

8.3 MAXIMUM POWER SPECTRAL DENSITY

8.3.1 Applicable Standard

According to FCC Part15.247(e) and KDB 558074 D01 15.247 Meas Guidance v05r02

8.3.2 Conformance Limit

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.3.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

8.3.4 Test Procedure

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance

The transmitter output (antenna port) was connected to the spectrum analyzer

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: 3 kHz Set the VBW to:10 kHz. Set Detector = peak.

Set Sweep time = auto couple. Set Trace mode = max hold. Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

Note: If antenna Gain exceeds 6 dBi, then PSD Limit=8-(Gain- 6)

8.3.5 Test Results

Temperature:	17 ℃
Relative Humidity:	60%
ATM Pressure:	1011 mbar

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
	1	2412	-4.97	8	PASS
802.11b	6	2437	-3.90	8	PASS
	11	2462	-5.07	8	PASS
	1	2412	-8.65	8	PASS
802.11g	6	2437	-9.08	8	PASS
	11	2462	-9.32	8	PASS
802.11n	1	2412	-10.91	8	PASS
(HT20)	6	2437	-10.31	8	PASS
(11120)	11	2462	-9.35	8	PASS
802.11n	3	2422	-13.95	8	PASS
(HT40)	6	2437	-13.23	8	PASS
(11140)	9	2452	-13.40	8	PASS

Report No. ENB2312280211W00201R











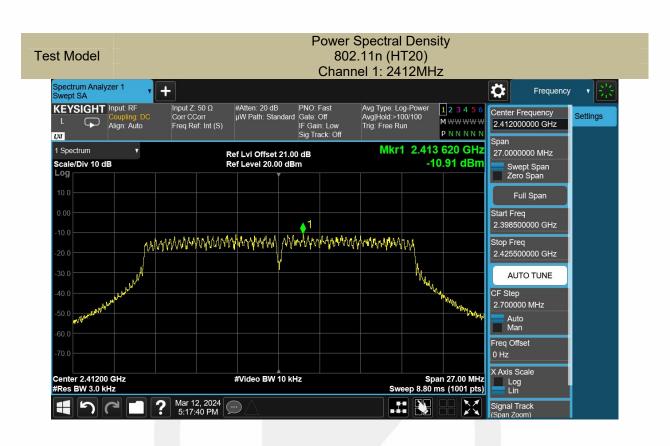






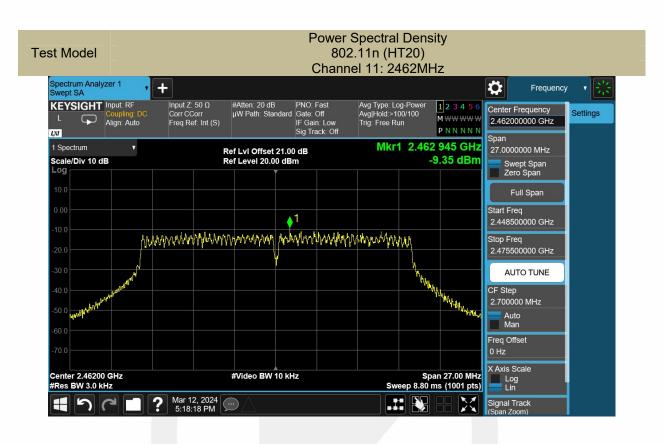






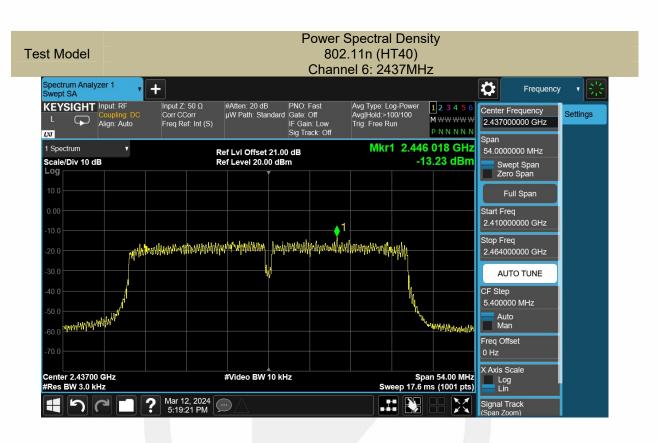
















8.4 UNWANTED EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS

8.4.1 Applicable Standard

According to FCC Part15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02

8.4.2 Conformance Limit

According to FCC Part 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

8.4.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

8.4.4 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

■ Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to ≥ 1.5 times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW \geq 3 x RBW.

