

## Partial FCC Test Report

**Report No.:** RF191114C18-3

**FCC ID:** PPD-QCNFA344AH

**Test Model:** QCNFA344A

**Received Date:** Nov. 14, 2019

**Test Date:** Mar. 21, 2020

**Issued Date:** Mar. 25, 2020

**Applicant:** Qualcomm Atheros, Inc.

**Address:** 1700 Technology Drive, San Jose, CA 95110

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

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

**Test Location:** No.215, Sec. 3, Beixin Rd., Xindian Dist., New Taipei City 231, Taiwan

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



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### Release Control Record

Issue No.	Description	Date Issued
RF191114C18-3	Original Release	Mar. 25, 2020

## 1 Certificate of Conformity

**Product:** 802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card

**Brand:** Qualcomm Atheros

**Test Model:** QCNFA344A

**Sample Status:** Engineering Sample

**Applicant:** Qualcomm Atheros, Inc.

**Test Date:** Mar. 21, 2020

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)

ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

**Prepared by :** Shelly Hsueh, **Date:** Mar. 25, 2020

Shelly Hsueh / Specialist

**Approved by :** Dylan Chiou, **Date:** Mar. 25, 2020

Dylan Chiou / Senior 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 1
15.205 & 209	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -11.73 dB at 2483.5 MHz.
15.247(d)	Band Edge Measurement	N/A	Refer to Note 1
15.247(d)	Antenna Port Emission	N/A	Refer to Note 1
15.247(a)(2)	6 dB Bandwidth	N/A	Refer to Note 1
---	Occupied Bandwidth Measurement	N/A	Refer to Note 1
15.247(b)	Conducted Power	N/A	Refer to Note 1
15.247(e)	Power Spectral Density	N/A	Refer to Note 1
15.203	Antenna Requirement	N/A	Refer to Note 1

Note:

1. This report is a partial report according to customer requirements, only test item of Radiated Emissions (above 1GHz) Harmonic and Band Edge Measurement were performed for this report. Other testing data please refer to BV CPS report no.: RF150107E06B-3 for module (Brand: Qualcomm Atheros, Model: QCNFA344A).
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

### 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) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.79 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

<b>Product</b>	802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card
<b>Brand</b>	Qualcomm Atheros
<b>Test Model</b>	QCNFA344A
<b>Status of EUT</b>	Engineering Sample
<b>Nominal Voltage</b>	20.0 Vdc (adapter)
<b>Modulation Type</b>	GFSK
<b>Transfer Rate</b>	Up to 1 Mbps
<b>Operating Frequency</b>	2402 ~ 2480 MHz
<b>Number of Channel</b>	40
<b>Antenna Type</b>	Refer to Note as below
<b>Antenna Connector</b>	N/A
<b>Accessory Device</b>	Refer to Note as below
<b>Data Cable Supplied</b>	N/A

Note:

1. The WLAN/BT module (Brand: Qualcomm Atheros, Model: QCNFA344A) was installed in the EUT.
2. The antenna information is listed as below.

