

TEST REPORT (SPOT CHECK)

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 15, Subpart E (Section 15.407)

Report No.: RFBFBE-WTW-P21070951A-1

FCC ID: YAW529027-Z

Original FCC ID: YAW529027

Model No.: PVS6

Received Date: 2022/4/14

Test Date: 2022/5/17 ~ 2022/5/19

Issued Date: 2022/6/22

Applicant: SunPower Corporation

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

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Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

FCC Registration / 723255 / TW2022

Designation Number:

Approved by: _____, **Date:** 2022/6/22
May Chen / Manager

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Prepared by : Vivian Huang / Specialist



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Release Control Record

Issue No.	Description	Date Issued
RFBFBE-WTW-P21070951A-1	Original release.	2022/6/22

1 Certificate

Product: SunPower Monitoring System with PVS6

Brand: SUNPOWER

Test Model: PVS6

Sample Status: Engineering sample

Applicant: SunPower Corporation

Test Date: 2022/5/17 ~ 2022/5/19

Standard: 47 CFR FCC Part 15, Subpart E (Section 15.407)

Measurement ANSI C63.10-2013

procedure: KDB 789033 D02 General UNII Test Procedure New Rules v02r01

KDB 662911 D01 Multiple Transmitter Output v02r01

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.

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
Clause	Test Item	Result	Remark
15.407(a)(1/2/3)	RF Output Power	Pass	Meet the requirement of limit.
15.407(a)(1/2/3)	Power Spectral Density	NA	Refer to Note 1 below
15.407(e)	6 dB Bandwidth	NA	Refer to Note 1 below
---	Occupied Bandwidth	NA	Refer to Note 1 below
15.407(g)	Frequency Stability	NA	Refer to Note 1 below
15.407(b)(9)	AC Power Conducted Emissions	Pass	Minimum passing margin is -6.04 dB at 5.43750 MHz
15.407(b)(9)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -0.3 dB at 423.50 MHz
15.407(b)(1/2/3/4(i)/10)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -7.0 dB at 11490.00 MHz
15.203	Antenna Requirement	Pass	Antenna connector is I-PEX not a standard connector.

Notes:

1. RF Output Power & AC Power Conducted Emissions & Unwanted Emissions Measurement were performed for this addendum. The others testing data refer to original test report.
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	Specification	Expanded Uncertainty (k=2) (±)
AC Power Conducted Emissions	150 kHz ~ 30 MHz	1.9 dB
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	3.1 dB
	30 MHz ~ 1 GHz	5.4 dB
Unwanted Emissions above 1 GHz	1 GHz ~ 18 GHz	5.0 dB
	18 GHz ~ 40 GHz	5.3 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	SunPower Monitoring System with PVS6
Brand	SUNPOWER
Test Model	PVS6
Status of EUT	Engineering sample
Power Supply Rating	AC100-240V, 0.75A, 50/60Hz
Modulation Type	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode
Modulation Technology	OFDM
Transfer Rate	802.11a: up to 54Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.7Mbps
Operating Frequency	5180 ~ 5240 MHz 5745 ~ 5825 MHz
Number of Channel	802.11a, 802.11n (HT20), 802.11ac (VHT20): 9 802.11n (HT40), 802.11ac (VHT40): 4 802.11ac (VHT80): 2
Output Power	5180 ~ 5240 MHz : 191.219 mW (22.82 dBm) 5745 ~ 5825 MHz : 253.401 mW (24.04 dBm)
EUT Category	Outdoor Access Point, Client device
Accessory Device	Hole Plugs x 2 Bracket
Data Cable Supplied	Ethernet cable (Unshielded, 1.5m)

Note:

- Exhibit prepared and modification information is provided by the customer, the laboratory assists in evaluating the test conditions and Spot Check Verification report, for more details please refer to the declaration letter exhibit. need to be performed. And all data was verified to meet the requirements. (Original FCC ID: YAW529027, Report No.: RF180803E05A-1, Note: referenced exhibit has administrative typo for FCC ID on P1 of original filing)
- The EUT contains certified WWAN module which FCC ID: XMR2020BG95M1 (Brand: SUNPOWER; Model: PVS6)
- There are WLAN, Bluetooth and WWAN technology used for the EUT. The EUT has three radios as following table:

Radio 1	Radio 2	Radio 3
WLAN (2.4GHz+5GHz)	BT	WWAN (LTE)

- Simultaneously transmission condition.

Condition	Technology		
1	WLAN(2.4GHz)	BT	WWAN
2	WLAN(5GHz)	BT	WWAN

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

- The EUT needs to be supplied from an Internal power supply, the information is as below table:

Brand	Model No.	Spec.
WLAN WELL	IRM-30-12	AC Input: 100-240V, 0.75A, 50/60Hz DC Output: 12V, 2.5A

- This device can support different category application which switched by access point mode and client mode by software.
- The EUT will install at outdoor area, for U-NII-1 the highest antenna gain is 1.49dBi from the horizon above 30 degrees, for more detail information please refer to antenna specification and user manual.
- The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Antenna Description of EUT

1. The antenna information is listed as below.

Ant No.	Chain No.	Brand	Model	Antenna Net Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type
1	Chain 0 (Including BT)	airgain	65-031-212002B	2.2	2.4~2.4835	PCB	I-PEX
				3.8	5.15~5.25		
				4.2	5.725~5.85		
2	Chain 1 (WLAN use only)	airgain	65-031-212003B	4.2	2.4~2.4835	PCB	I-PEX
				4.1	5.15~5.25		
				4.8	5.725~5.85		

*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.

2. The EUT incorporates a MIMO function:

5GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11a	6 ~ 54Mbps	2TX	2RX
802.11n (HT20)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
802.11n (HT40)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
802.11ac (VHT20)	MCS0~8 Nss=1	2TX	2RX
	MCS0~8 Nss=2	2TX	2RX
802.11ac (VHT40)	MCS0~9 Nss=1	2TX	2RX
	MCS0~9 Nss=2	2TX	2RX
802.11ac (VHT80)	MCS0~9 Nss=1	2TX	2RX
	MCS0~9 Nss=2	2TX	2RX

1. The modulation and bandwidth are similar for 802.11n mode for 20 MHz (40 MHz) and 802.11ac mode for 20 MHz (40 MHz), therefore the manufacturer will control the power for 802.11n/ac mode is the same as the 802.11ax or more lower than it and investigated worst case to representative mode in test report.

