



REPORT No.: SZ19080084W01

TEST REPORT

APPLICANT : Nanjing Juplink Intelligent Technologies Co., Ltd.

PRODUCT NAME : Dual-band Gigabit Router

MODEL NAME : RX4-1500

BRAND NAME : JupLink

FCC ID : 2AT9Z-RX4-1500

STANDARD(S) : 47 CFR Part 15 Subpart E

RECEIPT DATE : 2019-08-08

TEST DATE : 2019-08-09 to 2019-09-01

ISSUE DATE : 2019-09-05



Edited by:

Zeng Xiaoying
Zeng Xiaoying (Rapporteur)

Approved by:

Peng Huarui
Peng Huarui (Supervisor)

NOTE: This document is issued by MORLAB, the test report shall not be reproduced except in full without prior written permission of the company. The test results apply only to the particular sample(s) tested and to the specific tests carried out which is available on request for validation and information confirmed at our website.

MORLAB

SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.
FL1-3, Building A, FeiYang Science Park, No.8 LongChang Road,
Block67, BaoAn District, ShenZhen , GuangDong Province, P. R. China

Tel: 86-755-36698555

Http://www.morlab.cn

Fax: 86-755-36698525

E-mail: service@morlab.cn





DIRECTORY

1. Technical Information	4
1.1. Applicant and Manufacturer Information	4
1.2. Equipment Under Test (EUT) Description	4
1.3. The channel number and frequency of EUT	5
1.4. Summary of Test Results	6
1.5. Environmental Conditions	7
2. 47 CFR Part 15E Requirements	8
2.1. Antenna requirement	8
2.2. Duty Cycle of the test signal	8
2.3. Maximum Conducted Output Power	12
2.4. Emission Bandwidth	15
2.5. Maximum Power Spectral Density	24
2.6. Frequency Stability	39
2.7. Conducted Emission	41
2.8. Restricted Frequency Bands	45
2.9. Radiated Emission	58
Annex A Test Uncertainty	75
Annex B Testing Laboratory Information	76



REPORT No.: SZ19080084W01

Change History		
Version	Date	Reason for change
1.0	2019-09-05	First edition



1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Nanjing Juplink Intelligent Technologies Co., Ltd.
Applicant Address:	No. 757, Dixiu Road, Binjiang Economic Development Zone, Jiangning District, Nanjing, China
Manufacturer:	Sichuan Tianyi Comheart Telecom Co., Ltd.
Manufacturer Address:	No. 198, Section 1, Xueshan Avenue, Dayi County, Chengdu, Sichuan, China

1.2. Equipment Under Test (EUT) Description

Product Name:	Dual-band Gigabit Router	
Serial No:	(N/A, marked #1 by test site)	
Hardware Version:	V1.0.0	
Software Version:	V1.0.1	
Modulation Type:	OFDMA	
Modulation Mode:	802.11ax(HEW20), 802.11ax(HEW40),802.11ax(HEW80)	
Data Rate	Up to 1200Mbps	
Operating Frequency Range:	5.180 GHz- 5.240 GHz; 5.745GHz- 5.825GHz	
Channel Number:	Refer to 1.3	
Antenna Type:	External antenna	
Antenna Gain:	Ant 0: 5 dBi; Ant 1: 5 dBi	
Directional Gain:	G_{Tx} : 8.01 dBi Note 2	
Accessory Information:	AC Adapter	
	Brand Name:	Transin
	Model No.:	TS-A012-120010Aq
	Serial No.:	(N/A, marked #1 by test site)
	Rated Output:	12V $\approx$ 1A
	Rated Input:	100-240V $\sim$ 50/60Hz 0.4A

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

Modulation Mode:	TX Function	Beamforming
802.11ax	2TX	Not Support



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

Note 3: For conducted test item Maximum Conducted Output Power and Maximum Power Spectral Density of each modulation mode, the report recorded the test result of two antennas separately, for other conducted test items both of the two antennas were tested separately, only recorded the worst test result(Ant 1) in this report.

Note 4: All radiation test items for 802.11ax modulation mode operate at the worst mode(CDD) in this report.

Note 5: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 6: Automatic stop transmission principle: After receiving the signal and confirming it is correct, the physical layer submits it to the MAC-PHY sublayer. After unpacking, the data is sent to the MAC layer and then it is determined whether it is data sent to the router. If yes, please turn in; otherwise, discard.

1.3.The channel number and frequency of EUT

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	5755	159	5795
80MHz	155	5775		

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



1.4. Summary of Test 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	Aug 09, 2019	Zhou Chuang	PASS	No deviation
3	15.407(a)	Maximum conducted output Power	Aug 21, 2019	Zhou Chuang	PASS	No deviation
4	15.407(a) (e)	Emission Bandwidth	Aug 09, 2019	Zhou Chuang	PASS	No deviation
5	15.407(a)	Maximum Power spectral density	Aug 14, 2019	Zhou Chuang	PASS	No deviation
6	15.407(g)	Frequency Stability	Aug 21, 2019	Zhou Chuang	PASS	No deviation
7	15.207	Conducted Emission	Sep 01, 2019	Peng Xuwei	PASS	No deviation
8	15.407(b)	Restricted Frequency Bands	Aug 17, 2019	Peng Xuwei	PASS	No deviation
9	15.407(b)	Radiated Emission	Aug 21, 2019	Peng Xuwei	PASS	No deviation

Note1: The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.10 2013.

Note2: These RF tests were performed according to the method of measurements prescribed in KDB789033 D02 General UNII Test Procedures New Rules v02r01, KDB662911 D01 Multiple Transmitter Output v02r01.

Note3: The path loss during the RF test is calibrated to correct the results by the offset setting



in the test equipments. The ref offset 12.5dB contains two parts that cable loss 2.5dB and Attenuator 10dB.

Note 4: Additions to, deviation, or exclusions from the method should be judged in the "method determination" column of add, deviate or exclude from the specific method should be explained in the "Remark" of the above table.

1.5. 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. 2.1.2 Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Duty Cycle of the test signal

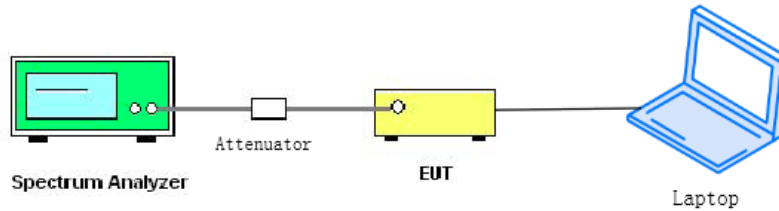
2.2.1. Requirement

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 subclause, 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 $\pm 2\%$; otherwise, the duty cycle is considered to be nonconstant.

2.2.2. Test Description

A. Test Set:



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.

B. Test Procedure

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

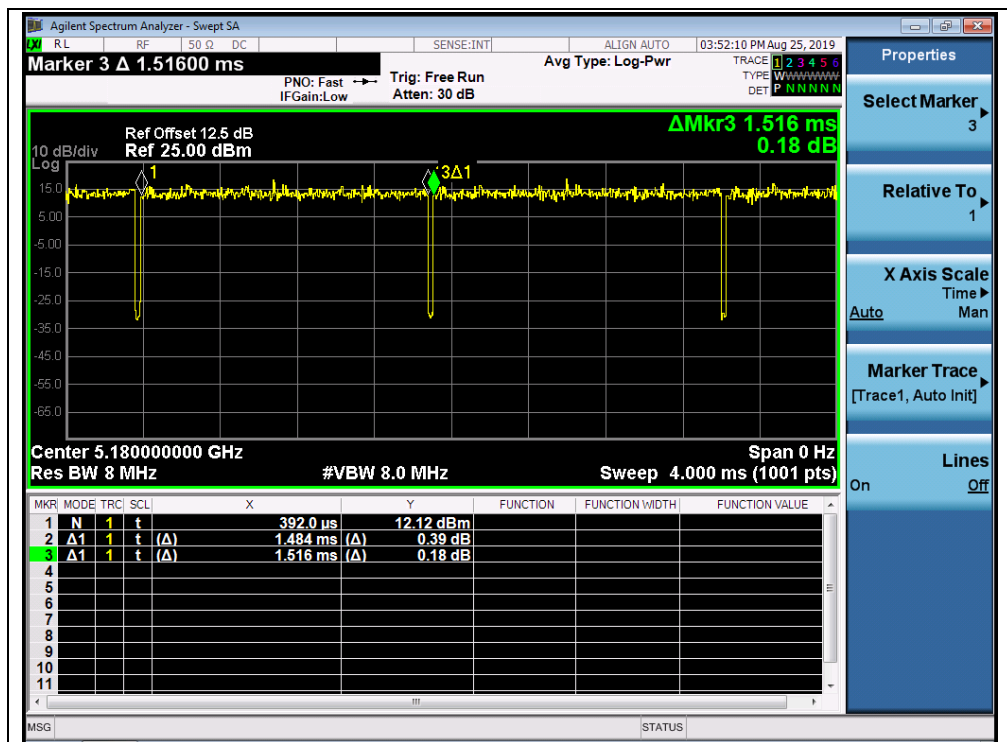


2.2.3. Test Result

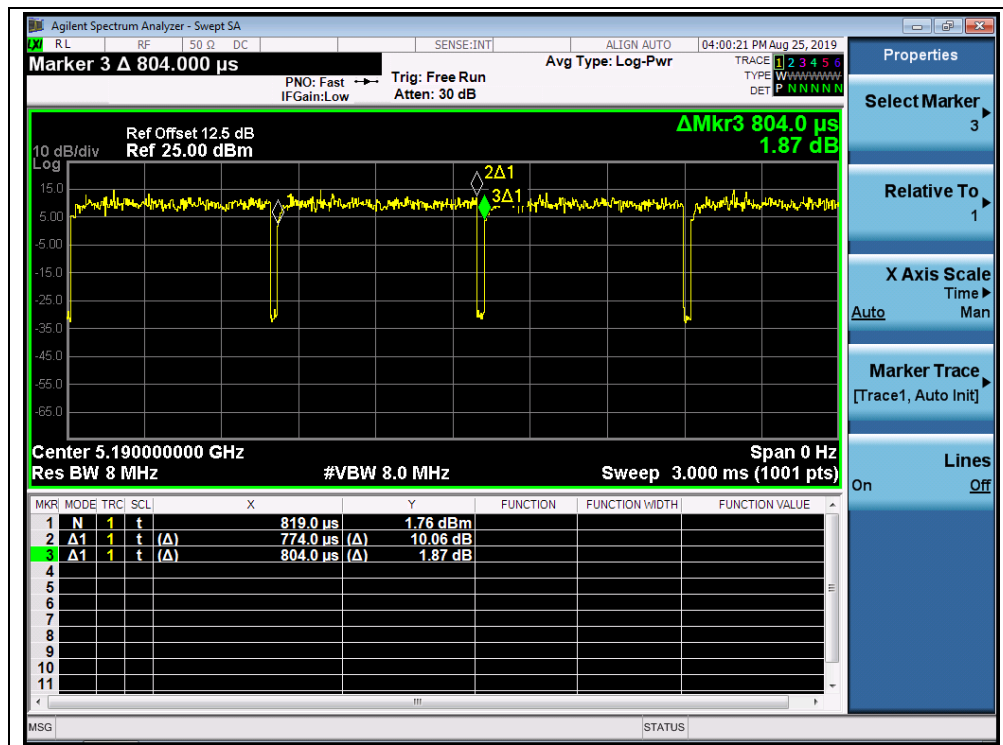
A. Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*log[1/D])
802.11ax (HEW20)	97.89	0.09
802.11ax (HEW40)	96.27	0.17
802.11ax (HEW80)	92.63	0.33

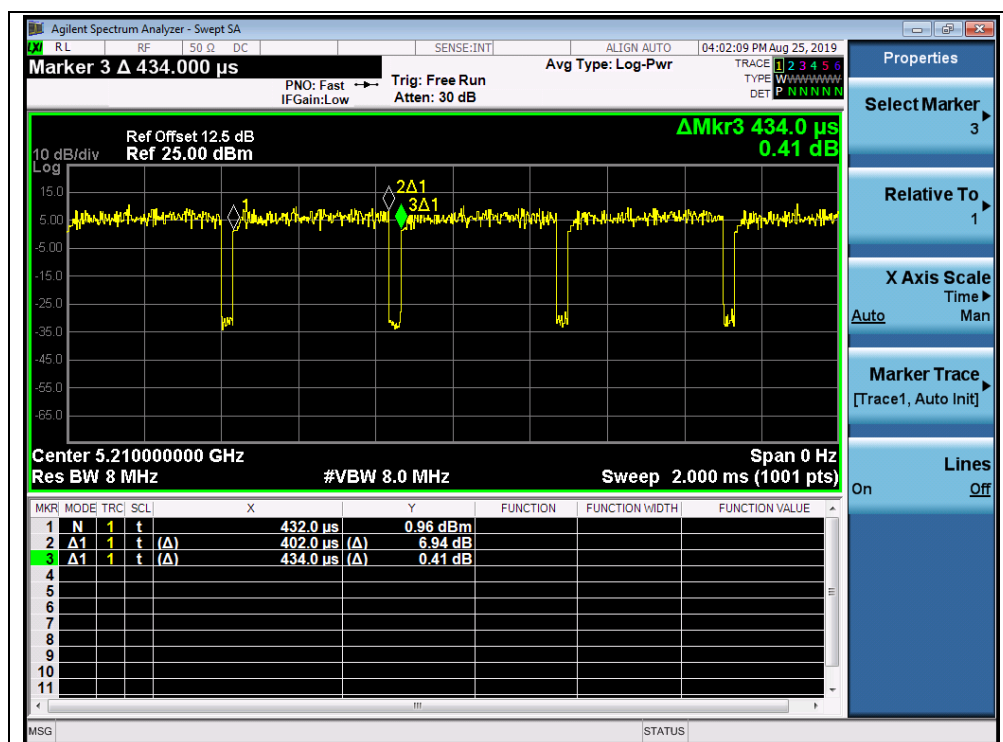
B. Test Plots



(CH36_5180MHz_802.11ax (HEW20))



(CH36_5180MHz_802.11ax (HEW40))



(CH38_5190MHz_802.11ax (HEW80))

2.3. Maximum Conducted Output Power

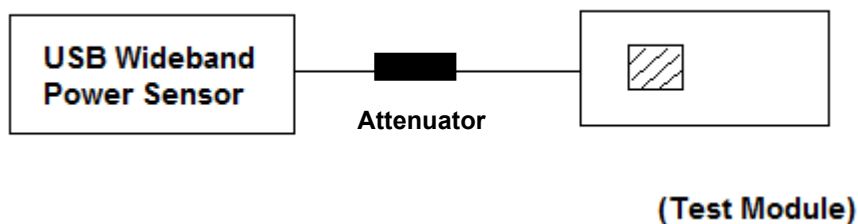
2.3.1. Limits of Maximum Conducted Output Power

Operation Band	Device Category		Limit (dBm)
U-NII-1		Outdoor Access Point	30
	√	Indoor Access Point	30
		Fixed point-to-point Access Point	30
		Mobile and Portable Client Device	24
U-NII-2A			Min [24,11+10logB]
U-NII-2C			Min [24,11+10logB]
U-NII-3	√		30
Note 1: If the directional gain (G_{Tx}) greater than 6 dBi ,the limit shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi, about directional gain (G_{Tx}), refer to clause 1.2 of this report. Directional gain = 5dBi +10log(2) = 8.01dBi>6dBi, so the power limit shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.			
Note 2: B is the 26dB emission bandwidth in megahertz.			

2.3.2. Test Description

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

A. 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.



2.3.3. Test Result

Maximum Peak Conducted Output Power

802.11ax(HEW20) Test mode

Channel	Frequency (MHz)	Measured Peak Power		Total Power		Limit (dBm)	Verdict
		ANT 0	ANT 1				
		dBm	dBm	W	dBm		
36	5180	20.37	20.39	0.22	23.39	27.99	PASS
40	5200	20.59	20.37	0.22	23.49		
48	5240	20.10	19.88	0.20	23.00		
149	5745	20.46	20.83	0.23	23.66	27.99	
157	5785	20.63	20.74	0.23	23.70		
165	5825	20.06	20.64	0.22	23.37		

802.11ax(HEW40) Test mode

Channel	Frequency (MHz)	Measured Peak Power		Total Power		Limit (dBm)	Verdict
		ANT 0	ANT 1				
		dBm	dBm	W	dBm		
38	5190	18.11	17.74	0.12	20.94	27.99	PASS
46	5230	17.49	17.26	0.11	20.39		
151	5755	17.64	17.85	0.12	20.76	27.99	
159	5795	17.87	17.77	0.12	20.83		

802.11ax(HEW80) Test mode

Channel	Frequency (MHz)	Measured Peak Power		Total Power		Limit (dBm)	Verdict
		ANT 0	ANT 1				
		dBm	dBm	W	dBm		
42	5210	15.74	15.10	0.07	18.44	27.99	PASS
155	5775	15.51	15.69	0.07	18.61	27.99	

**Maximum Average Conducted Output Power****802.11ax(HEW20) Test mode**

Channel	Frequency (MHz)	Average Power					Limit (dBm)	Verdict
		Measured		Duty Factor	Total Power with Duty Factor			
		ANT0	ANT1		Duty Factor			
		dBm	dBm		W	dBm		
36	5180	8.62	9.23	0.09	0.02	12.04	27.99	PASS
40	5200	8.64	8.65		0.01	11.75		PASS
48	5240	8.45	8.33		0.01	11.49		PASS
149	5745	8.83	9.15		0.02	12.10	27.99	PASS
157	5785	9.01	9.11		0.02	12.16		PASS
165	5825	8.61	8.92		0.02	11.87		PASS

802.11ax(HEW40) Test mode

Channel	Frequency (MHz)	Average Power					Limit (dBm)	Verdict
		Measured		Duty Factor	Total Power with Duty Factor			
		ANT0	ANT1		Duty Factor			
		dBm	dBm		W	dBm		
38	5190	8.56	8.61	0.17	0.01	11.76	27.99	PASS
46	5230	8.23	8.17		0.01	11.38		PASS
151	5755	8.62	8.75		0.02	11.86	27.99	PASS
159	5795	8.76	8.74		0.02	11.93		PASS

802.11ax(HEW80) Test mode

Channel	Frequency (MHz)	Average Power					Limit (dBm)	Verdict
		Measured		Duty Factor	Total Power with Duty Factor			
		ANT0	ANT1		Duty Factor			
		dBm	dBm		W	dBm		
42	5210	8.51	7.95	0.33	0.01	11.58	27.99	PASS
155	5775	8.27	8.73		0.02	11.85	27.99	PASS

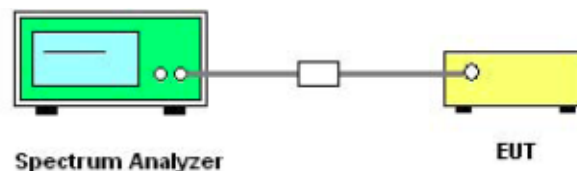
2.4. Emission Bandwidth

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

A. Test Set:



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

B. 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 the 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 5.725-5.85 GHz was used in order to prove compliance.

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ 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.

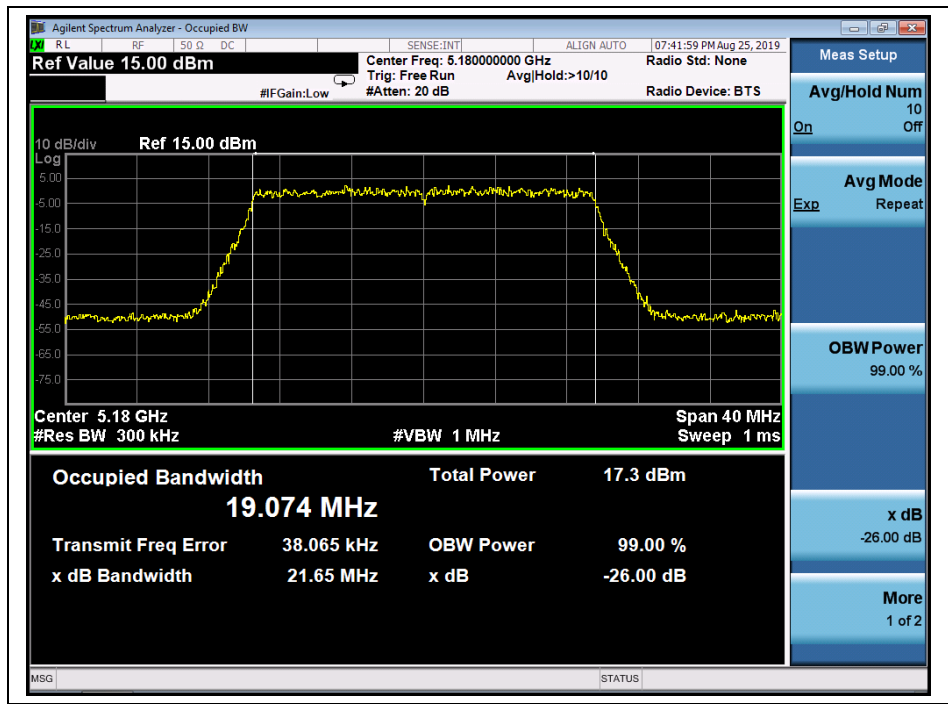
2.4.3. Test Result

802.11ax(HEW20) Test mode(ANT 1)

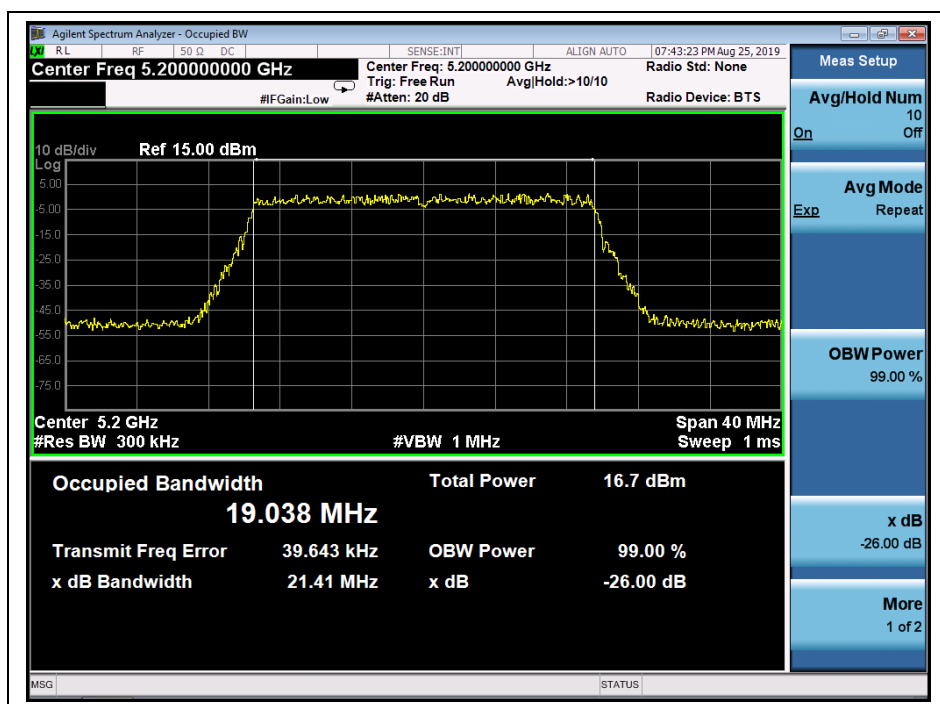
A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	21.65
40	5200	21.41
48	5240	21.58
Channel	Frequency (MHz)	6dB Bandwidth (MHz)
149	5745	18.97
157	5785	18.99
165	5825	19.02

