Aibo Standard Technology (Shenzhen) Co., Ltd.
101, Building B, Tuori New Energy Industrial Park, High-tech Park, Tianliao Community, Yutang Street, Guangming District, Shenzhen City, Guangdong Province, China
Tel.: +(86) 0755 85250797 E-mail: Aibonorm@aibonorm.com Website: www.Aibonorm.com

FCC TEST REPORT

Report No.....:	AB2506005FW04
FCC ID.....:	**2A9DQ-H5A**
Applicant.....:	ALPHA OPTIK(SHENZHEN) CO.,LTD.
Address..... :	Room 01-04,19th Floor, Tower A, Building 12,Shenzhen Bay Eco-Technology Park, No.18 Kejinan Road, Nanshan District, Shenzhen City, Guangdong Province
Manufacturer.....:	ALPHA OPTIK(SHENZHEN) CO.,LTD.
Address.....:	Room 01-04,19th Floor, Tower A, Building 12,Shenzhen Bay Eco-Technology Park, No.18 Kejinan Road, Nanshan District, Shenzhen City, Guangdong Province
Product Name.....:	Smart Projector
Trade Mark.....:	/
Test Model.....:	H5A
Additional Model(s).....:	H2,H2 Mini,H5,H6,E5,P1,P2,P3,WP12503,WP12505,WP22503
Standard.....:	FCC 47 CFR Part 15 Subpart E (Part 15.407)
Date of Receipt..... :	2025.06.04
Date of Test Date..... :	2025.06.04-2025.07.24
Date of Issue..... :	2025.07.24
Test Result..... :	Pass

Compiled by: (Printed Name + Signature)	Huaijie Li	Huaijie Li
Supervised by: (Printed Name + Signature)	Jay Liu	jay liu
Approved by: (Printed Name + Signature)	Mic Cheng	Mic Cheng

Testing Laboratory Name..... :	Aibo Standard Technology (Shenzhen) Co., Ltd.
Address..... :	101, Building B, Tuori New Energy Industrial Park, High-tech Park, Tianliao Community, Yutang Street, Guangming District, Shenzhen City, Guangdong Province, China

FCC TEST REPORT

Test Report No.: AB2506005FW04	2025.07.24 Date of issue

EUT.....	:	Smart Projector
Test Model.....	:	H5A
Applicant.....	:	**ALPHA OPTIK(SHENZHEN) CO.,LTD.**
Address.....	:	Room 01-04,19th Floor, Tower A, Building 12,Shenzhen Bay Eco-Technology Park, No.18 Kejinan Road, Nanshan District, Shenzhen City, Guangdong Province
Telephone.....	:	/
Fax.....	:	/
Manufacturer.....	:	**ALPHA OPTIK(SHENZHEN) CO.,LTD.**
Address.....	:	Room 01-04,19th Floor, Tower A, Building 12,Shenzhen Bay Eco-Technology Park, No.18 Kejinan Road, Nanshan District, Shenzhen City, Guangdong Province
Telephone.....	:	/
Fax.....	:	/
Factory.....	:	**ALPHA OPTIK(SHENZHEN) CO.,LTD.**
Address.....	:	Room 01-04,19th Floor, Tower A, Building 12,Shenzhen Bay Eco-Technology Park, No.18 Kejinan Road, Nanshan District, Shenzhen City, Guangdong Province
Telephone.....	:	/
Fax.....	:	/

Test Result	Positive

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

REPORT VERSION

Version No.	Issue Date	Description
01	2025.07.24	Initial Issue

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. GENERAL DESCRIPTION OF EUT

Product Name:	Smart Projector		
Trade Mark:	/		
Test Model:	H5A		
Additional Model(s):	H2,H2 Mini,H5,H6,E5,P1,P2,P3,WP12503,WP12505,WP22503		
Model Difference:	All models are the same circuit and RF module, except the model name		
Hardware Version:	/		
Software Version:	/		
Power Supply:	Adapter input:100-240V ~50/60Hz 1.5A Output: 5V⎓3A/ 9V⎓3A/ 12V⎓3A/ 15V⎓3A/ 20V⎓5A, 100W Max PPS: 5.0V~21.0V⎓5.0A 100W Max Input: DC20V/5A		
EUT Supports Function: (Provided by the customer)	5GHz U-NII Bands	5150MHz~5250MHz	IEEE 802.11a/n/ac
		5725MHz~5850MHz	IEEE 802.11a/n/ac
Test Sample(s) Number:	AB2506005-01 (Engineer Sample) AB2506005-02 (Normal Sample)		
Radio Specification Subject to this Report			
Radio Specification:	IEEE 802.11a/n/ac		
Frequency Range:	5180MHz~5240MHz for U-NII Band1 5745MHz~5825MHz for U-NII Band3		
Modulation Type:	IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64-QAM, 16-QAM, QPSK, BPSK) IEEE 802.11ac: OFDM(256QAM, 64QAM, 16QAM, QPSK, BPSK)		
Channel Spacing:	IEEE 802.11a/n(HT20)/ac(VHT20): 20MHz IEEE 802.11n(HT40)/ac(VHT40): 40MHz IEEE 802.11ac(VHT80): 80MHz		
Channel Number(s):	**U-NII Band1:** 4 for IEEE 802.11a/n(HT20)/ac(VHT20) 2 for IEEE 802.11n(HT40))/ac(VHT40) 1 for IEEE 802.11ac(VHT80) **U-NII Band3:** 5 for IEEE 802.11a/n(HT20)/ac(VHT20) 2 for IEEE 802.11n(HT40))/ac(VHT40) 1 for IEEE 802.11ac(VHT80)		
Antenna Type:	Integral Antenna		
Antenna Gain:	U-NII Band1:	ANT1:3.88dBi, ANT2:5.11dBi	
		MIMO Gain：8.12dBi	
	U-NII Band3:	ANT1:3.56dBi, ANT2:4.72dBi	
		MIMO Gain：7.73dBi	

1.2. DESCRIPTION OF SUPPORT EQUIPMENT

Description	Manufacturer	Model	Serial Number	Supplied by
AC/DC Adapter	Quick Charger	PD1005UX-1001P	5003982	Applicant

1.3. DESCRIPTION OF EXTERNAL I/O

I/O Port Description	Quantity	Cable
USB Type-C Interface	1	0.8m, unshielded
Earphone Jack	1	N/A

1.4. GENERAL DESCRIPTION OF APPLIED STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.407 - General technical requirements of Unlicensed National Information Infrastructure Devices.

ANSI C63.10-2013 - American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

KDB 789033 D02 General UNII Test Procedures New Rules v02r01 - Guidelines For Compliance Testing Of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E

1.5. DESCRIPTION OF TEST FACILITY

Test Lab: Aibo Standard Technology (Shenzhen) Co., Ltd.

Address: 101, Building B, Tuori New Energy Industrial Park, High-tech Park, Tianliao Community, Yutang Street, Guangming District, Shenzhen City, Guangdong Province, China

Tel.: +(86) 0755 85250797

E-mail: Aibonorm@aibonorm.com

Website: www.Aibonorm.com

The test facility is recognized, certified, or accredited by the following organizations:

A2LA-Lab Certificate No.: 7514.01

Aibo Standard Technology (Shenzhen) Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC Accredited Lab.

Designation Number: CN1411

Test Firm Registration Number: 567066

ISED Wireless Device Testing Laboratories

CAB identifier: CN0185

1.6. MEASUREMENT UNCERTAINTY

The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Items	Measurement Uncertainty
Power Line Conducted Emission (9kHz~150kHz)	±3.62dB
Power Line Conducted Emission (150kHz~30MHz)	±3.38dB
Radiated Emission (9kHz~30MHz)	±3.10dB
Radiated Emission (30MHz~1GHz)	±4.90dB
Radiated Emission (1GHz~18GHz)	±3.88dB
Radiated Emission (18GHz~40GHz)	±5.32dB
RF Conducted Power	±0.57dB
Conducted Spurious Emissions	±1.60dB
RF Frequency	±6.0 x 10^{-7}

Note: All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

1.7. ENVIRONMENTAL CONDITIONS

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	+15°C ~ +35°C
Lative Humidity	20 % ~ 75 %
Air Pressure	98KPa ~ 101KPa

1.8. DESCRIPTION OF TEST MODES

Mode	Tx/Rx Frequency (MHz)	Test Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11a IEEE 802.11n(HT20) IEEE 802.11ac(VHT20)	5150MHz~5250MHz	Channel 36	Channel 40	Channel 48
		5180MHz	5200MHz	5240MHz
	5725MHz~5850MHz	Channel 149	Channel 157	Channel 165
		5745MHz	5785MHz	5825MHz
IEEE 802.11n(HT40) IEEE 802.11ac(VHT40)	5150MHz~5250MHz	Channel 38	--	Channel 46
		5190MHz	--	5230MHz
	5725MHz~5850MHz	Channel 151	--	Channel 159
		5755MHz	--	5795MHz
IEEE 802.11ac(VHT80)	5150MHz~5250MHz	--	Channel 42	--
		--	5210MHz	--
	5725MHz~5850MHz	--	Channel 155	--
		--	5775MHz	--

For portable device, radiated emission was verified over X, Y, Z Axis, and shown the worst case in this report. The following operating modes were applied for the related test items. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data packets and antenna ports (if EUT with antenna diversity architecture), only the result of the worst case was recorded in the report.

