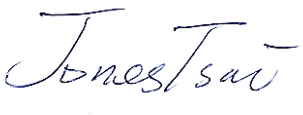
Variant FCC RF Test Report

APPLICANT	:	**Pismo Labs Technology Limited**
EQUIPMENT	:	**Pepwave/Peplink/Pismo Labs Wireless Product**
BRAND NAME	:	**Pepwave / Peplink / Pismo**
MODEL NAME	:	**MAX Transit** **MAX Transit LTE** **MAX Transit LTEA** **MAX transit with Content Hub (MAX-TST-CHBA-E-T, MAX-TST-CHBB-E-T, MAX-TST-CHBC-E-T)** **MAX Transit with M12 Connector** **MAX Transit with ContentHub with M12 connector** **MAX Transit with Content Hub with M12 connector** **MAX Transit LTEA with M12 Connector** **MAX Transit LTEA with ContentHub with M12 connector** **MAX Transit LTEA with Content Hub with M12 connector** **Pismo813** **Pismo 813** **MAX Transit Quad** **MAX Transit Quad LTE** **MAX Transit Quad LTEA** **MAX Transit Duo** **MAX Transit Duo LTE** **MAX Transit Duo LTEA** **MAX Transit Duo with M12 Connector** **MAX Transit Duo with ContentHub with M12 connector** **MAX Transit Duo with Content Hub with M12 connector** **MAX Transit Duo LTEA with M12 Connector** **MAX Transit Duo LTEA with ContentHub with M12 connector** **MAX Transit Duo LTEA with Content Hub with M12 connector** **Pismo813M12** **Pismo 813M12** **(for more details please refer to section 1.3)**
FCC ID	:	**U8G-P1813**
STANDARD	:	**FCC Part 15 Subpart E §15.407**
CLASSIFICATION	:	**(NII) Unlicensed National Information Infrastructure**

The product was received on Feb. 05, 2018 and testing was completed on Feb. 14, 2018. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor



Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR820530B	Rev. 01	Initial issue of report	Apr. 25, 2018

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
-	2.1049 15.403(i)	6dB, 26dB and 99% Occupied Bandwidth	-	Not Required	-
-	15.407(a)	Maximum Conducted Output Power	FCC ≤ 24 dBm (depend on band)	Not Required	-
-	15.407(a)	Power Spectral Density	FCC ≤ 17 dBm (depend on band)	Not Required	-
3.1	15.407(b)	Unwanted Emissions	15.407(b)(4)(i) &15.209(a)	Pass	Under limit 1.82 dB at 38.640 MHz for Quasi-Peak
3.2	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 0.76 dB at 2.980 MHz
-	15.407(c)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
-	15.203 & 15.407(a)	Antenna Requirement	N/A	Pass	-

Remark: Not Required means the change does not affect the test result.

1 General Description

1.1 Applicant

Pismo Labs Technology Limited
Flat A5, 5/F HK Spinners Ind. Bldg., Phase 6, 481 Castle Peak Road, Cheung Sha Wan, Kowloon, Hong Kong

1.2 Manufacturer

Pismo Labs Technology Limited
Flat A5, 5/F HK Spinners Ind. Bldg., Phase 6, 481 Castle Peak Road, Cheung Sha Wan, Kowloon, Hong Kong

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Pepwave/Peplink/Pismo Labs Wireless Product
Brand Name	Pepwave / Peplink / Pismo
Model Name	Please refer to remark 3 below which list all model names
FCC ID	U8G-P1813
EUT supports Radios application	WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80
Power Supply Rating	12-56Vdc from power adapter or 12-56Vdc from Terminal Block
HW Version	3
SW Version	7.0.3
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. Based on the similarity between current and previous project, only the worst cases of RSE from original test report (BV Report Number “RF150713E08-1”) and conduction item were verified for the differences.

3. This is a variant report changing non-RF component and adding serial models for FCC class II permissive change. The difference compared with the original report design is as the following table:

Brand	Product Name	Model Name		Difference
Pepwave / Peplink / Pismo	Pepwave / Peplink / Pismo Labs Wireless Product	MAX Transit (original)	With one module slot & cellular SIM slot	a. equipped with M12 connector and the M12 connector board's size is larger b. has an extension board (Piggy board) added with 2 PCIE slots
		MAX Transit LTE (original)		
		MAX Transit LTEA (original)		
		MAX transit with Content Hub (MAX-TST-CHBA-E-T, MAX-TST-CHBB-E-T, MAX-TST-CHBC-E-T) (original)		
		MAX Transit with M12 Connector		
		MAX Transit with ContentHub with M12 connector		
		MAX Transit with Content Hub with M12 connector		
		MAX Transit LTEA with M12 Connector		
		MAX Transit LTEA with ContentHub with M12 connector		
		MAX Transit LTEA with Content Hub with M12 connector		
		Pismo813		
		Pismo 813 (original)		
		MAX Transit Quad (original)		
		MAX Transit Quad LTE (original)		
		MAX Transit Quad LTEA (original)		
		MAX Transit Duo (original)	With two module slots & cellular SIM slots	
		MAX Transit Duo LTE (original)		
		MAX Transit Duo LTEA (original)		
		MAX Transit Duo with M12 Connector		
		MAX Transit Duo with ContentHub with M12 connector		
		MAX Transit Duo with Content Hub with M12 connector		
		MAX Transit Duo LTEA with M12 Connector		
		MAX Transit Duo LTEA with ContentHub with M12 connector		
		MAX Transit Duo LTEA with Content Hub with M12 connector		
		Pismo813M12		
		Pismo 813M12		

4. The antennas provided to the EUT, please refer to the following table:

For WLAN						
Antenna No.	Band	Model	Ant. Gain (dBi)	Frequency range (GHz to GHz)	Antenna Type	Connecter Type
1	SmartAnt	SAA06-220690	3	2.4~2.4835	Dipole	RP-SMA
			5.5	5.15~5.25		
			6	5.725~5.85		
2	SmartAnt	SAA06-220690	3	2.4~2.4835	Dipole	RP-SMA
			5.5	5.15~5.25		
			6	5.725~5.85		

5. EUT must be supplied with two power adapters as following table:

NO.	Brand Name	Model No.	Spec.
Adapter 1	Ten Pao	S024AMM1200200	Input: 100-240V, 600mA, 50/60Hz Output: 12Vdc, 2A DC output cable: non-shielded, 1.5m with 1 core
Adapter 2	DVE	DSA-24PFM-12 FUS	Input 100-240V ,800mA, 50/60Hz Output: 12 Vdc, 2,0 A DC output cable: non-shielded, 1.5m without core

6. The EUT was pre-tested under the following test modes:

Pre-test Mode	Power
Mode A	**Power from Adapter 1**
Mode B	Power from Adapter 2
Mode C	Power from (Terminal Block: 56Vdc)
Mode D	Power from (Terminal Block: 48Vdc)
Mode E	Power from (Terminal Block: 12Vdc)

The worst radiated emissions & conducted emissions were found in **Mode A**. Therefore only the test data of the modes were recorded in this report

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	5180 MHz ~ 5240 MHz 5745 MHz ~ 5825 MHz
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1098 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	**Sporton Site No.**	
	CO01-HY	03CH15-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- FCC KDB 644545 D03 Guidance for IEEE 802 11ac New Rules v01
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conducted emission (150 kHz to 30 MHz) and radiated emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5150-5250 MHz Band 1 (U-NII-1)	36	5180	44	5220
	38*	5190	46*	5230
	40	5200	48	5240
	42#	5210		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5725-5850 MHz Band 4 (U-NII-3)	149	5745	157	5785
	151*	5755	159*	5795
	153	5765	161	5805
	155#	5775	165	5825

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40.
2. The above Frequency and Channel in "#" were 802.11ac VHT80.

2.2 Test Mode

Final test mode of conducted test items and radiated spurious emissions are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11a	6 Mbps
802.11ac VHT20	MCS0

AC Conducted Emission	Mode 1 : 11a_20M_CH157 + Adapter

Ch. #		Band I：5150-5250 MHz		
		802.11a	802.11n HT20	802.11n HT40
L	Low	36	36	38
M	Middle	44	44	-
H	High	48	48	46

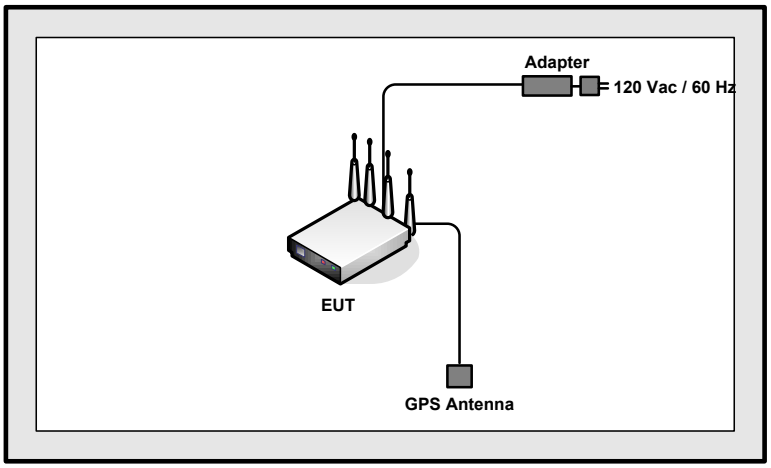
Ch. #		Band I：5150-5250 MHz		
		802.11ac VHT20	802.11ac VHT40	802.11ac VHT80
L	Low	36	38	-
M	Middle	44	-	42
H	High	48	46	-

