



RF MEASUREMENT REPORT

FCC ID: LNQ-WF189

Applicant: Actiontec Electronics Inc.

Product: High-Speed Tri-Band 2x2 Wi-Fi 7 Wireless AP

Model No.: WF-189

Brand Name: Actiontec

FCC Classification: Unlicensed National Information Infrastructure (NII)

FCC Rule Part(s): Part 15 Subpart E (Section 15.407)

Result: Complies

Received Date: 2024-12-02

Test Date: 2024-12-20 ~ 2025-01-14

Reviewed By:

Kevin Guo

Approved By:

Robin Wu



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 KDB789033. 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 (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2412RSU001-U4	V01	Initial Report	2025-02-23	Valid

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1. General Information

1.1. Applicant

Actiontec Electronics Inc.

2445 Augustine Drive Suite 501, Santa Clara, California 95054, United States

1.2. Manufacturer

Actiontec Electronics Inc.

2445 Augustine Drive Suite 501, Santa Clara, California 95054, United States

1.3. Testing Facility

☒	Test Site – MRT Suzhou Laboratory Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China Laboratory Location (Suzhou - SIP) 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China Laboratory Location (Suzhou - Wujiang) Building 1, No.1 Xingdong Road, Wujiang, Suzhou, Jiangsu, People's Republic of China Laboratory Accreditations A2LA: 3628.01 CNAS: L10551 FCC: CN1166 ISED: CN0001 VCCI: ☐ R-20025 ☐ G-20034 ☐ C-20020 ☐ T-20020 ☐ R-20141 ☐ G-20134 ☐ C-20103 ☐ T-20104
☐	Test Site – MRT Shenzhen Laboratory Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China Laboratory Accreditations A2LA: 3628.02 CNAS: L10551 FCC: CN1284 ISED: CN0105
☐	Test Site – MRT Taiwan Laboratory Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) Laboratory Accreditations TAF: 3261 FCC: 291082, TW3261 ISED: TW3261

1.4. Product Information

Product Name	High-Speed Tri-Band 2x2 Wi-Fi 7 Wireless AP
Model No.	WF-189
EUT Identification No.	20241202Sample#13
Wi-Fi Specification	802.11a/b/g/n/ac/ax/be
Bluetooth Specification	BLE Only
Antenna Information	Refer to section 1.7
Operating Temp.	-5 ~ 40°C
Power Type	DC: 12V, 2.5A; or PoE Inject (802.3at)
Note: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification under Test

Frequency Range	For 802.11a/n-HT20/ac-VHT20/ax-HE20/be-EHT20: 5180~5240MHz, 5260~5320MHz, 5500~5720MHz, 5745~5825MHz For 802.11n-HT40/ac-VHT40/ax-HE40/be-EHT40: 5190~5230MHz, 5270~5310MHz, 5510~5710MHz, 5755~5795MHz For 802.11ac-VHT80/ax-HE80/be-EHT80: 5210MHz, 5290MHz, 5530MHz, 5610 MHz, 5690MHz, 5775MHz For 802.11ac-VHT160/ax-HE160/be-EHT160: 5250MHz, 5570MHz	
Type of Modulation	802.11a/n/ac: OFDM 802.11ax/be: OFDMA	
Data Rate	802.11a: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps 802.11ac: up to 1732Mbps 802.11ax: up to 2402Mbps 802.11be: up to 2882Mbps	
Channel Puncturing Function	☐ Supported	☒ Unsupported
Support RU	☒ Full RU	☐ Partial RU

1.6. Working Frequencies

802.11a/n-HT20/ac-VHT20/ax-HE20/be-EHT20

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/be-EHT40

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/be-EHT80

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

802.11ac-VHT160/ax-HE160/be-EHT160

Channel	Frequency	Channel	Frequency	Channel	Frequency
50	5250 MHz	114	5570 MHz	--	--

1.7. Antenna Details

Antenna Type	Frequency (MHz)	Tx Paths	Antenna Gain (dBi)		Directional Gain (dBi)	
			Ant 0	Ant 1	Correlated	Uncorrelated
Wi-Fi Antenna						
PIFA	5150 ~ 5250	2	6.7	5.6	8.4	5.4
	5250 ~ 5350	2	6.5	5.7	8.5	5.5
	5470 ~ 5725	2	6.8	6.9	8.9	5.9
	5725 ~ 5850	2	6.9	6.4	8.4	5.4
Remark:						
1. The antenna gain and directional gain refer to manufacturer's antenna specification. 2. The device supports CDD Mode, STBC mode and SISO mode, details refer to the table as below. 3. CDD signals are correlated, the directional gain as follows, For power measurements: Array Gain = 0 dB for $N_{ANT} \leq 4$, the directional gain = max antenna gain + array gain For power spectral density (PSD) measurements: the max directional gain (each angle) = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}]$ 4. STBC signals are uncorrelated, the directional gain as follows, the max directional gain (each angle) = $10 \log[(10^{G1/10} + 10^{G2/10} + \dots + 10^{GN/10}) / N_{ANT}]$						

Test Mode	Tx Paths	SISO	CDD Mode	STBC Mode
Wi-Fi 5G				
802.11a	2	X	√	X
802.11n/ac/ax/be	2	X	X	√
Remark: "√" means "Support", "X" means "Not support".				

2. Test Configuration

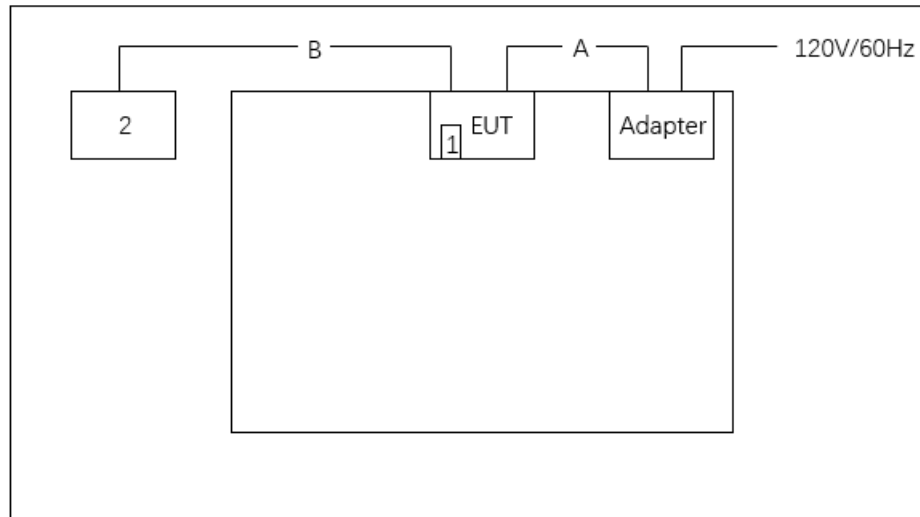
2.1. Test Mode

CDD Mode
Mode 1: Transmit by 802.11a_N _{SS} =1 (6Mbps)
STBC Mode
Mode 2: Transmit by 802.11ac-VHT20_N _{SS} =2 (MCS0)
Mode 3: Transmit by 802.11ac-VHT40_N _{SS} =2 (MCS0)
Mode 4: Transmit by 802.11ac-VHT80_N _{SS} =2 (MCS0)
Mode 5: Transmit by 802.11ac-VHT160_N _{SS} =2 (MCS0)
Mode 6: Transmit by 802.11ax-HE20_N _{SS} =2 (MCS0)
Mode 7: Transmit by 802.11ax-HE40_N _{SS} =2 (MCS0)
Mode 8: Transmit by 802.11ax-HE80_N _{SS} =2 (MCS0)
Mode 9: Transmit by 802.11ax-HE160_N _{SS} =2 (MCS0)
Mode 10: Transmit by 802.11be-EHT20_N _{SS} =2 (MCS0)
Mode 11: Transmit by 802.11be-EHT40_N _{SS} =2 (MCS0)
Mode 12: Transmit by 802.11be-EHT80_N _{SS} =2 (MCS0)
Mode 13: Transmit by 802.11be-EHT160_N _{SS} =2 (MCS0)
Notes:
- For Radiated emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power. - For CDD mode, this device supports 2 N_{SS} and power level is the same of spatial multiplexing. The worst case is N_{SS}=1. 802.11n and 802.11ac have same modulation type and same power value, so we only show 802.11ac test data in report. - As Designated by manufacturer, the lowest data rate was the worst condition, so all the tests were done with lowest data rate.

2.2. Test System Connection Diagram

The 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



No.	Cable Type	Cable Spec.	Length
A	Power Cable	Non-Shielding	1.5m
B	LAN Cable	Cat 6, Non-Shielding	>10.0m
No.	Product	Manufacturer	Model No.
1	USB Flash	SanDisk	16G
2	Notebook	Lenovo	Thinkbook 16

2.3. Test Software

The test utility software used during testing was “QSPR”, and the version was 5.0-00202.

Final power setting please refer to operational description.

2.4. Applied Standards

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

- FCC Part 15.407
- KDB 789033 D02v02r01
- KDB 662911 D01v02r01
- ANSI C63.10-2013

2.5. Test Environment Condition

Ambient Temperature	15 ~ 35°C
Relative Humidity	20 ~ 75%RH

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. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
Thermohygrometer	testo	608-H1	MRTSUE06402	1 year	2025-05-12	WZ-SR5
Shielding Room	HUAMING	WZ-SR5	MRTSUE06442	N/A	N/A	WZ-SR5
Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2025-05-08	WZ-SR5
Signal Analyzer	Keysight	N9010B	MRTSUE06558	1 year	2025-05-20	WZ-SR5
USB Power Sensor	Keysight	U2021XA	MRTSUE06446	1 year	2025-05-08	WZ-SR5
Attenuator	MVE	MVE2213	MRTSUE11092	1 year	2025-06-05	WZ-SR5
Horn Antenna	ETS	3117	MRTSUE06257	1 year	2025-09-08	WJ-AC1
Microwave Broadband Preamplifier	Schwarzbeck	BBV 9718 D	MRTSUE07084	1 year	2025-12-22	WJ-AC1
TRILOG Broad Band Antenna	Schwarzbeck	VULB 9163	MRTSUE07096	1 year	2025-04-24	WJ-AC1
EMI Test Receiver	R&S	ESR3	MRTSUE07110	1 year	2025-04-24	WJ-AC1
Anechoic Chamber	TDK	WJ-AC1	MRTSUE07115	1 year	2025-05-17	WJ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11314	1 year	2025-06-24	WJ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11333	1 year	2025-06-24	WJ-AC1
Active Loop Antenna	Schwarzbeck	FMZB 1519-60 D	MRTSUE07076	1 year	2025-11-19	WJ-AC1
EXA Signal Analyzer	Keysight	N9010B	MRTSUE07147	1 year	2025-04-28	WJ-AC1
TRILOG Broad Band Antenna	Schwarzbeck	VULB 9163	MRTSUE07097	1 year	2025-04-24	WJ-AC2
Preamplifier	EMCI	EMC118A45SE	MRTSUE07102	1 year	2025-04-11	WJ-AC2
Preamplifier	EMCI	EMC184045SE	MRTSUE07103	1 year	2025-04-14	WJ-AC2
Horn Antenna	EMCI	DRH18-E	MRTSUE07105	1 year	2025-05-12	WJ-AC2
Anechoic Chamber	TDK	WJ-AC2	MRTSUE07117	1 year	2025-05-14	WJ-AC2
Thermohygrometer	testo	608-H1	MRTSUE11315	1 year	2025-06-24	WJ-AC2
Thermohygrometer	testo	608-H1	MRTSUE11332	1 year	2025-06-24	WJ-AC2
Broadband Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE07100	1 year	2025-04-24	WJ-AC2
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2025-05-08	WZ-SR2
Shielding Room	MIX-BEP	WZ-SR2	MRTSUE06215	5 years	2026-12-20	WZ-SR2
Thermohygrometer	testo	608-H1	MRTSUE06404	1 year	2025-05-12	WZ-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06909	1 year	2025-09-05	WZ-SR2
EMI Test Receiver	Agilent	N9038A	MRTSUE06125	1 year	2025-05-08	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06171	1 year	2025-09-23	WZ-AC2
Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2025-05-06	WZ-AC2
Anechoic Chamber	RIKEN	WZ-AC2	MRTSUE06213	1 year	2025-04-18	WZ-AC2

Thermohygrometer	testo	608-H1	MRTSUE11263	1 year	2025-10-16	WZ-AC2
Temperature Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2025-09-02	WZ-TR3
Thermohygrometer	testo	608-H1	MRTSUE11268	1 year	2025-12-10	WZ-TR3
Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2025-05-08	WZ-TR3

Software	Version	Function
e3	230711	RE & CE
Controller_MF 7802	1.02	RE Antenna & Turntable
CONTROLLER CO3000	v 1.03.02	RE Antenna & Turntable
BenchVue Power Meter	2018.1	Power

5. Decision Rules and Measurement Uncertainty

5.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2.
(Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.2. 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
The maximum measurement uncertainty is evaluated as: 9kHz~150kHz: 3.02dB 150kHz~30MHz: 2.56dB
Radiated Emission Measurement
The maximum measurement uncertainty is evaluated as: Coaxial: 9kHz~30MHz: 2.35dB Coplanar: 9kHz~30MHz: 2.37dB Horizontal: 30MHz~200MHz: 3.46dB 200MHz~1GHz: 3.78dB 1GHz~40GHz: 4.97dB Vertical: 30MHz~200MHz: 4.07dB 200MHz~1GHz: 5.28dB 1GHz~40GHz: 4.78dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 2.5dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 1.3dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 2.5dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 2.6%

6. Test Result

6.1. Summary

FCC Section(s)	Test Description	Test Condition	Verdict
15.407(a)	26dB Bandwidth	Conducted	Pass
15.407(e)	6dB Bandwidth		Pass
15.407(a)(1)(ii), (2), (3)(i)	Maximum Conducted Output Power		Pass
15.407(h)(1)	Transmit Power Control		Pass
15.407(g)	Frequency Stability		Pass
15.407(a)(1)(ii), (2), (3)(i), (13)	Peak Power Spectral Density		Pass
15.407(h)(2)	Dynamic Frequency Selection (DFS)		Pass Remark 3
15.407(b)(1), (2), (3), (4)(i)	Undesirable Emissions	Radiated	Pass
15.205, 15.209 15.407(b)(8), (9), (10)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)		Pass
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	Pass

Remark:

- 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.
- 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.
- DFS report refer to 2412RSU001-U5.

