FCC TEST REPORT

Test report
On Behalf of
Shenzhen Botan Innovation Co.,Ltd.
For
Drone
Model No.:DSDR01A,DSDR01B,DSDR01C,DSDR01D,DSDR01E, DSDR01F,DSDR02A,DSDR02B,DSDR02C,DSDR02D,DSDR02E,DSDR03A, DSDR03B,DSDR03C,DSDR03D,DSDR03E,DSDR04A,DSDR04B， DSDR04C,DSDR04D,DSDR04E,DSDR05A,DSDR05B,DSDR05C, DSDR05D,DSDR06A,DSDR06B,DSDR06C,DSDR06D,DSDR07A, DSDR07B,DSDR07C,DSDR07D,DSDR08A,DSDR08B,DSDR08C DSDR08D,DSDR09A,DSDR09B,DSDR09C,DSDR09D,DSDR10A, DSDR10B,DSDR10C,DSDR10D,DSDR11A,DSDR11B,DSDR11C, DSDR11D

FCC ID: 2AUYR-DSDR01A-11D

Prepared for : **Shenzhen Botan Innovation Co.,Ltd.**
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Prepared By : **Shenzhen HUAK Testing Technology Co., Ltd.**
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TEST REPORT

Applicant's name ..... **Shenzhen Botan Innovation Co.,Ltd.**

Address ..... 21th floor,Building A,Cadre Building,No.168 Tongsha Road,Shenzhen,ChIna

Manufacture's Name ..... **Shenzhen Botan Innovation Co.,Ltd.**

Address ..... 21th floor,Building A,Cadre Building,No.168 Tongsha Road,Shenzhen,ChIna

Product description

Trade Mark: Potensic®

Product name ..... Drone

Model and/or type reference DSDR01A,DSDR01B,DSDR01C,DSDR01D,DSDR01E,DSDR01F, DSDR02A,DSDR02B,DSDR02C,DSDR02D,DSDR02E,DSDR03A, DSDR03B,DSDR03C,DSDR03D,DSDR03E,DSDR04A,DSDR04B, DSDR04C,DSDR04D,DSDR04E,DSDR05A,DSDR05B,DSDR05C, DSDR05D,DSDR06A,DSDR06B,DSDR06C,DSDR06D,DSDR07A, DSDR07B,DSDR07C,DSDR07D,DSDR08A,DSDR08B,DSDR08C DSDR08D,DSDR09A,DSDR09B,DSDR09C,DSDR09D,DSDR10A, DSDR10B,DSDR10C,DSDR10D,DSDR11A,DSDR11B,DSDR11C, DSDR11D

Standards ..... **47 CFR FCC Part 15 Subpart E 15.407**
ANSI C63.10: 2013

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Date of Test .....

Date (s) of performance of tests ..... Oct. 20, 2019~. Nov. 13, 2019

Date of Issue ..... Nov. 13, 2019

Test Result ..... **Pass**

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(Jason Zhou)

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1. SUMMARY

1.1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15 Subpart E—Unlicensed National Information Infrastructure Devices

ANSI C63.10:2013 : American National Standard for Testing Unlicensed Wireless Devices

KDB789033 D02: General UNII Test Procedures New Rules v02r01

1.2. Test Description

FCC Requirement		
FCC Part 15.207	AC Power Conducted Emission	N/A
FCC Part 15.407(a)	Emission Bandwidth(26dBm Bandwidth)	N/A
FCC Part 15.407(e)	Minimum Emission Bandwidth(6dBm Bandwidth)	PASS Note2
FCC Part 15.407(a)	Maximum Conducted Output Power	PASS
FCC Part 15.407(a)	Peak Power Spectral Density	PASS
FCC Part 15.407(g)	Frequency Stability	PASS
FCC Part 15.407(b)	Undesirable emission	PASS
FCC Part 15.407(b)/15.205/15.209	Radiated Emissions	PASS
FCC Part 15.407(h)	Dynamic Frequency Selection	N/A
FCC Part 15.203/15.247(b)	Antenna Requirement	PASS

Note 1: Apply to U-NII 1, U-NII 2A, and U-NII 2C band.
Note 2: Apply to U-NII 3 band only.

1.3. Test Facility

1.3.1 Address of the test laboratory

Shenzhen HUAK Testing Technology Co., Ltd.
1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen HUAK Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen HUAK Testing Technology Co., Ltd. is reported:

Measurement Uncertainty		
Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2. GENERAL INFORMATION

2.1. Environmental conditions

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

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

2.2. General Description of EUT

Product Name:	Drone			
Model:	DSDR01A			
Power supply:	DC 15.2V from battery			
ANT type:	FPC ANT			
ANT Gain:	5.85dBi			
WIFI				
Supported type:	20MHz system	40MHz system	80MHz system	160MHz system
	802.11a 802.11n	802.11n	N/A	N/A
Operation frequency:	5745MHz-5825MHz	5755MHz-5795MHz	N/A	N/A
Modulation:	OFDM	OFDM	N/A	N/A
Channel number:	9	4	N/A	N/A
Channel separation:	20MHz	40MHz	N/A	N/A

Note: For more details, please refer to the user’s manual of the EUT.

2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing.

All test performed at the low, middle and high of operational frequency range of each mode.

Operation Frequency List WIFI on 5G Band：

Operating band	20MHz		40MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)
U-NII 3 (5725MHz-5850MHz)	149	5745	151	5755
	153	5765		
	157	5785	159	5795
	161	5805		
	165	5825	--	--

Note:

1. “--“Means no channel(s) available any more.
2. The line display in grey is those Channels/Frequencies select to test in this report for each operation mode.

Data Rate Used:

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate
Maximum Conducted Output Power Power Spectral Density Emission Bandwidth(26dBm Bandwidth) Minimum Emission Bandwidth(6dBm Bandwidth) Undesirable emission Frequency Stability	11a/OFDM	6 Mbps
	11n(20MHz) /OFDM	7.2 Mbps
	11n(40MHz) /OFDM	15.0Mbps

2.4. Equipments Used during the Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 28, 2018	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 28, 2018	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 28, 2018	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 28, 2018	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2018	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 28, 2018	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 28, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 28, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 28, 2018	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 28, 2018	1 Year
11.	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	HKE-017	Dec. 28, 2018	1 Year
12.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 28, 2018	1 Year
13.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 28, 2018	1 Year
14.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 28, 2018	N/A
15.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 28, 2018	1 Year
16.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2018	1 Year
17.	Signal generator	Agilent	N5182A	HKE-029	Dec. 28, 2018	1 Year
18.	Signal Generator	Agilent	83630A	HKE-028	Dec. 28, 2018	1 Year
19.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 28, 2018	3 Year
20.	RF Cable(below 1GHz)	HUBER+SUHNER	RG214	HKE-055	Dec. 28, 2018	1 Year
21.	RF Cable(above 1GHz)	HUBER+SUHNER	RG214	HKE-056	Dec. 28, 2018	1 Year

The calibration interval was one year

2.5. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.407 of the FCC Part 15, Subpart E Rules.

2.6. Modifications

No modifications were implemented to meet testing criteria.

3. TEST CONDITIONS AND RESULTS

3.1. Conducted Emissions Test

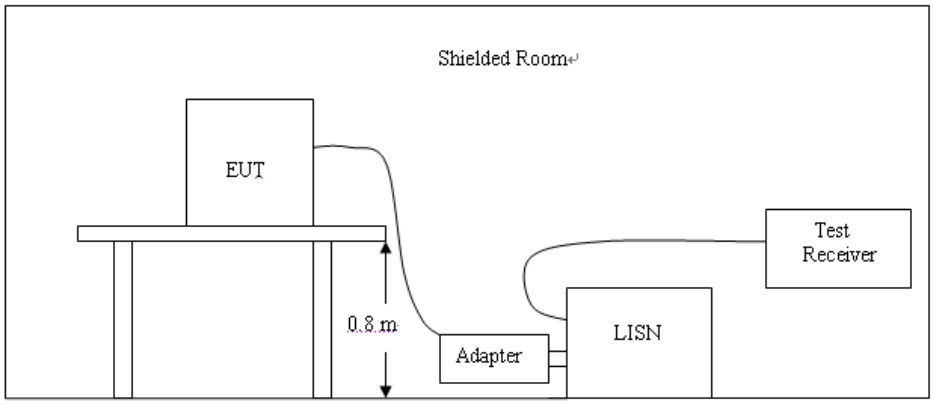
LIMIT

According to FCC CFR Title 47 Part 15 Subpart C Section 15.207, AC Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus as below:

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 CONFIGURATION



TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
4. The adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST RESULTS

The EUT is powered by Battery, so test item is not applicable for the EUT

3.2. Radiated Emissions

Limit

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 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. 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 e.i.r.p. of −27 dBm/MHz.
(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 e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Undesirable emission limits

Requirement	Limit(EIRP)	Limit (Field strength at 3m) Note1
15.407(b)(1)	PK:-27(dBm/MHz)	PK:68.2(dBμV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)		

Note1: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

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

(5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209

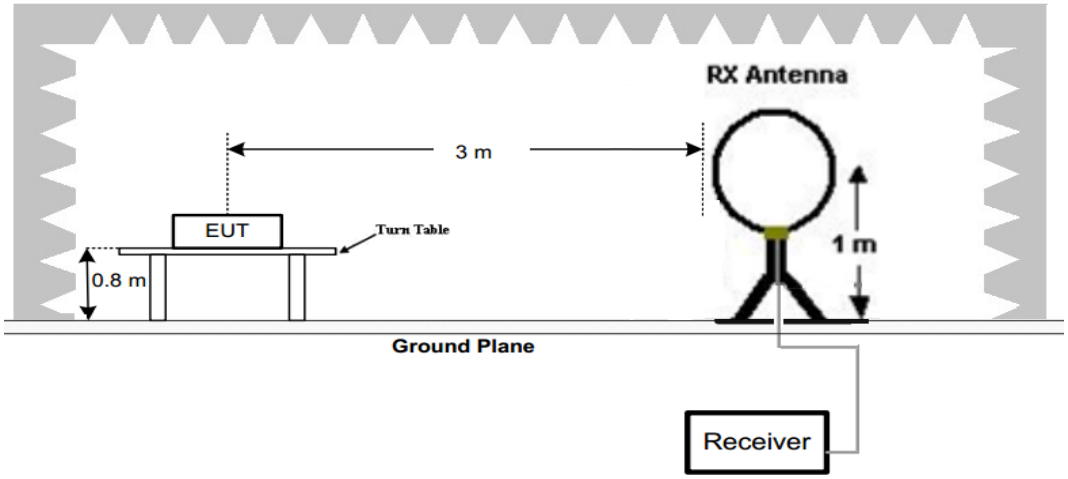
(6)In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

