TEST REPORT

FCC ID:QIC-MSE12

IC:30055-MSE12

Product	:	**WorldPenScan Ai Reader**
Model Name	:	**MSE12**
Brand	:	**PenPower**
Report No.	:	**NCT24051473E1-4**

Prepared for

PENPOWER TECHNOLOGY LTD.

7F, NO.47, Lane 2, Sec.2, Kuang-Fu Rd., Hsinchu City 300, Taiwan

Prepared by

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1 TEST RESULT CERTIFICATION

Applicant’s name	:	PENPOWER TECHNOLOGY LTD.
Address	:	7F, NO.47, Lane 2, Sec.2, Kuang-Fu Rd., Hsinchu City 300, Taiwan
Manufacture's name	:	PENPOWER TECHNOLOGY LTD.
Address	:	7F, NO.47, Lane 2, Sec.2, Kuang-Fu Rd., Hsinchu City 300, Taiwan
Product name	:	WorldPenScan Ai Reader
Model name	:	MSE12
Standards	:	FCC CFR Title 47 Part 15 Subpart C Section 15.407 ANSI C63.10:2020 KDB 789033 D02 v02r01 RSS-247 Issue 3, August 2023, RSS-Gen Issue 5, Amendment 2, February, 2021
Test procedure	:	ANSI C63.10:2020
Test Date	:	Dec. 21, 2024 to Mar. 27, 2025
Date of Issue	:	Mar. 27, 2025
Test Result	:	Pass

This device described above has been tested by NCT, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Test Engineer:

Keven Wu / Engineer

Technical Manager:

Henry Wang / Manager

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2 Test Summary

FCC Part15 (15.407) , Subpart E			
Standard Section	Test Item	Judgment	Remark
15.407(b), 15.209 RSS-Gen 6.13	Radiated Spurious Emission	PASS	
15.207 RSS-Gen 8.8	Conducted Emission	PASS	
15.407 (a) 15.407 (e) RSS-247 6.2 RSS-GEN 6.7	99% , 6dB and 26dB Bandwidth	PASS	
15.407 (a) RSS-247 6.2	Maximum Conducted Output Power	PASS	
15.407(b) RSS-247 6.2 RSS-247 Gen 8.10	Band Edge	PASS	
15.407 (a) RSS-247 6.2	Power Spectral Density	PASS	
15.407(g) RSS-Gen 8.11	Frequency Stability	PASS	
15.203 RSS-Gen 6.8	Antenna Requirement	PASS	

Remark:

1. “N/A” denotes test is not applicable in this Test Report.

3 TEST FACILITY

Site Description

EMC Lab. : Accredited by CNAS, 2022-09-27

The certificate is valid until 2028.01.07

The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2017)

The Certificate Registration Number is L8251

Designation Number: CN1347

Test Firm Registration Number: 894804

Accredited by A2LA, June 14, 2023

The Certificate Registration Number is 6837.01

Accredited by Industry Canada, November 09, 2018

The Conformity Assessment Body Identifier is CN0150

Company Number: 30806

Name of Firm : Shenzhen NCT Testing Technology Co., Ltd.

Site Location : A101&2F B2, Fuqiao 6th Area, Xintian Community, Fuhai Street, Baoan District, Shenzhen, People's Republic of China

4 General Information

4.1 General Description of E.U.T.

Product Name:	WorldPenScan Ai Reader
Model No.:	MSE12
HVIN:	MSE12
Sample ID	24051473-001#
Sample(s) Status:	Engineer sample
series model	N/A
Operation Frequency:	WIFI 5.2G: 5150MHz~5250MHz WIFI 5.8G:5725MHz~5850MHz
Modulation type:	OFDM with BPSK/QPSK/16QAM/64QAM/256QAM for 802.11a/n/ac
Antenna Type:	Internal Antenna
Antenna gain:	WIFI 5.2G:0.65dBi; WIFI 5.8G:0.93dBi
Power supply	DC 3.8V by battery (1200mAh); Charging input: DC 5V
Hardware Version:	N/A
Software Version:	N/A
Remark:	the Antenna gain is provided by customer from Antenna spec. and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.

802.11a/n/ac(20MHz) Frequency Channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	40	5200	44	5220	48	5240

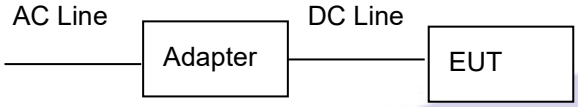
802.11/n/ac(40MHz) Frequency Channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190	46	5230	-	-	-	-

802.11a/n/ac(20 MHz) Frequency Channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	153	5765	157	5785	161	5805
165	5825	-	-	-	-	-	-

802.11/n/ac/ax(40MHz) Frequency Channel					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
151	5755	159	5795	-	-

4.2 Test Setup Configuration

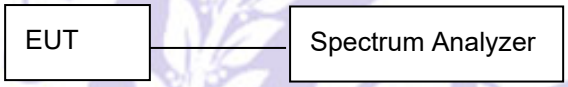
Conducted Emission



Radiated Emission(30MHz-1GHz)

Radiated Emission(above 1GHz)

Conducted Spurious



4.3 Test Mode

Transmitting mode	Keep the EUT in continuously transmitting mode.
Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.	

Test Software	The EUT enters engineering mode
Power level setup	10

5 Equipment During Test

5.1 Equipments List

Conducted emission Test Equipment

Name	Model No.	Serial No.	Manufacturer	Date of Cal.	Due Date
944 Shielded Room	944 Room	/	EMToni	2022/5/31	2025/5/30
EMI Test Receiver	ESPI	101604	Rohde & Schwarz	2024/6/17	2025/6/16
LISN	ENV 216	102796	Rohde & Schwarz	2024/6/17	2025/6/16
LISN	VN1-13S	004023	CRANAGE	2024/6/17	2025/6/16
Cable	RG223-1500MM	NA	RG	2024/6/17	2025/6/16

Radiated emission & Radio Frequency Test Equipment

Name	Model No.	Serial No.	Manufacturer	Date of Cal.	Due Date
966 Shielded Room	966 Room	/	EMToni	2022/5/31	2025/5/30
EMI Test Receiver	ESCI	101178	Rohde & Schwarz	2024/6/17	2025/6/16
Amplifi（30MHz-1GHz）	BBV 9743 B	00374	SCHNWARZBECK	2024/6/17	2025/6/16
Bilog Antenna（30MHz-1GHz）	VULB9162	00473	SCHNWARZBECK	2023/3/19	2025/3/18
Horn antenna（1GHz-18GHz）	BBHA 9120 D	02622	SCHNWARZBECK	2023/3/19	2025/3/18
Pream plifier（1GHz-18GHz）	BBV 9718D	0024	SCHNWARZBECK	2024/6/17	2025/6/16
Spectrum Analyze（10Hz-40GHz）	FSV 40	100952	Rohde & Schwarz	2024/6/17	2025/6/16
Pream plifier（18GHz-40GHz）	BBV 9721	0056	SCHNWARZBECK	2024/6/17	2025/6/16
Double Ridge Guide Horn Antenna（18GHz-40GHz）	SAS-574	588	A.H.System	2023/3/19	2025/3/18
Loop Antenna (9KHz-30MHz)	FMZB1519B	014	SCHNWARZBECK	2024/6/17	2025/6/16
Amplifier (9KHz-30MHz)	CVP 9222 C	00109	CHNWARZBECK	2024/6/17	2025/6/16

