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FCC RADIO TEST REPORT

Applicant's company	**TRENDnet, Inc.**
Applicant Address	20675 Manhattan Place,Torrance, CA 90501 USA
FCC ID	**XU8TEW828DRU**

Product Name	AC3200 Tri Band Wireless Router
Brand Name	TRENDnet
Model No.	TEW-828DRU
Test Rule Part(s)	47 CFR FCC Part 15 Subpart E § 15.407
Test Freq. Range	5150 ~ 5250 MHz / 5725 ~ 5850 MHz
Received Date	Nov. 06, 2014
Final Test Date	Dec. 04, 2014
Submission Type	Original Equipment

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 v01, KDB662911 D01 v02r01, KDB644545 D03 v01.**

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

Testing Laboratory
1190

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR4N0617AB	Rev. 01	Initial issue of report	Dec. 12, 2014

Certificate No.: CB10312024

1. CERTIFICATE OF COMPLIANCE

Product Name	:	AC3200 Tri Band Wireless Router
Brand Name	:	TRENDnet
Model No.	:	TEW-828DRU
Applicant	:	TRENDnet, Inc.
Test Rule Part(s)	:	47 CFR FCC Part 15 Subpart E § 15.407

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Nov. 06, 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

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	7.02 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	1.40 dB
4.5	15.407(a)	Power Spectral Density	Complies	2.49 dB
4.6	15.407(b)	Radiated Emissions	Complies	0.15 dB
4.7	15.407(b)	Band Edge Emissions	Complies	0.03 dB
4.8	15.407(g)	Frequency Stability	Complies	-
4.9	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

IEEE 802.11n/ac

Items	Description
Product Type	WLAN (3TX, 3RX)
Radio Type	Intentional Transceiver
Power Type	From power adapter
Modulation	see the below table for IEEE 802.11n/ac
Data Modulation	For 802.11n: OFDM (BPSK / QPSK / 16QAM / 64QAM) For 802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
Data Rate (Mbps)	see the below table for IEEE 802.11n/ac
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%)	Band 1: 802.11ac MCS0/Nss1 (VHT20): 23.62 MHz ; 802.11ac MCS0/Nss1 (VHT40): 38.21 MHz ; 802.11ac MCS0/Nss1 (VHT80): 76.41 MHz Band 4: 802.11ac MCS0/Nss1 (VHT20): 18.06 MHz ; 802.11ac MCS0/Nss1 (VHT40): 37.19 MHz ; 802.11ac MCS0/Nss1 (VHT80): 74.67 MHz
Maximum Conducted Output Power	Band 1: 802.11ac MCS0/Nss1 (VHT20): 25.19 dBm ; 802.11ac MCS0/Nss1 (VHT40): 24.21 dBm ; 802.11ac MCS0/Nss1 (VHT80): 19.95 dBm Band 4: 802.11ac MCS0/Nss1 (VHT20): 25.29 dBm ; 802.11ac MCS0/Nss1 (VHT40): 25.93 dBm ; 802.11ac MCS0/Nss1 (VHT80): 21.73 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

IEEE 802.11a

Items	Description
Product Type	WLAN (3TX, 3RX)
Radio Type	Intentional Transceiver
Power Type	From power adapter
Modulation	OFDM for IEEE 802.11a
Data Modulation	OFDM (BPSK / QPSK / 16QAM / 64QAM)
Data Rate (Mbps)	OFDM (6/9/12/18/24/36/48/54)
Frequency Range	5150 ~ 5250 MHz / 5725 ~ 5850 MHz
Channel Number	9
Channel Band Width (99%)	Band 1: 18.06 MHz ; Band 4: 21.36 MHz
Maximum Conducted Output Power	Band 1: 24.53 dBm ; Band 4: 27.58 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

Items	Description	
Communication Mode	☒ IP Based (Load Based)	☐ Frame Based
Beamforming Function	☒ With beamforming	☐ Without beamforming
Operating Mode	☐ Outdoor access point	
	☒ Indoor access point	
	☐ Fixed point-to-point access points	
	☐ Mobile and portable client devices	

Note: The product has beamforming function for 802.11n and 802.11ac.

Antenna and Band width

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

IEEE 11n/ac Spec.

Protocol	Number of Transmit Chains (NTX)	Data Rate / MCS
802.11n (HT20)	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 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

Power	Brand	Model No.	Rating
Adapter 1	Ktec	KSAS0451200350HU	INPUT: 100-240Vac, 50/60Hz, 1.2A OUTPUT: 12Vdc, 3.5A
Adapter 2	HON-KWANG	HK-X142-A12	INPUT: 100-240Vac, 50/60Hz, 1.5A OUTPUT: 12Vdc, 0-3.5A (SER AT 3.5A)
Others			
RJ-45 Cable*1: Non-shielded, 1.5m			

3.3. Table for Filed Antenna

Ant.	Brand	Model No.	Type	Connector	Antenna Gain (dBi)		Cable Loss (dB)		True Gain (dBi)	
					2.4GHz	5GHz	2.4GHz	5GHz	2.4GHz	5GHz
1	JOYMAX	TWF-1561MPXX-711	Dipole	I-PEX	3.0	5.0	0.8	1.1	2.2	3.9
2	JOYMAX	TWF-1561MPXX-711	Dipole	I-PEX	3.0	5.0	0.8	1.1	2.2	3.9
3	JOYMAX	TWF-1561MPXX-711	Dipole	I-PEX	3.0	5.0	0.8	1.1	2.2	3.9
4	JOYMAX	TWF-1561MPXX-711	Dipole	I-PEX	-	5.0	-	1.1	-	3.9
5	JOYMAX	TWF-1561MPXX-711	Dipole	I-PEX	-	5.0	-	1.1	-	3.9
6	JOYMAX	TWF-1561MPXX-711	Dipole	I-PEX	-	5.0	-	1.1	-	3.9

Note: The EUT has six antennas of one set.

Ant. 1～ Ant. 3 supports 2.4GHz WLAN function and 5GHz Band 1 WLAN function.

Ant. 4～ Ant. 6 supports 5GHz Band 4 WLAN function only.

For 2.4GHz Band:

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

Only Chain 1 can be used as transmitting, but Chain 1, Chain 2 and Chain 3 could receive simultaneously.

For IEEE 802.11n mode (3TX, 3RX):

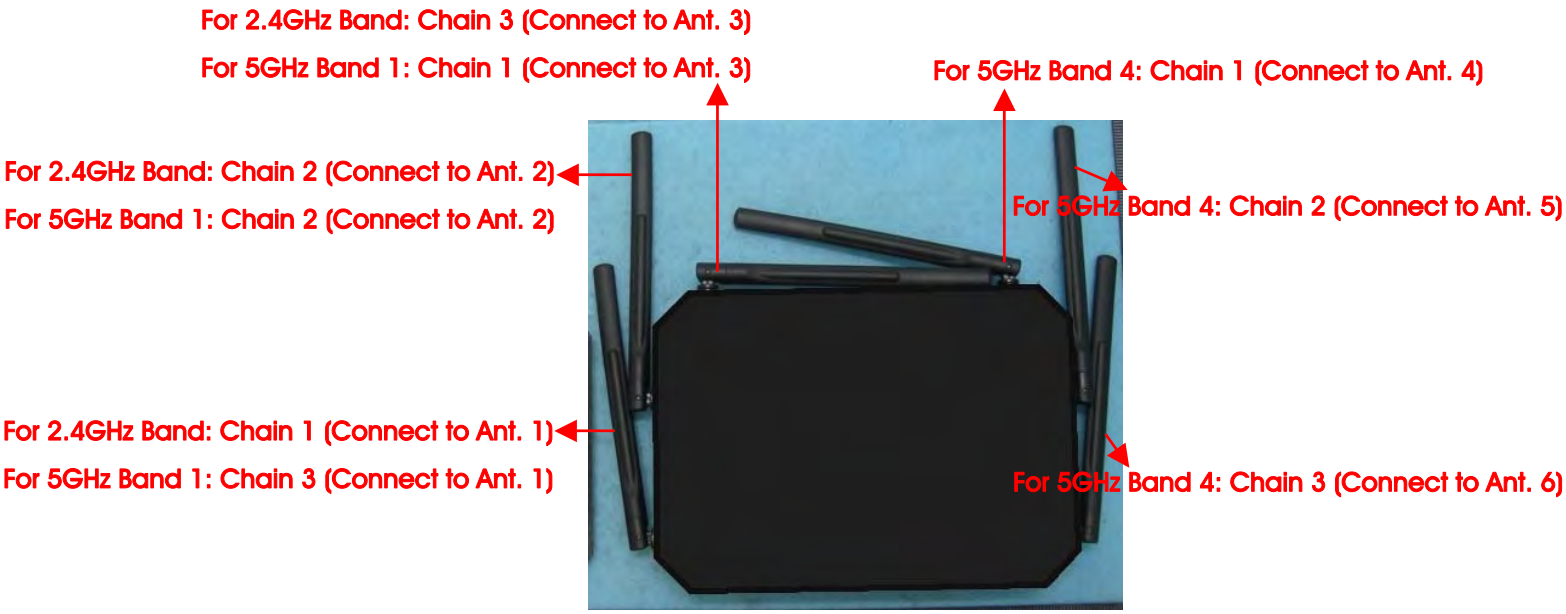
Chain 1, Chain 2 and Chain 3 could transmit/receive simultaneously.

For 5GHz Band 1:

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

For 5GHz Band 4:

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 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	11ac VHT20	Band 1&4	MCS0/Nss1	36/40/48/149/157/165	1+2+3
	11ac VHT40	Band 1&4	MCS0/Nss1	38/46/151/159	1+2+3
	11ac VHT80	Band 1&4	MCS0/Nss1	42/155	1+2+3
	11a/BPSK	Band 1&4	6Mbps	36/40/48/149/157/165	1+2+3
Power Spectral Density	11ac VHT20	Band 1&4	MCS0/Nss1	36/40/48/149/157/165	1+2+3
	11ac VHT40	Band 1&4	MCS0/Nss1	38/46/151/159	1+2+3
	11ac VHT80	Band 1&4	MCS0/Nss1	42/155	1+2+3
	11a/BPSK	Band 1&4	6Mbps	36/40/48/149/157/165	1+2+3
26dB&6dB Spectrum Bandwidth 99% Occupied Bandwidth Measurement	11ac VHT20	Band 1&4	MCS0/Nss1	36/40/48/149/157/165	1+2+3
	11ac VHT40	Band 1&4	MCS0/Nss1	38/46/151/159	1+2+3
	11ac VHT80	Band 1&4	MCS0/Nss1	42/155	1+2+3
	11a/BPSK	Band 1&4	6Mbps	36/40/48/149/157/165	1+2+3
Radiated Emission Below 1GHz	Normal Link		-	-	-
Radiated Emission Above 1GHz	11ac VHT20	Band 1&4	MCS0/Nss1	36/40/48/149/157/165	1+2+3
	11ac VHT40	Band 1&4	MCS0/Nss1	38/46/151/159	1+2+3
	11ac VHT80	Band 1&4	MCS0/Nss1	42/155	1+2+3
	11a/BPSK	Band 1&4	6Mbps	36/40/48/149/157/165	1+2+3

Band Edge Emission	11ac VHT20	Band 1&4	MCS0/Nss1	36/40/48/149/157 /165	1+2+3
	11ac VHT40	Band 1&4	MCS0/Nss1	38/46/151/159	1+2+3
	11ac VHT80	Band 1&4	MCS0/Nss1	42/155	1+2+3
	11a/BPSK	Band 1&4	6Mbps	36/40/48/149/157 /165	1+2+3
Frequency Stability	Un-modulation		-	40	1+2+3

Note: 1. VHT20/VHT40 covers HT20/HT40, due to same modulation.

2. There are two functions of EUT, one is beamforming function, and the other is non-beamforming function for 802.11n/ac, after evaluating, beamforming function 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 AC Power Line Conducted Emissions test:

Mode 1. EUT + Adapter 1

Mode 2. EUT + Adapter 2

Mode 2 is the worst case, so it was selected to record in this test report.

For Radiated Emissions Below 1GHz and Radiated Emission Co-location test:

Mode 1. EUT laying + Adapter 1

Mode 2. EUT standing + Adapter 1

Mode 1 has been evaluated to be the worst case among Mode 1~2, thus measurement for Mode 3 will follow this same test mode.

Mode 3. EUT laying + Adapter 2

For Radiated Emissions Below 1GHz test:

Mode 3 is the worst case, so it was selected to record in this test report.

For Radiated Emission Co-location test:

Mode 3 generated the worst test result for radiated emission below 1GHz test, thus the measurement for radiated emission co-location test will follow this same test configuration.

For Radiated Emissions Above 1GHz test:

Mode 1. EUT laying + Antenna in 90°

Mode 2. EUT standing + Antenna in 90°

Mode 2 has been evaluated to be the worst case among Mode 1~2, thus measurement for Mode 3 will follow this same test mode.

Mode 3. EUT standing + Antenna in 0°

Mode 2 is the worst case, so it was selected to record in this test report.

For Co-location MPE and Radiated Emission Co-location 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 Appendix B) and Radiated Emission Co-location (please refer to Appendix C) tests are added for simultaneously transmit between 2.4GHz WLAN function, 5GHz Band 1 WLAN function and 5GHz Band 4 WLAN 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 Supporting Units

For Test Site No: CO01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	E6430	DoC
NB	DELL	E6430	DoC
NB	DELL	E6430	DoC
NB	DELL	E6430	DoC
NB	DELL	E6430	DoC
Flash Disk	Transcend	604108 8255	DoC
Flash Disk	TDK	TF30	DoC

For Test Site No: 03CH01-CB (below 1GHz)

Support Unit	Brand	Model	FCC ID
NB	DELL	M1330	DoC
NB	DELL	M1340	DoC
NB	DELL	E6430	DoC
NB	DELL	D420	DoC
NB	Apple	Mac Book	DoC
Flash Disk	Silicon	D33B01	DoC
Flash Disk	TDK	TF30	DoC

Test Site No: 03CH01-CB (above 1GHz)

For non-beamforming function:

Support Unit	Brand	Model	FCC ID
NB	DELL	M1330	DoC

For beamforming function:

Support Unit	Brand	Model	FCC ID
NB	DELL	M1330	DoC
NB	DELL	M1340	DoC
WLAN ac Dongle	Netgear	A6200	PY312200200

For Test Site No: TH01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	E6220	DoC

3.8. 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.

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT20

Test Software Version	MTool_2.0.1.0					
Frequency	5180 MHz	5200 MHz	5240 MHz	5745 MHz	5785 MHz	5825 MHz
MCS0/Nss1 VHT20	80	83	84	72	80	77

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT40

Test Software Version	MTool_2.0.1.0			
Frequency	5190 MHz	5230 MHz	5755 MHz	5795 MHz
MCS0/Nss1 VHT40	79	82	61	80

Power Parameters of IEEE 802.11ac MCS0/Nss1 VHT80

Test Software Version	MTool_2.0.1.0	
Frequency	5210 MHz	5775 MHz
MCS0/Nss1 VHT80	75	66

Power Parameters of IEEE 802.11a

Test Software Version	MTool_2.0.1.0					
Frequency	5180 MHz	5200 MHz	5240 MHz	5745 MHz	5785 MHz	5825 MHz
802.11a	82	83	83	74	90	80

3.9. EUT Operation during Test

For non-beamforming function:

The EUT was programmed to be in continuously transmitting mode.

For beamforming function:

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:

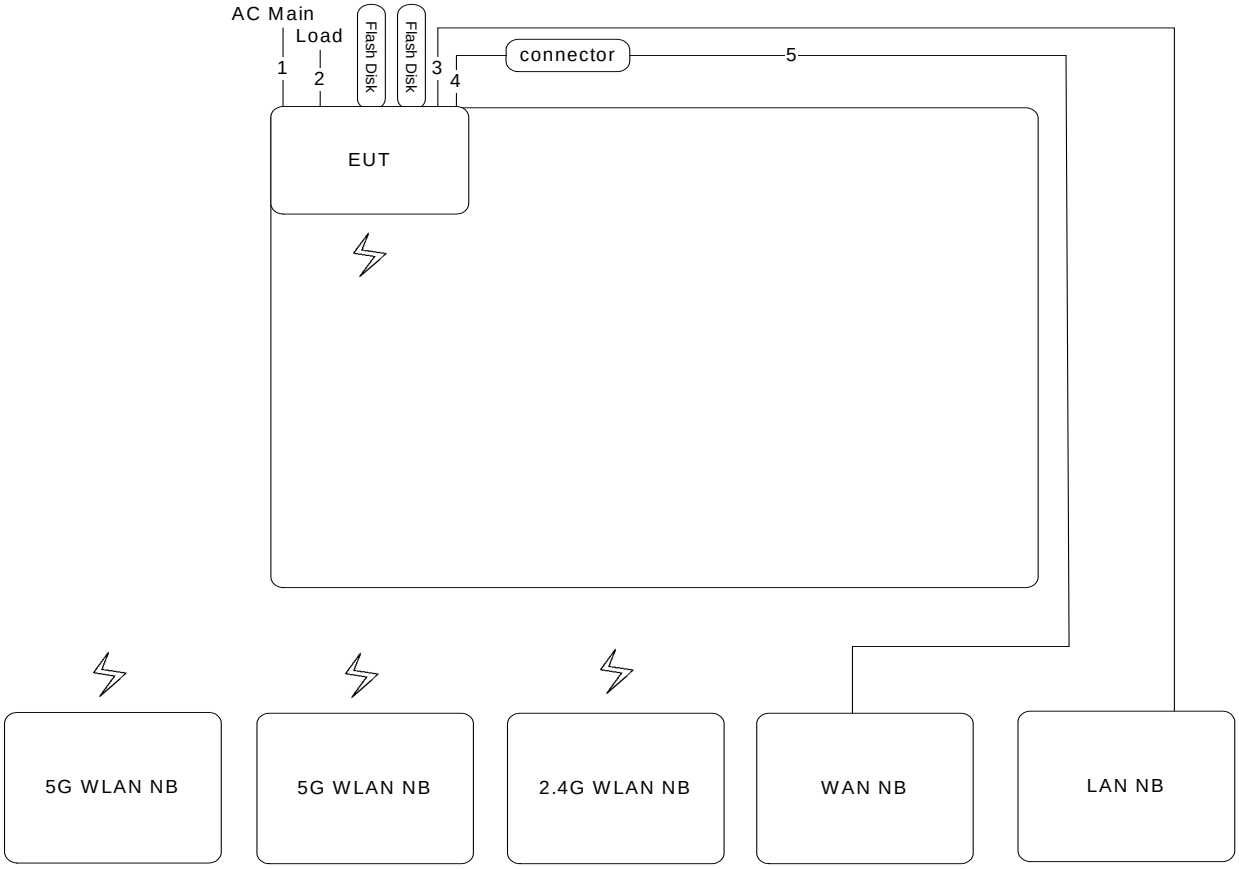
1. During the test, the EUT operation to normal function.
2. Executed command fixed test channel under DOS.
3. Executed "Lantest.exe " to link with the remote workstation to receive and transmit packet by WLAN ac Dongle and transmit duty cycle no less 98%

3.10. Duty Cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
802.11ac MCS0/Nss1 VHT20	3.980	4.120	96.60	0.15	0.25
802.11ac MCS0/Nss1 VHT40	3.667	4.073	90.04	0.46	0.27
802.11ac MCS0/Nss1 VHT80	5.015	5.420	92.51	0.34	0.20
802.11a	2.059	2.091	98.47	0.07	0.01

3.11. Test Configurations

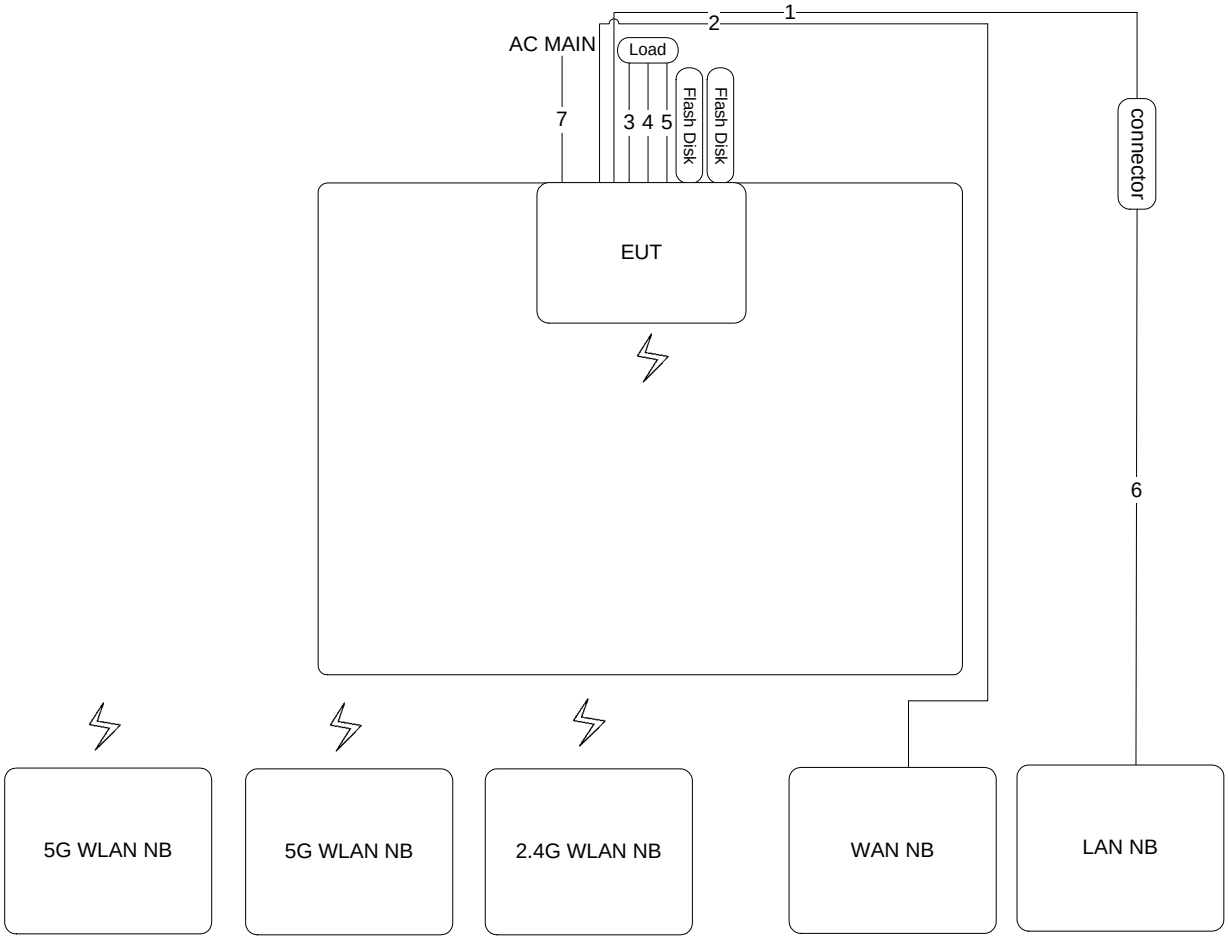
3.11.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length	Remark
1	Power cable	No	1.5m	-
2	RJ-45 cable*3	No	1m	Load
3	RJ-45 cable	No	10m	-
4	RJ-45 cable	No	1.5m	-
5	RJ-45 cable	No	10m	-