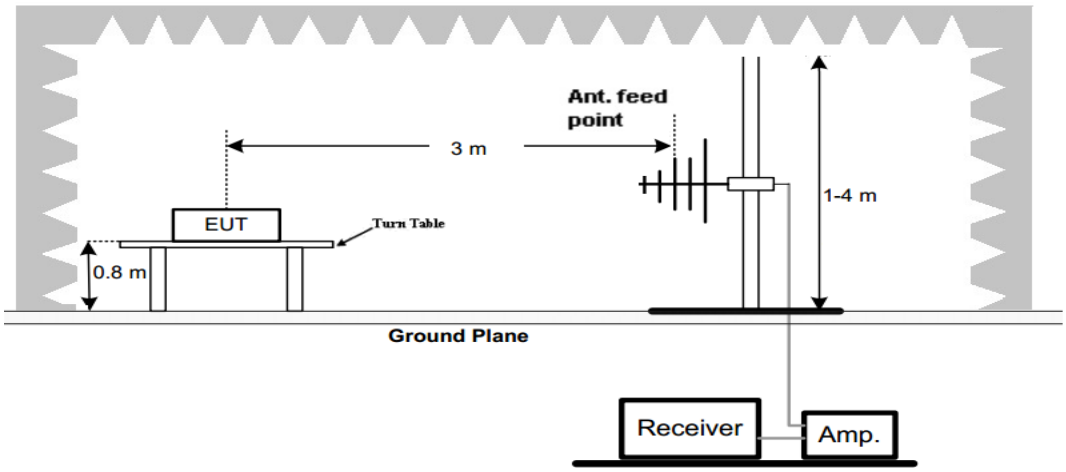
Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST CONFIGURATION

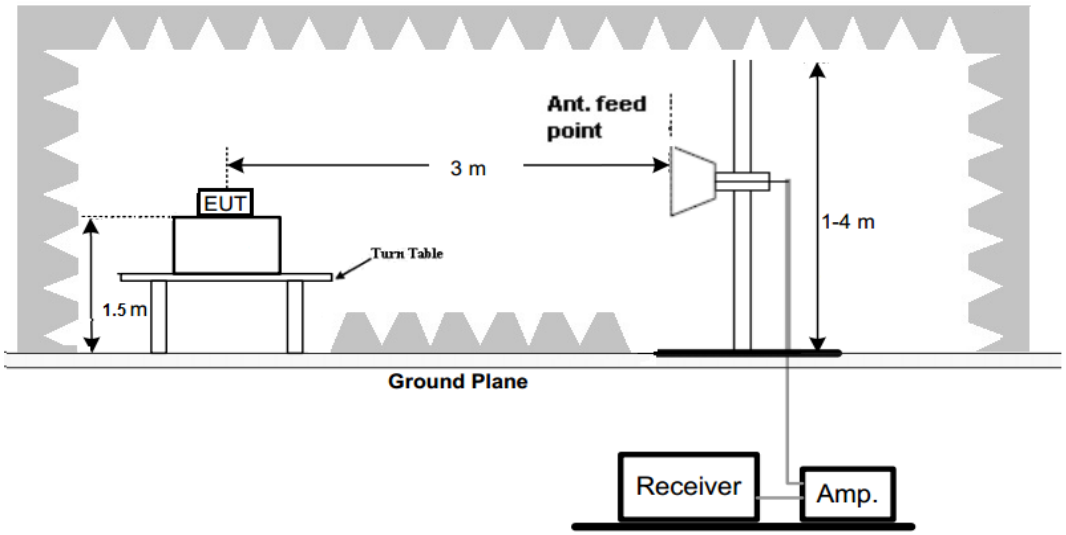
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



Test Procedure

1. 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.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Radiated emission test frequency band from 9KHz to 40GHz.
6. 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

7. Setting test receiver/spectrum as following table states:

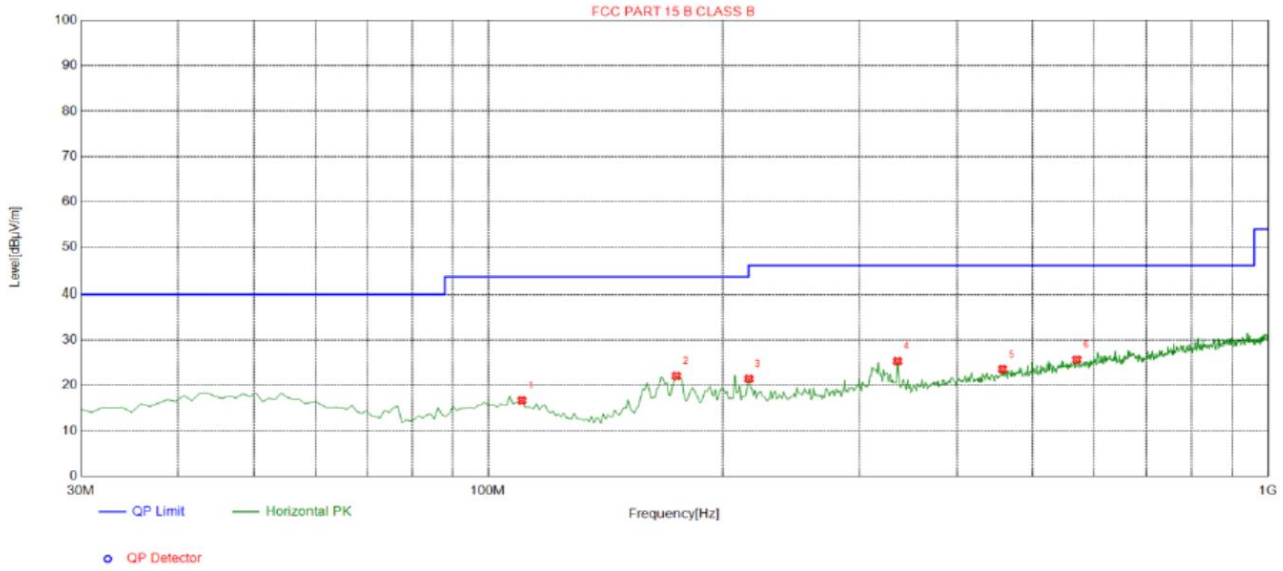
Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz,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

TEST RESULTS

Remark:
1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
2. All 802.11a / 802.11n (HT20) / 802.11n (HT40) modes have been tested for below 1GHz test, only the worst case 802.11ac (HT20) low channel of U-NII 1 band was recorded.
3. All 802.11a / 802.11n (HT20) / 802.11n (HT40) modes have been tested for above 1GHz test, only the worst case 802.11a (HT20) was recorded.
4. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

For 30MHz-1GHz

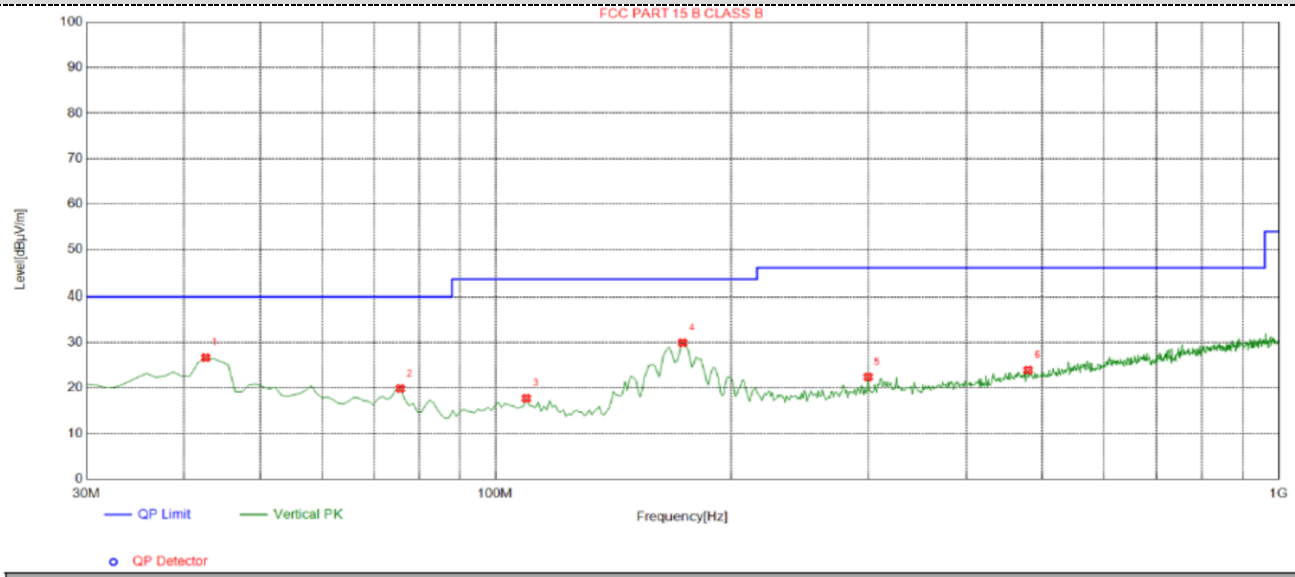
Horizontal



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	110.510	16.69	-15.52	43.50	26.81	100	228	Horizontal
2	174.530	22.07	-17.10	43.50	21.43	100	262	Horizontal
3	216.240	21.45	-14.65	46.00	24.55	100	247	Horizontal
4	335.550	25.32	-11.62	46.00	20.68	100	0	Horizontal
5	457.770	23.56	-8.74	46.00	22.44	100	186	Horizontal
6	570.290	25.67	-6.41	46.00	20.33	100	71	Horizontal

Vertical



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	42.6100	26.69	-14.08	40.00	13.31	100	181	Vertical
2	75.5900	19.91	-18.68	40.00	20.09	100	124	Vertical
3	109.540	17.75	-15.43	43.50	25.75	100	232	Vertical
4	173.560	29.95	-17.14	43.50	13.55	100	223	Vertical
5	299.660	22.44	-12.74	46.00	23.56	100	334	Vertical
6	480.080	23.95	-8.45	46.00	22.05	100	44	Vertical

For 1GHz to 25GHz

Note: All 802.11a / 802.11n (HT20) / 802.11n (HT40) and MIMO*2 modes have been tested for above 1GHz test, only the worst case 802.11a (HT20) was recorded.