MXG Signal Analyzer	N9020A	MY50510202	Agilent	2024/6/17	2025/6/16
MXG Vector Signal Generator	N5182A	MY50140020	Agilent	2024/6/17	2025/6/16
MXG Analog Signal Generator	N5181A	MY47420919	Agilent	2024/6/17	2025/6/16
Power Sensor	TR1029-2	512364	Techoy	2024/6/17	2025/6/16
RF Swith	TR1029-1	512364	Techoy	2024/6/17	2025/6/16
Cable	DA800-4000MM	NA	DA	2024/6/17	2025/6/16
Cable	DA800-11000MM	NA	DA	2024/6/17	2025/6/16

Other

Item	Name	Manufacturer	Model	Software version
1	EMC Conduction Test System	FALA	EZ-EMC	Ver.EMC-CON 3A1.1+
2	EMC radiation test system	FALA	EZ-EMC	Ver.FA-03A2 RE+
3	RF test system	TACHOY	RFTest	V1.0.0
4	RF communication test system	TACHOY	RFTest	V1.0.0

5.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	± 1 x 10^{-6}
Bandwidth	± 1.5 x 10^{-6}
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conducted Emissions (150kHz~30MHz)	±3.64dB
Radiated Emission(9KHz~30MHz)	±4.51dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB
Radiated Emission(25GHz~40GHz)	±3.38dB
Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95%	

5.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	WorldPenScan Ai Reader	PenPower	MSE12	N/A	EUT
E-2	Adapter	OMIX	X2903	N/A	Auxiliary

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

6 Conducted Emission

Test Requirement:	:	FCC CFR 47 Part 15 Section 15.207; RSS-Gen 8.8
Test Method:	:	ANSI C63.10:2020
Test Result:	:	PASS
Frequency Range:	:	150kHz to 30MHz
Class/Severity:	:	Class B
Detector:	:	Peak for pre-scan (9kHz Resolution Bandwidth)

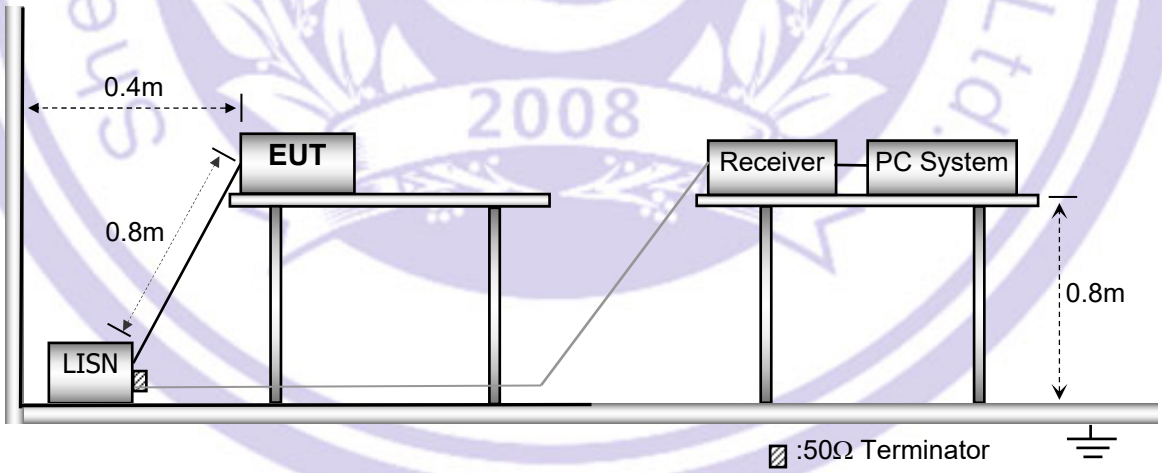
6.1 E.U.T. Operation

Operating Environment **:**

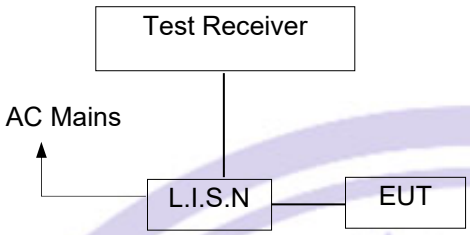
Temperature:	:	23.2°C
Humidity:	:	51 % RH
Atmospheric Pressure:	:	101.12 kPa
Test Voltage	:	AC 120V/60Hz

6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10: 2013



6.3 Test SET-UP (Block Diagram of Configuration)



6.4 Measurement Procedure:

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

6.5 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:

1. The lower limit shall apply at the transition frequencies
2.The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

6.6 Measurement Description

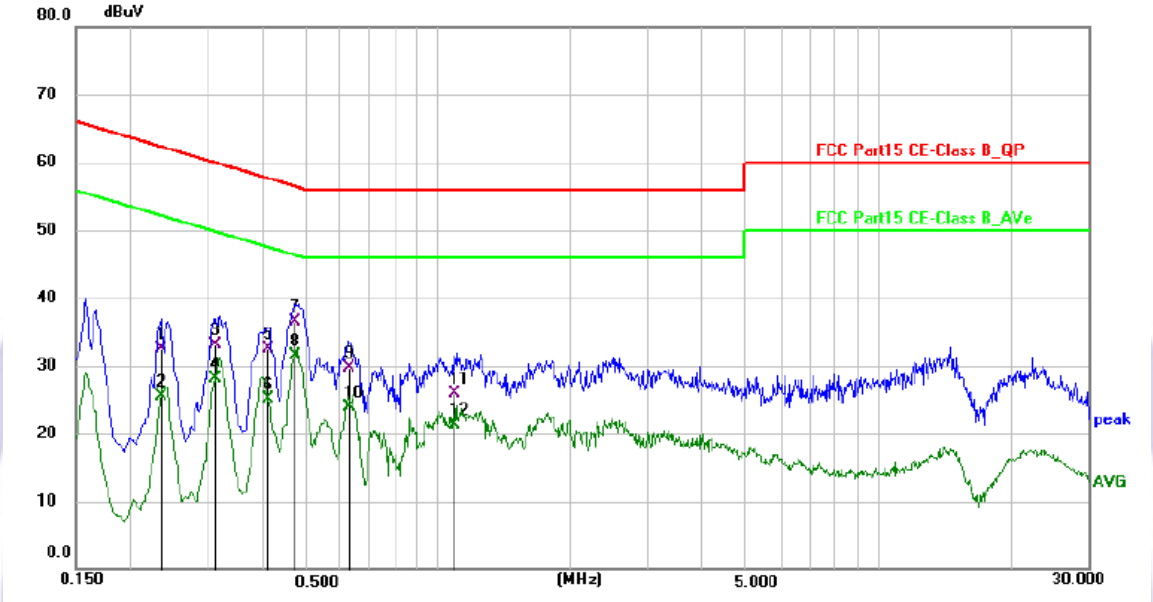
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.7 Conducted Emission Test Result

