

RF MEASUREMENT REPORT

FCC ID: LNQ-WF710GF
Applicant: Actiontec Electronics Inc.
Product: Tri-band Wi-Fi 7 Mesh AP
Model No.: GEBE320C, WF-710GF
FCC Classification: Unlicensed National Information Infrastructure (NII)
FCC Rule Part(s): Part 15 Subpart E (Section 15.407)
Result: Complies
Received Date: 2024-03-04
Test Date: 2024-03-23 ~ 2024-04-22

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
2403RSU002-U3	V01	Initial Report	2024-04-25	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

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

1.4. Product Information

Product Name	Tri-band Wi-Fi 7 Mesh AP
Model No.	GEBE320C, WF-710GF
EUT Identification No.	20240304Sample#02
Wi-Fi Specification	802.11a/b/g/n/ac/ax/be
Bluetooth Specification	BLE only
Antenna Information	Refer to selection 1.7
Power Type	AC/DC Adapter
Operating Environment	Indoor Use
Accessory	
Adapter	Model: V30-V5000R120-060K0-US Input: 100-240V ~ 50/60Hz 1.5A max Output: 12.0V = 5.0A
Notes:	
<ol style="list-style-type: none"> There is not any hardware or software differences between GEBE320C and WF-710GF, only for different brand. 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	<input type="checkbox"/> Supported	<input checked="" type="checkbox"/> Unsupported
Support RU	<input checked="" type="checkbox"/> Full RU	<input type="checkbox"/> 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	Ant 2	Ant 3	Correlated	Uncorrelated
Wi-Fi Antenna								
PCB	2412 ~ 2462	2	3.64	3.81	--	--	4.96	2.06
	5180 ~ 5825	2	4.85	4.46	--	--	6.62	3.61
	5925 ~ 7125	4	4.38	4.48	3.51	3.65	5.59	-0.07
Bluetooth Antenna								
PCB	2402 ~ 2480	1	2.36				--	--
Remark: <ol style="list-style-type: none"> The antenna gain and directional gain refer to manufacturer's antenna specification. The device supports CDD Mode, STBC mode and SISO mode, details refer to the table as below. 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) = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}]$ 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 2.4G				
802.11b/g	2	X	√	X
802.11n/ax/be	2	X	X	√
Wi-Fi 5G				
802.11a	2	X	√	X
802.11n/ac/ax/be	2	X	X	√
Wi-Fi 6G				
802.11a	1 (Ant 0)	√	X	X
802.11a	4	X	√	X
802.11ax/be	4	X	X	√
Remark: "√" means "Support", "X" means "Not support".				

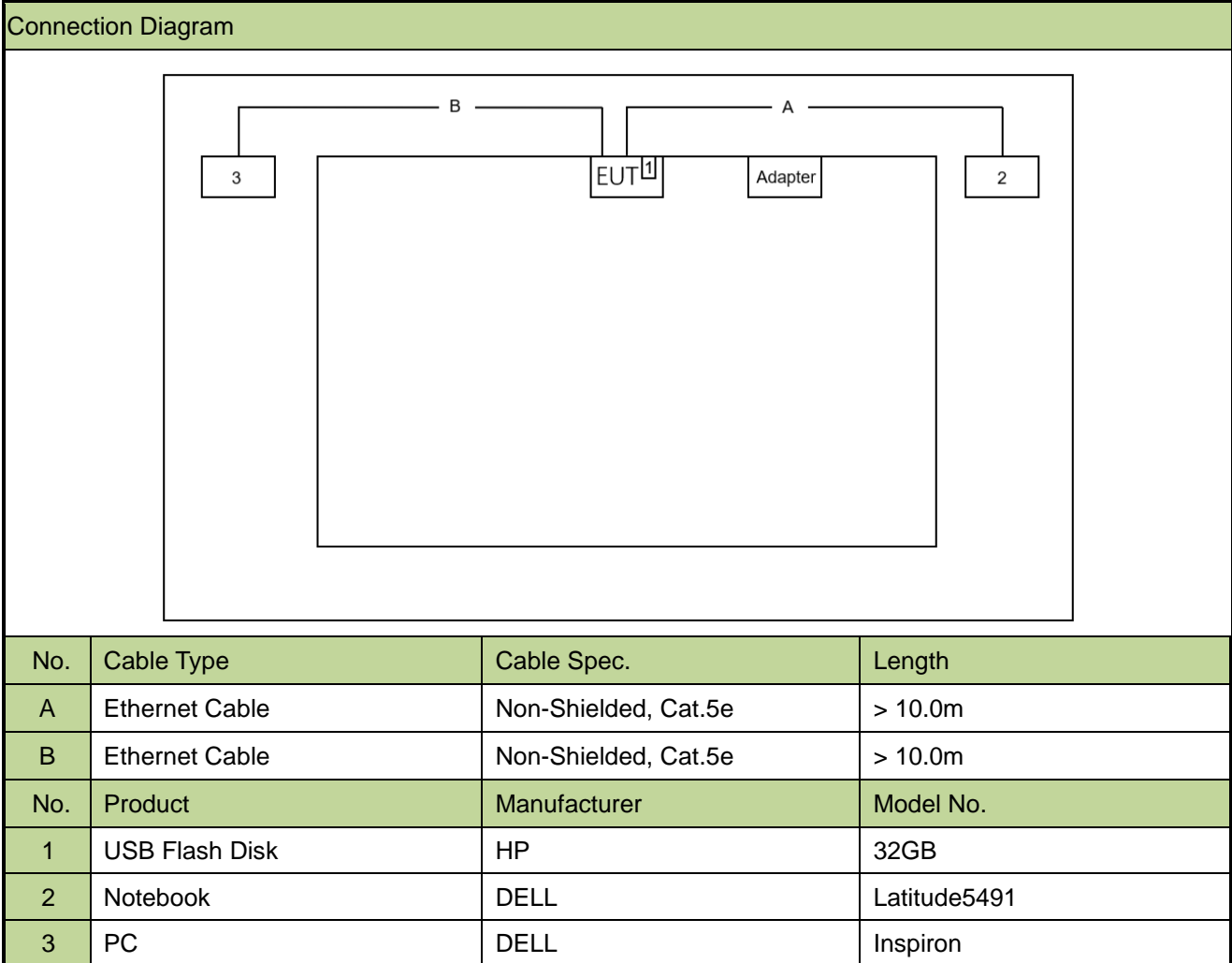
2. Test Configuration

2.1. Test Mode

CDD Mode
Mode 1: Transmit by 802.11a_Nss=1 (6Mbps)
STBC Mode
Mode 2: Transmit by 802.11ac-VHT20_Nss=2 (MCS0)
Mode 3: Transmit by 802.11ac-VHT40_Nss=2 (MCS0)
Mode 4: Transmit by 802.11ac-VHT80_Nss=2 (MCS0)
Mode 5: Transmit by 802.11ac-VHT160_Nss=2 (MCS0)
Mode 6: Transmit by 802.11ax-HE20_Nss=2 (MCS0)
Mode 7: Transmit by 802.11ax-HE40_Nss=2 (MCS0)
Mode 8: Transmit by 802.11ax-HE80_Nss=2 (MCS0)
Mode 9: Transmit by 802.11ax-HE160_Nss=2 (MCS0)
Mode 10: Transmit by 802.11be-EHT20_Nss=2 (MCS0)
Mode 11: Transmit by 802.11be-EHT40_Nss=2 (MCS0)
Mode 12: Transmit by 802.11be-EHT80_Nss=2 (MCS0)
Mode 13: Transmit by 802.11be-EHT160_Nss=2 (MCS0)
Notes:
<ol style="list-style-type: none"> 1. For Radiated emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power. 2. 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. 3. 802.11n and 802.11ac have same modulation type and same power value, so we only show 802.11ac test data in report. 4. 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.



2.3. Test Software

The test utility software used during testing was "QSPR", and the version was 5.0-00188.

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
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2024-12-17	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2024-08-09	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2024-10-11	WZ-AC1
Preamplifier	Agilent	83017A	MRTSUE06076	1 year	2024-11-09	WZ-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2024-06-09	WZ-AC1
Anechoic Chamber	TDK	WZ-AC1	MRTSUE06212	1 year	2024-04-20	WZ-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06607	1 year	2024-10-23	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11039	1 year	2024-10-25	WZ-AC1
Horn Antenna	ETS	3117	MRTSUE06257	1 year	2024-09-23	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2024-11-04	WZ-AC1
Preamplifier	EMCI	EMC184045SE	MRTSUE06640	1 year	2025-01-11	WZ-AC1
Preamplifier	EMCI	EMC051845SE	MRTSUE06987	1 year	2024-09-07	WZ-AC1
Active Loop Antenna	Schwarzbeck	FMZB 1519-60 D	MRTSUE07076	1 year	2024-12-04	WZ-AC1
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2024-05-23	WZ-SR2
Shielding Room	MIX-BEP	WZ-SR2	MRTSUE06215	5 years	2026-12-20	WZ-SR2
Thermohygrometer	testo	608-H1	MRTSUE06404	1 year	2024-05-31	WZ-SR2
Four-Line V-Network	R&S	ENV432	MRTSUE06615	1 year	2024-09-27	WZ-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06909	1 year	2024-09-27	WZ-SR2
USB Power Sensor	Keysight	U2021XA	MRTSUE06446	1 year	2024-05-23	WZ-SR5
Thermohygrometer	testo	608-H1	MRTSUE06402	1 year	2024-05-31	WZ-SR5
Shielding Room	HUAMING	WZ-SR5	MRTSUE06442	N/A	N/A	WZ-SR5
Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2024-05-23	WZ-SR5
Attenuator	MVE	MVE2213	MRTSUE11092	1 year	2024-06-08	WZ-SR5
Temperature Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2024-09-27	WZ-TR3
Thermohygrometer	testo	608-H1	MRTSUE11268	1 year	2024-12-14	WZ-TR3
Signal Analyzer	Keysight	N9010B	MRTSUE07027	1 year	2024-10-23	WZ-TR3

Software	Version	Function
EMI V3	V 3.0.0	EMI Test Software
Controller_MF 7802	2.03C	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: 3.58dB 150kHz~30MHz: 3.20dB
Radiated Emission Measurement
The maximum measurement uncertainty is evaluated as: Coaxial: 9kHz~30MHz: 2.61dB Coplanar: 9kHz~30MHz: 2.62dB Horizontal: 30MHz~200MHz: 3.79dB 200MHz~1GHz: 3.91dB 1GHz~40GHz: 4.99dB Vertical: 30MHz~200MHz: 4.06dB 200MHz~1GHz: 5.21dB 1GHz~40GHz: 4.90dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 2.2dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 1.4dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 2.2dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 2.7%

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 <small>Remark 3</small>
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 2403RSU002-U6.

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

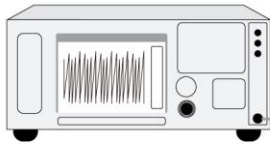
1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth
2. RBW = approximately 1% of the emission bandwidth.
3. VBW > RBW
4. Detector = Peak.
5. Trace mode = max hold.
6. Measure the maximum width of the emission that is 26 dB down from the maximum of the emission.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

Spectrum Analyzer



DC Block
&
Attenuator



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.

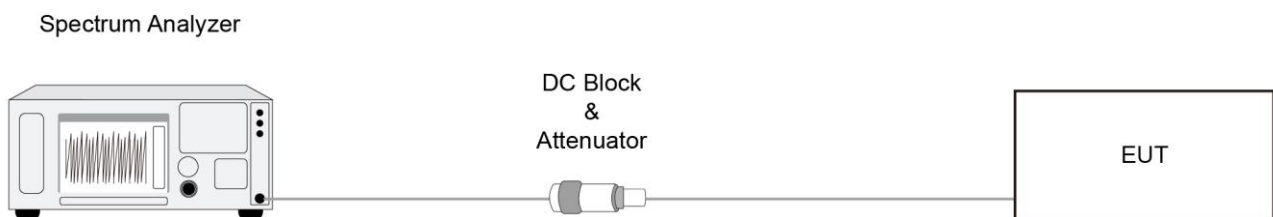
6.3.2. Test Procedure

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

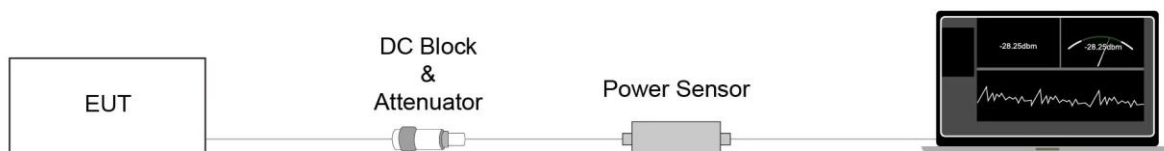
KDB 789033D02v02r01- Section II)E)3)b) Method PM-G

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.