LOW CH 149 (802.11 a Mode with 5.8G)/5745

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5720	64.26	-4.45	59.81	68.2	-8.39	peak
5720	47.23	-4.45	42.78	54	-11.22	AVG
11490	50.23	4.21	54.44	68.2	-13.76	peak
11490	43.12	4.21	47.33	54	-6.67	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5720	61.85	-4.45	57.4	68.2	-10.8	peak
5720	49.62	-4.45	45.17	54	-8.83	AVG
11490	56.75	4.21	60.96	68.2	-7.24	peak
11490	43.12	4.21	47.33	54	-6.67	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

MID CH157 (802.11 a Mode with 5.8G)/5785

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
11570	57.16	4.26	61.42	68.2	-6.78	peak
11570	42.16	4.26	46.42	54	-7.58	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
11570	56.89	4.26	61.15	68.2	-7.05	peak
11570	42.19	4.26	46.45	54	-7.55	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

HIGH CH 165 (802.11a Mode with 5.8G)/5825

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5855	62.46	-4.63	57.83	68.2	-10.37	peak
5855	50.47	-4.63	45.84	54	-8.16	AVG
11650	54.25	4.84	59.09	68.2	-9.11	peak
11650	40.75	4.84	45.59	54	-8.41	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
5855	63.18	-4.63	58.55	68.2	-9.65	peak
5855	51.36	-4.63	46.73	54	-7.27	AVG
11650	54.85	4.84	59.69	68.2	-8.51	peak
11650	40.67	4.84	45.51	54	-8.49	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：

(1) Measuring frequencies from 1 GHz to the 40 GHz。

(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) Data of measurement within this frequency range shown “--- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

3.3. Maximum Conducted Average Output Power

Limit

FCC requirement:

For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

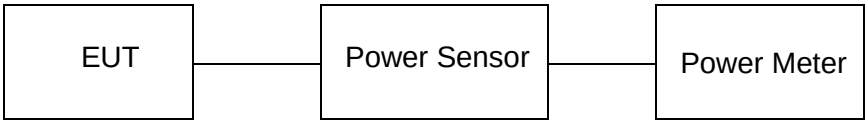
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

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

Test Procedure

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

Test Configuration



Test Results

U-NII 3

For ANT 1:

Type	Channel	Output power Average (dBm)	10log(1/x) Factor[dB]	Output power Average (dBm)	Limit (dBm)	Result
802.11a	149	11.05	0.14	11.19	30.00	Pass
	157	10.73	0.15	10.88		
	165	10.82	0.15	10.97		
802.11n(HT20)	149	10.75	0.15	10.9	30.00	Pass
	157	10.23	0.15	10.38		
	165	10.63	0.15	10.78		
802.11n(HT40)	151	10.72	0.30	11.02	30.00	Pass
	159	10.5	0.30	10.8		

For ANT 2:

Type	Channel	Output power Average (dBm)	10log(1/x) Factor[dB]	Output power Average (dBm)	Limit (dBm)	Result
802.11a	149	10.36	0.14	10.5	30.00	Pass
	157	10.85	0.14	10.99		
	165	10.69	0.14	10.83		
802.11n(HT20)	149	10.78	0.15	10.93	30.00	Pass
	157	10.61	0.15	10.76		
	165	10.74	0.16	10.9		
802.11n(HT40)	151	10.78	0.30	11.08	30.00	Pass
	159	10.49	0.30	10.79		

For MIMO*2

Type	Channel	ANT 1 Output power Average (dBm)	ANT 2 Output power Average (dBm)	MIMO*2 Output power Average (dBm)	Limit (dBm)	Result
802.11n(HT20)	149	11.19	10.5	14.21	30.00	Pass
	157	10.88	10.99	14.28		
	165	10.97	10.83	14.25		
802.11n(HT40)	151	10.9	10.93	14.26	30.00	Pass
	159	10.38	10.76	13.95		

Note:

1. Duty cycle is considered in the test results;
2. Measured output power at difference data rate for each mode and recorded worst case for each mode.
3. Test results including cable loss;
4. Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20 and IEEE 802.11n HT40,

3.4. Power Spectral Density

Limit

FCC requirement:
For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.[note1]

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.[note1]

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. [note1]

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands

The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

IC requirement:

For the band 5.15-5.25 GHz.

The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

Frequency band 5250-5350 MHz

The power spectral density shall not exceed 11 dBm in any 1.0 MHz band

Frequency bands 5470-5600 MHz and 5650-5725 MHz

The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

For the band 5.725 - 5.85 GHz

The maximum power spectral density shall not exceed 30 dBm in any 500 kHz band. [note1, note2]

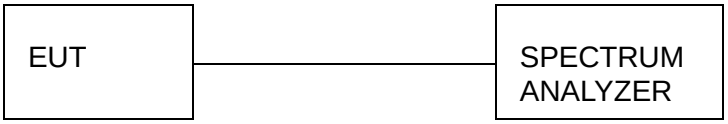
Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: Fixed point - to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi 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.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 1MHz for U-NII 1, U-NII 2A, U-NII C band and 510KHz for U-NII 3 band.
3. Set the VBW ≥ 3× RBW.
4. Set the span to encompass the entire EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.

Test Configuration



Test Results

U-NII 3

For ANT 1

Type	*Channel*	*Level [dBm/500kHz]*	*10log(1/x) Factor[dB]*	*Power Spectral Density (dBm/500KHz)*	*Limit (dBm/500KHz)*	*Result*
802.11a	149	-3.06	0.14	-2.92	30	Pass
	157	-3.08	0.15	-2.93		
	165	-2.80	0.15	-2.65		
802.11n(HT20)	149	-2.87	0.15	-2.72		
	157	-2.81	0.15	-2.66		
	165	-3.19	0.15	-3.04		
802.11n(HT40)	151	-7.77	0.30	-7.47		
	159	-7.00	0.30	-6.70		

For ANT 2

Type	*Channel*	*Level [dBm/500kHz]*	*10log(1/x) Factor[dB]*	*Power Spectral Density (dBm/500KHz)*	*Limit (dBm/500KHz)*	*Result*
802.11a	149	-3.53	0.14	-3.39	30	Pass
	157	-2.46	0.14	-2.32		
	165	-2.54	0.14	-2.40		
802.11n(HT20)	149	-2.87	0.15	-2.72		
	157	-3.83	0.15	-3.68		
	165	-3.00	0.16	-2.84		
802.11n(HT40)	151	-5.75	0.30	-5.45		
	159	-6.98	0.30	-6.68		

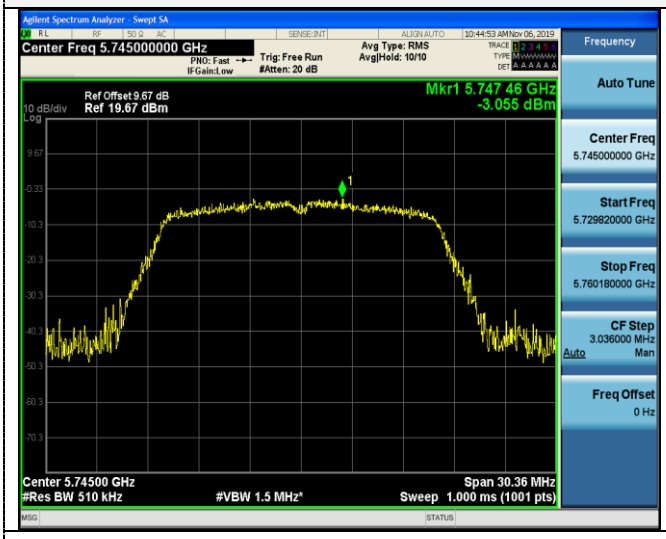
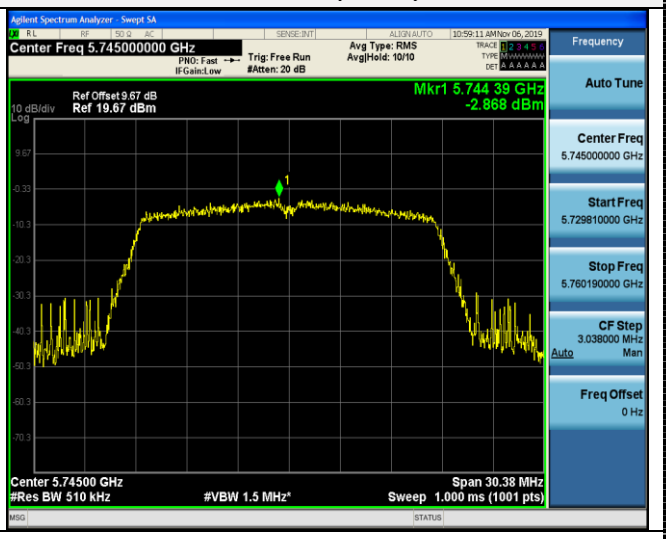
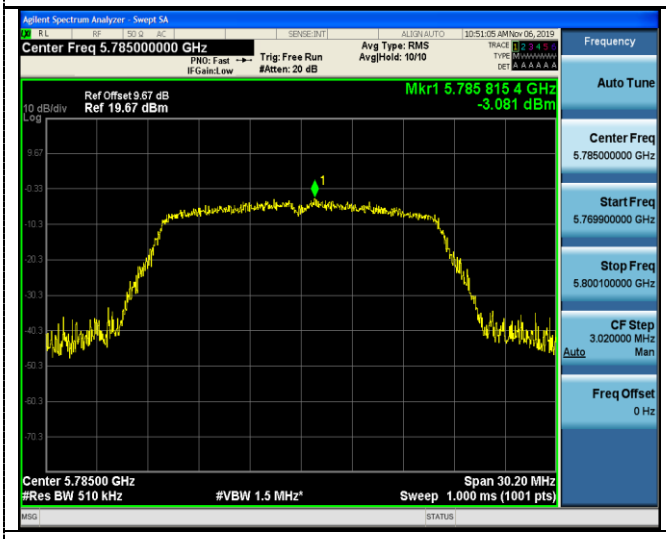
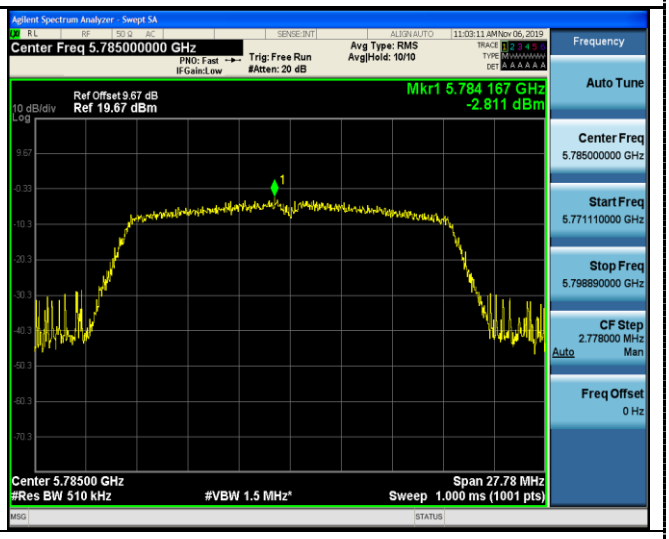
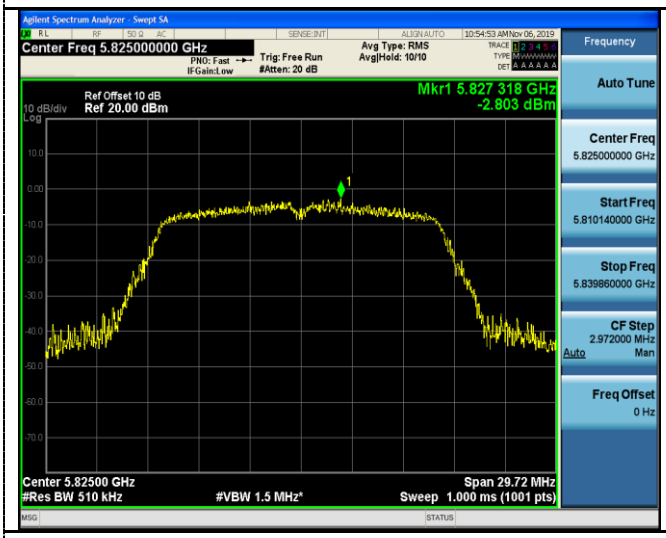
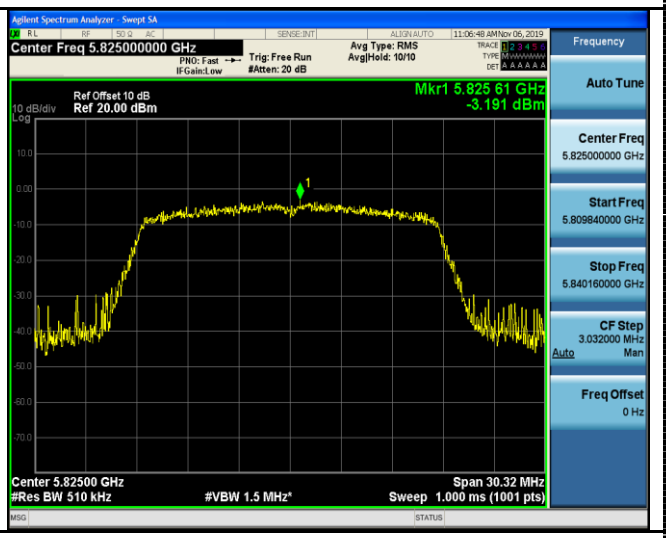
*For MIMO*2*

