

## Variant FCC Test Report

**Report No.:** RF170818C25C

**FCC ID:** XOJ-WA2000

**Test Model:** WA2000C, WA2000U, WA2000M

**Received Date:** Jul. 23, 2018

**Test Date:** Sep. 04, 2018 ~ Sep. 06, 2018

**Issued Date:** Oct. 17, 2018

**Applicant:** Tibbo Technology Inc.

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22180

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

**Lab Address:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan  
( R.O.C )

**Test Location (1):** No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City  
33383, Taiwan, R.O.C.

**Test Location (2):** No.215, Sec. 3, Beixin Rd., Xindian Dist., New Taipei City 231, Taiwan,  
R.O.C

**FCC Registration /**  
**Designation Number:** 427177 / TW0011



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### Release Control Record

Issue No.	Description	Date Issued
RF170818C25C	Original Release	Oct. 17, 2018

## 1 Certificate of Conformity

**Product:** WA2000

**Brand:** Tibbo Technology Inc.

**Test Model:** WA2000C, WA2000U, WA2000M

**Sample Status:** Production Unit

**Applicant:** Tibbo Technology Inc.

**Test Date:** Sep. 04, 2018 ~ Sep. 06, 2018

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.10:2013

This report is issued as a supplementary report to BV CPS report no.: RF170818C25. This report shall be used by combining with its original report.

**Prepared by :** Gina Liu, **Date:** Oct. 17, 2018  
Gina Liu / Specialist

**Approved by :** Dylan Chiou, **Date:** Oct. 17, 2018  
Dylan Chiou / Project Engineer

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	N/A	Refer to Note
15.205 & 209	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -9.03 dB at 2483.52 MHz.
15.247(d)	Band Edge Measurement	N/A	Refer to Note
15.247(d)	Antenna Port Emission	N/A	Refer to Note
15.247(a)(2)	6 dB Bandwidth	N/A	Refer to Note
---	Occupied Bandwidth Measurement	N/A	Refer to Note
15.247(b)	Conducted Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	N/A	Refer to Note
15.203	Antenna Requirement	N/A	Refer to Note

**Note:** Only radiated emission tests and conducted Power had been performed for the addendum. Refer to original report for other test data.

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) ( $\pm$ )
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.0153 dB
	200 MHz ~ 1000 MHz	2.0224 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.0121 dB
	18 GHz ~ 40 GHz	1.1508 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

<b>Product</b>	WA2000
<b>Brand</b>	Tibbo Technology Inc.
<b>Test Model</b>	WA2000C, WA2000U, WA2000M
<b>Status of EUT</b>	Production Unit
<b>Power Supply Rating</b>	3.3 Vdc (Host equipment)
<b>Modulation Type</b>	GFSK
<b>Transfer Rate</b>	1 Mbps
<b>Operating Frequency</b>	2402 ~ 2480 MHz
<b>Number of Channel</b>	40
<b>Output Power</b>	4.05 mW
<b>Antenna Type</b>	Refer to Note as below
<b>Antenna Connector</b>	Refer to Note as below
<b>Accessory Device</b>	N/A
<b>Data Cable Supplied</b>	N/A

Note:

1. This report is issued as a supplementary report to BV CPS report no.: RF170818C25. The difference compared with original report is adding new antennas and changing applicant, product name, brand name, model name. Therefore, only conducted power and radiated emission tests had been performed for this report.
2. The EUT contains 3 samples listed as below.

Sample	Model	Description
C	WA2000C	Chip antenna onboard
B	WA2000U	with U.FL Connector
A	WA2000M	with MHF4 connector

3. The antenna information is listed as below.

	Antenna Type	Brand	Model	Antenna Gain (dBi)			Connector Type
				BT	WLAN 2.4 GHz	WLAN 5 GHz	
1	PCB	Johanson Technology	2450AD14A5500	1.0	1.0	4.0	none (like solder)
2	Monopole	WIFI-Link Technologies Co Ltd	WLD1	6.0	6.0	5.0	R-SMA
3	Monopole	WIFI-Link Technologies Co Ltd	WLD1	6.0	6.0	5.0	R-SMA

4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or User's Manual.

### 3.2 Description of Test Modes

40 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

### 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE $\geq$ 1G	RE<1G	PLC	APCM	
A	√	√	-	√	Sample A
B	√	√	-	√	Sample B
C	√	√	-	√	Sample C

Where **RE $\geq$ 1G**: Radiated Emission above 1 GHz **RE<1G**: Radiated Emission below 1 GHz  
**PLC**: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement

**Note:** The EUT had been pre-tested on the positioned of each 0 and 90 degree for antenna. The worst case was found when positioned on **90 degree**.

