REPORT No.: SZ22080397W04

TEST REPORT

APPLICANT	:	Anker Innovations Limited
PRODUCT NAME	:	Nebula Capsule 3 Laser
MODEL NAME	:	D2426
BRAND NAME	:	NEBULA
FCC ID	:	2AOKB-D2426
STANDARD(S)	:	47 CFR Part 15 Subpart E
RECEIPT DATE	:	2022-09-06
TEST DATE	:	2022-09-09 to 2022-10-12
ISSUE DATE	:	2022-10-21

Edited by: Zeng Xiaoying (Rapporteur)

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DIRECTORY

Change History		
Version	Date	Reason for change
1.0	2022-10-21	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Anker Innovations Limited
Applicant Address:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong
Manufacturer:	Anker Innovations Limited
Manufacturer Address:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong

1.2. Equipment Under Test (EUT) Description

Product Name:	Nebula Capsule 3 Laser	
Sample No.:	1#	
Hardware Version:	V0.5	
Software Version:	V11.1.16	
Modulation Technology:	OFDM	
Modulation Mode:	802.11a, 802.11n (HT20), 802.11n (HT40) 802.11ac (VHT20), 802.11ac (VHT40), 802.11ac (VHT80),	
Operating Frequency Range:	5180MHz-5240MHz; 5260MHz-5320MHz; 5500MHz-5720MHz; 5745MHz-5825MHz	
Channel Number:	Refer to 1.3	
Antenna Type:	PIFA Antenna	
Antenna Gain:	ANT 1: 4.87dBi; ANT 2: 4.96dBi	
Directional Gain:	7.97dBi(Type B)Note 2	
Accessory Information:	Battery	
	Brand Name:	N/A
	Model No.:	M3 21700M50LT-3S
	Serial No.:	N/A
	Capacity:	4700mAh
	Rated Voltage:	11.07V
	Charge Limit:	12.6V
	Manufacturer:	Guangdong Pow-Tech New Power Co.,Ltd.

Accessory Information:	AC Adapter	
	Brand Name:	XinSPower
	Model No.:	PN453I
	Serial No.:	N/A
	Rated Output:	5V⎓3A, 9V⎓3A, 12V⎓3A 15V⎓3A, 20V⎓2.25A
	Rated Input:	100-240V~50/60Hz, 1.2A
	Manufacturer:	Shenzhen Xinspower Technology Co., Ltd

Note 1: The EUT supports a MIMO function. Physically, the EUT provides two completed transmitters and two receivers for 802.11n and 802.11ac modulation mode.

Modulation Mode:	**TX Function**
802.11a	1TX
802.11n	2TX
802.11ac	2TX

Note 2: According to KDB 662911 D01, the directional gain = G_{ANT} + 10log(N_{ANT}) dBi, where G_{ANT} is the maximum antenna gain in dBi, N_{ANT} is the number of outputs.

Note 3: For conducted test item Conducted Output Power and Peak Power Spectral Density of each modulation mode, we recorded the test result of two antennas separately, for other conducted test items both of the two antennas were tested separately, we only recorded the worst test result (ANT2) in this report.

Note 4: All radiation test items for 802.11n and 802.11ac modulation mode operate at MIMO mode during the test. Other modulation mode operate at SISO mode, both of the two antennas were tested separately, we only recorded the worst test result(ANT2) in this report.

Note 5: We use the dedicated software to control the EUT continuous transmission.

Note 6: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. Modulation Type and Data Rate of EUT

Mode	Bandwidth (MHz)	Modulation Technology	Modulation Type	Data Rate	RU Size
802.11a	20	OFDM	**DBPSK**	**1**/2/5.5/11Mbps	N/A
			DQPSK		
			CCK		
802.11n	20/40 (HT20/40)	OFDM	**BPSK**	**MCS0**~MCS7	N/A
			QPSK		
			16QAM		
			64QAM		
802.11ac	20/40/80 (VHT20/40/80)	OFDM	**BPSK**	**MSC0**~MCS9	N/A
			QPSK		
			16QAM		
			64QAM		
			256QAM		

Note1: The worst-case mode(black bold) in all data rates has been determined during the pre-scan, only the test data of the worst-case were recorded in this report.

1.4. The Channel Number and Frequency

(U-NII-1) 5180MHz-5240MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**36**	**5180**	40	5200
	44	**5220**	**48**	**5240**
40MHz	**38**	**5190**	**46**	**5230**
80MHz	**42**	**5210**		
(U-NII-2A) 5260MHz-5320MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**52**	**5260**	56	5280
	60	**5300**	**64**	**5320**
40MHz	**54**	**5270**	**62**	**5310**
80MHz	**58**	**5290**		
(U-NII-2C) 5500MHz-5720MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**100**	**5500**	105	5520
	108	5540	112	5560
	116	5580	**120**	**5600**
	124	5620	128	5640
	132	5660	136	5680
	140	5700	**144**	**5720**
40MHz	**102**	**5510**	110	5550
	118	5590	**126**	**5630**
	134	5670	**142**	**5710**
80MHz	**106**	**5530**	**122**	**5610**
	138	**5690**		
(U-NII-3) 5745MHz-5825MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**149**	**5745**	153	5765
	157	**5785**	161	5805
	165	**5825**		
40MHz	**151**	**5775**	**159**	**5795**
80MHz	**155**	**5775**		

Note 1: The black bold channels were selected for test.

1.5. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart E (U-NII band) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15(5-1-14 Edition)	Radio Frequency Devices

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

No.	Section	Description	Test Date	Test Engineer	Result	Method Determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	ANSI C63.10	Duty Cycle of the Test Signal	Sep. 14, 2022	Zhong Yanshan	PASS	No deviation
3	15.407(a)	Maximum Conducted Output Power	Oct. 12, 2022	Zhong Yanshan	PASS	No deviation
4	15.407(a) (e)	Emission Bandwidth	Sep. 21&22, 2022	Zhong Yanshan	PASS	No deviation
5	15.407(a)	Peak Power Spectral Density	Sep. 22&23, 2022	Zhong Yanshan	PASS	No deviation
6	15.407(g)	Frequency Stability	Oct. 12, 2022	Zhong Yanshan	PASS	No deviation
7	15.207	Conducted Emission	Sep. 14, 2022	Wu Zhaoling	PASS	No deviation
8	15.407(b)	Restricted Frequency Bands	Sep. 19, 2022	Lin Jiayong	PASS	No deviation
9	15.407(b)	Radiated Emission	Sep. 13&19, 2022	Lin Jiayong	PASS	No deviation

Note 1: The DFS test report was documented in a separate report (Report No.: SZ22080397W05).

Note 2: The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.102013.

Note 3: These RF tests were performed according to the method of measurements prescribed in KDB789033 D02 v02r01, KDB662911 D01 v02r01.