3.11.2. Radiation Emissions Test Configuration

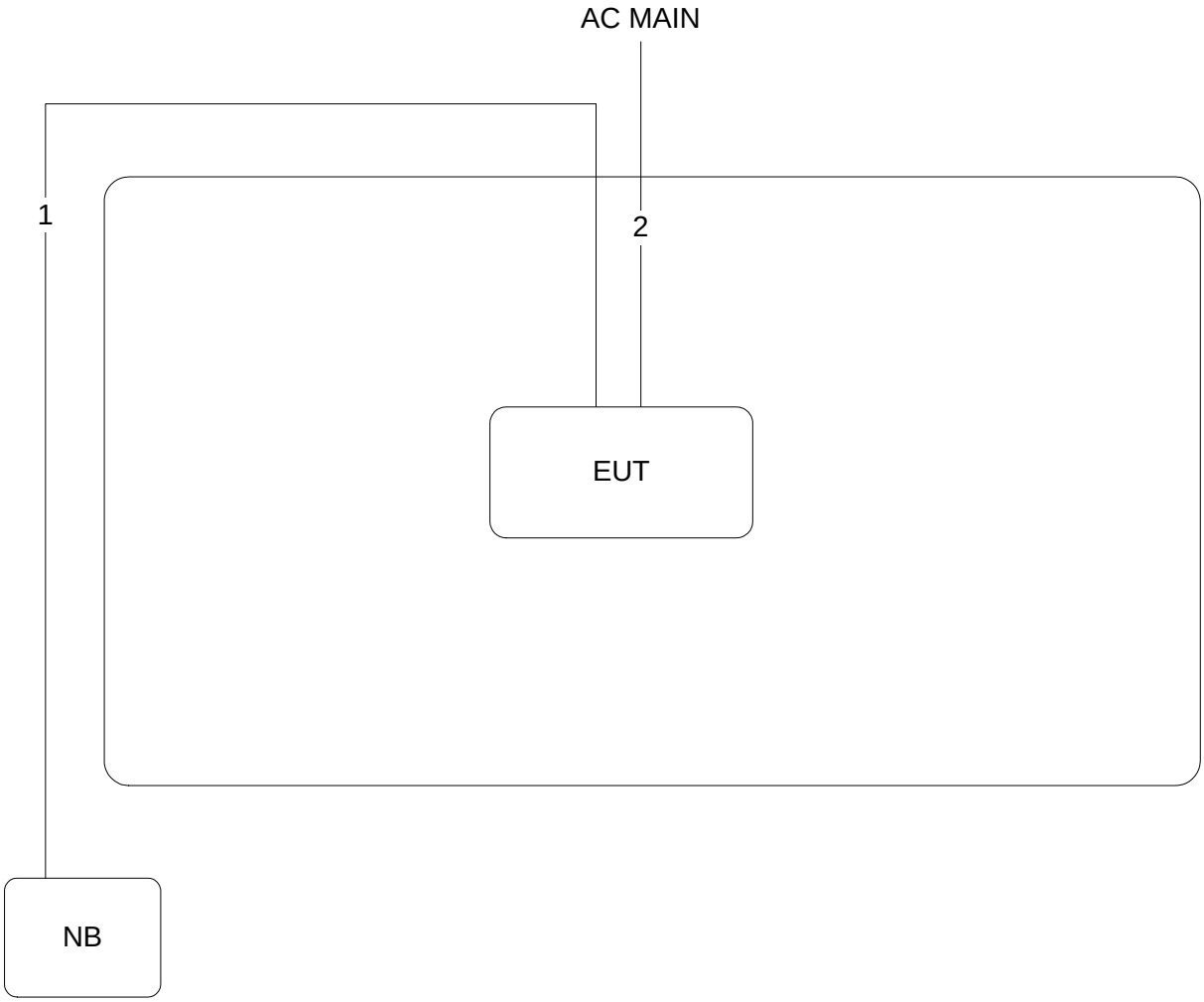
Test Configuration: 30MHz~1GHz



Item	Connection	Shielded	Length	Remark
1	RJ-45 cable	No	1.5m	-
2	RJ-45 cable	No	10m	-
3	RJ-45 cable	No	1.5m	Load
4	RJ-45 cable	No	1.5m	Load
5	RJ-45 cable	No	1.5m	Load
6	RJ-45 cable	No	10m	-
7	Power cable	No	1.5m	-

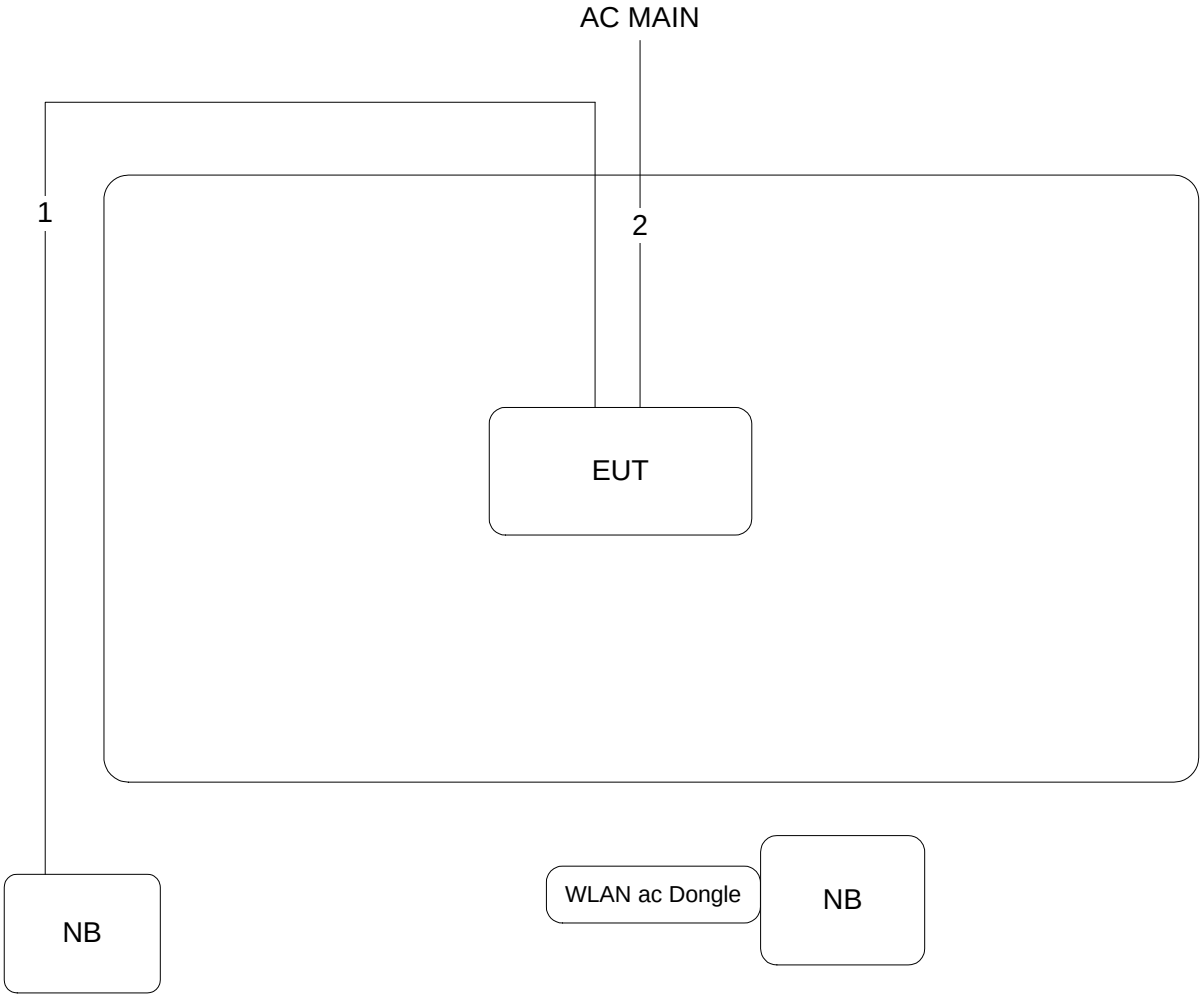
Test Configuration: above 1GHz

For non-beamforming function:



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

For beamforming function:



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

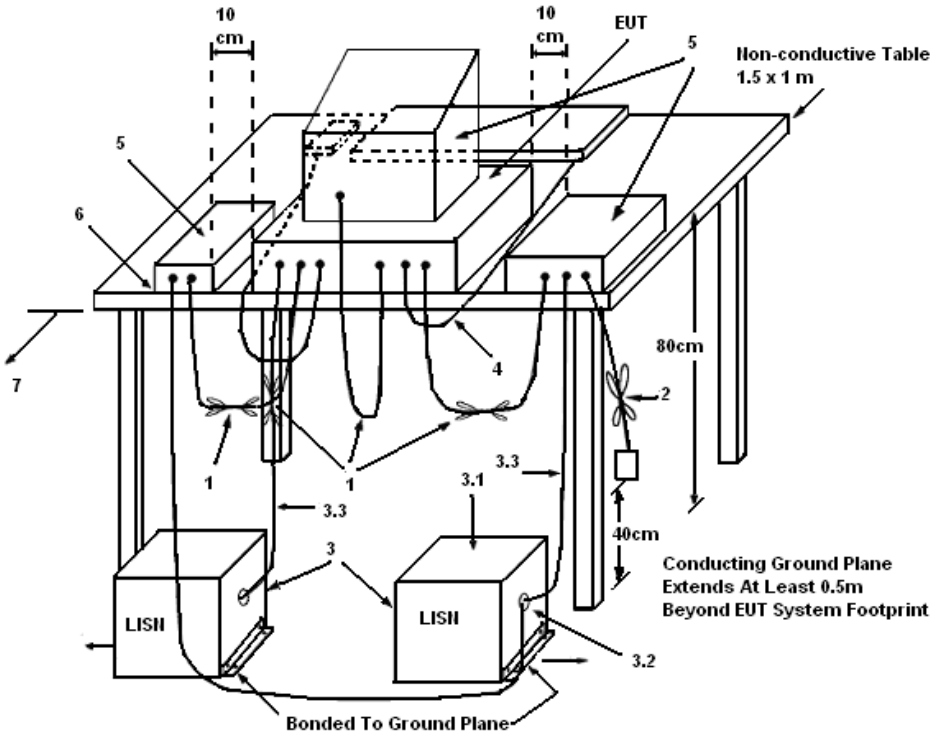
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

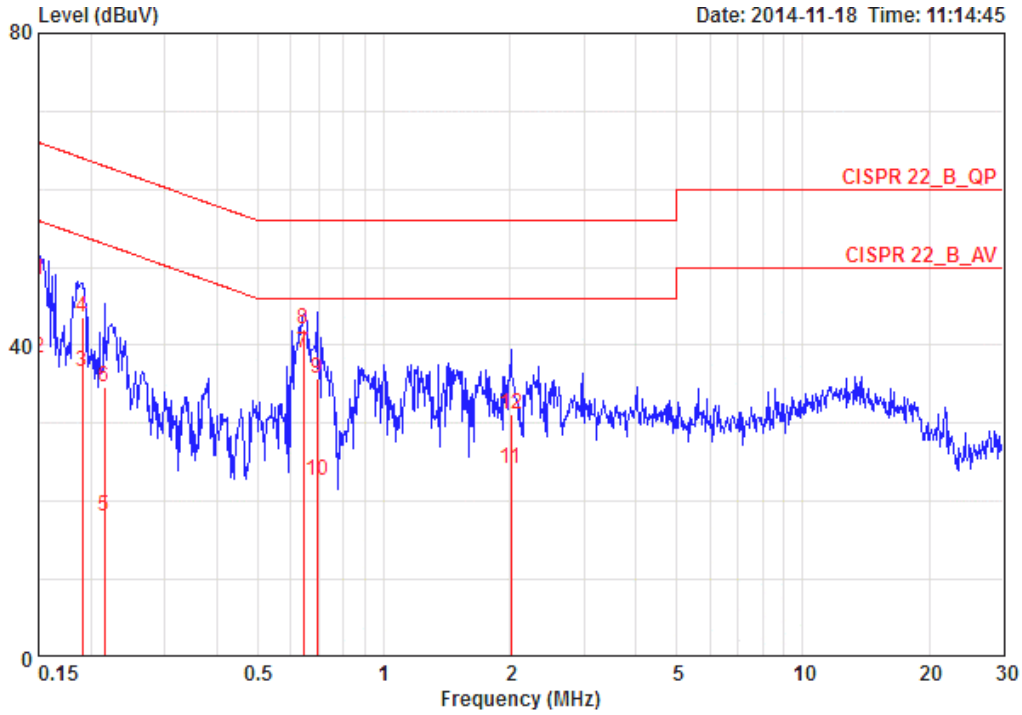
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

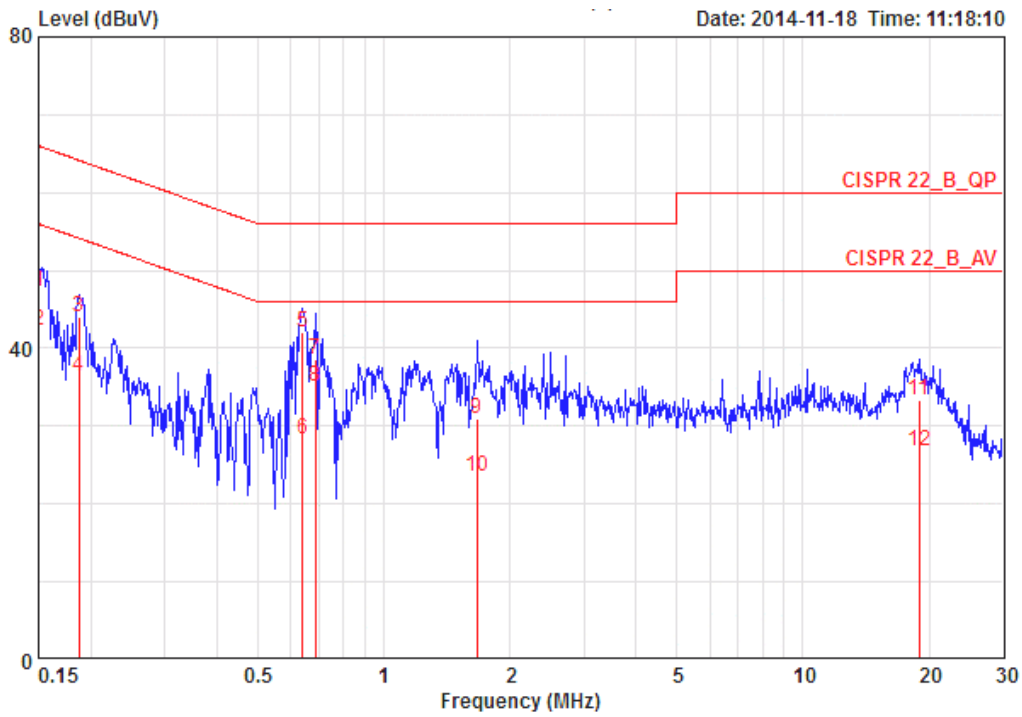
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	23°C	Humidity	55%
Test Engineer	Edison Lin	Phase	Line
Configuration	Normal Link	Test Mode	Mode 2



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.15000	48.30	-17.70	66.00	38.18	9.96	0.16	QP	LINE
2	0.15000	38.47	-17.53	56.00	28.35	9.96	0.16	AVERAGE	LINE
3	0.19039	36.59	-17.43	54.02	26.47	9.96	0.16	AVERAGE	LINE
4	0.19039	43.62	-20.40	64.02	33.50	9.96	0.16	QP	LINE
5	0.21506	18.01	-35.00	53.01	7.88	9.96	0.17	AVERAGE	LINE
6	0.21506	34.77	-28.24	63.01	24.64	9.96	0.17	QP	LINE
7 @	0.64398	38.98	-7.02	46.00	28.81	9.98	0.19	AVERAGE	LINE
8	0.64398	42.04	-13.96	56.00	31.87	9.98	0.19	QP	LINE
9	0.69357	35.71	-20.29	56.00	25.54	9.98	0.19	QP	LINE
10	0.69357	22.73	-23.27	46.00	12.56	9.98	0.19	AVERAGE	LINE
11	2.012	24.21	-21.79	46.00	13.93	10.03	0.25	AVERAGE	LINE
12	2.012	31.22	-24.78	56.00	20.94	10.03	0.25	QP	LINE

Temperature	23°C	Humidity	55%
Test Engineer	Edison Lin	Phase	Neutral
Configuration	Normal Link	Test Mode	Mode 2



		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
		MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1		0.15000	47.31	-18.69	66.00	37.20	9.95	0.16	QP	NEUTRAL
2		0.15000	42.29	-13.71	56.00	32.18	9.95	0.16	AVERAGE	NEUTRAL
3		0.18739	44.11	-20.04	64.15	34.00	9.95	0.16	QP	NEUTRAL
4		0.18739	36.47	-17.68	54.15	26.36	9.95	0.16	AVERAGE	NEUTRAL
5		0.64058	42.12	-13.88	56.00	31.96	9.97	0.19	QP	NEUTRAL
6		0.64058	28.41	-17.59	46.00	18.25	9.97	0.19	AVERAGE	NEUTRAL
7		0.68626	38.61	-17.39	56.00	28.45	9.97	0.19	QP	NEUTRAL
8	@	0.68626	35.02	-10.98	46.00	24.86	9.97	0.19	AVERAGE	NEUTRAL
9		1.671	30.95	-25.05	56.00	20.71	10.00	0.24	QP	NEUTRAL
10		1.671	23.45	-22.55	46.00	13.21	10.00	0.24	AVERAGE	NEUTRAL
11		18.920	33.33	-26.67	60.00	22.47	10.37	0.50	QP	NEUTRAL
12		18.920	26.89	-23.11	50.00	16.03	10.37	0.50	AVERAGE	NEUTRAL

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	26°C	Humidity	63%
Test Engineer	James Chou	Configurations	IEEE 802.11ac

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
36	5180 MHz	31.65	18.64
40	5200 MHz	36.99	23.62
48	5240 MHz	35.36	19.57
149	5745 MHz	21.13	17.36
157	5785 MHz	29.65	18.06
165	5825 MHz	25.73	17.97

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

Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
38	5190 MHz	52.17	37.05
46	5230 MHz	72.81	38.21
151	5755 MHz	40.14	36.03
159	5795 MHz	76.23	37.19

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

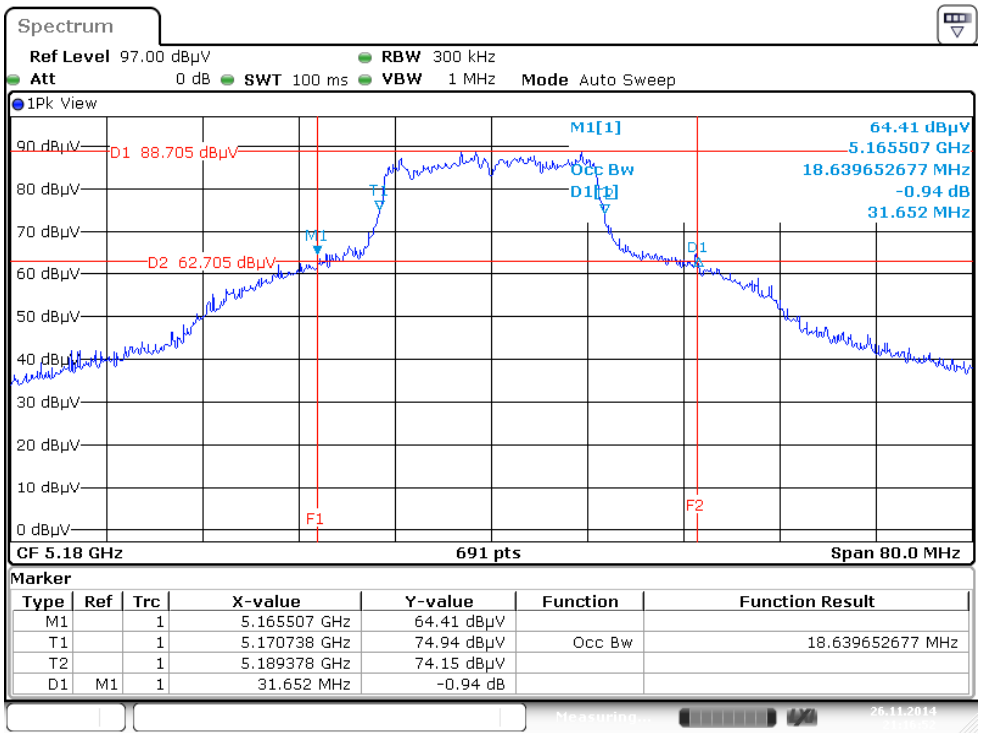
Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
42	5210 MHz	81.16	76.41
155	5775 MHz	80.29	74.67