Ch. #		Band IV：5725-5850 MHz		
		802.11a	802.11n HT20	802.11n HT40
L	Low	149	149	151
M	Middle	157	157	-
H	High	165	165	159

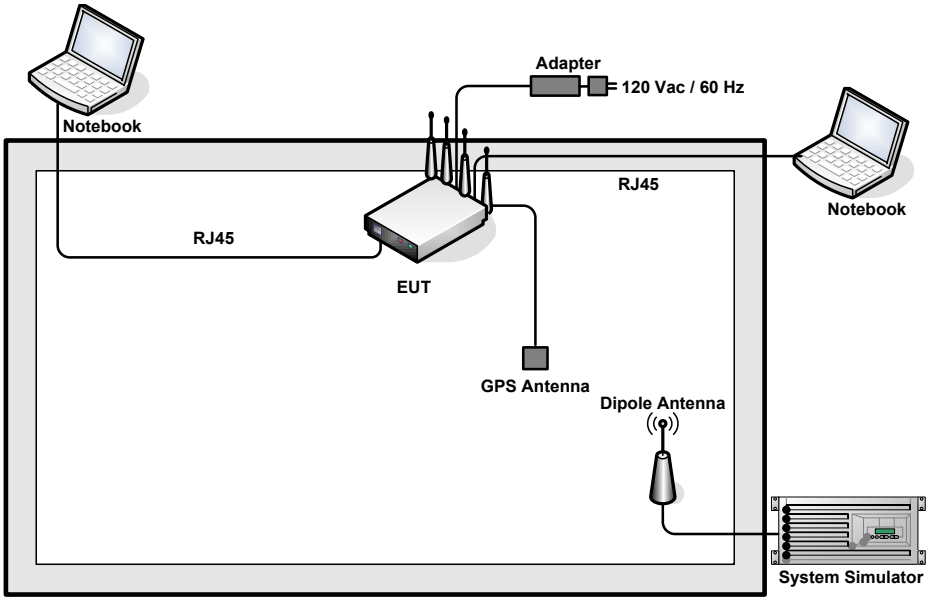
Ch. #		Band IV：5725-5850 MHz		
		802.11ac VHT20	802.11ac VHT40	802.11ac VHT80
L	Low	149	151	-
M	Middle	157	-	155
H	High	165	159	-

2.3 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	DC Power supply	Topward	6303D	N/A	N/A	N/A
2.	GPS Antenna	N/A	N/A	N/A	N/A	N/A

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit/receive.

3 Test Result

3.1 Unwanted Emissions Measurement

This section as specified in FCC Part 15.407(b) is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement. The unwanted emissions shall comply with 15.407(b)(1) to (6), and restricted bands per FCC Part15.205.

3.1.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

(2) For transmitters operating in the 5.725-5.85 GHz band:
15.407(b)(4)(i) 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.

(3) Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table,

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

Note: The following formula is used to convert the EIRP to field strength.

$$E=\frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts)

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.3

(4) KDB789033 D02 v01r04 G)2)c)

(i) Section 15.407(b)(1) to (b)(3) specify the unwanted emission limits for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz.[3]

(ii) Section 15.407(b)(4) specifies the unwanted emission limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are in terms of a Peak detector. An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the devices using the alternative limit.[4]

Note 3: An out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit.

Note 4: Only devices with antenna gains of 10 dBi or less may be approved using the emission limits specified in Section 15.247(d) till March 2, 2018; all other devices operating in this band must use the mask specified in Section 15.407(b)(4)(i).

3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04. Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

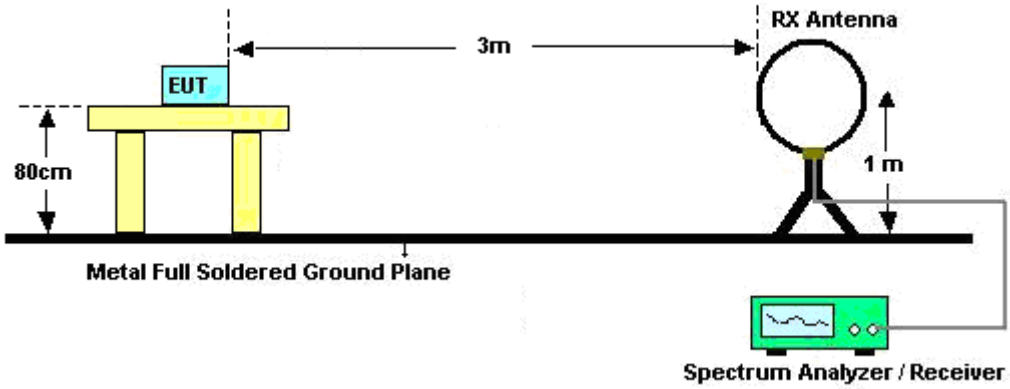
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
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. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.