**Note:** "-" means no effect.

#### Radiated Emission Test (Above 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
A, B, C	0 to 39	0, 19, 39	GFSK	1

#### Radiated Emission Test (Below 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
A, B, C	0 to 39	39	GFSK	1

#### Antenna Port Conducted Measurement:

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
A, B, C	0 to 39	0, 19, 39	GFSK	1

#### Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE $\geq$ 1G	25 deg. C, 65 % RH	3.3 Vdc	Harry Hsueh, Karl Lee
RE<1G	25 deg. C, 65 % RH	3.3 Vdc	Harry Hsueh
APCM	25 deg. C, 65 % RH	3.3 Vdc	Gavin Wu



### 3.3 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.

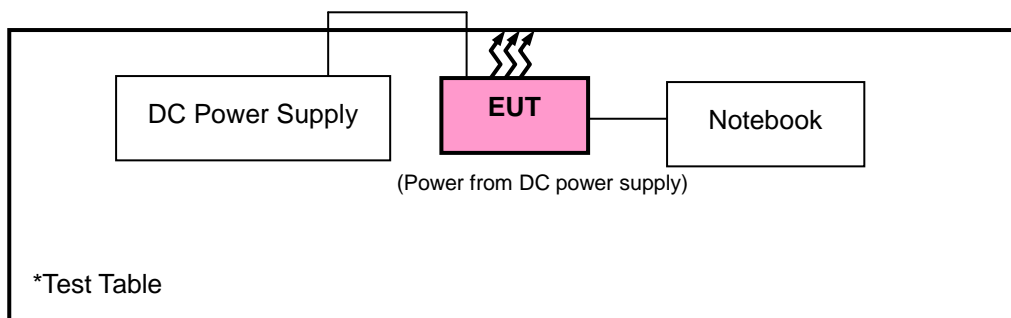
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Notebook	DELL	Inspiron 14R	8LRKKW1	N/A
2.	DC power supply	Keysight	U8002A	MY56330015	N/A

No.	Signal Cable Description Of The Above Support Units
1.	N/A
2.	N/A

Note:

1. All power cords of the above support units are non-shielded (1.8m).

#### 3.3.1 Configuration of System under Test



### 3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C (15.247)**

**KDB 558074 D01 15.247 Meas Guidance v05**

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

#### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

Frequencies (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:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

#### 4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent Technologies	N9038A	MY52260177	Aug. 20, 2018	Aug. 19, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Jan. 11, 2018	Jan. 10, 2019
BILOG Antenna SCHWARZBECK	VULB 9168	9168-616	Dec. 14, 2017	Dec. 13, 2018
HORN Antenna ETS-Lindgren	3117	00143293	Dec. 13, 2017	Dec. 12, 2018
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Dec. 01, 2017	Nov. 30, 2018
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 16, 2018	Apr. 15, 2019
Loop Antenna TESEQ	HLA 6121	45745	Jun. 14, 2018	Jun. 13, 2019
Preamplifier Agilent	310N	187226	Jun. 19, 2018	Jun. 18, 2019
Preamplifier Agilent	83017A	MY39501357	Jun. 19, 2018	Jun. 18, 2019
Power Meter Anritsu	ML2495A	1232002	Dec. 07, 2017	Dec. 06, 2018
Power Sensor Anritsu	MA2411B	1207325	Dec. 07, 2017	Dec. 06, 2018
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(R FC-SMS-100-SM S-120+RFC-SMS -100-SMS-400)	Jun. 19, 2018	Jun. 18, 2019
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(R FC-SMS-100-SM S-24)	Jun. 19, 2018	Jun. 18, 2019
Software BV ADT	E3 8.130425b	NA	NA	NA
Antenna Tower MF	NA	NA	NA	NA
Turn Table MF	NA	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HsinTien Chamber 1.
3. The horn antenna and preamplifier (model: 83017A) are used only for the measurement of emission frequency above 1GHz if tested.
4. The IC Site Registration No. is IC7450I-1.

#### 4.1.3 Test Procedures

##### **For Radiated Emission below 30 MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### **Note:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.

##### **For Radiated Emission above 30 MHz**

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

##### **Note:**

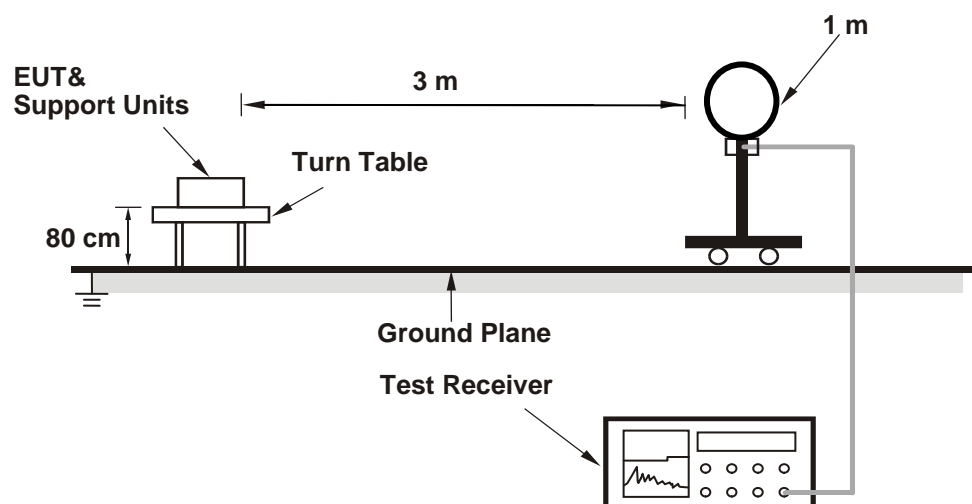
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98 %) or 10 Hz (Duty cycle  $\geq 98$  %) for Average detection (AV) at frequency above 1 GHz. (RBW = 1 MHz, VBW = 3 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

