# RF MEASUREMENT REPORT

| | |
|---|---|
| **FCC ID:** | VW3FAST5697 |
| **Applicant:** | SAGEMCOM BROADBAND SAS |
| **Product:** | WIFI7 tri-band Gateway |
| **Model No.:** | FAST5697 |
| **Brand Name:** | SAGEMCOM |
| **FCC Classification:** | Unlicensed National Information Infrastructure (NII) |
| **FCC Rule Part(s):** | Part 15 Subpart E (Section 15.407) |
| **Result:** | Complies |
| **Received Date:** | 2025-03-19 |
| **Test Date:** | 2025-03-26 ~ 2025-04-23 |

**Reviewed By:** Sunny Sun

**Approved By:** Robin Wu

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

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 |
|---|---|---|---|---|
| R25S1048034-U204 | V01 | Initial Report | 2025-06-03 | Invalid |
| R25S1048034-U204 | V02 | Updated the PSD limit | 2025-06-09 | Valid |
| | | | | |

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# 1. General Information

## 1.1. Applicant

SAGEMCOM BROADBAND SAS
4 ALLEE DES MESSAGERIES
92271 BOIS-COLOMBES CEDEX - FRANCE

## 1.2. Manufacturer

SAGEMCOM BROADBAND SAS
4 ALLEE DES MESSAGERIES
92271 BOIS-COLOMBES CEDEX - FRANCE

## 1.3. Testing Facility

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

### 1.4. Product Information

| | |
|---|---|
| Product Name | WIFI7 tri-band Gateway |
| Model No. | FAST5697 |
| EUT Identification No. | 20250319Sample#19 (Conducted)<br>20250319Sample#21 (Radiated) |
| Bluetooth Specification | Bluetooth_LE 1M |
| Zigbee Specification | 802.15.4 |
| Z-Wave Specification | 902 ~ 928MHz |
| Wi-Fi Specification | 802.11a/b/g/n/ac/ax/be |
| Antenna Information | Refer to section 1.7 |
| Working Voltage | By Adapter |
| Operating Environment | Indoor Use |
| Accessory | |
| Adapter#1 | Model: ADS-65HI-12A-2 12060E-L<br>Input: 100-127V ~ 50/60Hz 1.5A<br>Output: 12V=5.0A |

Remarks:

1. The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.
2. For this report, we select AC Adapter #1 for testing.

### 1.5. Radio Specification under Test

| | | |
|---|---|---|
| Frequency Range | For 802.11a/n-HT20/ac-VHT20/ax-HE20/be-EHT20:<br>5180~5240MHz, 5260~5320MHz, 5500~5720MHz, 5745~5825MHz<br>For 802.11n-HT40/ac-VHT40/ax-HE40/be-EHT40:<br>5190~5230MHz, 5270~5310MHz, 5510~5710MHz, 5755~5795MHz<br>For 802.11ac-VHT80/ax-HE80/be-EHT80:<br>5210MHz, 5290MHz, 5530MHz, 5610 MHz, 5690MHz, 5775MHz<br>For 802.11ac-VHT160/ax-HE160/be-EHT160:<br>5250MHz, 5570MHz | |
| Type of Modulation | 802.11a/n/ac: OFDM<br>802.11ax/be: OFDMA | |
| Data Rate | 802.11a: 6/9/12/18/24/36/48/54Mbps<br>802.11n: up to 600Mbps<br>802.11ac: up to 3466.7Mbps<br>802.11ax: up to 4803.9Mbps<br>802.11be: up to 5764.8Mbps | |
| 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 Band (GHz) | Antenna Gain (dBi) | | | | Directional Gain (dBi) | |
|---|---|---|---|---|---|---|---|
| | | Ant 0 | Ant 1 | Ant 2 | Ant 3 | For Power | For PSD |
| Wi-Fi Internal Antenna | | | | | | | |
| PCB Antenna | 2412 ~ 2462 | 4.59 | 3.50 | 2.28 | 3.62 | 4.59 | 5.00 |
| | 5150 ~ 5250 | 4.78 | 4.31 | 2.73 | 5.45 | 5.45 | 5.48 |
| | 5250 ~ 5350 | 5.62 | 4.48 | 3.08 | 4.44 | 5.62 | 5.78 |
| | 5470 ~ 5725 | 4.99 | 3.27 | 1.61 | 5.12 | 4.99 | 5.78 |
| | 5725 ~ 5850 | 5.19 | 4.69 | 2.80 | 4.51 | 5.19 | 6.64 |
| | 5925 ~ 7125 | 4.75 | 4.39 | 4.30 | 6.84 | 6.84 | 6.63 |

Note 1: The antenna gain and directional gain refer to manufacturer's antenna specification.

Note 2: The EUT supports Cyclic Delay Diversity (CDD) mode for 802.11a/b/g/n/ac/ax/be.

Note 3: Software automatically backs power down based on CDD power for beamforming operation.

# 2. Test Configuration

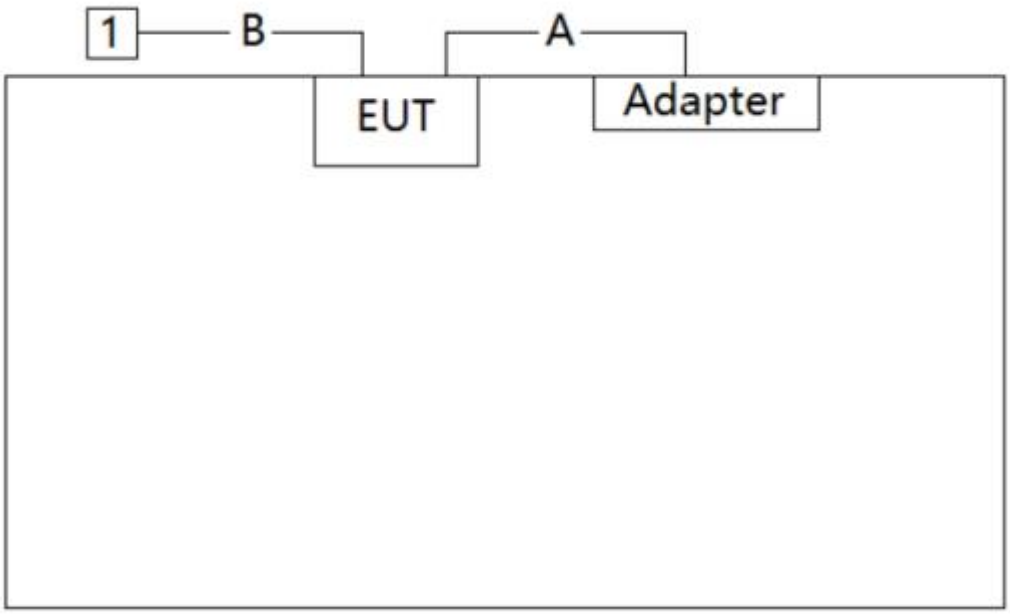
## 2.1. Test Mode

| CDD Mode |
|---|
| Mode 1: Transmit by 802.11a (6Mbps) |
| Mode 2: Transmit by 802.11ac-VHT20 (MCS0) |
| Mode 3: Transmit by 802.11ac-VHT40 (MCS0) |
| Mode 4: Transmit by 802.11ac-VHT80 (MCS0) |
| Mode 5: Transmit by 802.11ac-VHT160 (MCS0) |
| Mode 6 Transmit by 802.11be-EHT20 (MCS0) |
| Mode 7: Transmit by 802.11be-EHT40 (MCS0) |
| Mode 8: Transmit by 802.11be-EHT80 (MCS0) |
| Mode 9: Transmit by 802.11be-EHT160 (MCS0) |
| Notes:<br>1. For Radiated emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power.<br>2. For CDD mode, this device supports 4 $N_{SS}$ and power level is the same of spatial multiplexing. The worst case is $N_{SS}$=1.<br>3. 802.11n and 802.11ac & 802.11ax and 802.11be have the same modulation type and same power value, so we only show 802.11ac and 802.11be test data in report.<br>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.

Connection Diagram




| Cable Type | | Cable Description | Length |
|---|---|---|---|
| A | Power Cable | Non shielded | 2.0m |
| B | LAN Cable | Non shielded | > 10m |
| **Product** | | **Manufacturer** | **Model No.** |
| 1 | Notebook | ThinkPad | E14 Gen5 |

### 2.3. Test Software

The test utility software used during testing was “accessMTool.exe”, and the version was 3.3.0.6.

## 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 |
|---|---|---|---|---|---|---|
| Active Loop Antenna | Schwarzbeck | FMZB 1519-60 D | MRTSUE07075 | 1 year | 2025-11-19 | SIP-AC3 |
| EMI Test Receiver | R&S | ESR3 | MRTSUE06185 | 1 year | 2025-12-05 | SIP-AC3 |
| TRILOG Antenna | Schwarzbeck | VULB 9168 | MRTSUE06646 | 1 year | 2025-07-29 | SIP-AC3 |
| Signal Analyzer | Keysight | N9010B | MRTSUE06559 | 1 year | 2025-05-08 | SIP-AC3 |
| Thermohygrometer | testo | 608-H1 | MRTSUE06619 | 1 year | 2025-10-16 | SIP-AC3 |
| Preamplifier | EMCI | EMC012645SE | MRTSUE06642 | 1 year | 2026-01-05 | SIP-AC3 |
| Horn Antenna | R&S | HF907 | MRTSUE06611 | 1 year | 2025-07-07 | SIP-AC3 |
| Preamplifier | EMCI | EMC184045SE | MRTSUE06602 | 1 year | 2025-10-08 | SIP-AC3 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | MRTSUE06599 | 1 year | 2025-09-08 | SIP-AC3 |
| Anechoic Chamber | RIKEN | SIP-AC3 | MRTSUE06782 | 1 year | 2025-12-19 | SIP-AC3 |
| Two-Line V-Network | R&S | ENV216 | MRTSUE06003 | 1 year | 2025-05-08 | SIP-SR2 |
| EMI Test Receiver | R&S | ESR3 | MRTSUE06612 | 1 year | 2025-05-08 | SIP-SR2 |
| Four-Line V-Network | R&S | ENV432 | MRTSUE06614 | 1 year | 2025-10-13 | SIP-SR2 |
| Thermohygrometer | testo | 608-H1 | MRTSUE06621 | 1 year | 2025-10-29 | SIP-SR2 |
| Shielding Room | MIX-BEP | SIP-SR2 | MRTSUE06949 | 5 years | 2029-10-13 | SIP-SR2 |
| USB Power Sensor | Keysight | U2021XA | MRTSUE06596 | 1 year | 2025-07-23 | SIP-TR1 |
| Signal Analyzer | Keysight | N9010B | MRTSUE07036 | 1 year | 2026-01-21 | SIP-TR1 |
| Temperature Chamber | BAOYT | BYG-408CS | MRTSUE06847 | 1 year | 2026-01-21 | SIP-TR1 |
| Thermohygrometer | testo | 608-H1 | MRTSUE11022 | 1 year | 2025-10-16 | SIP-TR1 |

| Software | Version | Function |
|---|---|---|
| e3 | 230711 | EMI Test Software |
| Agilent Power Analyzer/Agilent Power Panel | V R03.09.00 | Power |
| Controller_MF 7802BS | 1.02 | RE Antenna & Turntable |

# 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:<br>9kHz~150kHz: 3.58dB<br>150kHz~30MHz: 3.20dB |
| **Radiated Emission Measurement** |
| The maximum measurement uncertainty is evaluated as:<br>Coaxial: 9kHz~30MHz: 2.35dB<br>Coplanar: 9kHz~30MHz: 2.37dB<br>Horizontal: 30MHz~200MHz: 3.47dB<br>200MHz~1GHz: 4.17dB<br>1GHz~40GHz: 4.97dB<br>Vertical: 30MHz~200MHz: 4.07dB<br>200MHz~1GHz: 5.28dB<br>1GHz~40GHz: 4.84dB |
| **Spurious Emissions, Conducted** |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>2.5dB |
| **Output Power** |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>1.5dB |
| **Power Spectrum Density** |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>2.5dB |
| **Occupied Bandwidth** |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>3.2% |

# 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<br>15.407(b)(8), (9), (10) | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | | Pass |
| 15.207 | AC Conducted Emissions<br>150kHz - 30MHz | Line Conducted | Pass |

**Remark:**

1. The analyzer plots shown in this section were captured using a correction table to account for cable and attenuator losses in the system connecting the EUT to the analyzer across relevant frequencies.
2. 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.
3. DFS report refer to R25S1048034-U205.

