REPORT No. : SZ20120032W01

TEST REPORT

APPLICANT	:	Guilin Zhishen Information Technology Co.,Ltd.
PRODUCT NAME	:	ZHIYUN MasterEye Visual Controller VC100
MODEL NAME	:	COV-04
BRAND NAME	:	ZHIYUN
FCC ID	:	2AIHFZYCOV-04
STANDARD(S)	:	47 CFR Part 15 Subpart E
RECEIPT DATE	:	2020-09-10
TEST DATE	:	2020-09-15 to 2020-12-24
ISSUE DATE	:	2021-02-03

Edited by: Peng Mi (Rapporteur)

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MORLAB

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DIRECTORY

Change History		
Version	Date	Reason for change
1.0	2021-02-03	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Guilin Zhishen Information Technology Co.,Ltd.
Applicant Address:	09 Huangtong Road, Tieshan Industrial Zone, Qixing District, Guilin, Guangxi, China
Manufacturer:	Guilin Zhishen Information Technology Co.,Ltd.
Manufacturer Address:	09 Huangtong Road, Tieshan Industrial Zone, Qixing District, Guilin, Guangxi, China

1.2. Equipment Under Test (EUT) Description

Product Name:	ZHIYUN MasterEye Visual Controller VC100	
Serial No.:	(N/A, marked #1 by test site)	
Hardware Version:	V1.0	
Software Version:	V1.0.0	
Modulation Type:	OFDM	
Modulation Mode:	802.11a, 802.11n (HT20), 802.11n (HT40)	
Operating Frequency Range:	5180MHz–5240MHz; 5745MHz-5825MHz	
Channel Number:	Refer to 1.3	
Antenna Type:	External Antenna	
Antenna Gain:	ANT A: 3.44dBi; ANT B: 3.44dBi	
Directional Gain:	6.45dBi$_{\text{Note 3}}$	
Accessory Information:	Battery	
	Brand Name:	N/A
	Model No.:	3X18650-2200mAh
	Serial No.:	(N/A, marked #1 by test site)
	Capacity:	2200mAh
	Rated Voltage:	11.1V
	Charge Limit:	12.6V
	Manufacturer:	DongGuan Howell Engergy Co., Ltd

Note 1: This test report is variant from the original report (Report No.: SZ20090099W01), based on the similarity between before, changed the product name, software version, model name and FCC ID, two models only the WiFi module and the power supply mode of the WiFi module is the same. All others are different. Due to the above changes, we have evaluated and retested worst case of Conducted Emission, Restricted Frequency Bands and Radiated Emission, the test results are better than before, all other test items are no need to be retested.

Note 2: WIFI hotspot does not support U-NII band.

Note 3: The EUT has two antennas and supports a MIMO function. Physically, the EUT provides two completed transmitters and two receivers for 802.11n modulation mode.

Modulation Mode:	**TX Function**
802.11n	2TX

Note 4: According to KDB 662911 D01, the directional gain = G_{ANT} + 10log(N_{ANT}) dBi, where G_{ANT} is the maximum antenna gain in dBi, N_{ANT} is the number of outputs.

Note 5: For conducted test item Maximum conducted output Power and Peak Power spectral density of each modulation mode, we recorded the test result of two antennas separately, for other conducted test items both of the two antennas were tested separately, we only recorded the worst test result(ANT B) in this report.

Note 6: All radiation test items for 802.11n modulation mode operate at MIMO mode during the test. Other modulation mode operate at SISO mode, both of the two antennas were tested separately, we only recorded the worst test result(ANT B) in this report.

Note 7: 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**…30
	QPSK	13.0…90
	16QAM	26.0…180
	64QAM	65.0…900

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: 5150MHz-5250MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**36**	**5180**	40	5200
	44	**5220**	**48**	**5240**
40MHz	**38**	**5190**	**46**	**5230**
Frequency Range: 5725MHz-5825MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**149**	**5745**	153	5765
	157	**5785**	161	5805
	165	**5825**		
40MHz	**151**	**5775**	**159**	**5795**

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$_{Note1}$	No deviation
2	ANSI C63.10	Duty Cycle of the Test Signal	Sep 15, 2020	Ouyang Feng	PASS$_{Note1}$	No deviation
3	15.407(a)	Maximum Conducted Output Power	Sep 15, 2020	Ouyang Feng	PASS$_{Note1}$	No deviation
4	15.407(a)(e)	Emission Bandwidth	Sep 15, 2020	Ouyang Feng	PASS$_{Note1}$	No deviation
5	15.407(a)	Peak Power Spectral Density	Sep 15, 2020	Ouyang Feng	PASS$_{Note1}$	No deviation
6	15.407(g)	Frequency Stability	Sep 15, 2020	Ouyang Feng	PASS$_{Note1}$	No deviation
7	15.207	Conducted Emission	Dec 17, 2020	Huang Zhiye	PASS	No deviation
8	15.407(b)	Restricted Frequency Bands	Dec 11&21&24, 2020	Gao Jianrou	PASS	No deviation
9	15.407(b)	Radiated Emission	Dec 11, 2020	Gao Jianrou	PASS	No deviation

Note 1: The test results of these test items in this report refer to the test report (Report No.: SZ20090099W01).

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

Note 3: These RF tests were performed according to the method of measurements prescribed in KDB789033 D02 v01r03.

Note 4: The path loss during the RF test is calibrated to correct the results by the offset setting in the test equipments. The ref offset 12dB contains two parts that cable loss 2dB and Attenuator 10dB.

Note 5: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

Note 6: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% risk level.

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 an external antenna coupled with the I-PEX connector. Please refer to the EUT internal photos.

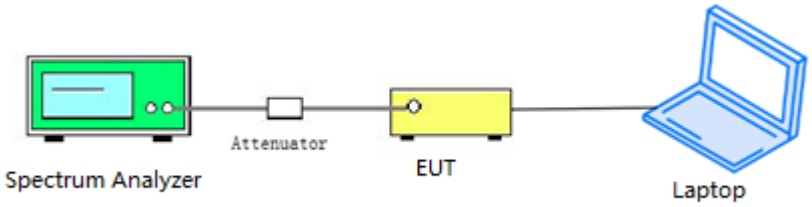
2.2. Duty Cycle of the Test Signal

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

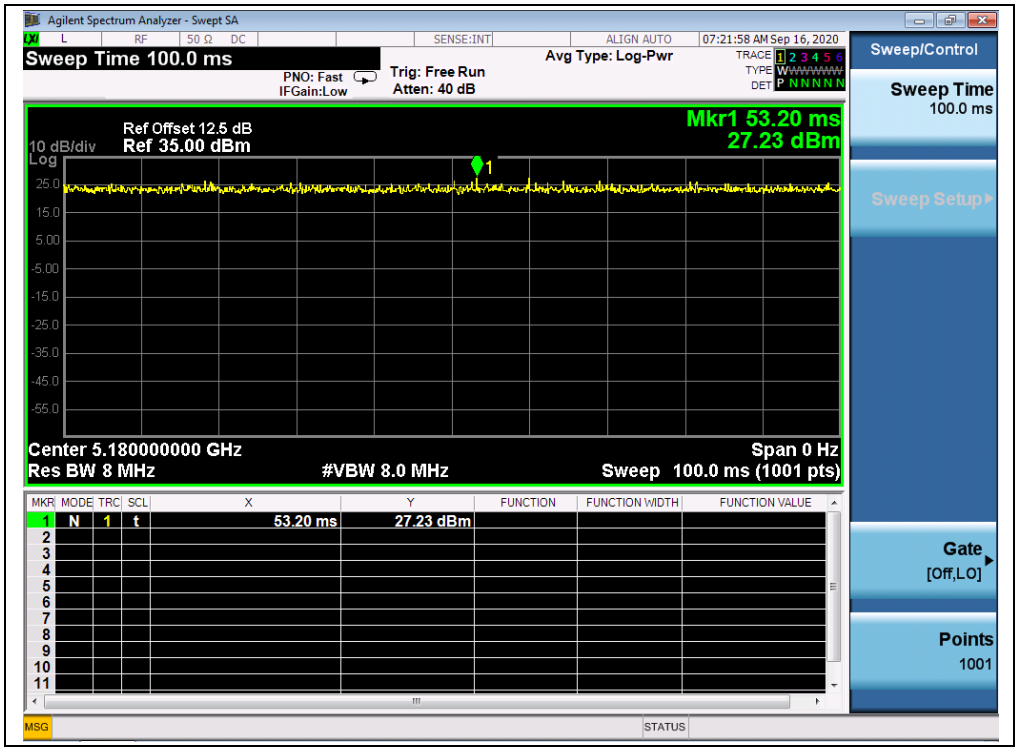
KDB 789033 Section B was used in order to prove compliance.

2.2.4.Test Result

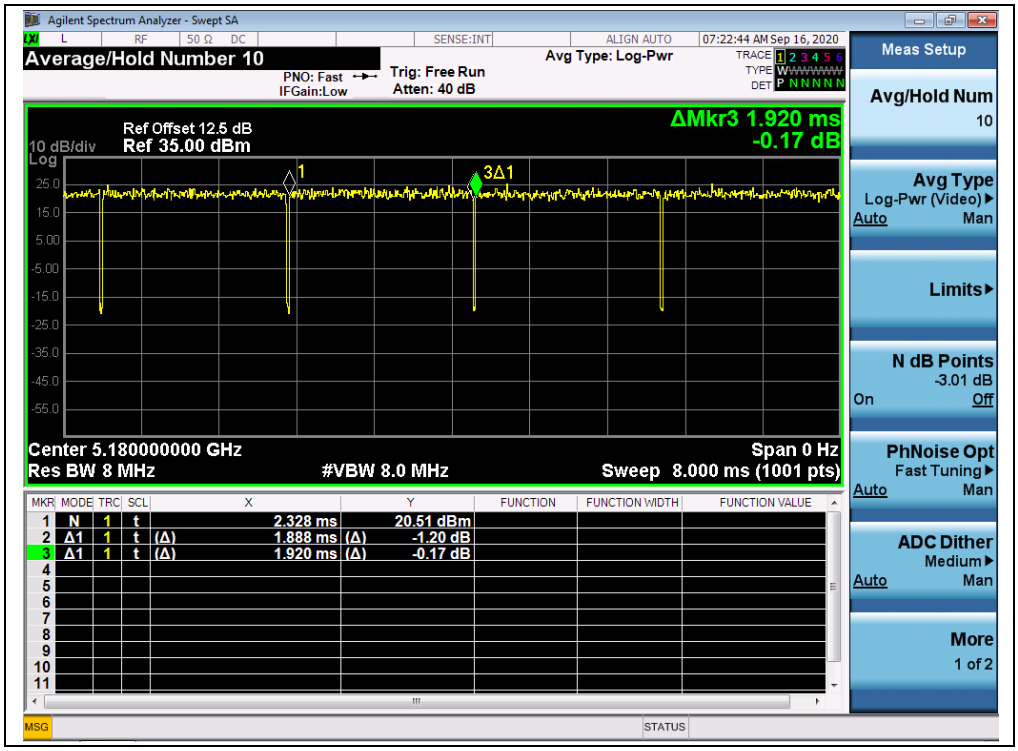
A.Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*log[1/D])
802.11a	100.00	0.00
802.11n (HT20)	98.33	0.07
802.11n (HT40)	96.67	0.15

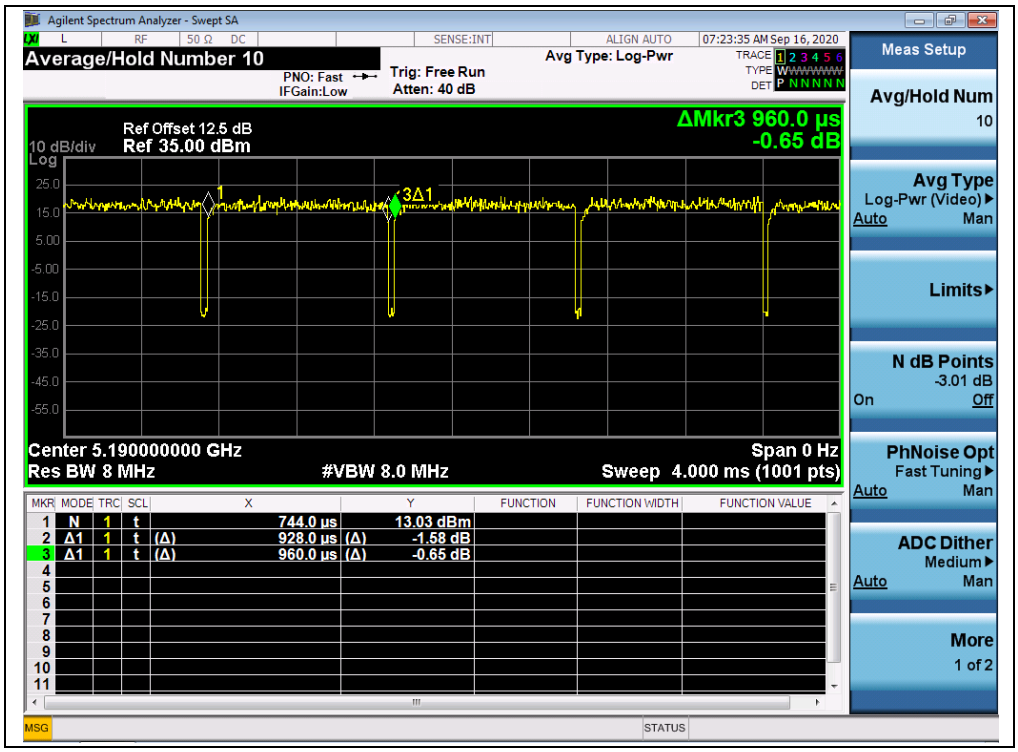
B.Test Plot:



(Channel 36, 5180MHz, 802.11a)



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



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

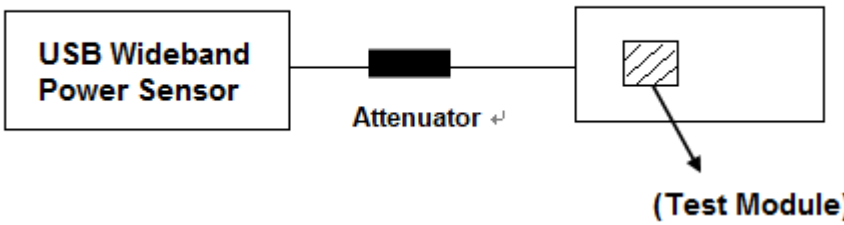
2.3. Maximum Conducted Output Power

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.

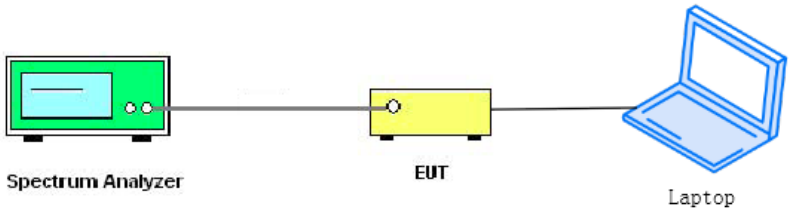
2.3.2.Test Description

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

Frequency (MHz)	Average Power							Limit		Verdict
	Measured		Duty Factor	Duty factor Calculated						
	ANTA	ANTB		ANTA		ANTB				
	dBm	dBm		dBm	W	dBm	W	dBm	W	
5180	15.81	13.30	0.00	15.81	0.038	13.30	0.021	24	0.25	PASS
5220	17.25	14.07		17.25	0.053	14.07	0.026			
5240	17.57	14.41		**17.57**	**0.057**	14.41	0.028			
5745	10.02	12.66		10.02	0.010	12.66	0.018	30	1	PASS
5785	9.56	11.39		9.56	0.009	11.39	0.014			
5825	8.03	11.70		8.03	0.006	11.70	0.015			

802.11n (HT20) Mode

Frequency (MHz)	Average Power					Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor				
	ANTA	ANTB						
	dBm	dBm		W	dBm	dBm	W	
5180	15.31	14.56	0.07	0.064	18.06	23.55	0.23	PASS
5220	16.24	14.97		0.075	18.75			
5240	16.76	15.17		**0.082**	**19.14**			
5745	10.33	13.45		0.033	15.19	29.55	0.90	PASS
5785	8.63	12.40		0.025	13.98			
5825	8.14	11.99		0.023	13.62			

Note: Directional gain = 3.44dBi +10log(2) = 6.45dBi＞6dBi, so the power limit shall be reduced to 24-(6.45-6) = 23.55dBm for 5.18-5.24 GHz band and reduced to 30-(6.45-6) = 29.55dBm for 5.745-5.825 GHz band.

802.11n (HT40) Mode

Frequency (MHz)	Average Power					Limit		Verdict
	Measured		Duty Factor	Total Power with Duty Factor				
	ANTA	ANTB						
	dBm	dBm		W	dBm	dBm	W	
5190	15.68	14.15	0.15	0.065	18.13	23.55	0.23	PASS
5230	16.20	14.64		**0.073**	**18.63**			
5755	10.20	12.09		0.028	14.47	29.55	0.90	
5795	8.97	11.55		0.023	13.62			
Note: Directional gain = 3.44dBi +10log(2) = 6.45dBi＞6dBi, so the power limit shall be reduced to 24-(6.45-6) = 23.55dBm for 5.18-5.24 GHz band and reduced to 30-(6.45-6) = 29.55dBm for 5.745-5.825 GHz band.								

