MEASUREMENT REPORT
(Class II Change)

FCC ID	:	2AXJ4X50OD
Applicant	:	TP-Link Corporation Limited
Application Type	:	Certification
Product	:	AX3000 Outdoor/Indoor Mesh Wi-Fi 6 AP
Model No.	:	HX510-Outdoor
Brand Name	:	tp-link
FCC Classification	:	Unlicensed National Information Infrastructure (NII)
FCC Rule Part(s)	:	Part15 Subpart E (Section 15.407)
Received Date	:	October 17, 2022
Test Date	:	October 26, 2022 ~ July 18, 2023

Tested By : Owen Tsai
(Owen Tsai)

Reviewed By : Paddy Chen
(Paddy Chen)

Approved By : Chenz Ker
(Chenz Ker)

Testing Laboratory
3261

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.

Revision History

Report No.	Version	Description	Issue Date	Note
2306TW0112-U1	V1.0	Original Report	2023-08-29	Valid

Note:

1. This time, the Wi-Fi 5GHz band has been enabled for U-NII2A and U-NII2C frequency bands. Therefore, retesting will be conducted specifically for Wi-Fi 5GHz U-NII2A and U-NII2C., so the FCC C2PC is executed.
2. FCC Original Report Grant Date: 12/19/2022, FCC ID: 2AXJ4X50OD.

CONTENTS

Description Page

General Information

Applicant	TP-Link Corporation Limited
Applicant Address	Room 901, 9/F., New East Ocean Centre, 9 Science Museum Road, Tsim Sha Tsui, Kowloon, Hongkong
Manufacturer	TP-Link Corporation Limited
Manufacturer Address	Room 901, 9/F., New East Ocean Centre, 9 Science Museum Road, Tsim Sha Tsui, Kowloon, Hongkong
Test Site	MRT Technology (Taiwan) Co., Ltd
Test Site Address	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)
MRT FCC Registration No.	291082
FCC Rule Part(s)	Part 15.407

Test Facility / Accreditations

1. MRT facility is a FCC registered (Reg. No. 291082) test facility with the site description report on file and is designated by the FCC as an Accredited Test Firm.
2. MRT facility is an IC registered (MRT Reg. No. 21723) test laboratory with the site description on file at Industry Canada.
3. MRT Lab is accredited to ISO 17025 by the Taiwan Accreditation Foundation (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC (Designation Number: TW3261), Industry Canada, EU and TELEC Rules.

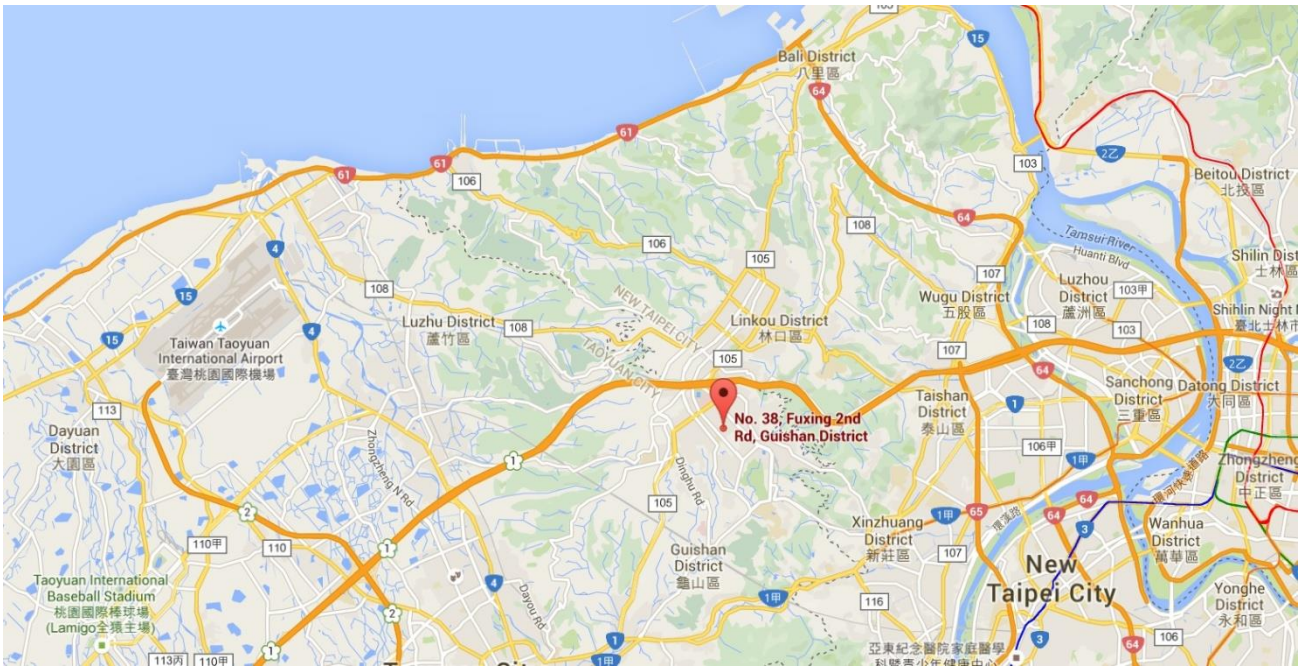
1. INTRODUCTION

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:	AX3000 Outdoor/Indoor Mesh Wi-Fi 6 AP
Model No.:	HX510-Outdoor
Brand Name:	tp-link
Wi-Fi Specification:	802.11a/b/g/n/ac/ax & VHT
EUT Identification No.:	#1-1 (Conducted) #1-2 (Radiated)
Power Supply:	AC100-240V~50/60Hz 0.5A 802.3at PoE: 42.5-57V 0.6A

2.2. Product Specification Subjective to this Report

Frequency Range:	For 802.11a/n-HT20/ac-VHT20/ax-HE20: 5260~5320MHz, 5500~5720MHz For 802.11n-HT40/ac-VHT40/ax-HE40: 5270~5310MHz, 5510~5710MHz For 802.11ac-VHT80/ax-HE80: 5290MHz, 5530MHz, 5610 MHz, 5690MHz For 802.11ac-VHT160/ax-HE160: 5570MHz
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 1733.3Mbps 802.11ax: up to 2402Mbps

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
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	--	--	--	--

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

Channel	Frequency	Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz	102	5510 MHz
110	5550MHz	118	5590 MHz	126	5630 MHz
134	5670 MHz	142	5710 MHz	--	--

802.11ac-VHT80/ax-HE80

Channel	Frequency	Channel	Frequency	Channel	Frequency
58	5290 MHz	106	5530 MHz	122	5610 MHz
138	5690 MHz	--	--	--	--

802.11ac-VHT160/ax-HE160

Channel	Frequency	Channel	Frequency	Channel	Frequency
114	5570 MHz	--	--	--	--

2.4. Description of Available Antennas

Antenna Type	Frequency Band (MHz)	T_X Paths	Max Antenna Gain (dBi)	Max. Antenna Gain (at any elevation angle above 30 degrees) (dBi)	CDD Directional Gain (dBi)	
					For Power	For PSD
Dipole Antenna	2412 ~ 2462	2	2.00	--	2.00	5.01
	5150 ~ 5250	2	1.00	-4.0	1.00	4.01
	5250 ~ 5850	2	1.00	--	1.00	4.01

Note:

1. The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are 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;

   - For power measurements on IEEE 802.11 devices,

   Array Gain = 0 dB for $N_{ANT} \leq 4$;

2. All information of antenna were from the antenna specification.

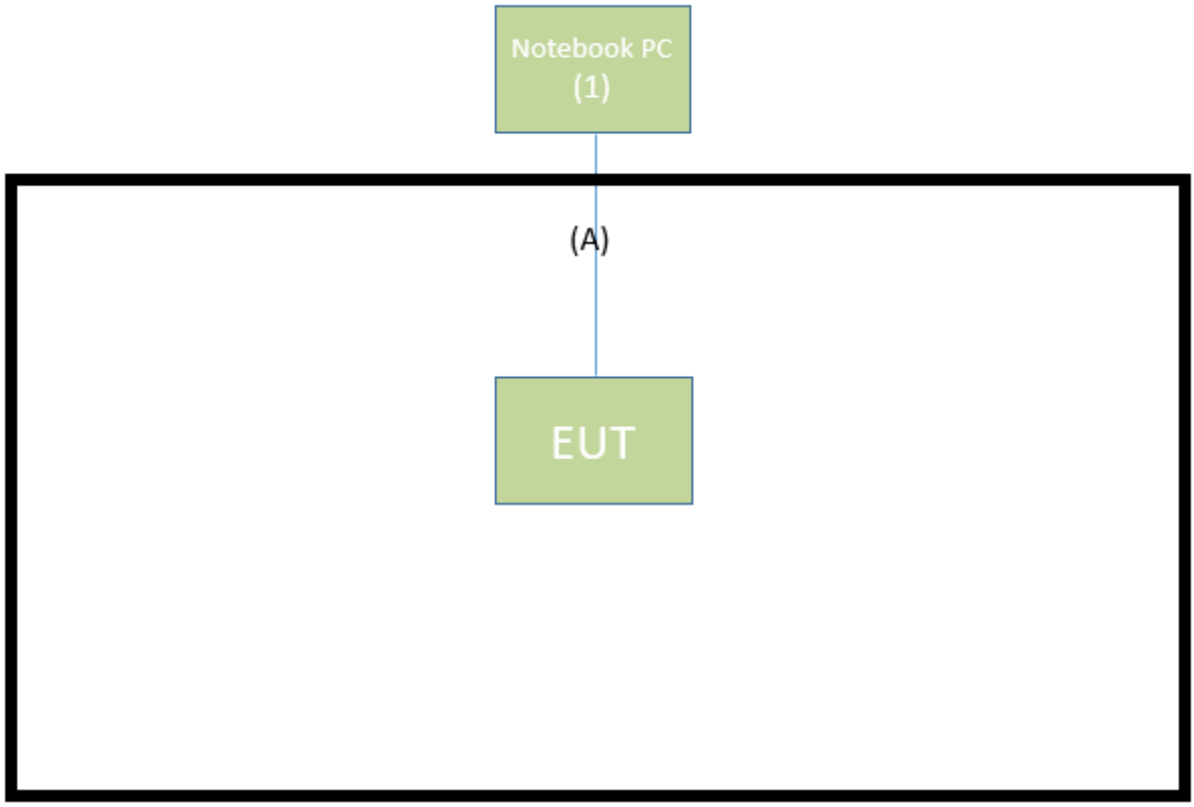
2.5. Test Mode

CDD Mode
Mode 1: Transmit by 802.11a_Nss=1 (6Mbps) (CDD mode)
Mode 2: Transmit by 802.11ac-VHT20_Nss=1 (MCS0) (CDD mode)
Mode 3: Transmit by 802.11ac-VHT40_Nss=1 (MCS0) (CDD mode)
Mode 4: Transmit by 802.11ac-VHT80_Nss=1 (MCS0) (CDD mode)
Mode 5: Transmit by 802.11ac-VHT160_Nss=1 (MCS0) (CDD mode)
Mode 6: Transmit by 802.11ax-HE20_Nss=1 (MCS0) (CDD mode)
Mode 7: Transmit by 802.11ax-HE40_Nss=1 (MCS0) (CDD mode)
Mode 8: Transmit by 802.11ax-HE80_Nss=1 (MCS0) (CDD mode)
Mode 9: Transmit by 802.11ax-HE160_Nss=1 (MCS0) (CDD mode)
Remark: 1. For Radiated emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power. 2. This device supports 2 N_{SS} and power level of 2 N_{SS} is less than or equal to the power of 1 N_{SS}. The worst case is N_{SS}=1. 3. 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 level for 802.11n-HT20 and HT40 will not be greater than 802.11ac-VHT20 and VHT40. 4. EUT supports one configuration only in 802.11ax full RU mode.

2.6. Configuration of Test System

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

Connection Diagram



Signal Cable Type		Signal Cable Description
A	LAN Cable	Non shielded, 10m

2.7. 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	Notebook PC	Lenovo	T450	N/A	Non-Shielded, 0.8m

2.8. Description of Test Software

The test utility software used during testing was “QDART”, the version is ver1.0.67.

Note: Final power setting please refer to operational description.