## 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

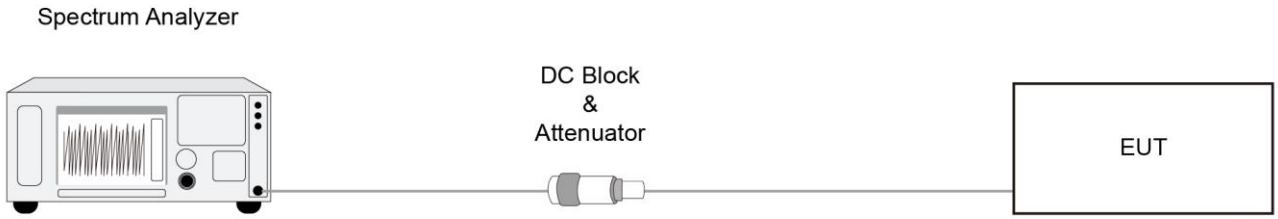
**26dB Bandwidth**

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 ≥ 3 × 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 6dBbandwidth shall be at least 500 kHz.

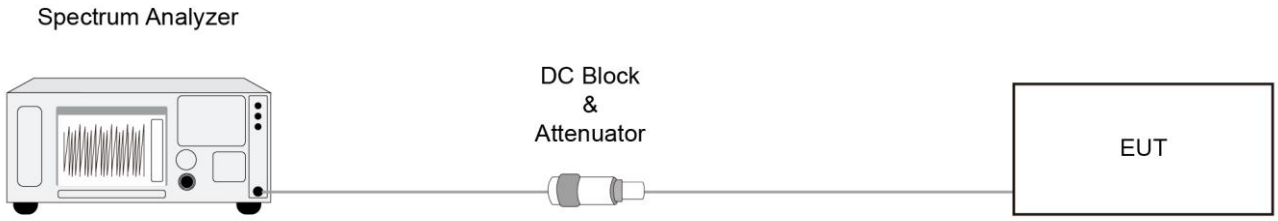
### 6.3.2. Test Procedure

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 ≥ 3 × 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 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

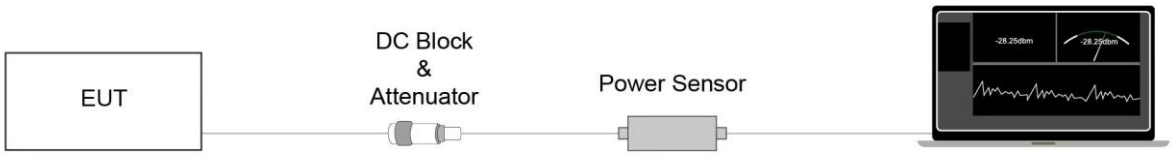
KDB 789033D02v02r01- Section Ⅱ)E)3)b) Method PM-G

### 6.4.3. Test Setting

**<u>Average Power Measurement</u>**

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.

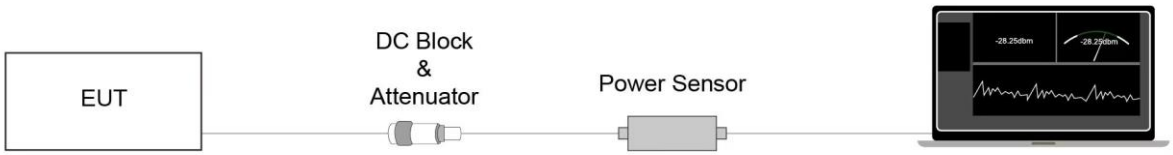
### 6.5.2. Test Procedure

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.

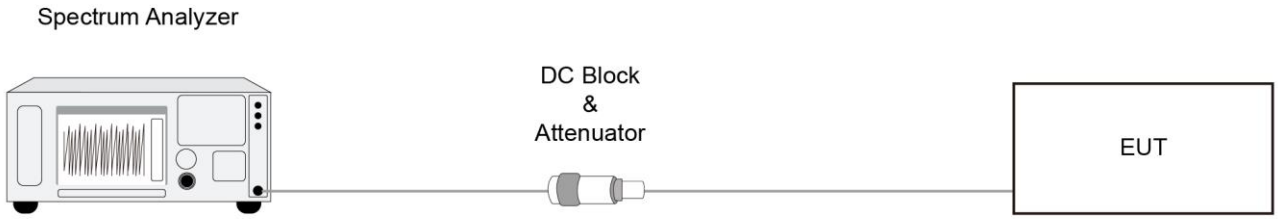
### 6.6.2. Test Procedure

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 ≥ 2 × (span / 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*log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10*log(1/0.25) = 6 dB if the duty cycle is 25 percent.

### 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:**

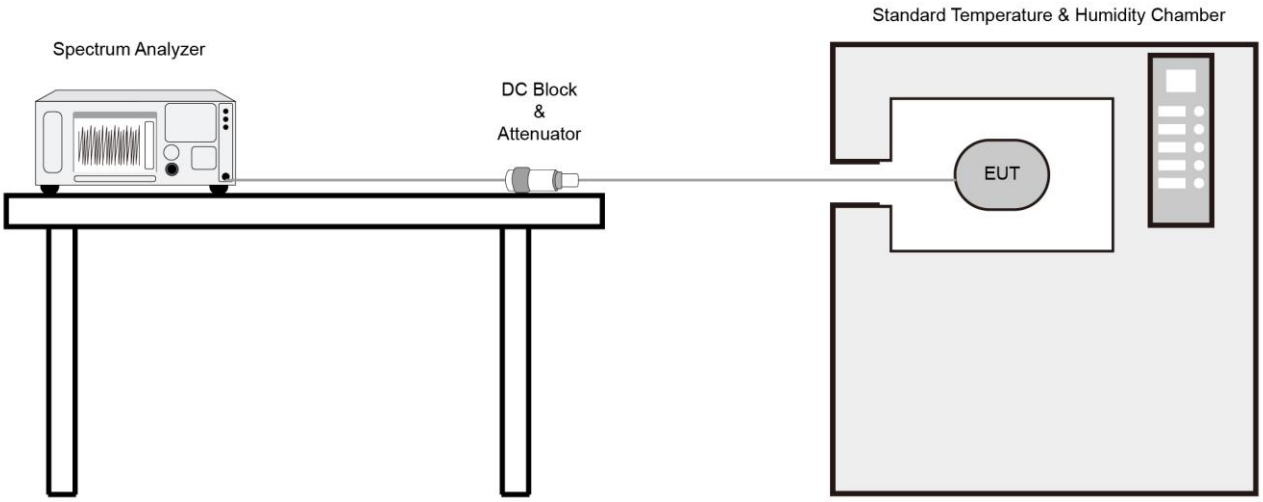
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain 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 (±15%) and endpoint, recordthe 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

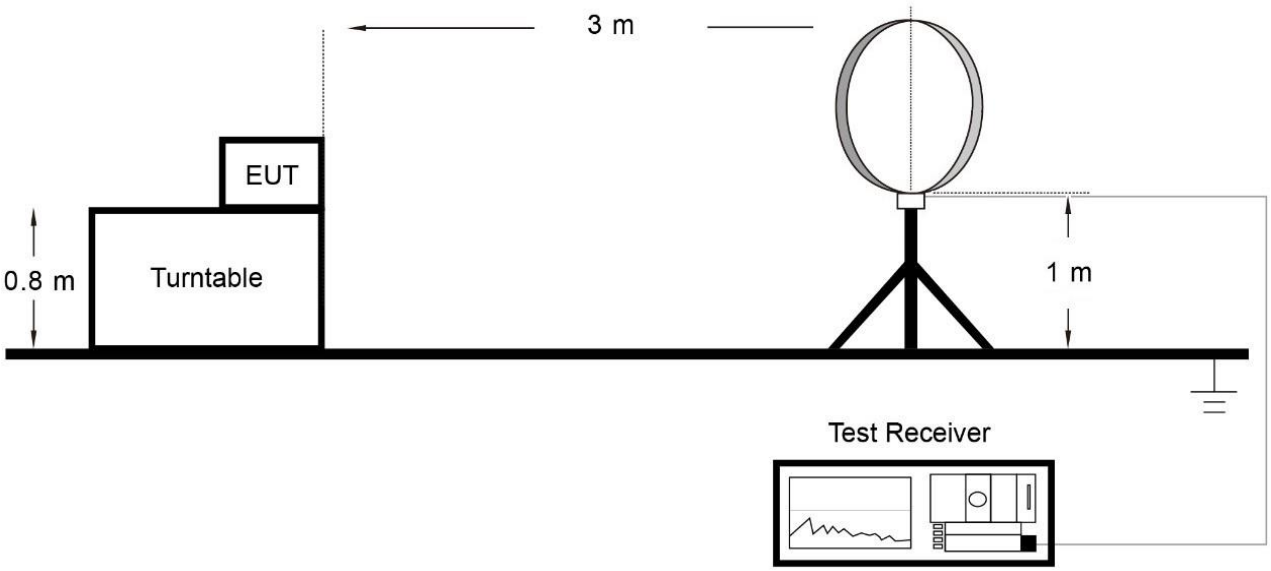
**Average Measurements above 1GHz (Method VB)**

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 ≥ 98%, set VBW = 10Hz

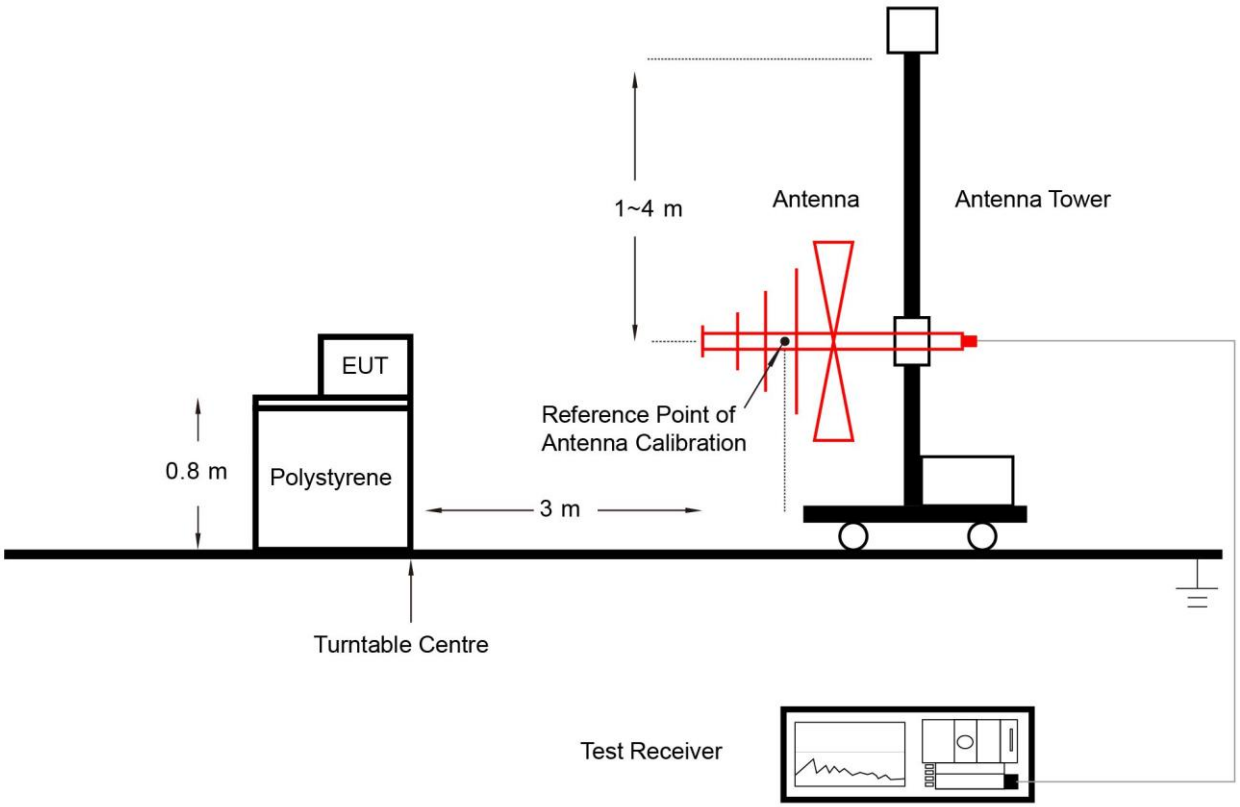
   If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.
4. As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display 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