Set Detector = peak.

Set Sweep time = auto couple.

Set Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

■ Emission level measurement

Set the center frequency and span to encompass frequency range to be measured.

Set the RBW = 100 kHz.

Set the VBW =300 kHz.

Set Detector = peak

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements. Report the three highest emissions relative to the limit.

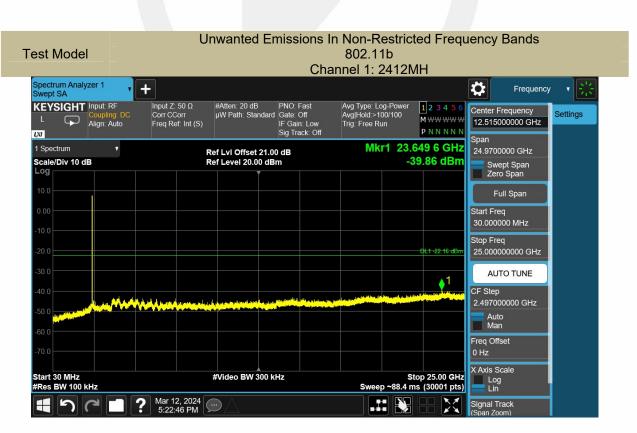
8.4.5 Test Results

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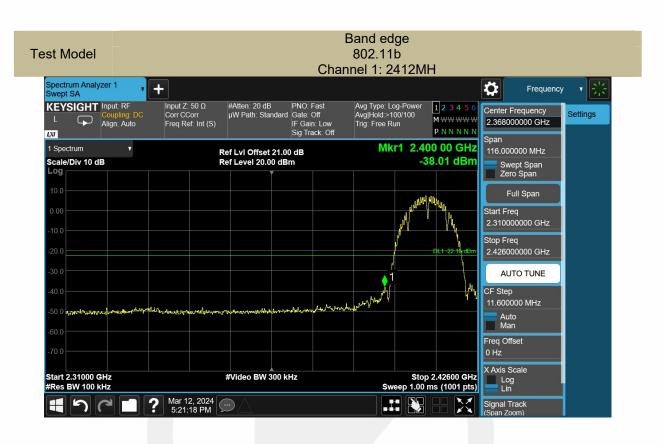


All modes 2.4G 802.11b/g/n have been tested, and the worst result 802.11b recorded was report as below:









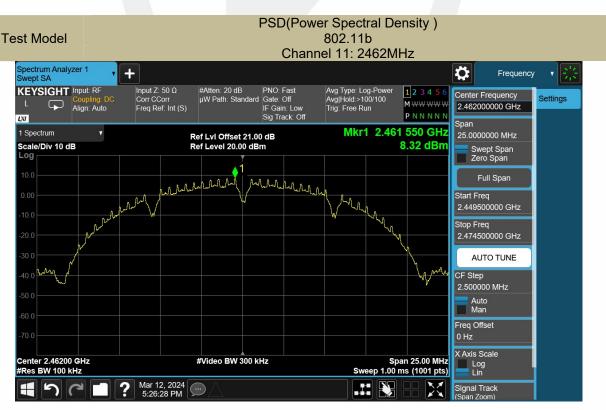




Test Model

Unwanted Emissions In Non-Restricted Frequency Bands 802.11b Channel 6: 2437MH



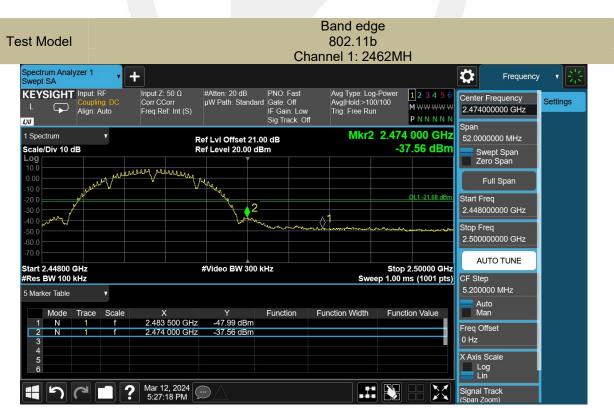




Test Model

Unwanted Emissions In Non-Restricted Frequency Bands 802.11b Channel 1: 2462MH







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

According to FCC Fart 13.203, 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	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	675 156.7-156.9 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	Field Strength (µV/m)	Field Strength	Measurement
Frequency(MHz)		(dBµV/m)	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 $f \ge 1$ 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:	18℃
Relative Humidity:	58%
ATM Pressure:	1011 mbar