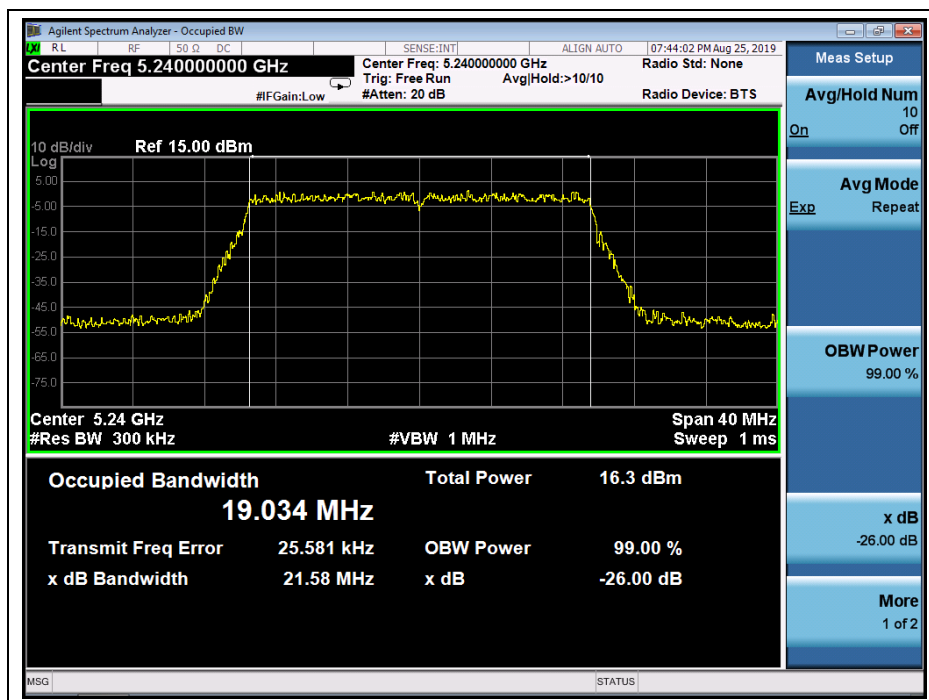
B. Test Plots



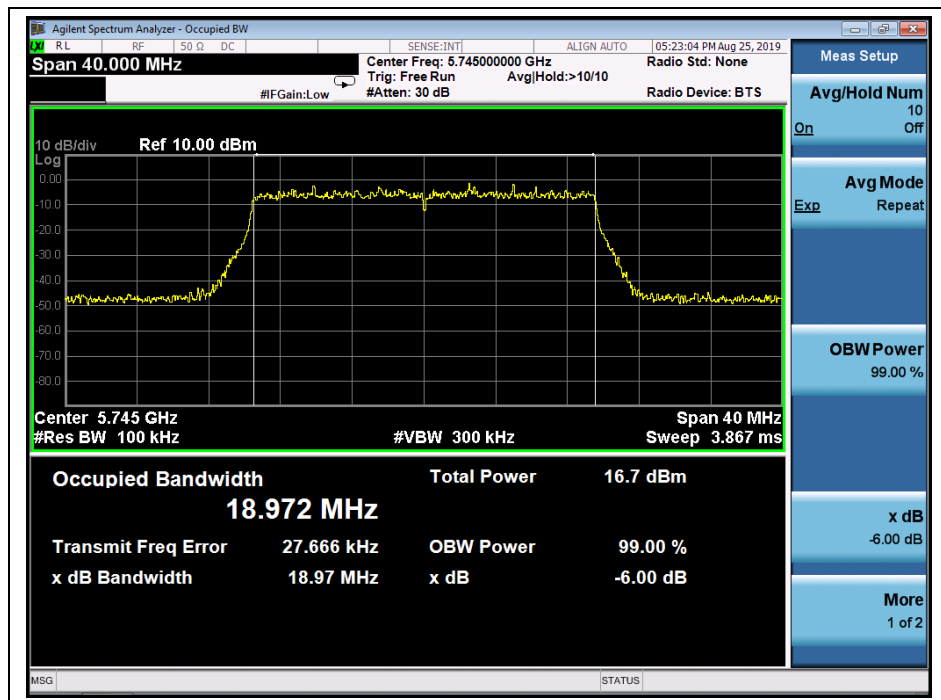
(Channel 36, 52180 MHz, 802.11ax(HEW20))



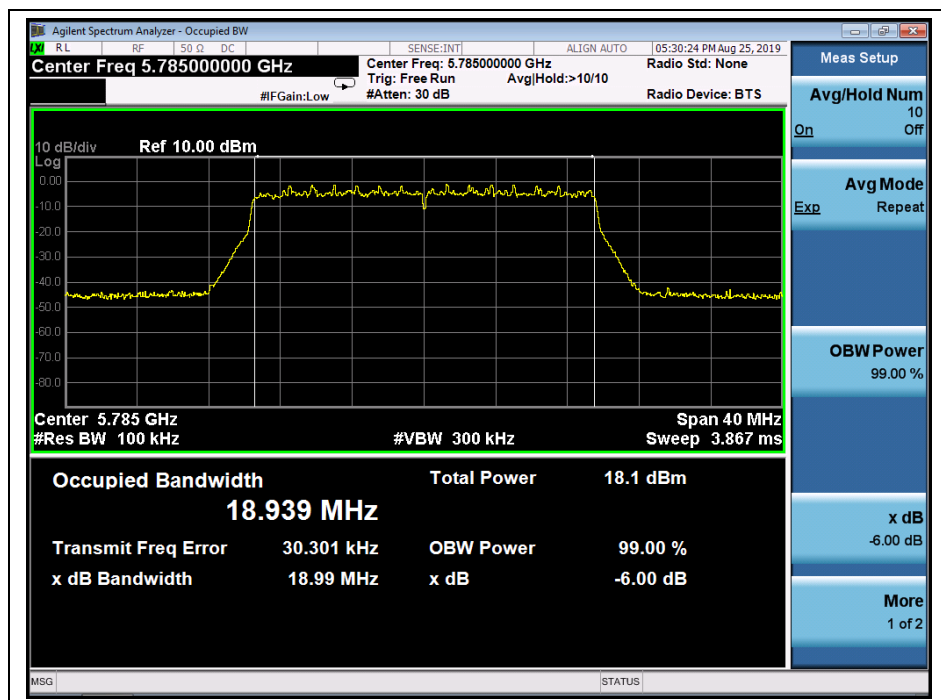
(Channel 40, 5200 MHz, 802.11ax(HEW20))



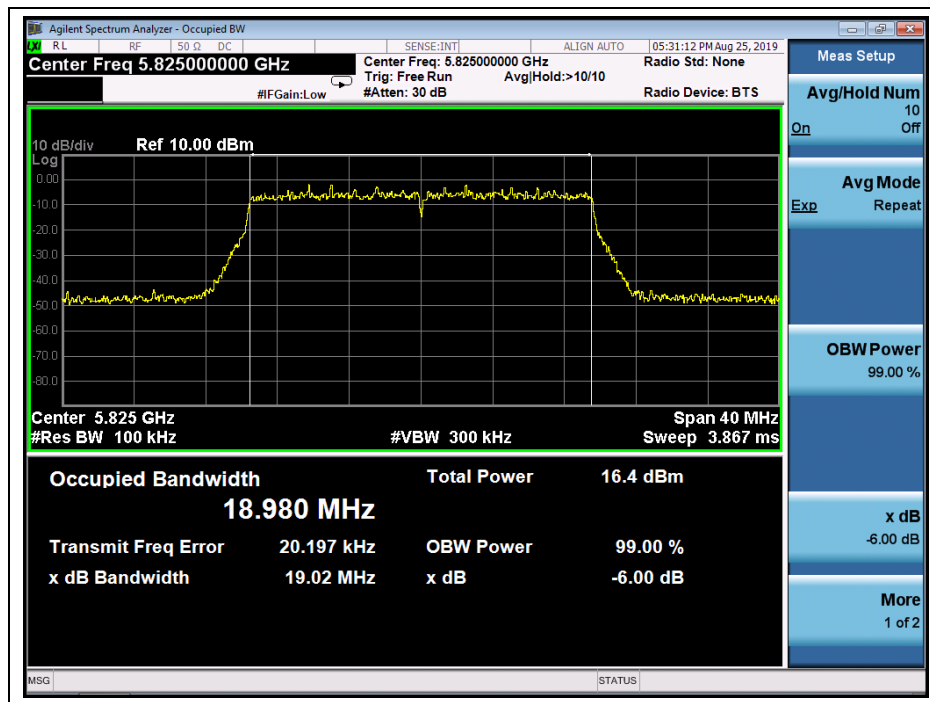
(Channel 48, 5240MHz, 802.11ax(HEW20))



(Channel 149, 5745MHz, 802.11ax(HEW20))



(Channel 157, 5785MHz, 802.11ax(HEW20))



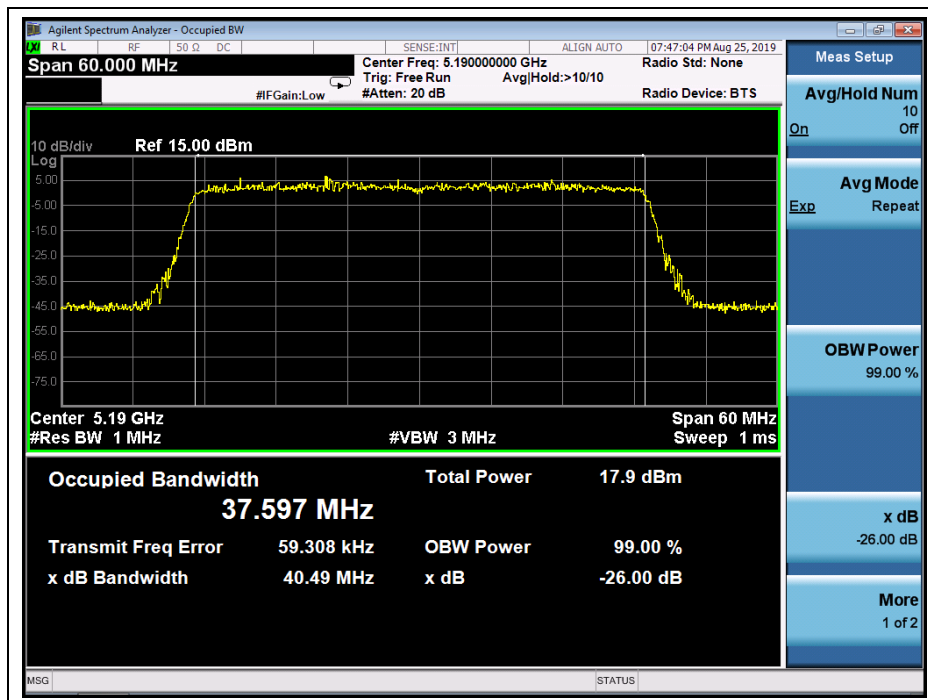
(Channel 165, 5825MHz, 802.11ax(HEW20))

802.11ax(HEW40) Test mode(ANT 1)

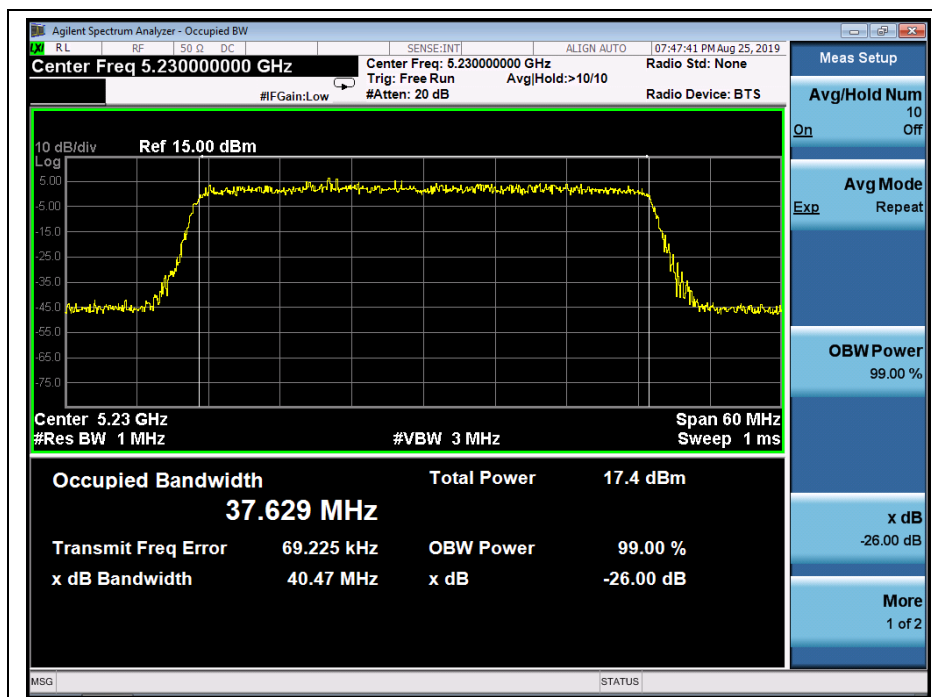
A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	40.49
46	5230	40.47
Channel	Frequency (MHz)	6dB Bandwidth (MHz)
151	5755	37.67
159	5795	37.57

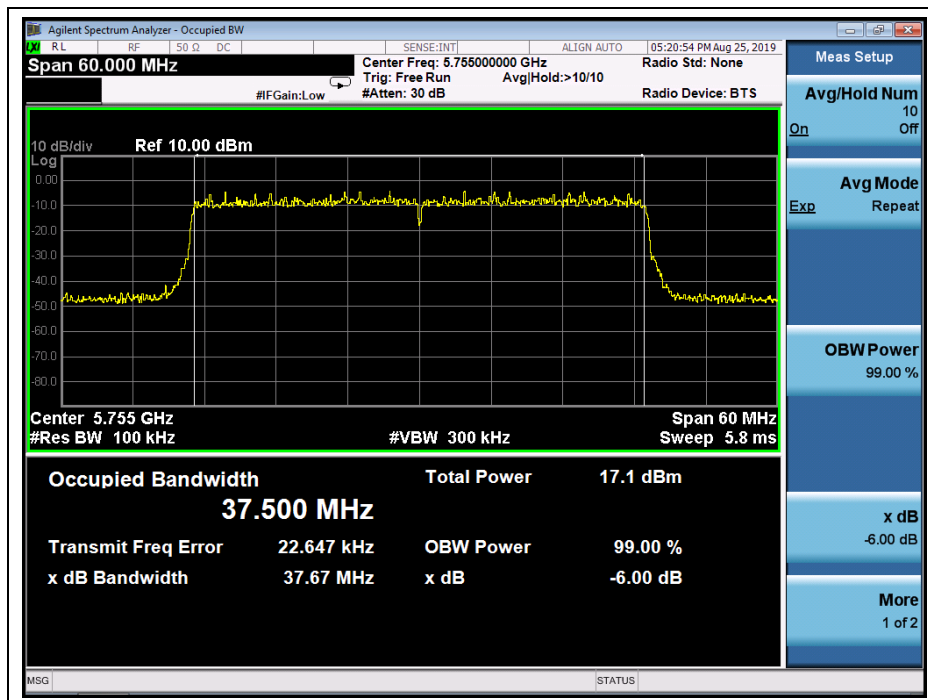
B. Test Plots



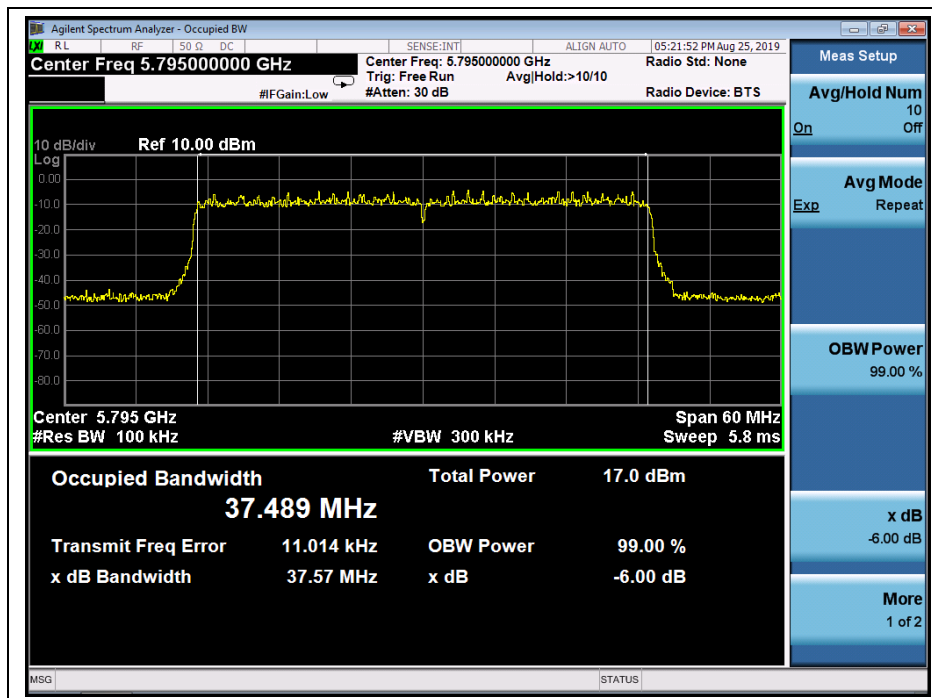
(Channel 38, 5190MHz, 802.11ax(HEW40))



(Channel 46, 5230 MHz, 802.11ax(HEW40))



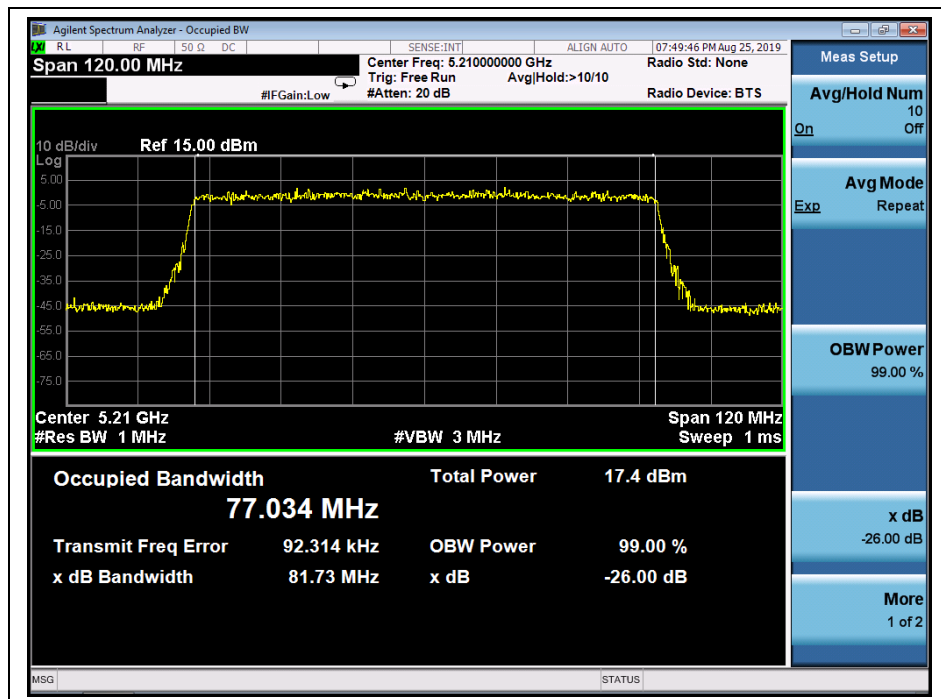
(Channel 151, 5755MHz, 802.11 802.11ax(HEW40))



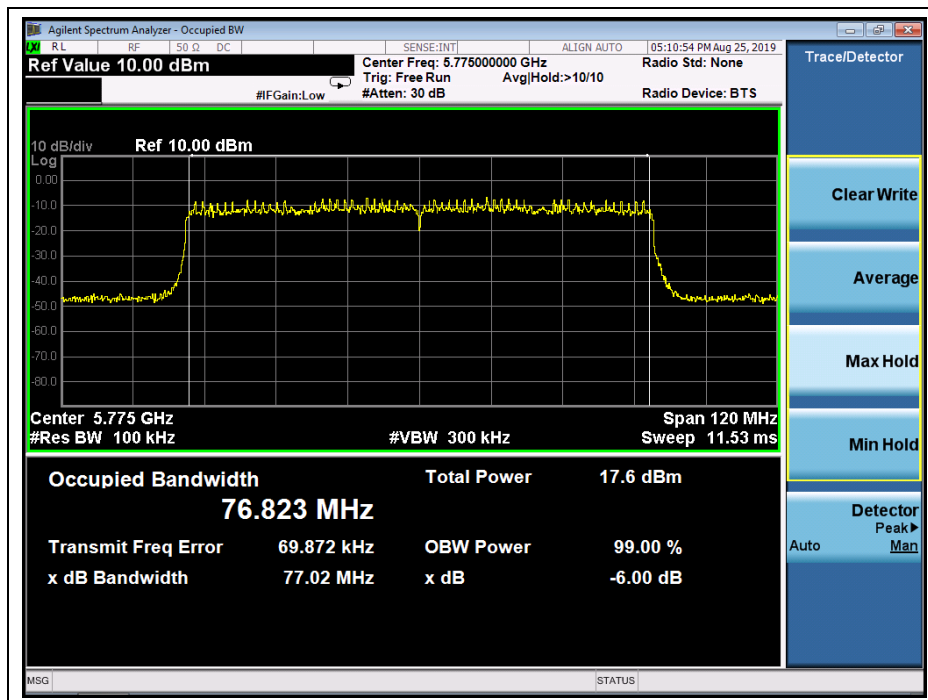
(Channel 159, 5795MHz, 802.11ax(HEW40))

**802.11ax(HEW80) Test mode(ANT 1)****A. Test Verdict:**

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
42	5210	81.73
Channel	Frequency (MHz)	6dB Bandwidth (MHz)
155	5775	77.02

B. Test Plots

(Channel 42, 5210MHz, 802.11ax(HEW80))



(Channel 155, 5775 MHz, 802.11ax(HEW80))

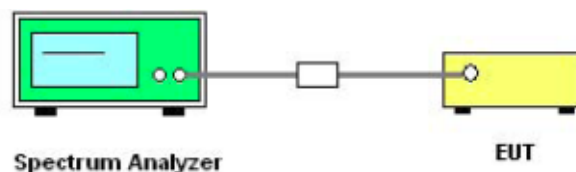
2.5. Maximum Power Spectral Density

2.5.1. Requirement

Operation Band	Device Category		Limit
U-NII-1		Outdoor Access Point	17 dBm/MHz
	✓	Indoor Access Point	17 dBm/MHz
		Fixed point-to-point Access Point	17 dBm/MHz
		Mobile and Portable Client Device	11 dBm/MHz
U-NII-2A			11 dBm/MHz
U-NII-2C			11 dBm/MHz
U-NII-3	✓		30 dBm/500kHz
Note 1: If the directional gain (G_{Tx}) greater than 6 dBi ,the limit shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi, about directional gain (G_{Tx}), refer to clause 1.2 of this report. Directional gain = 5dBi +10log(2) = 8.01dBi>6dBi, so the PSD limit shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.			

2.5.2. Test Description

A. Test Set:



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.