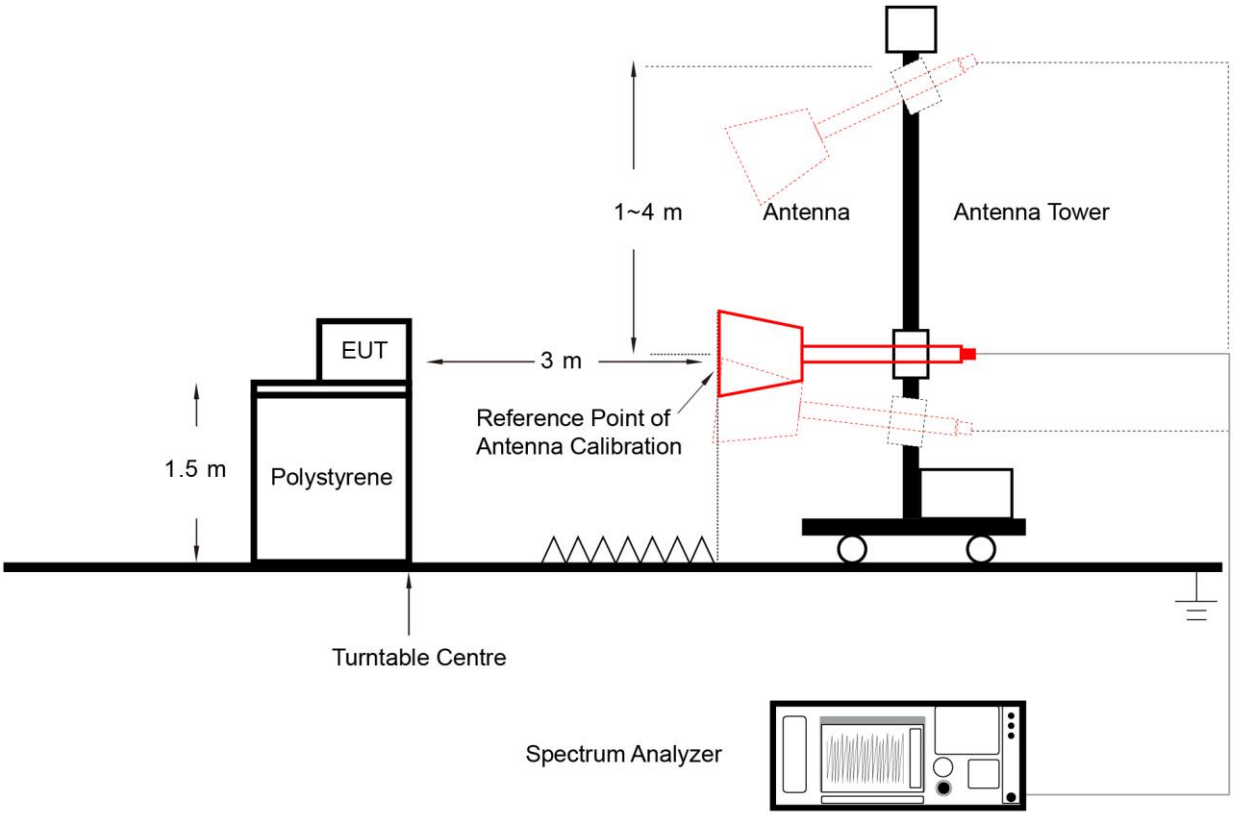
Below 30MHz Test Setup:




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**

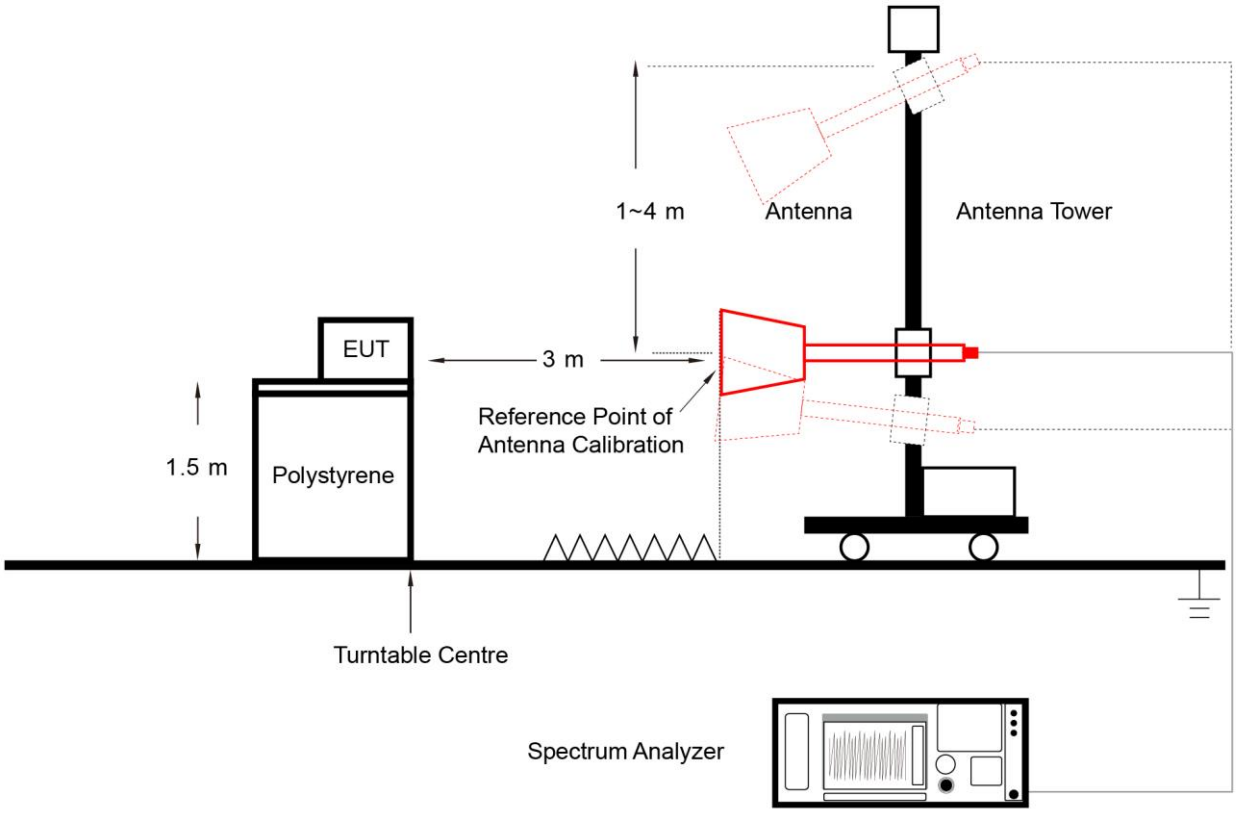
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

**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 ≥ 98%, set VBW = 10 Hz.

   If the EUT duty cycle is < 98%, set VBW ≥ 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

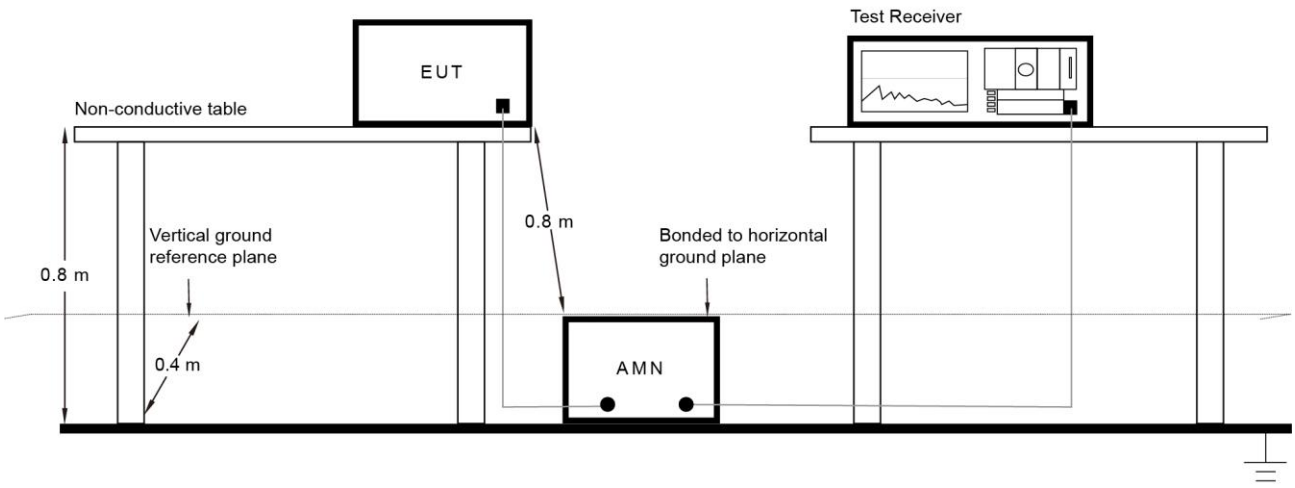
Refer to Appendix A.8.

## 6.10. AC Conducted Emissions Measurement

### 6.10.1. Test Limit

| FCC Part 15.207 Limits | | |
|---|---|---|
| Frequency (MHz) | QP (dBμV) | AV (dBμV) |
| 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.<br>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

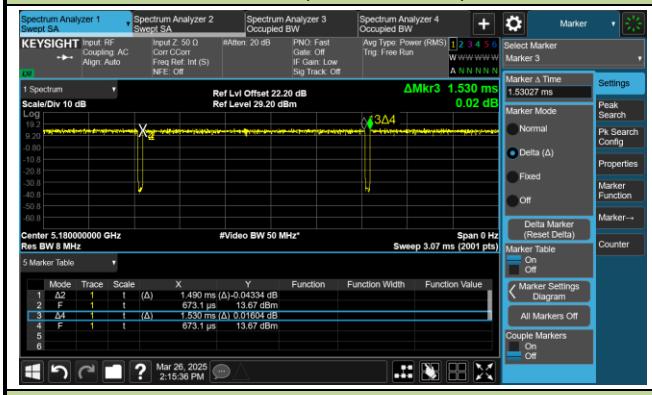
## A.1 Duty Cycle Test Result

| | | | |
|---|---|---|---|
| Test Site | SIP-TR1 | Test Engineer | Nolan Chen |
| Test Date | 2025-03-26 ~ 2025-04-01 | | |

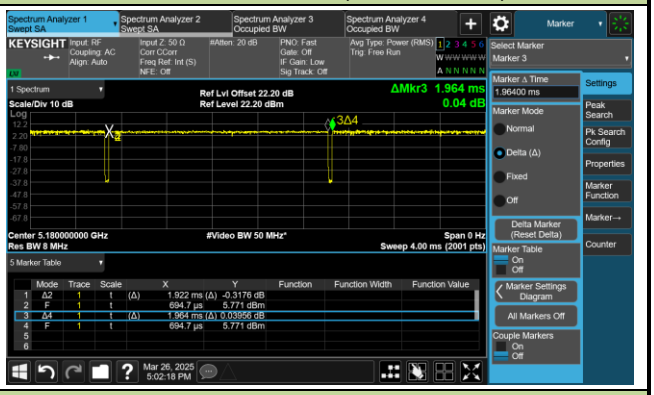
| Test Mode | Duty Cycle | Test Mode | Duty Cycle |
|---|---|---|---|
| 802.11a | 97.39% | 802.11be-EHT20 | 96.75% |
| 802.11ac-VHT20 | 97.86% | 802.11be-EHT40 | 94.70% |
| 802.11ac-VHT40 | 96.12% | 802.11be-EHT80 | 91.87% |
| 802.11ac-VHT80 | 92.71% | 802.11be-EHT160 | 87.13% |
| 802.11ac-VHT160 | 86.93% | -- | -- |

Duty Cycle (T = Transmission Duration)

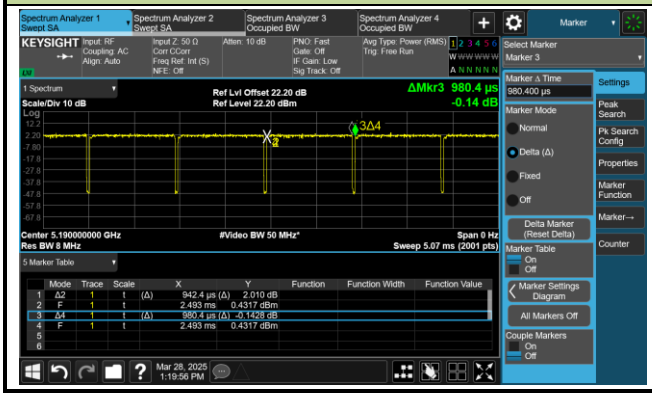
802.11a (T = 1.490ms)



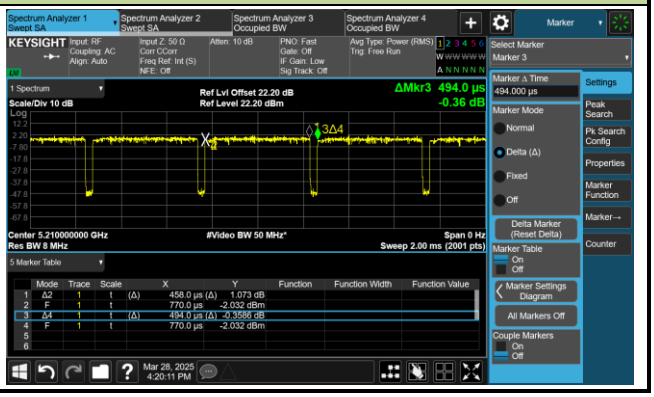

802.11ac-VHT20 (T = 1.922ms)

