Shenzhen CTL Testing Technology Co., Ltd.
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TEST REPORT

FCC PART 15 SUBPART E 15.407

Report Reference No. .....: **CTL1906244051-WF04**

Compiled by: (position+printed name+signature)	Happy Guo (File administrators)	
Tested by: (position+printed name+signature)	Nice Nong (Test Engineer)	Nice Nong
Approved by: (position+printed name+signature)	Ivan Xie (Manager)	Ivan Xie

Product Name.....: Beaglebone AI

Model/Type reference .....: Beaglebone AI

List Model(s).....: N/A

Trade Mark .....: N/A

FCC ID .....: 2ATUT-BBONE-AI

Applicant's name .....: **BeagleBoard.org Foundation**

Address of applicant .....: 4467 Ascot Court Oakland Township, Michigan, US 48306

Test Firm .....: **Shenzhen CTL Testing Technology Co., Ltd.**

Address of Test Firm .....: Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

Test specification.....:

Standard.....: **47 CFR FCC Part 15 Subpart E 15.407**

TRF Originator .....: Shenzhen CTL Testing Technology Co., Ltd.

Master TRF .....: Dated 2011-01

Date of receipt of test item.....: Jun. 26, 2019

Date of sampling .....: Jun. 26, 2019

Date of Test Date.....: Jun. 26, 2019–Jul. 08, 2019

Data of Issue.....: Jul. 09, 2019

Result .....: **Pass**

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TEST REPORT

Test Report No. :	CTL1906244051-WF04	Jul. 09, 2019 Date of issue

Equipment under Test	:	Beaglebone AI
Model /Type	:	Beaglebone AI
Listed Models	:	N/A
Applicant	:	**BeagleBoard.org Foundation**
Address	:	4467 Ascot Court Oakland Township, Michigan, US 48306
Manufacturer	:	**Embest Technology Co., Ltd**
Address	:	Tower B 4/F, Shanghai Building, Nanshan Yungu Innovation Industry Park, Liuxian Ave. No.1183, Taoyuan St., Nanshan District, Shenzhen, China.

Test result	**Pass ***

* In the configuration tested, the EUT complied with the standards specified page 5.

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.

** Modified History **

Revisions	Description	Issued Data	Report No.	Remark
Version 1.0	Initial Test Report Release	2019-07-09	CTL1906244051-WF04	Tracy Qi

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1. SUMMARY

1.1. TEST STANDARDS

The tests were performed according to following standards:

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

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

KDB789033 D02: General UNII Test Procedures New Rules v02r01

1.2. Test Description

FCC Requirement		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.407(a)	Emission Bandwidth(26dBm Bandwidth)	PASS$_{Note1}$
FCC Part 15.407(e)	Minimum Emission Bandwidth(6dBm Bandwidth)	PASS$_{Note2}$
FCC Part 15.407(a)	Maximum Conducted Output Power	PASS
FCC Part 15.407(a)	Peak Power Spectral Density	PASS
FCC Part 15.407(g)	Frequency Stability	PASS
FCC Part 15.407(b)	Undesirable emission	PASS
FCC Part 15.407(b)/15.205/15.209	Radiated Emissions	PASS
FCC Part 15.407(h)	Dynamic Frequency Selection	PASS$_{Note\ 3}$
FCC Part 15.203/15.247(b)	Antenna Requirement	PASS

Note 1: Apply to U-NII 1, U-NII 2A, and U-NII 2C band.
Note 2: Apply to U-NII 3 band only.
Note 3: Test result see DFS report.

1.3. Test Facility

1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.3.2 Laboratory accreditation

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

CNAS-Lab Code: L7497

Shenzhen CTL Testing Technology Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No. 4343.01

Shenzhen CTL Testing Technology Co., Ltd, EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

IC Registration No.: 9518B

CAB identifier: CN0041

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with Registration No.: 9518B on Jan. 22, 2019.

FCC-Registration No.: 399832

Designation No.: CN1216

Shenzhen CTL Testing Technology 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. Registration 399832, December 08, 2017.

1.4. Statement of the measurement uncertainty

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

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)

Conducted Disturbance0.15~30MHz	±3.20dB	(1)

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

2. GENERAL INFORMATION

2.1. Environmental conditions

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

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

2.2. General Description of EUT

Product Name:	Beaglebone AI			
Model:	Beaglebone AI			
Power supply:	DC 5.0V			
WIFI				
Supported type:	20MHz system	40MHz system	80MHz system	160MHz system
	802.11a 802.11n 802.11ac	802.11n 802.11ac	802.11ac	N/A
Operation frequency:	5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz	5190-5230MHz 5270-5310MHz 5510-5670MHz 5755MHz,5795MHz	5210MHz; 5290MHz; 5530MHz; 5610MHz; 5775MHz	N/A
Modulation:	OFDM	OFDM	OFDM	N/A
Channel number:	24	11	5	N/A
Channel separation:	20MHz	40MHz	80MHz	N/A
Antenna type:	Internal antenna			
Antenna gain:	1.5dBi			

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

2.3. Description of Test Modes and Test Frequency

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

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

Operation Frequency List WIFI on 5G Band：

Operating band	20MHz		40MHz		80MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
U-NII 1 (5150MHz-5250MHz)	36	5180	38	5190	42	5210
	40	5200				
	44	5220	46	5230		
	48	5240				
U-NII 2A (5260MHz-5350MHz)	52	5260	54	5270	58	5290
	56	5280				
	60	5300	62	5310		
	64	5320				
U-NII 2C (5500MHz-5725MHz)	100	5500	102	5510	106	5530
	104	5520				
	108	5540	110	5550		
	112	5560				
	116	5580	118	5590	122	5610
	120	5600				
	124	5620	126	5630		
	128	5640				
	132	5660	134	5670	--	--
	136	5680			--	--
	140	5700	--	--	--	--
U-NII 3 (5725MHz-5850MHz)	149	5745	151	5755	155	5775
	153	5765				
	157	5785	159	5795		
	161	5805				
	165	5825	--	--	--	--

Note:

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

Data Rate Used:

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

Test Items	Mode	Data Rate
Maximum Conducted Output Power Power Spectral Density Emission Bandwidth(26dBm Bandwidth) Minimum Emission Bandwidth(6dBm Bandwidth) Undesirable emission Frequency Stability	11a/OFDM	6 Mbps
	11n(20MHz),11ac(20MHz)/OFDM	7.2 Mbps
	11n(40MHz),11ac(40MHz)/OFDM	15.0Mbps
	11ac(80MHz)/OFDM	65.0Mbps

2.4. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.12	2019/05/24	2020/05/23
LISN	R&S	ESH2-Z5	860014/010	2019/05/24	2020/05/23
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2019/05/24	2020/05/23
EMI Test Receiver	R&S	ESCI	1166.5950.03	2019/05/24	2020/05/23
Power Sensor	Agilent	U2021XA	MY55130004	2019/05/24	2020/05/23
Power Meter	Agilent	U2021XA	MY55130006	2019/05/24	2020/05/23
Spectrum Analyzer	Agilent	E4407B	MY41440676	2019/05/24	2020/05/23
Spectrum Analyzer	Agilent	N9020	US46220290	2019/05/24	2020/05/23
Controller	EM Electronics	EM 1000	060859	2019/05/24	2020/05/23
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2019/05/24	2020/05/23
Active Loop Antenna	Da Ze	ZN30900A	/	2019/05/24	2020/05/23
Amplifier	Agilent	8449B	3008A02306	2019/05/24	2020/05/23
Signal Generator	Agilent	N5182A	MY47420864	2019/05/24	2020/05/23
Signal Generator	Wiltron	68347B	657OO1	2019/05/24	2020/05/23
Programmable constant temperature and humidity test chamber	ESPEC	EL-10KA	A20120523	2019/05/24	2020/05/23
Amplifier	Agilent	8447D	2944A10176	2019/05/24	2020/05/23
Temperature/Humidity Meter	Gangxing	CTH-608	02	2019/05/24	2020/05/23
High-Pass Filter	micro-tranics	HPM50108	G174	2019/05/24	2020/05/23
High-Pass Filter	micro-tranics	HPM50111	G142	2019/05/24	2020/05/23
Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-10M	10m	2019/05/24	2020/05/23
Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	2019/05/24	2020/05/23
Coaxial Cables	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	2019/05/24	2020/05/23
RF Cable	Megalon	RF-A303	N/A	2019/05/24	2020/05/23

The calibration interval was one year

2.5. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
ASUS	Notebook PC	FL5900U	9014	FCC ID:PPD-QCNFA335
Delta	AC Adapter	ADP-65DW A	00A99	SDOC

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

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

2.7. Modifications

No modifications were implemented to meet testing criteria.

3. TEST CONDITIONS AND RESULTS

3.1. Conducted Emissions Test

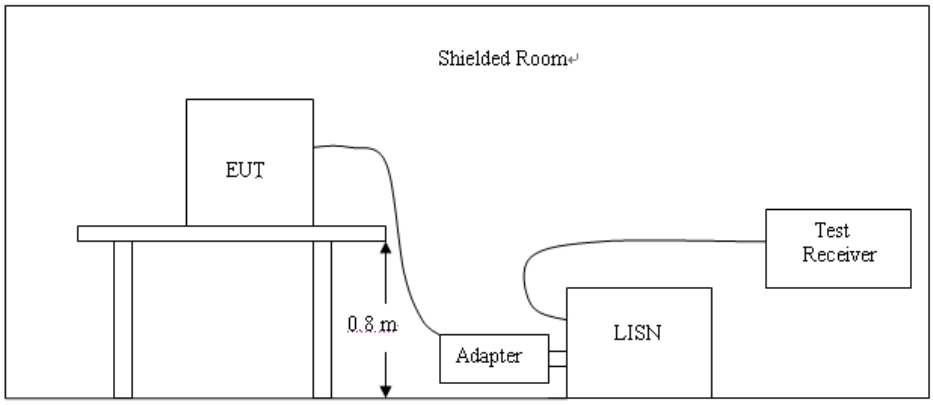
LIMIT

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

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

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

TEST RESULTS

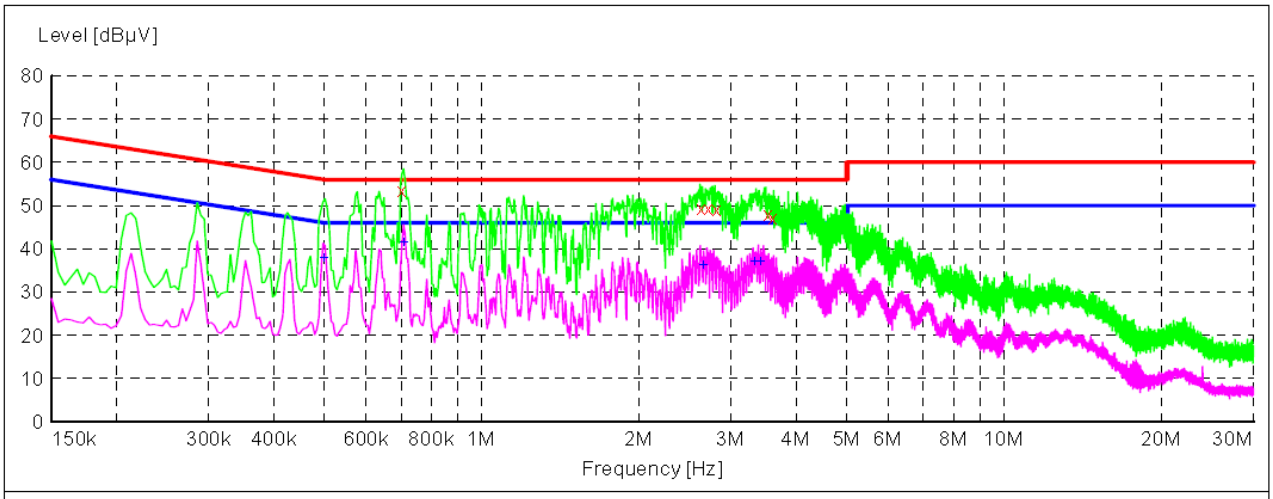
Remark:

1. All modes of 802.11a/ n/ac were tested at Low, Middle, and High channel; only the worst result of 802.11a CH36 was reported as below:
2. Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply have been tested, only the worst result of 120 VAC, 60 Hz was reported as below:
3. Pre-test AC conducted emission at power from AC mains mode and at charge from PC mode, recorded worst case.

Test Mode	WIFI	Line:	L

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



x x x MES CTL19075307_fin

MEASUREMENT RESULT: "CTL19075307_fin"

2019-7-07 10:12??

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.704000	53.70	11.2	56	2.3	QP	L1	GND
2.630000	49.50	11.4	56	6.5	QP	L1	GND
2.720000	49.30	11.4	56	6.7	QP	L1	GND
2.822000	49.20	11.4	56	6.8	QP	L1	GND
3.542000	48.00	11.4	56	8.0	QP	L1	GND
3.614000	47.30	11.4	56	8.7	QP	L1	GND

MEASUREMENT RESULT: "CTL19075307_fin2"

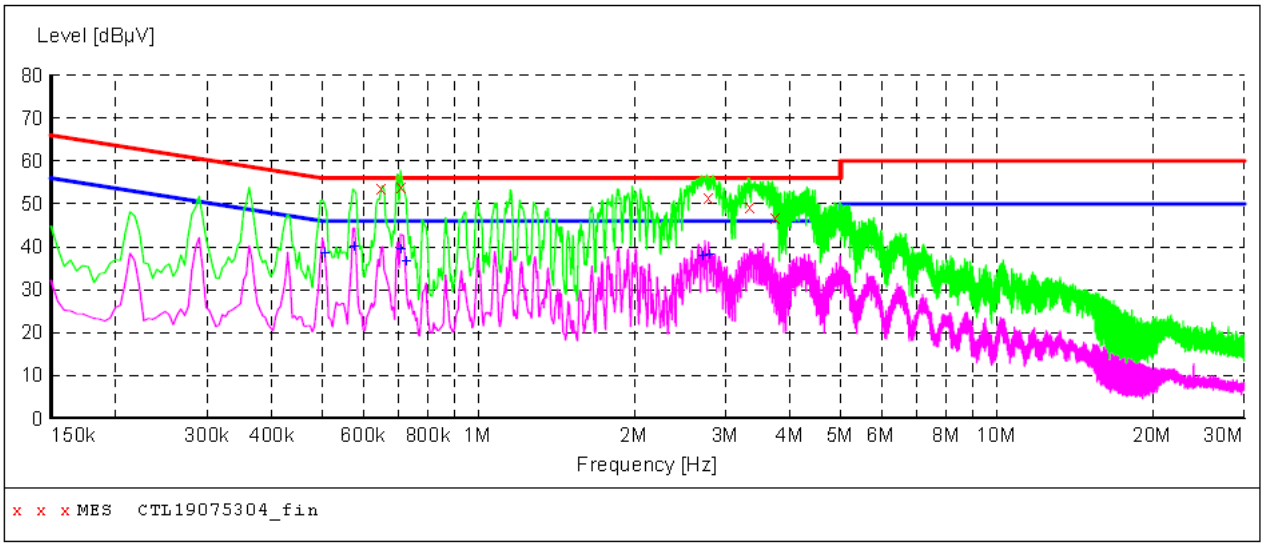
2019-7-07 10:12??

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.500000	37.70	11.2	46	8.3	AV	L1	GND
0.710000	41.40	11.2	46	4.6	AV	L1	GND
2.660000	36.30	11.4	46	9.7	AV	L1	GND
3.338000	37.10	11.4	46	8.9	AV	L1	GND
3.428000	36.90	11.4	46	9.1	AV	L1	GND

Test Mode	WIFI	Line:	N

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL19075304_fin"

2019-7-07 09:58??

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.650000	53.70	11.2	56	2.3	QP	N	GND
0.710000	54.00	11.2	56	2.0	QP	N	GND
2.780000	51.50	11.4	56	4.5	QP	N	GND
3.350000	49.30	11.4	56	6.7	QP	N	GND
3.734000	47.00	11.4	56	9.0	QP	N	GND

MEASUREMENT RESULT: "CTL19075304_fin2"

2019-7-15 09:58??

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.506000	38.50	11.2	46	7.5	AV	N	GND
0.578000	40.10	11.2	46	5.9	AV	N	GND
0.710000	39.40	11.2	46	6.6	AV	N	GND
0.728000	36.70	11.2	46	9.3	AV	N	GND
2.708000	38.00	11.4	46	8.0	AV	N	GND
2.786000	38.10	11.4	46	7.9	AV	N	GND

3.2. Radiated Emissions

Limit

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Undesirable emission limits

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

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

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

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

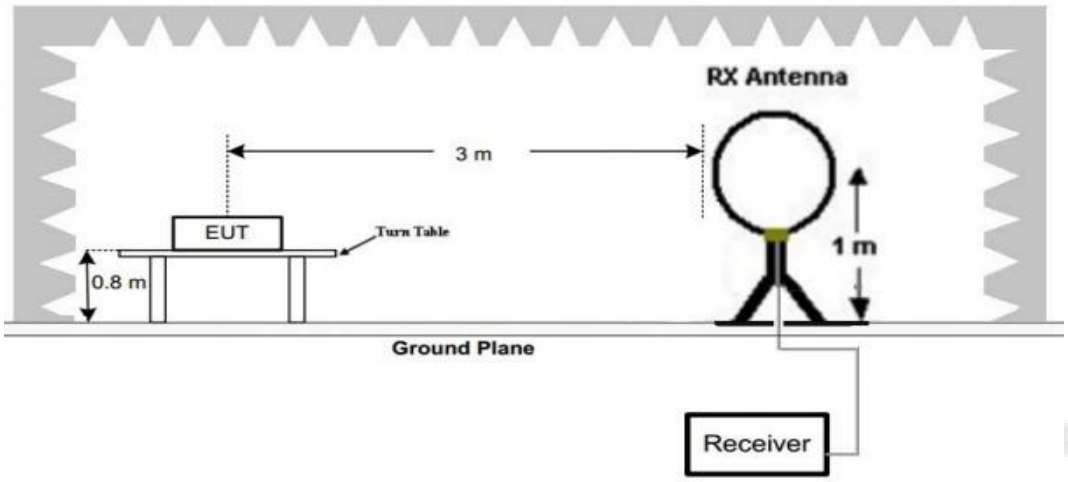
(6)In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

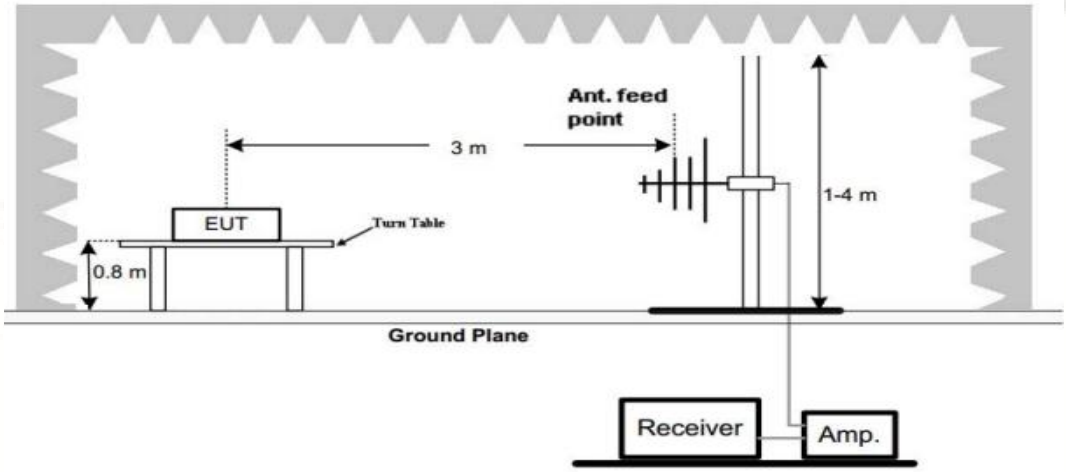
Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST CONFIGURATION

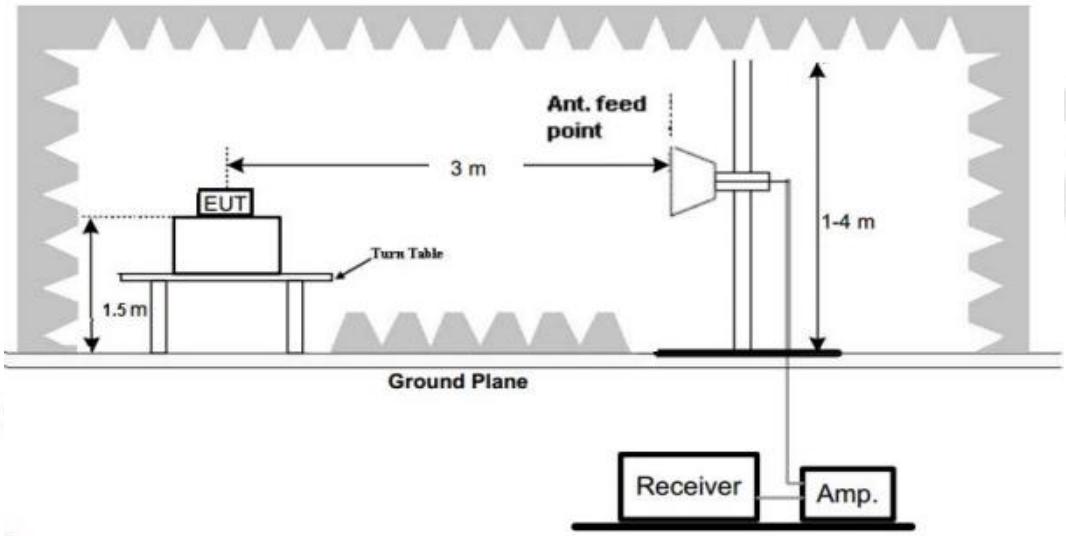
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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



