REPORT No. : SZ20120300W04

TEST REPORT

APPLICANT	:	Shenzhen Xhorse Electronics Co., Ltd.
PRODUCT NAME	:	KEY TOOL PLUS
MODEL NAME	:	XDKP00
BRAND NAME	:	Xhorse
FCC ID	:	2AI4T-XDKP00
STANDARD(S)	:	47 CFR Part 15 Subpart E
RECEIPT DATE	:	2021-01-29
TEST DATE	:	2021-04-21 to 2021-06-18
ISSUE DATE	:	2021-07-26

Edited by: Peng Mi (Rapporteur)

Approved by: Shen Junsheng (Supervisor)

MORLAB

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DIRECTORY

Change History		
Version	Date	Reason for change
1.0	2021-07-26	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Shenzhen Xhorse Electronics Co., Ltd.
Applicant Address:	Floor 28, Block A, Building NO.6, international innovation Valley, Nanshan District, Shenzhen, China
Manufacturer:	Shenzhen Xhorse Electronics Co., Ltd.
Manufacturer Address:	Floor 28, Block A, Building NO.6, international innovation Valley, Nanshan District, Shenzhen, China

1.2. Equipment Under Test (EUT) Description

Product Name:	KEY TOOL PLUS	
Serial No.:	(N/A, marked #1 by test site)	
Hardware Version:	v1.2.6	
Software Version:	v1.2.0	
Modulation Type:	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; 5745MHz-5825MHz	
Channel Number:	Refer to 1.3	
Antenna Type:	FPC Antenna	
Antenna Gain:	2.5dBi	
Accessory Information:	Battery	
	Brand Name:	BAK
	Model No.:	6060100-2P
	Serial No.:	(N/A, marked #1 by test site)
	Capacity:	10000.00mAh
	Rated Voltage:	3.70V
	Charge Limit:	4.20V
	Manufacturer:	Zhengzhou BAK Battery Co., Ltd.

Accessory Information:	AC Adapter	
	Brand Name:	FOULLPOWER
	Model No.:	TYPE-C30IC
	Serial No.:	(N/A, marked #1 by test site)
	Rated Output:	5.0V⎓3.0A, 9.0V⎓3.0A, 12.0V⎓2.5A, 15.0V⎓2.0A, 20.0V⎓1.5A
	Rated Input:	100-240V~50/60Hz, 0.80A
	Manufacturer:	SHENZHEN SHI YING YUAN ELECTRONICS CO LTD

Note 1: 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

Modulation Technology	Modulation Type	Data Rate (Mbps)Note1
OFDM (802.11a)	BPSK	**6**/9
	QPSK	12/18
	16QAM	24/36
	64QAM	48/54
OFDM (802.11n)	BPSK	**6.5**
	QPSK	13/19.5
	16QAM	26/39
	64QAM	52/58.5/65
OFDM (802.11ac)	BPSK	**6.5**
	QPSK	13/19.5
	16QAM	26/39
	64QAM	52/58.5/65
	256QAM	78

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

Frequency Range: 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**		
Frequency Range: 5745-5825MHz				
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	Apr 21, 2021	Liu Bo	PASS	No deviation
3	15.407(a)	Maximum Conducted Output Power	Jun 18, 2021	Liu Bo	PASS	No deviation
4	15.407(a)(e)	Emission Bandwidth	Apr 21, 2021	Liu Bo	PASS	No deviation
5	15.407(a)	Peak Power Spectral Density	Apr 25, 2021	Liu Bo	PASS	No deviation
6	15.407(g)	Frequency Stability	Apr 25, 2021	Liu Bo	PASS	No deviation
7	15.207	Conducted Emission	Apr 28, 2021	Wu Runfeng	PASS	No deviation
8	15.407(b)	Restricted Frequency Bands	Apr 24&25&26, 2021 Jun 17, 2021	Gao Jianrou	PASS	No deviation
9	15.407(b)	Radiated Emission	Apr 25, 2021	Gao Jianrou	PASS	No deviation

Note 1: The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.102013.
Note 2: These RF tests were performed according to the method of measurements prescribed in KDB789033 D02 v02r01.
Note 3: The path loss during the RF test is calibrated to correct the results by the offset setting in

the test equipments. The ref offset 11.5dB contains two parts that cable loss 1.5dB and Attenuator 10dB.

Note 4: 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 5: 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 FPC antenna coupled with the metal shrapnel. Please refer to the EUT internal photos.

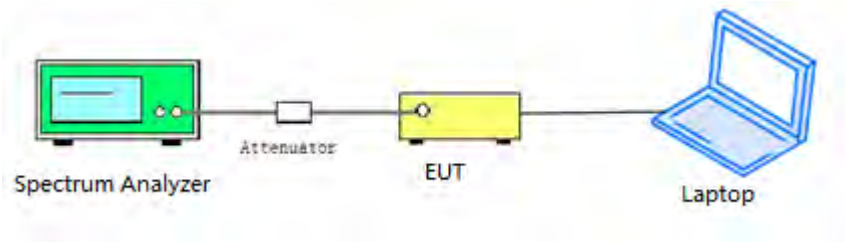
2.2. Duty Cycle of the Test Signal

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

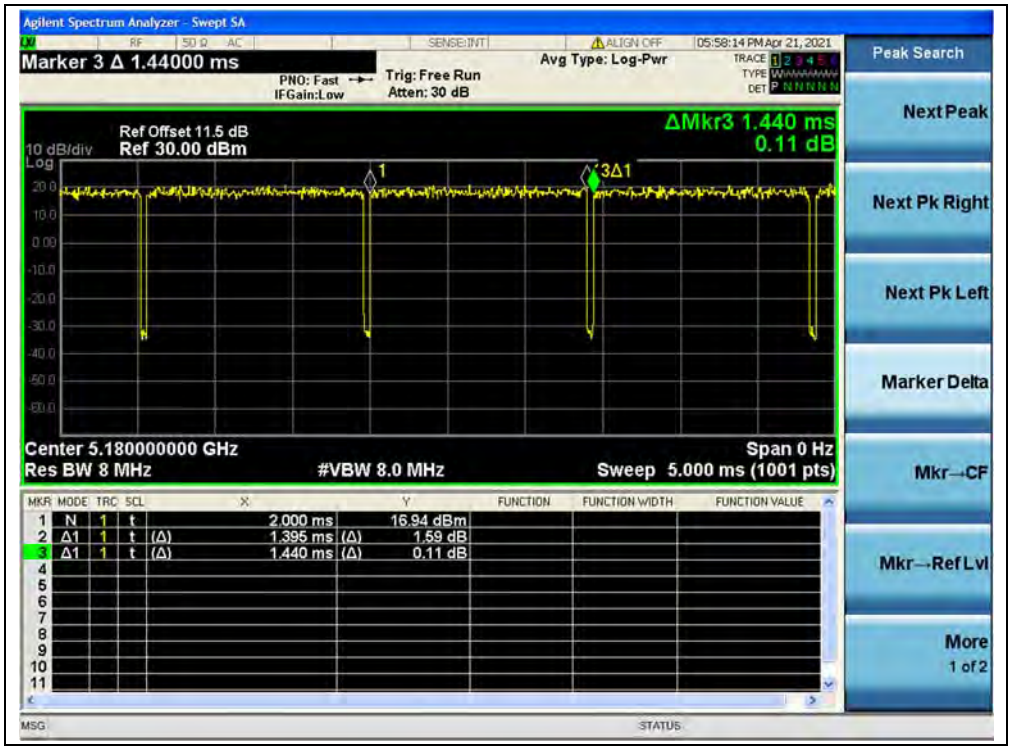
KDB 789033 Section B was used in order to prove compliance.

2.2.4. Test Result

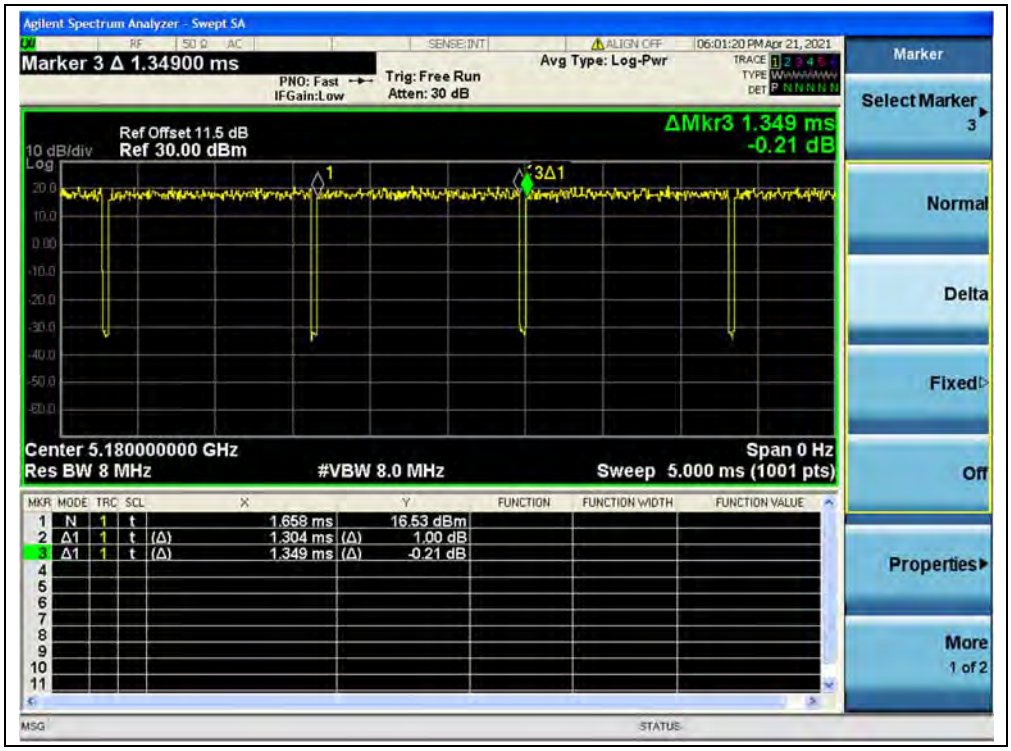
A.Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*log[1/D])
802.11a	96.88	0.14
802.11n (HT20)	96.66	0.15
802.11n (HT40)	93.56	0.29
802.11ac(VHT20)	96.68	0.15
802.11ac(VHT40)	93.53	0.29
802.11ac(VHT80)	87.97	0.56

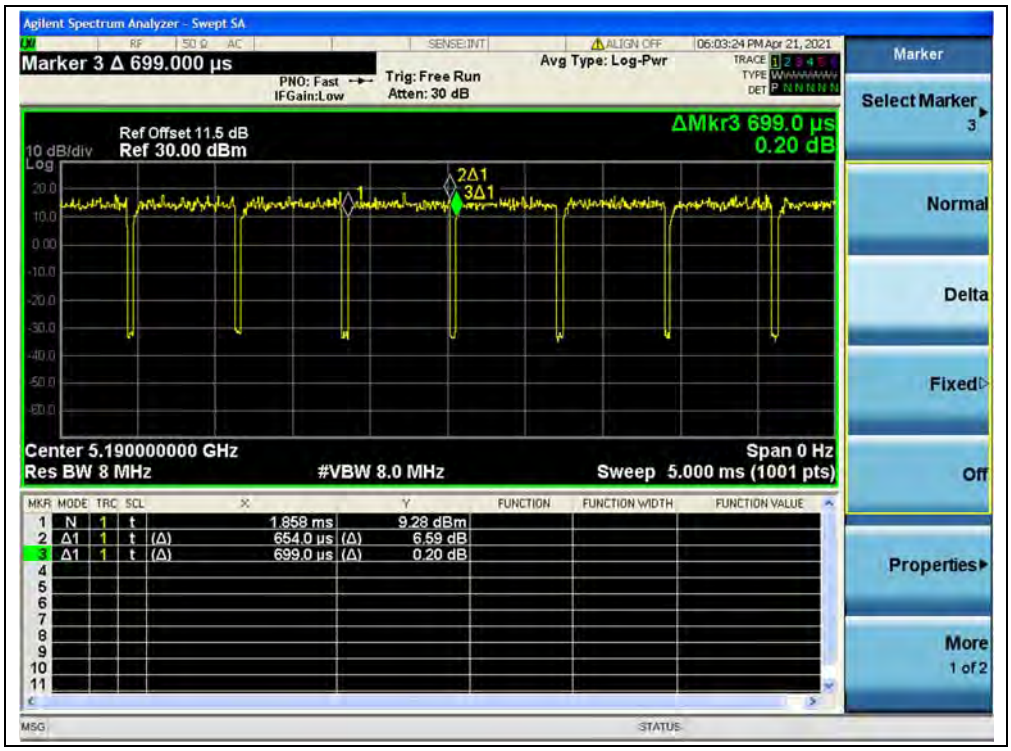
B.Test Plot:



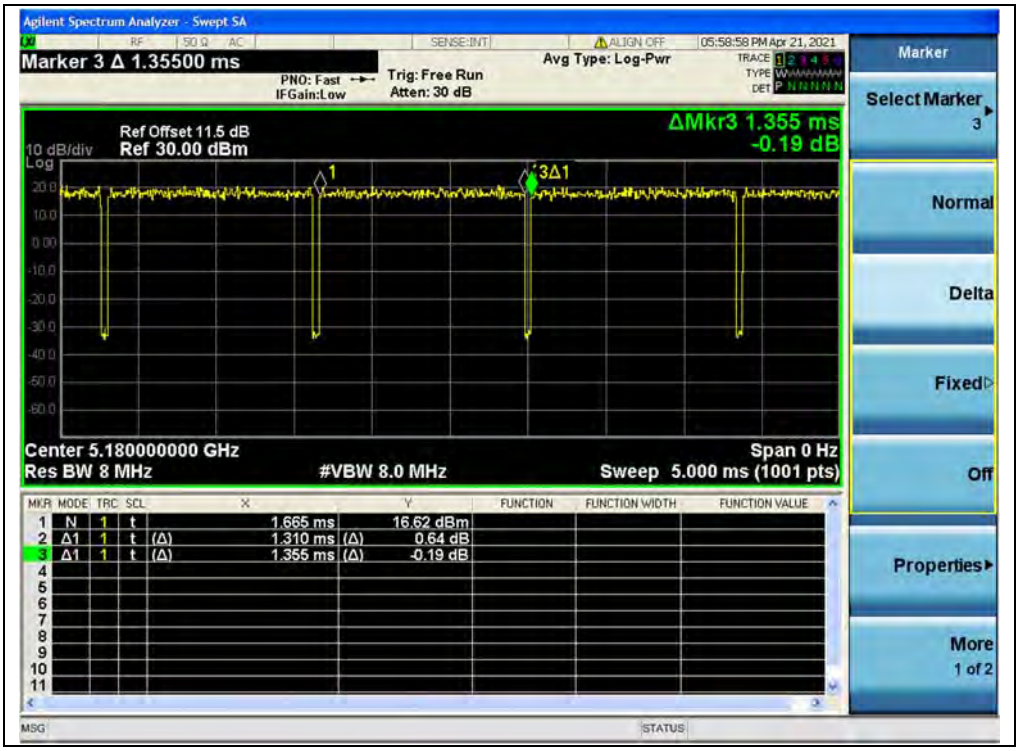
(Channel 36, 5180MHz, 802.11a)



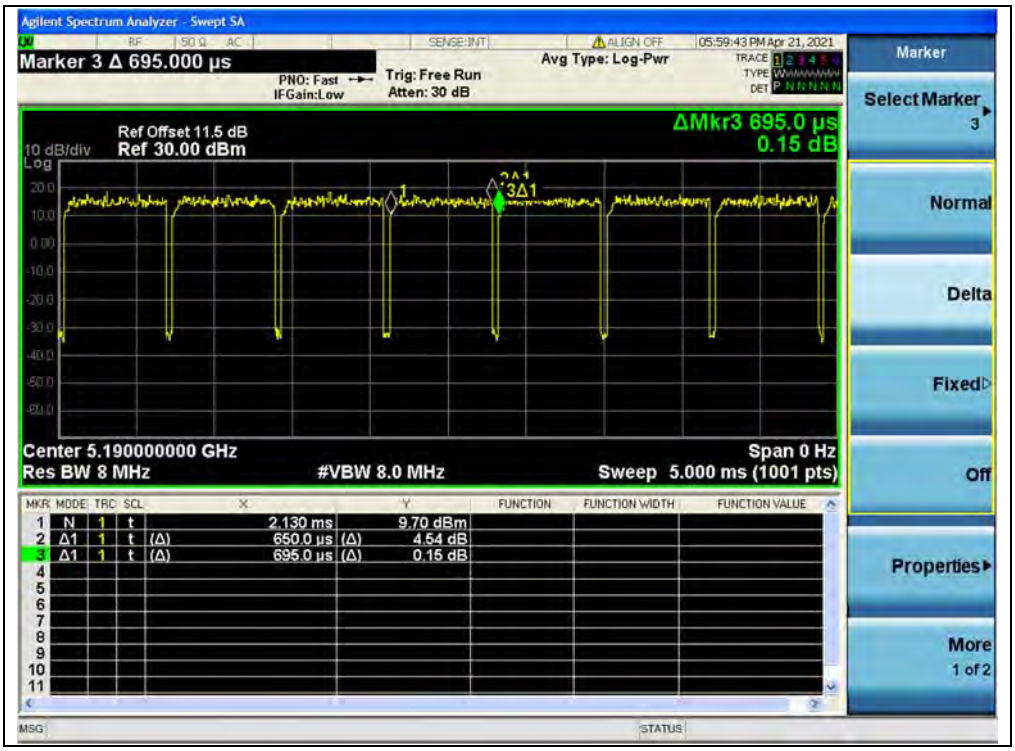
(Channel 36, 5180MHz, 802.11n (HT20))



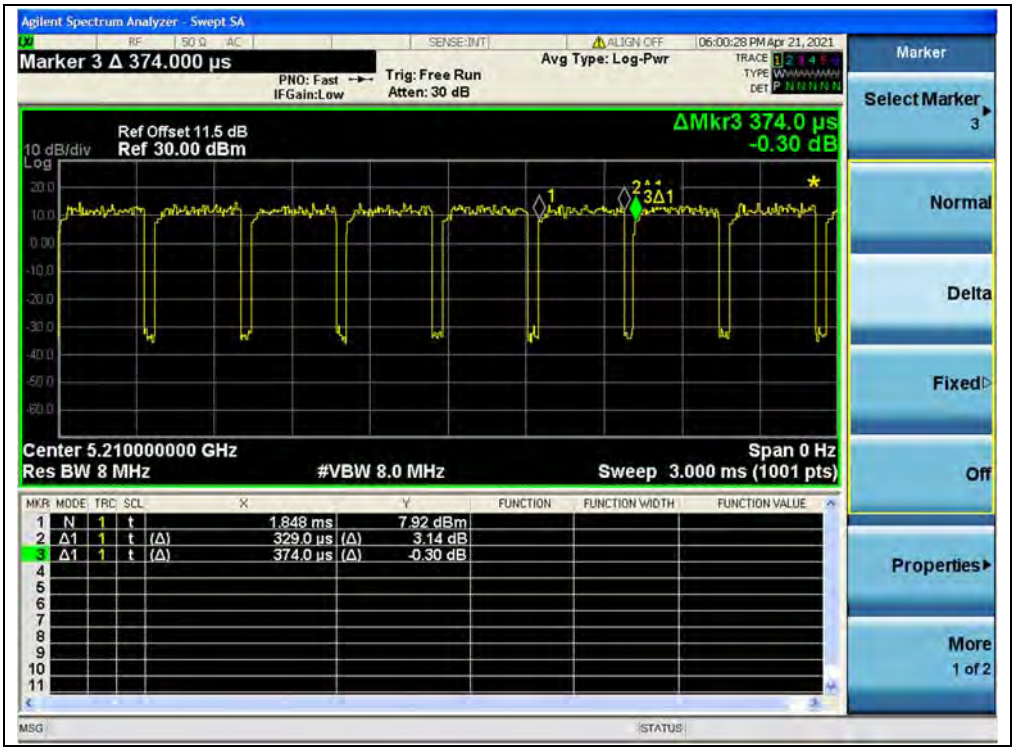
(Channel 38, 5190MHz, 802.11n (HT40))



(CH36_5180MHz _802.11ac (VHT20))



(CH38_5190MHz _802.11ac (VHT40))



(CH42_5210MHz _802.11ac (VHT80))

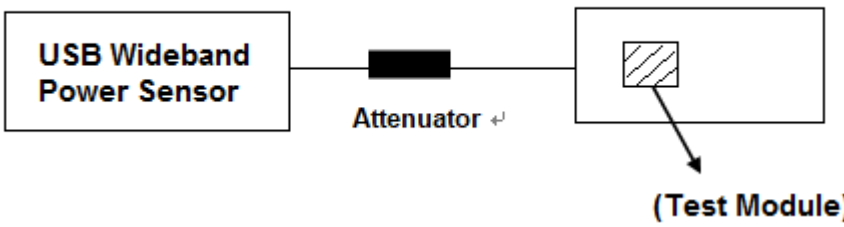
2.3. Maximum Conducted Output Power

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.

