

## RF TEST REPORT

**Applicant** Deer Management Systems LLC  
**FCC ID** 2BBNQ-RVG2  
**Product** Reveal X 2.0  
**Brand** Reveal  
**Model** Reveal X 2.0  
**Report No.** EFTA25040048-IE-01-R2  
**Issue Date** May 14, 2025

Eurofins TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2024)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

*Prepared by: Xu Ying*

*Approved by: Xu Kai*

**Eurofins TA Technology (Shanghai) Co., Ltd.**

*Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China*

*TEL: +86-021-50791141/2/3*

*FAX: +86-021-50791141/2/3-8000*

## TABLE OF CONTENT

|                                                     |     |
|-----------------------------------------------------|-----|
| 1. Test Laboratory .....                            | 4   |
| 1.1. Notes of the Test Report.....                  | 4   |
| 1.2. Test Facility .....                            | 4   |
| 1.3. Testing Location.....                          | 4   |
| 2. General Description of Equipment Under Test..... | 5   |
| 2.1. Applicant and Manufacturer Information .....   | 5   |
| 2.2. General Information .....                      | 5   |
| 3. Applied Standards .....                          | 6   |
| 4. Test Configuration .....                         | 7   |
| 5. Test Case Results .....                          | 8   |
| 5.1. Maximum output power .....                     | 8   |
| 5.2. 99% Bandwidth and 6dB Bandwidth .....          | 11  |
| 5.3. Band Edge .....                                | 31  |
| 5.4. Power Spectral Density .....                   | 44  |
| 5.5. Spurious RF Conducted Emissions.....           | 56  |
| 5.6. Unwanted Emission .....                        | 76  |
| 5.7. Conducted Emission .....                       | 117 |
| 6. Main Test Instruments.....                       | 122 |
| ANNEX A: The EUT Appearance.....                    | 123 |
| ANNEX B: Test Setup Photos .....                    | 124 |

## Summary of Measurement Results

| Number                                                                                                                                                                                                                                                                                         | Test Case                       | Clause in FCC rules        | Verdict |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------|---------|
| 1                                                                                                                                                                                                                                                                                              | Maximum output power            | 15.247(b)(3)               | PASS    |
| 2                                                                                                                                                                                                                                                                                              | 99% Bandwidth and 6dB Bandwidth | 15.247(a)(2)<br>C63.10 6.9 | PASS    |
| 3                                                                                                                                                                                                                                                                                              | Power spectral density          | 15.247(e)                  | PASS    |
| 4                                                                                                                                                                                                                                                                                              | Band Edge                       | 15.247(d)                  | PASS    |
| 5                                                                                                                                                                                                                                                                                              | Spurious RF Conducted Emissions | 15.247(d)                  | PASS    |
| 6                                                                                                                                                                                                                                                                                              | Unwanted Emissions              | 15.247(d), 15.205, 15.209  | PASS    |
| 7                                                                                                                                                                                                                                                                                              | Conducted Emissions             | 15.207                     | PASS    |
| Date of Testing: April 17, 2025 ~ April 23, 2025                                                                                                                                                                                                                                               |                                 |                            |         |
| Date of Sample Received: April 14, 2025                                                                                                                                                                                                                                                        |                                 |                            |         |
| Note: All indications of Pass/Fail in this report are opinions expressed by Eurofins TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. |                                 |                            |         |

## 1. Test Laboratory

### 1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **Eurofins TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

### 1.2. Test Facility

#### **FCC (Designation number: CN1179, Test Firm Registration Number: 446626)**

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

#### **A2LA (Certificate Number: 3857.01)**

Eurofins TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

### 1.3. Testing Location

Company: Eurofins TA Technology (Shanghai) Co., Ltd.  
Address: Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China  
City: Shanghai  
Post code: 201201  
Country: P. R. China  
Contact: Xu Kai  
Telephone: +86-021-50791141/2/3  
Fax: +86-021-50791141/2/3-8000  
Website: <https://www.eurofins.com/electrical-and-electronics>  
E-mail: Kain.Xu@cpt.eurofinscn.com

## 2. General Description of Equipment Under Test

### 2.1. Applicant and Manufacturer Information

|                      |                                         |
|----------------------|-----------------------------------------|
| Applicant            | Deer Management Systems LLC             |
| Applicant address    | 1668 Jordan West Road Decorah, IA 52101 |
| Manufacturer         | Deer Management Systems LLC             |
| Manufacturer address | 1668 Jordan West Road Decorah, IA 52101 |

### 2.2. General Information

| EUT Description                                                                                                         |                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Model                                                                                                                   | Reveal X 2.0                                                                                              |
| Lab internal SN                                                                                                         | EFTA25040048-IE-02/S01                                                                                    |
| HW Version                                                                                                              | P2                                                                                                        |
| SW Version                                                                                                              | 1.0.4.7                                                                                                   |
| Power Supply                                                                                                            | External power supply                                                                                     |
| Antenna Type                                                                                                            | Internal Antenna                                                                                          |
| Antenna Connector                                                                                                       | A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)                       |
| Antenna Gain                                                                                                            | Wi-Fi 2.4GHz: 3.39 dBi<br>Bluetooth LE: 2.56 dBi                                                          |
| Additional Beamforming Gain                                                                                             | NA                                                                                                        |
| Operating Frequency Range(s)                                                                                            | 802.11b/g/n(HT20): 2412 ~ 2462 MHz<br>802.11n(HT40): 2422 ~ 2452 MHz<br>Bluetooth LE V5.3: 2402 ~2480 MHz |
| Modulation Type                                                                                                         | 802.11b: DSSS<br>802.11g/n: OFDM<br>Bluetooth LE: GFSK                                                    |
| Max. Output Power                                                                                                       | Wi-Fi 2.4GHz: 13.38 dBm<br>Bluetooth LE: 3.22 dBm                                                         |
| Operating voltage range                                                                                                 | 6.0 Vdc to 12.0 Vdc                                                                                       |
| State voltage                                                                                                           | 9.0 Vdc                                                                                                   |
| Note: 1. The EUT is sent from the applicant to Eurofins TA and the information of the EUT is declared by the applicant. |                                                                                                           |

### 3. Applied Standards

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

**Test standards:**

**FCC CFR47 Part 15C (2024) Radio Frequency Devices**

**ANSI C63.10-2013**

**Reference standard:**

**KDB 558074 D01 15.247 Meas Guidance v05r02**

## 4. Test Configuration

### Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the loop antenna is vertical, the others are vertical and horizontal. and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate. Preliminary tests have been done on all the configuration for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates are shown as following table.

| Test Mode             | Data Rate    |
|-----------------------|--------------|
| Bluetooth(Low Energy) | 1Mbps; 2Mbps |
| 802.11b               | 1 Mbps       |
| 802.11g               | 6 Mbps       |
| 802.11n HT20          | MCS0         |
| 802.11n HT40          | MCS0         |

## 5. Test Case Results

### 5.1. Maximum output power

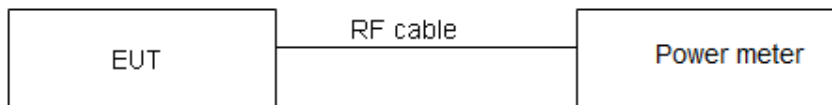
#### Ambient Condition

| Temperature | Relative humidity |
|-------------|-------------------|
| 15°C ~ 35°C | 20% ~ 80%         |

#### Methods of Measurement

During the process of the testing, The EUT was connected to Power meter with a known loss. The EUT is max power transmission with proper modulation.

#### Test Setup



#### Limits

Rule Part 15.247 (b) (3) specifies that " For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz: 1 Watt."

| Average Output Power | $\leq 1\text{W}$ (30dBm) |
|----------------------|--------------------------|
|----------------------|--------------------------|

#### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 2$ ,  $U = 0.44$  dB.

## Test Results

| Power Index |         |         |              |         |              |
|-------------|---------|---------|--------------|---------|--------------|
| Channel     | 802.11b | 802.11g | 802.11n HT20 | Channel | 802.11n HT40 |
| CH1         | 33      | 40      | 38           | CH3     | 33           |
| CH6         | 25      | 34      | 32           | CH6     | 33           |
| CH11        | 25      | 34      | 32           | CH9     | 34           |

| Power Index |                        |
|-------------|------------------------|
| Channel     | Bluetooth (Low Energy) |
| CH0         | 3                      |
| CH19        | 3                      |
| CH39        | 3                      |

| Test Mode                                                                      | Duty cycle | Duty cycle correction Factor (dB) |
|--------------------------------------------------------------------------------|------------|-----------------------------------|
| 802.11b                                                                        | 0.99       | 0.00                              |
| 802.11g                                                                        | 0.95       | 0.20                              |
| 802.11n HT20                                                                   | 0.93       | 0.30                              |
| 802.11n HT40                                                                   | 0.944      | 0.248                             |
| Bluetooth LE (1M)                                                              | 0.63       | 2.00                              |
| Bluetooth LE (2M)                                                              | 0.34       | 4.74                              |
| Note: when Duty cycle $\geq 0.98$ , Duty cycle correction Factor not required. |            |                                   |

| Test Mode                                                                                   | Carrier frequency (MHz)/ Channel | Average Power Measured (dBm) | Average Power with duty factor (dBm) | Limit (dBm) | Conclusion |
|---------------------------------------------------------------------------------------------|----------------------------------|------------------------------|--------------------------------------|-------------|------------|
| 802.11b                                                                                     | 2412/CH 1                        | 13.38                        | 13.38                                | 30          | PASS       |
|                                                                                             | 2437/CH 6                        | 13.27                        | 13.27                                | 30          | PASS       |
|                                                                                             | 2462/CH11                        | 13.31                        | 13.31                                | 30          | PASS       |
| 802.11g                                                                                     | 2412/CH 1                        | 11.12                        | 11.32                                | 30          | PASS       |
|                                                                                             | 2437/CH 6                        | 11.20                        | 11.40                                | 30          | PASS       |
|                                                                                             | 2462/CH11                        | 11.07                        | 11.27                                | 30          | PASS       |
| 802.11n<br>HT20                                                                             | 2412/CH 1                        | 10.09                        | 10.38                                | 30          | PASS       |
|                                                                                             | 2437/CH 6                        | 10.31                        | 10.61                                | 30          | PASS       |
|                                                                                             | 2462/CH11                        | 9.91                         | 10.21                                | 30          | PASS       |
| 802.11n<br>HT40                                                                             | 2422/CH3                         | 10.30                        | 10.55                                | 30          | PASS       |
|                                                                                             | 2437/CH6                         | 10.33                        | 10.58                                | 30          | PASS       |
|                                                                                             | 2452/CH9                         | 10.13                        | 10.37                                | 30          | PASS       |
| Bluetooth<br>(Low Energy)<br>(1M)                                                           | 2402/CH0                         | 1.07                         | 3.07                                 | 30          | PASS       |
|                                                                                             | 2440/CH19                        | 1.08                         | 3.08                                 | 30          | PASS       |
|                                                                                             | 2480/CH39                        | 1.22                         | 3.22                                 | 30          | PASS       |
| Bluetooth<br>(Low Energy)<br>(2M)                                                           | 2402/CH0                         | -1.79                        | 2.96                                 | 30          | PASS       |
|                                                                                             | 2440/CH19                        | -1.57                        | 3.17                                 | 30          | PASS       |
|                                                                                             | 2480/CH39                        | -1.54                        | 3.21                                 | 30          | PASS       |
| Note: Average Power with duty factor = Average Power Measured +Duty cycle correction factor |                                  |                              |                                      |             |            |

## 5.2. 99% Bandwidth and 6dB Bandwidth

### Ambient Condition

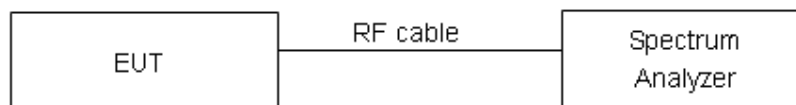
| Temperature | Relative humidity |
|-------------|-------------------|
| 15°C ~ 35°C | 20% ~ 80%         |

### Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 100 kHz; VBW is set to 300 kHz on spectrum analyzer. Dector=Peak, Trace mode=max hold.

The EUT was connected to the spectrum analyzer through a known loss cable. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value.

### Test Setup



### Limits

Rule Part 15.247 (a) (2) specifies that “Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.”

|                        |           |
|------------------------|-----------|
| minimum 6 dB bandwidth | ≥ 500 kHz |
|------------------------|-----------|

### Measurement Uncertainty

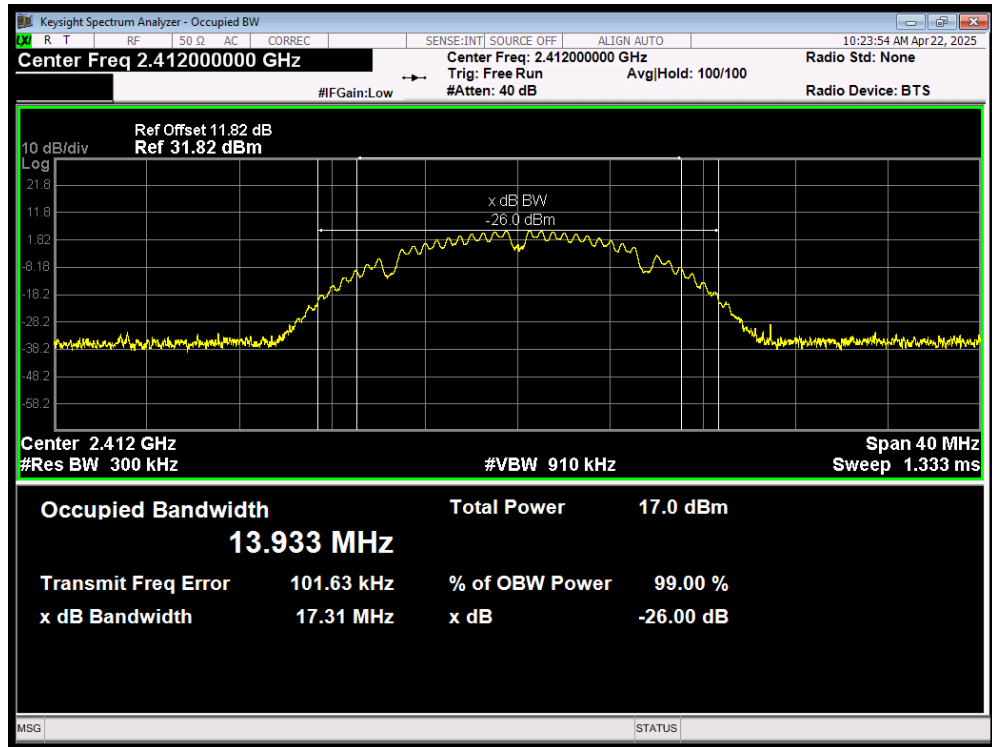
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 2$ ,  $U = 936$  Hz.

**Test Results:**

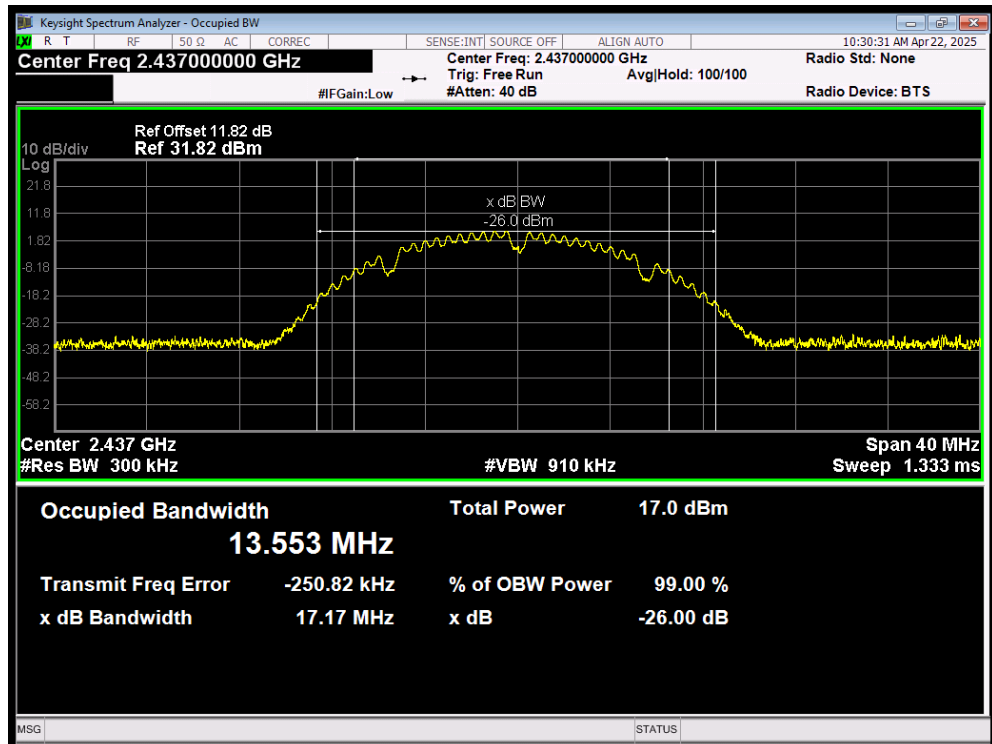
| Test Mode                   | Carrier frequency (MHz) | 99% bandwidth (MHz) | Minimum 6 dB bandwidth (MHz) | Limit (kHz) | Conclusion |
|-----------------------------|-------------------------|---------------------|------------------------------|-------------|------------|
| 802.11b                     | 2412                    | 13.933              | 8.972                        | 500         | PASS       |
|                             | 2437                    | 13.553              | 9.023                        | 500         | PASS       |
|                             | 2462                    | 13.099              | 8.080                        | 500         | PASS       |
| 802.11g                     | 2412                    | 17.032              | 16.432                       | 500         | PASS       |
|                             | 2437                    | 16.715              | 13.240                       | 500         | PASS       |
|                             | 2462                    | 16.397              | 14.165                       | 500         | PASS       |
| 802.11n HT20                | 2412                    | 18.057              | 17.636                       | 500         | PASS       |
|                             | 2437                    | 17.826              | 16.273                       | 500         | PASS       |
|                             | 2462                    | 17.507              | 14.043                       | 500         | PASS       |
| 802.11n HT40                | 2422                    | 35.864              | 25.024                       | 500         | PASS       |
|                             | 2437                    | 35.969              | 33.853                       | 500         | PASS       |
|                             | 2452                    | 36.249              | 35.432                       | 500         | PASS       |
| Bluetooth (Low Energy) (1M) | 2402                    | 1.039               | 0.672                        | 500         | PASS       |
|                             | 2440                    | 1.046               | 0.709                        | 500         | PASS       |
|                             | 2480                    | 1.048               | 0.693                        | 500         | PASS       |
| Bluetooth (Low Energy) (2M) | 2402                    | 2.050               | 1.125                        | 500         | PASS       |
|                             | 2440                    | 2.052               | 1.128                        | 500         | PASS       |
|                             | 2480                    | 2.056               | 1.120                        | 500         | PASS       |

