RF TEST REPORT

Report No.:	SET2019-13388
Product Name:	Industrial tablet
FCC ID:	2AC6AP80B
Model No. :	P80
Applicant:	Shenzhen Chainway Information Technology Co.,Ltd.
Address:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen, China
Dates of Testing:	08/28/2019 — 10/12/2019
Issued by:	CCIC Southern Testing Co., Ltd.
Lab Location:	Electronic Testing Building, No. 43 Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China. **Tel:** 86 755 26627338 **Fax:** 86 755 26627238

This test report consists of 56 pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product endorsement by CCIC-SET. The test results in the report only apply to the tested sample. The test report shall be invalid without all the signatures of testing engineers, reviewer and approver. Any objections must be raised to CCIC-SET. within 15 days since the date when the report is received. It will not be taken into consideration beyond this limit.

Test Report

Product Name	:	Industrial tablet
Brand Name	:	CHAINWAY
Trade Name	:	CHAINWAY
Applicant	:	Shenzhen Chainway Information Technology Co.,Ltd.
Applicant Address	:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen, China
Manufacturer	:	Shenzhen Chainway Information Technology Co.,Ltd.
Manufacturer Address	:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen, China
Test Standards	:	47 CFR Part 15 Subpart E 15.407
Test Result	:	PASS
Tested by	:	Vincent 2020.01.15 Vincent, Test Engineer
Reviewed by	:	Chris You 2020.01.15 Chris You, Senior Engineer
Approved by	:	Shuangwen Zhang 2020.01.15 Shuangwen Zhang, Manager

TABLE OF CONTENTS

Change History		
Issue	Date	Reason for change
1.0	2020.01.15	First edition

1. General Information

1.1. EUT Description

EUT Type	Industrial tablet
EUT supports Radios application	WLAN5.0GHz 802.11a/n (HT20/40)
Product Type	Indoor
Modulation Type	CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM,16QAM, QPSK, BPSK for OFDM
Transfer Rate	802.11a: 54/48/36/24/18/12/9/6 Mbps 802.11n : up to 135 Mbps
Frequency Range	Band UNII-1: 5150 ~ 5250MHz
Channel Bandwidth	802.11a: 20MHz 802.11n: 20MHz/40MHz
Channel Number	5150 MHz ~ 5250MHz: 4 for 802.11a, 802.11n (HT20), 2 for 802.11n (HT40)
Antenna Type	Internal
Antenna Gain	0.86dBi
Output Power (Max.)	13.82 dBm

1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart E for the EUT FCC Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart E § 15.407	Radio Frequency Devices
2	KDB Publication 789033D02v02	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
6	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Test detailed items/section required by FCC rules, and results are as below:

No.	FCC Rule	Description	Result
1	15.203	Antenna Requirement	PASS
2	15.407(a)	Maximum Conducted Output Power	PASS
3	15.407(a)	Emission Bandwidth（26 dB Bandwidth）	PASS
	15.407(e)	Emission Bandwidth（6 dB Bandwidth）	PASS
4	15.407(a)	Power spectral density (PSD)	PASS
5	15.207	AC Power Line Conducted Emission	PASS
6	15.209 15.407(b)	Radiated Band Edges and Spurious Emission	PASS
7	15.407(g)	Frequency Stability	PASS

1.3. Channel List

Operated band in 5150 MHz ~ 5250MHz

4 channels are provided for 802.11a, 802.11n-HT20

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n-HT40

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1.4. Test environment and mode

Operating Environment	
Temperature	24℃
Humidity	57 % RH
Atmospheric Pressure	1010 mbar
Test mode：	
Continuously transmitting mode	Keeps the EUT in 100% duty cycle transmitting with modulation in SISO, duty cycle factor is not required.

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

For Frequency band 5150 ~ 5250 MHz			
Mode	Modulation scheme / bandwidth		
	5180 MHz	5220 MHz	5240 MHz
802.11a	6 Mbps	6 Mbps	6 Mbps
802.11n – HT20	MCS 0	MCS 0	MCS 0
Frequency	5190 MHz		5230 MHz
802.11n – HT40	MCS 0		MCS 0

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation modes or test configuration modes mentioned above was evaluated respectively.

Pretest Test Mode	Description
Mode 1	TX A Mode / CH36, CH44, CH48 (UNII-1)
Mode 2	TX N20 Mode / CH36, CH44, CH48 (UNII-1)
Mode 3	TX N40 Mode / CH38, CH46 (UNII-1)
For Radiated Test	
Final Test Mode	Description
Mode 1	TX A Mode / CH36, CH44, CH48 (UNII-1)
Mode 2	TX N20 Mode / CH36, CH44, CH48 (UNII-1)
Mode 3	TX N40 Mode / CH38, CH46 (UNII-1)

1.5. Power level setup in software

Power level setup in software for 5G wifi			
UNII-1			
Frequency（MHz）	5180	5220	5240
A mode	25	25	25
Frequency（MHz）	5180	5220	5240
N20 mode	20	20	20
Frequency（MHz）	5190	5230	\
N40 mode	20	20	\

1.6. Laboratory Facilities

FCC-Registration No.: CN5031

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN5031, valid time is until December 31, 2020.

ISED Registration: 11185A-1

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on Aug. 04, 2016, valid time is until Dec. 31, 2020.

NVLAP Lab Code: 201008-0

CCIC-SET is a third party testing organization accredited by NVLAP according to ISO/IEC 17025. The accreditation certificate number is 201008-0.

2. 47 CFR Part 15E Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

And according to FCC 47 CFR Section 15.407(E), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

2.1.2. Antenna Information

Antenna Type	Internal antenna
Antenna Gain	0.86dBi

2.1.3. Result: comply

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Output Power

2.2.1. Limit of Output Power

FCC 15.407(a)

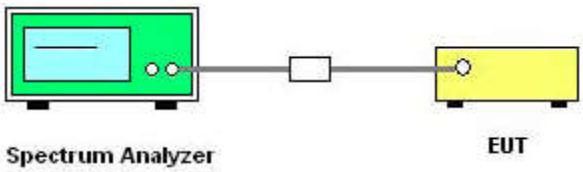
The maximum conducted output power should not exceed:

Band	EUT Category	Limit
U-NII-1	☐Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p ≤ 125mW(21dBm) at any elevation angle above 30 degrees as measured from the horizon)
	☐Fixed point-to-point Access device	1 Watt (30 dBm)
	☐Indoor Access Point	1 Watt (30 dBm)
	☒Mobile and portable client device	250mW (24 dBm)
U-NII-2A	☐	250mW (24 dBm) or 11dBm+10logB* Whichever is less.
U-NII-2C	☐	250mW (24 dBm) or 11dBm+10logB* Whichever is less.
U-NII-3	☐	1 Watt (30 dBm)
Note: B* is the 26 dB emission bandwidth in MHz.		

2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.2.3. Test Setup



2.2.4. Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013
2. The RF output of EUT was connected to spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW=1MHz, VBW=3MHz, Sweep time=Auto, Detector=average(RMS), Compute power by integrating the spectrum across the 99%OBW.
5. Measure the conducted output power and record the results in the test report.

2.2.5. Test Result

Please refer to APPENDIX A for detail

2.3. Emission Bandwidth

2.3.1. Limit of Bandwidth

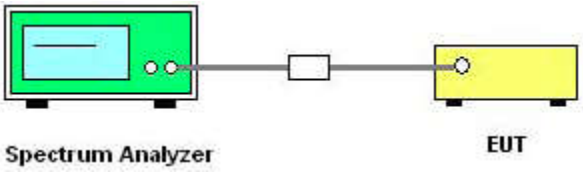
There is no limit bandwidth for bandU-NII-1, U-NII-2A and U-NII-2C.

The minimum of 6dB bandwidth measurement is 0.5 MHz for U-NII-3.

2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.3.3. Test Setup



2.3.4. Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013.

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

4. For 26dB bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = approximately 1%EBW, VBW≥3RBW , Detector = Peak, Trace mode = max hold

Span ＞26 dB bandwidth and Sweep time = auto

5. Use the spectrum analyzer N dB down function to find the 26dB bandwidth.

6. For 6 Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) =100kHz VBW = 300 kHz, Detector = Peak, Trace mode = max hold

7. Use the spectrum analyzer N dB down function to find the 6dB bandwidth

8. Measure and record the worst results in the test report.

2.3.5. Test Results Bandwidth

Please refer to APPENDIX A for detail

2.4. Power spectral density (PSD)

2.4.1. Limit of Power Spectral Density

FCC 15.407(a)

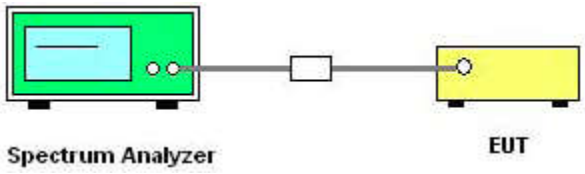
The maximum power spectral density should not exceed:

Band	EUT Category	Limit
U-NII-1	☐Access Point (Master device)	17 dBm/MHz
	☐Fixed point-to-point Access device	
	☒Mobile and portable client device	11 dBm/MHz
U-NII-2A	☐	11 dBm/MHz
U-NII-2C	☐	11 dBm/MHz
U-NII-3	☐	30dBm/500kHz

2.4.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.4.3. Test Setup



2.4.4. Test Procedures

1. Place the EUT on the table and set it in transmitting mode.

2. The testing follows ANSI C63.10-2013.

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

4. **For U-NII-1, U-NII-2A, U-NII-2C Band:**

Using method SA-1

Set RBW=1MHz, VBW=3MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto, detector = sample, traces 100 sweeps of averaging mode.

For U-NII-3 Band:

Set RBW=500 kHz, VBW≥ 3RBW, where span is enough to capture the entire bandwidth, Sweep time = Auto, detector = sample, traces 100 sweeps of averaging mode.

5.Use peak search function on the instrument to find the peak of the spectrum and record its value

6. Repeat above procedures until all default test channel (low, middle, and high) was complete.

2.4.5. Test Results of Power spectral density

Please refer to APPENDIX A for detail

2.5. Frequency Stability

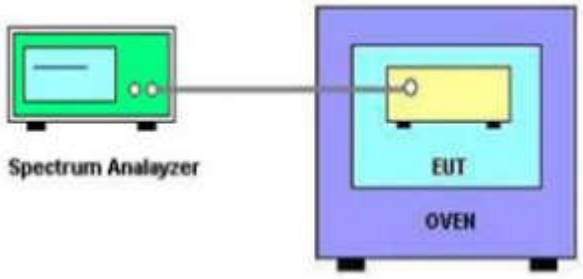
2.5.1. Limit

FCC 15.407(b) Frequency Stability	
Frequency Band(MHz)	Limit
5150~5250	Specified in the user's manual
5250~5350	
5470~5725	
5725~5850	

2.5.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.5.3. Test Setup



2.5.4. Test Procedures

1. The EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

2. Set to the maximum power setting and enable the EUT transmit continuously.

3. The EUT is installed in an environment test chamber with external power source.

4. Set the chamber to operate at 50 centigrade and external power source to output at nominal voltage of EUT.

5. A sufficient stabilization period at each temperatures in used prior to each frequency measurement.

6. The test shall be performed under -10 to 55 centigrade and 85 to 115 percent of the nominal voltage. Change setting of chamber and external power source to complete all conditions.

7. Measure and record the worst results in the test report.

2.5.5. Test Results of Frequency Stability

Please refer to APPENDIX A for detail

2.6. Radiated Band Edge and Spurious Emission

2.6.1. Limit of Radiated Band Edges and Spurious Emission

Radiated emission which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Limits of unwanted emission out of the restricted bands

Applicable To	Limit	
789033 D02 General UNII Test Procedures New Rules v02	Field Strength at 3m	
	PK:74(dBμV/m)	AV:54 (dBμV/m)

Frequency Band (MHz)	Frequency (MHz)	EIRP Limit (dBm)	Equivalent Field Strength (3m) (dBμV/m)
5150 - 5250	Outside of the 5.15~5.35 GHz	-27	68.2
5250 - 5350	Outside of the 5.15~5.35 GHz		
5470 -5725	Outside of the 5.47~5.725 GHz		

FCC 15.407			
Frequency Band (MHz)	Frequency (MHz)	EIRP Limit (dBm)	Equivalent Field Strength (3m) (dBμV/m)
5725 - 5850	＜5650	-27	68.2
	5650~5700	-27~10	68.2~105.2
	5700~5720	10~15.6	105.2~110.8
	5720~5725	15.6~27	110.8~122.2
	5850~5855	27~15.6	122.2~110.8
	5855~5875	15.6~10	110.8~105.2
	5875~5925	10~-27	105.2~68.2
	＞5925	-27	68.2

Note: 1. The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

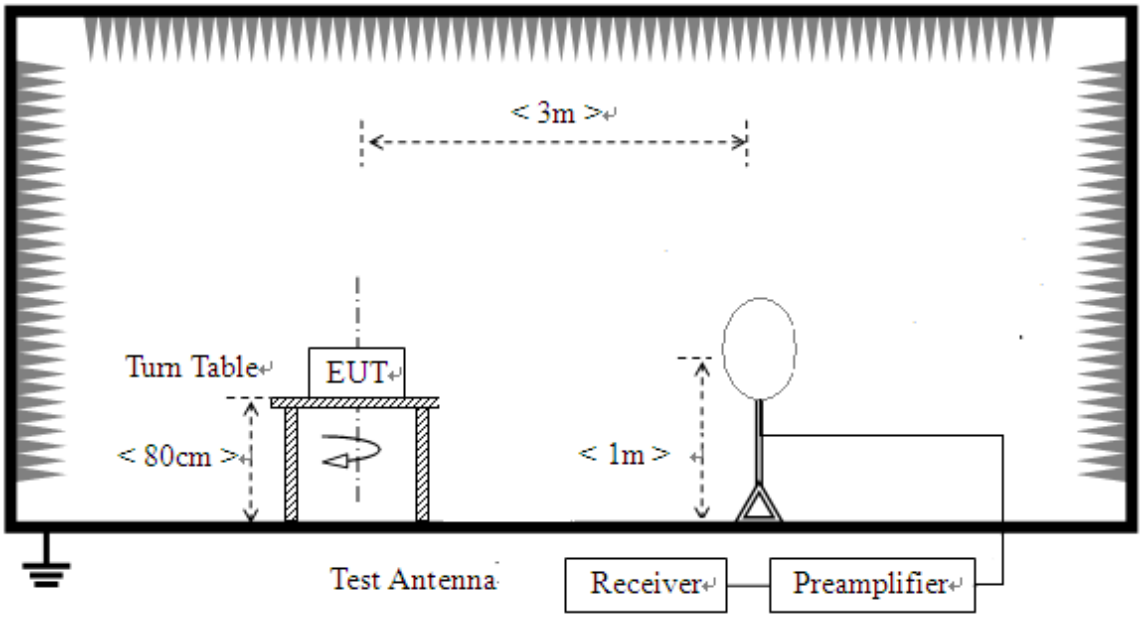
$$E = \frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts).