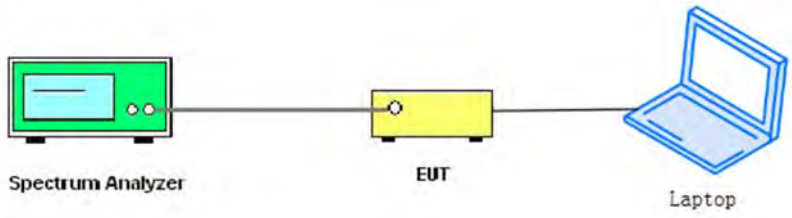
2.3.2. Test Description

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. Test Result

Maximum Average Conducted Output Power

802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)				Limit (dBm)		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
36	5180	7.43	0.14	7.57	0.006	24	0.25	PASS
44	5220	6.83		6.97	0.005			
48	5240	7.50		7.64	0.006			
149	5745	10.23		10.37	0.011	30	1	
157	5785	9.78		9.92	0.010			
165	5825	9.48		9.62	0.009			

802.11n (HT20) Mode

Channel	Frequency (MHz)	Average Power (dBm)				Limit (dBm)		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
36	5180	9.82	0.15	9.97	0.010	24	0.25	PASS
44	5220	9.92		10.07	0.010			
48	5240	9.91		10.06	0.010			
149	5745	10.71		**10.86**	**0.012**	30	1	
157	5785	10.03		10.18	0.010			
165	5825	9.99		10.14	0.010			

802.11n (HT40) Mode

Channel	Frequency (MHz)	Average Power				Limit (dBm)		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
38	5190	8.27	0.29	8.56	0.007	24	0.25	PASS
46	5230	7.83		8.12	0.006			
151	5755	9.38		9.67	0.009	30	1	
159	5795	8.66		8.95	0.008			

802.11ac (VHT20) Mode

Channel	Frequency (MHz)	Average Power (dBm)				Limit (dBm)		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
36	5180	9.68	0.15	9.83	0.010	24	0.25	PASS
44	5220	9.85		10.00	0.010			
48	5240	9.77		9.92	0.010			
149	5745	9.13		9.28	0.008	30	1	
157	5785	8.83		8.98	0.008			
165	5825	8.36		8.51	0.007			

802.11ac (VHT40) Mode

Channel	Frequency (MHz)	Average Power				Limit (dBm)		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
38	5190	10.33	0.29	10.62	0.012	24	0.25	PASS
46	5230	10.88		**11.17**	**0.013**			
151	5755	9.56		9.85	0.010	30	1	
159	5795	9.47		9.76	0.009			

802.11ac (VHT80) Mode

Channel	Frequency (MHz)	Average Power				Limit (dBm)		Verdict
		Measured	Duty Factor	Duty Factor Calculated				
		dBm		dBm	W	dBm	W	
42	5210	7.07	0.56	7.63	0.006	24	0.25	PASS
155	5775	8.95		9.51	0.009	30	1	

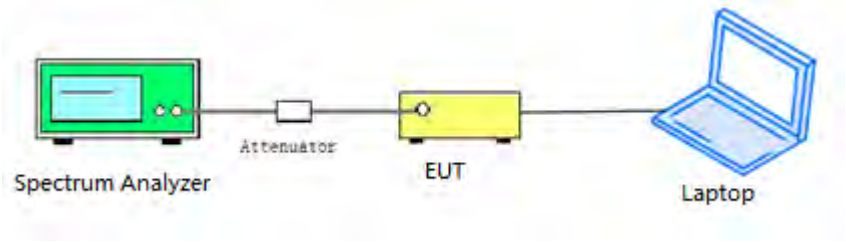
2.4. Emission Bandwidth

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

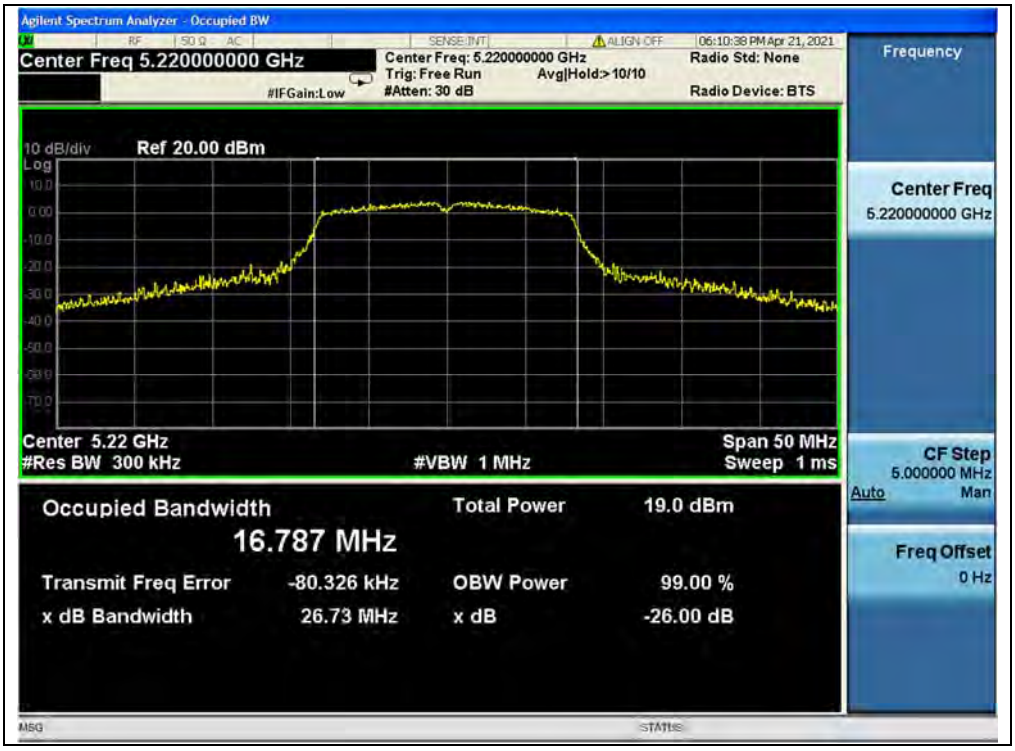
802.11a Mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	24.53
44	5220	26.73
48	5240	20.78
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
149	5745	15.69
157	5785	15.68
165	5825	15.04

B.Test Plot:

(Channel 36, 5180MHz, 802.11a)



(Channel 44, 5220 MHz, 802.11a)

(Channel 48, 5240MHz, 802.11a)

(Channel 149,5745MHz, 802.11a)

(Channel 157,5785MHz, 802.11a)

(Channel 165, 5825MHz, 802.11a)

802.11n (HT20) Mode

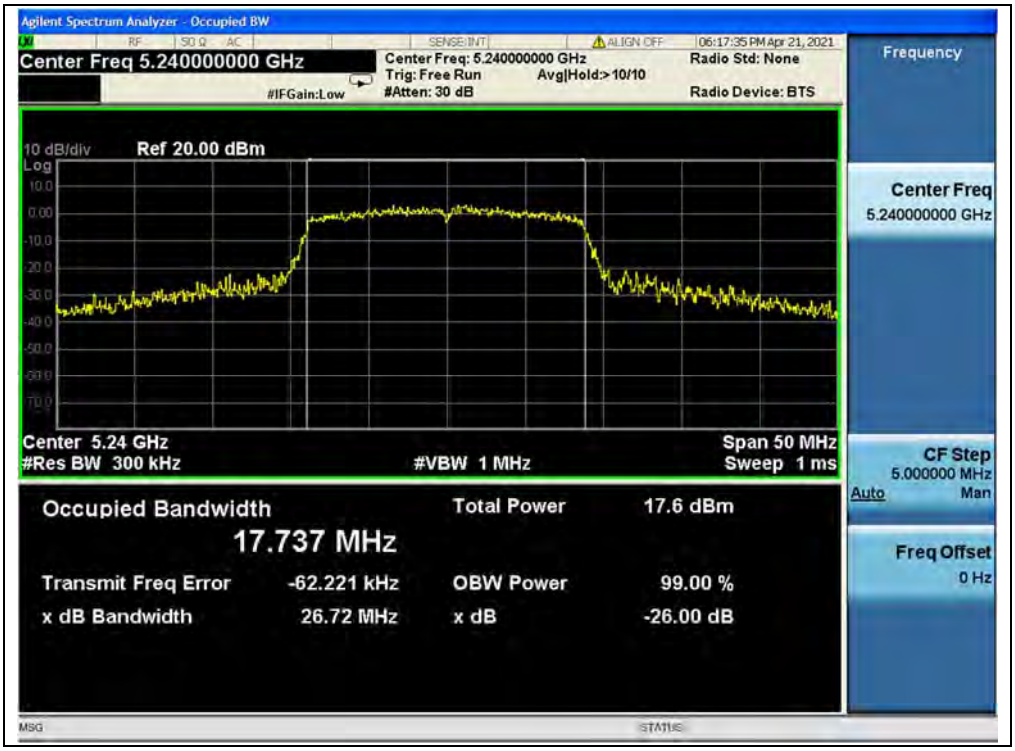
A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	25.21
44	5220	32.83
48	5240	26.72
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
149	5745	15.09
157	5785	15.08
165	5825	13.42

B.Test Plot:

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

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



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

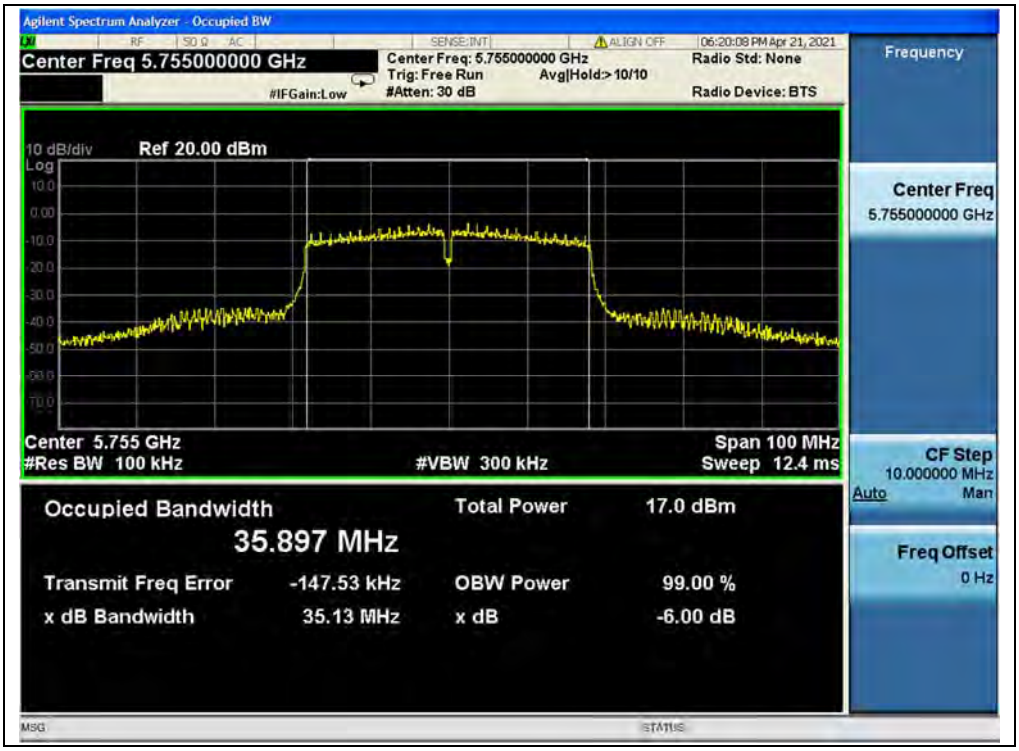
A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	58.24
46	5230	65.19
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
151	5755	35.13
159	5795	34.42

B.Test Plot:

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

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



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

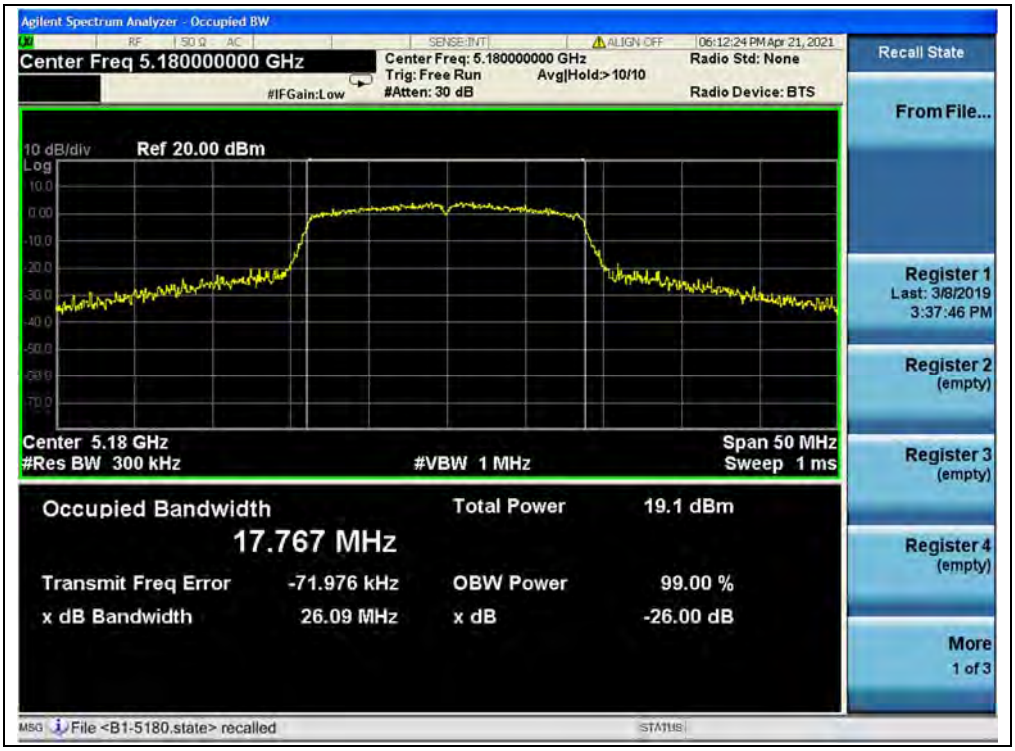
(Channel 159, 5795MHz, 802.11n (HT40))

802.11ac (VHT20) Mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	26.09
44	5220	22.65
48	5240	20.14
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
149	5745	15.91
157	5785	15.10
165	5825	17.54

B.Test Plot:

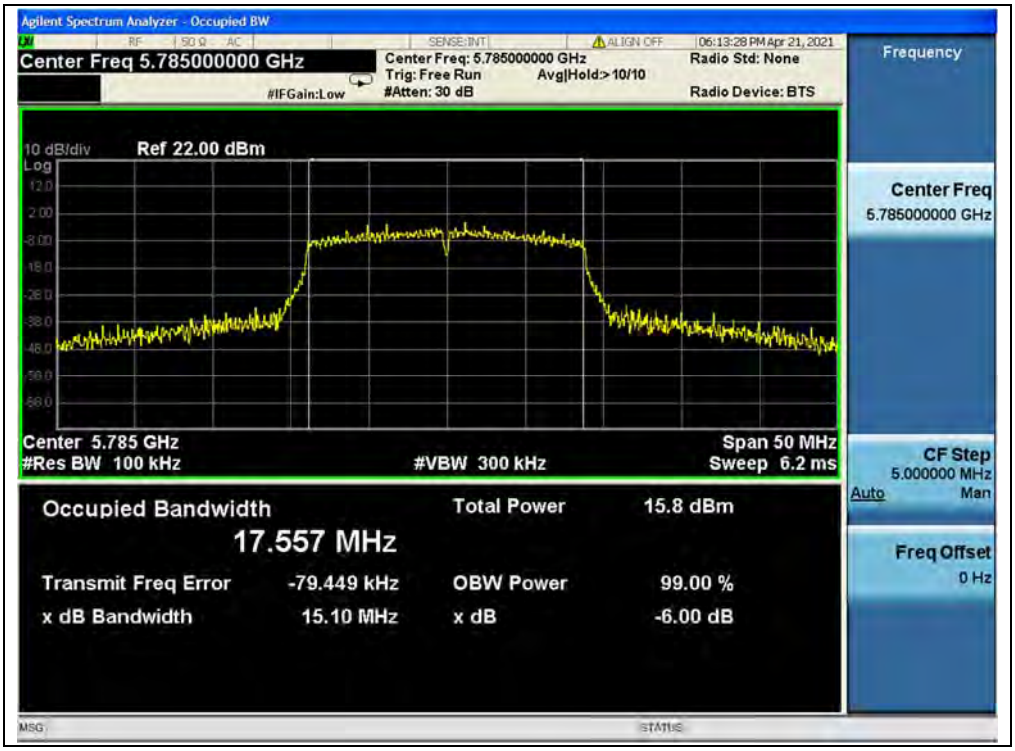


(Channel 36, 5180MHz, 802.11ac (VHT20))

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

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

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



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

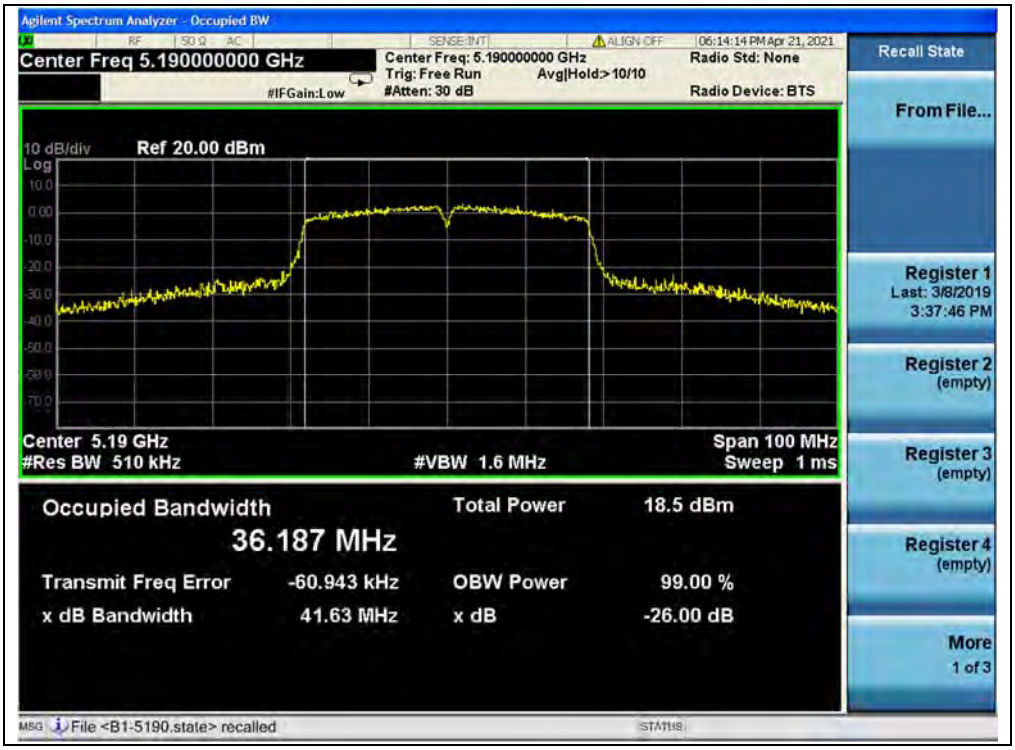
(Channel 165, 5825MHz, 802.11ac (VHT20))

802.11 ac (VHT40) Mode

A.Test Verdict:

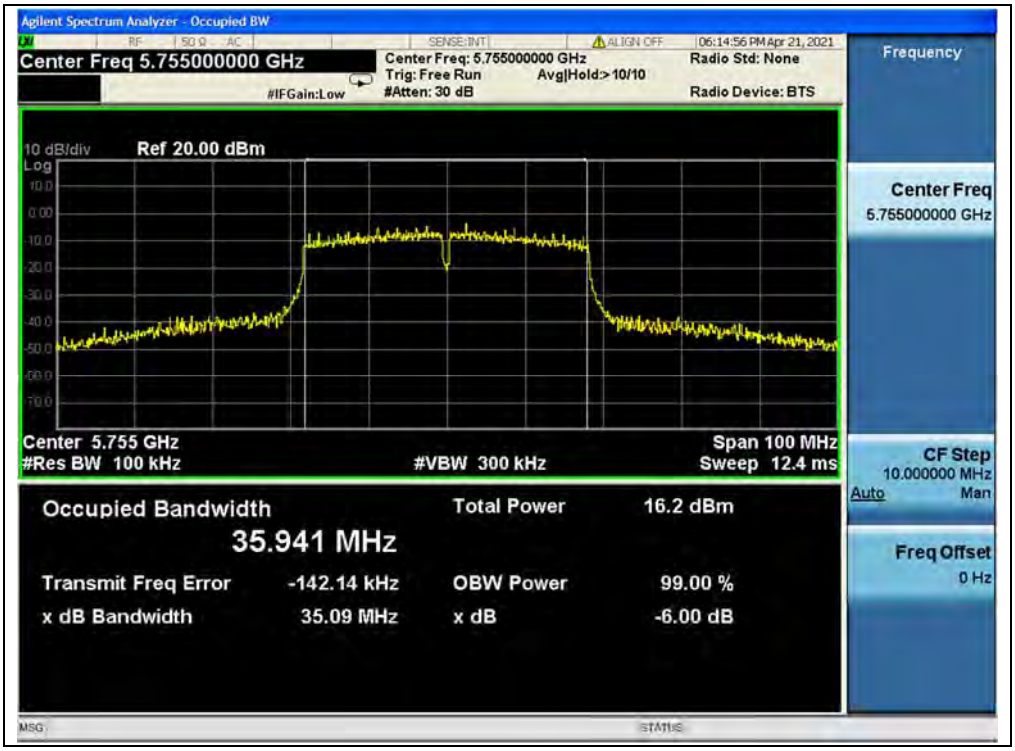
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	41.63
46	5230	42.17
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
151	5755	35.09
159	5795	35.14

B.Test Plot:



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

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



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

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

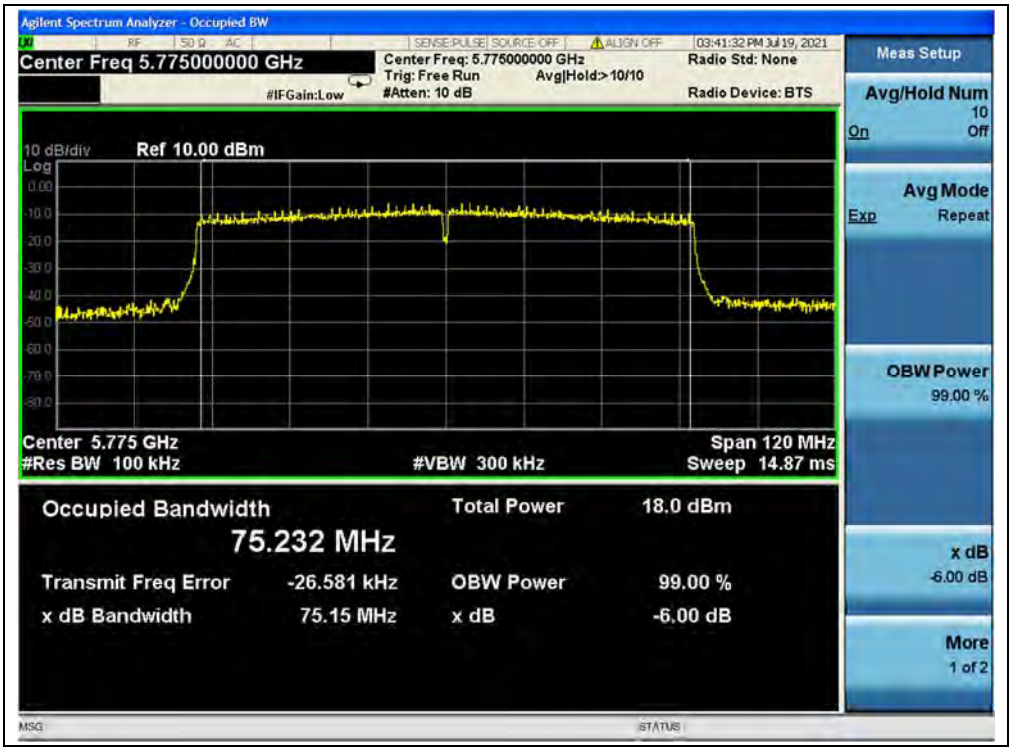
802.11 ac (VHT80) Mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
42	5210	111.70
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
155	5775	75.15

