Partial FCC Test Report

Report No.:	RFBEDW-WTW-P20110606-2
FCC ID:	O57AX200NGW
Test Model:	AX200NGW
Received Date:	Nov. 19, 2020
Test Date:	Dec. 30, 2020 ~ Jan. 05, 2021
Issued Date:	Jan. 11, 2021
Applicant:	Lenovo(Shanghai) Electronics Technology Co., Ltd.
Address:	Section 304-305, Building No.4, #222, Meiyue Road, China(Shanghai) Pilot Free Trade Zone ,Shanghai 200131 , China (Peoples Republic Of)
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

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBEDW-WTW-P20110606-2	Original Release	Jan. 11, 2021

1 Certificate of Conformity

Product:	WLAN and BT , 2x2 Pcle M.2 2230 adapter card
Brand:	Intel® Wi-Fi 6 AX200
Test Model:	AX200NGW
Sample Status:	Engineering Sample
Applicant:	Lenovo(Shanghai) Electronics Technology Co., Ltd.
Test Date:	Dec. 30, 2020 ~ Jan. 05, 2021
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10:2013

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

Prepared by : _____ , **Date:** Jan. 11, 2021

Shelly Hsueh / Specialist

Approved by : _____ , **Date:** Jan. 11, 2021

Dylan Chiou / Senior Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	**Test Item**	**Result**	**Remarks**
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -6.27 dB at 0.15000 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -3.0 dB at 78.50 MHz.
15.247(d)	Antenna Port Emission	N/A	Refer to Note
15.247(a)(2)	6 dB Bandwidth	N/A	Refer to Note
---	Occupied Bandwidth Measurement	N/A	Refer to Note
15.247(b)	Conducted power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	N/A	Refer to Note
15.203	Antenna Requirement	Pass	Antenna connector is I-PEX not a standard connector.

Note:

1. This report is a partial report, only test item of Conducted Emission, Radiated Emissions and Maximum Peak Output Power were performed for this report. Other testing data please refer to Intel report no.: 181210-03.TR04 for module (Brand: Intel® Wi-Fi 6 AX200 , Model: AX200NGW).
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.79 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	WLAN and BT , 2x2 Pcle M.2 2230 adapter card
Brand	**Intel® Wi-Fi 6 AX200**
Test Model	AX200NGW
Status of EUT	Engineering Sample
Nominal Voltage	3.3Vdc form host equipment
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 1024QAM for OFDMA
Modulation Technology	DSSS, OFDM, OFDMA
Transfer Rate	802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to 300.0 Mbps 802.11ax: up to 573.5 Mbps
Operating Frequency	2412 ~ 2472 MHz
Number of Channel	13 for 802.11b, 802.11g, 802.11n (HT20), 802.11ax (HE20) 9 for 802.11n (HT40), 802.11ax (HE40)
Output Power	242.103 mW
Antenna Type	Refer to Note as below
Antenna Connector	Refer to Note as below
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx Function
802.11b	1TX
802.11g	1TX
802.11n (HT20)	1/2TX
802.11n (HT40)	1/2TX
802.11ax (HE20)	1/2TX
802.11ax (HE40)	1/2TX

* The modulation and bandwidth are similar for 802.11n mode for HT20 / HT40 and 802.11ax mode for HE20 / HE40, therefore investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)

2. The EUT is authorized for use in specific End-product. Please refer to below table for more details.

Product	Brand	Model
Notebook Computer	Lenovo	IdeaPad 5 Pro 14ACN6**********
Note: *=0~9,A-Z,a~z,"-" or blank, for marketing use only, with no impact on RF compliance of the product.		

3. The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter 1	Lenovo	ADLX65YLC3D	I/P: 100-240Vac, 50-60Hz, 1.8A O/P: 20.0V===3.25A, 65.0W / 15.0V ===3.0A / 9.0V===2.0A / 5.0V ===2.0 A, 10.0W 1.75M / 0core
Adapter 2	Lenovo	ADLX65YDC3D	I/P: 100-240Vac, 50-60Hz, 1.8A O/P: 20.0V===3.25A, 65.0W / 15.0V ===3.0A / 9.0V===2.0A / 5.0V ===2.0 A, 10.0W 1.75M / 0core
Adapter 3	Lenovo	ADLX65UDGC2A	I/P: 100-240Vac, 50-60Hz, 1.8A O/P: 5.0V===3.0A, 15.0W / 9.0V ===3.0A 15.0V===3.0A / 20.0V ===3.25A, 65.0W 1.75M / 0core
Adapter 4	Lenovo	ADLX65UDGU2A	I/P: 100-240Vac, 50-60Hz, 1.8A O/P: 5.0V===3.0A, 15.0W / 9.0V ===3.0A 5.0V===3.0A / 20.0V ===3.25A, 65.0W 1.75M / 0core
Adapter 5	Lenovo	ADLX65UCGU2A	I/P: 100-240Vac, 50-60Hz, 1.8A O/P: 5.0V===3.0A, 15.0W / 9.0V ===3.0A 15.0V===3.0A / 20.0V ===3.25A, 65.0W 1.75M / 0core
Battery 1	Lenovo	L20D3PF0	13.2 Vdc, 4775 mAh
Battery 2	Lenovo	L20M3PF1	13.2 Vdc, 4775 mAh
Battery 3	Lenovo	L20C3PF1	13.2 Vdc, 4775 mAh