List of Test Modes	
Test Mode(s)	Description
TM1	Keep the EUT works in continuously transmitting mode (IEEE 802.11a)
TM2	Keep the EUT works in continuously transmitting mode (IEEE 802.11n)
TM3	Keep the EUT works in continuously transmitting mode (IEEE 802.11ac)

Power setting during the test:

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Mode	U-NII Band1	U-NII Band3
	Power Setting	
IEEE 802.11a	Default	Default
IEEE 802.11n(HT20)	Default	Default
IEEE 802.11n(HT40)	Default	Default
IEEE 802.11ac(VHT20)	Default	Default
IEEE 802.11ac(VHT40)	Default	Default
IEEE 802.11ac(VHT80)	Default	Default

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Following data rate was (were) selected for the final test as listed below:

Mode	Worst-case data rates
IEEE 802.11a	6Mbps
IEEE 802.11n(HT20)	MCS0
IEEE 802.11n(HT40)	MCS0
IEEE 802.11ac(VHT20)	MCS0
IEEE 802.11ac(VHT40)	MCS0
IEEE 802.11ac(VHT80)	MCS0

2. SUMMARY OF TEST RESULT

FCC 47 CFR Part 15 Subpart E Test Cases			
FCC Rule	**Description of Test Item(s)**	**Result**	**Test Engineer**
Part 15.203 Part 15.407(a)	Antenna Requirement	Pass	Jacey Fu
Part 15.407(a)	Duty Cycle	Pass	Jacey Fu
Part 15.407(a)	Maximum Conducted Output Power	Pass	Jacey Fu
Part 15.407(a)	26dB Bandwidth and Occupied Bandwidth	Pass	Jacey Fu
Part 15.407(e)	6dB Bandwidth	Pass	Jacey Fu
Part 15.407(a)	Power Spectral Density	Pass	Jacey Fu
Part 15.407(b) Part 15.205 Part 15.209	Radiated Emissions and Radiated Band Edges Measurement	Pass	Jacey Fu
Part 15.407(g)	Frequency Stability	Pass	Jacey Fu
Part 15.407(c)	Automatically Discontinue Transmission	N/A	Jacey Fu
Part 15.407(h)	Dynamic Frequency Selection	N/A	Jacey Fu
Part 15.207	Power Line Conducted Emissions	Pass	Jacey Fu
Part 15.407(f)	RF Exposure (see the RF Exposure Report)	Pass	Jacey Fu

3. MEASUREMENT INSTRUMENTS LIST

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Until
1	Loop Antenna	Schwarzbeck	FMZB 1519	1519-025	02/19/2025	02/18/2026
2	Power Amplifier	HZEMC	HPA-9K0133	HYPA23029	02/19/2025	02/18/2026
3	Broadband Antenna	Schwarzbeck	VULB 9168	01763	02/19/2025	02/18/2026
4	Attenuator	PRM	ATT50-6-3	ATT50-6-3	01/20/2025	01/19/2026
5	Spectrum Analyzer	R&S	FSV40-N	101365	01/20/2025	01/19/2026
6	Horn Antenna	Schwarzbeck	BBHA 9120 D	02786	02/19/2025	02/18/2026
7	Horn Antenna	Schwarzbeck	ZLB7-18-40G-77	072410839	02/19/2025	02/18/2026
8	Power Amplifier	HZEMC	PA0118-43	HYPA23030	02/19/2025	02/18/2026
9	Power Amplifier	HZEMC	PA01840-45	HYPA23031	02/19/2025	02/18/2026
10	EMI Test Receiver	R&S	ESCI	101196	01/20/2025	01/19/2026
11	LISN	R&S	ENV216	102374	01/20/2025	01/19/2026
12	Pulse Limiter	Schwarzbeck	ESH3-Z2	0357.8810.54	01/20/2025	01/19/2026
13	MXA Signal Analyzer	Keysight	N9020A	MY52091389	01/20/2025	01/19/2026
14	Power Sensor	Agilent	U2021XA	MY54110007	01/31/2025	01/30/2026
15	Power Sensor	Agilent	U2021XA	MY54110009	01/31/2025	01/30/2026
16	MXG Vector Signal Generator	Agilent	N5182A	MY47070153	01/20/2025	01/19/2026
17	Analog Signal Source	Keysight	N5173B	MY60403029	01/20/2025	01/19/2026
18	Vector Signal Generator	R&S	SMCV100B	106103	01/20/2025	01/19/2026
19	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW500	118780	01/20/2025	01/19/2026
20	DC POWER SUPPLY	MAISHENG	MT-305DS	2021040016	02/28/2025	02/27/2026
21	Const Temp. & Humidity Chamber	GRT	GR-HWX-150L	GR25010601	01/20/2025	01/19/2026

Test Software		
Software name	Model	Version
Conducted Emission Measurement Software	FASLAB	V4.1
Radiated Emission Measurement Software	FASLAB	V4.1
Bluetooth and WIFI Test System	MTS 8310	V3.0.0.0

4. ANTENNA REQUIREMENT

1) Standard Requirement

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.407(a)(1) (2) requirement:

The conducted output power limit specified in paragraph (a) of this section is based on the use of antennas with directional gains that do not exceed 6dBi. Except as shown in paragraph (a) of this section, if transmitting antennas of directional gain greater than 6dBi are used, the conducted output power and the peak power spectral density shall be reduced by the by the amount in dB that the directional gain of the antenna exceeds 6dBi.

2) Conclusion

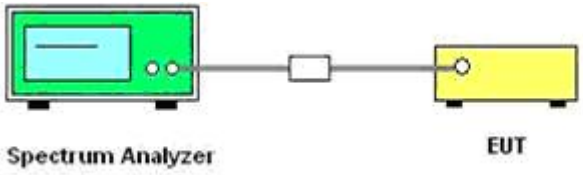
Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is See section 1.1(page 6). It complies with the standard requirement.

5. DUTY CYCLE

5.1. LIMIT

All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum-power transmission duration, T, are required for each tested mode of operation.

5.2. TEST SETUP



5.3. TEST PROCEDURE

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

a) Set the Centre frequency of the spectrum analyzer to the transmitting frequency;

b) Set RBW >= EBW if possible; otherwise, set RBW to the largest available value(8MHz);

c) Set VBW >= RBW, Span = 0, Detector = Peak;

d) Trace Mode = Clear Write;

e) When the trace is complete, measure the sending time of 1 burst and the duty cycle of 1 burst cycle.

5.4. TEST RESULT

Pass.

Please refer to the Appendix H 5G WiFi ANT1 RF Conducted Test Data.

Please refer to the Appendix I 5G WiFi ANT2 RF Conducted Test Data.

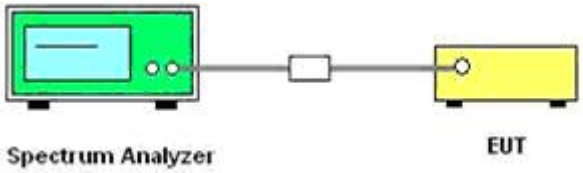
Note: 1) The test results including the cable lose.
2) Duty cycle= On Time/ Period;
3) Duty Cycle factor = 10*log(1/Duty cycle)

6. 26DB BANDWIDTH AND OCCUPIED BANDWIDTH

6.1. LIMIT

None; for reporting purposes only.

6.2. TEST SETUP



6.3. TEST PROCEDURE

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Use the following spectrum analyzer settings:

For 26dB Bandwidth Measurement:

a) Set RBW = approximately 1% of the emission bandwidth.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Detector = Peak.

e) Trace mode = max hold.

f) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

For 99% Occupied Bandwidth Measurement:

a) Set center frequency to the nominal EUT channel center frequency.

b) Set span = 1.5 times to 5.0 times the OBW.

c) Set RBW = 1 % to 5 % of the OBW.

d) Set VBW ≥ 3 x RBW.

e) Detector function = peak

f) Trace = max hold

g) Use the 99% power bandwidth function of the instrument to measure the Occupied Bandwidth and recoded.

6.4. TEST RESULT

Please refer to the Appendix H 5G WiFi ANT1 RF Conducted Test Data.

