FCC RADIO TEST REPORT

FCC ID	:	**PY322100564**
Equipment	:	**Netgear 5G MHS Travel Router**
Brand Name	:	**Netgear**
Model Name	:	**MR6150**
Applicant	:	**Netgear Inc** **350 E. Plumeria Drive, San Jose, CA 95134, United States**
Manufacturer	:	**Netgear Inc** **350 E. Plumeria Drive, San Jose, CA 95134, United States**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on May 11, 2022 and testing was performed from May 23, 2022 to Jun. 15, 2022. 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 report apply exclusively to the tested model / sample. Without written approval from 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 (R.O.C.)

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 Modification of EUT 5
1.3 Testing Location 6
1.4 Applicable Standards 6
2 Test Configuration of Equipment Under Test **7**
2.1 Carrier Frequency and Channel 7
2.2 Test Mode 8
2.3 Connection Diagram of Test System 9
2.4 Support Unit used in test configuration and system 9
2.5 EUT Operation Test Setup 9
2.6 Measurement Results Explanation Example 10
3 Test Result **11**
3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement 11
3.2 Maximum Conducted Output Power Measurement 16
3.3 Power Spectral Density Measurement 17
3.4 Unwanted Emissions Measurement 21
3.5 AC Conducted Emission Measurement 26
3.6 Antenna Requirements 28
4 List of Measuring Equipment **30**
5 Uncertainty of Evaluation **32**
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	Issue Date
FR190614-04C	01	Initial issue of report	Jun. 22, 2022
FR190614-04C	02	Revise Test mode and section 3.3.5	Aug. 31, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.403(i)	6dB & 26dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.407(a)	Maximum Conducted Output Power	Pass	-
3.3	15.407(a)	Power Spectral Density	Pass	-
3.4	15.407(b)	Unwanted Emissions	Pass	7.10 dB under the limit at 50.790 MHz
3.5	15.207	AC Conducted Emission	Pass	9.49 dB under the limit at 0.593 MHz
3.6	15.203 15.407(a)	Antenna Requirement	Pass	-

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
   It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Avis Chuang

Report Producer: Rachel Hsieh

1 General Description

1.1 Product Feature of Equipment Under Test

LTE/5G NR, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax, Wi-Fi 5GHz 802.11a/n/ac/ax, and GPS

Product Feature	
Antenna Type	WWAN: **<Ant. 1>**: Monopole Antenna **<Ant. 2>**: Monopole Antenna WLAN: **<Ant. 3>**: Monopole Antenna **<Ant. 4>**: Monopole Antenna GPS: PIFA Antenna

Antenna information		
5725 MHz ~ 5850 MHz	Peak Gain (dBi)	Ant. 3: 2.90 Ant. 4: 1.95

Remark: The EUT's information above is declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 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 (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	CO05-HY, 03CH07-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 (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	TH05-HY (TAF Code: 3786)
Remark	The Conducted test item subcontracted to Sporton International Inc. Wensan Laboratory.

FCC designation No.: TW1190 and TW3786

1.4 Applicable Standards

According to the specifications declared by 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 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

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 (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find X plane as worst plane.

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 with "*" are 802.11n HT40 and 802.11ac VHT40 and 802.11ax HE40.
2. The above Frequency and Channel with "#" are 802.11ac VHT80 and 802.11ax HE80.

2.2 Test Mode

The CDD mode is chosen as worst case configuration for all test cases due to higher power than SISO mode.

The 802.11n/ac mode has no higher power and PSD than 802.11ax mode, thus the 802.11ax mode is chosen as main test configuration, and the 802.11n/ac mode is verified the power.

The final test modes consider the modulation and the worst data rates as shown in the table below.

MIMO Mode

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20 (Covered by HE20)	MCS0
802.11n HT40 (Covered by HE40)	MCS0
802.11ac VHT20 (Covered by HE20)	MCS0
802.11ac VHT40 (Covered by HE40)	MCS0
802.11ac VHT80 (Covered by HE80)	MCS0
802.11ax HE20	MCS0
802.11ax HE40	MCS0
802.11ax HE80	MCS0

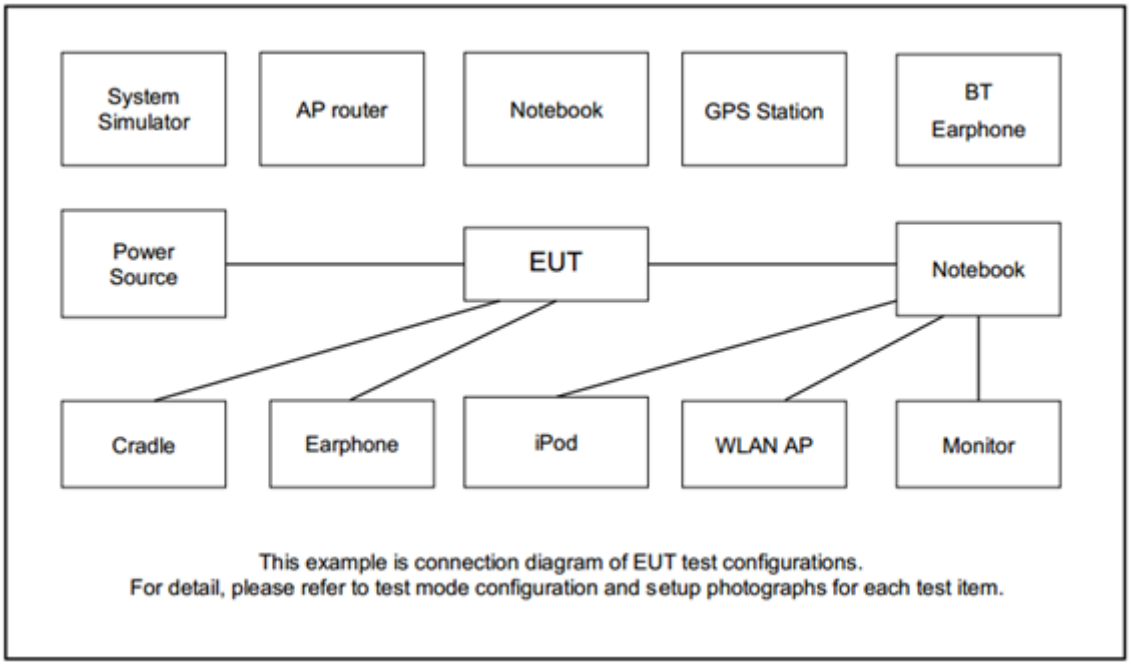
Remark: The conducted power level of each chain in MIMO mode is equal or higher than SISO mode.

Test Cases	
AC Conducted Emission	Mode 1 : LTE Band 7 Link +WLAN (5GHz) Link – Master + USB Cable (Charging from AC Adapter) + Battery

Ch. #		Band IV：5725-5850 MHz			
		802.11a	802.11ax HE20	802.11ax HE40	802.11ax HE80
L	Low	149	149	151	-
M	Middle	157	157	-	155
H	High	165	165	159	-

Remark: For radiation spurious emission, the modulation and the data rate picked for testing are determined by 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.	5G Wireless Test Platform	Anritsu	MT8000A	N/A	N/A	Unshielded, 1.8 m
2.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
3.	Notebook	DELL	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

The RF test items, utility “QPSR v.5.0-00197” 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.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

3.1.1 Description of 6dB and 26dB and 99% Occupied Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

26dB and 99% Occupied bandwidth are reporting only.

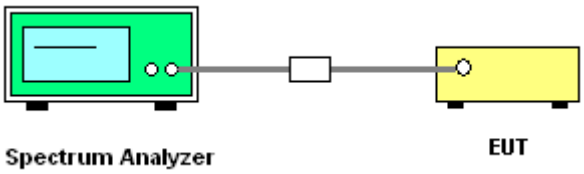
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section C) Emission bandwidth for the band 5.725-5.85 GHz
2. Set RBW = 100 kHz.
3. Set the VBW ≥ 3 x RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 6 dB down from the peak of the emission.
7. Measure and record the results in the test report.

3.1.4 Test Setup

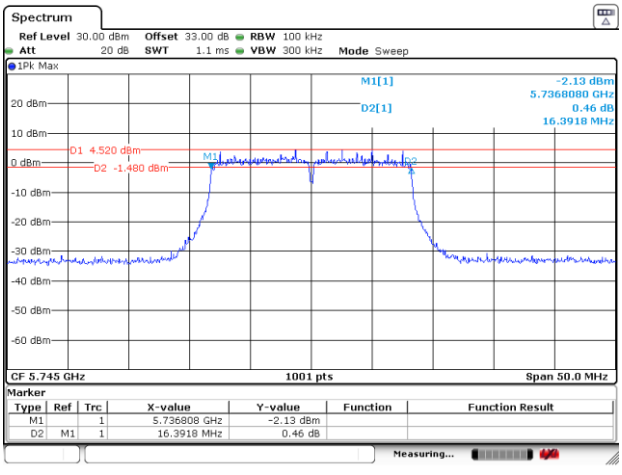
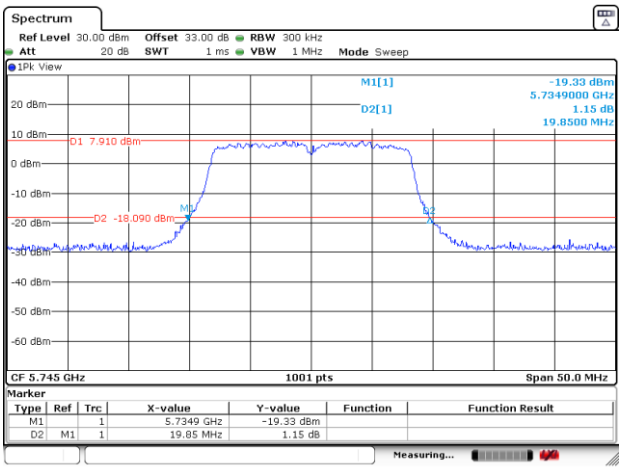
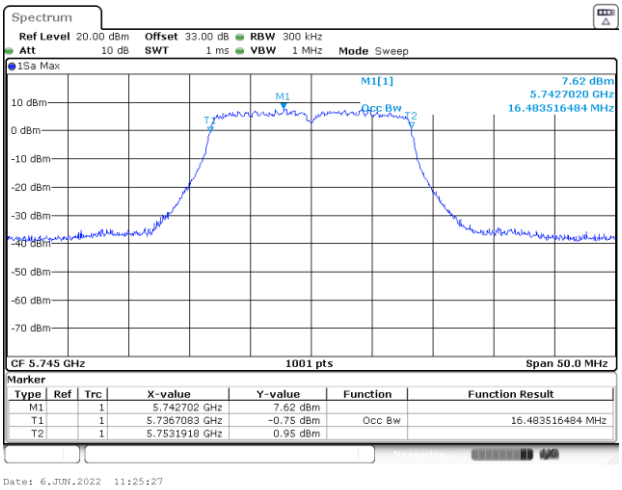


3.1.5 Test Result of 6dB and 26dB and 99% Occupied Bandwidth

Please refer to Appendix A.

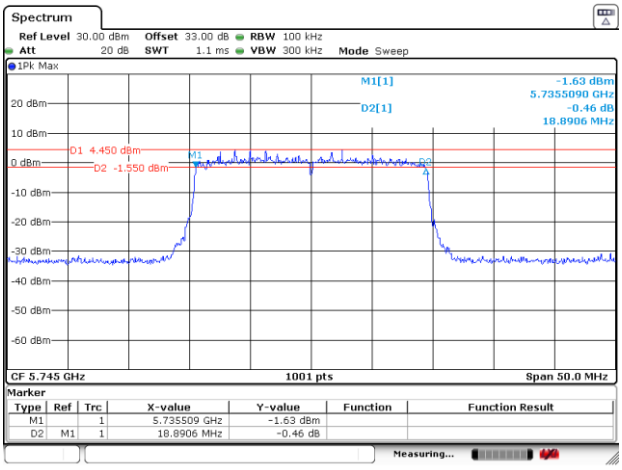
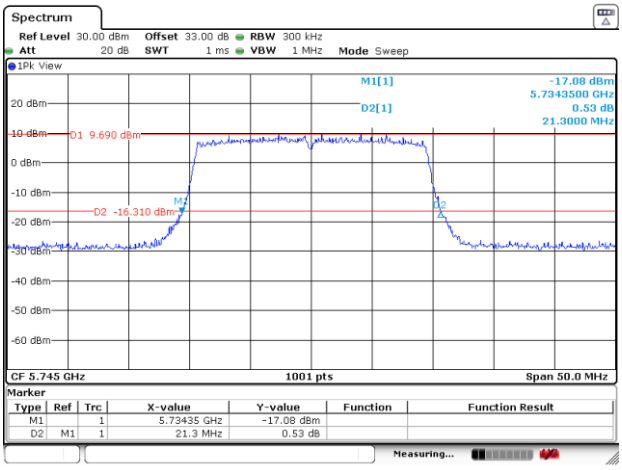
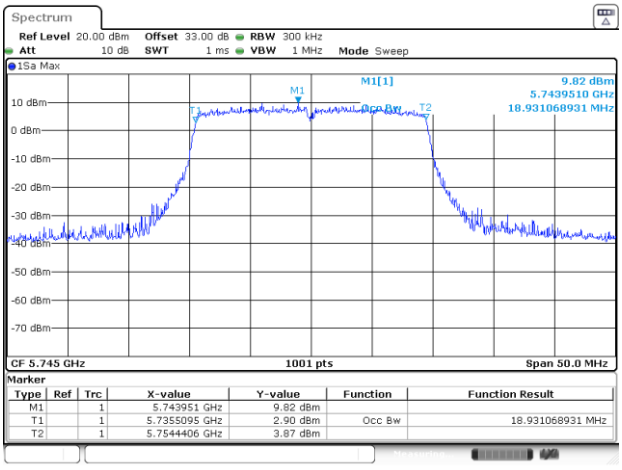
MIMO <Ant. 3+4>