2.9. Applied Standards

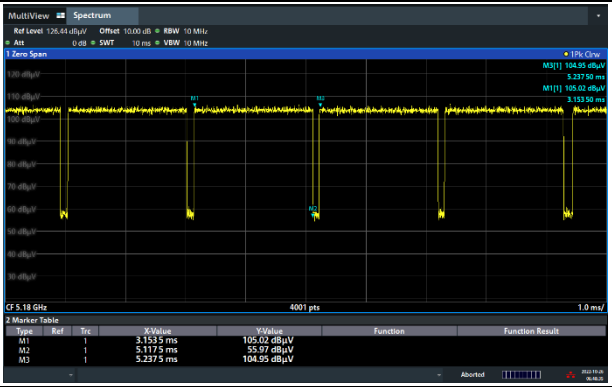
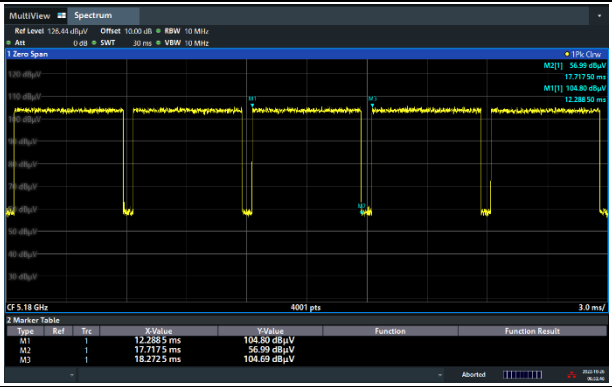
According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

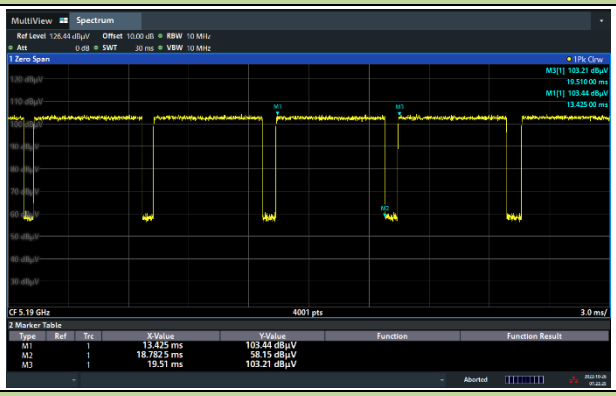
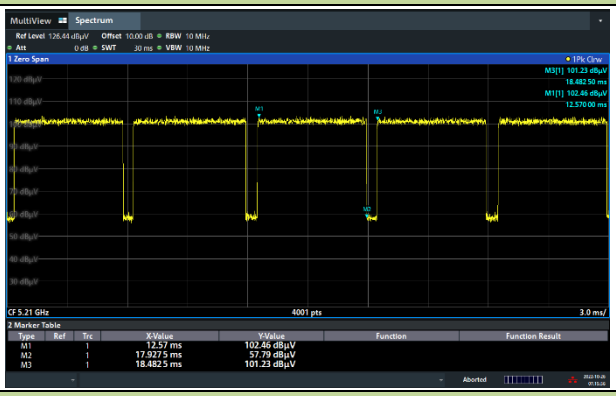
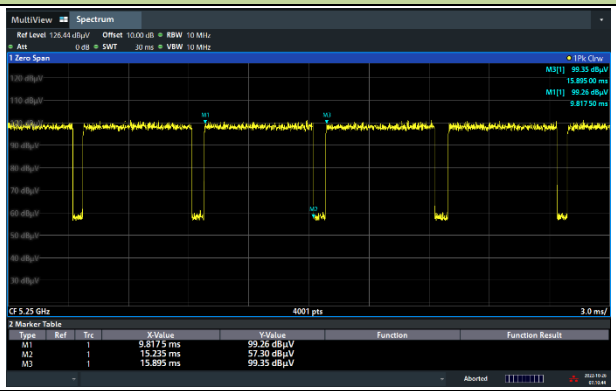
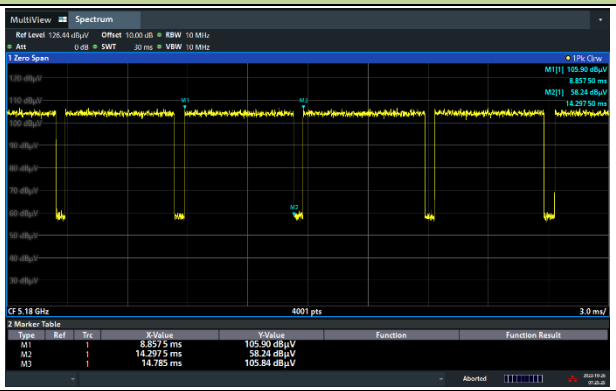
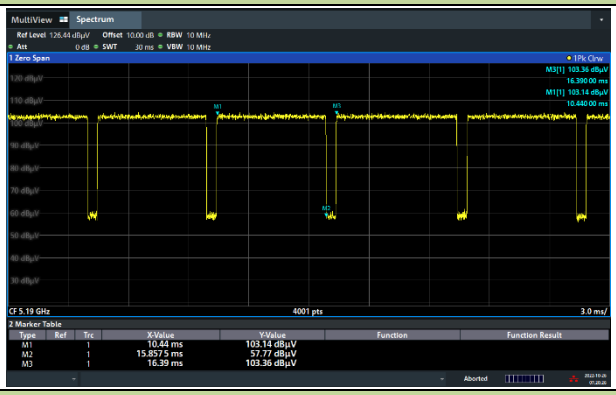
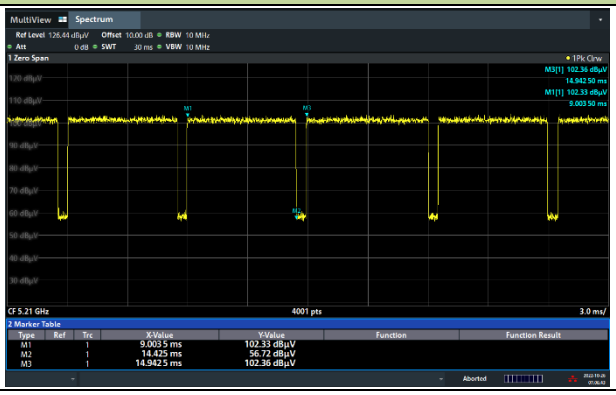
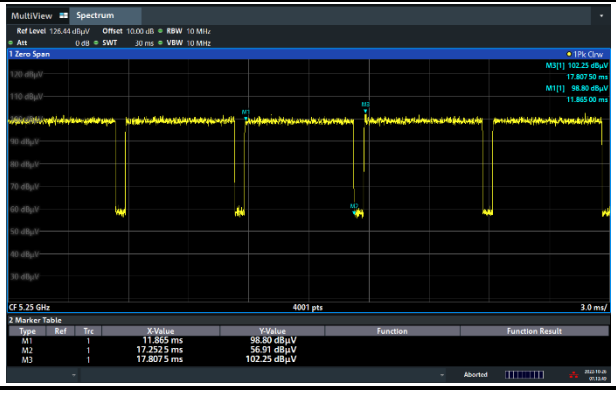
- FCC Part 15.247
- KDB 789033 D02v02r01,
- KDB 662911 D01v02r01
- ANSI C63.10-2013

2.10. 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
802.11a	94.24%
802.11ac-VHT20	90.73%
802.11ac-VHT40	88.04%
802.11ac-VHT80	90.61%
802.11ac-VHT160	89.14%
802.11ax-HE20	91.78%
802.11ax-HE40	91.05%
802.11ax-HE80	91.29%
802.11ax-HE160	90.66%

Duty Cycle	
802.11a	802.11ac-VHT20
	

Duty Cycle	
802.11ac-VHT40	802.11ac-VHT80
	
802.11ac-VHT160	802.11ax-HE20
	
802.11ax-HE40	802.11ax-HE80
	
802.11ax-HE160	
	

2.11. Test Configuration

The device was tested per the guidance of KDB 789033 D02v02r01.ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.12. EMI Suppression Device(s)/Modifications

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

2.13. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 789033 D02v02r01 were used in the measurement.

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.
The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.
Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.
An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An80cm high PVC support structure is placed on top of the turntable.
For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.
Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. 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.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Two-Line V-Network	R&S	ENV216	MRTTWA00019	1 year	2024/3/7
Two-Line V-Network	R&S	ENV216	MRTTWA00020	1 year	2024/4/17
EMI Test Receiver	R&S	ESR3	MRTTWA00045	1 year	2024/5/10
DIVA PLUS Funk-Wetterstation	TFA	35.1083	MRTTWA00050	1 year	2024/6/15

Radiated Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Acitve Loop Antenna	SCHWARZBECK	FMZB 1519B	MRTTWA00002	1 year	2024/5/22
Broadband TRILOG Antenna	SCHWARZBECK	VULB 9162	MRTTWA00001	1 year	2023/12/21
Broadband Hornantenna	RFSPIN	DRH18-E	MRTTWA00087	1 year	2024/5/17
Broadband Preamplifier	EMC Instruments corporation	EMC118A45SE	MRTTWA00088	1 year	2024/5/17
Breitband Hornantenna	SCHWARZBECK	BBHA 9170	MRTTWA00004	1 year	2024/3/20
Broadband Amplifier	SCHWARZBECK	BBV 9721	MRTTWA00006	1 year	2024/3/27
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2024/3/8
Signal Analyzer	R&S	FSVA3044	MRTTWA00092	1 year	2024/6/29
Antenna Cable	HUBERSUHNER	SF106	MRTTWE00034	1 year	2024/6/26
Cable	HUBERSUHNER	EMC105-NM-NM-3000	MRTTWE00035	1 year	2024/6/26
Temperature/Humidity Meter	TFA	35.1078.10.IT	MRTTWA00032	1 year	2024/6/4

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	2024/4/19
EXA Signal Analyzer	KEYSIGHT	N9010A	MRTTWA00012	1 year	2023/10/5
EXA Signal Analyzer	KEYSIGHT	N9010B	MRTTWA00074	1 year	2023/7/19
Attenuator	WTI	218FS-20	MRTTWE00026	1 year	2023/11/2
Attenuator	WTI	218FS-10	MRTTWE00027	1 year	2024/6/14
Temperature & Humidity Chamber	TEN BILLION	TTH-B3UP	MRTTWA00036	1 year	2024/6/11
DIVA PLUS Funk-Wetterstation	TFA	35.1083	MRTTWA00050	1 year	2024/6/15

Software	Version	Function
e3	9.160520a	EMI Test Software

6. 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=2Uc(y)): 150kHz~30MHz: ± 2.53dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: ± 4.25dB 1GHz ~ 40GHz: ± 4.45dB
Conducted Power (Carrier Power / Power Density)
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 0.84dB
Conducted Spurious Emission
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):± 2.65 dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ± 3.3%
Temp. / Humidity
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ±0.82°C/ ±3%
Frequency Error
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): ±78.4Hz

7. TEST RESULT

7.1. 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(a)(2)	Maximum Conducted Output Power	Refer to section 7.3		Pass	Section 7.3
15.407(h)(1)	Transmit Power Control	≤ 24 dBm		Pass	Section 7.4
15.407(a)(2) (12)	Peak Power Spectral Density	Refer to section 7.6		Pass	Section 7.5
15.407(g)	Frequency Stability	N/A		Pass	Section 7.6
15.407(b)(2), (3)	Undesirable Emissions	Refer to Section 7.7	Radiated	Pass	Section 7.7 & 7.8
15.205, 15.209 15.407(b)(8), (9), (10)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		Pass	

Notes:

1) Determining compliance is based on the test results met the regulation limits or requirements declared by clients, and the test results don't take into account the value of measurement uncertainty.
2) 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 ofthe system to connect the EUT to the analyzer at all frequencies of interest.
3) 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.
4) 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.

