

FCC TEST REPORT

for

YICHEN (SHENZHEN) TECHNOLOGY CO., LTD

Wi-Fi Range Extender

Model Number: JWA-AC2320M

Serial Number: JWA-AC2323M, WRAC1200

FCC ID: 2AJSTJWA-AC2320M

Prepared for : YICHEN (SHENZHEN) TECHNOLOGY CO., LTD
Address : 23/F, Block C1, Nanshan I Park, No. 1001, Xueyuan Road,
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Report No. : 17KWE025075F
Date of Test : Jan. 20 ~ Feb. 20, 2017
Date of Report : Feb. 20, 2017

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Keyway Testing Technology Co., Ltd.

Applicant:	YICHEN (SHENZHEN) TECHNOLOGY CO., LTD	
Address:	23/F, Block C1, Nanshan I Park, No. 1001, Xueyuan Road, Taoyuan Street, Nanshan District, Shenzhen, China	
Manufacturer:	YICHEN (SHENZHEN) TECHNOLOGY CO., LTD	
Address:	23/F, Block C1, Nanshan I Park, No. 1001, Xueyuan Road, Taoyuan Street, Nanshan District, Shenzhen, China	
E.U.T:	Wi-Fi Range Extender	
Model Number:	JWA-AC2320M	
Serial Model:	JWA-AC2323M, WRAC1200	
Trade Name:	 JCG	Serial No.: -----
Date of Receipt:	Jan. 18, 2017	Date of Test: Jan. 20 ~ Feb.20, 2017
Test Specification:	FCC Part 15, Subpart 15.407: 2016 ANSI C63.10:2013 KDB789033 D02 v01r03	
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.	
Issue Date: Feb. 20, 2017		
Tested by:	Reviewed by:	Approved by:
		
Keven Wu/ Engineer	Mark Li / Supervisor	Andy Gao/ Supervisor
Other Aspects: None.		
Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested		
This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.		

1. TEST SUMMARY

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Emissions	15.407(b)	PASS
26dB bandwidth and 99%dB Bandwidth	15.407 (a)	PASS
Power density	15.407 (a)	PASS
Maximum Peak Output Power	15.407 (a)	PASS
Emissions from out of band	15.407 (b)	PASS
Frequency Stability	15.407 (g)	PASS
Antenna Requirement	15.203	PASS

2. GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Product Name:	Wi-Fi Range Extender
Model No.:	JWA-AC2320M
Serial Model:	JWA-AC2323M, WRAC1200
Model Difference	All the models are the same circuit and RF module, except the model names and colour.
Operation Frequency:	5.15GHz ~ 5.24GHz
Channel numbers:	4 for 802.11a, 802.11n (HT20) 2 for 802.11n (HT40)
Modulation technology:	OFDM
Bit Rate of Transmitter	802.11a: 54/48/36/24/18/12/9/6Mbps 802.11n(HT20): 150/144.44/130/117/115.56/104/86.67/ 78/52/6.5Mbps 802.11n(HT40): 150/120/108/90/54/45/13.5Mbps
Antenna Type:	PIFA Antenna
Antenna gain:	2.29dBi

2.3. Test Supporting System

None.

2.4.Independent Operation Modes

The basic operation modes are:

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

For 5150~5250 MHz band:

802.11a, 802.11n(HT20) mode Channel 5180MHz, 5200MHz, 5240MHz were tested.

802.11n(HT40) mode Channel 5190MHz, 5230MHz were tested.

The software “RFTestTool” was used for testing, which was provided by manufacturer.

2.5.Test Sites

Test Facilities

Lab Qualifications : Certificated by Industry Canada
Registration No.: 9868A
Date of registration: December 8, 2011

Certificated by FCC, USA
Registration No.: 370994
Date of registration: February21, 2012

Certificated by CNASChina
Registration No.: CNAS L5783
Date of registration: August 8, 2012

2.6.List of Test and Measurement Instruments

For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 09,16	Apr. 09,17
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 09,16	Apr. 09,17
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	Apr. 09,16	Apr. 09,17
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 09,16	Apr. 09,17

For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 09,16	Apr. 09,17
System Simulator	Agilent	E5515C	GB43130245	Apr. 09,16	Apr. 09,17
Power Splitter	Weinschel	1506A	NW425	Apr. 09,16	Apr. 09,17
Bilog Antenna	ETS-LINDGREN	3142D	135452	Apr. 09,16	Apr. 09,17

Remark: Testable Frequency Range: 26MHz–6GHz

Spectrum Analyzer	Agilent	E4407B	MY4511304	Apr. 09,16	Apr. 09,17
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Remark: Testable Frequency Range: 100Hz–26.5GHz

Spectrum Analyzer	R&S	FSV40	132.1.3008K39 -100967	Apr. 09,16	Apr. 09,17
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Remark: Testable Frequency Range: 10Hz–40GHz

3m Semi-anechoic Chamber	ETS-LINDGREN	966	KW01	Apr. 09,16	Apr. 09,17
Signal Amplifier	SONOMA	310	187016	Apr. 09,16	Apr. 09,17
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 09,16	Apr. 09,17
RF Cable	IMRO	IMRO-400	966 Cable 1#	N/A	N/A
MULTI-DEVICE Controller	ETS-LINDGREN	2090	126913	N/A	N/A
Horn Antenna	DAZE	ZN30701	11003	Apr. 09,16	Apr. 09,17

Remark: Testable Frequency Range: 1GHz–18GHz

Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 09,16	Apr. 09,17
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Remark: Testable Frequency Range: 18GHz–40GHz

Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 09,16	Apr. 09,17
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Remark: Testable Frequency Range: 9kHz–22GHz

Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 09,16	Apr. 09,17
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Remark: Testable Frequency Range: 9kHz–26.5GHz

Signal Amplifier	DAZE	ZN3380C	11001	Apr. 09,16	Apr. 09,17
HighPass filter	Micro	HPM50111	324216	Apr. 09,16	Apr. 09,17
Filter	COM-MW	ZBSF-C836.5-25-X	KW032	Apr. 09,16	Apr. 09,17
Filter	COM-MW	ZBSF-C1747.5-75-X2	KW035	Apr. 09,16	Apr. 09,17
Filter	COM-MW	ZBSF-C1880-60-X2	KW037	Apr. 09,16	Apr. 09,17
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 09,16	Apr. 09,17
Splitter	Agilent	11636B	0025164	Apr. 09,16	Apr. 09,17
Power Meter	Anritsu	ML2495A	1204003	Apr. 24,16	Apr. 24,17
Power Sensor	Anritsu	MA2411B	1126150	Apr. 24,16	Apr. 24,17
Spectrum Analyzer	Agilent	N9020A	MY56070279	Jul.26,16	Jul.25,17

Remark: Testable Frequency Range: 10Hz–26.5GHz

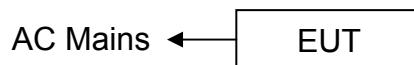
3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



(EUT: Wi-Fi Range Extender)

3.3. Special Accessories and Auxiliary Equipment

None.

3.4. Countermeasures to Achieve EMC Compliance

None.

4. EMISSION TEST RESULTS

4.1. Conducted Emission at the Mains Terminals Test

Limit 15.207 limits

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Test Setup

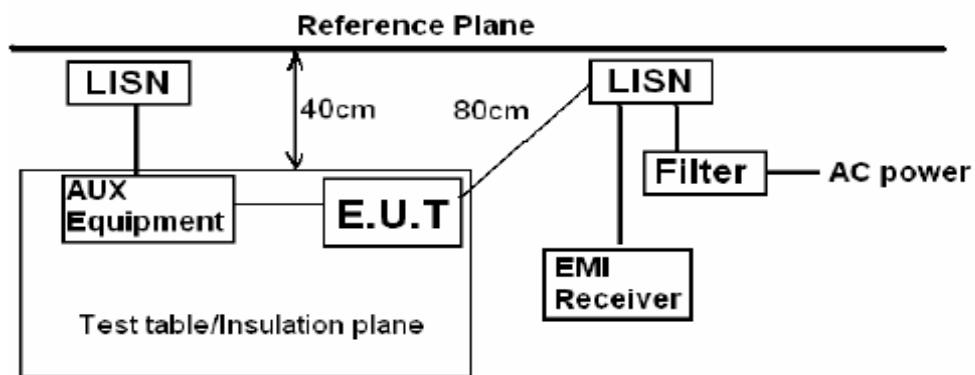
1. The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the center so as to form a bundle no longer than 0.4 m.

2. The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

3. The frequency range from 150 kHz to 30 MHz was investigated.

4. The bandwidth of the test receiver was set at 9 kHz.

5. Pretest for all mode, and the test data of the worst case condition(s) was reported on the following page.



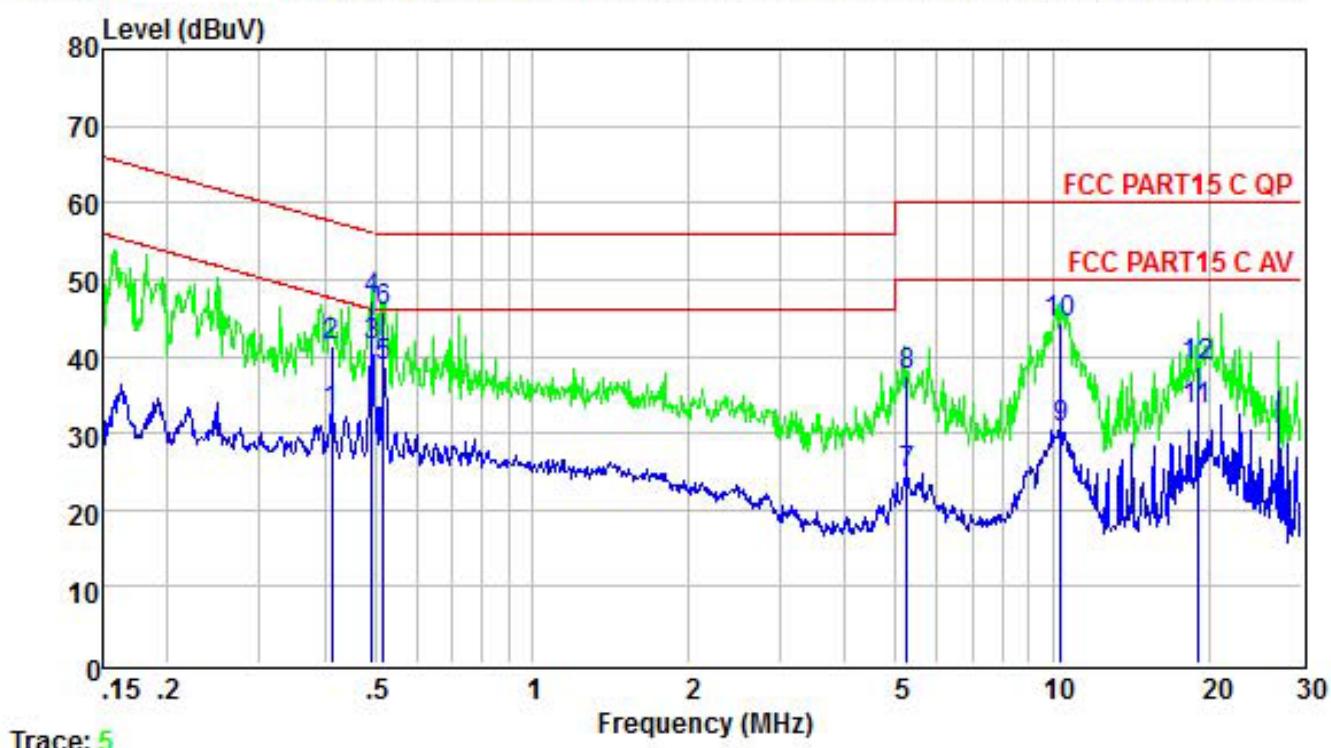
Remark:

E.U.T: Equipment Under Test

LISN: Line Impedance Stabilization Network

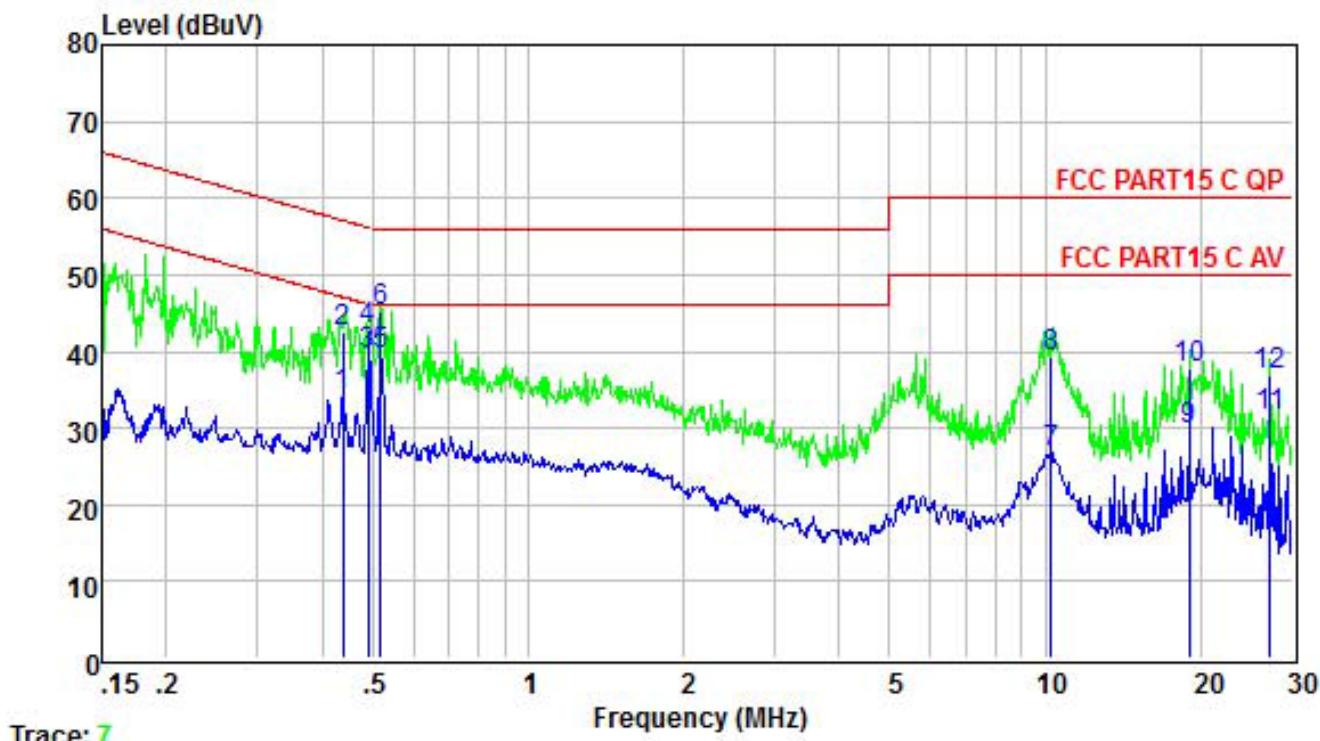
Test table height=0.8m

EUT :	Wi-Fi Range Extender	Model Name :	JWA-AC2320M
Temperature :	26°C	Relative Humidity :	54%
Pressure :	1010hPa	Phase:	L
Test Voltage :	AC 120V/60Hz	Test Mode :	Link Mode



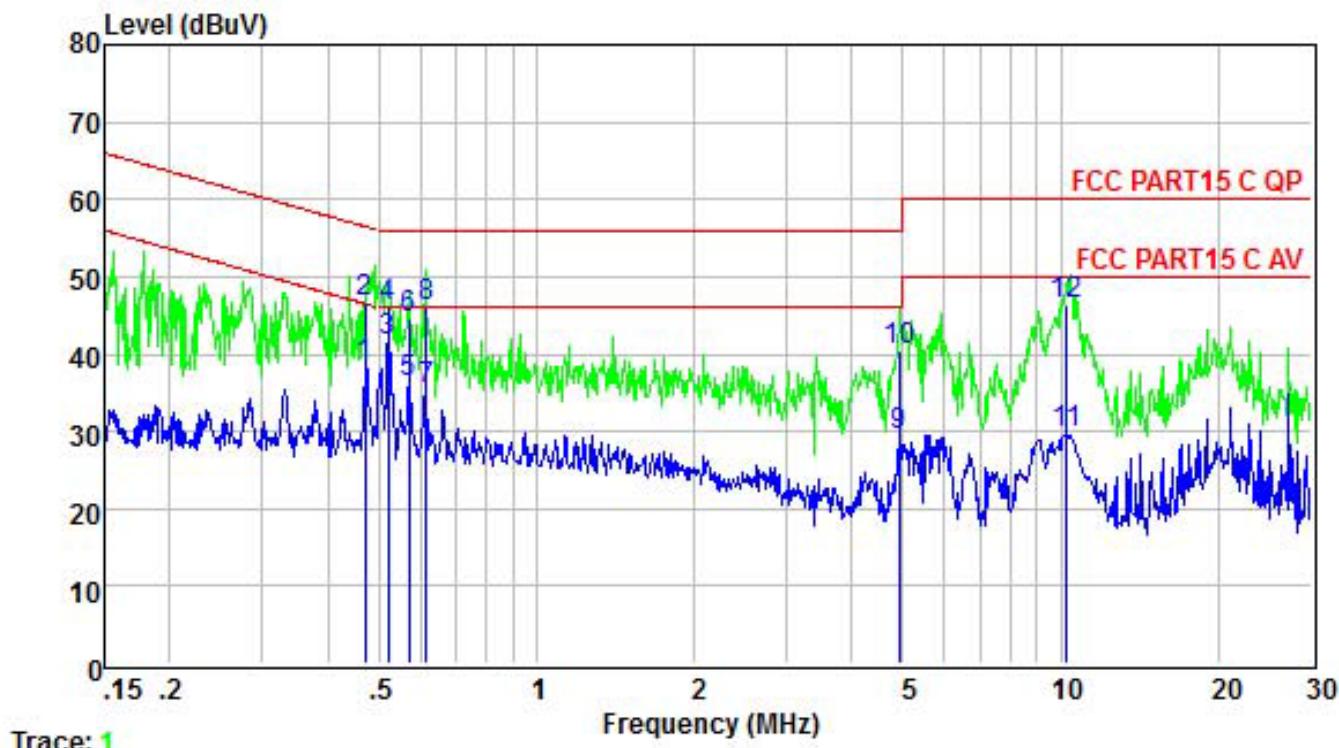
Freq	Level	Limit		Over	Remark
		Line	Limit		
	MHz	dBuV	dBuV	dB	
1	0.413	32.74	47.59	-14.85	Average
2	0.413	41.20	57.59	-16.39	QP
3	0.494	41.45	46.10	-4.65	Average
4	0.494	47.30	56.10	-8.80	QP
5	0.518	38.70	46.00	-7.30	Average
6	0.518	45.90	56.00	-10.10	QP
7	5.249	24.57	50.00	-25.43	Average
8	5.249	37.60	60.00	-22.40	QP
9	10.342	30.57	50.00	-19.43	Average
10	10.342	44.20	60.00	-15.80	QP
11	18.920	33.14	50.00	-16.86	Average
12	18.920	38.60	60.00	-21.40	QP

EUT :	Wi-Fi Range Extender	Model Name :	JWA-AC2320M
Temperature :	26°C	Relative Humidity :	54%
Pressure :	1010hPa	Phase:	N
Test Voltage :	AC 120V/60Hz	Test Mode :	Link Mode



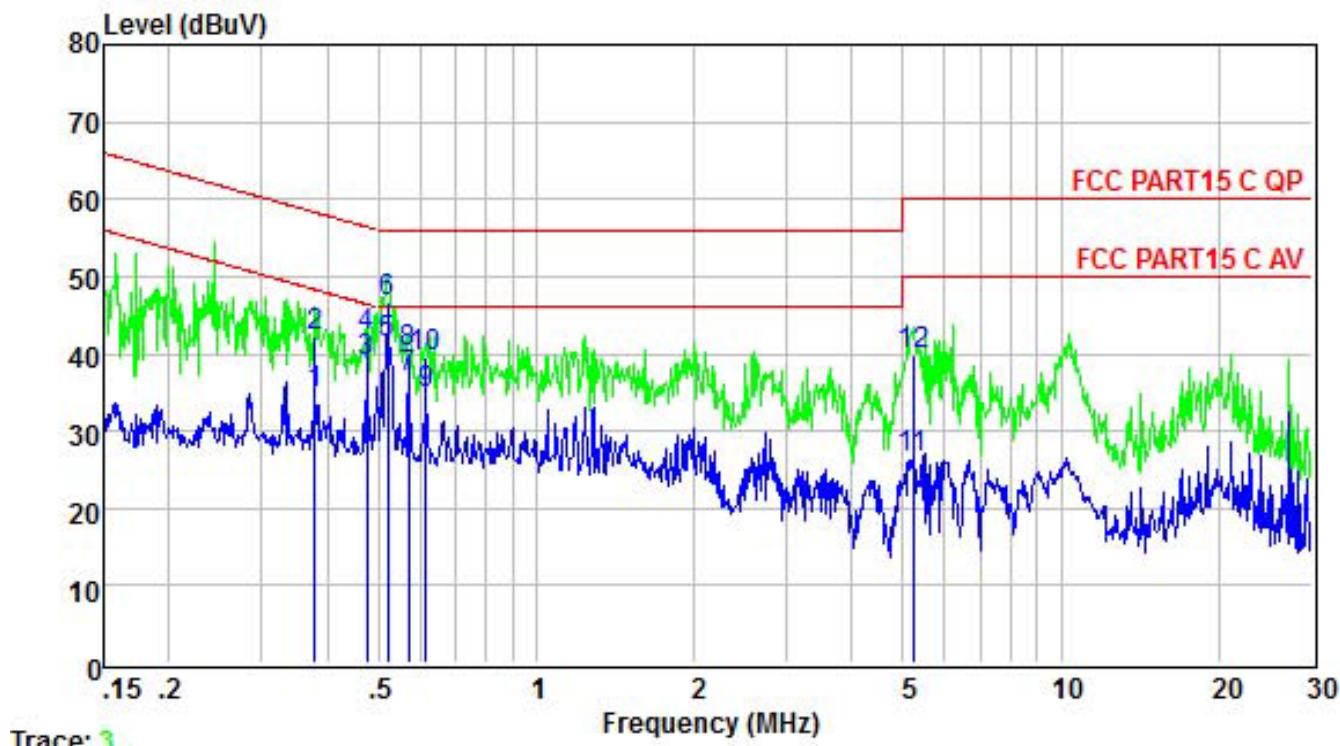
Freq	Level	Limit		Over Line Limit	Remark
		MHz	dBuV		
1	0.440	34.16	47.07	-12.91	Average
2	0.440	42.60	57.07	-14.47	QP
3	0.491	39.67	46.14	-6.47	Average
4	0.491	42.80	56.14	-13.34	QP
5	0.518	39.42	46.00	-6.58	Average
6	0.518	45.10	56.00	-10.90	QP
7	10.233	26.91	50.00	-23.09	Average
8	10.233	39.30	60.00	-20.70	QP
9	18.920	29.75	50.00	-20.25	Average
10	18.920	37.70	60.00	-22.30	QP
11	27.127	31.61	50.00	-18.39	Average
12	27.127	36.90	60.00	-23.10	QP