3.3 Channel List

FOR 5180 ~ 5240 MHz

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

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

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

Channel	Frequency
38	5190 MHz
46	5230 MHz

1 channels are provided for 802.11ac (VHT80):

Channel	Frequency
42	5210 MHz

FOR 5745 ~ 5825 MHz:

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

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

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

Channel	Frequency	Channel	Frequency
151	5755 MHz	159	5795 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775 MHz

3.4 Test Mode Applicability and Tested Channel Detail

Worst Case:	1. 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).
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Following channel(s) was (were) selected for the final test as listed below:

Test Item	EUT Configure Mode	Mode	Tested Channel	Modulation	Data Rate Parameter
AC Power Conducted Emissions	A	802.11ac (VHT20)	149	BPSK	MCS0
Unwanted Emissions below 1 GHz	A	802.11ac (VHT20)	149	BPSK	MCS0
Unwanted Emissions above 1 GHz	A	802.11ac (VHT20)	149	BPSK	MCS0
RF Output Power	A	802.11a	36, 40, 48, 149, 157, 165	BPSK	6Mb/s
		802.11ac (VHT20)	36, 40, 48, 149, 157, 165	BPSK	MCS0
		802.11ac (VHT40)	38, 46, 151, 159	BPSK	MCS0
		802.11ac (VHT80)	42, 155	BPSK	MCS0
	B	802.11a	36, 40, 48	BPSK	6Mb/s
		802.11ac (VHT20)	36, 40, 48	BPSK	MCS0
		802.11ac (VHT40)	38, 46	BPSK	MCS0
		802.11ac (VHT80)	42	BPSK	MCS0
EUT Configure Mode:	A	Master mode			
	B	Client mode (Only U-NII 1)			

3.5 Duty Cycle of Test Signal

Duty cycle of test signal is $\geq 98\%$, duty factor is not required.

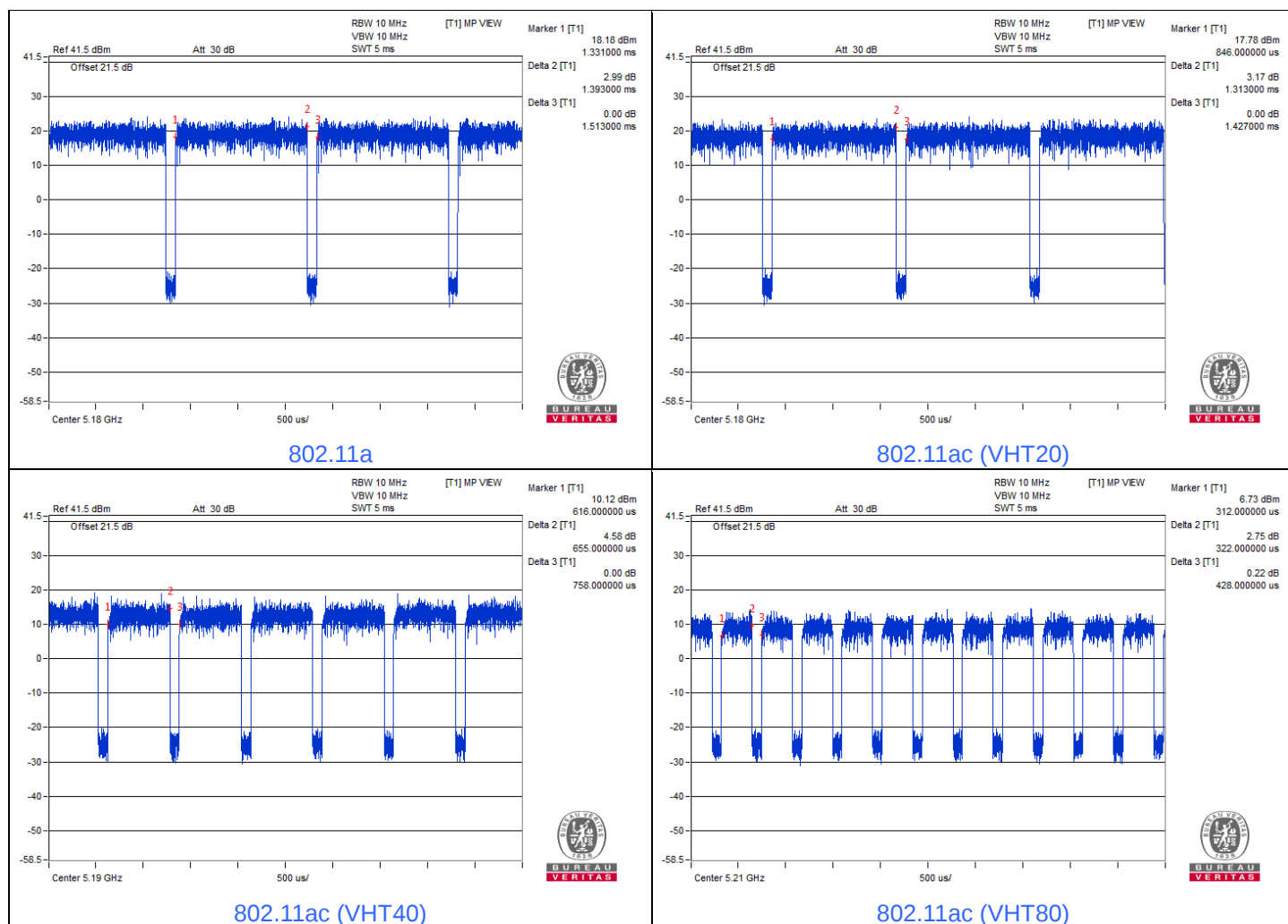
Duty cycle of test signal is $< 98\%$, duty factor shall be considered.

