FCC RADIO TEST REPORT

FCC ID	:	**PU5-TP00114C**
Equipment	:	**Notebook Computer**
Brand Name	:	**Lenovo**
Model Name	:	**TP00114C**
Applicant	:	**Wistron Corporation** **21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221,Taiwan**
Manufacturer	:	**Lenovo PC HK Limited** **23/F, Lincoln House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong,P.R. China**
Standard	:	**FCC Part 15 Subpart E §15.407**

Equipment: Intel AX200NGW tested inside of Lenovo Notebook Computer

The product was received on Apr. 08, 2021 and testing was started from Jun. 09, 2021 and completed on Jun. 17, 2021. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this partial report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan

Table of Contents

History of this test report **3**
Summary of Test Result **4**
1 General Description **5**
1.1 Product Feature of Equipment Under Test 5
1.2 Product Specification of Equipment Under Test 6
1.3 Modification of EUT 6
1.4 Testing Location 7
1.5 Applicable Standards 7
2 Test Configuration of Equipment Under Test **8**
2.1 Carrier Frequency and Channel 8
2.2 Test Mode 9
2.3 Connection Diagram of Test System 10
2.4 Support Unit used in test configuration and system 10
2.5 EUT Operation Test Setup 10
3 Test Result **11**
3.1 Maximum Conducted Output Power Measurement 11
3.2 Unwanted Emissions Measurement 12
3.3 AC Conducted Emission Measurement 16
3.4 Antenna Requirements 18
4 List of Measuring Equipment **19**
5 Uncertainty of Evaluation **20**
Appendix A. Conducted Test Results
Appendix B. AC Conducted Emission Test Result
Appendix C. Radiated Spurious Emission
Appendix D. Radiated Spurious Emission Plots
Appendix E. Duty Cycle Plots
Appendix F. Setup Photographs

History of this test report

Report No.	Version	Description	Issued Date
FR140857-01E	01	Initial issue of report	Jun. 15, 2021
FR140857-01E	02	Revise test data	Jun. 18, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.403(i)	6dB & 26dB Bandwidth	-	See Note
-	2.1049	99% Occupied Bandwidth	-	See Note
3.1	15.407(a)	Maximum Conducted Output Power	Pass	-
-	15.407(a)	Power Spectral Density	-	See Note
3.2	15.407(b)	Unwanted Emissions	Pass	Under limit 16.39 dB at 17355.000 MHz
3.3	15.207	AC Conducted Emission	Pass	Under limit 10.83 dB at 4.574 MHz
-	15.407(c)	Automatically Discontinue Transmission	-	See Note
3.4	15.203 15.407(a)	Antenna Requirement	Pass	-

Note: The module (Model: AX200NGW) makes no difference after verifying output power, this report reuses test data from the module report.

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sheng Kuo

Report Producer: Tina Chuang

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00114C
FCC ID	PU5-TP00114C
Sample 1	EUT with High-Tek Antenna
Sample 2	EUT with AWAN Antenna
EUT supports Radios application	WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT80/VHT160 WLAN 11ax HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer.
2. Equipment: Intel AX200NGW tested inside of Lenovo Notebook Computer.

Antenna Information			
Antenna 1 (WLAN)	**Manufacturer**	High-Tek	
	Antenna Type	Tx1:PIFA Antenna	Tx2:PIFA Antenna
	Part number	025.901JG.0011	025.901JH.0011
	Peak gain (dBi)	Main Antenna :	Aux Antenna :
		WLAN(5G B4):1.44	WLAN(5G B4):-0.75
Antenna 2 (WLAN)	**Manufacturer**	AWAN	
	Antenna Type	Tx1:PIFA Antenna	Tx2:PIFA Antenna
	Part number	025.901JG.0021	025.901JH.0021
	Peak gain (dBi)	Main Antenna :	Aux Antenna :
		WLAN(5G B4):-1.93	WLAN(5G B4):1.91

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.
2. For Radiated Test Cases, the tests were performed with “High-Tek Antenna”

1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx/Rx Frequency Range	5745 MHz ~ 5825 MHz
Maximum Output Power to Antenna	**<Chain A>** 802.11a: 12.40 dBm / 0.0174 W **<Chain B>** 802.11a: 12.20 dBm / 0.0166 W **MIMO<Chain A+B>** 802.11ax HE20: 12.46 dBm / 0.0176 W 802.11ax HE40: 12.41 dBm / 0.0174 W 802.11ax HE80: 12.41 dBm / 0.0174 W
Type of Modulation	802.11a/n: OFDM (BPSK/QPSK/16QAM/64QAM) 802.11ac: OFDM (BPSK/QPSK/16QAM/64QAM/256QAM) 802.11ax: OFDM (BPSK/QPSK/16QAM/64QAM/256QAM/ 1024QAM)
Antenna Function Description	

	Chain A	Chain B
802.11 a	V	V
802.11 ax MIMO	V	V

Note:

1. For other wireless features of this EUT, test report will be issued separately.
2. MIMO Chain A+B is a calculated result from sum of the power MIMO Chain A and MIMO Chain B.