No.	Antenna Type	Manufacturer	Parts Number	Antenna Gain (dBi)				
				BT	WLAN 2.4 GHz	WLAN 5.15~5.35 GHz	WLAN 5.47~5.72 5 GHz	WLAN 5.725~5.8 5 GHz
1	PIFA	Wistron Neweb Corporation	Main Antenna: DQ6615G8600 (81EAA615.G86) Aux. Antenna: DQ6615G8600 (81EAA615.G86)	Aux.: -1.18	Main: -1.80 Aux.: -1.18	Main: -0.26 Aux.: -0.15	Main: -1.13 Aux.: -2.01	Main: -0.80 Aux.: -2.01
2		Wistron Neweb Corporation	Main Antenna: DQ6615G9300 (81EAA615.G93) Aux. Antenna: DQ6615G9300 (81EAA615.G93)	Aux.: -0.53	Main: -2.27 Aux.: -0.53	Main: -0.53 Aux.: -0.29	Main: -1.55 Aux.: -0.82	Main: -1.19 Aux.: -0.99
3		High-Tek Electronics Co., Ltd	Main Antenna: DQ60ACQD063 (0ACQD019089N) Aux. Antenna: DQ60ACQD063 (0ACQD019089N)	Aux.: 0.75	Main: -1.71 Aux.: 0.75	Main: -0.03 Aux.: -0.5	Main: 1.88 Aux.: 0.27	Main: 2.8 Aux.: 0.27
4		High-Tek Electronics Co., Ltd	Main Antenna: DQ60ACQD064 (0ACQD019069N) Aux. Antenna: DQ60ACQD064 (0ACQD019069N)	Aux.: -0.86	Main: 0.05 Aux.: -0.86	Main: 1.74 Aux.: -0.71	Main: 2.27 Aux.: 0.92	Main: 2.87 Aux.: 0.13

3. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter	Lenovo	ADLX65YCC3D	I/P: 100-240 Vac, 50-60 Hz, 1.8 A O/P: 20V, 3.25A / 15V, 3A / 9V, 2A / 5V, 2A 1.75M/0core
Adapter	Lenovo	ADLX65YDC3D	I/P: 100-240 Vac, 50-60 Hz, 1.8 A O/P: 20V, 3.25A / 15V, 3A / 9V, 2A / 5V, 2A 1.8M/0core

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)						
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≥1G	
-	✓	-

Where RE≥1G: Radiated Emission above 1 GHz

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

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)
-	0 to 39	0, 19, 39	GFSK	1

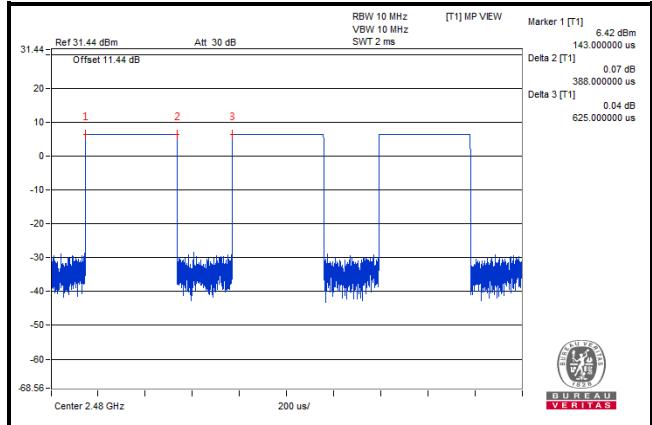
#### Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE≥1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Karl Lee

### 3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor shall be considered.

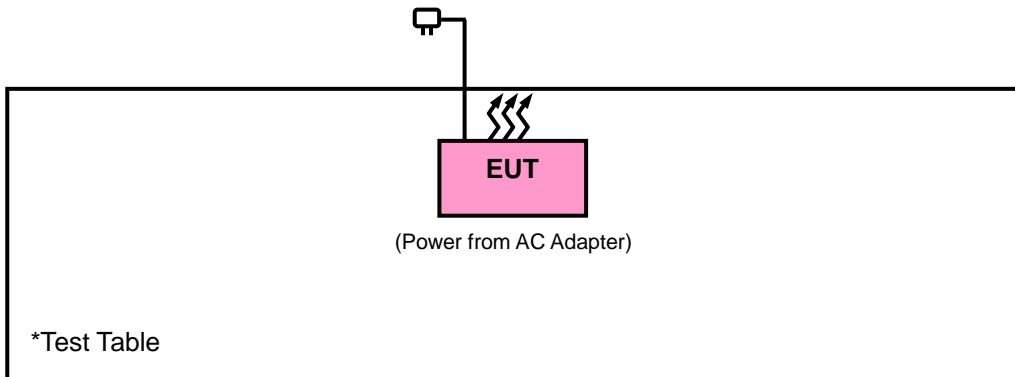
Duty cycle =  $0.383\text{ms}/0.625\text{ms} = 0.613$ , Duty factor =  $10 * \log(1/0.613) = 2.125$



### 3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

#### 3.4.1 Configuration of System under Test



### 3.5 General Description of Applied Standards and References

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

#### Test Standard:

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

ANSI C63.10-2013

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

#### References Test Guidance:

##### KDB 558074 D01 15.247 Meas Guidance v05r02

All test items have been performed as a reference to the above KDB test guidance.

