Partial FCC Test Report

Report No.:	RFBHDI-WTW-P21120081-3
FCC ID:	2ARXKVHE09-4GL
Test Model:	VHE09-4GL, VHH09-4GL
Series Model:	VHE09XXXXX (X=A-Z, 0-9, blank or “-”)
Received Date:	Dec. 24, 2021
Test Date:	Jan. 22 ~ Mar. 28, 2022
Issued Date:	Apr. 22, 2022
Applicant:	Veea Inc
Address:	164 E 83rd Street, New York NY, 10028, USA
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. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number:	788550 / TW0003

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Release Control Record

Issue No.	Description	Date Issued
RFBHDI-WTW-P21120081-3	Original Release	Apr. 22, 2022

1 Certificate of Conformity

Product:	veeaHub
Brand:	veeaHub
Test Model:	VHE09-4GL, VHH09-4GL
Series Model:	VHE09XXXXX (X=A-Z, 0-9, blank or "-")
Sample Status:	Engineering Sample
Applicant:	Veea Inc
Test Date:	Jan. 22 ~ Mar. 28, 2022
Standards:	47 CFR FCC Part 15, Subpart E (Section 15.407) 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 : Lena Wang , **Date:** Apr. 22, 2022

Lena Wang / Specialist

Approved by : Jeremy Lin , **Date:** Apr. 22, 2022

Jeremy Lin / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
FCC Clause	Test Item	Result	Remarks
15.407(b)(9)	AC Power Conducted Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -1.39 dB at 0.48190 MHz.
15.407(b) (1/2/3/4(i/ii)/9)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.31 dB at 4650.15 MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	Pass	Meet the requirement of limit.
---	Occupied Bandwidth Measurement	-	Reference only.
15.407(a)(1/2/3)	Peak Power Spectral Density	N/A	Refer to note 1
15.407(e)	6dB bandwidth	N/A	Refer to note 1
15.407(g)	Frequency Stability	N/A	Refer to note 1
15.203	Antenna Requirement	Pass	No antenna connector is used.

Note:

1. This report is a partial report. Therefore, only AC Power Conducted Emission, Max Average Transmit Power and Radiated Emissions were verified and recorded in this report. Other testing data please refer to the original BV CPS report no.: RF200424C06-1.
2. For U-NII-3 band compliance with rule part 15.407(b)(4)(i), the OOBE test plots were recorded in Annex A.
3. For U-NII-1, U-NII-2A, U-NII-2C band compliance with rule 15.407(b) of the band-edge items, the test plots were recorded in Annex B. Test Procedures refer to report 4.1.3.
4. 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

Product	veeaHub
Brand	veeaHub™
Test Model	VHE09-4GL, VHH09-4GL
Series Model	VHE09XXXXX (X=A-Z, 0-9, blank or “-”)
Model Difference	Marketing purposes
Sample Status	Engineering Sample
Power Supply Rating	48Vdc (Adapter and PoE)
Modulation Type	256QAM, 64QAM, 16QAM, QPSK, BPSK
Modulation Technology	OFDM
Transfer Rate	802.11a: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 600Mbps 802.11ac: up to 3466.7Mbps
Operating Frequency	5180~5240MHz, 5260~5320MHz, 5500~5720MHz, 5745~5825MHz
Number of Channel	5180 ~ 5240MHz: 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80), 802.11ac (VHT80+VHT80) 5260~5320MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 4 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1 5500~5720MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 12 802.11n (HT40), 802.11ac (VHT40): 6 802.11ac (VHT80): 3 5745 ~ 5825MHz: 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80), 802.11ac (VHT80+VHT80)
Output Power	CDD Mode: 5180~5240MHz: 74.496mW Beamforming Mode: 5180~5240MHz: 18.627mW
Antenna Type	Chip antenna with 2.1dBi gain
Antenna Connector	NA
Accessory Device	Adapter
Cable Supplied	NA

Note:

1. This report is issued as a supplementary report to BV CPS report no. RF200424C06-1. The difference compared with original report is adding model name (VHH09-4GL), updating mainboard and changing WWAN Module (EG25-G MINIPCIE).Therefore, only Max Average Transmit Power, AC Power Conducted Emission and Radiated Emissions were verified and recorded in this report. AC Power Conducted Emission and Radiated Emission tests according to original report radiated emission worst channel.

2. Model difference as below

Model	Type	LoRa Module	LTE Module	LED for LTE Status	Power Button	USB 3.0	Console	SD Slot	Power	PCB Design
VHE09-4GL	Indoor	RG-1008M (915MHz)	EC25A	Y	Y	Y	Y(RS-232)	Y	65W DC-48V desktop power adapter	Same design (VHE09/VHE10/VHH10)
VHH09-4GL	Outdoor	RG-1008M (915MHz)	EG25G	N	N	N	Y(M.12)	N	Power adapter or PoE	

3. The EUT incorporates a MIMO function. Physically, the EUT provides 4 completed transmitter and 4 receivers.

Band	Modulation Mode	CDD Mode	Beamforming Mode	TX Function
5GHz	802.11a	Support	Not Support	4TX
	802.11n (HT20)	Support	Support	4TX
	802.11n (HT40)	Support	Support	4TX
	802.11ac (VHT20)	Support	Support	4TX
	802.11ac (VHT40)	Support	Support	4TX
	802.11ac (VHT80)	Support	Support	4TX
	802.11ac (VHT80+VHT80)	Support	Support	2TX+2TX

* The modulation and bandwidth are similar for 802.11n mode for HT20/HT40 and 802.11ac mode for VHT20/VHT40. After pre-testing, 802.11ac (VHT20/VHT40) power is lower than 802.11n (HT20/HT40), therefore 802.11n (HT20/HT40) is the worst case to representative mode in test report. (Final test mode refer section 3.2.1)

4. The EUT uses following adapter and PoE.

Adapter	
Brand	EDAC Power Electronics Co., Ltd.
Model	EA1062SGR-480
Input Power	100-240Vac ~2.5A, 50-60Hz
Output Power	48Vdc / 1.35A
Power Line	1.2m DC cable with one core

PoE (Support unit)	
Model	APOE02-WM
Output Power	48Vdc

5. WLAN, zigbee, Bluetooth and LoRa technology can transmit at same time.

6. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

7. The EUT contains certified WWAN module with FCC ID: 2ATM8EG25G.

8. The EUT will install at outdoor area, the highest antenna gain from the horizon above 30 degrees as below, for more detail information please refer to antenna specification and user manual.

Internal antenna (Chip)	2.1dBi	
Due to device will restricted installation position as above photo, to the maximum antenna gain are chosen		

3.2 Description of Test Modes

5180 ~ 5240MHz:

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80), 802.11ac (VHT80+VHT80):

Channel	Frequency
42	5210MHz

5260~5320MHz:

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
52	5260 MHz	60	5300 MHz
56	5280 MHz	64	5320 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
58	5290 MHz

5500~5720MHz:

12 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
100	5500 MHz	124	5620 MHz
104	5520 MHz	128	5640 MHz
108	5540 MHz	132	5660 MHz
112	5560 MHz	136	5680 MHz
116	5580 MHz	140	5700 MHz
120	5600 MHz	144	5720 MHz

6 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
102	5510 MHz	126	5630 MHz
110	5550 MHz	134	5670 MHz
118	5590 MHz	142	5710 MHz

3 channels are provided for 802.11ac (VHT80):

Channel	Frequency	Channel	Frequency
106	5530 MHz	138	5690 MHz
122	5610 MHz		

5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz		

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80), 802.11ac (VHT80+VHT80):

Channel	Frequency
155	5775MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description
	RE≥1G	RE<1G	ROP	PLC	
A	√	√	√	√	Power from adapter
B	-	√	-	√	Power from PoE

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement RE<1G: Radiated Emission below 1 GHz
ROP: RF Output Power PLC: Power Line Conducted Emission

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

Radiated Emission Test (Above 1GHz):

☒ 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	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
A	802.11n (HT40)	5180-5240	38 to 46	46	OFDM	13.5
	802.11ac (VHT80)	5260-5320	58	58	OFDM	29.3
	802.11ac (VHT80)	5500-5700	106 to 122	106	OFDM	29.3
	802.11ac (VHT80)	5745-5825	155	155	OFDM	29.3
	802.11ac (VHT80 + VHT80)	5180-5240 5745-5825	42 + 155	42 + 155	OFDM	58.5

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	Frequency Band (MHz)	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
A, B	5745-5825	802.11ac (VHT80)	155	155	OFDM	BPSK	29.3

RF Output Power:

☒ 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	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
A	802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0
A	802.11n (HT20)	36 to 48	36, 40, 48	OFDM	BPSK	6.5
A	802.11n (HT40)	38 to 46	38, 46	OFDM	BPSK	13.5
A	802.11n (VHT80)	42	42	OFDM	BPSK	29.3

Power Line Conducted Emission Test:

☒ 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	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
A, B	802.11ac (VHT80)	5745-5825	155	155	OFDM	29.3

Test Condition:

Applicable to	Environmental Conditions	Input Power	Tested by
RE≥1G	21 deg. C, 73% RH	120Vac, 60Hz	Vincent Chen
RE<1G	23 deg. C, 65% RH	120Vac, 60Hz	Vincent Chen
ROP	25 deg. C, 65% RH	120Vac, 60Hz	Vincent Huang
PLC	25 deg. C, 75% RH	120Vac, 60Hz 48Vdc	Vincent Chen

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is ≥ 98 %, duty factor is not required.