7.2. 26dB Bandwidth Measurement

7.2.1.Test Limit

N/A

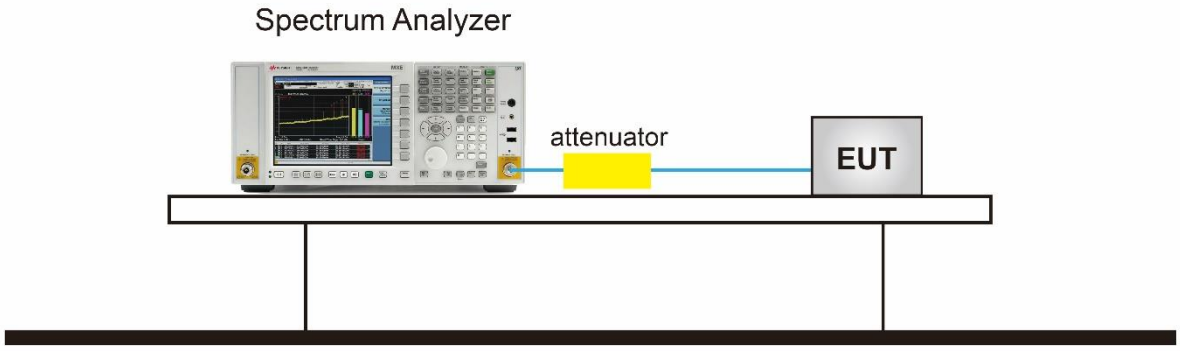
7.2.2.Test Procedure used

KDB 789033 D02v02r01- Section C.1

7.2.3.Test Setting

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 ≥ 3×RBW.
4. Detector = Peak.
5. Trace mode = max hold.

7.2.4.Test Setup



7.2.5.Test Result

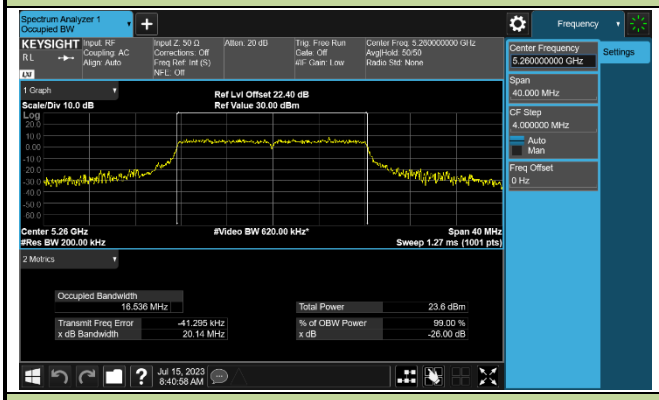
Product	AX3000 Outdoor/Indoor Mesh Wi-Fi 6 AP	Test Engineer	Xuan
Test Site	SR6	Test Date	2023/7/11~2023/7/15

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 1					
802.11a	6Mbps	52	5260	20.140	16.536
802.11a	6Mbps	60	5300	22.110	16.543
802.11a	6Mbps	64	5320	21.160	16.559
802.11a	6Mbps	100	5500	22.380	16.520
802.11a	6Mbps	116	5580	21.390	16.541
802.11a	6Mbps	140	5700	23.370	16.517
802.11a	6Mbps	144	5720	23.010	16.532
802.11ac-VHT20	MCS0	52	5260	21.450	17.761
802.11ac-VHT20	MCS0	60	5300	22.680	17.772
802.11ac-VHT20	MCS0	64	5320	21.100	17.750
802.11ac-VHT20	MCS0	100	5500	20.770	17.753
802.11ac-VHT20	MCS0	116	5580	21.350	17.755
802.11ac-VHT20	MCS0	140	5700	21.380	17.763
802.11ac-VHT20	MCS0	144	5720	21.640	17.742
802.11ac-VHT40	MCS0	54	5270	46.690	36.455
802.11ac-VHT40	MCS0	62	5310	43.970	36.442
802.11ac-VHT40	MCS0	102	5510	42.610	36.390
802.11ac-VHT40	MCS0	110	5550	43.470	36.392
802.11ac-VHT40	MCS0	134	5670	43.660	36.431
802.11ac-VHT40	MCS0	142	5710	42.320	36.384
802.11ac-VHT80	MCS0	58	5290	87.730	76.123
802.11ac-VHT80	MCS0	106	5530	87.870	76.102
802.11ac-VHT80	MCS0	122	5610	85.850	76.212
802.11ac-VHT80	MCS0	138	5690	90.360	76.256
802.11ac-VHT160	MCS0	114	5570	239.000	155.690

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
Ant 1					
802.11ax-HE20	MCS0	52	5260	21.410	19.071
802.11ax-HE20	MCS0	60	5300	21.270	19.065
802.11ax-HE20	MCS0	64	5320	21.460	19.027
802.11ax-HE20	MCS0	100	5500	21.470	19.016
802.11ax-HE20	MCS0	116	5580	21.080	19.022
802.11ax-HE20	MCS0	140	5700	21.540	19.007
802.11ax-HE20	MCS0	144	5720	21.740	19.028
802.11ax-HE40	MCS0	54	5270	53.000	38.045
802.11ax-HE40	MCS0	62	5310	43.870	37.970
802.11ax-HE40	MCS0	102	5510	42.690	38.058
802.11ax-HE40	MCS0	110	5550	42.360	37.982
802.11ax-HE40	MCS0	134	5670	44.970	37.986
802.11ax-HE40	MCS0	142	5710	48.660	38.024
802.11ax-HE80	MCS0	58	5290	84.530	77.743
802.11ax-HE80	MCS0	106	5530	84.290	77.736
802.11ax-HE80	MCS0	122	5610	87.770	77.771
802.11ax-HE80	MCS0	138	5690	83.180	77.924
802.11ax-HE160	MCS0	114	5570	190.400	157.300

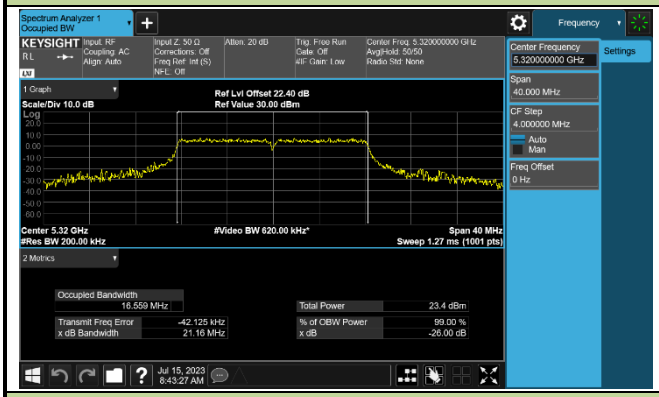
802.11a 26dB Bandwidth & 99% Bandwidth

Channel 52 (5260MHz)

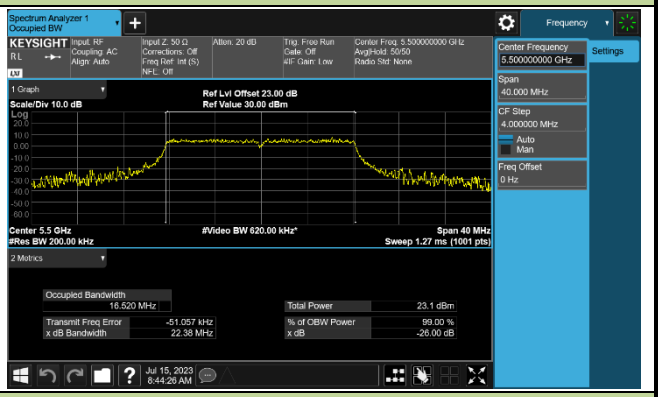


Channel 60 (5300MHz)

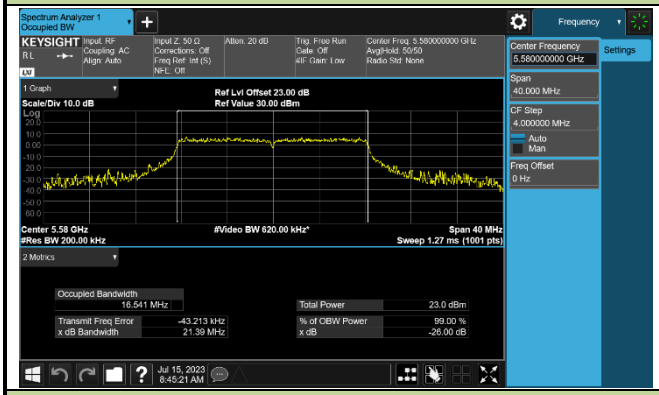
Channel 64 (5320MHz)



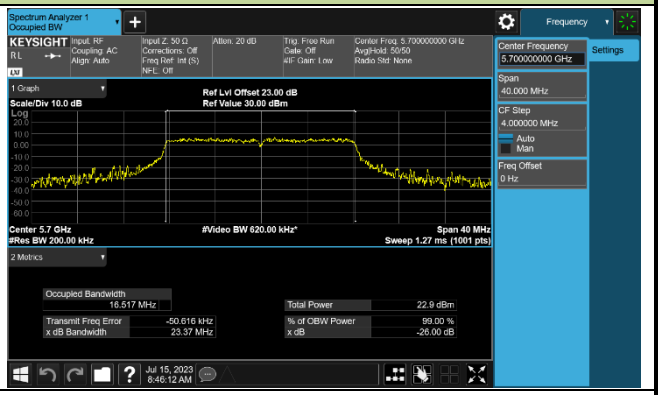
Channel 100 (5500MHz)



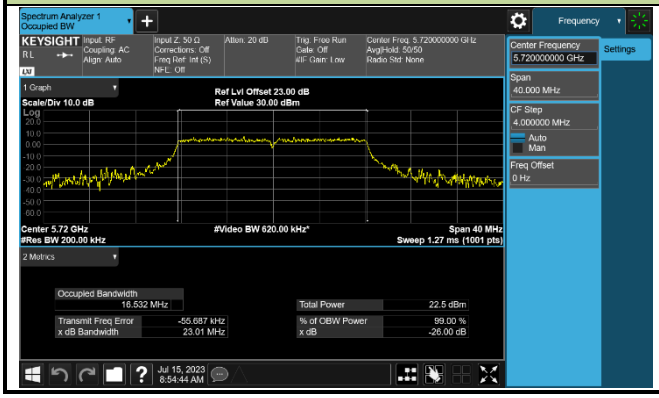
Channel 116 (5580MHz)



Channel 140 (5700MHz)

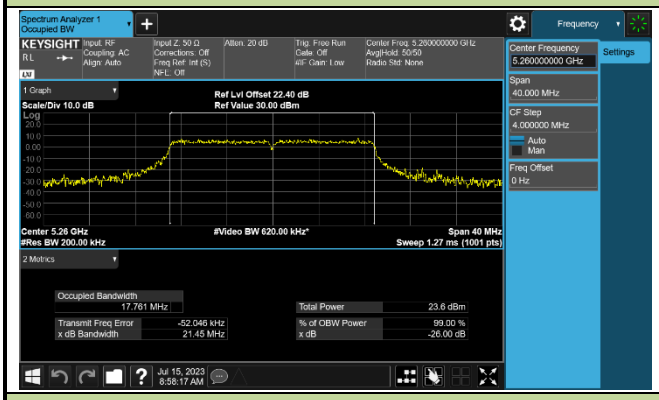


Channel 144 (5720MHz)

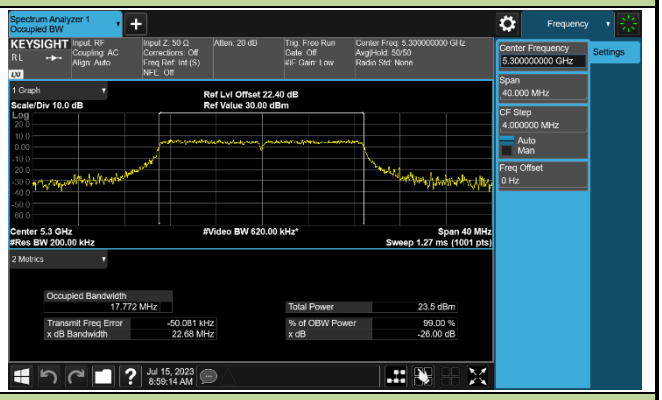


802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth

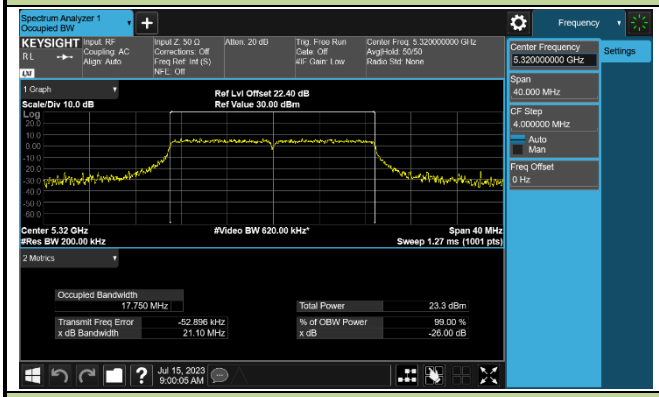
Channel 52 (5260MHz)