2.6.2. Measuring Instruments

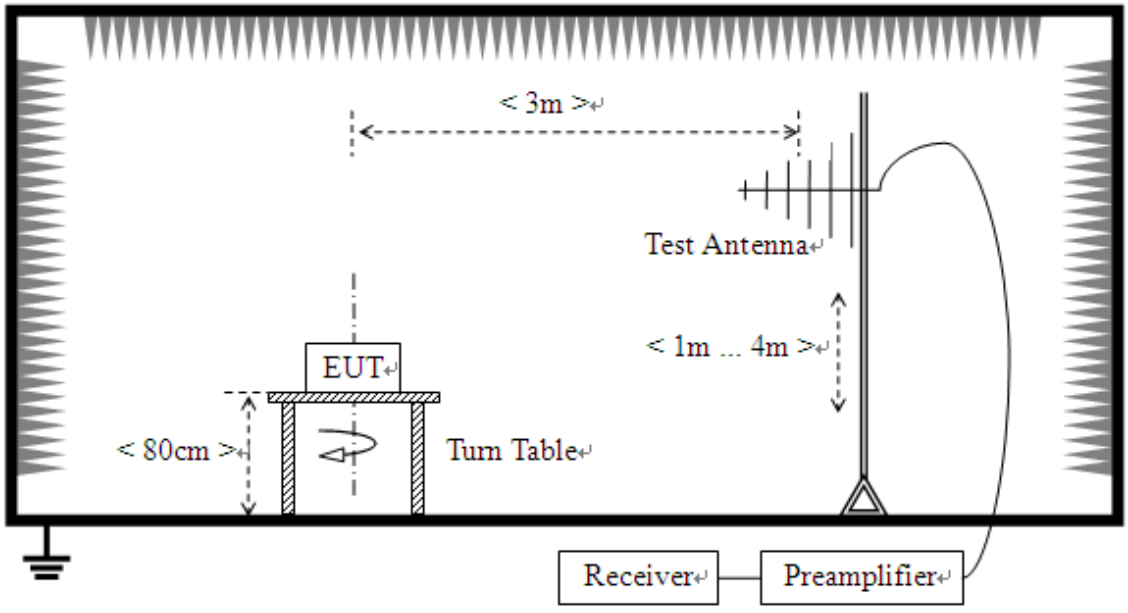
The measuring equipment is listed in the section 3 of this test report.

2.6.3. Test Setup

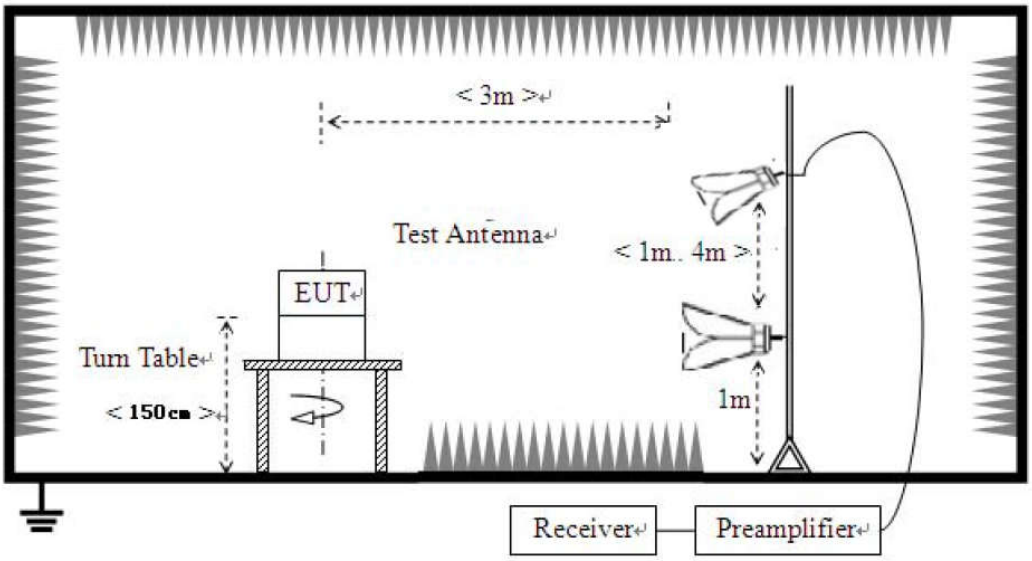
For radiated emissions from 9 KHz to 30 MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



2.6.4. Test Procedures

1. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
6. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

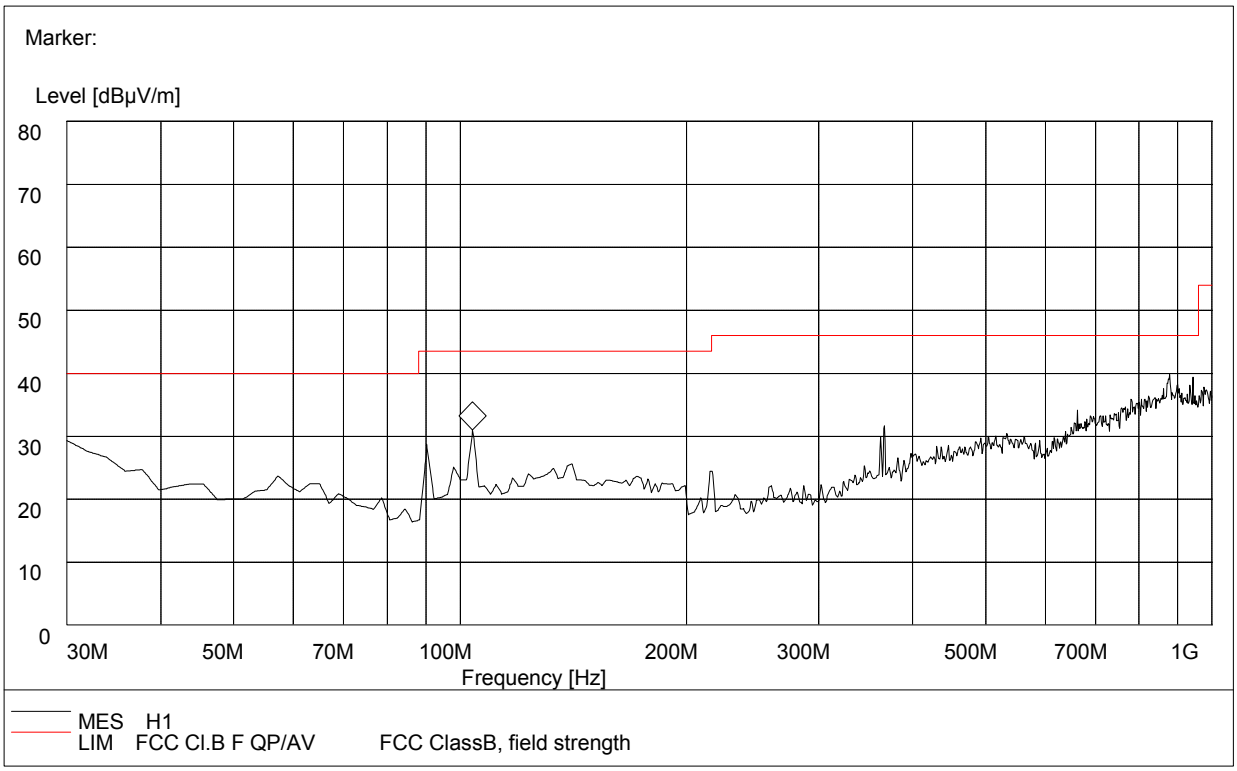
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (10 log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

2.6.5. Test Results of Radiated Band Edge and Spurious Emission

For 9 KHz to 30MHz

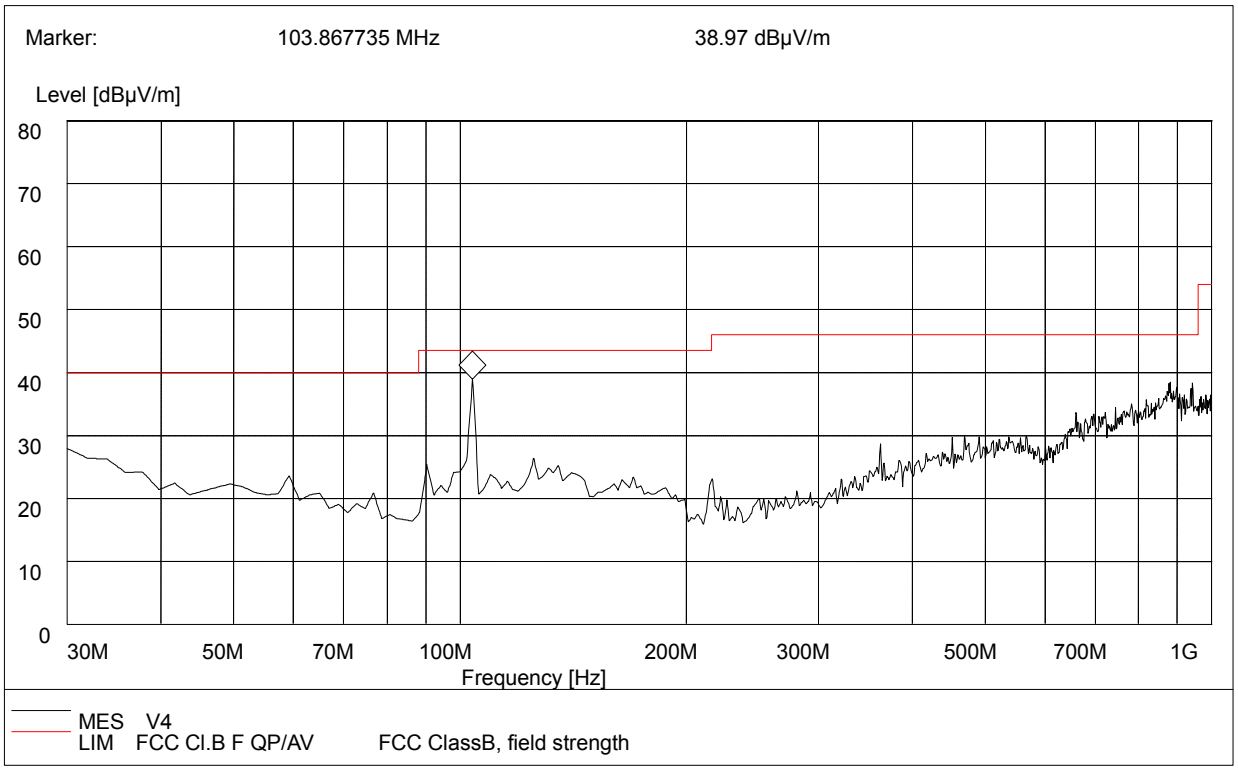
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

For 30MHz to 1000 MHz



30MHz to 1GHz, Antenna Horizontal

Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Corr. Factor (dB/m)	Antenna height (cm)	Limit (dB µ V/m)	Margin	Antenna	Verdict
90.35	28.14	120.000	7.0	100.0	43.5	15.36	Horizontal	Pass
103.98	32.15	120.000	10.2	100.0	43.5	11.35	Horizontal	Pass
215.27	24.83	120.000	11.0	100.0	43.5	18.67	Horizontal	Pass
365.47	32.15	120.000	15.8	100.0	46.0	13.85	Horizontal	Pass
675.84	33.84	120.000	22.0	100.0	46.0	12.16	Horizontal	Pass
881.54	39.67	120.000	24.8	100.0	46.0	6.33	Horizontal	Pass



30MHz to 1GHz, Antenna Vertical

Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Corr. Factor (dBµV/m)	Antenna height (cm)	Limit (dB µ V/m)	Margin	Antenna	Verdict
58.74	23.66	120.000	8.2	100.0	40.0	16.34	Vertical	Pass
103.74	39.84	120.000	10.2	100.0	43.5	3.66	Vertical	Pass
374.65	28.65	120.000	17.5	100.0	46.0	17.35	Vertical	Pass
462.58	29.87	120.000	19.3	100.0	46.0	16.13	Vertical	Pass
874.65	36.57	120.000	23.9	100.0	46.0	9.43	Vertical	Pass
934.17	37.41	120.000	25.2	100.0	46.0	8.59	Vertical	Pass

For 1GHz to 40 GHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11a_5180MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5150.00	58.74	PK	74.00	-15.26	2.00	180	51.24	7.50
2	5150.00	48.44	AV	54.00	-5.56	2.00	180	40.94	7.50
3	10360.00	56.36	PK	68.20	-11.84	1.50	90	36.56	19.80
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11a_5180MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5150.00	59.24	PK	74.00	-14.76	1.50	0	51.74	7.50
2	5150.00	49.26	AV	54.00	-4.74	1.50	0	41.76	7.50
3	10360.00	57.48	PK	68.20	-10.72	1.50	180	37.68	19.80

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11a_5220MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	10400.00	61.74	PK	68.20	-6.46	2.00	0	41.84	19.90
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11a_5220MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	10400.00	62.35	PK	68.20	-5.85	2.00	180	42.45	19.90

