TEST REPORT

Reference No.	:	WTS18S02102628X1W
FCC ID	:	2AC47-ZBT-WE1326
Applicant	:	SHENZHEN ZHIBOTONG ELECTRONICS CO.,LTD
Address	:	Bldg., A, No.229 Renmin Rd., Yuexingwei Community, Guanlan, Longhua District, Shenzhen, China
Manufaturer	:	The same as above
Address	:	The same as above
Product	:	wireless router
Model(s)	:	ZBT-WE1326, ZBT-WE1026-5G, ZBT-WE3526, ZBT-WE826-Q, ZBT-APG521, ZBT-APG721, ZBT-WE4626, ZBT-APG621,ZBT-WE4726, ZBT-WD223
Standards	:	FCC CFR47 Part 15 C Section 15.407: 2017
Date of Receipt sample	:	2018-02-02
Date of Test	:	2018-02-05 to 2018-03-15
Date of Issue	:	2018-05-07
Test Result	:	**Pass**

Remarks:
The 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.

Prepared By:
Waltek Services (Shenzhen) Co., Ltd.
Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China
Tel :+86-755-83551033
Fax:+86-755-83552400

Compiled by:

Jack Wen

Jack Wen / Test Engineer

Approved by:

Philo Zhong

Philo Zhong / Manager

1 Laboratories Introduction

Waltek Services (Shenzhen) Co., Ltd is a professional third-party testing and certification laboratory with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by ILAC (International Laboratory Accreditation Cooperation) member. A2LA (American Association for Laboratory Accreditation) of USA, Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CEC(California energy efficiency), IC(Industry Canada). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as Intertek(ETL-SEMKO), TÜV Rheinland, TÜV SÜD, etc.

Waltek Services (Shenzhen) Co., Ltd is one of the largest and the most comprehensive third party testing laboratory in China. Our test capability covered four large fields: safety test. ElectroMagnetic Compatibility(EMC), and energy performance, wireless radio. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

1.1 Test Facility

A. Accreditations for Conformity Assessment (International)

Country/Region	Accreditation Body	Scope	Note
USA	**A2LA (Certificate No.: 4243.01)**	FCC ID \ DOC \ VOC	1
Canada		IC ID \ VOC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India	**International Services**	WPC	-
Thailand		NTC	-
Singapore		IDA	-
Note: 1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476. 2. IC Canada Registration No.: 7760A			

B.TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of …	Notify body number
TUV Rheinland	Optional.
Intertek	
TUV SUD	
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

2 Revision History

Test report #	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS18S02102628W	2018-02-02	2018-02-05 to 2018-03-15	2018-03-16	original	-	Replaced
WTS18S02102628X1W	2018-02-02	2018-02-05 to 2018-03-15	2018-05-07	Revised	-	Valid

2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207(a)	PASS
Radiated Emissions	15.407(a) 15.205(a) 15.209(a)	PASS
Duty Cycle	KDB 789033	PASS
6dB Bandwidth	15.407(a)	PASS
26 dB Emission Bandwidth & 99% Occupied Bandwidth	15.407(a)	PASS
Maximum Conducted Output Power	15.407(a)	PASS
Power Spectral Density	15.407(a)	PASS
Restricted bands around fundamental frequency	15.407(a)	PASS
Antenna Requirement	15.203	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

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4 General Information

4.1 General Description of E.U.T

Product:	wireless router
Model(s):	ZBT-WE1326, ZBT-WE1026-5G, ZBT-WE3526, ZBT-WE826-Q, ZBT-APG521, ZBT-APG721, ZBT-WE4626, ZBT-APG621,ZBT-WE4726, ZBT-WD223
Model Description:	Only the model names are different. The model ZBT-WE1326 is the test sample.
Operation Frequency:	IEEE 802.11a/n(HT20): 5725MHz to 5850MHz(20MHz bandwidth only)
Type of modulation:	IEEE for 802.11n : OFDM(BPSK/QPSK/16QAM/64QAM) IEEE for 802.11a : OFDM(BPSK/QPSK/16QAM/64QAM/256QAM)
The Lowest Oscillator:	32.768kHz
Antenna installation:	External antenna with RP-SMA connector
Antenna Gain:	5dBi for ANT1 5dBi for ANT2

4.2 Details of E.U.T

Ratings:	Input: DC 12V

4.3 Channel List

U-NII-3 (5.725-5.85GHz)	
channel	Frequency(MHz)
149	5745
151	5755
153	5765
155	5775
157	5785
159	5795
161	5805
162	5815
163	5825

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

For 802.11a/n(HT20):

channel	Frequency(MHz)
149	5745
157	5785
165	5825

Test Mode Description:

During testing, Channel and 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.

Transmitting duty cycle is no less 98%.

The software is installed in operation system, named “Rosewill Inc”.

Test Items	Mode	Data Rate	Channel	TX/RX
Radiated Emission	802.11n(HT20)	MCS0	U-NII-3 149/155/165	TX
	802.11a	MCS0	U-NII-3 149/155/165	TX
Duty Cycle	802.11n(HT20)	MCS0	U-NII-3 149/155/165	TX
	802.11a	MCS0	U-NII-3 149/155/165	TX
Band Edge	802.11n(HT20)	MCS0	U-NII-3 149/155/165	TX
	802.11a	MCS0	U-NII-3 149/155/165	TX
6dB Bandwidth	802.11n(HT20)	MCS0	U-NII-3 149/155/165	TX
	802.11a	MCS0	U-NII-3 149/155/165	TX
26dB Bandwidth and 99% Occupied Bandwidth	802.11n(HT20)	MCS0	U-NII-3 149/155/165	TX
	802.11a	MCS0	U-NII-3 149/155/165	TX
Conducted Output Power	802.11n(HT20)	MCS0	U-NII-3 149/155/165	TX
	802.11a	MCS0	U-NII-3 149/155/165	TX
Power Spectral Density	802.11n(HT20)	MCS0	U-NII-3 149/155/165	TX
	802.11a	MCS0	U-NII-3 149/155/165	TX
Frequency Stability	Un-modulation	/	U-NII-3 149/155/165	TX

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions Test Site 1#						
Item	**Equipment**	**Manufaturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	R&S	ESCI	100947	2017-09-12	2018-09-11
2.	LISN	R&S	ENV216	101215	2017-09-12	2018-09-11
3.	Cable	Top	TYPE16(3.5M)	-	2017-09-12	2018-09-11
Conducted Emissions Test Site 2#						
Item	**Equipment**	**Manufaturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	R&S	ESCI	101155	2017-09-12	2018-09-11
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2017-09-12	2018-09-11
3.	Limiter	York	MTS-IMP-136	261115-001-0024	2017-09-12	2018-09-11
4.	Cable	LARGE	RF300	-	2017-09-12	2018-09-11
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	**Equipment**	**Manufaturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMC Analyzer	Agilent	E7405A	MY45114943	2017-09-14	2018-09-13
2	Ative Loop Antenna	Beijing Dazhi	ZN30900A	-	2017-10-16	2018-10-15
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2017-04-09	2018-04-08
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2017-09-12	2018-09-11
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2017-04-09	2018-04-08
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2017-09-14	2018-09-13
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2017-04-13	2018-04-12
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	2017-04-13	2018-04-12
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	**Equipment**	**Manufaturer**	**Model No.**	**Serial No**	**Last Calibration Date**	**Calibration Due Date**
1	Test Receiver	R&S	ESCI	101296	2017-04-13	2018-04-12
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2017-04-08	2018-04-07
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	2017-04-13	2018-04-12
4	Cable	HUBER+SUHNER	CBL2	525178	2017-04-13	2018-04-12
RF Conducted Testing						

Item	Equipment	Manufaturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	2017-09-14	2018-09-13
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2017-09-12	2018-09-11
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2017-09-12	2018-09-11

5.2 Description of Support Units

Equipment	Manufaturer	Model No.	Series No.
Apple PC	Apple	A1278	-

5.3 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 10^{-6}
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 5.47 dB (1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (A mains 150KHz~30MHz)

5.4 Test Equipment Calibration

All the test equipments used are valid and calibrated by GUANG ZHOU GRG METROLOGY & TEST CO., LTD. address is No.163, Pingyun Rd. West of Huangpu Ave,Tianhe District, Guangzhou, Guangdong, China.

6 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.10:2013
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dBμV between 0.15MHz & 0.5MHz
	56 dBμV between 0.5MHz & 5MHz
	60 dBμV between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

6.1 E.U.T. Operation

Operating Environment **:**

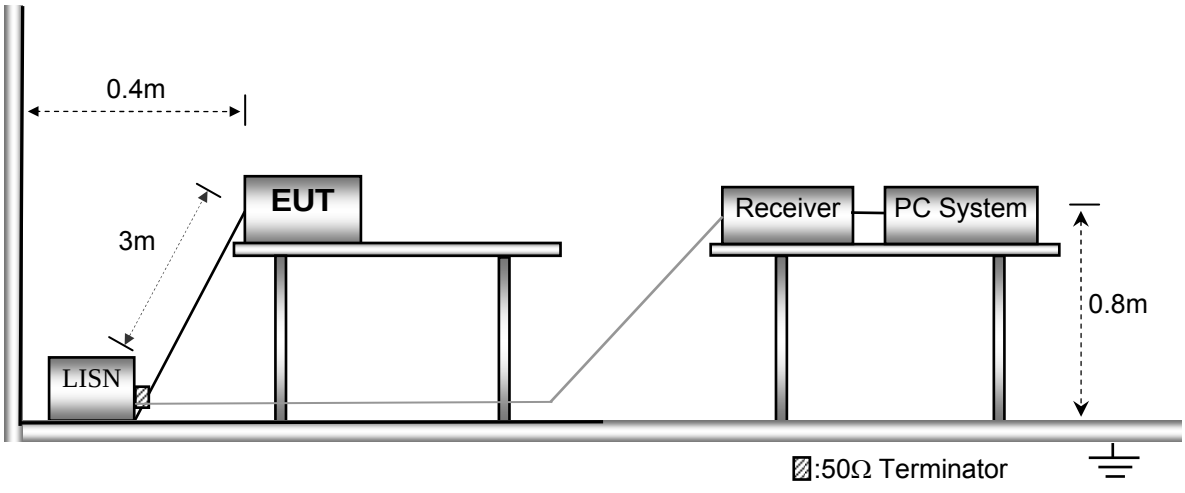
Temperature:	21.5 °C
Humidity:	51.9 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation **:**

The test was performed in transmitting mode, the test data were shown in the report.

6.2 EUT Setup

The conducted emission tests were performed using the setup acordance with the ANSI C63.10:2013.



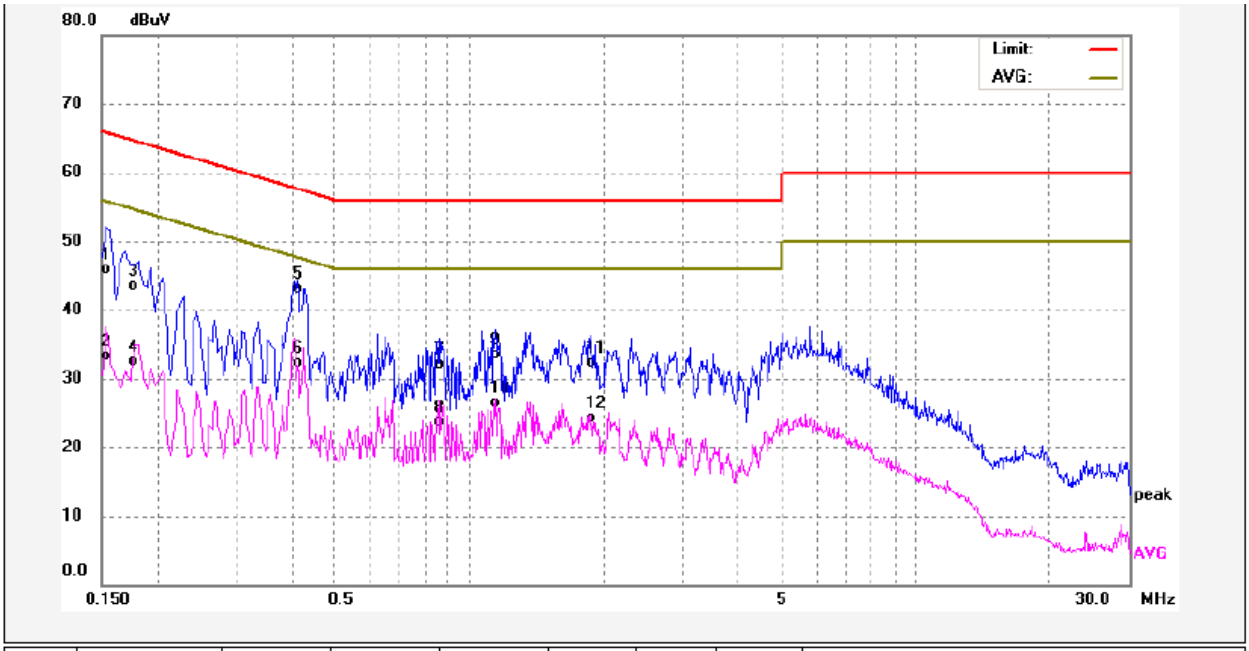
6.3 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.4 Conducted Emission Test Result

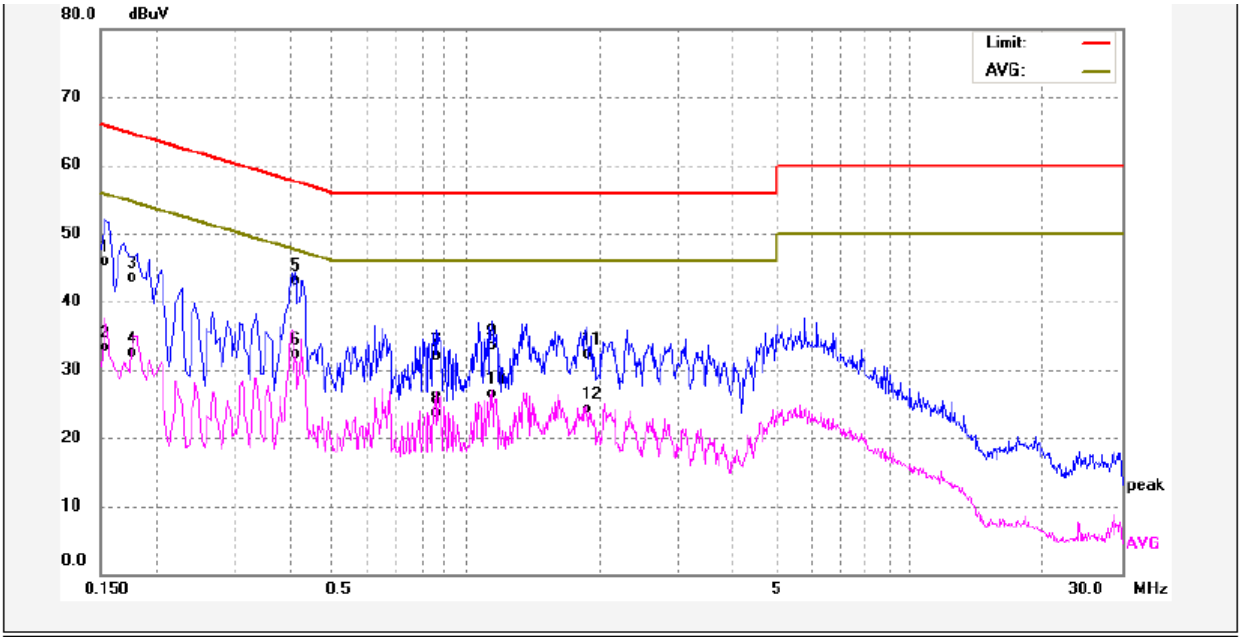
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	35.95	10.02	45.97	65.78	-19.81	QP	
2	0.1539	23.27	10.02	33.29	55.78	-22.49	AVG	
3	0.1779	33.66	9.87	43.53	64.58	-21.05	QP	
4	0.1779	22.69	9.87	32.56	54.58	-22.02	AVG	
5	0.4140	33.05	10.04	43.09	57.57	-14.48	QP	
6	0.4140	22.36	10.04	32.40	47.57	-15.17	AVG	
7	0.8540	22.12	10.07	32.19	56.00	-23.81	QP	
8	0.8540	13.65	10.07	23.72	46.00	-22.28	AVG	
9	1.1420	23.24	10.32	33.56	56.00	-22.44	QP	
10	1.1420	16.17	10.32	26.49	46.00	-19.51	AVG	
11	1.8620	22.09	10.19	32.28	56.00	-23.72	QP	
12	1.8620	14.02	10.19	24.21	46.00	-21.79	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	35.95	10.02	45.97	65.78	-19.81	QP	
2	0.1539	23.27	10.02	33.29	55.78	-22.49	AVG	
3	0.1779	33.66	9.87	43.53	64.58	-21.05	QP	
4	0.1779	22.69	9.87	32.56	54.58	-22.02	AVG	
5	0.4140	33.05	10.04	43.09	57.57	-14.48	QP	
6	0.4140	22.36	10.04	32.40	47.57	-15.17	AVG	
7	0.8540	22.12	10.07	32.19	56.00	-23.81	QP	
8	0.8540	13.65	10.07	23.72	46.00	-22.28	AVG	
9	1.1420	23.24	10.32	33.56	56.00	-22.44	QP	
10	1.1420	16.17	10.32	26.49	46.00	-19.51	AVG	
11	1.8620	22.09	10.19	32.28	56.00	-23.72	QP	
12	1.8620	14.02	10.19	24.21	46.00	-21.79	AVG	

