FCC/ISED TEST REPORT

Test report
On Behalf of
Shenzhen SEI Robotics Co., Ltd.
For
4K Set top box
Model No.: IPA1114HDW-02,SN6BBAX(X=A TO Z) [for FCC]
IPA1114HDW-02, SN6BBAO [for ISED]

FCC ID: 2AOVU-SN6BBAX
IC: 25669-IPA1114HDW

Prepared for :	**Shenzhen SEI Robotics Co., Ltd.** 501, Block A, Productivity Building #5 Hi-tech Middle 2nd Road, Nanshan District, Shenzhen, China
Prepared By :	**Shenzhen HUAK Testing Technology Co., Ltd.** **1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China**
Date of Test:	**Nov 6, 2019~ Dec 17, 2019**
Date of Report:	**Dec 18, 2019**
Report Number:	**HK1910302722-E2**

TEST RESULT CERTIFICATION

Applicant's name ..... :	**Shenzhen SEI Robotics Co., Ltd.**
Address ..... :	501, Block A, Productivity Building #5 Hi-tech Middle 2nd Road, Nanshan District, Shenzhen, China
Manufacture's Name ..... :	**LIAN TECH Co., Ltd.**
Address ..... :	Workshop CN-05-06, lot Cn-05,Van Trung Industrial Park, Viet Yen District, Bac Giang Province,Vietnam
Product description	
Trade Mark ..... :	eSTREAM4K
Product name ..... :	4K Set top box
Model and/or type reference :	Refer to page1
Standards ..... :	FCC Rules and Regulations Part 15 Subpart E Section 15.407 RSS 247 Issue 2, February 2017 RSS GEN Issue 5, March 2019 ANSI C63.10: 2013

Date of Test ..... :	
Date (s) of performance of tests..... :	Nov 6, 2019~ Dec 17, 2019
Date of Issue ..... :	Dec 18, 2019
Test Result..... :	**Pass**

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(Jason Zhou)

Revision History

Revision	Issue Date	Revisions	Revised By
000	Dec 18, 2019	Initial Issue	Jason Zhou

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	4K Set top box
Model Number	:	Refer to page1
Model Declaration	:	All the same except for the shape and color of cover.
Test Model	:	IPA1114HDW-02
Power Supply	:	DC 5V by adapter
Hardware version	:	SMB.207.05
Software version	:	android9.0
Bluetooth Version	:	V5.0+EDR
Channel Number	:	79 Channels for Bluetooth EDR(DSS) 40 Channels for Bluetooth BLE(DTS)
Modulation Technology	:	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth EDR(DSS) GFSK for Bluetooth BLE(DTS)
Data Rates	:	Bluetooth EDR(DSS): 1~3Mbps;Bluetooth BLE(DTS): 1Mbps
WLAN	:	Supported IEEE 802.11a/b/g/n/ac
WLAN FCC Operation Frequency	:	IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz / 5180-5240MHz / 5745-5825MHz IEEE 802.11n HT40: 5190-5230MHz / 5755-5795MHz IEEE 802.11a: 5180-5240MHz / 5745-5825MHz IEEE 802.11ac VHT20: 5180-5240MHz / 5745-5825MHz IEEE 802.11ac VHT40: 5190-5230MHz / 5755-5795MHz IEEE 802.11ac VHT80: 5210MHz / 5775MHz
WLAN Channel Number	:	11 Channels for 2412-2462MHz(IEEE 802.11b/g/n HT20) 4 Channels for 5180-5240MHz (IEEE 802.11a/ac VHT20/n HT20) 2 Channels for 5190-5230MHz (IEEE 802.11ac VHT40/n HT40) 1 Channels for 5210MHz (IEEE 802.11ac VHT80) 5 Channels for 5745-5825MHz(IEEE 802.11a/ac VHT20/n HT20) 2 Channels for 5755-5795MHz(IEEE 802.11ac VHT40/n HT40) 1 Channels for 5775MHz(IEEE 802.11ac VHT80)
WLAN Modulation Technology	:	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Type And Gain	:	Three Antennas: Internal Antenna 1: 2.88 dBi(Max.), for TX/RX (WLAN 2.4G Band), 2.56 dBi(Max.), for TX/RX (WLAN 5.2G Band) 3.27 dBi(Max.), for TX/RX (WLAN 5.8G Band) Internal Antenna 2: 2.83 dBi(Max.), for TX/RX (WLAN 2.4G Band), 6.39 dBi(Max.), for TX/RX (WLAN 5.2G Band) 5.93 dBi(Max.), for TX/RX (WLAN 5.8G Band) Internal Antenna 3: 1.43 dBi(Max.), for TX/RX (Bluetooth),
Directional Gain	:	5.87 dBi for MIMO(2.4G Band) 7.82dBi for MIMO(5.2G Band) 7.81 dBi for MIMO(5.8G Band)

Note: Antenna position refer to EUT Photos.

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
SUNUN	Adapter	SA12V-050200U	N/A	N/A
Aohai	Adapter	A912-050200W-US1	N/A	N/A

1.3. External I/O Port

I/O Port Description	Quantity	Cable
USB Port	2	N/A
HDMI Port	1	N/A
LAN Port	1	N/A
DC Port	1	N/A
OPTICAL Port	1	N/A
AV OUT Port	1	N/A
MICRO SD Port	1	N/A

1.4. Description of Test Facility

Designation Number: CN1229
Test Firm Registration Number: 616276

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010

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 HUAK 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	±3.08dB	(1)
		30MHz~1000MHz	±4.42dB	(1)
		1GHz~40GHz	±4.06dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±2.23dB	(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.

Worst-case mode and channel used for 150 kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power that was determined to be **IEEE 802.11ac mode@chain 1 + chain 2 (High Channel)**.

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be **IEEE 802.11ac mode@chain 1 + chain 2 (High Channel).**

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 802.11ac VHT20 Mode: MCS0
IEEE 802.11n HT20 Mode: MCS0.
IEEE 802.11ac VHT40 Mode: MCS0.
IEEE 802.11n HT40 Mode: MCS0.
IEEE 802.11ac VHT80 Mode: MCS0.

Antenna & Bandwidth

Antenna	Single (Port.1)			Two (Port.1 + Port.2)		
Bandwidth Mode	20MHz	40MHz	80MHz	20MHz	40MHz	80MHz
IEEE 802.11a	☐	☐	☐	☑	☐	☐
IEEE 802.11n	☐	☐	☐	☑	☑	☐
IEEE 802.11ac	☐	☐	☐	☑	☑	☑

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen HUAK Testing Technology Co., 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 789033 D02 General UNII Test Procedures New Rules v02r01 and KDB 662911 are 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

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT 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, which is 0.8 m above ground plane. 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 transmits condition.

3.2. EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software (Ampak.apk) provided by application.

3.3. Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	TV	AOC	280LM00003	JVVGJA000307	/	/	/

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen HUAK Testing Technology Co., 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

FCC Rules	ISED Rules	Description of Test	Result
§15.407(a)	RSS-247 6.2.1.1	Maximum Conducted Output Power	Compliant
§15.407(a)	RSS-247 6.2.1.1	Power Spectral Density	Compliant
§15.407(a)	RSS-247 6.2.1.2	26dB Bandwidth	Compliant
§15.407(a)	RSS-247 6.2.1.1	99% Occupied Bandwidth	Compliant
§15.407(b)	RSS-247 6.2.1.2 RSS-Gen 8.9	Radiated Emissions	Compliant
§15.407(b)	RSS-247 6.2.1.2 RSS-Gen 8.9	Band edge Emissions	Compliant
§15.205	RSS-247 6.2.1.2 RSS-Gen 8.10	Emissions at Restricted Band	Compliant
§15.407(g)	RSS-Gen 8.11	Frequency Stability	Compliant

§15.207(a)	RSS-Gen 8.8	Line Conducted Emissions	Compliant
§15.203	/	Antenna Requirements	Compliant
§2.1093	RSS-102	RF Exposure	Compliant

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 section 6 of equipment list in this report. The following table is the setting of the spectrum analyzer.

5.1.3. Test Procedures

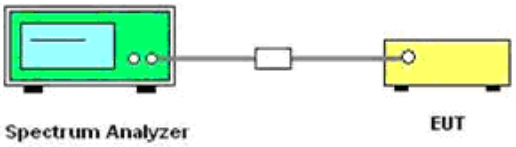
1. Set the centre frequency of the spectrum analyzer to the transmitting frequency;

2. Set the span=0MHz, RBW=10MHz, VBW=10MHz, Sweep time=5ms;

3. Detector = peak;

4. Trace mode = Single hold.

5.1.4. Test Setup Layout



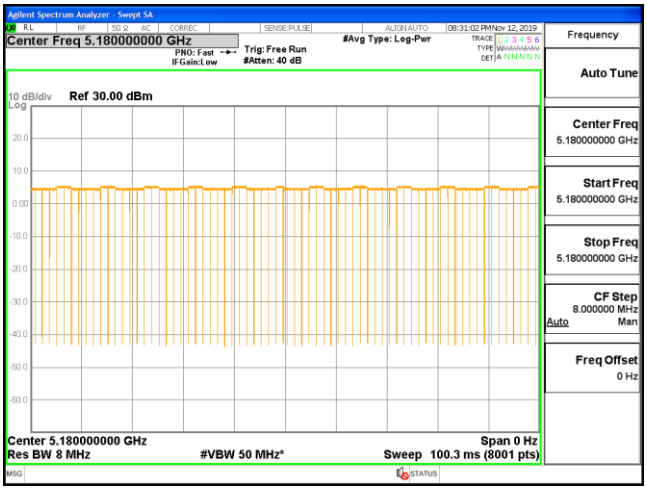
5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

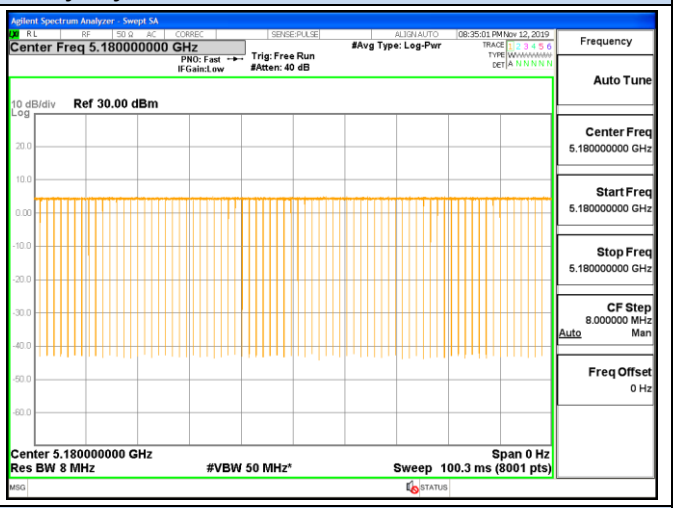
5.1.6. Test result

Mode	On Time Points	Total Sweep points	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (KHz)
IEEE 802.11a	7836	8001	97.94	0.09	0.01
IEEE 802.11n HT20	7829	8001	97.85	0.09	0.01
IEEE 802.11ac HT20	7830	8001	97.86	0.09	0.01
IEEE 802.11n HT40	7653	8001	95.65	0.19	0.01
IEEE 802.11ac HT40	7665	8001	95.80	0.19	0.01
IEEE 802.11ac HT80	7351	8001	91.88	0.37	0.01

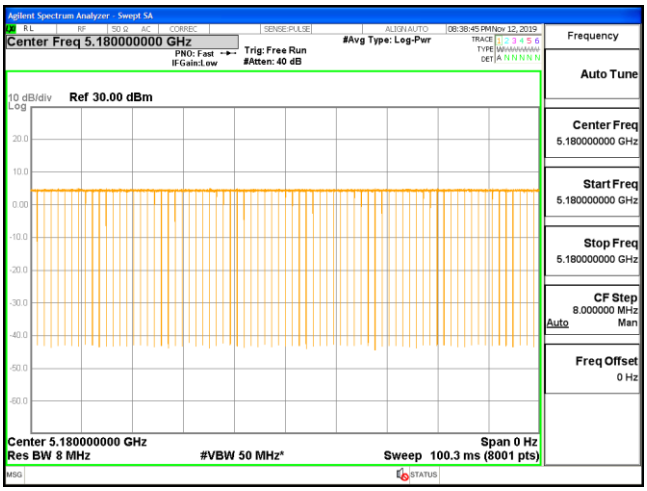
On Time and Duty Cycle



IEEE 802.11a

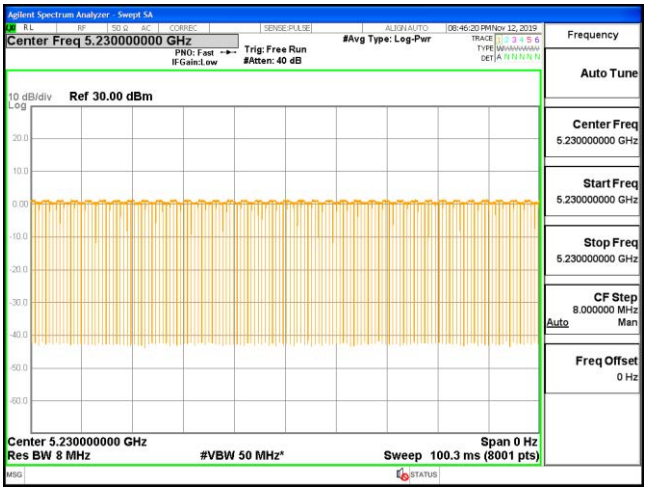


IEEE 802.11n HT20

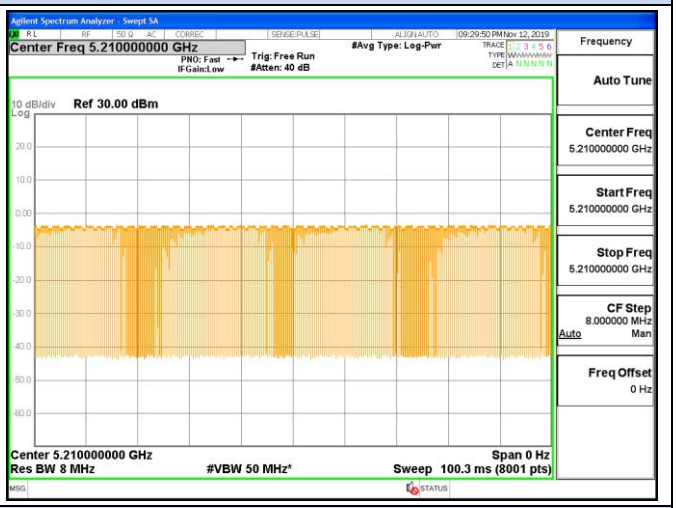


IEEE 802.11ac VHT20

IEEE 802.11n HT40



IEEE 802.11ac VHT40



IEEE 802.11ac VHT80

5.2. Maximum Conducted Output Power Measurement

5.2.1. Standard Applicable

(1) For the band 5.15-5.25 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. 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 section 6 of 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.

