

MEASUREMENT REPORT

FCC PART 15.407 WLAN 802.11a/n/ac/ax

FCC ID: 2ALJ3AP31X

APPLICANT: HAN Networks Co., Ltd.

Application Type: Certification

Product: HAN Access Point

Model No.: AP311

Brand Name: HAN NETWORKS; HANNETWORKS

FCC Classification: Unlicensed National Information Infrastructure (NII)

FCC Rule Part(s): Part15 Subpart E (Section 15.407)

Test Procedure(s): ANSI C63.10-2013

Test Date: September 02 ~ October 12, 2020

Reviewed By:



(Paddy Chen)

Approved By:



(Chenz Ker)



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 789033 D02v02r01. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Taiwan) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2010TW0002-U2	Rev. 01	Initial Report	11-09-2020	Valid

CONTENTS

Description	Page
1. INTRODUCTION	7
1.1. Scope	7
1.2. MRT Test Location	7
2. PRODUCT INFORMATION	8
2.1. Equipment Description	8
2.2. Product Specification Subjective to this Report.....	8
2.3. Working Frequencies for this report	9
2.4. Description of Available Antennas	10
2.5. Description of Antenna RF Port.....	11
2.6. Test Mode	12
2.7. Description of Test Software.....	12
2.8. Duty Cycle	13
2.9. EMI Suppression Device(s)/Modifications	15
2.10. Configuration of Tested System	16
2.11. Test System Details	16
3. ANTENNA REQUIREMENTS	17
4. TEST EQUIPMENT CALIBRATION DATE	18
5. MEASUREMENT UNCERTAINTY	20
6. TEST RESULT	21
6.1. Summary	21
6.2. 26dB Bandwidth Measurement	22
6.2.1. Test Limit	22
6.2.2. TestProcedure used	22
6.2.3. TestSetting.....	22
6.2.4. Test Setup	22
6.2.5. Test Result.....	23
6.3. 6dB Bandwidth Measurement	40
6.3.1. Test Limit	40
6.3.2. Test Procedure used	40
6.3.3. TestSetting.....	40
6.3.4. Test Setup	40
6.3.5. Test Result.....	41
6.4. Output Power Measurement	47
6.4.1. TestLimit	47

6.4.2. Test Procedure Used	47
6.4.3. Test Setting.....	47
6.4.4. Test Setup	47
6.4.5. Test Result.....	48
6.5. Transmit Power Control.....	52
6.5.1. Test Limit	52
6.5.2. Test Procedure Used	52
6.5.3. Test Setting.....	52
6.5.4. Test Setup	52
6.5.5. Test Result.....	52
6.6. Power Spectral Density Measurement	53
6.6.1. TestLimit	53
6.6.2. Test Procedure Used	53
6.6.3. Test Setting.....	53
6.6.4. Test Setup	54
6.6.5. Test Result.....	55
6.7. Frequency Stability Measurement.....	92
6.7.1. TestLimit	92
6.7.2. Test Procedure Used	92
6.7.3. Test Setup	93
6.7.4. Test Result.....	94
6.8. Radiated Spurious Emission Measurement	96
6.8.1. Test Limit	96
6.8.2. Test Procedure Used	96
6.8.3. Test Setting.....	96
6.8.4. Test Setup	98
6.8.5. Test Result.....	99
6.9. Radiated Restricted Band Edge Measurement	259
6.9.1. Test Limit	259
6.9.2. Test Procedure Used	260
6.9.3. Test Setting.....	261
6.9.4. Test Setup	262
6.9.5. Test Result.....	263
6.10. AC Conducted Emissions Measurement.....	419
6.10.1. TestLimit	419
6.10.2. Test Procedure	419
6.10.3. Test Setup	420
6.10.4. Test Result.....	421

7. CONCLUSION.....	425
Appendix A - Test Setup Photograph.....	426
Appendix B-EUT Photograph	427

General Information

Applicant:	HAN Networks Co., Ltd.
Applicant Address:	101-A16, 1st Floor, Building 3, No.9 compound, Yongfeng Road, Haidian District, Beijing, P.R. China
Manufacturer:	HAN Networks Co., Ltd.
Manufacturer Address:	101-A16, 1st Floor, Building 3, No.9 compound, Yongfeng Road, Haidian District, Beijing, P.R. China
Test Site:	MRT Technology (Taiwan) Co., Ltd
Test Site Address:	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Fuxing Rd., Taoyuan, Taiwan (R.O.C)

- MRT facility is an FCC registered (Reg. No. 291082 and 153292) test facility with the site description report on file and is designated by the FCC as an Accredited Test Film.
- MRT facility is an IC registered (MRT Reg. No. 21723-1) test laboratory with the site description on file at Industry Canada.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (TAF) under the American Association for Laboratory Accreditation Program (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, Taiwan, EU and TELEC Rules.

TAF certificate here



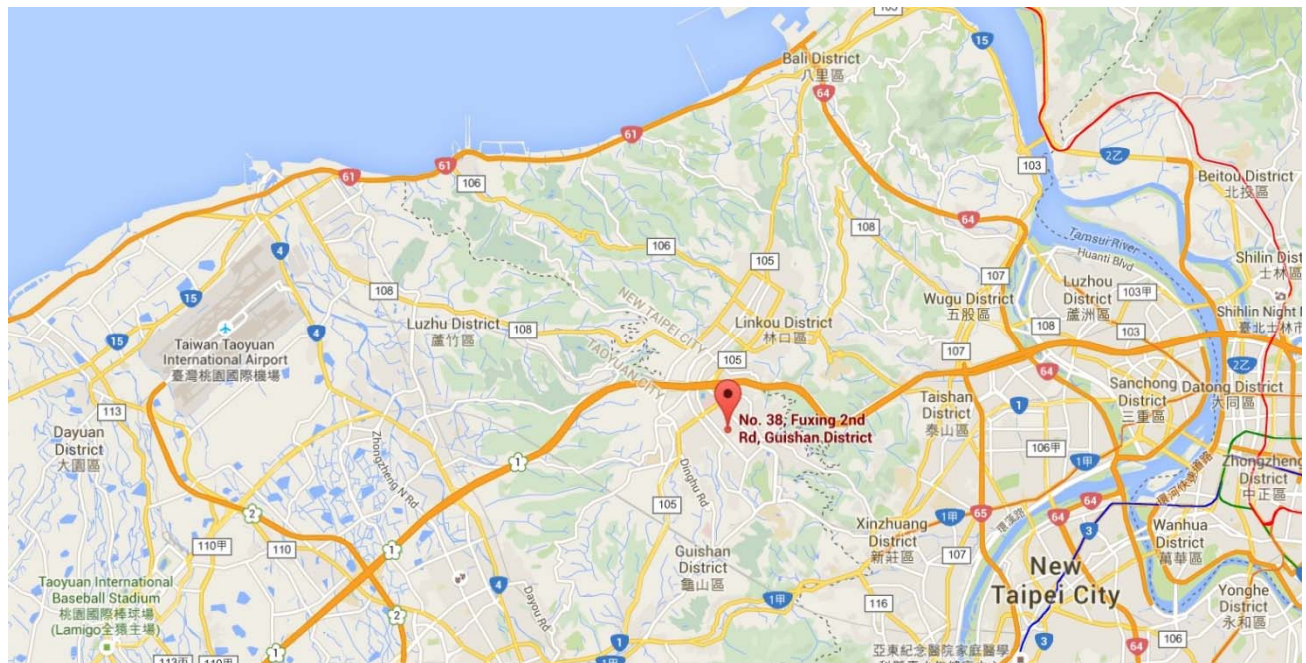
1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada and Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taoyuan City. These measurement tests were conducted at the MRT Technology (Taiwan) Co., Ltd. Facility located at No.38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan (R.O.C).



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	HAN Access Point
Model No.:	AP311
Brand Name:	HAN NETWORKS; HANNETWORKS
Wi-Fi Specification:	802.11a/b/g/n/ac/ax
Bluetooth Specification:	V5.1 BLE only
Operating Temperature:	0 ~ 50 °C
Power Type:	PoE input or AC adapter input
Operating Environment:	Indoor Use
EUT Identification No.:	20200824Sample#01(Conducted) 20200824Sample#02(Radiated & AC conducted emission)

2.2. Product Specification Subjective to this Report

Frequency Range:	For 802.11a/n-HT20/ac-VHT20/ax-HE20: 5180~5320MHz, 5500~5720MHz, 5745~5825MHz For 802.11n-HT40/ac-VHT40/ax-HE40: 5190~5310MHz, 5510~5710MHz, 5755~5795MHz For 802.11ac-VHT80/ax-HE80: 5210MHz, 5290MHz,5530MHz, 5610 MHz,5690 MHz,5775MHz
Type of Modulation:	802.11a/n/ac: OFDM 802.11ax: OFDMA
Data Rate:	802.11a: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.6Mbps 802.11ax: up to 1201Mbps

Note: For other features of this EUT, test report will be issued separately.

2.3. Working Frequencies for this report

802.11a/n-HT20/ac-VHT20/ax-HE20

Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz	44	5220 MHz
48	5240 MHz	52	5260 MHz	56	5280 MHz
60	5300 MHz	64	5320 MHz	100	5500 MHz
104	5520 MHz	108	5540 MHz	112	5560 MHz
116	5580 MHz	120	5600 MHz	124	5620 MHz
128	5640 MHz	132	5660 MHz	136	5680 MHz
140	5700 MHz	144	5720 MHz	149	5745 MHz
153	5765 MHz	157	5785 MHz	161	5805 MHz
165	5825 MHz	--	--	--	--

802.11n-HT40/ac-VHT40/ax-HE40

Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz	54	5270 MHz
62	5310 MHz	102	5510 MHz	110	5550MHz
118	5590 MHz	126	5630 MHz	134	5670 MHz
142	5710 MHz	151	5755 MHz	159	5795 MHz

802.11ac-VHT80/ax-HE80

Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	58	5290 MHz	106	5530 MHz
122	5610 MHz	138	5690 MHz	155	5775 MHz

2.4. Description of Available Antennas

Antenna Type	Frequency Band (GHz)	Tx Paths	Bandwidth (MHz)	Max Peak Gain (dBi)		Directional Gain (dBi)		Beamforming Directional Gain (dBi)
				Ant 0	Ant 1	Power	PSD	
Wi-Fi Internal Antenna List (2.4GHz 2*2 MIMO, 5GHz 2*2 MIMO)								
PIFA	2412 ~ 2462	2	20, 40	3.20	3.30	3.30	6.31	6.26
Antenna	5150 ~ 5850	2	20, 40, 80	3.10	3.30	3.30	6.31	6.21
Bluetooth Internal Antenna								
Antenna Type		Frequency Band (GHz)			Max Peak Gain (dBi)			
PIFA Antenna		2400 ~ 2483.5			3.20			
Scan Antenna (1Tx)								
Antenna Type		Frequency Band (GHz)			Max Peak Gain (dBi)			
PIFA Antenna		2412 ~ 2462			3.20			
		5150 ~ 5250			3.30			
		5725~5850			3.30			

Note 1: The EUT supports Cyclic Delay Diversity (CDD) technology for 802.11a/b/g/n/ac/ax and Beam Forming technology for 802.11n/ac/ax.

Note 2: When the EUT supports Cyclic Delay Diversity (CDD) and it is correlated.

If all antennas have the same gain, G_{ANT} , Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

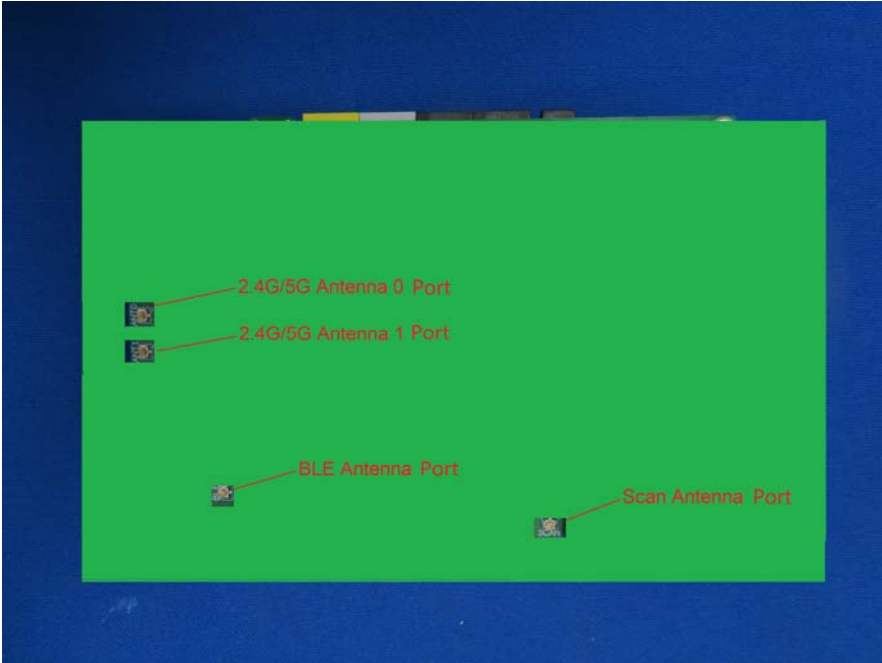
- For power spectral density (PSD) measurements on all devices,
Array Gain = $10 \log (N_{ANT} / N_{SS})$ dB = 3.01;
- For power measurements on IEEE 802.11 devices,
Array Gain = 0 dB for $N_{ANT} \leq 4$;

If antenna gains are not equal, Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain.