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11a_5240MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5350.00	60.34	PK	74.00	-13.66	1.50	360	52.34	8.00
2	5350.00	49.99	AV	54.00	-4.01	1.50	360	41.99	8.00
3	10480.00	61.25	PK	68.20	-6.95	1.80	90	41.35	19.90
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11a_5240MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5350.00	61.25	PK	74.00	-12.75	1.00	360	53.25	8.00
2	5350.00	51.11	AV	54.00	-2.89	1.00	360	43.11	8.00
3	10480.00	60.78	PK	68.20	-7.42	1.50	0	40.88	19.90

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11n20_5180MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5150.00	59.68	PK	74.00	-14.32	1.50	0	52.18	7.50
2	5150.00	49.38	AV	54.00	-4.62	1.50	0	41.88	7.50
3	10360.00	59.57	PK	68.20	-8.63	2.00	180	39.77	19.80
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11n20_5180MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5150.00	60.25	PK	74.00	-13.75	2.50	150	52.75	7.50
2	5150.00	50.27	AV	54.00	-3.73	2.50	150	42.77	7.50
3	10360.00	59.36	PK	68.20	-8.84	1.50	0	39.56	19.80

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11n20_5220MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	10400.00	60.35	PK	68.20	-7.85	1.50	180	40.45	19.90
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11n20_5220MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	10400.00	60.79	PK	68.20	-7.41	1.50	0	40.89	19.90

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11n20_5240MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5350.00	61.25	PK	74.00	-12.75	1.50	360	53.25	8.00
2	5350.00	50.90	AV	54.00	-3.1	1.50	360	42.90	8.00
3	10480.00	60.74	PK	68.20	-7.46	1.80	90	40.84	19.90
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11n20_5240MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5350.00	59.68	PK	74.00	-14.32	2.00	180	51.68	8.00
2	5350.00	49.54	AV	54.00	-4.46	2.00	180	41.54	8.00
3	10480.00	59.98	PK	68.20	-8.22	2.00	0	40.08	19.90

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11n40_5190MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5150.00	57.48	PK	74.00	-16.52	1.50	360.00	49.98	7.50
2	5150.00	46.70	AV	54.00	-7.3	1.50	360.00	39.20	7.50
3	10380.00	58.98	PK	68.20	-9.22	2.00	150.00	39.18	19.80
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11n40_5190MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5150.00	59.47	PK	74.00	-14.53	2.00	180.00	51.97	7.50
2	5150.00	49.49	AV	54.00	-4.51	2.00	180.00	41.99	7.50
3	10380.00	58.78	PK	68.20	-9.42	2.00	150.00	38.98	19.80

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（802.11n40_5230MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5350.00	60.14	PK	74.00	-13.86	2.00	0.00	52.14	8.00
2	5350.00	49.79	AV	54.00	-4.21	2.00	90.00	41.79	8.00
3	10460.00	59.25	PK	68.20	-8.95	1.50	0.00	39.35	19.90
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（802.11n40_5230MHz）									
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Correction Factor (dB/m)
1	5350.00	60.47	PK	74.00	-13.53	1.50	180.00	52.47	8.00
2	5350.00	50.33	AV	54.00	-3.67	1.50	180.00	42.33	8.00
3	10460.00	59.97	PK	68.20	-21.54	1.50	150.00	40.07	19.90

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

2.7. Conducted Emission

2.7.1. Limit of Conducted Emission

FCC 15.207,

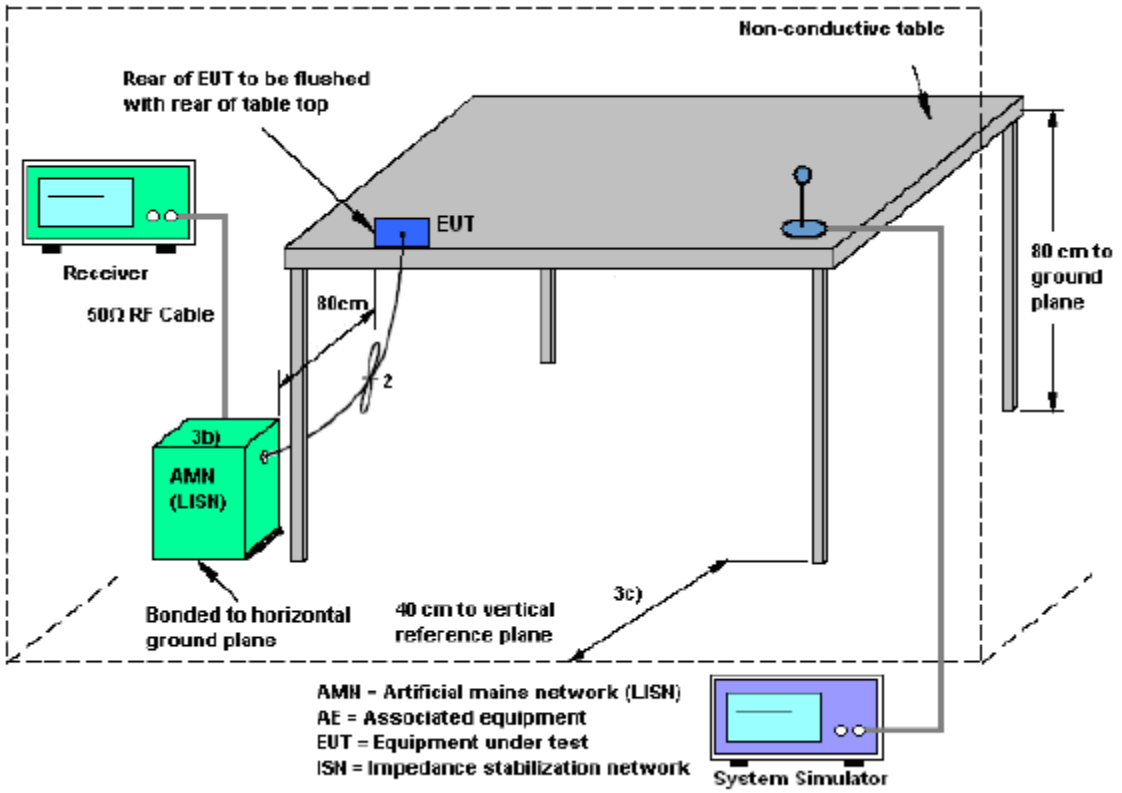
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

2.7.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.7.3. Test Setup

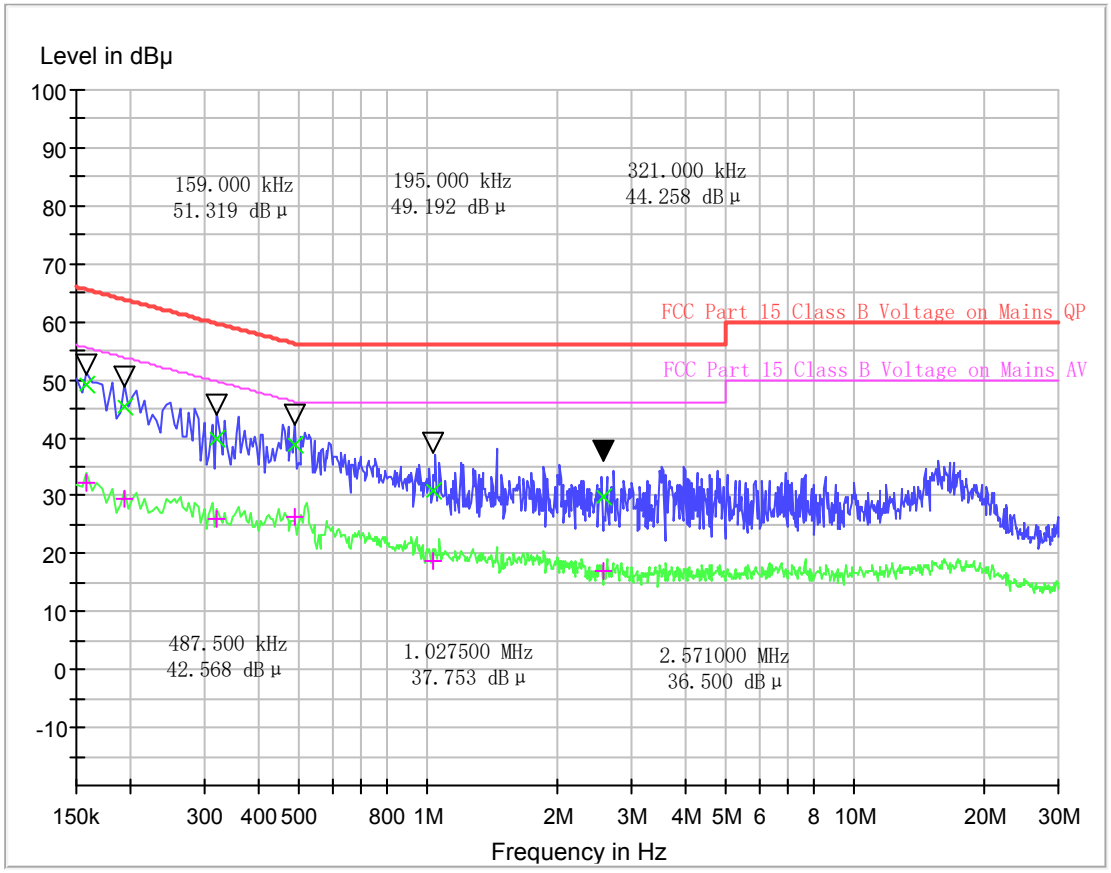


2.7.4. Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

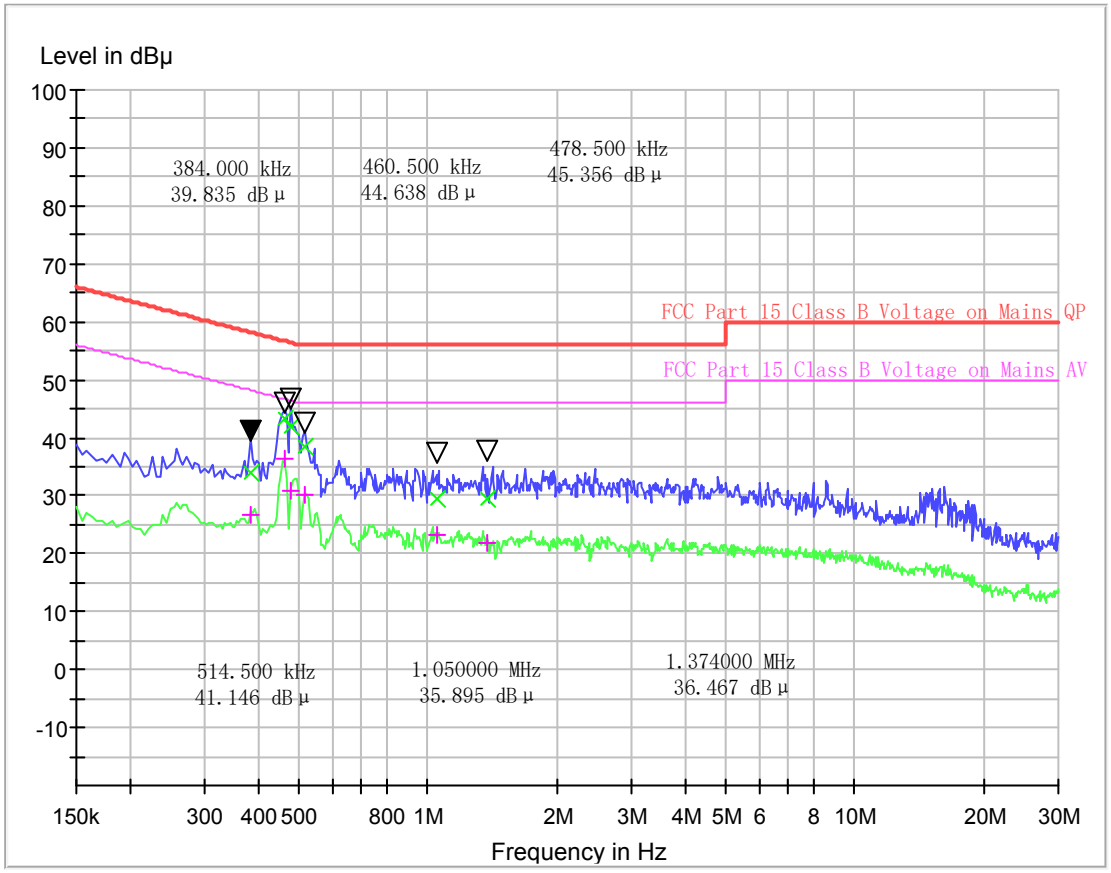
2.7.5. Test Results of Conducted Emission

The EUT configuration of the emission tests is 5G WLAN Link + USB Cable (Charging from Adapter)



(Plot A: L Phase)

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dBµV)
0.159000	49.13	32.07	0.1	10.1	16.39	65.5	23.45	55.5
0.195000	45.26	29.48	0.1	10.1	18.56	63.8	24.34	53.8
0.321000	39.88	25.97	0.6	10.6	19.80	59.7	23.71	49.7
0.487500	38.94	26.23	0.6	10.6	17.27	56.2	19.98	46.2
1.027500	30.67	18.78	0.6	10.6	25.33	56.0	27.22	46.0
2.571000	29.83	16.96	0.7	10.7	26.17	56.0	29.04	46.0



(Plot B: N Phase)

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dBµV)
0.384000	33.94	26.80	0.1	10.1	24.25	58.2	21.39	48.2
0.460500	43.38	36.34	0.1	10.1	13.30	56.7	10.34	46.7
0.478500	41.80	30.73	0.1	10.1	14.57	56.4	15.64	46.4
0.514500	38.37	30.27	0.1	10.1	17.63	56.0	15.73	46.0
1.050000	29.57	23.20	0.2	10.2	26.43	56.0	22.80	46.0
1.374000	29.28	21.93	0.2	10.2	26.72	56.0	24.07	46.0