B.Test Plot:

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



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

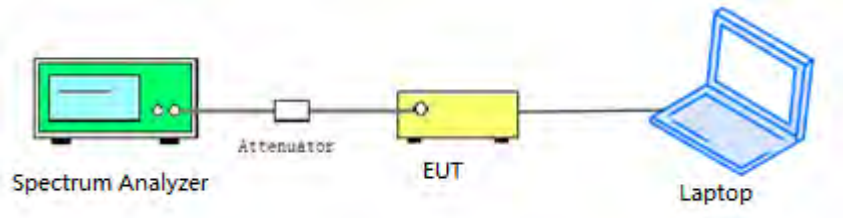
2.5. Peak Power Spectral Density

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-1 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

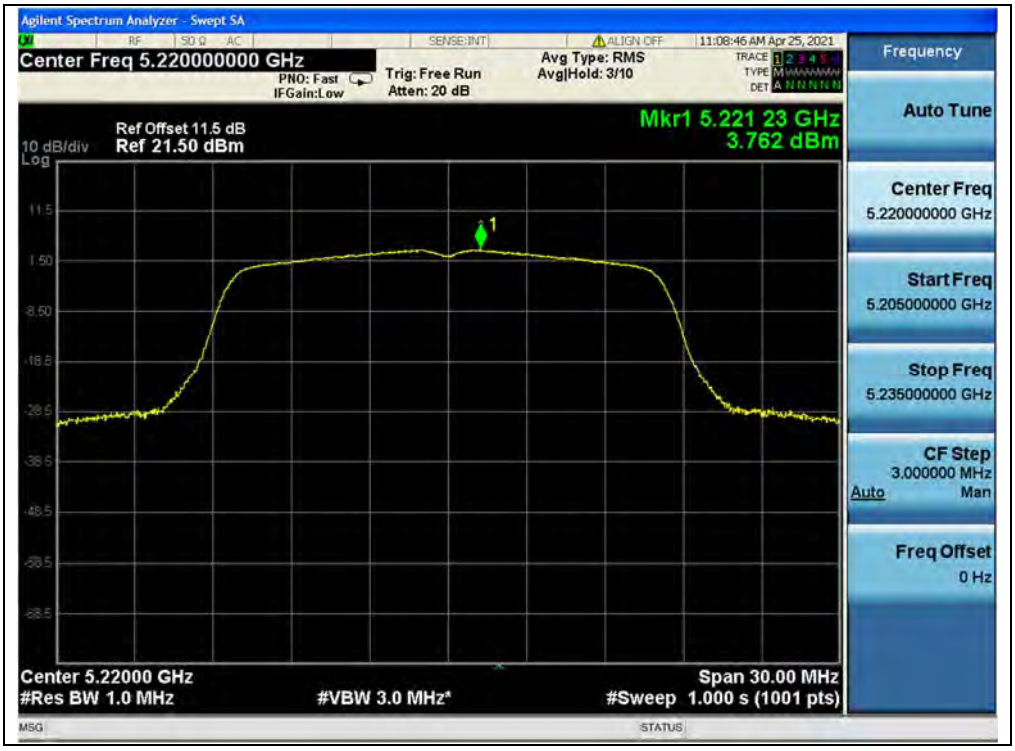
802.11a Mode

A.Test Verdict:

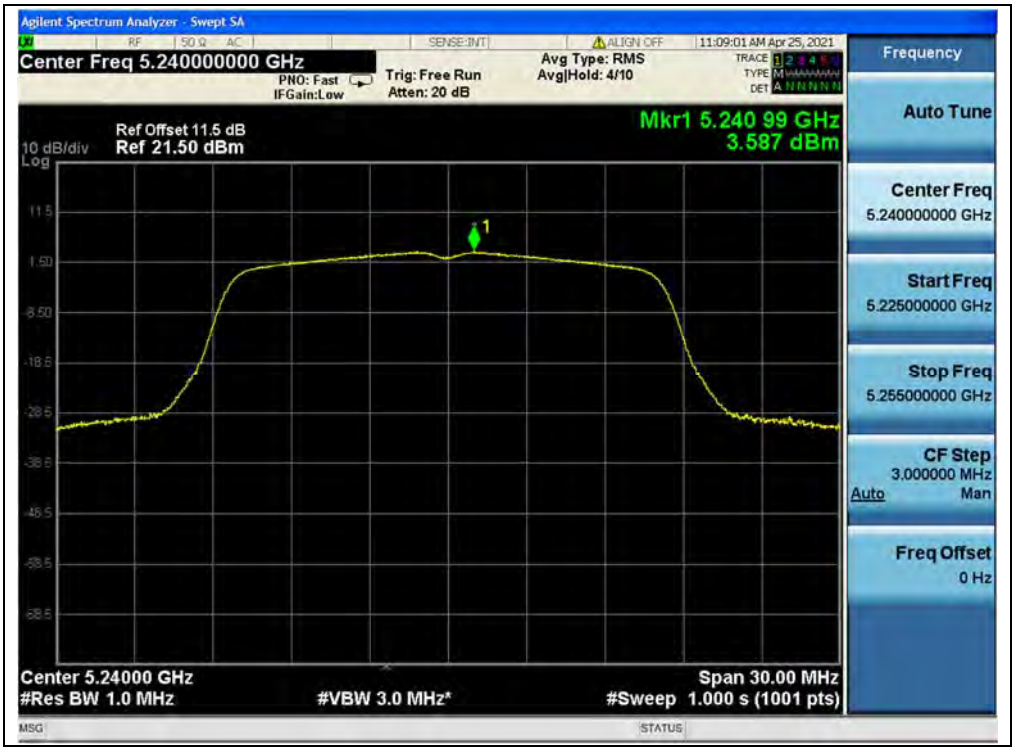
Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
36	5180	**4.03**	0.14	**4.17**	11	PASS
44	5220	3.76		3.90		
48	5240	3.59		3.73		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
149	5745	2.27	0.14	2.41	30	PASS
157	5785	1.73		1.87		
165	5825	0.89		1.03		

B.Test Plot:

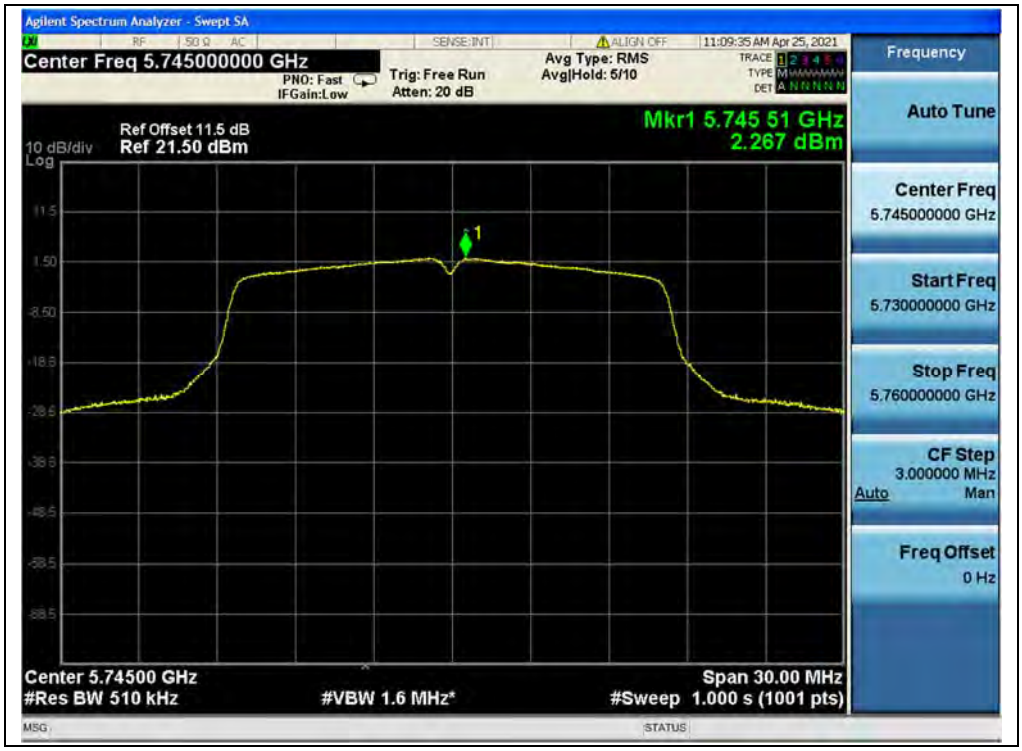
(Channel 36, 5180MHz, 802.11)



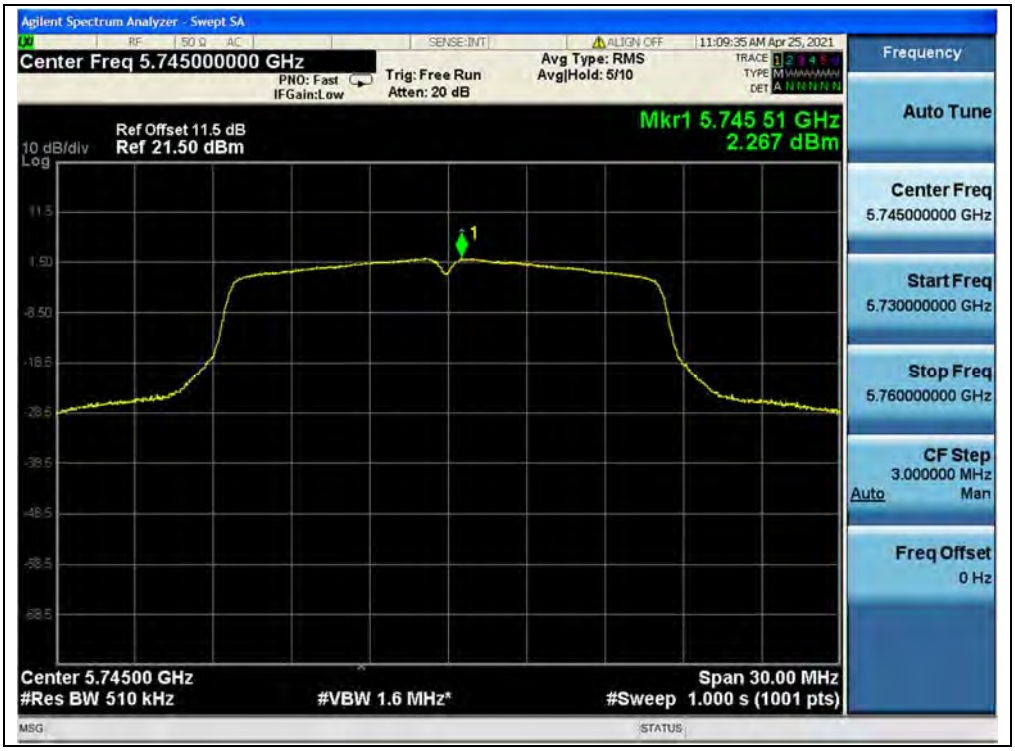
(Channel 44, 5220MHz, 802.11a)



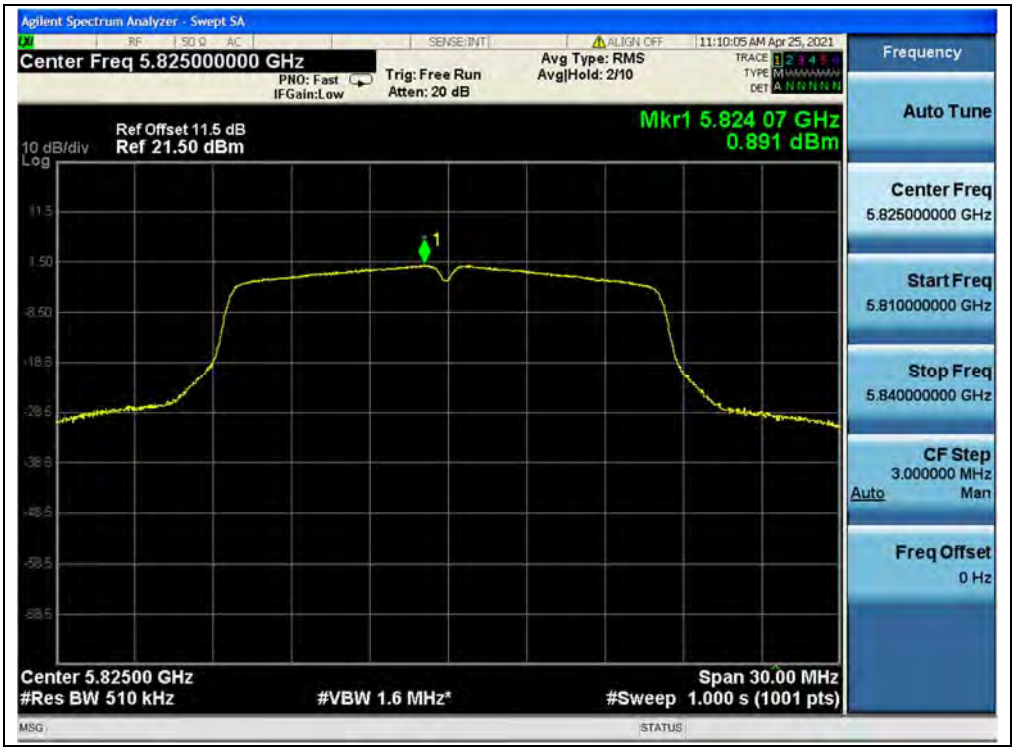
(Channel 48, 5240MHz, 802.11a)



(Channel 149, 5745MHz, 802.11a)



(Channel 157, 5785MHz, 802.11a)



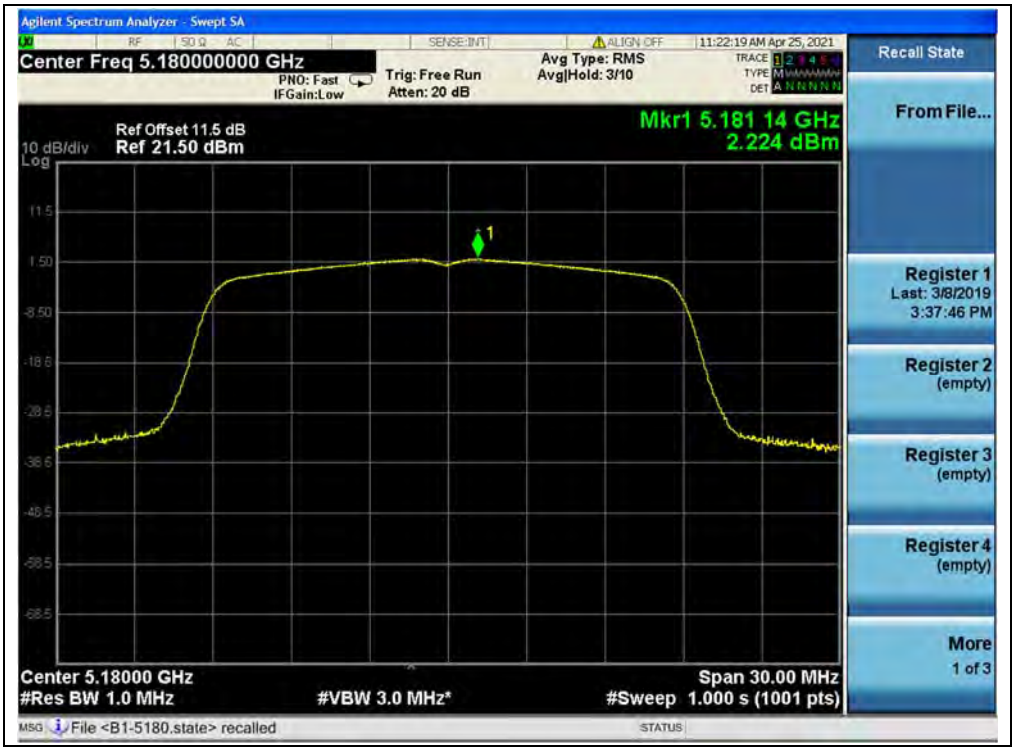
(Channel 165, 5825MHz, 802.11a)

802.11n (HT20) Mode

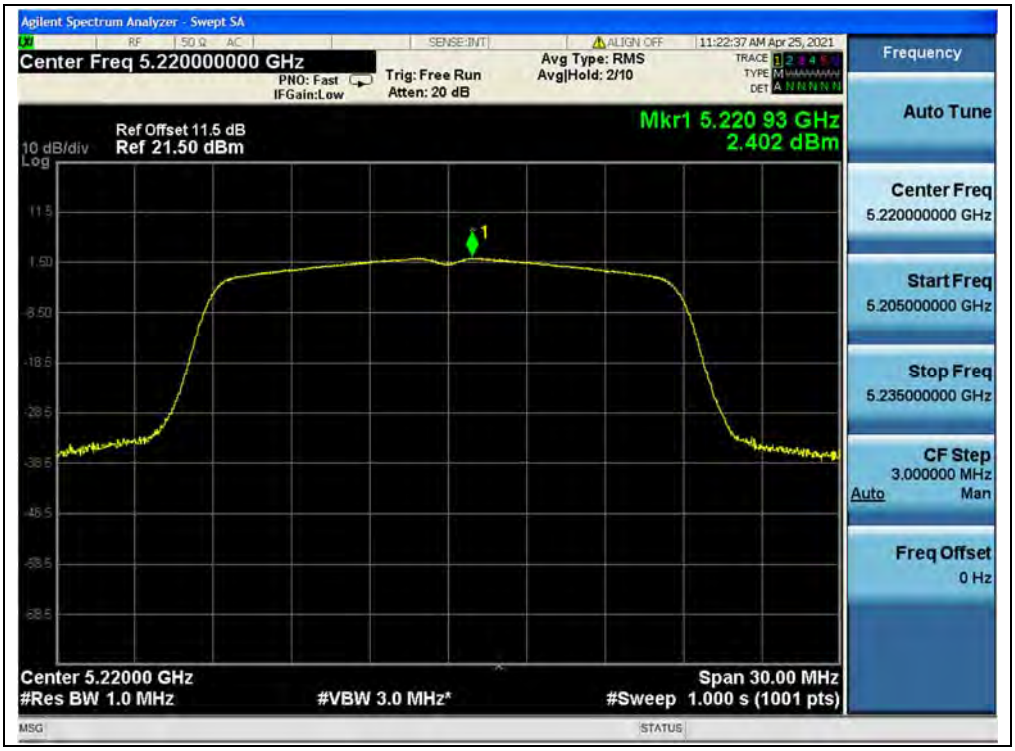
A.Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
36	5180	2.22	0.15	2.37	11	PASS
44	5220	2.40		2.55		
48	5240	2.20		2.35		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
149	5745	1.54	0.15	1.69	30	PASS
157	5785	0.61		0.76		
165	5825	-0.31		-0.16		

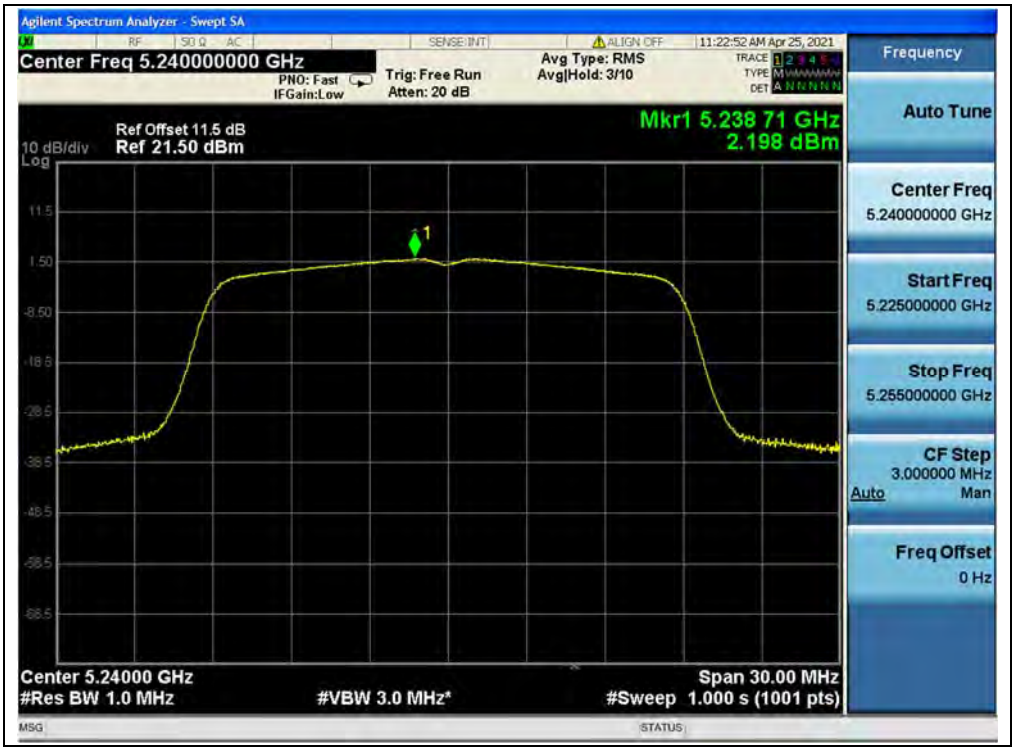
B.Test Plot:



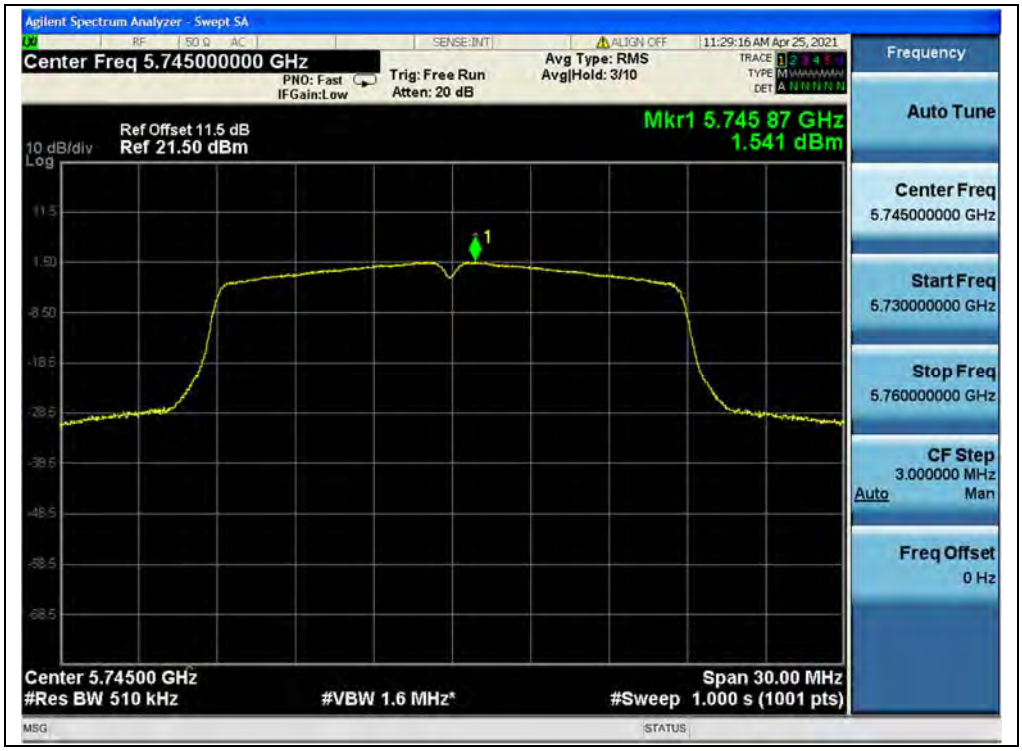
(Channel 36, 5180MHz, 802.11n (HT20))