Pass

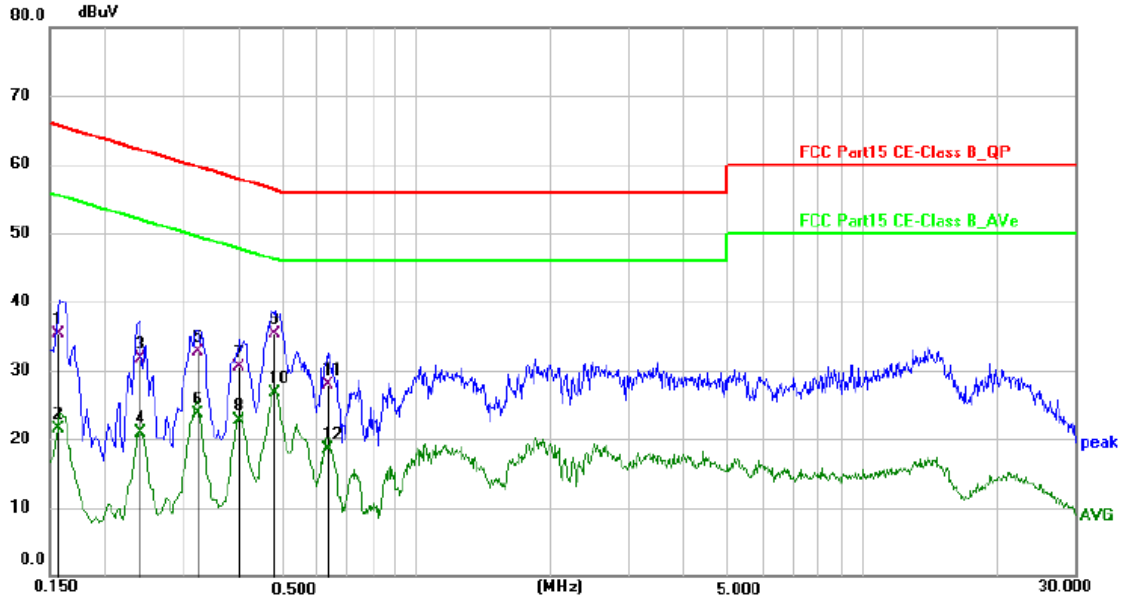
Conducted emission at both 120V & 240V is assessed, and emission at 120V represents the worst case. All the modulation modes were tested the data of the worst mode (802.11a,Lowest channel) are recorded in the following pages and the others modulation methods do not exceed the limits.

Temperature:	26°C	Relative Humidity:	54%
Pressure:	101kPa	Phase :	L
Test Voltage :	AC 120V/60Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.2357	22.76	9.67	32.43	62.25	-29.82	QP	P
2	0.2357	15.82	9.67	25.49	52.25	-26.76	AVG	P
3	0.3121	23.38	9.67	33.05	59.91	-26.86	QP	P
4	0.3121	18.40	9.67	28.07	49.91	-21.84	AVG	P
5	0.4118	22.87	9.67	32.54	57.61	-25.07	QP	P
6	0.4118	15.35	9.67	25.02	47.61	-22.59	AVG	P
7	0.4737	26.84	9.66	36.50	56.45	-19.95	QP	P
8 *	0.4737	21.85	9.66	31.51	46.45	-14.94	AVG	P
9	0.6293	19.97	9.67	29.64	56.00	-26.36	QP	P
10	0.6293	14.21	9.67	23.88	46.00	-22.12	AVG	P
11	1.0961	16.19	9.66	25.85	56.00	-30.15	QP	P
12	1.0961	11.67	9.66	21.33	46.00	-24.67	AVG	P

Temperature:	26°C	Relative Humidity:	54%
Pressure:	101kPa	Phase :	N
Test Voltage :	AC 120V/60Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1570	25.61	9.67	35.28	65.62	-30.34	QP	P
2	0.1570	11.93	9.67	21.60	55.62	-34.02	AVG	P
3	0.2398	22.00	9.66	31.66	62.10	-30.44	QP	P
4	0.2398	11.33	9.66	20.99	52.10	-31.11	AVG	P
5	0.3245	23.10	9.66	32.76	59.59	-26.83	QP	P
6	0.3245	14.01	9.66	23.67	49.59	-25.92	AVG	P
7	0.3992	20.90	9.67	30.57	57.87	-27.30	QP	P
8	0.3992	12.95	9.67	22.62	47.87	-25.25	AVG	P
9	0.4788	25.55	9.67	35.22	56.36	-21.14	QP	P
10 *	0.4788	17.01	9.67	26.68	46.36	-19.68	AVG	P
11	0.6302	18.33	9.67	28.00	56.00	-28.00	QP	P
12	0.6302	8.91	9.67	18.58	46.00	-27.42	AVG	P

Notes:
1.An initial pre-scan was performed on the line and neutral lines with peak detector.
2.Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3.Mesurement Level = Reading level + Correct Factor

7 Radiated Spurious Emissions

Test Requirement	:	FCC CFR47 Part 15 Section 15.209 & 15.407 RSS-247; RSS-Gen 6.13
Test Method	:	ANSI C63.10:2020
Test Result	:	PASS
Measurement Distance	:	3m
Limit	:	See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Undesirable emission limits

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge

Requirement	Limit(EIRP)	Limit (Field strength at 3m)
15.407(b)(1)	PK:-27(dBm/MHz)	PK:68.2(dBμV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)		

7.1 EUT Operation

Operating Environment :

Temperature : 24.5 °C

Humidity : 55.5% RH

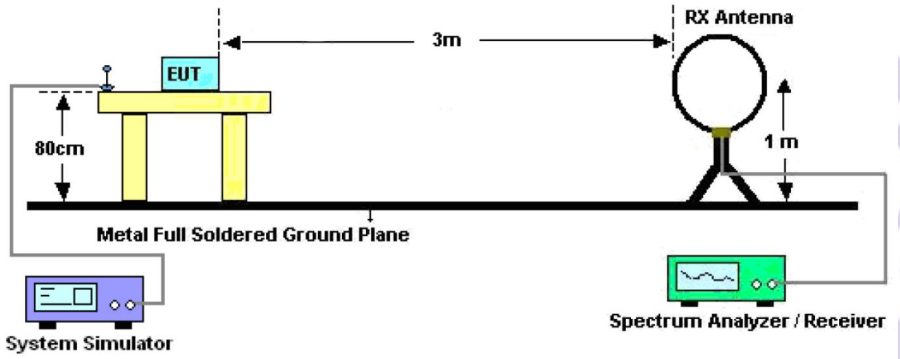
Atmospheric Pressure : 101.3kPa

Test Voltage : DC 3.8V

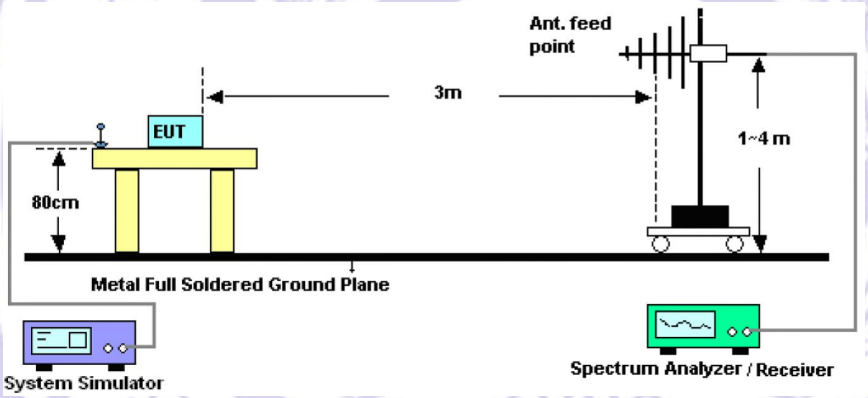
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

