TEST REPORT

APPLICANT	:	ZHEJIANG YONGYUAN TECHNOLOGY CO., LTD
PRODUCT NAME	:	Automatic Key Cutting Machine
MODEL NAME	:	XP-005L
BRAND NAME	:	Xhorse
FCC ID	:	2ATSV-XP05L1
STANDARD(S)	:	47 CFR Part 15 Subpart E
RECEIPT DATE	:	2021-06-15
TEST DATE	:	2021-06-16 to 2021-07-30
ISSUE DATE	:	2021-08-10

Edited by: Peng Mi

Peng Mi (Rapporteur)

Approved by: Shen Junsheng

Shen Junsheng (Supervisor)

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DIRECTORY

1. Technical Information ····· 3
1.1. Applicant and Manufacturer Information ····· 3
1.2. Equipment Under Test (EUT) Description ····· 3
1.3. Modulation Type and Data Rate of EUT ····· 4
1.4. The Channel Number and Frequency ····· 5
1.5. Test Standards and Results ····· 6
1.6. Environmental Conditions ····· 7
2. 47 CFR Part 15E Requirements ····· 8
2.1. Antenna Requirement ····· 8
2.2. Duty Cycle of the Test Signal ····· 9
2.3. Maximum Conducted Output Power ····· 14
2.4. Emission Bandwidth ····· 18
2.5. Peak Power Spectral Density ····· 39
2.6. Frequency Stability ····· 60
2.7. Conducted Emission ····· 62
2.8. Restricted Frequency Bands ····· 66
2.9. Radiated Emission ····· 78
Annex A Test Uncertainty ····· 94
Annex B Testing Laboratory Information ····· 95

Change History		
Version	Date	Reason for change
1.0	2021-08-10	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	ZHEJIANG YONGYUAN TECHNOLOGY CO., LTD
Applicant Address:	No.17 SHAODONG ROAD, YUYAO CITY, ZHEJIANG PROVINCE, China
Manufacturer:	ZHEJIANG YONGYUAN TECHNOLOGY CO., LTD
Manufacturer Address:	No.17 SHAODONG ROAD, YUYAO CITY, ZHEJIANG PROVINCE, China

1.2. Equipment Under Test (EUT) Description

Product Name:	Automatic Key Cutting Machine	
Sample No.:	2#	
Hardware Version:	VER.3	
Software Version:	V2.2.3	
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:	3dBi	
Accessory Information:	Battery	
	Brand Name:	Xhorse
	Model No.:	XP005B01
	Serial No.:	(N/A, marked #1 by test site)
	Capacity:	2550mAh
	Rated Voltage:	25.2V
	Charge Limit:	29.4V
	Manufacturer:	ZHEJIANG YONGYUAN TECHNOLOGY CO., LTD.

Accessory Information:	AC Adapter	
	Brand Name:	meanwell
	Model No.:	GST160A24
	Serial No.:	(N/A, marked #1 by test site)
	Rated Output:	24V⎓6.67A
	Rated Input:	100-240V~50/60Hz, 2A
	Manufacturer:	MEAN WELL Enterprises 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	Jul 20, 2021	Meng Shurui	PASS	No deviation
3	15.407(a)	Maximum Conducted Output Power	Jul 20, 2021	Meng Shurui	PASS	No deviation
4	15.407(a)(e)	Emission Bandwidth	Jul 26, 2021	Meng Shurui	PASS	No deviation
5	15.407(a)	Peak Power Spectral Density	Jul 20, 2021	Meng Shurui	PASS	No deviation
6	15.407(g)	Frequency Stability	Jul 27, 2021	Meng Shurui	PASS	No deviation
7	15.207	Conducted Emission	Jun 16, 2021	Wu Runfeng	PASS	No deviation
8	15.407(b)	Restricted Frequency Bands	Jul 30, 2021	Gao Jianrou	PASS	No deviation
9	15.407(b)	Radiated Emission	Jul 30, 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 12.0dB contains two parts that cable loss 2.0dB 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 I-PEX connector. Please refer to the EUT internal photos.

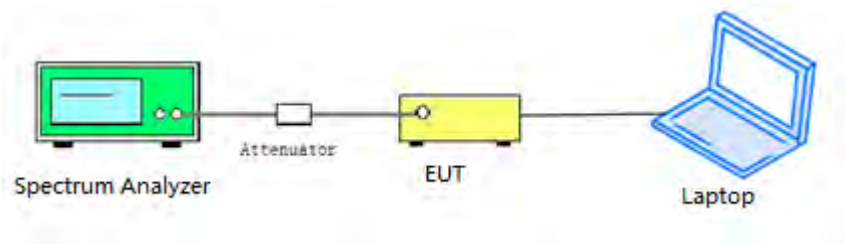
2.2. Duty Cycle of the Test Signal

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

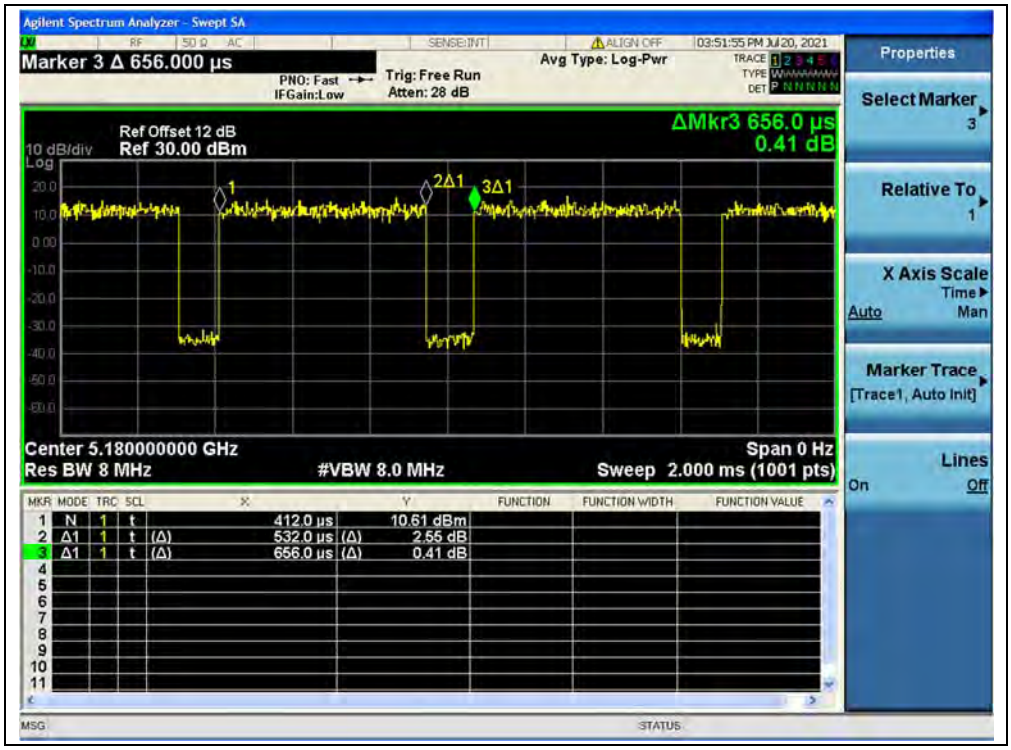
KDB 789033 Section B was used in order to prove compliance.

2.2.4. Test Result

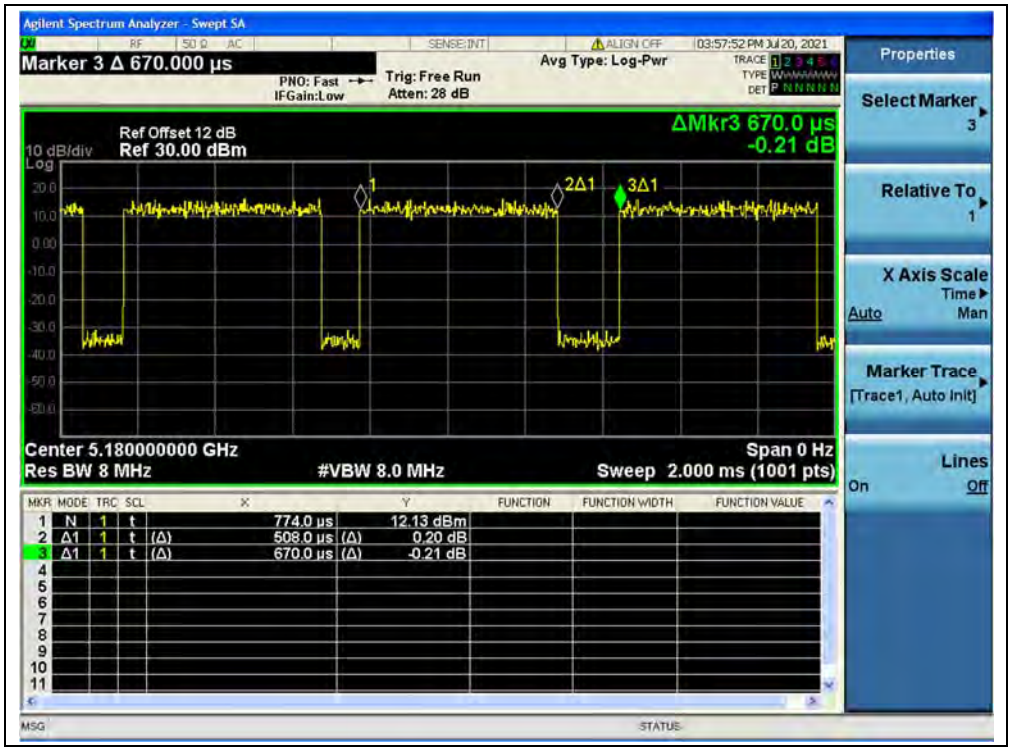
A.Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*log[1/D])
802.11a	80.30	0.95
802.11n (HT20)	76.12	1.19
802.11n (HT40)	70.27	1.53
802.11ac(VHT20)	92.82	0.32
802.11ac(VHT40)	89.62	0.48
802.11ac(VHT80)	68.66	1.63

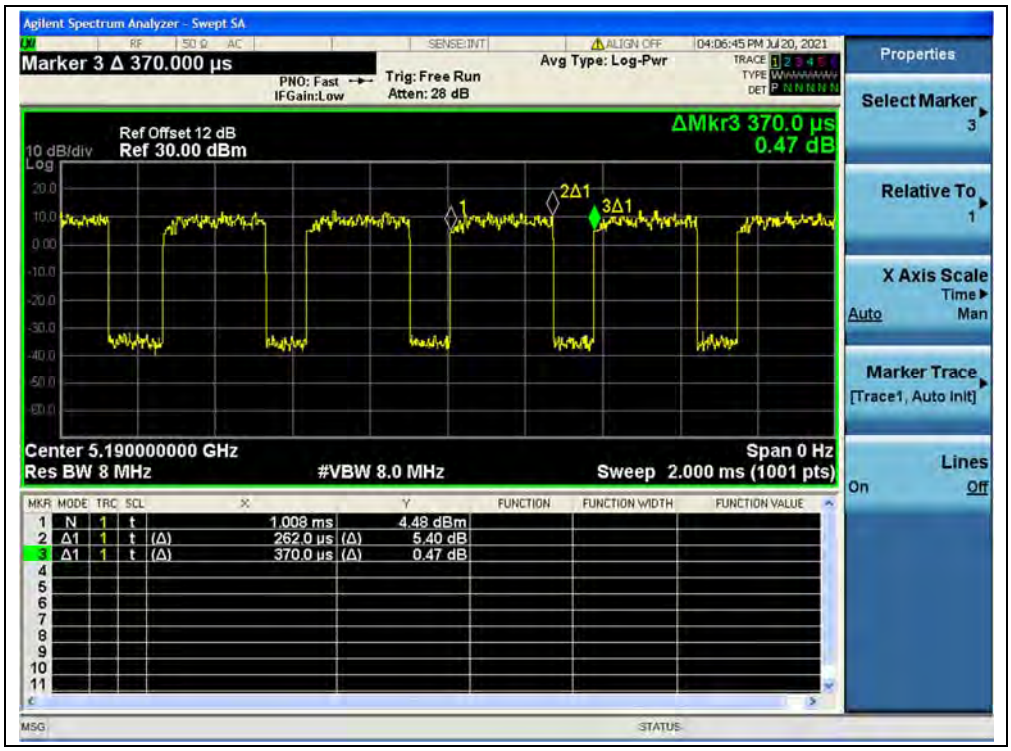
B.Test Plot:



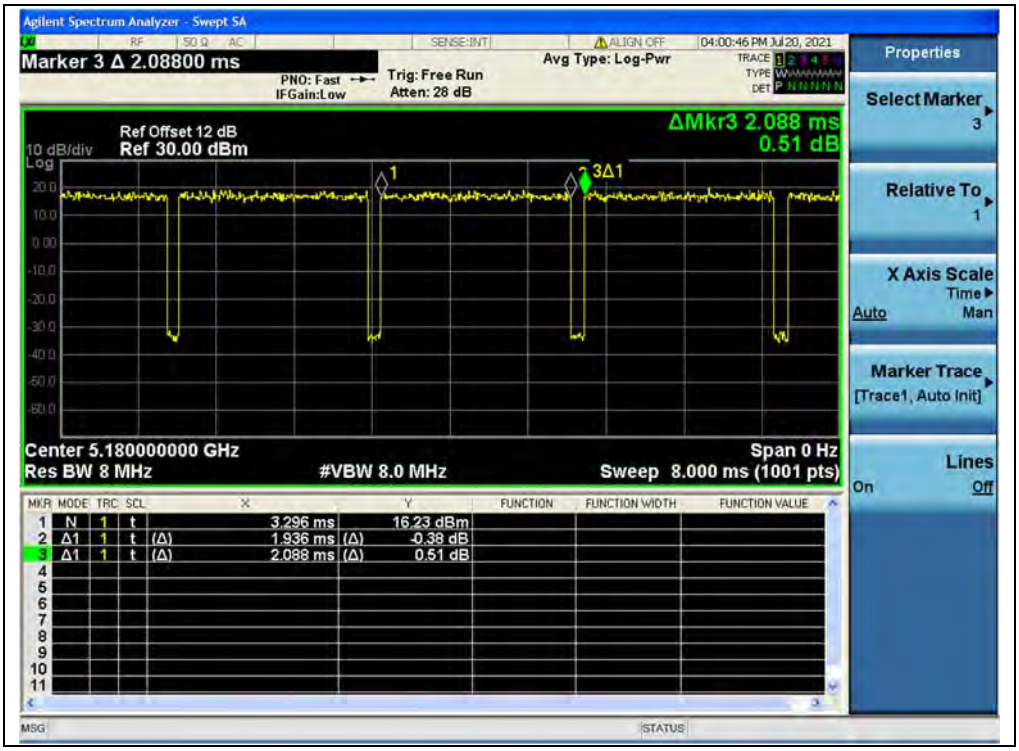
(Channel 36, 5180MHz, 802.11a)