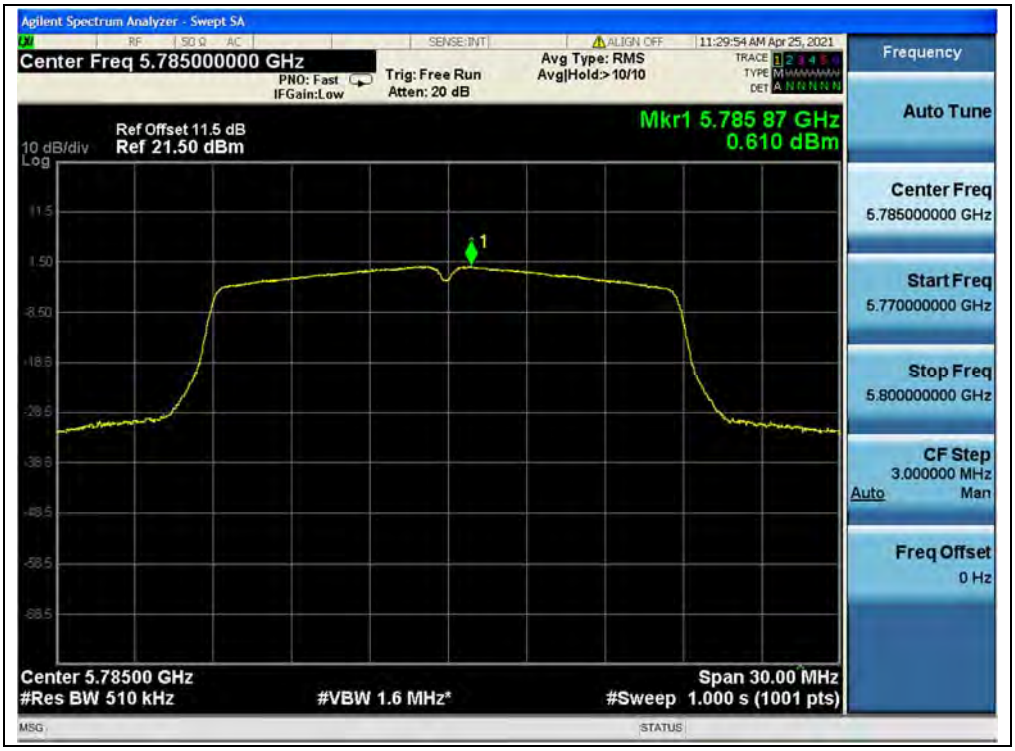
(Channel 44, 5220MHz, 802.11n (HT20))



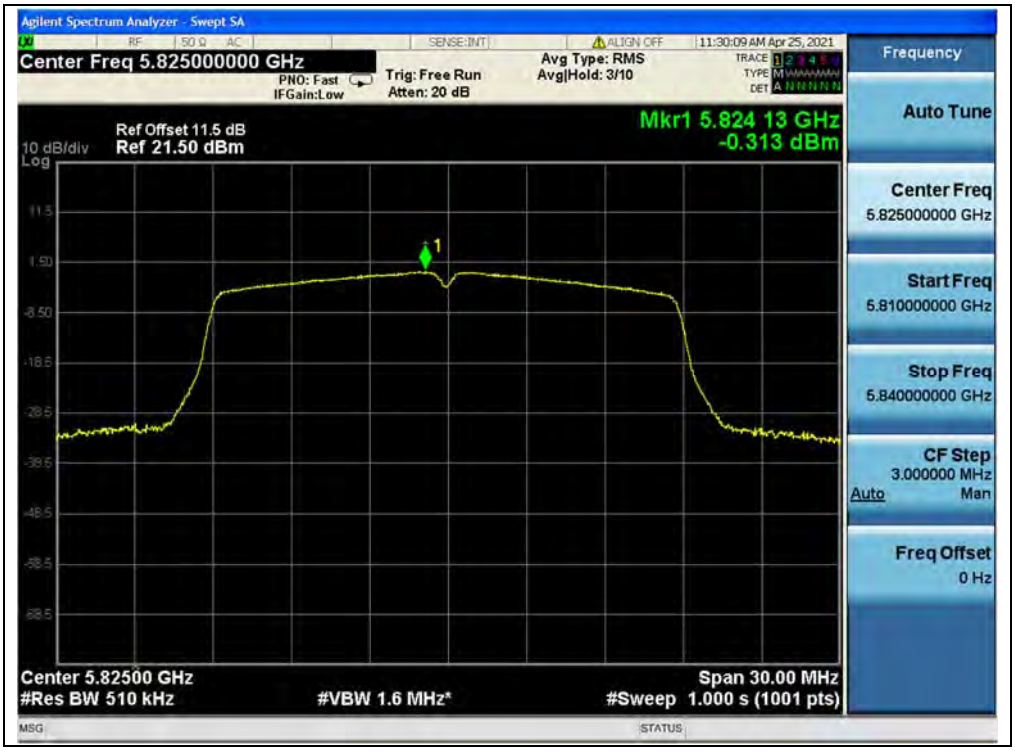
(Channel 48, 5240MHz, 802.11n (HT20))



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



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



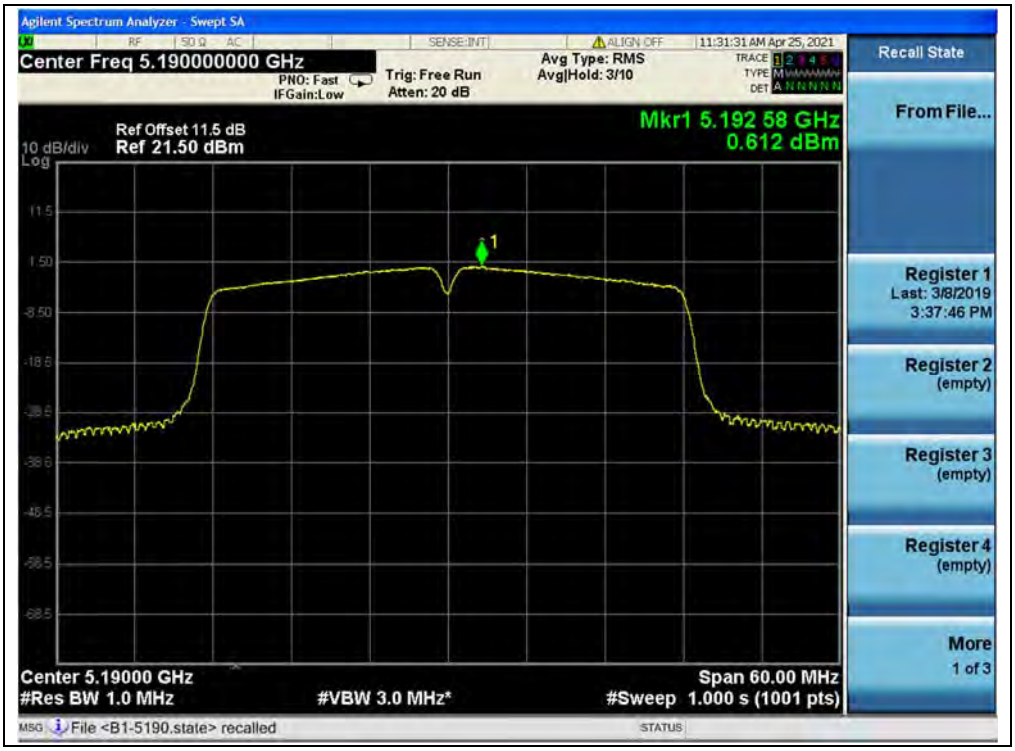
(Channel 165, 5825MHz, 802.11n (HT20))

802.11n (HT40) Mode

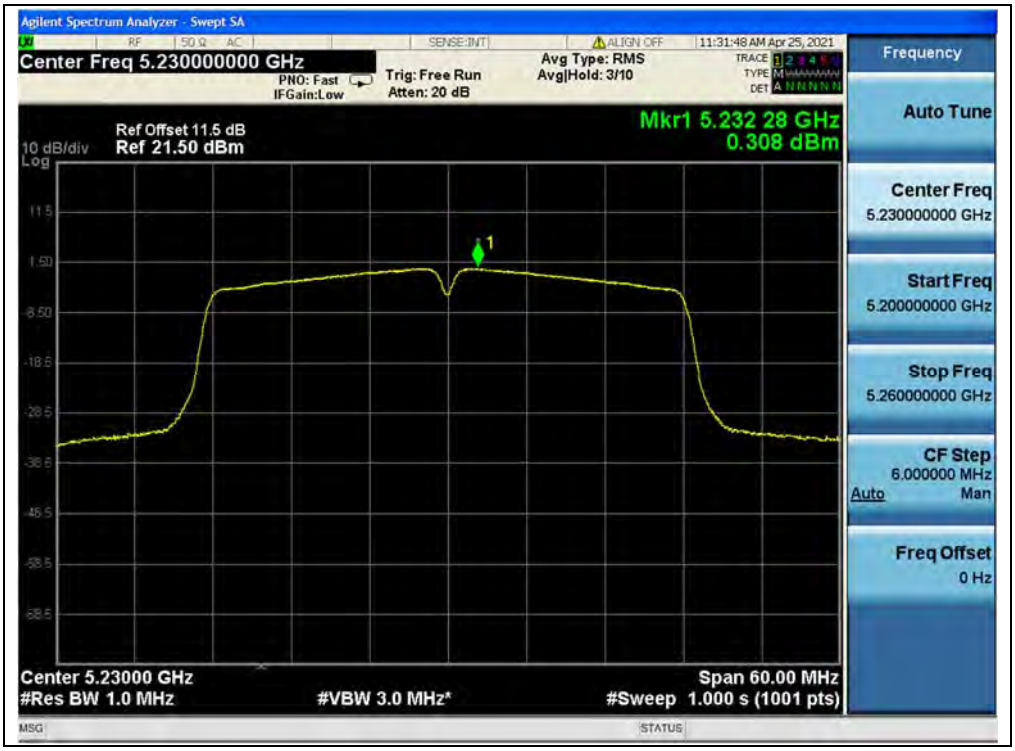
A.Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
38	5190	0.61	0.29	0.90	11	PASS
46	5230	0.31		0.60		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
151	5755	-1.77	0.29	-1.48	30	PASS
159	5795	-2.68		-2.39		

B.Test Plot:



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



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

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

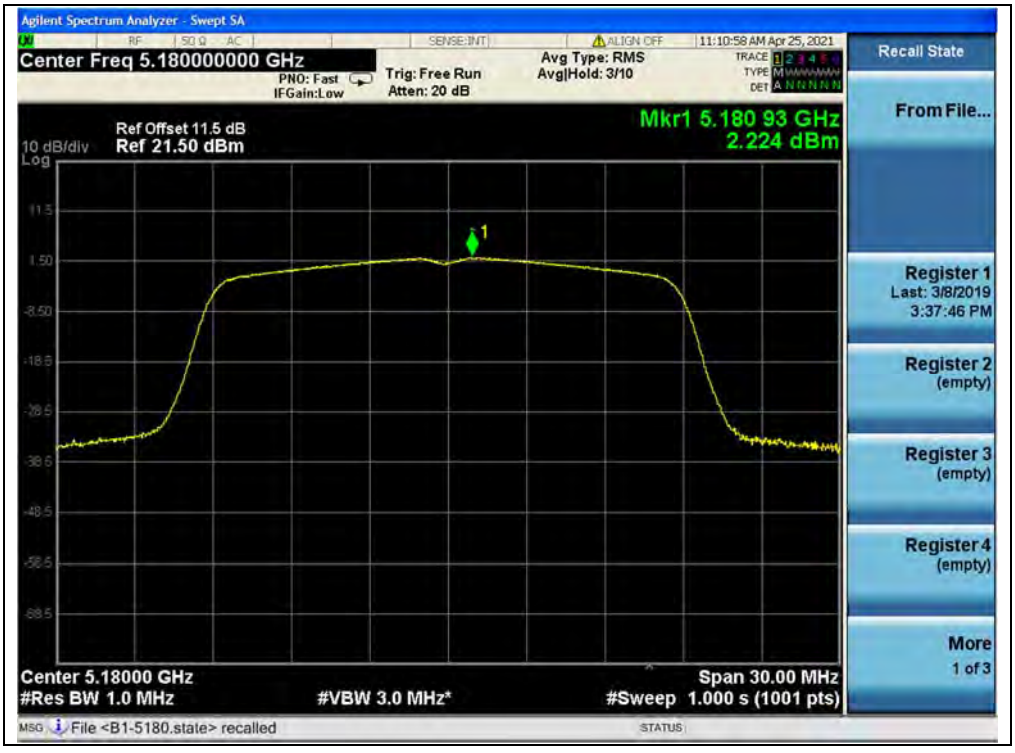
(Channel 159, 5795MHz, 802.11n (HT40))

802.11ac (VHT20) Mode

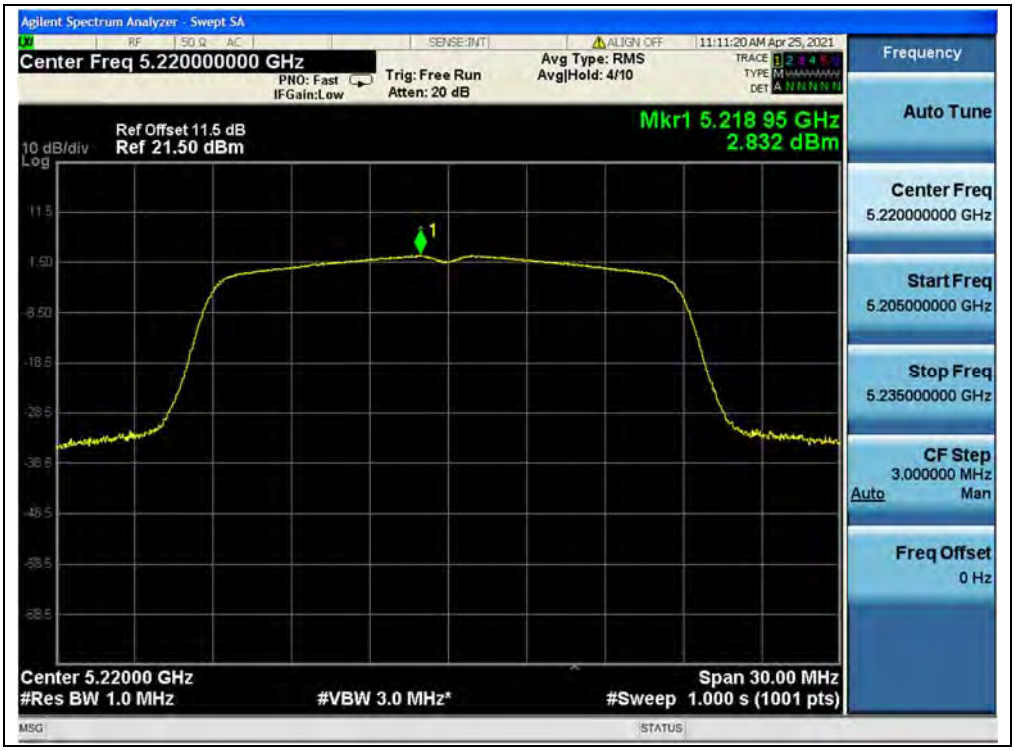
A.Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
36	5180	2.22	0.15	2.37	11	PASS
44	5220	2.83		2.98		
48	5240	2.15		2.30		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
149	5745	0.90	0.15	1.05	30	PASS
157	5785	0.92		1.07		
165	5825	-0.37		-0.22		

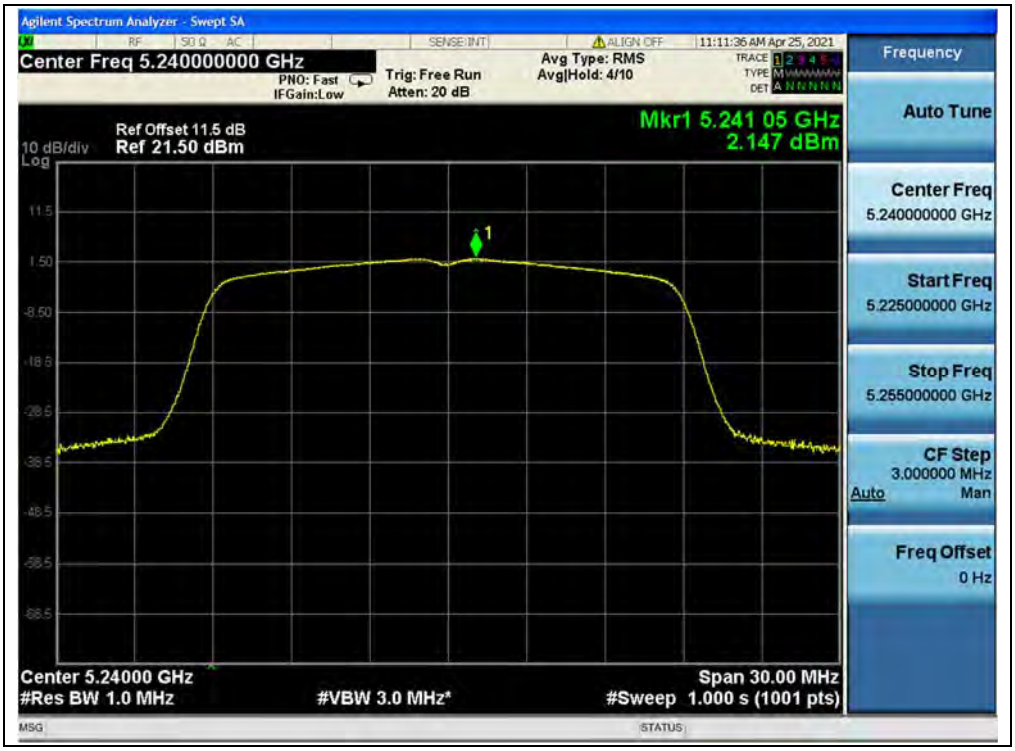
B.Test Plot:



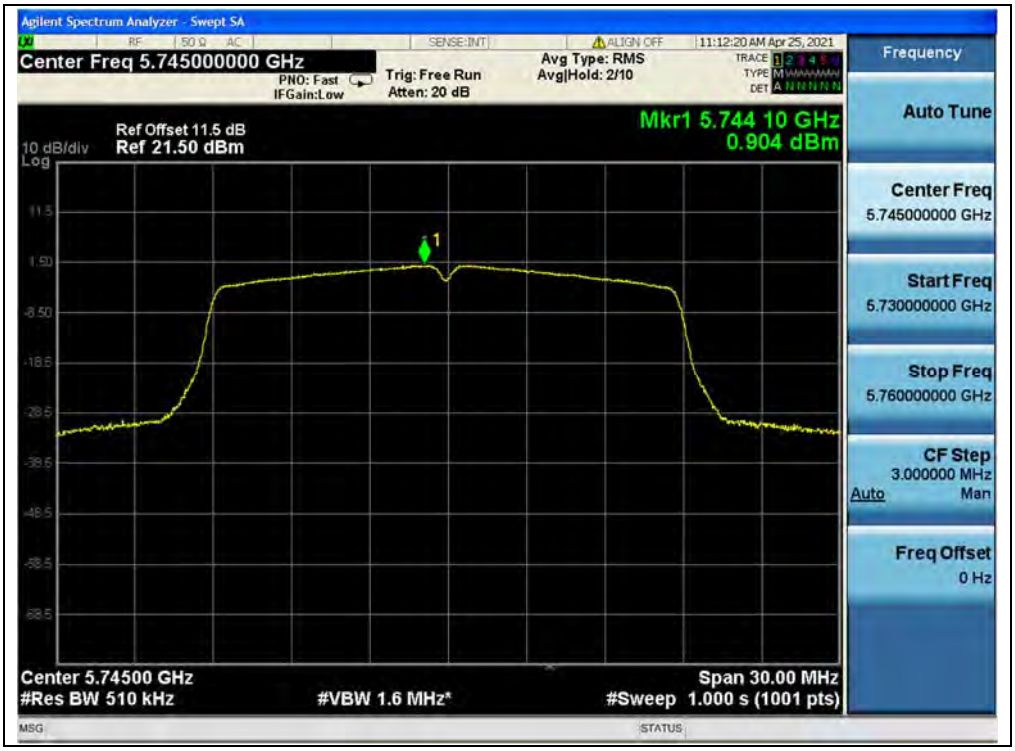
(Channel 36, 5180MHz, 802.11ac (VHT20))



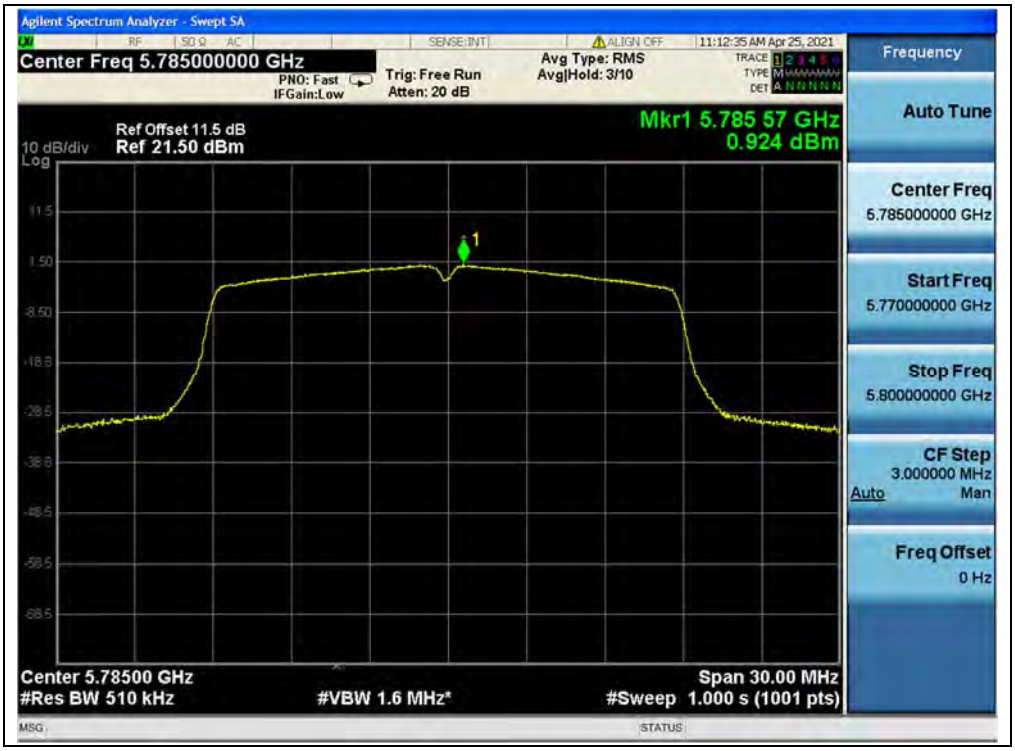
(Channel 44, 5220 MHz, 802.11ac (VHT20))