802.11a: Duty cycle = $1.393 \text{ ms} / 1.513 \text{ ms} \times 100\% = 92.1\%$, duty factor = $10 * \log (1/\text{Duty cycle}) = 0.36 \text{ dB}$

802.11ac (VHT20): Duty cycle = $1.313 \text{ ms} / 1.427 \text{ ms} \times 100\% = 92.0\%$, duty factor = $10 * \log (1/\text{Duty cycle}) = 0.36 \text{ dB}$

802.11ac (VHT40): Duty cycle = $0.655 \text{ ms} / 0.758 \text{ ms} \times 100\% = 86.4\%$, duty factor = $10 * \log (1/\text{Duty cycle}) = 0.63 \text{ dB}$

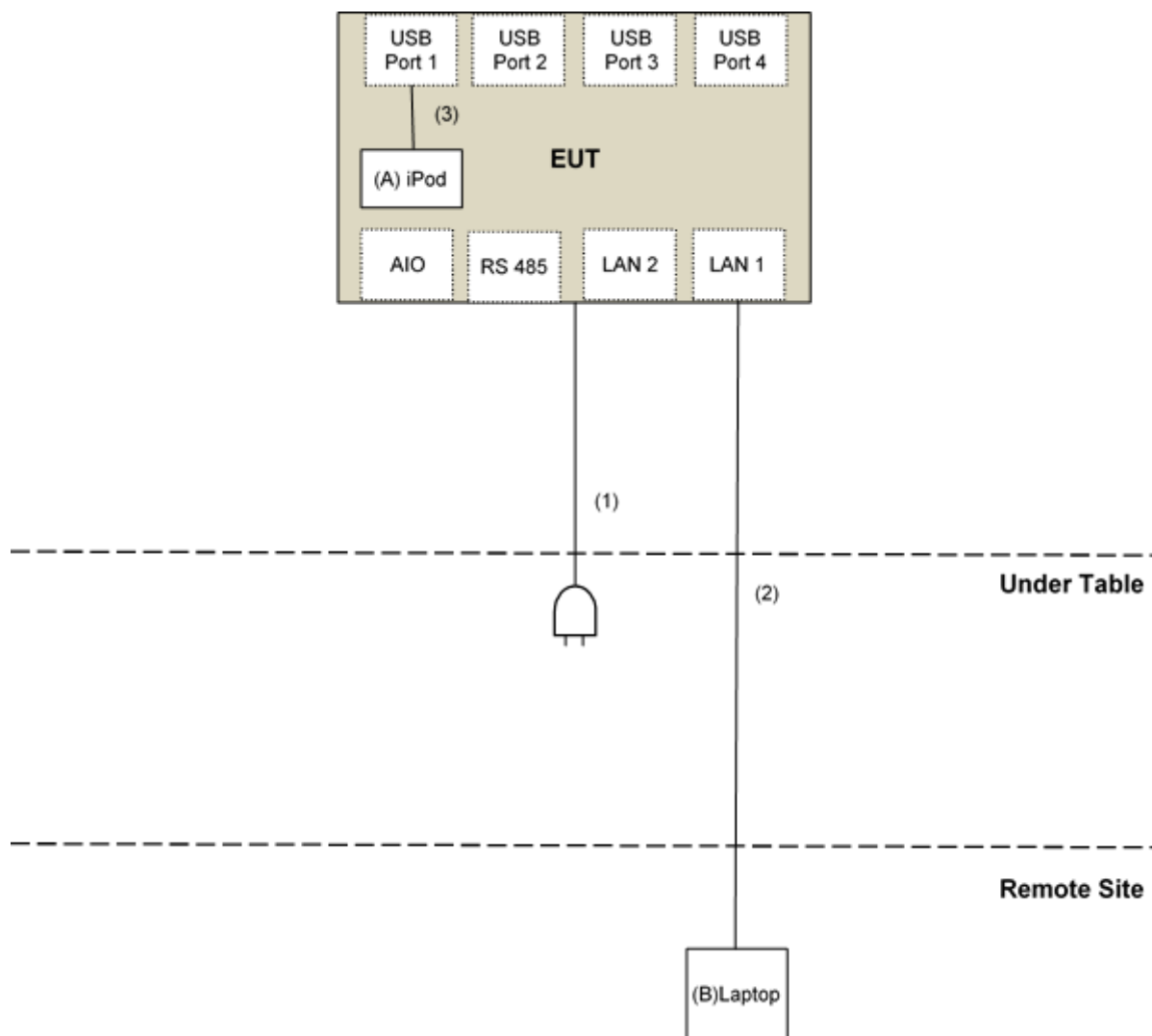
802.11ac (VHT80): Duty cycle = $0.322 \text{ ms} / 0.428 \text{ ms} \times 100\% = 75.2\%$, duty factor = $10 * \log (1/\text{Duty cycle}) = 1.24 \text{ dB}$



3.6 Test Program Used and Operation Descriptions

Controlling software (Run Tera Term Ver 4.77.0.0) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

3.7 Connection Diagram of EUT and Peripheral Devices



NOTE: The test configuration was defined by the applicant requirement.

3.8 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	iPod	Apple	MC749TA/A	CC4DMFJUDEFDM	N/A	Provided by Lab
B	Laptop	Lenovo	20U5S01X00 L14	PF-28LKK7	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	AC Cable	1	1.8	No	0	Supplied by Applicant
2	RJ-45 Cable	1	10	No	0	Provided by Lab
3	USB Cable	1	0.1	Yes	0	Provided by Lab

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 RF Output Power

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	2022/4/5	2023/4/4
Power Meter Anritsu	ML2495A	1529002	2021/6/21	2022/6/20
Pulse Power Sensor Anritsu	MA2411B	1339443	2021/5/31	2022/5/30
Software	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2022/5/19

4.2 AC Power Conducted Emissions

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
50 ohms Terminator	50	3	2021/10/27	2022/10/26
Fixed attenuator STI	STI02-2200-10	005	2021/8/27	2022/8/26
LISN R&S	ESH3-Z5	848773/004	2021/10/29	2022/10/28
RF Coaxial Cable JYEBO	5D-FB	COCCAB-001	2021/9/25	2022/9/24
Software BVADT	BVADT_Cond_V7.3.7.4	N/A	N/A	N/A
TEST RECEIVER R&S	ESCS 30	847124/029	2021/10/13	2022/10/12

Notes:

1. The test was performed in Conduction 1
2. Tested Date: 2022/5/19

4.3 Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	N/A	N/A
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	2021/9/23	2022/9/22
LOOP ANTENNA Electro-Metrics	EM-6879	264	2022/3/18	2023/3/17
MXE EMI Receiver(20 Hz to 44 GHz) Keysight	N9038A	MY54450088	2021/7/6	2022/7/5
Pre_Amplifier EMCI	EMC001340	980142	2021/5/24	2022/5/23
Pre_Amplifier Mini-Circuits	ZFL-1000VH2	QA0838008	2021/10/19	2022/10/18
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-001	2022/1/6	2023/1/5
		LOOPCAB-002	2022/1/6	2023/1/5
RF Coaxial Cable COMMATE/PEWC	8D	001	2022/2/26	2023/2/25
		966-3-2	2022/2/26	2023/2/25
		966-3-3	2022/2/26	2023/2/25
Software	ADT_Radiated_V8.7.08	N/A	N/A	N/A
Spectrum Analyzer KEYSIGHT	N9030B	MY57142938	2022/4/26	2023/4/25
Trilog Broadband Antenna Schwarzbeck	VULB 9168	9168-361	2021/10/26	2022/10/25

Notes:

1. The test was performed in 966 Chamber No. 3.
2. Tested Date: 2022/5/17

4.4 Unwanted Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	N/A	N/A
Fix tool for Boresight antenna tower BV	FBA-01	FBA_SIP01	N/A	N/A
Horn Antenna Schwarzbeck	BBHA9120-D	9120D-406	2021/11/14	2022/11/13
	BBHA 9170	9170-739	2021/11/14	2022/11/13
MXE EMI Receiver(20 Hz to 44 GHz) Keysight	N9038A	MY54450088	2021/7/6	2022/7/5
Pre_Amplifier EMCI	EMC12630SE	980384	2022/1/10	2023/1/9
	EMC184045SE	980387	2022/1/10	2023/1/9
RF Cable EMCI	EMC104-SM-SM-6000	210201	2022/5/10	2023/5/9
RF Cable-Frequency range: 1- 40GHz EMCI	EMC102-KM-KM-1200	160924	2022/1/10	2023/1/9
RF Coaxial Cable EMCI	EMC104-SM-SM-1500	180504	2022/4/25	2023/4/24
	EMC104-SM-SM-2000	180601	2021/6/8	2022/6/7
	EMC-KM-KM-4000	200214	2022/3/8	2023/3/7
Software	ADT_Radiated_V8.7.08	N/A	N/A	N/A
Spectrum Analyzer KEYSIGHT	N9030B	MY57142938	2022/4/26	2023/4/25
Spectrum Analyzer Keysight	N9030A	MY54490679	2021/7/9	2022/7/8

Notes:

1. The test was performed in 966 Chamber No. 3.
2. Tested Date: 2022/5/17

5 Limits of Test Items

5.1 RF Output Power

Operation Band	EUT Category	Limit
U-NII-1	Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p $\leq$ 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	250 mW (24 dBm)

Operation Band	Limit
U-NII-3	1 Watt (30 dBm)

Per KDB 662911 D01 Multiple Transmitter Output 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.

5.2 AC Power Conducted Emissions

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

Notes:

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 0.50 MHz.

5.3 Unwanted Emissions below 1 GHz

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	$2400/F(\text{kHz})$	300
0.490 ~ 1.705	$24000/F(\text{kHz})$	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = $20 \log$ Emission level (uV/m).

5.4 Unwanted Emissions above 1 GHz

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)
Above 960	500	3

Notes:

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

Limits of unwanted emission out of the restricted bands

Applicable To		Limit	
789033 D02 General UNII Test Procedure New Rules v02r01		Field Strength at 3 m	
		PK: 74 (dBμV/m)	AV: 54 (dBμV/m)
Frequency Band	Applicable To	EIRP Limit	Equivalent Field Strength at 3 m
5150~5250 MHz	15.407(b)(1)	PK: -27 (dBm/MHz)	PK: 68.2 (dBμV/m)
5250~5350 MHz	15.407(b)(2)		
5470~5725 MHz	15.407(b)(3)		
5725~5850 MHz	15.407(b)(4)(i)	PK: -27 (dBm/MHz) ^{*1} PK: 10 (dBm/MHz) ^{*2} PK: 15.6 (dBm/MHz) ^{*3} PK: 27 (dBm/MHz) ^{*4}	PK: 68.2 (dBμV/m) ^{*1} PK: 105.2 (dBμV/m) ^{*2} PK: 110.8 (dBμV/m) ^{*3} PK: 122.2 (dBμV/m) ^{*4}
^{*1} beyond 75 MHz or more above of the band edge. ^{*3} below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.		^{*2} below the band edge increasing linearly to 10 dBm/MHz at 25 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.	

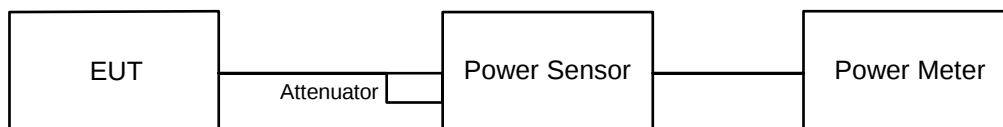
Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

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

6 Test Arrangements

6.1 RF Output Power

6.1.1 Test Setup

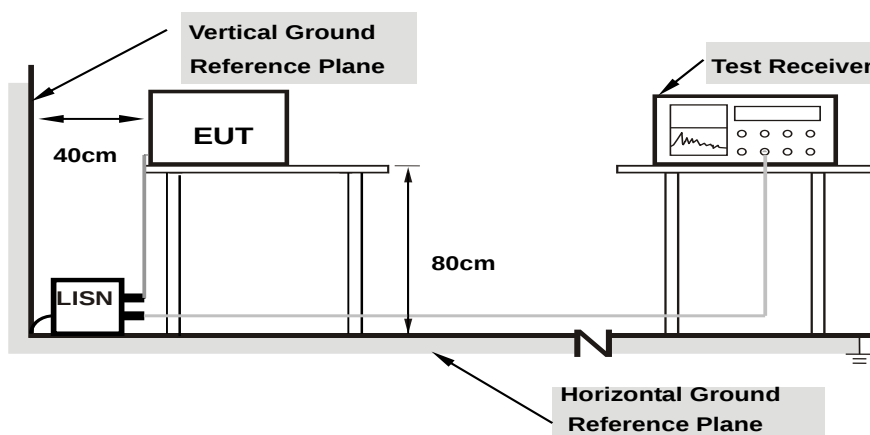


6.1.2 Test Procedure

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 and set the detector to average. Duty factor is not added to measured value.