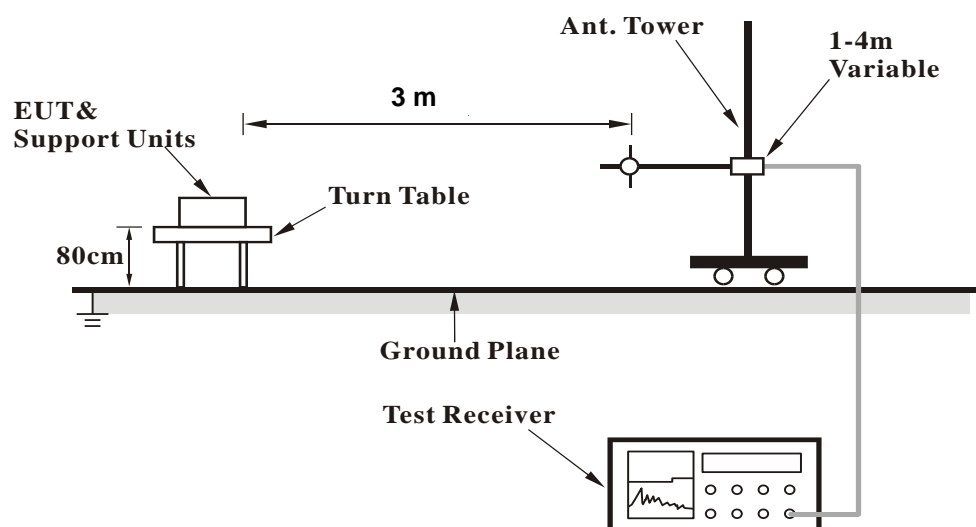
No deviation.

#### 4.1.5 Test Set Up

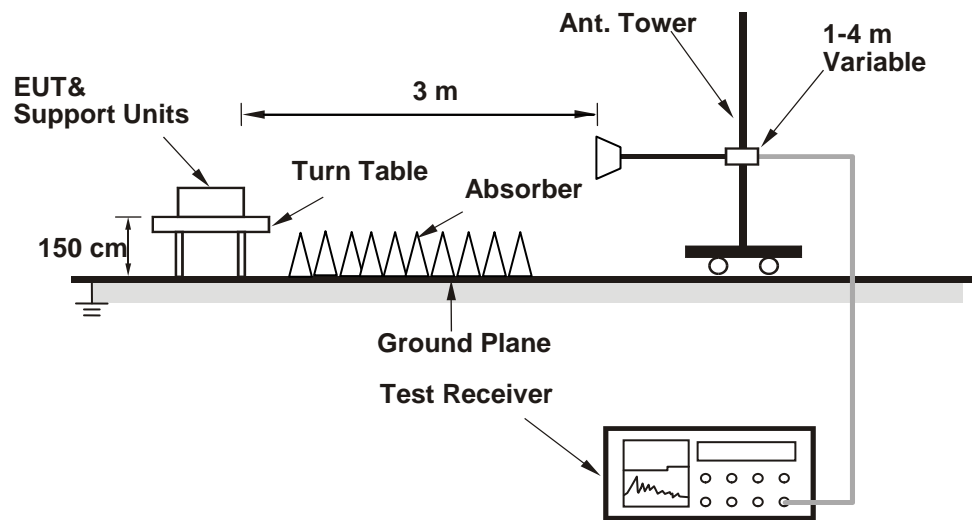
##### <Radiated Emission below 30 MHz>



##### <Radiated Emission 30 MHz to 1 GHz>



### <Radiated Emission above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Set the EUT under transmission condition continuously at specific channel frequency.

#### 4.1.7 Test Results

##### Above 1 GHz Data:

##### Mode A

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 25 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2386.59	41.98	40.27	54	-12.02	31.8	5.4	35.49	146	208	Average
2386.59	52.47	50.76	74	-21.53	31.8	5.4	35.49	146	208	Peak
2402	109.06	107.33			31.8	5.4	35.47	146	208	Average
2402	110.69	108.96			31.8	5.4	35.47	146	208	Peak
4804	36.66	28.57	54	-17.34	33.96	8.25	34.12	122	125	Average
4804	46.15	38.06	74	-27.85	33.96	8.25	34.12	122	125	Peak

Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2378.58	41.51	39.85	54	-12.49	31.78	5.37	35.49	202	236	Average
2378.58	52.14	50.48	74	-21.86	31.78	5.37	35.49	202	236	Peak
2402	100.76	99.03			31.8	5.4	35.47	202	236	Average
2402	101.2	99.47			31.8	5.4	35.47	202	236	Peak
4804	36.79	28.7	54	-17.21	33.96	8.25	34.12	166	195	Average
4804	46.56	38.47	74	-27.44	33.96	8.25	34.12	166	195	Peak

##### Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2402 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	1 GHz ~ 25 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2387.31	41.43	39.72	54	-12.57	31.8	5.4	35.49	202	236	Average
2387.31	51.89	50.18	74	-22.11	31.8	5.4	35.49	202	236	Peak
2440	100.17	98.32			31.85	5.46	35.46	202	236	Average
2440	101.34	99.49			31.85	5.46	35.46	202	236	Peak
2491.8	41.97	39.95	54	-12.03	31.9	5.53	35.41	202	236	Average
2491.8	52.42	50.4	74	-21.58	31.9	5.53	35.41	202	236	Peak
4880	38.08	29.89	54	-15.92	33.98	8.27	34.06	102	154	Average
4880	47.49	39.3	74	-26.51	33.98	8.27	34.06	102	154	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2363.1	41.45	39.82	54	-12.55	31.76	5.37	35.5	146	207	Average
2363.1	51.87	50.24	74	-22.13	31.76	5.37	35.5	146	207	Peak
2440	109.17	107.32			31.85	5.46	35.46	146	207	Average
2440	110.94	109.09			31.85	5.46	35.46	146	207	Peak
2483.96	42.16	40.2	54	-11.84	31.88	5.5	35.42	146	207	Average
2483.96	52.2	50.24	74	-21.8	31.88	5.5	35.42	146	207	Peak
4880	38.08	29.89	54	-15.92	33.98	8.27	34.06	158	30	Average
4880	46.74	38.55	74	-27.26	33.98	8.27	34.06	158	30	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
2. 2440 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.



EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	1 GHz ~ 25 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2480	108.5	106.54			31.88	5.5	35.42	146	207	Average
2480	109.93	107.97			31.88	5.5	35.42	146	207	Peak
2483.52	44.97	43.01	54	-9.03	31.88	5.5	35.42	146	207	Average
2483.52	57.25	55.29	74	-16.75	31.88	5.5	35.42	146	207	Peak
4960	38.18	29.91	54	-15.82	33.99	8.29	34.01	111	201	Average
4960	47.71	39.44	74	-26.29	33.99	8.29	34.01	111	201	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2480	99.51	97.55			31.88	5.5	35.42	202	236	Average
2480	100.67	98.71			31.88	5.5	35.42	202	236	Peak
2484.76	42	40.01	54	-12	31.88	5.53	35.42	202	236	Average
2484.76	52.27	50.28	74	-21.73	31.88	5.53	35.42	202	236	Peak
4960	37.27	29	54	-16.73	33.99	8.29	34.01	166	195	Average
4960	46.68	38.41	74	-27.32	33.99	8.29	34.01	166	195	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2480 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

## Mode B

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 25 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2389.11	41.48	39.77	54	-12.52	31.8	5.4	35.49	146	207	Average
2389.11	53.07	51.36	74	-20.93	31.8	5.4	35.49	146	207	Peak
2402	102.3	100.57			31.8	5.4	35.47	146	207	Average
2402	103.71	101.98			31.8	5.4	35.47	146	207	Peak
4804	38.96	30.87	54	-15.04	33.96	8.25	34.12	125	162	Average
4804	48.45	40.36	74	-25.55	33.96	8.25	34.12	125	162	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2365.44	41.53	39.89	54	-12.47	31.76	5.37	35.49	202	236	Average
2365.44	52.4	50.76	74	-21.6	31.76	5.37	35.49	202	236	Peak
2402	93.32	91.59			31.8	5.4	35.47	202	236	Average
2402	95	93.27			31.8	5.4	35.47	202	236	Peak
4804	37.99	29.9	54	-16.01	33.96	8.25	34.12	158	178	Average
4804	48.04	39.95	74	-25.96	33.96	8.25	34.12	158	178	Peak

### Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2402 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	1 GHz ~ 25 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2382.27	41.32	39.63	54	-12.68	31.78	5.4	35.49	185	267	Average
2382.27	52.04	50.35	74	-21.96	31.78	5.4	35.49	185	267	Peak
2440	94.55	92.7			31.85	5.46	35.46	185	267	Average
2440	95.96	94.11			31.85	5.46	35.46	185	267	Peak
2491.72	42.31	40.3	54	-11.69	31.9	5.53	35.42	185	267	Average
2491.72	52.5	50.49	74	-21.5	31.9	5.53	35.42	185	267	Peak
4880	38.18	29.99	54	-15.82	33.98	8.27	34.06	122	162	Average
4880	47.4	39.21	74	-26.6	33.98	8.27	34.06	122	162	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2373.81	41.44	39.78	54	-12.56	31.78	5.37	35.49	145	207	Average
2373.81	52.1	50.44	74	-21.9	31.78	5.37	35.49	145	207	Peak
2440	102.37	100.52			31.85	5.46	35.46	145	207	Average
2440	103.51	101.66			31.85	5.46	35.46	145	207	Peak
2487.72	41.93	39.92	54	-12.07	31.9	5.53	35.42	145	207	Average
2487.72	52.99	50.98	74	-21.01	31.9	5.53	35.42	145	207	Peak
4880	38.09	29.9	54	-15.91	33.98	8.27	34.06	151	147	Average
4880	47.65	39.46	74	-26.35	33.98	8.27	34.06	151	147	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
2. 2440 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	1 GHz ~ 25 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2480	102.48	100.52			31.88	5.5	35.42	145	207	Average
2480	103.93	101.97			31.88	5.5	35.42	145	207	Peak
2484.28	43.25	41.26	54	-10.75	31.88	5.53	35.42	145	207	Average
2484.28	57.47	55.48	74	-16.53	31.88	5.53	35.42	145	207	Peak
4960	38.18	29.91	54	-15.82	33.99	8.29	34.01	100	159	Average
4960	47.36	39.09	74	-26.64	33.99	8.29	34.01	100	159	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2480	94.48	92.52			31.88	5.5	35.42	185	267	Average
2480	95.56	93.6			31.88	5.5	35.42	185	267	Peak
2488.44	42.19	40.18	54	-11.81	31.9	5.53	35.42	185	267	Average
2488.44	52.71	50.7	74	-21.29	31.9	5.53	35.42	185	267	Peak
4960	38.18	29.91	54	-15.82	33.99	8.29	34.01	148	60	Average
4960	47.1	38.83	74	-26.9	33.99	8.29	34.01	148	60	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2480 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

