8.5 RADIATED SPURIOUS EMISSION

8.5.1 Applicable Standard

According to FCC Part 15.247(d) and 15.209 and KDB 558074 D01 15.247 Meas Guidance v05r02

8.5.2 Conformance Limit

According to FCC Part 15.247(d): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	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	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)
13.36-13.41			

According to FCC Part15.205,the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log (uV/m)	300
0.490-1.705	24000/F(KHz)	20 log (uV/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

8.5.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

8.5.4 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:
The EUT was placed on a turn table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz(1GHz to 25GHz), 100 kHz for f < 1 GHz(30MHz to 1GHz), 200Hz for f<150KHz(9KHz to 150KHz), 9KHz for f<30MHz(150KHz to 30KHz)
VBW ≥ RBW
Sweep = auto

Detector function = peak
Trace = max hold
Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.
Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.
Repeat above procedures until all frequency measured was complete.

8.5.5 Test Results

Temperature:	22.5° C
Relative Humidity:	45%
ATM Pressure:	1011 mbar

■ Spurious Emission below 30MHz(9KHz to 30MHz)

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

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

- Spurious Emission Above 1GHz(1GHz to 25GHz)
- All modes 2.4G 802.11b/g/n have been tested, and the worst result 802.11g recorded was report as below:

Test mode: 802.11 g Frequency: Channel 1: 2412MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
5065.928	V	50.98	38.37	74.00	54.00	-23.02	-15.63
10986.30	V	56.95	41.39	74.00	54.00	-17.05	-12.61
15723.13	V	61.58	46.81	74.00	54.00	-12.42	-7.19
5050.235	H	51.00	37.61	74.00	54.00	-23.00	-16.39
11534.27	H	56.59	41.73	74.00	54.00	-17.41	-12.27
15724.44	H	61.50	46.80	74.00	54.00	-12.50	-7.20

Test mode: 802.11 g Frequency: Channel 6: 2437MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
5012.309	V	50.35	38.07	74.00	54.00	-23.65	-15.93
11024.23	V	56.42	42.09	74.00	54.00	-17.58	-11.91
14943.68	V	60.59	46.27	74.00	54.00	-13.41	-7.73
4863.220	H	51.01	38.67	74.00	54.00	-22.99	-15.33
11139.31	H	56.82	42.37	74.00	54.00	-17.18	-11.63
14497.73	H	61.13	48.07	74.00	54.00	-12.87	-5.93

Test mode: 802.11 g Frequency: Channel 11: 2462MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
5181.014	V	51.50	37.50	74.00	54.00	-22.50	-16.50
10888.22	V	56.94	42.38	74.00	54.00	-17.06	-11.62
15003.84	V	60.85	46.27	74.00	54.00	-13.15	-7.73
6997.538	H	51.80	38.37	74.00	54.00	-22.20	-15.63
11072.62	H	56.67	41.37	74.00	54.00	-17.33	-12.63
14653.35	H	60.91	45.27	74.00	54.00	-13.09	-8.73

Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

All modes 2.4G 802.11b/g/n have been tested, and the worst result 802.11g recorded was report as below:

Test mode: 802.11 g Frequency: Channel 1: 2412MHz

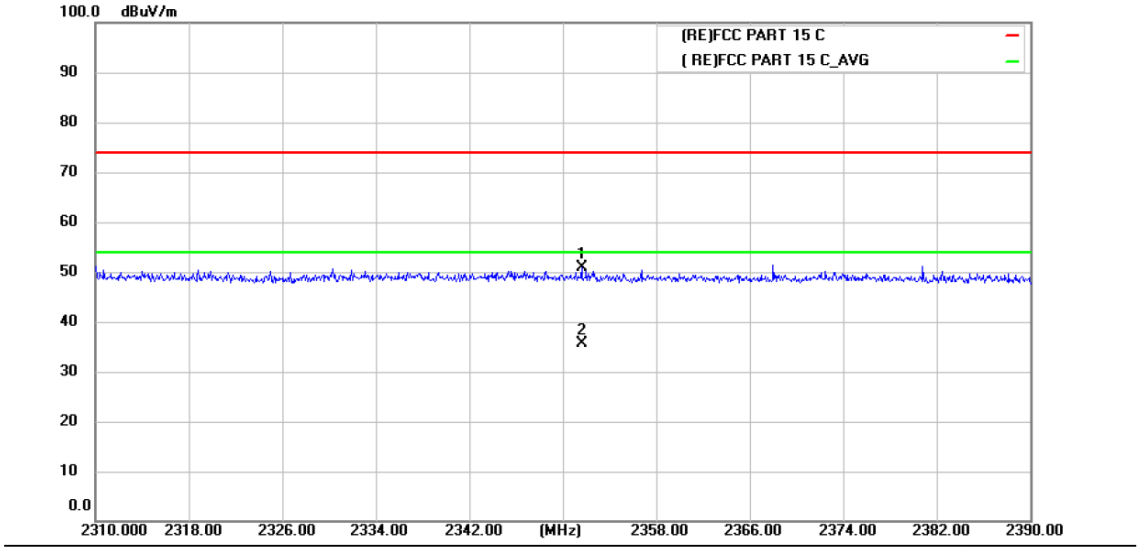
Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2351.615	H	50.90	74.00	35.64	54.00
2314.345	V	53.43	74.00	40.64	54.00

