FCC TEST REPORT

For

CamFi Limited

CamFi Pro

Test Model: CP101

Additional Model No. : /

Prepared for	:	CamFi Limited
Address	:	Room A1002-1,Venture Building, TsingHua Science Park, No.101 College Road, Tangjiawan, Zhuhai, China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
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Date of receipt of test sample	:	Mar 30, 2018
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	Mar 30, 2018~Apr 11, 2018
Date of Report	:	Apr 13, 2018

FCC TEST REPORT

FCC CFR 47 PART 15 E(15.407)

Report Reference No.	**:**	**LCS171221044AEB**
Date of Issue	:	Apr 13, 2018
Testing Laboratory Name	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure.....	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name	**:**	**CamFi Limited**
Address	:	Room A1002-1,Venture Building, TsingHua Science Park, No.101 College Road, Tangjiawan, Zhuhai, China
Test Specification		
Standard.....	:	FCC CFR 47 PART 15 E(15.407): 2015 / ANSI C63.10: 2013
Test Report Form No.....	**:**	LCSEMC-1.0
TRF Originator.....	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	:	Dated 2011-03

Test Item Description.	**:**	**CamFi Pro**
Trade Mark	:	CamFi Pro
Test Model.....	:	CP101
Ratings	:	DC 3.8V by Li-ion battery(3200mAh) Recharged input: DC 5V/1A(max) by power adapter
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Calvin Weng	Dick Su	Gavin Liang
Calvin Weng/ Administrators	Dick Su/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS171221044AEB	Apr 13, 2018 Date of issue

Test Model.....	:	CP101
EUT.....	:	CamFi Pro
Applicant.....	**:**	**CamFi Limited**
Address.....	:	Room A1002-1,Venture Building, TsingHua Science Park, No.101 College Road, Tangjiawan, Zhuhai, China
Telephone.....	:	
Fax.....	:	
Manufacturer.....	**:**	**CamFi Limited**
Address.....	:	Room A1002-1,Venture Building, TsingHua Science Park, No.101 College Road, Tangjiawan, Zhuhai, China
Telephone.....	:	
Fax.....	:	
Factory.....	**:**	**CamFi Limited**
Address.....	:	Room A1002-1,Venture Building, TsingHua Science Park, No.101 College Road, Tangjiawan, Zhuhai, China
Telephone.....	:	
Fax.....	:	

Test Result	Positive

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	Apr 13, 2018	Initial Issue	Gavin Liang

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	CamFi Pro
Test Model	:	CP101
Power Supply	:	DC 3.8V by Li-ion battery(3200mAh) Recharged input: DC 5V/1A(max) by power adapter
Hardware Version	:	CP101
Software Version	:	6.2.1.235
WIFI(2.4G Band)	:	
WLAN	:	Supports IEEE 802.11b/802.11g/802.11n
WLAN FCC Operation Frequency	:	IEEE 802.11b/g/n HT20: 2412 – 2462 MHz IEEE 802.11n HT40: 2422 – 2452 MHz
Channel Spacing	:	5MHz
WLAN Channel Number	:	11 Channels for WIFI 20MHz Bandwidth(IEEE 802.11b/g/n HT20) 7 Channels for WIFI 40MHz Bandwidth(IEEE 802.11n HT40)
Modulation Type	:	IEEE 802.11b: DSSS; 802.11g/n: OFDM
Antenna Description	:	PIFA Antenna
Antenna Gain	:	Antenna 0: maximum antenna gain is 2.0dBi Antenna 1: maximum antenna gain is 2.0dBi
Directional Gain	:	$2.0+10\log_{10}(2)=5.01$dBi for 802.11n mode
WIFI(5G Band)	:	
Frequency Range	:	5180-5240MHz, 5745-5825MHz
Channel Number	:	9 Channels for 20MHz Bandwidth(IEEE 802.11a/n HT20)/ac VHT20) 4 Channels for 40MHz Bandwidth(IEEE 802.11n HT40/ac VHT40) 2 Channels for 80MHz Bandwidth(IEEE 802.11ac VHT80)
Modulation Type	:	IEEE 802.11a/n20/n40/ac VHT20/ac VHT40/ac VHT80: OFDM
Antenna Gain	:	Antenna 0: maximum antenna gain is 2.0dBi Antenna 1: maximum antenna gain is 2.0dBi
Directional Gain	:	$2.0+10\log_{10}(2)=5.01$dBi for 802.11n/ac mode

1.2. Support Equipment List

Manufacturer	Description	Model	Serial Number	Certificate
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1.3. External I/O

I/O Port Description	Quantity	Cable
Mini USB Port	1	0.6m unshielded cable
USB Port	1	0.2m unshielded cable

1.4. Description of Test Facility

FCC Registration Number. is 254912.

Industry Canada Registration Number. is 9642A-1.

ESMD Registration Number. is ARCB0108.

UL Registration Number. is 100571-492.

TUV SUD Registration Number. is SCN1081.

TUV RH Registration Number. is UA 50296516-001

There is one 3m semi-anechoic chamber and one line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4: 2014, CISPR 32/EN 55032 and CISPR16-1-4 SVSWR requirements.

1.5. 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 LCS 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.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	3.10dB	(1)
		30MHz~200MHz	2.96dB	(1)
		200MHz~1000MHz	3.10dB	(1)
		1GHz~26.5GHz	3.80dB	(1)
		26.5GHz~40GHz	3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	1.63dB	(1)
Power disturbance	:	30MHz~300MHz	1.60dB	(1)

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

1.7. Description of Test Modes

The EUT has been tested under operating condition.

The EUT was set to transmit at 100% duty cycle. This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in Y position.

For pre-testing, when performed power line conducted emission measurement, the input Voltage/Frequency AC 120V/60Hz and AC 240V/50Hz were used. Only recorded the worst case in this report.

Worst-case mode and channel used for 150 KHz-30 MHz power line conducted emissions was determined to be IEEE 802.11ac VHT20 mode (Mid Channel, 5180-5240MHz Band).

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was determined to be IEEE 802.11ac VHT20 mode (Mid Channel, 5180-5240MHz Band).

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:
IEEE 802.11a Mode: 6 Mbps, OFDM.
IEEE 802.11n HT20 Mode: MCS0, OFDM.
IEEE 802.11n HT40 Mode: MCS0, OFDM.
IEEE 802.11ac VHT20 Mode: MCS0, OFDM.
IEEE 802.11ac VHT40 Mode: MCS0, OFDM.
IEEE 802.11ac VHT80 Mode: MCS0, OFDM.

Support Bandwidth For 5G WIFI Part:

Bandwidth Mode	20MHz	40MHz	80MHz
IEEE 802.11a	☑	☐	☐
IEEE 802.11n HT20	☑	☐	☐
IEEE 802.11n HT40	☐	☑	☐
IEEE 802.11ac VHT20	☑	☐	☐
IEEE 802.11ac VHT40	☐	☑	☐
IEEE 802.11ac VHT80	☐	☐	☑

Channel & Frequency:

Frequency Band	Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)
5180~5240MHz	36	5180	44	5220
	38	5190	46	5230
	40	5200	48	5240
	42	5210	/	/
For IEEE 802.11a/n HT20/ac VHT20, Channel 36, 40 and 48 were tested. For IEEE 802.11n HT40/ac VHT40, Channel 38 and 46 were tested. For IEEE 802.11ac VHT80, Channel 42 was tested.				
5745~5825MHz	149	5745	157	5785
	151	5755	159	5795
	153	5765	161	5805
	155	5775	165	5825
For 802.11a/n(HT20)/ac(VHT20), Channel 149, 157 and 165 were tested. For 802.11n(HT40)/ac(VHT40), Channel 151 and 159 were tested. For 802.11ac(VHT80), Channel 155 was tested.				

1.8. List Of Measuring Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	Power Meter	R&S	NRVS	100444	2017-06-17	2018-06-16
2	Power Sensor	R&S	NRV-Z81	100458	2017-06-17	2018-06-16
3	Power Sensor	R&S	NRV-Z32	10057	2017-06-17	2018-06-16
4	EPM Series Power Meter	Agilent	E4419B	MY45104493	2017-06-17	2018-06-16
5	E-SERIES AVG POWER SENSOR	Agilent	E9301H	MY41495234	2017-06-17	2018-06-16
6	ESA-E SERIES SPECTRUM ANALYZER	Agilent	E4407B	MY41440754	2017-11-18	2018-11-17
7	MXA Signal Analyzer	Agilent	N9020A	MY49100040	2017-06-17	2018-06-16
8	SPECTRUM ANALYZER	R&S	FSP	100503	2017-06-17	2018-06-16
9	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2017-06-17	2018-06-16
10	Positioning Controller	MF	MF-7082	/	2017-06-17	2018-06-16
11	EMI Test Software	AUDIX	E3	N/A	2017-06-17	2018-06-16
12	EMI Test Receiver	ROHDE & SCHWARZ	ESR 7	101181	2017-06-17	2018-06-16
13	AMPLIFIER	QuieTek	QTK-A2525G	CHM10809065	2017-11-18	2018-11-17
14	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2017-06-23	2018-06-22
15	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2017-05-02	2018-05-01
16	Horn Antenna	EMCO	3115	6741	2017-06-23	2018-06-22
17	Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	2017-06-10	2018-06-09
18	RF Cable-R03m	Jye Bao	RG142	CB021	2017-06-17	2018-06-16
19	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2017-06-17	2018-06-16
20	TEST RECEIVER	R&S	ESCI	101142	2017-06-17	2018-06-16
21	RF Cable-CON	UTIFLEX	3102-26886-4	CB049	2017-06-17	2018-06-16
22	10dB Attenuator	SCHWARZBECK	MTS-IMP136	261115-001-003 2	2017-06-17	2018-06-16
23	Artificial Mains	R&S	ENV216	101288	2017-06-17	2018-06-16

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10: 2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure KDB 789033 D02 General UNII Test Procedures New Rules v01 is required to be used for this kind of FCC 15.407 UII device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E.

2.3. General Test Procedures

2.3.1 Conducted Emissions

According to the requirements in Section 6.2 of ANSI C63.10: 2013, AC power-line conducted emissions shall be measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table and the turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10: 2013.

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmit condition.

3.2. EUT Exercise Software

The sample will be controlled by RFTest tool to enter RF test mode to control sample change channel, modulation and so on;

3.3. Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	PC	Lenovo	Ideapad	A131101550	/	/	DOC
2	Power adapter	Lenovo	CPA-A090	36200414	1.00m	unshielded	DOC

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart E		
FCC Rules	Description of Test	Result
§15.407(a)	Maximum Conducted Output Power	Compliant
§15.407(a)	Power Spectral Density	Compliant
§15.407(a)	26dB Bandwidth	Compliant
§15.407(a)	99% Occupied Bandwidth	Compliant
§15.407(e)	6dB Bandwidth	Compliant
§15.407(b)	Radiated Emissions	Compliant
§15.407(b)	Band edge Emissions	Compliant
§15.205	Emissions at Restricted Band	Compliant
§15.407(g)	Frequency Stability	N/A
§15.207(a)	Line Conducted Emissions	Compliant
§15.203	Antenna Requirements	Compliant
§2.1093	RF Exposure	Compliant

Note: The customer declared frequency stability is better than 20ppm which ensures that the signal remains in the allocated bands under all operational conditions stated in the user manual.

5. TEST RESULT

5.1. On Time and Duty Cycle

5.1.1. Standard Applicable

None; for reporting purpose only.

5.1.2. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of the spectrum analyzer.

5.1.3. Test Procedures

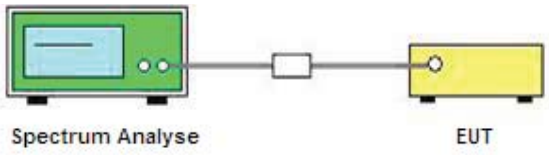
1). Set the Centre frequency of the spectrum analyzer to the transmitting frequency;

2). Set the span=0MHz, RBW=8MHz, VBW=50MHz, Sweep time=5ms;

3). Detector = peak;

4). Trace mode = Single hold.

5.1.4. Test Setup Layout



5.1.5. EUT Operation during Test

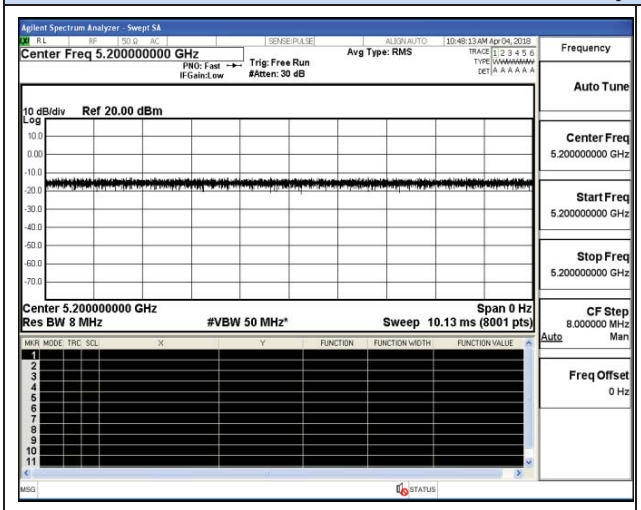
The EUT was programmed to be in continuously transmitting mode.

5.1.6. Test result

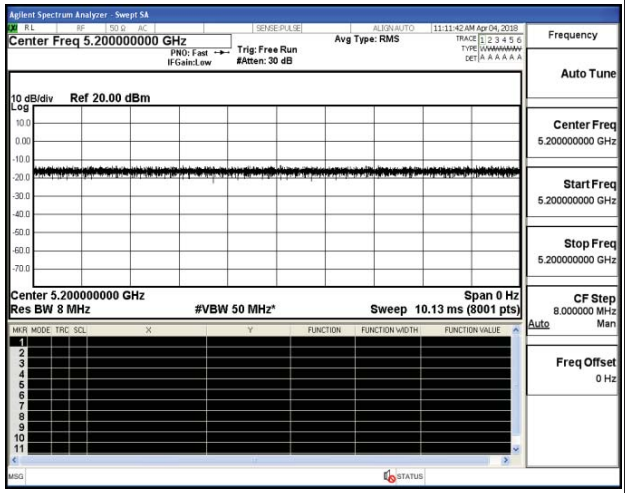
5.1.6.1 Band 1

Mode	On Time B (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW(KHz)
IEEE 802.11a	5.0	5.0	1	100%	0	0.01
IEEE 802.11n HT20	5.0	5.0	1	100%	0	0.01
IEEE 802.11n HT40	5.0	5.0	1	100%	0	0.01
IEEE 802.11ac VHT20	5.0	5.0	1	100%	0	0.01
IEEE 802.11ac VHT40	5.0	5.0	1	100%	0	0.01
IEEE 802.11ac VHT80	5.0	5.0	1	100%	0	0.01
Note: Duty Cycle Correction Factor=10log(1/Duty cycle) As ant 0 & ant 1 are set to transmit at the same duty cycle, only recorded test result of ant 0.						

