FCC Test Report

Report No.:	RFBDQY-WTW-P22040472-1
FCC ID:	2ACTO-APX320X
Test Model:	APX 320X
Received Date:	Apr. 13, 2022
Test Date:	May 12 ~ May 13, 2022
Issued Date:	Oct. 19, 2022
Applicant:	Sophos Ltd
Address:	The Pentagon, Abingdon Science Park, Abingdon OX14 3YP, United Kingdom
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
RFBDQY-WTW-P22040472-1	Original release	Oct. 19, 2022

1 Certificate of Conformity

Product:	Sophos Access Point
Brand:	Sophos
Test Model:	APX 320X
Sample Status:	Engineering sample
Applicant:	Sophos Ltd
Test Date:	May 12 ~ May 13, 2022
Standards:	47 CFR FCC Part 15, Subpart E (Section 15.407) ANSI C63.10:2013

This report is issued as a supplementary report of RF191104C18-2. This report shall be used combined together with its original report.

Prepared by : Polly Chien / Specialist , **Date:** Oct. 19, 2022

Approved by : Jeremy Lin / Project Engineer , **Date:** Oct. 19, 2022

Note: Radiated emission below 1GHz and conducted emission are performed for the addendum. Refer to original report for the other test data.

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 -1.51dB at 14.74212MHz.
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 -2.8dB at 37.76MHz and 38.73MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	N/A	Refer to Note 1
---	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	Antenna connector is N-Type connector not a standard connector.

Note:

1. Radiated emission below 1GHz and conducted emission are performed for the addendum. Refer to original report for the other test data.
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	150kHz ~ 30MHz	2.79 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.59 dB
	200MHz ~1000MHz	3.60 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Sophos Access Point			
Brand	Sophos			
Test Model	APX 320X			
Sample Status	Engineering sample			
Power Supply Rating	55Vdc (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 300Mbps 802.11ac: up to 867Mbps			
Operating Frequency	5180 ~ 5240MHz, 5260 ~ 5320MHz, 5500 ~ 5700MHz, 5745 ~ 5825MHz			
Number of Channel	5180 ~ 5240MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 4 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1 5260 ~ 5320MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 4 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1 5500 ~ 5700MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 11 802.11n (HT40), 802.11ac (VHT40): 5 802.11ac (VHT80): 2 5745 ~ 5825MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 5 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1			
Output Power		Dipole antenna	Directional antenna	Sector antenna
	CDD Mode			
	5180 ~ 5240MHz	140.275mW	6.953mW	6.953mW
	5260 ~ 5320MHz	220.863mW	51.488mW	51.488mW
	5500 ~ 5700MHz	183.736mW	49.191mW	49.191mW
	5745 ~ 5825MHz	198.616mW	189.930mW	189.930mW
	Beamforming Mode			
	5180 ~ 5240MHz	69.735mW	3.445mW	3.445mW
	5260 ~ 5320MHz	156.359mW	25.805mW	25.805mW
	5500 ~ 5700MHz	130.743mW	24.654mW	24.654mW
	5745 ~ 5825MHz	198.616mW	95.379mW	95.379mW

Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	NA
Cable Supplied	NA

Note:

1. This report is prepared for FCC class II permissive change. The difference compared with the original report no. RF191104C18-2 is removing TPM IC. Therefore, radiated emission below 1GHz and conducted emission are performed for the addendum. Refer to original report for the other test data.
2. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

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

* The modulation and bandwidth are similar for 802.11n mode for 20MHz/40MHz and 802.11ac mode for 20MHz/40MHz, therefore investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)

3. The EUT uses the following PoE. (Support unit only)

Brand	Microsemi
Model	PD-9001GR/AC
Input Power	100-240Vac~50/60Hz, 0.67A
Output Power	55Vdc / 0.6A

4. The EUT uses the following antennas.

NO.	Type	Gain(dBi)								Connector
		2400 MHz	2450 MHz	2500 MHz	5150 MHz	5325 MHz	5500 MHz	5675 MHz	5850 MHz	
1	Dipole	3.1	3.2	3.1	5.1	5.0	5.6	5.7	6.0	N type
2	Directional	11.6	12.0	11.9	10.55	11.2	11.5	11.2	11.5	N type
3	Sector	10.6	11.4	11.2	12.57	12.7	13.0	12.4	13.1	N type

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

5. 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

Antenna No.	Antenna gain	Antenna install degree
1	-0.50dBi	
Due to device will restricted installation position as above photo, thus consider to above 30 degrees highest antenna gain are chosen from XZ Plane and YZ Plane antenna specification of 120-240° degrees, for XY plane antenna gain it will not effect to above 30 degrees from the horizon, therefore not required to evaluation.		
2	10.55dBi	
3	12.57dBi	