1.3 Modification of EUT

No modifications are made to the EUT during all test items.

1.4 Testing Location

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan
Test Site No.	**Sporton Site No.**
	TH02-HY, CO05-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan
Test Site No.	**Sporton Site No.**
	03CH12-HY (TAF Code: 3786)
Remark	The Radiated Spurious Emissions test item subcontracted to Sporton International Inc. Wensan Laboratory.

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW1190 and TW3786

1.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (1 GHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in Tablet Type (three orthogonal panels, X, Y, Z) and Notebook Type. The worst cases (Y plane) were recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5725-5850 MHz Band 4 (U-NII-3)	149	5745	157	5785
	151*	5755	159*	5795
	153	5765	161	5805
	155#	5775	165	5825

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ax HE40.
2. The above Frequency and Channel in "#" were 802.11ac VHT80 and 802.11ax HE80.

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

Single Mode

Modulation	Data Rate
802.11a	6 Mbps

MIMO Mode

Modulation	Data Rate
802.11n HE20	MCS0
802.11n HE40	MCS0
802.11n HE80	MCS0

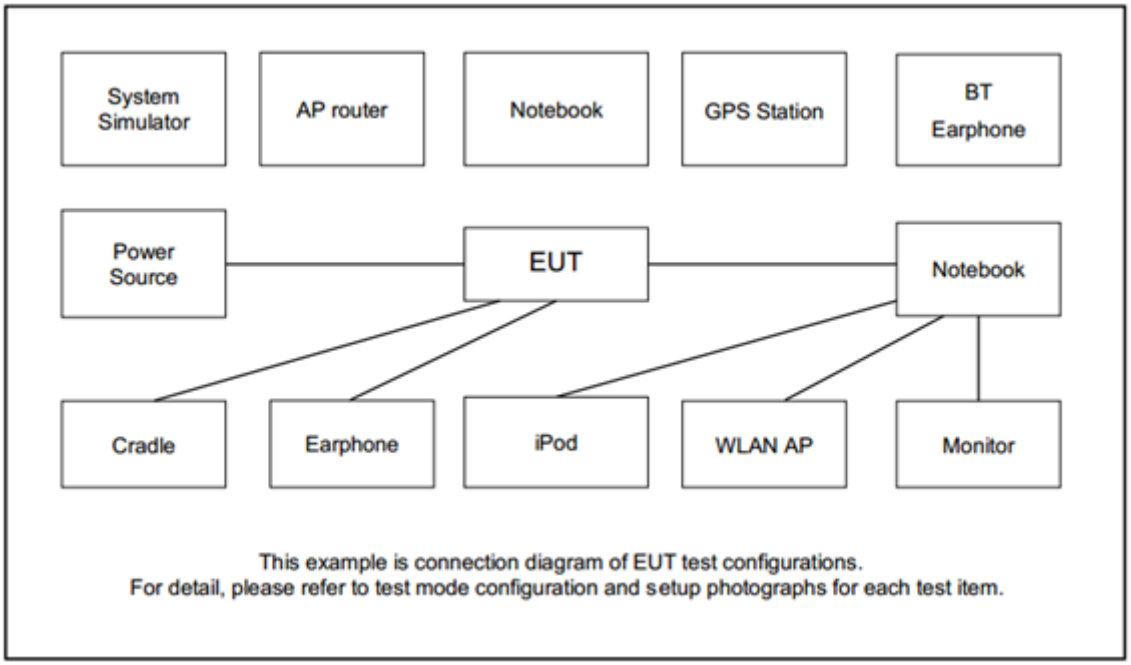
Test Cases	
AC Conducted Emission	Mode 1 : Bluetooth Link + WLAN (2.4GHz) Link + TC + TF + Adapter

Remark:
1. TF stands for test function, and consists of H-Pattern, MPEG4, Camera, and fingerprint.
2. TC stands for test configuration, and consists of Earphone + Mic, Micro SD Card, USB HD (Data Link) (USB *2), LCD Monitor (HDMI out) and LAN Link.
3. Data Link means data application transferred mode between EUT and USB HD.
4. HDMI means media application transferred between EUT and external display.

Ch. #		Band IV：5725-5850 MHz	
		802.11a	802.11ax HE20
L	Low	-	-
M	Middle	157	157
H	High	-	-

Remark: For radiation spurious emission, the final modulation and the worst data rate was reference the max RF conducted power.

