TCT 通测检测
TESTING CENTRE TECHNOLOGY

TEST REPORT

FCC ID: QAM019

Product: ActivPanel PC for Android

Model No.: PRM-ACON1-OPS

Additional Model No.: N/A

Trade Mark: Promethean

Report No.: TCT171117E038

Issued Date: Nov. 21, 2017

Issued for:

Promethean Ltd
Promethean House, Lower Philips Rd, Blackburn, Lancashire
United Kingdom

Issued By:

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1. Test Certification

Product:	ActivPanel PC for Android
Model No.:	PRM-ACON1-OPS
Additional Model No.:	N/A
Trade Mark:	**Promethean**
Applicant:	Promethean Ltd
Address:	Promethean House, Lower Philips Rd, Blackburn, Lancashire United Kingdom
Manufacturer:	Promethean Ltd
Address:	Promethean House, Lower Philips Rd, Blackburn, Lancashire United Kingdom
Date of Test:	Oct. 13, 2017 - Nov. 18, 2017
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart E Section 15.407: 2017 ANSI C63.10-2013 KDB789033 D02 General U-NII Test Procedures New Rules v01r04 KDB662911 D01 Multiple Transmitter Output v02r01 KDB662911 D02 MIMO with Cross-Polarized Antennas v01

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By:	***Jin Wang***	***Date:***	***Oct. 13, 2017***
Reviewed By:	***Joe Zhou***	***Date:***	***Nov. 18, 2017***
Approved By:	***Tomsin***	***Date:***	***Nov. 21, 2017***

2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203	PASS
AC Power Line Conducted Emission	§15.207	PASS
Maximum Conducted Output Power	§15.407(a) §2.1046	PASS
6dB Emission Bandwidth	§15.407(a) §2.1049	PASS
26dB Emission Bandwidth& 99% Occupied Bandwidth	§15.407(a) §2.1049	PASS
Power Spectral Density	§15.407(a)	PASS
Band edge	§15.407(a)	PASS
Radiated Emission	§15.407(a) §2.1053	PASS
Frequency Stability	§15.407(g) §2.1055	PASS

Note:

1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

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3. EUT Description

Product:	ActivPanel PC for Android
Model No.:	PRM-ACON1-OPS
Additional Model No.:	N/A
Trade Mark:	**Promethean**
Operation Frequency:	Band I: 5180MHz-5240MHz; 5190MHz-5230MHz;5210 MHz Band IV: 5745MHz-5825MHz; 5755MHz-5795MHz; 5775 MHz
Channel Bandwidth:	802.11a/n(HT20): 20MHz 802.11n(HT40): 40MHz 802.11ac(HT80): 80MHz
Modulation Technology:	Orthogonal Frequency Division Multiplexing(OFDM)
Modulation Type	64QAM, 16QAM, BPSK, QPSK
Antenna Type:	2 Transmit, 2 Receive
Antenna Gain:	3.00 dBi
Power Supply:	DC 12-19V
Adapter:	-

NOTE:802.11a SISO mode only,802.11n/802.11ac MIMO mode only
Directional gain of MIMO mode is 3+10log2=6dBi
802.11ac only have 80MHz mode

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Operation Frequency each of channel

20MHz		40MHz		80MHz	
Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180	38	5190	42	5210
40	5200	46	5230	155	5775
44	5220	151	5755		
48	5240	159	5790		
149	5745				
153	5765				
157	5785				
161	5805				
165	5825				

Note:

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

For 802.11a/n (HT20)

Band I (5150 - 5250 MHz)			Band IV (5725 - 5850 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
36	Low	5180	149	Low	5745
40	Mid	5200	157	Mid	5785
48	High	5240	165	High	5825

For 802.11n (HT40)

Band I (5150 - 5250 MHz)			Band IV (5725 - 5850 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
38	Low	5190	151	Low	5755
46	High	5230	159	High	5795

For 802.11n (HT80)

Band I (5150 - 5250 MHz)			Band IV (5725 - 5850 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
42	Mid	5210	155	Mid	5775

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4. Genera Information

4.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 100%)
The sample was placed 0.8m/1.5m for blow/above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:	
Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.	
Mode	Data rate
802.11a	6 Mbps
802.11n(HT20)	MCS0
802.11n(HT40)	MCS0
802.11ac(HT80)	MCS0
Final Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation

4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3. For conducted measurements (Output Power, Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

5. Facilities and Accreditations

5.1. Facilities

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

- FCC - Registration No.: 645098
  Shenzhen Tongce Testing Lab
  The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.
- IC - Registration No.: 10668A-1
  The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

5.2. Location

Shenzhen Tongce Testing Lab
Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China
TEL: +86-755-27673339

5.3. Measurement Uncertainty

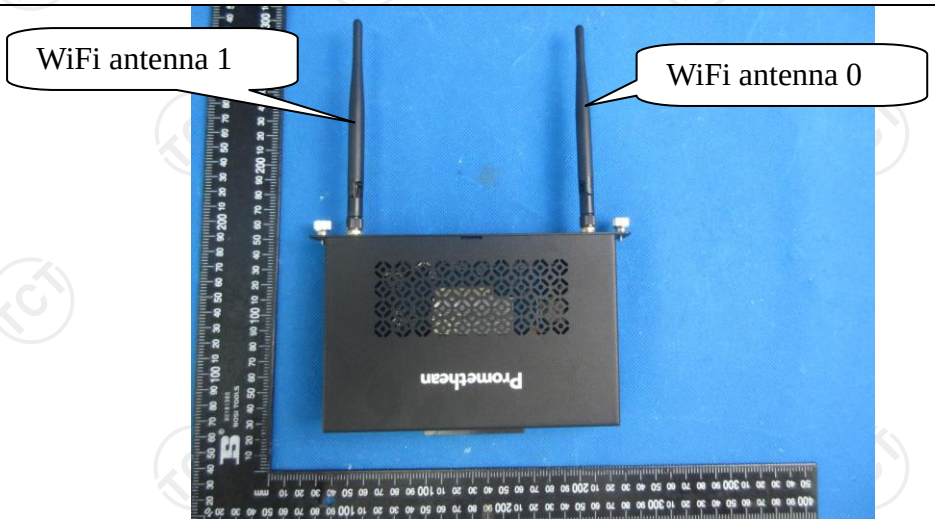
The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	±2.56dB
2	RF power, conducted	±0.12dB
3	Spurious emissions, conducted	±0.11dB
4	All emissions, radiated(<1G)	±3.92dB
5	All emissions, radiated(>1G)	±4.28dB
6	Temperature	±0.1°C
7	Humidity	±1.0%

