REPORT No.: SZ19050100W04

TEST REPORT

APPLICANT	:	dormakaba EAD GmbH
PRODUCT NAME	:	data collection terminal
MODEL NAME	:	9600-K6 BLE WiFi
BRAND NAME	:	dormakaba
FCC ID	:	NVI-KT9600K6BWL
STANDARD(S)	:	47 CFR Part 15 Subpart E
RECEIPT DATE	:	2019-05-20
TEST DATE	:	2019-10-29 to 2019-11-06
ISSUE DATE	:	2019-11-12

Edited by: Zeng Xiaoying (Rapporteur)

Approved by: Peng Huarui (Supervisor)

MORLAB

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DIRECTORY

Change History		
Version	**Date**	**Reason for change**
1.0	2019-11-12	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	dormakaba EAD GmbH
Applicant Address:	Albertistr. 3, 78056 Villingen-Schwenningen, Germany
Manufacturer:	In-Tech Electronics Ltd
Manufacturer Address:	Unit A,13/F, Wing Tai Centre,12 Hing Yip Street, Kwun Tong Kowloon, Hong Kong

1.2. Equipment Under Test (EUT) Description

Product Name:	data collection terminal	
Serial No:	(N/A, marked #1 by test site)	
Hardware Version:	02	
Software Version:	V5	
Modulation Technology:	OFDM	
Modulation Mode:	802.11a, 802.11n(HT20), 802.11n(HT40)	
Operating Frequency Range:	5.180 GHz- 5.240 GHz; 5.260 GHz -5.320 GHz ; 5.500 GHz -5.720 GHz ; 5.745GHz- 5.825GHz	
Channel Number:	Refer to 1.4	
Antenna Type:	PCB Antenna	
Antenna Gain:	5.1dBi	
Accessory Information:	Battery	
	Brand Name:	Renata
	Model No.:	CR2450N
	Serial No.:	(N/A, marked #1 by test site)
	Capacity:	540mAh
	Rated Voltage:	3.0V
	Charge Limit:	N/A

Note 1: WIFI hotspot does not support U-NII band.

Note 2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. Modulation Type and Data Rate of EUT

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

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

1.4. The Channel Number and Frequency

Frequency Range: 5180MHz-5240MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**36**	**5180**	40	5200
	44	**5220**	**48**	**5240**
40MHz	**38**	**5190**	**46**	**5230**
Frequency Range: 5260MHz-5320MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**52**	**5260**	56	5280
	60	**5300**	**64**	**5320**
40MHz	**54**	**5270**	**62**	**5310**
Frequency Range: 5500MHz-5720MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**100**	**5500**	105	5520
	108	5540	112	5560
	116	5580	**120**	**5600**
	124	5620	128	5640
	132	5660	136	5680
	140	5700	**144**	**5720**
40MHz	**102**	**5510**	110	5550
	118	5590	**126**	**5630**
	134	5670	**142**	**5710**
Frequency Range: 5745-5825MHz				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	**149**	**5745**	153	5765
	157	**5785**	161	5805
	165	**5825**		
40MHz	**151**	**5775**	**159**	**5795**

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

1.5. Test Standards and Results

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

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

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

No.	Section	Description	Test Date	Test Engineer	Result	Method determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	ANSI C63.10	Duty Cycle of the test signal	Oct 29, 2019	Wang Meng	PASS	No deviation
3	15.407(a)	Maximum conducted output Power	Oct 30, 2019	Wang Meng	PASS	No deviation
4	15.407(a)(e)	Emission Bandwidth	Oct 29, 2019	Wang Meng	PASS	No deviation
5	15.407(a)	Maximum Power spectral density	Oct 29, 2019	Wang Meng	PASS	No deviation
6	15.407(g)	Frequency Stability	Oct 29, 2019	Wang Meng	PASS	No deviation
7	15.207	Conducted Emission	Nov 06, 2019	Lin Jiayong	PASS	No deviation
8	15.407(b)	Restricted Frequency Bands	Nov 05, 2019	Peng Xuewei	PASS	No deviation
9	15.407(b)	Radiated Emission	Nov 05, 2019	Peng Xuewei	PASS	No deviation

Note1: The DFS test report was documented in a separate report (Report No.: SZ19050100W05).

Note2: The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.10 2013.

Note3: These RF tests were performed according to the method of measurements prescribed in KDB789033 D02 General UNII Test Procedures New Rules v02r01.

Note4: The path loss during the RF test is calibrated to correct the results by the offset setting

in the test equipments. The ref offset 13dB contains two parts that cable loss 3dB and Attenuator 10dB.

Note 5: 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.

1.6. 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. Result: Compliant

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

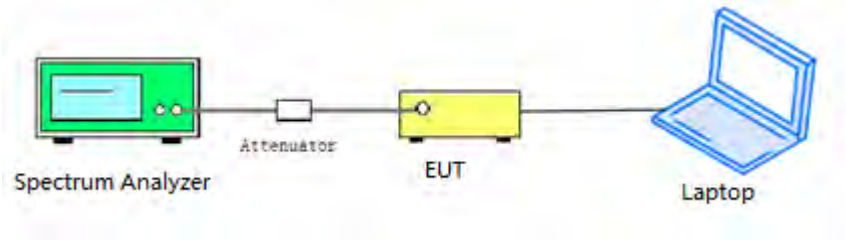
2.2. Duty Cycle of the Test Signal

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 ±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

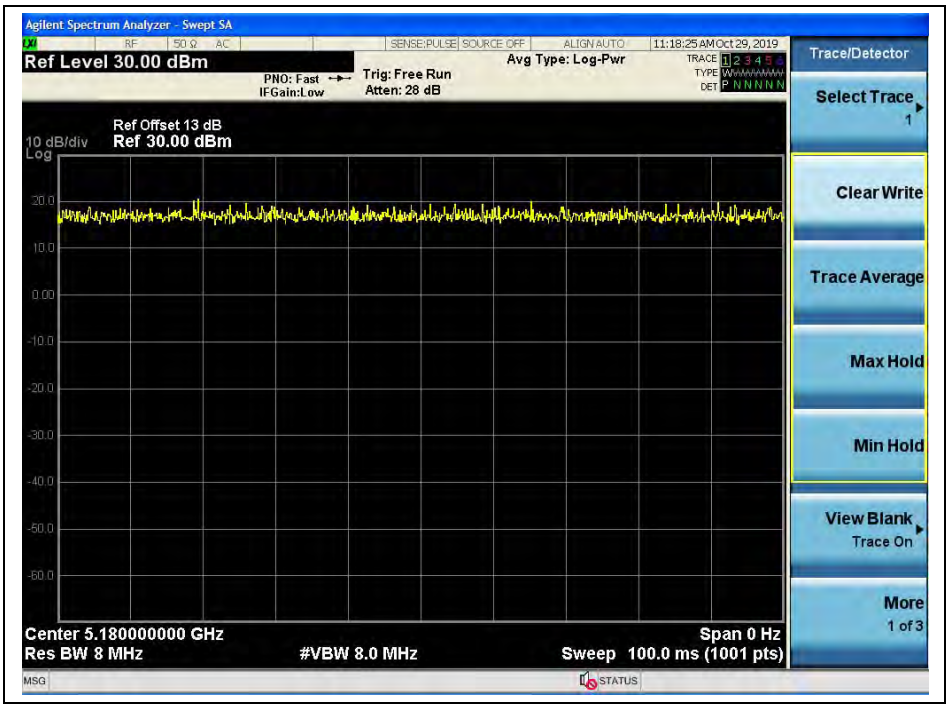
KDB 789033 Section B was used in order to prove compliance.

2.2.4. Test Result

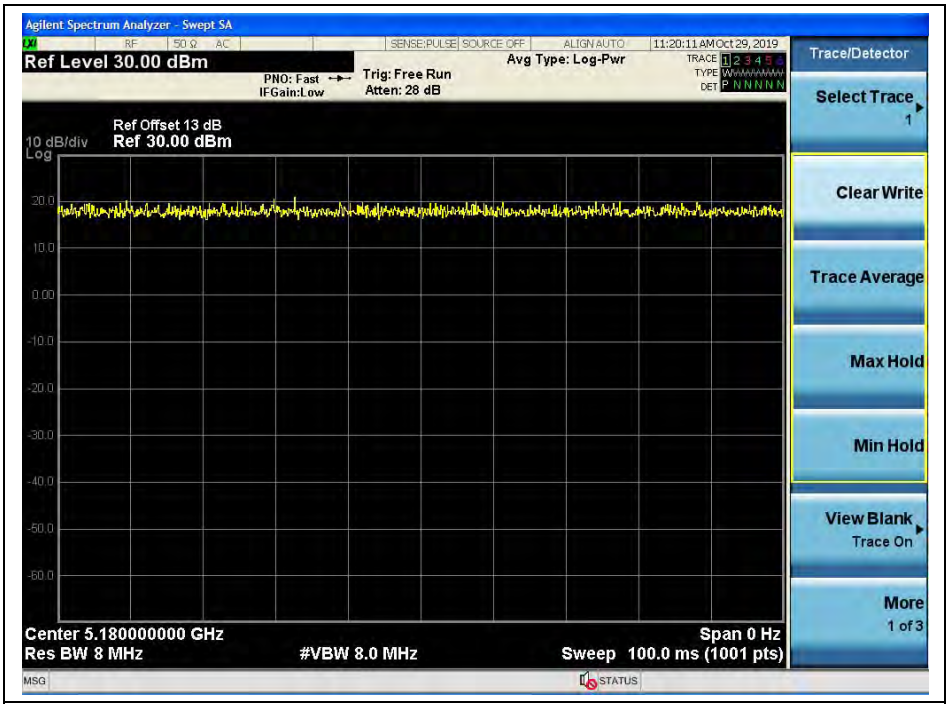
A. Test Verdict:

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

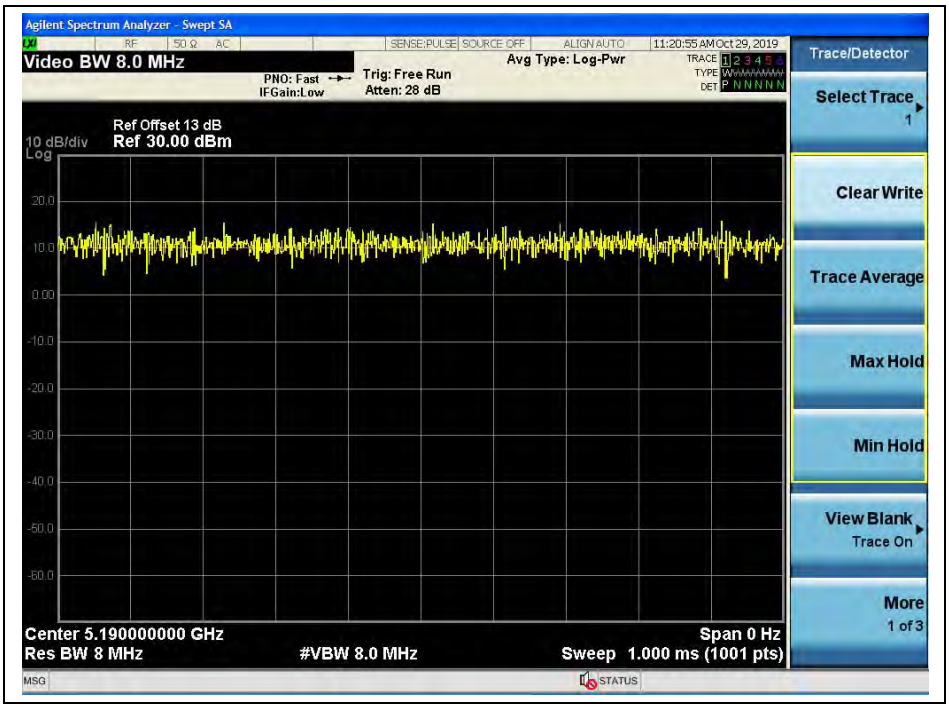
B. Test Plots



(CH36_5180MHz_802.11a)



(CH36_5180MHz _802.11n(HT20))



(CH38_5190MHz _802.11n(HT40))

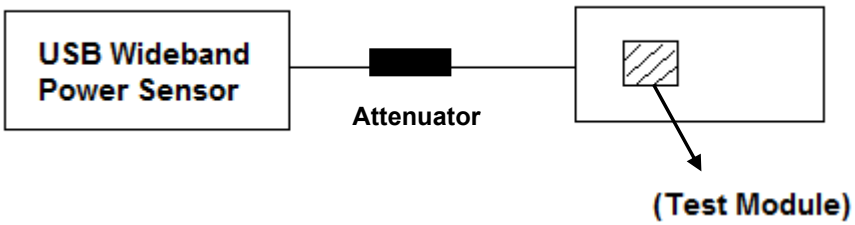
2.3. Maximum Conducted Output Power

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 250 mW provided the maximum antenna gain does not exceed 6 dBi.
(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 250 mW or 11 dBm + 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 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(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.