B. Test Procedure

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



2.5.3. Test Result

802.11ax (HEW20) Test mode

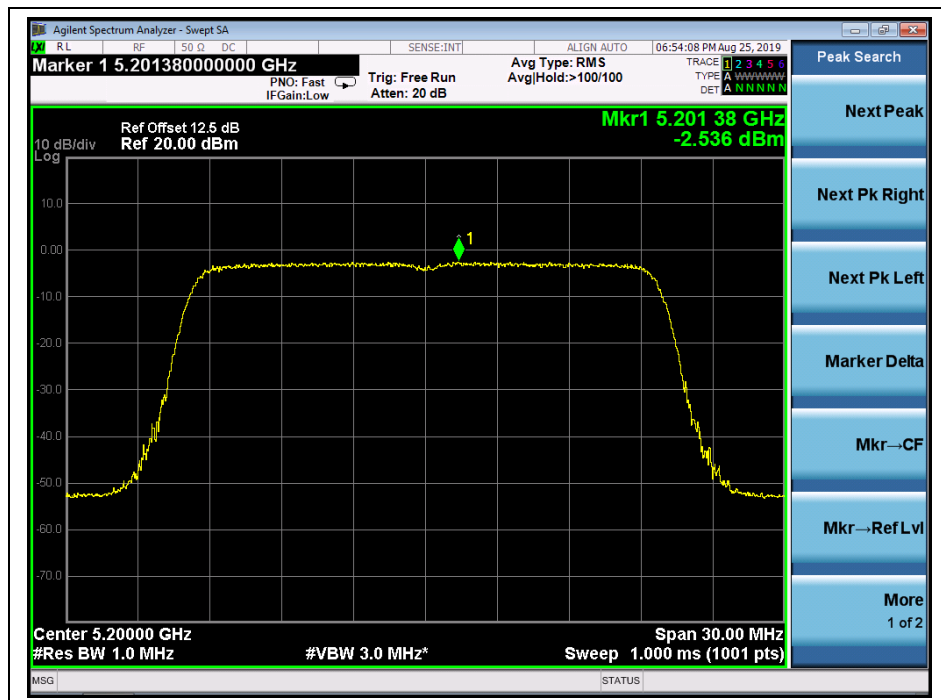
A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Total PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
		ANT 0	ANT 1			
36	5180	-1.51	-1.51	1.50	14.99	PASS
40	5200	-2.54	-2.54	0.47		
48	5240	-2.55	-2.55	0.46		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Total PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
		ANT 0	ANT 1			
149	5745	-4.42	-3.76	-1.07	27.99	PASS
157	5785	-5.10	-4.82	-1.95		
165	5825	-4.83	-5.17	-1.99		

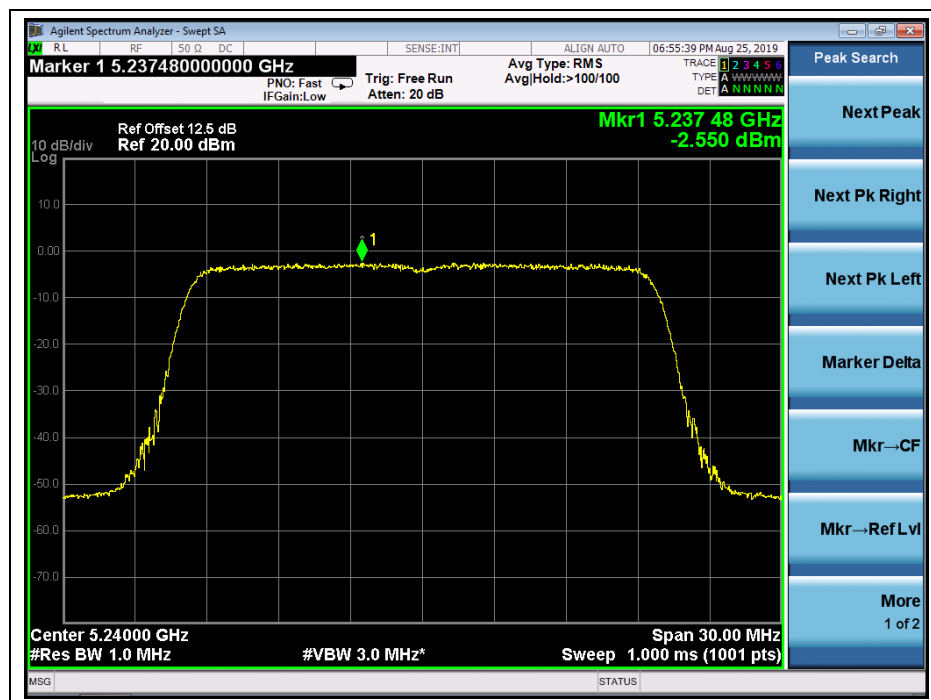
B. Test Plots



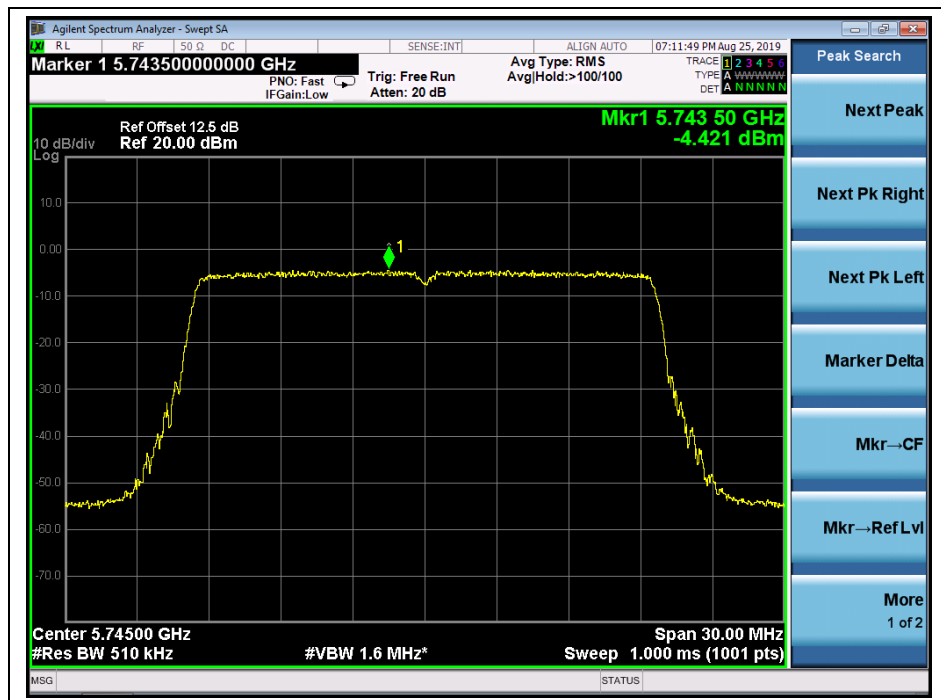
(Channel 36, 5180 MHz, 802.11a, ANT 0)



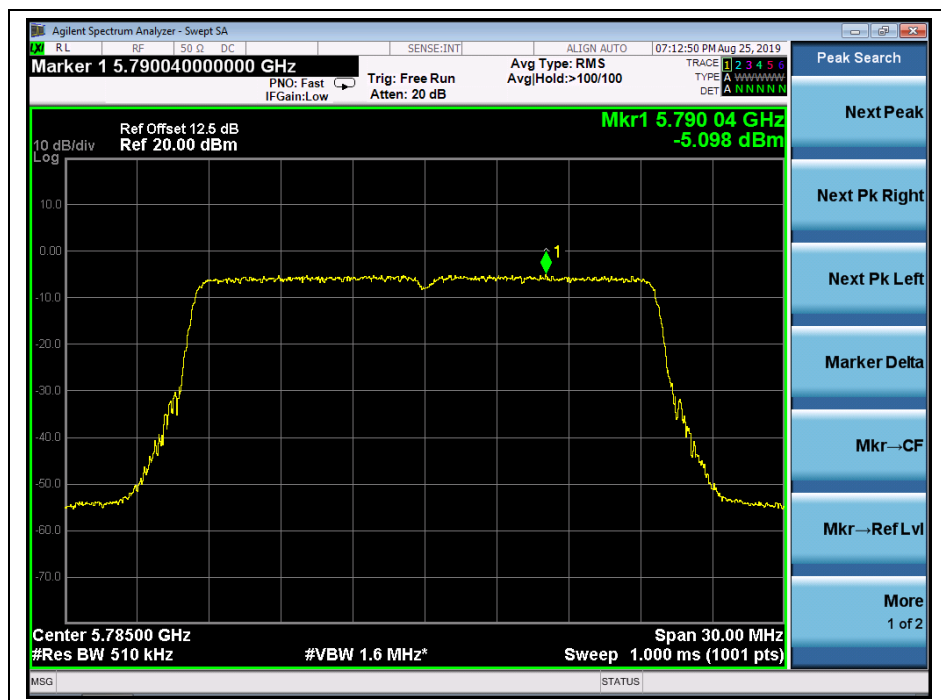
(Channel 40, 5200 MHz, 802.11a, ANT 0)



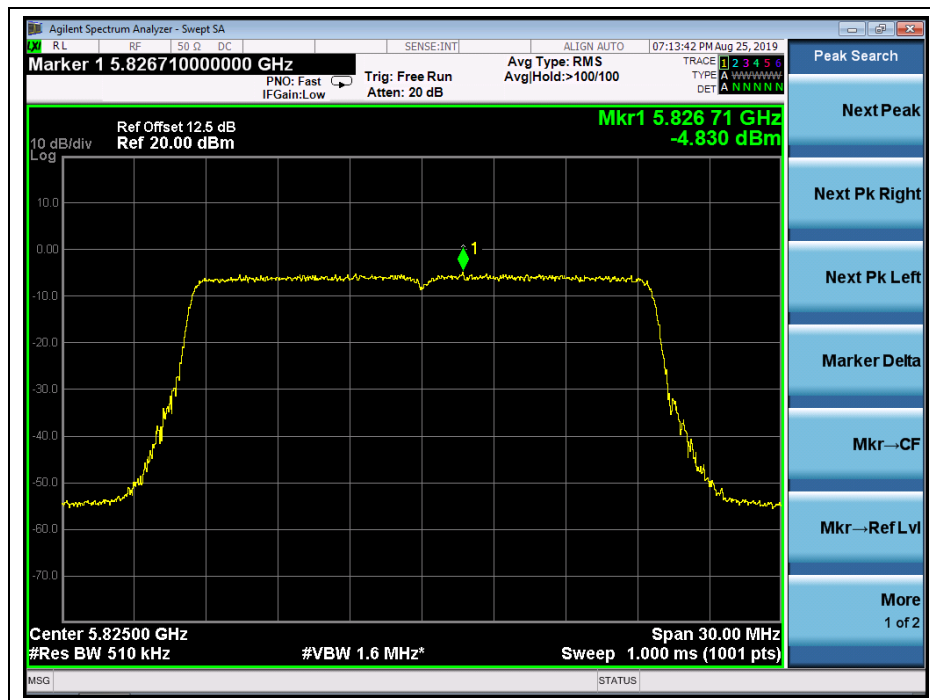
(Channel 48, 5240MHz, 802.11a, ANT 0)



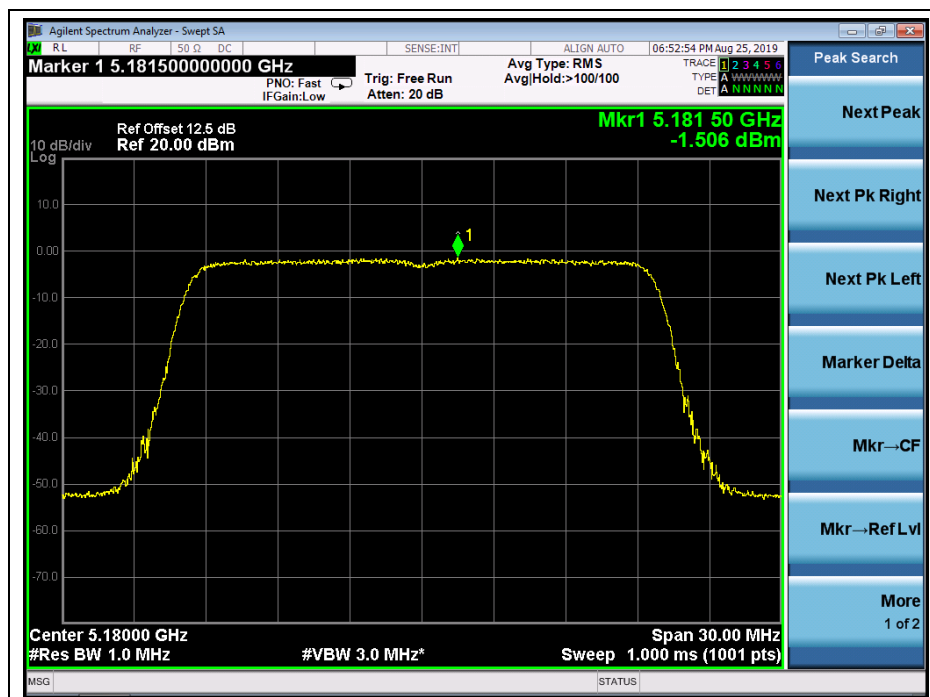
(Channel 149, 5745MHz, 802.11a, ANT 0)



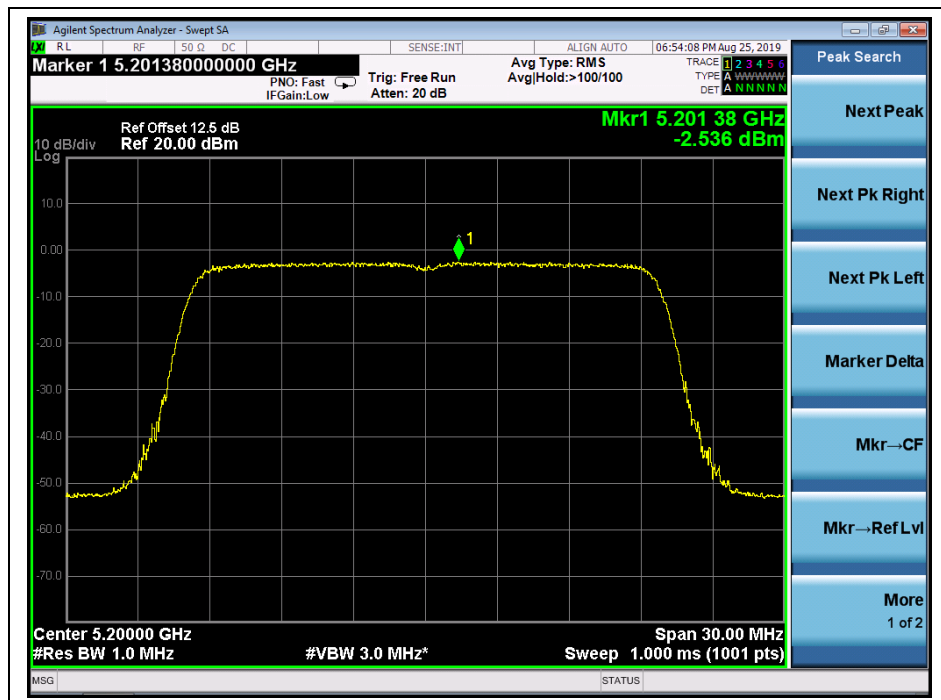
(Channel 157, 5785MHz, 802.11a, ANT 0)



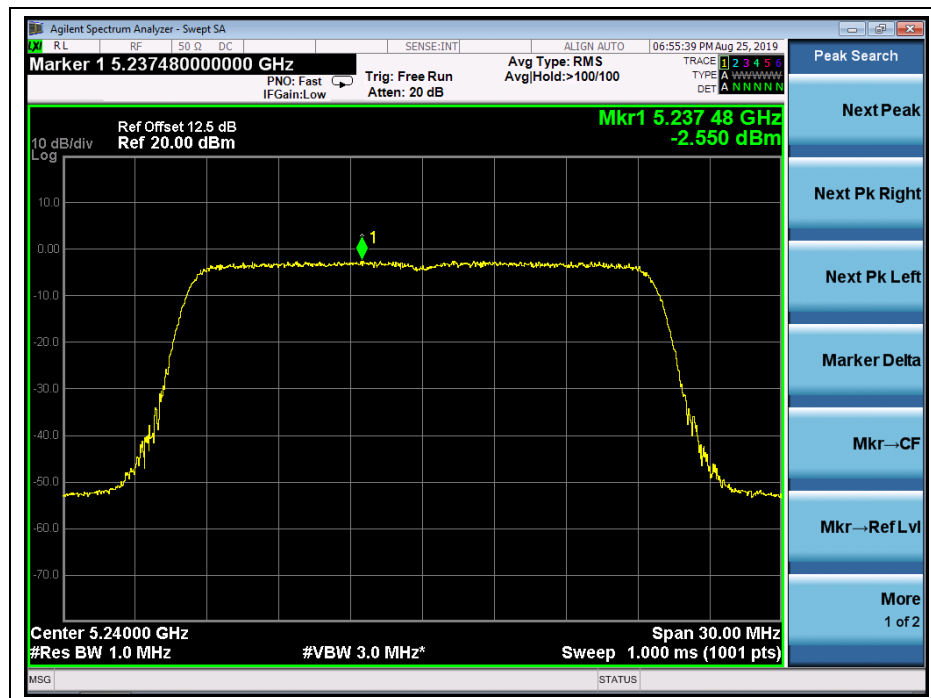
(Channel 165, 5825MHz, 802.11a, ANT 0)



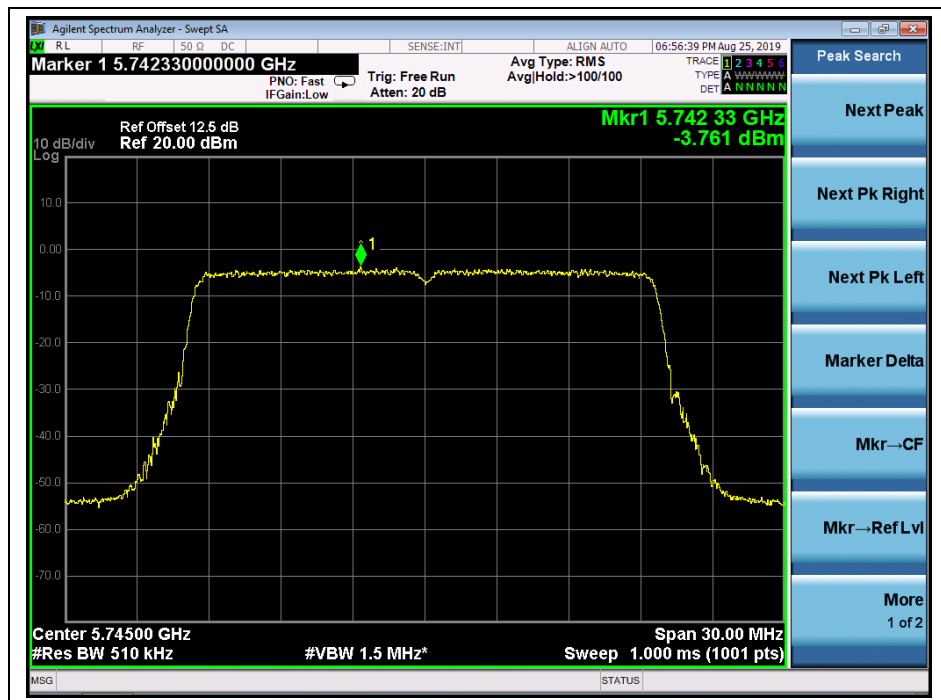
(Channel 36, 5180MHz, 802.11a, ANT 1)



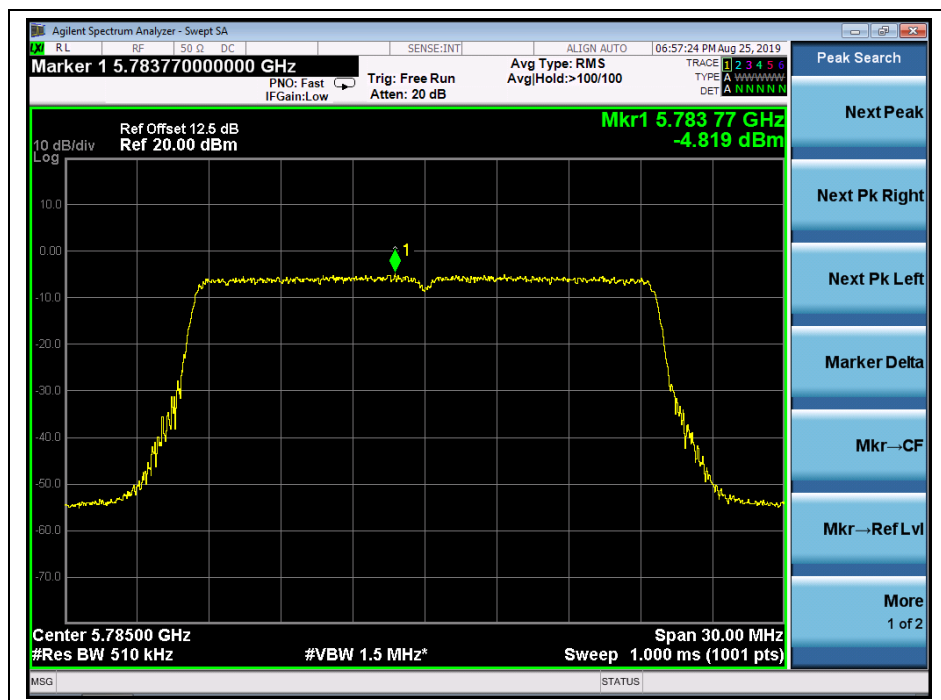
(Channel 40, 5200 MHz, 802.11a, ANT 1)



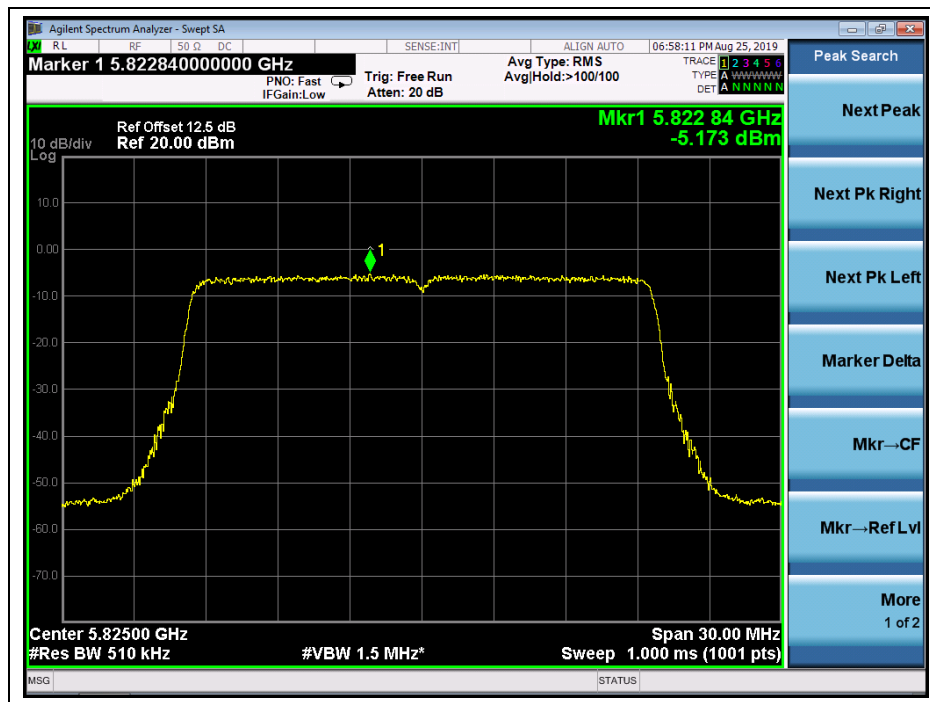
(Channel 48, 5240MHz, 802.11a, ANT 1)