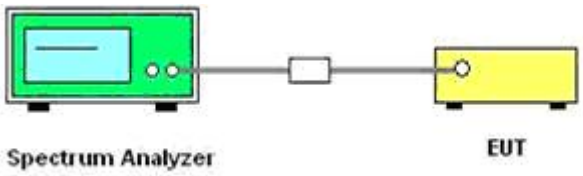
Please refer to the Appendix I 5G WiFi ANT2 RF Conducted Test Data.

7. 6DB BANDWIDTH

7.1. LIMIT

According to FCC 47 CFR Part 15 Subpart C Section 15.407(e), Within the 5.725-5.85GHz band, the minimum 6dB bandwidth of U-NII devices shall be at least 500kHz.

7.2. TEST SETUP



7.3. TEST PROCEDURE

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Use the following spectrum analyzer settings:

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 * RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.4. TEST RESULT

Please refer to the Appendix H 5G WiFi ANT1 RF Conducted Test Data.

Please refer to the Appendix I 5G WiFi ANT2 RF Conducted Test Data.

8. CONDUCTED OUTPUT POWER

8.1. LIMIT

According to FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3).

For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W provided the maximum antenna gain does not exceed 6dBi. In addition, the maximum power spectral density shall not exceed 17dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125mW (21dBm).

(ii) For an indoor access point operating in the band 5.15-5.25GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W provided the maximum antenna gain does not exceed 6dBi. In addition, the maximum power spectral density shall not exceed 17dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23dBi, a 1dB reduction in maximum conducted output power and maximum power spectral density is required for each 1dB of antenna gain in excess of 23dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15-5.25GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250mW provided the maximum antenna gain does not exceed 6dBi. In addition, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

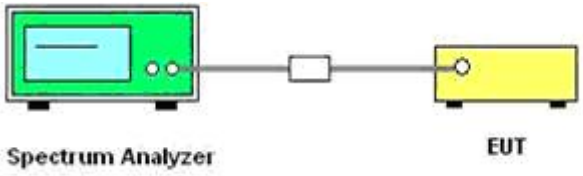
For the 5.25-5.35GHz and 5.47-5.725GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250mW or 11dBm + 10logB, where B is the 26dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

For the band 5.725-5.85GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W. In addition, the maximum power spectral density shall not exceed 30dBm in any 500kHz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power

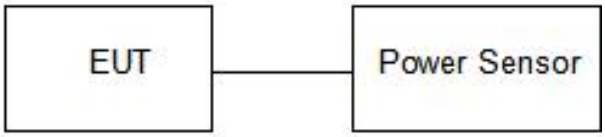
and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

8.2. TEST SETUP

☒ **Using a Spectrum Analyzer for Testing:**



☐ **Using a Broadband Power Meter for Testing:**



8.3. TEST PROCEDURE

☒ **Using a Spectrum Analyzer for Testing:**

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Use the following spectrum analyzer settings:

a) Set span to encompass the entire 26dB EBW or 99% OBW of the signal.

b) Set RBW = 1 MHz, Set VBW >= 3MHz, Number of points in sweep >= [2*span / RBW]. (This gives bin-to-bin spacing <= RBW / 2, so that narrowband signals are not lost between frequency bins.)

c) Set Sweep time = auto, Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

d) Do not use sweep triggering. Allow the sweep to “free run.”.

e) Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the ON and OFF periods of the transmitter.

f) Compute power by integrating the spectrum across the 26dB EBW or 99% OBW of the signal using the instrument’s band power measurement function with band limits set equal to the EBW or OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at 1MHz intervals extending across the 26 dB EBW or 99% OBW of the spectrum.

g) Add [10*log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the ON and OFF times of the transmission). For example, add [10 log (1 / 0.25)] = 6dB if the duty cycle is 25%.

☐ **Using a Broadband Power Meter for Testing:**

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the broadband power meter and measure the average output power. Add [10*log (1 / D)] to calculate the final result.

8.4. TEST RESULT

Pass.

Please refer to the Appendix H 5G WiFi ANT1 RF Conducted Test Data.

Please refer to the Appendix I 5G WiFi ANT2 RF Conducted Test Data.

Note: The test results including the cable lose.

MIMO POWER:

Mode	Frequency (MHz)	Conducted power_Ant1 (dBm)	Conducted power_Ant2(dBm)	Conducted power_Ant1+2(dBm)	MIMO Limit (dBm)	Verdict
n20	5180	5.5	6.65	9.12	21.88	Pass
n20	5200	5.31	5.41	8.37	21.88	Pass
n20	5240	5.37	5.37	8.38	21.88	Pass
n20	5745	6.55	6.7	9.64	28.27	Pass
n20	5785	6.26	6.22	9.25	28.27	Pass
n20	5825	6.41	6.56	9.50	28.27	Pass
n40	5190	5.67	5.68	8.69	21.88	Pass
n40	5230	5.59	5.58	8.60	21.88	Pass
n40	5755	6.78	6.75	9.78	28.27	Pass
n40	5795	6.26	6.29	9.29	28.27	Pass
ac20	5180	5.48	5.53	8.52	21.88	Pass
ac20	5200	5.49	5.49	8.50	21.88	Pass
ac20	5240	5.55	5.48	8.53	21.88	Pass
ac20	5745	6.75	6.74	9.76	28.27	Pass
ac20	5785	6.22	6.23	9.24	28.27	Pass
ac20	5825	6.46	6.5	9.49	28.27	Pass
ac40	5190	5.17	5.76	8.49	21.88	Pass
ac40	5230	5.49	5.62	8.57	21.88	Pass
ac40	5755	6.88	6.77	9.84	28.27	Pass
ac40	5795	6.28	6.23	9.27	28.27	Pass
ac80	5210	5.53	5.47	8.51	21.88	Pass
ac80	5775	6.25	6.26	9.27	28.27	Pass

Note: MIMO Limit=Limit-(MAX Gai+10*Log(2)dBi-6)

9. POWER SPECTRAL DENSITY

9.1. LIMIT

According to FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3):

For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W provided the maximum antenna gain does not exceed 6dBi. In addition, the maximum power spectral density shall not exceed 17dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125mW (21dBm).

(ii) For an indoor access point operating in the band 5.15-5.25GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W provided the maximum antenna gain does not exceed 6dBi. In addition, the maximum power spectral density shall not exceed 17dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23dBi, a 1dB reduction in maximum conducted output power and maximum power spectral density is required for each 1dB of antenna gain in excess of 23dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

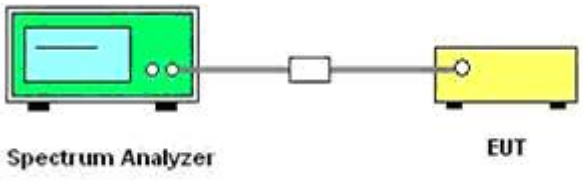
(iv) For client devices in the 5.15-5.25GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250mW provided the maximum antenna gain does not exceed 6dBi. In addition, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

For the 5.25-5.35GHz and 5.47-5.725GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250mW or 11dBm + 10logB, where B is the 26dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

For the band 5.725-5.85GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W. In addition, the maximum power spectral density shall not exceed 30dBm in any 500kHz band. If transmitting antennas of directional gain greater than 6dBi are used, both the maximum conducted output power

and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

9.2. TEST SETUP



9.3. TEST PROCEDURE

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

For U-NII-1, U-NII-2A, U-NII-2C band:

Using method SA-2

a) Set span to encompass the entire emission bandwidth (EBW) of the signal.

b) Set RBW = 1 MHz, Set VBW ≥ 3 RBW, Detector = RMS

c) Sweep time = auto, trigger set to “free run”.

d) Trace average at least 100 traces in power averaging mode.

e) Record the max value and add 10 log (1/duty cycle)

For U-NII-3 band:

a) Set span to encompass the entire emission bandwidth (EBW) of the signal.

b) Set RBW = 510 kHz, Set VBW ≥ 3 RBW, Detector = RMS

c) Use the peak marker function to determine the maximum power level in any 500 kHz band segment within the fundamental EBW.

d) Sweep time = auto, trigger set to “free run”.

e) Trace average at least 100 traces in power averaging mode.

f) Record the max value and add 10 log (1/duty cycle)

9.4. TEST RESULT

Pass.

Please refer to the Appendix H 5G WiFi ANT1 RF Conducted Test Data.

Please refer to the Appendix I 5G WiFi ANT2 RF Conducted Test Data.