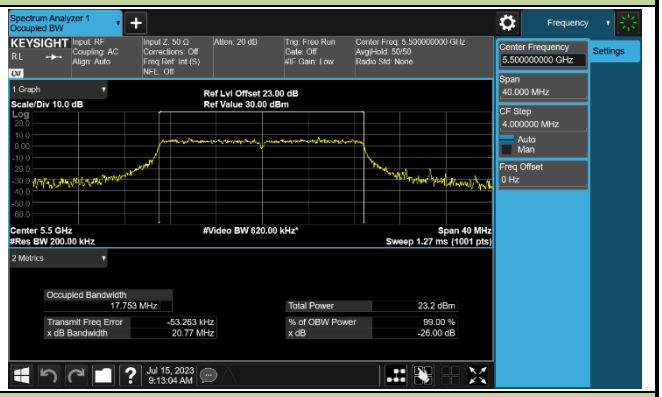
Channel 60 (5300MHz)



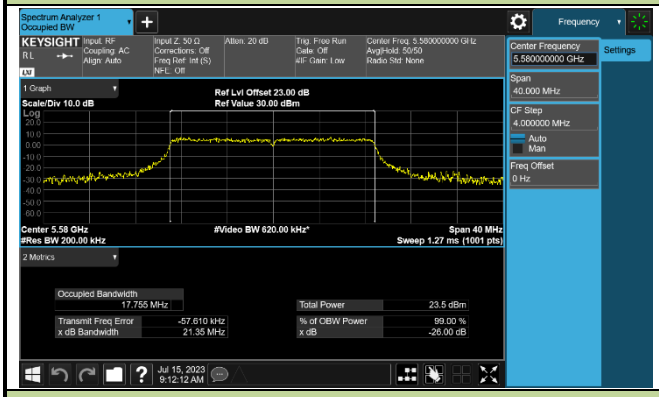
Channel 64 (5320MHz)



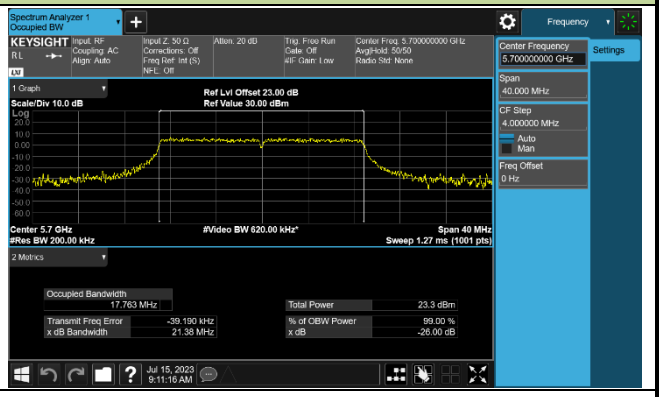
Channel 100 (5500MHz)



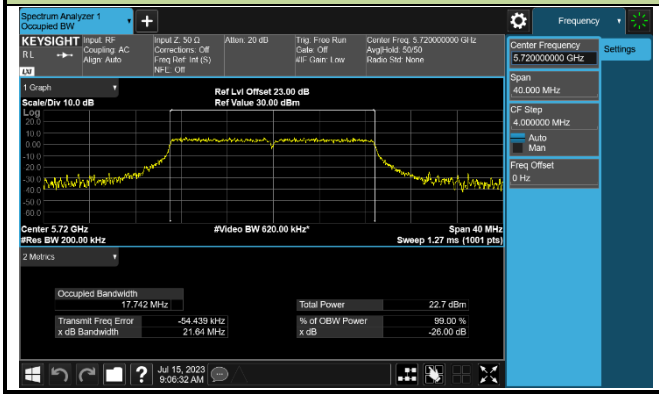
Channel 116 (5580MHz)

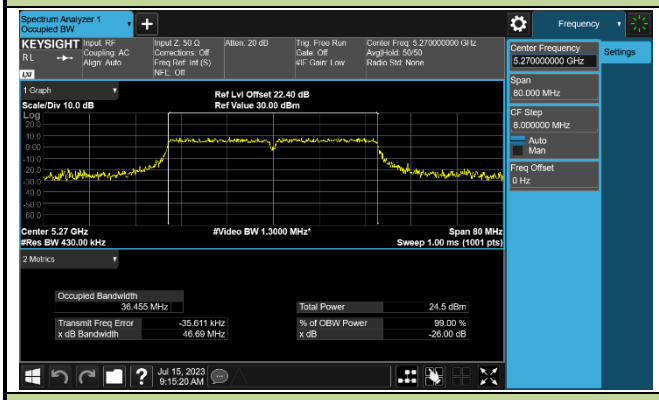
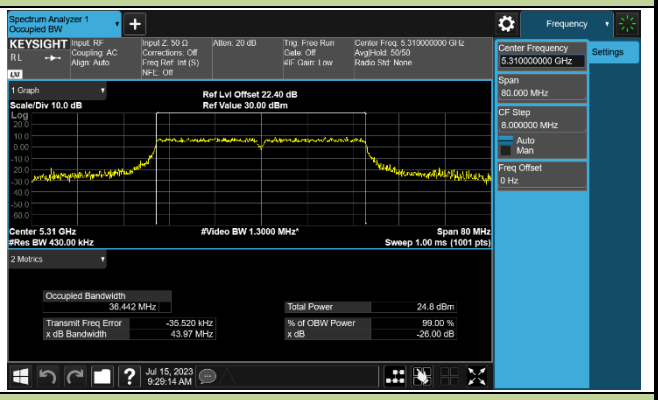
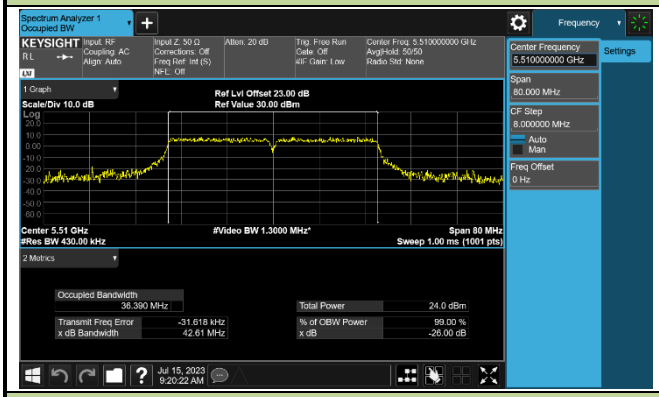
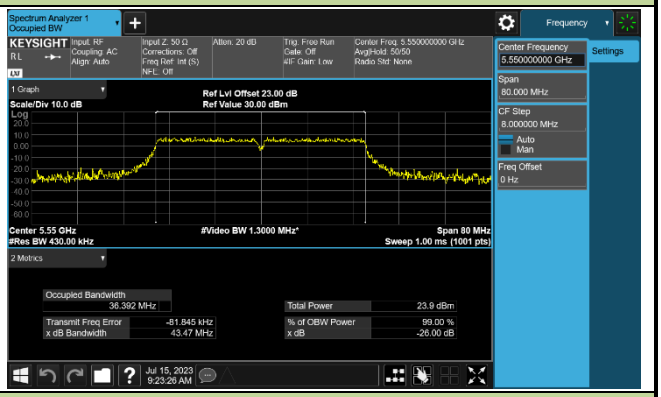
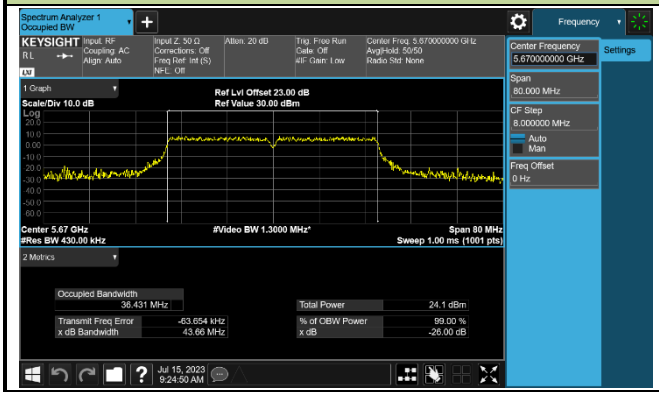
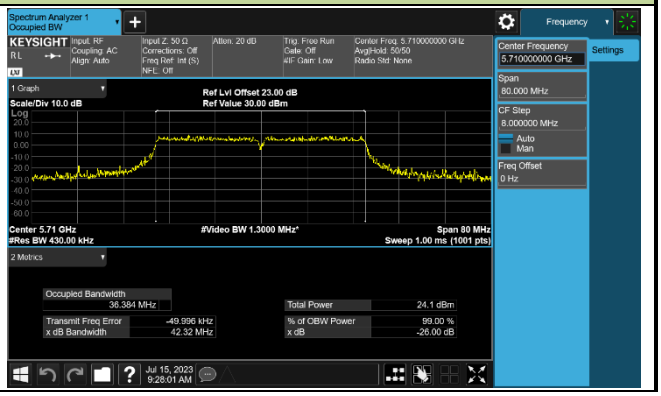


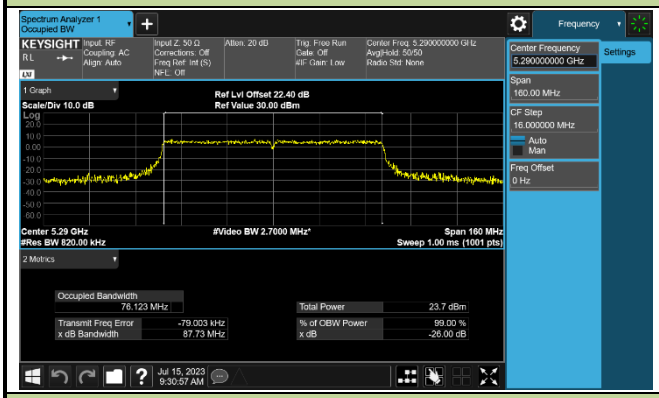
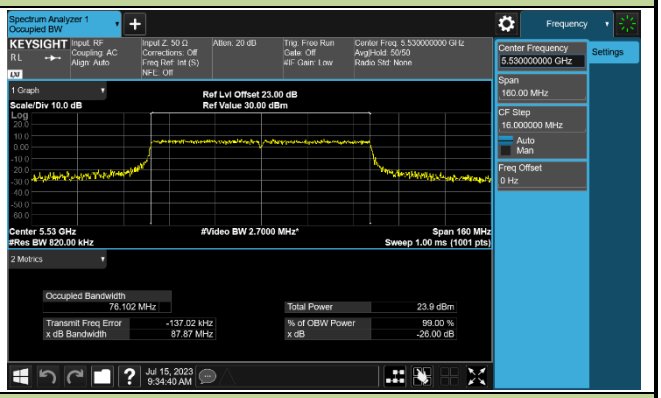
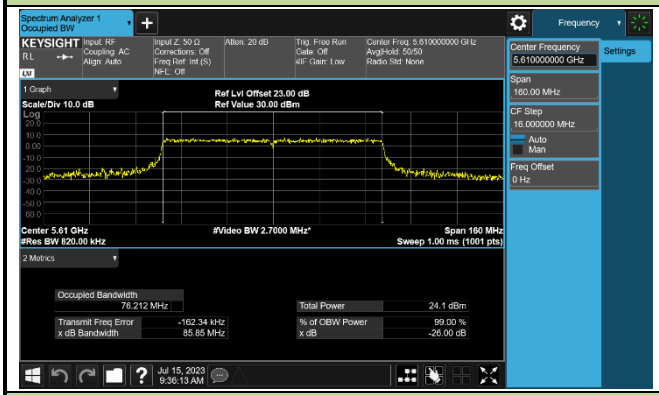
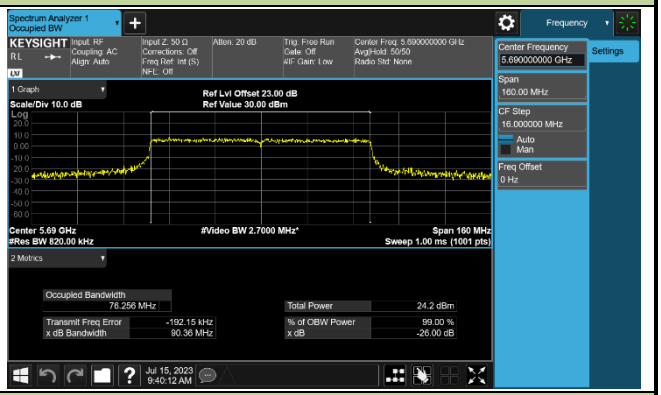
Channel 140 (5700MHz)

