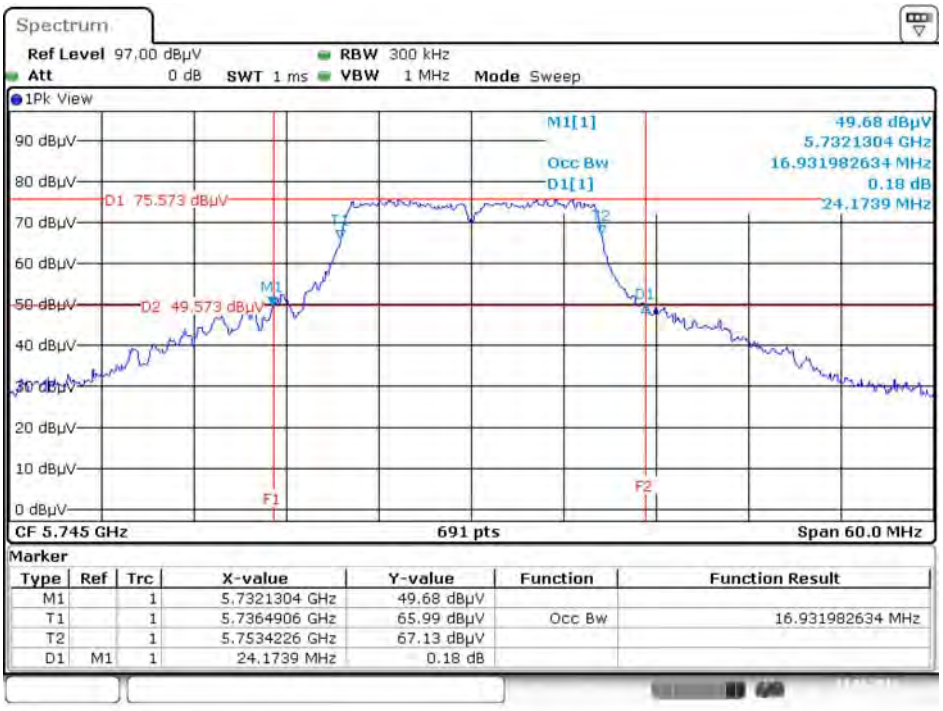
For 2TX: Chain 1 + Chain 2

Mode	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11ac MCS0/Nss1 VHT20	5745 MHz	21.57	17.89
	5785 MHz	34.00	18.49
	5825 MHz	22.09	17.97
802.11ac MCS0/Nss1 VHT40	5755 MHz	45.07	37.19
	5795 MHz	71.88	37.77
802.11ac MCS0/Nss1 VHT80	5775 MHz	82.90	75.54

<For non-beamforming mode>

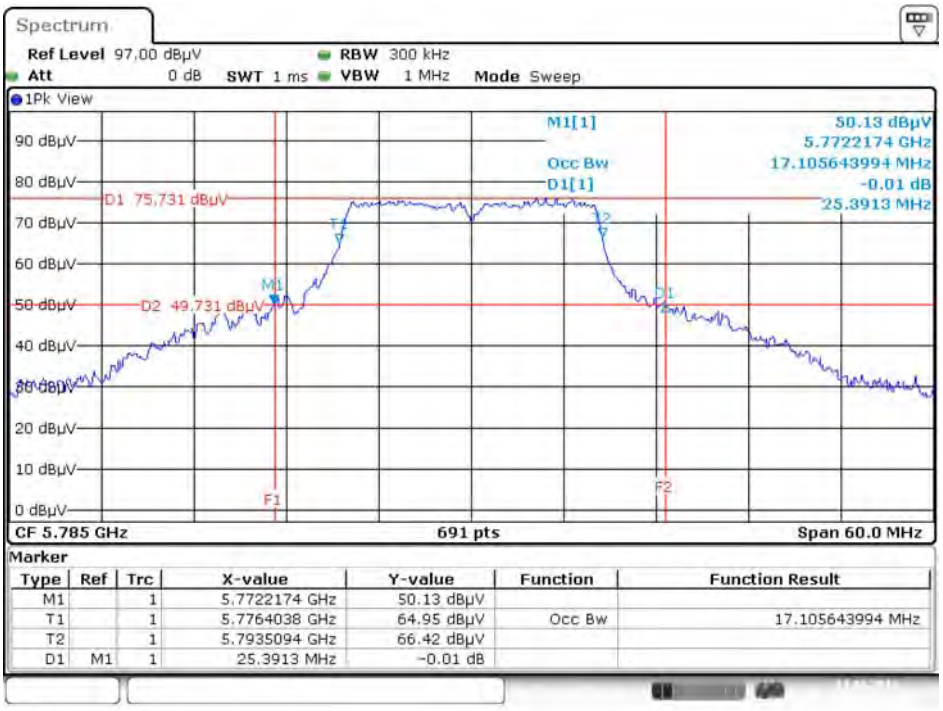
For 1TX:

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



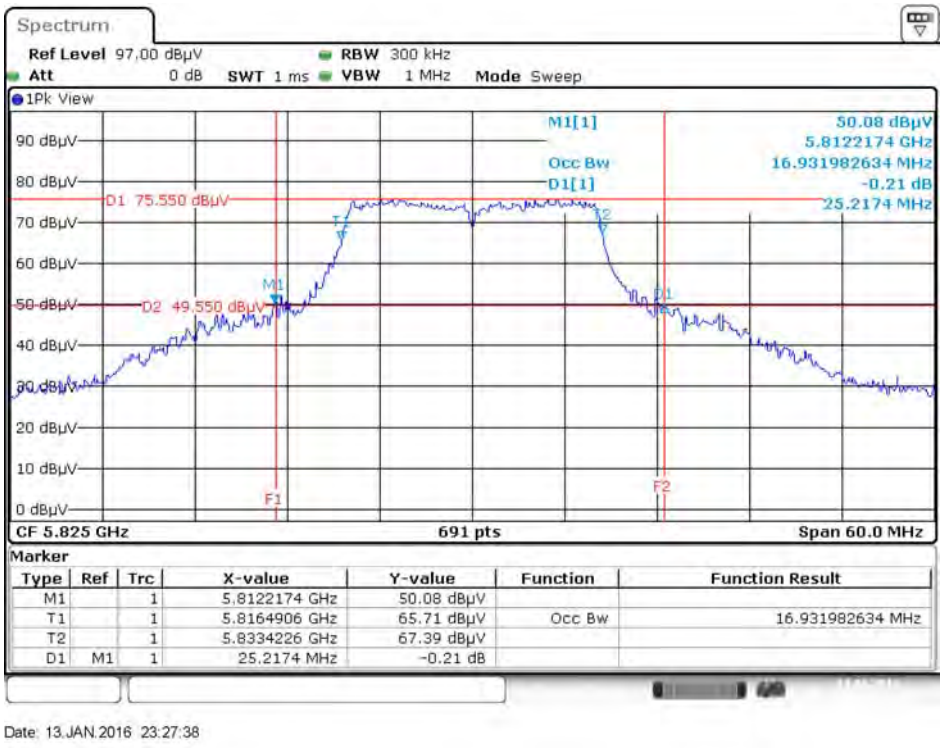
Date: 13.JAN.2016 23:26:56

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



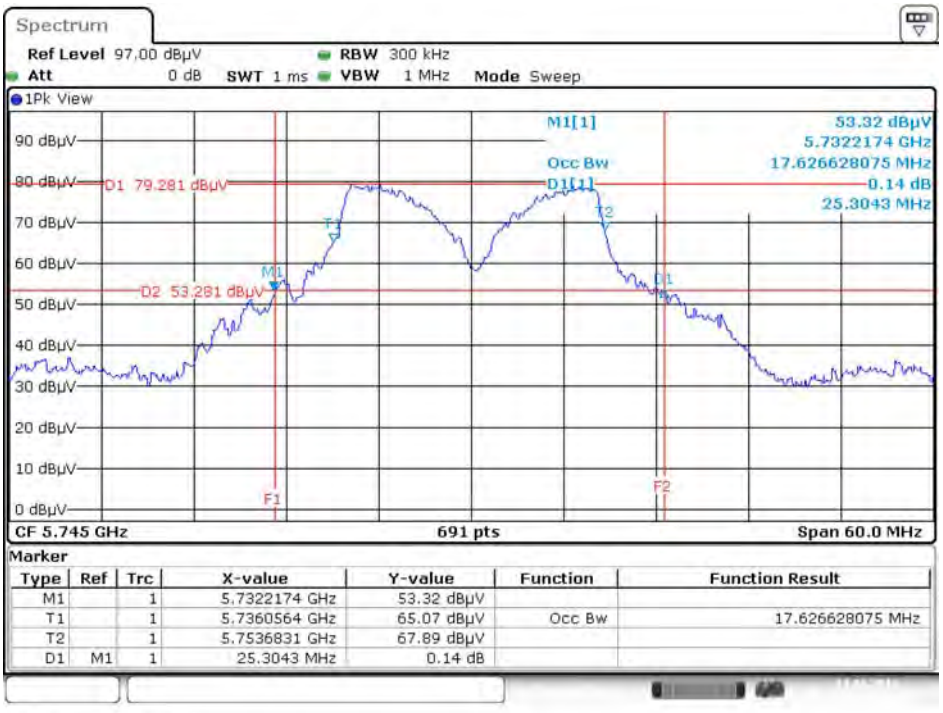
Date: 13.JAN.2016 23:27:15

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



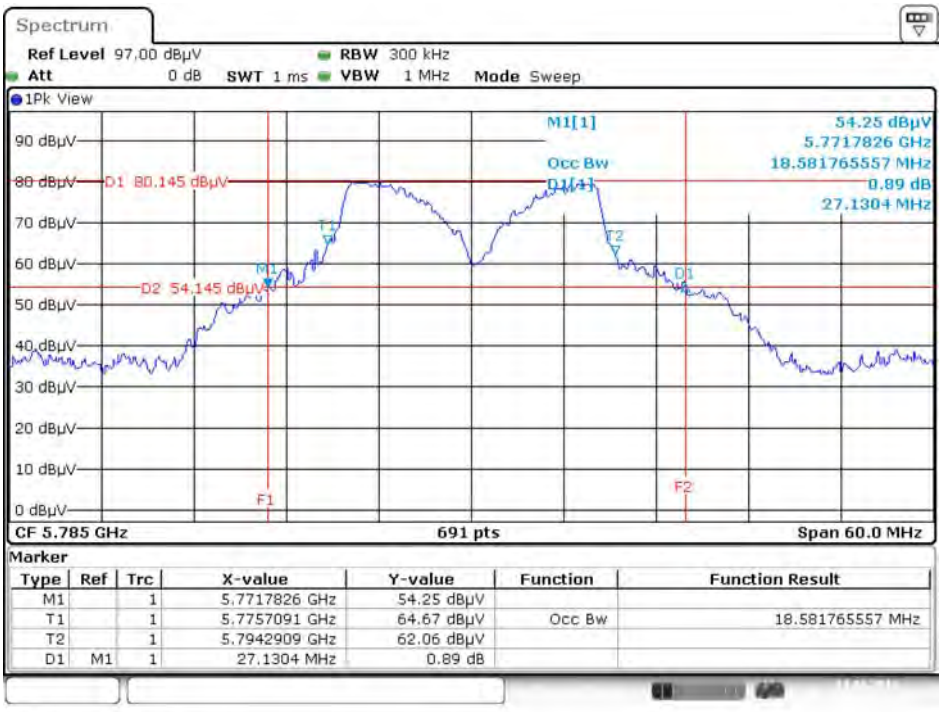
For 2TX:

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 / 5745 MHz



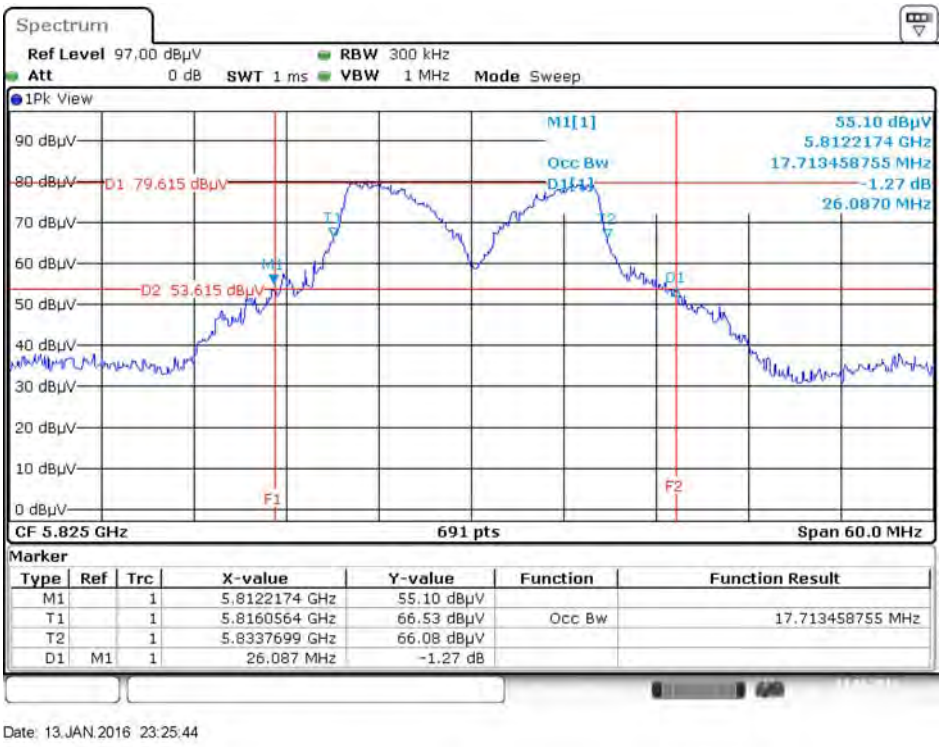
Date: 13.JAN.2016 23:24:49

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 / 5785 MHz



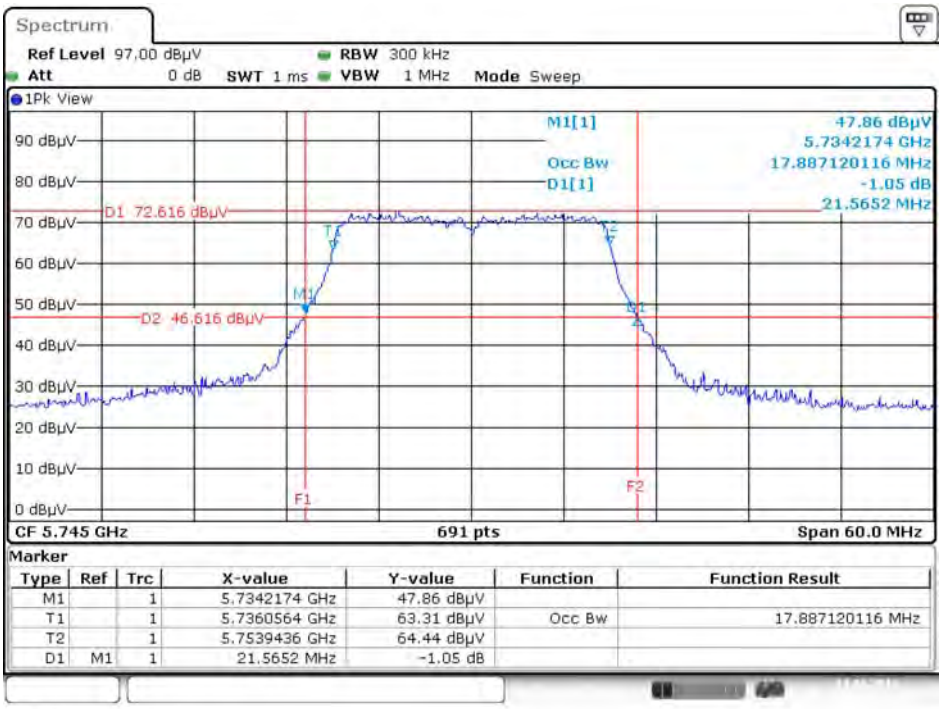
Date: 13.JAN.2016 23:25:12

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 / 5825 MHz



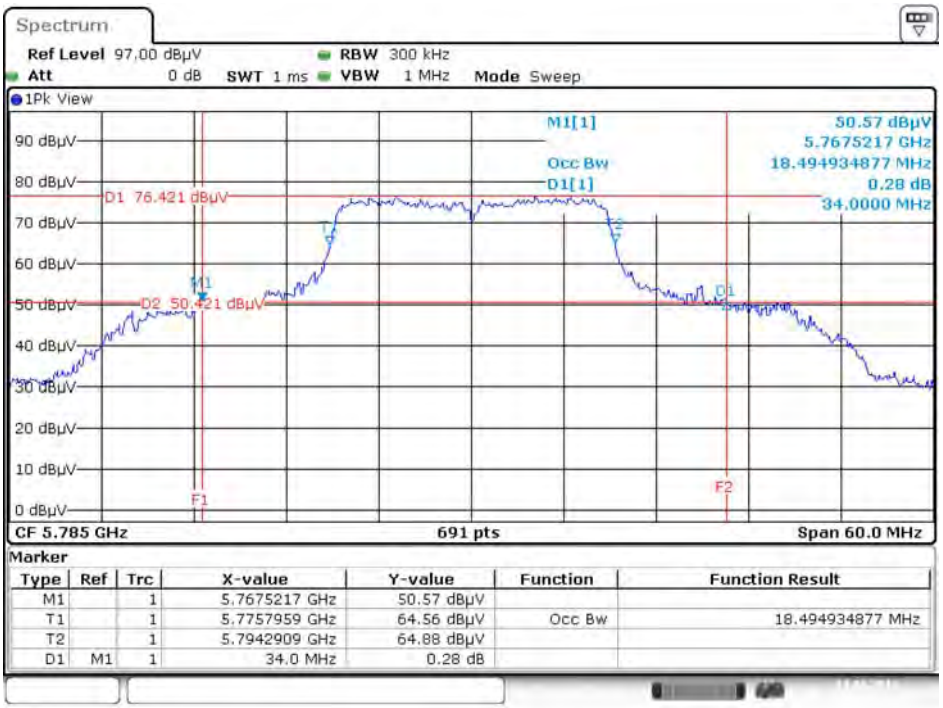
<For beamforming mode>

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



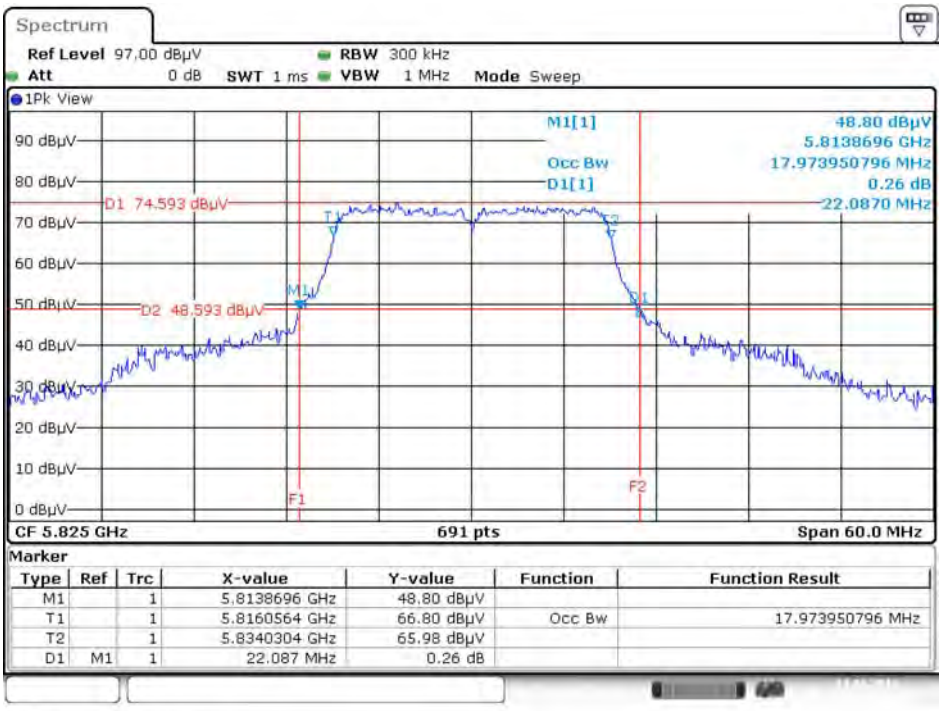
Date: 13.JAN.2016 23:09:12

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5785 MHz



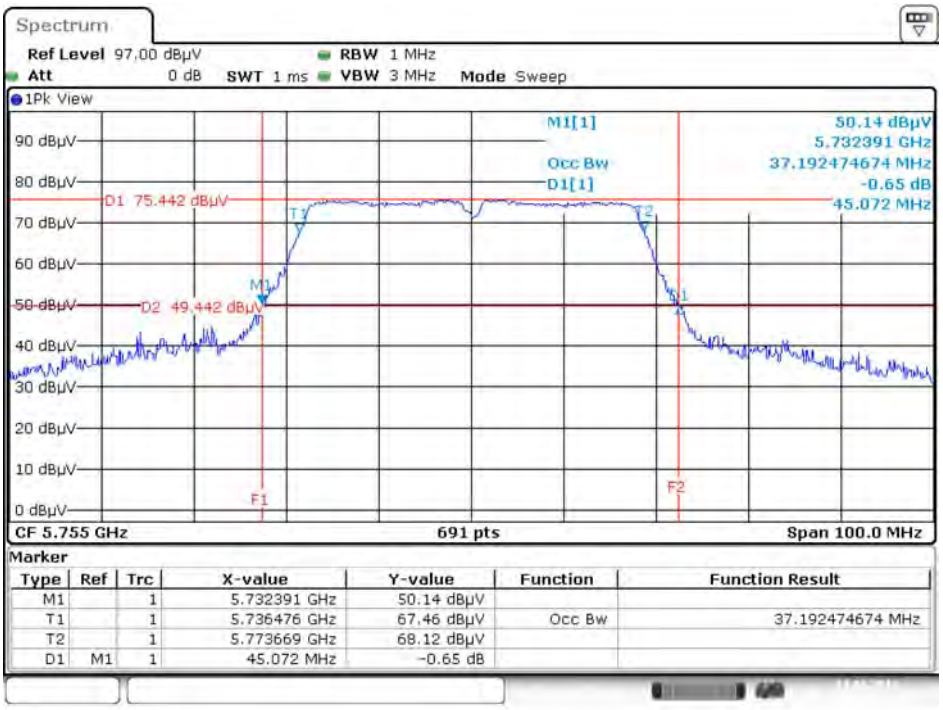
Date: 13.JAN.2016 23:07:45

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



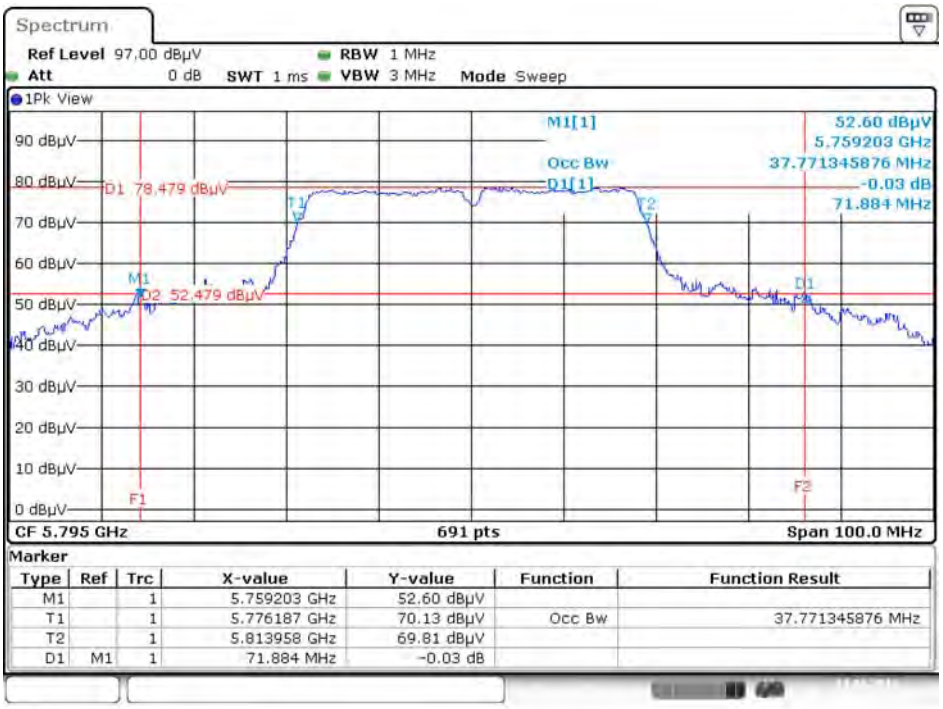
Date: 13.JAN.2016 23:07:06

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



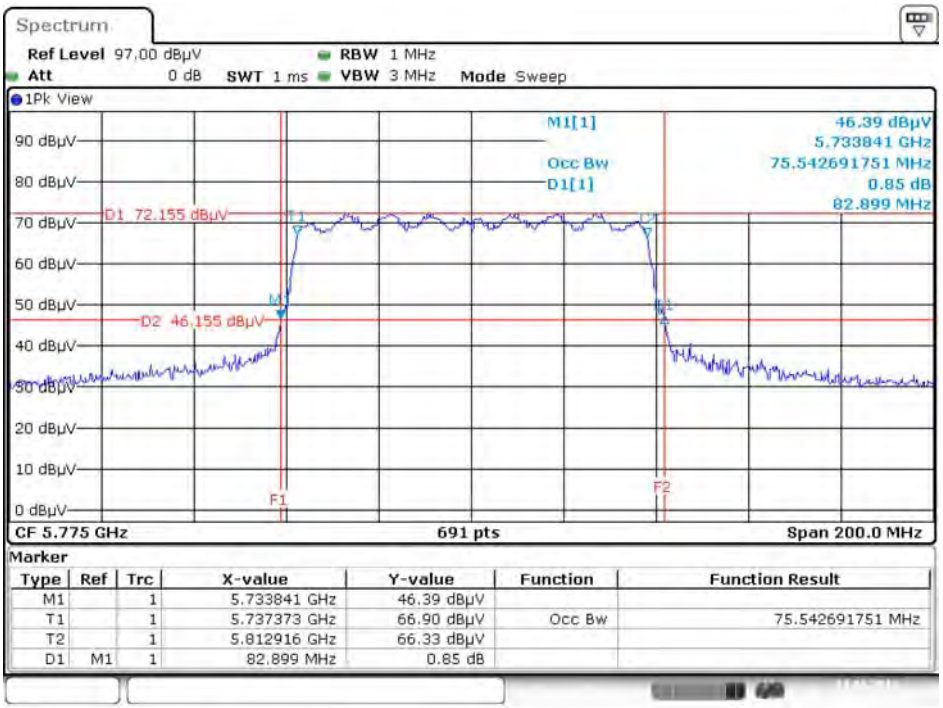
Date: 13.JAN.2016 23:10:36

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



Date: 13.JAN.2016 23:11:04

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



Date: 13.JAN.2016 23:12:42

4.3. 6dB Spectrum Bandwidth Measurement

4.3.1. Limit

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

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 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