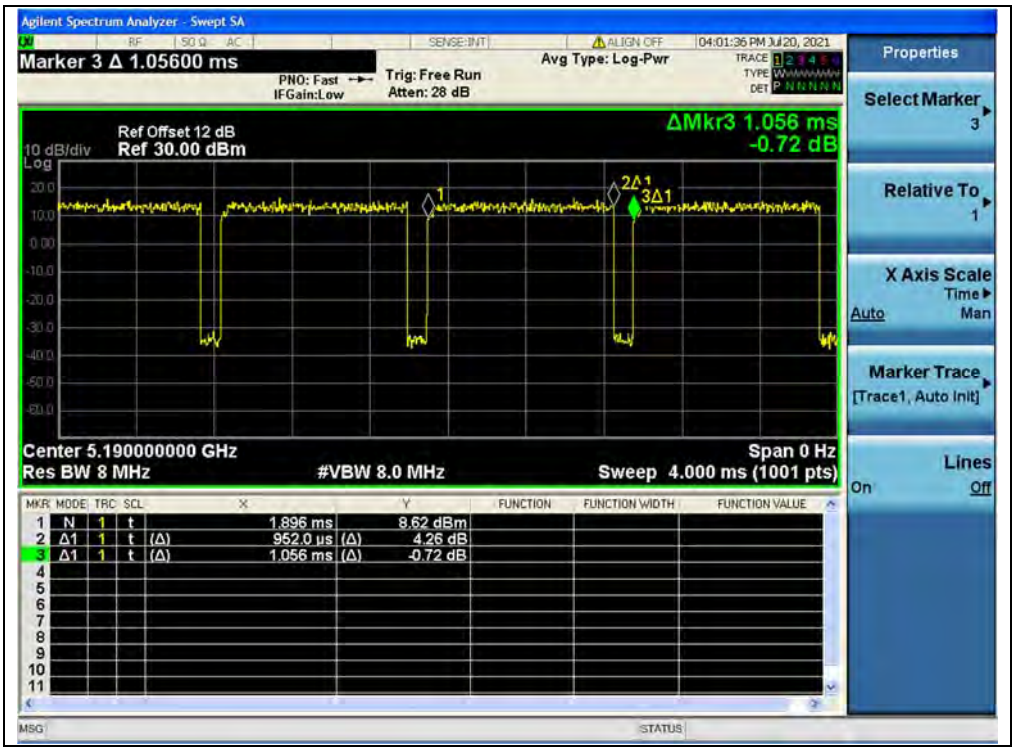
(Channel 36, 5180MHz, 802.11n (HT20))



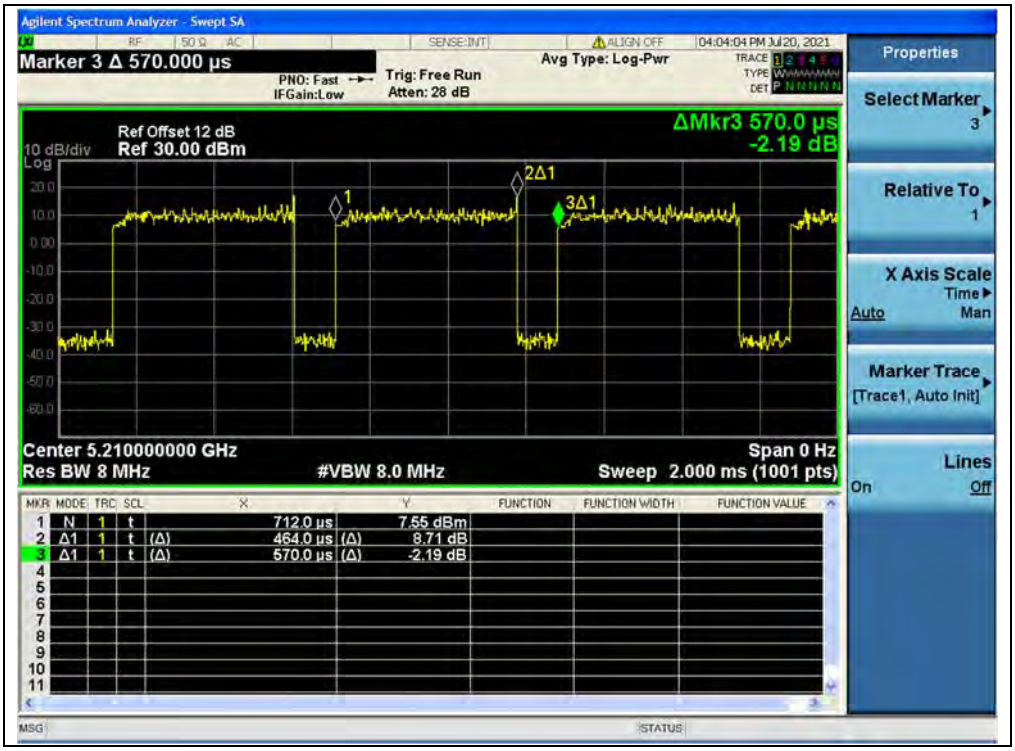
(Channel 38, 5190MHz, 802.11n (HT40))



(CH36_5180MHz _802.11ac (VHT20))



(CH38_5190MHz _802.11ac (VHT40))



(CH42_5210MHz _802.11ac (VHT80))

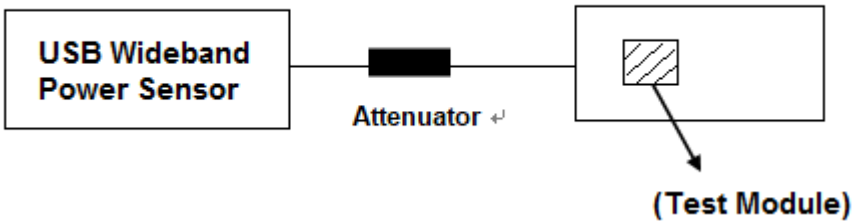
2.3. Maximum Conducted Output Power

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.

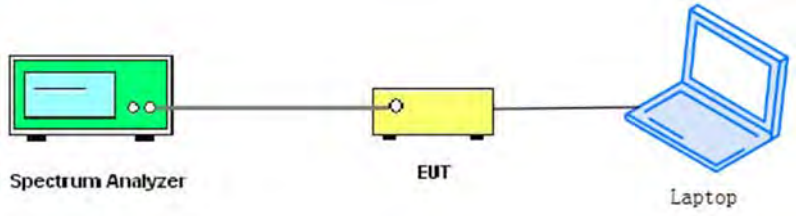
2.3.2. Test Description

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	13.22	0.95	14.17	0.026	24	0.25	PASS
44	5220	12.72		13.67	0.023			
48	5240	12.29		13.24	0.021			
149	5745	10.98		11.93	0.016	30	1	
157	5785	11.67		12.62	0.018			
165	5825	11.87		12.82	0.019			

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	13.12	1.19	14.31	0.027	24	0.25	PASS
44	5220	12.94		14.13	0.026			
48	5240	12.51		13.70	0.023			
149	5745	13.65		**14.84**	**0.030**	30	1	
157	5785	12.93		14.12	0.026			
165	5825	12.51		13.70	0.023			

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	12.78	1.53	14.31	0.027	24	0.25	PASS
46	5230	12.33		13.86	0.024			
151	5755	13.07		14.60	0.029	30	1	
159	5795	12.38		13.91	0.025			

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	13.39	0.32	13.71	0.023	24	0.25	PASS
44	5220	13.17		13.49	0.022			
48	5240	12.87		13.19	0.021			
149	5745	14.53		**14.85**	**0.031**	30	1	
157	5785	13.36		13.68	0.023			
165	5825	12.93		13.25	0.021			

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	13.36	0.48	13.84	0.024	24	0.25	PASS
46	5230	12.88		13.36	0.022			
151	5755	14.00		14.48	0.028	30	1	
159	5795	13.38		13.86	0.024			

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	11.95	1.63	13.58	0.023	24	0.25	PASS
155	5775	12.37		14.00	0.025	30	1	

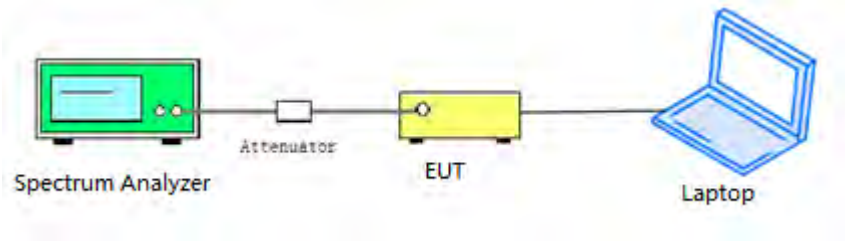
2.4. Emission Bandwidth

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	38.56
44	5220	39.22
48	5240	37.19
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
149	5745	16.46
157	5785	16.45
165	5825	16.46

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:

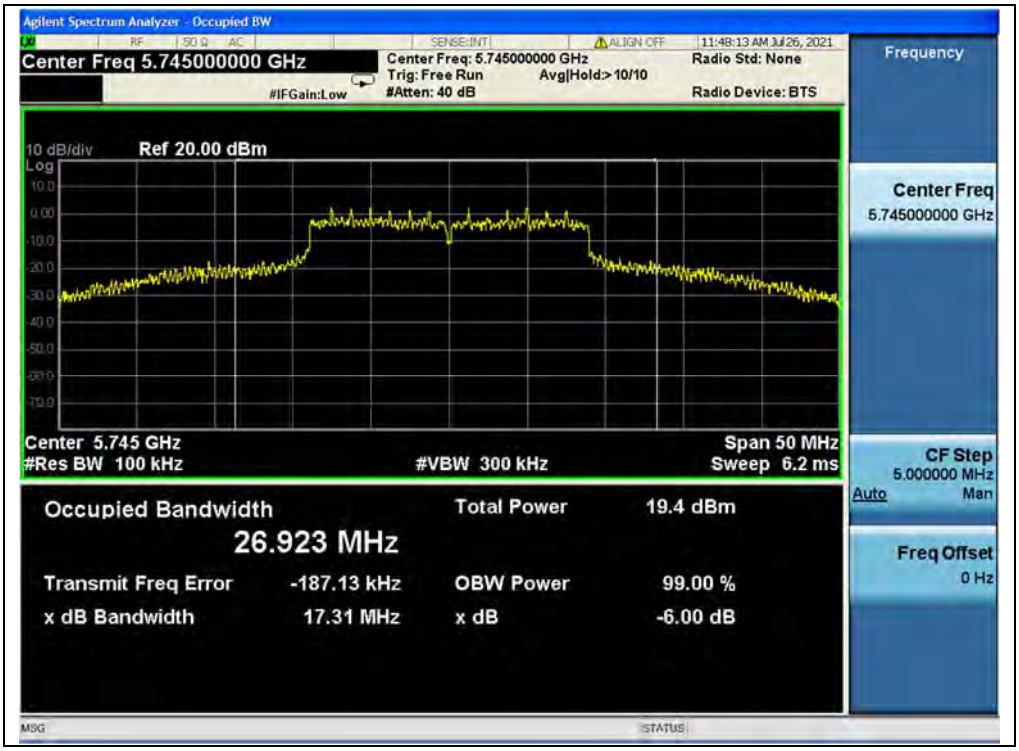
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	38.49
44	5220	45.08
48	5240	37.58
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
149	5745	17.31
157	5785	17.67
165	5825	17.43

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	85.70
46	5230	86.78
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
151	5755	36.50
159	5795	36.46

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	21.41
44	5220	22.84
48	5240	21.33
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
149	5745	15.70
157	5785	15.11
165	5825	14.41

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))

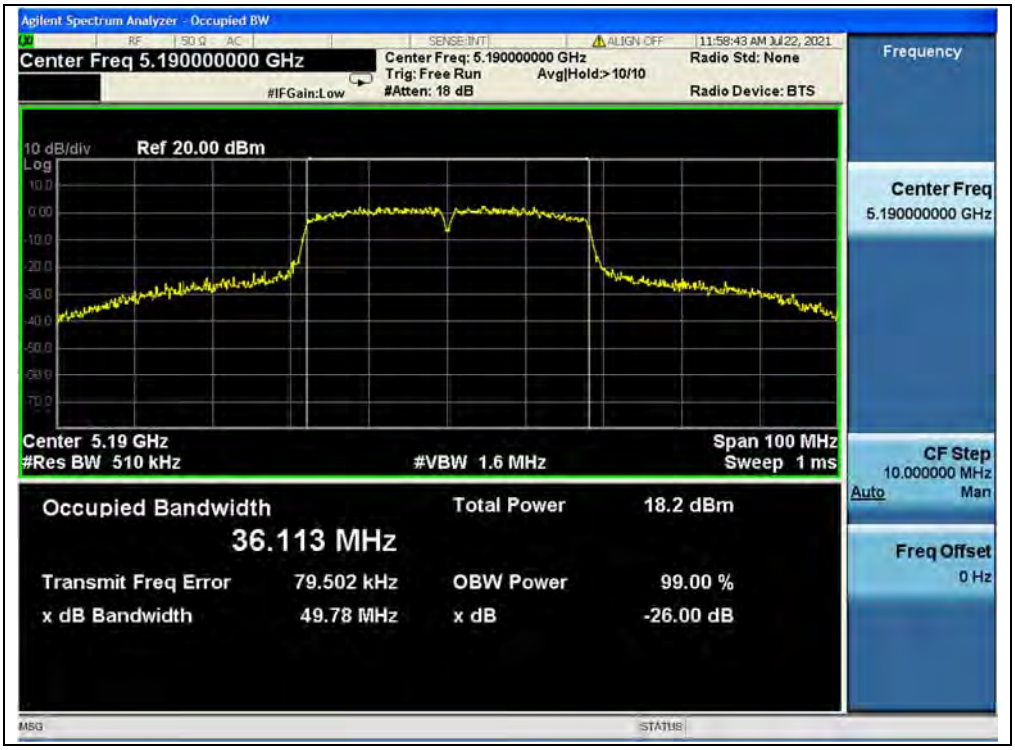
(Channel 165, 5825MHz, 802.11ac (VHT20))

802.11 ac (VHT40) Mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	49.78
46	5230	48.84
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
151	5755	32.61
159	5795	32.00

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))