Test Procedure

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Radiated emission test frequency band from 9KHz to 40GHz.
6. The distance between test antenna and EUT as following table states:

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

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

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

TEST RESULTS

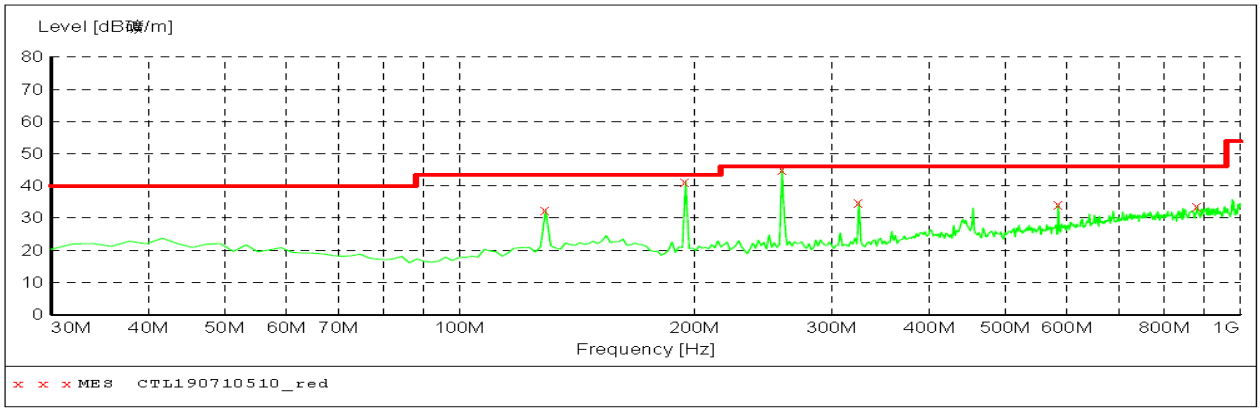
Remark:
1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
2. All 802.11a / 802.11n (HT20) / 802.11ac (HT20) / 802.11n (HT40) / 802.11ac (HT40) / 802.11ac (HT80) modes have been tested for below 1GHz test, only the worst case 802.11ac (HT20) low channel of U-NII 1 band was recorded.
3. All 802.11a / 802.11n (HT20) / 802.11ac (HT20) / 802.11n (HT40) / 802.11ac (HT40) / 802.11ac (HT80) modes have been tested for above 1GHz test, only the worst case 802.11ac (HT20) was recorded.
4. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

For 30MHz-1GHz

Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	120 kHz	VULB9168



MEASUREMENT RESULT: "CTL190710510_red"

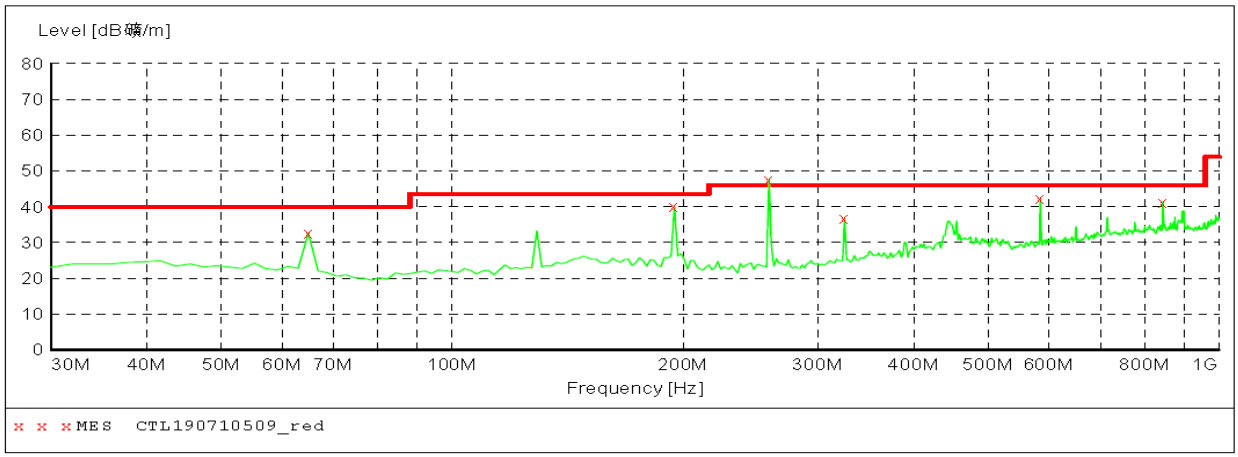
2019-7-11 18:55

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
128.940000	32.40	13.7	43.5	11.1	QP	0.0	0.00	HORIZONTAL
194.900000	41.30	11.3	43.5	2.2	QP	0.0	0.00	HORIZONTAL
258.920000	45.30	13.0	46.0	0.7	QP	0.0	0.00	HORIZONTAL
324.880000	34.80	14.8	46.0	11.2	QP	0.0	0.00	HORIZONTAL
584.840000	34.10	19.8	46.0	11.9	QP	0.0	0.00	HORIZONTAL
881.660000	33.50	23.5	46.0	12.5	QP	0.0	0.00	HORIZONTAL

Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	120 kHz	VULB9168



MEASUREMENT RESULT: "CTL190710509_red"

2019-7-11 18:52

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
64.920000	32.60	12.4	40.0	7.4	QP	0.0	0.00	VERTICAL
194.900000	40.20	11.3	43.5	3.3	QP	0.0	0.00	VERTICAL
258.920000	45.50	13.0	46.0	0.5	QP	0.0	0.00	VERTICAL
324.880000	36.80	14.8	46.0	9.2	QP	0.0	0.00	VERTICAL
584.840000	42.30	19.8	46.0	3.7	QP	0.0	0.00	VERTICAL
844.800000	41.20	23.1	46.0	4.8	QP	0.0	0.00	VERTICAL

For 1GHz to 25GHz

Note: All 802.11a / 802.11n (HT20) / 802.11ac (HT20) / 802.11n (HT40) / 802.11ac (HT40) / 802.11ac (HT80) modes have been tested for above 1GHz test, only the worst case 802.11ac (HT20) was recorded.

U-NII 1 & 802.11ac (HT20) Mode (above 1GHz)

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
36 (5180MHz)	5150.00	48.78	PK	H	68.20	19.42	37.42	37.64	9.28	35.56	11.36
	10360.00	50.69	PK	H	68.20	17.51	34.96	39.20	11.45	34.92	15.73
	--	--	--	--	--	--	--	--	--	--	--
40 (5200MHz)	10400.00	49.98	PK	H	68.20	18.22	34.17	39.22	11.48	34.89	15.81
	--	--	--	--	--	--	--	--	--	--	--
48 (5240MHz)	5350.50	48.57	PK	H	68.20	19.63	37.16	37.64	9.28	35.51	11.41
	10480.00	50.89	PK	H	68.20	17.31	34.90	39.27	11.55	34.83	15.99
	--	--	--	--	--	--	--	--	--	--	--

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
36 (5180MHz)	5150.00	47.98	PK	V	68.20	20.22	36.62	37.64	9.28	35.56	11.36
	10360.00	50.54	PK	V	68.20	17.66	34.81	39.20	11.45	34.92	15.73
	--	--	--	--	--	--	--	--	--	--	--
40 (5200MHz)	10400.00	49.35	PK	V	68.20	18.85	33.54	39.22	11.48	34.89	15.81
	--	--	--	--	--	--	--	--	--	--	--
48 (5240MHz)	5350.50	48.14	PK	V	68.20	20.06	36.73	37.64	9.28	35.51	11.41
	10480.00	51.24	PK	V	68.20	16.96	35.25	39.27	11.55	34.83	15.99
	--	--	--	--	--	--	--	--	--	--	--

U-NII 2A & 802.11ac (HT20) Mode (above 1GHz)

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
52 (5260MHz)	5250.00	52.69	PK	H	68.20	15.51	41.31	37.64	9.28	35.54	11.38
	10520.00	48.54	PK	H	68.20	19.66	32.45	39.29	11.59	34.79	16.09
	--	--	--	--	--	--	--	--	--	--	--
56 (5280MHz)	10560.00	48.84	PK	H	68.20	19.36	32.67	39.31	11.62	34.76	16.17
	--	--	--	--	--	--	--	--	--	--	--
64 (5320MHz)	5350.50	47.79	PK	H	68.20	20.41	36.38	37.64	9.28	35.51	11.41
	10640.00	50.86	PK	H	68.20	17.34	34.51	39.36	11.69	34.70	16.35
	--	--	--	--	--	--	--	--	--	--	--

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
52 (5260MHz)	5250.00	53.98	PK	V	68.20	14.22	42.60	37.64	9.28	35.54	11.38
	10520.00	49.74	PK	V	68.20	18.46	33.65	39.29	11.59	34.79	16.08
	--	--	--	--	--	--	--	--	--	--	--
56 (5280MHz)	10560.00	50.63	PK	V	68.20	17.57	34.46	39.31	11.62	34.76	16.17
	--	--	--	--	--	--	--	--	--	--	--
64 (5320MHz)	5350.50	48.85	PK	V	68.20	19.35	37.44	37.64	9.28	35.51	11.41
	10640.00	50.29	PK	V	68.20	17.91	33.94	39.36	11.69	34.70	16.35
	--	--	--	--	--	--	--	--	--	--	--

U-NII 2C & 802.11ac (HT20) Mode (above 1GHz)

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
100 (5500MHz)	5470.00	46.78	PK	H	68.20	21.42	35.34	37.64	9.28	35.48	11.44
	11000.00	49.63	PK	H	68.20	18.57	32.47	39.56	12.01	34.41	17.16
	--	--	--	--	--	--	--	--	--	--	--
120 (5600MHz)	11200.00	48.89	PK	H	68.20	19.31	31.29	39.61	12.37	34.38	17.6
	--	--	--	--	--	--	--	--	--	--	--
140 (5700MHz)	5725.00	51.63	PK	H	68.20	16.57	40.12	37.64	9.28	35.41	11.51
	11400.00	49.18	PK	H	68.20	19.02	31.12	39.66	12.74	34.34	18.06
	--	--	--	--	--	--	--	--	--	--	--

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
100 (5500MHz)	5470.00	47.39	PK	V	68.20	20.81	35.95	37.64	9.28	35.48	11.44
	11000.00	50.52	PK	V	68.20	17.68	33.36	39.56	12.01	34.41	17.16
	--	--	--	--	--	--	--	--	--	--	--
120 (5600MHz)	11200.00	48.28	PK	V	68.20	19.92	30.68	39.61	12.37	34.38	17.6
	--	--	--	--	--	--	--	--	--	--	--
140 (5700MHz)	5725.00	52.32	PK	V	68.20	15.88	40.81	37.64	9.28	35.41	11.51
	11400.00	49.54	PK	V	68.20	18.66	31.48	39.66	12.74	34.34	18.06
	--	--	--	--	--	--	--	--	--	--	--

U-NII 3 & 802.11ac (HT20) Mode (above 1GHz)

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
149 (5745MHz)	5720.00	50.36	PK	H	68.20	17.84	38.85	37.64	9.28	35.41	11.51
	11490.00	52.45	PK	H	68.20	15.75	34.19	39.69	12.90	34.33	18.26
	--	--	--	--	--	--	--	--	--	--	--
157 (5785MHz)	11570.00	51.98	PK	H	68.20	16.22	33.53	39.71	13.05	34.31	18.45
	--	--	--	--	--	--	--	--	--	--	--
165 (5825MHz)	5855.00	49.54	PK	H	68.20	18.66	38.00	37.64	9.28	35.38	11.54
	11650.00	52.21	PK	H	68.20	15.99	33.59	39.73	13.19	34.30	18.62
	--	--	--	--	--	--	--	--	--	--	--

Tested Channel	Frequency (MHz)	Emission Level (dBuV/m)	Detector Mode	ANT Pol	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre amplifier (dB)	Correction Factor (dB/m)
149 (5745MHz)	5720.00	49.20	PK	V	68.20	19.00	37.69	37.64	9.28	35.41	11.51
	11490.00	52.22	PK	V	68.20	15.98	33.96	39.69	12.90	34.33	18.26
	--	--	--	--	--	--	--	--	--	--	--
157 (5785MHz)	11570.00	51.98	PK	V	68.20	16.22	33.53	39.71	13.05	34.31	18.45
	--	--	--	--	--	--	--	--	--	--	--
165 (5825MHz)	5855.00	49.21	PK	V	68.20	18.99	37.67	37.64	9.28	35.38	11.54
	11650.00	52.13	PK	V	68.20	16.07	33.51	39.73	13.19	34.30	18.62
	--	--	--	--	--	--	--	--	--	--	--

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)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the other emission levels were very low against the limit.
5. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.
6. Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20 ,IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;

3.3. Maximum Conducted Average Output Power

Limit

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

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

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

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

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

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

Test Procedure

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

Test Configuration

Test Results

U-NII 1

Type	Channel	Output power Average (dBm)	Limit (dBm)	Result
802.11a	36	6.72	23.98	Pass
	40	6.68		
	48	6.43		
802.11n(HT20)	36	6.65	23.98	Pass
	40	6.47		
	48	5.62		
802.11n(HT40)	38	6.21	23.98	Pass
	46	5.93		
802.11ac(HT20)	36	6.76	23.98	Pass
	40	6.35		
	48	6.17		
802.11ac(HT40)	38	6.89	23.98	Pass
	46	6.24		
802.11ac(HT80)	42	4.13	23.98	Pass

U-NII 2A

Type	Channel	Output power Average (dBm)	Limit (dBm)	Result
802.11a	52	5.26	23.98	Pass
	60	5.74		
	64	5.23		
802.11n(HT20)	52	3.01	23.98	Pass
	60	2.87		
	64	3.05		
802.11n(HT40)	54	2.60	23.98	Pass
	62	2.65		
802.11ac(HT20)	52	2.72	23.98	Pass
	60	2.74		
	64	3.03		
802.11ac(HT40)	54	2.36	23.98	Pass
	62	2.60		
802.11ac(HT80)	58	2.33	23.98	Pass

U-NII 2C

Type	Channel	Output power Average (dBm)	Limit (dBm)	Result
802.11a	100	4.05	23.98	Pass
	116	4.21		
	140	5.37		
802.11n(HT20)	100	6.49	23.98	Pass
	116	5.26		
	140	4.64		
802.11n(HT40)	102	5.08	23.98	Pass
	118	5.26		
	134	4.67		
802.11ac(HT20)	100	4.92	23.98	Pass
	120	5.48		
	140	4.74		
802.11ac(HT40)	102	4.81	23.98	Pass
	118	5.04		
	134	4.48		
802.11ac(HT80)	106	4.52	23.98	Pass
	122	4.18		

U-NII 3

Type	Channel	Output power Average (dBm)	Limit (dBm)	Result
802.11a	149	6.72	30.00	Pass
	157	5.94		
	165	5.03		
802.11n(HT20)	149	6.34	30.00	Pass
	157	5.37		
	165	5.28		
802.11n(HT40)	151	5.96	30.00	Pass
	159	5.77		
802.11ac(HT20)	149	6.76	30.00	Pass
	157	5.82		
	165	5.04		
802.11ac(HT40)	151	5.42	30.00	Pass
	159	5.83		
802.11ac(HT80)	155	4.54	30.00	Pass

Note:

1. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20 ,IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*

3.4. Power Spectral Density

Limit

FCC requirement:
For the band 5.15-5.25 GHz.

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

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

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

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

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

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

IC requirement:

For the band 5.15-5.25 GHz.

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

Frequency band 5250-5350 MHz

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

Frequency bands 5470-5600 MHz and 5650-5725 MHz

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

For the band 5.725 - 5.85 GHz

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

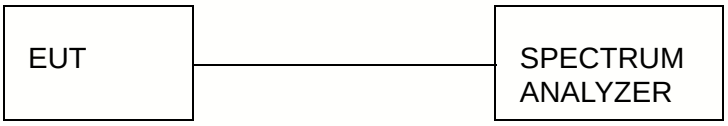
Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: Fixed point - to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

Test Procedure

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

Test Configuration



Test Results

U-NII 1

Type	*Channel*	*P.S.D (dBm/MHz)*	*Limit (dBm/ MHz)*	*Result*
802.11a	36	-1.382	11	Pass
	40	-1.448		
	48	-1.634		
802.11n(HT20)	36	-1.361		Pass
	40	-2.177		
	48	-1.896		
802.11n(HT40)	38	-5.266		Pass
	46	-5.232		
802.11ac(HT20)	36	-1.985		Pass
	40	-2.343		
	48	-1.996		
802.11ac(HT40)	38	-5.390		Pass
	46	-5.388		
802.11ac(HT80)	42	-8.336		Pass

U-NII 2A

Type	*Channel*	*P.S.D (dBm/MHz)*	*Limit (dBm/ MHz)*	*Result*
802.11a	52	-1.280	11	Pass
	60	-0.814		
	64	-1.021		
802.11n(HT20)	52	-2.950		Pass
	60	-3.022		
	64	-3.780		
802.11n(HT40)	54	-6.368		Pass
	62	-6.722		
802.11ac(HT20)	52	-3.522		Pass
	60	-3.233		
	64	-3.802		
802.11ac(HT40)	54	-5.940		Pass
	62	-6.692		
802.11ac(HT80)	58	-9.320		Pass

U-NII 2C

Type	*Channel*	*P.S.D (dBm/MHz)*	*Limit (dBm/ MHz)*	*Result*
802.11a	100	-2.178	11	Pass
	120	-2.615		
	140	-0.575		
802.11n(HT20)	100	-3.688		Pass
	120	-2.486		
	140	-0.974		
802.11n(HT40)	102	-7.019		Pass
	118	-7.128		
	134	-4.672		
802.11ac(HT20)	100	-3.450		Pass
	120	-2.989		
	140	-0.575		
802.11ac(HT40)	102	-6.700		Pass
	118	-6.997		
	134	-4.720		
802.11ac(HT80)	106	-9.727		Pass
	122	-8.484		

U-NII 3

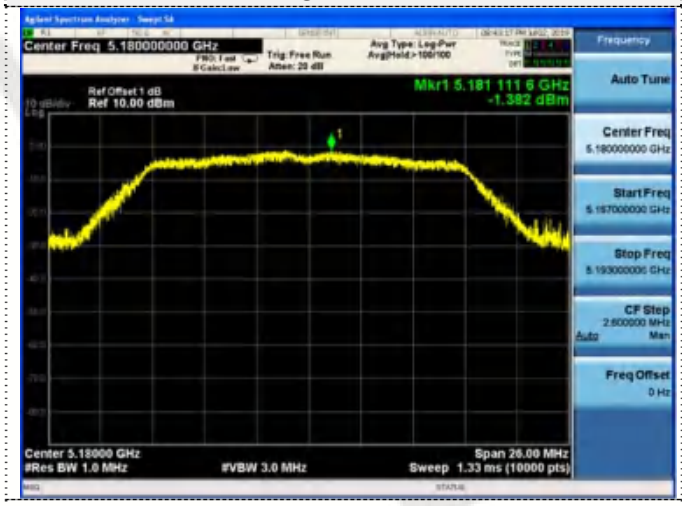
Type	*Channel*	*Power Spectral Density (dBm/500KHz)*	*Limit (dBm/500KHz)*	*Result*
802.11a	149	-4.659	30	Pass
	157	-4.311		
	165	-4.333		
802.11n(HT20)	149	-4.701		
	157	-3.749		
	165	-3.938		
802.11n(HT40)	151	-7.490		
	159	-7.670		
802.11ac(HT20)	149	-4.567		
	157	-4.455		
	165	-4.364		
802.11ac(HT40)	151	-7.523		
	159	-7.736		
802.11ac(HT80)	155	-11.30		

Note:

1. *Measured output power at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20 ,IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *Please refer to following test plots;*