<802.11a>

6dB Bandwidth	26dB Bandwidth
	
99% Occupied Bandwidth	**NA**
	

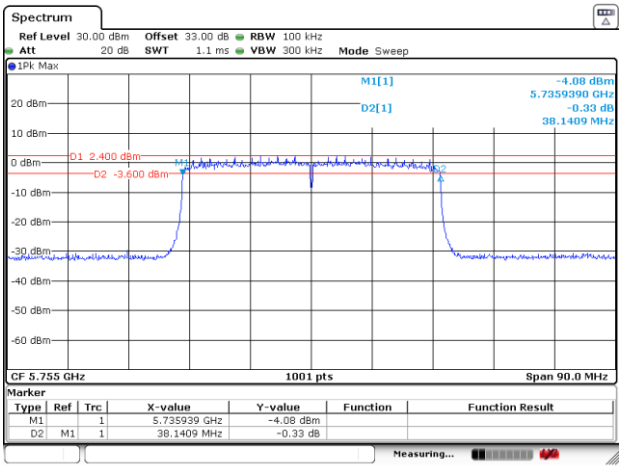
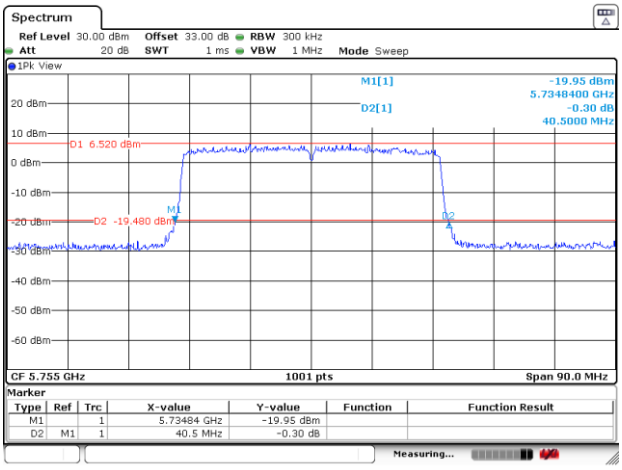
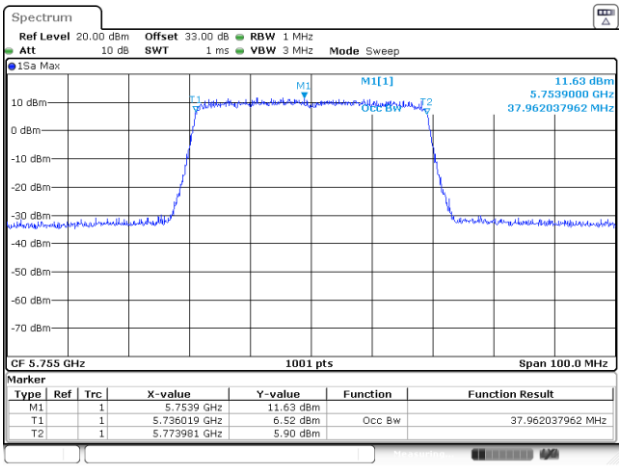
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11ax HE20>

6dB Bandwidth	26dB Bandwidth
	
99% Occupied Bandwidth	**NA**
	

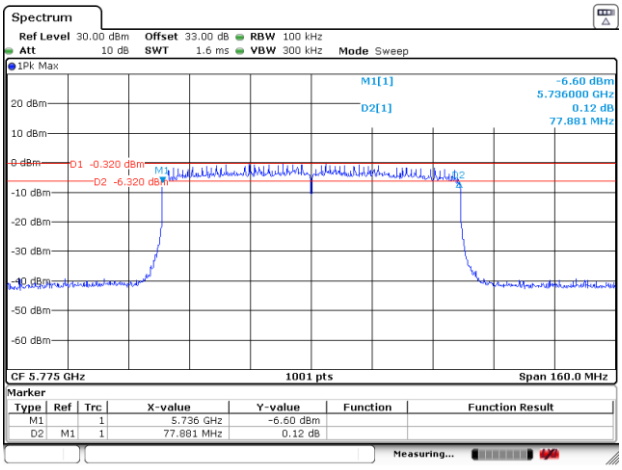
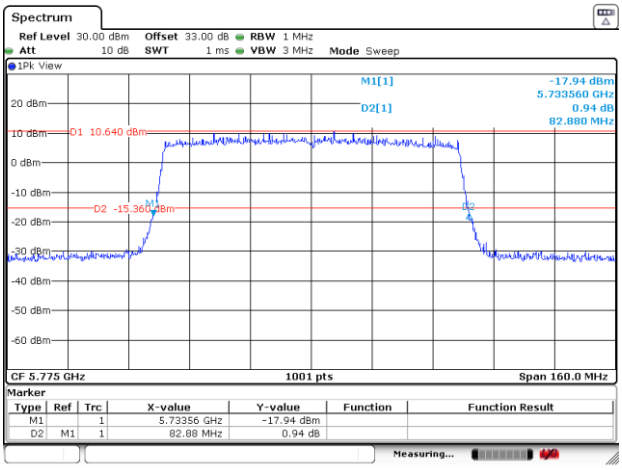
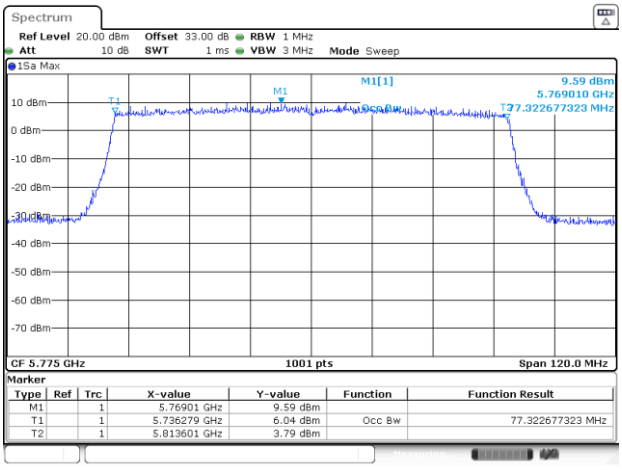
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11ax HE40>

6dB Bandwidth	26dB Bandwidth
	
99% Occupied Bandwidth	**NA**
	

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11ax HE80>

6dB Bandwidth	26dB Bandwidth
	
99% Occupied Bandwidth	**NA**
	

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Maximum Conducted Output Power Measurement

3.2.1 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.

3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

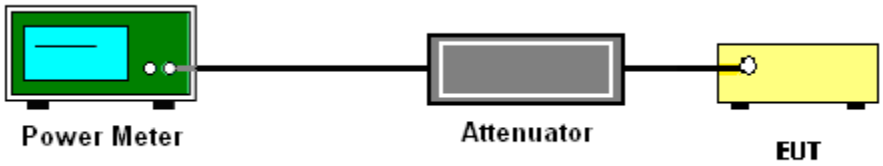
3.2.3 Test Procedures

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.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

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.

3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Section F) Maximum power spectral density.

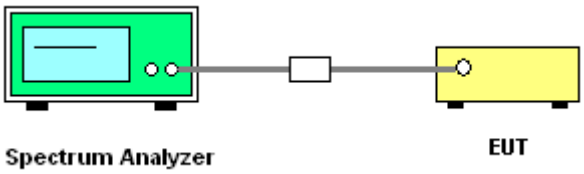
 # Method SA-3 #

(power averaging (rms) detection with max hold):

- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz.
- Set VBW ≥ 1 MHz.
- Number of points in sweep ≥ 2 Span / RBW.
- Add 10 log (500 kHz/RBW) to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement
- Sweep time ≤ (number of points in sweep) × 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.
  Detector = power averaging (rms).
- Trace mode = max hold.
- Allow max hold to run for at least 60 seconds, or longer as needed to allow the trace to stabilize.

1. The RF output of EUT is connected to the spectrum analyzer by a low loss cable.
2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.
3. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
   Method (c): Measure and add 10 log(N_{ANT}) dB.
   With this technique, spectrum measurements are performed at each output of the device, but rather than summing the spectra or the spectral peaks across the outputs, the quantity 10 log(N_{ANT}) dB is added to each spectrum value before comparing to the emission limit. The addition of 10 log(N_{ANT}) dB serves to apportion the emission limit among the N_{ANT} outputs so that each output is permitted to contribute no more than $1/N_{ANT}$ th of the PSD limit.

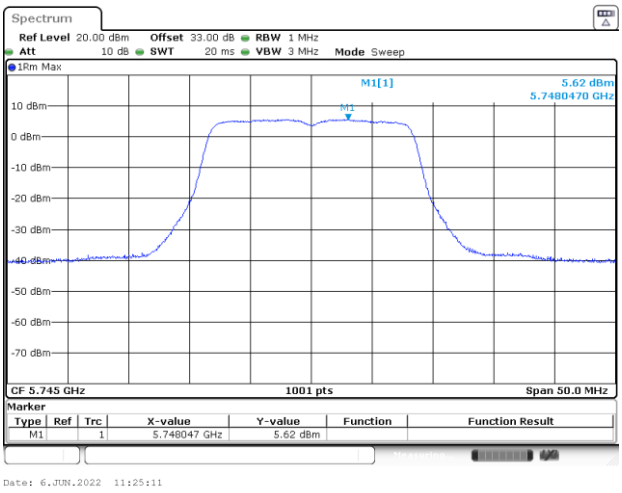
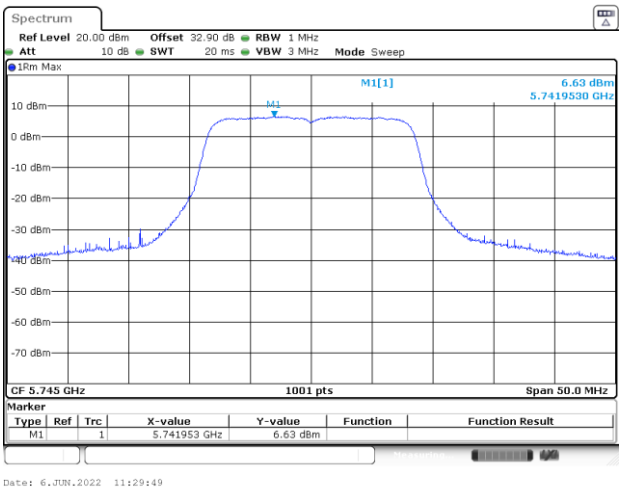
3.3.4 Test Setup



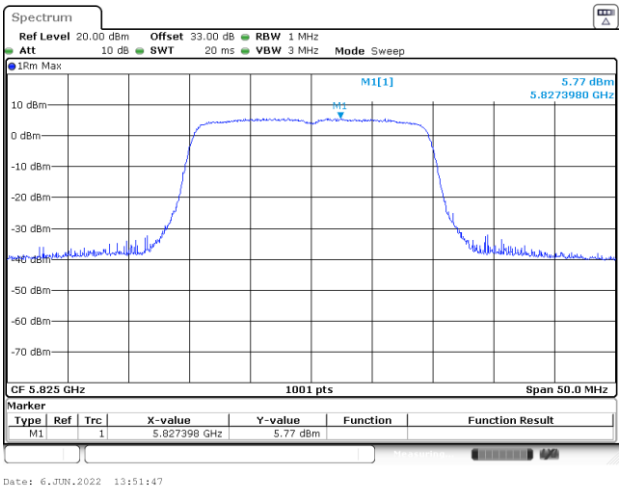
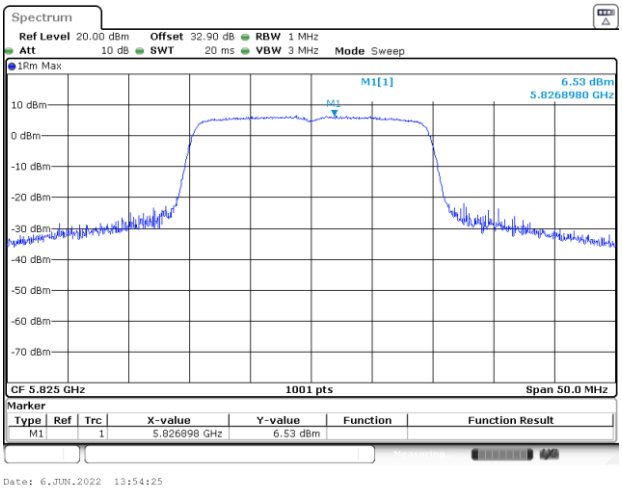
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