Temperature	26°C	Humidity	63%
Test Engineer	James Chou	Configurations	IEEE 802.11a

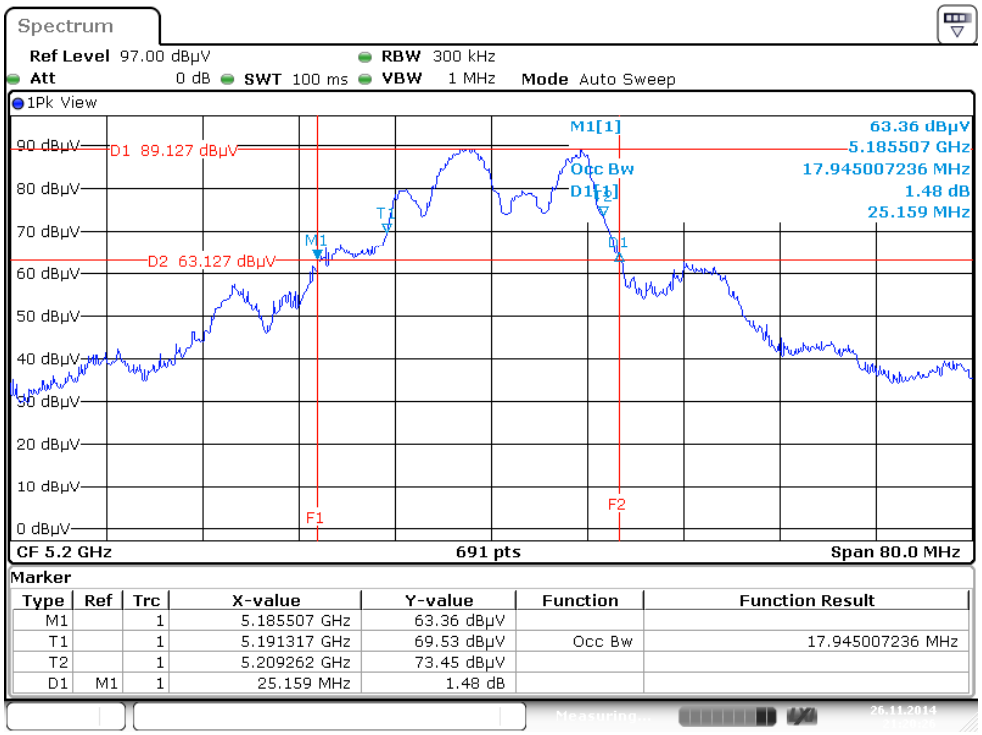
Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
36	5180 MHz	23.77	17.37
40	5200 MHz	25.16	17.95
48	5240 MHz	25.04	18.06
149	5745 MHz	20.78	16.93
157	5785 MHz	36.43	21.36
165	5825 MHz	22.78	17.36

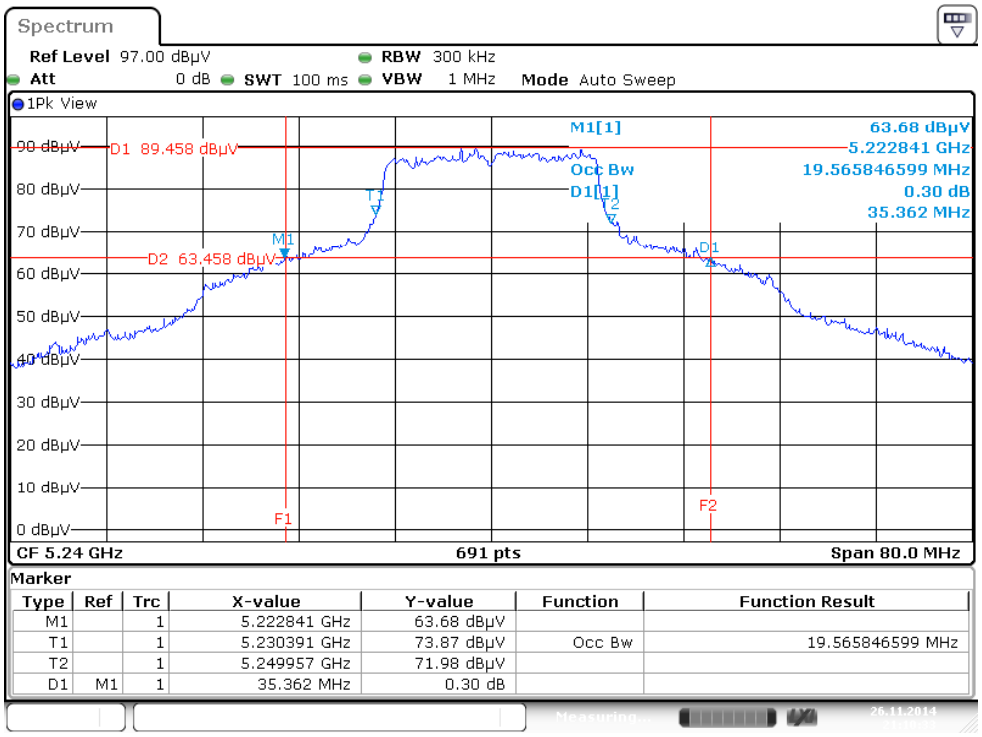
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5180 MHz



26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5200 MHz



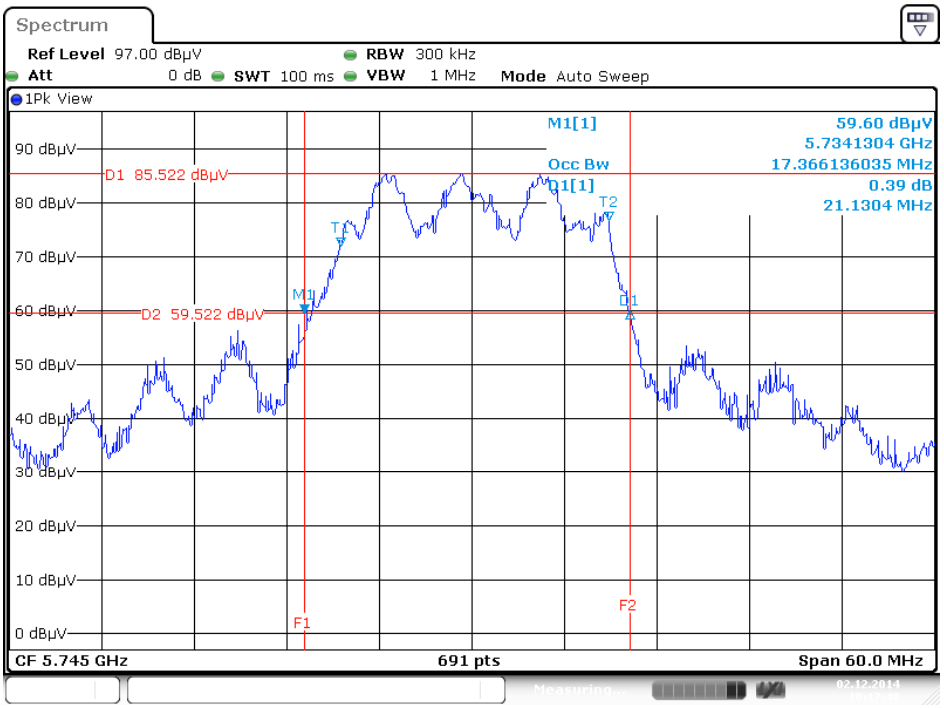
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5240 MHz



Marker

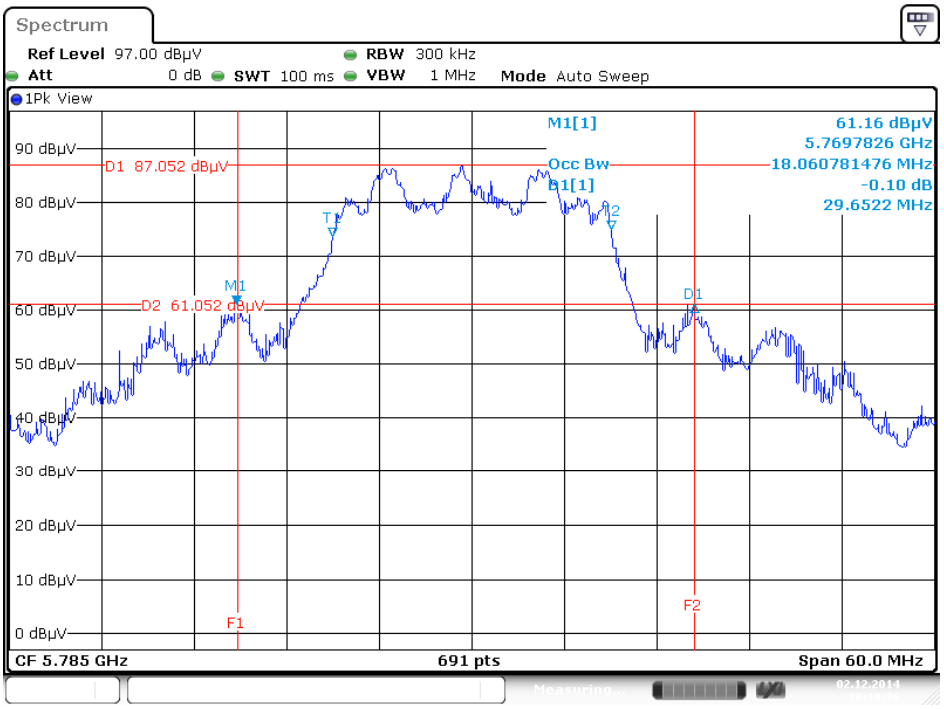
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.222841 GHz	63.68 dBµV		
T1		1	5.230391 GHz	73.87 dBµV	Occ Bw	19.565846599 MHz
T2		1	5.249957 GHz	71.98 dBµV		
D1	M1	1	35.362 MHz	0.30 dB		

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



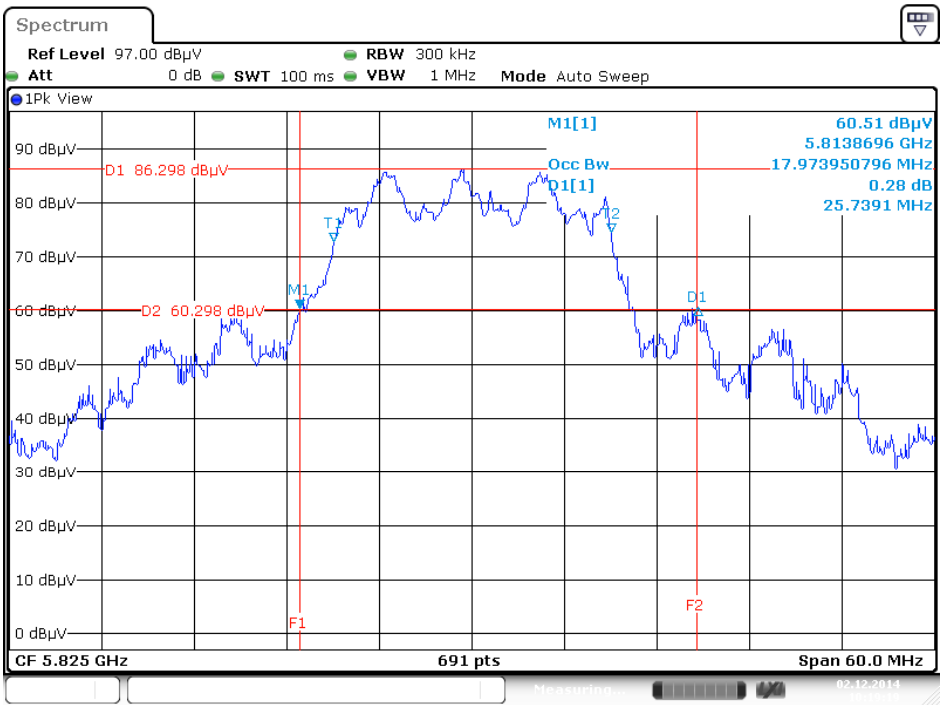
Date: 2.DEC.2014 10:17:40

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5785 MHz



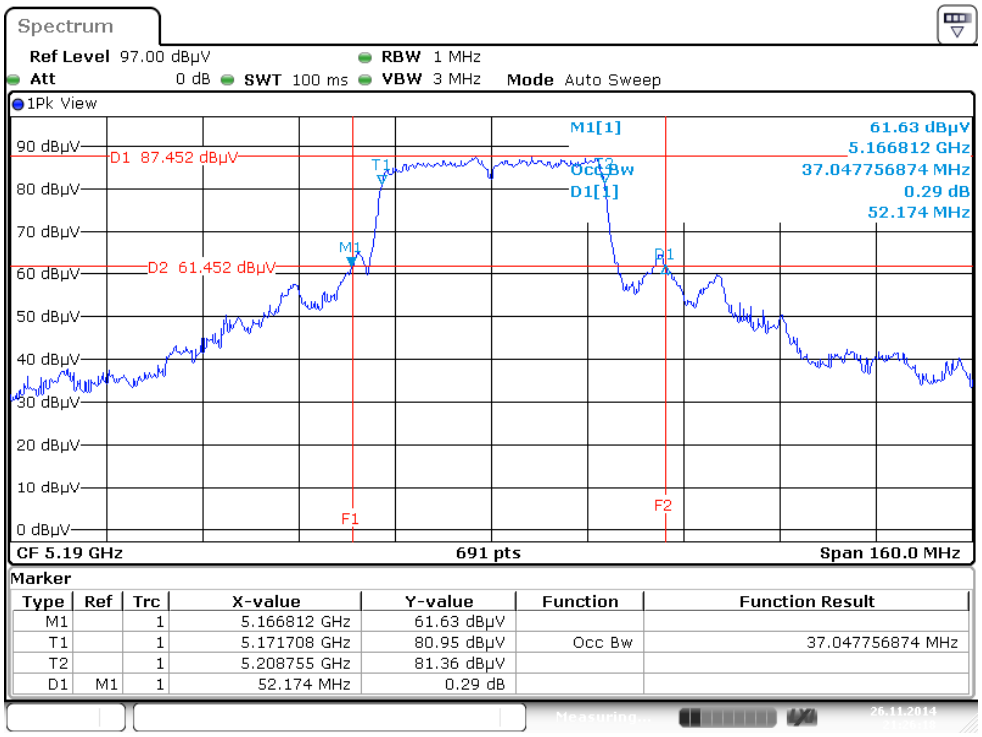
Date: 2.DEC.2014 10:18:36

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

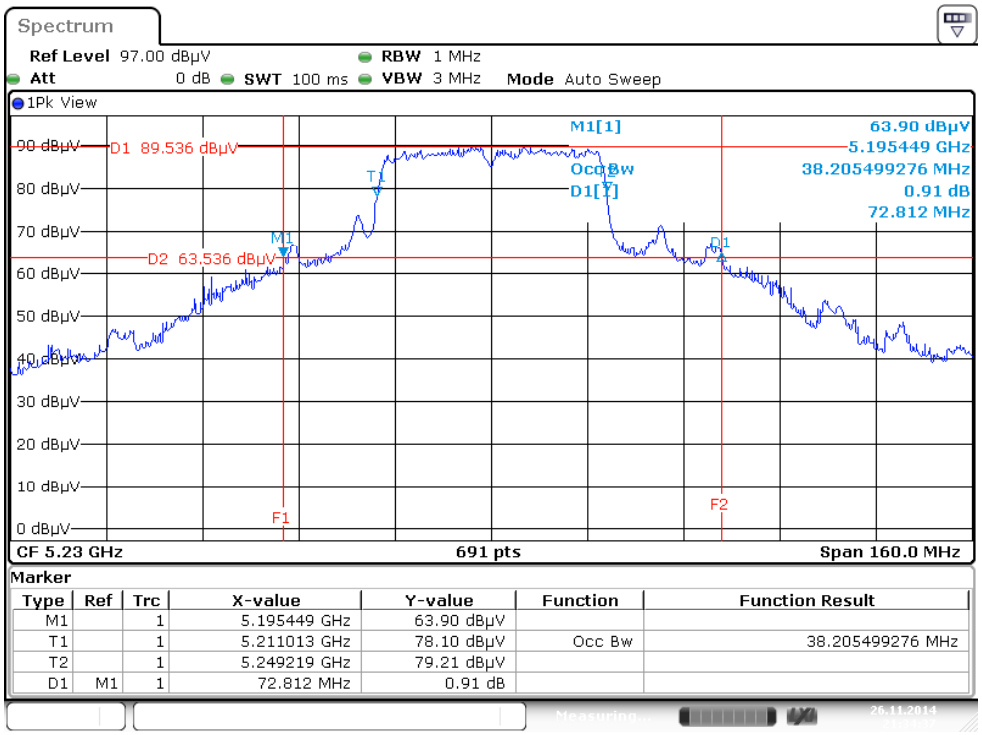


Date: 2.DEC.2014 10:19:20

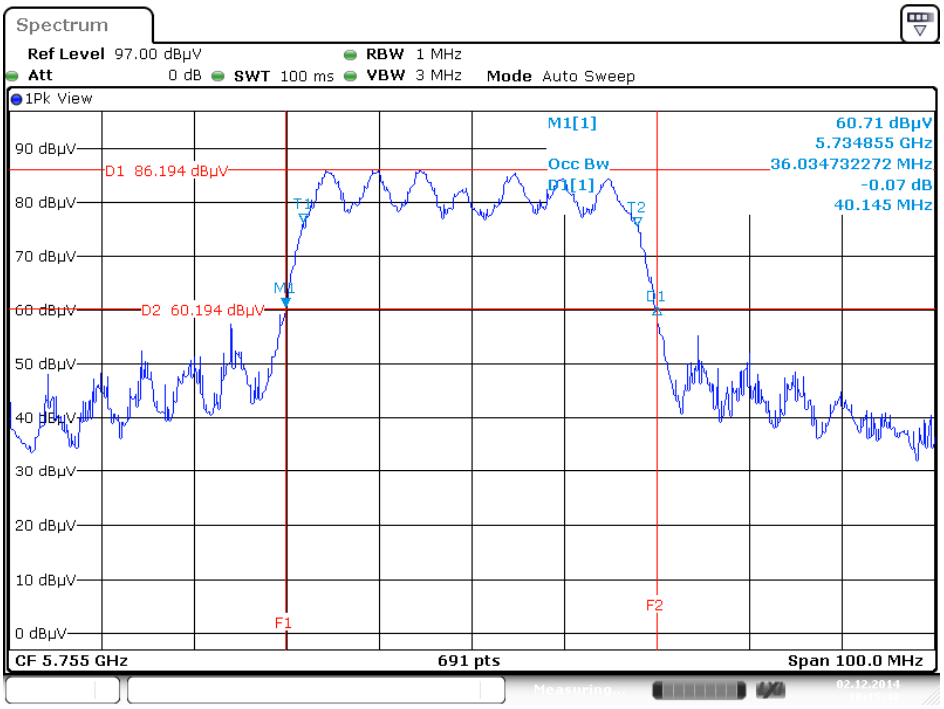
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5190 MHz