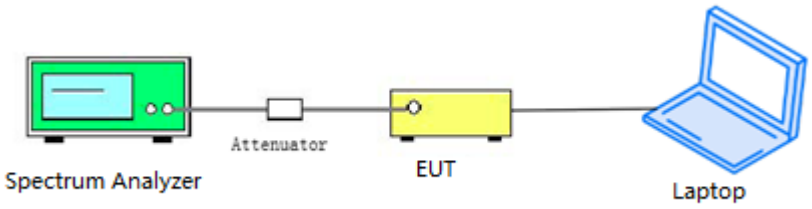
2.4. Emission Bandwidth

2.4.1.Requirement

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

2.4.2.Test Description

Test Setup:



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

2.4.3.Test Procedure

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

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

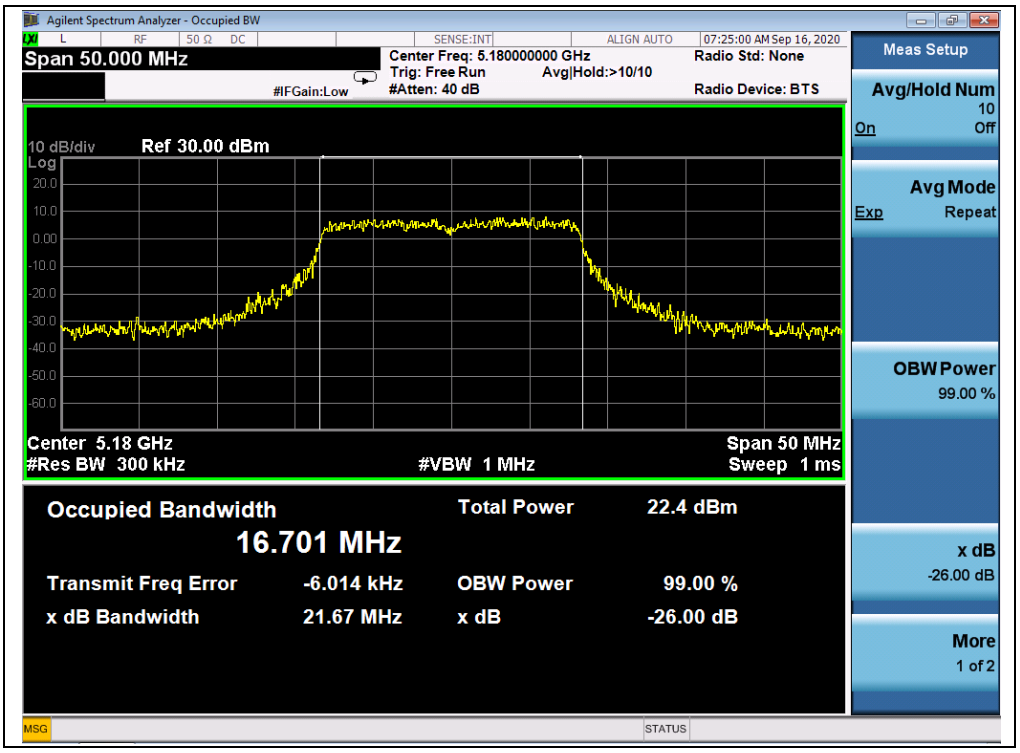
2.4.4.Test Result

802.11a Mode

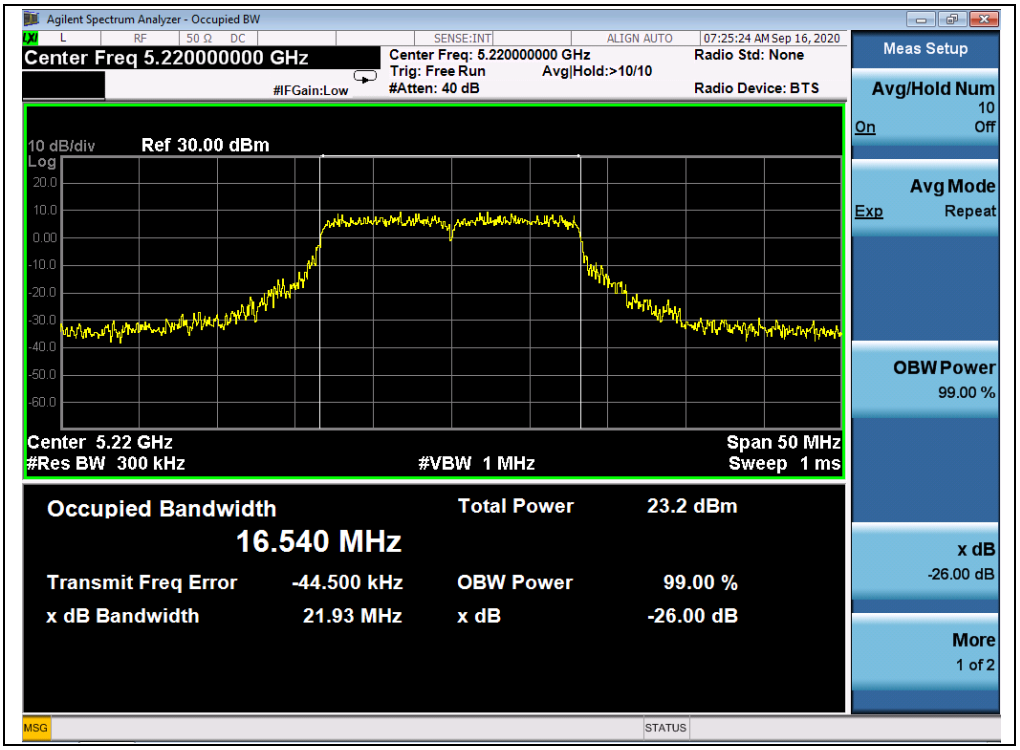
A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	21.67
44	5220	21.93
48	5240	21.40
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
149	5745	16.39
157	5785	16.43
165	5825	16.33

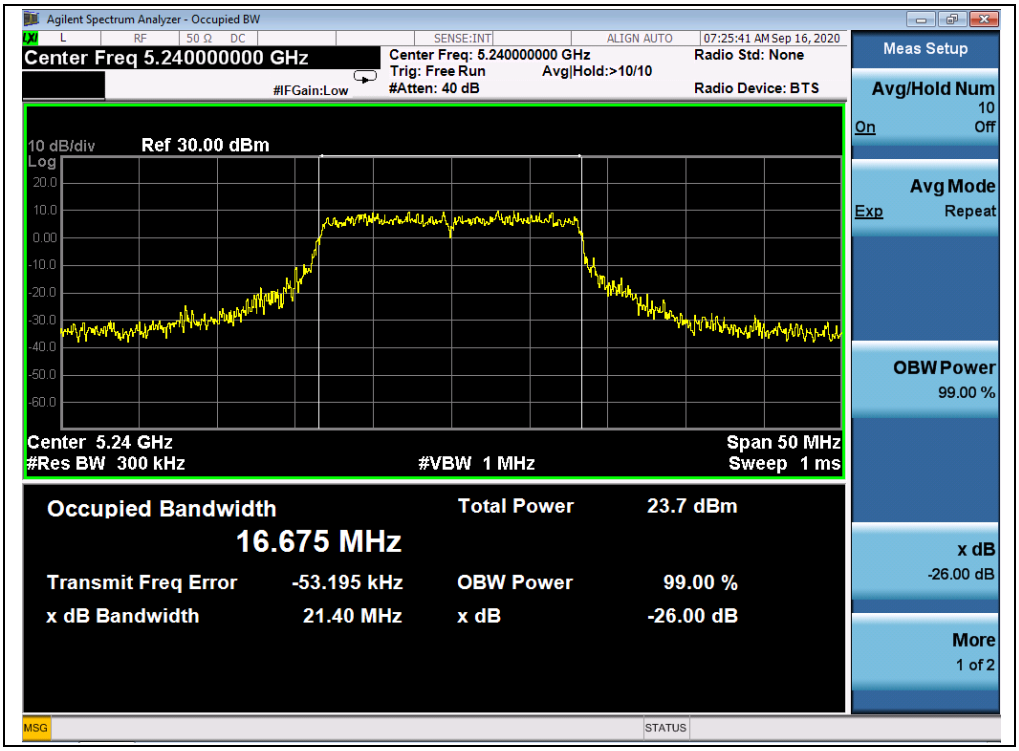
B.Test Plot:



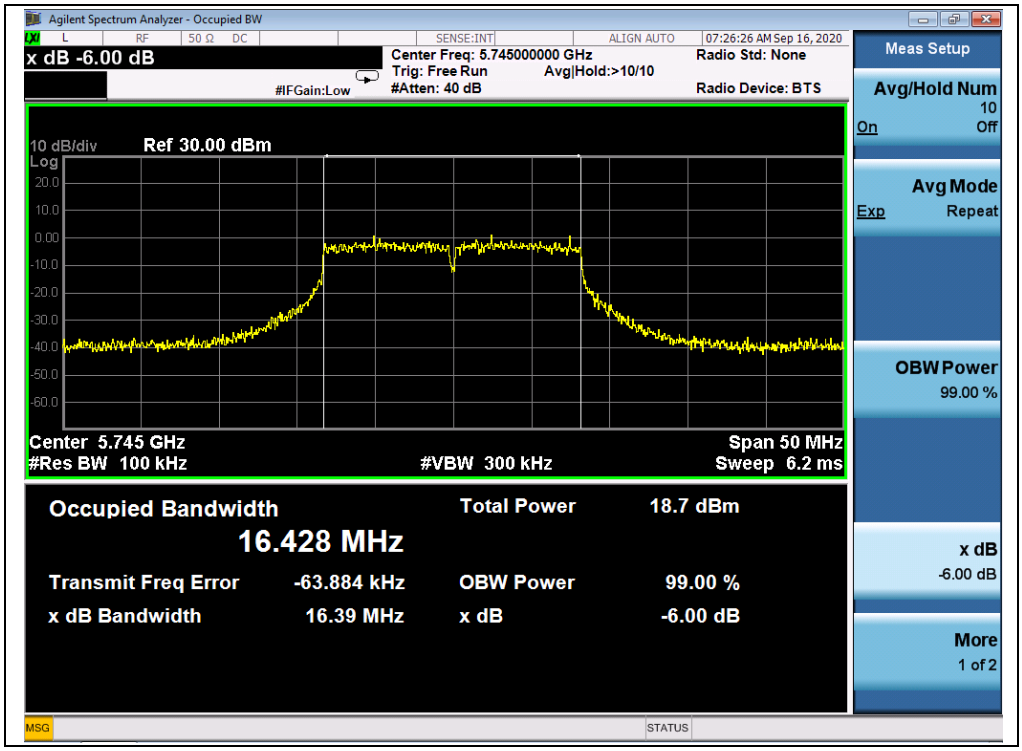
(Channel 36, 5180MHz, 802.11a)



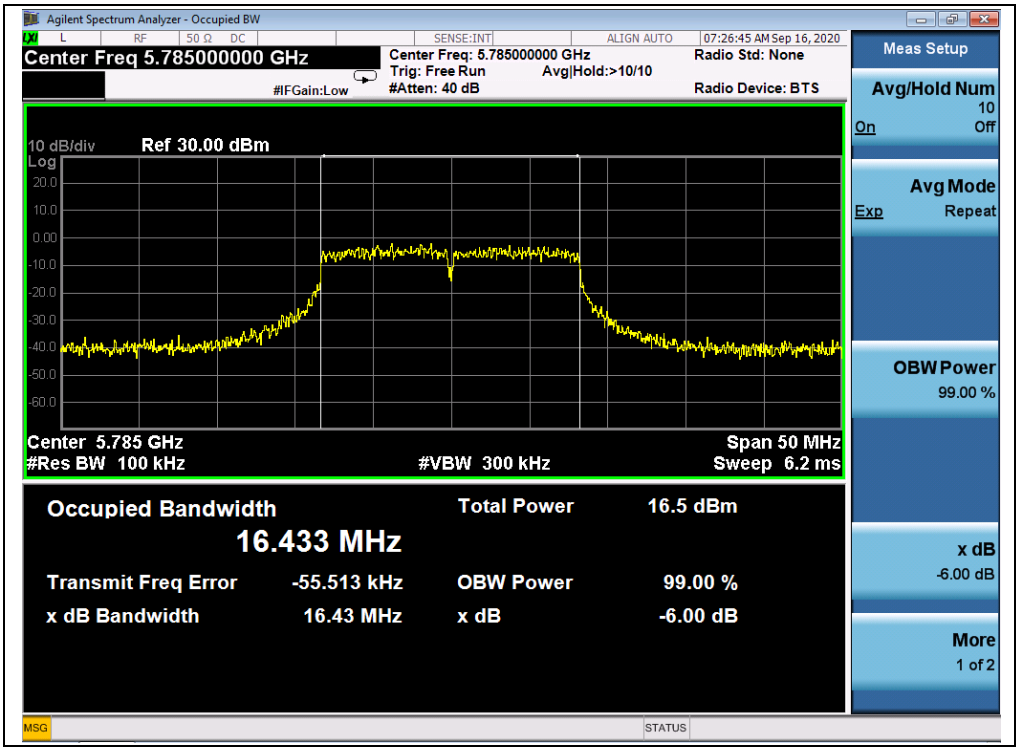
(Channel 44, 5220 MHz, 802.11a)



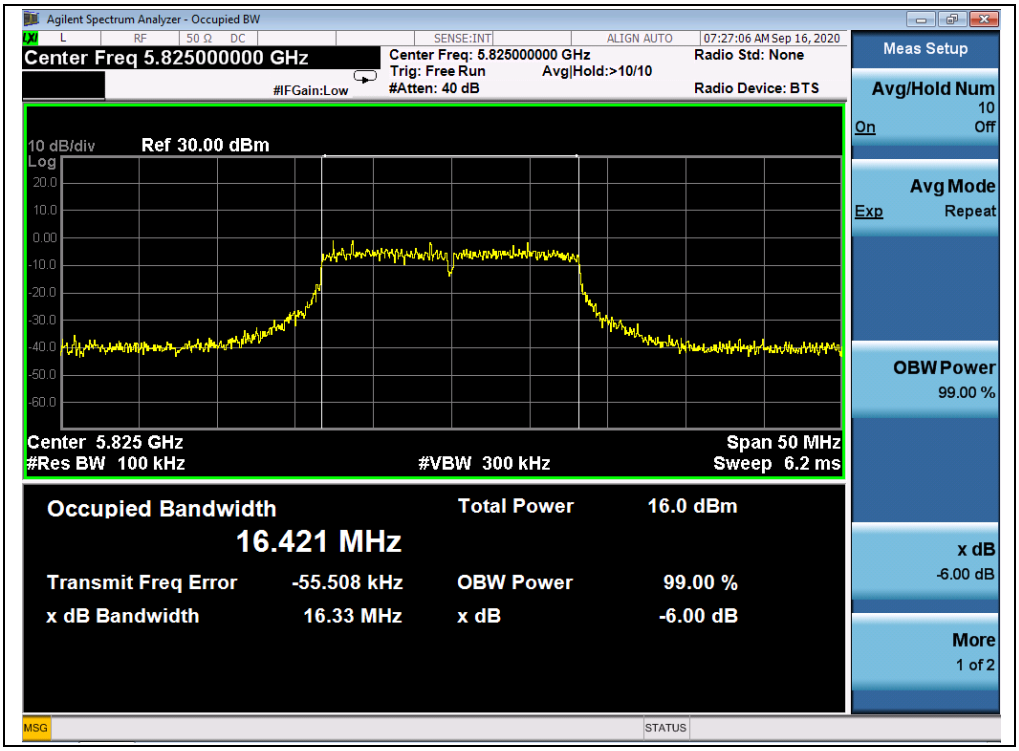
(Channel 48, 5240MHz, 802.11a)



(Channel 149,5745MHz, 802.11a)



(Channel 157,5785MHz, 802.11a)



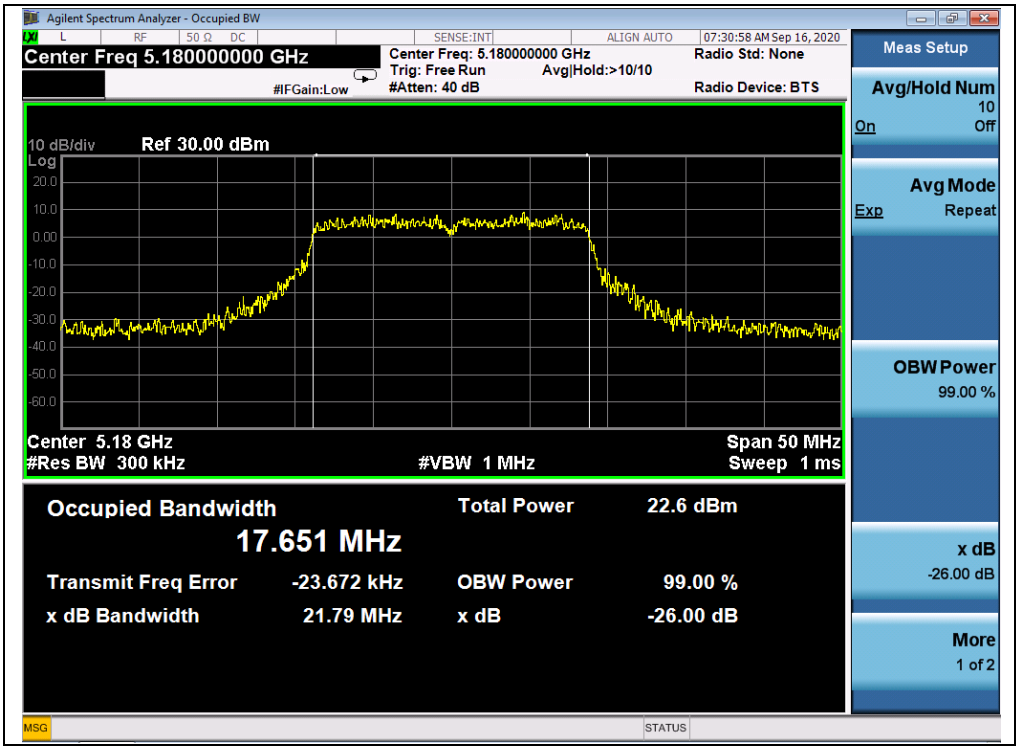
(Channel 165, 5825MHz, 802.11a)