6. Test Results and Measurement Data

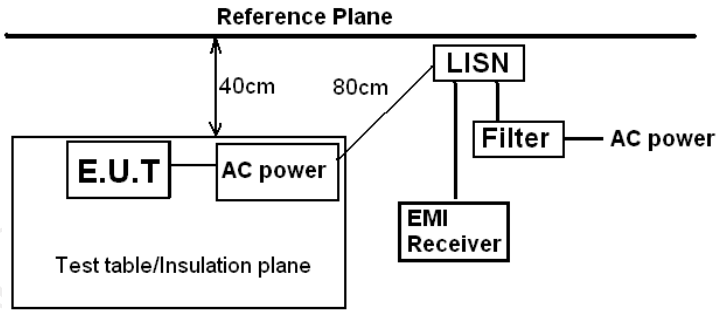
6.1. Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.	
E.U.T Antenna:	
The directional gain of the antenna is 6 dBi, please refer to the below antenna photo.	



6.2. Conducted Emission

6.2.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.207</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Frequency Range:</td><td>150 kHz to 30 MHz</td></tr>
<tr><td>Receiver setup:</td><td>RBW=9 kHz, VBW=30 kHz, Sweep time=auto</td></tr>
<tr><td>Limits:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
</td></tr>
<tr><td>Test Setup:</td><td>


Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m
</td></tr>
<tr><td>Test Mode:</td><td>Tx Mode</td></tr>
<tr><td>Test Procedure:</td><td>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.
2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).
3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</td></tr>
<tr><td>Test Result:</td><td>PASS</td></tr>
</table>

6.2.2. Test Instruments

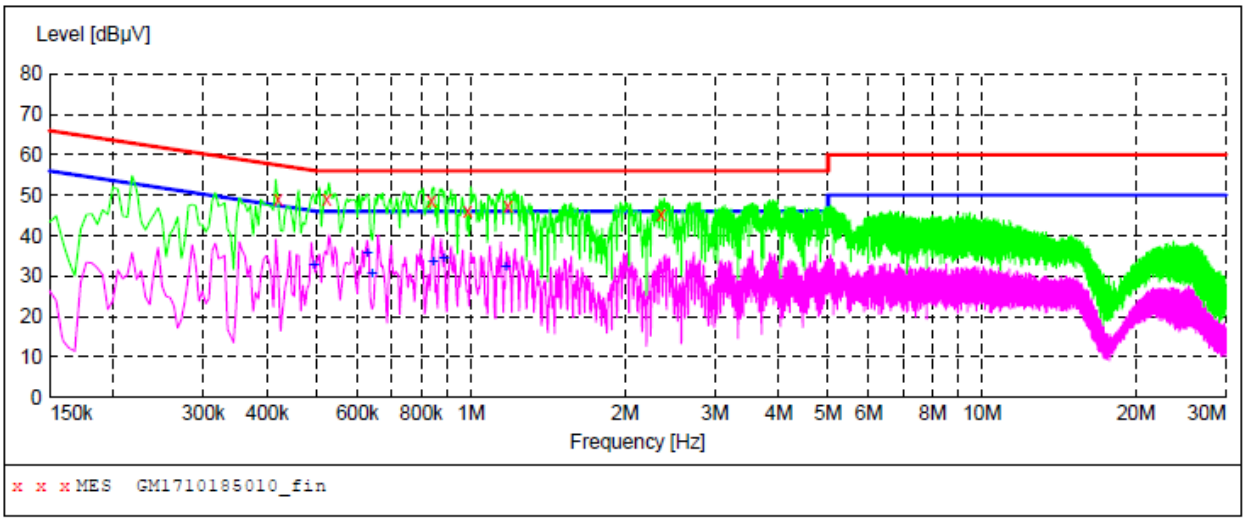
Conducted Emission Shielding Room Test Site (843)				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Test Receiver	R&S	ESPI	101401	Jun. 12, 2018
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 27, 2018
Coax cable (9KHz-30MHz)	TCT	CE-05	N/A	Sep. 27, 2018
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.2.3. Test data

Please refer to following diagram for individual

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)