26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5230 MHz

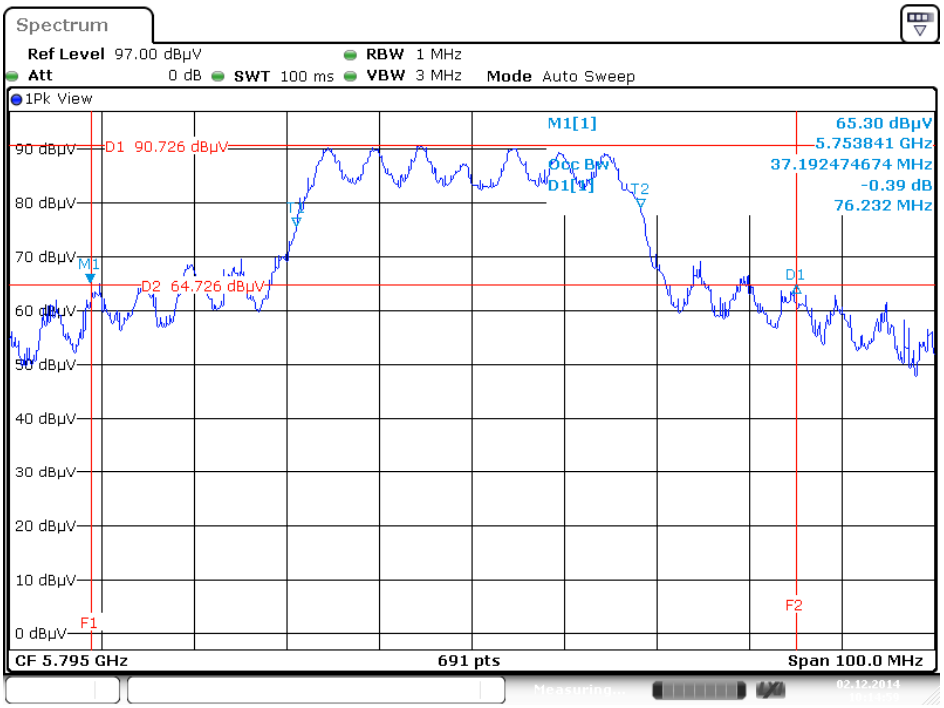


26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5755 MHz



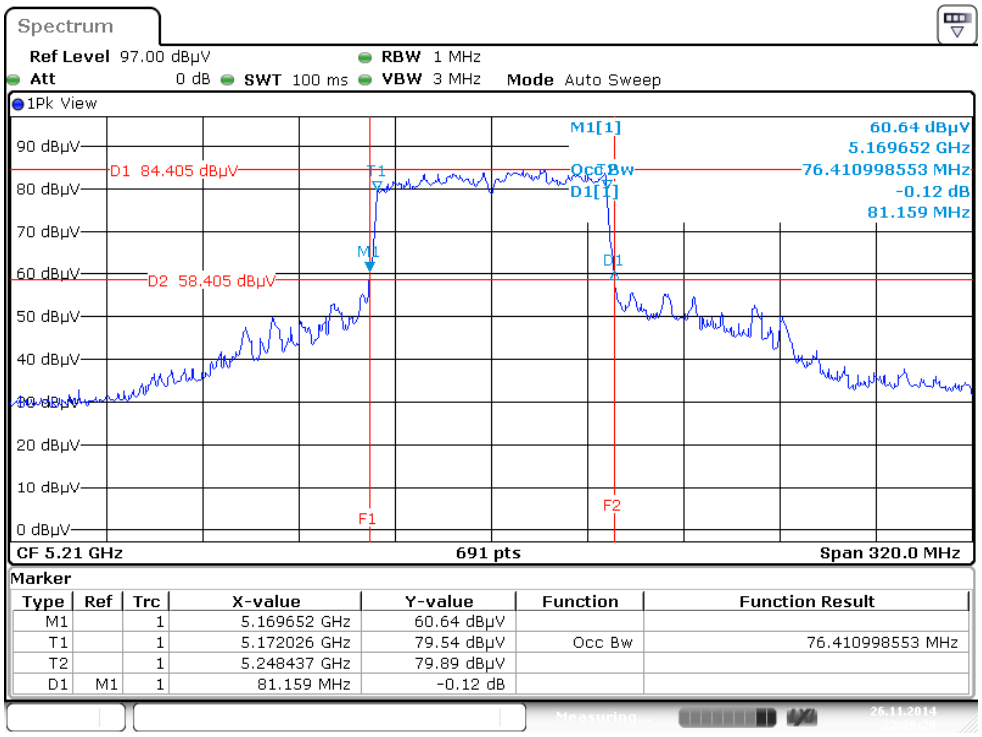
Date: 2.DEC.2014 10:15:49

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

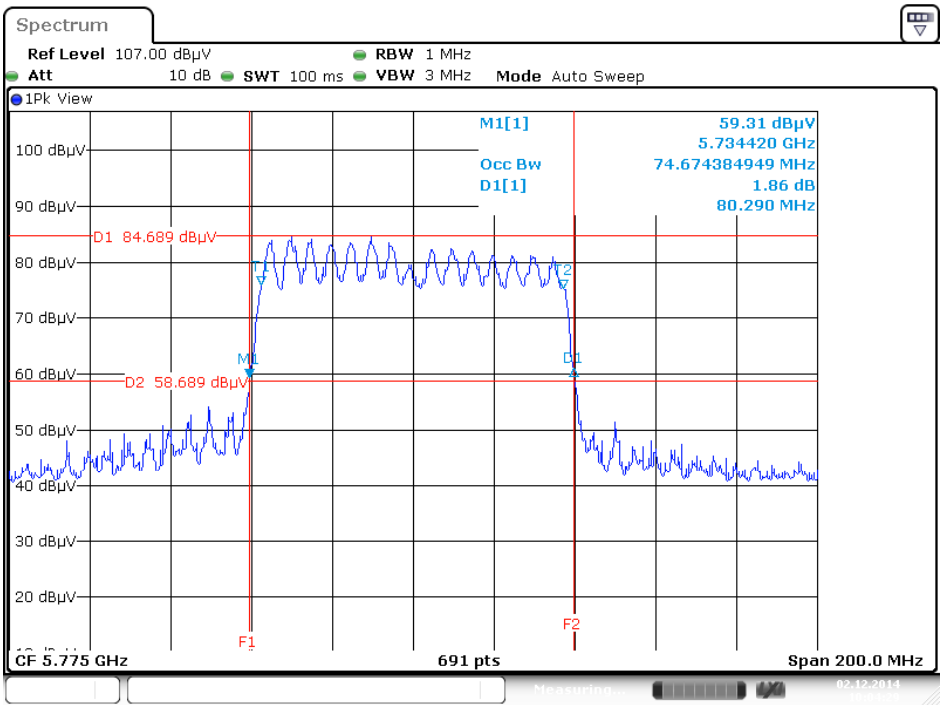


Date: 2.DEC.2014 10:14:59

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5210 MHz

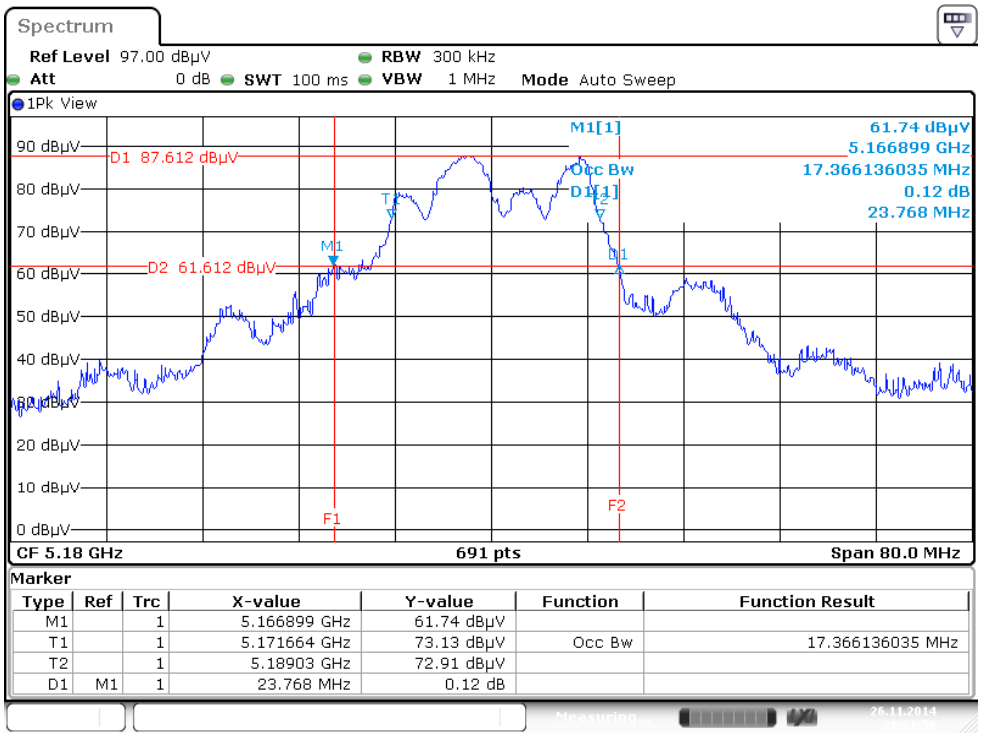


26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5775 MHz

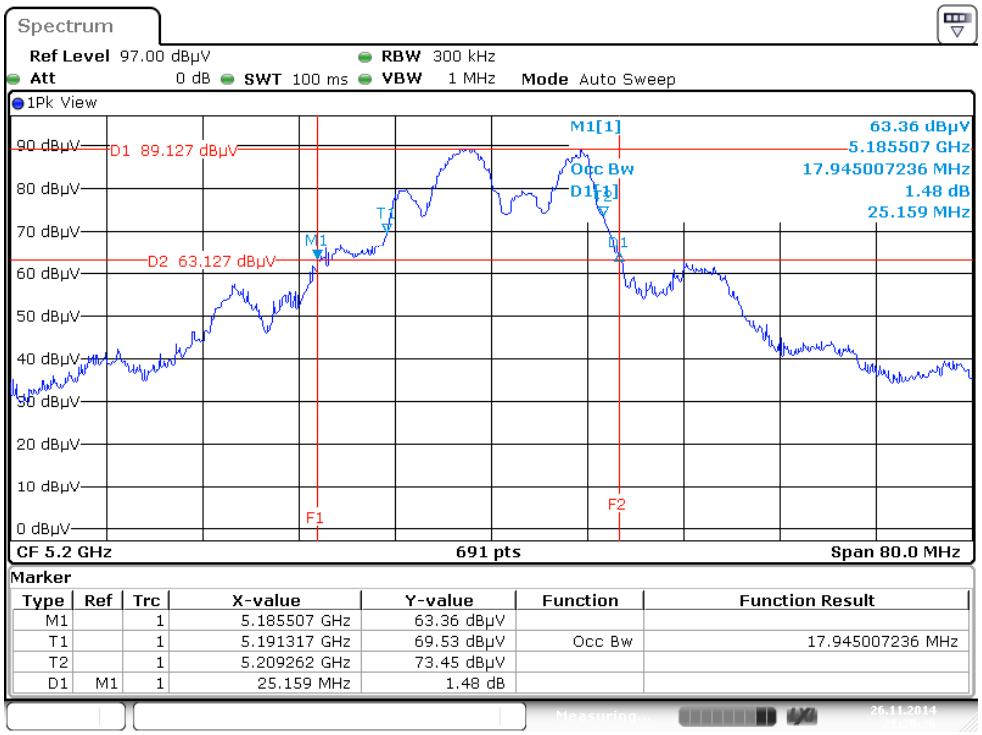


Date: 2.DEC.2014 10:04:29

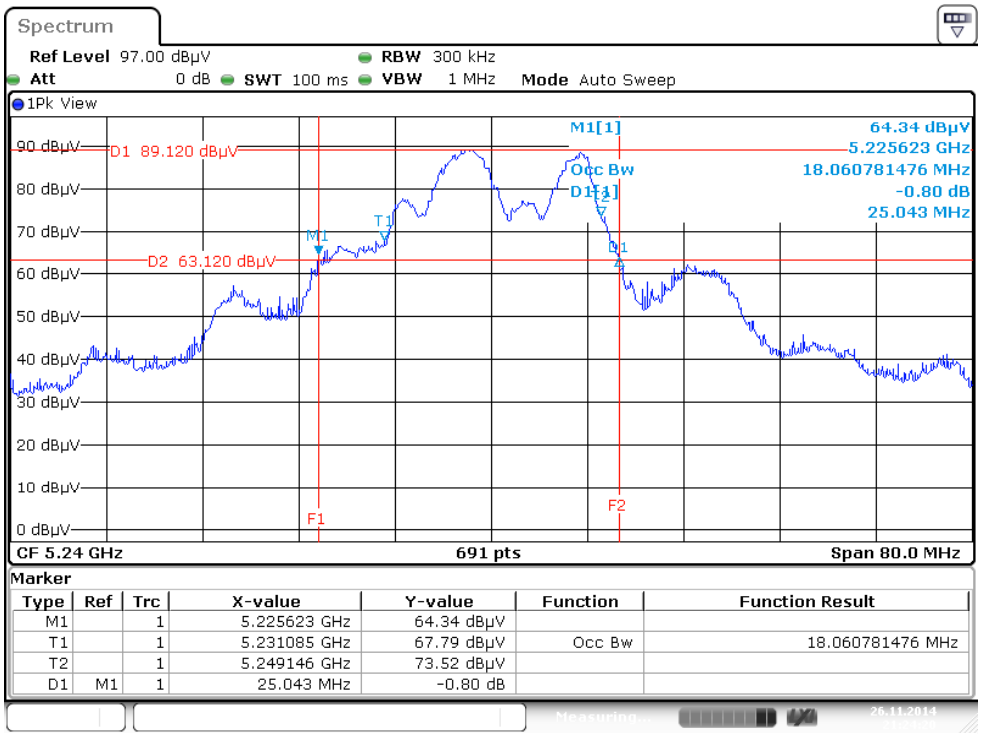
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5180 MHz



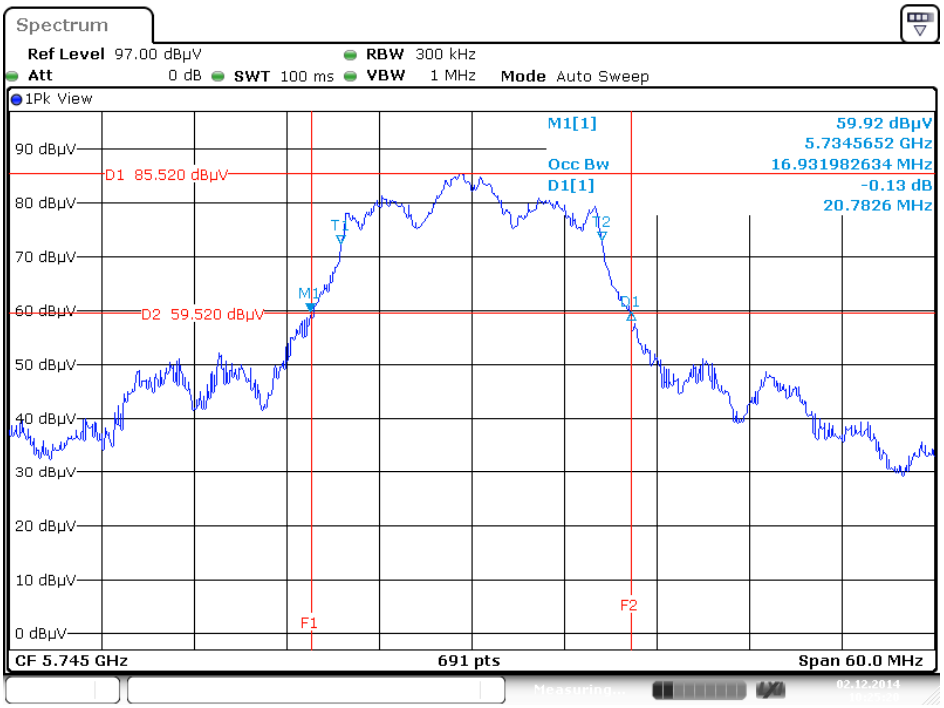
26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5200 MHz



26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5240 MHz

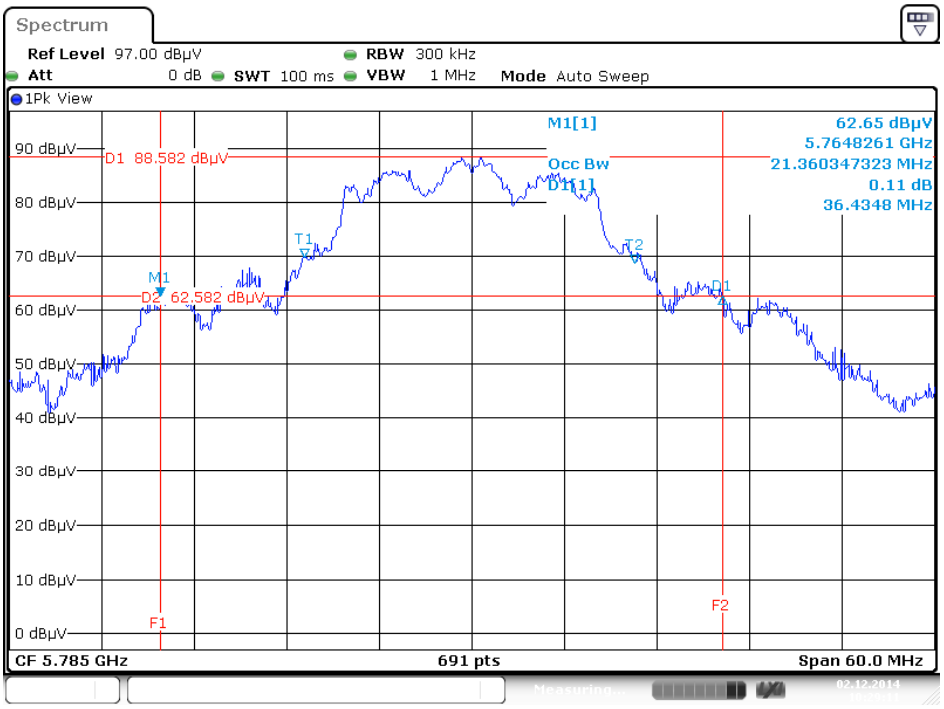


26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5745 MHz



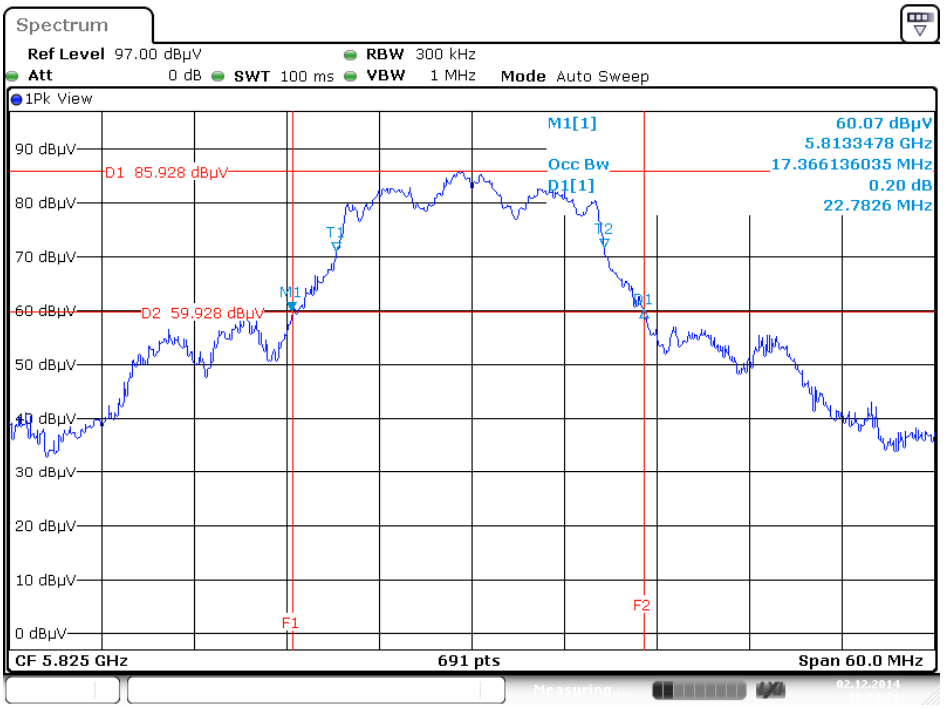
Date: 2.DEC.2014 10:25:20

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5785 MHz



Date: 2.DEC.2014 10:29:10

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



Date: 2.DEC.2014 10:23:21

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	approximately 1% of the emission bandwidth
VBW	VBW > 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 v01 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	26°C	Humidity	63%
Test Engineer	James Chou	Configurations	IEEE 802.11ac

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
149	5745 MHz	15.07	500	Complies
157	5785 MHz	16.28	500	Complies
165	5825 MHz	15.18	500	Complies

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

Channel	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
151	5755 MHz	31.76	500	Complies
159	5795 MHz	33.85	500	Complies

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

Channel	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
155	5775 MHz	71.42	500	Complies

Temperature	26°C	Humidity	63%
Test Engineer	James Chou	Configurations	IEEE 802.11a

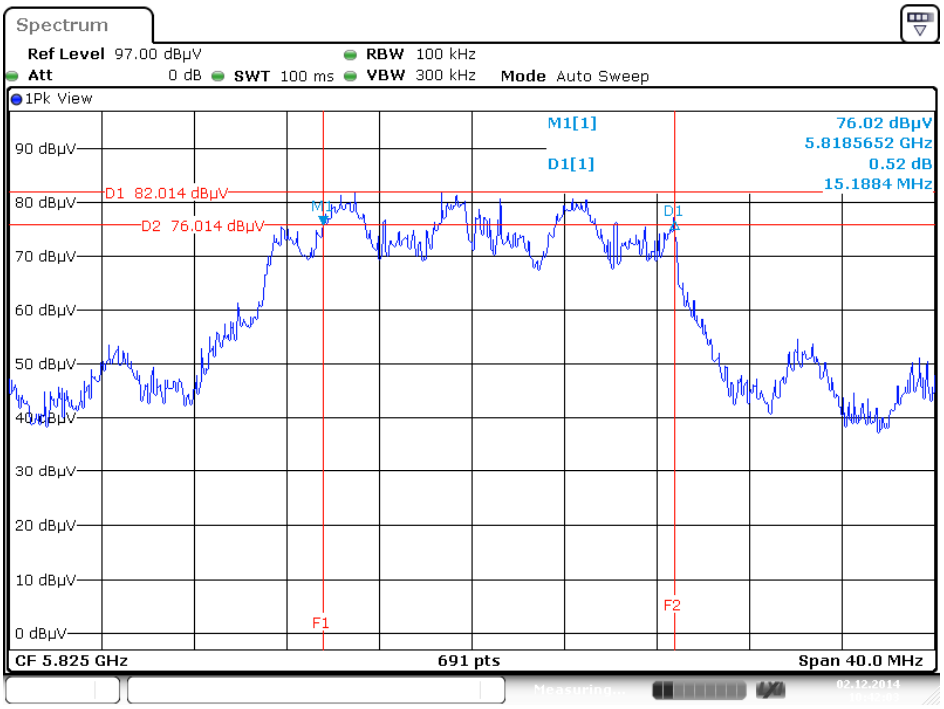
Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
149	5745 MHz	16.28	500	Complies
157	5785 MHz	14.49	500	Complies
165	5825 MHz	13.79	500	Complies

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

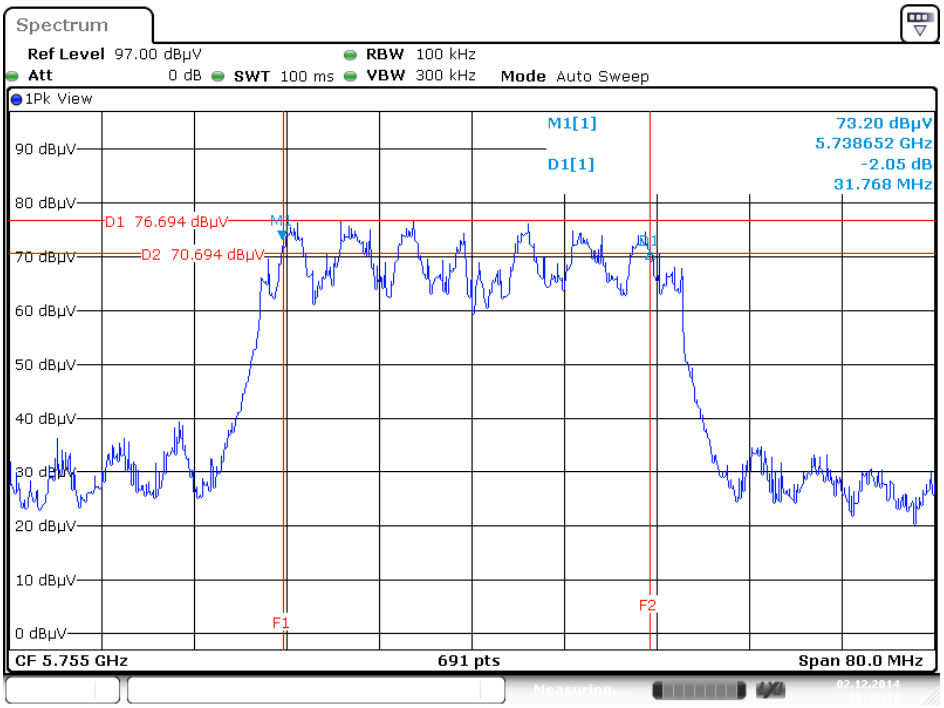
For plots, only the channel with worse result was shown.