Test mode: 802.11 g Frequency: Channel 11: 2462MHz

Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2485.871	H	54.67	74.00	40.79	54.00
2493.378	V	64.00	74.00	50.19	54.00

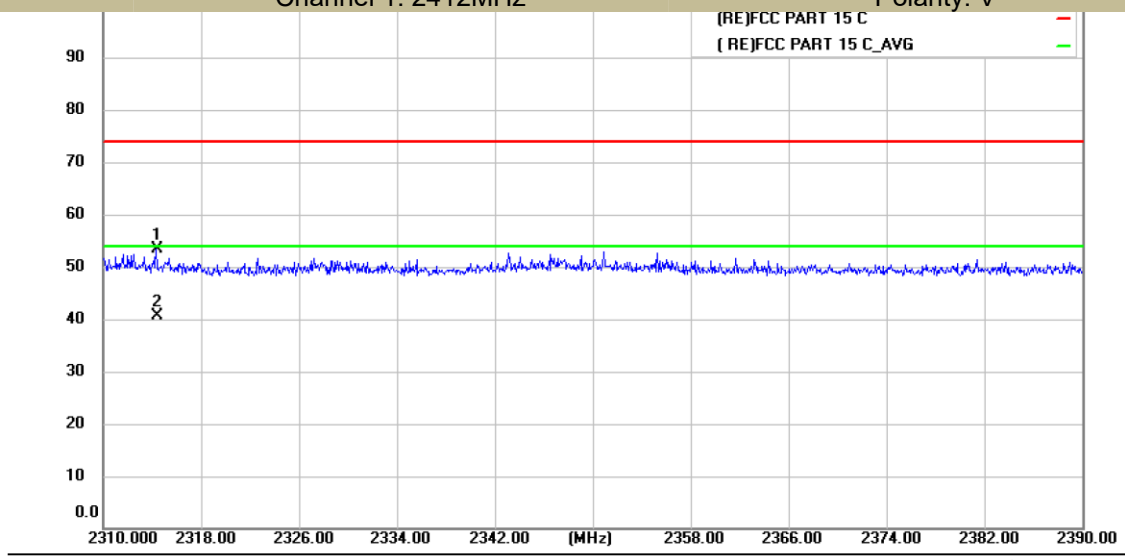
Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor +Cable Loss.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Test Model	Spurious Emission in Restricted Band 2310-2390MHz 802.11g	
	Channel 1: 2412MHz	Polarity: H



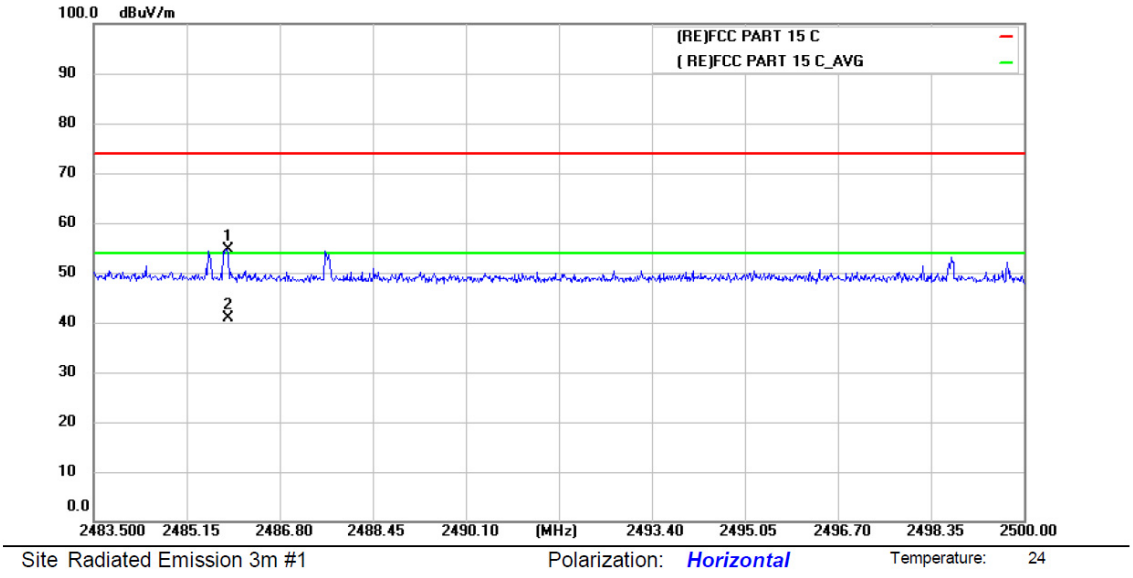
Site Radiated Emission 3m #1 Polarization: *Horizontal* Temperature: 24