EUT :	Wi-Fi Range Extender	Model Name :	JWA-AC2320M
Temperature :	26°C	Relative Humidity :	54%
Pressure :	1010hPa	Phase:	L
Test Voltage :	AC 240V/60Hz	Test Mode :	Link Mode



Freq	Level	Limit	Over	Remark
		Line	Limit	
MHz	dBuV	dBuV	dB	
1	0.471	38.30	46.49	-8.19 Average
2	0.471	46.80	56.49	-9.69 QP
3	0.521	41.60	46.00	-4.40 Average
4	0.521	46.20	56.00	-9.80 QP
5	0.570	36.20	46.00	-9.80 Average
6	0.570	44.70	56.00	-11.30 QP
7	0.617	35.30	46.00	-10.70 Average
8	0.617	46.10	56.00	-9.90 QP
9	4.926	29.57	46.00	-16.43 Average
10	4.926	40.30	56.00	-15.70 QP
11	10.233	29.89	50.00	-20.11 Average
12	10.233	46.30	60.00	-13.70 QP

EUT :	Wi-Fi Range Extender	Model Name :	JWA-AC2320M
Temperature :	26°C	Relative Humidity :	54%
Pressure :	1010hPa	Phase:	N
Test Voltage :	AC 240V/60Hz	Test Mode :	Link Mode



Freq	Level	Limit		Over Line Limit	Remark
		MHz	dBuV	MHz	dBuV
1	0.379	34.81	48.30	-13.49	Average
2	0.379	42.30	58.30	-16.00	QP
3	0.476	39.11	46.41	-7.30	Average
4	0.476	42.30	56.41	-14.11	QP
5	0.521	41.30	46.00	-4.70	Average
6	0.521	46.80	56.00	-9.20	QP
7	0.570	36.86	46.00	-9.14	Average
8	0.570	40.20	56.00	-15.80	QP
9	0.617	34.76	46.00	-11.24	Average
10	0.617	39.60	56.00	-16.40	QP
11	5.221	26.60	50.00	-23.40	Average
12	5.221	39.80	60.00	-20.20	QP

4.2.Radiated Emission Test

Limit 15.209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		µV/m	dB(µV)/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(µV)/m (Peak) 54.0 dB(µV)/m (Average)	

Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

Test setup

The EUT was placed on a turn table which was 0.8 m(above 1GHz, the high was 1.5m) above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

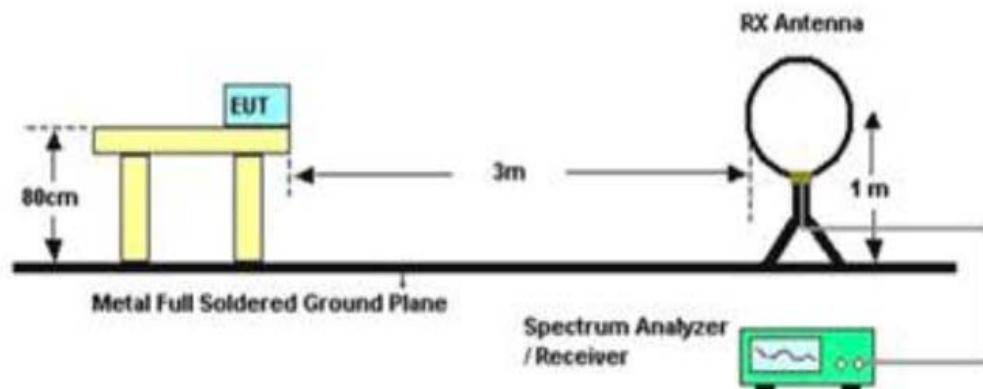
The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, Both PK and AV measure, PK detector is used.

The frequency range from 30MHz to 10th harmonicare checked. and no any emissions were found from 18GHz to 40 GHz, So the radiated emissions from 18GHz to 40GHz were not record.

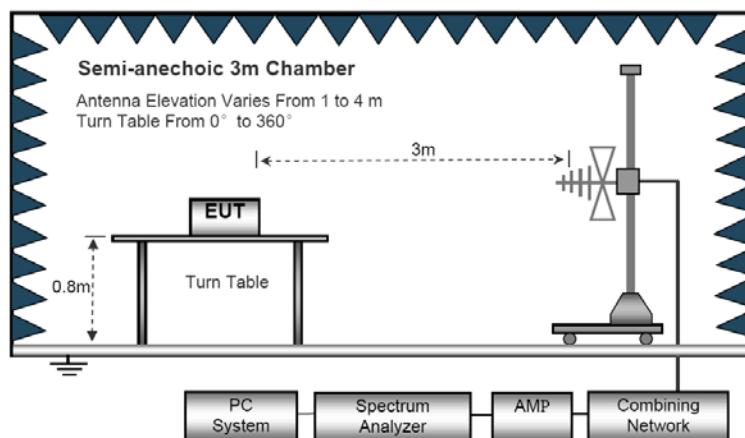
- Notes:
1. Emission Level = Antenna Factor + Cable Loss + Meter Reading+Preamp Factor.
 2. Measurement Uncertainty: ± 3.2 dB at a level of confidence of 95%.
 3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
 4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.
 5. For Both PK and AV value above 1GHz, PK detector is used.

Radiated Emission Test-Up

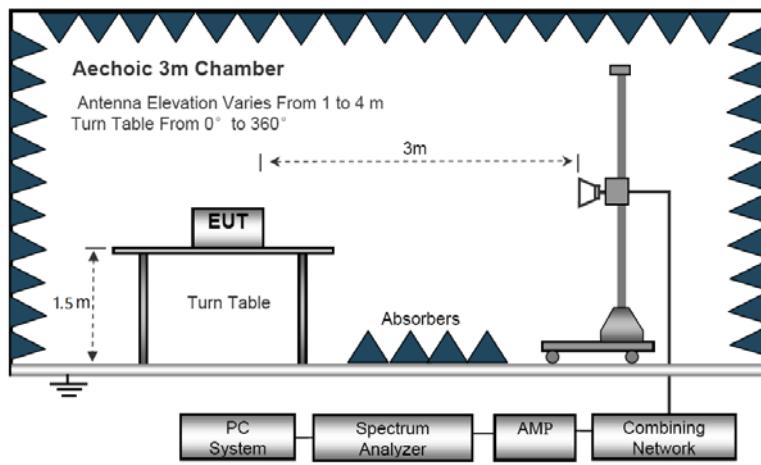
Below 30MHz



Below 1GHz



Above 1GHz



EUT :	Wi-Fi Range Extender	Model Name :	JWA-AC2320M
Temperature :	20°C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	Link Mode
Test Voltage :	AC 120V/60Hz		

Below 30MHz

Freq. (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	State P/F
--	--	--	--	P
--	--	--	--	P

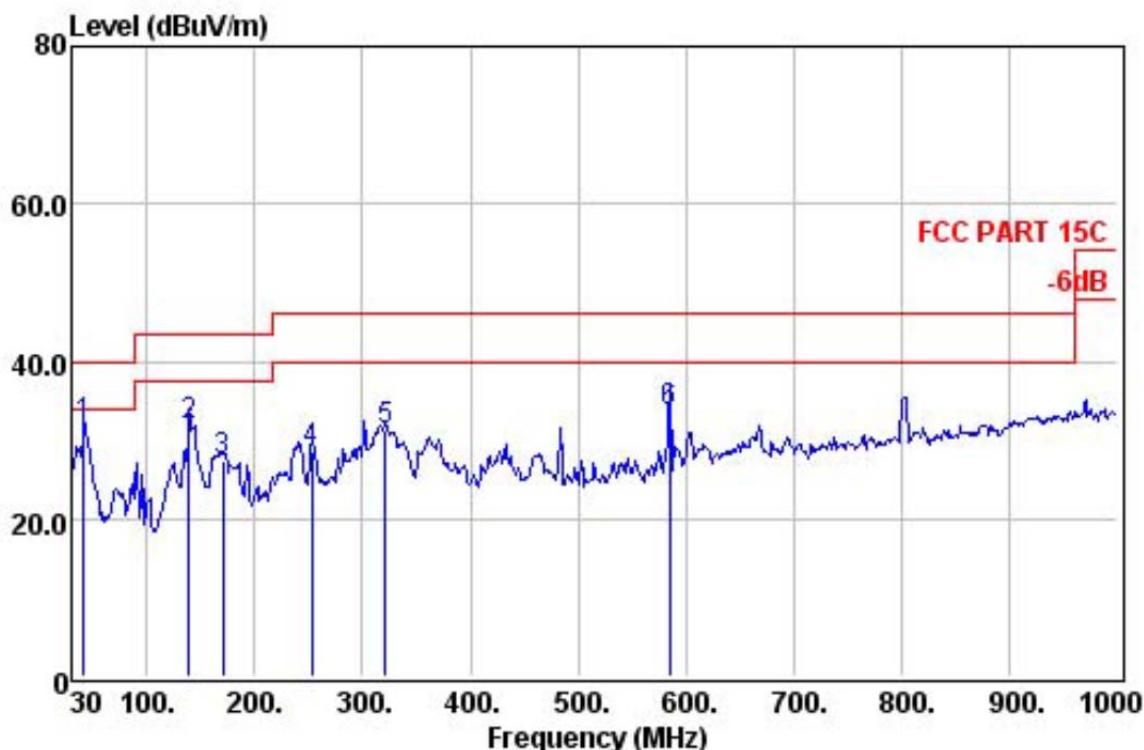
Note:

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

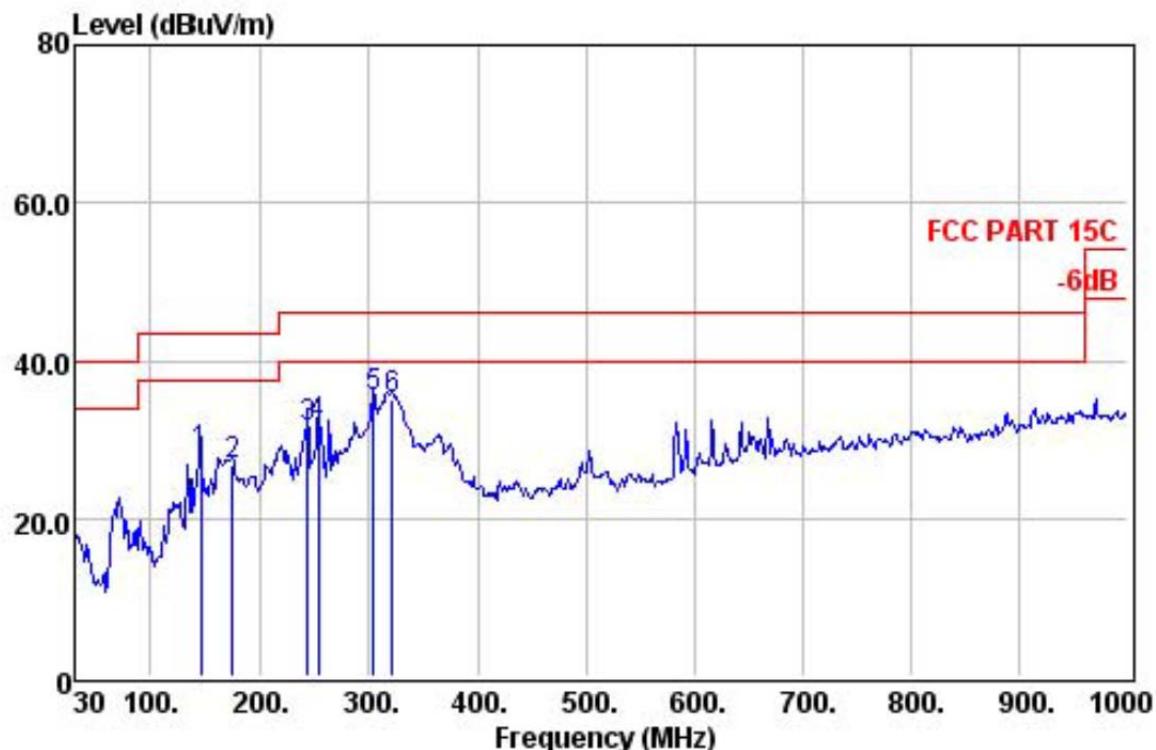
Distance extrapolation factor = $40 \log (\text{specific distance}/\text{test distance})$ (dB);

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

Below 1GHz			
EUT :	Wi-Fi Range Extender	Model Name :	JWA-AC2320M
Temperature :	20°C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	TX-5180(802.11a)
Test Voltage :	AC 120V/60Hz		

Vertical

Freq	Preamp		Antenna Factor	Read Level	Cable Loss		Limit Level	Line Limit	Over Line Limit	Remark
	Factor	Factor			dBuV	dB				
MHz	dB	dB/m								
1	41.64	31.38	12.23	50.56	0.56	31.97	40.00	-8.03	QP	
2	138.64	31.21	8.39	53.38	1.22	31.78	43.50	-11.72	QP	
3	170.65	31.19	10.12	47.14	1.30	27.37	43.50	-16.13	QP	
4	253.10	30.97	12.91	44.96	1.70	28.60	46.00	-17.40	QP	
5	321.00	30.84	14.39	45.53	2.02	31.10	46.00	-14.90	QP	
6	584.84	30.73	20.11	41.17	3.20	33.75	46.00	-12.25	QP	

Horizontal

Preamp Freq	Antenna Factor	Read Level	Cable		Limit Line	Over Limit	Remark
			Factor	Loss			
MHz	dB	dB/m	dBuV	dB	dBuV/m	dBuV/m	dB
1	144.46	31.23	8.67	49.53	1.22	28.19	43.50 -15.31 QP
2	173.56	31.18	10.21	46.40	1.39	26.82	43.50 -16.68 QP
3	243.40	30.95	12.72	48.26	1.61	31.64	46.00 -14.36 QP
4	253.10	30.97	12.91	48.32	1.70	31.96	46.00 -14.04 QP
5	303.54	30.92	13.90	50.32	1.94	35.24	46.00 -10.76 QP
6	321.00	30.84	14.39	49.45	2.02	35.02	46.00 -10.98 QP

Note: 1. Absolute Level= Reading Level+ antenna Factor + cable loss - Preamp factor,

2. Over Limit= Absolute Level – Limit;

3. Only the worst case is presented in the report .

Above 1GHz				
EUT :	Wi-Fi Range Extender		Model Name :	JWA-AC2320M
Temperature :	20°C		Relative Humidity :	48%
Pressure :	1010hPa		Test Mode :	TX-802.11a
Test Voltage :	AC 120V/60HZ			

Polar (H/V)	Frequency	Meter Reading	Antenna Factor	Cable loss	Preamp factor	Emission Level	Limits	Margin	Remark
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
802.11a-5180									
V	10360	32.63	23.99	17.04	28.84	44.82	54	-9.18	Average
V	10360	45.33	23.99	17.04	28.84	57.52	74	-16.48	Peak
V	15540	29.65	23.53	20.34	29.63	43.89	54	-10.11	Average
V	15540	39.85	23.53	20.34	29.63	54.09	74	-19.91	Peak
H	10360	31.41	23.99	17.04	28.84	43.6	54	-10.4	Average
H	10360	42.67	23.99	17.04	28.84	54.86	74	-19.14	Peak
H	15540	26.85	23.53	20.34	29.63	41.09	54	-12.91	Average
H	15540	36.24	23.53	20.34	29.63	50.48	74	-23.52	Peak
802.11a-5200									
V	10400	31.53	24.04	17.04	28.84	43.77	54	-10.23	Average
V	10400	42.85	24.04	17.04	28.84	55.09	74	-18.91	Peak
V	15600	30.35	23.79	20.39	29.64	44.89	54	-9.11	Average
V	15600	39.86	23.79	20.39	29.64	54.4	74	-19.6	Peak
H	10400	32.14	24.04	17.04	28.84	44.38	54	-9.62	Average
H	10400	43.65	24.04	17.04	28.84	55.89	74	-18.11	Peak
H	15600	28.48	23.79	20.39	29.64	43.02	54	-10.98	Average
H	15600	38.52	23.79	20.39	29.64	53.06	74	-20.94	Peak
802.11a-5240									
V	10480	31.39	25.17	17.06	28.85	44.77	54	-9.23	Average
V	10480	43.46	25.17	17.06	28.85	56.84	74	-17.16	Peak
V	15720	31.65	24.25	20.45	29.67	46.68	54	-7.32	Average
V	15720	38.71	24.25	20.45	29.67	53.74	74	-20.26	Peak
H	10480	30.77	25.17	17.06	28.85	44.15	54	-9.85	Average
H	10480	43.98	25.17	17.06	28.85	57.36	74	-16.64	Peak
H	15720	28.51	24.25	20.45	29.67	43.54	54	-10.46	Average
H	15720	38.53	24.25	20.45	29.67	53.56	74	-20.44	Peak

Note:

Absolute Level= Reading Level+antenna Factor+cable loss+preamp factor,

Over Limit= Absolute Level – Limit

“802.11a” mode is the worst mode and show in the report. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.

5. BAND EDGE COMPLIANCE TEST

5.1.Limits

All emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

5.2.Test setup

Test method: FCC KDB 789033 G)& Parts 15.407(b)(4) & 15.209(a)

Same as Clause 4.2.

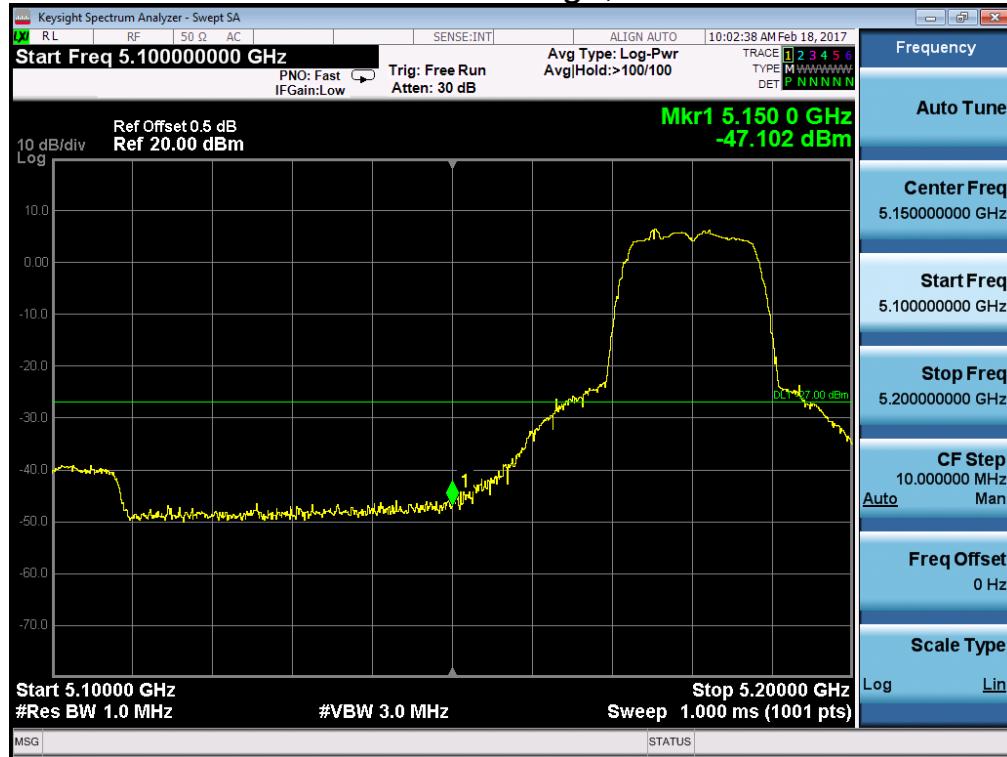
5.3.Test Data

Frequency (MHz)	Meter Reading (dB μ V)	antenna Factor (dB)	cable loss (dB)	preamp factor (dB)	Emission Level (dB μ V/m)	EIRP [dBm]	Limit [dBm]	Result	Comment
802.11a									
5150	35.12	28.66	12.93	27.62	49.09	-46.11	-27.00	Pass	Vertical
5350	35.55	28.73	13.09	27.62	49.75	-45.45	-27.00	Pass	Vertical
5150	31.75	27.63	15.16	27.67	46.87	-48.33	-27.00	Pass	Horizontal
5350	32.98	27.82	15.66	27.68	48.78	-46.42	-27.00	Pass	Horizontal
802.11n(HT20)									
5150	34.84	28.66	12.93	27.62	48.81	-46.39	-27.00	Pass	Vertical
5350	34.12	28.73	13.09	27.62	48.32	-46.88	-27.00	Pass	Vertical
5150	30.34	27.63	15.16	27.67	45.46	-49.74	-27.00	Pass	Horizontal
5350	31.65	27.82	15.66	27.68	47.45	-47.75	-27.00	Pass	Horizontal
802.11n(HT40)									
5150	34.12	28.66	12.93	27.62	48.09	-47.11	-27.00	Pass	Vertical
5350	34.35	28.73	13.09	27.62	48.55	-46.65	-27.00	Pass	Vertical
5150	30.74	27.63	15.16	27.67	45.86	-49.34	-27.00	Pass	Horizontal
5350	31.43	27.82	15.66	27.68	47.23	-47.97	-27.00	Pass	Horizontal