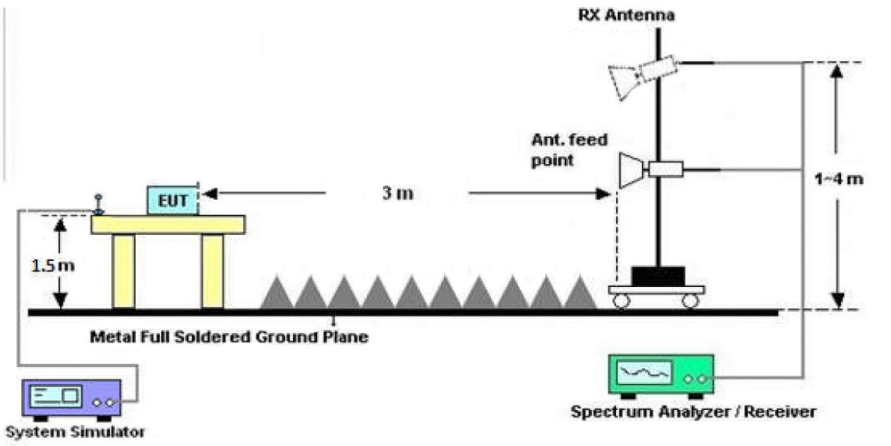
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / *10Hz* for Average

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

7.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2020.

2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.

3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.

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

6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.

7. Test Procedure of measurement (For Above 1GHz):

1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).

2) Change the antenna polarization and repeat 1) with vertical polarization.

3) Make a hardcopy of the spectrum.

4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

5) Change the analyser mode to Clear/ Write and found the cone of emission.

6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.

7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.

8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

7.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	>20

Note:

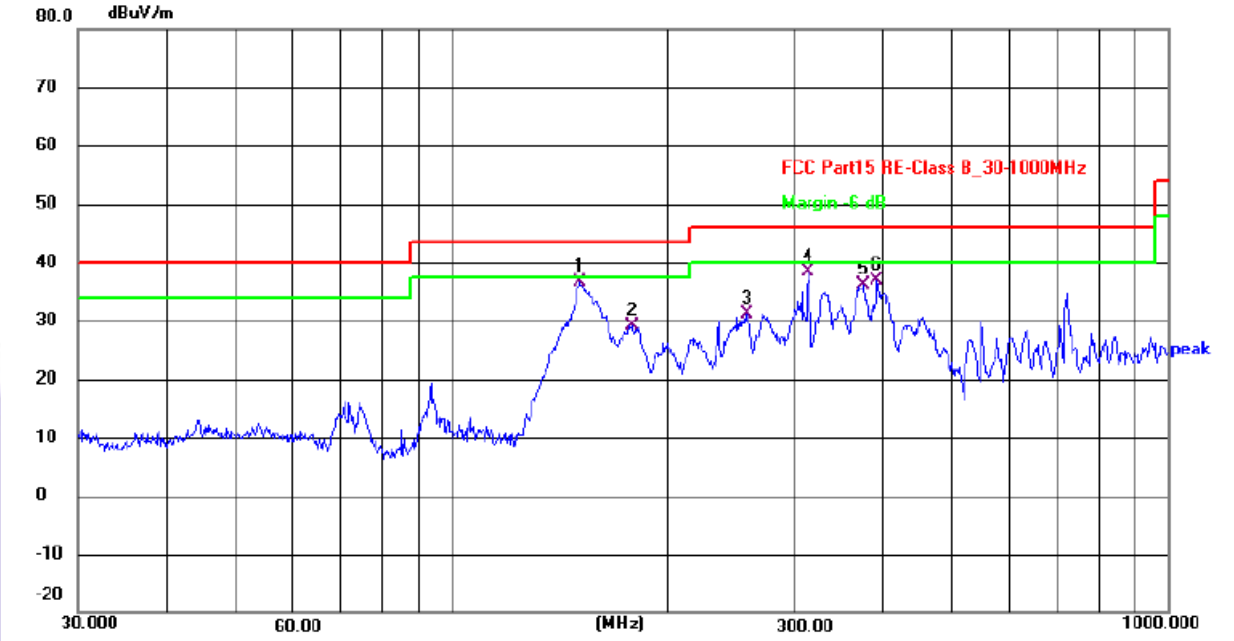
The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Please refer to the following test plots,Low Channel Worst case 802.11a for record:

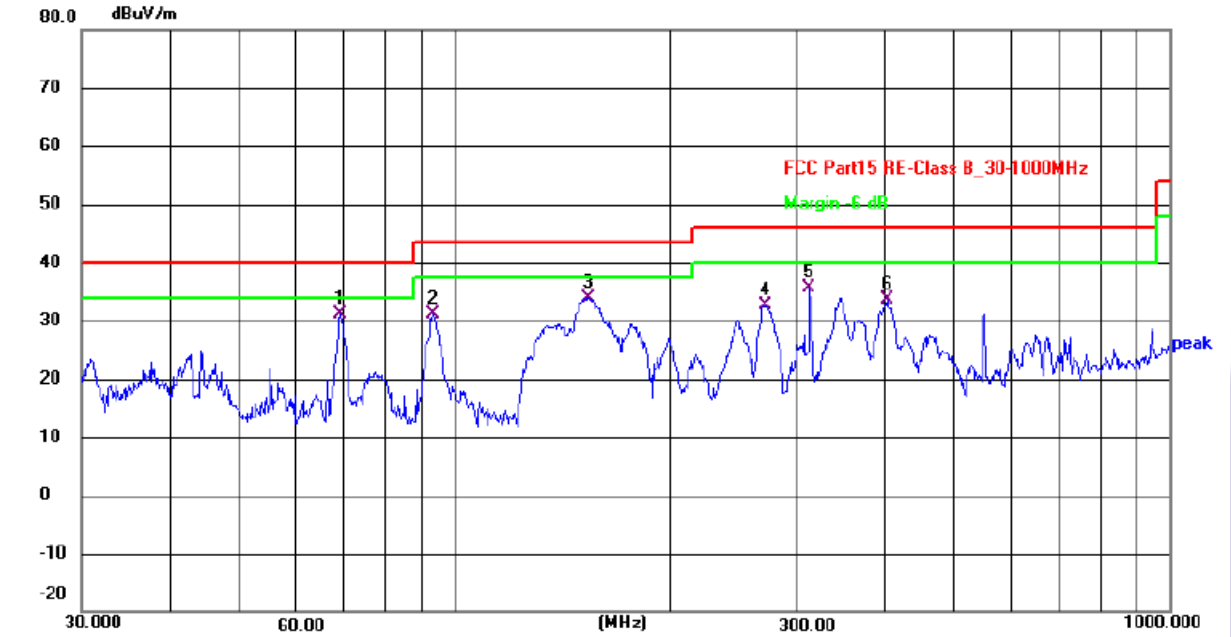
Temperature:	26℃	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Horizontal
Test Voltage:	DC 3.8V		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	151.0663	55.81	-19.25	36.56	43.50	-6.94	QP
2	178.1322	46.84	-17.70	29.14	43.50	-14.36	QP
3	258.3263	46.08	-14.88	31.20	46.00	-14.80	QP
4	314.3763	51.78	-13.38	38.40	46.00	-7.60	QP
5	375.9384	48.18	-11.98	36.20	46.00	-9.80	QP
6	392.0950	48.69	-11.70	36.99	46.00	-9.01	QP