6.2 AC Power Conducted Emissions

6.2.1 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).

6.2.2 Test Procedure

- 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/ 50 uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

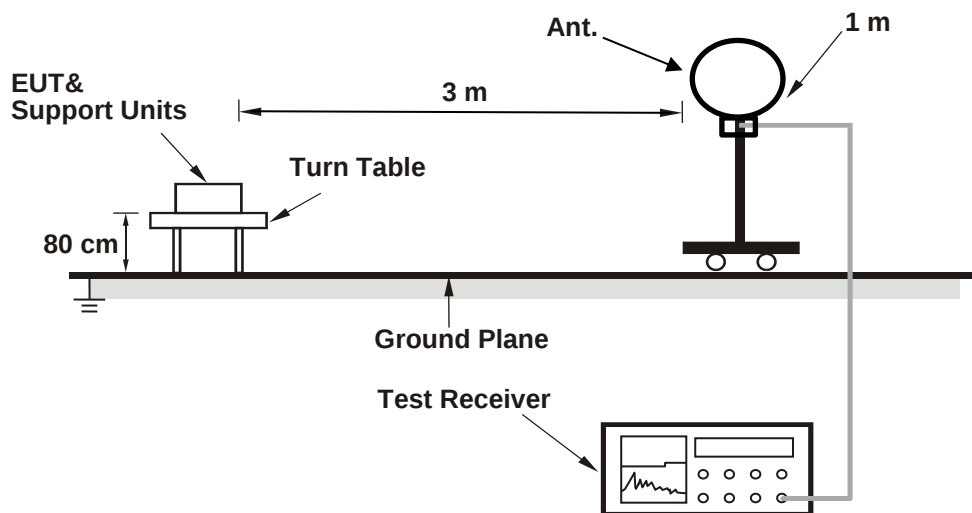
Note:

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

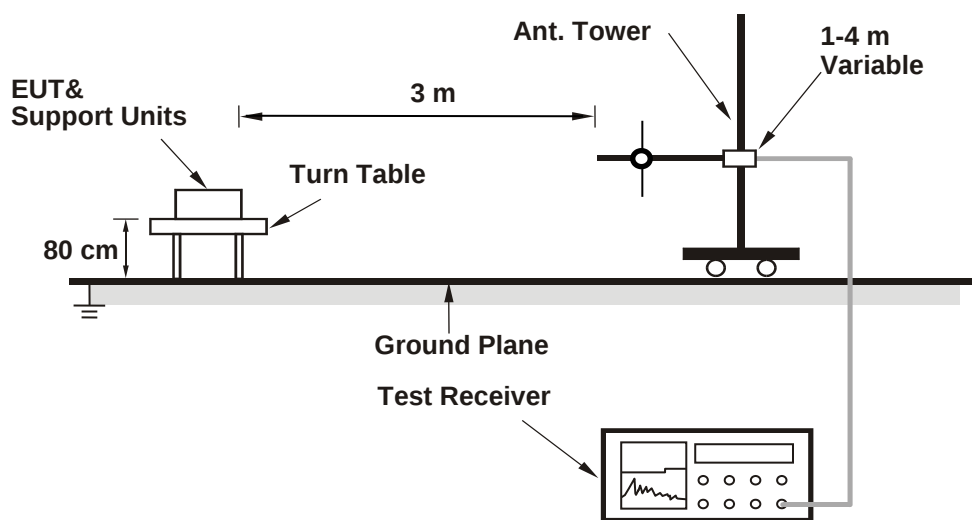
6.3 Unwanted Emissions below 1 GHz

6.3.1 Test Setup

For Radiated emission below 30 MHz



For Radiated emission above 30 MHz



6.3.2 Test Procedure

For Radiated emission below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 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. 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.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated emission above 30 MHz

- 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.

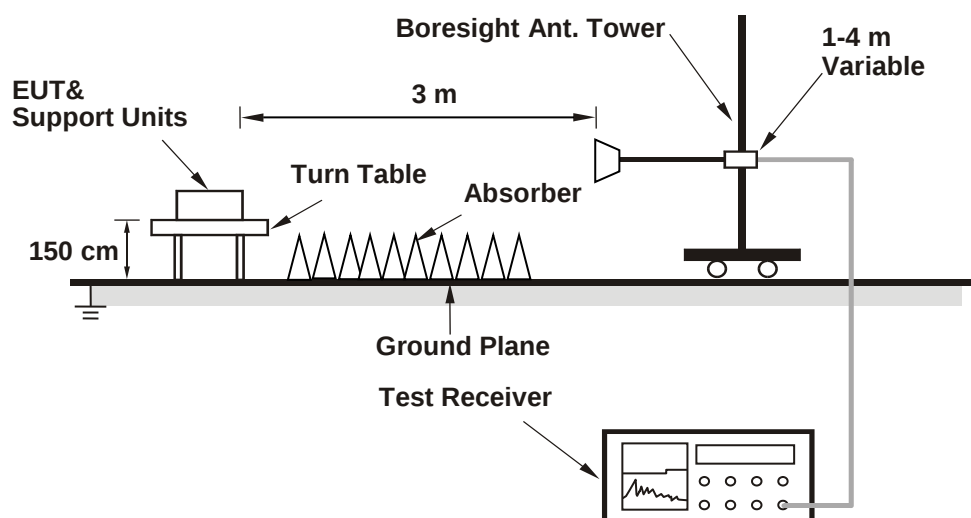
Notes:

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

6.4 Unwanted Emissions above 1 GHz

6.4.1 Test Setup

For Radiated emission above 1 GHz



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

6.4.2 Test Procedure

- The EUT was placed on the top of a rotating table 1.5 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.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- The test-receiver system was set to peak and average detects 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.

Notes:

- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1 GHz.
- All modes of operation were investigated and the worst-case emissions are reported.