(Channel 149, 5745MHz, 802.11a, ANT 1)



(Channel 157, 5785MHz, 802.11a, ANT 1)



(Channel 165, 5825MHz, 802.11a, ANT 1)

802.11ax (HEW40) Test mode

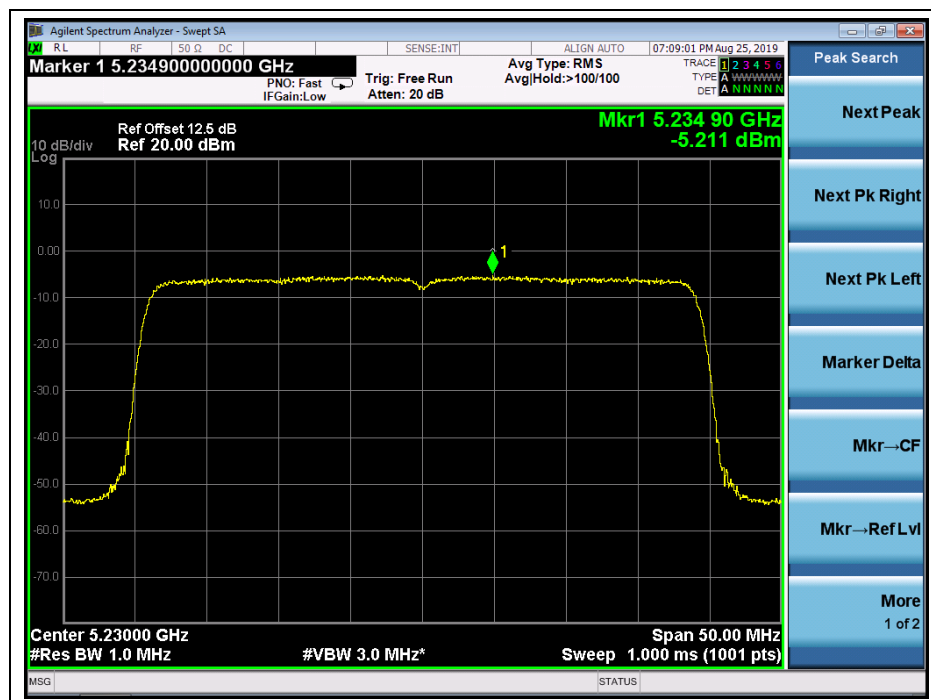
A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Total PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
		ANT 0	ANT 1			
38	5190	-4.98	-4.80	-1.88	14.99	PASS
46	5230	-5.21	-5.36	-2.27		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Total PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
		ANT 0	ANT 1			
151	5755	-6.61	-6.84	-3.71	27.99	PASS
159	5795	-6.96	-7.77	-4.34		

B. Test Plots



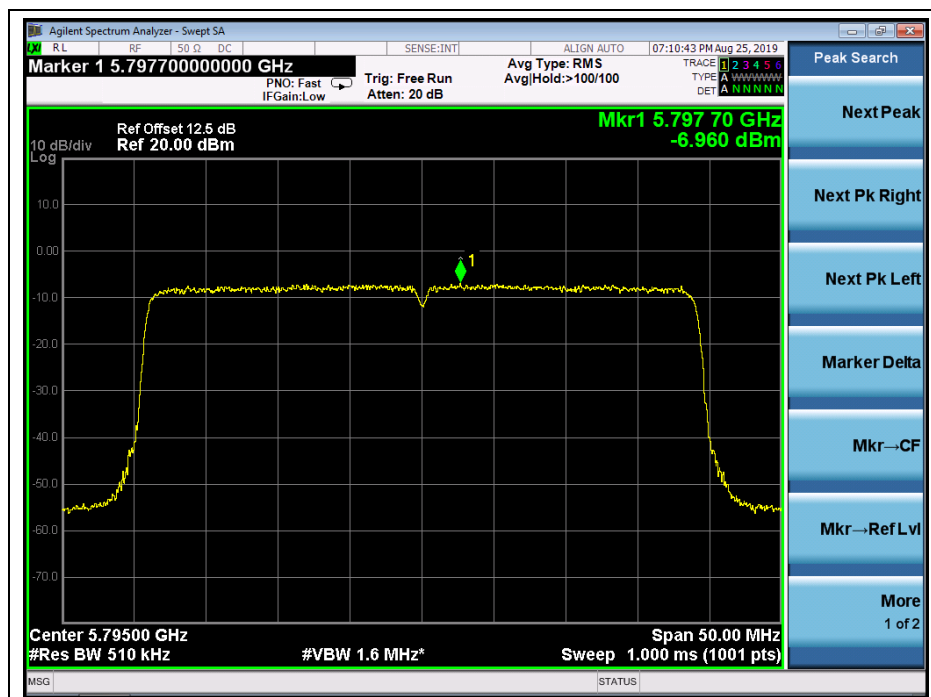
(Channel 38, 5190MHz, 802.11ax (HEW40), ANT0)



(Channel 46, 5230 MHz, 802.11ax (HEW40), ANT0)



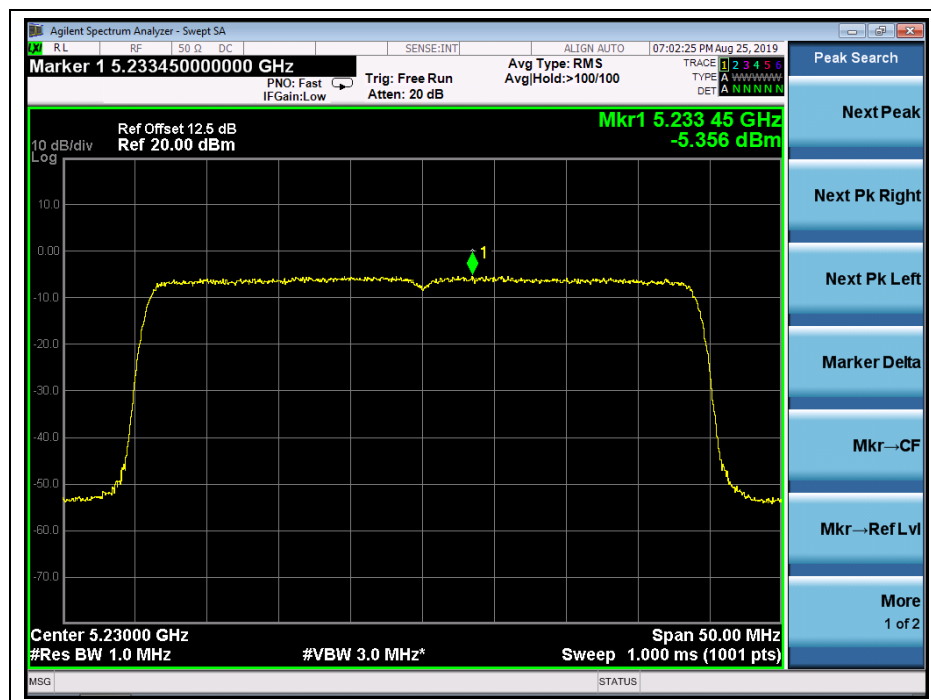
(Channel 151, 5755 MHz, 802.11ax (HEW40), ANT0)



(Channel 159, 5795MHz, 802.11ax (HEW40), ANT0)



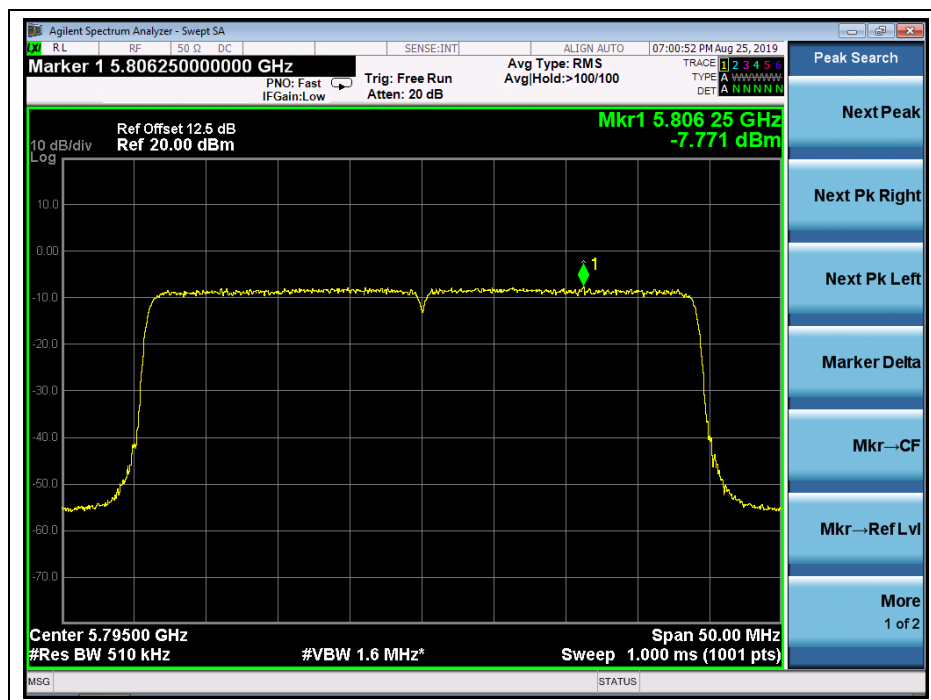
(Channel 38, 5190MHz, 802.11ax (HEW40), ANT1)



(Channel 46, 5230 MHz, 802.11ax (HEW40), ANT1)



(Channel 151, 5755 MHz, 802.11ax (HEW40), ANT1)



(Channel 159, 5795MHz, 802.11ax (HEW40), ANT1)



802.11 ax (HEW80) Test mode(ANT 1)

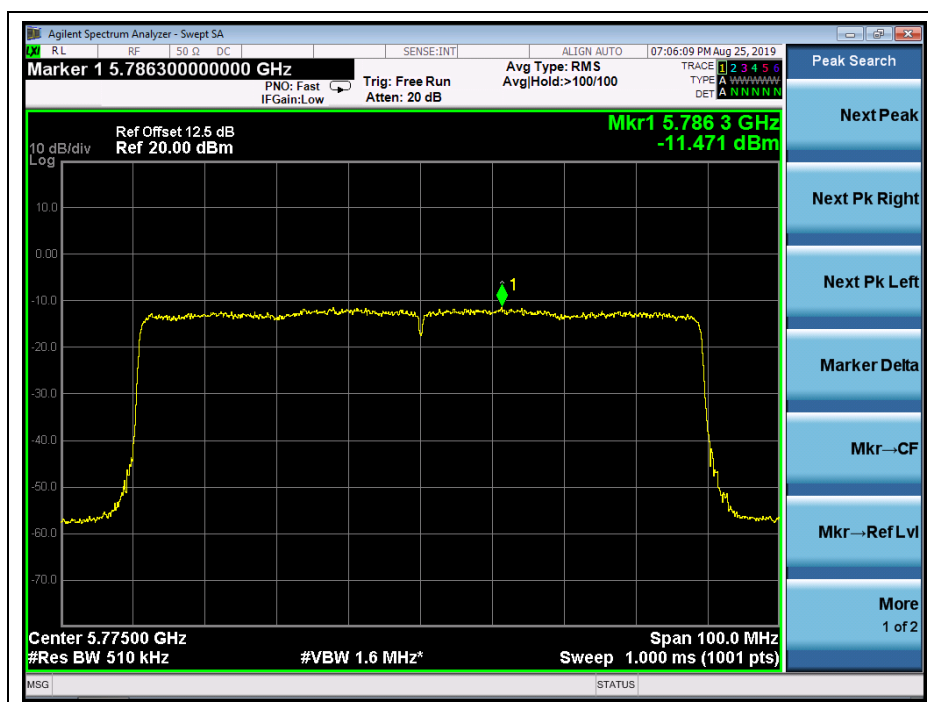
A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Tatal PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
		ANT 0	ANT 1			
42	5210	-8.07	-8.51	-5.27	14.99	PASS
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Tatal PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
		ANT 0	ANT 1			
155	5775	-11.47	-10.34	-7.86	27.99	PASS

B. Test Plots



(Channel 42, 5210MHz, 802.11ax (HEW80), ANT0)



(Channel 155, 5775 MHz, 802.11ax (HEW80), ANT0)



(Channel 42, 5210MHz, 802.11ax (HEW80), ANT1)



(Channel 155, 5775 MHz, 802.11ax (HEW80), ANT1)



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°C to 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

ANT 1

U-NII-1 (Ch. 36) 5180MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Freq Dev. (Hz)	Deviation (ppm)
100%	12	+20(Ref)	45	0.009
100%		-30	21	0.004
100%		-20	38	0.007
100%		-10	50	0.010
100%		0	26	0.005
100%		+10	17	0.003
100%		+20	20	0.004
100%		+30	38	0.007
100%		+40	29	0.006
100%		+50	43	0.008
85%	10.2	+20	48	0.009
115%	13.8	+20	42	0.008



U-NII-3 (Ch. 149)				
5745MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Freq Dev. (Hz)	Deviation (ppm)
100%	12	+20(Ref)	22	0.004
100%		-30	32	0.006
100%		-20	23	0.004
100%		-10	18	0.003
100%		0	34	0.006
100%		+10	41	0.007
100%		+20	21	0.004
100%		+30	49	0.009
100%		+40	51	0.009
100%		+50	24	0.004
85%	10.2	+20	41	0.007
115%	13.8	+20	34	0.006

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 50 μ H/50 Ω line impedance stabilization network (LISN).

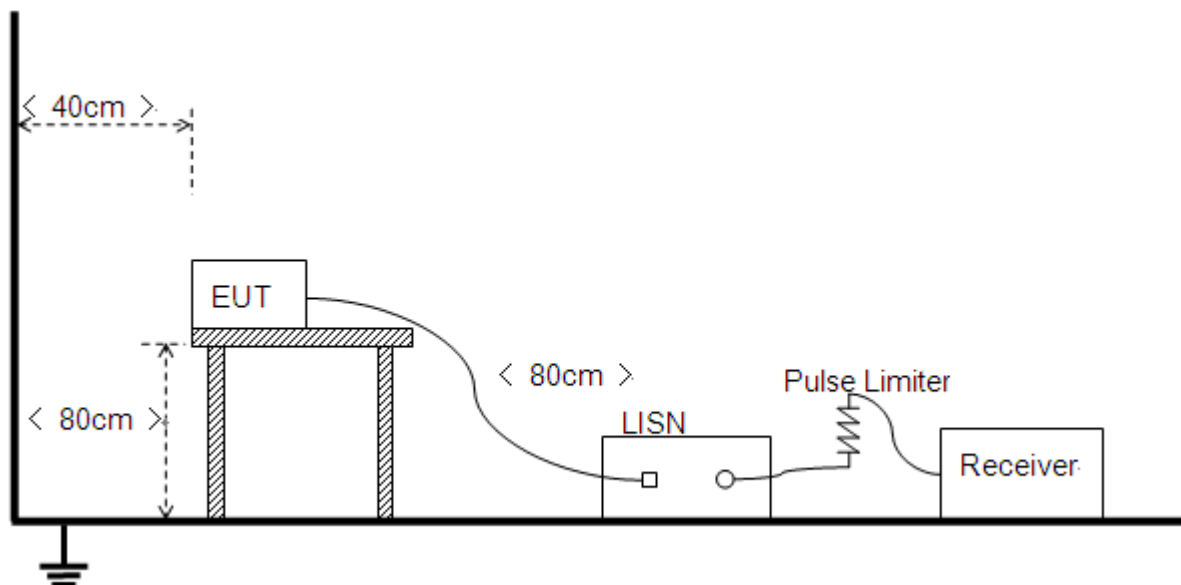
Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- The lower limit shall apply at the band edges.
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.7.2. Test Description

A. 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. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were 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+ ADAPTOR + WIFI TX

Test Voltage: AC 120V/60Hz

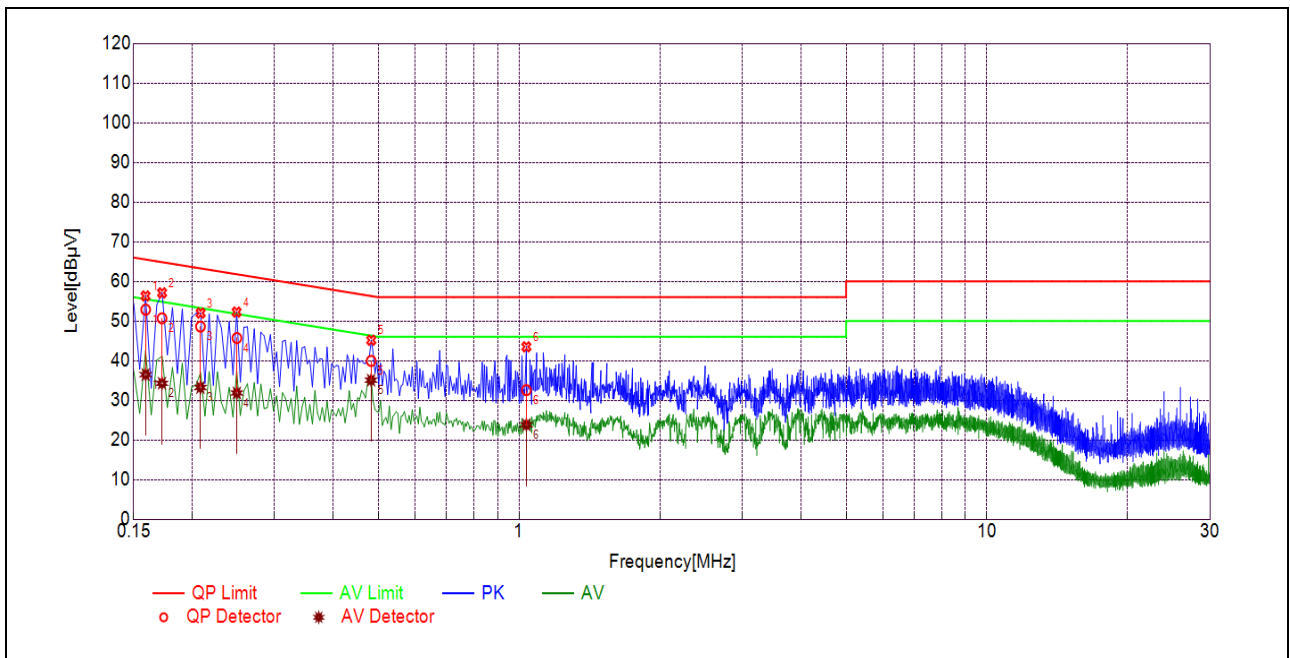
The measurement results are obtained as below:

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

U_R : Receiver Reading

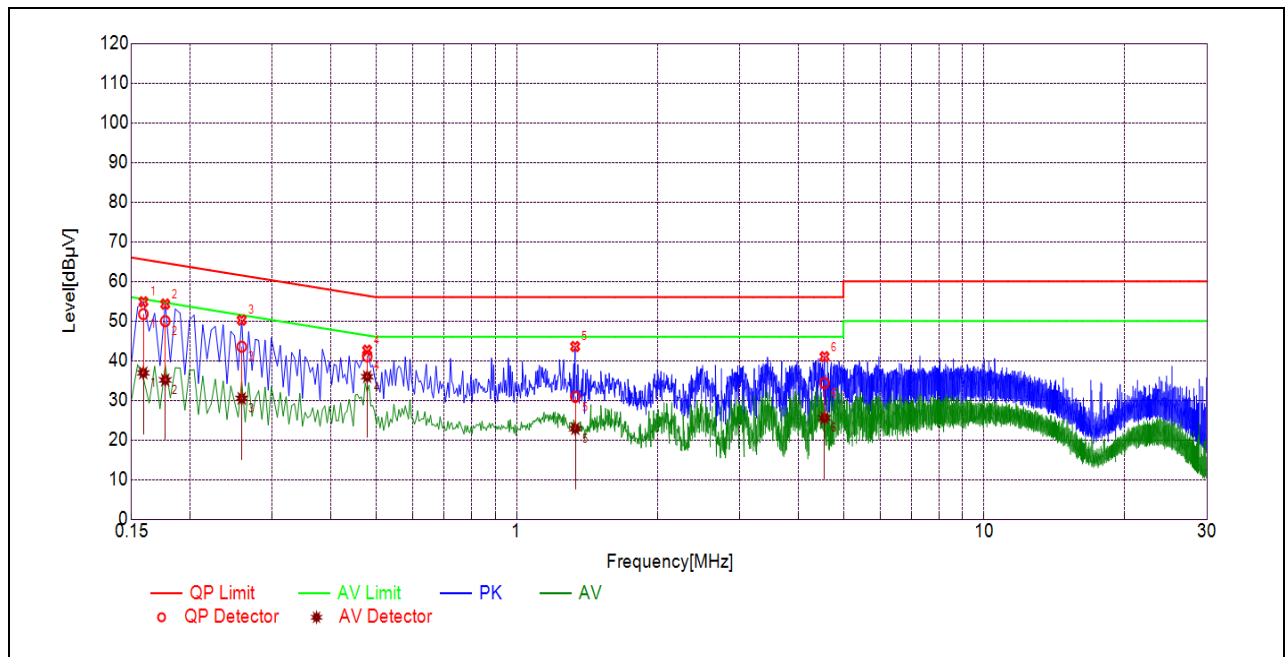
A_{Factor} : Voltage division factor of LISN

B. Test Plots:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1591	52.87	36.49	65.51	55.51	Line	PASS
2	0.1724	50.69	34.30	64.85	54.85		PASS
3	0.2083	48.61	33.24	63.27	53.27		PASS
4	0.2492	45.70	31.85	61.78	51.78		PASS
5	0.4826	39.94	35.09	56.29	46.29		PASS
6	1.0362	32.58	23.82	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	0.1589	51.74	36.92	65.52	55.52	Neutral	PASS
2	0.1770	49.97	35.14	64.63	54.63		PASS
3	0.2580	43.51	30.49	61.50	51.50		PASS
4	0.4787	41.13	35.96	56.36	46.36		PASS
5	1.3347	30.86	22.86	56.00	46.00		PASS
6	4.5548	34.36	25.53	56.00	46.00		PASS

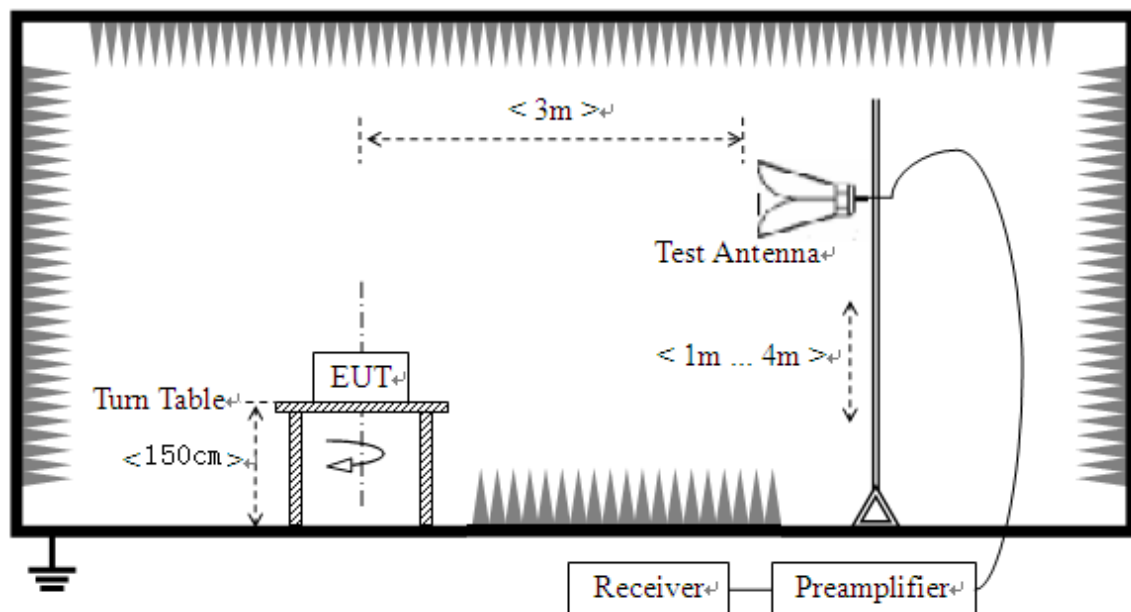
2.8. Restricted Frequency Bands

2.8.1. Requirement

According to FCC section 15.407(b)(7), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

2.8.2. Test Description

A. Test Setup



The Module 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:

$$E \text{ [dB}\mu\text{V/m]} = U_R + A_T + A_{\text{Factor}} \text{ [dB]}; A_T = L_{\text{Cable loss}} \text{ [dB]} - G_{\text{preamp}} \text{ [dB]}$$

A_T : Total correction Factor except Antenna; U_R : Receiver Reading

G_{preamp} : Preamplifier Gain; A_{Factor} : Antenna Factor at 3m

Note: 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.