Test Result: PASS

Note: Correction factor=Cabel loss+ attenuation factor

attenuation factor=10dB

3. List of measuring equipment

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI TEST RECEIVER	R&S	ESIB7	A0501375	2019.07.30	2020.07.29
2	Power Meter	R&S	NRP-Z31	102872	2019.05.05	2020.05.04
3	TURNTABLE	ETS	2088	2149	N/A	N/A
4	ANTENNA MAST	ETS	2075	2346	N/A	N/A
5	EMI TEST Software	R&S	ESK1	N/A	N/A	N/A
6	Horn antenna (18GHz~26.5GHz)	AR	AT4002A	305753	2017.11.10	2020.11.09
7	Amplifer	MILMEGA	80RF1000-250	A140901925	2017.10.09	2020.10.08
8	JS amplifer	AR	25S1G4AM1	A0304248	2017.10.09	2020.10.08
9	High pass filter	Compliance Direction systems	BSU-6	34202	2019.11.10	2020.11.09
13	Horn Antenna	AR	AT4002A	305753	2017.07.12	2020.07.11
14	Horn Antenna	AR	AT4510	325306	2018.07.14	2020.07.13
15	Horn Antenna (26.5-40GHz)	R&S	Oct-60	71688	2018.08.29.	2020.08.28
16	ULTRA-BROADBAND ANTENNA	R&S	HL562	A0304224	2017.07.14	2020.07.13
17	Passive Loop Antenna	R&S	HFH2-Z2	100047	2019.04.26	2022.04.25
18	Temperature chamber	Dongguan gaoda instrument CO.LTD	GD-7005-100	130130101	2019.04.22	2020.04.21
19	Spectrum Analyzer	KEYSIGHT	N9030A	A160702554	2019.06.05	2020.06.04
20	Power Supply	R&S	NGMO1	101037	2019.08.03	2020.08.02
21	EMI TEST RECEIVER	KEYSIGHT	ESIB26	A0304218	2019.05.20	2020.05.19
22	LISN	R&S	ESH2-Z5	A0304221	2019.04.30	2020.04.29
23	Cable	MATCHING PAD	W7	/	2019.01.02	2020.01.01

4. Uncertainty of Evaluation

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

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	2.6dB

Uncertainty of Radiated Emission Measurement (30MHz~1GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	2.4dB

Uncertainty of Radiated Emission Measurement (1GHz~40GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	2.8dB

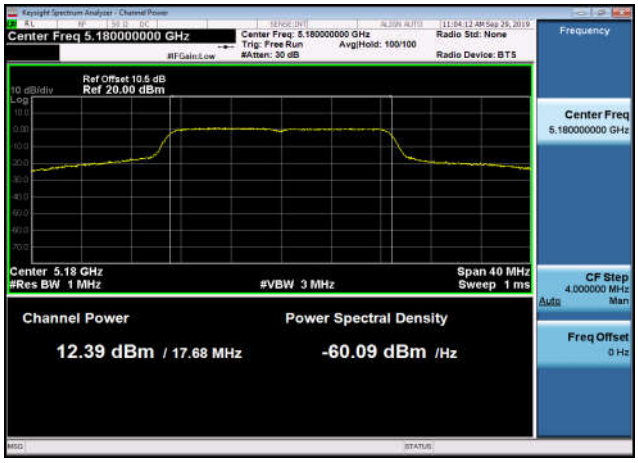
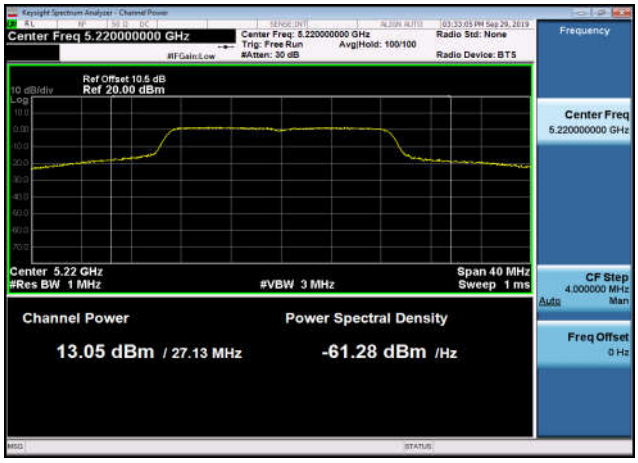
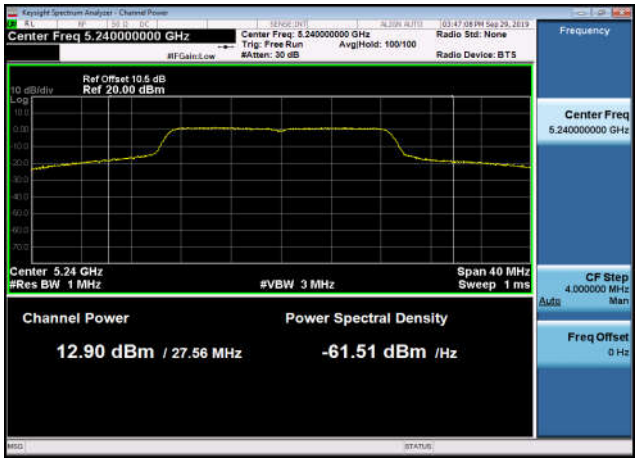
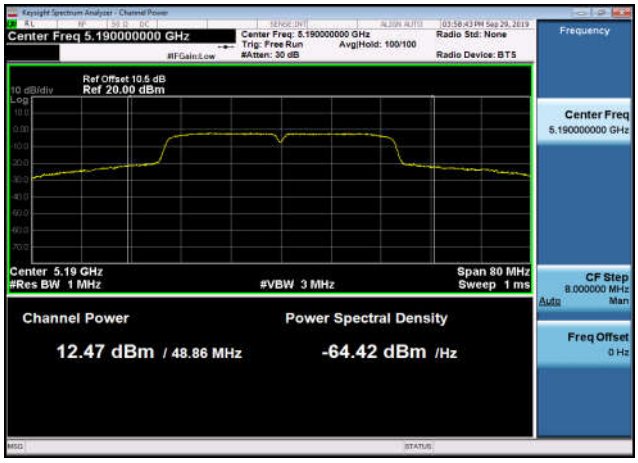
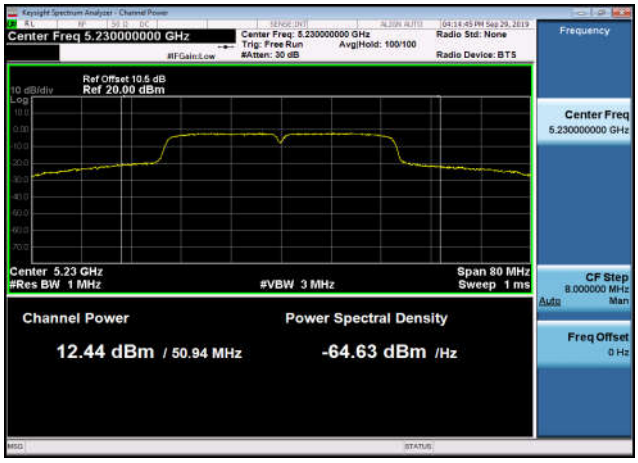
Appendix A

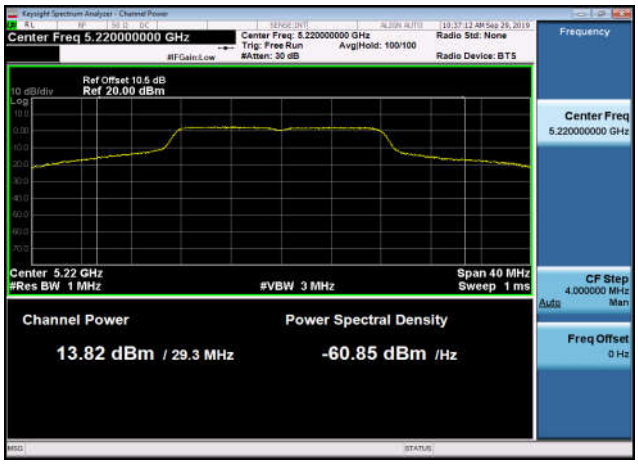
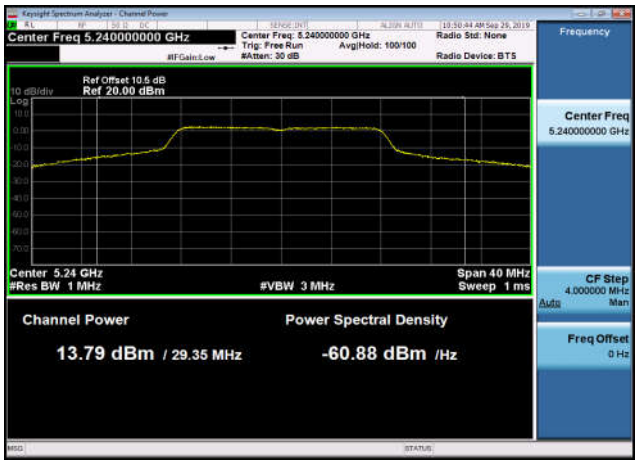
Conducted output power

Test results

U-NII-1 AVGSA Output Power				
Mode	Test Frequency (MHz)	Max Conducted Output Power (dBm)	Limit (dBm)	Result
802.11n (20MHz)	5180	12.39	24	Pass
802.11n (20MHz)	5220	13.05	24	Pass
802.11n (20MHz)	5240	12.90	24	Pass
802.11n (40MHz)	5190	12.47	24	Pass
802.11n (40MHz)	5230	12.44	24	Pass
802.11a (20MHz)	5180	13.66	24	Pass
802.11a (20MHz)	5220	13.82	24	Pass
802.11a (20MHz)	5240	13.79	24	Pass

Test Plots

U-NII-1 Output Power-802.11n(20MHz) ,5180MHz,Ant1	U-NII-1 Output Power-802.11n(20MHz) ,5220MHz,Ant1
	
U-NII-1 Output Power-802.11n(20MHz) ,5240MHz,Ant1	U-NII-1 Output Power-802.11n(40MHz) ,5190MHz,Ant1
	
U-NII-1 Output Power-802.11n(40MHz) ,5230MHz,Ant1	U-NII-1 Output Power-802.11a(20MHz) ,5180MHz,Ant1
	

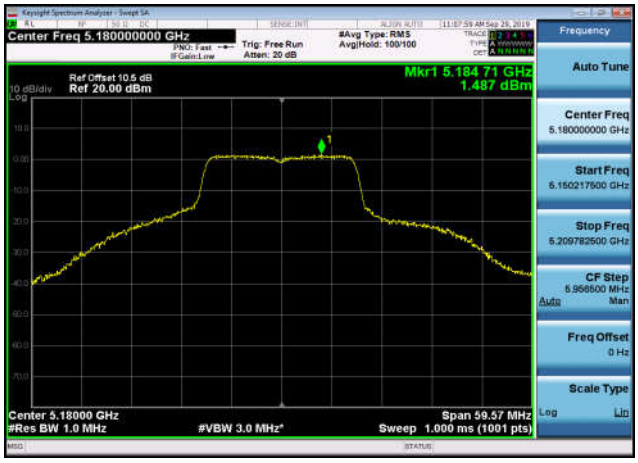
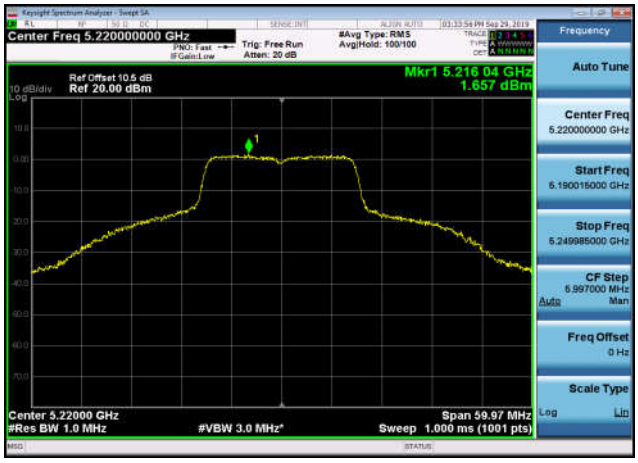
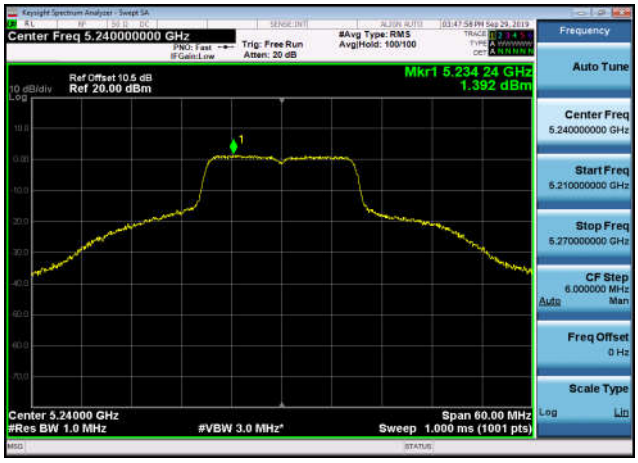
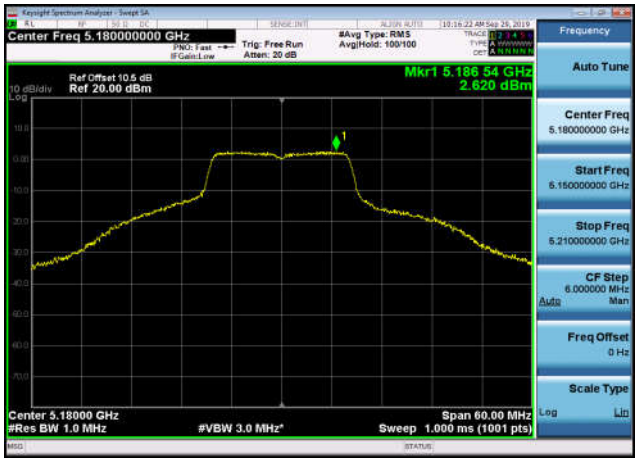
U-NII-1 Output Power-802.11a(20MHz) ,5220MHz,Ant1	U-NII-1 Output Power-802.11a(20MHz) ,5240MHz,Ant1
	