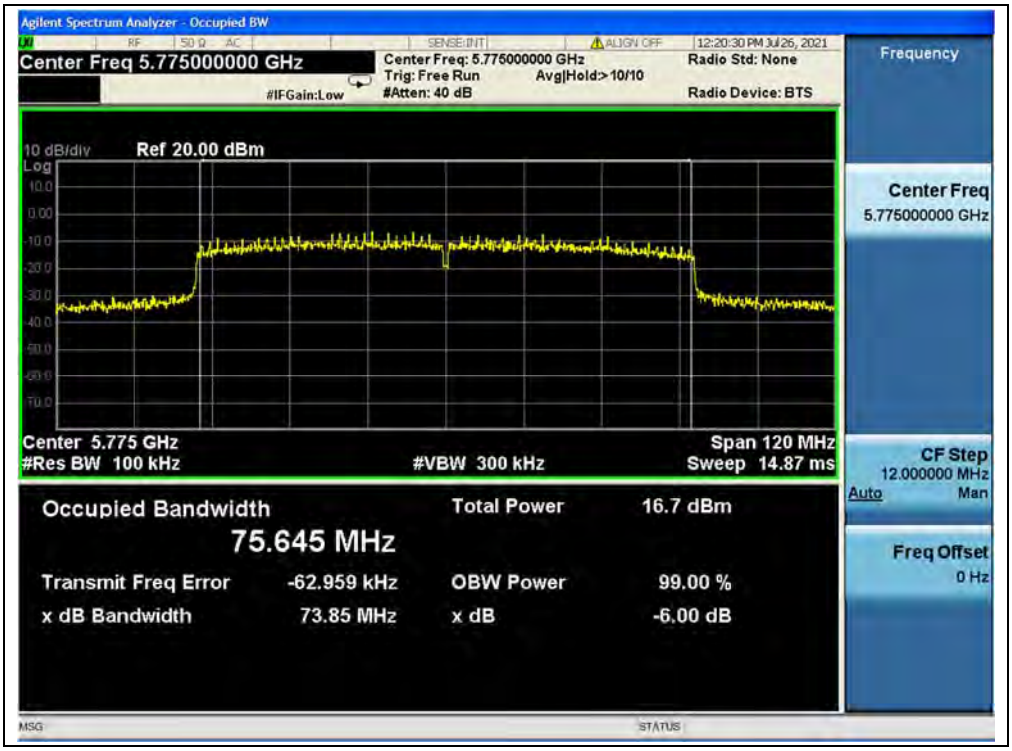
802.11 ac (VHT80) Mode

A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
42	5210	98.82
Channel	**Frequency (MHz)**	**6dB Bandwidth (MHz)**
155	5775	73.85

B.Test Plot:

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



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

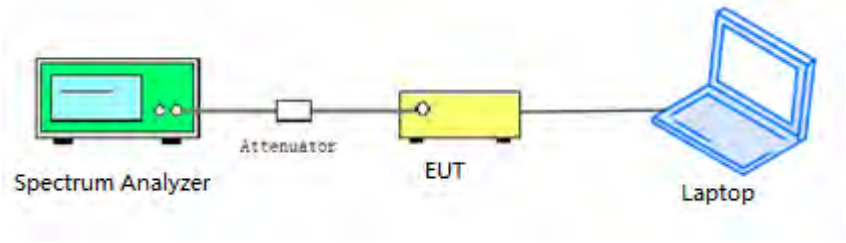
2.5. Peak Power Spectral Density

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	2.24	0.95	**3.19**	11	PASS
44	5220	2.14		3.09		
48	5240	1.75		2.70		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
149	5745	0.99	0.95	1.94	30	PASS
157	5785	-0.05		0.90		
165	5825	-0.39		0.56		

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	2.75	1.19	3.94	11	PASS
44	5220	2.80		**3.99**		
48	5240	2.33		3.52		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
149	5745	0.69	1.19	1.88	30	PASS
157	5785	-0.25		0.94		
165	5825	-0.80		0.39		

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	-0.87	1.53	0.66	11	PASS
46	5230	-0.89		0.64		
Channel	**Frequency (MHz)**	**Measured PPSD (dBm/500KHz)**	**Duty Factor**	**Corrected (dBm/500KHz)**	**Limit (dBm/500KHz)**	**Verdict**
151	5755	-2.79	1.53	-1.26	30	PASS
159	5795	-3.63		-2.10		

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	2.85	0.32	3.17	11	PASS
44	5220	2.69		3.01		
48	5240	2.29		2.61		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
149	5745	1.06	0.32	1.38	30	PASS
157	5785	-0.18		0.14		
165	5825	-0.72		-0.40		

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	-0.98	0.48	-0.50	11	PASS
46	5230	-1.45		-0.97		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
151	5755	-2.64	0.48	-2.16	30	PASS
159	5795	-3.20		-2.72		

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	-5.35	1.63	-3.72	11	PASS
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
155	5775	-7.21	1.63	-5.58	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 10° 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)	21	4.054
100%		-30	25	4.826
100%		-20	30	5.792
100%		-10	29	5.598
100%		0	22	4.247
100%		+10	19	3.668
100%		+20	23	4.440
100%		+30	32	6.178
100%		+40	35	6.757
100%		+50	25	4.826
85%	4.25	+20	27	5.212
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)	18	3.133
100%		-30	22	3.829
100%		-20	25	4.352
100%		-10	27	4.700
100%		0	19	3.307
100%		+10	17	2.959
100%		+20	21	3.655
100%		+30	26	4.526
100%		+40	30	5.222
100%		+50	25	4.352
85%	4.25	+20	19	3.307
115%	5.75	+20	21	3.655

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

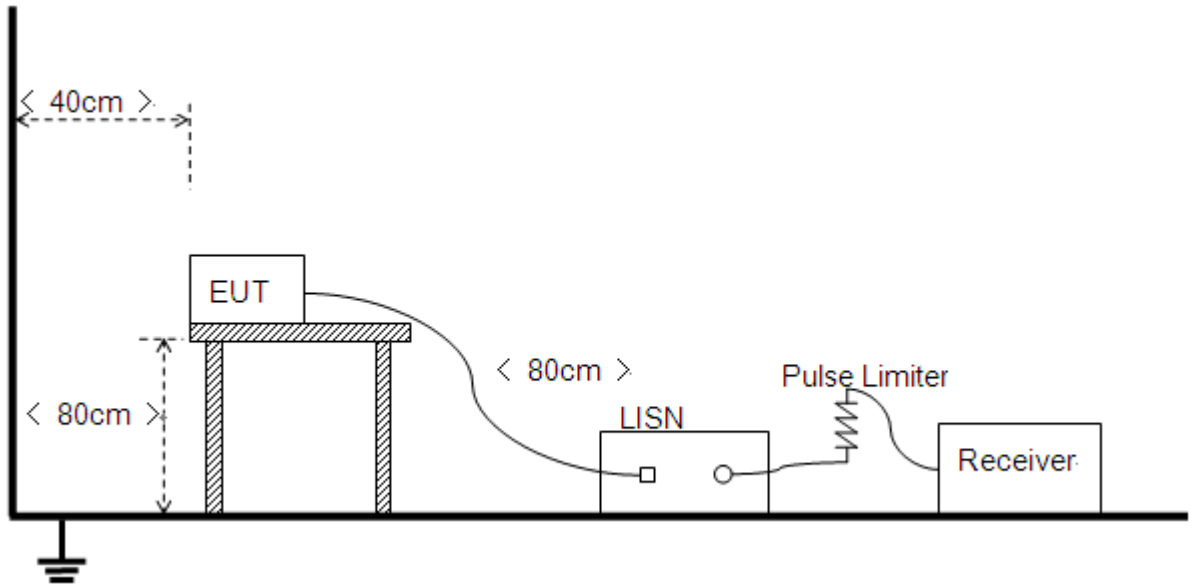
Note:

(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

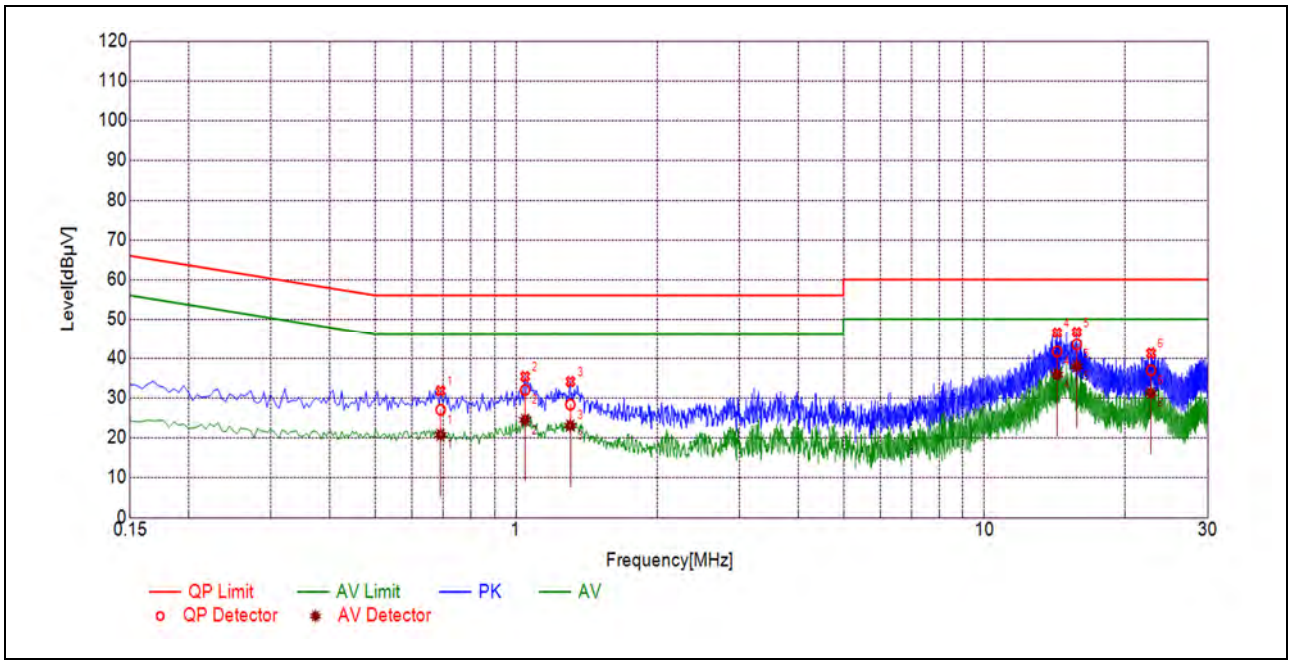
The measurement results are obtained as below:

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

U_R: Receiver Reading

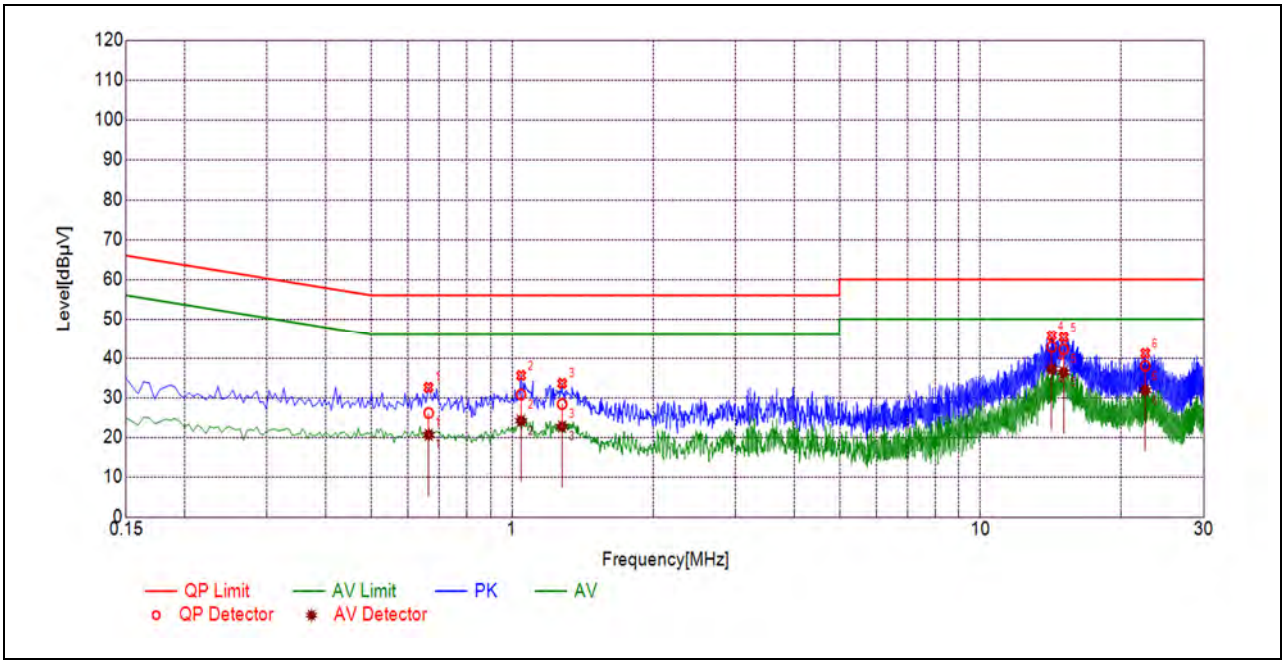
A_{Factor}: Voltage division factor of LISN

B.Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.6900	26.97	20.69	56.00	46.00	Line	PASS
2	1.0451	31.96	24.44	56.00	46.00		PASS
3	1.3056	28.28	23.03	56.00	46.00		PASS
4	14.2907	41.66	35.84	60.00	50.00		PASS
5	15.7480	43.44	37.91	60.00	50.00		PASS
6	22.6841	36.90	31.15	60.00	50.00		PASS



(N Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.6636	26.12	20.61	56.00	46.00	Neutral	PASS
2	1.0449	30.80	24.17	56.00	46.00		PASS
3	1.2787	28.38	22.70	56.00	46.00		PASS
4	14.1946	42.79	37.19	60.00	50.00		PASS
5	15.0558	42.21	36.39	60.00	50.00		PASS
6	22.4933	38.01	31.84	60.00	50.00		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