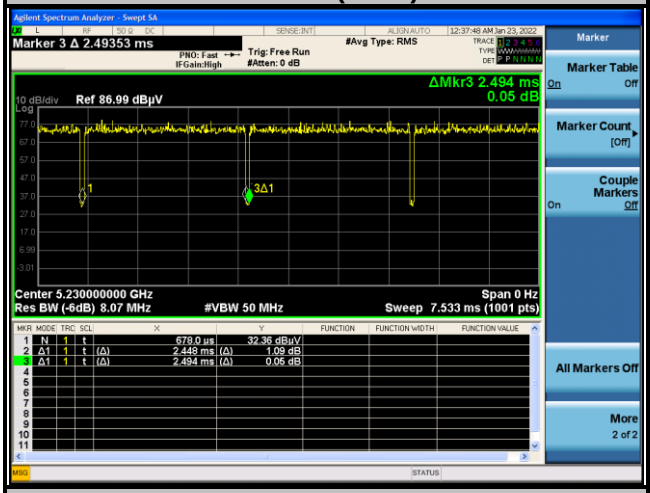
Duty cycle of test signal is < 98 %, duty factor is required.

802.11n (HT40): Duty cycle = 0.2448/0.2494 = 0.982

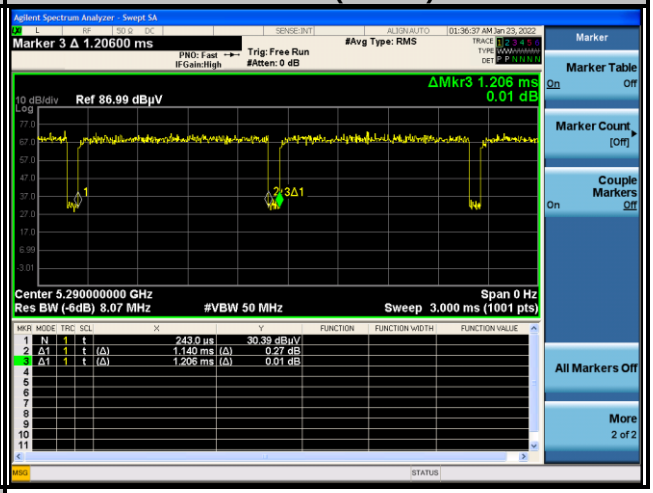
802.11ac (VHT80): Duty cycle = 0.114/0.1206 = 0.945, Duty factor = 10 * log(1/0.945) = 0.246

802.11ac (VHT80 + VHT80): Duty cycle = 0.114/0.1206 = 0.945, Duty factor = 10 * log(1/0.945) = 0.246

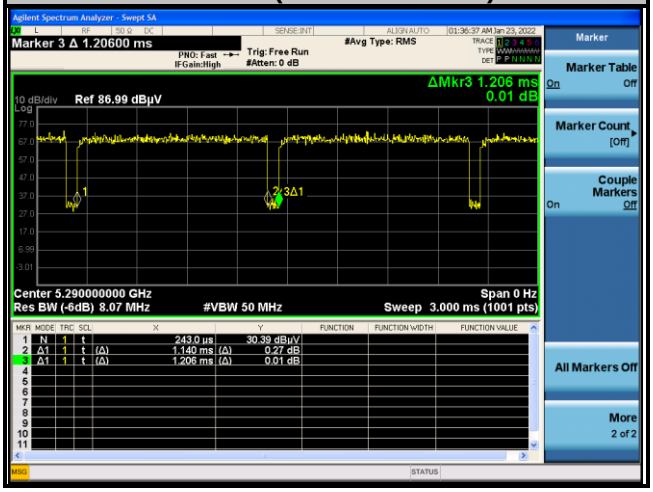
802.11n (HT40)



802.11ac (VHT80)



802.11ac (VHT80 + VHT80)



Note: Channel 42+155 duty cycle same as Channel 58

3.4 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.

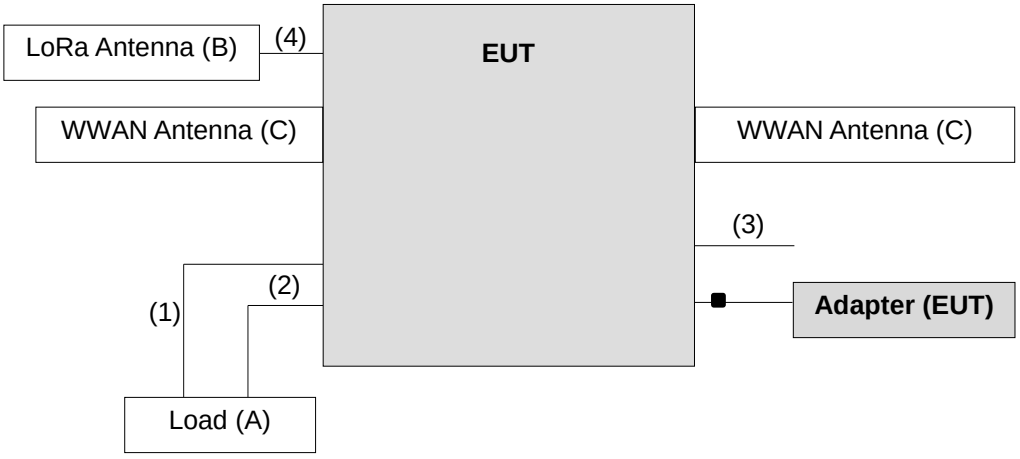
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Load	NA	NA	NA	NA	-
B.	LoRa Antenna	PCTEL	MFB9155NF	NA	NA	Provided by manufacturer
C.	WWAN Antenna	2J	2J2124W -C315N	NA	NA	Provided by manufacturer
D.	PoE	NA	TL-POE16S	4215031002252	NA	-

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

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	LAN cable	1	0.4	N	0	RJ45, Cat5e
2.	LAN cable	1	0.4	N	0	RJ45, Cat5e
3.	RS232 cable	1	0.4	Y	0	-
4.	Coaxial cable	1	1.5	Y	0	-

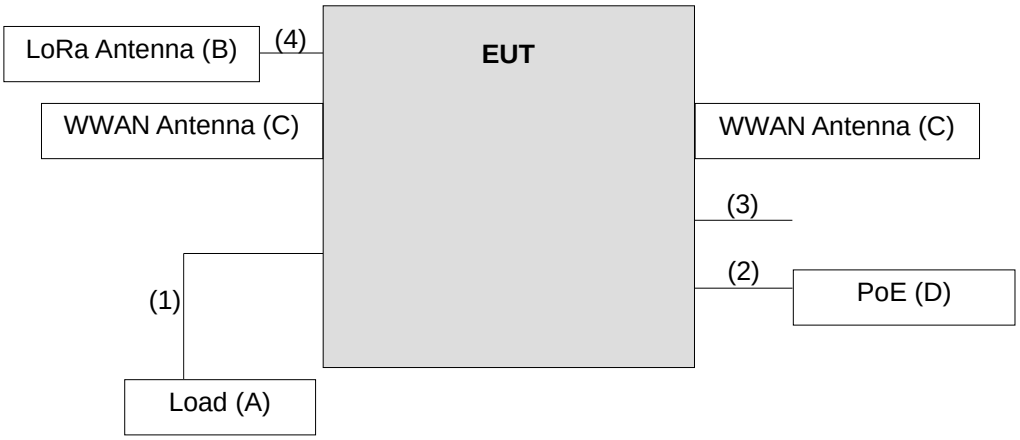
3.4.1 Configuration of System under Test

Adapter Mode



Remote site

PoE Mode



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 E (15.407)
ANSI C63.10:2013

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

References Test Guidance:
KDB 789033 D02 General UNII Test Procedure New Rules v02r01
KDB 662911 D01 Multiple Transmitter Output v02r01

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.