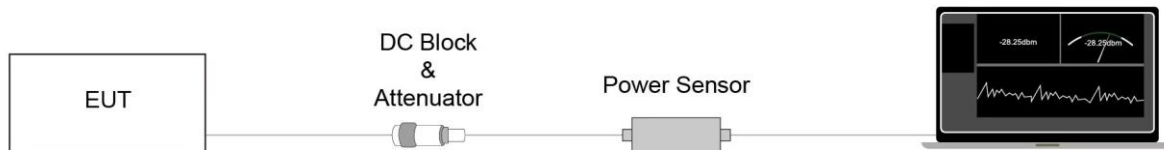
6.5.2. Test Procedure

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

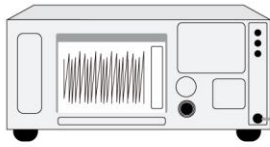
KDB 789033 D02v02r01-Section II)F)

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 × 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 $10 \cdot \log(1/0.25) = 6$ dB if the duty cycle is 25 percent.

6.6.4. Test Setup

Spectrum Analyzer



DC Block
&
Attenuator



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:

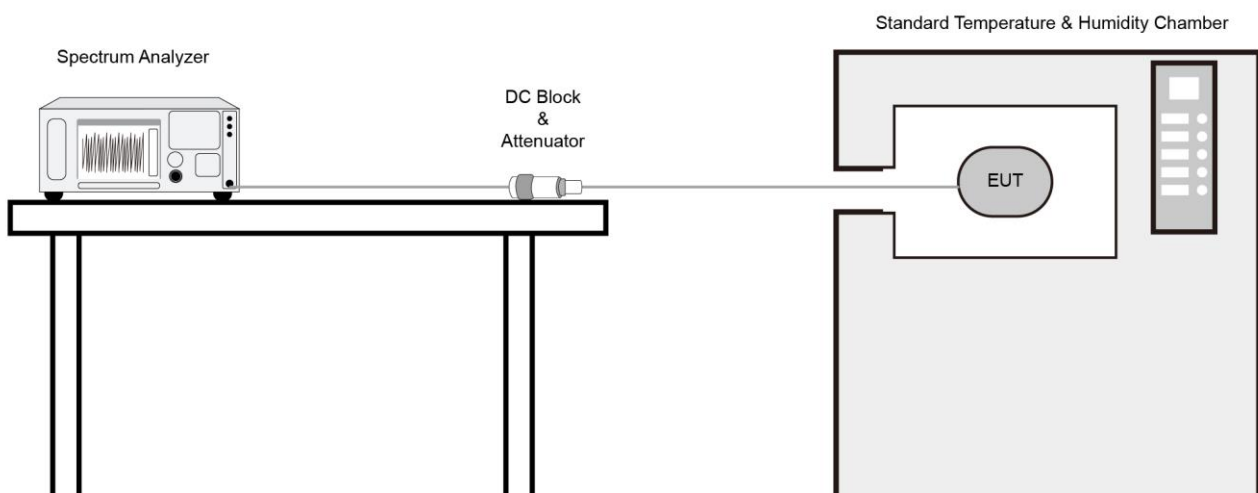
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain 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 [$\mu\text{V/m}$]	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

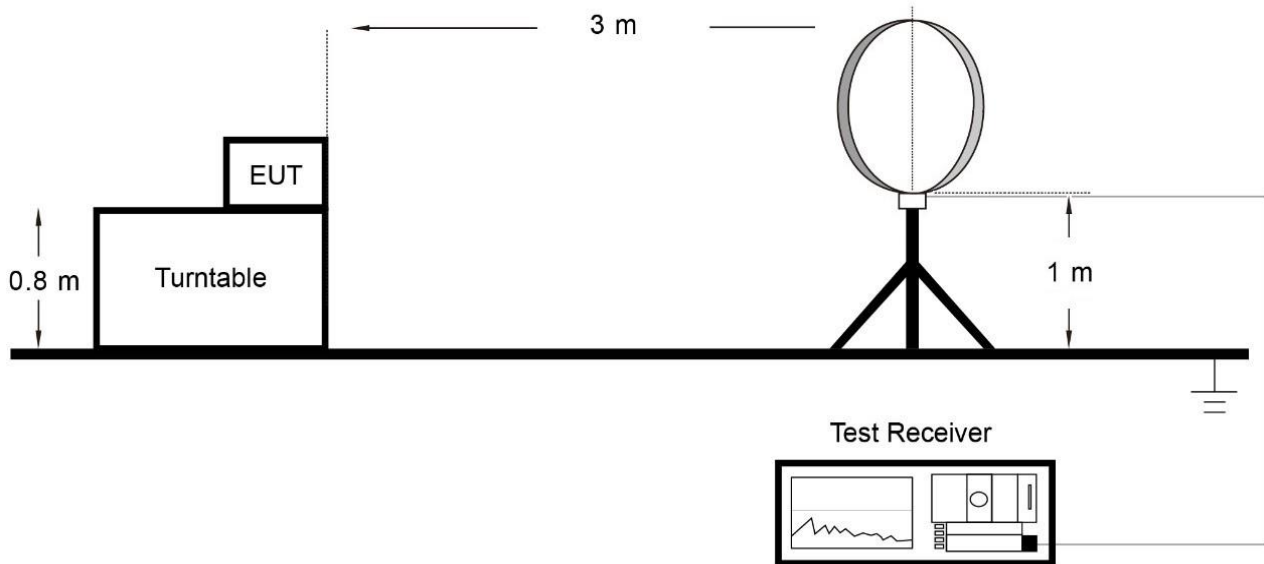
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

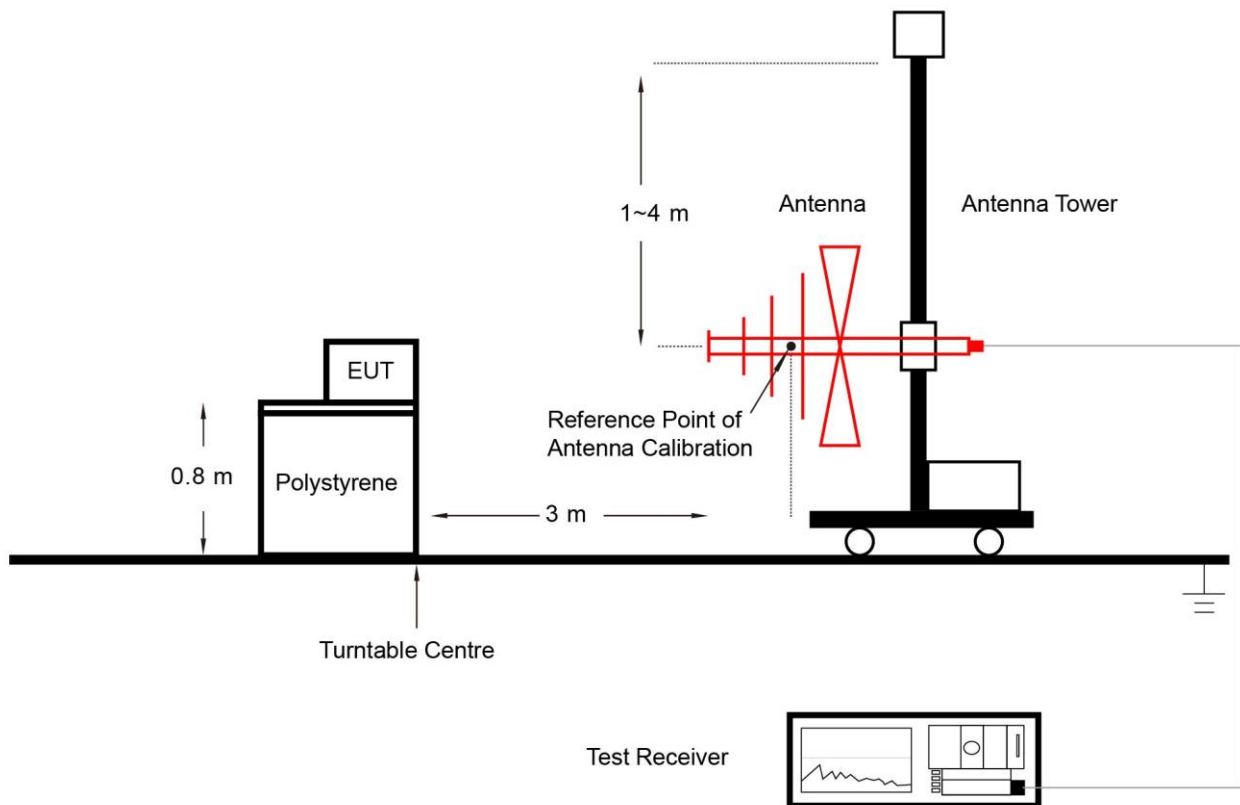
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; if the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW = 10Hz
If the EUT duty cycle is $< 98\%$, set VBW $\geq 1/T$. T is the minimum transmission duration.
4. 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

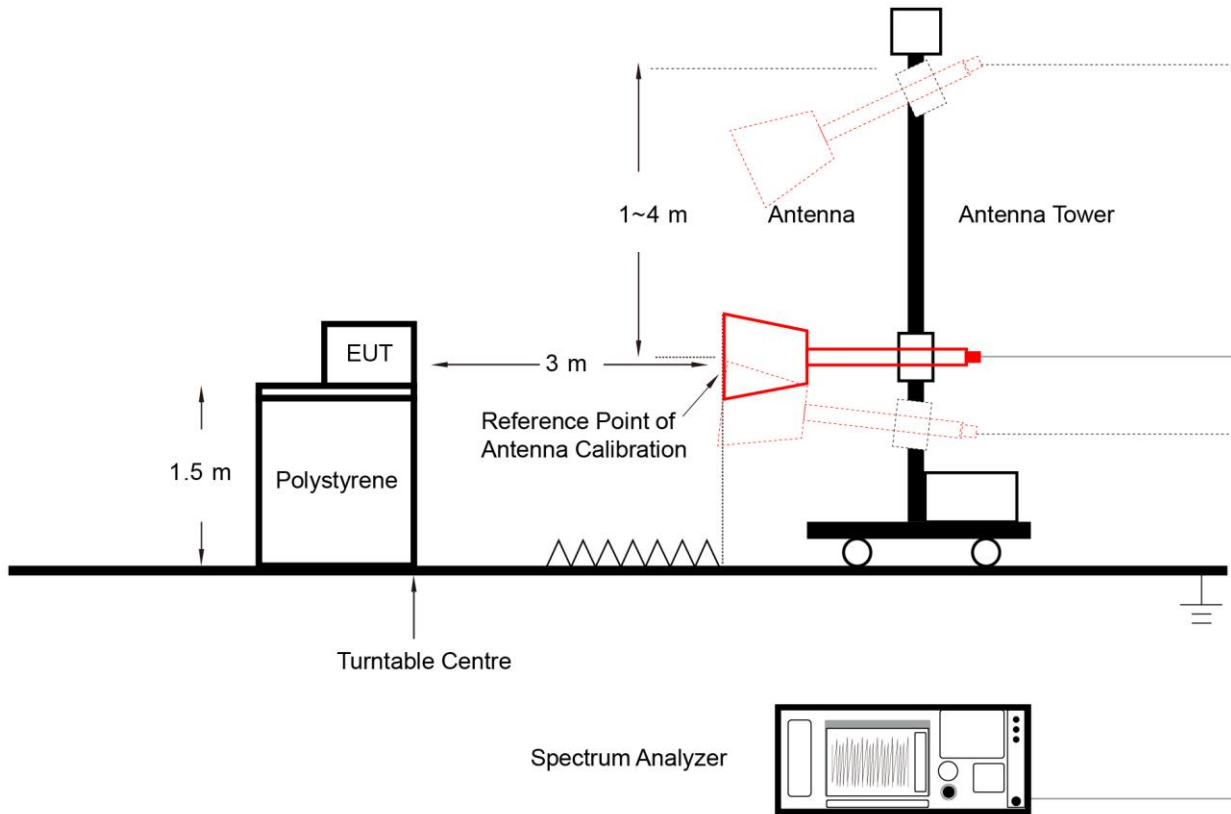
Below 30MHz Test Setup:



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

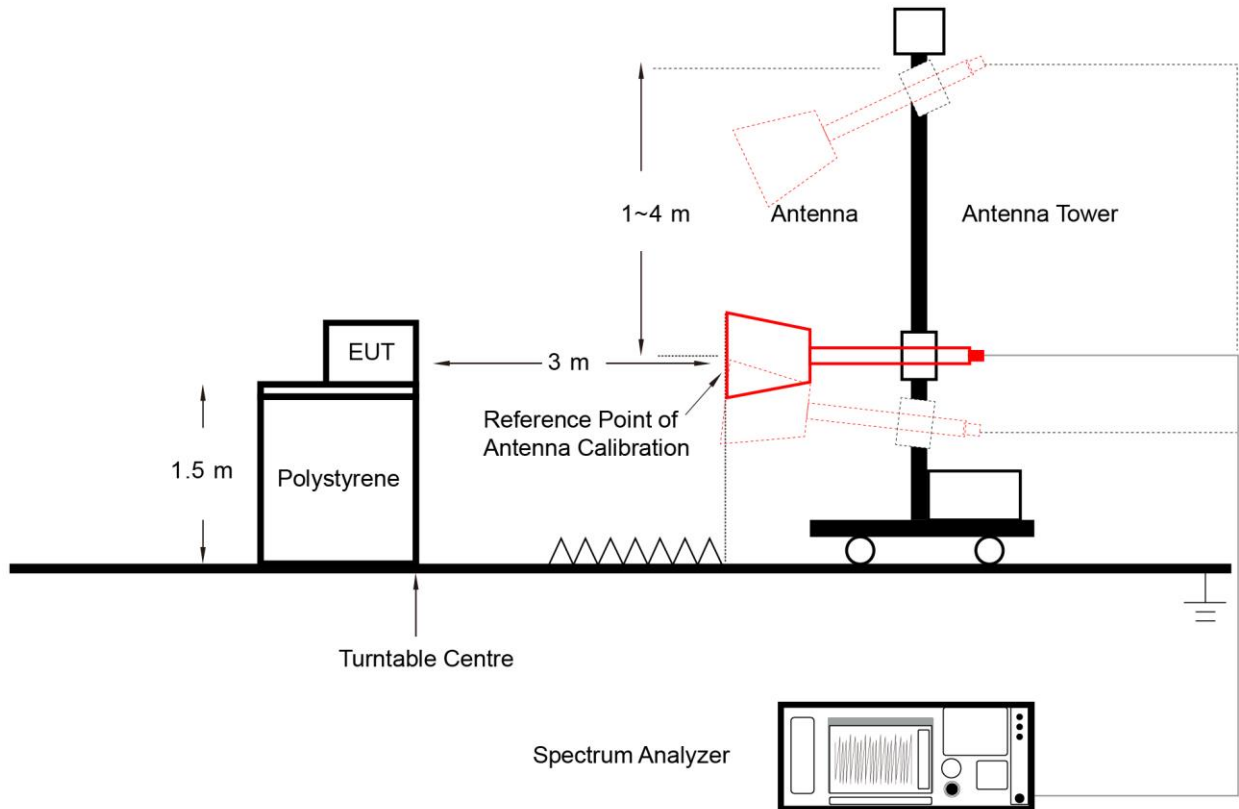
Peak Field Strength Measurements

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 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

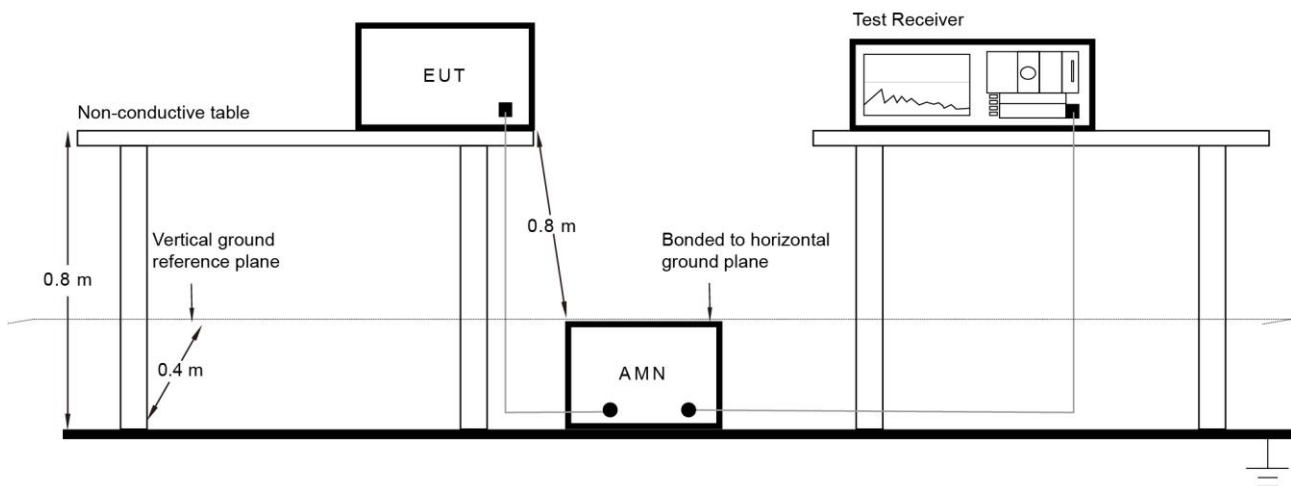
6.10.1. Test Limit

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

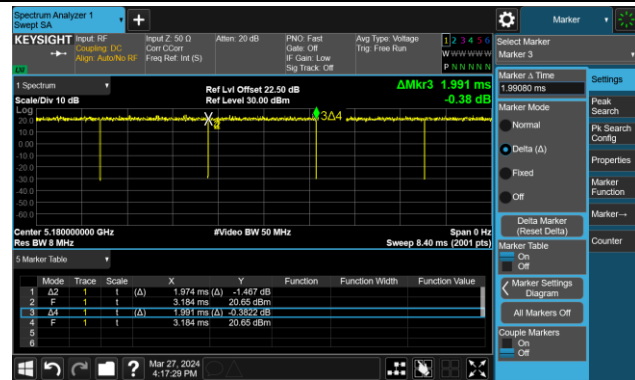
A.1 Duty Cycle Test Result

Test Site	WZ-SR5	Test Engineer	Luis Yang
Test Date	2024-03-27	Test Mode	CDD Mode

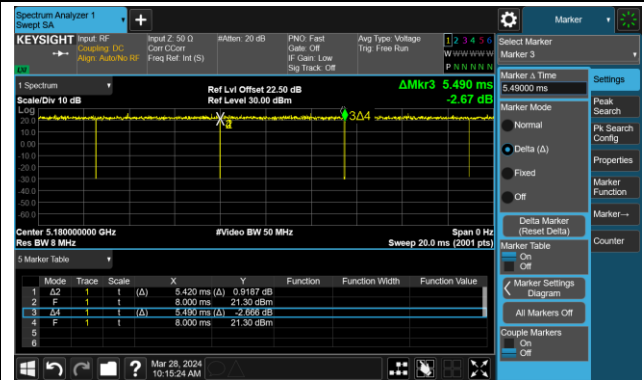
Test Mode	Duty Cycle
802.11a	99.15%
802.11ac-VHT20	98.72%
802.11ac-VHT40	99.63%
802.11ac-VHT80	99.63%
802.11ac-VHT160	99.63%
802.11ax-HE20	99.63%
802.11ax-HE40	99.62%
802.11ax-HE80	99.63%
802.11ax-HE160	99.63%
802.11be-EHT20	99.63%
802.11be-EHT40	99.63%
802.11be-EHT80	99.63%
802.11be-EHT160	99.63%

Duty Cycle (T = Transmission Duration)

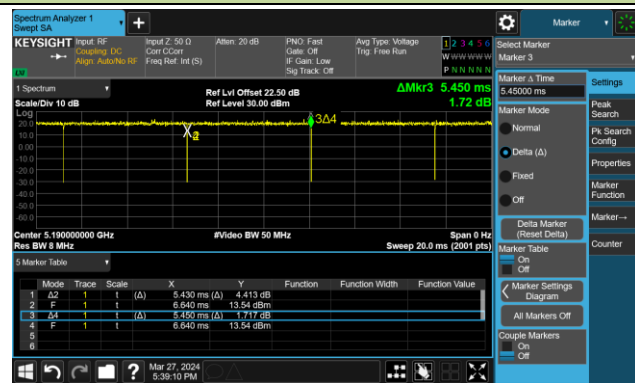
802.11a (T = 1.974ms)



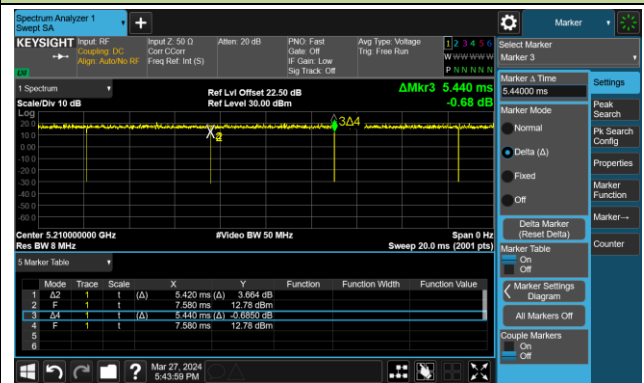
802.11ac-VHT20 (T = 5.420ms)



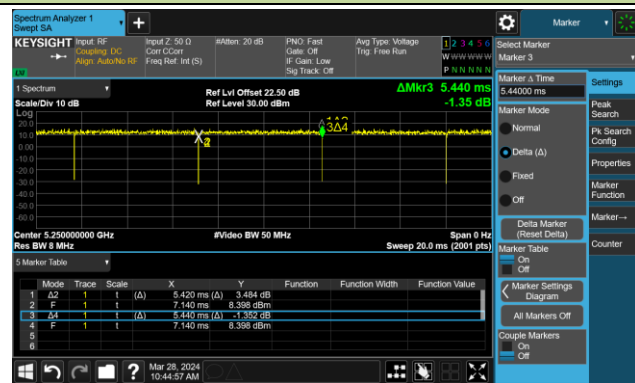
802.11ac-VHT40 (T = 5.430ms)



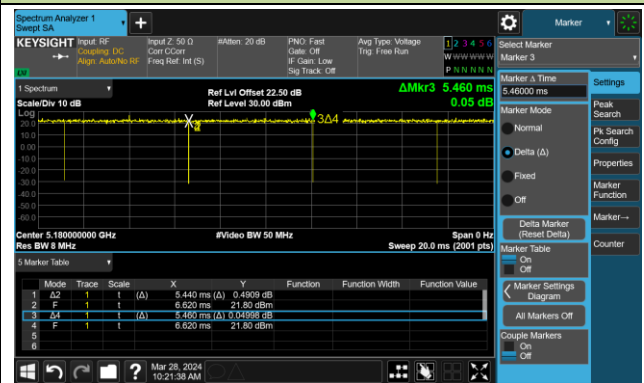
802.11ac-VHT80 (T = 5.420ms)



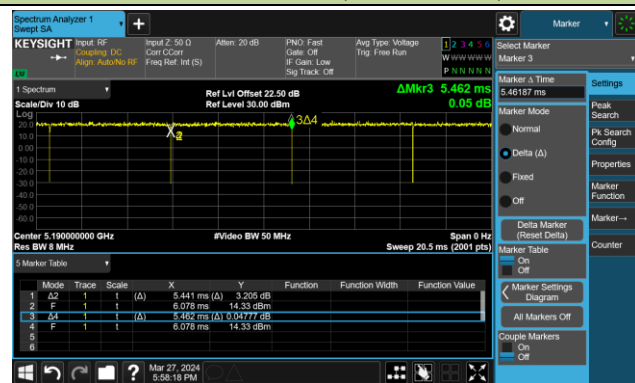
802.11ac-VHT160 (T = 5.420ms)



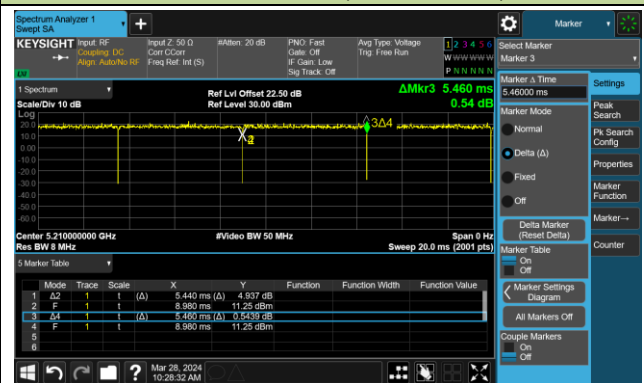
802.11ax-HE20 (T = 5.440ms)



802.11ax-HE40 (T = 5.441ms)