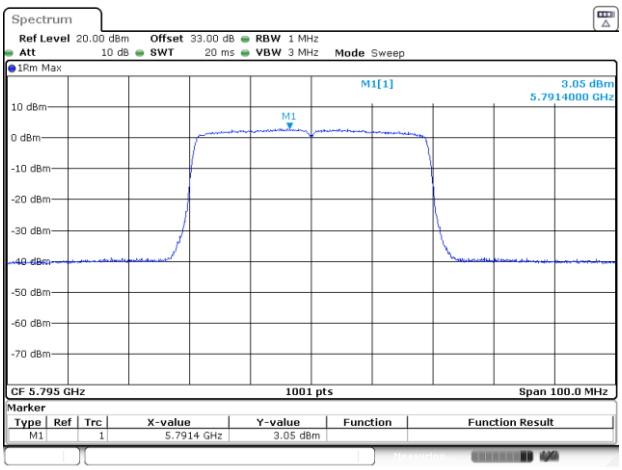
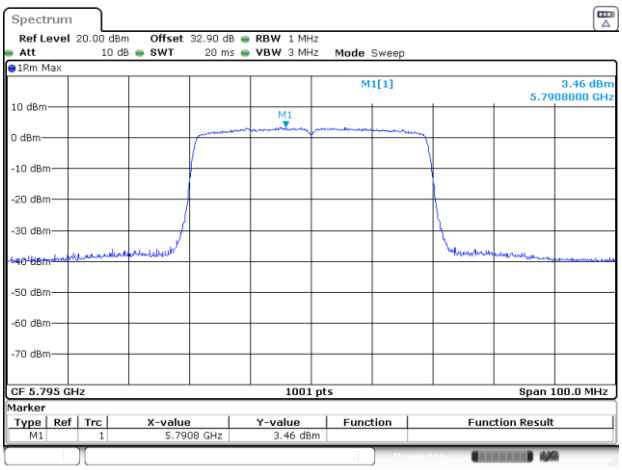
<802.11a>

Maximum Power Density Plot (dBm/MHz)	
MIMO Ant. 3	**MIMO Ant. 4**
	

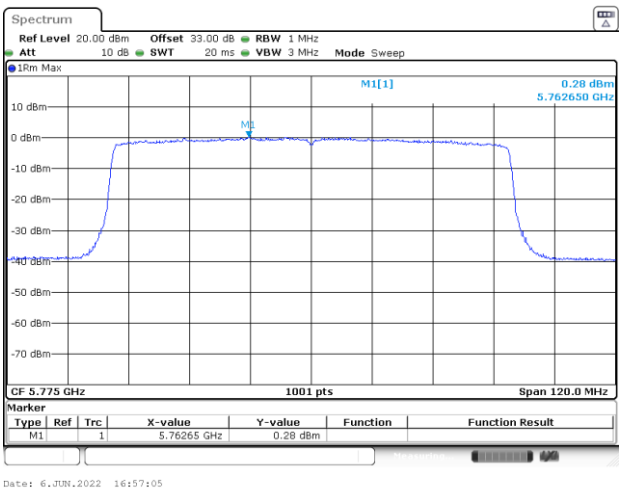
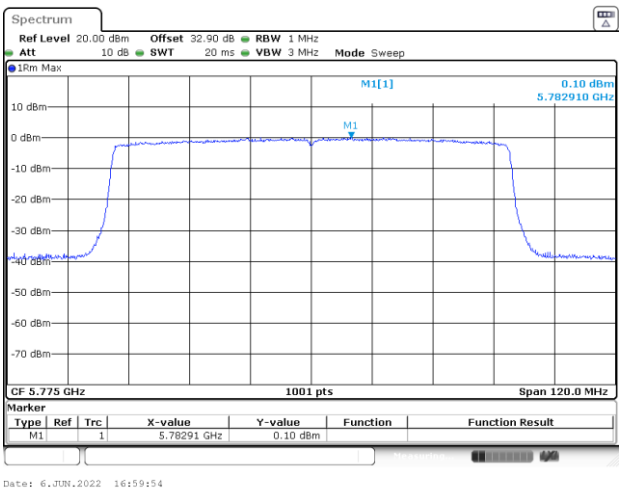
<802.11ax HE20>

Maximum Power Density Plot (dBm/MHz)	
MIMO Ant. 3	**MIMO Ant. 4**
	

<802.11ax HE40>

Maximum Power Density Plot (dBm/MHz)	
MIMO Ant. 3	**MIMO Ant. 4**
	

<802.11ax HE80>

Maximum Power Density Plot (dBm/MHz)	
MIMO Ant. 3	**MIMO Ant. 4**
	

3.4 Unwanted Emissions Measurement

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

3.4.1 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 falls 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.

3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.4.3 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 Unwanted Emissions Measurements Below 1000 MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

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

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

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

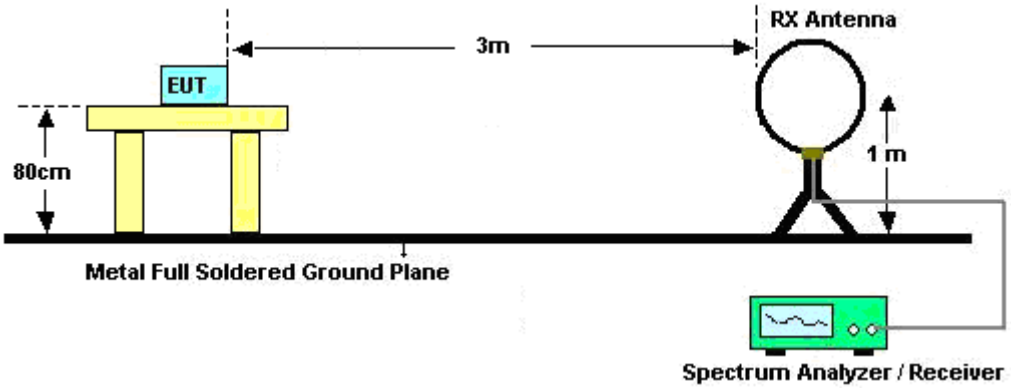
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

2. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
3. The EUT is set 3 meters away from the receiving antenna which is 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 is 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.

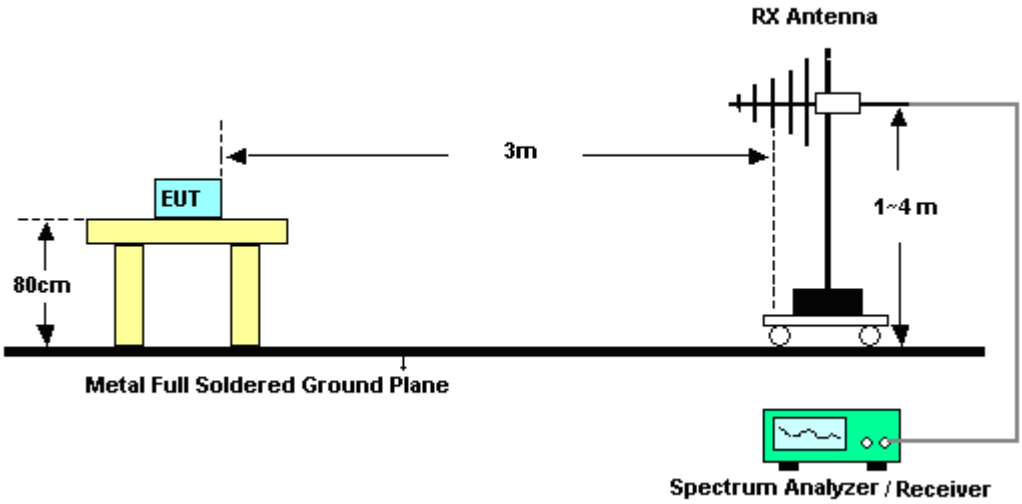
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as "-"..
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies.
   When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".

3.4.4 Test Setup

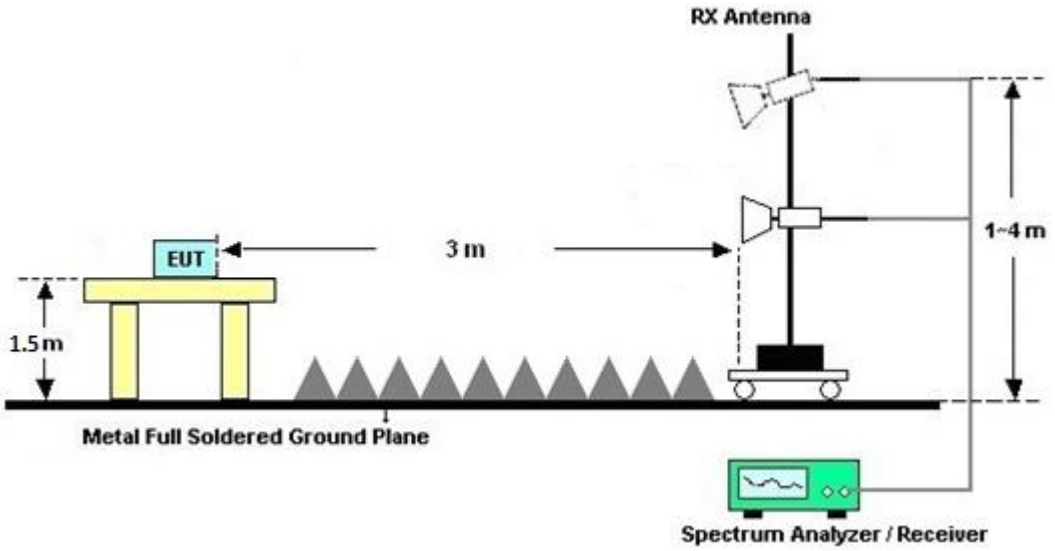
For radiated emissions below 30MHz



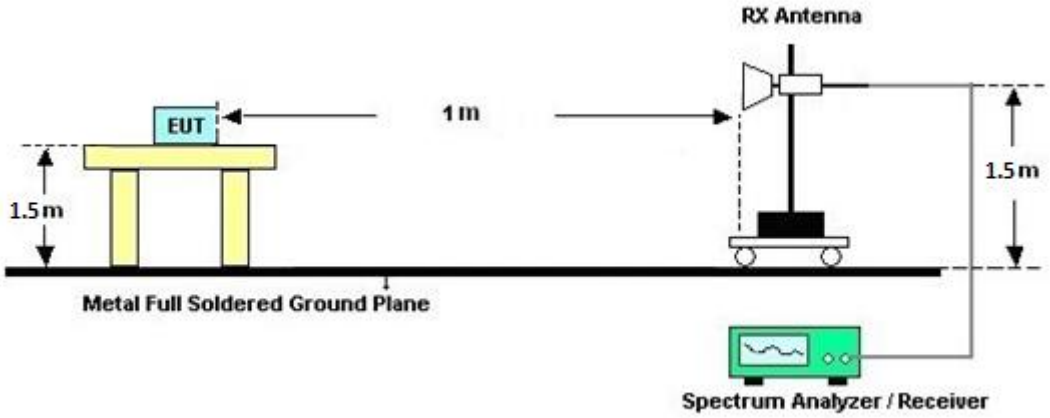
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.4.5 Test Results of Radiated Emissions (9 kHz ~ 30 MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.4.6 Test Result of Radiated Band Edges

Please refer to Appendix C and D.

3.4.7 Duty Cycle

Please refer to Appendix E.

3.4.8 Test Result of Unwanted Radiated Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.

3.5 AC Conducted Emission Measurement

3.5.1 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.