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 1000MHz, 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 20dB under any condition of modulation.

Limits of unwanted emission out of the restricted bands

<table>
<tr><td colspan="3">Applicable To</td><td colspan="2">Limit</td></tr>
<tr><td colspan="3" rowspan="2">789033 D02 General UNII Test Procedure New Rules v02r01</td><td colspan="2">Field Strength at 3m</td></tr>
<tr><td>PK: 74 (dBµV/m)</td><td>AV: 54 (dBµV/m)</td></tr>
<tr><td>Frequency Band</td><td colspan="2">Applicable To</td><td>EIRP Limit</td><td>Equivalent Field Strength at 3m</td></tr>
<tr><td>5150~5250 MHz</td><td colspan="2">15.407(b)(1)</td><td rowspan="3">PK: -27 (dBm/MHz)</td><td rowspan="3">PK: 68.2(dBµV/m)</td></tr>
<tr><td>5250~5350 MHz</td><td colspan="2">15.407(b)(2)</td></tr>
<tr><td>5470~5725 MHz</td><td colspan="2">15.407(b)(3)</td></tr>
<tr><td rowspan="2">5725~5850 MHz</td><td>☒</td><td>15.407(b)(4)(i)</td><td>PK: -27 (dBm/MHz) *1
PK: 10 (dBm/MHz) *2
PK: 15.6 (dBm/MHz) *3
PK: 27 (dBm/MHz) *4</td><td>PK: 68.2(dBµV/m) *1
PK: 105.2 (dBµV/m) *2
PK: 110.8(dBµV/m) *3
PK: 122.2 (dBµV/m) *4</td></tr>
<tr><td>☐</td><td>15.407(b)(4)(ii)</td><td colspan="2">Emission limits in section 15.247(d)</td></tr>
<tr><td colspan="5">*1 beyond 75 MHz or more above of the band edge.
*2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.
*3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.
*4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.</td></tr>
</table>

Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer Agilent	N9010A	MY52220207	Jan. 06, 2022	Jan. 05, 2023
Test Receiver Agilent	N9038A	MY51210203	Sep. 22, 2021	Sep. 21, 2022
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Apr. 12, 2021	Apr. 11, 2022
Broadband Horn Antenna SCHWARZBECK	BBHA 9170	148	Oct. 19, 2021	Oct. 18, 2022
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-969	Nov. 14, 2021	Nov. 13, 2022
BILOG Antenna SCHWARZBECK	VULB 9168	9168-472	Oct. 28, 2021	Oct. 27, 2022
Fixed Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	Apr. 13, 2021	Apr. 12, 2022
Preamplifier EMCI	EMC 012645	980115	Oct. 05, 2021	Oct. 04, 2022
Preamplifier EMCI	EMC 184045	980116	Oct. 05, 2021	Oct. 04, 2022
Preamplifier EMCI	EMC 330H	980112	Oct. 05, 2021	Oct. 04, 2022
RF Coaxial Cable EMCI	EMC104-SM-SM-8000	171005	Oct. 05, 2021	Oct. 04, 2022
RF Coaxial Cable HUBER+SUHNNER	SUCOFLEX 104	EMC104-SM-SM-1000(140807)	Oct. 05, 2021	Oct. 04, 2022
RF Coaxial Cable WOKEN	8D-FB	Cable-Ch10-01	Oct. 05, 2021	Oct. 04, 2022
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	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 / 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 10.

4.1.3 Test Procedures

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) 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 detect 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 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
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 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.

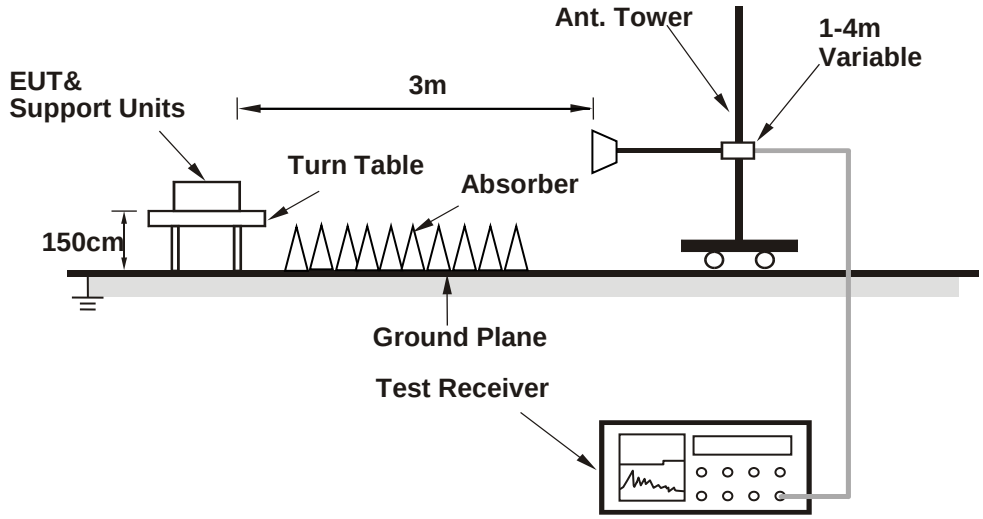
   (11n (HT40): RBW = 1 MHz, VBW = 5 kHz ; 11ac (VHT80), 11ac (VHT80 + VHT80): RBW = 1 MHz, VBW = 10 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

No deviation.

4.1.5 Test Set Up

For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

a. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz data:

RF Mode	TX 802.11n (HT40)	Channel	CH 46：5230 MHz
Frequency Range	1GHz ~ 40GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	54.71 PK	74.00	-19.29	2.17 H	273	71.43	-16.72
2	5150.00	43.46 AV	54.00	-10.54	2.17 H	273	60.18	-16.72
3	*5230.00	114.47 PK			2.17 H	273	78.18	36.29
4	*5230.00	106.01 AV			2.17 H	273	69.72	36.29
5	5350.00	50.43 PK	74.00	-23.57	2.17 H	273	66.96	-16.53
6	5350.00	39.67 AV	54.00	-14.33	2.17 H	273	56.20	-16.53
7	#10460.00	53.36 PK	68.20	-14.84	1.93 H	141	57.28	-3.92
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	53.13 PK	74.00	-20.87	3.84 V	185	69.85	-16.72
2	5150.00	42.89 AV	54.00	-11.11	3.84 V	185	59.61	-16.72
3	*5230.00	112.66 PK			3.84 V	185	76.37	36.29
4	*5230.00	105.06 AV			3.84 V	185	68.77	36.29
5	5350.00	50.42 PK	74.00	-23.58	3.84 V	185	66.95	-16.53
6	5350.00	39.63 AV	54.00	-14.37	3.84 V	185	56.16	-16.53
7	#10460.00	53.20 PK	68.20	-15.00	1.39 V	228	57.12	-3.92

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

RF Mode	TX 802.11ac (VHT80)	Channel	CH 58：5290 MHz
Frequency Range	1GHz ~ 40GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5290.00	101.01 PK			2.02 H	262	64.88	36.13
2	*5290.00	93.03 AV			2.02 H	262	56.90	36.13
3	5350.00	60.90 PK	74.00	-13.10	2.02 H	262	77.43	-16.53
4	5350.00	50.16 AV	54.00	-3.84	2.02 H	262	66.69	-16.53
5	#10580.00	54.50 PK	68.20	-13.70	1.65 H	232	58.30	-3.80
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5290.00	96.83 PK			1.94 V	232	60.70	36.13
2	*5290.00	89.29 AV			1.94 V	232	53.16	36.13
3	5350.00	57.25 PK	74.00	-16.75	1.94 V	232	73.78	-16.53
4	5350.00	47.36 AV	54.00	-6.64	1.94 V	232	63.89	-16.53
5	#10580.00	53.60 PK	68.20	-14.60	2.32 V	141	57.40	-3.80