802.11n (HT20) Mode

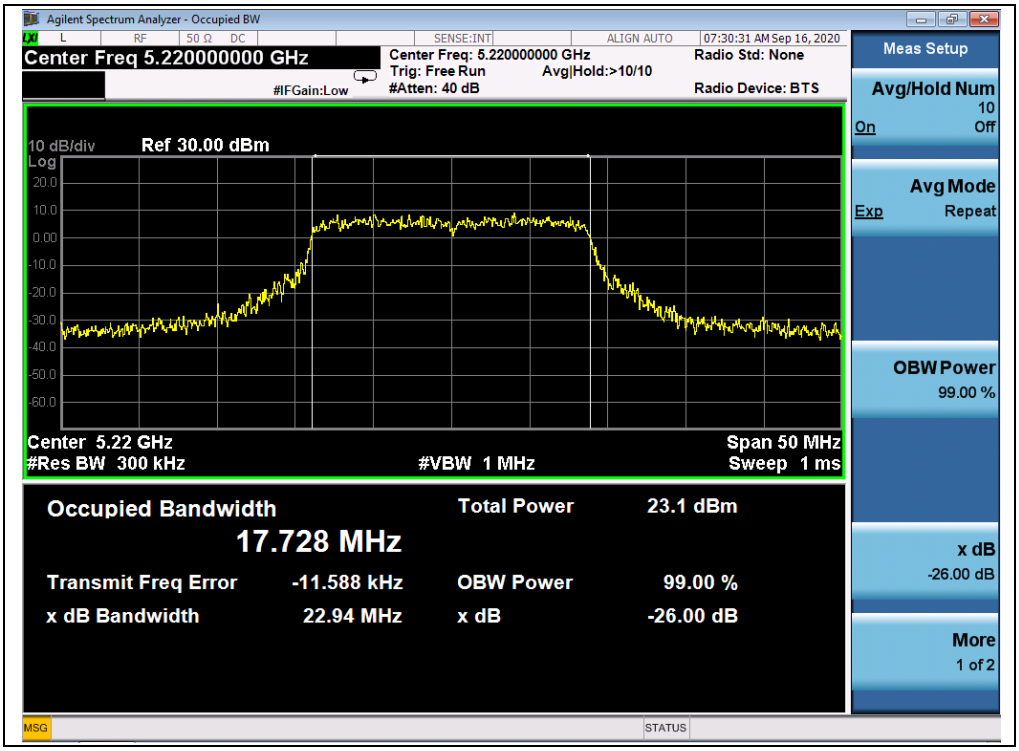
A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	21.79
44	5220	22.94
48	5240	22.98
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
149	5745	17.61
157	5785	17.51
165	5825	17.62

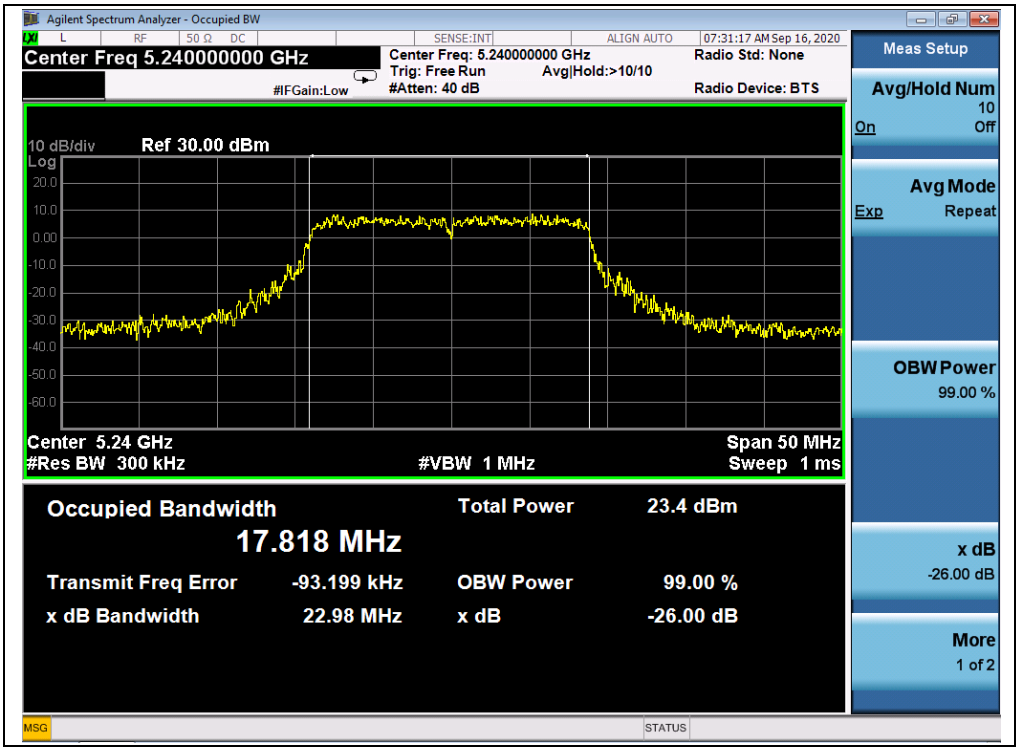
B.Test Plot:



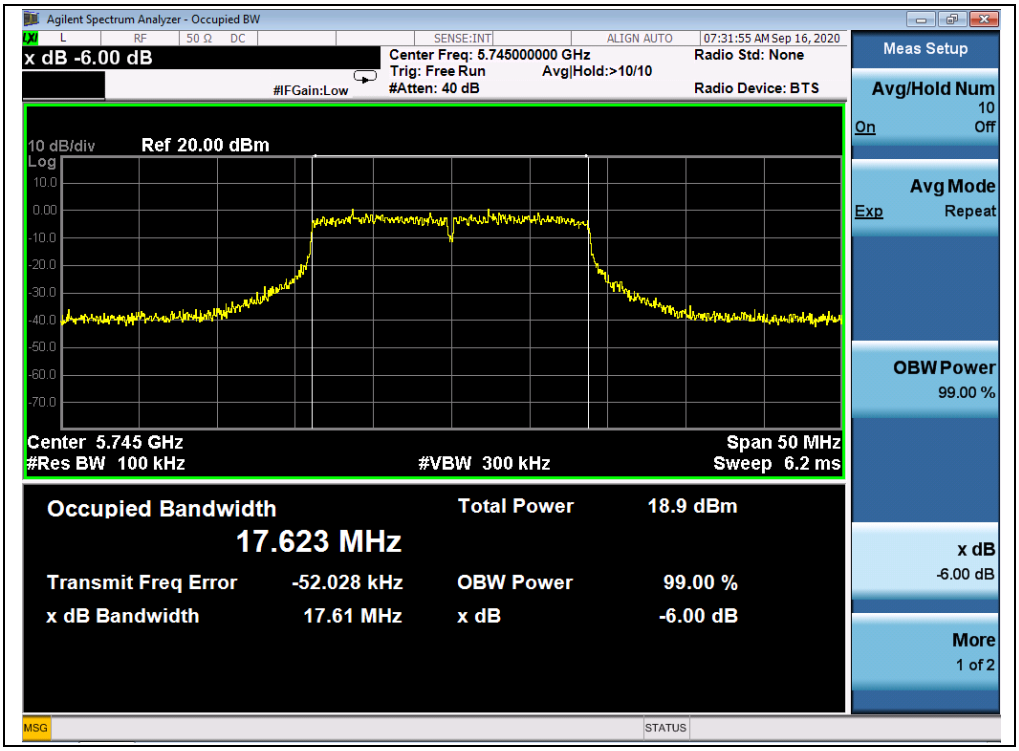
(Channel 36, 5180MHz, 802.11n (HT20))



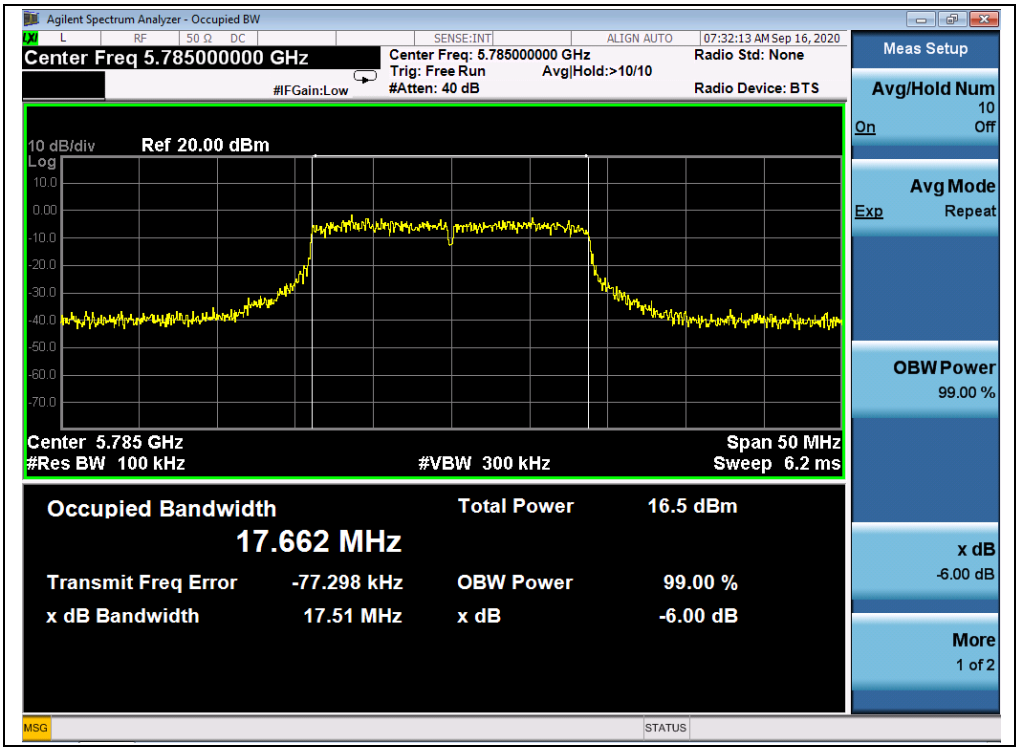
(Channel 44, 5220MHz, 802.11n (HT20))



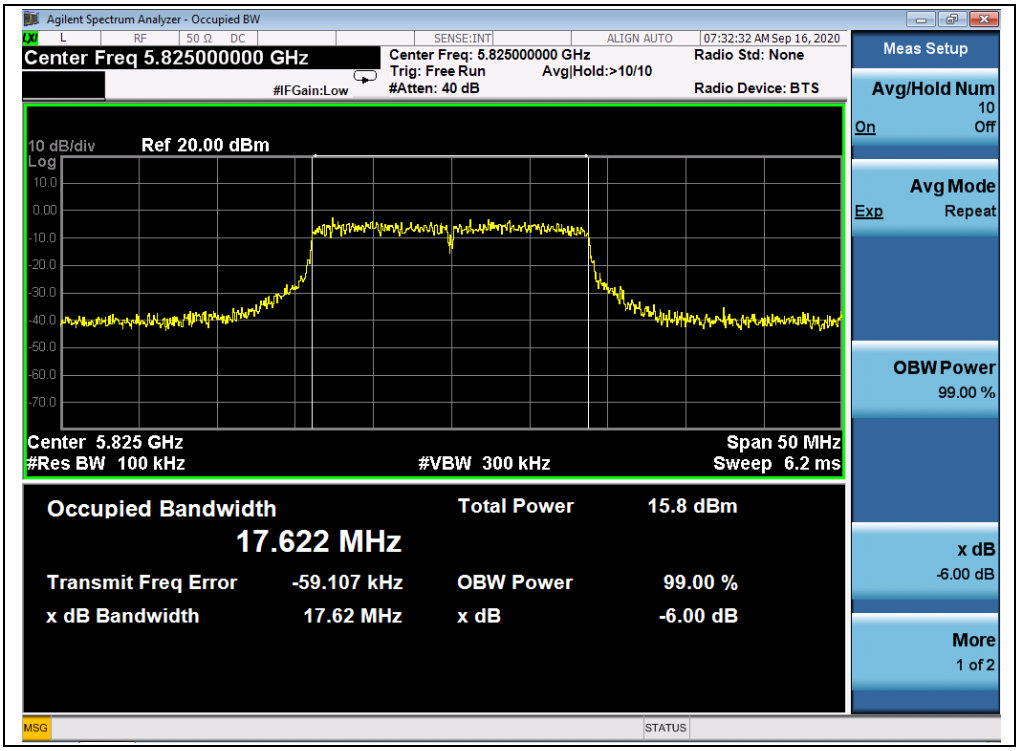
(Channel 48, 5240MHz, 802.11n (HT20))



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



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



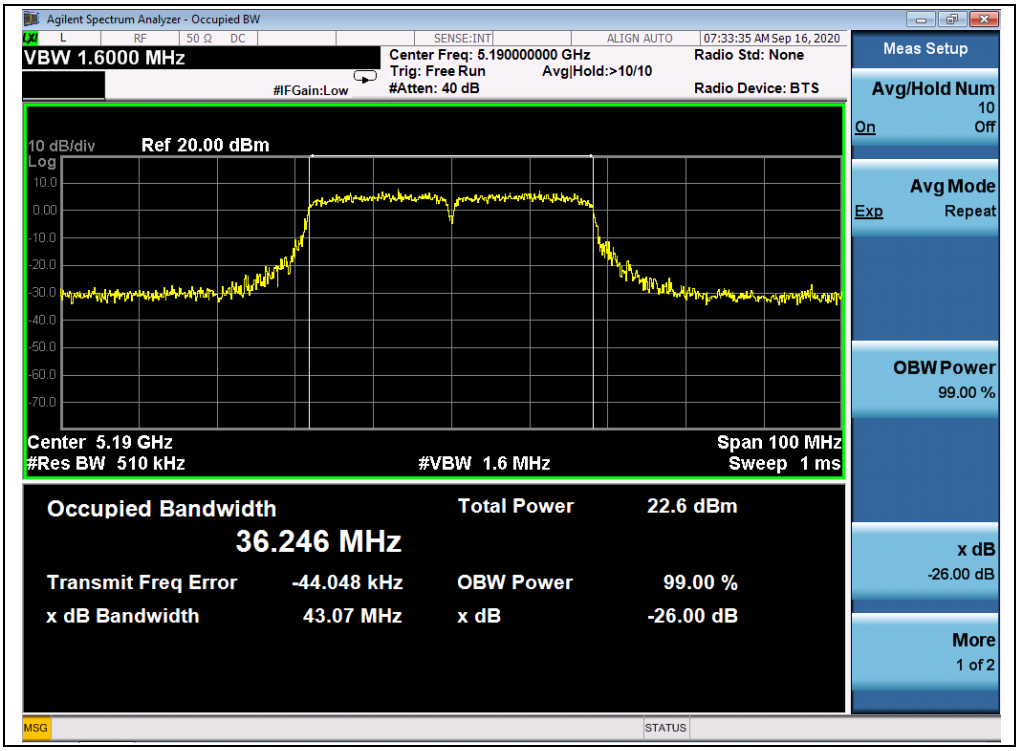
(Channel 165, 5825MHz, 802.11 n (HT20))

802.11n (HT40) Test mode

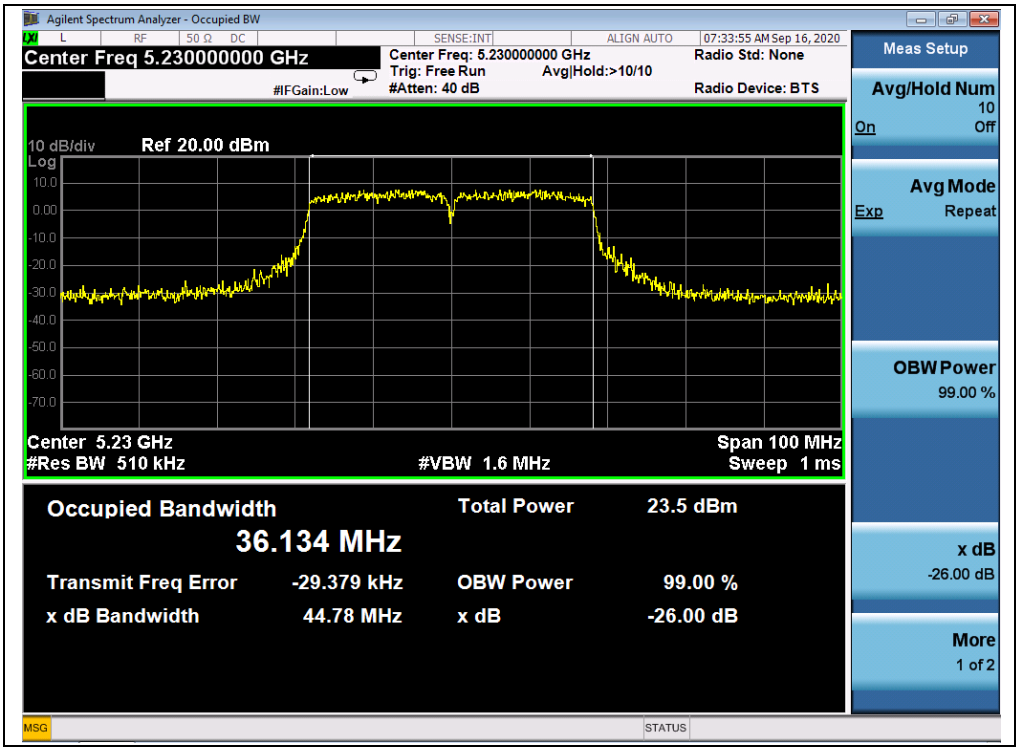
A.Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	43.07
46	5230	44.78
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
151	5755	36.37
159	5795	35.73

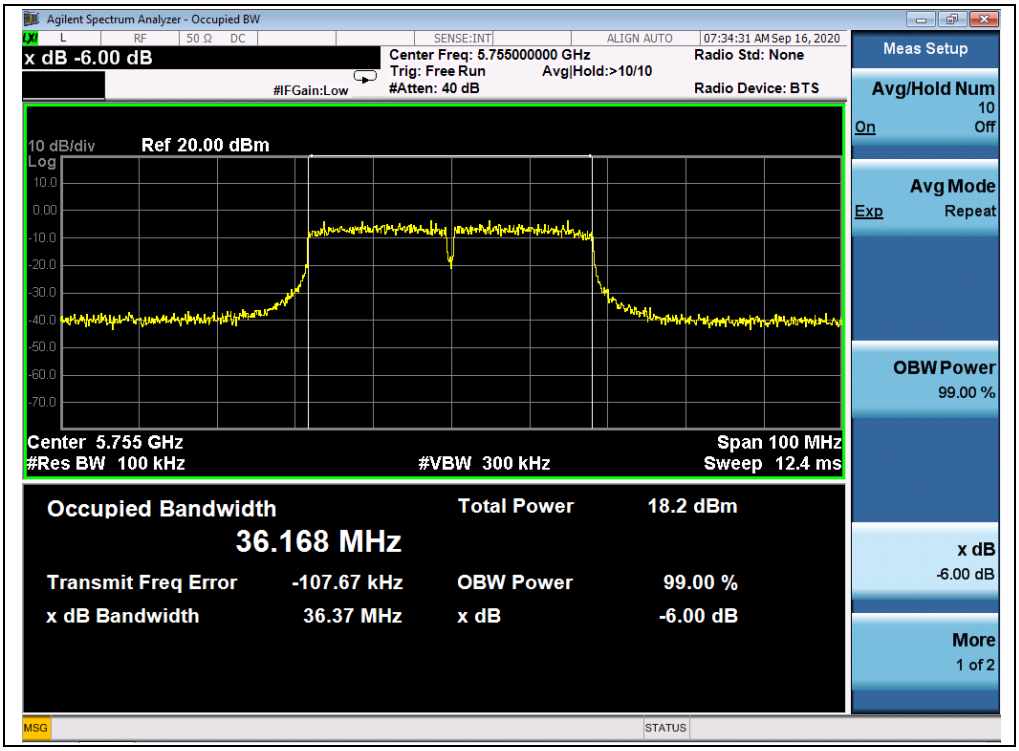
B.Test Plot:



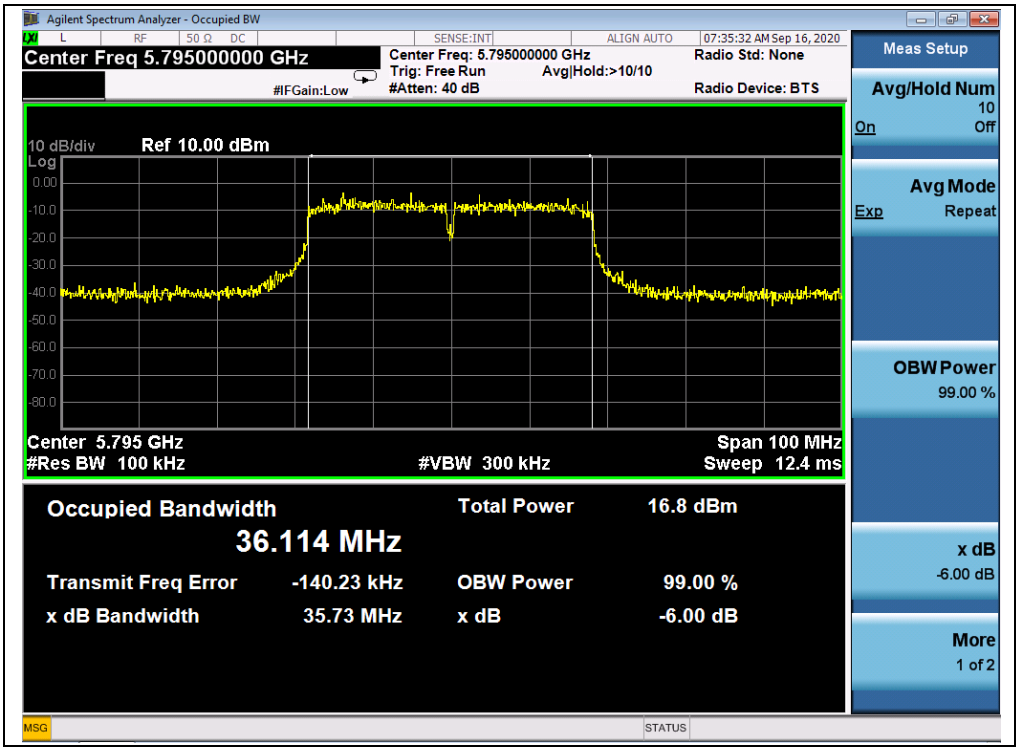
(Channel 38, 5190MHz, 802.11n (HT40))



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



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



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

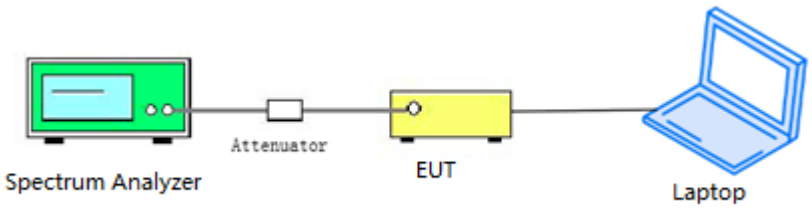
2.5. Peak Power Spectral Density

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 = Peak
5) Trace mode=Max hold
6) Record the max value

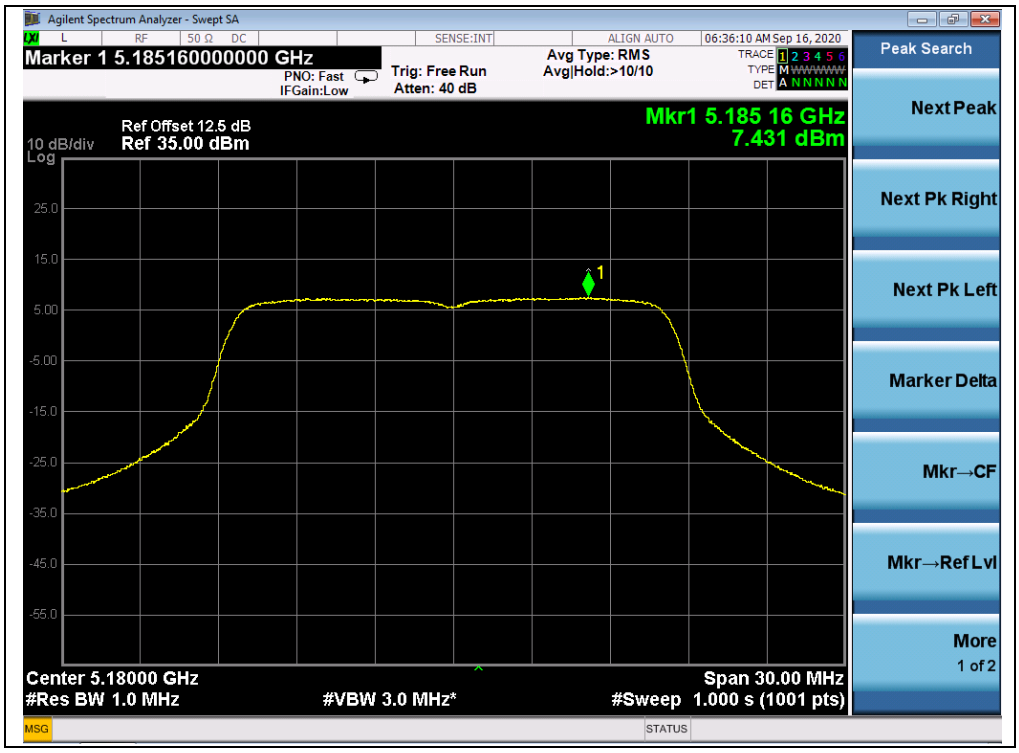
2.5.4.Test Result

802.11a Mode

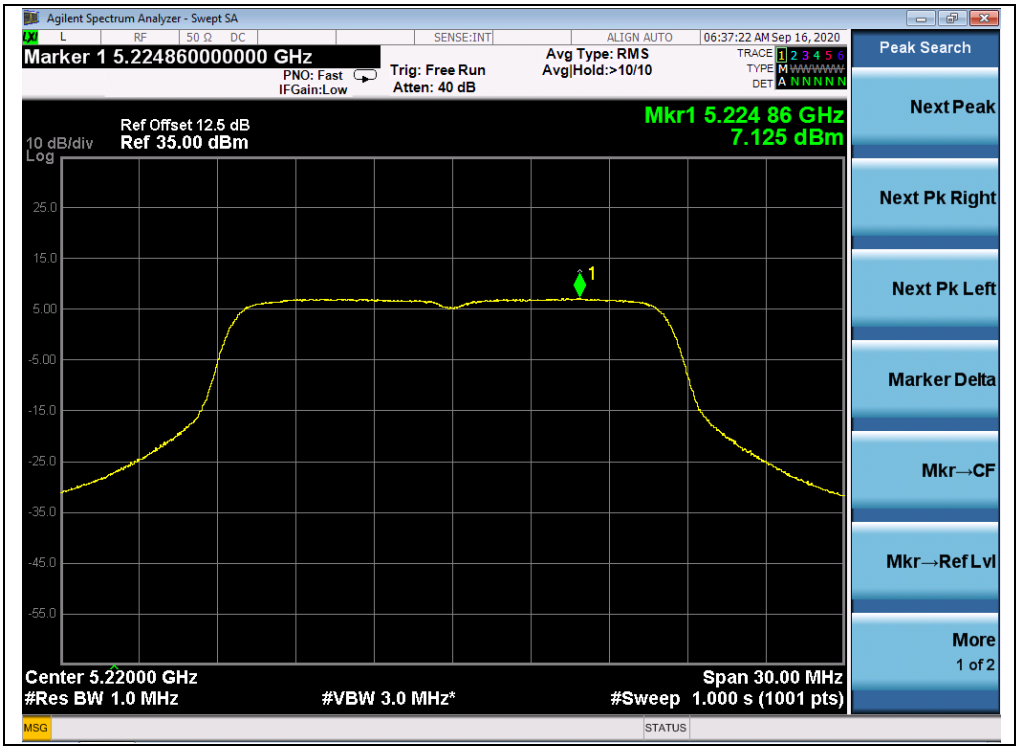
A.Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Duty Factor	Corrected PPSD (dBm/MHz)		Limit (dBm/MHz)	Verdict
		ANT A	ANT B		ANT A	ANT B		
36	5180	7.68	7.43	0.00	7.68	7.43	11	PASS
44	5220	6.88	7.13		6.88	7.13		
48	5240	7.93	7.19		7.93	7.19		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Duty Factor	Total PPSD (dBm/500KHz)		Limit (dBm/500KHz)	Verdict
		ANT A	ANT B		ANT A	ANT B		
149	5745	-0.17	2.18	0.00	-0.17	2.18	30	PASS
157	5785	-1.31	-0.25		-1.31	-0.25		
165	5825	-2.46	0.20		-2.46	0.20		

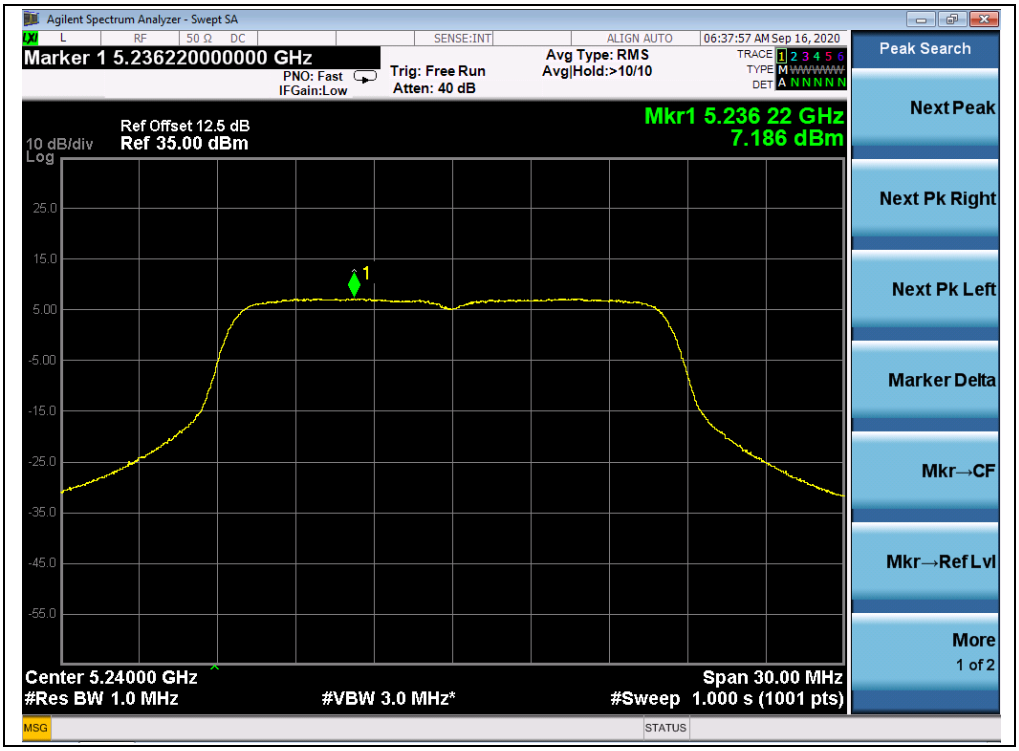
B.Test Plot:



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



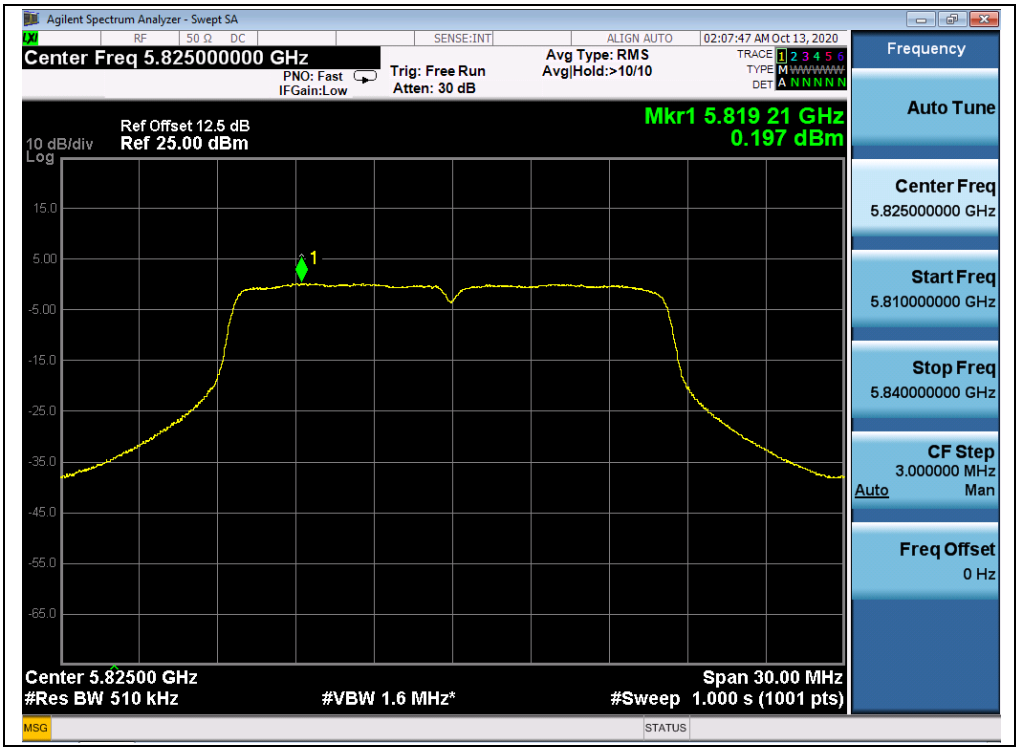
(Channel 44, 5220MHz, 802.11a, ANT B)



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

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

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



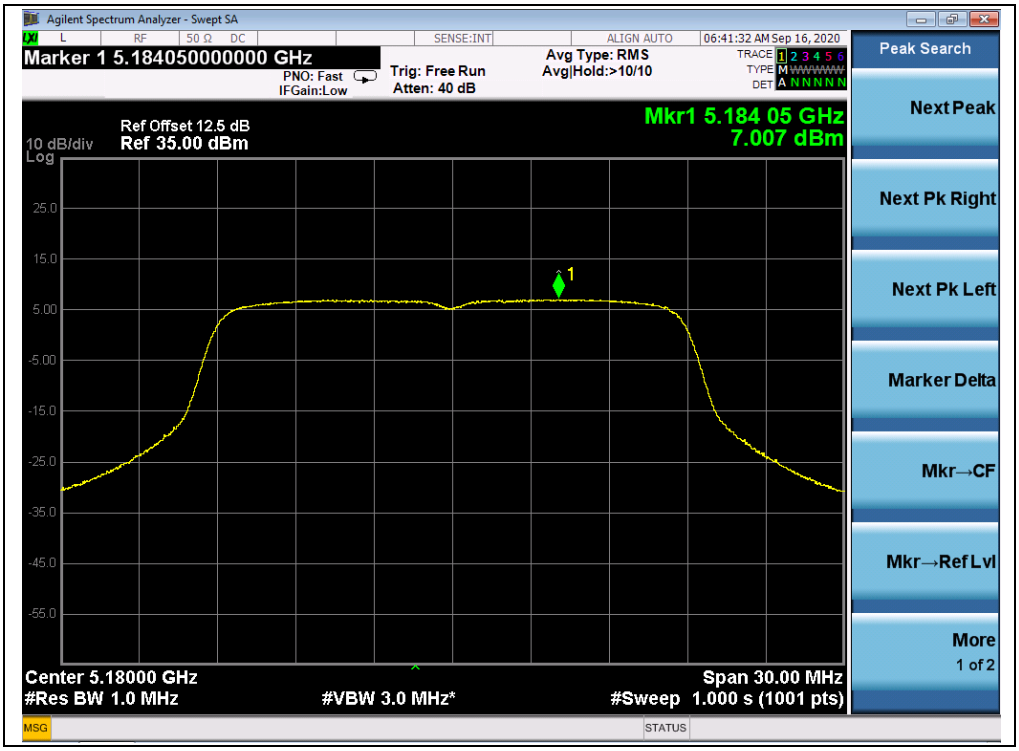
(Channel 165, 5825MHz, 802.11a, ANT B)

802.11n (HT20) Mode

A.Test Verdict:

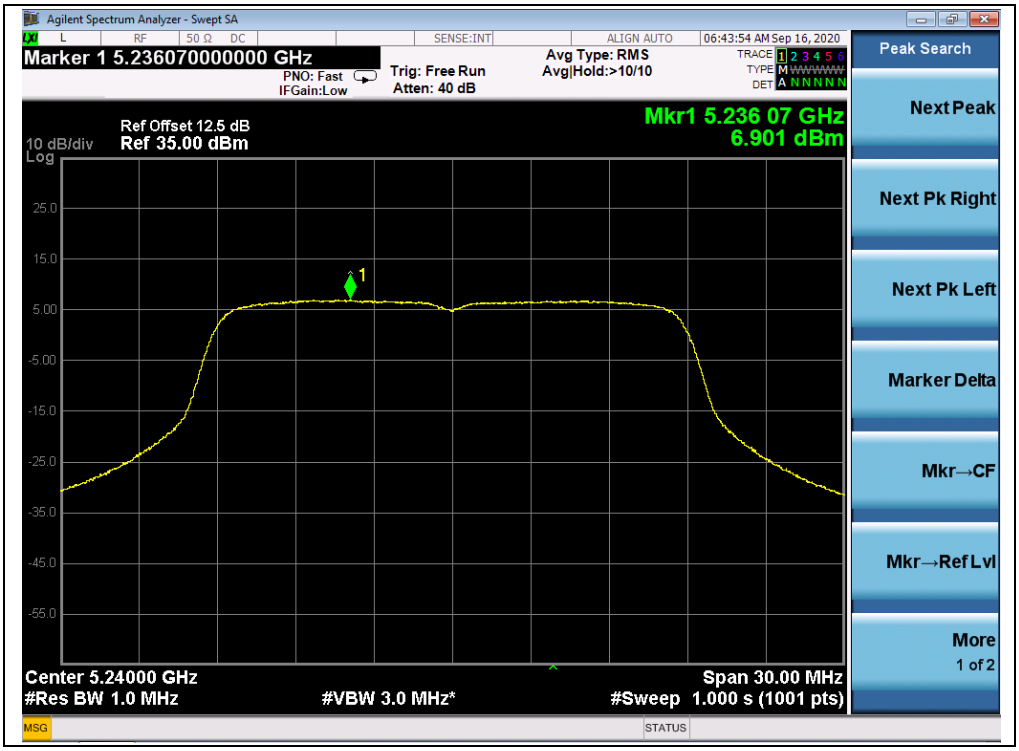
Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Duty Factor	Total PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
		ANT A	ANT B				
36	5180	6.84	7.01	0.07	10.01	10.55	PASS
44	5220	7.49	6.87		10.27		
48	5240	7.75	6.90		10.43		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Duty Factor	Total PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
		ANT A	ANT B				
149	5745	0.19	0.82	0.07	3.60	29.55	PASS
157	5785	-2.10	0.27		2.33		
165	5825	-1.31	-0.47		2.21		
Note: Directional gain =3.44dBi +10log(2) =6.45dBi＞6dBi, so the limit shall be reduced to 11-(6.45-6) = 10.55dBm dBm/MHz for 5.18-5.24 GHz band and reduced to 30-(6.45-6) = 29.55dBm dBm/500KHz for 5.745-5.825 GHz band.							