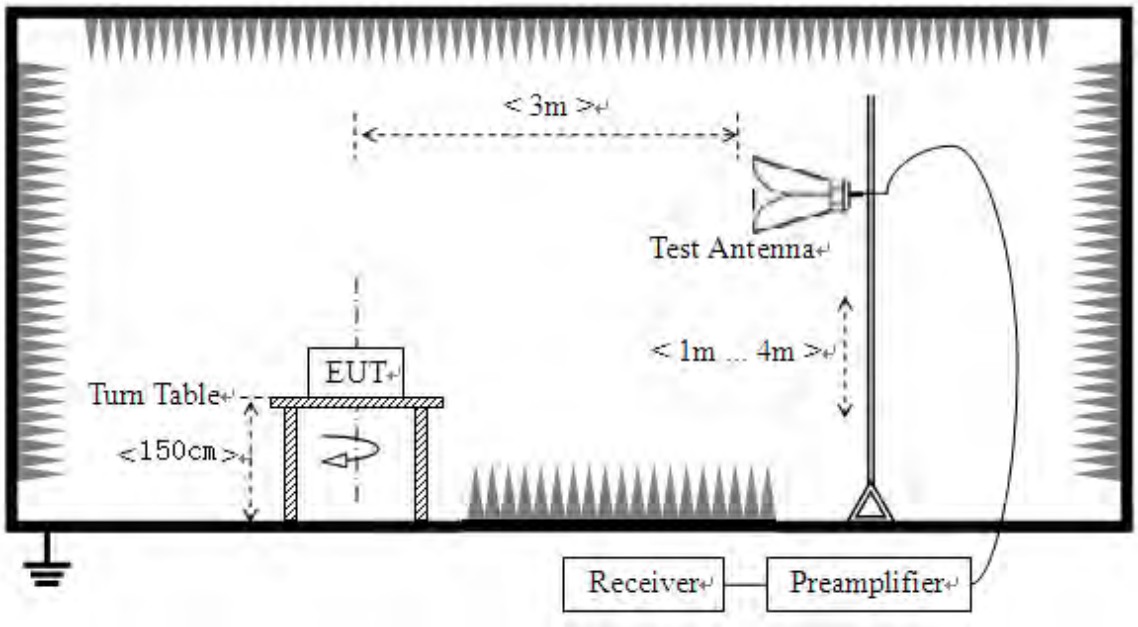
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following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

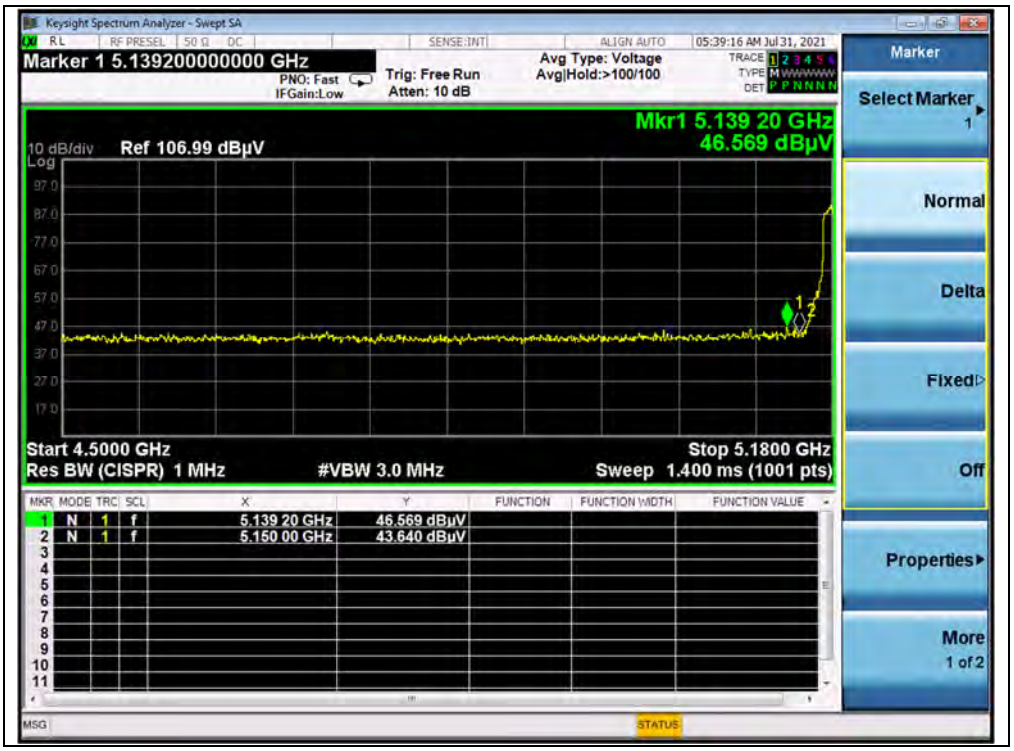
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]$-G_{preamp}$ [dB]
A_T: Total correction Factor except Antenna; U_R: Receiver Reading
G_{preamp}: Preamplifier 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

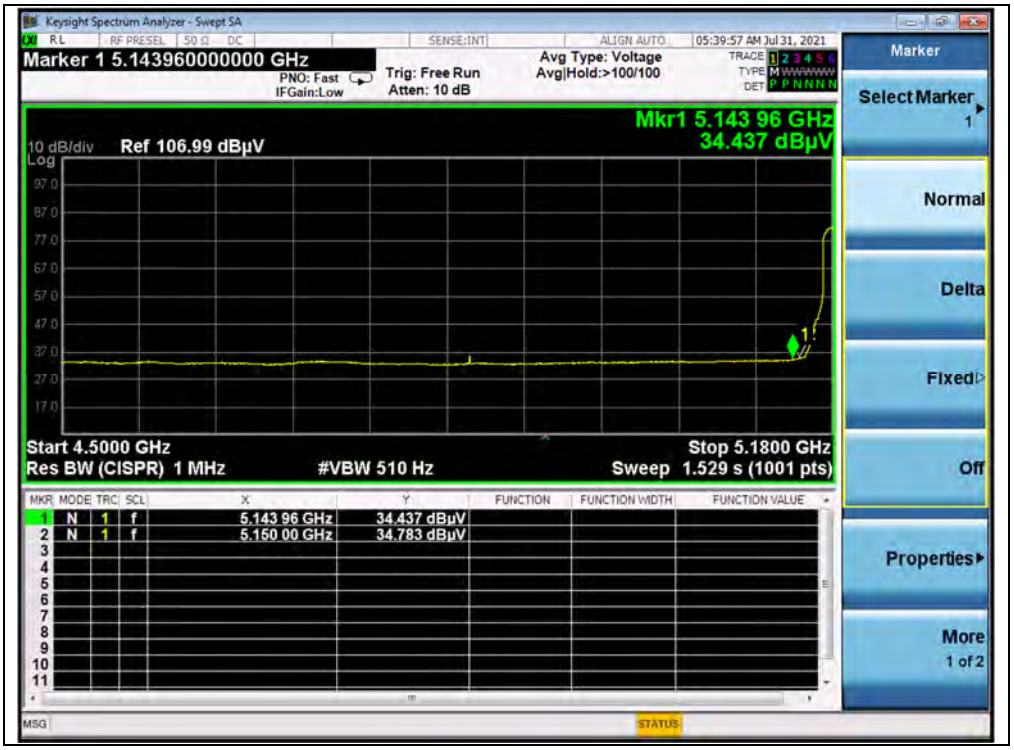
A.Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
36	5139.20	PK	46.57	-19.54	32.20	59.23	74	PASS
36	5150.00	AV	34.78	-19.54	32.20	47.44	54	PASS
48	5361.88	PK	43.14	-19.54	32.20	55.80	74	PASS
48	5350.00	AV	31.69	-19.54	32.20	44.35	54	PASS
149	5725.00	PK	51.14	-19.01	32.20	64.33	122.23	PASS
165	5855.00	PK	43.28	-19.01	32.20	56.47	110.83	PASS

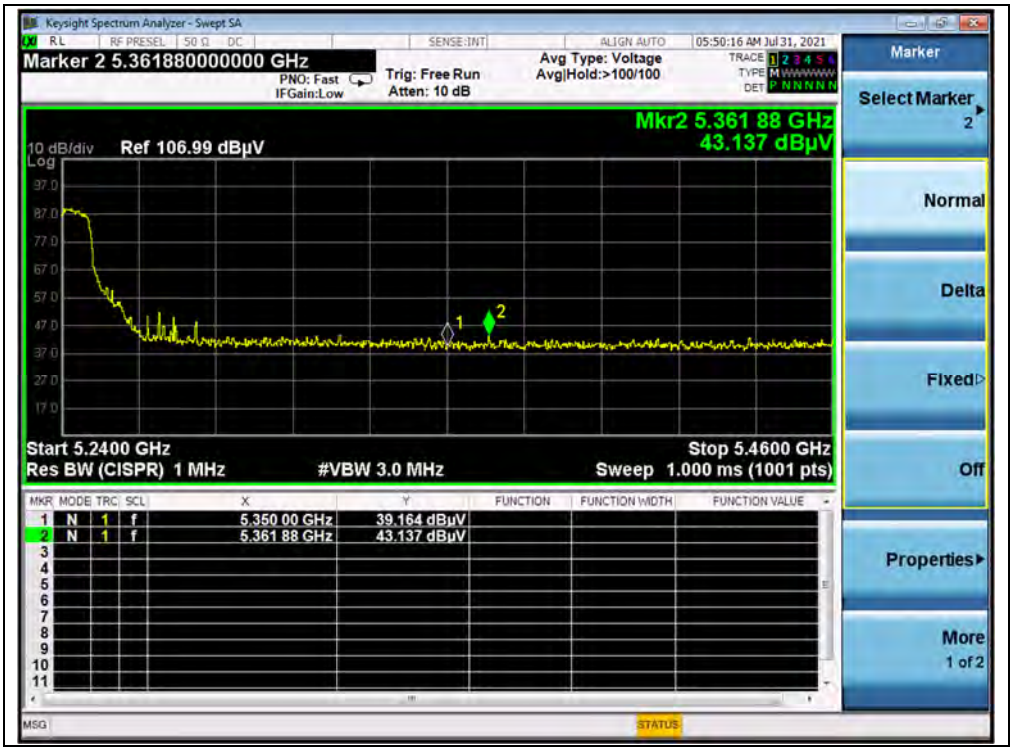
B.Test Plot:



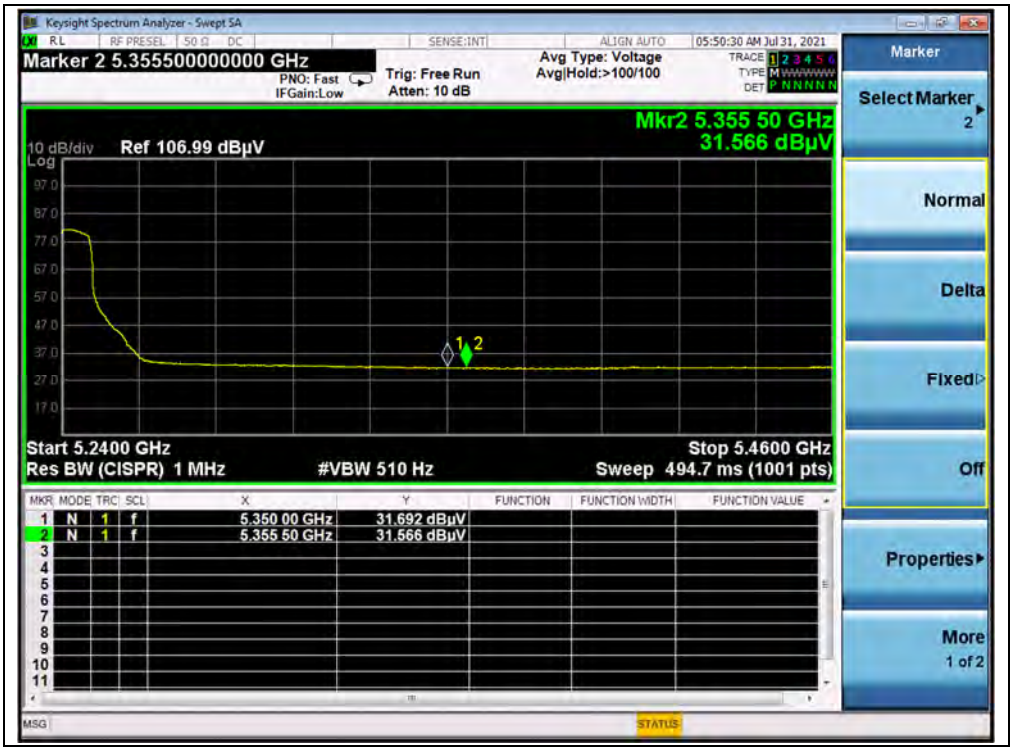
(PEAK, Channel 36, 802.11a)



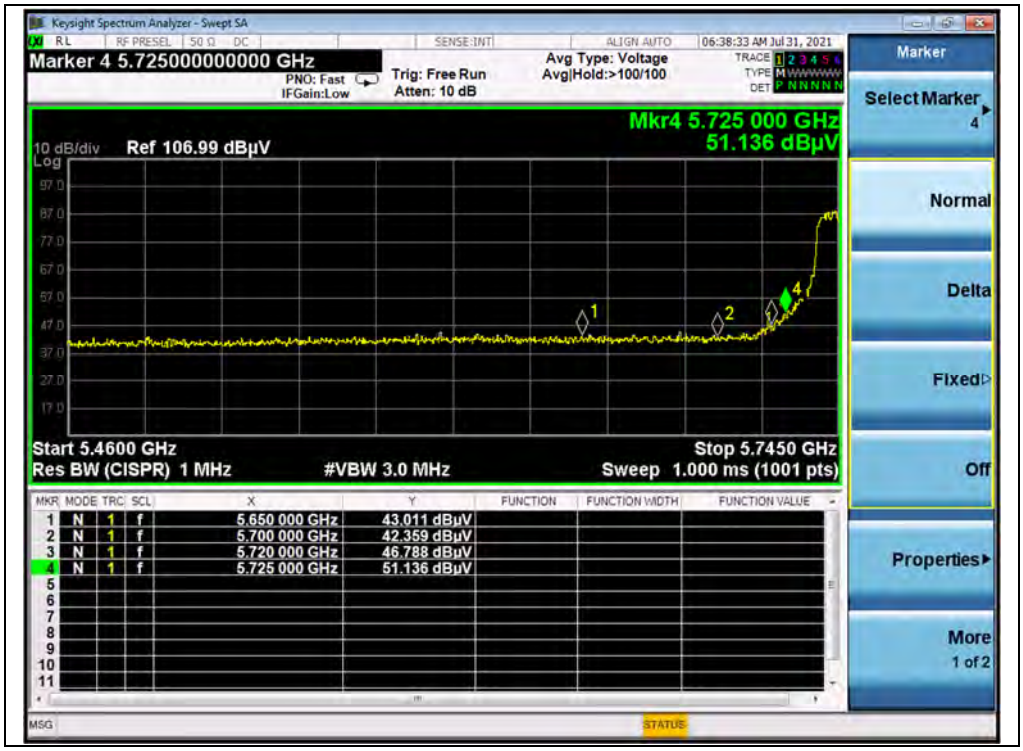
(AVERAGE, Channel 36, 802.11a)