Note 4: The path loss during the RF test is calibrated to correct the results by the offset setting in the test equipments. The ref offset 12.5dB contains two parts that cable loss 2.5dB and Attenuator 10dB.
Note 5: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.
Note 6: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

1.6. Environmental Conditions

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

Temperature (°C):	15-35
Relative Humidity (%):	30-60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR Part 15E Requirements

2.1. Antenna Requirement

2.1.1. Applicable Standard

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

2.1.2. Test Result: Compliant

Inside of the EUT has a PIFA antenna coupled with the metal shrapnel. Please refer to the EUT internal photos.

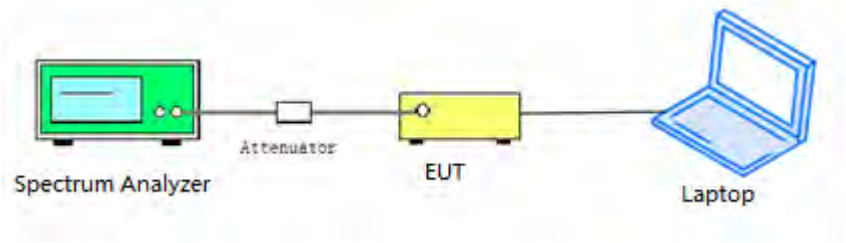
2.2. Duty Cycle of the Test Signal

2.2.1. Requirement

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be used to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data are being acquired (i.e., no transmitter OFF-time is to be considered).
When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternative procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle (D). Within this sub clause, the duty cycle refers to the fraction of time over which the transmitter is ON and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than ±2%; otherwise, the duty cycle is considered to be nonconstant.

2.2.2. Test Description

Test Setup:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

2.2.3. Test Procedure

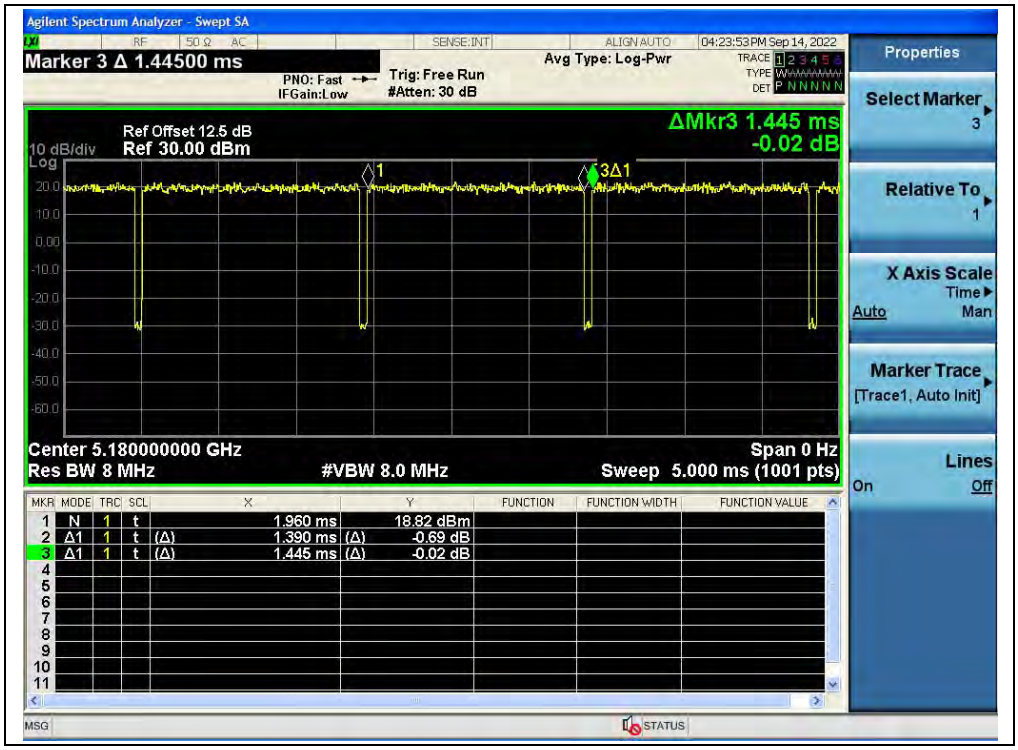
KDB 789033 Section B was used in order to prove compliance.

2.2.4. Test Result

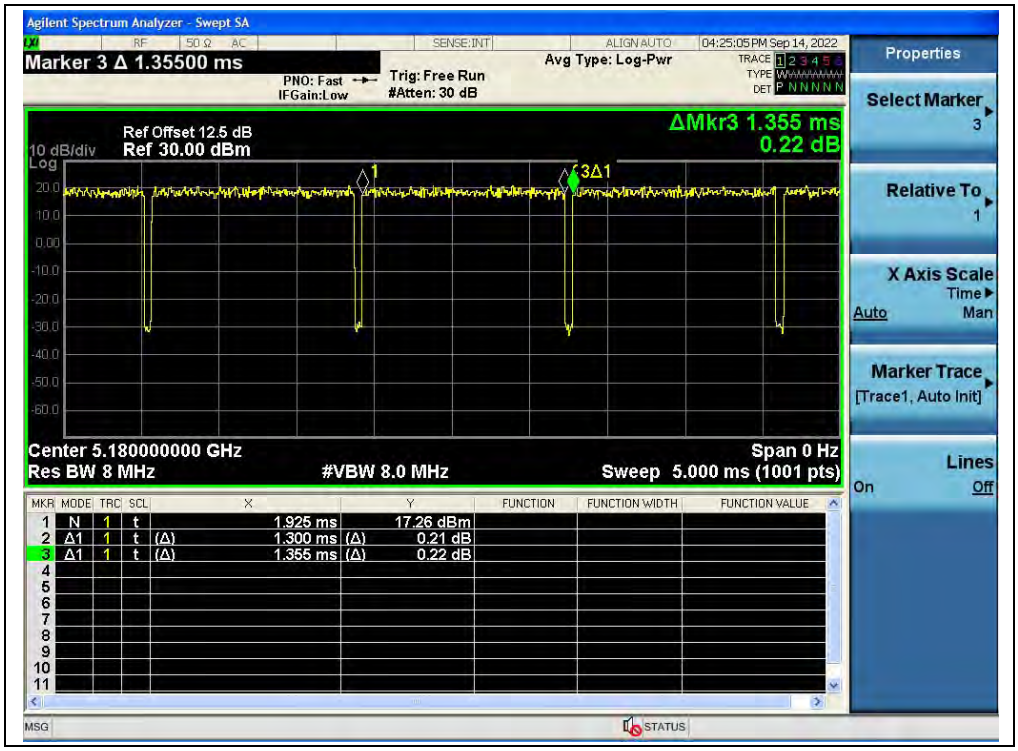
A.Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*log[1/D])
802.11a	96.19	0.17
802.11n (HT20)	95.94	0.18
802.11n (HT40)	92.31	0.35
802.11ac (VHT20)	95.97	0.18
802.11ac (VHT40)	92.34	0.35
802.11ac (VHT80)	85.71	0.67