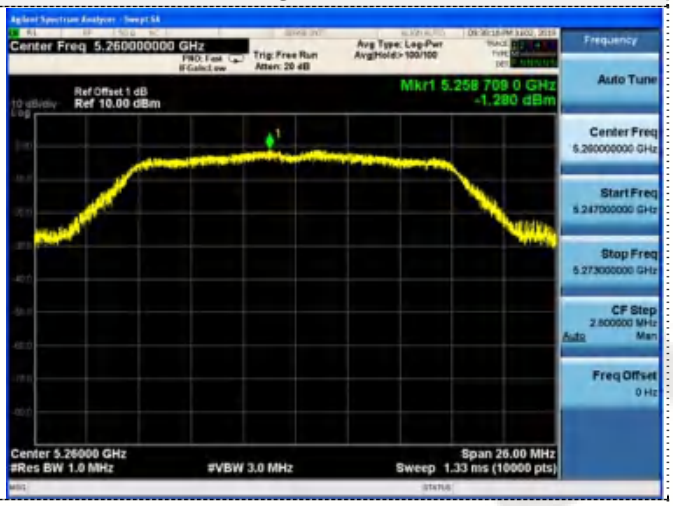
802.11a

U-NII 1

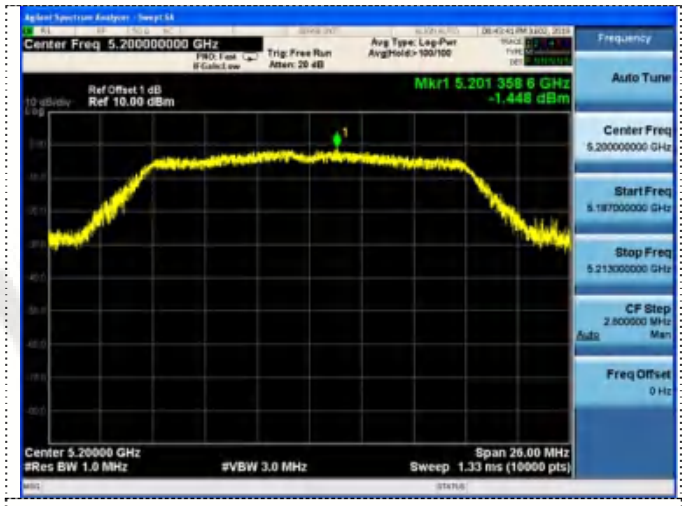


CH36

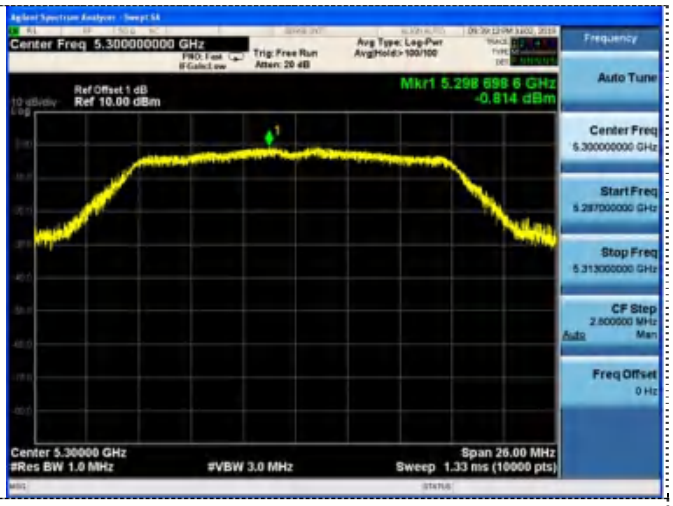
U-NII 2A



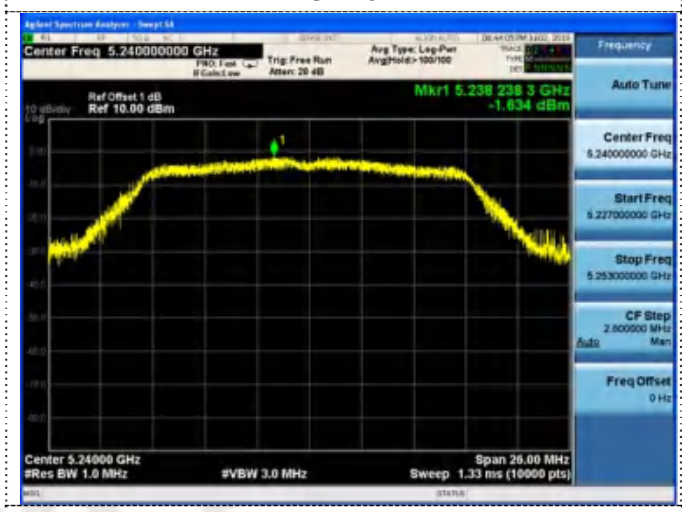
CH52



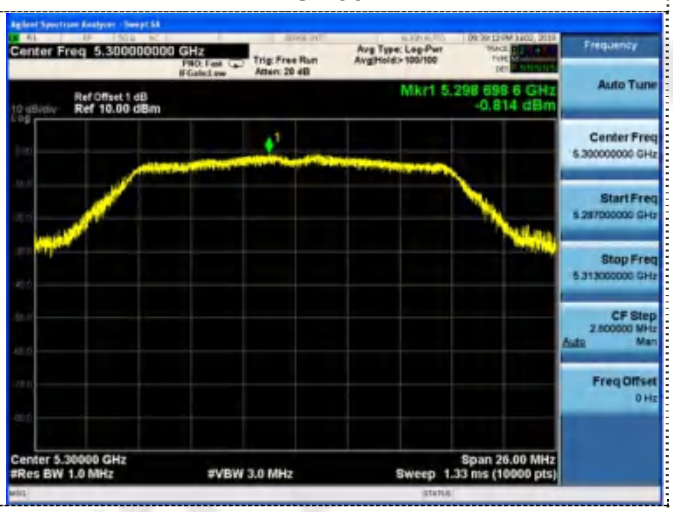
CH40



CH60



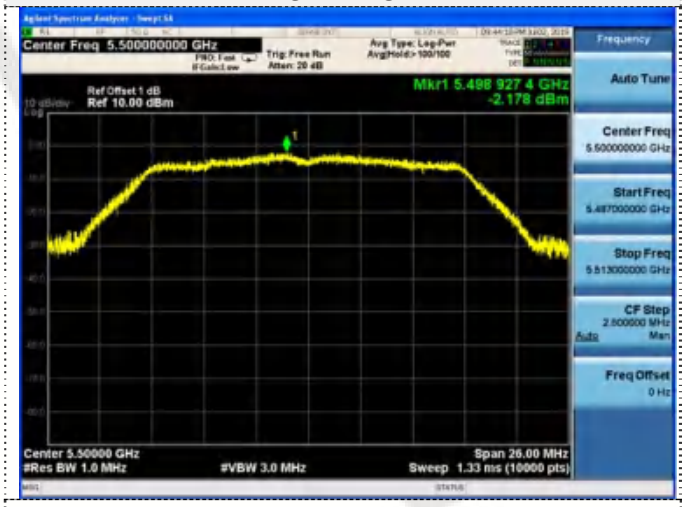
CH48



CH64

802.11a

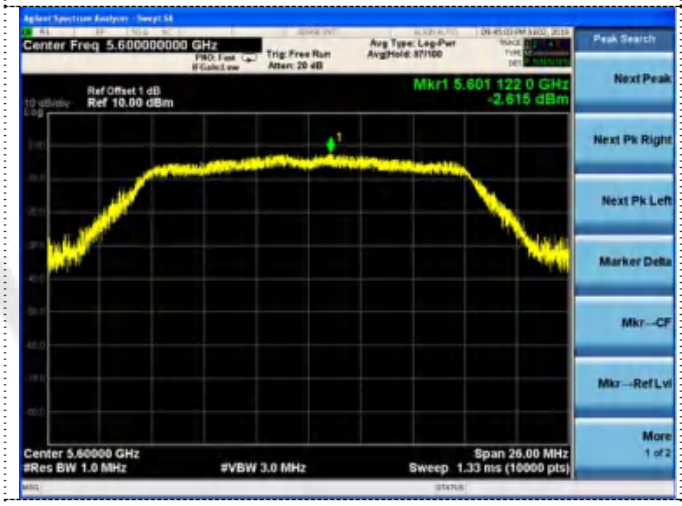
U-NII 2C



CH100

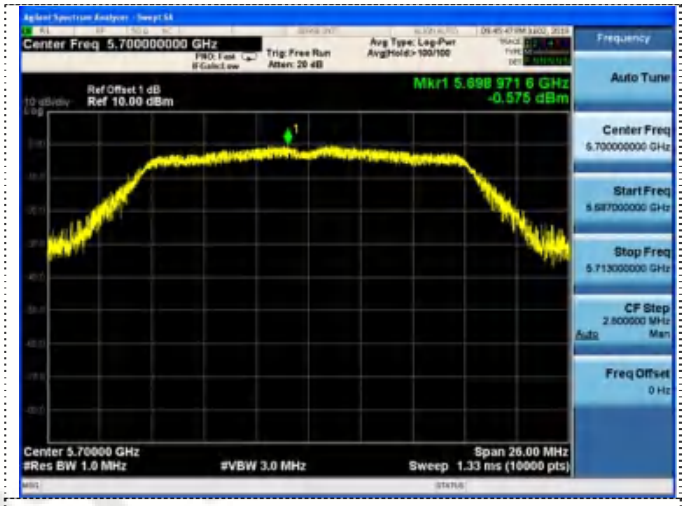
U-NII 3

CH149



CH120

CH157

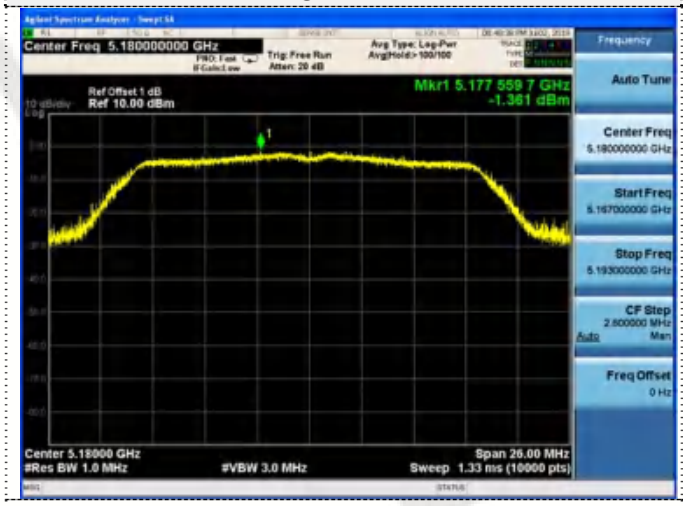


CH140

CH165

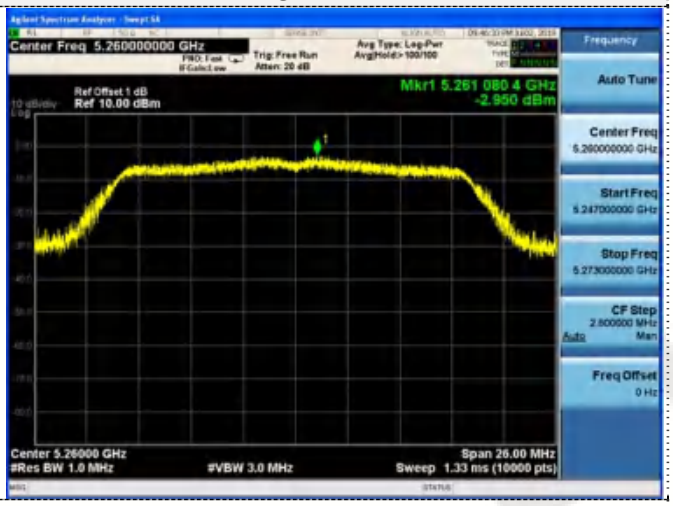
802.11n20

U-NII 1

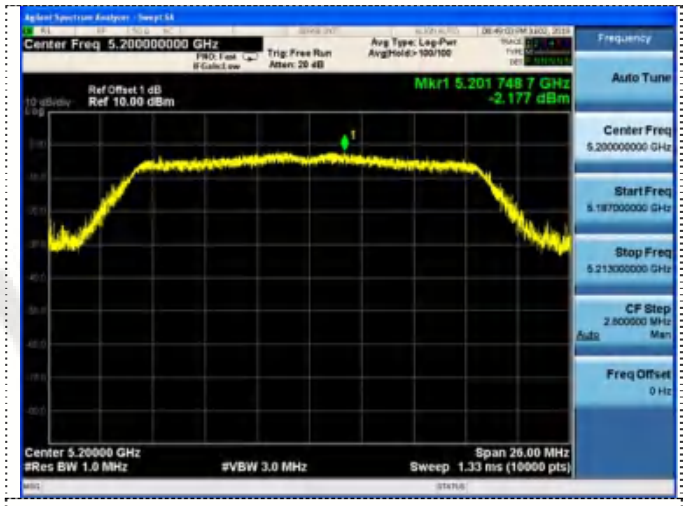


CH36

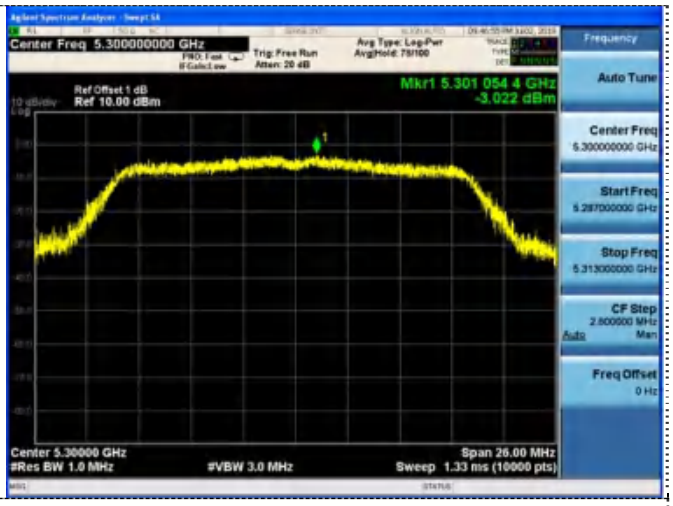
U-NII 2A



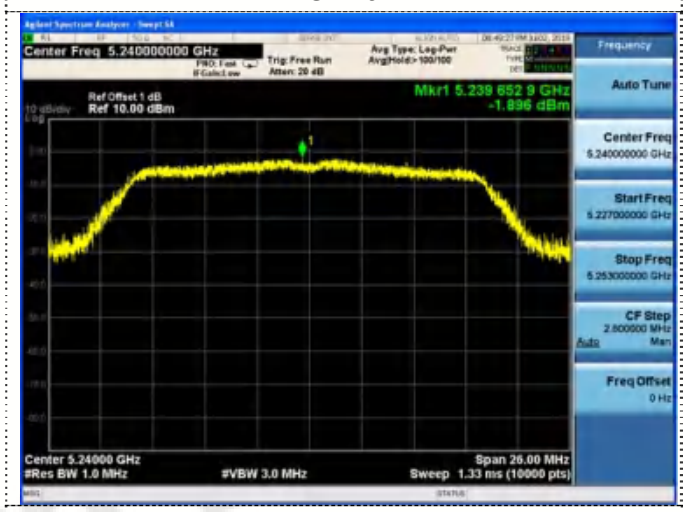
CH52



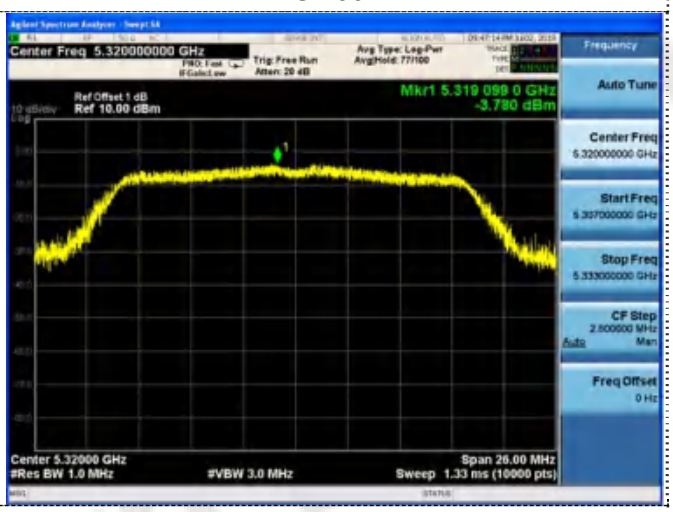
CH40



CH60



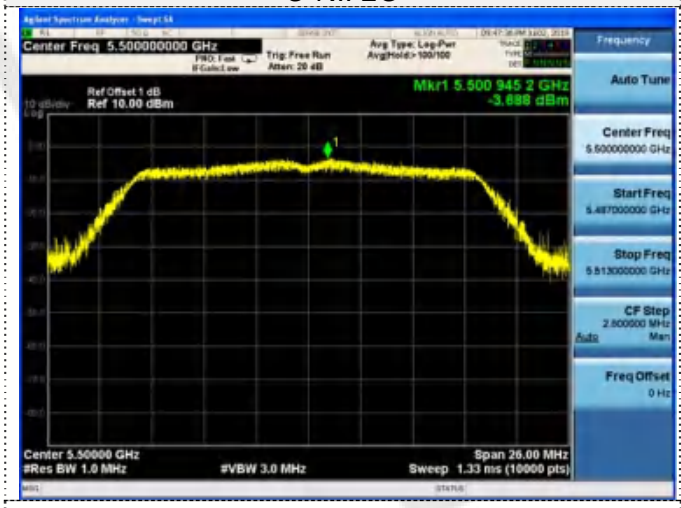
CH48



CH64

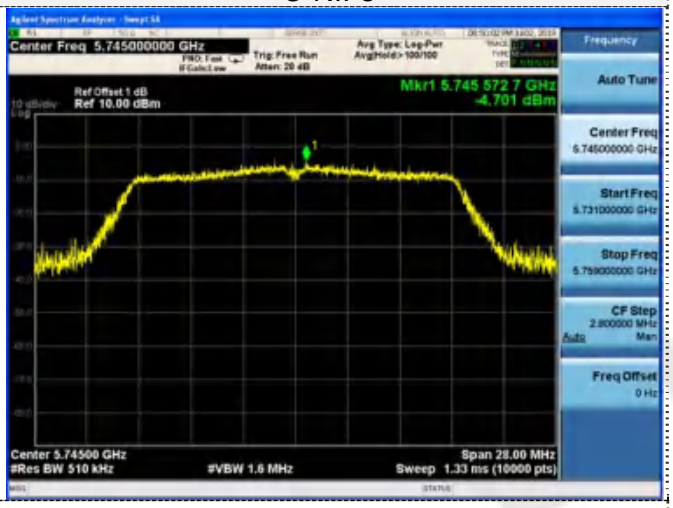
802.11n20

U-NII 2C

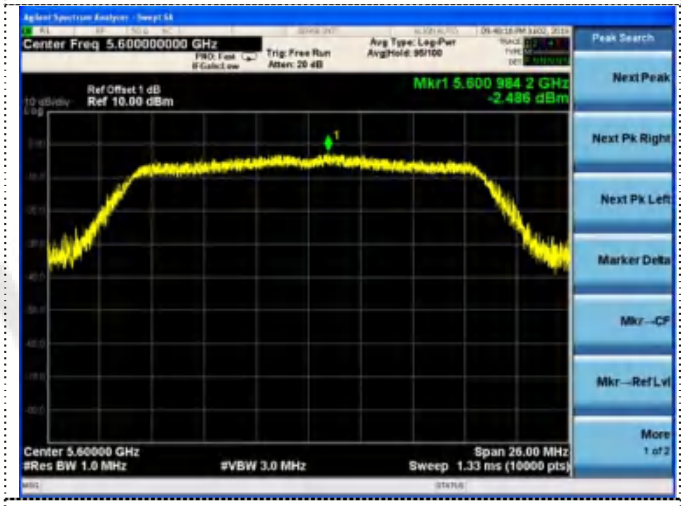


CH100

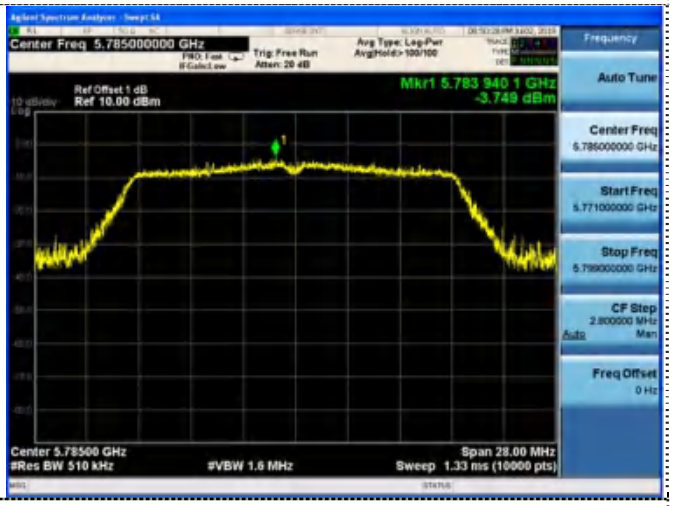
U-NII 3