Note 3: The EUT also supports Beam Forming mode, and the Beam Forming support 802.11n/ac/ax, not include 802.11a/b/g. The directional gain = $10 \log [(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}]$ dBi.

Note 4: Antenna type and antenna gain are provided by the manufacturer.

2.5. Description of Antenna RF Port

Antenna RF Port					
Software Control Port	2.4G RF Port		5G RF Port		Scan RF Port
	Ant 0	Ant 1	Ant 0	Ant 1	Ant 0
					

2.6. Test Mode

Test Mode	Mode 1: Transmit by 802.11a (6Mbps)
	Mode 2: Transmit by 802.11ac-VHT20 (MCS0)
	Mode 3: Transmit by 802.11ac-VHT40 (MCS0)
	Mode 4: Transmit by 802.11ac-VHT80 (MCS0)
	Mode 5: Transmit by 802.11ax-HE20 (MCS0)
	Mode 6: Transmit by 802.11ax-HE40 (MCS0)
	Mode 7: Transmit by 802.11ax-HE80 (MCS0)

Note: Due to the same modulation between 802.11n and 802.11ac, so 802.11n-HT20 and HT40 are covered by 802.11ac-VHT20 and VHT40 in this report, meanwhile, power setting for 802.11n-HT20 and HT40 is same as 802.11ac-VHT20 and VHT40.

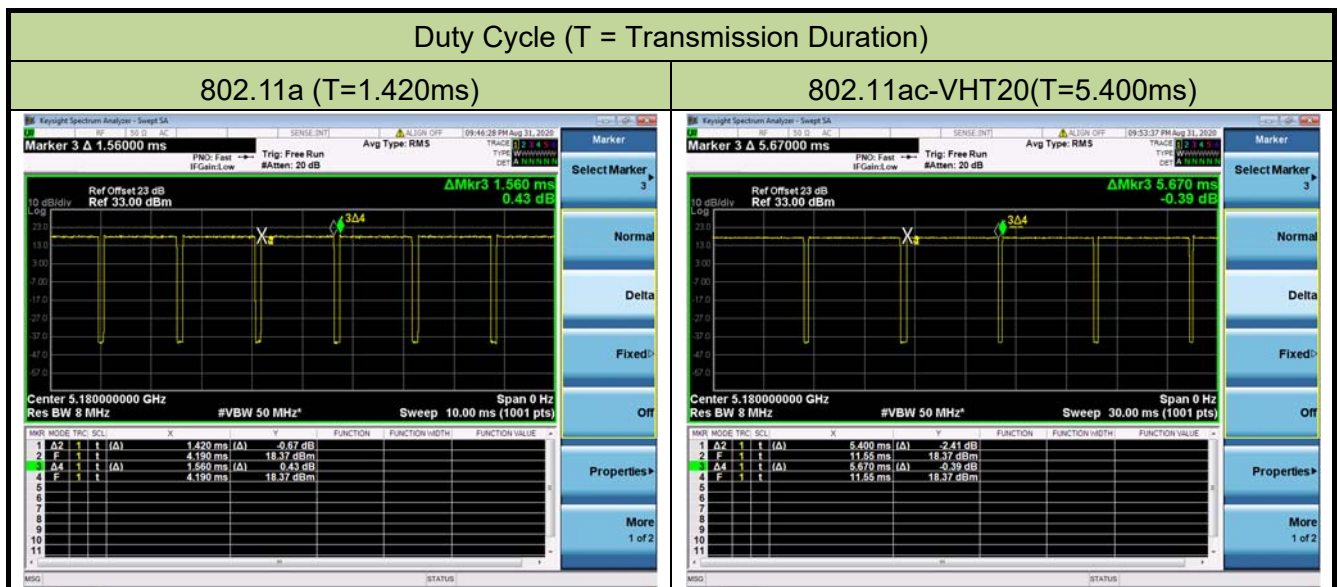
2.7. Description of Test Software

The test utility software used during testing was “QSPR”, and the version was “v50-00186”.

2.8. Duty Cycle

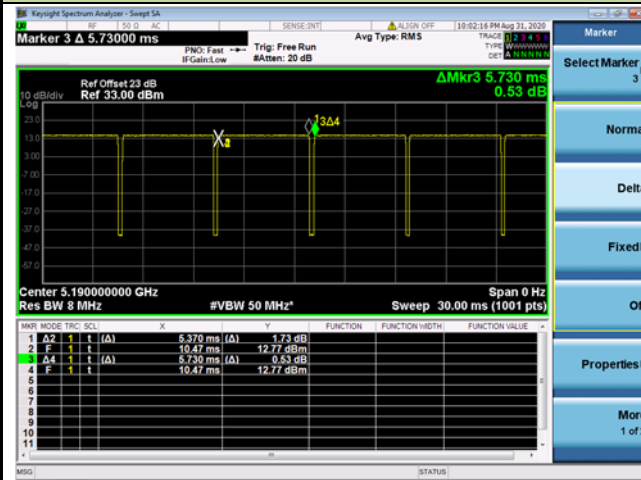
5GHz (NII) operation is possible in 20MHz, 40MHz, 80MHz and 160MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Test Mode	Duty Cycle	
	AP311	AP311 Scan Antenna
802.11a	91.0%	96.2%
802.11ac-VHT20	95.2%	--
802.11ac-VHT40	93.7%	--
802.11ac-VHT80	94.7%	--
802.11ax-HE20	94.7%	--
802.11ax-HE40	95.2%	--
802.11ax-HE80	94.7%	--

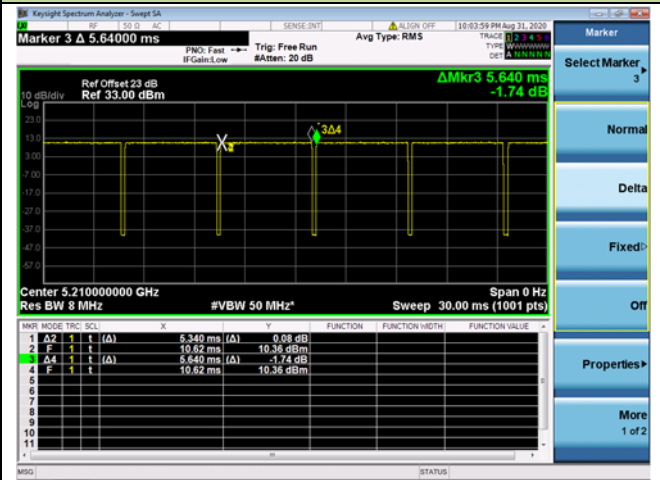


Duty Cycle (T = Transmission Duration)

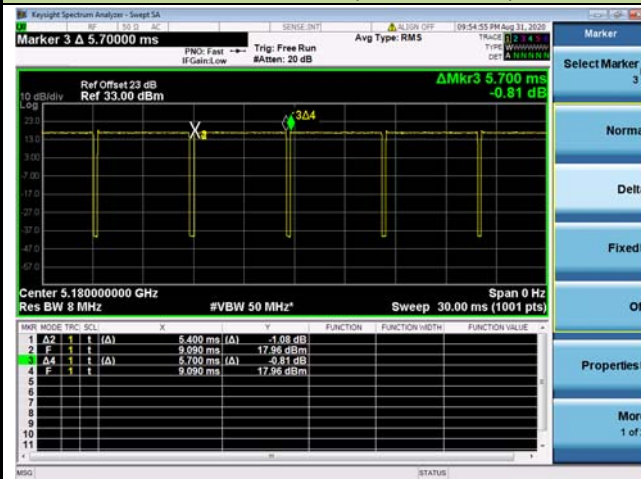
802.11ac-VHT40(T=5.370ms)



802.11ac-VHT80(T=5.340ms)



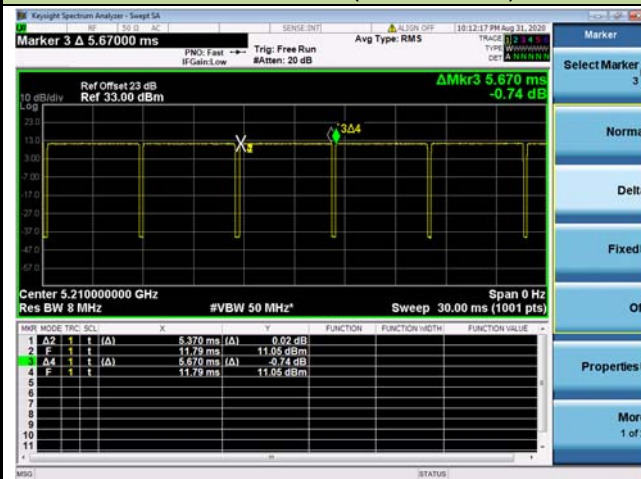
802.11ax-HE20(T=5.400ms)

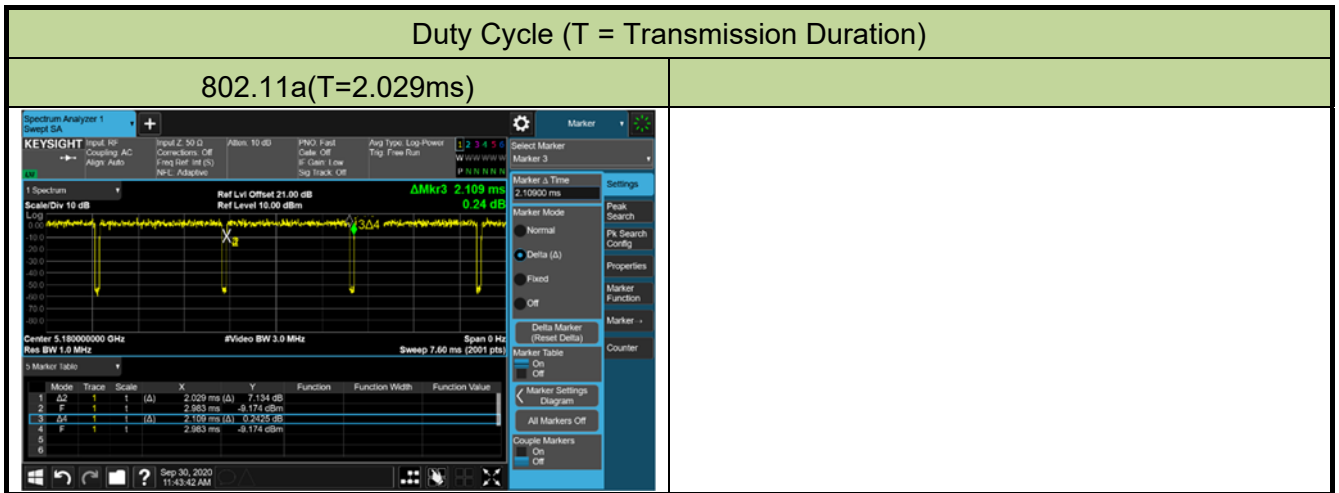


802.11ax-HE40(T=5.400ms)



802.11ax-HE80(T=5.370ms)





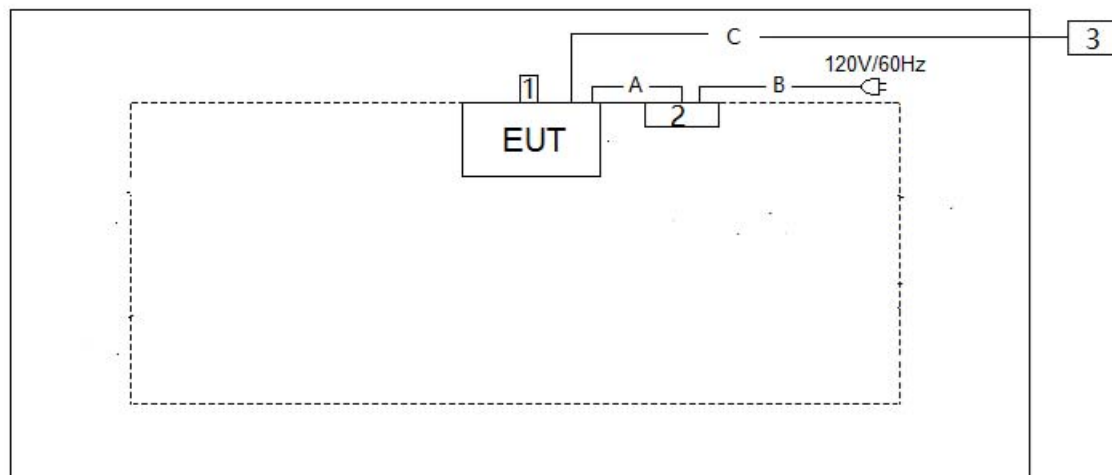
2.9. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.10. Configuration of Tested System

This device was tested per the guidance ANSI C63.10:2013 was used to reference the appropriate EUT setup for radiated emissions testing and AC line conducted testing.