2.3.3. Limits

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

Mode	Band	Channel (MHz)	26dB BW (MHz)	11+10log(26dB BW)	Limits (dBm)
a	UNII-2a	5260	25.17	25.01	24.00
		5300	23.23	24.66	24.00
		5320	23.62	24.73	24.00
	UNII-2c	5500	26.08	25.16	24.00
		5600	23.78	24.76	24.00
		5720	23.87	24.78	24.00
n20	UNII-2a	5260	25.03	24.98	24.00
		5300	25.36	25.04	24.00
		5320	26.32	25.20	24.00
	UNII-2c	5500	27.71	25.43	24.00
		5600	26.92	25.30	24.00
		5720	24.72	24.93	24.00

2.3.4. Test Result

Maximum Average Conducted Output Power

802.11a Test mode

Frequency (MHz)	Average Power (dBm)				Limit (dBm)		Verdict
	Measured	Duty Factor	Duty factor Calculated				
	dBm		dBm	W	dBm	W	
5180	12.68	0.00	12.68	0.019	24	0.25	PASS
5220	12.07		12.07	0.016			
5240	12.16		12.16	0.016			
5260	12.20		12.20	0.017			
5300	12.23		12.23	0.017			
5320	12.52		12.52	0.018			
5500	13.68		**13.68**	**0.023**			
5600	12.58		12.58	0.018			
5720	12.71		12.71	0.019			
5745	12.92		12.92	0.020	30	1	
5785	13.26		13.26	0.021			
5825	13.27		13.27	0.021			

802.11 n (HT20) Test mode

Frequency (MHz)	Average Power (dBm)				Limit (dBm)		Verdict
	Measured	Duty Factor	Duty factor Calculated				
	dBm		dBm	W	dBm	W	
5180	12.86	0.00	12.86	0.019	24	0.25	PASS
5220	12.39		12.39	0.017			
5240	12.40		12.40	0.017			
5260	12.31		12.31	0.017			
5300	12.48		12.48	0.018			
5320	12.42		12.42	0.017			
5500	13.96		**13.96**	**0.025**			
5600	12.52		12.52	0.018			
5720	12.57		12.57	0.018			
5745	12.37		12.37	0.017	30	1	
5785	13.56		13.56	0.023			
5825	13.49		13.49	0.022			

802.11 n (HT40) Test mode

Frequency (MHz)	Average Power (dBm)				Limit (dBm)		Verdict
	Measured	Duty Factor	Duty factor Calculated				
	dBm		dBm	W	dBm	W	
5190	13.26	0.00	13.26	0.021	24	0.25	PASS
5230	12.45		12.45	0.018			
5270	12.26		12.26	0.017			
5310	12.72		12.72	0.019			
5510	13.75		**13.75**	**0.024**			
5630	12.63		12.63	0.018			
5710	12.35		12.35	0.017			
5755	12.84		12.84	0.019	30	1	
5795	12.88		12.88	0.019			

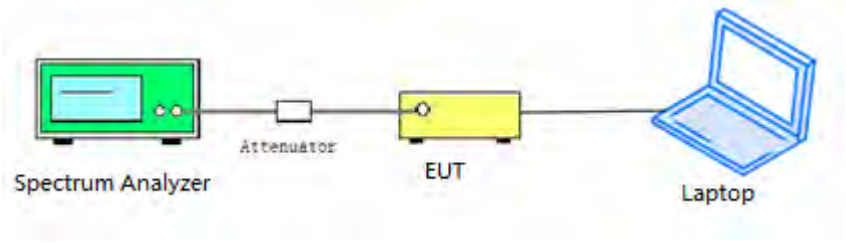
2.4. Emission Bandwidth

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 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 5.725-5.85GHz was used in order to prove compliance.
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for 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) ≥ 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

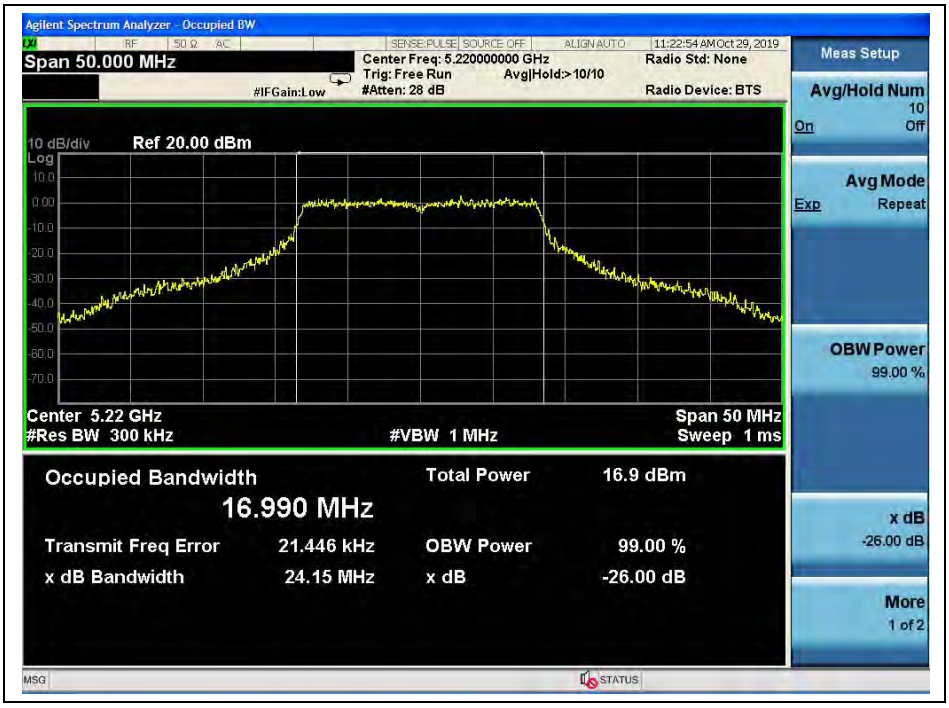
802.11a Test mode

A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	23.87
44	5220	24.15
48	5240	24.49
52	5260	25.17
60	5300	23.23
64	5320	23.62
100	5500	26.08
120	5600	23.78
144	5720	23.87
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
144	5720	16.60
149	5745	16.56
157	5785	16.57
165	5825	16.59

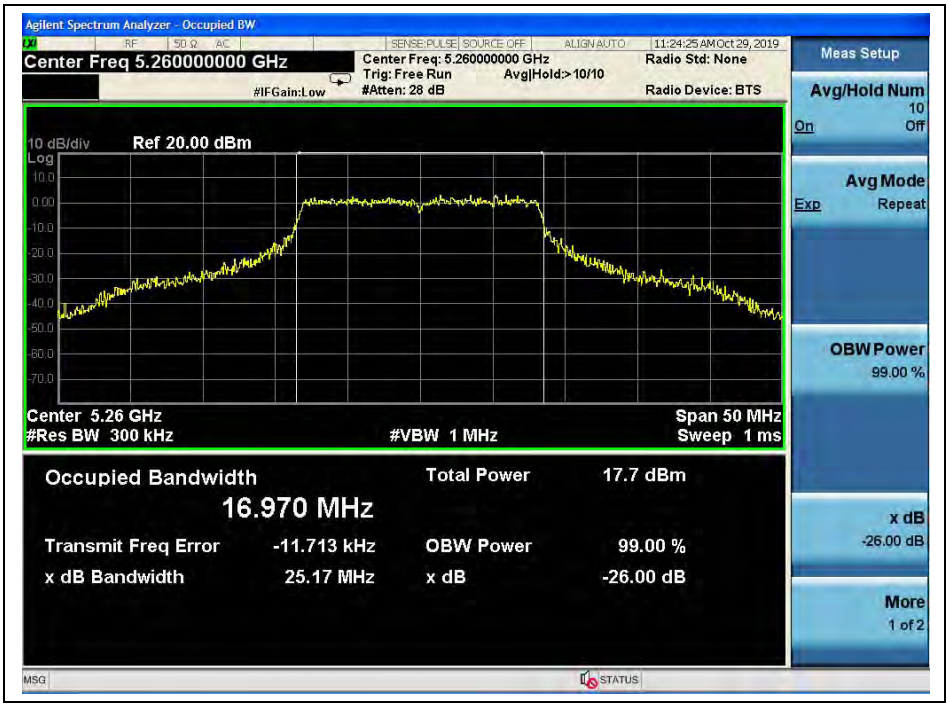
B. Test Plots

(Channel 36, 5180MHz, 802.11a,)



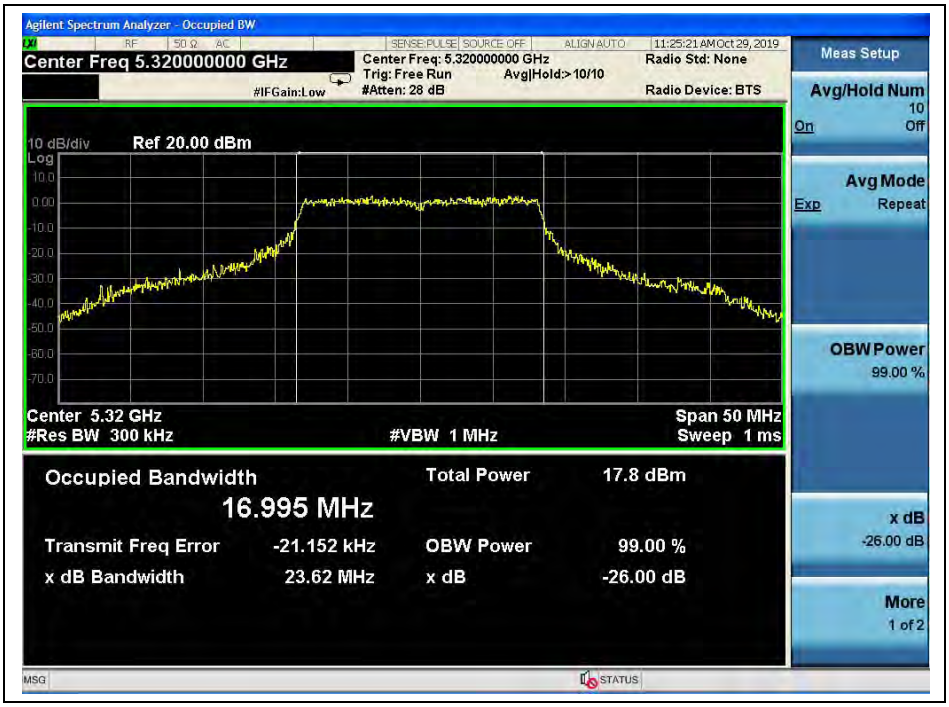
(Channel 44, 5220 MHz, 802.11a,)

(Channel 48, 5240MHz, 802.11a,)



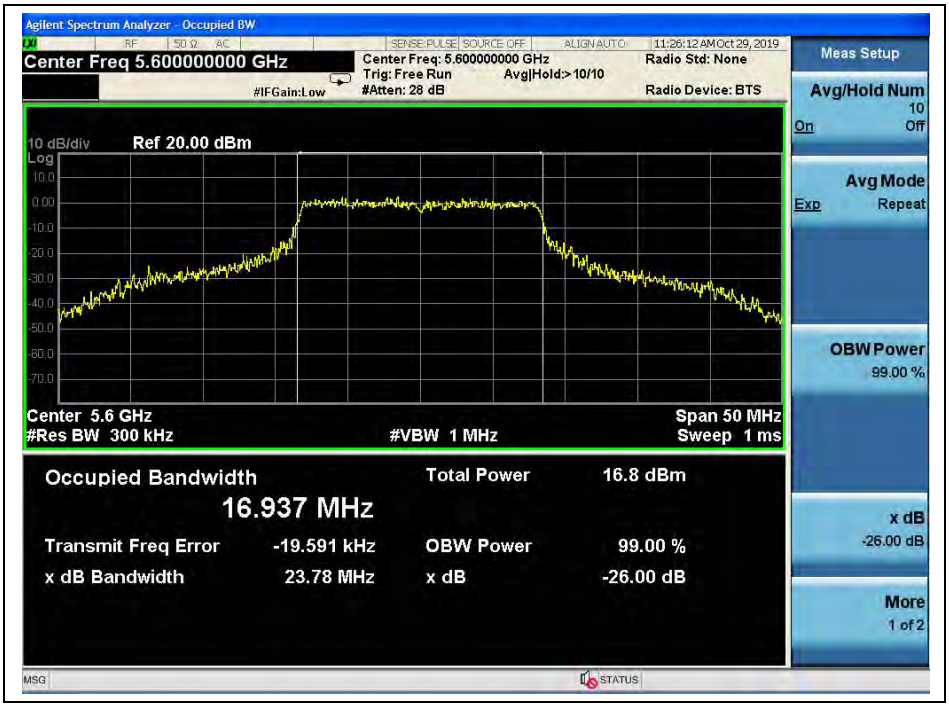
(Channel 52, 5260MHz, 802.11a,)

(Channel 60, 5300 MHz, 802.11a,)



(Channel 64, 5320MHz, 802.11a,)

(Channel 100, 5500MHz, 802.11a,)



(Channel 120, 5600 MHz, 802.11a,)

(Channel 144, 5720MHz, 802.11a,)

(Channel 144, 5720MHz, 802.11a,)

(Channel 149, 5745MHz, 802.11a)

(Channel 157, 5785MHz, 802.11a)

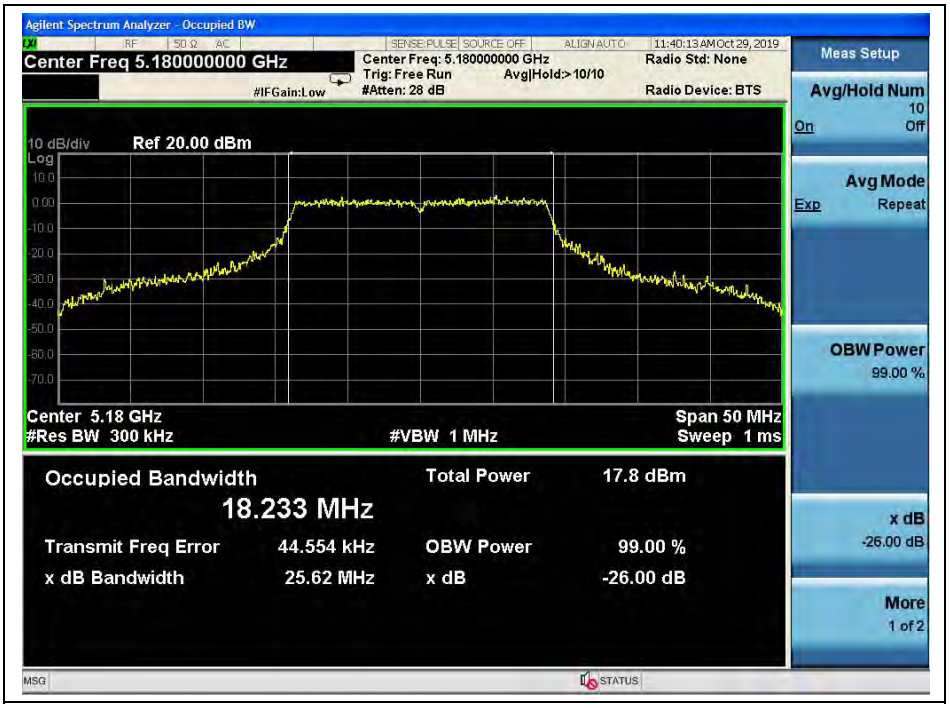
(Channel 165, 5825MHz, 802.11a)

802.11n (HT20) Test mode

A. Test Verdict:

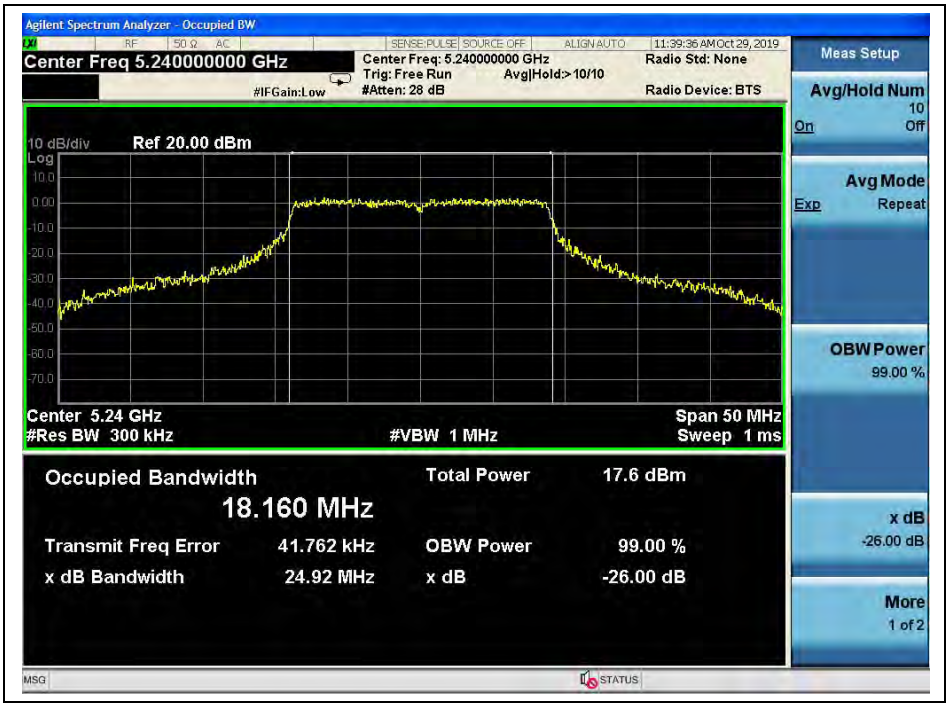
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	25.62
44	5220	26.13
48	5240	24.92
52	5260	25.03
60	5300	25.36
64	5320	26.32
100	5500	27.71
120	5600	26.92
144	5720	24.72
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
144	5720	17.81
149	5745	17.82
157	5785	17.80
165	5825	17.78