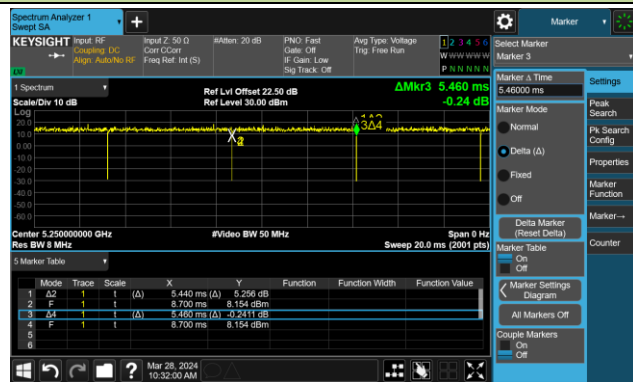


802.11ax-HE80 (T = 5.440ms)

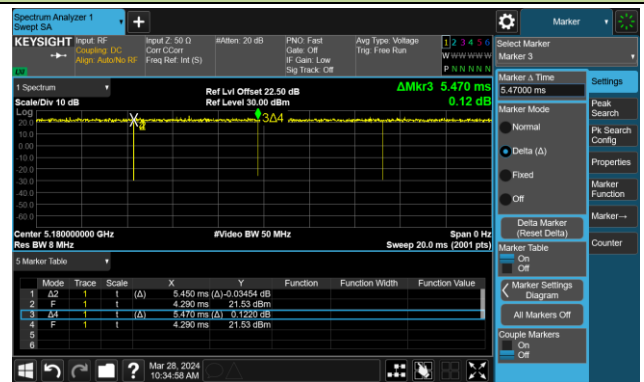


Duty Cycle (T = Transmission Duration)

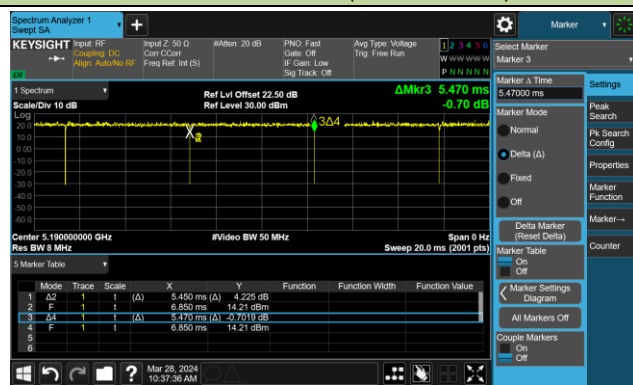
802.11ax-HE160 (T = 5.440ms)



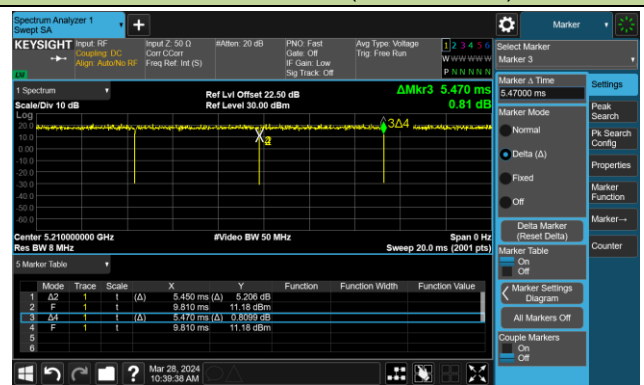
802.11be-EHT20 (T = 5.450ms)



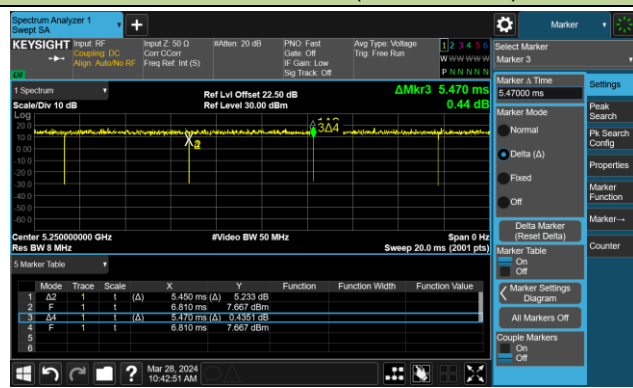
802.11be-EHT40 (T = 5.450ms)



802.11be-EHT80 (T = 5.450ms)



802.11be-EHT160 (T = 5.450ms)



A.2 26dB Bandwidth Test Result

Test Site	WZ-SR5	Test Engineer	Luis Yang
Test Date	2024-04-02 ~ 2024-04-03		

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	6Mbps	36	5180	22.81	16.976
11a	6Mbps	44	5220	22.87	16.952
11a	6Mbps	48	5240	22.62	16.965
11a	6Mbps	52	5260	22.47	16.909
11a	6Mbps	60	5300	22.88	16.948
11a	6Mbps	64	5320	22.71	16.906
11a	6Mbps	100	5500	22.53	16.964
11a	6Mbps	116	5580	22.58	16.949
11a	6Mbps	140	5700	22.48	16.860
11a	6Mbps	144	5720	22.34	16.999
11a	6Mbps	149	5745	22.34	16.907
11a	6Mbps	157	5785	22.49	16.862
11a	6Mbps	165	5825	22.27	16.994
11ac-VHT20	MCS0	36	5180	23.58	17.991
11ac-VHT20	MCS0	44	5220	22.80	18.026
11ac-VHT20	MCS0	48	5240	23.56	17.984
11ac-VHT20	MCS0	52	5260	22.96	17.958
11ac-VHT20	MCS0	60	5300	22.84	17.984
11ac-VHT20	MCS0	64	5320	22.48	17.938
11ac-VHT20	MCS0	100	5500	22.51	17.934
11ac-VHT20	MCS0	116	5580	22.68	17.921
11ac-VHT20	MCS0	140	5700	22.63	17.989
11ac-VHT20	MCS0	144	5720	22.77	17.967
11ac-VHT20	MCS0	149	5745	22.68	17.933
11ac-VHT20	MCS0	157	5785	23.55	17.950
11ac-VHT20	MCS0	165	5825	23.43	17.983

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
11ac-VHT40	MCS0	38	5190	45.03	36.566
11ac-VHT40	MCS0	46	5230	44.94	36.507
11ac-VHT40	MCS0	54	5270	44.49	36.563
11ac-VHT40	MCS0	62	5310	44.63	36.473
11ac-VHT40	MCS0	102	5510	44.94	36.670
11ac-VHT40	MCS0	110	5550	44.29	36.563
11ac-VHT40	MCS0	134	5670	44.66	36.496
11ac-VHT40	MCS0	142	5710	44.44	36.563
11ac-VHT40	MCS0	151	5755	43.99	36.460
11ac-VHT40	MCS0	159	5795	44.36	36.463
11ac-VHT80	MCS0	42	5210	89.07	76.064
11ac-VHT80	MCS0	58	5290	90.74	76.159
11ac-VHT80	MCS0	106	5530	90.13	76.093
11ac-VHT80	MCS0	122	5610	89.65	76.045
11ac-VHT80	MCS0	138	5690	89.97	76.111
11ac-VHT80	MCS0	155	5775	88.01	76.076
11ac-VHT160	MCS0	50	5250	176.1	155.45
11ac-VHT160	MCS0	114	5570	173.5	155.84
11ax-HE20	MCS0	36	5180	23.03	19.084
11ax-HE20	MCS0	44	5220	23.09	19.111
11ax-HE20	MCS0	48	5240	22.23	19.049
11ax-HE20	MCS0	52	5260	22.67	19.056
11ax-HE20	MCS0	60	5300	22.47	19.063
11ax-HE20	MCS0	64	5320	22.70	19.061
11ax-HE20	MCS0	100	5500	22.25	19.071
11ax-HE20	MCS0	116	5580	22.43	19.061
11ax-HE20	MCS0	140	5700	22.21	19.029
11ax-HE20	MCS0	144	5720	22.79	19.035
11ax-HE20	MCS0	149	5745	22.80	19.090
11ax-HE20	MCS0	157	5785	22.67	19.089
11ax-HE20	MCS0	165	5825	22.94	19.083

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
11ax-HE40	MCS0	38	5190	44.29	38.007
11ax-HE40	MCS0	46	5230	43.39	37.986
11ax-HE40	MCS0	54	5270	43.77	37.925
11ax-HE40	MCS0	62	5310	43.61	37.943
11ax-HE40	MCS0	102	5510	43.38	37.979
11ax-HE40	MCS0	110	5550	43.98	38.010
11ax-HE40	MCS0	134	5670	43.39	37.964
11ax-HE40	MCS0	142	5710	43.02	38.005
11ax-HE40	MCS0	151	5755	43.20	38.004
11ax-HE40	MCS0	159	5795	43.52	37.948
11ax-HE80	MCS0	42	5210	86.30	77.667
11ax-HE80	MCS0	58	5290	85.77	77.689
11ax-HE80	MCS0	106	5530	86.55	77.612
11ax-HE80	MCS0	122	5610	86.78	77.620
11ax-HE80	MCS0	138	5690	85.71	77.605
11ax-HE80	MCS0	155	5775	86.37	77.560
11ax-HE160	MCS0	50	5250	172.6	156.93
11ax-HE160	MCS0	114	5570	173.4	156.90
11be-EHT20	MCS0	36	5180	23.29	19.087
11be-EHT20	MCS0	44	5220	22.60	19.046
11be-EHT20	MCS0	48	5240	22.95	19.084
11be-EHT20	MCS0	52	5260	22.92	19.123
11be-EHT20	MCS0	60	5300	22.95	19.124
11be-EHT20	MCS0	64	5320	22.94	19.068
11be-EHT20	MCS0	100	5500	23.00	19.109
11be-EHT20	MCS0	116	5580	23.48	19.092
11be-EHT20	MCS0	140	5700	22.29	19.075
11be-EHT20	MCS0	144	5720	23.27	19.099
11be-EHT20	MCS0	149	5745	23.19	19.132
11be-EHT20	MCS0	157	5785	23.12	19.066
11be-EHT20	MCS0	165	5825	23.21	19.071

Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
11be-EHT40	MCS0	38	5190	43.98	38.026
11be-EHT40	MCS0	46	5230	42.86	38.029
11be-EHT40	MCS0	54	5270	43.31	37.954
11be-EHT40	MCS0	62	5310	43.65	37.970
11be-EHT40	MCS0	102	5510	42.66	37.977
11be-EHT40	MCS0	110	5550	43.40	38.015
11be-EHT40	MCS0	134	5670	43.14	37.987
11be-EHT40	MCS0	142	5710	44.15	37.982
11be-EHT40	MCS0	151	5755	43.48	38.000
11be-EHT40	MCS0	159	5795	43.54	37.971
11be-EHT80	MCS0	42	5210	87.65	77.670
11be-EHT80	MCS0	58	5290	87.15	77.635
11be-EHT80	MCS0	106	5530	87.70	77.597
11be-EHT80	MCS0	122	5610	87.43	77.515
11be-EHT80	MCS0	138	5690	86.90	77.639
11be-EHT80	MCS0	155	5775	87.22	77.616
11be-EHT160	MCS0	50	5250	172.4	156.66
11be-EHT160	MCS0	114	5570	173.2	156.87

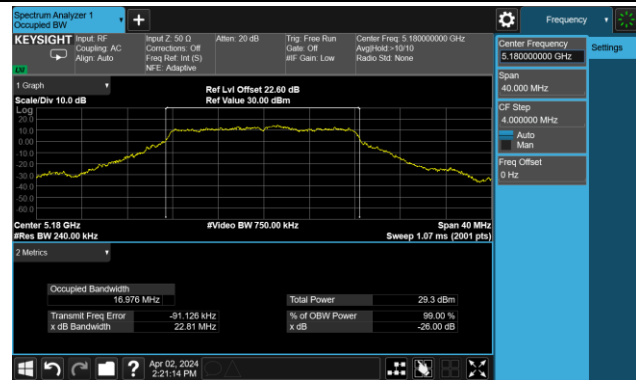
Test Mode	Data Rate/ MCS	Channel No.	Frequency (MHz)	F _H (MHz)	Limit (MHz)
802.11a	6Mbps	48	5240	5248.48	< 5250
802.11ac-VHT20	MCS0	48	5240	5248.99	< 5250
802.11ac-VHT40	MCS0	46	5230	5248.25	< 5250
802.11ac-VHT80	MCS0	42	5210	5248.03	< 5250
802.11ax-HE20	MCS0	48	5240	5249.52	< 5250
802.11ax-HE40	MCS0	46	5230	5248.99	< 5250
802.11ax-HE80	MCS0	42	5210	5248.83	< 5250
802.11be-EHT20	MCS0	48	5240	5249.54	< 5250
802.11be-EHT40	MCS0	46	5230	5249.01	< 5250
802.11be-EHT80	MCS0	42	5210	5248.84	< 5250

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

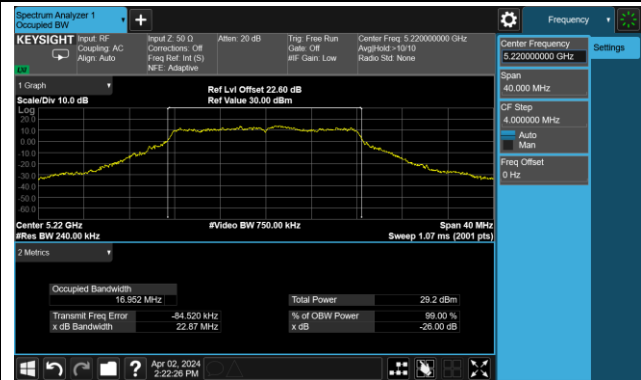
For example, 802.11ac-VHT20 5240MHz, $F_H = 5240 \text{ MHz} + 17.984 \text{ MHz} / 2 = 5248.99 \text{ MHz}$.