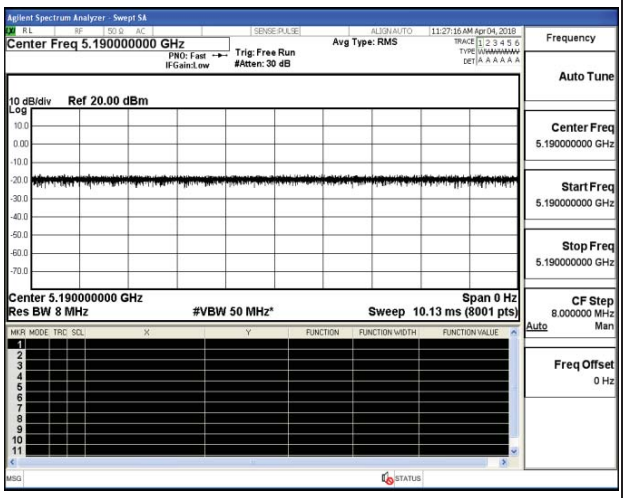
On Time and Duty Cycle-band 1-ant0



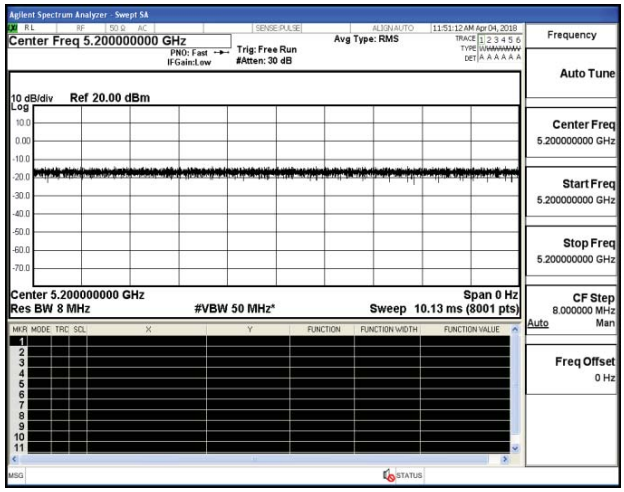
IEEE 802.11a



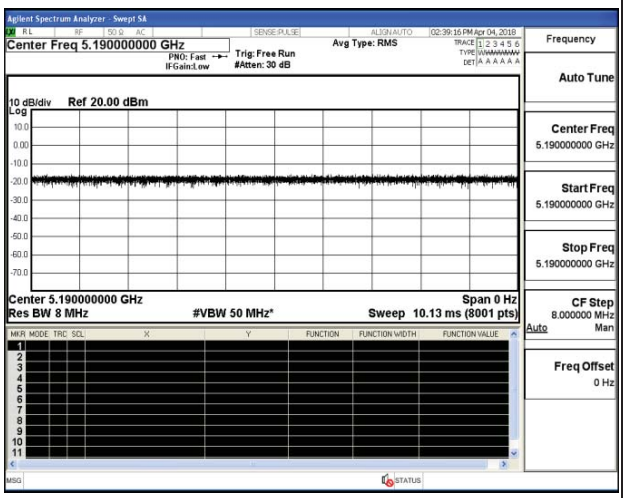
IEEE 802.11n HT20



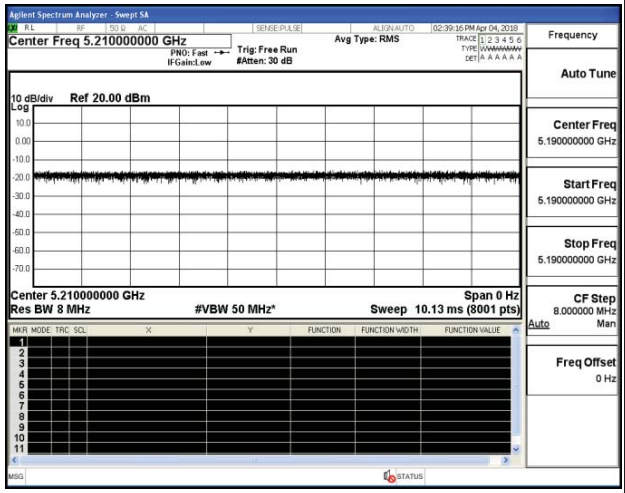
IEEE 802.11n HT40



IEEE 802.11ac VHT20



IEEE 802.11ac VHT40

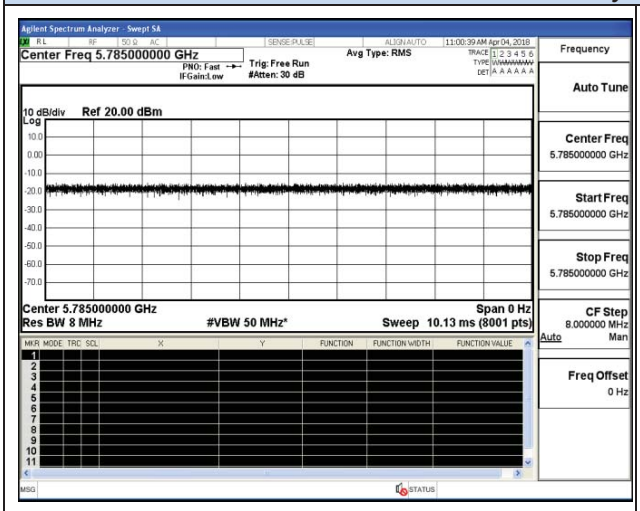


IEEE 802.11ac VHT80

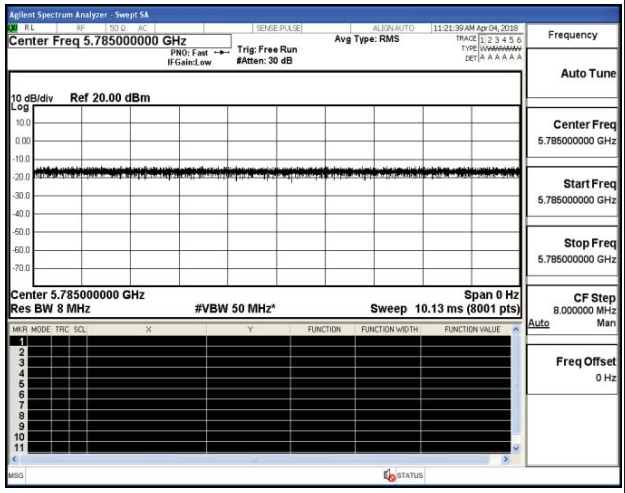
5.1.6.2 Band 3

Mode	On Time B (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW(KHz)
IEEE 802.11a	5.0	5.0	1	100%	0	0.01
IEEE 802.11n HT20	5.0	5.0	1	100%	0	0.01
IEEE 802.11n HT40	5.0	5.0	1	100%	0	0.01
IEEE 802.11ac VHT20	5.0	5.0	1	100%	0	0.01
IEEE 802.11ac VHT40	5.0	5.0	1	100%	0	0.01
IEEE 802.11ac VHT80	5.0	5.0	1	100%	0	0.01
Note: Duty Cycle Correction Factor=10log(1/Duty cycle) As ant 0 & ant 1 are set to transmit at the same duty cycle, only recorded test result of ant 0.						

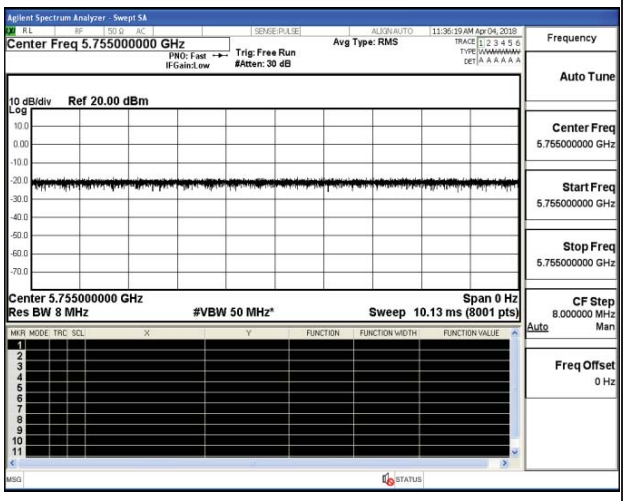
On Time and Duty Cycle-band 3-ant 0



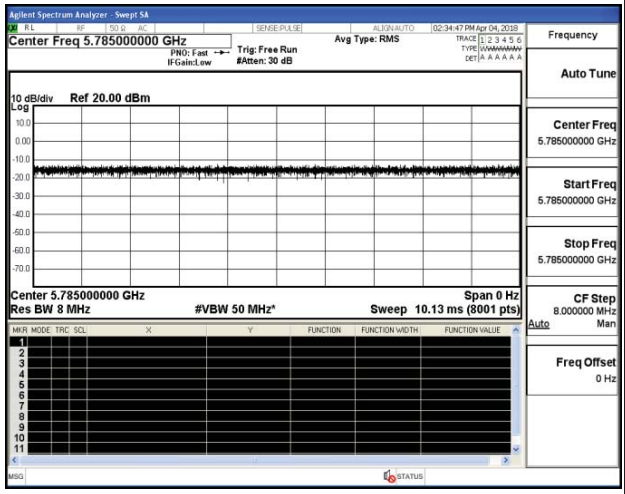
IEEE 802.11a



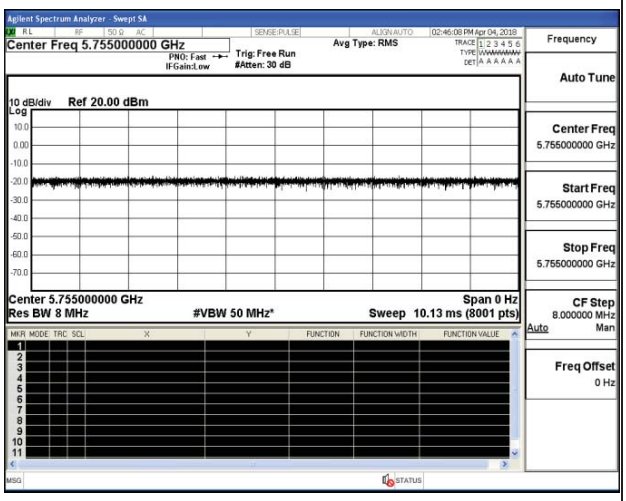
IEEE 802.11n HT20



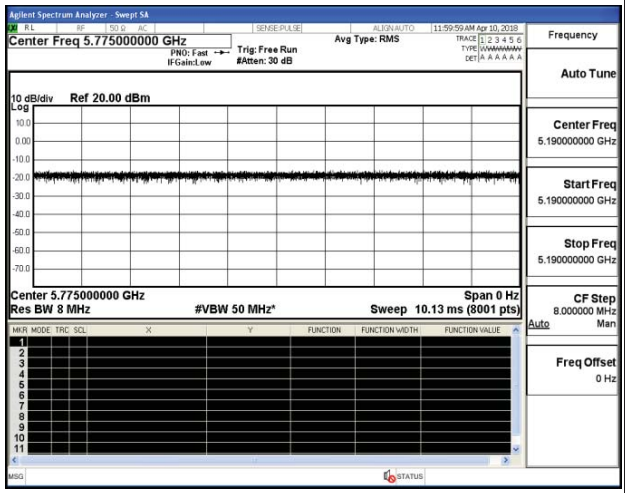
IEEE 802.11n HT40



IEEE 802.11ac VHT20



IEEE 802.11ac VHT40



IEEE 802.11ac VHT80

5.2. Maximum Conducted Output Power Measurement

5.2.1. Standard Applicable

(1) For the band 5.15~5.25GHz

(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. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(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. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 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. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1dB reduction in maximum conducted output power is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable 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. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2.2. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of the power meter.

5.2.3. Test Procedures

The transmitter output (antenna port) was connected to the power meter.

According to KDB 789033 D02 Section 3 (a) Method PM (Measurement using an RF average power meter):

(i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

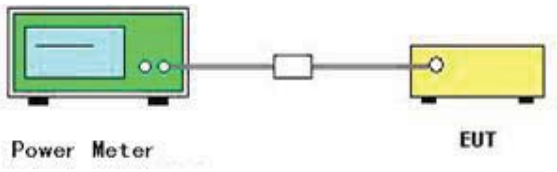
- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

(ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.

(iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

(iv) Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25%).