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

RF Mode	TX 802.11ac (VHT80)	Channel	CH 106：5530 MHz
Frequency Range	1GHz ~ 40GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5460.00	58.64 PK	74.00	-15.36	1.97 H	274	74.75	-16.11
2	5460.00	48.16 AV	54.00	-5.84	1.97 H	274	64.27	-16.11
3	#5470.00	59.73 PK	68.20	-8.47	1.97 H	274	75.84	-16.11
4	*5530.00	101.39 PK			1.97 H	274	64.77	36.62
5	*5530.00	93.51 AV			1.97 H	274	56.89	36.62
6	11060.00	54.80 PK	74.00	-19.20	3.23 H	41	58.39	-3.59
7	11060.00	44.70 AV	54.00	-9.30	3.23 H	41	48.29	-3.59
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5460.00	58.07 PK	74.00	-15.93	2.01 V	219	74.18	-16.11
2	5460.00	48.16 AV	54.00	-5.84	2.01 V	219	64.27	-16.11
3	#5470.00	59.32 PK	68.20	-8.88	2.01 V	219	75.43	-16.11
4	*5530.00	101.15 PK			2.01 V	219	64.53	36.62
5	*5530.00	92.10 AV			2.01 V	219	55.48	36.62
6	11060.00	54.00 PK	74.00	-20.00	1.32 V	287	57.59	-3.59
7	11060.00	43.70 AV	54.00	-10.30	1.32 V	287	47.29	-3.59

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

RF Mode	TX 802.11ac (VHT80)	Channel	CH 155：5775 MHz
Frequency Range	1GHz ~ 40GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5649.60	57.30 PK	68.20	-10.90	2.00 H	289	73.12	-15.82
2	*5775.00	107.36 PK			2.00 H	289	70.37	36.99
3	*5775.00	99.61 AV			2.00 H	289	62.62	36.99
4	#5932.00	54.31 PK	68.20	-13.89	2.00 H	289	69.76	-15.45
5	11550.00	54.55 PK	74.00	-19.45	1.09 H	337	57.31	-2.76
6	11550.00	43.49 AV	54.00	-10.51	1.09 H	337	46.25	-2.76
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5640.40	52.09 PK	68.20	-16.11	2.40 V	228	67.97	-15.88
2	*5775.00	106.04 PK			2.40 V	228	69.05	36.99
3	*5775.00	98.26 AV			2.40 V	228	61.27	36.99
4	#5935.20	51.36 PK	68.20	-16.84	2.40 V	228	66.82	-15.46
5	11550.00	54.27 PK	74.00	-19.73	1.63 V	274	57.03	-2.76
6	11550.00	43.47 AV	54.00	-10.53	1.63 V	274	46.23	-2.76

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

RF Mode	TX 802.11ac (VHT80+80)	Channel	CH 42+155：5775 MHz
Frequency Range	1GHz ~ 40GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4650.15	63.02 PK	74.00	-10.98	2.16 H	285	80.83	-17.81
2	**4650.15**	**53.69 AV**	**54.00**	**-0.31**	**2.16 H**	**285**	**71.50**	**-17.81**
3	5150.00	61.17 PK	74.00	-12.83	2.16 H	285	77.89	-16.72
4	5150.00	51.72 AV	54.00	-2.28	2.16 H	285	68.44	-16.72
5	*5210.00	97.60 PK			2.16 H	285	61.28	36.32
6	*5210.00	90.73 AV			2.16 H	285	54.41	36.32
7	#5648.80	60.19 PK	68.20	-8.01	2.21 H	179	76.02	-15.83
8	*5775.00	108.35 PK			2.21 H	179	71.36	36.99
9	*5775.00	100.57 AV			2.21 H	179	63.58	36.99
10	#5929.20	57.73 PK	68.20	-10.47	2.21 H	179	73.17	-15.44
11	#10420.00	54.47 PK	68.20	-13.73	2.32 H	145	58.40	-3.93
12	11550.00	55.84 PK	74.00	-18.16	2.32 H	145	58.60	-2.76
13	11550.00	45.94 AV	54.00	-8.06	2.32 H	145	48.70	-2.76
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5150.00	61.81 PK	74.00	-12.19	2.32 V	232	78.53	-16.72
2	5150.00	50.22 AV	54.00	-3.78	2.32 V	232	66.94	-16.72
3	*5210.00	99.81 PK			2.32 V	232	63.49	36.32
4	*5210.00	90.97 AV			2.32 V	232	54.65	36.32
5	#5636.40	51.77 PK	68.20	-16.43	3.22 V	205	67.67	-15.90
6	*5775.00	104.05 PK			3.22 V	205	67.06	36.99
7	*5775.00	94.84 AV			3.22 V	205	57.85	36.99
8	#5934.80	50.41 PK	68.20	-17.79	3.22 V	205	65.87	-15.46
9	#10420.00	53.47 PK	68.20	-14.73	2.32 V	154	57.40	-3.93
10	11550.00	54.74 PK	74.00	-19.26	1.54 V	232	57.50	-2.76
11	11550.00	44.84 AV	54.00	-9.16	1.54 V	232	47.60	-2.76

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

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

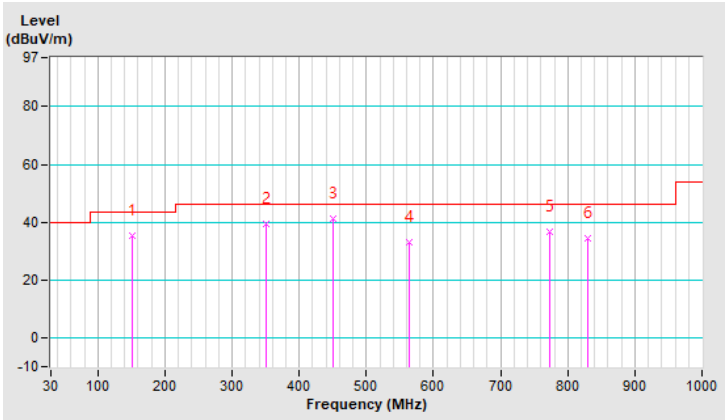
802.11ac (VHT80)

RF Mode	TX 802.11ac (VHT80)	Channel	CH 155：5775 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	150.28	35.46 QP	43.50	-8.04	1.78 H	198	47.60	-12.14
2	350.10	39.35 QP	46.00	-6.65	2.06 H	214	49.69	-10.34
3	450.01	41.22 QP	46.00	-4.78	1.77 H	152	48.61	-7.39
4	564.47	32.85 QP	46.00	-13.15	2.39 H	279	37.75	-4.90
5	773.02	36.65 QP	46.00	-9.35	3.30 H	166	36.75	-0.10
6	830.25	34.28 QP	46.00	-11.72	1.41 H	70	33.36	0.92

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

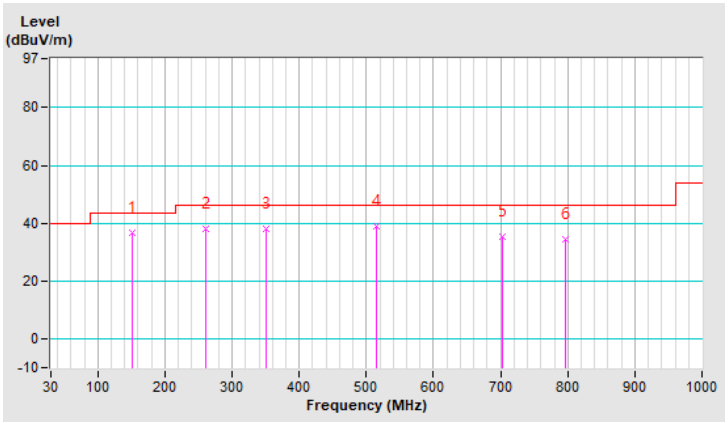


RF Mode	TX 802.11ac (VHT80)	Channel	CH 155：5775 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	150.28	36.76 QP	43.50	-6.74	1.96 V	200	48.90	-12.14
2	259.89	37.97 QP	46.00	-8.03	2.23 V	66	52.18	-14.21
3	350.10	38.20 QP	46.00	-7.80	1.47 V	213	48.54	-10.34
4	514.03	39.07 QP	46.00	-6.93	1.35 V	106	44.92	-5.85
5	702.21	35.26 QP	46.00	-10.74	2.08 V	271	37.12	-1.86
6	797.27	34.51 QP	46.00	-11.49	1.23 V	267	34.27	0.24