6.2. 26dB & 99% Bandwidth Measurement

6.2.1. Test Limit

N/A

6.2.2. Test Procedure

KDB 789033 D02v02r01- Section II)C)1) (26dB Bandwidth)

KDB 789033 D02v02r01- Section II)D) (99% Bandwidth)

6.2.3. Test Setting

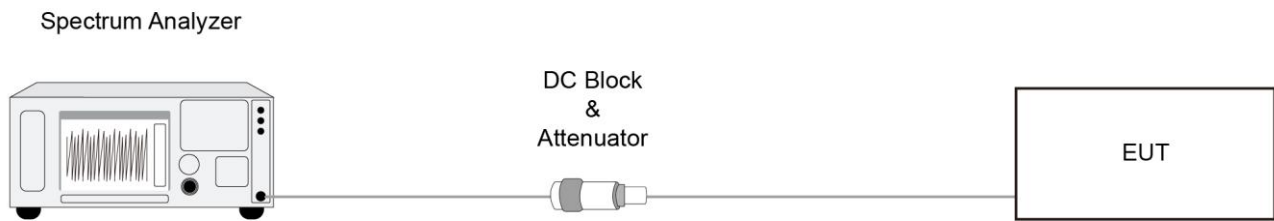
26dB Bandwidth

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth
2. RBW = approximately 1% of the emission bandwidth.
3. VBW > RBW
4. Detector = Peak.
5. Trace mode = max hold.
6. Measure the maximum width of the emission that is 26 dB down from the maximum 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%.

99% Bandwidth

1. Set center frequency to the nominal EUT channel center frequency.
2. RBW = 1% to 5% of the OBW
3. $VBW \geq 3 \times RBW$
4. Span = 1.5 times to 5 times the OBW
5. Detector = peak
6. Trace mode = max hold
7. Allow the trace to stabilize
8. Use the 99% power bandwidth function of the instrument.

6.2.4. Test Setup



6.2.5. Test Result

Refer to Appendix A.2.

6.3. 6dB Bandwidth Measurement

6.3.1. Test Limit

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

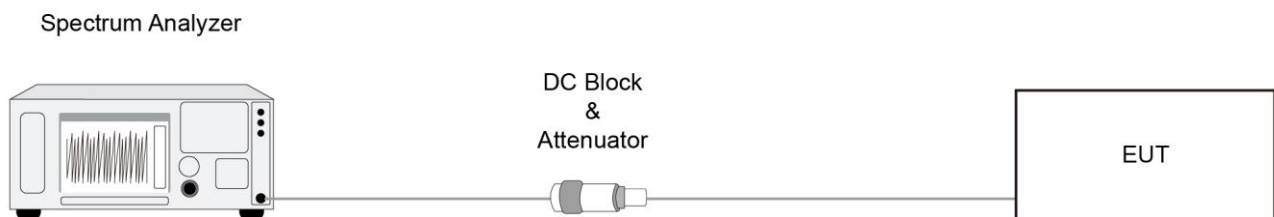
6.3.2. Test Procedure

KDB 789033 D02v02r01- Section II)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



6.3.5. Test Result

Refer to Appendix A.3.

6.4. Output Power Measurement

6.4.1. Test Limit

For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

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 $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm).

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.

6.4.2. Test Procedure

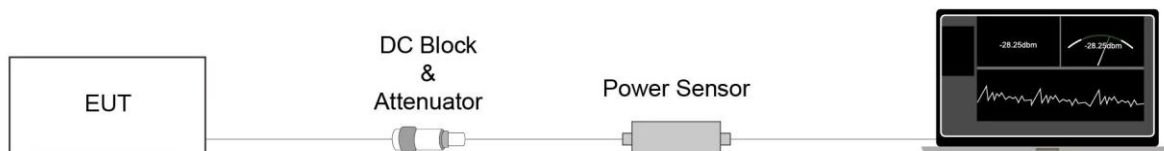
KDB 789033D02v02r01- Section II(E)3)b) Method PM-G

6.4.3. Test Setting

Average Power Measurement

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.

6.4.4. Test Setup



6.4.5. Test Result

Refer to Appendix A.4.

6.5. Transmit Power Control Measurement

6.5.1. 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.

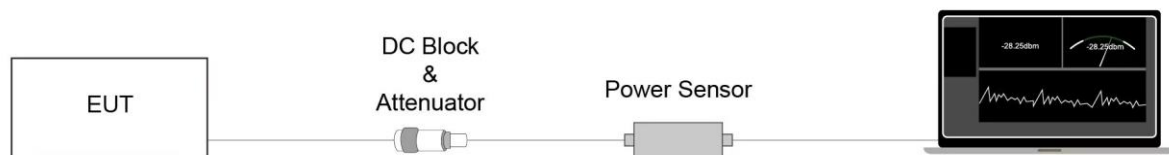
6.5.2. Test Procedure

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

6.5.3. 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.

6.5.4. Test Setup



6.5.5. Test Result

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

6.6. Power Spectral Density Measurement

6.6.1. Test Limit

For the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

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.

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz 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.

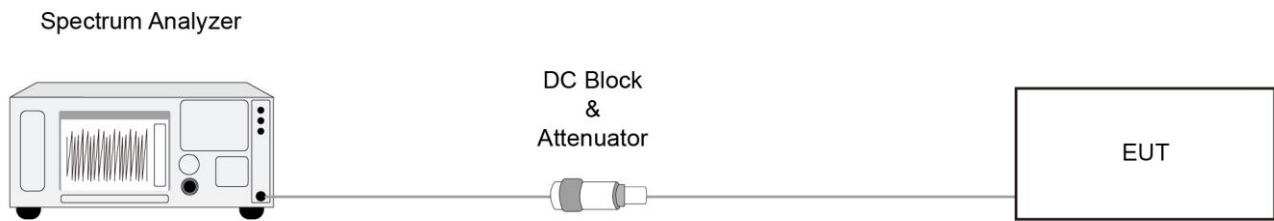
6.6.2. Test Procedure

KDB 789033 D02v02r01-Section II)F)

6.6.3. 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 (510kHz, if measurement bandwidth of Maximum PSD is specified in 500 kHz)
4. VBW = $3 \times \text{RBW}$
5. Number of sweep points $\geq 2 \times (\text{span} / \text{RBW})$
6. Detector = power averaging (Average)
7. Sweep time = auto
8. Trigger = free run
9. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.
10. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
11. Add $10 \cdot \log(1/x)$, 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 $10 \cdot \log(1/0.25) = 6 \text{ dB}$ if the duty cycle is 25 percent.

6.6.4. Test Setup



6.6.5. Test Result

Refer to Appendix A.5.

6.7. Frequency Stability Measurement

6.7.1. Test Limit

Manufactures 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.

6.7.2. Test Procedure

Frequency Stability Under Temperature Variations:

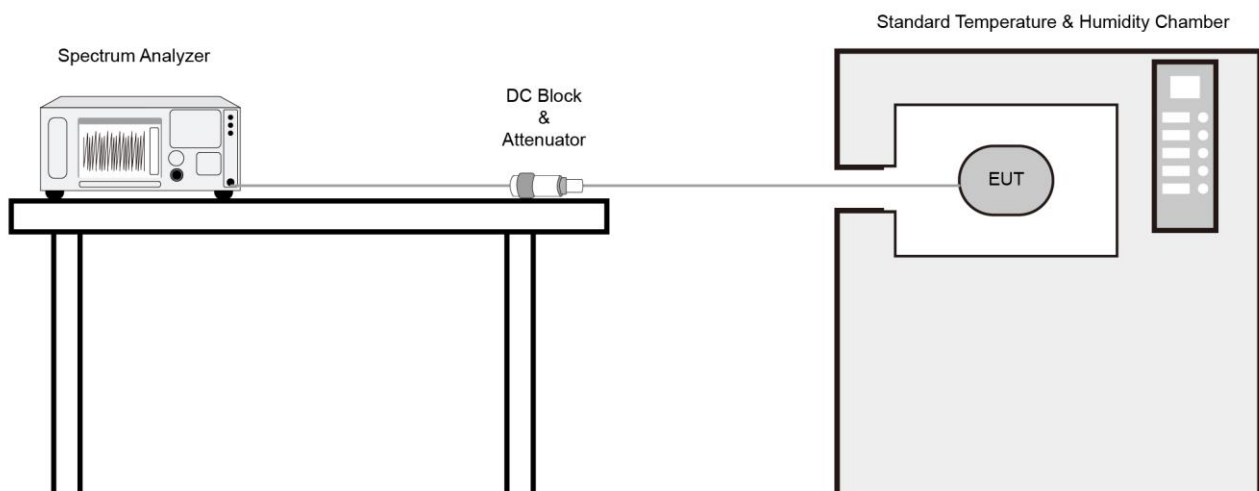
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ($\pm 15\%$) and endpoint, record the maximum frequency change.

6.7.3. Test Setup



6.7.4. Test Result

Refer to Appendix A.6.

6.8. Radiated Spurious Emission Measurement

6.8.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [μV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.8.2. Test Procedure

KDB 789033 D02v02r01- Section II)G)

6.8.3. Test Setting

Table 1 - RBW as a function of frequency

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000MHz	1MHz

Quasi-Peak Measurements below 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = as specified in Table 1
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

Peak Measurements above 1GHz

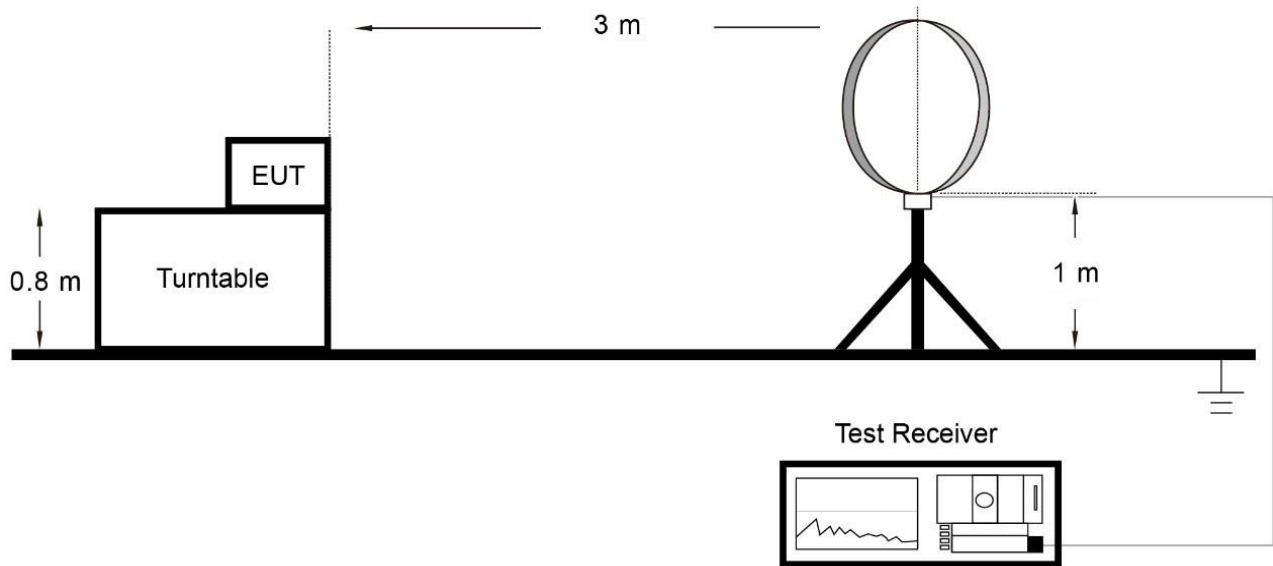
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