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
2.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
3.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A
4.	Notebook	Dell	Latitude 3400	FCC DoC	N/A	AC I/P：Unshielded, 1.2m DC O/P：Shielded, 1.8m
5.	LCD Monitor	Asus	PB27UQ	FCC DoC	N/A	Unshielded,1.8m
6.	USB HD	ADATA	HV620S-1T	FCC DoC	Shielded, 1.0m	N/A
7.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “DRTU 12.1947.0-10428” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

3 Test Result

3.1 Maximum Conducted Output Power Measurement

3.1.1 Limit of Maximum Conducted Output Power

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

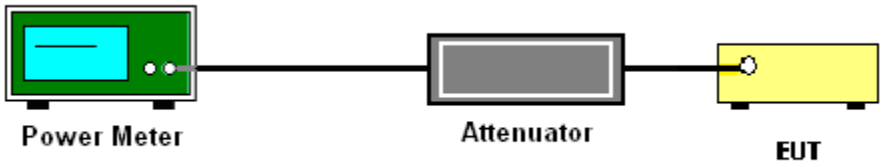
3.1.3 Test Procedures

The testing follows Method PM-G of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM-G (Measurement using a gated RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit at its maximum power control level.
3. Measure the average power of the transmitter.
4. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

3.1.4 Test Setup



3.1.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.

3.2 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.2.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5.725-5.85 GHz band:

15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Frequency (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: The following formula is used to convert the EIRP to field strength.

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

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.3

(3) KDB789033 D02 v02r01 G)2)c)

(i) Sections 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of −27 dBm/MHz.

(ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are based on the use of a peak detector.

3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.

   (1) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

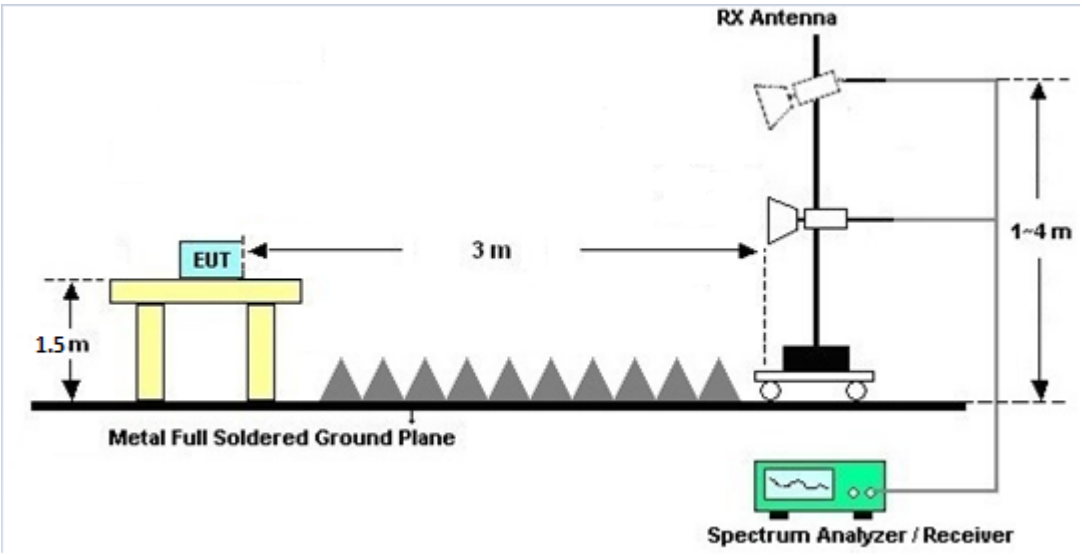
   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

   (2) Procedures for Average Unwanted Emissions Measurements Above 1000 MHz

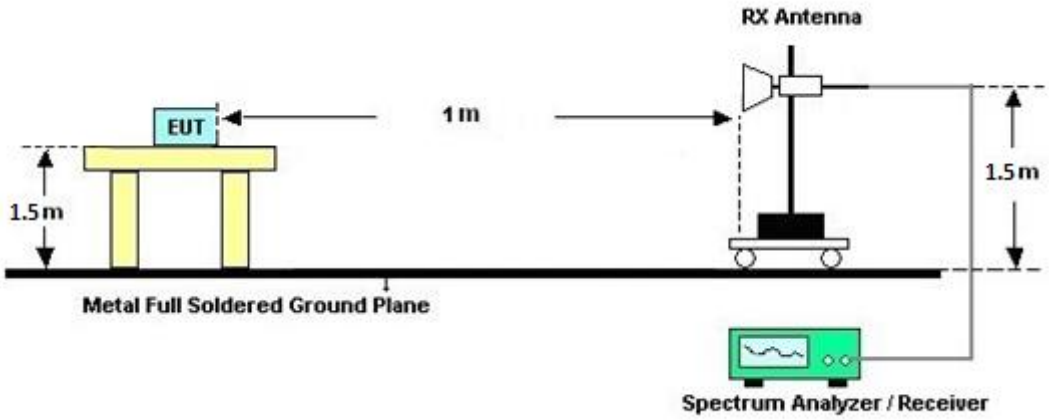
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT was placed on a turntable with 1.5 meter for frequency above 1 GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.2.4 Test Setup

For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.2.5 Test Result of Radiated Band Edges

Please refer to Appendix C and D.