802.11a 26dB Bandwidth & 99% Bandwidth

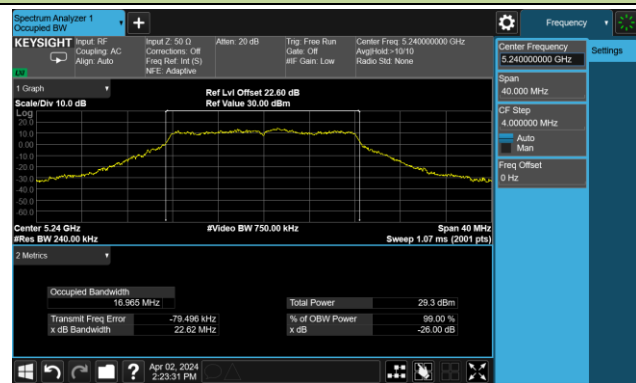
Channel 36 (5180MHz)



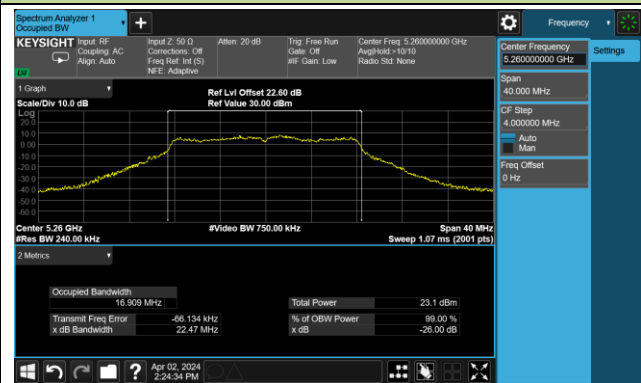
Channel 44 (5220MHz)



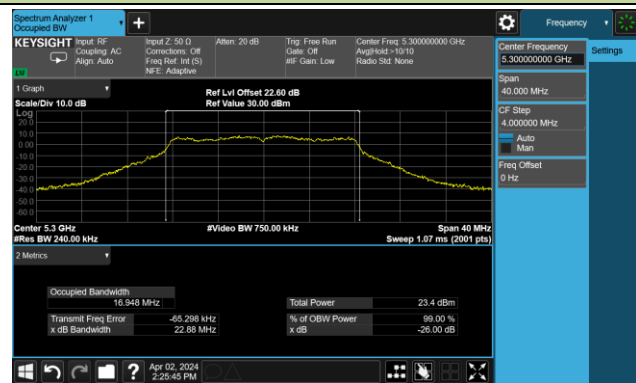
Channel 48 (5240MHz)



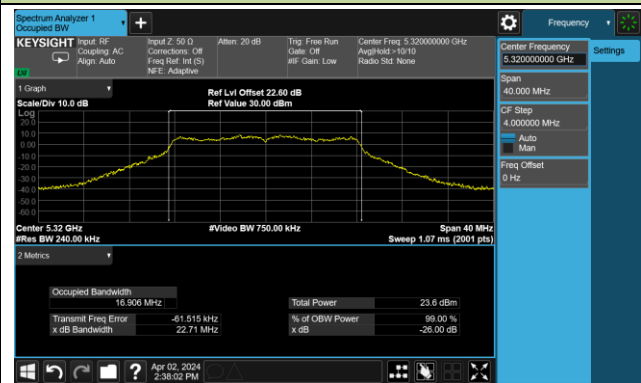
Channel 52 (5260MHz)



Channel 60 (5300MHz)



Channel 64 (5320MHz)



Channel 100 (5500MHz)

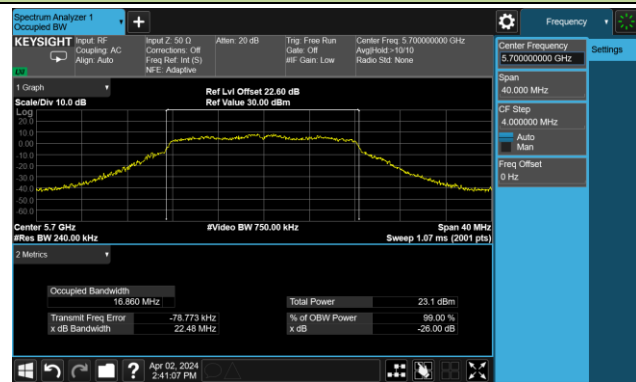


Channel 116 (5580MHz)

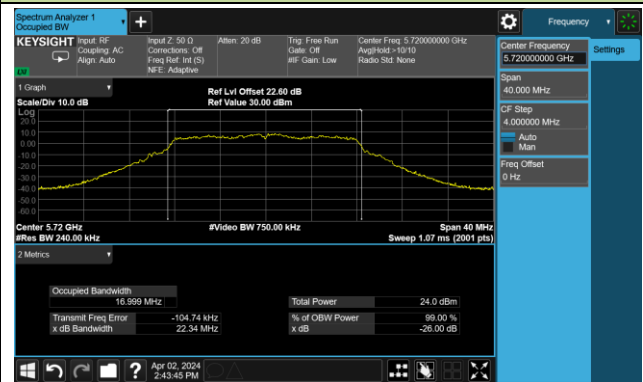


802.11a 26dB Bandwidth & 99% Bandwidth

Channel 140 (5700MHz)



Channel 144(5720MHz)



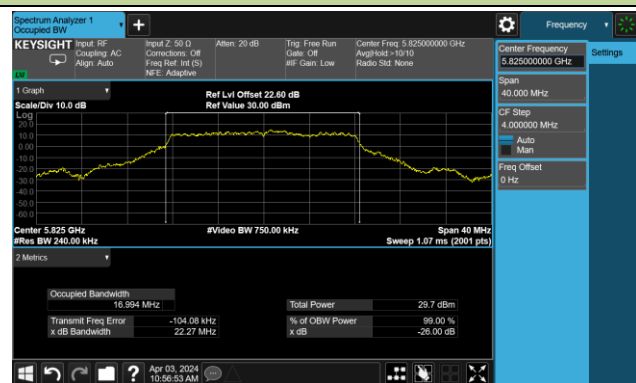
Channel 149 (5745MHz)



Channel 157 (5785MHz)

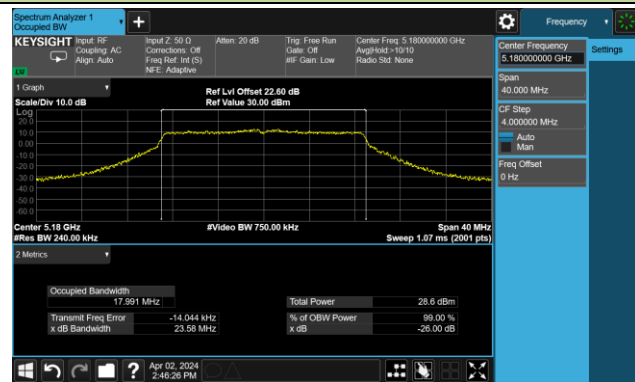


Channel 165 (5825MHz)

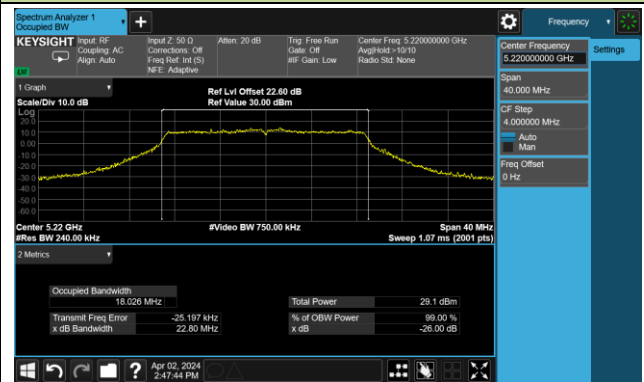


802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth

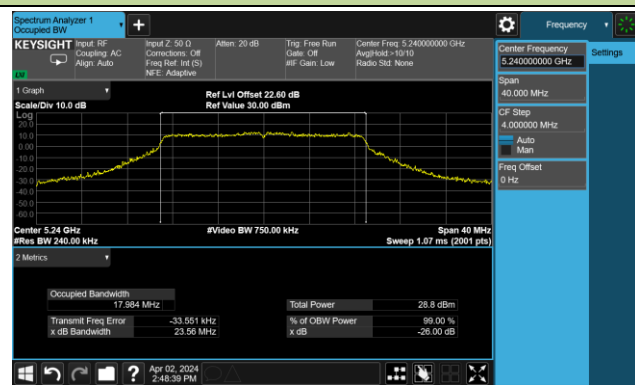
Channel 36 (5180MHz)



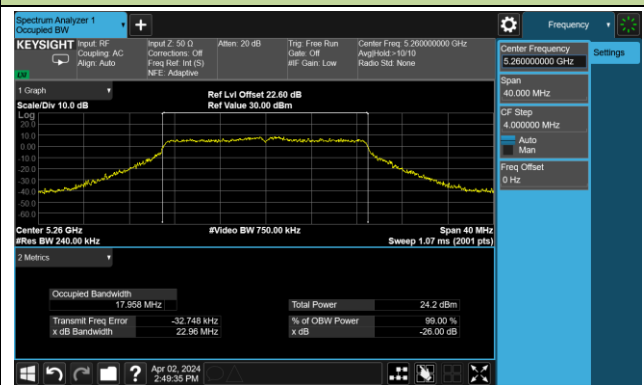
Channel 44 (5220MHz)



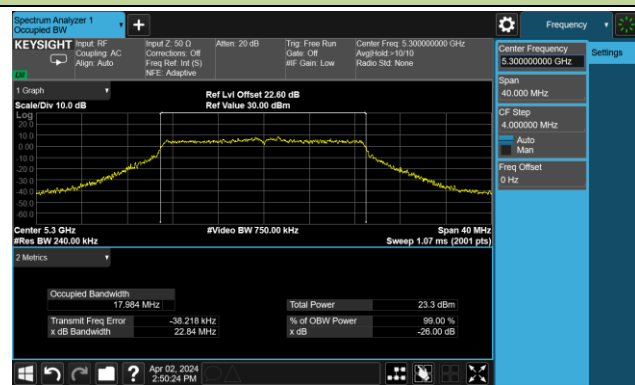
Channel 48 (5240MHz)



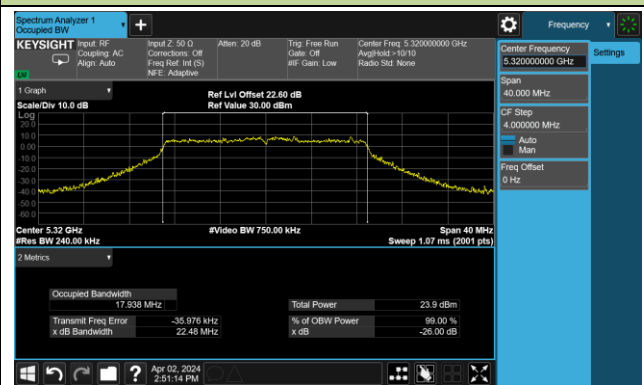
Channel 52 (5260MHz)



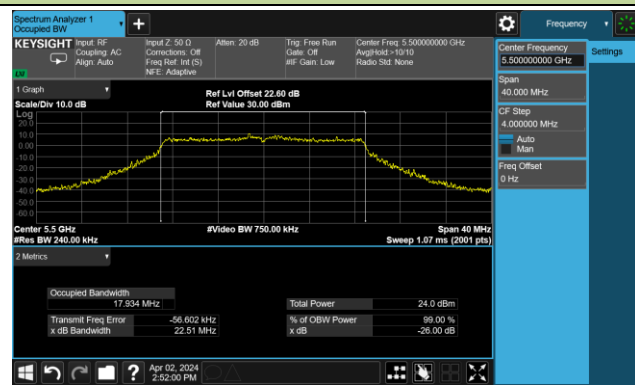
Channel 60 (5300MHz)