Test Model	Spurious Emission in Restricted Band 2310-2390MHz 802.11g	
	Channel 1: 2412MHz	Polarity: V

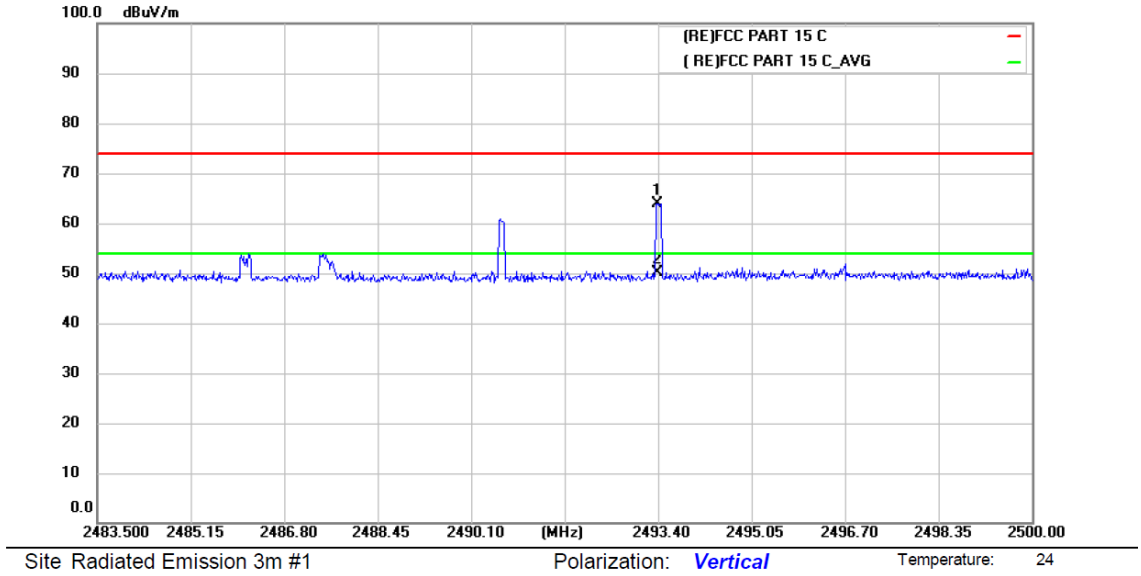


Site Radiated Emission 3m #1 Polarization: *Vertical* Temperature: 24

Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz 802.11g Channel 11: 2462MHz Polarity: H