99%bandwidth

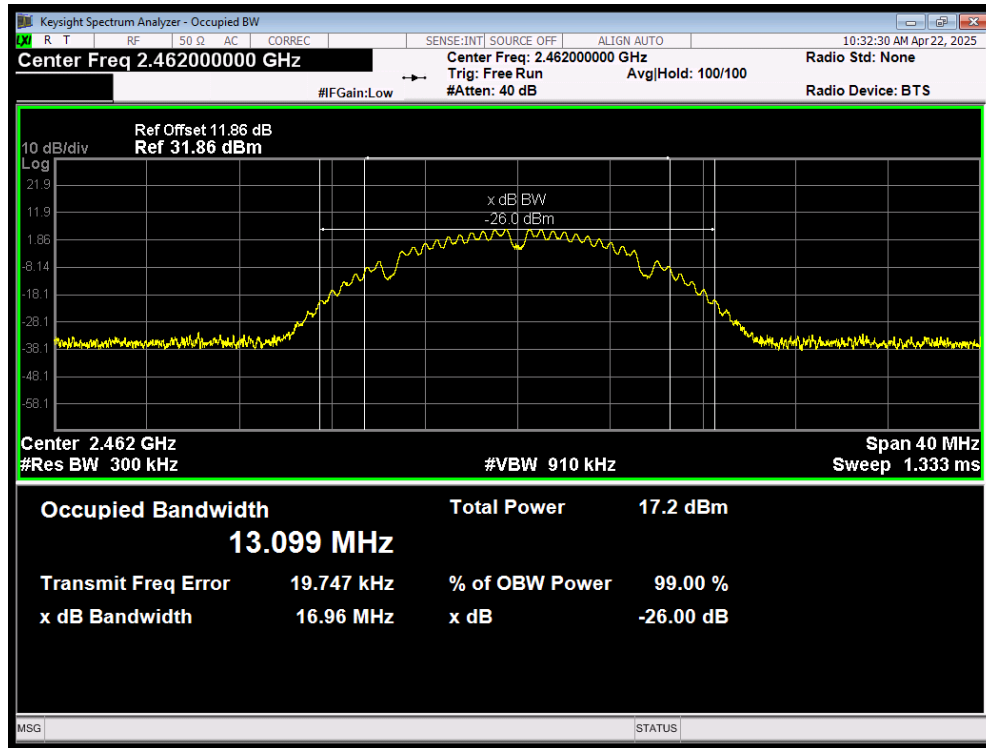
OBW 802.11b 2412MHz



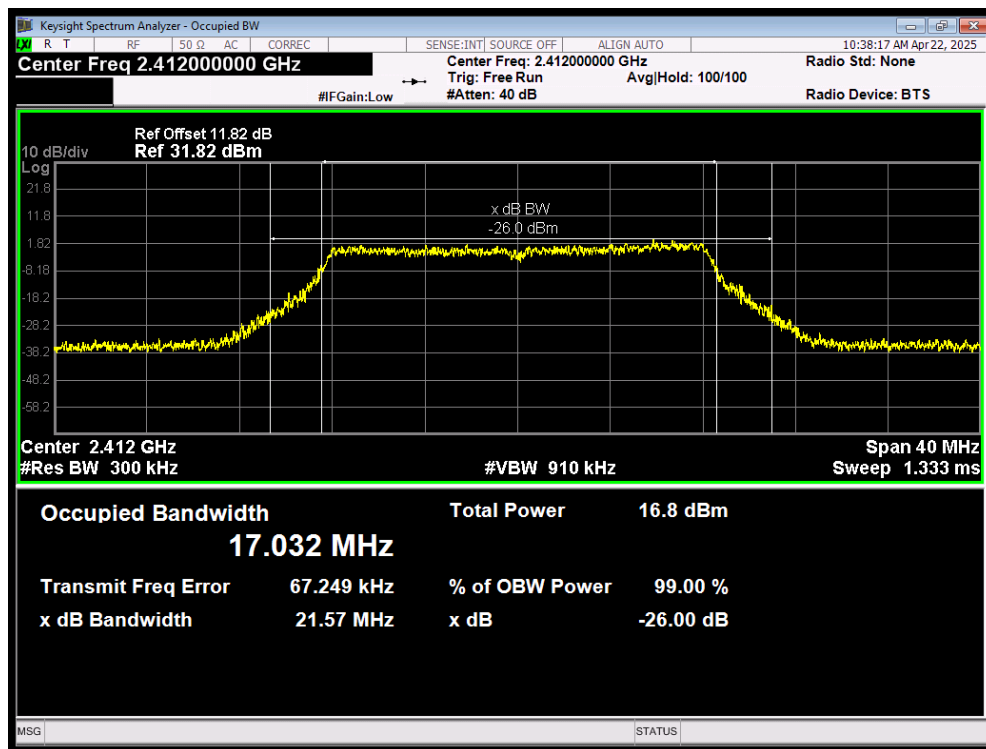
OBW 802.11b 2437MHz



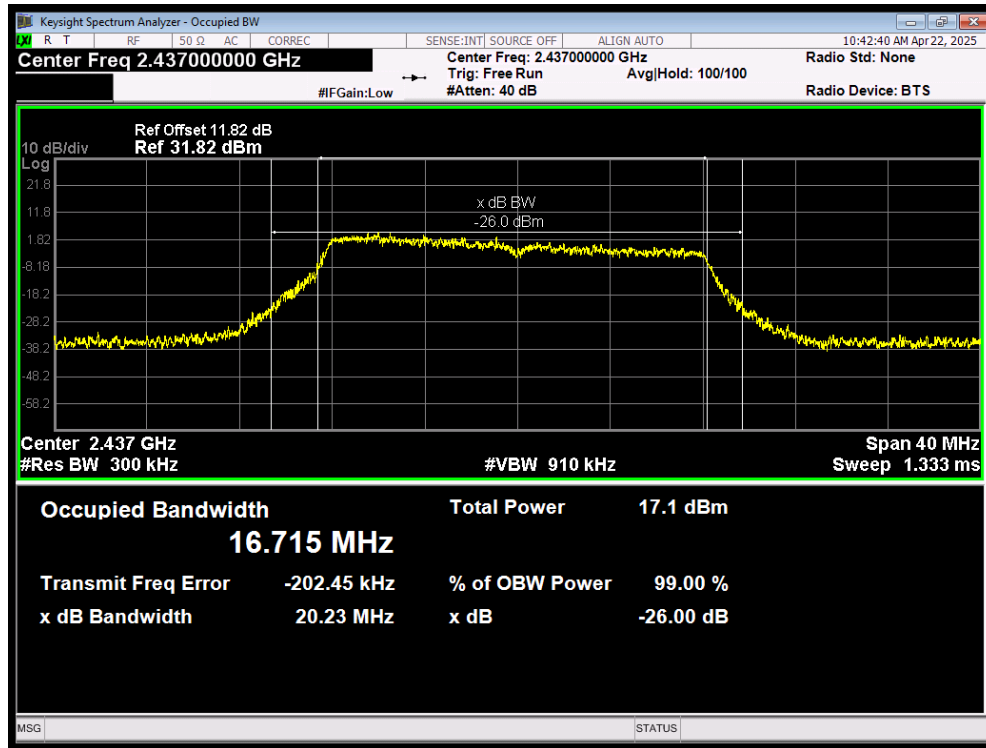
OBW 802.11b 2462MHz



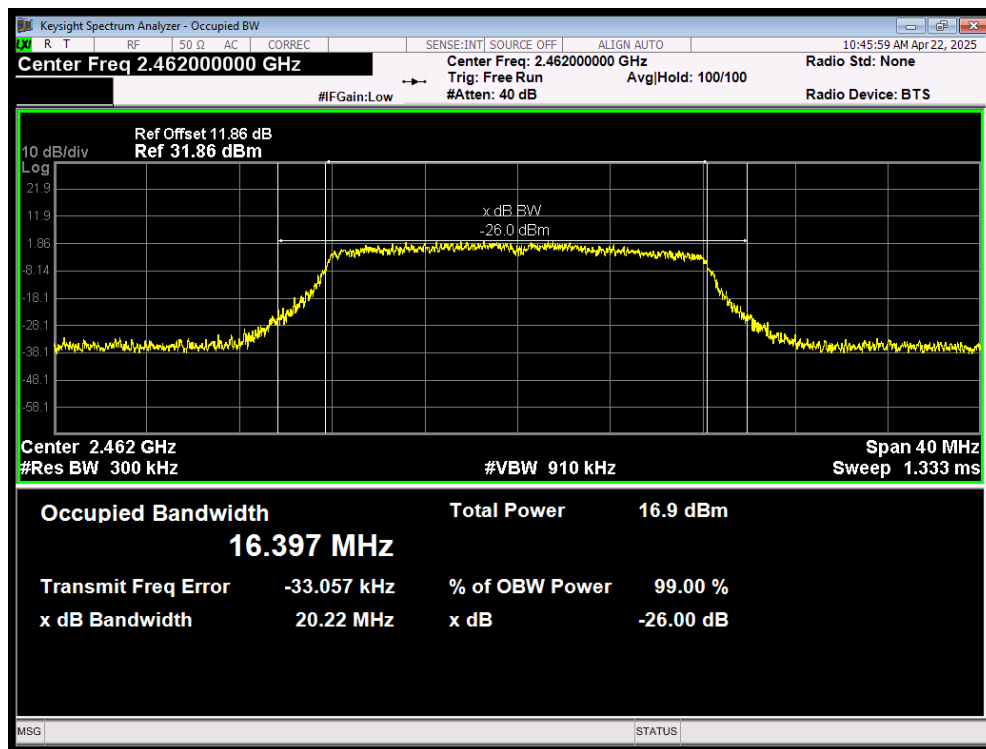
OBW 802.11g 2412MHz



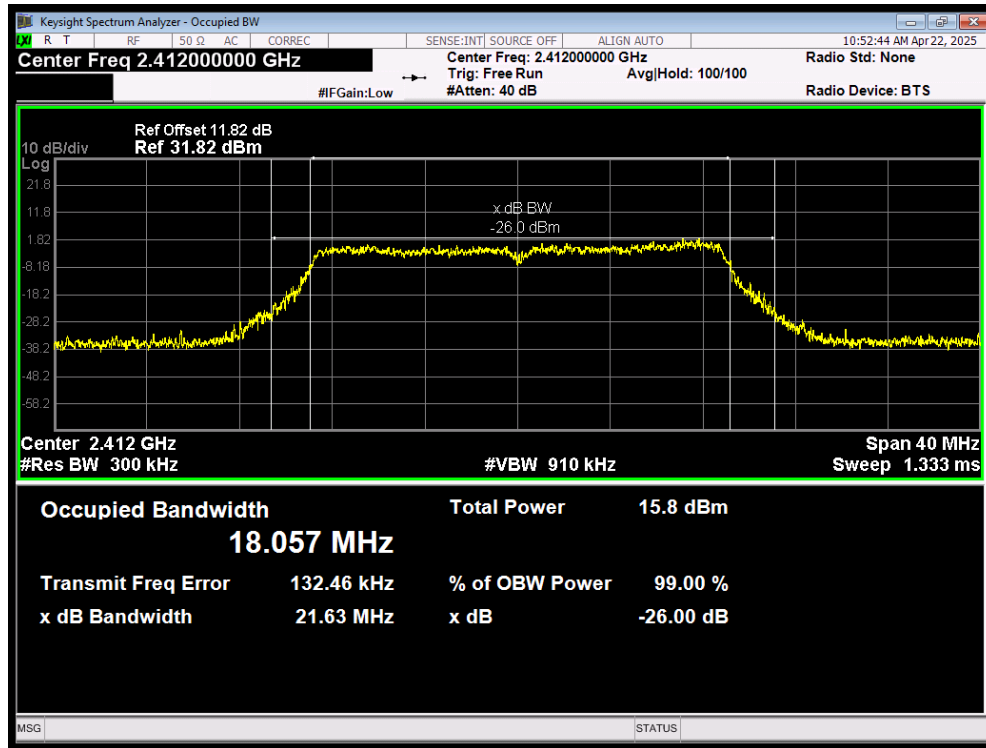
OBW 802.11g 2437MHz



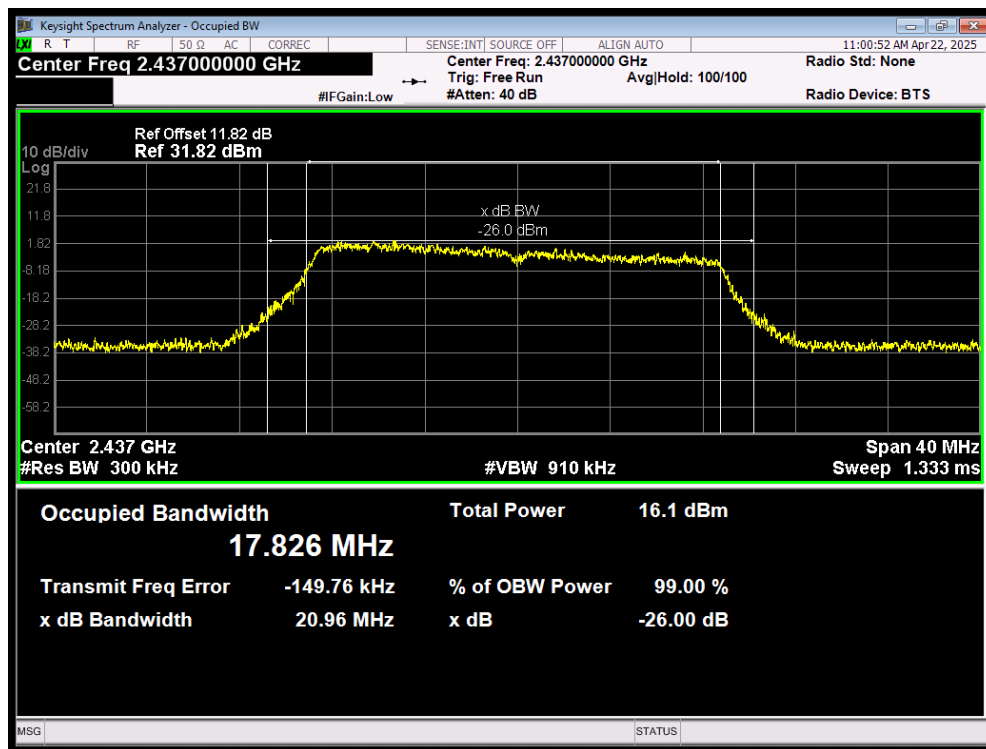
OBW 802.11g 2462MHz



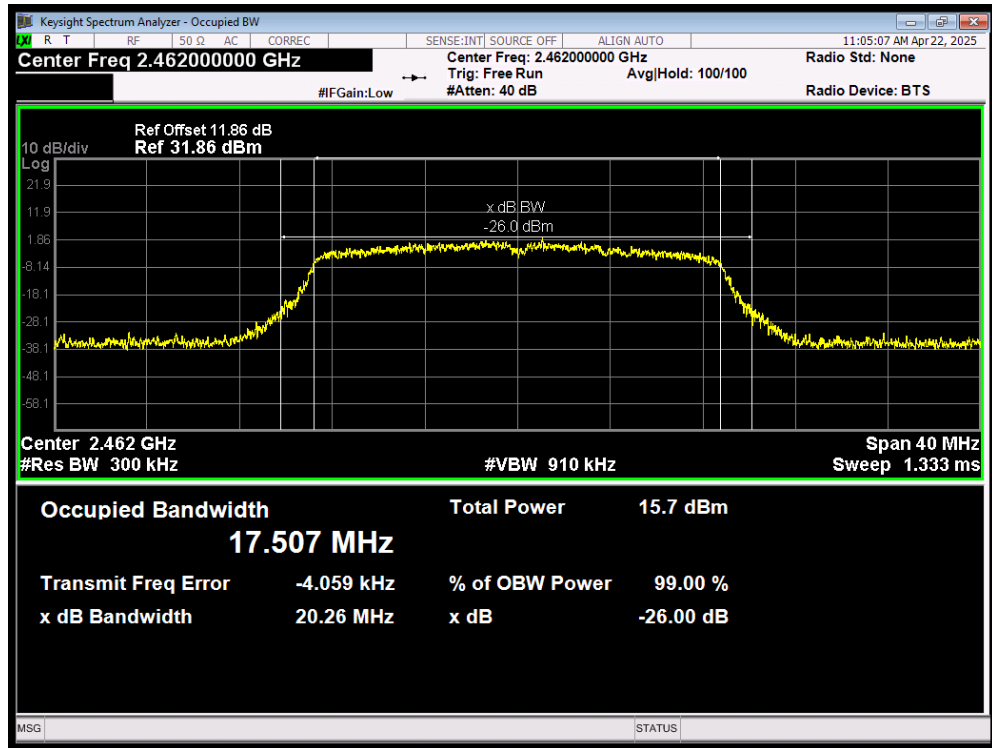
OBW 802.11n(HT20) 2412MHz



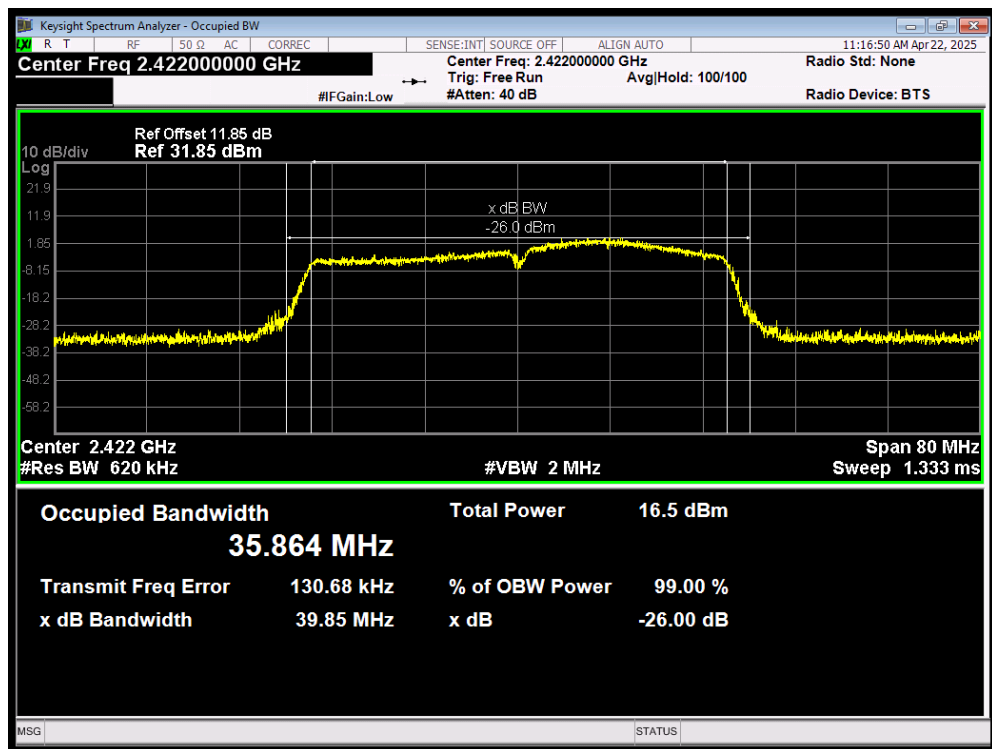
OBW 802.11n(HT20) 2437MHz



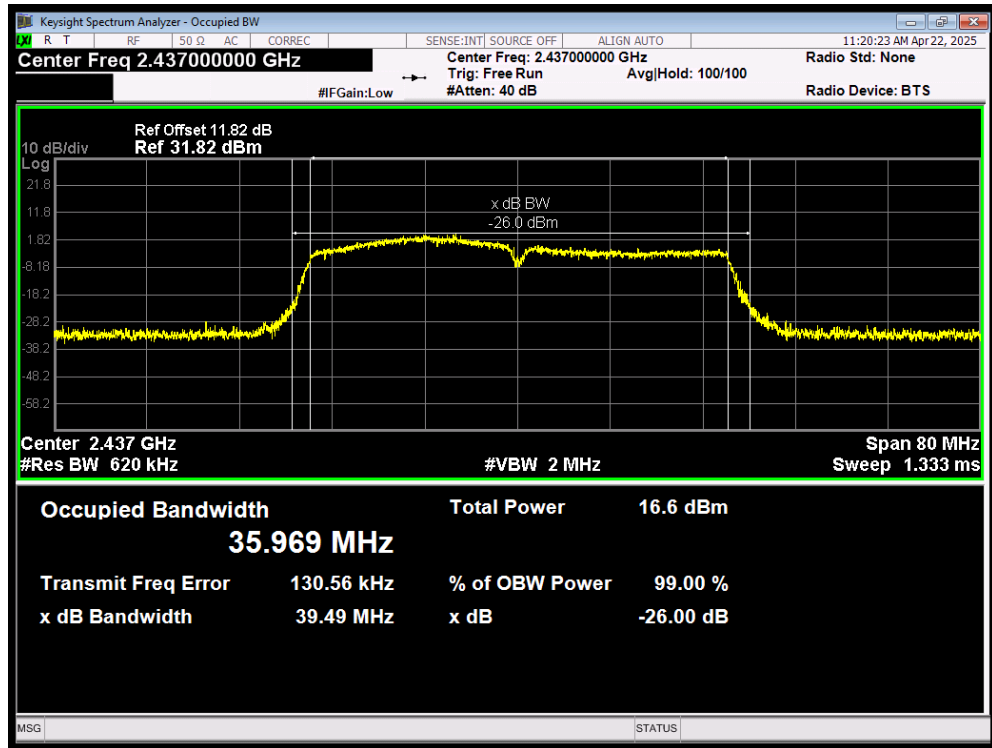
## OBW 802.11n(HT20) 2462MHz



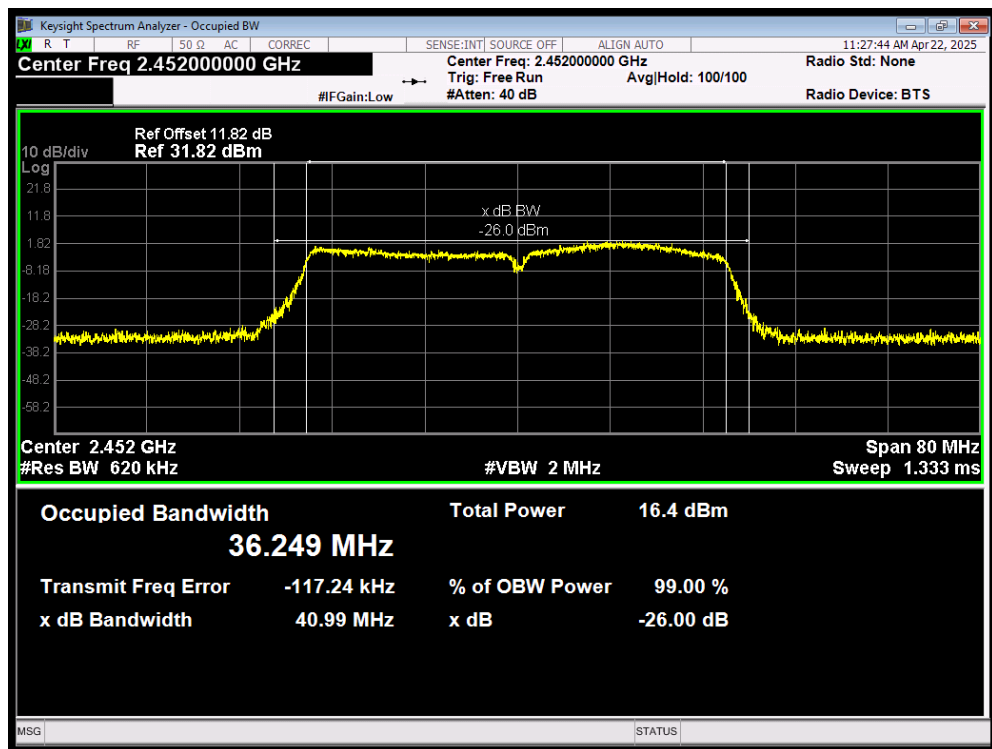
## OBW 802.11n(HT40) 2422MHz



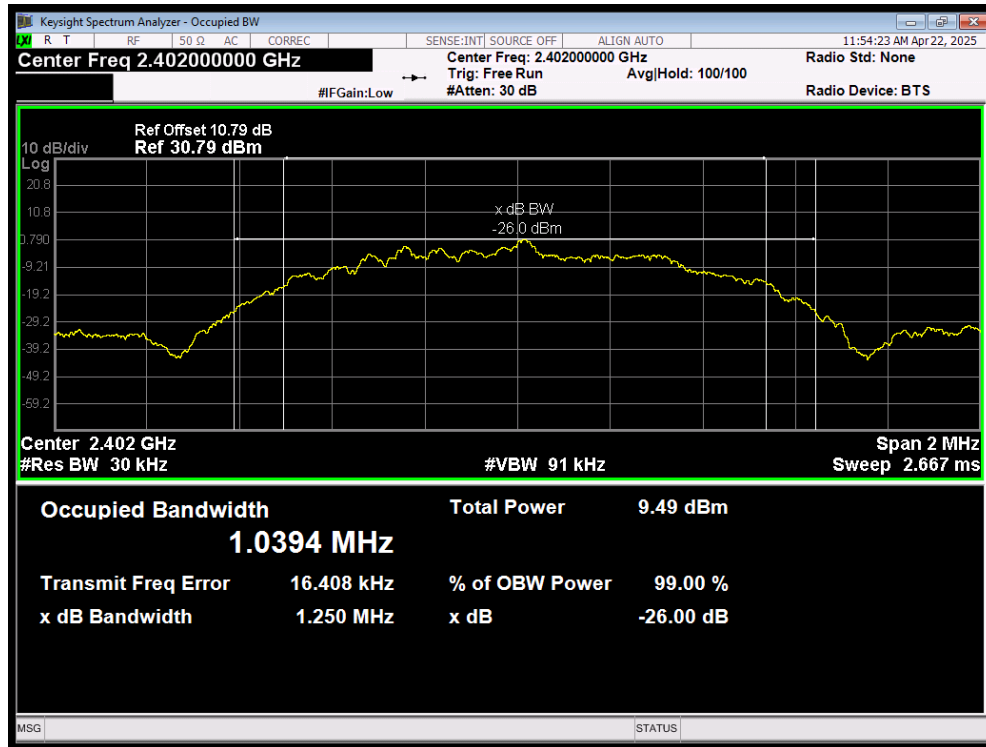