4. The antenna information is listed as below.

Ant. Type	Brand	Model	Ant.	Antenna Peak Gain (dBi)				
				BT	2400-2500MHz	5150-5350MHz	5470-5725MHz	5725-5850MHz
PIFA	MAGLAYERS	DC33002HW00 / PCA-3010-25GC7-A2	Main	-	1.05	0.25	0.09	0.82
			Aux.	0.32	0.32	1.15	0.59	0.59
	High-Tek Electronics Co., Ltd	DC33002I200 / 0ACCN020007N	Main	-	-2.11	-1.02	1.88	1.88
			Aux.	0.10	0.10	-0.93	-1.70	-3.42
* The Max antenna gain was chosen for final test.								

5. 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.
6. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

13 channels are provided for 802.11b, 802.11g and 802.11n (HT20), 802.11ax (HE20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	8	2447
2	2417	9	2452
3	2422	10	2457
4	2427	11	2462
5	2432	12	2467
6	2437	13	2472
7	2442		

9 channels are provided for 802.11n (HT40), 802.11ax (HE40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	8	2447
4	2427	9	2452
5	2432	10	2457
6	2437	11	2462
7	2442		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE≥1G	RE<1G	PLC	Power	
A	√	√	√	√	EUT with Ant.- MAG. and Adapter 1
B	-	-	√	-	EUT with Ant.- HTK and Adapter 5

Where **RE≥1G:** Radiated Emission above 1 GHz **RE<1G:** Radiated Emission below 1 GHz
PLC: Power Line Conducted Emission **Power:** Maximum Output Power Measurement

Note: "-"means no effect.
Note: For radiated emission (below 1GHz) and power line conducted emission test items chosen the worst maximum fundamental emission level channel

Radiated Emission Test (Above 1 GHz):

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
A	802.11g	1 to 13	6	OFDM	BPSK	6.0

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	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
A	802.11g	1 to 13	6	OFDM	BPSK	6.0

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	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
A	802.11g	1 to 13	6	OFDM	BPSK	6.0

Maximum Output Power Measurement:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
A	802.11b	1 to 13	1, 6, 11, 12, 13	DSSS	DBPSK	1.0
	802.11g	1 to 13	1, 6, 11, 12, 13	OFDM	BPSK	6.0
	802.11n (HT20)	1 to 13	1, 6, 11, 12, 13	OFDM	BPSK	6.5
	802.11n (HT40)	3 to 11	3, 6, 9, 10, 11	OFDM	BPSK	13.5
	802.11ax (HE20)	1 to 13	1, 6, 11, 12, 13	OFDMA	BPSK	MCS0
	802.11ax (HE40)	3 to 11	3, 6, 9, 10, 11	OFDMA	BPSK	MCS0

Test Condition:

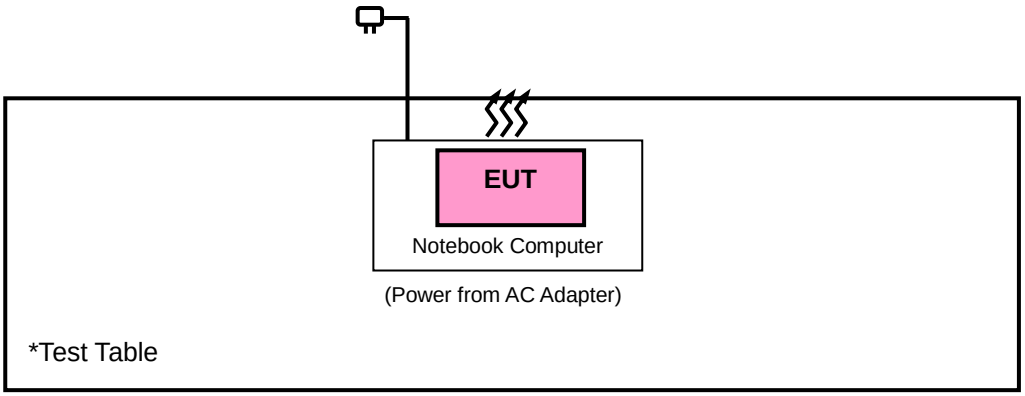
Applicable To	Environmental Conditions	Input Power	Tested by
RE≥1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Greg Lin
RE<1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Greg Lin
PLC	25 deg. C, 65 % RH	120 Vac, 60 Hz	Titan Hsu
Power	25 deg. C, 65 % RH	120 Vac, 60 Hz	Titan Hsu

