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FCC RADIO TEST REPORT

Applicant's company	**Roku, Inc.**
Applicant Address	12980 Saratoga Avenue Suite #D Saratoga California United States 95070
FCC ID	**TC2-R1009**
Manufacturer's company	**Lite-On Network Communication (Dongguan) Limited**
Manufacturer Address	30#Keji Rd., Yin Hu Industrial Area, Qingxi Town, DongGuan City, Guangdong, China

Product Name	Media Player Device
Brand Name	Roku
Model No.	4210X2, 4230X2
Test Rule Part(s)	47 CFR FCC Part 15 Subpart E § 15.407
Test Freq. Range	5150 ~ 5250 MHz / 5725 ~ 5850 MHz
Received Date	Apr. 30, 2015
Final Test Date	Nov. 09, 2015
Submission Type	Original Equipment

Statement

Test result included is for the IEEE 802.11n and IEEE 802.11a 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.**

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
FR561812AB	Rev. 01	Initial issue of report	Nov. 16, 2015

1. VERIFICATION OF COMPLIANCE

Product Name	:	Media Player Device
Brand Name	:	Roku
Model No.	:	4210X2, 4230X2
Applicant	:	Roku, 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 Apr. 30, 2015 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.

Sam Chen

SPORTON INTERNATIONAL INC.

2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart E				
Part	**Rule Section**	**Description of Test**	**Result**	**Under Limit**
4.1	15.207	AC Power Line Conducted Emissions	Complies	6.98 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	3.79dB
4.5	15.407(a)	Power Spectral Density	Complies	3.85 dB
4.6	15.407(b)	Radiated Emissions	Complies	3.80 dB
4.7	15.407(b)	Band Edge Emissions	Complies	0.02 dB
4.8	15.407(g)	Frequency Stability	Complies	-
4.9	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Product Type	IEEE 802.11a: WLAN (1TX, 1RX) IEEE 802.11n: WLAN (2TX, 2RX)
Radio Type	Intentional Transceiver
Power Type	From power adapter
Modulation	IEEE 802.11a: OFDM IEEE 802.11n: see the below table
Data Modulation	IEEE 802.11a/n: OFDM (BPSK / QPSK / 16QAM / 64QAM)
Data Rate (Mbps)	IEEE 802.11a: OFDM (6/9/12/18/24/36/48/54) IEEE 802.11n: see the below table
Frequency Range	5150 ~ 5250 MHz / 5725 ~ 5850 MHz
Channel Number	9 for 20MHz bandwidth
Channel Band Width (99%)	Band 1: IEEE 802.11a: 17.04 MHz IEEE 802.11n MCS0 (HT20): 17.76 MHz Band 4: IEEE 802.11a: 17.16 MHz IEEE 802.11n MCS0 (HT20): 17.76 MHz
Maximum Conducted Output Power	Band 1: IEEE 802.11a: 17.22 dBm IEEE 802.11n MCS0 (HT20): 20.21 dBm Band 4: IEEE 802.11a: 17.15 dBm IEEE 802.11n MCS0 (HT20): 20.25 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	

Antenna and Band width

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

IEEE 11n Spec.

Protocol	Number of Transmit Chains (NTX)	Data Rate / MCS
802.11n (HT20)	2	MCS0-15
Note 1: IEEE Std. 802.11n modulation consists of HT20 and HT40 (HT: High Throughput). Then EUT supports HT20.		
Note 2: Modulation modes consist of below configuration: HT20: IEEE 802.11n		

3.2. Accessories

Power	Brand	Model	Rating
Adapter 1	Roku	FA-1201000SUD	Input: 120V~60Hz, 0.5A Output: 12.0V, 1.0A
Adapter 2	Roku	MU12AH120100-A1	Input: 100-240V~50/60Hz, 0.5A Output: 12V, 1.0A
Adapter 3	Roku	PA-1120-42RU	Input: 100-240V~50/60Hz, 0.5A Output: 12V, 1.0A
Remote controller	**Brand Holder**	**Model**	**Remark**
Remote controller 1	SMK Electronics Coperation	RXT9000-5502EC	RF remote
Remote controller 2	ShenZhen C&D Electronics CO.Ltd.	RC16D-1, RC16D-2, RC16D-RC52	IR remote

3.3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)		
					2.4GHz	5GHz	
						Band 1	Band 4
1	LiteON	SWD219B	Note 1	N/A	2.1	1.5	2.0
2	LiteON	SWD219B	Note 1	N/A	-2.0	3.6	2.5

Note1: The 4-layer board uses a combination of the TDK Chip antennas and a printed antenna.

Note2: The EUT has two antennas.

For 2.4GHz

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

The EUT supports the antenna with TX and RX diversity functions.

Both Ant. 1 and Ant. 2 support transmit and receive functions, but only one of them will be used at one time.

The Ant. 2 generated the worst case, so it was selected to test and record in the report.

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

Ant. 1 and Ant. 2 will transmit/receive the same signal simultaneously.

Ant. 1 and Ant. 2 can be used as transmitting/receiving antennas.

For 5GHz

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

The EUT supports the antenna with TX and RX diversity functions.

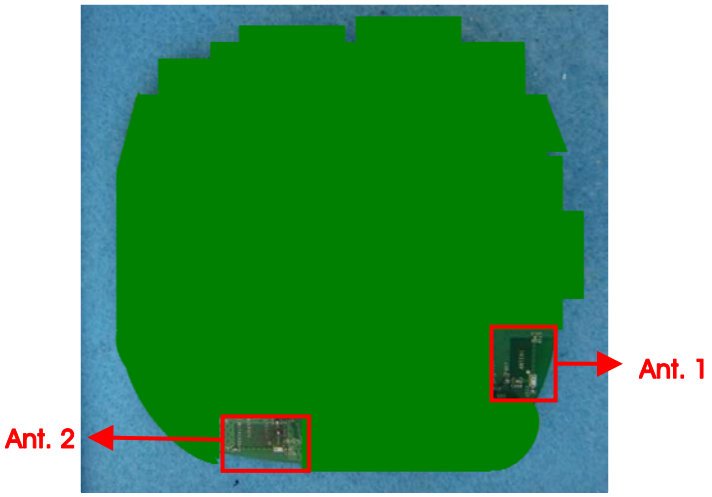
Both Ant. 1 and Ant. 2 support transmit and receive functions, but only one of them will be used at one time.

The Ant. 2 generated the worst case, so it was selected to test and record in the report.

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

Ant. 1 and Ant. 2 will transmit/receive the same signal simultaneously.

Ant. 1 and Ant. 2 can be used as transmitting/receiving antennas.



3.4. Table for Carrier Frequencies

The EUT has one bandwidth system.

For 20MHz bandwidth systems, use Channel 36, 40, 44, 48, 149, 153, 157, 161, 165.

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
5725~5850 MHz Band 4	149	5745 MHz	159	5795 MHz
	151	5755 MHz	161	5805 MHz
	153	5765 MHz	165	5825 MHz
	157	5785 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	Ant.
AC Power Conducted Emission	Normal Link		-	-	-
Max. Conducted Output Power	11a/BPSK	Band 1,4	6Mbps	36/40/48/149/157/165	2
	11n HT20	Band 1,4	MCS0	36/40/48/149/157/165	1+2
Power Spectral Density	11a/BPSK	Band 1,4	6Mbps	36/40/48/149/157/165	2
	11n HT20	Band 1,4	MCS0	36/40/48/149/157/165	1+2
26dB Spectrum Bandwidth & 99% Occupied Bandwidth Measurement	11a/BPSK	Band 1,4	6Mbps	36/40/48/149/157/165	2
	11n HT20	Band 1,4	MCS0	36/40/48/149/157/165	1+2
6dB Spectrum Bandwidth Measurement	11a/BPSK	Band 4	6Mbps	149/157/165	2
	11n HT20	Band 4	MCS0	149/157/165	1+2
Radiated Emission Below 1GHz	Normal Link		-	-	-
Radiated Emission Above 1GHz	11a/BPSK	Band 1,4	6Mbps	36/40/48/149/157/165	2
	11n HT20	Band 1,4	MCS0	36/40/48/149/157/165	1+2
Band Edge Emission	11a/BPSK	Band 1,4	6Mbps	36/40/48/149/157/165	2
	11n HT20	Band 1,4	MCS0	36/40/48/149/157/165	1+2
Frequency Stability	20 MHz	Band 1,4	-	40/157	2

The following test modes were performed for all tests:

For Conducted Emission test:

Mode 1. LAN mode with Adapter 1

Mode 2. LAN mode with Adapter 2

Mode 3. LAN mode with Adapter 3

Mode 4. WiFi mode in 2.4GHz with Adapter 1

Mode 5. WiFi mode in 2.4GHz with Adapter 2

Mode 6. WiFi mode in 2.4GHz with Adapter 3

Mode 7. WiFi mode in 5GHz with Adapter 1

Mode 8. WiFi mode in 5GHz with Adapter 2

Mode 9. WiFi mode in 5GHz with Adapter 3

Mode 5 is the worst case, so it was selected to record in this test report.

For Radiated Emission test (Below 1GHz):

Mode 1. LAN mode with Adapter 1

Mode 2. LAN mode with Adapter 2

Mode 3. LAN mode with Adapter 3

Mode 4. WiFi mode in 2.4GHz with Adapter 1

Mode 5. WiFi mode in 2.4GHz with Adapter 2

Mode 6. WiFi mode in 2.4GHz with Adapter 3

Mode 7. WiFi mode in 5GHz with Adapter 1

Mode 8. WiFi mode in 5GHz with Adapter 2

Mode 9. WiFi mode in 5GHz with Adapter 3

Mode 9 is the worst case, so it was selected to record in this test report.

For Radiated Emission test (Above 1GHz):

The EUT could be performed at Z axis only, so the measurement will follow this same test configuration.

Mode 1. CTX-EUT in Z axis

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	-
CO02-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 Multiple Listing

The EUT has two model names which are identical to each other in all aspects except for the following table:

Model Name	Remote controller 1	Remote controller 2	Description
4210X2	X	V	These two models are identical except for the different remote controllers.
4230X2	V	X	

From the above models, model: 4210X2 was selected as representative model for the test and its data was recorded in this report.

3.8. Table for Supporting Units

For Test Site No: CO02-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC
AP	TAMIO	N500RDG	N/A
Flash disk	LightForce	LF-MKU002	N/A
SD care	Kingston	SDC 10	N/A
LCD TV	SONY	KLV-32U300A	DoC

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

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC
AP	TAMIO	N500RDG	N/A
Flash disk	LightForce	LF-MKU002	N/A
SD care	Kingston	SDC 10	N/A
LCD TV	SONY	KLV-32U300A	DoC

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

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC

For Test Site No: TH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E4300	DoC

3.9. Table for Parameters of Test Software Setting

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

Test Software Version	Mtool 2.0.0.3					
Mode	Test Frequency (MHz)					
	NCB: 20MHz					
	5180 MHz	5200 MHz	5240 MHz	5745 MHz	5785 MHz	5825 MHz
802.11a	55	55	55	56	61	61
802.11n MCS0 HT20	56	56	56	50	62	56