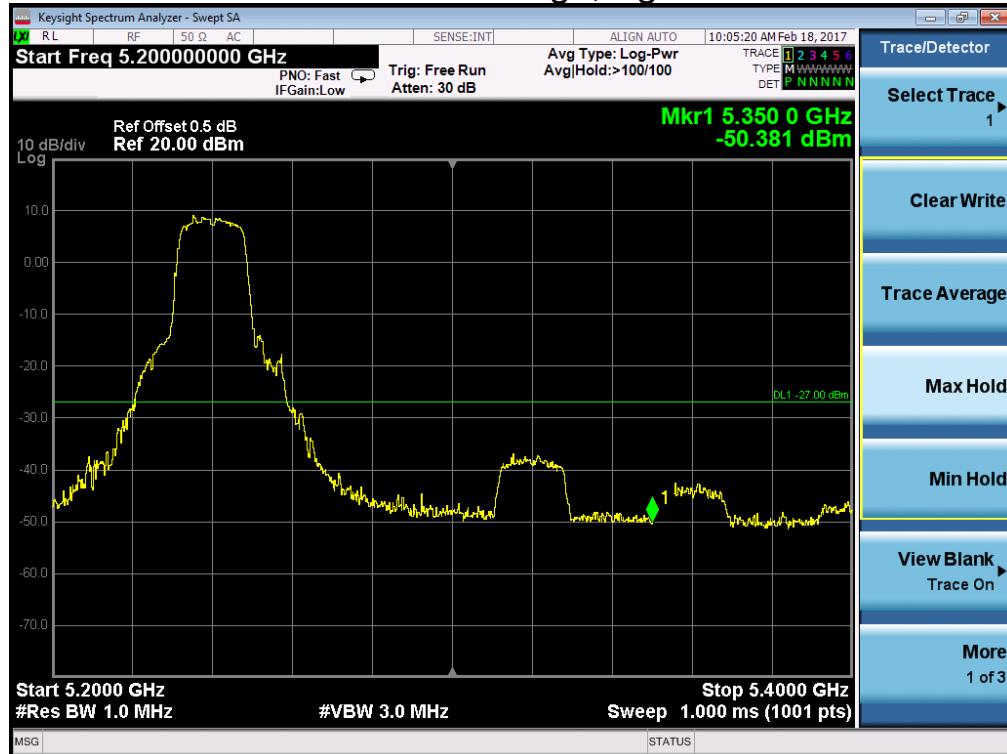
Remark: 1. According to KDB 789033 D02section H) d) (iii), for measurement above 1000MHz@3m distance, the limit of EIRP is calculated as follows: EIRP[dBm] = E[dB μ V/m] - 95.2

For conducted test:

802.11a: Band Edge,Left Side



802.11a: Band Edge,Right Side



Note: EIRP BAND EDGE=Reading Level+antenna gain

802.11n (20) : Band Edge,Left Side



802.11n (20) : Band Edge,Right Side



Note: EIRP BAND EDGE=Reading Level+antenna gain

802.11n (40) : Band Edge,Left Side



802.11n (40) : Band Edge,Right Side



Note: EIRP BAND EDGE=Reading Level+antenna gain

6. 26DB AND 6DB BANDWIDTH TEST

6.1.Applicable Standard

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum power control level, as defined in KDB 789033, at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26 dB bandwidth.

The 26 dB bandwidth is used to determine the conducted power limits.

The minimum of 6dB Bandwidth measurement is 0.5 MHz for U-NII-3

6.2.Test Procedure

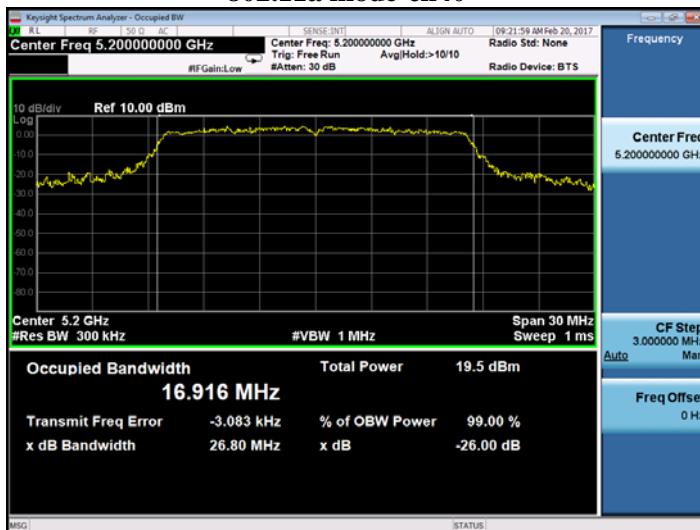
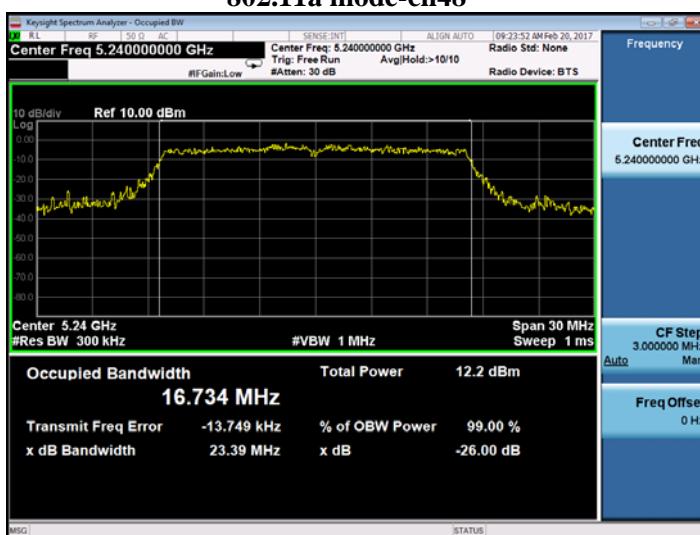
1. Emission Bandwidth (EBW)

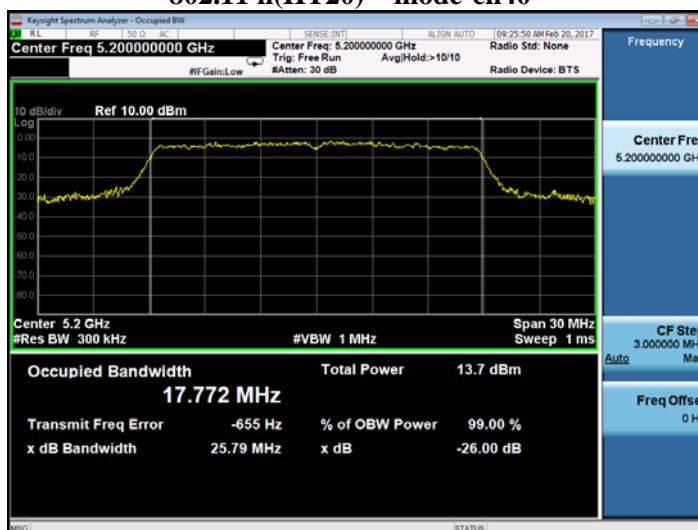
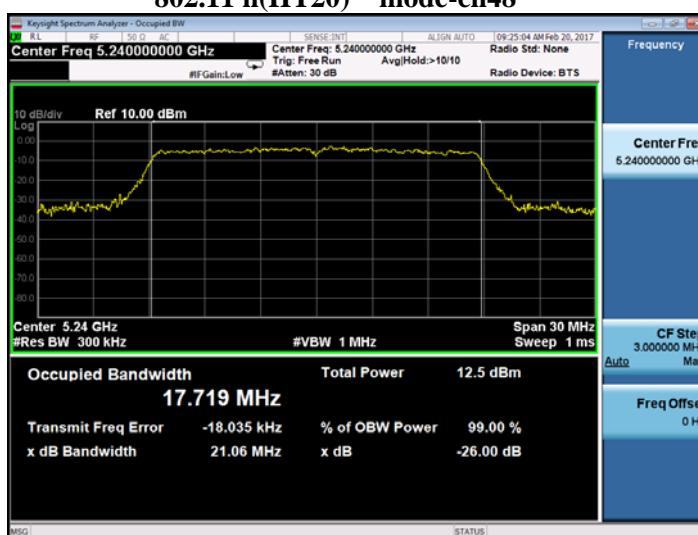
- a) Set RBW = approximately 1% of the emission bandwidth.
- b) Set the VBW > RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

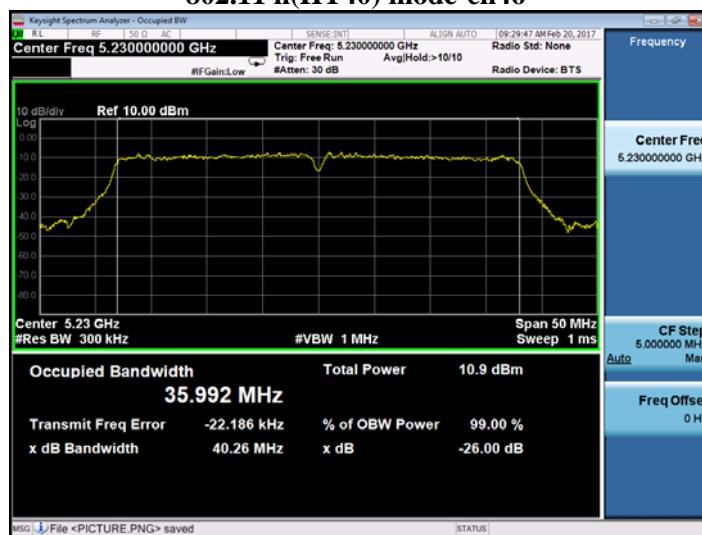
6.3.Test setup



Mode	Channel number	Frequency (MHz)	26dB Bandwidth (MHz)
802.11a	36	5180	20.07
	40	5200	26.80
	48	5240	23.39
802.11n (HT20)	36	5180	27.00
	40	5200	25.79
	48	5240	21.06
802.11n (HT40)	38	5190	40.18
	46	5230	40.26

802.11a mode-ch36**802.11a mode-ch40****802.11a mode-ch48**

802.11n(HT20) mode-ch36**802.11 n(HT20) mode-ch40****802.11 n(HT20) mode-ch48**

802.11n(HT40) mode-ch38**802.11 n(HT40) mode-ch46**

7. OUTPUT POWER TEST

7.1.Limits

Band 5.15-5.25GHz:

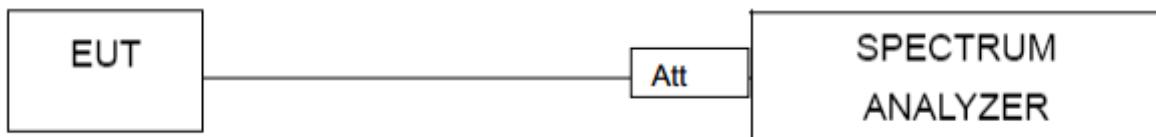
FCC: For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

7.2.Test setup

1. The maximum average conducted output power can be measured using Method PM-G (Measurement using a gated RF average power meter):
2. Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.
 - a. The Transmitter output (antenna port) was connected to the power meter.
 - b. Turn on the EUT and power meter and then record the power value.
 - c. Repeat above procedures on all channels needed to be tested.