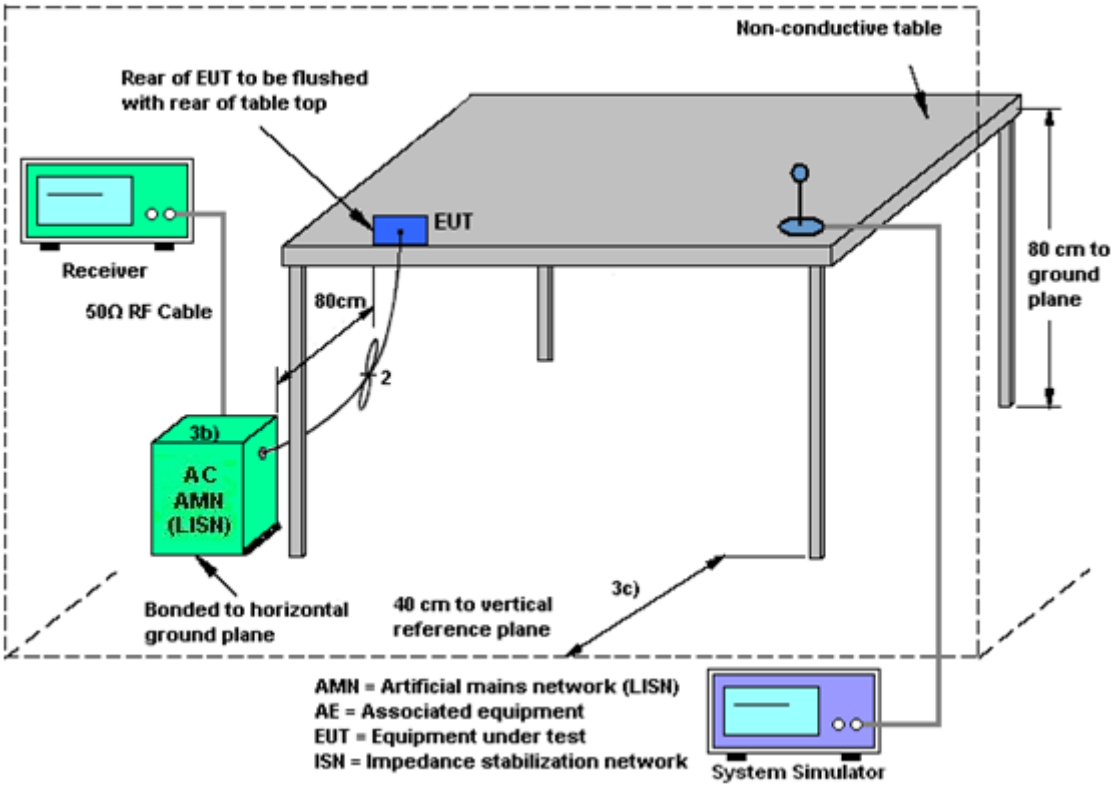
3.5.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.5.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is 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 Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.5.4 Test Setup



3.5.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.6 Antenna Requirements

3.6.1 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.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.6.3 Antenna Gain

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For power measurements on IEEE 802.11 devices,

Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows:

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$.

G_{ANT} is set equal to the gain of the antenna having the highest gain.

For PSD measurements, the directional gain calculation follows F)2)f)ii) of KDB 662911 D01 v02r01.

$$DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

where

Each antenna is driven by no more than one spatial stream;

N_{SS} = the number of independent spatial streams of data;

N_{ANT} = the total number of antennas

$g_{j,k} = 10^{G_k/20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;

G_k is the gain in dBi of the kth antenna.

As minimum N_{SS}=1 is supported by EUT, the formula can be simplified as:

Directional gain = $10*\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ dBi

Where G1, G2….GN denote single antenna gain.

For example: If a device has two antenna, G_{ANT1}= 3.6dBi; G_{ANT2}=4.2dBi

Directional gain of power measurement = max(3.6, 4.2) + 0 = 4.2 dBi

Directional gain of PSD measurement = $10 * \log[(10^{3.6/20} + 10^{4.2/20})^2 / 2]$ = 6.92 dBi

The directional gain of EUT is listed in the following table.

<CDD Modes>						
	Ant. 3 (dBi)	Ant. 4 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
Band IV	2.90	1.95	2.90	5.45	0.00	0.00

Power Limit Reduction = DG(Power) – 6dBi, (min = 0)

PSD Limit Reduction = DG(PSD) – 6dBi, (min = 0)

Calculation example:

For the Band IV, the DG for PSD is derived from formula is

10 x log { { [10^ (2.90 dBi / 20) + 10^ (1.95 dBi / 20)] ^ 2 } / 2 }

= 5.45 dBi

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	35419 & 03	30MHz~1GHz	Apr. 24, 2022	May 23, 2022~ Jun. 08, 2022	Apr. 23, 2023	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 03, 2021	May 23, 2022~ Jun. 08, 2022	Dec. 02, 2022	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 07, 2022	May 23, 2022~ Jun. 08, 2022	Jan. 06, 2023	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590075	1GHz~18GHz	Apr. 21, 2022	May 23, 2022~ Jun. 08, 2022	Apr. 20, 2023	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	Oct. 04, 2021	May 23, 2022~ Jun. 08, 2022	Oct. 03, 2022	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Oct. 04, 2021	May 23, 2022~ Jun. 08, 2022	Oct. 03, 2022	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Jul. 23, 2021	May 23, 2022~ Jun. 08, 2022	Jul. 22, 2022	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Jul. 22, 2021	May 23, 2022~ Jun. 08, 2022	Jul. 21, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682/4	30MHz to 18GHz	Feb. 23, 2022	May 23, 2022~ Jun. 08, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971/4	9kHz to 18GHz	Feb. 23, 2022	May 23, 2022~ Jun. 08, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4	9kHz to 18GHz	Feb. 23, 2022	May 23, 2022~ Jun. 08, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126	532078/126E	30MHz~18GHz	Sep. 17, 2021	May 23, 2022~ Jun. 08, 2022	Sep. 16, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2	18GHz~40GHz	Feb. 23, 2022	May 23, 2022~ Jun. 08, 2022	Feb. 22, 2023	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801606/2	9KHz ~ 40GHz	Apr. 14, 2022	May 23, 2022~ Jun. 08, 2022	Apr. 13, 2023	Radiation (03CH07-HY)
Controller	EMEC	EM1000	N/A	Control Ant Mast	N/A	May 23, 2022~ Jun. 08, 2022	N/A	Radiation (03CH07-HY)
Controller	MF	MF-7802	N/A	Control Turn table	N/A	May 23, 2022~ Jun. 08, 2022	N/A	Radiation (03CH07-HY)
Antenna Mast	EMEC	AM-BS-4500E	N/A	Boresight mast 1M~4M	N/A	May 23, 2022~ Jun. 08, 2022	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	May 23, 2022~ Jun. 08, 2022	N/A	Radiation (03CH07-HY)
Software	Audix	E3	N/A	N/A	N/A	May 23, 2022~ Jun. 08, 2022	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPEL	TR-32	HE17XB2495	N/A	Mar. 07, 2022	May 23, 2022~ Jun. 08, 2022	Mar. 06, 2023	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Nov. 30, 2021	May 23, 2022~ Jun. 08, 2022	Nov. 29, 2022	Radiation (03CH07-HY)

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jun. 15, 2022	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Dec. 01, 2021	Jun. 15, 2022	Nov. 30, 2022	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 17, 2021	Jun. 15, 2022	Nov. 16, 2022	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 03, 2021	Jun. 15, 2022	Dec. 02, 2022	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32	N/A	N/A	N/A	Jun. 15, 2022	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	00691	N/A	Jul. 28, 2021	Jun. 15, 2022	Jul. 27, 2022	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 30, 2021	Jun. 15, 2022	Dec. 29, 2022	Conduction (CO05-HY)
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 16. 2021	Jun. 02, 2022~ Jun. 06, 2022	Nov. 15. 2022	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO 12 (NO:113)	10MHz~6GHz	Dec. 16, 2021	Jun. 02, 2022~ Jun. 06, 2022	Dec. 15, 2022	Conducted (TH05-HY)
Power Meter	Anritsu	ML2495A	932001	N/A	Sep. 30, 2021	Jun. 02, 2022~ Jun. 06, 2022	Sep. 29, 2022	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 30, 2021	Jun. 02, 2022~ Jun. 06, 2022	Aug. 29, 2022	Conducted (TH05-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.1 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.1 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.8 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.0 dB

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Mina Liu	Temperature:	21~25	°C
Test Date:	2022/6/2~2022/6/6	Relative Humidity:	51~54	%

TEST RESULTS DATA
6dB and 26dB EBW and 99% OBW

Band IV MIMO												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)		26dB Bandwidth (MHz)		6 dB Bandwidth (MHz)		6 dB Bandwidth Min. Limit (MHz)	Pass/Fail
					Ant 3	Ant 4	Ant 3	Ant 4	Ant 3	Ant 4		
11a	6Mbps	2	149	5745	16.48	16.38	19.85	19.70	16.39	16.39	0.5	Pass
11a	6Mbps	2	157	5785	16.48	16.38	19.75	19.45	16.39	16.39	0.5	Pass
11a	6Mbps	2	165	5825	16.48	16.43	19.95	19.95	16.39	16.44	0.5	Pass

TEST RESULTS DATA
Average Power Table

Band IV MIMO													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
					Ant 3	Ant 4	SUM	Ant 3	Ant 4	Ant 3	Ant 4	
11a	6Mbps	2	149	5745	17.00	17.90	20.48	30.00		2.90		Pass
11a	6Mbps	2	157	5785	17.00	17.90	20.48	30.00		2.90		Pass
11a	6Mbps	2	165	5825	17.10	17.90	20.53	30.00		2.90		Pass
HT20	MCS0	2	149	5745	16.90	17.70	20.33	30.00		2.90		Pass
HT20	MCS0	2	157	5785	16.90	17.60	20.27	30.00		2.90		Pass
HT20	MCS0	2	165	5825	16.90	17.70	20.33	30.00		2.90		Pass
HT40	MCS0	2	151	5755	16.80	17.20	20.01	30.00		2.90		Pass
HT40	MCS0	2	159	5795	16.90	17.60	20.27	30.00		2.90		Pass
VHT20	MCS0	2	149	5745	16.90	17.70	20.33	30.00		2.90		Pass
VHT20	MCS0	2	157	5785	16.90	17.60	20.27	30.00		2.90		Pass
VHT20	MCS0	2	165	5825	16.90	17.70	20.33	30.00		2.90		Pass
VHT40	MCS0	2	151	5755	16.80	17.20	20.01	30.00		2.90		Pass
VHT40	MCS0	2	159	5795	16.90	17.60	20.27	30.00		2.90		Pass
VHT80	MCS0	2	155	5775	17.00	17.40	20.21	30.00		2.90		Pass

Report Number : FR190614-04C

TEST RESULTS DATA
Power Spectral Density

Band IV MIMO															
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	10log (500kHz /RBW) Factor (dB)		Average Power Density (dBm/500kHz)			Average PSD Limit (dBm/500kHz)		DG (dBi)		Pass /Fail
					Ant 3	Ant 4	Ant 3	Ant 4	SUM	Ant 3	Ant 4	Ant 3	Ant 4	
11a	6Mbps	2	149	5745	2.22		7.84	8.85	11.86	30.00		5.45		Pass
11a	6Mbps	2	157	5785	2.22		8.12	8.78	11.79	30.00		5.45		Pass
11a	6Mbps	2	165	5825	2.22		8.01	8.81	11.82	30.00		5.45		Pass

Note: PSD Sum = Max PSD(Ant. 1, Ant. 2) + 10 log (n)

TEST RESULTS DATA
6dB and 26dB EBW and 99% OBW

Band IV MIMO													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	99% Bandwidth (MHz)		26dB Bandwidth (MHz)		6 dB Bandwidth (MHz)		6 dB Bandwidth Min. Limit (MHz)	Pass/Fail
						Ant 3	Ant 4	Ant 3	Ant 4	Ant 3	Ant 4		
HE20	MCS0	2	149	5745	Full	18.93	18.93	21.30	22.30	18.89	18.94	0.5	Pass
HE20	MCS0	2	157	5785	Full	18.93	18.98	21.35	21.65	18.59	18.98	0.5	Pass
HE20	MCS0	2	165	5825	Full	18.93	18.93	21.40	21.50	19.04	19.09	0.5	Pass
HE40	MCS0	2	151	5755	Full	37.96	37.96	40.50	40.50	38.14	38.05	0.5	Pass
HE40	MCS0	2	159	5795	Full	37.96	37.96	40.41	40.32	38.14	37.96	0.5	Pass
HE80	MCS0	2	155	5775	Full	77.32	77.32	82.88	82.56	77.88	77.72	0.5	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 3	Ant 4	SUM	Ant 3	Ant 4	Ant 3	Ant 4	
HE20	MCS0	2	149	5745	Full	17.00	17.80	20.43	30.00		2.90		Pass
HE20	MCS0	2	157	5785	Full	17.00	17.70	20.37	30.00		2.90		Pass
HE20	MCS0	2	165	5825	Full	17.00	17.80	20.43	30.00		2.90		Pass
HE40	MCS0	2	151	5755	Full	16.90	17.30	20.11	30.00		2.90		Pass
HE40	MCS0	2	159	5795	Full	17.00	17.70	20.37	30.00		2.90		Pass
HE80	MCS0	2	155	5775	Full	17.10	17.50	20.31	30.00		2.90		Pass

TEST RESULTS DATA
Power Spectral Density

Band IV MIMO																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	10log (500kHz /RBW) Factor (dB)		Average Power Density (dBm/500kHz)			Average PSD Limit (dBm/500kHz)		DG (dBi)		Pass /Fail
						Ant 3	Ant 4	Ant 3	Ant 4	SUM	Ant 3	Ant 4	Ant 3	Ant 4	
HE20	MCS0	2	149	5745	Full	2.22		7.81	8.56	11.57	30.00		5.45		Pass
HE20	MCS0	2	157	5785	Full	2.22		7.83	8.73	11.74	30.00		5.45		Pass
HE20	MCS0	2	165	5825	Full	2.22		7.99	8.75	11.76	30.00		5.45		Pass
HE40	MCS0	2	151	5755	Full	2.22		5.13	4.96	8.14	30.00		5.45		Pass
HE40	MCS0	2	159	5795	Full	2.22		5.27	5.68	8.69	30.00		5.45		Pass
HE80	MCS0	2	155	5775	Full	2.22		2.50	2.32	5.51	30.00		5.45		Pass