## 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 (dB<sub>uV</sub>/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. 26, 2019	Aug. 25, 2020
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 15, 2019	Apr. 14, 2020
HORN Antenna ETS-Lindgren	3117	00143293	Nov. 24, 2019	Nov. 23, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Nov. 24, 2019	Nov. 23, 2020
BILOG Antenna SCHWARZBECK	VULB 9168	9168-616	Nov. 12, 2019	Nov. 11, 2020
Loop Antenna	EM-6879	269	Sep. 16, 2019	Sep. 15, 2020
Preamplifier Agilent	310N	187226	Jun. 18, 2019	Jun. 17, 2020
Preamplifier Agilent	83017A	MY39501357	Jun. 18, 2019	Jun. 17, 2020
Preamplifier EMCI	EMC 184045	980116	Oct. 08, 2019	Oct. 07, 2020
RF signal cable ETS-LINDGREN	5D-FB	Cable-CH1-01(R FC-SMS-100-SM S-120+RFC-SMS -100-SMS-400)	Jun. 18, 2019	Jun. 17, 2020
RF signal cable ETS-LINDGREN	8D-FB	Cable-CH1-02(R FC-SMS-100-SM S-24)	Jun. 18, 2019	Jun. 17, 2020
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
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.

#### 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:

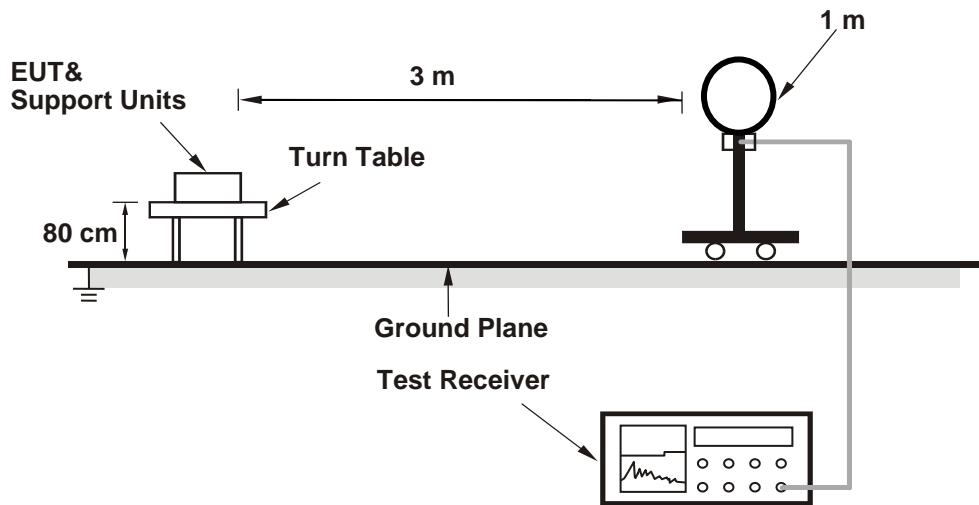
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) 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