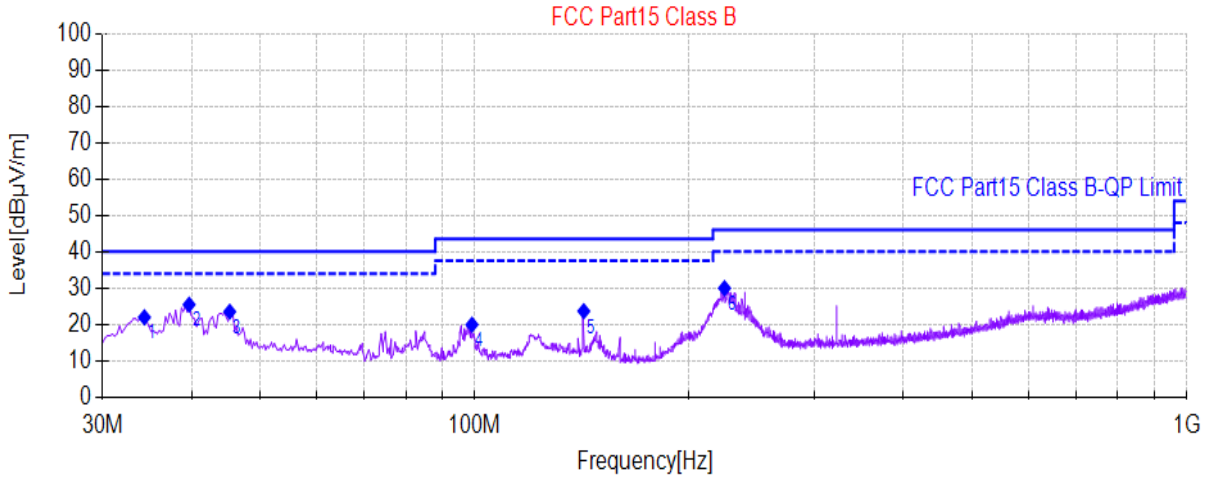


Test Model	Spurious Emission in Restricted Band2483.5-2500MHz 802.11g Channel 11: 2462MHz Polarity: V



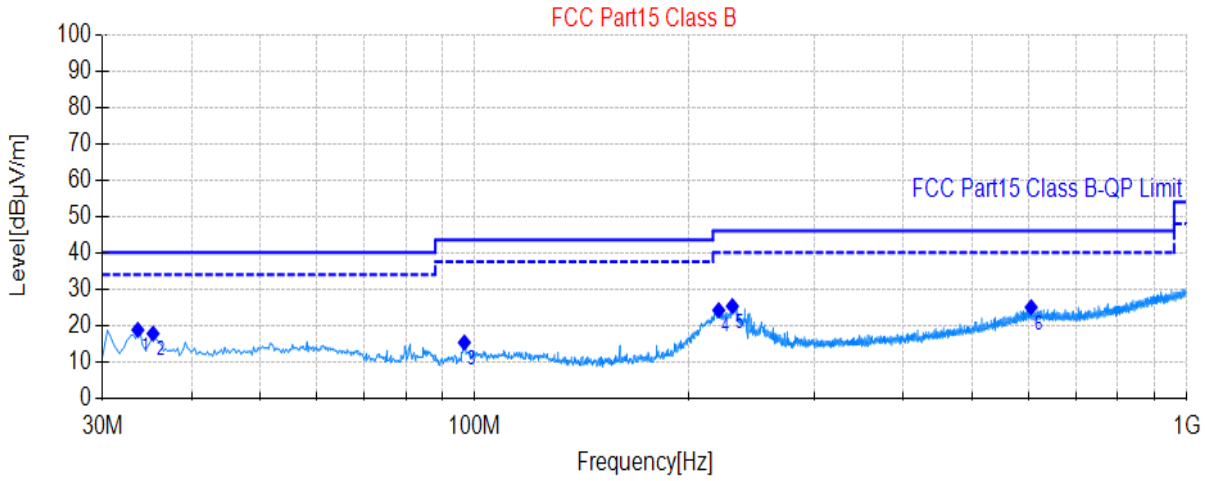
- Spurious Emission below 1GHz (30MHz to 1GHz)
- All modes 2.4G 802.11b/g/n have been tested, and the worst result 802.11g recorded was report as below:

Project Information			
Mode:	2412 MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 25℃; Humi:60%	Engineer:	Allen Tang



Final Data List										
NO.	Freq. [MHz]	QP Reading [dBµV/m]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	34.365	46.08	-24.13	21.95	40.00	18.05	100	53	Vertical	Pass
2	39.700	48.74	-23.29	25.45	40.00	14.55	100	131	Vertical	Pass
3	45.278	46.91	-23.42	23.49	40.00	16.51	100	244	Vertical	Pass
4	99.113	43.95	-24.02	19.93	43.50	23.57	100	136	Vertical	Pass
5	142.278	49.62	-25.98	23.64	43.50	19.86	100	4	Vertical	Pass
6	224.243	52.45	-22.47	29.98	46.00	16.02	100	328	Vertical	Pass