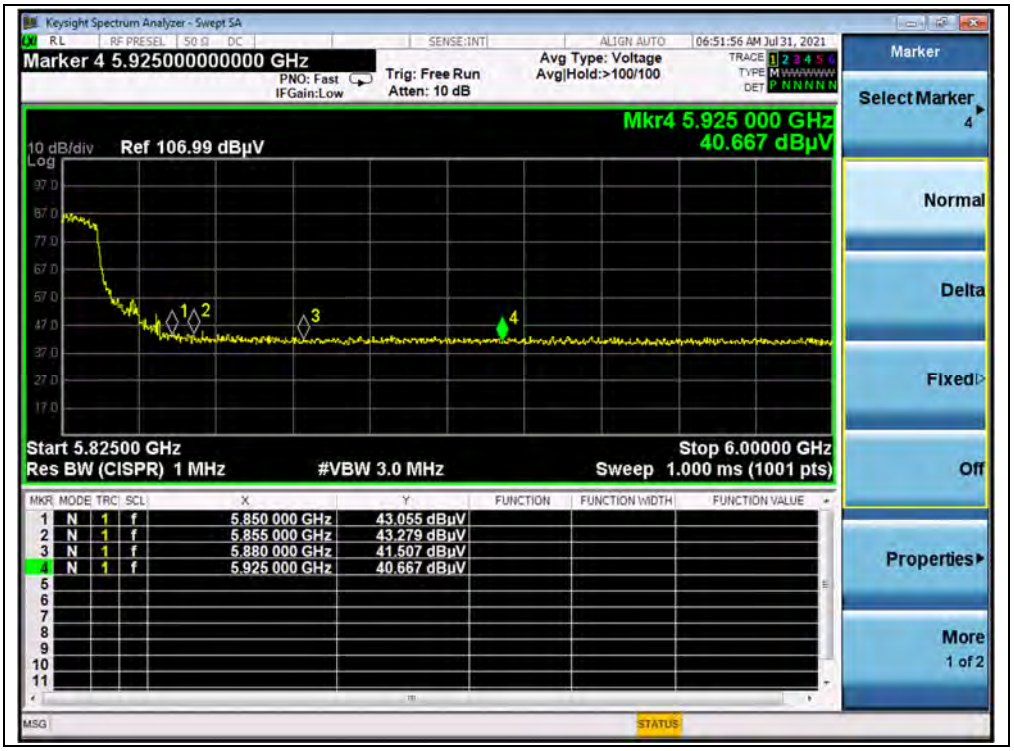
(PEAK, Channel 48, 802.11a)



(AVERAGE, Channel 48, 802.11a)



(PEAK, Channel 149, 802.11a)



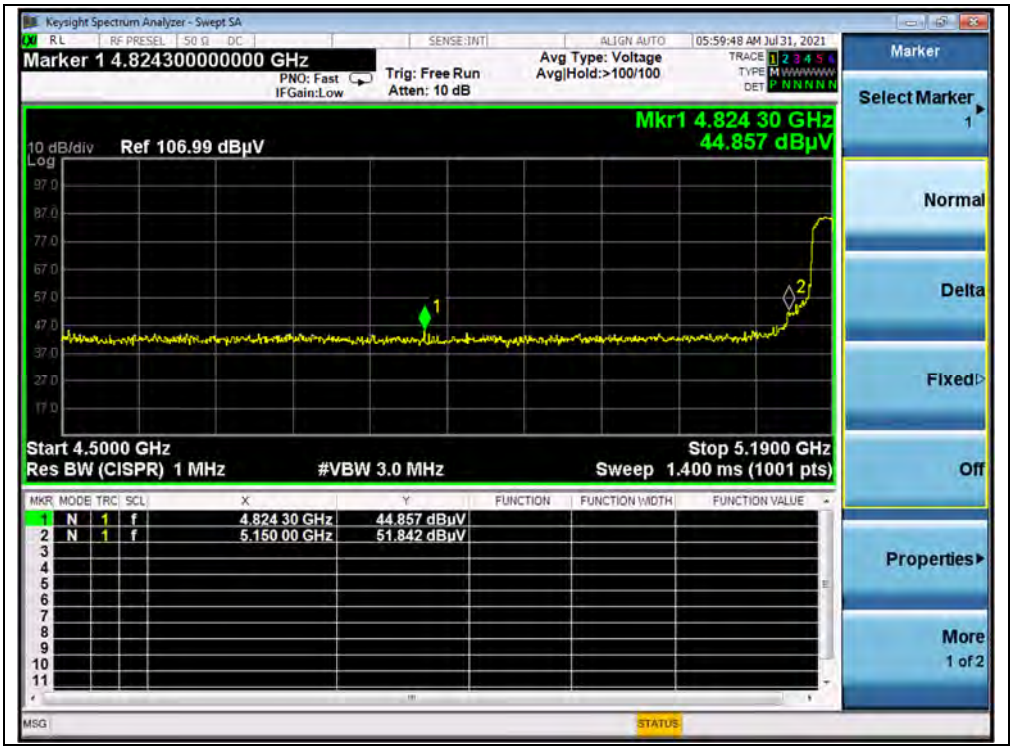
(PEAK, Channel 165, 802.11a)

802.11n (HT40) Mode

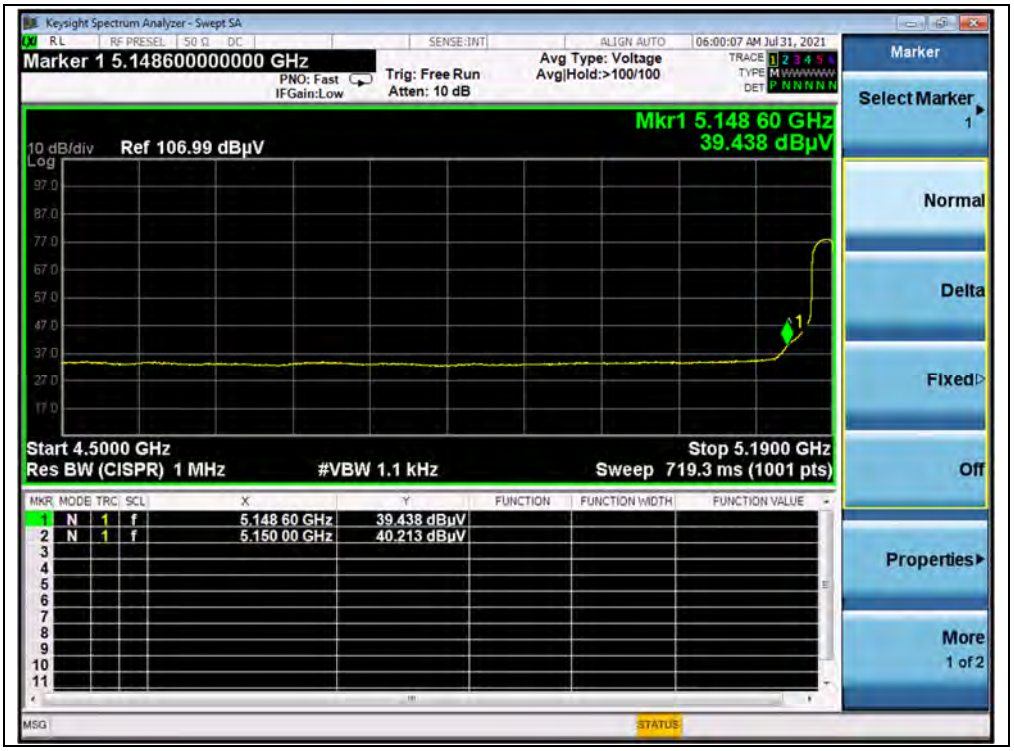
A.Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
38	5150.00	PK	51.84	-19.54	32.20	64.50	74	PASS
38	5150.00	AV	40.21	-19.54	32.20	52.87	54	PASS
48	5431.84	PK	43.47	-19.54	32.20	56.13	74	PASS
48	5350.00	AV	31.78	-19.54	32.20	44.44	54	PASS
151	5725.00	PK	55.49	-19.01	32.20	68.68	122.23	PASS
159	5850.00	PK	41.91	-19.01	32.20	55.10	122.23	PASS

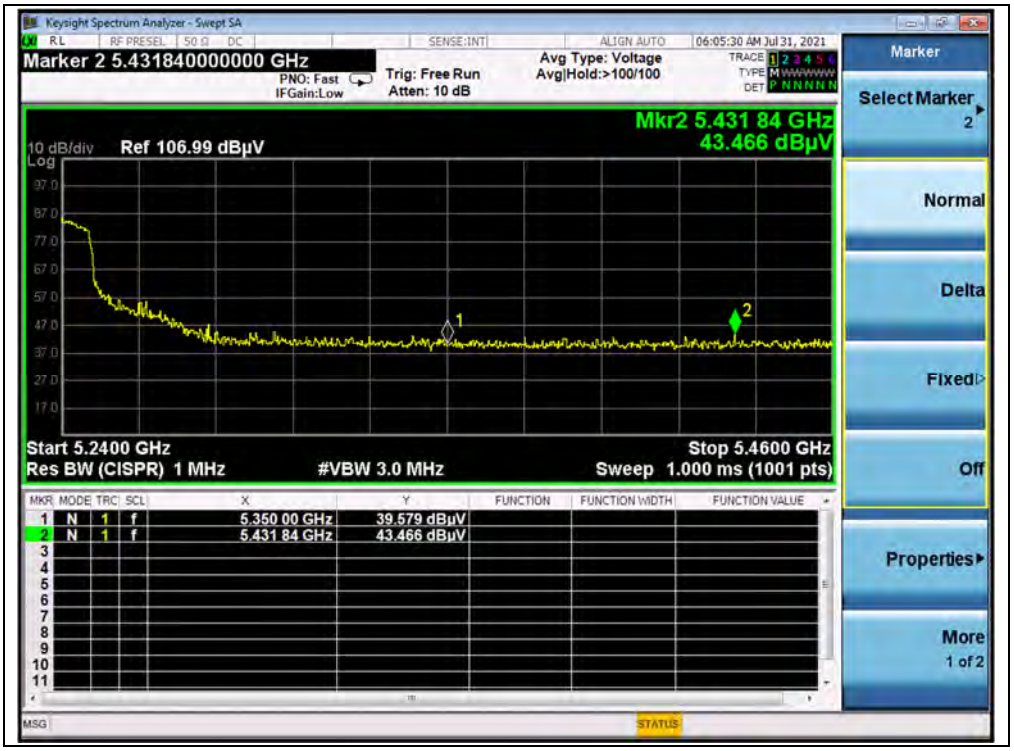
B.Test Plot:



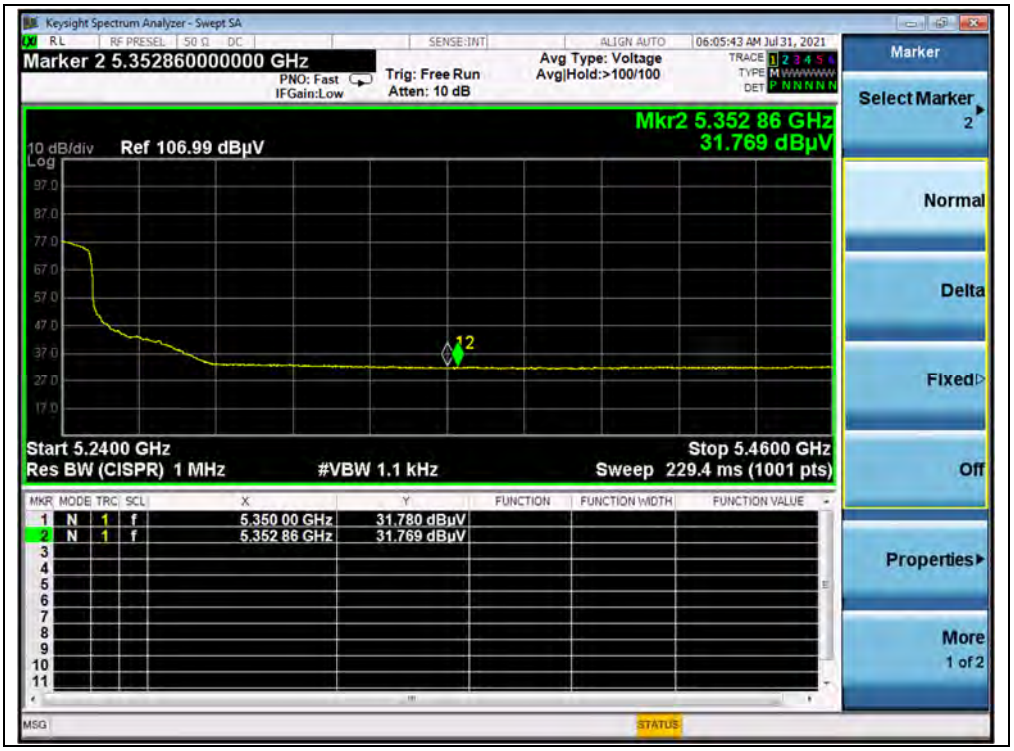
(PEAK, Channel 38, 802.11n (HT40))



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



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



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

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

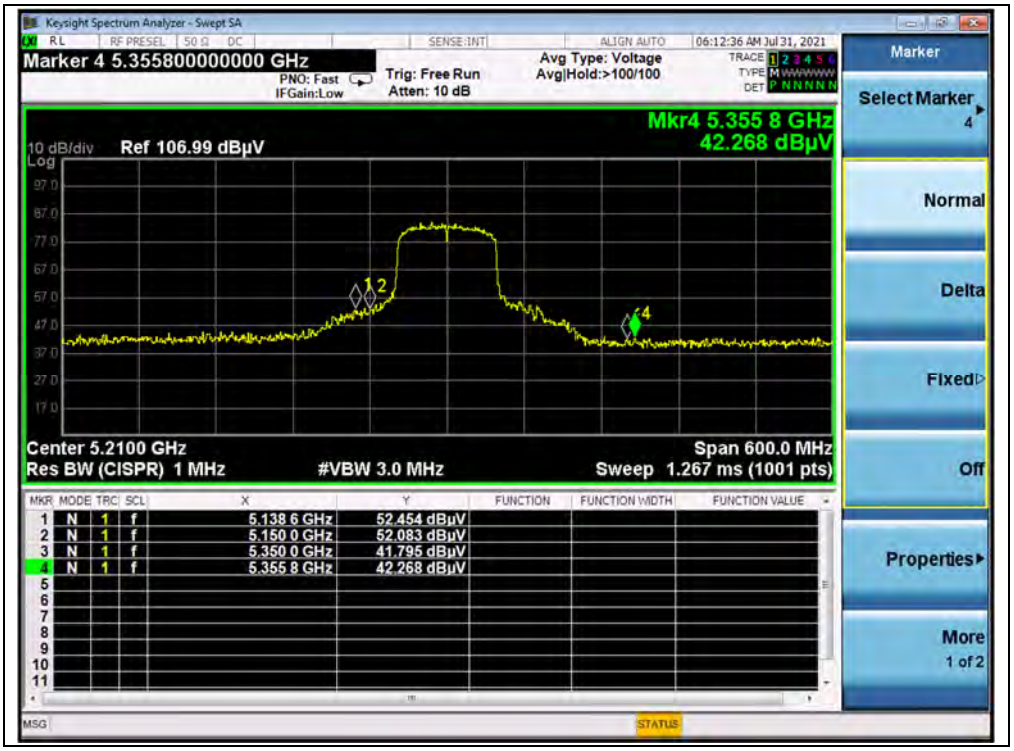
(PEAK, Channel 159, 802.11n (HT40))