B. Test Plots

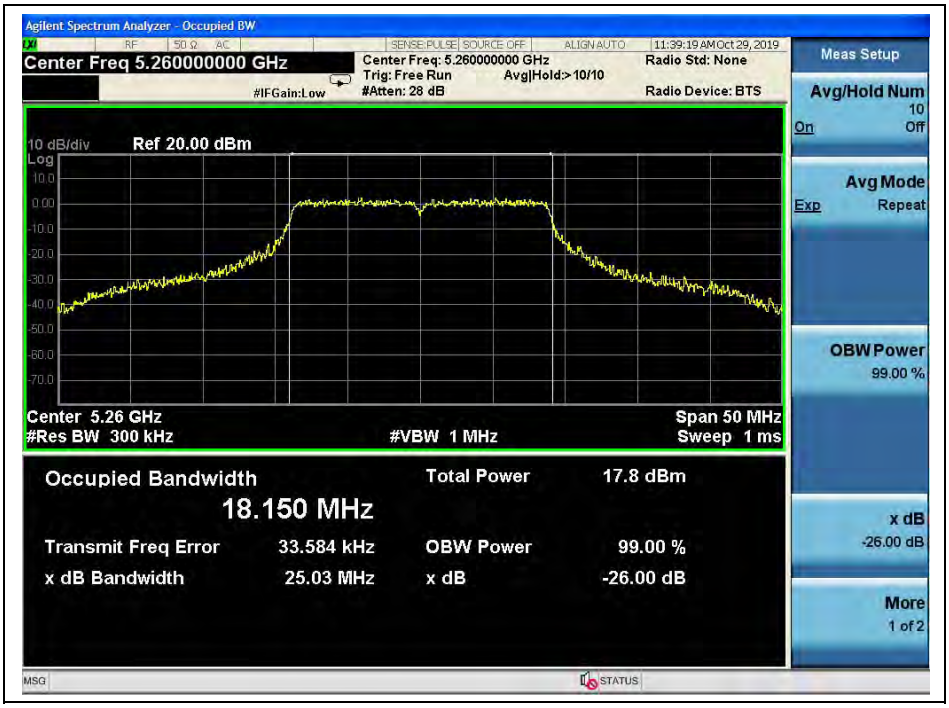


(Channel 36, 5180MHz, 802.11 n (HT20))

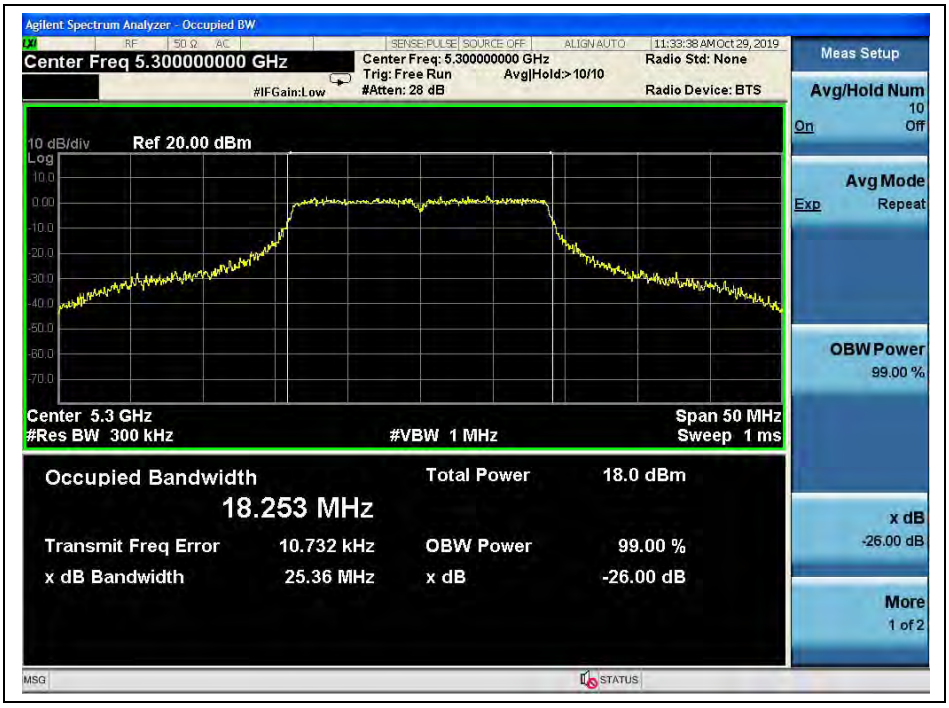
(Channel 44, 5220 MHz, 802.11 n (HT20))



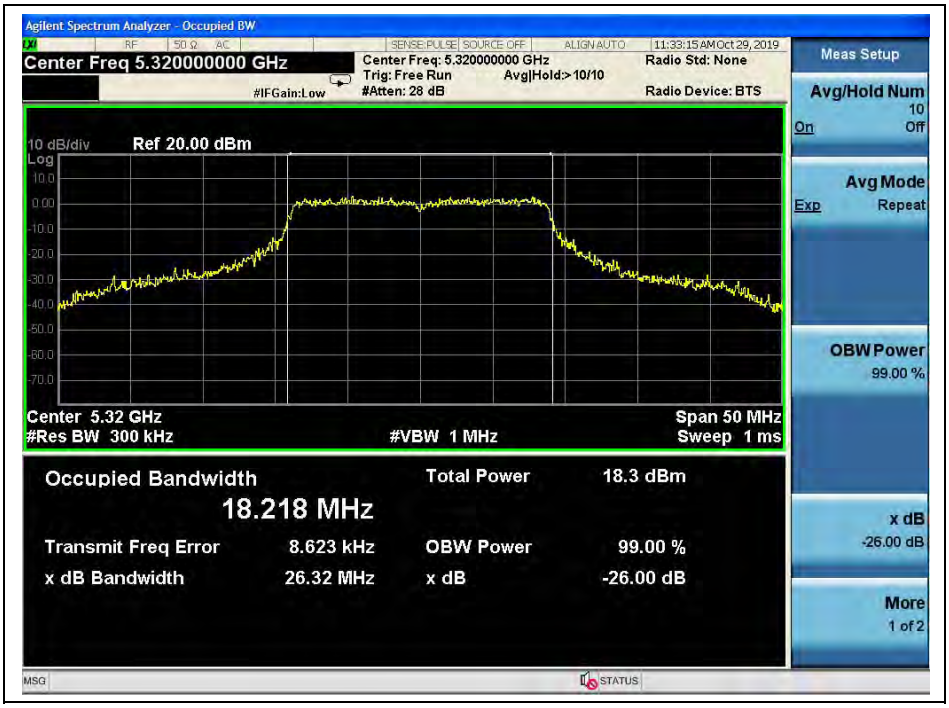
(Channel 48, 5240MHz, 802.11 n (HT20))



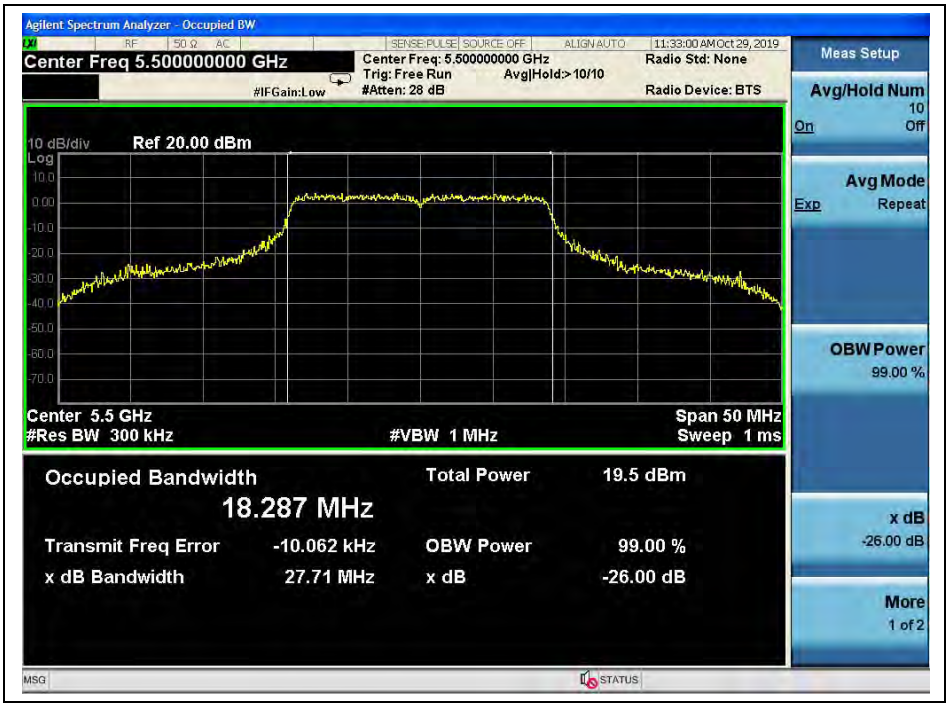
(Channel 52, 5260MHz, 802.11 n (HT20))



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

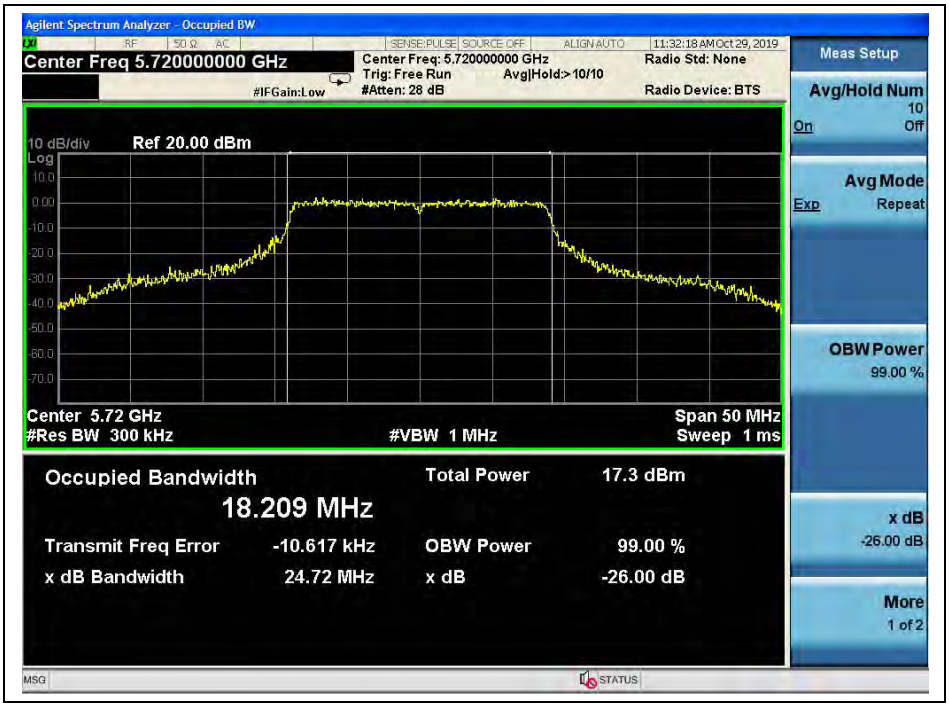


(Channel 64, 5320MHz, 802.11 n (HT20))



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

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



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

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

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

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

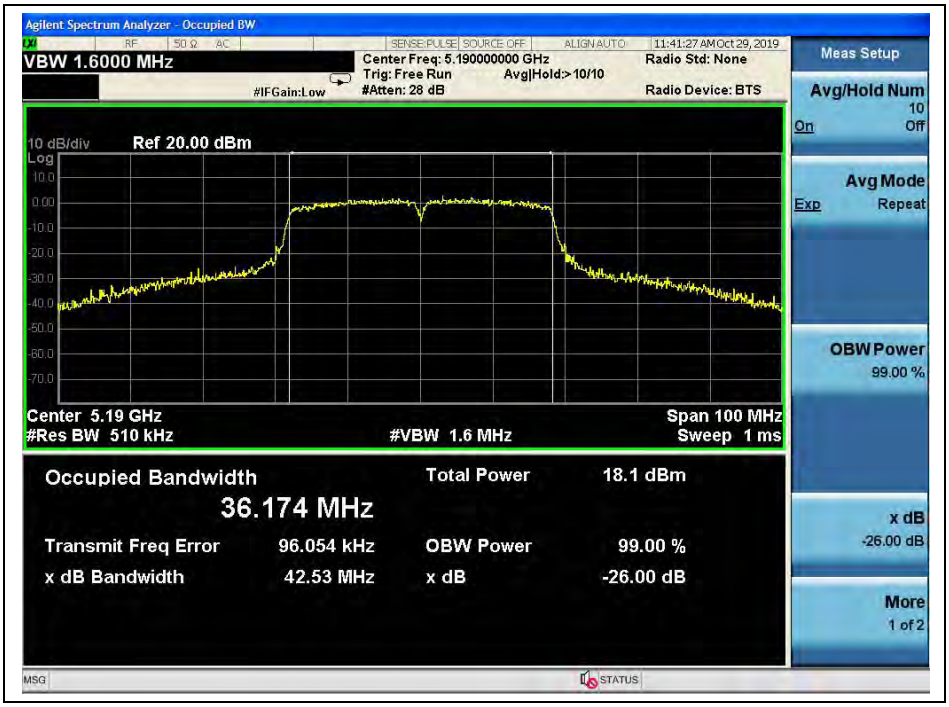
(Channel 165, 5825MHz, 802.11 n (HT20))