3.10. EUT Operation during Test

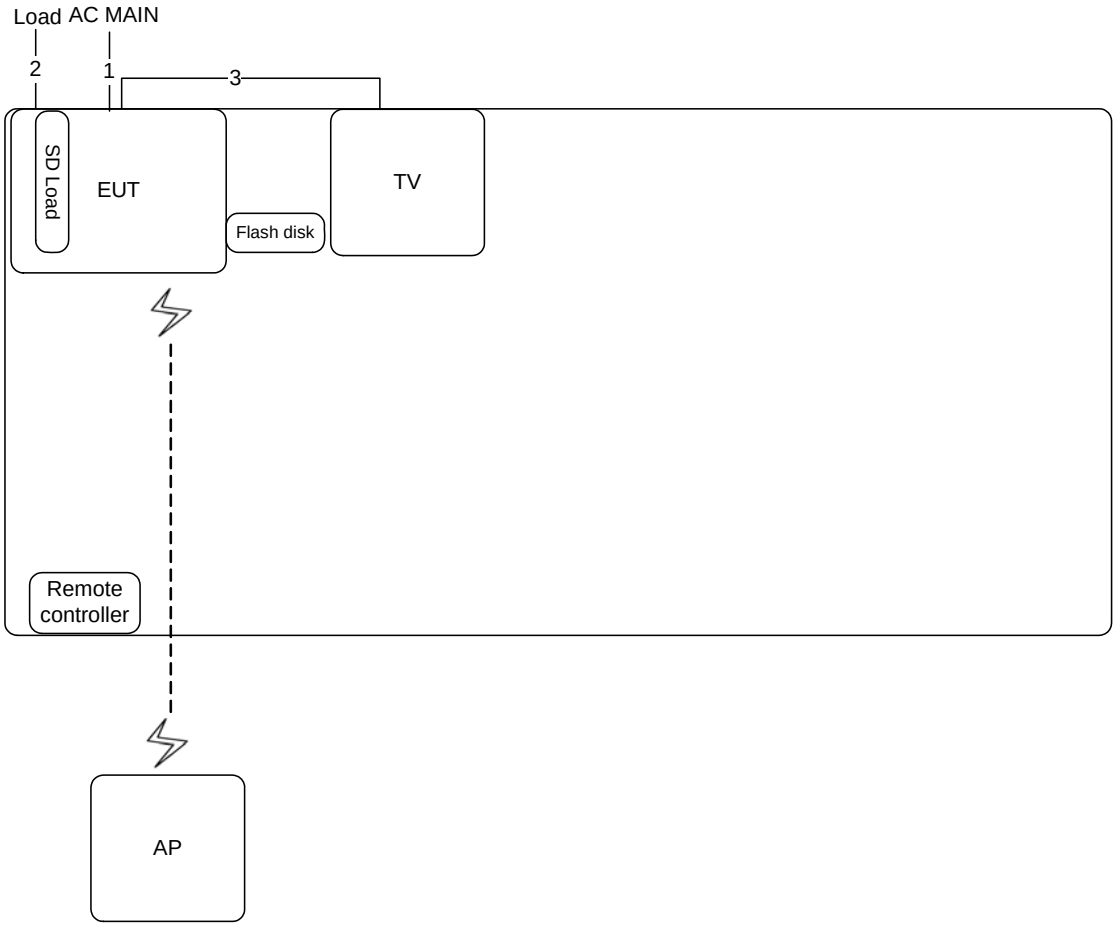
The EUT was programmed to be in continuously transmitting mode.

3.11. Duty Cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
802.11a	2.080	2.090	99.52	0.02	0.01
802.11n MCS0 HT20	1.900	1.930	98.45	0.07	0.01

3.12. Test Configurations

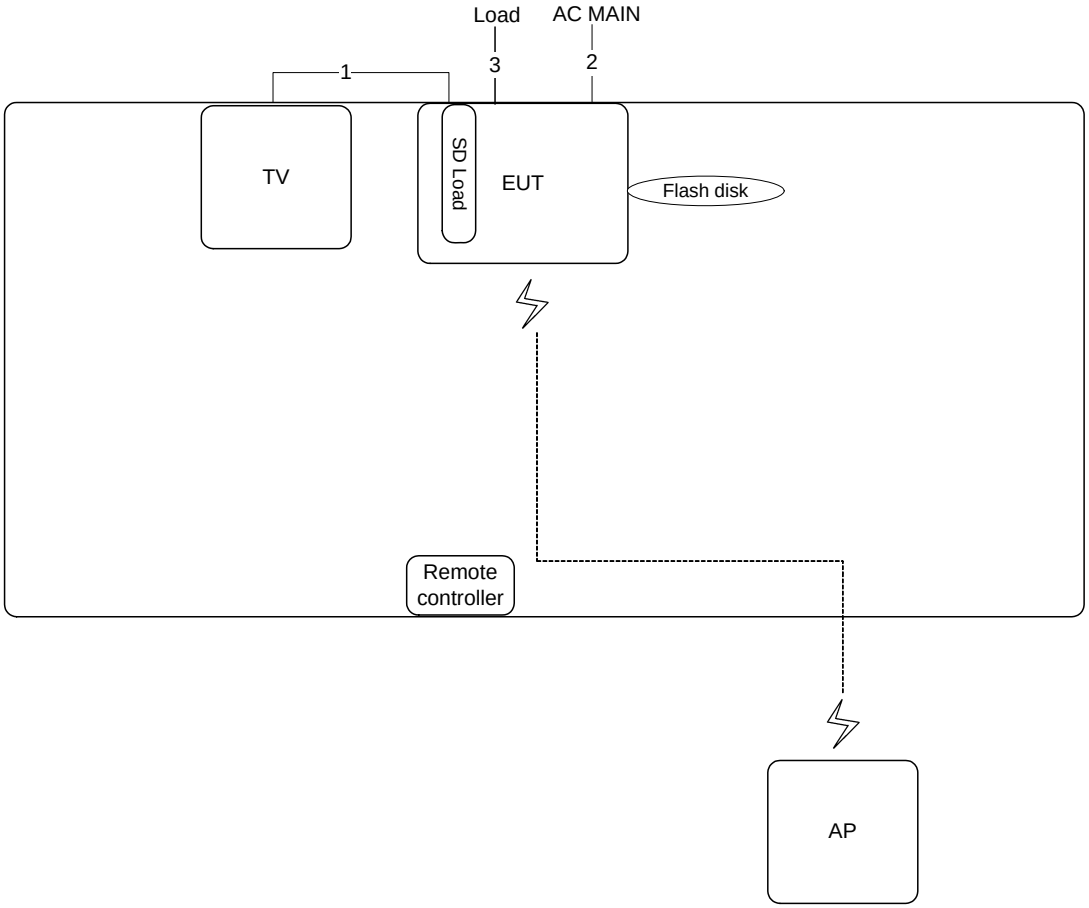
3.12.1. AC Power Line Conduction Emissions Test Configuration



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

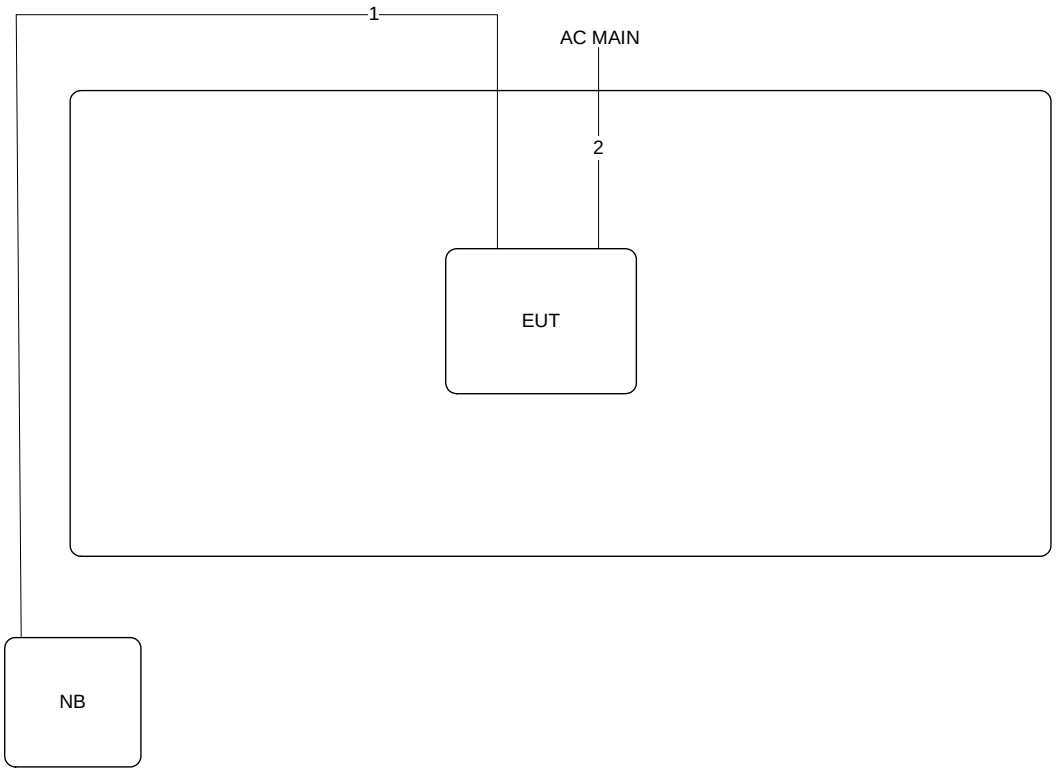
3.12.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz ~1GHz



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

Test Configuration: above 1GHz



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

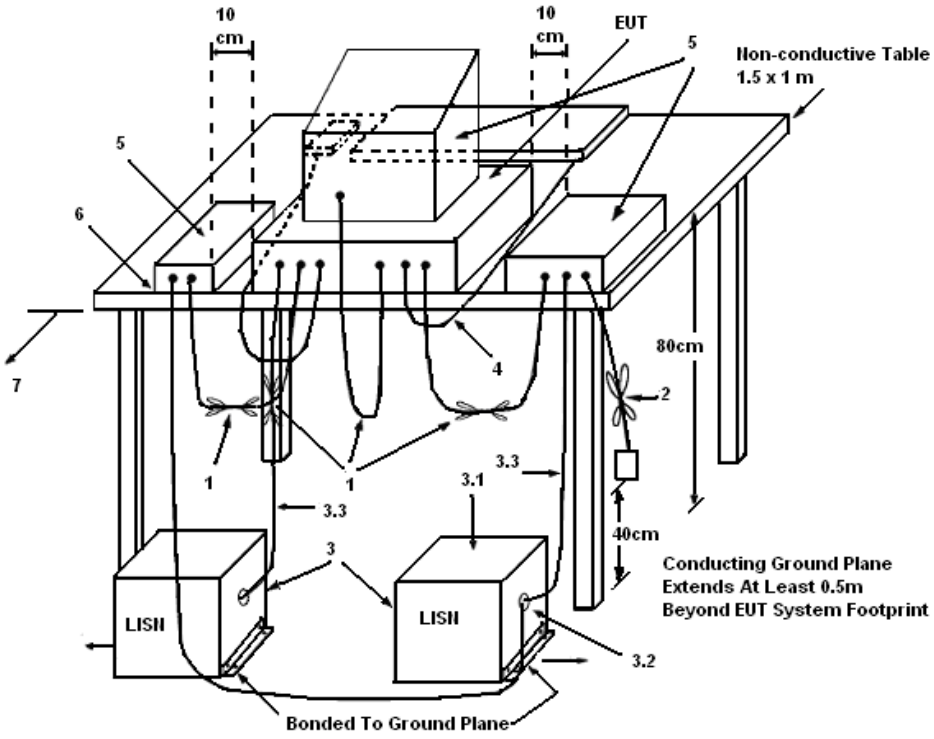
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

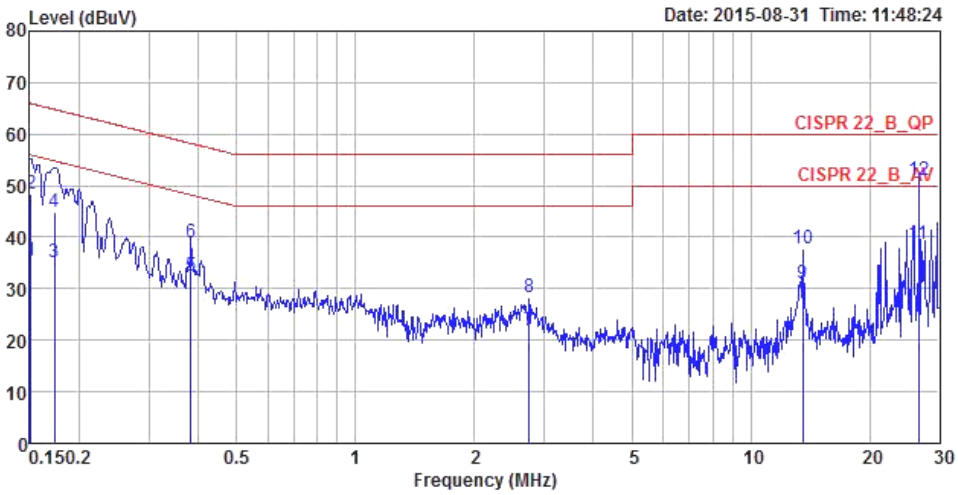
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