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Vertical
Test Voltage:	DC 3.8V		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	69.1140	48.91	-17.83	31.08	40.00	-8.92	QP
2	93.1131	48.58	-17.52	31.06	43.50	-12.44	QP
3	153.7384	52.90	-19.05	33.85	43.50	-9.65	QP
4	271.3245	46.96	-14.33	32.63	46.00	-13.37	QP
5	313.2760	49.06	-13.38	35.68	46.00	-10.32	QP
6	401.8383	45.09	-11.55	33.54	46.00	-12.46	QP

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Test Frequency 1GHz-40GHz

802.11a

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel:5745MHz									
V	11490	42.09	32.29	8.39	38.9	57.09	74	-16.91	PK
V	11490	20.84	32.29	8.39	38.9	35.84	54	-18.16	AV
V	17233.3	38.12	31.19	9.62	40.37	56.92	68.2	-11.28	PK
V	17233.3	20.86	31.19	9.62	40.37	39.66	54	-14.34	AV
V	22980	39.4	27.02	7.2	38.98	58.56	74	-15.44	PK
V	22980	18.94	27.02	7.2	38.98	38.1	54	-15.9	AV
V	28723.3	36.45	27.1	7.56	40.18	57.09	68.2	-11.11	PK
V	28723.3	17.02	27.1	7.56	40.18	37.66	54	-16.34	AV
H	11490	42.51	32.29	8.39	38.9	57.51	74	-16.49	PK
H	11490	21.66	32.29	8.39	38.9	36.66	54	-17.34	AV
H	17233.3	38.54	31.19	9.62	40.37	57.34	68.2	-10.86	PK
H	17233.3	18.54	31.19	9.62	40.37	37.34	54	-16.66	AV
H	22980	37.01	27.02	7.2	38.98	56.17	74	-17.83	PK
H	22980	20.5	27.02	7.2	38.98	39.66	54	-14.34	AV
H	28723.3	37.67	27.1	7.56	40.18	58.31	68.2	-9.89	PK
H	28723.3	16.26	27.1	7.56	40.18	36.9	54	-17.1	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Middle Channel:5785MHz									
V	11570	42.03	32.26	8.48	38.9	57.15	74	-16.85	PK
V	11570	18.03	32.26	8.48	38.9	33.15	54	-20.85	AV
V	17353.3	36.96	31.08	9.67	40.61	56.16	68.2	-12.04	PK
V	17353.3	16.05	31.08	9.67	40.61	35.25	54	-18.75	AV
V	23140	36.4	27.03	7.24	39.03	55.64	68.2	-12.56	PK
V	23140	15.97	27.03	7.24	39.03	35.21	54	-18.79	AV
V	28923.3	35.72	27.1	7.58	40.34	56.54	68.2	-11.66	PK
V	28923.3	16.67	27.1	7.58	40.34	37.49	54	-16.51	AV
H	11570	37.99	32.26	8.48	38.9	53.11	74	-20.89	PK
H	11570	19.25	32.26	8.48	38.9	34.37	54	-19.63	AV
H	17353.3	35.57	31.08	9.67	40.61	54.77	68.2	-13.43	PK
H	17353.3	15.08	31.08	9.67	40.61	34.28	54	-19.72	AV
H	23140	35.45	27.03	7.24	39.03	54.69	68.2	-13.51	PK
H	23140	16.34	27.03	7.24	39.03	35.58	54	-18.42	AV
H	28923.3	35.81	27.1	7.58	40.34	56.63	68.2	-11.57	PK
H	28923.3	13.11	27.1	7.58	40.34	33.93	54	-20.07	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
High Channel:5825MHz									
V	11650	44.79	32.23	8.56	38.9	60.02	74	-13.98	PK
V	11650	32.09	32.23	8.56	38.9	47.32	54	-6.68	AV
V	17473.3	43.05	30.97	9.73	40.85	62.66	68.2	-5.54	PK
V	17473.3	27.9	30.97	9.73	40.85	47.51	54	-6.49	AV
V	23300	41.79	27.03	7.26	39.06	61.08	68.2	-7.12	PK
V	23300	23.81	27.03	7.26	39.06	43.1	54	-10.9	AV
V	29123.3	41.63	27.1	7.61	40.4	62.54	68.2	-5.66	PK
V	29123.3	23.52	27.1	7.61	40.4	44.43	54	-9.57	AV
H	11650	43.92	32.23	8.56	38.9	59.15	74	-14.85	PK
H	11650	30.16	32.23	8.56	38.9	45.39	54	-8.61	AV
H	17473.3	44.32	30.97	9.73	40.85	63.93	68.2	-4.27	PK
H	17473.3	27.46	30.97	9.73	40.85	47.07	54	-6.93	AV
H	23300	44.72	27.03	7.26	39.06	64.01	68.2	-4.19	PK
H	23300	23.03	27.03	7.26	39.06	42.32	54	-11.68	AV
H	29123.3	37.91	27.1	7.61	40.4	58.82	68.2	-9.38	PK
H	29123.3	23.75	27.1	7.61	40.4	44.66	54	-9.34	AV