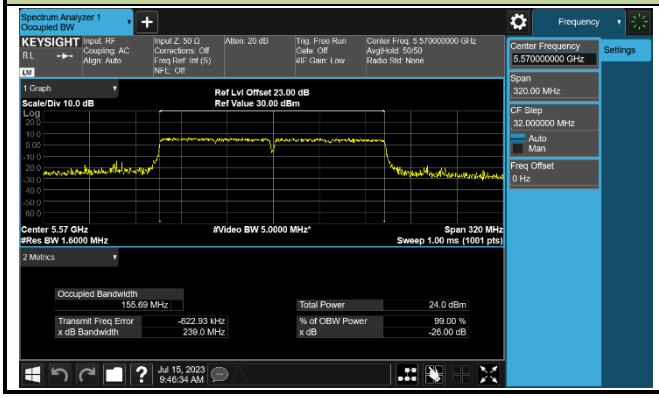


Channel 144 (5720MHz)



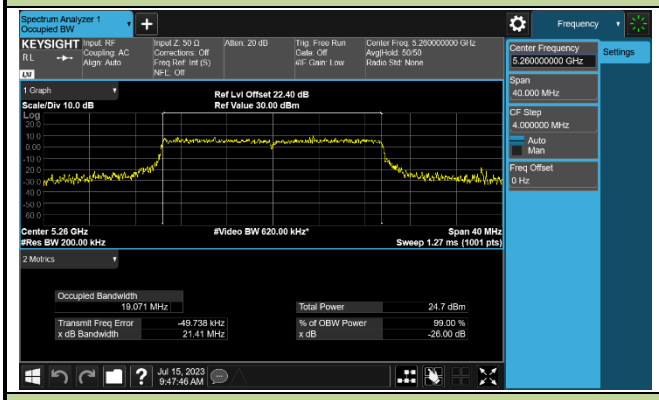
802.11ac-VHT40 26dB Bandwidth & 99% Bandwidth	
Channel 54 (5270MHz)	Channel 62 (5310MHz)
	
Channel 102 (5510MHz)	Channel 110 (5550MHz)
	
Channel 134 (5670MHz)	Channel 142 (5710MHz)
	

802.11ac-VHT80 26dB Bandwidth & 99% Bandwidth	
Channel 58 (5290MHz)	Channel 106 (5530MHz)
	
Channel 122 (5610MHz)	Channel 138 (5690MHz)
	

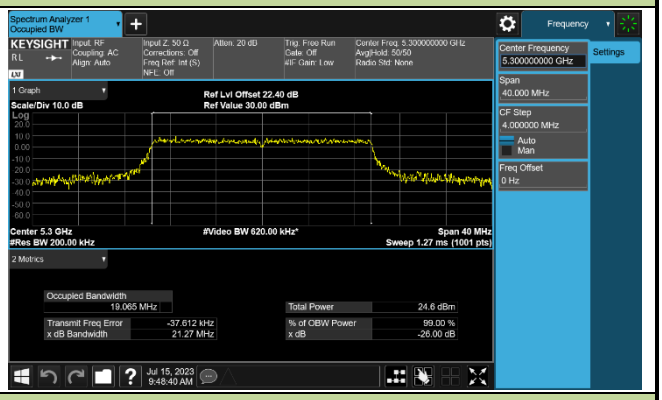
802.11ac-VHT160 26dB Bandwidth & 99% Bandwidth	
Channel 114 (5570MHz)	
	

802.11ax-HE20 26dB Bandwidth & 99% Bandwidth

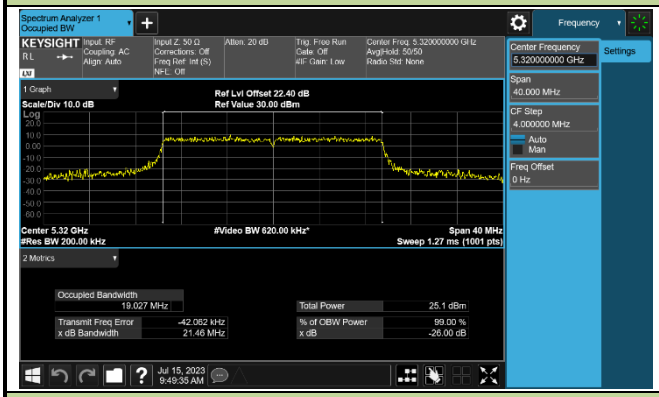
Channel 52 (5260MHz)



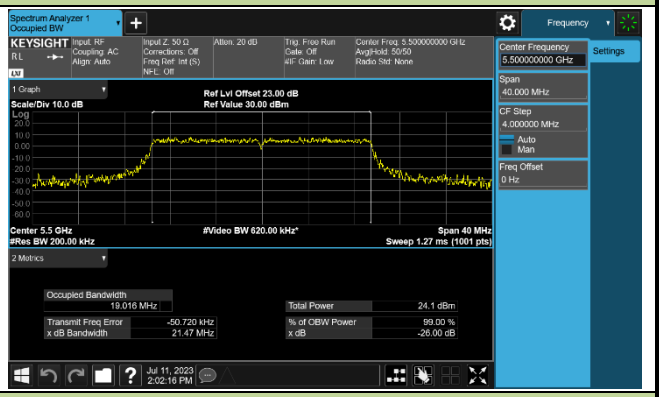
Channel 60 (5300MHz)



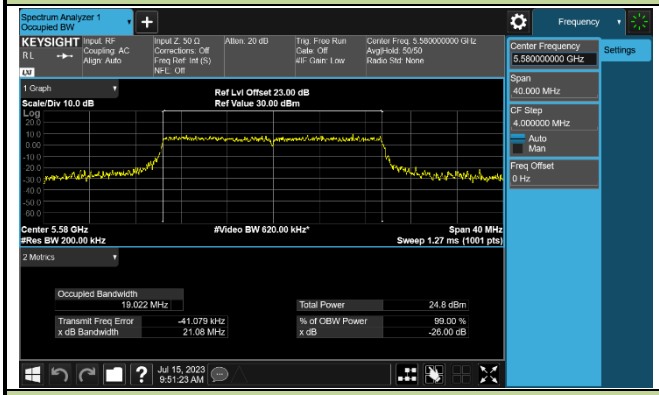
Channel 64 (5320MHz)



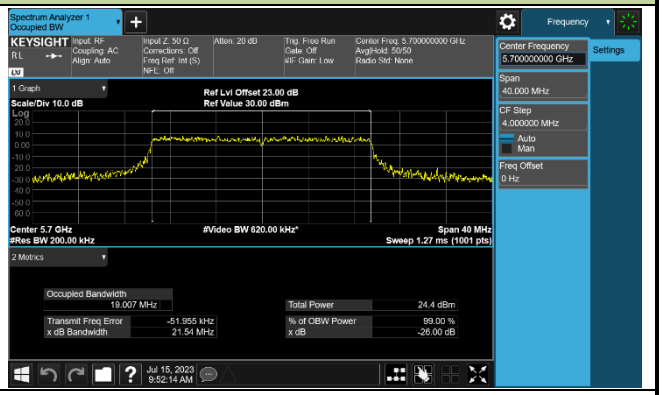
Channel 100 (5500MHz)



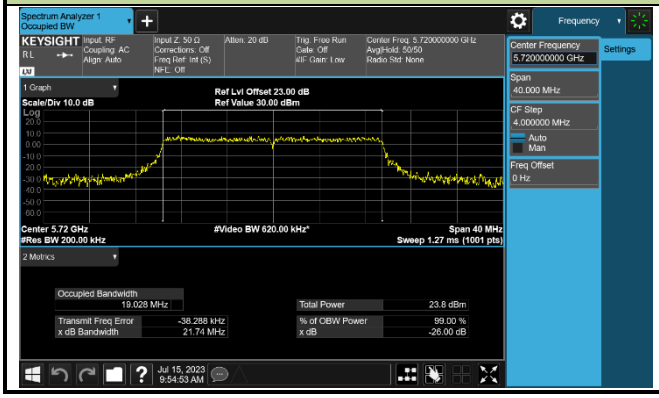
Channel 116 (5580MHz)



Channel 140 (5700MHz)

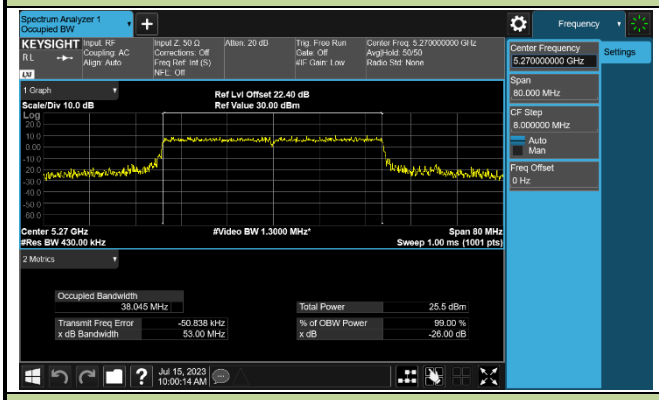


Channel 144 (5720MHz)

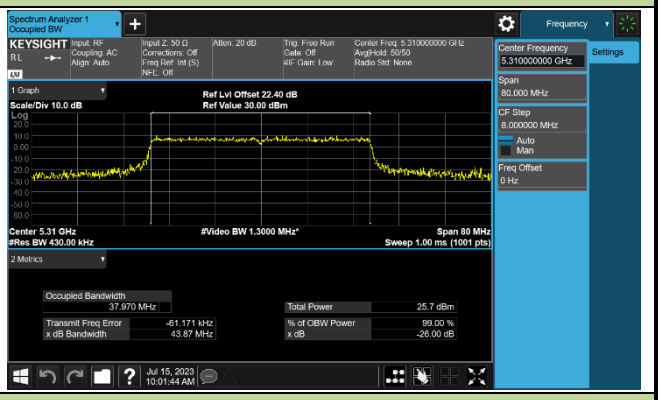


802.11ax-HE40 26dB Bandwidth & 99% Bandwidth

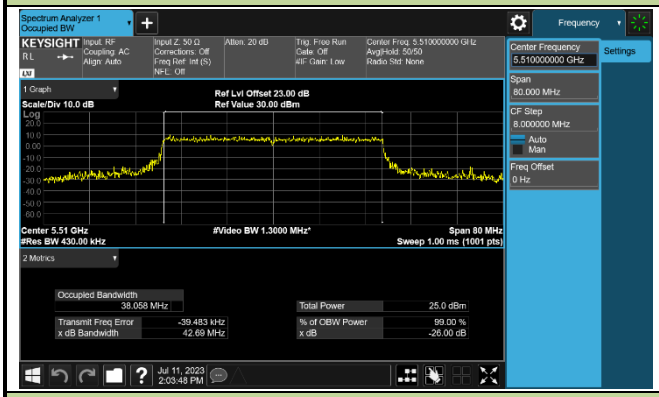
Channel 54 (5270MHz)



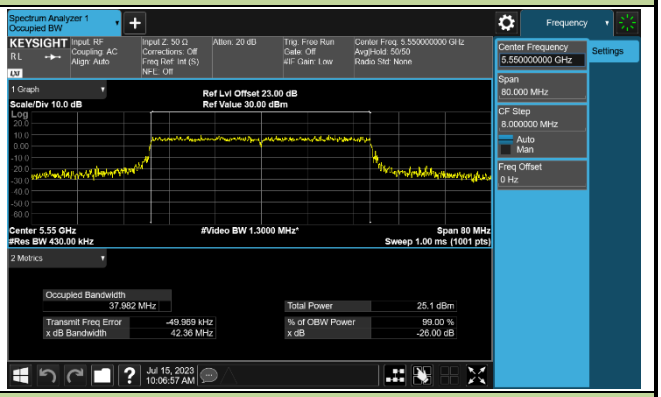
Channel 62 (5310MHz)



