TEST REPORT

Applicant:	Shantou Shangheng Toy Technology Co., Ltd
Address of Applicant:	6th Floor, No. 2, Lane 2, Garden Road, Neilong Industrial Zone, Waisha Town, Longhu District, Shantou City, Guangdong Province, China
Manufacturer:	Shantou Shangheng Toy Technology Co., Ltd
Address of Manufacturer:	6th Floor, No. 2, Lane 2, Garden Road, Neilong Industrial Zone, Waisha Town, Longhu District, Shantou City, Guangdong Province, China
Equipment Under Test (EUT)	
Product Name:	Four axis aircraft
Model No.:	See section 5.1
FCC ID:	2BDDG-AE86PROMAX
Applicable standards:	FCC CFR Title 47 Part 15 Subpart E Section 15.407
Date of sample receipt:	October 10, 2023
Date of Test:	October 11-27, 2023
Date of report issue:	October 27, 2023
Test Result :	PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Robinson Luo
Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	*October 27, 2023*	*Original*

Prepared By: ***Date:*** *October 27, 2023*

Project Engineer

Check By: ***Date:*** *October 27, 2023*

Reviewer

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4 Test Summary

Test Item	Section	Result
Antenna requirement	FCC part 15.203	PASS
AC Power Line Conducted Emission	FCC part 15.207	PASS
Emission Bandwidth	FCC part 15.407	PASS
Maximum Conducted Output Power	FCC part 15.407(a)(1)(2)	PASS
Power Spectral Density	FCC part 15.407(a)(1)(2)	PASS
Undesirable Emission	FCC part 15.407(b), 15.205/15.209	PASS
Radiated Emission	FCC part 15.205/15.209	PASS
Band Edge	FCC part 15.407(b)(1)(2)(3)	PASS
Frequency Stability	FCC part 15.407(g)	PASS

Remark:

Pass: The EUT complies with the essential requirements in the standard.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz-30MHz	3.1dB	(1)
Radiated Emission	30MHz-200MHz	3.8039dB	(1)
Radiated Emission	200MHz-1GHz	3.9679dB	(1)
Radiated Emission	1GHz-18GHz	4.29dB	(1)
Radiated Emission	18GHz-40GHz	3.30dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	3.44dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

5 General Information

5.1 General Description of EUT

Product Name:	Four axis aircraft
Model No.:	AE86 Pro Max, A10 Max, A20 Max, A30 Max, A60 Max, AE3 Pro Max, AE8 Pro Max, AE8 EVO, AE86 Pro Max, AE4 Pro, AE5 Pro, AE6 Pro, AE7 Pro, AE1, AE2, AE3, AE9, AE10 mini, AE11, AE12, AE13, AE14, AE15, A40, A50, A70, A80, A90, A380, AE16, AE17, AE18, AE19, AE01, AE02, AE03, AE04, AE05, AE06, AE07, AE08, AE09, AE10, AE20, AE30, AE40, AE50, AE60, AE70, AE80, AE90, AE11, AE21, AE31, AE41, AE51, AE61, AE71, AE81, AE91, AE101, AE102, AE103, AE104, AE105, AE106, AE22, AE33, AE44, AE55, AE66, AE77, AE88, AE99, YK1, YK2, YK3, YK5, YK6, YK8, YK9, YK10, YK18, YK20, K6 Max, K9, K10, GX, G5, S150, S151, S155, S138, P8, P10, P11, P14, P15, P20, S802, S806, S808, E58, E68, E88, E99, L1, L2, G6, G7, H203, H303, P9, YP1
Test Model No:	AE86 Pro Max
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are appearance color and model name for commercial purpose.	
Test sample(s) ID:	GTS2023100034-1
Sample(s) Status:	Engineer sample
S/N:	N/A
Operation Frequency:	

Band	Mode	Frequency Range(MHz)	Number of channels
U-NII Band I	IEEE 802.11a	5180-5240	4
	IEEE 802.11n/ac 20MHz	5180-5240	4

Modulation technology:	OFDM
Antenna Type:	Integral Antenna
Antenna gain:	ANT 1: 2.4dBi ANT 2: 2.4dBi
Power supply:	TX: DC 3.7V, 18650/1500mAh for Li-ion battery The battery is charged via USB DC5V

Remark:
1. Antenna gain information provided by the customer
2. The relevant information of the sample is provided by the entrusting company, and the laboratory is not responsible for its authenticity.

Channel list for 802.11a/n/ac(HT20)							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180MHz	40	5200MHz	44	5220MHz	48	5240MHz

5.2 Test mode

Transmitting mode	Keep the EUT in transmitting with modulation..

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Pre-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

Mode	Data rate
802.11a/n/ac(HT20)	6/6.5 Mbps

5.3 Test Facility

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

● **FCC —Registration No.: 381383**

Designation Number: CN5029

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files.

● **ISED—Registration No.: 9079A**

CAB identifier: CN0091

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of ISED for radio equipment testing .

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

5.4 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.
Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102
Tel: 0755-27798480
Fax: 0755-27798960

5.5 Description of Support Units

None.

5.6 Deviation from Standards

None.

5.7 Additional Instructions

Test Software	Special test software provided by manufacturer
Power level setup	Default