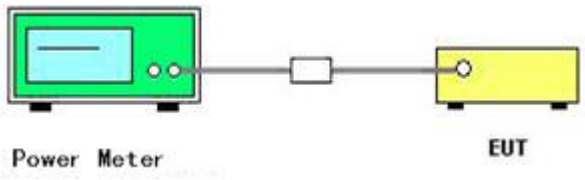
- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
- The integration period of the power meter exceeds the repetition period of the transmitted signal by at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

Temperature	23.6℃	Humidity	52.4%
Test Engineer	Gary Qian	Configurations	IEEE 802.11a/n/ac

Test Mode	Channel	Frequency (MHz)	Measured Conducted Average Power (dBm)			Duty Cycle factor (dB)	Report Average Power (dBm)			Limits (dBm)	Verdict
			Antenna 1	Antenna 2	Sum		Antenna 1	Antenna 2	Sum		
IEEE 802.11a	36	5180	7.671	7.503	/	0.09	7.76	7.59	/	Antenna 1: 24.00 Antenna 2: 23.61	PASS
	40	5200	7.429	7.551	/	0.09	7.52	7.64	/		
	48	5240	7.645	7.397	/	0.09	7.74	7.49	/		
IEEE 802.11n HT20	36	5180	7.507	7.345	10.44	0.09	7.60	7.44	10.53	22.18	PASS
	40	5200	7.16	7.176	10.18	0.09	7.25	7.27	10.27		
	48	5240	7.381	7.274	10.34	0.09	7.47	7.36	10.43		
IEEE 802.11ac VHT20	36	5180	7.542	7.453	10.51	0.09	7.63	7.54	10.60	22.18	PASS
	40	5200	7.408	7.373	10.40	0.09	7.50	7.46	10.49		
	48	5240	7.338	7.168	10.26	0.09	7.43	7.26	10.35		
IEEE 802.11n HT40	38	5190	6.969	6.744	9.87	0.19	7.16	6.93	10.06	22.18	PASS
	46	5230	6.878	6.886	9.89	0.19	7.07	7.08	10.08		
IEEE 802.11ac VHT40	38	5190	6.952	6.962	9.97	0.19	7.14	7.15	10.16	22.18	PASS
	46	5230	6.882	6.761	9.83	0.19	7.07	6.95	10.02		
IEEE 802.11ac VHT80	42	5210	0.287	0.525	3.42	0.37	0.66	0.90	3.79	22.18	PASS

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 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *For MIMO with CCD technology device, The Directional Gain= Gain of individual transmit antennas (dBi) + Array gain;*
   Directional gain = 10 log[($10^{G1/10}$ + $10^{G2/10}$ + … + $10^{GN/10}$)/N_{ANT}] dBi,where antenna gains given by G1, G2, …, GN dBi, N_{ANT} is the antennas total Number.
5. *limits= 24.0 – max(0, (Direction Gain – 6));*
6. *Report conducted power = Measured conducted average power + Duty Cycle factor;*

5.3. Power Spectral Density Measurement

5.3.1. Standard Applicable

For 5150~5250MHz

(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.

5.3.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of Spectrum Analyzer.

5.3.3. Test Procedures

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.

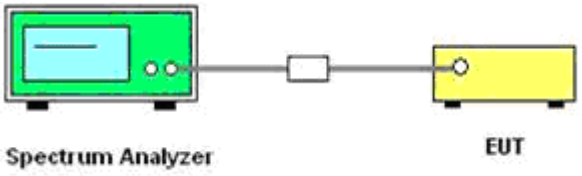
11. Allow trace to fully stabilize.

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.

5.3.4. Test Setup Layout



5.3.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

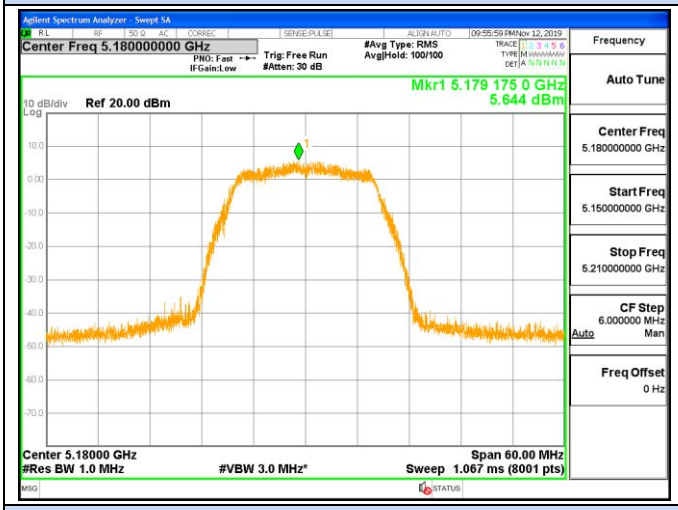
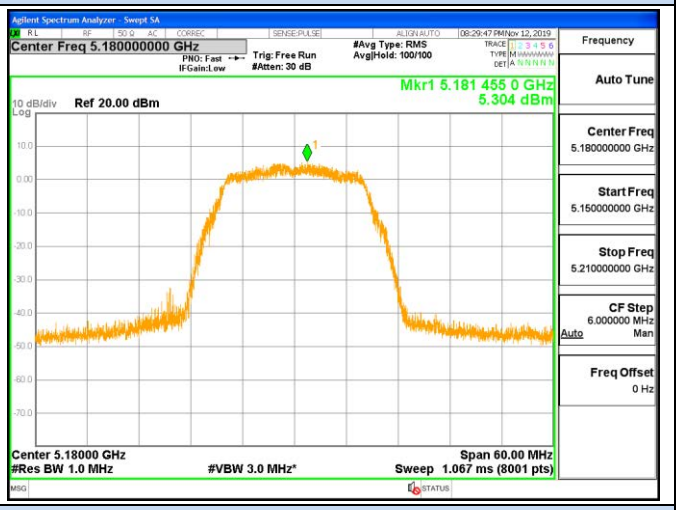
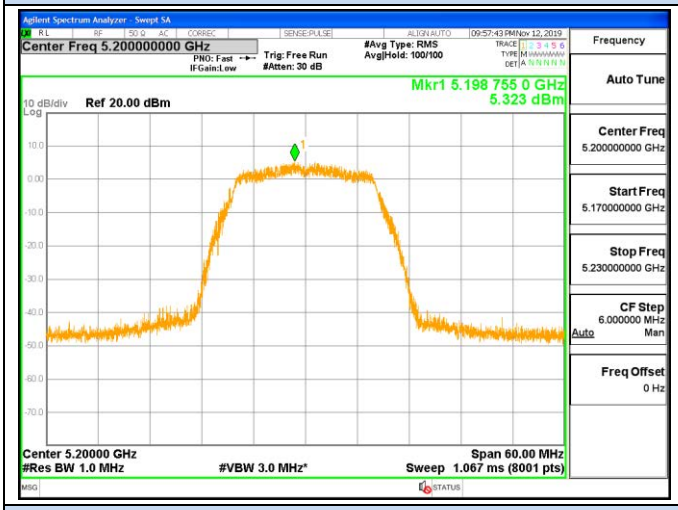
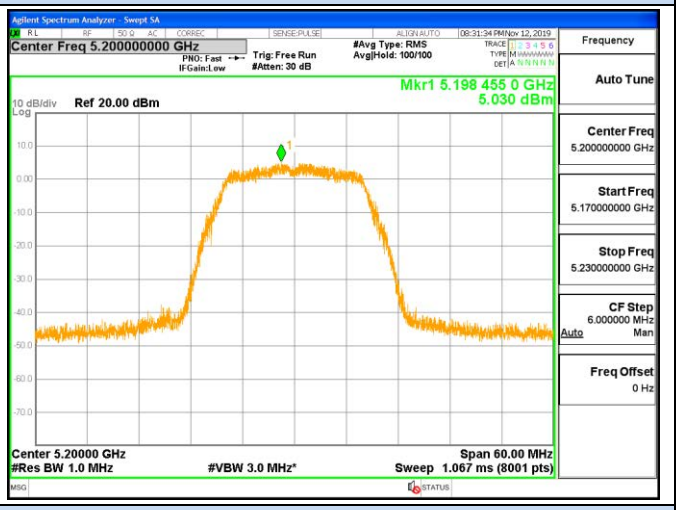
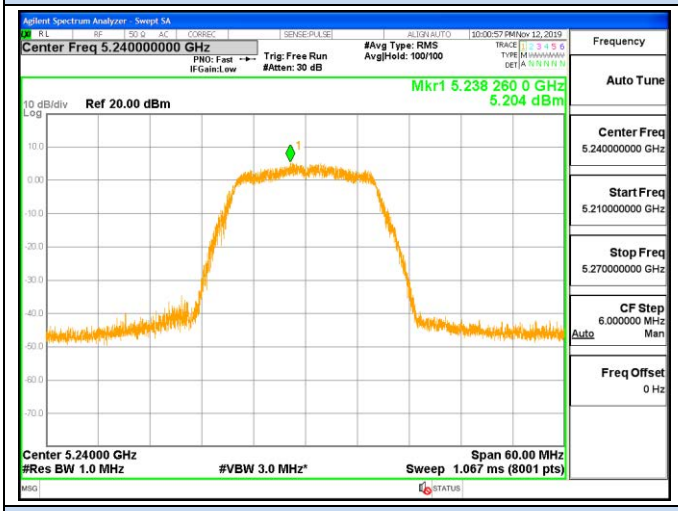
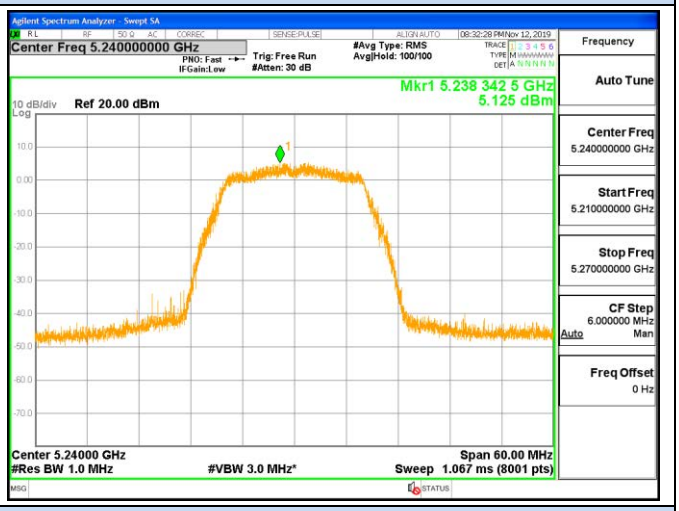
6.3.6. Test Result of Power Spectral Density

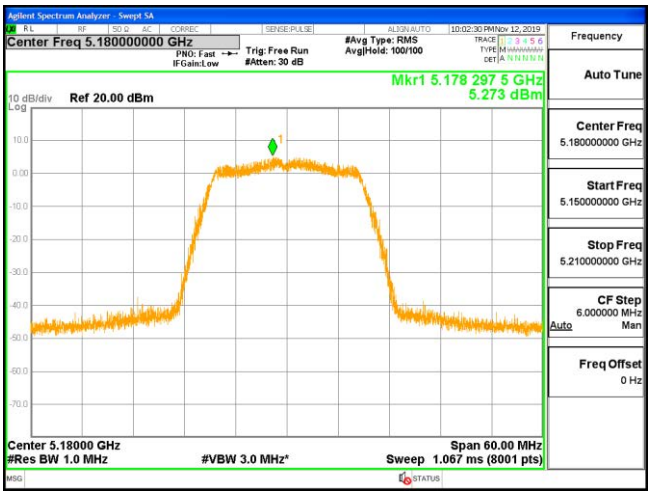
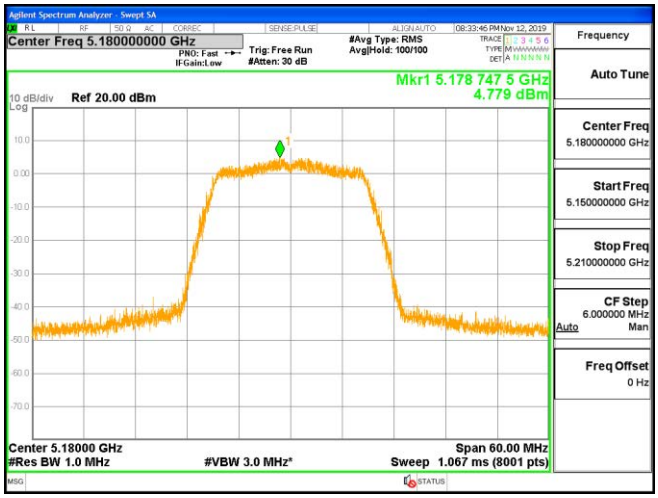
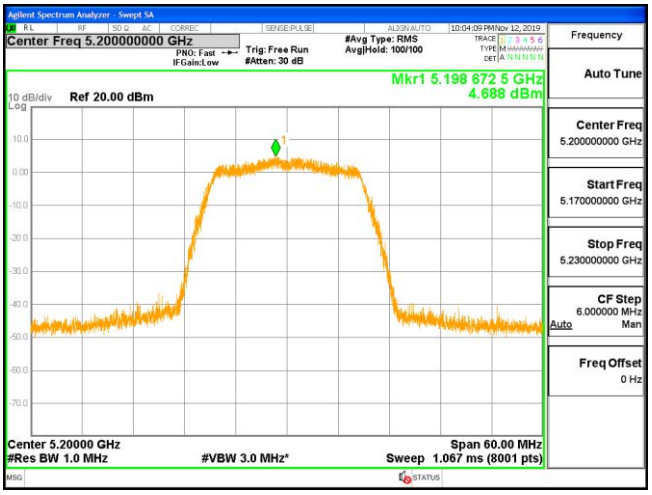
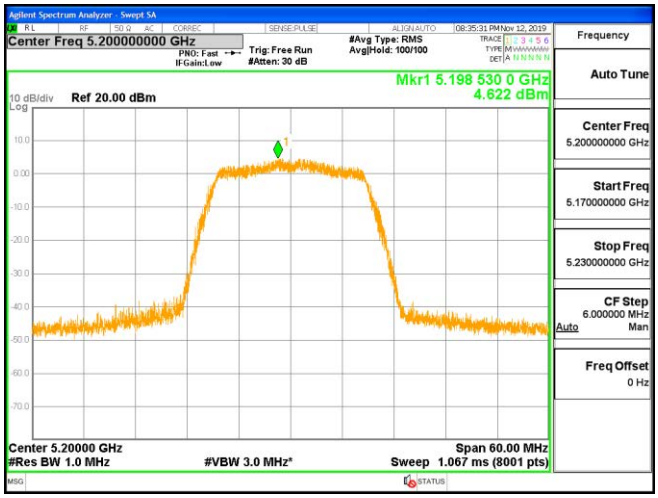
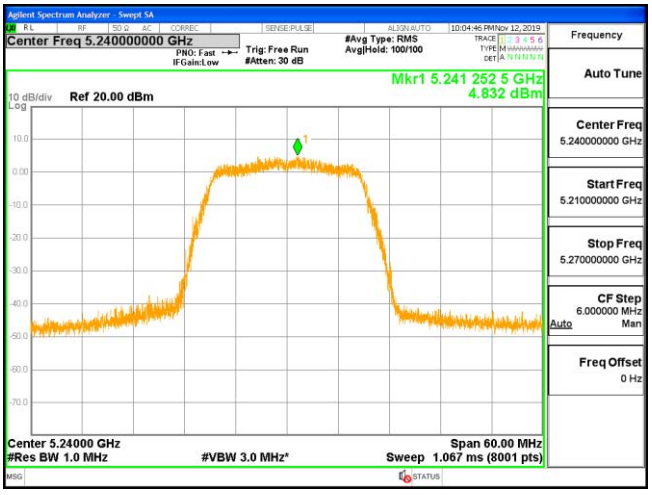
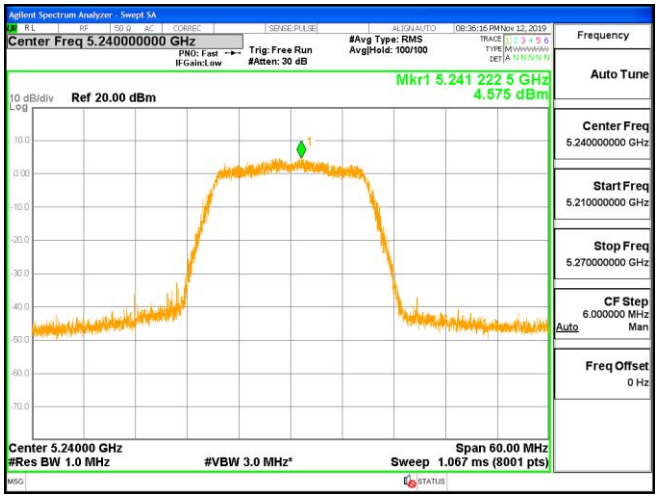
Temperature	23.6℃	Humidity	52.4%
Test Engineer	Gary Qian	Configurations	IEEE 802.11a/n/ac