6 dB Bandwidth Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5825 MHz



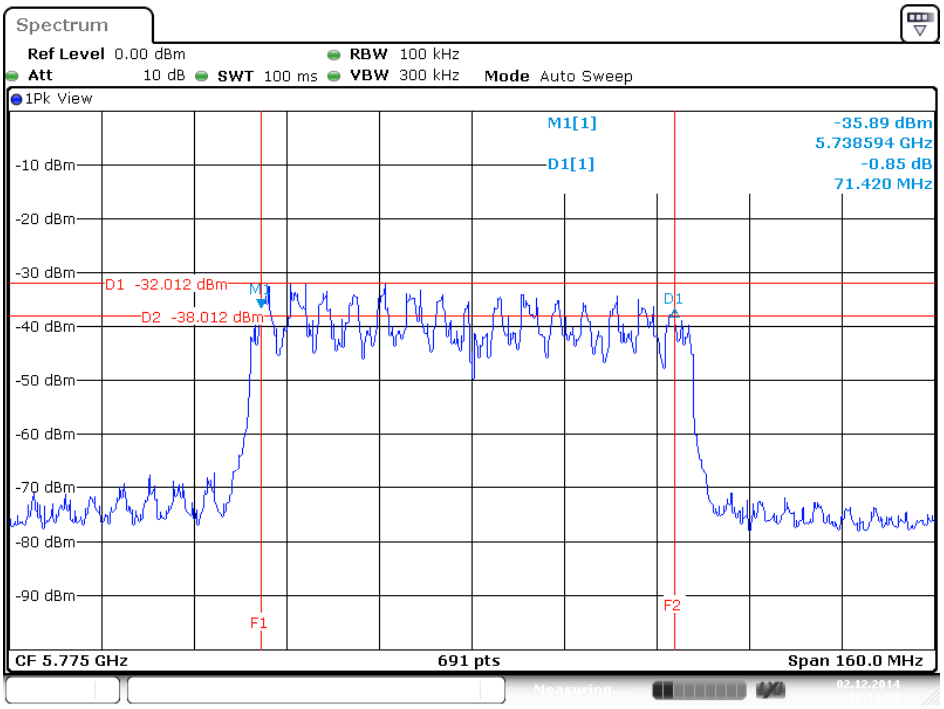
Date: 2.DEC.2014 10:42:03

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



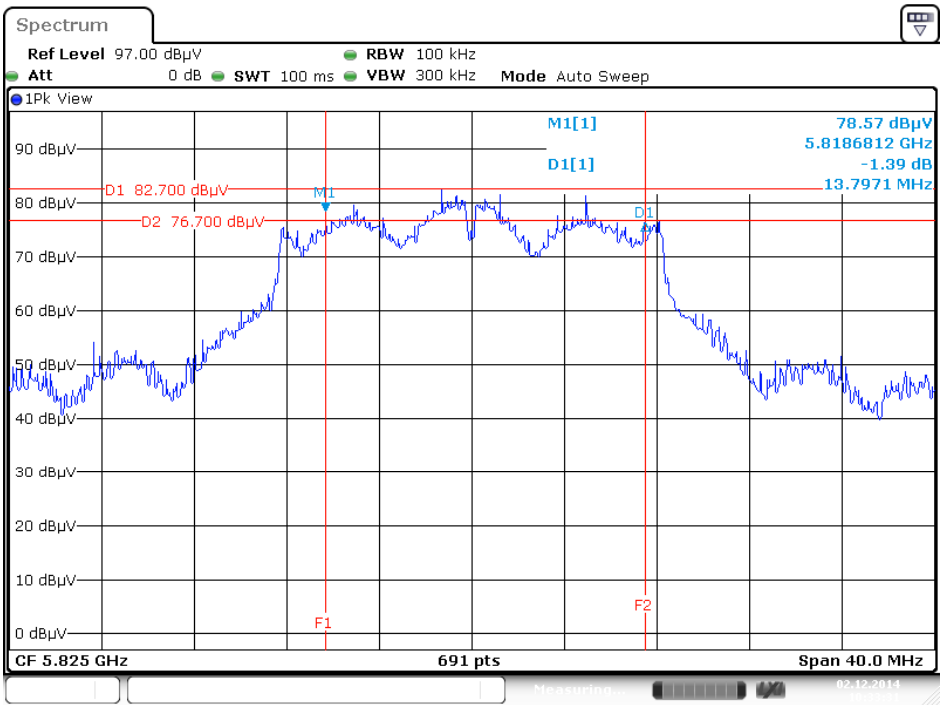
Date: 2.DEC.2014 10:43:32

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



Date: 2.DEC.2014 10:11:08

6 dB Bandwidth Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5825 MHz



Date: 2.DEC.2014 10:33:32

4.4. Maximum Conducted Output Power Measurement

4.4.1. Limit

Frequency Band			Limit
☒	5.15~5.25 GHz		
	Operating Mode		
	☐	Outdoor access point	The maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm) provided the maximum antenna gain does not exceed 6 dBi. 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. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
	☒	Indoor access point	The maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm) provided the maximum antenna gain does not exceed 6 dBi. 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.
	☐	Fixed point-to-point access points	The maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm). Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.
	☐	Mobile and portable client devices	The maximum conducted output power over the frequency band of operation shall not exceed 250 mW (24dBm) provided the maximum antenna gain does not exceed 6 dBi. 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.

☒	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

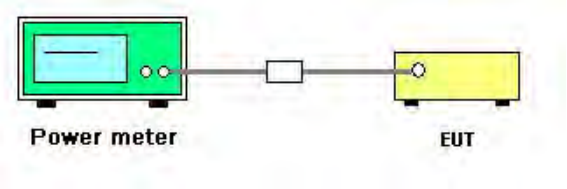
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

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 v01 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	26°C	Humidity	63%
Test Engineer	James Chou	Configurations	IEEE 802.11ac
Test Date	Nov. 26, 2014		

Configuration IEEE 802.11ac MCS0/Nss1 VHT20

Channel	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Chain 1	Chain 2	Chain 3	Total		
36	5180 MHz	17.14	18.54	16.59	22.27	27.33	Complies
40	5200 MHz	19.99	21.18	19.4	25.03	27.33	Complies
48	5240 MHz	19.63	21.61	19.71	25.19	27.33	Complies
149	5745 MHz	18.84	17.87	19.01	23.37	27.33	Complies
157	5785 MHz	20.68	20.16	20.69	25.29	27.33	Complies
165	5825 MHz	19.57	19.27	19.82	24.33	27.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=30 – (8.67 – 6)=27.33dBm.

Configuration IEEE 802.11ac MCS0/Nss1 VHT40

Channel	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Chain 1	Chain 2	Chain 3	Total		
38	5190 MHz	14.62	15.40	14.22	19.55	27.33	Complies
46	5230 MHz	18.68	20.58	18.77	24.21	27.33	Complies
151	5755 MHz	16.58	15.87	16.87	21.23	27.33	Complies
159	5795 MHz	21.19	20.91	21.36	25.93	27.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=30 – (8.67 – 6)=27.33dBm.

Configuration IEEE 802.11ac MCS0/Nss1 VHT80

Channel	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Chain 1	Chain 2	Chain 3	Total		
42	5210 MHz	14.77	16.11	14.46	19.95	27.33	Complies
155	5775 MHz	17.02	16.32	17.45	21.73	27.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=30 – (8.67 – 6)=27.33dBm.

Temperature	26°C	Humidity	63%
Test Engineer	James Chou	Configurations	IEEE 802.11a
Test Date	Nov. 26, 2014		

Configuration IEEE 802.11a

Channel	Frequency	Conducted Power (dBm)				Max. Limit (dBm)	Result
		Chain 1	Chain 2	Chain 3	Total		
36	5180 MHz	18.45	19.69	18.14	23.58	30.00	Complies
40	5200 MHz	19.41	20.78	18.87	24.53	30.00	Complies
48	5240 MHz	19.33	20.82	18.35	24.39	30.00	Complies
149	5745 MHz	19.21	18.54	19.39	23.83	30.00	Complies
157	5785 MHz	23.08	22.41	22.92	27.58	30.00	Complies
165	5825 MHz	20.32	19.86	20.44	24.98	30.00	Complies

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
☒	5.15~5.25 GHz		
	Operating Mode		
	☐	Outdoor access point	17 dBm/MHz
	☒	Indoor access point	17 dBm/MHz
	☐	Fixed point-to-point access points	17 dBm/MHz
	☐	Mobile and portable client devices	11 dBm/MHz
☒	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.

For 5.15~5.25 GHz

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

For 5.725~5.85 GHz

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Set the span to 1.5 times the DTS channel bandwidth.
RBW	RBW ≥ 1/T
VBW	VBW ≥ 3 RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto couple
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

For 5.15~5.25 GHz

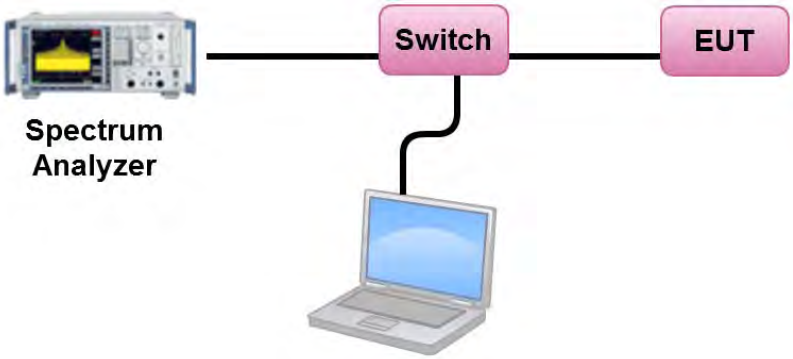
1. The transmitter output (antenna port) was connected RF switch to the spectrum analyzer.
2. Test was performed in accordance with KDB789033 D02 v01 for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - section (F) Maximum Power Spectral Density (PSD).
3. Multiple 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.

For 5.725~5.85 GHz

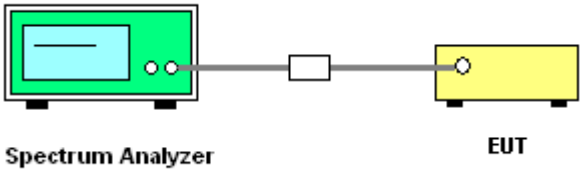
1. Test procedures refer KDB662911 D01 v02r01 section In-Band Power Spectral Density (PSD) Measurements option (b) Measure and sum spectral maximal across the outputs.
2. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
3. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW (use of a greater number of measurement points than this minimum requirement is recommended).
4. Use the peak marker function to determine the maximum level in any 3 kHz band segment within the fundamental EBW.
5. The measured result of PSD level must add 10log(500kHz/RBW) and the final result should ≤ 30 dBm.

4.5.4. Test Setup Layout

For 5.15~5.25 GHz



For 5.725~5.85 GHz



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	26°C	Humidity	63%
Test Engineer	James Chou	Configurations	IEEE 802.11ac
Test Date	Nov. 26, 2014		

Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
36	5180 MHz	8.86	14.33	Complies
40	5200 MHz	11.84	14.33	Complies
48	5240 MHz	13.07	14.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{ch}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=17 – (8.67 – 6)=14.33dBm/MHz.

Channel	Frequency	Power Density (dBm/3kHz)				BWCF factor	Total Power Density	Power Density Limit	Result
		Chain 1	Chain 2	Chain 3	Total	3kHz to 500kHz	dBm/500kHz		
149	5745 MHz	-7.33	-6.53	-9.02	-2.74	22.22	19.48	27.33	Complies
157	5785 MHz	-5.31	-6.68	-7.22	-1.56	22.22	20.66	27.33	Complies
165	5825 MHz	-7.33	-6.53	-9.02	-2.74	22.22	19.48	27.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{ch}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=30 – (8.67 – 6)=27.33dBm/500kHz.

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

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
38	5190 MHz	3.28	14.33	Complies
46	5230 MHz	9.70	14.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{ss}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=17 – (8.67 – 6)=14.33dBm/MHz.

Channel	Frequency	Power Density (dBm/3kHz)				BWCF factor	Total Power Density	Power Density Limit	Result
		Chain 1	Chain 2	Chain 3	Total	3kHz to 500kHz	dBm/500kHz		
151	5755 MHz	-12.65	-13.27	-14.42	-8.61	22.22	13.61	27.33	Complies
159	5795 MHz	-8.18	-8.85	-8.55	-3.75	22.22	18.47	27.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{ss}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=30 – (8.67 – 6)=27.33dBm/500kHz.

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

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
42	5210 MHz	0.38	14.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{ss}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=17 – (8.67 – 6) =14.33dBm/MHz.

Channel	Frequency	Power Density (dBm/3kHz)				BWCF factor	Total Power Density	Power Density Limit	Result
		Chain 1	Chain 2	Chain 3	Total	3kHz to 500kHz	dBm/500kHz		
155	5775 MHz	-14.10	-16.24	-15.04	-10.27	22.22	11.95	27.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{ss}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=30 – (8.67 – 6)=27.33dBm/500kHz.

Temperature	26°C	Humidity	63%
Test Engineer	James Chou	Configurations	IEEE 802.11a
Test Date	Nov. 26, 2014		

Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3

Channel	Frequency	Total Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
36	5180 MHz	10.12	14.33	Complies
40	5200 MHz	11.21	14.33	Complies
48	5240 MHz	11.32	14.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=17 – (8.67 – 6)=14.33dBm/MHz.

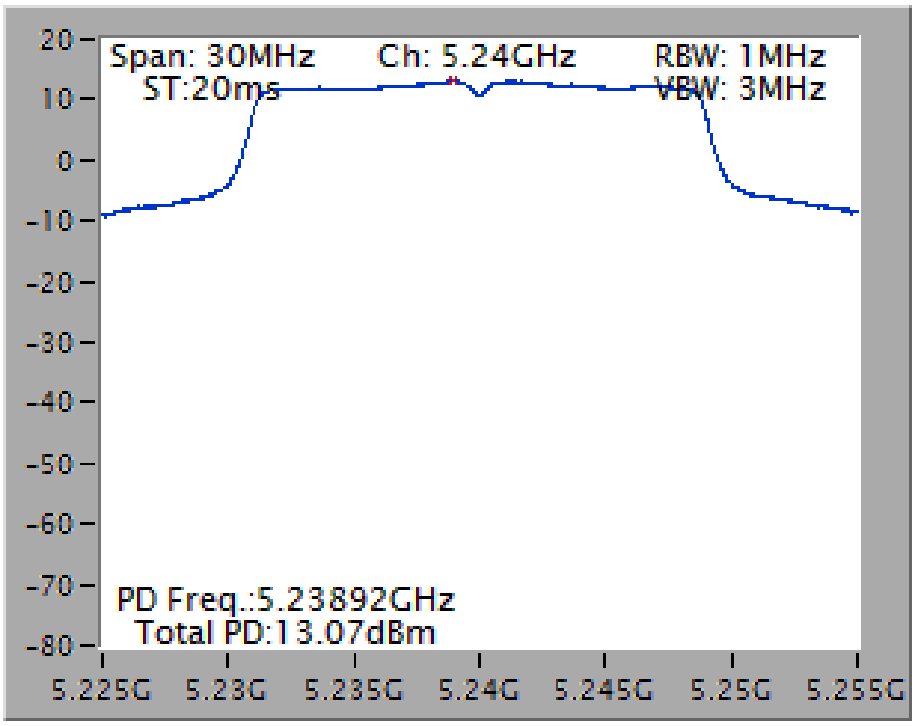
Channel	Frequency	Power Density (dBm/3kHz)				BWCF factor	Total Power Density	Power Density Limit	Result
		Chain 1	Chain 2	Chain 3	Total	3kHz to 500kHz	dBm/500kHz		
149	5745 MHz	-4.99	-7.11	-8.46	-1.84	22.22	20.38	27.33	Complies
157	5785 MHz	-1.51	-3.60	-5.58	1.52	22.22	23.74	27.33	Complies
165	5825 MHz	-4.67	-5.81	-6.51	-0.83	22.22	21.39	27.33	Complies

Note: Directional gain= $10\cdot\log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =8.67dBi>6dBi, so limit=30 – (8.67 – 6)=27.33dBm/500kHz.

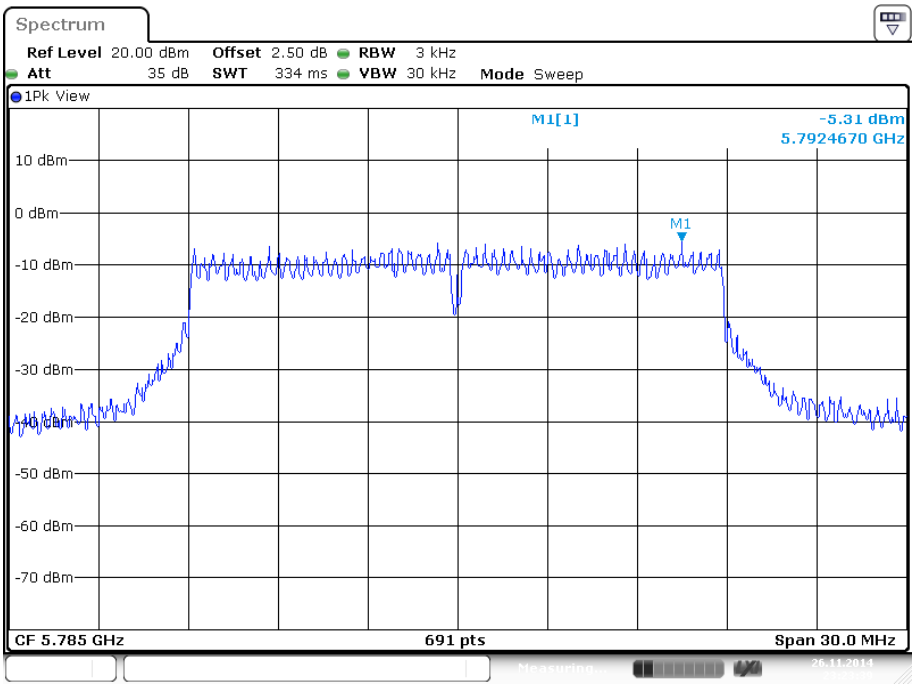
Note: All the test values were listed in the report.