3.2 Description of Test Modes

For 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):

Channel	Frequency
42	5210MHz

For 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	5290MHz

For 5500 ~ 5700MHz:

11 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		

5 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		

2 channels are provided for 802.11ac (VHT80):

Channel	Frequency	Channel	Frequency
106	5530 MHz	122	5610

For 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):

Channel	Frequency
155	5775MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO		DESCRIPTION
	RE<1G	PLC	
A	√	√	EUT with Dipole antenna
B	√	√	EUT with Directional antenna
C	√	√	EUT with Sector antenna

Where **RE<1G:** Radiated Emission below 1GHz **PLC:** Power Line Conducted Emission

Note:
1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.
2. For radiated emission (below 1GHz) and power line conducted emission test items, the worst maximum power was selected.

Radiated Emission Test (Below 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, B, C	802.11ac (VHT80)	5180-5240	42	155	OFDM	29.3
	802.11ac (VHT80)	5260-5320	58		OFDM	29.3
	802.11ac (VHT80)	5500-5700	106 to 122		OFDM	29.3
	802.11ac (VHT80)	5745-5825	155		OFDM	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, C	802.11ac (VHT80)	5180-5240	42	155	OFDM	29.3
	802.11ac (VHT80)	5260-5320	58		OFDM	29.3
	802.11ac (VHT80)	5500-5700	106 to 122		OFDM	29.3
	802.11ac (VHT80)	5745-5825	155		OFDM	29.3

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE<1G	23deg. C, 68%RH	120Vac, 60Hz	Adair Peng
PLC	25deg. C, 75%RH	120Vac, 60Hz	Rex Wang

3.3 Description of Support Units

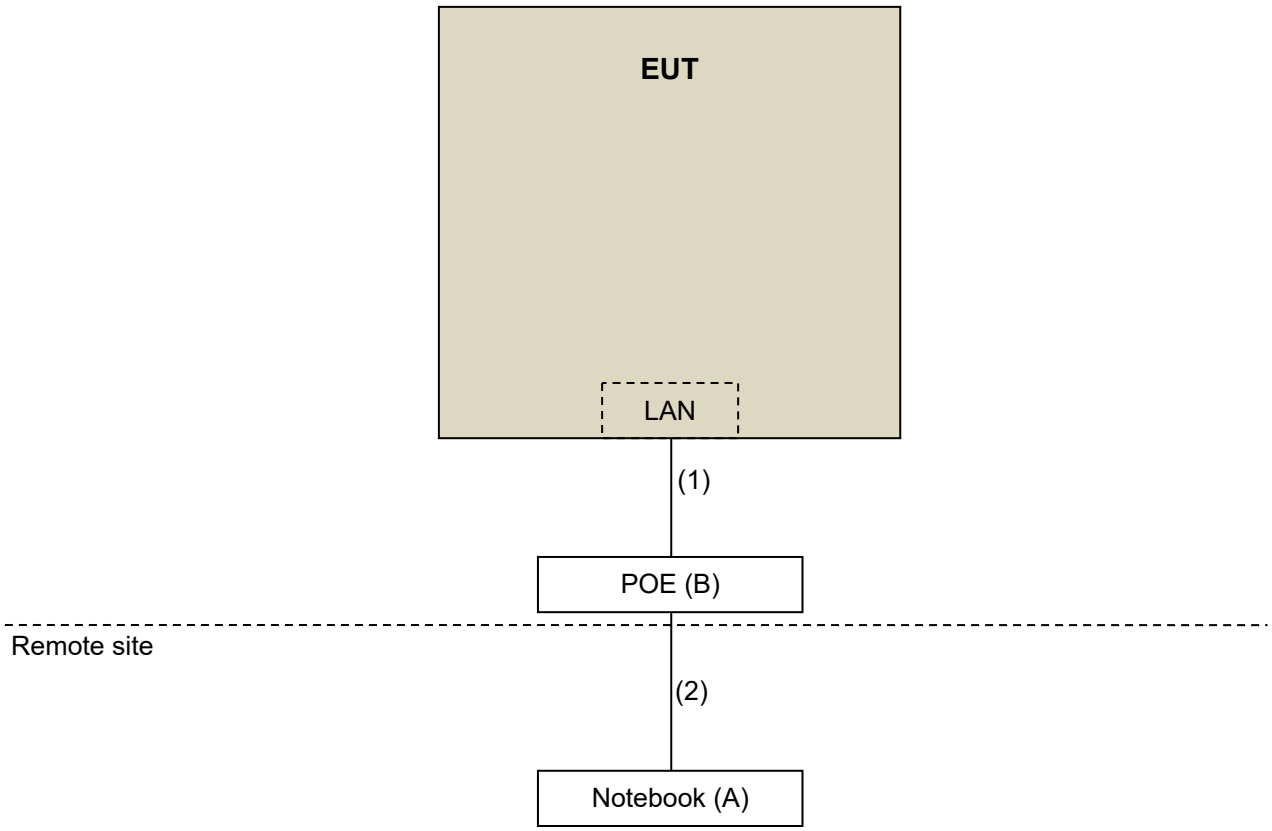
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	Lenovo	80Q7	PF0KUGU6	NA	-
B.	PoE	Microsemi	PD-9001GR/AC	NA	NA	-