4.3.3. 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 v01r01 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.

4.3.4. Test Setup Layout

For Radiated 6dB Bandwidth Measurement:

This test setup layout is the same as that shown in section 4.6.4.

4.3.5. Test Deviation

There is no deviation with the original standard.

4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of 6dB Spectrum Bandwidth

Temperature	24°C	Humidity	60%
Test Engineer	Clemens Fang		

<For non-beamforming mode>

For 1TX: Chain 1

Mode	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
802.11a	5745 MHz	16.58	500	Complies
	5785 MHz	16.52	500	Complies
	5825 MHz	16.58	500	Complies

For 2TX: Chain 1+Chain2

Mode	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
802.11a	5745 MHz	16.58	500	Complies
	5785 MHz	16.58	500	Complies
	5825 MHz	16.58	500	Complies

<For beamforming mode>

For 2TX: Chain 1+Chain2

Mode	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
802.11ac MCS0/Nss1 VHT20	5745 MHz	17.68	500	Complies
	5785 MHz	17.68	500	Complies
	5825 MHz	17.74	500	Complies
802.11ac MCS0/Nss1 VHT40	5755 MHz	45.07	500	Complies
	5795 MHz	71.88	500	Complies
802.11ac MCS0/Nss1 VHT80	5775 MHz	76.52	500	Complies

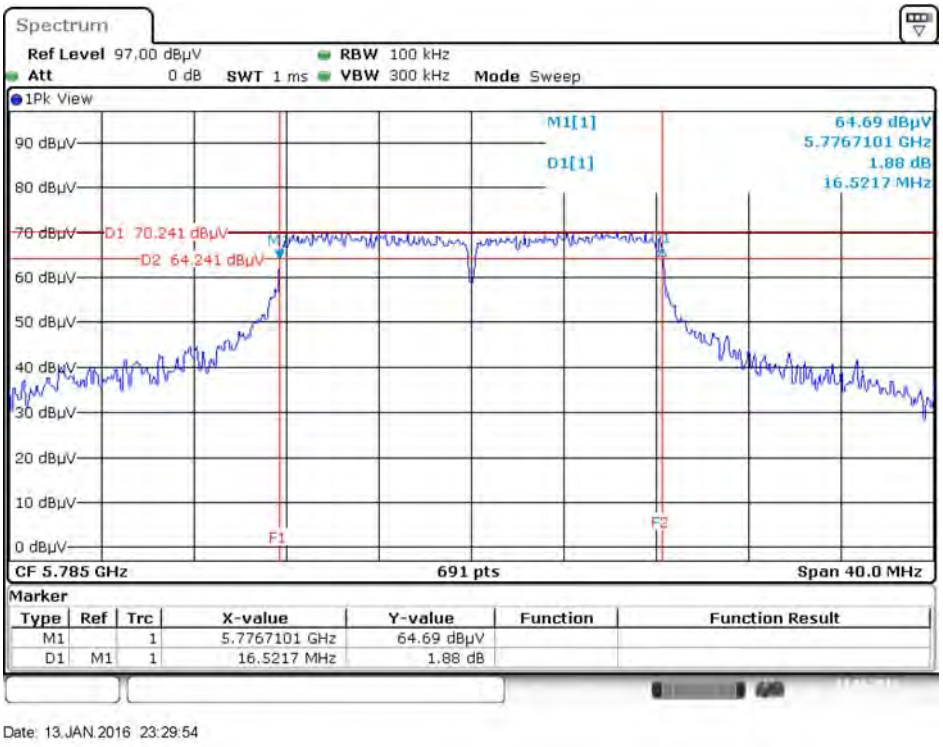
Note: All the test values were listed in the report.