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
1.	Notebook Computer	Lenovo	IdeaPad 5 Pro 14ACN6**********	NA	NA	-
2.	Adapter	Lenovo	ADLX65YLC3D	NA	NA	Mode A
3.	Adapter	Lenovo	ADLX65UCGU2A	NA	NA	Mode B

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

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

Test Standard:

FCC Part 15, Subpart C (15.247)
ANSI C63.10-2013

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

References Test Guidance:

KDB 558074 D01 Meas Guidance v05r02
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. Other emissions shall be at least 20 dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1.705	24000/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 16, 2020	Apr. 15, 2021
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Jun. 12, 2020	Jun. 11, 2021
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Nov. 06, 2020	Nov. 05, 2021
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Nov. 22, 2020	Nov. 21, 2021
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 22, 2020	Nov. 21, 2021
Loop Antenna EMCI	EM-6879	269	Sep. 17, 2020	Sep. 16, 2021
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Jun. 08, 2020	Jun. 07, 2021
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 18, 2020	Feb. 17, 2021
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM-SM8000	CABLE-CH9-02 (248780+171006)	Jan. 18, 2020	Jan. 17, 2021
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Jan. 18, 2020	Jan. 17, 2021
RF signal cable Woken	8D-FB	Cable-CH9-01	Jun. 08, 2020	Jun. 07, 2021
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	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
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 13, 2020	Jul. 12, 2021

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.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

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

Note:

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

For Radiated Emission above 30 MHz

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

Note:

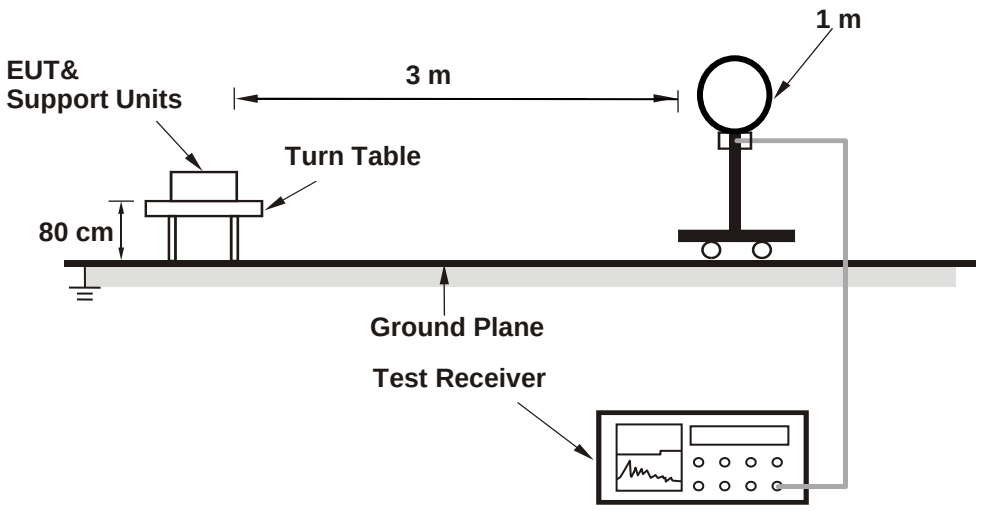
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz. (11b: RBW = 1 MHz, VBW =1 kHz ; 11g: RBW = 1 MHz, VBW = 1 kHz ;
   11ax (HE20): RBW = 1 MHz, VBW = 1 kHz ; 11ax (HE40): RBW = 1 MHz, VBW = 3 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