Duty cycle



7.3. Test result

	Frequency (MHz)	Average Output Power (dBm)	FCC Limit (dBm)	Result
802.11a	5180	11.17	24	Pass
	5200	10.62	24	Pass
	5240	11.14	24	Pass
802.11n (HT20)	5180	11.39	24	Pass
	5200	11.14	24	Pass
	5240	10.57	24	Pass
802.11n (HT40)	5190	10.21	24	Pass
	5230	11.32	24	Pass

NOTE: During the test the EUT is in 100% duty cycle transmitting.

8. DUTY CYCLE

8.1. Test Procedure

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW \geq OBW if possible; otherwise, set RBW to the largest available value. Set VBW \geq RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \leq 16.7$ microseconds.)

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Zero Span

RBW = 8MHz

VBW = 50MHz

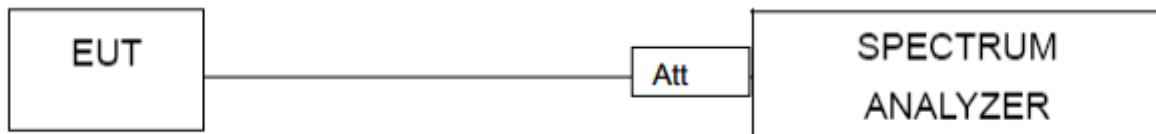
Number of points in Sweep >100

Detector function = peak

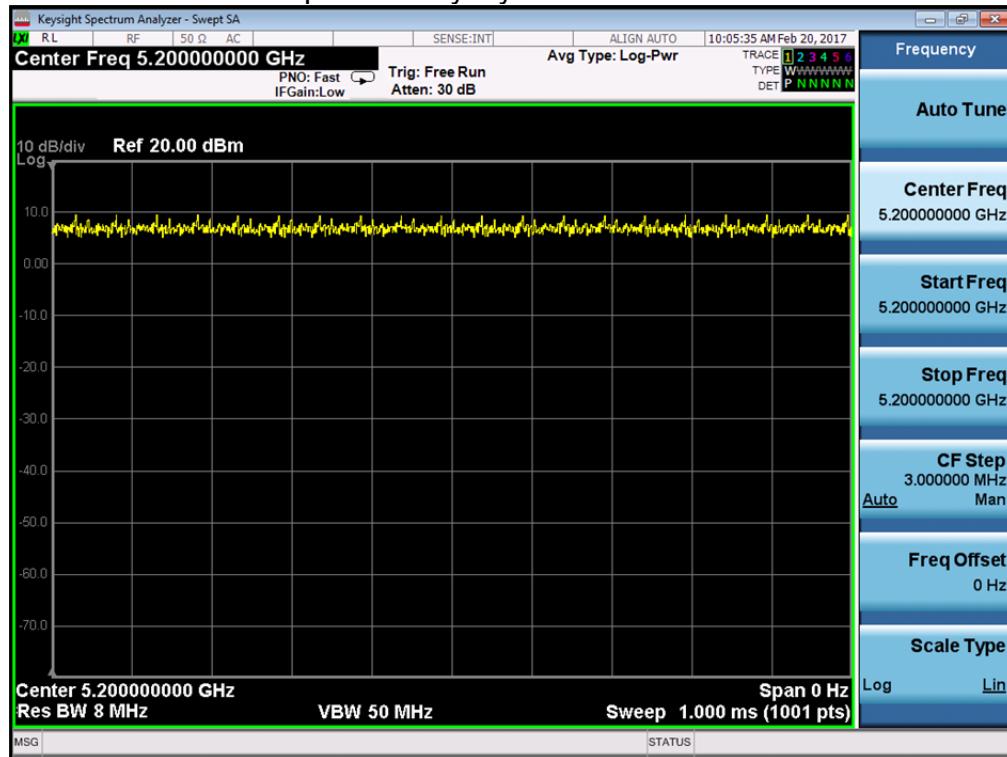
Trace = Clear write Measure Ttotal and Ton

Calculate Duty Cycle = Ton / Ttotal and Duty Cycle Factor=10*log(1/Duty Cycle)

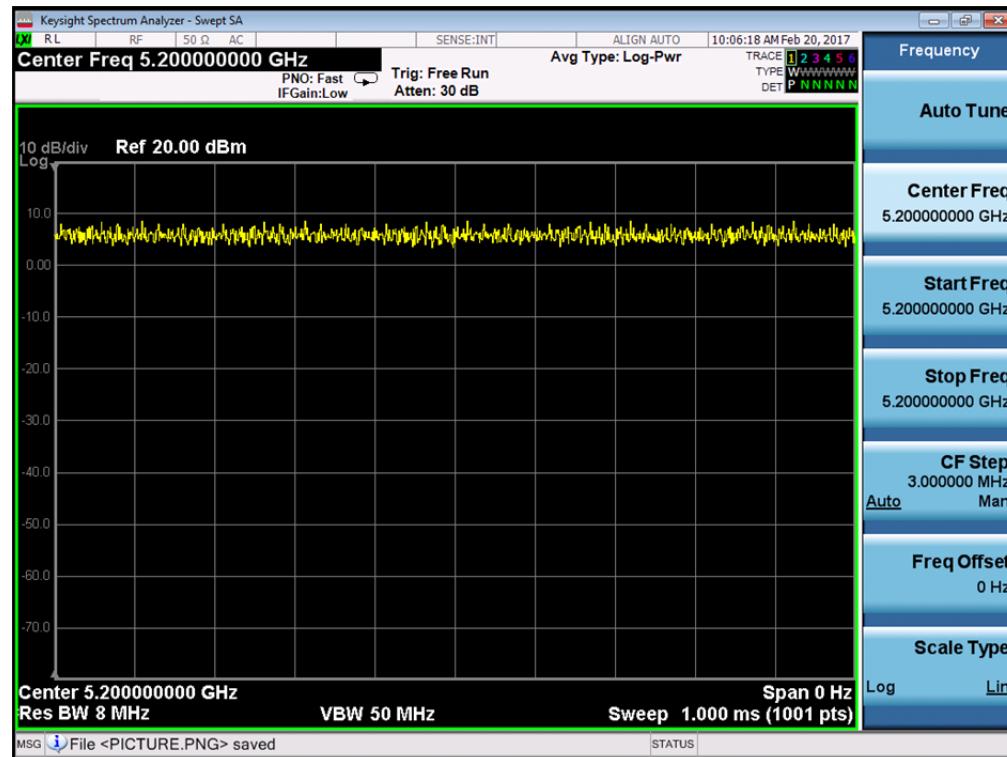
8.2. Test Setup



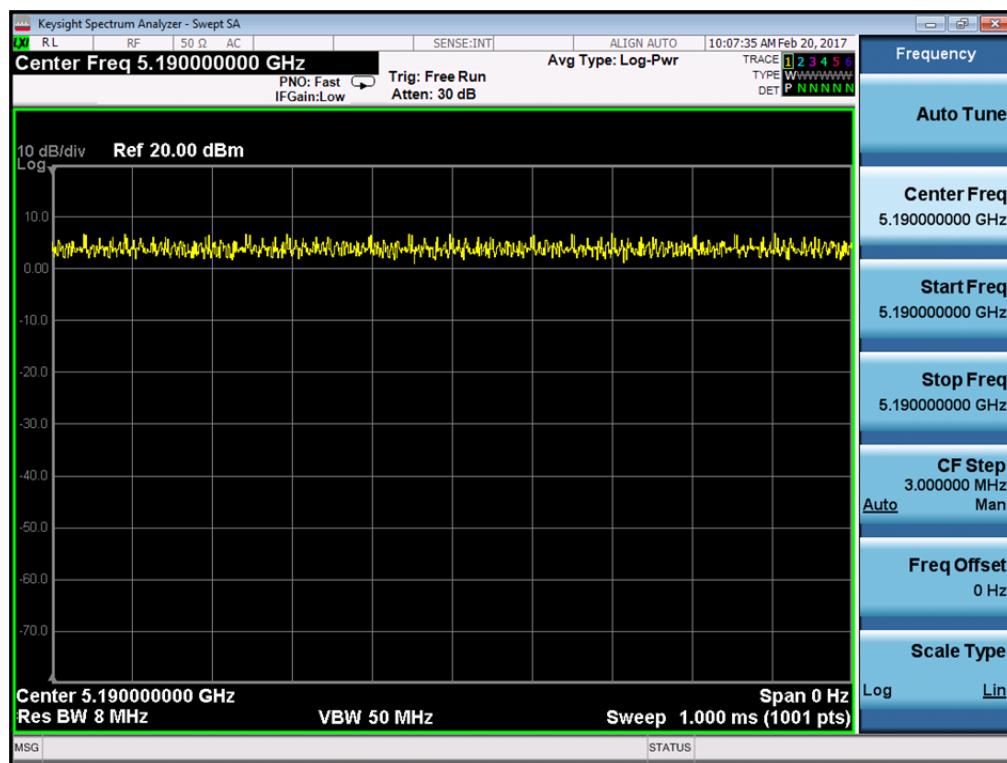
Test plot of Duty Cycle for 802.11a



Test plot of Duty Cycle for 802.11n(HT20)



Test plot of Duty Cycle for 802.11n(HT40)



9. PEAK POWER SPECTRAL DENSITY TEST

9.1.Limits

Band 5.15-5.25GHz:

FCC: In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

9.2.Test setup

Methods refer to FCC KDB 789033

- 1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section E)2) for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power...”.
- 2) Use the peak search function on the instrument to find the peak of the spectrum.
- 3) The result is the PPSD.
- 4) The above procedures make use of 1 MHz resolution bandwidth to satisfy the 1 MHz measurement bandwidth specified in the 15.407(a)(5). That rule section also permits use of resolution bandwidths less than 1 MHz “provided that the measured power is integrated to show the total power over the measurement bandwidth” (i.e., 1 MHz). If measurements are performed using a reduced resolution bandwidth and integrated over 1 MHz bandwidth



9.3. Test data

Test data as below

Mode	Frequency (MHz)	Power Density.	FCC Limit (dBm)
802.11a	5180	0.504	11
	5200	3.241	11
	5240	2.350	11
802.11n (HT20)	5180	2.012	11
	5200	1.498	11
	5240	0.574	11
802.11n (HT40)	5190	3.865	11
	5230	2.487	11

802.11a mode-ch36



802.11a mode-ch40



802.11a mode-ch48



802.11n(HT20) mode-ch36**802.11 n(HT20) mode-ch40****802.11 n(HT20) mode-ch48**

802.11n(HT40) mode-ch38



802.11 n(HT40) mode-ch46

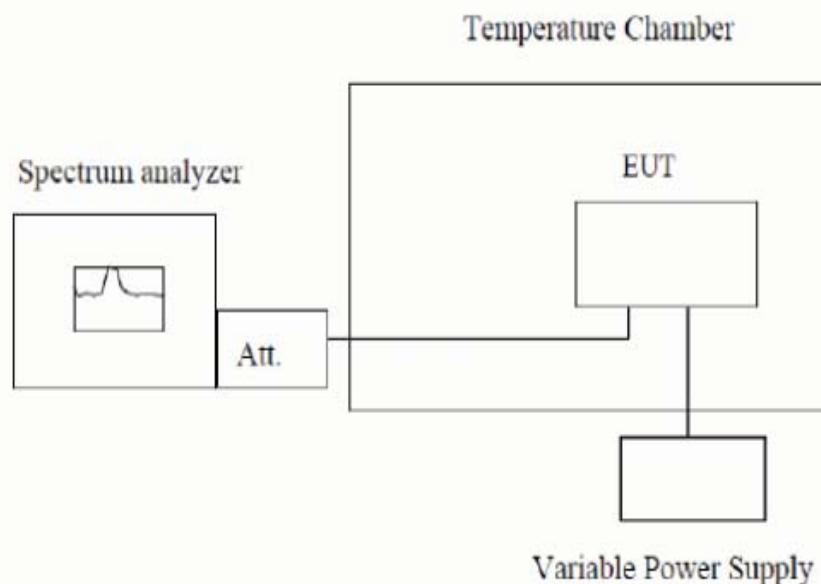


10. FREQUENCY STABILITY TEST

10.1.Limit

According to §15.407(g), manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

10.2.Test Configuration



10.3.Test Procedure

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 max hold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is $(fc-f)/fc \times 10^6$ ppm and the limit is less than ± 20 ppm (IEEE 802.11n specification).
6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature rule is -30°C~50°C..