802.11a

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel:5180MHz									
V	10360	45.58	32.7	7.72	38.59	59.19	68.2	-9.01	PK
V	10360	24.03	32.7	7.72	38.59	37.64	54	-16.36	AV
V	15540	43.18	31.74	9.44	39.29	60.17	74	-13.83	PK
V	15540	17.56	31.74	9.44	39.29	34.55	54	-19.45	AV
V	20720	42.05	26.93	6.64	37.94	59.7	74	-14.3	PK
V	20720	19.36	26.93	6.64	37.94	37.01	54	-16.99	AV
V	25900	36.51	27.1	7.9	39.32	56.63	68.2	-11.57	PK
V	25900	22.64	27.1	7.9	39.32	42.76	54	-11.24	AV
H	10360	37.94	32.7	7.72	38.59	51.55	68.2	-16.65	PK
H	10360	23.03	32.7	7.72	38.59	36.64	54	-17.36	AV
H	15540	38.7	31.74	9.44	39.29	55.69	74	-18.31	PK
H	15540	23.46	31.74	9.44	39.29	40.45	54	-13.55	AV
H	20720	42.5	26.93	6.64	37.94	60.15	74	-13.85	PK
H	20720	17.27	26.93	6.64	37.94	34.92	54	-19.08	AV
H	25900	40.1	27.1	7.9	39.32	60.22	68.2	-7.98	PK
H	25900	20.46	27.1	7.9	39.32	40.58	54	-13.42	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Middle Channel:5200MHz									
V	10400	44.8	32.69	7.73	38.62	58.46	68.2	-9.74	PK
V	10400	25.59	32.69	7.73	38.62	39.25	54	-14.75	AV
V	15600	40.54	31.72	9.45	39.28	57.55	74	-16.45	PK
V	15600	20.64	31.72	9.45	39.28	37.65	54	-16.35	AV
V	20800	38.48	26.93	6.73	37.96	56.24	74	-17.76	PK
V	20800	21.39	26.93	6.73	37.96	39.15	54	-14.85	AV
V	26000	38.63	27.1	7.94	39.3	58.77	68.2	-9.43	PK
V	26000	17.04	27.1	7.94	39.3	37.18	54	-16.82	AV
H	10400	42.75	32.69	7.73	38.62	56.41	68.2	-11.79	PK
H	10400	20.95	32.69	7.73	38.62	34.61	54	-19.39	AV
H	15600	39.77	31.72	9.45	39.28	56.78	74	-17.22	PK
H	15600	21.2	31.72	9.45	39.28	38.21	54	-15.79	AV
H	20800	40.39	26.93	6.73	37.96	58.15	74	-15.85	PK
H	20800	19.4	26.93	6.73	37.96	37.16	54	-16.84	AV
H	26000	38.5	27.1	7.94	39.3	58.64	68.2	-9.56	PK
H	26000	16.76	27.1	7.94	39.3	36.9	54	-17.1	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
High Channel:5240MHz									
V	10480	41.21	32.66	7.74	38.68	54.97	68.2	-13.23	PK
V	10480	24.9	32.66	7.74	38.68	38.66	54	-15.34	AV
V	15720	38.14	31.68	9.48	39.26	55.2	74	-18.8	PK
V	15720	18.38	31.68	9.48	39.26	35.44	54	-18.56	AV
V	20960	38.46	26.94	6.91	37.99	56.42	74	-17.58	PK
V	20960	21.01	26.94	6.91	37.99	38.97	54	-15.03	AV
V	26200	38.51	27.1	7.89	39.5	58.8	68.2	-9.4	PK
V	26200	16.24	27.1	7.89	39.5	36.53	54	-17.47	AV
H	10480	45.12	32.66	7.74	38.68	58.88	68.2	-9.32	PK
H	10480	24.04	32.66	7.74	38.68	37.8	54	-16.2	AV
H	15720	40.97	31.68	9.48	39.26	58.03	74	-15.97	PK
H	15720	20.72	31.68	9.48	39.26	37.78	54	-16.22	AV
H	20960	38.94	26.94	6.91	37.99	56.9	74	-17.1	PK
H	20960	21.62	26.94	6.91	37.99	39.58	54	-14.42	AV
H	26200	35.5	27.1	7.89	39.5	55.79	68.2	-12.41	PK
H	26200	18.86	27.1	7.89	39.5	39.15	54	-14.85	AV

Remark:
1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,
Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
4. The worst mode is 802.11a, only the worst data is recorded.

Restrict Band EMISSION MEASUREMENT

Frequency	Meter Reading	antenna Factor	cable loss	preamp factor	Emission Level	Limit	Margin	Polar	Detector Type	Result
(MHz)	(dBuV/m)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(H/V)		
802.11a:5180MHz										
5150	52.73	33.14	5.29	33.88	58.76	74.00	-15.24	V	PK	Pass
5150	34.77	33.14	5.29	33.88	40.8	54.00	-13.2	V	AV	Pass
5145	54.36	33.14	5.29	33.88	60.39	74.00	-13.61	V	PK	Pass
5145	34.84	33.14	5.29	33.88	40.87	54.00	-13.13	V	AV	Pass
5150	54.36	33.14	5.29	33.88	60.39	74.00	-13.61	H	PK	Pass
5150	34.91	33.14	5.29	33.88	40.94	54.00	-13.06	H	AV	Pass
5145	52.31	33.14	5.29	33.88	58.34	74.00	-15.66	H	PK	Pass
5145	33.98	33.14	5.29	33.88	40.01	54.00	-13.99	H	AV	Pass
802.11a:5240MHz										
5350	56.53	33.06	5.44	33.72	62.63	74.00	-11.37	V	PK	Pass
5350	36.65	33.06	5.44	33.72	42.75	54.00	-11.25	V	AV	Pass
5370	51.96	33.05	5.45	33.7	58.06	74.00	-15.94	V	PK	Pass
5370	35.89	33.05	5.45	33.7	41.99	54.00	-12.01	V	AV	Pass
5350	56.2	33.06	5.44	33.72	62.3	74.00	-11.7	H	PK	Pass
5350	37.96	33.06	5.44	33.72	44.06	54.00	-9.94	H	AV	Pass
5370	53.79	33.05	5.45	33.7	59.89	74.00	-14.11	H	PK	Pass
5370	35.71	33.05	5.45	33.7	41.81	54.00	-12.19	H	AV	Pass
802.11n20:5180MHz										
5150	53.55	33.14	5.29	33.88	59.58	74.00	-14.42	V	PK	Pass

5150	37.23	33.14	5.29	33.88	43.26	54.00	-10.74	V	AV	Pass
5145	54.1	33.14	5.29	33.88	60.13	74.00	-13.87	V	PK	Pass
5145	35.2	33.14	5.29	33.88	41.23	54.00	-12.77	V	AV	Pass
5150	54.26	33.14	5.29	33.88	60.29	74.00	-13.71	H	PK	Pass
5150	37.22	33.14	5.29	33.88	43.25	54.00	-10.75	H	AV	Pass
5145	51.88	33.14	5.29	33.88	57.91	74.00	-16.09	H	PK	Pass
5145	36.15	33.14	5.29	33.88	42.18	54.00	-11.82	H	AV	Pass
802.11n20:5240MHz										
5350	54.05	33.14	5.29	33.88	60.08	74.00	-13.92	V	PK	Pass
5350	34.3	33.14	5.29	33.88	40.33	54.00	-13.67	V	AV	Pass
5370	55.21	33.14	5.29	33.88	61.24	74.00	-12.76	V	PK	Pass
5370	35.13	33.14	5.29	33.88	41.16	54.00	-12.84	V	AV	Pass
5350	54.21	33.14	5.29	33.88	60.24	74.00	-13.76	H	PK	Pass
5350	35.96	33.14	5.29	33.88	41.99	54.00	-12.01	H	AV	Pass
5370	52.07	33.14	5.29	33.88	58.1	74.00	-15.9	H	PK	Pass
5370	34.74	33.14	5.29	33.88	40.77	54.00	-13.23	H	AV	Pass
802.11ac20:5180MHz										
5150	56.98	33.06	5.44	33.72	63.08	74.00	-10.92	V	PK	Pass
5150	37.08	33.06	5.44	33.72	43.18	54.00	-10.82	V	AV	Pass
5145	52.87	33.05	5.45	33.7	58.97	74.00	-15.03	V	PK	Pass
5145	37.01	33.05	5.45	33.7	43.11	54.00	-10.89	V	AV	Pass
5150	55.75	33.06	5.44	33.72	61.85	74.00	-12.15	H	PK	Pass
5150	37.9	33.06	5.44	33.72	44	54.00	-10	H	AV	Pass
5145	53.96	33.05	5.45	33.7	60.06	74.00	-13.94	H	PK	Pass
5145	36.23	33.05	5.45	33.7	42.33	54.00	-11.67	H	AV	Pass