Connection Diagram



Cable Type	cable Description	
A	Power Cable	Non-Shielding, 1.5m
B	Power Cable	Non-Shielding, 1.5m
C	LAN Cable	Non-Shielding, > 10m

2.11. Test System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	USB Dongle	SanDisk	BL161025264V	N/A	N/A
2	AC Adapter	DELTA	ADP-30HR B	1WMD05S00T5	Non-Shielded, 1.8m
3	Notebook	ASUS	PRO45V	N/A	Non-Shielded, 1.8m

3. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.”

- The antenna of the device is **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

4. TEST EQUIPMENT CALIBRATION DATE

Radiated Disturbance :

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2021/10/5
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	1 year	2021/4/27
Broadband Hornantenna	SCHWARZBECK	BBHA 9120D	MRTTWA00003	1 year	2021/4/24
Breitband Hornantenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	1 year	2021/4/24
Broadband Preamplifier	SCHWARZBECK	BBV 9718	MRTTWA00005	1 year	2021/4/24
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	1 year	2021/4/24
Signal Analyzer	R&S	FSV40	MRTTWA00007	1 year	2021/3/24
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2021/3/25
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2021/10/14
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2021/7/14
Antenna Cable	HUBERSUHNER	SF106	MRTTWE00010	1 year	2021/6/16
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00032	1 year	2021/5/29
Cable	Rosnol	K1K50-UP0264-K1 K50-4M	MRTTWE00012	1 year	2021/6/21

Conducted Emissions :

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Two-Line V-Network	R&S	ENV216	MRTTWA00019	1 year	2021/3/26
Two-Line V-Network	R&S	ENV216	MRTTWA00020	1 year	2021/4/24
8-Wire ISN (T8-Cat6)	R&S	ENY81 CA6	MRTTWA00017	1 year	2021/5/25
8-Wire ISN (T8)	R&S	ENY81	MRTTWA00018	1 year	2021/5/25
8-Wire ISN	TESEQ	CDN ST08AS	MRTTWA00083	1 year	2021/9/2
EMI Test Receiver	R&S	ESR3	MRTTWA00045	1 year	2021/5/26
Conducted Cable	Rosnol	N1C50-RG400-B1C 50-500CM	MRTTWE00013	1 year	2021/6/21
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2021/5/28

Conducted Test Equipment:

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
X-Series USB Peak and Average Power Sensor	KEYSIGHT	U2021XA	MRTTWA00014	1 year	2021/4/24
X-Series USB Peak and Average Power Sensor	KEYSIGHT	U2021XA	MRTTWA00015	1 year	2021/3/26
Wideband Radio Communication Taster	R&S	CMW 500	MRTTWA00041	1 year	2021/1/7
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2021/11/14
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2021/7/14
Signal Analyzer	R&S	FSV40	MRTTWA00007	1 year	2021/3/24
Temperature & Humidity Chamber	TEN BILLION	TTH-B3UP	MRTTWA00036	1 year	2021/6/9
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00033	1 year	2021/5/28

Software	Version	Function
e3	9.160520a	EMI Test Software

5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 150kHz~30MHz: 2.53dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 9kHz ~ 1GHz: 4.25dB 1GHz ~ 40GHz: 4.45dB
Conducted Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): ± 0.84 dB
Conducted Spurious Emission
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): ± 2.65 dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 3.3%
Temp. / Humidity
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): $\pm 0.82^\circ\text{C}$ / $\pm 3\%$
Frequency Error
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): ± 78.4 Hz

6. TEST RESULT

6.1. Summary

FCC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.407(a)	26dB Bandwidth	N/A	Conducted	Pass	Section 7.2
15.407(e)	6dB Bandwidth	$\geq 500\text{kHz}$		Pass	Section 7.3
15.407(a)(1)(ii), (2), (3)	Maximum Conducted Output Power	Refer to section 7.4		Pass	Section 7.4
15.407(h)(1)	Transmit Power Control	$\leq 24\text{ dBm}$		Pass	Section 7.5
15.407(a)(1)(ii), (2), (3)	Peak Power Spectral Density	Refer to section 7.6		Pass	Section 7.6
15.407(g)	Frequency Stability	$\pm 20\text{ ppm}$		Pass	Section 7.7
15.407(b)(1), (2), (3), (4)(i)	Undesirable Emissions	Refer to Section 7.8	Radiated	Pass	Section 7.8 & 7.9
15.205, 15.209 15.407(b)(1), (2), (3), (4)(i)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		Pass	
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.10

Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) Output power test was verified over all data rates of each mode (data refers to operational description), and then choose the maximum power output (low data rate) for final test of each channel.
- 3) For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
- 4) Test Items "6dB Bandwidth" & "Band Edge / Out-of-Band Emissions" have been assessed MIMO transmission, and showed the worst test data in this report.
- 5) The power setting of CDD & Beam-Forming mode are the same.

6.2. 26dB Bandwidth Measurement

6.2.1.Test Limit

N/A

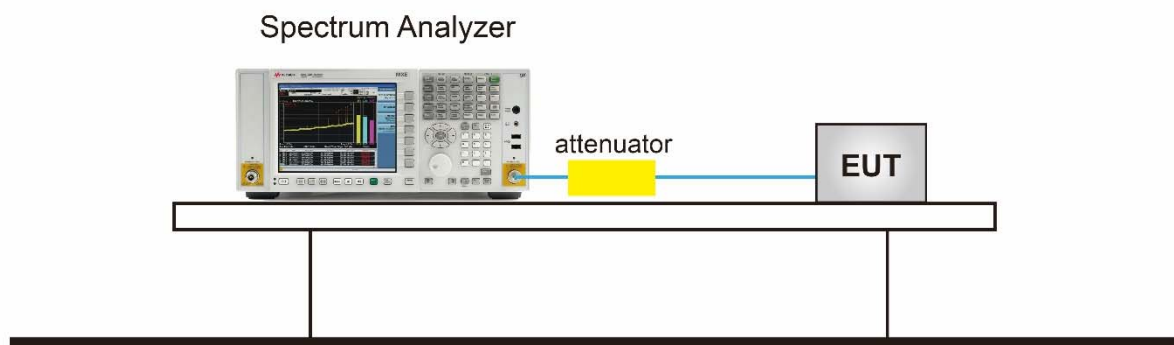
6.2.2.TestProcedure used

KDB 789033 D02v02r01- Section C.1

6.2.3.TestSetting

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to $X = 26$. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediated power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth.
3. VBW $\geq 3 \times$ RBW.
4. Detector = Peak.
5. Trace mode = max hold.

6.2.4.Test Setup



6.2.5.Test Result

Product	HAN Access Point, AP311	Temperature	24 ~ 25°C
Test Engineer	Kevin Ker	Relative Humidity	48 ~ 56%
Test Site	SR1	Test Date	2020/09/17
Test Mode	AP311		

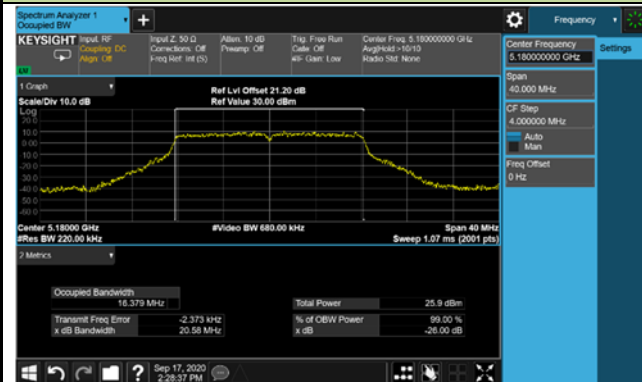
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 1/ Ant 0 + 1					
802.11a	6Mbps	36	5180	20.58	16.38
802.11a	6Mbps	44	5220	19.92	16.44
802.11a	6Mbps	48	5240	19.25	16.40
802.11a	6Mbps	52	5260	20.75	16.38
802.11a	6Mbps	60	5300	20.46	16.44
802.11a	6Mbps	64	5320	19.84	16.41
802.11a	6Mbps	100	5500	19.70	16.41
802.11a	6Mbps	116	5580	19.44	16.43
802.11a	6Mbps	140	5700	19.84	16.40
802.11a	6Mbps	144	5720	19.98	16.41
802.11a	6Mbps	149	5745	19.28	16.43
802.11a	6Mbps	157	5785	20.36	16.38
802.11a	6Mbps	165	5825	20.05	16.41
802.11ac-VHT20	MCS0	36	5180	19.97	17.62
802.11ac-VHT20	MCS0	44	5220	19.91	17.61
802.11ac-VHT20	MCS0	48	5240	20.89	17.60
802.11ac-VHT20	MCS0	52	5260	20.95	17.62
802.11ac-VHT20	MCS0	60	5300	20.68	17.60
802.11ac-VHT20	MCS0	64	5320	19.78	17.60
802.11ac-VHT20	MCS0	100	5500	20.33	17.58
802.11ac-VHT20	MCS0	116	5580	20.22	17.59
802.11ac-VHT20	MCS0	140	5700	20.67	17.60
802.11ac-VHT20	MCS0	144	5720	20.84	17.60
802.11ac-VHT20	MCS0	149	5745	20.43	17.60
802.11ac-VHT20	MCS0	157	5785	21.09	17.61
802.11ac-VHT20	MCS0	165	5825	21.00	17.61

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 1/ Ant 0 + 1					
802.11ac-VHT40	MCS0	38	5190	39.22	36.01
802.11ac-VHT40	MCS0	46	5230	39.45	35.90
802.11ac-VHT40	MCS0	54	5270	39.39	36.01
802.11ac-VHT40	MCS0	62	5310	38.88	35.97
802.11ac-VHT40	MCS0	102	5510	38.36	35.88
802.11ac-VHT40	MCS0	110	5550	39.14	35.88
802.11ac-VHT40	MCS0	134	5670	38.83	35.84
802.11ac-VHT40	MCS0	142	5710	38.63	35.81
802.11ac-VHT40	MCS0	151	5755	38.14	35.82
802.11ac-VHT40	MCS0	159	5795	38.64	35.81
802.11ac-VHT80	MCS0	42	5210	81.07	75.40
802.11ac-VHT80	MCS0	58	5290	80.88	75.41
802.11ac-VHT80	MCS0	106	5530	80.62	75.31
802.11ac-VHT80	MCS0	122	5610	80.96	75.44
802.11ac-VHT80	MCS0	138	5690	80.84	75.43
802.11ac-VHT80	MCS0	155	5775	81.17	75.30
802.11ax-HE20	MCS0	36	5180	20.98	18.93
802.11ax-HE20	MCS0	44	5220	20.80	18.93
802.11ax-HE20	MCS0	48	5240	21.12	18.91
802.11ax-HE20	MCS0	52	5260	21.17	18.93
802.11ax-HE20	MCS0	60	5300	20.58	18.88
802.11ax-HE20	MCS0	64	5320	21.23	18.92
802.11ax-HE20	MCS0	100	5500	20.79	18.86
802.11ax-HE20	MCS0	116	5580	20.92	18.94
802.11ax-HE20	MCS0	140	5700	20.57	18.94
802.11ax-HE20	MCS0	144	5720	21.06	18.93
802.11ax-HE20	MCS0	149	5745	20.98	18.90
802.11ax-HE20	MCS0	157	5785	20.76	18.89
802.11ax-HE20	MCS0	165	5825	20.55	18.92