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45 cable	1	2	N	0	-
2.	RJ45 cable	1	10	N	0	-

3.3.1 Configuration of System under Test



3.4 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="2">Applicable To</td><td colspan="2">Limit</td></tr>
<tr><td colspan="2" 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>Applicable To</td><td>EIRP Limit</td><td>Equivalent Field Strength at 3m</td></tr>
<tr><td>5150~5250 MHz</td><td>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>15.407(b)(2)</td></tr>
<tr><td>5470~5725 MHz</td><td>15.407(b)(3)</td></tr>
<tr><td>5725~5850 MHz</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 colspan="4">*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
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 27, 2022	Apr. 26, 2023
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Jun. 10, 2021	Jun. 09, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Oct. 28, 2021	Oct. 27, 2022
Loop Antenna TESEQ	HLA 6121	45745	Jul. 21, 2021	Jul. 20, 2022
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Jun. 05, 2021	Jun. 04, 2022
RF signal cable Woken	8D-FB	Cable-CH9-01	Jun. 05, 2021	Jun. 04, 2022
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower &Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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 Chamber 9.
3. Tested date: May 12, 2022

4.1.3 Test Procedures

For Radiated emission below 30MHz

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 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters 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.

Note:

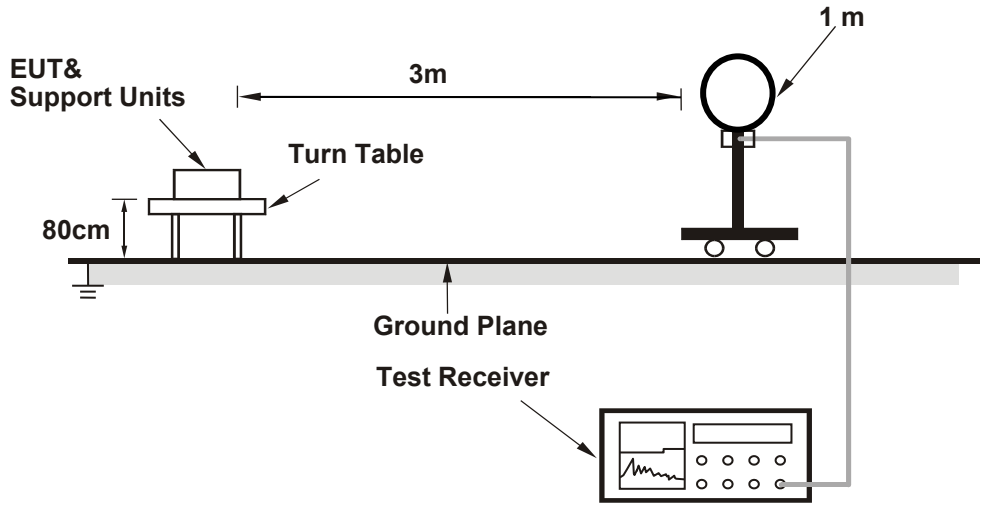
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

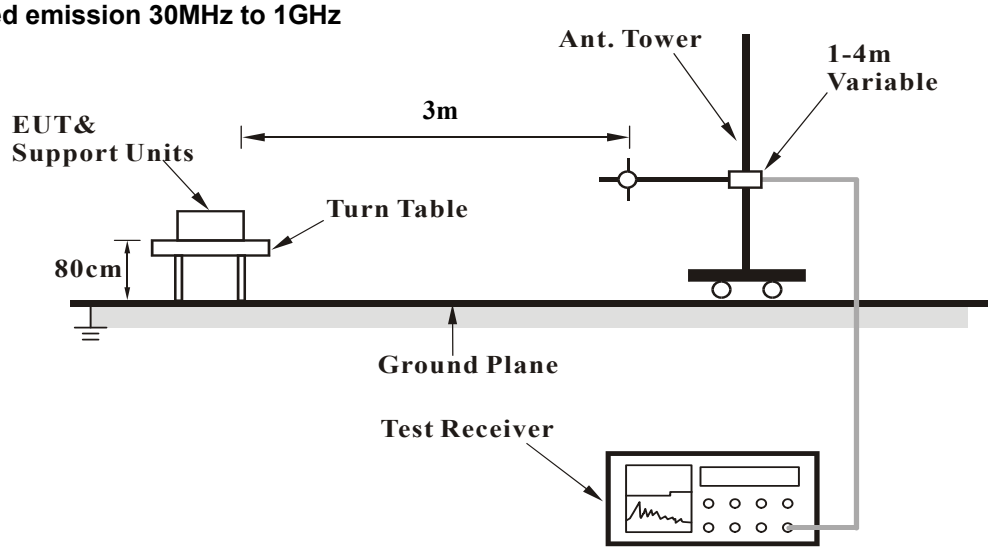
No deviation.