5.2.4. Test Setup Layout



5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.2.6. Test Result of Maximum Conducted Output Power

5.2.6.1 Band 1

Test Mode	Channel	Frequency (MHz)	AVG Conducted Power (dBm)			Duty Cycle Factor (dB)	Report Conducted Power (dBm)			Maximum Limit (dBm)	Result
			Ant 0	Ant 1	Sum		Ant 0	Ant 1	Sum		
IEEE 802.11a	36	5180	4.36	4.32	-/-	0.00	4.36	4.32	-/-	24	Complies
	40	5200	4.46	4.42	-/-	0.00	4.46	4.42	-/-		
	48	5240	4.37	3.94	-/-	0.00	4.37	3.94	-/-		
IEEE 802.11n HT20	36	5180	2.71	2.87	5.80	0.00	2.71	2.87	5.80	24	Complies
	40	5200	2.33	2.68	5.52	0.00	2.33	2.68	5.52		
	48	5240	2.91	2.35	5.65	0.00	2.91	2.35	5.65		
IEEE 802.11n HT40	38	5190	2.44	1.58	5.04	0.00	2.44	1.58	5.04	24	Complies
	46	5230	1.29	1.58	4.45	0.00	1.29	1.58	4.45		
IEEE 802.11 ac VHT20	36	5180	3.09	3.73	6.43	0.00	3.09	3.73	6.43	24	Complies
	40	5200	3.71	3.87	**6.80**	0.00	3.71	3.87	**6.80**		
	48	5240	3.33	3.49	6.42	0.00	3.33	3.49	6.42		
IEEE 802.11 ac VHT40	38	5190	1.83	1.8	4.83	0.00	1.83	1.8	4.83	24	Complies
	46	5230	1.01	1.4	4.22	0.00	1.01	1.4	4.22		
IEEE 802.11 ac VHT80	42	5210	1.06	1.23	4.16	0.00	1.06	1.23	4.16	24	Complies

Remark:

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, IEEE 802.11ac VHT80;*
4. *Report conducted power = Measured conducted average power + Duty Cycle factor;*

5.2.6.2 Band 3

Test Mode	Channel	Frequency (MHz)	AVG Conducted Power (dBm)			Duty Cycle Factor (dB)	Report Conducted Power (dBm)			Maximum Limit (dBm)	Result
			Ant 0	Ant 1	Sum		Ant 0	Ant 1	Sum		
IEEE 802.11a	149	5745	3.37	3.03	-/-	0.00	3.37	3.03	-/-	30	Complies
	157	5785	3.22	3.53	-/-	0.00	3.22	3.53	-/-		
	165	5825	3.24	3.05	-/-	0.00	3.24	3.05	-/-		
IEEE 802.11n HT20	149	5745	2.29	2.27	5.29	0.00	2.29	2.27	5.29	30	Complies
	157	5785	2.44	2.62	5.45	0.00	2.44	2.62	5.45		
	165	5825	2.26	2.40	5.34	0.00	2.26	2.40	5.34		
IEEE 802.11n HT40	151	5755	1.35	0.55	3.98	0.00	1.35	0.55	3.98	30	Complies
	159	5795	1.11	0.42	3.79	0.00	1.11	0.42	3.79		
IEEE 802.11 ac VHT20	149	5745	3.09	3.73	**6.43**	0.00	3.09	3.73	**6.43**	30	Complies
	157	5785	3.71	2.87	6.32	0.00	3.71	2.87	6.32		
	165	5825	3.33	3.49	6.42	0.00	3.33	3.49	6.42		
IEEE 802.11 ac VHT40	151	5755	1.83	1.8	4.83	0.00	1.83	1.8	4.83	30	Complies
	159	5795	1.01	1.4	4.22	0.00	1.01	1.4	4.22		
IEEE 802.11 ac VHT80	155	5775	1.37	1.16	4.28	0.00	1.37	1.16	4.28	30	Complies

Remark:

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, IEEE 802.11ac VHT80;*
4. *Report conducted power = Measured conducted average power + Duty Cycle factor;*

5.3. Power Spectral Density Measurement

5.3.1. Standard Applicable

For 5.15~5.25GHz

(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
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.

For 5725~5850MHz

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, 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. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.3.2. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of Spectrum Analyzer.

5.3.3. Test Procedures

5.3.3.1 UNII Band 1

1). The transmitter was connected directly to a Spectrum Analyzer through a directional couple.
2). The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3). Set the RBW = 1MHz.
4). Set the VBW ≥ 3MHz
5). Span=Encompass the entire emissions bandwidth (EBW) of the signal (or, alternatively, the entire 99% occupied bandwidth) of the signal.
6). Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
7). Manually set sweep time ≥ 10 × (number of points in sweep) × (total on/off period of the transmitted signal).
8). Set detector = power averaging (rms).
9). Sweep time = auto couple.
10). Trace mode = max hold.
11). Allow trace to fully stabilize.
12). Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, levels (in power units) at 1 MHz intervals extending across the EBW (or,

alternatively.

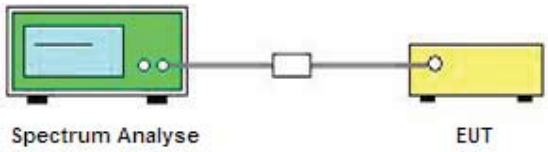
13). Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log (1/0.25) = 6 dB if the duty cycle is 25%.

14). Use the peak marker function to determine the maximum power level in any 1MHz band segment within the fundamental EBW.

5.3.3.2 UNII Band 3

1). The transmitter was connected directly to a Spectrum Analyzer through a directional couple.
2). The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3). Set the RBW = 300 kHz
4). Set the VBW ≥ 3*RBW
5). Span=Encompass the entire emissions bandwidth (EBW) of the signal
6). Detector = RMS.
7). Sweep time = auto couple.
8). Trace mode = max hold.
9). Allow trace to fully stabilize.
10). If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
11). If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
12). Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

5.3.4. Test Setup Layout



5.3.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

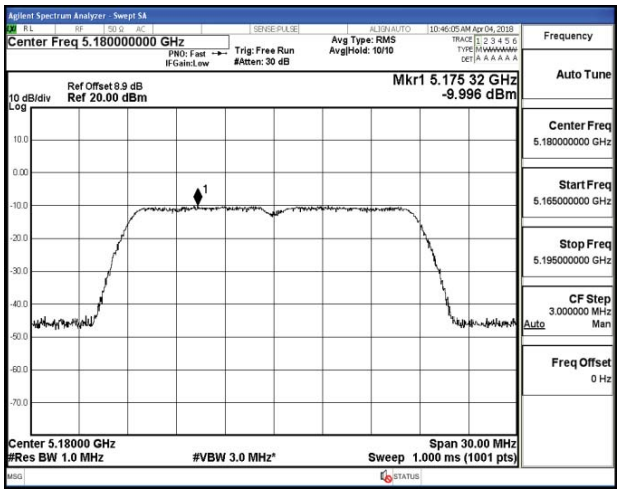
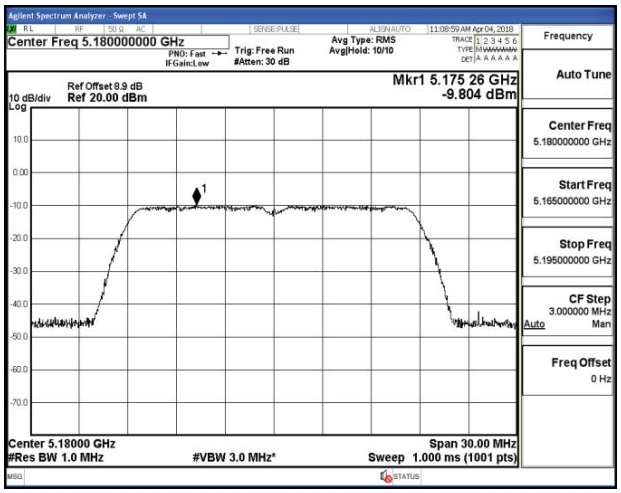
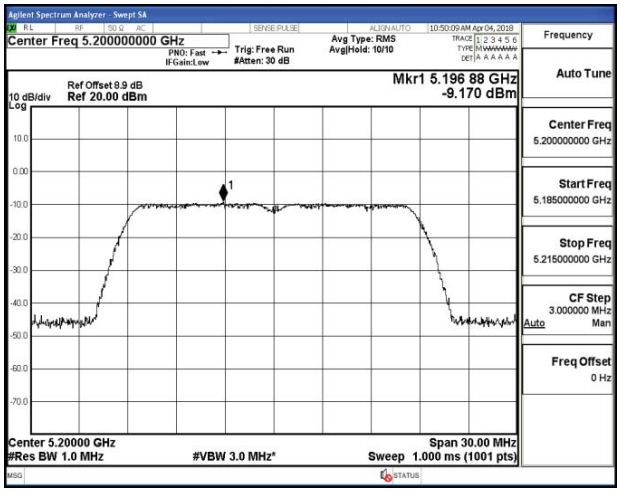
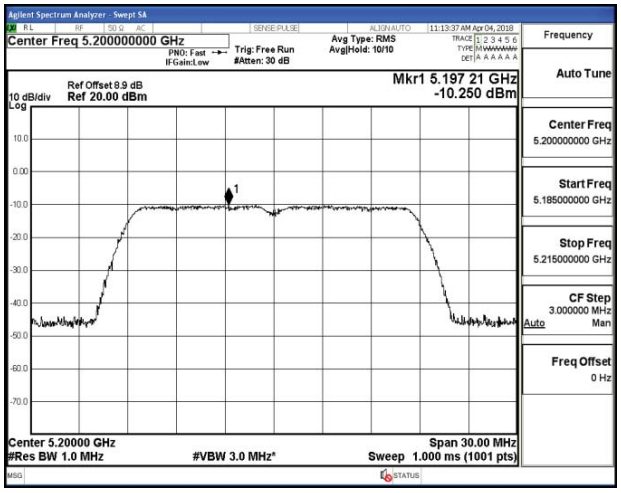
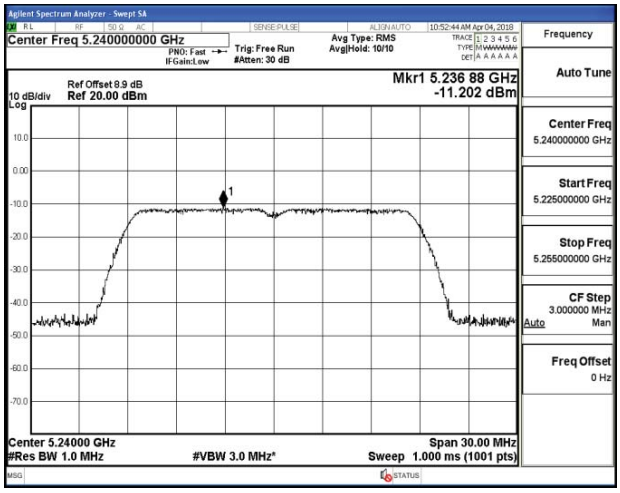
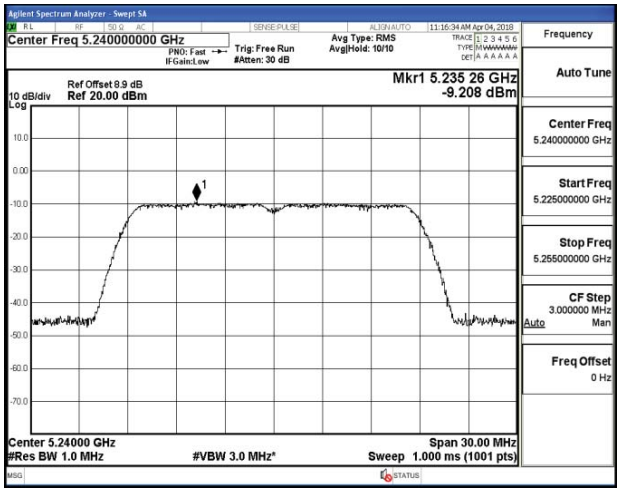
5.3.6. Test Result of Power Spectral Density

5.3.6.1 UNII Band 1

Test Mode	Channel	Frequency (MHz)	Power Density (dBm/MHz)			Duty cycle factor (dB)	Report conducted PSD (dBm/MHz)			Max. Limit (dBm/MHz)	Result
			Ant 0	Ant 1	Sum		Ant 0	Ant 1	Sum		
IEEE 802.11a	36	5180	-10.00	-10.12	-/-	0.000	-10.00	-10.12	-/-	11.00	Complies
	40	5200	-9.17	-9.87	-/-	0.000	-9.17	-9.87	-/-		
	48	5240	-11.20	-10.58	-/-	0.000	-11.20	-10.58	-/-		
IEEE 802.11n HT20	36	5180	-9.80	-9.20	-6.48	0.000	-9.80	-9.20	-6.48	11.00	Complies
	40	5200	-10.25	-9.43	-6.81	0.000	-10.25	-9.43	-6.81		
	48	5240	-9.21	-10.14	-6.64	0.000	-9.21	-10.14	-6.64		
IEEE 802.11n HT40	38	5190	-12.45	-12.26	-9.34	0.000	-12.45	-12.26	-9.34	11.00	Complies
	46	5230	-13.08	-11.94	-9.46	0.000	-13.08	-11.94	-9.46		
IEEE 802.11 ac VHT20	36	5180	-9.02	-9.52	-6.25	0.000	-9.02	-9.52	-6.25	11.00	Complies
	40	5200	-10.78	-9.19	-6.90	0.000	-10.78	-9.19	-6.90		
	48	5240	-9.96	-10.95	-7.42	0.000	-9.96	-10.95	-7.42		
IEEE 802.11 ac VHT40	38	5190	-11.91	-12.28	-9.08	0.000	-11.91	-12.28	-9.08	11.00	Complies
	46	5230	-11.04	-12.78	-8.81	0.000	-11.04	-12.78	-8.81		
IEEE 802.11 ac VHT80	42	5210	-14.55	-14.52	-11.52	0.000	-14.55	-14.52	-11.52	11.00	Complies

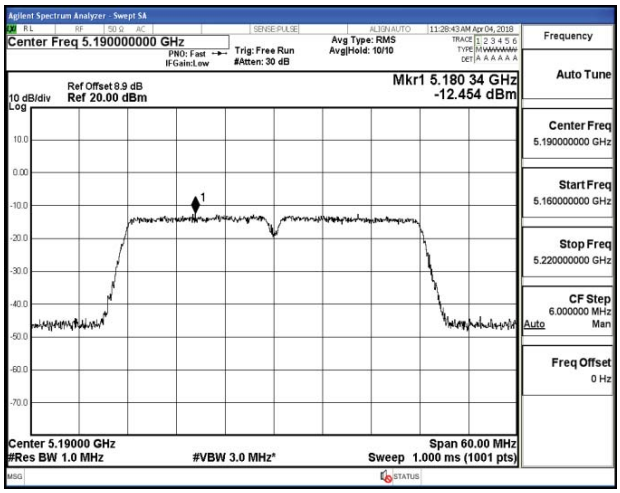
Remark:

1. *Measured power spectrum density 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, IEEE 802.11ac VHT80;*
4. *Report conducted PSD = Measured conducted average power + Duty Cycle factor;*
5. *Please refer to following test plots;*

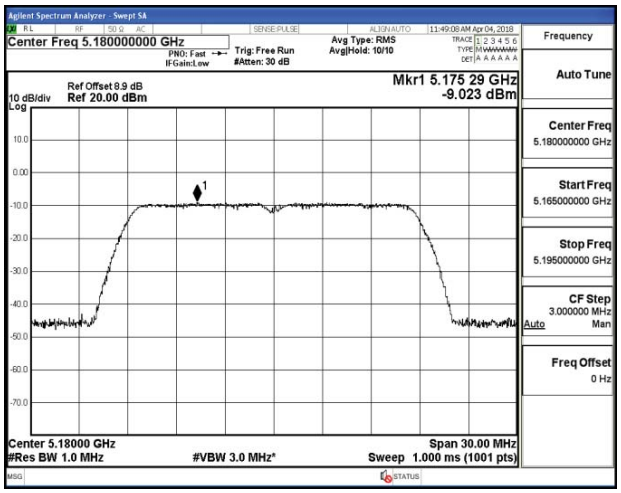
Power Spectral Density-ant 0	
IEEE 802.11a	IEEE 802.11n HT20
	