802.11 ac (VHT80) Mode

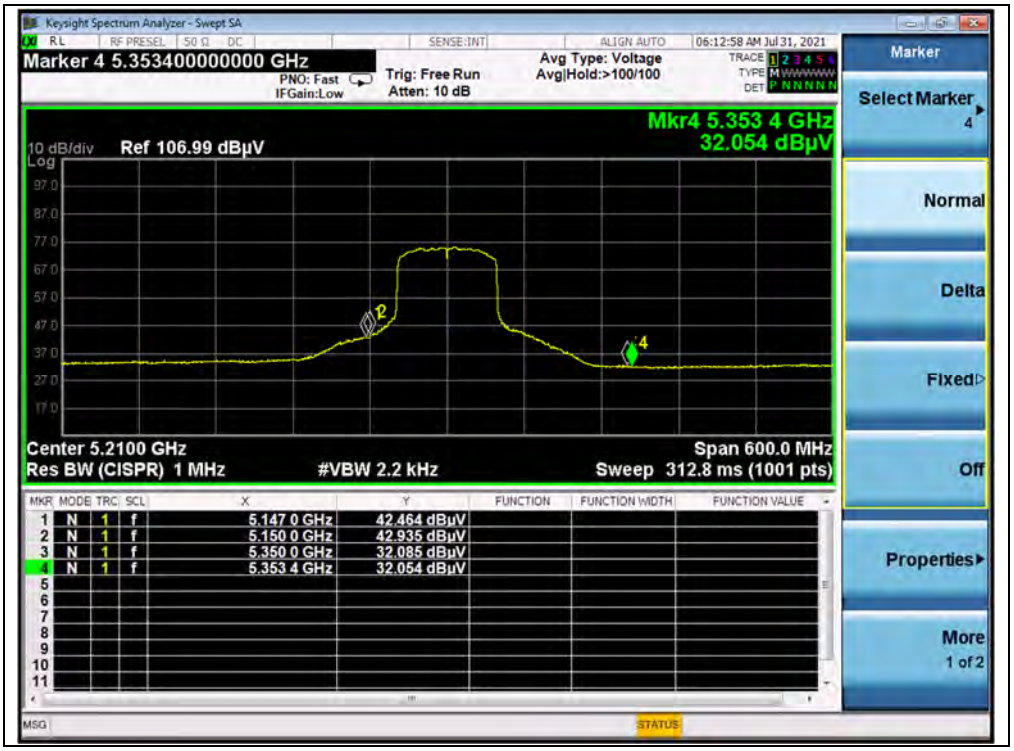
A.Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
42	5138.60	PK	52.45	-19.54	32.20	65.11	74	PASS
42	5150.00	AV	42.94	-19.54	32.20	55.6	54	PASS
42	5355.80	PK	42.27	-19.54	32.20	54.93	74	PASS
42	5350.00	AV	32.09	-19.54	32.20	44.75	54	PASS
155	5725.00	PK	56.21	-19.01	32.20	69.40	110.83	PASS
155	5850.00	PK	51.28	-19.01	32.20	64.47	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:

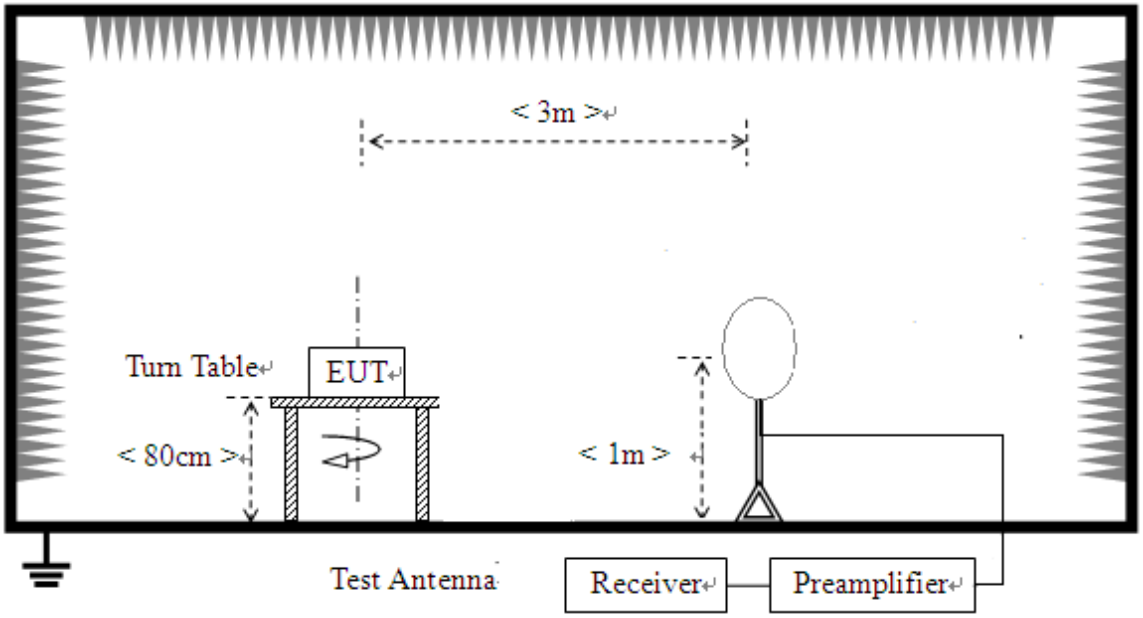
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

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).

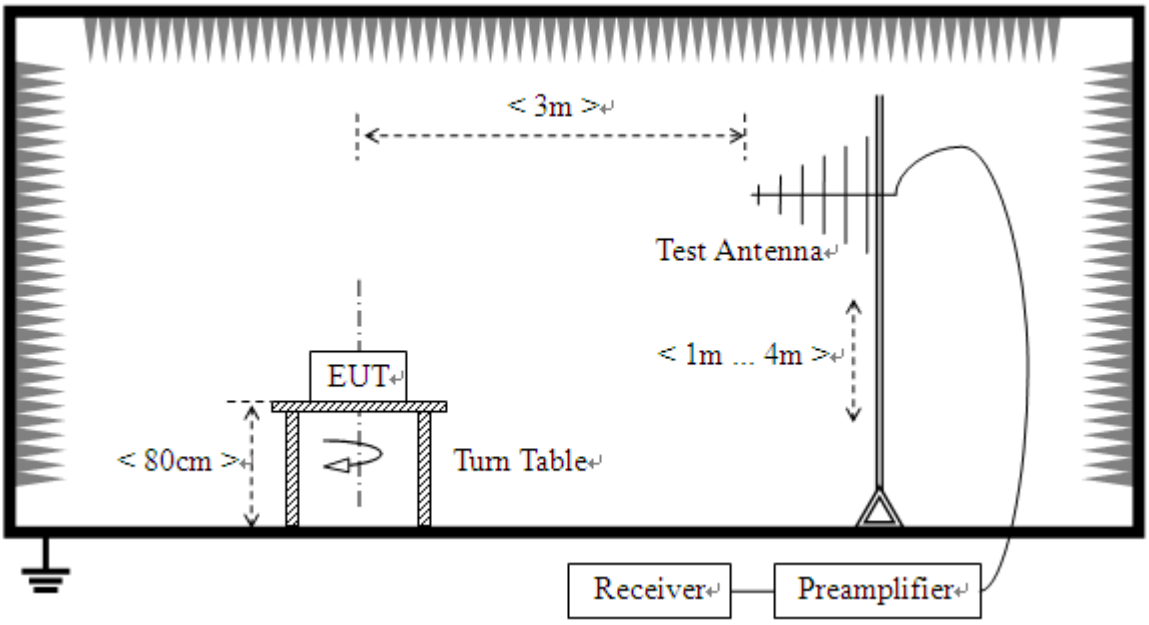
2.9.2. Test Description

Test Setup:

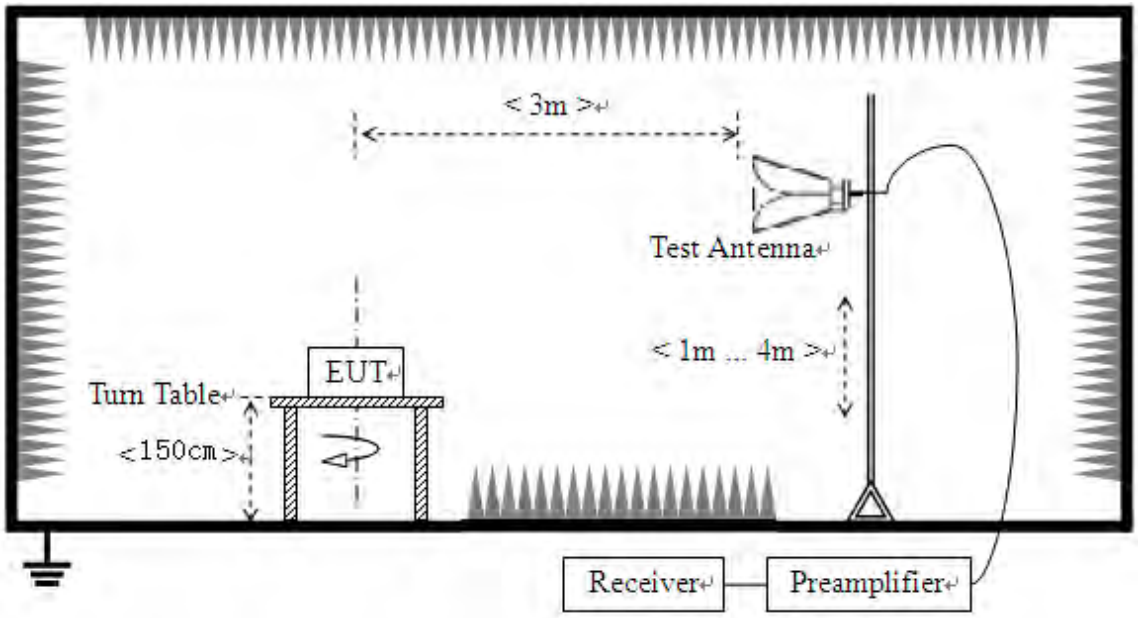
1) For radiated emissions from 9kHz to 30MHz



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 [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

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.

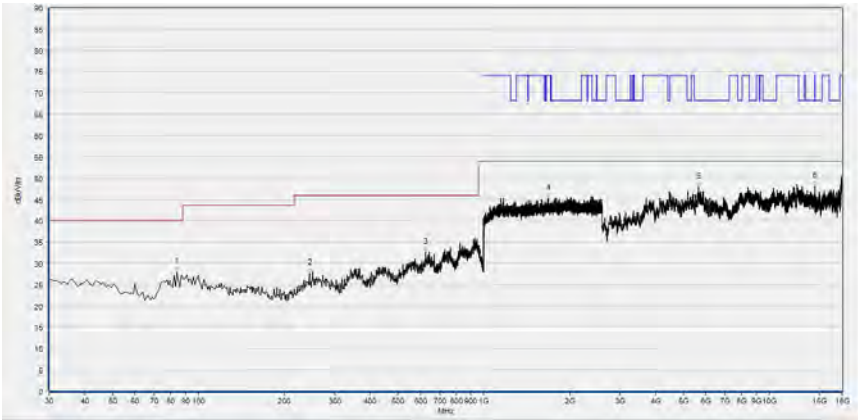
Note 2: For the frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

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.

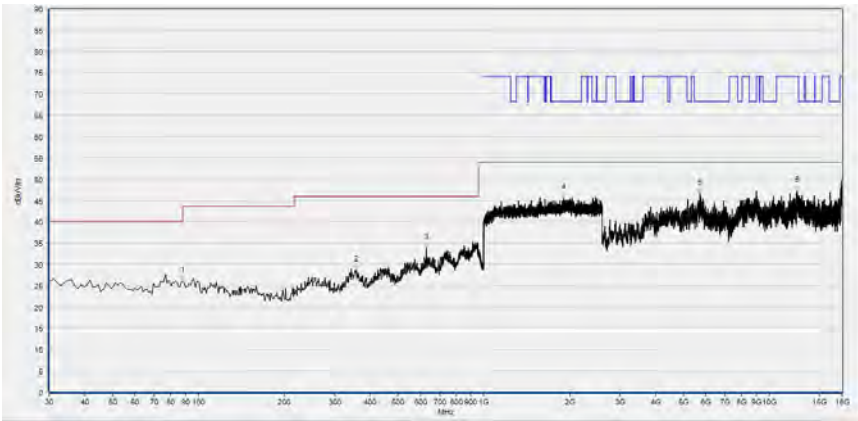
802.11a Mode

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
84.320	27.95	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
245.340	27.59	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
625.580	32.57	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1684.800	45.20	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5649.200	47.95	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
14424.120	48.13	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

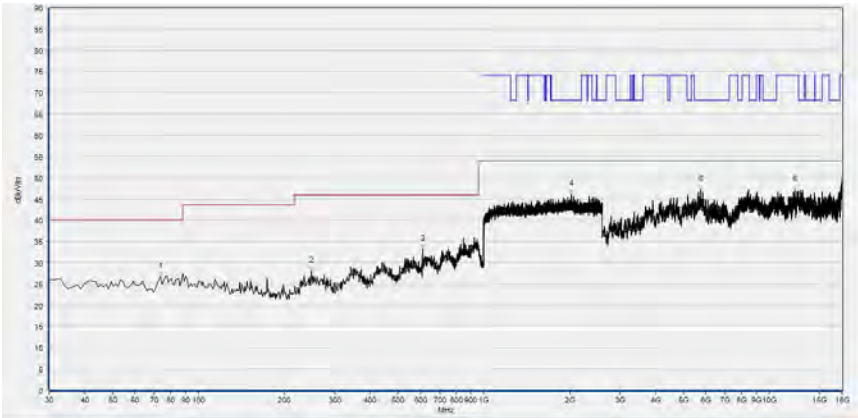
(Antenna Horizontal, 30MHz to 18GHz)



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
88.200	26.08	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
356.890	28.74	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
627.520	33.80	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1897.067	45.59	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5723.120	46.56	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12551.480	47.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