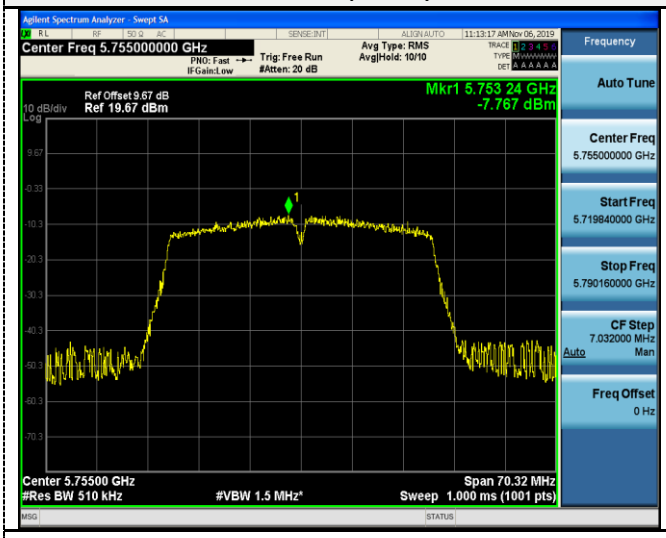
Type	Channel	ANT 1 *Power Spectral Density (dBm/500KHz)*	ANT 2 *Power Spectral Density (dBm/500KHz)*	MIMO*2 *Power Spectral Density (dBm/500KHz)*	Limit (dBm)	Result
802.11n(HT20)	149	-2.72	-2.72	0.29	27.15	Pass
	157	-2.66	-3.68	-0.13		
	165	-3.04	-2.84	0.07		
802.11n(HT40)	151	-7.47	-5.45	-3.33	27.15	Pass
	159	-6.70	-6.68	-3.68		

Note:

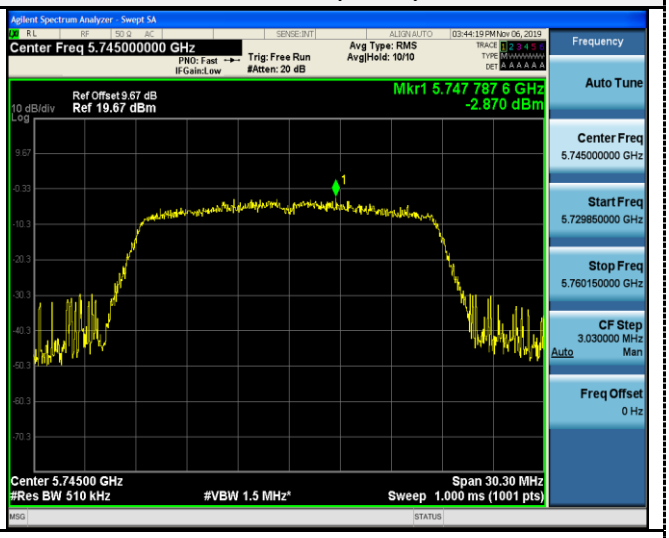
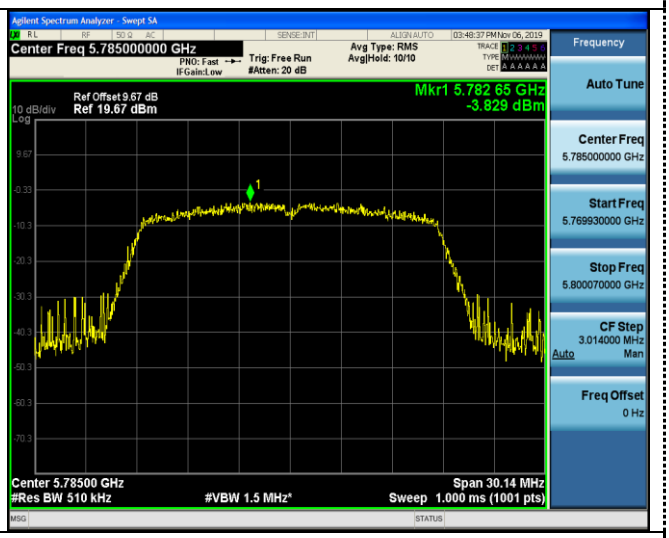
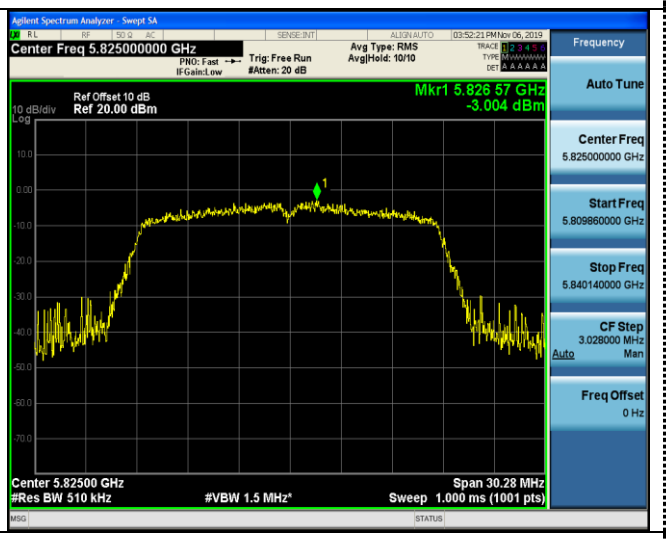
1. *Duty cycle is considered in the test results;*
2. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*
3. *Test results including cable loss;*
4. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20 and IEEE 802.11n HT40,*
5. *Please refer to following test plots;*

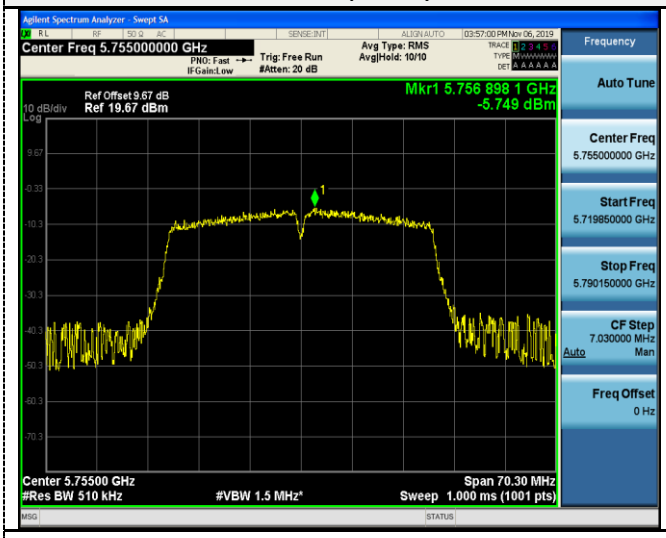
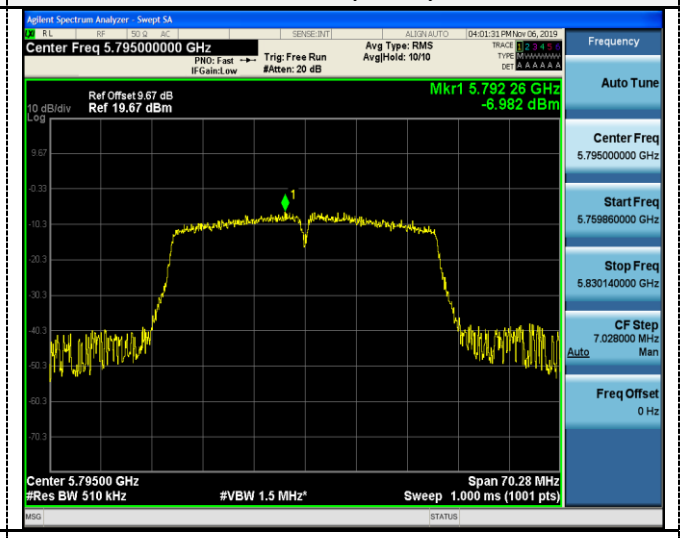
For ANT 1:

802.11a	802.11n(HT20)
	
CH149	CH149
	
CH157	CH157
	
CH165	CH165

802.11n(HT40)	802.11n(HT40)
	
CH151	CH159

For ANT 2:

802.11a	802.11n(HT20)
	
CH149	CH149
	
CH157	CH157
	
CH165	CH165

802.11n(HT40)	802.11n(HT40)
	
CH151	CH159

3.5. Minimum Emission Bandwidth (6dBm Bandwidth)

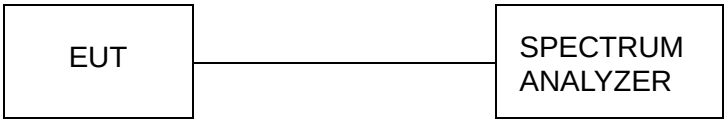
Limit

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Procedure

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth 3 x RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. 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.