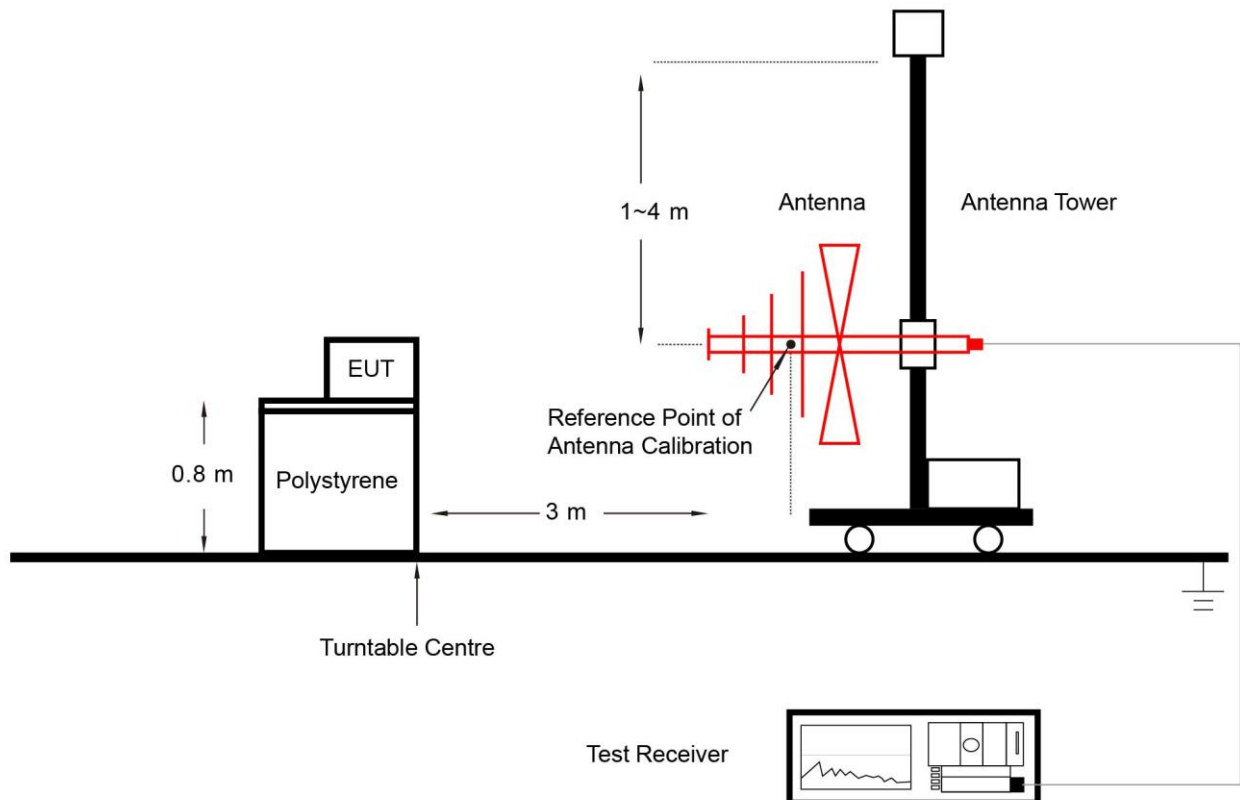
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; if the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW = 10Hz
If the EUT duty cycle is $< 98\%$, set $\text{VBW} \geq 1/T$. T is the minimum transmission duration.
4. As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
5. Detector = Peak
6. Sweep time = Auto
7. Trace mode = Max hold
8. Trace was allowed to stabilize

6.8.4. Test Setup

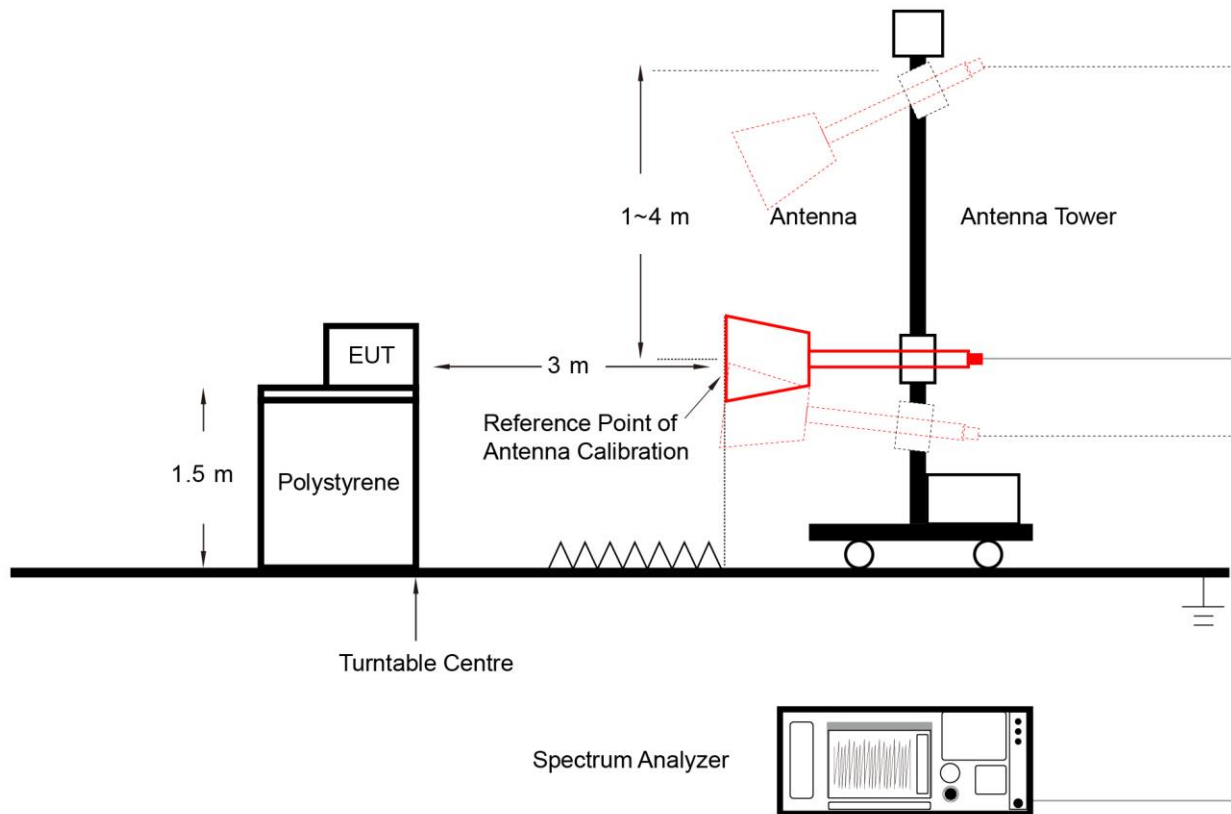
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



6.8.5. Test Result

Refer to Appendix A.7.

6.9. Radiated Restricted Band Edge Measurement

6.9.1. Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41	--	--	--

For 15.407(b) requirement:

For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Refer to KDB 789033 D02v02r01 G)2)c), as specified in § 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a maximum emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in § 15.407(b)(4)). However, an out-of-band emission that complies with both the peak and average limits of § 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz maximum emission limit.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [μV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.9.2. Test Procedure

KDB 789033 D02v02r01- Section II)G)

6.9.3. Test Setting

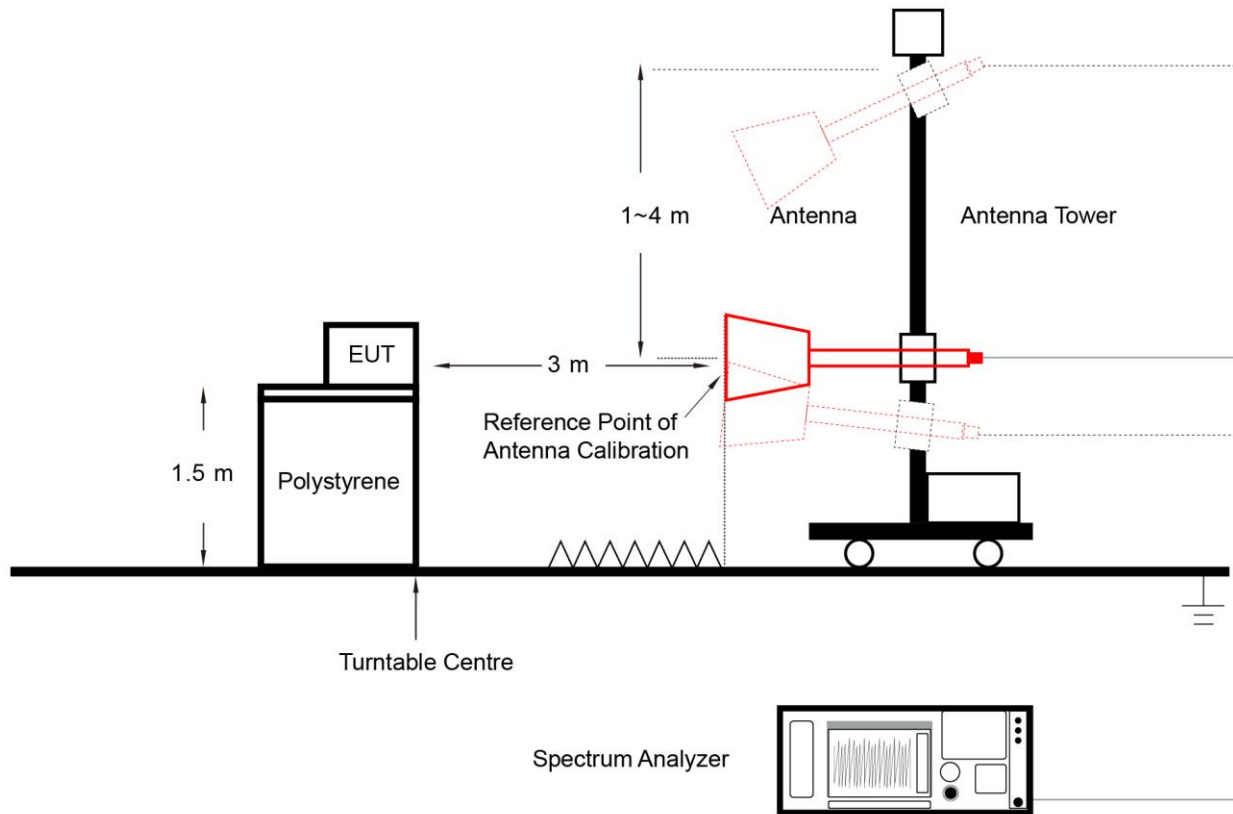
Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW = 10 Hz.
If the EUT duty cycle is $< 98\%$, set $\text{VBW} \geq 1/T$. T is the minimum transmission duration.
4. As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
5. Detector = Peak
6. Sweep time = auto
7. Trace mode = max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

6.9.4. Test Setup



6.9.5. Test Result

Refer to Appendix A.8.

6.10. AC Conducted Emissions Measurement

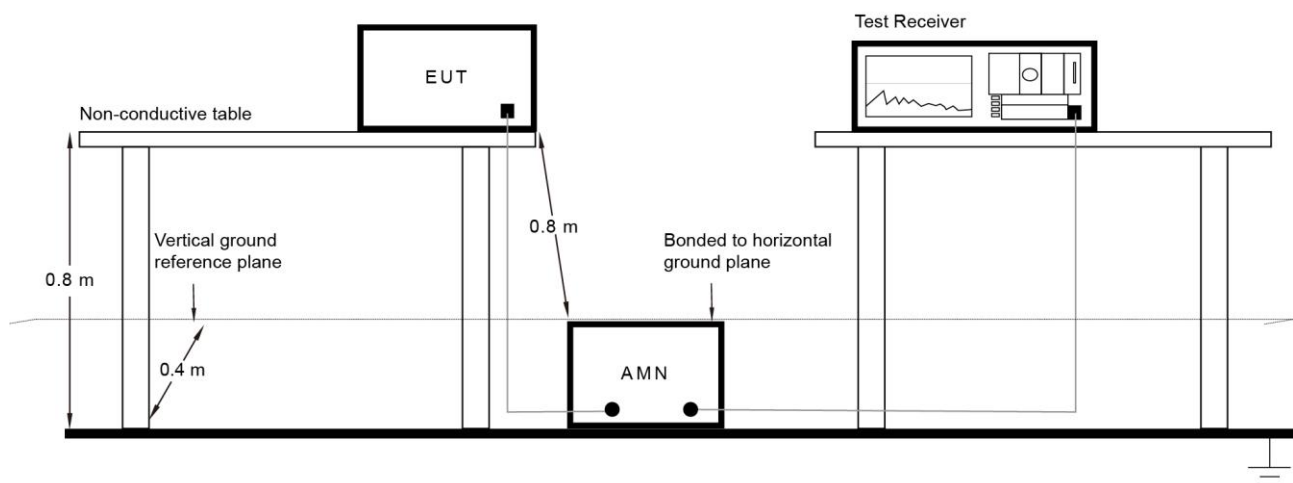
6.10.1. Test Limit

FCC Part 15.207 Limits		
Frequency (MHz)	QP (dB μ V)	AV (dB μ V)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

6.10.2. Test Setup



6.10.3. Test Result

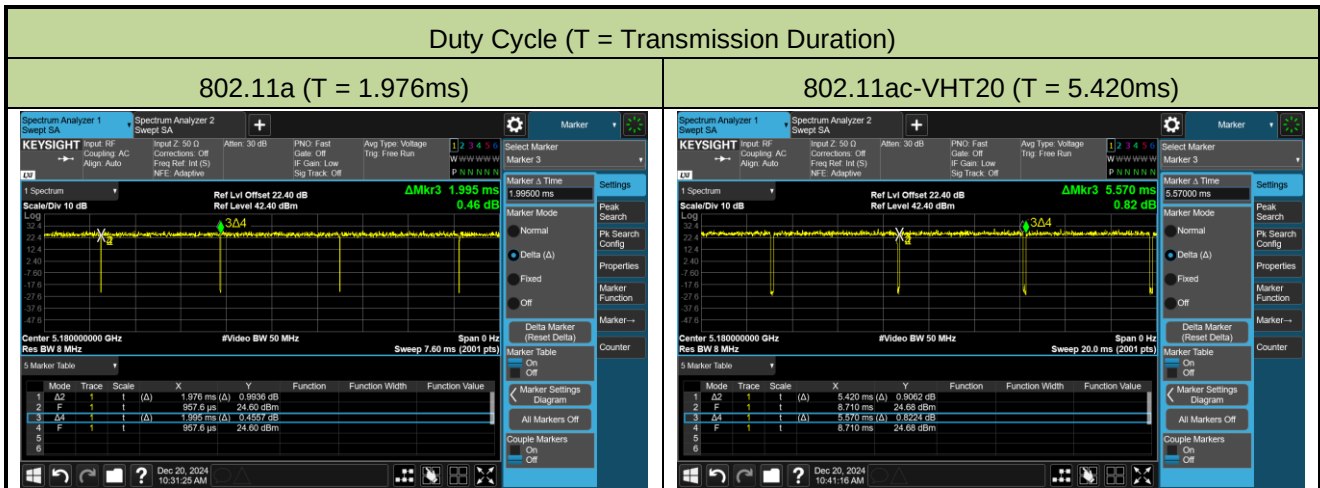
Refer to Appendix A.9.