MIMO PSD:

Mode	Frequency (MHz)	PSD_Ant1 (dBm)	PSD_Ant2(dBm)	PSD_Ant1+2(dBm)	MIMO Limit (dBm)	Verdict
n20	5180	-4.2	-3.17	-0.64	8.88	Pass
n20	5200	-4.19	-4.26	-1.21	8.88	Pass
n20	5240	-4.34	-4.31	-1.31	8.88	Pass
n40	5190	-7.24	-6.87	-4.04	8.88	Pass
n40	5230	-6.65	-7.03	-3.83	8.88	Pass
ac20	5180	-4.38	-4.16	-1.26	8.88	Pass
ac20	5200	-4.4	-4.21	-1.29	8.88	Pass
ac20	5240	-4.06	-4.29	-1.16	8.88	Pass
ac40	5190	-7.62	-7.09	-4.34	8.88	Pass
ac40	5230	-7.43	-6.9	-4.15	8.88	Pass
ac80	5210	-9.93	-10.31	-7.11	8.88	Pass
n20	5745	-6.76	-7.49	-4.10	28.27	Pass
n20	5785	-7.60	-7.82	-4.70	28.27	Pass
n20	5825	-7.45	-7.55	-4.49	28.27	Pass
n40	5755	-9.53	-10.03	-6.76	28.27	Pass
n40	5795	-10.23	-11.02	-7.60	28.27	Pass
ac20	5745	-7.12	-7.25	-4.17	28.27	Pass
ac20	5785	-7.96	-7.39	-4.66	28.27	Pass
ac20	5825	-7.92	-7.27	-4.57	28.27	Pass
ac40	5755	-9.53	-9.44	-6.47	28.27	Pass
ac40	5795	-10.79	-10.61	-7.69	28.27	Pass
ac80	5775	-13.94	-13.11	-10.49	28.27	Pass

Note: MIMO Limit=Limit-(MAX Gai+3.01-6)

10. OUT OF BAND EMISSIONS(CONDUCTED)

10.1. LIMIT

According to §15.407(b), *Undesirable emission limits.* Except as shown in paragraph (b)(10) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25GHz band: All emissions outside of the 5.15-5.35GHz band shall not exceed an e.i.r.p. of −27dBm/MHz.

(2) For transmitters operating in the 5.25-5.35GHz band: All emissions outside of the 5.15-5.35GHz band shall not exceed an e.i.r.p. of −27dBm/MHz.

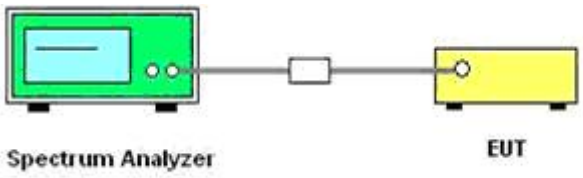
(3) For transmitters operating in the 5.47-5.725GHz band: All emissions outside of the 5.47-5.725GHz band shall not exceed an e.i.r.p. of −27dBm/MHz.

(4) For transmitters operating solely in the 5.725-5.850GHz band:

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

(ii) Devices certified before March 2, 2017 with antenna gain greater than 10dBi may demonstrate compliance with the emission limits in § 15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10dBi or less may demonstrate compliance with the emission limits in § 15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

10.2. TEST SETUP



10.3. TEST PROCEDURE

(1) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

(2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.

(3) Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.

(4) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

(5) Repeat above procedures until all measured frequencies were complete.

10.4. TEST RESULT

Pass.

Please refer to the Appendix H 5G WiFi ANT1 RF Conducted Test Data.

Please refer to the Appendix I 5G WiFi ANT2 RF Conducted Test Data.

11. RADIATED EMISSIONS AND RADIATED BAND EDGES MEASUREMENT

11.1. LIMIT

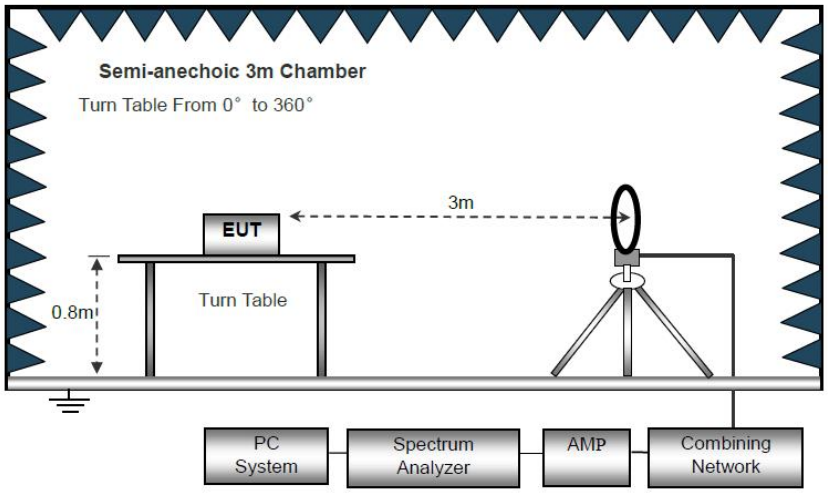
Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Limits of Spurious Emissions				
Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009MHz~0.490MHz	2400/F(kHz)	---	---	300
0.490MHz~1.705MHz	24000/F(kHz)	---	---	30
1.705MHz~30MHz	30	---	---	30
30MHz~88MHz	100	40.0	Quasi-peak	3
88MHz~216MHz	150	43.5	Quasi-peak	3
216MHz~960MHz	200	46.0	Quasi-peak	3
960MHz~1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

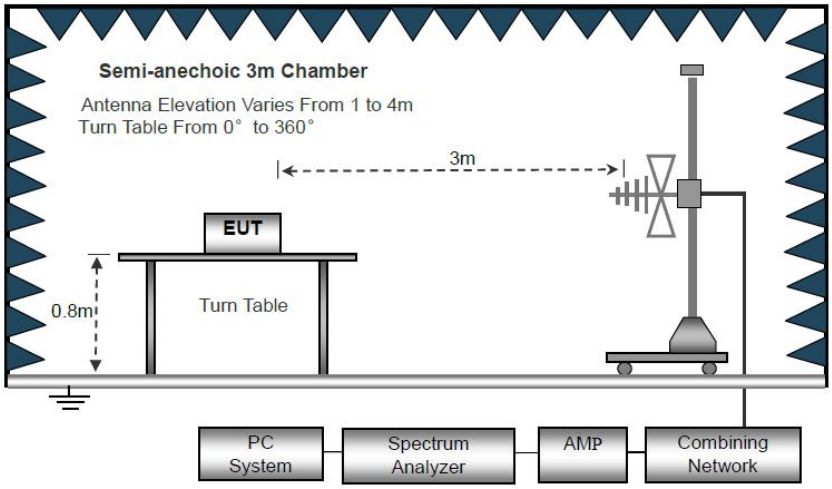
Remark:
a) The lower limit shall apply at the transition frequencies.
b) Emission level (dBuV/m) = 20*log Emission level (uV/m).
c) For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
d) Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

Limits of Unwanted Emission Out of the Restricted Bands		
Applicable To	**Limit**	
KDB 789033 D02 General UNII Test Procedures New Rules v02r01	**Field Strength at 3 m**	
	PK: 74 (dBμV/m)	**AV: 54 (dBμV/m)**
Applicable To	EIRP Limit	Equivalent Field Strength at 3 m
FCC Part 15.407 (b)(1)	PK: -27 (dBm/MHz)	PK: 68.2 (dBμV/m)
FCC Part 15.407 (b)(2)	PK: -27 (dBm/MHz)	PK: 68.2 (dBμV/m)
FCC Part 15.407 (b)(3)	PK: -27 (dBm/MHz)	PK: 68.2 (dBμV/m)
FCC Part 15.407 (b)(4)	27dBm/MHz at frequencies from the band edges decreasing linearly to 15.6dBm/MHz at 5MHz above or below the band edges;	PK: 68.2 (dBμV/m)
	15.6dBm/MHz at 5MHz above or below the band edges decreasing linearly to 10dBm/MHz at 25MHz above or below the band edges;	
	10dBm/MHz at 25MHz above or below the band edges decreasing linearly to -27dBm/MHz at 75MHz above or below the band edges;	
	-27dBm/MHz at frequencies more than 75MHz above or below the band edges.	