## Mode C

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 25 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2384.43	40.67	38.98	54	-13.33	31.78	5.4	35.49	111	2	Average
2384.43	51.94	50.25	74	-22.06	31.78	5.4	35.49	111	2	Peak
2402	88.37	86.64			31.8	5.4	35.47	111	2	Average
2402	90.24	88.51			31.8	5.4	35.47	111	2	Peak
4804	36.72	28.63	54	-17.28	33.96	8.25	34.12	163	108	Average
4804	46.39	38.3	74	-27.61	33.96	8.25	34.12	163	108	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2384.16	40.68	38.99	54	-13.32	31.78	5.4	35.49	226	11	Average
2384.16	52.01	50.32	74	-21.99	31.78	5.4	35.49	226	11	Peak
2402	90.32	88.59			31.8	5.4	35.47	226	11	Average
2402	92.18	90.45			31.8	5.4	35.47	226	11	Peak
4804	37.51	29.42	54	-16.49	33.96	8.25	34.12	143	185	Average
4804	47.21	39.12	74	-26.79	33.96	8.25	34.12	143	185	Peak

### Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2402 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail	
Channel	Channel 19	Frequency Range	1 GHz ~ 25 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Karl Lee

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2386.68	40.74	39.03	54	-13.26	31.8	5.4	35.49	111	2	Average
2386.68	52.21	50.5	74	-21.79	31.8	5.4	35.49	111	2	Peak
2440	89.05	87.2			31.85	5.46	35.46	111	2	Average
2440	90.94	89.09			31.85	5.46	35.46	111	2	Peak
2495.76	41.19	39.17	54	-12.81	31.9	5.53	35.41	111	2	Average
2495.76	52.5	50.48	74	-21.5	31.9	5.53	35.41	111	2	Peak
4880	36.94	28.75	54	-17.06	33.98	8.27	34.06	103	182	Average
4880	46.57	38.38	74	-27.43	33.98	8.27	34.06	103	182	Peak

Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2386.86	40.61	38.9	54	-13.39	31.8	5.4	35.49	226	11	Average
2386.86	52.24	50.53	74	-21.76	31.8	5.4	35.49	226	11	Peak
2440	90.9	89.05			31.85	5.46	35.46	226	11	Average
2440	92.78	90.93			31.85	5.46	35.46	226	11	Peak
2485.28	41.26	39.27	54	-12.74	31.88	5.53	35.42	226	11	Average
2485.28	52.43	50.44	74	-21.57	31.88	5.53	35.42	226	11	Peak
4880	37.43	29.24	54	-16.57	33.98	8.27	34.06	172	46	Average
4880	46.81	38.62	74	-27.19	33.98	8.27	34.06	172	46	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
2. 2440 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.

EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	1 GHz ~ 25 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Karl Lee

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2480	89.48	87.52			31.88	5.5	35.42	111	2	Average
2480	91.39	89.43			31.88	5.5	35.42	111	2	Peak
2497.16	41.25	39.23	54	-12.75	31.9	5.53	35.41	111	2	Average
2497.16	51.94	49.92	74	-22.06	31.9	5.53	35.41	111	2	Peak
4960	37.26	28.99	54	-16.74	33.99	8.29	34.01	169	243	Average
4960	46.85	38.58	74	-27.15	33.99	8.29	34.01	169	243	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2480	91.29	89.33			31.88	5.5	35.42	226	11	Average
2480	93.16	91.2			31.88	5.5	35.42	226	11	Peak
2484.56	41.3	39.31	54	-12.7	31.88	5.53	35.42	226	11	Average
2484.56	53.18	51.19	74	-20.82	31.88	5.53	35.42	226	11	Peak
4960	37.15	28.88	54	-16.85	33.99	8.29	34.01	136	158	Average
4960	46.62	38.35	74	-27.38	33.99	8.29	34.01	136	158	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2480 MHz: Fundamental frequency.
- The emission levels of other frequencies were very low against the limit.