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

<For non-beamforming mode>

For 1TX:

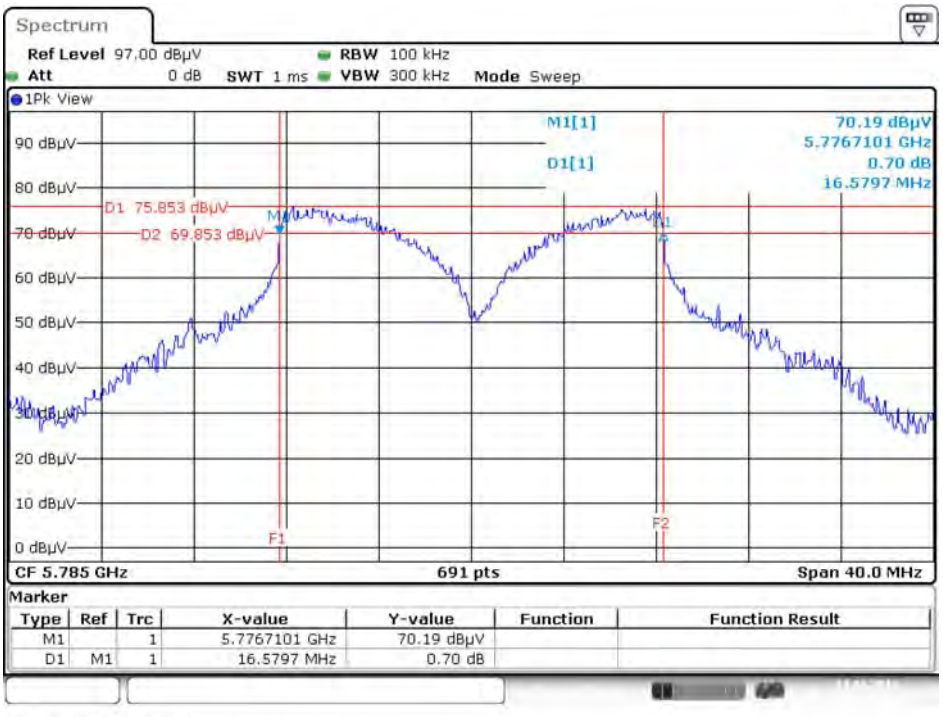
6 dB Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 / 5785 MHz



Date: 13.JAN.2016 23:29:54

For 2TX:

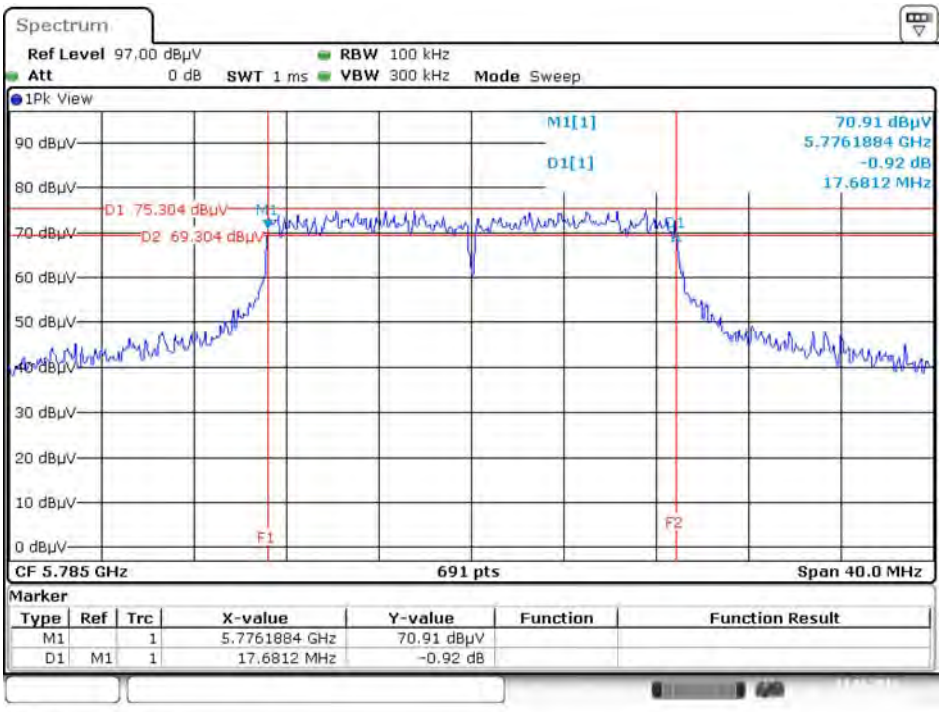
6 dB Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 / 5785 MHz



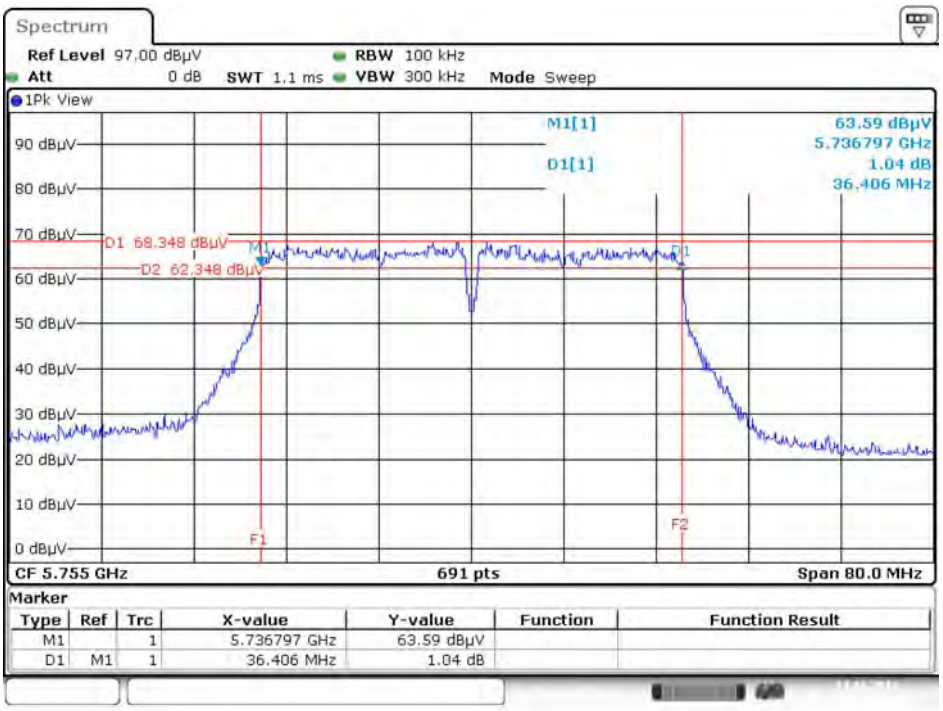
Date: 13.JAN.2016 23:31:08

<For beamforming mode>

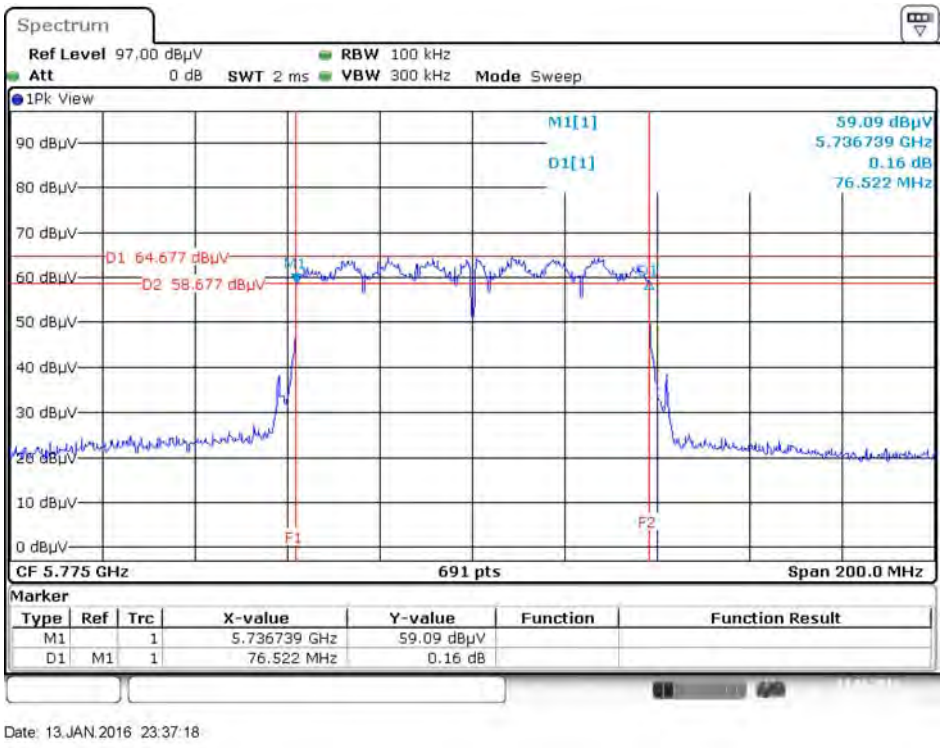
6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5785 MHz



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



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



4.4. Maximum Conducted Output Power Measurement

4.4.1. 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.

4.4.2. Measuring Instruments and Setting

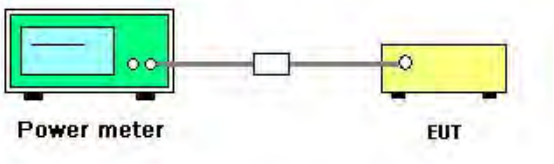
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Detector	AVERAGE

4.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the power meter.
2. Test was performed in accordance with KDB789033 D02 v01r01 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.