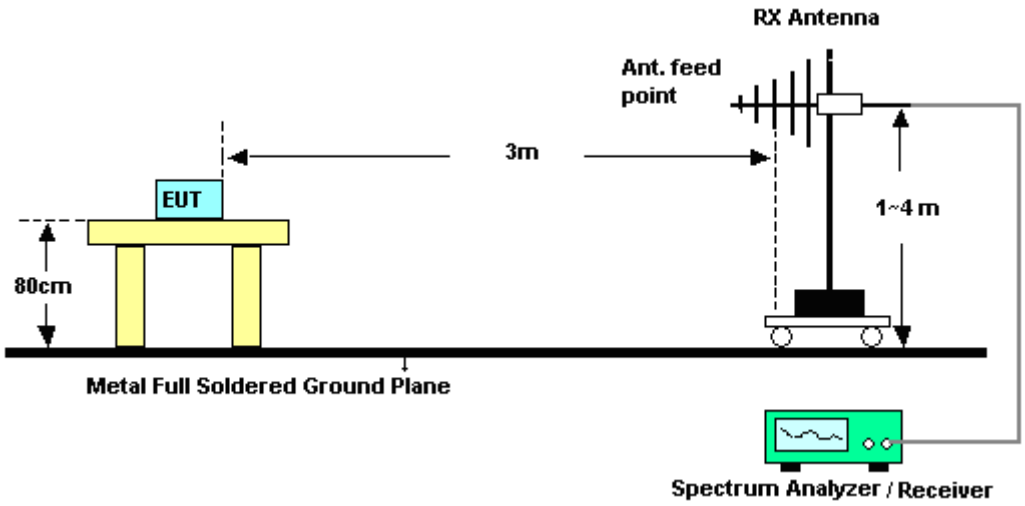
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.1.4 Test Setup

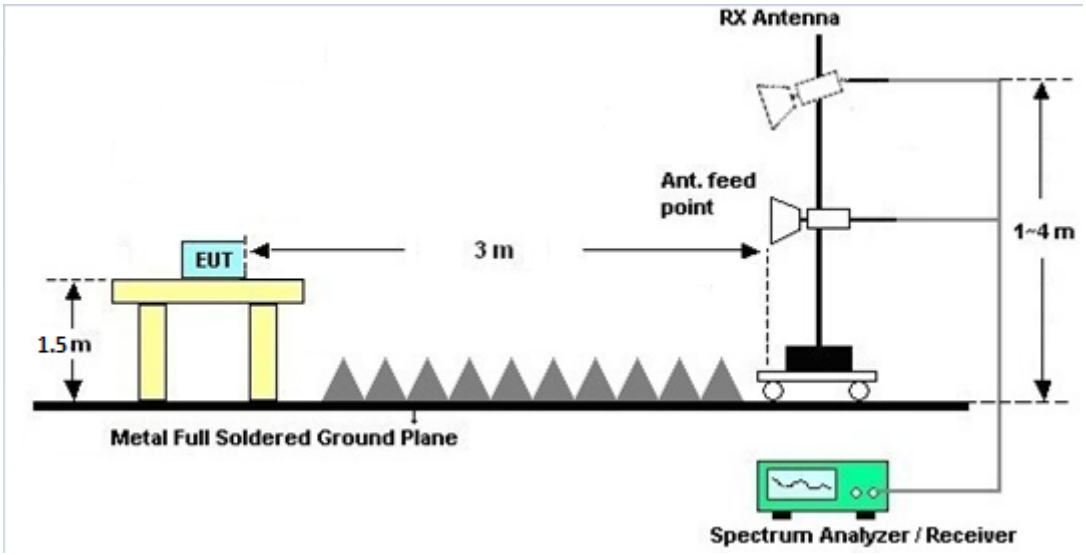
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.1.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.1.7 Duty Cycle

Please refer to Original Report.

3.1.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix A.