10.4. Test result

Measurement Data (the worst model was 802.11a):

Frequency Stability under Temperature

Operating Frequency: 5180 MHz				
Environment Temperature(oC)	Voltage(V)	Measured Frequency(MHz)	Test Result (MHz)	Max. Deviation (ppm)
50	120	5180	5180.0141	2.722
40	120	5180	5180.0201	3.880
30	120	5180	5180.0135	2.606
20	120	5180	5180.0137	2.645
10	120	5180	5180.0122	2.355
0	120	5180	5180.0153	2.954
-10	120	5180	5180.0114	2.201
-20	120	5180	5180.0146	2.819
-30	120	5180	5180.0127	2.452

Frequency Stability under Voltage

Operating Frequency: 5180 MHz			
DC Voltage(V)	Measured Frequency(MHz)	Test Result(MHz)	Max. Deviation(ppm)
108	5180	5180.0153	2.954
120	5180	5180.0241	4.653
132	5180	5180.0152	2.934

Frequency Stability under Temperature

Operating Frequency: 5200 MHz				
Environment Temperature(oC)	Voltage(V)	Measured Frequency(MHz)	Test Result (MHz)	Max. Deviation (ppm)
50	120	5200	5200.0336	6.462
40	120	5200	5200.0274	5.269
30	120	5200	5200.0327	6.288
20	120	5200	5200.0283	5.442
10	120	5200	5200.0239	4.596
0	120	5200	5200.0247	4.750
-10	120	5200	5200.0313	6.019
-20	120	5200	5200.0239	4.596
-30	120	5200	5200.0374	7.192

Frequency Stability under Voltage

Operating Frequency: 5200 MHz			
DC Voltage(V)	Measured Frequency(MHz)	Test Result(MHz)	Max. Deviation(ppm)
108	5200	5200.0289	5.558
120	5200	5200.0342	6.577
132	5200	5200.0351	6.750

Frequency Stability under Temperature

Operating Frequency: 5240 MHz				
Environment Temperature(oC)	Voltage(V)	Measured Frequency(MHz)	Test Result (MHz)	Max. Deviation (ppm)
50	120	5240	5240.0315	6.011
40	120	5240	5240.0368	7.023
30	120	5240	5240.0327	6.240
20	120	5240	5240.0341	6.508
10	120	5240	5240.0295	5.630
0	120	5240	5240.0313	5.973
-10	120	5240	5240.0323	6.164
-20	120	5240	5240.0305	5.821
-30	120	5240	5240.0297	5.668

Frequency Stability under Voltage

Operating Frequency: 5240 MHz			
DC Voltage(V)	Measured Frequency(MHz)	Test Result(MHz)	Max. Deviation(ppm)
108	5240	5240.0342	6.527
120	5240	5240.0297	5.668
132	5240	5240.0341	6.508

11. ANTENNA REQUIREMENTS

11.1. Limits

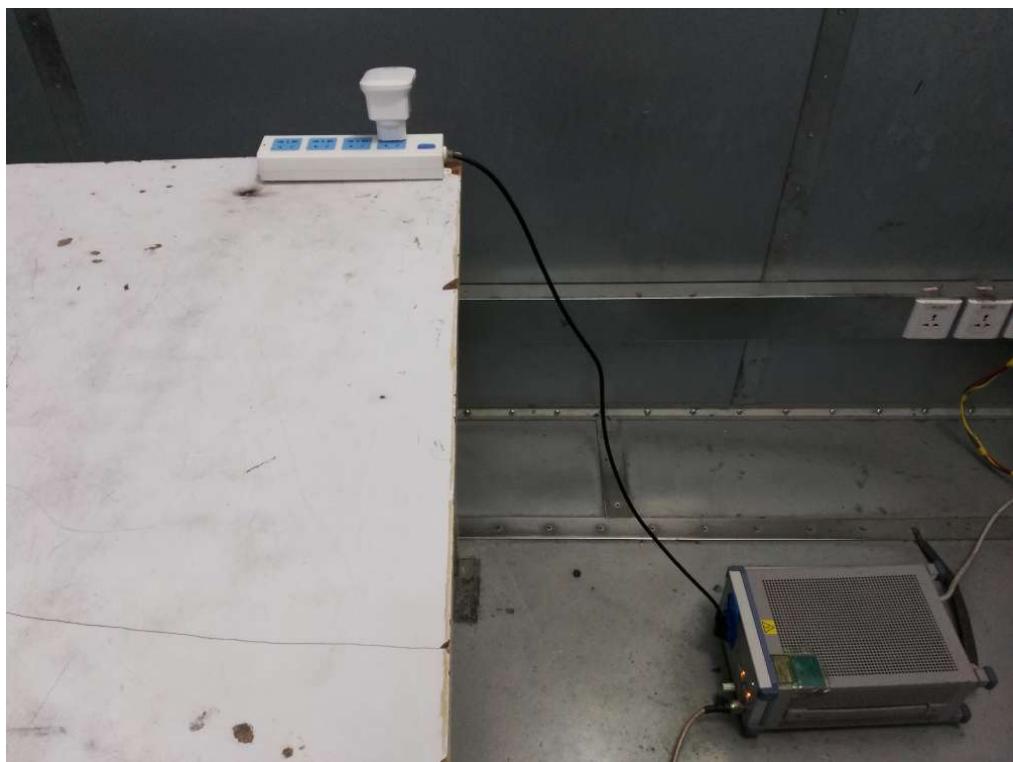
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2. Result

The antenna used for this product is PIFA Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 2.29dBi.