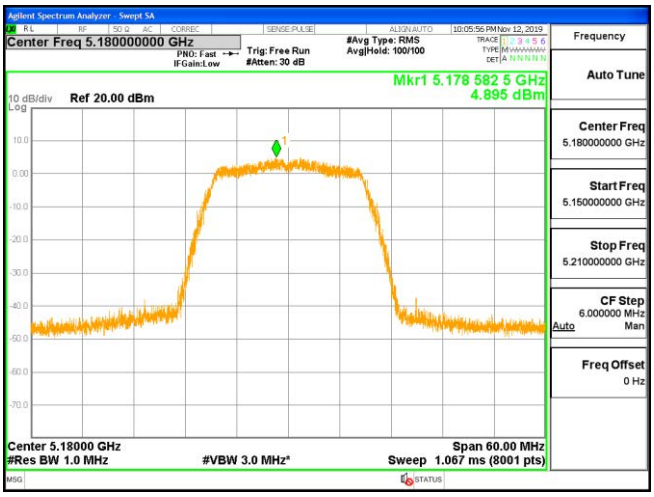
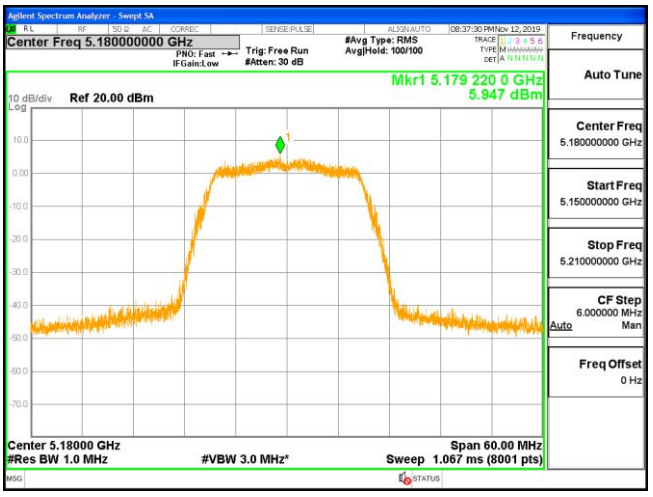
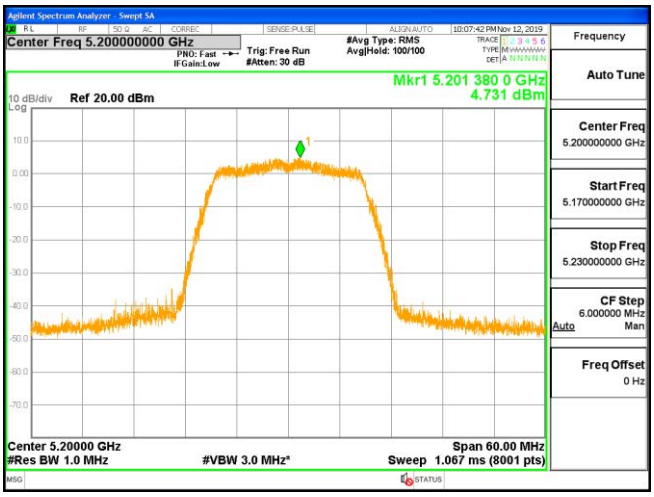
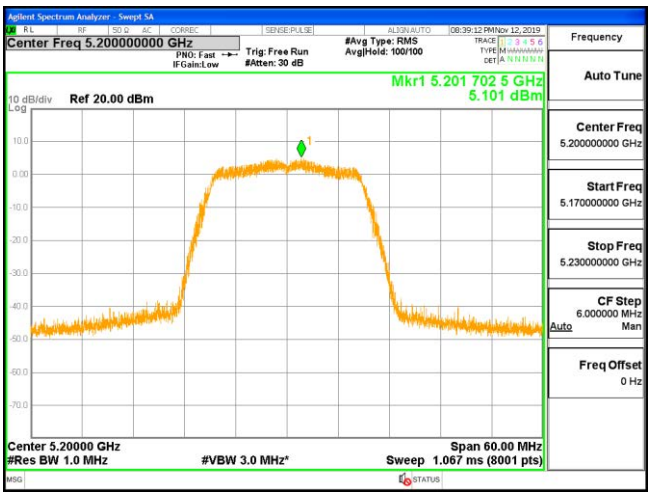
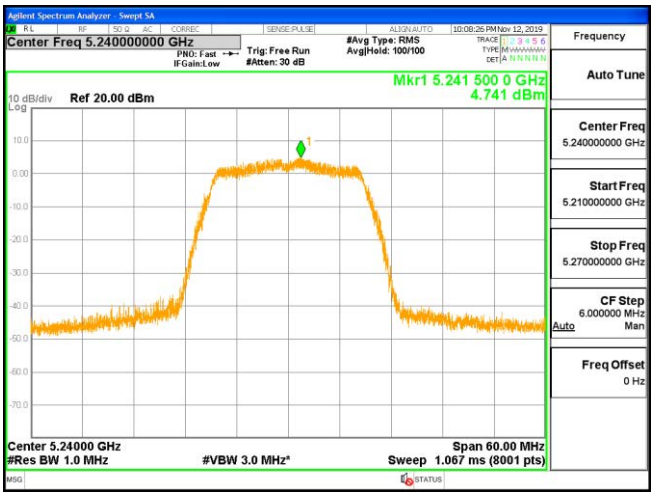
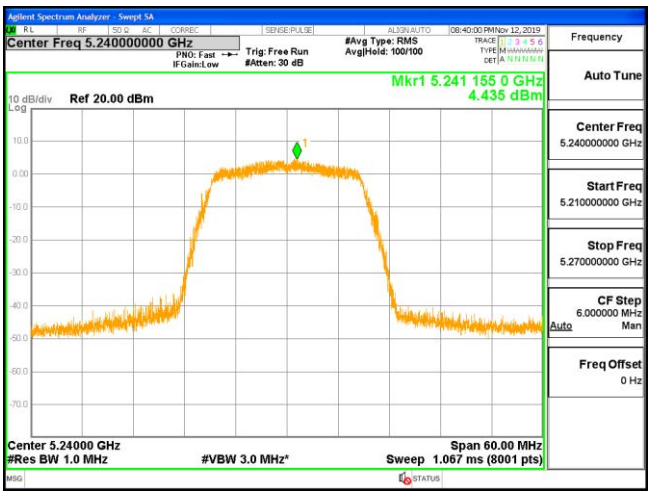
Test Mode	Channel	Frequency (MHz)	Measured Conducted PSD (dBm/MHz)			Duty Cycle factor (dB)	Report Conducted PSD (dBm/MHz)			PSD Limits (dBm/MHz)	Verdict
			Antenna 1	Antenna 2	Sum		Antenna 1	Antenna 2	Sum		
IEEE 802.11a	36	5180	5.644	5.304	/	0.09	5.73	5.39	/	Antenna 1: 11.00 Antenna 2: 10.61	PASS
	40	5200	5.323	5.03	/	0.09	5.41	5.12	/		
	48	5240	5.204	5.125	/	0.09	5.29	5.22	/		
IEEE 802.11n HT20	36	5180	5.273	4.779	8.04	0.09	5.36	4.87	8.13	9.18	PASS
	40	5200	4.688	4.622	7.67	0.09	4.78	4.71	7.76		
	48	5240	4.832	4.575	7.72	0.09	4.92	4.67	7.81		
IEEE 802.11ac VHT20	36	5180	4.895	5.947	8.46	0.09	4.99	6.04	8.55	9.18	PASS
	40	5200	4.731	5.101	7.93	0.09	4.82	5.19	8.02		
	48	5240	4.741	4.435	7.60	0.09	4.83	4.53	7.69		
IEEE 802.11n HT40	38	5190	1.543	2.333	4.97	0.19	1.73	2.52	5.16	9.18	PASS
	46	5230	1.577	1.997	4.80	0.19	1.77	2.19	4.99		
IEEE 802.11ac VHT40	38	5190	1.938	1.643	4.80	0.19	2.13	1.83	4.99	9.18	PASS
	46	5230	1.688	1.663	4.69	0.19	1.88	1.85	4.88		
IEEE 802.11ac VHT80	42	5210	-7.593	-7.234	-4.40	0.37	-7.22	-6.86	-4.03	9.18	PASS

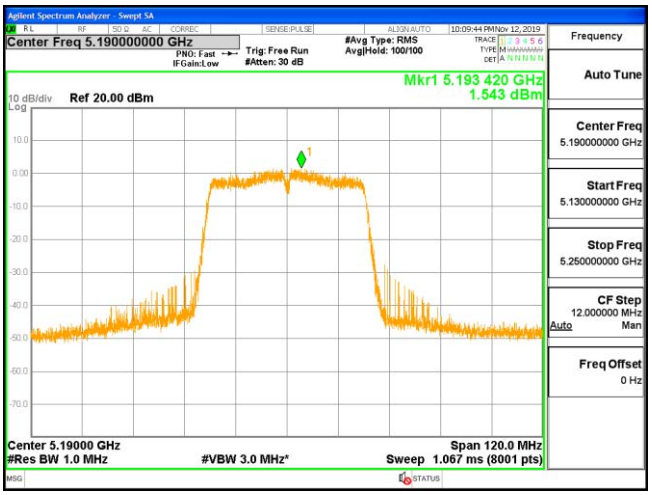
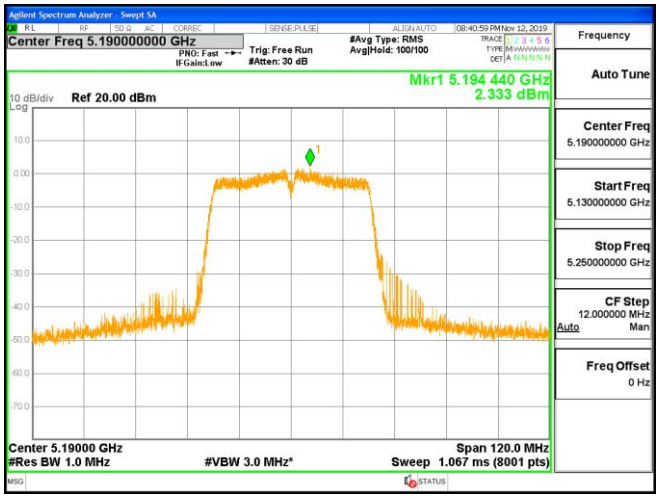
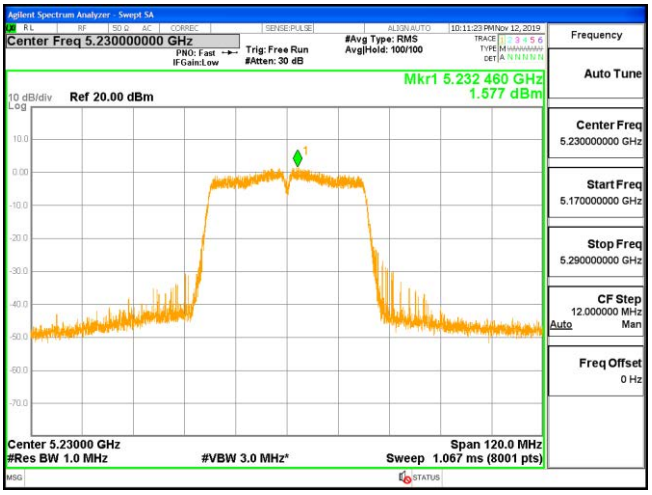
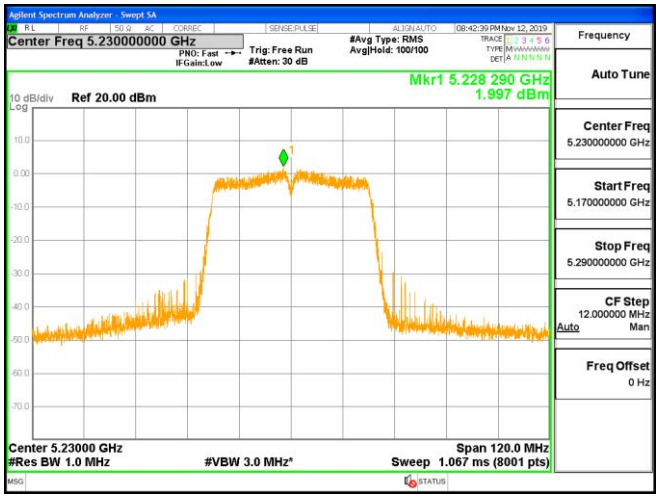
Remark:

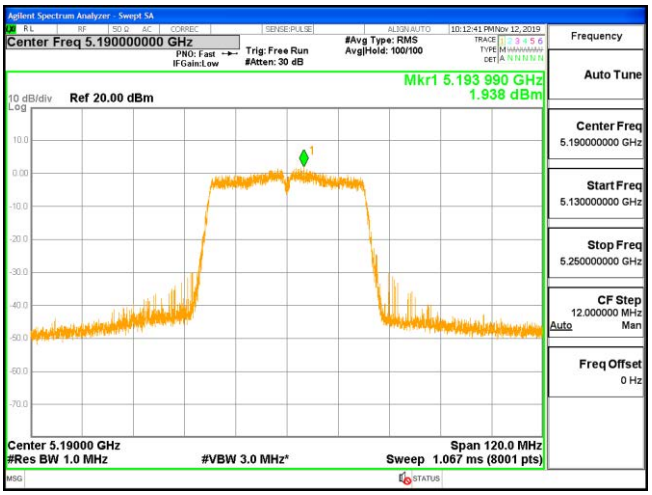
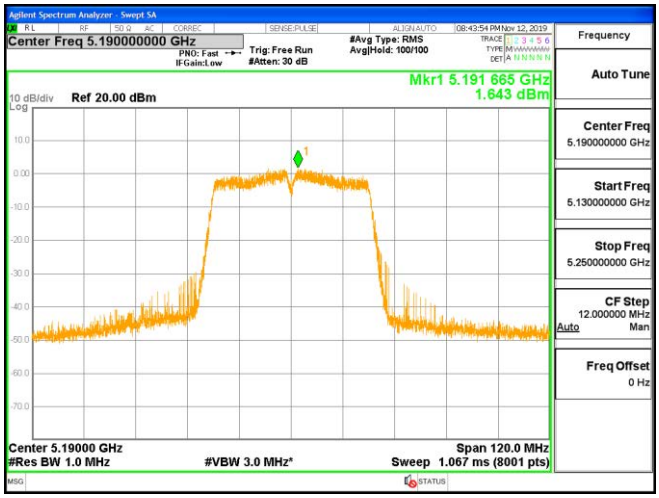
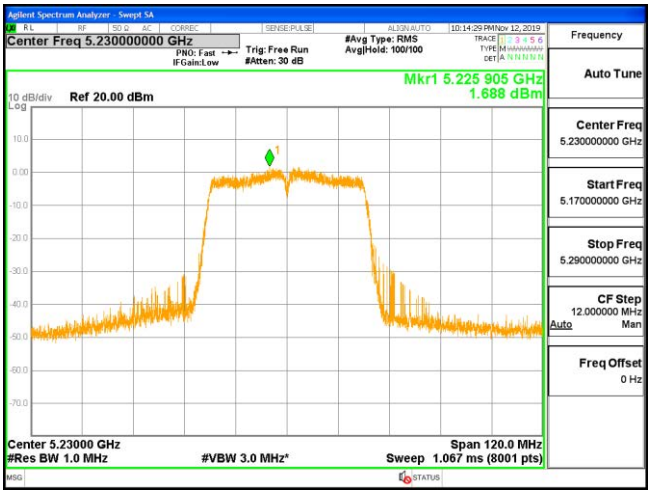
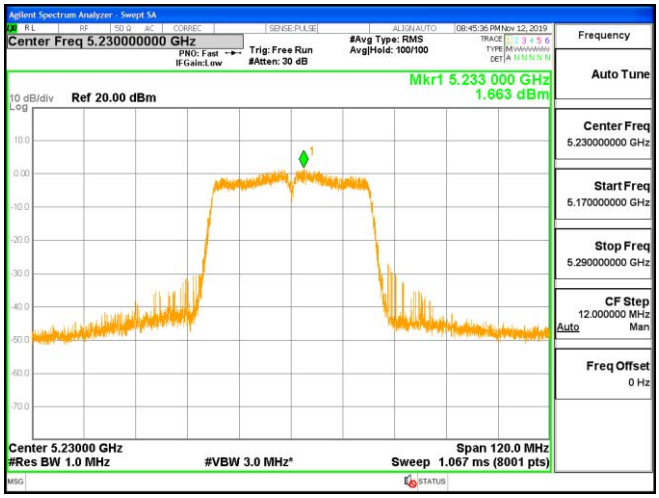
1. *Measured power spectrum density at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *For MIMO with CCD technology device:*
   Directional gain = 10 log[($10^{G1/10}$ + $10^{G2/10}$ + … + $10^{GN/10}$)/N_{ANT}] dBi,where antenna gains given by G1, G2, …, GN dBi, N_{ANT} is the antennas total Number
5. *limits= 11.0 – max(0, (Direction Gain – 6));*
6. *Report conducted PSD = Measured conducted PSD + Duty Cycle factor;*
7. *Please refer to following test plots;*

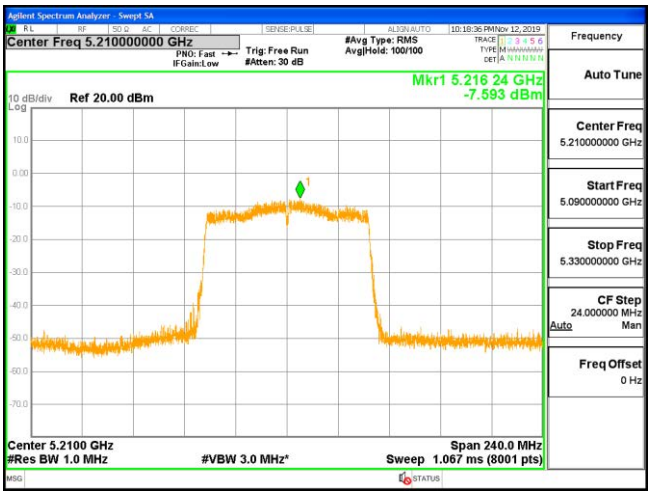
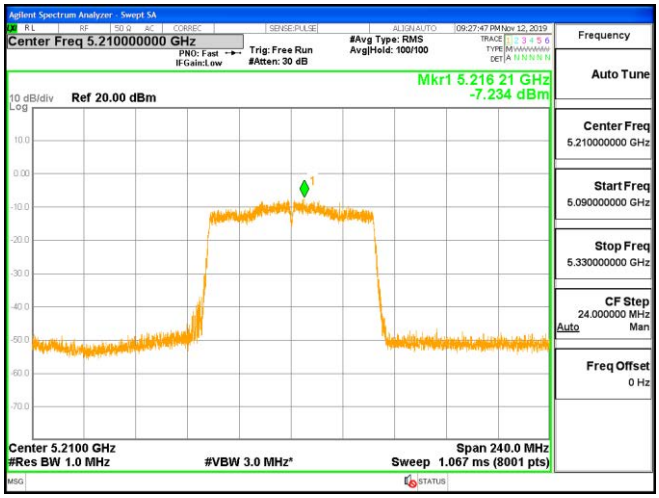
Power Spectrum Density	
IEEE 802.11a	
Antenna Chain 1	Antenna Chain 2
	
Channel 36 / 5180 MHz	Channel 36 / 5180 MHz
	
Channel 40 / 5200 MHz	Channel 40 / 5200 MHz
	
Channel 48 / 5240 MHz	Channel 48 / 5240 MHz

Power Spectrum Density	
IEEE 802.11n HT20	
Antenna Chain 1	Antenna Chain 2
	
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 Spectrum Density	
IEEE 802.11ac VHT20	
Antenna Chain 1	Antenna Chain 2
	
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 Spectrum Density	
IEEE 802.11n HT40	
Antenna Chain 1	Antenna Chain 2
	
Channel 38 / 5190 MHz	Channel 38 / 5190 MHz
	
Channel 46 / 5230 MHz	Channel 46 / 5230 MHz

Power Spectrum Density	
IEEE 802.11ac VHT40	
Antenna Chain 1	Antenna Chain 2
	
Channel 38 / 5190 MHz	Channel 38 / 5190 MHz
	
Channel 46 / 5230 MHz	Channel 46 / 5230 MHz

Power Spectrum Density	
IEEE 802.11ac VHT80	
Antenna Chain 1	Antenna Chain 2
	
Channel 48 / 5210 MHz	Channel 48 / 5210 MHz

5.4. 99% Occupied Bandwidth and 26dB Emission Bandwidth Measurement

5.4.1. Standard Applicable

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

5.4.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of the Spectrum Analyzer.

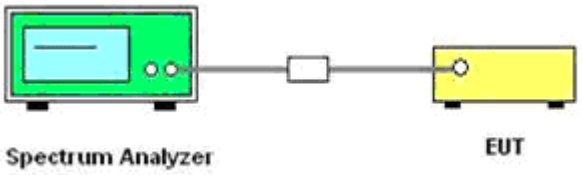
Spectrum Parameter	Setting
Attenuation	Auto
Span	> 26dB Bandwidth
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

5

5.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. Set the RBW = approximately 1% of the emission bandwidth.
3. Set the VBW ≥ 3 * RBW
4. 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.

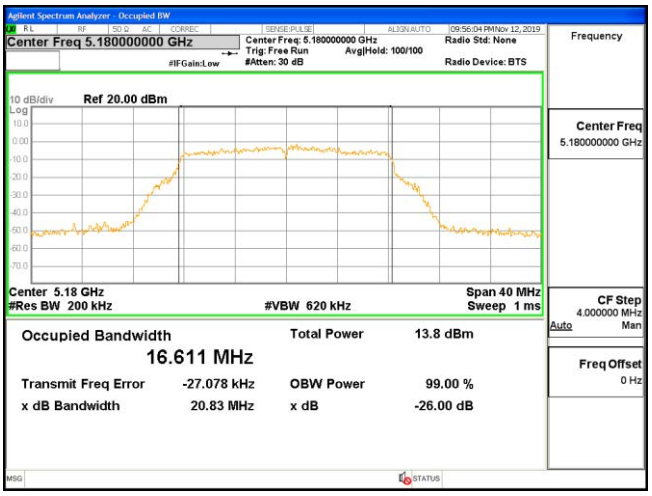
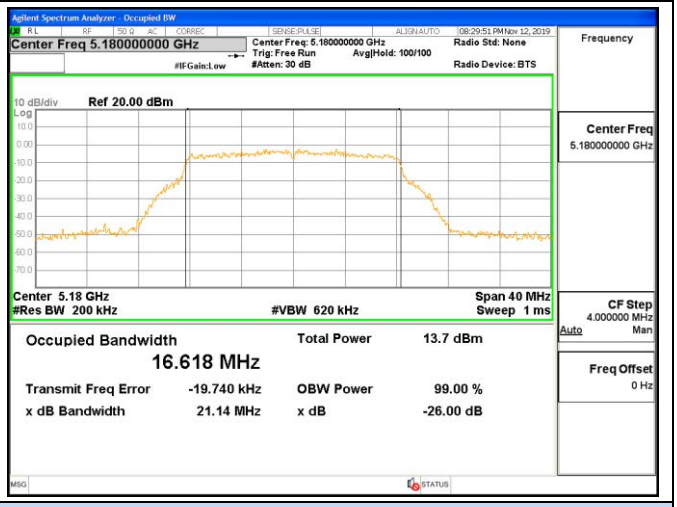
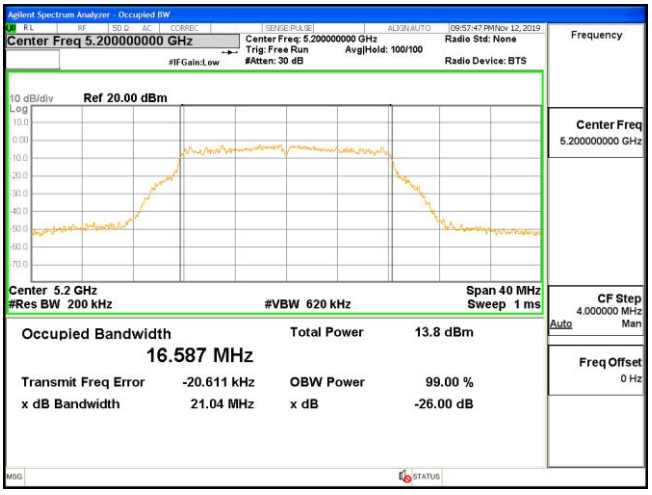
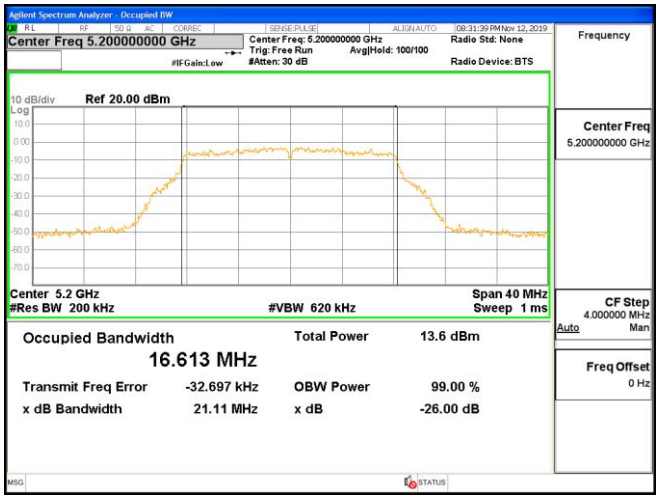
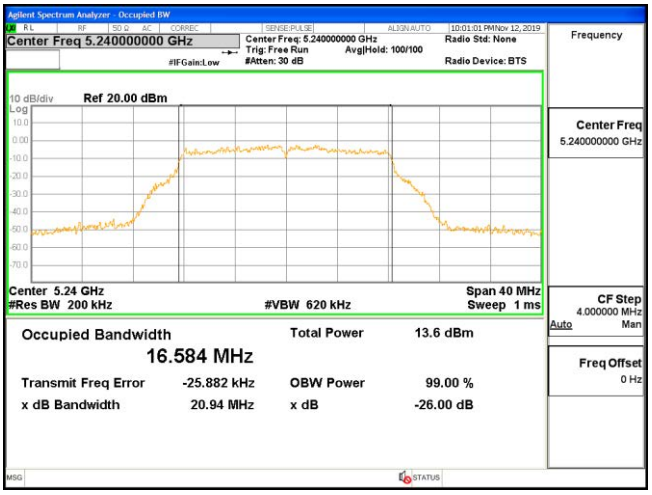
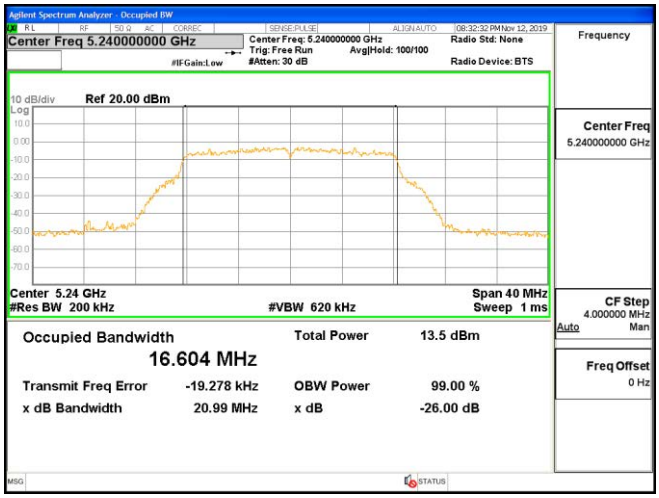
5.4.6. Test Result of 99% Occupied Bandwidth and 26dB Emission Bandwidth