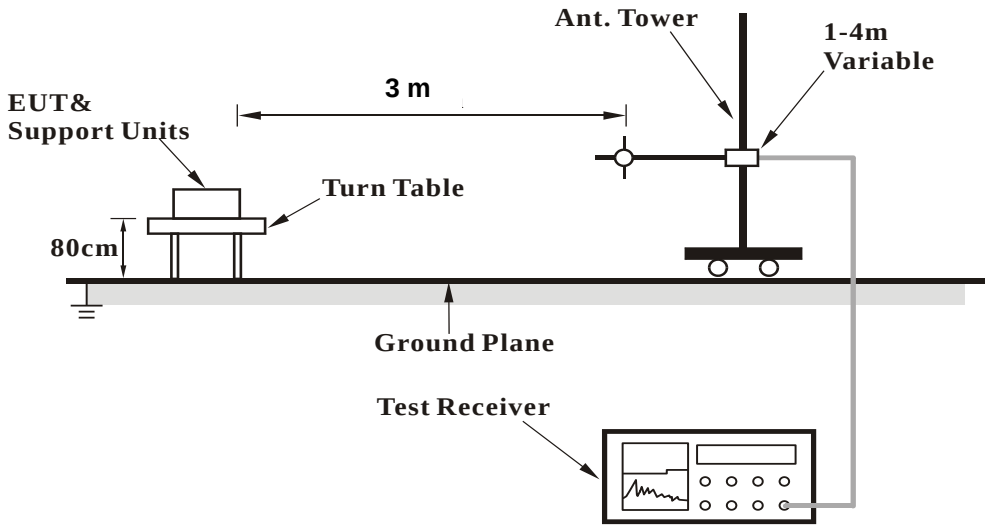
No deviation.

4.1.5 Test Set Up

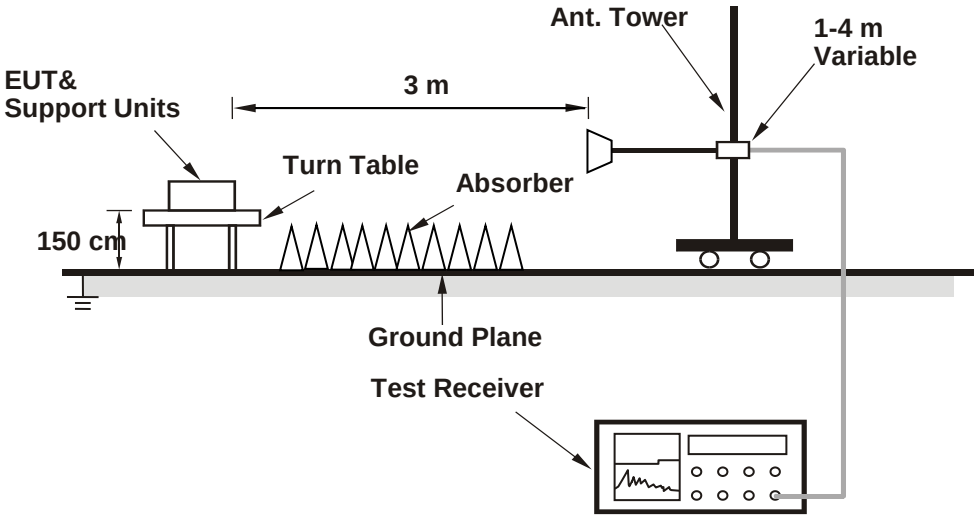
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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

4.1.6 EUT Operating Conditions

a. Placed the EUT on a testing table.
b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

ABOVE 1GHz DATA

RF Mode	TX 802.11b	**Channel**	CH 6：2437 MHz
Frequency Range	1GHz ~ 25GHz	**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	*2437.00	101.8 PK			1.73 H	218	70.7	31.1
2	*2437.00	97.8 AV			1.73 H	218	66.7	31.1
3	4874.00	43.0 PK	74.0	-31.0	3.34 H	303	40.9	2.1
4	4874.00	30.3 AV	54.0	-23.7	3.34 H	303	28.2	2.1
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	*2437.00	106.0 PK			3.33 V	14	74.9	31.1
2	*2437.00	102.1 AV			3.33 V	14	71.0	31.1
3	4874.00	44.2 PK	74.0	-29.8	2.79 V	2	42.1	2.1
4	4874.00	33.6 AV	54.0	-20.4	2.79 V	2	31.5	2.1

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

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:

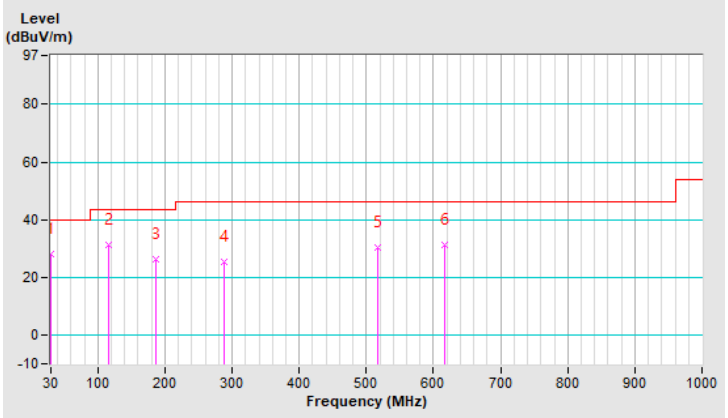
802.11b

RF Mode	TX 802.11b	Channel	CH 6：2437 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	30.00	28.1 QP	40.0	-11.9	1.25 H	213	38.4	-10.3
2	115.36	31.4 QP	43.5	-12.1	1.50 H	238	42.6	-11.2
3	187.14	26.1 QP	43.5	-17.4	1.00 H	326	36.7	-10.6
4	288.02	25.3 QP	46.0	-20.7	2.00 H	308	32.3	-7.0
5	516.94	30.2 QP	46.0	-15.8	1.25 H	4	32.5	-2.3
6	615.88	31.4 QP	46.0	-14.6	1.50 H	55	31.5	-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. 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.