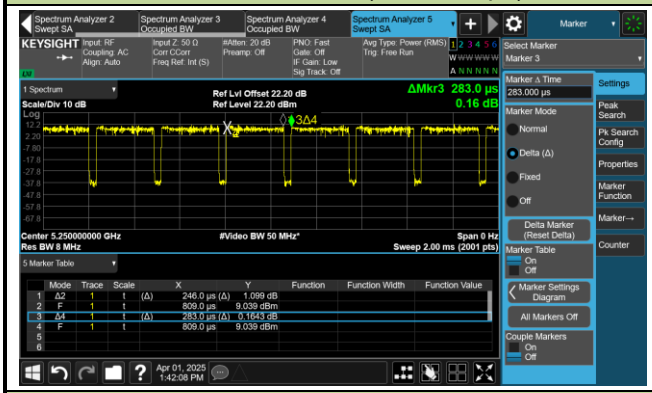
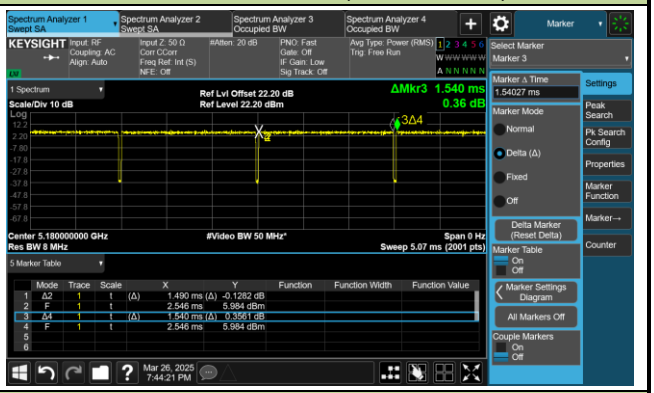
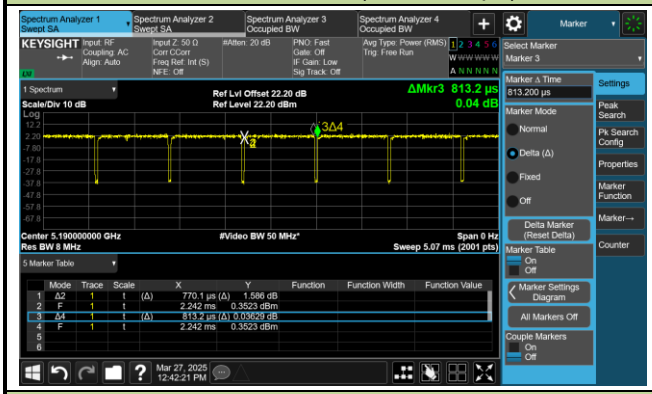
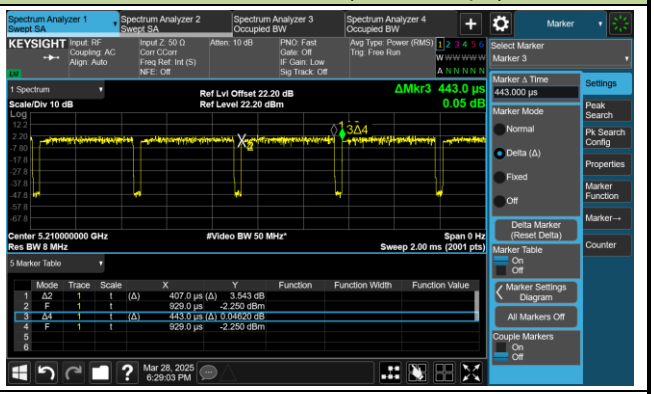
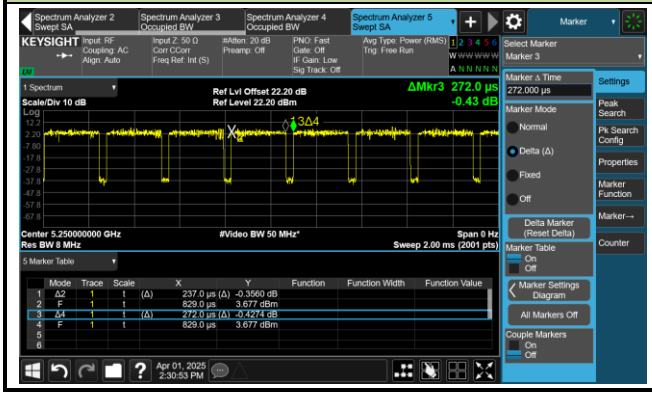



802.11ac-VHT40 (T = 942.4μs)




802.11ac-VHT80 (T = 458.0μs)



| Duty Cycle (T = Transmission Duration) | |
|---|---|
| 802.11ac-VHT160 (T = 246.0μs) | 802.11be-EHT20 (T = 1.490ms) |
|  |  |
| 802.11be-EHT40 (T = 770.1μs) | 802.11be-EHT80 (T = 407.0μs) |
|  |  |
| 802.11be-EHT160 (T = 237.0μs) | |
|  | |

### A.2 26dB Bandwidth Test Result

| Test Site | SIP-TR1 | Test Engineer | Nolan Chen |
|---|---|---|---|
| Test Date | 2025-03-26 ~ 2025-04-02 | | |

| Test Mode | Data Rate/ MCS | Channel No. | Frequency (MHz) | 26dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|---|---|
| 11a | 6Mbps | 36 | 5180 | 27.46 | 17.396 |
| 11a | 6Mbps | 44 | 5220 | 29.23 | 17.379 |
| 11a | 6Mbps | 48 | 5240 | 26.23 | 17.526 |
| 11a | 6Mbps | 52 | 5260 | 23.69 | 17.353 |
| 11a | 6Mbps | 60 | 5300 | 22.65 | 17.169 |
| 11a | 6Mbps | 64 | 5320 | 24.64 | 17.195 |
| 11a | 6Mbps | 100 | 5500 | 25.84 | 17.211 |
| 11a | 6Mbps | 116 | 5580 | 25.44 | 17.219 |
| 11a | 6Mbps | 140 | 5700 | 21.54 | 16.910 |
| 11a | 6Mbps | 144 | 5720 | 24.29 | 17.294 |
| 11a | 6Mbps | 149 | 5745 | 29.56 | 17.486 |
| 11a | 6Mbps | 157 | 5785 | 31.33 | 17.584 |
| 11a | 6Mbps | 165 | 5825 | 38.74 | 19.447 |
| 11ac-VHT20 | MCS0 | 36 | 5180 | 25.78 | 18.450 |
| 11ac-VHT20 | MCS0 | 44 | 5220 | 34.65 | 18.846 |
| 11ac-VHT20 | MCS0 | 48 | 5240 | 37.61 | 18.784 |
| 11ac-VHT20 | MCS0 | 52 | 5260 | 23.96 | 18.124 |
| 11ac-VHT20 | MCS0 | 60 | 5300 | 22.72 | 18.100 |
| 11ac-VHT20 | MCS0 | 64 | 5320 | 26.47 | 18.252 |
| 11ac-VHT20 | MCS0 | 100 | 5500 | 24.26 | 18.246 |
| 11ac-VHT20 | MCS0 | 116 | 5580 | 24.03 | 18.230 |
| 11ac-VHT20 | MCS0 | 140 | 5700 | 21.63 | 18.055 |
| 11ac-VHT20 | MCS0 | 144 | 5720 | 25.51 | 18.247 |
| 11ac-VHT20 | MCS0 | 149 | 5745 | 37.43 | 19.124 |
| 11ac-VHT20 | MCS0 | 157 | 5785 | 36.49 | 19.170 |
| 11ac-VHT20 | MCS0 | 165 | 5825 | 38.50 | 19.716 |

| Test Mode | Data Rate/ MCS | Channel No. | Frequency (MHz) | 26dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|---|---|
| 11ac-VHT40 | MCS0 | 38 | 5190 | 53.58 | 36.626 |
| 11ac-VHT40 | MCS0 | 46 | 5230 | 54.97 | 36.394 |
| 11ac-VHT40 | MCS0 | 54 | 5270 | 45.55 | 36.482 |
| 11ac-VHT40 | MCS0 | 62 | 5310 | 55.15 | 36.619 |
| 11ac-VHT40 | MCS0 | 102 | 5510 | 52.45 | 36.692 |
| 11ac-VHT40 | MCS0 | 110 | 5550 | 55.08 | 36.653 |
| 11ac-VHT40 | MCS0 | 134 | 5670 | 44.37 | 36.531 |
| 11ac-VHT40 | MCS0 | 142 | 5710 | 44.54 | 36.398 |
| 11ac-VHT40 | MCS0 | 151 | 5755 | 78.20 | 37.418 |
| 11ac-VHT40 | MCS0 | 159 | 5795 | 78.62 | 38.634 |
| 11ac-VHT80 | MCS0 | 42 | 5210 | 91.23 | 76.067 |
| 11ac-VHT80 | MCS0 | 58 | 5290 | 97.17 | 75.998 |
| 11ac-VHT80 | MCS0 | 106 | 5530 | 98.91 | 76.085 |
| 11ac-VHT80 | MCS0 | 122 | 5610 | 88.16 | 76.005 |
| 11ac-VHT80 | MCS0 | 138 | 5690 | 84.23 | 75.917 |
| 11ac-VHT80 | MCS0 | 155 | 5775 | 97.49 | 75.999 |
| 11ac-VHT160 | MCS0 | 50 | 5250 | 165.3 | 154.47 |
| 11ac-VHT160 | MCS0 | 114 | 5570 | 188.1 | 154.99 |
| 11be-EHT20 | MCS0 | 36 | 5180 | 26.33 | 19.165 |
| 11be-EHT20 | MCS0 | 44 | 5220 | 29.09 | 19.212 |
| 11be-EHT20 | MCS0 | 48 | 5240 | 25.93 | 19.241 |
| 11be-EHT20 | MCS0 | 52 | 5260 | 24.24 | 19.215 |
| 11be-EHT20 | MCS0 | 60 | 5300 | 23.40 | 19.212 |
| 11be-EHT20 | MCS0 | 64 | 5320 | 23.98 | 19.217 |
| 11be-EHT20 | MCS0 | 100 | 5500 | 24.13 | 19.305 |
| 11be-EHT20 | MCS0 | 116 | 5580 | 21.62 | 19.167 |
| 11be-EHT20 | MCS0 | 140 | 5700 | 21.51 | 19.118 |
| 11be-EHT20 | MCS0 | 144 | 5720 | 24.05 | 19.235 |
| 11be-EHT20 | MCS0 | 149 | 5745 | 29.10 | 19.246 |
| 11be-EHT20 | MCS0 | 157 | 5785 | 34.36 | 19.401 |
| 11be-EHT20 | MCS0 | 165 | 5825 | 38.00 | 19.997 |

| Test Mode | Data Rate/ MCS | Channel No. | Frequency (MHz) | 26dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|---|---|
| 11be-EHT40 | MCS0 | 38 | 5190 | 41.90 | 37.862 |
| 11be-EHT40 | MCS0 | 46 | 5230 | 77.29 | 38.371 |
| 11be-EHT40 | MCS0 | 54 | 5270 | 45.44 | 37.954 |
| 11be-EHT40 | MCS0 | 62 | 5310 | 43.22 | 37.929 |
| 11be-EHT40 | MCS0 | 102 | 5510 | 42.75 | 37.895 |
| 11be-EHT40 | MCS0 | 110 | 5550 | 42.67 | 37.919 |
| 11be-EHT40 | MCS0 | 134 | 5670 | 44.78 | 37.918 |
| 11be-EHT40 | MCS0 | 142 | 5710 | 45.16 | 37.919 |
| 11be-EHT40 | MCS0 | 151 | 5755 | 79.94 | 39.648 |
| 11be-EHT40 | MCS0 | 159 | 5795 | 73.68 | 38.470 |
| 11be-EHT80 | MCS0 | 42 | 5210 | 84.45 | 77.312 |
| 11be-EHT80 | MCS0 | 58 | 5290 | 86.28 | 77.411 |
| 11be-EHT80 | MCS0 | 106 | 5530 | 88.11 | 77.429 |
| 11be-EHT80 | MCS0 | 122 | 5610 | 83.50 | 77.290 |
| 11be-EHT80 | MCS0 | 138 | 5690 | 83.71 | 77.505 |
| 11be-EHT80 | MCS0 | 155 | 5775 | 144.8 | 78.438 |
| 11be-EHT160 | MCS0 | 50 | 5250 | 164.4 | 155.86 |
| 11be-EHT160 | MCS0 | 114 | 5570 | 162.9 | 156.21 |

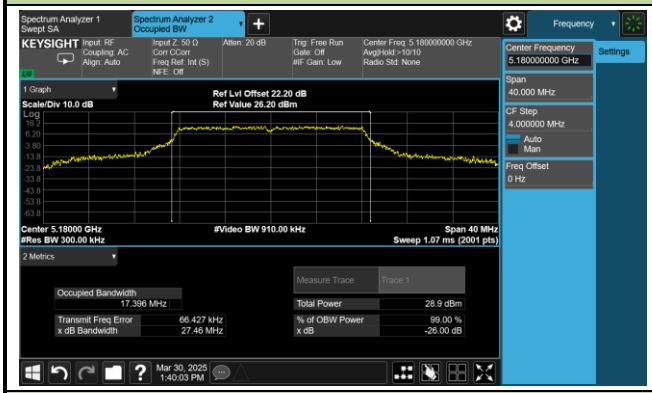
| Test Mode | Data Rate/ MCS | Channel No. | Frequency (MHz) | $F_H$ (MHz) | Limit (MHz) |
|---|---|---|---|---|---|
| 802.11a | 6Mbps | 48 | 5240 | 5248.76 | < 5250 |
| 802.11ac-VHT20 | MCS0 | 48 | 5240 | 5249.39 | < 5250 |
| 802.11ac-VHT40 | MCS0 | 46 | 5230 | 5248.20 | < 5250 |
| 802.11ac-VHT80 | MCS0 | 42 | 5210 | 5248.03 | < 5250 |
| 802.11be-EHT20 | MCS0 | 48 | 5240 | 5249.62 | < 5250 |
| 802.11be-EHT40 | MCS0 | 46 | 5230 | 5249.19 | < 5250 |
| 802.11be-EHT80 | MCS0 | 42 | 5210 | 5248.66 | < 5250 |

Note: $F_H$ = Centre frequency + 99% OBW / 2.