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



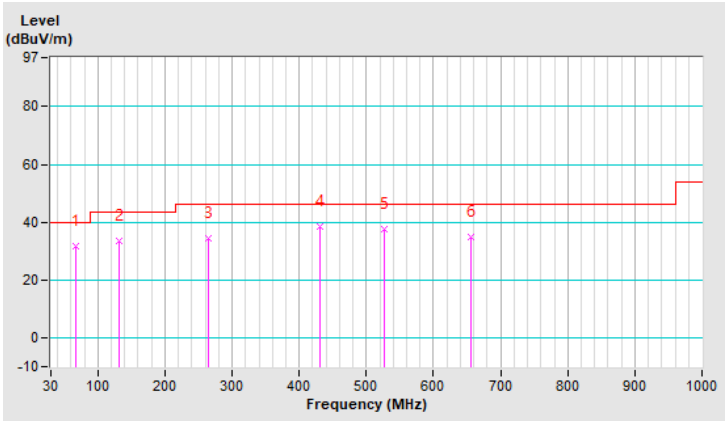
Mode B

RF Mode	TX 802.11ac (VHT80)	Channel	CH 155：5775 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	66.86	31.88 QP	40.00	-8.12	1.15 H	254	46.13	-14.25
2	131.85	33.56 QP	43.50	-9.94	1.61 H	266	46.81	-13.25
3	263.77	34.59 QP	46.00	-11.41	2.61 H	57	48.51	-13.92
4	431.58	38.53 QP	46.00	-7.47	2.75 H	269	46.54	-8.01
5	527.61	37.66 QP	46.00	-8.34	3.07 H	116	43.31	-5.65
6	655.65	34.89 QP	46.00	-11.11	1.06 H	60	37.42	-2.53

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

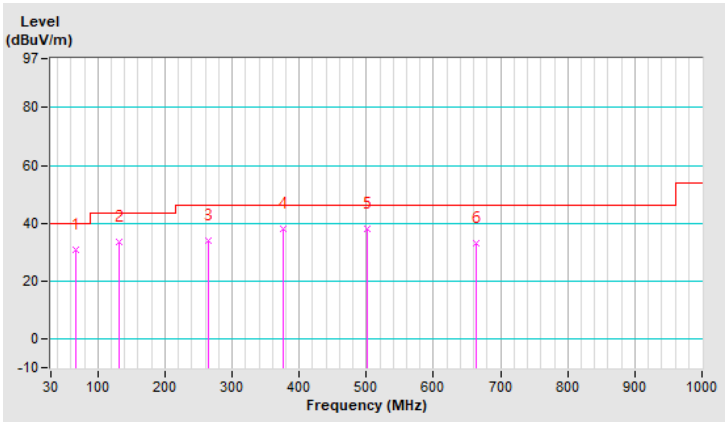


RF Mode	TX 802.11ac (VHT80)	Channel	CH 155：5775 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	66.86	31.03 QP	40.00	-8.97	3.13 V	234	45.28	-14.25
2	131.85	33.36 QP	43.50	-10.14	1.05 V	200	46.61	-13.25
3	263.77	33.87 QP	46.00	-12.13	2.90 V	72	47.79	-13.92
4	375.32	37.96 QP	46.00	-8.04	2.42 V	156	47.63	-9.67
5	500.45	38.15 QP	46.00	-7.85	2.02 V	118	44.23	-6.08
6	664.38	33.07 QP	46.00	-12.93	2.78 V	311	35.37	-2.30

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 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.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESR3	102783	Dec. 20, 2021	Dec. 19, 2022
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Sep. 04, 2021	Sep. 03, 2022
LISN/AMN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Feb. 17, 2022	Feb. 16, 2023
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Sep. 17, 2021	Sep. 16, 2022
Software ADT	BV ADT_Cond_ V7.3.7.4	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 HwaYa Shielded Room 2 (Conduction 2).
3. The VCCI Site Registration No. is C-12047.

4.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

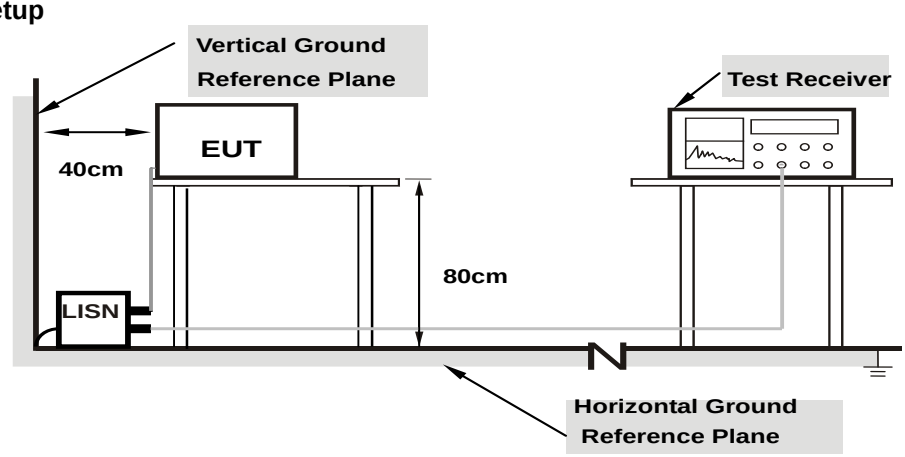
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

4.2.7 Test Results

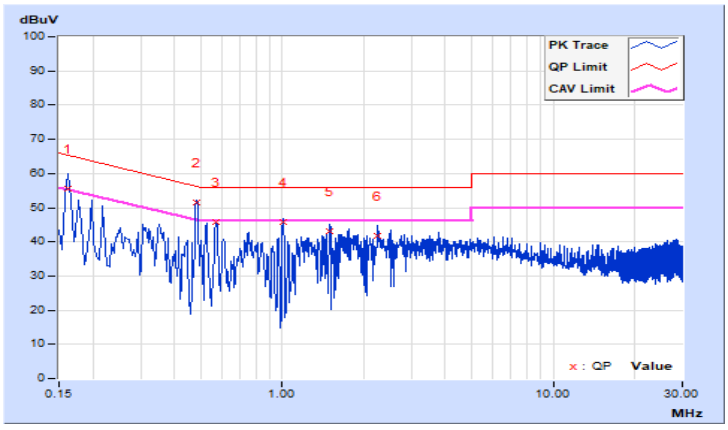
Mode A

Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	**Environmental Conditions**	25 °C, 75% RH
Tested by	Vincent Chen	**Test Date**	2022/3/28

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.16200	10.14	45.26	33.06	55.40	43.20	65.36	55.36	-9.96	-12.16
2	**0.48190**	**10.25**	**41.23**	**34.67**	**51.48**	**44.92**	**56.31**	**46.31**	**-4.83**	**-1.39**
3	0.56890	10.26	35.66	33.99	45.92	44.25	56.00	46.00	-10.08	-1.75
4	1.00600	10.30	35.48	30.98	45.78	41.28	56.00	46.00	-10.22	-4.72
5	1.50200	10.34	32.80	27.93	43.14	38.27	56.00	46.00	-12.86	-7.73
6	2.25400	10.37	31.36	27.12	41.73	37.49	56.00	46.00	-14.27	-8.51

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

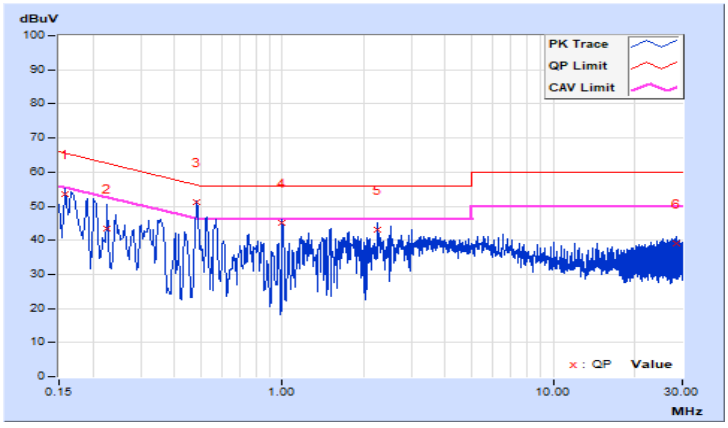


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	**Environmental Conditions**	25 °C, 75% RH
Tested by	Vincent Chen	**Test Date**	2022/3/28

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15800	10.15	43.23	30.58	53.38	40.73	65.57	55.57	-12.19	-14.84
2	0.22600	10.20	33.15	19.93	43.35	30.13	62.60	52.60	-19.25	-22.47
3	0.48200	10.27	41.07	34.22	51.34	44.49	56.30	46.30	-4.96	-1.81
4	1.00200	10.31	34.64	31.81	44.95	42.12	56.00	46.00	-11.05	-3.88
5	2.25800	10.37	32.58	29.18	42.95	39.55	56.00	46.00	-13.05	-6.45
6	28.33800	10.50	28.66	27.24	39.16	37.74	60.00	50.00	-20.84	-12.26