7 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.407

Test Method: ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Distance	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

7.1 EUT Operation

Operating Environment **:**

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

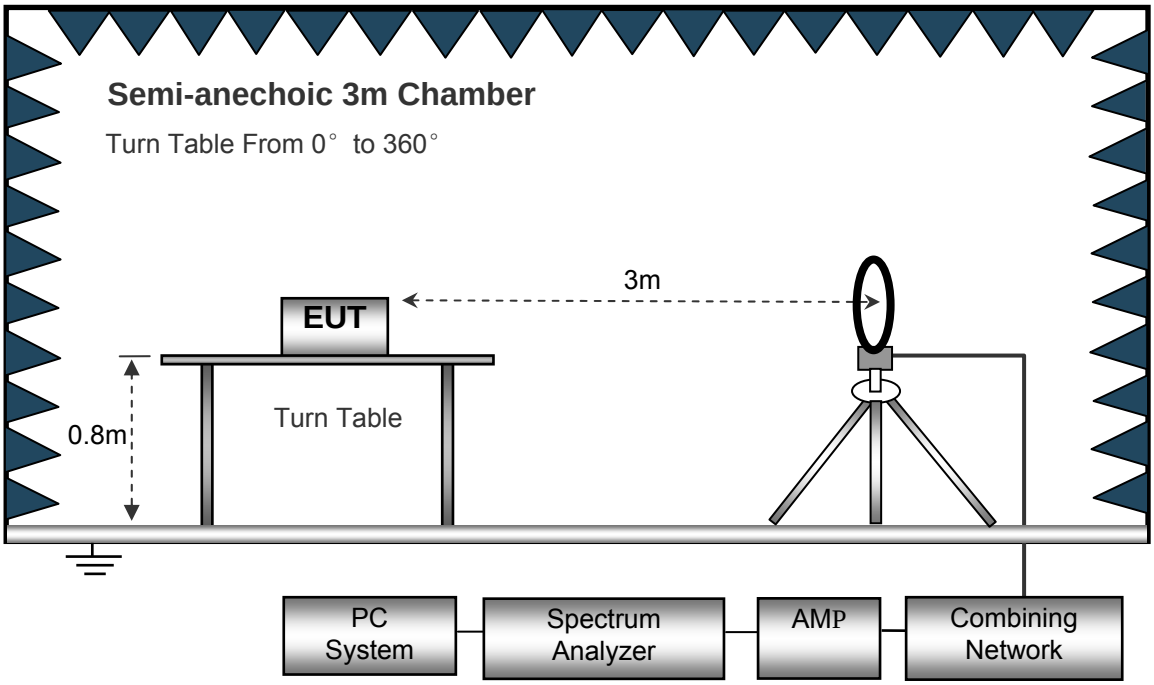
EUT Operation **:**

The test was performed in transmitting mode, the test data were shown in the report.

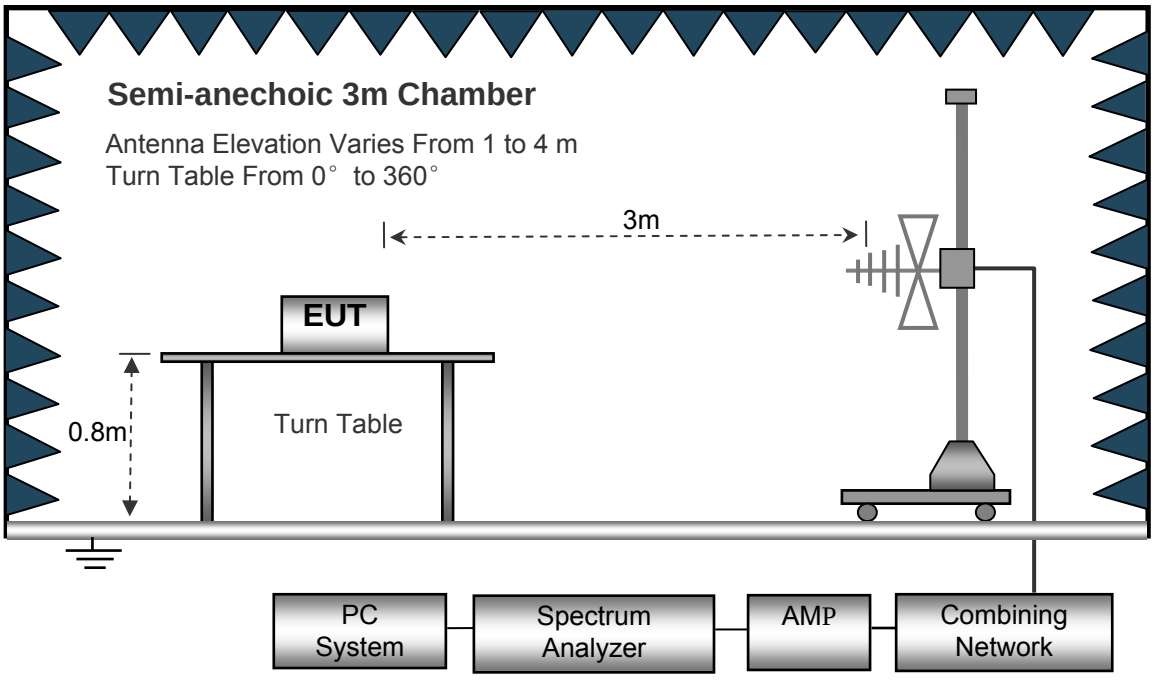
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup acordance with the ANSI C63.10: 2013.

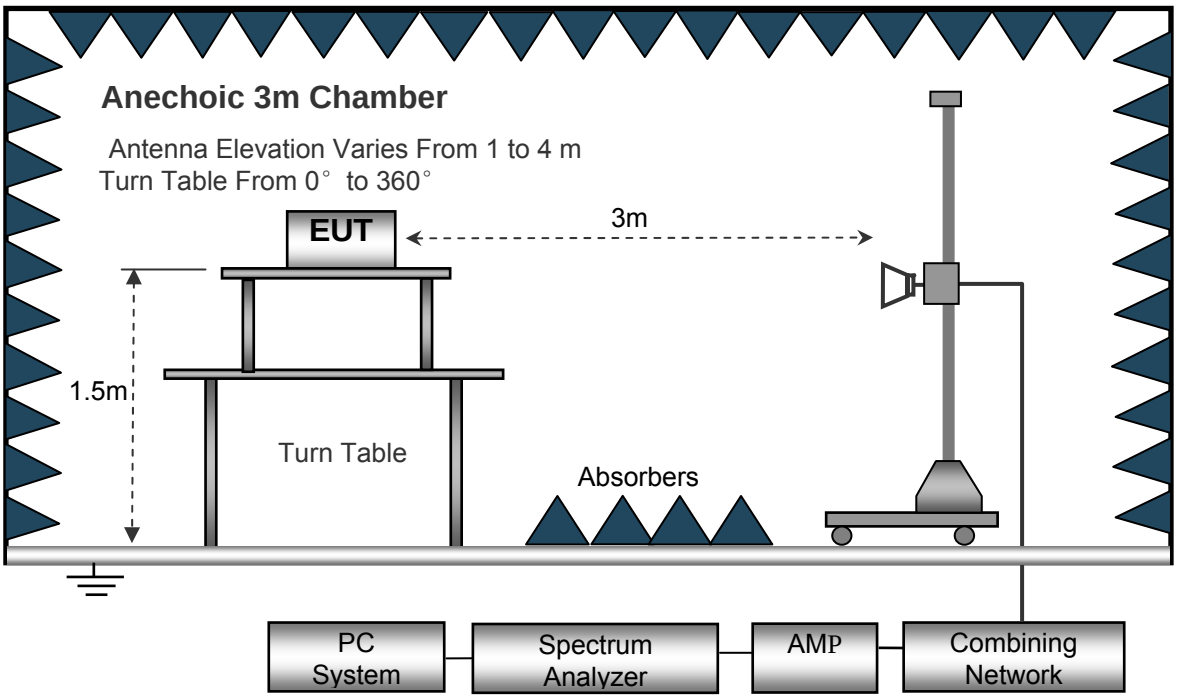
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed ..... Auto
IF Bandwidth..... 10kHz
Video Bandwidth..... 10kHz
Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz
Detector ..... Ave.
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 10Hz

7.4 Test Procedure

1. The EUT is plaed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, eah emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in X axis,so the worst data were shown as follow.
8. A 2.4GHz high –pass filter is used druing radiated emissions above 1GHz measurement.

7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Fator and Cable Fator, and subtrating the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Fator + Cable Fator - Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

7.6 Summary of Test Results

FCC Part15.33: For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph: If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Test Frequency: 9kHz ~ 30MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency : 30MHz ~ 18GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Correcte d Fator	Corrected Amplitud e	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
802.11n(HT20) U-NII-3 low Channel 5745MHz									
226.93	45.22	QP	67	1.3	H	-11.10	34.12	46	-11.88
226.93	45.28	QP	185	1.8	V	-11.10	34.18	46	-11.82
4513.27	43.69	PK	300	1.3	H	-1.60	42.09	74	-31.91
4513.27	42.46	Ave	251	1.5	H	-1.60	40.86	54	-13.14
5138.48	43.10	PK	179	1.4	H	-0.83	42.28	74	-31.72
5138.48	43.48	Ave	149	1.5	H	-0.83	42.65	54	-11.35
11490.00	40.83	PK	333	1.9	H	6.01	46.84	74	-27.16
11490.00	22.48	Ave	67	1.1	H	6.01	28.49	54	-25.51
17235.00	39.90	PK	9	1.3	H	10.98	50.88	74	-23.12
17235.00	31.48	Ave	178	1.4	H	10.98	42.46	54	-11.54
802.11n(HT20) U-NII-3 middle channel 5785MHz									
226.61	45.27	QP	194	1.1	H	-11.24	34.03	46	-11.97
226.61	45.25	QP	325	1.3	V	-11.24	34.01	46	-11.99
4512.76	44.45	PK	181	1.8	H	-1.55	42.90	74	-31.10
4512.76	43.10	Ave	250	1.7	H	-1.55	41.54	54	-12.46
5138.87	43.11	PK	211	1.8	H	-0.96	42.15	74	-31.85
5138.87	42.70	Ave	54	1.6	H	-0.96	41.75	54	-12.25
11570.00	41.11	PK	138	1.7	H	4.25	45.36	74	-28.64
11570.00	22.99	Ave	11	1.4	H	4.25	27.24	54	-26.76
17355.00	39.74	PK	186	1.1	H	11.24	50.98	74	-23.02
17355.00	31.97	Ave	62	1.1	H	11.24	43.21	54	-10.79

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Fator	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
802.11n(HT20) U-NII-3 High channel 5825MHz									
227.16	45.47	QP	309	1.6	H	-11.18	34.29	46	-11.71
227.16	44.63	QP	74	1.5	V	-11.18	33.45	46	-12.55
4512.97	43.93	PK	339	1.2	H	-1.77	42.16	74	-31.84
4512.97	43.04	Ave	286	2.0	H	-1.77	41.27	54	-12.73
5138.94	42.88	PK	288	2.0	H	-0.93	41.96	74	-32.04
5138.94	43.17	Ave	86	1.8	H	-0.93	42.25	54	-11.75
11650.00	41.04	PK	23	1.8	H	5.47	46.51	74	-27.49
11650.00	23.14	Ave	155	1.5	H	5.47	28.61	54	-25.39
17475.00	40.02	PK	224	1.6	H	12.36	52.38	74	-21.62
17475.00	31.84	Ave	257	1.7	H	12.36	44.20	54	-9.80

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Fator	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
802.11a U-NII-3 low Channel 5745MHz									
226.95	45.62	QP	285	1.6	H	-10.99	34.63	46	-11.37
226.95	44.59	QP	53	1.2	V	-10.99	33.60	46	-12.40
4512.65	44.52	PK	261	1.5	H	-1.51	43.01	74	-30.99
4512.65	43.22	Ave	331	1.7	H	-1.51	41.71	54	-12.29
5138.07	42.85	PK	6	1.4	H	-0.95	41.90	74	-32.10
5138.07	42.69	Ave	171	1.1	H	-0.95	41.75	54	-12.25
11490.00	40.78	PK	157	1.8	H	6.01	46.79	74	-27.21
11490.00	22.49	Ave	227	1.5	H	6.01	28.50	54	-25.50
17235.00	40.32	PK	16	1.7	H	10.98	51.30	74	-22.70
17235.00	32.28	Ave	233	1.4	H	10.98	43.26	54	-10.74
802.11a U-NII-3 low Channel 5785MHz									
227.06	45.93	QP	25	1.8	H	-11.25	34.68	46	-11.32
227.06	44.80	QP	50	1.9	V	-11.25	33.54	46	-12.46
4513.40	44.34	PK	345	1.7	H	-1.73	42.61	74	-31.39
4513.40	43.27	Ave	148	1.2	H	-1.73	41.54	54	-12.46
5138.74	42.65	PK	104	1.1	H	-0.99	41.66	74	-32.34
5138.74	43.04	Ave	161	1.3	H	-0.99	42.05	54	-11.95
11570.00	40.19	PK	344	1.2	H	4.25	44.44	74	-29.56
11570.00	22.47	Ave	257	1.9	H	4.25	26.72	54	-27.28
17355.00	40.04	PK	326	1.6	H	11.24	51.28	74	-22.72
17355.00	31.87	Ave	328	1.3	H	11.24	43.11	54	-10.89

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Fator	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
802.11a U-NII-3 low Channel 5825MHz									
226.87	45.87	QP	104	1.1	H	-11.25	34.62	46	-11.38
226.87	45.07	QP	272	1.6	V	-11.25	33.82	46	-12.18
4513.16	43.99	PK	56	1.4	H	-1.59	42.39	74	-31.61
4513.16	42.38	Ave	287	1.0	H	-1.59	40.79	54	-13.21
5138.32	42.91	PK	87	1.5	H	-0.81	42.10	74	-31.90
5138.32	43.17	Ave	305	1.3	H	-0.81	42.37	54	-11.63
11650.00	40.88	PK	77	2.0	H	5.47	46.35	74	-27.65
11650.00	22.45	Ave	49	1.7	H	5.47	27.92	54	-26.08
17475.00	39.57	PK	93	1.1	H	12.36	51.93	74	-22.07
17475.00	31.52	Ave	28	1.3	H	12.36	43.88	54	-10.12

Test Frequency: 18GHz~40GHz

The measurements were more than 20 dB below the limit and not recorded.

8 Duty cycle

Test Requirement:	47 CFR Part 15C 15.407 and 789033 D02 General UNII Test Procedures New Rules v02r01, Section (B)
Test Method:	ANSI C63.10: 2013
Test Limit:	N/A
Test Result:	PASS
Remark:	Through Pre-scan, and found 802.11a at lowest channel is the worst case. Only the worst case is recorded in the report.

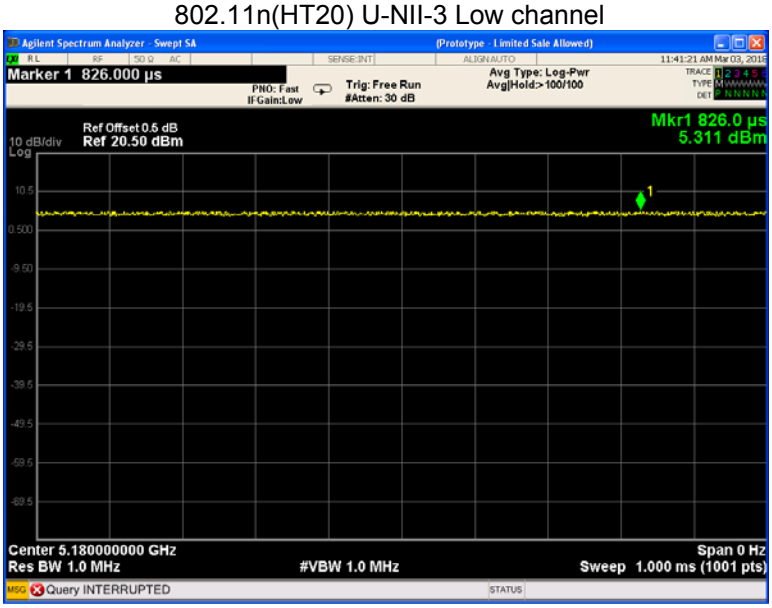
8.1 Summary of Test Results

For ANT1:

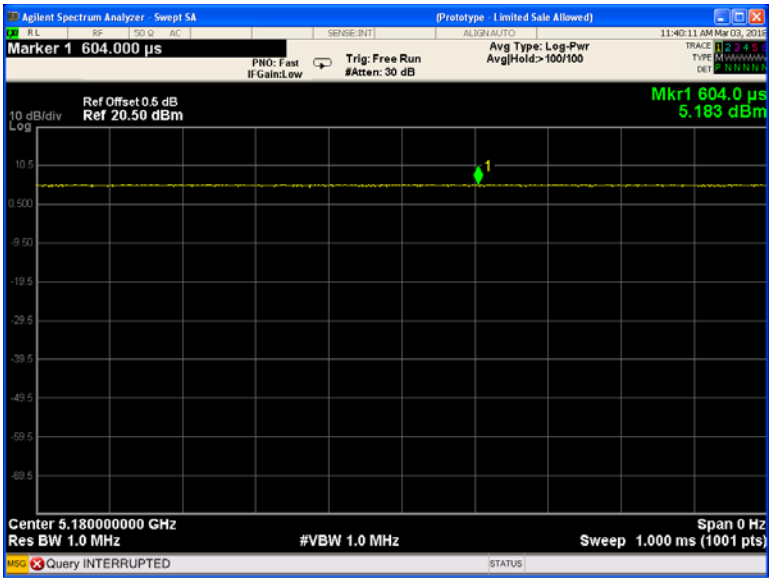
802.11n(HT20) mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
149	100	100	100
802.11a mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
149	100	100	100