B.Test Plot:



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

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



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

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

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

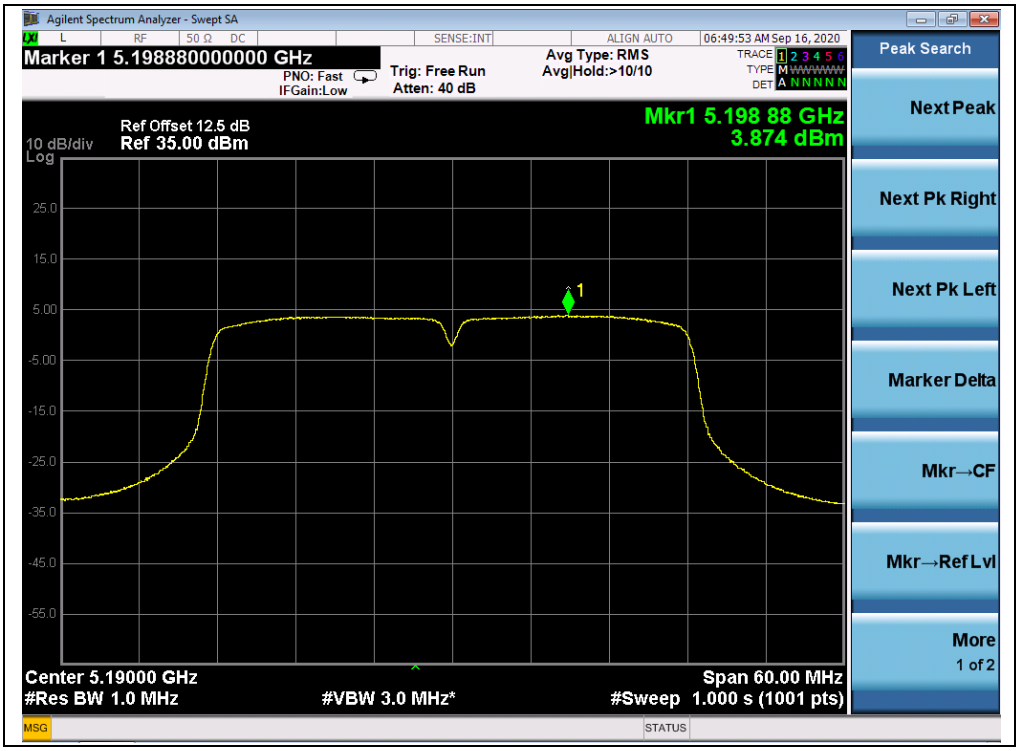
(Channel 165, 5825MHz, 802.11n (HT20), ANT B)

802.11n (HT40) Mode

A.Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)		Duty Factor	Total PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
		ANT A	ANT B				
38	5190	4.43	3.87	0.15	7.50	10.55	PASS
46	5230	4.36	3.54		7.13		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Duty Factor	Total PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
		ANT A	ANT B				
151	5755	-3.86	-2.05	0.15	0.30	29.55	PASS
159	5795	-5.31	-4.43		-1.69		
Note: Directional gain =3.44dBi +10log(2) =6.45dBi＞6dBi, so the limit shall be reduced to 11-(6.45-6) = 10.55dBm dBm/MHz for 5.18-5.24 GHz band and reduced to 30-(6.45-6) = 29.55dBm dBm/500KHz for 5.745-5.825 GHz band.							

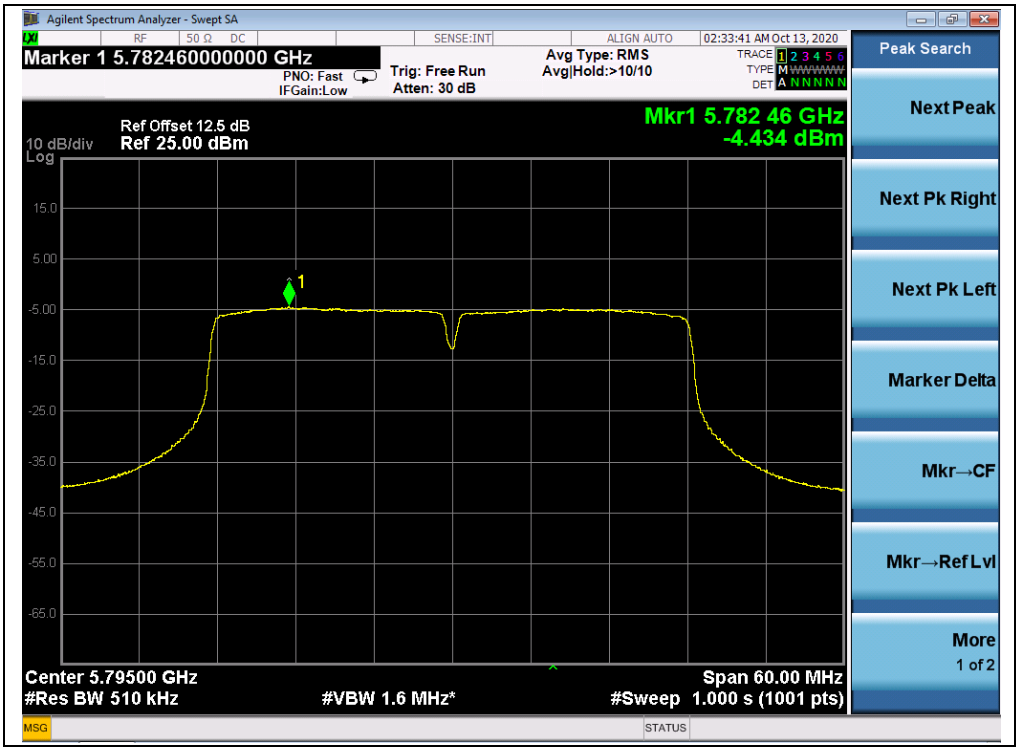
B.Test Plot:



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

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

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



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

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^{o} 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%	3.80	+20(Ref)	21	4.054
100%		-30	26	5.019
100%		-20	30	5.792
100%		-10	25	4.826
100%		0	19	3.668
100%		+10	21	4.054
100%		+20	18	3.475
100%		+30	22	4.247
100%		+40	25	4.826
100%		+50	27	5.212
85%	3.23	+20	19	3.668
115%	4.37	+20	17	3.282

U-NII-3 (Ch. 149) 5745MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Fre. Dev. (kHz)	Deviation (ppm)
100%	3.80	+20(Ref)	18	3.133
100%		-30	24	4.178
100%		-20	26	4.526
100%		-10	30	5.222
100%		0	14	2.437
100%		+10	16	2.785
100%		+20	25	4.352
100%		+30	21	3.655
100%		+40	23	4.003
100%		+50	27	4.700
85%	3.23	+20	29	5.048
115%	4.37	+20	25	4.352

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

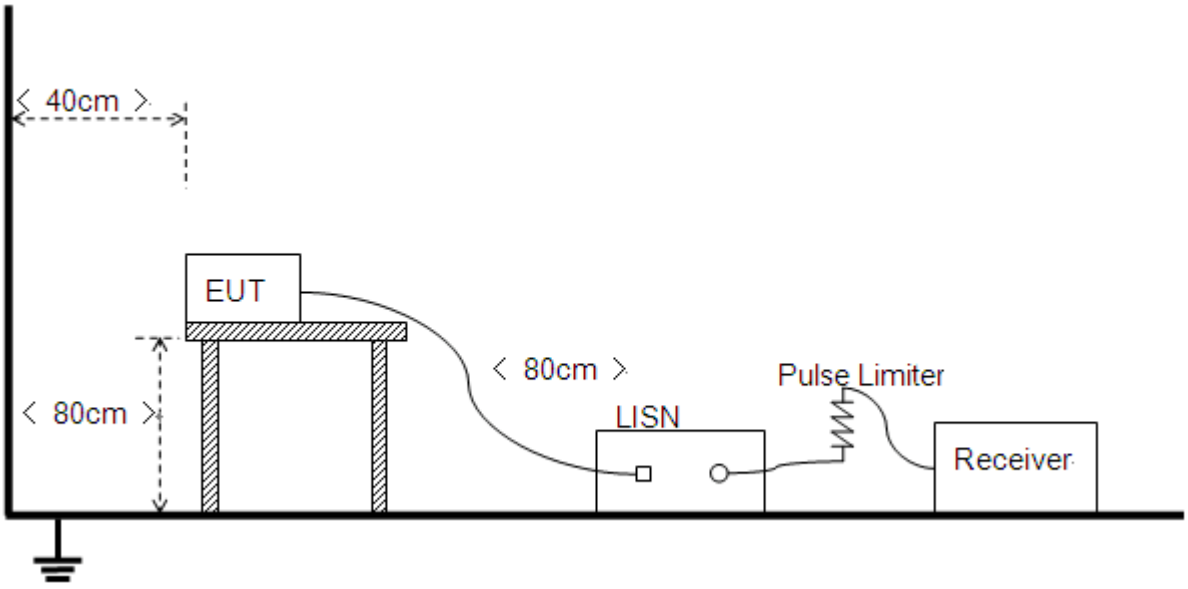
Note:

(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. Refer to recorded points and Plot 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+ +SD card + headphones + spare battery + WIFI TX

Test Voltage: AC 120V/60Hz

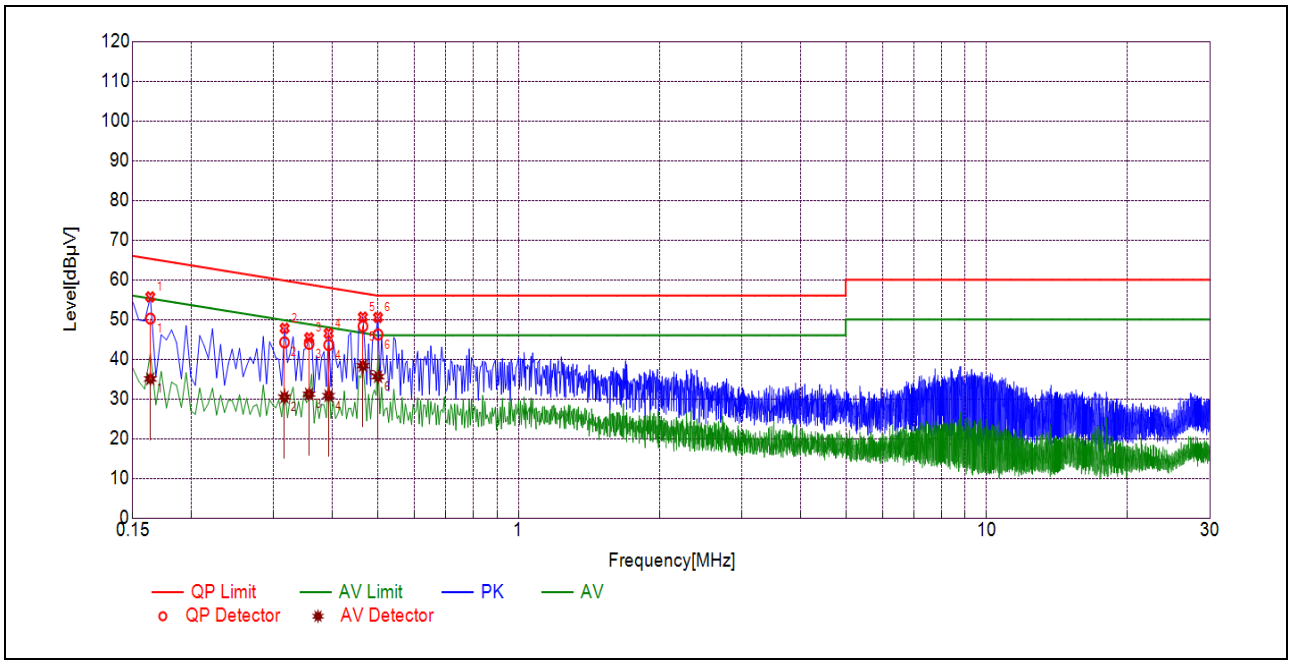
The measurement results are obtained as below:

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

U_R: Receiver Reading

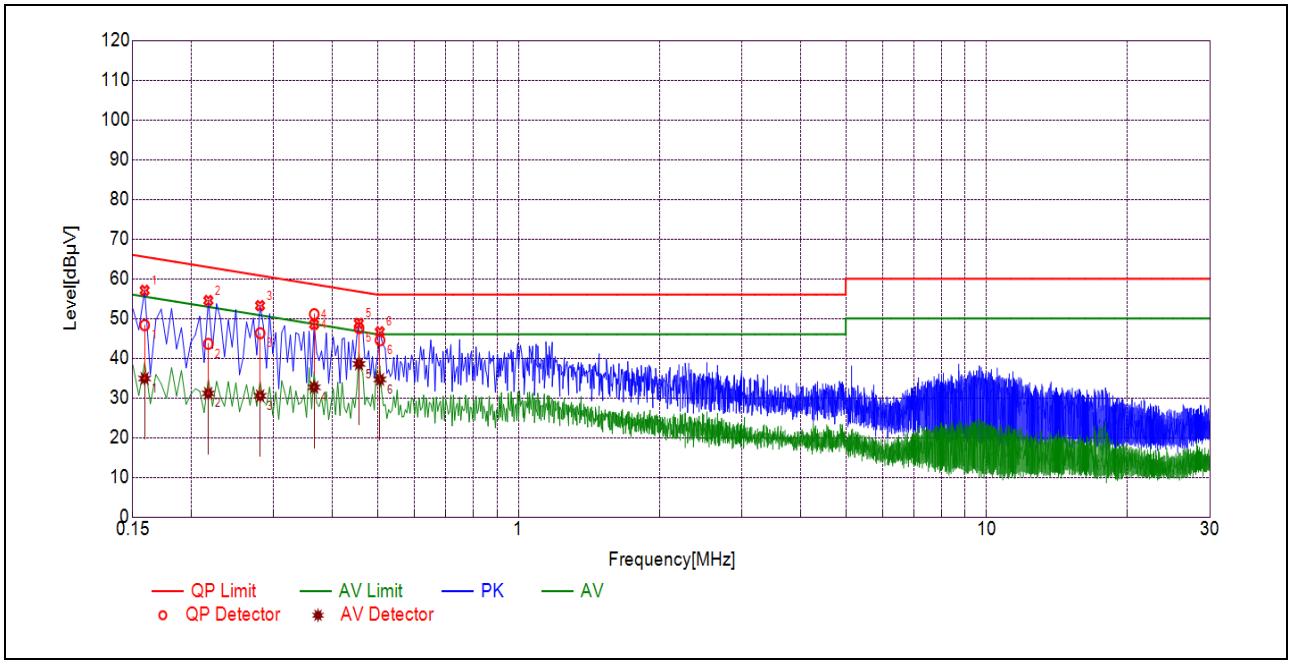
A_{Factor}: Voltage division factor of LISN

B.Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1635	50.21	35.04	65.28	55.28	Line	PASS
2	0.3162	44.25	30.47	59.81	49.81		PASS
3	0.3570	43.88	31.22	58.80	48.80		PASS
4	0.3929	43.58	30.80	58.00	48.00		PASS
5	0.4653	48.27	38.35	56.60	46.60		PASS
6	0.5012	46.22	35.60	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	0.1590	48.32	34.88	65.52	55.52	Neutral	PASS
2	0.2174	43.63	31.15	62.92	52.92		PASS
3	0.2806	46.30	30.53	60.80	50.80		PASS
4	0.3661	51.09	32.68	58.59	48.59		PASS
5	0.4564	47.58	38.55	56.76	46.76		PASS
6	0.5060	44.52	34.65	56.00	46.00		PASS

2.8. Restricted Frequency Bands

2.8.1.Requirement

The peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.

(2) For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.