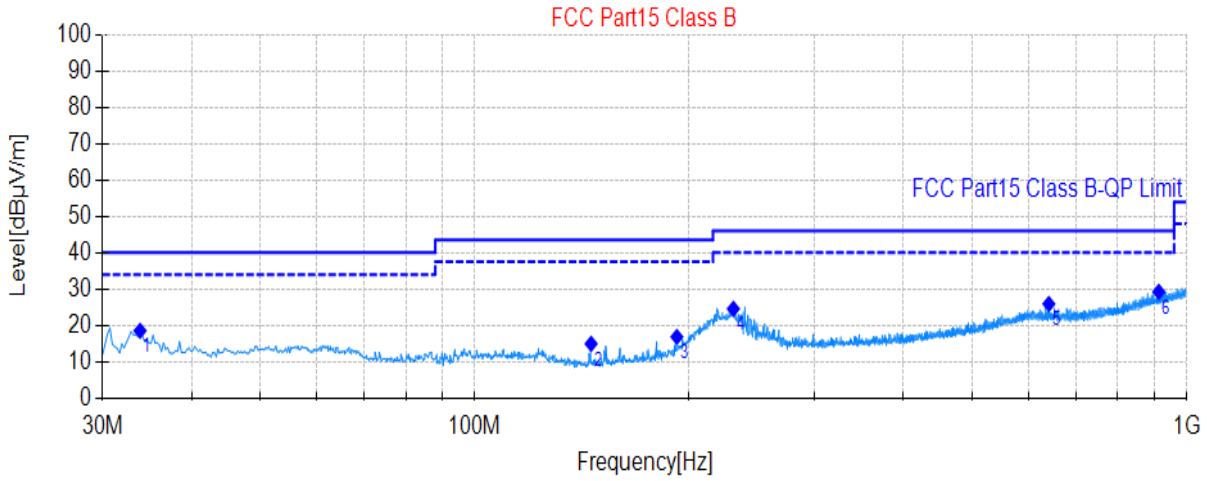
Project Information			
Mode:	2412 MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 25℃; Humi:60%	Engineer:	Allen Tang



Final Data List

NO.	Freq. [MHz]	QP Reading [dBµV/m]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	33.638	42.96	-24.20	18.76	40.00	21.24	100	153	Horizontal	Pass
2	35.335	41.76	-24.02	17.74	40.00	22.26	200	217	Horizontal	Pass
3	96.688	39.77	-24.50	15.27	43.50	28.23	200	176	Horizontal	Pass
4	220.120	46.77	-22.60	24.17	46.00	21.83	200	309	Horizontal	Pass
5	230.063	47.58	-22.29	25.29	46.00	20.71	100	296	Horizontal	Pass
6	604.483	37.65	-12.67	24.98	46.00	21.02	100	8	Horizontal	Pass

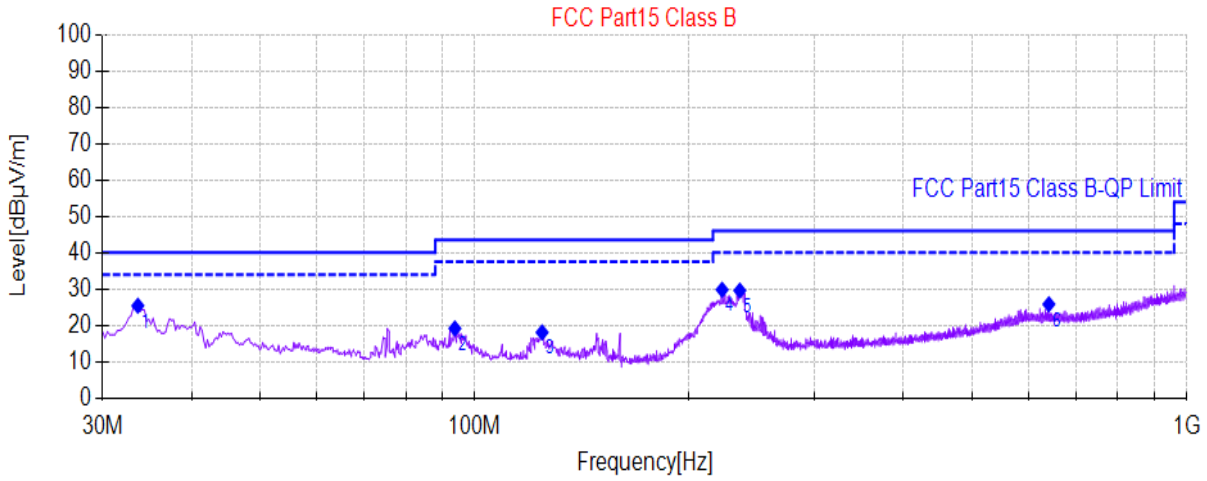
Project Information			
Mode:	2437 MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 25℃; Humi:60%	Engineer:	Allen Tang



Final Data List

NO.	Freq. [MHz]	QP Reading [dBµV/m]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	33.880	42.69	-24.18	18.51	40.00	21.49	100	134	Horizontal	Pass
2	145.673	40.86	-25.93	14.93	43.50	28.57	100	158	Horizontal	Pass
3	192.233	40.49	-23.65	16.84	43.50	26.66	100	270	Horizontal	Pass
4	230.790	46.84	-22.27	24.57	46.00	21.43	100	267	Horizontal	Pass
5	640.130	38.65	-12.75	25.90	46.00	20.10	200	215	Horizontal	Pass
6	913.428	37.83	-8.61	29.22	46.00	16.78	100	86	Horizontal	Pass