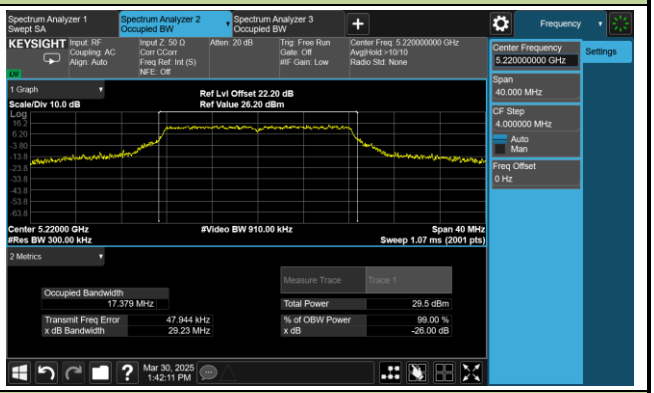
For example, 802.11a 5240MHz, $F_H$ = 5240 MHz + 17.526 MHz / 2 = 5248.76 MHz.

## 802.11a 26dB Bandwidth & 99% Bandwidth

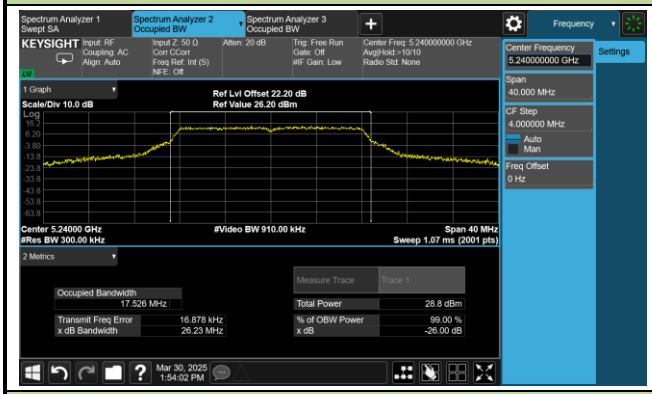
### Channel 36 (5180MHz)



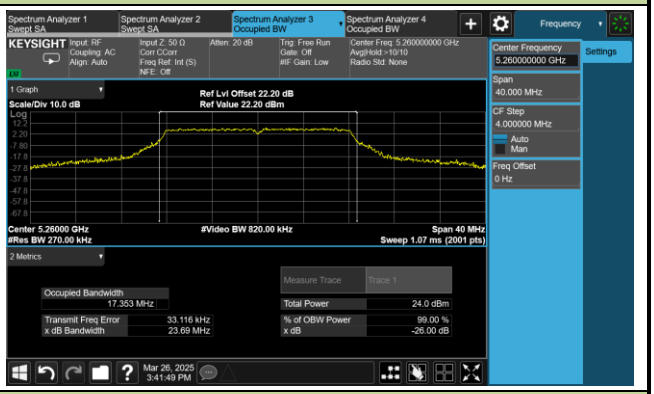

### Channel 44 (5220MHz)



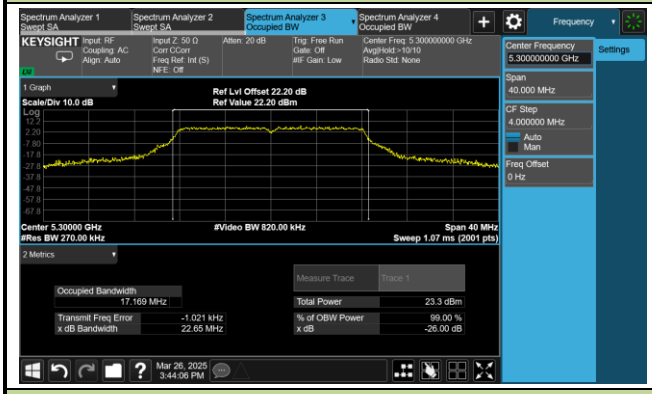

### Channel 48 (5240MHz)



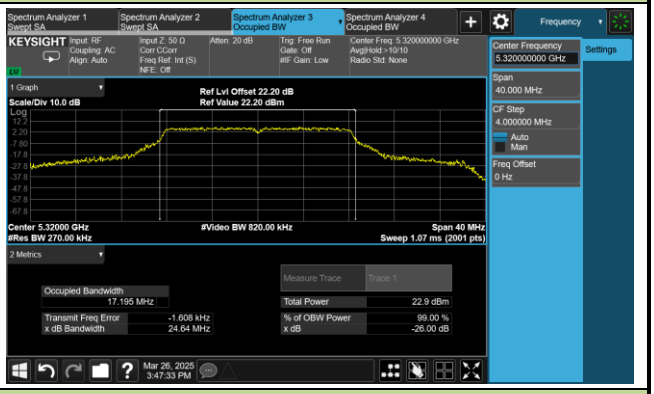

### Channel 52 (5260MHz)



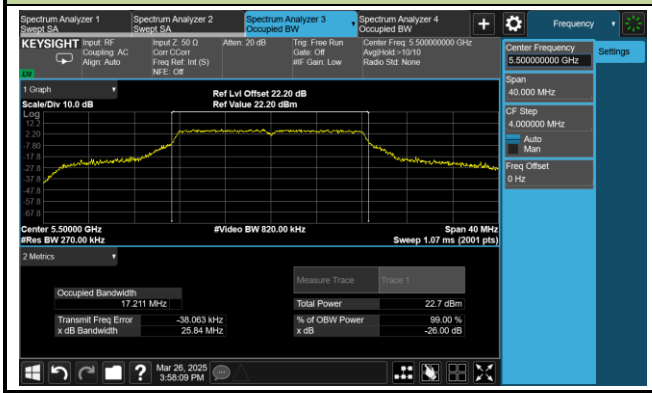

### Channel 60 (5300MHz)



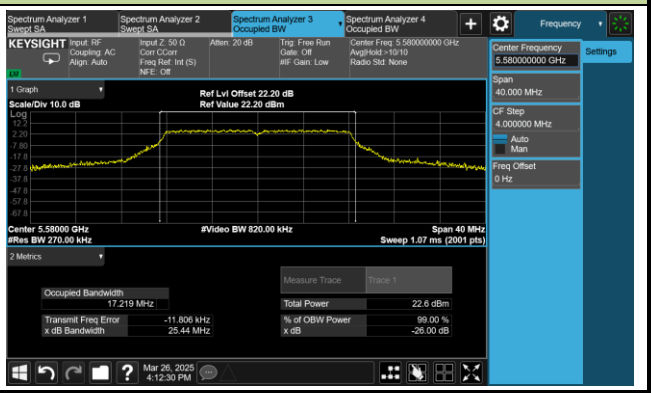

### Channel 64 (5320MHz)

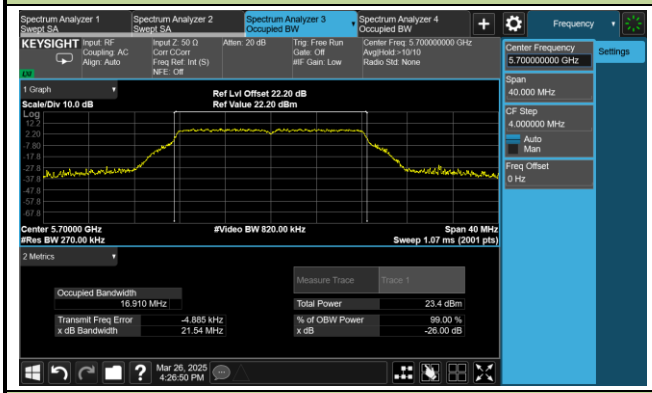
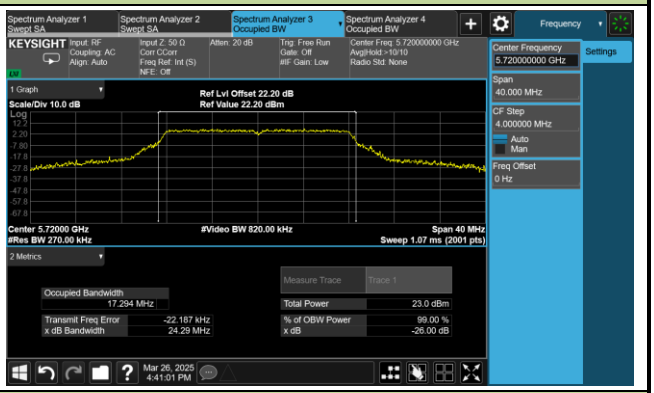
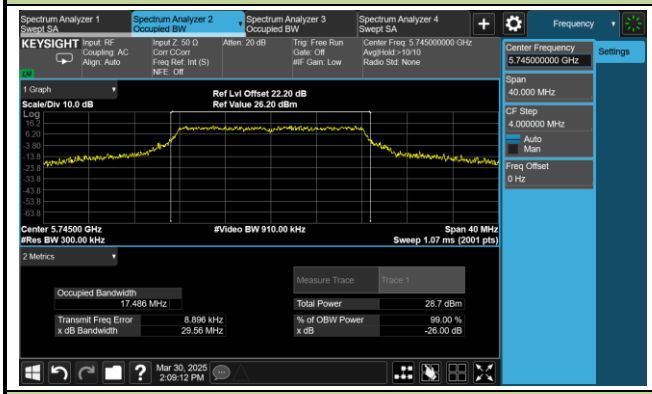
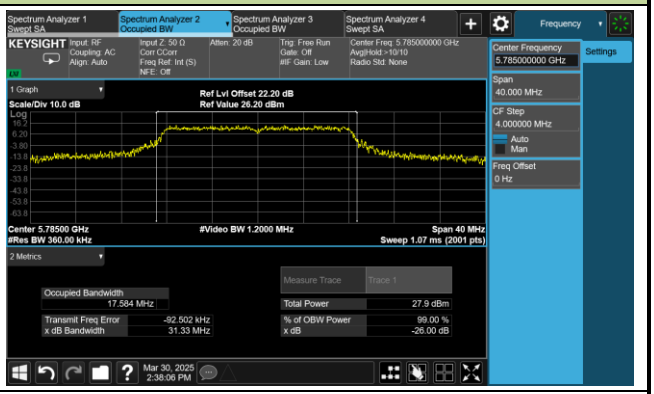
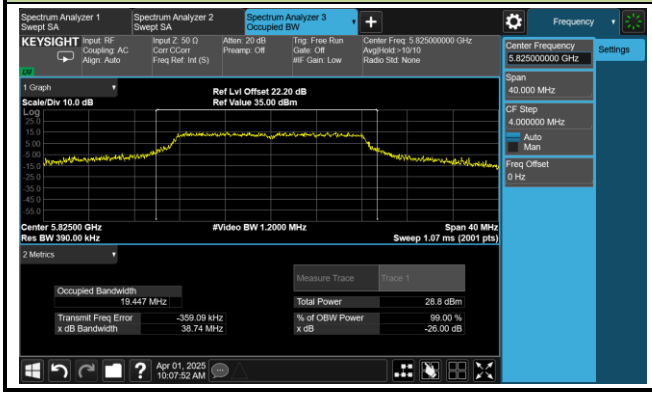