Appendix A – Test Result

A.1 Duty Cycle Test Result

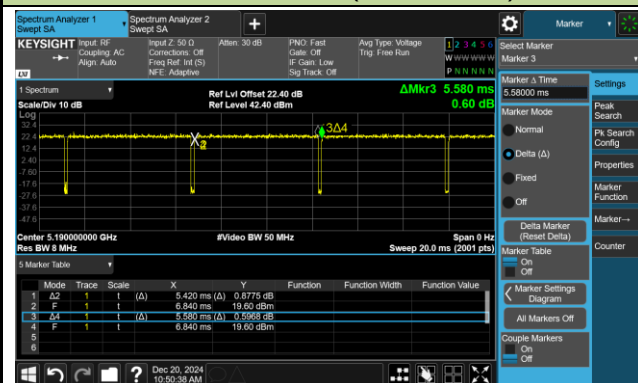
Test Site	WZ-SR5	Test Engineer	Lynn Yang
Test Date	2024-12-20		

Test Mode	Duty Cycle
802.11a	99.05%
802.11ac-VHT20	97.31%
802.11ac-VHT40	97.13%
802.11ac-VHT80	98.55%
802.11ac-VHT160	99.72%
802.11ax-HE20	99.67%
802.11ax-HE40	97.82%
802.11ax-HE80	97.61%
802.11ax-HE160	99.65%
802.11be-EHT20	98.00%
802.11be-EHT40	99.69%
802.11be-EHT80	98.29%
802.11be-EHT160	99.65%

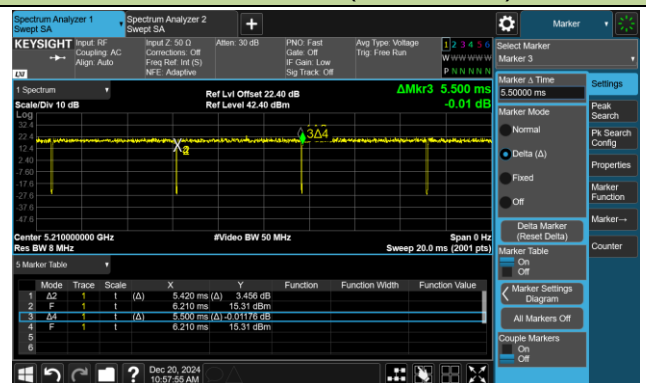


Duty Cycle (T = Transmission Duration)

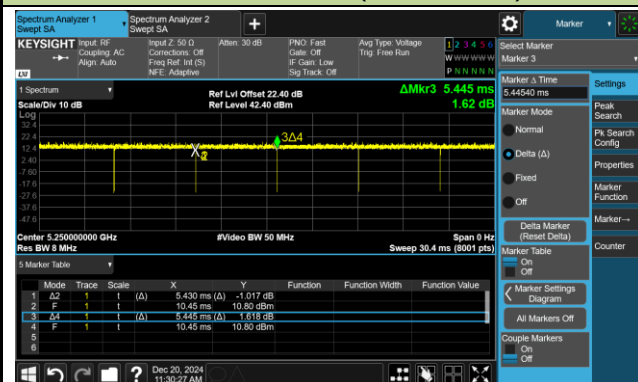
802.11ac-VHT40 (T = 5.420ms)



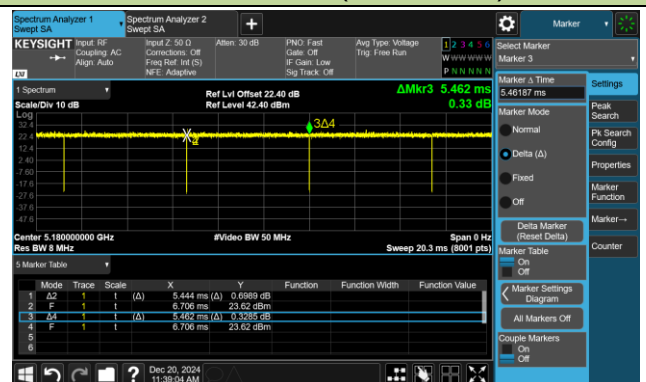
802.11ac-VHT80 (T = 5.420ms)



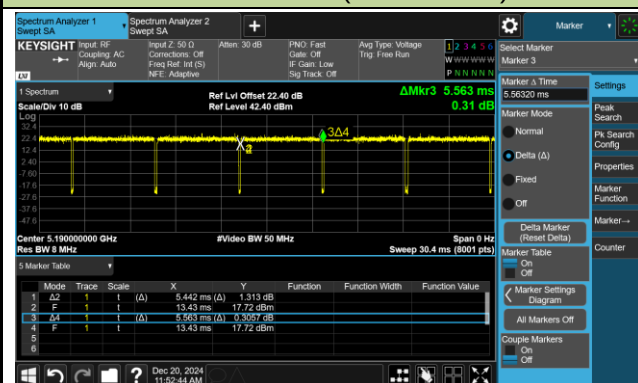
802.11ac-VHT160 (T = 5.430ms)



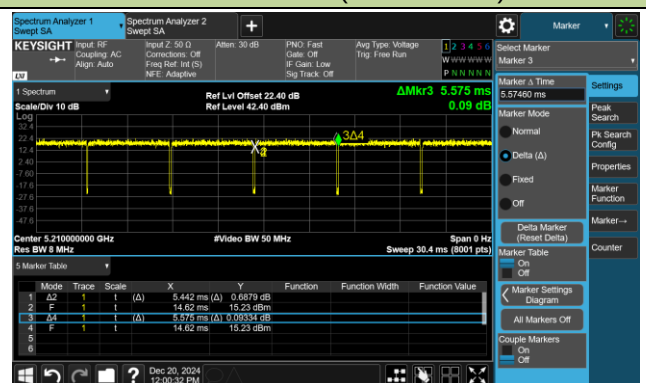
802.11ax-HE20 (T = 5.444ms)



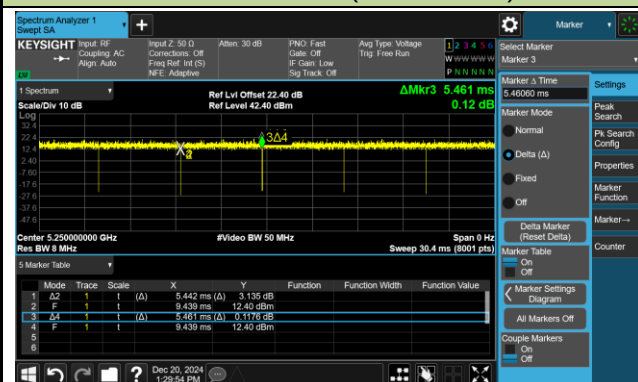
802.11ax-HE40 (T = 5.442ms)



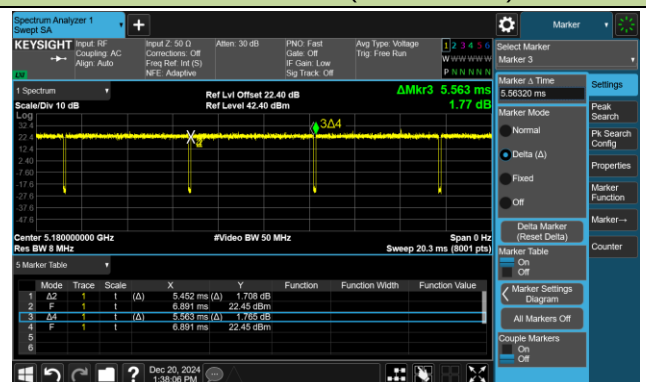
802.11ax-HE80 (T = 5.442ms)



802.11ax-HE160 (T = 5.442ms)

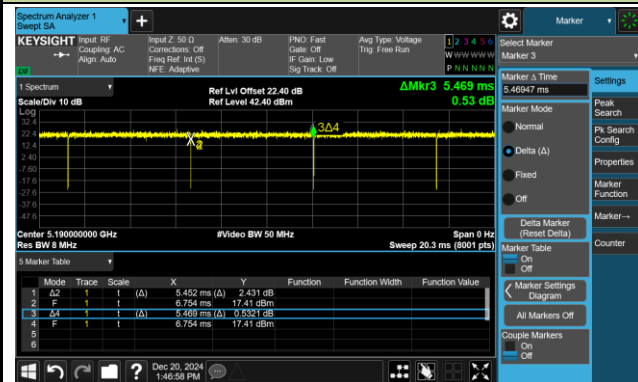


802.11be-EHT20 (T = 5.452ms)

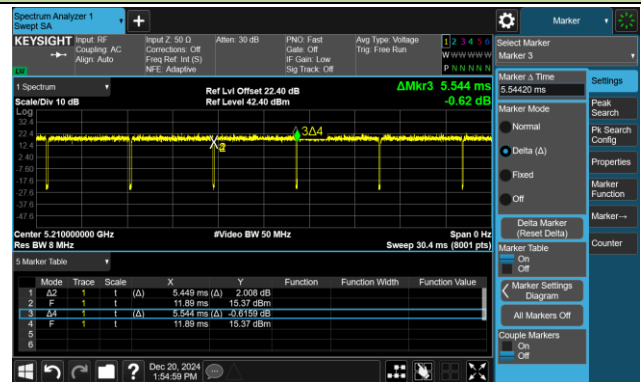


Duty Cycle (T = Transmission Duration)

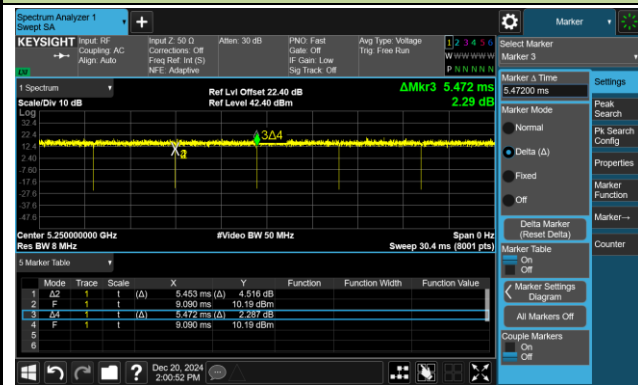
802.11be-EHT40 (T = 5.452ms)



802.11be-EHT80 (T = 5.449ms)



802.11be-EHT160 (T = 5.453ms)



A.2 26dB Bandwidth Test Result

Test Site	WZ-SR5	Test Engineer	Luis Yang
Test Date	2024-12-31 ~ 2025-01-01		

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	6Mbps	36	5180	23.01	17.027
11a	6Mbps	44	5220	37.72	19.979
11a	6Mbps	48	5240	36.65	19.293
11a	6Mbps	52	5260	22.38	16.883
11a	6Mbps	60	5300	22.43	16.883
11a	6Mbps	64	5320	22.36	16.898
11a	6Mbps	100	5500	22.34	16.907
11a	6Mbps	116	5580	22.41	16.936
11a	6Mbps	140	5700	22.25	16.913
11a	6Mbps	144	5720	22.88	16.852
11a	6Mbps	149	5745	23.09	17.073
11a	6Mbps	157	5785	24.69	17.465
11a	6Mbps	165	5825	37.49	19.252
11ac-VHT20	MCS0	36	5180	23.79	18.093
11ac-VHT20	MCS0	44	5220	37.57	18.985
11ac-VHT20	MCS0	48	5240	38.81	19.481
11ac-VHT20	MCS0	52	5260	23.54	18.023
11ac-VHT20	MCS0	60	5300	23.02	17.982
11ac-VHT20	MCS0	64	5320	23.64	18.012
11ac-VHT20	MCS0	100	5500	23.45	18.018
11ac-VHT20	MCS0	116	5580	23.51	18.092
11ac-VHT20	MCS0	140	5700	22.98	17.953
11ac-VHT20	MCS0	144	5720	22.79	17.926
11ac-VHT20	MCS0	149	5745	23.29	18.036
11ac-VHT20	MCS0	157	5785	28.96	18.299
11ac-VHT20	MCS0	165	5825	37.92	18.939