3.2.6 Duty Cycle

Please refer to Appendix E.

3.2.7 Test Result of Unwanted Radiated Emission

Please refer to Appendix C and D.

3.3 AC Conducted Emission Measurement

3.3.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

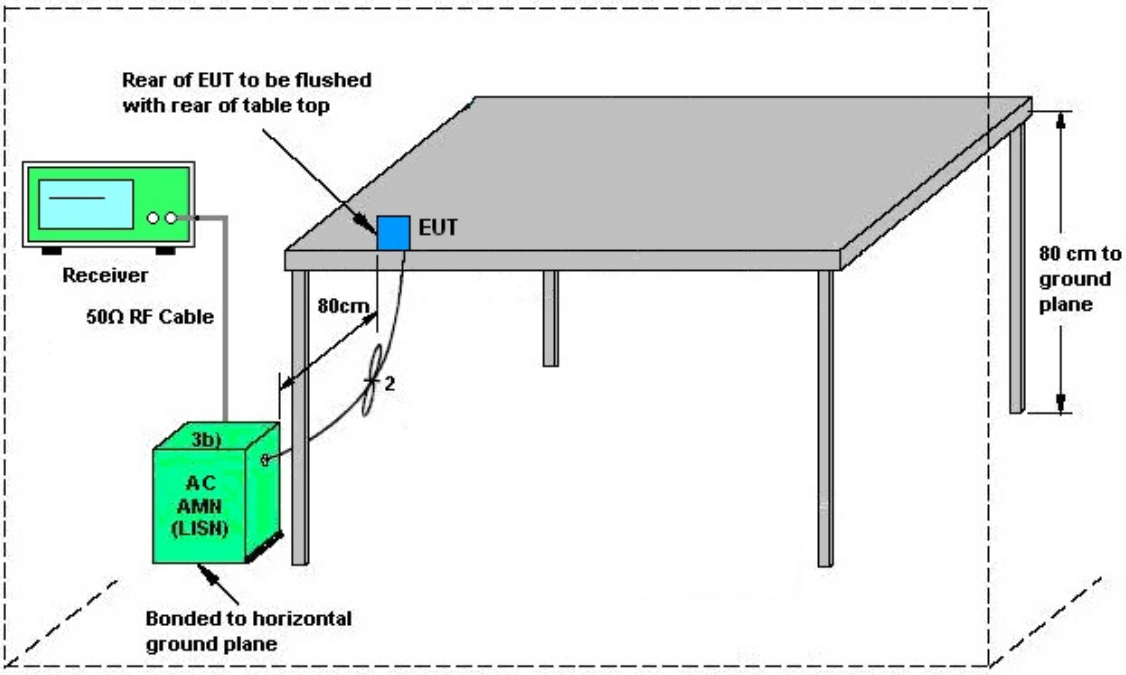
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.3.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.3.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.4 Antenna Requirements

3.4.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1328	1GHz~18GHz	Nov. 23, 2020	Jun. 10, 2021~ Jun. 14, 2021	Nov. 22, 2021	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	00993	18GHz~40GHz	Nov. 19, 2020	Jun. 10, 2021~ Jun. 14, 2021	Nov. 18, 2021	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY57280120	1GHz~26.5GHz	Jul. 20, 2020	Jun. 10, 2021~ Jun. 14, 2021	Jul. 19, 2021	Radiation (03CH12-HY)
Preamplifier	E-INSTRUMENT TECH LTD.	ERA-100M-18G-56-01-A70	EC1900249	1GHz-18GHz	Dec. 05, 2020	Jun. 10, 2021~ Jun. 14, 2021	Dec. 04, 2021	Radiation (03CH12-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 11, 2020	Jun. 10, 2021~ Jun. 14, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Jan. 15, 2021	Jun. 10, 2021~ Jun. 14, 2021	Jan. 14, 2022	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 11, 2020	Jun. 10, 2021~ Jun. 14, 2021	Dec. 10, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 22, 2021	Jun. 10, 2021~ Jun. 14, 2021	Feb. 21, 2022	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz~40GHz	Feb. 22, 2021	Jun. 10, 2021~ Jun. 14, 2021	Feb. 21, 2022	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Jun. 10, 2021~ Jun. 14, 2021	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jun. 10, 2021~ Jun. 14, 2021	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Jun. 10, 2021~ Jun. 14, 2021	N/A	Radiation (03CH12-HY)
Filter	Wainwright	WLKS1200-12SS	SN2	1.2GHz Low Pass Filter	Mar. 17, 2021	Jun. 10, 2021~ Jun. 14, 2021	Mar. 16, 2022	Radiation (03CH12-HY)
Filter	Wainwright	WHKX8-5872.5-6750-18000-40ST	SN2	6.75GHz High Pass Filter	Mar. 17, 2021	Jun. 10, 2021~ Jun. 14, 2021	Mar. 16, 2022	Radiation (03CH12-HY)
Power Sensor	DARE	RPR3006W	17100015SNO37	10MHz~6GHz	Dec. 02, 2020	Jun. 09, 2021- Jun. 17, 2021	Dec. 01, 2021	Conducted (TH02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSQ	200578/026	20Hz-26.5GHz	Jul. 17, 2020	Jun. 09, 2021- Jun. 17, 2021	Jul. 16, 2021	Conducted (TH02-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW200302	N/A	Mar. 17, 2021	Jun. 09, 2021- Jun. 17, 2021	Mar. 16, 2022	Conducted (TH02-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jun. 12, 2021	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 30, 2020	Jun. 12, 2021	Nov. 29, 2021	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 01, 2020	Jun. 12, 2021	Nov. 30, 2021	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 16, 2020	Jun. 12, 2021	Nov. 15, 2021	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Jun. 12, 2021	N/A	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Feb. 25, 2021	Jun. 12, 2021	Feb. 24, 2022	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 31, 2020	Jun. 12, 2021	Dec. 30, 2021	Conduction (CO05-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.3 dB**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.6 dB**