### Channel 100 (5500MHz)



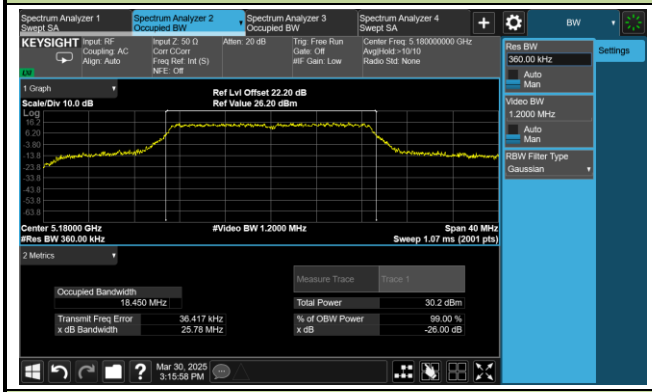

### Channel 116 (5580MHz)



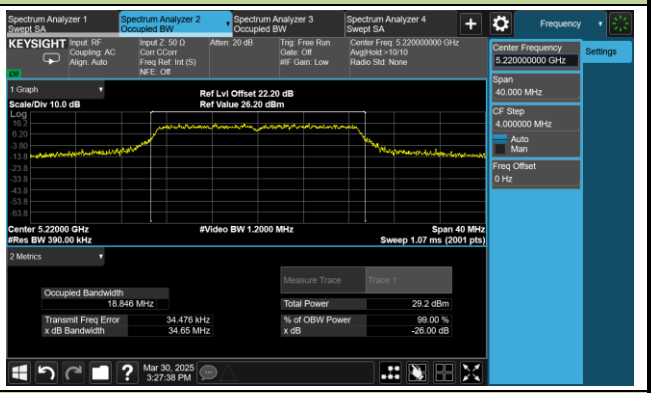
| 802.11a 26dB Bandwidth & 99% Bandwidth | |
|---|---|
| Channel 140 (5700MHz) | Channel 144(5720MHz) |
|  |  |
| Channel 149 (5745MHz) | Channel 157 (5785MHz) |
|  |  |
| Channel 165 (5825MHz) | |
|  | |

## 802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth

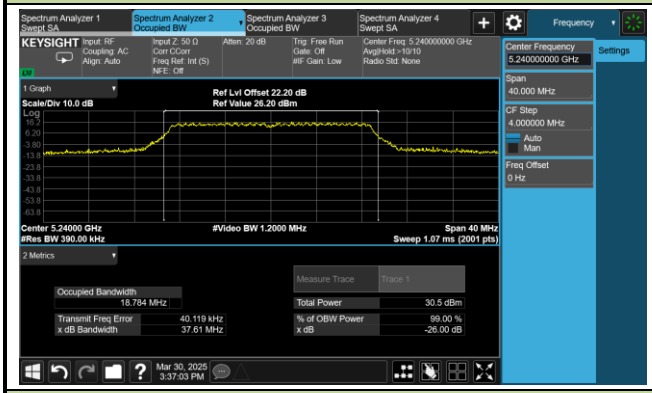
### Channel 36 (5180MHz)



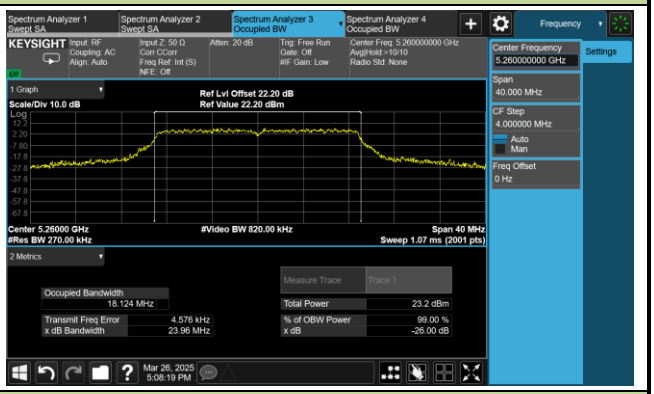

### Channel 44 (5220MHz)



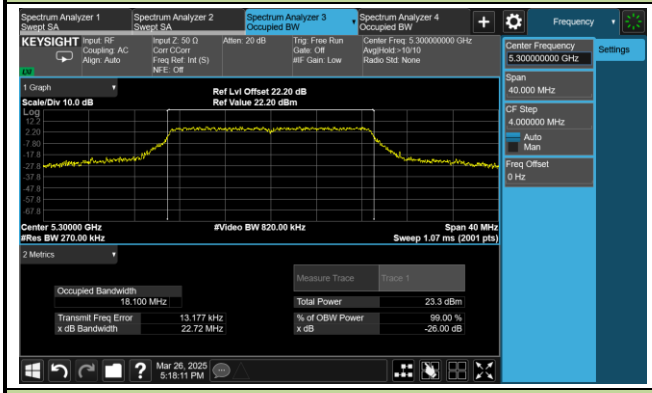

### Channel 48 (5240MHz)



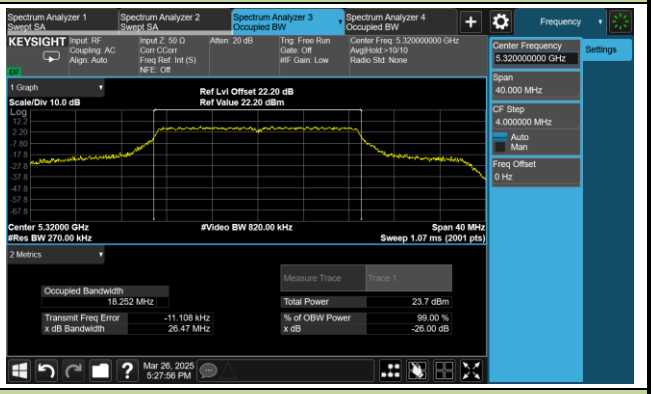

### Channel 52 (5260MHz)



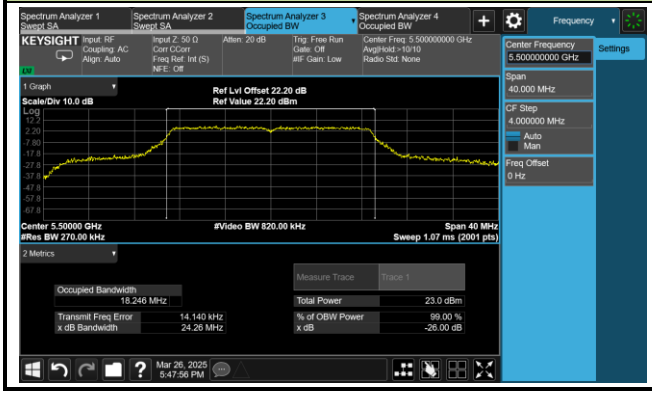

### Channel 60 (5300MHz)



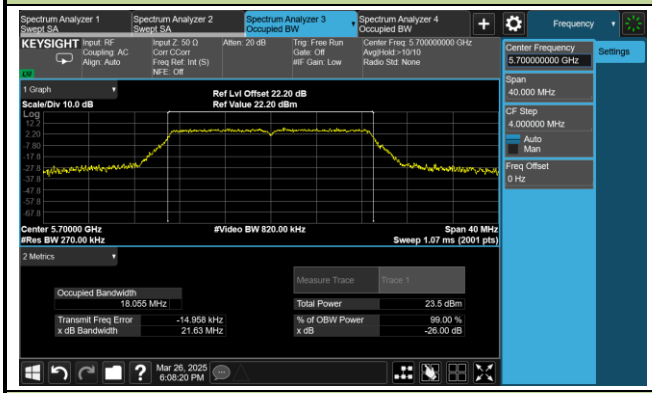
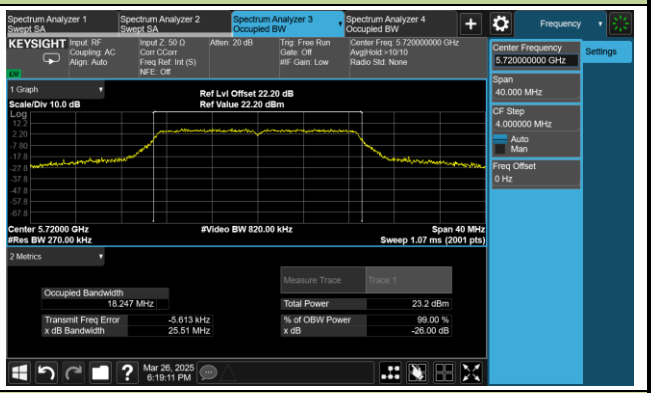
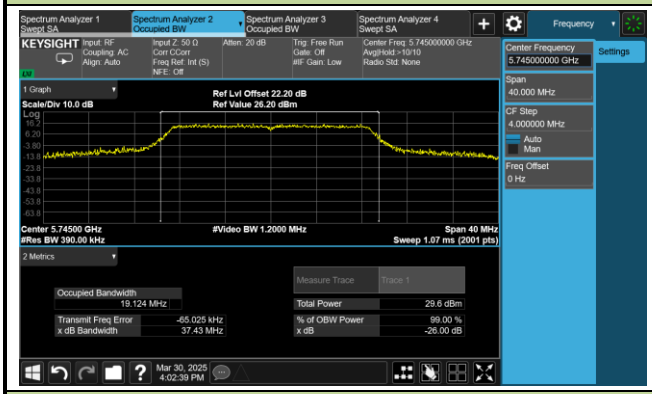
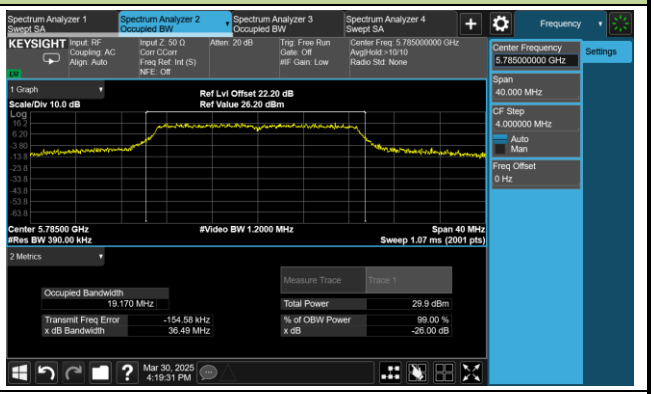
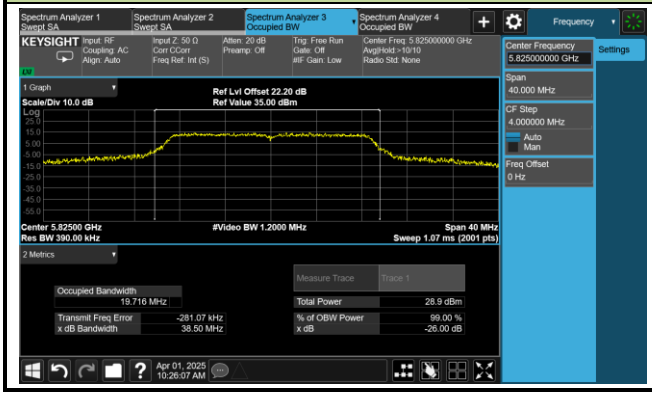

### Channel 64 (5320MHz)




### Channel 100 (5500MHz)

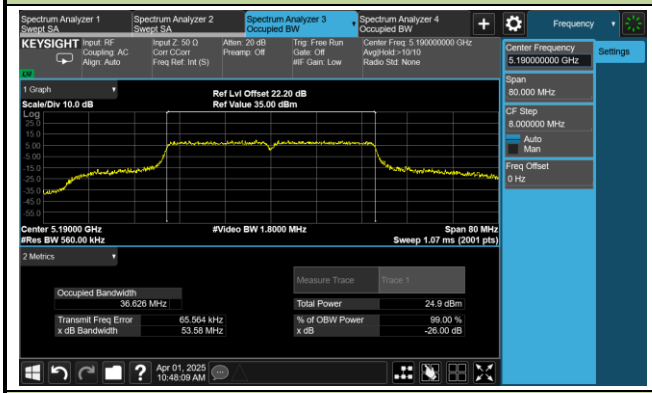



### Channel 116 (5580MHz)

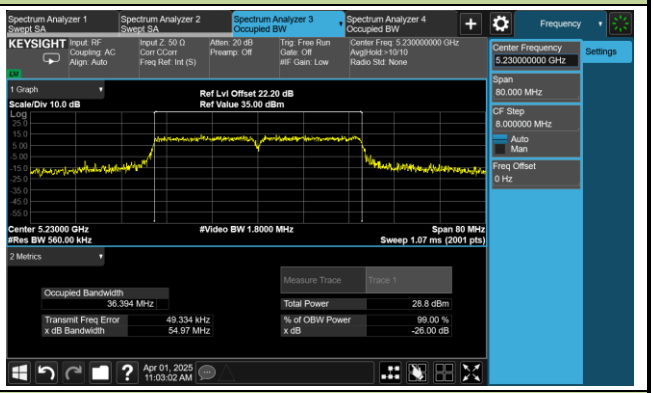
| 802.11ac-VHT20 26dB Bandwidth & 99% Bandwidth | |
|---|---|
| Channel 140 (5700MHz) | Channel 144(5720MHz) |
|  |  |
| Channel 149 (5745MHz) | Channel 157 (5785MHz) |
|  |  |
| Channel 165 (5825MHz) | |
|  | |