Test result plots shown as follows:

802.11n(HT20) U-NII-3 Low channel



802.11a U-NII-3 Low channel

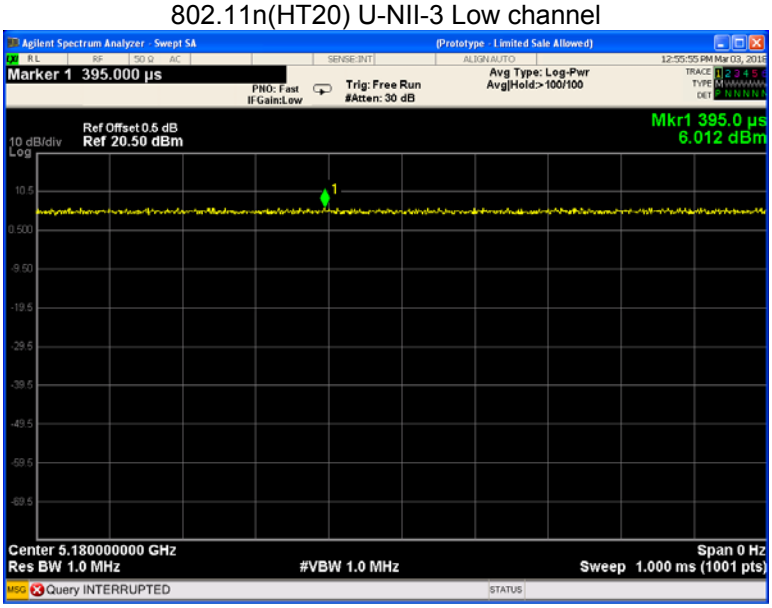


For ANT2:

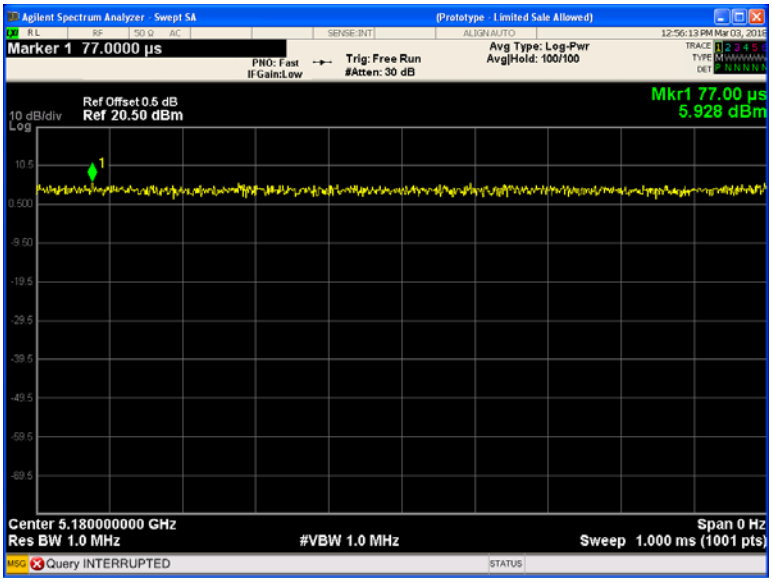
802.11n(HT20) mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
149	100	100	100
802.11a mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
149	100	100	100

Test result plots shown as follows:

802.11n(HT20) U-NII-3 Low channel



802.11a U-NII-3 Low channel



9 Band Edge

Test Requirement:	FCC CFR47 Part 15 Section 15.407
Test Method:	ANSI C63.10 2013
Test Limit:	For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.
Test Result:	PASS

9.1 Test Produce

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 to 1MHz and VBW of spectrum analyzer to 3MHz with a convenient frequency span including 100 kHz bandwidth from band edge.
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.

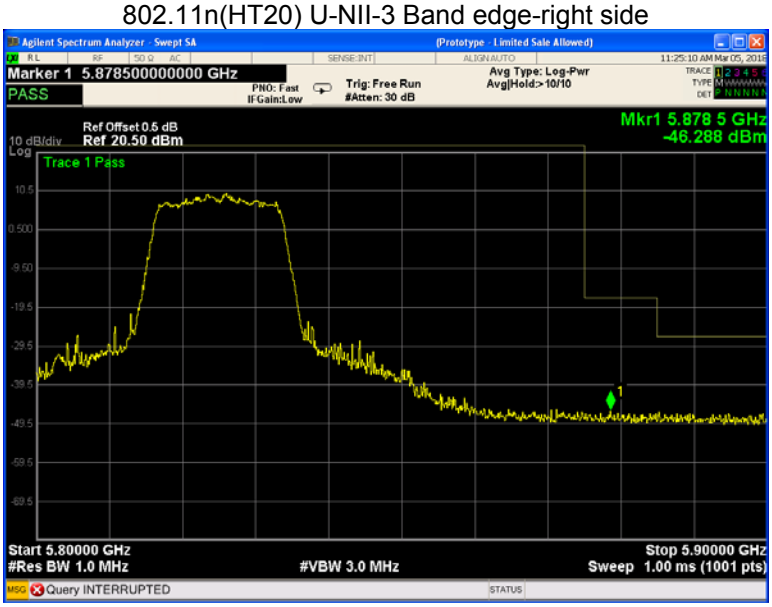
9.2 Test Result

For ANT1:

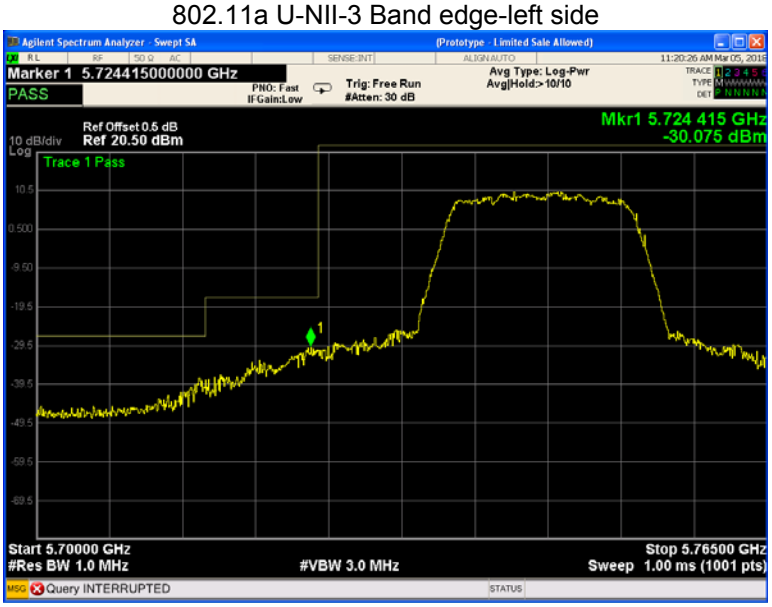
Test result plots shown as follows:

802.11n(HT20) U-NII-3 Band edge-left side

802.11n(HT20) U-NII-3 Band edge-right side



802.11a U-NII-3 Band edge-left side

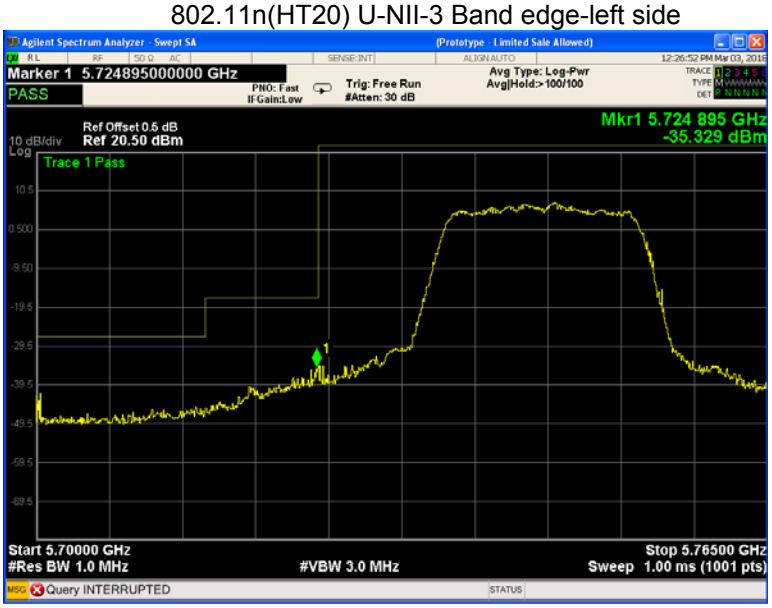


802.11a U-NII-3 Band edge-right side

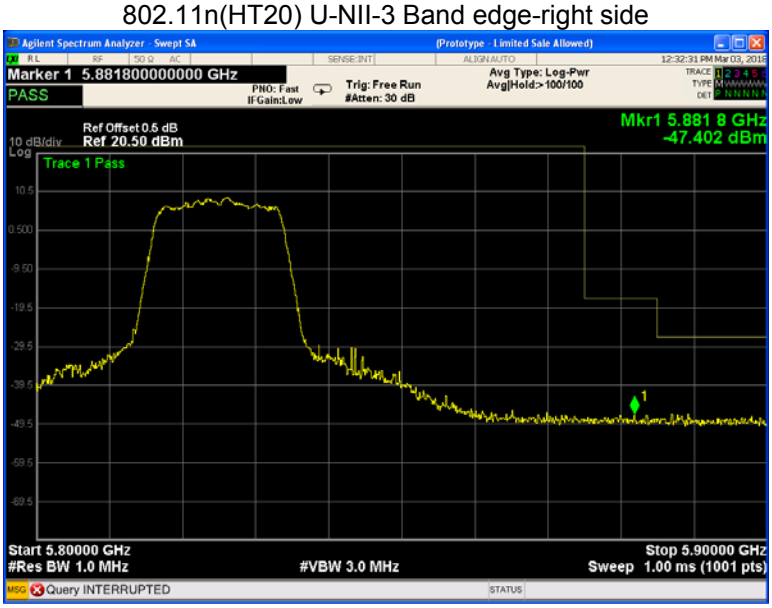
For ANT2:

Test result plots shown as follows:

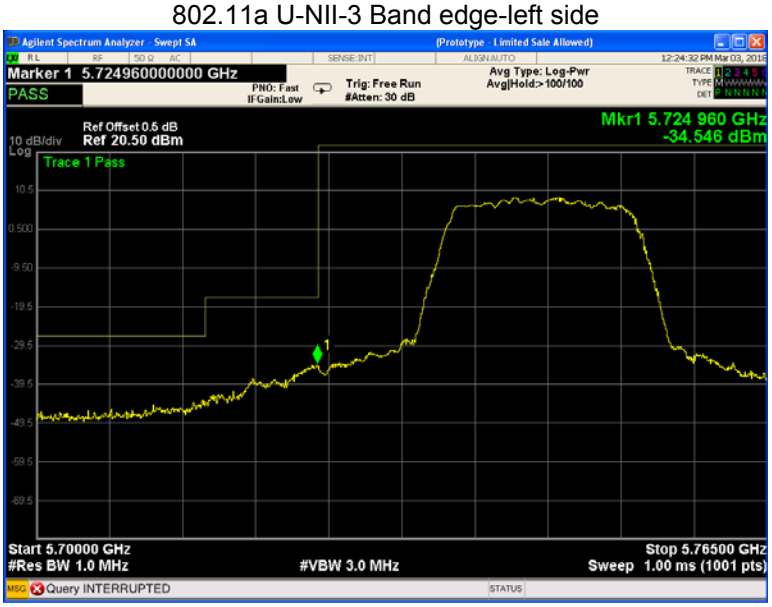
802.11n(HT20) U-NII-3 Band edge-left side



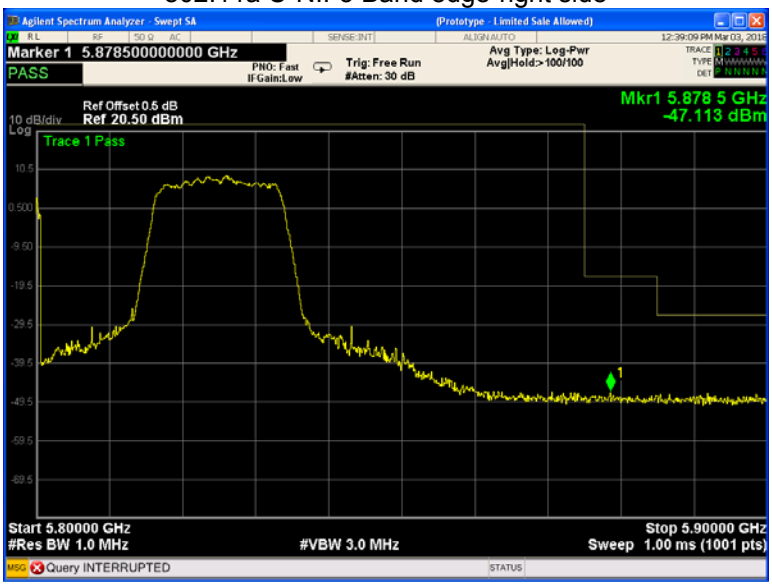
802.11n(HT20) U-NII-3 Band edge-right side



802.11a U-NII-3 Band edge-left side



802.11a U-NII-3 Band edge-right side



10 6 dB Bandwidth

Test Requirement:	FCC CFR47 Part 15 Section 15.407(e)
Test Method:	KDB662911 D01 Multiple Transmitter Output v02r01 KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C
Test Limit:	≥ 500 kHz
Test Result:	PASS

10.1 Test Procedure:

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

2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

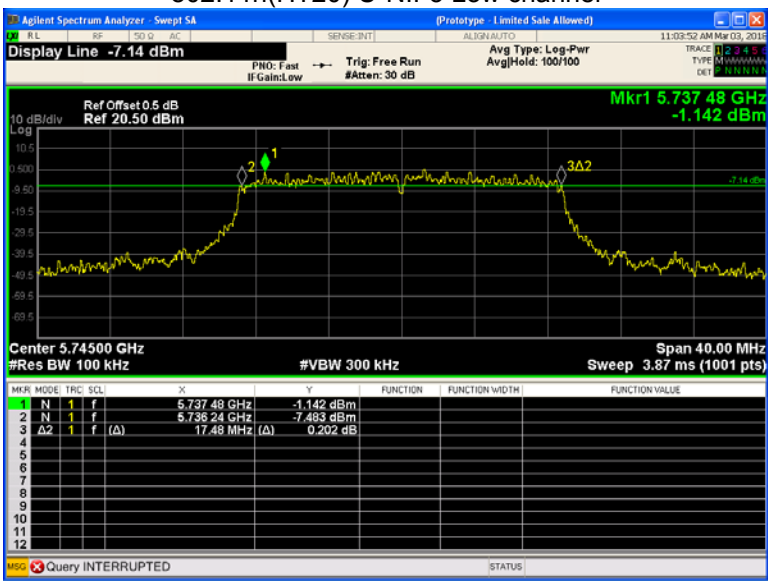
10.2 Test Result:

For ANT1:

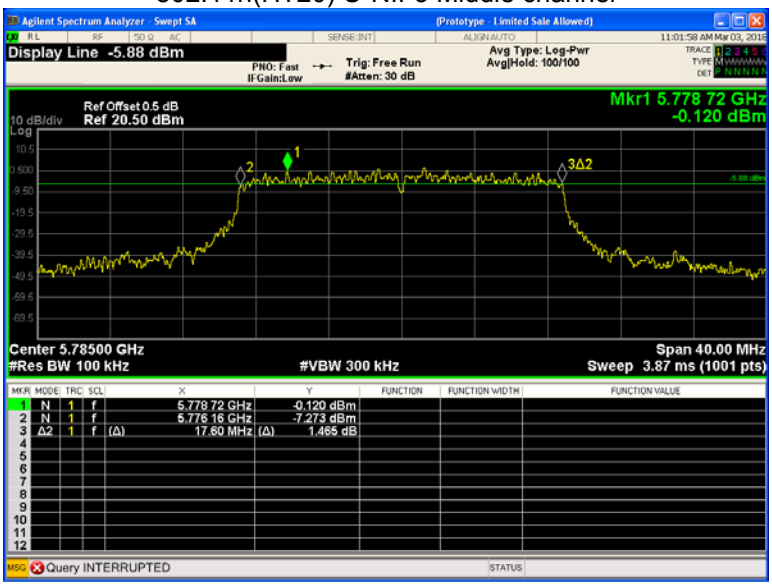
Band	Operation mode	6 dB Bandwidth (MHz)		
		Low	Middle	High
U-NII-3	802.11n(HT20)	17.48	17.60	17.48
	802.11a	16.28	16.28	16.24

Test result plots shown as follows:

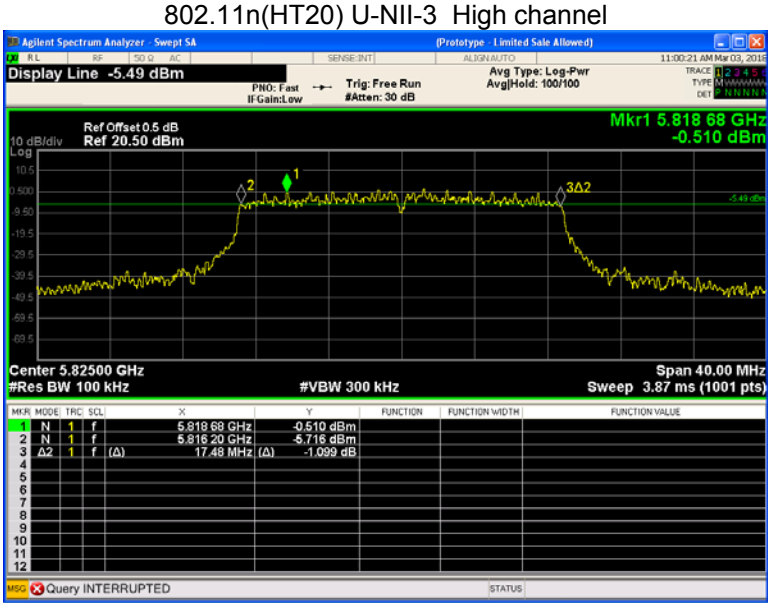
802.11n(HT20) U-NII-3 Low channel



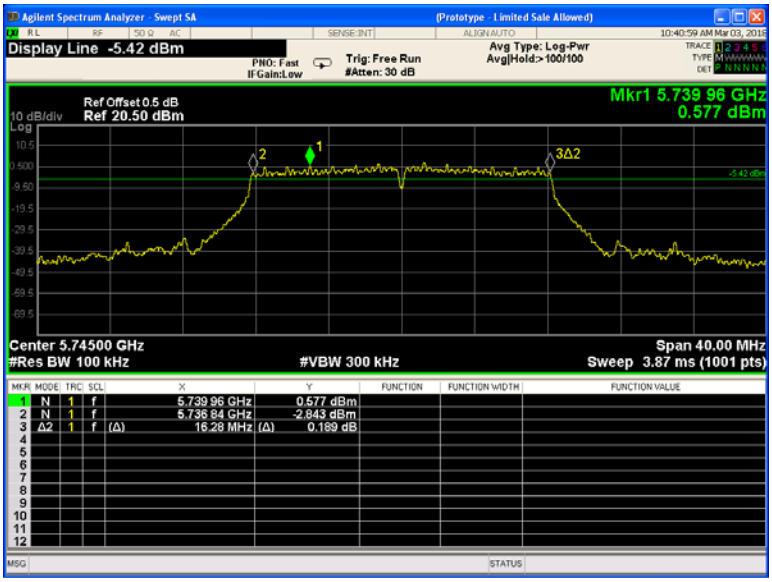
802.11n(HT20) U-NII-3 Middle channel



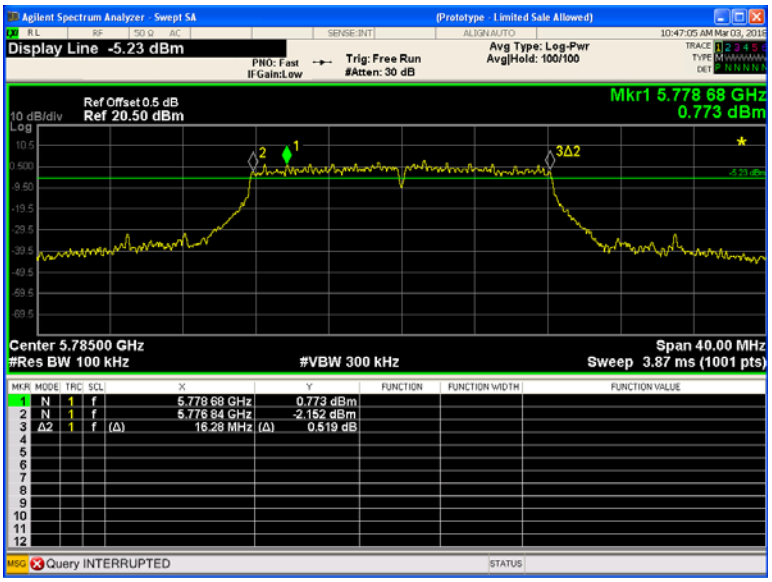
802.11n(HT20) U-NII-3 High channel



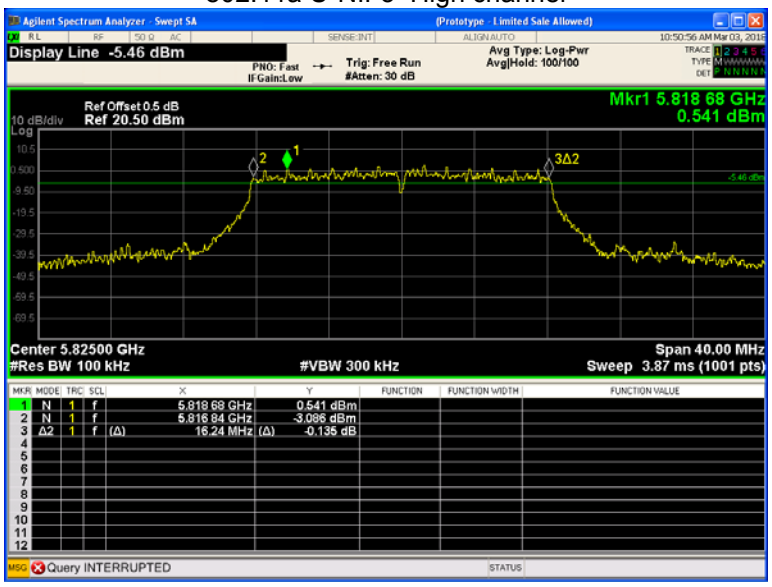
802.11a U-NII-3 Low channel



802.11a U-NII-3 Middle channel



802.11a U-NII-3 High channel

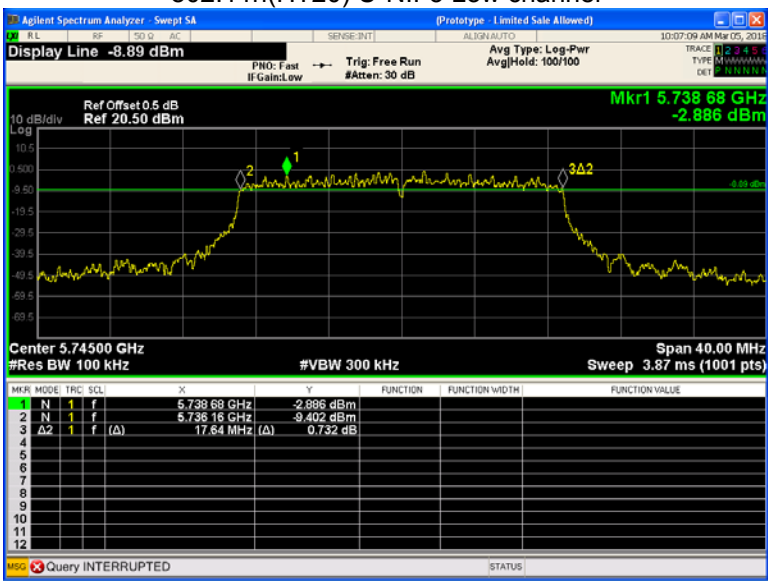


For ANT2:

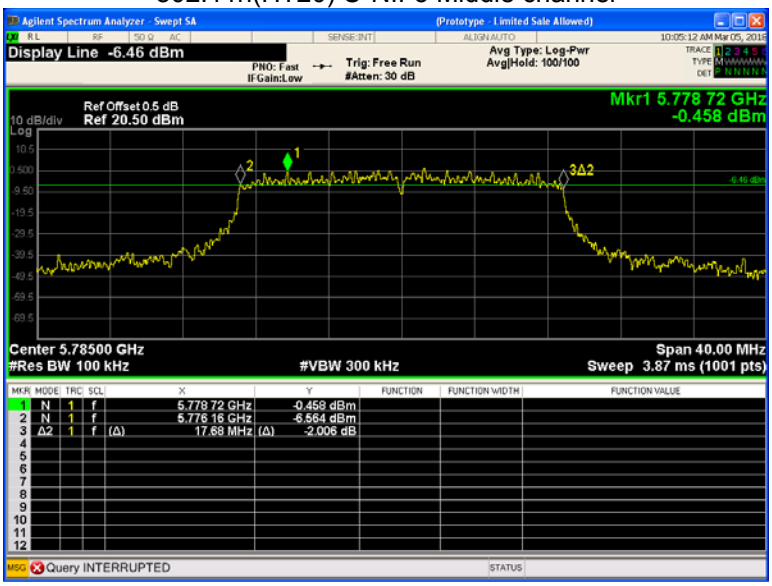
Band	Operation mode	6 dB Bandwidth (MHz)		
		Low	Middle	High
U-NII-3	802.11n(HT20)	17.64	17.68	17.52
	802.11a	16.32	16.28	16.36

Test result plots shown as follows:

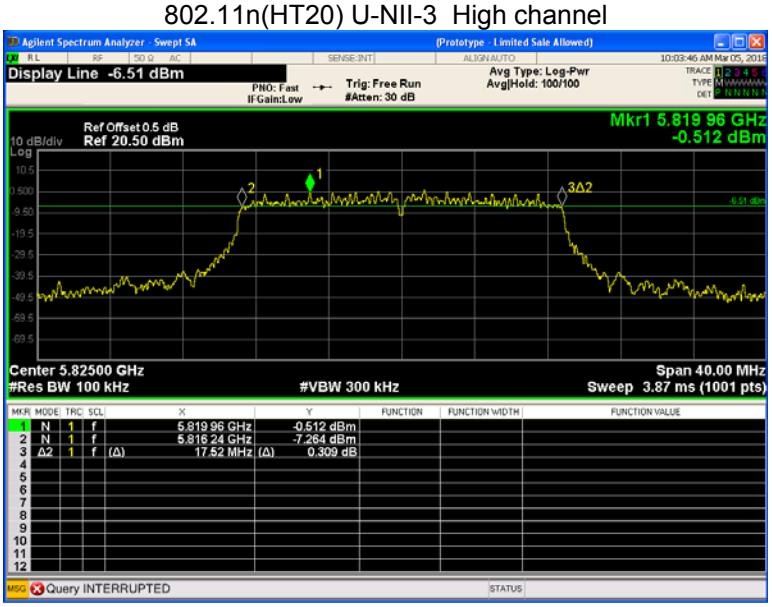
802.11n(HT20) U-NII-3 Low channel



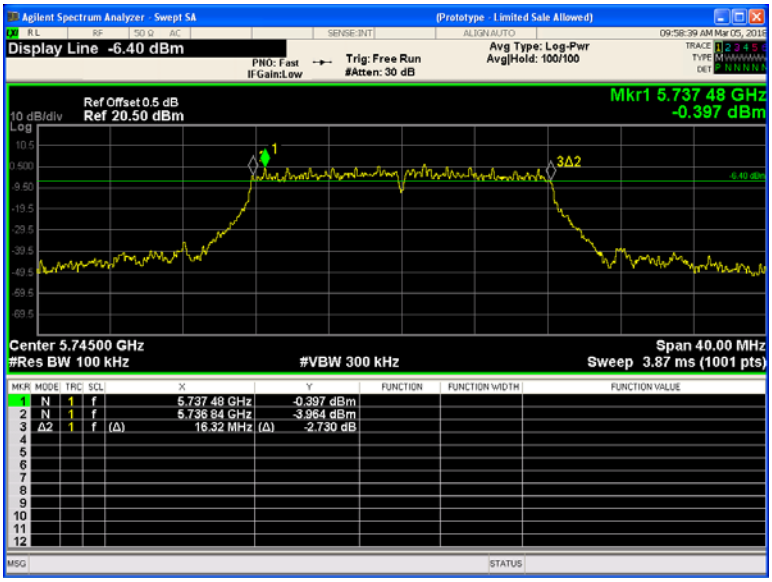
802.11n(HT20) U-NII-3 Middle channel



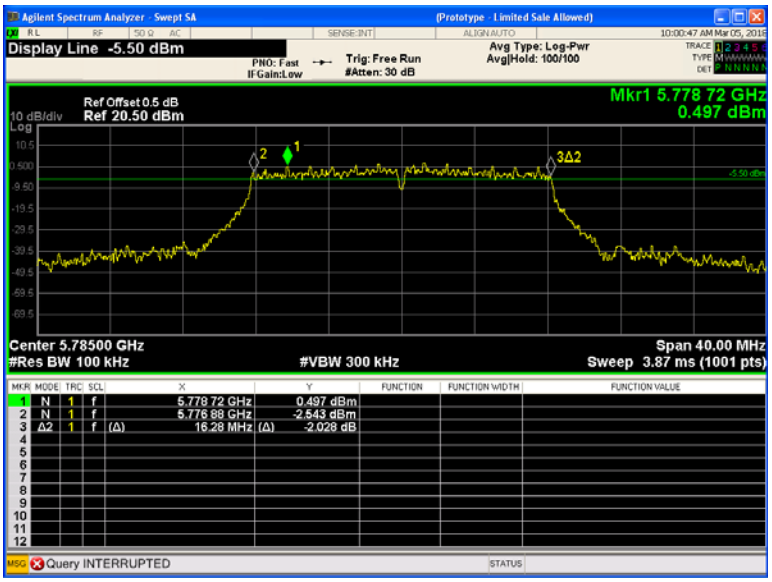
802.11n(HT20) U-NII-3 High channel



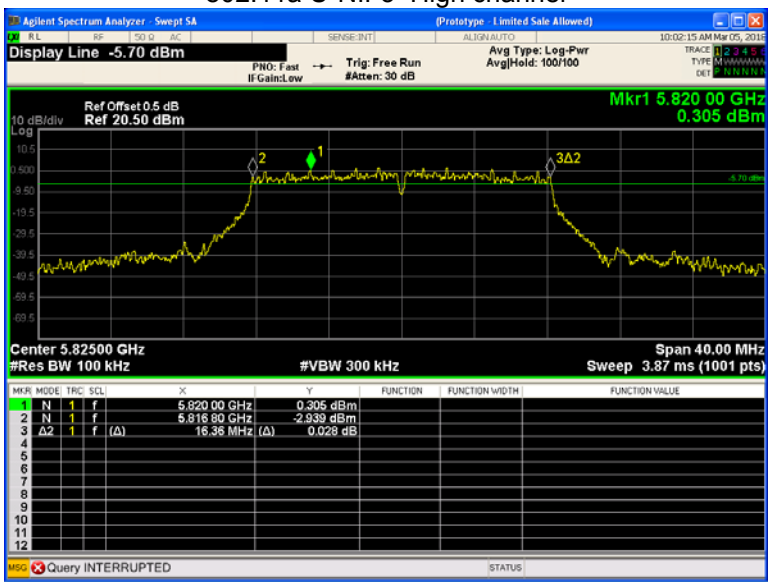
802.11a U-NII-3 Low channel



802.11a U-NII-3 Middle channel



802.11a U-NII-3 High channel



11 26 dB Bandwidth and 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.407 (a)
Test Method:	KDB662911 D01 Multiple Transmitter Output v02r01 KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section C
Test Limit:	No restriction limits
Test Result:	PASS

11.1 Test Procedure:

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

2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

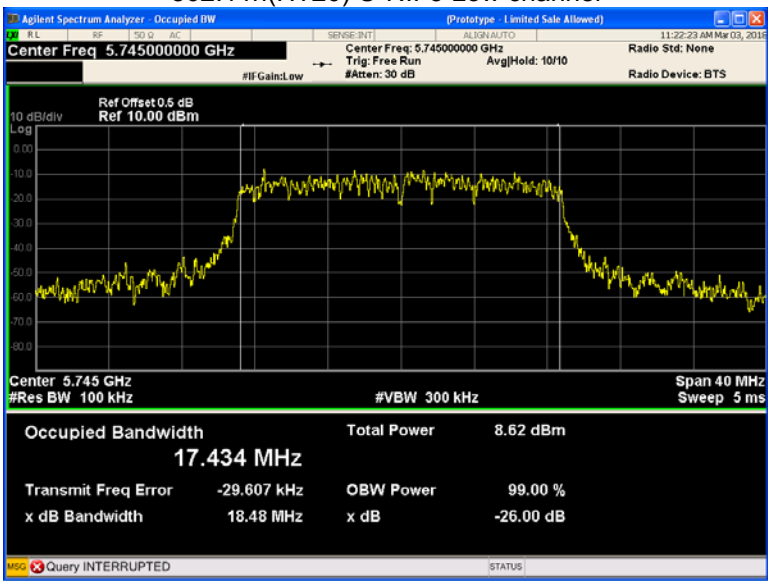
11.2 Test Result:

For ANT1:

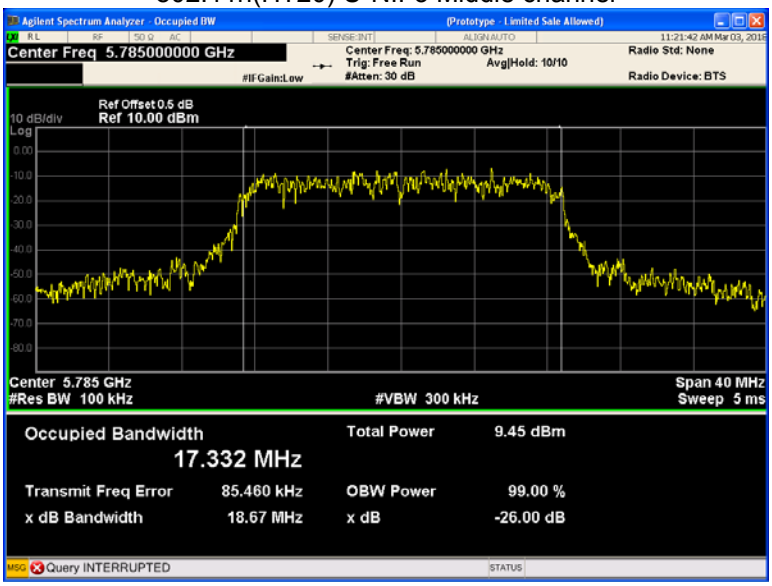
Band	Operation mode	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
		Low	Middle	High	Low	Middle	High
U-NII-3	802.11n(HT20)	18.480	18.670	18.800	17.434	17.332	17.357
	802.11a	18.080	17.870	18.150	16.380	16.342	16.370