6 Test Instruments list

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	June 23, 2021	June 22, 2024
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	April 14, 2023	April 13, 2024
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9168	GTS640	March 19, 2023	March 18, 2025
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	April 17, 2023	April 16, 2025
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	April 14, 2023	April 13, 2024
8	Loop Antenna	ZHINAN	ZN30900A	GTS534	Nov. 29, 2022	Nov. 28, 2023
9	Broadband Preamplifier	SCHWARZBECK	BBV9718	GTS535	April 14, 2023	April 13, 2024
10	Amplifier(1GHz-26.5GHz)	HP	8449B	GTS601	April 14, 2023	April 13, 2024
11	Horn Antenna (18-26.5GHz)	/	UG-598A/U	GTS664	Oct. 30, 2022	Oct. 29, 2023
12	Horn Antenna (26.5-40GHz)	A.H Systems	SAS-573	GTS665	Oct. 30, 2022	Oct. 29, 2023
13	FSV·Signal Analyzer (10Hz-40GHz)	Keysight	FSV-40-N	GTS666	March 13, 2023	March 12, 2024
14	Amplifier	/	LNA-1000-30S	GTS650	April 14, 2023	April 13, 2024
15	CDNE M2+M3-16A	HCT	30MHz-300MHz	GTS668	Dec. 20, 2022	Dec.19, 2023
16	Wideband Amplifier	/	WDA-01004000-15P35	GTS602	April 14, 2023	April 13, 2024
17	Thermo meter	JINCHUANG	GSP-8A	GTS643	April 19, 2023	April 18, 2024
18	RE cable 1	GTS	N/A	GTS675	July 31. 2023	July 30. 2024
19	RE cable 2	GTS	N/A	GTS676	July 31. 2023	July 30. 2024
20	RE cable 3	GTS	N/A	GTS677	July 31. 2023	July 30. 2024
21	RE cable 4	GTS	N/A	GTS678	July 31. 2023	July 30. 2024
22	RE cable 5	GTS	N/A	GTS679	July 31. 2023	July 30. 2024
23	RE cable 6	GTS	N/A	GTS680	July 31. 2023	July 30. 2024
24	RE cable 7	GTS	N/A	GTS681	July 31. 2023	July 30. 2024
25	RE cable 8	GTS	N/A	GTS682	July 31. 2023	July 30. 2024

Conducted Emission						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	July 12, 2022	July 11, 2027
2	EMI Test Receiver	R&S	ESCI 7	GTS552	April 14, 2023	April 13, 2024
3	LISN	ROHDE & SCHWARZ	ENV216	GTS226	April 14, 2023	April 13, 2024
4	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
5	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
6	Thermo meter	JINCHUANG	GSP-8A	GTS642	April 19, 2023	April 18, 2024
7	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	April 14, 2023	April 13, 2024
8	ISN	SCHWARZBECK	NTFM 8158	GTS565	April 14, 2023	April 13, 2024
9	High voltage probe	SCHWARZBECK	TK9420	GTS537	April 14, 2023	April 13, 2024
10	Antenna end assembly	Weinschel	1870A	GTS560	April 14, 2023	April 13, 2024

RF Conducted Test:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	April 14, 2023	April 13, 2024
2	EMI Test Receiver	R&S	ESCI 7	GTS552	April 14, 2023	April 13, 2024
3	PSA Series Spectrum Analyzer	Agilent	E4440A	GTS536	April 14, 2023	April 13, 2024
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	April 14, 2023	April 13, 2024
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	April 14, 2023	April 13, 2024
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	April 14, 2023	April 13, 2024
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	April 14, 2023	April 13, 2024
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	April 14, 2023	April 13, 2024
9	Thermo meter	JINCHUANG	GSP-8A	GTS641	April 19, 2023	April 18, 2024
10	EXA Signal Analyzer	Keysight	N9010B	MY60241168	Nov. 04, 2022	Nov. 03, 2023

General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Barometer	KUMAO	SF132	GTS647	April 19, 2023	April 18, 2024

7 Test results and Measurement Data

7.1 Antenna requirement:

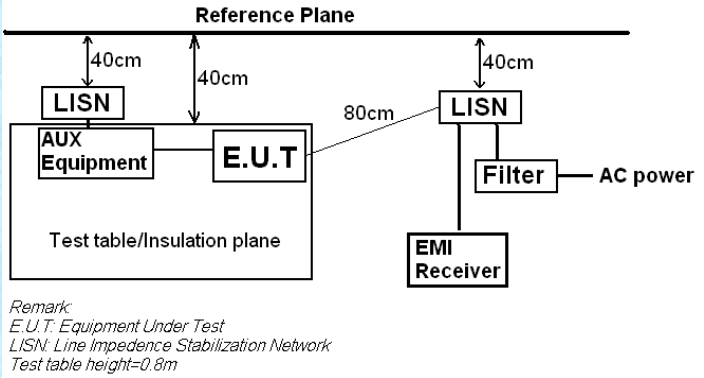
Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling 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.	
E.U.T Antenna:	
The antenna is integral antenna, reference to the appendix II for details	

7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10:2013
Test Frequency Range:	150KHz to 30MHz
Receiver setup:	RBW=9KHz, VBW=30KHz
Limit:	

Frequency range (MHz)	Limit (dBuV)	
	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.

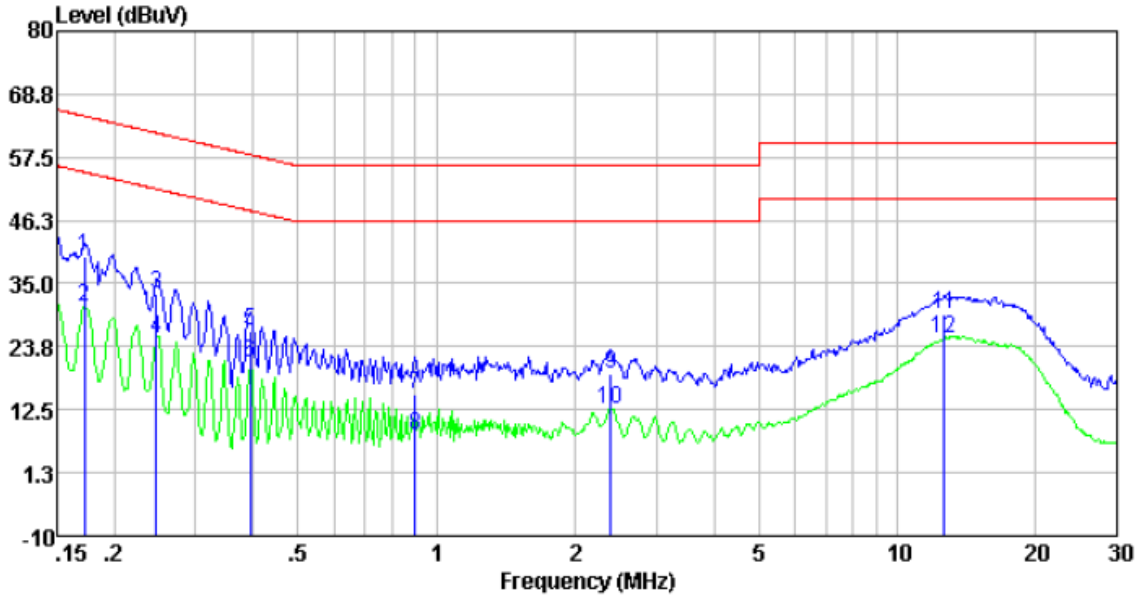
Test procedure	The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). The provide a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.
Test setup:	

Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar
Test voltage:	AC 120V, 60Hz					
Test results:	Pass					

Measurement data:

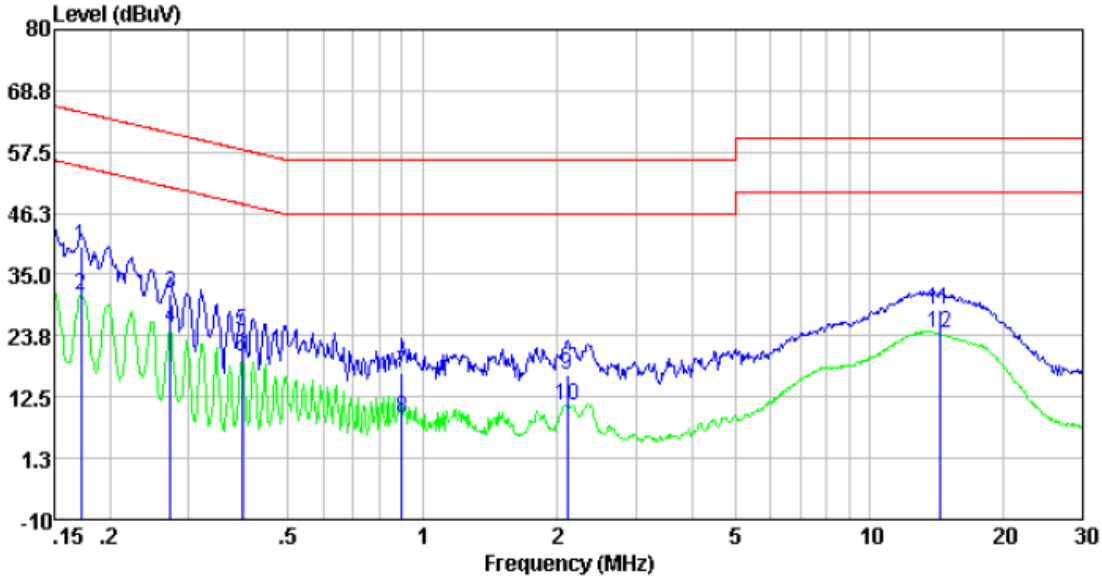
Pre-scan all test modes, found worst case at 802.11ac(VHT20) 5180MHz@Ant 1, and so only show the test result of it.

Line:



Freq	Reading level	LISN/ISN factor	Cable loss	Level	Limit level	Over limit	Remark
MHz	dBuV	dB	dB	dBuV	dBuV	dB	
0.17	30.29	9.54	0.01	39.84	64.86	-25.02	QP
0.17	21.19	9.54	0.01	30.74	54.86	-24.12	Average
0.25	23.52	9.50	0.01	33.03	61.86	-28.83	QP
0.25	15.78	9.50	0.01	25.29	51.86	-26.57	Average
0.39	17.11	9.49	0.01	26.61	57.99	-31.38	QP
0.39	11.41	9.49	0.01	20.91	47.99	-27.08	Average
0.90	5.66	9.49	0.03	15.18	56.00	-40.82	QP
0.90	-1.51	9.49	0.03	8.01	46.00	-37.99	Average
2.38	9.25	9.58	0.05	18.88	56.00	-37.12	QP
2.38	3.11	9.58	0.05	12.74	46.00	-33.26	Average
12.65	19.93	9.46	0.14	29.53	60.00	-30.47	QP
12.65	15.58	9.46	0.14	25.18	50.00	-24.82	Average

Neutral:

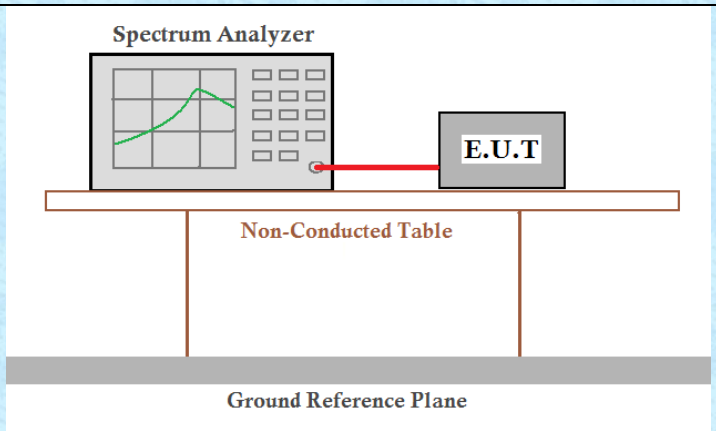


Freq	Reading level	LISN/ISN factor	Cable loss	Level	Limit level	Over limit	Remark
MHz	dBuV	dB	dB	dBuV	dBuV	dB	
0.17	30.56	9.55	0.01	40.12	64.86	-24.74	QP
0.17	21.46	9.55	0.01	31.02	54.86	-23.84	Average
0.27	21.98	9.56	0.01	31.55	61.03	-29.48	QP
0.27	15.64	9.56	0.01	25.21	51.03	-25.82	Average
0.39	14.92	9.57	0.01	24.50	57.99	-33.49	QP
0.39	10.40	9.57	0.01	19.98	47.99	-28.01	Average
0.90	7.17	9.55	0.03	16.75	56.00	-39.25	QP
0.90	-1.06	9.55	0.03	8.52	46.00	-37.48	Average
2.11	7.02	9.55	0.05	16.62	56.00	-39.38	QP
2.11	1.31	9.55	0.05	10.91	46.00	-35.09	Average
14.36	18.61	9.65	0.15	28.41	60.00	-31.59	QP
14.36	14.24	9.65	0.15	24.04	50.00	-25.96	Average