4.1.5 Test Setup

For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



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

4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Prepared a notebook to act as a communication partner and placed it outside of testing area.
c. The communication partner connected with EUT via a RJ45 cable and ran a test program (QRCT3) to enable EUT under transmission condition continuously at specific channel frequency.
d. The communication partner sent data to EUT by command "PING".

4.1.7 Test Results

Below 1GHz Worst-Case Data:

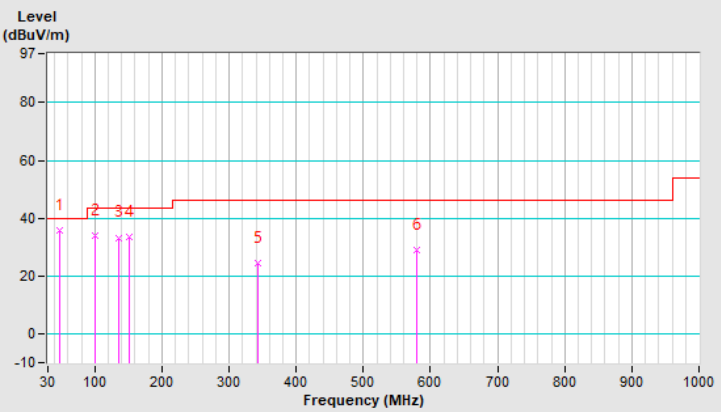
802.11ac (VHT80)

CHANNEL	TX Channel 155	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		
TEST MODE	A		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	47.46	36.0 QP	40.0	-4.0	1.50 H	222	45.0	-9.0
2	100.81	34.1 QP	43.5	-9.4	1.50 H	293	47.5	-13.4
3	135.73	33.3 QP	43.5	-10.2	1.00 H	117	43.0	-9.7
4	152.22	33.6 QP	43.5	-9.9	2.00 H	9	42.5	-8.9
5	342.34	24.4 QP	46.0	-21.6	1.00 H	203	30.5	-6.1
6	579.99	28.9 QP	46.0	-17.1	1.00 H	317	29.7	-0.8

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. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz
4. Margin value = Emission Level – Limit value
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

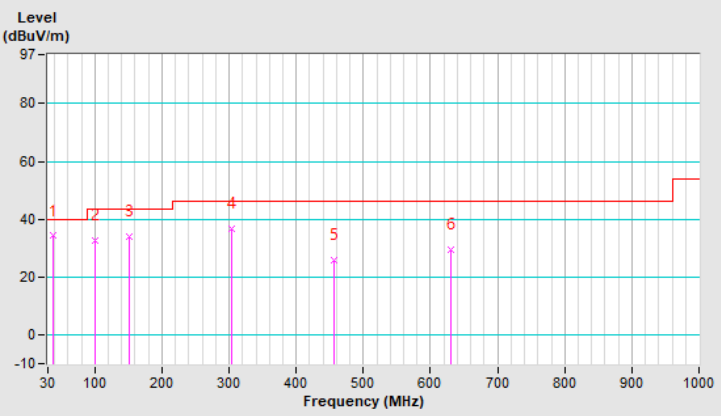


CHANNEL	TX Channel 155	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		
TEST MODE	A		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	38.73	34.2 QP	40.0	-5.8	1.00 V	181	44.1	-9.9
2	100.81	32.6 QP	43.5	-10.9	1.00 V	139	46.0	-13.4
3	152.22	34.1 QP	43.5	-9.4	1.50 V	216	43.0	-8.9
4	303.54	36.5 QP	46.0	-9.5	1.50 V	47	43.3	-6.8
5	455.83	26.0 QP	46.0	-20.0	1.00 V	57	29.3	-3.3
6	630.43	29.3 QP	46.0	-16.7	2.00 V	195	29.2	0.1

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. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz
4. Margin value = Emission Level – Limit value
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