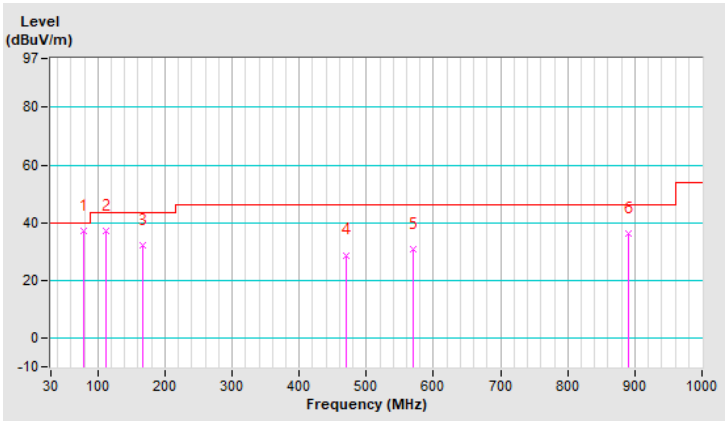


RF Mode	TX 802.11b	Channel	CH 6：2437 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

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	**78.50**	**37.0 QP**	**40.0**	**-3.0**	**1.00 V**	**198**	**49.9**	**-12.9**
2	111.48	37.1 QP	43.5	-6.4	1.25 V	262	48.6	-11.5
3	167.74	32.3 QP	43.5	-11.2	2.00 V	327	40.8	-8.5
4	470.38	28.8 QP	46.0	-17.2	1.50 V	17	31.8	-3.0
5	569.32	30.9 QP	46.0	-15.1	1.00 V	158	32.3	-1.4
6	891.36	36.1 QP	46.0	-9.9	1.25 V	79	31.4	4.7

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 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 0.50 MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 04, 2020	Dec. 03, 2021
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Sep. 04, 2020	Sep. 03, 2021
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 19, 2020	Mar. 18, 2021
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 28, 2020	Aug. 27, 2021
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.

4.2.3 Test Procedures

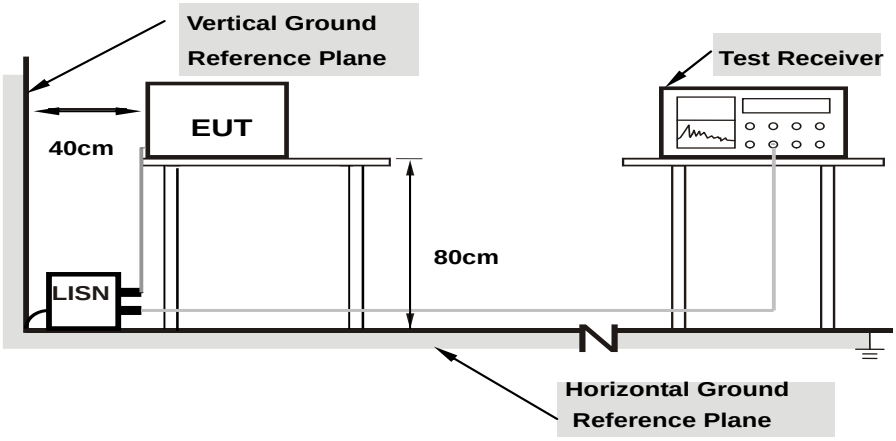
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling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

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

a. Placed the EUT on a testing table.
b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

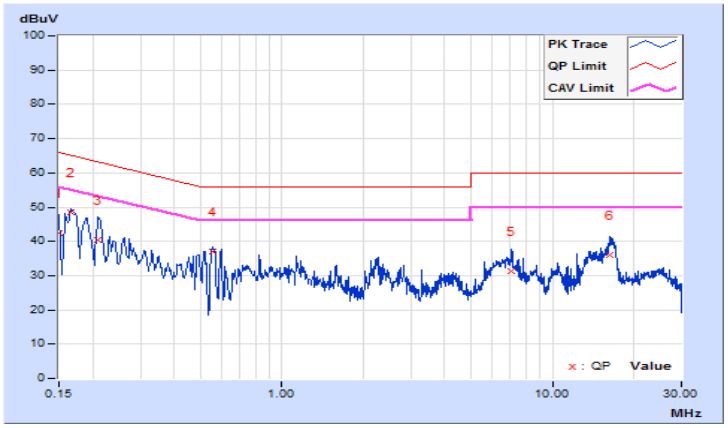
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	23℃, 66%RH
Tested by	Titan Hsu	Test Date	2021/01/05
Test Mode	Mode A		