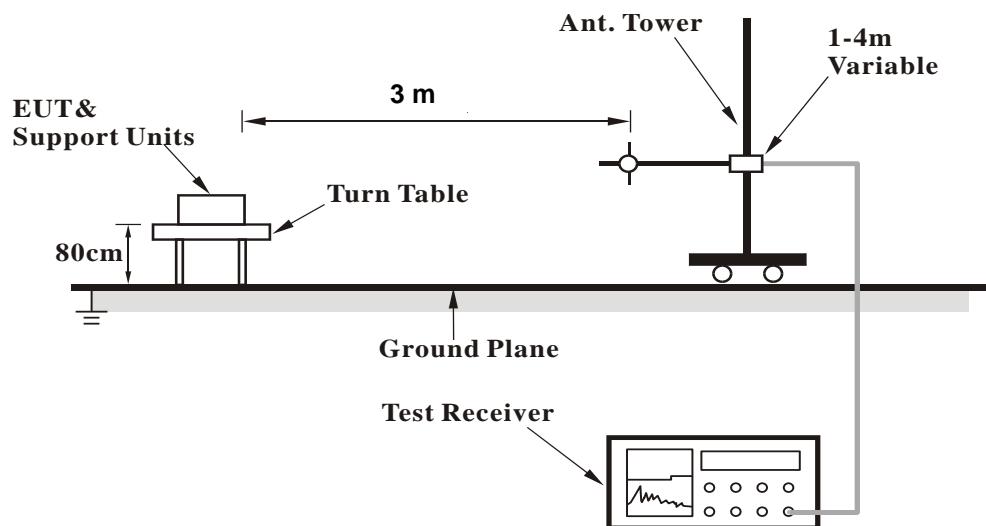
No deviation.

#### 4.1.5 Test Set Up

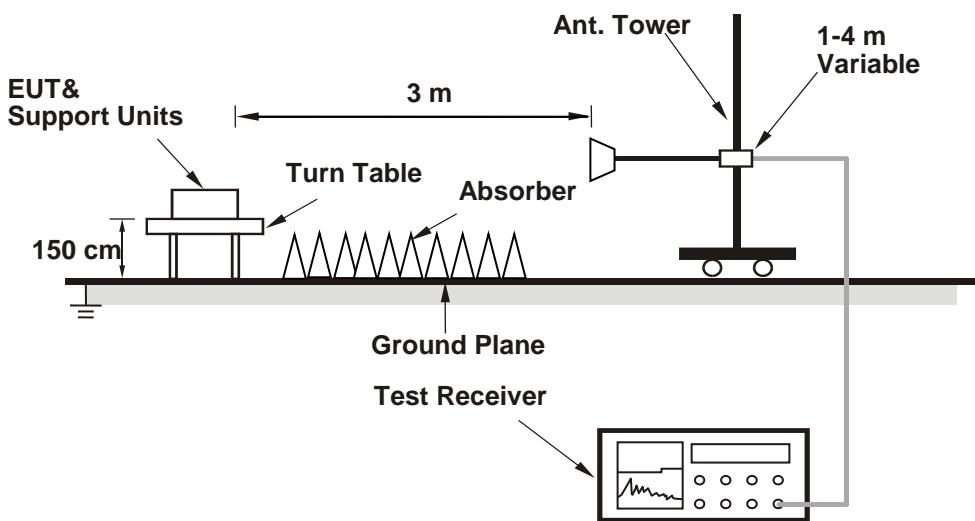
##### <Radiated Emission below 30 MHz>



##### <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:

EUT Test Condition		Measurement Detail			
Channel		Channel 0		Frequency Range	1 GHz ~ 25 GHz
Input Power		120 Vac, 60 Hz		Detector Function	Peak (PK) Average (AV)
Environmental Conditions		25 deg. C, 65 % RH		Tested By	Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	40.73	36.23	4.5	54	-13.27	163	244	Average
2390	51.22	46.72	4.5	74	-22.78	163	244	Peak
*2402	81.96	77.44	4.52			163	244	Average
*2402	82.23	77.71	4.52			163	244	Peak
4804	41.57	31.22	10.35	54	-12.43	157	7	Average
4804	47.52	37.17	10.35	74	-26.48	157	7	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	42.15	37.65	4.5	54	-11.85	321	339	Average
2390	50.93	46.43	4.5	74	-23.07	321	339	Peak
*2402	84	79.48	4.52			321	339	Average
*2402	85.78	81.26	4.52			321	339	Peak
4804	41.8	31.45	10.35	54	-12.2	114	16	Average
4804	47.95	37.6	10.35	74	-26.05	114	16	Peak

##### Remarks:

1. Emission Level = Read Level + Factor  
Margin value = Emission level – Limit value
2. 2402 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.
4. " \* ": Fundamental frequency.