4.4.4. 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 Maximum Conducted Output Power

Temperature	24°C	Humidity	60%
Test Engineer	Clemens Fang	Test Date	Jan. 13, 2016

<For non-beamforming mode>

For 1TX: Chain 1

Mode	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
802.11a	5745 MHz	17.71	30.00	Complies
	5785 MHz	17.66	30.00	Complies
	5825 MHz	17.83	30.00	Complies

For 2TX: Chain 1 + Chain 2

Mode	Frequency	Conducted Power (dBm)			Max. Limit (dBm)	Result
		Chain 1	Chain 2	Total		
802.11a	5745 MHz	16.98	16.82	19.91	30.00	Complies
	5785 MHz	17.52	17.84	20.69	30.00	Complies
	5825 MHz	16.97	17.35	20.17	30.00	Complies

<For beamforming mode>

For 2TX: Chain 1 + Chain 2

Mode	Frequency	Conducted Power (dBm)			Max. Limit (dBm)	Result
		Chain 1	Chain 2	Total		
802.11ac MCS0/Nss1 VHT20	5745 MHz	15.75	15.47	18.62	27.99	Complies
	5785 MHz	17.84	17.67	20.77	27.99	Complies
	5825 MHz	16.35	16.17	19.27	27.99	Complies
802.11ac MCS0/Nss1 VHT40	5755 MHz	13.19	13.47	16.34	27.99	Complies
	5795 MHz	17.87	17.57	20.73	27.99	Complies
802.11ac MCS0/Nss1 VHT80	5775 MHz	13.52	13.28	16.41	27.99	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.01dBi, so limit = 30-(8.01-6)=27.99 dBm.

4.5. Power Spectral Density Measurement

4.5.1. Limit

The following table is power spectral density limits and decrease power density limit rule refer to section 4.4.1.

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

4.5.2. Measuring Instruments and Setting

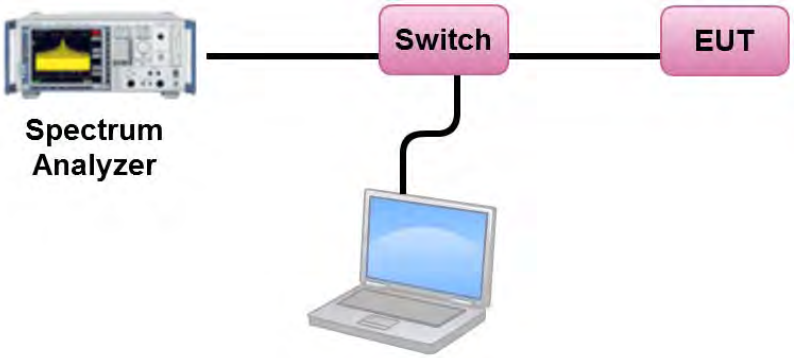
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

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.	

4.5.3. 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 v01r01 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 (a) Measure and sum the spectra across the outputs.
4. When measuring first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3 and so on up to the Nth output to obtain the value for the first frequency bin of the summed spectrum. The summed spectrum value for each of the other frequency bins is computed in the same way.
5. For 5.725~5.85 GHz, the measured result of PSD level must add 10log(500kHz/RBW) and the final result should ≤ 30 dBm.

4.5.4. Test Setup Layout



4.5.5. Test Deviation

There is no deviation with the original standard.

4.5.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.5.7. Test Result of Power Spectral Density

Temperature	24°C	Humidity	60%
Test Engineer	Clemens Fang		

<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	4.66	-3.01	1.65	30.00	Complies
157	5785 MHz	4.63	-3.01	1.62	30.00	Complies
165	5825 MHz	4.73	-3.01	1.72	30.00	Complies

Configuration IEEE 802.11a / Chain 1 + Chain 2

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
149	5745 MHz	6.84	-3.01	3.83	27.99	Complies
157	5785 MHz	7.55	-3.01	4.54	27.99	Complies
165	5825 MHz	7.08	-3.01	4.07	27.99	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.01dBi, so limit = 30-(8.01-6)=27.99 dBm/500kHz.

<For beamforming mode>

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
149	5745 MHz	5.59	-3.01	2.58	27.99	Complies
157	5785 MHz	7.59	-3.01	4.58	27.99	Complies
165	5825 MHz	6.18	-3.01	3.17	27.99	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.01dBi, so limit = 30-(8.01-6)=27.99 dBm/500kHz.

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

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
151	5755 MHz	0.26	-3.01	-2.75	27.99	Complies
159	5795 MHz	4.53	-3.01	1.52	27.99	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.01dBi, so limit = 30-(8.01-6)=27.99 dBm/500kHz.

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

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
155	5775 MHz	-2.70	-3.01	-5.71	27.99	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.01dBi, so limit = 30-(8.01-6)=27.99 dBm/500kHz.

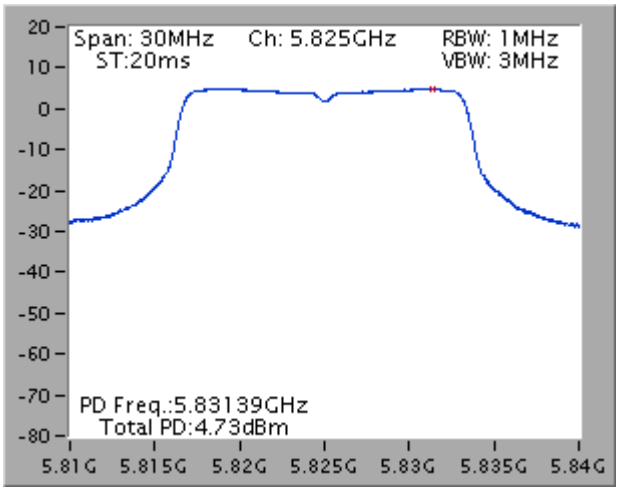
Note: All the test values were listed in the report.

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

<For non-beamforming mode>

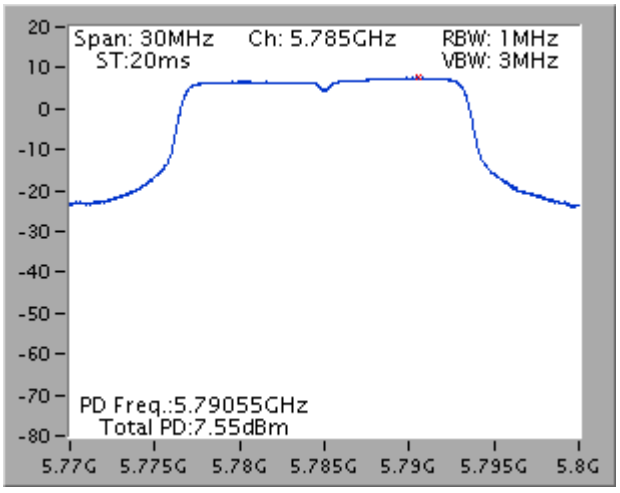
For 1TX:

Power Density Plot on Configuration IEEE 802.11a / Chain 1 / 5825 MHz



For 2TX:

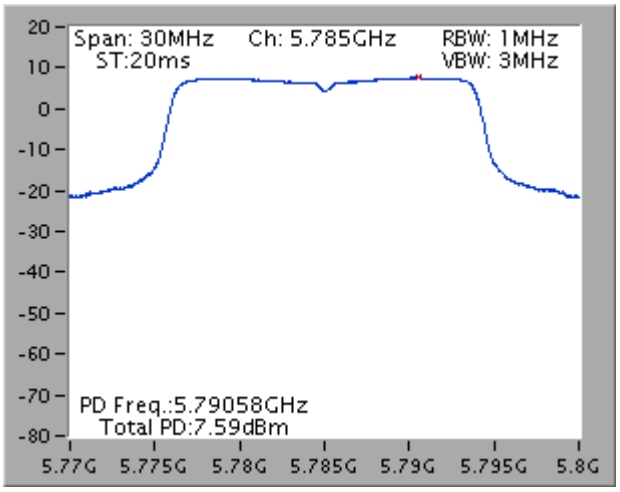
Power Density Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 / 5785 MHz



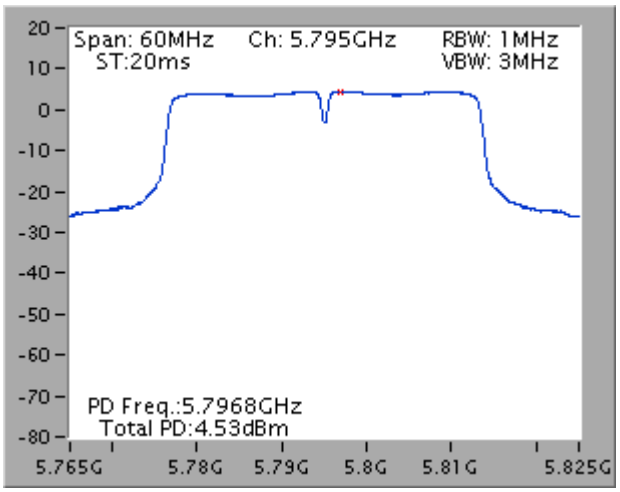
<For beamforming mode>

For 2TX:

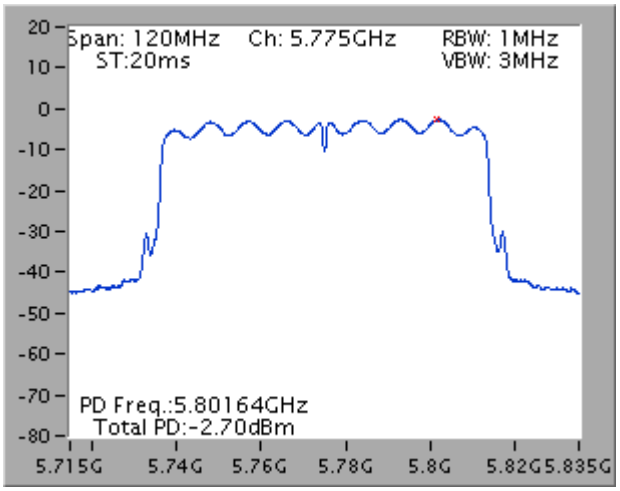
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 / 5785 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 / 5795 MHz



Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 / 5775 MHz



4.6. Radiated Emissions Measurement

4.6.1. Limit

For transmitters operating in the 5.725-5.85 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.