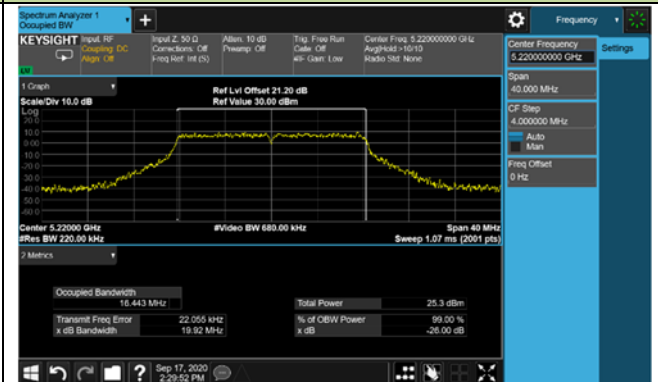
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 1/ Ant 0 + 1					
802.11ax-HE40	MCS0	38	5190	39.11	37.17
802.11ax-HE40	MCS0	46	5230	39.54	37.16
802.11ax-HE40	MCS0	54	5270	39.28	36.96
802.11ax-HE40	MCS0	62	5310	39.09	37.00
802.11ax-HE40	MCS0	102	5510	39.30	37.13
802.11ax-HE40	MCS0	110	5550	39.46	37.07
802.11ax-HE40	MCS0	134	5670	38.96	37.07
802.11ax-HE40	MCS0	142	5710	39.83	37.37
802.11ax-HE40	MCS0	151	5755	39.16	37.30
802.11ax-HE40	MCS0	159	5795	39.39	37.27
802.11ax-HE80	MCS0	42	5210	80.72	77.10
802.11ax-HE80	MCS0	58	5290	80.90	77.15
802.11ax-HE80	MCS0	106	5530	82.14	77.14
802.11ax-HE80	MCS0	122	5610	81.21	76.93
802.11ax-HE80	MCS0	138	5690	80.72	76.92
802.11ax-HE80	MCS0	155	5775	81.20	77.03

802.11a 26dB Bandwidth & 99% Bandwidth

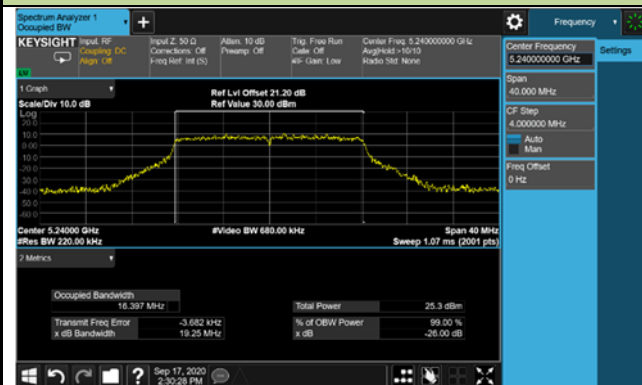
Channel 36 (5180MHz)



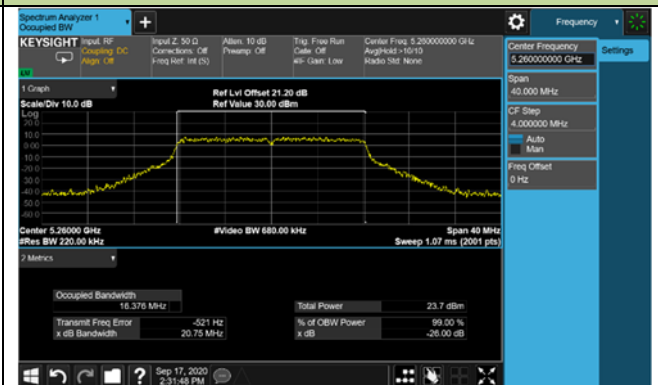
Channel 44 (5220MHz)



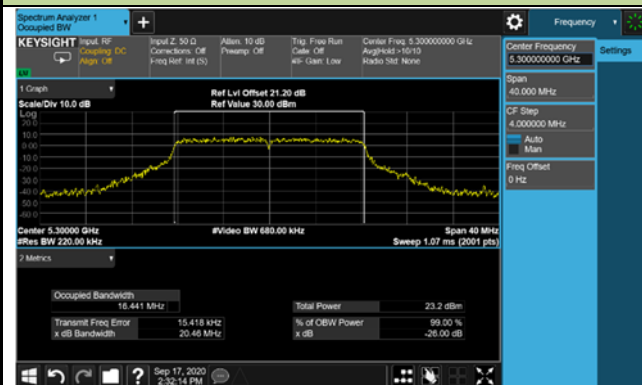
Channel 48 (5240MHz)



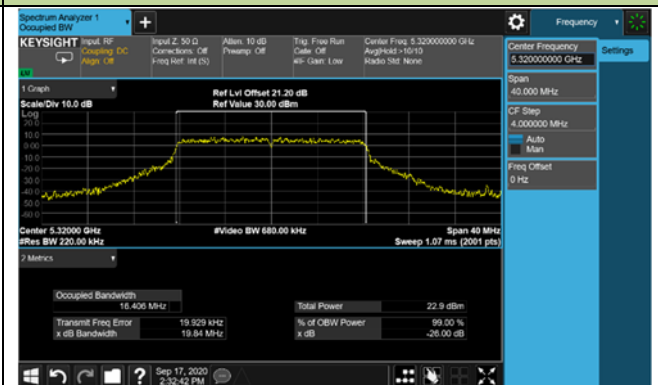
Channel 52 (5260MHz)



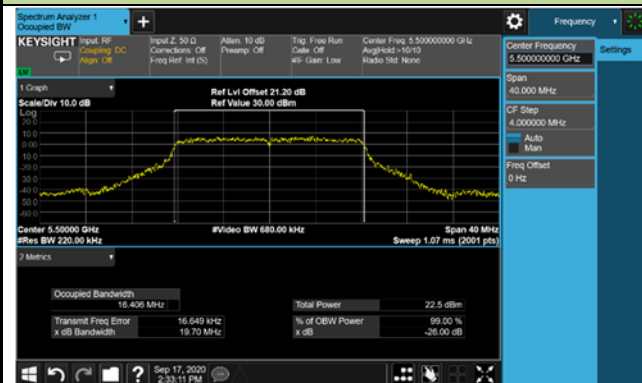
Channel 60 (5300MHz)



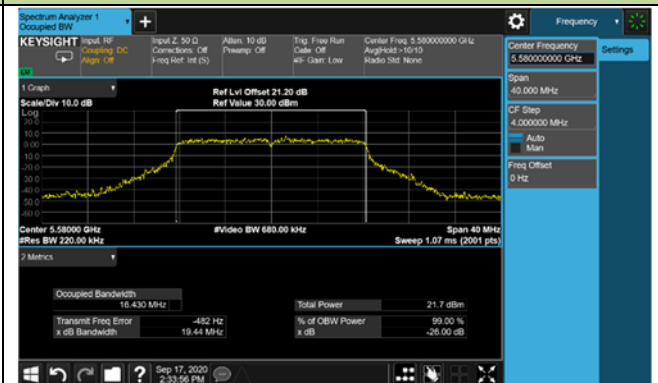
Channel 64 (5320MHz)

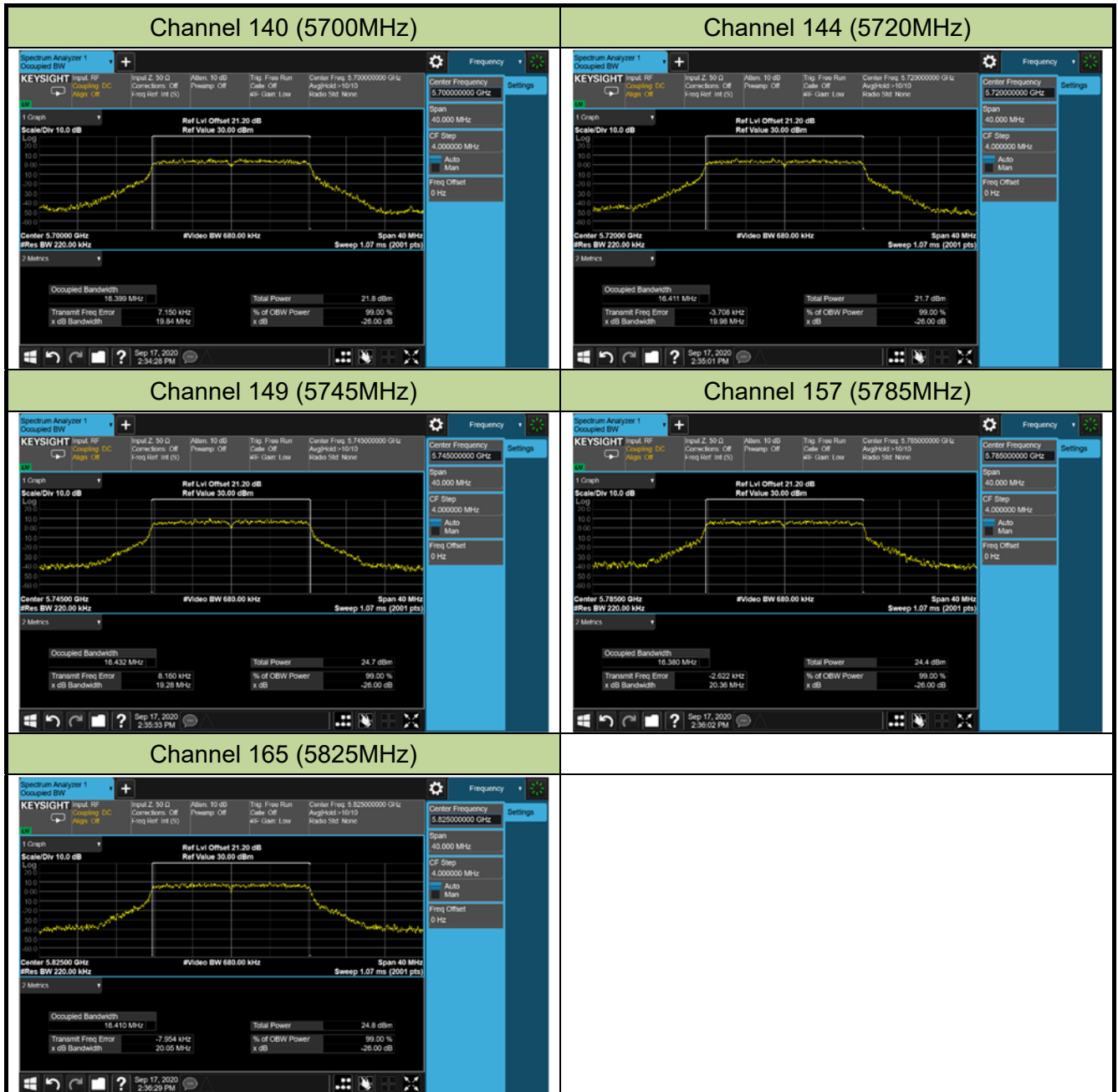


Channel 100 (5500MHz)



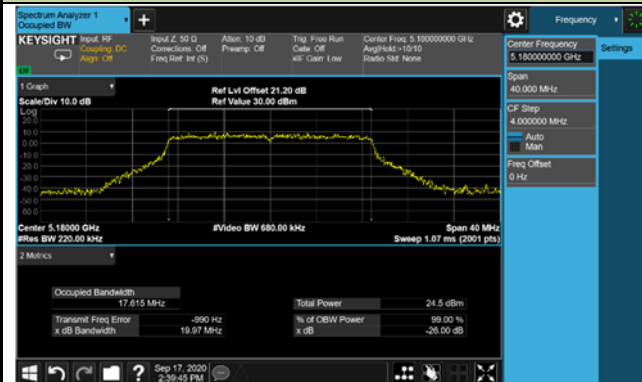
Channel 116 (5580MHz)