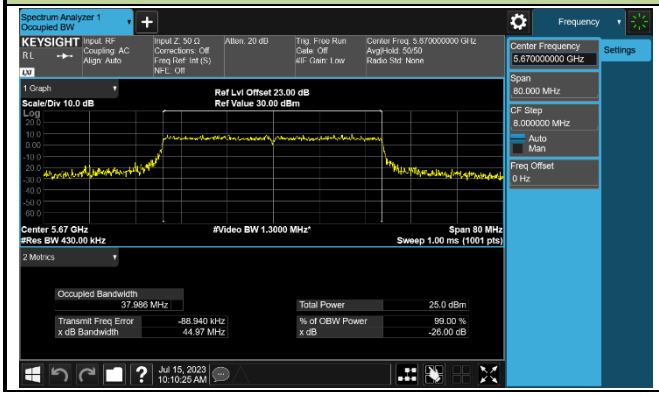
Channel 102 (5510MHz)



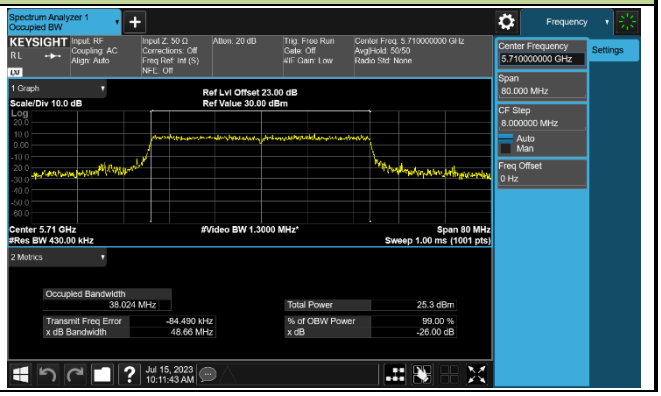
Channel 110 (5550MHz)

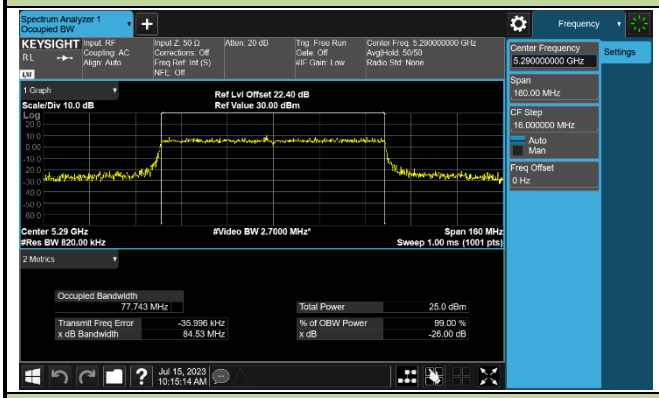
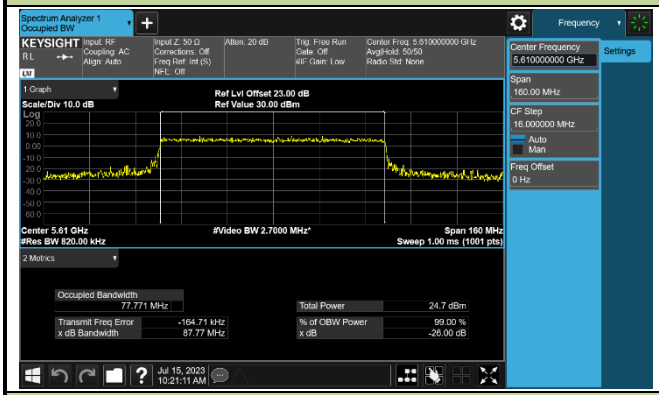


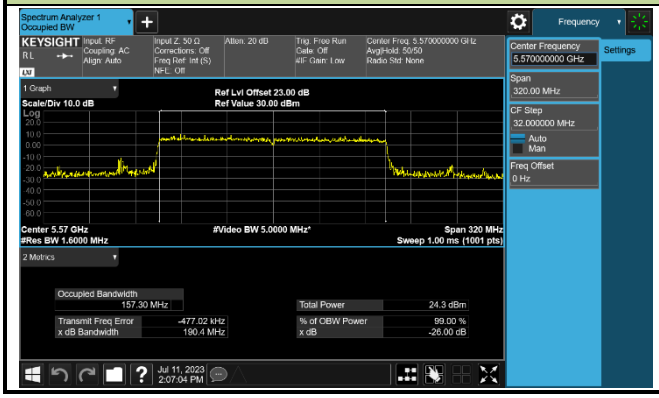
Channel 134 (5670MHz)



Channel 142 (5710MHz)



8802.11ax-HE80 26dB Bandwidth & 99% Bandwidth	
Channel 58 (5290MHz)	Channel 106 (5530MHz)
	
Channel 122 (5610MHz)	Channel 138 (5690MHz)
	

802.11ax-HE160 26dB Bandwidth & 99% Bandwidth	
Channel 114 (5570MHz)	
	

7.3. Output Power Measurement

7.3.1.Test Limit

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.

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.

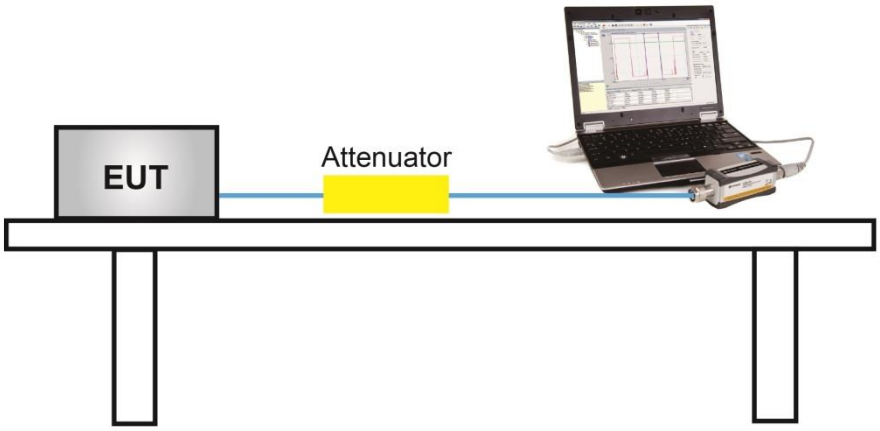
7.3.2.Test Procedure Used

KDB 789033D02v02r01- Section E)3)b) Method PM-G

7.3.3.Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

7.3.4.Test Setup



7.3.5.Test Result

Product	AX3000 Outdoor/Indoor Mesh Wi-Fi 6 AP	Test Engineer	Xuan
Test Site	SR6	Test Date	2023/7/11
Test Mode	CDD Mode		

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Power Limit (dBm)	Result
11a	6Mbps	52	5260	19.25	20.18	22.75	≤ 23.98	Pass
11a	6Mbps	60	5300	19.44	20.03	22.76	≤ 23.98	Pass
11a	6Mbps	64	5320	19.35	19.87	22.63	≤ 23.98	Pass
11a	6Mbps	100	5500	20.28	19.84	23.08	≤ 23.98	Pass
11a	6Mbps	116	5580	20.10	19.73	22.93	≤ 23.98	Pass
11a	6Mbps	140	5700	19.67	19.75	22.72	≤ 23.98	Pass
11a	6Mbps	144	5720	19.28	19.32	22.31	≤ 23.18	Pass
11ac-VHT20	MCS0	52	5260	19.48	20.53	23.05	≤ 23.98	Pass
11ac-VHT20	MCS0	60	5300	19.46	20.16	22.83	≤ 23.98	Pass
11ac-VHT20	MCS0	64	5320	19.31	19.99	22.67	≤ 23.98	Pass
11ac-VHT20	MCS0	100	5500	20.37	19.95	23.18	≤ 23.98	Pass
11ac-VHT20	MCS0	116	5580	20.62	20.39	23.52	≤ 23.98	Pass
11ac-VHT20	MCS0	140	5700	20.40	20.30	23.36	≤ 23.98	Pass
11ac-VHT20	MCS0	144	5720	19.41	19.52	22.48	≤ 22.99	Pass
11ac-VHT40	MCS0	54	5270	21.00	20.24	23.65	≤ 23.98	Pass
11ac-VHT40	MCS0	62	5310	20.68	20.20	23.46	≤ 23.98	Pass
11ac-VHT40	MCS0	102	5510	20.58	20.76	23.68	≤ 23.98	Pass
11ac-VHT40	MCS0	110	5550	20.61	20.50	23.57	≤ 23.98	Pass
11ac-VHT40	MCS0	134	5670	20.51	20.75	23.64	≤ 23.98	Pass
11ac-VHT40	MCS0	142	5710	20.62	20.75	23.70	≤ 23.98	Pass
11ac-VHT80	MCS0	58	5290	19.41	20.19	22.83	≤ 23.98	Pass
11ac-VHT80	MCS0	106	5530	20.51	20.52	23.53	≤ 23.98	Pass
11ac-VHT80	MCS0	122	5610	20.53	20.32	23.44	≤ 23.98	Pass
11ac-VHT80	MCS0	138	5690	20.77	20.96	23.88	≤ 23.98	Pass
11ac-VHT160	MCS0	114	5570	20.67	20.60	23.65	≤ 23.98	Pass

Test Mode	Data Rate/ MCS	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Total Average Power (dBm)	Power Limit (dBm)	Result
11ax-HE20	MCS0	52	5260	19.60	20.50	23.08	≤ 23.98	Pass
11ax-HE20	MCS0	60	5300	19.54	20.27	22.93	≤ 23.98	Pass
11ax-HE20	MCS0	64	5320	19.80	20.81	23.34	≤ 23.98	Pass
11ax-HE20	MCS0	100	5500	20.19	20.04	23.13	≤ 23.98	Pass
11ax-HE20	MCS0	116	5580	20.71	20.55	23.64	≤ 23.98	Pass
11ax-HE20	MCS0	140	5700	20.47	20.38	23.44	≤ 23.98	Pass
11ax-HE20	MCS0	144	5720	19.35	19.31	22.34	≤ 23.01	Pass
11ax-HE40	MCS0	54	5270	21.20	20.41	23.83	≤ 23.98	Pass
11ax-HE40	MCS0	62	5310	20.93	20.30	23.64	≤ 23.98	Pass
11ax-HE40	MCS0	102	5510	20.74	20.83	23.80	≤ 23.98	Pass
11ax-HE40	MCS0	110	5550	20.50	20.59	23.56	≤ 23.98	Pass
11ax-HE40	MCS0	134	5670	20.55	20.78	23.68	≤ 23.98	Pass
11ax-HE40	MCS0	142	5710	20.63	20.87	23.76	≤ 23.98	Pass
11ax-HE80	MCS0	58	5290	20.00	20.72	23.39	≤ 23.98	Pass
11ax-HE80	MCS0	106	5530	20.36	20.68	23.53	≤ 23.98	Pass
11ax-HE80	MCS0	122	5610	20.54	20.43	23.50	≤ 23.98	Pass
11ax-HE80	MCS0	138	5690	20.61	20.95	23.79	≤ 23.98	Pass
11ax-HE160	MCS0	114	5570	20.91	20.69	23.81	≤ 23.98	Pass

Note 1:

The Total Average Power (dBm) = $10*\log\{10^{(\text{Ant 0 Average Power }/10)} + 10^{(\text{Ant 1 Average Power }/10)}\}$.

Note 2:

For 802.11a_ch 144 (5720MHz), Average Power Limit (dBm) = $11+10*\log(5\text{MHz} + BW_{26dBc}/2)$ = 23.18dBm.

For 802.11ac_ch 144 (5720MHz), Average Power Limit (dBm) = $11+10*\log(5\text{MHz} + BW_{26dBc}/2)$ = 22.99dBm.

For 802.11ax_ch 144 (5720MHz), Average Power Limit (dBm) = $11+10*\log(5\text{MHz} + BW_{26dBc}/2)$ = 23.01dBm.

7.4. Transmit Power Control

7.4.1.Test Limit

The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm.