## 802.11ac-VHT40 26dB Bandwidth & 99% Bandwidth

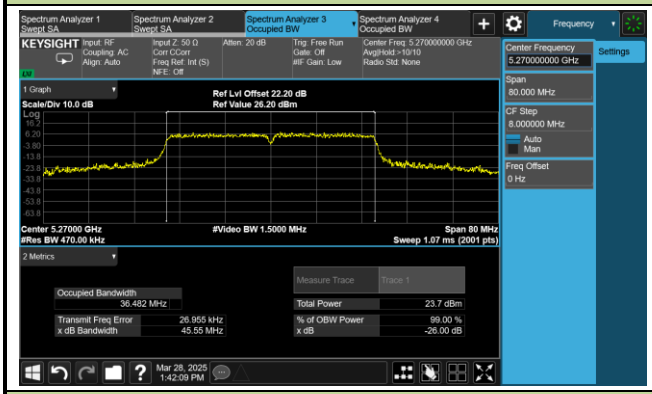
### Channel 38 (5190MHz)




### Channel 46 (5230MHz)

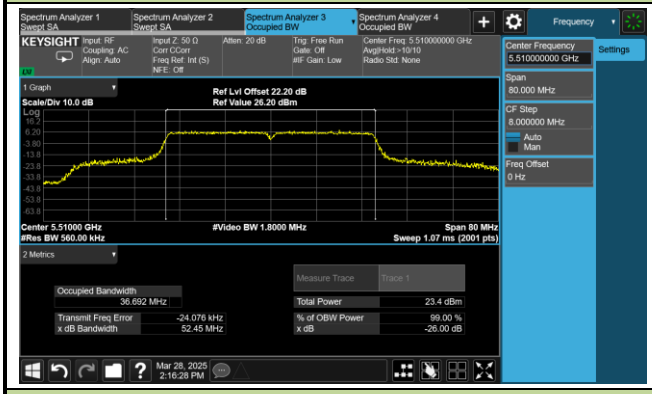



### Channel 54 (5270MHz)

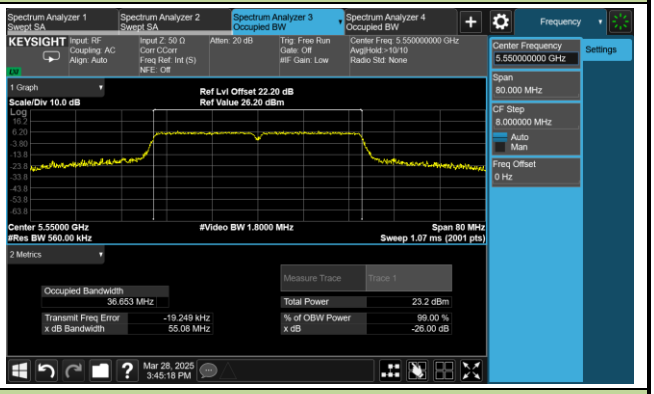



### Channel 62 (5310MHz)

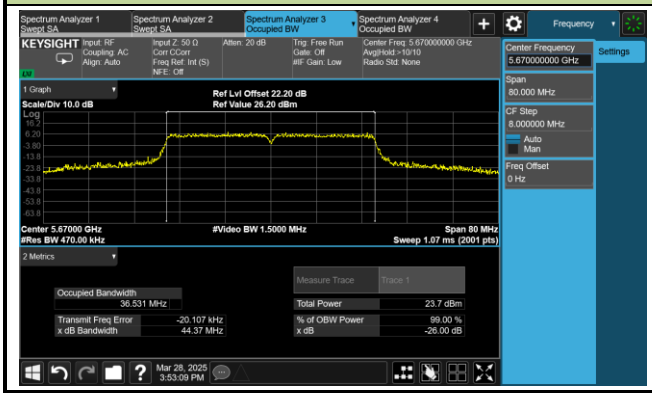
### Channel 102 (5510MHz)



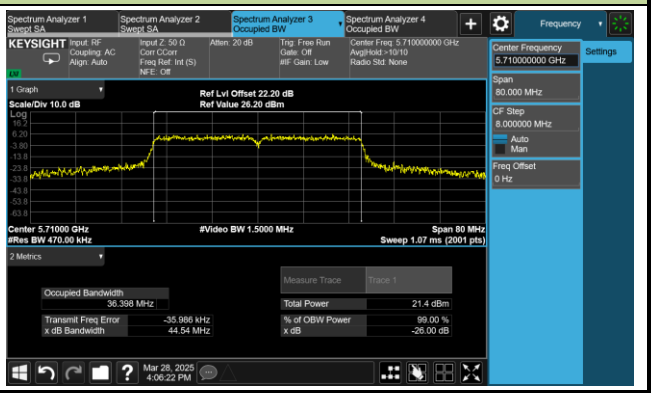

### Channel 110 (5550MHz)

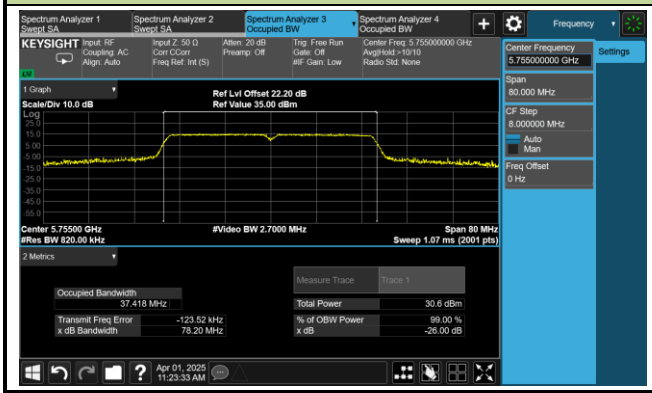
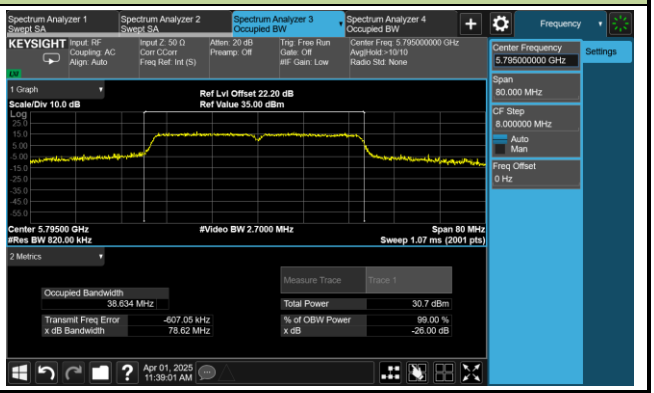


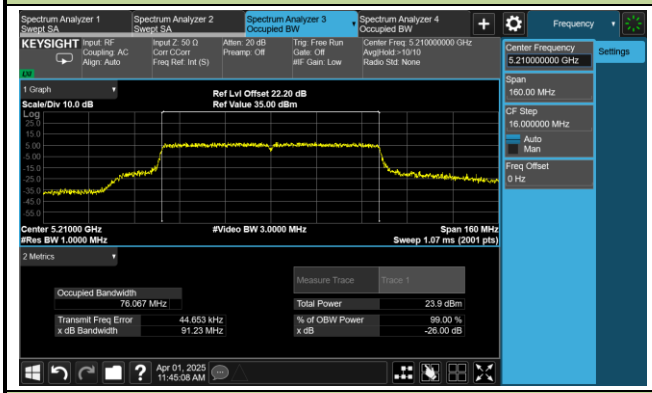
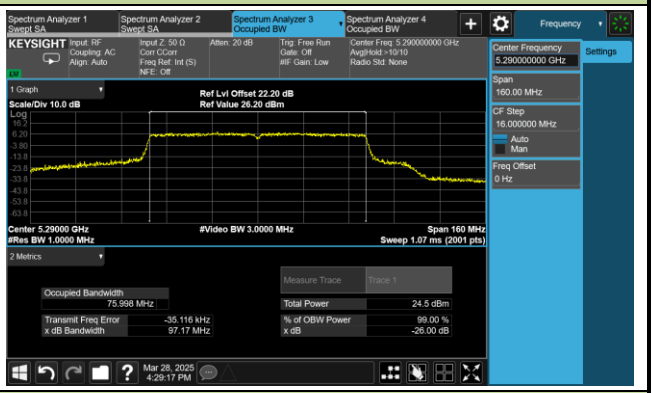
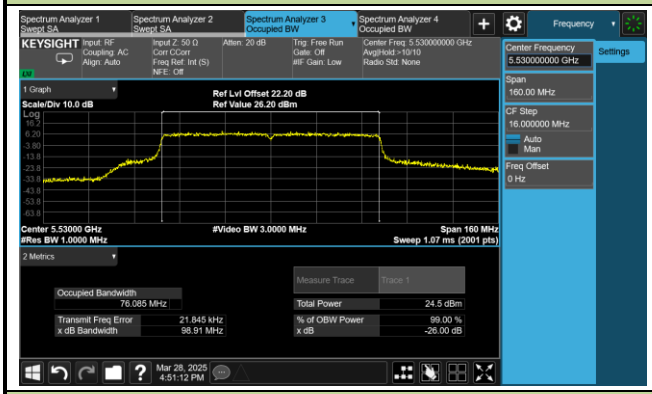
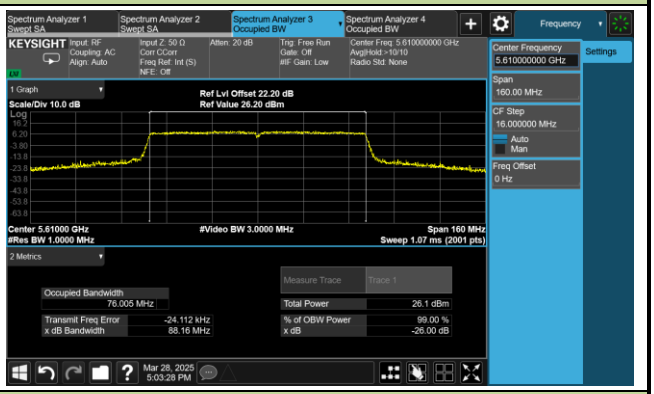
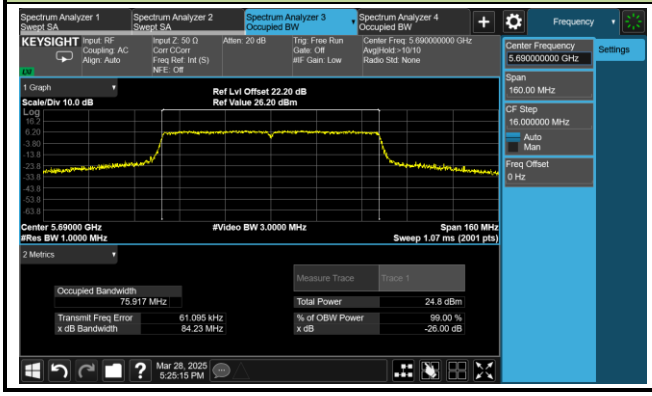
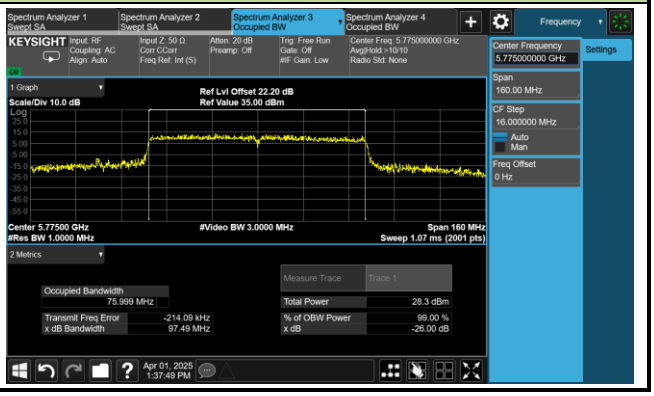

### Channel 134 (5670MHz)

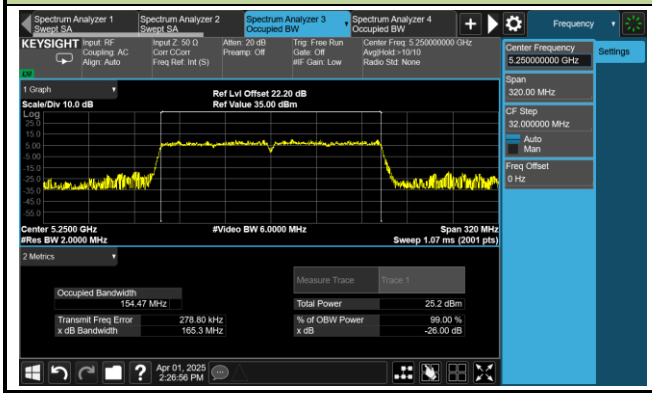
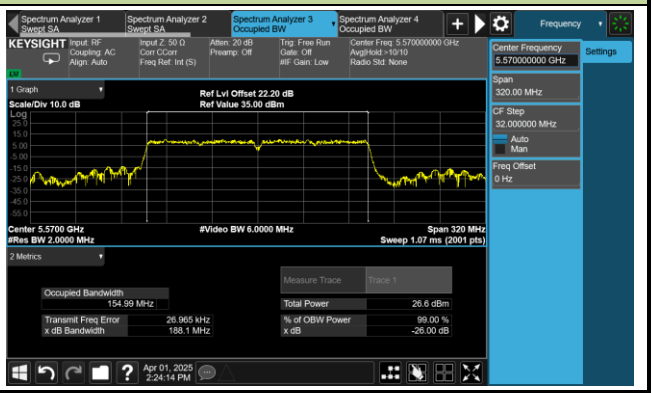