## OBW 802.11n(HT40) 2437MHz



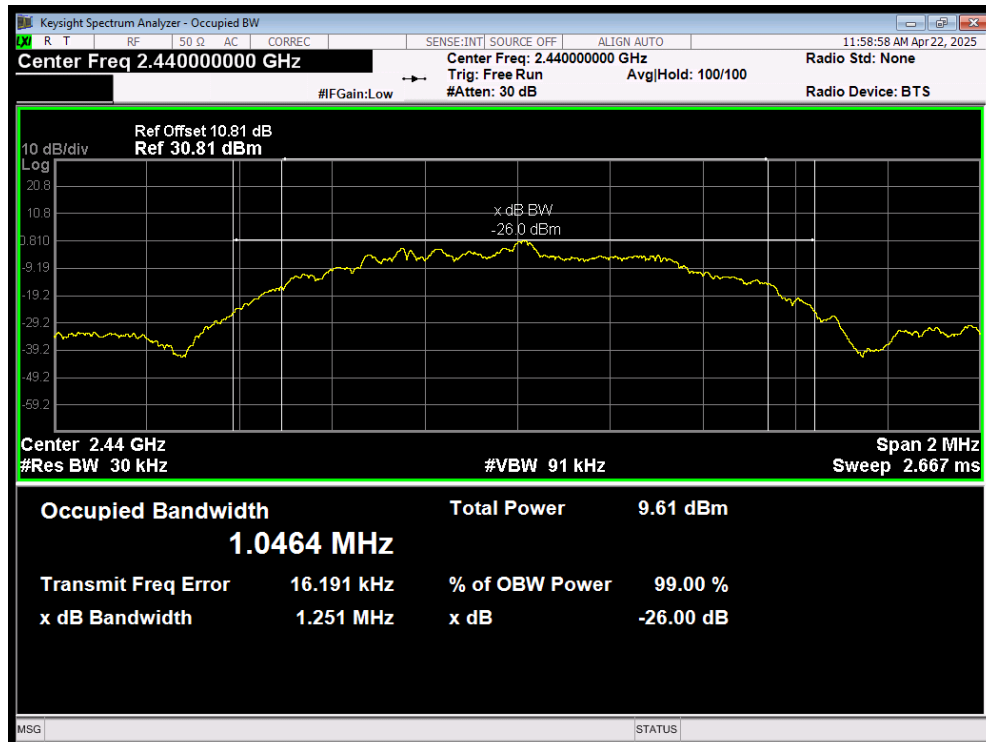
## OBW 802.11n(HT40) 2452MHz



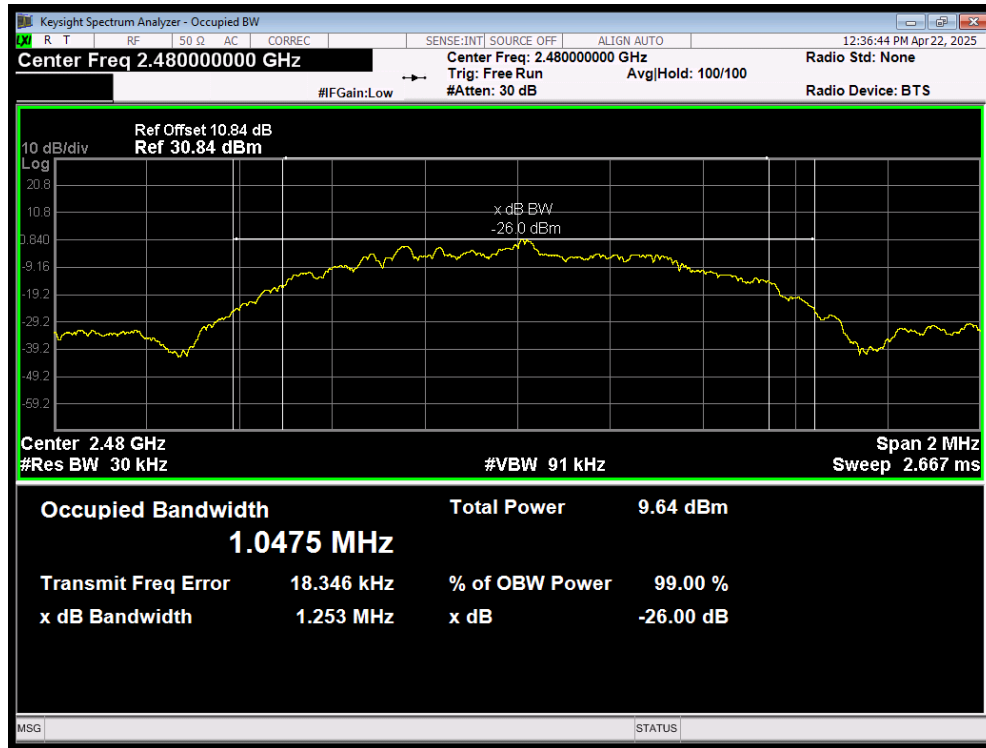
## OBW Bluetooth LE (1M) 2402MHz



## OBW Bluetooth LE (1M) 2440MHz



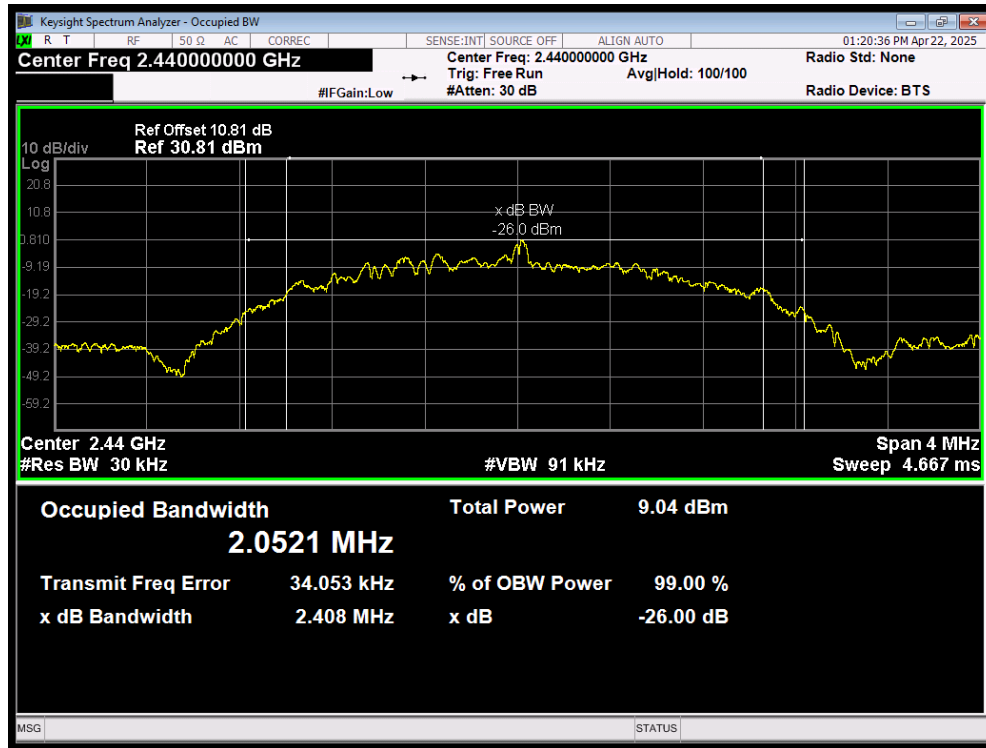
## OBW Bluetooth LE (1M) 2480MHz



## OBW Bluetooth LE (2M) 2402MHz



## OBW Bluetooth LE (2M) 2440MHz

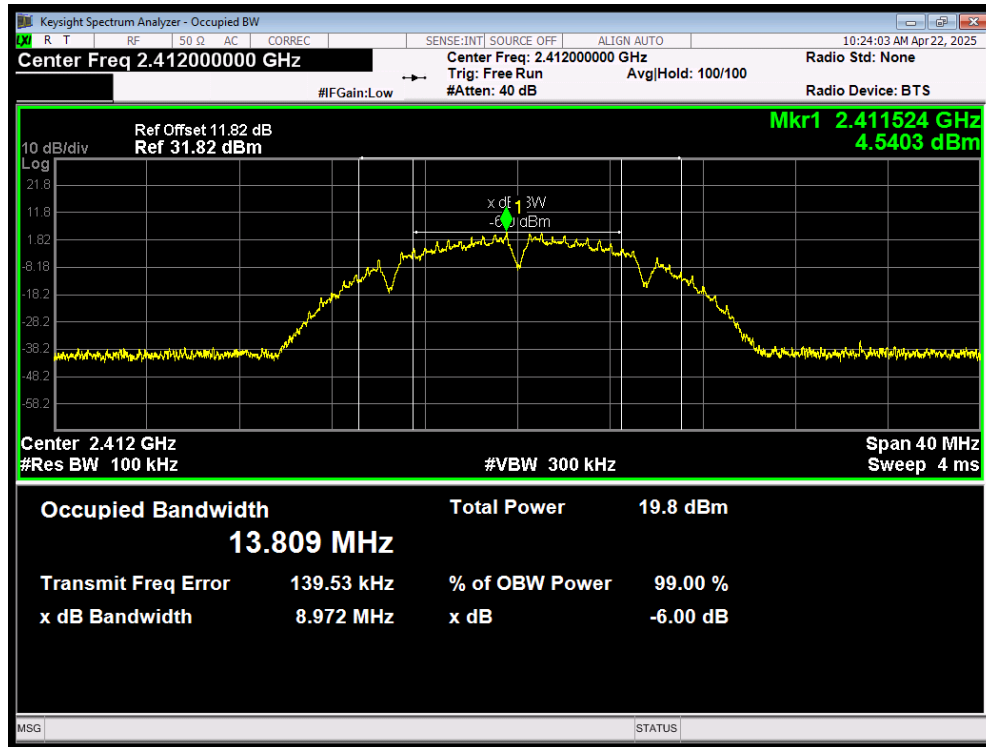


## OBW Bluetooth LE (2M) 2480MHz

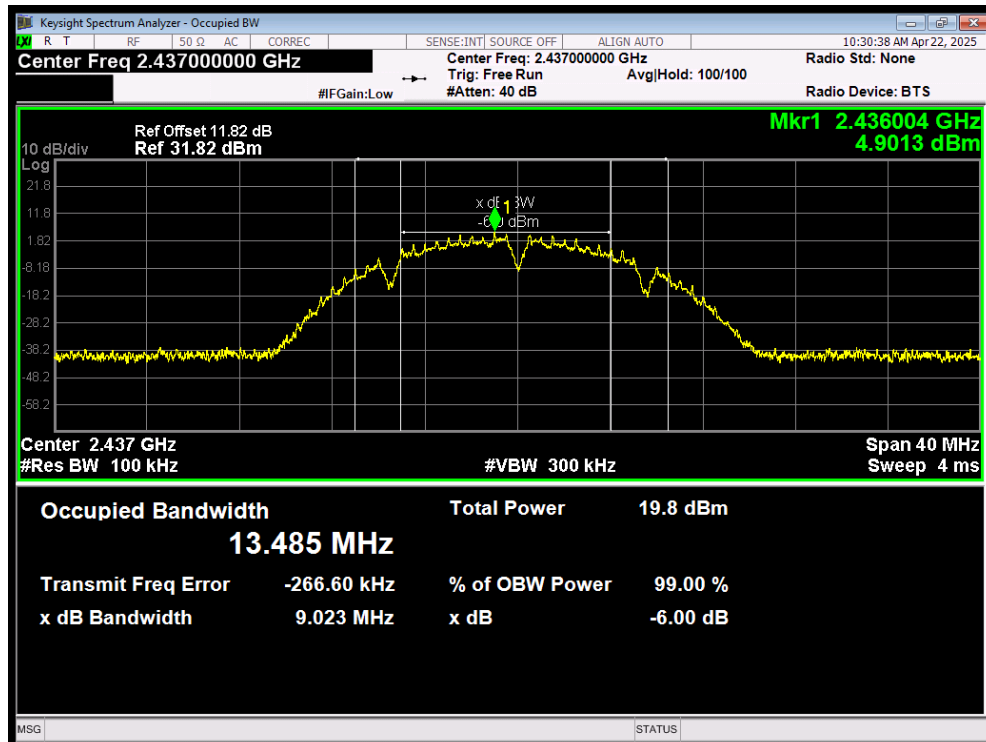


6 dB bandwidth

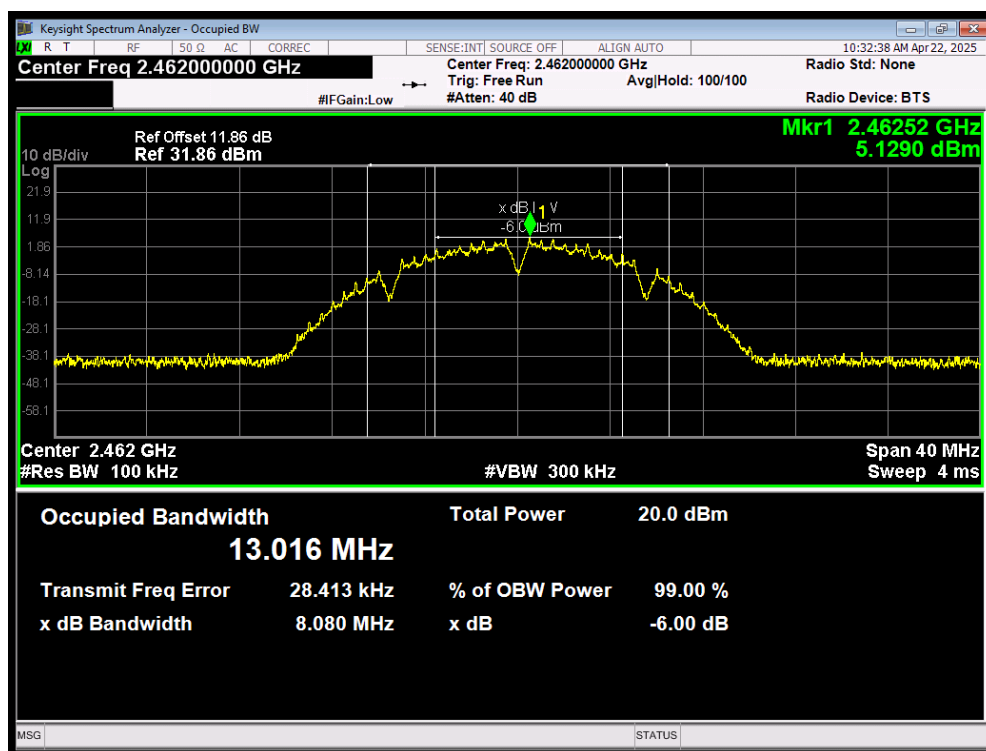
-6dB Bandwidth 802.11b 2412MHz



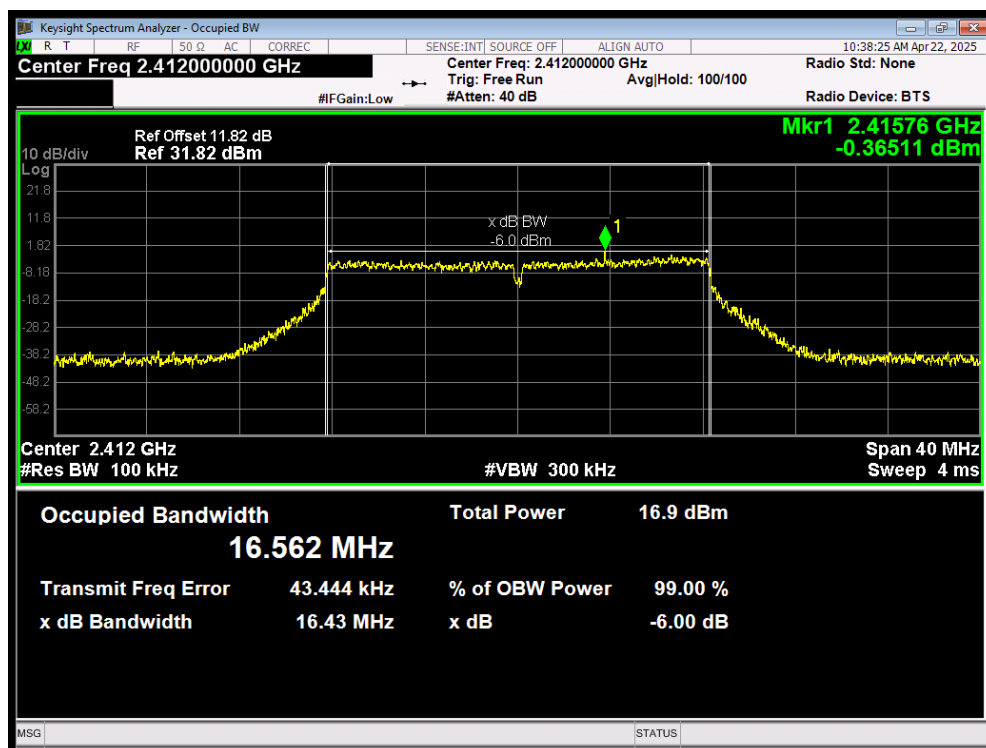
-6dB Bandwidth 802.11b 2437MHz



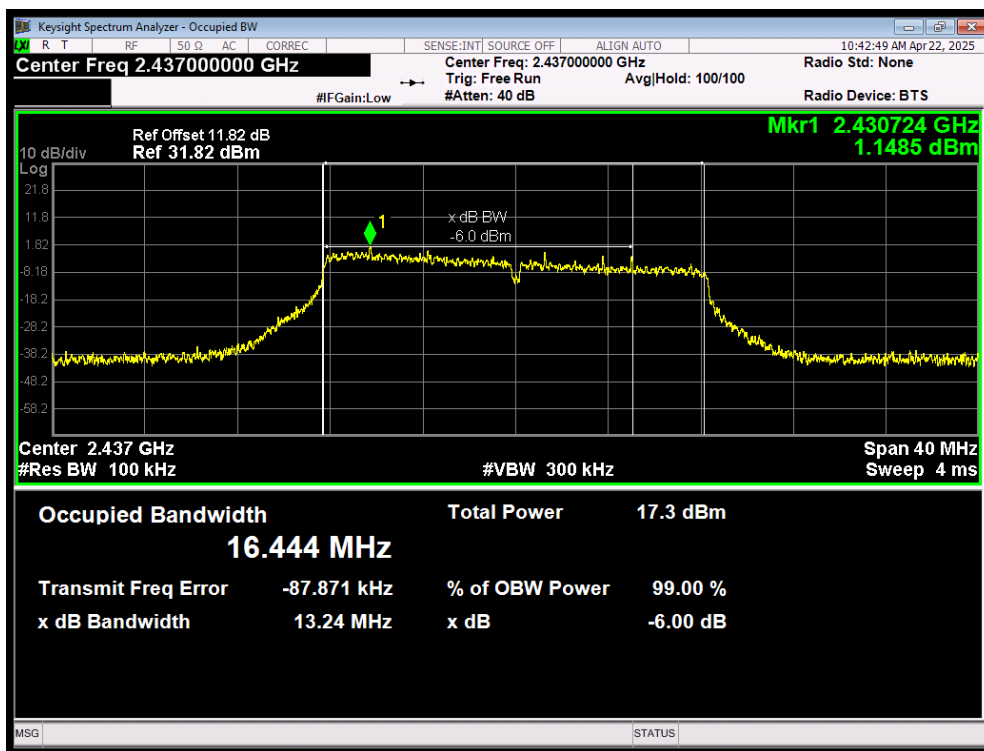
-6dB Bandwidth 802.11b 2462MHz



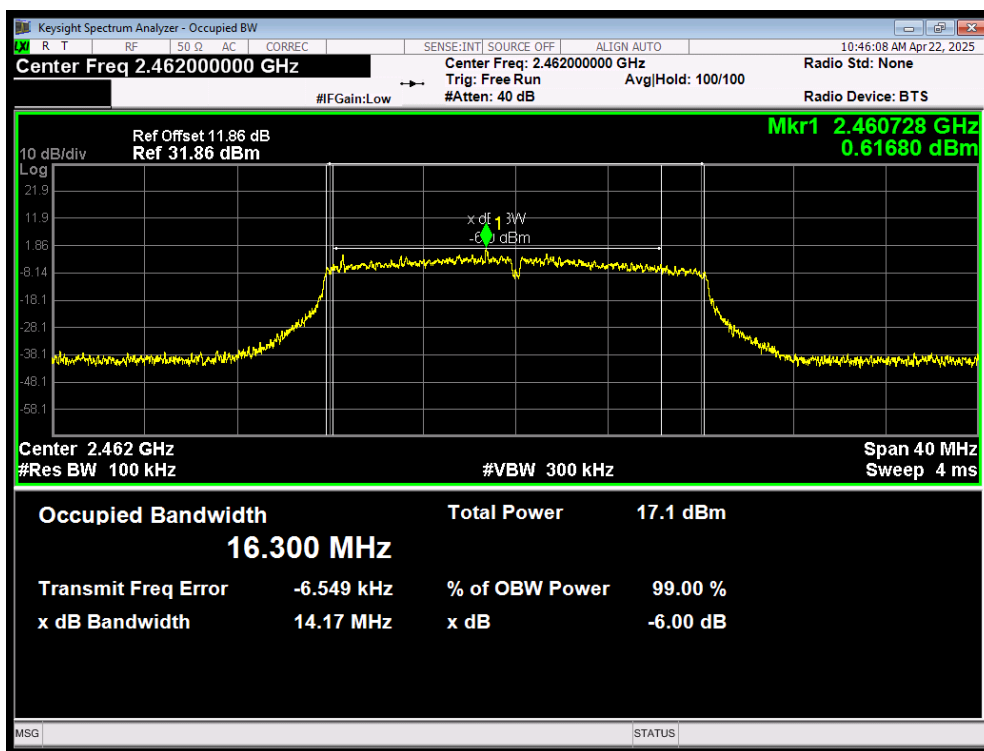