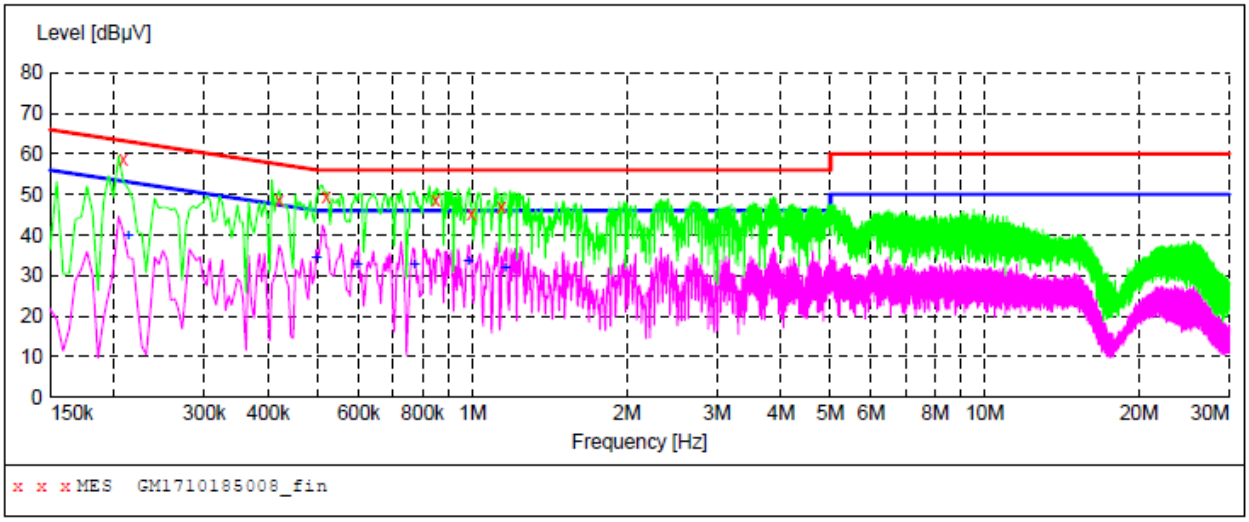


Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.420000	49.20	10.2	57	8.2	QP	L1	GND
0.523500	49.10	10.2	56	6.9	QP	L1	GND
0.838500	48.60	10.1	56	7.4	QP	L1	GND
0.987000	46.10	10.2	56	9.9	QP	L1	GND
1.180500	47.40	10.2	56	8.6	QP	L1	GND
2.355000	45.20	10.2	56	10.8	QP	L1	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.492000	32.50	10.2	46	13.6	AV	L1	GND
0.627000	35.40	10.2	46	10.6	AV	L1	GND
0.640500	30.70	10.2	46	15.3	AV	L1	GND
0.843000	33.40	10.1	46	12.6	AV	L1	GND
0.883500	34.20	10.1	46	11.8	AV	L1	GND
1.167000	32.20	10.2	46	13.8	AV	L1	GND

Remark:
Transd = Cable lose+ PULSE LIMITER factor + ARTIFICIAL MAINS factor; Margin= Limit - Level

Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



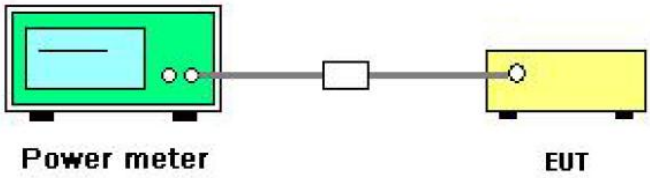
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.208500	58.60	10.3	63	4.7	QP	N	GND
0.420000	48.40	10.2	57	9.0	QP	N	GND
0.519000	49.30	10.2	56	6.7	QP	N	GND
0.847500	48.40	10.1	56	7.6	QP	N	GND
0.996000	45.40	10.2	56	10.6	QP	N	GND
1.140000	46.80	10.2	56	9.2	QP	N	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.213000	39.70	10.3	53	13.4	AV	N	GND
0.496500	34.50	10.2	46	11.6	AV	N	GND
0.595500	32.80	10.2	46	13.2	AV	N	GND
0.771000	32.80	10.2	46	13.2	AV	N	GND
0.982500	33.70	10.2	46	12.3	AV	N	GND
1.158000	31.70	10.2	46	14.3	AV	N	GND

Remark:
Transd = Cable lose+ PULSE LIMITER factor + ARTIFICIAL MAINS factor; Margin= Limit - Level

6.3. Maximum Conducted Output Power

6.3.1. Test Specification

Test Requirement:	FCC Part15 E Section 15.407(a)& Part 2 J Section 2.1046
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section E
Limit:	Frequency Band (MHz) / Limit 5150-5250 / 250mW for client devices 5725-5850 / 1 W
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows the Measurement Procedure of KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section E, 3, a 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 5. Measure the conducted output power and record the results in the test report.
Test Result:	PASS
Remark:	Conducted output power= measurement power +10log(1/x) X is duty cycle=1, so 10log(1/1)=0 Conducted output power= measurement power

6.3.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
Power Meter	Agilent	N1911A	MY45101557	Sep. 27, 2018
Power Sensor	Agilent	N1922A	MY44124432	Sep. 27, 2018
RF Cable (9KHz-40GHz)	TCT	RE-03	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-03	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.3.3. Test Data

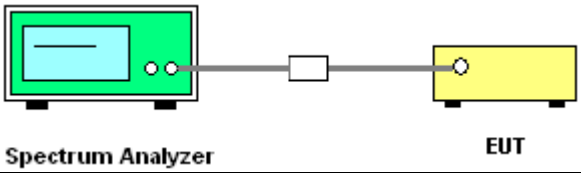
Configuration Band I (5150 - 5250 MHz)						
Mode	Test channel	Maximum Conducted Output Power (dBm)			FCC Limit (dBm)	Result
		Antenna 0	Antenna 1	Total Power		
11a	CH36	16.95	16.69	-	24	PASS
11a	CH40	11.39	17.04	-	24	PASS
11a	CH48	11.66	16.68	-	24	PASS
11n(HT20)	CH36	16.17	17.23	19.74	24	PASS
11n(HT20)	CH40	10.42	16.06	17.14	24	PASS
11n(HT20)	CH48	10.73	15.64	16.82	24	PASS
11n(HT40)	CH38	12.16	18.18	19.17	24	PASS
11n(HT40)	CH46	11.07	16.66	17.76	24	PASS
11ac(HT80)	CH42	15.67	18.30	20.20	24	PASS

Configuration Band IV (5725 - 5850 MHz)						
Mode	Test channel	Maximum Conducted Output Power (dBm)			FCC Limit (dBm)	Result
		Antenna 0	Antenna 1	Total Power		
11a	CH149	17.61	15.93	-	30	PASS
11a	CH157	16.90	15.57	-	30	PASS
11a	CH165	16.29	15.34	-	30	PASS
11n(HT20)	CH149	16.31	14.88	18.67	30	PASS
11n(HT20)	CH157	16.34	14.77	18.62	30	PASS
11n(HT20)	CH165	15.59	14.44	18.05	30	PASS
11n(HT40)	CH151	16.03	15.87	18.96	30	PASS
11n(HT40)	CH159	16.11	15.46	18.82	30	PASS
11ac(HT80)	CH155	15.58	15.02	18.32	30	PASS

Note：802.11a is SISO mode only, 802.11n/802.11ac is MIMO mode only.