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	0.15000	9.65	32.66	29.18	42.31	38.83	66.00	56.00	-23.69	-17.17
2	0.16600	9.65	38.80	25.92	48.45	35.57	65.16	55.16	-16.71	-19.59
3	0.21000	9.66	30.68	20.55	40.34	30.21	63.21	53.21	-22.87	-23.00
4	0.55400	9.66	27.34	21.38	37.00	31.04	56.00	46.00	-19.00	-14.96
5	7.03800	9.77	21.61	16.07	31.38	25.84	60.00	50.00	-28.62	-24.16
6	16.37800	9.85	26.22	18.75	36.07	28.60	60.00	50.00	-23.93	-21.40

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

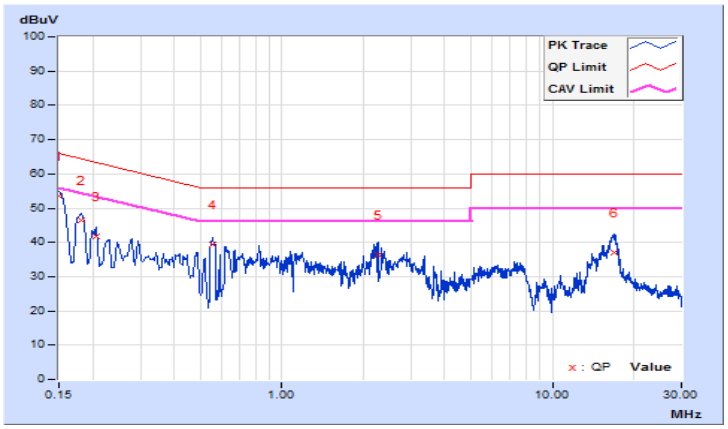


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	23℃, 66%RH
Tested by	Titan Hsu	Test Date	2021/01/05
Test Mode	Mode A		

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	0.15000	9.68	43.90	31.65	53.58	41.33	66.00	56.00	-12.42	-14.67
2	0.18085	9.68	36.63	25.75	46.31	35.43	64.45	54.45	-18.14	-19.02
3	0.20577	9.68	32.22	22.36	41.90	32.04	63.37	53.37	-21.47	-21.33
4	0.55400	9.68	29.62	24.78	39.30	34.46	56.00	46.00	-16.70	-11.54
5	2.27000	9.74	26.77	14.12	36.51	23.86	56.00	46.00	-19.49	-22.14
6	17.02200	9.95	27.16	19.16	37.11	29.11	60.00	50.00	-22.89	-20.89

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

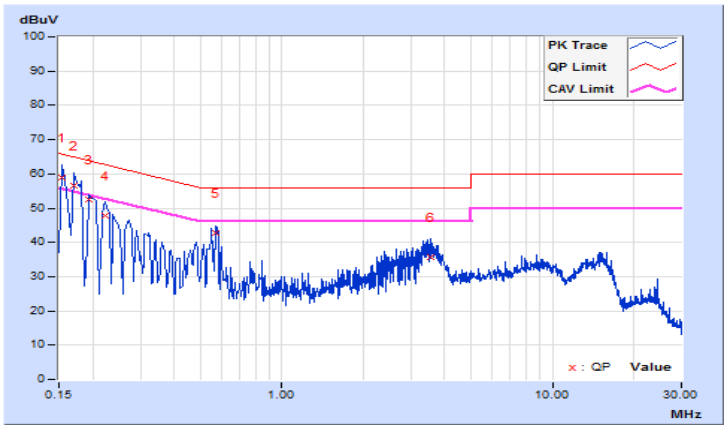


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	23℃, 66%RH
Tested by	Titan Hsu	Test Date	2021/01/05
Test Mode	Mode B		

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	0.15400	9.82	49.27	34.05	59.09	43.87	65.78	55.78	-6.69	-11.91
2	0.17000	9.83	46.81	31.59	56.64	41.42	64.96	54.96	-8.32	-13.54
3	0.19400	9.85	42.65	28.38	52.50	38.23	63.86	53.86	-11.36	-15.63
4	0.22200	9.85	37.91	24.10	47.76	33.95	62.74	52.74	-14.98	-18.79
5	0.57000	9.88	32.93	23.32	42.81	33.20	56.00	46.00	-13.19	-12.80
6	3.54200	9.99	25.63	14.75	35.62	24.74	56.00	46.00	-20.38	-21.26