### 9 kHz ~ 30 MHz Data:

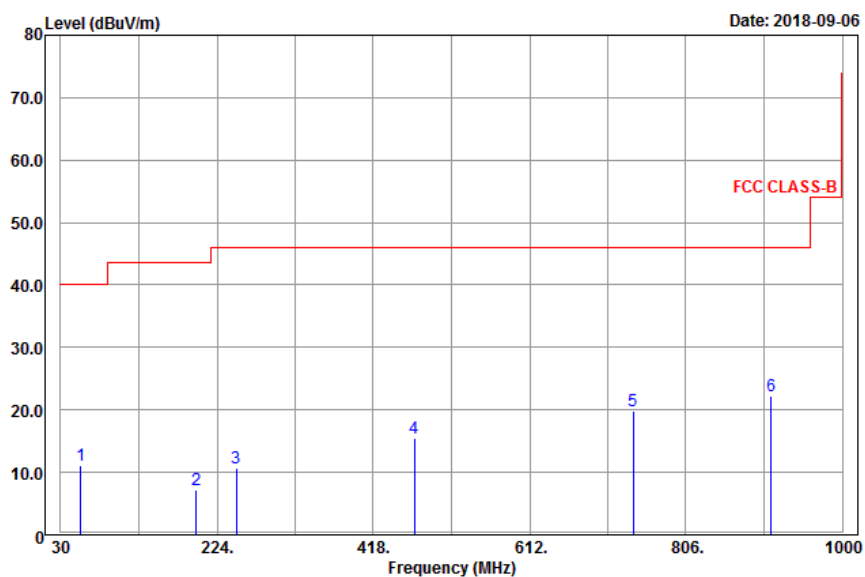
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

### 30 MHz ~ 1 GHz Worst-Case Data:

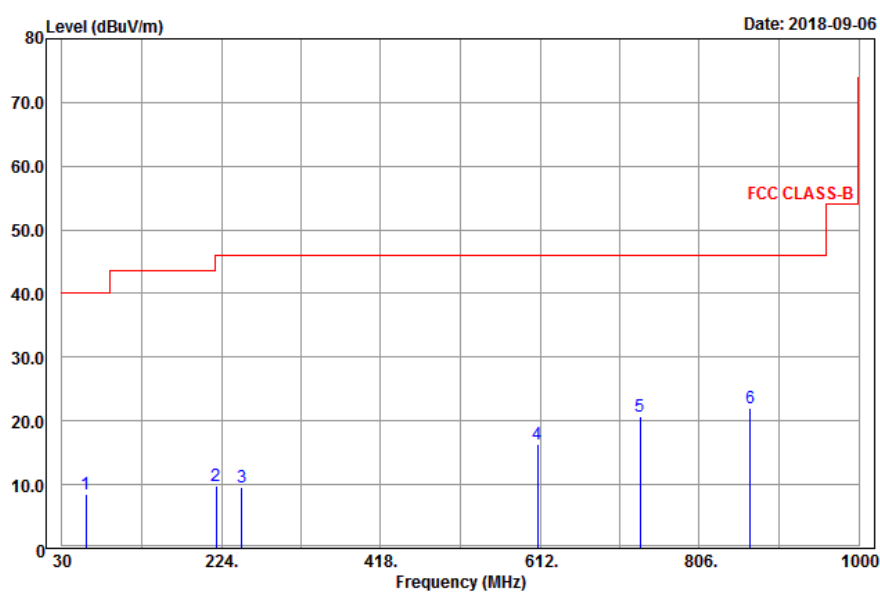
#### Mode A

EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	30 MHz ~ 1 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

#### Horizontal



#### Vertical





Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
55.11	11.17	28.36	40	-28.83	14.14	0.9	32.23	141	165	Peak
198.21	7.29	26.95	43.5	-36.21	11.02	1.61	32.29	198	221	Peak
247.89	10.6	28.57	46	-35.4	12.28	1.85	32.1	106	207	Peak
468.7	15.39	29.1	46	-30.61	15.86	2.56	32.13	124	4	Peak
741	19.74	29	46	-26.26	19.72	3.16	32.14	135	336	Peak
911.8	22.17	28.52	46	-23.83	21.52	3.53	31.4	132	170	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
59.16	8.59	26.4	40	-31.41	13.52	0.9	32.23	129	99	Peak
217.65	9.78	29.07	46	-36.22	11.29	1.65	32.23	127	214	Peak
249.24	9.5	27.45	46	-36.5	12.3	1.85	32.1	118	185	Peak
609.4	16.28	27.58	46	-29.72	18.02	2.87	32.19	154	180	Peak
734	20.69	30.01	46	-25.31	19.65	3.16	32.13	124	300	Peak
868.4	21.99	29	46	-24.01	21.23	3.44	31.68	128	228	Peak