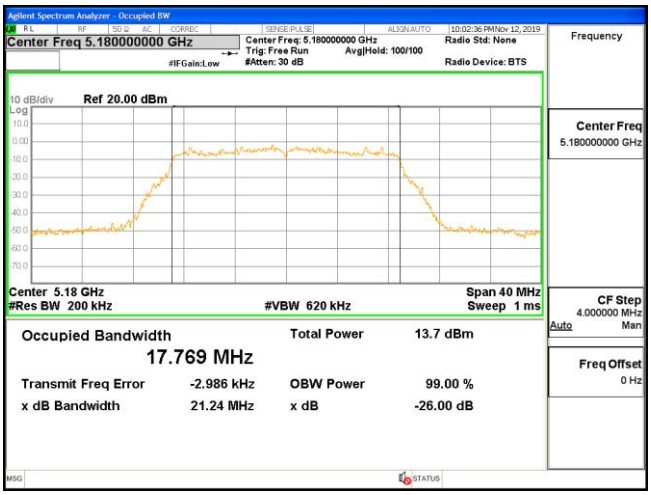
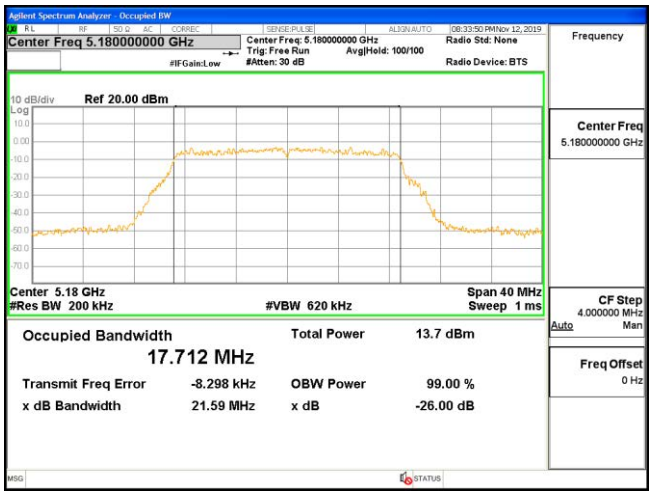
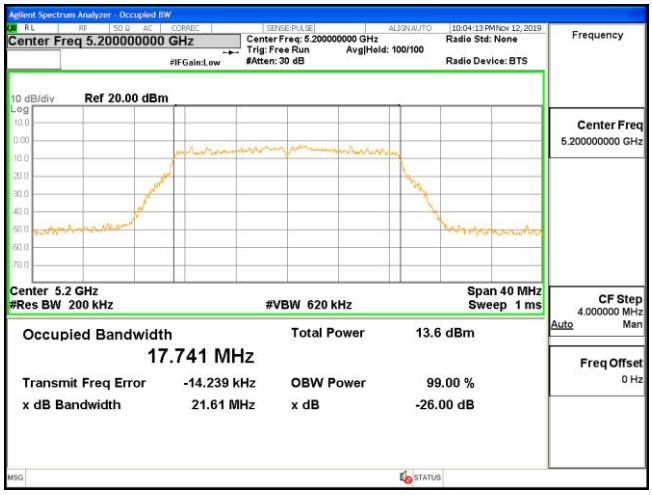
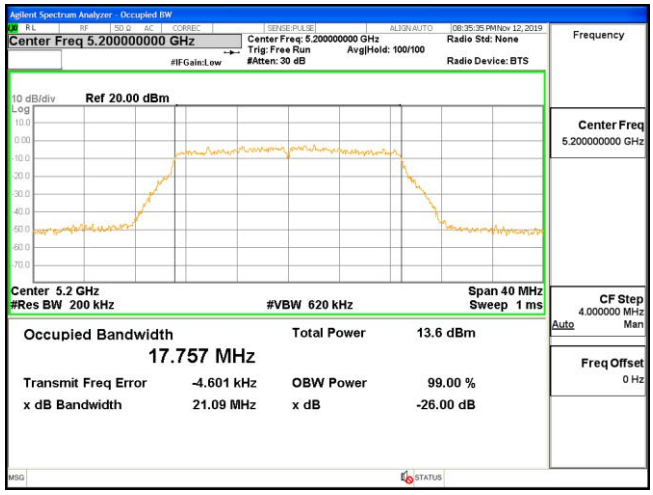
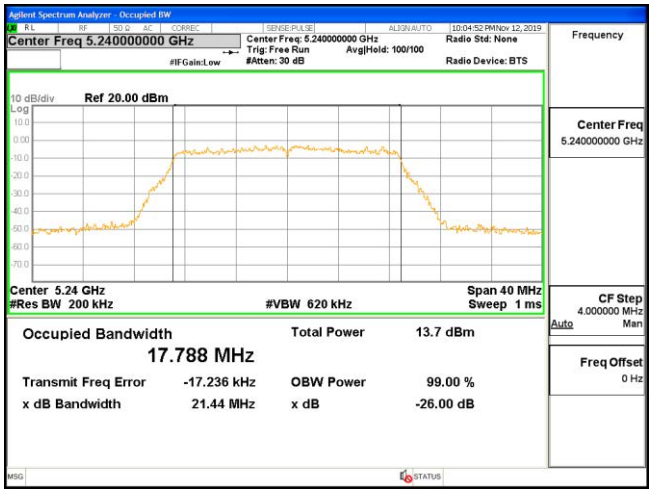
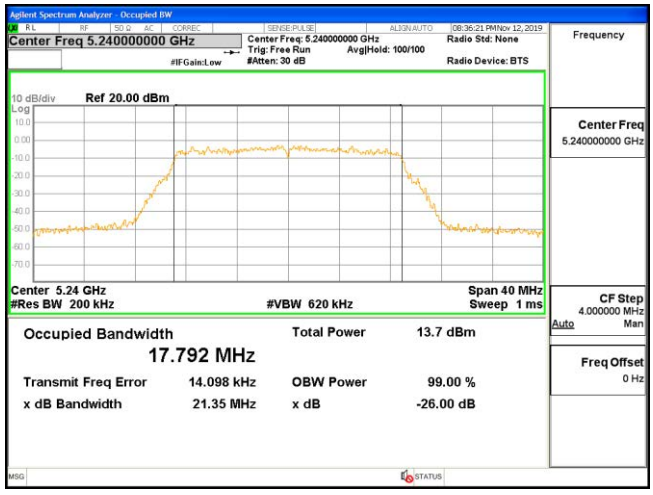
Temperature	23.6℃	Humidity	52.4%
Test Engineer	Gary Qian	Configurations	IEEE 802.11a/n/ac

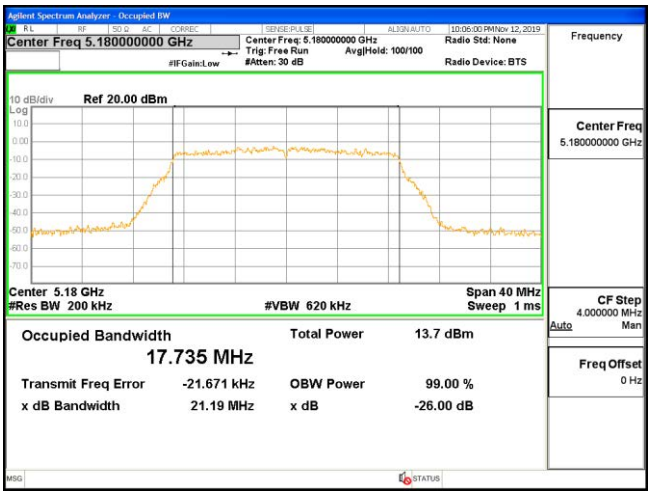
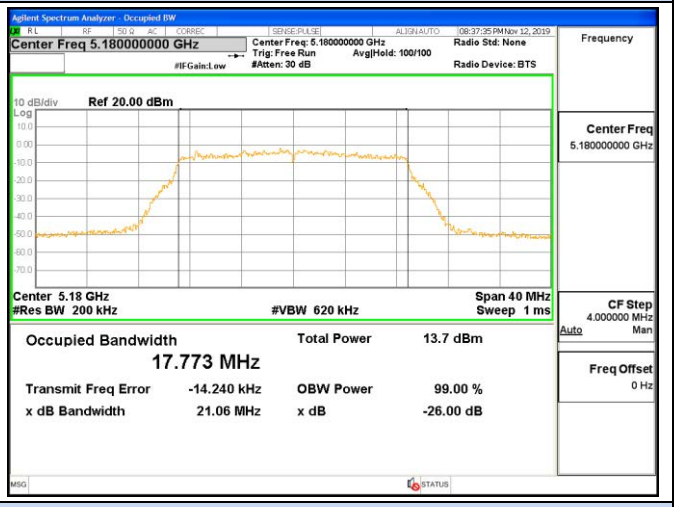
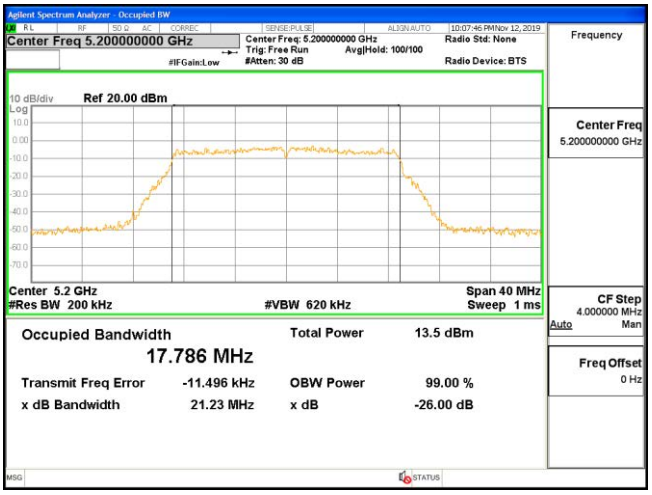
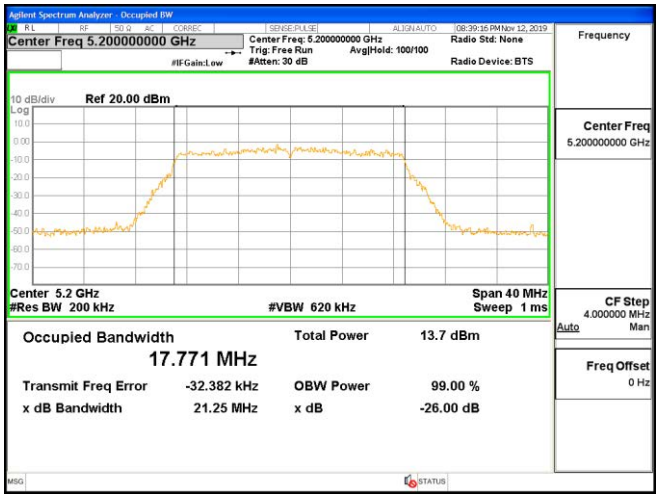
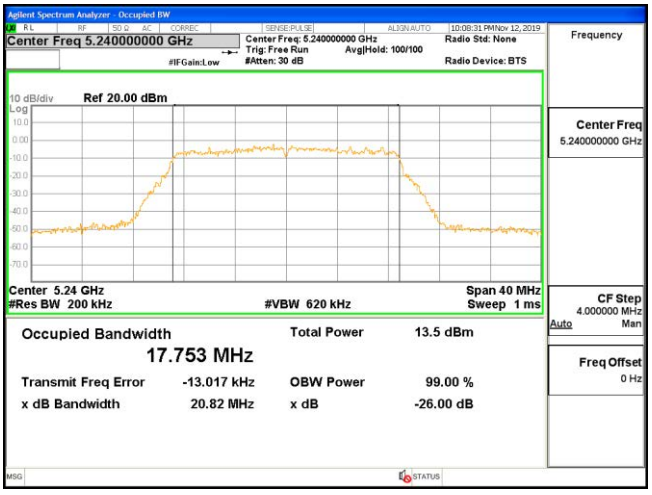
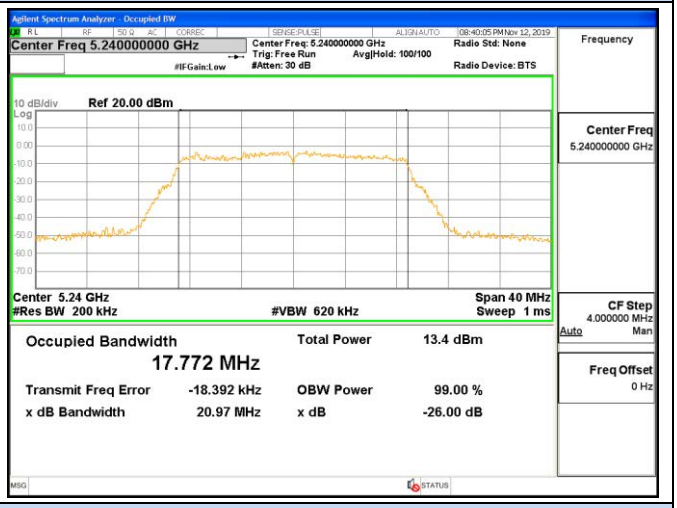
Test Mode	Channel	Frequency (MHz)	26dB Bandwidth (MHz)		99% Bandwidth (MHz)		Limits (MHz)	Verdict
			Antenna 1	Antenna 2	Antenna 1	Antenna 2		
IEEE 802.11a	36	5180	20.83	21.14	16.611	16.618	No Limit	PASS
	40	5200	21.04	21.11	16.587	16.613		
	48	5240	20.94	20.99	16.584	16.604		
IEEE 802.11n HT20	36	5180	21.24	21.59	17.769	17.712	No Limit	PASS
	40	5200	21.61	21.09	17.741	17.757		
	48	5240	21.44	21.35	17.788	17.792		
IEEE 802.11ac VHT20	36	5180	21.19	21.06	17.735	17.773	No Limit	PASS
	40	5200	21.23	21.25	17.786	17.771		
	48	5240	20.82	20.97	17.753	17.772		
IEEE 802.11n HT40	38	5190	39.60	39.42	36.216	36.238	No Limit	PASS
	46	5230	39.43	39.89	36.144	36.204		
IEEE 802.11ac VHT40	38	5190	39.38	39.55	36.214	36.206	No Limit	PASS
	46	5230	39.65	39.17	36.202	36.207		
IEEE 802.11ac VHT80	42	5210	80.92	81.08	75.515	75.573	No Limit	PASS