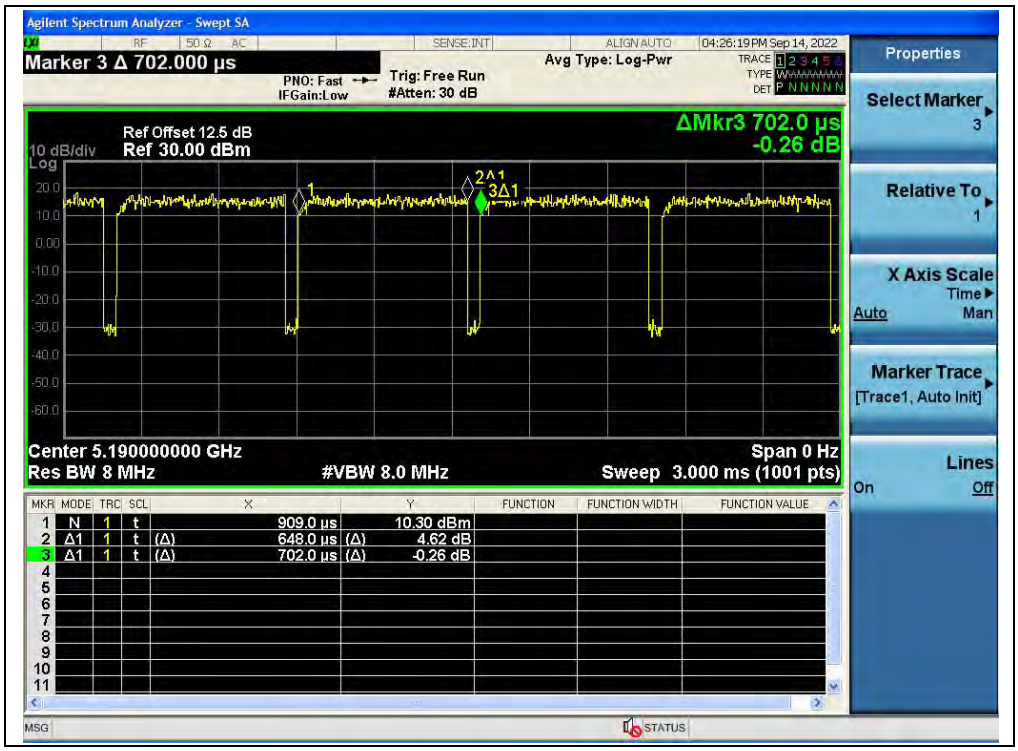
B.Test Plot:



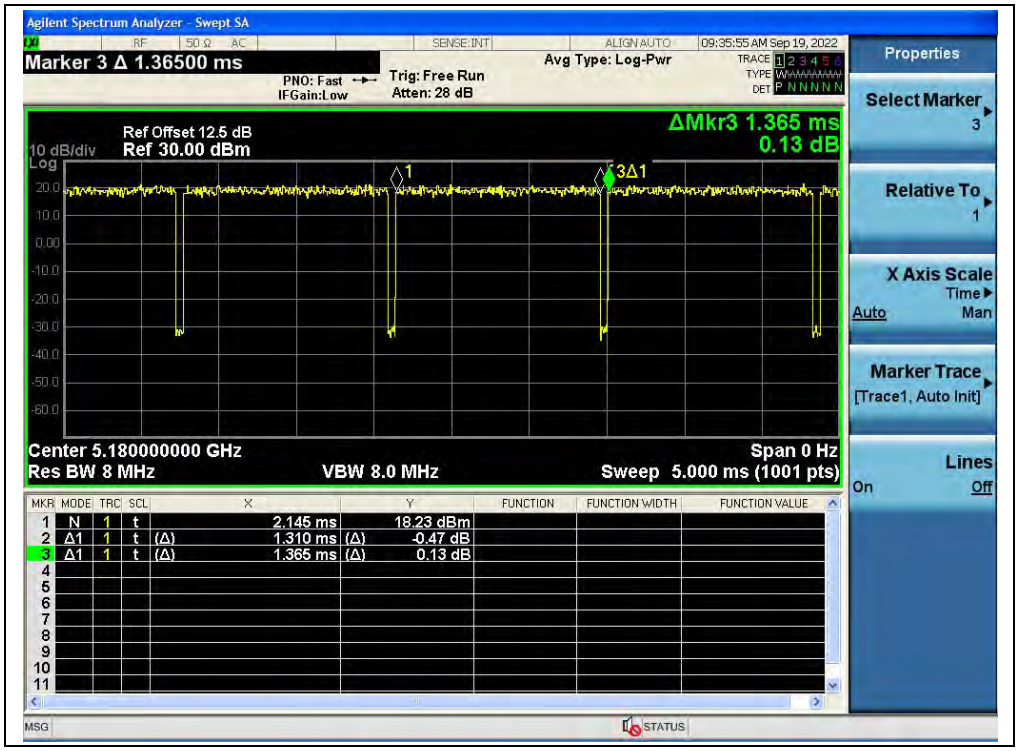
(Channel 36, 5180MHz, 802.11a)



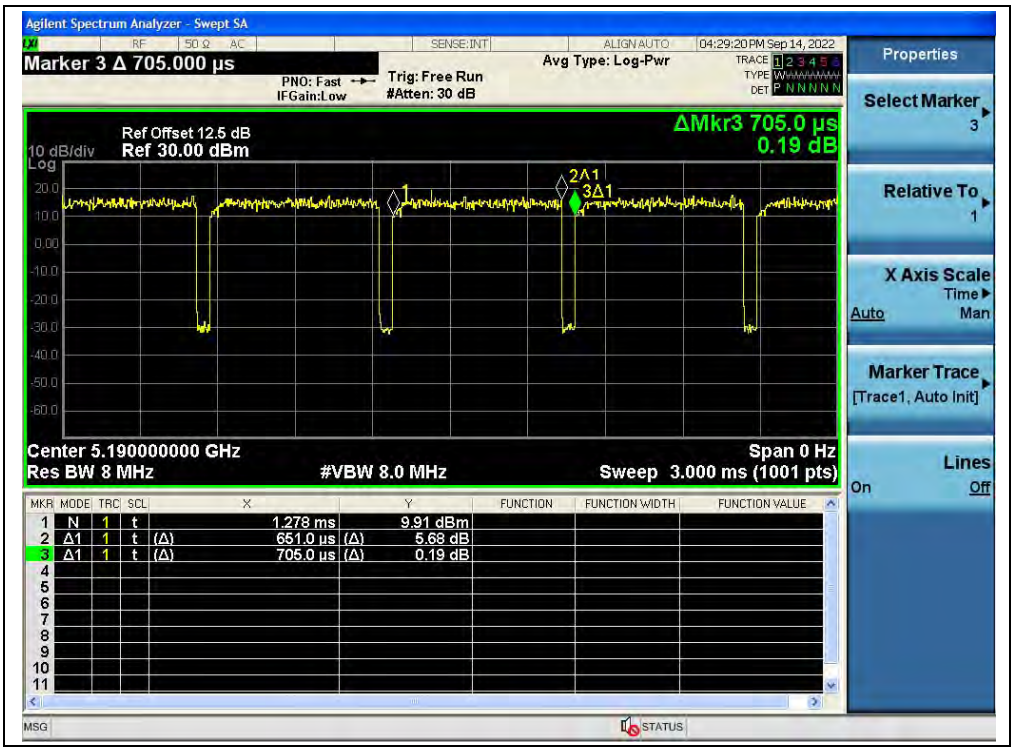
(Channel 36, 5180MHz, 802.11n (HT20))