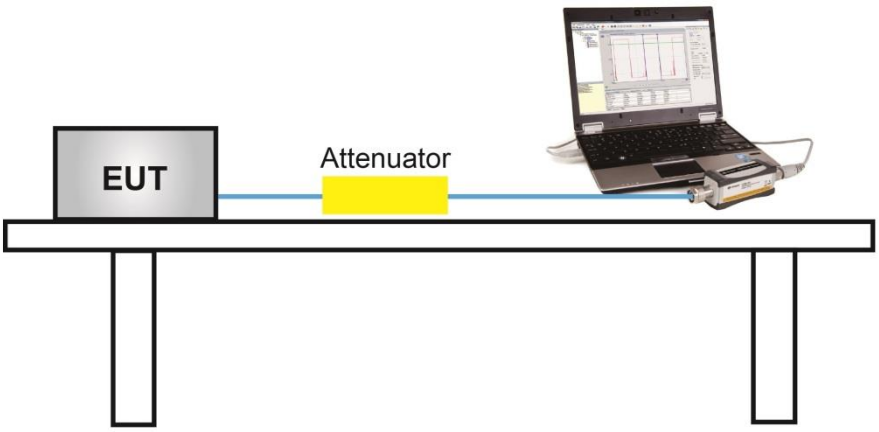
7.4.2.Test Procedure Used

KDB 789033 D02v02r01- Section E)3)b) Method PM-G

7.4.3.Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

7.4.4.Test Setup



7.4.5.Test Result

Device supports TPC mechanism, details refer to the operational description.

7.5. Power Spectral Density Measurement

7.5.1.Test Limit

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.

If transmitting antennas of directional gain greater than 6dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

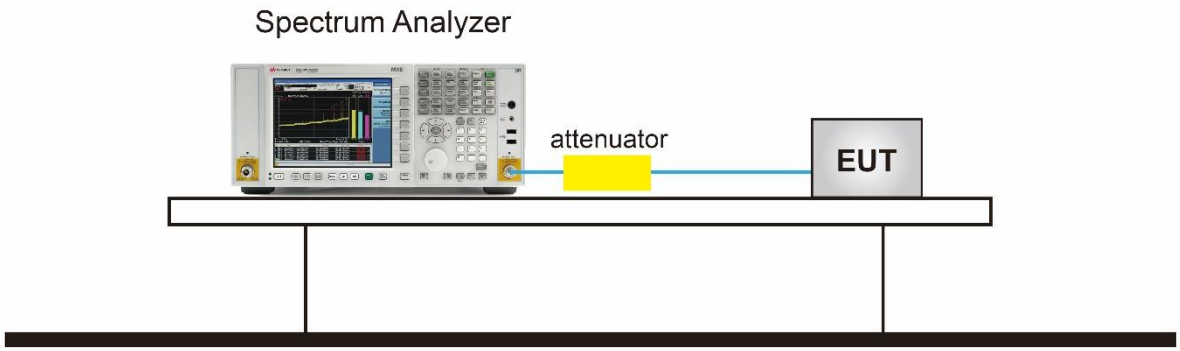
7.5.2.Test Procedure Used

KDB 789033 D02v02r01-SectionF

7.5.3.Test Setting

1. Analyzer was set to the center frequency of the UNII channel under investigation.
2. Span was set to encompass the entire 26dB EBW of the signal.
3. RBW = 1MHz
4. VBW = 3MHz
5. Number of sweep points ≥ 2 × (span / RBW)
6. Detector = power averaging (Average)
7. Sweep time = auto
8. Trigger = free run
9. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
10. Add 10*log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10*log(1/0.25) = 6 dB if the duty cycle is 25 percent.

7.5.4.Test Setup



7.5.5.Test Result

Product	AX3000 Outdoor/Indoor Mesh Wi-Fi 6 AP	Test Engineer	Xuan
Test Site	SR6	Test Date	2023/7/11~2023/7/15
Mode	Power Spectral Density (U-NII-2a / -2c) CDD Mode		

Test Mode	Data Rate /MCS	Ch. No.	Freq. (MHz)	Ant 0 PSD (dBm/MHz)	Ant 1 PSD (dBm/MHz)	Duty Cycle (%)	Total PSD (dBm/ MHz)	PSD Limit (dBm/MHz)	Result
11a	6Mbps	52	5260	8.096	6.999	94.24%	10.850	≤11.00	Pass
11a	6Mbps	60	5300	7.925	7.244	94.24%	10.866	≤11.00	Pass
11a	6Mbps	64	5320	7.967	6.921	94.24%	10.743	≤11.00	Pass
11a	6Mbps	100	5500	7.181	7.640	94.24%	10.685	≤11.00	Pass
11a	6Mbps	116	5580	7.149	7.505	94.24%	10.599	≤11.00	Pass
11a	6Mbps	140	5700	7.571	7.340	94.24%	10.725	≤11.00	Pass
11a	6Mbps	144	5720	7.178	7.292	94.24%	10.503	≤11.00	Pass
11ac-VHT20	MCS0	52	5260	7.737	6.515	90.73%	10.602	≤11.00	Pass
11ac-VHT20	MCS0	60	5300	7.873	6.881	90.73%	10.838	≤11.00	Pass
11ac-VHT20	MCS0	64	5320	7.520	6.927	90.73%	10.666	≤11.00	Pass
11ac-VHT20	MCS0	100	5500	7.236	7.299	90.73%	10.700	≤11.00	Pass
11ac-VHT20	MCS0	116	5580	7.208	7.671	90.73%	10.878	≤11.00	Pass
11ac-VHT20	MCS0	140	5700	7.305	7.351	90.73%	10.761	≤11.00	Pass
11ac-VHT20	MCS0	144	5720	6.665	6.650	90.73%	10.090	≤11.00	Pass
11ac-VHT40	MCS0	54	5270	4.977	5.842	88.04%	8.994	≤11.00	Pass
11ac-VHT40	MCS0	62	5310	4.906	5.680	88.04%	8.874	≤11.00	Pass
11ac-VHT40	MCS0	102	5510	5.704	5.459	88.04%	9.147	≤11.00	Pass
11ac-VHT40	MCS0	110	5550	5.005	5.047	88.04%	8.590	≤11.00	Pass
11ac-VHT40	MCS0	134	5670	5.725	5.221	88.04%	9.044	≤11.00	Pass
11ac-VHT40	MCS0	142	5710	5.446	5.143	88.04%	8.861	≤11.00	Pass
11ac-VHT80	MCS0	58	5290	0.832	1.632	90.61%	4.689	≤11.00	Pass
11ac-VHT80	MCS0	106	5530	2.291	2.219	90.61%	5.694	≤11.00	Pass
11ac-VHT80	MCS0	122	5610	1.817	2.030	90.61%	5.363	≤11.00	Pass
11ac-VHT80	MCS0	138	5690	2.976	2.351	90.61%	6.113	≤11.00	Pass
11ac-VHT160	MCS0	114	5570	-0.683	-0.286	89.14%	3.030	≤11.00	Pass

Test Mode	Data Rate /MCS	Ch. No.	Freq. (MHz)	Ant 0 PSD (dBm/MHz)	Ant 1 PSD (dBm/MHz)	Duty Cycle (%)	Total PSD (dBm/ MHz)	PSD Limit (dBm/MHz)	Result
11ax-HE20	MCS0	52	5260	7.638	7.012	91.78%	10.719	≤11.00	Pass
11ax-HE20	MCS0	60	5300	7.513	6.937	91.78%	10.617	≤11.00	Pass
11ax-HE20	MCS0	64	5320	7.685	7.344	91.78%	10.901	≤11.00	Pass
11ax-HE20	MCS0	100	5500	7.339	7.520	91.78%	10.813	≤11.00	Pass
11ax-HE20	MCS0	116	5580	7.627	7.349	91.78%	10.873	≤11.00	Pass
11ax-HE20	MCS0	140	5700	7.227	7.354	91.78%	10.674	≤11.00	Pass
11ax-HE20	MCS0	144	5720	6.799	7.002	91.78%	10.285	≤11.00	Pass
11ax-HE40	MCS0	54	5270	4.797	5.663	91.05%	8.669	≤11.00	Pass
11ax-HE40	MCS0	62	5310	4.951	5.771	91.05%	8.798	≤11.00	Pass
11ax-HE40	MCS0	102	5510	5.218	5.268	91.05%	8.661	≤11.00	Pass
11ax-HE40	MCS0	110	5550	5.156	5.154	91.05%	8.573	≤11.00	Pass
11ax-HE40	MCS0	134	5670	5.727	5.019	91.05%	8.805	≤11.00	Pass
11ax-HE40	MCS0	142	5710	5.464	5.335	91.05%	8.817	≤11.00	Pass
11ax-HE80	MCS0	58	5290	1.368	2.034	91.29%	5.120	≤11.00	Pass
11ax-HE80	MCS0	106	5530	2.367	2.050	91.29%	5.617	≤11.00	Pass
11ax-HE80	MCS0	122	5610	2.098	1.976	91.29%	5.443	≤11.00	Pass
11ax-HE80	MCS0	122	5690	2.540	2.724	91.29%	6.039	≤11.00	Pass
11ax-HE160	MCS0	114	5570	-0.274	-0.091	90.66%	3.255	≤11.00	Pass

Note 1: When EUT duty cycle ≥ 98%,

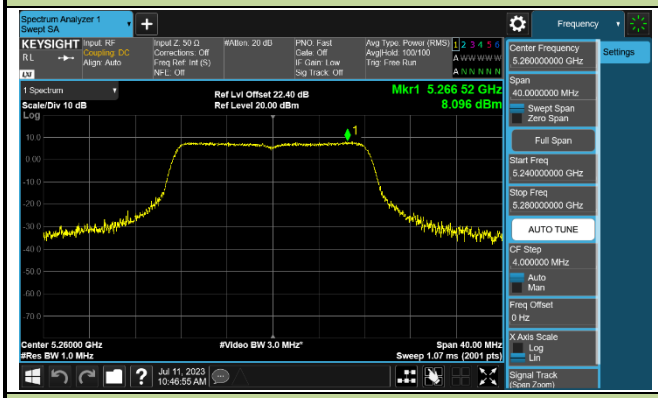
the total PSD (dBm/MHz) = $10*\log \{10^{(\text{Ant 0 PSD}/10)} + 10^{(\text{Ant 1 PSD}/10)}\}$ (dBm/MHz).

When EUT duty cycle < 98%,

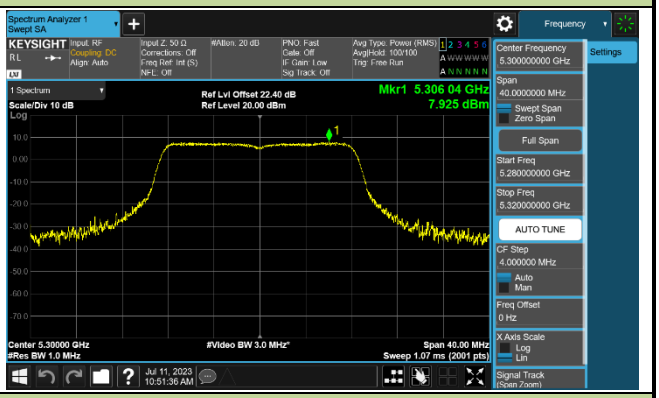
the total PSD (dBm/MHz) = $10*\log \{10^{(\text{Ant 0 PSD}/10)} + 10^{(\text{Ant 1 PSD}/10)}\} + 10*\log$ (1/Duty Cycle)(dBm/MHz).