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
11ac-VHT40	MCS0	38	5190	45.14	36.703
11ac-VHT40	MCS0	46	5230	79.42	36.208
11ac-VHT40	MCS0	54	5270	46.10	36.905
11ac-VHT40	MCS0	62	5310	44.67	36.656
11ac-VHT40	MCS0	102	5510	45.03	36.632
11ac-VHT40	MCS0	110	5550	43.98	36.593
11ac-VHT40	MCS0	134	5670	45.07	36.726
11ac-VHT40	MCS0	142	5710	44.10	36.701
11ac-VHT40	MCS0	151	5755	47.60	36.957
11ac-VHT40	MCS0	159	5795	74.85	37.320
11ac-VHT80	MCS0	42	5210	92.61	76.377
11ac-VHT80	MCS0	58	5290	92.35	76.265
11ac-VHT80	MCS0	106	5530	91.95	76.368
11ac-VHT80	MCS0	122	5610	91.97	76.306
11ac-VHT80	MCS0	138	5690	92.59	76.361
11ac-VHT80	MCS0	155	5775	134.70	77.444
11ac-VHT160	MCS0	50	5250	172.00	155.410
11ac-VHT160	MCS0	114	5570	173.70	155.660
11ax-HE20	MCS0	36	5180	23.55	19.127
11ax-HE20	MCS0	44	5220	39.95	19.886
11ax-HE20	MCS0	48	5240	39.71	19.613
11ax-HE20	MCS0	52	5260	23.01	19.119
11ax-HE20	MCS0	60	5300	23.20	19.089
11ax-HE20	MCS0	64	5320	23.19	19.139
11ax-HE20	MCS0	100	5500	22.86	19.070
11ax-HE20	MCS0	116	5580	22.77	19.157
11ax-HE20	MCS0	140	5700	22.89	19.061
11ax-HE20	MCS0	144	5720	22.49	19.077
11ax-HE20	MCS0	149	5745	23.62	19.157
11ax-HE20	MCS0	157	5785	25.42	19.191
11ax-HE20	MCS0	165	5825	25.28	19.221

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
11ax-HE40	MCS0	38	5190	44.46	38.032
11ax-HE40	MCS0	46	5230	45.47	38.090
11ax-HE40	MCS0	54	5270	43.86	38.006
11ax-HE40	MCS0	62	5310	43.77	38.046
11ax-HE40	MCS0	102	5510	44.88	38.040
11ax-HE40	MCS0	110	5550	44.26	38.020
11ax-HE40	MCS0	134	5670	44.61	38.024
11ax-HE40	MCS0	142	5710	44.31	38.021
11ax-HE40	MCS0	151	5755	44.55	38.080
11ax-HE40	MCS0	159	5795	45.87	38.100
11ax-HE80	MCS0	42	5210	90.59	77.789
11ax-HE80	MCS0	58	5290	89.99	77.754
11ax-HE80	MCS0	106	5530	89.96	77.762
11ax-HE80	MCS0	122	5610	89.79	77.761
11ax-HE80	MCS0	138	5690	90.87	77.868
11ax-HE80	MCS0	155	5775	95.22	77.928
11ax-HE160	MCS0	50	5250	171.50	157.000
11ax-HE160	MCS0	114	5570	171.80	156.850
11be-EHT20	MCS0	36	5180	23.68	19.172
11be-EHT20	MCS0	44	5220	34.84	19.435
11be-EHT20	MCS0	48	5240	26.62	19.312
11be-EHT20	MCS0	52	5260	22.84	19.100
11be-EHT20	MCS0	60	5300	23.53	19.100
11be-EHT20	MCS0	64	5320	22.79	19.107
11be-EHT20	MCS0	100	5500	23.18	19.103
11be-EHT20	MCS0	116	5580	22.65	19.111
11be-EHT20	MCS0	140	5700	23.52	19.100
11be-EHT20	MCS0	144	5720	22.73	19.081
11be-EHT20	MCS0	149	5745	23.54	19.074
11be-EHT20	MCS0	157	5785	26.01	19.158
11be-EHT20	MCS0	165	5825	24.90	19.197

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
11be-EHT40	MCS0	38	5190	43.36	38.021
11be-EHT40	MCS0	46	5230	44.36	38.039
11be-EHT40	MCS0	54	5270	43.15	38.018
11be-EHT40	MCS0	62	5310	43.50	37.977
11be-EHT40	MCS0	102	5510	44.80	38.010
11be-EHT40	MCS0	110	5550	44.74	38.028
11be-EHT40	MCS0	134	5670	43.18	38.030
11be-EHT40	MCS0	142	5710	43.57	38.038
11be-EHT40	MCS0	151	5755	43.68	38.158
11be-EHT40	MCS0	159	5795	46.24	38.247
11be-EHT80	MCS0	42	5210	87.62	77.821
11be-EHT80	MCS0	58	5290	90.39	77.754
11be-EHT80	MCS0	106	5530	88.72	77.779
11be-EHT80	MCS0	122	5610	90.35	77.798
11be-EHT80	MCS0	138	5690	88.32	77.788
11be-EHT80	MCS0	155	5775	93.05	77.852
11be-EHT160	MCS0	50	5250	169.10	156.880
11be-EHT160	MCS0	114	5570	169.40	156.640

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	F _H (MHz)	Limit (MHz)
802.11a	6Mbps	48	5240	5249.65	< 5250
802.11ac-VHT20	MCS0	48	5240	5249.74	< 5250
802.11ac-VHT40	MCS0	46	5230	5248.10	< 5250
802.11ac-VHT80	MCS0	42	5210	5248.19	< 5250
802.11ax-HE20	MCS0	48	5240	5249.81	< 5250
802.11ax-HE40	MCS0	46	5230	5249.05	< 5250
802.11ax-HE80	MCS0	42	5210	5248.89	< 5250
802.11be-EHT20	MCS0	48	5240	5249.66	< 5250
802.11be-EHT40	MCS0	46	5230	5249.02	< 5250
802.11be-EHT80	MCS0	42	5210	5248.91	< 5250

Note: $F_H = \text{Centre frequency} + 99\% \text{ OBW} / 2$.

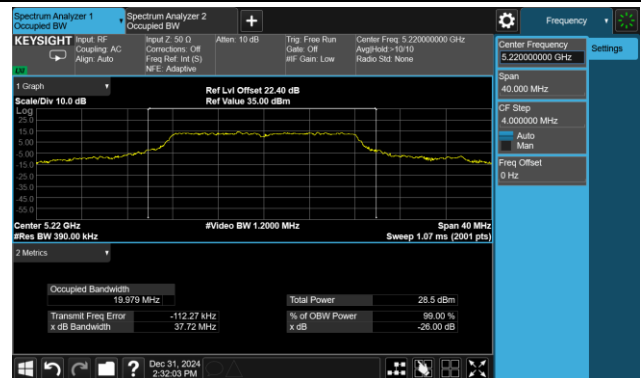
For example, 802.11a 5240MHz, $F_H = 5240 \text{ MHz} + 19.293 \text{ MHz} / 2 = 5249.65 \text{ MHz}$.

802.11a 26dB Bandwidth & 99% Bandwidth

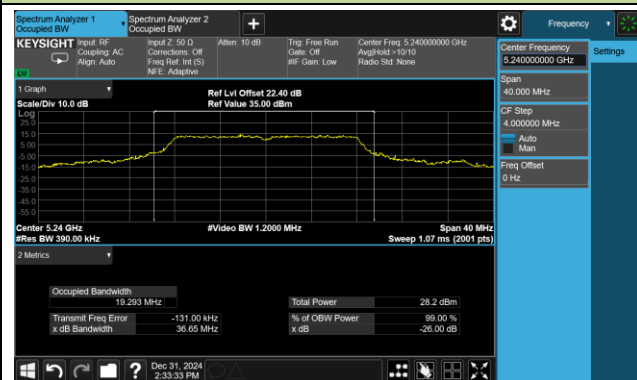
Channel 36 (5180MHz)



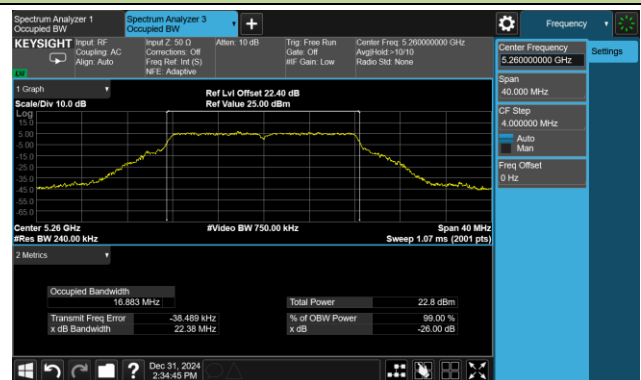
Channel 44 (5220MHz)



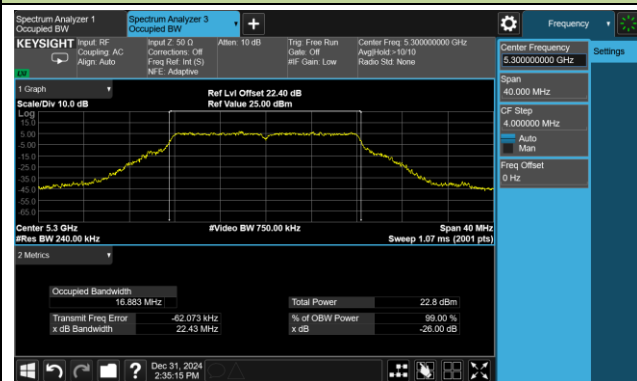
Channel 48 (5240MHz)



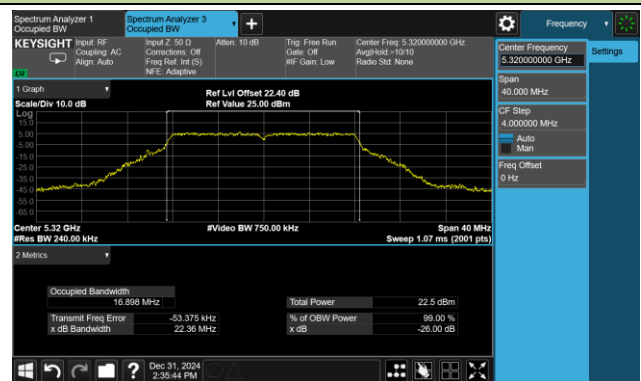
Channel 52 (5260MHz)



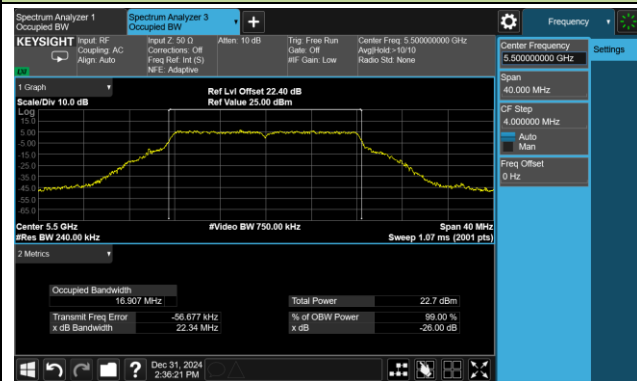
Channel 60 (5300MHz)



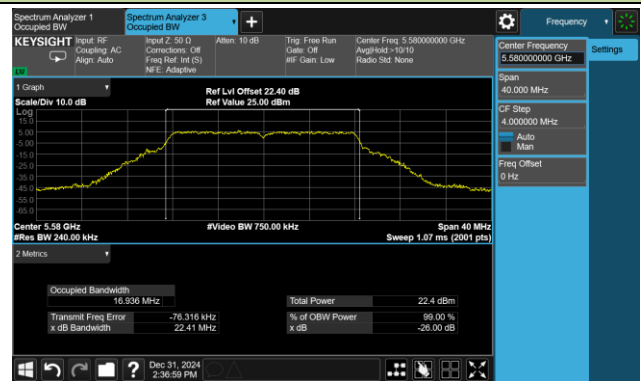
Channel 64 (5320MHz)



Channel 100 (5500MHz)

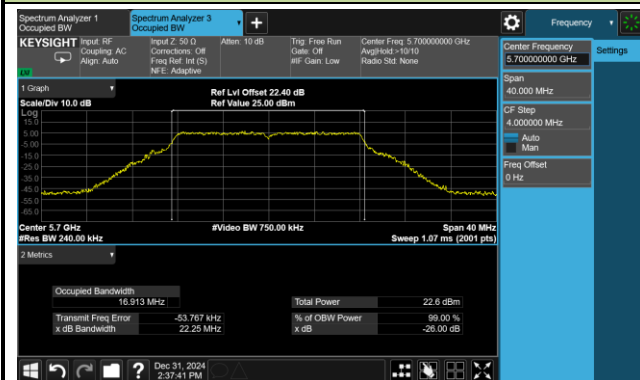


Channel 116 (5580MHz)