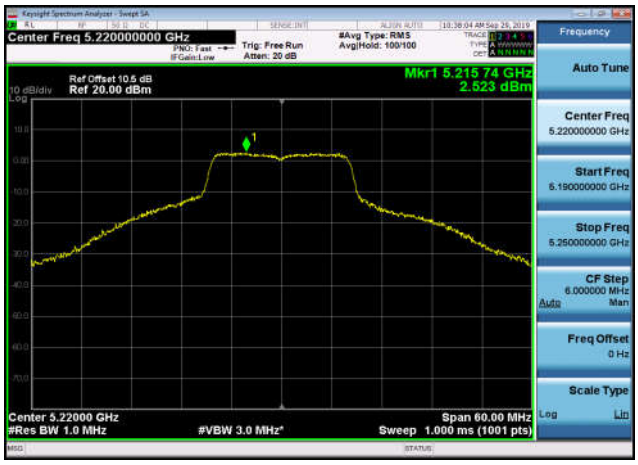
AVGSA Power Spectral Density

Test Result and Data

U-NII-1 AVGSA Power Spectral Density				
Mode	Test Frequency (MHz)	PSD (dBm/1MHz)	Limit (dBm/1MHz)	Result
802.11n (20MHz)	5180	1.487	11	Pass
802.11n (20MHz)	5220	1.657	11	Pass
802.11n (20MHz)	5240	1.392	11	Pass
802.11n (40MHz)	5190	-1.689	11	Pass
802.11n (40MHz)	5230	-2.340	11	Pass
802.11a (20MHz)	5180	2.620	11	Pass
802.11a (20MHz)	5220	2.523	11	Pass
802.11a (20MHz)	5240	2.712	11	Pass

Test Plots

U-NII-1 Power spectral density-802.11 n(20MHz),5180MHz,Ant1	U-NII-1 Power spectral density-802.11 n(20MHz),5220MHz,Ant1
	
U-NII-1 Power spectral density-802.11 n(20MHz),5240MHz,Ant1	U-NII-1 Power spectral density-802.11 n(40MHz),5190MHz,Ant1
	
U-NII-1 Power spectral density-802.11 n(40MHz),5230MHz,Ant1	U-NII-1 Power spectral density-802.11 a(20MHz),5180MHz,Ant1
	

U-NII-1 Power spectral density-802.11 a(20MHz),5220MHz,Ant1	U-NII-1 Power spectral density-802.11 a(20MHz),5240MHz,Ant1
	

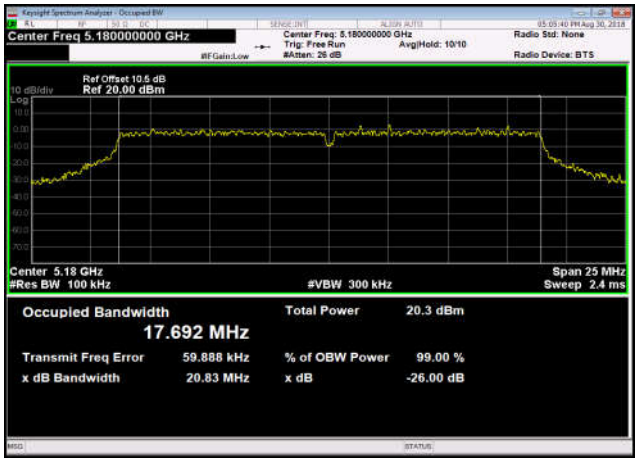
26dB Bandwidth

Test Result and Data

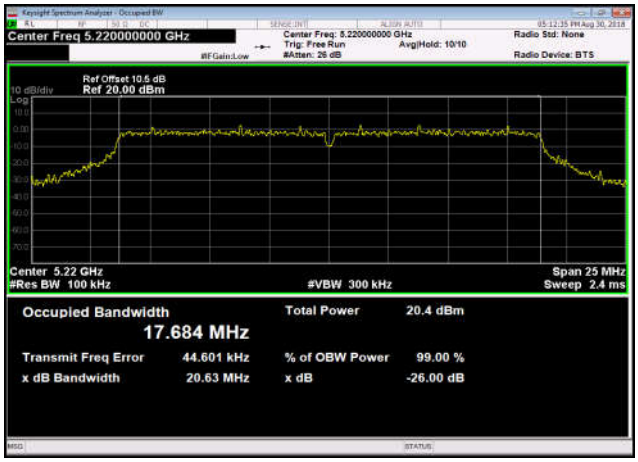
U-NII-1 26dB Occupied Bandwidth			
Mode	Test Frequency (MHz)	26dB Occupied Bandwidth (MHz)	Result
802.11n (20MHz)	5180	20.83	Pass
802.11n (20MHz)	5220	20.63	Pass
802.11n (20MHz)	5240	20.64	Pass
802.11n (40MHz)	5190	38.50	Pass
802.11n (40MHz)	5230	39.68	Pass
802.11a (20MHz)	5180	19.98	Pass
802.11a (20MHz)	5220	21.06	Pass
802.11a (20MHz)	5240	20.65	Pass

Test plot

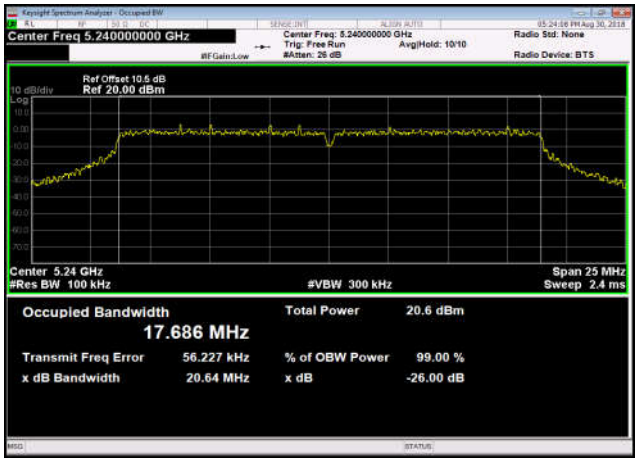
U-NII-1 26dB Bandwidth-802.11n(20MHz) ,5180MHz



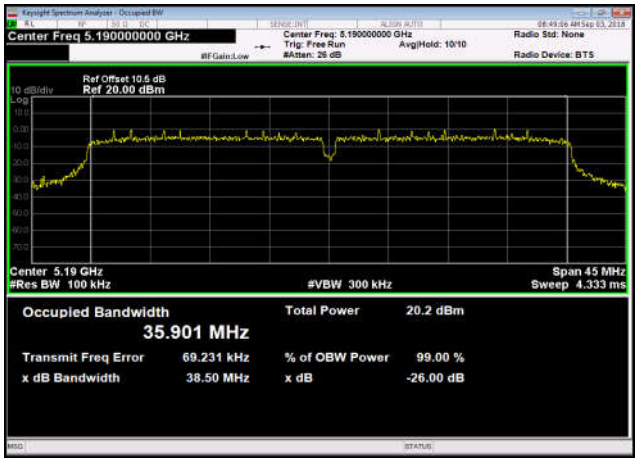
U-NII-1 26dB Bandwidth-802.11n(20MHz) ,5220MHz



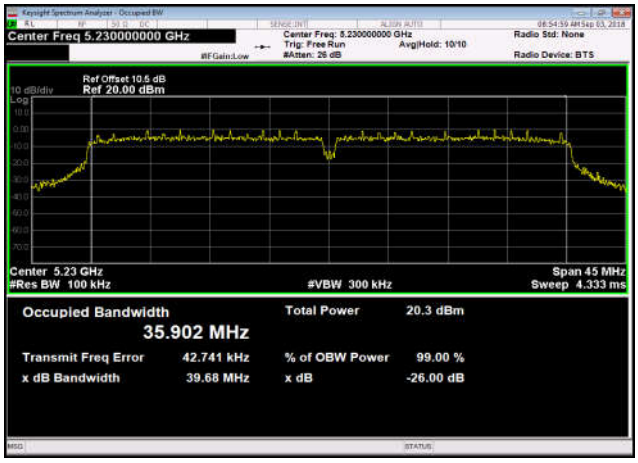
U-NII-1 26dB Bandwidth-802.11n(20MHz) ,5240MHz



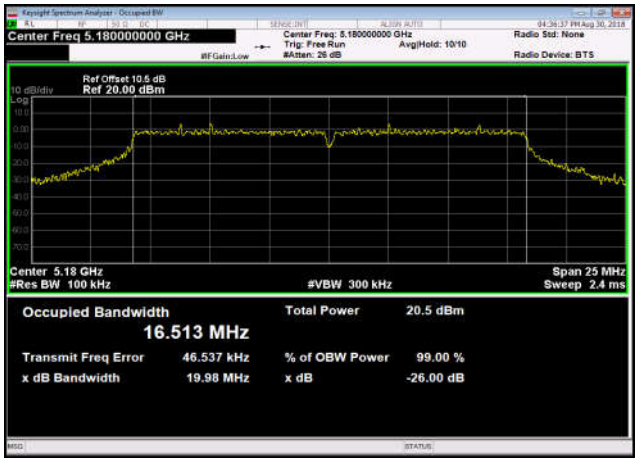
U-NII-1 26dB Bandwidth-802.11n(40MHz) ,5190MHz

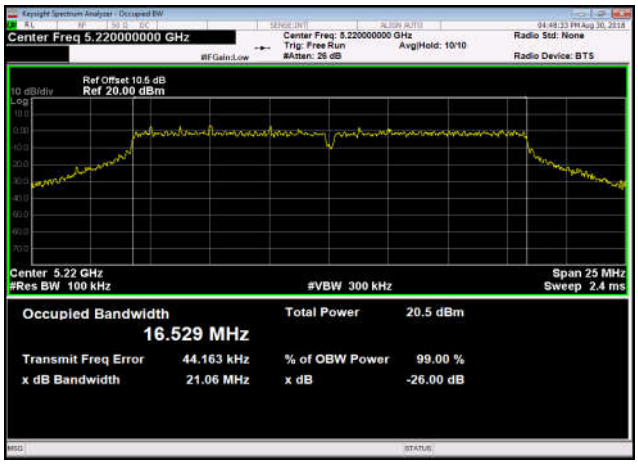
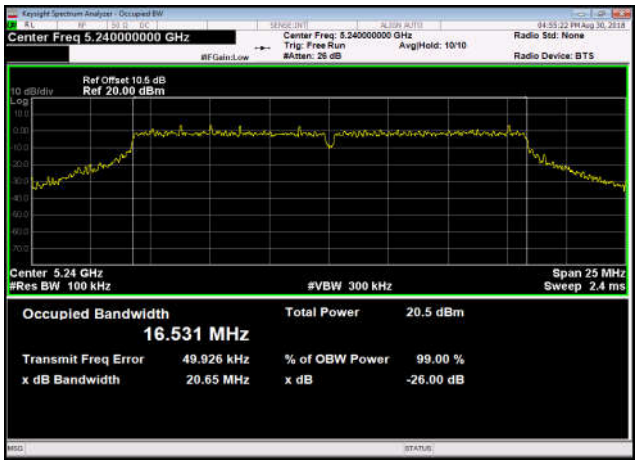