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.9 dB**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Ching Chen	Temperature:	24~25	°C
Test Date:	2021/6/9-2021/6/17	Relative Humidity:	51~54	%

Remark: For Conducted Test Items, Ant. 1 means Chain A (Aux.) and Ant. 2 means Chain B (Main).

TEST RESULTS DATA
Average Power Table

Band IV single antenna												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	157	5785	12.40	12.20		30.00	30.00	-0.75	1.44	Pass

TEST RESULTS DATA
Average Power Table

Band IV MIMO													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
						Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
HE20	MCS0	2	157	5785	Full	9.60	9.30	12.46	30.00		1.44		Pass
HE40	MCS0	2	151	5755	Full	9.60	9.20	12.41	30.00		1.44		Pass
HE40	MCS0	2	159	5795	Full	9.60	9.20	12.41	30.00		1.44		Pass
HE80	MCS0	2	155	5775	Full	9.60	9.20	12.41	30.00		1.44		Pass

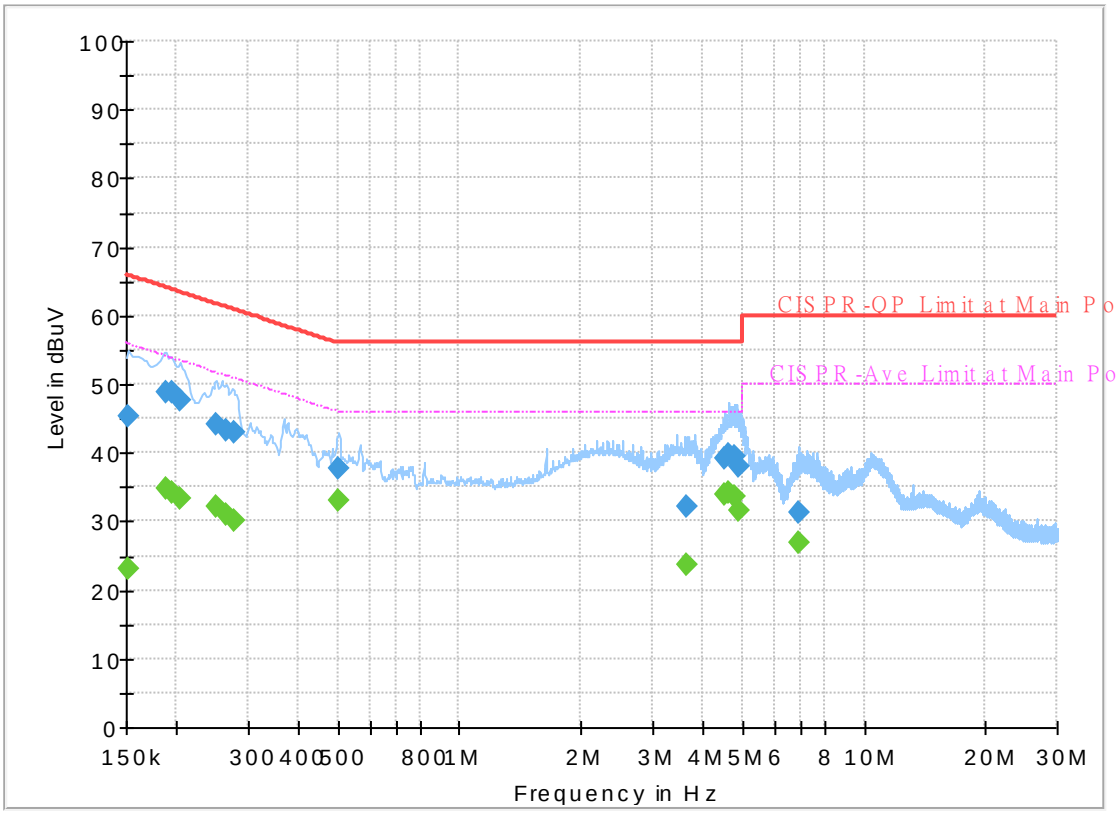
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Tom Lee	**Temperature :**	23~26℃
		Relative Humidity :	40~50%