6.4. 6dB Emission Bandwidth

6.4.1. Test Specification

Test Requirement:	FCC CFR47 Part 15 Section 15.407(e)& Part 2 J Section 2.1049
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section C
Limit:	>500kHz
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section C 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz. 4. Measure and record the results in the test report.
Test Result:	PASS

6.4.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
RF Cable (9KHz-40GHz)	TCT	RE-03	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-03	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.4.3. Test data

Band IV (5725 - 5850 MHz)					
Mode	Test channel	Frequency (MHz)	6 dB Bandwidth (MHz) Antenna 0 (Worst case)	Limit (MHz)	Result
11a	CH149	5745	16.07	0.5	PASS
11a	CH157	5785	16.08	0.5	PASS
11a	CH161	5825	16.10	0.5	PASS
11n(HT20)	CH149	5745	16.53	0.5	PASS
11n(HT20)	CH157	5785	16.64	0.5	PASS
11n(HT20)	CH161	5825	16.09	0.5	PASS
11n(HT40)	CH151	5755	35.52	0.5	PASS
11n(HT40)	CH159	5795	35.68	0.5	PASS
11ac(HT80)	CH155	5775	75.17	0.5	PASS

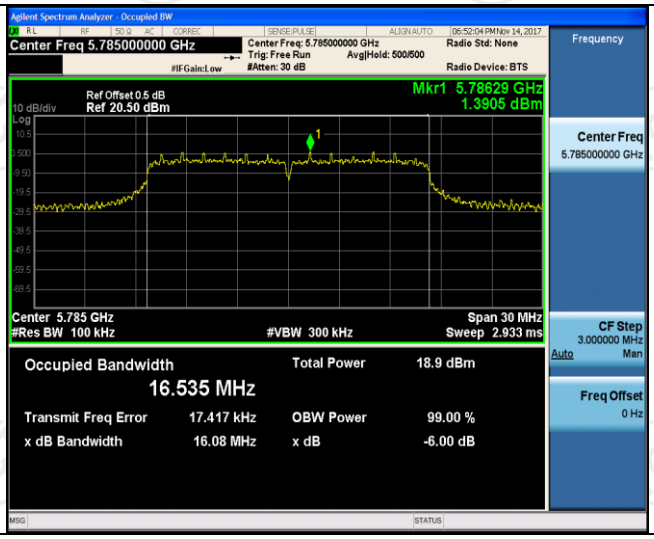
Band IV (5725 - 5850 MHz)					
Mode	Test channel	Frequency (MHz)	6 dB Bandwidth (MHz) Antenna 1 (Worst case)	Limit (MHz)	Result
11a	CH149	5745	15.76	0.5	PASS
11a	CH157	5785	16.06	0.5	PASS
11a	CH161	5825	15.93	0.5	PASS
11n(HT20)	CH149	5745	16.32	0.5	PASS
11n(HT20)	CH157	5785	16.57	0.5	PASS
11n(HT20)	CH161	5825	16.07	0.5	PASS
11n(HT40)	CH151	5755	35.21	0.5	PASS
11n(HT40)	CH159	5795	35.67	0.5	PASS
11ac(HT80)	CH155	5775	75.18	0.5	PASS

Test plots as follows:

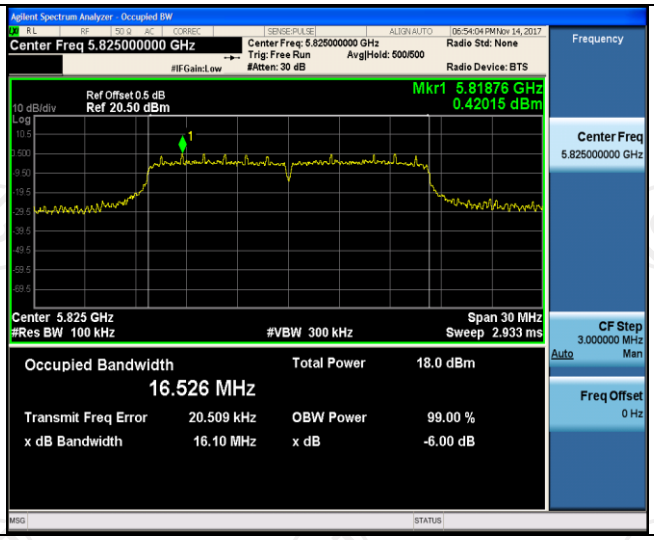
Band IV (5725 – 5850 MHz) Antenna 0

802.11a

Low

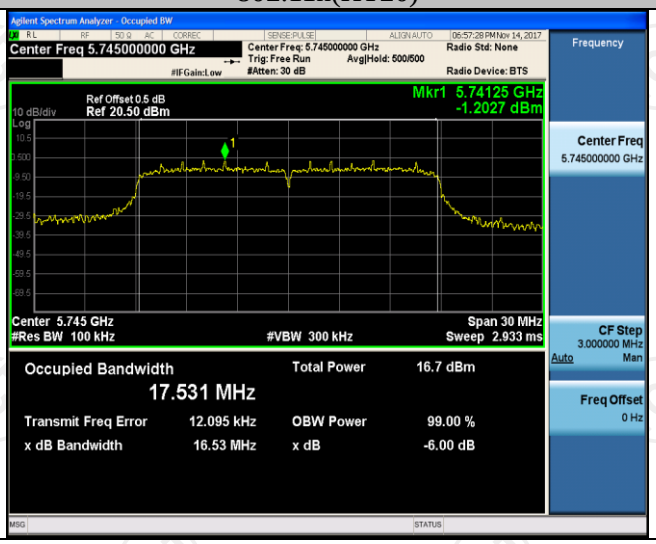


Mid

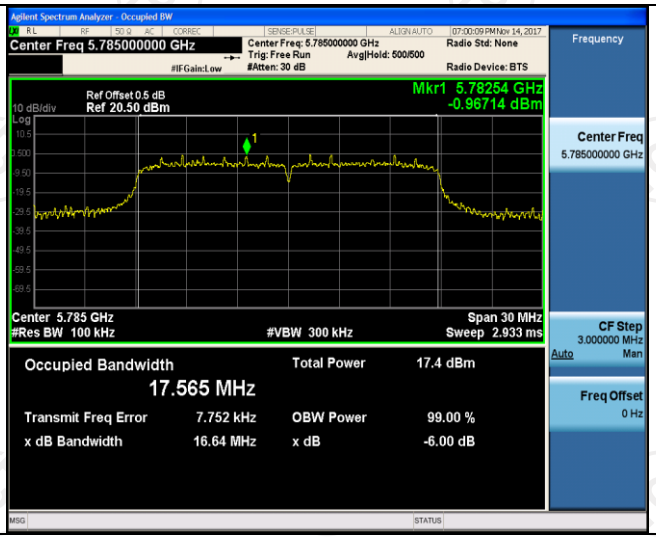


High

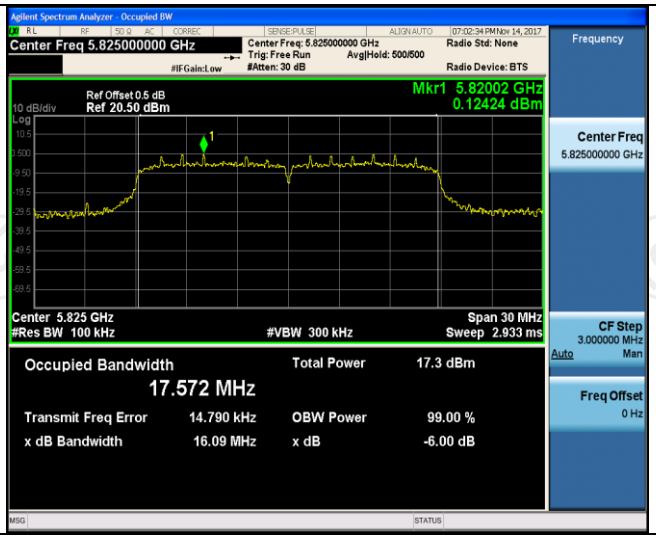
802.11n(HT20)



Low



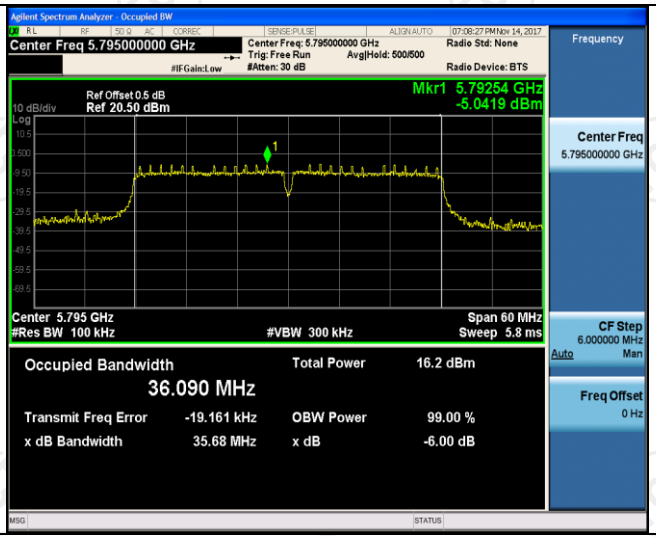
Mid



High

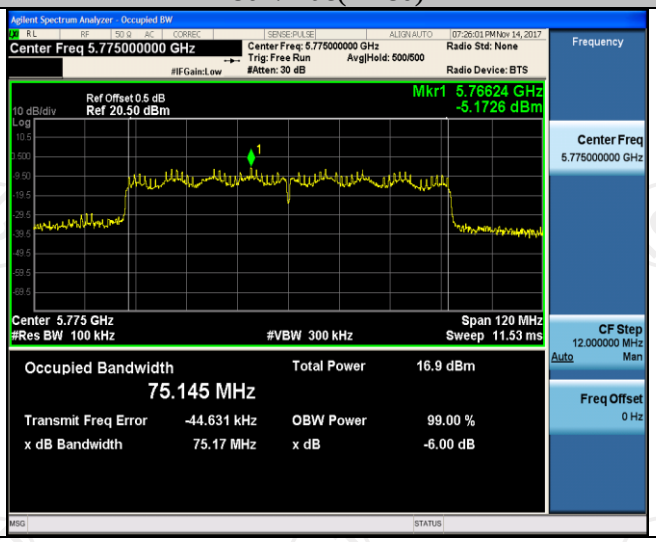
802.11n(HT40)

Low



High

802.11ac(HT80)