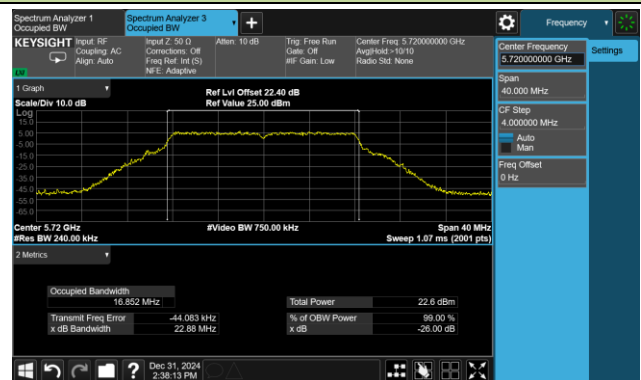


802.11a 26dB Bandwidth & 99% Bandwidth

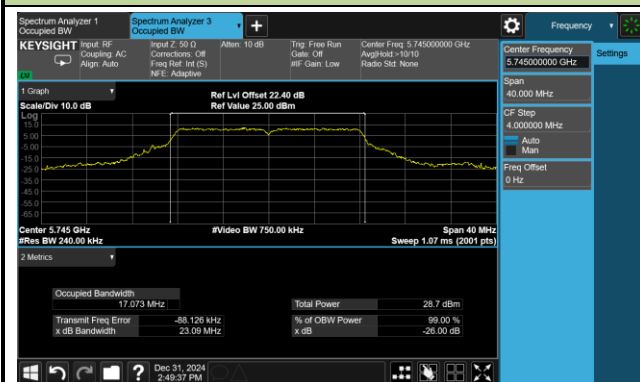
Channel 140 (5700MHz)



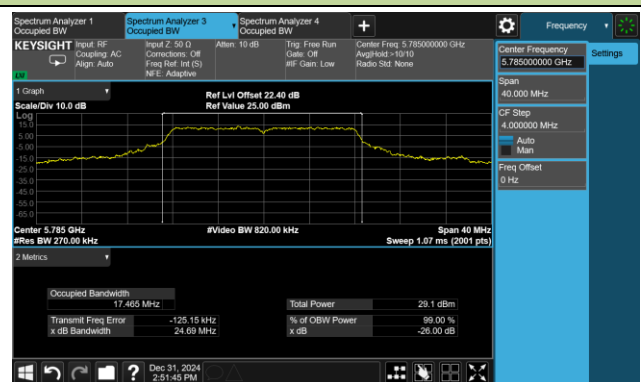
Channel 144(5720MHz)



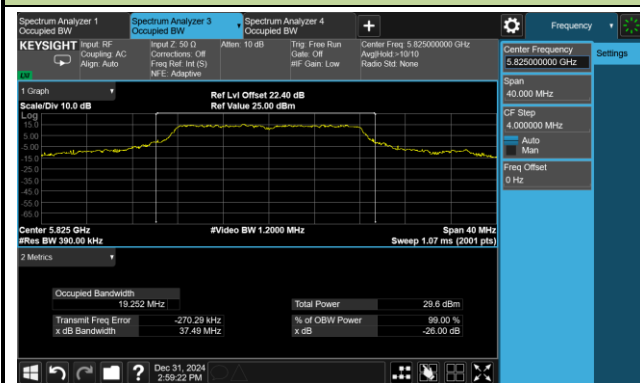
Channel 149 (5745MHz)



Channel 157 (5785MHz)

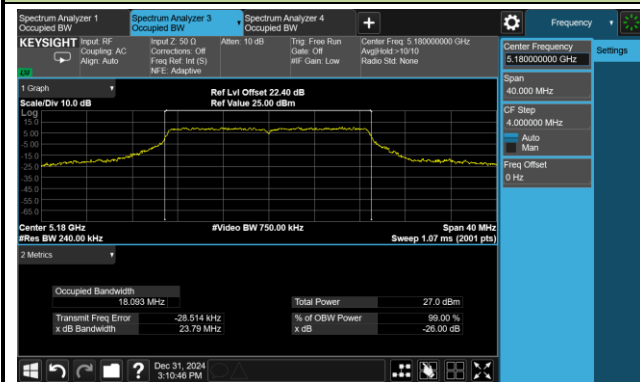


Channel 165 (5825MHz)

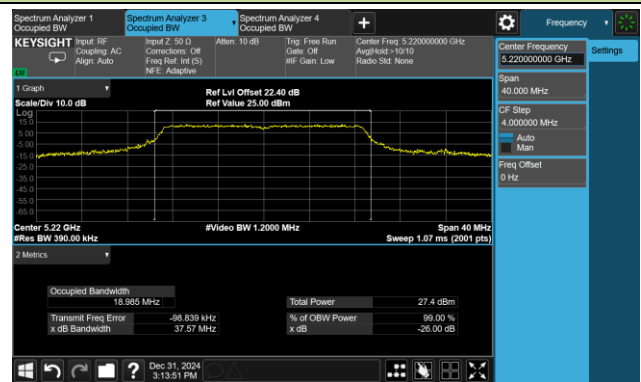


802.11ac-VHT20 26dB Bandwidth

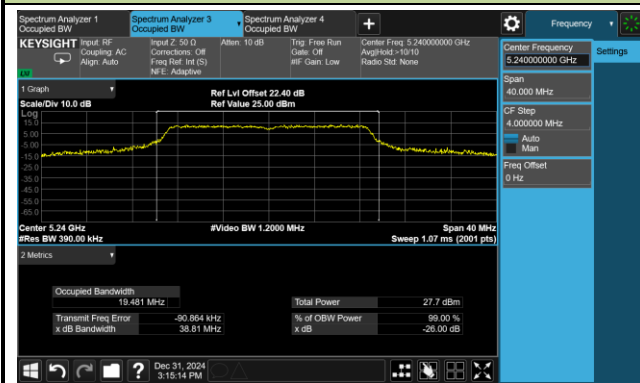
Channel 36 (5180MHz)



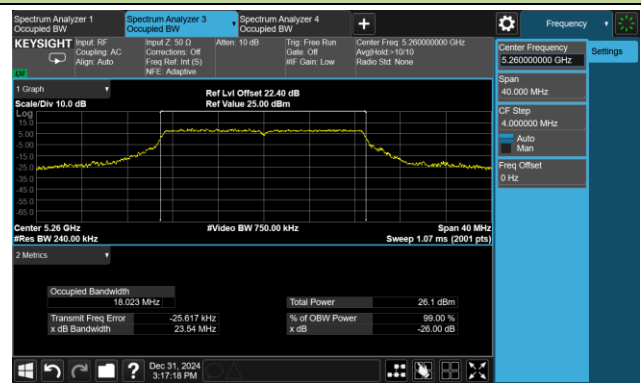
Channel 44 (5220MHz)



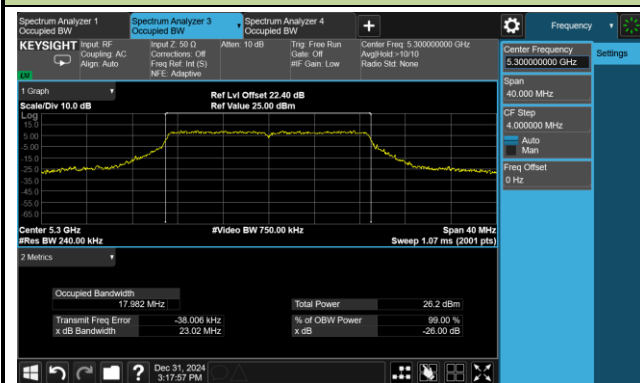
Channel 48 (5240MHz)



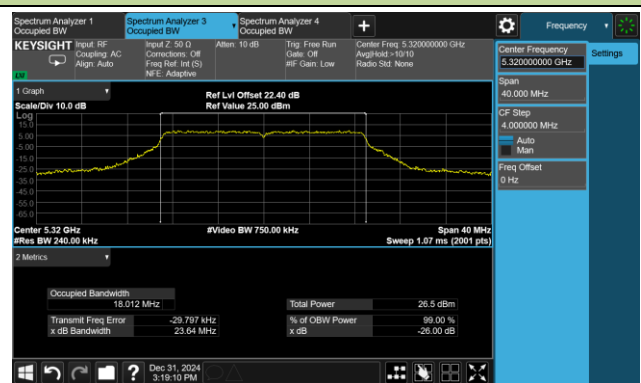
Channel 52 (5260MHz)



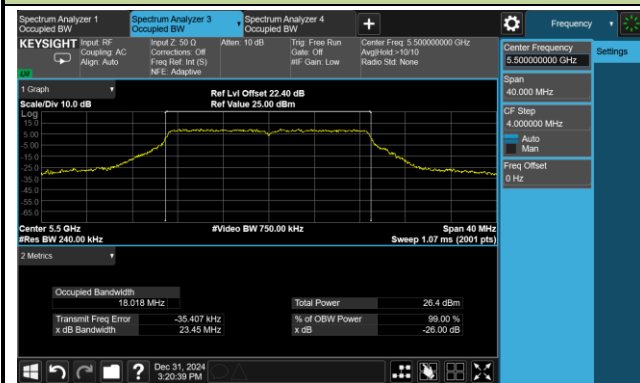
Channel 60 (5300MHz)



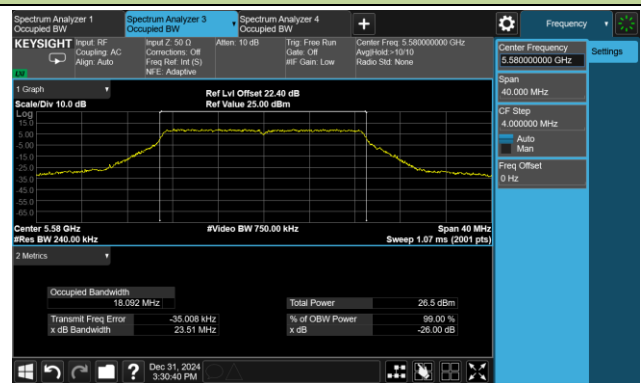
Channel 64 (5320MHz)



Channel 100 (5500MHz)

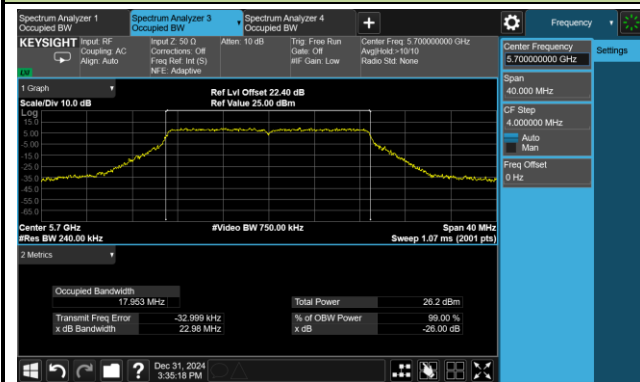


Channel 116 (5580MHz)

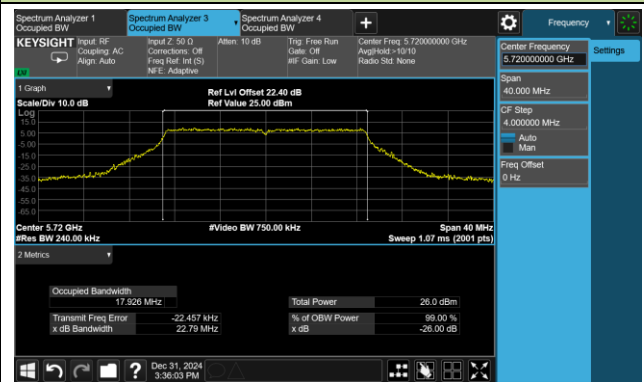


802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth

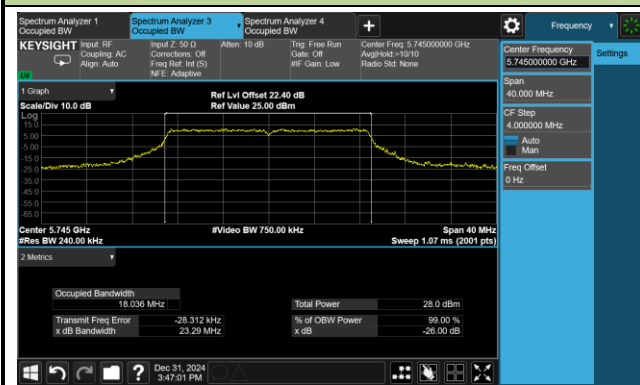
Channel 140 (5700MHz)



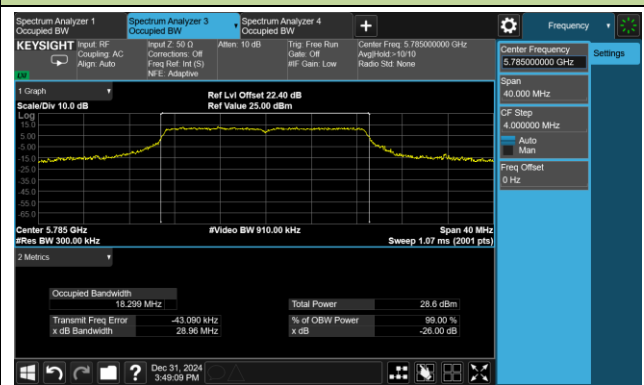
Channel 144(5720MHz)