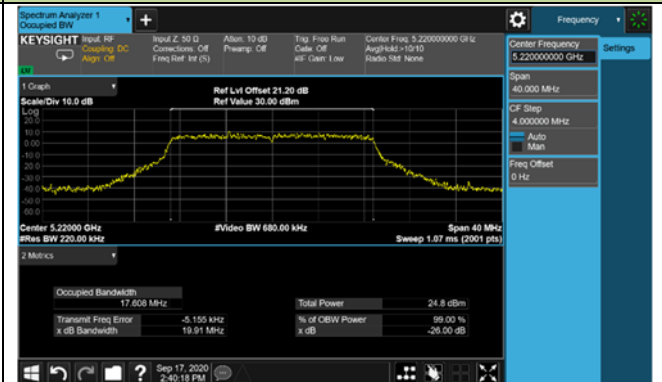


802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth

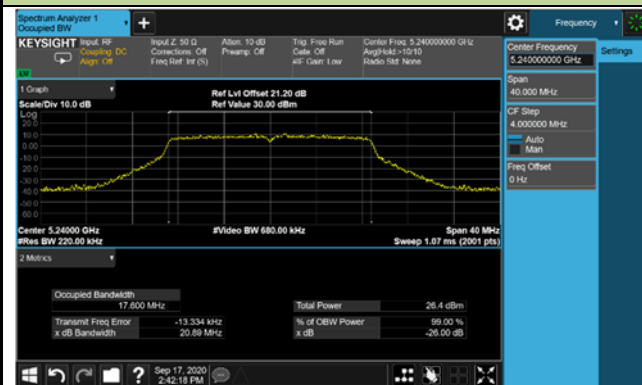
Channel 36 (5180MHz)



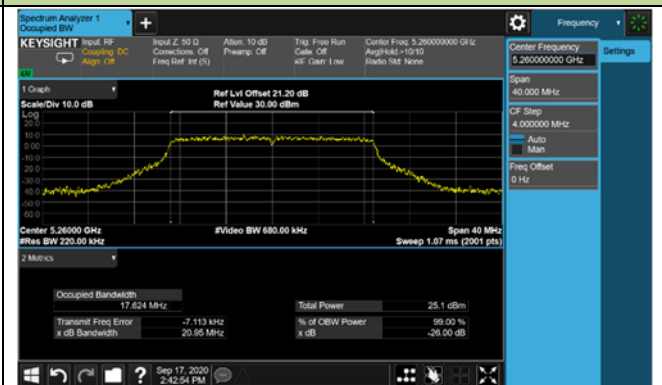
Channel 44 (5220MHz)



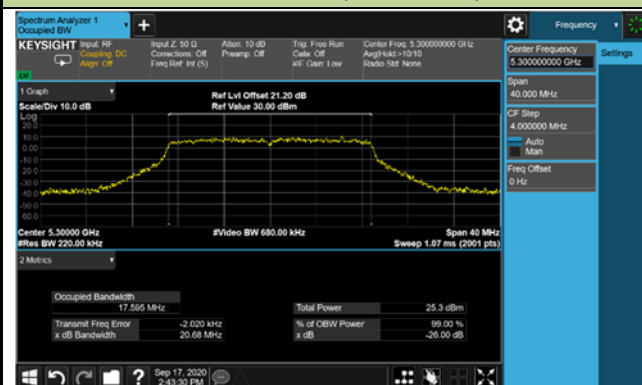
Channel 48 (5240MHz)



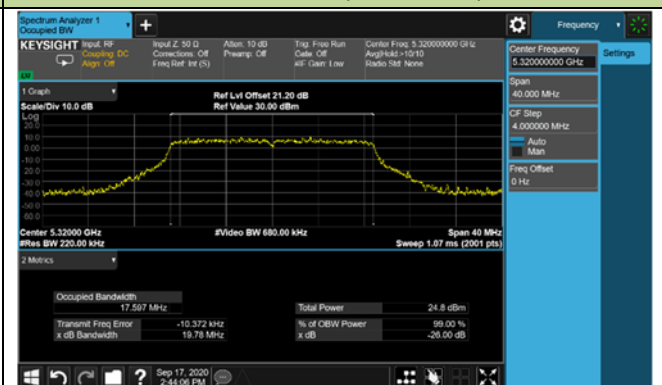
Channel 52 (5260MHz)



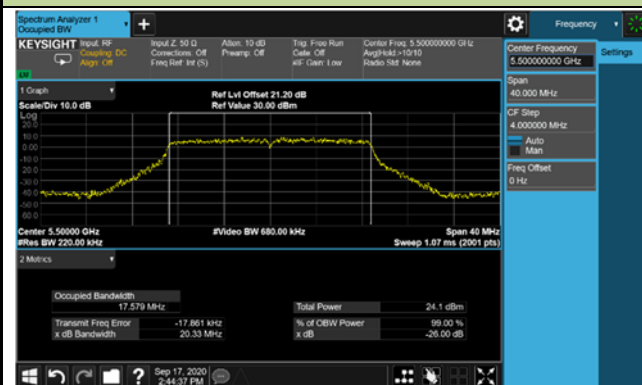
Channel 60 (5300MHz)



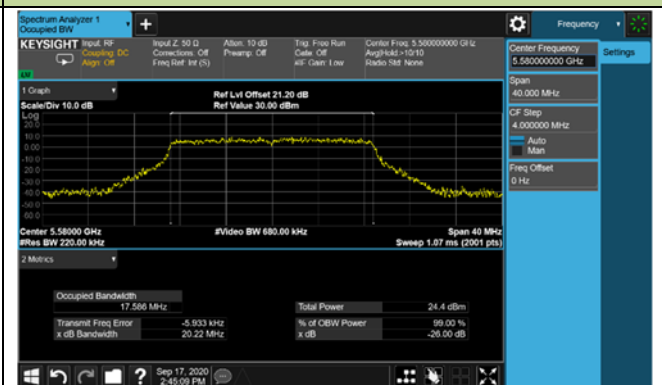
Channel 64 (5320MHz)

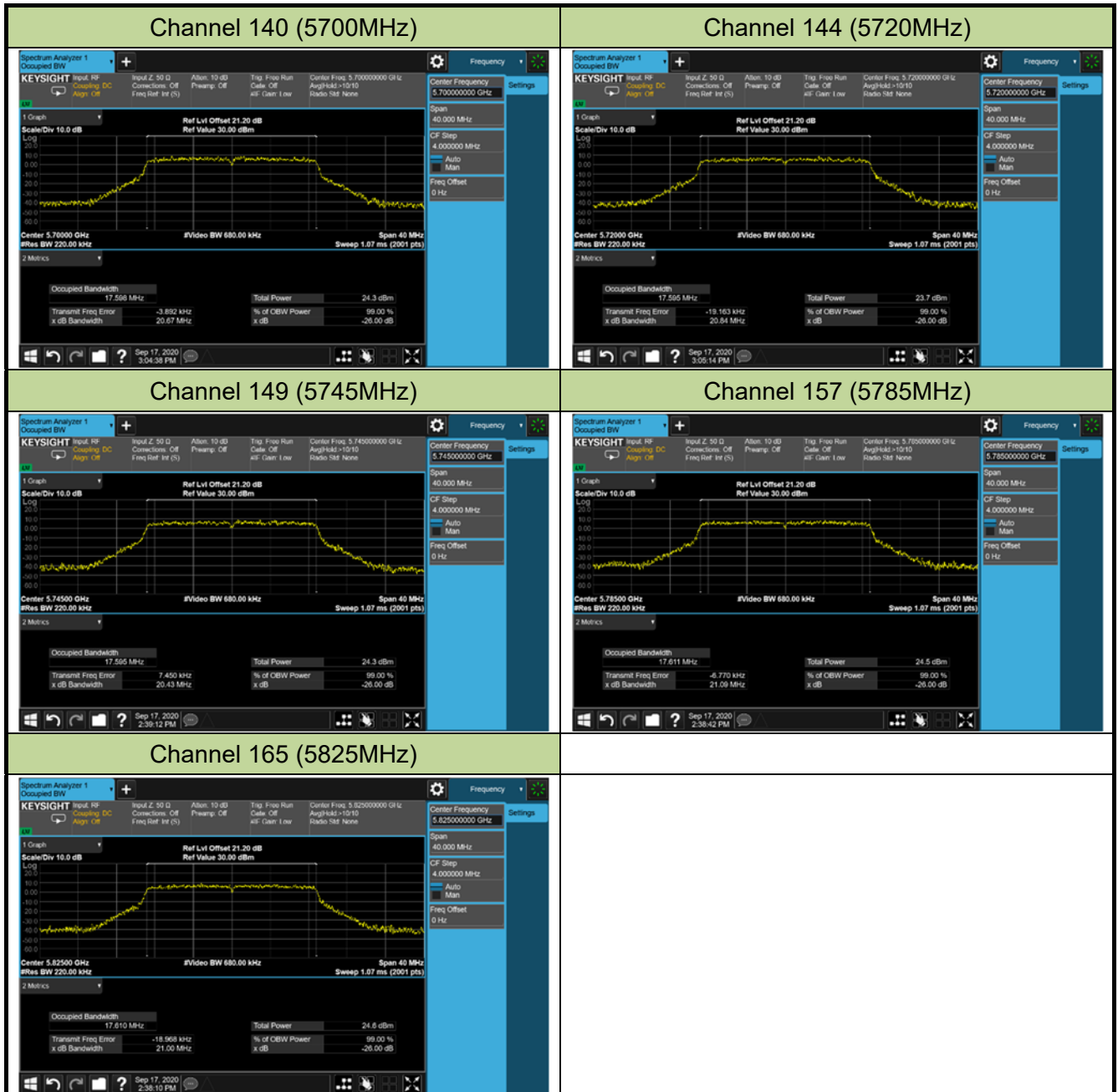


Channel 100 (5500MHz)



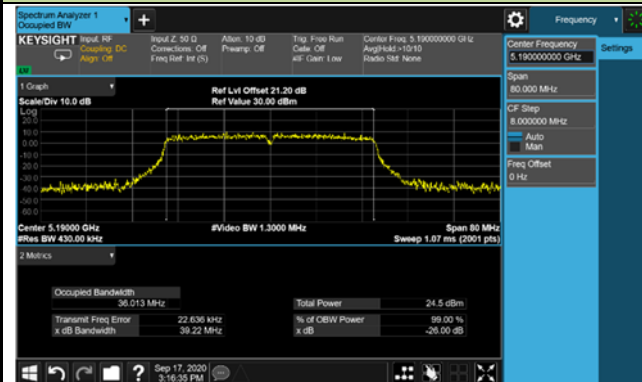
Channel 116 (5580MHz)



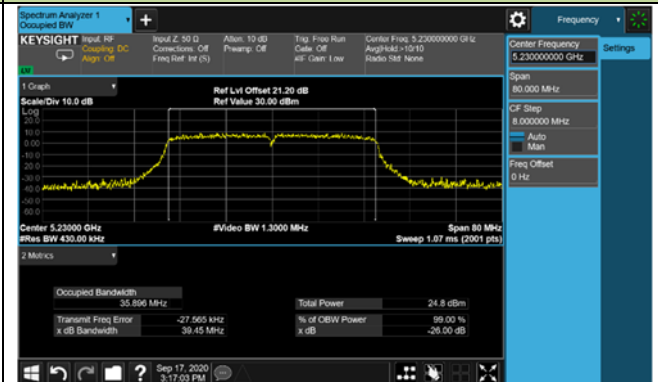


802.11ac-VHT40 26dB Bandwidth & 99% Bandwidth

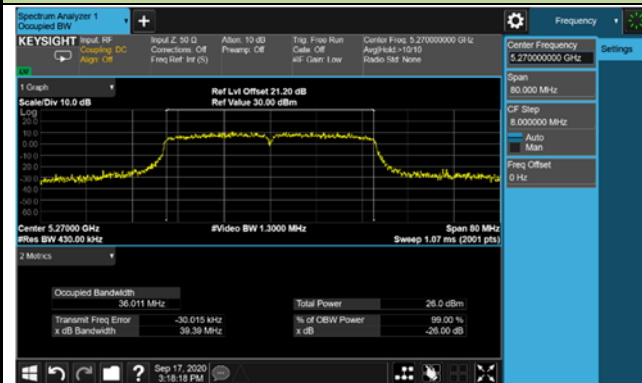
Channel 38 (5190MHz)