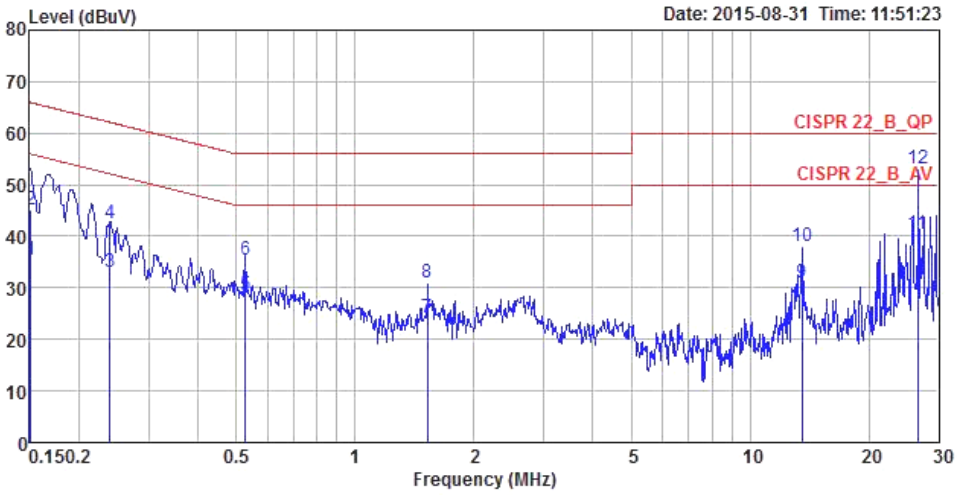
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	22°C	Humidity	54%
Test Engineer	Da Deng	Phase	Line
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1508	35.49	-20.47	55.96	25.32	10.00	0.17	LINE	Average
2	0.1508	48.36	-17.60	65.96	38.19	10.00	0.17	LINE	QP
3	0.1731	34.98	-19.83	54.81	24.81	10.00	0.17	LINE	Average
4	0.1731	44.74	-20.07	64.81	34.57	10.00	0.17	LINE	QP
5	0.3832	32.56	-15.65	48.21	22.35	10.01	0.20	LINE	Average
6	0.3832	38.92	-19.29	58.21	28.71	10.01	0.20	LINE	QP
7	2.7502	21.78	-24.22	46.00	11.44	10.06	0.28	LINE	Average
8	2.7502	28.27	-27.73	56.00	17.93	10.06	0.28	LINE	QP
9	13.5609	30.85	-19.15	50.00	20.14	10.29	0.42	LINE	Average
10	13.5609	37.66	-22.34	60.00	26.95	10.29	0.42	LINE	QP
11	26.5937	38.60	-11.40	50.00	27.58	10.48	0.54	LINE	Average
12	26.5937	51.13	-8.87	60.00	40.11	10.48	0.54	LINE	QP

Temperature	22°C	Humidity	54%
Test Engineer	Da Deng	Phase	Neutral
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.1508	35.32	-20.64	55.96	25.15	10.00	0.17	NEUTRAL	Average
2	0.1508	45.08	-20.88	65.96	34.91	10.00	0.17	NEUTRAL	QP
3	0.2391	33.13	-19.00	52.13	22.93	10.01	0.19	NEUTRAL	Average
4	0.2391	42.40	-19.73	62.13	32.20	10.01	0.19	NEUTRAL	QP
5	0.5265	28.61	-17.39	46.00	18.39	10.02	0.20	NEUTRAL	Average
6	0.5265	35.43	-20.57	56.00	25.21	10.02	0.20	NEUTRAL	QP
7	1.5274	24.17	-21.83	46.00	13.90	10.04	0.23	NEUTRAL	Average
8	1.5274	30.89	-25.11	56.00	20.62	10.04	0.23	NEUTRAL	QP
9	13.5599	30.92	-19.08	50.00	20.21	10.29	0.42	NEUTRAL	Average
10	13.5599	37.95	-22.05	60.00	27.24	10.29	0.42	NEUTRAL	QP
11	26.5987	40.47	-9.53	50.00	29.45	10.48	0.54	NEUTRAL	Average
12	26.5987	53.02	-6.98	60.00	42.00	10.48	0.54	NEUTRAL	QP

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

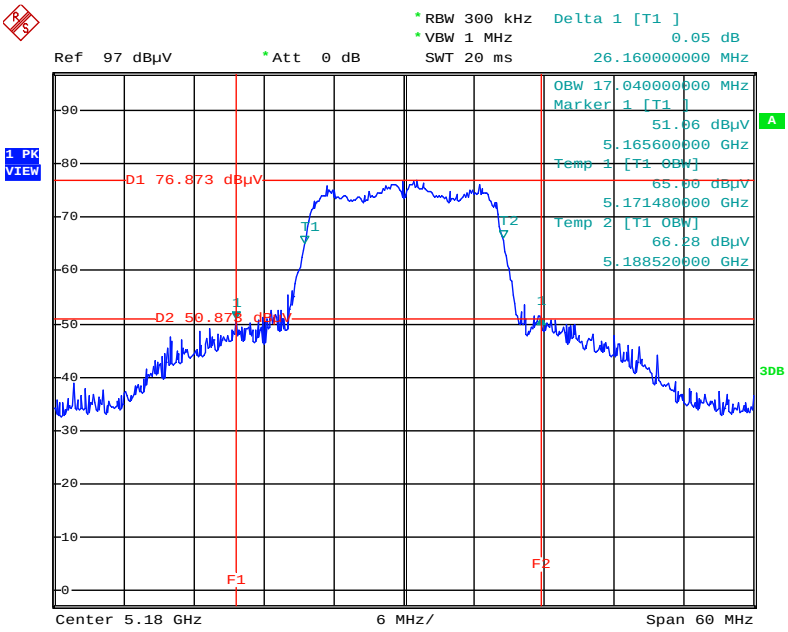
The EUT was programmed to be in continuously transmitting mode.

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

Temperature	25°C	Humidity	45%
Test Engineer	Eddie Weng		

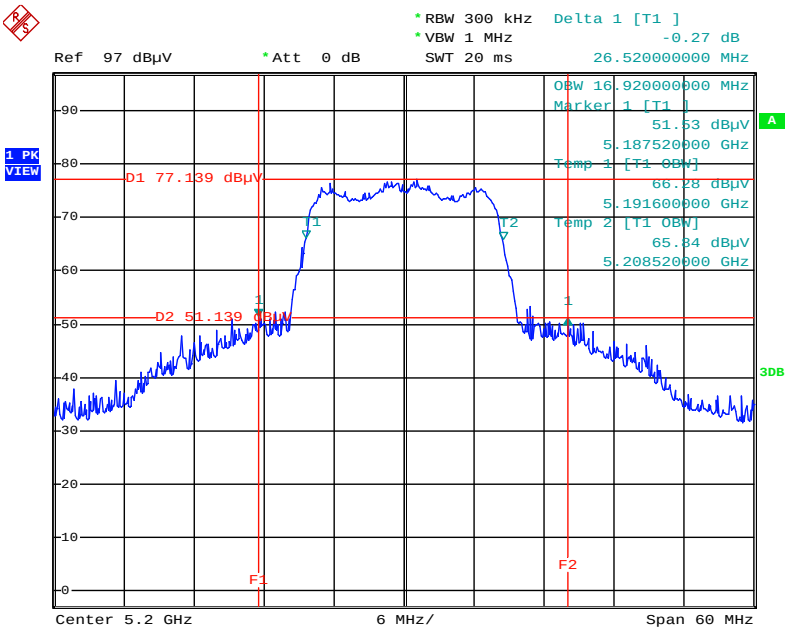
Mode	Frequency	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a	5180 MHz	26.16	17.04
	5200 MHz	26.52	16.92
	5240 MHz	23.64	17.04
	5745 MHz	27.84	16.80
	5785 MHz	28.80	17.04
	5825 MHz	30.12	17.16
802.11n MCS0 HT20	5180 MHz	27.24	17.64
	5200 MHz	27.60	17.52
	5240 MHz	27.72	17.76
	5745 MHz	20.16	17.40
	5785 MHz	33.00	17.76
	5825 MHz	20.04	17.52