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

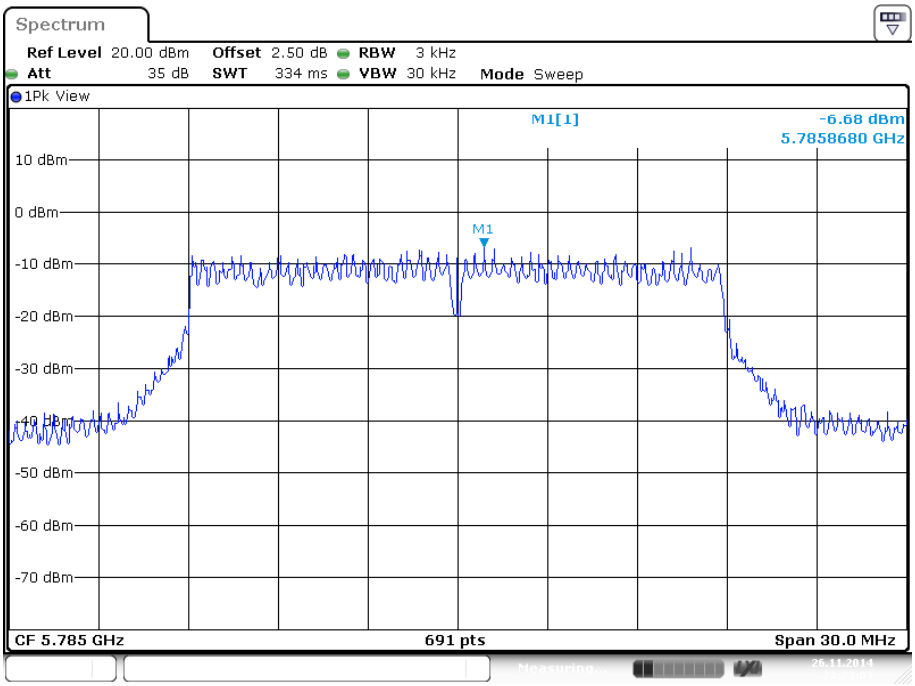
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 + Chain 2 + Chain 3 / 5240 MHz



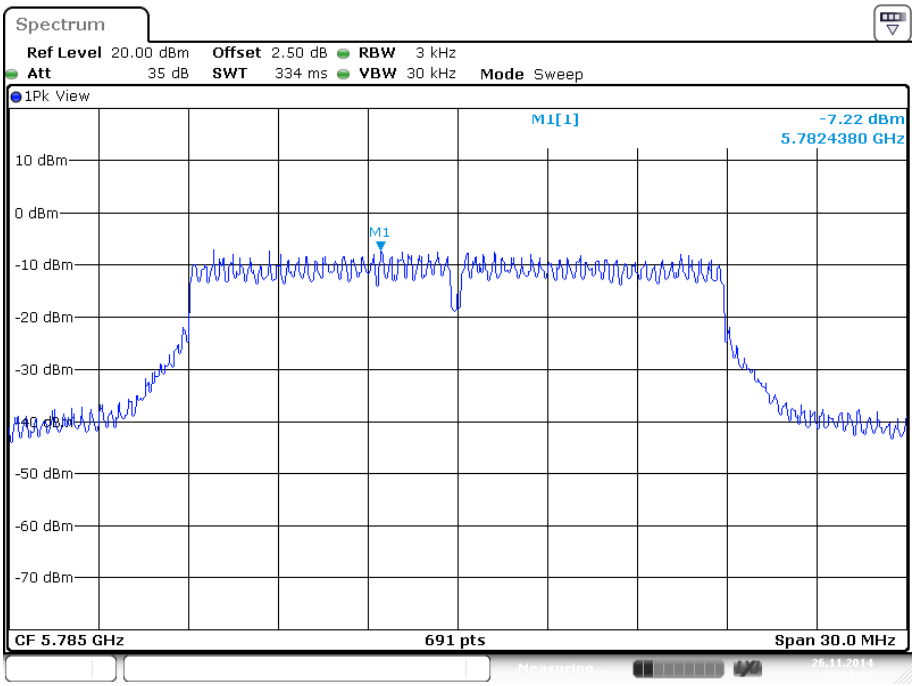
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 1 / 5785 MHz



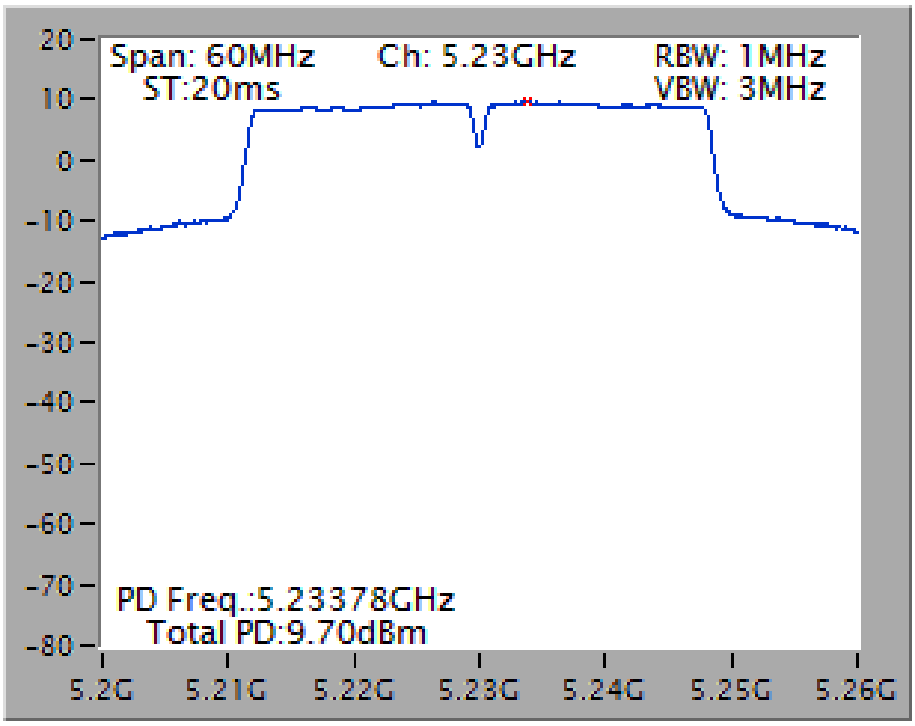
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 2 / 5785 MHz



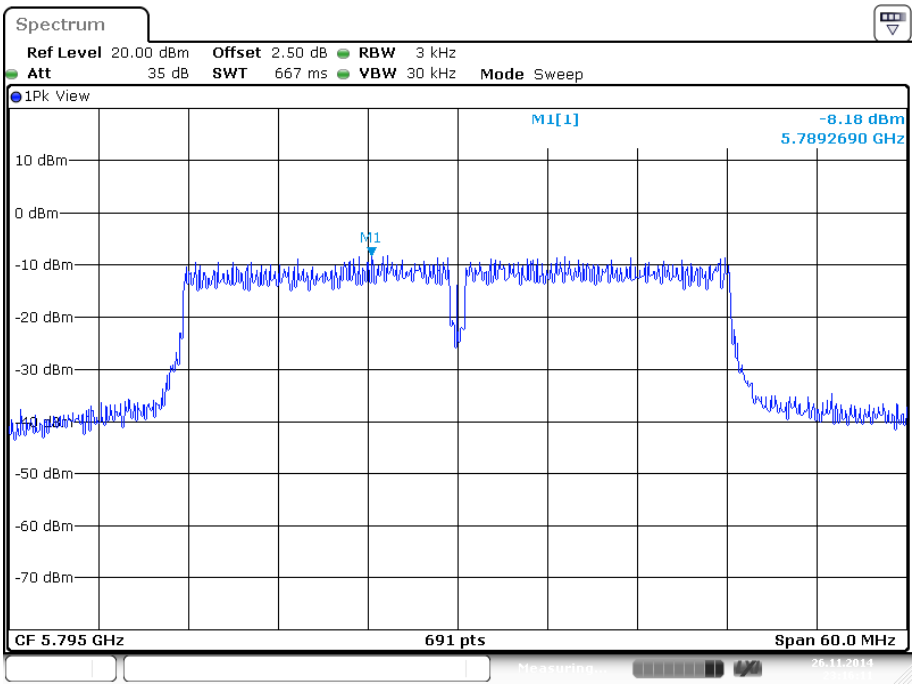
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT20 / Chain 3 / 5785 MHz



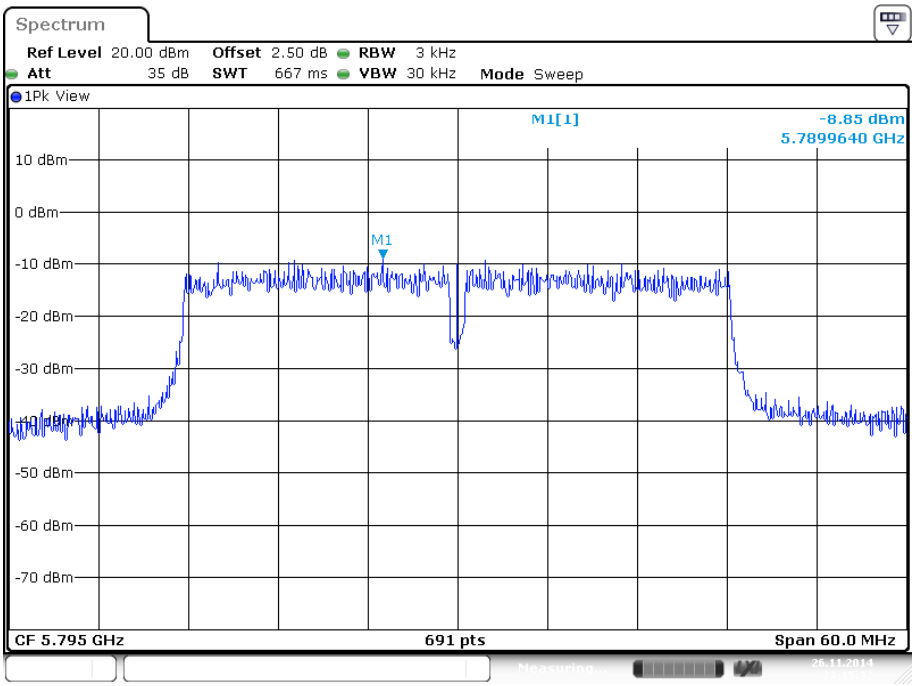
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 + Chain 2 + Chain 3 / 5230 MHz



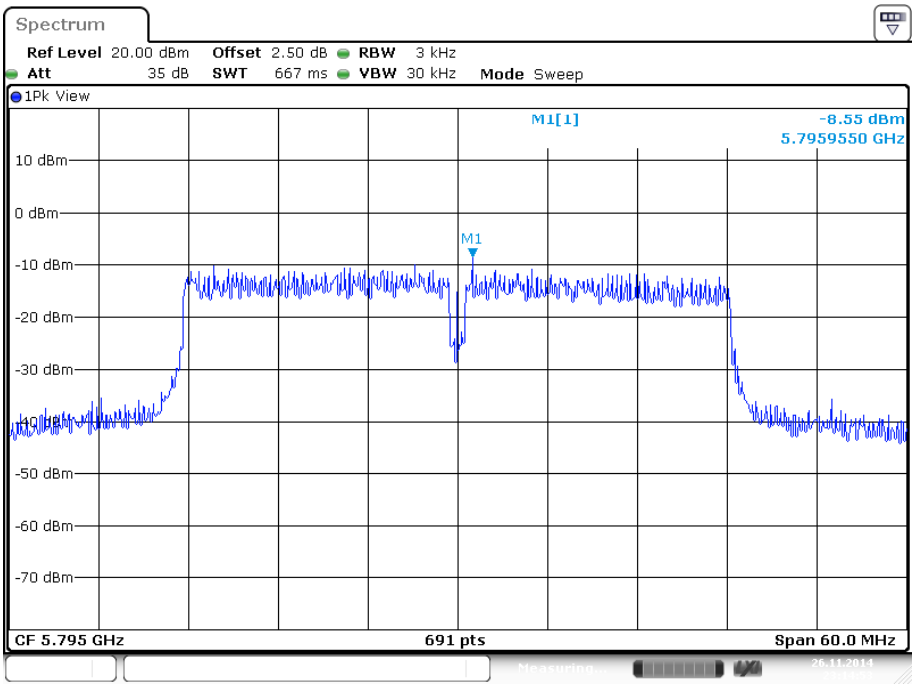
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 1 / 5795 MHz



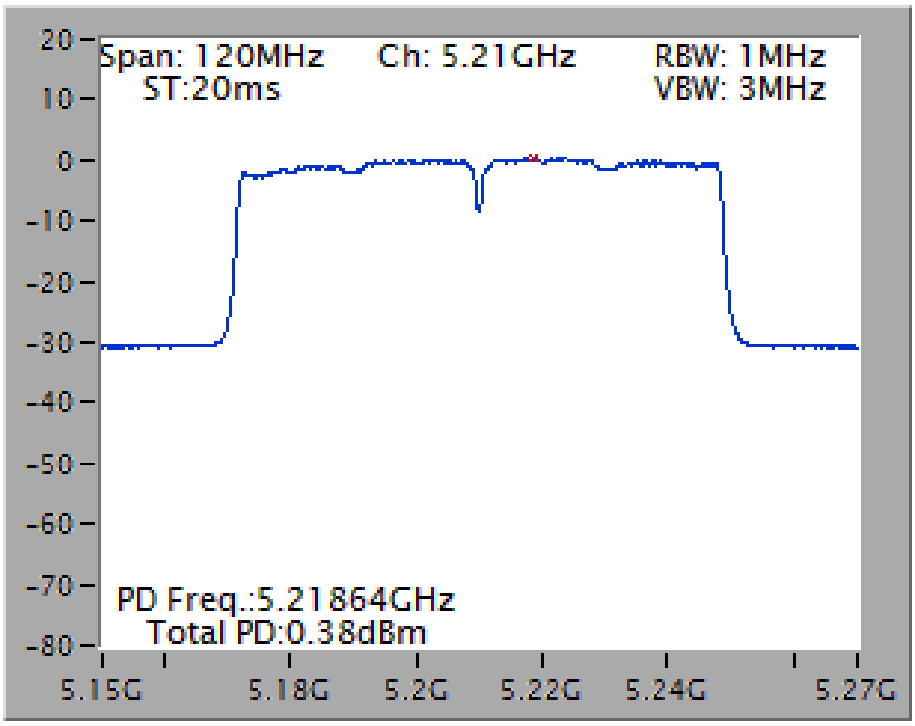
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 2 / 5795 MHz



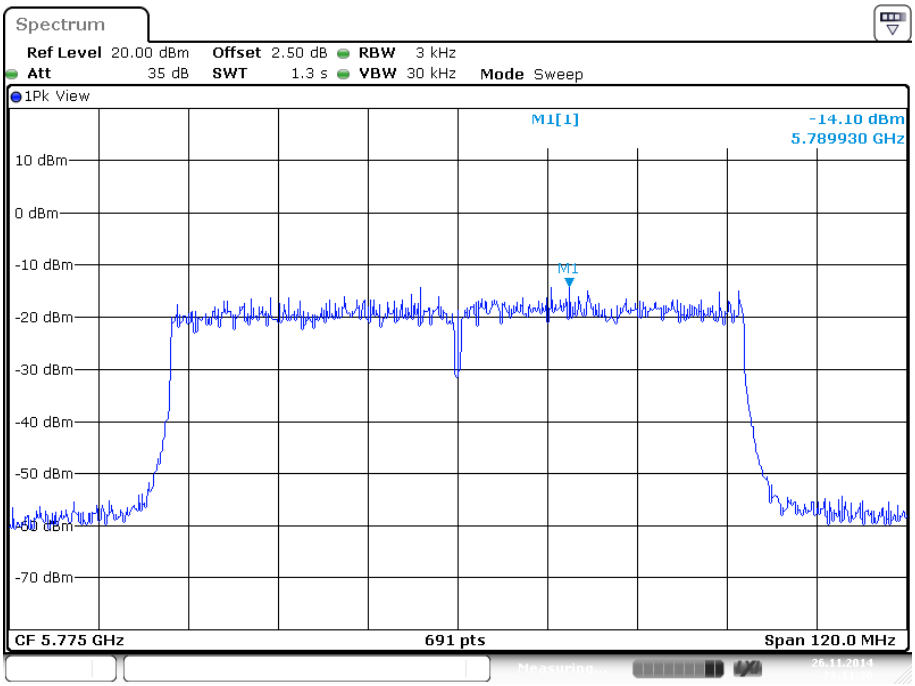
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT40 / Chain 3 / 5795 MHz



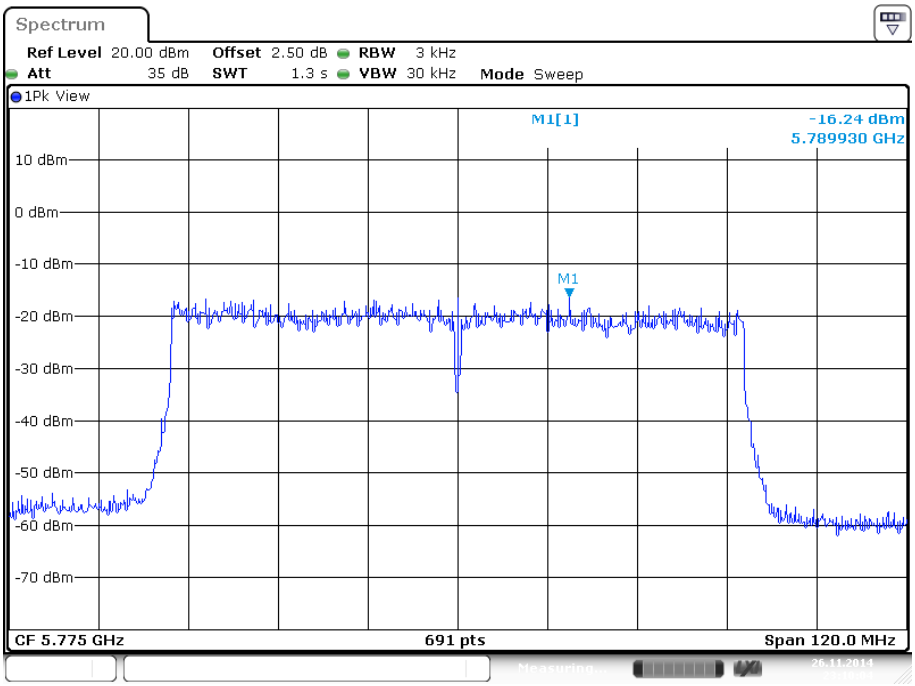
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 + Chain 2 + Chain 3 / 5210 MHz



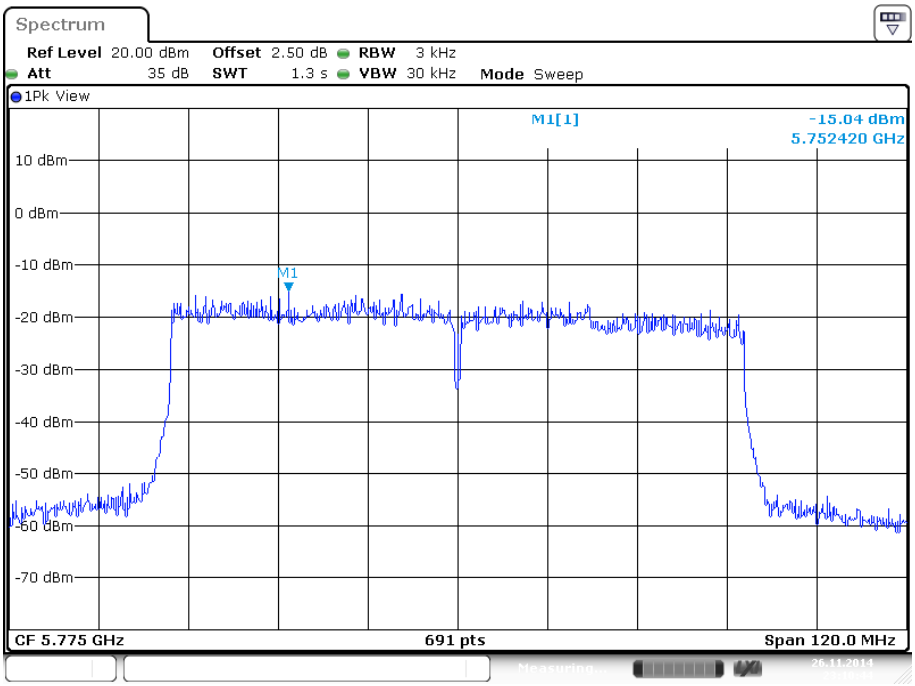
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 1 / 5775 MHz



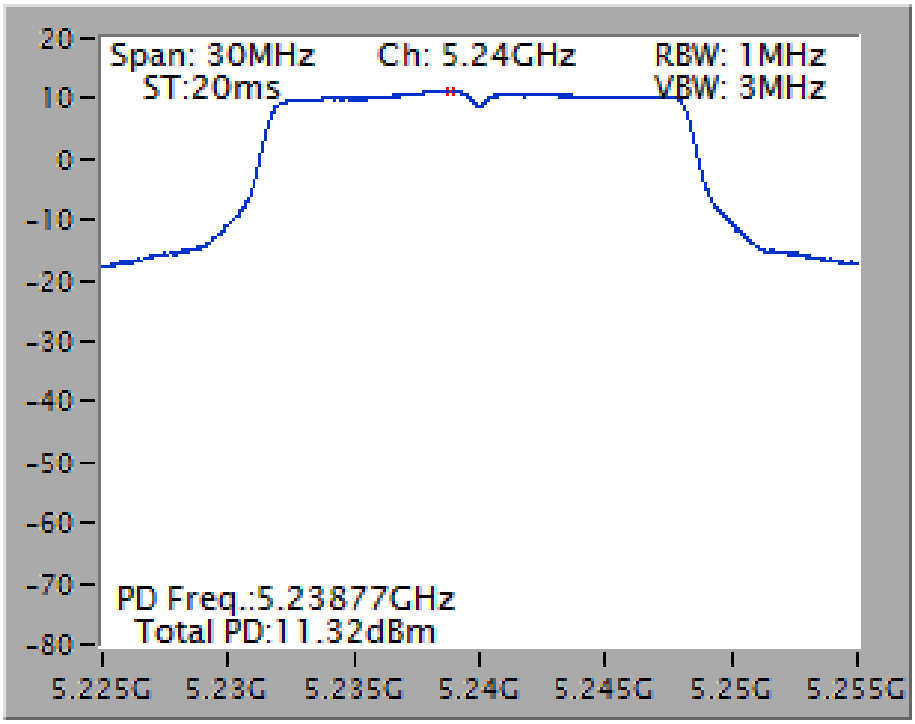
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 2 / 5775 MHz