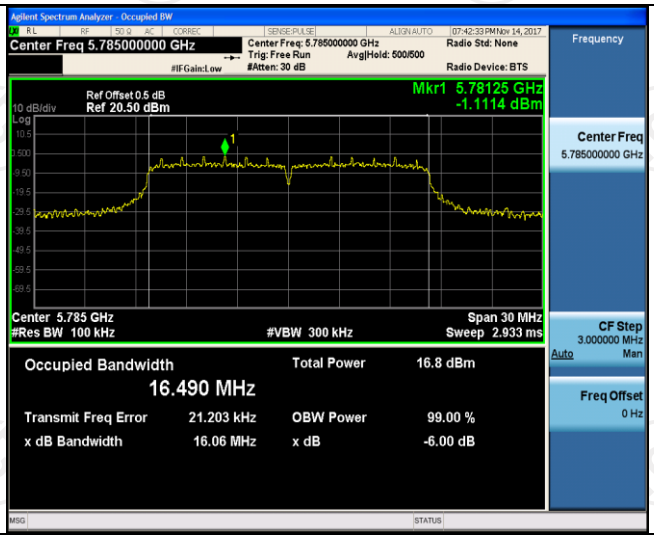


Mid

Band IV (5725 – 5850 MHz) Antenna 1

802.11a

Low



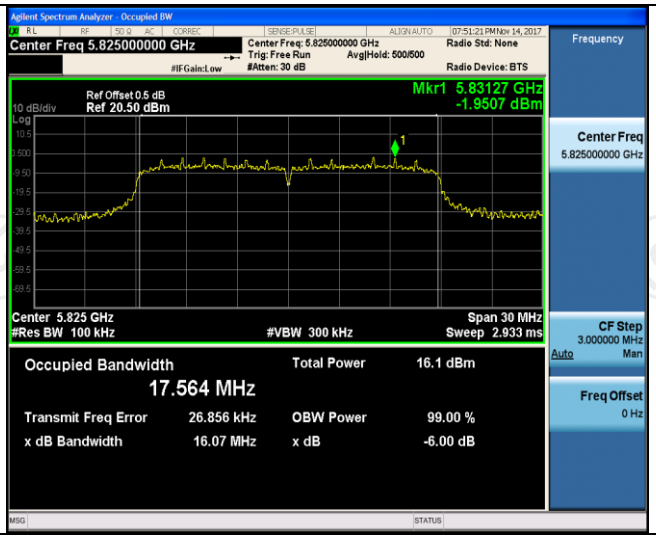
Mid

High

802.11n(HT20)

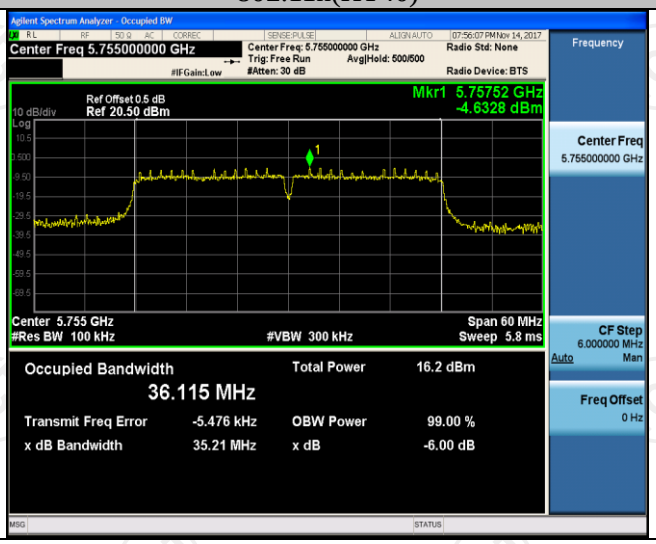
Low

Mid

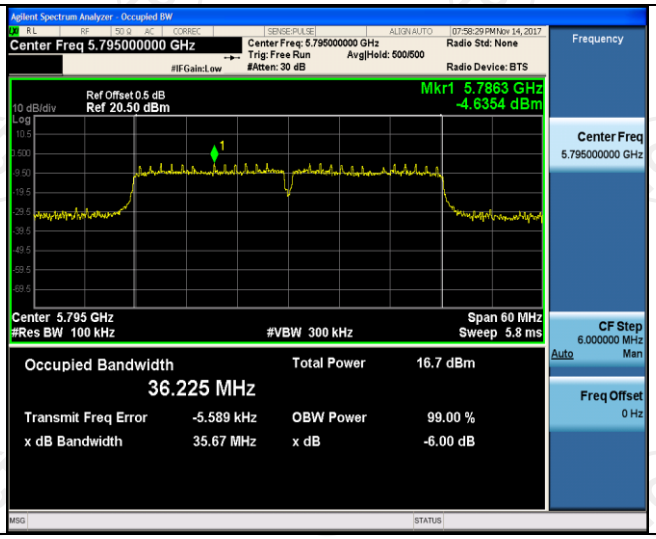


High

802.11n(HT40)

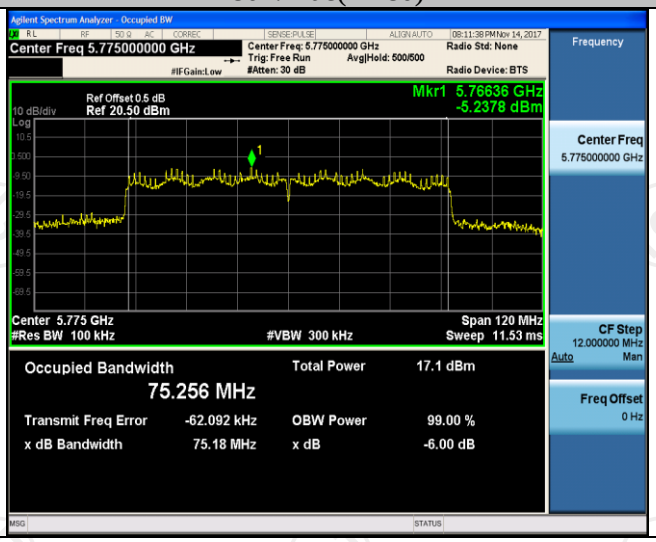


Low



High

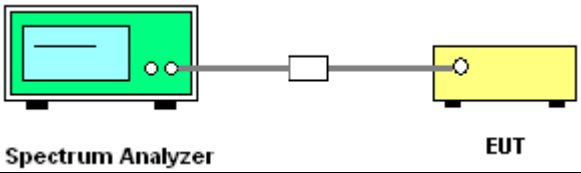
802.11ac(HT80)