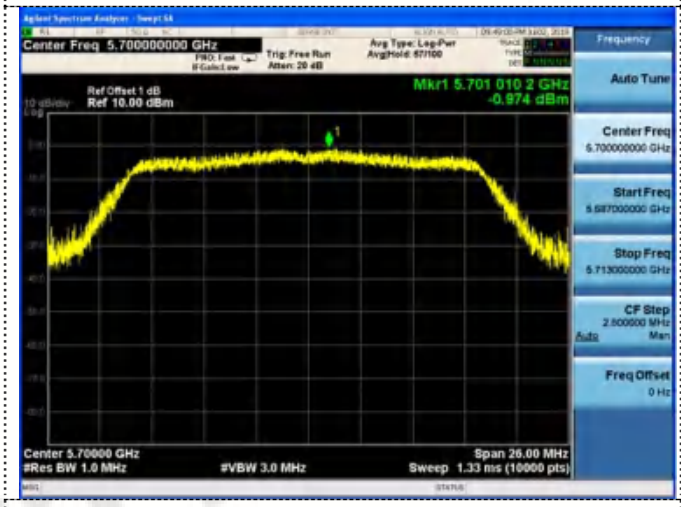
CH149



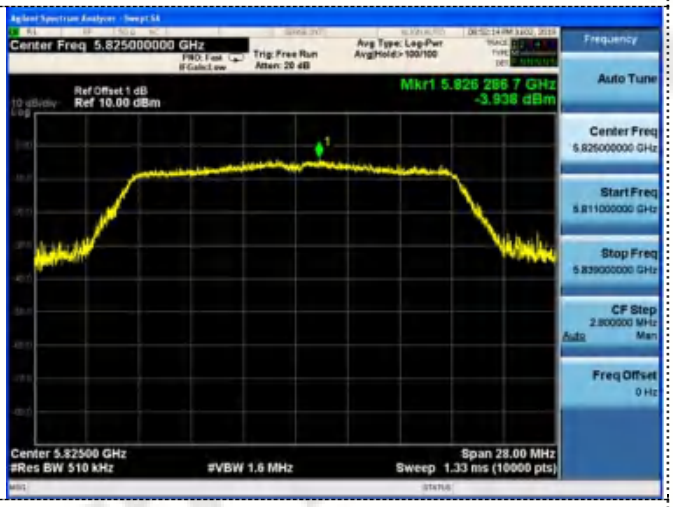
CH120



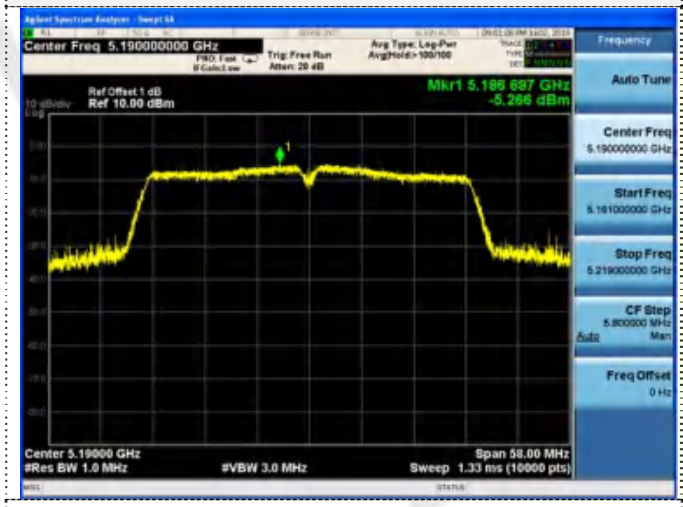
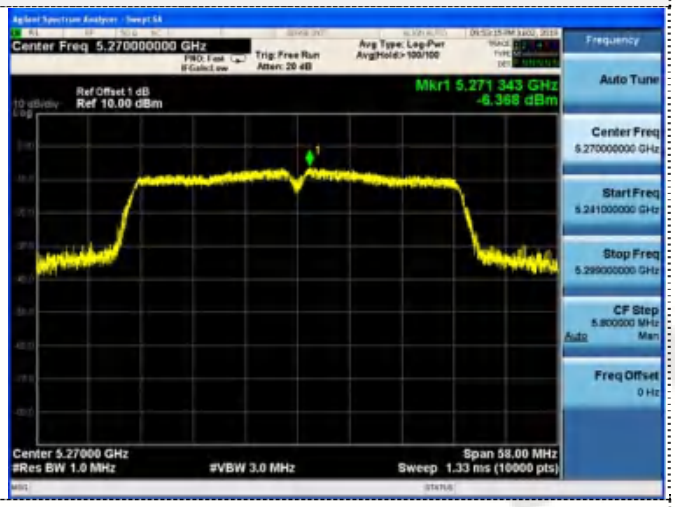
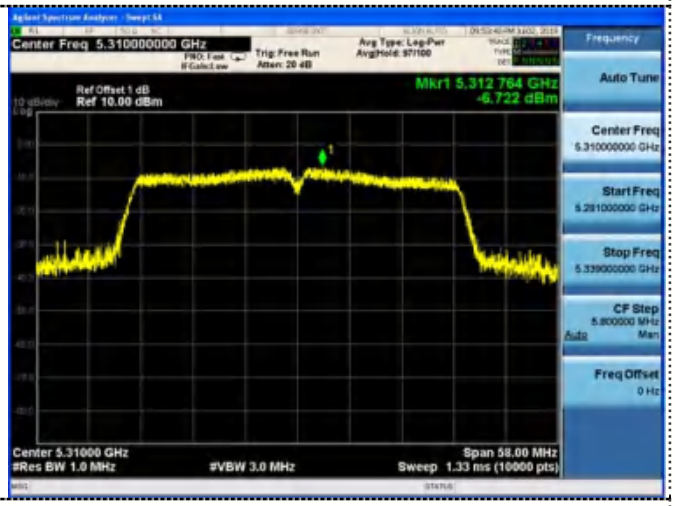
CH157



CH140

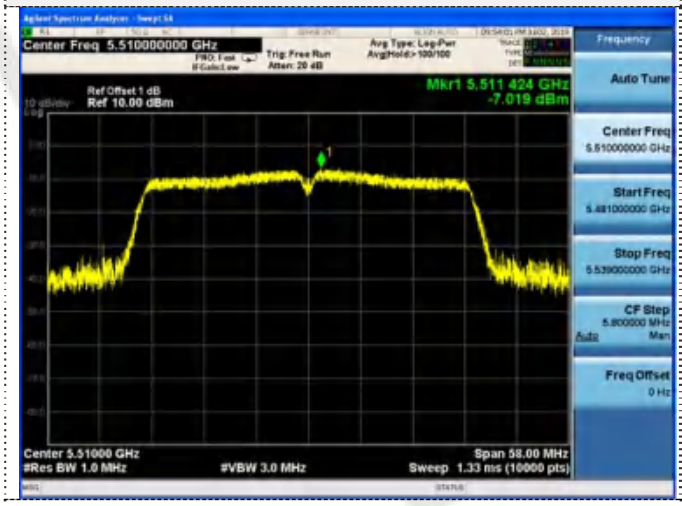


CH165

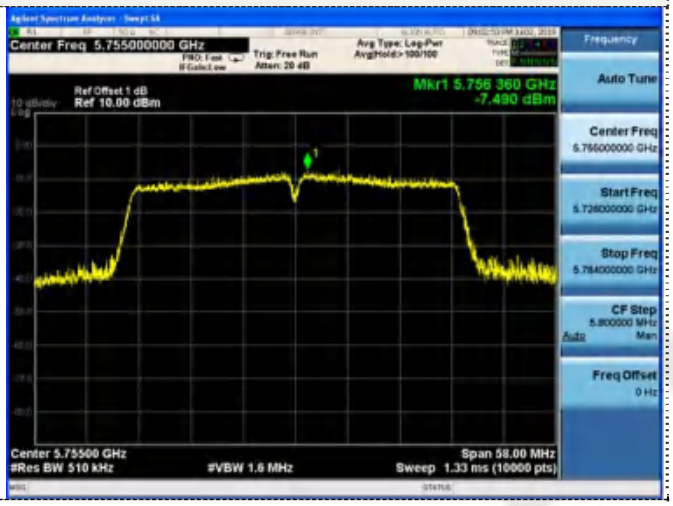
802.11n(HT40)	
U-NII 1	U-NII 2A
	
CH38	CH54
	
CH46	CH62

802.11n(HT40)

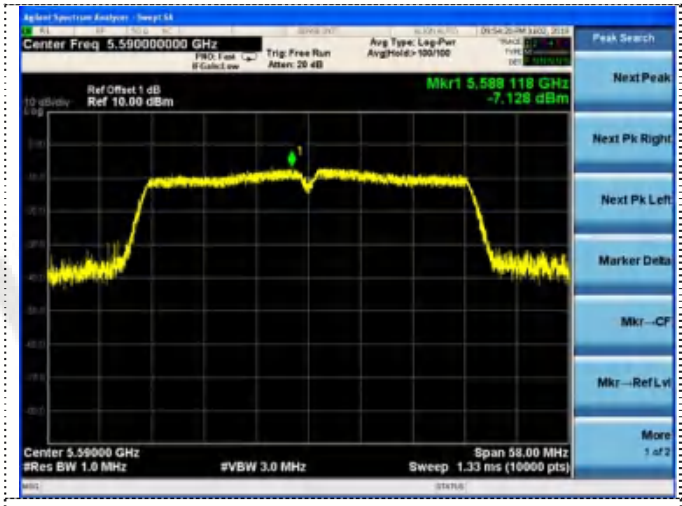
U-NII 2C



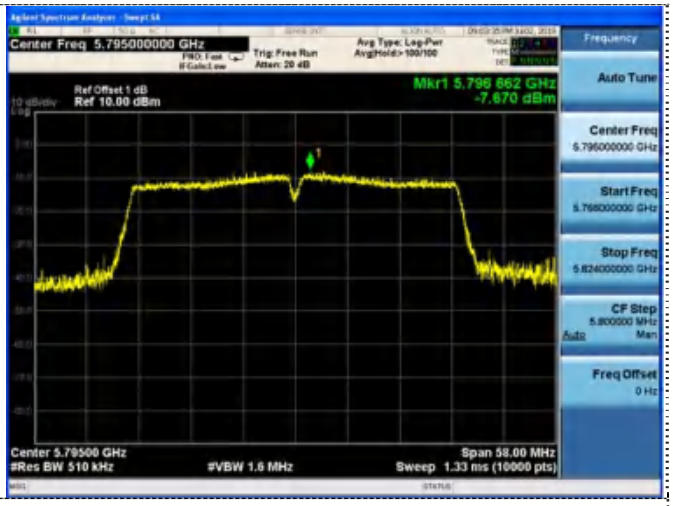
U-NII 3



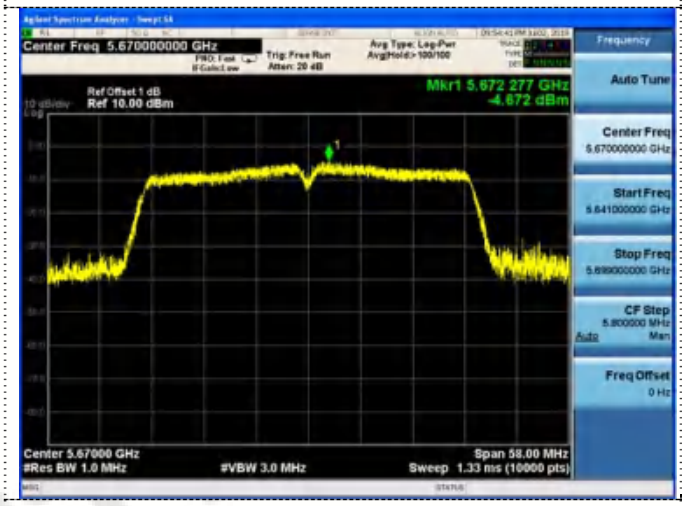
CH102



CH151



CH118

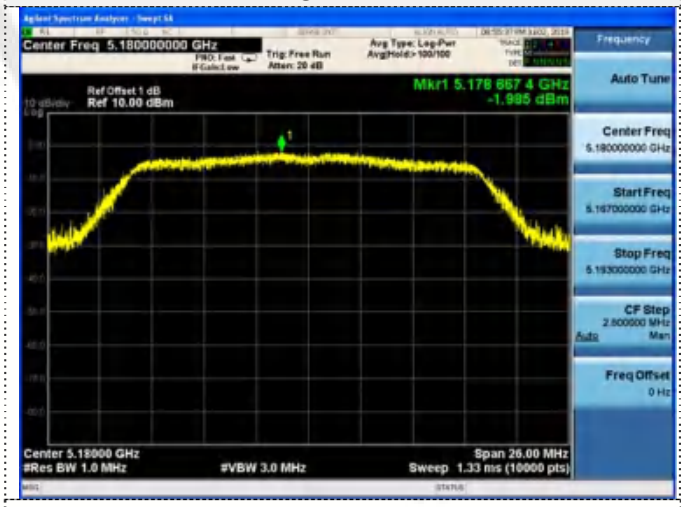


CH159

CH134

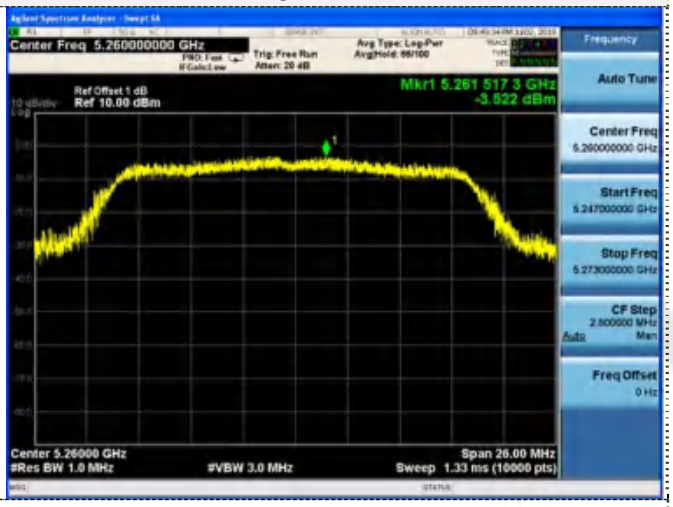
802.11ac(HT20)

U-NII 1

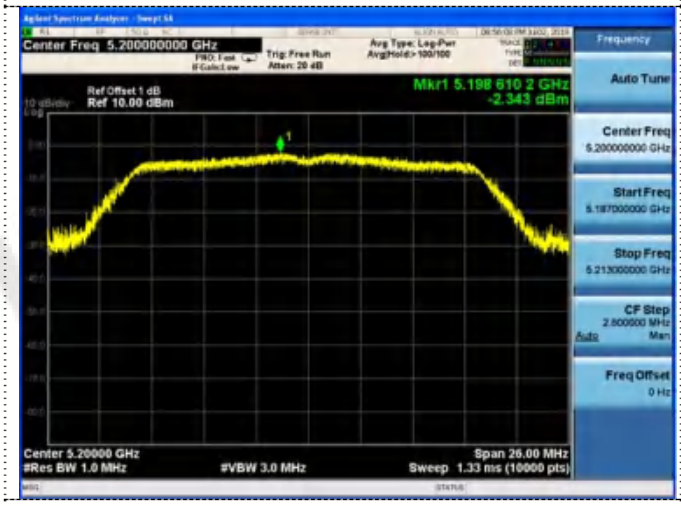


CH36

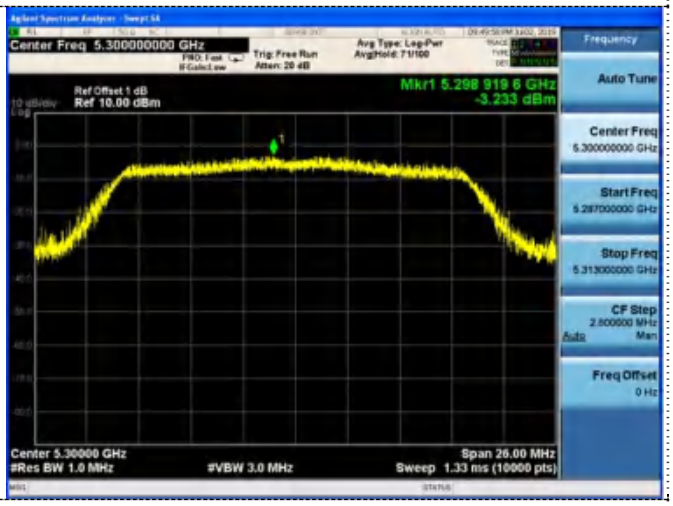
U-NII 2A



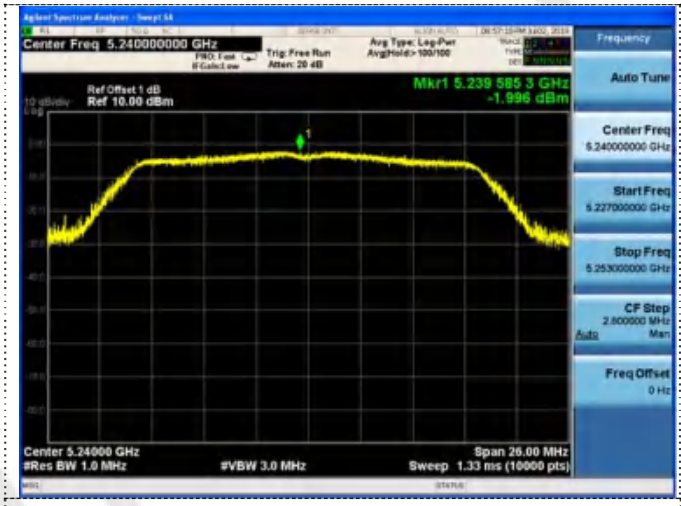
CH52



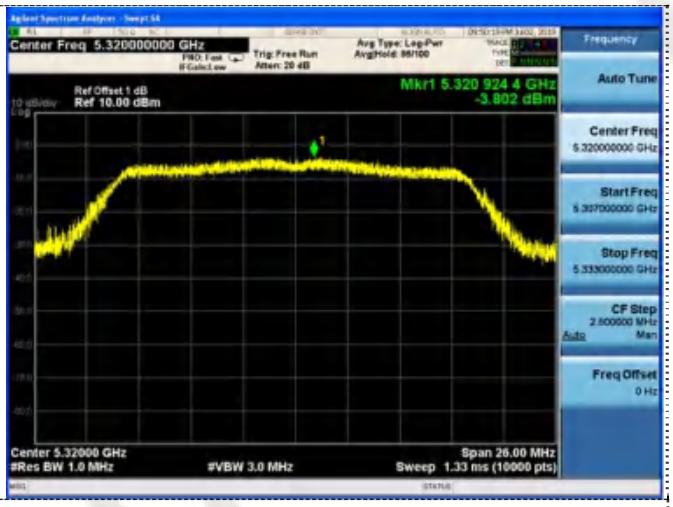
CH40



CH60



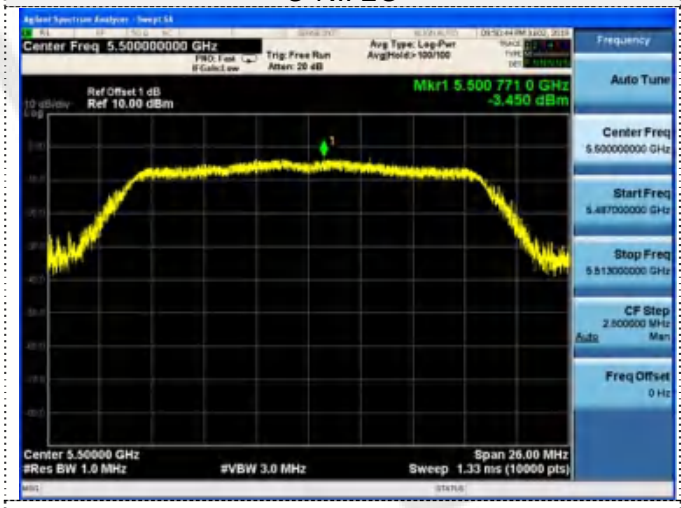
CH48



CH64

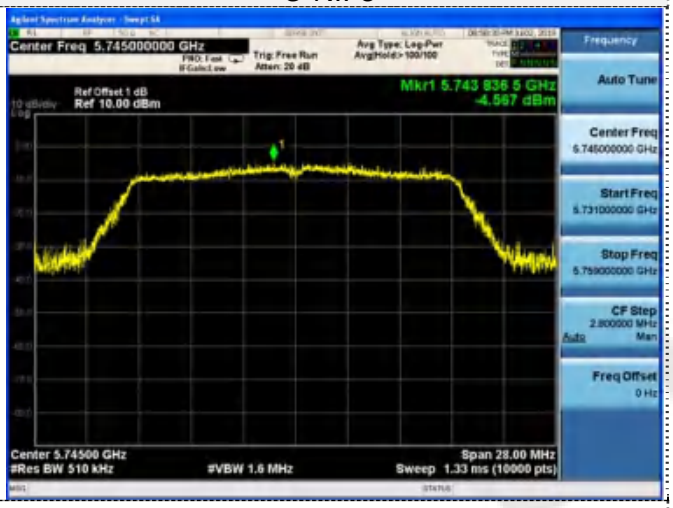
802.11ac(HT20)