-6dB Bandwidth 802.11g 2412MHz



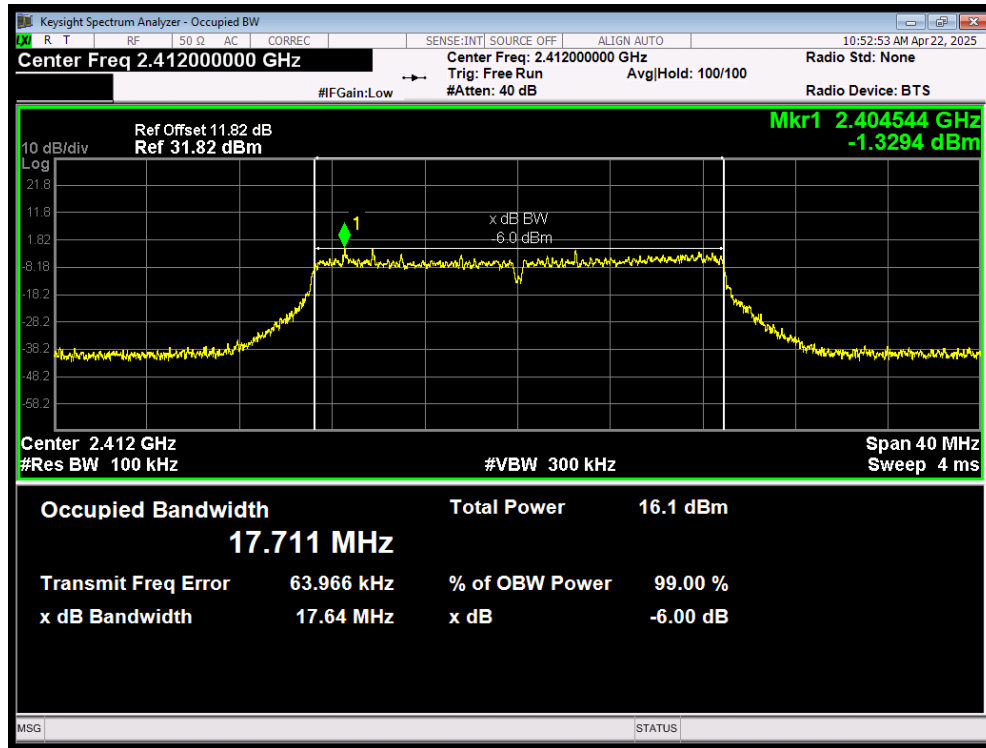
-6dB Bandwidth 802.11g 2437MHz



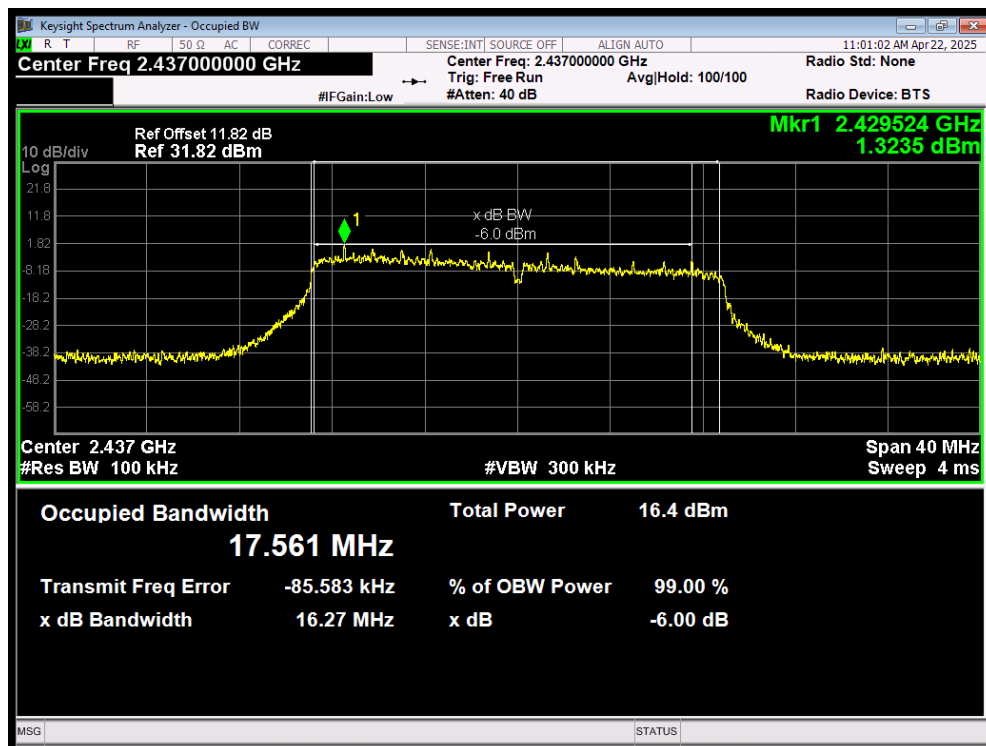
-6dB Bandwidth 802.11g 2462MHz



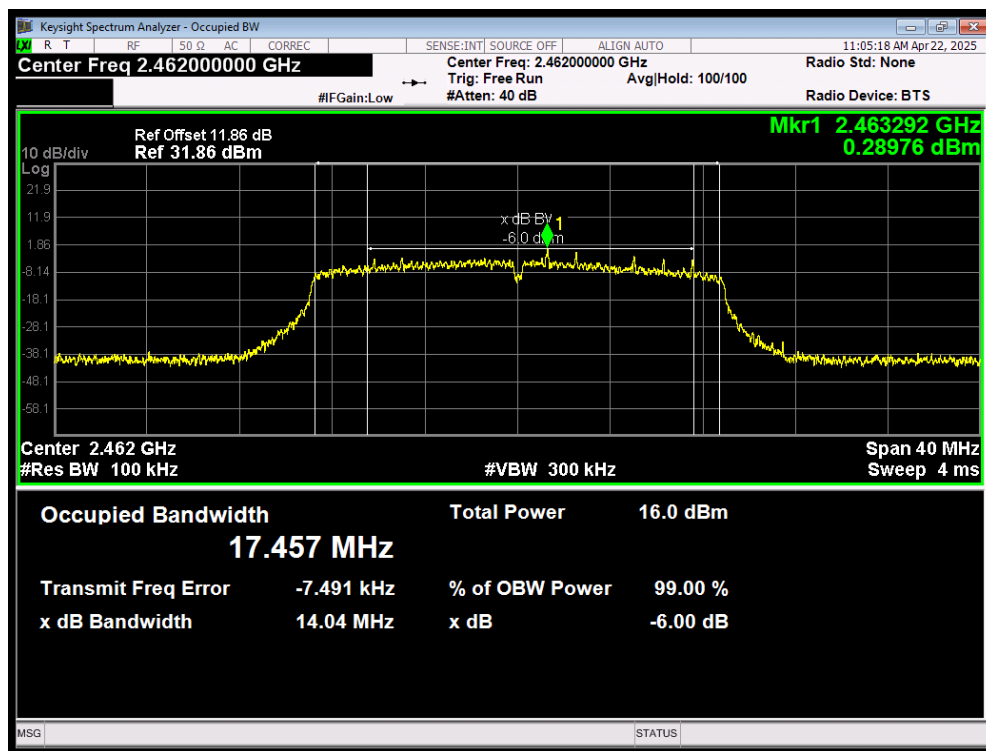
-6dB Bandwidth 802.11n(HT20) 2412MHz



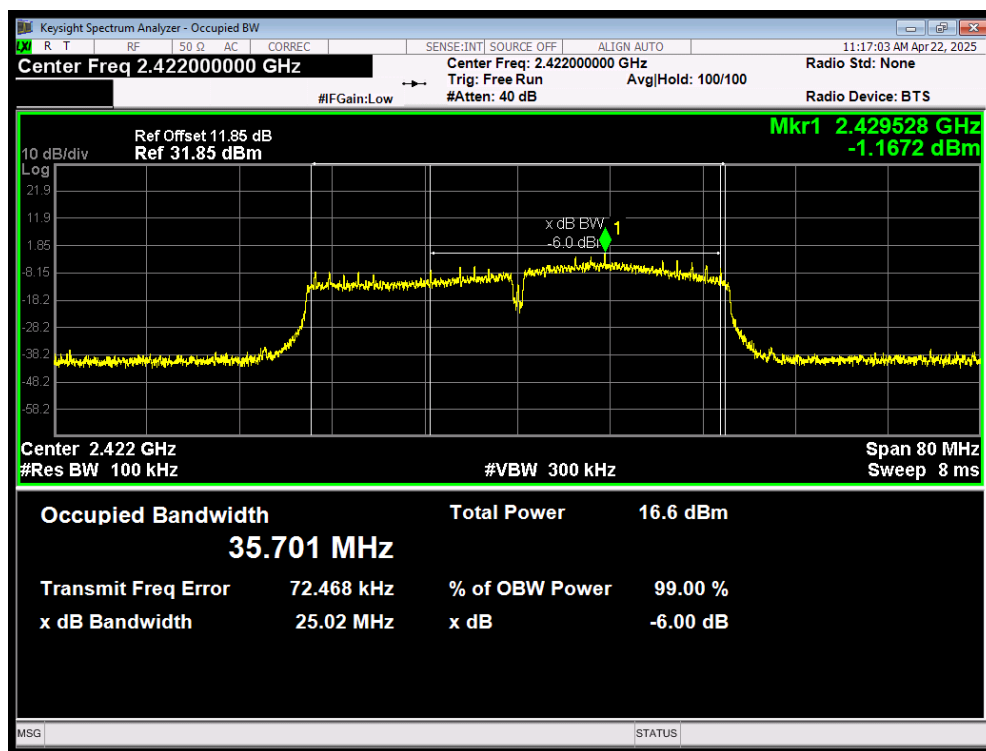
-6dB Bandwidth 802.11n(HT20) 2437MHz



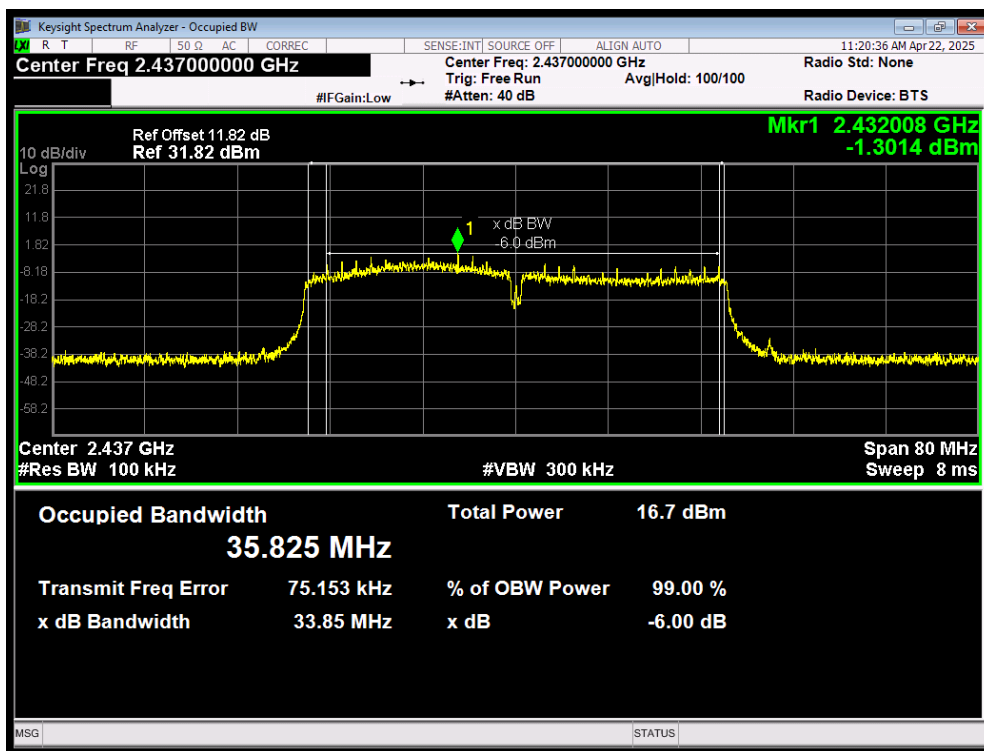
-6dB Bandwidth 802.11n(HT20) 2462MHz



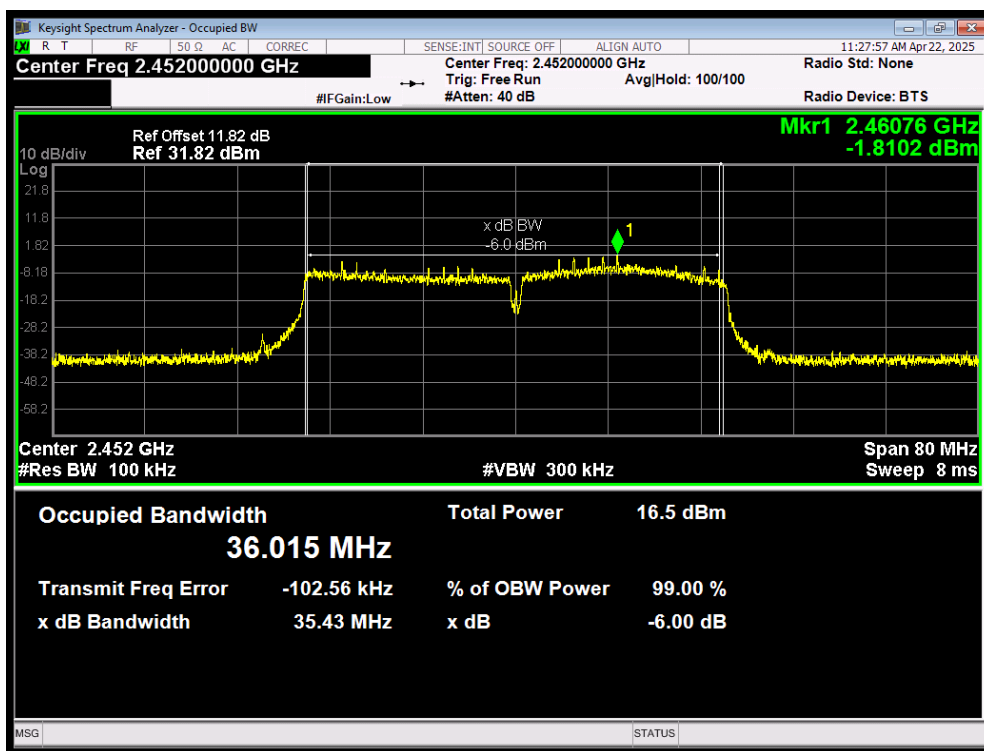
-6dB Bandwidth 802.11n(HT40) 2422MHz



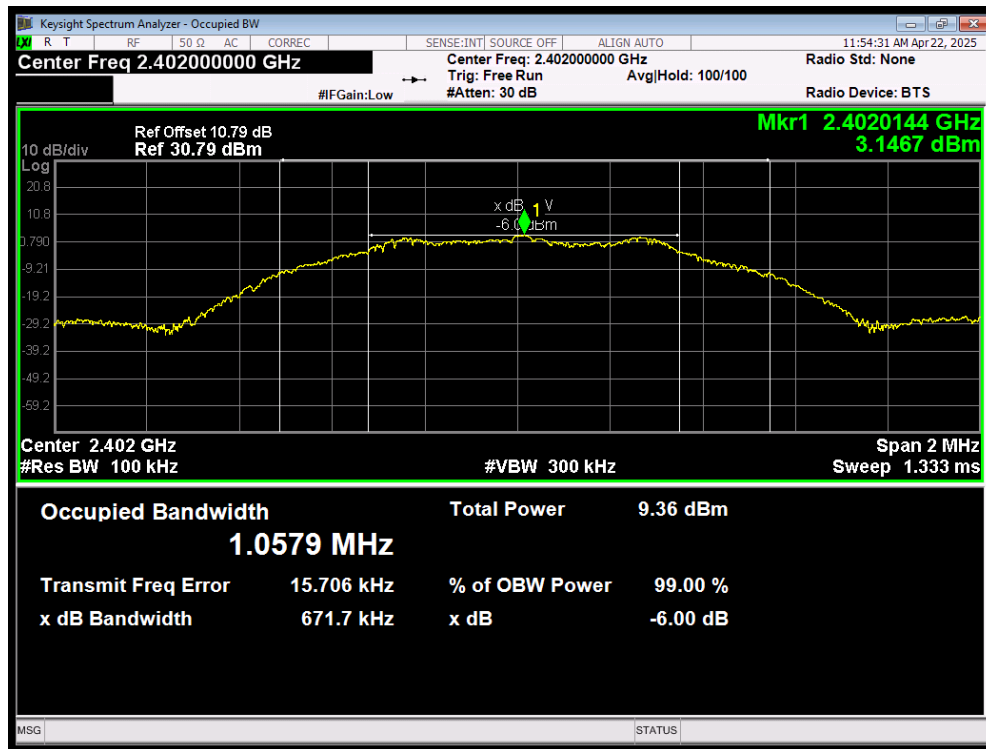
-6dB Bandwidth 802.11n(HT40) 2437MHz



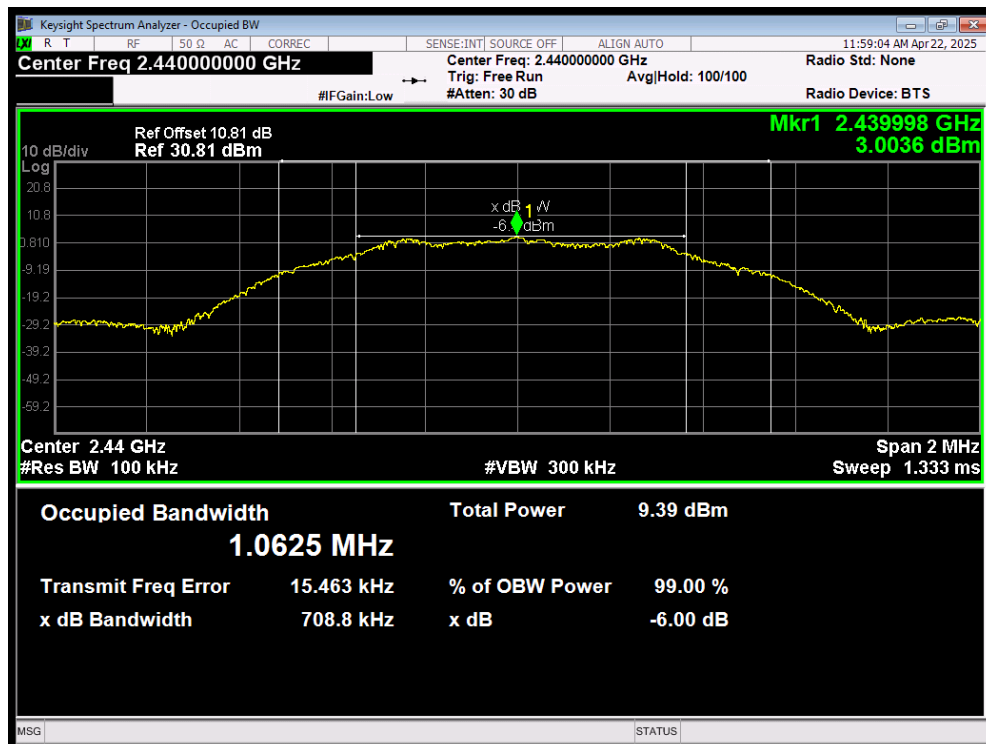
-6dB Bandwidth 802.11n(HT40) 2452MHz



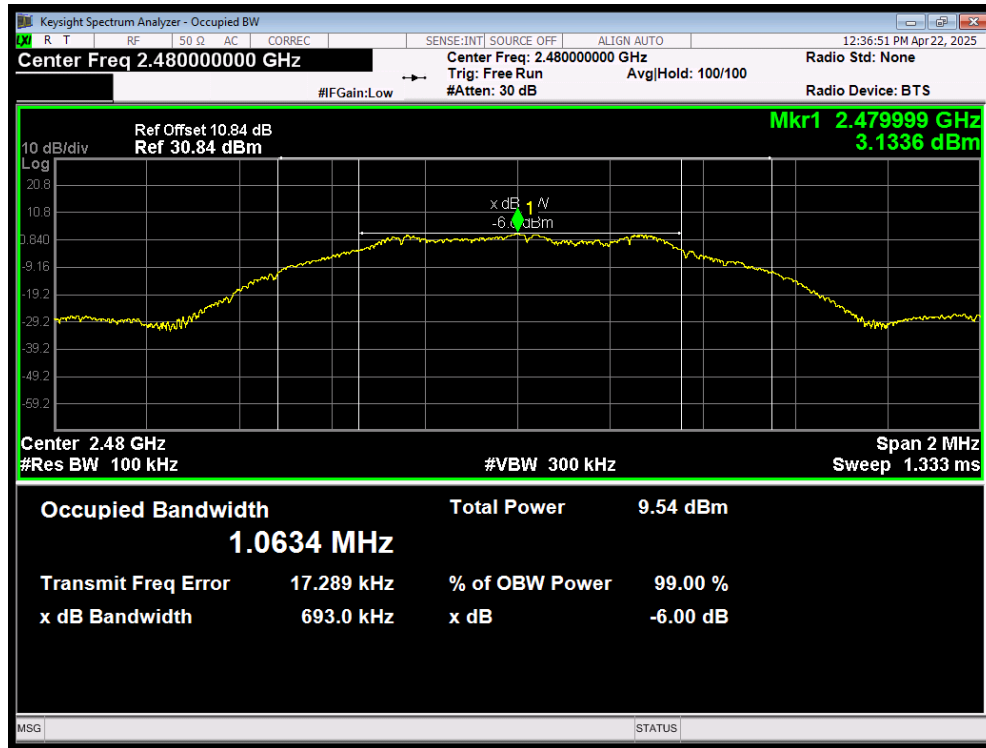
-6dB Bandwidth Bluetooth LE (1M) 2402MHz