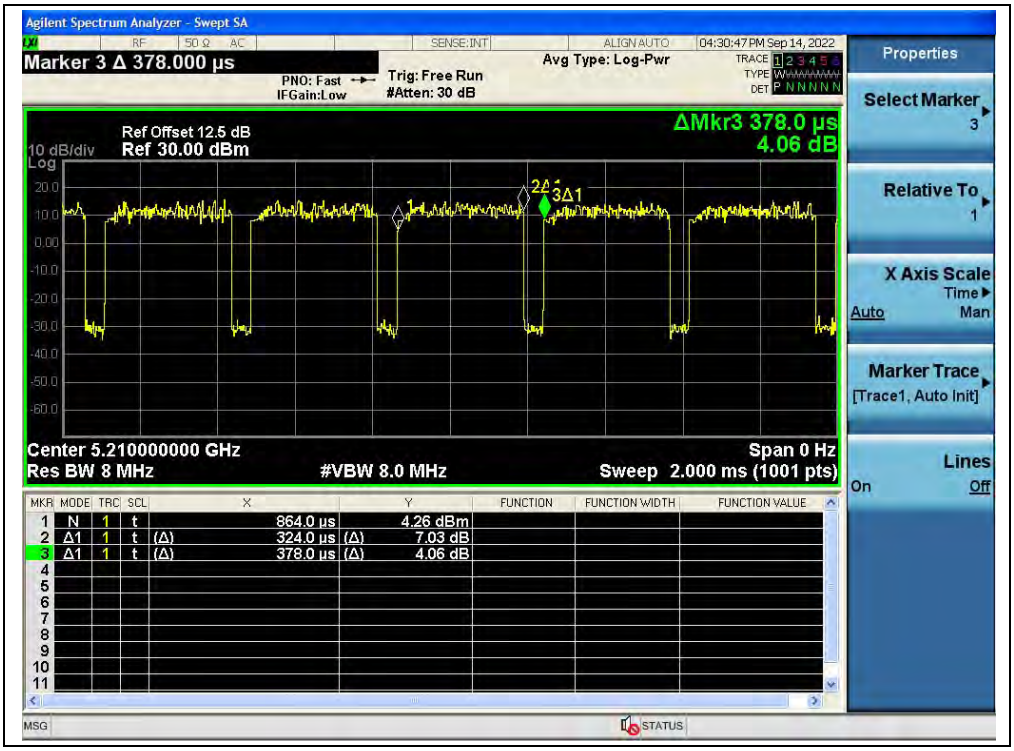
(Channel 38, 5190MHz, 802.11n (HT40))



(Channel 36, 5180MHz, 802.11ac (VHT20))



(Channel 38, 5190MHz, 802.11ac (VHT40))



(Channel 42, 5210MHz, 802.11ac (VHT80))

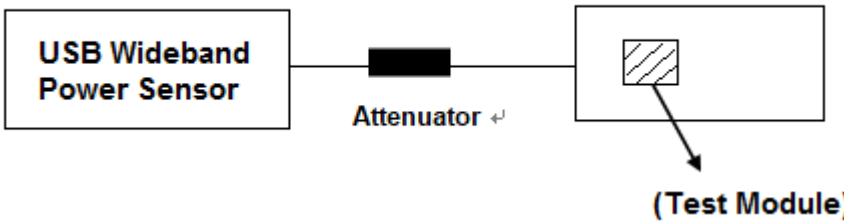
2.3. Maximum Conducted Output Power

2.3.1. Requirement

(1) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250mW provided the maximum antenna gain does not exceed 6dBi.
(2)For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250mW or 11dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.
(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.
If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.
(4) According to KDB662911D01Measure-and-sum technique, the conducted emission level (e.g., transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in units that are directly proportional to power.
(5) According to KDB 662911 D01, the directional gain = G_{ANT} +10log(N_{ANT})dBi, where G_{ANT} is the antenna gain in dBi, N_{ANT} is the number of outputs.

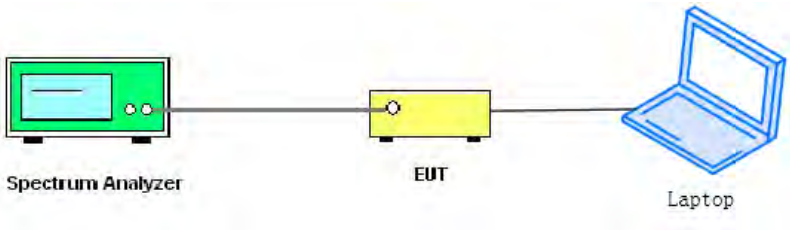
2.3.2. Test Description

Section E) 3) of KDB 789033 defines a methodology using a USB Wideband Power Sensor.
Test Setup:



The EUT (Equipment under the test) which is coupled to the USB Wideband Power Sensor; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in USB Wideband Power Sensor.

For ac (VHT80) mode power



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

2.3.3. Limits

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

Mode	Band	Channel (MHz)	26dB BW (MHz)	10+10log(26dB BW)	Limits (dBm)
a	UNII-2a	5260	20.25	24.06	24.00
		5300	20.31	24.08	24.00
		5320	20.10	24.03	24.00
	UNII-2c	5500	20.21	24.06	24.00
		5600	20.13	24.04	24.00
		5720	20.28	24.07	24.00
n20	UNII-2a	5260	20.49	24.12	24.00
		5300	20.60	24.14	24.00
		5320	20.45	24.11	24.00
	UNII-2c	5500	20.51	24.12	24.00
		5600	20.65	24.15	24.00
		5720	20.98	24.22	24.00
ac20	UNII-2a	5260	20.47	24.11	24.00
		5300	20.60	24.14	24.00
		5320	20.46	24.11	24.00
	UNII-2c	5500	20.48	24.11	24.00
		5600	20.79	24.18	24.00
		5720	21.51	24.33	24.00

2.3.4. Test Result

Maximum Average Conducted Output Power

802.11a Mode

Frequency (MHz)	Average Power							Limit		Verdict
	Measured		Duty Factor	Duty Factor Calculated						
	ANT1	ANT2		ANT1		ANT2				
	dBm	dBm		dBm	W	dBm	W	dBm	W	
5180	13.53	12.73	0.17	13.70	0.023	12.90	0.019	24	0.25	PASS
5220	13.67	12.98		13.84	0.024	13.15	0.021			PASS
5240	13.72	13.36		13.89	0.024	13.53	0.023			
5260	16.34	17.73		16.51	0.045	17.90	0.062			
5300	16.42	17.61		16.59	0.046	17.78	0.060			
5320	16.60	17.85		**16.77**	**0.048**	**18.02**	**0.063**			
5500	14.55	16.52		14.72	0.030	16.69	0.047			
5600	14.52	16.65		14.69	0.029	16.82	0.048			
5720	15.76	17.39		15.93	0.039	17.56	0.057			
5745	15.62	17.44		15.79	0.038	17.61	0.058	30	1	
5785	15.67	17.43		15.84	0.038	17.60	0.058			
5825	15.90	17.43		16.07	0.040	17.60	0.058			