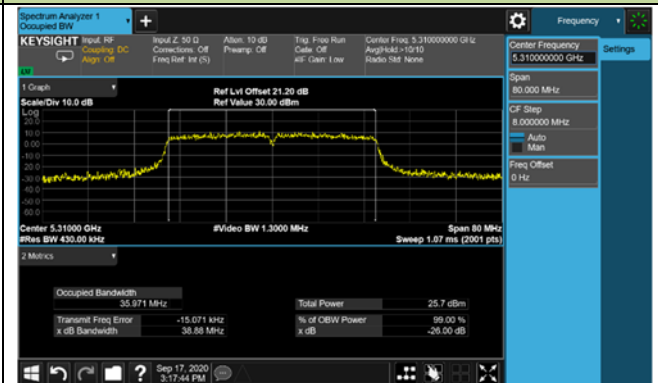
Channel 46 (5230MHz)



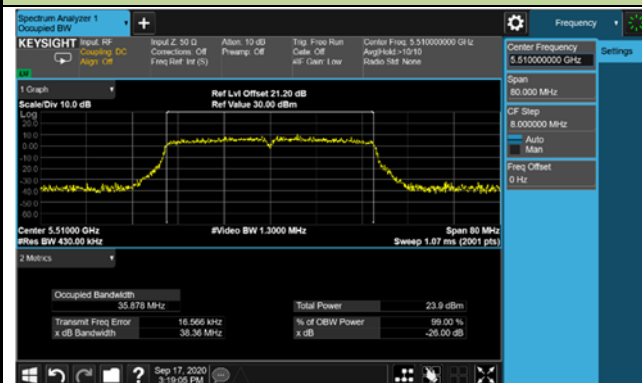
Channel 54 (5270MHz)



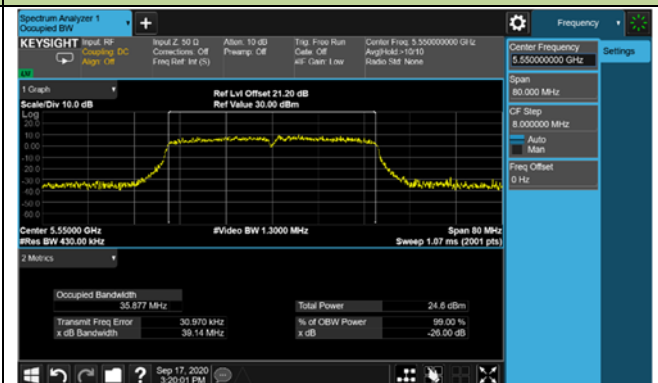
Channel 62 (5310MHz)



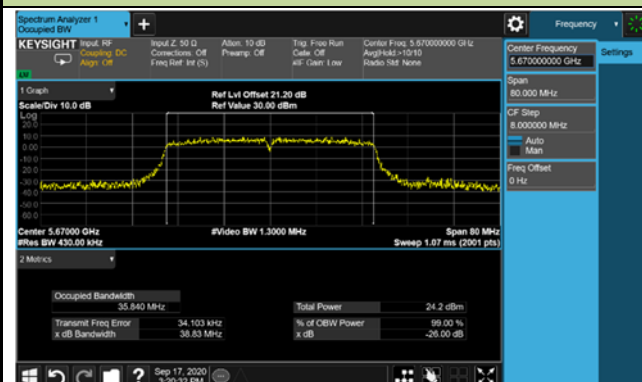
Channel 102 (5510MHz)



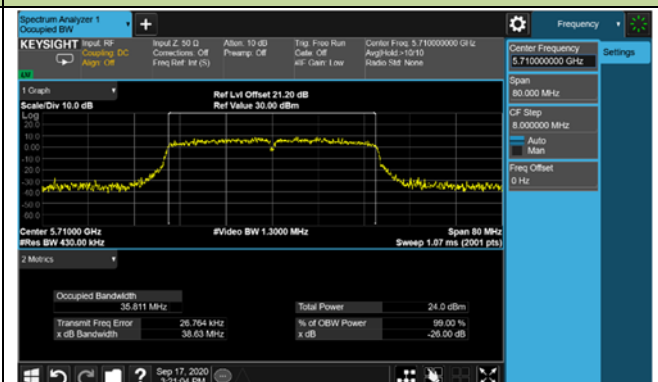
Channel 110 (5550MHz)

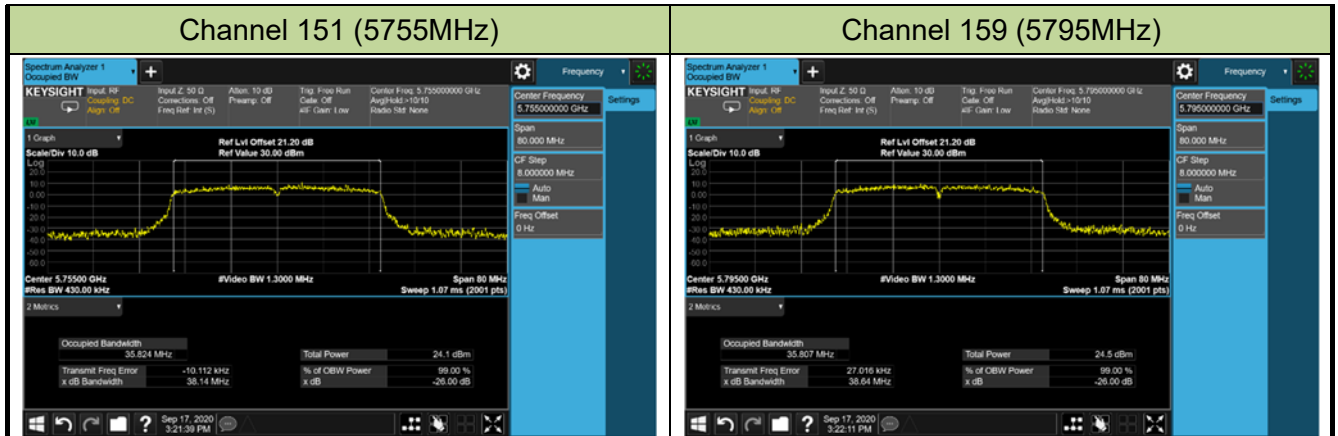


Channel 134 (5670MHz)



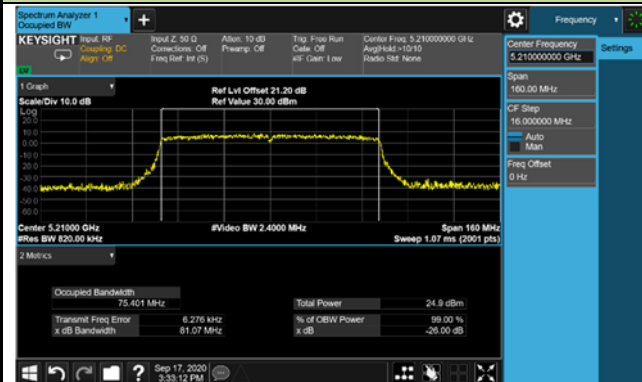
Channel 142 (5710MHz)



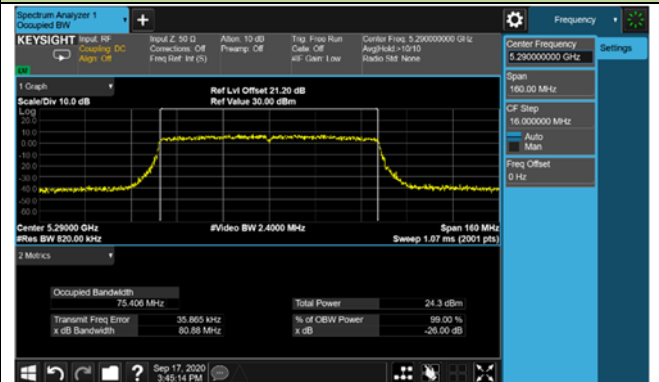


802.11ac-VHT80 26dB Bandwidth & 99% Bandwidth

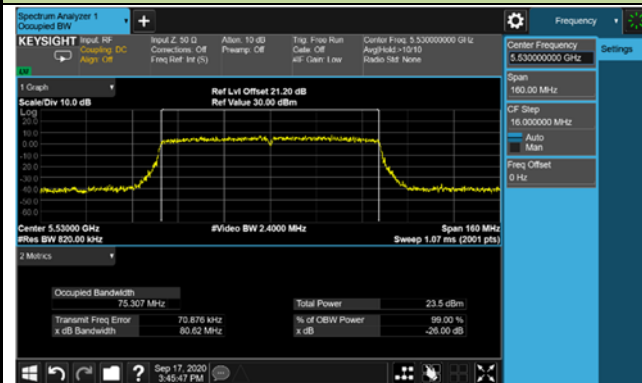
Channel 42 (5210MHz)



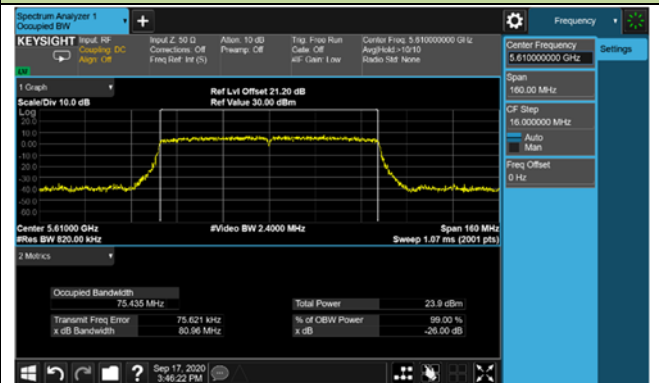
Channel 58 (5290MHz)



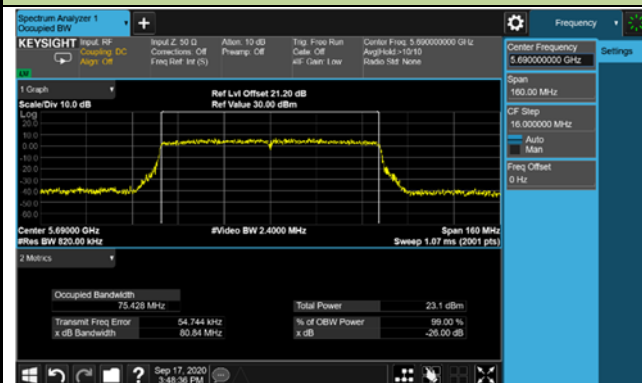
Channel 106 (5530MHz)



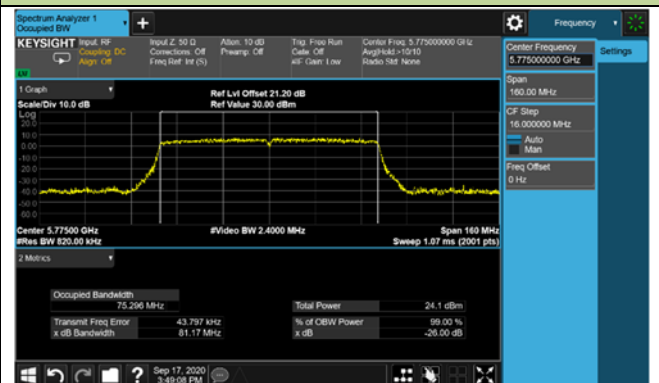
Channel 122 (5610MHz)



Channel 138 (5690MHz)

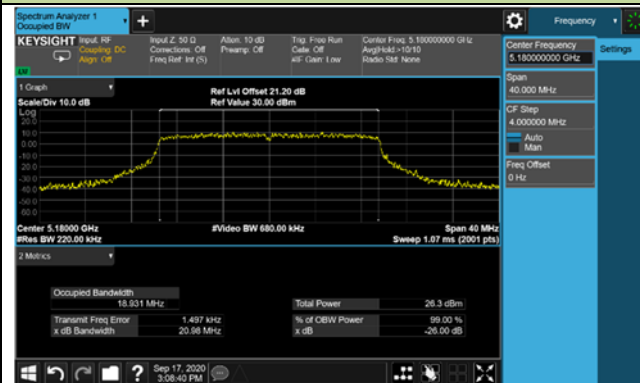


Channel 155 (5775MHz)