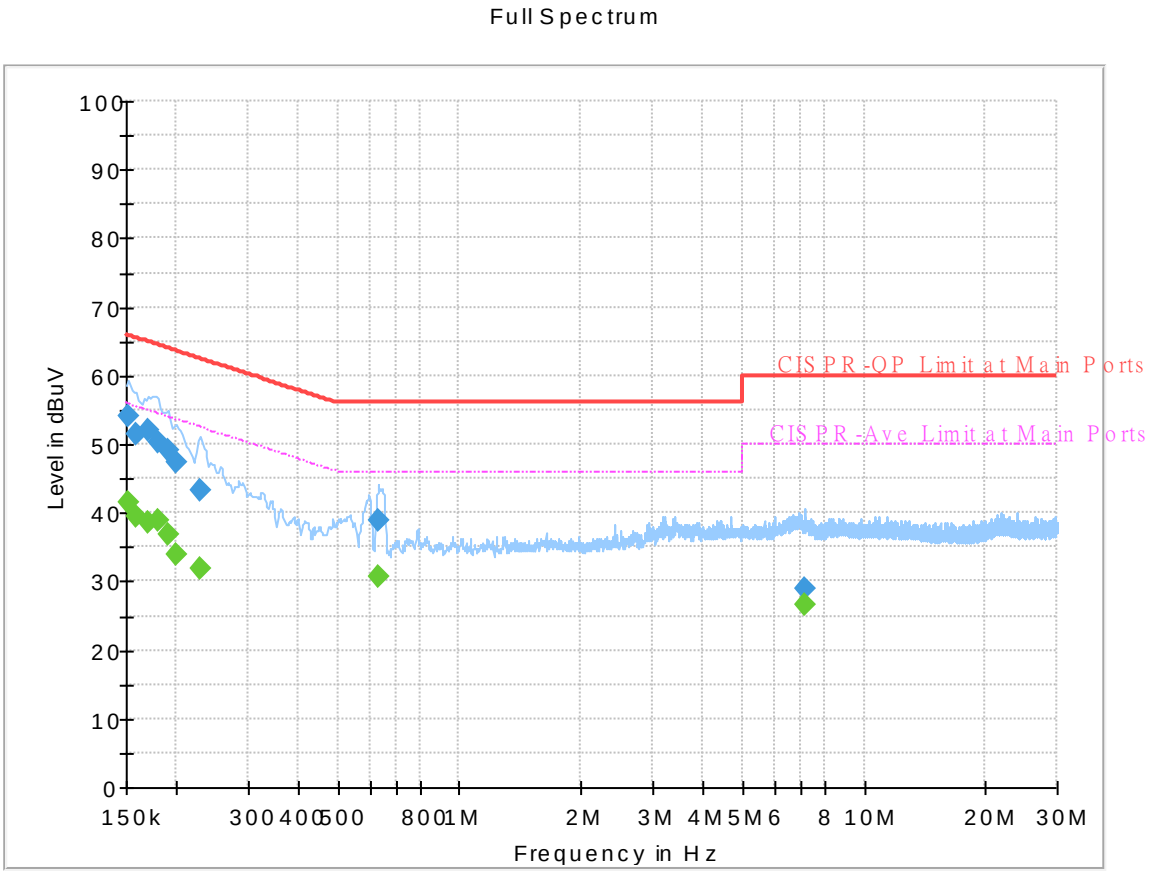
Note: PSD Sum = Max PSD(Ant. 1, Ant. 2) + 10 log (n)

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Calivn Wang	**Temperature :**	23~26℃
		Relative Humidity :	45~55%

EUT Information

Report NO :	190614-04
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line



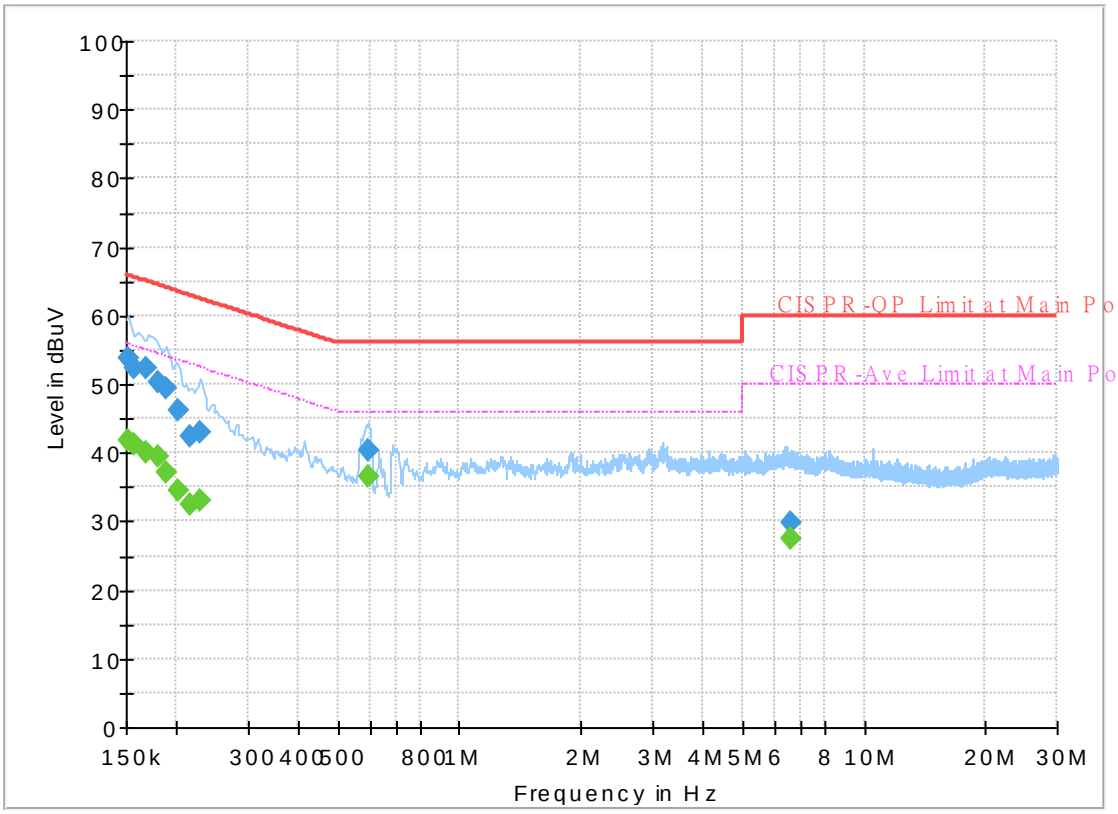
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	41.38	55.88	14.50	L1	OFF	19.6
0.152250	54.10	---	65.88	11.78	L1	OFF	19.6
0.159000	---	39.34	55.52	16.18	L1	OFF	19.6
0.159000	51.58	---	65.52	13.94	L1	OFF	19.6
0.170250	---	38.67	54.95	16.28	L1	OFF	19.6
0.170250	52.08	---	64.95	12.87	L1	OFF	19.6
0.179250	---	38.77	54.52	15.75	L1	OFF	19.6
0.179250	50.42	---	64.52	14.10	L1	OFF	19.6
0.190500	---	36.74	54.02	17.28	L1	OFF	19.6
0.190500	48.98	---	64.02	15.04	L1	OFF	19.6
0.199500	---	33.98	53.63	19.65	L1	OFF	19.6
0.199500	47.32	---	63.63	16.31	L1	OFF	19.6
0.228750	---	31.99	52.50	20.51	L1	OFF	19.6
0.228750	43.26	---	62.50	19.24	L1	OFF	19.6
0.631500	---	30.57	46.00	15.43	L1	OFF	19.6
0.631500	39.02	---	56.00	16.98	L1	OFF	19.6
7.149750	---	26.71	50.00	23.29	L1	OFF	19.9
7.149750	29.01	---	60.00	30.99	L1	OFF	19.9

EUT Information

Report NO :	190614-04
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral

Full Spectrum



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	41.89	55.88	13.99	N	OFF	19.6
0.152250	53.80	---	65.88	12.08	N	OFF	19.6
0.156750	---	41.20	55.63	14.43	N	OFF	19.6
0.156750	52.42	---	65.63	13.21	N	OFF	19.6
0.168000	---	40.05	55.06	15.01	N	OFF	19.6
0.168000	52.32	---	65.06	12.74	N	OFF	19.6
0.179250	---	39.45	54.52	15.07	N	OFF	19.6
0.179250	50.17	---	64.52	14.35	N	OFF	19.6
0.188250	---	37.20	54.11	16.91	N	OFF	19.6
0.188250	49.45	---	64.11	14.66	N	OFF	19.6
0.201750	---	34.63	53.54	18.91	N	OFF	19.6
0.201750	46.29	---	63.54	17.25	N	OFF	19.6
0.215250	---	32.57	53.00	20.43	N	OFF	19.6
0.215250	42.52	---	63.00	20.48	N	OFF	19.6
0.228750	---	32.91	52.50	19.59	N	OFF	19.6
0.228750	42.88	---	62.50	19.62	N	OFF	19.6
0.593250	---	36.51	46.00	9.49	N	OFF	19.6
0.593250	40.46	---	56.00	15.54	N	OFF	19.6
6.614250	---	27.38	50.00	22.62	N	OFF	19.9
6.614250	29.93	---	60.00	30.07	N	OFF	19.9

Appendix C. Radiated Spurious Emission

Test Engineer :	Jesse Wang, Stan Hsieh and Ken Wu	Temperature :	22~28.1°C
		Relative Humidity :	53.3~67.5%

Band 4 - 5725~5850MHz

WIFI 802.11a (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
3+4		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 149 5745MHz		5646.4	48.2	-20	68.2	36.39	34.7	12.26	35.15	381	355	P	H
		5699.8	51.1	-53.95	105.05	39.08	34.9	12.28	35.16	381	355	P	H
		5718.2	55.85	-54.45	110.3	43.71	35.01	12.29	35.16	381	355	P	H
		5721.2	56.07	-57.47	113.54	43.91	35.03	12.29	35.16	381	355	P	H
	*	5745	109.71	-	-	97.4	35.17	12.31	35.17	381	355	P	H
	*	5745	102.99	-	-	90.68	35.17	12.31	35.17	381	355	A	H
													H
													H
		5630	49.19	-19.01	68.2	37.39	34.7	12.25	35.15	299	198	P	V
		5693.6	49.52	-50.96	100.48	37.53	34.87	12.28	35.16	299	198	P	V
		5716.6	53.1	-56.75	109.85	40.97	35	12.29	35.16	299	198	P	V
		5724.2	57.69	-62.69	120.38	45.5	35.05	12.3	35.16	299	198	P	V
	*	5745	111.93	-	-	99.62	35.17	12.31	35.17	299	198	P	V
	*	5745	104.72	-	-	92.41	35.17	12.31	35.17	299	198	A	V
													V
													V

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Margin (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		5614.8	48.27	-19.93	68.2	36.46	34.7	12.25	35.14	321	352	P	H
		5684.6	50.54	-43.3	93.84	38.58	34.84	12.28	35.16	321	352	P	H
		5710	48.51	-59.49	108	36.42	34.96	12.29	35.16	321	352	P	H
		5723.8	47.73	-71.73	119.46	35.55	35.04	12.3	35.16	321	352	P	H
	*	5785	109.74	-	-	97.39	35.2	12.32	35.17	321	352	P	H
	*	5785	102.66	-	-	90.31	35.2	12.32	35.17	321	352	A	H
		5853.6	48.66	-65.33	113.99	36.23	35.2	12.41	35.18	321	352	P	H
		5865	50.95	-57.05	108	38.52	35.2	12.42	35.19	321	352	P	H
		5913	50.25	-26.8	77.05	37.79	35.17	12.49	35.2	321	352	P	H
		5926.2	50.61	-17.59	68.2	38.15	35.15	12.51	35.2	321	352	P	H
													H
													H
		5605.8	49.58	-18.62	68.2	37.78	34.7	12.24	35.14	295	202	P	V
		5669.2	49.2	-33.25	82.45	37.3	34.78	12.27	35.15	295	202	P	V
		5714	50.08	-59.04	109.12	37.97	34.98	12.29	35.16	295	202	P	V
		5721.4	48.29	-65.7	113.99	36.13	35.03	12.29	35.16	295	202	P	V
	*	5785	111.57	-	-	99.22	35.2	12.32	35.17	295	202	P	V
	*	5785	104.07	-	-	91.72	35.2	12.32	35.17	295	202	A	V
		5852.4	49.98	-66.75	116.73	37.55	35.2	12.41	35.18	295	202	P	V
		5870.4	48.88	-57.61	106.49	36.44	35.2	12.43	35.19	295	202	P	V
		5909.4	50.13	-29.58	79.71	37.66	35.18	12.49	35.2	295	202	P	V
		5936	51.53	-16.67	68.2	39.07	35.13	12.53	35.2	295	202	P	V
													V
													V