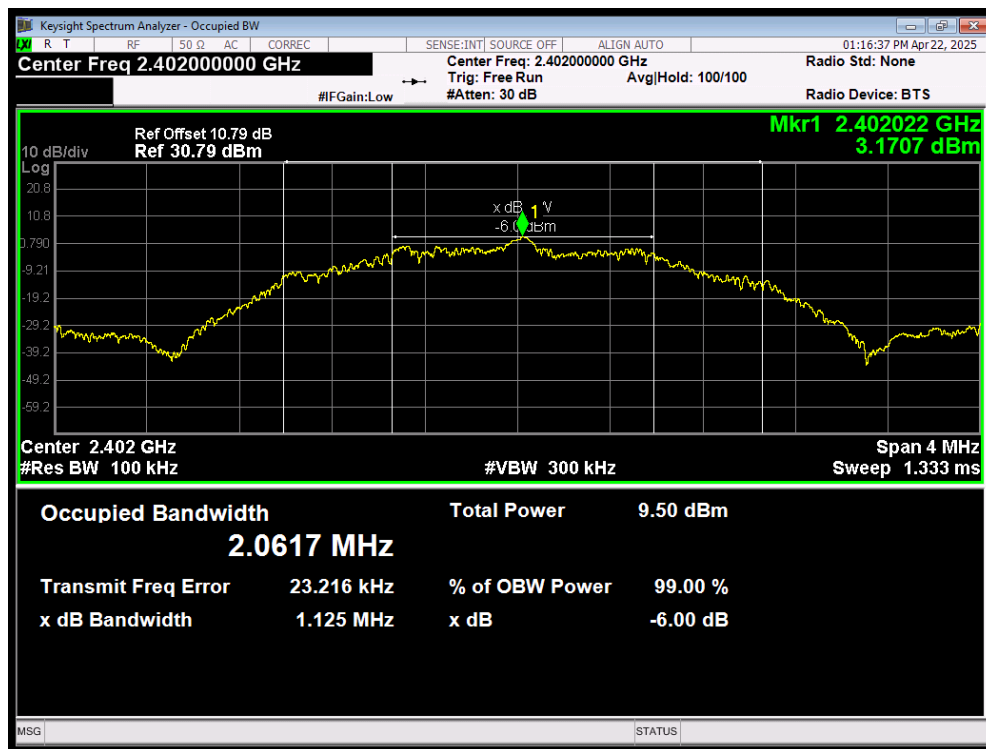
-6dB Bandwidth Bluetooth LE (1M) 2440MHz



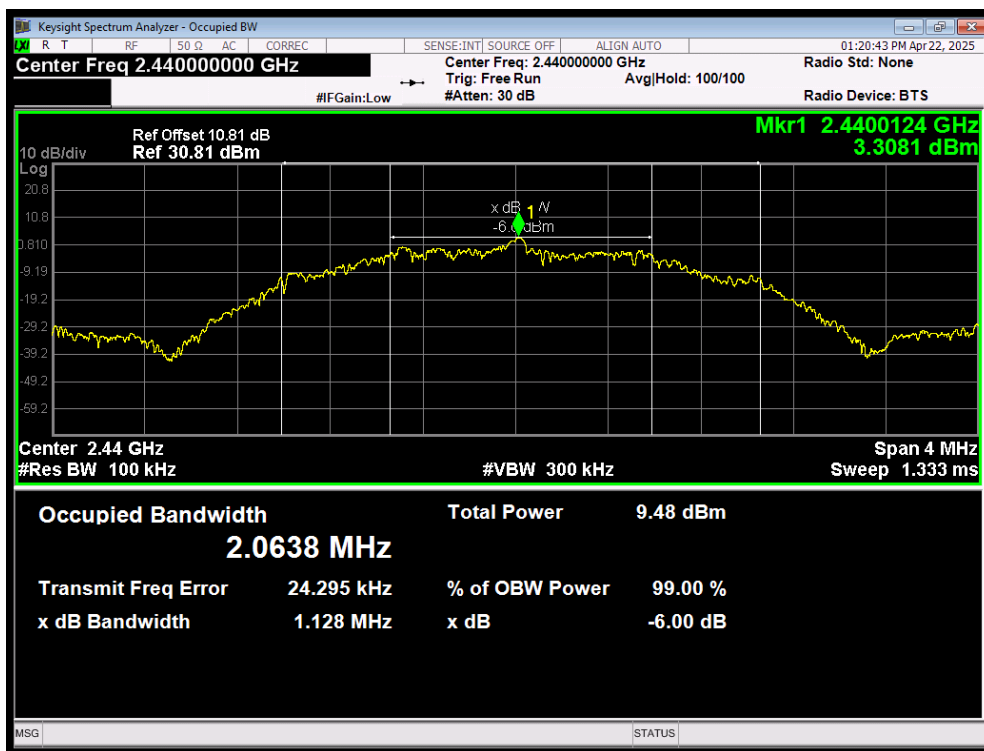
-6dB Bandwidth Bluetooth LE (1M) 2480MHz



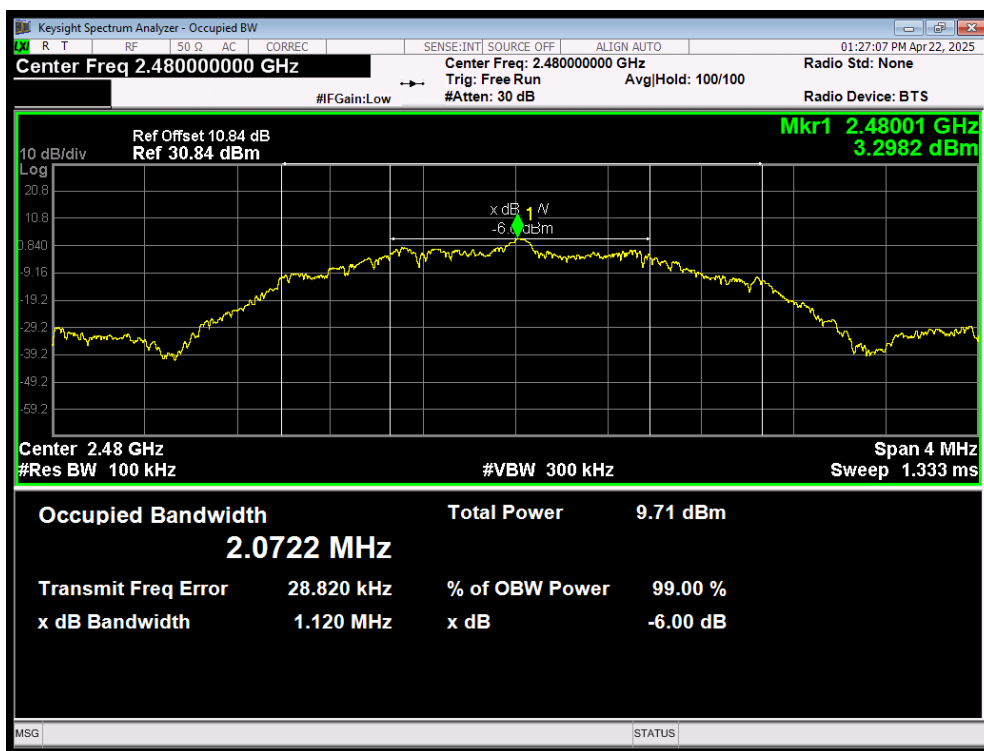
-6dB Bandwidth Bluetooth LE (2M) 2402MHz



-6dB Bandwidth Bluetooth LE (2M) 2440MHz



-6dB Bandwidth Bluetooth LE (2M) 2480MHz



### 5.3. Band Edge

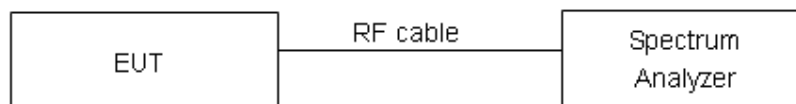
#### Ambient Condition

| Temperature | Relative humidity |
|-------------|-------------------|
| 15°C ~ 35°C | 20% ~ 80%         |

#### Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer. Spectrum analyzer plots are included on the following pages.

#### Test Setup



#### Limits

Rule Part 15.247(d) specifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.” If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.”

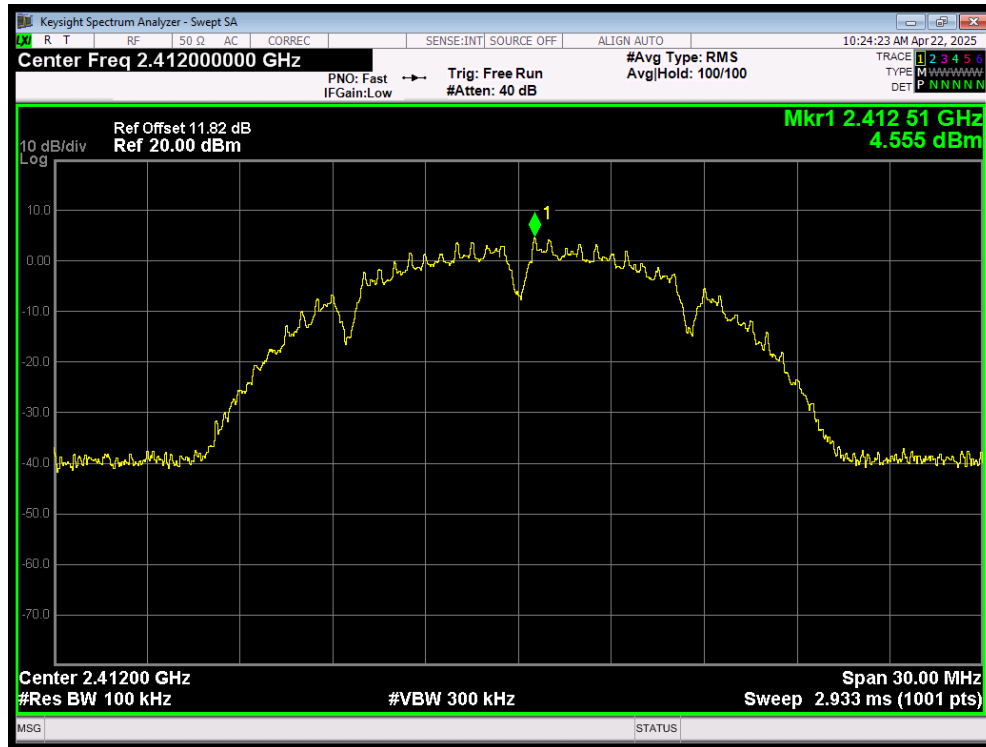
#### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ .

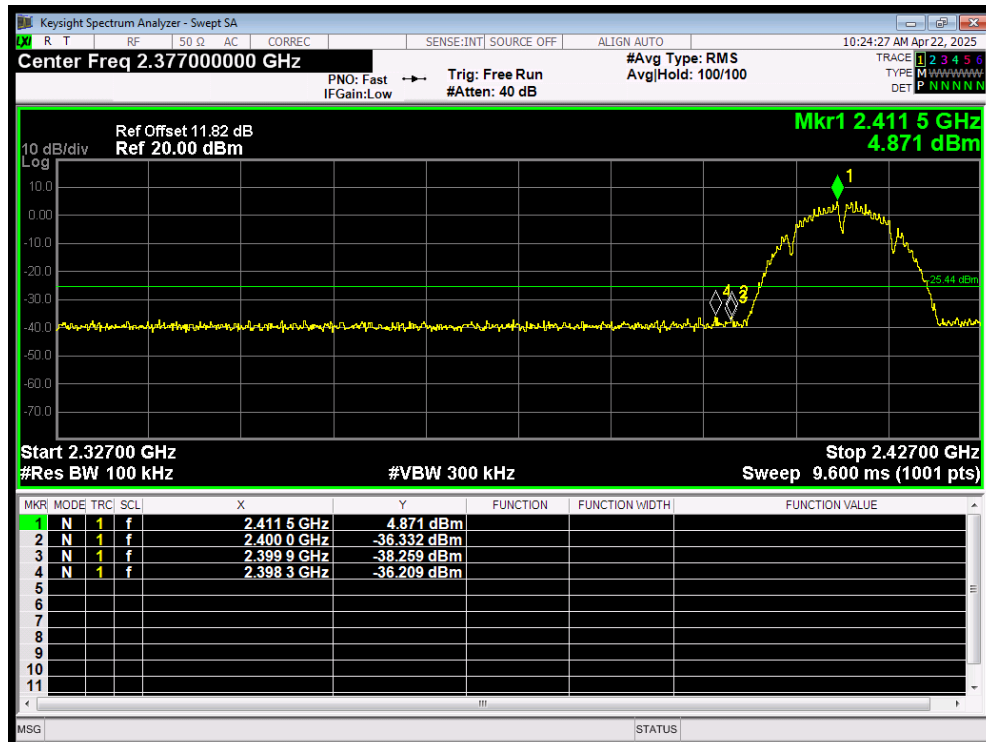
| Frequency | Uncertainty |
|-----------|-------------|
| 2GHz-3GHz | 1.407 dB    |