802.11n (HT20) Mode

Frequency (MHz)	Average Power						Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor					
	ANT1	ANT2							
	dBm	dBm		dBm	W		dBm	W	
5180	10.34	14.59	0.18	16.13	0.041		22.03	0.16	PASS
5220	10.60	10.81		13.98	0.025				PASS
5240	10.74	11.12		14.15	0.026				
5260	14.63	11.38		16.53	0.045				
5300	14.80	11.41		16.63	0.046				
5320	14.37	11.52		16.33	0.043				
5500	12.91	15.83		17.78	0.060				
5600	13.03	15.92		17.92	0.062				
5720	14.22	11.29		16.23	0.042				
5745	14.21	16.75		18.86	0.077		28.03	0.63	
5785	14.15	16.76		18.86	0.077				
5825	14.07	16.59		18.69	0.074				
Note: Directional gain = 4.96dBi +10log(2) = 7.97dBi＞6dBi, so the power limit shall be reduced to 24-(7.97-6) = 22.03dBm for 5.18-5.24GHz, 5.260-5.320GHz, 5.500-5.720GHz band and reduced to 30-(7.97-6) = 28.03dBm for 5.745-5.825GHz band.									

802.11n (HT40) Mode

Frequency (MHz)	Average Power						Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor					
	ANT1	ANT2							
	dBm	dBm		dBm	W		dBm	W	
5190	13.38	14.92	0.35	17.56	0.057		22.03	0.16	PASS
5230	12.93	15.07		17.48	0.056				PASS
5270	14.77	16.64		19.19	0.083				
5310	14.98	16.66		**19.24**	**0.084**				
5510	12.76	15.39		17.63	0.058				
5630	13.82	15.96		18.39	0.069				
5710	14.51	16.41		18.92	0.078				
5755	14.36	16.22		18.75	0.075		28.03	0.63	
5795	14.31	16.01		18.57	0.072				
Note: Directional gain = 4.96dBi +10log(2) = 7.97dBi＞6dBi, so the power limit shall be reduced to 24-(7.97-6) = 22.03dBm for 5.18-5.24GHz, 5.260-5.320GHz, 5.500-5.720GHz band and reduced to 30-(7.97-6) = 28.03dBm for 5.745-5.825GHz band.									

802.11ac (VHT20) Mode

Frequency (MHz)	Average Power						Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor					
	ANT1	ANT2							
	dBm	dBm		dBm	W		dBm	W	
5180	10.04	10.86	0.18	13.62	0.023		22.03	0.16	PASS
5220	10.87	10.47		13.80	0.024				PASS
5240	10.85	10.75		13.98	0.025				
5260	14.58	11.76		16.63	0.046				
5300	14.80	11.83		16.72	0.047				
5320	14.95	11.85		16.90	0.049				
5500	12.90	15.58		17.63	0.058				
5600	13.05	15.44		17.63	0.058				
5720	14.20	12.64		16.72	0.047				
5745	14.24	16.15		18.51	0.071		28.03	0.63	
5785	14.27	15.86		18.33	0.068				
5825	14.26	15.87		18.33	0.068				
Note: Directional gain = 4.96dBi +10log(2) = 7.97dBi＞6dBi, so the power limit shall be reduced to 24-(7.97-6) = 22.03dBm for 5.18-5.24GHz, 5.260-5.320GHz, 5.500-5.720GHz band and reduced to 30-(7.97-6) = 28.03dBm for 5.745-5.825GHz band.									

802.11ac (VHT40) Mode

Frequency (MHz)	Average Power						Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor					
	ANT1	ANT2							
	dBm	dBm		dBm	W		dBm	W	
5190	10.61	13.41	0.35	15.56	0.036		22.03	0.16	PASS
5230	10.71	13.15		15.44	0.035				PASS
5270	14.64	16.66		19.14	0.082				
5310	15.02	16.58		**19.24**	**0.084**				
5510	12.72	15.38		17.63	0.058				
5630	13.66	15.99		18.33	0.068				
5710	14.36	16.46		18.92	0.078				
5755	14.35	16.34		18.81	0.076		28.03	0.63	
5795	14.31	16.08		18.63	0.073				
Note: Directional gain = 4.96dBi +10log(2) = 7.97dBi＞6dBi, so the power limit shall be reduced to 24-(7.97-6) = 22.03dBm for 5.18-5.24GHz, 5.260-5.320GHz, 5.500-5.720GHz band and reduced to 30-(7.97-6) = 28.03dBm for 5.745-5.825GHz band.									

802.11ac (VHT80) Mode

Frequency (MHz)	Average Power					Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor				
	ANT0	ANT1						
	dBm	dBm		dBm	W	dBm	W	
5210	14.10	16.36	0.67	19.03	0.080	22.03	0.16	PASS
5290	14.37	16.30		**19.14**	**0.082**			
5530	12.17	14.95		17.48	0.056			
5610	12.83	15.38		17.99	0.063			
5690	13.70	16.09		18.75	0.075			
5775	13.92	15.92		18.69	0.074	28.03	0.63	

Note: Directional gain = 4.96dBi +10log(2) = 7.97dBi＞6dBi, so the power limit shall be reduced to 24-(7.97-6) = 22.03dBm for 5.18-5.24GHz, 5.260-5.320GHz, 5.500-5.720GHz band and reduced to 30-(7.97-6) = 28.03dBm for 5.745-5.825GHz band.

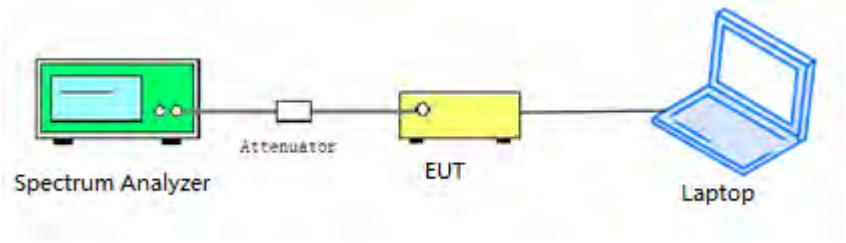
2.4. Emission Bandwidth

2.4.1. Requirement

For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement. Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

2.4.2. Test Description

Test Setup:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

2.4.3. Test Procedure

1. KDB 789033 Section C) 1) Emission Bandwidth was used in order to prove compliance
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
2. KDB 789033 Section C) 2) minimum emission bandwidth for the band 5.725-5.85GHz was used in order to prove compliance.
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for theband5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 kHz.
b) Set video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

2.4.4. Test Result

802.11a Mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	20.09
44	5220	20.21
48	5240	20.28
52	5260	20.25
60	5300	20.31
64	5320	20.10
100	5500	20.21
120	5600	20.13
144	5720	20.28
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
144	5720	15.11
149	5745	15.13
157	5785	15.12
165	5825	15.13