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

Freq.	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
(MHz)	H/V	PK `	ÁV	PK	AV	PK	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 802.11b recorded was report as below:

Test mode:	802.1	1 b Freque		ency:	icy: Channel 1: 2412MHz		
Freq.	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4824.000	V	40.66	26.47	74.00	54.00	-33.34	-27.53
13889.500	V	52.79	37.13	74.00	54.00	-21.21	-16.87
17961.500	V	55.71	39.62	74.00	54.00	-18.29	-14.38
4824.000	Н	48.03	33.46	74.00	54.00	-25.97	-20.54
7236.500	Н	48.26	32.16	74.00	54.00	-25.74	-21.84
17981.500	Н	54.72	38.75	74.00	54.00	-19.28	-15.25

Test mode: 802.11 b			Frequency: Chan			el 6: 2437MHz		
Freq. Ant.Pol.			Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV	
4874.000	V	42.19	29.00	74.00	54.00	-31.81	-25.00	
11058.000	V	51.58	34.75	74.00	54.00	-22.42	-19.25	
17945.500	V	55.61	36.74	74.00	54.00	-18.39	-17.26	
4874.500	Н	48.64	33.26	74.00	54.00	-25.36	-20.74	
14118.500	Н	53.20	39.22	74.00	54.00	-20.80	-14.78	
17980.500	Н	55.54	38.76	74.00	54.00	-18.46	-15.24	

Test mode:	est mode: 802.11 b		Frequ	Frequency: Channe		el 11: 2462MHz	
Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
(IVII IZ)	H/V	PK	AV	PK	AV	PK	AV
4924.500	V	43.76	29.87	74.00	54.00	-30.24	-24.13
13959.000	V	53.94	38.74	74.00	54.00	-20.06	-15.26
17983.500	>	55.51	39.78	74.00	54.00	-18.49	-14.22
4924.500	Η	45.51	31.26	74.00	54.00	-28.49	-22.74
14119.500	Η	52.99	38.71	74.00	54.00	-21.01	-15.29
17871.000	Н	55.09	40.23	74.00	54.00	-18.91	-13.77

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 b 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)
2389.520	Н	60.70	74.00	46.36	54.00
2387.000	V	57.42	74.00	41.23	54.00

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

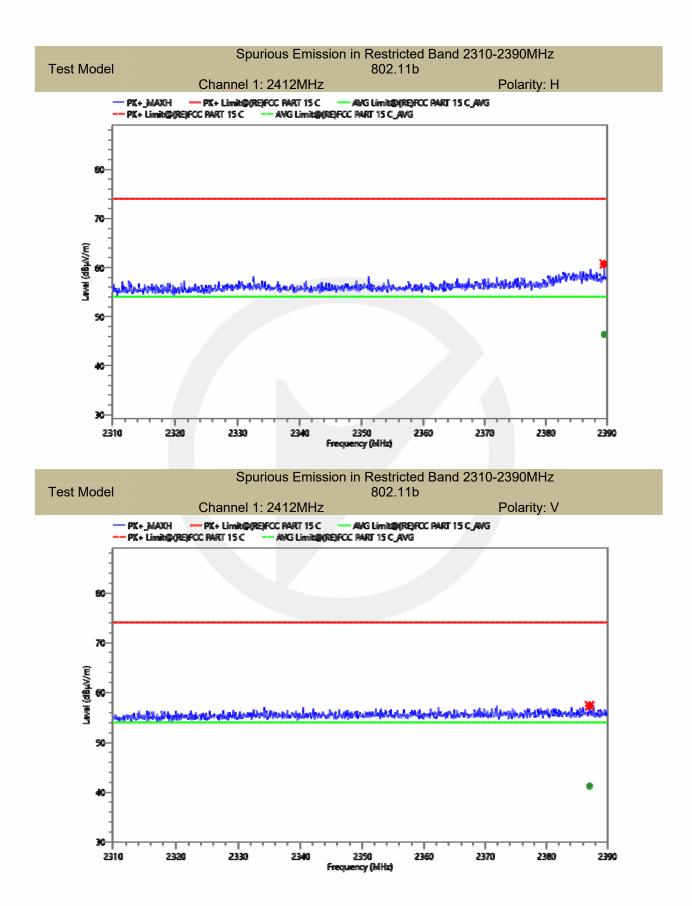
Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2490.983	Н	61.41	74.00	46.18	54.00
2491.263	V	58.78	74.00	43.25	54.00

Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).

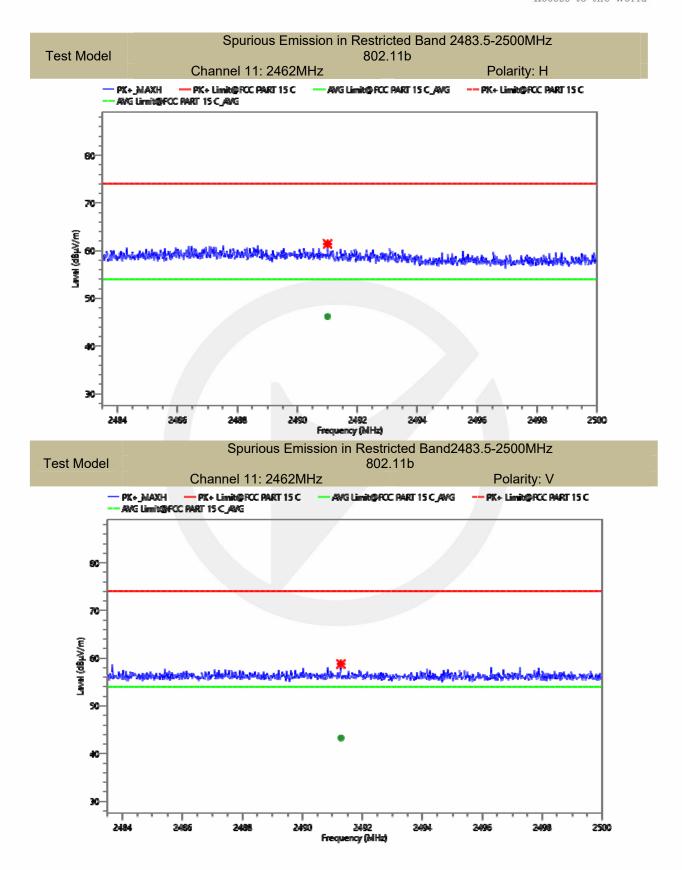
- (2) Emission Level= Reading Level+Correct Factor +Cable Loss.
- (3) Correct Factor= Ant_F + Cab_L Preamp
- (4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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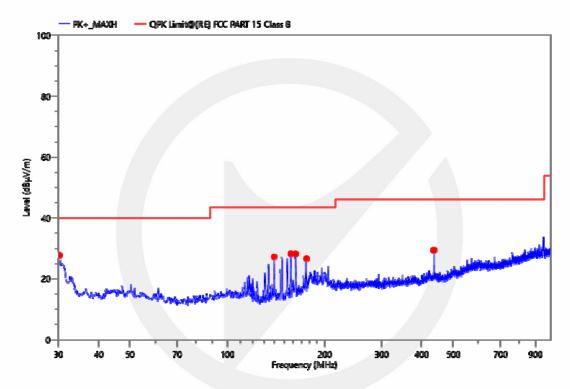






- Spurious Emission below 1GHz (30MHz to 1GHz)
- All modes 2.4G 802.11b/g/n have been tested, and the worst result 802.11g recorded was report as below:

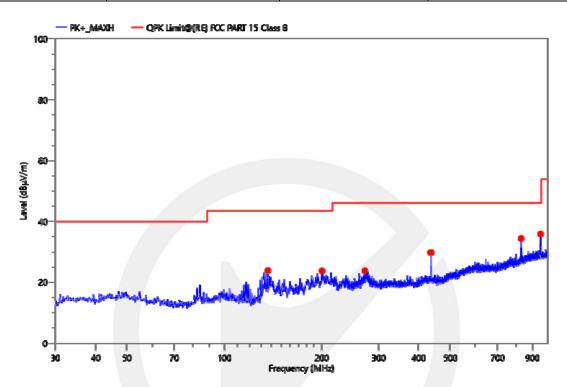
Project Information							
Mode: TX2412 MHz Voltage: DC 5V							
Environment:	Temp: 18°C; Humi:68%	Engineer:	Victor Chen				



Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
30.194	53.29	-25.53	27.76	40.00	12.24	QPK	100	٧	297.5	PASS
139.319	54.65	-27.43	27.22	43.50	16.28	QPK	100	V	210.6	PASS
157.167	54.80	-26.55	28.25	43.50	15.25	QPK	100	V	210.6	PASS
162.599	54.56	-26.35	28.21	43.50	15.29	QPK	100	V	210.6	PASS
175.888	52.66	-26.01	26.65	43.50	16.85	QPK	100	V	210.6	PASS
435.072	47.96	-18.55	29.41	46.00	16.59	QPK	100	V	258.2	PASS



Project Information							
Mode:	Mode: TX2412 MHz Voltage: DC 5V						
Environment:	Temp: 18°C; Humi:68%	Engineer:	Victor Chen				

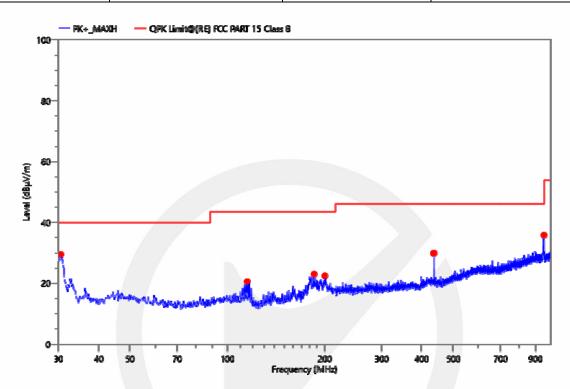


Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
136.021	51.28	-27.38	23.90	43.50	19.60	QPK	200	Η	136.4	PASS
200.041	47.94	-24.19	23.75	43.50	19.75	QPK	200	Ι	180.4	PASS
272.500	45.83	-22.05	23.78	46.00	22.22	QPK	100	Ι	10.0	PASS
435.072	48.35	-18.55	29.80	46.00	16.20	QPK	100	Η	321.3	PASS
828.795	46.69	-12.28	34.41	46.00	11.59	QPK	200	Η	317.9	PASS
953.634	46.70	-10.83	35.87	46.00	10.13	QPK	100	Τ	208.8	PASS

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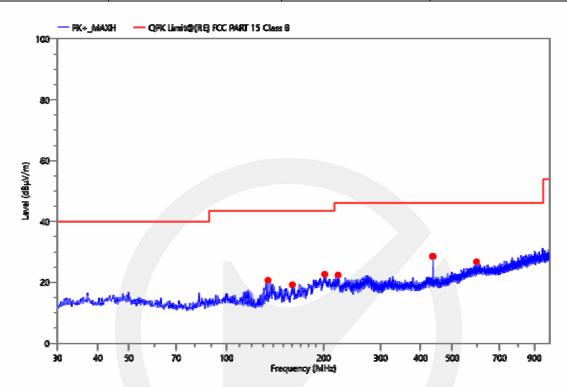
Project Information								
Mode:	TX2437 MHz	Voltage:	DC 5V					
Environment:	Temp: 18°C; Humi:68%	Engineer:	Victor Chen					



Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
30.485	54.96	-25.46	29.50	40.00	10.50	QPK	100	>	42.5	PASS
115.263	46.65	-26.05	20.60	43.50	22.90	QPK	100	V	44.9	PASS
185.879	48.57	-25.54	23.03	43.50	20.47	QPK	100	V	177.7	PASS
199.750	46.71	-24.22	22.49	43.50	21.01	QPK	100	V	208.6	PASS
435.072	48.44	-18.55	29.89	46.00	16.11	QPK	100	V	116.3	PASS
955.962	46.66	-10.84	35.82	46.00	10.18	QPK	100	V	150.9	PASS