Test Results: PASS

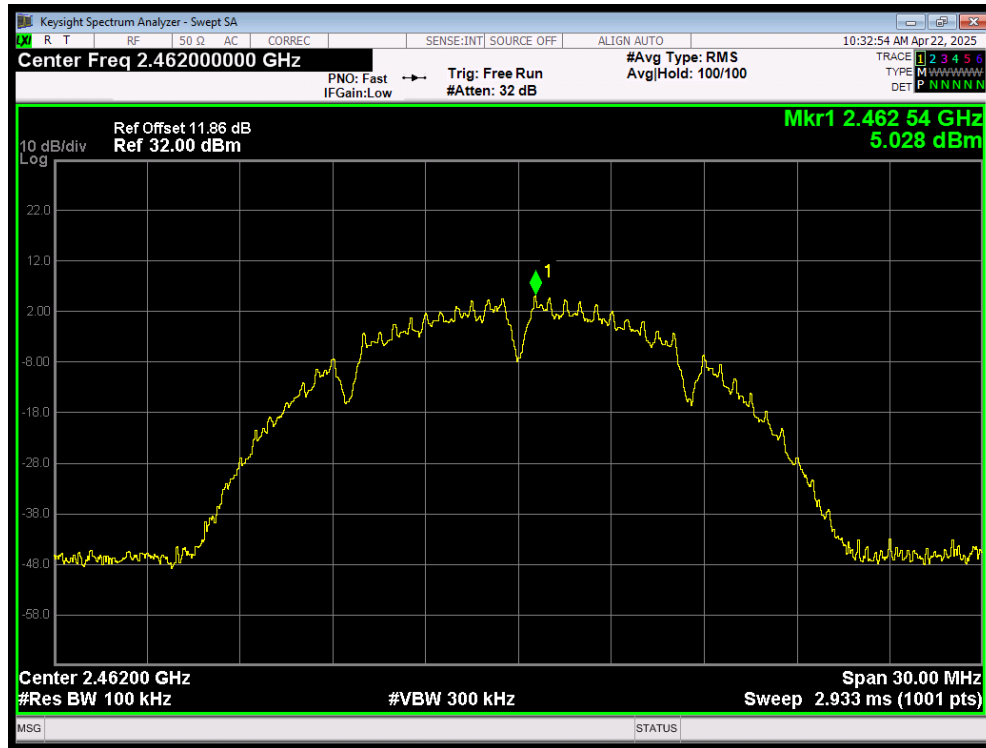
Band Edge 802.11b 2412MHz Ref



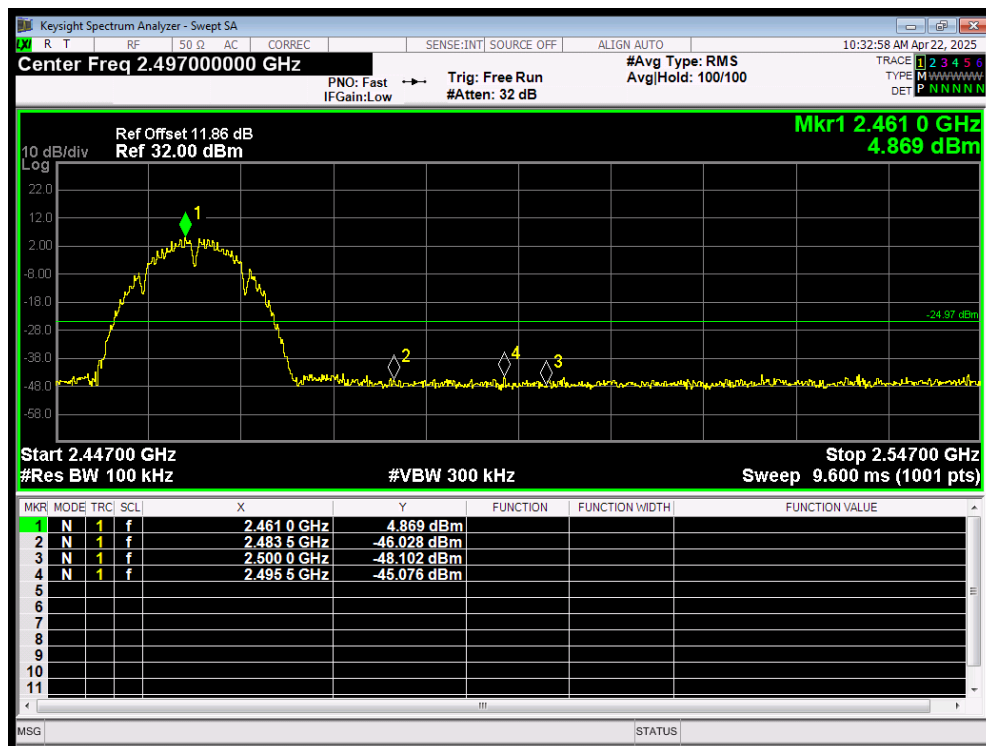
Band Edge 802.11b 2412MHz Emission



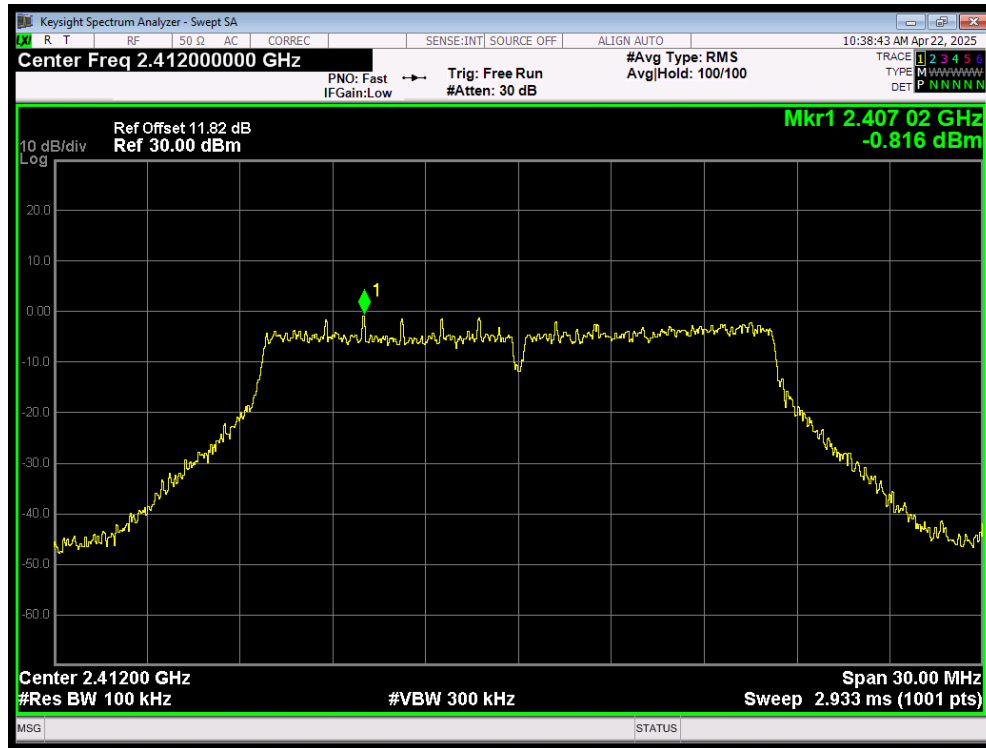
Band Edge 802.11b 2462MHz Ref



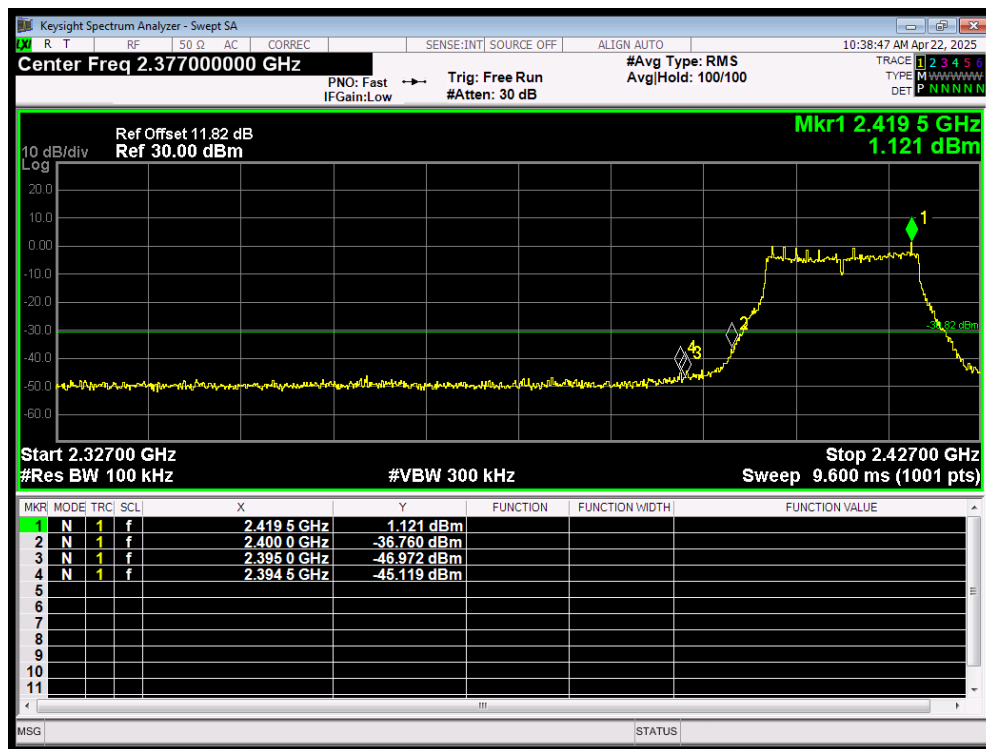
Band Edge 802.11b 2462MHz Emission



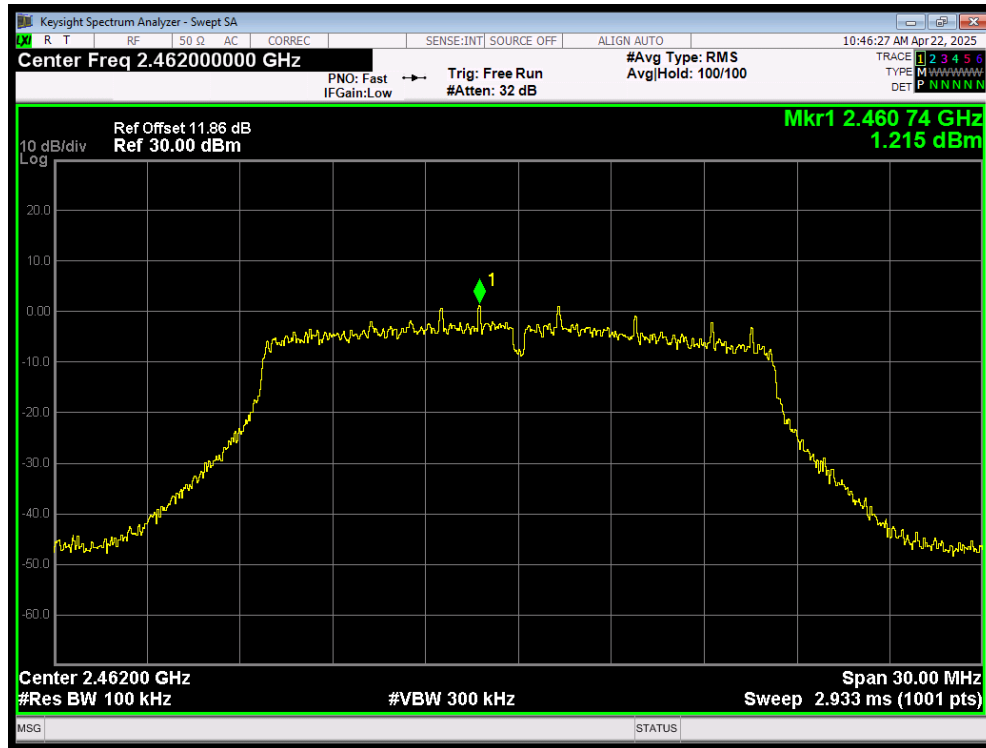
Band Edge 802.11g 2412MHz Ref



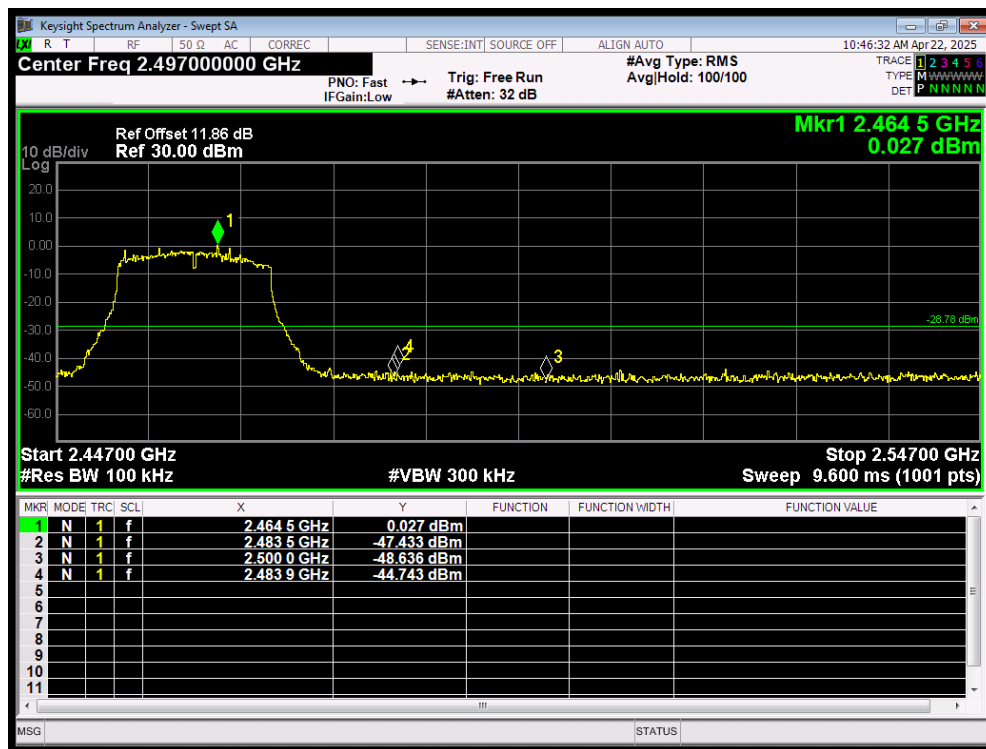
Band Edge 802.11g 2412MHz Emission



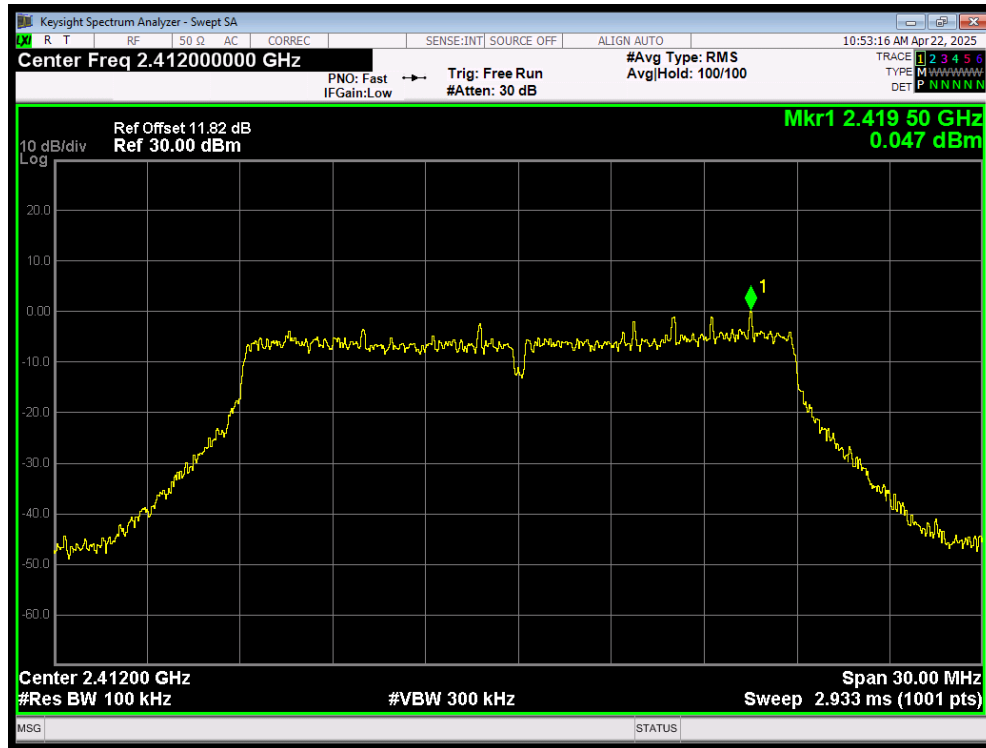
Band Edge 802.11g 2462MHz Ref



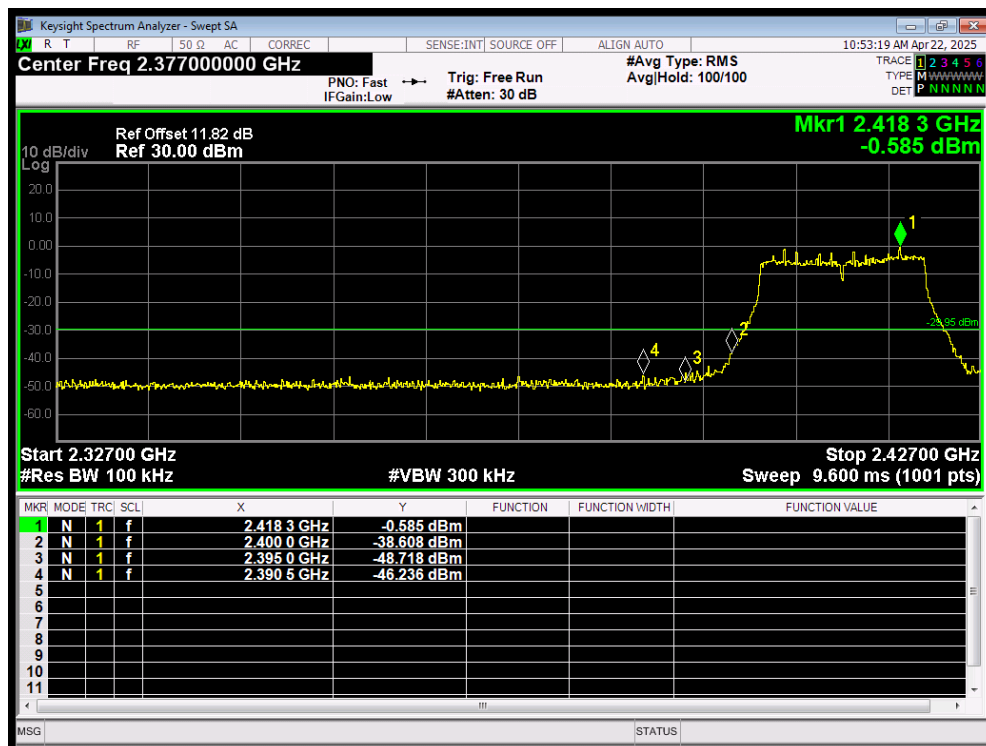
Band Edge 802.11g 2462MHz Emission



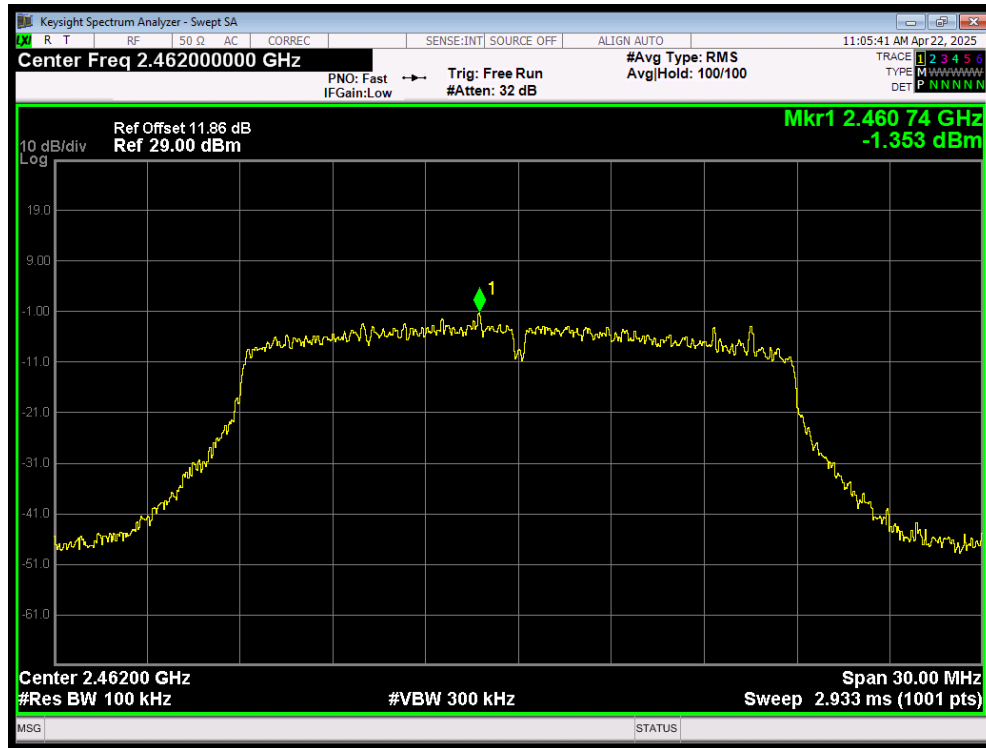
Band Edge 802.11n(HT20) 2412MHz Ref



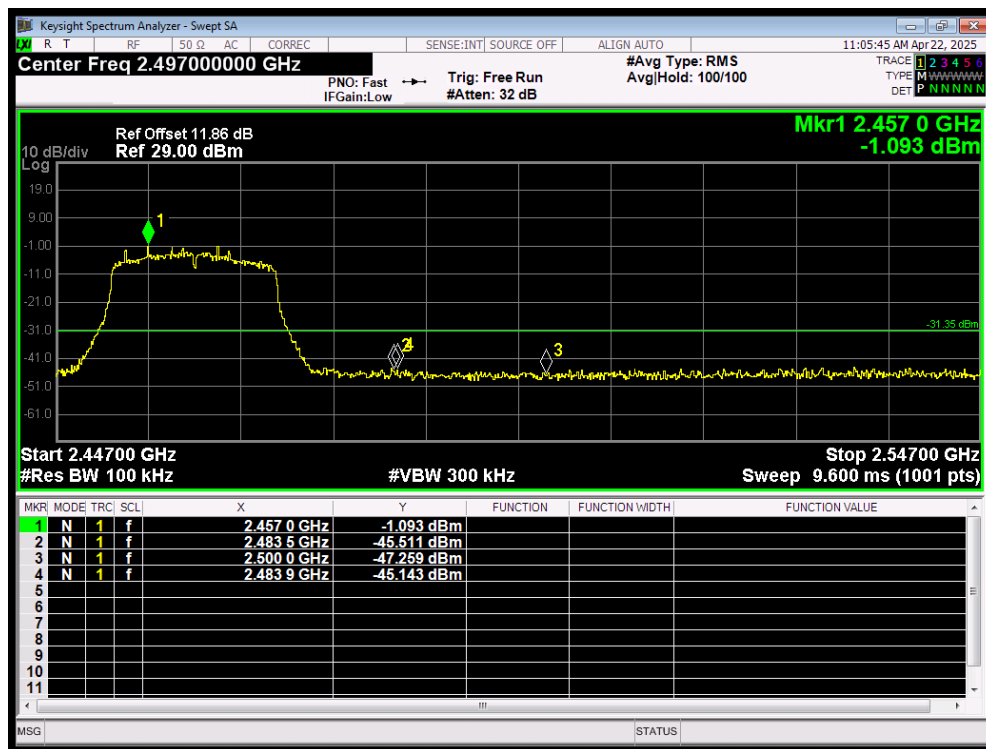
Band Edge 802.11n(HT20) 2412MHz Emission



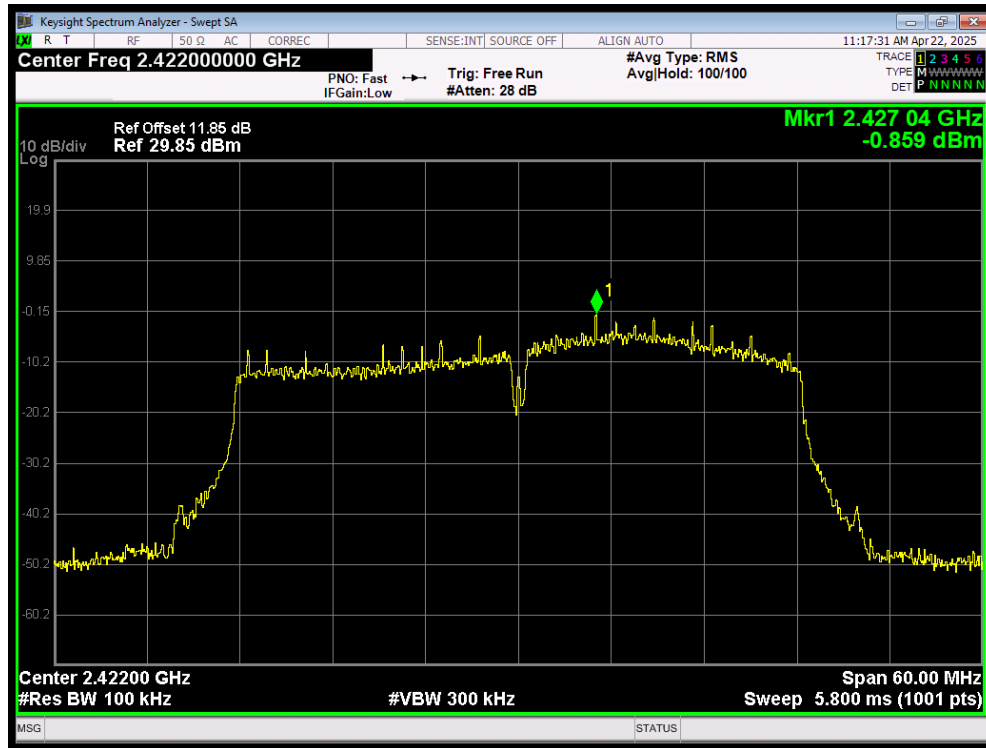
Band Edge 802.11n(HT20) 2462MHz Ref



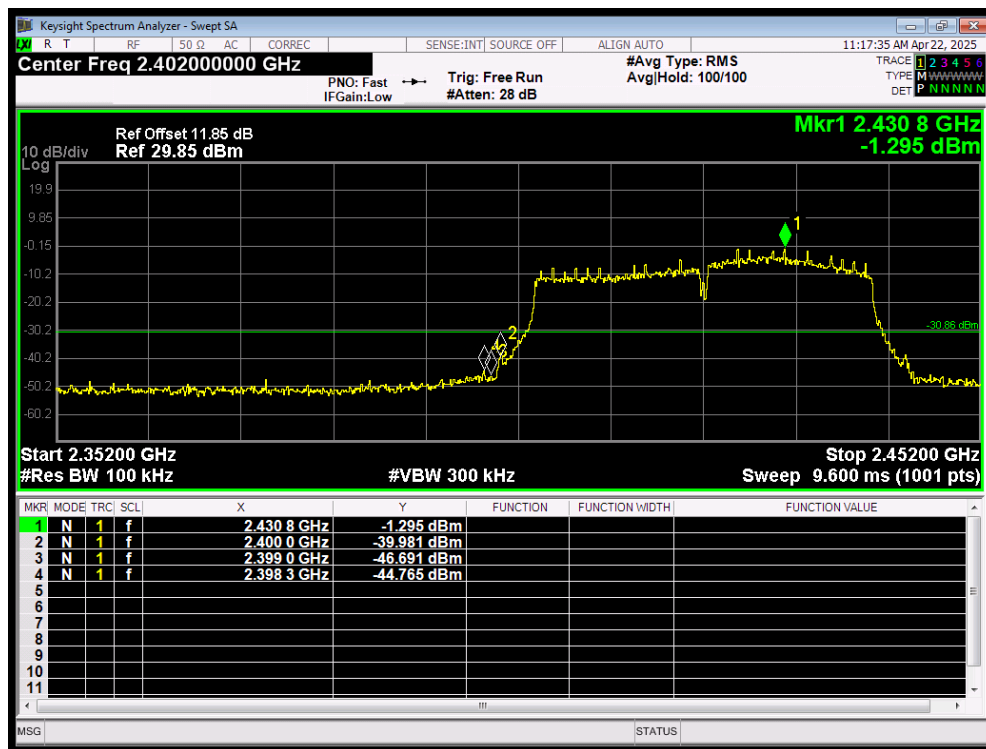
Band Edge 802.11n(HT20) 2462MHz Emission