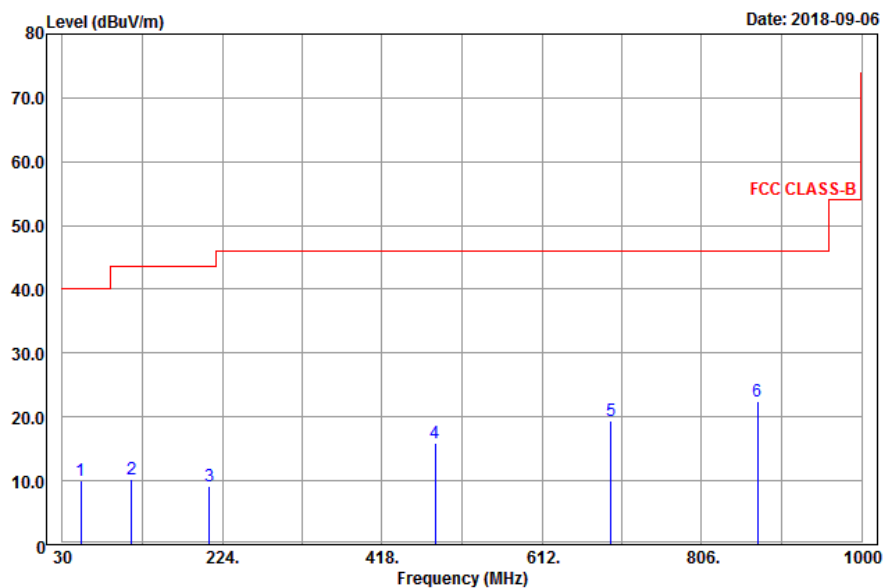
Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- The emission levels of other frequencies were very low against the limit.

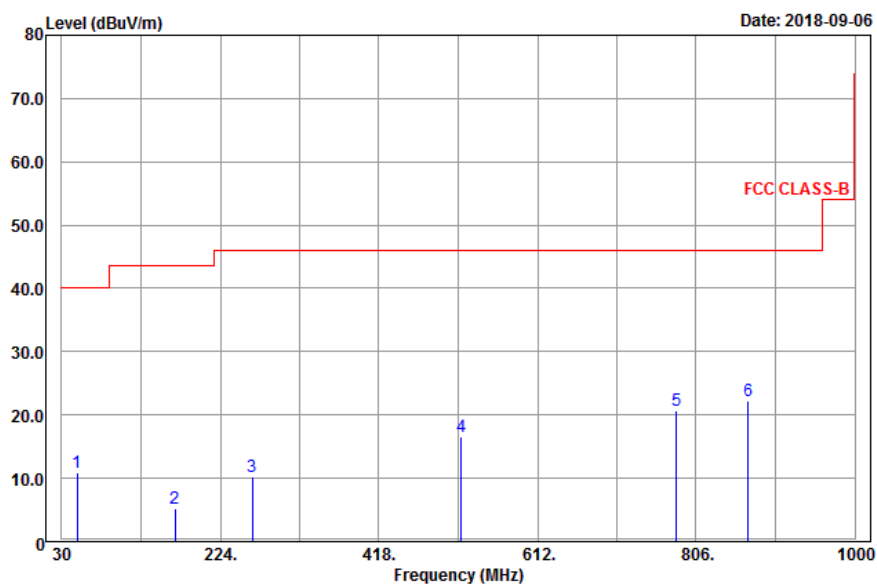
## Mode B

EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	30 MHz ~ 1 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

## Horizontal



## Vertical



### Antennal Polarity & Test Distance: Horizontal at 3 m

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
52.68	11.99	28.94	40	-28.01	14.38	0.9	32.23	118	157	Peak
103.44	9.85	28.44	43.5	-33.65	12.39	1.28	32.26	103	4	Peak
155.55	8.32	30.51	43.5	-35.18	8.56	1.52	32.27	156	222	Peak
644.4	19.16	29.97	46	-26.84	18.35	2.99	32.15	124	191	Peak
832.7	21.11	28.8	46	-24.89	20.81	3.38	31.88	124	208	Peak
868.4	21.72	28.73	46	-24.28	21.23	3.44	31.68	146	111	Peak

### Antennal Polarity & Test Distance: Vertical at 3 m

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
54.84	11.63	28.82	40	-28.37	14.14	0.9	32.23	124	155	Peak
200.91	8.51	28.06	43.5	-34.99	11.09	1.65	32.29	166	200	Peak
254.91	10.17	27.93	46	-35.83	12.4	1.94	32.1	124	3	Peak
414.8	14.4	29.02	46	-31.6	15.17	2.41	32.2	168	12	Peak
631.8	18.29	29.31	46	-27.71	18.22	2.93	32.17	198	8	Peak
775.3	20.95	29.7	46	-25.05	20.08	3.27	32.1	134	232	Peak