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

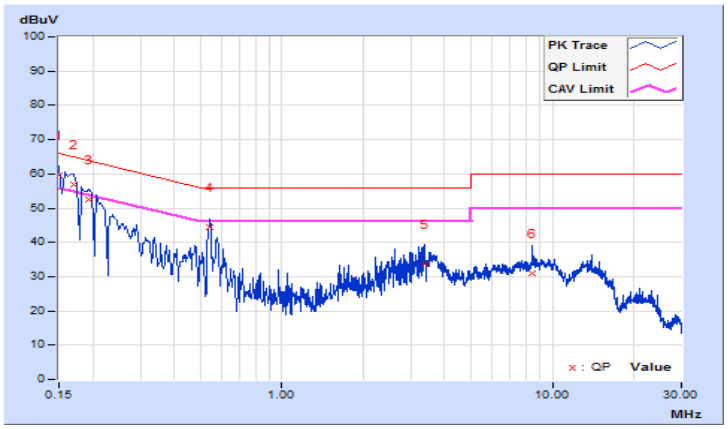


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	23℃, 66%RH
Tested by	Titan Hsu	Test Date	2021/01/05
Test Mode	Mode B		

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	**0.15000**	**9.84**	**49.89**	**35.13**	**59.73**	**44.97**	**66.00**	**56.00**	**-6.27**	**-11.03**
2	0.16932	9.84	47.23	32.84	57.07	42.68	64.99	54.99	-7.92	-12.31
3	0.19367	9.85	42.75	28.54	52.60	38.39	63.88	53.88	-11.28	-15.49
4	0.54200	9.91	34.70	26.94	44.61	36.85	56.00	46.00	-11.39	-9.15
5	3.35400	10.03	23.75	11.00	33.78	21.03	56.00	46.00	-22.22	-24.97
6	8.42200	10.11	20.89	14.38	31.00	24.49	60.00	50.00	-29.00	-25.51

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



4.3 Conducted Output Power Measurement

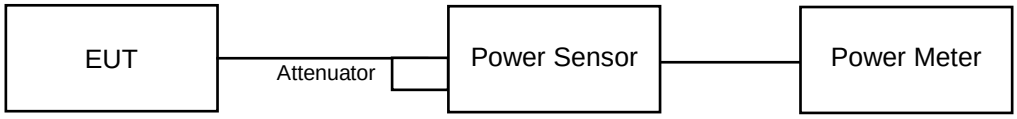
4.3.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 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 NANT ≤ 4;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;
Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less for 20 MHz channel widths with NANT ≥ 5.

For power measurements on all other devices: Array Gain = 10 log(NANT/NSS) dB.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

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

4.3.5 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 Results

(SISO)

802.11b

Channel	Frequency (MHz)	Peak Power (mW)		Peak Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
1	2412	185.780	162.555	22.69	22.11
6	2437	211.349	242.103	23.25	23.84
11	2462	210.378	217.270	23.23	23.37
12	2467	104.472	113.501	20.19	20.55
13	2472	90.365	60.674	19.56	17.83

Channel	Frequency (MHz)	Average Power (mW)		Average Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
1	2412	76.033	71.285	18.81	18.53
6	2437	96.161	96.605	19.83	19.85
11	2462	72.111	71.779	18.58	18.56
12	2467	48.195	43.451	16.83	16.38
13	2472	28.840	24.434	14.6	13.88

802.11g

Channel	Frequency (MHz)	Peak Power (mW)		Peak Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
1	2412	95.719	90.573	19.81	19.57
6	2437	160.694	174.985	22.06	22.43
11	2462	86.497	84.140	19.37	19.25
12	2467	49.204	48.865	16.92	16.89
13	2472	65.464	78.524	18.16	18.95

Channel	Frequency (MHz)	Average Power (mW)		Average Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
1	2412	40.832	40.926	16.11	16.12
6	2437	77.983	79.983	18.92	19.03
11	2462	32.359	32.434	15.1	15.11
12	2467	17.824	17.989	12.51	12.55
13	2472	11.402	11.429	10.57	10.58

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (mW)		Peak Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
1	2412	103.992	103.992	20.17	20.17
6	2437	116.950	115.611	20.68	20.63
11	2462	85.704	83.753	19.33	19.23
12	2467	52.723	45.394	17.22	16.57
13	2472	94.406	71.614	19.75	18.55

Channel	Frequency (MHz)	Average Power (mW)		Average Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
1	2412	40.087	39.994	16.03	16.02
6	2437	47.973	44.978	16.81	16.53
11	2462	32.285	31.989	15.09	15.05
12	2467	17.906	17.989	12.53	12.55
13	2472	11.858	11.272	10.74	10.52

802.11n (HT40)