3.2 AC Conducted Emission Measurement

3.2.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

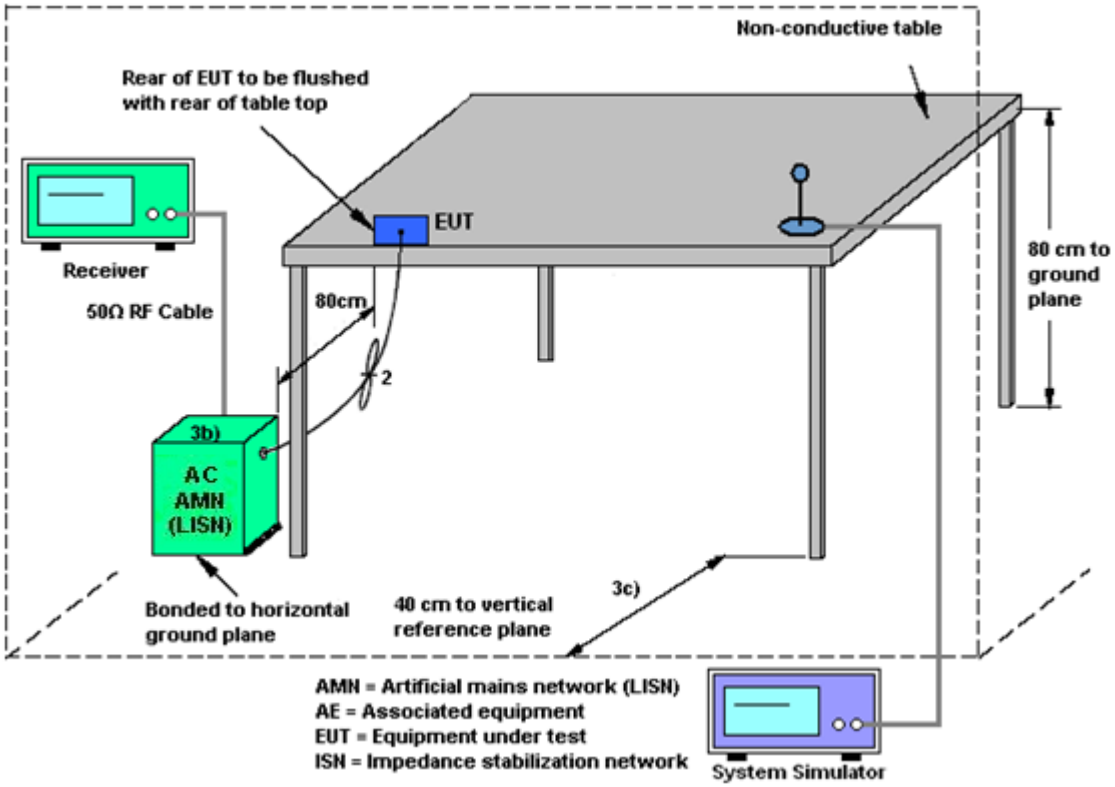
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

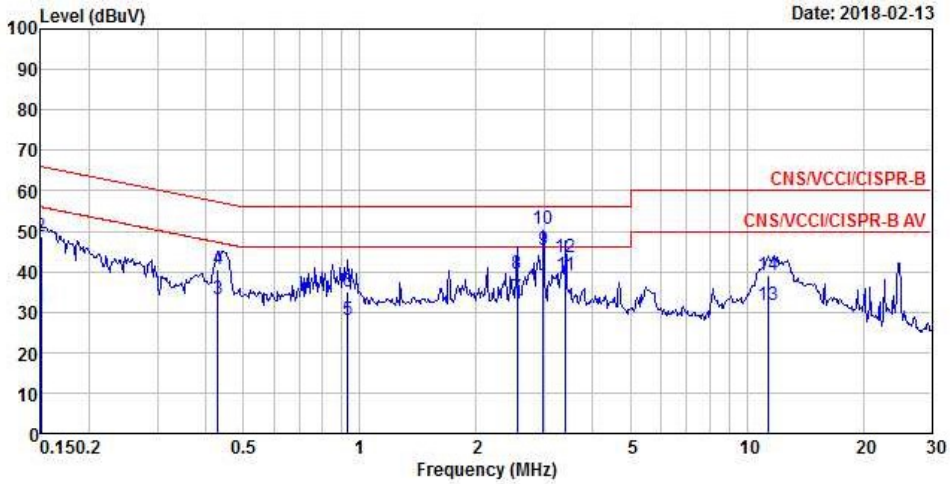
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.2.4 Test Setup