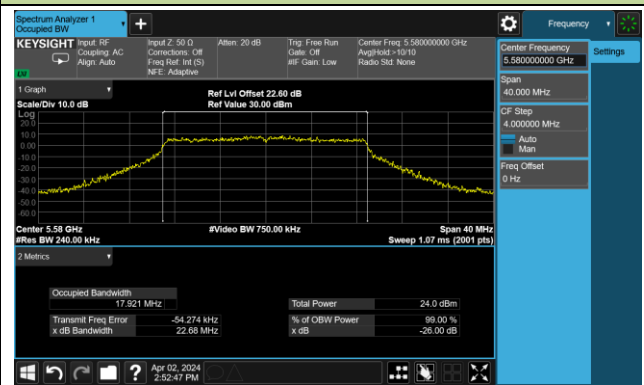
Channel 64 (5320MHz)



Channel 100 (5500MHz)

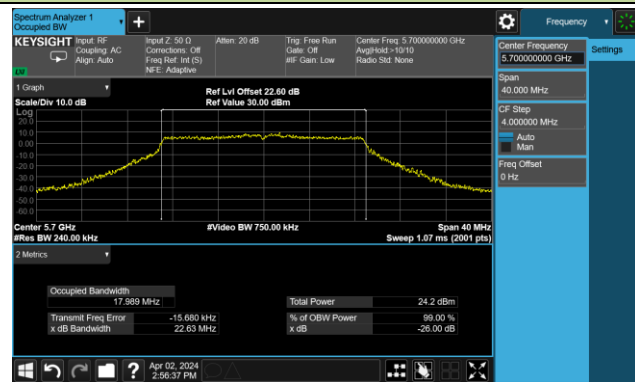


Channel 116 (5580MHz)

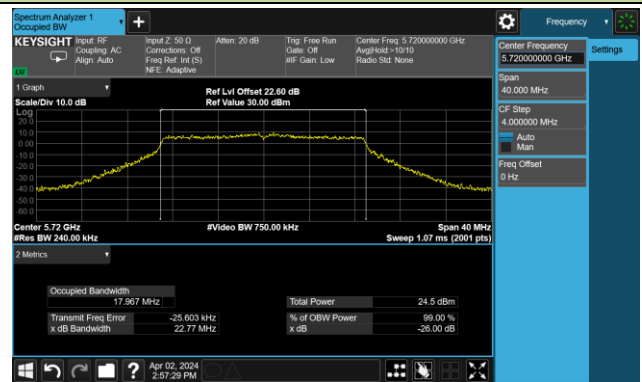


802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth

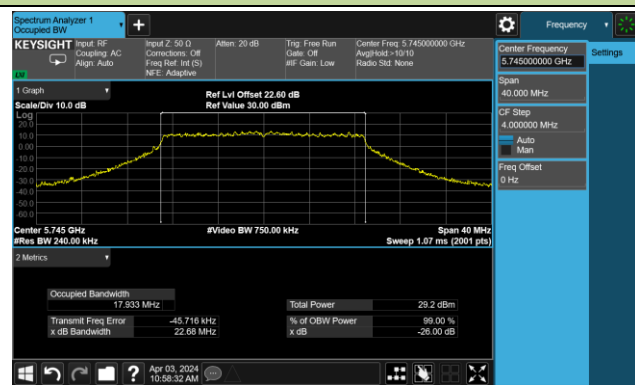
Channel 140 (5700MHz)



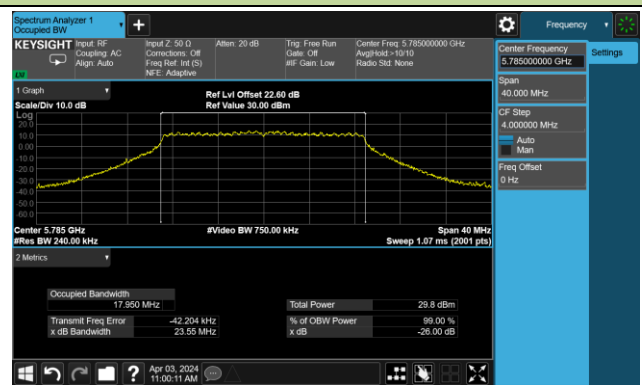
Channel 144(5720MHz)



Channel 149 (5745MHz)



Channel 157 (5785MHz)

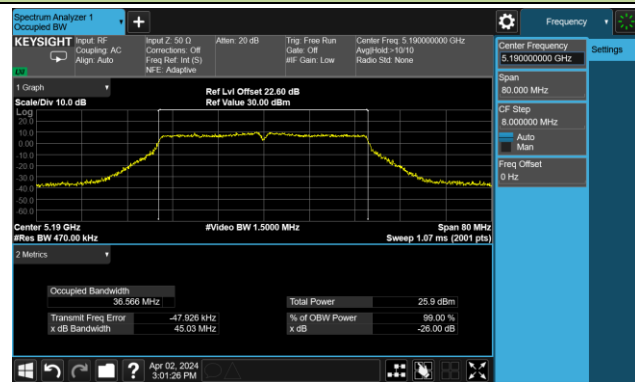


Channel 165 (5825MHz)

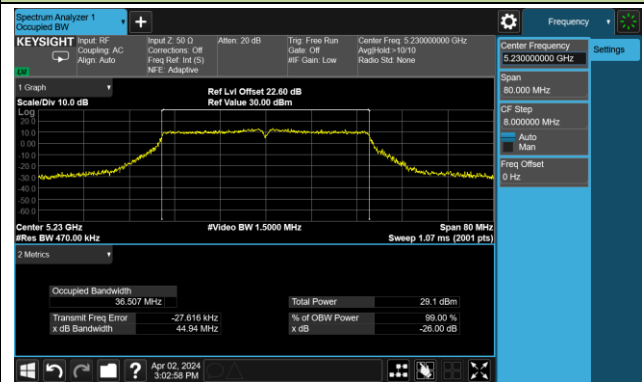


802.11ac-VHT40 26dB Bandwidth & 99% Bandwidth

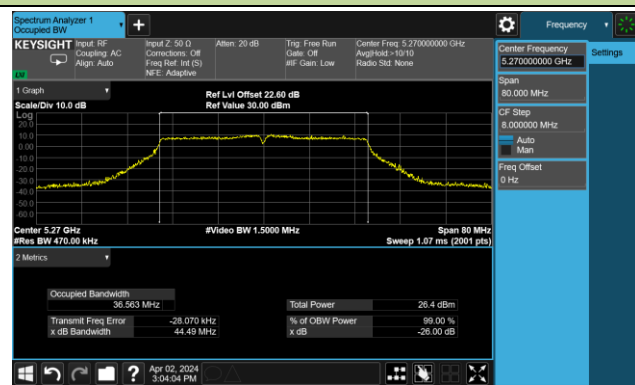
Channel 38 (5190MHz)



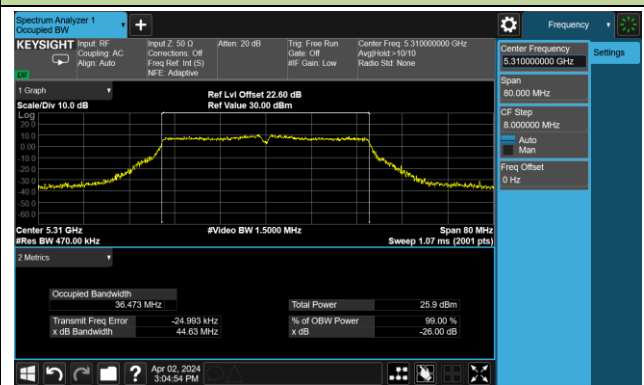
Channel 46 (5230MHz)



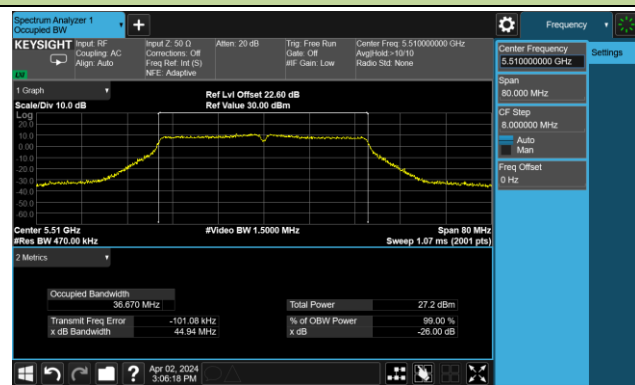
Channel 54 (5270MHz)



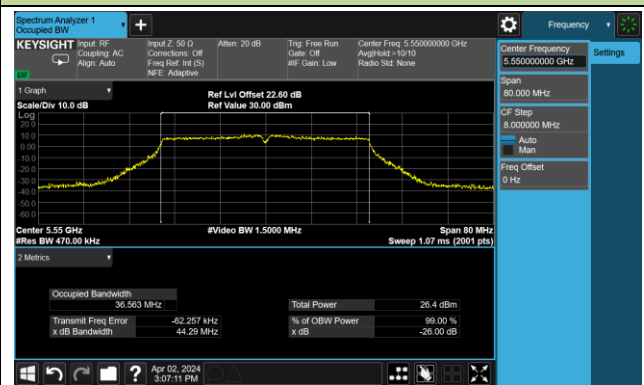
Channel 62 (5310MHz)



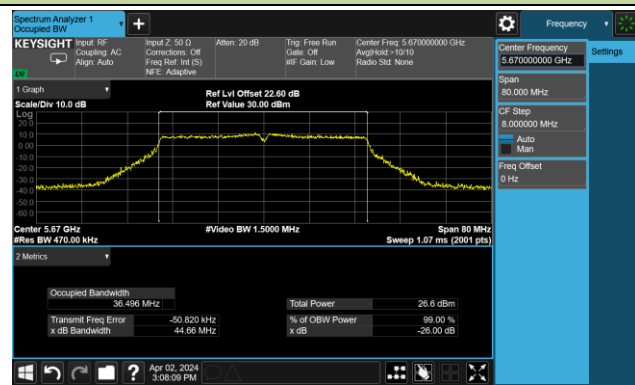
Channel 102 (5510MHz)



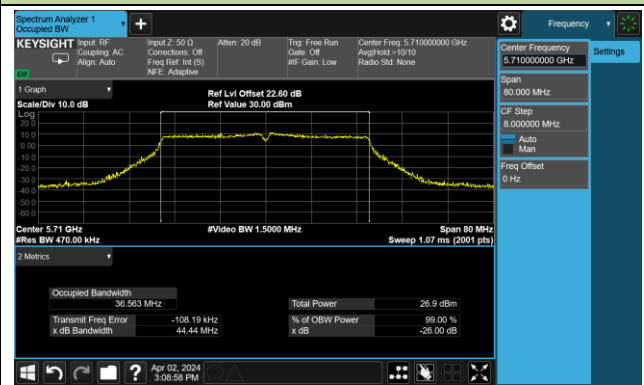
Channel 110 (5550MHz)

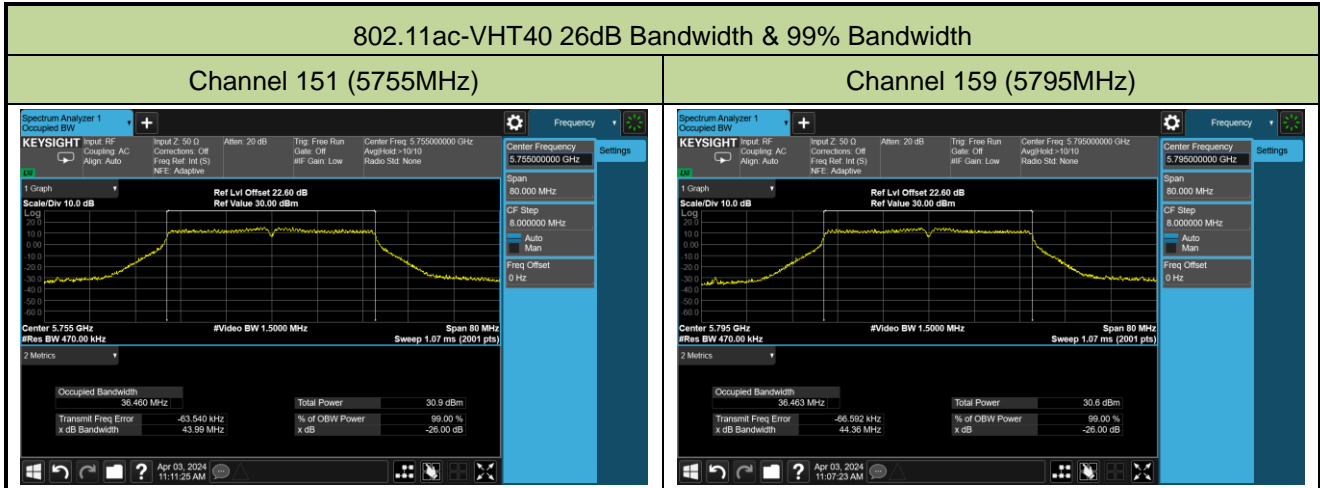


Channel 134 (5670MHz)