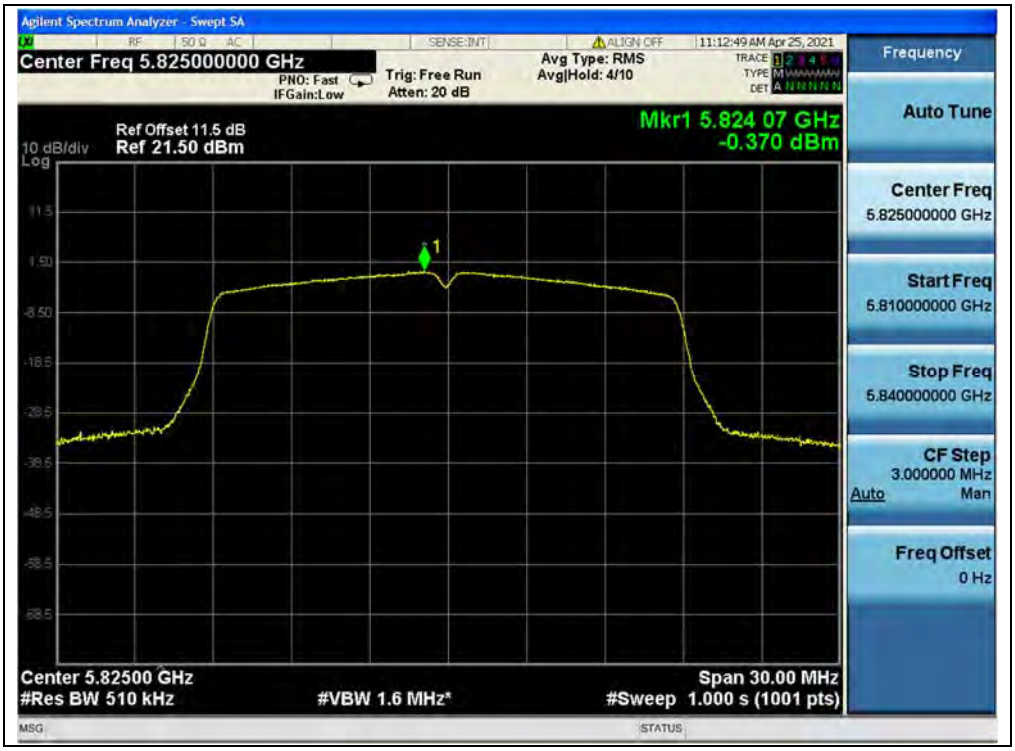
(Channel 48, 5240MHz, 802.11ac (VHT20))



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



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



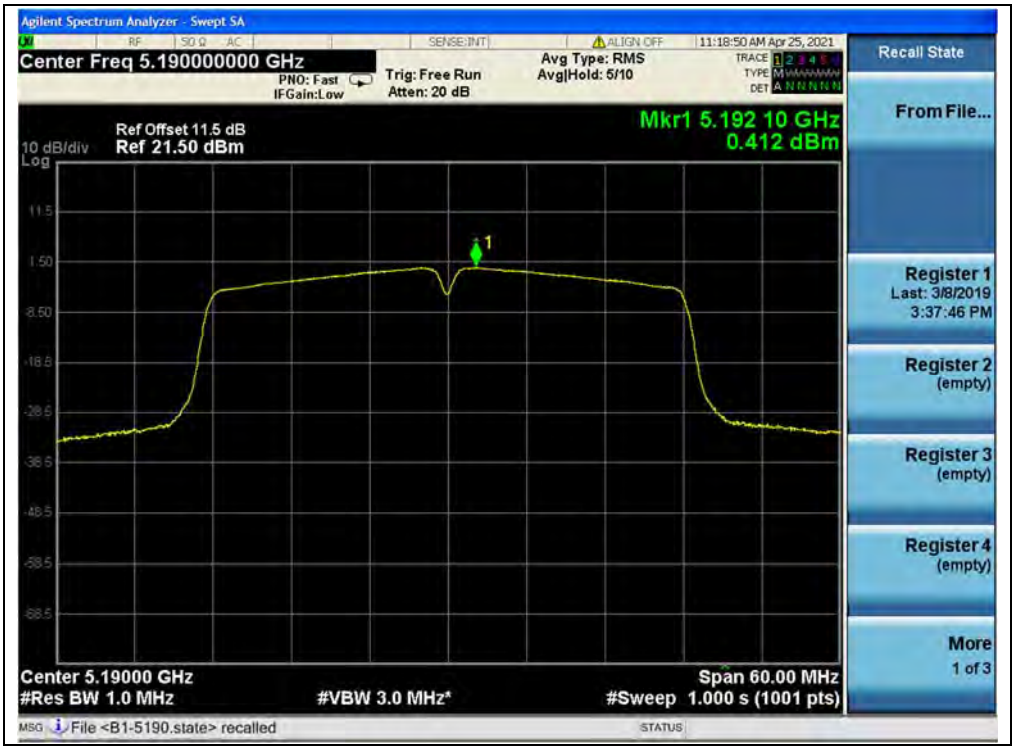
(Channel 165, 5825MHz, 802.11ac (VHT20))

802.11ac (VHT40) Mode

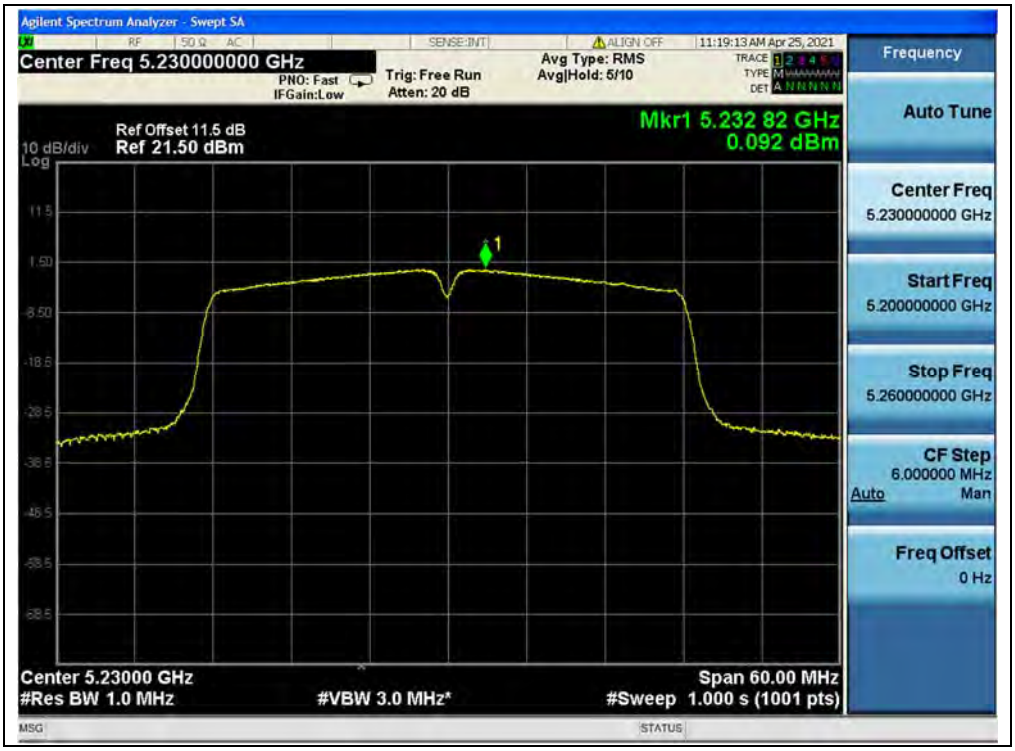
A.Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
38	5190	0.41	0.29	0.70	11	PASS
46	5230	0.09		0.38		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
151	5755	-6.98	0.29	-6.69	30	PASS
159	5795	-3.73		-3.44		

B.Test Plot:

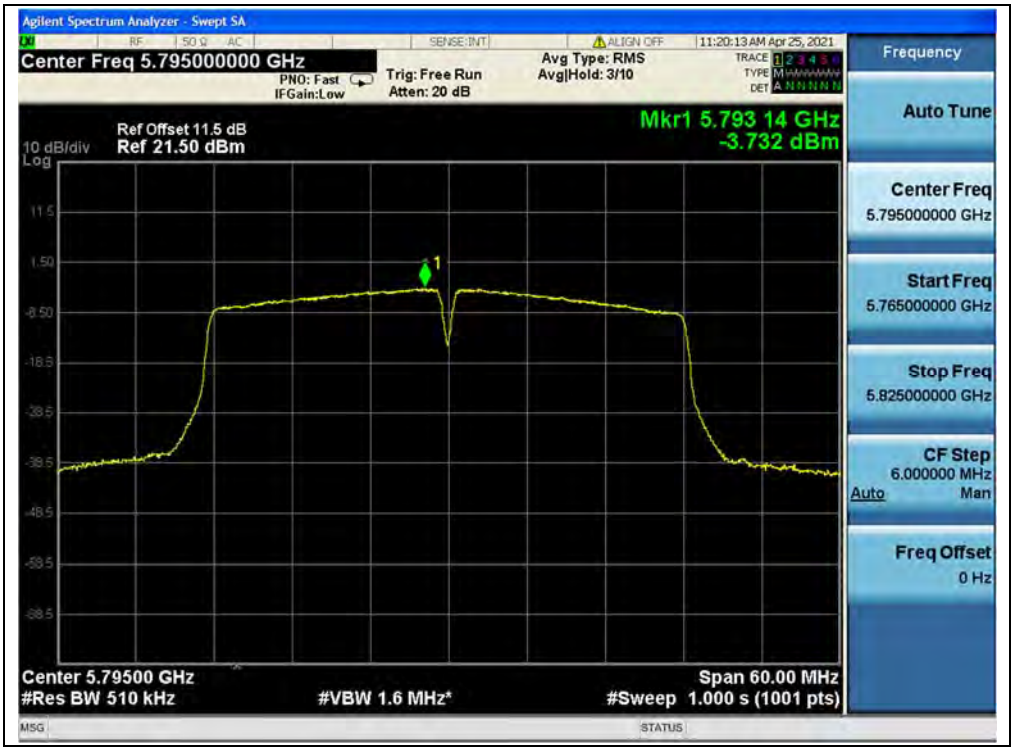


(Channel 38, 5190MHz, 802.11ac (VHT40))



(Channel 46, 5230 MHz, 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)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
42	5210	-2.85	0.56	-2.29	11	PASS
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
155	5775	-6.98	0.56	-6.42	30	PASS

B.Test Plot:

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

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

2.6. Frequency Stability

2.6.1. Requirement

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

2.6.2. Test Procedure

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between 5°Cto 40°C. The temperature was incremented by 10º intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded. Data for the worst case channel is shown below.

2.6.3. Test Result

U-NII-1 (Ch. 36) 5180MHz				
Voltage (%)	Power (VDC)	Temp (°C)	Fre. Dev. (kHz)	Deviation (ppm)
100%	5.00	+20(Ref)	22	4.247
100%		-30	31	5.985
100%		-20	29	5.598
100%		-10	26	5.019
100%		0	25	4.826
100%		+10	22	4.247
100%		+20	20	3.861
100%		+30	23	4.440
100%		+40	26	5.019
100%		+50	23	4.440
85%	4.25	+20	28	5.405
115%	5.75	+20	30	5.792

U-NII-3 (Ch. 149) 5745MHz				
Voltage (%)	Power (VDC)	Temp (°C)	Fre. Dev. (kHz)	Deviation (ppm)
100%	5.00	+20(Ref)	22	3.829
100%		-30	26	4.526
100%		-20	27	4.700
100%		-10	21	3.655
100%		0	30	5.222
100%		+10	25	4.352
100%		+20	26	4.526
100%		+30	26	4.526
100%		+40	28	4.874
100%		+50	28	4.874
85%	4.25	+20	31	5.396
115%	5.75	+20	29	5.048

2.7. Conducted Emission

2.7.1. Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency Range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

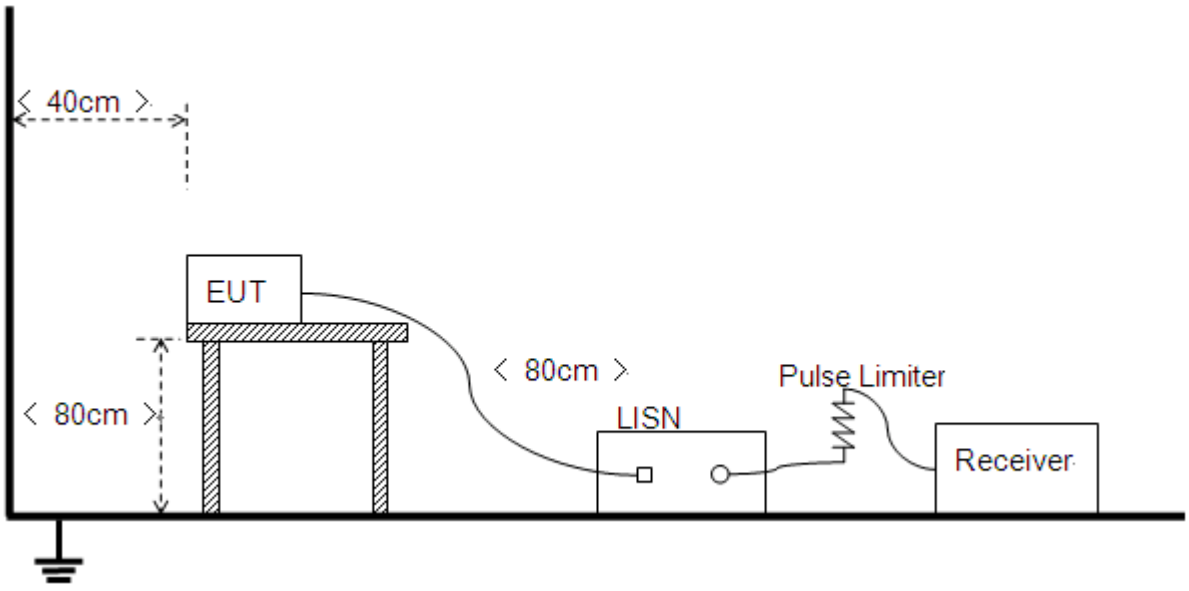
Note:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.7.2. Test Description

Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

2.7.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Set RBW=9kHz, VBW=30kHz. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hzwere considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

A.Test Setup:

Test Mode: EUT+ADAPTER + WIFI TX

Test Voltage: AC 120V/60Hz

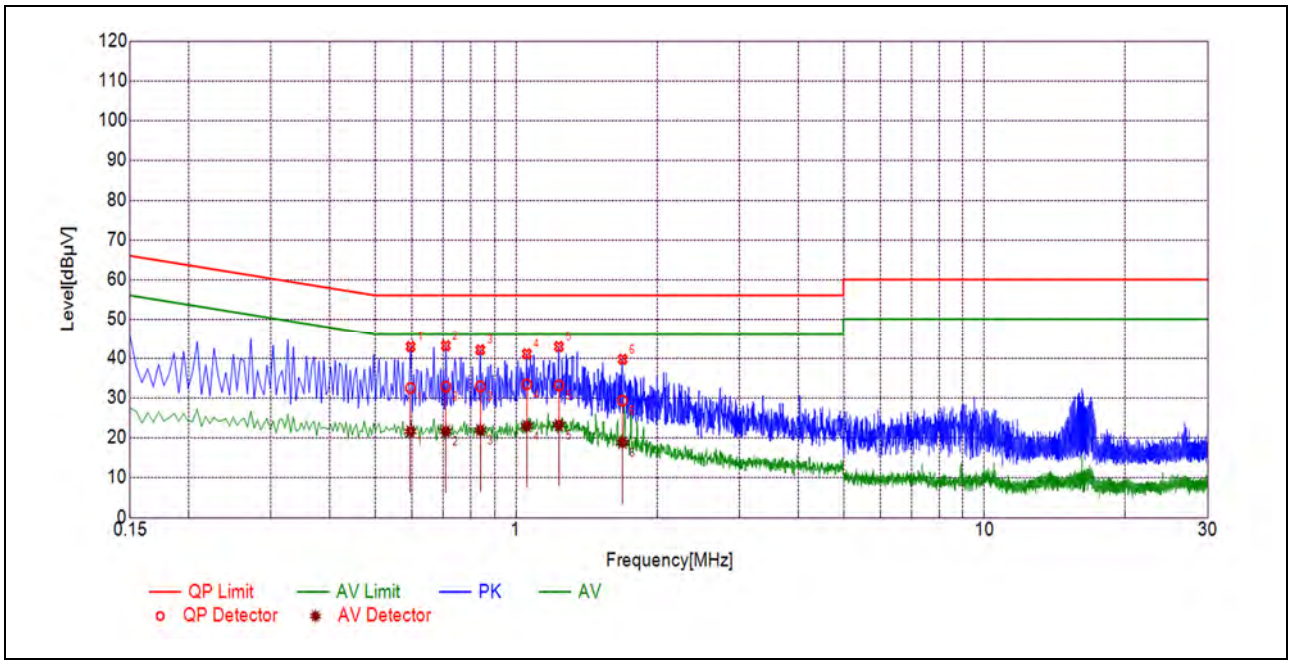
The measurement results are obtained as below:

$E\ [dB\mu V] = U_R + L_{Cable\ loss}\ [dB] + A_{Factor}$

U_R: Receiver Reading

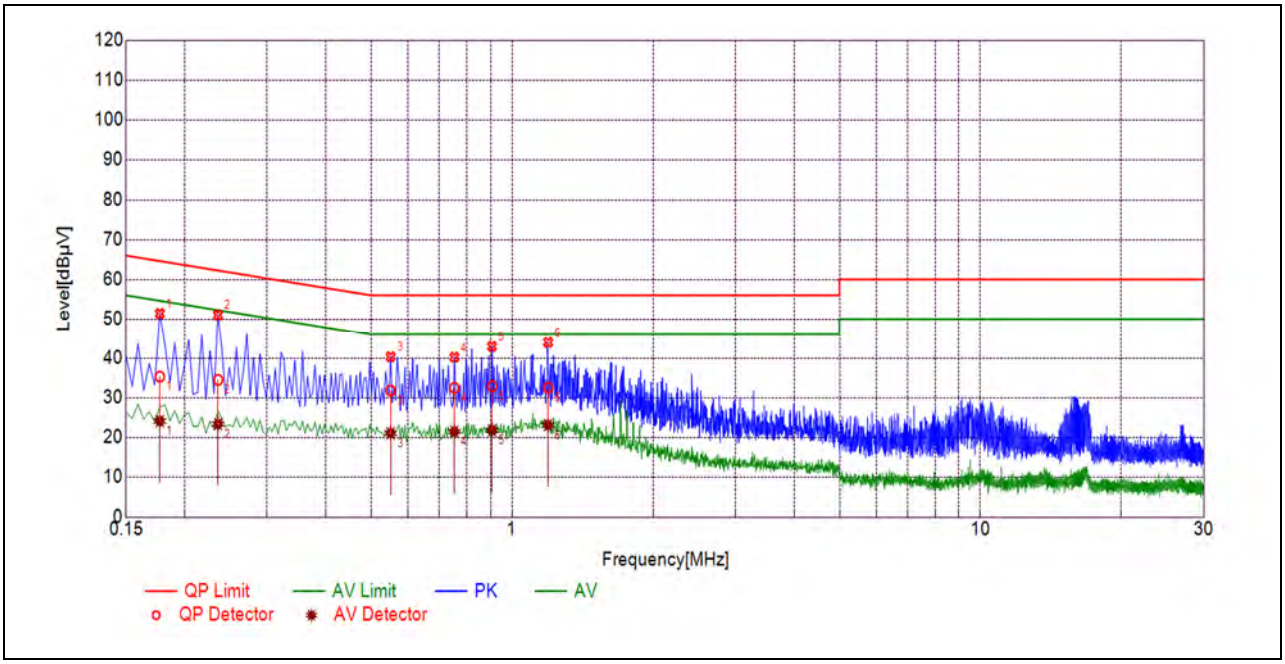
A_{Factor}: Voltage division factor of LISN

B.Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.5949	32.45	21.54	56.00	46.00	Line	PASS
2	0.7080	32.79	21.59	56.00	46.00		PASS
3	0.8385	32.87	21.86	56.00	46.00		PASS
4	1.0537	33.36	22.88	56.00	46.00		PASS
5	1.2344	33.12	23.16	56.00	46.00		PASS
6	1.6873	29.28	18.75	56.00	46.00		PASS



(N Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1770	35.31	24.08	64.62	54.62	Neutral	PASS
2	0.2357	34.48	23.33	62.25	52.25		PASS
3	0.5503	31.78	21.01	56.00	46.00		PASS
4	0.7529	32.46	21.42	56.00	46.00		PASS
5	0.9065	32.90	21.78	56.00	46.00		PASS
6	1.1933	32.49	23.06	56.00	46.00		PASS

2.8. Restricted Frequency Bands

2.8.1. Requirement

The peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.
(2) For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.
(3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of -27dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band:
(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
The following formula is used to convert the equipment isotropic radiated power(e.i.r.p.) to field strength (dBμV/m);

$$E = 1000000 \times \sqrt{30P} / 3 \ \mu V/m$$

where P is the EIRP in Watts

Therefore: -27 dBm/MHz = 68.23 dBuV/m

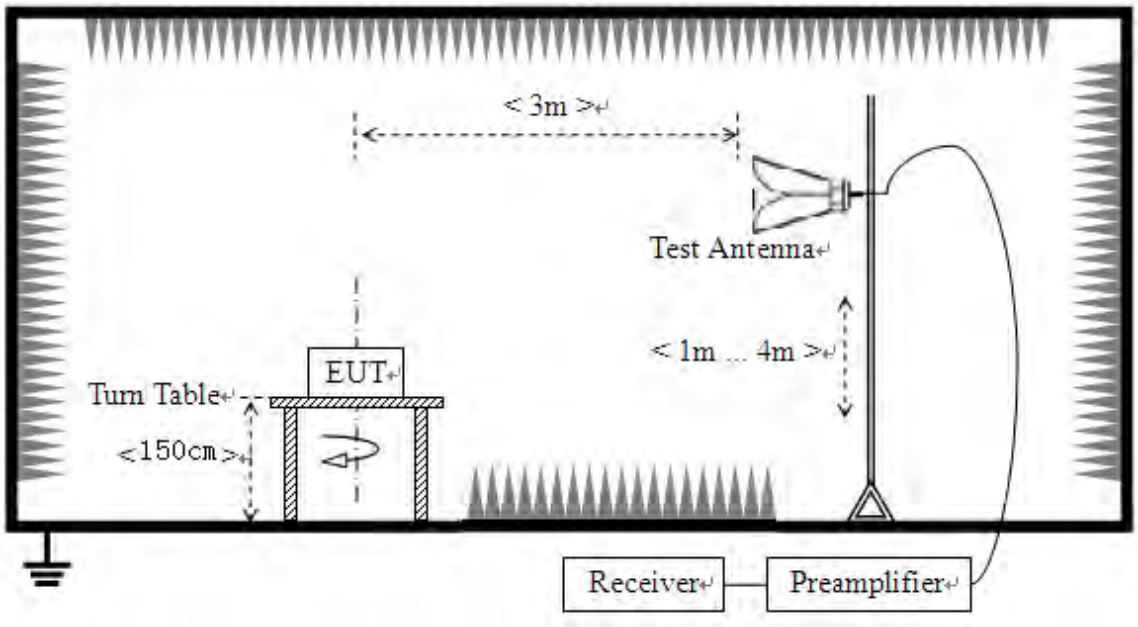
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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

For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table).