Notes:

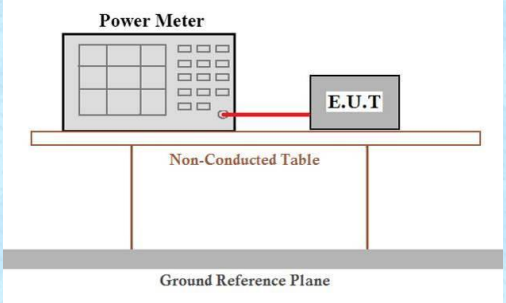
1. *An initial pre-scan was performed on the line and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Cable Loss*

7.3 Emission Bandwidth

Test Requirement :	FCC Part15 E Section 15.407
Test Method :	ANSI C63.10:2013 & KDB 789033 D02 v02r01
Limit:	N/A
Test setup:	
Test procedure:	According to KDB 789033 D02 General U-NII Test Procedures New Rules v02r01.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

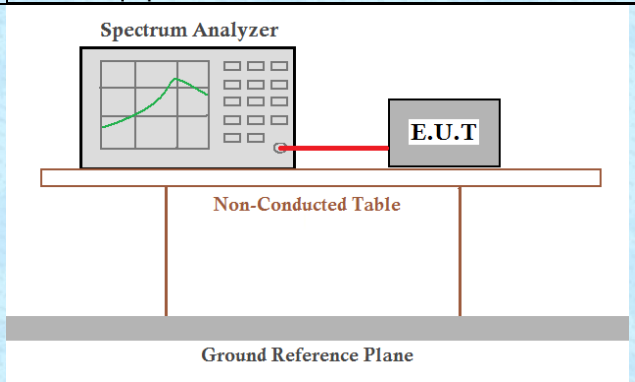
Measurement Data: The detailed test data see Appendix.

7.4 Maximum Conducted Output Power

Test Requirement	FCC Part15 E Section 15.407
Test Method :	ANSI C63.10:2013 & KDB 789033 D02 v02r01
Limit:	<table><tr><th>Frequency band (MHz)</th><th>Limit</th></tr><tr><td rowspan="2">5150-5250</td><td>≤1W(30dBm) for master device</td></tr><tr><td>≤250Mw(23.98dBm) for client device</td></tr><tr><td>5250-5350</td><td>≤250Mw(23.98dBm) for client device or 11dBm+10logB*</td></tr><tr><td>5470-5725</td><td>≤250Mw(23.98dBm) for client device or 11dBm+10logB*</td></tr><tr><td colspan="2">Remark: *Where B is the 26Db emission bandwidth in MHz. The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.</td></tr></table>
Test setup:	
Duty Cycle set up:	RBW=VBW=8MHz
Test procedure:	**Measurement using an RF average power meter** (i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied a) The EUT is configured to transmit continuously or to transmit with a constant duty cycle. b) At all times when the EUT is transmitting, it must be transmitting at its maximum power control level. c) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five. (ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section B). (iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter. (iv) Adjust the measurement in dBm by adding 10 log(1/x) where x is the duty cycle (e.g., 10log(1/0.25) if the duty cycle is 25 percent).
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data: The detailed test data see Appendix.

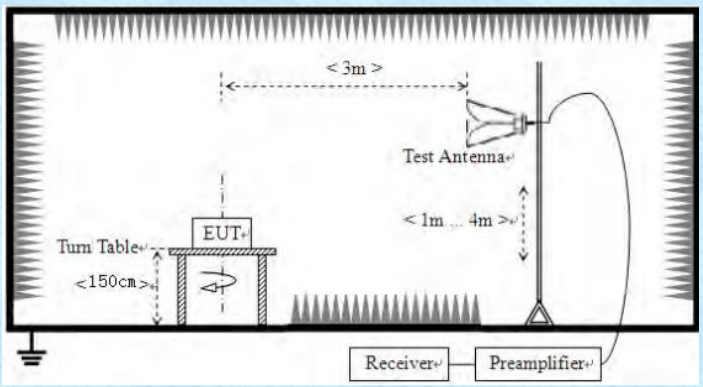
7.5 Power Spectral Density

Test Requirement:	FCC Part15 E Section 15.407
Test Method :	ANSI C63.10:2013 & KDB 789033 D02 v02r01
Limit:	<table><tr><th>Frequency band (MHz)</th><th>Limit</th></tr><tr><td rowspan="2">5150-5250</td><td>≤17dBm in 1MHz for master device</td></tr><tr><td>≤11dBm in 1MHz for client device</td></tr><tr><td>5250-5350</td><td>≤11dBm in 1MHz for client device</td></tr><tr><td>5470-5725</td><td>≤11dBm in 1MHz for client device</td></tr><tr><td colspan="2">Remark: The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test.</td></tr></table>
Test setup:	
Test procedure:	1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section E)2) for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power…”. 2) Use the peak search function on the instrument to find the peak of the spectrum. 3) Make the following adjustments to the peak value of the spectrum, if applicable: a) If Method SA-2 or SA-2 Alternative was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum. b) If Method SA-3 Alternative was used and the linear mode was used in step E)2)g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging. 4) The result is the PSD.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data: The detailed test data see Appendix.