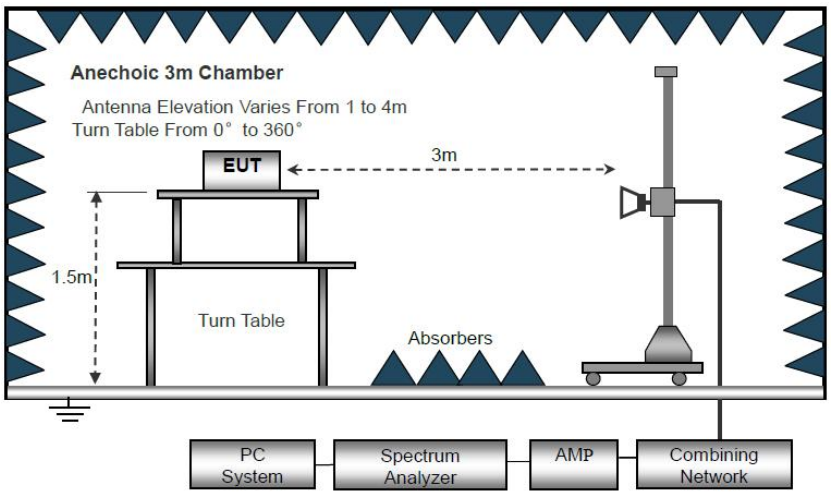
11.2. TEST SETUP



Block Diagram of Radiated Emission Below 30MHz



Block Diagram of Radiated Emission From 30MHz to 1GHz



Block Diagram of Radiated Emission Above 1GHz

11.3. TEST PROCEDURE

a) Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.

b) Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0 degree to 360 degree to acquire the highest emissions from EUT.

c) And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

d) Repeat above procedures until all frequency measurements have been completed.

e) Radiated emission test frequency band from 9KHz to 40GHz.

f) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and record the worst case in this report.

g) The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz~30MHz	Active Loop Antenna	3
30MHz~1GHz	Bilog Antenna	3
1GHz~18GHz	Horn Antenna	3
18GHz~25GHz	Horn Anternna	1

h) Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz~150KHz	RBW=200Hz/VBW=3KHz, Sweep time=Auto	QP
150KHz~30MHz	RBW=9KHz/VBW=100KHz, Sweep time=Auto	QP
30MHz~1GHz	RBW=120KHz/VBW=1000KHz, Sweep time=Auto	QP
1GHz~40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

11.4. TEST RESULT

Pass.

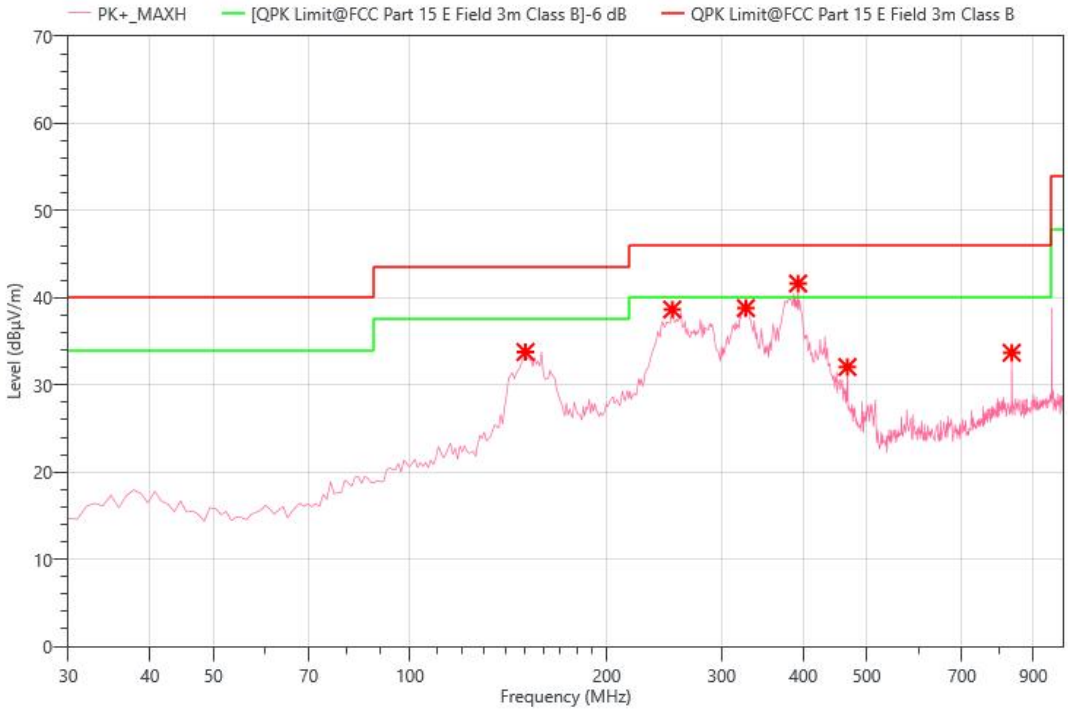
Remark:

a) Pre-scan all modes and recorded the worst case in this report.

b) Radiated emission test from 9KHz to 10th harmonic of fundamental was verified, and the emission levels from 9kHz to 30MHz are attenuated 20dB below the limit and not recorded in report.

c)All of the 802.11a, 802.11n , 802.11ac modes have been tested, the EUT complied with the FCC Part 15.209 standard limit for a wireless device, and with the worst case Ant1 802.11a 5180MHz as below:

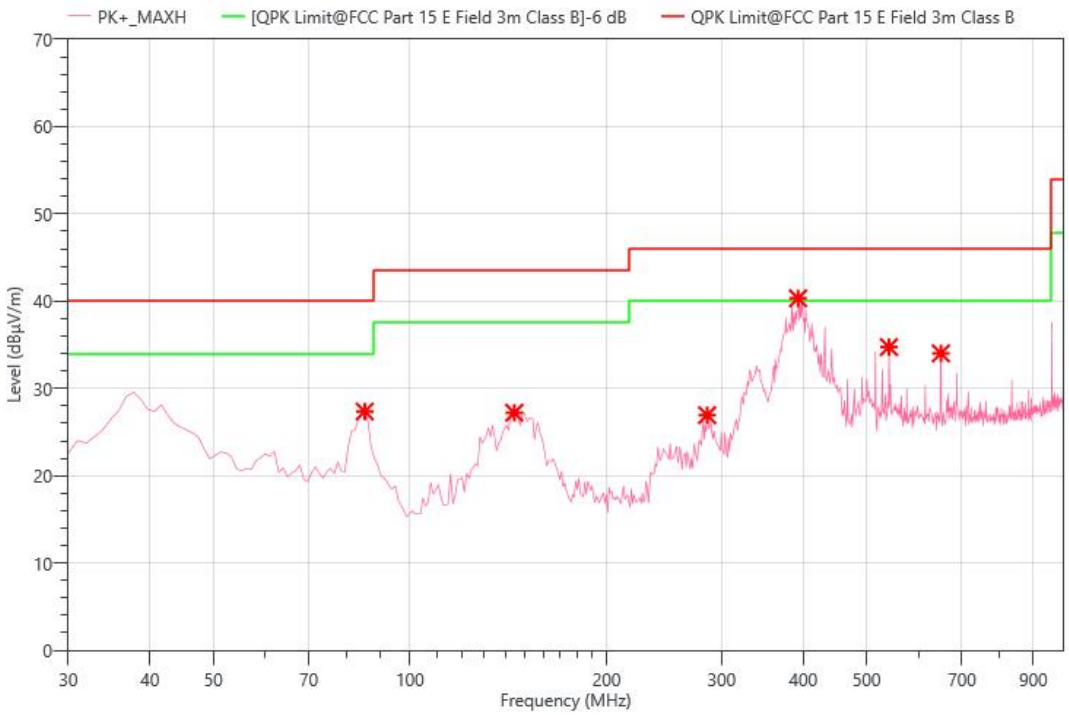
Radiated Emission Test Data (30MHz to 1GHz)			
Environmental Conditions	24.6℃, 53.4% RH	Test Engineer	Jacey Fu
Worst Test Mode:	802.11a(Channel 36)	Polarity:	Horizontal



No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	150.280	45.67	-11.9	33.77	43.50	9.73	PK+	H
2	252.130	52.17	-13.52	38.65	46.00	7.35	PK+	H
3	326.820	50.24	-11.43	38.81	46.00	7.19	PK+	H
4	392.780	51.53	-9.9	41.63	46.00	4.37	PK+	H
5	467.470	40.19	-8.14	32.05	46.00	13.95	PK+	H
6	834.130	35.81	-2.12	33.69	46.00	12.31	PK+	H

Remark:
Emission Level = Reading + Factor;
Factor = Antenna Factor + Cable Loss – Pre-amplifier;
Margin= Limit - Emission Level .

Radiated Emission Test Data (30MHz to 1GHz)			
Environmental Conditions	24.6℃, 53.4% RH	Test Engineer	Jacey Fu
Worst Test Mode:	802.11a(Channel 36)	Polarity:	Vertical



No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Det.	Pol.
1	85.290	44.69	-17.33	27.36	40.00	12.64	PK+	V
2	144.460	39.46	-12.24	27.22	43.50	16.28	PK+	V
3	285.110	39.56	-12.62	26.94	46.00	19.06	PK+	V
4	392.780	50.23	-9.9	40.33	46.00	5.67	PK+	V
5	541.190	41.46	-6.72	34.74	46.00	11.26	PK+	V
6	649.830	38.39	-4.37	34.02	46.00	11.98	PK+	V

Remark:
Emission Level = Reading + Factor;
Factor = Antenna Factor + Cable Loss – Pre-amplifier;
Margin= Limit - Emission Level .