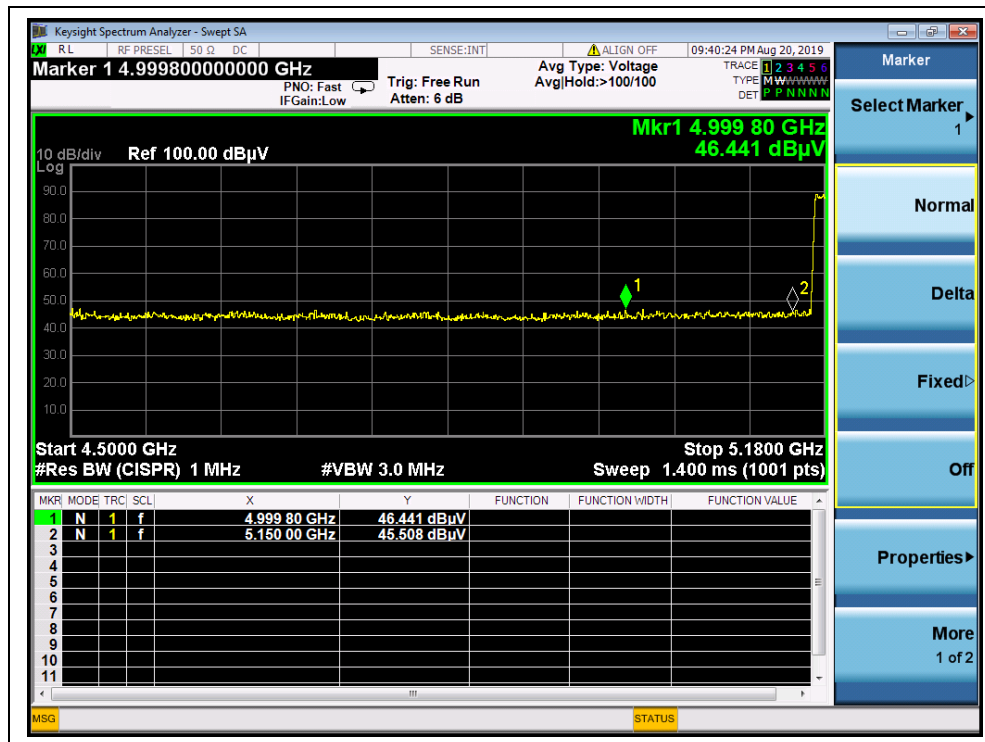
802.11ax(HEW20) Test mode

A. Test Verdict:

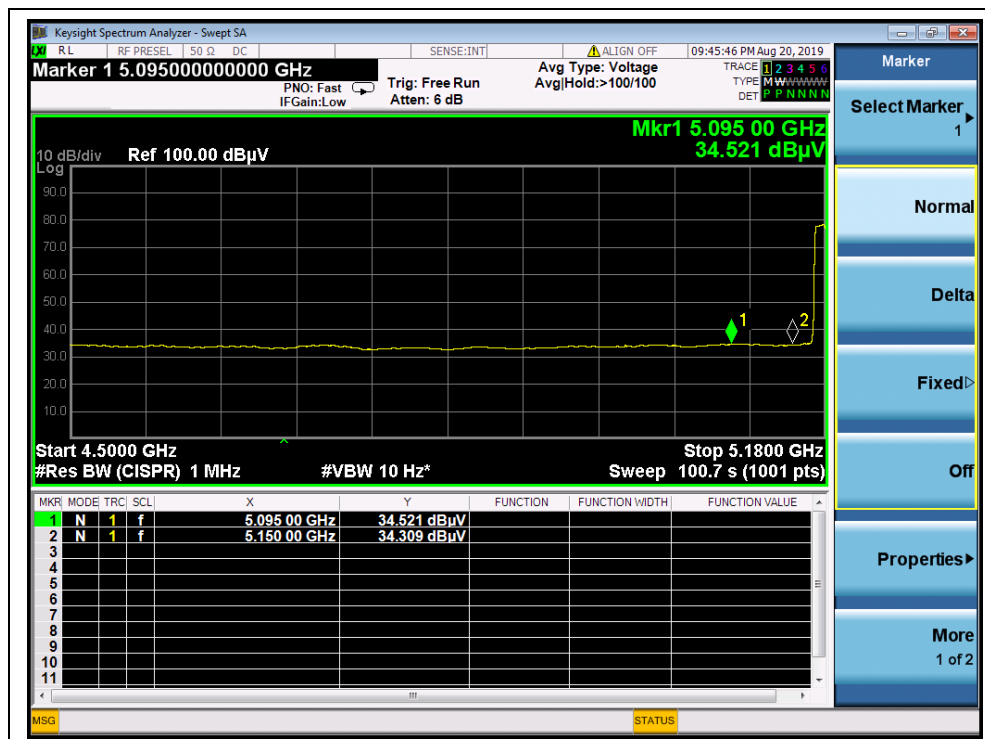
Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
36	4999.80	PK	46.44	-26.92	32.20	51.72	74	PASS
36	5095.00	AV	34.52	-26.92	32.20	39.80	54	PASS
48	5354.62	PK	44.09	-26.92	32.20	49.37	74	PASS
48	5352.86	AV	33.29	-26.92	32.20	38.57	54	PASS
149	5703.92	PK	46.90	-26.23	32.20	52.87	106.33	PASS
149	5724.68	AV	34.46	-26.23	32.20	40.43	54	PASS
165	5929.01	PK	44.73	-26.23	32.20	50.70	68.23	PASS
165	5850.87	AV	34.52	-26.23	32.20	40.49	54	PASS



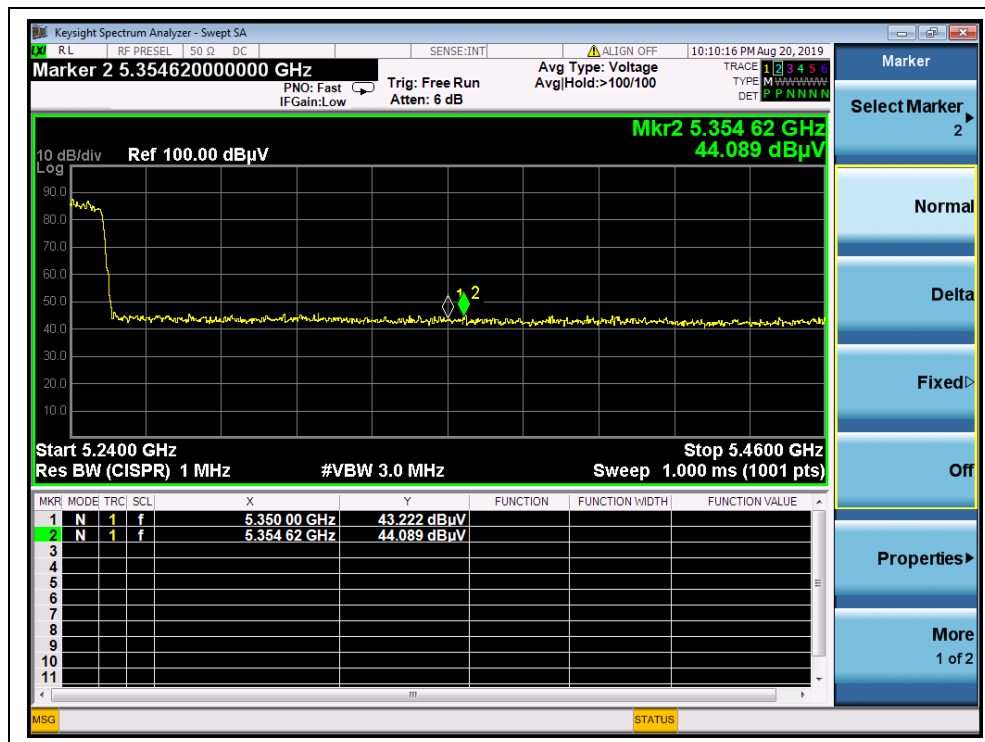
B. Test Plots:



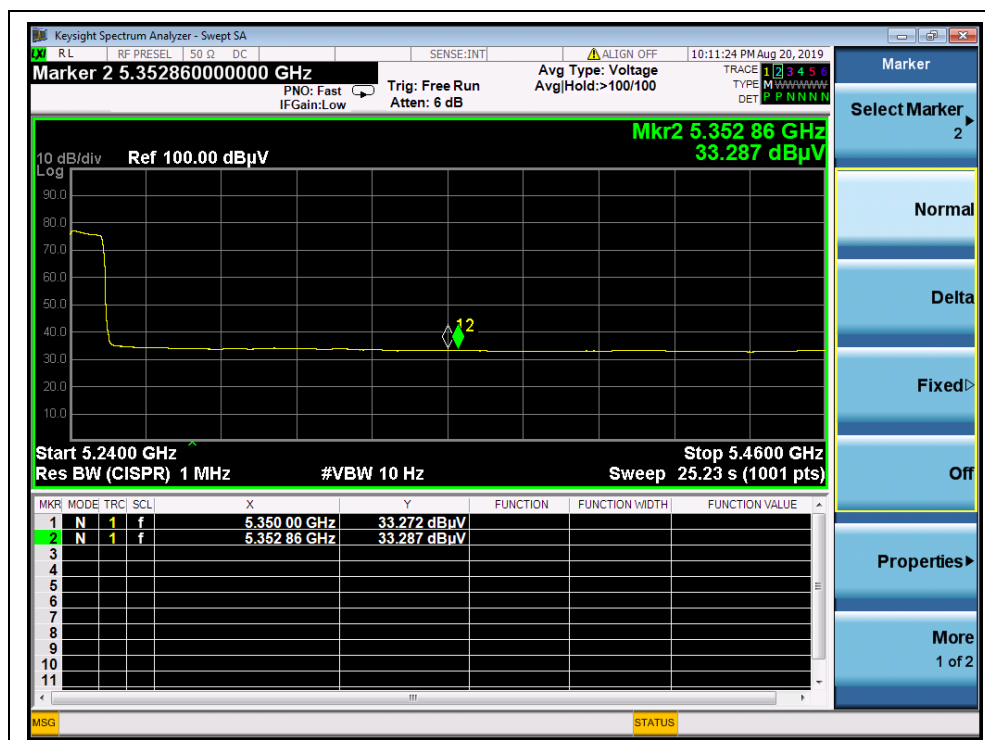
(Channel 36, PEAK, 802.11ax(HEW20))



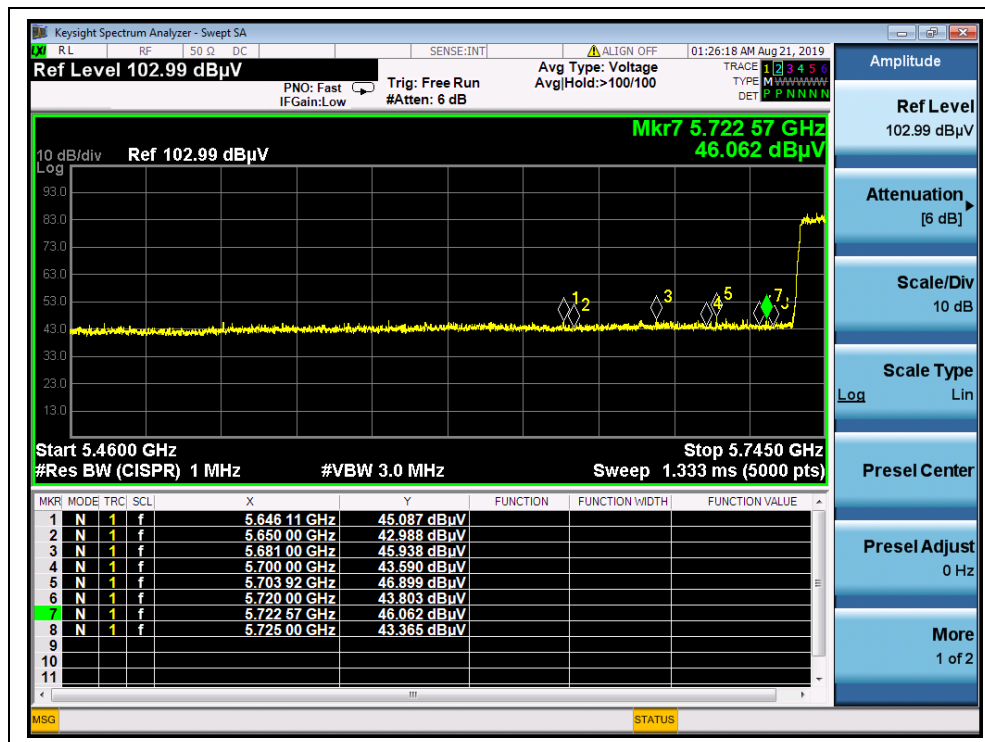
(Channel 36, AVG, 802.11ax(HEW20))



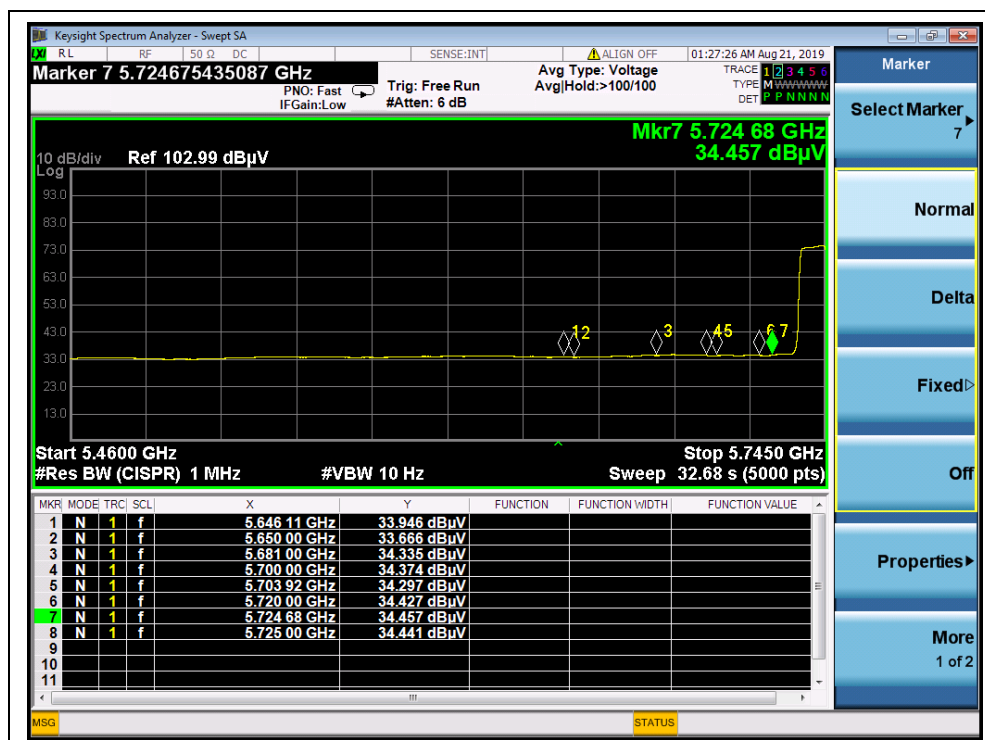
(Channel 48, PEAK, 802.11ax(HEW20))



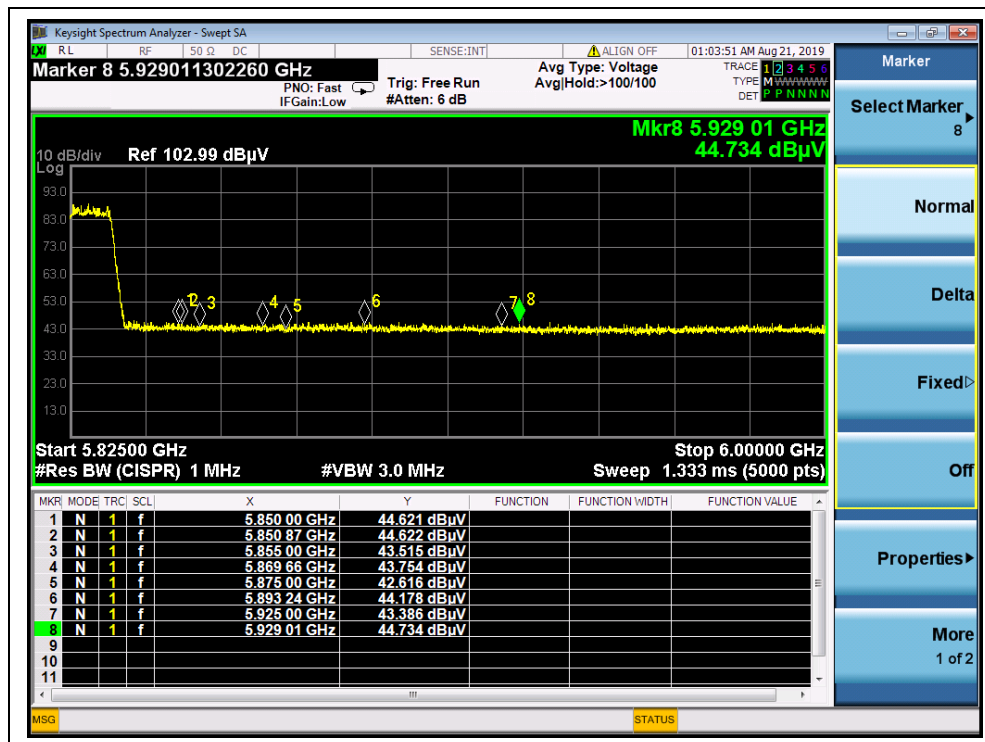
(Channel 48, AVG, 802.11ax(HEW20))



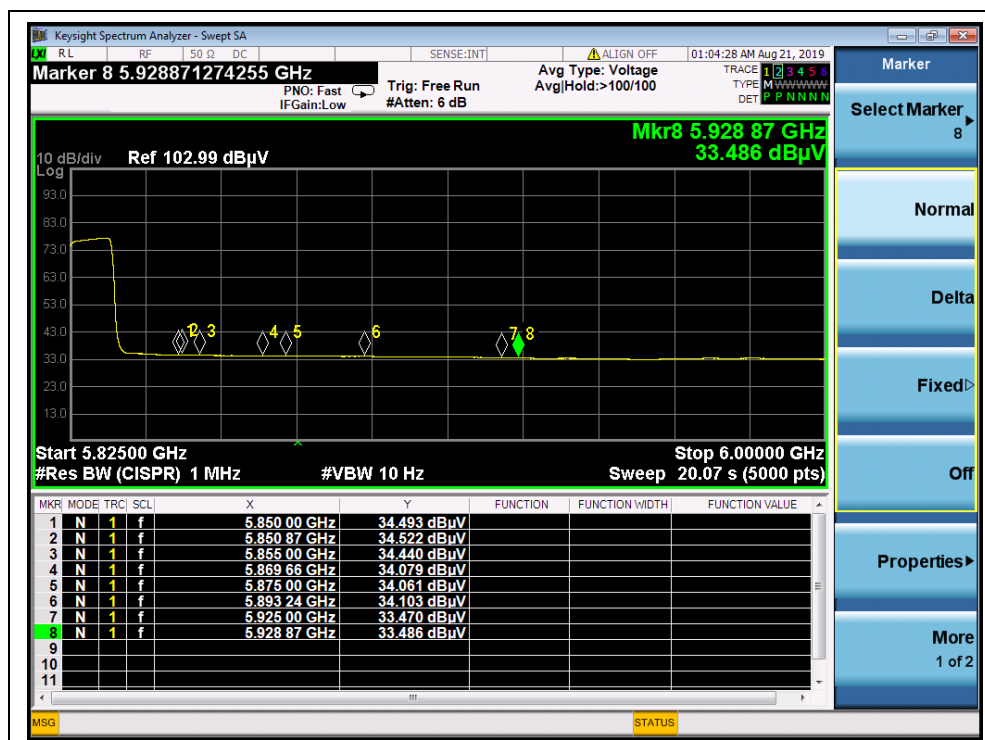
(Channel 149, PEAK, 802.11ax(HEW20))



(Channel 149, AVG, 802.11ax(HEW20))



(Channel 165, PEAK, 802.11ax(HEW20))



(Channel 165, AVG, 802.11ax(HEW20))