2.8.2. Test Description

Test Setup



The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.
KDB 789033 Section H) 3)5)6(d)) was used in order to prove compliance
For the Test Antenna:
Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

2.8.3. Test Result

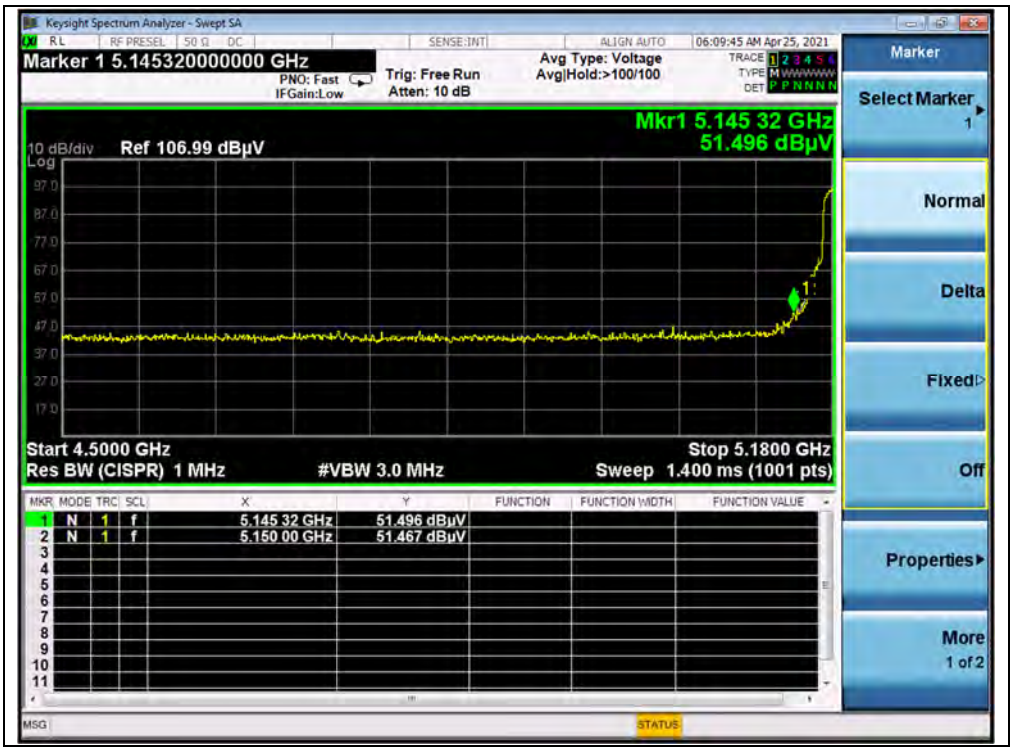
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] =U_R + A_T + A_{Factor} [dB]; A_T =$L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
A_T: Total correction Factor except Antenna; U_R: Receiver Reading
G_{preamp}: Preamplifier Gain; A_{Factor}: Antenna Factor at 3m
Note 1: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.
Note 2 All test modes and bandwidth were considered and evaluated respectively by performing full test, only the worst data were recorded for each bandwidth.

802.11a Mode

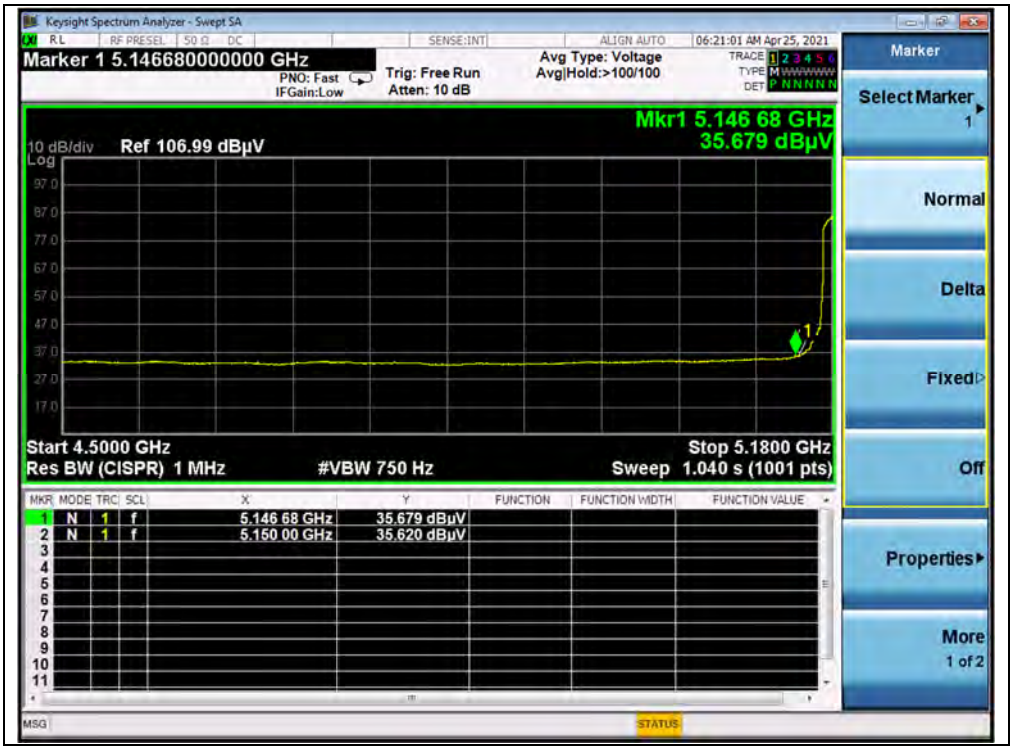
A.Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
36	5145.32	PK	51.50	-19.54	32.20	64.16	74	PASS
36	5146.68	AV	35.68	-19.54	32.20	48.34	54	PASS
48	5400.16	PK	43.34	-19.54	32.20	56.00	74	PASS
48	5350.00	AV	32.67	-19.54	32.20	45.33	54	PASS
149	5725.00	PK	62.39	-19.01	32.20	75.58	122.23	PASS
165	5850.00	PK	57.91	-19.01	32.20	71.10	122.23	PASS

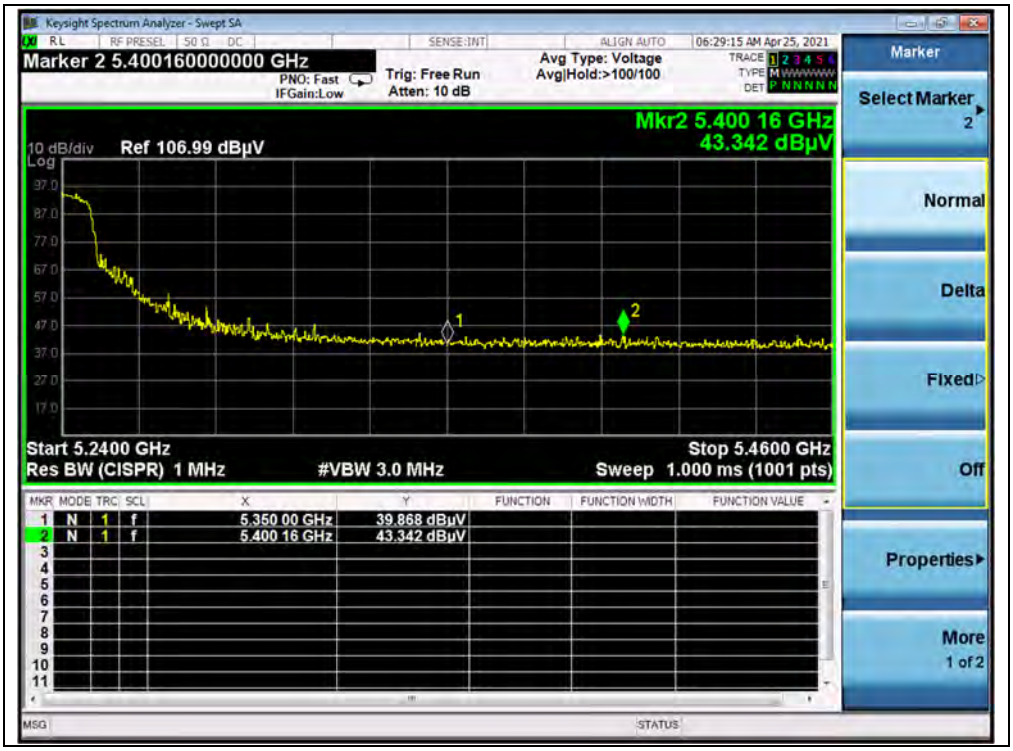
B.Test Plot:



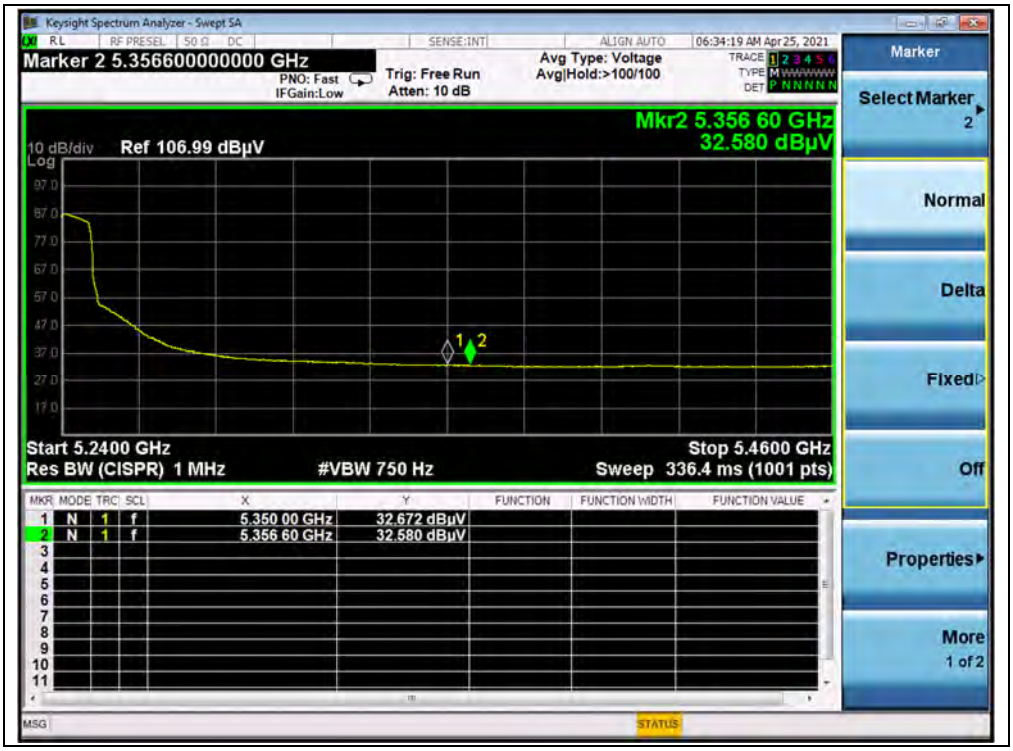
(PEAK, Channel 36, 802.11a)



(AVERAGE, Channel 36, 802.11a)



(PEAK, Channel 48, 802.11a)



(AVERAGE, Channel 48, 802.11a)

(PEAK, Channel 149, 802.11a)

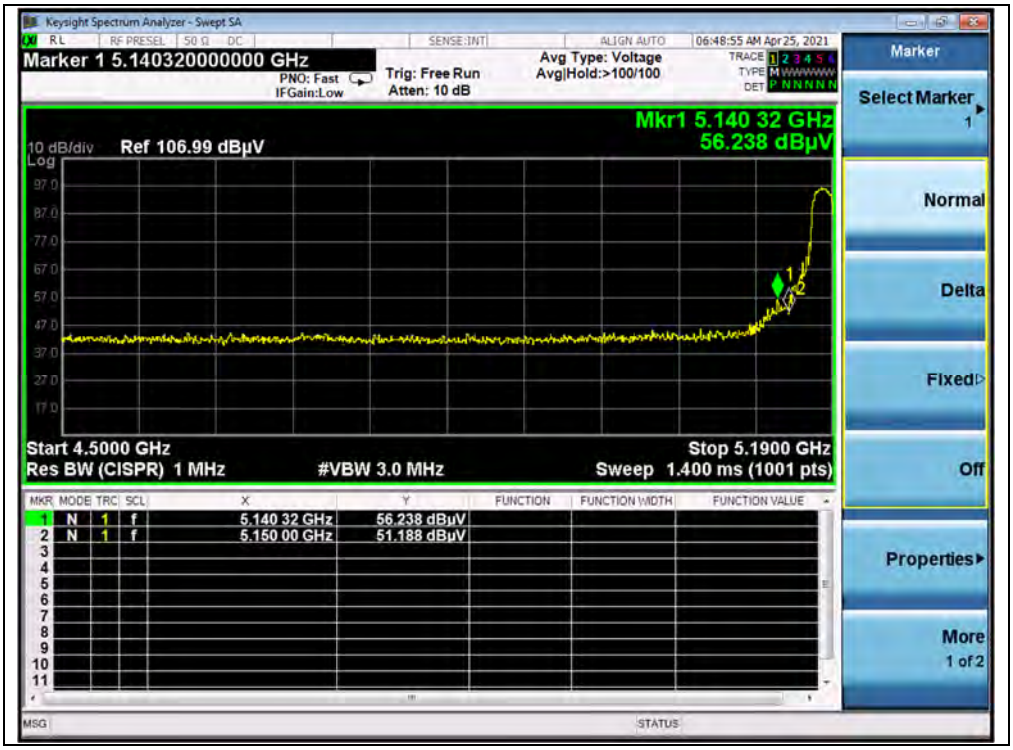
(PEAK, Channel 165, 802.11a)

802.11n (HT40) Mode

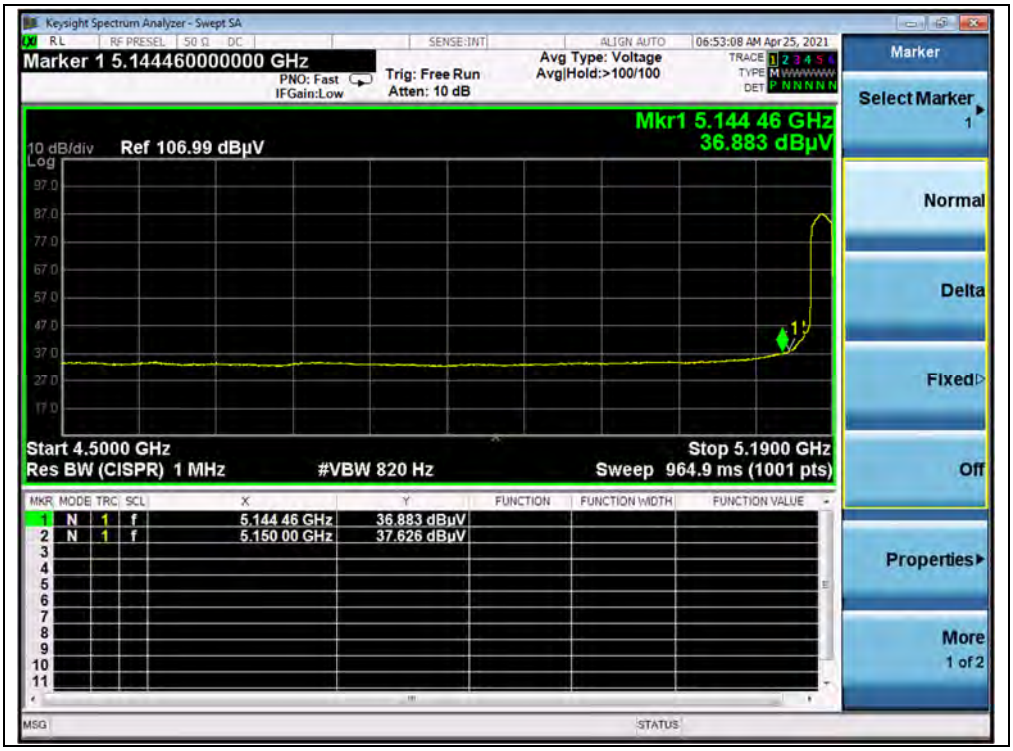
A.Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
38	5140.32	PK	56.24	-19.54	32.20	68.90	74	PASS
38	5150.00	AV	37.63	-19.54	32.20	50.29	54	PASS
48	5351.50	PK	43.72	-19.54	32.20	56.38	74	PASS
48	5350.00	AV	33.03	-19.54	32.20	45.69	54	PASS
151	5725.00	PK	64.02	-19.01	32.20	77.21	122.23	PASS
159	5850.00	PK	44.33	-19.01	32.20	57.52	122.23	PASS

B.Test Plot:

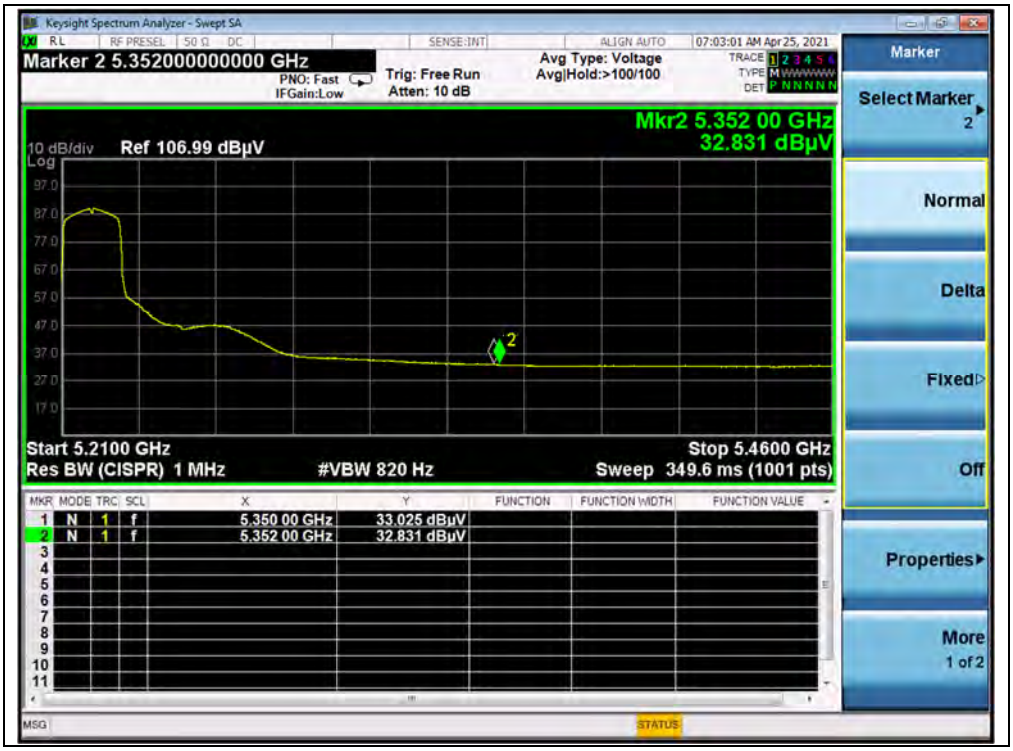


(PEAK, Channel 38, 802.11n (HT40))



(AVERAGE, Channel 38, 802.11n (HT40))

(PEAK, Channel 48, 802.11n (HT40))



(AVERAGE, Channel 48, 802.11n (HT40))

(PEAK, Channel 151, 802.11n (HT40))

(PEAK, Channel 159, 802.11n (HT40))

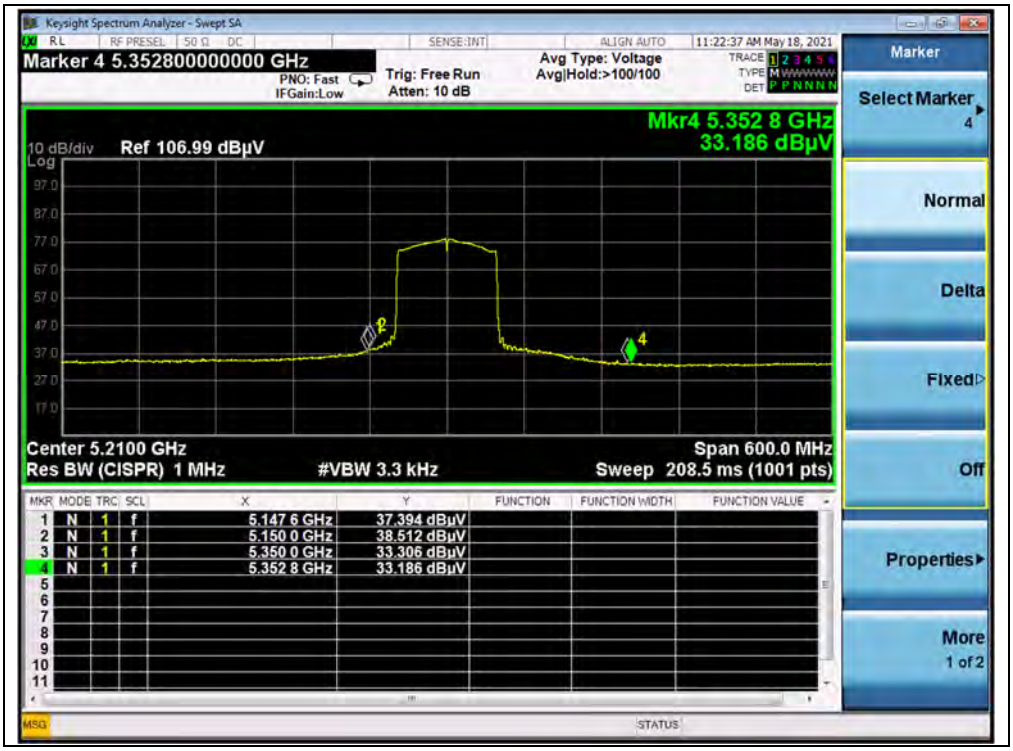
802.11 ac (VHT80) Mode

A.Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
42	5150.00	PK	58.32	-19.54	32.20	70.98	74	PASS
42	5150.00	AV	38.51	-19.54	32.20	51.17	54	PASS
42	5354.60	PK	45.74	-19.54	32.20	58.40	74	PASS
42	5350.00	AV	33.31	-19.54	32.20	45.97	54	PASS
155	5720.00	PK	65.46	-19.01	32.20	78.65	110.83	PASS
155	5850.00	PK	57.97	-19.01	32.20	71.16	122.23	PASS