EUT Information

Report NO :	140857-01
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

Full Spectrum



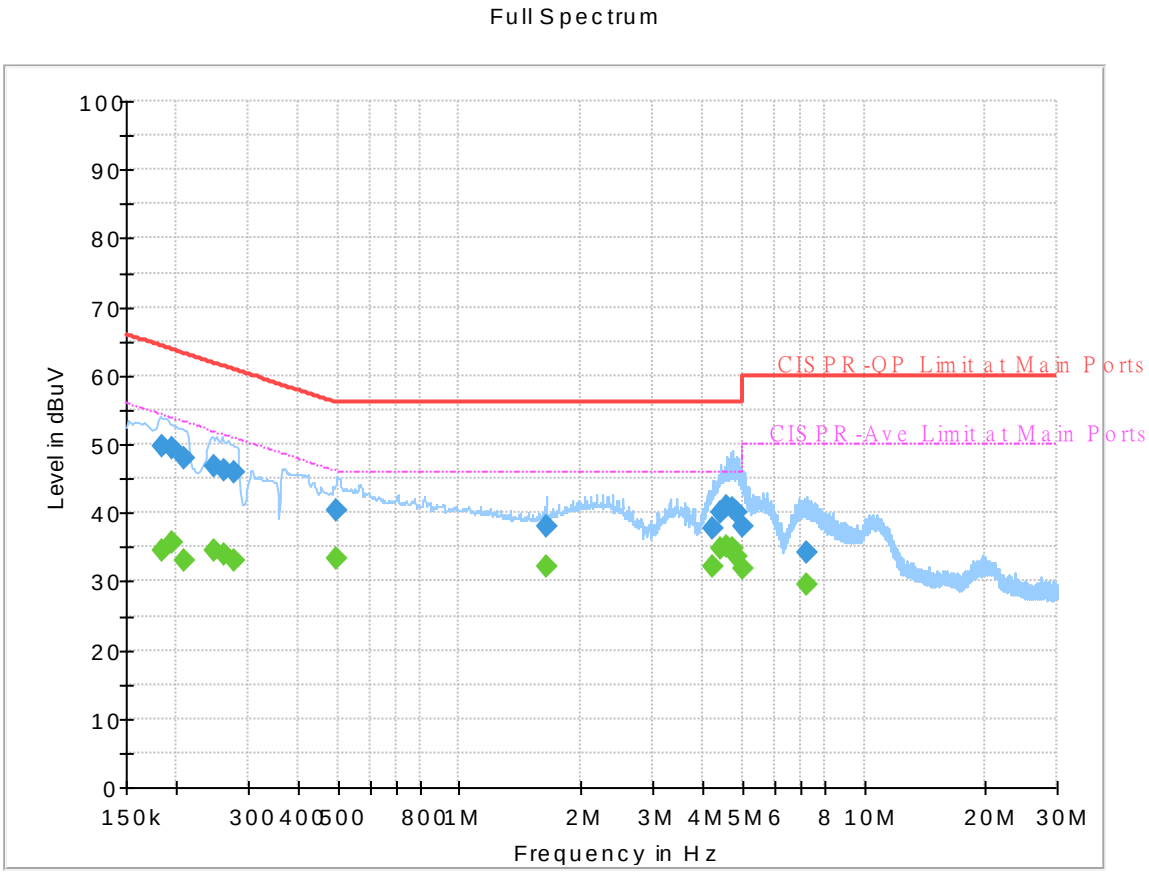
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	23.11	55.88	32.77	L1	OFF	19.6
0.152250	45.30	---	65.88	20.58	L1	OFF	19.6
0.188250	---	34.70	54.11	19.41	L1	OFF	19.6
0.188250	48.80	---	64.11	15.31	L1	OFF	19.6
0.195000	---	34.12	53.82	19.70	L1	OFF	19.6
0.195000	48.69	---	63.82	15.13	L1	OFF	19.6
0.204000	---	33.32	53.45	20.13	L1	OFF	19.6
0.204000	47.65	---	63.45	15.80	L1	OFF	19.6
0.251250	---	32.20	51.72	19.52	L1	OFF	19.6
0.251250	44.06	---	61.72	17.66	L1	OFF	19.6
0.264750	---	31.04	51.28	20.24	L1	OFF	19.6
0.264750	43.32	---	61.28	17.96	L1	OFF	19.6
0.276000	---	30.17	50.94	20.77	L1	OFF	19.6
0.276000	42.86	---	60.94	18.08	L1	OFF	19.6
0.503250	---	32.90	46.00	13.10	L1	OFF	19.7
0.503250	37.62	---	56.00	18.38	L1	OFF	19.7
3.664500	---	23.66	46.00	22.34	L1	OFF	19.9
3.664500	32.13	---	56.00	23.87	L1	OFF	19.9
4.508250	---	33.98	46.00	12.02	L1	OFF	19.9
4.508250	39.32	---	56.00	16.68	L1	OFF	19.9
4.650000	---	34.07	46.00	11.93	L1	OFF	19.9