U-NII-1 26dB Bandwidth-802.11n(40MHz) ,5230MHz

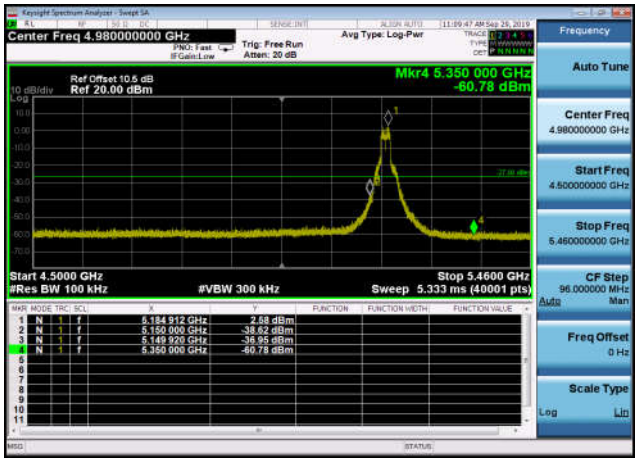
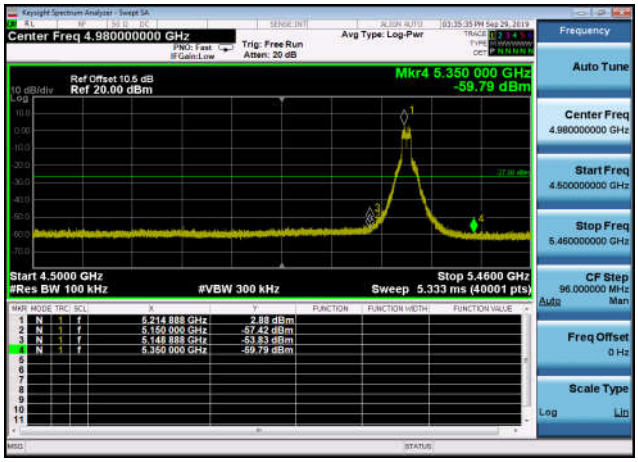
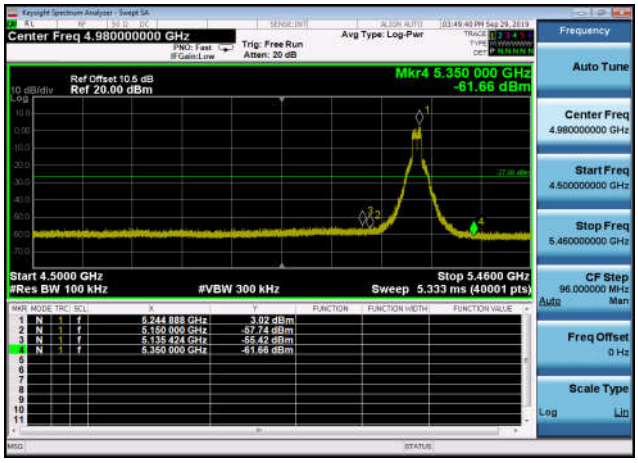
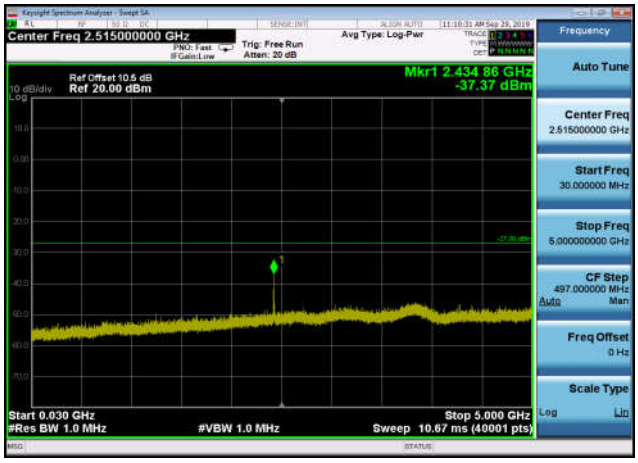
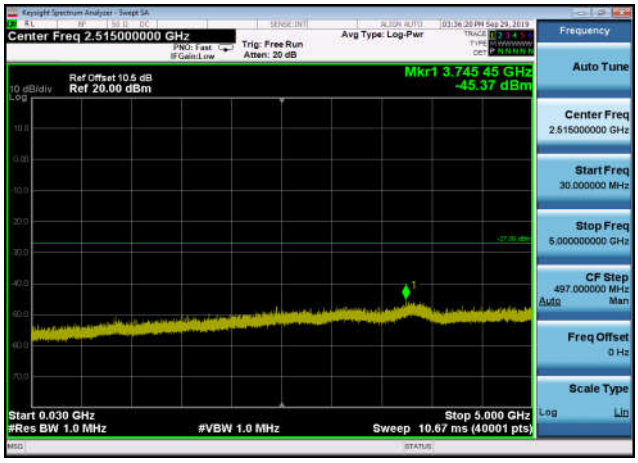
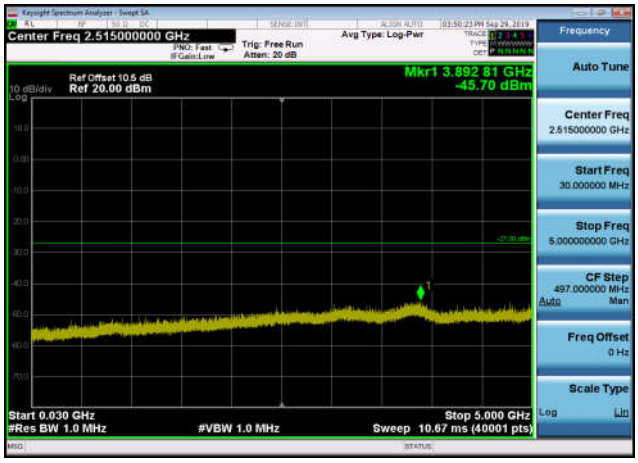


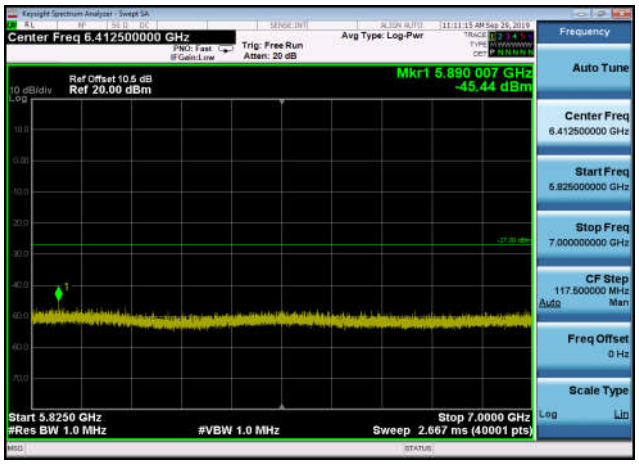
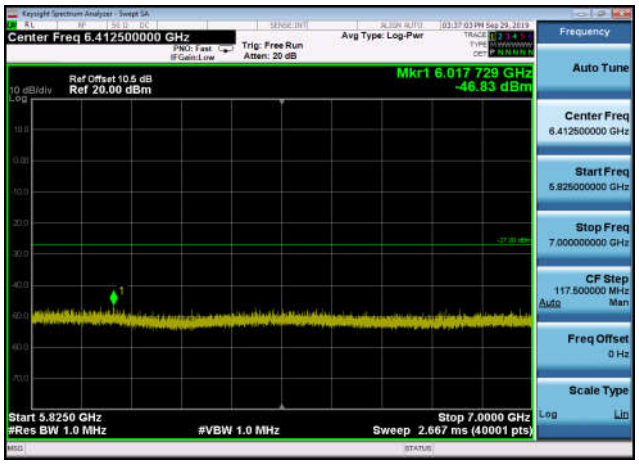
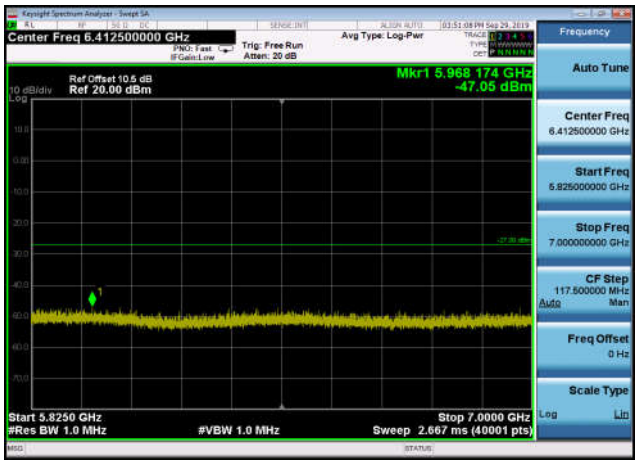
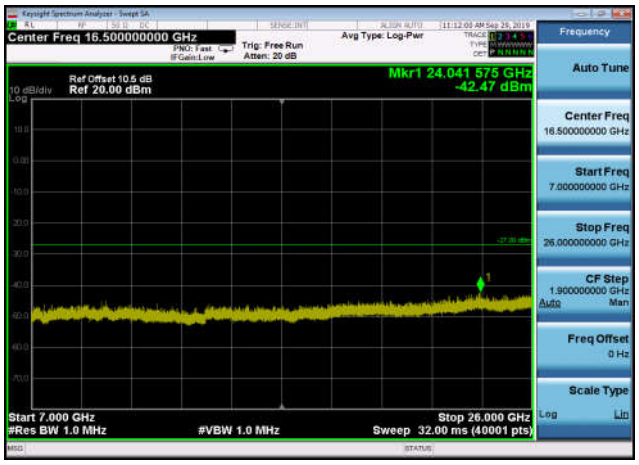
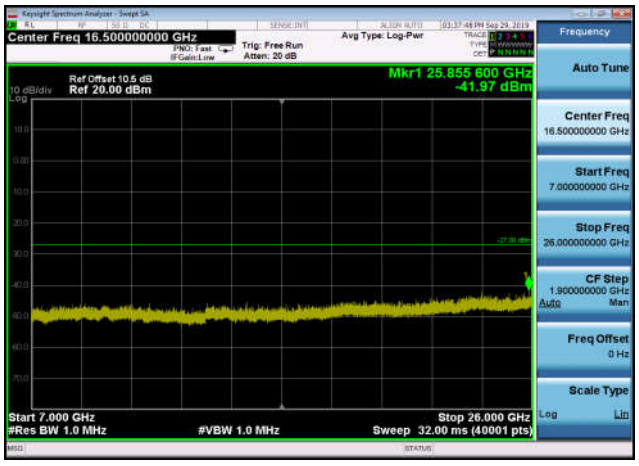
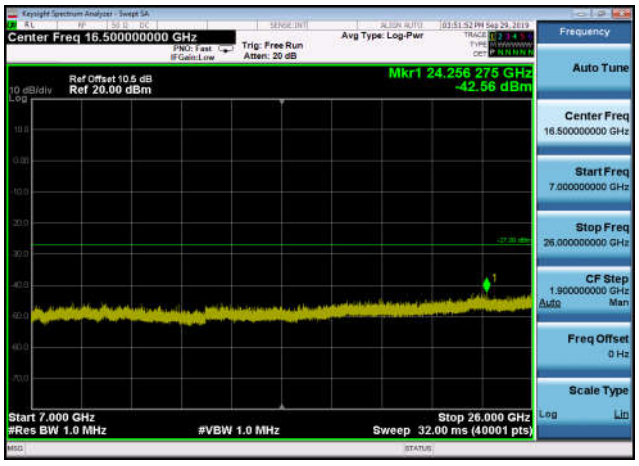
U-NII-1 26dB Bandwidth-802.11a(20MHz) ,5180MHz

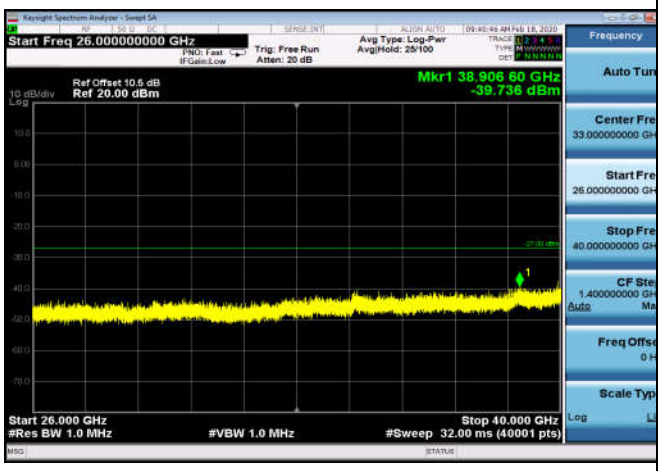
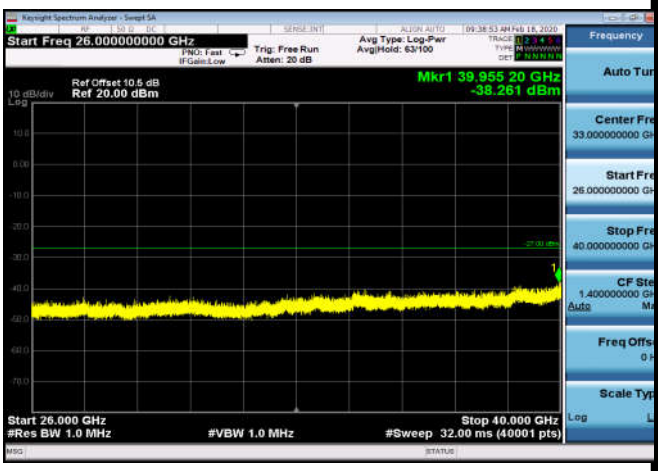
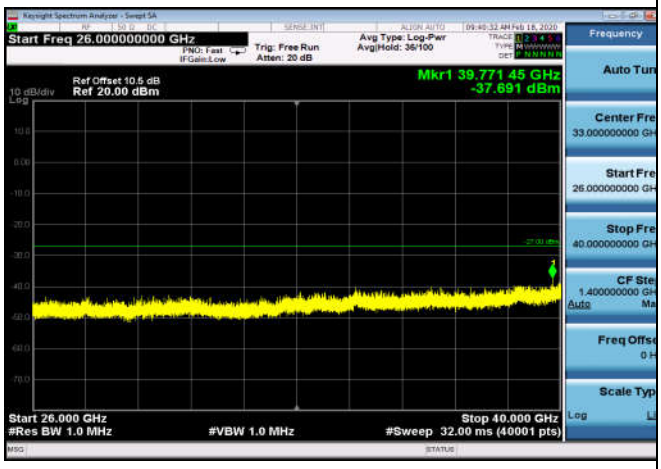
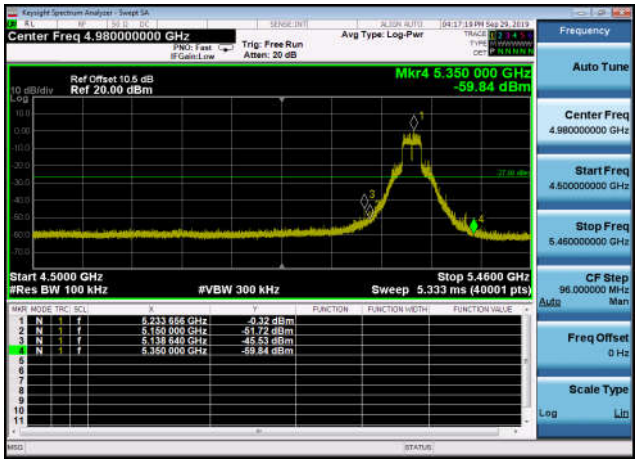
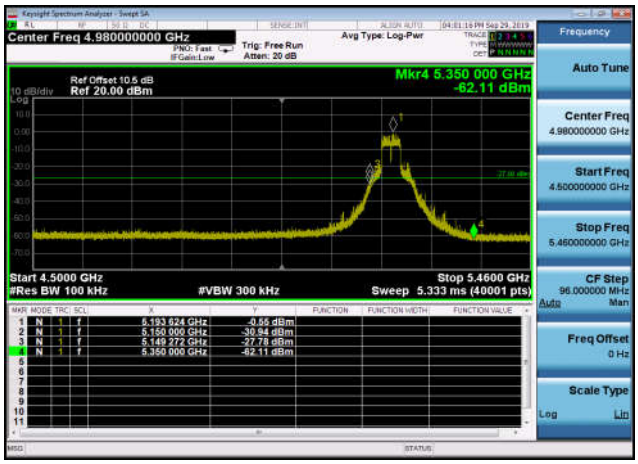
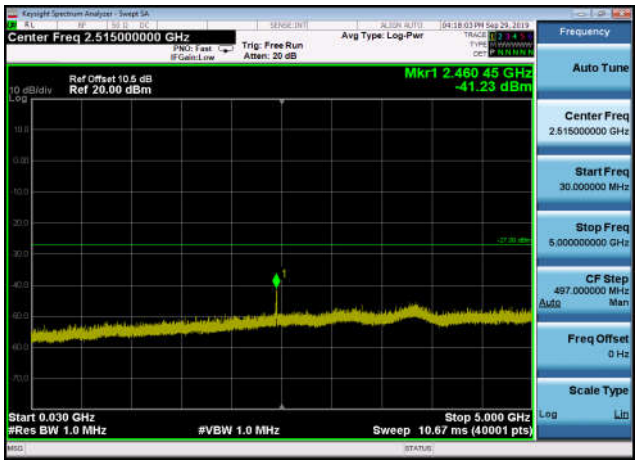