### Channel 142(5710MHz)



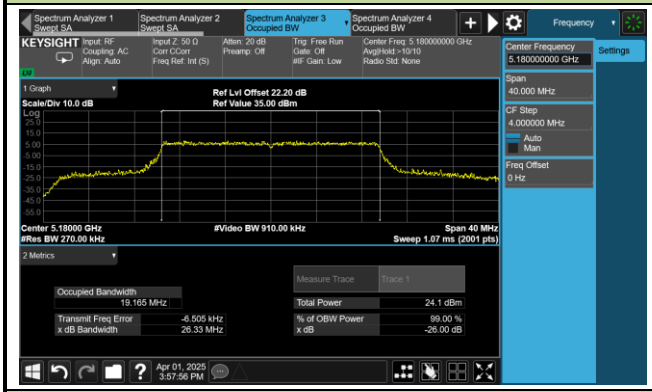
| 802.11ac-VHT40 26dB Bandwidth & 99% Bandwidth | |
|---|---|
| Channel 151 (5755MHz) | Channel 159 (5795MHz) |
|  |  |

| 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) |
|  |  |

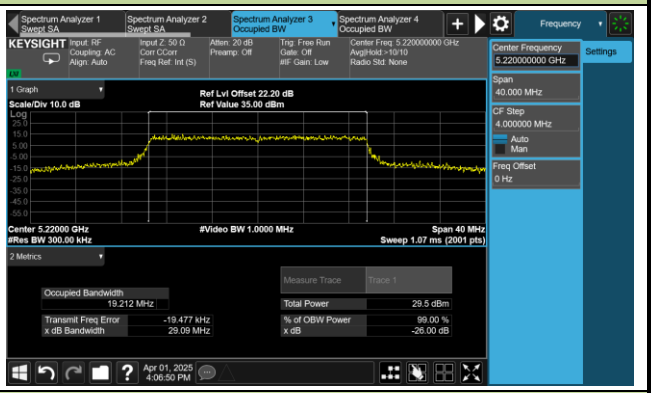
| 802.11ac-VHT160 26dB Bandwidth & 99% Bandwidth | |
|---|---|
| Channel 50 (5250MHz) | Channel 114 (5570MHz) |
|  |  |

## 802.11be-EHT20 26dB Bandwidth & 99% Bandwidth

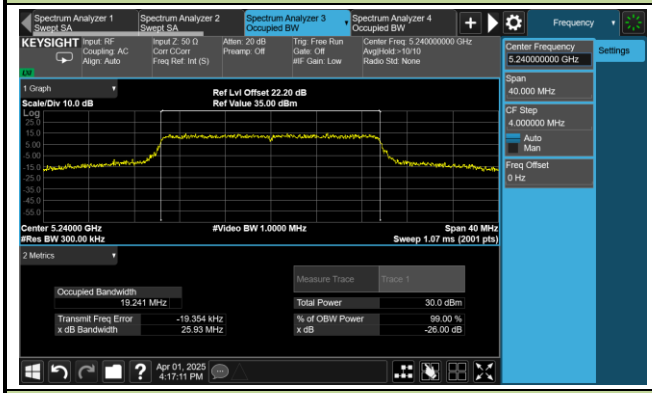
### Channel 36 (5180MHz)



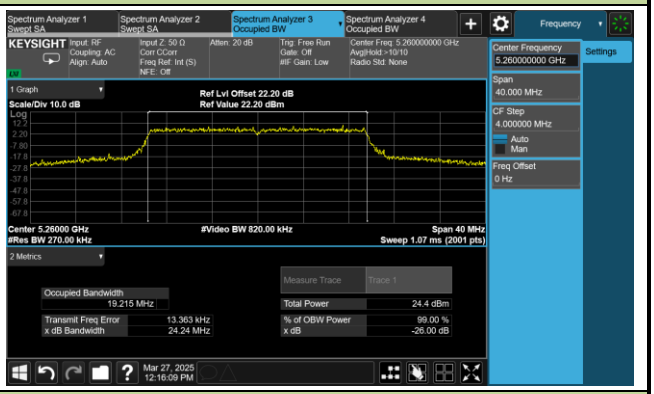

### Channel 44 (5220MHz)



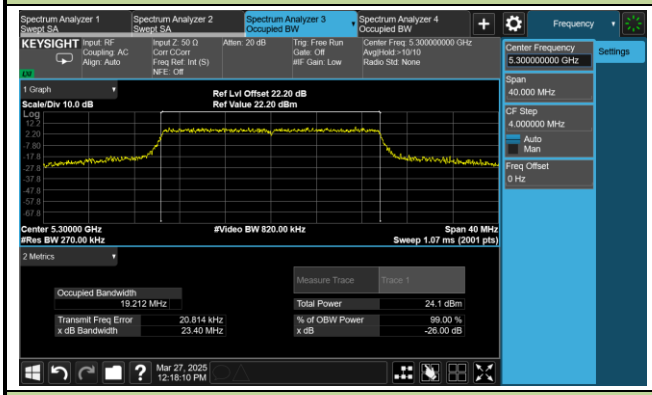

### Channel 48 (5240MHz)



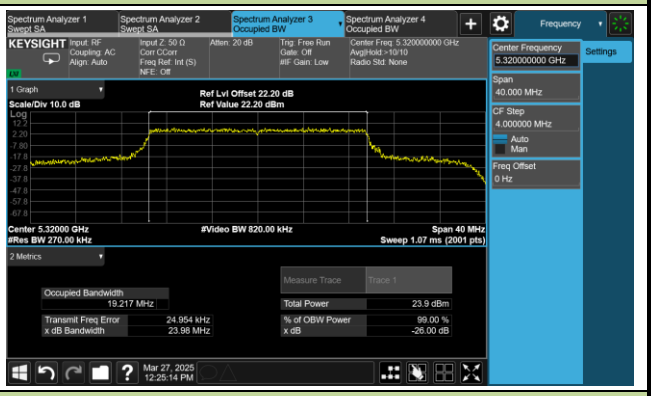

### Channel 52 (5260MHz)



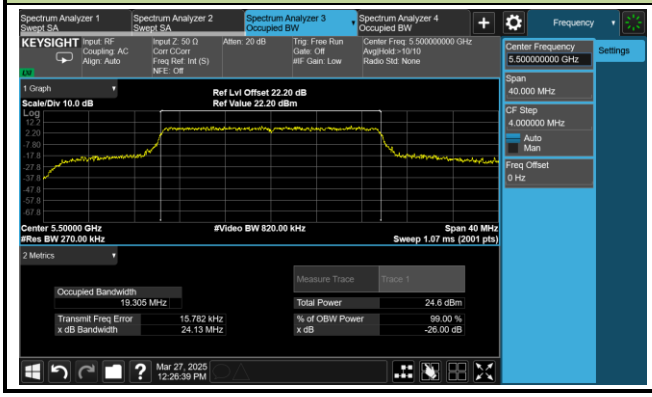

### Channel 60 (5300MHz)



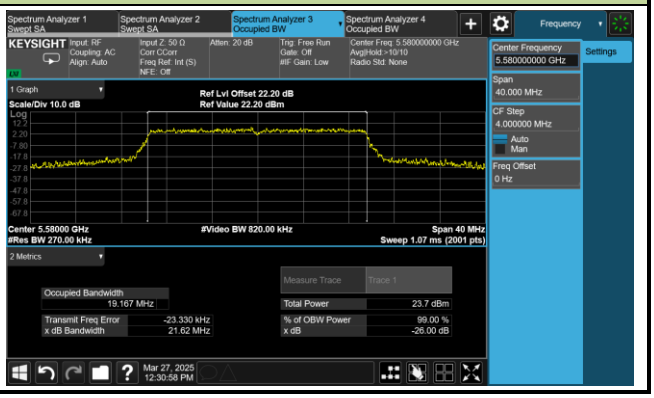

### Channel 64 (5320MHz)

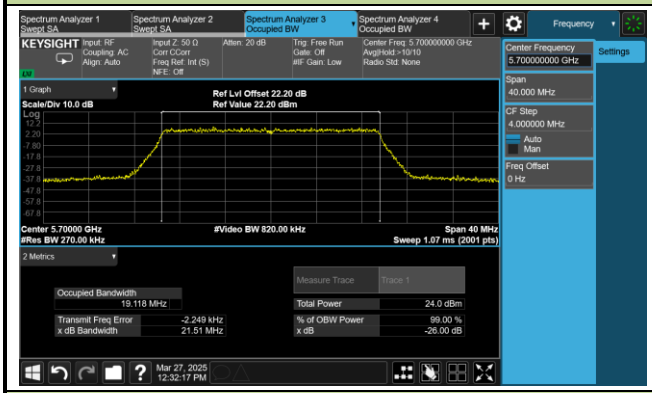
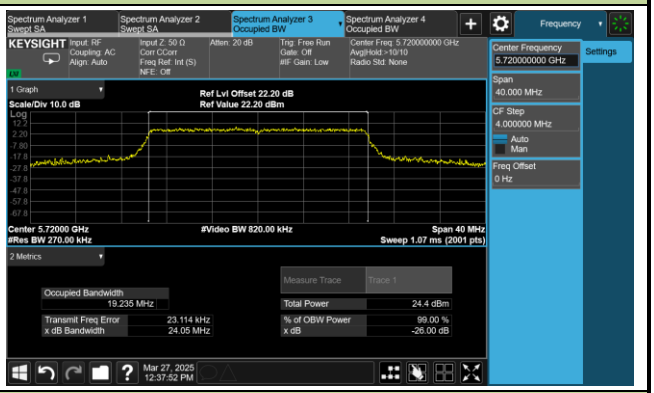
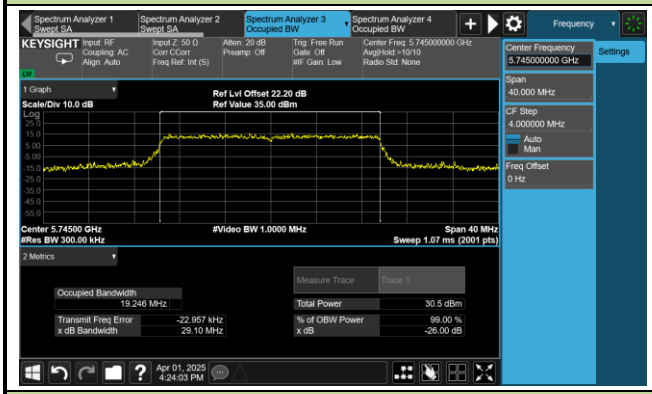
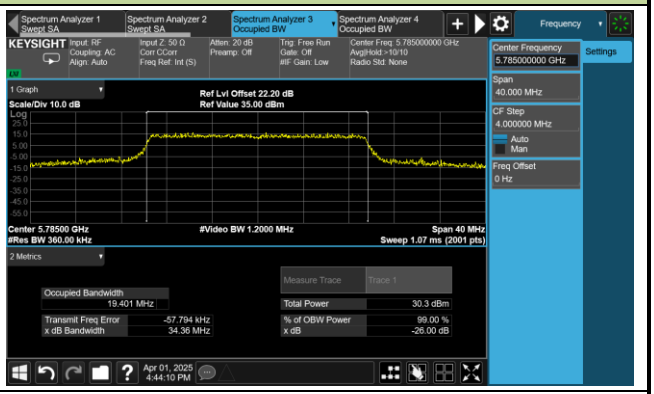
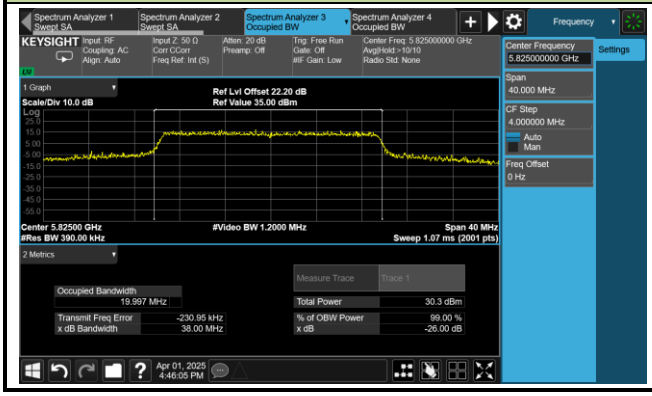



### Channel 100 (5500MHz)




### Channel 116 (5580MHz)



| 802.11be-EHT20 26dB Bandwidth & 99% Bandwidth | |
|---|---|
| Channel 140 (5700MHz) | Channel 144(5720MHz) |
|  |  |
| Channel 149 (5745MHz) | Channel 157 (5785MHz) |
|  |  |
| Channel 165 (5825MHz) | |
|  | |