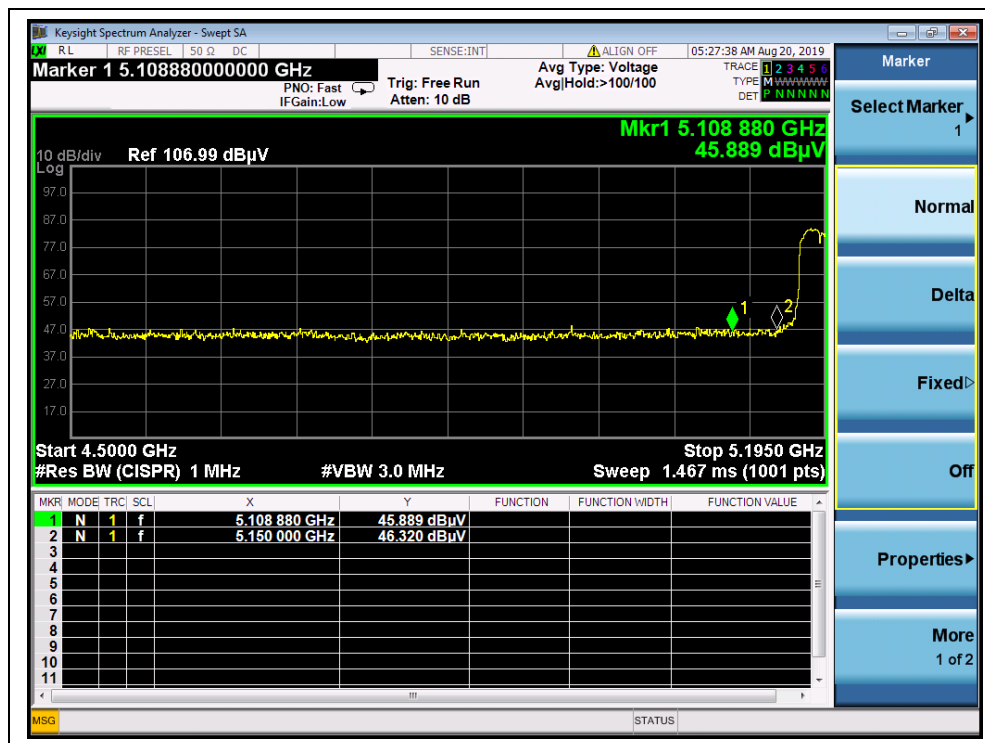


802.11 ax(HEW40) Test mode

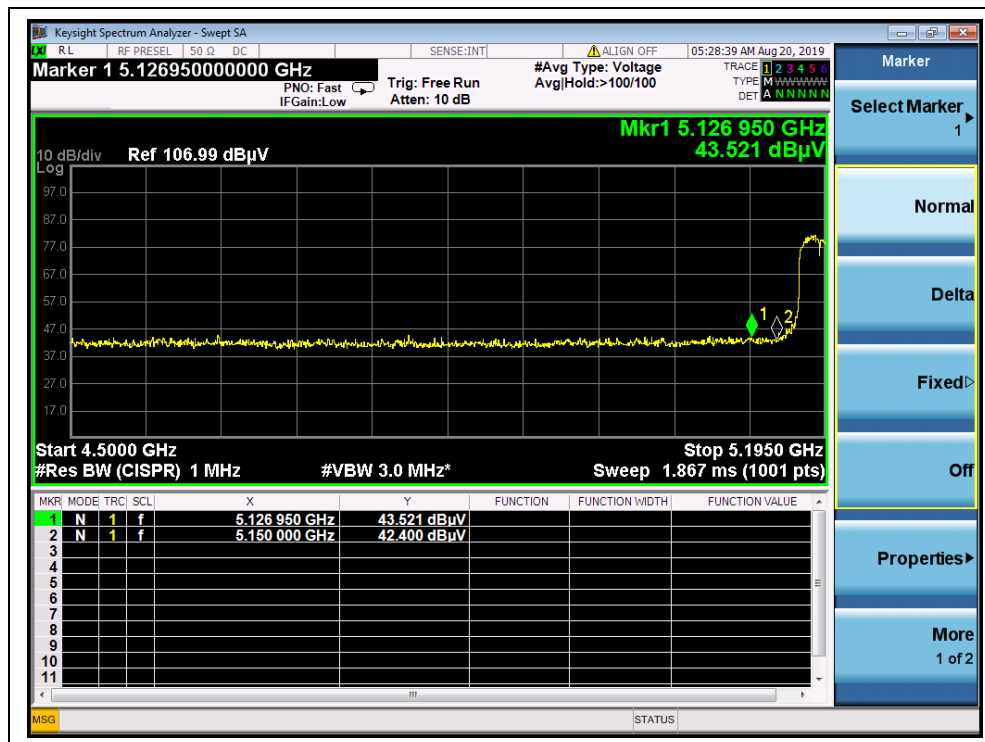
A. Test Verdict:

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						
38	5150.00	PK	46.32	-26.92	32.20	51.60	74	PASS
38	5126.95	AV	43.52	-26.92	32.20	48.80	54	PASS
46	5363.68	PK	45.30	-26.92	32.20	50.58	74	PASS
46	5394.27	AV	44.34	-26.92	32.20	49.62	54	PASS
151	5643.24	PK	45.64	-26.23	32.20	51.61	68.23	PASS
151	5697.64	AV	34.62	-26.23	32.20	40.59	54	PASS
159	5929.08	PK	45.61	-26.23	32.20	51.58	68.23	PASS
159	5928.87	AV	34.53	-26.23	32.20	40.50	54	PASS

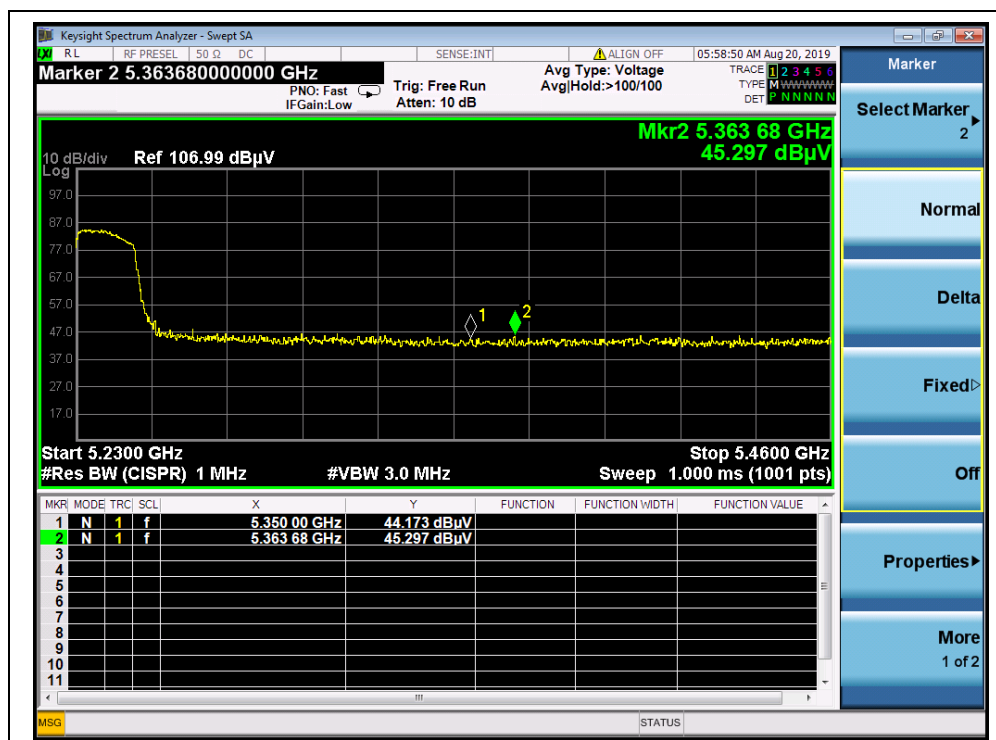
B. Test Plots:



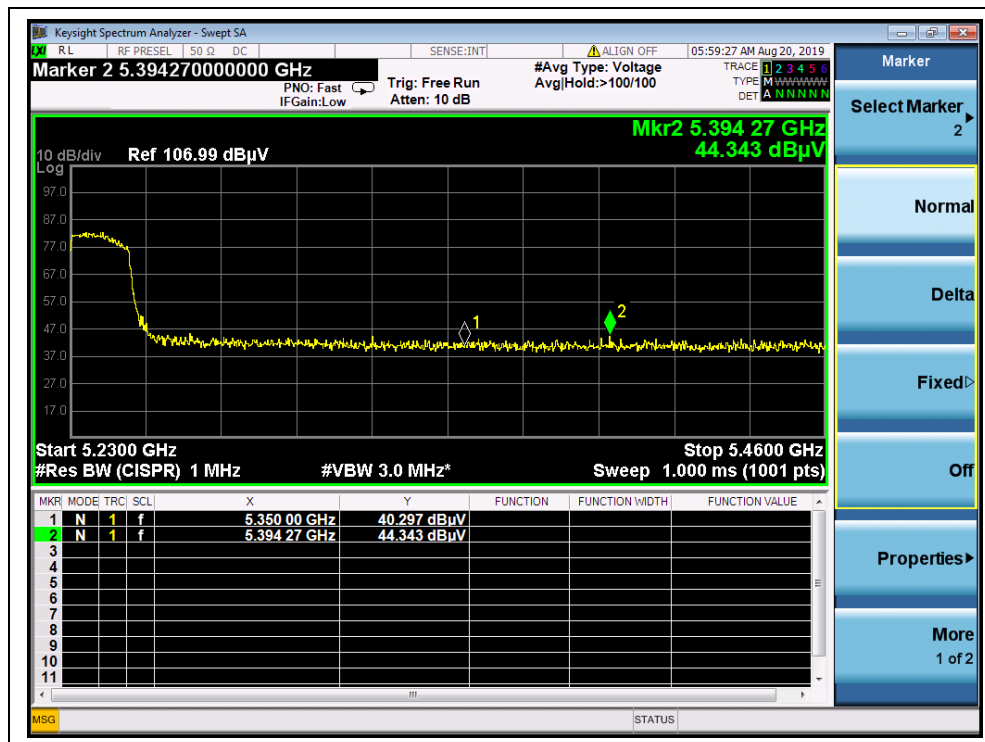
(Channel 38, PEAK, 802.11 ax(HEW40))



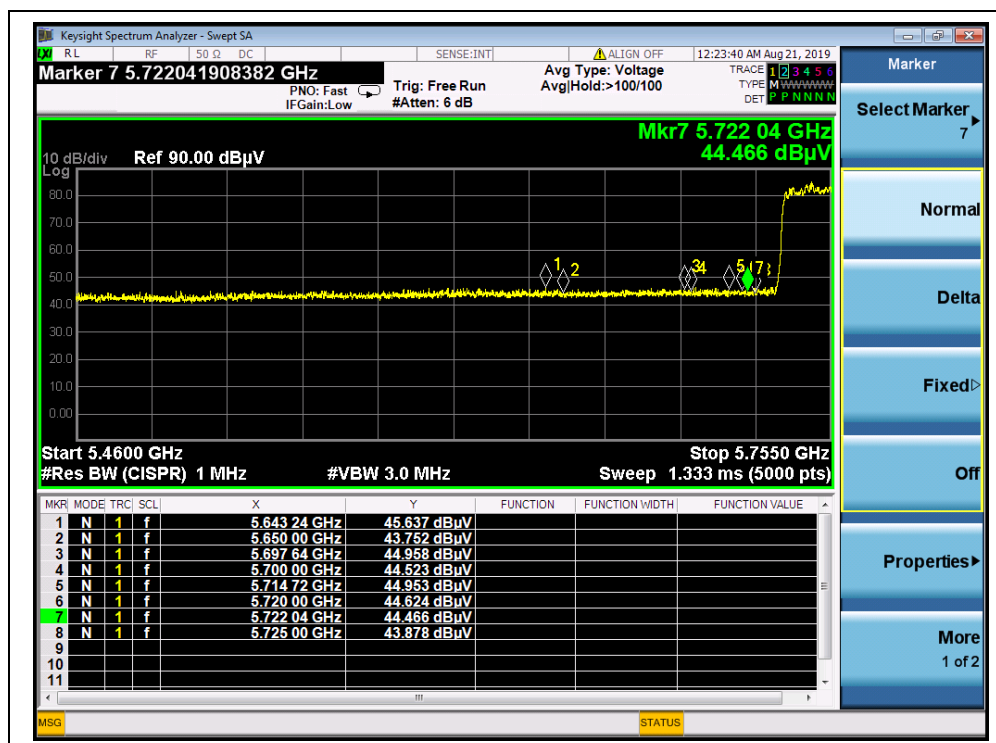
(Channel 38, AVG, 802.11 ax(HEW40))



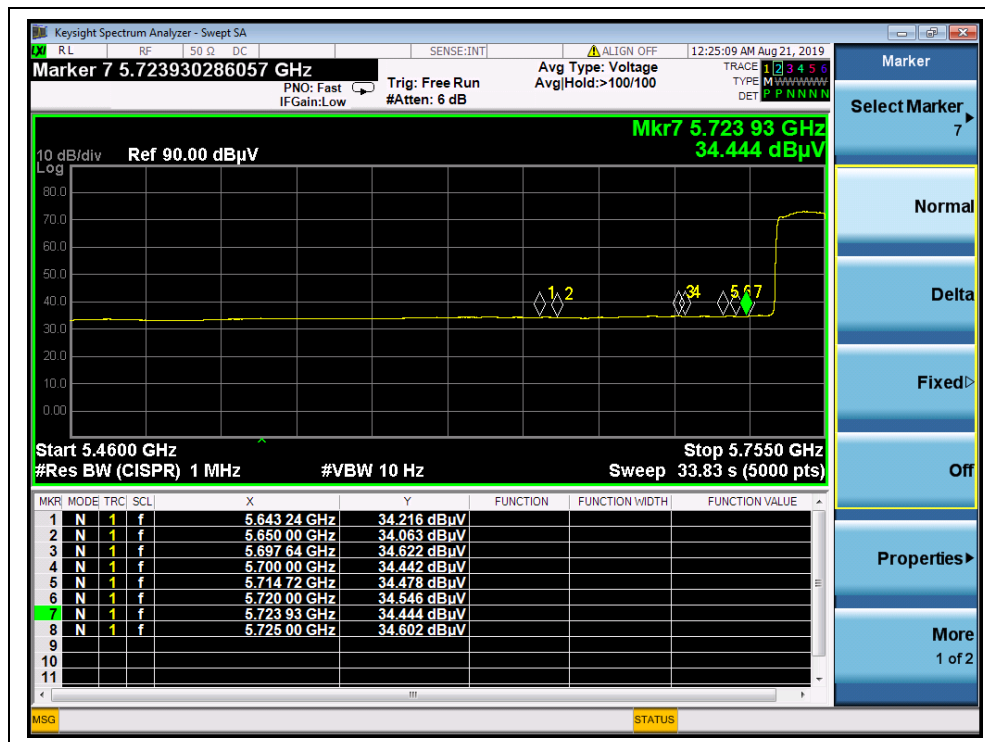
(Channel 46, PEAK, 802.11 ax(HEW40))



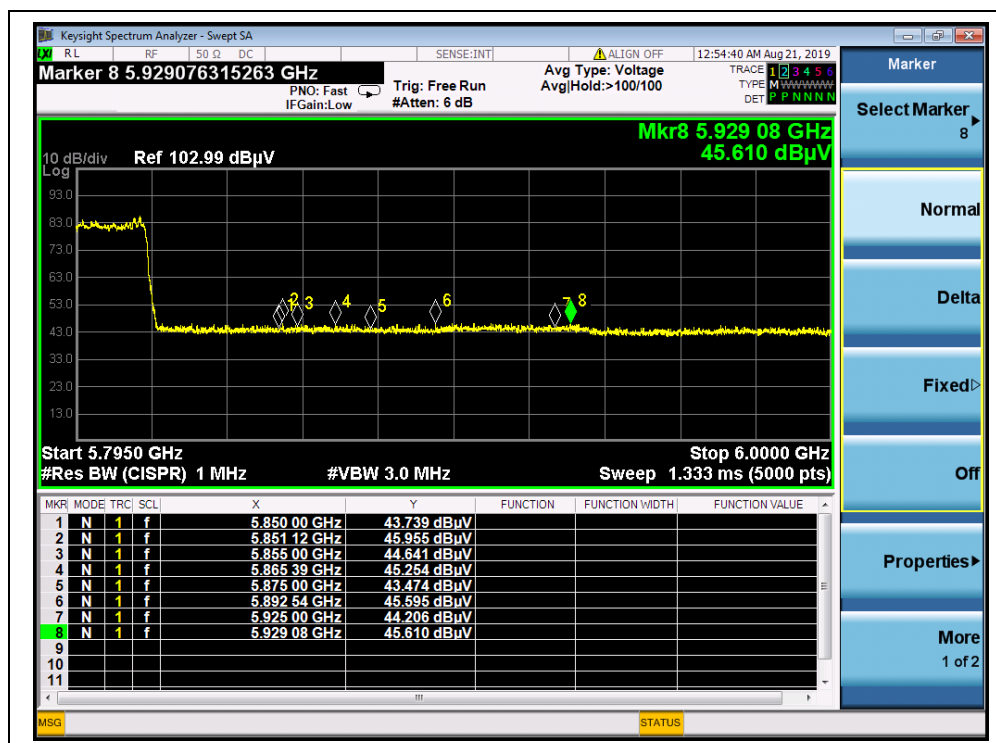
(Channel 46, AVG, 802.11 ax(HEW40))



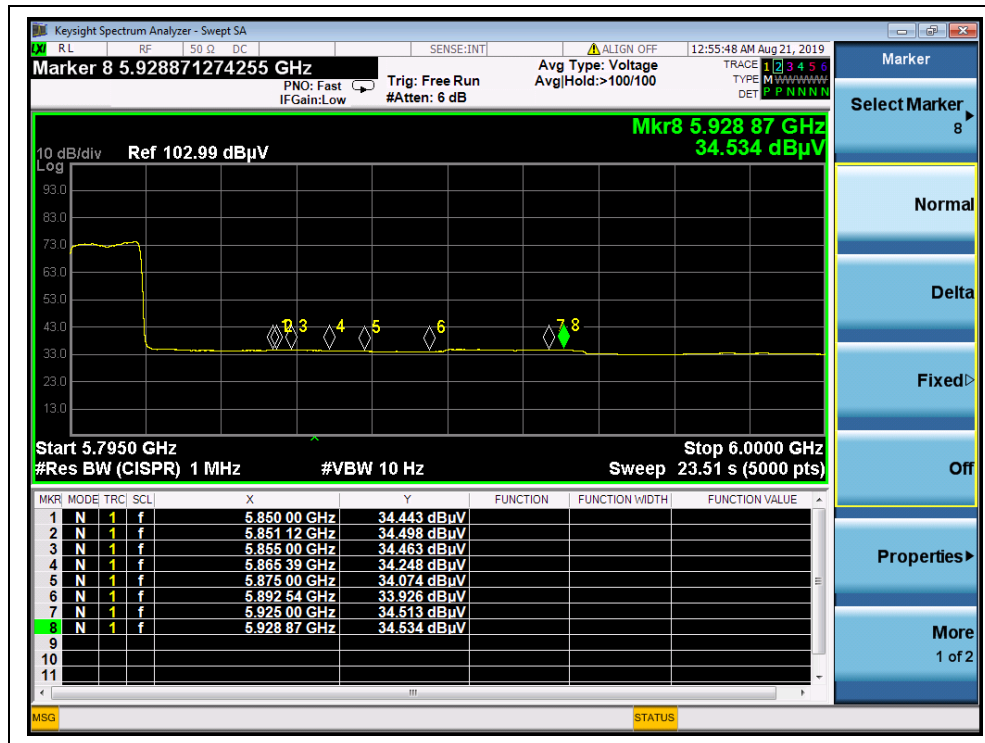
(Channel 151, PEAK, 802.11 ax(HEW40))



(Channel 151, AVG, 802.11 ax(HEW40))



(Channel 159, PEAK, 802.11 ax(HEW40))



(Channel 159, AVG, 802.11 ax(HEW40))

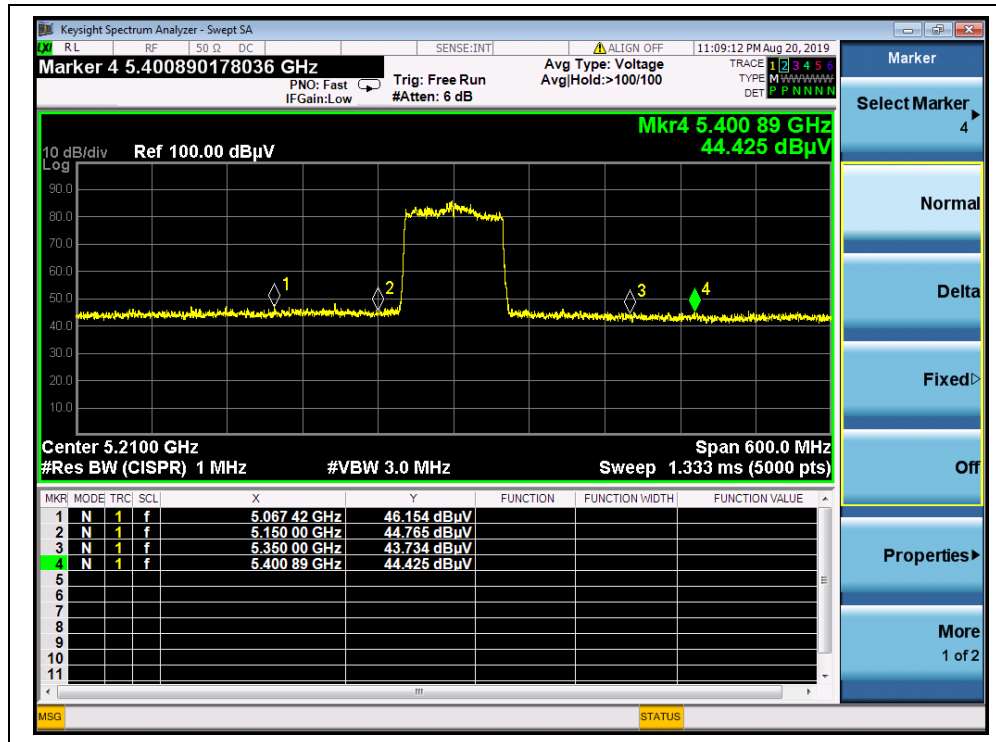
802.11 ax(HEW80) Test mode

A. Test Verdict:

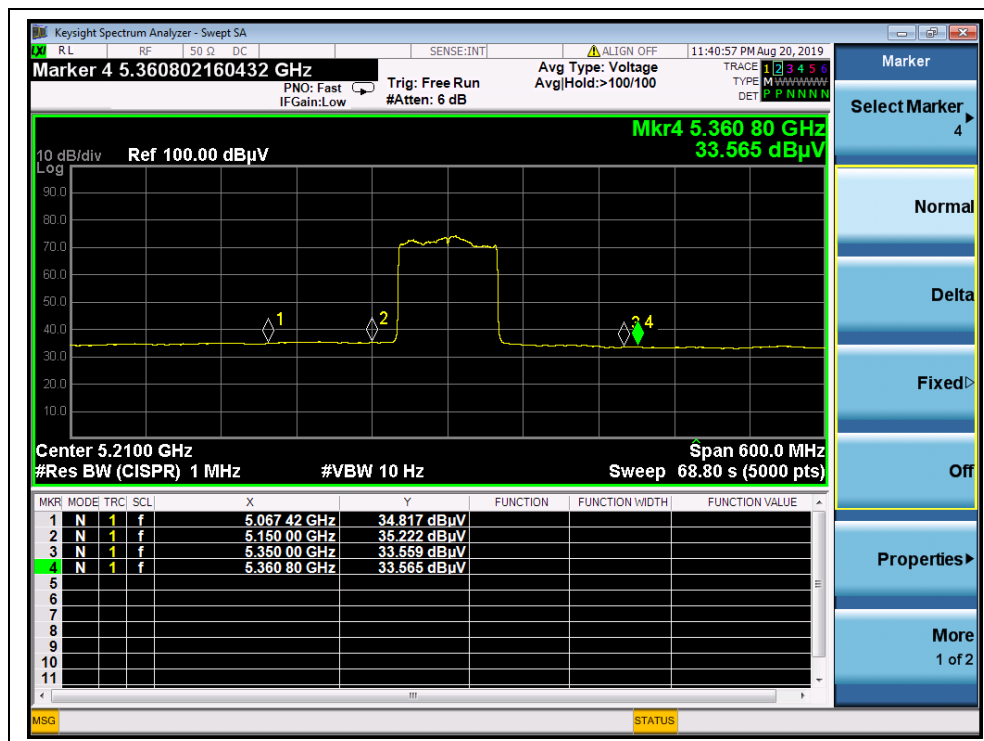
Channel	Frequency (MHz)	Detector	Receiver Reading U _R (dBμV)	A _T (dB)	A _{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
42	5067.42	PK	46.15	-26.92	32.20	51.43	74	PASS
42	5150.00	AV	35.22	-26.92	32.20	40.50	54	PASS
42	5400.89	PK	44.43	-26.92	32.20	49.71	74	PASS
42	5360.80	AV	33.57	-26.92	32.20	38.85	54	PASS
155	5717.36	PK	45.09	-26.23	32.20	51.06	110.09	PASS
155	5717.36	AV	34.72	-26.23	32.20	40.69	54	PASS
155	5864.67	PK	46.54	-26.23	32.20	52.51	83.75	PASS
155	5850.00	AV	34.37	-26.23	32.20	40.34	54	PASS