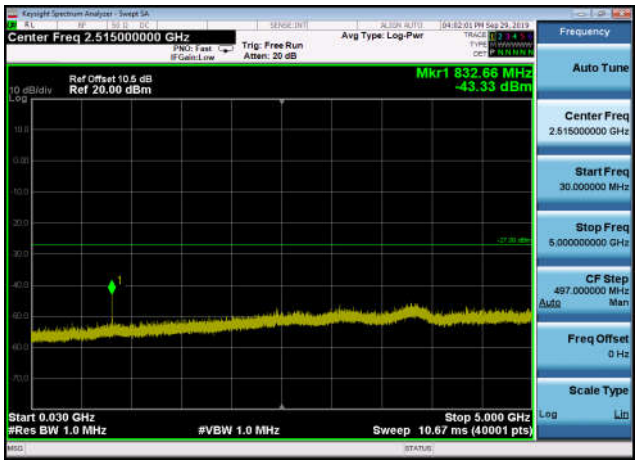
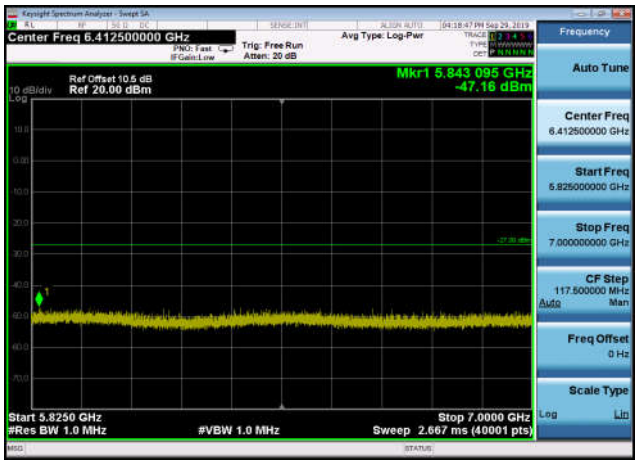
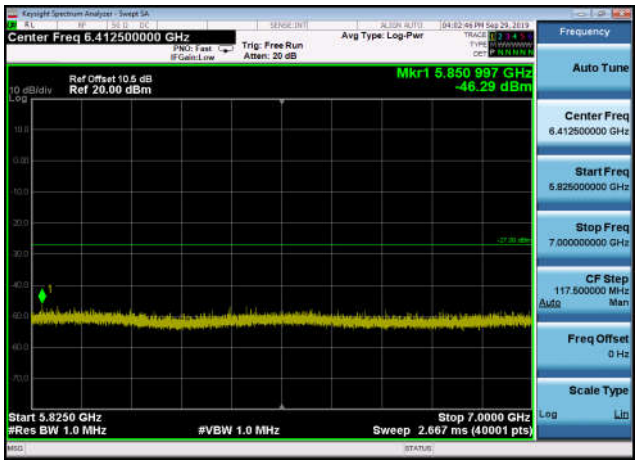
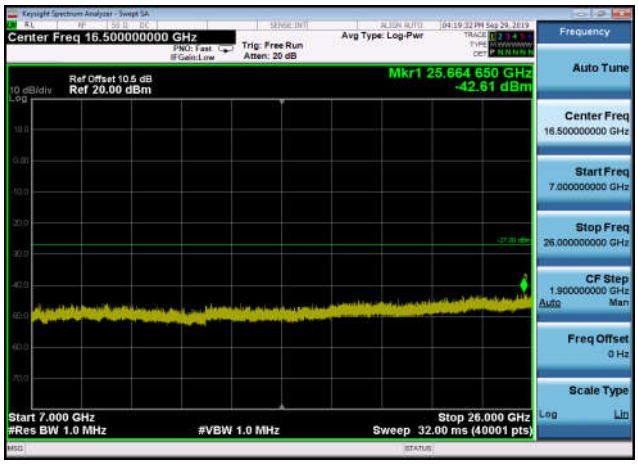
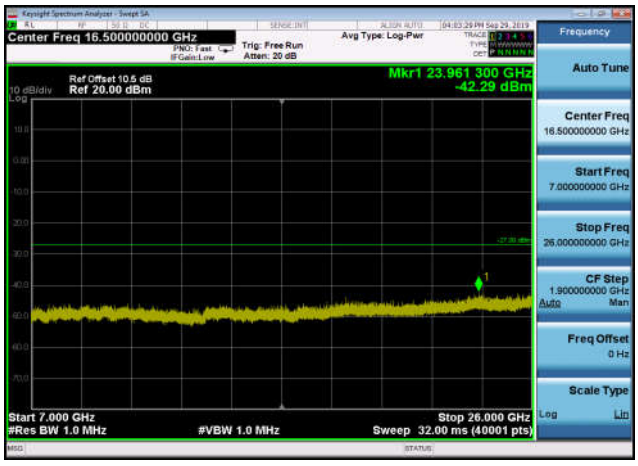
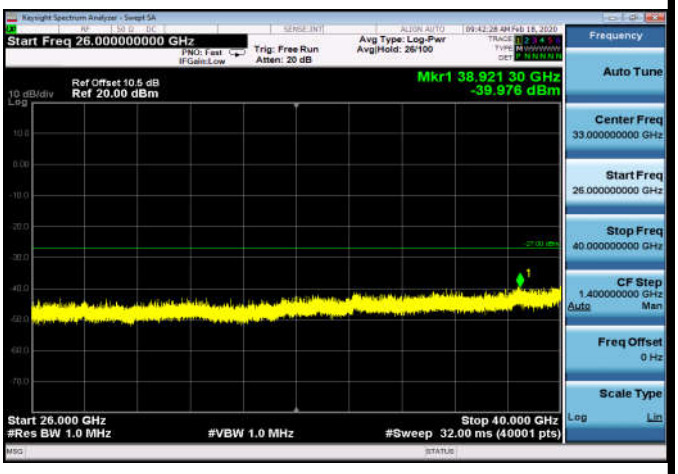
U-NII-1 26dB Bandwidth-802.11a(20MHz) ,5220MHz	U-NII-1 26dB Bandwidth-802.11a(20MHz) ,5240MHz
	

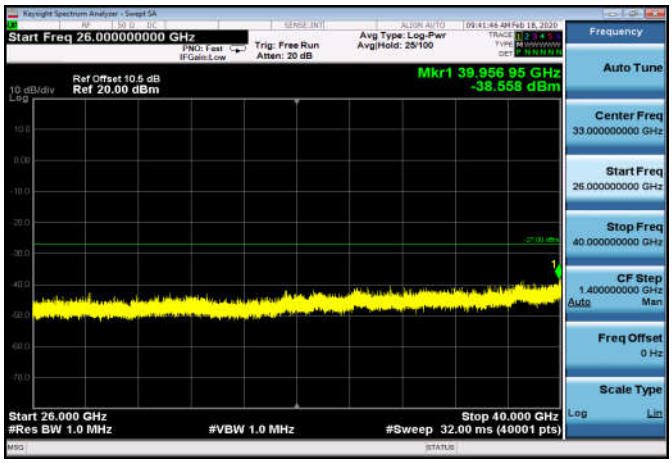
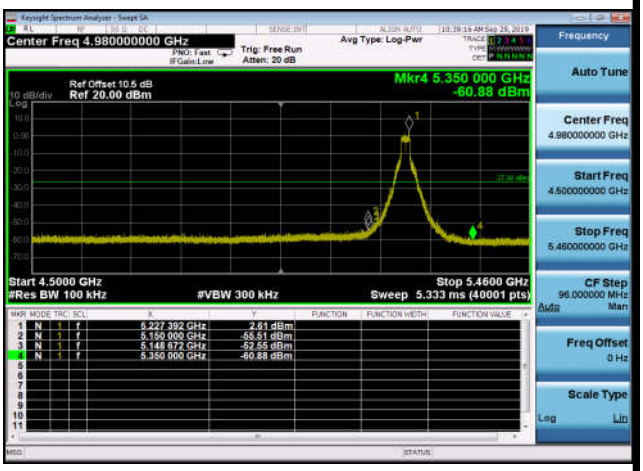
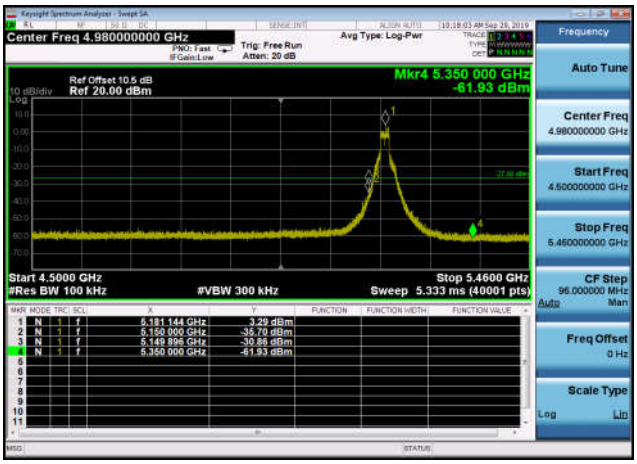
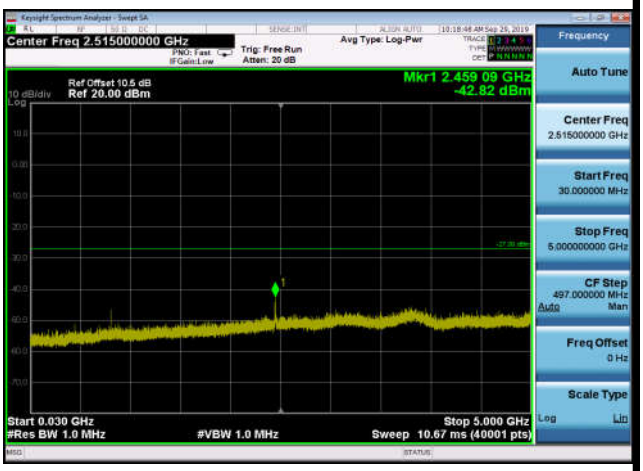
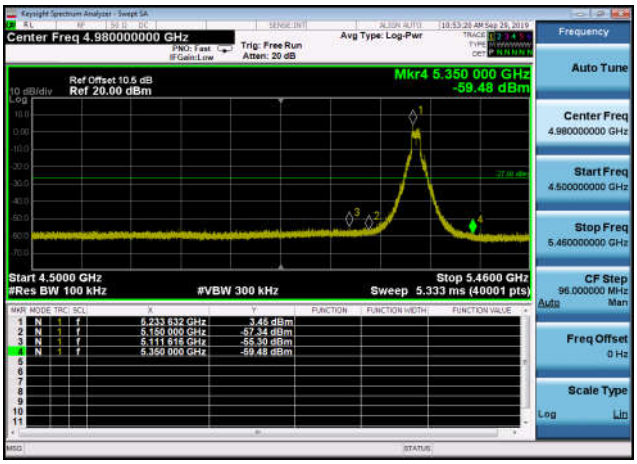
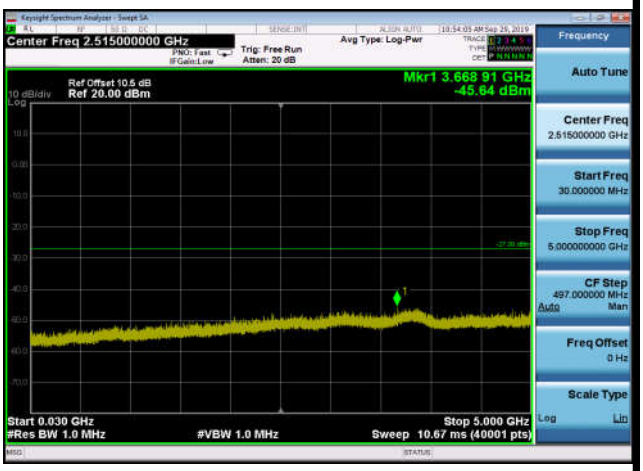
Conducted spurious emission