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



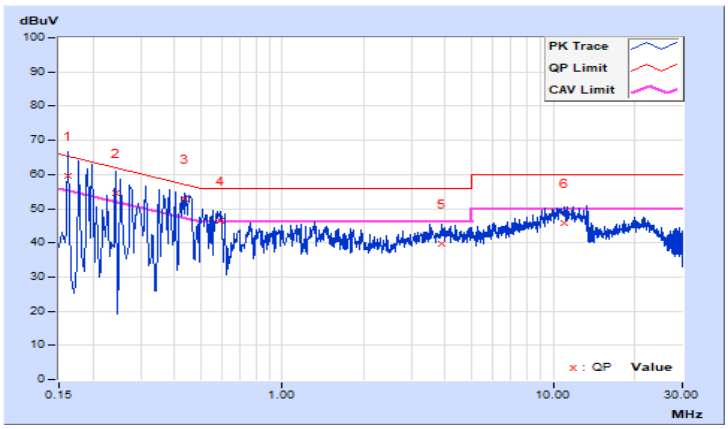
Mode B

Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	48Vdc	**Environmental Conditions**	25 °C, 75% RH
Tested by	Vincent Chen	**Test Date**	2022/3/28

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.16200	10.13	49.61	20.95	59.74	31.08	65.36	55.36	-5.62	-24.28
2	0.24200	10.14	44.33	17.79	54.47	27.93	62.03	52.03	-7.56	-24.10
3	0.43800	10.16	42.66	32.49	52.82	42.65	57.10	47.10	-4.28	-4.45
4	0.59000	10.17	36.42	25.10	46.59	35.27	56.00	46.00	-9.41	-10.73
5	3.88200	10.25	29.36	21.41	39.61	31.66	56.00	46.00	-16.39	-14.34
6	10.97800	10.30	35.35	28.95	45.65	39.25	60.00	50.00	-14.35	-10.75

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

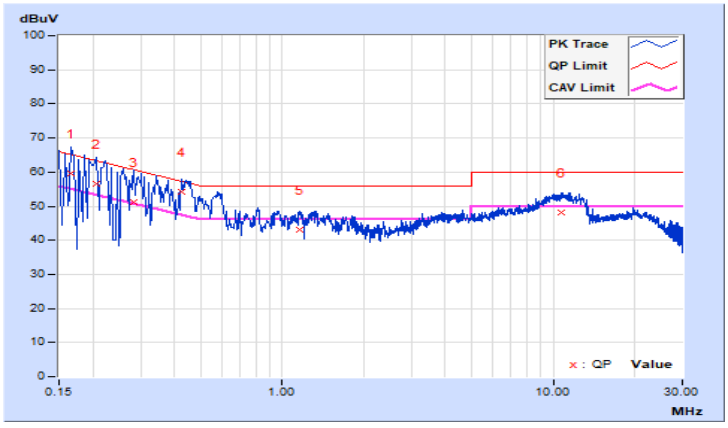


Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	48Vdc	**Environmental Conditions**	25 °C, 75% RH
Tested by	Vincent Chen	**Test Date**	2022/3/28

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.16600	10.14	49.31	19.58	59.45	29.72	65.16	55.16	-5.71	-25.44
2	0.20577	10.15	46.37	18.44	56.52	28.59	63.37	53.37	-6.85	-24.78
3	0.28200	10.16	41.02	23.83	51.18	33.99	60.76	50.76	-9.58	-16.77
4	0.42600	10.17	44.03	27.62	54.20	37.79	57.33	47.33	-3.13	-9.54
5	1.15400	10.20	33.00	21.68	43.20	31.88	56.00	46.00	-12.80	-14.12
6	10.77000	10.36	37.66	30.52	48.02	40.88	60.00	50.00	-11.98	-9.12

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



4.3 Transmit Power Measurement

4.3.1 Limits of Transmit Power Measurement

Operation Band	EUT Category		LIMIT
U-NII-1	√	Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p ≦ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
		Fixed point-to-point Access Point	1 Watt (30 dBm)
		Indoor Access Point	1 Watt (30 dBm)
		Mobile and Portable client device	250mW (24 dBm)
U-NII-2A			250mW (24 dBm) or 11 dBm+10 log B*
U-NII-2C			250mW (24 dBm) or 11 dBm+10 log B*
U-NII-3			1 Watt (30 dBm)

*B is the 26 dB emission bandwidth in megahertz

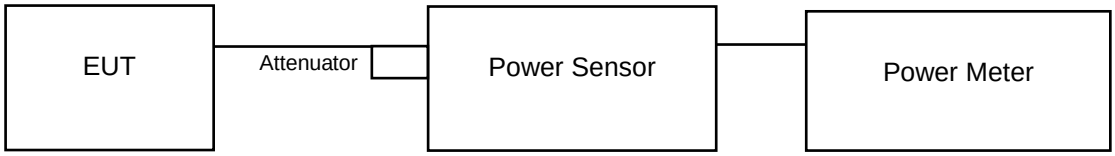
Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

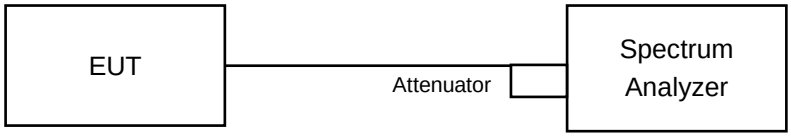
For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

4.3.2 Test Setup

For Power Output
802.11a, 802.11n (HT20), 802.11n (HT40)



802.11ac (VHT80), 802.11ac (VHT80+VHT80)



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

For Average Power Measurement

For 802.11a, 802.11n (HT20), 802.11n (HT40)

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

For 802.11ac (VHT80), 802.11ac (VHT80+VHT80)

a. Set span to encompass the entire 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
b. Set sweep trigger to “free run”.
c. Set RBW = 1 MHz
d. Set VBW ≥ 3 MHz
e. Number of points in sweep ≥ 2 Span / RBW
f. Sweep time ≤ (number of points in sweep) * T
g. Using emission bandwidth to determine the frequency span for integration the channel bandwidth.
h. Detector = RMS
i. Trace mode = max hold
j. Allow max hold to run for at least 60 seconds, or longer as needed to allow the trace to stabilize.
k. Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

Power Output:

CDD Mode

802.11a

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Ant Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3							
36	5180	12.33	13.07	12.28	12.71	72.945	18.63	30.00	2.1	20.73	21.00	Pass
40	5200	12.52	13.15	12.30	12.64	73.866	18.68	30.00	2.1	20.78	21.00	Pass
48	5240	12.61	12.75	12.03	12.24	69.784	18.44	30.00	2.1	20.54	21.00	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Ant Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3							
36	5180	12.21	12.91	12.82	12.80	74.375	18.71	30.00	2.1	20.81	21.00	Pass
40	5200	12.36	13.08	12.56	12.77	**74.496**	**18.72**	30.00	2.1	20.82	21.00	Pass
48	5240	12.62	12.71	12.58	12.65	73.466	18.66	30.00	2.1	20.76	21.00	Pass

802.11n (HT40)

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Ant Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3							
38	5190	12.45	13.08	12.06	12.58	72.086	18.58	30.00	2.1	20.68	21.00	Pass
46	5230	12.65	13.01	11.96	12.74	72.903	18.63	30.00	2.1	20.73	21.00	Pass

802.11ac (VHT80)

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Ant Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3							
42	5210	12.43	13.09	12.14	12.59	72.392	18.60	30.00	2.1	20.70	21.00	Pass

Beamforming Mode

802.11n (HT20)

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Ant Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3							
36	5180	6.19	6.89	6.80	6.78	18.596	12.69	27.88	8.12	20.81	21.00	Pass
40	5200	6.34	7.06	6.54	6.75	**18.627**	**12.70**	27..88	8.12	20.82	21.00	Pass
48	5240	6.60	6.69	6.56	6.63	18.369	12.64	27..88	8.12	20.76	21.00	Pass

Note:

1. Antenna gain = 2.1dBi + 10log(4)=8.12dBi>6, so the limit shall be reduced to 30-(8.12-6) = 27.88dBm
2. EIRP = conducted power + Directional gain

802.11n (HT40)