802.11n (HT40) Test mode

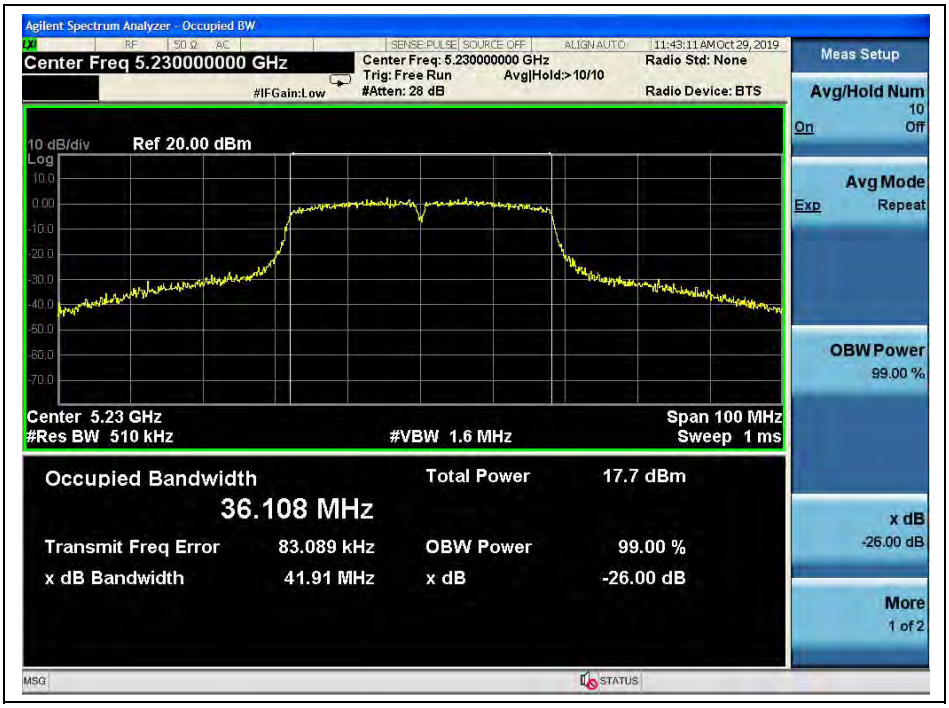
A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	42.53
46	5230	41.91
54	5270	43.11
62	5310	42.68
102	5510	44.68
126	5630	45.40
142	5710	44.29
Channel	**Frequency (MHz)**	**6 dB Bandwidth (MHz)**
142	5710	36.41
151	5755	36.40
159	5795	36.37

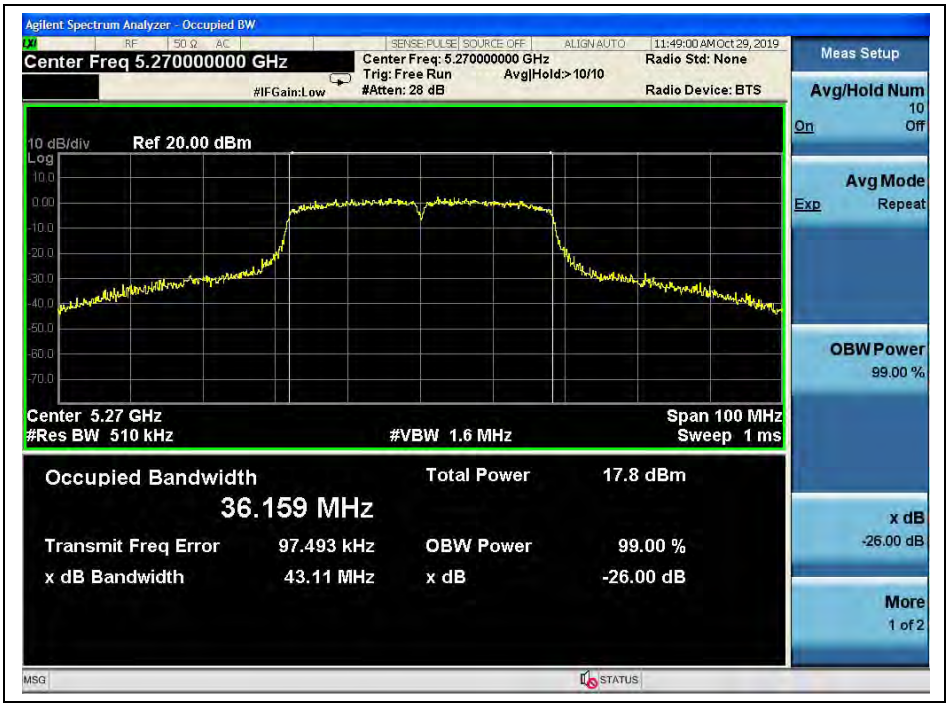
B. Test Plots



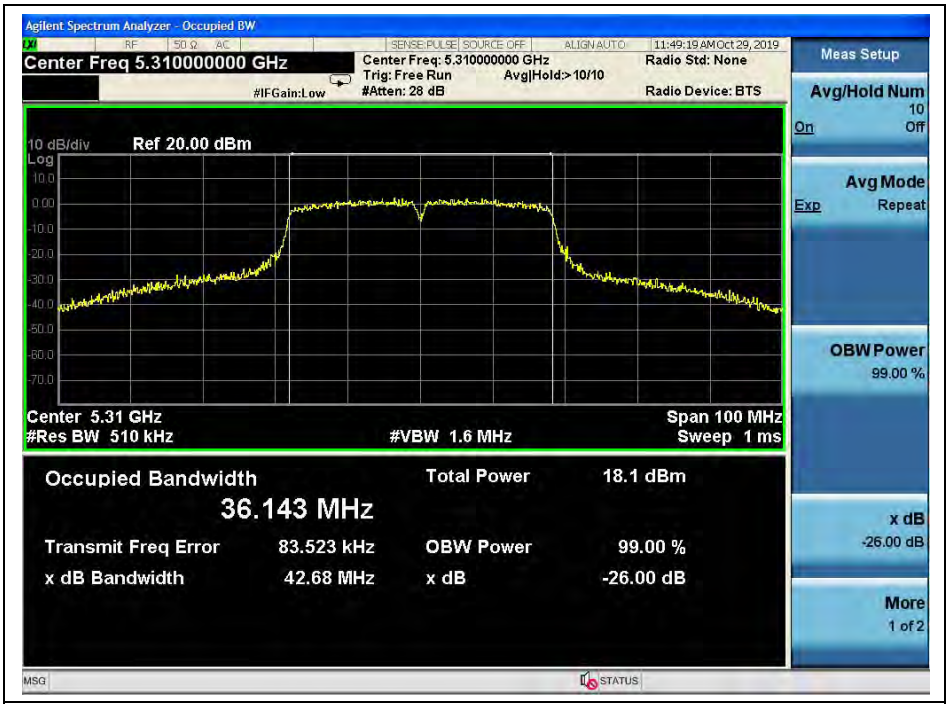
(Channel 38, 5190MHz, 802.11n (HT40))



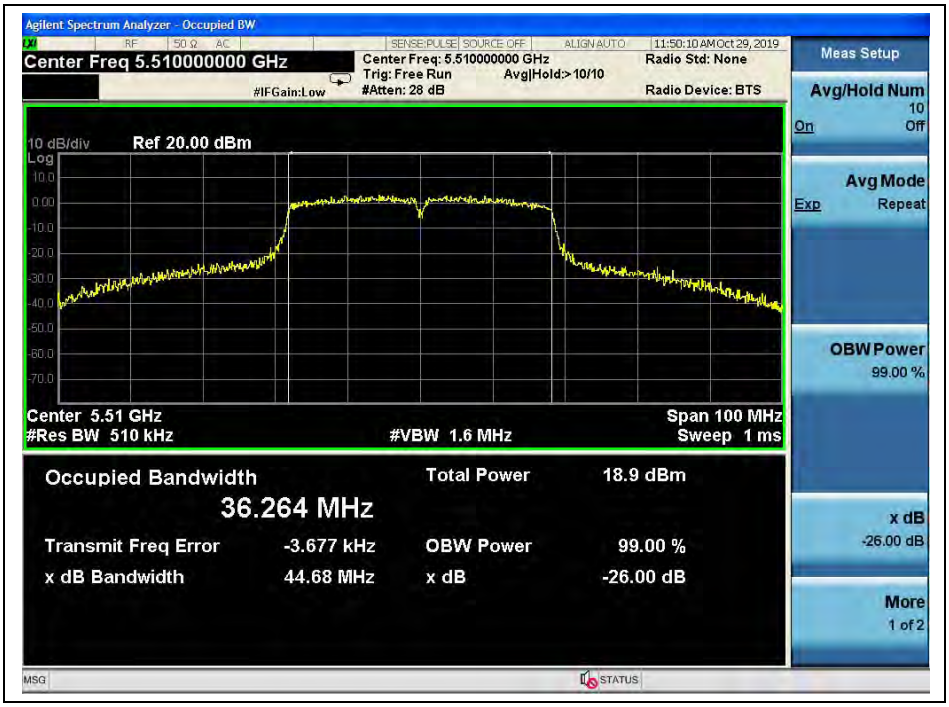
(Channel 46, 5230 MHz, 802.11n (HT40))



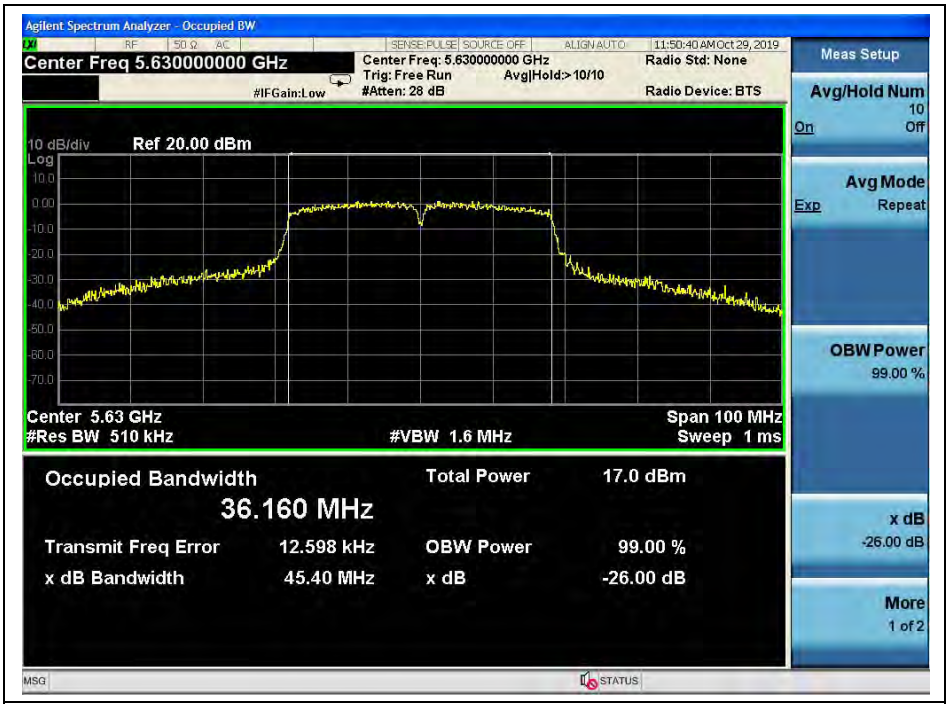
(Channel 54, 5270MHz, 802.11n (HT40))



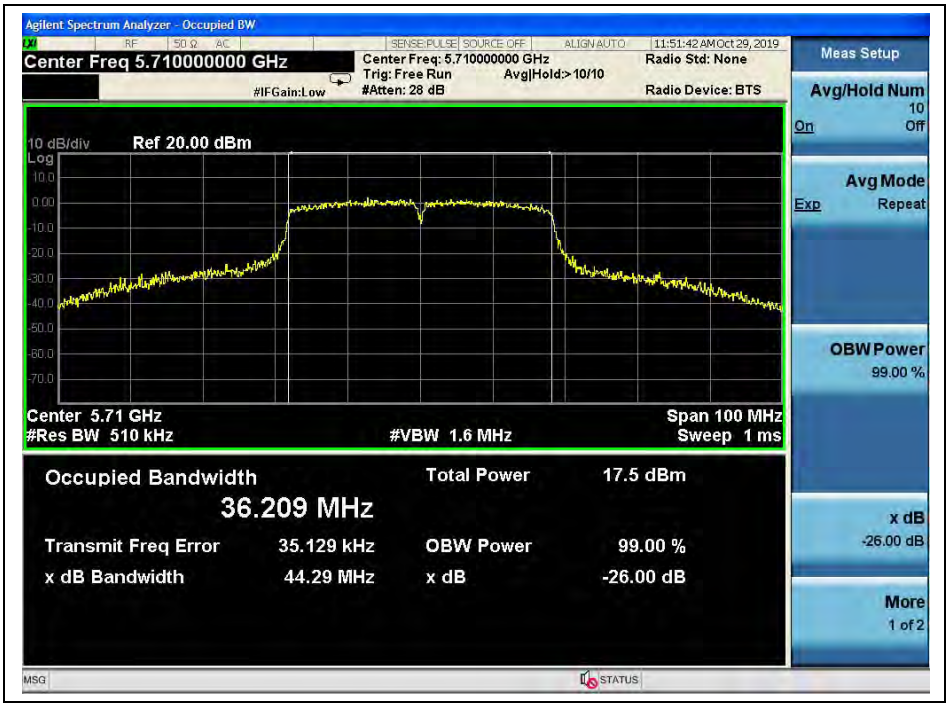
(Channel 62, 5310 MHz, 802.11n (HT40))



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



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



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

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

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

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

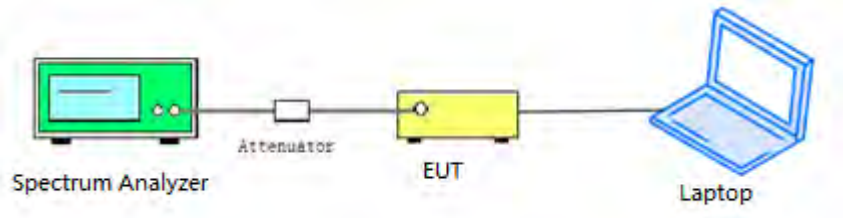
2.5. Peak Power spectral density

2.5.1. Requirement

(1) For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm 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 11 dBm in any 1 megahertz band.
(3) For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500KHz band.
If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(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 = 1 MHz. Set VBW ≥ 3 MHz.
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