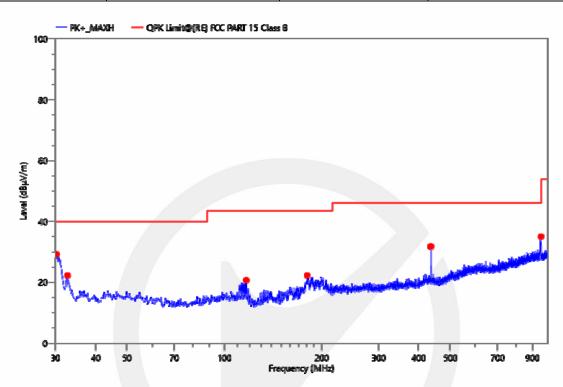
Project Information							
Mode:	Mode: TX2437 MHz Voltage: DC 5V						
Environment:	Temp: 18°C; Humi:68%	Engineer:	Victor Chen				



Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
134.178	48.02	-27.35	20.67	43.50	22.83	QPK	100	Ι	320.8	PASS
159.980	45.61	-26.39	19.22	43.50	24.28	QPK	100	Н	343.5	PASS
201.011	46.80	-24.17	22.63	43.50	20.87	QPK	100	Н	227.4	PASS
221.284	45.98	-23.6	22.38	46.00	23.62	QPK	100	Н	360.0	PASS
435.072	47.11	-18.55	28.56	46.00	17.44	QPK	100	Н	288.1	PASS
594.928	41.22	-14.45	26.77	46.00	19.23	QPK	100	Η	337.5	PASS



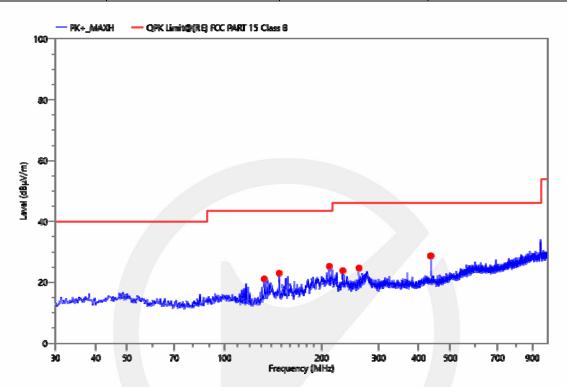
Project Information							
Mode:	TX2462 MHz	Voltage:	DC 5V				
Environment:	Temp: 18°C; Humi:68%	Engineer:	Victor Chen				



Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
30.194	54.73	-25.53	29.20	40.00	10.80	QPK	100	>	25.1	PASS
32.716	47.15	-24.89	22.26	40.00	17.74	QPK	100	V	218.5	PASS
117.009	46.97	-26.28	20.69	43.50	22.81	QPK	100	V	5.4	PASS
180.641	48.08	-25.82	22.26	43.50	21.24	QPK	100	V	150.1	PASS
434.975	50.30	-18.55	31.75	46.00	14.25	QPK	100	V	0.0	PASS
956.932	45.86	-10.84	35.02	46.00	10.98	QPK	100	V	44.1	PASS



Project Information								
Mode:	TX2462 MHz	Voltage:	DC 5V					
Environment:	Temp: 18°C; Humi:68%	Engineer:	Victor Chen					



Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Height (cm)	Pol.	Azimuth (deg)	Verdict
132.529	48.47	-27.33	21.14	43.50	22.36	QPK	100	Η	134.3	PASS
147.661	50.06	-27.06	23.00	43.50	20.50	QPK	100	Ι	14.7	PASS
211.002	49.22	-23.94	25.28	43.50	18.22	QPK	100	Ι	0.0	PASS
232.439	47.00	-23.18	23.82	46.00	22.18	QPK	200	Η	0.0	PASS
261.151	46.82	-22.13	24.69	46.00	21.31	QPK	200	Η	0.0	PASS
434.975	47.24	-18.55	28.69	46.00	17.31	QPK	100	Η	0.0	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

N/A.



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.
• Note:	The EUT has 1 antenna: one a PCB antenna for WIFI 2.4G, the gain is -0.37 dBi,
	Which in accordance to section 15.203, please refer to the internal photos.
	*** End of Report ***



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