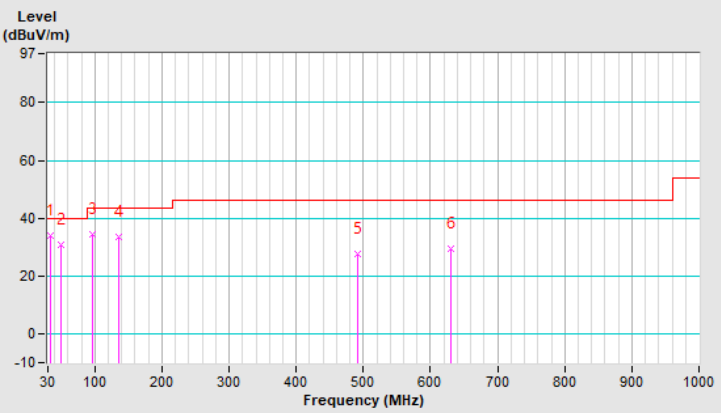


CHANNEL	TX Channel 155	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		
TEST MODE	B		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	33.88	33.9 QP	40.0	-6.1	1.00 H	95	44.5	-10.6
2	50.37	31.0 QP	40.0	-9.0	1.00 H	3	40.0	-9.0
3	95.96	34.3 QP	43.5	-9.2	2.00 H	297	49.0	-14.7
4	135.73	33.6 QP	43.5	-9.9	1.50 H	6	43.3	-9.7
5	491.72	27.7 QP	46.0	-18.3	1.00 H	276	30.4	-2.7
6	629.46	29.5 QP	46.0	-16.5	1.50 H	6	29.4	0.1

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. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz
4. Margin value = Emission Level – Limit value
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

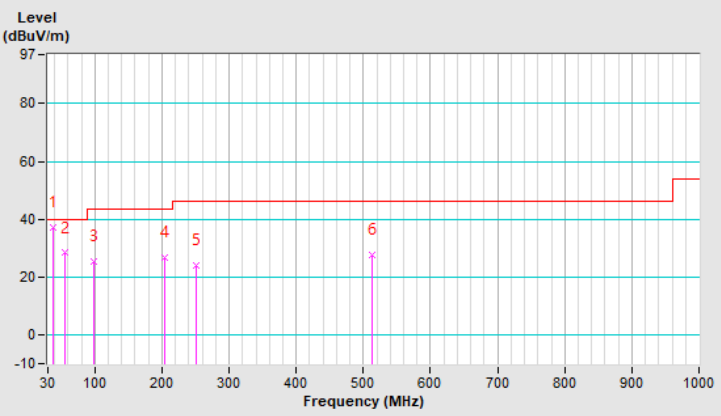


CHANNEL	TX Channel 155	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		
TEST MODE	B		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	**37.76**	**37.2 QP**	**40.0**	**-2.8**	**1.00 V**	**290**	**46.9**	**-9.7**
2	56.19	28.3 QP	40.0	-11.7	1.00 V	138	37.6	-9.3
3	97.90	25.4 QP	43.5	-18.1	1.50 V	230	39.5	-14.1
4	203.63	26.9 QP	43.5	-16.6	1.50 V	214	38.4	-11.5
5	250.19	23.8 QP	46.0	-22.2	1.00 V	89	32.7	-8.9
6	513.06	27.5 QP	46.0	-18.5	1.00 V	284	29.7	-2.2

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. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz
4. Margin value = Emission Level – Limit value
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

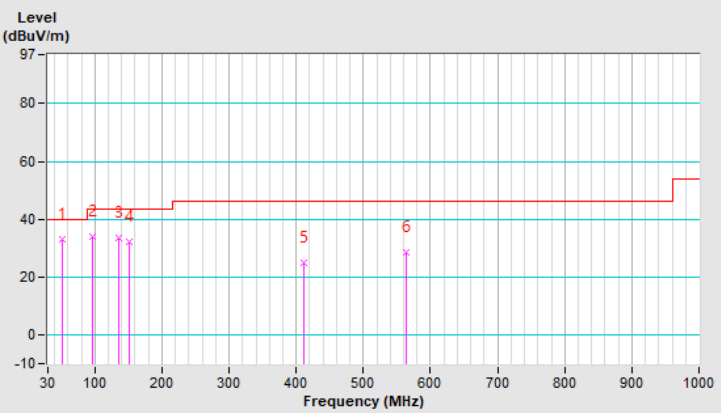


CHANNEL	TX Channel 155	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		
TEST MODE	C		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	51.34	32.9 QP	40.0	-7.1	1.50 H	72	41.9	-9.0
2	95.96	33.9 QP	43.5	-9.6	1.50 H	162	48.6	-14.7
3	135.73	33.7 QP	43.5	-9.8	1.00 H	162	43.4	-9.7
4	152.22	32.3 QP	43.5	-11.2	1.00 H	34	41.2	-8.9
5	411.21	24.9 QP	46.0	-21.1	1.00 H	332	29.7	-4.8
6	564.47	28.6 QP	46.0	-17.4	2.00 H	338	29.9	-1.3