7.6 Band Edge

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 E Section 15.407 and 5.205</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m (Semi-Anechoic Chamber)</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>AV</td><td>1MHz</td><td>3MHz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td>30MHz-88MHz</td><td>40.0</td><td>Quasi-peak Value</td></tr>
<tr><td>88MHz-216MHz</td><td>43.5</td><td>Quasi-peak Value</td></tr>
<tr><td>216MHz-960MHz</td><td>46.0</td><td>Quasi-peak Value</td></tr>
<tr><td>960MHz-1GHz</td><td>54.0</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>54.0</td><td>Average Value</td></tr>
<tr><td>68.2</td><td>Peak Value</td></tr>
</table>
Undesirable emission limits:
(1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.
(2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.
(3) For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.
</td></tr>
<tr><td>Test Procedure:</td><td>
a. The EUT was placed on the top of a rotating table 1.5 m above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data
</td></tr>
</table>

	sheet.
Test setup:	For radiated emissions above 1GHz 
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Remarks:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.*
4. *All antennas were tested and passed, only ant 1 report.*
5. *According to KDB 789033 D02 v02r01 section G) 1) (d), for For measurements above 1000 MHz @ 3m distance, the limit of field strength is computed as follows:*
   E[dBuV/m] = EIRP[dBm] + 95.2;
   For example, if EIRP = -27dBm
   E[dBuV/m] = -27 + 95.2 = 68.2dBuV/m.

Measurement Data:
All antennas have test, only the worst case ANT 1 report.

Worse case mode:		802.11a		Test Frequency:		5180MHz	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
5150	49.97	-3.63	46.34	68.20	-21.86	peak	H
5150	45.83	-3.63	42.20	54.00	-11.80	AVG	H
5150	51.85	-3.63	48.22	68.20	-19.98	peak	V
5150	45.08	-3.63	41.45	54.00	-12.55	AVG	V
Worse case mode:		802.11a		Test Frequency:		5240MHz	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
5350	48.72	-3.59	45.13	68.20	-23.07	peak	H
5350	45.30	-3.59	41.71	54.00	-12.29	AVG	H
5350	50.16	-3.59	46.57	68.20	-21.63	peak	V
5350	43.89	-3.59	40.30	54.00	-13.70	AVG	V
Worse case mode:		802.11n		Test Frequency:		5180MHz	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
5150	49.53	-3.63	45.90	68.20	-22.30	peak	H
5150	45.96	-3.63	42.33	54.00	-11.67	AVG	H
5150	51.92	-3.63	48.29	68.20	-19.91	peak	V
5150	44.73	-3.63	41.10	54.00	-12.90	AVG	V
Worse case mode:		802.11n		Test Frequency:		5240MHz	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
5350	48.84	-3.59	45.25	68.20	-22.95	peak	H
5350	45.32	-3.59	41.73	54.00	-12.27	AVG	H
5350	49.69	-3.59	46.10	68.20	-22.10	peak	V
5350	43.88	-3.59	40.29	54.00	-13.71	AVG	V

Worse case mode:		802.11ac(HT20)		Test Frequency:		5180MHz	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
5150	49.97	-3.63	46.34	68.20	-21.86	peak	H
5150	45.83	-3.63	42.20	54.00	-11.80	AVG	H
5150	51.85	-3.63	48.22	68.20	-19.98	peak	V
5150	45.07	-3.63	41.44	54.00	-12.56	AVG	V
Worse case mode:		802.11ac(HT20)		Test Frequency:		5240MHz	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
5350	48.72	-3.59	45.13	68.20	-23.07	peak	H
5350	45.29	-3.59	41.70	54.00	-12.30	AVG	H
5350	50.15	-3.59	46.56	68.20	-21.64	peak	V
5350	43.88	-3.59	40.29	54.00	-13.71	AVG	V

7.7 Radiated Emission

Test Requirement :	FCC Part15 C Section 15.209 and 15.205
Test Method :	ANSI C63.10: 2013
Test Frequency Range:	9kHz to 40GHz
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber)
Receiver setup:	

Frequency	Detector	RBW	VBW	Value
9kHz-150KHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	AV	1MHz	3MHz	Average Value

Note: For Duty cycle ≥ 98%, average detector set as above For Duty cycle < 98%, average detector set as below: VBW ≥ 1 / T

Limit:

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

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Test Procedure:

Substitution method was performed to determine the actual ERP emission levels of the EUT.
The following test procedure as below:
1>.Below 1GHz test procedure:

1. The EUT was placed on the top of a rotating table (0.8m for below 1GHz and 1.5 meters for above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that

did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

2>.Above 1GHz test procedure:

1. On the test site as test setup graph above,the EUT shall be placed at the 0.8m support on the turntable and in the position closest to normal use as declared by the provider.
2. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter.The output of the test antenna shall be connected to the measuring receiver.
3. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
4. The test antenna shall be raised and lowered from 1m to 4m until a maximum signal level is detected by the measuring receiver. Then the turntable should be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
5. Repeat step 4 for test frequency with the test antenna polarized horizontally.
6. Remove the transmitter and replace it with a substitution antenna
7. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends vertically polarized, and with the signal generator tuned to a particular test frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.
8. Repeat step 7 with both antennas horizontally polarized for each test frequency.
9. Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps 7 and 8 by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:

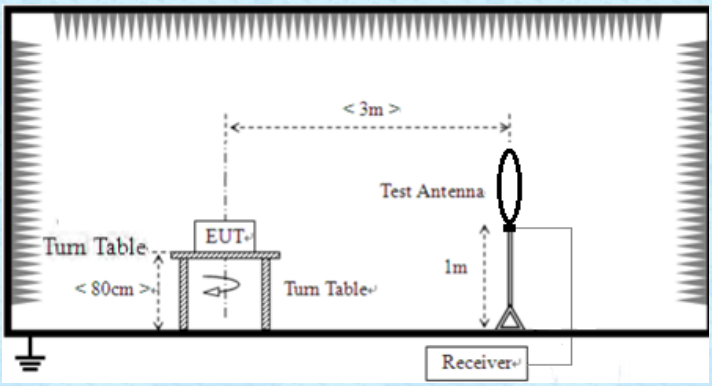
   EIRP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBi)

   where:

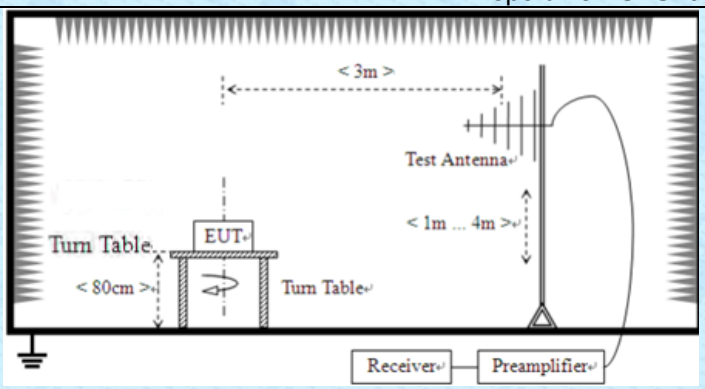
   Pg is the generator output power into the substitution antenna.

Test setup:

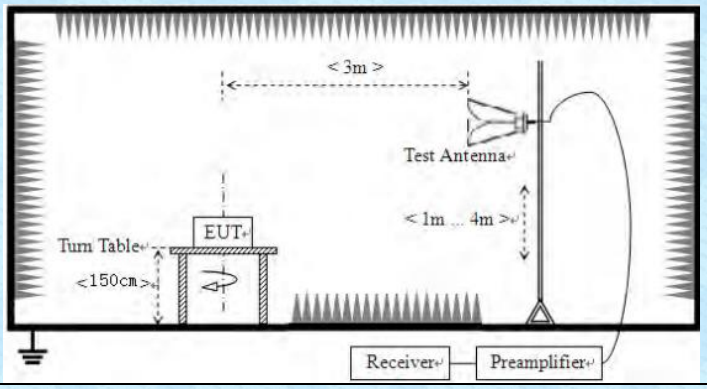
For radiated emissions from 9kHz to 30MHz



For radiated emissions from 30MHz to1GHz



For radiated emissions above 1GHz



Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar
Test voltage:	AC 120V, 60Hz					
Test results:	Pass					

Remarks:

1. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

Measurement Data:

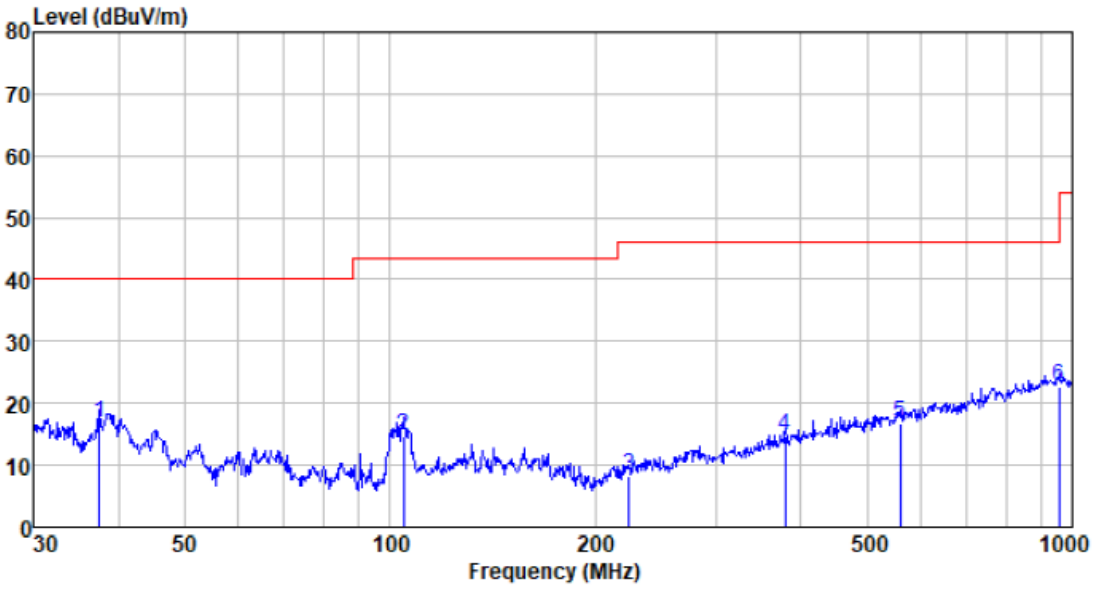
9 kHz ~ 30 MHz

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

30MHz~ 1GHz

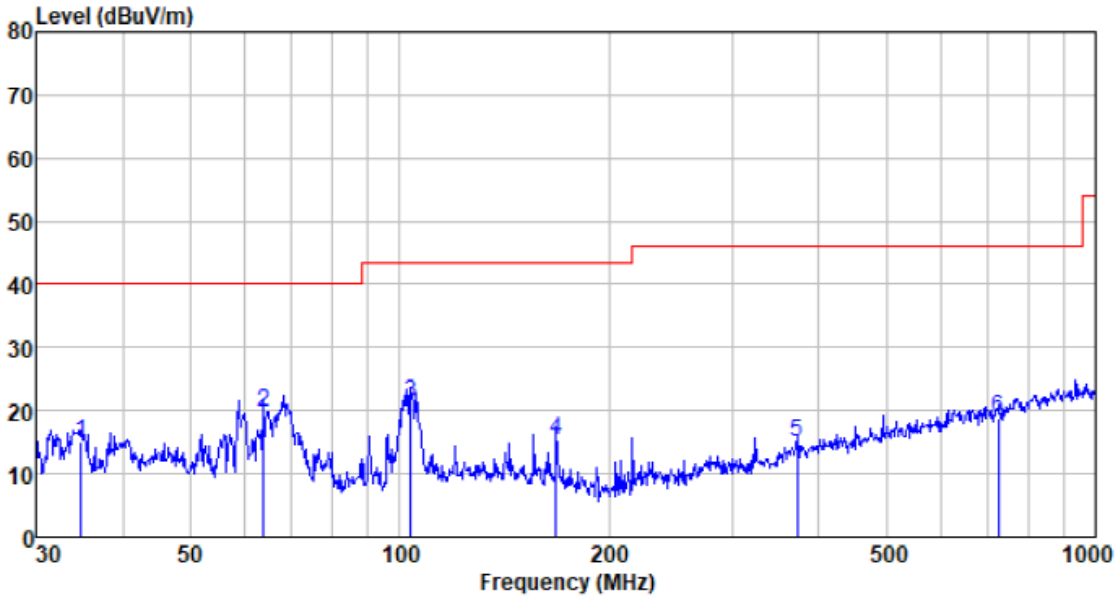
Pre-scan all test modes, found worst case at 802.11ac(VHT20) 5180MHz@Ant 1, and so only show the test result of it.