Channel 36 / 5180 MHz	Channel 36 / 5180 MHz
	
Channel 40 / 5200 MHz	Channel 40 / 5200 MHz
	
Channel 48 / 5240 MHz	Channel 48 / 5240 MHz

Power Spectral Density-ant 0

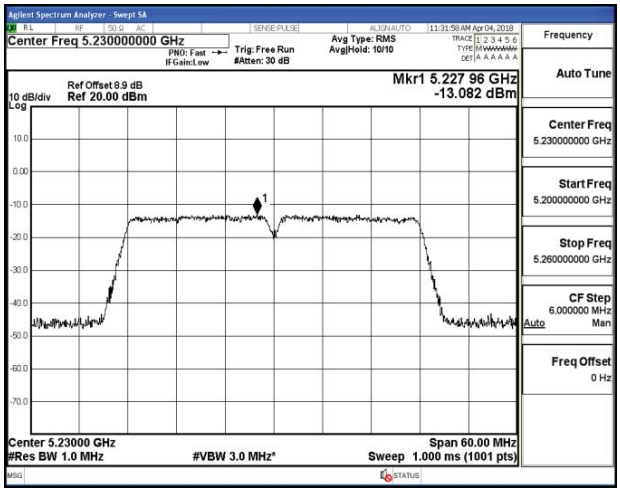
IEEE 802.11n HT40



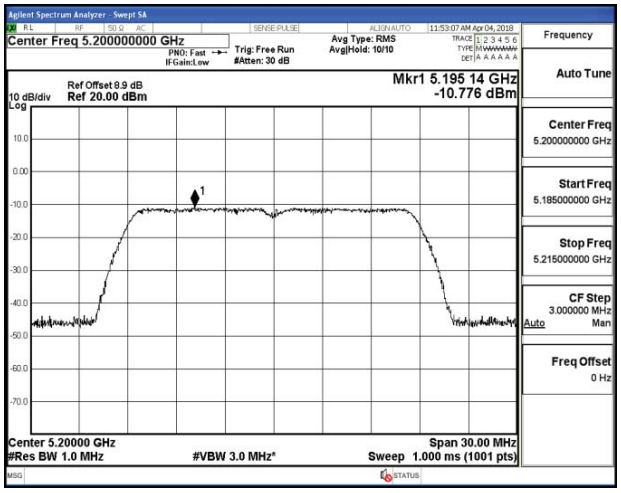
IEEE 802.11ac VHT20



Channel 38 / 5190 MHz

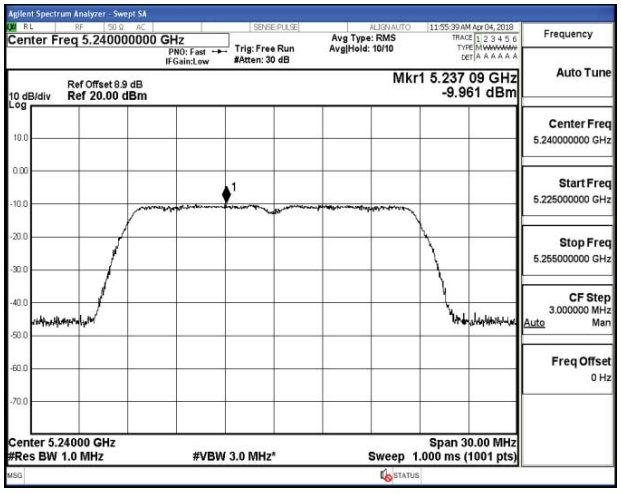


Channel 36 / 5180 MHz

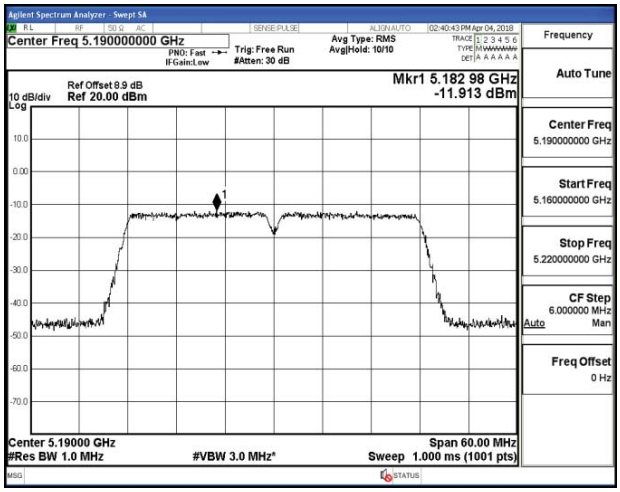
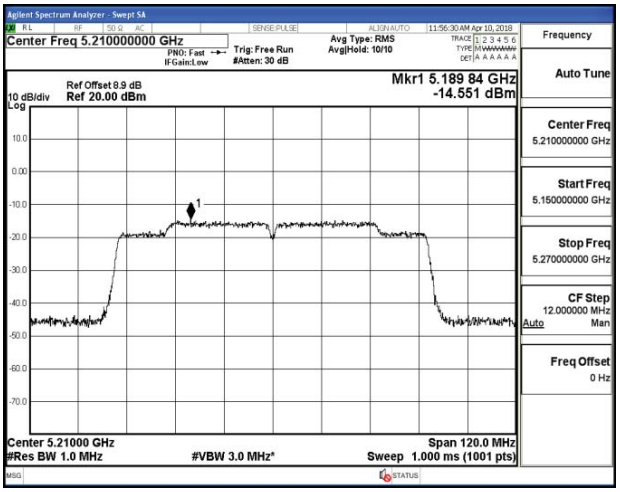
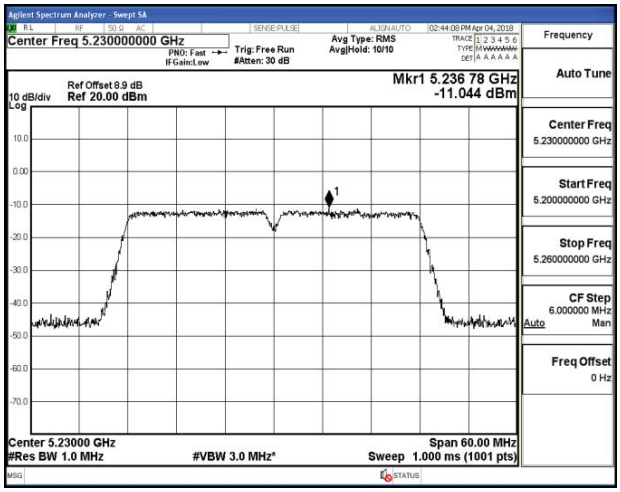


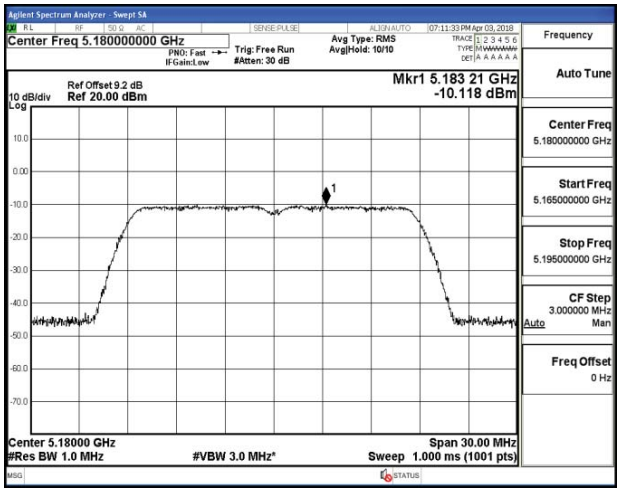
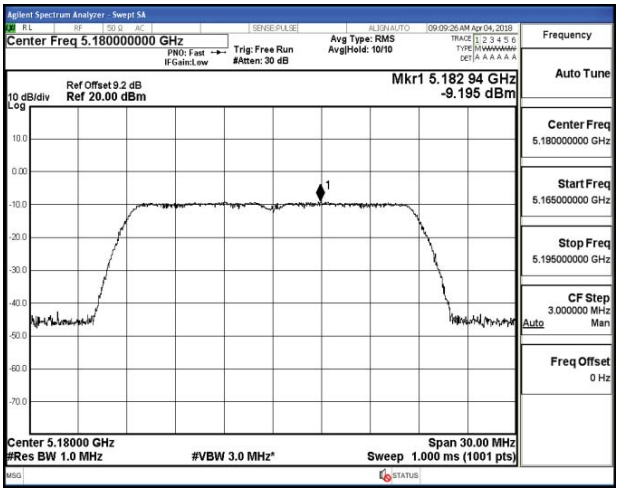
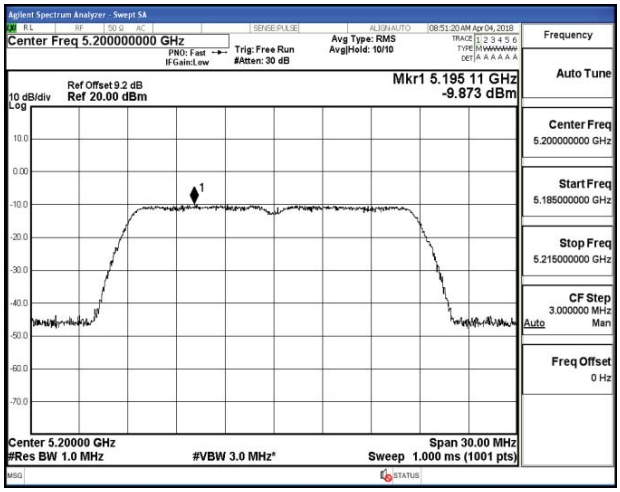
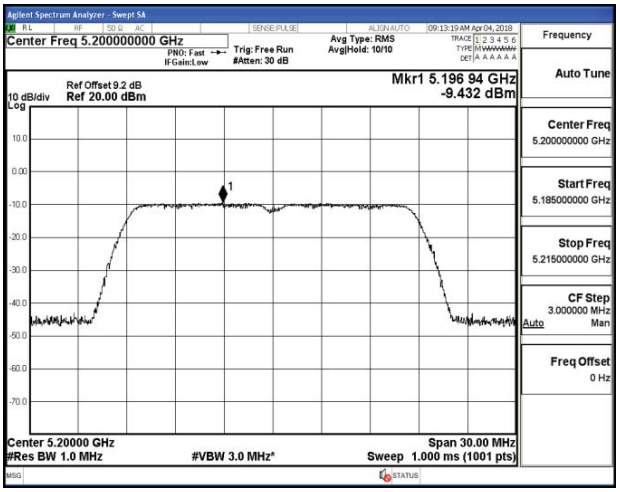
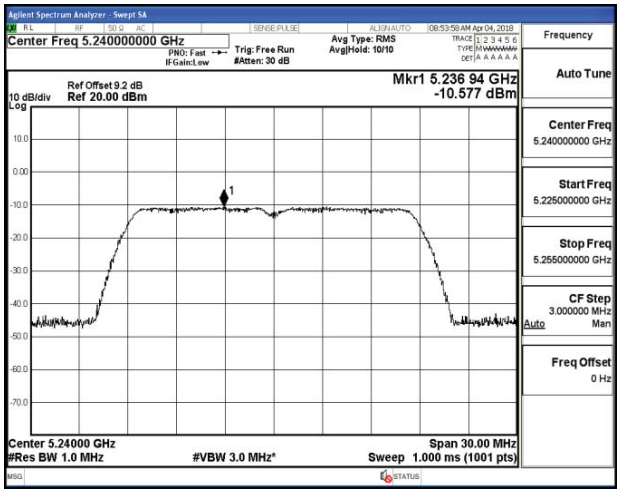
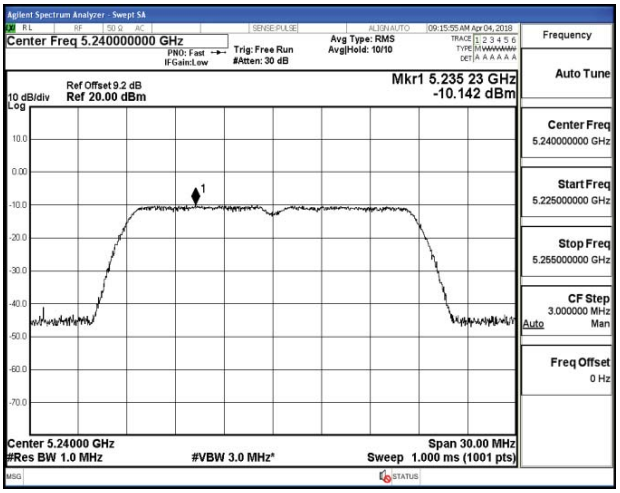
Channel 46 / 5230 MHz

Channel 40 / 5200 MHz



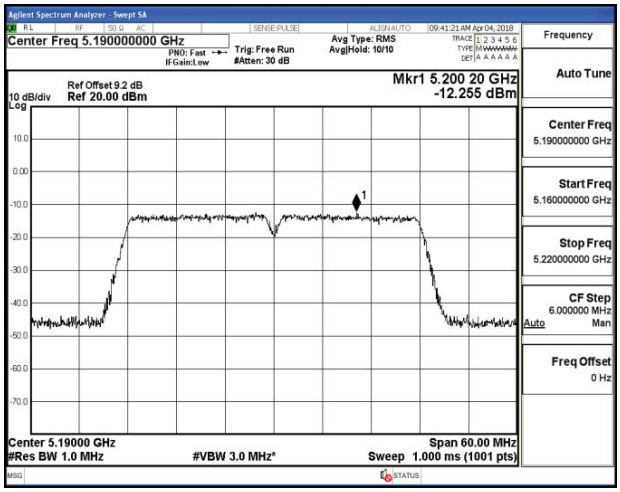
Channel 48 / 5240 MHz

Power Spectral Density-ant 0	
IEEE 802.11ac VHT40	IEEE 802.11ac VHT80
	
Channel 38 / 5190 MHz	Channel 42 / 5210 MHz
	
Channel 46 / 5230 MHz	

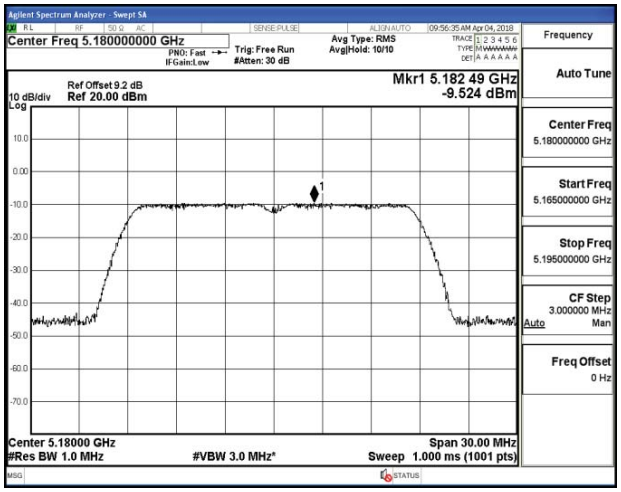
Power Spectral Density-ant 1	
IEEE 802.11a	IEEE 802.11n HT20
	