Test result plots shown as follows:

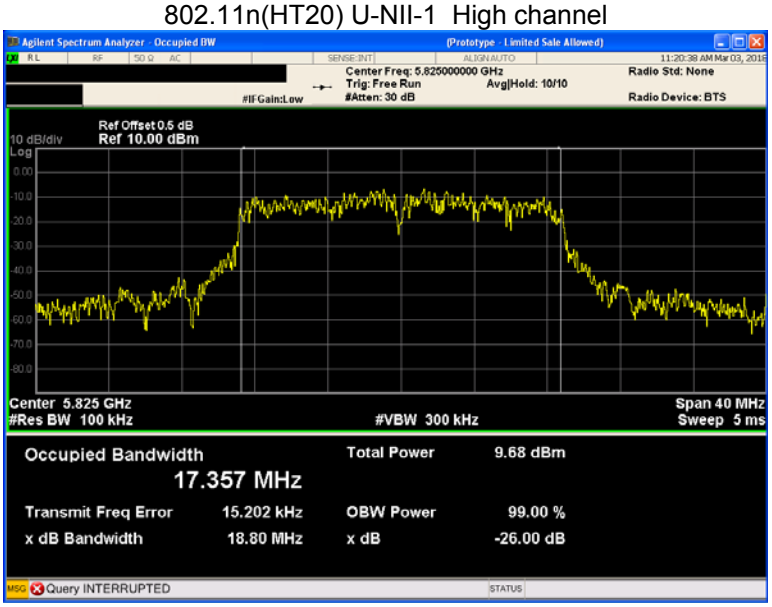
802.11n(HT20) U-NII-3 Low channel



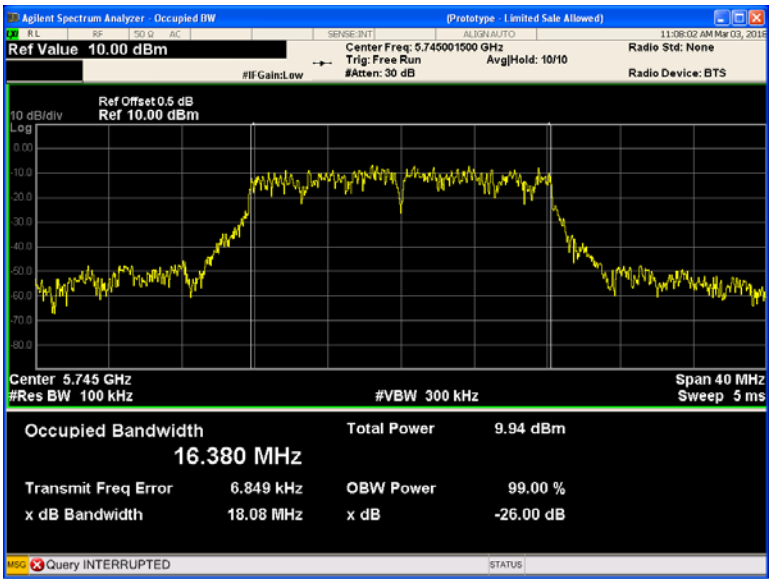
802.11n(HT20) U-NII-3 Middle channel



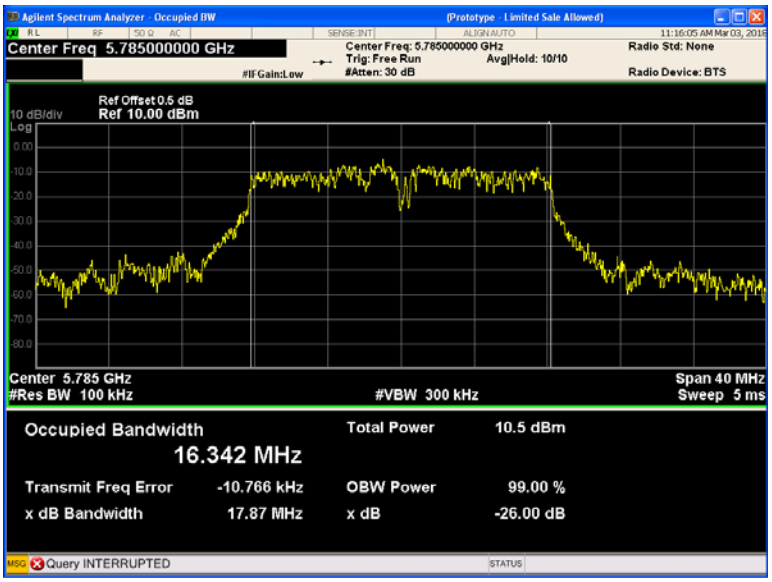
802.11n(HT20) U-NII-1 High channel



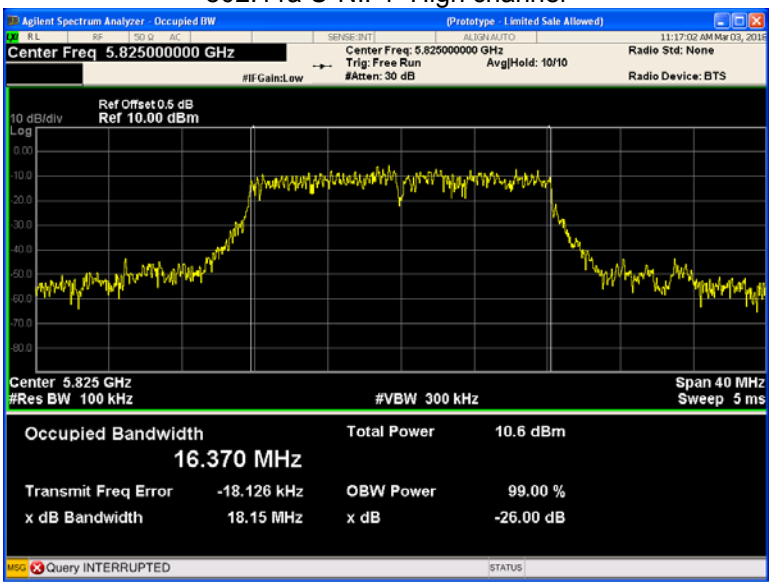
802.11a U-NII-1 Low channel



802.11a U-NII-1 Middle channel



802.11a U-NII-1 High channel

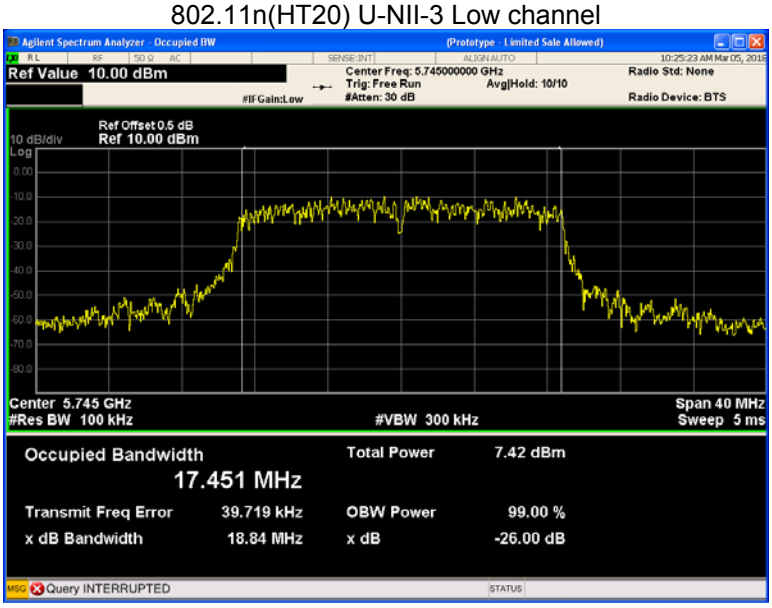


For ANT2:

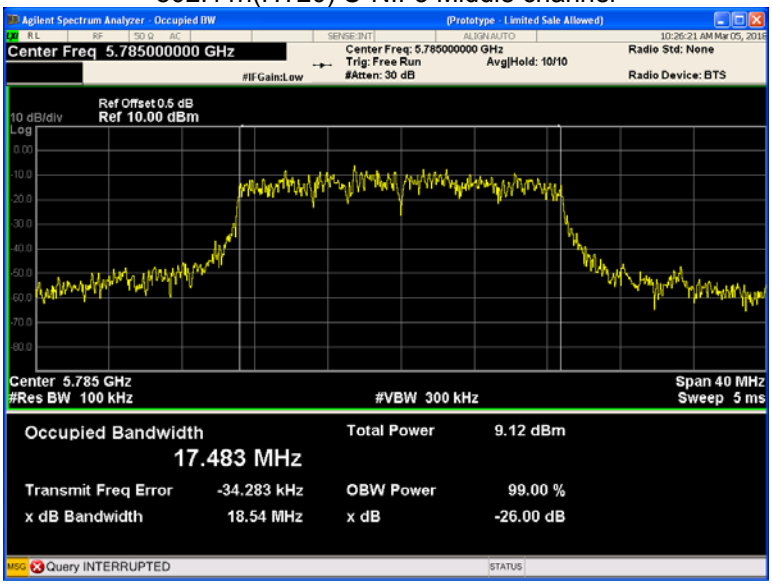
Band	Operation mode	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
		Low	Middle	High	Low	Middle	High
U-NII-3	802.11n(HT20)	18.840	18.540	18.750	17.451	17.483	17.354
	802.11a	18.430	17.840	18.590	16.380	16.373	16.258

Test result plots shown as follows:

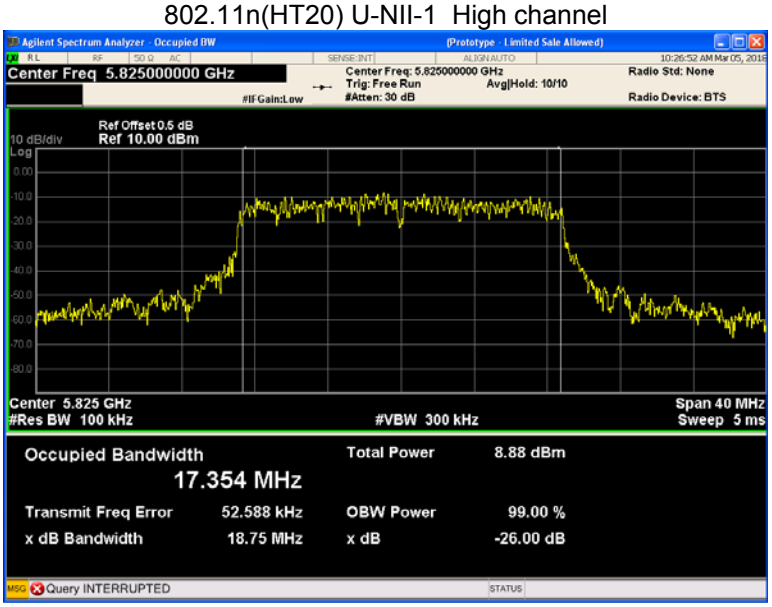
802.11n(HT20) U-NII-3 Low channel



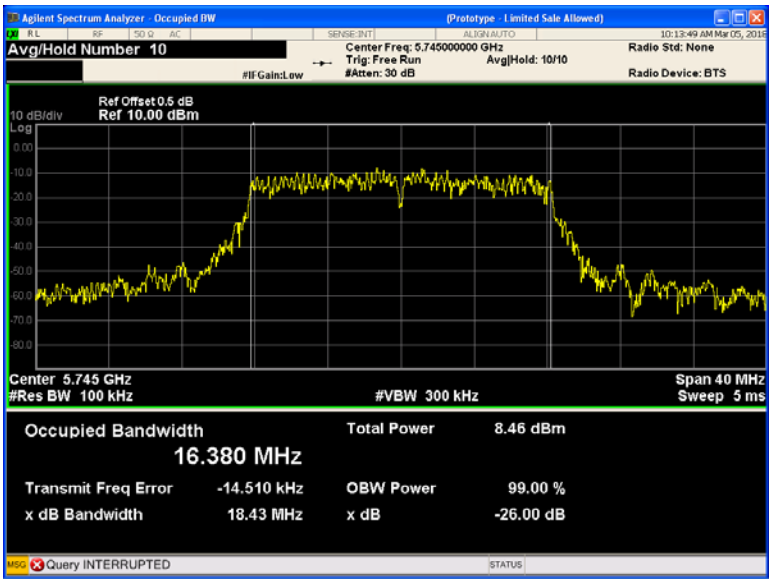
802.11n(HT20) U-NII-3 Middle channel



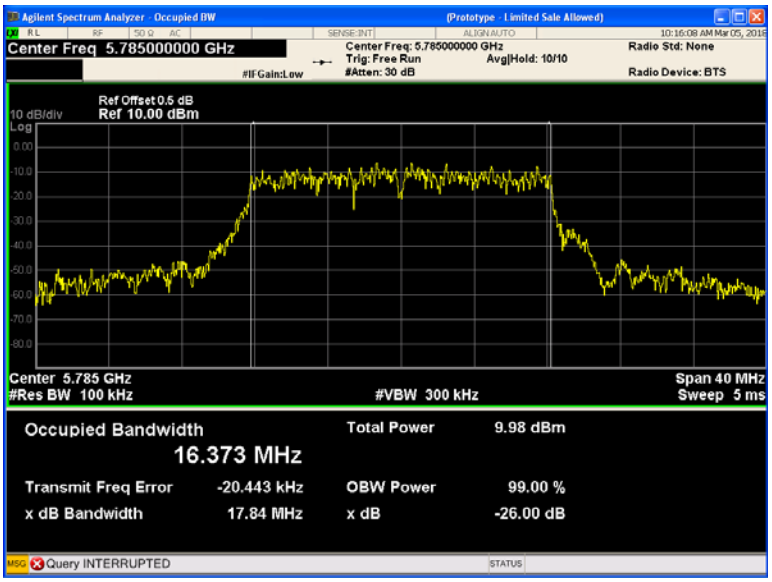
802.11n(HT20) U-NII-1 High channel



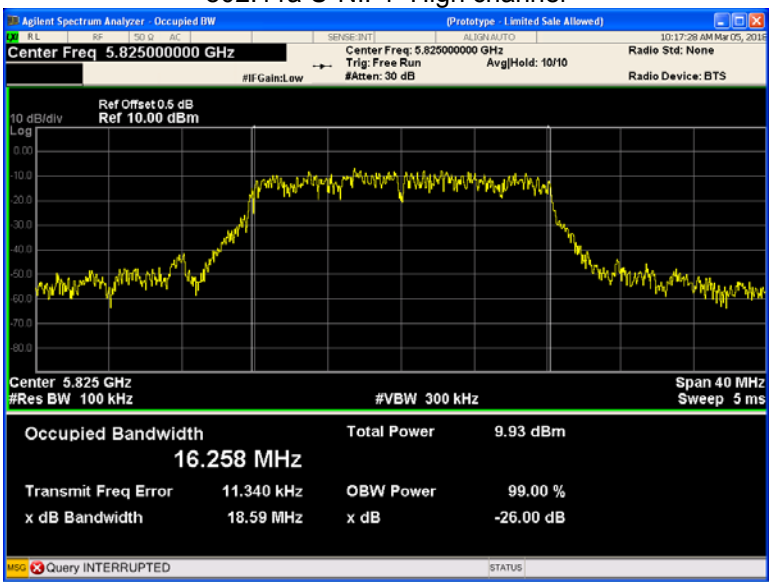
802.11a U-NII-1 Low channel



802.11a U-NII-1 Middle channel



802.11a U-NII-1 High channel



12 Conducted Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.407(a)
Test Method:	KDB662911 D01 Multiple Transmitter Output v02r01 KDB789033 D02 General UNII Test Procedures New Rules v02r01 Section E
Test Limit:	U-NII-3 1W(30dBm)
Test Result:	PASS
Remark:	Conducted output power= measurement power+10log(1/x) X is duty cycle=1, so 10log(1/1)=0 Conducted output power= measurement power

12.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak, Set the span to fully encompass the DTS bandwidth.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

12.2 Test Result:

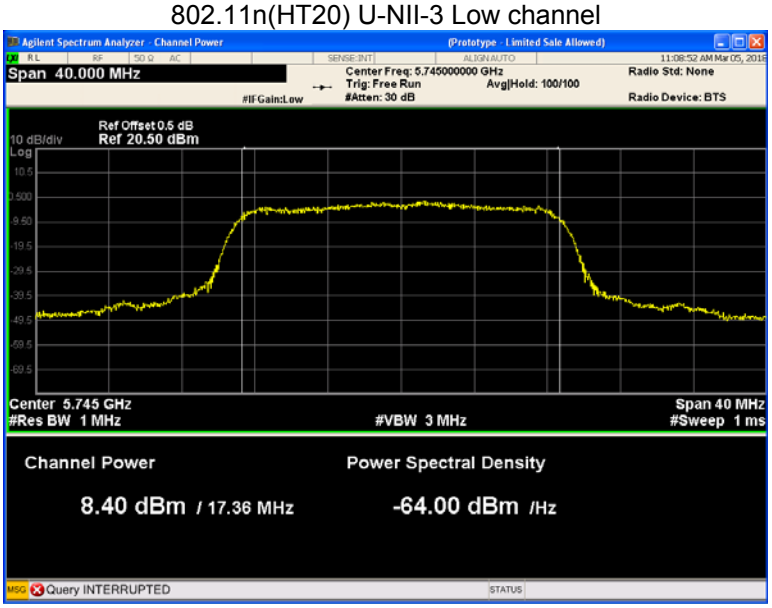
Band	Operation mode	channel	Conducted Output Power (dBm)		
			ANT1	ANT2	ANT1+ ANT2
U-NII-3	802.11n(HT20)	Low	8.40	7.26	10.88
		Middle	9.61	8.59	12.14
		High	9.73	8.74	12.27
	802.11a	Low	9.89	8.32	12.19
		Middle	10.47	9.70	13.11
		High	10.61	9.87	13.27

* All transmit signals are completely uncorrelated with each other, Directional gain = G_{ANT} which is less than 6dBi. So the limit does not be reduced.