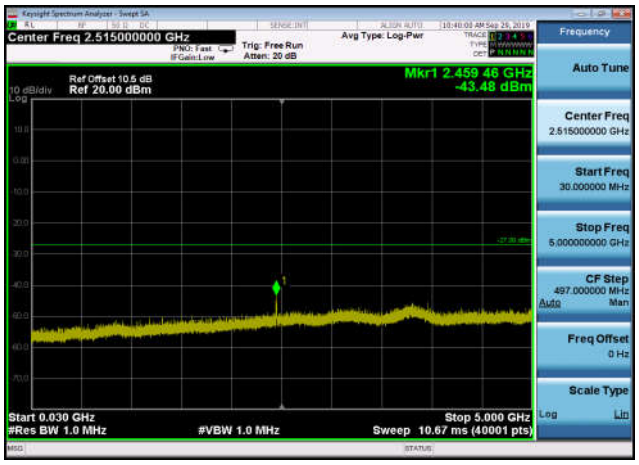
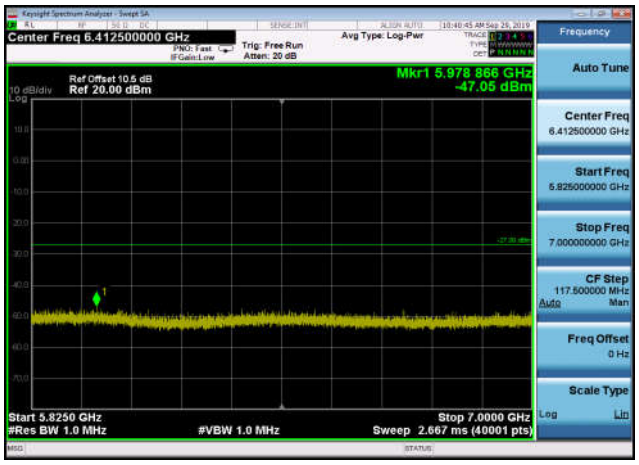
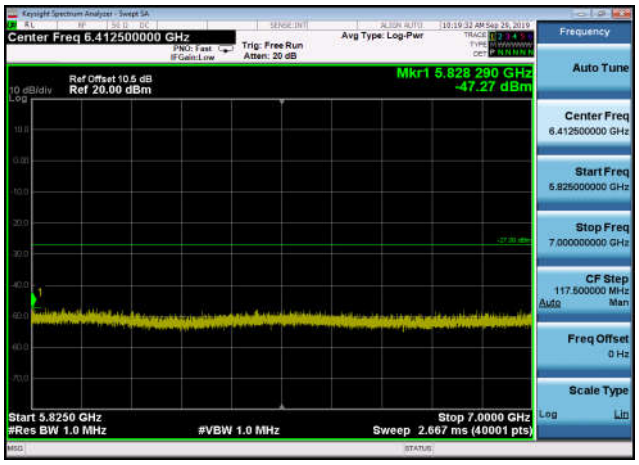
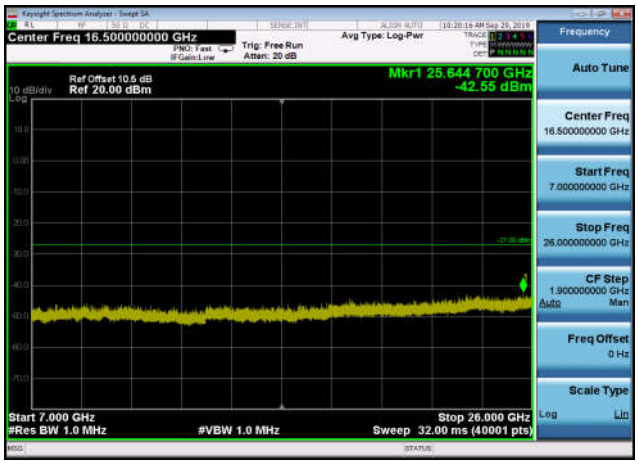
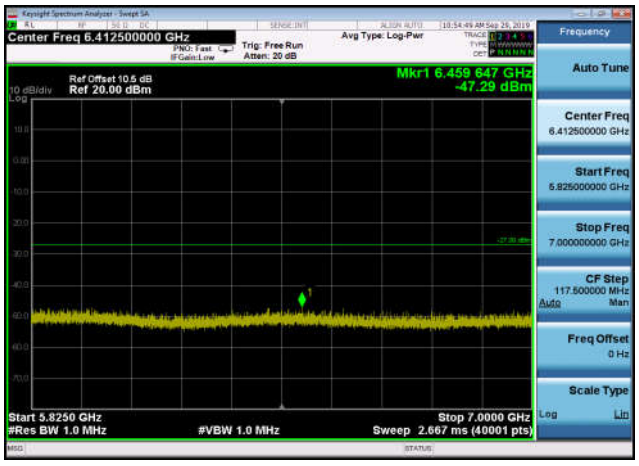
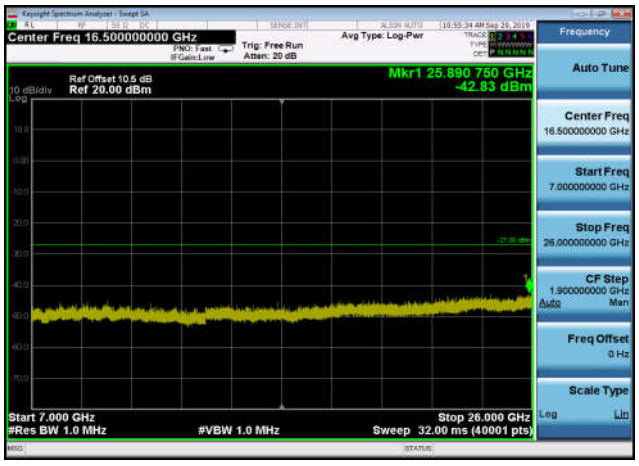
U-NII-1 ,Plot 1,Band Edge-802.11n(20MHz),5180MHz,Ant1	U-NII-1 ,Plot 1,Band Edge-802.11n(20MHz),5220MHz,Ant1
	
U-NII-1 ,Plot 1,Band Edge-802.11n(20MHz),5240MHz,Ant1	U-NII-1 ,Plot 2,30MHz~5000MHz-802.11n(20MHz),5180MHz,Ant1
	
U-NII-1 ,Plot 2,30MHz~5000MHz-802.11n(20MHz),5220MHz,Ant1	U-NII-1 ,Plot 2,30MHz~5000MHz-802.11n(20MHz),5240MHz,Ant1
	

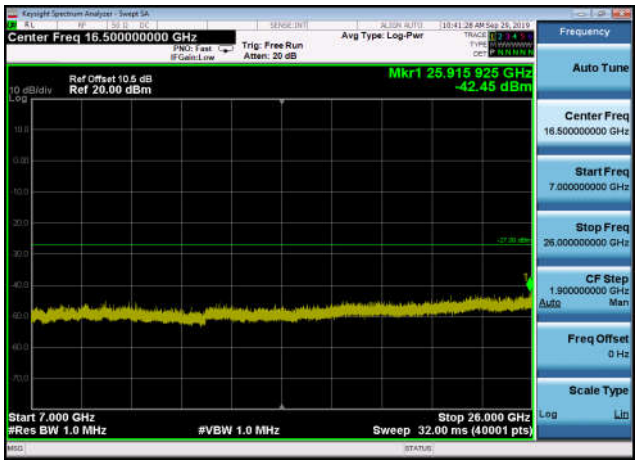
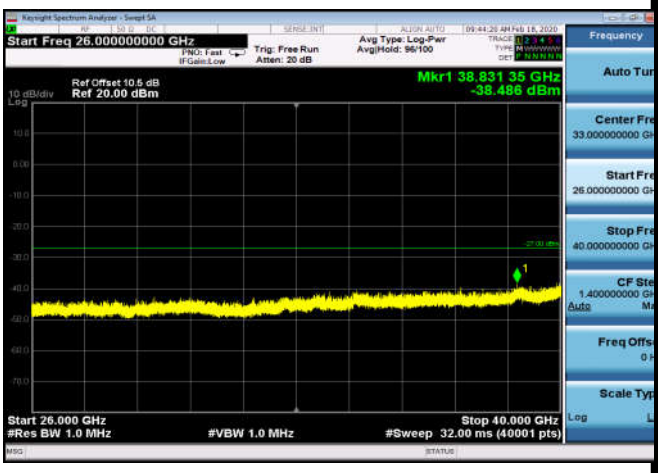
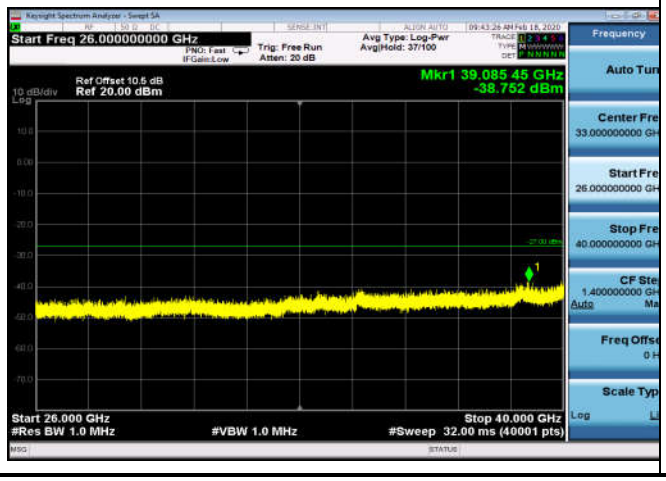
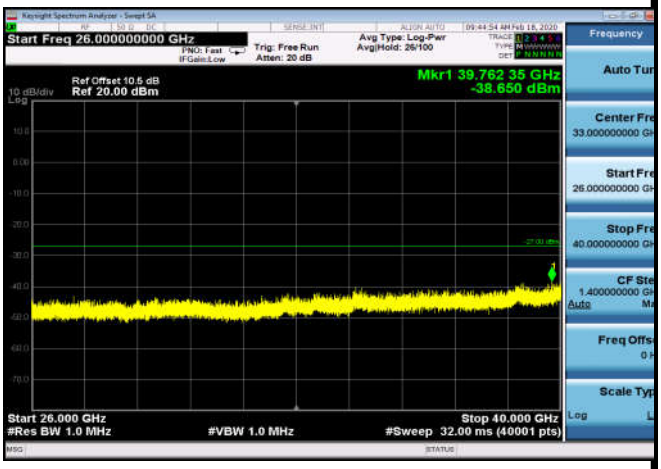
U-NII-1 ,Plot 3,5825MHz~7000MHz-802.11n(20MHz),5180MHz,Ant1	U-NII-1 ,Plot 3,5825MHz~7000MHz-802.11n(20MHz),5220MHz,Ant1
	
U-NII-1 ,Plot 3,5825MHz~7000MHz-802.11n(20MHz),5240MHz,Ant1	U-NII-1 ,Plot 4,7000MHz~26000MHz-802.11n(20MHz),5180MHz,Ant1
	
U-NII-1 ,Plot 4,7000MHz~26000MHz-802.11n(20MHz),5220MHz,Ant1	U-NII-1 ,Plot 4,7000MHz~26000MHz-802.11n(20MHz),5240MHz,Ant1
	

U-NII-1 ,Plot 5,26000MHz~40000MHz-802.11n(20MHz),5180MHz,Ant1	U-NII-1 ,Plot 5,26000MHz~40000MHz-802.11n(20MHz),5220MHz,Ant1
	
U-NII-1 ,Plot 5,26000MHz~40000MHz-802.11n(20MHz),5240MHz,Ant1	U-NII-1 ,Plot 1,Band Edge-802.11n(40MHz),5230MHz,Ant1
	
U-NII-1 ,Plot 1,Band Edge-802.11n(40MHz),5190MHz,Ant1	U-NII-1 ,Plot 2,30MHz~5000MHz-802.11n(40MHz),5230MHz,Ant1
	

U-NII-1 ,Plot 2,30MHz~5000MHz-802.11n (40MHz),5190MHz,Ant1	U-NII-1 ,Plot 3,5825MHz~7000MHz-802.11n(40MHz),5230MHz,Ant1
	
U-NII-1 ,Plot 3,5825MHz~7000MHz-802.11n(40MHz),5190MHz,Ant1	U-NII-1 ,Plot 4,7000MHz~26000MHz-802.11n(40MHz),5230MHz,Ant1
	
U-NII-1 ,Plot 4,7000MHz~26000MHz-802.11n(40MHz),5190MHz,Ant1	U-NII-1 ,Plot 5,26000MHz~40000MHz-802.11n(40MHz),5230MHz,Ant1
	

U-NII-1 ,Plot 5,26000MHz~40000MHz-802.11n(40MHz),5190MHz,Ant1	U-NII-1 ,Plot 1,Band Edge-802.11a(20MHz),5220MHz,Ant1
	
U-NII-1 ,Plot 1,Band Edge-802.11a(20MHz),5180MHz,Ant1	U-NII-1 ,Plot 2,30MHz~5000MHz-802.11a(20MHz),5180MHz,Ant1
	
U-NII-1 ,Plot 1,Band Edge-802.11a(20MHz),5240MHz,Ant1	U-NII-1 ,Plot 2,30MHz~5000MHz-802.11a(20MHz),5240MHz,Ant1
	

U-NII-1 ,Plot 2,30MHz~5000MHz-802.11a (20MHz),5220MHz,Ant1	U-NII-1 ,Plot 3,5825MHz~7000MHz-802.11a(20MHz),5220MHz,Ant1
	
U-NII-1 ,Plot 3,5825MHz~7000MHz-802.11a(20MHz),5180MHz,Ant1	U-NII-1 ,Plot 4,7000MHz~26000MHz-802.11a(20MHz),5180MHz,Ant1
	
U-NII-1 ,Plot 3,5825MHz~7000MHz-802.11a(20MHz),5240MHz,Ant1	U-NII-1 ,Plot 4,7000MHz~26000MHz-802.11a(20MHz),5240MHz,Ant1
	

U-NII-1 ,Plot 4,7000MHz~26000MHz-802.11a(20MHz),5220MHz,Ant1	U-NII-1 ,Plot 5,26000MHz~40000MHz-802.11a(20MHz),5220MHz,Ant1
	
U-NII-1 ,Plot 5,26000MHz~40000MHz-802.11a(20MHz),5180MHz,Ant1	U-NII-1 ,Plot 5,26000MHz~40000MHz-802.11a(20MHz),5240MHz,Ant1
	

Frequency Stability

Mode	Test Frequency (MHz)	LF (MHz)	HF (MHz)	CF (MHz)	Freq Stability (ppm)	Test Result
802.11n (20MHz)	5180	5171.010	5188.812	5179.911	-17.210	Pass
802.11n (20MHz)	5220	5211.004	5228.813	5219.909	-17.480	Pass
802.11n (20MHz)	5240	5231.004	5248.818	5239.911	-16.940	Pass
802.11n (40MHz)	5190	5171.667	5208.155	5189.911	-17.200	Pass
802.11n (40MHz)	5230	5211.726	5248.087	5229.906	-17.930	Pass
802.11a (20MHz)	5180	5171.628	5188.193	5179.911	-17.210	Pass
802.11a (20MHz)	5220	5211.595	5228.220	5219.908	-17.720	Pass
802.11a (20MHz)	5240	5231.629	5248.181	5239.905	-18.130	Pass

** END OF REPORT **