Mid

6.5. 26dB Bandwidth and 99% Occupied Bandwidth

6.5.1. Test Specification

Test Requirement:	47 CFR Part 15C Section 15.407 (a)& Part 2 J Section 2.1049
Test Method:	KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section D
Limit:	No restriction limits
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. KDB789033 D02 General UNII Test Procedures New Rules v01r04 Section D 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. 4. Measure and record the results in the test report.
Test Result:	PASS

6.5.2. Test Instruments

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100060	Sep. 27, 2018
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 27, 2018
Antenna Connector	TCT	RFC-01	N/A	Sep. 27, 2018

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

6.5.3. Test data

Band I Antenna 0 (Worst case)

Mode	Test channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH36	5180	20.42	16.63
11a	CH40	5220	21.21	16.63
11a	CH48	5240	20.78	16.59
11n(HT20)	CH36	5180	20.97	17.60
11n(HT20)	CH40	5220	20.87	17.68
11n(HT20)	CH48	5240	21.41	17.64
11n(HT40)	CH38	5190	43.73	36.43
11n(HT40)	CH46	5230	43.47	36.55
11ac(HT80)	CH42	5210	81.40	75.41

Band I Antenna 1 (Worst case)

Mode	Test channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH36	5180	20.35	16.57
11a	CH40	5220	20.73	16.62
11a	CH48	5240	20.82	16.71
11n(HT20)	CH36	5180	21.78	17.67
11n(HT20)	CH40	5220	21.41	17.66
11n(HT20)	CH48	5240	21.10	17.62
11n(HT40)	CH38	5190	48.81	36.39
11n(HT40)	CH46	5230	42.83	36.47
11ac(HT80)	CH42	5210	80.68	75.06

Test plots as follows:

Band I （5150 – 5250 MHz）Antenna 0

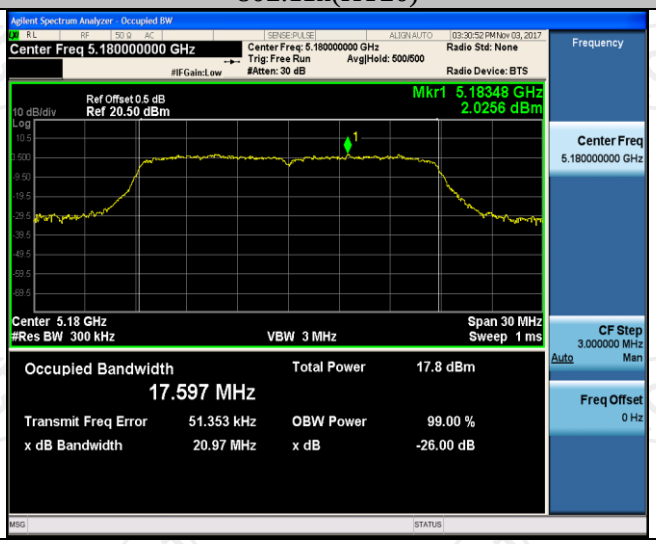
802.11a

Low

Mid

High

802.11n(HT20)

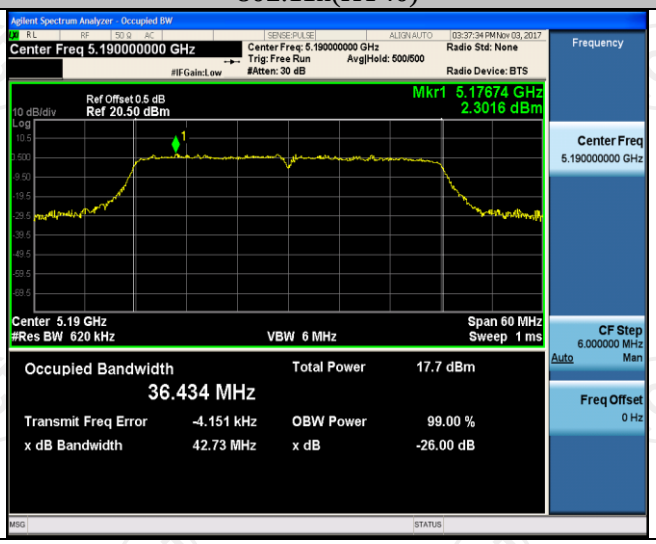


Low

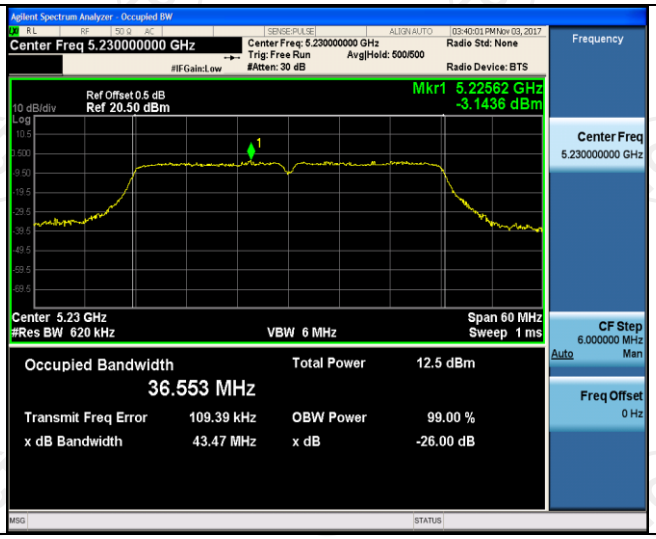
Mid

High

802.11n(HT40)