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBµV/m)	Margin (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)
	*	5825	109.84	-	-	97.45	35.2	12.37	35.18	300	352	P	H
	*	5825	102.36	-	-	89.97	35.2	12.37	35.18	300	352	A	H
		5853.4	54.76	-59.69	114.45	42.33	35.2	12.41	35.18	300	352	P	H
		5872.6	52.46	-53.41	105.87	40.01	35.2	12.44	35.19	300	352	P	H
		5879.4	50.8	-51.13	101.93	38.34	35.2	12.45	35.19	300	352	P	H
		5938.6	49.8	-18.4	68.2	37.35	35.12	12.53	35.2	300	352	P	H
													H
802.11a													H
CH 165	*	5825	110.6	-	-	98.21	35.2	12.37	35.18	337	198	P	V
5825MHz	*	5825	103.22	-	-	90.83	35.2	12.37	35.18	337	198	A	V
		5852.2	53.07	-64.11	117.18	40.64	35.2	12.41	35.18	337	198	P	V
		5858	51.78	-58.18	109.96	39.36	35.2	12.41	35.19	337	198	P	V
		5913.6	50.77	-25.84	76.61	38.31	35.17	12.49	35.2	337	198	P	V
		5929.4	50.52	-17.68	68.2	38.06	35.14	12.52	35.2	337	198	P	V
													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 802.11a (Harmonic @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Margin (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 149 5745MHz		11490	53.03	-20.97	74	52.48	38.11	19.32	56.88	354	175	P	H
		11490	42.49	-11.51	54	41.94	38.11	19.32	56.88	354	175	A	H
		17235	50.38	-17.82	68.2	40.68	41.5	23.89	55.69	-	-	P	H
													H
		11490	52.76	-21.24	74	52.21	38.11	19.32	56.88	365	155	P	V
		11490	42.42	-11.58	54	41.87	38.11	19.32	56.88	365	155	A	V
		17235	51.27	-16.93	68.2	41.57	41.5	23.89	55.69	-	-	P	V
													V
802.11a CH 157 5785MHz		11570	49.85	-24.15	74	48.97	38.24	19.39	56.75	100	51	P	H
		11570	41.21	-12.79	54	40.33	38.24	19.39	56.75	100	51	A	H
		17355	51.31	-16.89	68.2	41.38	41.44	23.99	55.5	-	-	P	H
													H
		11570	50.8	-23.2	74	49.92	38.24	19.39	56.75	100	315	P	V
		11570	41.74	-12.26	54	40.86	38.24	19.39	56.75	100	315	A	V
		17355	51.34	-16.86	68.2	41.41	41.44	23.99	55.5	-	-	P	V
													V
802.11a CH 165 5825MHz		11650	47.76	-26.24	74	46.56	38.4	19.45	56.65	-	-	P	H
		17475	50.84	-17.36	68.2	40.75	41.33	24.08	55.32	-	-	P	H
													H
													H
		11650	49.62	-24.38	74	48.42	38.4	19.45	56.65	100	278	P	V
		11650	41.11	-12.89	54	39.91	38.4	19.45	56.65	100	278	A	V
		17475	50.64	-17.56	68.2	40.55	41.33	24.08	55.32	-	-	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Band 4 5725~5850MHz

WIFI 802.11ax HE20_Full (Band Edge @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Margin (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)
		5641.2	48.28	-19.92	68.2	36.47	34.7	12.26	35.15	307	351	P	H
		5696.8	50.78	-52.06	102.84	38.77	34.89	12.28	35.16	307	351	P	H
		5719.8	54.84	-55.9	110.74	42.69	35.02	12.29	35.16	307	351	P	H
		5721.6	61.78	-52.67	114.45	49.62	35.03	12.29	35.16	307	351	P	H
	*	5745	111.23	-	-	98.92	35.17	12.31	35.17	307	351	P	H
	*	5745	102.89	-	-	90.58	35.17	12.31	35.17	307	351	A	H
802.11ax													H
HE20 Full													H
CH 149		5607.2	48.51	-19.69	68.2	36.71	34.7	12.24	35.14	300	197	P	V
5745MHz		5697	51.2	-51.79	102.99	39.19	34.89	12.28	35.16	300	197	P	V
		5719.2	56.21	-54.37	110.58	44.06	35.02	12.29	35.16	300	197	P	V
		5723.2	60.88	-57.22	118.1	48.7	35.04	12.3	35.16	300	197	P	V
	*	5745	113.21	-	-	100.9	35.17	12.31	35.17	300	197	P	V
	*	5745	104.04	-	-	91.73	35.17	12.31	35.17	300	197	A	V
													V
													V

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Margin (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)
	*	5825	112.61	-	-	100.22	35.2	12.37	35.18	317	348	P	H
	*	5825	102.97	-	-	90.58	35.2	12.37	35.18	317	348	A	H
		5851.4	60.59	-58.42	119.01	48.17	35.2	12.4	35.18	317	348	P	H
		5855.6	59.3	-51.33	110.63	46.87	35.2	12.41	35.18	317	348	P	H
		5883.4	51.27	-47.69	98.96	38.81	35.2	12.45	35.19	317	348	P	H
		5926.8	50.64	-17.56	68.2	38.18	35.15	12.51	35.2	317	348	P	H
802.11ax													H
HE20 Full													H
CH 165	*	5825	113.99	-	-	101.6	35.2	12.37	35.18	302	190	P	V
5825MHz	*	5825	104.69	-	-	92.3	35.2	12.37	35.18	302	190	A	V
		5850.8	62.97	-57.41	120.38	50.55	35.2	12.4	35.18	302	190	P	V
		5855.2	57.72	-53.02	110.74	45.29	35.2	12.41	35.18	302	190	P	V
		5880	51.8	-49.69	101.49	39.34	35.2	12.45	35.19	302	190	P	V
		5948	51.81	-16.39	68.2	39.37	35.1	12.54	35.2	302	190	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. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Margin (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	48.9	-25.1	74	48.02	38.24	19.39	56.75	100	118	P	H
		11570	40.63	-13.37	54	39.75	38.24	19.39	56.75	100	118	A	H
		17355	52.38	-15.82	68.2	42.45	41.44	23.99	55.5	-	-	P	H
													H
		11570	48.97	-25.03	74	48.09	38.24	19.39	56.75	100	315	P	V
		11570	40.78	-13.22	54	39.9	38.24	19.39	56.75	100	315	A	V
		17355	50.65	-17.55	68.2	40.72	41.44	23.99	55.5	-	-	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Band 4 5725~5850MHz

WIFI 802.11ax HE40_Full (Band Edge @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Margin (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)
		5622	50.19	-18.01	68.2	38.38	34.7	12.25	35.14	308	347	P	H
		5699.2	54.36	-50.25	104.61	42.34	34.9	12.28	35.16	308	347	P	H
		5719	60.28	-50.24	110.52	48.14	35.01	12.29	35.16	308	347	P	H
		5721.6	60.44	-54.01	114.45	48.28	35.03	12.29	35.16	308	347	P	H
	*	5755	110.42	-	-	98.08	35.2	12.31	35.17	308	347	P	H
	*	5755	100.74	-	-	88.4	35.2	12.31	35.17	308	347	A	H
		5850	50.18	-72.02	122.2	37.76	35.2	12.4	35.18	308	347	P	H
		5862.6	51.05	-57.62	108.67	38.62	35.2	12.42	35.19	308	347	P	H
		5878	51.06	-51.91	102.97	38.61	35.2	12.44	35.19	308	347	P	H
		5947.6	49.68	-18.52	68.2	37.24	35.1	12.54	35.2	308	347	P	H
802.11ax													H
HE40 Full													H
CH 151		5647	48.78	-19.42	68.2	36.97	34.7	12.26	35.15	329	192	P	V
5755MHz		5693.2	56.72	-43.47	100.19	44.73	34.87	12.28	35.16	329	192	P	V
		5708	61.52	-45.92	107.44	49.44	34.95	12.29	35.16	329	192	P	V
		5722.2	60.77	-55.05	115.82	48.61	35.03	12.29	35.16	329	192	P	V
	*	5755	111.08	-	-	98.74	35.2	12.31	35.17	329	192	P	V
	*	5755	102.54	-	-	90.2	35.2	12.31	35.17	329	192	A	V
		5854.4	49.62	-62.55	112.17	37.19	35.2	12.41	35.18	329	192	P	V
		5864.6	50.68	-57.43	108.11	38.25	35.2	12.42	35.19	329	192	P	V
		5906.2	51.02	-31.06	82.08	38.54	35.19	12.48	35.19	329	192	P	V
		5926.4	49.77	-18.43	68.2	37.31	35.15	12.51	35.2	329	192	P	V
													V
													V

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Margin (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)
		5623.6	48.56	-19.64	68.2	36.75	34.7	12.25	35.14	395	350	P	H
		5695.2	49.31	-52.35	101.66	37.31	34.88	12.28	35.16	395	350	P	H
		5704	50.32	-56	106.32	38.27	34.92	12.29	35.16	395	350	P	H
		5722.8	49.99	-67.19	117.18	37.81	35.04	12.3	35.16	395	350	P	H
	*	5795	109.32	-	-	96.96	35.2	12.33	35.17	395	350	P	H
	*	5795	100.37	-	-	88.01	35.2	12.33	35.17	395	350	A	H
		5852	51.25	-66.39	117.64	38.82	35.2	12.41	35.18	395	350	P	H
		5860	54.9	-54.5	109.4	42.47	35.2	12.42	35.19	395	350	P	H
		5875.6	51.37	-53.38	104.75	38.92	35.2	12.44	35.19	395	350	P	H
		5927.6	49.76	-18.44	68.2	37.3	35.14	12.52	35.2	395	350	P	H
802.11ax													H
HE40 Full													H
CH 159		5648.8	48.51	-19.69	68.2	36.7	34.7	12.26	35.15	324	190	P	V
5795MHz		5680	48.58	-41.86	90.44	36.64	34.82	12.28	35.16	324	190	P	V
		5712.8	51.43	-57.36	108.79	39.32	34.98	12.29	35.16	324	190	P	V
		5723.4	50.04	-68.51	118.55	37.86	35.04	12.3	35.16	324	190	P	V
	*	5795	110.85	-	-	98.49	35.2	12.33	35.17	324	190	P	V
	*	5795	102.05	-	-	89.69	35.2	12.33	35.17	324	190	A	V
		5855	50.27	-60.53	110.8	37.84	35.2	12.41	35.18	324	190	P	V
		5860.8	50.31	-58.86	109.17	37.88	35.2	12.42	35.19	324	190	P	V
		5888.8	51.69	-43.27	94.96	39.22	35.2	12.46	35.19	324	190	P	V
		5933	51.23	-16.97	68.2	38.78	35.13	12.52	35.2	324	190	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 HE80_Full (Band Edge @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Margin (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)
		5624.2	52.68	-15.52	68.2	40.87	34.7	12.25	35.14	378	347	P	H
		5682.4	57.9	-34.31	92.21	45.95	34.83	12.28	35.16	378	347	P	H
		5712.6	61.43	-47.3	108.73	49.32	34.98	12.29	35.16	378	347	P	H
		5723.6	62.08	-56.93	119.01	49.9	35.04	12.3	35.16	378	347	P	H
	*	5775	106.89	-	-	94.54	35.2	12.32	35.17	378	347	P	H
	*	5775	98.25	-	-	85.9	35.2	12.32	35.17	378	347	A	H
		5852.6	57.65	-58.62	116.27	45.22	35.2	12.41	35.18	378	347	P	H
		5858.4	57.53	-52.32	109.85	45.11	35.2	12.41	35.19	378	347	P	H
		5877.2	54.51	-49.06	103.57	42.06	35.2	12.44	35.19	378	347	P	H
		5941	50.86	-17.34	68.2	38.41	35.12	12.53	35.2	378	347	P	H
802.11ax													H
HE80 Full													H
CH 155		5645.2	53.61	-14.59	68.2	41.8	34.7	12.26	35.15	280	76	P	V
5775MHz		5677	60.65	-27.57	88.22	48.72	34.81	12.27	35.15	280	76	P	V
		5712.6	64.28	-44.45	108.73	52.17	34.98	12.29	35.16	280	76	P	V
		5722.2	58.78	-57.04	115.82	46.62	35.03	12.29	35.16	280	76	P	V
	*	5775	107.39	-	-	95.04	35.2	12.32	35.17	280	76	P	V
	*	5775	98.13	-	-	85.78	35.2	12.32	35.17	280	76	A	V
		5853.4	63.17	-51.28	114.45	50.74	35.2	12.41	35.18	280	76	P	V
		5855	59.87	-50.93	110.8	47.44	35.2	12.41	35.18	280	76	P	V
		5875	57.67	-47.53	105.2	45.22	35.2	12.44	35.19	280	76	P	V
		5925	51.52	-16.68	68.2	39.06	35.15	12.51	35.2	280	76	P	V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.