U-NII 2C

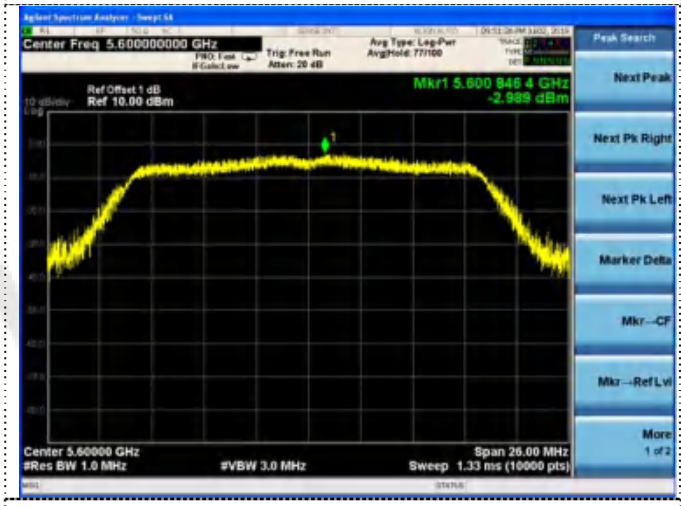


CH100

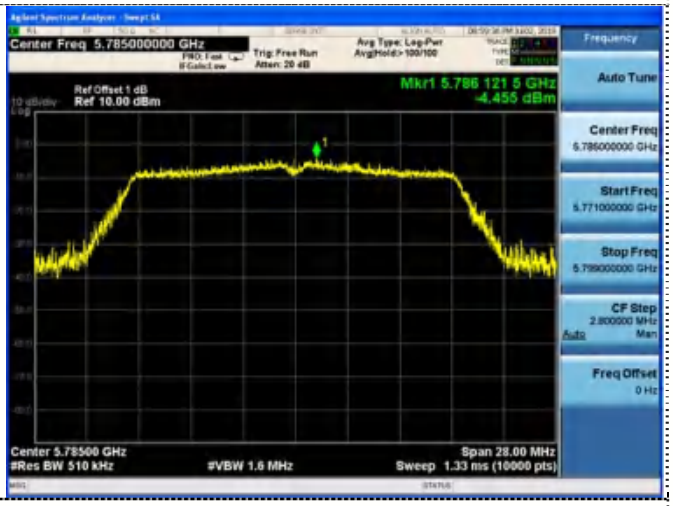
U-NII 3



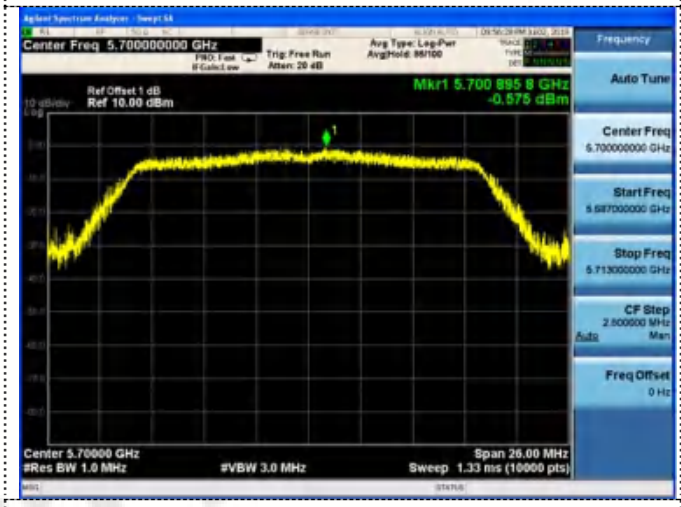
CH149



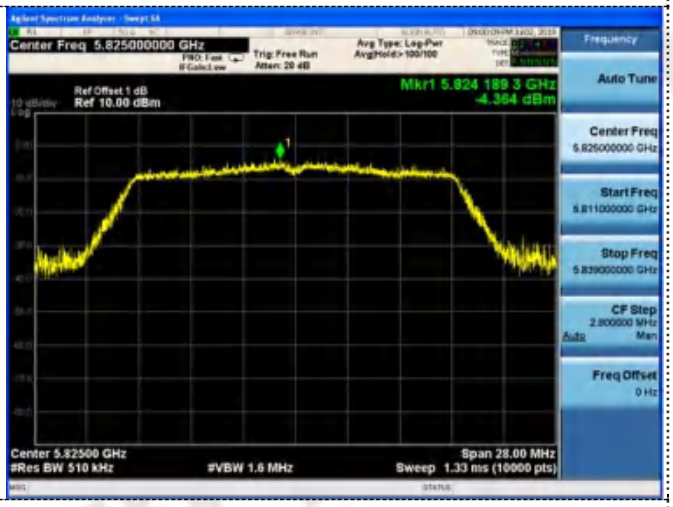
CH120



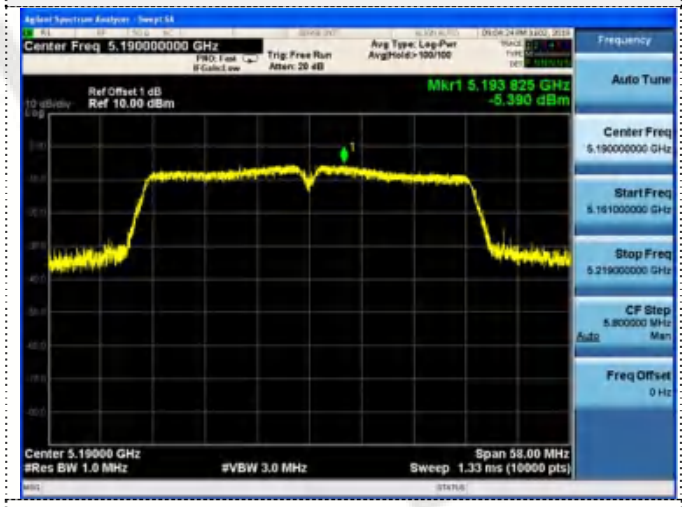
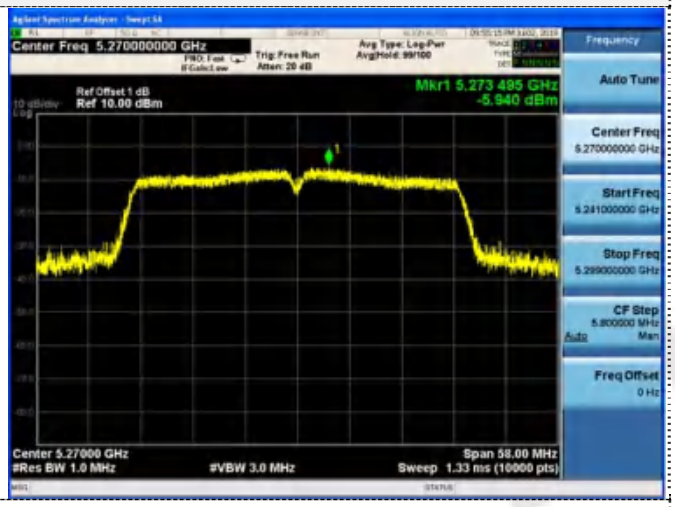
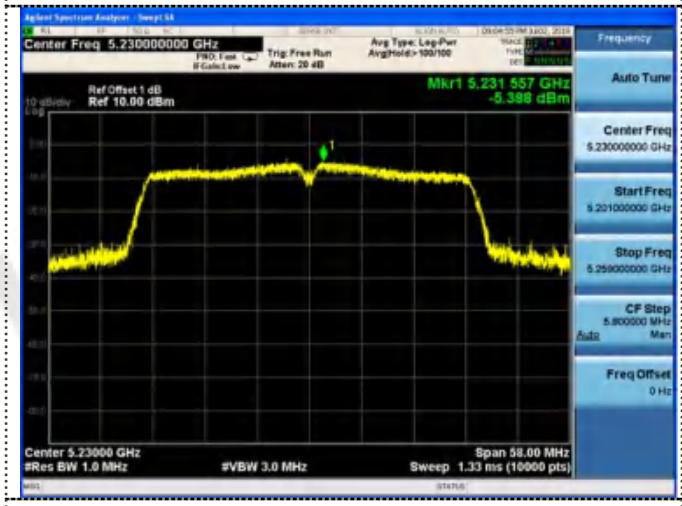
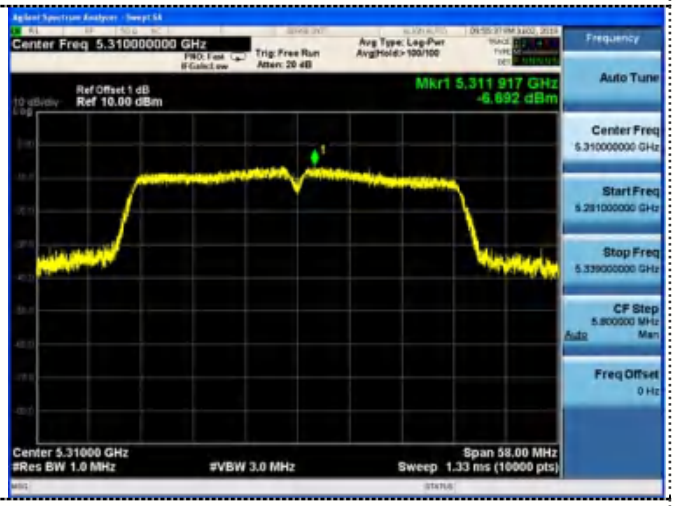
CH157



CH140

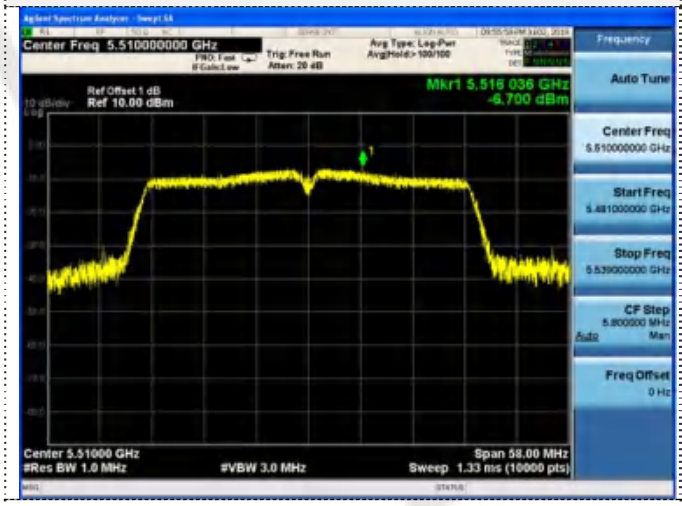


CH165

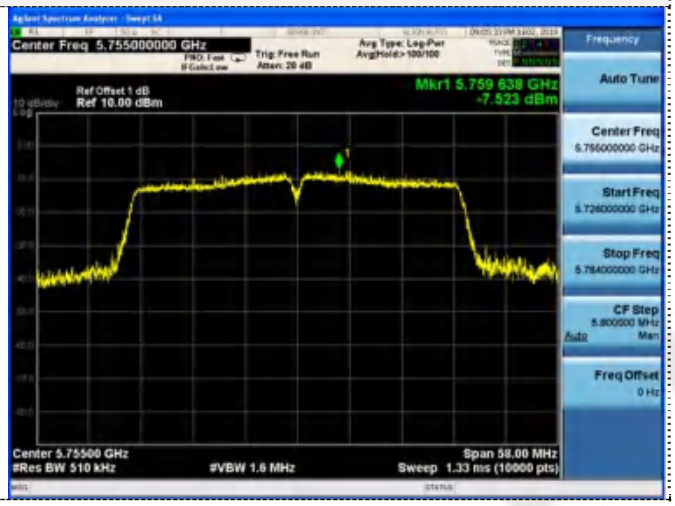
802.11ac(HT40)	
U-NII 1	U-NII 2A
	
CH38	CH54
	
CH46	CH62

802.11ac(HT40)

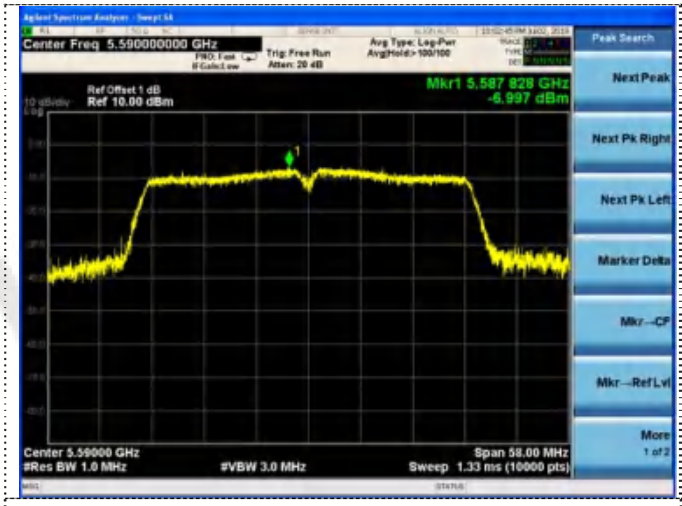
U-NII 2C



U-NII 3

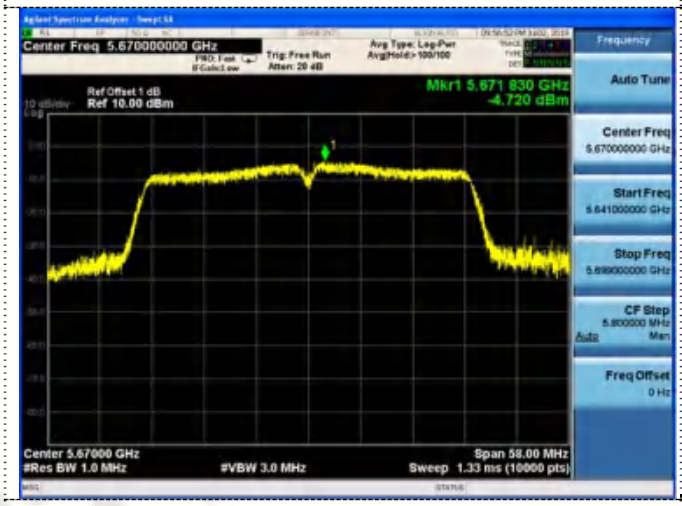


CH102



CH151

CH118

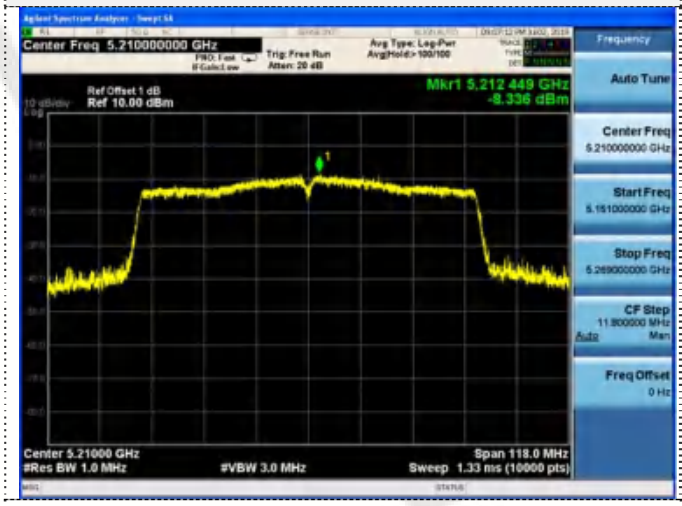


CH134

CH159

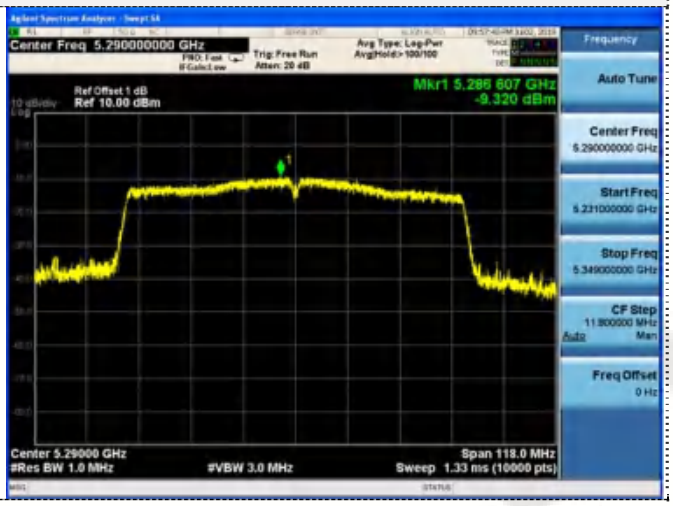
802.11ac(HT80)

U-NII 1



CH42

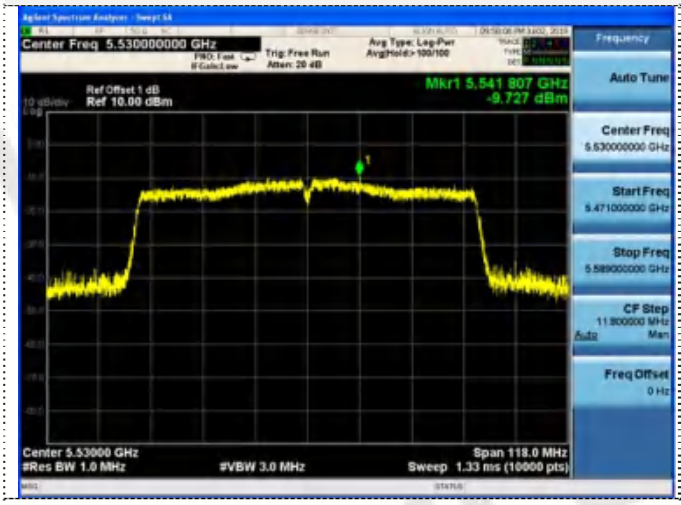
U-NII 2A



CH58

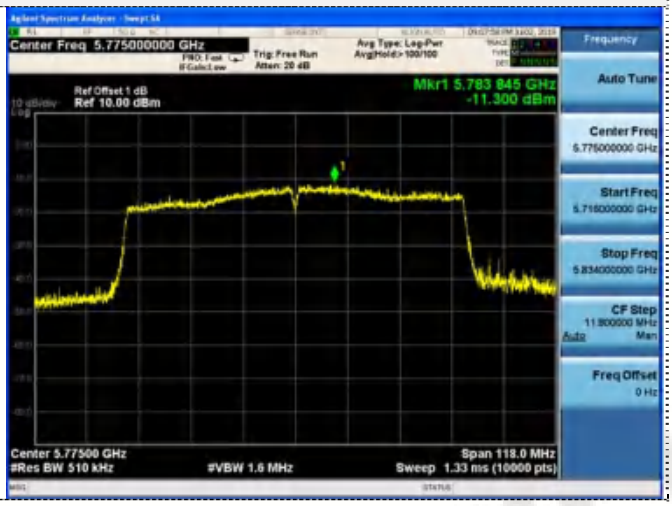
802.11ac(HT80)

U-NII 2C

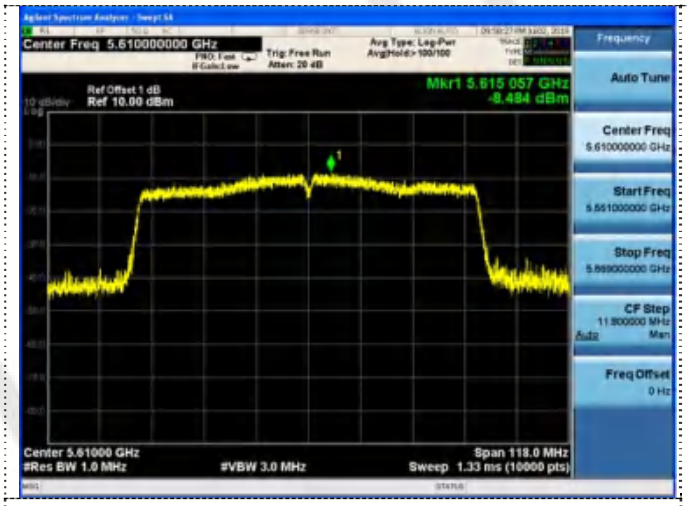


CH106

U-NII 3



CH155



CH122

3.5. Emission Bandwidth (26dBm Bandwidth)

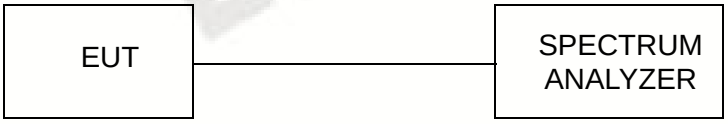
Limit

N/A

Test Procedure

1. Set resolution bandwidth (RBW) = approximately 1 % of the EBW.
2. Set the video bandwidth (VBW) > RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW / EBW ratio is approximately 1 %.