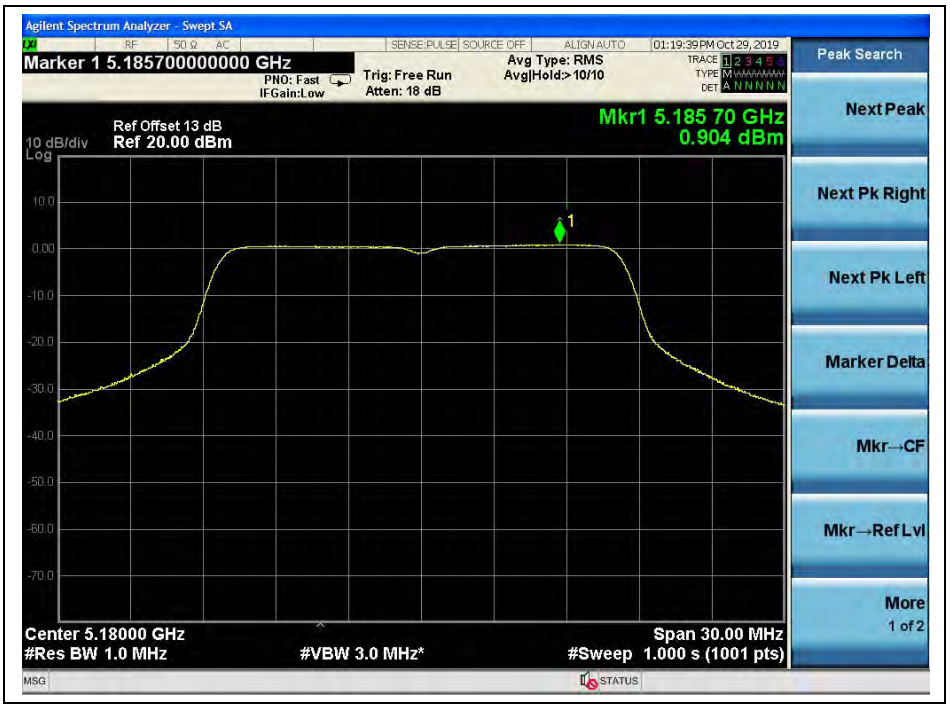
2.5.4. Test Result

802.11a Test mode

A. Test Verdict:

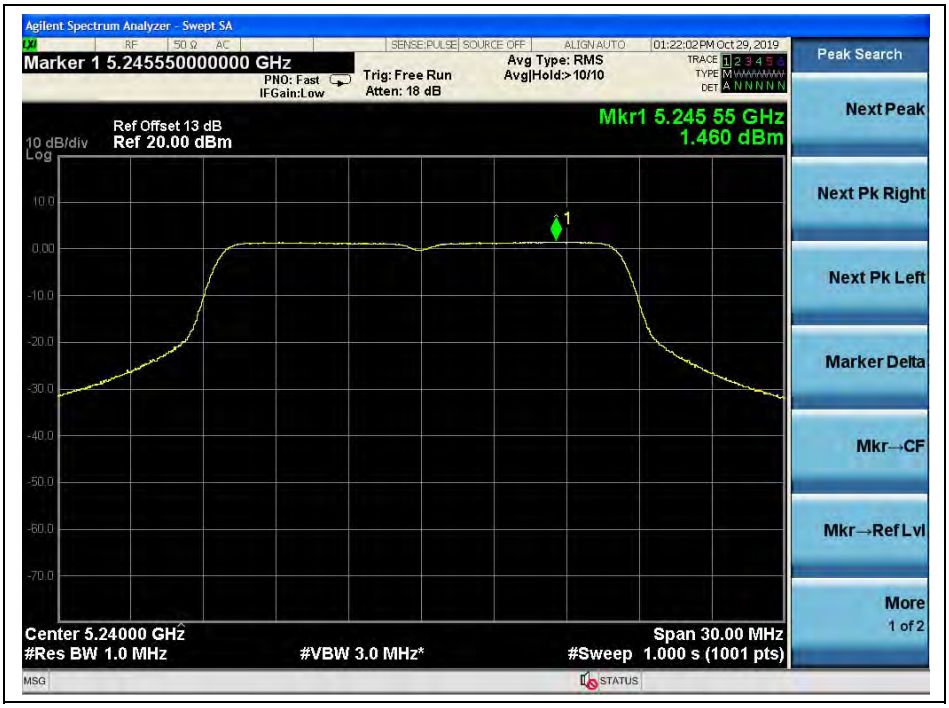
Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
36	5180	0.90	11	PASS
44	5220	1.26		
48	5240	1.46		
52	5260	1.71		
60	5300	1.85		
64	5320	1.94		
100	5500	2.72		
120	5600	1.64		
144	5720	1.16		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
144	5720	-2.23	30	PASS
149	5745	-1.39		
157	5785	-0.99		
165	5825	-0.87		

B. Test Plots

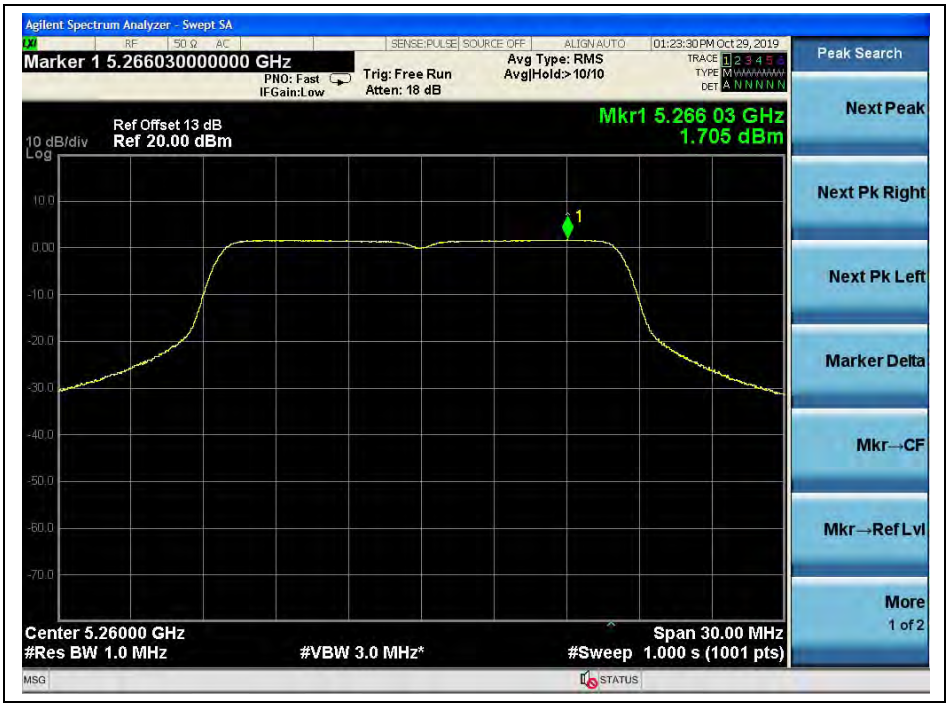


(Channel 36, 5180MHz, 802.11a,)

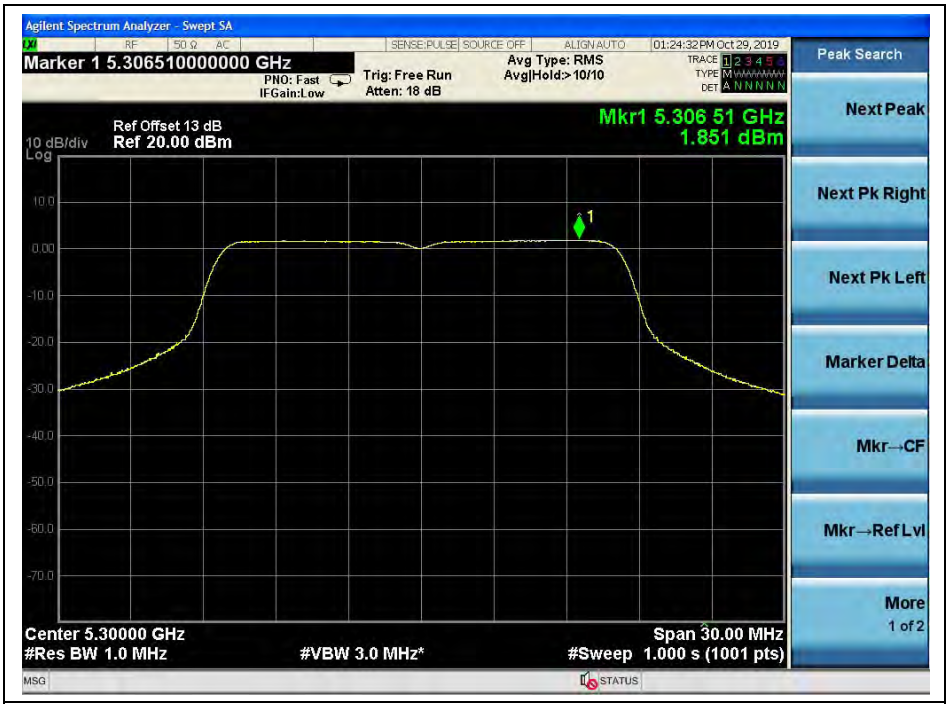
(Channel 44, 5220 MHz, 802.11a,)



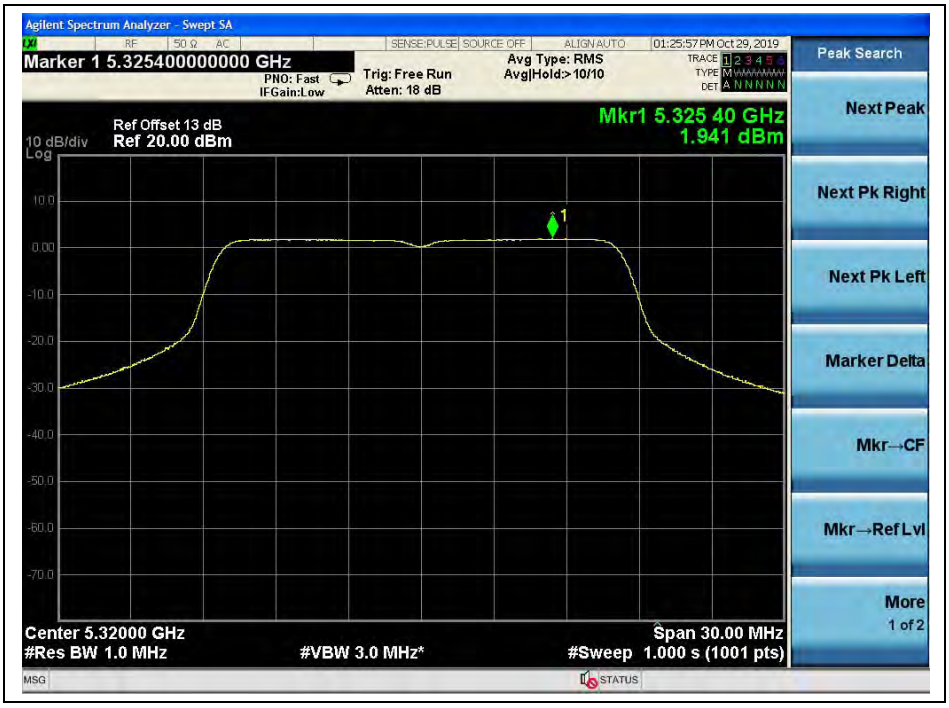
(Channel 48, 5240MHz, 802.11a,)



(Channel 52, 5260MHz, 802.11a,)



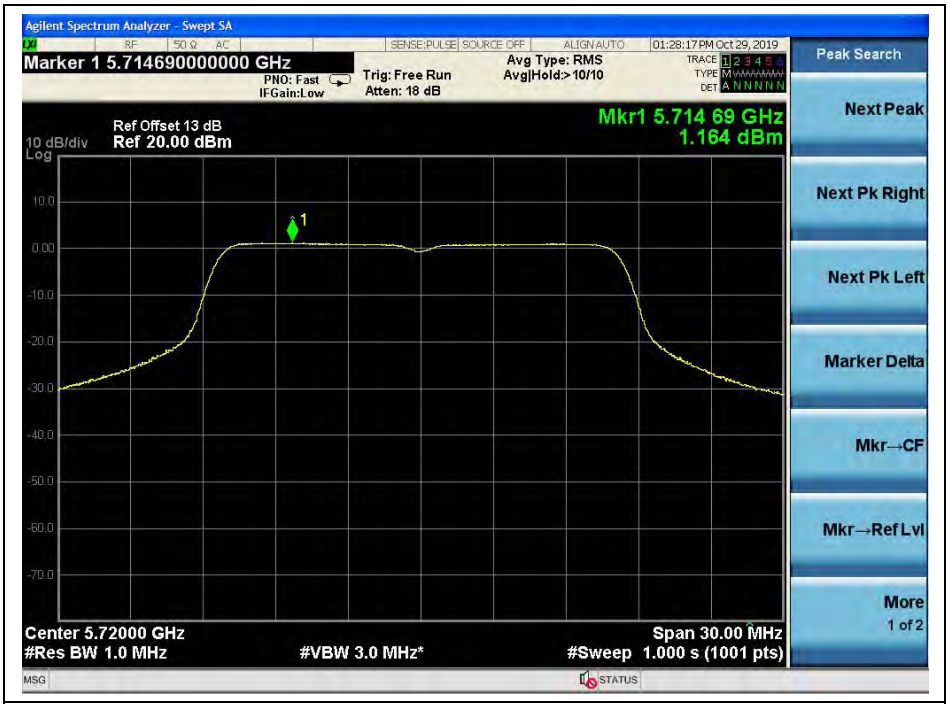
(Channel 60, 5300 MHz, 802.11a,)



(Channel 64, 5320MHz, 802.11a,)

(Channel 100, 5500MHz, 802.11a,)

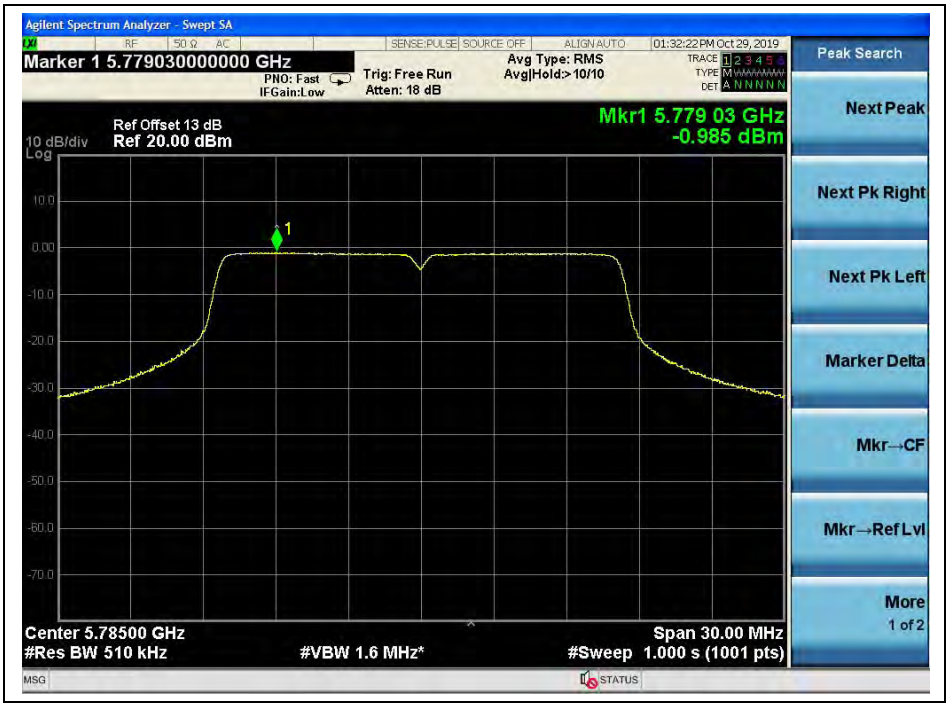
(Channel 120, 5600 MHz, 802.11a,)