Horizontal:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
37.548	33.19	13.12	0.64	30.00	16.95	40.00	-23.05	QP
104.536	33.47	10.06	1.23	30.00	14.76	43.50	-28.74	QP
223.733	25.63	10.55	1.98	30.00	8.16	46.00	-37.84	QP
379.914	26.95	15.11	2.76	30.00	14.82	46.00	-31.18	QP
558.730	24.71	18.64	3.56	30.00	16.91	46.00	-29.09	QP
955.438	23.34	24.35	5.06	30.00	22.75	46.00	-23.25	QP

Vertical:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
34.882	31.67	12.69	0.61	30.00	14.97	40.00	-25.03	QP
63.759	37.07	11.77	0.89	30.00	19.73	40.00	-20.27	QP
103.806	40.03	10.01	1.22	30.00	21.26	43.50	-22.24	QP
167.824	31.96	11.67	1.67	30.00	15.30	43.50	-28.20	QP
372.005	27.34	14.87	2.72	30.00	14.93	46.00	-31.07	QP
724.261	23.37	21.28	4.18	30.00	18.83	46.00	-27.17	QP

Above 1GHz:

All antennas have test, only the worst case ANT 1 report.

802.11a(HT20)				Test Frequency: 5180MHz				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10360	36.19	38.96	8.27	35.64	47.78	68.20	-20.42	Vertical
15540	34.17	38.40	10.57	35.35	47.79	68.20	-20.41	Vertical
10360	35.38	38.96	8.27	35.64	46.97	68.20	-21.23	Horizontal
15540	31.76	38.40	10.57	35.35	45.38	68.20	-22.82	Horizontal
10360	28.67	38.96	8.27	35.64	40.26	54.00	-13.74	Vertical
15540	27.01	38.40	10.57	35.35	40.63	54.00	-13.37	Vertical
10360	26.47	38.96	8.27	35.64	38.06	54.00	-15.94	Horizontal
15540	26.54	38.40	10.57	35.35	40.16	54.00	-13.84	Horizontal
802.11aHT20)				Test Frequency: 5200MHz				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10400	36.04	39.01	8.29	35.67	47.67	68.20	-20.53	Vertical
15600	34.22	38.30	10.62	35.36	47.78	68.20	-20.42	Vertical
10400	35.79	39.01	8.29	35.67	47.42	68.20	-20.78	Horizontal
15600	29.83	38.30	10.62	35.36	43.39	68.20	-24.81	Horizontal
10400	29.56	39.01	8.29	35.67	41.19	54.00	-12.81	Vertical
15600	28.26	38.30	10.62	35.36	41.82	54.00	-12.18	Vertical
10400	24.85	39.01	8.29	35.67	36.48	54.00	-17.52	Horizontal
15600	25.57	38.30	10.62	35.36	39.13	54.00	-14.87	Horizontal

802.11a(HT20)				Test Frequency: 5240MHz				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10480	36.67	39.15	8.32	35.78	48.36	68.20	-19.84	Vertical
15720	33.15	38.00	10.72	35.37	46.50	68.20	-21.70	Vertical
10480	33.31	39.15	8.32	35.78	45.00	68.20	-23.20	Horizontal
15720	33.36	38.00	10.72	35.37	46.71	68.20	-21.49	Horizontal
10480	27.30	39.15	8.32	35.78	38.99	54.00	-15.01	Vertical
15720	25.12	38.00	10.72	35.37	38.47	54.00	-15.53	Vertical
10480	25.74	39.15	8.32	35.78	37.43	54.00	-16.57	Horizontal
15720	22.48	38.00	10.72	35.37	35.83	54.00	-18.17	Horizontal
802.11nHT20)				Test Frequency: 5180MHz				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10360	36.05	39.20	8.34	35.82	47.77	68.20	-20.43	Vertical
15540	34.64	37.90	10.77	35.38	47.93	68.20	-20.27	Vertical
10360	36.00	39.20	8.34	35.82	47.72	68.20	-20.48	Horizontal
15540	29.91	37.90	10.77	35.38	43.20	68.20	-25.00	Horizontal
10360	28.26	39.20	8.34	35.82	39.98	54.00	-14.02	Vertical
15540	25.81	37.90	10.77	35.38	39.10	54.00	-14.90	Vertical
10360	24.13	39.20	8.34	35.82	35.85	54.00	-18.15	Horizontal
15540	24.19	37.90	10.77	35.38	37.48	54.00	-16.52	Horizontal

802.11n(HT20)					Test Frequency: 5200MHz			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10400	36.96	38.96	8.27	35.64	48.55	68.20	-19.65	Vertical
15600	32.19	38.40	10.57	35.35	45.81	68.20	-22.39	Vertical
10400	33.03	38.96	8.27	35.64	44.62	68.20	-23.58	Horizontal
15600	33.92	38.40	10.57	35.35	47.54	68.20	-20.66	Horizontal
10400	30.15	38.96	8.27	35.64	41.74	54.00	-12.26	Vertical
15600	28.46	38.40	10.57	35.35	42.08	54.00	-11.92	Vertical
10400	27.44	38.96	8.27	35.64	39.03	54.00	-14.97	Horizontal
15600	22.66	38.40	10.57	35.35	36.28	54.00	-17.72	Horizontal
802.11n(HT20)					Test Frequency: 5240MHz			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10480	33.75	39.15	8.32	35.78	45.44	68.20	-22.76	Vertical
15720	33.24	38.00	10.72	35.37	46.59	68.20	-21.61	Vertical
10480	32.93	39.15	8.32	35.78	44.62	68.20	-23.58	Horizontal
15720	29.17	38.00	10.72	35.37	42.52	68.20	-25.68	Horizontal
10480	28.30	39.15	8.32	35.78	39.99	54.00	-14.01	Vertical
15720	27.93	38.00	10.72	35.37	41.28	54.00	-12.72	Vertical
10480	24.58	39.15	8.32	35.78	36.27	54.00	-17.73	Horizontal
15720	25.78	38.00	10.72	35.37	39.13	54.00	-14.87	Horizontal