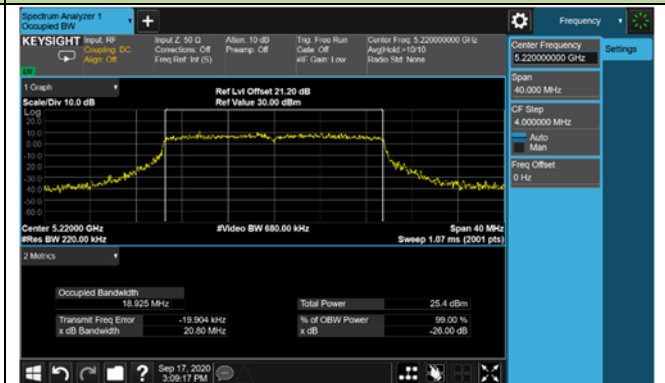


802.11ax-HE20 26dB Bandwidth & 99% Bandwidth

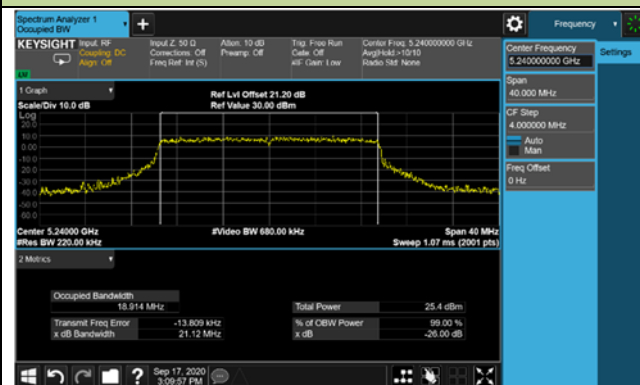
Channel 36 (5180MHz)



Channel 44 (5220MHz)



Channel 48 (5240MHz)



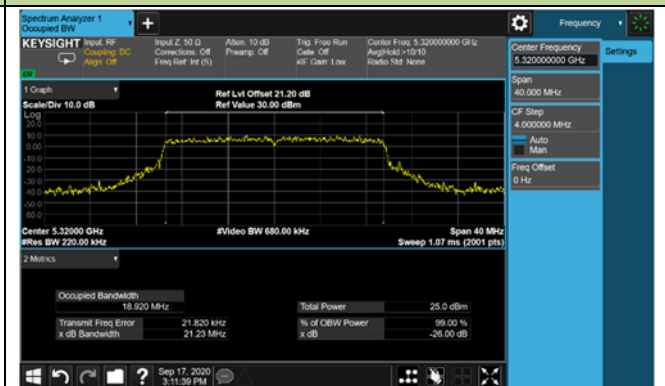
Channel 52 (5260MHz)



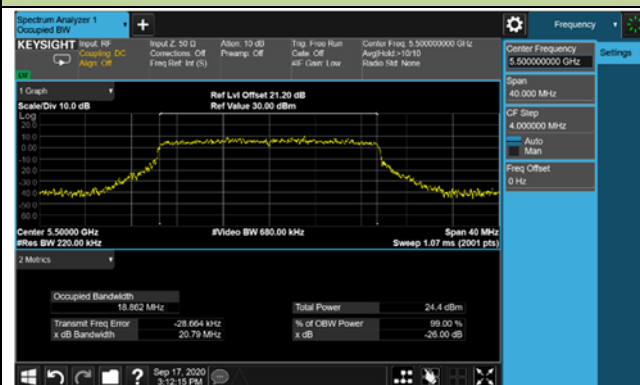
Channel 60 (5300MHz)



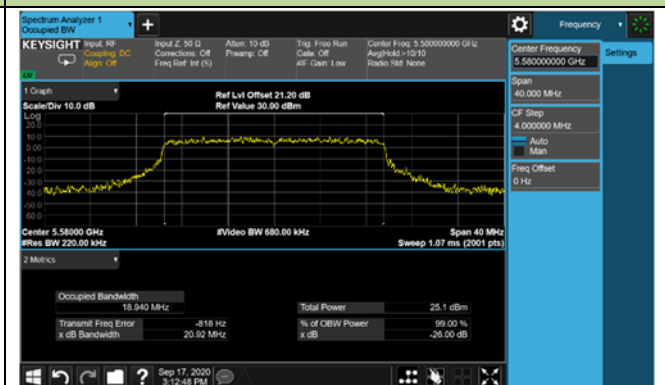
Channel 64 (5320MHz)

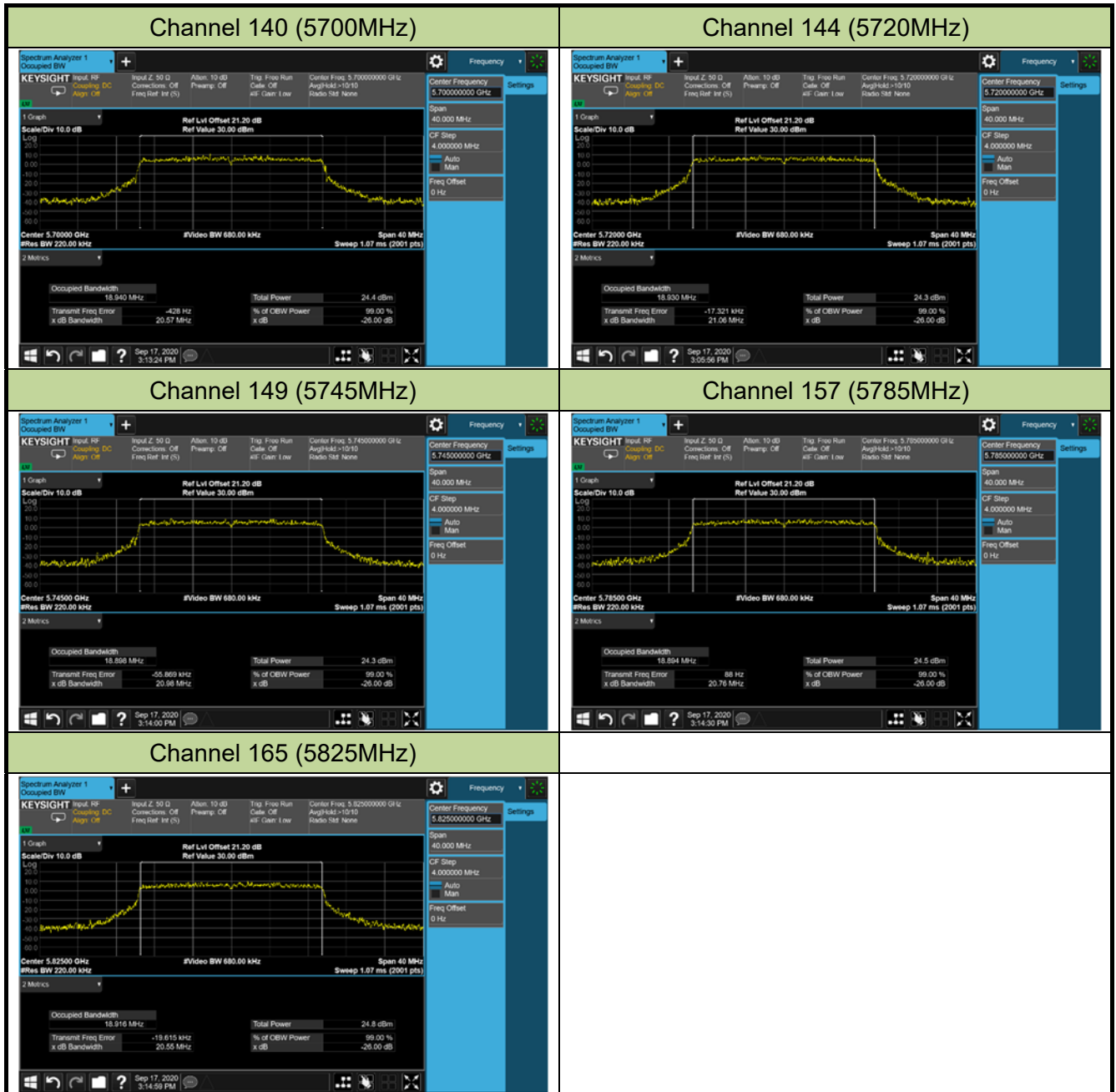


Channel 100 (5500MHz)



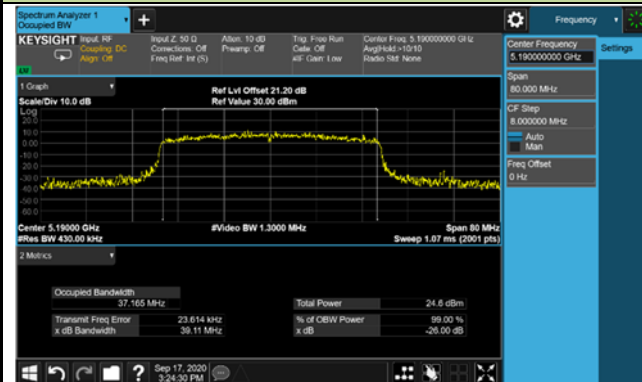
Channel 116 (5580MHz)



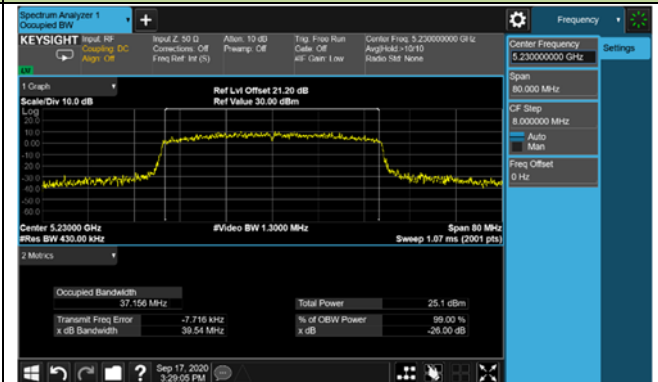


802.11ax-HE40 26dB Bandwidth & 99% Bandwidth

Channel 38 (5190MHz)



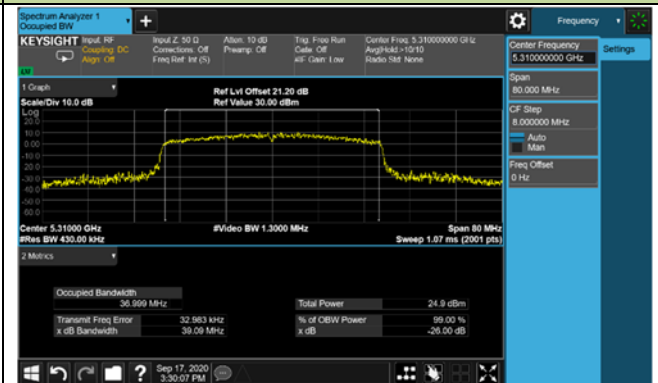
Channel 46 (5230MHz)



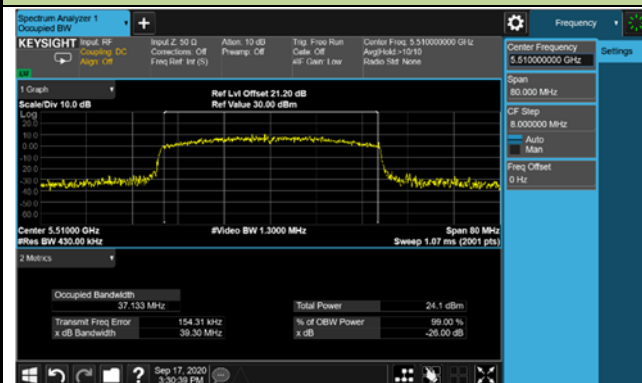
Channel 54 (5270MHz)



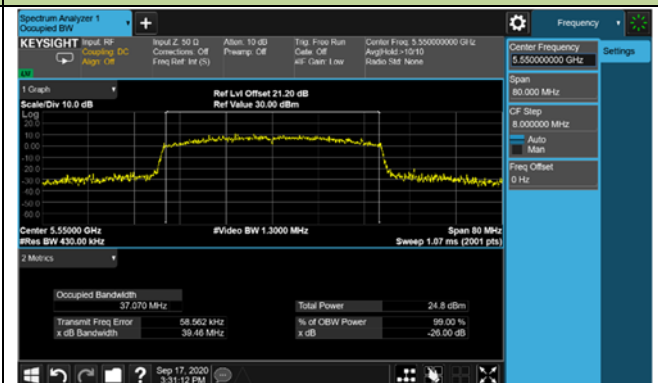
Channel 62 (5310MHz)