802.11ac20:5240MHz										
5350	55.51	33.06	5.44	33.72	61.61	74.00	-12.39	V	PK	Pass
5350	40.32	33.06	5.44	33.72	46.42	54.00	-7.58	V	AV	Pass
5370	53.65	33.05	5.45	33.7	59.75	74.00	-14.25	V	PK	Pass
5370	39.88	33.05	5.45	33.7	45.98	54.00	-8.02	V	AV	Pass
5350	56.83	33.06	5.44	33.72	62.93	74.00	-11.07	H	PK	Pass
5350	43.73	33.06	5.44	33.72	49.83	54.00	-4.17	H	AV	Pass
5370	54.86	33.05	5.45	33.7	60.96	74.00	-13.04	H	PK	Pass
5370	38.68	33.05	5.45	33.7	44.78	54.00	-9.22	H	AV	Pass
802.11n40:5190MHz										
5150	53.51	33.14	5.29	33.88	59.54	74.00	-14.46	V	PK	Pass
5150	38.61	33.14	5.29	33.88	44.64	54.00	-9.36	V	AV	Pass
5145	54.2	33.14	5.29	33.88	60.23	74.00	-13.77	V	PK	Pass
5145	37.37	33.14	5.29	33.88	43.4	54.00	-10.6	V	AV	Pass
5150	55.26	33.14	5.29	33.88	61.29	74.00	-12.71	H	PK	Pass
5150	38.55	33.14	5.29	33.88	44.58	54.00	-9.42	H	AV	Pass
5145	52.64	33.14	5.29	33.88	58.67	74.00	-15.33	H	PK	Pass
5145	37.7	33.14	5.29	33.88	43.73	54.00	-10.27	H	AV	Pass
802.11n40:5230MHz										
5350	56.09	33.06	5.44	33.72	62.19	74.00	-11.81	V	PK	Pass
5350	40.56	33.06	5.44	33.72	46.66	54.00	-7.34	V	AV	Pass
5370	53.71	33.05	5.45	33.7	59.81	74.00	-14.19	V	PK	Pass
5370	40.2	33.05	5.45	33.7	46.3	54.00	-7.7	V	AV	Pass
5350	56.93	33.06	5.44	33.72	63.03	74.00	-10.97	H	PK	Pass
5350	43.42	33.06	5.44	33.72	49.52	54.00	-4.48	H	AV	Pass

5370	55.77	33.05	5.45	33.7	61.87	74.00	-12.13	H	PK	Pass
5370	39.79	33.05	5.45	33.7	45.89	54.00	-8.11	H	AV	Pass
802.11ac40:5190MHz										
5150	54.18	33.14	5.29	33.88	60.21	74.00	-13.79	V	PK	Pass
5150	37.61	33.14	5.29	33.88	43.64	54.00	-10.36	V	AV	Pass
5145	54.2	33.14	5.29	33.88	60.23	74.00	-13.77	V	PK	Pass
5145	37.63	33.14	5.29	33.88	43.66	54.00	-10.34	V	AV	Pass
5150	54.51	33.14	5.29	33.88	60.54	74.00	-13.46	H	PK	Pass
5150	37.84	33.14	5.29	33.88	43.87	54.00	-10.13	H	AV	Pass
5145	52.14	33.14	5.29	33.88	58.17	74.00	-15.83	H	PK	Pass
5145	38.27	33.14	5.29	33.88	44.3	54.00	-9.7	H	AV	Pass
802.11ac40:5230MHz										
5350	55.95	33.06	5.44	33.72	62.05	74.00	-11.95	V	PK	Pass
5350	40.93	33.06	5.44	33.72	47.03	54.00	-6.97	V	AV	Pass
5370	53.7	33.05	5.45	33.7	59.8	74.00	-14.2	V	PK	Pass
5370	39.8	33.05	5.45	33.7	45.9	54.00	-8.1	V	AV	Pass
5350	56.99	33.06	5.44	33.72	63.09	74.00	-10.91	H	PK	Pass
5350	43.66	33.06	5.44	33.72	49.76	54.00	-4.24	H	AV	Pass
5370	55.34	33.05	5.45	33.7	61.44	74.00	-12.56	H	PK	Pass
5370	39.26	33.05	5.45	33.7	45.36	54.00	-8.64	H	AV	Pass

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,

   Margin= Emission Level - Limit

2. If peak below the average limit, the average emission was no test.

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

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2008

8 POWER SPECTRAL DENSITY TEST

8.1 Test Standard and Limit

According to FCC §15.407(3)

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. 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).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. 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.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. 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. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. 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.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. 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

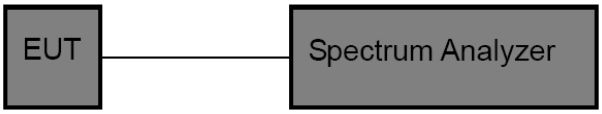
without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

According to RSS-247 6.2

For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

For the band 5.725-5.85 GHz,the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band.

8.2 Test Setup



8.3 Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above,

2. The testing follows FCC KDB 789033 D02.

3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Spectrum.

4. For U-NII1, U-NII-2A, U-NII-2C Band:

Set RBW=1MHz, VBW=3MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)

For U-NII-3 Band:

Set RBW=510 kHz, VBW=3*RBW, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)

5. User the cursor on spectrum to peak search the highest level of trace

6. Record the max. reading and add 10 log(1/duty cycle).

8.4 Test Data

Please see the attachment for WIFI5.2G and WIFI5.8G data.

For ISED

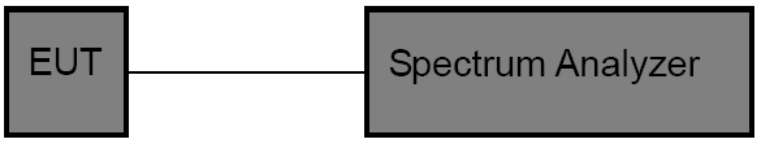
WIFI5.2G						
Type	Channel	Power Spectral Density (dBm/MHz)	Antenna Gain (dBi)	PSD Eirp (dBm/MHz)	Limit (dBm)	Result
802.11a	Low	-9.75	0.65	-9.1	10.00	Pass
	Moddle	-10.21	0.65	-9.56		
	High	-10.35	0.65	-9.7		
802.11n(HT20)	Low	-10.42	0.65	-9.77	10.00	Pass
	Moddle	-10.61	0.65	-9.96		
	High	-10.72	0.65	-10.07		
802.11ac(HT20)	Low	-10.90	0.65	-10.25	10.00	Pass
	Moddle	-10.63	0.65	-9.98		
	High	-10.56	0.65	-9.91		
802.11n(HT40)	Low	-12.83	0.65	-12.18	10.00	Pass
	High	-12.55	0.65	-11.9		
802.11ac(HT40)	Low	-12.85	0.65	-12.2	10.00	Pass
	High	-12.50	0.65	-11.85		

9 26DB & 6DB & 99% Emission Bandwidth Test

9.1 Test Standard

Test Standard	FCC Part15 C Section 15.407, RSS-247
	The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band, the minimum bandwidth 6 dB bandwidth of U-NII devices shall be at least 500KHz. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

9.2 Test Setup



9.3 Test Procedure

The following procedure shall be used for measuring -6dB Emission Bandwidth :

a) Set RBW = 100KHz.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.