Channel 36 / 5180 MHz	Channel 36 / 5180 MHz
	
Channel 40 / 5200 MHz	Channel 40 / 5200 MHz
	
Channel 48 / 5240 MHz	Channel 48 / 5240 MHz

Power Spectral Density-ant 1

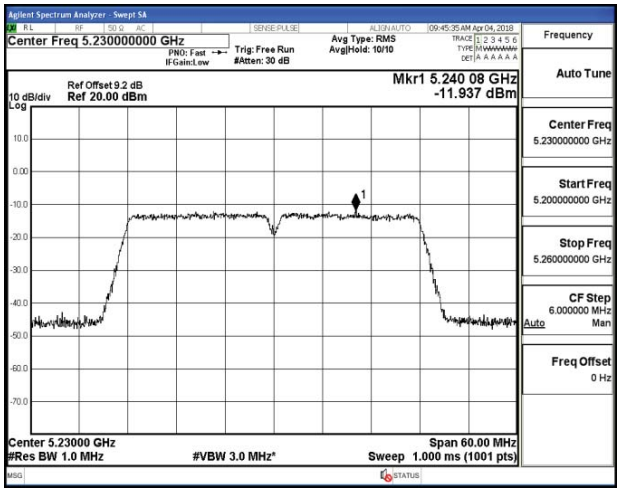
IEEE 802.11n HT40



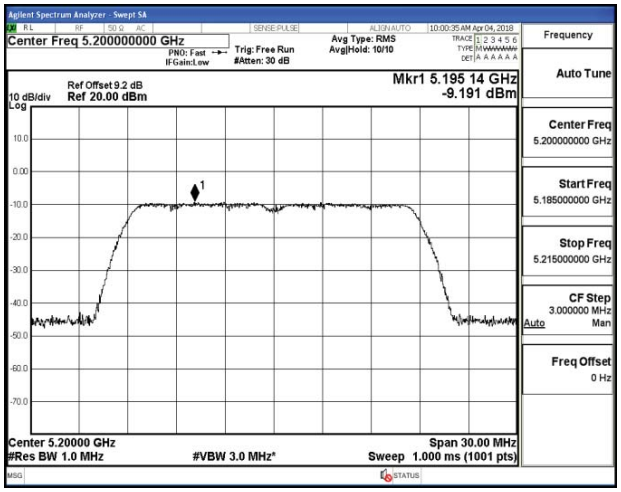
IEEE 802.11ac VHT20



Channel 38 / 5190 MHz

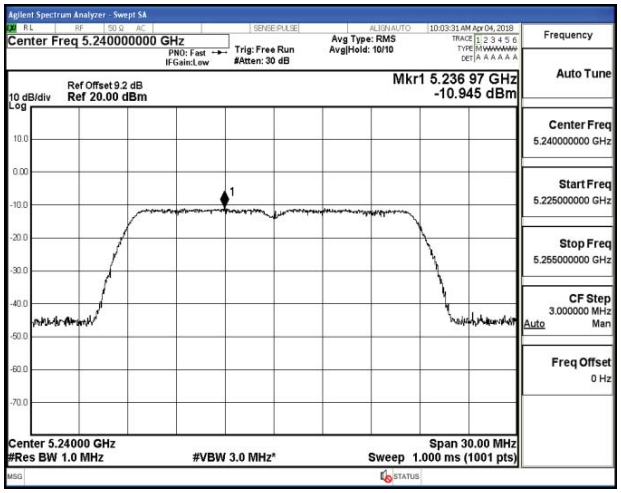


Channel 36 / 5180 MHz

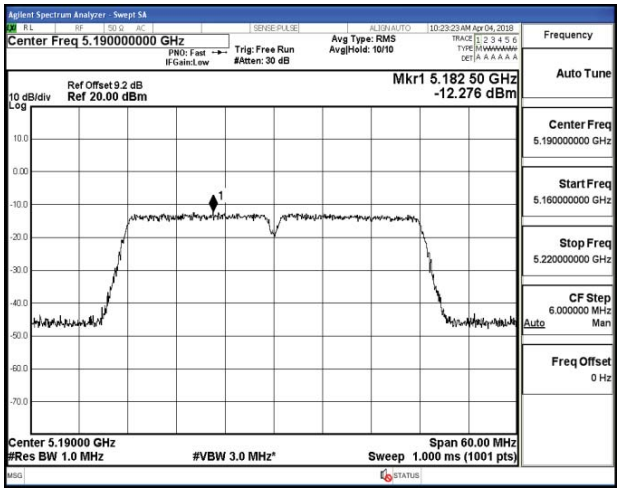
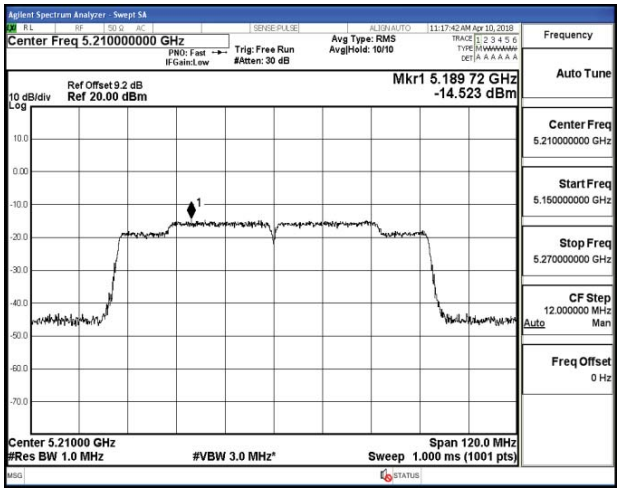
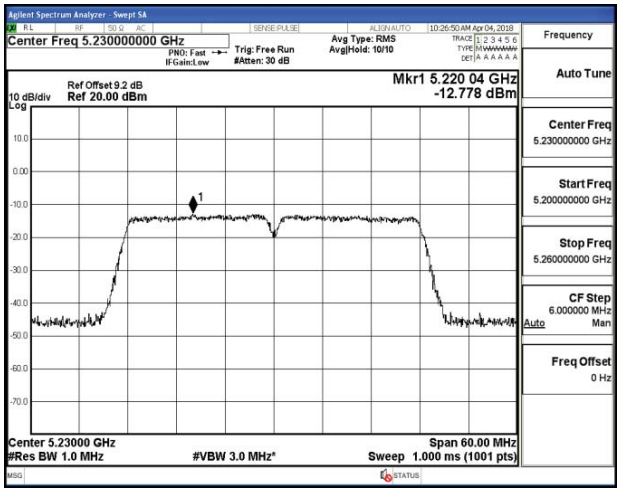


Channel 46 / 5230 MHz

Channel 40 / 5200 MHz



Channel 48 / 5240 MHz

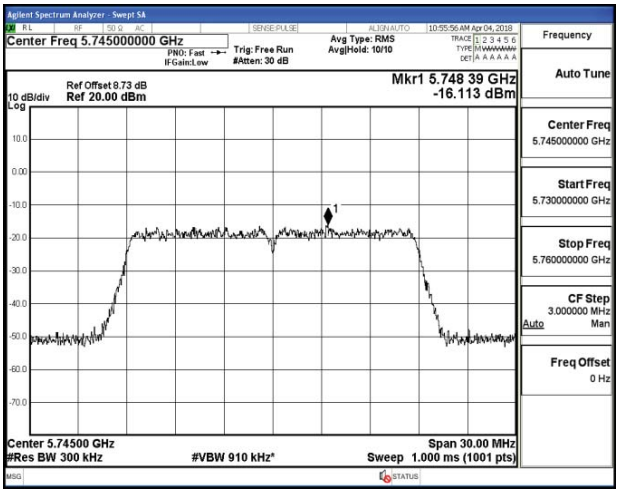
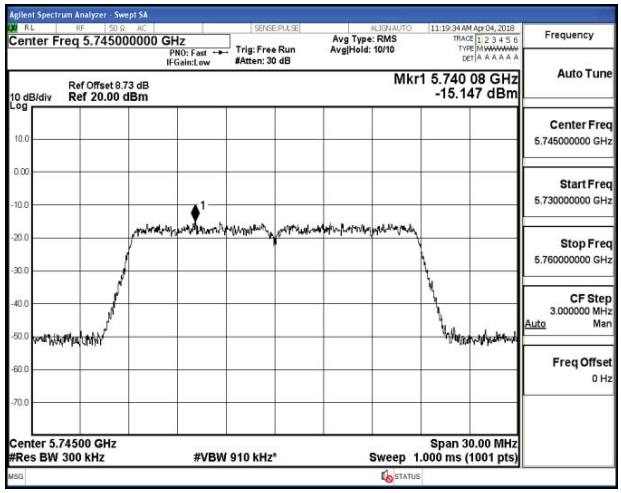
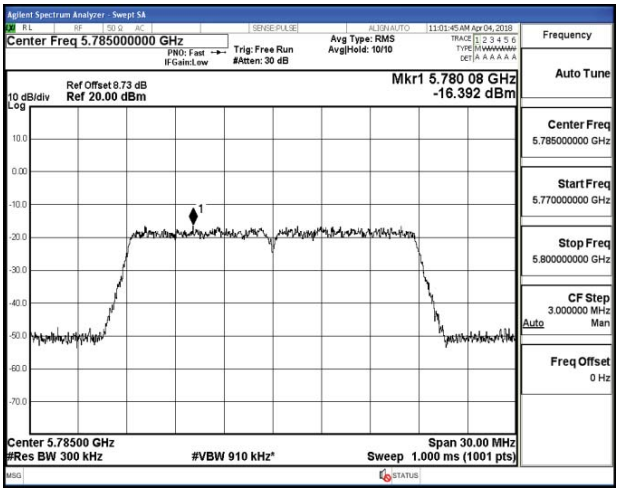
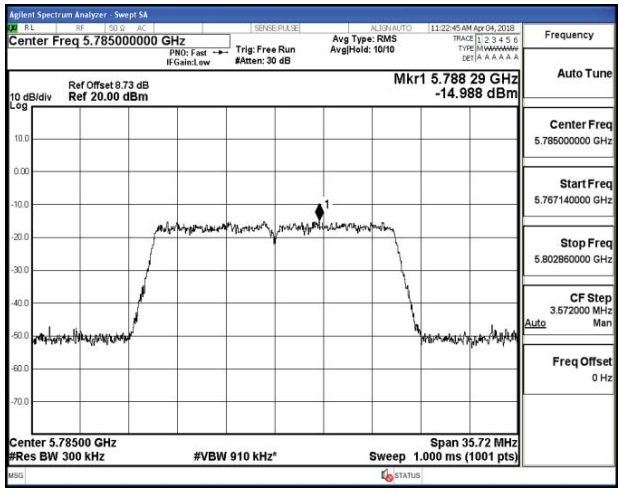
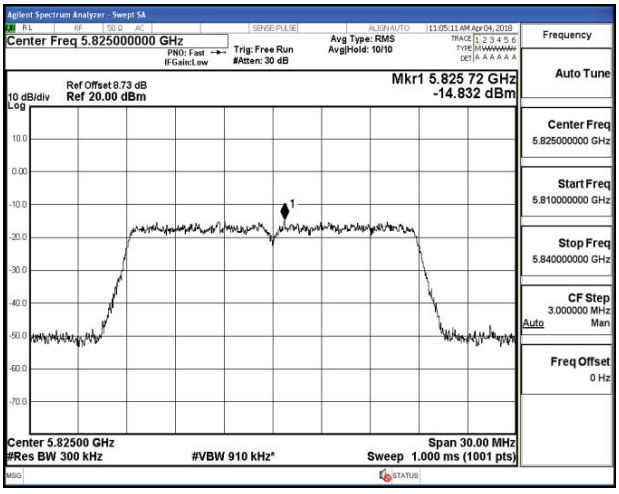
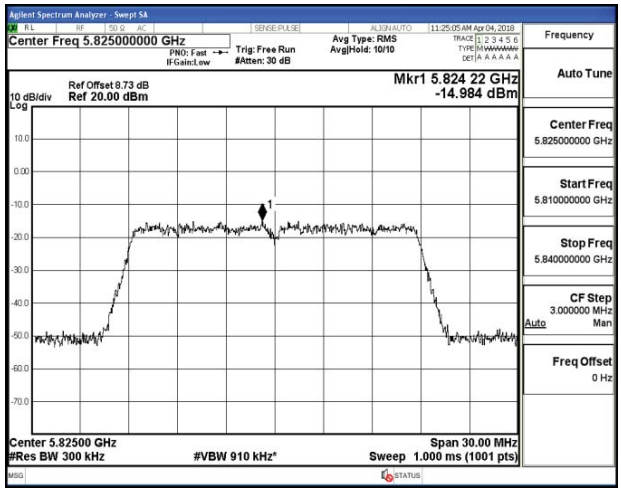
Power Spectral Density-ant 1	
IEEE 802.11ac VHT40	IEEE 802.11ac VHT80
	