3.2.5 Test Result of AC Conducted Emission

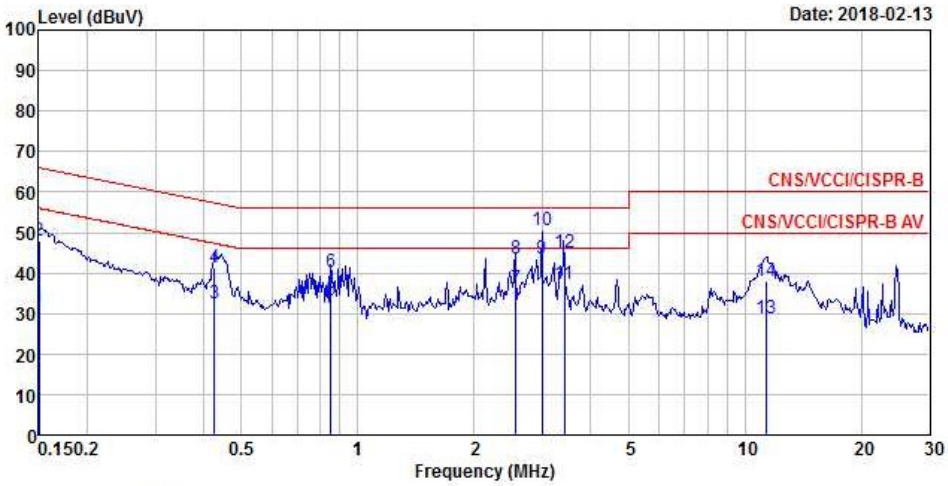
Test Mode :	Mode 1	Temperature :	22~24℃
Test Engineer :	Will Chen	Relative Humidity :	54~56%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	11a_20M_CH157 + Adapter		



Site : CO01-HY
Condition: CNS/VCCI/CISPR-B LISN216-101274-10604 LINE
Power : 120Vac/60Hz

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.15	31.25	-24.75	56.00	21.60	9.63	0.02	Average
2	0.15	48.59	-17.41	66.00	38.94	9.63	0.02	QP
3	0.43	33.17	-14.07	47.24	23.52	9.63	0.02	Average
4	0.43	40.65	-16.59	57.24	31.00	9.63	0.02	QP
5	0.93	27.86	-18.14	46.00	18.21	9.63	0.02	Average
6	0.93	34.91	-21.09	56.00	25.26	9.63	0.02	QP
7	2.55	33.52	-12.48	46.00	23.81	9.65	0.06	Average
8	2.55	39.54	-16.46	56.00	29.83	9.65	0.06	QP
9 MAX	2.98	45.24	-0.76	46.00	35.51	9.66	0.07	Average
10	2.98	50.74	-5.26	56.00	41.01	9.66	0.07	QP
11	3.41	38.97	-7.03	46.00	29.24	9.66	0.07	Average
12	3.41	43.51	-12.49	56.00	33.78	9.66	0.07	QP
13	11.32	31.74	-18.26	50.00	21.88	9.69	0.17	Average
14	11.32	39.11	-20.89	60.00	29.25	9.69	0.17	QP

Test Mode :	Mode 1	Temperature :	22~24℃
Test Engineer :	Will Chen	Relative Humidity :	54~56%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	11a_20M_CH157 + Adapter		



Site : CO01-HY
Condition: CNS/VCCI/CISPR-B LISN216-101274-10604 NEUTRAL
Power : 120Vac/60Hz

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.15	30.88	-25.12	56.00	21.21	9.65	0.02	Average
2	0.15	47.91	-18.09	66.00	38.24	9.65	0.02	QP
3	0.43	32.64	-14.69	47.33	22.98	9.64	0.02	Average
4	0.43	41.40	-15.93	57.33	31.74	9.64	0.02	QP
5	0.85	33.19	-12.81	46.00	23.53	9.64	0.02	Average
6	0.85	40.20	-15.80	56.00	30.54	9.64	0.02	QP
7	2.56	36.26	-9.74	46.00	26.54	9.66	0.06	Average
8	2.56	43.40	-12.60	56.00	33.68	9.66	0.06	QP
9 MAX	2.99	43.47	-2.53	46.00	33.73	9.67	0.07	Average
10	2.99	50.70	-5.30	56.00	40.96	9.67	0.07	QP
11	3.41	37.39	-8.61	46.00	27.65	9.67	0.07	Average
12	3.41	44.87	-11.13	56.00	35.13	9.67	0.07	QP
13	11.32	28.77	-21.23	50.00	18.85	9.75	0.17	Average
14	11.32	37.96	-22.04	60.00	28.04	9.75	0.17	QP