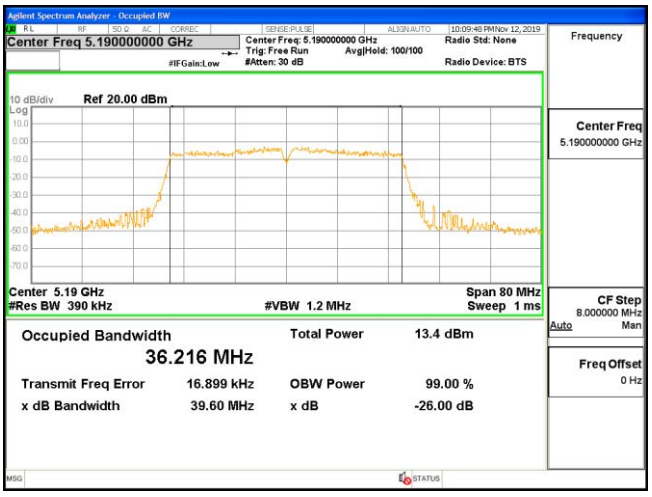
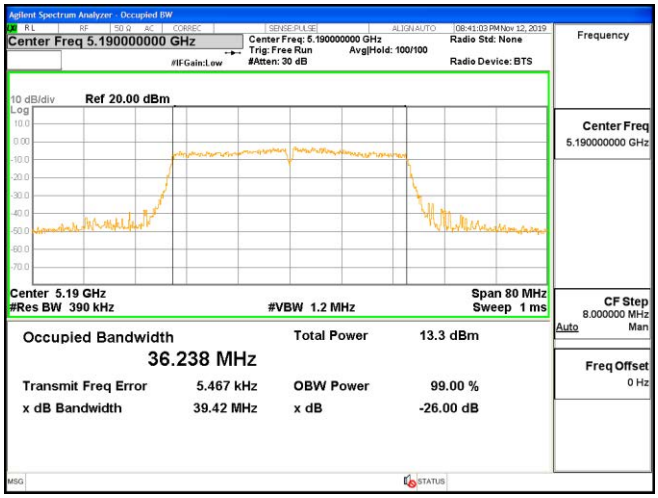
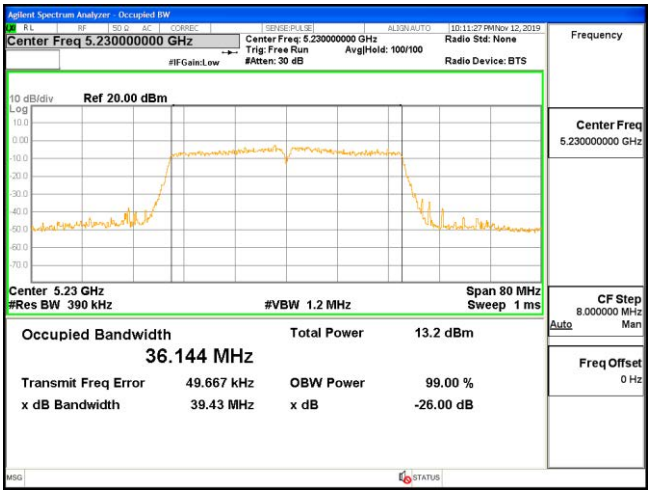
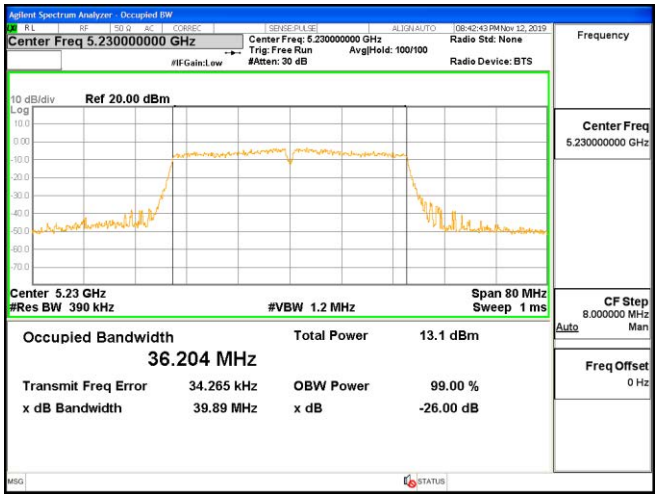
Remark:

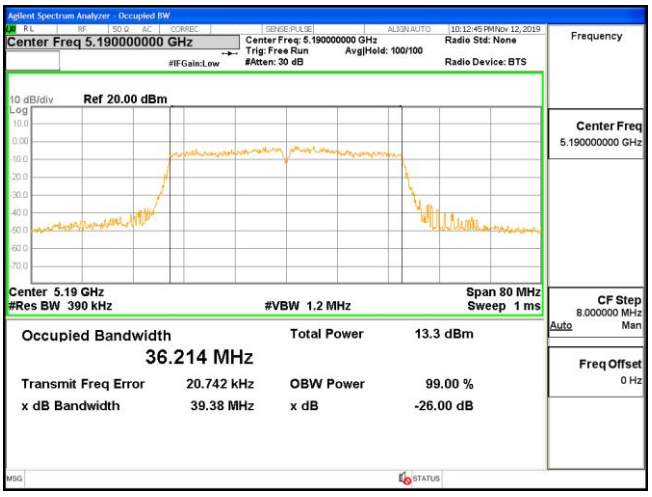
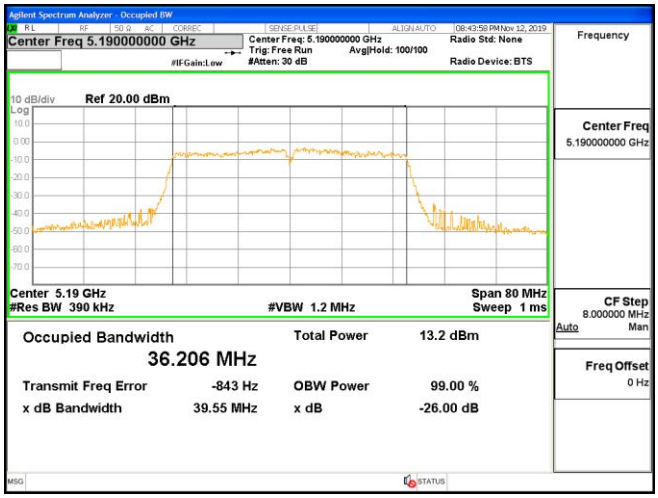
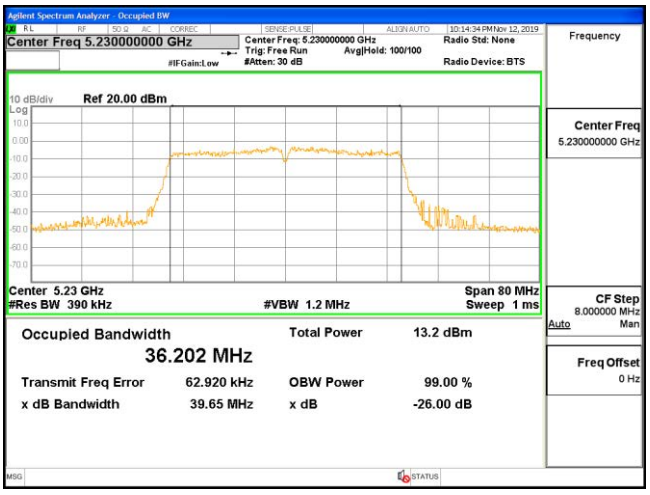
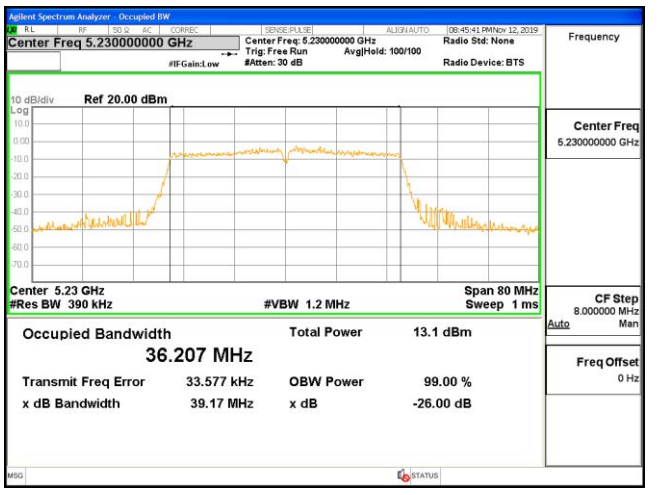
1. *Measured 99% and 26dB bandwidth at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11a VHT20, IEEE 802.11ac VHT40 and IEEE 802.11ac VHT80;*
4. *Please refer to following test plots;*