B.Test Plot:

(Channel 36, 5180MHz, 802.11a)

(Channel 44, 5220 MHz, 802.11a)

(Channel 48, 5240MHz, 802.11a)

(Channel 52,5260MHz, 802.11a)

(Channel 60, 5300 MHz, 802.11a)

(Channel 64, 5320MHz, 802.11a)

(Channel 100,5500MHz, 802.11a)

(Channel 120, 5600 MHz, 802.11a)

(Channel 144, 5720MHz, 802.11a)

(Channel 144, 5720MHz, 802.11a)

(Channel 149,5745MHz, 802.11a)

(Channel 157,5785MHz, 802.11a)

(Channel 165, 5825MHz, 802.11a)

802.11n (HT20) Mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	20.41
44	5220	20.50
48	5240	20.54
52	5260	20.49
60	5300	20.60
64	5320	20.45
100	5500	20.51
120	5600	20.65
144	5720	20.98
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
144	5720	15.14
149	5745	16.58
157	5785	15.11
165	5825	15.13

B.Test Plot:

(Channel 36, 5180MHz, 802.11n (HT20))

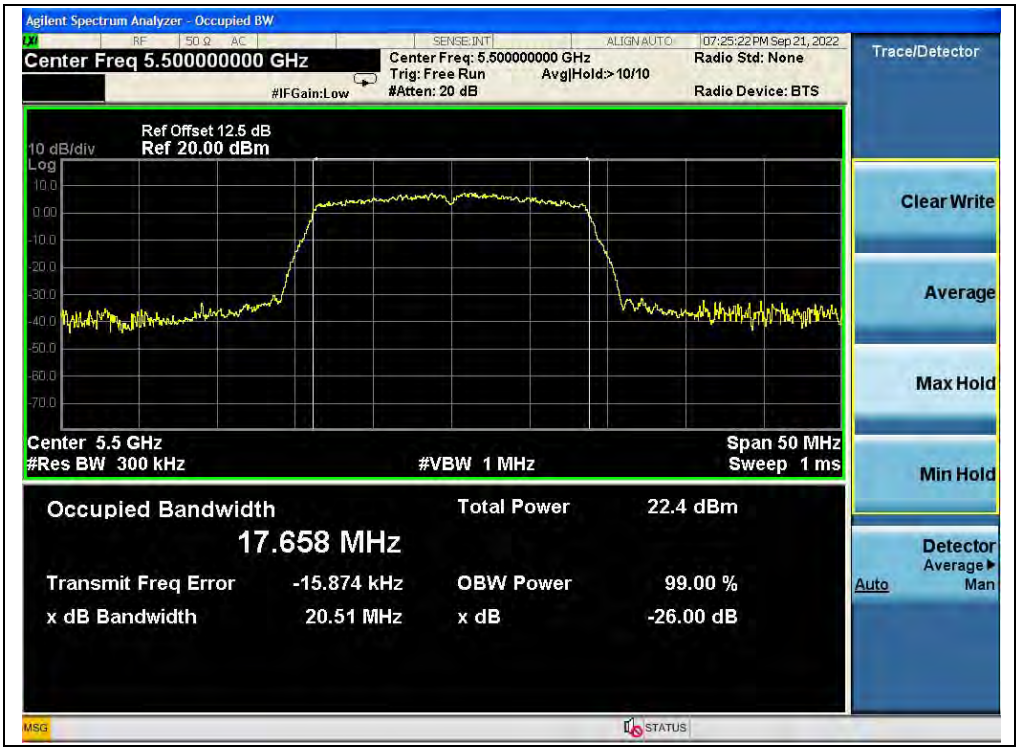
(Channel 44, 5220MHz, 802.11n (HT20))

(Channel 48, 5240MHz, 802.11n (HT20))

(Channel 52, 5260MHz, 802.11n (HT20))

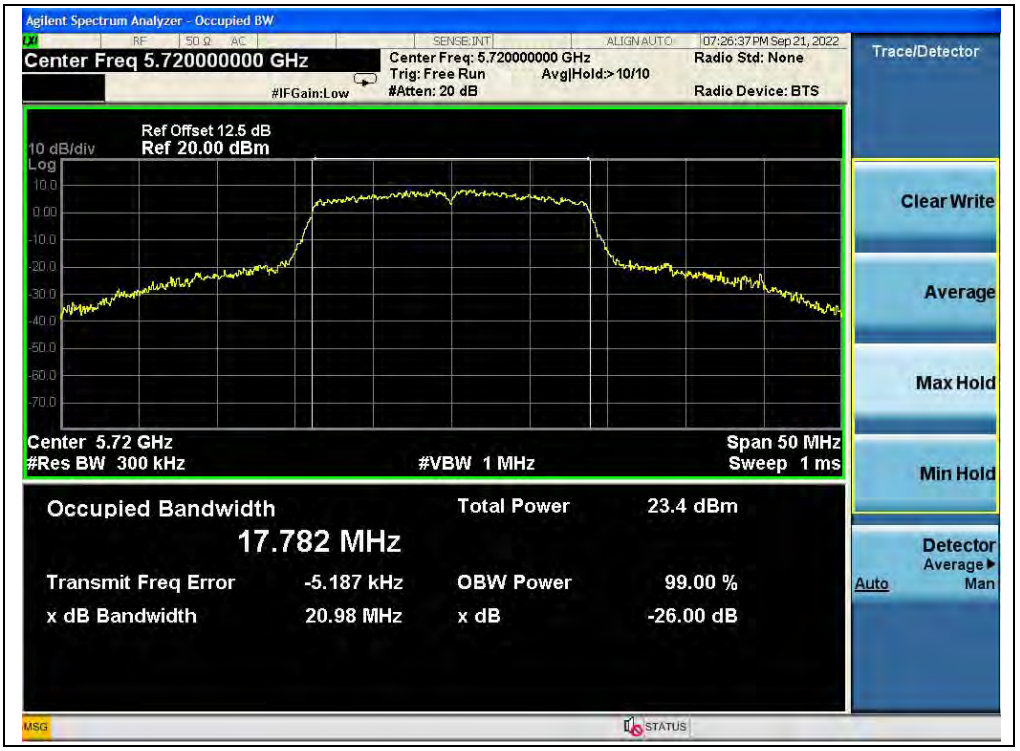
(Channel 60, 5300MHz, 802.11n (HT20))

(Channel 64, 5320MHz, 802.11n (HT20))



(Channel 100, 5500MHz, 802.11n (HT20))

(Channel 120, 5600MHz, 802.11n (HT20))



(Channel 144, 5720MHz, 802.11n (HT20))

(Channel 144, 5720MHz, 802.11 n (HT20))

(Channel 149, 5745MHz, 802.11 n (HT20))

(Channel 157, 5785MHz, 802.11 n (HT20))

(Channel 165, 5825MHz, 802.11 n (HT20))