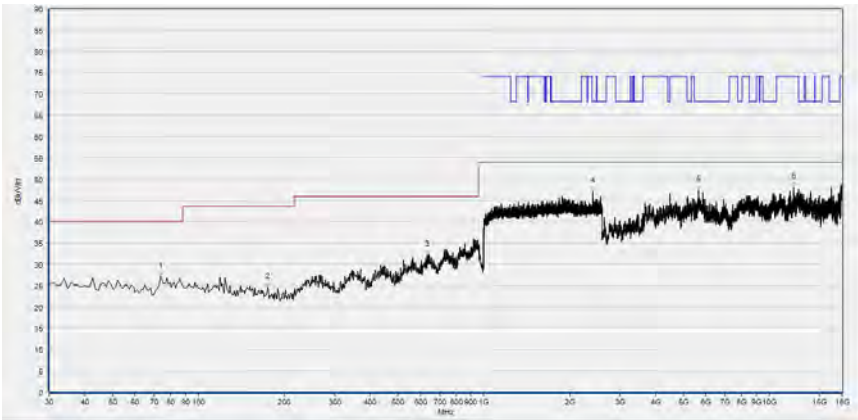
(Antenna Vertical, 30MHz to 18GHz)

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
73.650	26.62	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
249.220	28.05	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
610.060	33.23	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2031.467	46.14	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5763.160	47.02	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12305.080	47.08	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

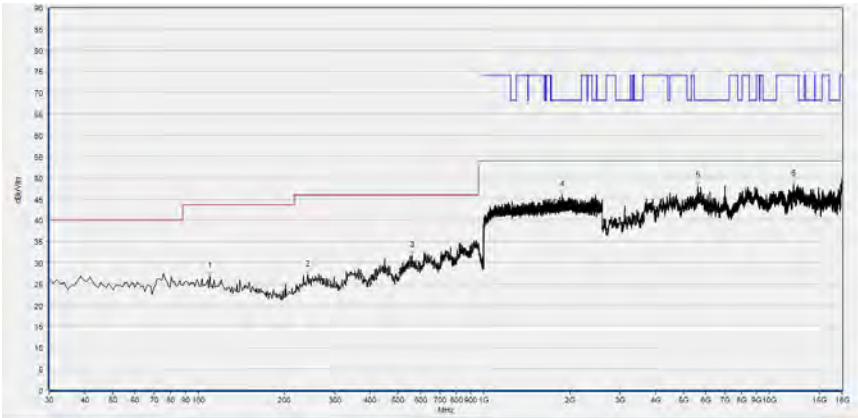
(Antenna Horizontal, 30MHz to 18GHz)



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
73.650	27.20	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
174.530	24.70	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
633.340	32.26	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2410.133	47.04	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5661.520	47.50	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12157.240	48.04	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

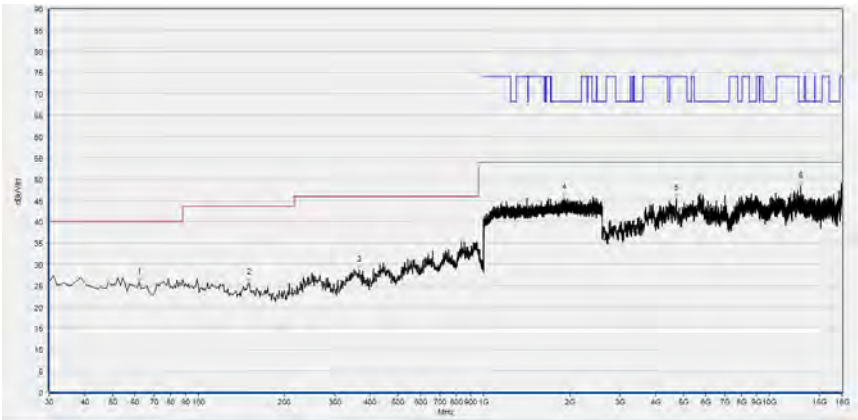
(Antenna Vertical, 30MHz to 18GHz)

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
109.540	26.83	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
241.460	27.08	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
559.620	31.66	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1884.267	45.95	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5624.560	48.02	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12157.240	48.41	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

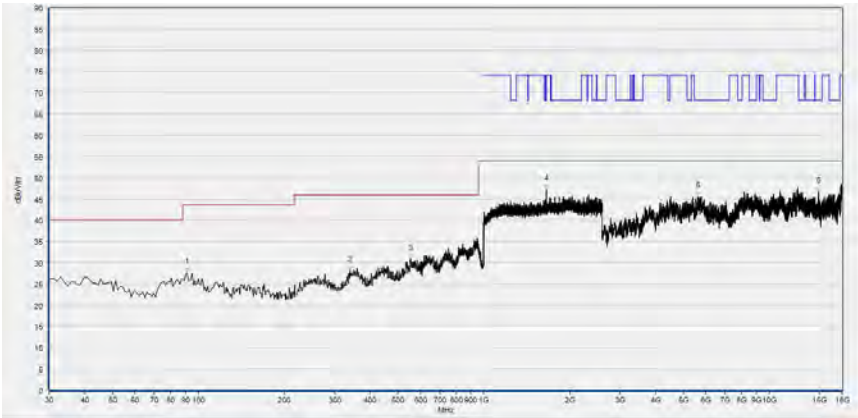
(Antenna Horizontal, 30MHz to 18GHz)



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
62.010	25.87	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
150.280	25.57	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
366.590	28.58	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1916.267	45.50	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
4715.960	45.43	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12887.200	48.23	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

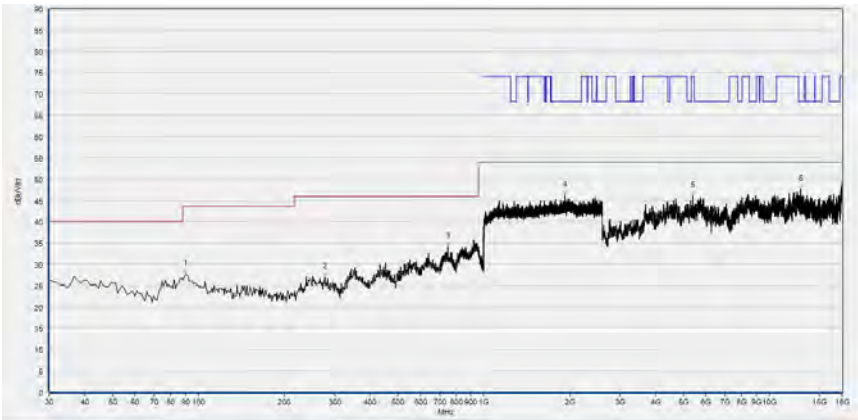
(Antenna Vertical, 30MHz to 18GHz)

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
91.110	27.67	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
339.430	28.21	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
553.800	30.85	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1657.067	47.23	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5627.640	45.62	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
14867.640	46.80	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

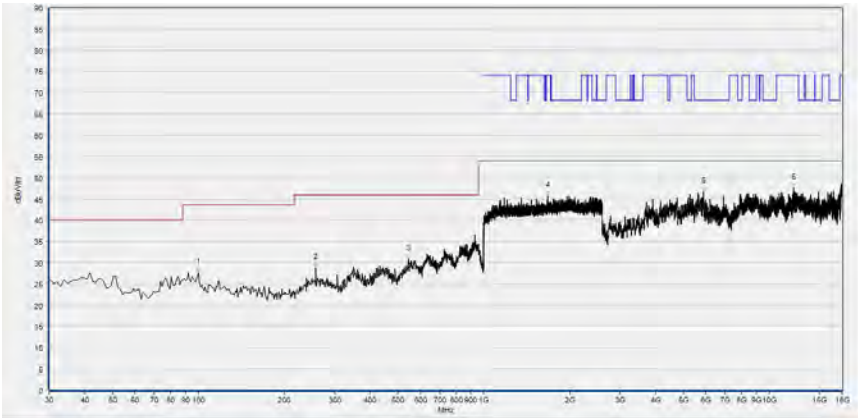
(Antenna Horizontal, 30MHz to 18GHz)



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
90.140	27.61	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
277.350	26.93	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
746.830	34.19	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1924.267	46.29	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5405.880	46.12	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12893.360	47.59	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

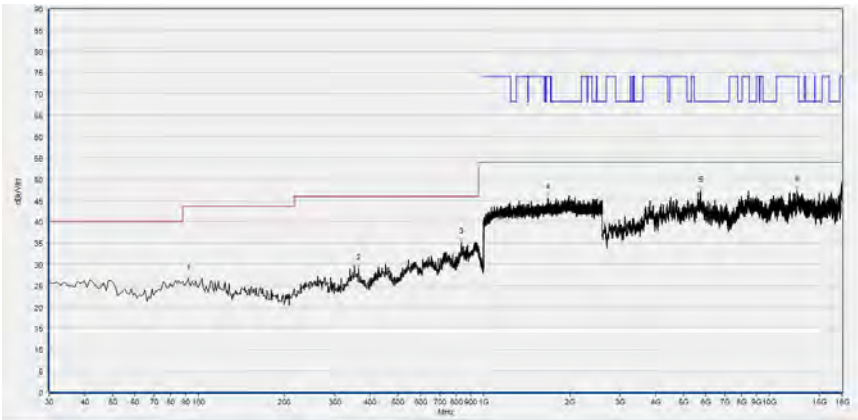
(Antenna Vertical, 30MHz to 18GHz)

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
99.840	27.60	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
257.950	28.74	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
545.070	30.76	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1678.400	45.84	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5886.360	46.71	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12148.000	47.63	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

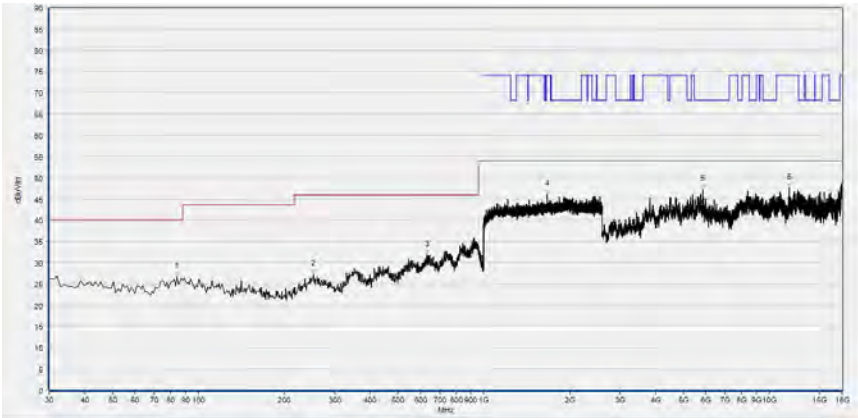
(Antenna Horizontal, 30MHz to 18GHz)



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
92.080	26.64	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
364.650	28.97	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
833.160	35.28	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1674.133	45.67	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5760.080	47.20	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12514.520	47.38	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

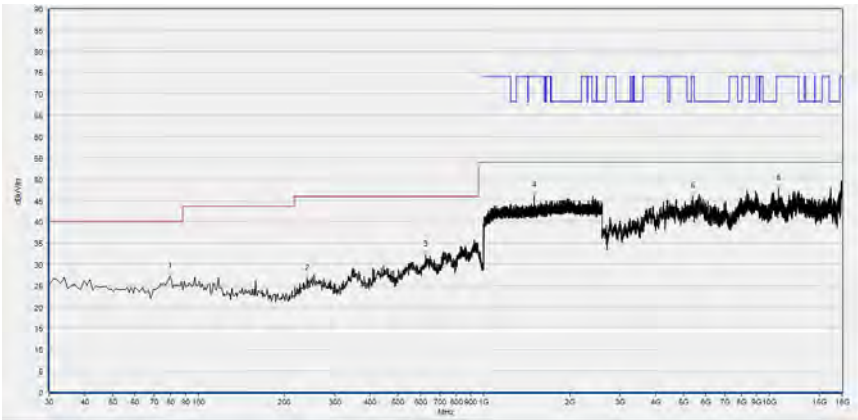
(Antenna Vertical, 30MHz to 18GHz)

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
84.320	26.64	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
253.100	27.34	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
633.340	31.87	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1670.400	46.02	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5858.640	47.30	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
11735.280	47.62	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

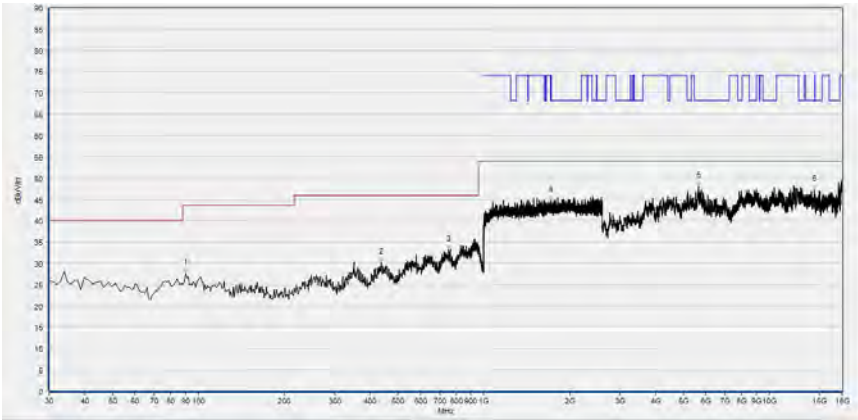


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
79.470	27.09	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
240.490	26.65	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
624.610	32.11	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1497.600	46.03	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5402.800	45.92	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10762.000	47.76	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

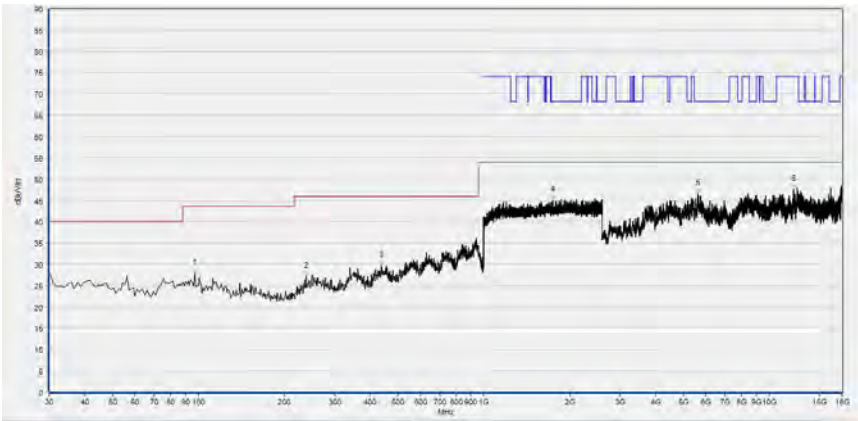
802.11n (HT40) Mode

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
90.140	27.70	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
437.400	30.10	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
751.680	33.18	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1716.267	44.74	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5652.280	48.09	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
14405.640	47.34	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