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Ant. 2/ 5180 MHz



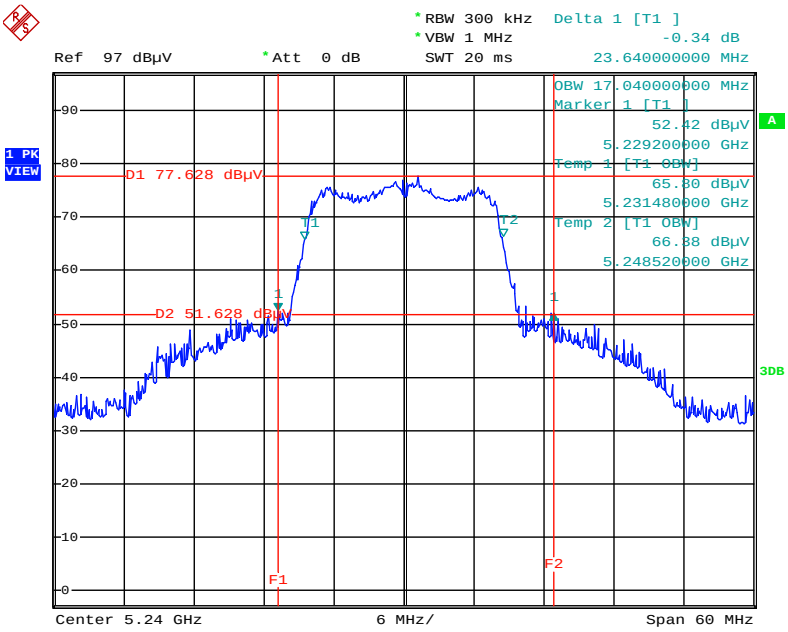
Date: 27.AUG.2015 10:16:11

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Ant. 2 / 5200 MHz



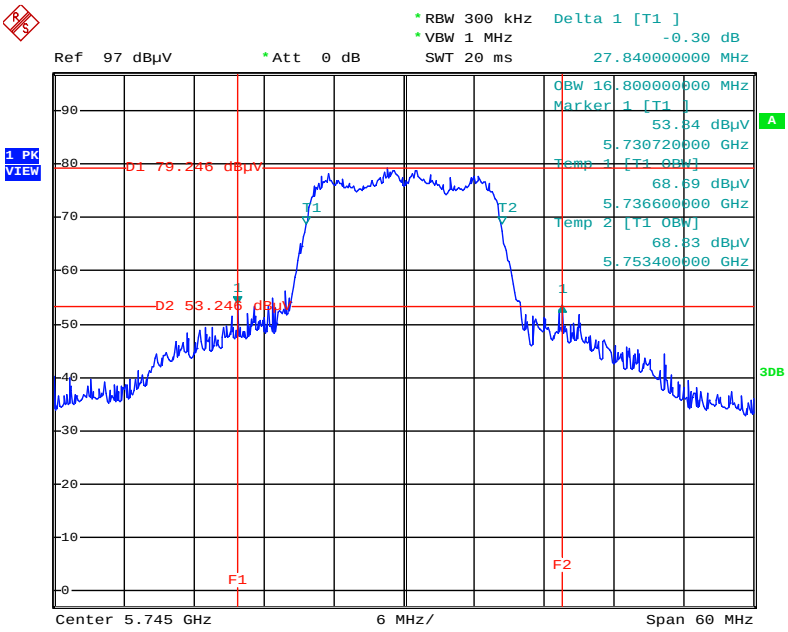
Date: 27.AUG.2015 10:16:51

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Ant. 2 / 5240 MHz



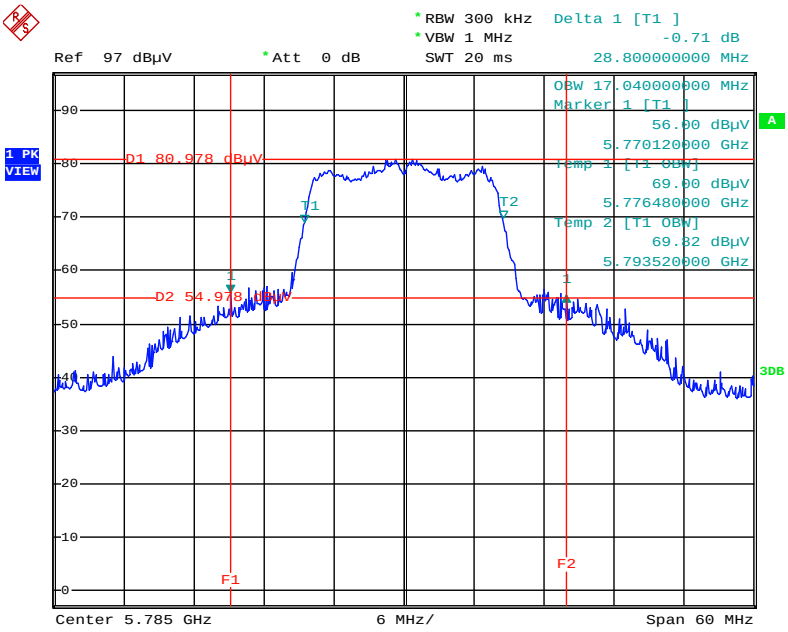
Date: 27.AUG.2015 10:17:19

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Ant. 2 / 5745 MHz



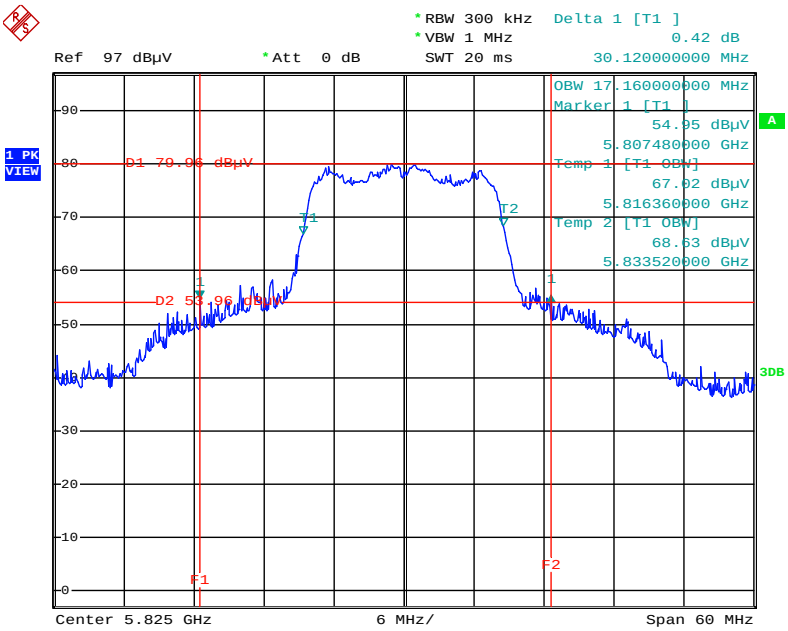
Date: 27.AUG.2015 16:45:33

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Ant. 2 / 5785 MHz



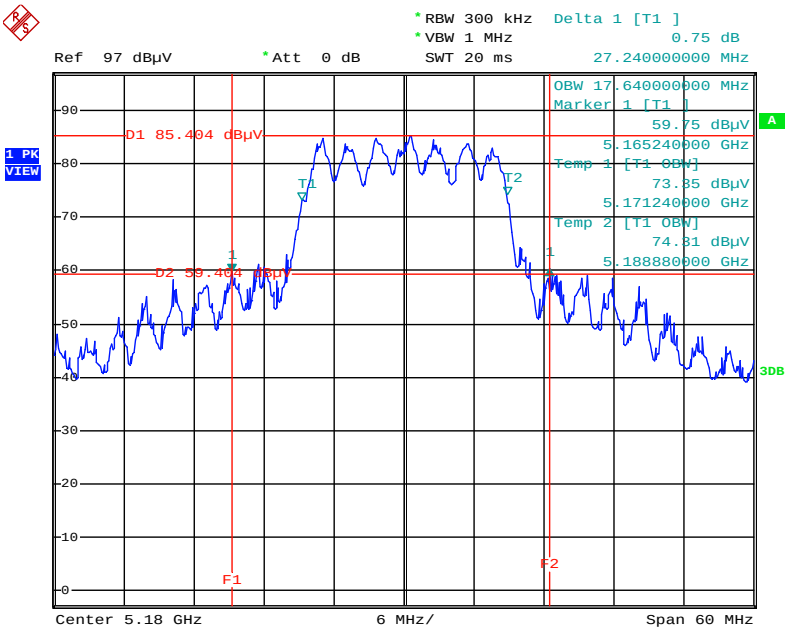
Date: 27.AUG.2015 16:45:55

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11a / Ant. 2 / 5825 MHz



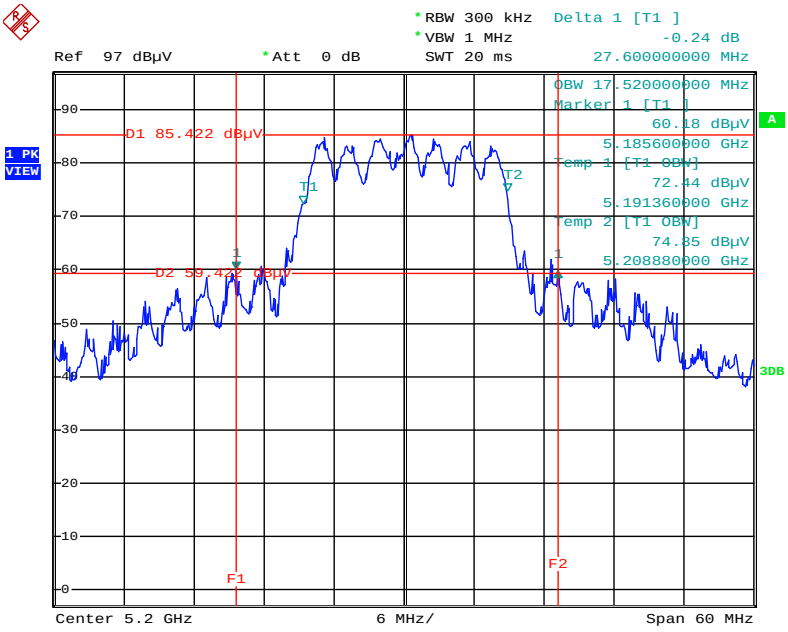
Date: 27.AUG.2015 16:46:07

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11n MCS0 HT20 / Ant. 1 + Ant. 2 / 5180 MHz



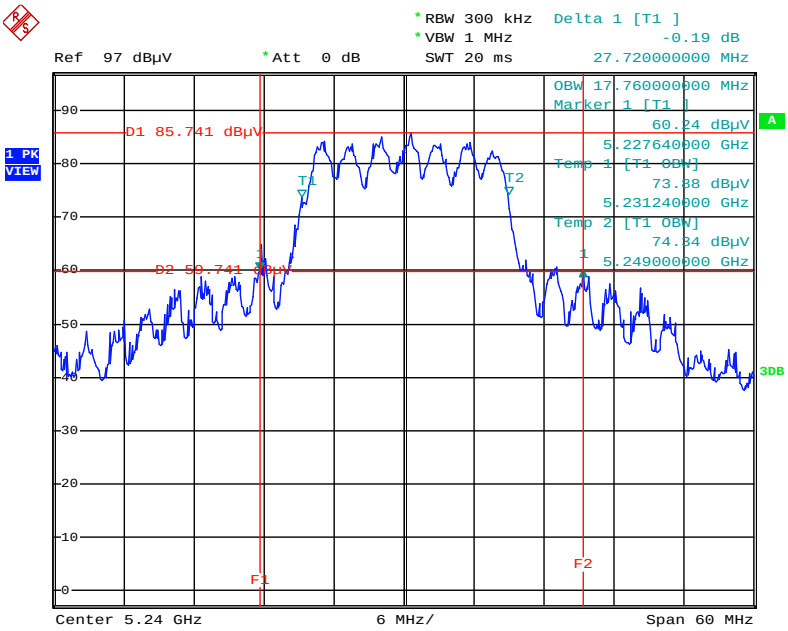
Date: 27.AUG.2015 16:42:10

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11n MCS0 HT20 / Ant. 1 + Ant. 2 / 5200 MHz



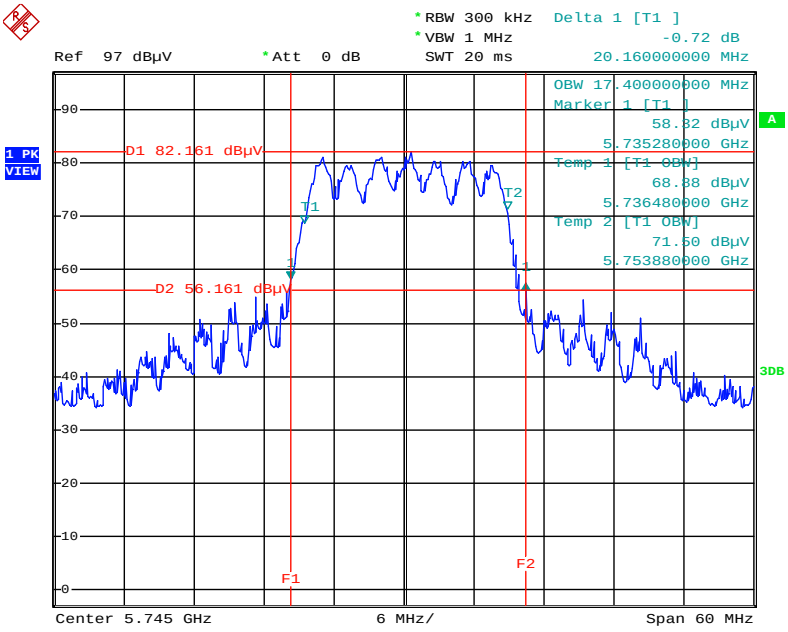
Date: 27.AUG.2015 16:42:47

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11n MCS0 HT20 / Ant. 1 + Ant. 2 / 5240 MHz



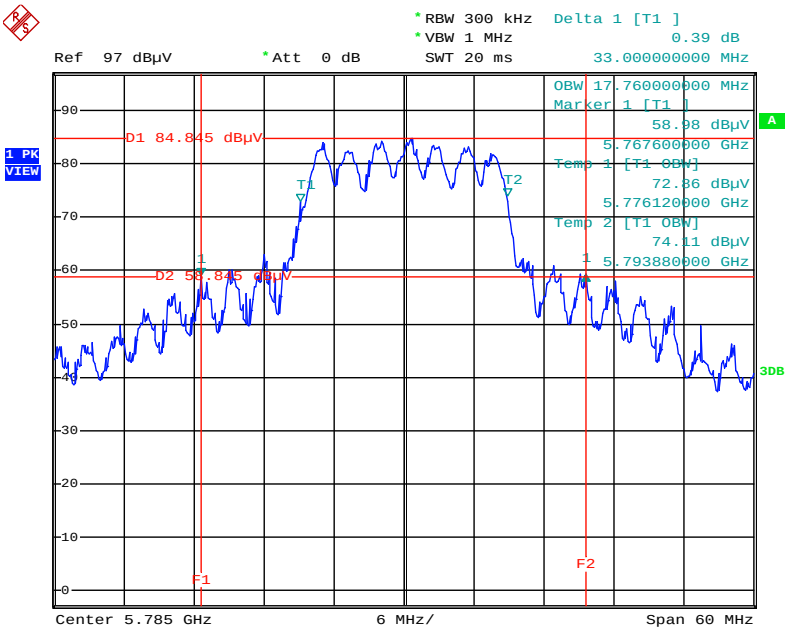
Date: 27.AUG.2015 16:43:05

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11n MCS0 HT20 / Ant. 1 + Ant. 2 / 5745 MHz