802.11n (HT40) Test mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	40.41
46	5230	40.62
54	5270	40.95
62	5310	40.52
102	5510	40.43
126	5630	41.55
142	5710	44.77
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
142	5710	35.13
151	5755	35.13
159	5795	35.12

B.Test Plot:

(Channel 38, 5190MHz, 802.11n (HT40))

(Channel 46, 5230MHz, 802.11n (HT40))

(Channel 54, 5270MHz, 802.11n (HT40))

(Channel 62, 5310MHz, 802.11n (HT40))

(Channel 102, 5510MHz, 802.11n (HT40))

(Channel 126, 5630MHz, 802.11n (HT40))

(Channel 142, 5710MHz, 802.11n (HT40))

(Channel 142, 5710MHz, 802.11n (HT40))

(Channel 151, 5755MHz, 802.11n (HT40))

(Channel 159, 5795MHz, 802.11n (HT40))

802.11ac (VHT20) Mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	20.47
44	5220	20.57
48	5240	20.56
52	5260	20.47
60	5300	20.60
64	5320	20.46
100	5500	20.48
120	5600	20.79
144	5720	21.51
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
144	5720	15.12
149	5745	15.12
157	5785	15.12
165	5825	15.13

B.Test Plot:

(Channel 36, 5180MHz, 802.11ac (VHT20))

(Channel 44, 5220MHz, 802.11ac (VHT20))

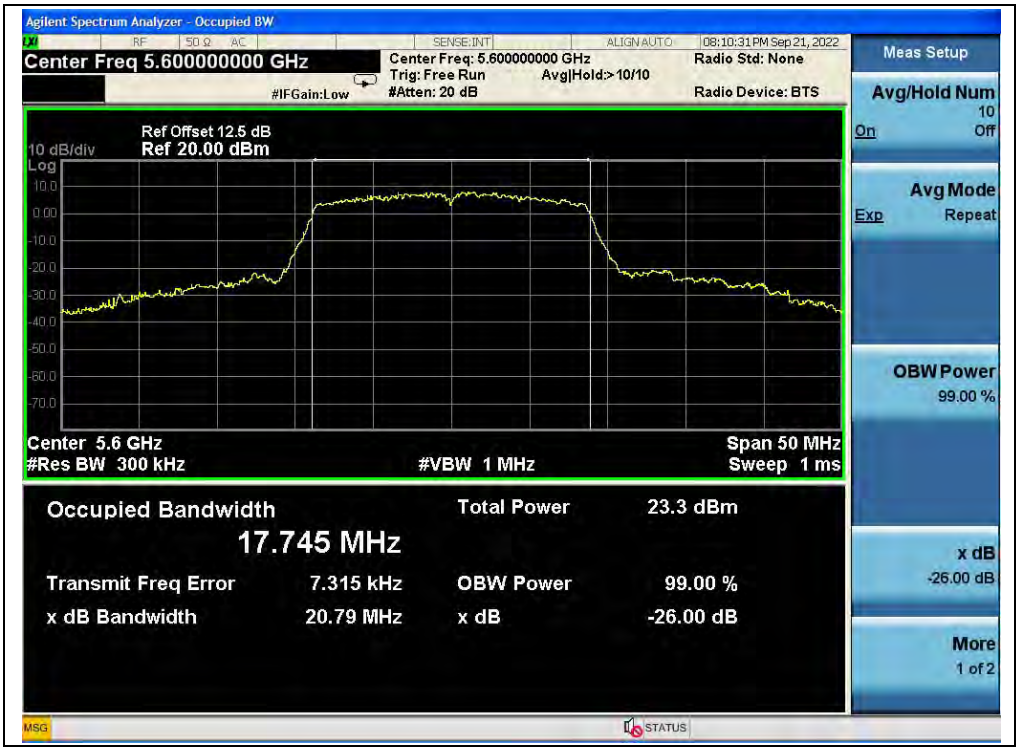
(Channel 48, 5240MHz, 802.11ac (VHT20))

(Channel 52, 5260MHz, 802.11ac (VHT20))

(Channel 60, 5300MHz, 802.11ac (VHT20))

(Channel 64, 5320MHz, 802.11ac (VHT20))

(Channel 100, 5500MHz, 802.11ac (VHT20))



(Channel 120, 5600MHz, 802.11ac (VHT20))

(Channel 144, 5720MHz, 802.11ac (VHT20))

(Channel 144, 5720MHz, 802.11ac (VHT20))

(Channel 149, 5745MHz, 802.11 ac (VHT20))

(Channel 157, 5785MHz, 802.11 ac (VHT20))

(Channel 165, 5825MHz, 802.11 ac (VHT20))

802.11ac (VHT40) Mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	40.52
46	5230	40.84
54	5270	40.79
62	5310	40.60
102	5510	40.89
126	5630	40.99
142	5710	44.62
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
142	5710	35.12
151	5755	35.11
159	5795	35.14

B.Test Plot:

(Channel 38, 5190MHz, 802.11ac (VHT40))

(Channel 46, 5230MHz, 802.11ac (VHT40))

(Channel 54, 5270MHz, 802.11ac (VHT40))

(Channel 62, 5310MHz, 802.11ac (VHT40))

(Channel 102, 5510MHz, 802.11ac (VHT40))

(Channel 126, 5630MHz, 802.11ac (VHT40))

(Channel 142, 5710MHz, 802.11ac (VHT40))

(Channel 142, 5710MHz, 802.11ac (VHT40))

(Channel 151, 5755MHz, 802.11ac (VHT40))

(Channel 159, 5795MHz, 802.11ac (VHT40))

802.11ac (VHT80) Mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
42	5210	81.33
58	5290	81.43
106	5530	81.42
122	5610	81.14
138	5690	88.04
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
138	5690	75.19
155	5775	75.19

B.Test Plot:

(Channel 42, 5210MHz, 802.11ac (VHT80))

(Channel 58, 5290MHz, 802.11ac (VHT80))

(Channel 106, 5530MHz, 802.11ac (VHT80))

(Channel 122, 5610MHz, 802.11ac (VHT80))

(Channel 138, 5690MHz, 802.11ac (VHT80))

(Channel 138, 5690MHz, 802.11ac (VHT80))

(Channel 155, 5775MHz, 802.11ac (VHT80))

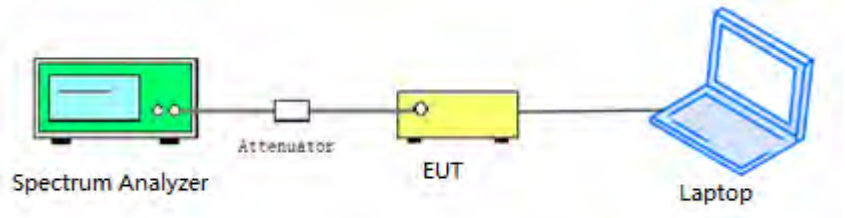
2.5. Peak Power Spectral Density

2.5.1. Requirement

(1)For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.
(2)For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.
(3) For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30dBm in any 500kHz band.
If transmitting antennas of directional gain greater than 6dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.
(4) According to KDB662911D01Measure-and-sum technique, the conducted emission level (e.g., transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in units that are directly proportional to power.
(5) According to KDB 662911 D01, the directional gain = G_{ANT} +10log(N_{ANT}) dBi, where G_{ANT} is the antenna gain in dBi, N_{ANT} is the number of outputs.