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Test Date	Due Date	Remark
EMC Receiver	R&S	ESR3	102052	Apr. 05, 2017	Feb. 13, 2018	Apr. 04, 2018	Conduction (CO01-HY)
LISN	R&S	ENV 216	101274	Apr. 20, 2017	Feb. 13, 2018	Apr. 19, 2018	Conduction (CO01-HY)
RF Cable-CON	HUBER+SUHNER	RG213/U	07611832010001	Mar. 06, 2017	Feb. 13, 2018	Mar. 05, 2018	Conduction (CO01-HY)
Impuls Begrenzer Pulse Limiter	SCHWARZBECK	VTSD 9561F	9495	Oct. 12, 2017	Feb. 13, 2018	Oct. 11, 2018	Conduction (CO01-HY)
Software	Audix	e3	6.12 160809	NCR	Feb. 13, 2018	NCR	Conduction (CO01-HY)
Bilog Antenna	TESEQ	CBL6111D&00800N1D01N-06	41912&05	Jan. 10, 2018	Feb. 14, 2018	Jan. 09, 2019	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1620	Oct. 03, 2017	Feb. 14, 2018	Oct. 02, 2018	Radiation (03CH15-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	Nov. 10, 2017	Feb. 14, 2018	Nov. 09, 2019	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	Apr. 26, 2018	Feb. 14, 2018	Apr. 26, 2018	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY53270195	Aug. 20, 2018	Feb. 14, 2018	Aug. 20, 2018	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	Dec. 25, 2018	Feb. 14, 2018	Dec. 25, 2018	Radiation (03CH15-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	Jul. 17, 2018	Feb. 14, 2018	Jul. 17, 2018	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	N/A	Feb. 14, 2018	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	N/A	Feb. 14, 2018	N/A	Radiation (03CH15-HY)
Spectrum Analyzer	Rohde & Schwarz	FSQ	200578	Mar. 21, 2018	Feb. 14, 2018	Mar. 21, 2018	Radiation (03CH15-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV	101183	Jan. 03, 2019	Feb. 14, 2018	Jan. 03, 2019	Radiation (03CH15-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102317	Jul. 19, 2018	Feb. 14, 2018	Jul. 19, 2018	Radiation (03CH15-HY)
RF signal cable	HUBER+SUHNNER	SUCOFLEX 104	MY11681/4PE	Mar. 15, 2018	Feb. 14, 2018	Mar. 15, 2018	Radiation (03CH15-HY)
RF signal cable	HUBER+SUHNNER	SUCOFLEX 104	MY36980/4	Mar. 16, 2018	Feb. 14, 2018	Mar. 16, 2018	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24	N/A	N/A	Feb. 14, 2018	N/A	Radiation (03CH15-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.3dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.6dB

Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.5dB

Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.7dB

Appendix A. Radiated Spurious Emission

Band 1 5150~5250MHz

WIFI 802.11ac (Spurious Emission @ 3m)

WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11ac 20M CH 40 5200MHz		5031.2	49.23	-4.77	54	41.79	31.72	5.8	30.08	100	256	A	H
		5081.38	61.01	-12.99	74	53.51	31.75	5.84	30.09	100	256	P	H
	*	5200	105.05	-	-	97.4	31.82	5.94	30.11	100	256	A	H
	*	5200	114.01	-	-	106.36	31.82	5.94	30.11	100	256	P	H
		5378.62	61.8	-12.2	74	53.99	31.93	6.01	30.13	100	256	P	H
		5450.64	49.9	-4.1	54	42	31.97	6.07	30.14	100	256	A	H
		10400	62.09	-6.11	68.2	44.74	39.7	8.5	31.32	100	137	P	H
		5033.8	49.06	-4.94	54	41.62	31.72	5.8	30.08	396	175	A	V
		5044.2	61.42	-12.58	74	53.97	31.73	5.81	30.09	396	175	P	V
	*	5200	91.67	-	-	84.02	31.82	5.94	30.11	396	175	A	V
	*	5200	100.53	-	-	92.88	31.82	5.94	30.11	396	175	P	V
		5447.52	60.18	-13.82	74	52.29	31.97	6.05	30.13	396	175	P	V
		5451.42	49.41	-4.59	54	41.51	31.97	6.07	30.14	396	175	A	V
		10400	60.51	-7.69	68.2	43.16	39.7	8.5	31.32	382	180	P	V

Remark

1. No other spurious found.
2. All results are PASS against limit line.

Emission below 1GHz

Band 1 WIFI (LF)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Quasi -Peak	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/QP)	(H/V)
Band 1 WIFI LF		60.24	26.54	-13.46	40	46.52	11.96	0.67	32.61	-	-	P	H
		215.76	27.96	-15.54	43.5	44.07	15.27	1.16	32.54	-	-	P	H
		280.02	38.46	-7.54	46	50.78	18.88	1.33	32.53	-	-	P	H
		440	43.06	-2.94	46	50.99	22.94	1.67	32.54	137	191	QP	H
		699.7	41.1	-4.9	46	44.79	26.7	2.1	32.49	-	-	P	H
		920.2	42.79	-3.21	46	42.18	29.71	2.43	31.53	178	341	QP	H
		38.1	37.98	-2.02	40	49.67	20.49	0.46	32.64	100	64	QP	V
		58.35	36.63	-3.37	40	56.39	12.18	0.67	32.61	100	302	QP	V
		215.76	23.7	-19.8	43.5	39.81	15.27	1.16	32.54	-	-	P	V
		440	42.79	-3.21	46	50.72	22.94	1.67	32.54	-	-	P	V
		699.7	37.39	-8.61	46	41.08	26.7	2.1	32.49	-	-	P	V
		920.2	37.57	-8.43	46	36.96	29.71	2.43	31.53	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Band 4 5725~5850MHz