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 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

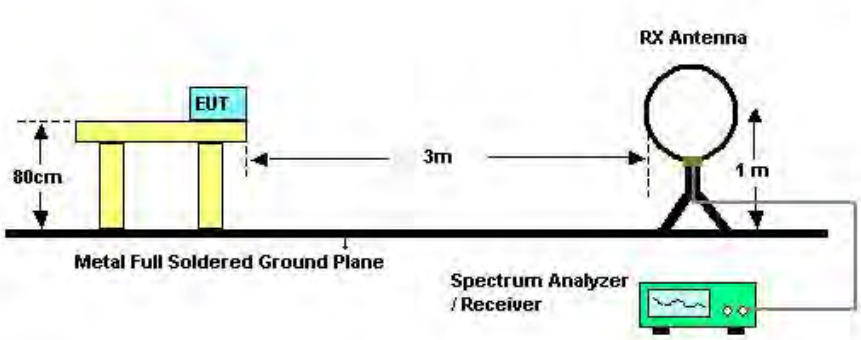
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.6.3. Test Procedures

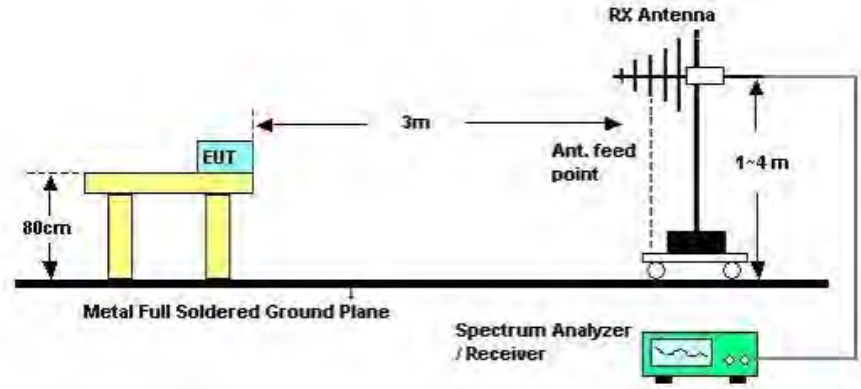
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting 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.

4.6.4. Test Setup Layout

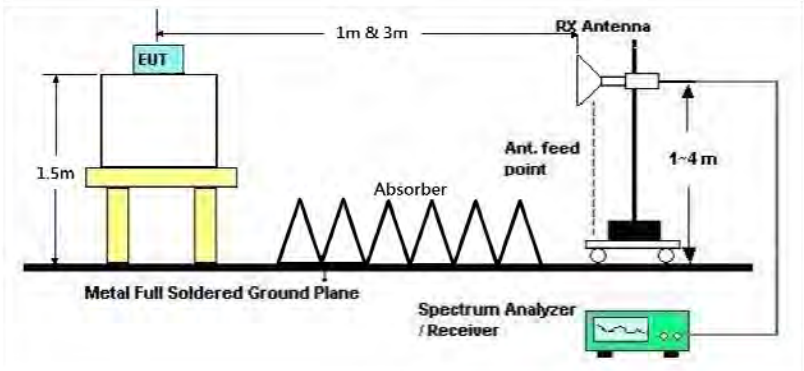
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



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

Temperature	26°C	Humidity	68%
Test Engineer	Lucas Huang / Andy Tsai	Configurations	Normal Link
Test Date	Nov. 28, 2014		

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

Note:

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

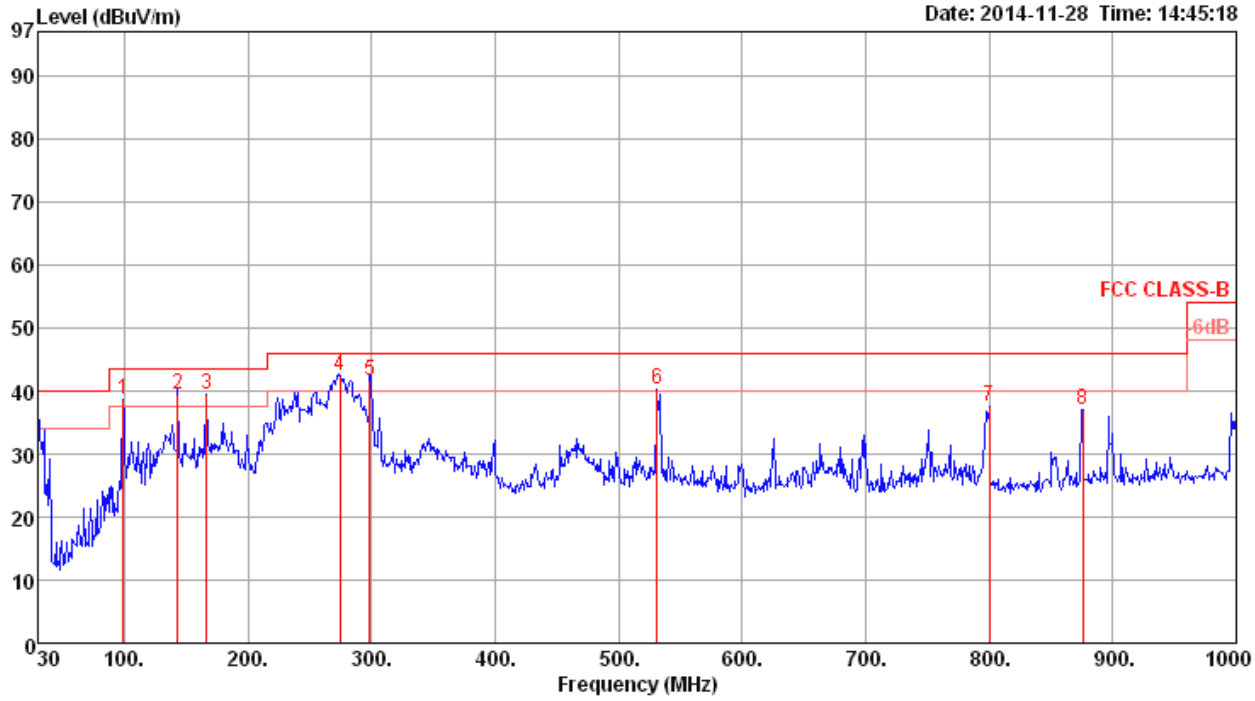
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

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

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

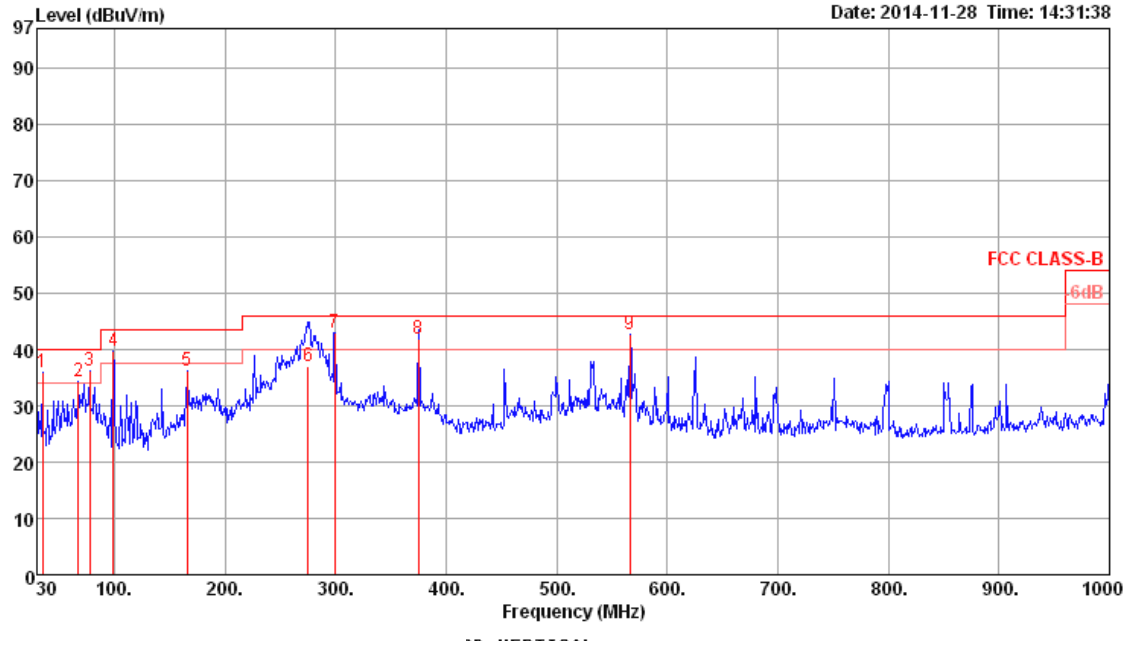
Temperature	26°C	Humidity	68%
Test Engineer	Lucas Huang / Andy Tsai	Configurations	Normal Link

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	98.87	38.76	43.50	-4.74	54.41	1.17	10.79	27.61	Peak	100	0	HORIZONTAL
2	143.49	39.55	43.50	-3.95	53.34	1.42	12.17	27.38	Peak	100	0	HORIZONTAL
3	166.77	39.33	43.50	-4.17	52.60	1.46	12.54	27.27	Peak	100	0	HORIZONTAL
4	274.44	42.52	46.00	-3.48	54.51	1.90	13.06	26.95	Peak	100	0	HORIZONTAL
5	298.69	41.67	46.00	-4.33	53.19	2.03	13.35	26.90	Peak	100	0	HORIZONTAL
6	531.49	40.14	46.00	-5.86	47.52	2.74	17.98	28.10	Peak	100	0	HORIZONTAL
7	800.18	37.47	46.00	-8.53	42.08	3.22	19.77	27.60	Peak	100	0	HORIZONTAL
8	875.84	37.10	46.00	-8.90	40.74	3.46	20.35	27.45	Peak	100	0	HORIZONTAL

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	34.85	36.04	40.00	-3.96	47.06	0.70	16.08	27.80	Peak	400	0	VERTICAL
2	67.83	34.26	40.00	-5.74	54.35	0.97	6.67	27.73	Peak	400	0	VERTICAL
3	77.53	36.33	40.00	-3.67	56.04	0.95	7.03	27.69	Peak	400	0	VERTICAL
4	98.87	39.75	43.50	-3.75	55.40	1.17	10.79	27.61	Peak	400	0	VERTICAL
5	165.80	36.21	43.50	-7.29	49.56	1.45	12.47	27.27	Peak	400	0	VERTICAL
6	275.41	36.90	46.00	-9.10	48.87	1.91	13.07	26.95	QP	298	360	VERTICAL
7	299.66	42.85	46.00	-3.15	54.36	2.03	13.36	26.90	Peak	400	0	VERTICAL
8	375.32	42.00	46.00	-4.00	51.83	2.20	15.40	27.43	QP	159	224	VERTICAL
9	566.41	42.75	46.00	-3.25	49.68	2.79	18.38	28.10	Peak	400	0	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.