(Channel 144, 5720MHz, 802.11a,)

(Channel 144, 5720MHz, 802.11a,)

(Channel 149, 5745MHz, 802.11a)



(Channel 157, 5785MHz, 802.11a)

(Channel 165, 5825MHz, 802.11a)

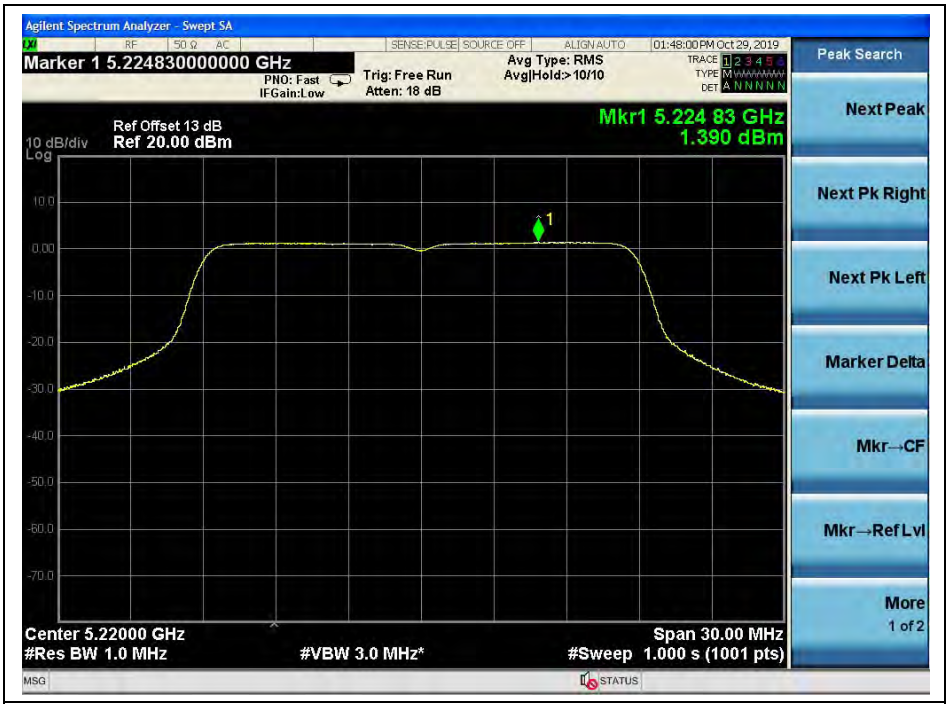
802.11n (HT20) Test mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
36	5180	1.39	11	PASS
44	5220	1.39		
48	5240	0.84		
52	5260	2.23		
60	5300	1.46		
64	5320	1.67		
100	5500	2.71		
116	5600	1.25		
144	5720	1.17		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
144	5720	-2.17	30	PASS
149	5745	-1.64		
157	5785	-1.23		
165	5825	-0.77		

B. Test Plots

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



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

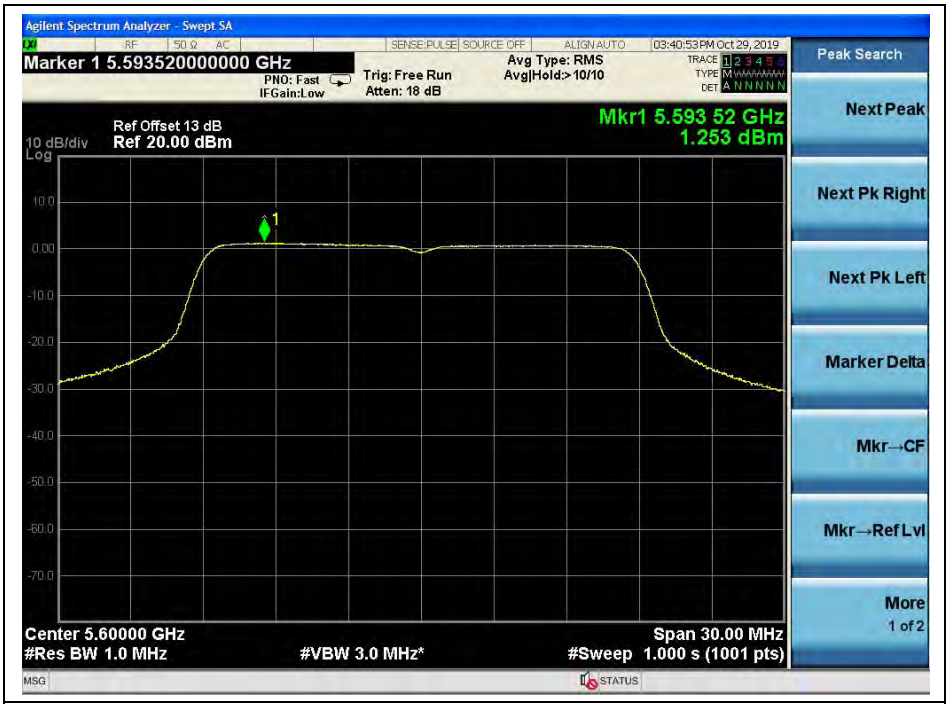
(Channel 48, 5240MHz, 802.11 n (HT20))

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

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

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

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

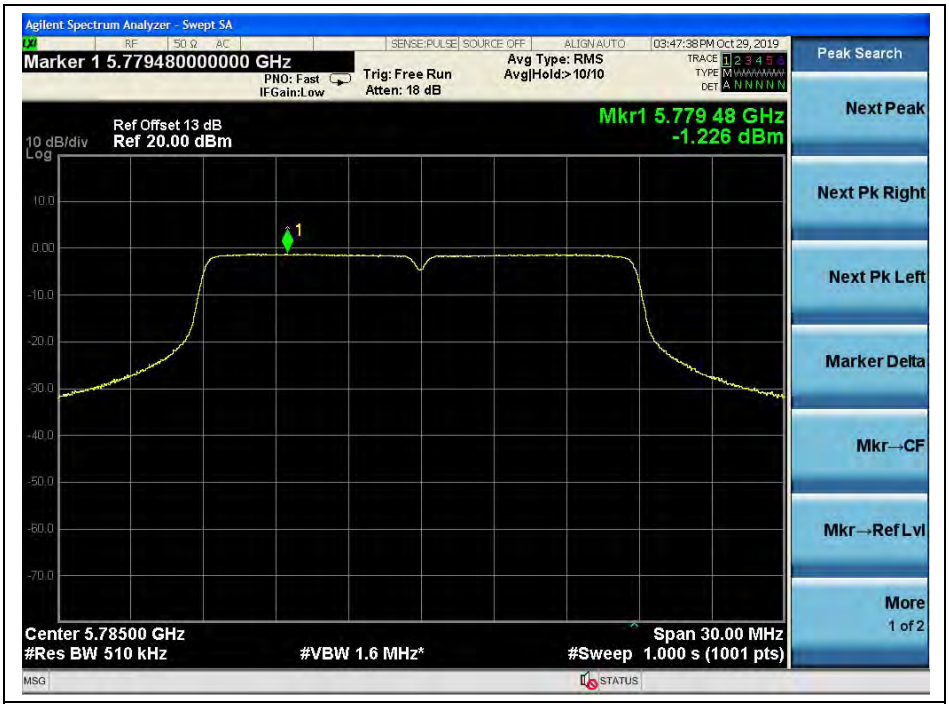


(Channel 120, 5600 MHz, 802.11 n (HT20))

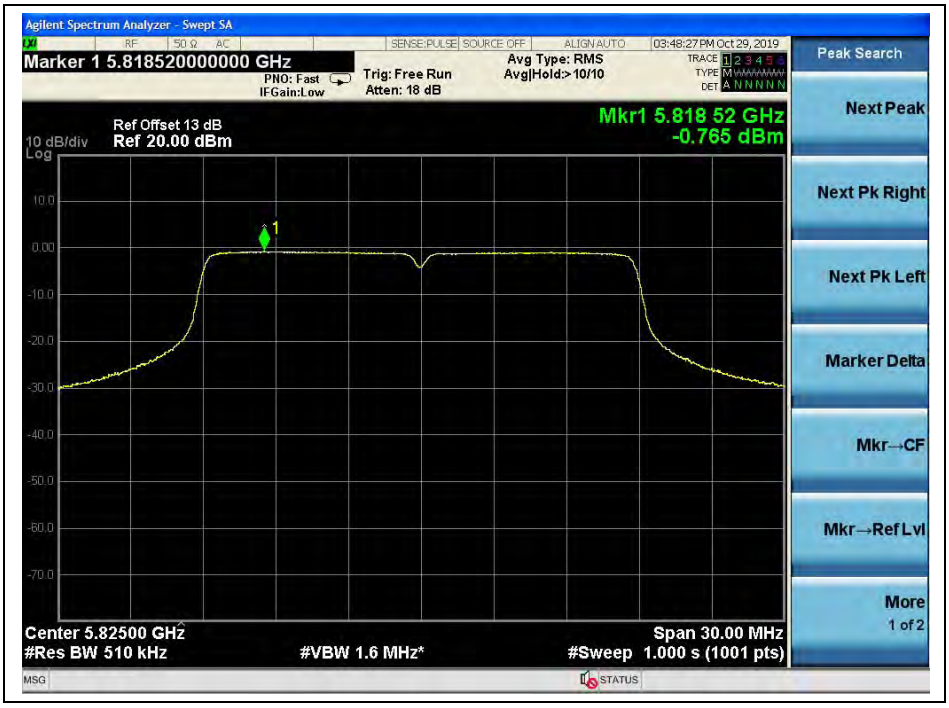
(Channel 144, 5720MHz, 802.11 n (HT20))

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

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



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



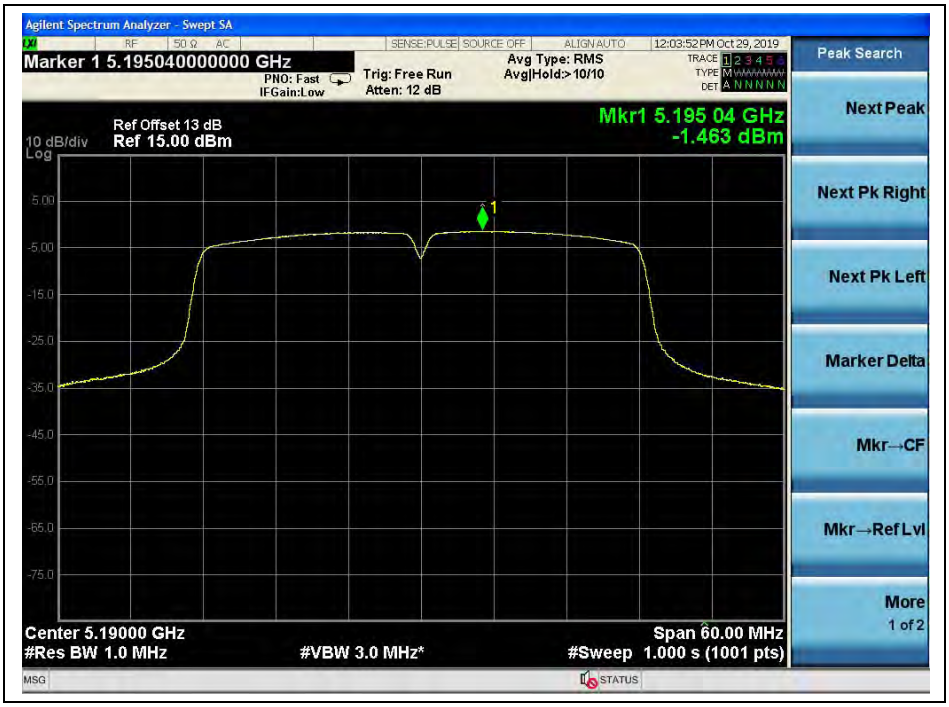
(Channel 165, 5825MHz, 802.11 n (HT20))

802.11n (HT40) Test mode

A. Test Verdict:

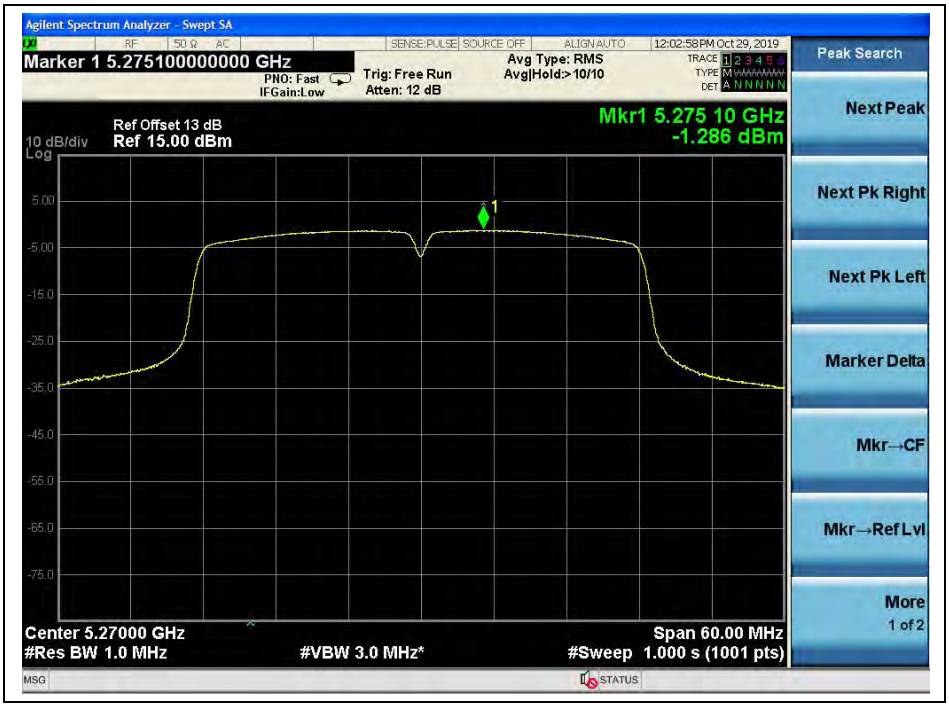
Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
38	5190	-1.46	11	PASS
46	5230	-1.68		
54	5270	-1.29		
62	5310	-0.83		
102	5510	-0.24		
126	5630	-1.82		
142	5710	-2.31		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
142	5710	-4.55	30	PASS
151	5755	-4.30		
159	5795	-4.17		