Test Configuration



Test Results

Type	Bands	Channel	26dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Result
802.11a	U-NII 1	36	24.870	16.848	N/A	Pass
		40	24.410	16.768		
		48	24.280	16.754		
	U-NII 2A	52	26.800	16.901		
		60	24.220	16.792		
		64	27.390	16.903		
	U-NII 2C	100	21.290	16.612		
		120	21.240	16.619		
		140	21.930	16.634		
802.11n(HT20)	U-NII 1	36	24.000	17.897		
		40	26.080	17.933		
		48	25.660	17.843		
	U-NII 2A	52	23.420	17.875		
		60	25.660	17.880		
		64	26.400	17.928		
	U-NII 2C	100	21.490	17.772		
		120	22.430	17.777		
		140	21.780	17.765		
802.11n(HT40)	U-NII 1	38	56.170	36.366		
		46	45.160	36.295		
	U-NII 2A	54	52.620	36.406		
		52	49.440	36.326		
	U-NII 2C	102	39.580	36.262		
		118	45.730	36.235		
		134	44.270	36.301		

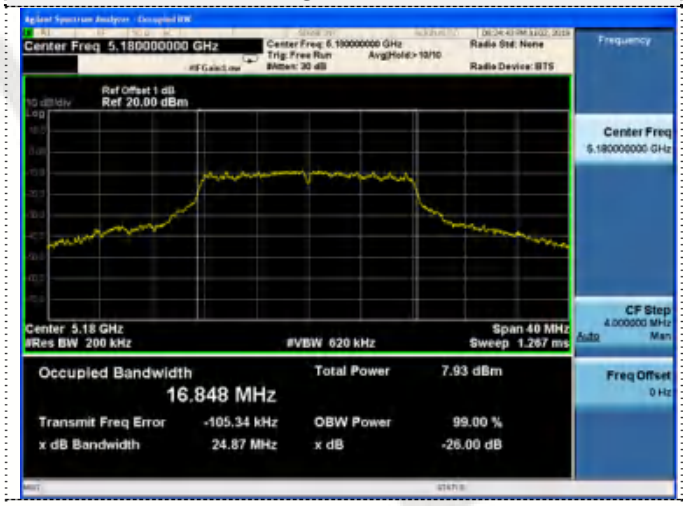
Type	Bands	Channel	26dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Result
802.11ac(HT20)	U-NII 1	36	26.770	17.904	N/A	Pass
		40	26.470	17.945		
		48	27.490	17.991		
	U-NII 2A	52	25.650	17.879		
		60	24.390	17.866		
		64	24.820	17.865		
	U-NII 2C	100	22.020	17.800		
		120	22.780	17.773		
		140	21.930	17.784		
802.11ac(HT40)	U-NII 1	38	47.500	36.390		
		46	42.280	36.245		
	U-NII 2A	54	52.220	36.355		
		52	47.050	36.308		
	U-NII 2C	102	39.830	36.232		
		118	44.660	36.350		
		134	40.300	36.259		
802.11ac(HT80)	U-NII 1	42	108.00	75.879		
	U-NII 2A	58	108.90	75.830		
	U-NII 2C	106	83.070	75.759		
		122	80.770	75.559		

Note:

1. *Measured 26dB bandwidth at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20 ,IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *Please refer to following test plots;*

802.11a

U-NII 1

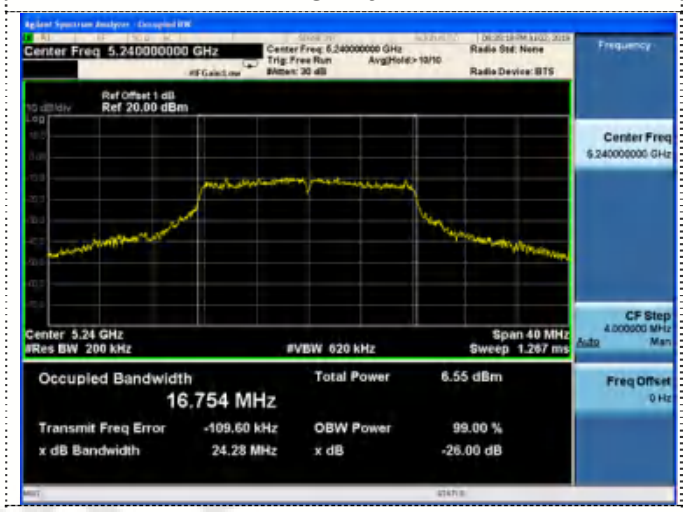


U-NII 2A

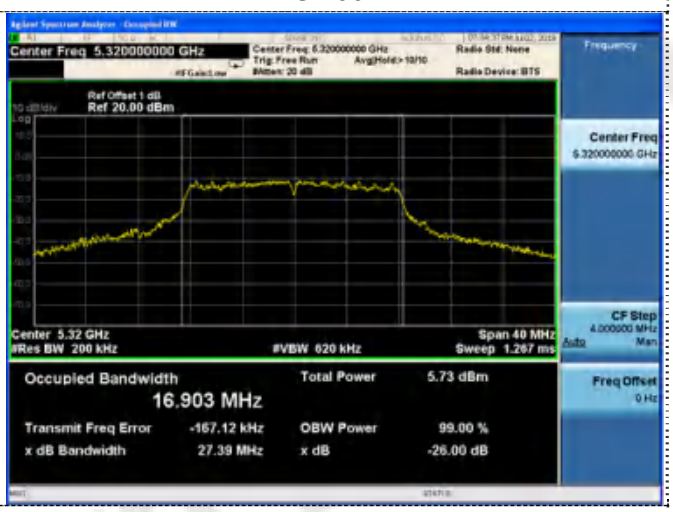
CH36

CH52

CH40



CH60



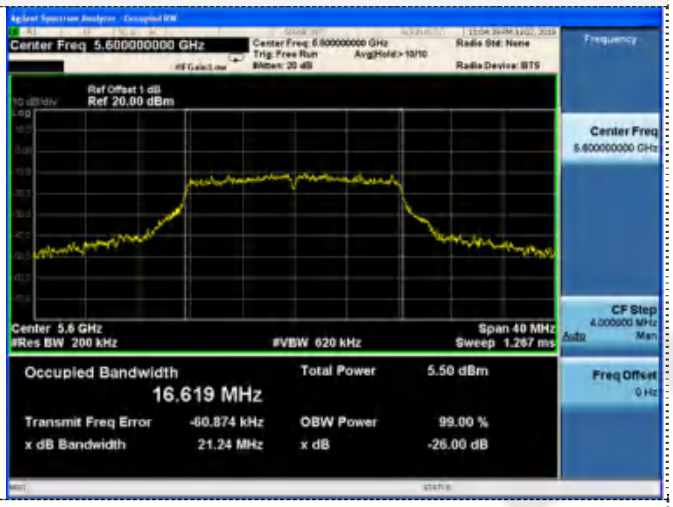
CH48

CH64

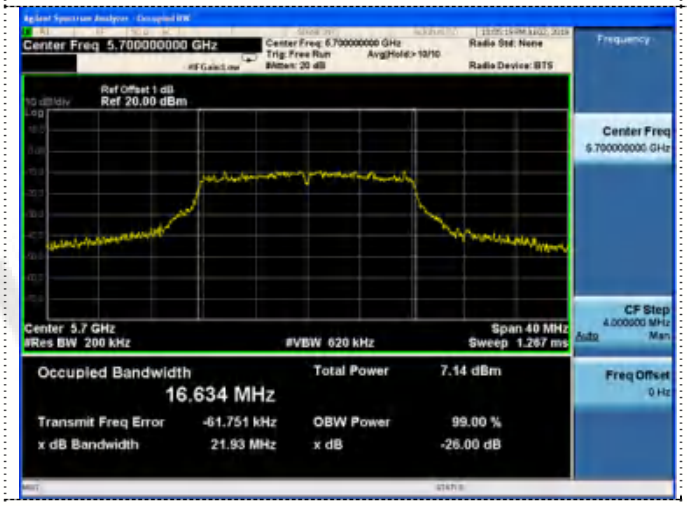
802.11a

U-NII 2C

CH100



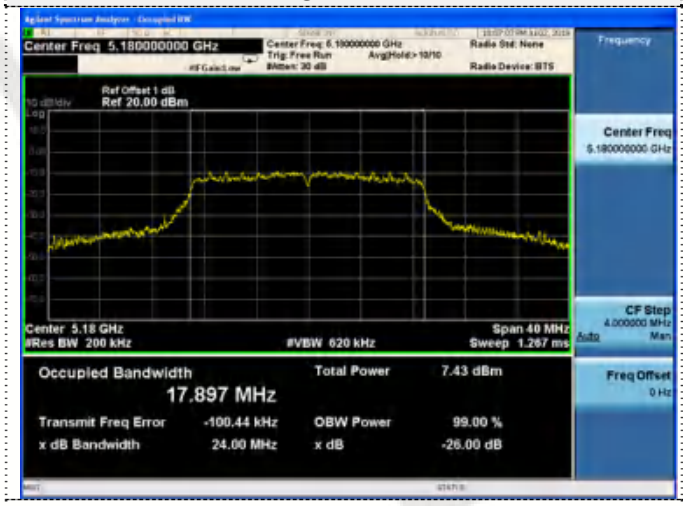
CH120



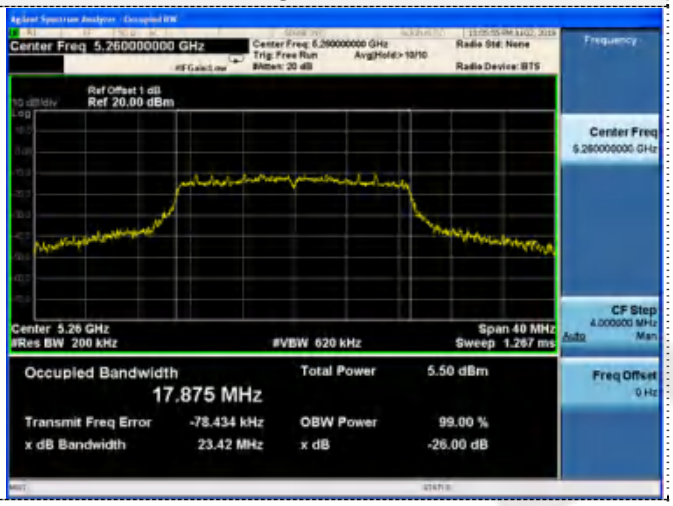
CH140

802.11n(HT20)

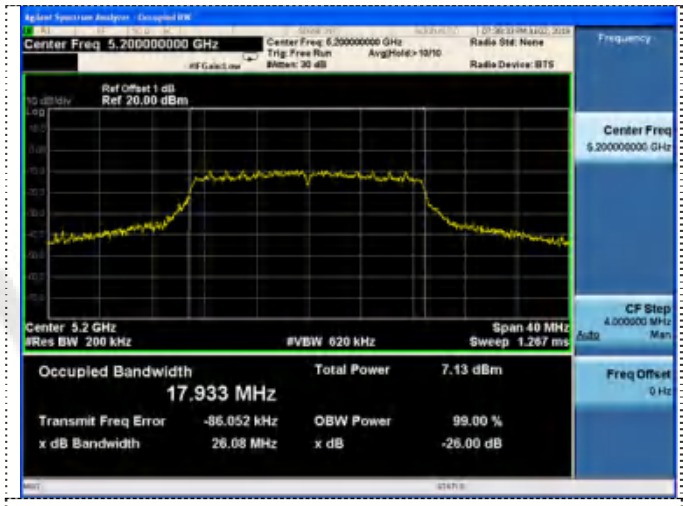
U-NII 1



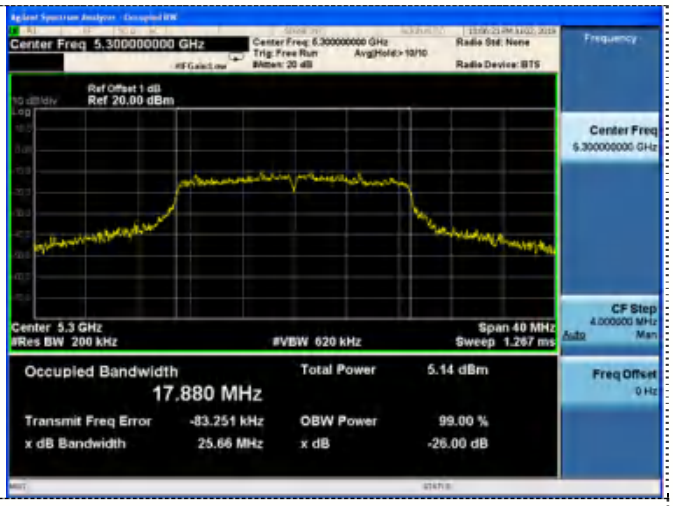
U-NII 2A



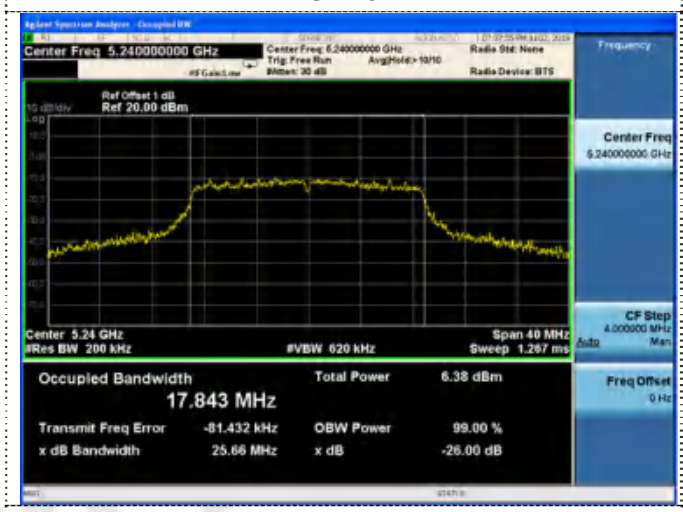
CH36



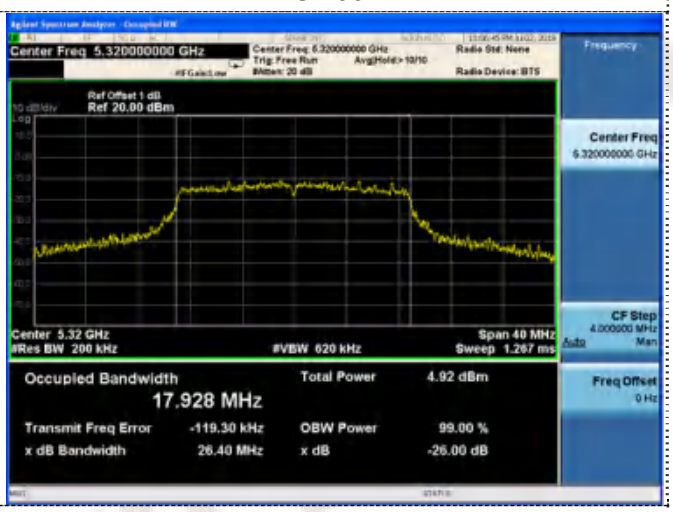
CH52



CH40



CH60



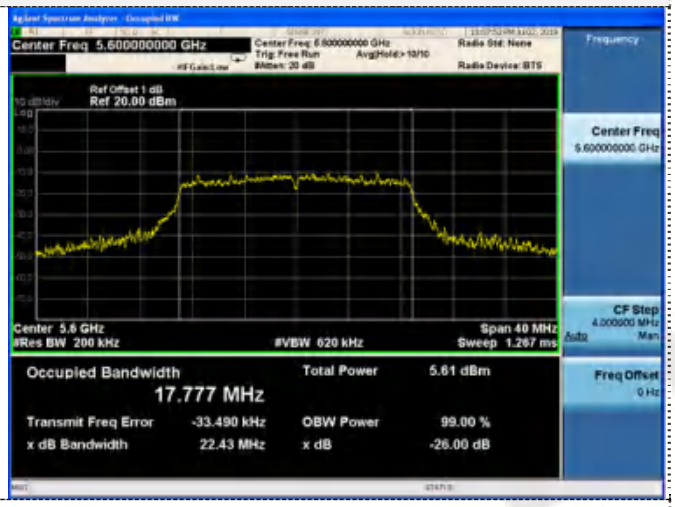
CH48

CH64

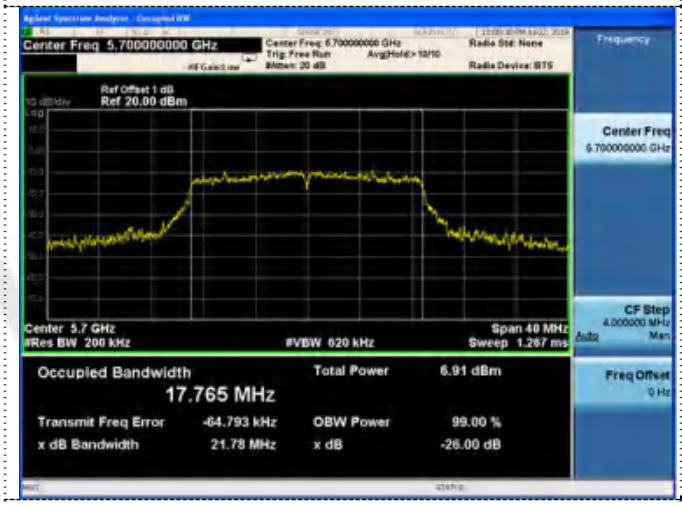
802.11n(HT20)

U-NII 2C

CH100



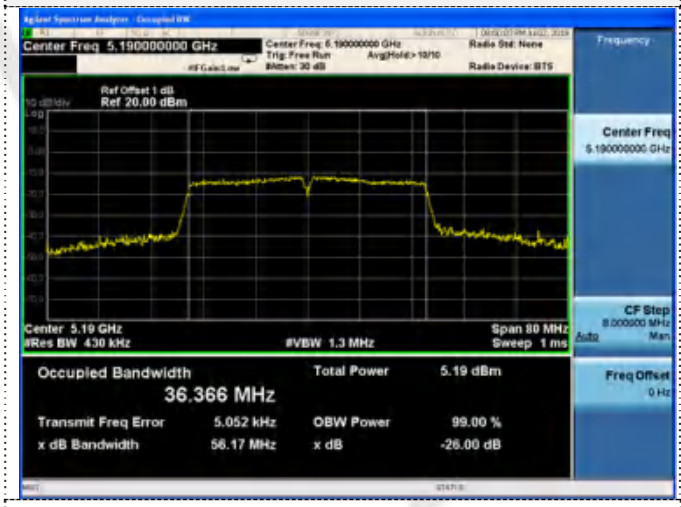
CH120



CH140

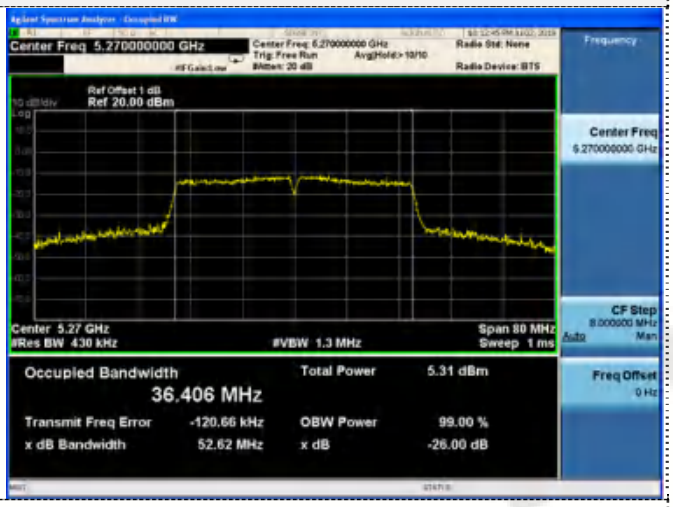
802.11n(HT40)

U-NII 1



CH38

U-NII 2A



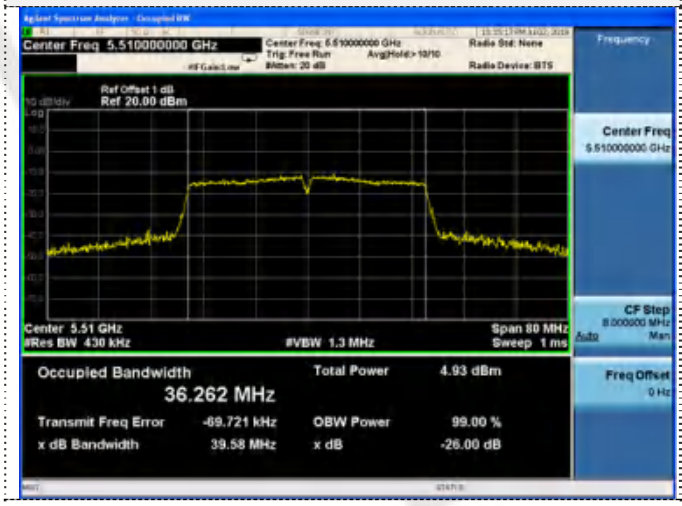
CH54

CH46

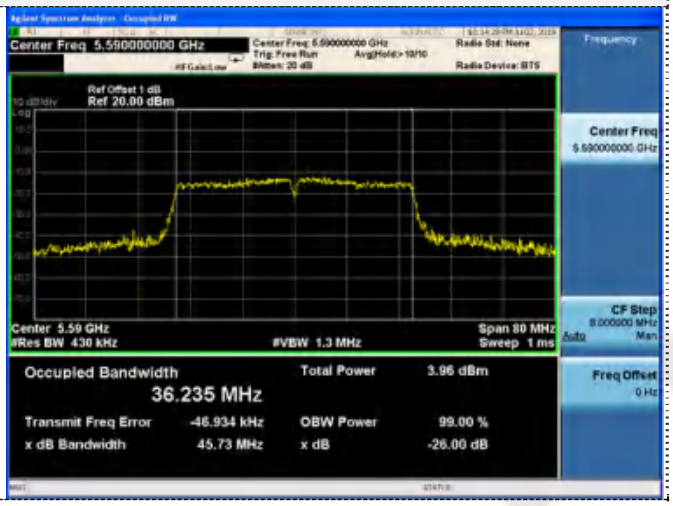
CH62

802.11n(HT40)