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Ant Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3							
38	5190	6.43	7.06	6.04	6.56	18.024	12.56	27..88	8.12	20.68	21.00	Pass
46	5230	6.63	6.99	5.94	6.72	18.228	12.61	27..88	8.12	20.73	21.00	Pass

Note:

1. Antenna gain = 2.1dBi + 10log(4)=8.12dBi>6, so the limit shall be reduced to 30-(8.12-6) = 27.88dBm
2. EIRP = conducted power + Directional gain

802.11ac (VHT80)

Channel	Frequency (MHz)	Maximum Conducted Power (dBm)				Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Ant Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2	Chain 3							
42	5210	6.41	7.07	6.12	6.57	18.101	12.58	27..88	8.12	20.7	21.00	Pass

Note:

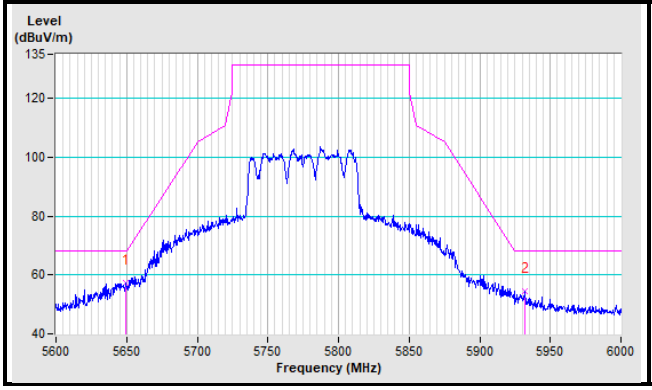
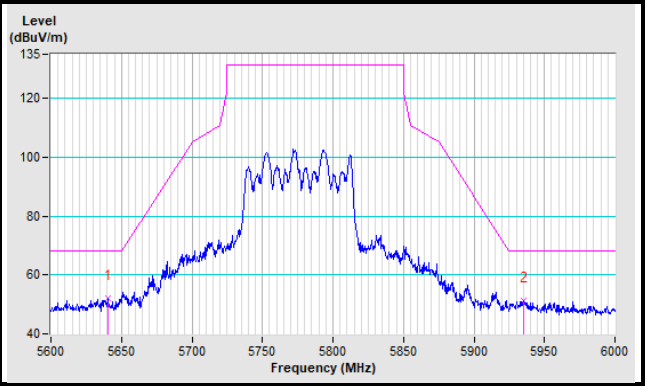
1. Antenna gain = 2.1dBi + 10log(4)=8.12dBi>6, so the limit shall be reduced to 30-(8.12-6) = 27.88dBm
2. EIRP = conducted power + Directional gain

5 Pictures of Test Arrangements

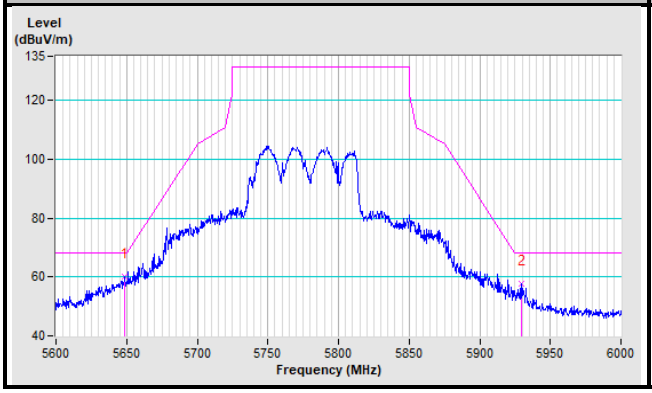
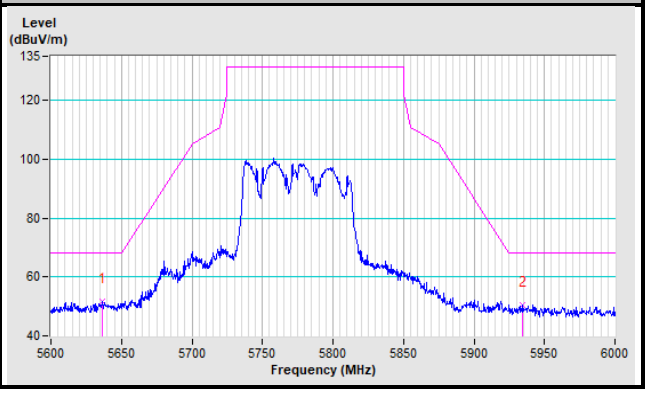
Please refer to the attached file (Test Setup Photo).

Annex A- Radiated Out of Band Emission (OOBE) Measurement (For U-NII-3 band)

802.11ac (VHT80)

Ch 155	
Horizontal	Vertical
	

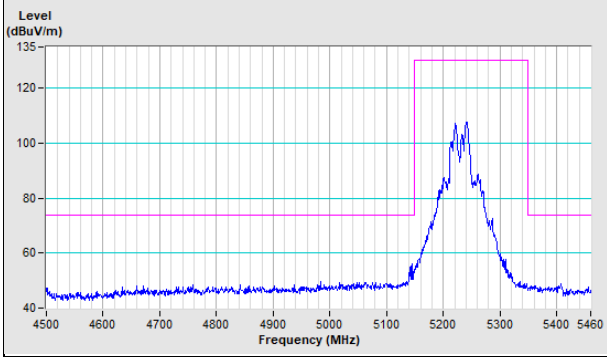
802.11ac (VHT80 + VHT80)

Ch 42 + 155	
Horizontal	Vertical
	

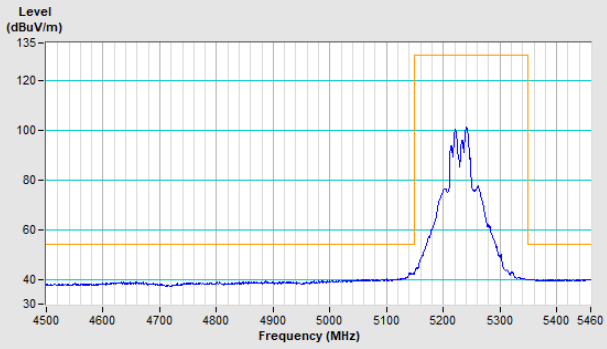
Annex B- Band Edge Measurement

802.11n (HT40) Channel 46

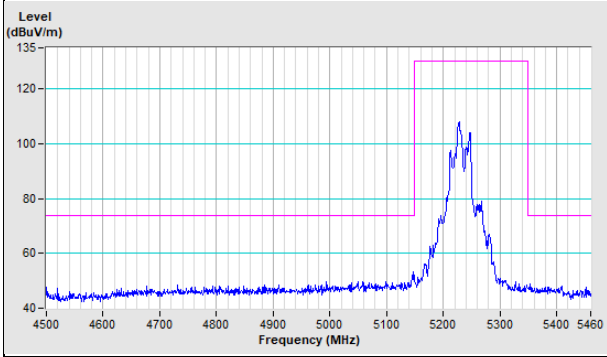
Horizontal (Peak)



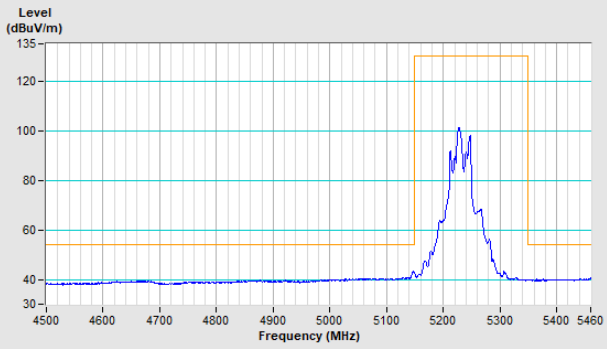
Horizontal (Average)



Vertical (Peak)

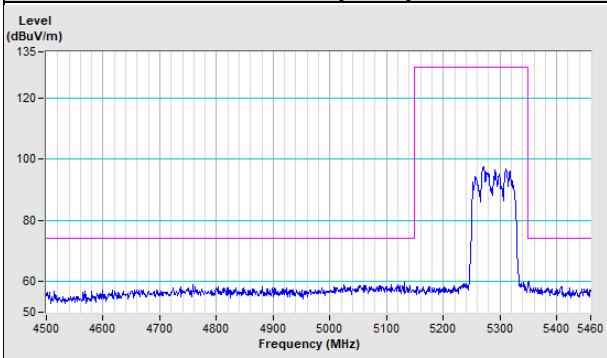


Vertical (Average)