Test Configuration



Test Results

For ANT 1:

Type	Bands	Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (KHz)	Result
802.11a	U-NII 3	149	15.18	16.340	≥500KHz	Pass
		157	15.10	16.329		
		165	14.86	16.353		
802.11n(HT20)	U-NII 3	149	15.19	17.694		
		157	13.89	17.538		
		165	15.16	17.515		
802.11n(HT40)	U-NII 3	151	35.16	35.818		
		159	35.19	35.866		

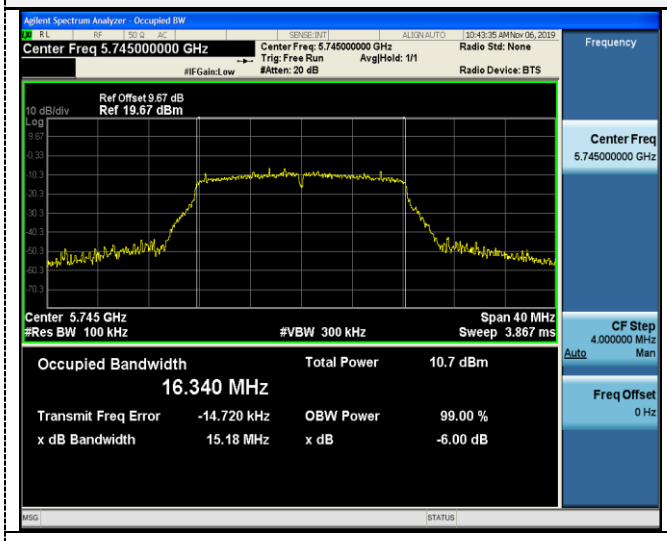
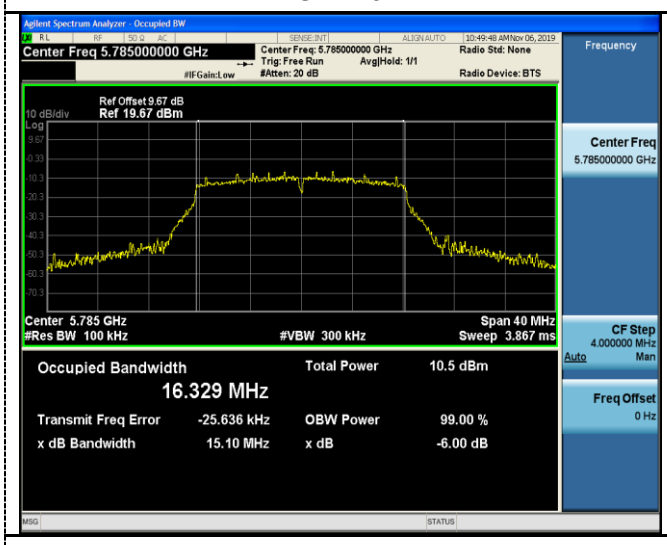
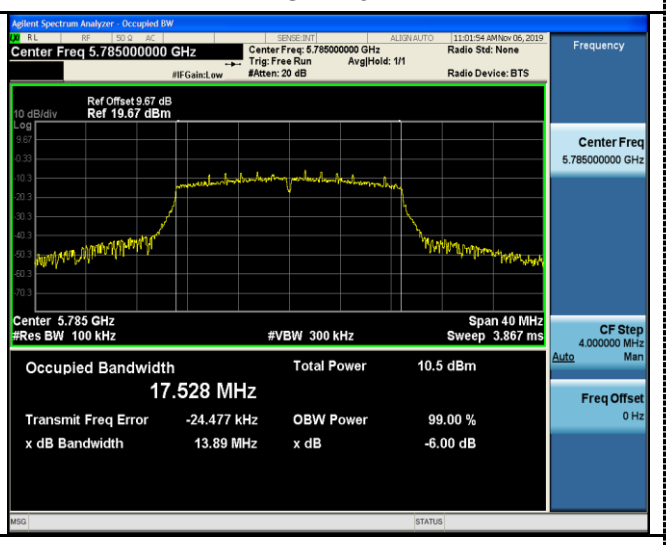
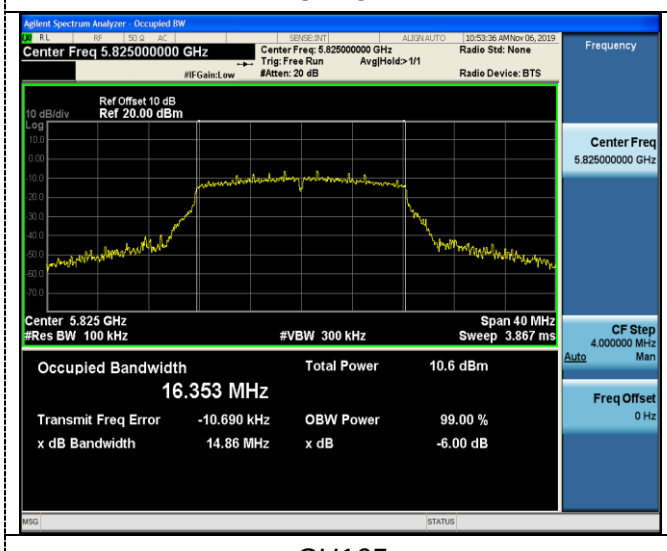
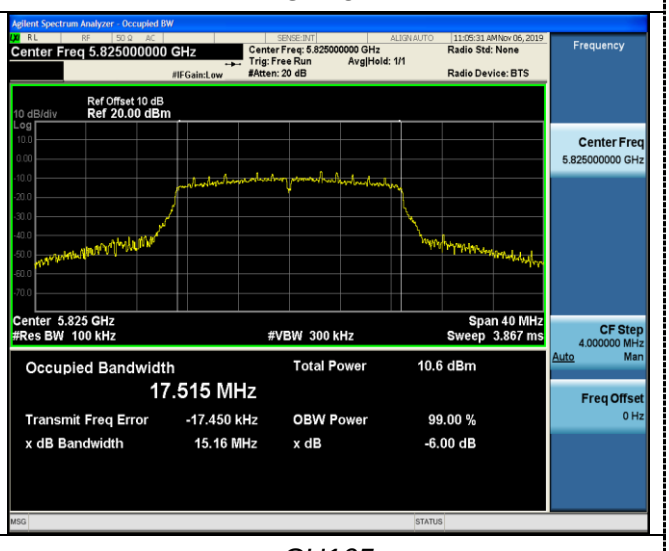
For ANT 2:

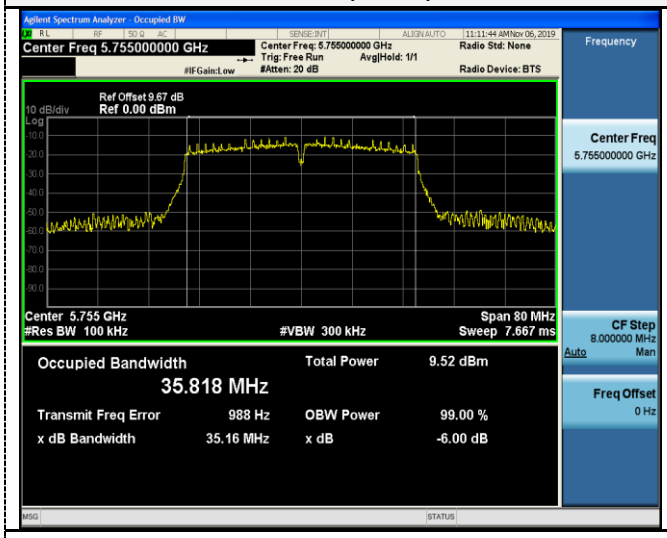
Type	Bands	Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (KHz)	Result
802.11a	U-NII 3	149	14.07	16.343	≥500KHz	Pass
		157	15.17	16.349		
		165	12.90	16.348		
802.11n(HT20)	U-NII 3	149	15.15	17.531		
		157	15.07	17.526		
		165	15.14	17.535		
802.11n(HT40)	U-NII 3	151	35.15	35.860		
		159	35.14	35.834		

Note:

1. *Measured 6dB bandwidth at difference data rate for each mode and recorded worst case for each mode.*
2. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20 and IEEE 802.11n HT40*
3. *Please refer to following test plots;*

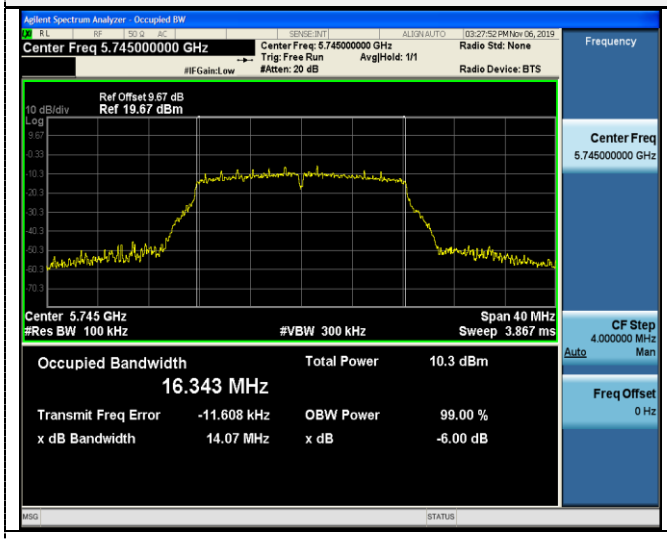
For ANT 1:

802.11a	802.11n(HT20)
	
CH149	CH149
	
CH157	CH157
	
CH165	CH165

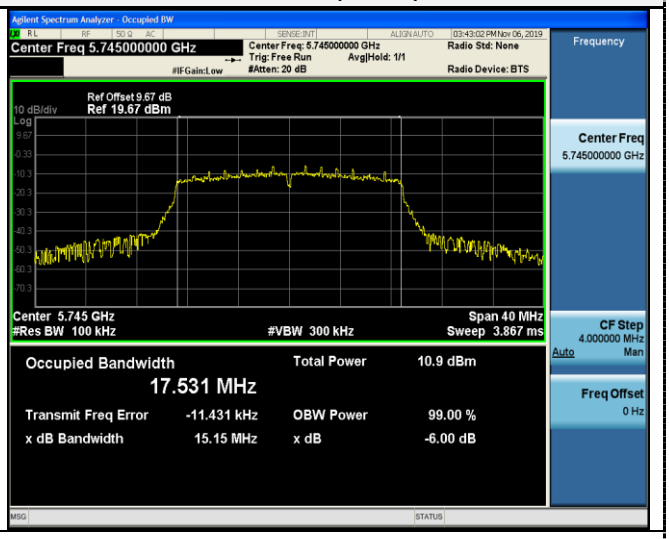
802.11n(HT40)	802.11n(HT40)
	
CH151	CH159

For ANT 2:

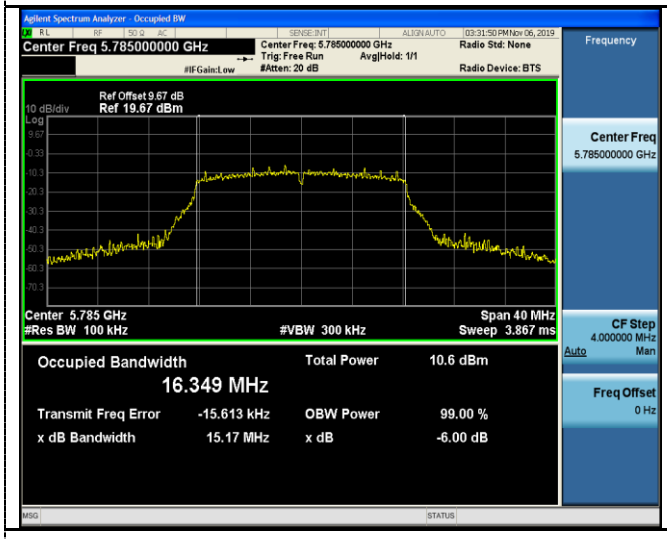
802.11a



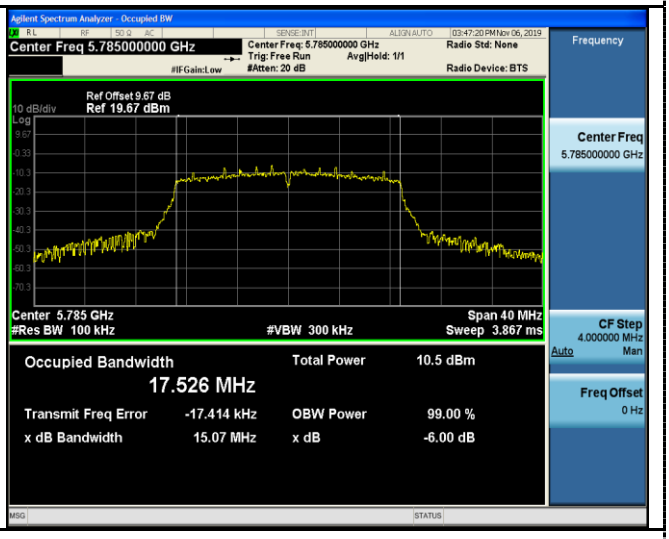
802.11n(HT20)



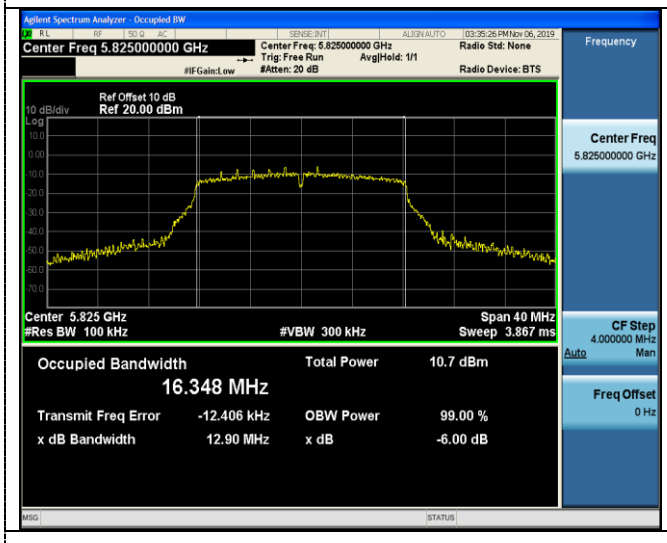
CH149



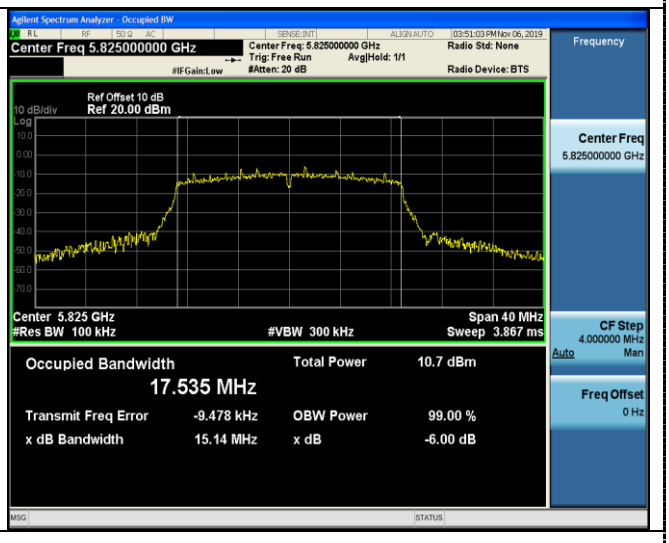
CH149



CH157

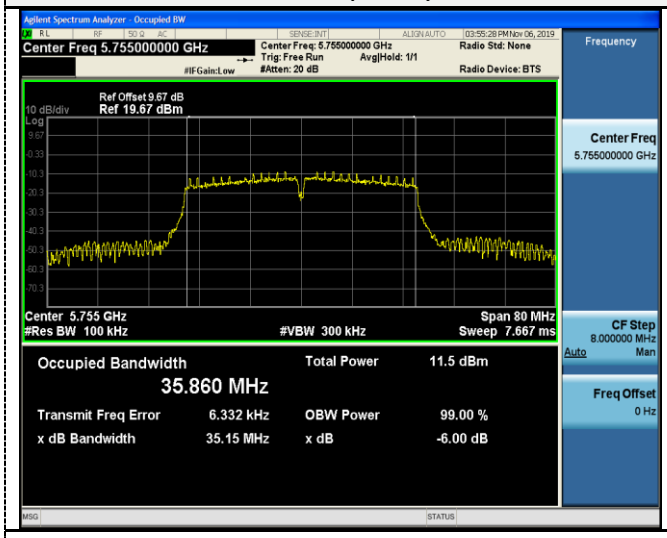


CH157



CH165

CH165

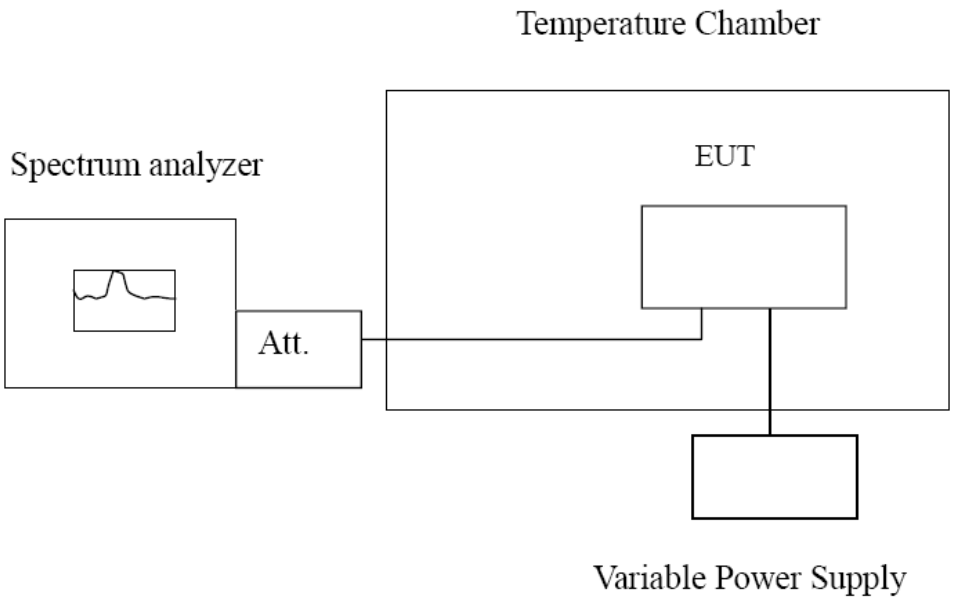
802.11n(HT40)	802.11n(HT40)
	
CH151	CH159

3.6. Frequency Stability

LIMIT

Manufacturers 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 users manual.

TEST CONFIGURATION



TEST PROCEDURE

Frequency Stability under Temperature Variations:
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20℃ operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30℃. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached.

Frequency Stability under Voltage Variations:
Set chamber temperature to 20℃. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, record the maximum frequency change.

TEST RESULTS

Record worst case as below:

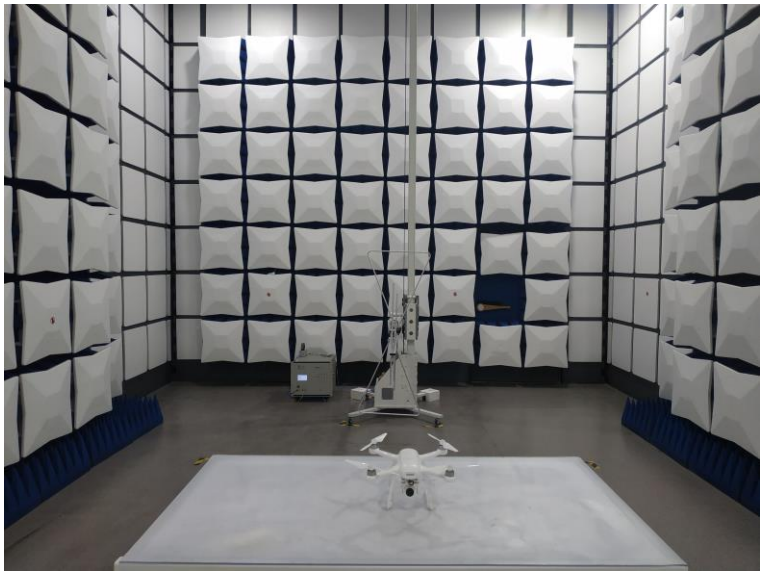
For ANT 1:

Reference Frequency: 802.11ac channel=149 frequency=5745MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
15.2	-30	625	0.109	Within the band of operation	Pass
	-20	719	0.125		
	-10	416	0.072		
	0	328	0.057		
	10	238	0.041		
	20	69	0.012		
	30	111	0.019		
	40	287	0.050		
	50	582	0.101		
17.4	25	638	0.111		
13.70	25	628	0.109		

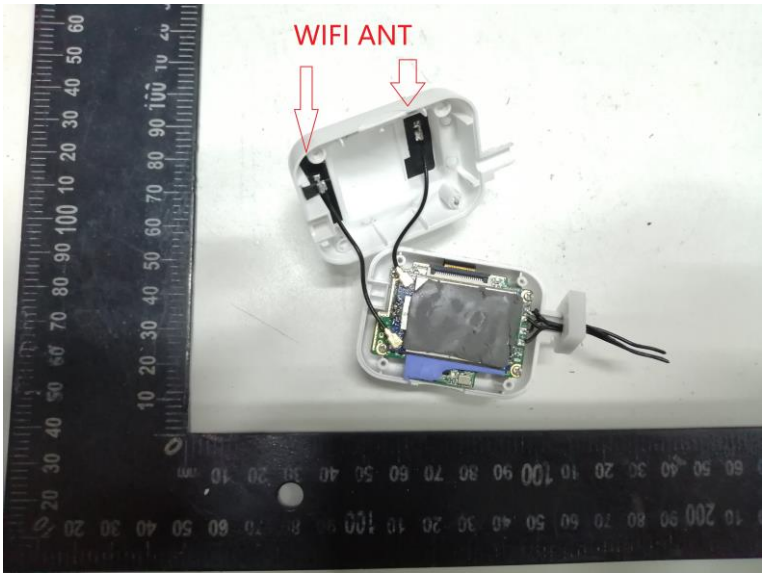
For ANT 2:

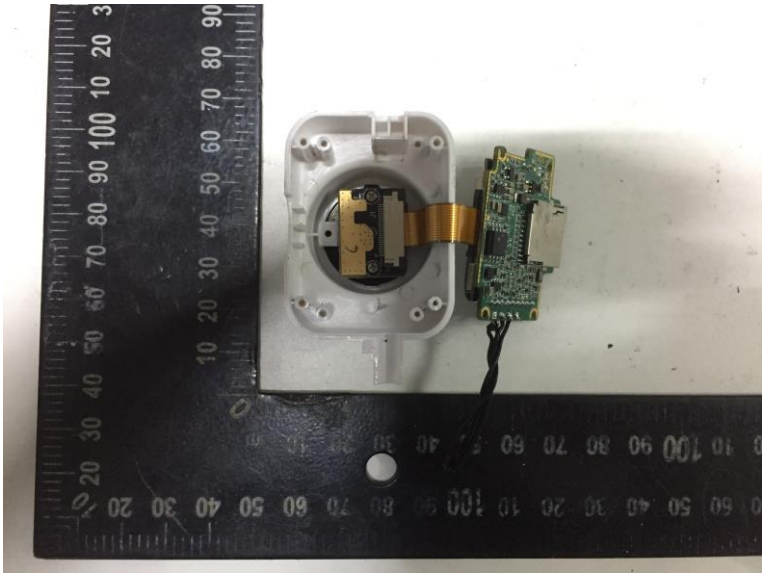
Reference Frequency: 802.11ac channel=149 frequency=5745MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
15.2	-30	586	0.102	Within the band of operation	Pass
	-20	682	0.119		
	-10	538	0.094		
	0	362	0.063		
	10	428	0.074		
	20	268	0.047		
	30	658	0.115		
	40	362	0.063		
	50	475	0.083		
17.4	25	583	0.101		
13.70	25	657	0.114		