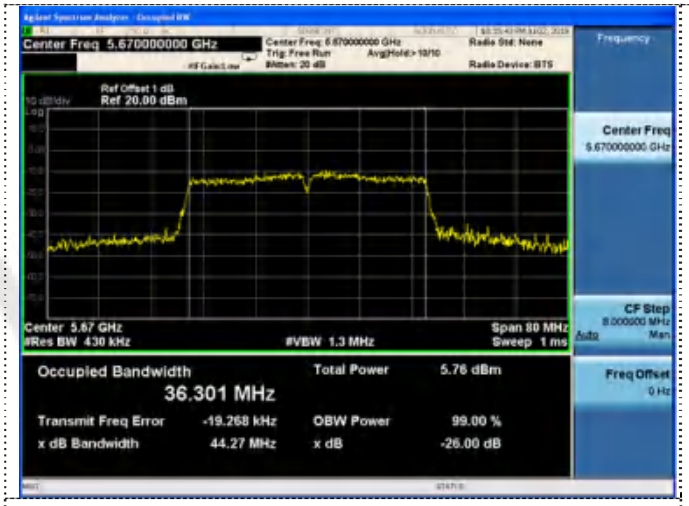
U-NII 2C



CH102



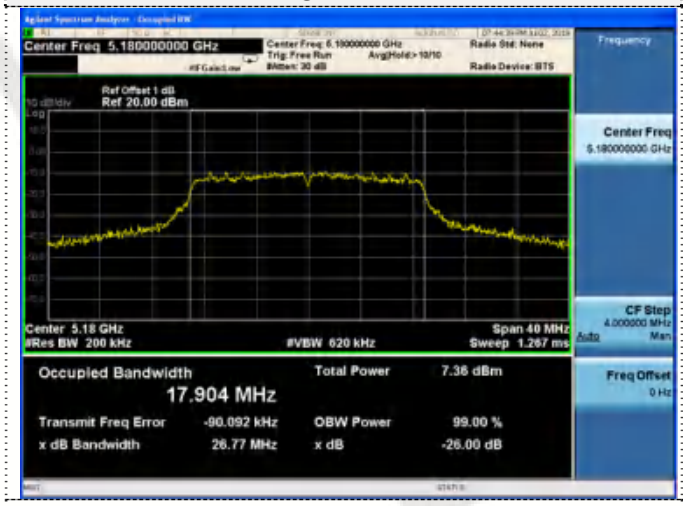
CH118



CH134

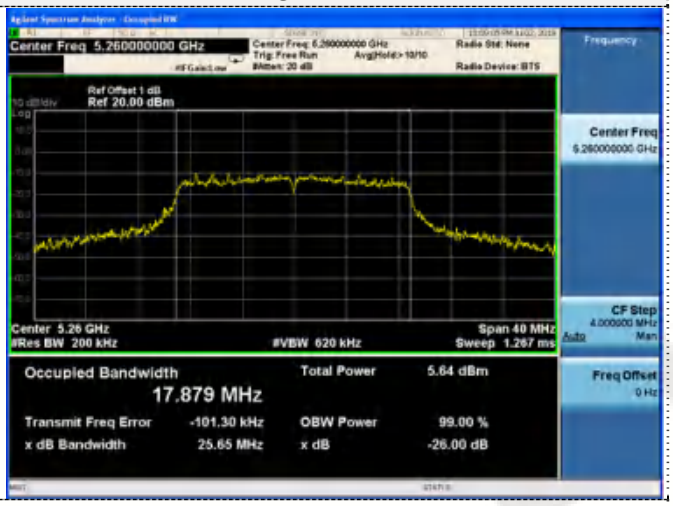
802.11ac(HT20)

U-NII 1

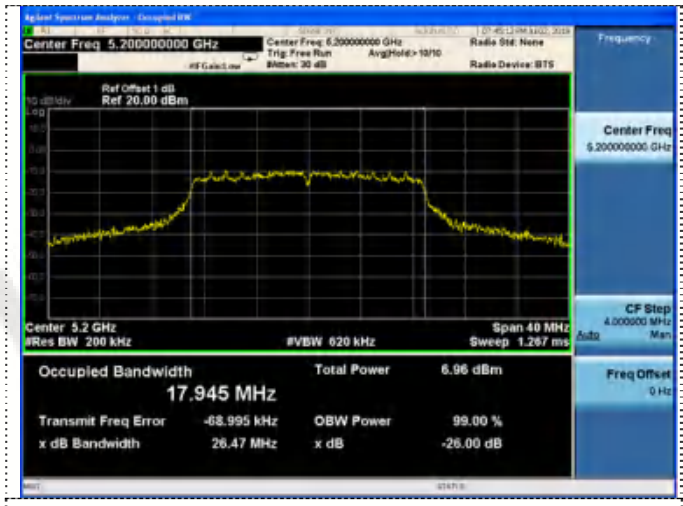


CH36

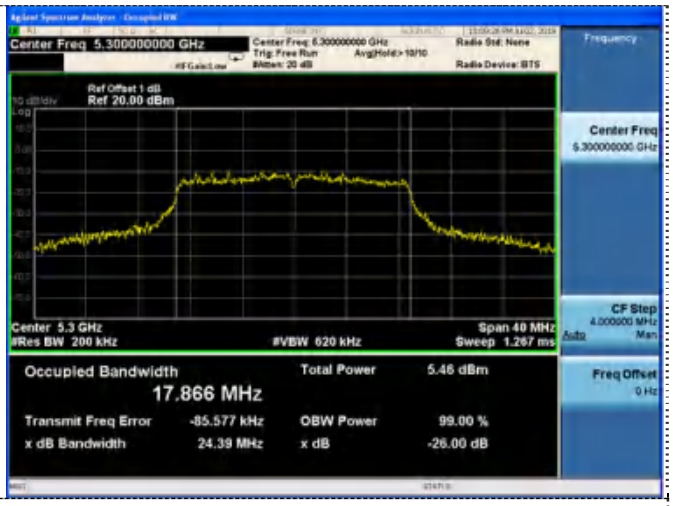
U-NII 2A



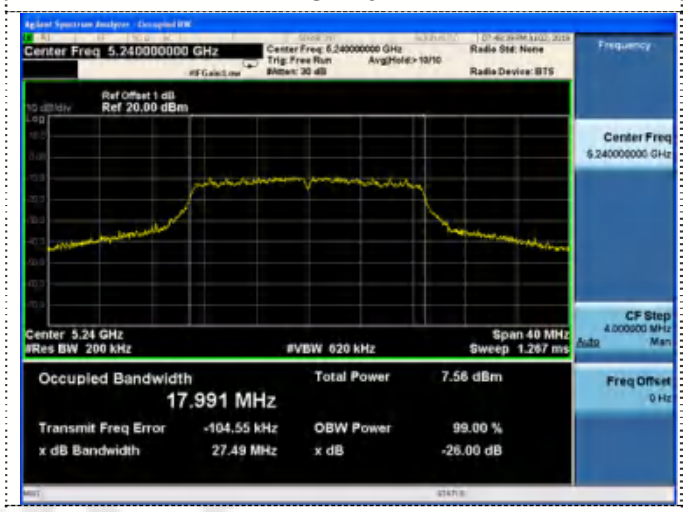
CH52



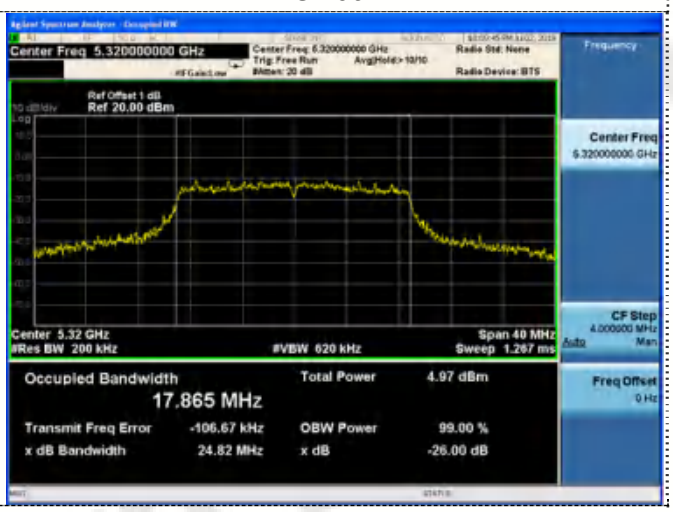
CH40



CH60



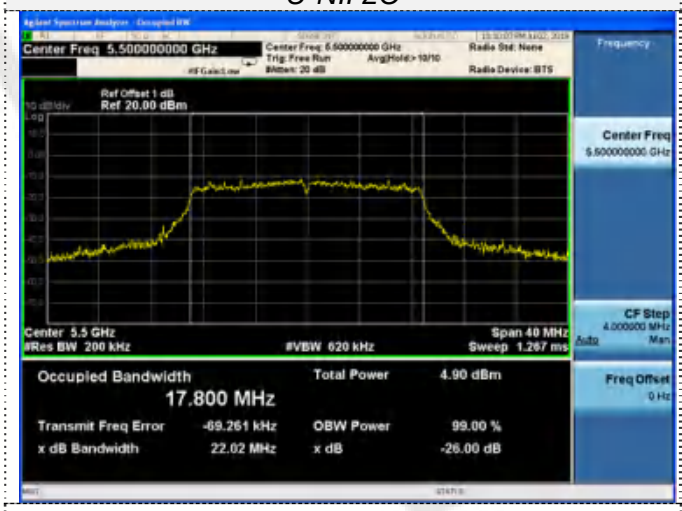
CH48



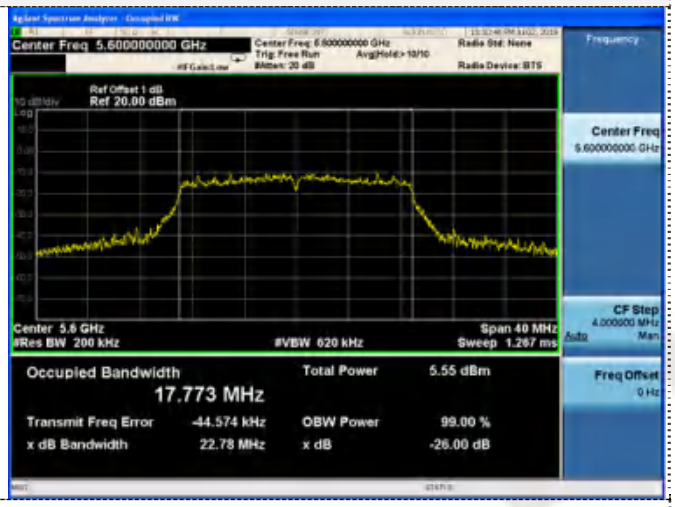
CH64

802.11ac(HT20)

U-NII 2C

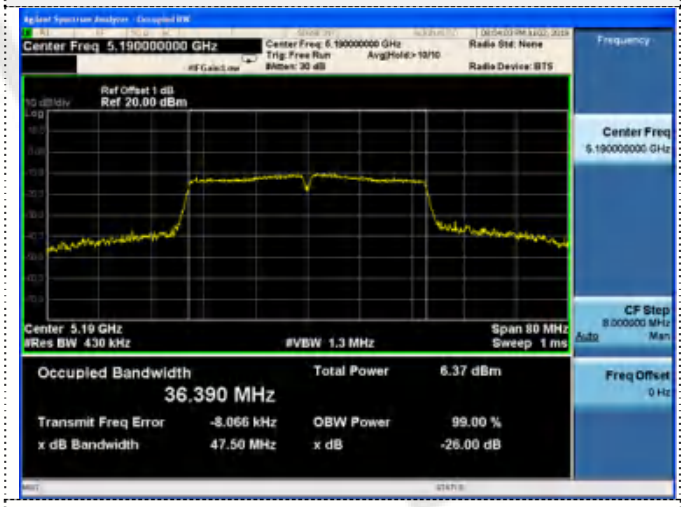
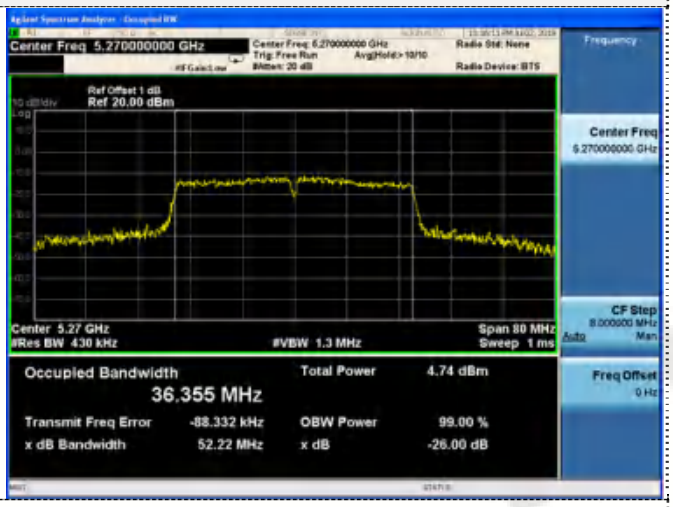


CH100



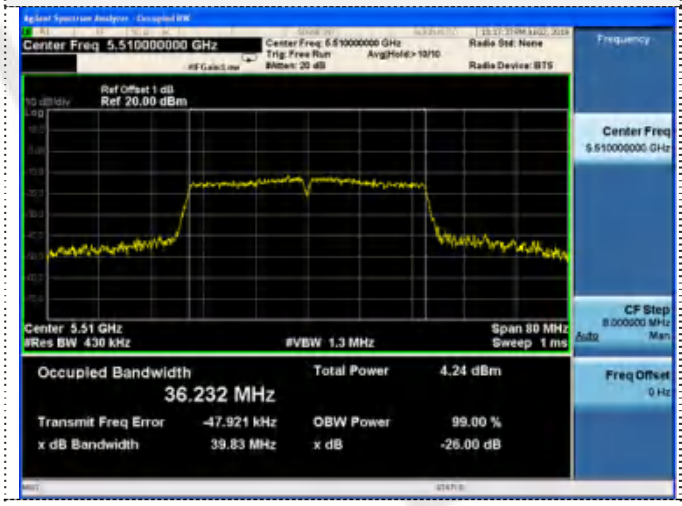
CH120

CH140

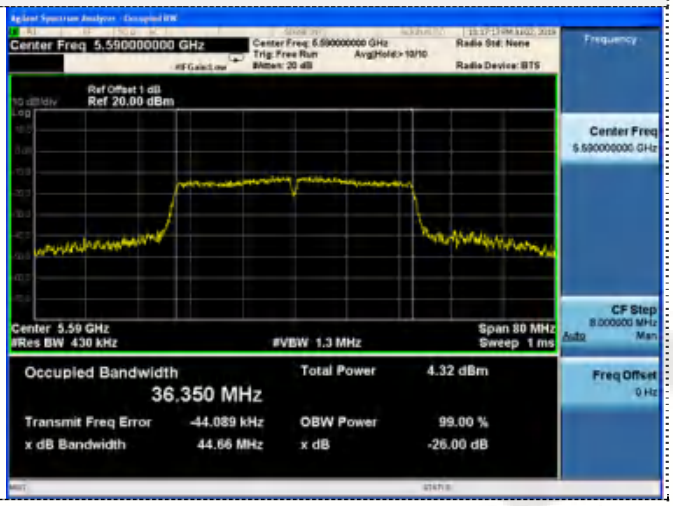
802.11ac(HT40)	
U-NII 1	U-NII 2A
	
CH38	CH54
CH46	CH62

802.11ac(HT40)

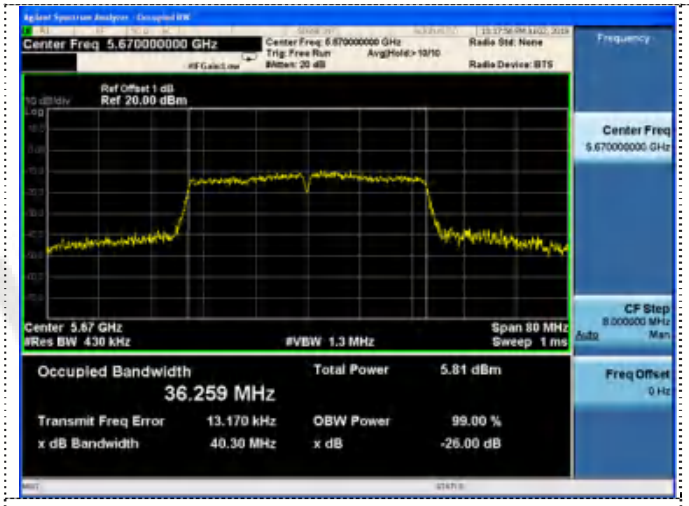
U-NII 2C



CH102

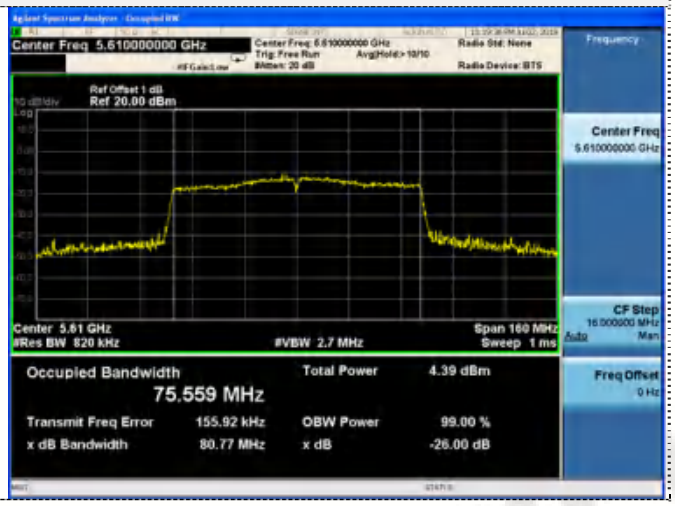


CH118



CH134

802.11ac(HT80)	
U-NII 1	U-NII 2A
CH42	CH58

802.11ac(HT80)	
U-NII 2C	
	
CH106	CH122

3.6. Minimum Emission Bandwidth (6dBm Bandwidth)

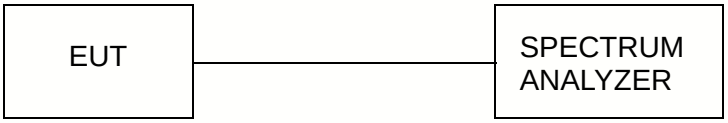
Limit

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

Test Procedure

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth 3 x RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Configuration

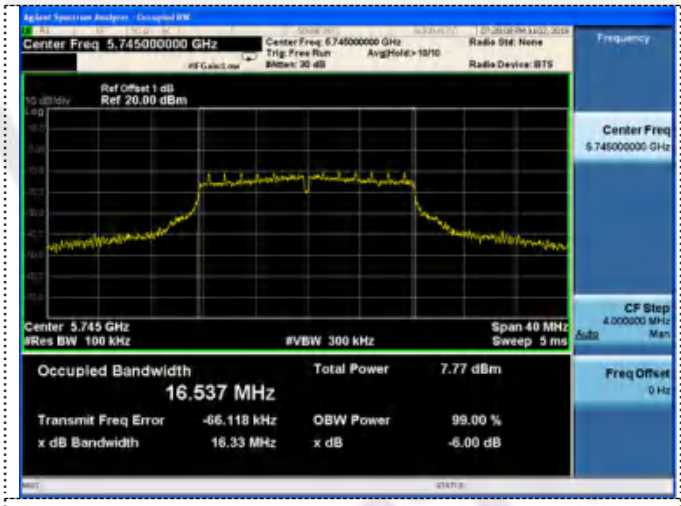
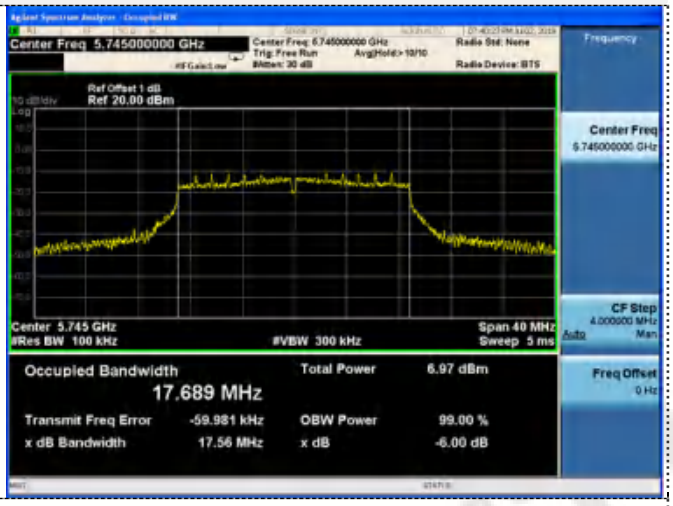
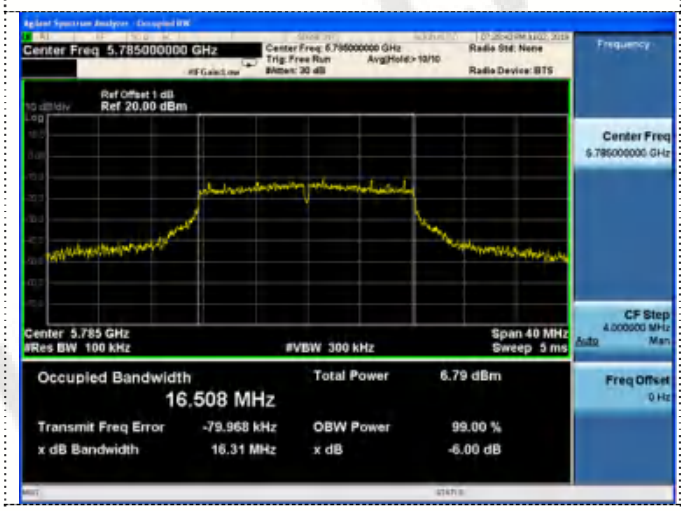
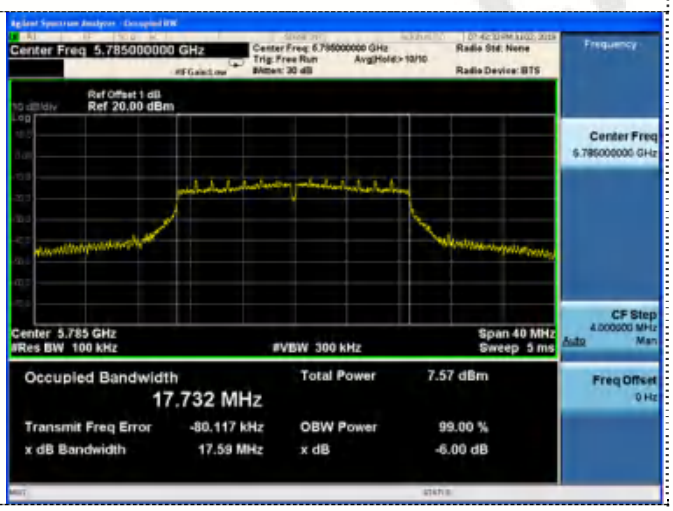
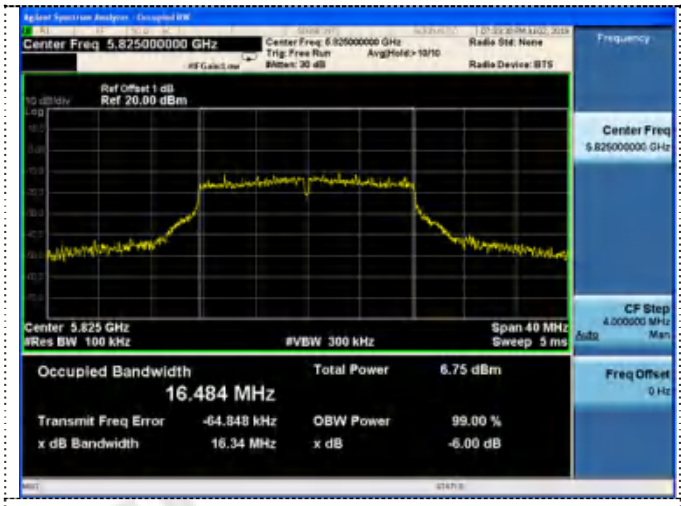
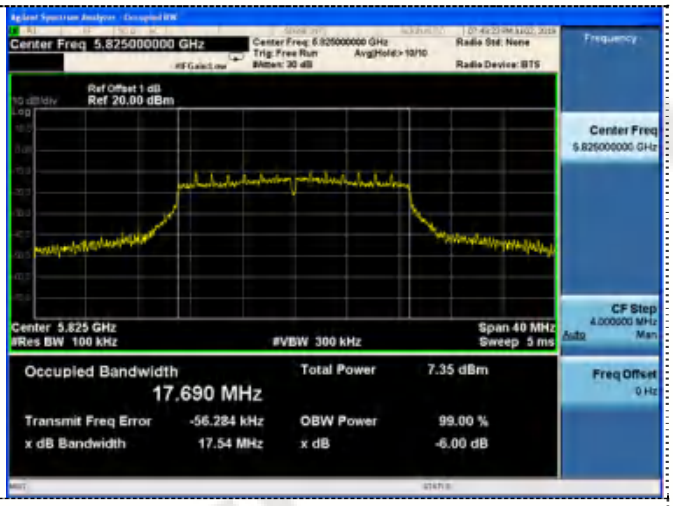