EUT Test Condition		Measurement Detail		
Channel		Frequency Range		1 GHz ~ 25 GHz
Input Power		Detector Function		Peak (PK) Average (AV)
Environmental Conditions		Tested By		Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	41.75	37.25	4.5	54	-12.25	163	244	Average
2390	51.23	46.73	4.5	74	-22.77	163	244	Peak
*2440	80.6	43.55	37.05			163	244	Average
*2440	81.47	44.42	37.05			163	244	Peak
<b>2483.5</b>	<b>42.27</b>	<b>37.61</b>	<b>4.66</b>	<b>54</b>	<b>-11.73</b>	<b>163</b>	<b>244</b>	<b>Average</b>
2483.5	51.45	46.79	4.66	74	-22.55	163	244	Peak
4880	40.86	30.65	10.21	54	-13.14	147	7	Average
4880	46.67	36.46	10.21	74	-27.33	147	7	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	41.81	37.31	4.5	54	-12.19	321	339	Average
2390	50.83	46.33	4.5	74	-23.17	321	339	Peak
*2440	83.07	78.48	4.59			321	339	Average
*2440	84.66	80.07	4.59			321	339	Peak
2483.5	42.22	37.56	4.66	54	-11.78	321	339	Average
2483.5	51.53	46.87	4.66	74	-22.47	321	339	Peak
4880	41.05	30.84	10.21	54	-12.95	187	199	Average
4880	47.72	37.51	10.21	74	-26.28	187	199	Peak

Remarks:

1. Emission Level = Read Level + 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.
4. " \* ": Fundamental frequency.

EUT Test Condition		Measurement Detail		
Channel		Frequency Range		1 GHz ~ 25 GHz
Input Power		Detector Function		Peak (PK) Average (AV)
Environmental Conditions		Tested By		Karl Lee

Antenna Polarity & Test Distance: Horizontal at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*2480	80.77	76.13	4.64			163	244	Average
*2480	81.61	76.97	4.64			163	244	Peak
2483.5	41.25	36.59	4.66	54	-12.75	163	244	Average
2483.5	51.5	46.84	4.66	74	-22.5	163	244	Peak
4960	41.39	31.03	10.36	54	-12.61	165	66	Average
4960	47.24	36.88	10.36	74	-26.76	165	66	Peak
Antenna Polarity & Test Distance: Vertical at 3 m								
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
*2480	83.63	78.99	4.64			321	339	Average
*2480	84.14	79.5	4.64			321	339	Peak
2483.5	42.16	37.5	4.66	54	-11.84	321	339	Average
2483.5	52.04	47.38	4.66	74	-21.96	321	339	Peak
4960	41.48	31.12	10.36	54	-12.52	134	307	Average
4960	47.31	36.95	10.36	74	-26.69	134	307	Peak