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

<For non-beamforming mode>

Temperature	26°C	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11a CH 149 / Chain 1
Test Date	Dec. 15, 2015		

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	11486.52	44.57	54.00	-9.43	24.50	14.24	39.20	33.37	166	309	Average	HORIZONTAL
2	11490.90	56.62	74.00	-17.38	36.55	14.24	39.20	33.37	166	309	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	11487.08	57.01	74.00	-16.99	36.94	14.24	39.20	33.37	194	295	Peak	VERTICAL
2	11493.24	44.56	54.00	-9.44	24.49	14.24	39.20	33.37	194	295	Average	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11a CH 157 / Chain 1
Test Date	Dec. 15, 2015		

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	11565.74	44.03	54.00	-9.97	23.87	14.35	39.20	33.39	180	289	Average	HORIZONTAL
2	11566.42	57.75	74.00	-16.25	37.59	14.35	39.20	33.39	180	289	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	11565.42	44.99	54.00	-9.01	24.83	14.35	39.20	33.39	177	295	Average	VERTICAL
2	11567.12	57.96	74.00	-16.04	37.80	14.35	39.20	33.39	177	295	Peak	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11a CH 165 / Chain 1
Test Date	Dec. 15, 2015		

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	11646.70	45.29	54.00	-8.71	25.05	14.45	39.20	33.41	196	307	Average	HORIZONTAL
2	11651.86	56.84	74.00	-17.16	36.54	14.51	39.20	33.41	196	307	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	44.18	54.00	-9.82	23.94	14.45	39.20	33.41	182	301	Average	VERTICAL
2	11654.04	57.37	74.00	-16.63	37.07	14.51	39.20	33.41	182	301	Peak	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11a CH 149 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	11482.48	54.97	74.00	-19.03	38.31	12.86	39.15	35.35	159	177	Peak	HORIZONTAL
2	11493.48	43.14	54.00	-10.86	26.39	12.90	39.20	35.35	159	177	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	11481.76	54.77	74.00	-19.23	38.11	12.86	39.15	35.35	144	184	Peak	VERTICAL
2	11498.28	43.13	54.00	-10.87	26.38	12.90	39.20	35.35	144	184	Average	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11a CH 157 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	11576.88	55.60	74.00	-18.40	38.78	12.99	39.20	35.37	155	185	Peak	HORIZONTAL
2	11577.72	43.70	54.00	-10.30	26.88	12.99	39.20	35.37	155	185	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	11575.36	57.23	74.00	-16.77	40.41	12.99	39.20	35.37	140	177	Peak	VERTICAL
2	11579.96	43.64	54.00	-10.36	26.82	12.99	39.20	35.37	140	177	Average	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11a CH 165 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	11646.24	56.49	74.00	-17.51	39.60	13.08	39.20	35.39	135	155	Peak	HORIZONTAL
2	11655.20	44.65	54.00	-9.35	27.71	13.13	39.20	35.39	135	155	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	11647.60	44.35	54.00	-9.65	27.46	13.08	39.20	35.39	152	164	Average	VERTICAL
2	11657.68	56.66	74.00	-17.34	39.72	13.13	39.20	35.39	152	164	Peak	VERTICAL

<For beamforming mode>

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	61.16	74.00	-12.84	41.09	14.24	39.20	33.37	150	258	Peak	HORIZONTAL
2	11489.74	47.96	54.00	-6.04	27.89	14.24	39.20	33.37	150	258	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	11480.26	48.63	54.00	-5.37	28.66	14.19	39.15	33.37	150	295	Average	VERTICAL
2	11481.79	61.32	74.00	-12.68	41.35	14.19	39.15	33.37	150	295	Peak	VERTICAL

Temperature	26°C	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 157 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	11561.76	60.22	74.00	-13.78	40.06	14.35	39.20	33.39	150	251	Peak	HORIZONTAL
2	11569.04	47.80	54.00	-6.20	27.64	14.35	39.20	33.39	150	251	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	11568.94	61.33	74.00	-12.67	41.17	14.35	39.20	33.39	150	185	Peak	VERTICAL
2	11572.21	47.73	54.00	-6.27	27.57	14.35	39.20	33.39	150	185	Average	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 165 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	11642.15	47.90	54.00	-6.10	27.66	14.45	39.20	33.41	150	215	Average	HORIZONTAL
2	11642.79	60.82	74.00	-13.18	40.58	14.45	39.20	33.41	150	215	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	11640.77	48.18	54.00	-5.82	27.94	14.45	39.20	33.41	150	248	Average	VERTICAL
2	11650.00	61.73	74.00	-12.27	41.49	14.45	39.20	33.41	150	248	Peak	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	11508.01	61.04	74.00	-12.96	40.97	14.24	39.20	33.37	150	159	Peak	HORIZONTAL
2	11513.65	47.83	54.00	-6.17	27.77	14.24	39.20	33.38	150	159	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	11500.06	47.76	54.00	-6.24	27.69	14.24	39.20	33.37	150	159	Average	VERTICAL
2	11503.62	60.28	74.00	-13.72	40.21	14.24	39.20	33.37	150	159	Peak	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 159 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	11591.12	60.22	74.00	-13.78	40.02	14.40	39.20	33.40	150	254	Peak	HORIZONTAL
2	11599.68	47.92	54.00	-6.08	27.72	14.40	39.20	33.40	150	254	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	11589.36	60.61	74.00	-13.39	40.41	14.40	39.20	33.40	150	186	Peak	VERTICAL
2	11590.83	47.68	54.00	-6.32	27.48	14.40	39.20	33.40	150	186	Average	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 155 / Chain 1 + Chain
Test Date	Dec. 15, 2015		

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	11501.51	60.72	74.00	-13.28	40.65	14.24	39.20	33.37	150	196	Peak	HORIZONTAL
2	11502.92	47.71	54.00	-6.29	27.64	14.24	39.20	33.37	150	196	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	11504.90	60.61	74.00	-13.39	40.54	14.24	39.20	33.37	150	216	Peak	VERTICAL
2	11518.94	47.79	54.00	-6.21	27.68	14.29	39.20	33.38	150	216	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.

4.7. Band Edge Emissions Measurement

4.7.1. Limit

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.

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

4.7.2. 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	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

4.7.3. Test Procedures

1. The test procedure is the same as section 4.6.3.

4.7.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.6.4.

4.7.5. Test Deviation

There is no deviation with the original standard.

4.7.6. 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.

4.7.7. Test Result of Band Edge and Fundamental Emissions

Temperature	26°C	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11a CH 149, 157, 165 / Chain 1
Test Date	Dec. 15, 2015		

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	5713.60	64.76	68.20	-3.44	54.95	8.51	34.43	33.13	150	290	Peak	VERTICAL
2	5725.00	72.36	78.20	-5.84	62.58	8.47	34.44	33.13	150	290	Peak	VERTICAL
3	5738.60	108.92			99.15	8.47	34.44	33.14	150	290	Peak	VERTICAL
4	5740.00	99.43			89.69	8.43	34.45	33.14	150	290	Average	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	5703.80	62.19	68.20	-6.01	52.34	8.56	34.42	33.13	220	315	Peak	HORIZONTAL
2	5722.20	61.63	78.20	-16.57	51.85	8.47	34.44	33.13	220	315	Peak	HORIZONTAL
3	5790.60	106.11			96.47	8.31	34.48	33.15	220	315	Peak	HORIZONTAL
4	5791.40	97.03			87.39	8.31	34.48	33.15	220	315	Average	HORIZONTAL
5	5851.20	62.45	78.20	-15.75	52.55	8.56	34.51	33.17	220	315	Peak	HORIZONTAL
6	5865.40	63.36	68.20	-4.84	53.38	8.64	34.52	33.18	220	315	Peak	HORIZONTAL

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	5830.60	108.82			99.02	8.47	34.50	33.17	142	287	Peak	VERTICAL
2	5831.40	99.77			89.97	8.47	34.50	33.17	142	287	Average	VERTICAL
3	5852.60	67.32	78.20	-10.88	57.42	8.56	34.51	33.17	142	287	Peak	VERTICAL
4	5860.80	64.03	68.20	-4.17	54.05	8.64	34.52	33.18	142	287	Peak	VERTICAL

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

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11a CH 149, 157, 165 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	5714.80	64.92	68.20	-3.28	55.11	8.51	34.43	33.13	257	77	Peak	VERTICAL
2	5723.20	75.84	78.20	-2.36	66.06	8.47	34.44	33.13	257	77	Peak	VERTICAL
3	5738.80	112.17			102.43	8.43	34.45	33.14	257	77	Peak	VERTICAL
4	5739.80	102.73			92.99	8.43	34.45	33.14	257	77	Average	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	5711.80	63.70	68.20	-4.50	53.89	8.51	34.43	33.13	207	66	Peak	VERTICAL
2	5724.20	61.05	78.20	-17.15	51.27	8.47	34.44	33.13	207	66	Peak	VERTICAL
3	5791.40	103.83			94.19	8.31	34.48	33.15	207	66	Average	VERTICAL
4	5791.80	112.44			102.80	8.31	34.48	33.15	207	66	Peak	VERTICAL
5	5854.20	63.67	78.20	-14.53	53.77	8.56	34.51	33.17	207	66	Peak	VERTICAL
6	5884.20	63.08	68.20	-5.12	53.01	8.72	34.53	33.18	207	66	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	5818.60	112.65			102.93	8.39	34.49	33.16	144	285	Peak	VERTICAL
2	5819.80	103.45			93.73	8.39	34.49	33.16	144	285	Average	VERTICAL
3	5857.80	70.09	78.20	-8.11	60.10	8.64	34.52	33.17	144	285	Peak	VERTICAL
4	5860.00	66.52	68.20	-1.68	56.54	8.64	34.52	33.18	144	285	Peak	VERTICAL

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

Temperature	26℃	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149, 157, 165 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	5707.50	65.83	74.00	-8.17	56.02	8.51	34.43	33.13	180	283	Peak	VERTICAL
2	5715.00	50.02	54.00	-3.98	40.21	8.51	34.43	33.13	180	283	Average	VERTICAL
3	5724.49	76.63	78.20	-1.57	66.85	8.47	34.44	33.13	180	283	Peak	VERTICAL
4	5739.87	97.08			87.34	8.43	34.45	33.14	180	283	Average	VERTICAL
5	5749.97	112.03			102.29	8.43	34.45	33.14	180	283	Peak	VERTICAL