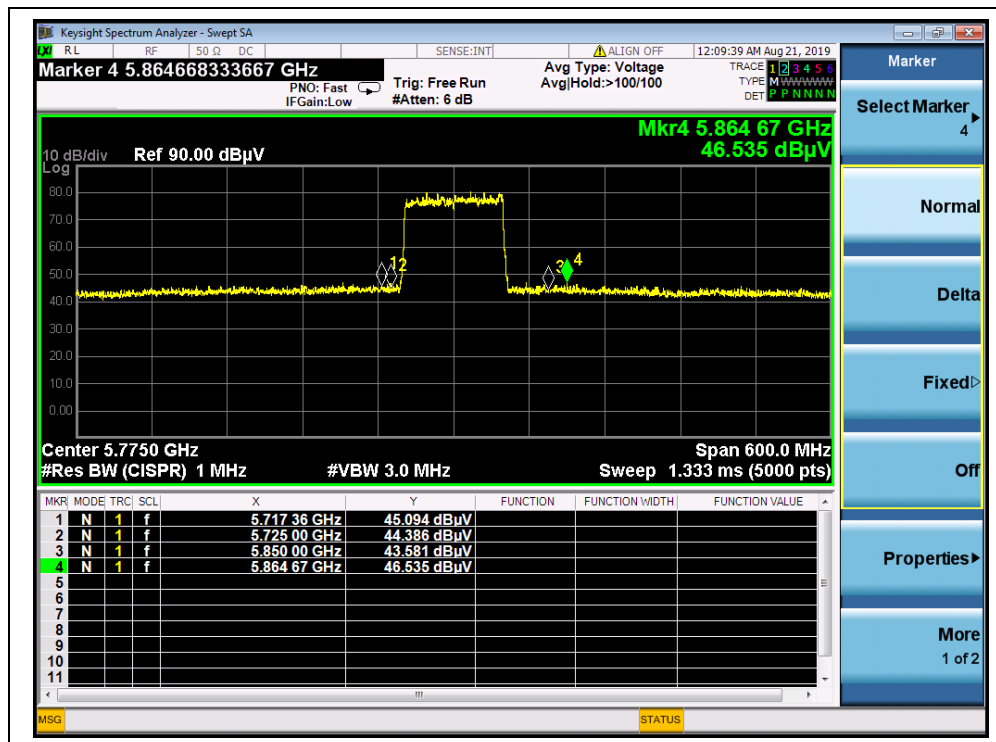
B. Test Plots:



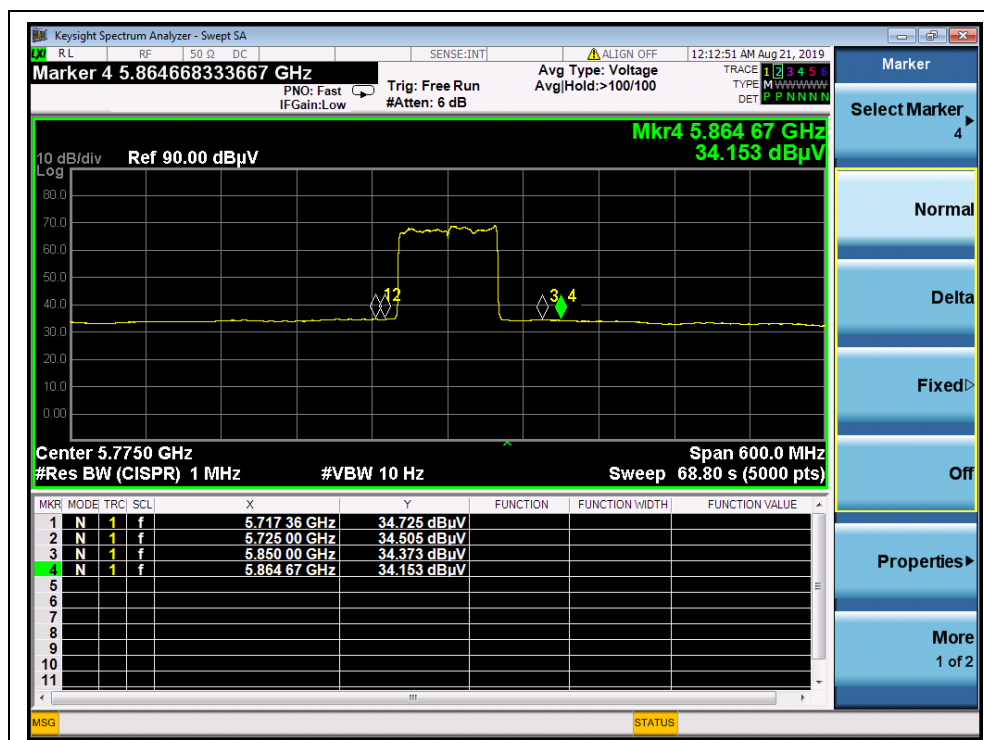
(Channel 42, PEAK, 802.11 ax(HEW80))



(Channel 42, AVG, 802.11 ax(HEW80))



(Channel 155, PEAK, 802.11 ax(HEW80))



(Channel 155, AVG, 802.11 ax(HEW80))

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(eirp) to field strength (dBμV/m);

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

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

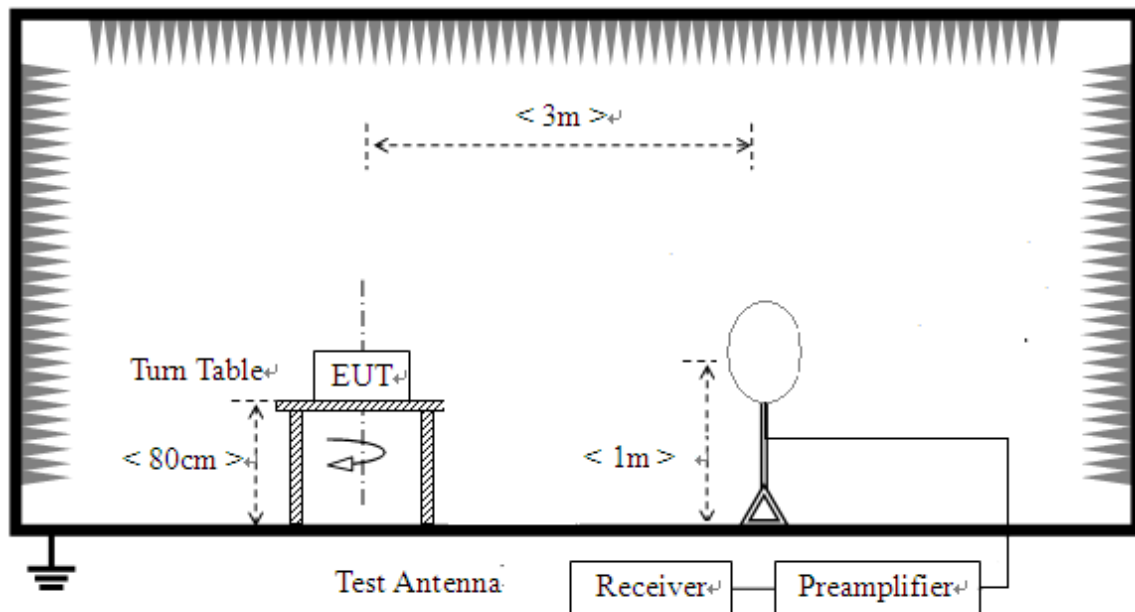
Note:

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.

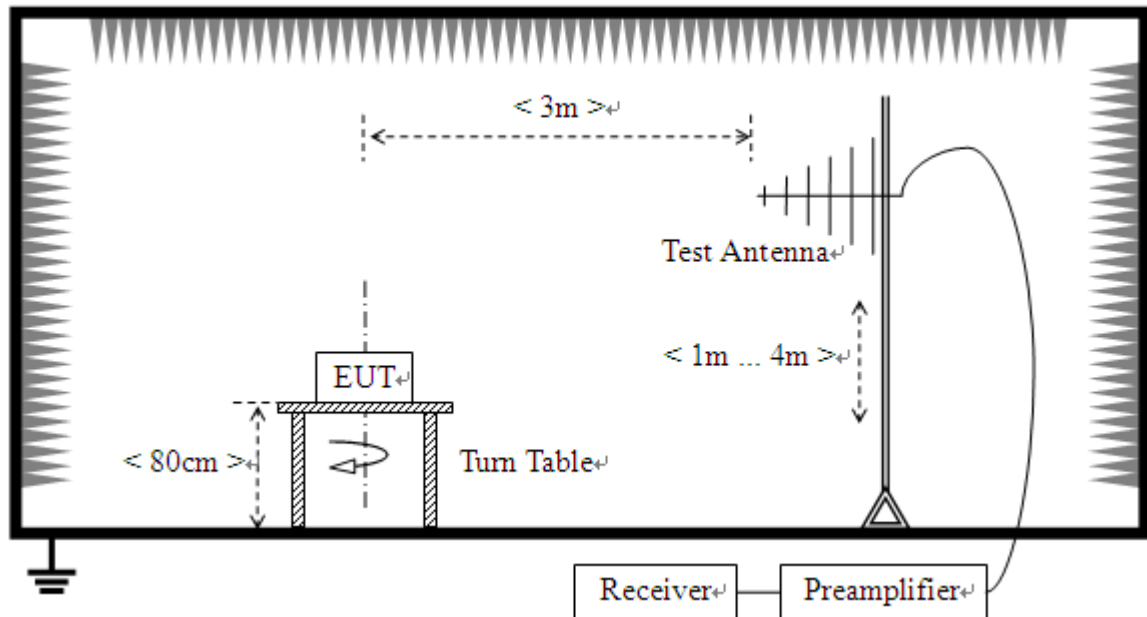
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

2.9.2. Test Description
A. Test Setup:

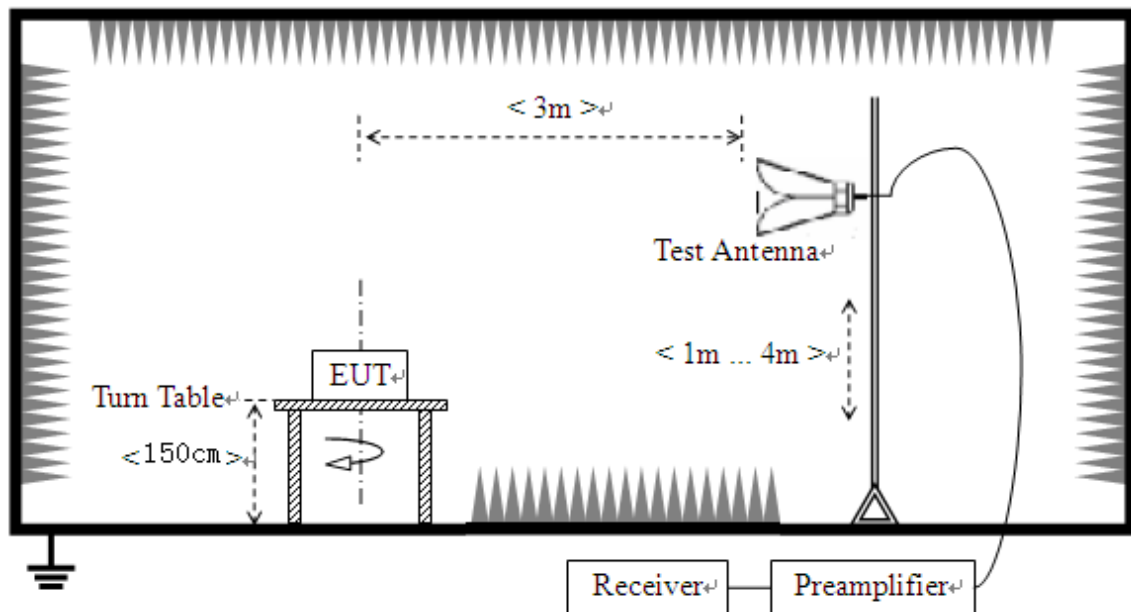
- 1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10 (2013). For radiated emissions below or equal to 1GHz, The EUT was set-up on insulator 80cm above the Ground Plane, For radiated emissions above 1GHz, The EUT



was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10

For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

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

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.

(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The test antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final test antenna elevation shall be that which maximizes the emissions. The test antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The emission levels at both horizontal and vertical polarizations should be tested.



2.9.3. Test Result

According to ANSI C63.4 selection 4.2.2, 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 limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

$$E [\text{dB}\mu\text{V/m}] = U_R + A_T + A_{\text{Factor}} [\text{dB}]; A_T = L_{\text{Cable loss}} [\text{dB}] - G_{\text{preamp}} [\text{dB}]$$

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.

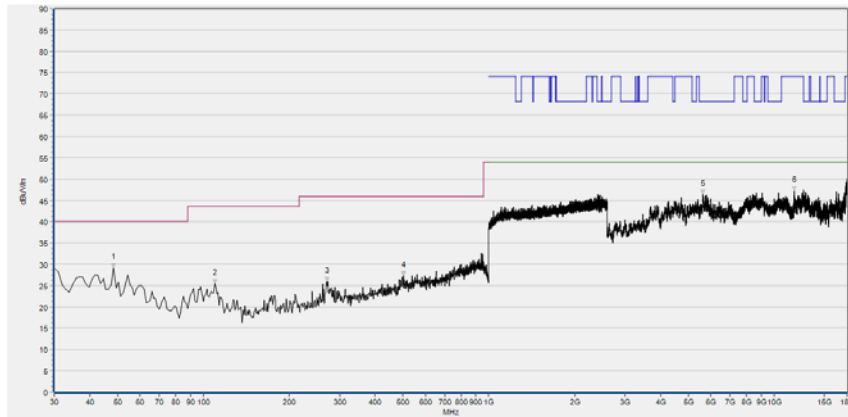
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Note2: For the frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Note3: For the frequency, which started from 25GHz to 40GHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

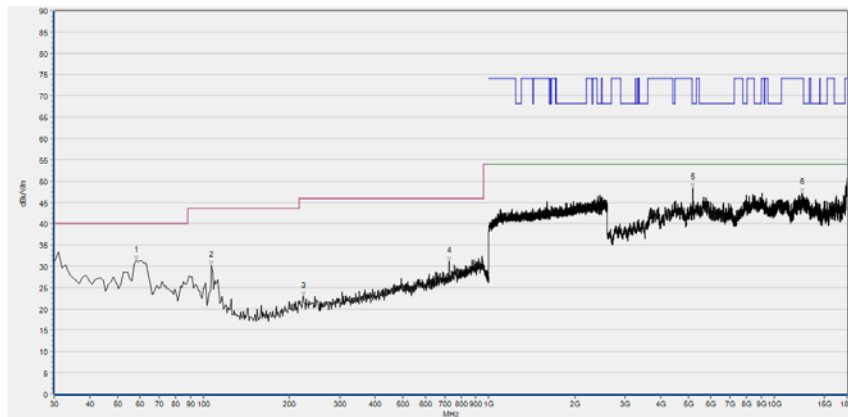
**802.11 ax(HEW20) Test mode**

Plots 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
48.448	29.21	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
109.620	25.41	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
270.801	25.94	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
501.892	27.36	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5622.084	46.43	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
11734.027	47.20	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS

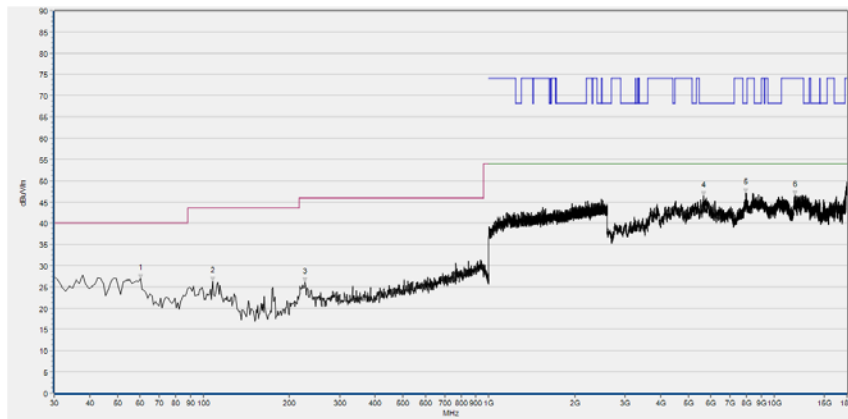
(Antenna Horizontal, 30MHz to 25GHz)



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
58.158	31.41	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
106.707	30.20	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
224.194	23.02	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
725.215	31.25	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5184.637	48.39	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
12544.229	47.19	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

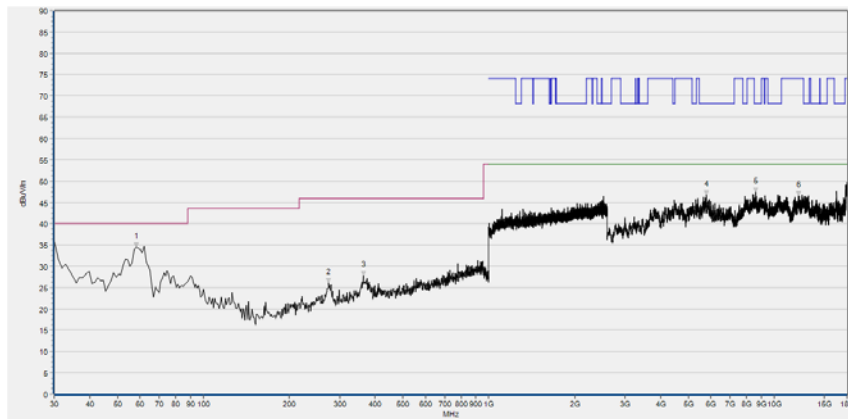
(Antenna Vertical, 30MHz to 25GHz)

Plots 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
60.100	26.92	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
107.678	26.29	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
227.107	26.09	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5655.971	46.36	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
7963.353	47.04	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
11820.284	46.57	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

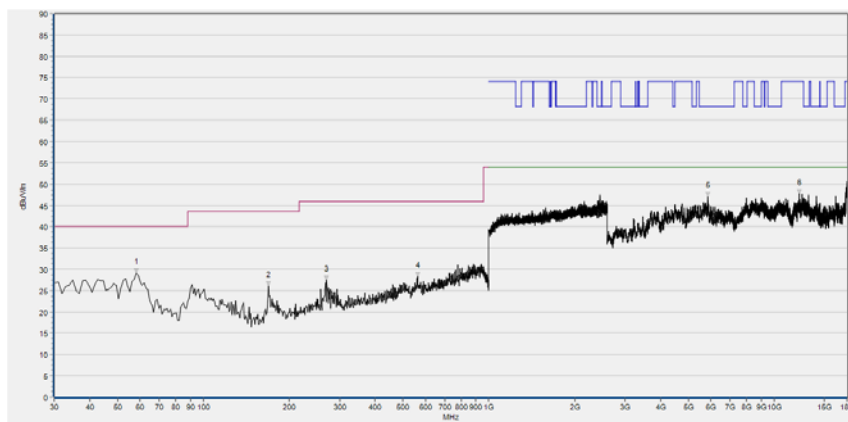


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
58.158	34.57	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
274.685	26.07	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
363.043	27.78	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5776.115	46.70	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
8591.798	47.36	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
12168.394	46.56	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

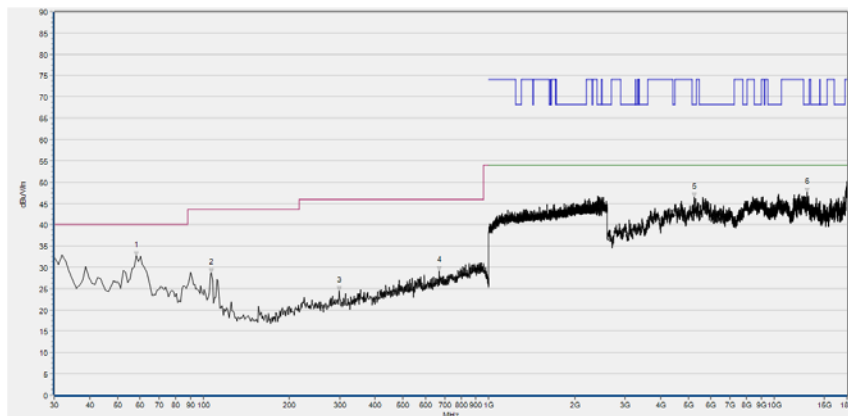


Plot for Channel = 48



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
58.158	29.10	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
168.849	26.21	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
269.830	27.54	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
563.063	28.37	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5862.372	47.03	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
12199.200	47.79	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

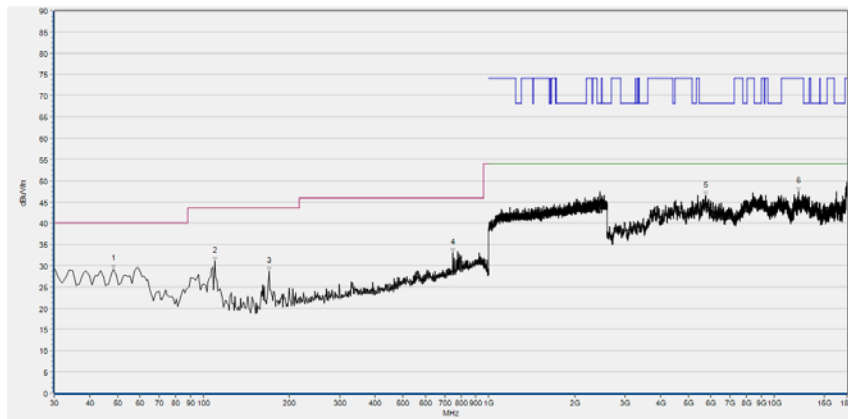
(Antenna Horizontal, 30MHz to 25GHz)



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
58.158	32.62	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
106.707	28.62	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
298.959	24.54	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
670.841	29.19	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5230.846	46.47	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
13043.289	47.64	N/A	N/A	68.23	N/A	54.00	Vertical	PASS

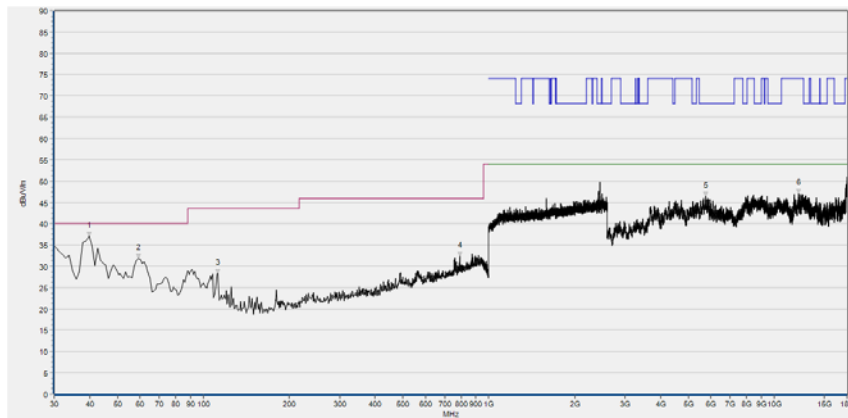
(Antenna Vertical, 30MHz to 25GHz)