Test Results

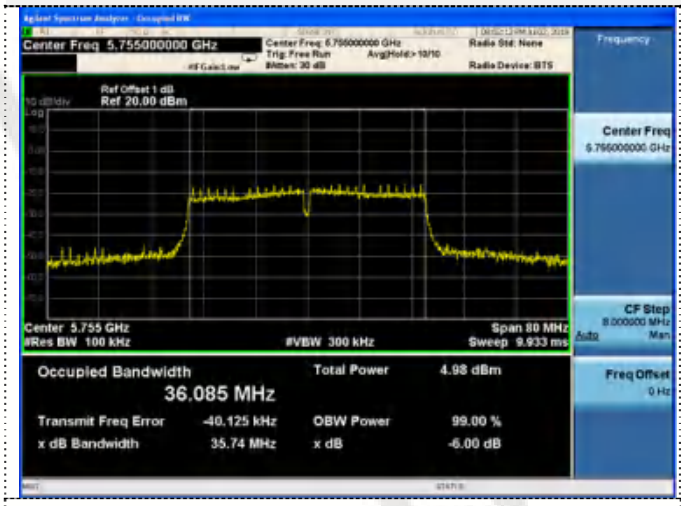
Type	Bands	Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (KHz)	Result
802.11a	U-NII 3	149	16.33	16.537	≥500KHz	Pass
		157	16.31	16.508		
		165	16.34	16.484		
802.11n(HT20)	U-NII 3	149	17.56	17.689		
		157	17.59	17.732		
		165	17.54	17.690		
802.11n(HT40)	U-NII 3	151	35.74	36.085		
		159	35.78	36.084		
802.11ac(HT20)	U-NII 3	149	17.55	17.684		
		157	17.55	17.684		
		165	17.55	17.666		
802.11ac(HT40)	U-NII 3	151	35.77	36.116		
		159	36.28	36.128		
802.11ac(HT80)	U-NII 3	155	75.78	75.367		

Note:

1. *Measured 26dB bandwidth at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20 ,IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *Please refer to following test plots;*

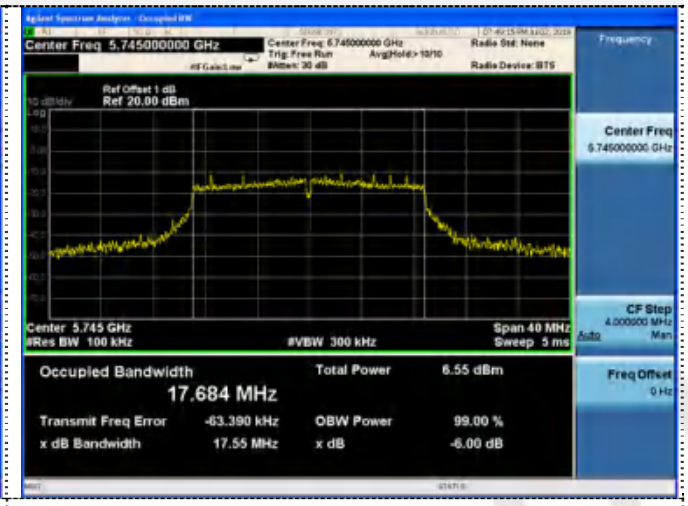
802.11a	802.11n(HT20)
	
CH149	CH149
	
CH157	CH157
	
CH165	CH165

802.11n(HT40)

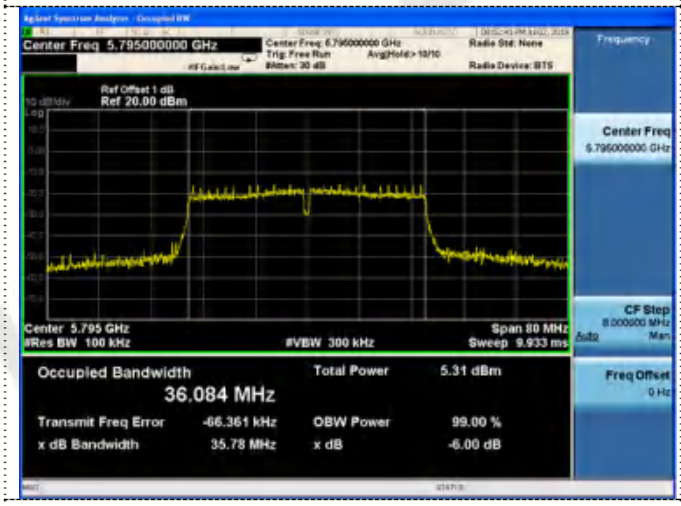


CH151

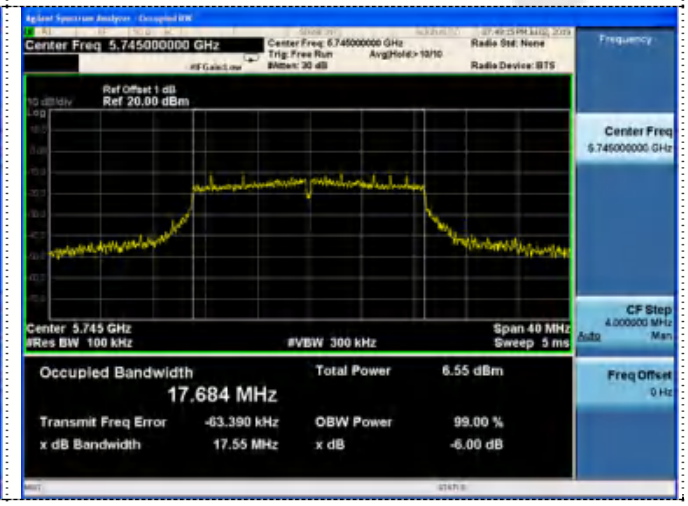
802.11ac(HT20)



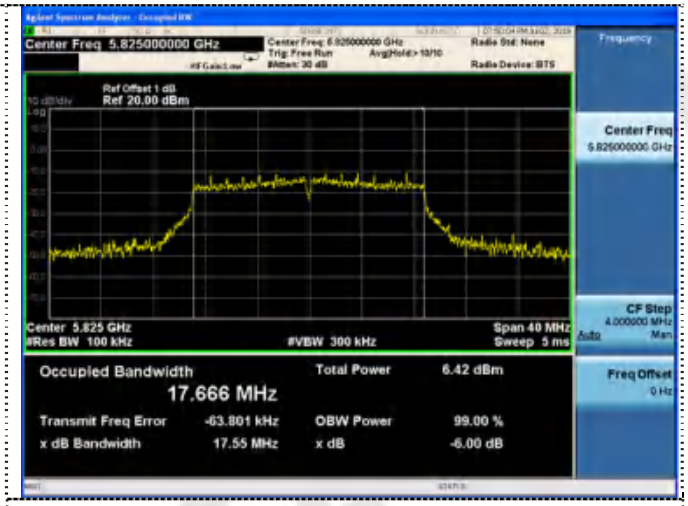
CH149



CH159

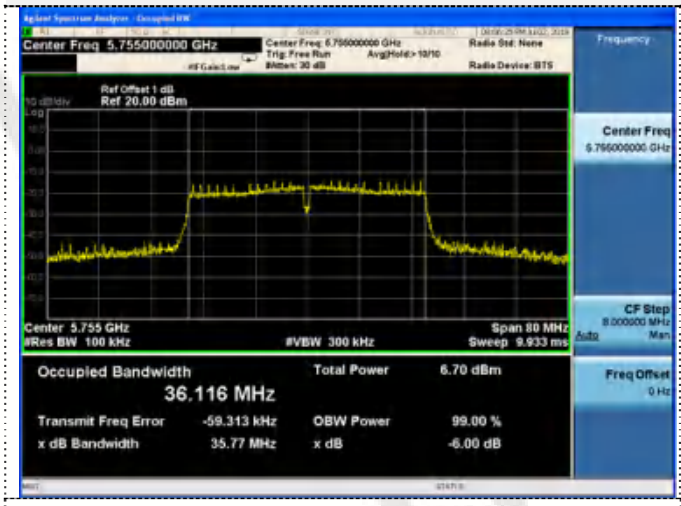


CH157



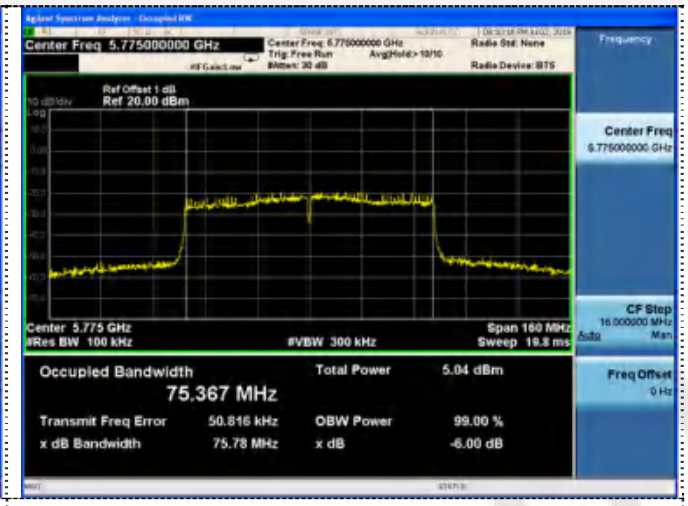
CH165

802.11ac(HT40)

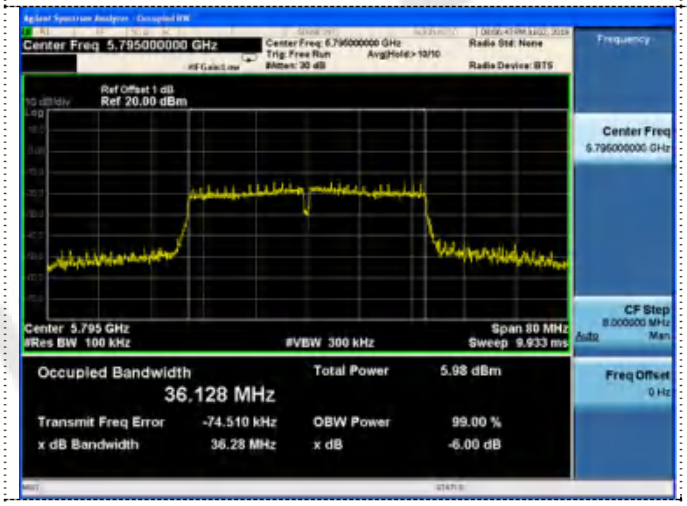


CH151

802.11ac(HT80)



CH155



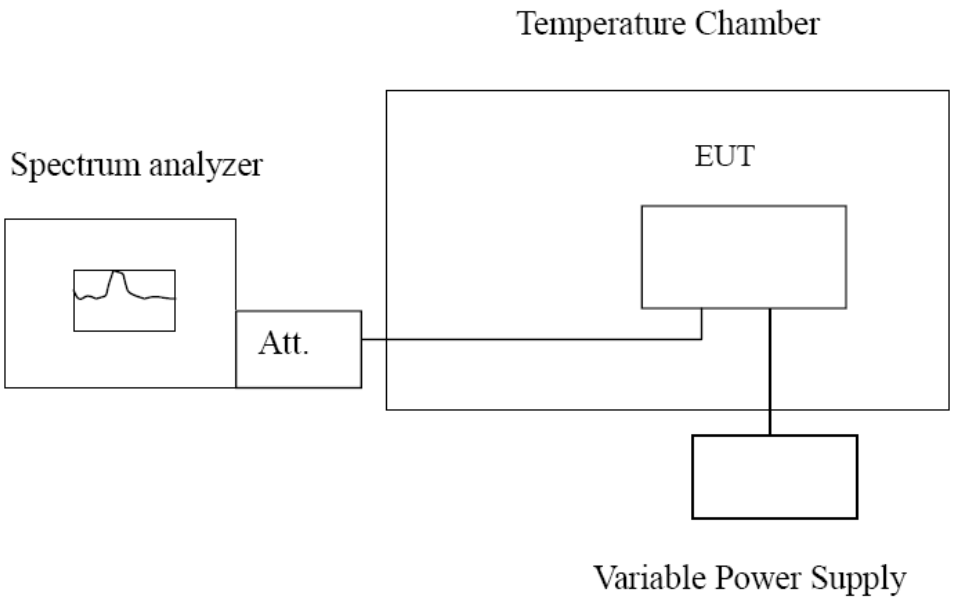
CH159

3.7. Frequency Stability

LIMIT

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

TEST CONFIGURATION



TEST PROCEDURE

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

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

TEST RESULTS

Record worst case as below:

Reference Frequency: 802.11ac channel=36 frequency=5180MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
5.00	-30	455	0.088	Within the band of operation	Pass
	-20	668	0.129		
	-10	793	0.153		
	0	832	0.161		
	10	837	0.162		
	20	656	0.127		
	30	527	0.102		
	40	566	0.110		
	50	502	0.097		
5.75	25	905	0.175		
4.25	25	455	0.088		

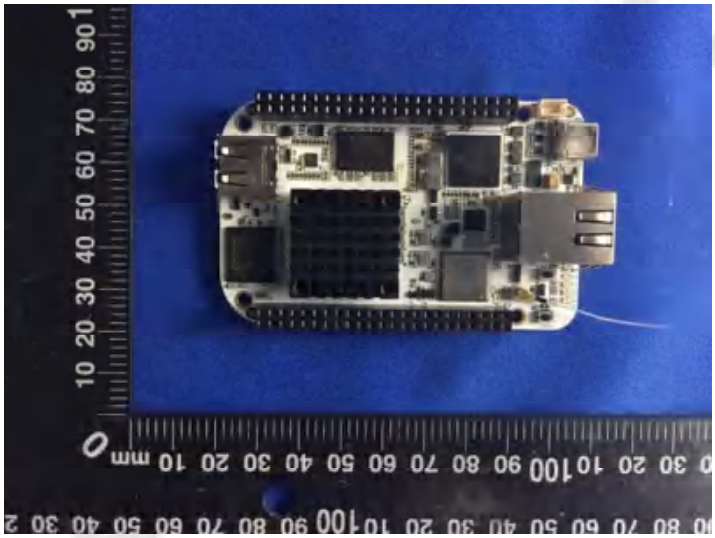
Reference Frequency: 802.11ac channel=52 frequency=5260MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
5.00	-30	560	0.106	Within the band of operation	Pass
	-20	670	0.127		
	-10	552	0.105		
	0	543	0.103		
	10	534	0.101		
	20	918	0.175		
	30	592	0.113		
	40	454	0.086		
	50	514	0.098		
5.75	25	948	0.179		
4.25	25	427	0.081		

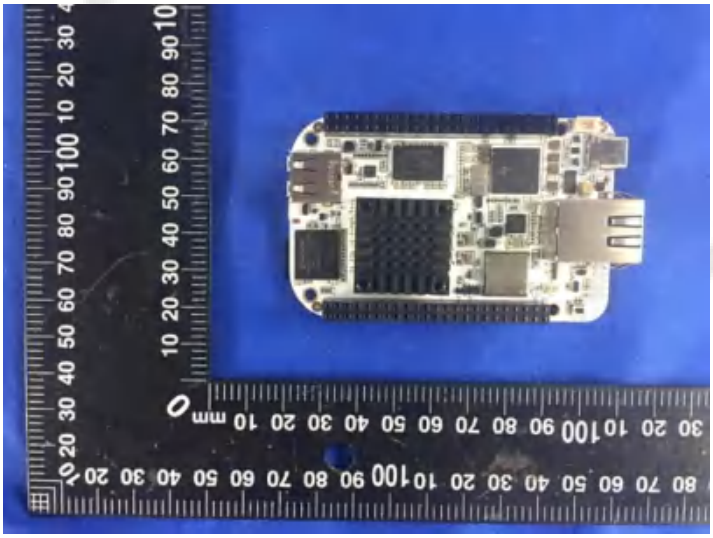
Reference Frequency: 802.11ac channel=100 frequency=5500MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
5.00	-30	694	0.126	Within the band of operation	Pass
	-20	982	0.178		
	-10	866	0.157		
	0	534	0.098		
	10	618	0.111		
	20	454	0.083		
	30	746	0.136		
	40	443	0.080		
	50	794	0.144		
5.75	25	727	0.132		
4.25	25	762	0.139		

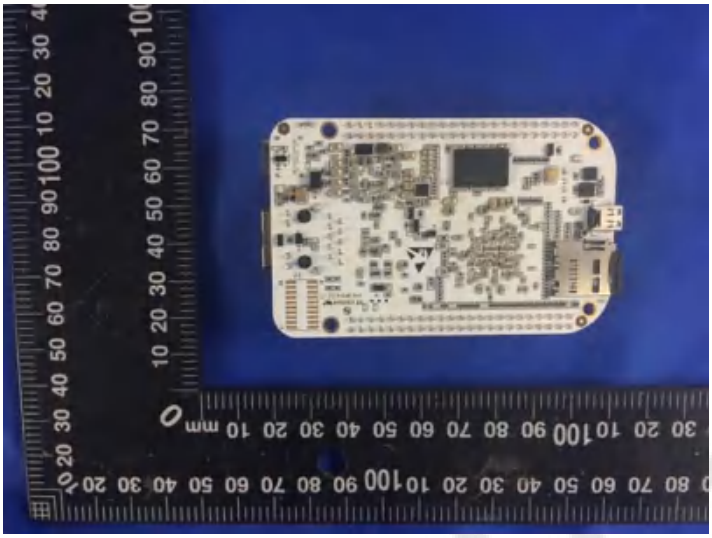
Reference Frequency: 802.11ac channel=149 frequency=5745MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
5.00	-30	697	0.013	Within the band of operation	Pass
	-20	614	0.011		
	-10	765	0.014		
	0	833	0.015		
	10	722	0.013		
	20	712	0.013		
	30	815	0.015		
	40	994	0.018		
	50	655	0.012		
5.75	25	681	0.012		
4.25	25	936	0.017		

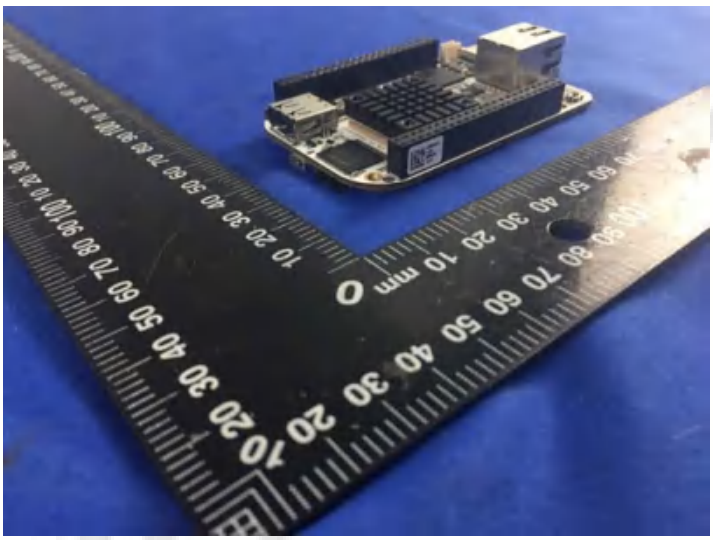
4. Test Setup Photos of the EUT

5. Photos of the EUT









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