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. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz
4. Margin value = Emission Level – Limit value
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

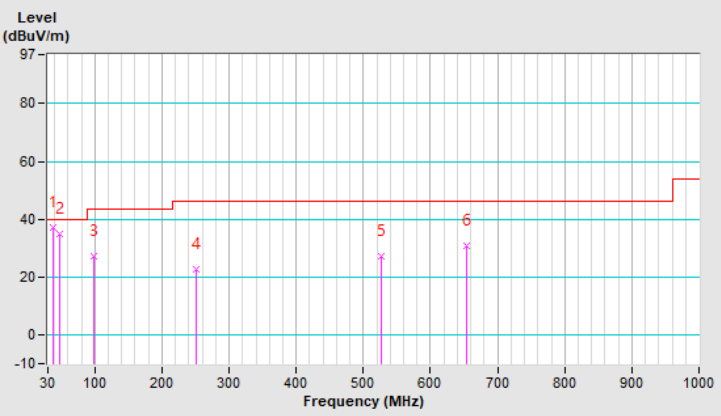


CHANNEL	TX Channel 155	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		
TEST MODE	C		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	**38.73**	**37.2 QP**	**40.0**	**-2.8**	**1.00 V**	**26**	**47.1**	**-9.9**
2	48.43	35.1 QP	40.0	-4.9	1.50 V	9	44.1	-9.0
3	97.90	27.2 QP	43.5	-16.3	1.00 V	235	41.3	-14.1
4	250.19	22.8 QP	46.0	-23.2	1.00 V	5	31.7	-8.9
5	526.64	27.3 QP	46.0	-18.7	2.00 V	15	29.2	-1.9
6	653.71	30.7 QP	46.0	-15.3	1.00 V	4	30.5	0.2

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. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz
4. Margin value = Emission Level – Limit value
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	ESCI	100613	Dec. 03, 2021	Dec. 02, 2022
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Jan. 15, 2022	Jan. 14, 2023
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Mar. 14, 2022	Mar. 13, 2023
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Sep. 07, 2021	Sep. 06, 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 1 (Conduction 1).
3. The VCCI Site Registration No. is C-12040.
4. Test Date: May 13, 2022

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.

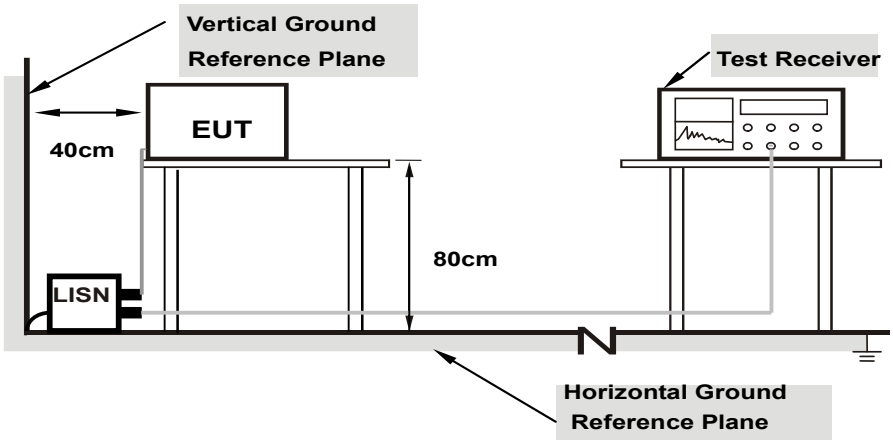
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

Worst-case data:

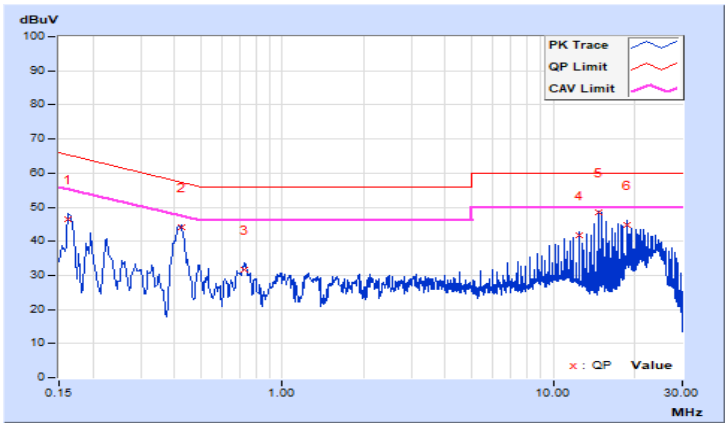
802.11ac (VHT80)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16173	9.62	36.95	28.68	46.57	38.30	65.37	55.37	-18.80	-17.07
2	0.42334	9.69	34.42	28.75	44.11	38.44	57.38	47.38	-13.27	-8.94
3	0.72465	9.70	21.85	15.41	31.55	25.11	56.00	46.00	-24.45	-20.89
4	12.47432	9.83	31.98	31.83	41.81	41.66	60.00	50.00	-18.19	-8.34
5	**14.74212**	**9.84**	**38.71**	**38.65**	**48.55**	**48.49**	**60.00**	**50.00**	**-11.45**	**-1.51**
6	18.71077	9.86	35.05	34.50	44.91	44.36	60.00	50.00	-15.09	-5.64

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.