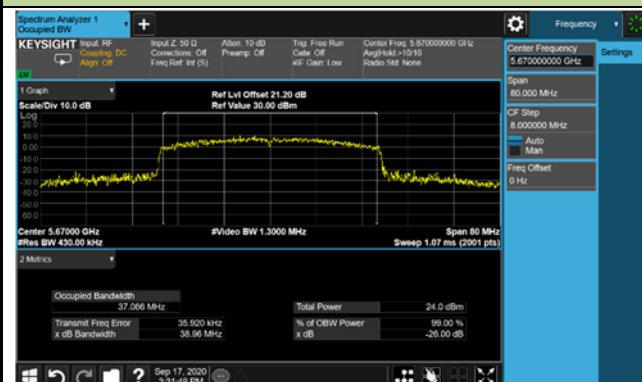
Channel 102 (5510MHz)



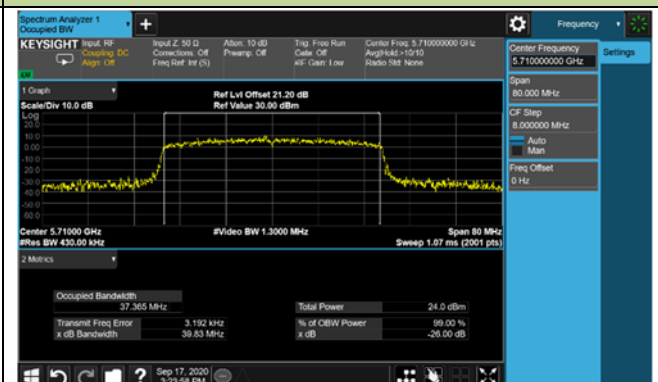
Channel 110 (5550MHz)

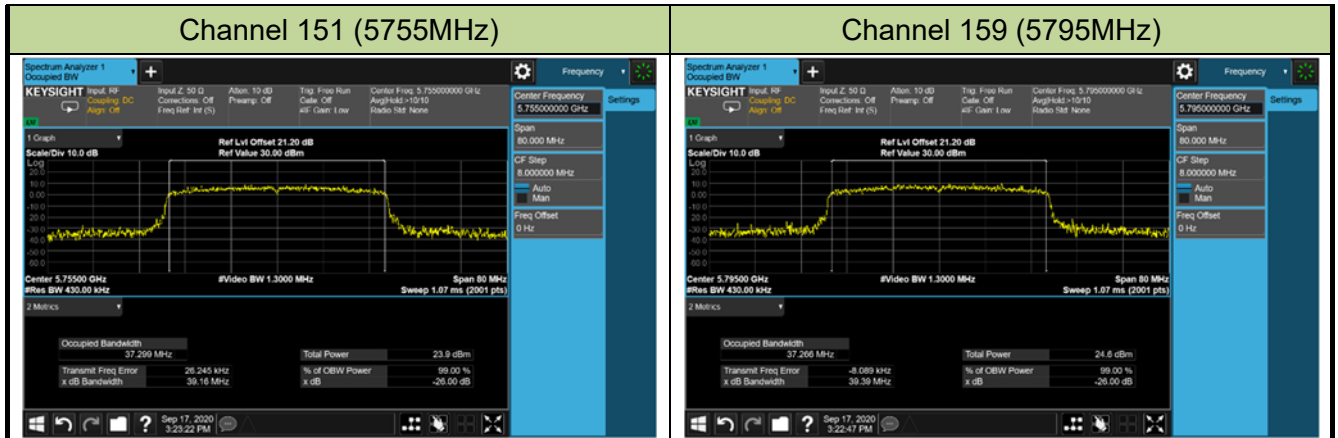


Channel 134 (5670MHz)



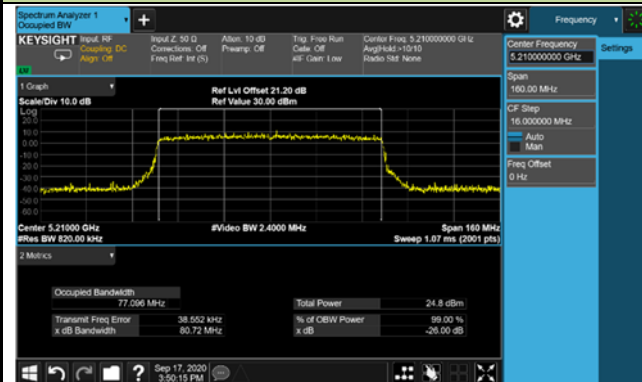
Channel 142 (5710MHz)



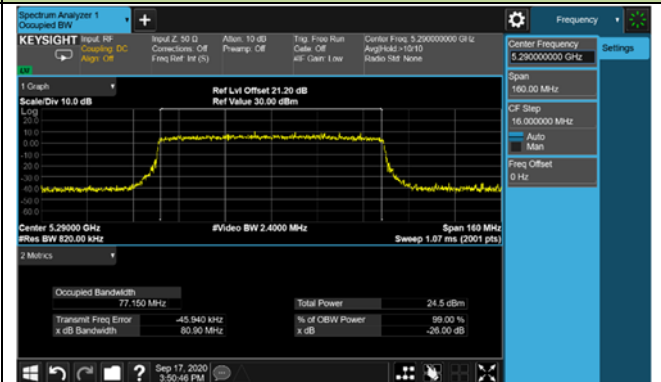


802.11ax-HE80 26dB Bandwidth & 99% Bandwidth

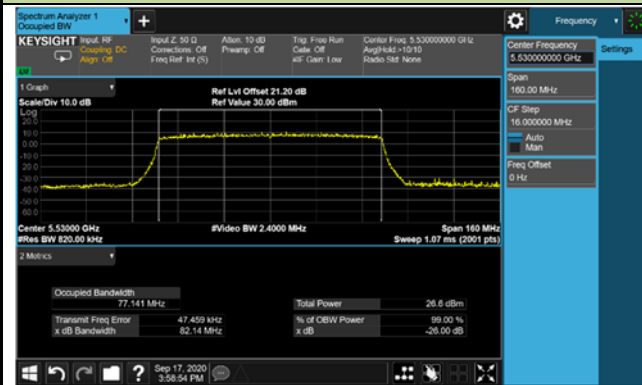
Channel 42 (5210MHz)



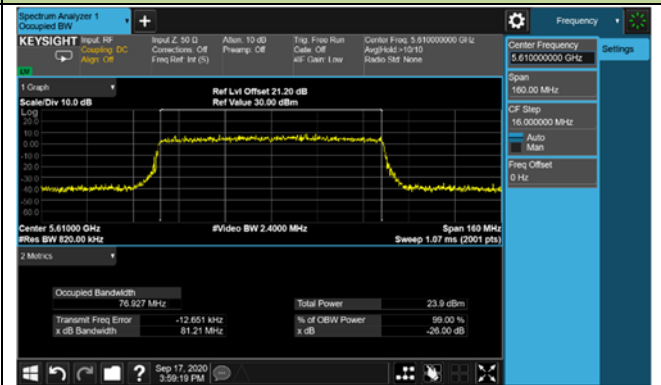
Channel 58 (5290MHz)



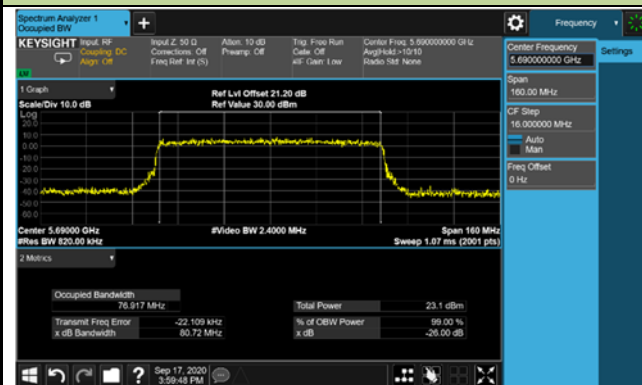
Channel 106 (5530MHz)



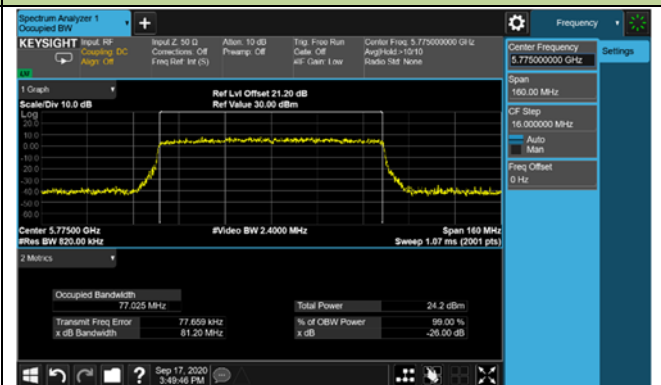
Channel 122 (5610MHz)



Channel 138 (5690MHz)



Channel 155 (5775MHz)



Product	HAN Access Point, AP311	Temperature	24 ~ 25°C
Test Engineer	Kevin Ker	Relative Humidity	48 ~ 56%
Test Site	SR1	Test Date	2020/09/30
Test Mode	AP311 Scan Antenna		

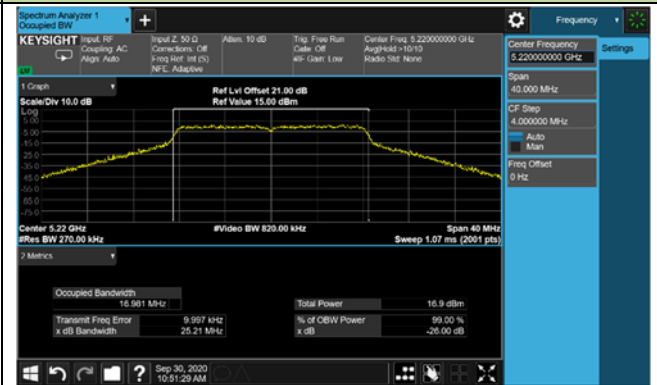
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	6Mbps	36	5180	26.19	17.09
802.11a	6Mbps	44	5220	25.21	16.98
802.11a	6Mbps	48	5240	25.48	17.07
802.11a	6Mbps	149	5745	25.81	17.10
802.11a	6Mbps	157	5785	26.62	17.08
802.11a	6Mbps	165	5825	27.42	17.22

802.11a 26dB Bandwidth & 99% Bandwidth

Channel 36 (5180MHz)



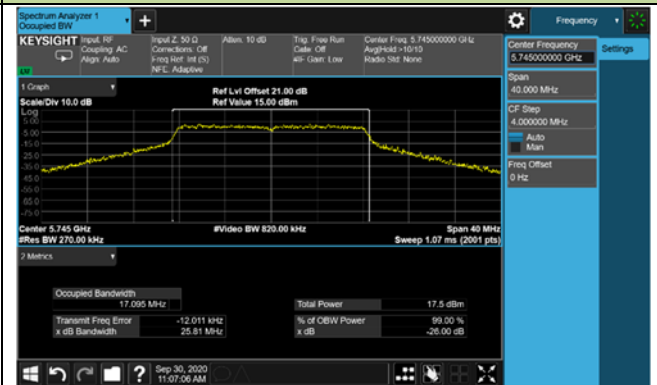
Channel 44 (5220MHz)



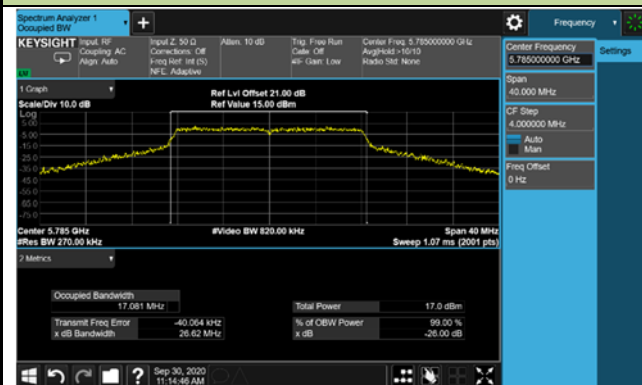
Channel 48 (5240MHz)



Channel 149 (5745MHz)



Channel 157 (5785MHz)



Channel 165 (5825MHz)



6.3. 6dB Bandwidth Measurement

6.3.1. Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

6.3.2. Test Procedure used

KDB 789033 D02v02r01- Section C.2

6.3.3. Test Setting

1. Set center frequency to the nominal EUT channel center frequency.
2. RBW = 100 kHz.
3. VBW $\geq 3 \times$ RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. 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.

6.3.4. Test Setup