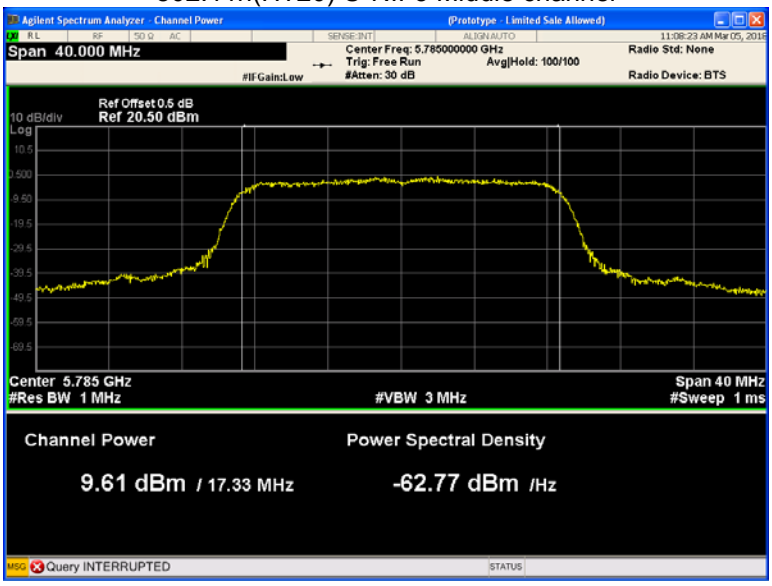
For ANT1:

Test result plots shown as follows:

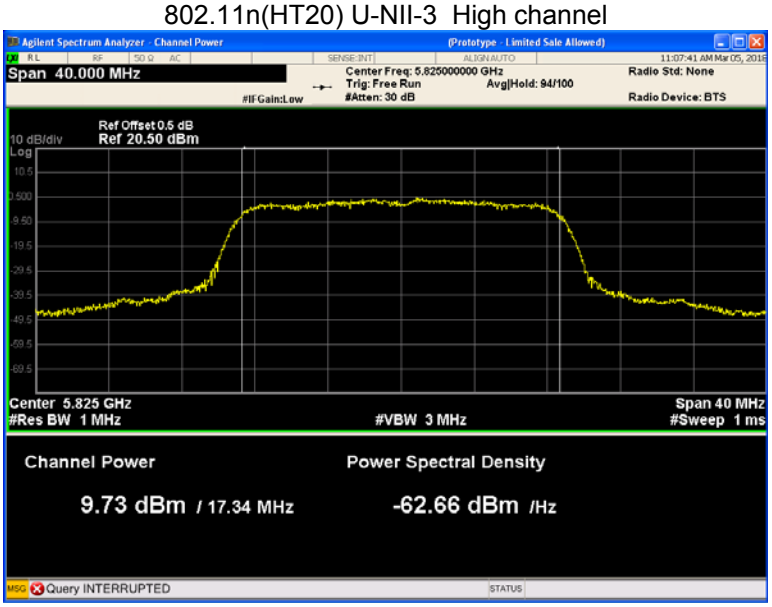
802.11n(HT20) U-NII-3 Low channel



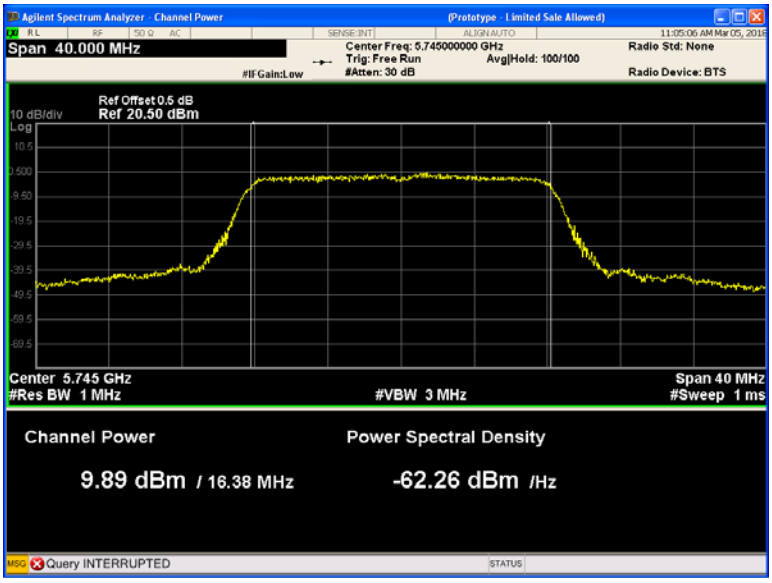
802.11n(HT20) U-NII-3 Middle channel



802.11n(HT20) U-NII-3 High channel

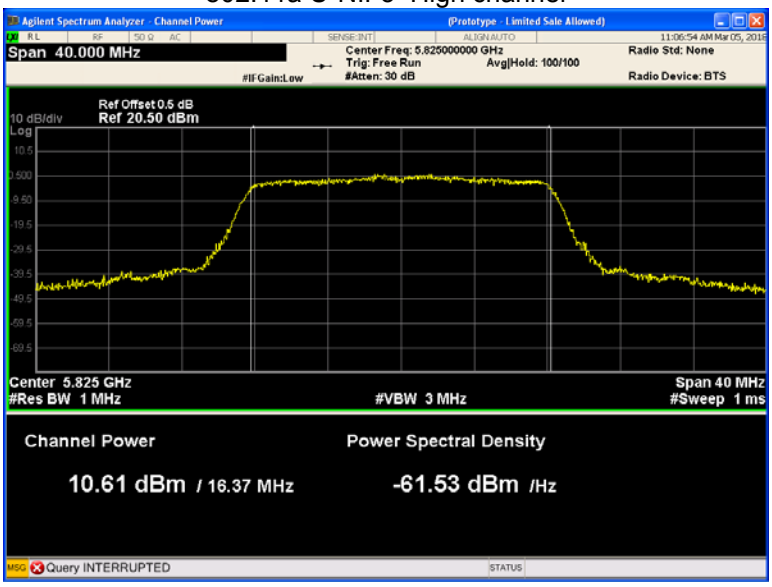


802.11a U-NII-3 Low channel



802.11a U-NII-3 Middle channel

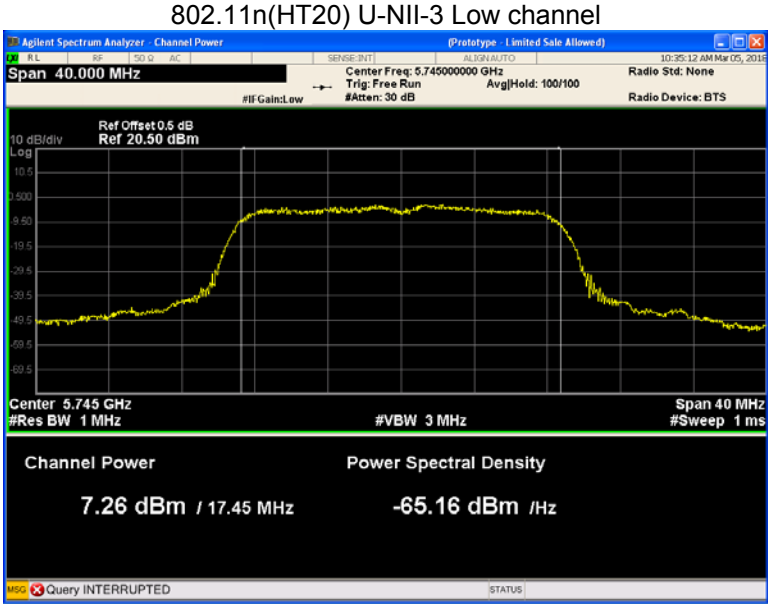
802.11a U-NII-3 High channel



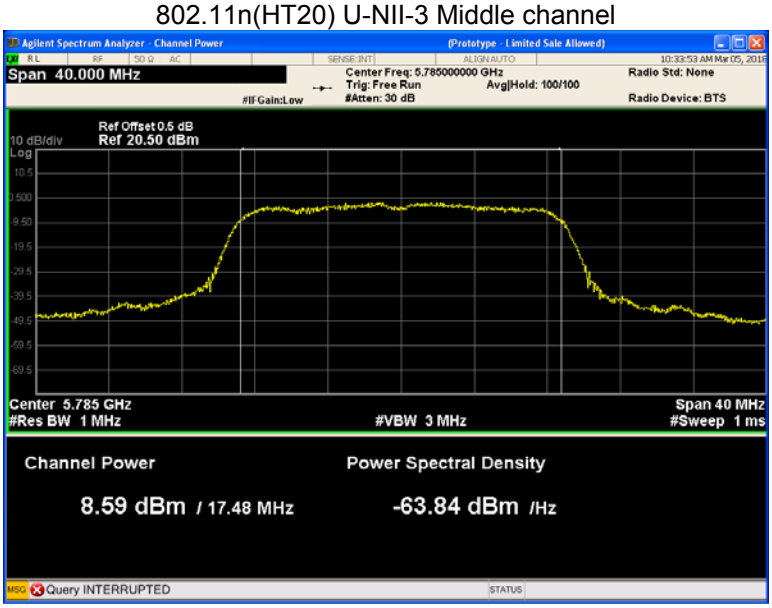
For ANT2:

Test result plots shown as follows:

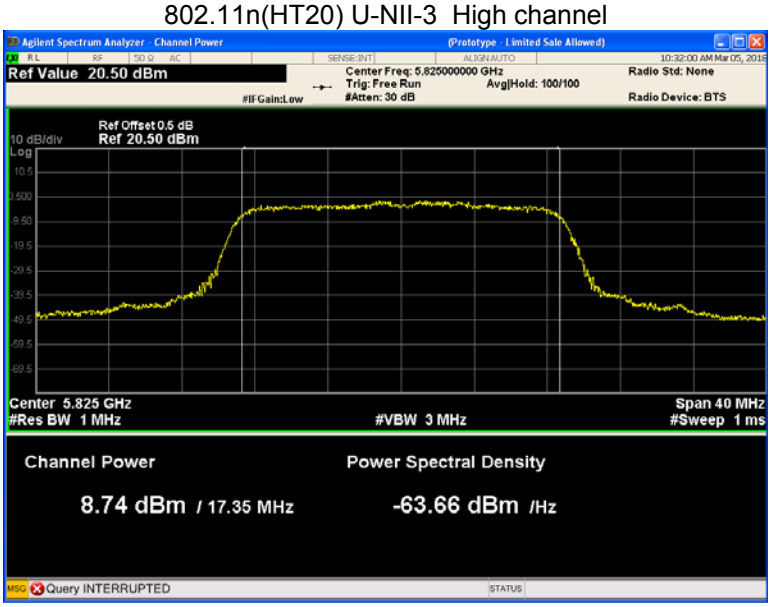
802.11n(HT20) U-NII-3 Low channel



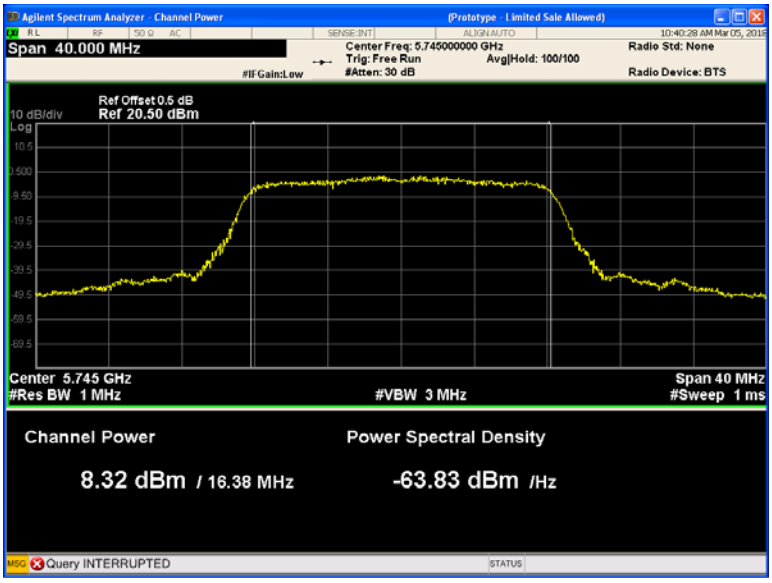
802.11n(HT20) U-NII-3 Middle channel



802.11n(HT20) U-NII-3 High channel

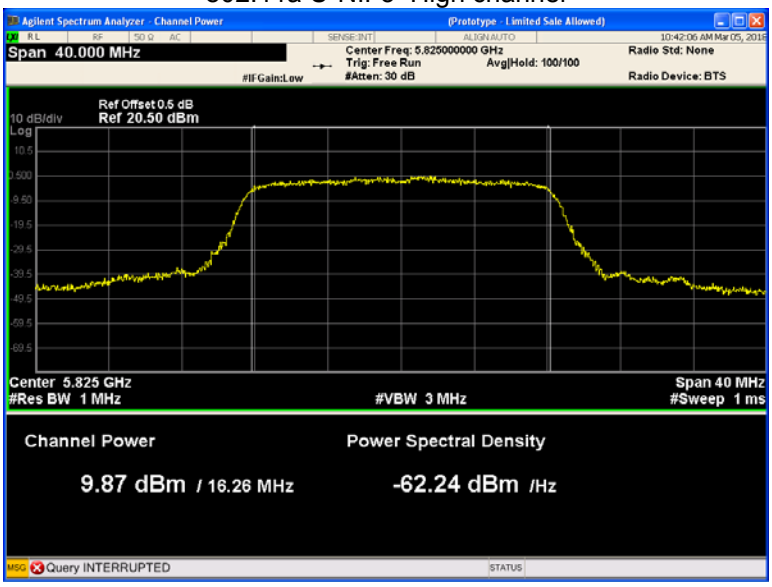


802.11a U-NII-3 Low channel



802.11a U-NII-3 Middle channel

802.11a U-NII-3 High channel



13 Power Spectral density

Test Requirement:	FCC CFR47 Part 15 Section 15.407(a)
Test Method:	KDB662911 D01 Multiple Transmitter Output v02r01 KDB789033 D02 General UNII Test Procedures New Rules v02r01, Section F
Test Limit:	<30dBm in any 500-kHz for Operation in the U-NII-3(5725MHz-5850MHz)of mobile device
Test Result:	PASS

13.1 Test Procedure:

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

2. Set the spectrum analyzer:

U-NII-1

RBW = 1MHz, VBW ⩾3* RBW Sweep = auto; Detector Function = Peak. Trae = Max hold.

U-NII-3

RBW = 510KHz, VBW ⩾3* RBW Sweep = auto; Detector Function = Peak. Trae = Max hold.

3. Allow the trae to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjaent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

13.2 Test Result:

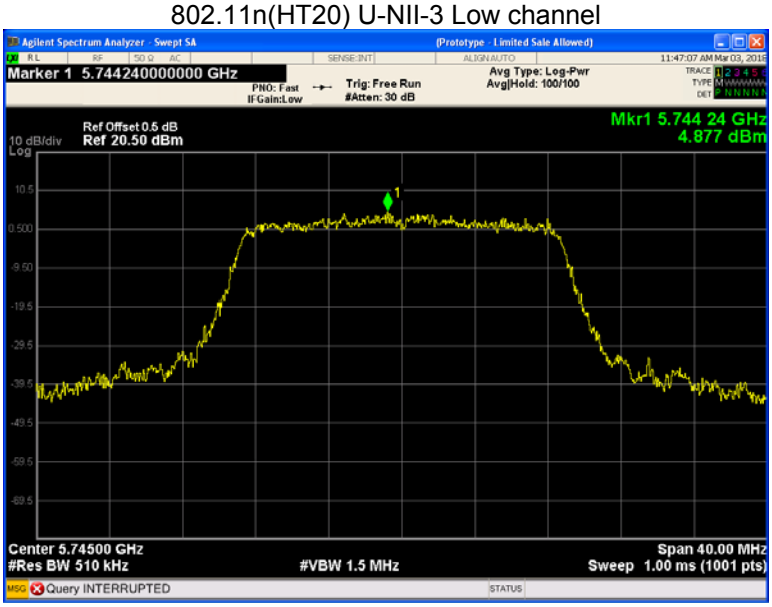
Band	Operation mode	CH	Power Spectral Density (dBm/MHz)		
			ANT1	ANT2	ANT1+ANT2
U-NII-1	802.11n(HT20)	Low	4.877	4.790	7.84
		Middle	6.257	6.116	9.20
		High	6.948	5.587	9.33
	802.11a	Low	6.891	5.598	9.30
		Middle	7.477	6.392	9.98
		High	8.059	6.481	10.35
	Limit		<30dBm in any 500-kHz band		

* All transmit signals are completely uncorrelated with eah other, Directional gain = G_{ANT} which is less than 6dBi. So the limit does not be reduced.