(3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of -27dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

The following formula is used to convert the equipment isotropic radiated power(e.i.r.p.) to field strength (dBμV/m);

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

where P is the EIRP in Watts

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

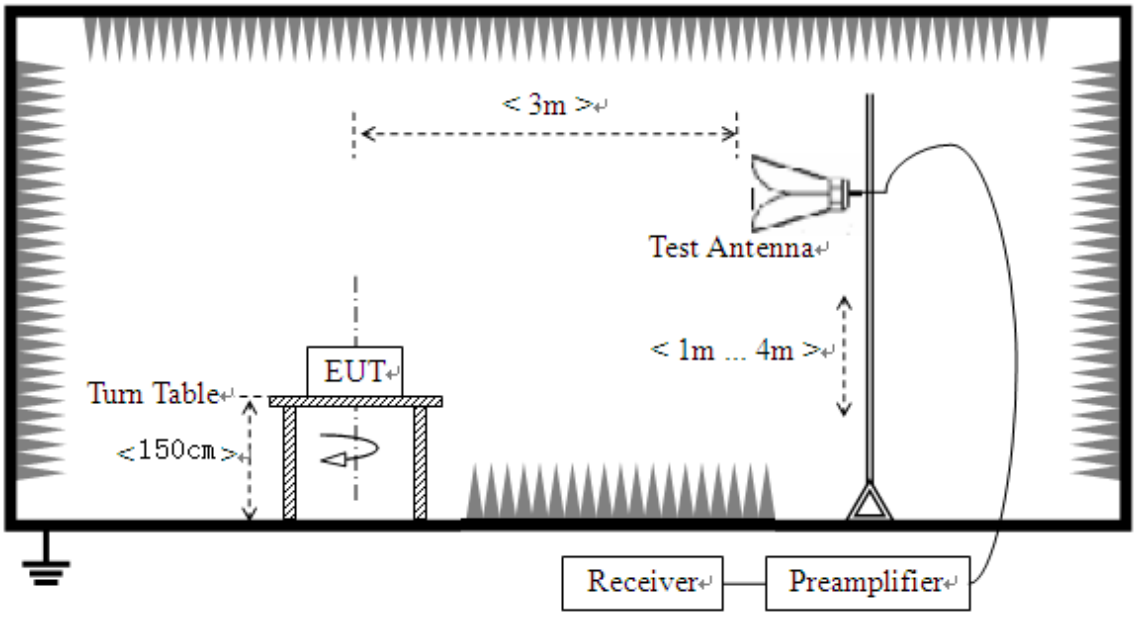
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following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

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

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)

2.8.2.Test Description

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

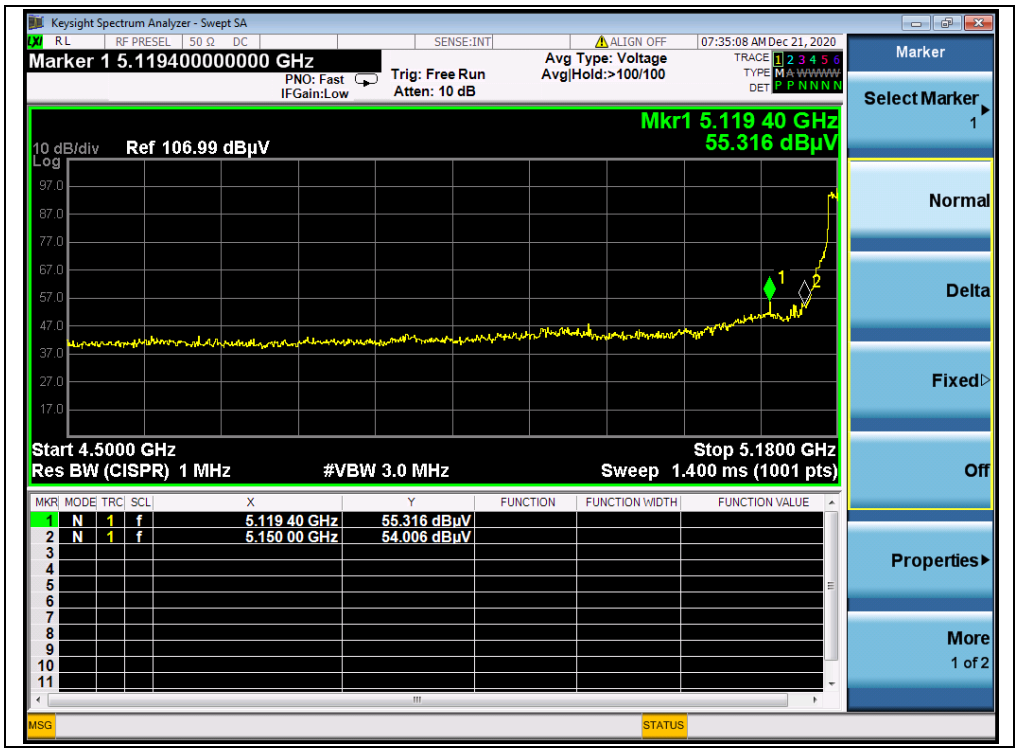
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] =U_R + A_T + A_{Factor} [dB]; A_T =$L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
A_T: Total correction Factor except Antenna; U_R: Receiver Reading
G_{preamp}: Preamplifier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

802.11a Mode

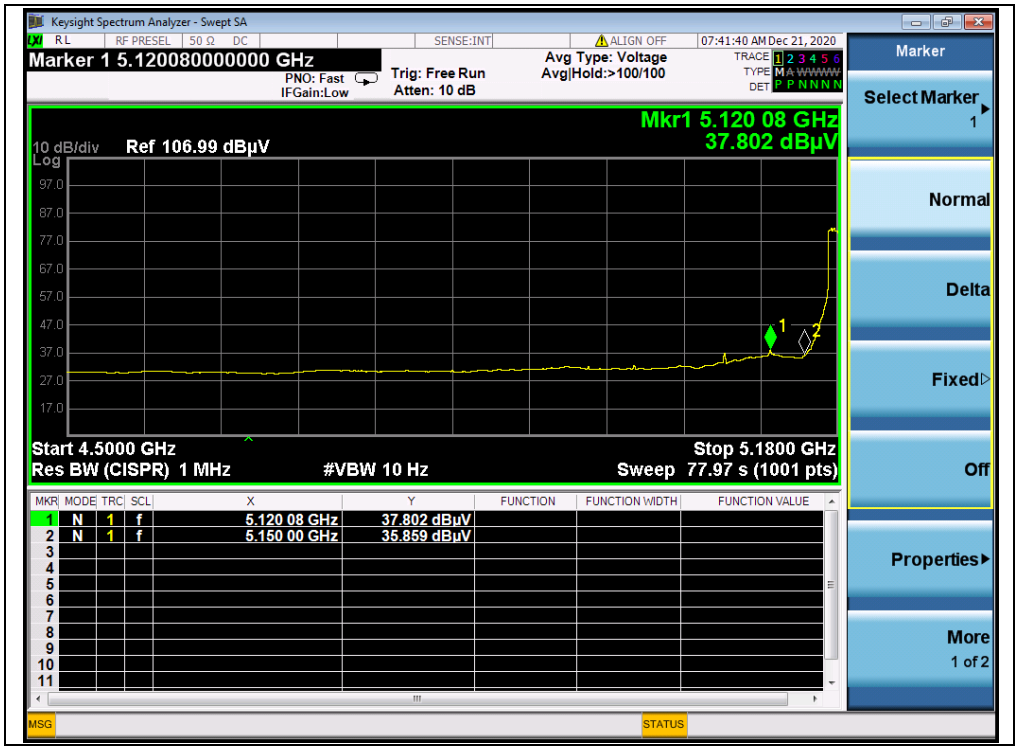
A.Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
36	5119.40	PK	55.32	-16.92	32.20	70.60	74	PASS
36	5120.08	AV	37.80	-16.92	32.20	53.08	54	PASS
48	5365.62	PK	42.85	-16.92	32.20	58.13	74	PASS
48	5359.90	AV	32.31	-16.92	32.20	47.59	54	PASS
149	5725.00	PK	64.65	-16.23	32.20	80.62	122.23	PASS
165	5850.00	PK	51.04	-16.23	32.20	67.01	122.23	PASS

B.Test Plot:

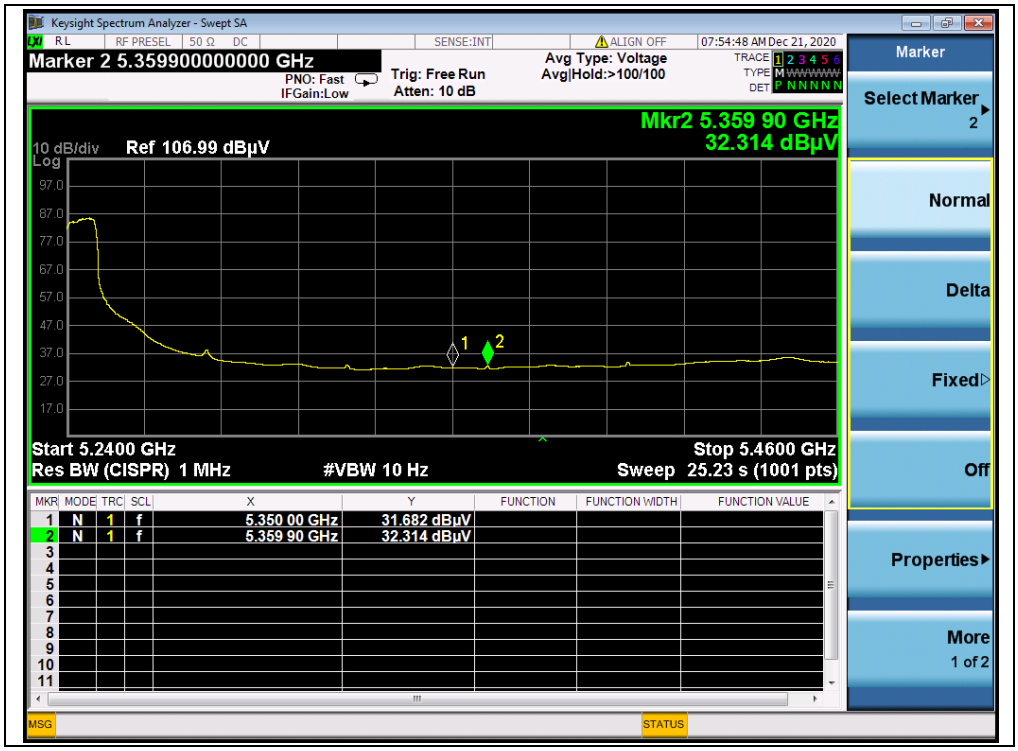


(PEAK, Channel 36, 802.11a)



(AVERAGE, Channel 36, 802.11a)

(PEAK, Channel 48, 802.11a)



(AVERAGE, Channel 48, 802.11a)

(PEAK, Channel 149, 802.11a)

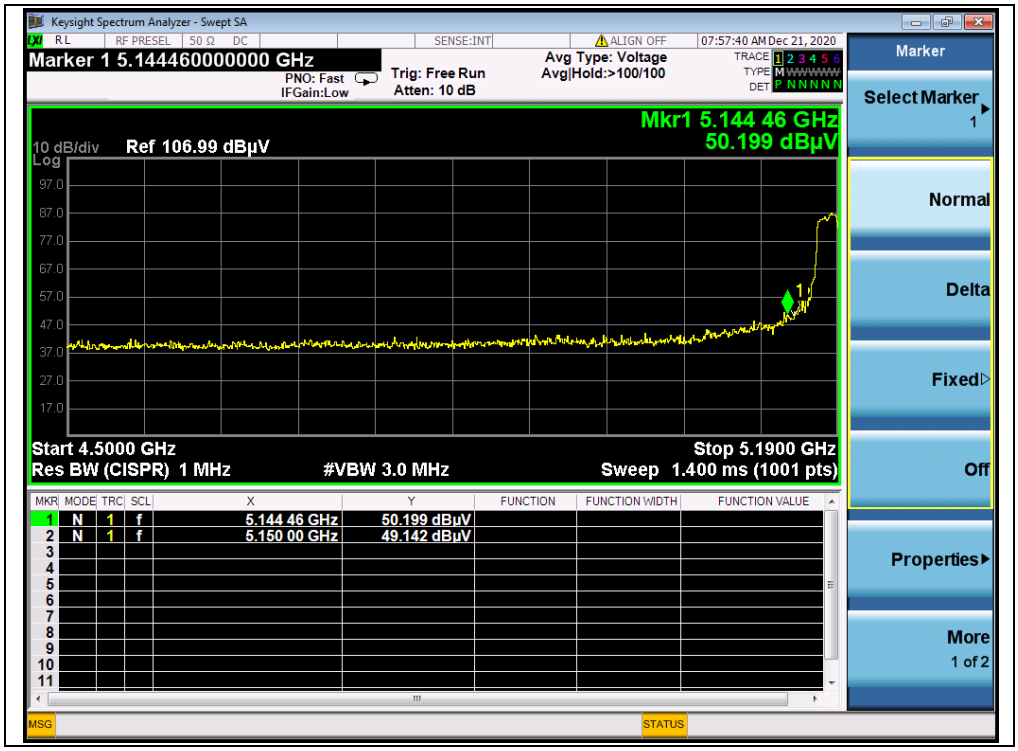
(PEAK, Channel 165, 802.11a)

802.11n (HT40) Mode

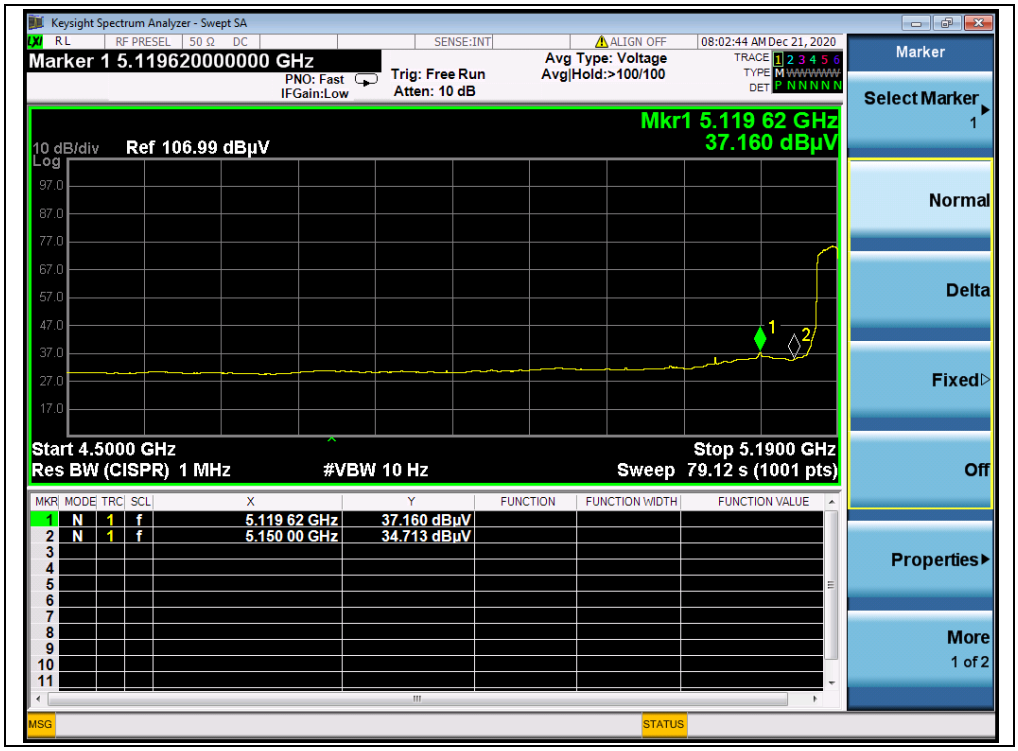
A.Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
38	5144.46	PK	50.20	-16.92	32.20	65.48	74	PASS
38	5119.62	AV	37.16	-16.92	32.20	52.44	54	PASS
48	5369.10	PK	44.34	-16.92	32.20	59.62	74	PASS
48	5364.26	AV	33.95	-16.92	32.20	49.23	54	PASS
151	5725.00	PK	64.23	-16.23	32.20	80.20	122.23	PASS
159	5850.00	PK	47.32	-16.23	32.20	63.29	122.23	PASS

B.Test Plot:

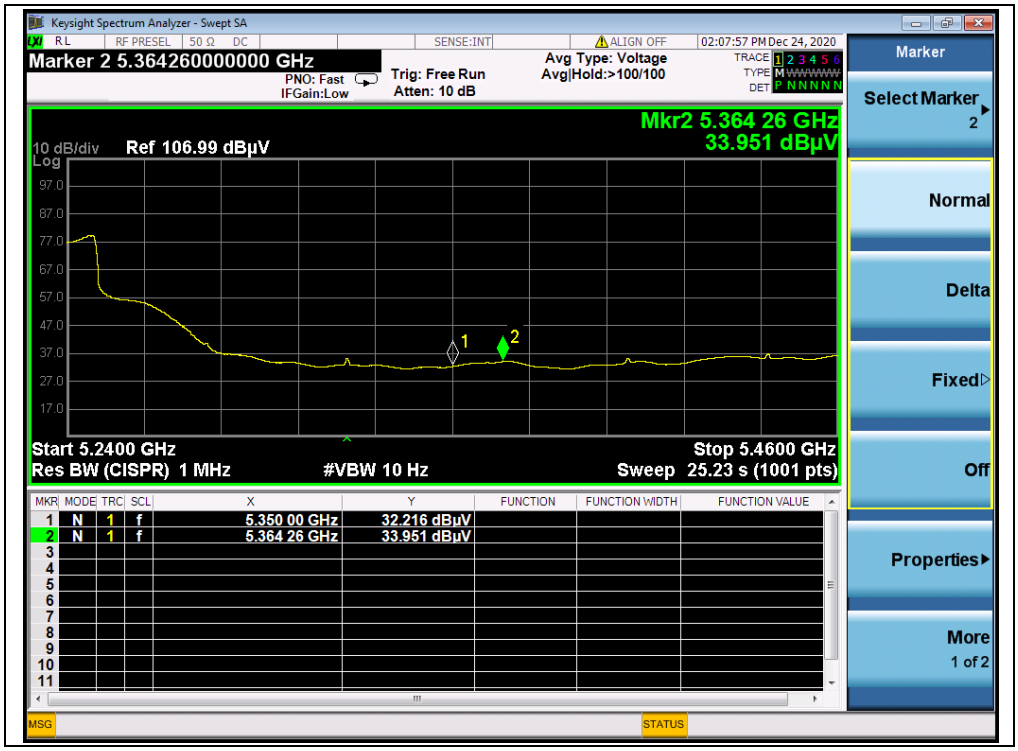


(PEAK, Channel 38, 802.11n (HT40))



(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))

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:

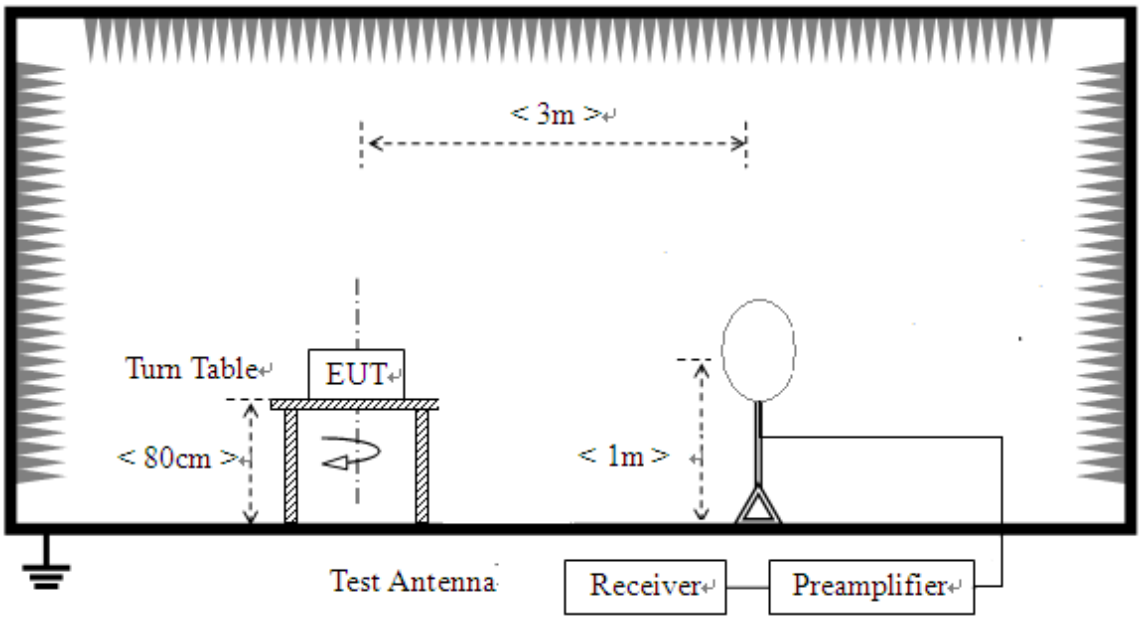
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

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)

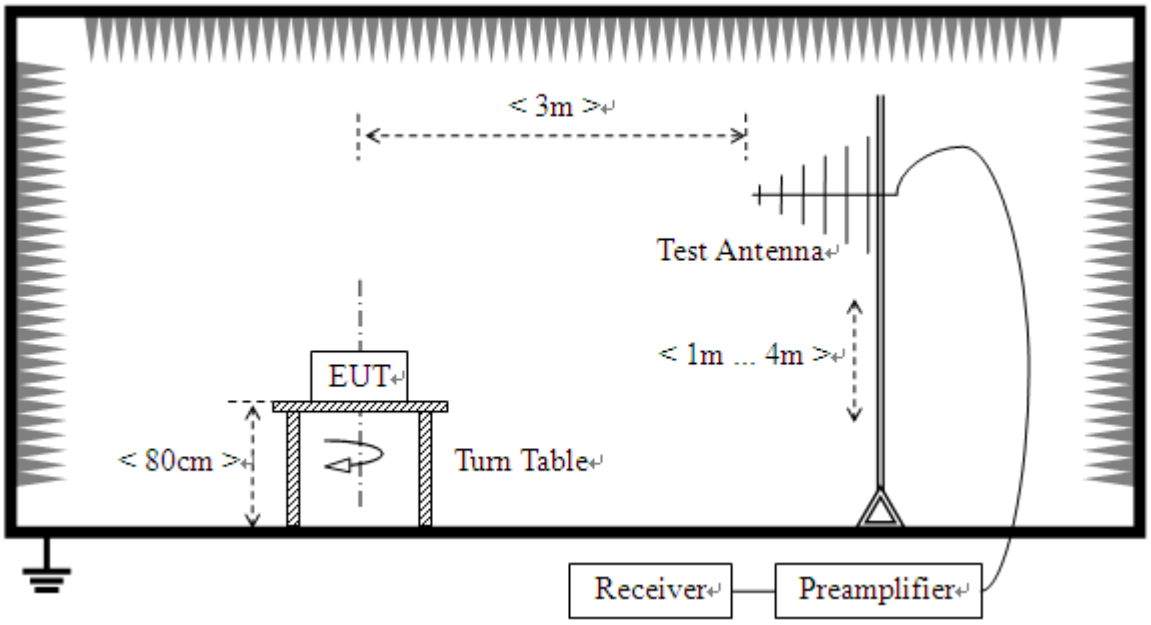
2.9.2.Test Description

Test Setup:

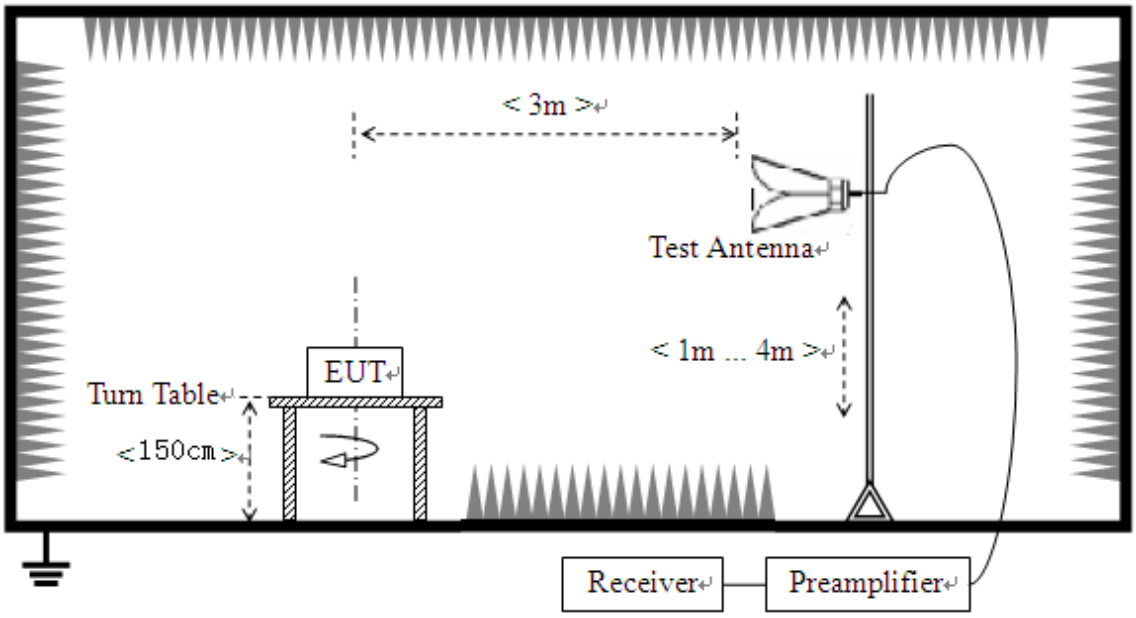
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



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

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

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

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

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

2.9.3.Test Result

According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak (or average) limit, it is unnecessary to perform an quasi-peak measurement (or average).

The measurement results are obtained as below:

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

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

During the test, the total correction Factor A_T and A_{Factor} were built in test software.

Note 1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

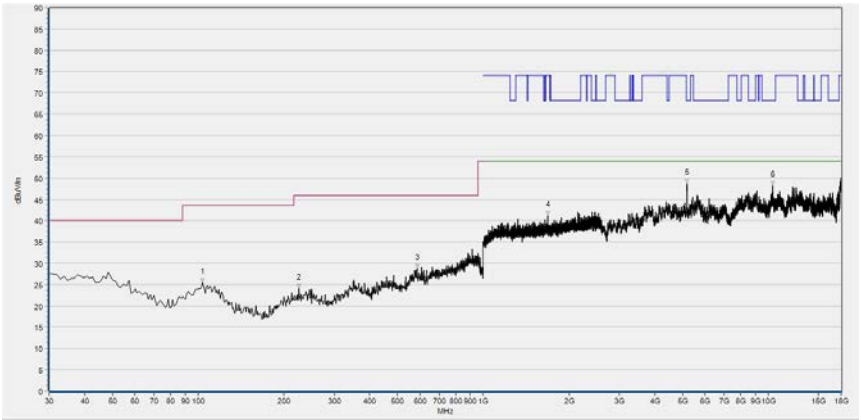
Note 2: For the frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Note 3: For the frequency, which started from 18GHz to 40GHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Note 4: All test modes and bandwidth were considered and evaluated respectively by performing full test, only the worst data were recorded for each bandwidth.

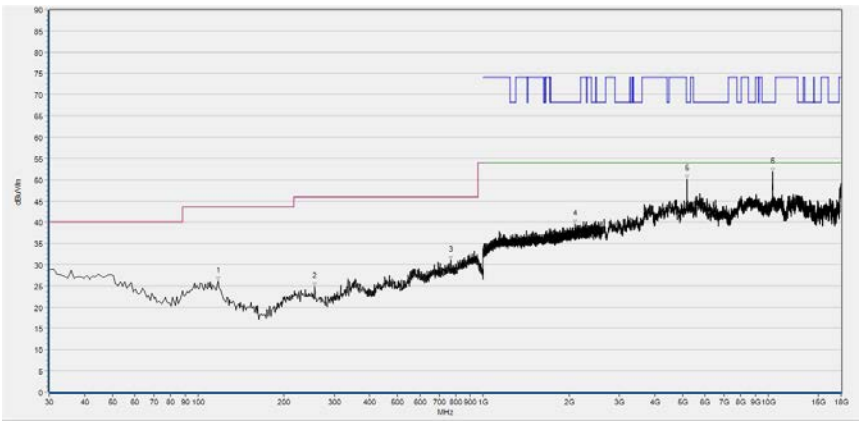
802.11a Mode

Plot for Channel 36



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
103.794	25.50	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
225.165	24.13	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
587.337	28.86	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1680.227	41.19	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5184.637	48.69	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
10356.991	48.27	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

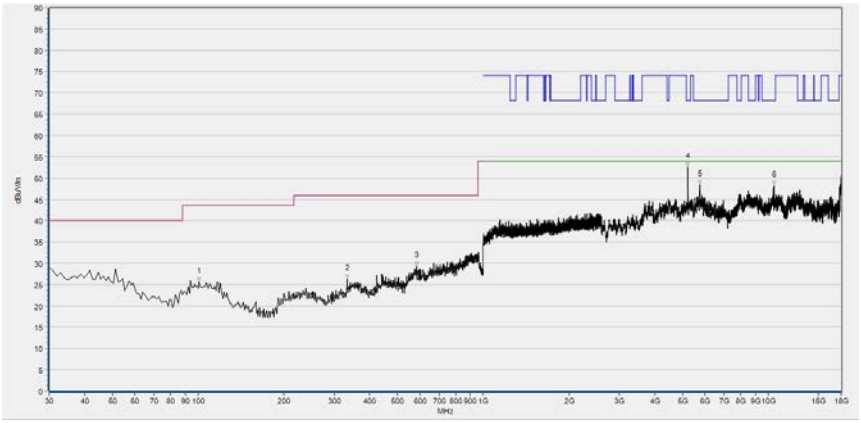
(Antenna Horizontal, 30MHz to 18GHz)



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
117.387	26.16	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
256.236	24.82	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
770.851	31.05	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2100.634	39.59	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5187.718	50.08	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
10364.000	56.37	N/A	38.56	68.23	N/A	N/A	Vertical	PASS

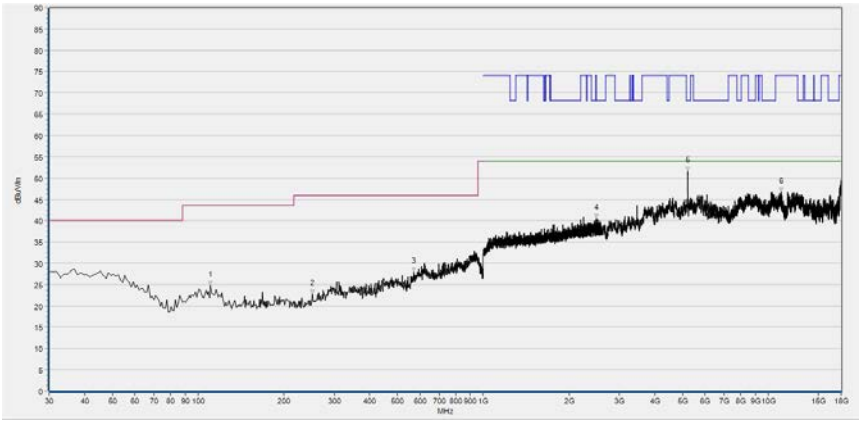
(Antenna Vertical, 30MHz to 18GHz)

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
100.881	25.62	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
332.943	26.27	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
583.453	29.29	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5215.443	52.66	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
5745.309	48.38	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
10443.249	48.34	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS

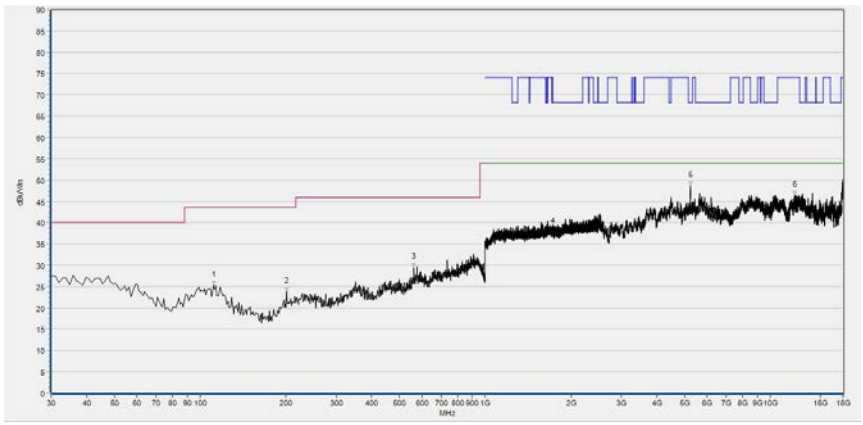
(Antenna Horizontal, 30MHz to 18GHz)



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
110.591	24.79	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
251.381	22.71	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
571.802	27.92	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2495.432	40.50	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5212.362	51.63	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
11124.065	46.82	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

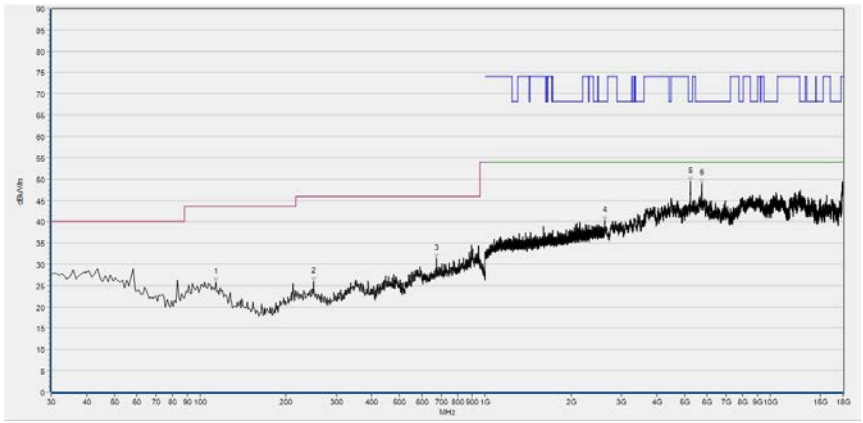
(Antenna Vertical, 30MHz to 18GHz)

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
111.562	25.26	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
200.891	23.88	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
562.092	29.44	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1719.707	39.52	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5233.927	48.54	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
12134.507	46.43	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

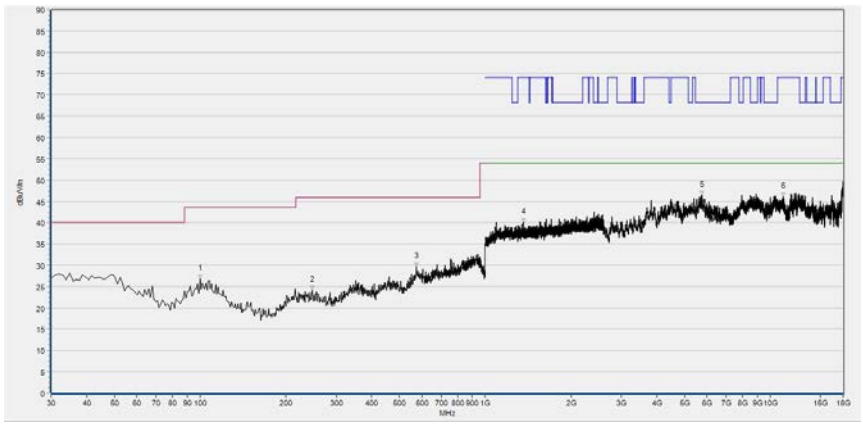
(Antenna Horizontal, 30MHz to 18GHz)



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
113.504	25.89	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.439	25.90	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
675.696	31.33	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2621.564	40.14	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5233.927	49.37	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5736.067	48.94	N/A	N/A	68.23	N/A	N/A	Vertical	PASS

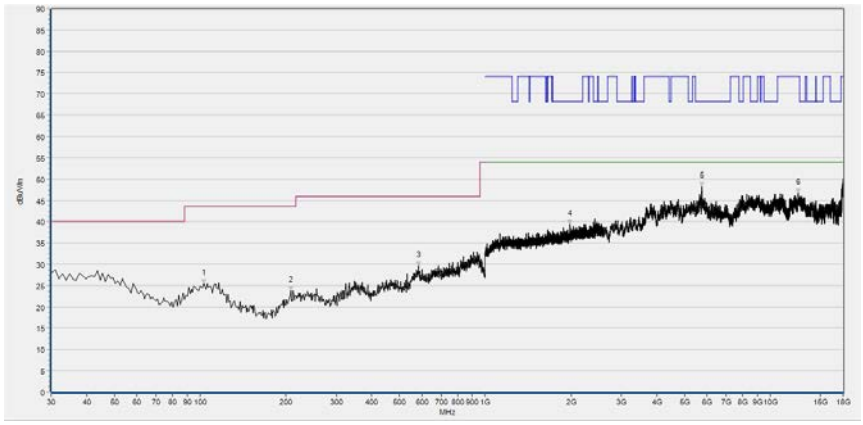
(Antenna Vertical, 30MHz to 18GHz)

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
99.910	26.75	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
247.497	24.10	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
572.773	29.69	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1357.986	40.00	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5748.390	46.46	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
11120.984	46.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