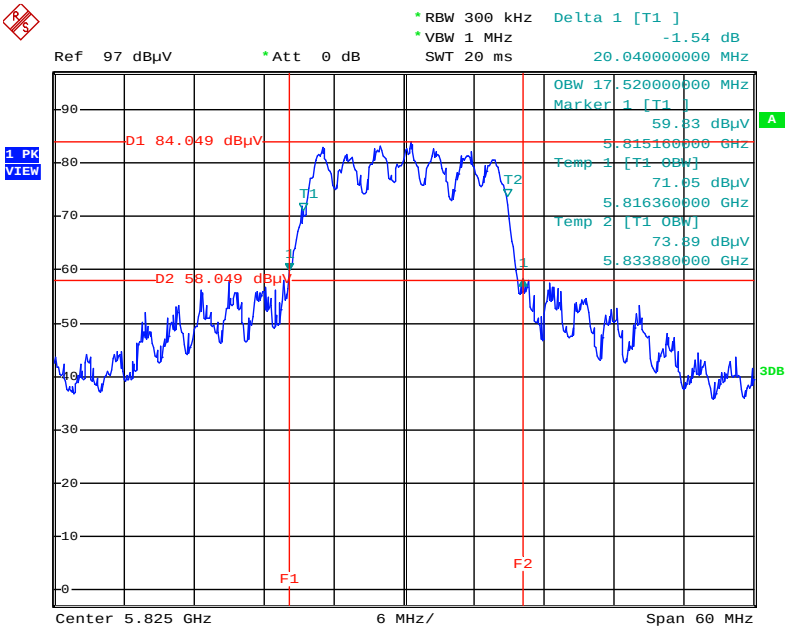
Date: 27.AUG.2015 16:43:26

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11n MCS0 HT20 / Ant. 1 + Ant. 2 / 5785 MHz



Date: 27.AUG.2015 16:43:51

26dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration IEEE 802.11n MCS0 HT20 / Ant. 1 + Ant. 2 / 5825 MHz



Date: 27.AUG.2015 16:44:11

4.3. 6dB Spectrum Bandwidth Measurement

4.3.1. Limit

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

4.3.2. Measuring Instruments and Setting

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

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

4.3.3. Test Procedures

For Radiated 6dB Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Test was performed in accordance with KDB789033 D02 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

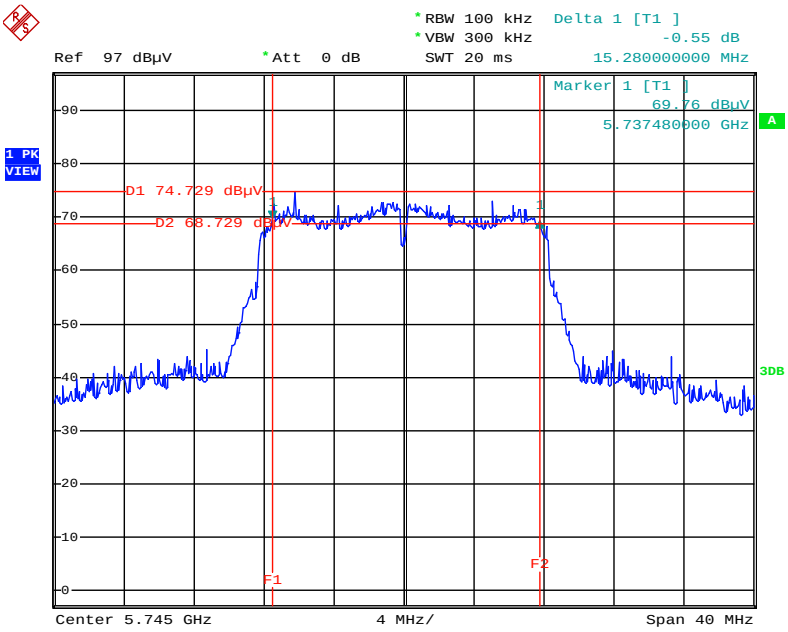
Temperature	25°C	Humidity	45%
Test Engineer	Eddie Weng		

Mode	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Test Result
802.11a	5745 MHz	15.28	500	Complies
	5785 MHz	15.36	500	Complies
	5825 MHz	14.80	500	Complies
802.11n MCS0 HT20	5745 MHz	15.68	500	Complies
	5785 MHz	15.68	500	Complies
	5825 MHz	15.76	500	Complies

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

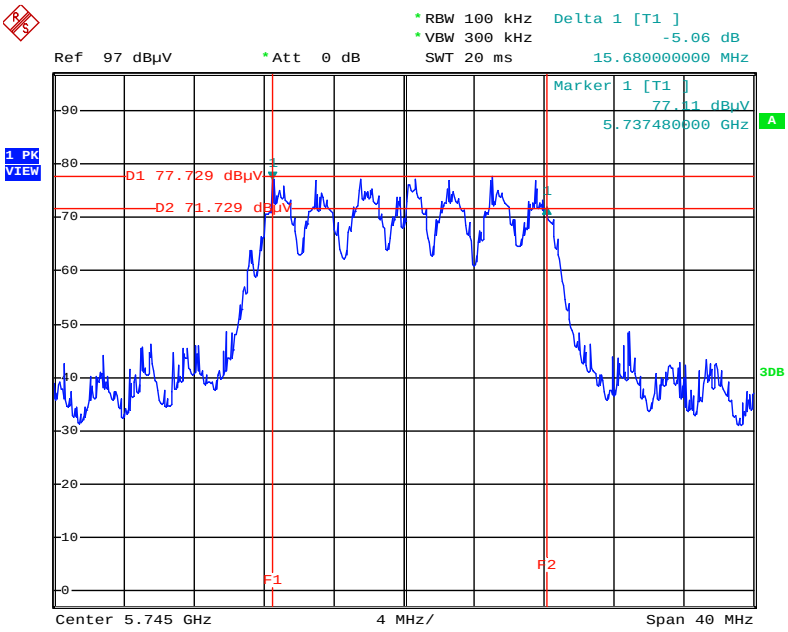
For plots, only the channel with worse result was shown.

6 dB Bandwidth Plot on Configuration IEEE 802.11a / Ant. 2 / 5745 MHz



Date: 27.AUG.2015 16:48:33

6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS0 HT20 / Ant. 1 + Ant. 2 / 5745 MHz



Date: 27.AUG.2015 16:50:38

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

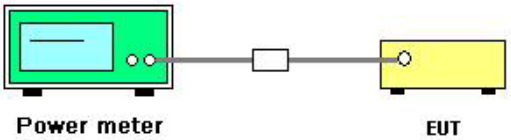
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Bandwidth	50MHz bandwidth is greater than the EUT emission bandwidth
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	25°C	Humidity	45%
Test Engineer	Eddie Weng	Test Date	Aug. 27, 2015

Mode	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
		Ant. 2		
802.11a	5180 MHz	17.05	24.00	Complies
	5200 MHz	17.22	24.00	Complies
	5240 MHz	17.17	24.00	Complies
	5745 MHz	16.17	30.00	Complies
	5785 MHz	17.15	30.00	Complies
	5825 MHz	17.08	30.00	Complies

Mode	Frequency	Conducted Power (dBm)			Max. Limit (dBm)	Result
		Ant. 1	Ant. 2	Total		
802.11n MCS0 HT20	5180 MHz	17.29	17.01	20.16	24.00	Complies
	5200 MHz	17.21	17.18	20.21	24.00	Complies
	5240 MHz	17.28	17.07	20.19	24.00	Complies
	5745 MHz	14.75	14.56	17.67	30.00	Complies
	5785 MHz	17.32	17.16	20.25	30.00	Complies
	5825 MHz	15.74	15.62	18.69	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

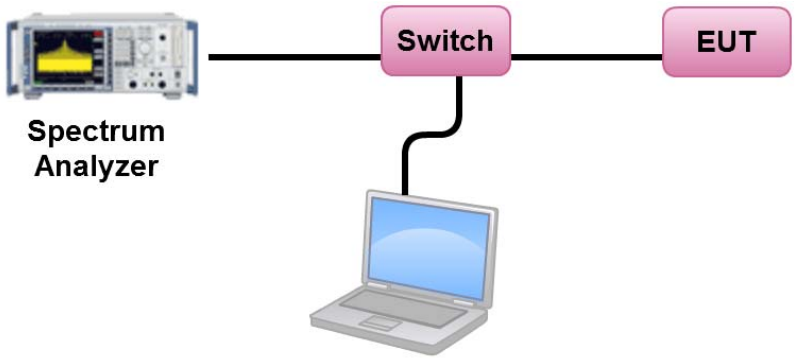
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

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

4.5.3. Test Procedures

1. The transmitter output (antenna port) was connected RF switch to the spectrum analyzer.
2. Test was performed in accordance with KDB789033 D02 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.
5. For 5.725~5.85 GHz, the measured result of PSD level must add 10log(500kHz/RBW) and the final result should ≤ 30 dBm.

4.5.4. Test Setup Layout



4.5.5. Test Deviation

There is no deviation with the original standard.

4.5.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.5.7. Test Result of Power Spectral Density

Temperature	25°C	Humidity	45%
Test Engineer	Eddie Weng		

Configuration IEEE 802.11a / Ant. 2

Channel	Frequency	Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
36	5180 MHz	4.03	11.00	Complies
40	5200 MHz	4.20	11.00	Complies
48	5240 MHz	4.18	11.00	Complies

Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
149	5745 MHz	3.12	-3.01	0.11	30.00	Complies
157	5785 MHz	4.01	-3.01	1.00	30.00	Complies
165	5825 MHz	4.04	-3.01	1.03	30.00	Complies

Configuration IEEE 802.11n MCS0 HT20 / Ant. 1 + Ant. 2

Channel	Frequency	Power Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
36	5180 MHz	7.15	11.00	Complies
40	5200 MHz	7.15	11.00	Complies
48	5240 MHz	7.09	11.00	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =5.62dBi <6dBi, so the limit doesn't reduce.

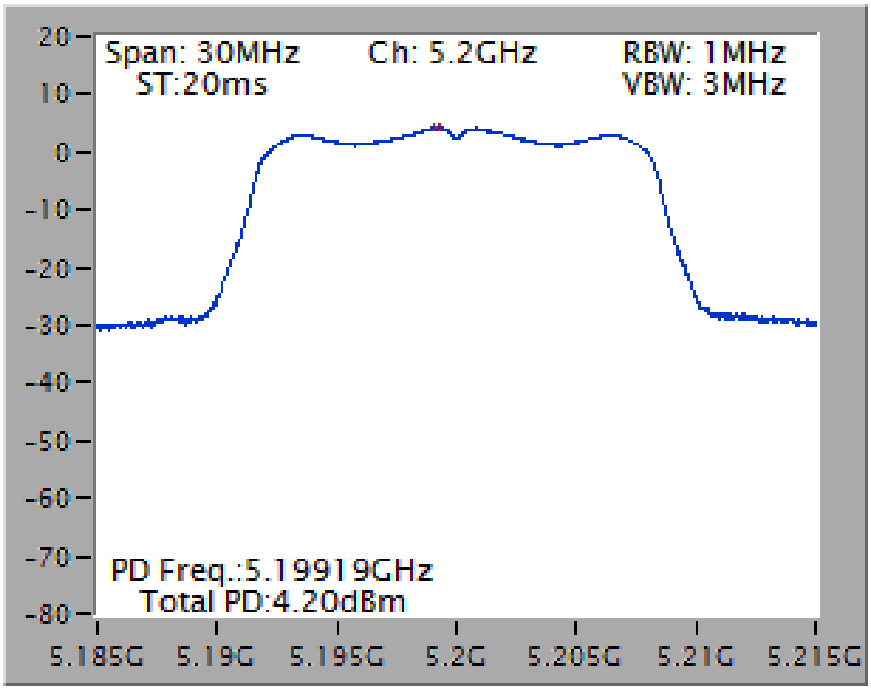
Channel	Frequency	Power Density (dBm/MHz)	10log(500kHz/RBW) Factor (dB)	Power Density (dBm/500kHz)	Power Density Limit (dBm/500kHz)	Result
149	5745 MHz	4.67	-3.01	1.66	30.00	Complies
157	5785 MHz	7.18	-3.01	4.17	30.00	Complies
165	5825 MHz	5.54	-3.01	2.53	30.00	Complies

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =5.26dBi <6dBi, so the limit doesn't reduce.