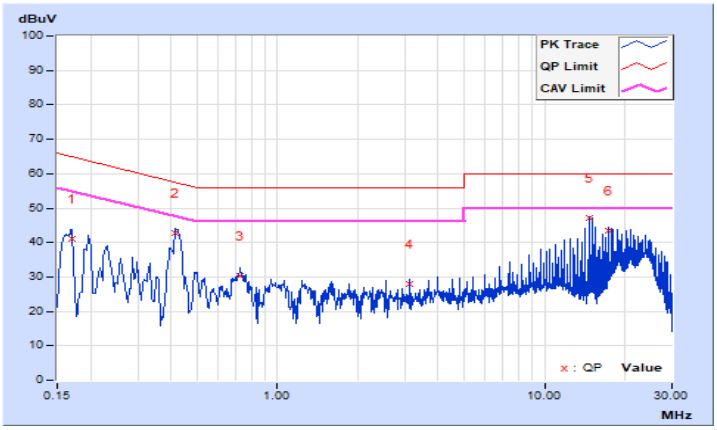


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	A		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16955	9.63	31.29	19.29	40.92	28.92	64.98	54.98	-24.06	-26.06
2	0.41560	9.69	33.09	24.33	42.78	34.02	57.54	47.54	-14.76	-13.52
3	0.72848	9.70	20.76	14.31	30.46	24.01	56.00	46.00	-25.54	-21.99
4	3.11769	9.74	18.11	15.90	27.85	25.64	56.00	46.00	-28.15	-20.36
5	14.74212	9.86	37.25	37.08	47.11	46.94	60.00	50.00	-12.89	-3.06
6	17.29535	9.88	33.68	33.48	43.56	43.36	60.00	50.00	-16.44	-6.64

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.

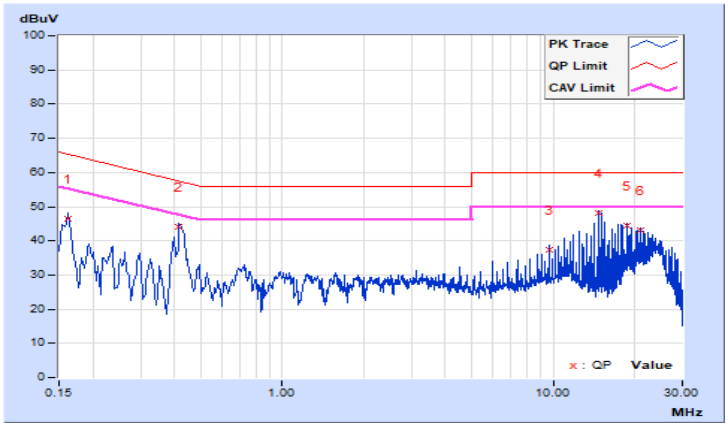


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16173	9.62	36.69	28.62	46.31	38.24	65.37	55.37	-19.06	-17.13
2	0.41588	9.69	34.33	25.75	44.02	35.44	57.53	47.53	-13.51	-12.09
3	9.63957	9.81	27.69	26.80	37.50	36.61	60.00	50.00	-22.50	-13.39
4	14.74212	9.84	38.37	38.12	48.21	47.96	60.00	50.00	-11.79	-2.04
5	18.71077	9.86	34.42	33.16	44.28	43.02	60.00	50.00	-15.72	-6.98
6	20.97857	9.87	33.06	32.07	42.93	41.94	60.00	50.00	-17.07	-8.06

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.