Plots for Channel = 149



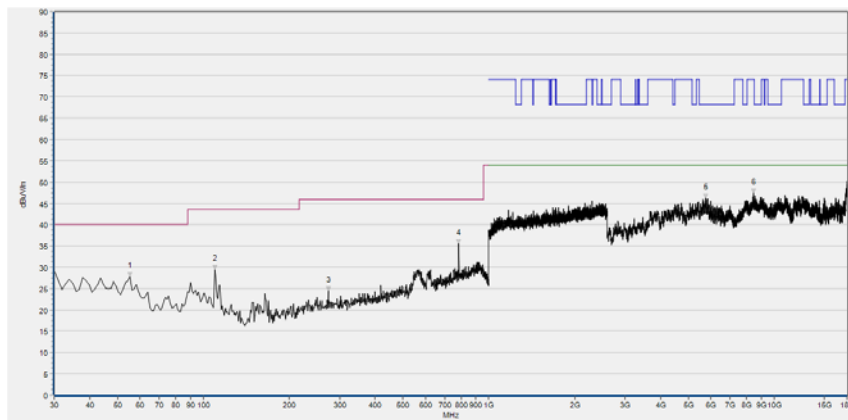
Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.448	29.18	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
109.620	30.94	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
169.820	28.65	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
747.548	32.97	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5748.390	46.39	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
12149.910	47.43	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)



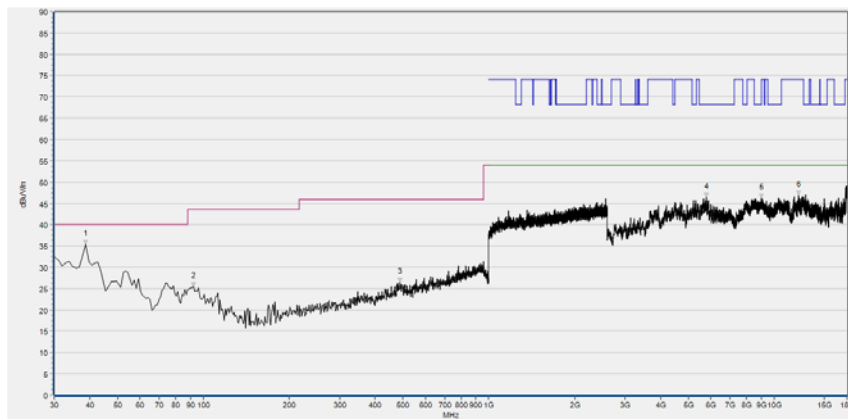
Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
39.710	36.97	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
59.129	31.88	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
112.533	28.25	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
790.270	32.27	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5739.148	46.40	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
12193.039	47.12	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

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
55.245	27.89	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
109.620	29.56	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
273.714	24.48	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
784.444	35.46	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5748.390	46.26	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
8459.332	47.39	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

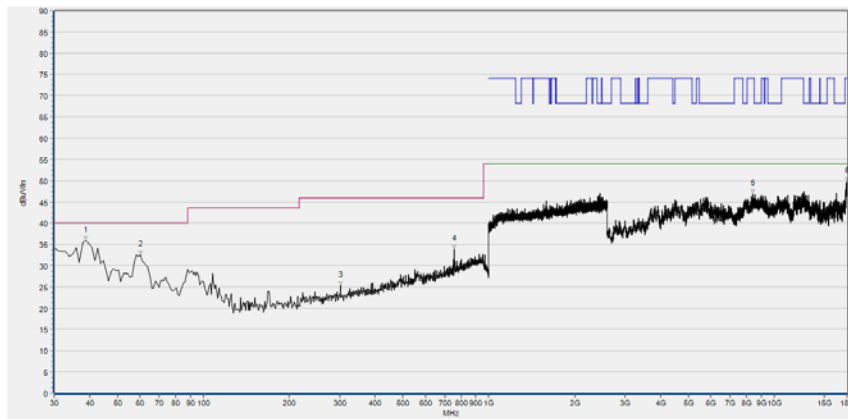
(Antenna Horizontal, 30MHz to 25GHz)



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
38.739	35.42	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
92.142	25.44	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
489.269	26.40	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5773.035	46.40	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
9004.601	46.28	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12149.910	47.01	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

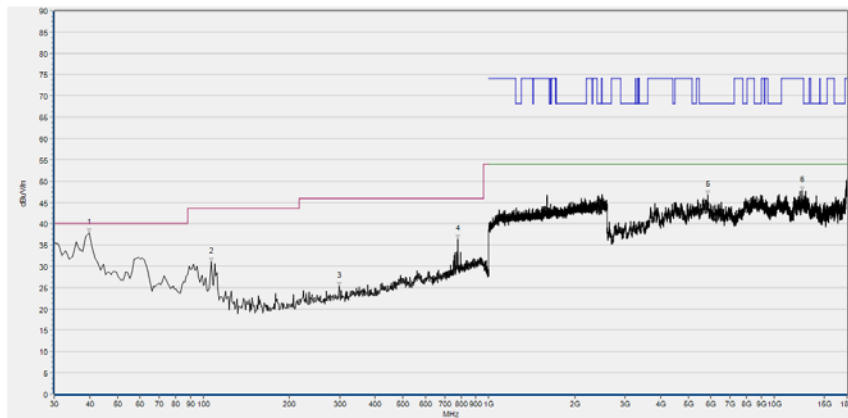
(Antenna Vertical, 30MHz to 25GHz)

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
38.739	35.93	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
60.100	32.54	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
301.872	25.33	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
755.315	33.91	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
8431.606	46.99	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
17993.839	49.69	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

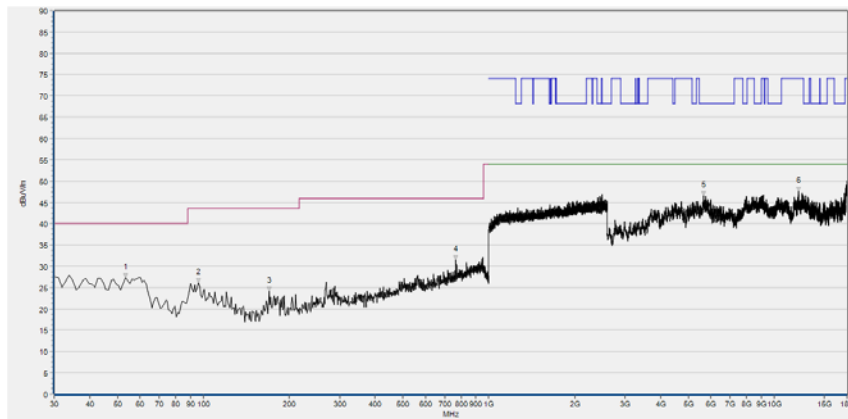


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
38.284	39.37	33.31	N/A	N/A	40.00	N/A	Vertical	PASS
106.707	31.09	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
298.959	25.39	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
779.590	36.41	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5853.131	46.75	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
12525.745	47.74	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

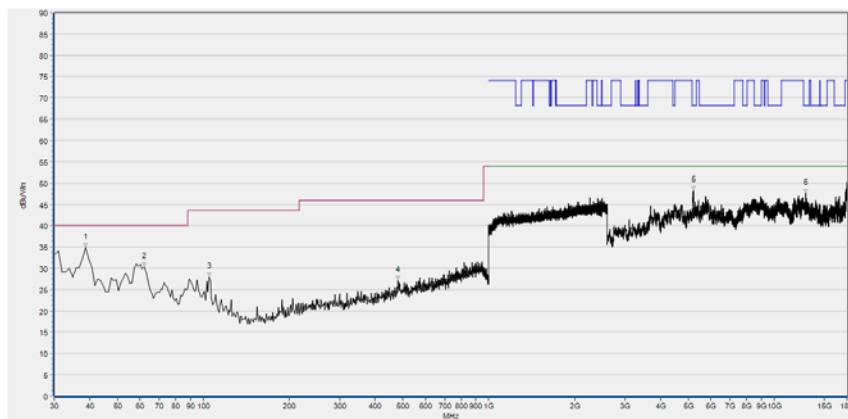
**802.11 ax(HEW40) Test mode**

Plots 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
53.303	27.38	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
96.026	26.06	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
169.820	24.21	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
766.967	31.43	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5649.810	46.55	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
12146.829	47.62	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

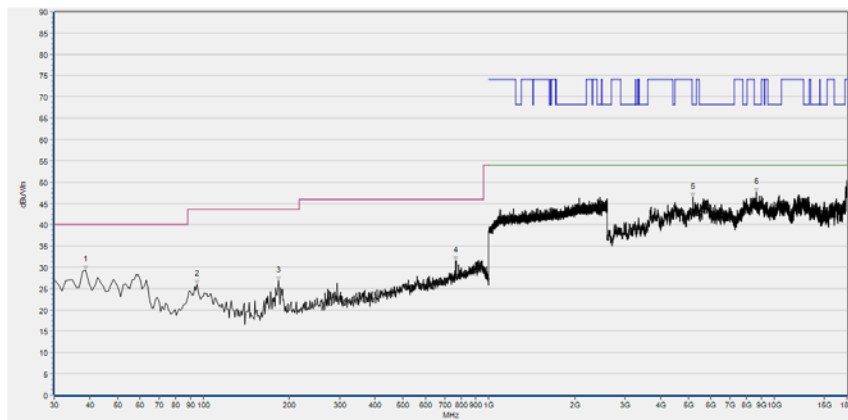


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
38.739	34.78	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
62.042	30.36	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
104.765	27.96	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
480.531	27.16	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5206.201	48.33	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
12876.935	47.64	N/A	N/A	68.23	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

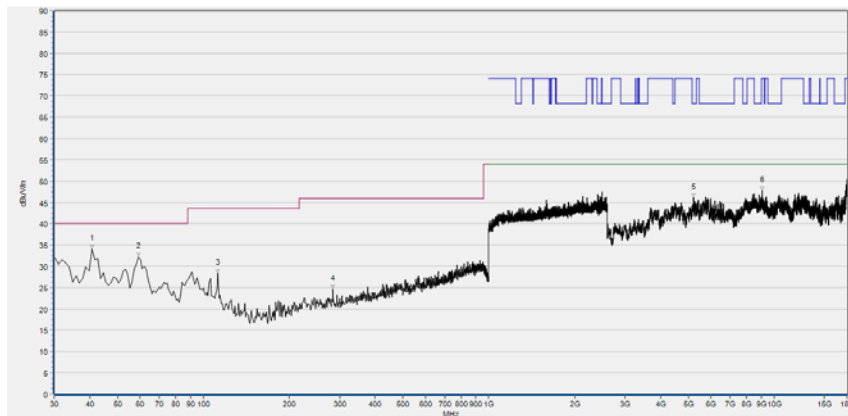


Plot for Channel = 46



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
38.739	29.34	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
95.055	26.01	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
183.413	26.85	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
764.054	31.52	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5196.959	46.39	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
8634.927	47.54	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS

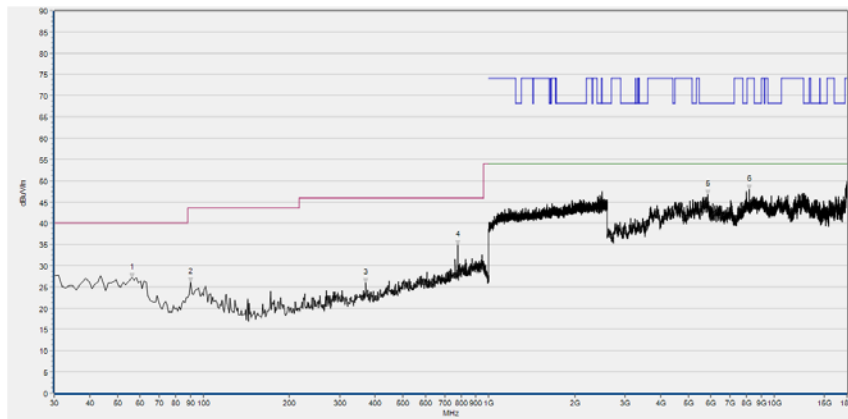
(Antenna Horizontal, 30MHz to 25GHz)



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
40.681	34.01	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
59.129	32.21	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
112.533	28.31	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
284.394	24.70	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5212.362	46.06	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
9090.858	47.73	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

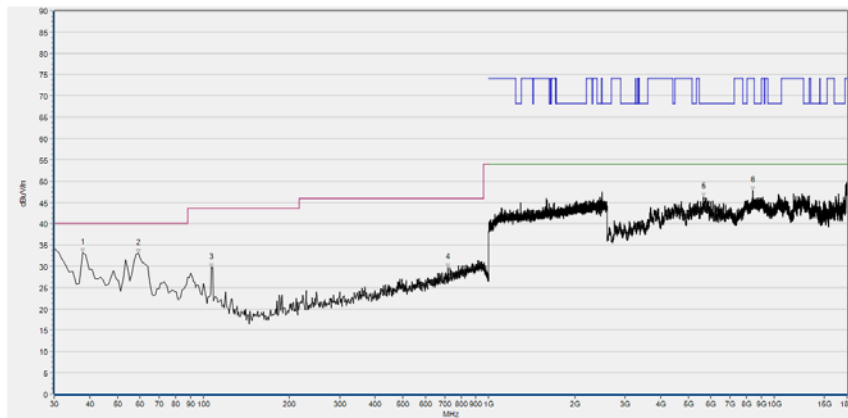
(Antenna Vertical, 30MHz to 25GHz)

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
56.216	27.23	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
90.200	26.21	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
370.811	26.02	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
779.590	34.79	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5856.211	46.72	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
8185.157	47.86	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

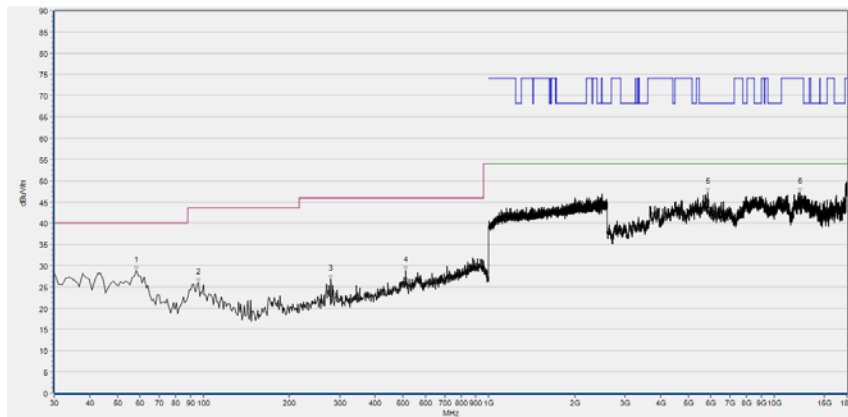
(Antenna Horizontal, 30MHz to 25GHz)



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
37.768	33.24	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
59.129	33.04	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
106.707	29.64	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
719.389	29.73	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5637.487	46.31	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
8428.526	47.69	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

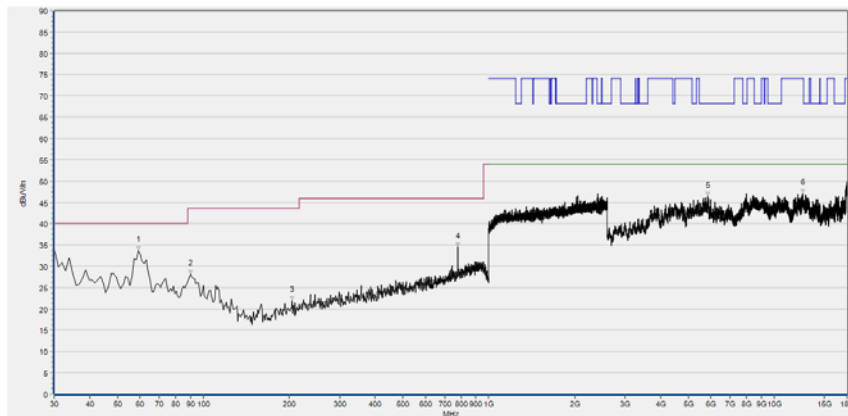
(Antenna Vertical, 30MHz to 25GHz)

Plots 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
58.158	28.76	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
96.026	26.05	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
279.540	26.83	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
512.573	28.89	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5853.131	47.25	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
12310.102	47.20	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

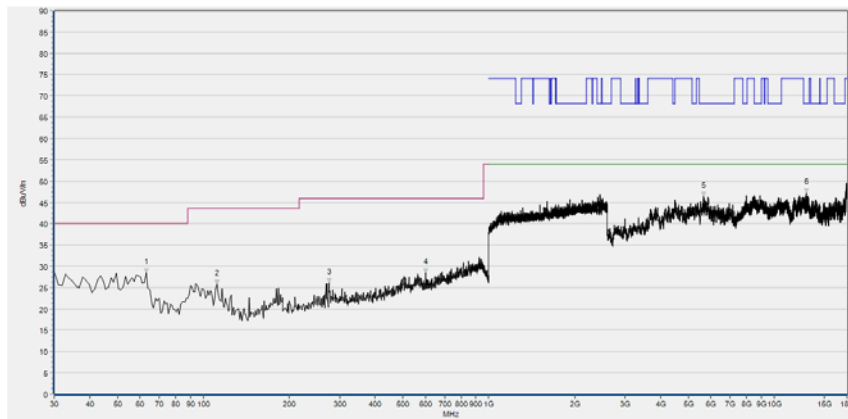


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
59.129	33.64	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
90.200	28.22	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
204.775	21.93	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
779.590	34.57	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5862.372	46.34	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
12593.519	47.05	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

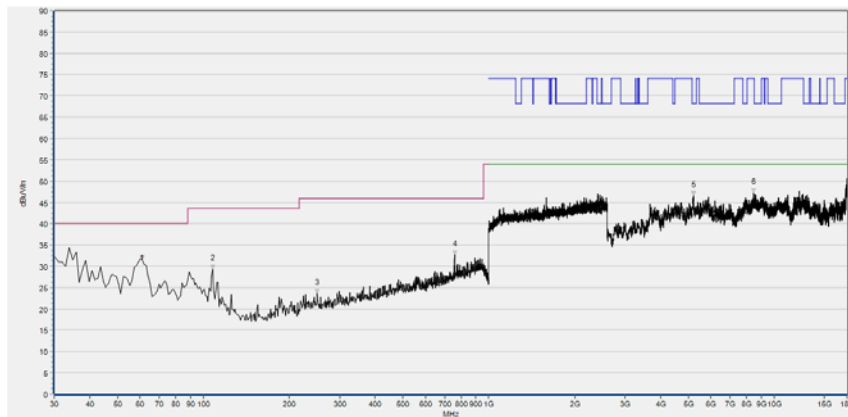
**802.11 ax(HEW80) Test mode**

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
63.013	28.52	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
111.562	25.82	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
275.656	26.20	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
599.960	28.46	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5649.810	46.48	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
12923.145	47.23	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

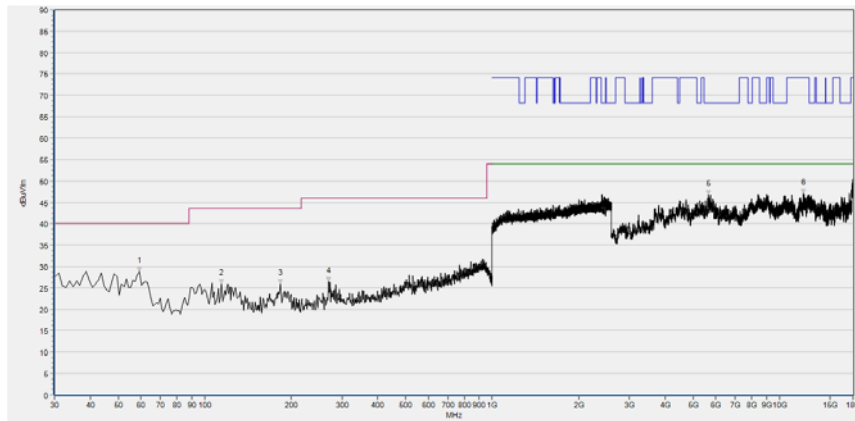


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
61.071	31.49	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
107.678	29.25	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
250.410	23.67	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
759.199	32.73	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5203.121	46.58	N/A	N/A	68.23	N/A	54.00	Vertical	PASS
8440.848	47.22	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

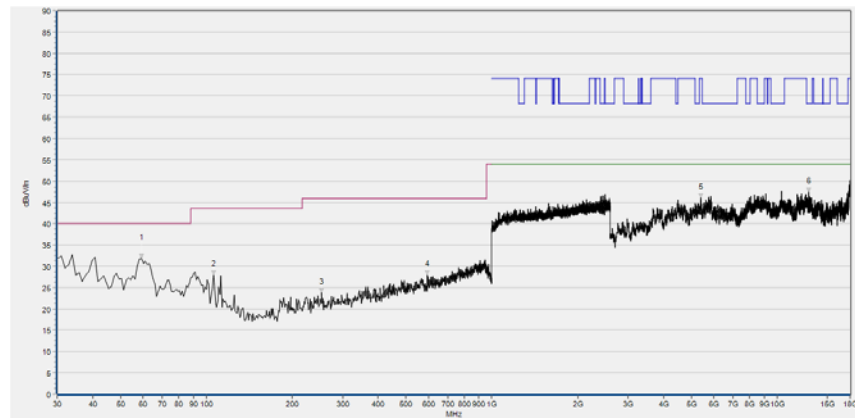


Plot for Channel = 155



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
59.129	28.77	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
114.474	26.05	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
183.413	25.93	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
268.859	26.43	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5652.891	46.81	N/A	N/A	68.23	N/A	54.00	Horizontal	PASS
12079.056	47.16	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)



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
59.129	31.85	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
105.736	27.97	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
253.323	23.80	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
594.134	27.99	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5394.119	46.02	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12895.419	47.45	N/A	N/A	68.23	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)



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	$\pm 2.22\text{dB}$
Power spectral density (PSD)	$\pm 2.22\text{dB}$
Bandwidth	$\pm 5\%$
Restricted Frequency Bands	$\pm 5\%$
Radiated Emission	$\pm 2.95\text{dB}$
Conducted Emission	$\pm 2.44\text{dB}$

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. Morlab Laboratory
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. Morlab Laboratory
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 C63.10-2013 and 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	Cal. Due
Attenuator 1	(N/A)	10dB	Resnet	N/A	N/A
EXA Signal Analyzer	MY53470836	N9010A	Agilent	2019.04.09	2020.04.08
USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2019.04.16	2020.04.15
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	YOMA	(N/A)	(N/A)	2019.01.22	2020.01.21
Computer	T430i	Think Pad	Lenovo	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2019.05.08	2020.05.09
LISN	812744	NSLK 8127	Schwarzbeck	2019.05.08	2020.05.09
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2019.05.08	2020.05.09
Coaxial cable(BNC)	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	V 1.0

**4.4 Radiated Test Equipments**

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY54130016	N9038A	Agilent	2019.07.26	2020.07.25
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2019.05.08	2020.05.09
Test Antenna - Horn	9170C-531	BBHA9170	Schwarzbeck	2019.02.15	2020.02.14
Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2019.07.26	2020.07.25
Test Antenna - Horn	01774	BBHA 9120D	Schwarzbeck	2019.07.26	2020.07.25
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	MA02	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
26GHz -40GHz pre-Amplifier	MA05	BBV9721	Rohde& Schwarz	2019.05.08	2020.05.09
Notch Filter	N/A	WRCG-5150-5350	Wainwright	2018.12.01	2019.11.30
Notch Filter	N/A	WRCG-5725-5850	Wainwright	2018.12.01	2019.11.30
Anechoic Chamber	N/A	9m*6m*6m	CRT	2017.11.19	2020.11.18

————— END OF REPORT —————