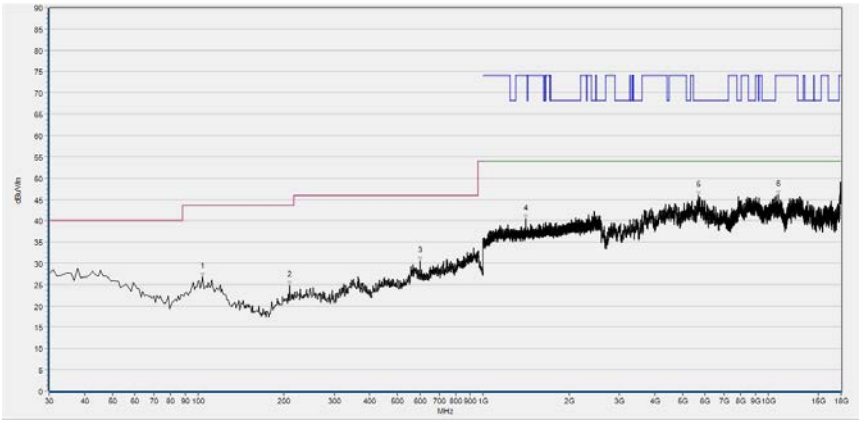
(Antenna Horizontal, 30MHz to 18GHz)



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
102.823	25.55	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
207.688	23.75	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
582.482	29.72	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1983.795	39.39	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5745.309	48.27	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12507.261	46.83	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

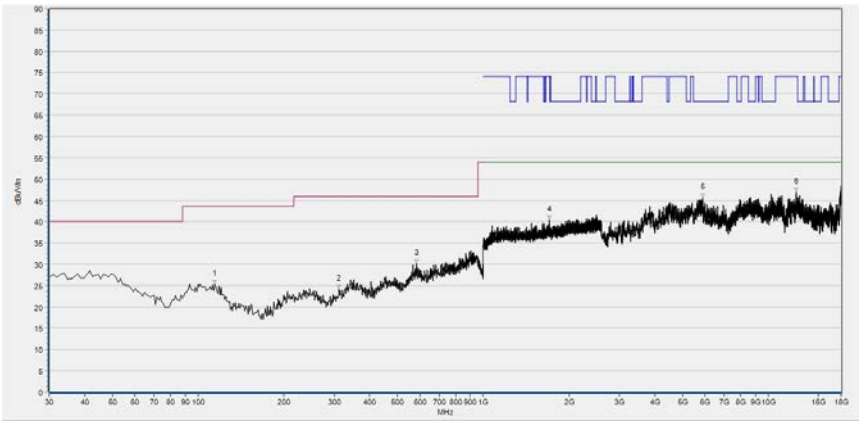
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 157



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
103.794	26.81	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
209.630	24.73	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
600.931	30.45	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1406.536	40.39	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5689.858	45.92	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
10822.164	46.02	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

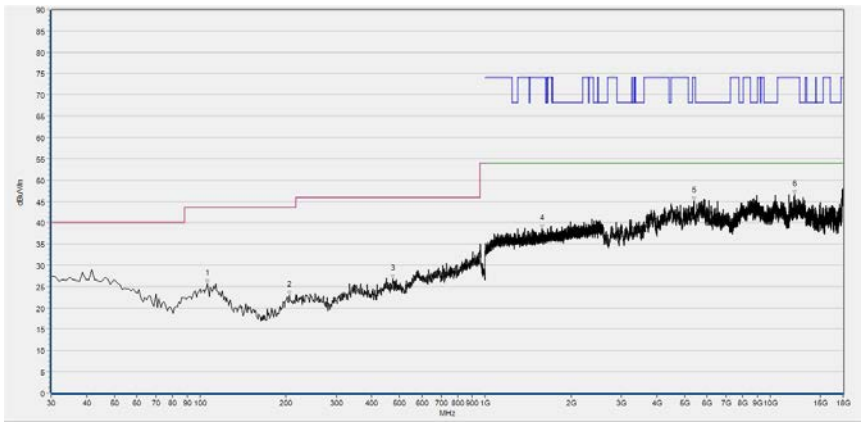
(Antenna Horizontal, 30MHz to 18GHz)



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
114.474	25.23	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
311.582	24.21	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
582.482	30.20	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1706.369	40.41	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5883.937	45.54	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
12553.471	46.99	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

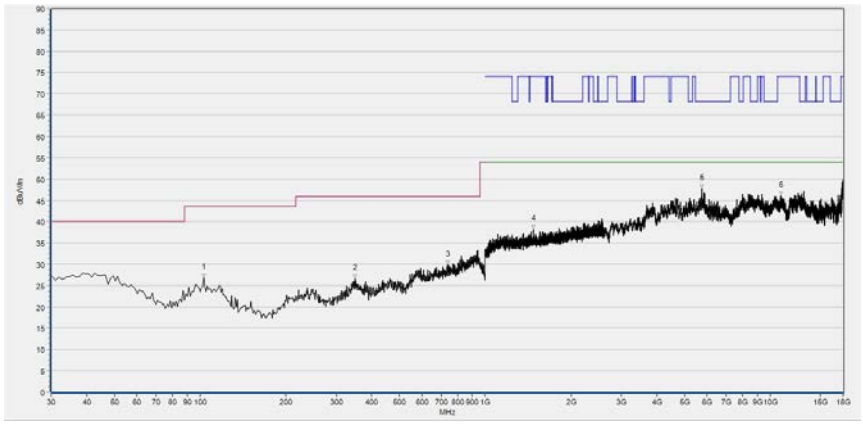
(Antenna Vertical, 30MHz to 18GHz)

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
105.736	25.61	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
205.746	22.93	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
473.734	26.77	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1582.594	38.63	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5387.958	45.06	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12146.829	46.67	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

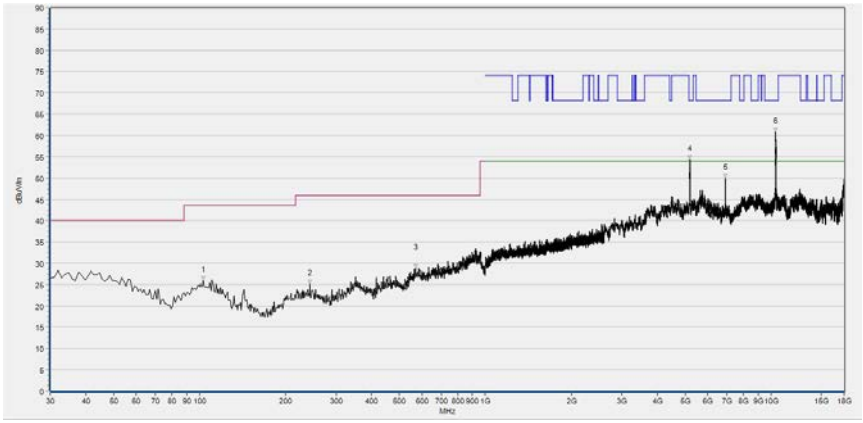


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
102.823	26.77	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
348.478	26.59	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
738.809	29.77	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1478.560	38.22	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5754.551	47.72	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
10908.422	46.11	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

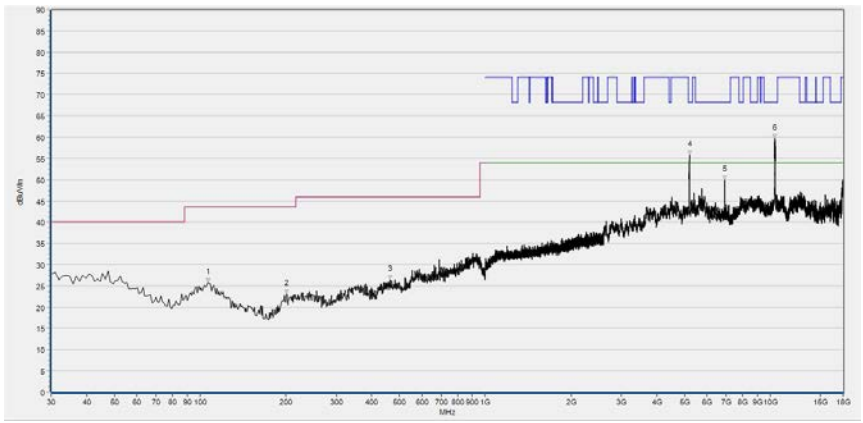
802.11n (HT40) mode

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
102.823	26.02	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
243.614	25.14	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
568.889	28.85	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5196.959	54.37	N/A	N/A	68.23	N/A	N/A	Horizontal	N/A
6919.024	49.98	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
10375.475	60.84	N/A	42.81	68.23	N/A	N/A	Horizontal	PASS

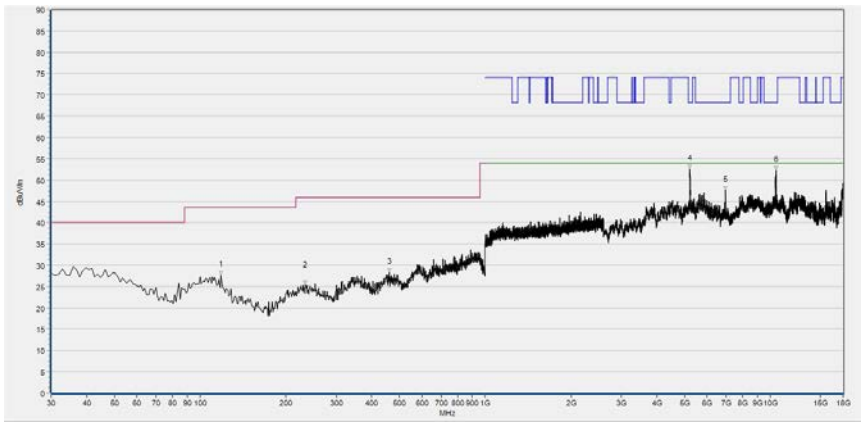
(Antenna Horizontal, 30MHz to 18GHz)



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
106.707	25.84	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
200.891	23.10	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
464.024	26.40	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
5200.040	55.86	N/A	N/A	68.23	N/A	N/A	Vertical	N/A
6919.024	49.87	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
10375.475	59.58	N/A	49.16	68.23	N/A	N/A	Vertical	PASS

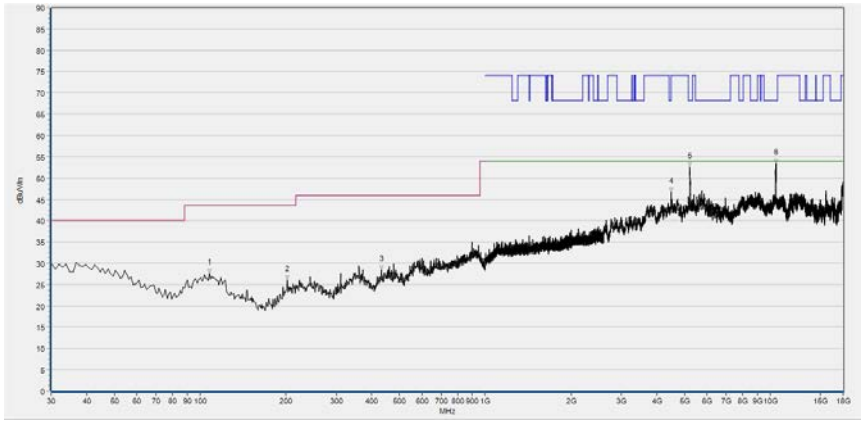
(Antenna Vertical, 30MHz to 18GHz)

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
118.358	27.73	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
233.904	25.53	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
460.140	28.30	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
5218.524	52.60	N/A	N/A	68.23	N/A	N/A	Horizontal	N/A
6974.475	47.61	N/A	N/A	68.23	N/A	N/A	Horizontal	PASS
10456.001	51.85	N/A	35.76	68.23	N/A	N/A	Horizontal	PASS

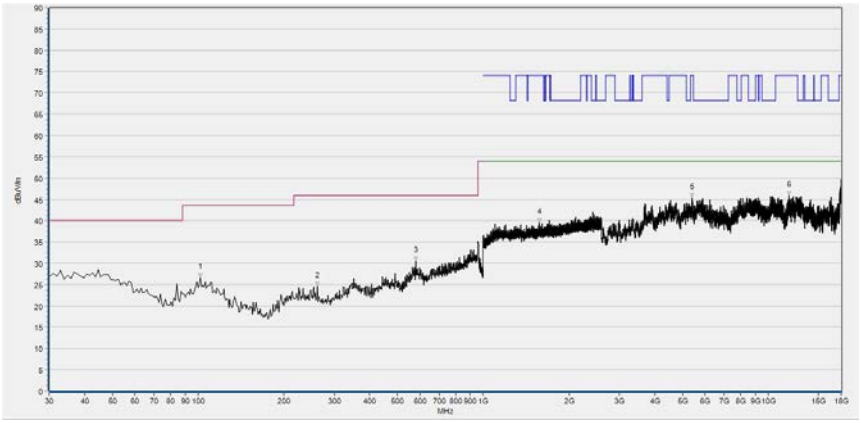
(Antenna Horizontal, 30MHz to 18GHz)



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
107.678	27.67	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
201.862	26.17	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
431.982	28.56	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
4479.176	46.68	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5215.443	52.62	N/A	N/A	68.23	N/A	N/A	Vertical	N/A
10455.571	53.47	N/A	44.70	68.23	N/A	N/A	Vertical	PASS

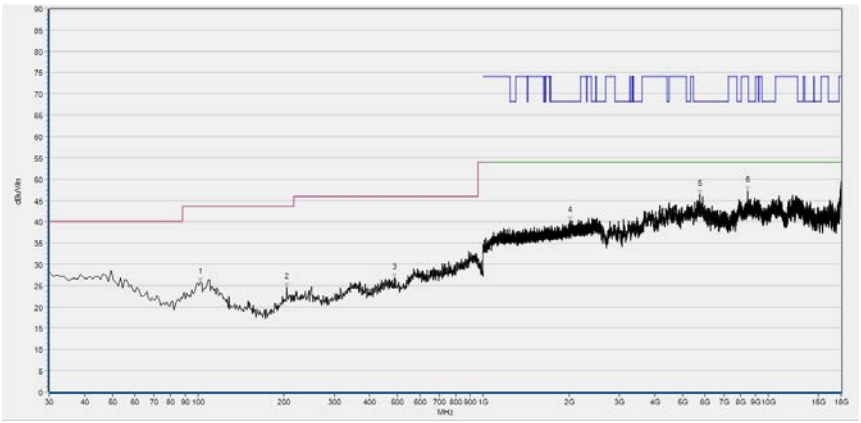
(Antenna Vertical, 30MHz to 18GHz)

Plot for Channel 151



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
101.852	26.65	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
262.062	24.69	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
578.599	30.57	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1570.323	39.56	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5400.280	45.39	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
11841.848	45.86	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

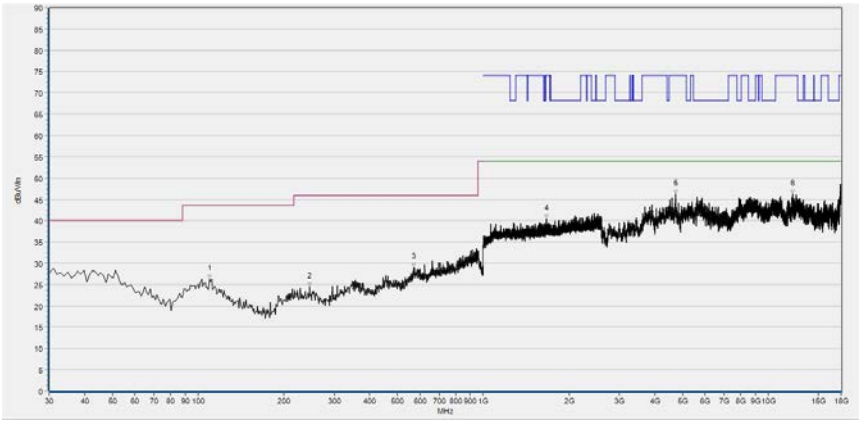
(Antenna Horizontal, 30MHz to 18GHz)



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
101.852	25.81	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
204.775	24.63	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
488.298	26.86	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2011.004	40.26	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5757.632	46.35	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
8453.171	47.25	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

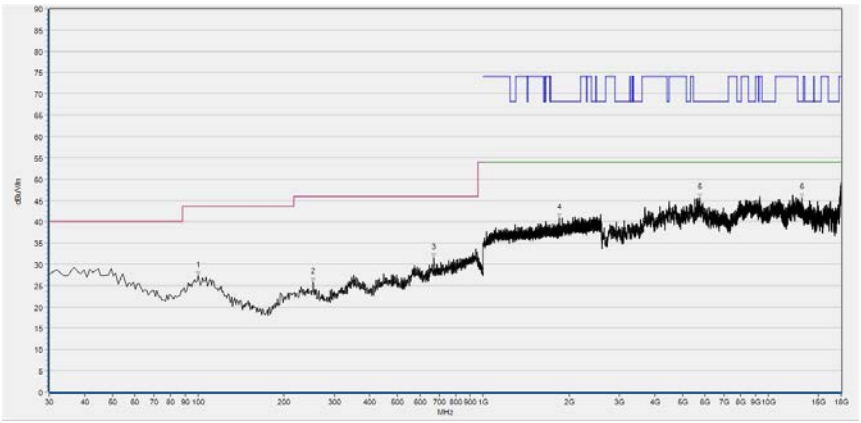
(Antenna Vertical, 30MHz to 18GHz)

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
109.620	26.28	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
246.527	24.44	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
570.831	28.91	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1661.020	40.34	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4734.867	46.19	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12196.119	46.18	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
99.910	27.37	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
253.323	25.88	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
671.812	31.52	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1852.551	40.83	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
5760.712	45.53	N/A	N/A	68.23	N/A	N/A	Vertical	PASS
13138.788	45.61	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 (PSD)	±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. 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 C63.10-2013and 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	2020.04.01	2021.03.31
USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2020.04.01	2021.03.31
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	2020.01.08	2021.01.07

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY56400093	N9038A	KEYSIGHT	2020.03.26	2021.03.25
LISN	812744	NSLK 8127	Schwarzbeck	2020.03.26	2021.03.25
Pulse Limiter (10dB)	VTSD 9561 F-B #206	VTSD 9561-F	Schwarzbeck	2020.07.24	2021.07.23
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A
Adapter	K68249G620 9896	HW-05920 0CHQ	HUAWEI	NA	NA

4.3 List of Software Used

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

4.4Radiated Test Equipments

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

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

END OF REPORT