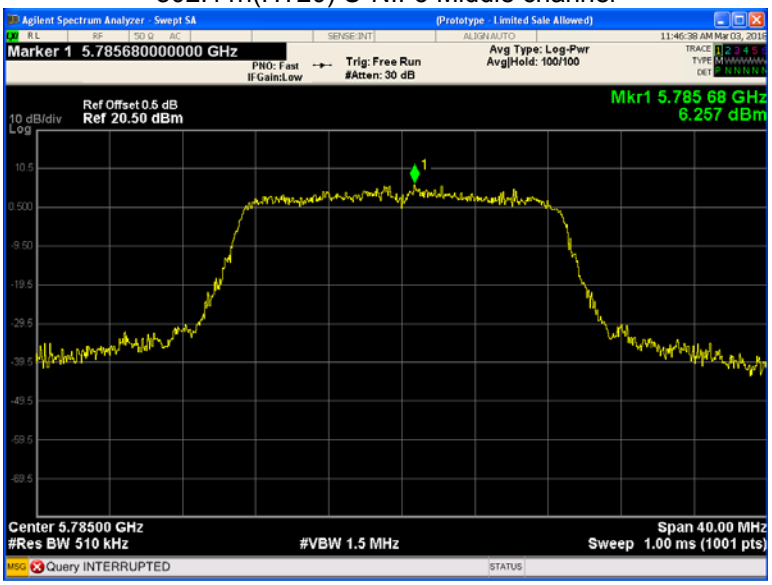
For ANT1:

Test result plots shown as follows:

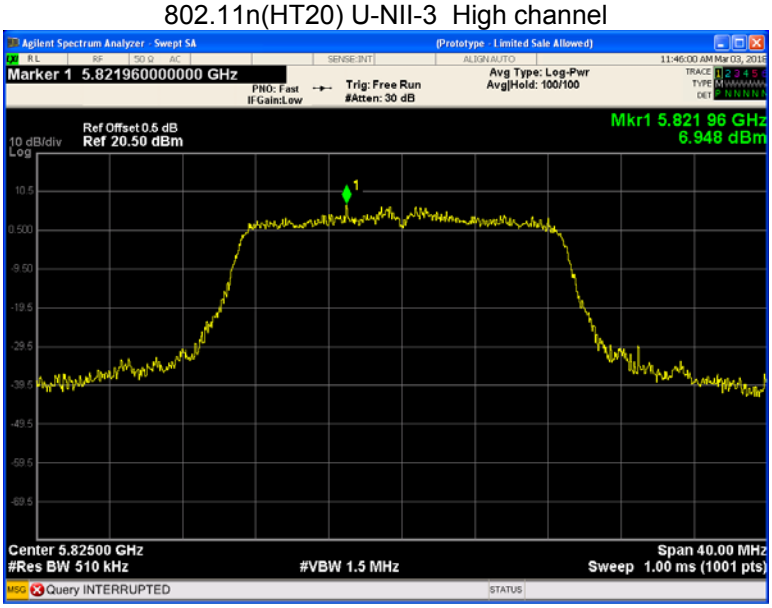
802.11n(HT20) U-NII-3 Low channel



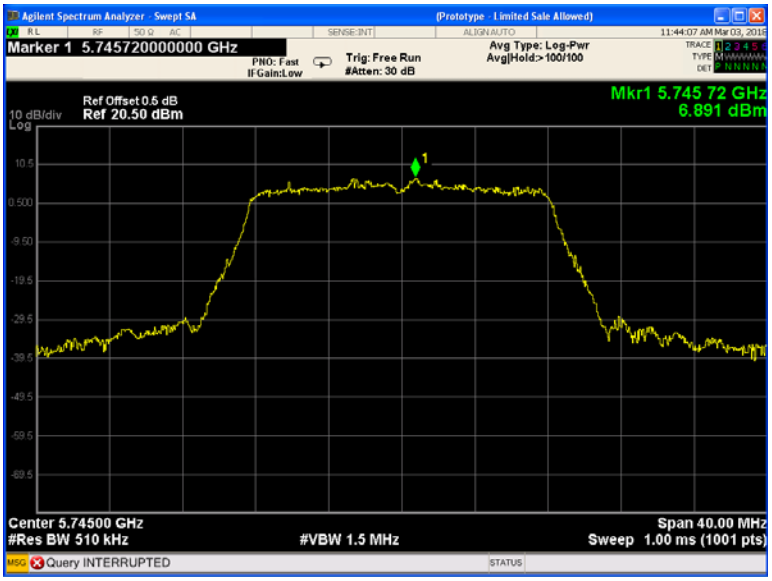
802.11n(HT20) U-NII-3 Middle channel



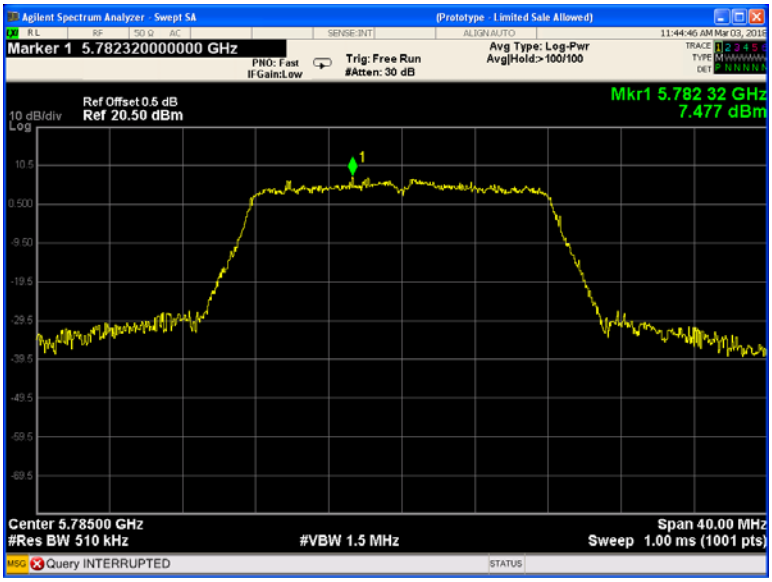
802.11n(HT20) U-NII-3 High channel



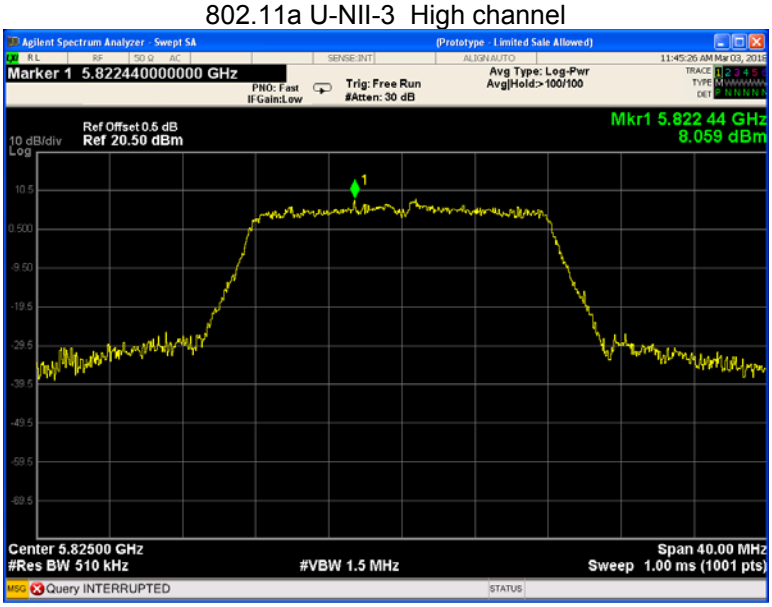
802.11a U-NII-3 Low channel



802.11a U-NII-3 Middle channel



802.11a U-NII-3 High channel



14 Frequency Stability

Test Requirement:	FCC CFR47 Part 15 Section 15.407(g)
Test Method:	ANSI C63.10:2013
Test Limit:	Manufaturers 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 or 20ppm.
Test Result:	PASS

14.1 Test Procedure:

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
   EUT have transmitted absence of unmodulation signal and fixed channelise. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 106 ppm and the limit is less than ±20ppm The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.

2. Extreme temperature rule is 0°C~ 35°C.

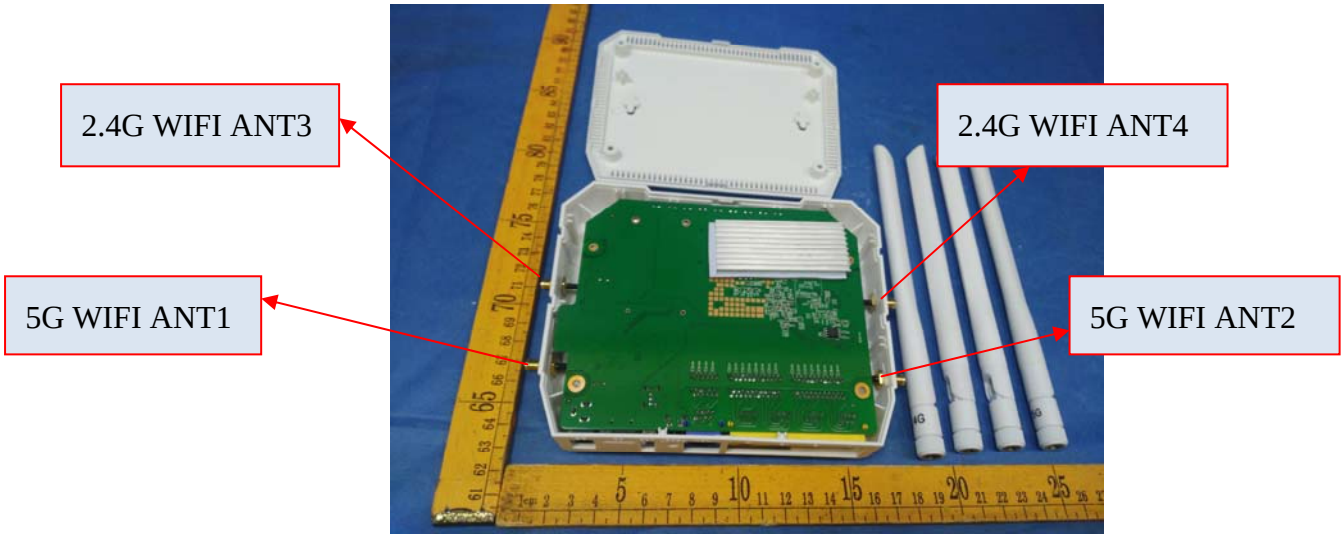
14.2 Test Result:

U-NII-3 Test Frequency:5745MHz				
Temperature (℃)	Power Supply (V)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
35	12	11.63	0.202	20
20		10.88	0.189	20
10		10.24	0.178	20
0		11.90	0.207	20
20	10.8	9.18	0.160	20
20	13.2	8.82	0.153	20

15 Antenna 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 attahed antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufaturer may design the unit so that a broken antenna can be replaed by the user, but the use of a standard antenna jak or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in acordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

This device have four External antenna with RP-SMA connector complied with the requirement.



16 RF Exposure

Test Requirement: FCC Part 1.1307

Test Method: FCC Part 2.1091

16.1 Requirements

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E)	Magnetic Field	Power Density (S) (mW/	Averaging Time
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-			5	6

Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E)	Magnetic Field	Power Density (S) (mW/ cm2)	Averaging Time
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

16.2 Evaluation Result

E (V/m) $= \frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) $= \frac{E^2}{377}$

E = Electric field (V/m)
P = Peak RF output power (W)
G = EUT Antenna numeric gain (numeric)
d = Separation distance between radiator and human body (m)
The formula can be changed to

$$\boldsymbol{Pd} = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
5(ANT1)	3.162	10.61	10.26	0.0065	1
5(ANT2)	3.162	9.87	9.94	0.0063	1
5(ANT1+ANT2)	3.162	13.27	11.23	0.0071	1

Result: Compliance.

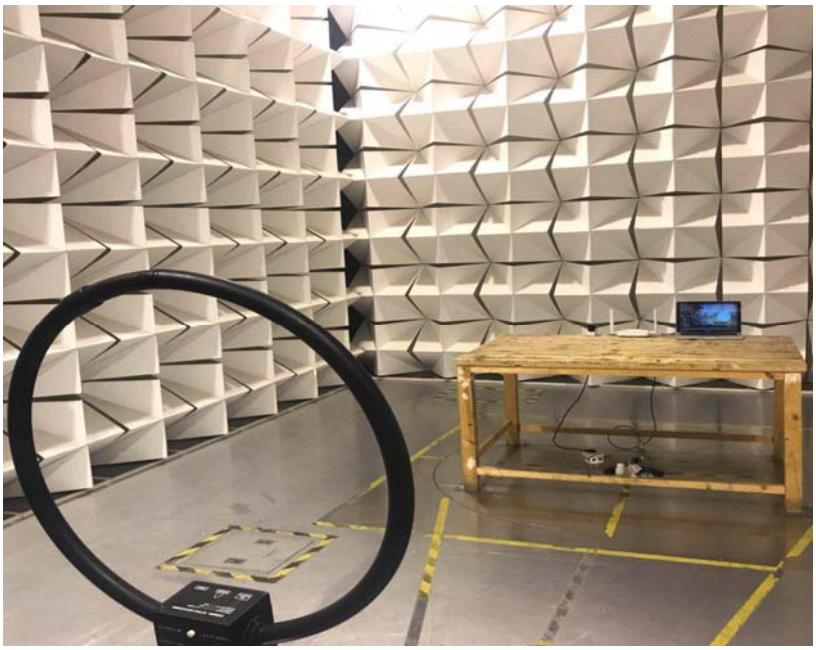
No SAR measurement is required.