7 Test Results of Test Item

7.1 RF Output Power

Mode A

Input Power:	120 Vac, 60 Hz	Environmental Conditions:	25°C, 60% RH	Tested By:	Eric Peng
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802.11a

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Maximum Gain (dBi)	EIRP (mW)	EIRP (dBm)	EIRP Limit (dBm)	Test Result
		Chain 0	Chain 1								
36	5180	16.19	15.93	80.765	19.07	30	1.49	113.763	20.56	21	Pass
40	5200	15.88	15.73	76.137	18.82	30	1.49	107.399	20.31	21	Pass
48	5240	16.21	16.03	81.87	19.13	30	1.49	115.345	20.62	21	Pass

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
149	5745	20.77	21.13	249.117	23.96	30	Pass
157	5785	20.61	21.02	241.554	23.83	30	Pass
165	5825	20.51	21.18	243.68	23.87	30	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. This device is outdoor access point and for U-NII-1 antenna gain at any elevation angle above 30 degrees as measured from the horizon is 1.49dBi, therefore Max. e.i.r.p $\leq$ 125mW(21 dBm) to compliance.
3. For U-NII-3, the maximum gain is 4.8 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Maximum Gain (dBi)	EIRP (mW)	EIRP (dBm)	EIRP Limit (dBm)	Test Result
		Chain 0	Chain 1								
36	5180	16.07	16.31	83.214	19.20	30	1.49	117.22	20.69	21	Pass
40	5200	16.05	15.95	79.627	19.01	30	1.49	112.202	20.5	21	Pass
48	5240	16.04	16.08	80.73	19.07	30	1.49	113.763	20.56	21	Pass

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
149	5745	20.76	21.28	253.401	24.04	30	Pass
157	5785	20.77	21.10	248.224	23.95	30	Pass
165	5825	20.53	21.03	239.745	23.80	30	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. This device is outdoor access point and for U-NII-1 antenna gain at any elevation angle above 30 degrees as measured from the horizon is 1.49dBi, therefore Max. e.i.r.p $\leq$ 125mW(21 dBm) to compliance.
3. For U-NII-3, the maximum gain is 4.8 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Maximum Gain (dBi)	EIRP (mW)	EIRP (dBm)	EIRP Limit (dBm)	Test Result
		Chain 0	Chain 1								
38	5190	13.26	13.06	41.414	16.17	30	1.49	58.345	17.66	21	Pass
46	5230	15.97	16.47	83.898	19.24	30	1.49	118.304	20.73	21	Pass

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
151	5755	19.39	19.68	179.793	22.55	30	Pass
159	5795	20.88	21.10	251.287	24.00	30	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. This device is outdoor access point and for U-NII-1 antenna gain at any elevation angle above 30 degrees as measured from the horizon is 1.49dBi, therefore Max. e.i.r.p $\leq$ 125mW(21 dBm) to compliance.
3. For U-NII-3, the maximum gain is 4.8 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Maximum Gain (dBi)	EIRP (mW)	EIRP (dBm)	EIRP Limit (dBm)	Test Result
		Chain 0	Chain 1								
42	5210	12.01	12.27	32.751	15.15	30	1.49	46.132	16.64	21	Pass

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
155	5775	17.35	17.26	107.536	20.32	30	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. This device is outdoor access point and for U-NII-1 antenna gain at any elevation angle above 30 degrees as measured from the horizon is 1.49dBi, therefore Max. e.i.r.p $\leq$ 125mW(21 dBm) to compliance.
3. For U-NII-3, the maximum gain is 4.8 dBi < 6 dBi, so the output power limit shall not be reduced.

Mode B

Input Power:	120 Vac, 60 Hz	Environmental Conditions:	25°C, 60% RH	Tested By:	Eric Peng
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802.11a

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
36	5180	17.00	17.02	100.469	20.02	24	Pass
40	5200	18.52	18.28	138.419	21.41	24	Pass
48	5240	19.81	19.80	191.219	22.82	24	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. For U-NII-1, the maximum gain is 4.1 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
36	5180	16.36	16.60	88.96	19.49	24	Pass
40	5200	18.07	18.71	138.423	21.41	24	Pass
48	5240	19.55	19.69	183.268	22.63	24	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. For U-NII-1, the maximum gain is 4.1 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
38	5190	13.27	12.94	40.911	16.12	24	Pass
46	5230	17.35	17.51	110.689	20.44	24	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. For U-NII-1, the maximum gain is 4.1 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Test Result
		Chain 0	Chain 1				
42	5210	12.03	12.18	32.478	15.12	24	Pass

Notes:

1. Directional gain is the maximum gain of antennas.
2. For U-NII-1, the maximum gain is 4.1 dBi < 6 dBi, so the output power limit shall not be reduced.

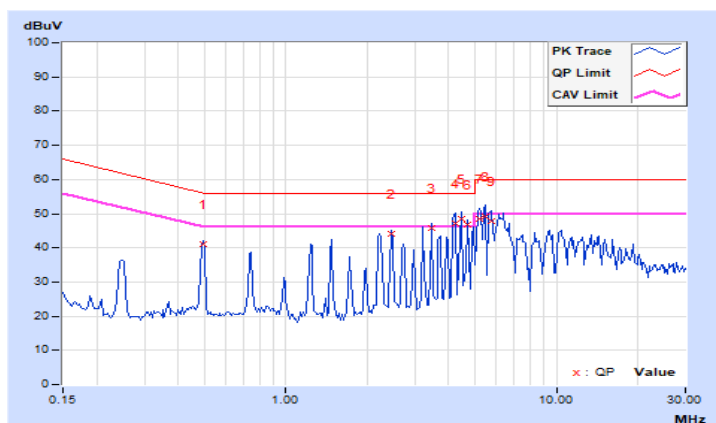
7.2 AC Power Conducted Emissions

RF Mode	TX 802.11ac (VHT20)	Channel	CH 149 : 5745 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	25°C, 75% RH
Tested By	Ryan Du		

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	0.49375	10.07	30.88	29.90	40.95	39.97	56.10	46.10	-15.15	-6.13
2	2.46094	10.18	34.04	25.98	44.22	36.16	56.00	46.00	-11.78	-9.84
3	3.46484	10.23	35.56	27.41	45.79	37.64	56.00	46.00	-10.21	-8.36
4	4.23438	10.27	36.93	24.07	47.20	34.34	56.00	46.00	-8.80	-11.66
5	4.48438	10.29	38.20	24.82	48.49	35.11	56.00	46.00	-7.51	-10.89
6	4.67578	10.30	36.55	26.75	46.85	37.05	56.00	46.00	-9.15	-8.95
7	5.17188	10.33	38.04	27.76	48.37	38.09	60.00	50.00	-11.63	-11.91
8	5.43359	10.34	38.96	29.56	49.30	39.90	60.00	50.00	-10.70	-10.10
9	5.72266	10.36	37.49	25.65	47.85	36.01	60.00	50.00	-12.15	-13.99