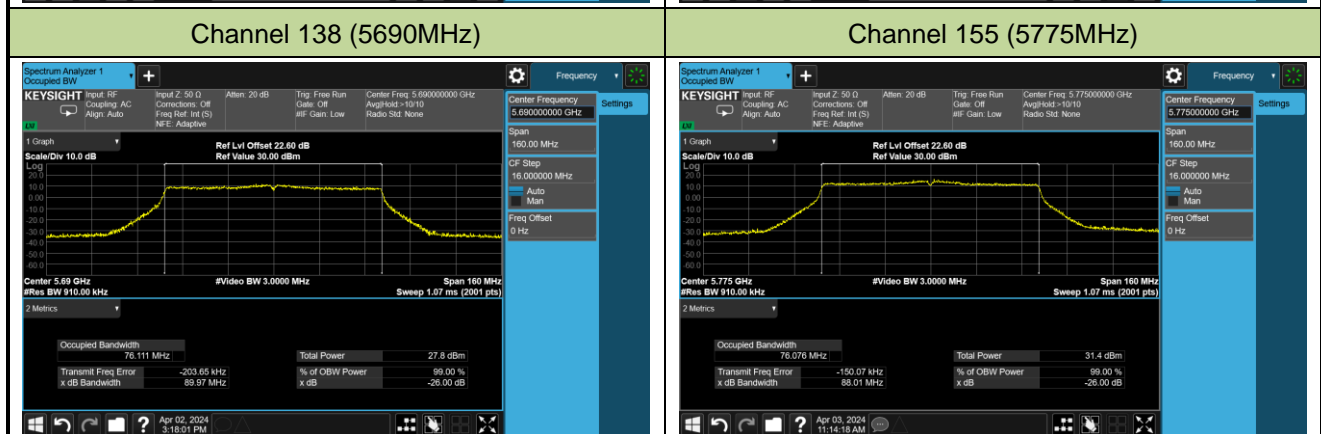
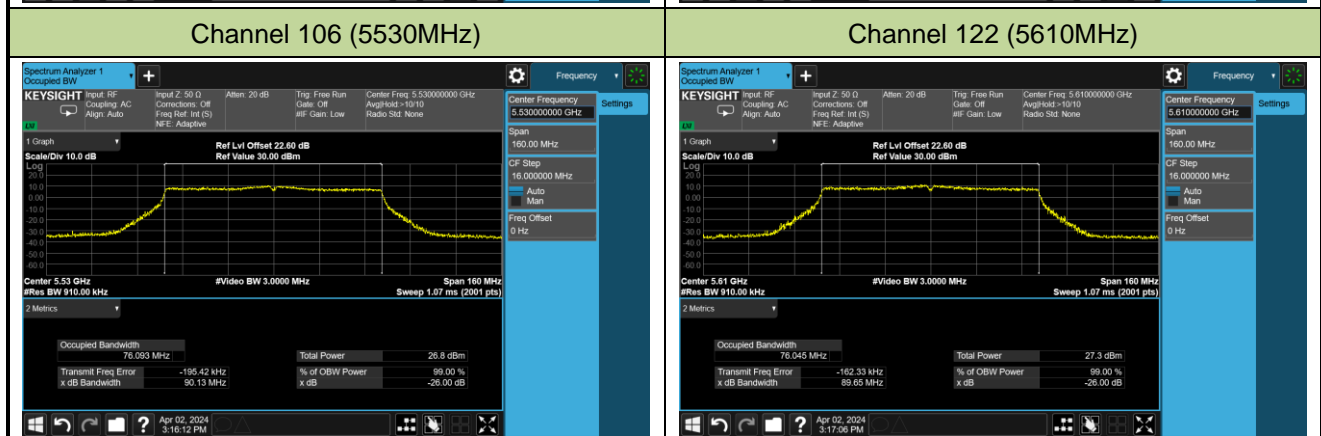
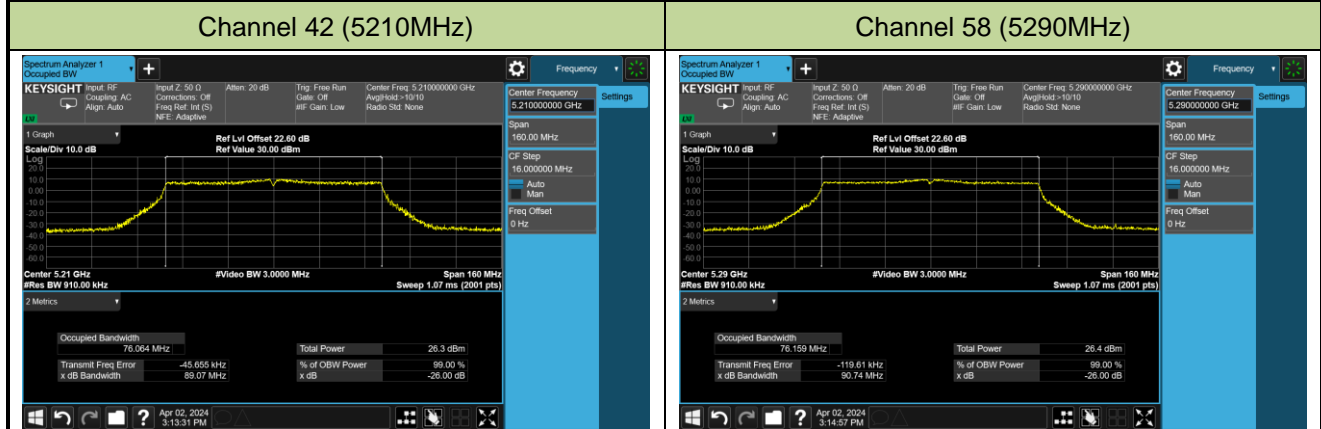


Channel 142(5710MHz)

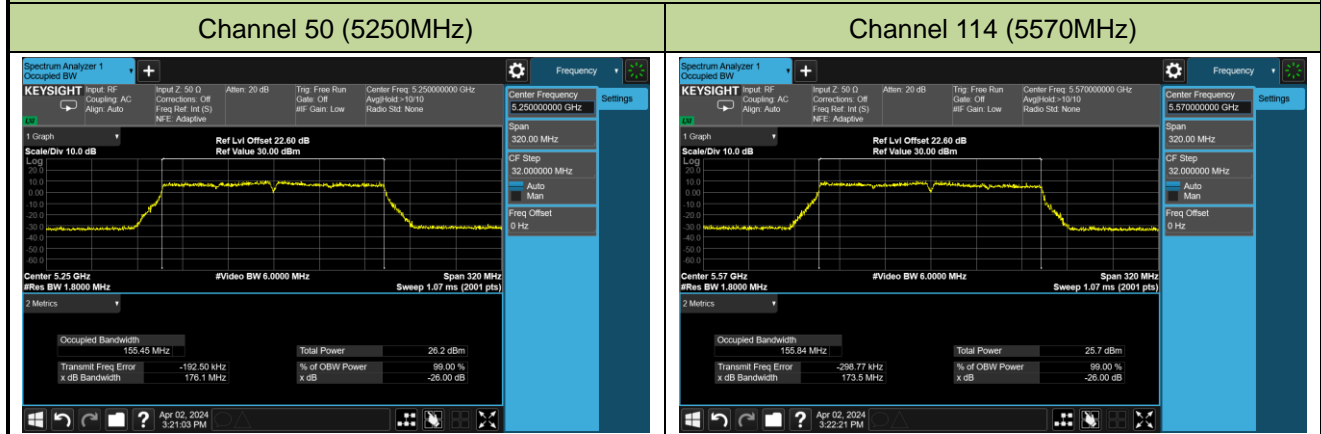




802.11ac-VHT80 26dB Bandwidth & 99% Bandwidth

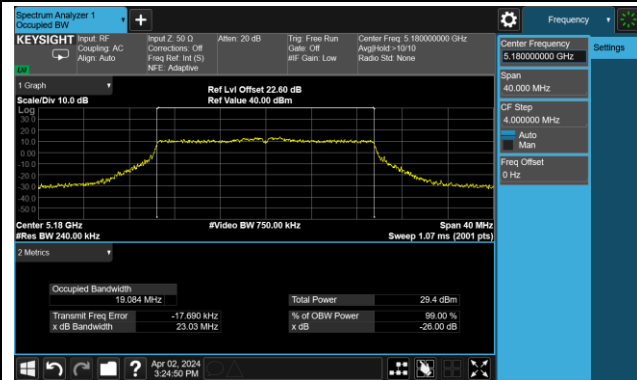


802.11ac-VHT160 26dB Bandwidth & 99% Bandwidth

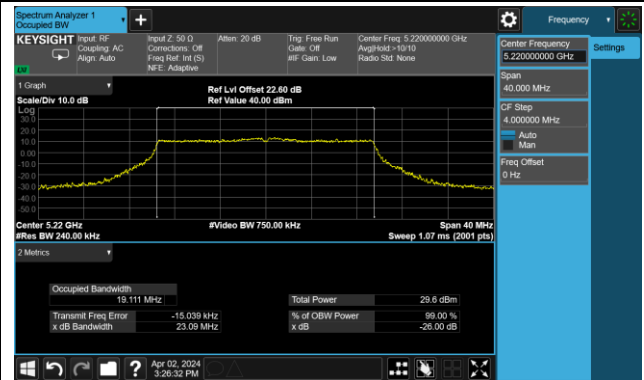


802.11ax-HE20 26dB Bandwidth & 99% Bandwidth

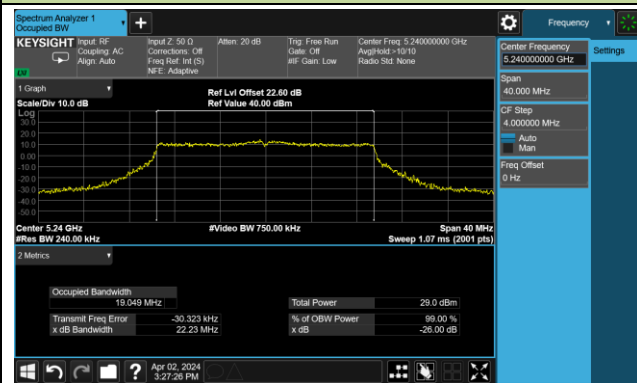
Channel 36 (5180MHz)



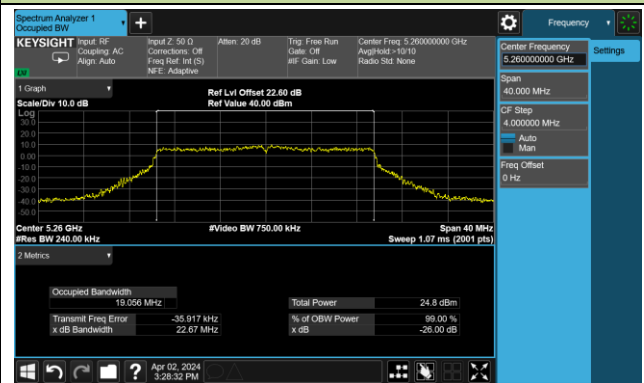
Channel 44 (5220MHz)



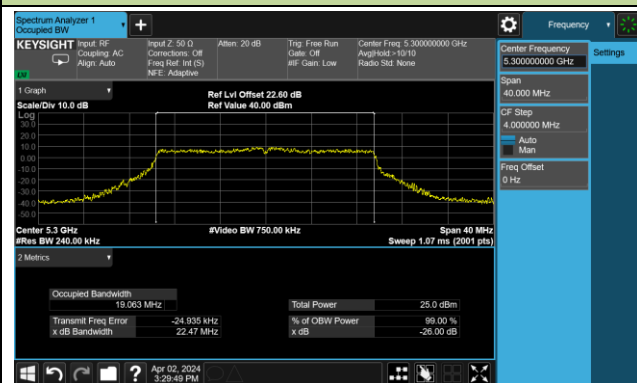
Channel 48 (5240MHz)