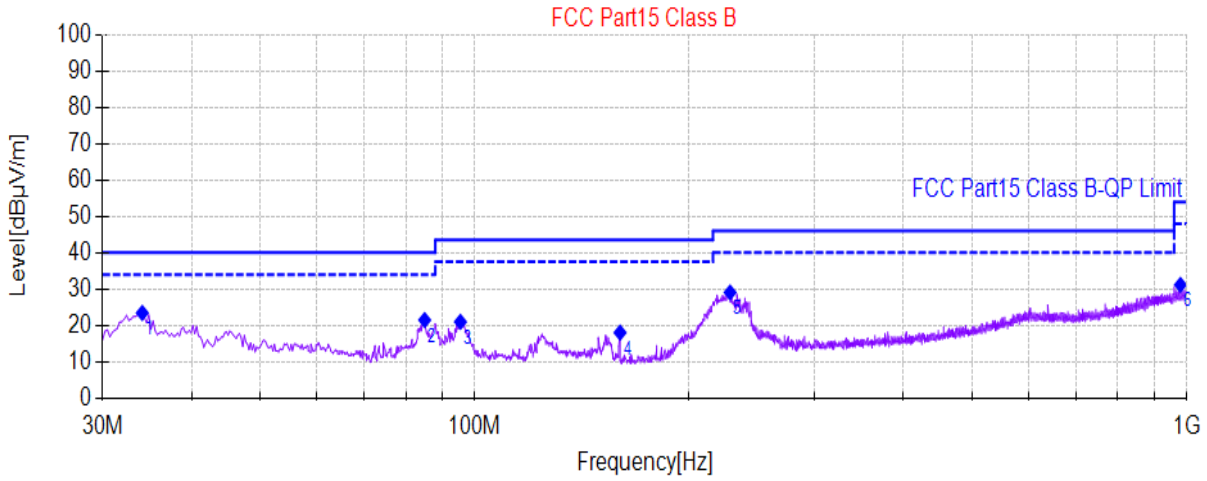
Project Information			
Mode:	2437 MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 25℃; Humi:60%	Engineer:	Allen Tang



Final Data List

NO.	Freq. [MHz]	QP Reading [dBμV/m]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	33.638	49.61	-24.20	25.41	40.00	14.59	100	302	Vertical	Pass
2	93.778	44.17	-25.00	19.17	43.50	24.33	100	183	Vertical	Pass
3	124.333	42.45	-24.40	18.05	43.50	25.45	100	259	Vertical	Pass
4	222.545	52.33	-22.52	29.81	46.00	16.19	100	0	Vertical	Pass
5	235.640	51.71	-22.12	29.59	46.00	16.41	100	327	Vertical	Pass
6	640.130	38.57	-12.75	25.82	46.00	20.18	100	156	Vertical	Pass

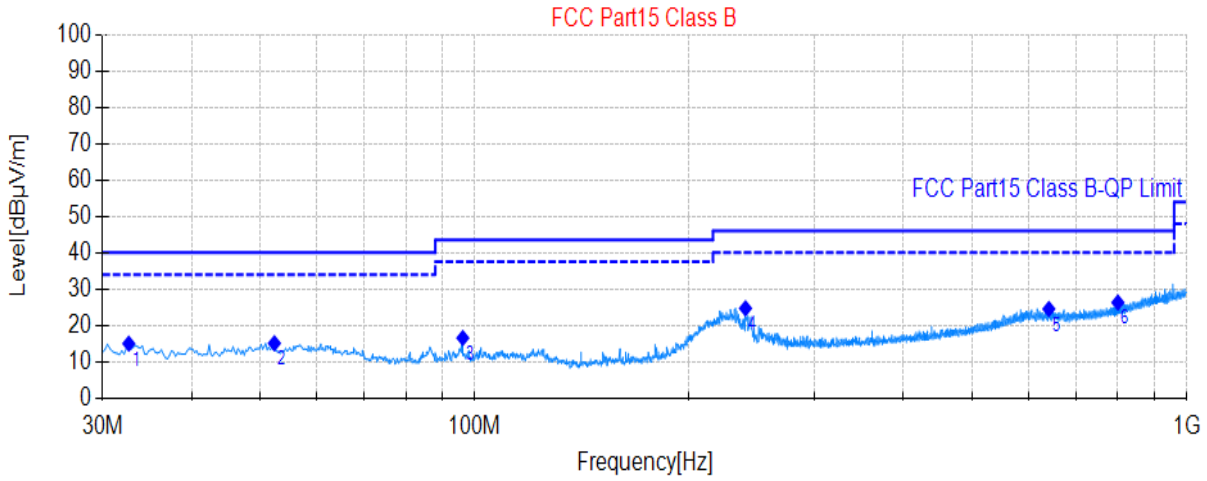
Project Information			
Mode:	2462 MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 25℃; Humi:60%	Engineer:	Allen Tang