Channel 38 / 5190 MHz	Channel 42 / 5210 MHz
	
Channel 46 / 5230 MHz	

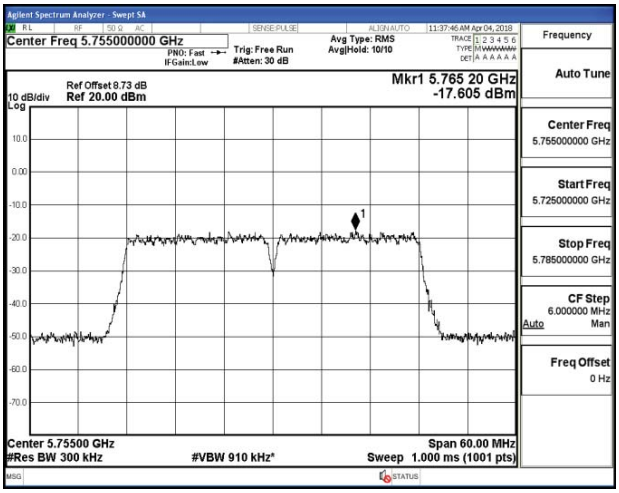
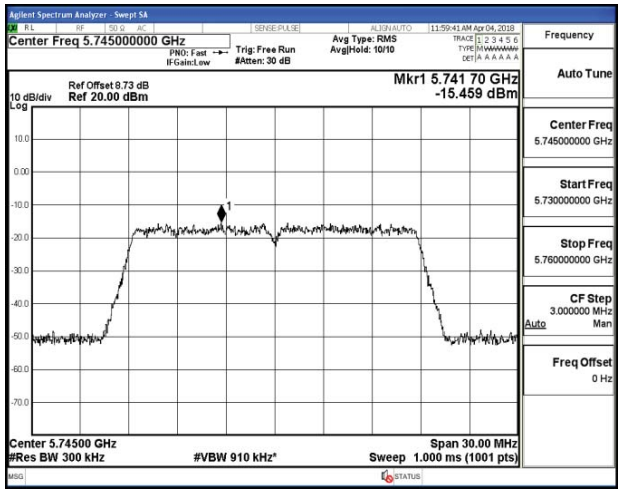
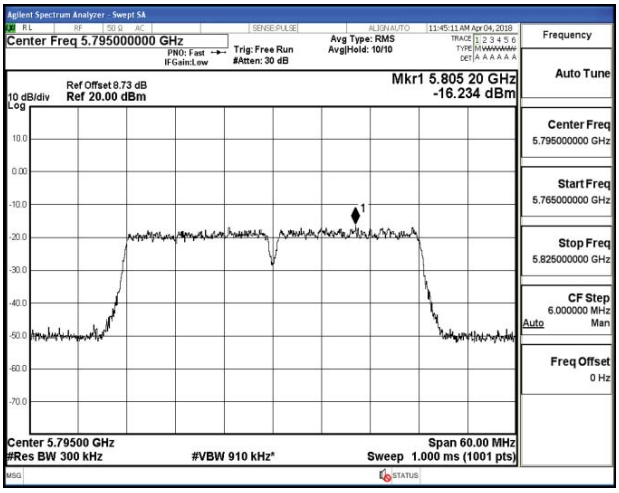
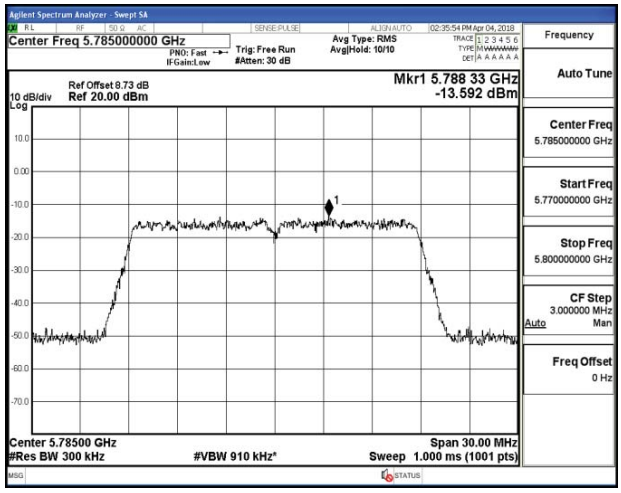
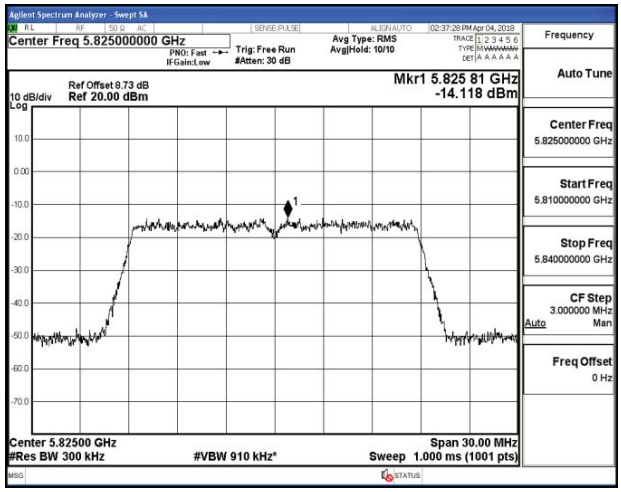
5.3.6.2 UNII Band 3

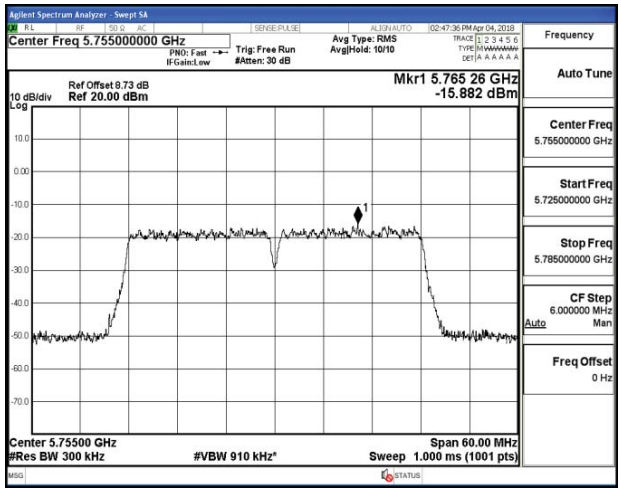
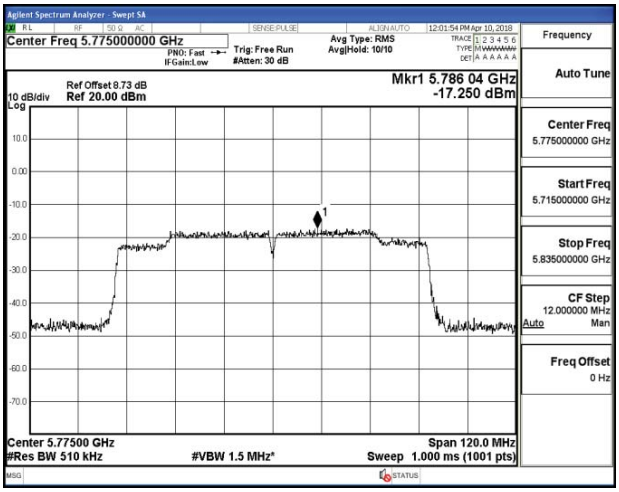
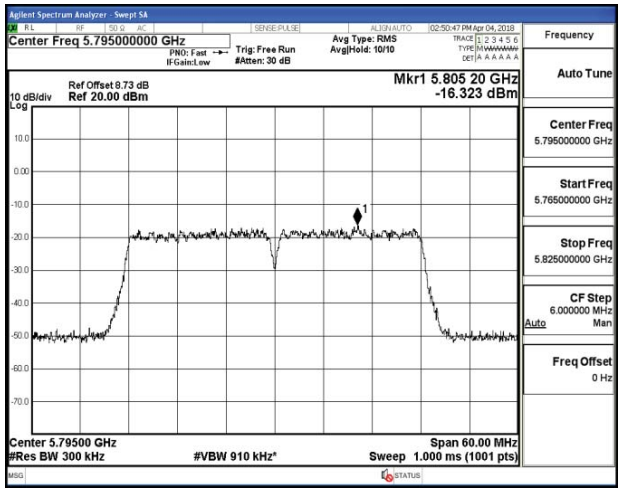
Test Mode	Channel	Frequency (MHz)	Power Density (dBm/MHz)			Duty cycle factor (dB)	RBW factor (dB)	Report conducted PSD (dBm/MHz)			Maximum Limit (dBm/ 500KHz)	Result
			Ant 0	Ant 1	Sum			Ant 0	Ant 1	Sum		
IEEE 802.11a	149	5745	-16.11	-14.04	-/-	0.00	2.22	-13.89	-11.82	-/-	30	Complies
	157	5785	-16.39	-16.16	-/-	0.00	2.22	-14.17	-13.94	-/-		
	165	5825	-14.83	-12.63	-/-	0.00	2.22	-12.61	-10.41	-/-		
IEEE 802.11n HT20	149	5745	-15.15	-14.98	-12.05	0.00	2.22	-12.93	-12.76	-9.83	30	Complies
	157	5785	-14.99	-14.46	-11.71	0.00	2.22	-12.77	-12.24	-9.49		
	165	5825	-14.98	-14.55	-11.75	0.00	2.22	-12.76	-12.33	-9.53		
IEEE 802.11n HT40	151	5755	-17.61	-17.09	-14.33	0.00	2.22	-15.39	-14.87	-12.11	30	Complies
	159	5795	-16.23	-17.64	-13.87	0.00	2.22	-14.01	-15.42	-11.65		
IEEE 802.11 ac VHT20	149	5745	-15.46	-14.88	-12.15	0.00	2.22	-13.24	-12.66	-9.93	30	Complies
	157	5785	-13.59	-14.49	-11.01	0.00	2.22	-11.37	-12.27	-8.79		
	165	5825	-14.12	-14.46	-11.28	0.00	2.22	-11.90	-12.24	-9.06		
IEEE 802.11 ac VHT40	151	5755	-15.88	-17.08	-13.43	0.00	2.22	-13.66	-14.86	-11.21	30	Complies
	159	5795	-16.32	-17.23	-13.74	0.00	2.22	-14.10	-15.01	-11.52		
IEEE 802.11 ac VHT80	155	5775	-17.25	-18.99	-15.02	0.00	2.22	-15.03	-16.77	-12.8	30	Complies

Remark:

1. *Measured power spectrum density 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, IEEE 802.11ac VHT80;*
4. *Report conducted PSD = measured conducted PSD + Duty Cycle factor + RBW factor;*
5. *RBW factor = 10 log (500 KHz / 300 KHz) = 2.22 dB;*
6. *Please refer to following test plots;*

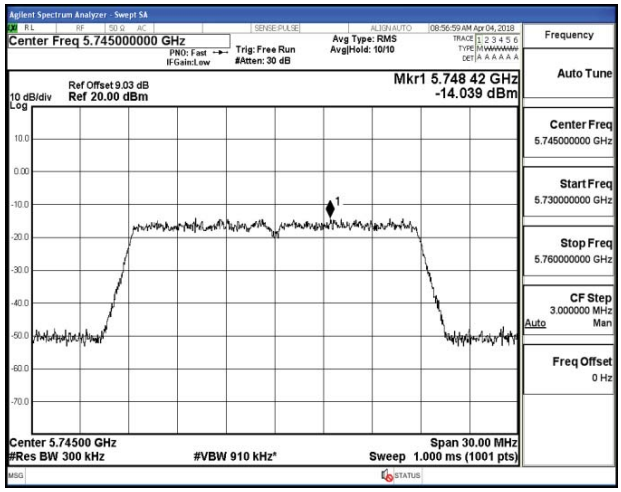
Power Spectral Density-ant 0	
IEEE 802.11a	IEEE 802.11n HT20
	