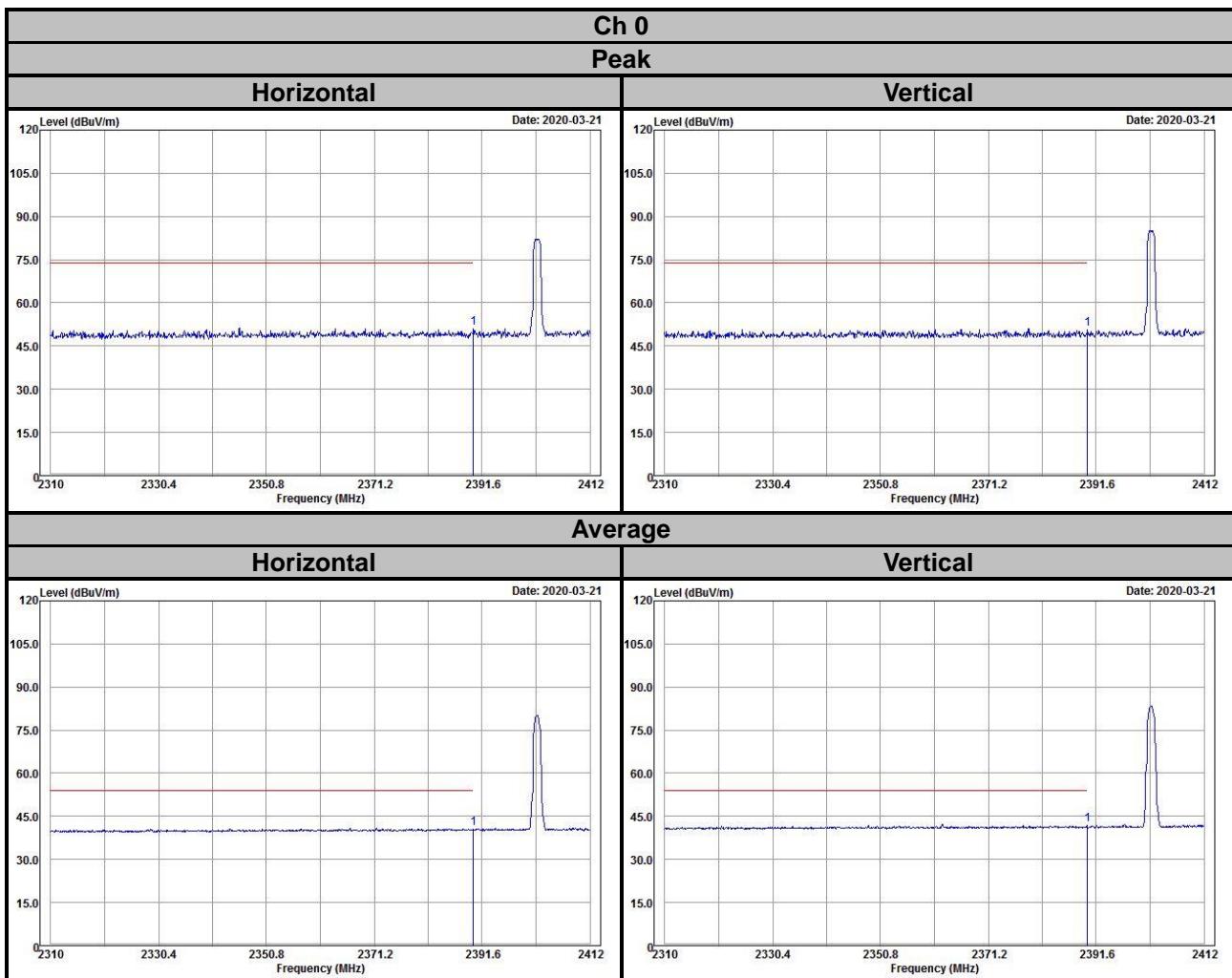
Remarks:

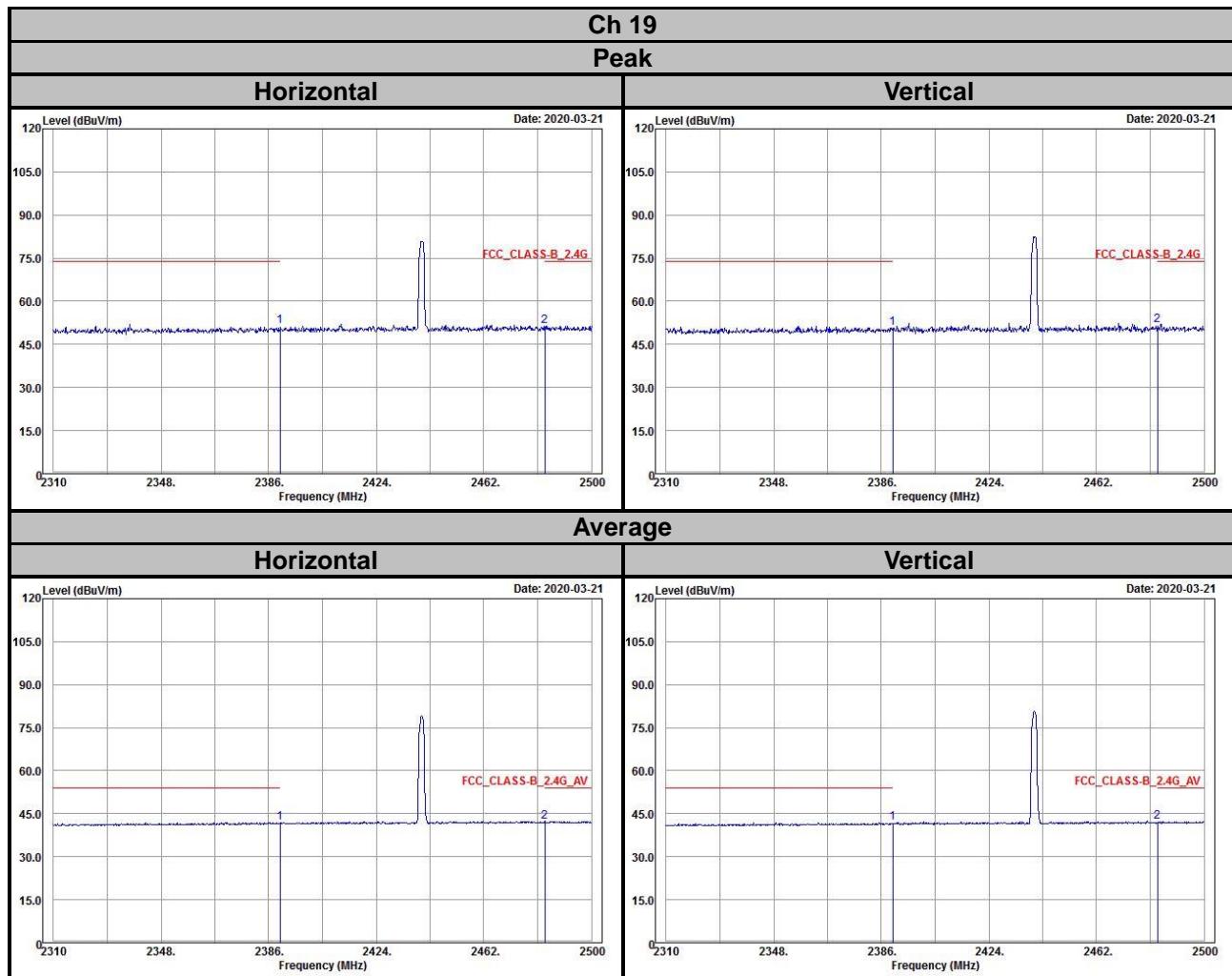
1. Emission Level = Read Level + Factor  
Margin value = Emission level – Limit value
2. 2480 MHz: Fundamental frequency.
3. The emission levels of other frequencies were very low against the limit.
4. " \* ": Fundamental frequency.