26dB Emission Bandwidth	
IEEE 802.11a	
Antenna Chain 1	Antenna Chain 2
	
Channel 36 / 5180 MHz	Channel 36 / 5180 MHz
	
Channel 40 / 5200 MHz	Channel 40 / 5200 MHz
	
Channel 48 / 5240 MHz	Channel 48 / 5240 MHz

26dB Emission Bandwidth	
IEEE 802.11n HT20	
Antenna Chain 1	Antenna Chain 2
	
Channel 36 / 5180 MHz	Channel 36 / 5180 MHz
	
Channel 40 / 5200 MHz	Channel 40 / 5200 MHz
	
Channel 48 / 5240 MHz	Channel 48 / 5240 MHz

26dB Emission Bandwidth	
IEEE 802.11ac VHT20	
Antenna Chain 1	Antenna Chain 2
	
Channel 36 / 5180 MHz	Channel 36 / 5180 MHz
	
Channel 40 / 5200 MHz	Channel 40 / 5200 MHz
	
Channel 48 / 5240 MHz	Channel 48 / 5240 MHz

26dB Emission Bandwidth	
IEEE 802.11n HT40	
Antenna Chain 1	Antenna Chain 2
	
Channel 38 / 5190 MHz	Channel 38 / 5190 MHz
	
Channel 46 / 5230 MHz	Channel 46 / 5230 MHz

26dB Emission Bandwidth	
IEEE 802.11ac VHT40	
Antenna Chain 1	Antenna Chain 2
	
Channel 38 / 5190 MHz	Channel 38 / 5190 MHz
	
Channel 46 / 5230 MHz	Channel 46 / 5230 MHz

26dB Emission Bandwidth	
IEEE 802.11ac VHT80	
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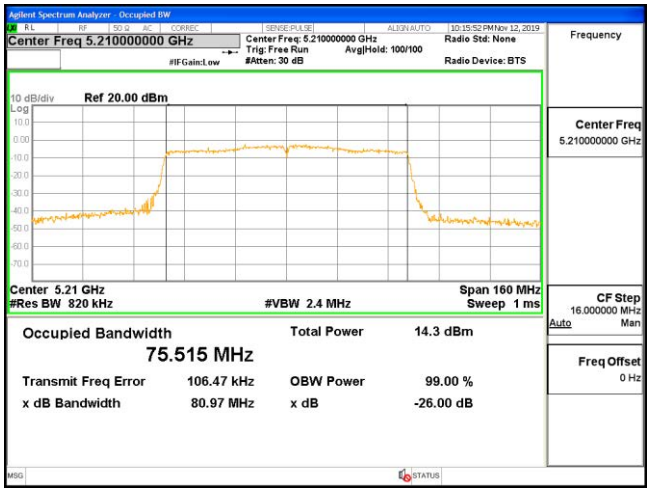
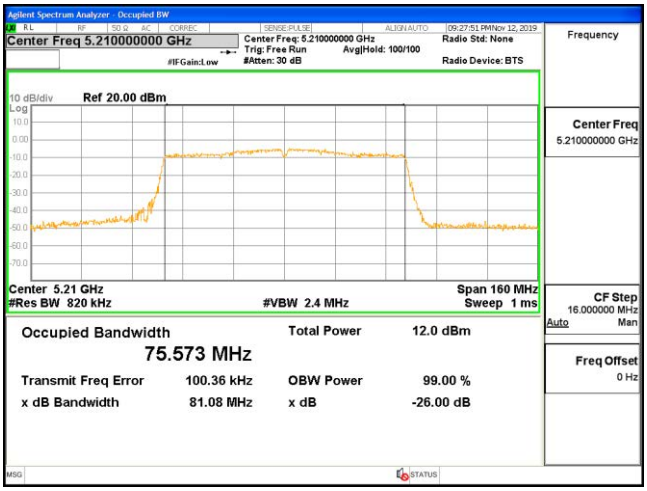
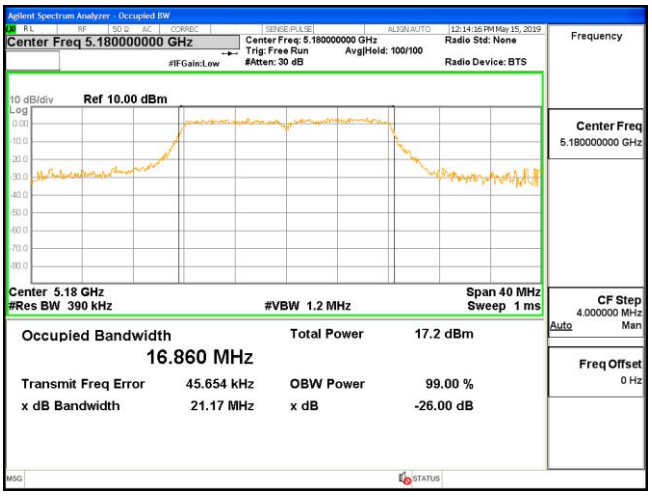
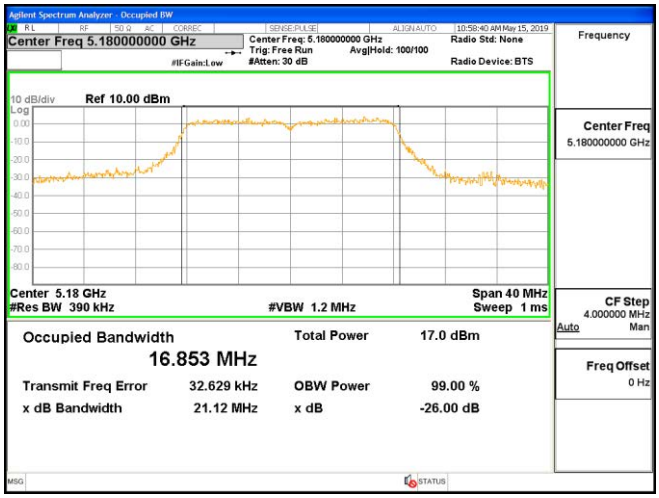
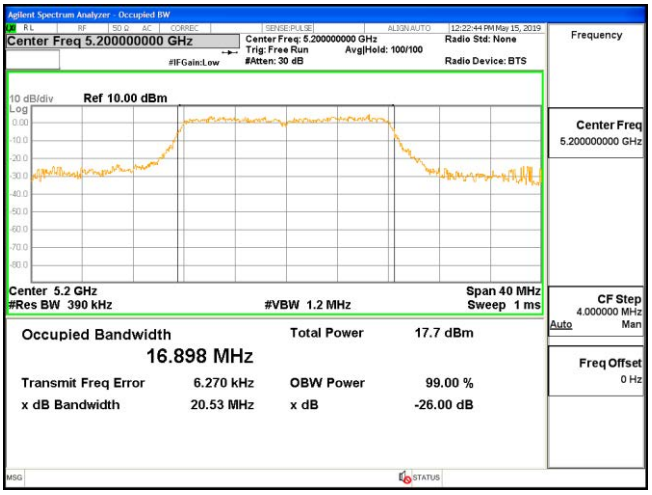
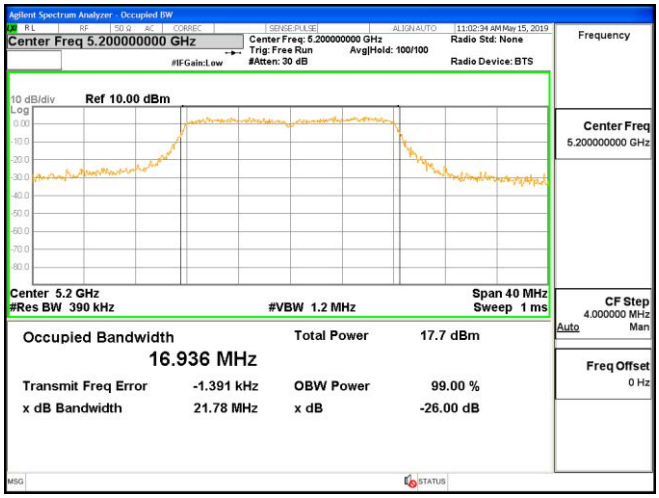
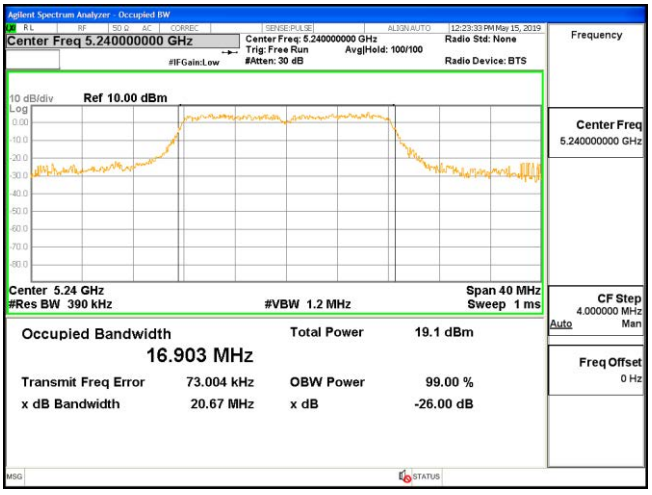
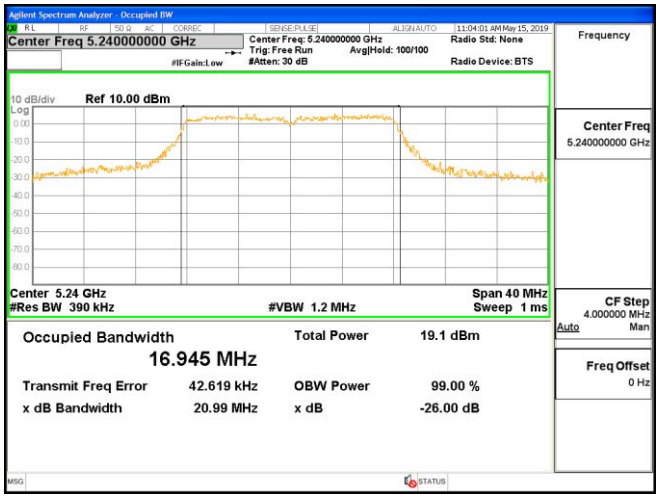
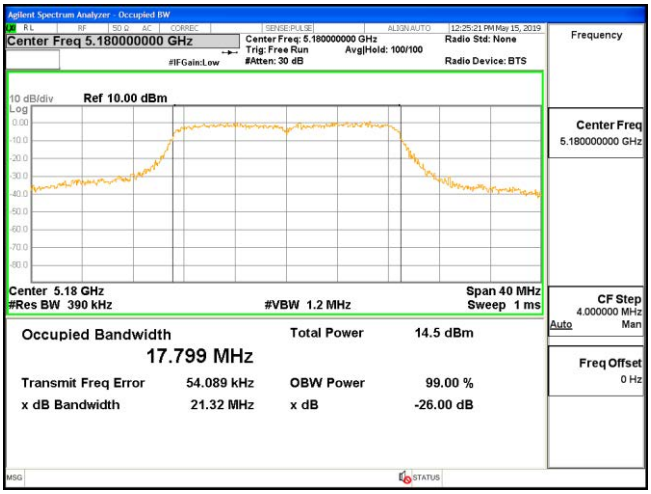
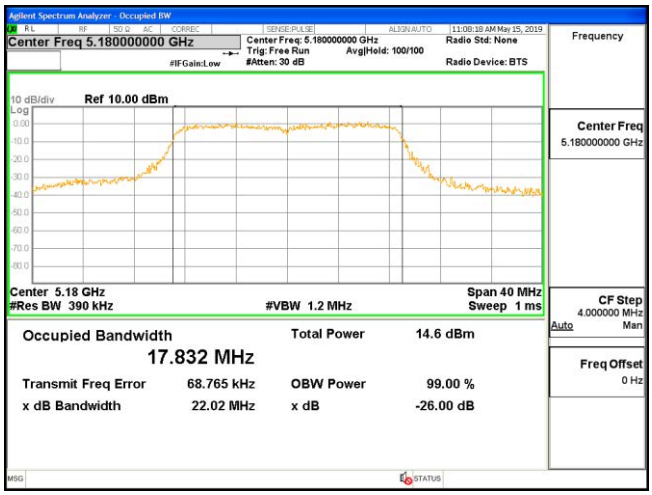
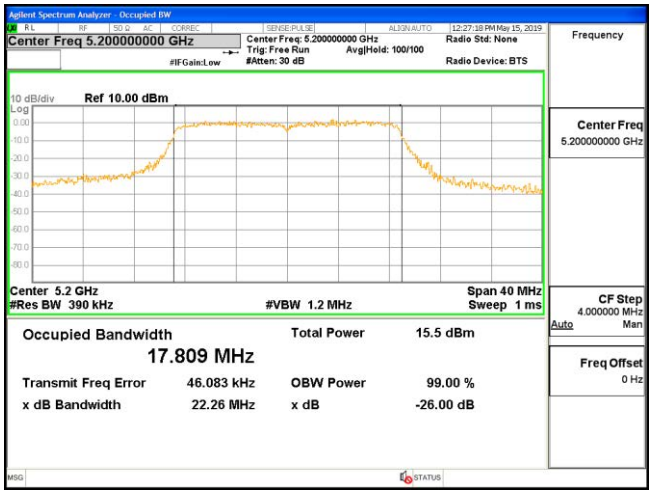
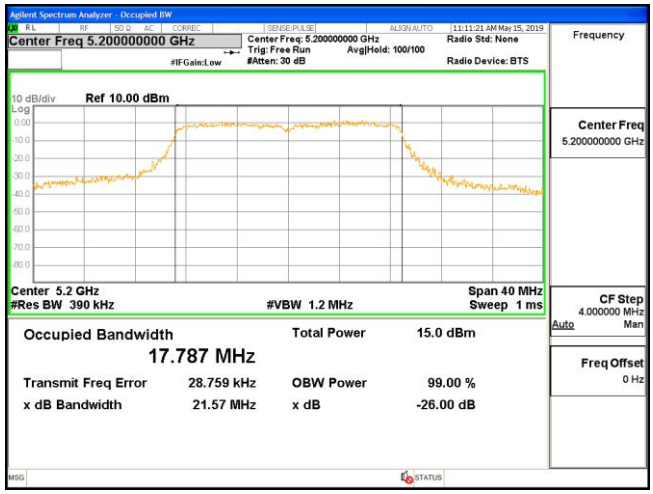
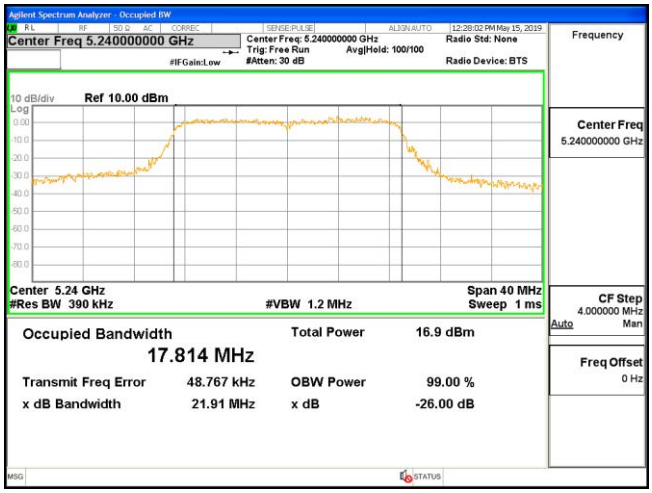
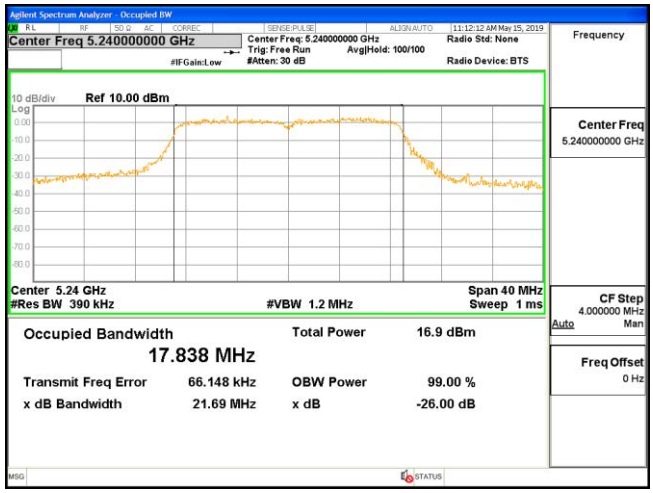
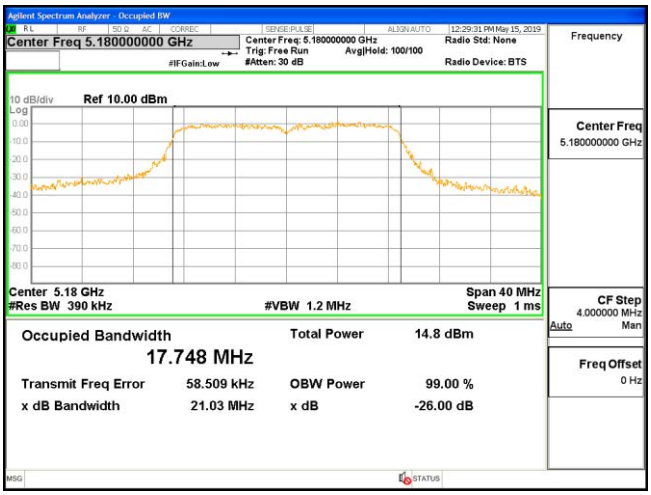
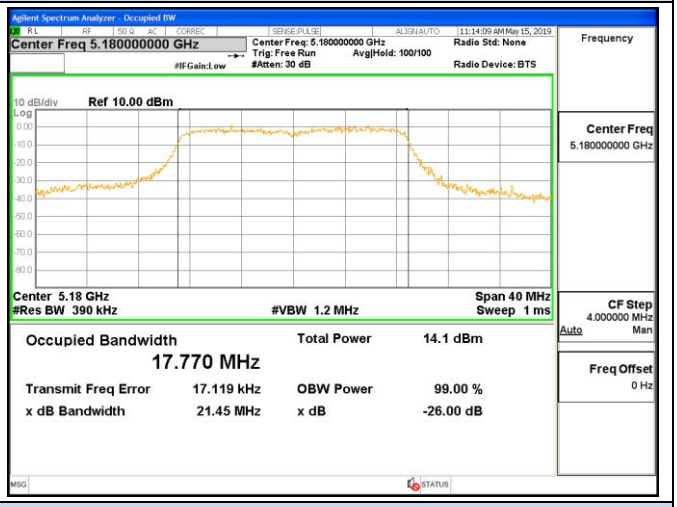
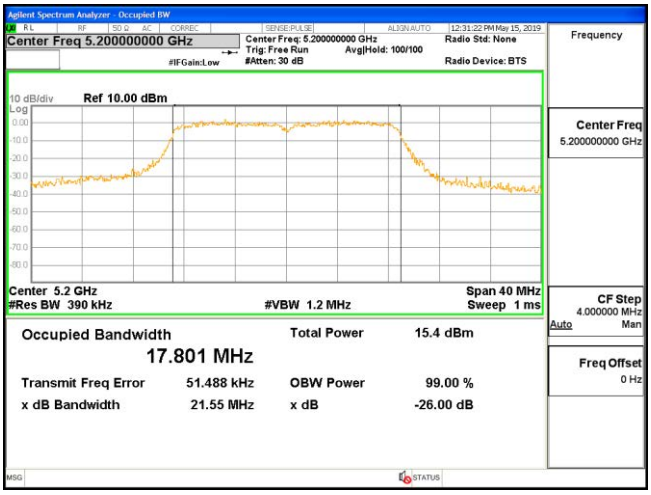
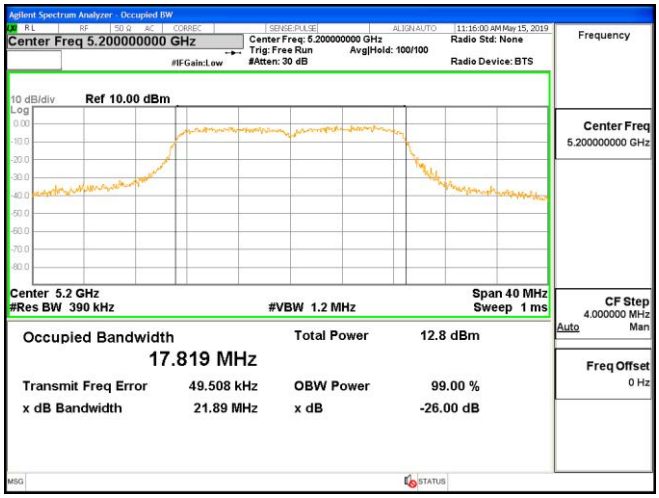
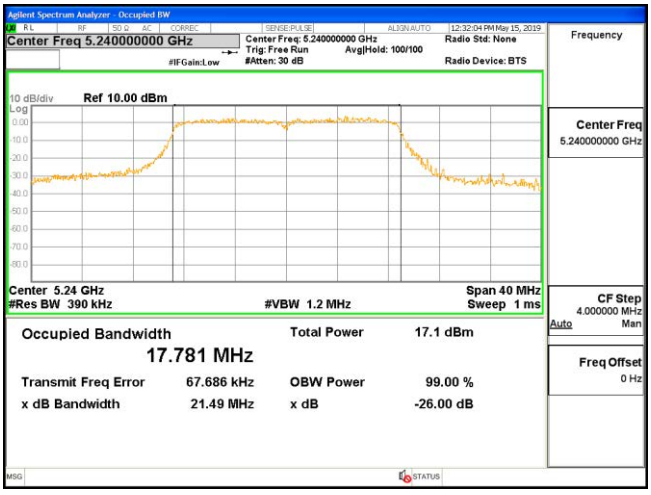
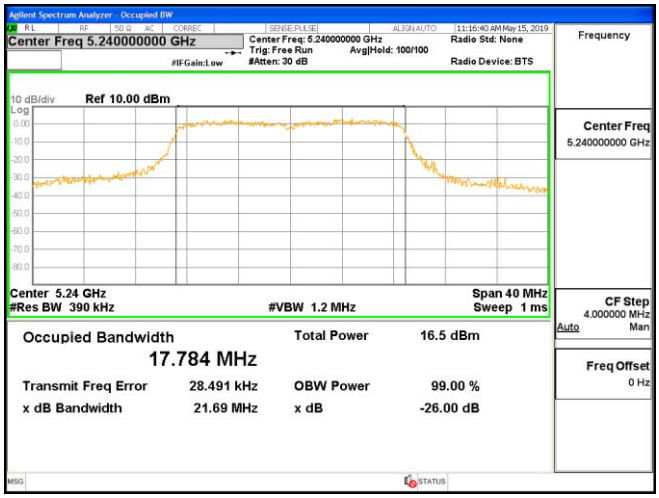
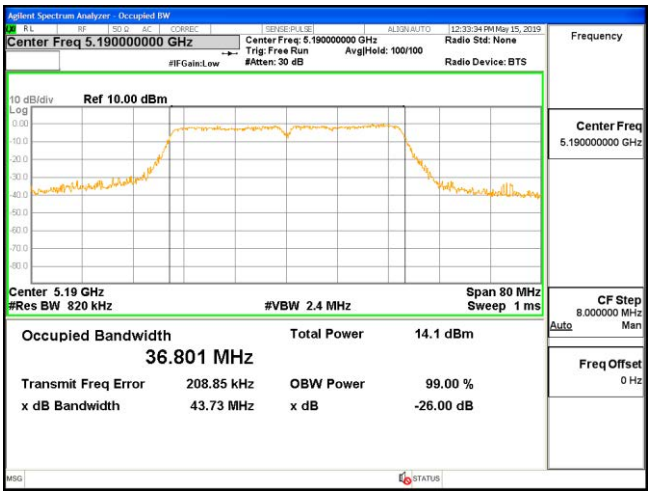
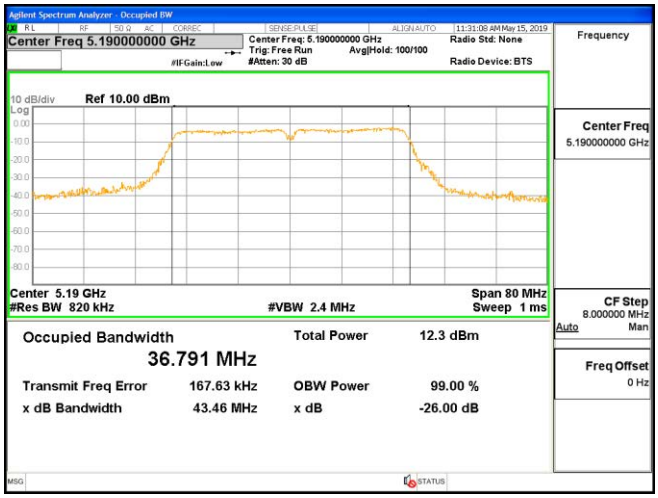
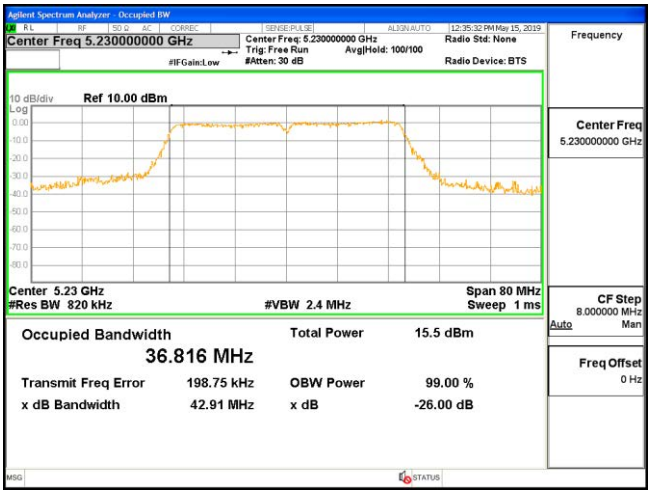
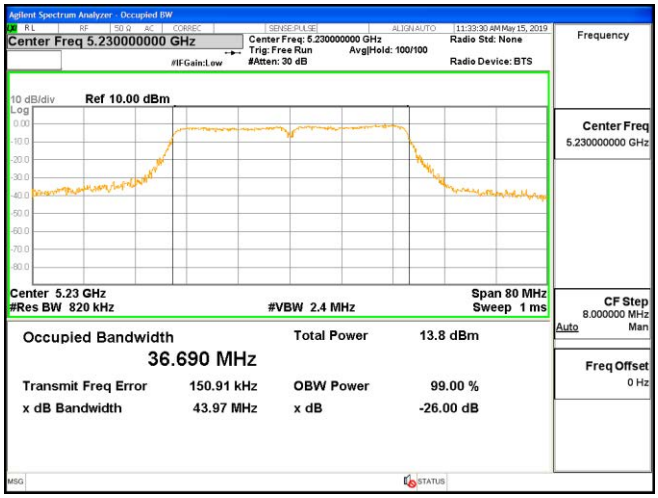
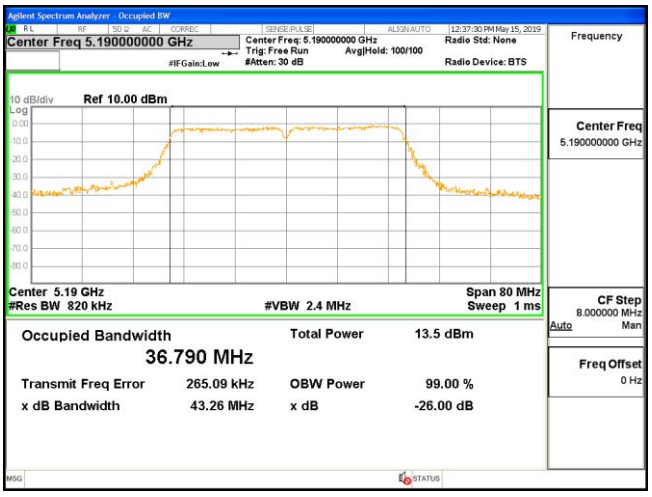
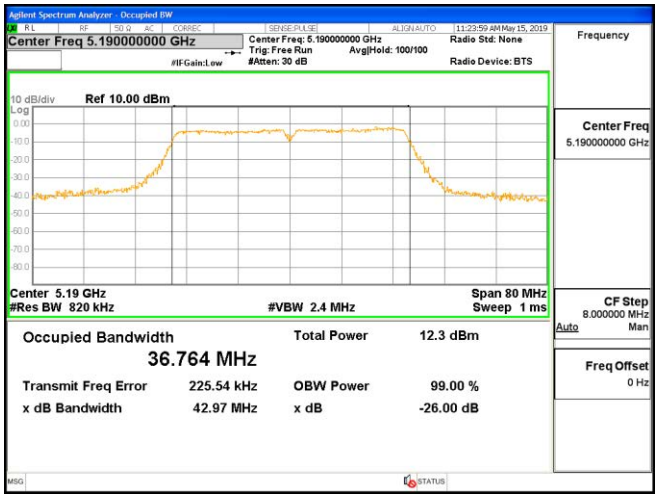
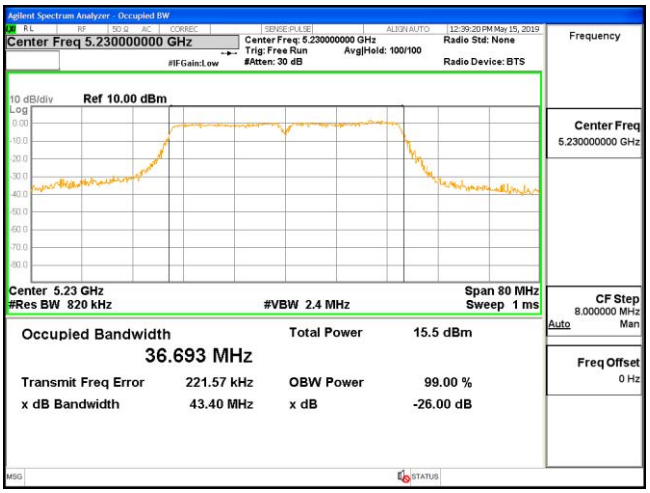
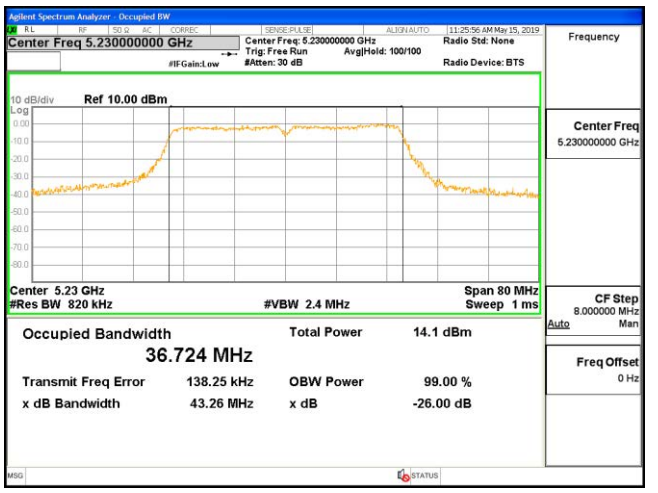
	