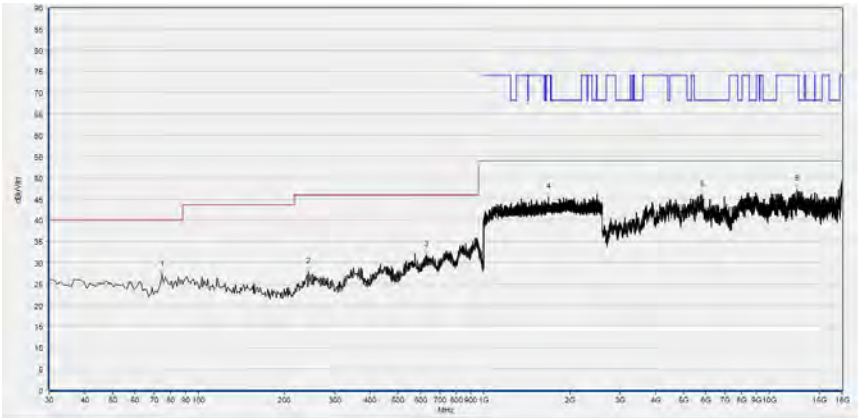
(Antenna Horizontal, 30MHz to 18GHz)



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
96.930	27.87	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
239.520	27.21	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
436.430	29.67	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1741.333	45.08	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5630.720	46.51	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12157.240	47.59	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

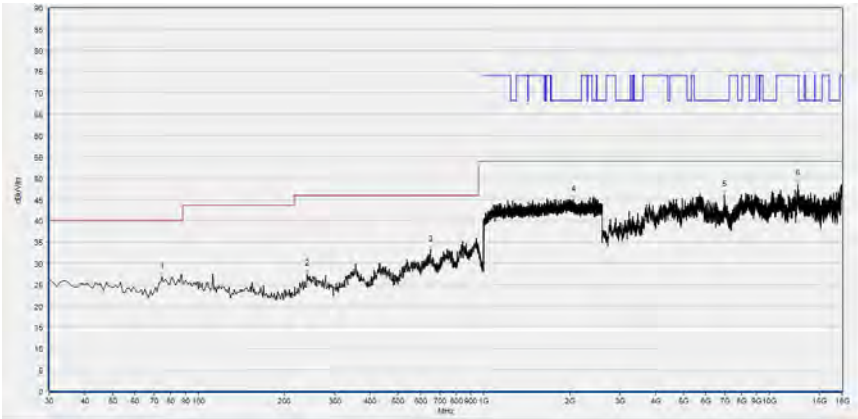
(Antenna Vertical, 30MHz to 18GHz)

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
74.620	27.10	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
243.400	27.79	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
628.490	31.80	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1683.200	45.47	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5812.440	45.88	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12529.920	47.33	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

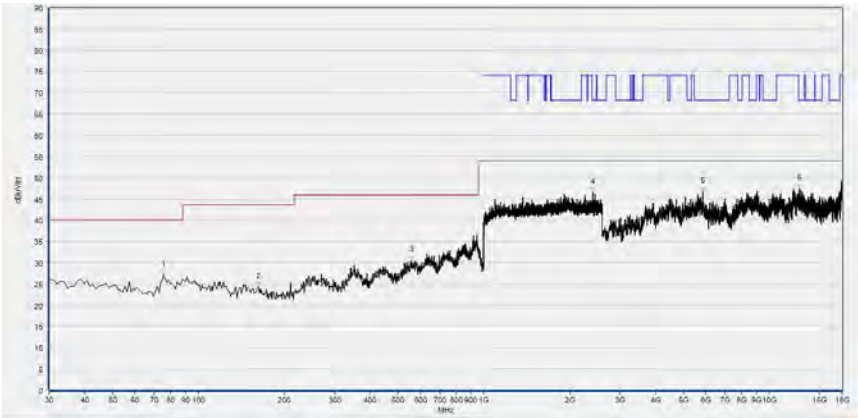
(Antenna Horizontal, 30MHz to 18GHz)



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
74.620	26.87	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
240.490	27.47	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
649.830	33.21	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2058.133	44.94	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
6973.600	46.01	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12625.400	48.67	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

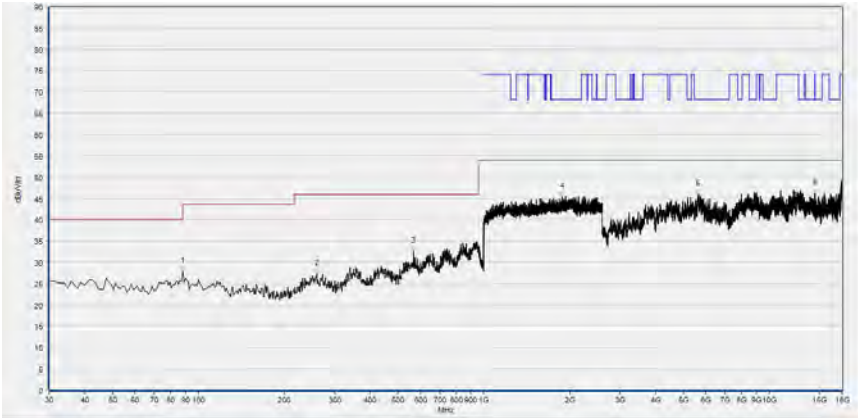
(Antenna Vertical, 30MHz to 18GHz)

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
75.590	27.15	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
161.920	24.33	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
556.710	30.43	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2412.800	46.65	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5855.560	46.77	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12702.400	47.51	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

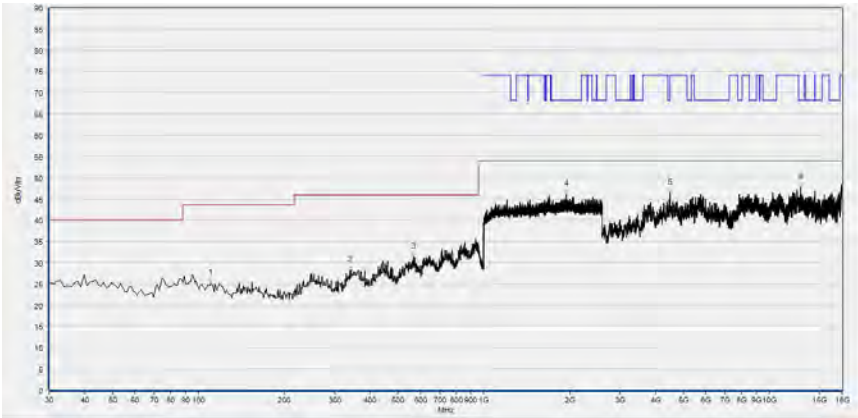
(Antenna Horizontal, 30MHz to 18GHz)



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
88.200	27.75	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
259.890	27.33	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
568.350	32.45	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1883.733	45.37	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5633.800	45.89	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
14427.200	46.33	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

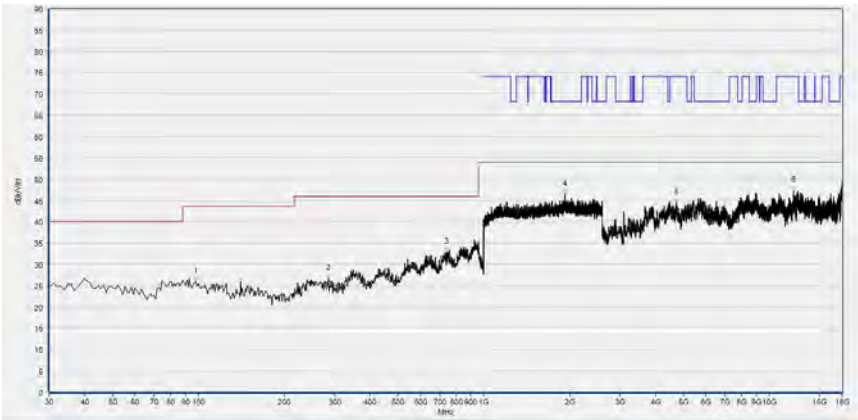
(Antenna Vertical, 30MHz to 18GHz)

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
110.510	25.13	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
339.430	28.20	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
567.380	31.37	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1948.267	46.12	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
4497.280	46.47	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12896.440	47.80	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

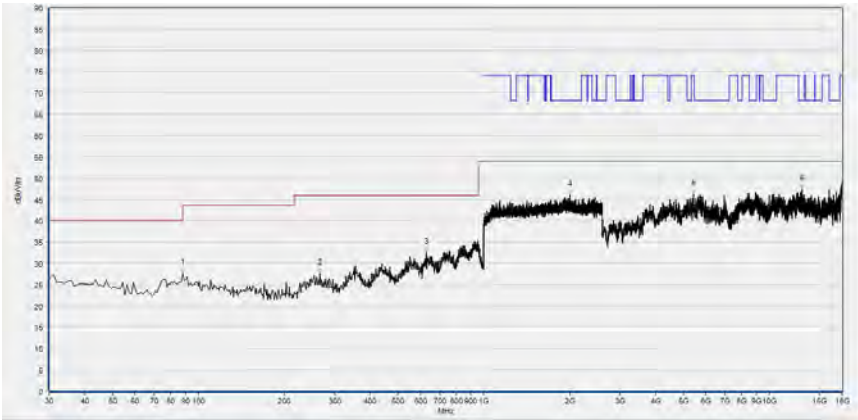


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
97.900	26.03	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
286.080	26.57	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
741.010	32.90	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1929.067	46.38	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
4719.040	44.36	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12166.480	47.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

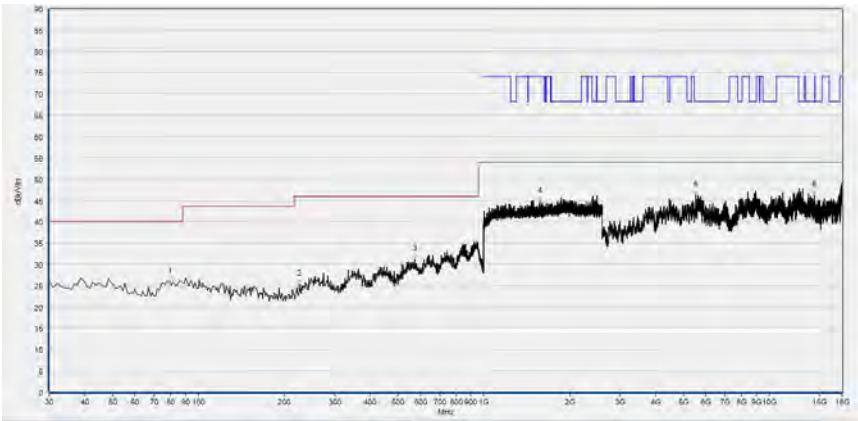
802.11ac (VHT80) Mode

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
88.200	27.63	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
266.680	27.70	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
627.520	32.46	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2000.533	46.04	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5436.680	46.32	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13059.680	47.41	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

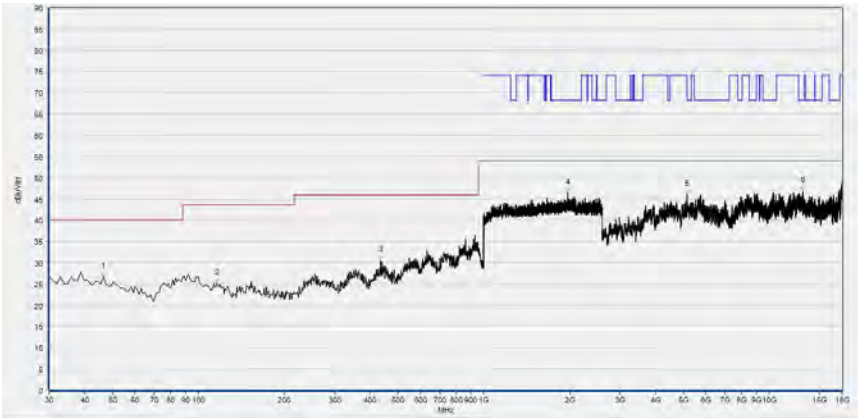
(Antenna Horizontal, 30MHz to 18GHz)



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
79.470	25.92	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
225.940	25.33	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
575.140	31.25	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1569.067	44.73	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5538.320	46.25	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
14402.560	46.31	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

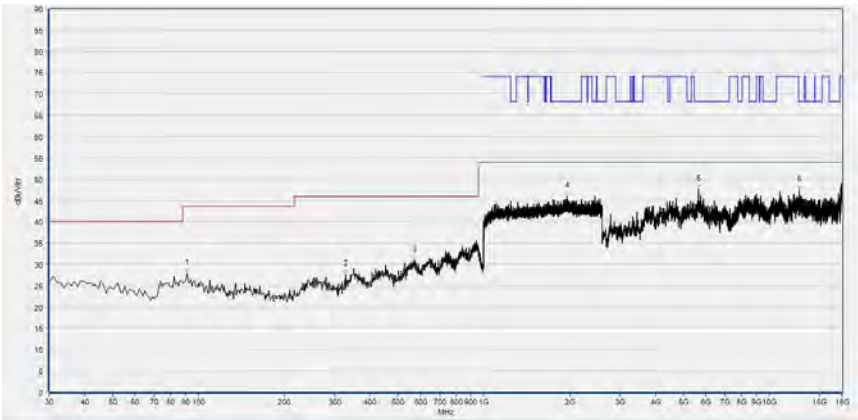
(Antenna Vertical, 30MHz to 18GHz)

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
46.490	26.68	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
116.330	25.16	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
434.490	30.46	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1964.800	46.48	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5162.560	46.08	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
13093.560	47.01	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
91.110	27.82	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
328.760	27.59	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
569.320	30.85	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1960.533	45.95	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5643.040	47.62	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12739.360	47.41	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
				2021.07.21	2022.07.20
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
				2021.07.16	2022.07.15
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
				2021.07.15	2022.07.14
26-40GHz pre-Amplifier	56774	S40M400L4002	Tonscend	2020.07.21	2021.07.20
				2021.07.15	2022.07.14
18-26.5GHz pre-Amplifier	46732	S10M100L3802	Tonscend	2020.07.21	2021.07.20
				2021.07.15	2022.07.14
Notch Filter	N/A	WRCG-5150-5350	Wainwright	2020.07.21	2021.07.20
				2021.07.15	2022.07.14
Notch Filter	N/A	WRCG-5470-5725	Wainwright	2020.07.21	2021.07.20
				2021.07.15	2022.07.14
Notch Filter	N/A	WRCG-5725-5850	Wainwright	2020.07.21	2021.07.20
				2021.07.15	2022.07.14

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