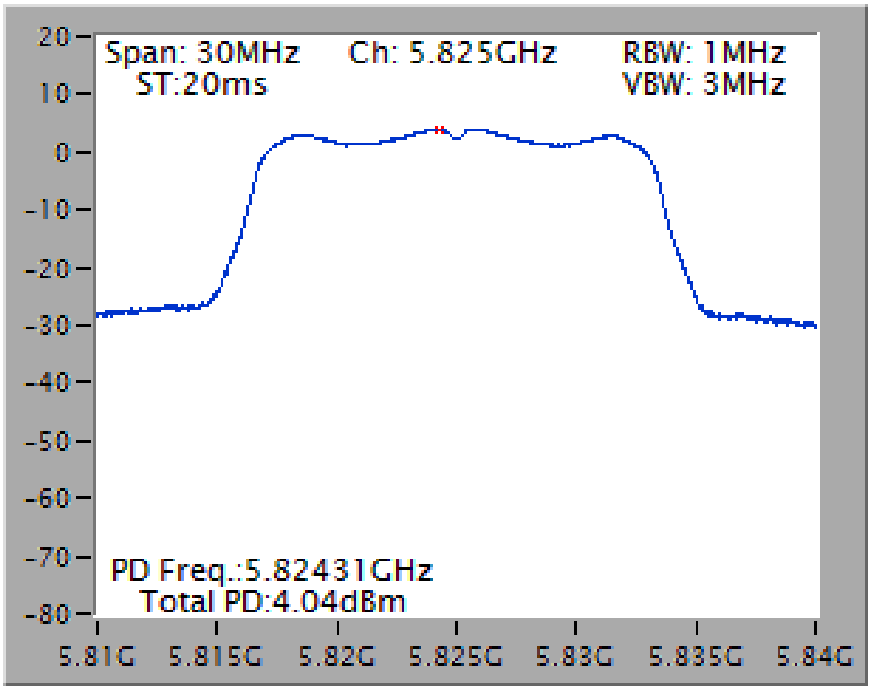
Note: All the test values were listed in the report.

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

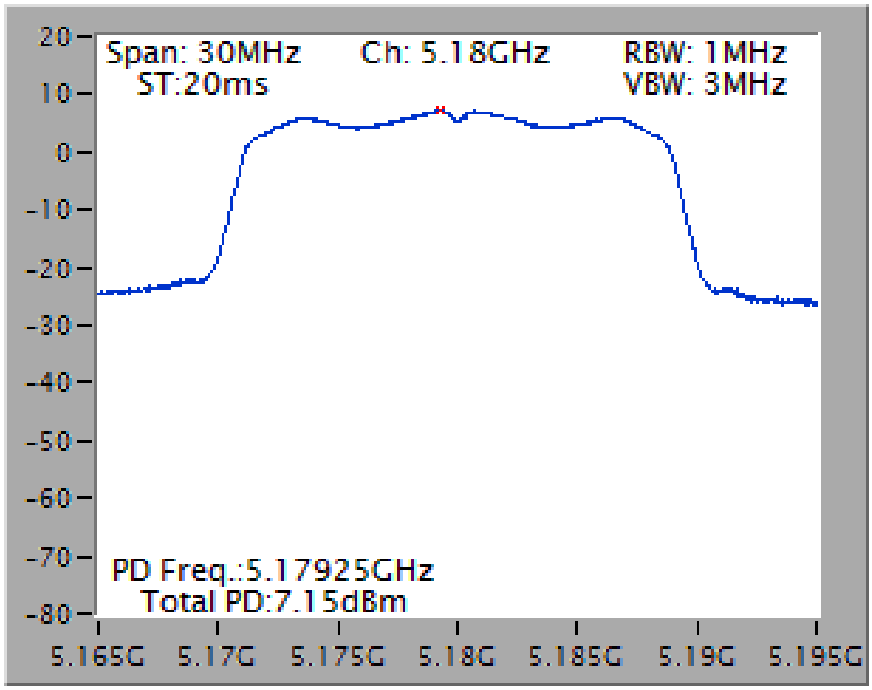
Power Density Plot on Configuration IEEE 802.11a / Ant. 2 / 5200 MHz



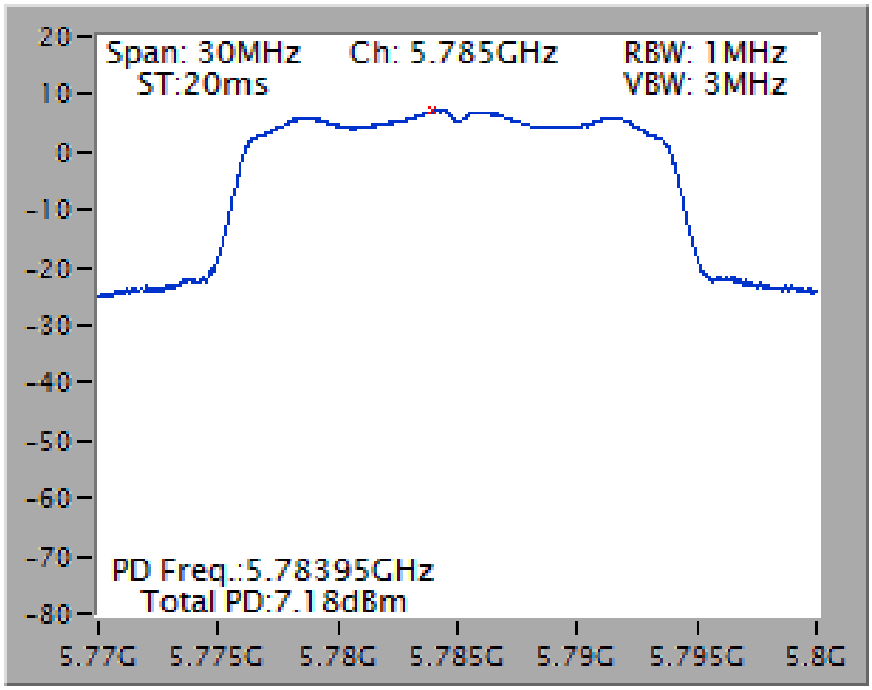
Power Density Plot on Configuration IEEE 802.11a / Ant. 2 / 5825 MHz



Power Density Plot on Configuration IEEE 802.11n MCS0 HT20 / Ant. 1 + Ant. 2 / 5180 MHz



Power Density Plot on Configuration IEEE 802.11n MCS0 HT20 / Ant. 1 + Ant. 2 / 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 5.15-5.25 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

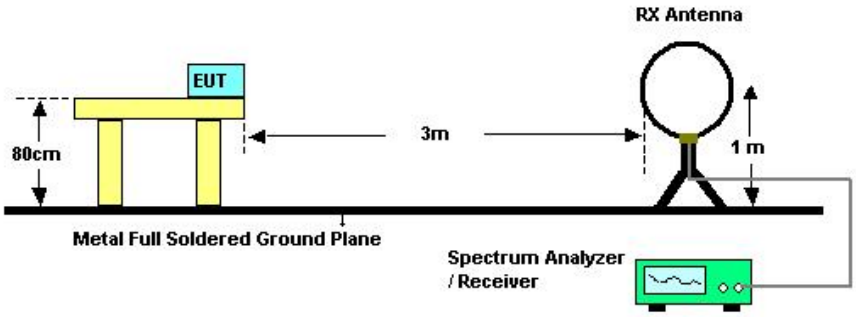
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.6.3. Test Procedures

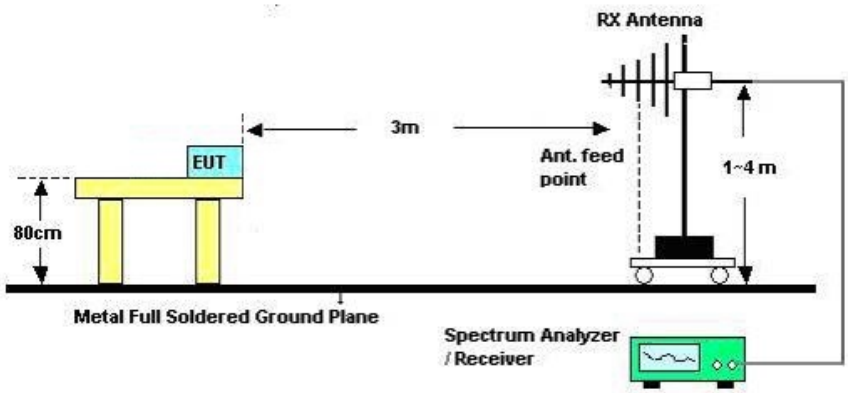
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting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

4.6.4. Test Setup Layout

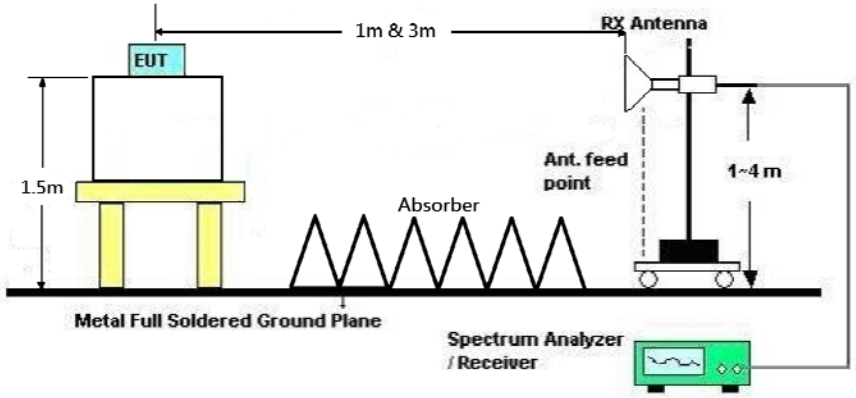
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



4.6.5. Test Deviation

There is no deviation with the original standard.

4.6.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

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

Temperature	26°C	Humidity	68%
Test Engineer	Alvin Li	Configurations	Normal Link
Test Date	Nov. 03, 2015	Test Mode	Mode 9

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.

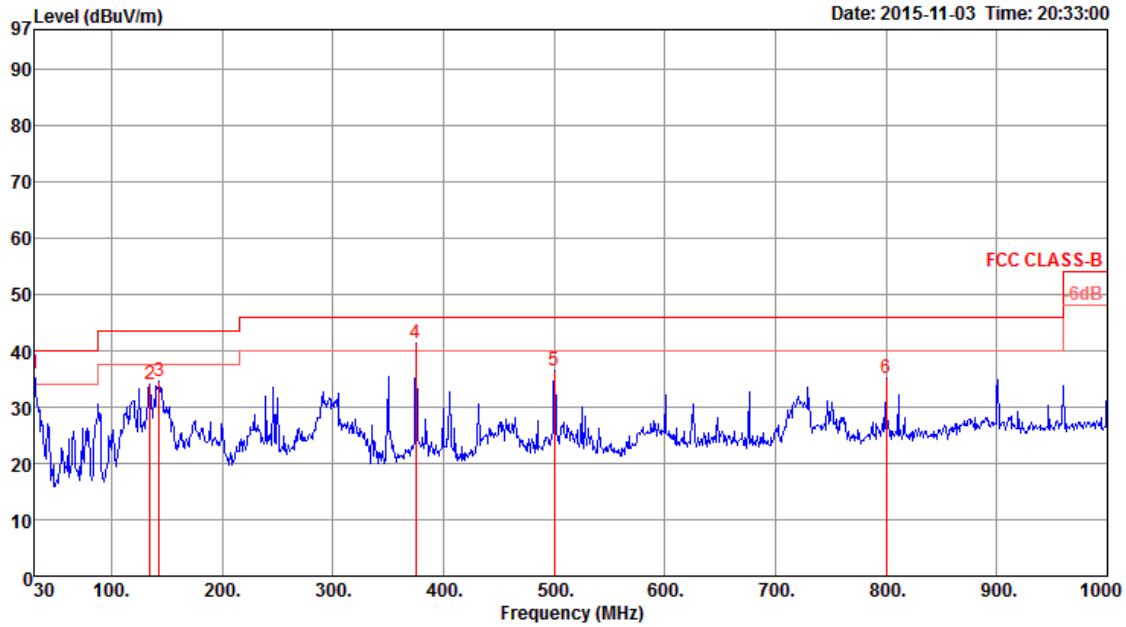
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