4.650000	39.70	---	56.00	16.30	L1	OFF	19.9
4.791750	---	33.53	46.00	12.47	L1	OFF	19.9
4.791750	39.39	---	56.00	16.61	L1	OFF	19.9
4.924500	---	31.70	46.00	14.30	L1	OFF	19.9
4.924500	37.90	---	56.00	18.10	L1	OFF	19.9
6.913500	---	26.95	50.00	23.05	L1	OFF	20.0
6.913500	31.43	---	60.00	28.57	L1	OFF	20.0

EUT Information

Report NO :	140857-01
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.183750	---	34.55	54.31	19.76	N	OFF	19.6
0.183750	49.82	---	64.31	14.49	N	OFF	19.6
0.195000	---	35.74	53.82	18.08	N	OFF	19.6
0.195000	49.49	---	63.82	14.33	N	OFF	19.6
0.208500	---	33.13	53.27	20.14	N	OFF	19.6
0.208500	47.88	---	63.27	15.39	N	OFF	19.6
0.246750	---	34.43	51.87	17.44	N	OFF	19.6
0.246750	46.86	---	61.87	15.01	N	OFF	19.6
0.262500	---	33.99	51.35	17.36	N	OFF	19.6
0.262500	46.32	---	61.35	15.03	N	OFF	19.6
0.276000	---	32.96	50.94	17.98	N	OFF	19.6
0.276000	45.80	---	60.94	15.14	N	OFF	19.6
0.498750	---	33.28	46.02	12.74	N	OFF	19.7
0.498750	40.39	---	56.02	15.63	N	OFF	19.7
1.637250	---	32.16	46.00	13.84	N	OFF	20.1
1.637250	38.14	---	56.00	17.86	N	OFF	20.1
4.231500	---	32.22	46.00	13.78	N	OFF	19.9
4.231500	37.59	---	56.00	18.41	N	OFF	19.9
4.431750	---	34.76	46.00	11.24	N	OFF	19.9
4.431750	39.95	---	56.00	16.05	N	OFF	19.9
4.573500	---	35.17	46.00	10.83	N	OFF	19.9

4.573500	40.79	---	56.00	15.21	N	OFF	19.9
4.715250	---	34.74	46.00	11.26	N	OFF	19.9
4.715250	40.75	---	56.00	15.25	N	OFF	19.9
4.848000	---	33.68	46.00	12.32	N	OFF	19.9
4.848000	39.96	---	56.00	16.04	N	OFF	19.9
4.992000	---	31.90	46.00	14.10	N	OFF	19.9
4.992000	37.99	---	56.00	18.01	N	OFF	19.9
7.244250	---	29.52	50.00	20.48	N	OFF	20.0
7.244250	34.14	---	60.00	25.86	N	OFF	20.0

Appendix C. Radiated Spurious Emission

Test Engineer :	Jack Cheng , Lance Chiang and Chuan Chu	Temperature :	21.8~26.8°C
		Relative Humidity :	53.6~68.2%

Remark: For Radiated Spurious Emission Test Items, Ant. 1 means Chain A (Aux.) and Ant. 2 means Chain B (Main).

Band 4 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 157 5785MHz		11570	49.43	-24.57	74	58.72	39.72	17.03	66.04	100	0	P	H
		17355	51.31	-16.89	68.2	57.05	41	20.42	67.16	100	0	P	H
													H
													H
		11570	49.1	-24.9	74	58.39	39.72	17.03	66.04	100	0	P	V
		17355	51.49	-16.71	68.2	57.23	41	20.42	67.16	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 4 5725~5850MHz

WIFI 802.11ax HE20 Full (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ax HE20 Full CH 157 5785MHz		11570	49.33	-24.67	74	58.62	39.72	17.03	66.04	100	0	P	H
		17355	51.81	-16.39	68.2	57.55	41	20.42	67.16	100	0	P	H
													H
													H
		11570	49.39	-24.61	74	58.68	39.72	17.03	66.04	100	0	P	V
		17355	51.62	-16.58	68.2	57.36	41	20.42	67.16	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".