Final Data List

NO.	Freq. [MHz]	QP Reading [dBµV/m]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	34.123	47.59	-24.16	23.43	40.00	16.57	100	96	Vertical	Pass
2	85.048	46.56	-25.09	21.47	40.00	18.53	100	137	Vertical	Pass
3	95.475	45.72	-24.74	20.98	43.50	22.52	100	174	Vertical	Pass
4	159.980	42.91	-24.91	18.00	43.50	25.50	100	199	Vertical	Pass
5	228.365	51.41	-22.34	29.07	46.00	16.93	100	323	Vertical	Pass
6	979.630	38.89	-7.74	31.15	54.00	22.85	100	261	Vertical	Pass

Project Information			
Mode:	2462 MHz	Voltage:	AC 120V/60Hz
Environment:	Temp: 25℃; Humi:60%	Engineer:	Allen Tang



Final Data List										
NO.	Freq. [MHz]	QP Reading [dBµV/m]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	32.668	39.26	-24.28	14.98	40.00	25.02	200	148	Horizontal	Pass
2	52.310	37.39	-22.32	15.07	40.00	24.93	100	327	Horizontal	Pass
3	96.203	41.13	-24.59	16.54	43.50	26.96	200	328	Horizontal	Pass
4	240.005	46.67	-21.98	24.69	46.00	21.31	100	216	Horizontal	Pass
5	640.130	37.27	-12.75	24.52	46.00	21.48	200	243	Horizontal	Pass
6	800.180	37.83	-11.52	26.31	46.00	19.69	200	256	Horizontal	Pass

8.6 CONDUCTED EMISSIONS TEST

8.6.1 Applicable Standard

According to FCC Part 15.207(a)

8.6.2 Conformance Limit

Conducted Emission Limit		
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.