Channel 42 / 5210 MHz	Channel 42 / 5210 MHz

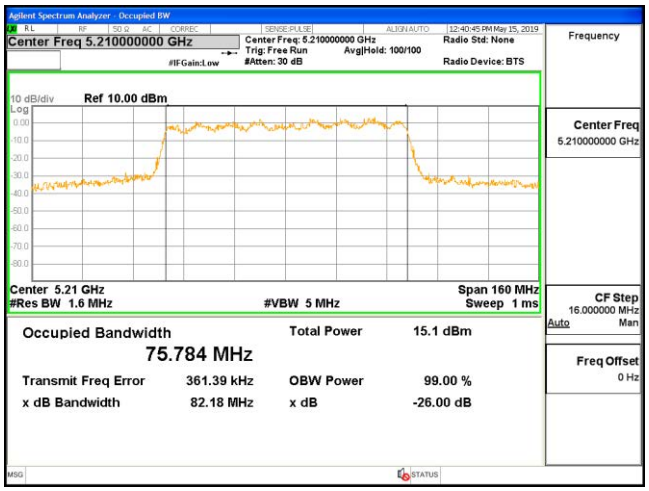
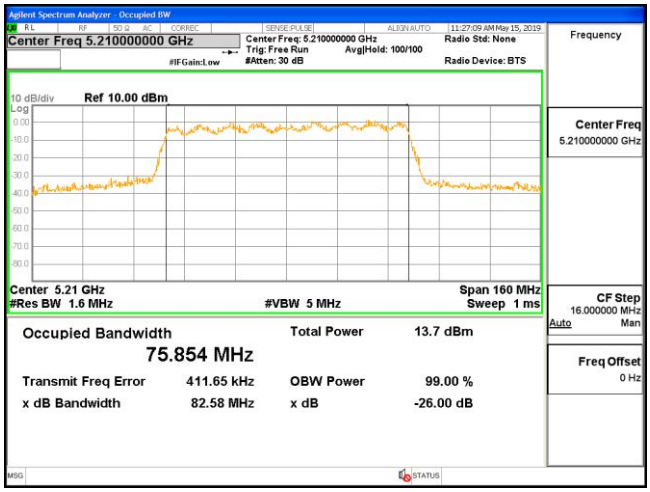
99% Occupied Bandwidth	
IEEE 802.11a	
Antenna Chain 1	Antenna Chain 2
	
Channel 36 / 5180 MHz	Channel 36 / 5180 MHz
	
Channel 40 / 5200 MHz	Channel 40 / 5200 MHz
	
Channel 48 / 5240 MHz	Channel 48 / 5240 MHz

99% Occupied Bandwidth	
IEEE 802.11n HT20	
Antenna Chain 1	Antenna Chain 2
	
Channel 36 / 5180 MHz	Channel 36 / 5180 MHz
	
Channel 40 / 5200 MHz	Channel 40 / 5200 MHz
	
Channel 48 / 5240 MHz	Channel 48 / 5240 MHz

99% Occupied Bandwidth	
IEEE 802.11ac VHT20	
Antenna Chain 1	Antenna Chain 2
	
Channel 36 / 5180 MHz	Channel 36 / 5180 MHz
	
Channel 40 / 5200 MHz	Channel 40 / 5200 MHz
	
Channel 48 / 5240 MHz	Channel 48 / 5240 MHz

99% Occupied Bandwidth	
IEEE 802.11n HT40	
Antenna Chain 1	Antenna Chain 2
	
Channel 38 / 5190 MHz	Channel 38 / 5190 MHz
	
Channel 46 / 5230 MHz	Channel 46 / 5230 MHz

99% Occupied Bandwidth	
IEEE 802.11ac VHT40	
Antenna Chain 1	Antenna Chain 2
	
Channel 38 / 5190 MHz	Channel 38 / 5190 MHz
	
Channel 46 / 5230 MHz	Channel 46 / 5230 MHz

99% Occupied Bandwidth	
IEEE 802.11ac VHT80	
Antenna Chain 1	Antenna Chain 2
	

5.5. Radiated Emissions Measurement

5.5.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
\2\ Above 38.6

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 (68.2dBuV/m at 3m).

In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

5.5.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

5.5.3. Test Procedures

1) **Sequence of testing 9 kHz to 30 MHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.5 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.