Radiated Emission Test Data (Above 1GHz): Worst Case Configuration							
Environmental Conditions	24.6℃, 53.4% RH		Test Engineer		Jacey Fu		
Ant1 IEEE 802.11a_Channel 36							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
10360	33.65	3.98	37.63	54	-16.37	AVG	H
10360	51.14	3.98	55.12	68.2	-13.08	PEAK	H
15540	36.17	8.26	44.43	54	-9.57	AVG	H
15540	48.68	8.26	56.94	74	-17.06	PEAK	H
10360	39.47	2.70	42.17	54	-11.83	AVG	V
10360	52.36	2.70	55.06	68.2	-13.14	PEAK	V
15540	32.14	7.37	39.51	54	-14.49	AVG	V
15540	40.67	7.37	48.04	74	-25.96	PEAK	V
Ant1 IEEE 802.11a_Channel 40							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
10440	37.02	2.50	39.52	54	-14.48	AVG	H
10440	49.33	2.50	51.83	68.2	-16.37	PEAK	H
15660	35.67	7.27	42.94	54	-11.06	AVG	H
15660	40.20	7.27	47.47	74	-26.53	PEAK	H
10440	36.63	3.16	39.79	54	-14.21	AVG	V
10440	54.32	3.16	57.48	68.2	-10.72	PEAK	V
15660	30.24	8.09	38.33	54	-15.67	AVG	V
15660	49.32	8.09	57.41	74	-16.59	PEAK	V
Ant1 IEEE 802.11a_Channel 48							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
10480	30.25	2.57	32.82	54	-21.18	AVG	H
10480	49.27	2.57	51.84	68.2	-16.36	PEAK	H
15720	34.86	7.74	42.60	54	-11.4	AVG	H
15720	43.62	7.74	51.36	74	-22.64	PEAK	H
10480	40.54	2.78	43.32	54	-10.68	AVG	V
10480	48.50	2.78	51.28	68.2	-16.92	PEAK	V
15720	34.18	7.22	41.40	54	-12.6	AVG	V
15720	48.94	7.22	56.16	74	-17.84	PEAK	V
Ant1 IEEE 802.11a_Channel 149							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
11490	33.63	1.22	34.85	54	-19.15	AVG	H
11490	42.49	1.22	43.71	74	-30.29	PEAK	H
17235	32.79	8.01	40.80	54	-13.2	AVG	H
17235	43.93	8.01	51.94	68.2	-16.26	PEAK	H
11490	31.87	1.44	33.31	54	-20.69	AVG	V
11490	49.48	1.44	50.92	74	-23.08	PEAK	V
17235	33.44	9.93	43.37	54	-10.63	AVG	V
17235	44.85	9.93	54.78	68.2	-13.42	PEAK	V
Ant1 IEEE 802.11a_Channel 157							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
11570	32.40	2.40	34.80	54	-19.2	AVG	H
11570	43.35	2.40	45.75	74	-28.25	PEAK	H
17355	32.71	8.55	41.26	54	-12.74	AVG	H
17355	42.91	8.55	51.46	68.2	-16.74	PEAK	H
11570	29.49	1.15	30.64	54	-23.36	AVG	V
11570	41.56	1.15	42.71	74	-31.29	PEAK	V
17355	33.39	9.47	42.86	54	-11.14	AVG	V
17355	38.92	9.47	48.39	68.2	-19.81	PEAK	V
Ant1 IEEE 802.11a_Channel 165							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)

11650	34.44	1.64	36.08	54	-17.92	AVG	H
11650	49.48	1.64	51.12	74	-22.88	PEAK	H
17475	29.30	8.41	37.71	54	-16.29	AVG	H
17475	42.30	8.41	50.71	68.2	-17.49	PEAK	H
11650	28.18	2.48	30.66	54	-23.34	AVG	V
11650	49.33	2.48	51.81	74	-22.19	PEAK	V
17475	26.58	9.78	36.36	54	-17.64	AVG	V
17475	45.93	9.78	55.71	68.2	-12.49	PEAK	V
Ant1 IEEE 802.11n(HT20)_Channel 36							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
10360	36.14	3.88	40.02	54	-13.98	AVG	H
10360	52.58	3.88	56.46	68.2	-11.74	PEAK	H
15540	34.98	8.47	43.45	54	-10.55	AVG	H
15540	47.04	8.47	55.51	74	-18.49	PEAK	H
10360	30.34	2.72	33.06	54	-20.94	AVG	V
10360	48.59	2.72	51.31	68.2	-16.89	PEAK	V
15540	27.13	8.05	35.18	54	-18.82	AVG	V
15540	46.34	8.05	54.39	74	-19.61	PEAK	V
Ant1 IEEE 802.11n(HT20)_Channel 40							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
10440	37.40	3.20	40.60	54	-13.4	AVG	H
10440	42.91	3.20	46.11	68.2	-22.09	PEAK	H
15660	28.21	7.87	36.08	54	-17.92	AVG	H
15660	42.55	7.87	50.42	74	-23.58	PEAK	H
10440	32.86	4.26	37.12	54	-16.88	AVG	V
10440	42.93	4.26	47.19	68.2	-21.01	PEAK	V
15660	27.99	7.42	35.41	54	-18.59	AVG	V
15660	40.44	7.42	47.86	74	-26.14	PEAK	V
Ant1 IEEE 802.11n(HT20)_Channel 48							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
10480	32.59	3.58	36.17	54	-17.83	AVG	H
10480	46.10	3.58	49.68	68.2	-18.52	PEAK	H
15720	31.76	7.54	39.30	54	-14.7	AVG	H
15720	46.08	7.54	53.62	74	-20.38	PEAK	H
10480	35.71	2.52	38.23	54	-15.77	AVG	V
10480	41.73	2.52	44.25	68.2	-23.95	PEAK	V
15720	33.51	7.47	40.98	54	-13.02	AVG	V
15720	45.60	7.47	53.07	74	-20.93	PEAK	V
Ant1 IEEE 802.11n(HT20)_Channel 149							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
11490	31.91	2.08	33.99	54	-20.01	AVG	H
11490	40.11	2.08	42.19	74	-31.81	PEAK	H
17235	32.02	8.60	40.62	54	-13.38	AVG	H
17235	42.83	8.60	51.43	68.2	-16.77	PEAK	H
11490	27.48	1.51	28.99	54	-25.01	AVG	V
11490	43.69	1.51	45.20	74	-28.8	PEAK	V
17235	25.48	9.98	35.46	54	-18.54	AVG	V
17235	44.65	9.98	54.63	68.2	-13.57	PEAK	V
Ant1 IEEE 802.11n(HT20)_Channel 157							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
11570	33.00	2.13	35.13	54	-18.87	AVG	H
11570	44.16	2.13	46.29	74	-27.71	PEAK	H
17355	26.94	9.09	36.03	54	-17.97	AVG	H
17355	45.35	9.09	54.44	68.2	-13.76	PEAK	H
11570	35.58	2.18	37.76	54	-16.24	AVG	V
11570	41.08	2.18	43.26	74	-30.74	PEAK	V