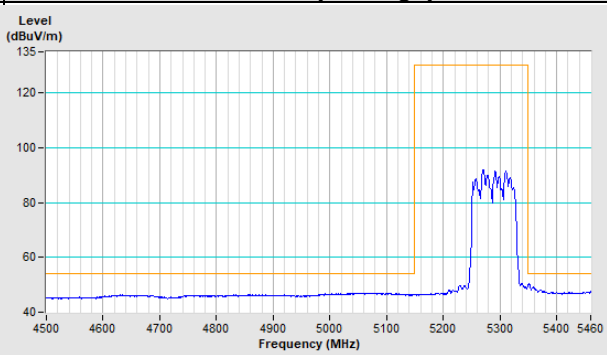


802.11ac (VHT80) Channel 58

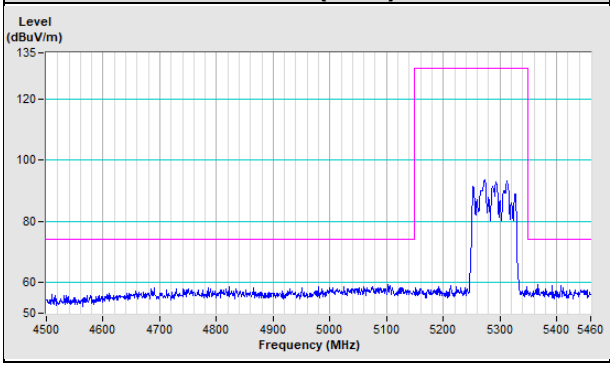
Horizontal (Peak)



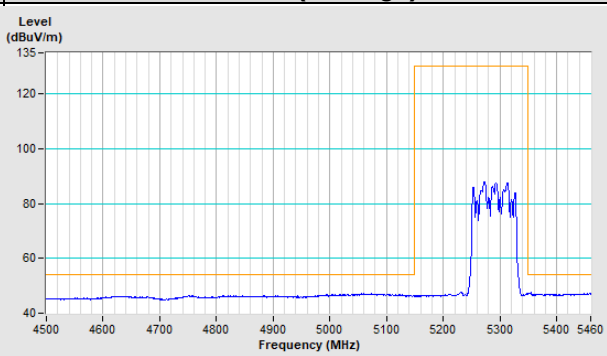
Horizontal (Average)



Vertical (Peak)

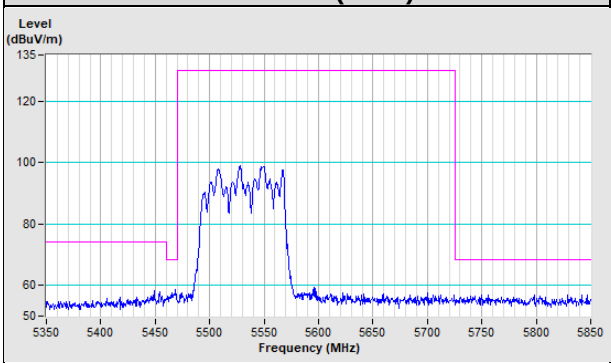


Vertical (Average)

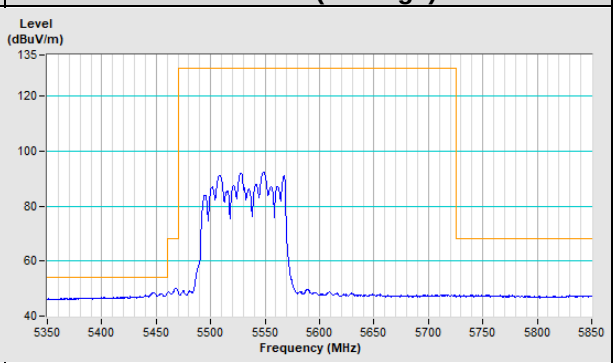


802.11ac (VHT80) Channel 106

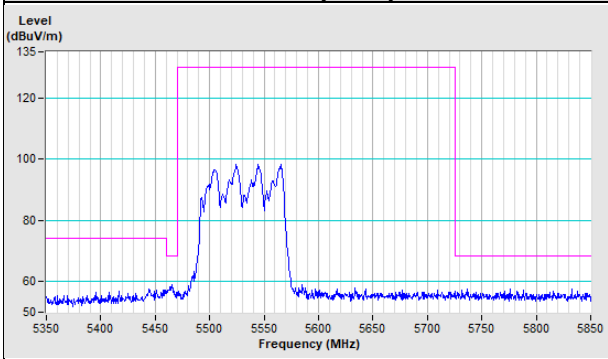
Horizontal (Peak)



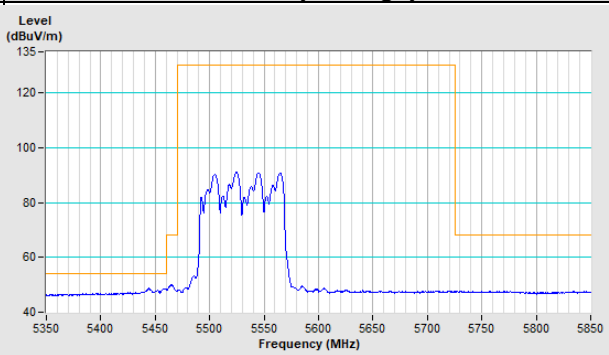
Horizontal (Average)



Vertical (Peak)

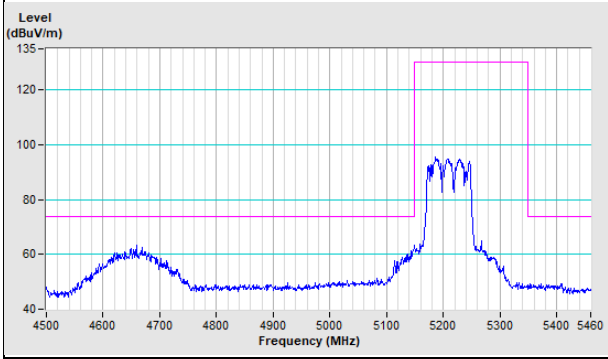


Vertical (Average)

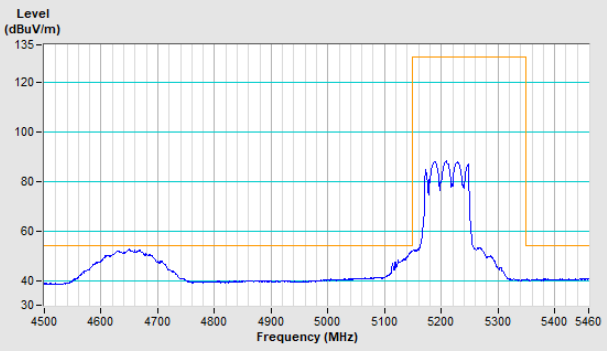


802.11ac (VHT80+80) Channel 42+155

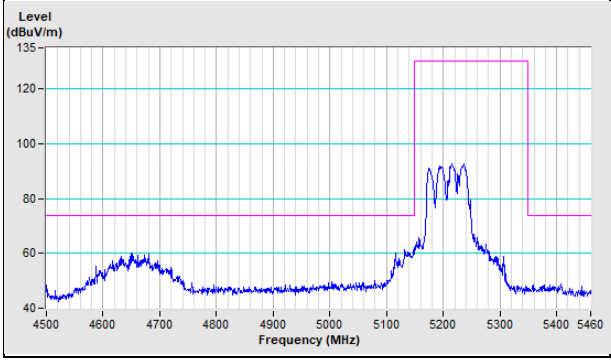
Horizontal (Peak)



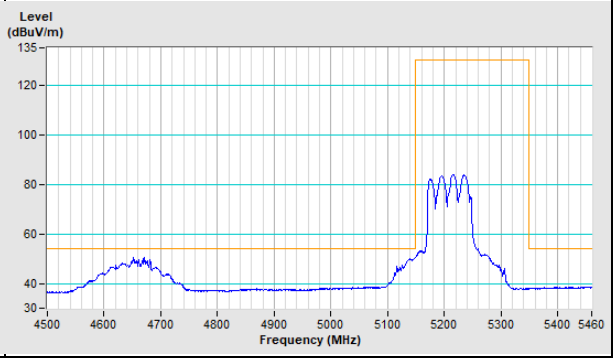
Horizontal (Average)



Vertical (Peak)



Vertical (Average)



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 and approved according to ISO/IEC 17025.

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

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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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