2.5.2. Test Description

Test Setup:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

2.5.3. Test Procedure

KDB 789033 Section F) Maximum Power Spectral Density (PSD) Method SA-3 was used in order to prove compliance

1) Set span to encompass the entire 26-dB emission bandwidth
2) Set RBW = 1MHz. Set VBW ≥ 3MHz
3) Number of points in sweep ≥ 2 Span / RBW. Sweep time = auto
4) Detector = Average
5) Trace mode=Max hold
6) Record the max value

2.5.4. Test Result

802.11a Mode

A.Test Verdict:

Frequency (MHz)	Measured PPSD (dBm/MHz)		Duty Factor	Corrected PPSD (dBm/MHz)		Limit (dBm/MHz)	Verdict
	ANT1	ANT2		ANT1	ANT2		
5180	3.77	3.24	0.17	3.94	3.41	11	PASS
5220	4.22	3.53		4.39	3.70		
5240	4.30	4.01		4.47	4.18		
5260	6.96	6.17		7.13	6.34		
5300	7.03	6.17		7.20	6.34		
5320	7.44	6.28		7.61	6.45		
5500	4.57	4.54		4.74	4.71		
5600	4.53	5.03		4.70	5.20		
5720	5.96	6.26		6.13	6.43		
Frequency (MHz)	Measured PPSD (dBm/500KHz)		Duty Factor	Total PPSD (dBm/500KHz)		Limit (dBm/500KHz)	Verdict
	ANT1	ANT2		ANT1	ANT2		
5720	3.21	3.50	0.17	3.38	3.67	30	PASS
5745	3.33	3.37		3.50	3.54		
5785	3.27	3.32		3.44	3.49		
5825	3.38	3.52		3.55	3.69		

B.Test Plot:

(Channel 36, 5180MHz, 802.11a, ANT 2)

(Channel 44, 5220MHz, 802.11a, ANT 2)

(Channel 48, 5240MHz, 802.11a, ANT 2)

(Channel 52, 5260MHz, 802.11a, ANT 2)

(Channel 60, 5300MHz, 802.11a, ANT 2)

(Channel 64, 5320MHz, 802.11a, ANT 2)

(Channel 100, 5500MHz, 802.11a, ANT 2)

(Channel 120, 5600MHz, 802.11a, ANT 2)

(Channel 144, 5720MHz, 802.11a, ANT 2)

(Channel 144, 5720MHz, 802.11a, ANT 2)

(Channel 149, 5745MHz, 802.11a, ANT 2)

(Channel 157, 5785MHz, 802.11a, ANT 2)

(Channel 165, 5825MHz, 802.11a, ANT 2)

802.11n (HT20) Mode

A.Test Verdict:

Frequency (MHz)	Measured PPSD (dBm/MHz)		Duty Factor	Total PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
	ANT1	ANT 2				
5180	0.66	0.73	0.18	3.89	9.03	PASS
5220	1.03	0.98		4.15		
5240	1.17	1.54		4.55		
5260	5.69	3.42		7.89		
5300	5.95	3.49		8.08		
5320	6.27	3.42		8.27		
5500	3.41	6.13		8.17		
5600	3.30	6.53		8.40		
5720	4.74	1.36		6.56		
Frequency (MHz)	Measured PPSD (dBm/500KHz)		Duty Factor	Total PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
	ANT1	ANT 2				
5720	2.03	4.96	0.18	6.93	28.03	PASS
5745	2.09	4.93		6.93		
5785	2.06	4.76		6.81		
5825	2.28	4.75		6.88		
Note: Directional gain = 4.96dBi +10log(2) = 7.97dBi＞6dBi, so the limit shall be reduced to 11-(7.97-6) = 9.03dBm for 5.18-5.24GHz, 5.260-5.320GHz, 5.500-5.720GHz band and reduced to 30-(7.97-6) = 28.03dBm for 5.745-5.825GHz band.						

B.Test Plot:

(Channel 36, 5180MHz, 802.11n (HT20), ANT 2)

(Channel 44, 5220MHz, 802.11n (HT20), ANT 2)

(Channel 48, 5240MHz, 802.11n (HT20), ANT 2)

(Channel 52, 5260MHz, 802.11n (HT20), ANT 2)

(Channel 60, 5300MHz, 802.11n (HT20), ANT 2)

(Channel 64, 5320MHz, 802.11n (HT20), ANT 2)

(Channel 100, 5500MHz, 802.11n (HT20), ANT 2)

(Channel 120, 5600MHz, 802.11n (HT20), ANT 2)

(Channel 144, 5720MHz, 802.11n (HT20), ANT 2)

(Channel 144, 5720MHz, 802.11n (HT20), ANT 2)

(Channel 149, 5745MHz, 802.11n (HT20), ANT 2)

(Channel 157, 5785MHz, 802.11n (HT20), ANT 2)

(Channel 165, 5825MHz, 802.11n (HT20), ANT 2)

802.11n (HT40) Mode

A.Test Verdict:

Frequency (MHz)	Measured PPSD (dBm/MHz)		Duty Factor	Total PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
	ANT1	ANT 2				
5190	-0.39	2.29	0.35	4.51	9.03	PASS
5230	0.24	2.54		4.90		
5270	2.73	4.64		7.15		
5310	2.98	4.66		7.26		
5510	0.05	3.07		5.18		
5630	0.67	3.88		5.93		
5710	1.62	4.62		6.73		
Frequency (MHz)	Measured PPSD (dBm/500KHz)		Duty Factor	Total PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
	ANT1	ANT 2				
5710	-1.24	1.77	0.35	3.88	28.03	PASS
5755	-1.10	1.72		3.90		
5795	-1.08	1.69		3.88		

Note: Directional gain = 4.96dBi +10log(2) = 7.97dBi＞6dBi, so the limit shall be reduced to 11-(7.97-6) = 9.03dBm for 5.18-5.24GHz, 5.260-5.320GHz, 5.500-5.720GHz band and reduced to 30-(7.97-6) = 28.03dBm for 5.745-5.825GHz band.

B.Test Plot:

(Channel 38, 5190MHz, 802.11n (HT40), ANT 2)

(Channel 46, 5230MHz, 802.11n (HT40), ANT 2)

(Channel 54, 5270MHz, 802.11n (HT40), ANT 2)

(Channel 62, 5310MHz, 802.11n (HT40), ANT 2)

(Channel 102, 5510MHz, 802.11n (HT40), ANT 2)

(Channel 126, 5630 MHz, 802.11n (HT40), ANT 2)

(Channel 142, 5710MHz, 802.11n (HT40), ANT 2)

(Channel 142, 5710MHz, 802.11n (HT40), ANT 2)

(Channel 151, 5755MHz, 802.11n (HT40), ANT 2)

(Channel 159, 5795MHz, 802.11n (HT40), ANT 2)