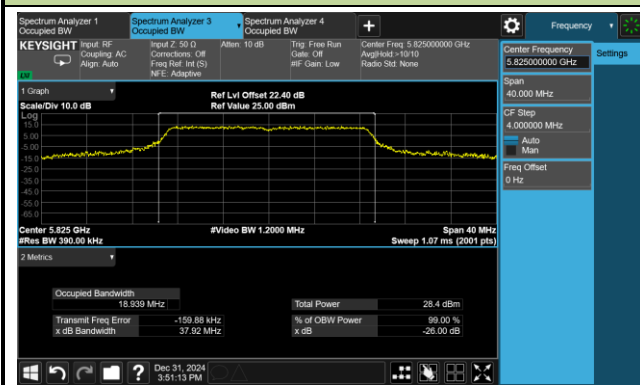
Channel 149 (5745MHz)



Channel 157 (5785MHz)

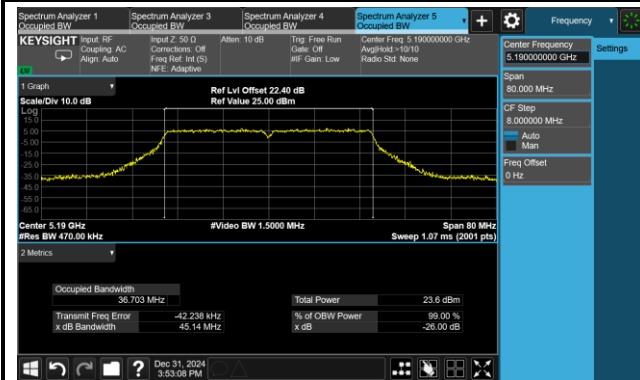


Channel 165 (5825MHz)

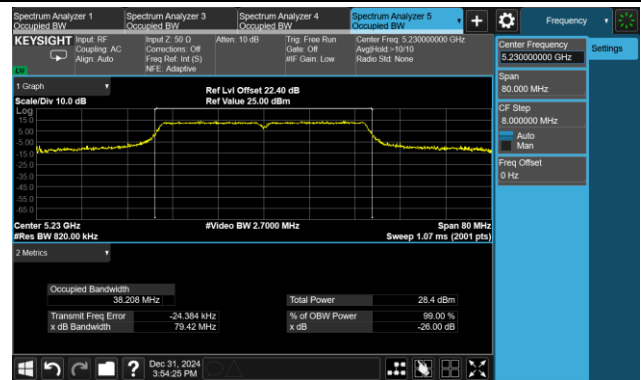


802.11ac-VHT40 26dB Bandwidth

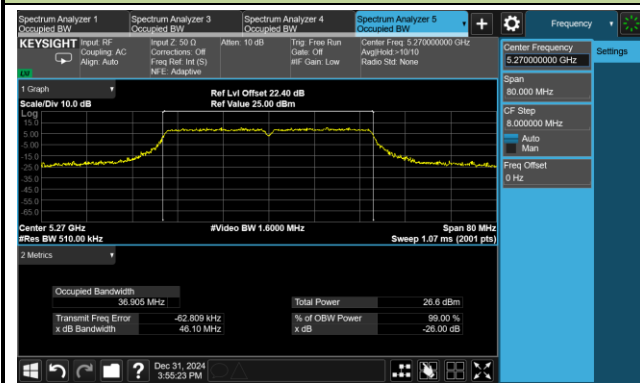
Channel 38 (5190MHz)



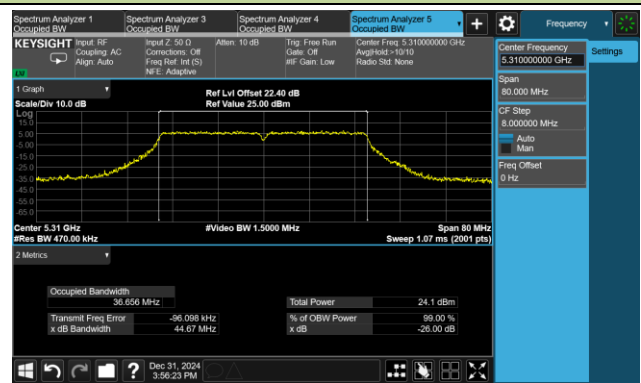
Channel 46 (5230MHz)



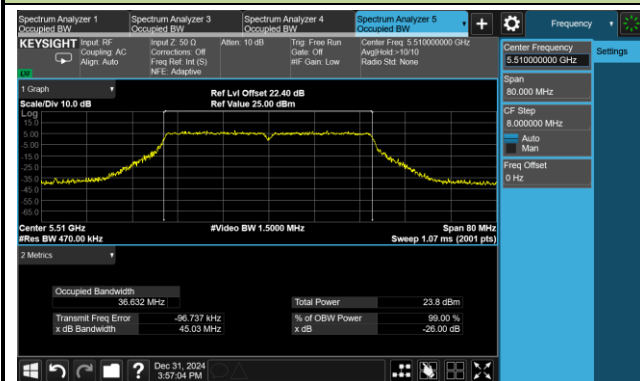
Channel 54 (5270MHz)



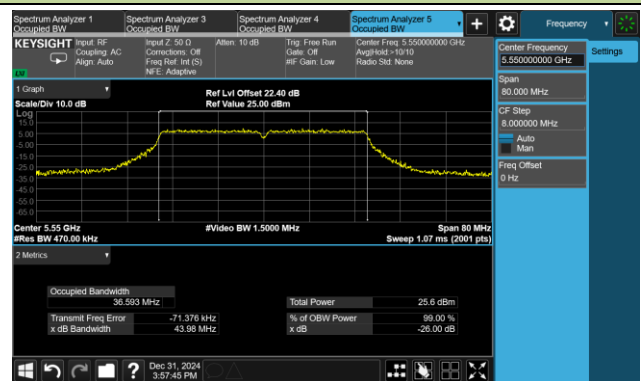
Channel 62 (5310MHz)



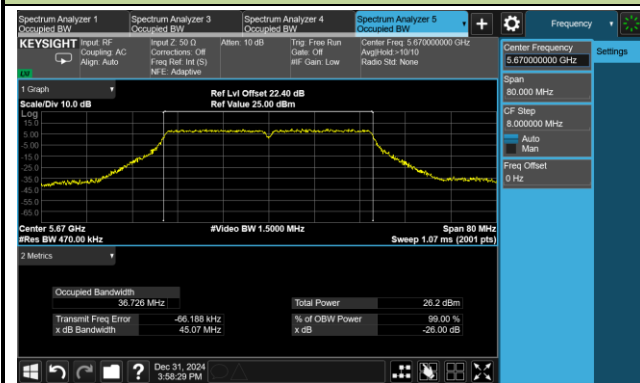
Channel 102 (5510MHz)



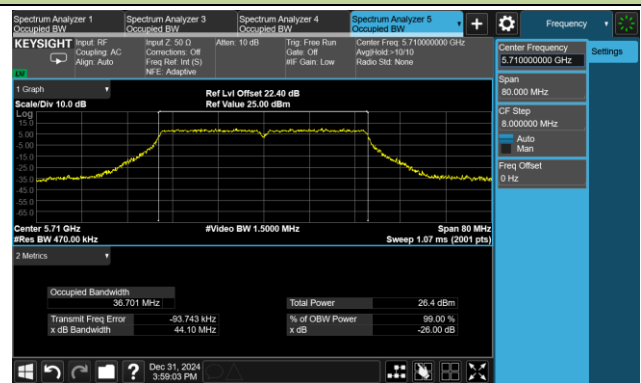
Channel 110 (5550MHz)

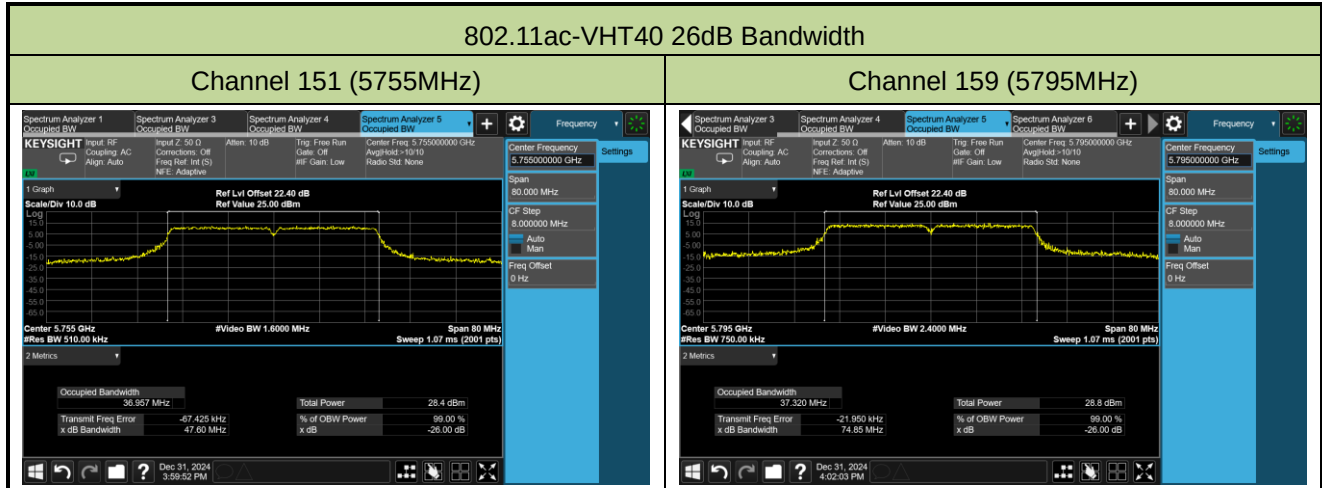


Channel 134 (5670MHz)



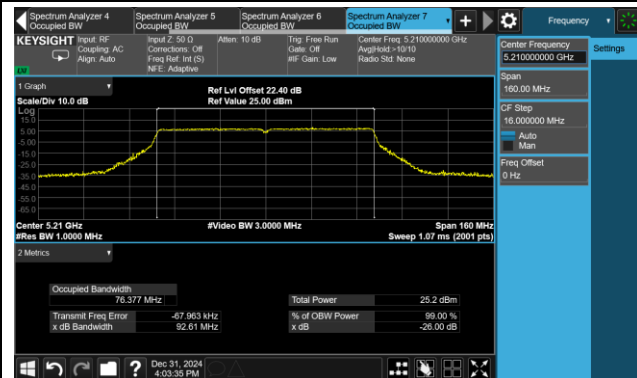
Channel 142(5710MHz)



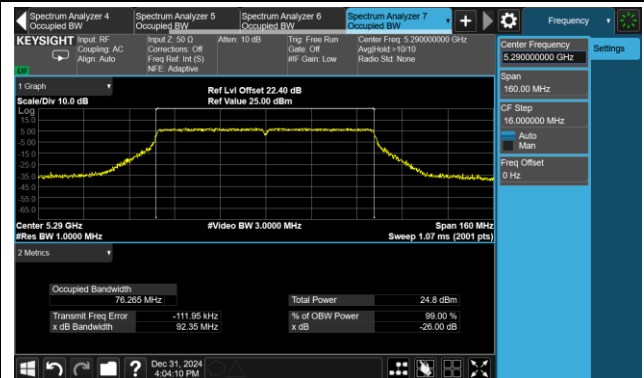


802.11ac-VHT80 26dB Bandwidth & 99% Bandwidth

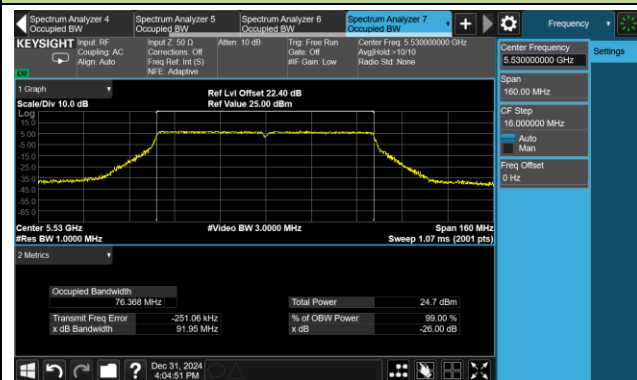
Channel 42 (5210MHz)



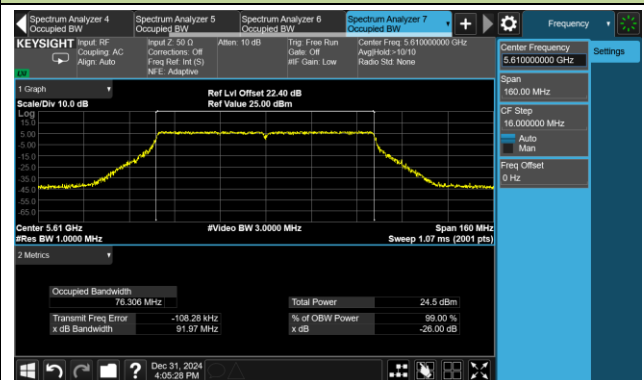
Channel 58 (5290MHz)