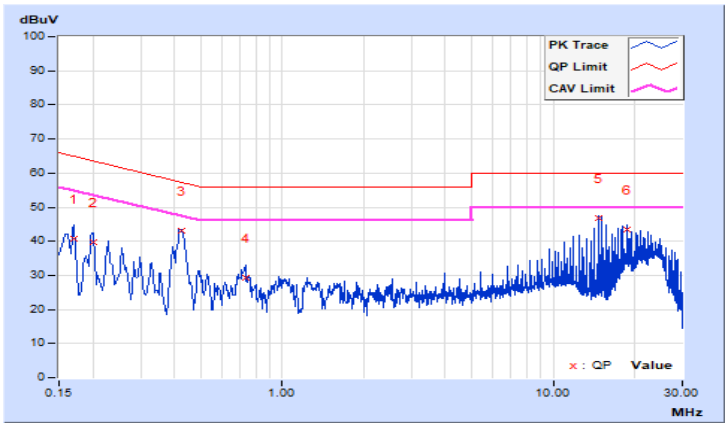


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	B		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16955	9.63	31.10	19.12	40.73	28.75	64.98	54.98	-24.25	-26.23
2	0.19978	9.64	30.08	20.27	39.72	29.91	63.62	53.62	-23.90	-23.71
3	0.42370	9.69	33.45	27.92	43.14	37.61	57.38	47.38	-14.24	-9.77
4	0.73233	9.70	19.72	12.69	29.42	22.39	56.00	46.00	-26.58	-23.61
5	14.74212	9.86	36.84	36.78	46.70	46.64	60.00	50.00	-13.30	-3.36
6	18.71077	9.89	33.56	32.80	43.45	42.69	60.00	50.00	-16.55	-7.31

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.

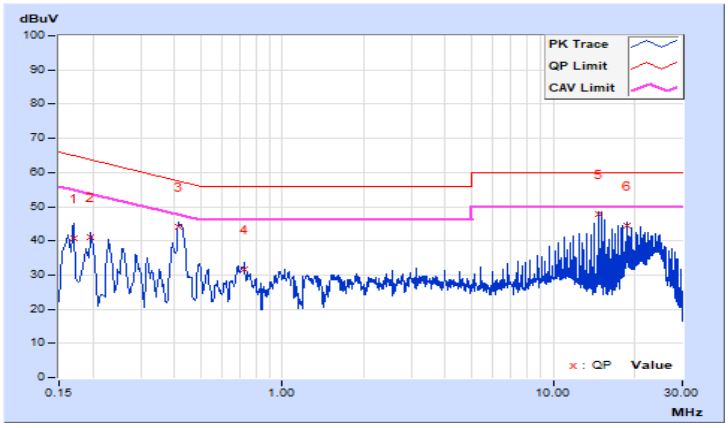


Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	C		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16955	9.63	31.06	20.00	40.69	29.63	64.98	54.98	-24.29	-25.35
2	0.19692	9.64	31.41	24.06	41.05	33.70	63.74	53.74	-22.69	-20.04
3	0.41560	9.69	34.42	25.70	44.11	35.39	57.54	47.54	-13.43	-12.15
4	0.72477	9.70	21.91	15.42	31.61	25.12	56.00	46.00	-24.39	-20.88
5	14.74212	9.84	38.03	37.68	47.87	47.52	60.00	50.00	-12.13	-2.48
6	18.71077	9.86	34.66	34.16	44.52	44.02	60.00	50.00	-15.48	-5.98

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.

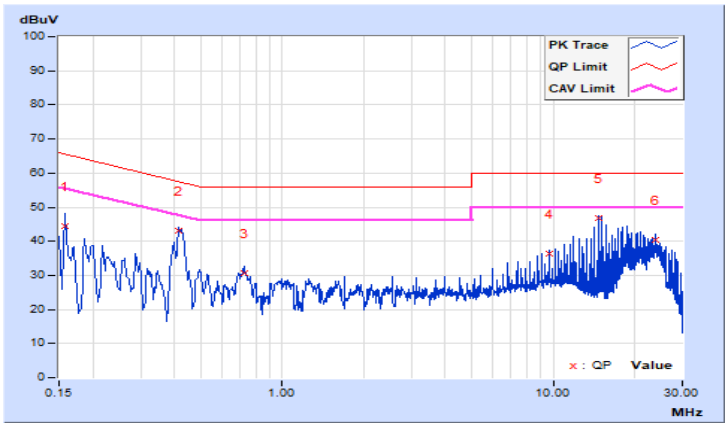


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Test Mode	C		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15782	9.62	34.81	22.87	44.43	32.49	65.58	55.58	-21.15	-23.09
2	0.41588	9.69	33.31	24.70	43.00	34.39	57.53	47.53	-14.53	-13.14
3	0.72084	9.70	21.04	14.29	30.74	23.99	56.00	46.00	-25.26	-22.01
4	9.63957	9.81	26.71	25.81	36.52	35.62	60.00	50.00	-23.48	-14.38
5	14.74212	9.86	37.04	36.96	46.90	46.82	60.00	50.00	-13.10	-3.18
6	23.81332	9.88	30.62	28.51	40.50	38.39	60.00	50.00	-19.50	-11.61

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.



5 Pictures of Test Arrangements

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

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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