WIFI 802.11a (Spurious Emission @ 3m)

WIFI	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a 20M CH 157 5785MHz		5632.6	65.12	-3.08	68.2	56.95	32.17	6.22	30.22	100	267	P	H
		5659.6	64.34	-10.99	75.33	56.16	32.19	6.22	30.23	100	267	P	H
		5701.2	64.45	-41.09	105.54	56.22	32.25	6.23	30.25	100	267	P	H
		5721.8	64.34	-50.56	114.9	56.09	32.27	6.24	30.26	100	267	P	H
	*	5785	110.45	-	-	102.17	32.33	6.25	30.3	100	267	A	H
	*	5785	119.82	-	-	111.54	32.33	6.25	30.3	100	267	P	H
		5850.8	62.86	-57.52	120.38	54.49	32.41	6.29	30.33	100	267	P	H
		5857.4	62.71	-47.42	110.13	54.32	32.43	6.29	30.33	100	267	P	H
		5875.6	61.93	-42.82	104.75	53.51	32.46	6.3	30.34	100	267	P	H
		5944.4	61.71	-6.49	68.2	53.22	32.54	6.33	30.38	100	267	P	H
		11570	47.54	-6.46	54	29.52	40.22	9.03	31.77	100	242	A	H
		11570	59.77	-14.23	74	41.75	40.22	9.03	31.77	100	242	P	H
		5610.8	62.17	-6.03	68.2	54.05	32.12	6.21	30.21	390	181	P	V
		5655.8	61.94	-10.57	72.51	53.76	32.19	6.22	30.23	390	181	P	V
		5712.6	60.63	-48.1	108.73	52.41	32.25	6.23	30.26	390	181	P	V
		5721	62.1	-50.98	113.08	53.85	32.27	6.24	30.26	390	181	P	V
	*	5785	100.94	-	-	92.66	32.33	6.25	30.3	390	181	A	V
	*	5785	110.33	-	-	102.05	32.33	6.25	30.3	390	181	P	V
		5852.8	60.34	-55.48	115.82	51.97	32.41	6.29	30.33	390	181	P	V
		5863.4	59.91	-48.54	108.45	51.52	32.43	6.3	30.34	390	181	P	V
		5890.2	61.62	-32.3	93.92	53.19	32.48	6.31	30.36	390	181	P	V
		5929.6	60.54	-7.66	68.2	52.07	32.52	6.32	30.37	390	181	P	V
		11570	46.31	-7.69	54	28.29	40.22	9.03	31.77	100	200	A	V
		11570	58.11	-15.89	74	40.09	40.22	9.03	31.77	100	200	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Band 4 WIFI (LF)

WIFI	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Quasi-Peak (P/QP)	Pol. (H/V)
Band 4 WIFI LF		59.7	27.17	-12.83	40	47.15	11.96	0.67	32.61	-	-	P	H
		214.95	28.15	-15.35	43.5	44.28	15.25	1.16	32.54	-	-	P	H
		280.02	39.35	-6.65	46	51.67	18.88	1.33	32.53	-	-	P	H
		440	42.97	-3.03	46	50.9	22.94	1.67	32.54	134	289	QP	H
		699.7	39.5	-6.5	46	43.19	26.7	2.1	32.49	-	-	P	H
		920.2	43.2	-2.8	46	42.59	29.71	2.43	31.53	112	81	QP	H
		38.64	38.18	-1.82	40	50.29	20.07	0.46	32.64	100	159	QP	V
		58.89	35.94	-4.06	40	55.81	12.07	0.67	32.61	100	253	QP	V
		280.02	28.39	-17.61	46	40.71	18.88	1.33	32.53	-	-	P	V
		440	42.81	-3.19	46	50.74	22.94	1.67	32.54	-	-	P	V
		700.4	37.17	-8.83	46	40.86	26.7	2.1	32.49	-	-	P	V
		920.2	38.09	-7.91	46	37.48	29.71	2.43	31.53	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
P/QP	**P**eak **or Q**uasi-**P**eak
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.