8.6.3 Test Configuration

Test according to clause 7.3conducted emission test setup

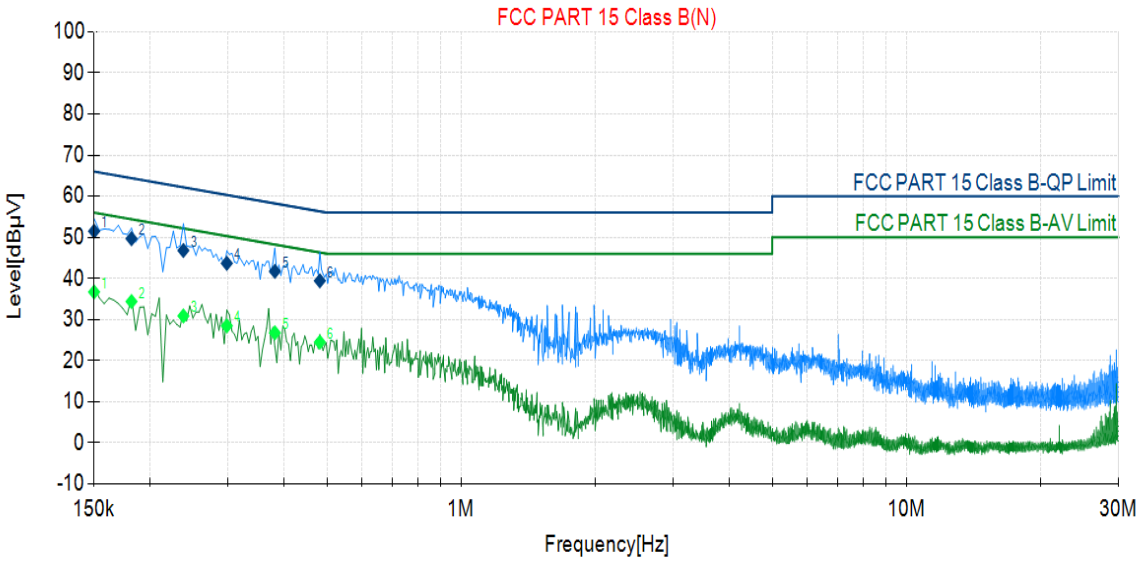
8.6.4 Test Procedure

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

8.6.5 Test Results

Pass

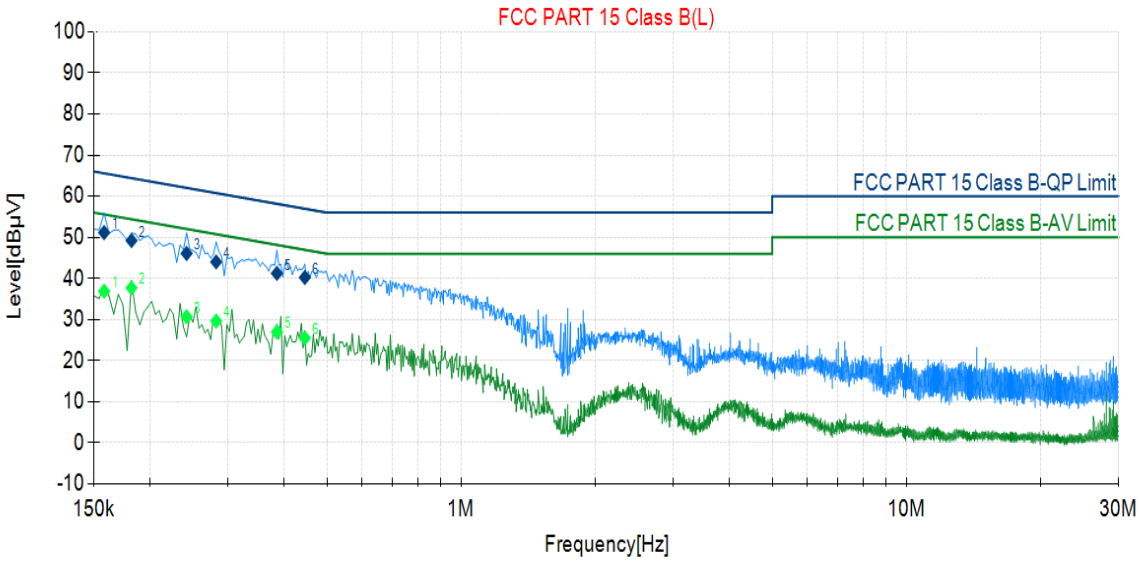
Project Information			
Mode:	TX	Voltage:	AC120V/60Hz
Environment:	Temp: 25℃; Humi:55%	Engineer:	Jo Liu



Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.150	10.50	40.97	51.47	66.00	14.53	26.20	36.70	56.00	19.30	PASS
2	0.182	10.47	39.20	49.67	64.39	14.72	23.91	34.38	54.39	20.01	PASS
3	0.238	10.45	36.34	46.79	62.17	15.38	20.41	30.86	52.17	21.31	PASS
4	0.298	10.43	33.24	43.67	60.30	16.63	18.03	28.46	50.30	21.84	PASS
5	0.382	10.40	31.31	41.71	58.24	16.53	16.36	26.76	48.24	21.48	PASS
6	0.482	10.41	29.01	39.42	56.30	16.88	14.06	24.47	46.30	21.83	PASS

Project Information			
Mode:	TX	Voltage:	AC120V/60Hz
Environment:	Temp: 25℃; Humi:60%	Engineer:	Jo Liu



Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.158	10.51	40.63	51.14	65.57	14.43	26.38	36.89	55.57	18.68	PASS
2	0.182	10.50	38.70	49.20	64.39	15.19	27.20	37.70	54.39	16.69	PASS
3	0.242	10.48	35.60	46.08	62.03	15.95	20.21	30.69	52.03	21.34	PASS
4	0.282	10.47	33.54	44.01	60.76	16.75	19.16	29.63	50.76	21.13	PASS
5	0.386	10.43	30.81	41.24	58.15	16.91	16.53	26.96	48.15	21.19	PASS
6	0.446	10.41	29.82	40.23	56.95	16.72	15.08	25.49	46.95	21.46	PASS

8.7 ANTENNA APPLICATION

8.7.1 Antenna Requirement

Standard	Requirement
FCC CRF Part15.203	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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217,§15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

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.

8.7.2 Result

PASS.

- The EUT has 1 antenna: one an Chip antenna for WIFI 2.4G, the gain is 4.75 dBi,

Note:
☒ Antenna uses a permanently attached antenna which is not replaceable.
☐ Not using a standard antenna jack or electrical connector for antenna replacement
☐ The antenna has to be professionally installed (please provide method of installation)

Which in accordance to section 15.203, please refer to the internal photos.

*** End of Report ***

声 明
Statement

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