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

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

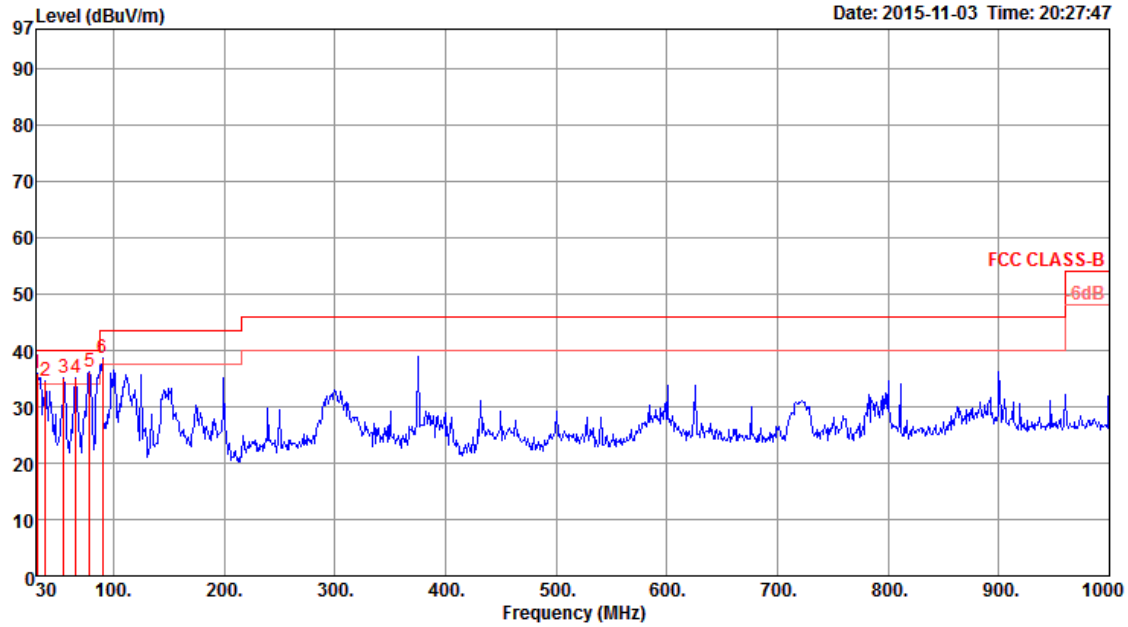
Temperature	26°C	Humidity	68%
Test Engineer	Alvin Li	Configurations	Normal Link
Test Mode	Mode 9		

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	30.00	35.88	40.00	-4.12	42.22	0.61	20.10	27.05	Peak	400	0	HORIZONTAL
2	134.76	34.00	43.50	-9.50	48.44	1.40	12.25	28.09	Peak	400	0	HORIZONTAL
3	143.49	34.57	43.50	-8.93	49.49	1.42	11.71	28.05	Peak	400	0	HORIZONTAL
4	375.32	41.27	46.00	-4.73	51.25	2.20	15.86	28.04	Peak	400	0	HORIZONTAL
5	500.45	36.35	46.00	-9.65	44.56	2.67	17.80	28.68	Peak	400	0	HORIZONTAL
6	800.18	35.23	46.00	-10.77	39.54	3.22	20.80	28.33	Peak	400	0	HORIZONTAL

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	30.97	36.01	40.00	-3.99	42.91	0.63	19.52	27.05	Peak	400	0	VERTICAL
2	38.73	34.52	40.00	-5.48	46.59	0.67	14.88	27.62	Peak	400	0	VERTICAL
3	55.22	35.14	40.00	-4.86	54.70	0.84	8.05	28.45	Peak	400	0	VERTICAL
4	65.89	35.02	40.00	-4.98	55.64	0.95	6.84	28.41	Peak	400	0	VERTICAL
5	78.50	36.20	40.00	-3.80	56.16	0.96	7.45	28.37	Peak	400	0	VERTICAL
6	90.14	38.68	43.50	-4.82	56.67	1.04	9.30	28.33	Peak	400	0	VERTICAL

Note:

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

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

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

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

Temperature	26°C	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11a CH 36 / Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	15535.36	43.00	54.00	-11.00	31.90	7.56	38.16	34.62	22	138	Average	HORIZONTAL
2	15540.32	55.35	74.00	-18.65	44.25	7.56	38.16	34.62	22	138	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	15536.38	42.77	54.00	-11.23	31.67	7.56	38.16	34.62	68	178	Average	VERTICAL
2	15538.66	55.59	74.00	-18.41	44.49	7.56	38.16	34.62	68	178	Peak	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11a CH 40 / Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	Cm		
1	15598.36	54.91	74.00	-19.09	43.71	7.58	38.29	34.67	192	155	Peak	HORIZONTAL
2	15598.58	42.76	54.00	-11.24	31.56	7.58	38.29	34.67	192	155	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	Cm		
1	15598.40	55.53	74.00	-18.47	44.33	7.58	38.29	34.67	139	141	Peak	VERTICAL
2	15601.61	42.94	54.00	-11.06	31.76	7.58	38.29	34.69	139	141	Average	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11a CH 48 / Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	15598.42	42.50	54.00	-11.50	31.30	7.58	38.29	34.67	171	153	Average	HORIZONTAL
2	15601.35	55.63	74.00	-18.37	44.45	7.58	38.29	34.69	171	153	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	15597.78	55.47	74.00	-18.53	44.27	7.58	38.29	34.67	145	141	Peak	VERTICAL
2	15599.08	42.60	54.00	-11.40	31.42	7.58	38.29	34.69	145	141	Average	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11a CH 149 / Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	Cm		
1	11490.06	42.48	54.00	-11.52	31.87	6.53	38.70	34.62	310	111	Average	HORIZONTAL
2	11490.12	54.96	74.00	-19.04	44.35	6.53	38.70	34.62	310	111	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	Cm		
1	11489.64	55.61	74.00	-18.39	45.00	6.53	38.70	34.62	207	113	Peak	VERTICAL
2	11490.00	42.72	54.00	-11.28	32.11	6.53	38.70	34.62	207	113	Average	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11a CH 157 / Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	11569.70	56.23	74.00	-17.77	45.61	6.55	38.71	34.64	308	111	Peak	HORIZONTAL
2	11569.76	43.65	54.00	-10.35	33.04	6.55	38.71	34.65	308	111	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	11569.70	46.14	54.00	-7.86	35.52	6.55	38.71	34.64	206	111	Average	VERTICAL
2	11569.82	60.64	74.00	-13.36	50.03	6.55	38.71	34.65	206	111	Peak	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11a CH 165 / Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	11649.46	44.74	54.00	-9.26	34.13	6.56	38.73	34.68	309	111	Average	HORIZONTAL
2	11649.70	56.93	74.00	-17.07	46.32	6.56	38.73	34.68	309	111	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	11649.16	48.80	54.00	-5.20	38.19	6.56	38.73	34.68	211	116	Average	VERTICAL
2	11654.44	61.12	74.00	-12.88	50.51	6.56	38.73	34.68	211	116	Peak	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11n MCS0 HT20 CH 36 / Ant. 1 + Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	15543.18	55.33	74.00	-18.67	44.23	7.56	38.16	34.62	0	150	Peak	HORIZONTAL
2	15544.80	43.05	54.00	-10.95	31.92	7.56	38.19	34.62	0	150	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	15540.78	44.40	54.00	-9.60	33.30	7.56	38.16	34.62	144	150	Average	VERTICAL
2	15544.08	55.17	74.00	-18.83	44.04	7.56	38.19	34.62	144	150	Peak	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11n MCS0 HT20 CH 40 / Ant. 1 + Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	15597.42	42.88	54.00	-11.12	31.68	7.58	38.29	34.67	288	151	Average	HORIZONTAL
2	15600.60	55.06	74.00	-18.94	43.88	7.58	38.29	34.69	288	151	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	15596.42	42.60	54.00	-11.40	31.40	7.58	38.29	34.67	118	148	Average	VERTICAL
2	15600.36	55.85	74.00	-18.15	44.67	7.58	38.29	34.69	118	148	Peak	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11n MCS0 HT20 CH 48 / Ant. 1 + Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	15717.52	42.92	54.00	-11.08	31.58	7.62	38.50	34.78	99	155	Average	HORIZONTAL
2	15720.76	55.61	74.00	-18.39	44.27	7.62	38.50	34.78	99	155	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	15719.77	55.47	74.00	-18.53	44.13	7.62	38.50	34.78	357	149	Peak	VERTICAL
2	15721.30	42.96	54.00	-11.04	31.62	7.62	38.50	34.78	357	149	Average	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11n MCS0 HT20 CH 149 / Ant. 1 + Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	11490.12	39.98	54.00	-14.02	29.37	6.53	38.70	34.62	315	118	Average	HORIZONTAL
2	11490.30	53.58	74.00	-20.42	42.97	6.53	38.70	34.62	315	118	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	11491.80	40.60	54.00	-13.40	29.99	6.53	38.70	34.62	215	105	Average	VERTICAL
2	11498.10	52.11	74.00	-21.89	41.49	6.54	38.70	34.62	215	105	Peak	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11n MCS0 HT20 CH 157 / Ant. 1 + Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	11572.58	43.55	54.00	-10.45	32.94	6.55	38.71	34.65	313	118	Average	HORIZONTAL
2	11572.82	55.86	74.00	-18.14	45.25	6.55	38.71	34.65	313	118	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	11564.96	58.36	74.00	-15.64	47.74	6.55	38.71	34.64	211	110	Peak	VERTICAL
2	11570.12	46.90	54.00	-7.10	36.29	6.55	38.71	34.65	211	110	Average	VERTICAL

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11n MCS0 HT20 CH 165 / Ant. 1 + Ant. 2
Test Date	Aug. 18, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	11650.00	42.33	54.00	-11.67	31.72	6.56	38.73	34.68	310	115	Average	HORIZONTAL
2	11657.32	54.79	74.00	-19.21	44.18	6.56	38.73	34.68	310	115	Peak	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	11650.18	44.15	54.00	-9.85	33.54	6.56	38.73	34.68	211	110	Average	VERTICAL
2	11657.26	57.05	74.00	-16.95	46.44	6.56	38.73	34.68	211	110	Peak	VERTICAL

Note:

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

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

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

4.7. Band Edge Emissions Measurement

4.7.1. Limit

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

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

In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

4.7.2. Measuring Instruments and Setting

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

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

4.7.3. Test Procedures

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

4.7.4. Test Setup Layout

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

4.7.5. Test Deviation

There is no deviation with the original standard.

4.7.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.7.7. Test Result of Band Edge and Fundamental Emissions

Temperature	26°C	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11a CH 36, 40, 48 / Ant. 2
Test Date	Aug. 18, 2015		

Channel 36

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	Cm		
1	5148.20	64.10	74.00	-9.90	61.04	4.26	33.27	34.47	163	102	Peak	HORIZONTAL
2	5150.00	48.12	54.00	-5.88	45.06	4.26	33.27	34.47	163	102	Average	HORIZONTAL
3	5180.20	105.83			102.70	4.27	33.33	34.47	163	102	Peak	HORIZONTAL
4	5181.00	94.54			91.41	4.27	33.33	34.47	163	102	Average	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	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	Cm		
1	5127.20	43.72	54.00	-10.28	40.70	4.25	33.24	34.47	47	109	Average	HORIZONTAL
2	5132.40	55.69	74.00	-18.31	52.67	4.25	33.24	34.47	47	109	Peak	HORIZONTAL
3	5199.60	97.52			94.35	4.28	33.36	34.47	47	109	Average	HORIZONTAL
4	5200.80	107.67			104.50	4.28	33.36	34.47	47	109	Peak	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	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	Cm		
1	5092.40	41.52	54.00	-12.48	38.58	4.23	33.18	34.47	45	108	Average	HORIZONTAL
2	5112.80	54.93	74.00	-19.07	51.95	4.24	33.21	34.47	45	108	Peak	HORIZONTAL
3	5240.00	107.54			104.29	4.30	33.42	34.47	45	108	Peak	HORIZONTAL
4	5241.20	97.09			93.84	4.30	33.42	34.47	45	108	Average	HORIZONTAL
5	5350.00	43.47	54.00	-10.53	39.96	4.35	33.63	34.47	45	108	Average	HORIZONTAL
6	5359.40	56.82	74.00	-17.18	53.31	4.35	33.63	34.47	45	108	Peak	HORIZONTAL

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

Temperature	26°C	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11a CH 149, 157, 165 / Ant. 2
Test Date	Aug. 18, 2015		

Channel 149

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	5713.00	70.63	74.00	-3.37	66.13	4.49	34.52	34.51	64	119	Peak	HORIZONTAL
2	5715.00	51.30	54.00	-2.70	46.80	4.49	34.52	34.51	64	119	Average	HORIZONTAL
3	5725.00	78.16	78.20	-0.04	73.60	4.50	34.57	34.51	64	119	Peak	HORIZONTAL
4	5744.60	95.08			90.48	4.50	34.62	34.52	64	119	Average	HORIZONTAL
5	5744.80	107.72			103.12	4.50	34.62	34.52	64	119	Peak	HORIZONTAL

Item 4, 5 are the fundamental frequency at 5745 MHz.