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

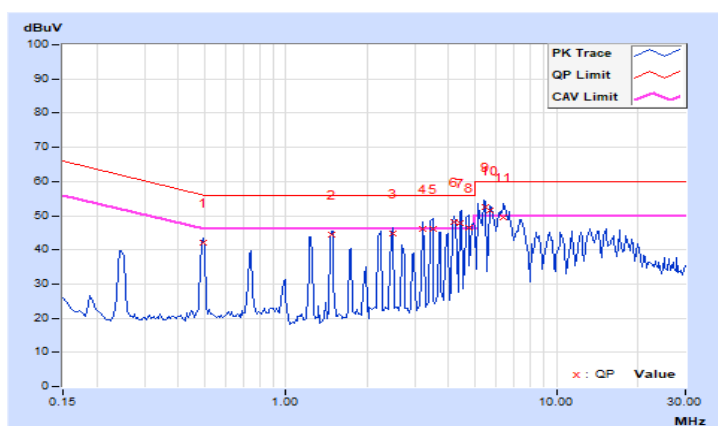


RF Mode	TX 802.11ac (VHT20)	Channel	CH 149 : 5745 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	25°C, 75% RH
Tested By	Ryan Du		

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	0.49766	10.04	32.09	27.70	42.13	37.74	56.04	46.04	-13.91	-8.30
2	1.47656	10.10	34.27	28.06	44.37	38.16	56.00	46.00	-11.63	-7.84
3	2.47266	10.15	34.70	27.02	44.85	37.17	56.00	46.00	-11.15	-8.83
4	3.19531	10.18	36.00	27.31	46.18	37.49	56.00	46.00	-9.82	-8.51
5	3.48828	10.19	35.97	22.58	46.16	32.77	56.00	46.00	-9.84	-13.23
6	4.19922	10.22	37.88	29.49	48.10	39.71	56.00	46.00	-7.90	-6.29
7	4.39063	10.23	37.68	25.49	47.91	35.72	56.00	46.00	-8.09	-10.28
8	4.73438	10.24	36.25	22.28	46.49	32.52	56.00	46.00	-9.51	-13.48
9	5.43750	10.28	42.35	33.68	52.63	43.96	60.00	50.00	-7.37	-6.04
10	5.65625	10.29	41.10	31.73	51.39	42.02	60.00	50.00	-8.61	-7.98
11	6.37891	10.32	39.32	28.27	49.64	38.59	60.00	50.00	-10.36	-11.41

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



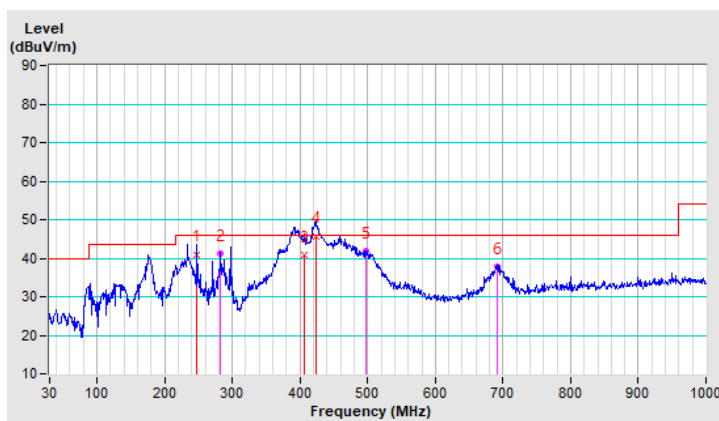
7.3 Unwanted Emissions below 1 GHz

RF Mode	TX 802.11ac (VHT20)	Channel	CH 149 : 5745 MHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	25°C, 75% RH
Tested By	Ryan Du		

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	247.43	41.0 QP	46.0	-5.0	1.00 H	252	50.6	-9.6
2	282.16	41.1 QP	46.0	-4.9	1.50 H	287	49.3	-8.2
3	407.11	40.7 QP	46.0	-5.3	1.50 H	143	45.8	-5.1
4	423.50	45.7 QP	46.0	-0.3	2.00 H	233	50.2	-4.5
5	497.61	41.7 QP	46.0	-4.3	1.50 H	232	44.6	-2.9
6	691.03	37.7 QP	46.0	-8.3	1.50 H	346	37.0	0.7

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 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

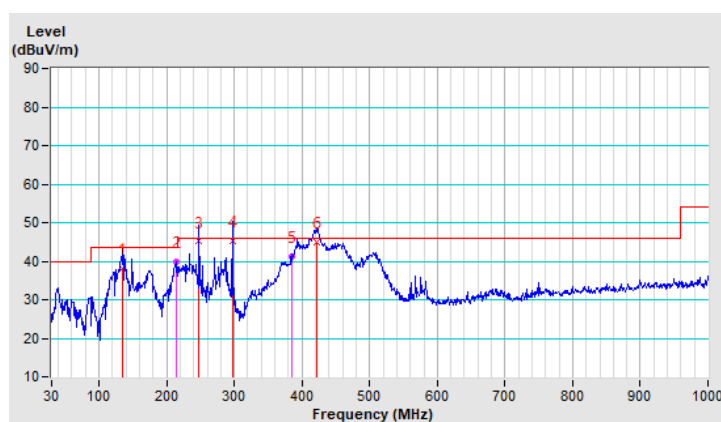


RF Mode	TX 802.11ac (VHT20)	Channel	CH 149 : 5745 MHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	25°C, 75% RH
Tested By	Ryan Du		