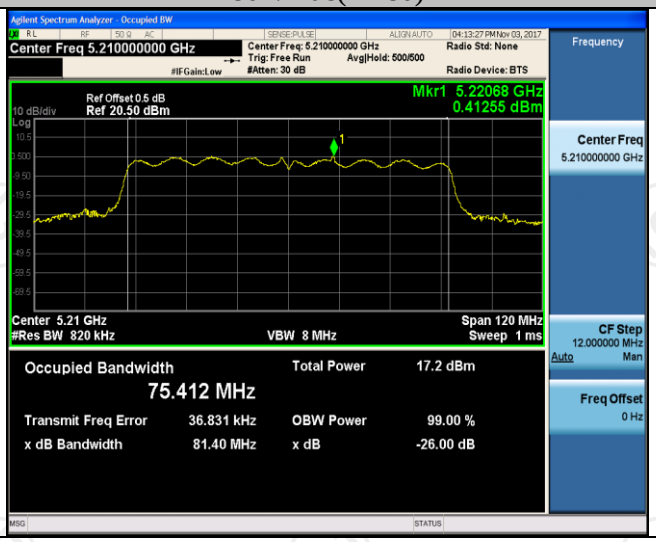


Low



High

802.11ac(HT80)



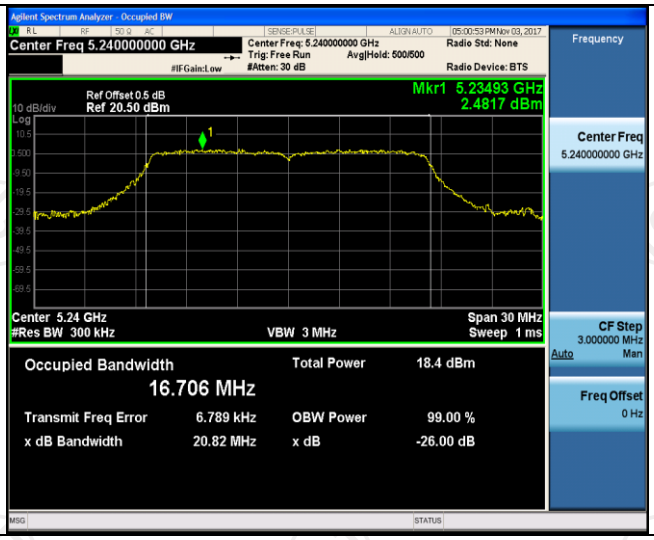
Mid

Band I （5150 – 5250 MHz）Antenna 1

802.11a

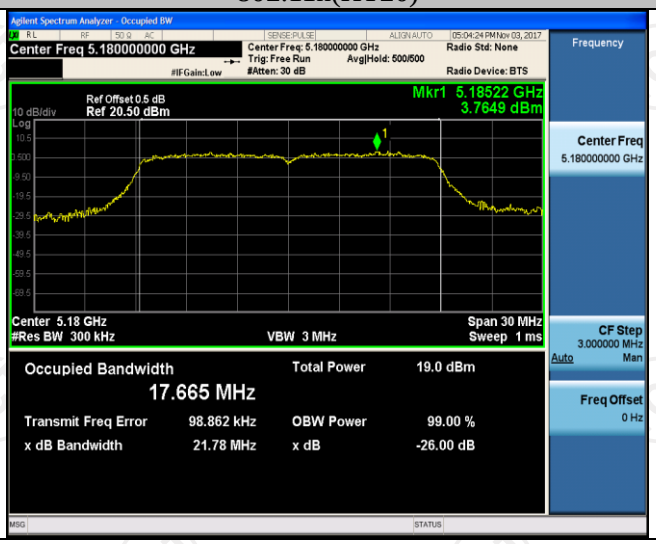
Low

Mid

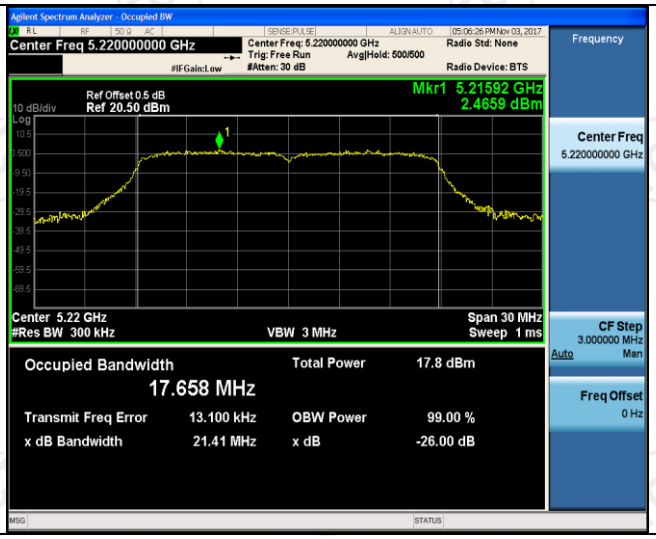


High

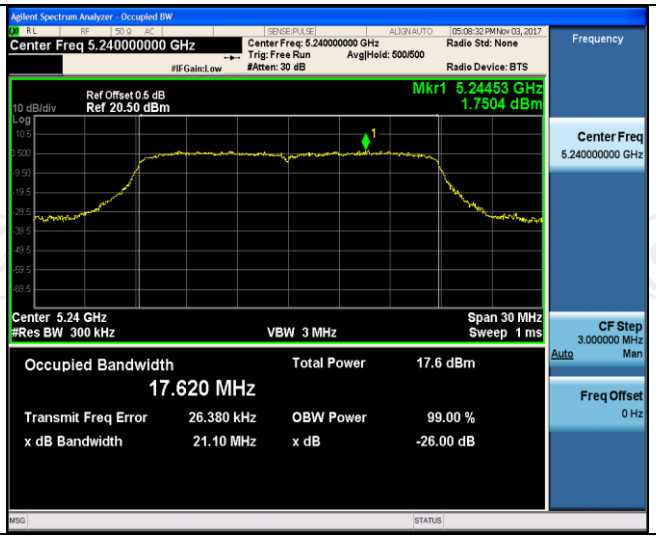
802.11n(HT20)



Low



Mid



High