Emission below 1GHz

5GHz WIFI 802.11a (LF @ 3m)

WIFI Ant. 3+4	Note	Frequency (MHz)	Level (dBμV/m)	Margin (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 LF		40.26	25.08	-14.92	40	34.88	19.26	1	30.06	-	-	P	H
		51.33	30.34	-9.66	40	45.53	13.68	1.16	30.03	-	-	P	H
		93.72	34.57	-8.93	43.5	47.64	15.21	1.72	30	-	-	P	H
		770.4	30.53	-15.47	46	27.25	27.75	4.89	29.36	-	-	P	H
		901.3	32.57	-13.43	46	27.31	28.61	5.46	28.81	-	-	P	H
		946.8	32.71	-13.29	46	25.79	30.04	5.54	28.66	-	-	P	H
		38.64	32.25	-7.75	40	41.18	20.16	0.98	30.07	-	-	P	V
		50.79	32.9	-7.1	40	47.83	13.95	1.15	30.03	-	-	P	V
		93.45	35.24	-8.26	43.5	48.33	15.19	1.72	30	-	-	P	V
		780.9	30.38	-15.62	46	26.98	27.78	4.94	29.32	-	-	P	V
		895.7	32.33	-13.67	46	27.09	28.63	5.44	28.83	-	-	P	V
		943.3	33.88	-12.12	46	27.18	29.84	5.53	28.67	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.												

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	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
3+4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 149 5745MHz		5650	55.45	-12.75	68.2	54.51	32.22	4.58	35.86	103	308	P	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. Margin(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 5650MHz:

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. Margin(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 68.2(dBμV/m)

= -12.75 (dB)

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

Appendix D. Radiated Spurious Emission Plots

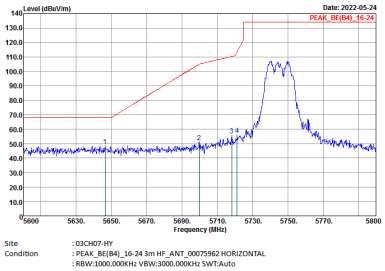
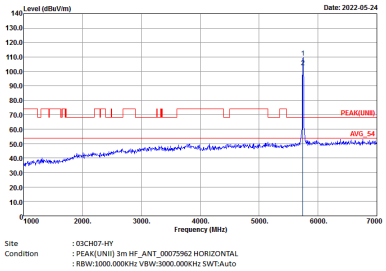
Test Engineer :	Jesse Wang, Stan Hsieh and Ken Wu	**Temperature :**	22~28.1°C
		Relative Humidity :	53.3~67.5%

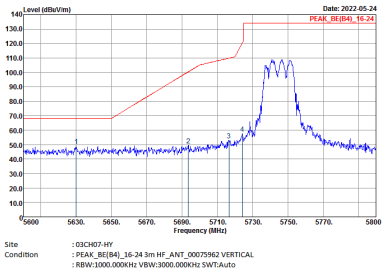
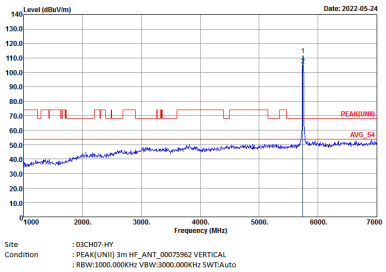
Note symbol

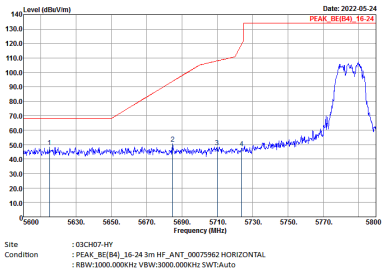
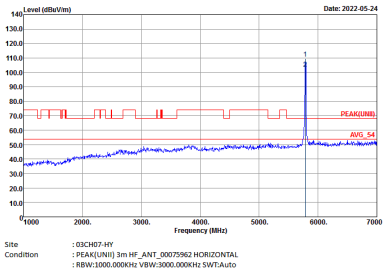
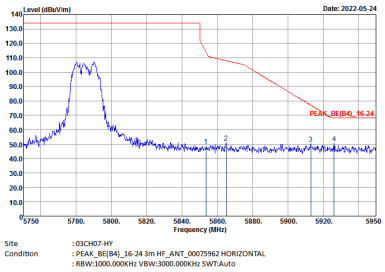
-L	**Low channel location**
-R	**High channel location**

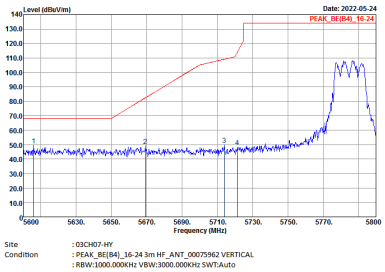
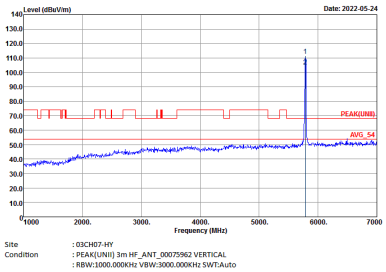
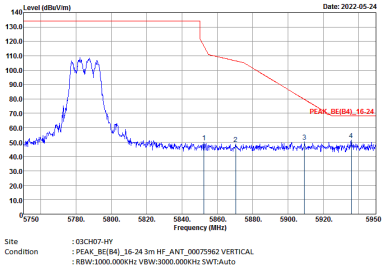
Band 4 - 5725~5850MHz

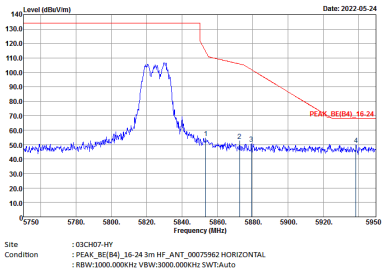
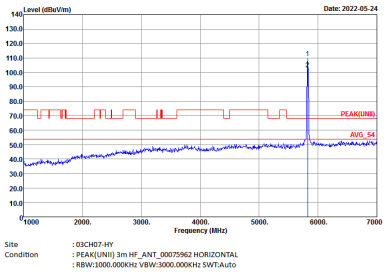
WIFI 802.11a (Band Edge @ 3m)

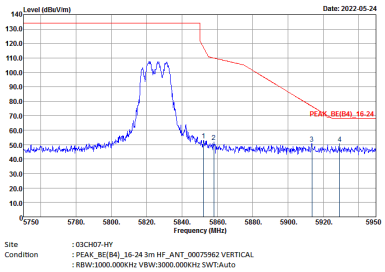
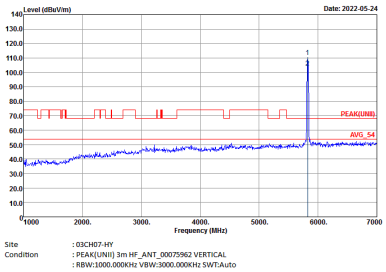
WIFI	**Band 4 5725~5850MHz Band Edge @ 3m**	
ANT	**802.11a CH149 5745MHz**	
3+4	**Horizontal**	**Fundamental**
Peak		

WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH149 5745MHz	
3+4	Vertical	Fundamental
Peak		

WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH157 5785MHz	
3+4	Horizontal	Fundamental
Peak		
Peak		Left blank

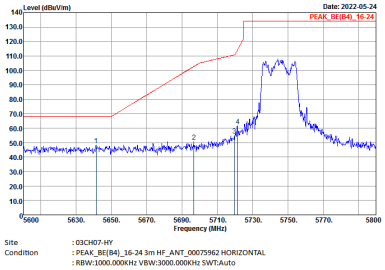
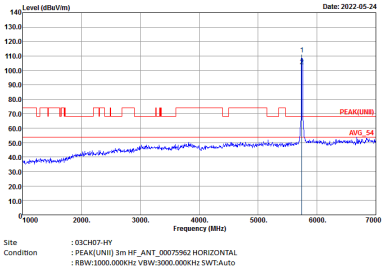
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH157 5785MHz	
3+4	Vertical	Fundamental
Peak		
Peak		Left blank

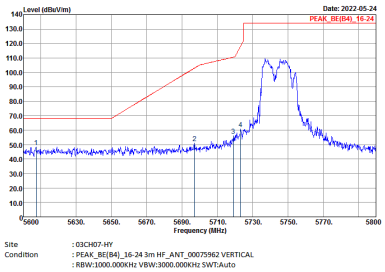
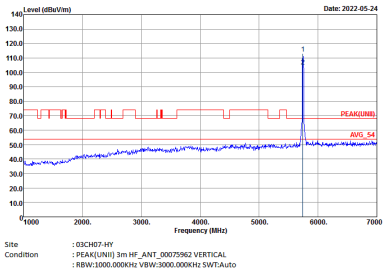
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH165 5825MHz	
3+4	Horizontal	Fundamental
Peak		

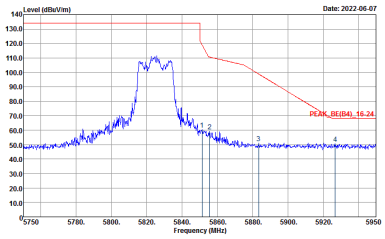
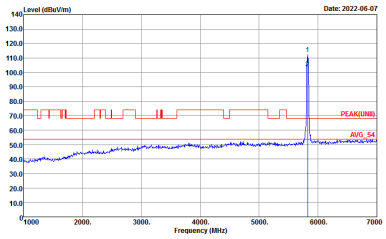
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH165 5825MHz	
3+4	Vertical	Fundamental
Peak		

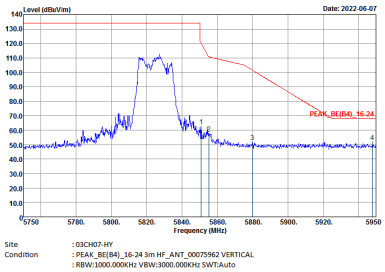
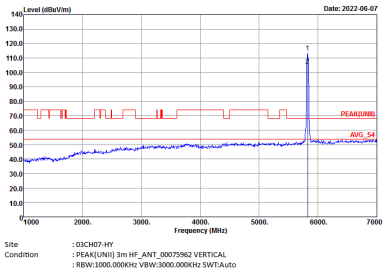
Band 4 5725~5850MHz

WIFI 802.11ax HE20 Full (Band Edge @ 3m)

WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ax HE20 Full CH149 5745MHz	
3+4	Horizontal	Fundamental
Peak		

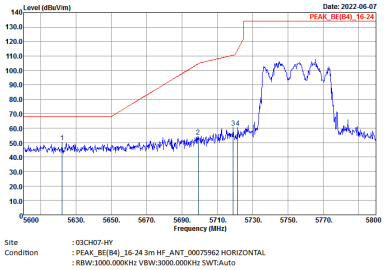
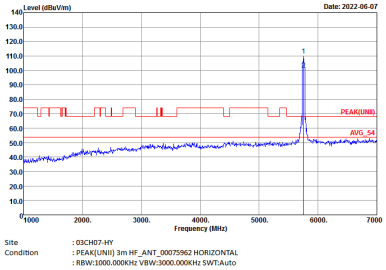
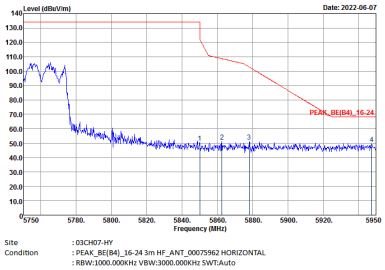
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ax HE20 Full CH149 5745MHz	
3+4	Vertical	Fundamental
Peak		

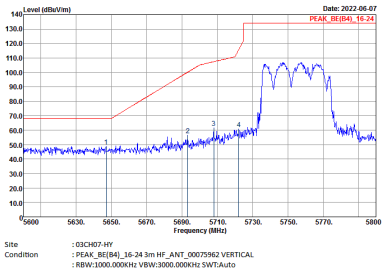
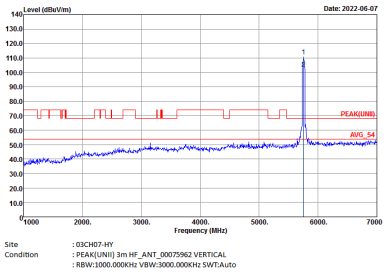
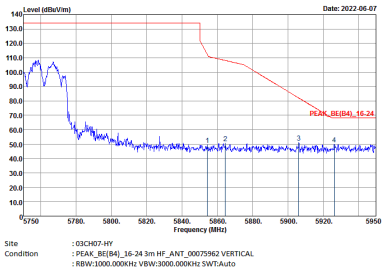
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ax HE20 Full CH165 5825MHz	
3+4	Horizontal	Fundamental
Peak		