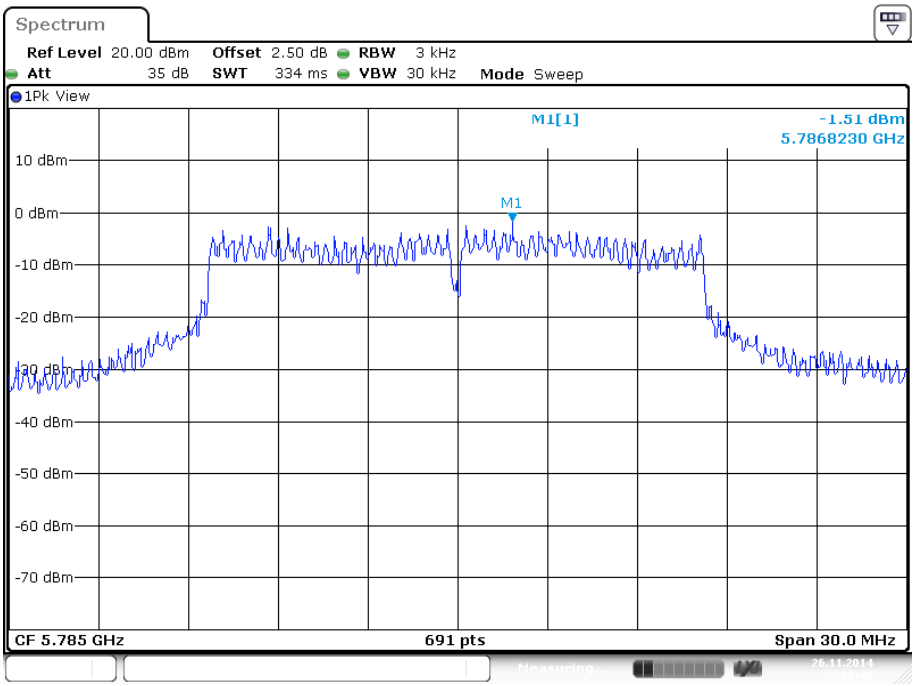
Power Density Plot on Configuration IEEE 802.11ac MCS0/Nss1 VHT80 / Chain 3 / 5775 MHz



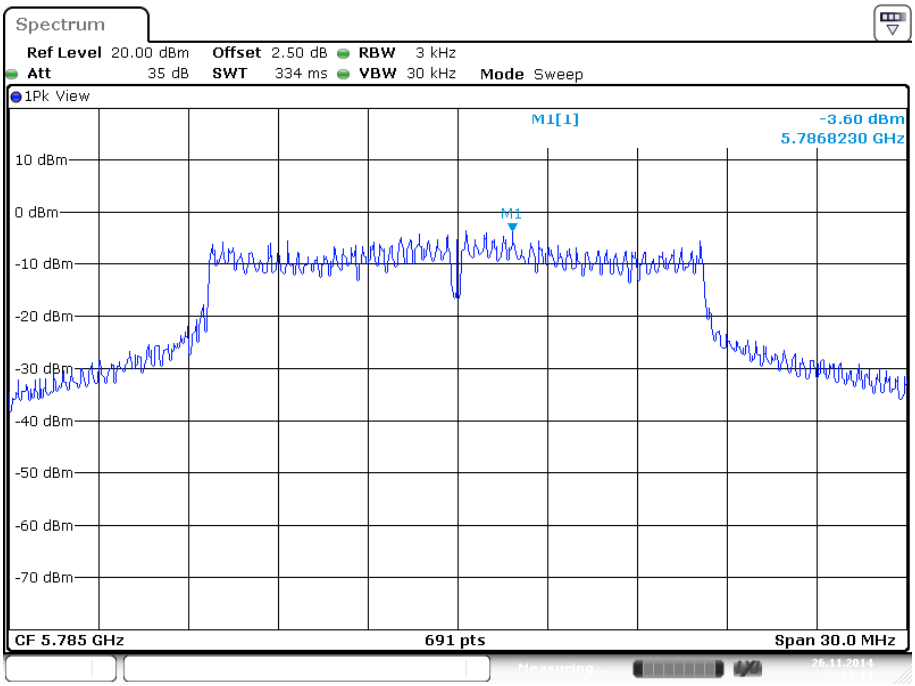
Power Density Plot on Configuration IEEE 802.11a / Chain 1 + Chain 2 + Chain 3 / 5240 MHz



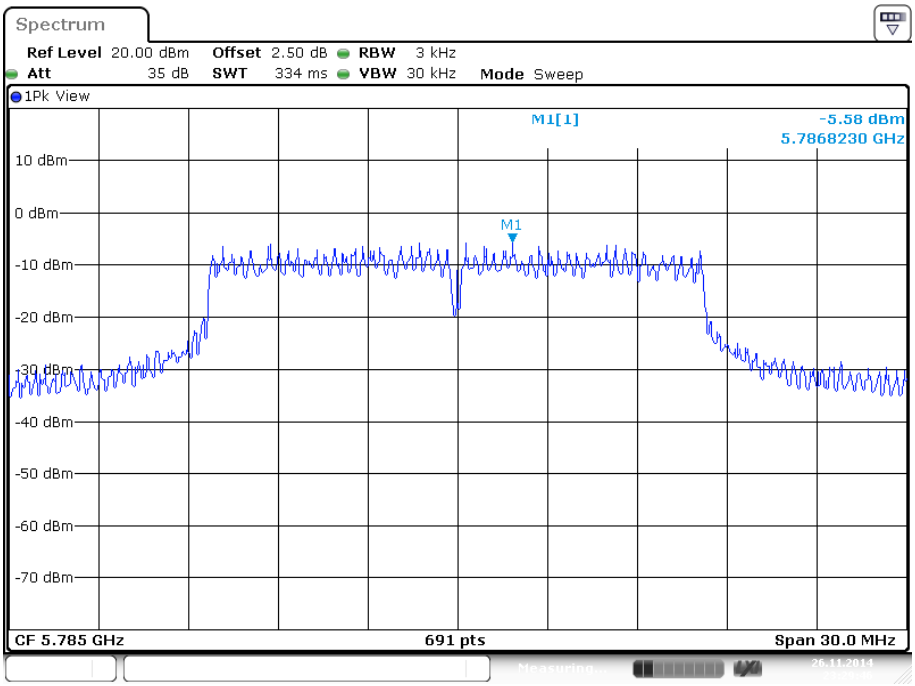
Power Density Plot on Configuration IEEE 802.11a / Chain 1 / 5785 MHz



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



Power Density Plot on Configuration IEEE 802.11a / Chain 3 / 5785 MHz



4.6. Radiated Emissions Measurement

4.6.1. 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

4.6.2. 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

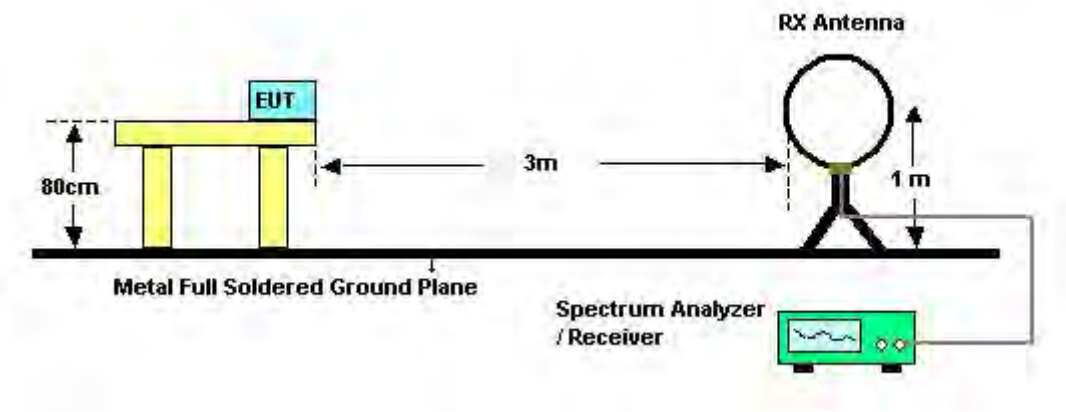
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.6.3. Test Procedures

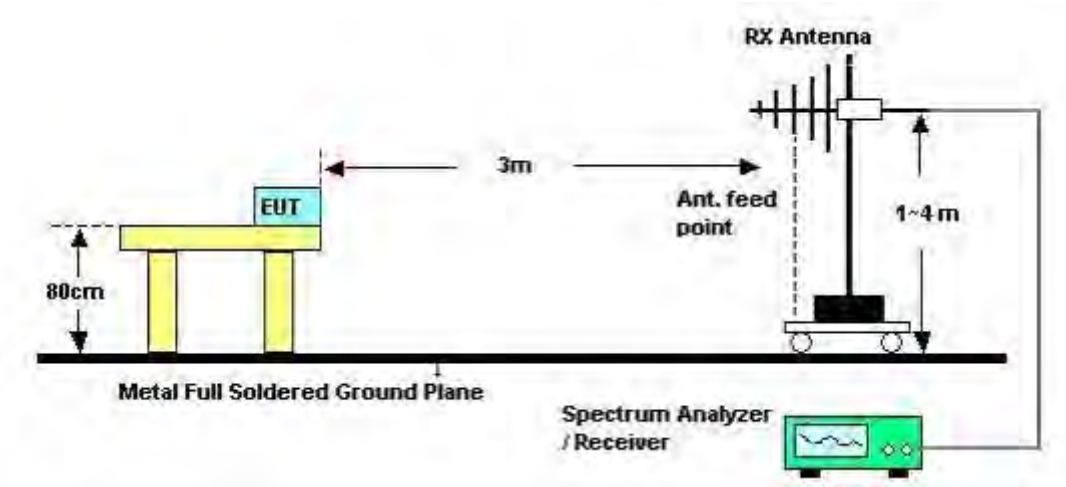
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting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

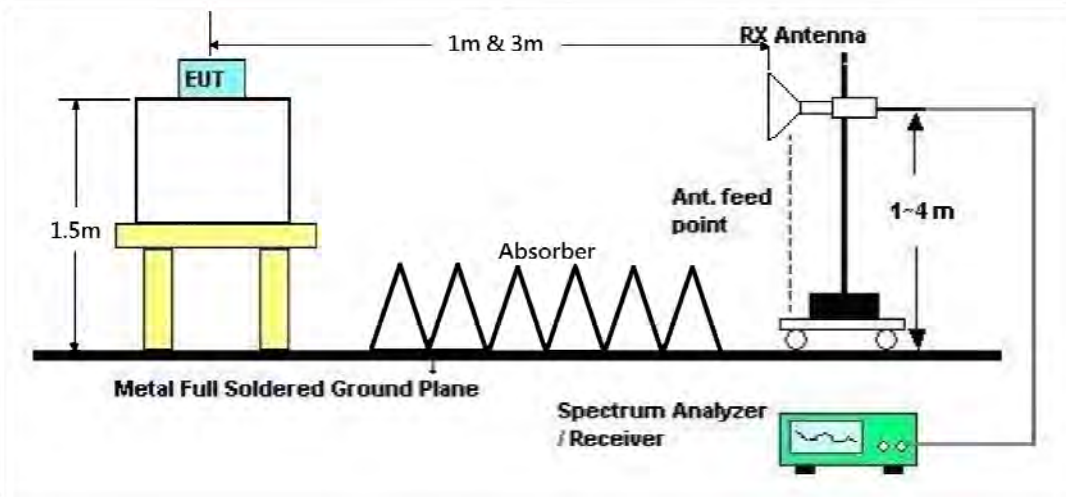
For Radiated Emissions: 9kHz ~30MHz



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 function:

The EUT was programmed to be in continuously transmitting mode.

For beamforming function:

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	Configurations	Normal Link
Test Date	Nov. 18, 2014	Test Mode	Mode 3

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.

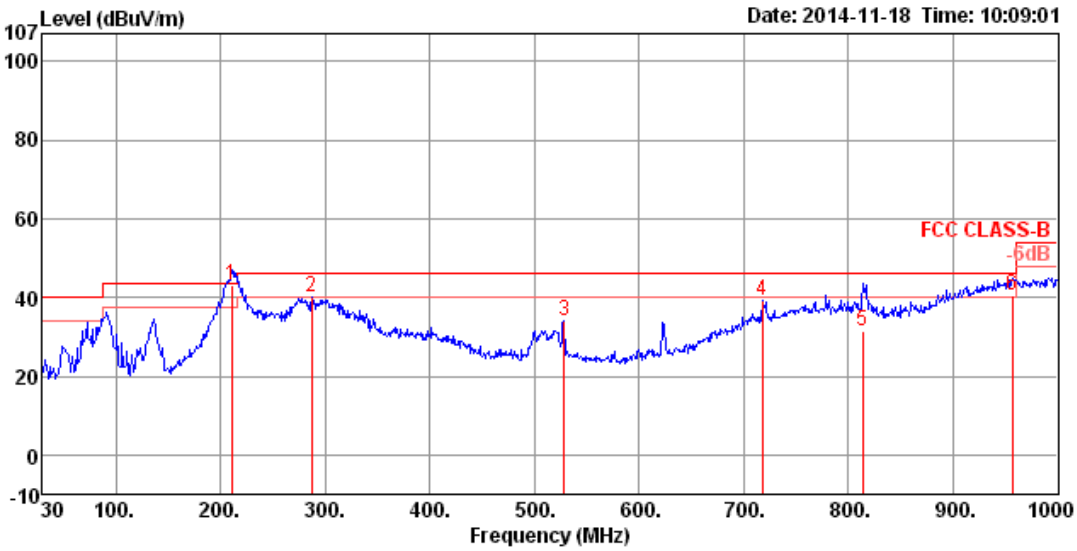
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

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

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

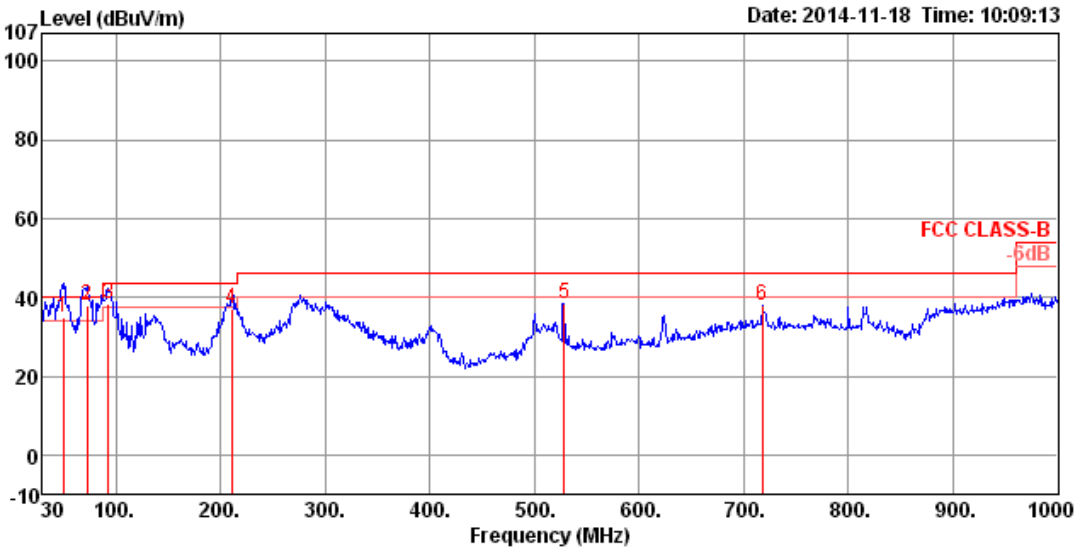
Temperature	26°C	Humidity	68%
Test Engineer	Lucas Huang	Configurations	Normal Link
Test Mode	Mode 3		

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	210.42	43.21	43.50	-0.29	64.35	1.77	31.42	8.51	HORIZONTAL	136	169	QP
2	287.05	40.21	46.00	-5.79	57.07	2.06	31.54	12.62	HORIZONTAL	82	125	Peak
3	528.58	34.08	46.00	-11.92	45.12	2.89	31.39	17.46	HORIZONTAL	59	100	Peak
4	717.73	39.40	46.00	-6.60	47.95	3.45	31.25	19.25	HORIZONTAL	96	125	Peak
5	813.76	31.38	46.00	-14.62	38.68	3.70	31.21	20.21	HORIZONTAL	164	100	QP
6	956.35	40.52	46.00	-5.48	46.52	4.09	31.10	21.01	HORIZONTAL	281	128	QP

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	49.40	34.86	40.00	-5.14	57.94	0.83	31.79	7.88	VERTICAL	360	100	QP
2	72.68	38.13	40.00	-1.87	63.21	1.01	31.73	5.64	VERTICAL	15	177	QP
3	93.05	38.21	43.50	-5.29	59.36	1.15	31.58	9.28	VERTICAL	281	100	QP
4	210.42	37.11	43.50	-6.39	58.25	1.77	31.42	8.51	VERTICAL	71	100	QP
5	528.58	38.56	46.00	-7.44	49.60	2.89	31.39	17.46	VERTICAL	156	100	Peak
6	717.73	37.92	46.00	-8.08	46.47	3.45	31.25	19.25	VERTICAL	86	100	Peak

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB 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)

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 36 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 04, 2014		

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	15536.96	57.01	74.00	-16.99	43.68	10.77	38.15	35.59	Peak	189	325	HORIZONTAL
2	15546.41	45.06	54.00	-8.94	31.75	10.78	38.12	35.59	Average	189	325	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	15535.14	54.10	74.00	-19.90	40.77	10.77	38.15	35.59	Peak	165	28	VERTICAL
2	15540.46	42.86	54.00	-11.14	29.56	10.77	38.12	35.59	Average	167	28	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 40 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 04, 2014		

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	10399.04	67.19	74.00	-6.81	54.11	8.55	39.81	35.28	Peak	231	26	HORIZONTAL
2	10400.82	50.39	54.00	-3.61	37.31	8.55	39.81	35.28	Average	231	26	HORIZONTAL
3	15592.79	69.08	74.00	-4.92	55.84	10.78	38.04	35.58	Peak	181	25	HORIZONTAL
4	15597.20	53.21	54.00	-0.79	39.97	10.78	38.04	35.58	Average	181	25	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	10400.00	57.81	74.00	-16.19	44.73	8.55	39.81	35.28	Peak	191	25	VERTICAL
2	10400.08	46.12	54.00	-7.88	33.04	8.55	39.81	35.28	Average	191	25	VERTICAL
3	15597.42	44.10	54.00	-9.90	30.86	10.78	38.04	35.58	Average	185	356	VERTICAL
4	15598.53	58.84	74.00	-15.16	45.60	10.78	38.04	35.58	Peak	185	356	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 48 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 04, 2014		

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	10479.62	52.07	54.00	-1.93	38.76	8.56	39.97	35.22	Average	231	28	HORIZONTAL
2	10480.67	67.25	74.00	-6.75	53.94	8.56	39.97	35.22	Peak	231	28	HORIZONTAL
3	15709.81	67.08	74.00	-6.92	54.00	10.79	37.85	35.56	Peak	165	355	HORIZONTAL
4	15713.17	53.85	54.00	-0.15	40.77	10.79	37.85	35.56	Average	165	355	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	10481.35	52.77	54.00	-1.23	39.46	8.56	39.97	35.22	Average	207	26	VERTICAL
2	10482.79	68.23	74.00	-5.77	54.92	8.56	39.97	35.22	Peak	207	26	VERTICAL
3	15714.13	44.78	54.00	-9.22	31.70	10.79	37.85	35.56	Average	165	31	VERTICAL
4	15714.42	59.45	74.00	-14.55	46.37	10.79	37.85	35.56	Peak	165	31	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 21, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11489.36	56.40	74.00	-17.60	43.06	9.09	34.85	39.10	HORIZONTAL	343	165	Peak
2	11489.70	45.13	54.00	-8.87	31.79	9.09	34.85	39.10	HORIZONTAL	343	165	Average
3	17226.61	52.02	54.00	-1.98	33.95	10.92	34.75	41.90	HORIZONTAL	318	159	Average
4	17226.61	62.02	74.00	-11.98	43.95	10.92	34.75	41.90	HORIZONTAL	318	159	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11492.14	56.83	74.00	-17.17	43.49	9.09	34.85	39.10	VERTICAL	268	168	Peak
2	11494.28	42.25	54.00	-11.75	28.90	9.10	34.85	39.10	VERTICAL	268	168	Average
3	17233.67	48.95	54.00	-5.05	30.88	10.92	34.75	41.90	VERTICAL	318	159	Average
4	17233.67	60.95	74.00	-13.05	42.88	10.92	34.75	41.90	VERTICAL	318	159	Peak

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 157 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 21, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11563.95	44.07	54.00	-9.93	30.80	9.11	34.85	39.01	HORIZONTAL	318	159	Average
2	11569.04	59.91	74.00	-14.09	46.64	9.11	34.85	39.01	HORIZONTAL	318	159	Peak
3	17354.62	69.05	74.00	-4.95	50.73	10.94	34.72	42.10	HORIZONTAL	357	166	Peak
4	17359.02	53.75	54.00	-0.25	35.43	10.94	34.72	42.10	HORIZONTAL	357	166	Average

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11571.36	41.86	54.00	-12.14	28.59	9.11	34.85	39.01	VERTICAL	222	162	Average
2	11579.96	57.42	74.00	-16.58	44.15	9.11	34.85	39.01	VERTICAL	222	162	Peak
3	17359.20	49.03	54.00	-4.97	30.71	10.94	34.72	42.10	VERTICAL	184	159	Average
4	17360.21	62.33	74.00	-11.67	44.01	10.94	34.72	42.10	VERTICAL	184	159	Peak

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 165 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 21, 2014 / Dec. 04, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11644.44	60.83	74.00	-13.17	47.64	9.11	34.85	38.93	HORIZONTAL	34	167	Peak
2	11649.80	43.11	54.00	-10.89	29.92	9.11	34.85	38.93	HORIZONTAL	34	167	Average
3	17466.32	51.48	54.00	-2.52	32.81	10.96	34.69	42.40	HORIZONTAL	0	162	Average
4	17467.04	65.51	74.00	-8.49	46.84	10.96	34.69	42.40	HORIZONTAL	0	162	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11640.97	57.22	74.00	-16.78	44.03	9.11	34.85	38.93	VERTICAL	190	164	Peak
2	11647.22	42.26	54.00	-11.74	29.07	9.11	34.85	38.93	VERTICAL	190	164	Average
3	17465.97	62.70	74.00	-11.30	44.03	10.96	34.69	42.40	VERTICAL	140	165	Peak
4	17482.06	49.79	54.00	-4.21	31.11	10.96	34.68	42.40	VERTICAL	140	165	Average

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 38 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 04, 2014		