Channel	Frequency (MHz)	Peak Power (mW)		Peak Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
3	2422	107.399	112.720	20.31	20.52
6	2437	132.739	136.458	21.23	21.35
9	2452	91.622	88.512	19.62	19.47
10	2457	68.234	73.282	18.34	18.65
11	2462	89.743	55.976	19.53	17.48

Channel	Frequency (MHz)	Average Power (mW)		Average Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
3	2422	35.727	35.810	15.53	15.54
6	2437	45.082	45.186	16.54	16.55
9	2452	28.510	27.102	14.55	14.33
10	2457	14.388	14.125	11.58	11.5
11	2462	13.062	11.246	11.16	10.51

802.11ax (HE20)

Channel	Frequency (MHz)	Peak Power (mW)		Peak Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
1	2412	71.614	71.779	18.55	18.56
6	2437	72.778	71.285	18.62	18.53
11	2462	74.645	70.307	18.73	18.47
12	2467	48.417	46.452	16.85	16.67
13	2472	81.470	84.140	19.11	19.25

Channel	Frequency (MHz)	Average Power (mW)		Average Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
1	2412	28.379	28.576	14.53	14.56
6	2437	28.510	28.314	14.55	14.52
11	2462	28.249	29.242	14.51	14.66
12	2467	17.783	17.824	12.5	12.51
13	2472	11.561	11.298	10.63	10.53

802.11ax (HE40)

Channel	Frequency (MHz)	Peak Power (mW)		Peak Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
3	2422	106.905	110.662	20.29	20.44
6	2437	130.617	134.276	21.16	21.28
9	2452	90.573	87.297	19.57	19.41
10	2457	67.143	72.277	18.27	18.59
11	2462	87.902	54.954	19.44	17.4

Channel	Frequency (MHz)	Average Power (mW)		Average Power (dBm)	
		Chain 0	Chain 1	Chain 0	Chain 1
3	2422	34.754	35.563	15.41	15.51
6	2437	44.566	44.668	16.49	16.5
9	2452	27.925	26.792	14.46	14.28
10	2457	14.191	13.996	11.52	11.46
11	2462	12.794	11.143	11.07	10.47

(MIMO)

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (mW)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	15.73	15.74	74.908	18.75
6	2437	16.71	16.87	95.522	19.80
11	2462	14.89	14.77	60.824	17.84
12	2467	11.92	11.76	30.557	14.85
13	2472	10.92	10.58	23.788	13.76

Channel	Frequency (MHz)	Average Power (mW)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	11.84	11.84	30.551	14.85
6	2437	13.06	13.11	40.695	16.10
11	2462	10.84	10.78	24.101	13.82
12	2467	7.84	7.91	12.262	10.89
13	2472	4.88	4.72	6.041	7.81

802.11n (HT40)

Channel	Frequency (MHz)	Peak Power (mW)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
3	2422	15.26	15.32	67.615	18.30
6	2437	16.11	16.09	81.476	19.11
9	2452	16.55	16.43	89.140	19.50
10	2457	14.23	14.51	54.734	17.38
11	2462	14.44	14.31	54.775	17.39

Channel	Frequency (MHz)	Average Power (mW)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
3	2422	10.52	10.32	22.037	13.43
6	2437	10.83	10.67	23.774	13.76
9	2452	10.73	10.87	24.048	13.81
10	2457	6.32	6.29	8.541	9.32
11	2462	6.29	6.21	8.434	9.26

802.11ax (HE20)

Channel	Frequency (MHz)	Peak Power (mW)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	15.67	15.67	73.796	18.68
6	2437	16.66	16.81	94.318	19.75
11	2462	14.81	14.73	59.986	17.78
12	2467	11.85	11.7	30.102	14.79
13	2472	10.86	10.49	23.384	13.69

Channel	Frequency (MHz)	Average Power (mW)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	11.77	11.79	30.132	14.79
6	2437	13.01	13.09	40.369	16.06
11	2462	10.76	10.82	23.991	13.80
12	2467	7.77	7.83	12.051	10.81
13	2472	4.81	4.7	5.978	7.77

802.11ax (HE40)

Channel	Frequency (MHz)	Peak Power (mW)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
3	2422	15.21	15.25	66.686	18.24
6	2437	16.02	16.01	79.897	19.03
9	2452	16.47	16.33	87.315	19.41
10	2457	14.15	14.42	53.671	17.30
11	2462	14.36	14.22	53.714	17.30

Channel	Frequency (MHz)	Average Power (mW)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
3	2422	10.45	10.25	21.684	13.36
6	2437	10.77	10.61	23.448	13.70
9	2452	10.69	10.82	23.800	13.77
10	2457	6.26	6.23	8.424	9.26
11	2462	6.21	6.16	8.309	9.20

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 according to ISO/IEC 17025.

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

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

--- END ---