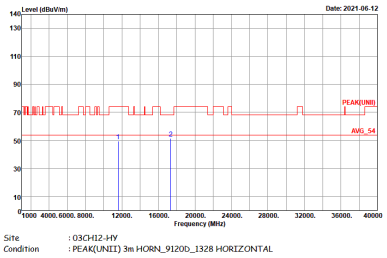
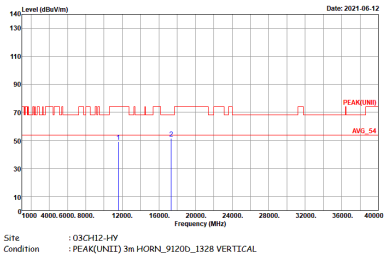
Appendix D. Radiated Spurious Emission Plots

Test Engineer :	Jack Cheng , Lance Chiang and Chuan Chu	**Temperature :**	21.8~26.8°C
		Relative Humidity :	53.6~68.2%

Remark: For Radiated Spurious Emission Test Items, Ant. 1 means Chain A (Aux.) and Ant. 2 means Chain B (Main).

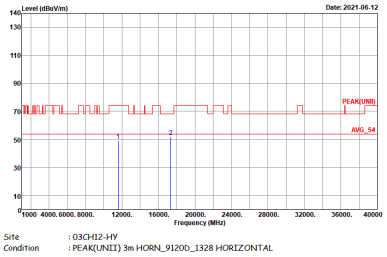
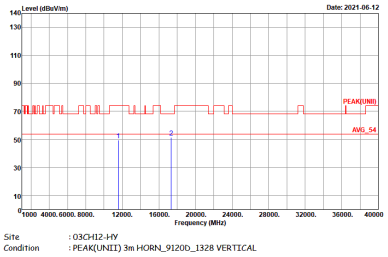
Band 4 - 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI	**Band 4 5725~5850MHz Harmonic @ 3m**	
ANT	**802.11a CH157 5785MHz**	
2	**Horizontal**	**Vertical**
Peak **Avg.**		

Band 4 - 5725~5850MHz

WIFI 802.11ax HE20 Full (Harmonic @ 3m)

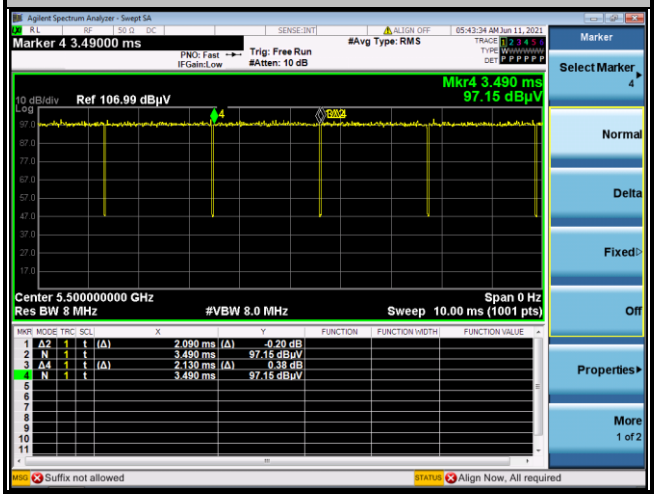
WIFI	Band 4 5725~5850MHz Harmonic @ 3m	
ANT	802.11ax HE20 Full CH157 5785MHz	
1+2	Horizontal	Vertical
Peak Avg.		

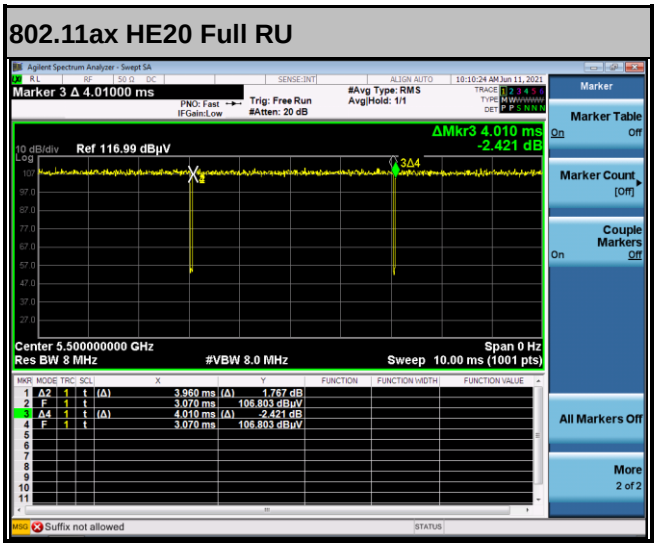
Appendix E. Duty Cycle Plots

Chain	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
B	802.11a	98.12	-	-	10Hz	0.08
A+B	5GHz 802.11ax HE20 Full RU	98.75	-	-	10Hz	0.05

<Chain B>

802.11a



MIMO <Chain A+B>

802.11ax HE20 Full RU