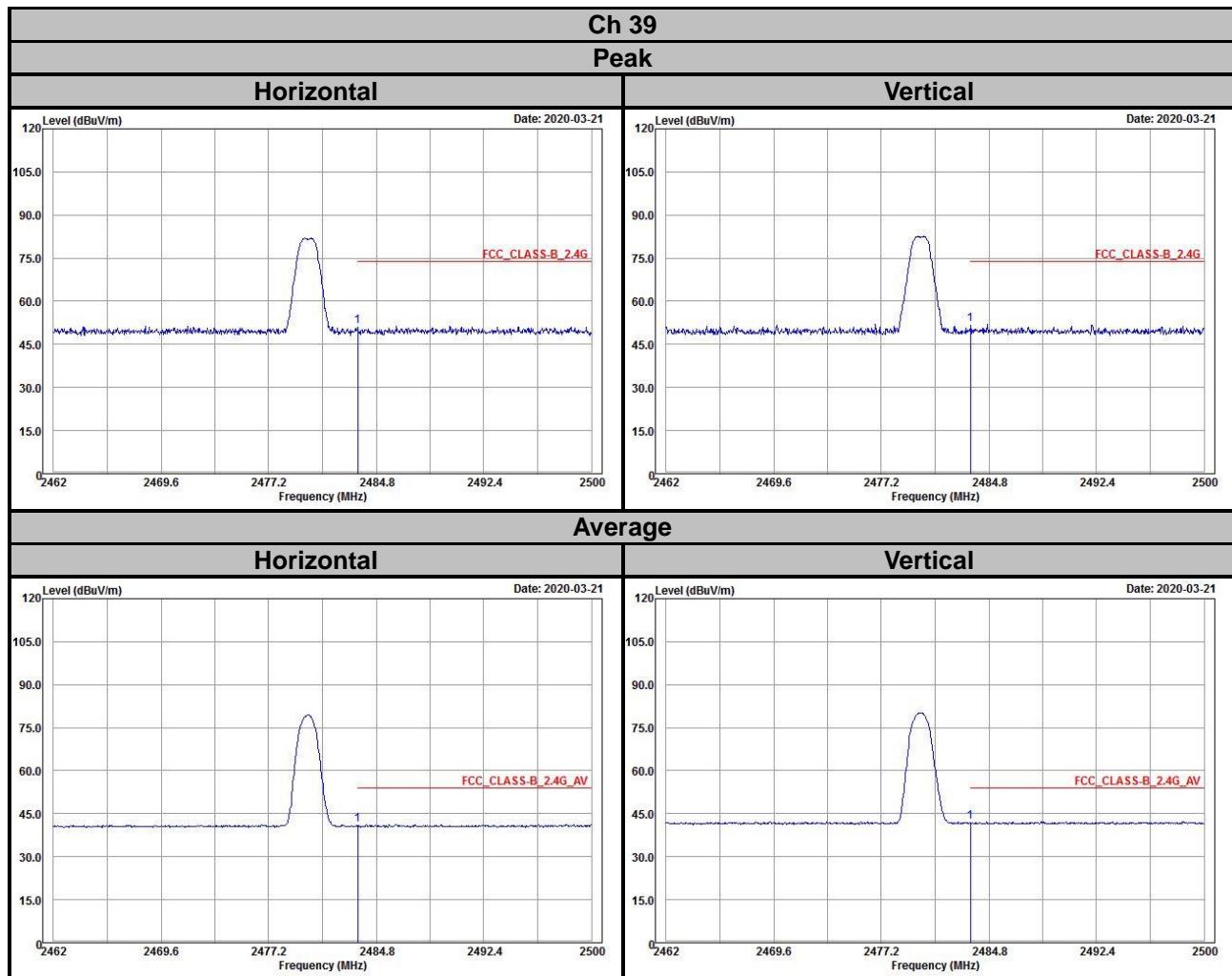
## 5 Pictures of Test Arrangements

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

## Annex A- Band-edge measurement







## Annex B- Conducted Output Power Measurement

For Average Power

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	1.611	2.07
19	2440	1.807	2.57
39	2480	1.832	2.63

## Appendix – Information of 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.

If you have any comments, please feel free to contact us at the following:

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**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

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

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