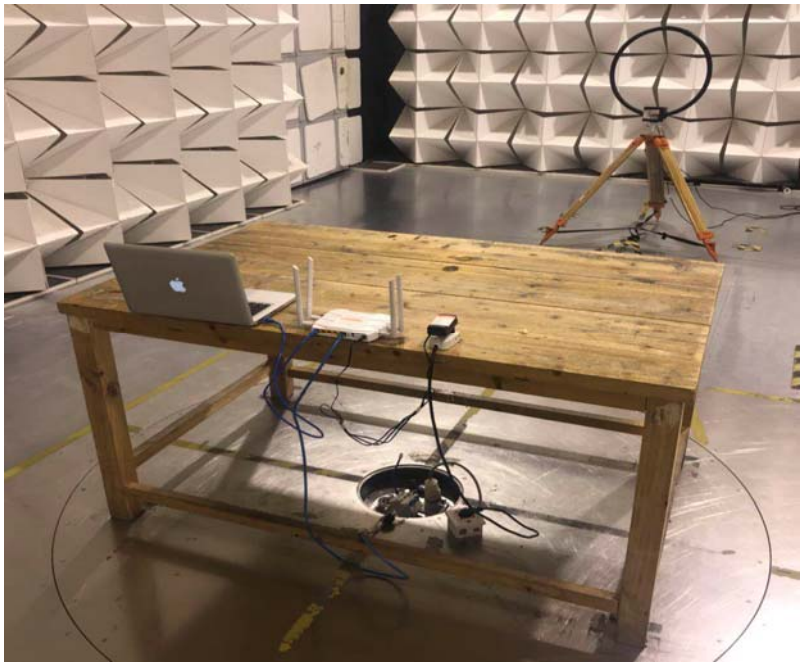
17 Photographs -Test Setup Photos

17.1 Photograph-Conducted Emissions Test Setup

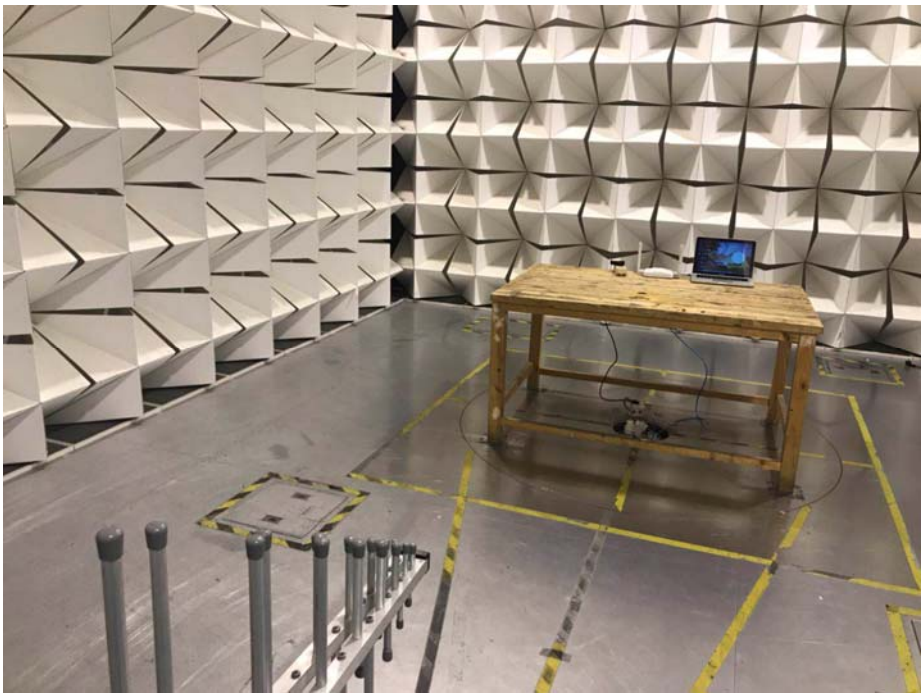
17.2 Photograph-Radiated Emissions

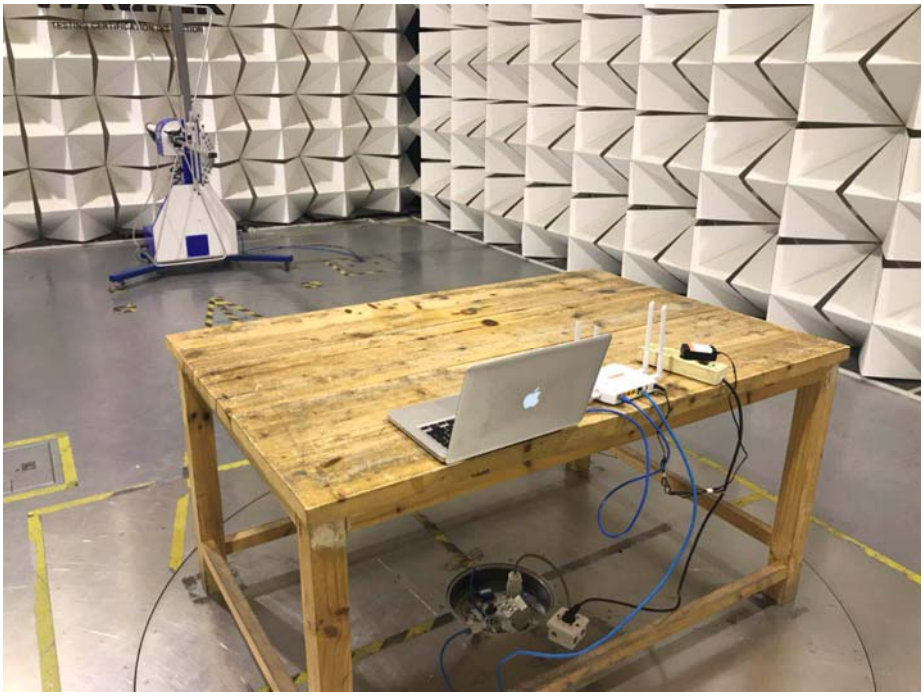
Below 30MHz



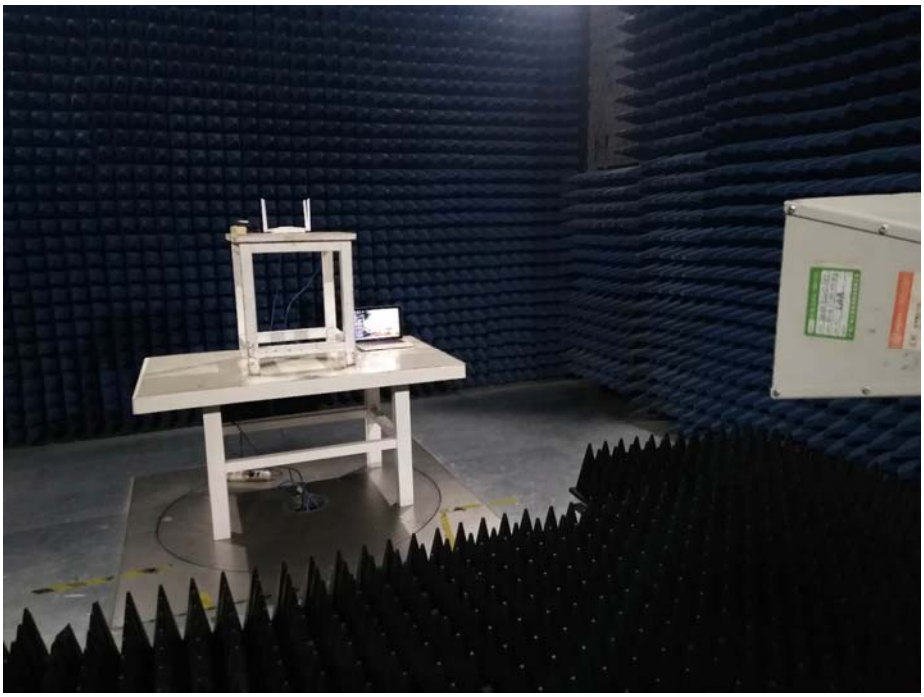


Test Frequency 30MHz to 1000MHz



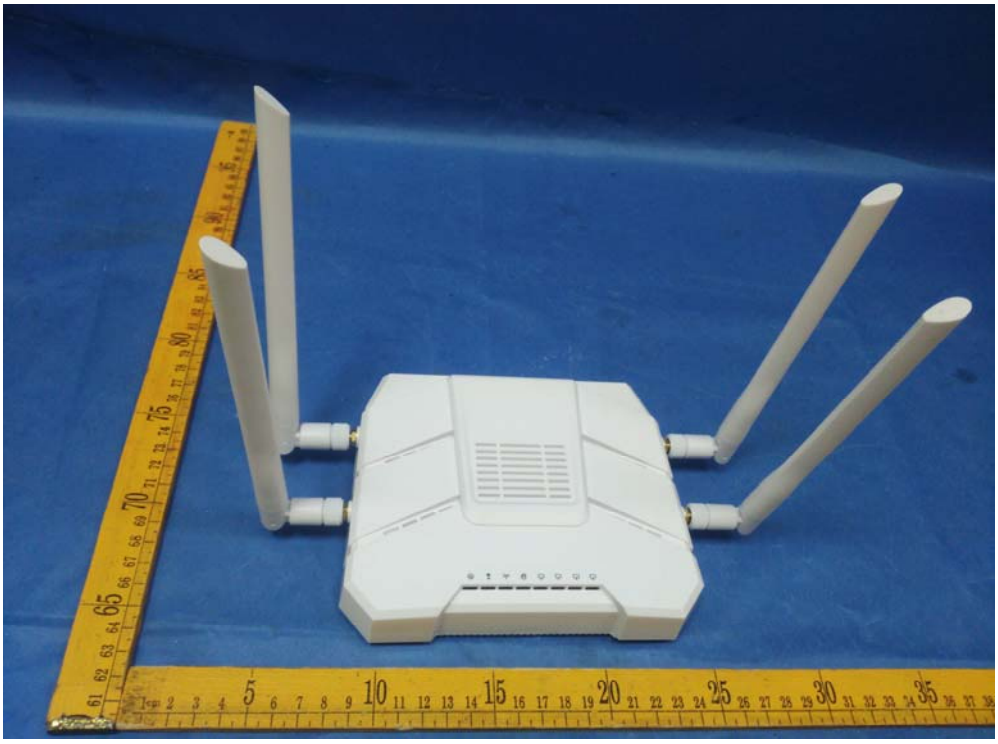


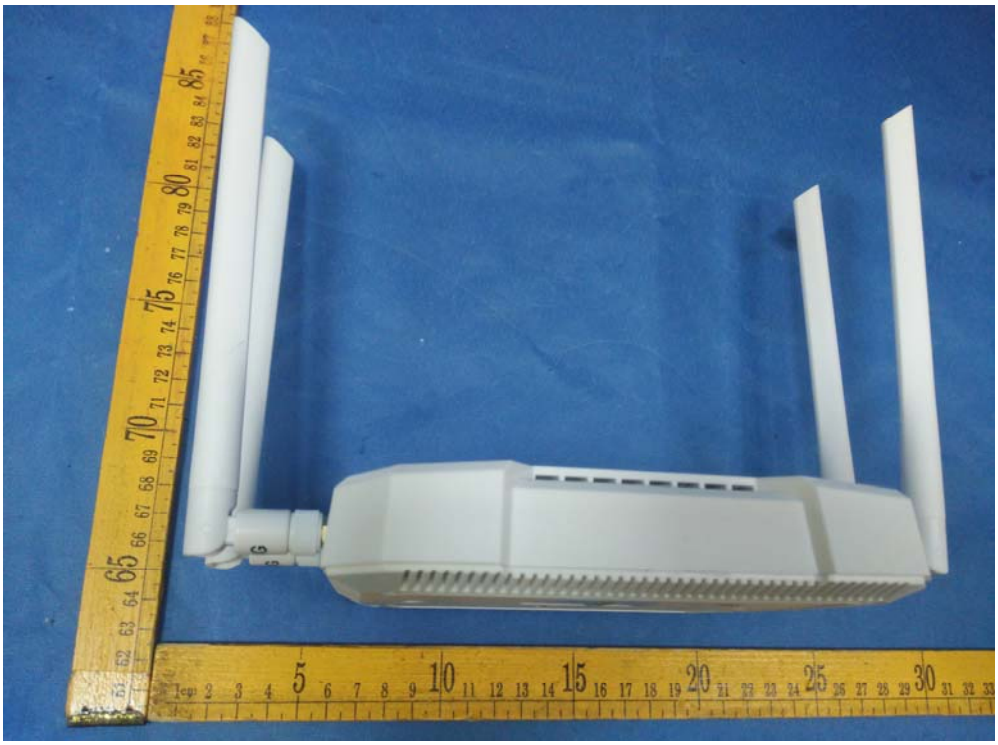
Test Frequency Above 1GHz



18 Photographs – Constructional Details

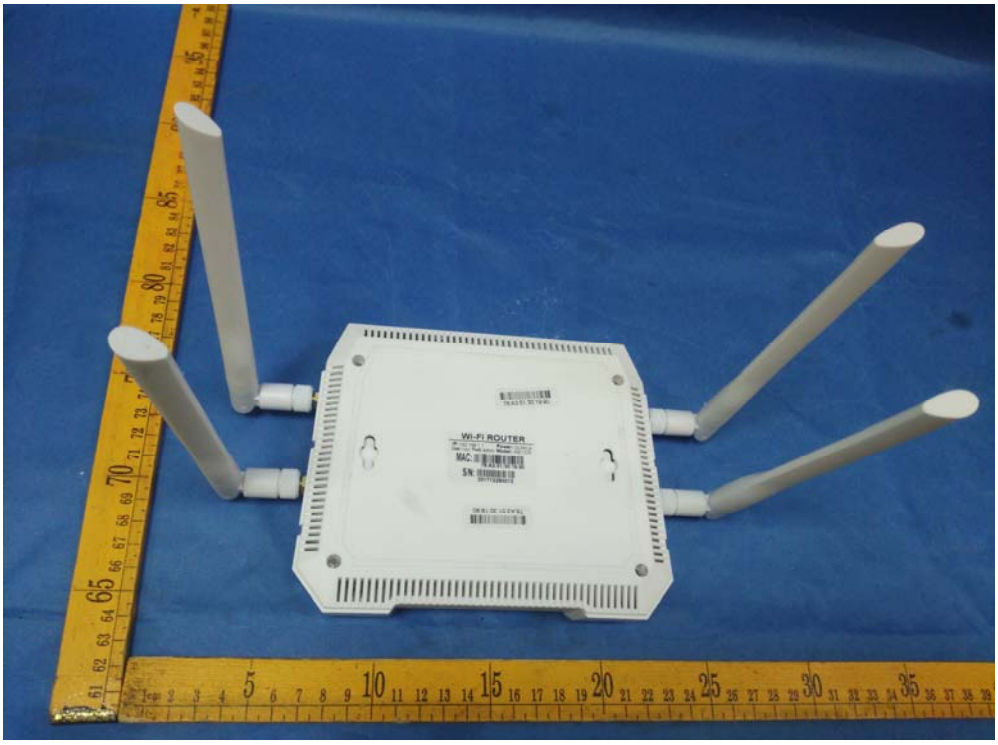
18.1 External Photos



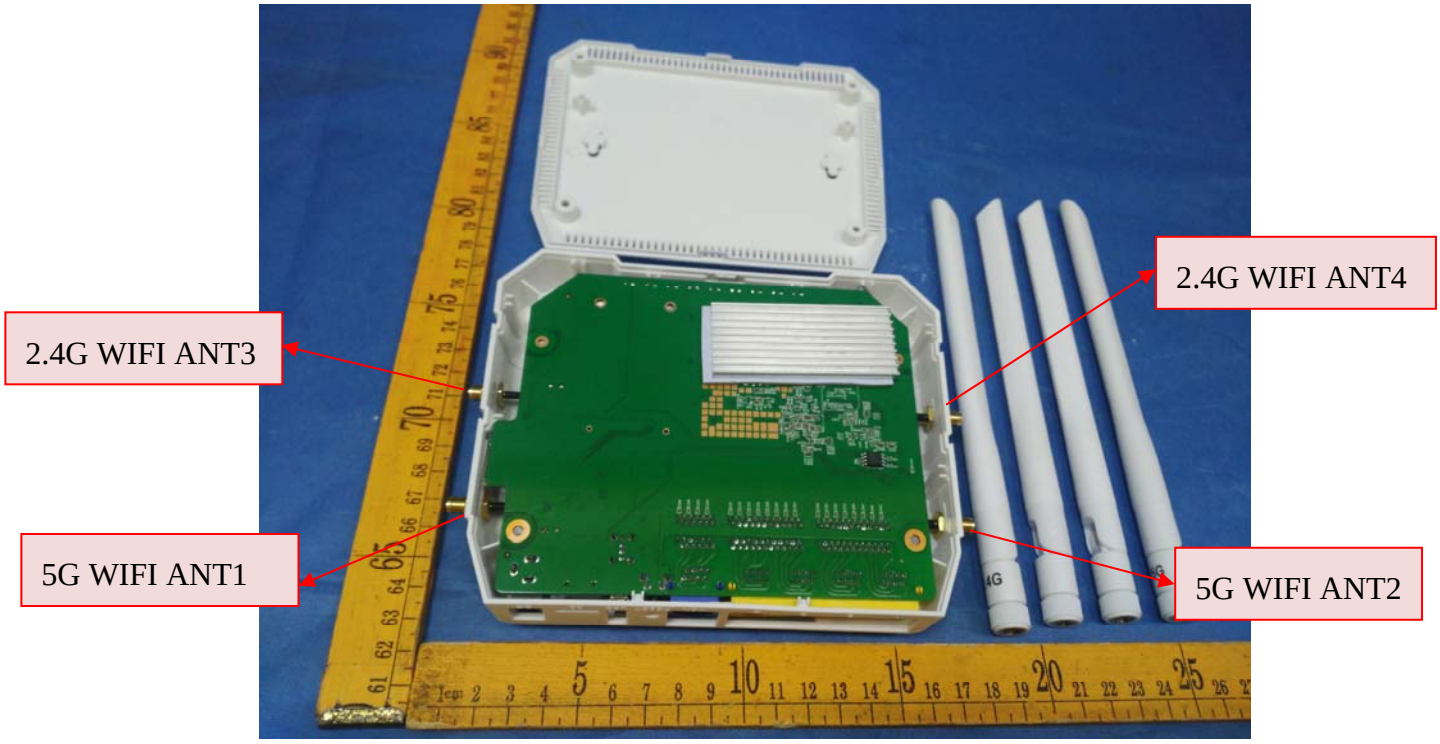


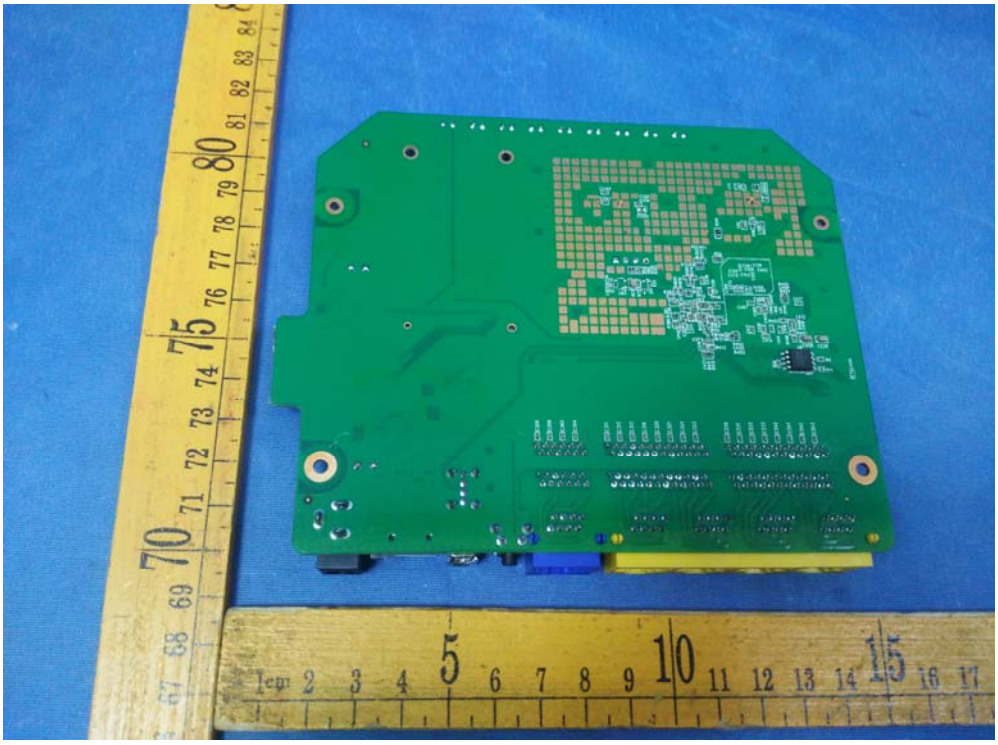

2.4G
5G


5G
2.4G


WI-FI ROUTER

18.2 Internal Photos





======End of Report======