Channel 149 / 5745 MHz	Channel 149 / 5745 MHz
	
Channel 157 / 5785 MHz	Channel 157 / 5785 MHz
	
Channel 165 / 5825 MHz	Channel 165 / 5825 MHz

Power Spectral Density-ant 0	
IEEE 802.11n HT40	IEEE 802.11ac VHT20
	
Channel 151 / 5755 MHz	Channel 149 / 5745 MHz
	
Channel 159 / 5795 MHz	Channel 157 / 5785 MHz
	
	Channel 165 / 5825 MHz

Power Spectral Density-ant 0	
IEEE 802.11ac VHT40	IEEE 802.11ac VHT80
	
Channel 151 / 5755 MHz	Channel 155 / 5775 MHz
	
Channel 159 / 5795 MHz	

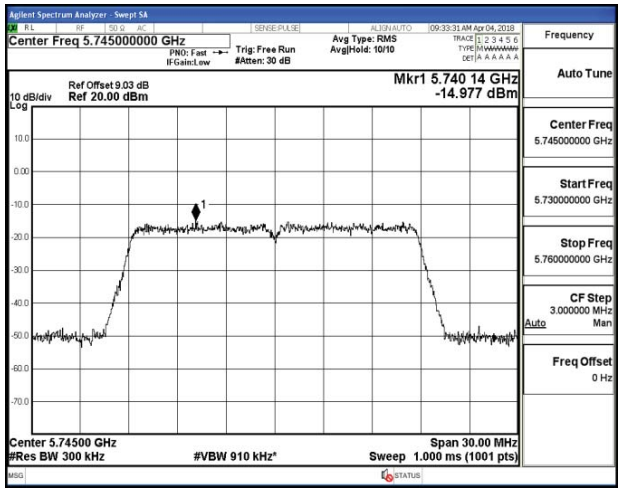
Power Spectral Density-ant 1

IEEE 802.11a

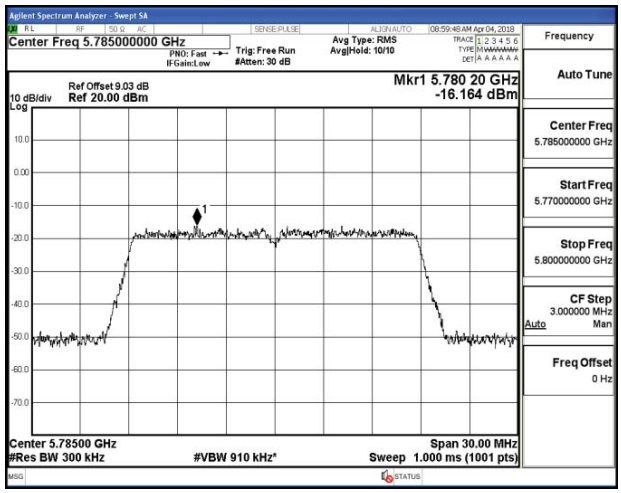


Channel 149 / 5745 MHz

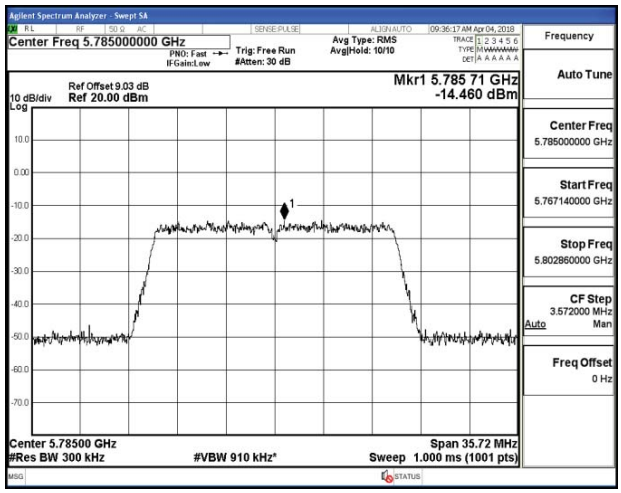
IEEE 802.11n HT20



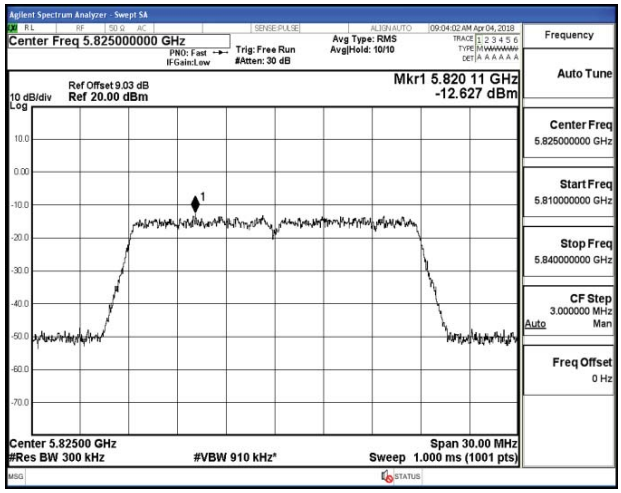
Channel 149 / 5745 MHz



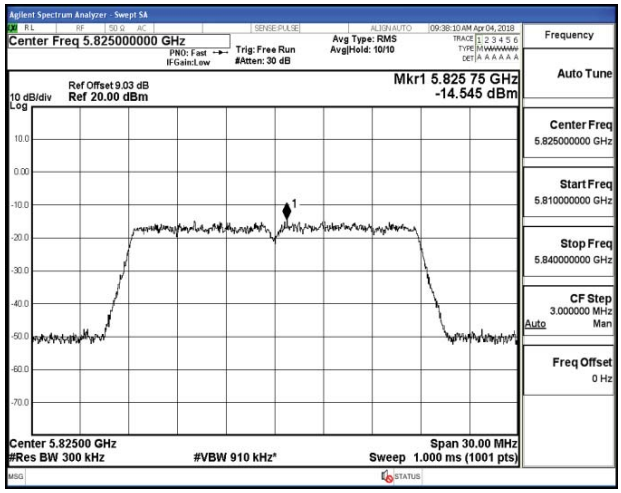
Channel 157 / 5785 MHz



Channel 157 / 5785 MHz



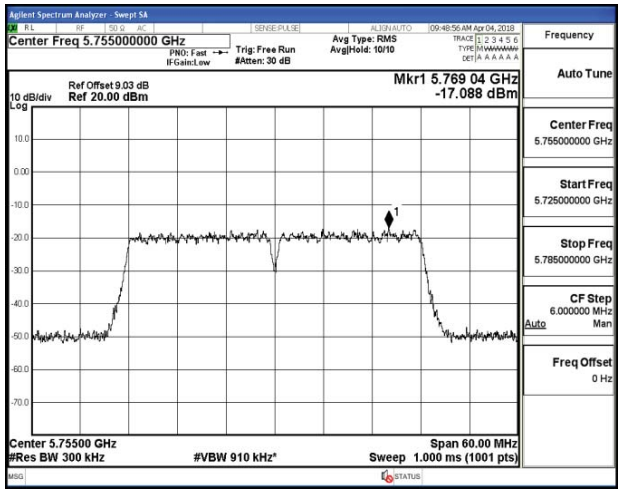
Channel 165 / 5825 MHz



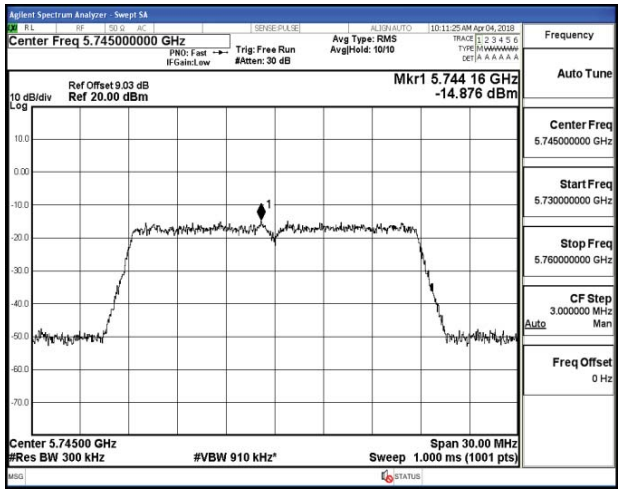
Channel 165 / 5825 MHz

Power Spectral Density-ant 1

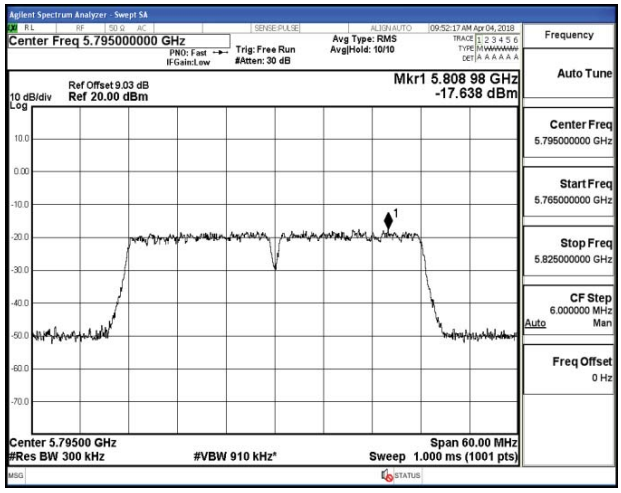
IEEE 802.11n HT40



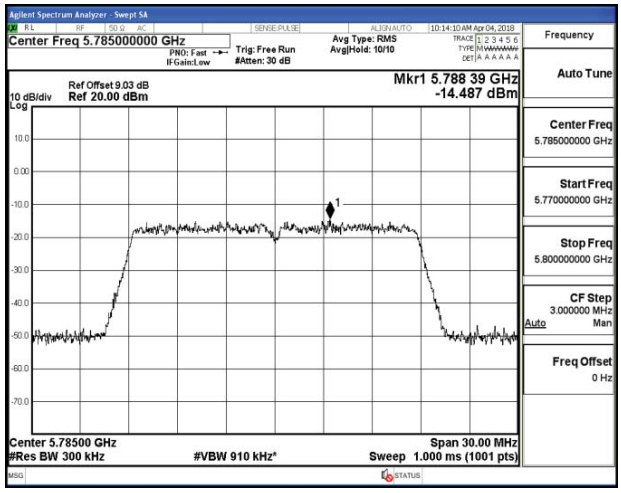
IEEE 802.11ac VHT20



Channel 151 / 5755 MHz

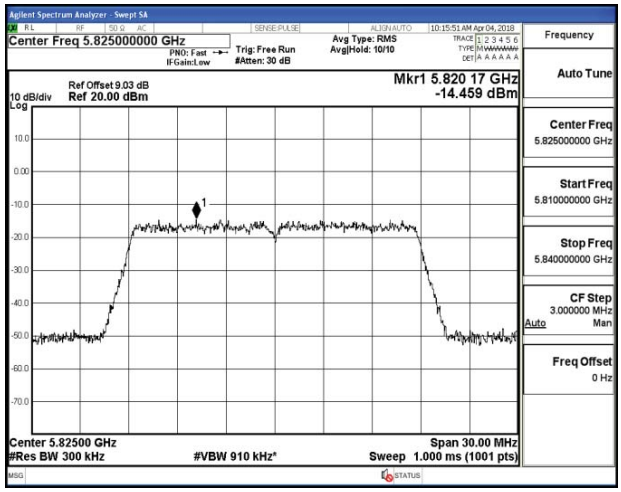


Channel 149 / 5745 MHz

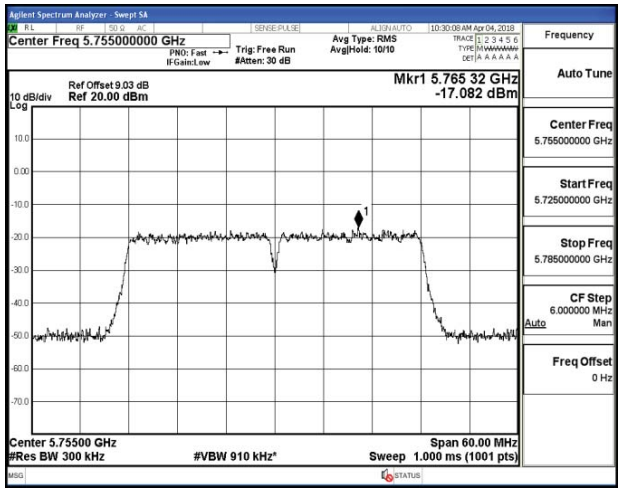
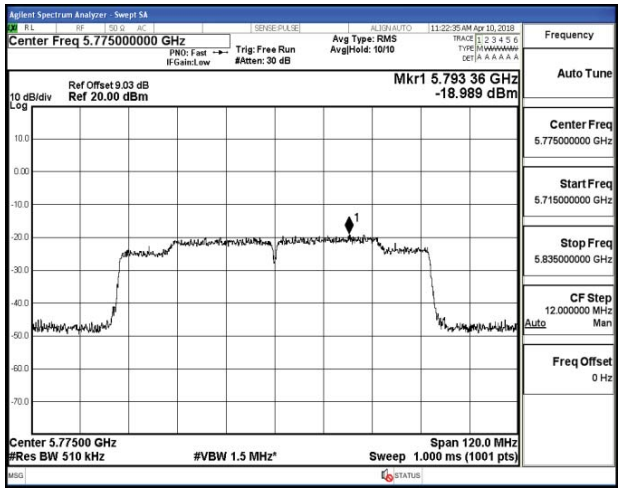
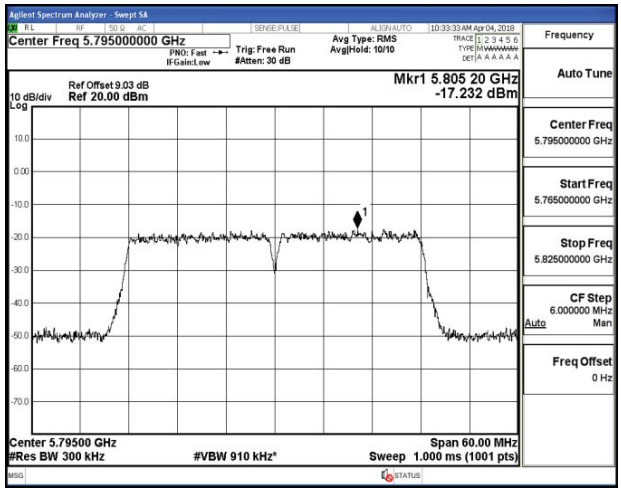


Channel 159 / 5795 MHz

Channel 157 / 5785 MHz



Channel 165 / 5825 MHz

Power Spectral Density-ant 1	
IEEE 802.11ac VHT40	IEEE 802.11ac VHT80
	
Channel 151 / 5755 MHz	Channel 155 / 5775 MHz
	
Channel 159 / 5795 MHz	

5.4. 99% and 26dB Occupied Bandwidth Measurement

5.4.1. Standard Applicable

No restriction limits. But resolution bandwidth within band edge measurement is 1% of the 99% occupied bandwidth.

99% and 26dB occupied bandwidth not applicable for UNII Band 3;

5.4.2. Measuring Instruments and Setting

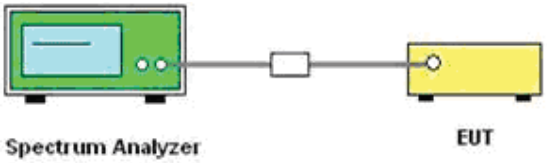
Please refer to equipment list in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span	> 26dB Bandwidth
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The RBW = 1% - 3% of occupied bandwidth, VBW = 3*RBW;
3. Measured the spectrum width with power higher than 26dB below carrier.

5.4.4. Test Setup Layout



5.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.4.6. Test Result of 99% and 26dB Occupied Bandwidth

5.4.6.1 UNII Band 1

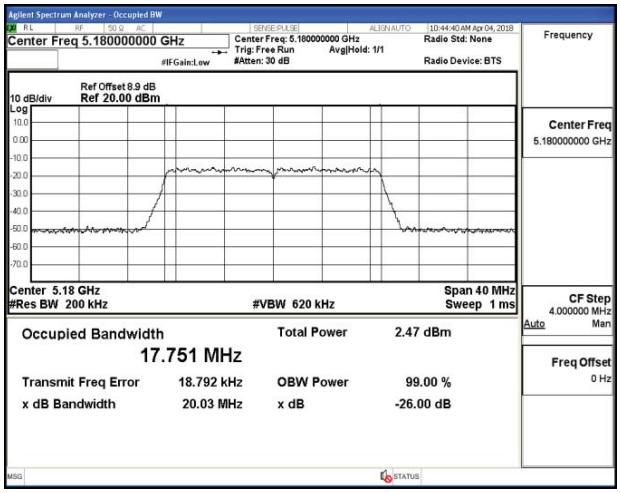
Test Mode	Channel	Frequency (MHz)	26dB Bandwidth (MHz)		99% Bandwidth (MHz)		Limits (MHz)	Verdict
			Ant 0	Ant 1	Ant 0	Ant 1		
IEEE 802.11a	36	5180	20.03	19.94	17.75	17.76	No Limit	PASS
	40	5200	20.04	20.00	17.75	17.76		
	48	5240	20.05	20.02	17.76	17.76		
IEEE 802.11n HT20	36	5180	20.00	20.19	17.76	17.84	No Limit	PASS
	40	5200	19.96	20.04	17.76	17.75		
	48	5240	20.00	20.04	17.75	17.76		
IEEE 802.11n HT40	38	5190	40.07	40.19	36.23	36.22	No Limit	PASS
	46	5230	40.23	40.60	36.23	36.19		
IEEE 802.11 ac VHT20	36	5180	19.96	20.02	17.74	17.75	No Limit	PASS
	40	5200	20.03	20.01	17.77	17.75		
	48	5240	19.99	20.03	17.75	17.75		
IEEE 802.11 ac VHT40	38	5190	39.94	40.01	36.20	36.19	No Limit	PASS
	46	5230	40.09	40.05	36.23	36.23		
IEEE 802.11 ac VHT80	42	5210	82.11	89.2	75.51	75.65	No Limit	PASS