17355	26.71	9.33	36.04	54	-17.96	AVG	V
17355	44.96	9.33	54.29	68.2	-13.91	PEAK	V
Ant1 IEEE 802.11n(HT20)_Channel 165							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
11650	33.49	2.34	35.83	54	-18.17	AVG	H
11650	46.80	2.34	49.14	74	-24.86	PEAK	H
17475	28.27	8.94	37.21	54	-16.79	AVG	H
17475	42.44	8.94	51.38	68.2	-16.82	PEAK	H
11650	28.57	1.89	30.46	54	-23.54	AVG	V
11650	49.39	1.89	51.28	74	-22.72	PEAK	V
17475	32.78	9.56	42.34	54	-11.66	AVG	V
17475	37.17	9.56	46.73	68.2	-21.47	PEAK	V
Ant1 IEEE 802.11n(HT40)_Channel 38							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
10380	30.86	4.36	35.22	54	-18.78	AVG	H
10380	42.22	4.36	46.58	68.2	-21.62	PEAK	H
15570	28.17	7.15	35.32	54	-18.68	AVG	H
15570	47.15	7.15	54.30	74	-19.7	PEAK	H
10380	35.21	2.59	37.80	54	-16.2	AVG	V
10380	42.53	2.59	45.12	68.2	-23.08	PEAK	V
15570	35.51	7.01	42.52	54	-11.48	AVG	V
15570	39.69	7.01	46.70	74	-27.3	PEAK	V
Ant1 IEEE 802.11n(HT40)_Channel 46							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
10460	29.54	4.10	33.64	54	-20.36	AVG	H
10460	49.34	4.10	53.44	68.2	-14.76	PEAK	H
15690	34.98	8.38	43.36	54	-10.64	AVG	H
15690	45.65	8.38	54.03	74	-19.97	PEAK	H
10460	33.26	3.49	36.75	54	-17.25	AVG	V
10460	51.45	3.49	54.94	68.2	-13.26	PEAK	V
15690	29.91	8.00	37.91	54	-16.09	AVG	V
15690	47.78	8.00	55.78	74	-18.22	PEAK	V
Ant1 IEEE 802.11n(HT40)_Channel 151							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
11510	36.45	1.46	37.91	54	-16.09	AVG	H
11510	41.99	1.46	43.45	74	-30.55	PEAK	H
17265	30.76	8.89	39.65	54	-14.35	AVG	H
17265	37.88	8.89	46.77	68.2	-21.43	PEAK	H
11510	36.35	2.80	39.15	54	-14.85	AVG	V
11510	41.25	2.80	44.05	74	-29.95	PEAK	V
17265	26.89	9.07	35.96	54	-18.04	AVG	V
17265	41.00	9.07	50.07	68.2	-18.13	PEAK	V
Ant1 IEEE 802.11n(HT40)_Channel 159							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
11590	32.33	1.87	34.20	54	-19.8	AVG	H
11590	44.44	1.87	46.31	74	-27.69	PEAK	H
17385	32.20	9.45	41.65	54	-12.35	AVG	H
17385	46.00	9.45	55.45	68.2	-12.75	PEAK	H
11590	27.32	1.92	29.24	54	-24.76	AVG	V
11590	44.90	1.92	46.82	74	-27.18	PEAK	V
17385	25.75	8.28	34.03	54	-19.97	AVG	V
17385	44.76	8.28	53.04	68.2	-15.16	PEAK	V
Ant1 IEEE 802.11ac(VHT80)_Channel 42							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
10420	34.13	2.72	36.85	54	-17.15	AVG	H
10420	46.62	2.72	49.34	68.2	-18.86	PEAK	H

15630	31.61	6.67	38.28	54	-15.72	AVG	H
15630	47.62	6.67	54.29	74	-19.71	PEAK	H
10420	36.17	3.25	39.42	54	-14.58	AVG	V
10420	49.32	3.25	52.57	68.2	-15.63	PEAK	V
15630	27.21	7.51	34.72	54	-19.28	AVG	V
15630	39.80	7.51	47.31	74	-26.69	PEAK	V
Ant1 IEEE 802.11ac(VHT80)_Channel 155							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
11550	27.64	1.21	28.85	54	-25.15	AVG	H
11550	41.73	1.21	42.94	74	-31.06	PEAK	H
17325	33.79	9.43	43.22	54	-10.78	AVG	H
17325	40.79	9.43	50.22	68.2	-17.98	PEAK	H
11550	33.13	2.02	35.15	54	-18.85	AVG	V
11550	39.17	2.02	41.19	74	-32.81	PEAK	V
17325	32.48	9.18	41.66	54	-12.34	AVG	V
17325	39.71	9.18	48.89	68.2	-19.31	PEAK	V

Remark:

Emission Level = Reading + Factor;

Factor = Antenna Factor + Cable Loss – Pre-amplifier;

Margin= Emission Level - Limit.

Note1:Antenna one and antenna two were tested. Among them, the data of antenna one was the worst, so the report recorded the data of antenna one.

Note 2: Testing is carried out with frequency rang 9kHz to the tenth harmonics. The measurements greater than 20dB below the limit from 9kHz to 30MHz.

Note 3: Other emissions are attenuated 20dB below the limits from 9kHz to 30MHz, so it does not recorded report, above 18GHz not recorded for no spurious point have a margin ofless than 6 dB with respect to the limits.

Spurious Emission in Restricted Band 4.50GHz~5.15GHz& 5.35GHz~5.46GHz) Radiated Band Edges Test Data: Worst-Case Configuration							
Environmental Conditions	24.6℃, 53.4% RH			Test Engineer		Jacey Fu	
U-NII Band1_IEEE 802.11ac(HT80)_Channel 42(5210MHz)							
Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector (PEAK/AVG)	Polar (H/V)
4500	57.68	-4.31	53.37	74	-20.63	PEAK	H
4500	45.51	-3.45	42.06	54	-11.94	AVG	H
4500	62.01	-3.27	58.74	74	-15.26	PEAK	H
4500	51.79	-2.67	49.12	54	-4.88	AVG	H
5150	67.62	-2.24	65.38	74	-8.62	PEAK	V
5150	53.24	-3.99	49.25	54	-4.75	AVG	V
5150	57.97	-2.33	55.64	74	-18.36	PEAK	V
5150	45.95	-3.06	42.89	54	-11.11	AVG	V
5350	62.74	-3.61	59.13	74	-14.87	PEAK	V
5350	42.79	-2.77	40.02	54	-13.98	AVG	V
5350	64.15	-3.79	60.36	74	-13.64	PEAK	V
5350	44.28	-3.42	40.86	54	-13.14	AVG	V

Remark:

(1) Emission Level = Reading + Factor;

Factor = Antenna Factor + Cable Loss – Pre-amplifier;

Margin= Emission Level - Limit.

(2) “IEEE 802.11ac(VHT80)” mode is the worst mode. When PK value is lower than the Average value limit, average don't record.

(3) ANT1 and ANT2 were tested. Among them, the data of antenna one was the worst, so the report recorded the data of antenna one.

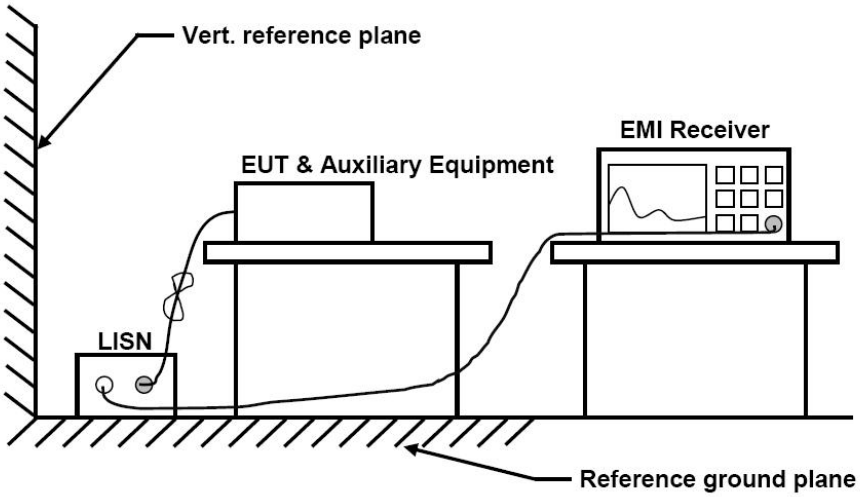
12. POWER LINE CONDUCTED EMISSIONS

12.1. LIMIT

According to the rule FCC Part 15.207, Conducted emissions limit, the limit for a wireless device as below:

Frequency Range (MHz)	Conducted emissions (dBuV)	
	Quasi-peak	Average
0.15~0.5	66 to 56	56 to 46
0.5~5	56	46
5~30	60	50
Remark: a) The lower limit shall apply at the transition frequencies. b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50MHz.		

12.2. TEST SETUP



12.3. TEST PROCEDURE

Test frequency range :150KHz-30MHz

a) The mains terminal disturbance voltage test was conducted in a shielded room.

b) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

c) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

d) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

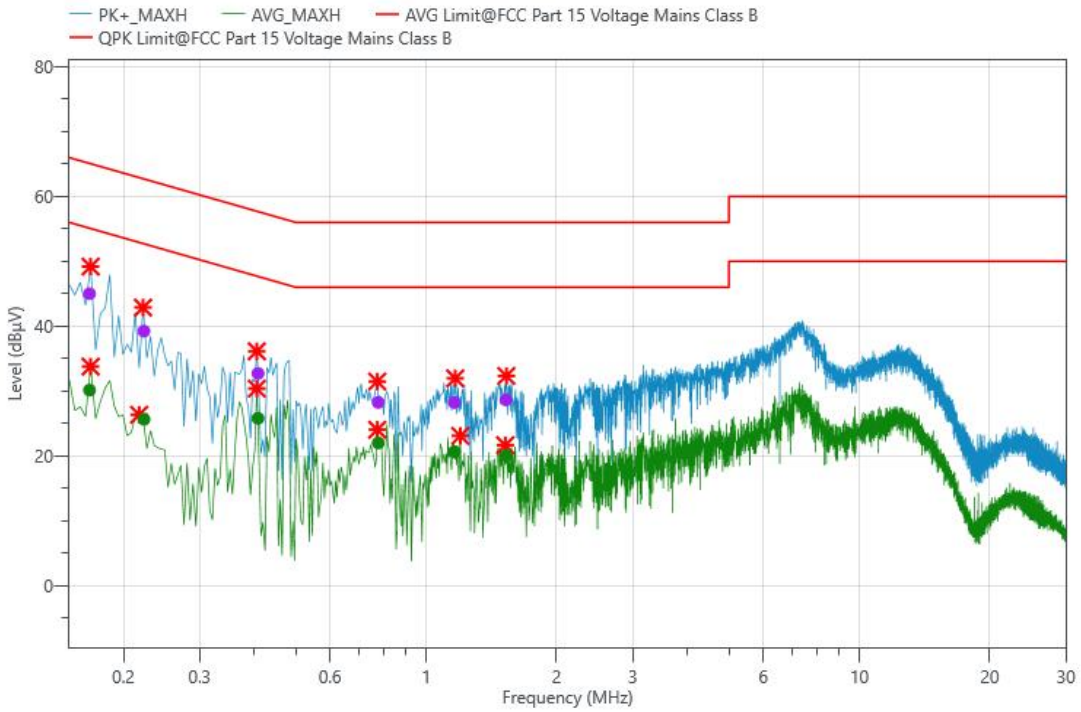
e) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