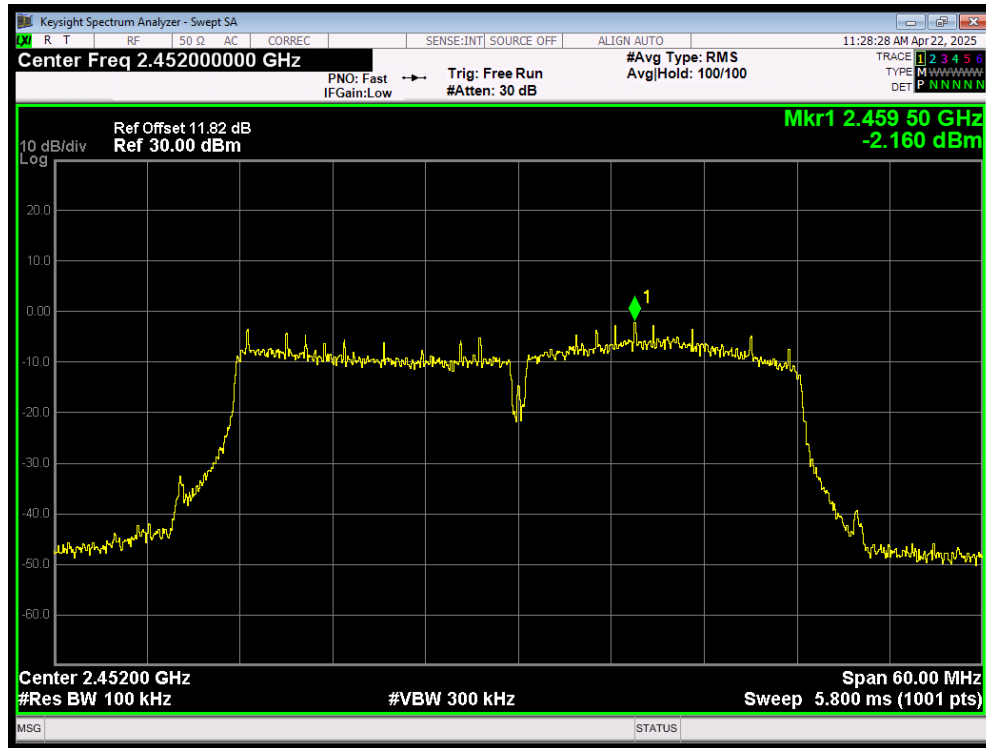
Band Edge 802.11n(HT40) 2422MHz Ref



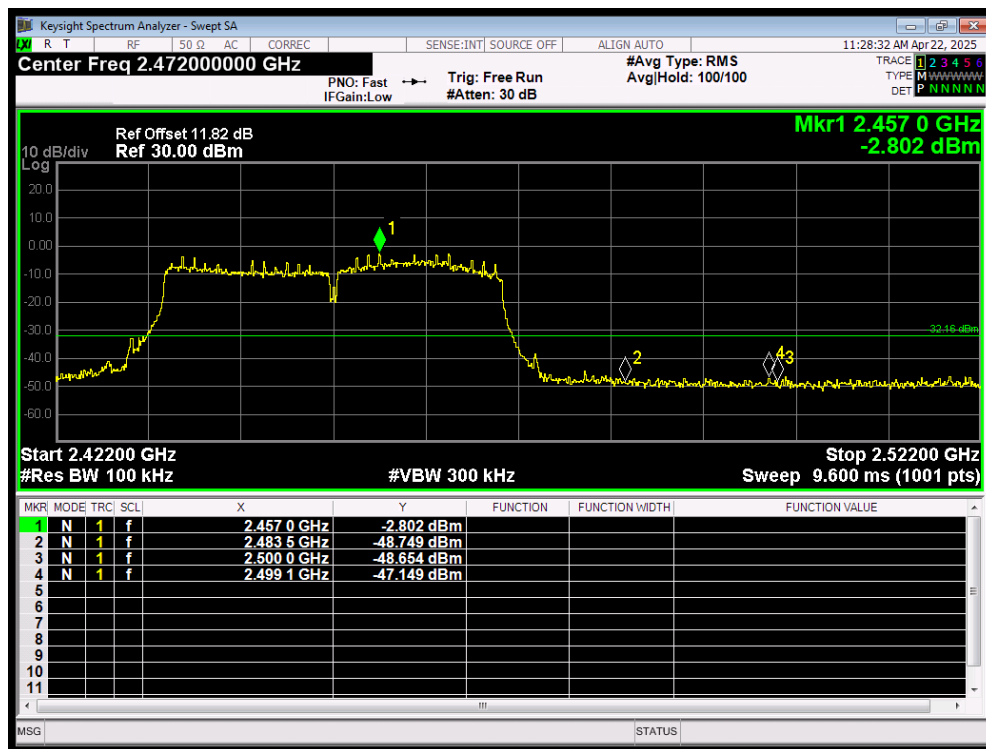
Band Edge 802.11n(HT40) 2422MHz Emission



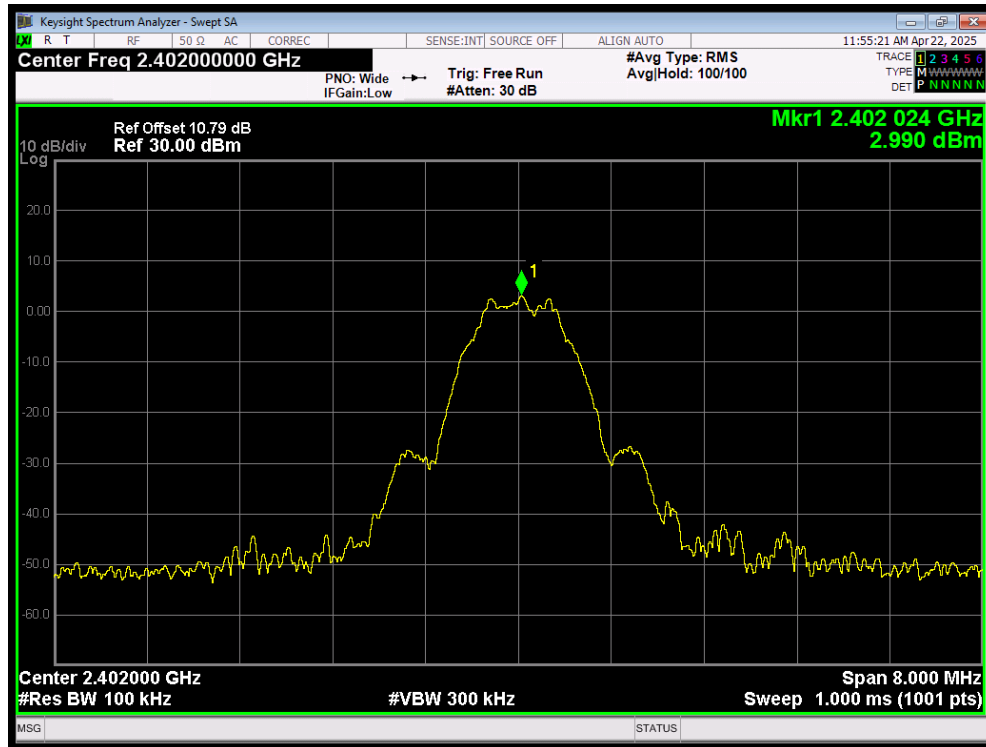
Band Edge 802.11n(HT40) 2452MHz Ref



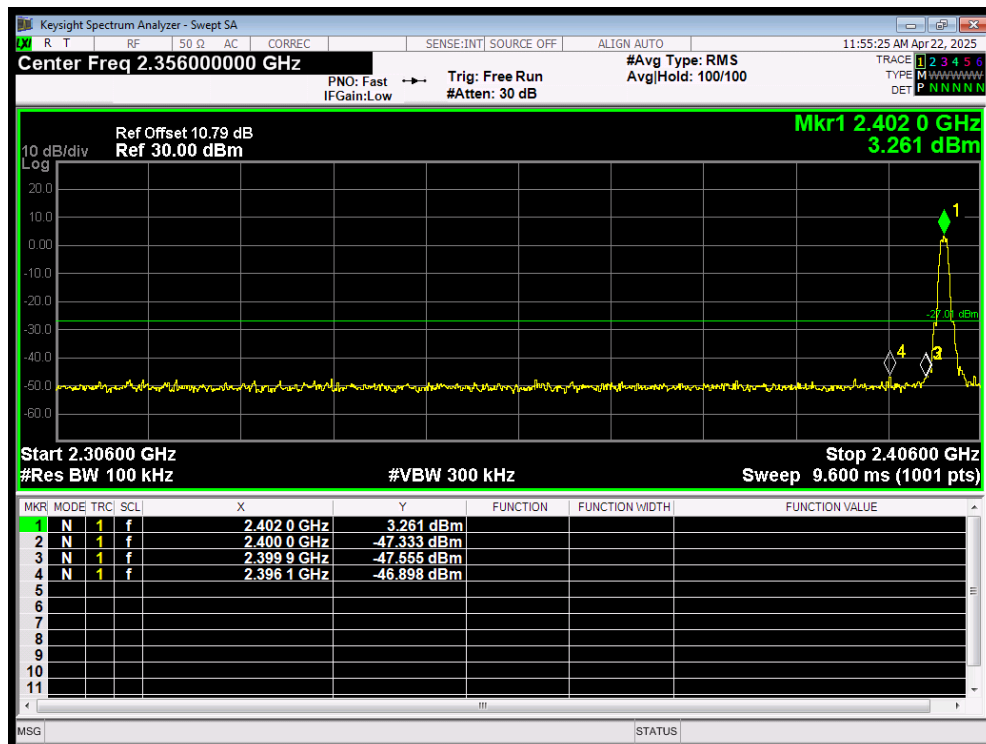
Band Edge 802.11n(HT40) 2452MHz Emission



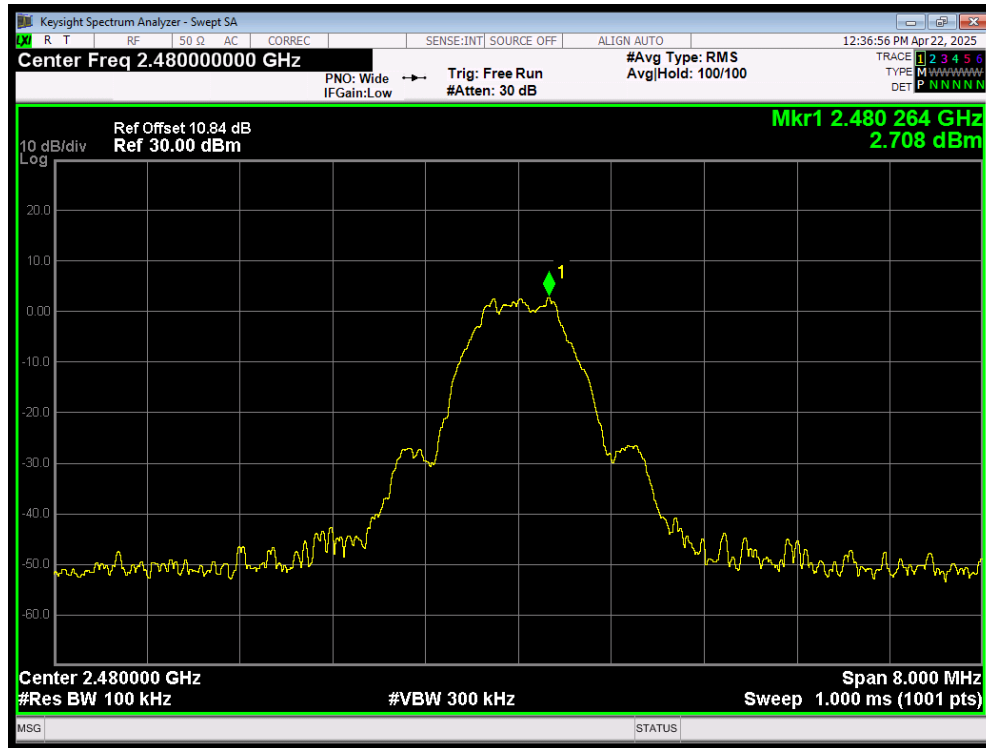
Band Edge Bluetooth LE (1M) 2402MHz Ref



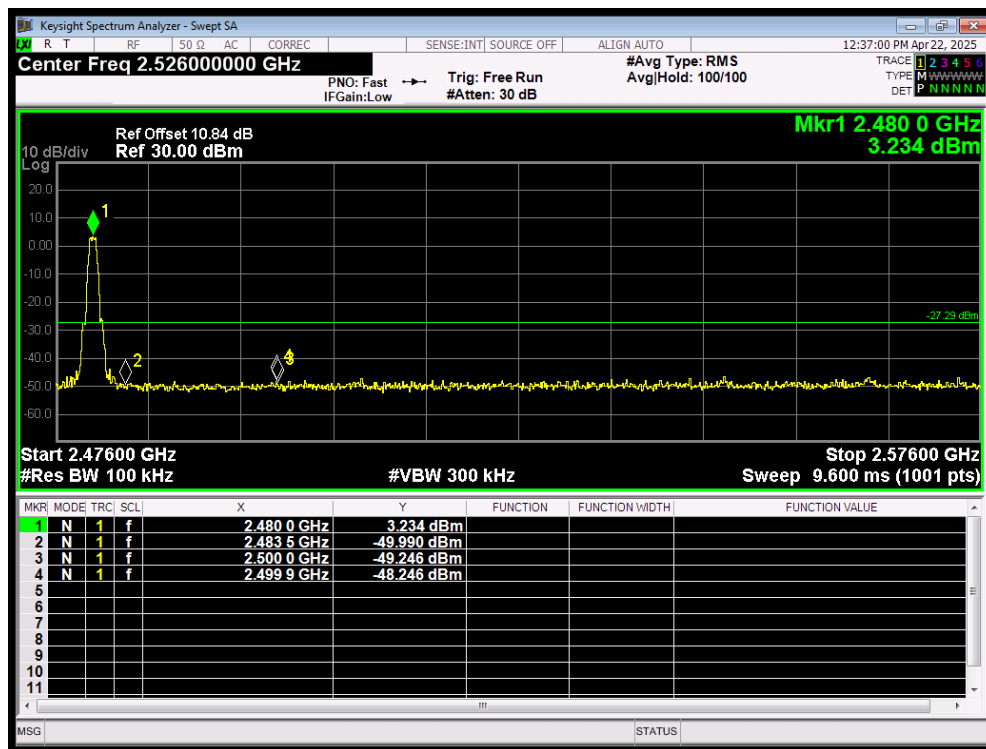
Band Edge Bluetooth LE (1M) 2402MHz Emission



Band Edge Bluetooth LE (1M) 2480MHz Ref



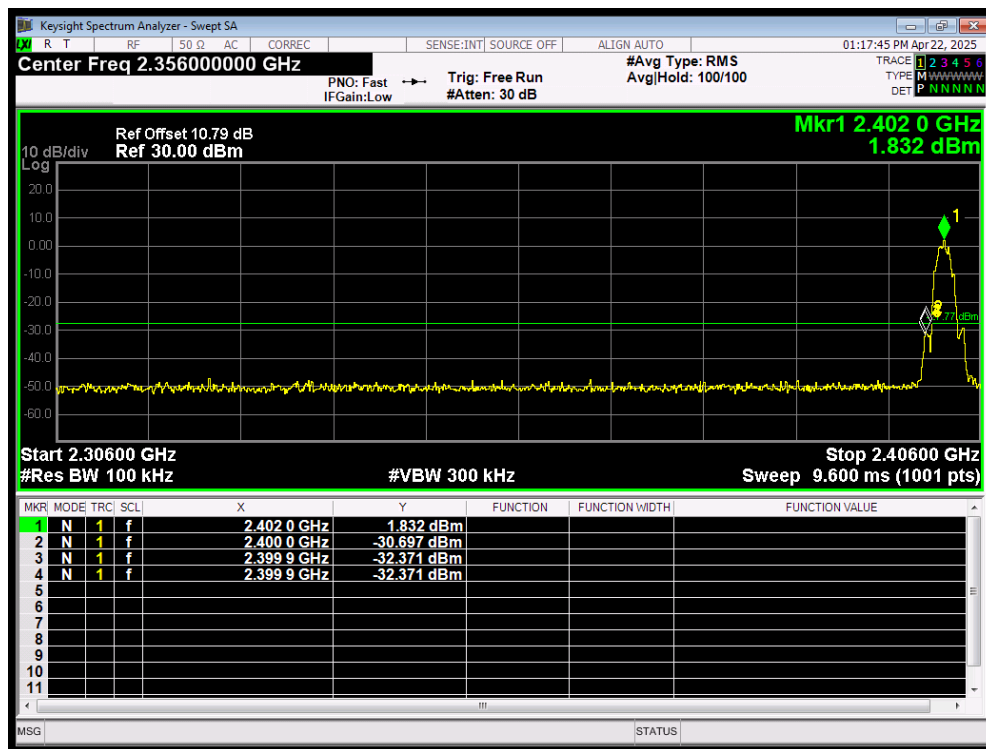
Band Edge Bluetooth LE (1M) 2480MHz Emission



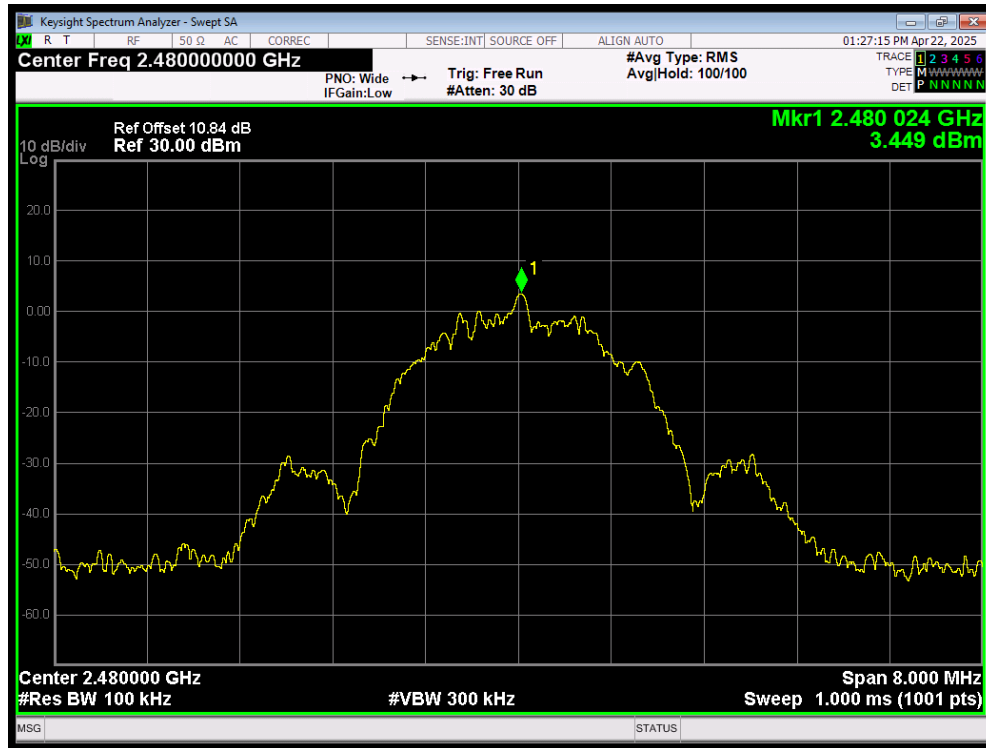
Band Edge Bluetooth LE (2M) 2402MHz Ref



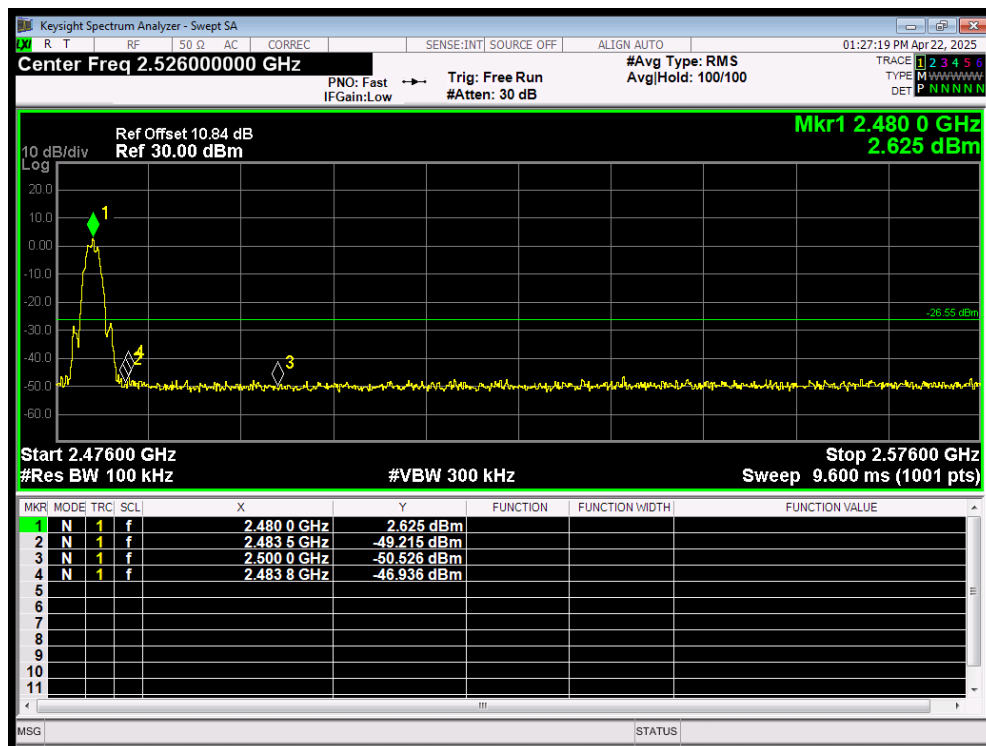
Band Edge Bluetooth LE (2M) 2402MHz Emission



Band Edge Bluetooth LE (2M) 2480MHz Ref



Band Edge Bluetooth LE (2M) 2480MHz Emission



## 5.4. Power Spectral Density

### Ambient Condition

| Temperature | Relative humidity |
|-------------|-------------------|
| 15°C ~ 35°C | 20% ~ 80%         |

### Method of Measurement

During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation.

Method AVGPSD-1 was used for this test.

- Set instrument center frequency to DTS channel center frequency
- Set span to at least 1.5 times the OBW
- Set RBW to:  $3\text{kHz} \leq \text{RBW} \leq 100\text{kHz}$
- Set VBW  $\geq [3 \times \text{RBW}]$
- Detector=power averaging (rms) or sample detector (when rms not available)
- Ensure that the number of measurement points in the sweep  $\geq [2 \times \text{span}/\text{RBW}]$
- Sweep time auto couple
- Employ trace averaging (rms) mode over a minimum of 100 traces
- Use the peak marker function to determine the maximum amplitude level.
- If the measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced)

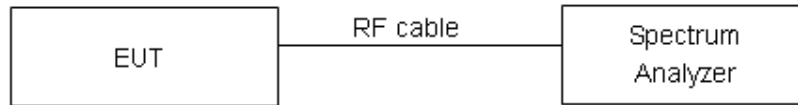
Method AVGPSD-2 was used for this test.

- Measure the duty cycle (D) of the transmitter output signal as described in 11.6
- Set instrument center frequency to DTS channel center frequency
- Set span to at least 1.5 times the OBW
- Set RBW to:  $3\text{kHz} \leq \text{RBW} \leq 100\text{kHz}$
- Set VBW  $\geq [3 \times \text{RBW}]$
- Detector= power averaging (rms) or sample detector (when rms not available)
- Ensure that the number of measurement points in the sweep  $\geq [2 \times \text{span}/\text{RBW}]$
- Sweep time =auto couple
- Do not use sweep triggering; allow sweep to "free run"
- Employ trace averaging (rms) mode over a minimum of 100 traces
- Use the peak marker function to determine the maximum amplitude level

l) Add  $[10 \log(1/D)]$ , where D is the duty cycle measured in step a), to the measured PSD to compute the average PSD during the actual transmission time

m) If measured value exceeds requirement specified by regulatory agency then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced)

### Test setup



### Limits

Rule Part 15.247(e) specifies that” For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. “

|        |                                    |
|--------|------------------------------------|
| Limits | $\leq 8 \text{ dBm} / 3\text{kHz}$ |
|--------|------------------------------------|

### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 2$ ,  $U = 0.75\text{dB}$ .