Channel 157

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	5711.00	57.93	74.00	-16.07	53.43	4.49	34.52	34.51	68	104	Peak	HORIZONTAL
2	5713.00	44.21	54.00	-9.79	39.71	4.49	34.52	34.51	68	104	Average	HORIZONTAL
3	5722.20	58.57	78.20	-19.63	54.01	4.50	34.57	34.51	68	104	Peak	HORIZONTAL
4	5784.60	106.78			102.06	4.52	34.73	34.53	68	104	Peak	HORIZONTAL
5	5784.60	95.62			90.90	4.52	34.73	34.53	68	104	Average	HORIZONTAL
6	5852.20	59.49	78.20	-18.71	54.56	4.54	34.93	34.54	68	104	Peak	HORIZONTAL
7	5860.60	43.88	54.00	-10.12	38.88	4.55	34.99	34.54	68	104	Average	HORIZONTAL
8	5875.00	57.43	74.00	-16.57	52.38	4.55	35.04	34.54	68	104	Peak	HORIZONTAL

Item 4, 5 are the fundamental frequency at 5785 MHz.

Channel 165

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	5824.20	95.24			90.36	4.53	34.88	34.53	166	119	Average	HORIZONTAL
2	5825.40	105.97			101.09	4.53	34.88	34.53	166	119	Peak	HORIZONTAL
3	5853.40	69.64	78.20	-8.56	64.71	4.54	34.93	34.54	166	119	Peak	HORIZONTAL
4	5860.00	51.60	54.00	-2.40	46.60	4.55	34.99	34.54	166	119	Average	HORIZONTAL
5	5860.60	67.50	74.00	-6.50	62.50	4.55	34.99	34.54	166	119	Peak	HORIZONTAL

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

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11n MCS0 HT20 CH 36, 40, 48 / Ant. 1 + Ant. 2
Test Date	Aug. 18, 2015		

Channel 36

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	5149.40	51.65	54.00	-2.35	48.59	4.26	33.27	34.47	48	106	Average	HORIZONTAL
2	5149.60	71.10	74.00	-2.90	68.04	4.26	33.27	34.47	48	106	Peak	HORIZONTAL
3	5179.60	97.11			93.98	4.27	33.33	34.47	48	106	Average	HORIZONTAL
4	5182.00	109.12			105.99	4.27	33.33	34.47	48	106	Peak	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	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	5126.80	45.39	54.00	-8.61	42.37	4.25	33.24	34.47	46	100	Average	HORIZONTAL
2	5142.40	57.67	74.00	-16.33	54.61	4.26	33.27	34.47	46	100	Peak	HORIZONTAL
3	5199.60	108.78			105.61	4.28	33.36	34.47	46	100	Peak	HORIZONTAL
4	5199.60	97.06			93.89	4.28	33.36	34.47	46	100	Average	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	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	5098.40	43.38	54.00	-10.62	40.44	4.23	33.18	34.47	53	100	Average	HORIZONTAL
2	5118.20	56.44	74.00	-17.56	53.46	4.24	33.21	34.47	53	100	Peak	HORIZONTAL
3	5239.40	97.12			93.87	4.30	33.42	34.47	53	100	Average	HORIZONTAL
4	5242.40	109.02			105.74	4.30	33.45	34.47	53	100	Peak	HORIZONTAL
5	5357.00	58.44	74.00	-15.56	54.93	4.35	33.63	34.47	53	100	Peak	HORIZONTAL
6	5363.00	45.14	54.00	-8.86	41.59	4.36	33.66	34.47	53	100	Average	HORIZONTAL

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

Temperature	26℃	Humidity	68%
Test Engineer	Alvin Li	Configurations	IEEE 802.11n MCS0 HT20 CH 149, 157, 165 / Ant. 1 + Ant. 2
Test Date	Aug. 18, 2015		

Channel 149

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	5711.80	70.95	74.00	-3.05	66.45	4.49	34.52	34.51	134	108	Peak	HORIZONTAL
2	5713.40	53.07	54.00	-0.93	48.57	4.49	34.52	34.51	134	108	Average	HORIZONTAL
3	5723.80	77.91	78.20	-0.29	73.35	4.50	34.57	34.51	134	108	Peak	HORIZONTAL
4	5746.20	109.76			105.16	4.50	34.62	34.52	134	108	Peak	HORIZONTAL
5	5746.20	97.11			92.51	4.50	34.62	34.52	134	108	Average	HORIZONTAL

Item 4, 5 are the fundamental frequency at 5745 MHz.

Channel 157

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	5713.40	61.40	74.00	-12.60	56.90	4.49	34.52	34.51	134	100	Peak	HORIZONTAL
2	5713.40	48.50	54.00	-5.50	44.00	4.49	34.52	34.51	134	100	Average	HORIZONTAL
3	5723.80	63.56	78.20	-14.64	59.00	4.50	34.57	34.51	134	100	Peak	HORIZONTAL
4	5786.20	112.05			107.28	4.52	34.78	34.53	134	100	Peak	HORIZONTAL
5	5786.20	100.09			95.32	4.52	34.78	34.53	134	100	Average	HORIZONTAL
6	5859.20	61.91	78.20	-16.29	56.91	4.55	34.99	34.54	134	100	Peak	HORIZONTAL
7	5861.00	47.51	54.00	-6.49	42.51	4.55	34.99	34.54	134	100	Average	HORIZONTAL
8	5869.40	61.21	74.00	-12.79	56.21	4.55	34.99	34.54	134	100	Peak	HORIZONTAL

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

Channel 165

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	5823.80	110.83			105.95	4.53	34.88	34.53	135	100	Peak	HORIZONTAL
2	5826.20	98.92			94.04	4.53	34.88	34.53	135	100	Average	HORIZONTAL
3	5851.40	73.81	78.20	-4.39	68.88	4.54	34.93	34.54	135	100	Peak	HORIZONTAL
4	5861.00	71.79	74.00	-2.21	66.79	4.55	34.99	34.54	135	100	Peak	HORIZONTAL
5	5861.40	53.98	54.00	-0.02	48.98	4.55	34.99	34.54	135	100	Average	HORIZONTAL

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

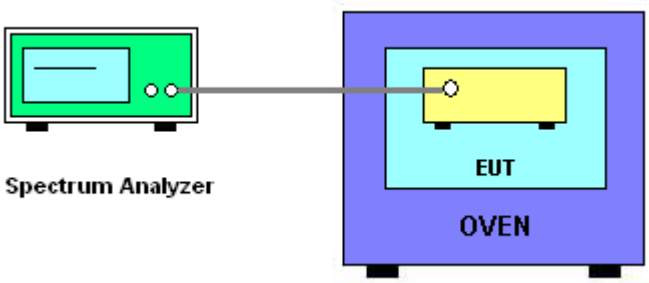
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

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. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
7. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
8. Extreme temperature is -20°C~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	25°C	Humidity	45%
Test Engineer	Eddie Weng	Test Date	Aug. 27, 2015

Mode: 20 MHz / Ant. 2

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5200 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5200.0006	5200.0005	5200.0007	5200.0007
110.00	5200.0006	5200.0006	5200.0007	5200.0008
93.50	5200.0007	5200.0007	5200.0007	5200.0008
Max. Deviation (MHz)	**0.0007**	**0.0007**	**0.0007**	**0.0008**
Max. Deviation (ppm)	**0.13**	**0.13**	**0.13**	**0.15**
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5200 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
-20	5200.0003	5200.0003	5200.0004	5200.0004
-10	5200.0004	5200.0003	5200.0004	5200.0006
0	5200.0004	5200.0005	5200.0006	5200.0006
10	5200.0006	5200.0006	5200.0007	5200.0007
20	5200.0006	5200.0006	5200.0007	5200.0008
30	5200.0007	5200.0008	5200.0008	5200.0009
40	5200.0008	5200.0008	5200.0009	5200.0009
50	5200.0009	5200.0009	5200.0009	5200.0009
Max. Deviation (MHz)	**0.0009**	**0.0009**	**0.0009**	**0.0009**
Max. Deviation (ppm)	**0.17**	**0.17**	**0.17**	**0.17**
Result	Complies			

Voltage vs. Frequency Stability

Voltage	Measurement Frequency (MHz)			
(V)	5785 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
126.50	5785.0036	5785.0035	5785.0037	5785.0036
110.00	5785.0036	5785.0036	5785.0037	5785.0037
93.50	5785.0037	5785.0036	5785.0037	5785.0038
Max. Deviation (MHz)	**0.0037**	**0.0036**	**0.0037**	**0.0038**
Max. Deviation (ppm)	**0.64**	**0.62**	**0.64**	**0.66**
Result	Complies			

Temperature vs. Frequency Stability

Temperature	Measurement Frequency (MHz)			
(°C)	5785 MHz			
	0 Minute	2 Minute	5 Minute	10 Minute
-20	5785.0033	5785.0033	5785.0033	5785.0035
-10	5785.0033	5785.0034	5785.0033	5785.0036
0	5785.0034	5785.0034	5785.0035	5785.0036
10	5785.0035	5785.0035	5785.0035	5785.0036
20	5785.0036	5785.0036	5785.0037	5785.0037
30	5785.0036	5785.0037	5785.0037	5785.0038
40	5785.0035	5785.0037	5785.0038	5785.0038
50	5785.0036	5785.0037	5785.0038	5785.0039
Max. Deviation (MHz)	**0.0036**	**0.0037**	**0.0038**	**0.0039**
Max. Deviation (ppm)	**0.62**	**0.64**	**0.66**	**0.67**
Result	Complies			

4.9. Antenna Requirements

4.9.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

4.9.2. Antenna Connector Construction

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

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
LISN	Schwarzbeck	NSLK 8127	8127650	9kHz ~ 30MHz	Nov. 17, 2014	Conduction (CO02-CB)
LISN	Schwarzbeck	NSLK 8127	8127478	9kHz ~ 30MHz	Nov. 17, 2014	Conduction (CO02-CB)
EMI Receiver	Agilent	N9038A	MY52260140	9kHz ~ 8.4GHz	Jan. 13, 2015	Conduction (CO02-CB)
COND Cable	Woken	Cable	01	0.15MHz ~ 30MHz	Dec. 01, 2014	Conduction (CO02-CB)
Software	Audix	E3	5.410e	-	N.C.R.	Conduction (CO02-CB)
Pulse Limiter	Schwarzbeck	VTSD 9561F	9561-F073	9kHz ~ 30MHz	Sep. 26, 2014	Conduction (CO02-CB)
Pulse Limiter	Schwarzbeck	VTSD 9561F	9561-F073	9kHz ~ 30MHz	Sep. 30, 2015	Conduction (CO02-CB)
BILOG ANTENNA	Schaffner	CBL6112D	22021	20MHz ~ 2GHz	May 06, 2015	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 12, 2015*	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 28, 2014	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 22, 2015	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Feb. 24, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 12, 2015	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Nov. 25, 2014	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 06, 2014	Radiation (03CH01-CB)
EMI Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8.4GHz	Jan. 21, 2015	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-40G-1	N/A	1 GHz ~ 40 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-2	N/A	1 GHz ~ 40 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100979	9kHz~40GHz	Dec. 12, 2014	Conducted (TH01-CB)
Temp. and Humidity Chamber	Ten Billion	TTH-D3SP	TBN-931011	-30~100 degree	Jun. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 03, 2014	Conducted (TH01-CB)

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

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

N.C.R means Non-Calibration required.

6. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%