Remark:

1. *Measured 99% and 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, IEEE 802.11ac VHT80;*
4. *Please refer to following test plots;*

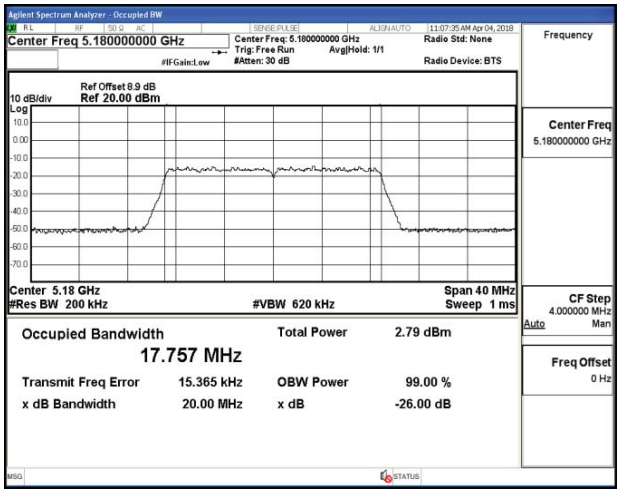
99% and 26dB Occupied Bandwidth-ant 0

IEEE 802.11a

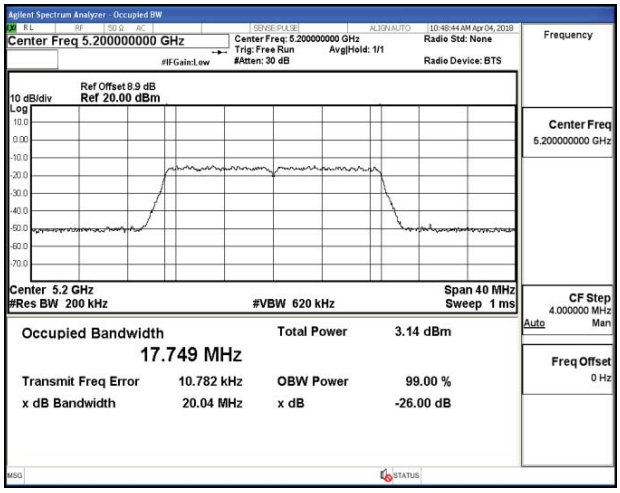


Channel 36 / 5180 MHz

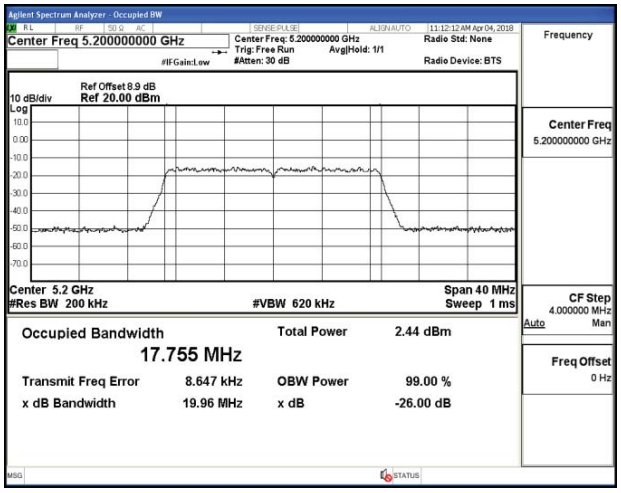
IEEE 802.11n HT20



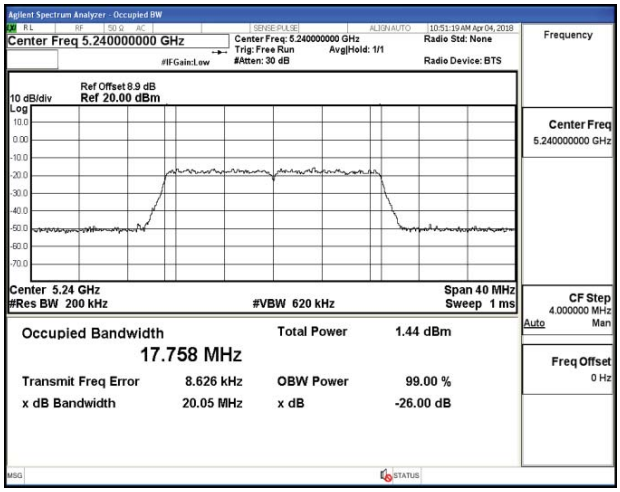
Channel 36 / 5180 MHz



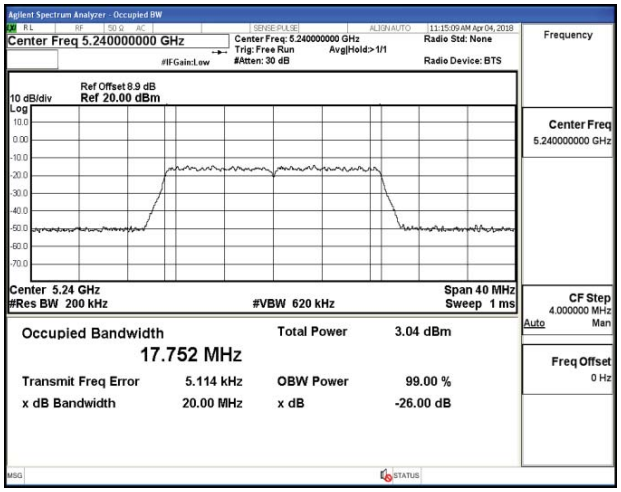
Channel 40 / 5200 MHz



Channel 40 / 5200 MHz



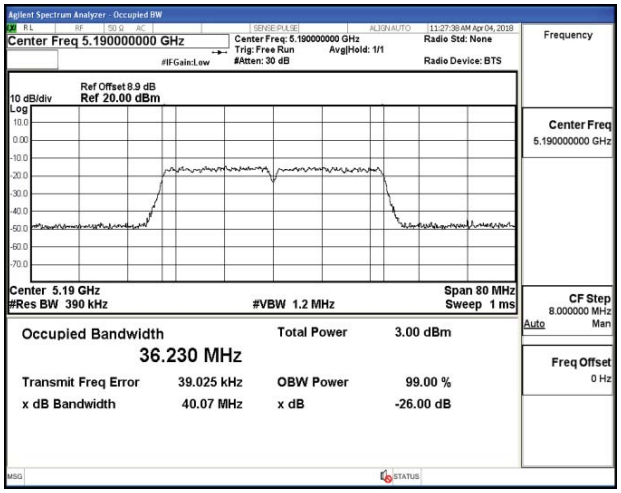
Channel 48 / 5240 MHz



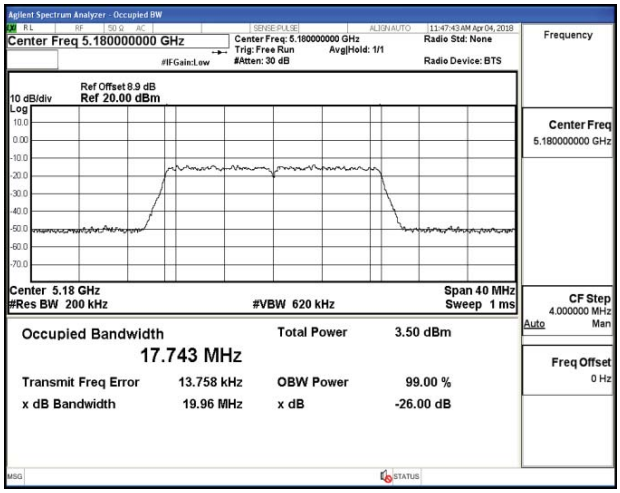
Channel 48 / 5240 MHz

99% and 26dB Occupied Bandwidth-ant 0

IEEE 802.11n HT40

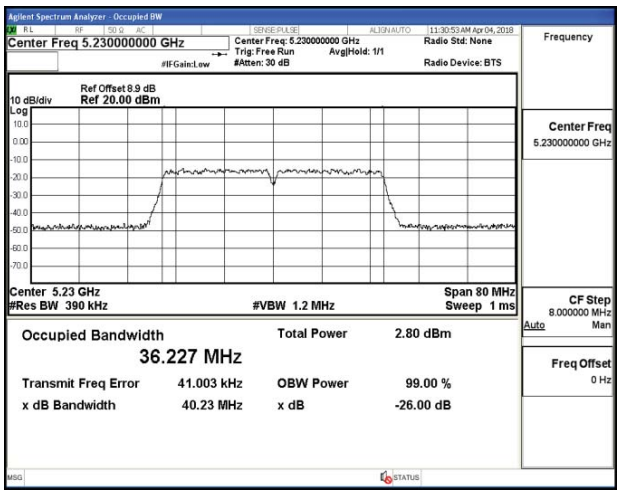


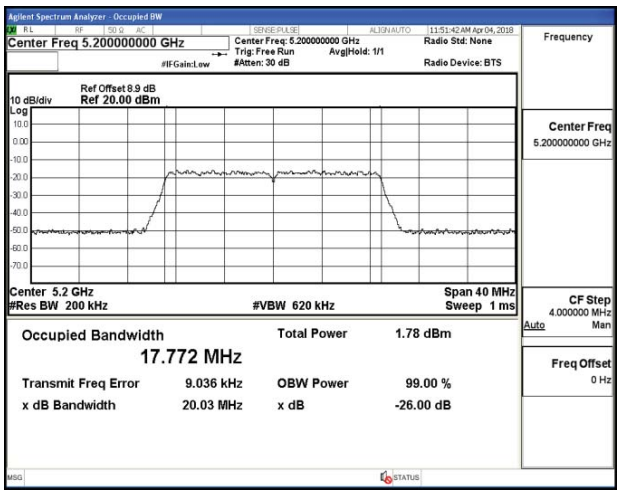
IEEE 802.11ac VHT20



Channel 38 / 5190 MHz

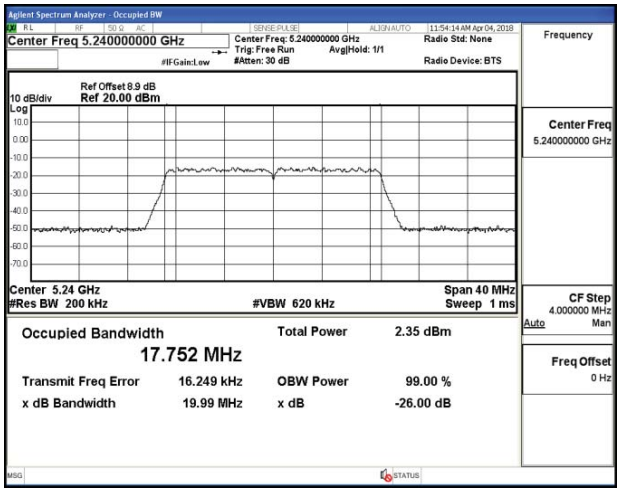
Channel 36 / 5180 MHz



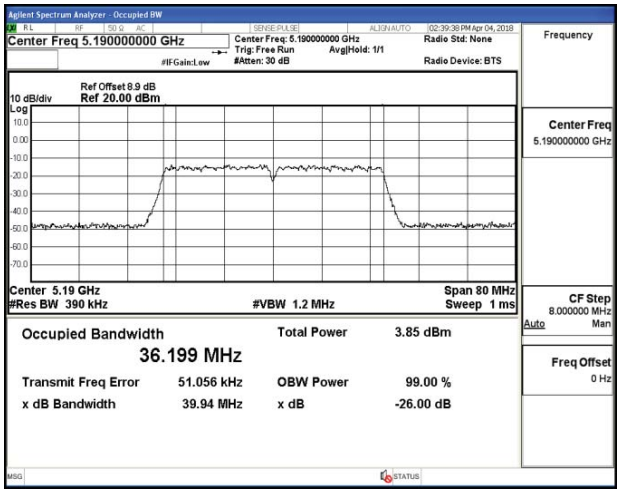
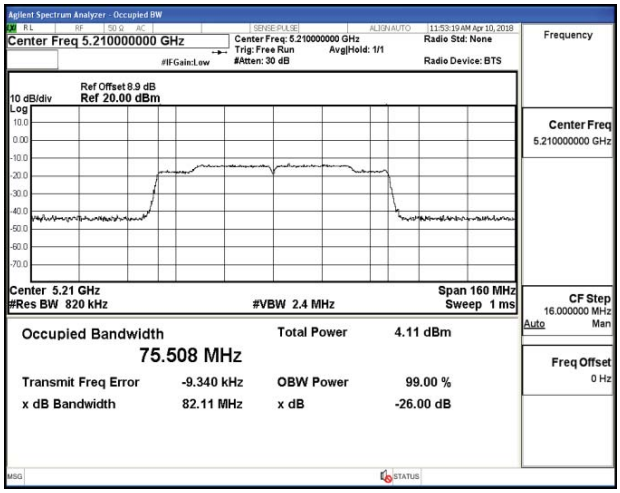
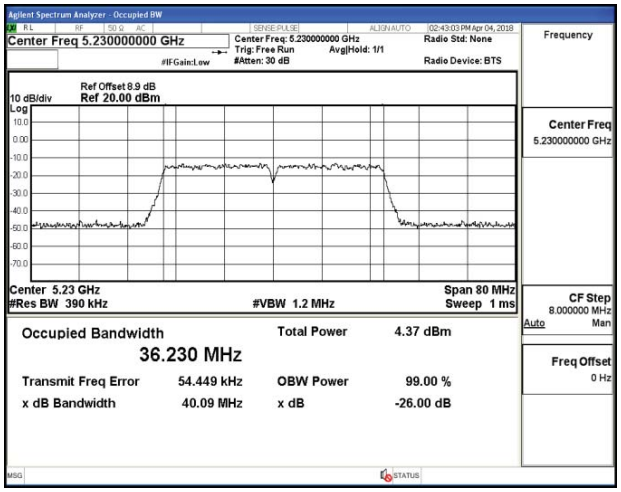


Channel 46 / 5230 MHz

Channel 40 / 5200 MHz



Channel 48 / 5240 MHz

99% and 26dB Occupied Bandwidth-ant 0	
IEEE 802.11ac VHT40	IEEE 802.11ac VHT80
	
Channel 38 / 5190 MHz	Channel 42 / 5210 MHz
	
Channel 46 / 5230 MHz	