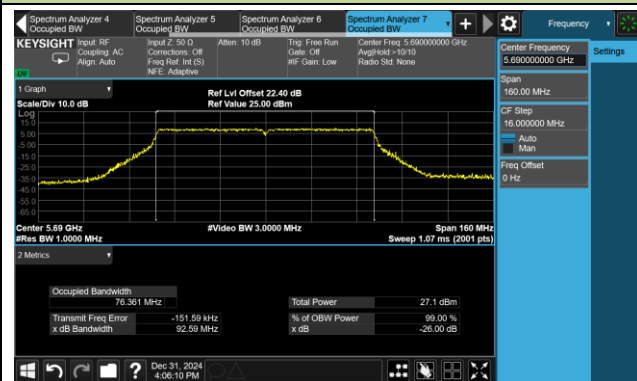
Channel 106 (5530MHz)



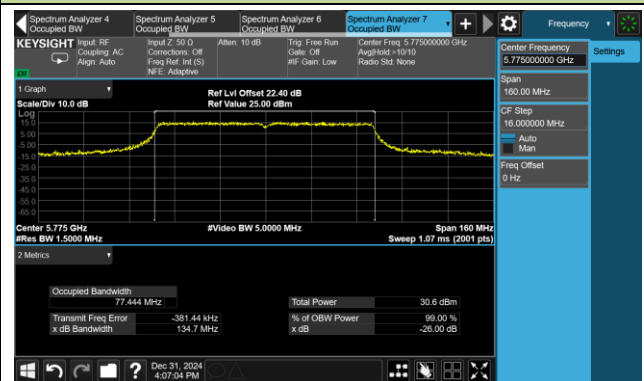
Channel 122 (5610MHz)



Channel 138 (5690MHz)

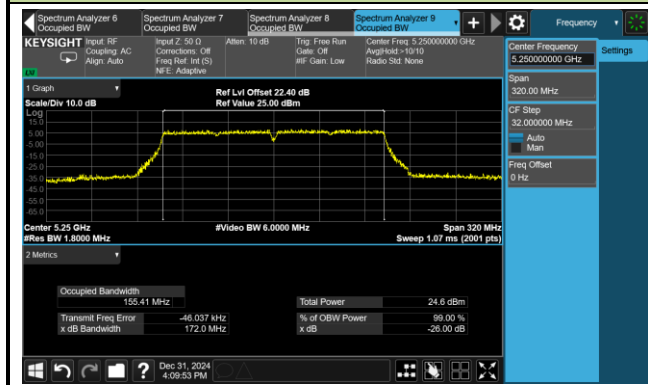


Channel 155 (5775MHz)

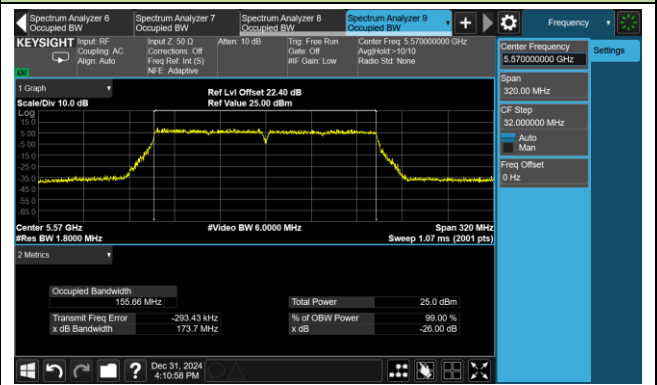


802.11ac-VHT160 26dB Bandwidth & 99% Bandwidth

Channel 50 (5250MHz)

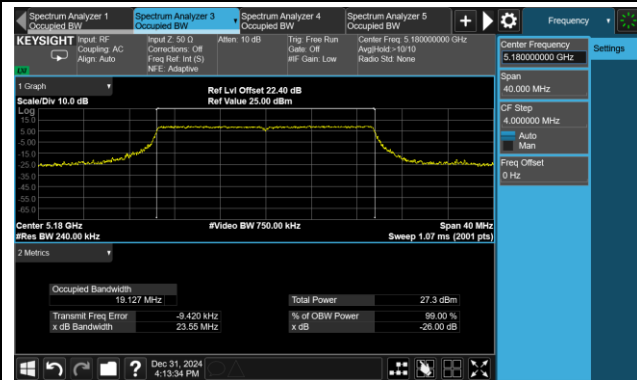


Channel 114 (5570MHz)

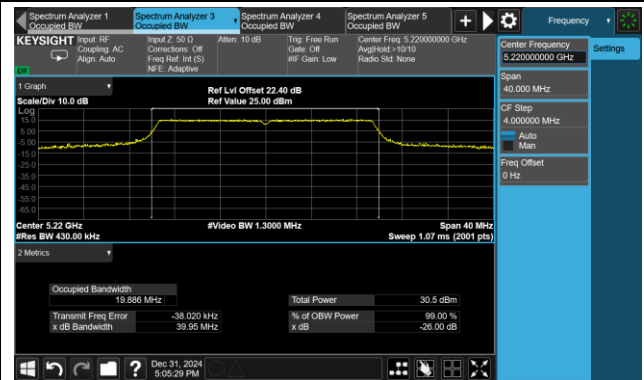


802.11ax-HE20 26dB Bandwidth

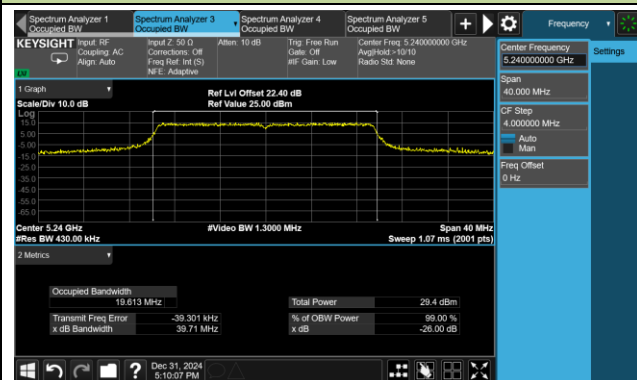
Channel 36 (5180MHz)



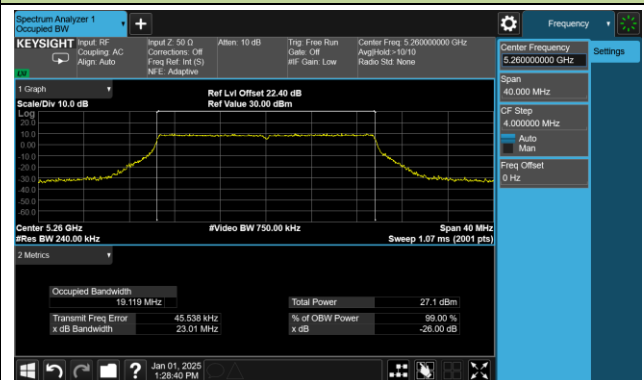
Channel 44 (5220MHz)



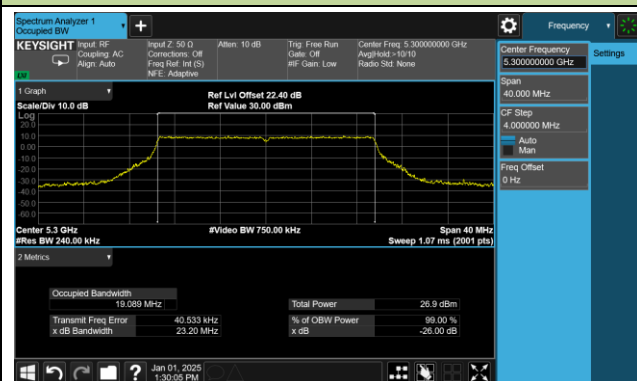
Channel 48 (5240MHz)



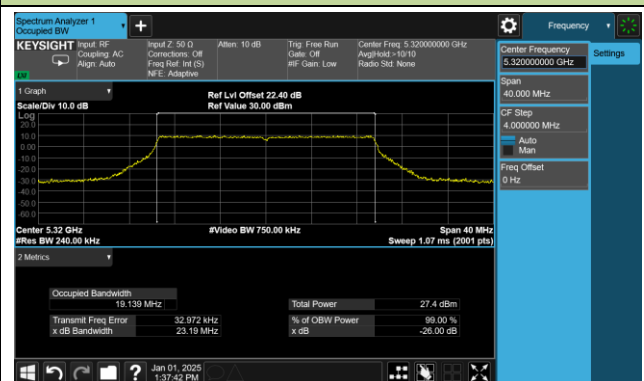
Channel 52 (5260MHz)



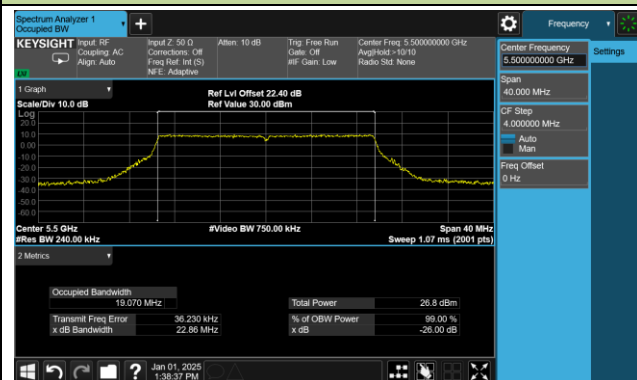
Channel 60 (5300MHz)



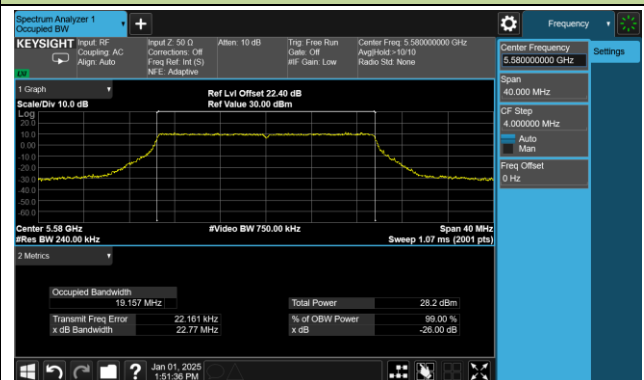
Channel 64 (5320MHz)



Channel 100 (5500MHz)

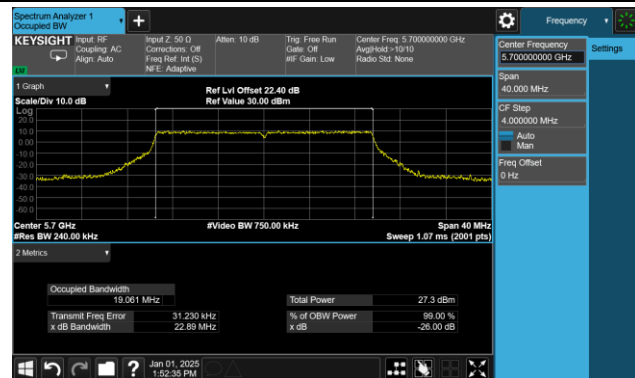


Channel 116 (5580MHz)

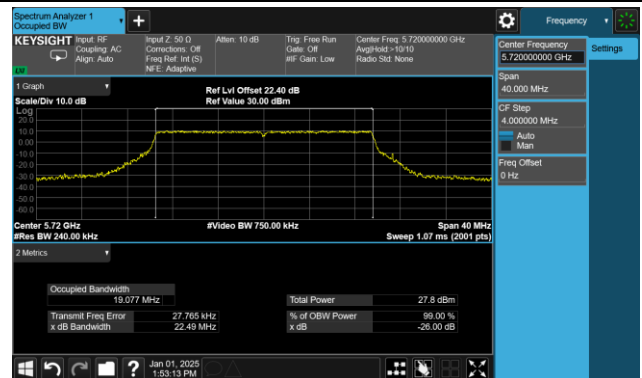


802.11ax-HE20 26dB Bandwidth

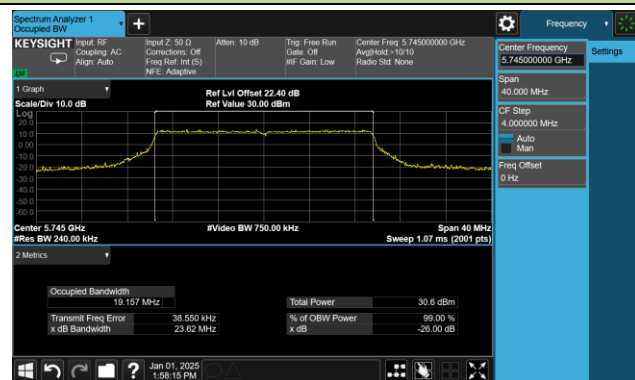
Channel 140 (5700MHz)



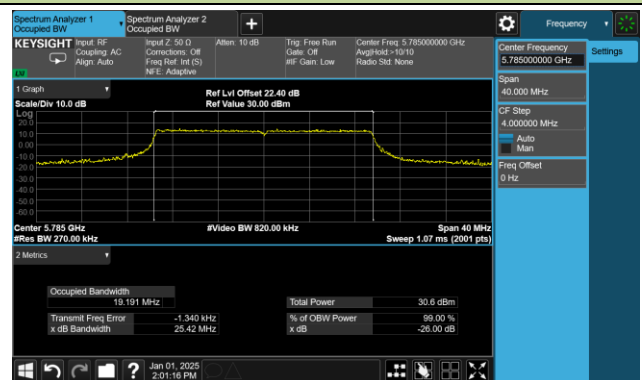
Channel 144(5720MHz)



Channel 149 (5745MHz)



Channel 157 (5785MHz)



Channel 165 (5825MHz)