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	15567.20	42.42	54.00	-11.58	29.13	10.78	38.09	35.58	Average	165	357	HORIZONTAL
2	15570.63	55.25	74.00	-18.75	41.96	10.78	38.09	35.58	Peak	165	357	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	15569.20	55.06	74.00	-18.94	41.77	10.78	38.09	35.58	Peak	100	44	VERTICAL
2	15570.32	42.62	54.00	-11.38	29.33	10.78	38.09	35.58	Average	100	44	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 46 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 04, 2014		

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	15688.08	63.95	74.00	-10.05	50.81	10.79	37.91	35.56	Peak	171	319	HORIZONTAL
2	15693.69	50.18	54.00	-3.82	37.07	10.79	37.88	35.56	Average	171	319	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	15688.81	56.75	74.00	-17.25	43.61	10.79	37.91	35.56	Peak	100	40	VERTICAL
2	15690.40	42.34	54.00	-11.66	29.20	10.79	37.91	35.56	Average	100	40	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 21, 2014 / Dec. 04, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11511.30	56.36	74.00	-17.64	43.01	9.10	34.85	39.10	HORIZONTAL	84	139	Peak
2	11514.57	42.24	54.00	-11.76	28.89	9.10	34.85	39.10	HORIZONTAL	84	139	Average
3	17256.11	48.87	54.00	-5.13	30.79	10.92	34.74	41.90	HORIZONTAL	4	165	Average
4	17265.78	62.60	74.00	-11.40	44.41	10.93	34.74	42.00	HORIZONTAL	4	165	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11515.18	42.09	54.00	-11.91	28.74	9.10	34.85	39.10	VERTICAL	181	166	Average
2	11515.59	56.49	74.00	-17.51	43.14	9.10	34.85	39.10	VERTICAL	181	166	Peak
3	17259.15	48.74	54.00	-5.26	30.66	10.92	34.74	41.90	VERTICAL	140	168	Average
4	17262.69	61.95	74.00	-12.05	43.76	10.93	34.74	42.00	VERTICAL	140	168	Peak

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 159 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 21, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11580.80	60.19	74.00	-13.81	46.92	9.11	34.85	39.01	HORIZONTAL	292	151	Peak
2	11589.74	47.23	54.00	-6.77	34.00	9.11	34.85	38.97	HORIZONTAL	292	151	Average
3	17375.80	65.35	74.00	-8.65	46.91	10.95	34.71	42.20	HORIZONTAL	358	166	Peak
4	17378.95	51.71	54.00	-2.29	33.27	10.95	34.71	42.20	HORIZONTAL	358	166	Average

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11586.32	56.99	74.00	-17.01	43.76	9.11	34.85	38.97	VERTICAL	159	100	Peak
2	11590.26	43.88	54.00	-10.12	30.65	9.11	34.85	38.97	VERTICAL	159	100	Average
3	17384.07	62.02	74.00	-11.98	43.58	10.95	34.71	42.20	VERTICAL	231	109	Peak
4	17384.33	49.18	54.00	-4.82	30.74	10.95	34.71	42.20	VERTICAL	231	109	Average

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 42 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 04, 2014		

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	10418.65	47.71	54.00	-6.29	34.60	8.55	39.84	35.28	Average	178	351	HORIZONTAL
2	10424.42	56.64	74.00	-17.36	43.51	8.55	39.84	35.26	Peak	178	351	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	10416.75	51.71	74.00	-22.29	38.60	8.55	39.84	35.28	Peak	100	111	VERTICAL
2	10417.52	43.14	54.00	-10.86	30.03	8.55	39.84	35.28	Average	100	111	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 155 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 21, 2014		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11548.20	54.84	74.00	-19.16	41.53	9.10	34.85	39.06	HORIZONTAL	221	154	Peak
2	11548.90	42.25	54.00	-11.75	28.94	9.10	34.85	39.06	HORIZONTAL	221	154	Average
3	17316.52	49.05	54.00	-4.95	30.75	10.93	34.73	42.10	HORIZONTAL	357	166	Average
4	17333.54	62.24	74.00	-11.76	43.92	10.94	34.72	42.10	HORIZONTAL	357	166	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	11545.00	41.98	54.00	-12.02	28.67	9.10	34.85	39.06	VERTICAL	23	161	Average
2	11545.00	53.20	74.00	-20.80	39.89	9.10	34.85	39.06	VERTICAL	23	165	Peak
3	17320.51	48.86	54.00	-5.14	30.55	10.94	34.73	42.10	VERTICAL	334	162	Average
4	17323.44	62.91	74.00	-11.09	44.60	10.94	34.73	42.10	VERTICAL	334	162	Peak

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11a CH 36 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 20, 2014		

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	15530.87	65.90	74.00	-8.10	52.57	10.77	38.15	35.59	Peak	190	25	HORIZONTAL
2	15539.84	48.61	54.00	-5.39	35.31	10.77	38.12	35.59	Average	190	25	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	15533.11	55.96	74.00	-18.04	42.63	10.77	38.15	35.59	Peak	100	280	VERTICAL
2	15549.97	41.99	54.00	-12.01	28.68	10.78	38.12	35.59	Average	100	280	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11a CH 40 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 20, 2014		

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	15598.65	68.96	74.00	-5.04	55.72	10.78	38.04	35.58	Peak	195	24	HORIZONTAL
2	15599.66	53.74	54.00	-0.26	40.50	10.78	38.04	35.58	Average	195	24	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	15597.36	43.24	54.00	-10.76	30.00	10.78	38.04	35.58	Average	165	314	VERTICAL
2	15608.08	57.33	74.00	-16.67	44.11	10.78	38.01	35.57	Peak	165	314	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11a CH 48 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 20, 2014		

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	15720.87	53.76	54.00	-0.24	40.68	10.79	37.85	35.56	Average	185	30	HORIZONTAL
2	15721.25	70.94	74.00	-3.06	57.86	10.79	37.85	35.56	Peak	185	30	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	15717.84	44.93	54.00	-9.07	31.85	10.79	37.85	35.56	Average	186	314	VERTICAL
2	15718.89	57.25	74.00	-16.75	44.17	10.79	37.85	35.56	Peak	186	314	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11a CH 149 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 03, 2014		

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	11488.85	65.64	74.00	-8.36	51.98	9.24	39.50	35.08	Peak	204	331	HORIZONTAL
2	11489.47	50.90	54.00	-3.10	37.24	9.24	39.50	35.08	Average	204	331	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	11490.00	48.16	54.00	-5.84	34.50	9.24	39.50	35.08	Average	222	332	VERTICAL
2	11490.38	62.04	74.00	-11.96	48.38	9.24	39.50	35.08	Peak	222	332	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11a CH 157 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 03, 2014		

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	11570.00	53.02	54.00	-0.98	39.38	9.26	39.47	35.09	Average	205	331	HORIZONTAL
2	11570.14	66.13	74.00	-7.87	52.49	9.26	39.47	35.09	Peak	205	331	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	11570.05	47.42	54.00	-6.58	33.78	9.26	39.47	35.09	Average	203	330	VERTICAL
2	11570.34	60.11	74.00	-13.89	46.47	9.26	39.47	35.09	Peak	203	330	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11a CH 165 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 03, 2014		

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	11650.29	62.49	74.00	-11.51	48.84	9.28	39.44	35.07	Peak	202	329	HORIZONTAL
2	11651.83	49.49	54.00	-4.51	35.84	9.28	39.44	35.07	Average	202	329	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	11649.13	59.55	74.00	-14.45	45.90	9.28	39.44	35.07	Peak	206	330	VERTICAL
2	11649.86	45.40	54.00	-8.60	31.75	9.28	39.44	35.07	Average	206	330	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, only the frequency range investigated is limited to 100MHz around band edges.

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 function:

The EUT was programmed to be in continuously transmitting mode.

For beamforming function:

The EUT was programmed to be in beamforming transmitting mode.

4.7.7. Test Result of Band Edge and Fundamental Emissions

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 36, 40, 48 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 03, 2014		

Channel 36

	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	5147.76	69.79	74.00	-4.21	64.85	6.13	34.01	35.20	Peak	262	12	VERTICAL
2	5150.00	52.91	54.00	-1.09	47.97	6.13	34.01	35.20	Average	262	12	VERTICAL
3	5180.00	118.02			112.99	6.15	34.08	35.20	Peak	262	12	VERTICAL
4	5180.64	107.90			102.87	6.15	34.08	35.20	Average	262	12	VERTICAL

Item 3, 4 are the fundamental frequency at 5180 MHz.

Channel 40

	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	5120.67	50.32	54.00	-3.68	45.47	6.11	33.94	35.20	Average	264	10	VERTICAL
2	5150.00	62.44	74.00	-11.56	57.50	6.13	34.01	35.20	Peak	264	10	VERTICAL
3	5198.56	108.17			103.10	6.16	34.11	35.20	Average	264	10	VERTICAL
4	5199.04	116.66			111.59	6.16	34.11	35.20	Peak	264	10	VERTICAL

Item 3, 4 are the fundamental frequency at 5200 MHz.

Channel 48

	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	5150.00	46.67	54.00	-7.33	41.73	6.13	34.01	35.20	Average	204	329	HORIZONTAL
2	5150.00	56.27	74.00	-17.73	51.33	6.13	34.01	35.20	Peak	204	329	HORIZONTAL
3	5238.72	108.69			103.53	6.18	34.18	35.20	Average	204	329	HORIZONTAL
4	5241.28	116.91			111.75	6.18	34.18	35.20	Peak	204	329	HORIZONTAL
5	5399.36	49.24	54.00	-4.76	43.62	6.29	34.53	35.20	Average	204	329	HORIZONTAL
6	5402.56	60.40	74.00	-13.60	54.78	6.29	34.53	35.20	Peak	204	329	HORIZONTAL

Item 3, 4 are the fundamental frequency at 5240 MHz.

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT20 CH 149, 157, 165 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 21, 2014		

Channel 149

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	5713.84	65.31	68.20	-2.89	60.16	6.34	35.35	34.16	HORIZONTAL	297	171	Peak
2	5725.00	78.03	78.20	-0.17	72.84	6.35	35.34	34.18	HORIZONTAL	297	171	Peak
3	5742.68	113.82			108.59	6.36	35.33	34.20	HORIZONTAL	297	171	Peak
4	5744.13	103.07			97.84	6.36	35.33	34.20	HORIZONTAL	297	171	Average

Item 3, 4 are the fundamental frequency at 5745 MHz.

Channel 157

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	5707.47	67.33	68.20	-0.87	62.19	6.34	35.36	34.16	HORIZONTAL	83	213	Peak
2	5725.00	60.85	78.20	-17.35	55.66	6.35	35.34	34.18	HORIZONTAL	83	213	Peak
3	5781.53	114.54			109.11	6.39	35.29	34.33	HORIZONTAL	83	213	Peak
4	5783.84	105.07			99.64	6.39	35.29	34.33	HORIZONTAL	83	213	Average

Item 3, 4 are the fundamental frequency at 5785 MHz.

Channel 165

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	5825.58	104.04			98.34	6.42	35.25	34.53	HORIZONTAL	79	237	Average
2	5826.74	113.42			107.72	6.42	35.25	34.53	HORIZONTAL	79	237	Peak
3	5850.58	72.92	78.20	-5.28	67.12	6.43	35.23	34.60	HORIZONTAL	79	237	Peak
4	5862.89	67.97	68.20	-0.23	62.08	6.44	35.22	34.67	HORIZONTAL	79	237	Peak

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

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 38, 46 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 03, 2014		

Channel 38

	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	5145.77	72.84	74.00	-1.16	67.90	6.13	34.01	35.20	Peak	196	329	HORIZONTAL
2	5150.00	53.71	54.00	-0.29	48.77	6.13	34.01	35.20	Average	196	329	HORIZONTAL
3	5185.83	112.67			107.64	6.15	34.08	35.20	Peak	196	329	HORIZONTAL
4	5193.53	102.28			97.24	6.16	34.08	35.20	Average	196	329	HORIZONTAL

Item 3, 4 are the fundamental frequency at 5190 MHz.

Channel 46

	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	5146.35	66.85	74.00	-7.15	61.91	6.13	34.01	35.20	Peak	204	330	HORIZONTAL
2	5148.75	53.84	54.00	-0.16	48.90	6.13	34.01	35.20	Average	204	330	HORIZONTAL
3	5231.92	115.66			110.50	6.18	34.18	35.20	Peak	204	330	HORIZONTAL
4	5234.81	106.11			100.95	6.18	34.18	35.20	Average	204	330	HORIZONTAL

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

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT40 CH 151, 159 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 21, 2014		

Channel 151

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	5713.55	67.70	68.20	-0.50	62.55	6.34	35.35	34.16	HORIZONTAL	296	216	Peak
2	5725.00	73.24	78.20	-4.96	68.05	6.35	35.34	34.18	HORIZONTAL	296	216	Peak
3	5747.47	107.94			102.69	6.37	35.32	34.20	HORIZONTAL	296	216	Peak
4	5749.50	97.57			92.32	6.37	35.32	34.20	HORIZONTAL	296	216	Average

Item 3, 4 are the fundamental frequency at 5755 MHz.

Channel 159

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	5710.66	67.35	68.20	-0.85	62.20	6.34	35.35	34.16	HORIZONTAL	85	208	Peak
2	5723.70	68.23	78.20	-9.97	63.04	6.35	35.34	34.18	HORIZONTAL	85	208	Peak
3	5791.09	102.97			97.45	6.40	35.28	34.40	HORIZONTAL	85	208	Average
4	5791.09	113.21			107.69	6.40	35.28	34.40	HORIZONTAL	85	208	Peak
5	5851.30	69.89	78.20	-8.31	64.09	6.43	35.23	34.60	HORIZONTAL	85	208	Peak
6	5861.74	67.38	68.20	-0.82	61.49	6.44	35.22	34.67	HORIZONTAL	85	208	Peak

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

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11ac MCS0/Nss1 VHT80 CH 42, 155 / Chain 1 + Chain 2 + Chain 3
Test Date	Dec. 04, 2014		

Channel 42

	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	5146.06	70.46	74.00	-3.54	65.52	6.13	34.01	35.20	Peak	176	332	HORIZONTAL
2	5149.42	53.82	54.00	-0.18	48.88	6.13	34.01	35.20	Average	176	332	HORIZONTAL
3	5198.46	108.27			103.20	6.16	34.11	35.20	Peak	176	332	HORIZONTAL
4	5221.06	98.25			93.13	6.17	34.15	35.20	Average	176	332	HORIZONTAL

Item 3, 4 are the fundamental frequency at 5210 MHz.

Channel 155

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	5711.53	68.17	68.20	-0.03	63.02	6.34	35.35	34.16	HORIZONTAL	300	197	Peak
2	5724.57	69.57	78.20	-8.63	64.38	6.35	35.34	34.18	HORIZONTAL	300	197	Peak
3	5746.35	104.54			99.29	6.37	35.32	34.20	HORIZONTAL	300	197	Peak
4	5766.75	94.36			89.02	6.38	35.31	34.27	HORIZONTAL	300	197	Average

Item 3, 4 are the fundamental frequency at 5775 MHz.

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11a CH 36, 40, 48 / Chain 1 + Chain 2 + Chain 3
Test Date	Nov. 20, 2014		

Channel 36

	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	5148.91	69.33	74.00	-4.67	64.39	6.13	34.01	35.20	Peak	175	326	HORIZONTAL
2	5150.00	52.74	54.00	-1.26	47.80	6.13	34.01	35.20	Average	175	326	HORIZONTAL
3	5181.92	116.67			111.64	6.15	34.08	35.20	Peak	175	326	HORIZONTAL
4	5182.24	107.31			102.28	6.15	34.08	35.20	Average	175	326	HORIZONTAL

Item 3, 4 are the fundamental frequency at 5180 MHz.

Channel 40

	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	5134.30	65.71	74.00	-8.29	60.81	6.12	33.98	35.20	Peak	177	328	HORIZONTAL
2	5150.00	53.49	54.00	-0.51	48.55	6.13	34.01	35.20	Average	177	328	HORIZONTAL
3	5201.92	121.78			116.71	6.16	34.11	35.20	Peak	177	328	HORIZONTAL
4	5202.24	110.52			105.45	6.16	34.11	35.20	Average	177	328	HORIZONTAL

Item 3, 4 are the fundamental frequency at 5200 MHz.

Channel 48

	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	5150.00	48.45	54.00	-5.55	43.51	6.13	34.01	35.20	Average	184	329	HORIZONTAL
2	5150.00	63.79	74.00	-10.21	58.85	6.13	34.01	35.20	Peak	184	329	HORIZONTAL
3	5242.56	109.49			104.31	6.20	34.18	35.20	Average	184	329	HORIZONTAL
4	5242.56	122.77			117.59	6.20	34.18	35.20	Peak	184	329	HORIZONTAL
5	5393.21	49.92	54.00	-4.08	44.35	6.28	34.49	35.20	Average	184	329	HORIZONTAL
6	5393.21	62.94	74.00	-11.06	57.37	6.28	34.49	35.20	Peak	184	329	HORIZONTAL

Item 3, 4 are the fundamental frequency at 5240 MHz.

Temperature	26℃	Humidity	68%
Test Engineer	Lucas Huang	Configurations	IEEE 802.11a CH 149, 157, 165 / Chain 1 + Chain 2 + Chain 3
Test Date	CH 149, 165: Nov. 20, 2014 CH 157: Nov. 20, 2014 / Dec. 02, 2014		

Channel 149

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	5713.99	64.29	68.20	-3.91	59.14	6.34	35.35	34.16	HORIZONTAL	298	100	Peak
2	5722.97	77.64	78.20	-0.56	72.45	6.35	35.34	34.18	HORIZONTAL	298	100	Peak
3	5741.82	113.48			108.25	6.36	35.33	34.20	HORIZONTAL	298	100	Peak
4	5752.24	102.46			97.21	6.37	35.32	34.20	HORIZONTAL	298	100	Average

Item 3, 4 are the fundamental frequency at 5745 MHz.

Channel 157

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	5707.47	67.52	68.20	-0.68	62.38	6.34	35.36	34.16	HORIZONTAL	83	220	Peak
2	5722.11	63.36	78.20	-14.84	58.19	6.35	35.34	34.16	HORIZONTAL	83	220	Peak
3	5787.89	106.49			101.06	6.39	35.29	34.33	HORIZONTAL	83	220	Average
4	5789.05	117.27			111.77	6.39	35.29	34.40	HORIZONTAL	83	220	Peak

Item 3, 4 are the fundamental frequency at 5785 MHz.

Channel 165

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Preamp Factor	Antenna Factor	Pol/Phase	T/Pos	A/Pos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB/m		deg	cm	
1	5827.32	114.60			108.90	6.42	35.25	34.53	HORIZONTAL	80	218	Peak
2	5827.89	105.23			99.53	6.42	35.25	34.53	HORIZONTAL	80	218	Average
3	5857.68	71.93	78.20	-6.27	66.05	6.44	35.23	34.67	HORIZONTAL	80	218	Peak
4	5897.63	67.43	68.20	-0.77	61.36	6.46	35.19	34.80	HORIZONTAL	80	218	Peak

Item 1, 2 are the fundamental frequency at 5825 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

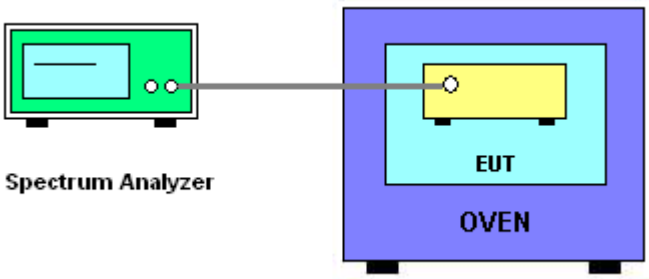
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

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. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature is -30°C～50°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	26°C	Humidity	63%
Test Engineer	James Chou	Test Date	Nov. 26, 2014

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)
(V)	5200 MHz
126.50	5199.9715
110.00	5199.9705
93.50	5199.9842
Max. Deviation (MHz)	0.0295
Max. Deviation (ppm)	5.68

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)
(°C)	5200 MHz
-30	5200.0298
-20	5200.0246
-10	5200.0168
0	5200.0144
10	5200.0060
20	5199.9705
30	5199.9615
40	5199.9484
50	5199.9039
Max. Deviation (MHz)	0.0961
Max. Deviation (ppm)	18.48

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. 23, 2014	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)
Signal analyzer	R&S	FSV40	101026	9kHz~40GHz	Aug. 28, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-7	-	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-8	-	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-9	-	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-10	-	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-11	-	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
Power Sensor	Anritsu	MA2411B	1126203	300MHz~40GHz	Oct. 06, 2014	Conducted (TH01-CB)
Power Meter	Anritsu	ML2495A	1210004	300MHz~40GHz	Oct. 06, 2014	Conducted (TH01-CB)
BILOG ANTENNA	Schaffner	CBL6112D	22021	20MHz ~ 2GHz	May 26, 2014	Radiation (03CH01-CB)
Loop Antenna	TESEQ	HLA 6120	31244	9 kHz - 30 MHz	Dec. 02, 2012*	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz~18GHz	Oct. 28, 2014	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Aug. 22, 2014	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	Dec. 16, 2013	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	--	26GHz ~ 40GHz	Feb. 17, 2014	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100304	9kHz ~ 40GHz	Dec. 18, 2013	Radiation (03CH01-CB)
EMI Test Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8GHz	Dec. 12, 2013	Radiation (03CH01-CB)
Turn Table	INN CO	CO 2000	N/A	0 ~ 360 degree	N.C.R.	Radiation (03CH01-CB)
Antenna Mast	INN CO	CO2000	N/A	1 m - 4 m	N.C.R.	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-1	N/A	1 GHz – 26.5 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-2	N/A	1 GHz – 26.5 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-3	N/A	1 GHz - 40 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-4	N/A	1 GHz - 40 GHz	Nov. 15, 2014	Radiation (03CH01-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)	2.4 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%