B. Test Plots

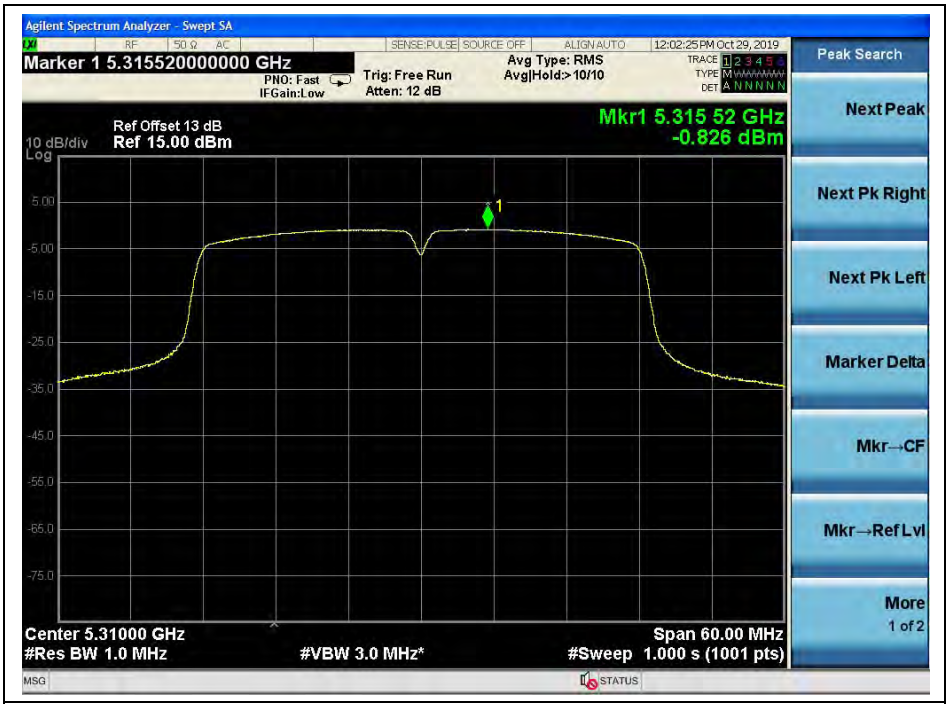


(Channel 38, 5190MHz, 802.11n (HT40))

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

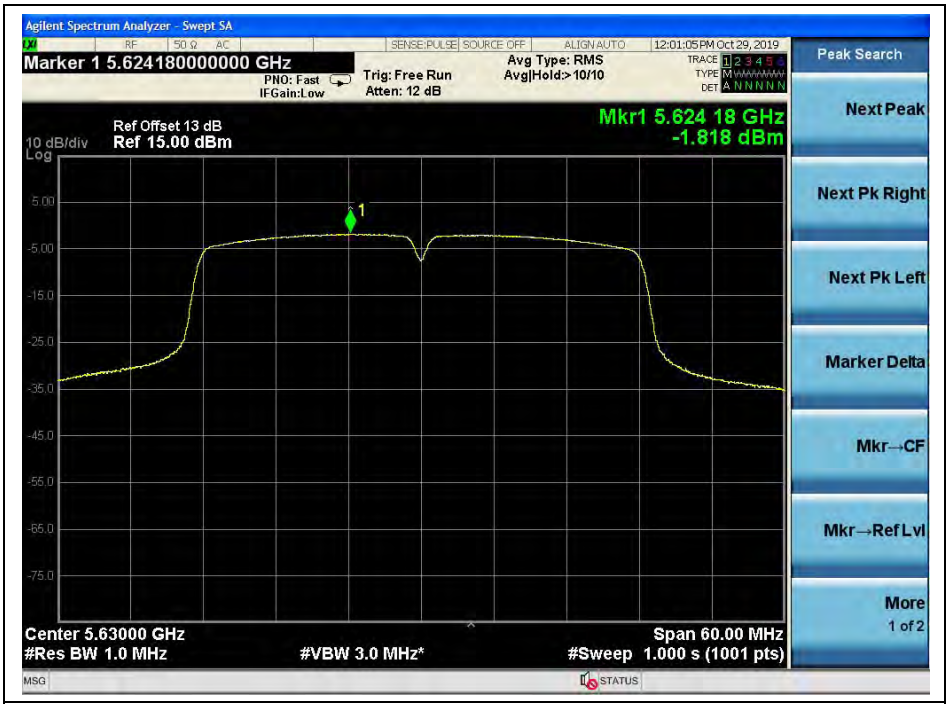


(Channel 54, 5270MHz, 802.11n (HT40))

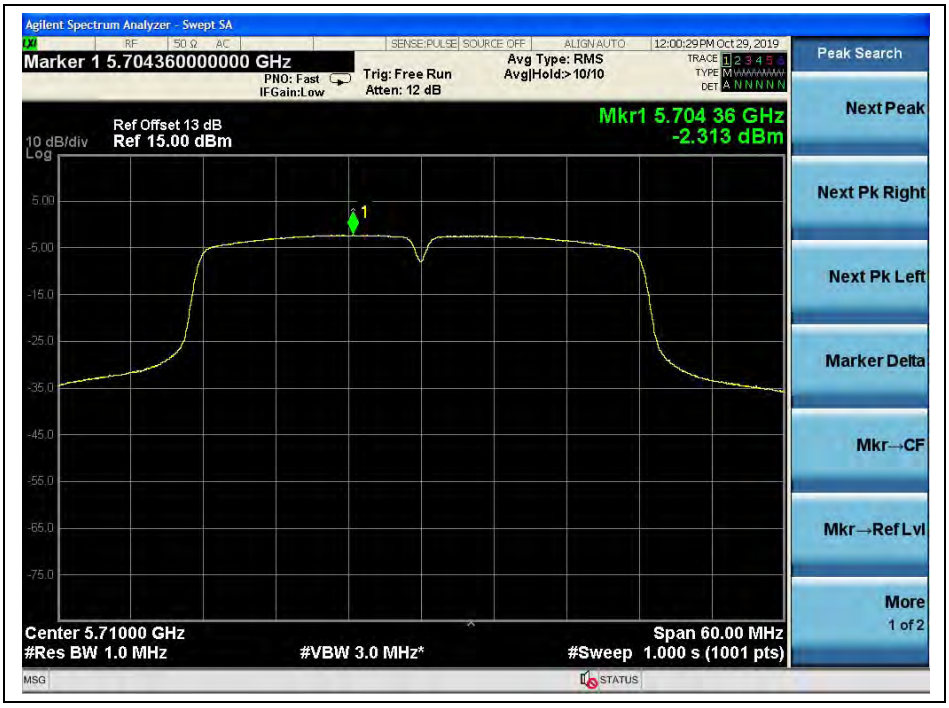


(Channel 62, 5310 MHz, 802.11n (HT40))

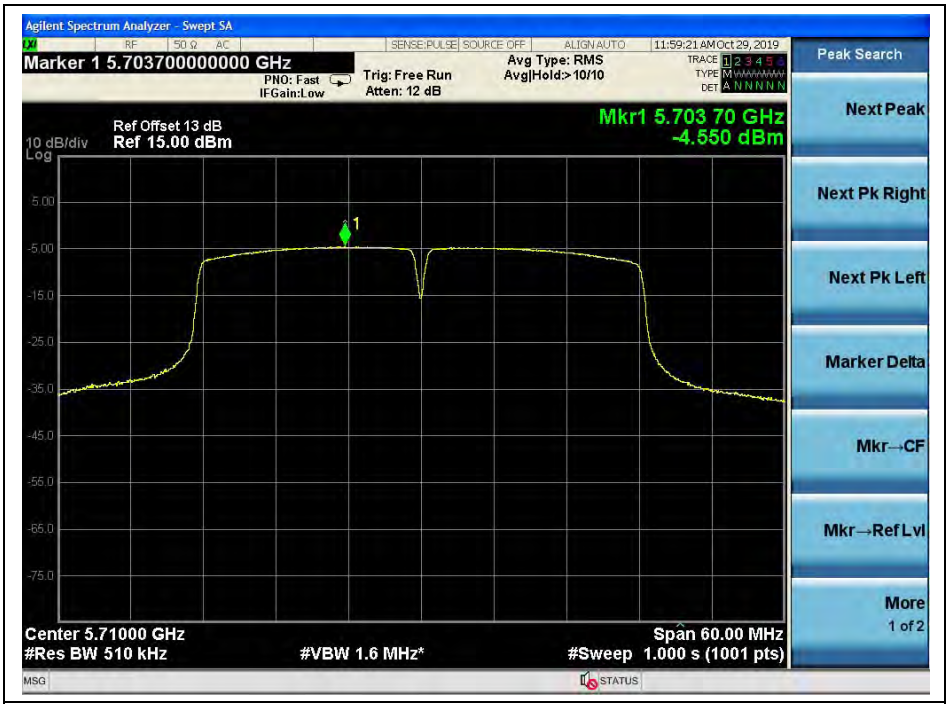
(Channel 102, 5510MHz, 802.11n (HT40))



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

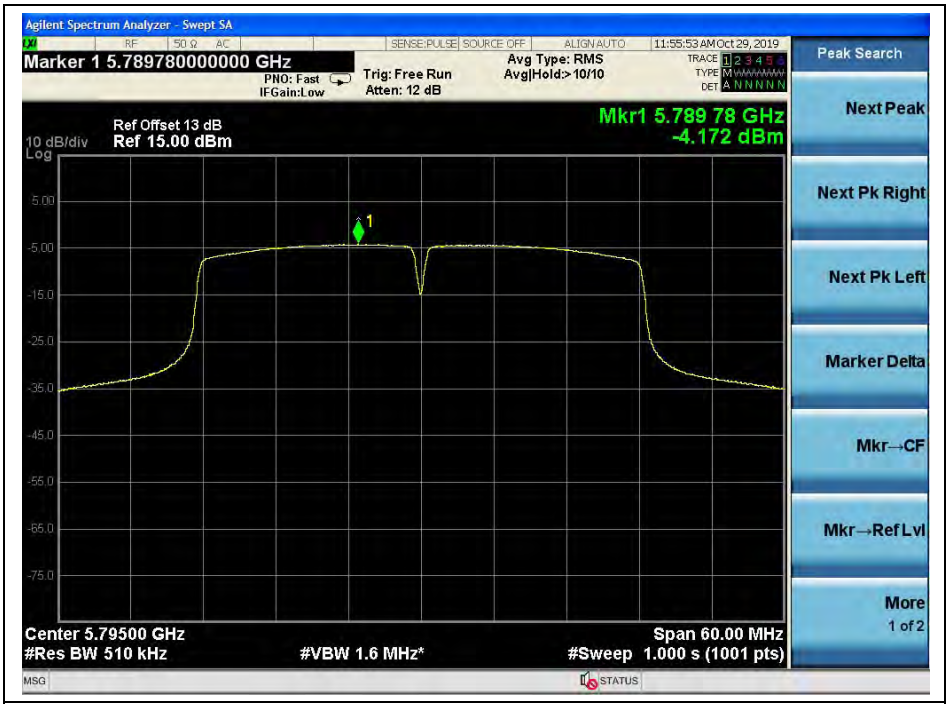


(Channel 142, 5710MHz, 802.11n (HT40))



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

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



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

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 Description

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

U-NII-1 (Ch. 36) 5180MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Freq Dev. (Hz)	Deviation (ppm)
100%	48.0	+20(Ref)	31	0.006
100%		-30	53	0.010
100%		-20	49	0.009
100%		-10	42	0.008
100%		0	35	0.007
100%		+10	24	0.005
100%		+20	29	0.006
100%		+30	33	0.006
100%		+40	41	0.008
100%		+50	47	0.009
85%	40.8	+20	51	0.010
115%	55.2	+20	42	0.008

U-NII-2A (Ch. 52) 5260MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Freq Dev. (Hz)	Deviation (ppm)
100%	48.0	+20(Ref)	30	0.006
100%		-30	51	0.010
100%		-20	42	0.008
100%		-10	37	0.007
100%		0	32	0.006
100%		+10	36	0.007
100%		+20	37	0.007
100%		+30	44	0.008
100%		+40	49	0.009
100%		+50	53	0.010
85%	40.8	+20	30	0.006
115%	55.2	+20	34	0.006

U-NII-2C (Ch. 100) 5500MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Freq Dev. (Hz)	Deviation (ppm)
100%	48.0	+20(Ref)	25	0.005
100%		-30	48	0.009
100%		-20	36	0.007
100%		-10	29	0.005
100%		0	24	0.004
100%		+10	20	0.004
100%		+20	26	0.005
100%		+30	29	0.005
100%		+40	35	0.006
100%		+50	47	0.009
85%	40.8	+20	30	0.005
115%	55.2	+20	36	0.007

U-NII-3 (Ch. 149) 5745MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Freq Dev. (Hz)	Deviation (ppm)
100%	48.0	+20(Ref)	28	0.005
100%		-30	54	0.009
100%		-20	46	0.008
100%		-10	37	0.006
100%		0	32	0.006
100%		+10	25	0.004
100%		+20	31	0.005
100%		+30	24	0.004
100%		+40	37	0.006
100%		+50	43	0.007
85%	40.8	+20	49	0.009
115%	55.2	+20	32	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 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

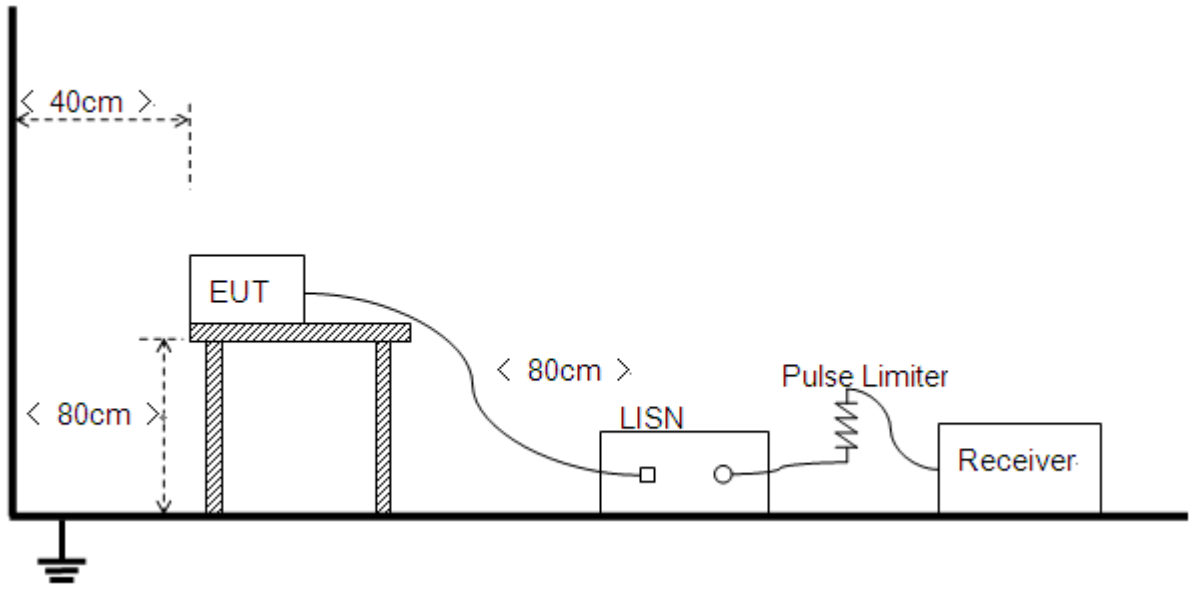
NOTE:

(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 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 + Network cable + Ethernet POE Switch +Adapter + WiFi TX

Test Voltage: AC 120V/60Hz

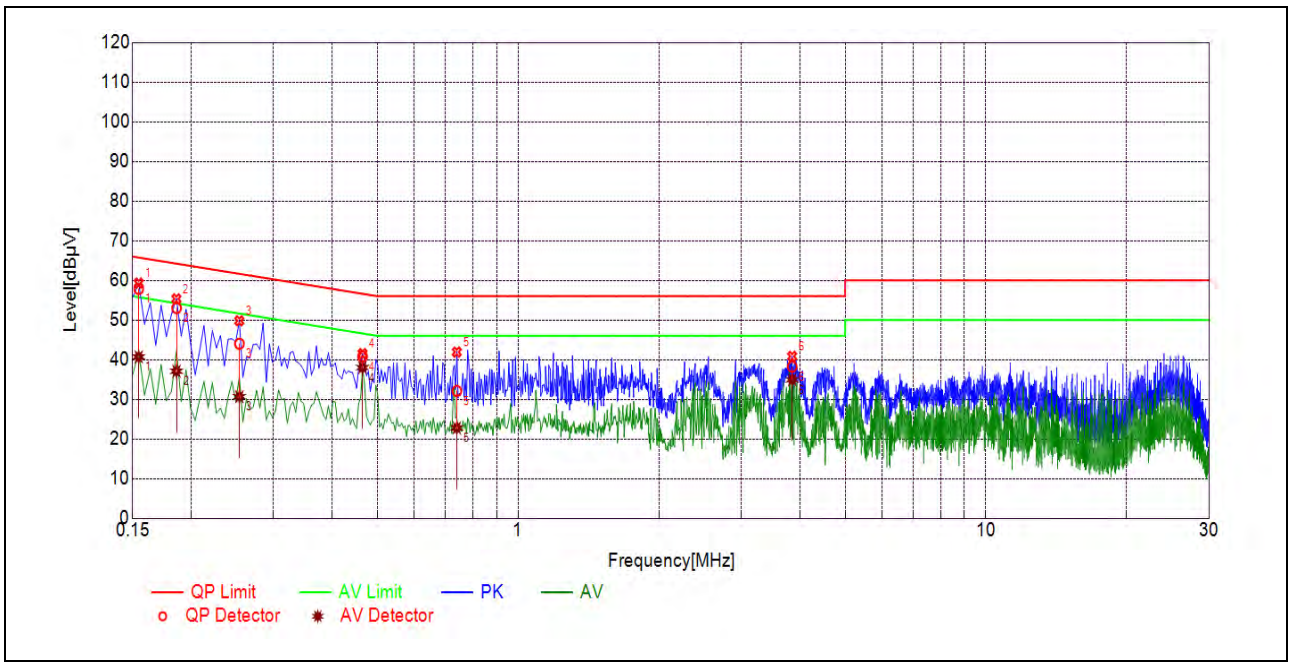
The measurement results are obtained as below:

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

U_R: Receiver Reading

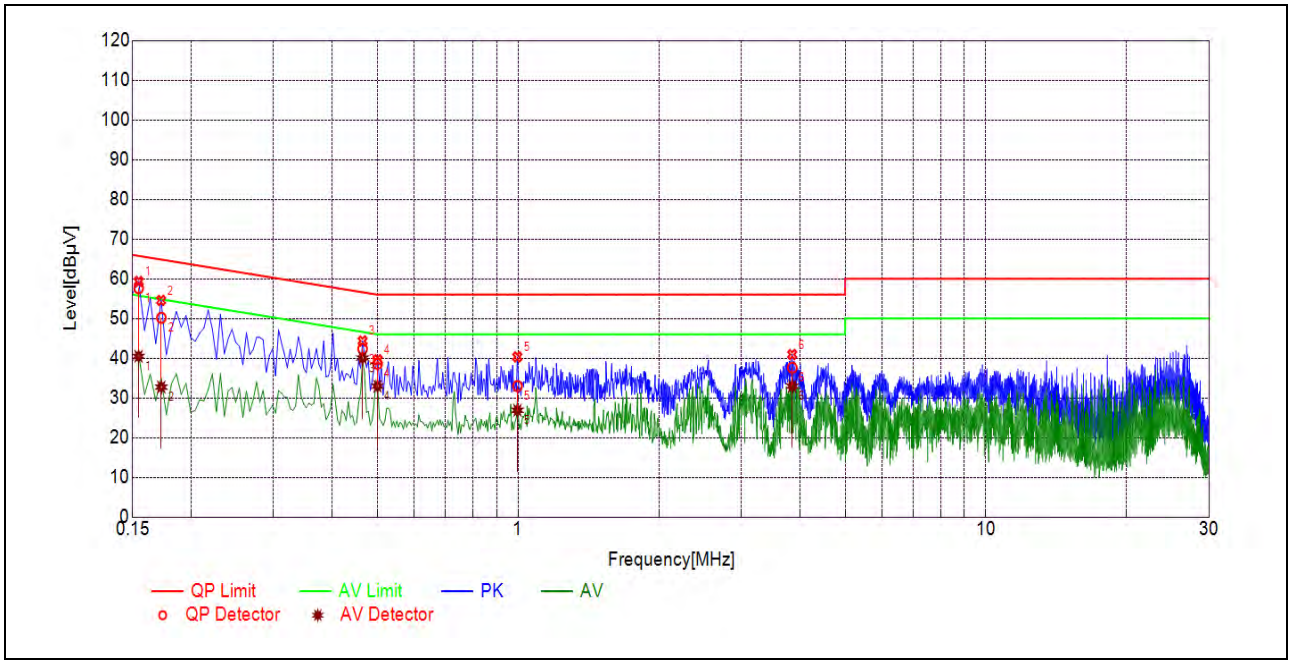
A_{Factor}: Voltage division factor of LISN

B. Test Plots:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1545	57.83	40.69	65.75	55.75	Line	PASS
2	0.1861	53.02	37.10	64.21	54.21		PASS
3	0.2536	44.01	30.65	61.64	51.64		PASS
4	0.4647	40.79	38.02	56.61	46.61		PASS
5	0.7395	32.12	22.78	56.00	46.00		PASS
6	3.8534	38.23	34.93	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	0.1544	57.65	40.48	65.76	55.76	Neutral	PASS
2	0.1727	50.16	32.73	64.83	54.83		PASS
3	0.4650	42.40	40.06	56.60	46.60		PASS
4	0.5005	38.58	32.94	56.00	46.00		PASS
5	0.9967	32.97	26.89	56.00	46.00		PASS
6	3.8552	37.61	32.96	56.00	46.00		PASS

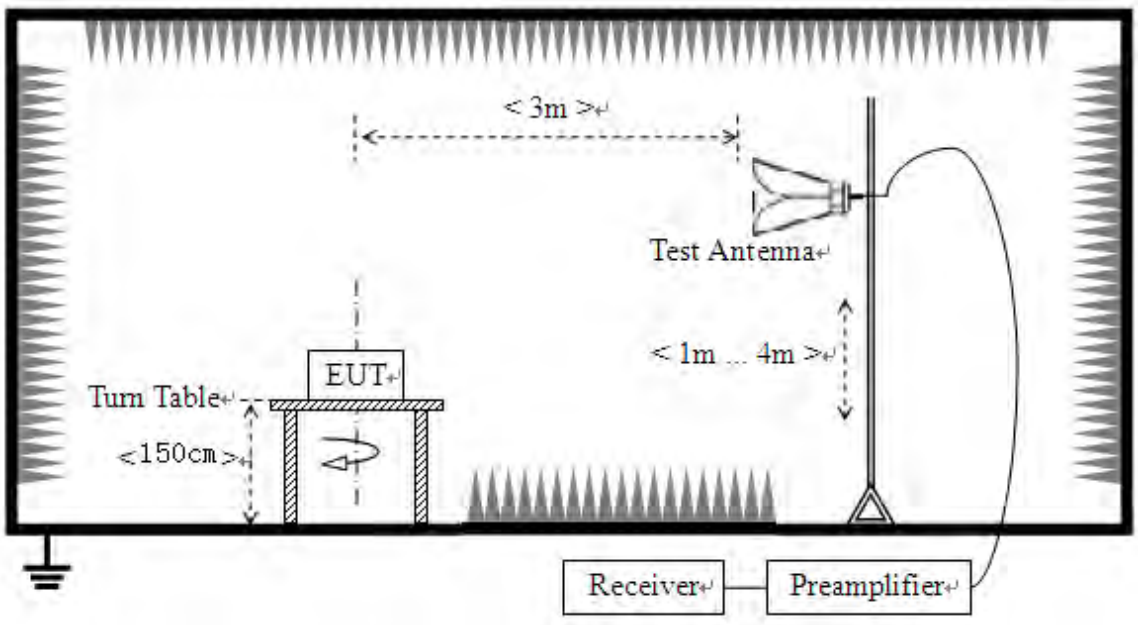
2.8. Restricted Frequency Bands

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

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

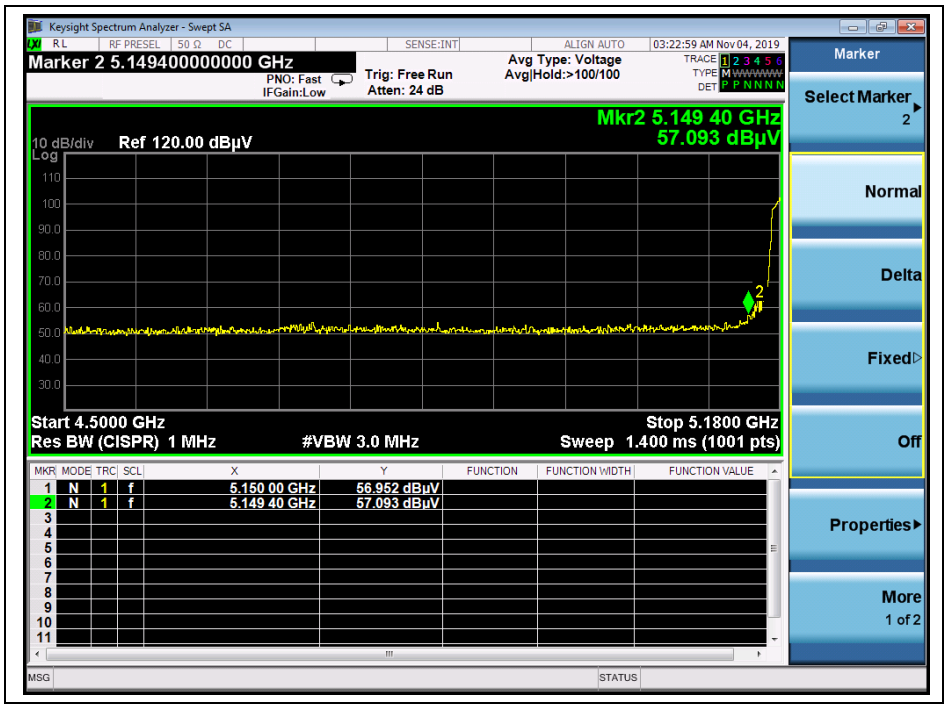
The lowest and highest channels are tested to verify Restricted Frequency Bands.
The measurement results are obtained as below:
E [dBμV/m] =U_R + A_T + A_{Factor} [dB]; A_T =$L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
A_T: Total correction Factor except Antenna; U_R: Receiver Reading
G_{preamp}: Preamplifier Gain; A_{Factor}: Antenna Factor at 3m
Note: 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.

802.11a Test mode

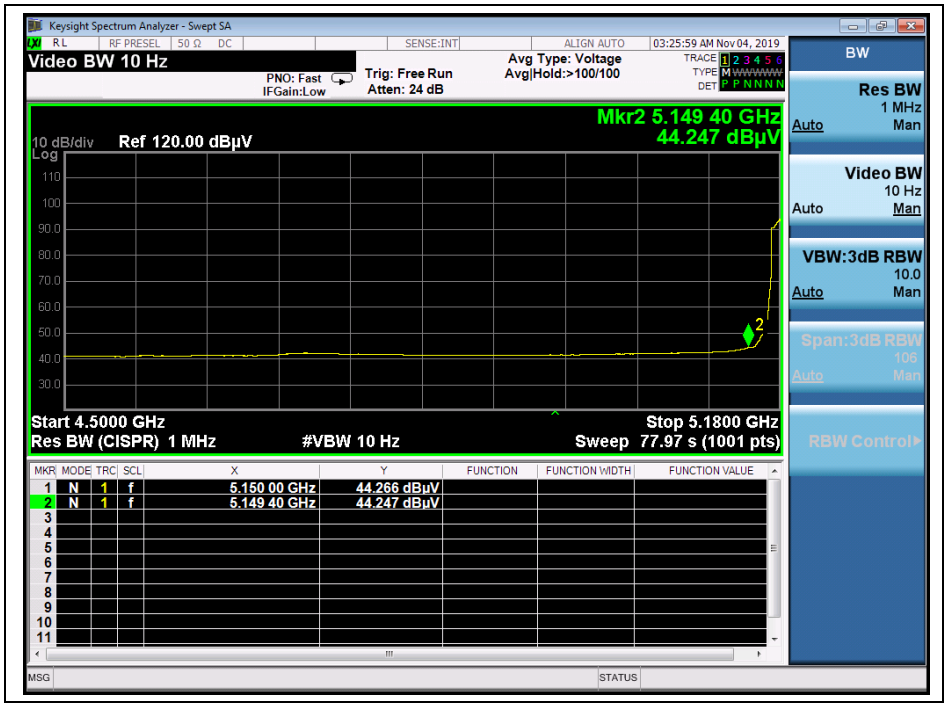
A. Test Verdict:

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	5149.40	PK	57.09	-26.92	32.20	62.37	74	PASS
36	5150.00	AV	44.27	-26.92	32.20	49.55	54	PASS
64	5352.94	PK	55.55	-26.80	32.20	60.95	74	PASS
64	5350.00	AV	42.52	-26.80	32.20	47.92	54	PASS
100	5467.50	PK	56.13	-26.64	32.20	61.69	68.23	PASS
100	5470.00	AV	42.39	-26.64	32.20	47.95	54	PASS
144	5726.80	PK	55.94	-26.64	32.20	61.50	68.23	PASS
144	5725.00	AV	42.52	-26.64	32.20	48.08	54	PASS
149	5723.34	PK	61.43	-26.23	32.20	67.40	118.44	PASS
149	5725.00	AV	45.90	-26.23	32.20	51.87	54	PASS
165	5850.00	PK	57.95	-26.23	32.20	63.92	122.23	PASS
165	5850.00	AV	44.25	-26.23	32.20	50.22	54	PASS

B. Test Plots:



(Channel 36, PEAK, 802.11a)



(Channel 36, AVG, 802.11a)