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	135.05	38.2 QP	43.5	-5.3	1.10 V	257	47.0	-8.8
2	213.38	39.8 QP	43.5	-3.7	1.00 V	354	51.0	-11.2
3	247.28	45.1 QP	46.0	-0.9	1.50 V	267	54.7	-9.6
4	297.08	45.4 QP	46.0	-0.6	1.50 V	343	53.2	-7.8
5	385.14	41.3 QP	46.0	-4.7	1.50 V	285	47.0	-5.7
6	421.35	45.0 QP	46.0	-1.0	1.50 V	328	49.6	-4.6

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 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



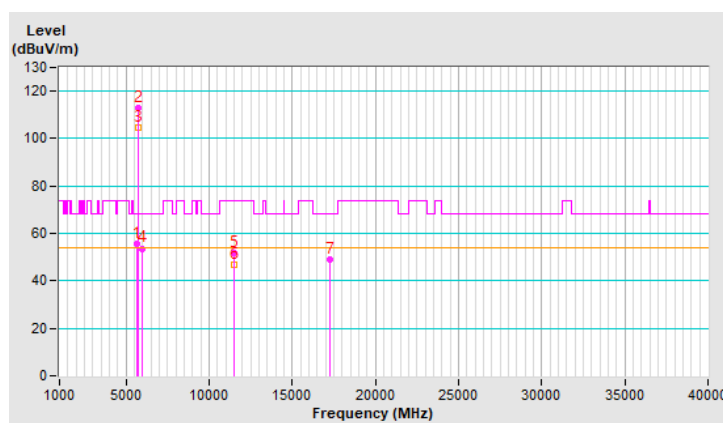
7.4 Unwanted Emissions above 1 GHz

RF Mode	TX 802.11ac (VHT20)	Channel	CH 149 : 5745 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 10 Hz
Input Power	120 Vac, 60 Hz	Environmental Conditions	20°C, 70% RH
Tested By	Nelson Teng		

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	#5647.86	55.7 PK	68.2	-12.5	1.87 H	243	50.8	4.9
2	*5745.00	112.7 PK			1.87 H	243	107.6	5.1
3	*5745.00	104.5 AV			1.87 H	243	99.4	5.1
4	#5966.08	53.7 PK	68.2	-14.5	1.87 H	243	48.2	5.5
5	11490.00	51.8 PK	74.0	-22.2	1.35 H	268	36.7	15.1
6	11490.00	47.0 AV	54.0	-7.0	1.35 H	268	31.9	15.1
7	#17235.00	48.9 PK	68.2	-19.3	1.62 H	210	30.6	18.3

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. 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.

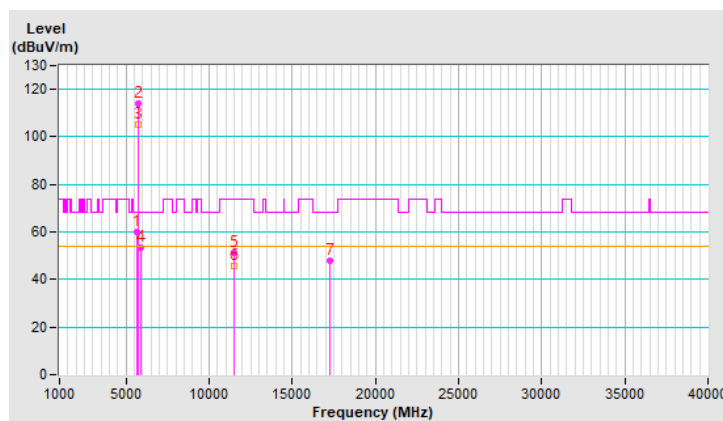


RF Mode	TX 802.11ac (VHT20)	Channel	CH 149 : 5745 MHz
Frequency Range	1 GHz ~ 40 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 10 Hz
Input Power	120 Vac, 60 Hz	Environmental Conditions	20°C, 70% RH
Tested By	Nelson Teng		

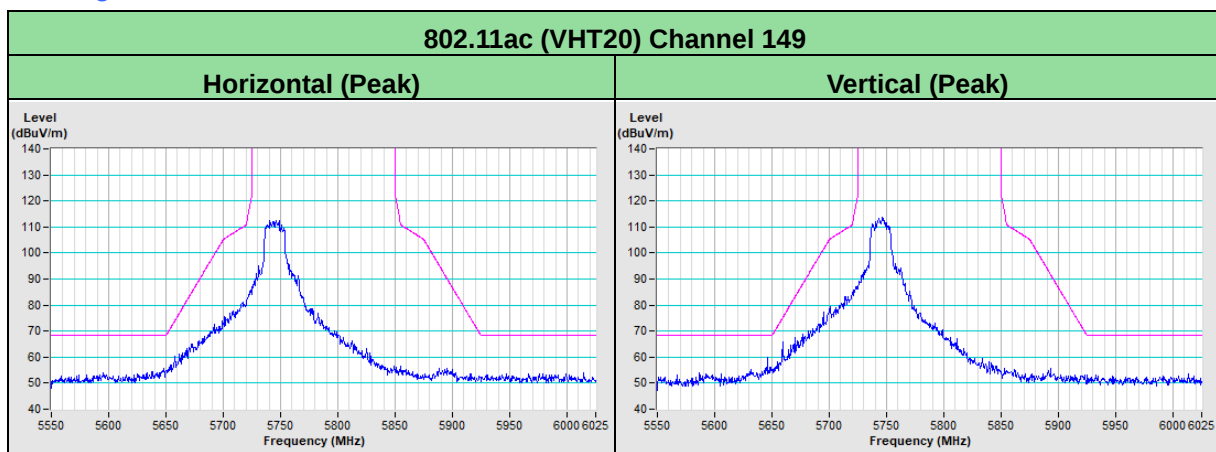
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5646.34	59.9 PK	68.2	-8.3	1.82 V	186	55.0	4.9
2	*5745.00	113.8 PK			1.82 V	186	108.7	5.1
3	*5745.00	105.4 AV			1.82 V	186	100.3	5.1
4	#5932.45	53.3 PK	68.2	-14.9	1.82 V	186	47.8	5.5
5	11490.00	51.3 PK	74.0	-22.7	1.26 V	166	36.2	15.1
6	11490.00	45.7 AV	54.0	-8.3	1.26 V	166	30.6	15.1
7	#17235.00	48.0 PK	68.2	-20.2	1.54 V	285	29.7	18.3

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. 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.



Plot of Band Edge



8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

9 Information of the Testing Laboratories

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

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

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

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