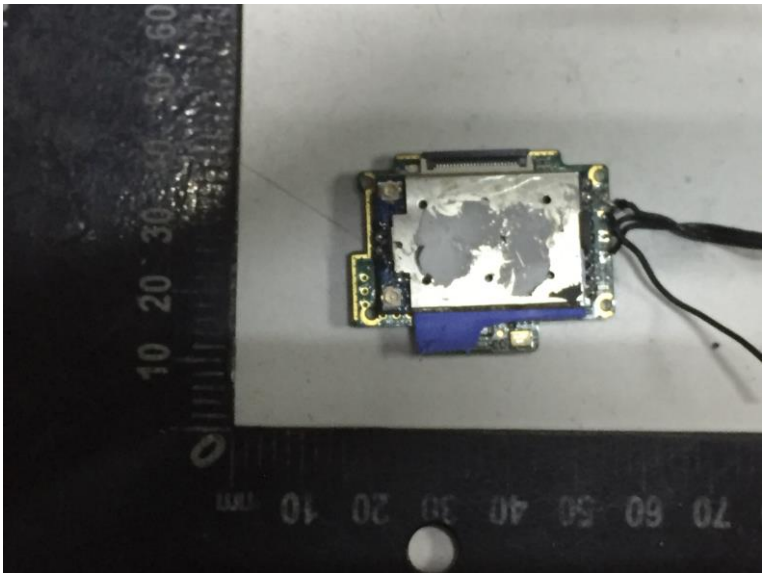
4. Test Setup Photos of the EUT

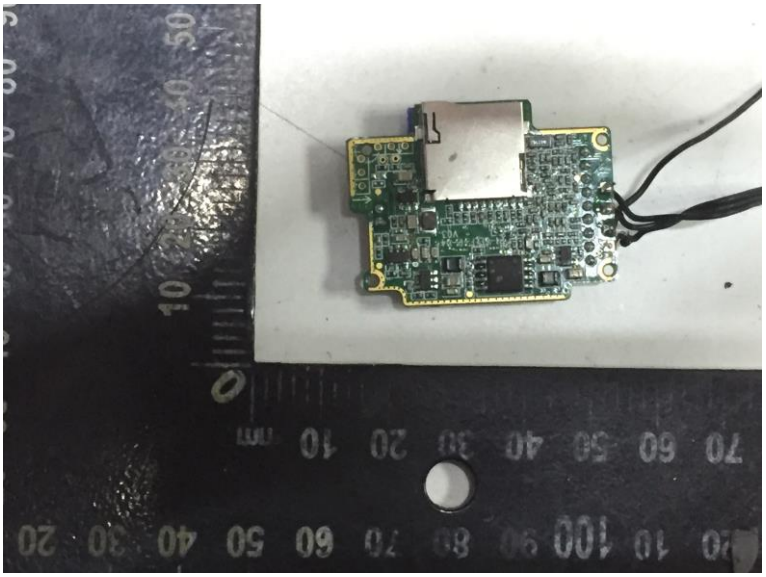


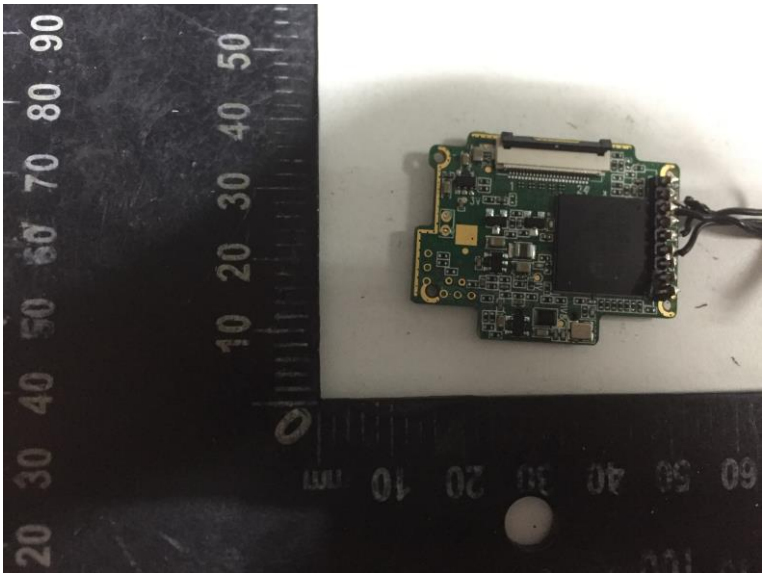
5. Photos of the EUT

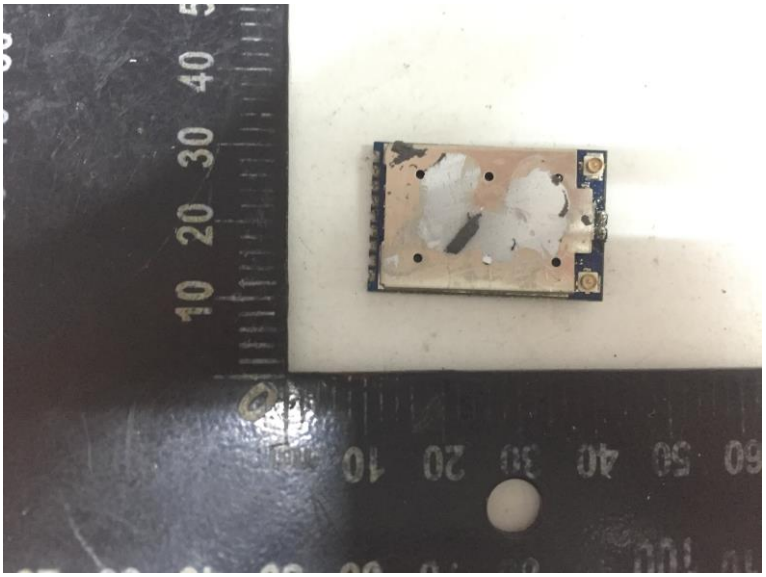

WIFI ANT

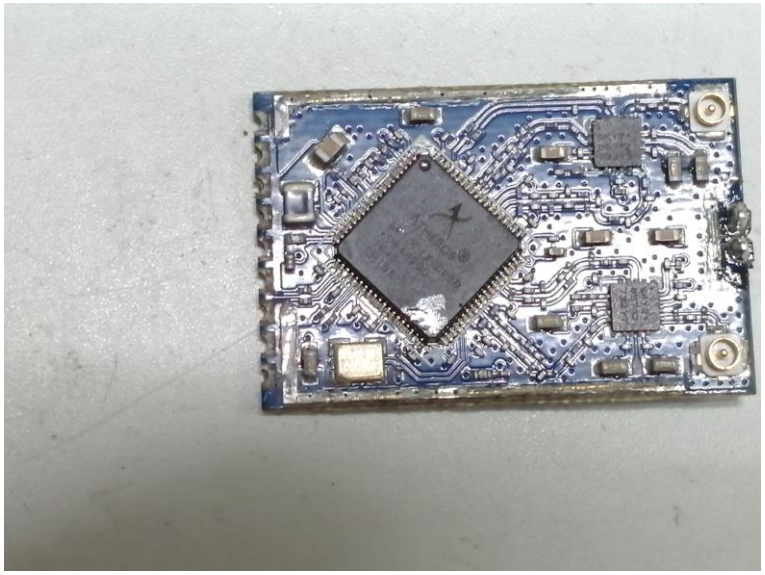


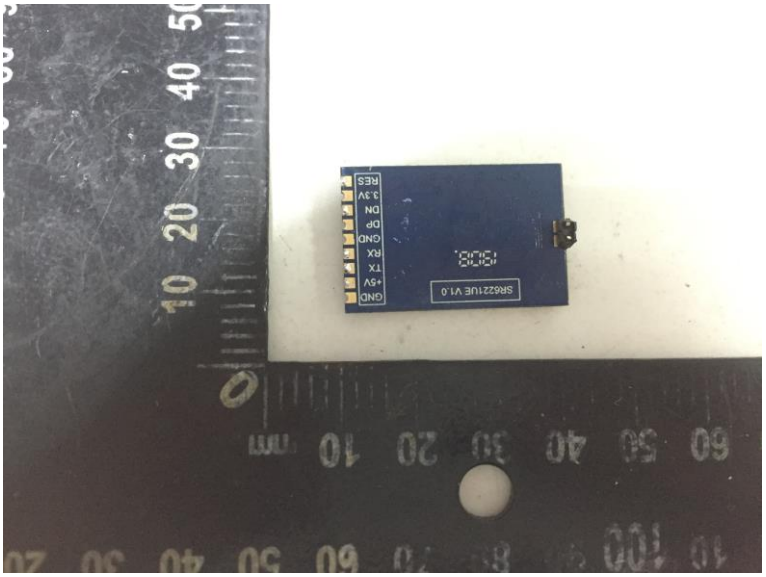


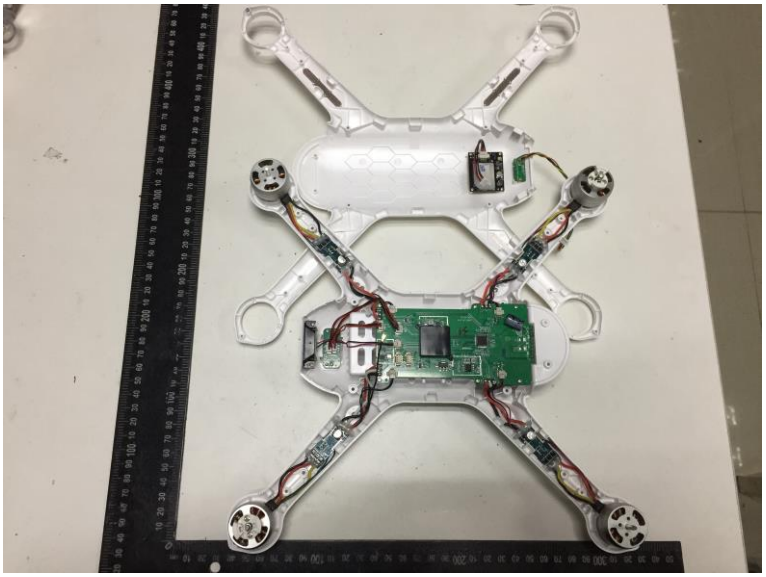


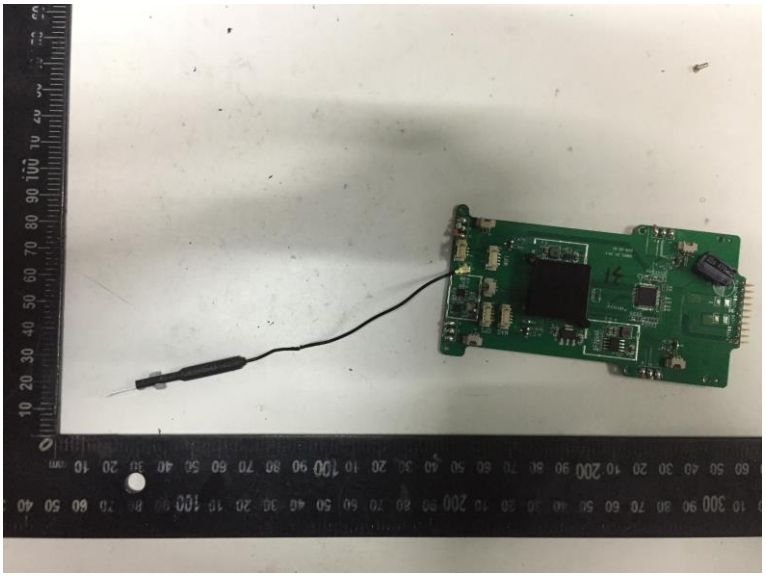


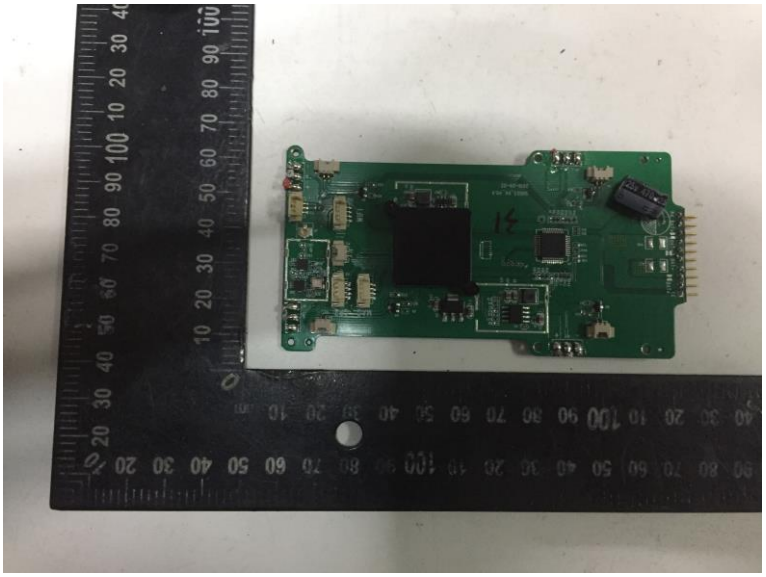


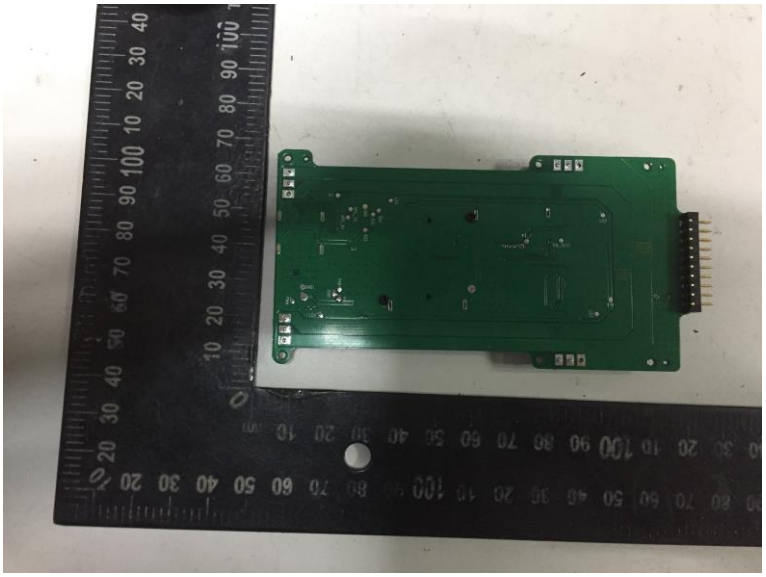


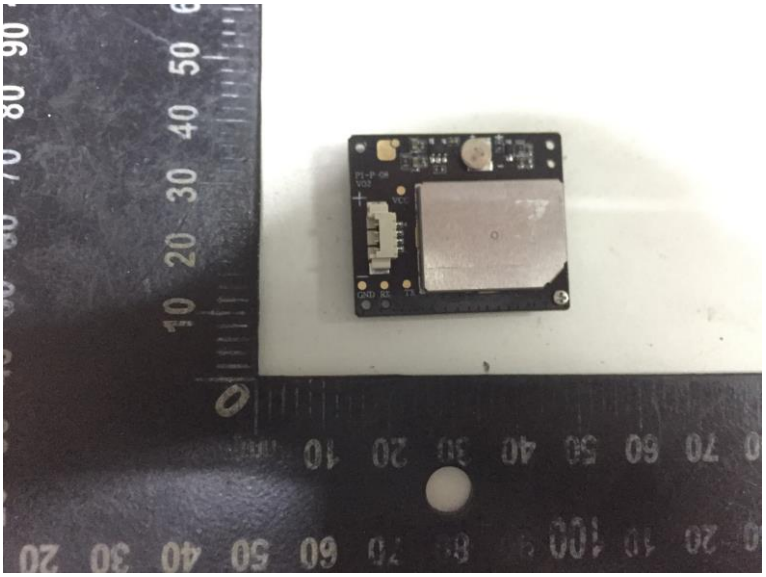

SR622-1UE V1.0
GND
+5V
TX
RX
GND
DP
DN
3.3V
RES

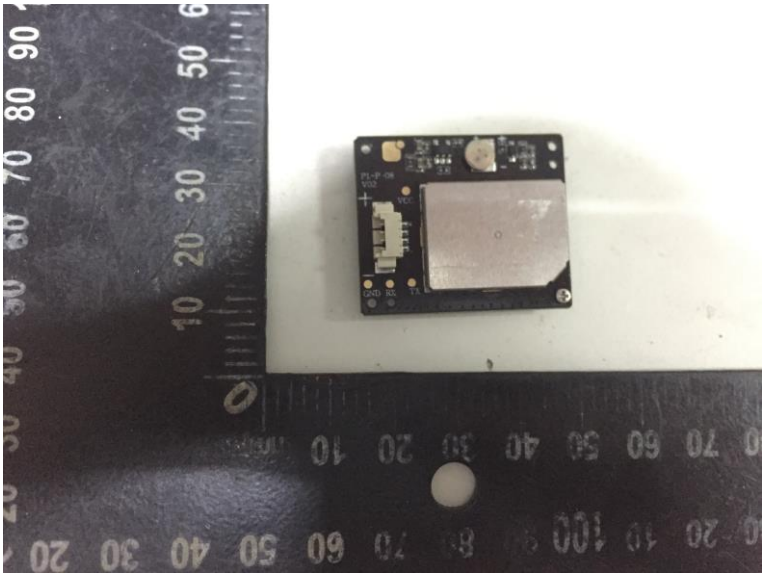


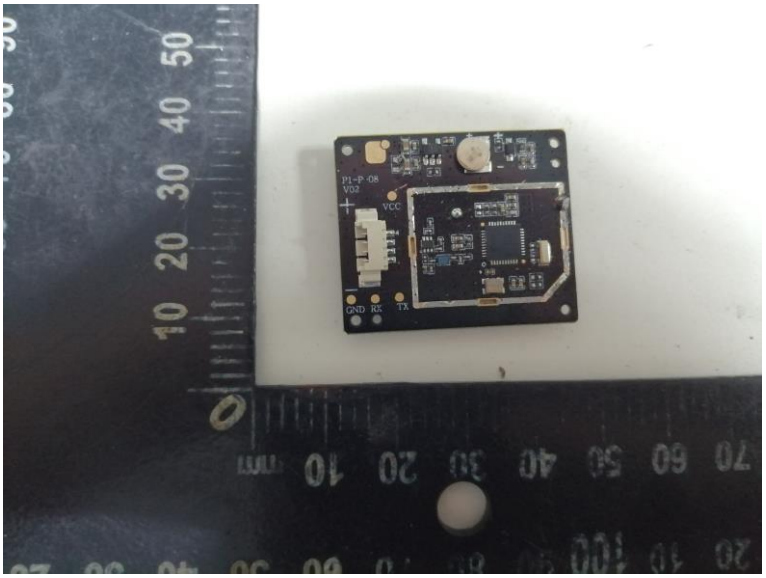


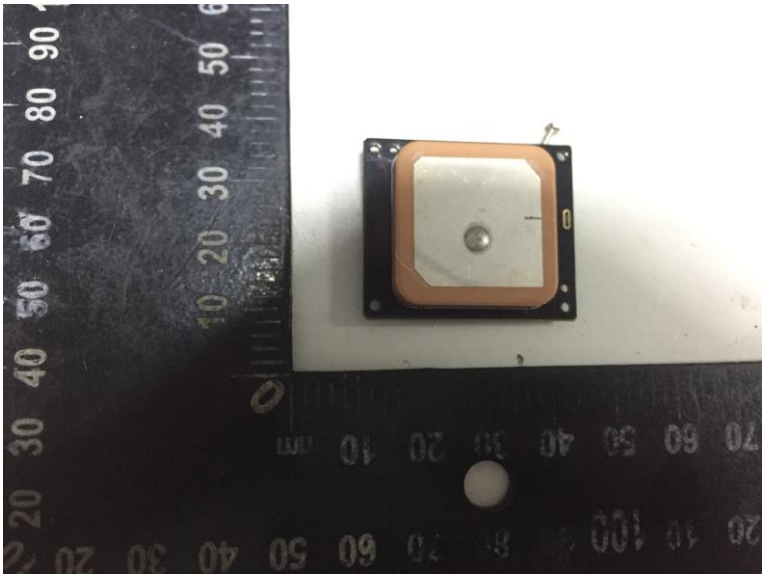







P1-P 08
V02
GND RX TX


P1-P 08
V02
VCC
GND RX TX



************************* End of Report *************************