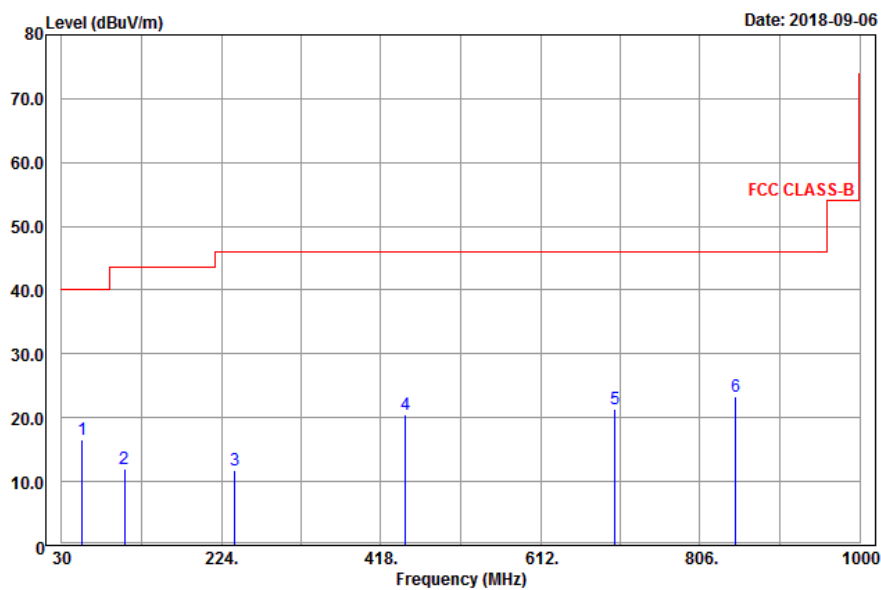
Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamplifier Factor  
Margin value = Emission level – Limit value
- The emission levels of other frequencies were very low against the limit.

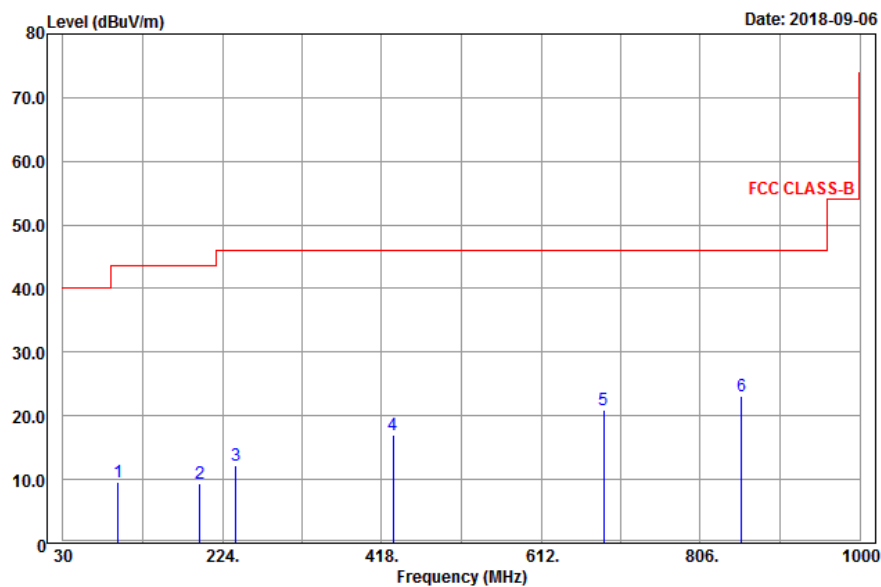
## Mode C

EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	30 MHz ~ 1 GHz
Input Power	3.3 Vdc	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Harry Hsueh

## Horizontal



## Vertical



Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
93.18	8.46	28.07	43.5	-35.04	11.16	1.11	31.88	154	111	Peak
161.22	5.44	27.41	43.5	-38.06	8.78	1.52	32.27	164	22	Peak
266.52	10.9	28.48	46	-35.1	12.59	1.94	32.11	124	109	Peak
540.8	17.13	29.65	46	-28.87	16.9	2.76	32.18	169	326	Peak
678.7	18.18	28.33	46	-27.82	18.91	3.05	32.11	181	188	Peak
803.3	21.04	29.38	46	-24.96	20.38	3.32	32.04	124	210	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
54.57	11.7	28.81	40	-28.3	14.22	0.9	32.23	116	296	Peak
163.92	5.34	27.19	43.5	-38.16	8.89	1.52	32.26	188	4	Peak
266.52	9.53	27.11	46	-36.47	12.59	1.94	32.11	134	310	Peak
442.8	14.04	28.25	46	-31.96	15.46	2.49	32.16	154	14	Peak
811.7	21.16	29.32	46	-24.84	20.52	3.32	32	187	118	Peak
876.1	22.13	28.97	46	-23.87	21.3	3.49	31.63	124	98	Peak

Remarks:

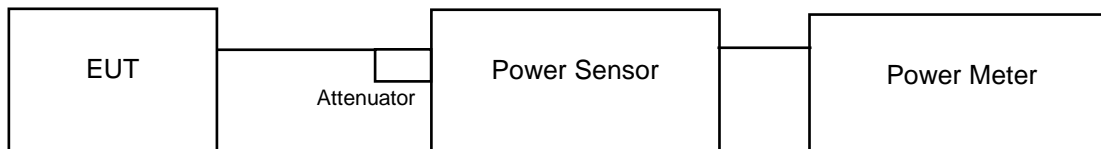
- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamplifier Factor  
Margin value = Emission level – Limit value
- The emission levels of other frequencies were very low against the limit.

## 4.2 Conducted Output Power Measurement

### 4.2.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30 dBm)

### 4.2.2 Test Setup



### 4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.2.4 Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

### 4.2.5 Deviation from Test Standard

No deviation.

### 4.2.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

## 4.2.7 Test Results

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
0	2402	3.79	5.79	30	Pass
19	2440	4.05	6.07	30	Pass
39	2480	3.99	6.01	30	Pass

## 5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).



## Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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