802.11ac(HT20)				Test Frequency: 5180MHz				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10360	34.03	38.96	8.27	35.64	45.62	68.20	-22.58	Vertical
15540	34.80	38.40	10.57	35.35	48.42	68.20	-19.78	Vertical
10360	32.64	38.96	8.27	35.64	44.23	68.20	-23.97	Horizontal
15540	33.04	38.40	10.57	35.35	46.66	68.20	-21.54	Horizontal
10360	26.86	38.96	8.27	35.64	38.45	54.00	-15.55	Vertical
15540	24.52	38.40	10.57	35.35	38.14	54.00	-15.86	Vertical
10360	25.00	38.96	8.27	35.64	36.59	54.00	-17.41	Horizontal
15540	22.30	38.40	10.57	35.35	35.92	54.00	-18.08	Horizontal
802.11ac(HT20)				Test Frequency: 5200MHz				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10400	36.96	39.01	8.29	35.67	48.59	68.20	-19.61	Vertical
15600	33.53	38.30	10.62	35.36	47.09	68.20	-21.11	Vertical
10400	33.44	39.01	8.29	35.67	45.07	68.20	-23.13	Horizontal
15600	33.88	38.30	10.62	35.36	47.44	68.20	-20.76	Horizontal
10400	29.48	39.01	8.29	35.67	41.11	54.00	-12.89	Vertical
15600	27.97	38.30	10.62	35.36	41.53	54.00	-12.47	Vertical
10400	24.23	39.01	8.29	35.67	35.86	54.00	-18.14	Horizontal
15600	26.72	38.30	10.62	35.36	40.28	54.00	-13.72	Horizontal

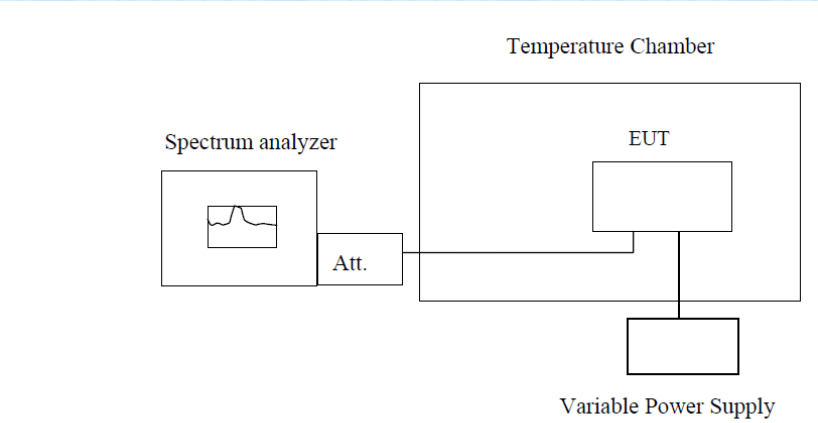
802.11ac(HT20)					Test Frequency: 5240MHz			
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
10480	32.47	39.15	8.32	35.78	44.16	68.20	-24.04	Vertical
15720	33.29	38.00	10.72	35.37	46.64	68.20	-21.56	Vertical
10480	34.15	39.15	8.32	35.78	45.84	68.20	-22.36	Horizontal
15720	34.00	38.00	10.72	35.37	47.35	68.20	-20.85	Horizontal
10480	27.26	39.15	8.32	35.78	38.95	54.00	-15.05	Vertical
15720	27.41	38.00	10.72	35.37	40.76	54.00	-13.24	Vertical
10480	23.59	39.15	8.32	35.78	35.28	54.00	-18.72	Horizontal
15720	24.84	38.00	10.72	35.37	38.19	54.00	-15.81	Horizontal

Notes:

1. Level = Read Level + Antenna Factor+ Cable loss- Preamp Factor.

2. The test trace is same as the ambient noise (the test frequency range: 18GHz~40GHz), therefore no data appear in the report.

7.8 Frequency stability

Test Requirement:	FCC Part15 C Section 15.407(g)
Test Method:	ANSI C63.10:2013, FCC Part 2.1055,
Limit:	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
Test Procedure:	The EUT was setup to ANSI C63.4, 2003; tested to 2.1055 for compliance to FCC Part 15.407(g) requirements.
Test setup:	 **Note :** Measurement setup for testing on Antenna connector
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data:

All were test, only the ANT 1 test result recorded in the report.

Test Condition	Test Mode	Test Frequency [MHz]	Ant	Result [ppm]	Limit [ppm]	Verdict
NTNV	Carrier	5180	1	-7.62	<=20	PASS
		5190	1	-7.21	<=20	PASS
		5200	1	-6.57	<=20	PASS
		5210	1	-4.67	<=20	PASS
		5230	1	-4.34	<=20	PASS
		5240	1	-3.46	<=20	PASS
		5180	2	-6.34	<=20	PASS
		5190	2	-6.43	<=20	PASS
		5200	2	-5.67	<=20	PASS
		5210	2	-3.45	<=20	PASS
		5230	2	-6.37	<=20	PASS
		5240	2	-6.34	<=20	PASS

8 Test Setup Photo

Reference to the **appendix I** for details.

9 EUT Constructional Details

Reference to the **appendix II** for details.

---END---