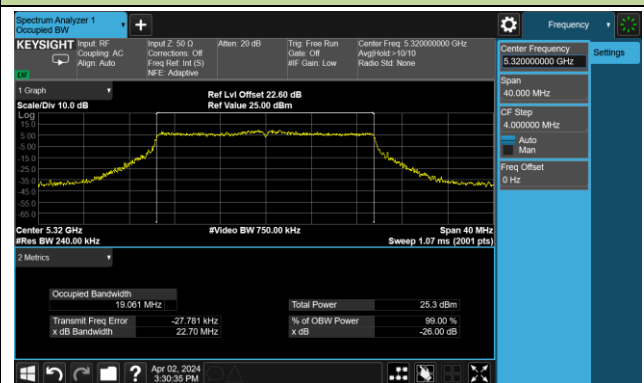
Channel 52 (5260MHz)



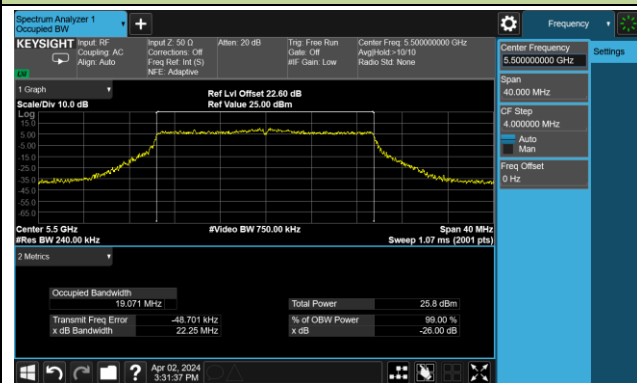
Channel 60 (5300MHz)



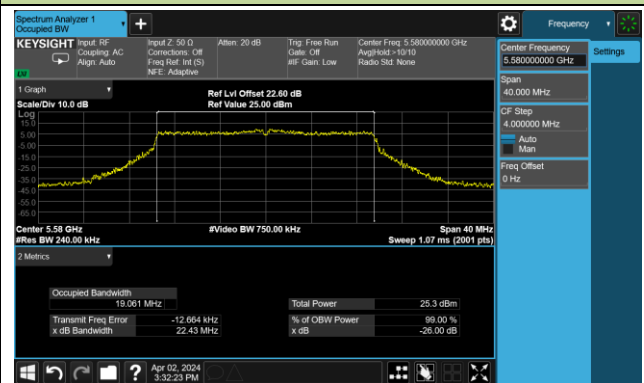
Channel 64 (5320MHz)



Channel 100 (5500MHz)

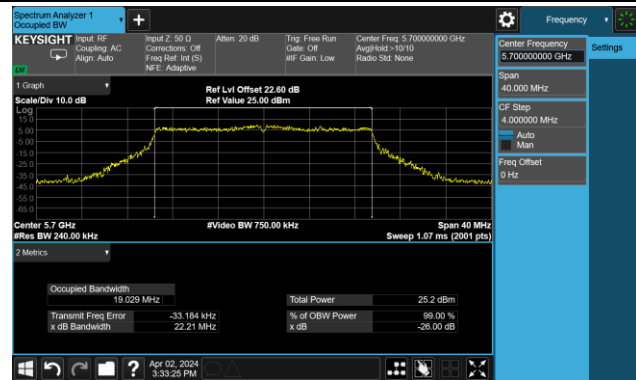


Channel 116 (5580MHz)

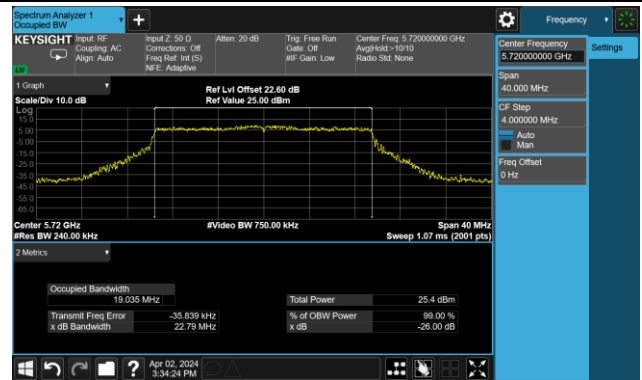


802.11ax-HE20 26dB Bandwidth & 99% Bandwidth

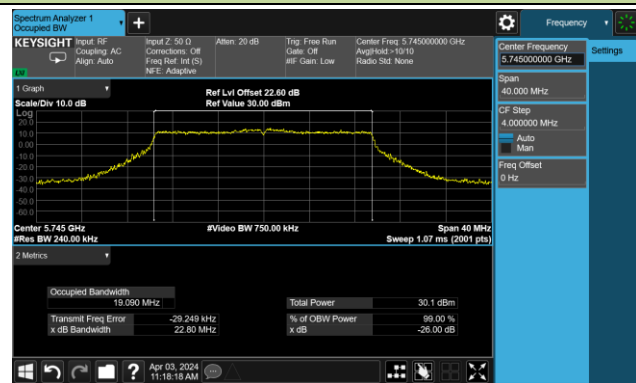
Channel 140 (5700MHz)



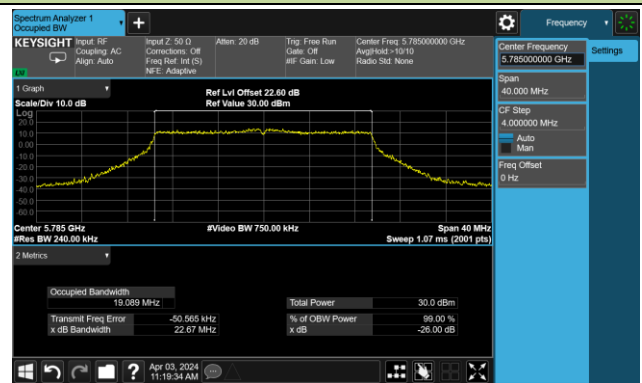
Channel 144(5720MHz)



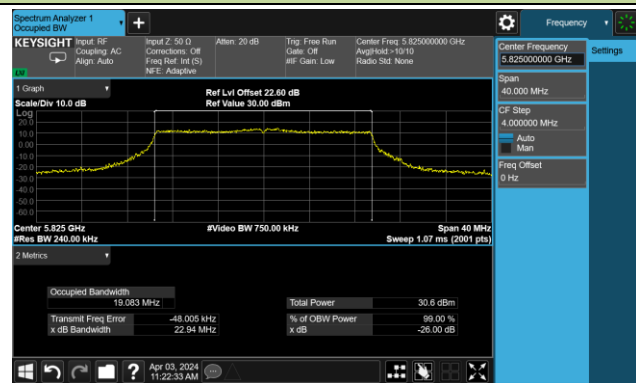
Channel 149 (5745MHz)



Channel 157 (5785MHz)

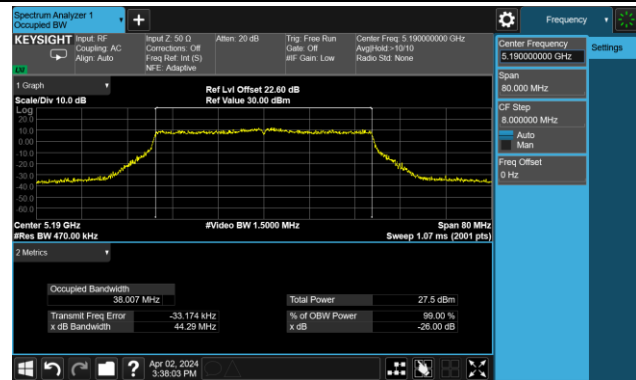


Channel 165 (5825MHz)

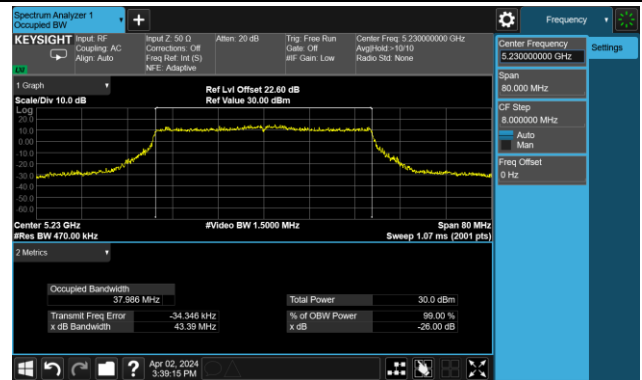


802.11ax-HE40 26dB Bandwidth & 99% Bandwidth

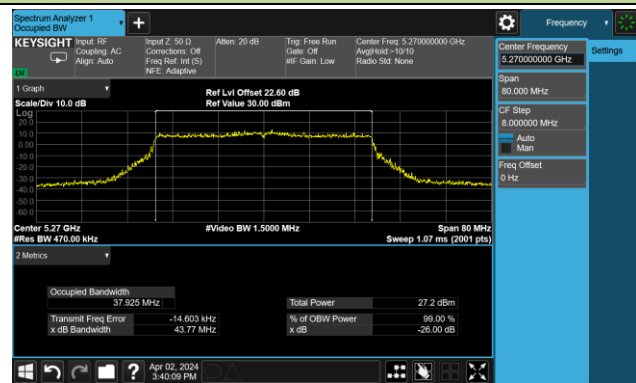
Channel 38 (5190MHz)



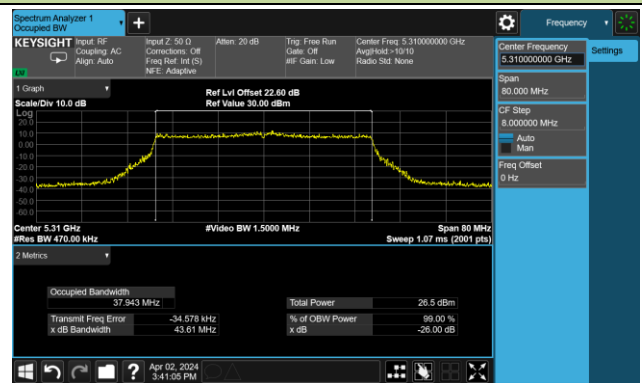
Channel 46 (5230MHz)



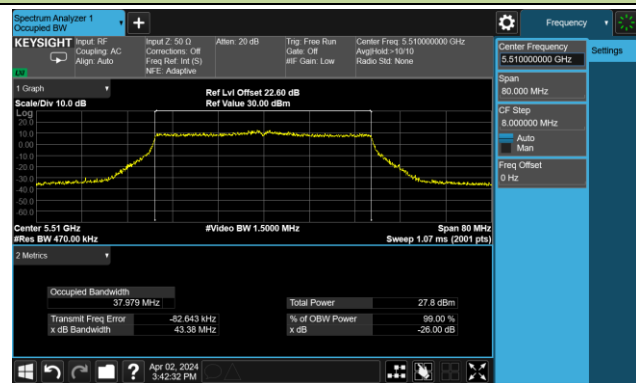
Channel 54 (5270MHz)



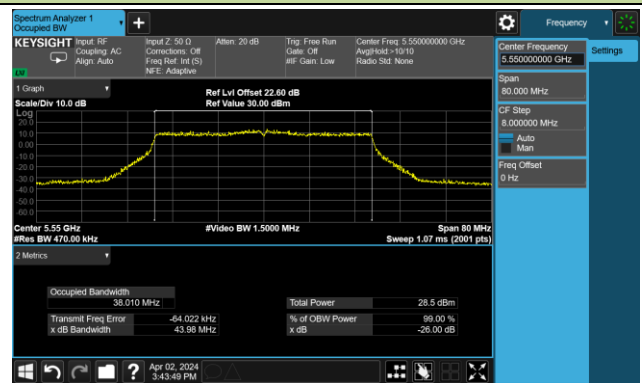
Channel 62 (5310MHz)



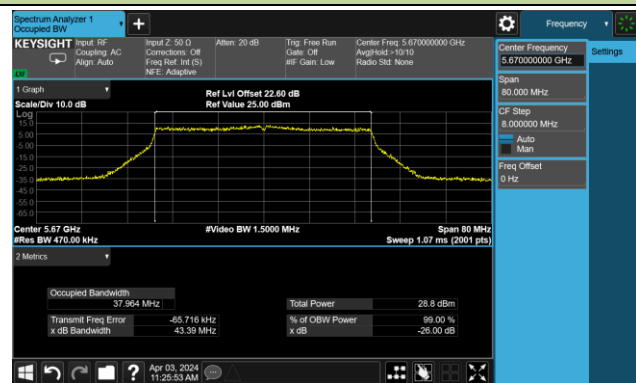
Channel 102 (5510MHz)



Channel 110 (5550MHz)



Channel 134 (5670MHz)



Channel 142(5710MHz)