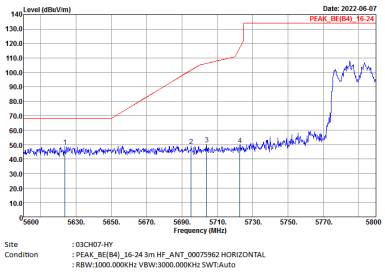
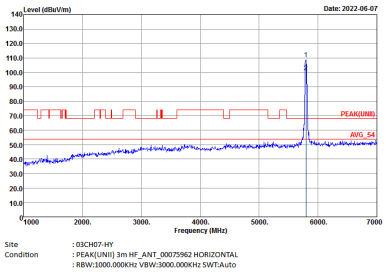
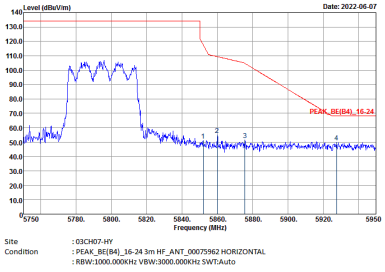
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ax HE20 Full CH165 5825MHz	
3+4	Vertical	Fundamental
Peak		

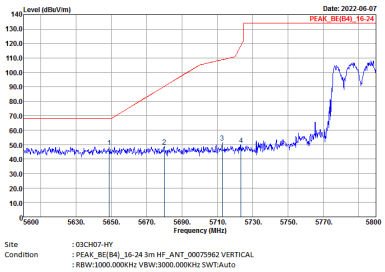
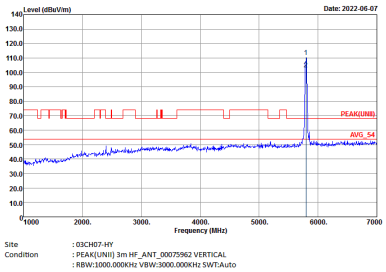
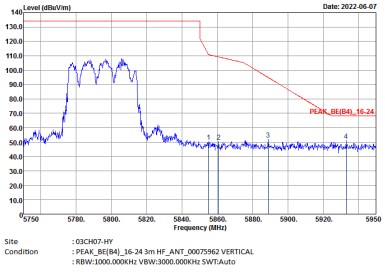
Band 4 5725~5850MHz

WIFI 802.11ax HE40 Full (Band Edge @ 3m)

WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ax HE40 Full CH151 5755MHz	
3+4	Horizontal	Fundamental
Peak		
Peak		Left blank

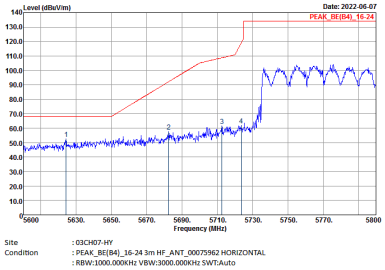
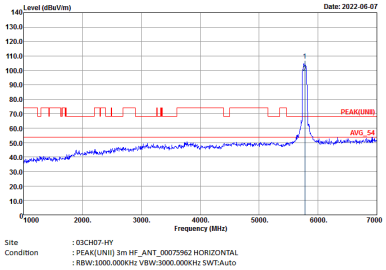
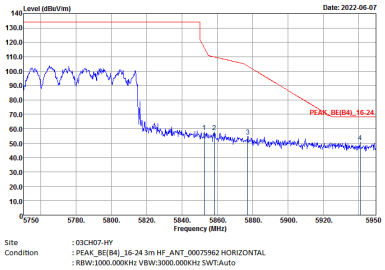
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ax HE40 Full CH151 5755MHz	
3+4	Vertical	Fundamental
Peak		
Peak		Left blank

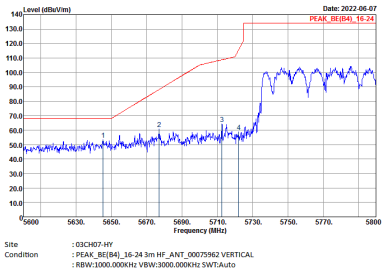
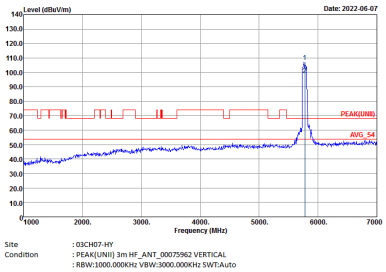
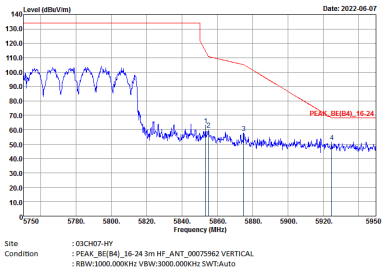
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ax HE40 Full HT40 CH159 5795MHz	
3+4	Horizontal	Fundamental
Peak		
Peak		Left blank

WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ax HE40 Full CH159 5795MHz	
3+4	Vertical	Fundamental
Peak		
Peak		Left blank

Band 4 5725~5850MHz

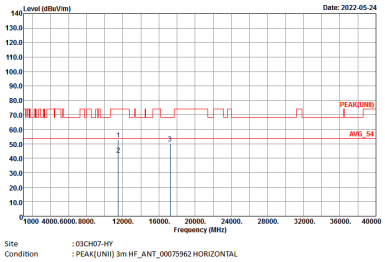
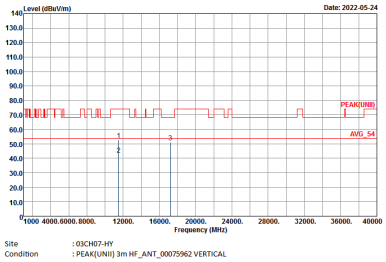
WIFI 802.11ax HE80 Full (Band Edge @ 3m)

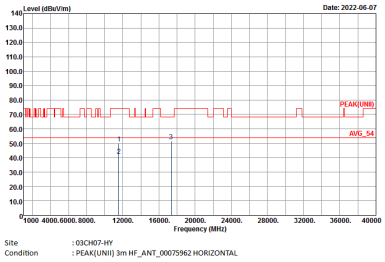
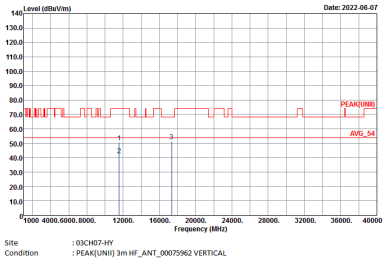
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH155 5775MHz	
3+4	Horizontal	Fundamental
Peak		
Peak		Left blank

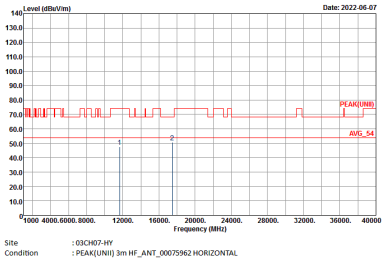
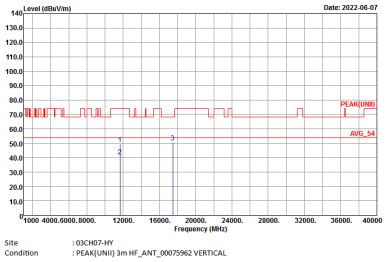
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11ax HE80 Full CH155 5775MHz	
3+4	Vertical	Fundamental
Peak		
Peak		Left blank

Band 4 - 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

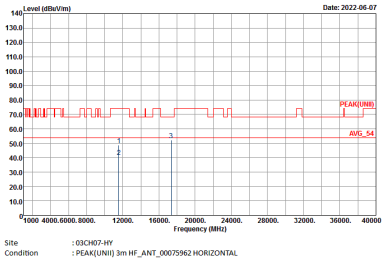
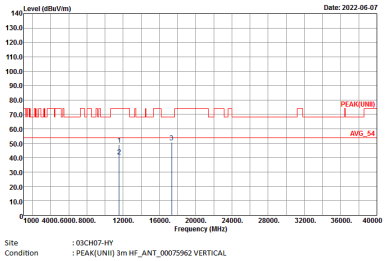
WIFI	Band 4 5725~5850MHz Harmonic @ 3m	
ANT	802.11a CH149 5745MHz	
3+4	Horizontal	Vertical
Peak Avg.		

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

WIFI	Band 4 5725~5850MHz Harmonic @ 3m	
ANT	802.11a CH165 5825MHz	
3+4	Horizontal	Vertical
Peak Avg.		

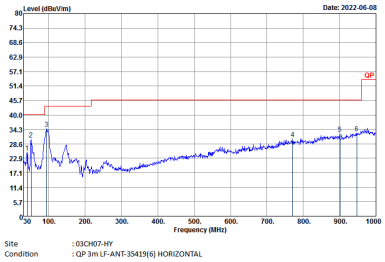
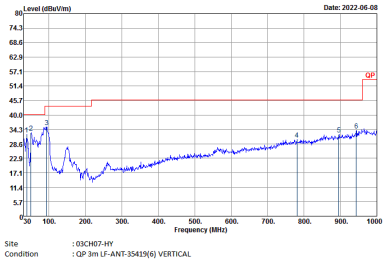
Band 4 5725~5850MHz

WIFI 802.11ax HE20 Full (Harmonic @ 3m)

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

Emission below 1GHz

5GHz WIFI 802.11a (LF @ 3m)

WIFI	5GHz WIFI	
ANT	802.11a LF	
3+4	Horizontal	Vertical
QP / Peak		

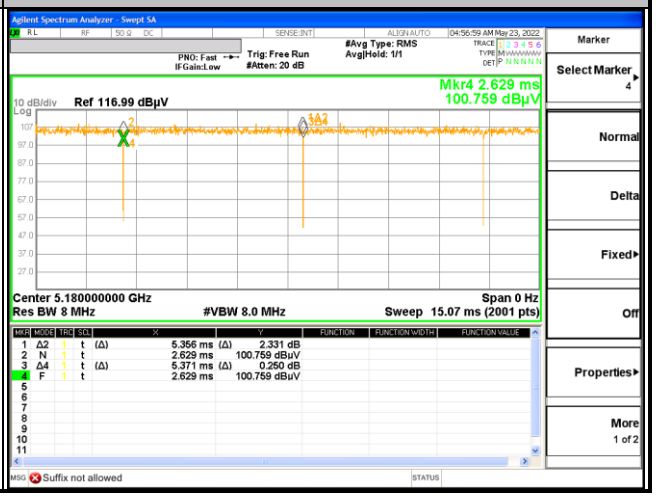
Appendix E. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
3+4	802.11a	99.10	-	-	10Hz
3+4	5GHz 802.11ax HE20 Full RU	99.72	-	-	10Hz
3+4	5GHz 802.11ax HE40 Full RU	99.69	-	-	10Hz
3+4	5GHz 802.11ax HE80 Full RU	99.42	-	-	10Hz

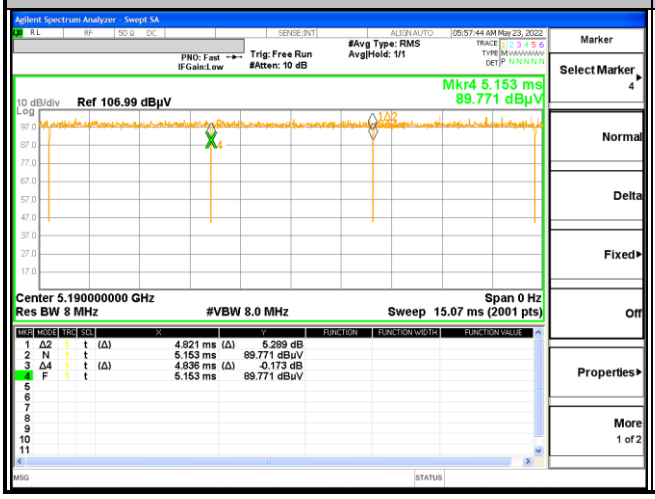
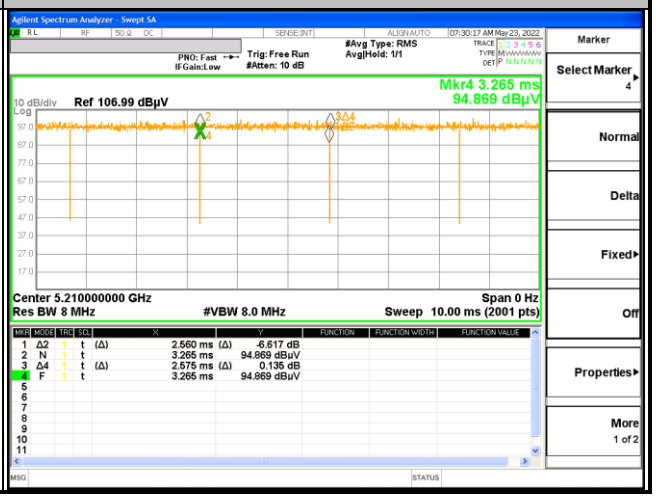
MIMO <Ant. 3+4>

802.11a

5GHz 802.11ax HE20 Full RU



5GHz 802.11ax HE40 Full RU



5GHz 802.11ax HE80 Full RU