12.PHOTOGRAPHS OF TEST SET-UP

Conducted Emission



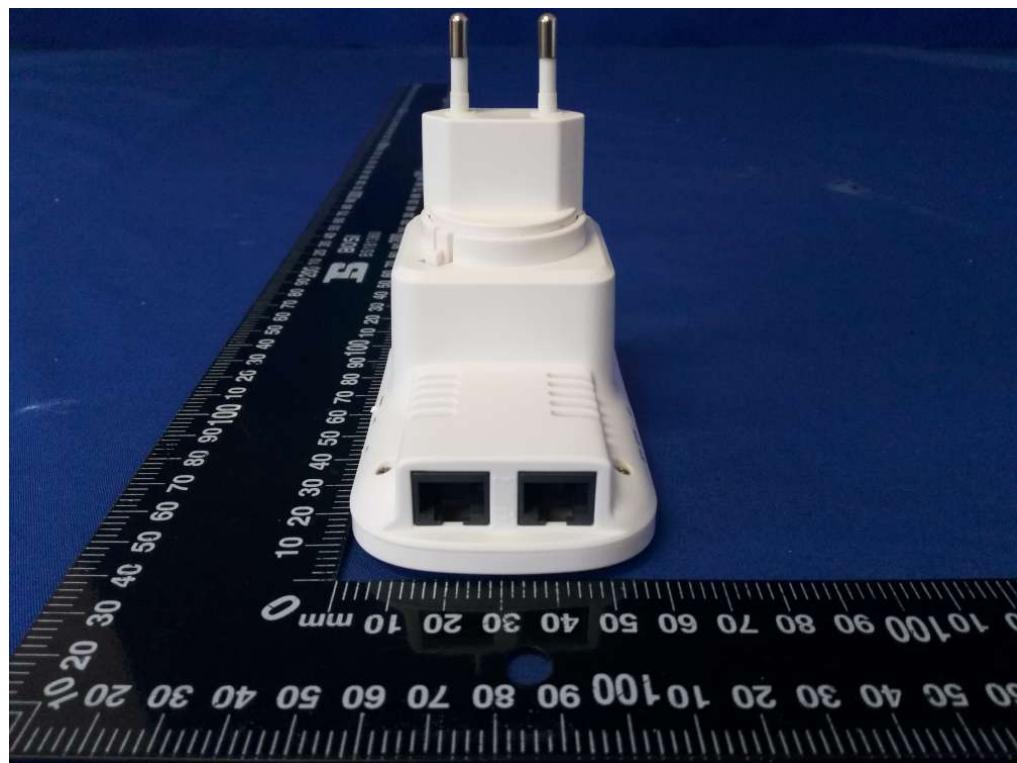
Radiated Emission Test

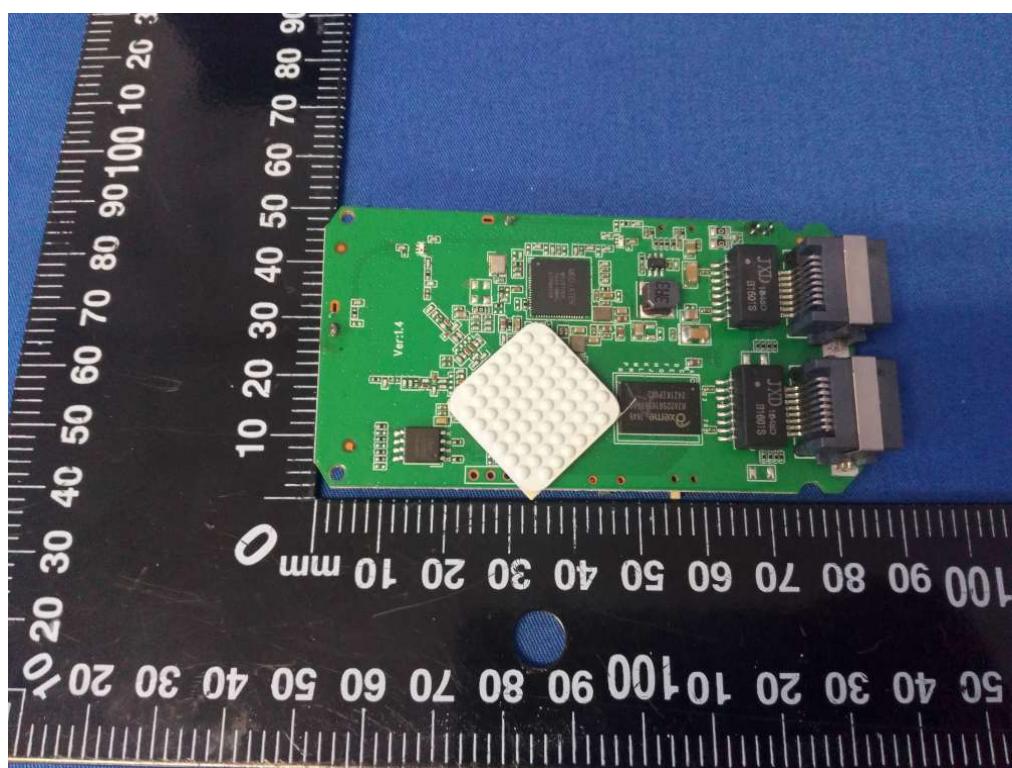


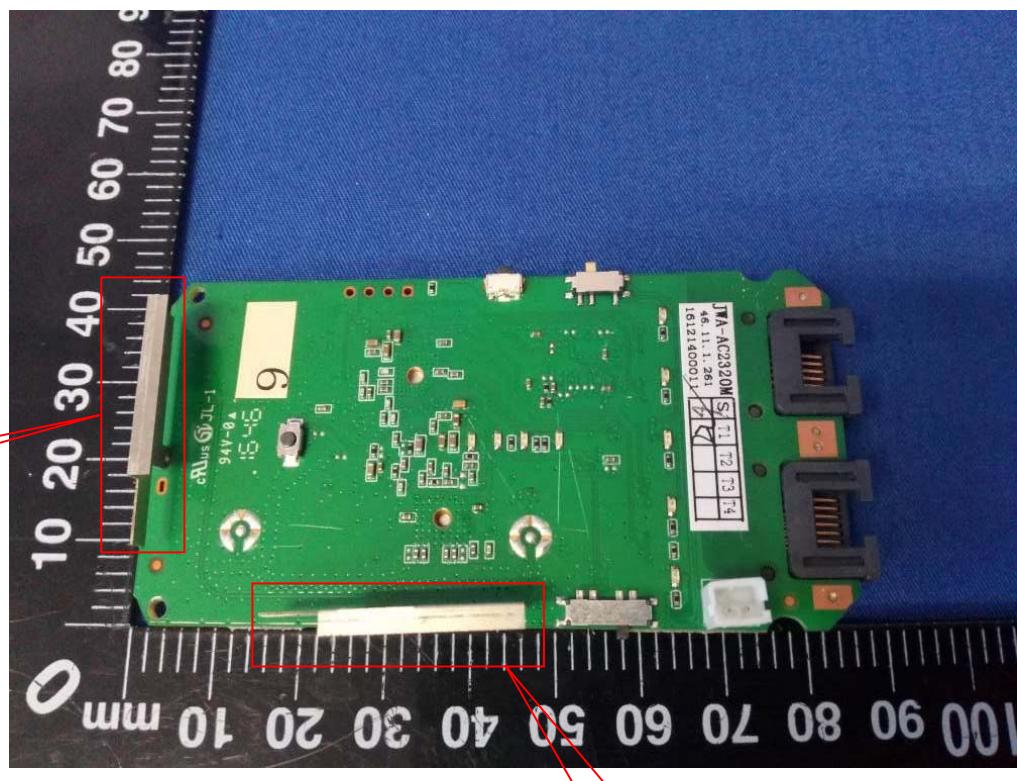
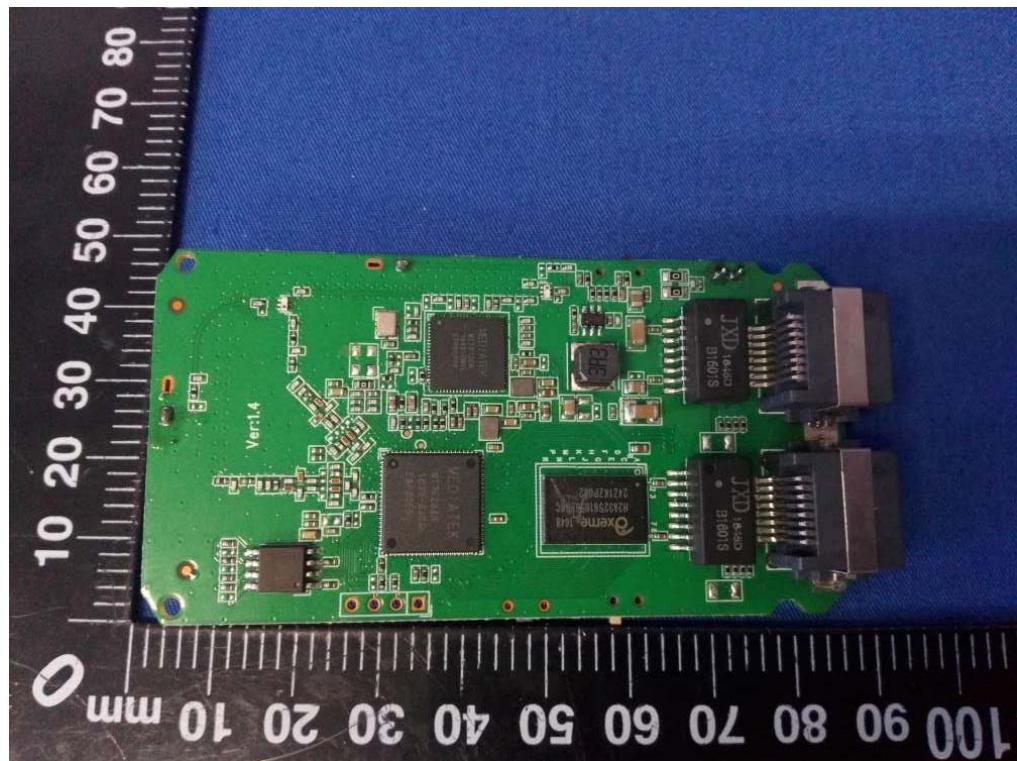
13.PHOTOGRAPHS OF THE EUT



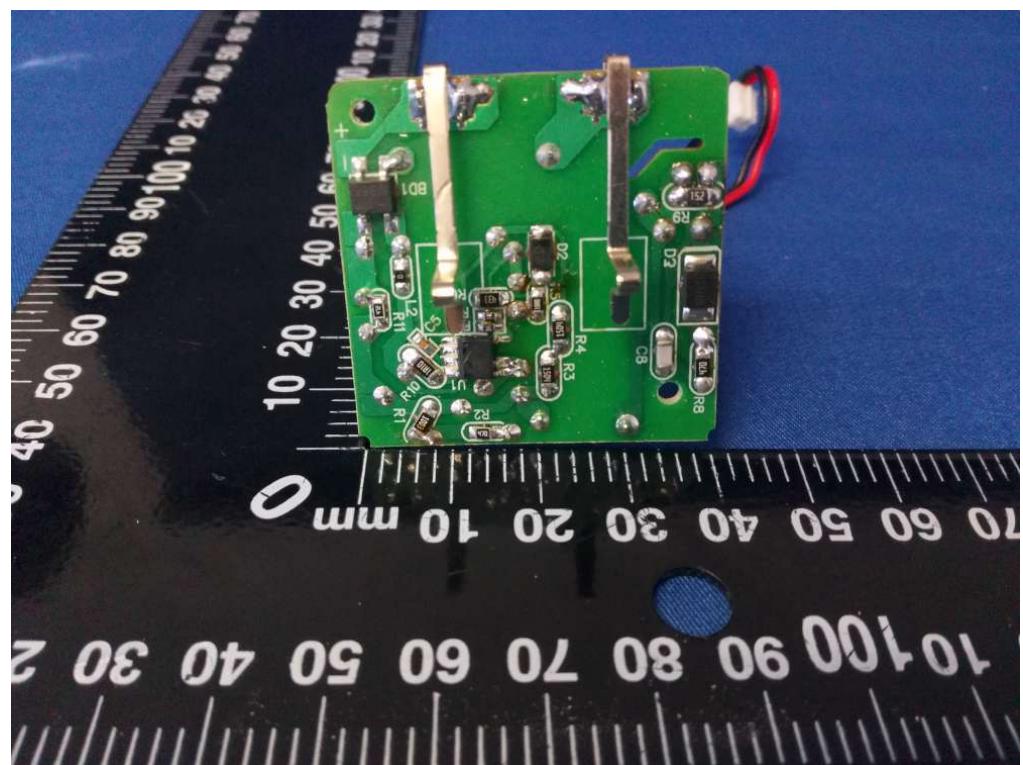
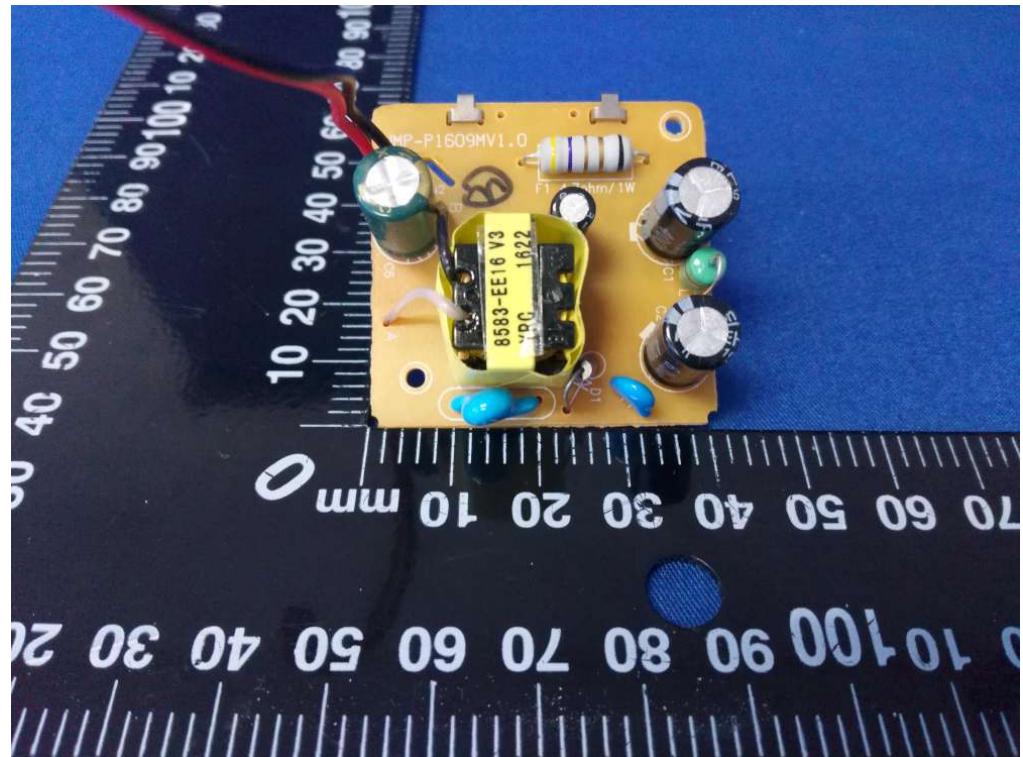








5G Antenna



*** the end of report ***