Item 4, 5 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	5690.77	61.21	74.00	-12.79	51.36	8.56	34.42	33.13	178	301	Peak	VERTICAL
2	5704.87	49.89	54.00	-4.11	40.04	8.56	34.42	33.13	178	301	Average	VERTICAL
3	5722.76	60.50	78.20	-17.70	50.72	8.47	34.44	33.13	178	301	Peak	VERTICAL
4	5778.59	102.32			92.65	8.35	34.47	33.15	178	301	Average	VERTICAL
5	5780.51	112.38			102.71	8.35	34.47	33.15	178	301	Peak	VERTICAL
6	5850.00	61.33	78.20	-16.87	51.43	8.56	34.51	33.17	178	301	Peak	VERTICAL
7	5865.13	50.03	54.00	-3.97	40.05	8.64	34.52	33.18	178	301	Average	VERTICAL
8	5873.46	61.44	74.00	-12.56	51.37	8.72	34.53	33.18	178	301	Peak	VERTICAL

Item 4, 5 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	5819.55	113.59			103.87	8.39	34.49	33.16	178	285	Peak	VERTICAL
2	5831.57	98.28			88.48	8.47	34.50	33.17	178	285	Average	VERTICAL
3	5850.00	76.29	78.20	-1.91	66.39	8.56	34.51	33.17	178	285	Peak	VERTICAL
4	5860.00	52.24	54.00	-1.76	42.26	8.64	34.52	33.18	178	285	Average	VERTICAL
5	5860.58	66.74	74.00	-7.26	56.76	8.64	34.52	33.18	178	285	Peak	VERTICAL

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

Temperature	26°C	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151, 159 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	5713.01	67.57	74.00	-6.43	57.76	8.51	34.43	33.13	180	293	Peak	VERTICAL
2	5715.00	52.47	54.00	-1.53	42.66	8.51	34.43	33.13	180	293	Average	VERTICAL
3	5724.55	74.47	78.20	-3.73	64.69	8.47	34.44	33.13	180	293	Peak	VERTICAL
4	5758.85	96.41			86.70	8.39	34.46	33.14	180	293	Average	VERTICAL
5	5770.39	106.81			97.11	8.39	34.46	33.15	180	293	Peak	VERTICAL

Item 4, 5 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	5714.23	61.56	74.00	-12.44	51.75	8.51	34.43	33.13	189	298	Peak	VERTICAL
2	5715.00	49.78	54.00	-4.22	39.97	8.51	34.43	33.13	189	298	Average	VERTICAL
3	5718.40	65.09	78.20	-13.11	55.28	8.51	34.43	33.13	189	298	Peak	VERTICAL
4	5791.47	95.42			85.78	8.31	34.48	33.15	189	298	Average	VERTICAL
5	5792.12	112.03			102.39	8.31	34.48	33.15	189	298	Peak	VERTICAL
6	5851.73	67.69	78.20	-10.51	57.79	8.56	34.51	33.17	189	298	Peak	VERTICAL
7	5860.71	50.82	54.00	-3.18	40.84	8.64	34.52	33.18	189	298	Average	VERTICAL
8	5871.92	65.37	74.00	-8.63	55.39	8.64	34.52	33.18	189	298	Peak	VERTICAL

Item 4, 5 are the fundamental frequency at 5795 MHz.

Temperature	26°C	Humidity	68%
Test Engineer	Charlie Cheng	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 155 / Chain 1 + Chain 2
Test Date	Dec. 15, 2015		

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	5700.64	66.97	74.00	-7.03	57.12	8.56	34.42	33.13	175	292	Peak	VERTICAL
2	5715.00	52.35	54.00	-1.65	42.54	8.51	34.43	33.13	175	292	Average	VERTICAL
3	5723.72	75.31	78.20	-2.89	65.53	8.47	34.44	33.13	175	292	Peak	VERTICAL
4	5738.46	107.74			97.97	8.47	34.44	33.14	175	292	Peak	VERTICAL
5	5774.20	90.74			81.07	8.35	34.47	33.15	175	292	Average	VERTICAL
6	5852.56	72.28	78.20	-5.92	62.38	8.56	34.51	33.17	175	292	Peak	VERTICAL
7	5860.00	66.50	74.00	-7.50	56.52	8.64	34.52	33.18	175	292	Peak	VERTICAL
8	5860.60	50.35	54.00	-3.65	40.37	8.64	34.52	33.18	175	292	Average	VERTICAL

Item 4, 5 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

4.8. Frequency Stability Measurement

4.8.1. 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).

4.8.2. Measuring Instruments and Setting

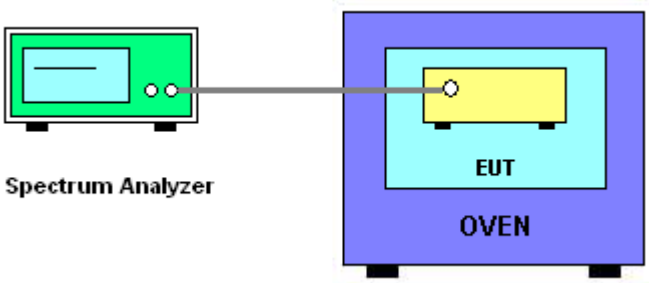
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

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

4.8.3. 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 -20°C~70°C.

4.8.4. Test Setup Layout



4.8.5. Test Deviation

There is no deviation with the original standard.

4.8.6. EUT Operation during Test

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

4.8.7. Test Result of Frequency Stability

Temperature	24°C	Humidity	60%
Test Engineer	Clemens Fang	Test Date	Jan. 13, 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	5785.0286	5785.0272	5785.0254	5785.0233
110.00	5785.0274	5785.0261	5785.0245	5785.0226
93.50	5785.0260	5785.0249	5785.0237	5785.0215
Max. Deviation (MHz)	**0.0285**	**0.0271**	**0.0253**	**0.0233**
Max. Deviation (ppm)	**4.94**	**4.69**	**4.38**	**4.02**
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5785 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
-20	5785.0328	5785.0315	5785.0298	5785.0274
-10	5785.0313	5785.0301	5785.0285	5785.0266
0	5785.0299	5785.0287	5785.0268	5785.0246
10	5785.0286	5785.0273	5785.0258	5785.0240
20	5785.0274	5785.0261	5785.0245	5785.0226
30	5785.0260	5785.0249	5785.0235	5785.0219
40	5785.0244	5785.0229	5785.0213	5785.0193
50	5785.0227	5785.0215	5785.0200	5785.0173
60	5785.0203	5785.0188	5785.0172	5785.0152
70	5785.0174	5785.0162	5785.0147	5785.0120
Max. Deviation (MHz)	**0.0328**	**0.0315**	**0.0298**	**0.0274**
Max. Deviation (ppm)	**5.66**	**5.44**	**5.14**	**4.73**
Result	Complies			

Mode: 40 MHz / Chain 1

Voltage vs. Frequency Stability

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5755 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5755.0333	5755.0319	5755.0301	5755.0280
110.00	5755.0321	5755.0308	5755.0292	5755.0273
93.50	5755.0307	5755.0296	5755.0284	5755.0262
Max. Deviation (MHz)	**0.0333**	**0.0319**	**0.0301**	**0.0280**
Max. Deviation (ppm)	**5.79**	**5.55**	**5.24**	**4.87**
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5755 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
-20	5755.0375	5755.0362	5755.0345	5755.0321
-10	5755.0360	5755.0348	5755.0332	5755.0313
0	5755.0346	5755.0334	5755.0315	5755.0293
10	5755.0333	5755.0320	5755.0305	5755.0287
20	5755.0321	5755.0308	5755.0292	5755.0273
30	5755.0307	5755.0296	5755.0282	5755.0266
40	5755.0291	5755.0276	5755.0260	5755.0240
50	5755.0274	5755.0262	5755.0247	5755.0220
60	5755.0250	5755.0235	5755.0219	5755.0199
70	5755.0221	5755.0209	5755.0194	5755.0167
Max. Deviation (MHz)	**0.0375**	**0.0362**	**0.0345**	**0.0321**
Max. Deviation (ppm)	**6.52**	**6.30**	**6.00**	**5.58**
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	5775.0268	5775.0254	5775.0236	5775.0215
110.00	5775.0256	5775.0243	5775.0227	5775.0208
93.50	5775.0242	5775.0231	5775.0219	5775.0197
Max. Deviation (MHz)	**0.0268**	**0.0254**	**0.0236**	**0.0215**
Max. Deviation (ppm)	**4.64**	**4.40**	**4.09**	**3.73**
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5775 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
-20	5775.0310	5775.0297	5775.0280	5775.0256
-10	5775.0295	5775.0283	5775.0267	5775.0248
0	5775.0281	5775.0269	5775.0250	5775.0228
10	5775.0268	5775.0255	5775.0240	5775.0222
20	5775.0256	5775.0243	5775.0227	5775.0208
30	5775.0242	5775.0231	5775.0217	5775.0201
40	5775.0226	5775.0211	5775.0195	5775.0175
50	5775.0209	5775.0197	5775.0182	5775.0155
60	5775.0185	5775.0170	5775.0154	5775.0134
70	5775.0156	5775.0144	5775.0129	5775.0102
Max. Deviation (MHz)	**0.0310**	**0.0297**	**0.0280**	**0.0256**
Max. Deviation (ppm)	**5.37**	**5.15**	**4.85**	**4.44**
Result	Complies			

4.9. Antenna Requirements

4.9.1. 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.

4.9.2. Antenna Connector Construction

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

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Test Receiver	R&S	ESCS 30	100355	9kHz ~ 2.75GHz	Apr. 12, 2013	Conduction (CO01-CB)
MXE EMI Receiver	Agilent	N9038A	MY52260140	9kHz ~ 8GHz	Dec. 25, 2013	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Nov. 23, 2013	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Nov. 23, 2013	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	Dec. 04, 2013	Conduction (CO01-CB)
Software	Audix	E3	5.410e	-	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA	Schaffner	CBL6112D	22021	20MHz ~ 2GHz	May 26, 2014	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9 kHz - 30 MHz	Nov. 05, 2012*	Radiation (03CH01-CB)
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	8447D	2944A10991	0.1MHz ~ 1.3GHz	Nov. 15, 2014	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 12, 2015	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Feb.10, 2015	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100019	9kHz~40GHz	Dec. 02, 2013	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Oct. 27, 2015	Radiation (03CH01-CB)
EMI Test Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8GHz	Dec. 12, 2013	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz - 1 GHz	Nov. 15, 2014	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)
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-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)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 02, 2015	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410002	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
Conducted Emission (150kHz ~ 30MHz)	3.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%