2. Set span = 1.5 times to 5 times the OBW.

3. Set RBW = 1 % to 5 % of the OBW

4. Set VBW ≥ 3 · RBW

5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

6. Use the 99 % power bandwidth function of the instrument (if available).

7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

The following procedure shall be used for measuring -26dB Emission Bandwidth:

1. Set RBW= shall be in the range of 1% to 5% ofthe emission bandwidth

2. Set the VBW > RBW

3. Detector = Peak.

4. Trace mode = max hold.

5. 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 instrument, Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is in the range of 1% to 5%.

9.4 Test Data

Please see the attachment for WIFI5.2G and WIFI5.8G data.

10 Maximum Conducted Output Power

10.1 Test Standard and Limit

According to FCC §15.407

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

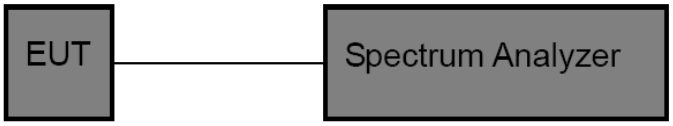
For the band 5.725–5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

According to RSS-247 6.2

For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

10.2 Test Setup



10.3 Test Procedure

The EUT was directly connected to the Power meter

1. Device Configuration

If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level (see section II.B.).

The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

b) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to

hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level with the transmit duration as long as possible and the duty cycle as high as possible.

2. Measurement using a Spectrum Analyzer or EMI Receiver (SA)

Measurement of maximum conducted output power using a spectrum analyzer requires integrating the spectrum across a frequency span that encompasses, at a minimum, either the EBW or the 99-percent occupied bandwidth of the signal.1 However, the EBW must be used to determine bandwidth dependent limits on maximum conducted output power in accordance with § 15.407(a).

a) The test method shall be selected as follows: (i) Method SA-1 or SA-1 Alternative (averaging with the EUT transmitting at full power throughout each sweep) shall be applied if either of the following conditions can be satisfied:

• The EUT transmits continuously (or with a duty cycle ≥ 98 percent).

• Sweep triggering or gating can be implemented in a way that the device transmits at the maximum power control level throughout the duration of each of the instrument sweeps to be averaged. This condition can generally be achieved by triggering the instrument's sweep if the duration of the sweep (with the analyzer configured as in Method SA-1, below) is equal to or shorter than the duration T of each transmission from the EUT and if those transmissions exhibit full power throughout their durations.

(ii) Method SA-2 or SA-2 Alternative (averaging across on and off times of the EUT transmissions, followed by duty cycle correction) shall be applied if the conditions of (i) cannot be achieved and the transmissions exhibit a constant duty cycle during the measurement duration. Duty cycle will be considered to be constant if variations are less than ± 2 percent.

(iii) Method SA-3 (RMS detection with max hold) or SA-3 Alternative (reduced VBW with max hold) shall be applied if the conditions of (i) and (ii) cannot be achieved.

b) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep):
(i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW ≥ 3 MHz.

(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(v) Sweep time = auto.

(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.

(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.

(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum

10.4 Test Data

Please see the attachment for WIFI5.2G.

For ISED

WIFI5.2G						
Type	Channel	Output power Ant (dBm)	Antenna Gain (dBi)	Eirp (dBm)	Limit (dBm)	Result
802.11a	Low	-2.39	0.65	-1.74	22.25	Pass
	Moddle	-3.40	0.65	-2.75		
	High	-2.95	0.65	-2.3		
802.11n(HT20)	Low	-3.20	0.65	-2.55	22.32	Pass
	Moddle	-3.42	0.65	-2.77		
	High	-2.96	0.65	-2.31		
802.11ac(HT20)	Low	-3.33	0.65	-2.68	22.50	Pass
	Moddle	-3.45	0.65	-2.8		
	High	-3.01	0.65	-2.36		
802.11n(HT40)	Low	-3.34	0.65	-2.69	23.00	Pass
	High	-3.02	0.65	-2.37		
802.11ac(HT40)	Low	-3.27	0.65	-2.62	23.00	Pass
	High	-2.99	0.65	-2.34		

11 Out of Band Emissions and Spurious Emission

11.1 Test Standard and Limit

According to FCC §15.407(b)

Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

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

(2) 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.

RSS-247 Section 6.2

Devices shall comply with the following:

All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p.; or

All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device, except devices installed in vehicles, shall be labelled or include in the user manual the following text “for indoor use only.”

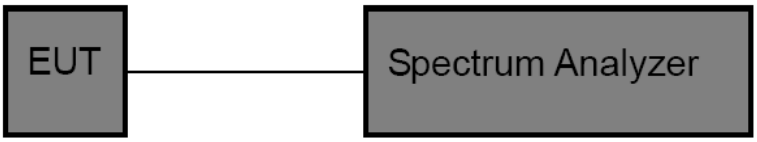
Devices operating in the band 5725-5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 Bm/MHz at 5 MHz above or below the band edges;

15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;

10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and -27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

11.2 Test Setup



11.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.

3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.

4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

5. Repeat above procedures until all measured frequencies were complete.

11.4 Test Data

Please see the attachment for WIFI5.2G and WIFI5.8G data.

12 Frequency Stability Measurement

12.1 Test Standard and Limit

FCC

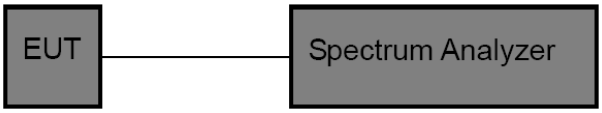
Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The transmitter center frequency tolerance shall be within operation frequency band for the 5 GHz band

IC

If the frequency stability of the licence-exempt radio apparatus is not specified in the applicable RSS, the fundamental emissions of the radio apparatus should be kept within at least the central 80% of its permitted operating frequency band in order to minimize the possibility of out-of-band operation. In addition, its occupied bandwidth shall be entirely outside the restricted bands and the prohibited TV bands of 54 72 MHz, 76-88 MHz, 174-216 MHz, and 470-602 MHz, unless otherwise indicated.

12.2 Test Setup



12.3 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 maxhold settings.

5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 106 ppm and the limit is less than ±20ppm (IEEE 802.11nspecification).

6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the

nominal value

7. Extreme temperature is -20°C~50°C.

12.4 Test Data

Please see the attachment for WIFI5.2G and WIFI5.8G data.

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2008

13 Antenna Requirement

13.1 Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203
Requirement	1) 15.203 requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. According to RSS-GEN section 6.8 The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list. For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below). When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer. The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

13.2 Antenna Connected Construction

The antenna is Internal Antenna which permanently attached, and the best case gain of the antenna is 0.65 dBi(WIFI 5.2G); 0.93 dBi(WIFI5.8G). It complies with the standard requirement.

14 TEST SETUP & EUT PHOTOGRAPH

Please see the attachment for details.

---------- End of Report ----------