12.4. TEST RESULT

Pass.

Remark:
a) AC Power line conducted emissions pre-test both at AC 120V/60Hz and AC 240V/50Hz modes, recorded worst case.
b) Worst-case mode and channel used for 150KHz~30MHz power line conducted emissions was determined to be ANT1 IEEE 802.11a_Channel 36.

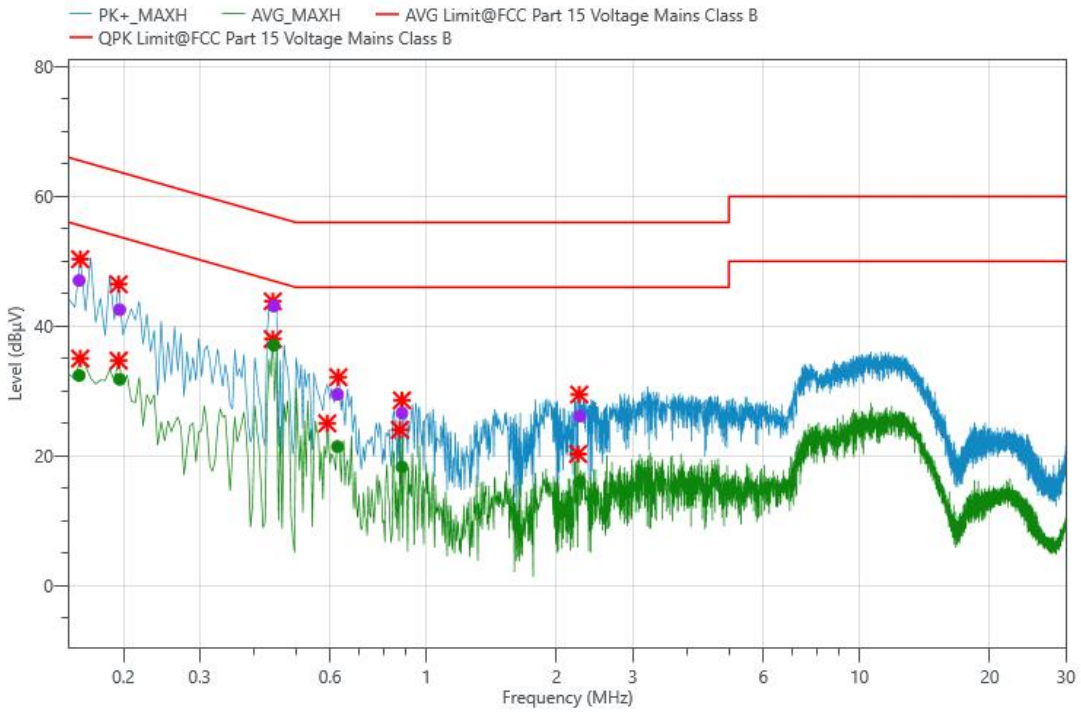
Test Plots and Data of Conducted Emissions (Worst Case: IEEE 802.11a_Channel 36)			
Environmental Conditions	24.6℃, 53.4% RH	Test Engineer	Jacey Fu
Test Voltage:	AC 120V/60Hz	Test Power Line:	Live



No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV)	Limit (dBµV)	Margin (dB)	Det.	Line	PE
1	0.167	35.02	9.99	45.01	65.11	20.10	QPK	L1	GND
2	0.167	20.16	9.99	30.15	55.11	24.96	AVG	L1	GND
3	0.223	29.25	9.99	39.24	62.71	23.47	QPK	L1	GND
4	0.223	15.66	9.99	25.65	52.71	27.06	AVG	L1	GND
5	0.409	22.74	9.99	32.73	57.67	24.94	QPK	L1	GND
6	0.409	15.81	9.99	25.80	47.67	21.87	AVG	L1	GND
7	0.775	18.26	10	28.26	56.00	27.74	QPK	L1	GND
8	0.775	12.01	10	22.01	46.00	23.99	AVG	L1	GND
9	1.161	18.23	10.01	28.24	56.00	27.76	QPK	L1	GND
10	1.161	10.64	10.01	20.65	46.00	25.35	AVG	L1	GND
11	1.528	18.63	10.02	28.65	56.00	27.35	QPK	L1	GND
12	1.528	10.08	10.02	20.10	46.00	25.90	AVG	L1	GND

Remark:
Emission Level = Reading + Correct Factor;
Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Attenuation Factor
Margin= Limit - Emission Level.

Test Plots and Data of Conducted Emissions (Worst Case: IEEE 802.11a_Channel 36)			
Environmental Conditions	24.6℃, 53.4% RH	Test Engineer	Jacey Fu
Test Voltage:	AC 120V/60Hz	Test Power Line:	Neutral



No.	Freq. (MHz)	Reading (dBµV)	Corr. (dB)	Meas. (dBµV)	Limit (dBµV)	Margin (dB)	Det.	Line	PE
1	0.158	37.06	9.99	47.05	65.57	18.52	QPK	N	GND
2	0.158	22.42	9.99	32.41	55.57	23.16	AVG	N	GND
3	0.196	32.56	9.99	42.55	63.78	21.23	QPK	N	GND
4	0.196	21.82	9.99	31.81	53.78	21.97	AVG	N	GND
5	0.445	33.12	9.99	43.11	56.97	13.86	QPK	N	GND
6	0.445	27.08	9.99	37.07	46.97	9.90	AVG	N	GND
7	0.624	19.49	10	29.49	56.00	26.51	QPK	N	GND
8	0.624	11.44	10	21.44	46.00	24.56	AVG	N	GND
9	0.879	16.60	10	26.60	56.00	29.40	QPK	N	GND
10	0.879	8.31	10	18.31	46.00	27.69	AVG	N	GND
11	2.263	16.10	10.03	26.13	56.00	29.87	QPK	N	GND
12	2.263	6.01	10.03	16.04	46.00	29.96	AVG	N	GND

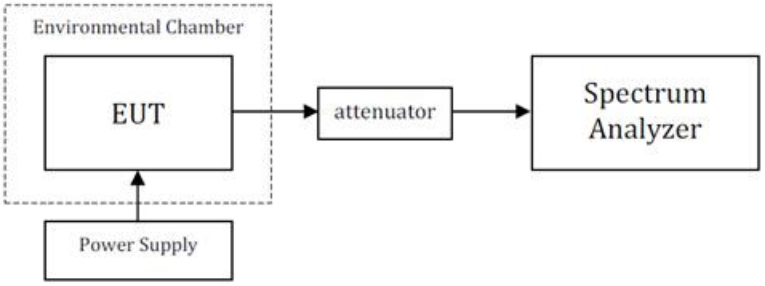
Remark:
Emission Level = Reading + Correct Factor;
Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Attenuation Factor
Margin= Limit - Emission Level.

13. FREQUENCY STABILITY

13.1. LIMIT

According to FCC 47 CFR Part 15 Subpart C Section 15.407(g), Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

13.2. TEST SETUP



13.3. TEST PROCEDURE

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Test is conducting under the description of ANSI C63.10-2013 section 6.8.

The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value. Extreme temperature is -20°C~70°C.

13.4. TEST RESULT

Pass.

Please refer to the Appendix H 5G WiFi ANT1 RF Conducted Test Data.

Please refer to the Appendix I 5G WiFi ANT2 RF Conducted Test Data.

15. PHOTOGRAPHS OF TEST SETUP

Please refer to separated files for Test Setup Photos of the EUT.

16. EXTERNAL PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

17. INTERNAL PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

**********THE END**********