B.Test Plot:

(Channel 42, PEAK, 802.11ac (VHT80))



(Channel 42, AVG, 802.11ac (VHT80))

(Channel 155, PEAK, 802.11ac (VHT80))

2.9. Radiated Emission

2.9.1. Requirement

The peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.
(2) For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.
(3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of -27dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.
The following formula is used to convert the equipment isotropic radiated power(e.i.r.p.) to field strength (dBμV/m);

$$E = 1000000 \times \sqrt{30P} / 3 \ \mu V/m$$

where P is the EIRP in Watts

Therefore: -27 dBm/MHz = 68.23 dBuV/m

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

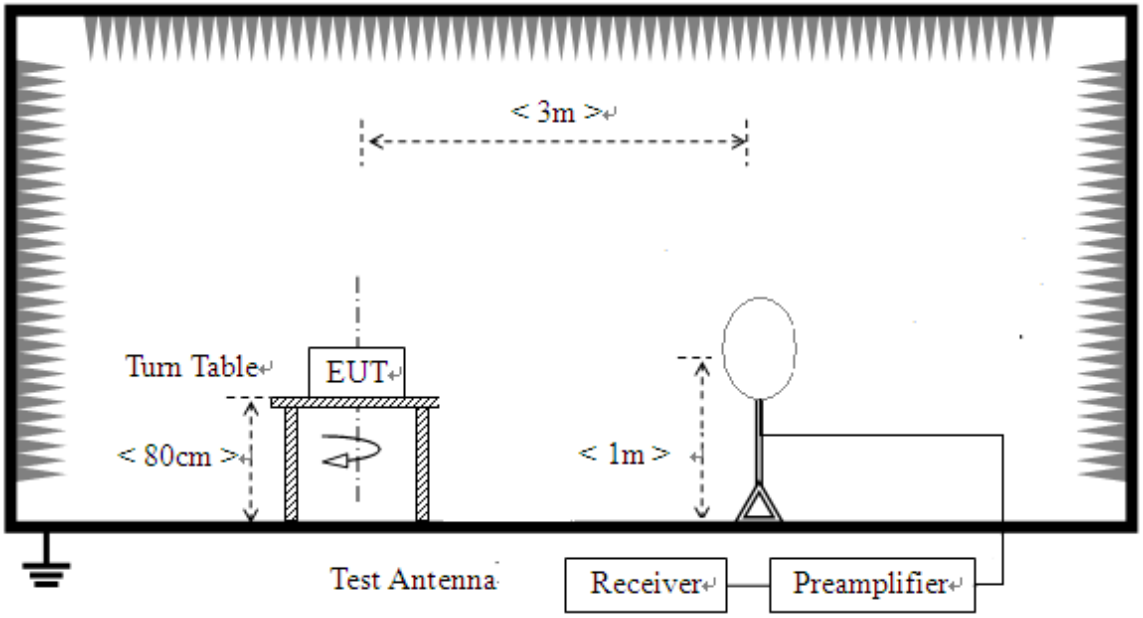
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table).

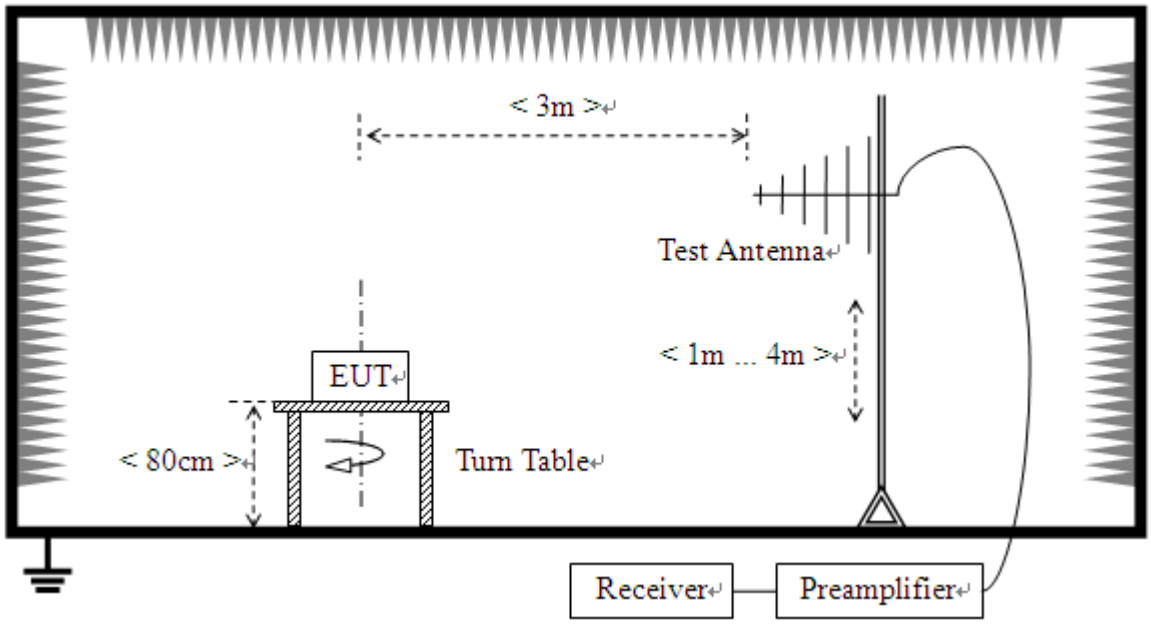
2.9.2. Test Description

Test Setup:

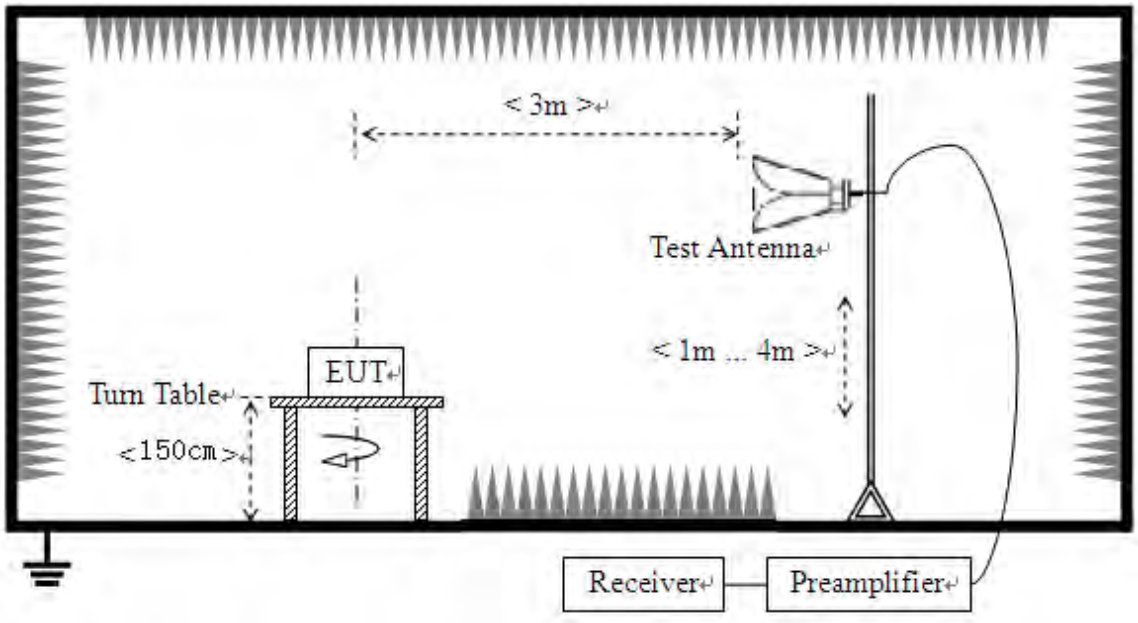
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz.The antenna to EUT distance is 3meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 30MHz, the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9kHz-90 kHz, 110kHz-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

For measurements below 1GHz the resolution bandwidth is set to 100kHz for peak detection measurements or 120kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1GHz the resolution bandwidth is set to 1MHz, the video band width is set to 3MHz for peak measurements and as applicable for average measurements.

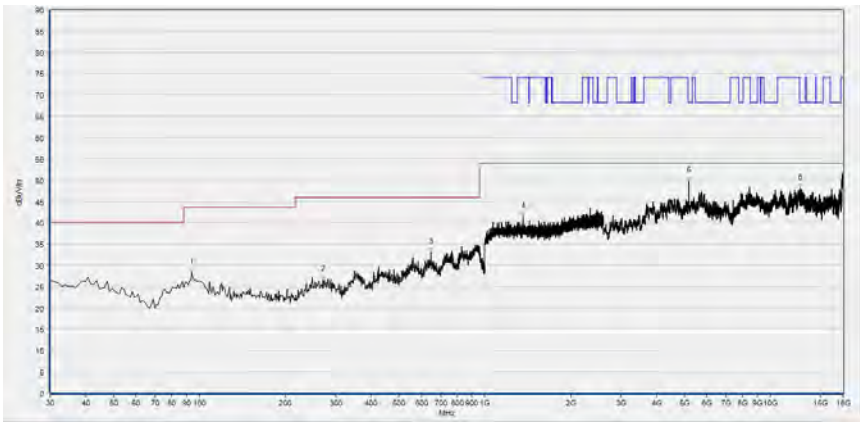
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

2.9.3. Test Result

According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak (or average) limit, it is unnecessary to perform an quasi-peak measurement (or average).
The measurement results are obtained as below:
$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m
During the test, the total correction Factor A_T and A_{Factor} were built in test software.
Note 1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.
Note 2: For the frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.
Note 3: For the frequency, which started from 18GHz to 40GHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.
Note 4: All test modes and bandwidth were considered and evaluated respectively by performing full test, only the worst data were recorded for each bandwidth.

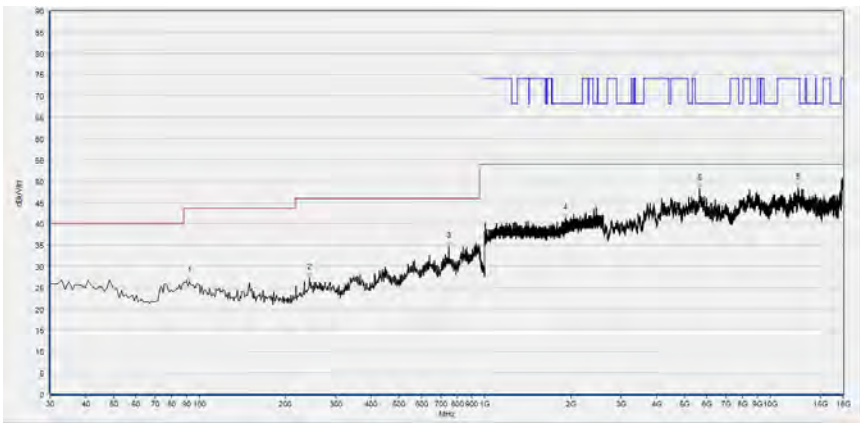
802.11a Mode

Plot for Channel 36



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
94.084	28.33	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
270.801	26.62	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
647.538	32.94	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1359.587	41.47	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5181.556	49.79	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12744.469	48.03	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

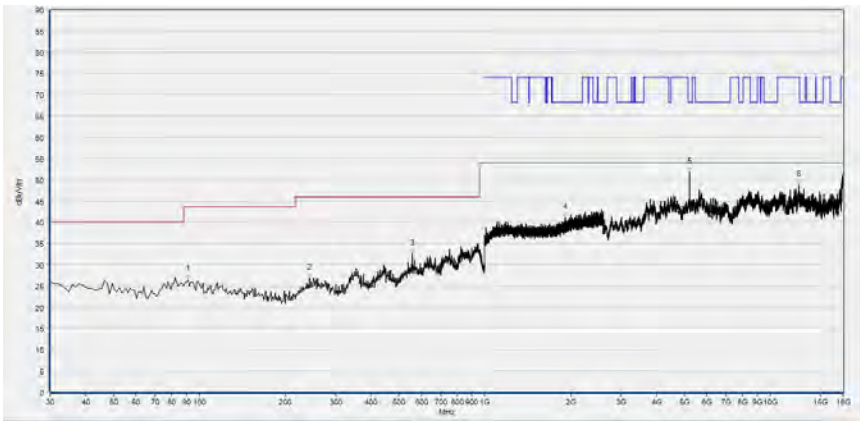
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
92.142	26.52	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
242.643	27.24	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
746.577	34.64	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1909.637	41.24	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5655.971	48.27	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12498.020	48.42	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

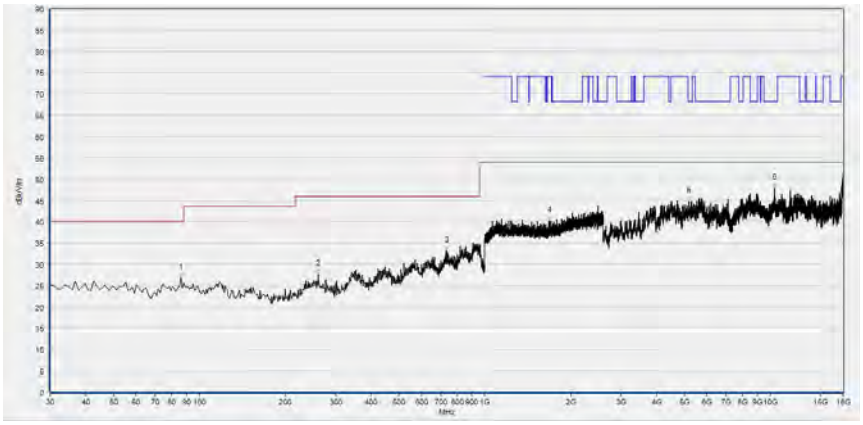
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 44



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
91.171	26.41	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
242.643	26.75	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
556.266	32.53	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1915.505	41.08	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5218.524	51.70	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12568.874	48.79	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

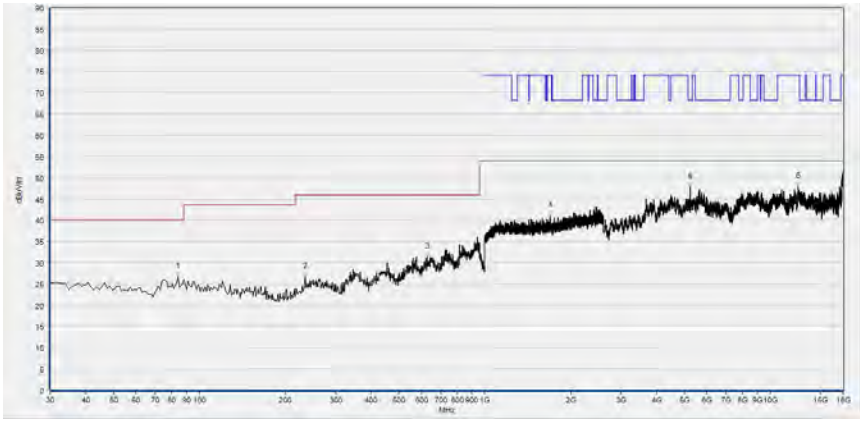
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
86.316	26.76	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
261.091	27.66	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
732.983	33.11	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1683.961	40.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5181.556	44.82	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
10341.588	48.00	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

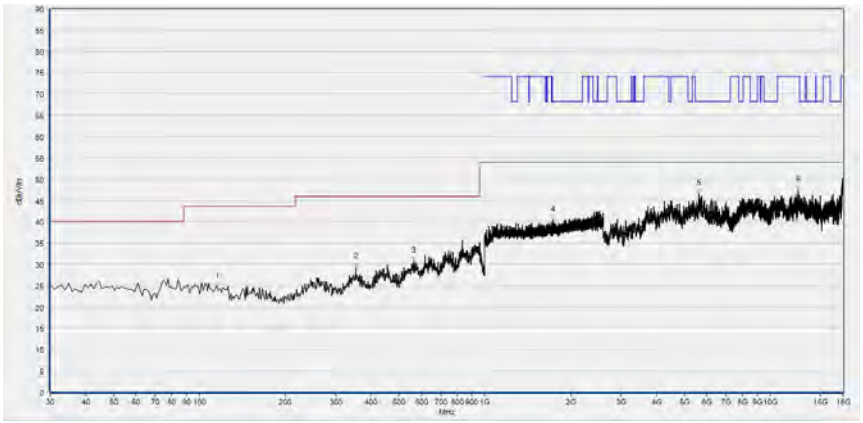
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 48



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
84.374	26.69	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
234.875	26.72	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
627.147	31.32	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1690.363	41.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5243.169	47.74	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12516.503	47.96	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

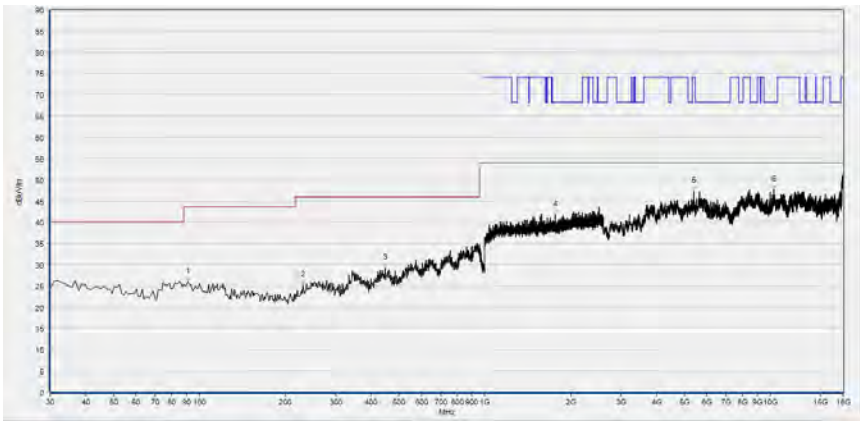
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
115.445	24.74	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
353.333	29.28	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
565.005	30.66	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1730.377	40.39	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5631.326	46.63	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12522.665	47.46	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

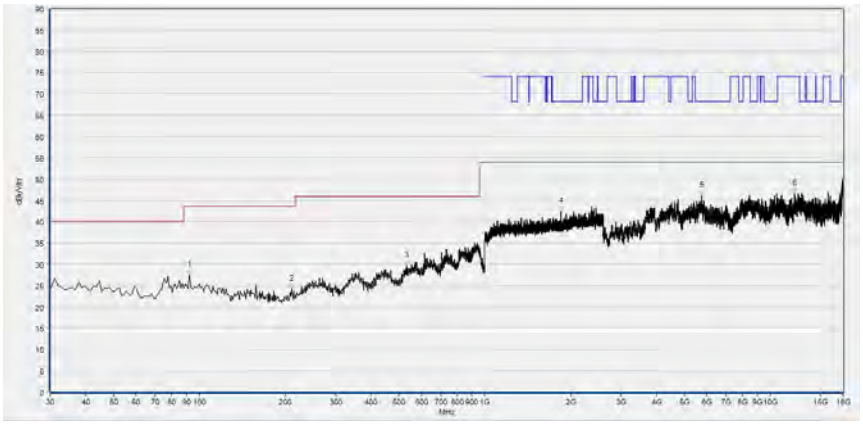
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 149



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
91.171	26.03	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
230.991	25.21	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
446.547	29.23	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1764.522	41.71	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5394.119	47.28	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10283.057	47.65	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

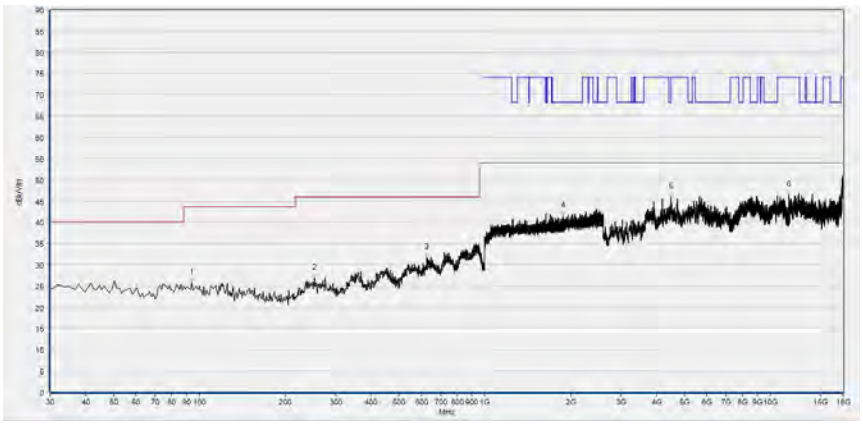
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
92.142	27.42	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
210.601	24.08	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
531.992	29.58	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1848.816	42.39	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5763.793	46.17	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12162.232	46.57	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

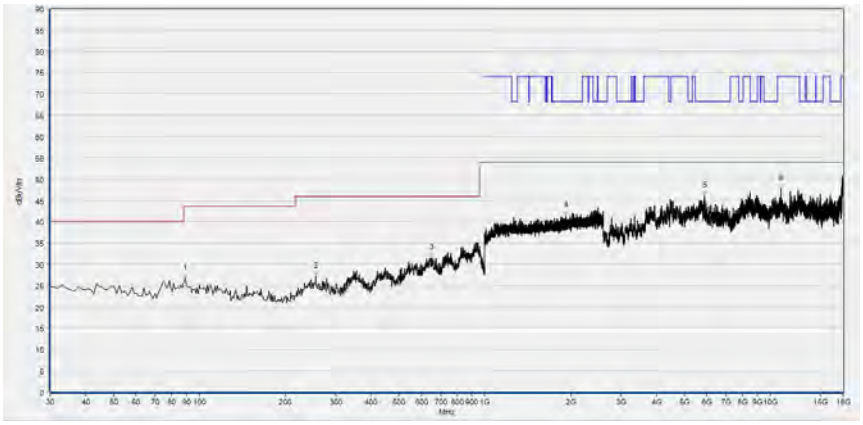
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 157