802.11a Power Spectral Density - Ant 0

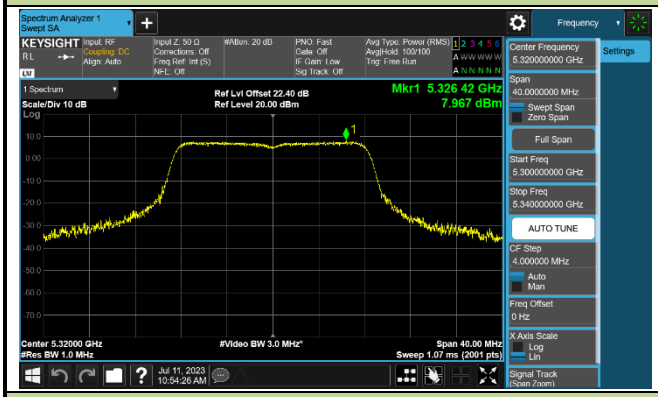
Channel 52 (5260MHz)



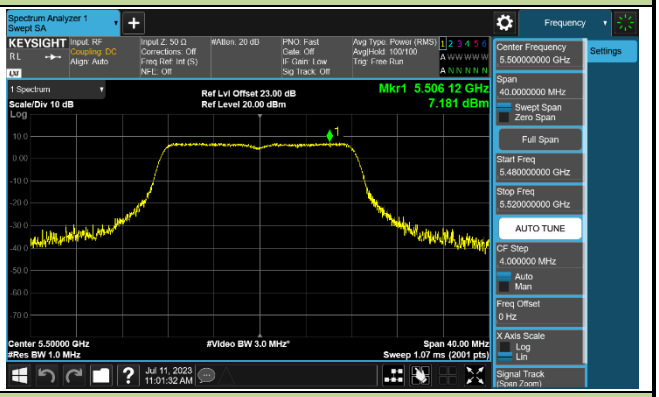
Channel 60 (5300MHz)



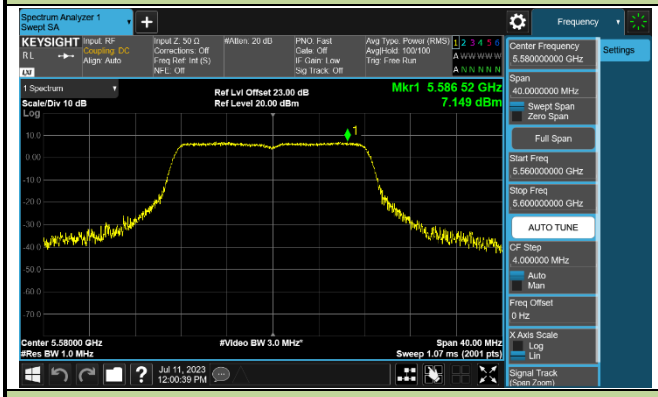
Channel 64 (5320MHz)



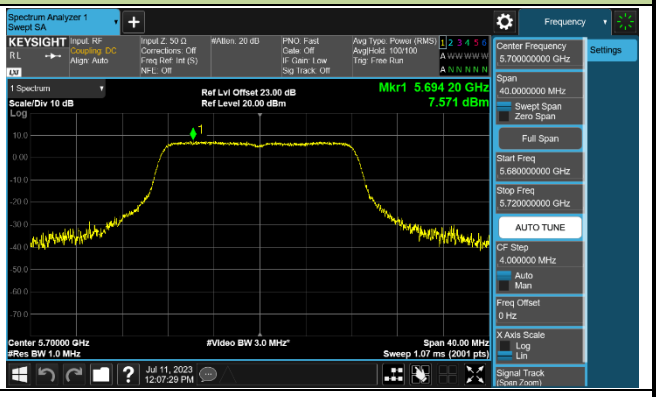
Channel 100 (5500MHz)



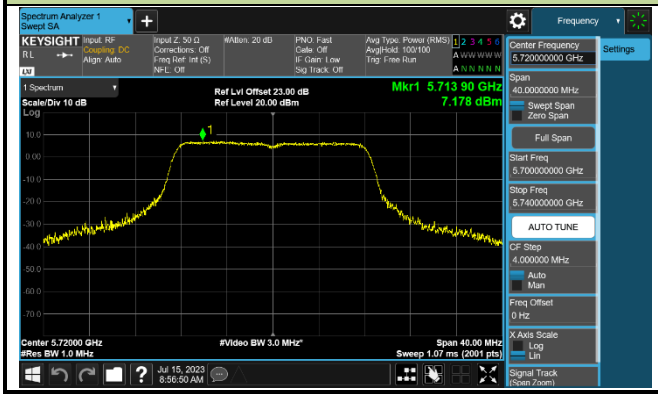
Channel 116 (5580MHz)

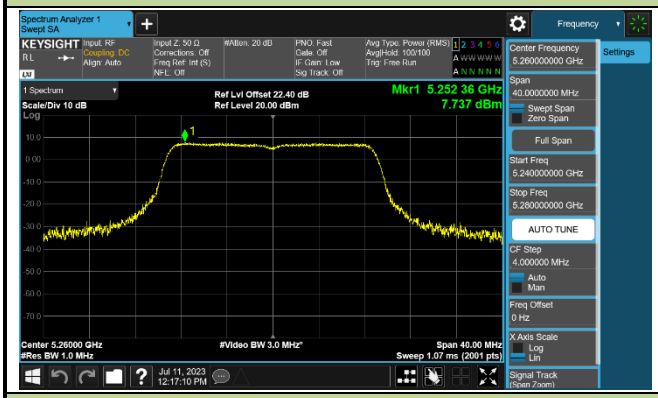
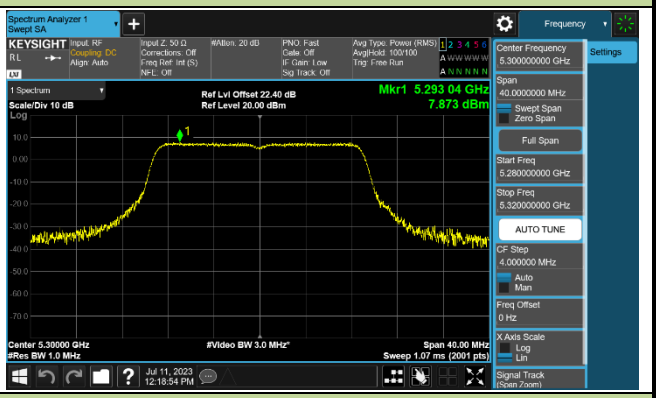
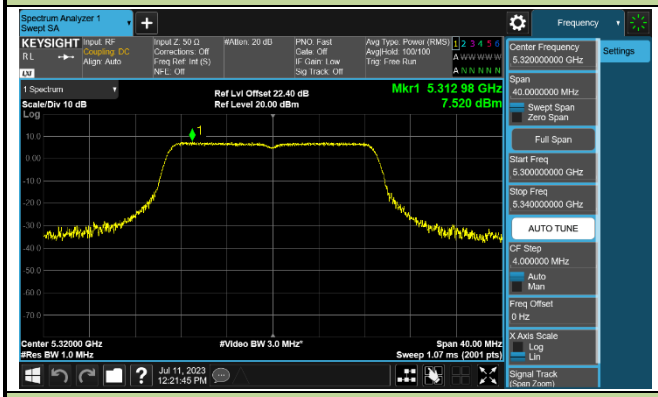
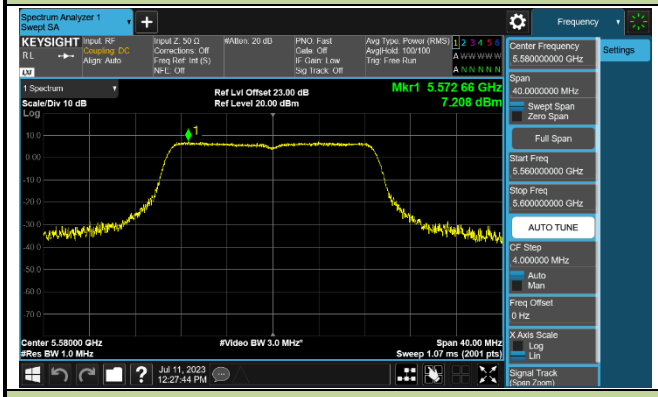
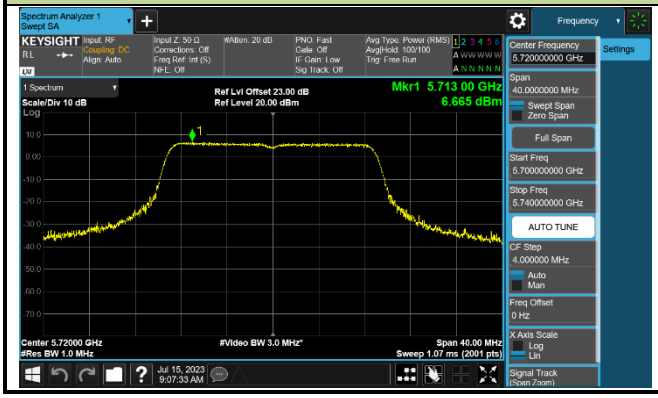


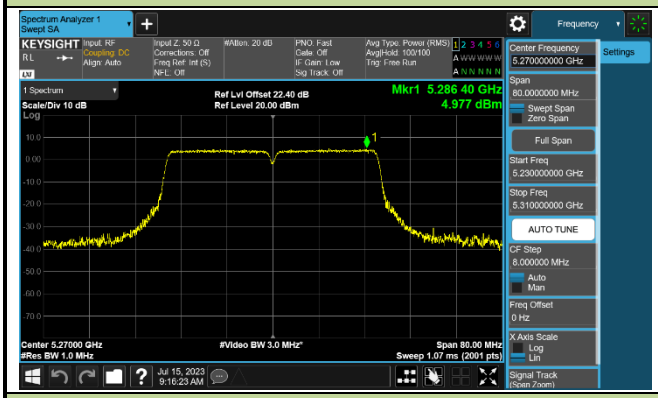
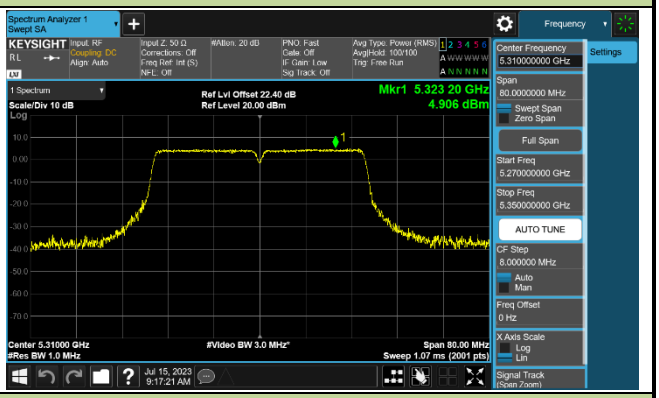
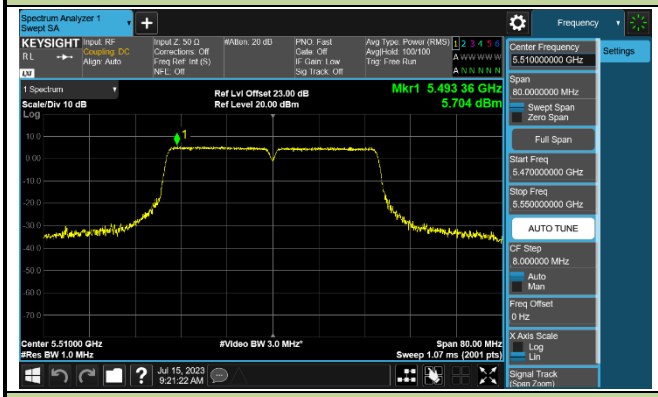
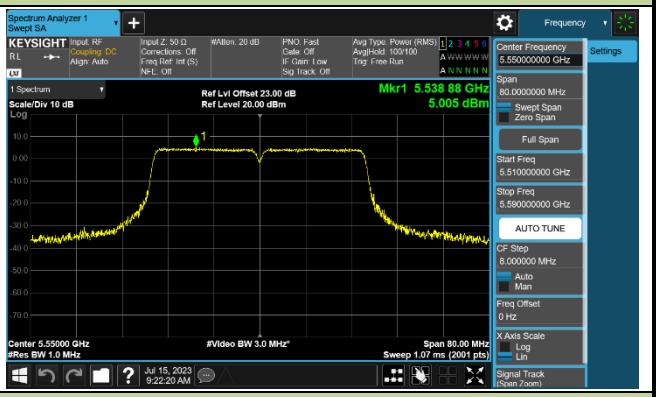
Channel 140 (5700MHz)



Channel 144 (5720MHz)



802.11ac-VHT20 Power Spectral Density - Ant 0	
Channel 52 (5260MHz)	Channel 60 (5300MHz)
	
Channel 64 (5320MHz)	Channel 100 (5500MHz)
	
Channel 116 (5580MHz)	Channel 140 (5700MHz)
	
Channel 144 (5720MHz)	
	

802.11ac-VHT40 Power Spectral Density - Ant 0	
Channel 54 (5270MHz)	Channel 62 (5310MHz)
	
Channel 102 (5510MHz)	Channel 110 (5550MHz)
	
Channel 134 (5670MHz)	Channel 142 (5710MHz)