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
94.084	25.83	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
253.323	26.74	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
626.176	31.75	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1878.693	41.39	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
4482.256	45.88	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
11604.641	46.42	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

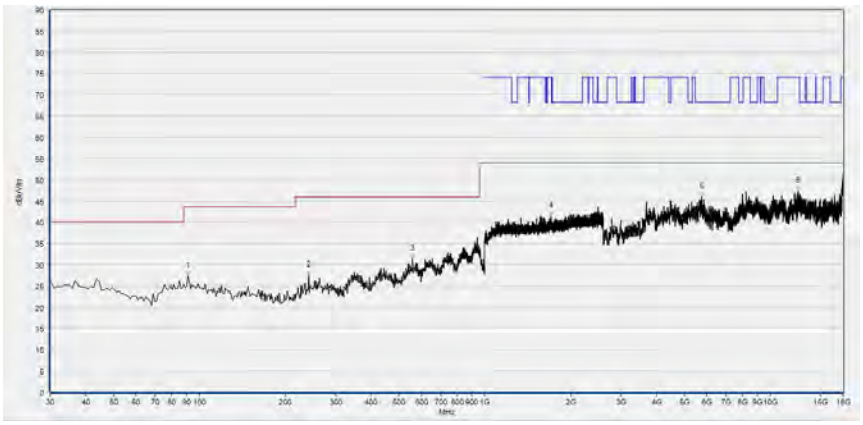
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
89.229	26.64	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
255.265	27.14	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
649.479	31.51	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1923.508	41.35	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5887.017	46.10	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
10896.099	47.70	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

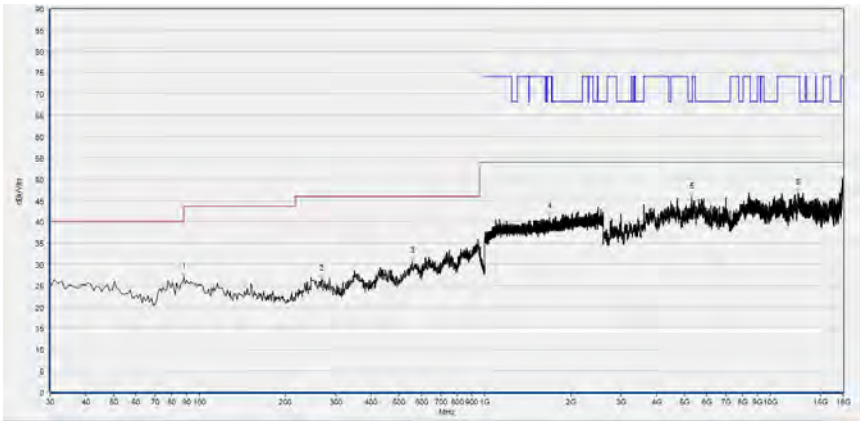
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 165



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
91.171	27.40	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
241.672	27.52	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
558.208	31.32	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1709.036	41.40	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5742.228	46.00	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12525.745	47.29	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

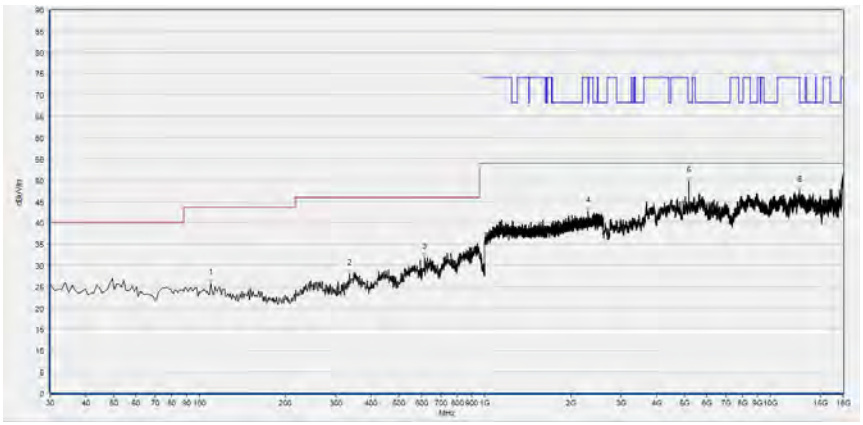


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
88.258	26.94	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
267.888	26.55	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
556.266	30.71	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1688.229	40.99	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5317.103	45.78	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12522.665	46.70	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

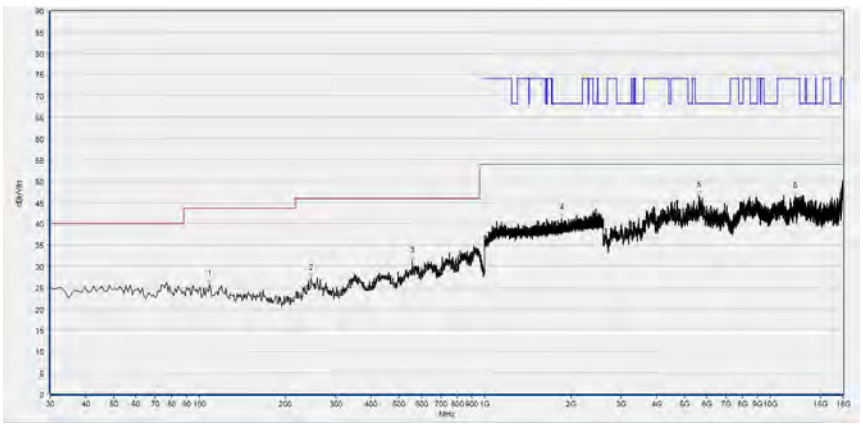
802.11n (HT40) Mode

Plot for Channel 38



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
109.620	25.81	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
335.856	28.05	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
615.495	31.81	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2300.700	42.71	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5178.476	49.73	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12670.534	47.64	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

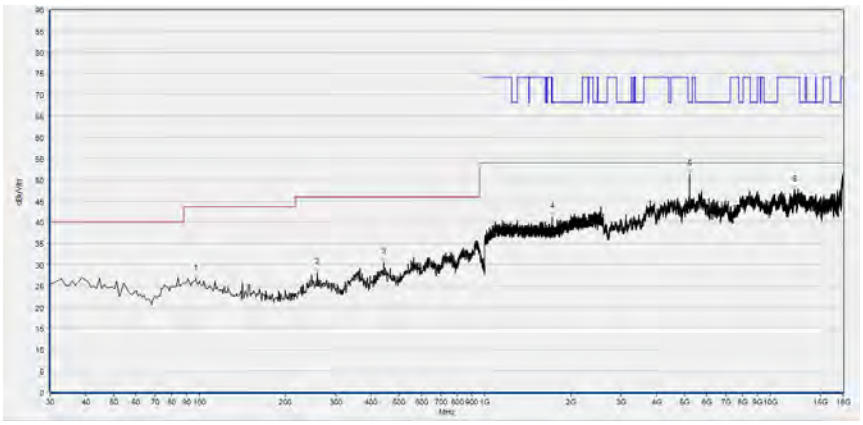
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
108.649	25.79	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
246.527	27.18	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
558.208	31.09	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1854.151	41.28	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5631.326	46.62	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12214.603	46.39	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

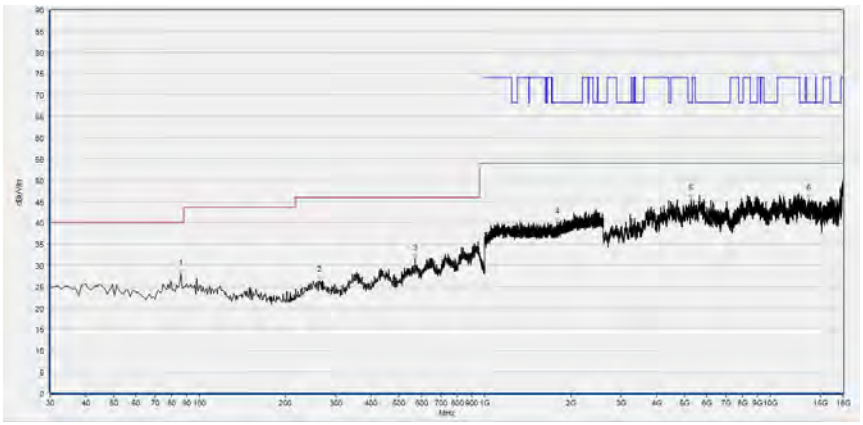
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 46



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
96.997	26.69	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
259.149	28.15	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
442.663	30.53	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1719.707	41.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5218.524	51.25	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12186.877	47.64	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

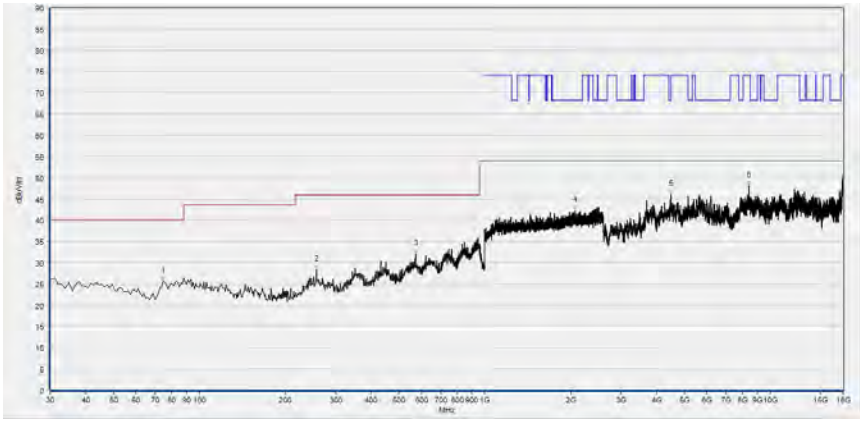
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
86.316	27.97	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
263.033	26.51	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
568.889	31.44	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1794.932	40.01	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5280.136	45.59	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
13668.654	45.61	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

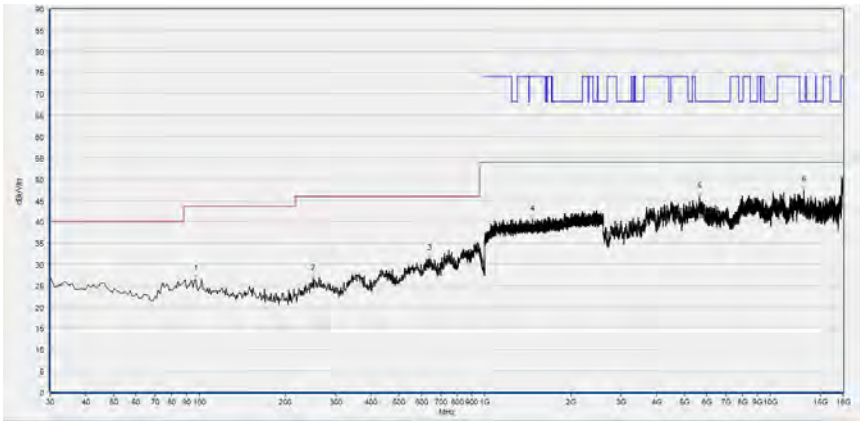
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 151



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
74.665	25.72	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
257.207	28.29	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
572.773	32.05	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2071.290	42.23	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
4488.418	46.08	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
8425.445	48.14	N/A	N/A	74.00	N/A	N/A	Horizontal	PASS

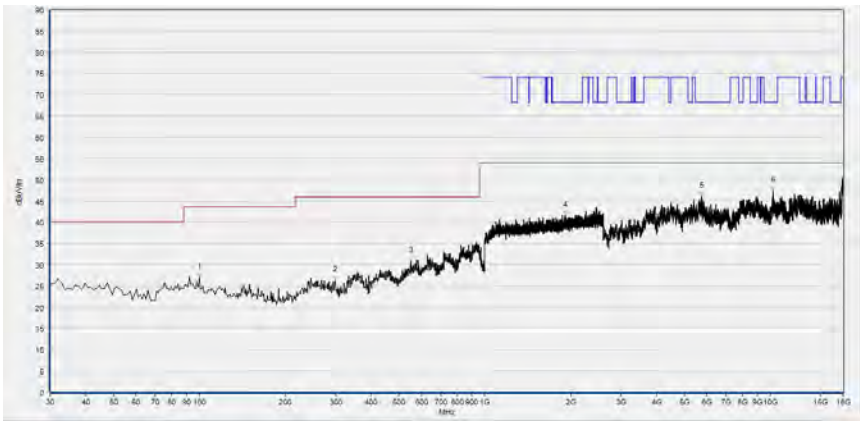
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
96.997	26.52	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
250.410	26.63	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
639.770	31.38	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1467.889	40.49	N/A	N/A	74.00	N/A	N/A	Vertical	PASS
5646.729	45.95	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
13101.820	47.36	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

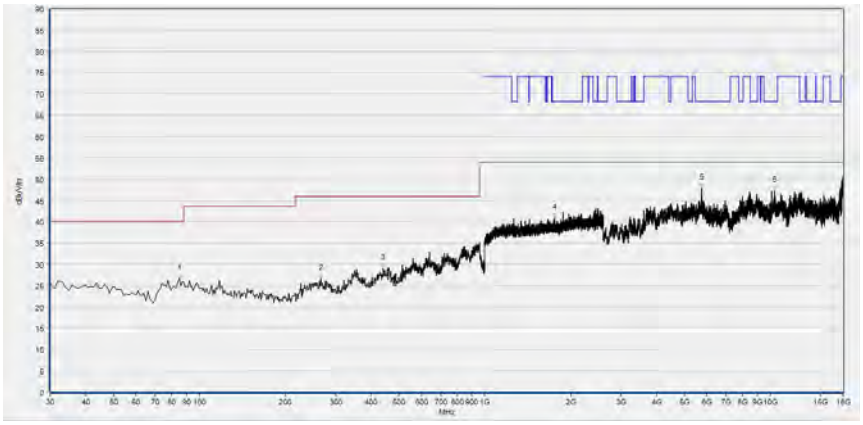
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 159



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
99.910	27.01	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
298.959	26.24	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
549.469	30.89	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1913.905	41.53	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5763.793	46.14	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
10249.170	47.36	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

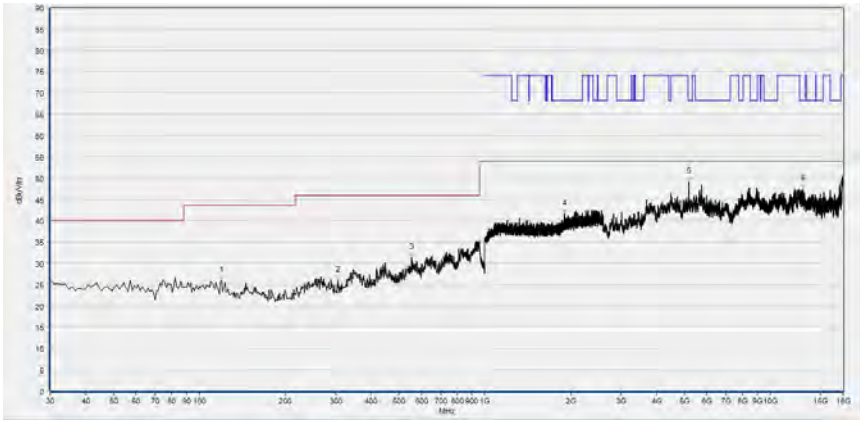


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
85.345	26.66	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
266.917	26.57	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
440.721	28.97	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1753.318	40.93	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5748.390	47.98	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
10332.346	47.31	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

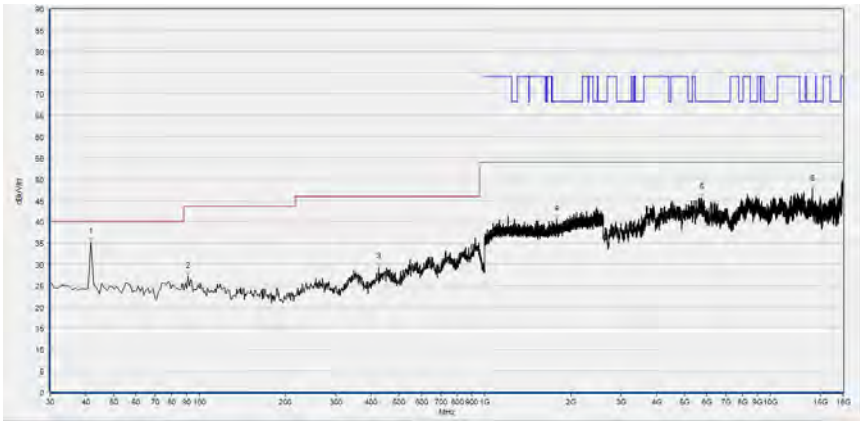
802.11ac (VHT80) Mode

Plot for Channel 42



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
119.329	25.97	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
306.727	25.95	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
553.353	31.29	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1902.167	41.52	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5181.556	49.06	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
13030.966	47.40	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

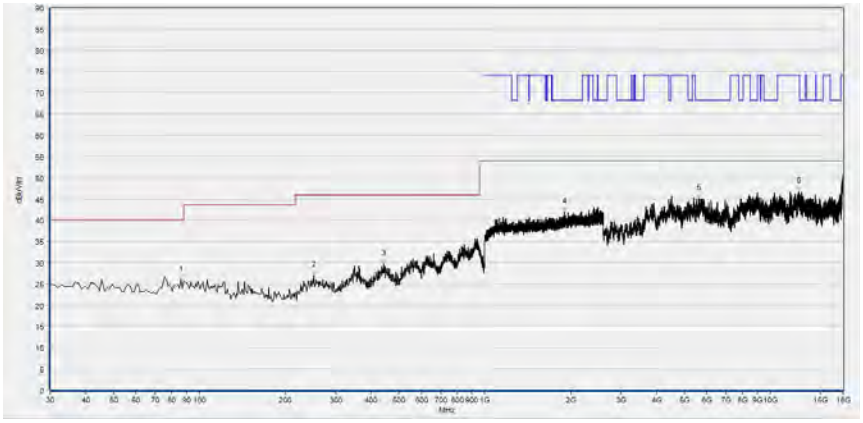
(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
41.652	35.26	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
91.171	27.11	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
424.214	29.29	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1785.862	40.61	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5754.551	45.66	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
14029.086	47.60	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

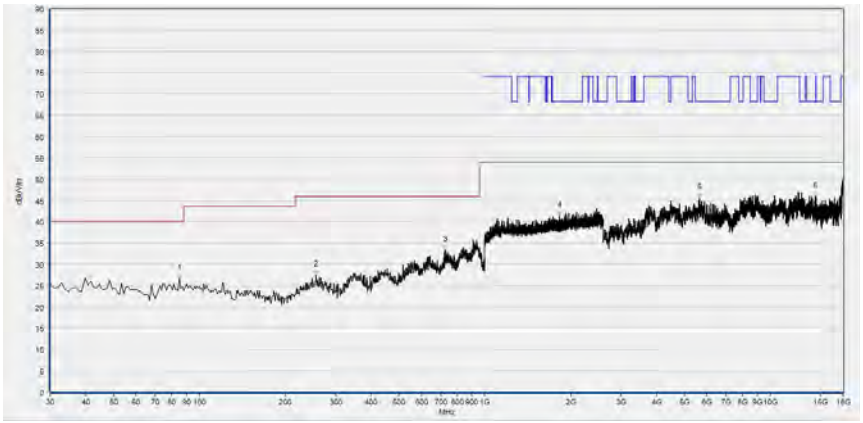
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 155



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
86.316	26.03	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
251.381	26.93	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
441.692	29.65	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1903.234	41.91	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5634.407	45.00	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12587.357	46.71	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
85.345	26.59	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
256.236	27.45	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
728.128	33.27	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1821.607	41.35	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5640.568	45.66	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
14417.243	45.94	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

Annex A Test Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Test Items	Uncertainty
Peak Output Power	±2.22dB
Power Spectral Density	±2.22dB
Bandwidth	±5%
Restricted Frequency Bands	±5%
Radiated Emission	±2.95dB
Conducted Emission	±2.44dB

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

Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.

4. Test Equipments Utilized

4.1 Conducted Test Equipments

Equipment	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Attenuator 1	N/A	10dB	Resnet	N/A	N/A
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2021.03.25	2022.03.24
USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2021.03.25	2022.03.24
RF Cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
Coaxial Cable	CB02	RF02	Morlab	N/A	N/A
SMA Connector	CN01	RF03	HUBER-SUHNER	N/A	N/A
Temperature Chamber	12108015	DTL-003S101	YOMA	2020.10.26	2021.10.25

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY56400093	N9038A	KEYSIGHT	2021.03.09	2022.03.08
LISN	812744	NSLK 8127	Schwarzbeck	2021.03.09	2022.03.08
Pulse Limiter (10dB)	VTSD 9561 F-B #206	VTSD 9561-F	Schwarzbeck	2020.07.24	2021.07.23
Coaxial Cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A

4.3 List of Software Used

Description	Manufacturer	Software Version
Test System	Tonscend	V2.6
Power Panel	Agilent	V3.8
MORLAB EMCR V1.2	MORLAB	V1.0
TS+ -[JS32-CE]	Tonscend	V2.5.0.0

4.4Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY54130016	N9038A	Agilent	2020.07.21	2021.07.20
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2019.05.24	2022.05.23
Test Antenna - Horn	BBHA9170 #774	BBHA 9170	Schwarzbeck	2019.07.26	2022.07.25
Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2019.02.14	2022.02.13
Test Antenna - Horn	01774	BBHA 9120D	Schwarzbeck	2019.07.26	2022.07.25
Coaxial Cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
Coaxial Cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
Coaxial Cable (N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
Coaxial Cable (N male) (30MHz-40GHz)	CB05	EMC05	Morlab	N/A	N/A
1-18GHz pre-Amplifier	61171/61172	S020180L3203	Tonscend	2020.07.21	2021.07.20
26-40GHz pre-Amplifier	56774	S40M400L4002	Tonscend	2020.07.21	2021.07.20
18-26.5GHz pre-Amplifier	46732	S10M100L3802	Tonscend	2020.07.21	2021.07.20
Notch Filter	N/A	WRCG-5150-5350	Wainwright	2020.07.21	2021.07.20
Notch Filter	N/A	WRCG-5470-5725	Wainwright	2020.07.21	2021.07.20
Notch Filter	N/A	WRCG-5725-5850	Wainwright	2020.07.21	2021.07.20

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Anechoic Chamber	N/A	9m*6m*6m	CRT	2020.01.06	2023.01.05

END OF REPORT