**Test Results:**

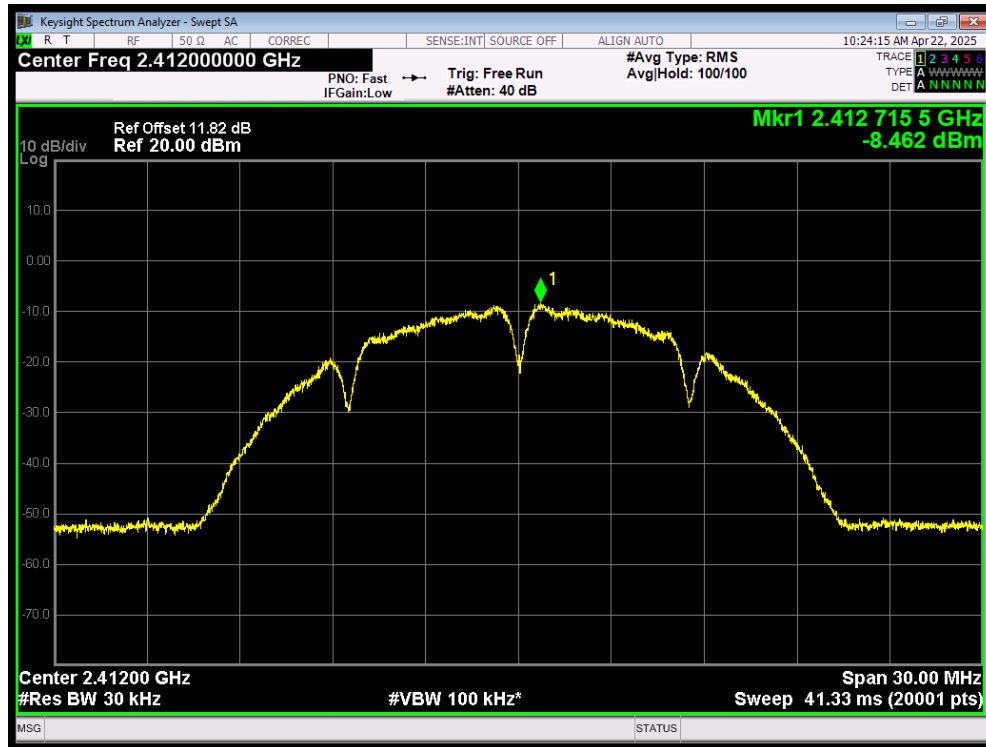
| Test Mode       | Carrier frequency (MHz) / Channel | Read Value (dBm / 30kHz) | Power Spectral Density (dBm / 3kHz) | Limit (dBm / 3kHz) | Conclusion |
|-----------------|-----------------------------------|--------------------------|-------------------------------------|--------------------|------------|
| 802.11b         | 2412/CH 1                         | -8.46                    | -18.46                              | 8                  | PASS       |
|                 | 2437/CH 6                         | -8.52                    | -18.52                              | 8                  | PASS       |
|                 | 2462/CH11                         | -7.82                    | -17.82                              | 8                  | PASS       |
| 802.11g         | 2412/CH 1                         | -11.87                   | -21.67                              | 8                  | PASS       |
|                 | 2437/CH 6                         | -10.63                   | -20.43                              | 8                  | PASS       |
|                 | 2462/CH11                         | -11.19                   | -20.99                              | 8                  | PASS       |
| 802.11n<br>HT20 | 2412/CH 1                         | -13.58                   | -23.28                              | 8                  | PASS       |
|                 | 2437/CH 6                         | -12.05                   | -21.75                              | 8                  | PASS       |
|                 | 2462/CH11                         | -13.56                   | -23.26                              | 8                  | PASS       |
| 802.11n<br>HT40 | 2422/CH3                          | -13.09                   | -22.84                              | 8                  | PASS       |
|                 | 2437/CH6                          | -14.47                   | -24.22                              | 8                  | PASS       |
|                 | 2452/CH9                          | -14.84                   | -24.59                              | 8                  | PASS       |

Note: Power Spectral Density (dBm/3kHz) =Read Value+Duty cycle correction factor + 10\*log10(3/30)

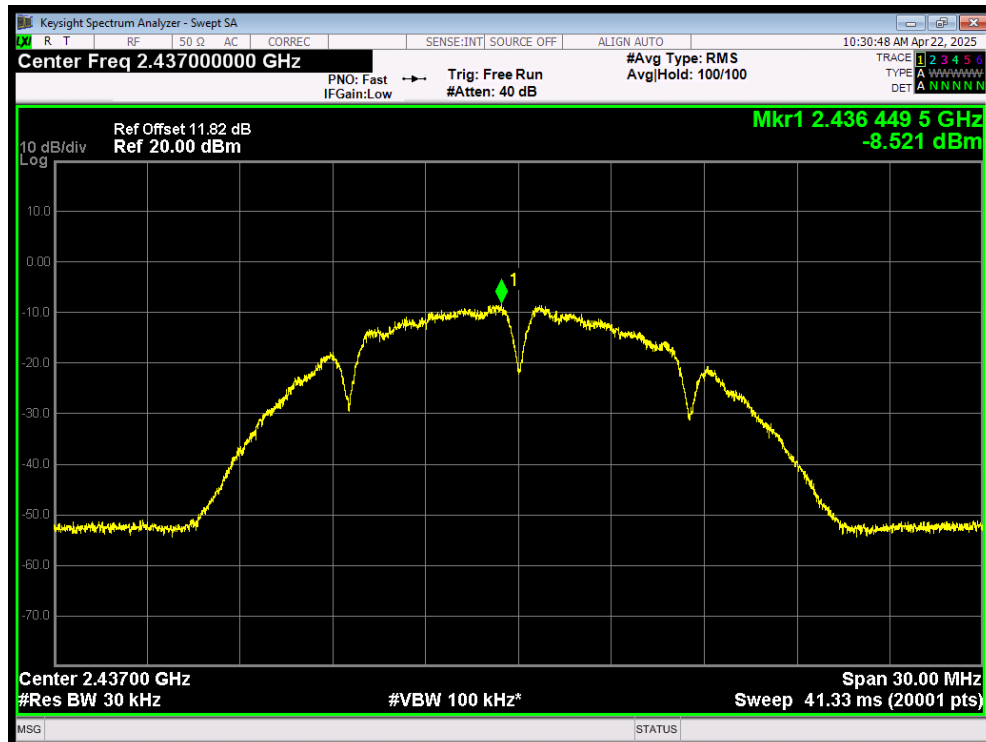
| Test Mode                         | Carrier frequency (MHz) / Channel | Read Value (dBm / 3kHz) | Power Spectral Density (dBm / 3kHz) | Limit (dBm / 3kHz) | Conclusion |
|-----------------------------------|-----------------------------------|-------------------------|-------------------------------------|--------------------|------------|
| Bluetooth<br>(Low Energy)<br>(1M) | 2402/CH0                          | -16.79                  | -14.79                              | 8                  | PASS       |
|                                   | 2440/CH19                         | -16.88                  | -14.88                              | 8                  | PASS       |
|                                   | 2480/CH39                         | -16.84                  | -14.84                              | 8                  | PASS       |
| Bluetooth<br>(Low Energy)<br>(2M) | 2402/CH0                          | -20.44                  | -15.70                              | 8                  | PASS       |
|                                   | 2440/CH19                         | -20.37                  | -15.63                              | 8                  | PASS       |
|                                   | 2480/CH39                         | -20.44                  | -15.70                              | 8                  | PASS       |

Note: Power Spectral Density =Read Value+Duty cycle correction factor

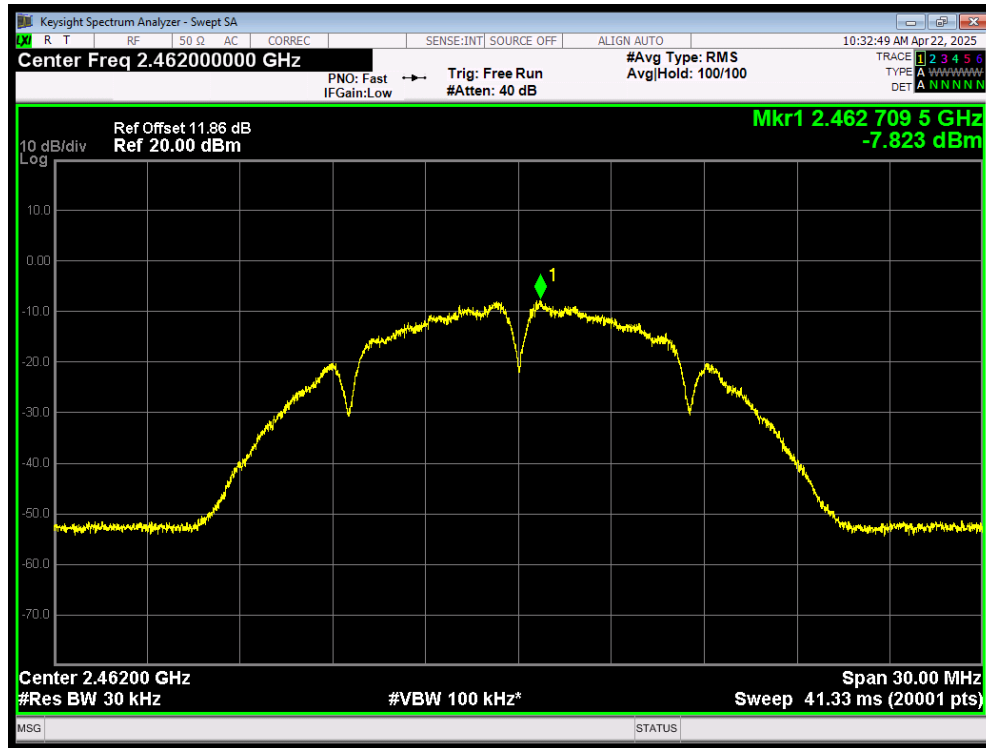
PSD 802.11b 2412MHz



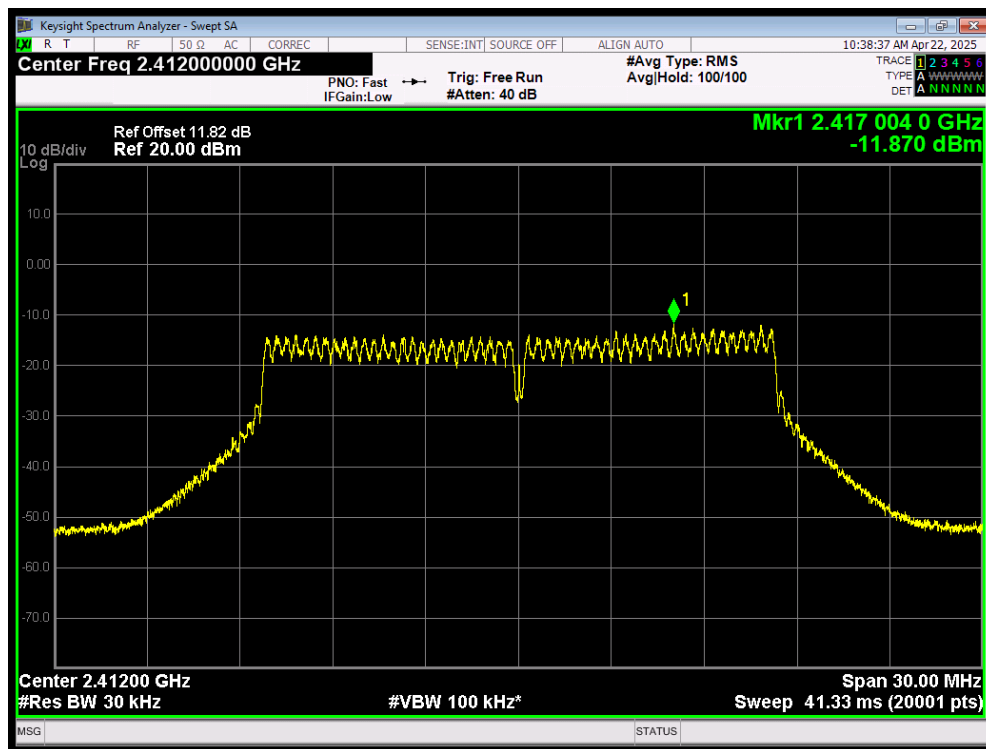
PSD 802.11b 2437MHz



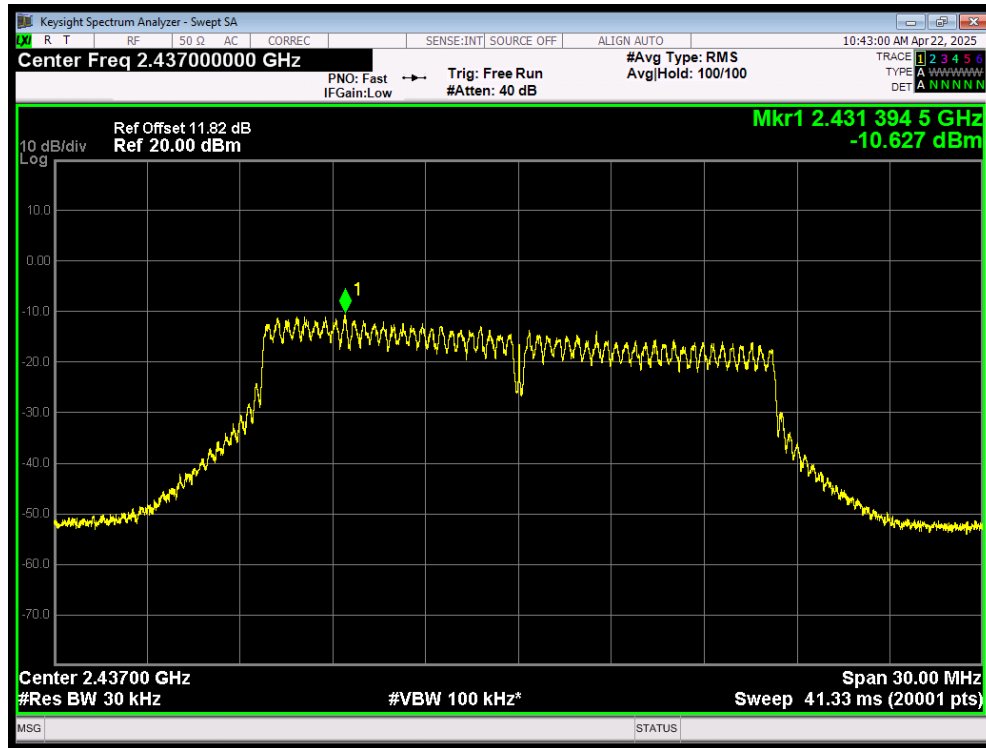
PSD 802.11b 2462MHz



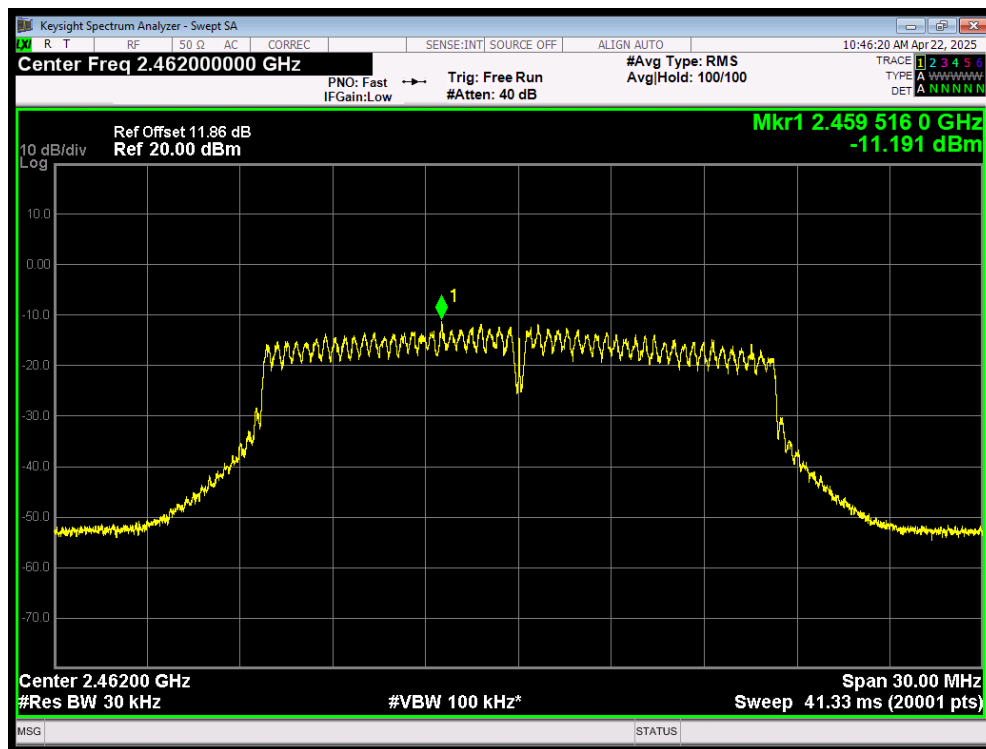
PSD 802.11g 2412MHz



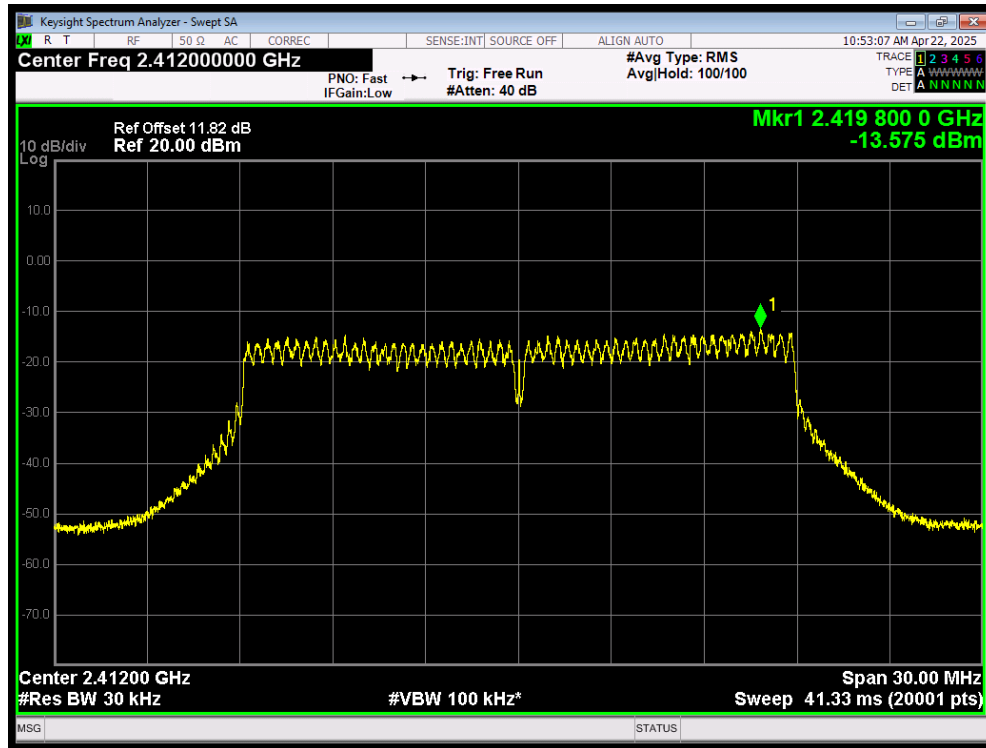
PSD 802.11g 2437MHz



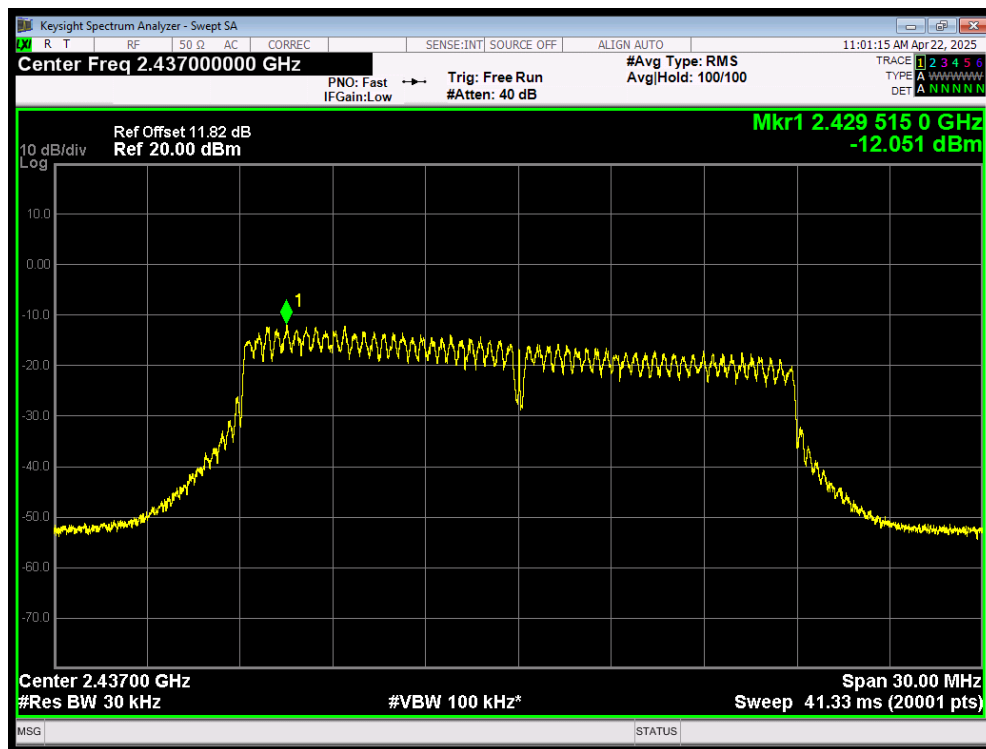
PSD 802.11g 2462MHz



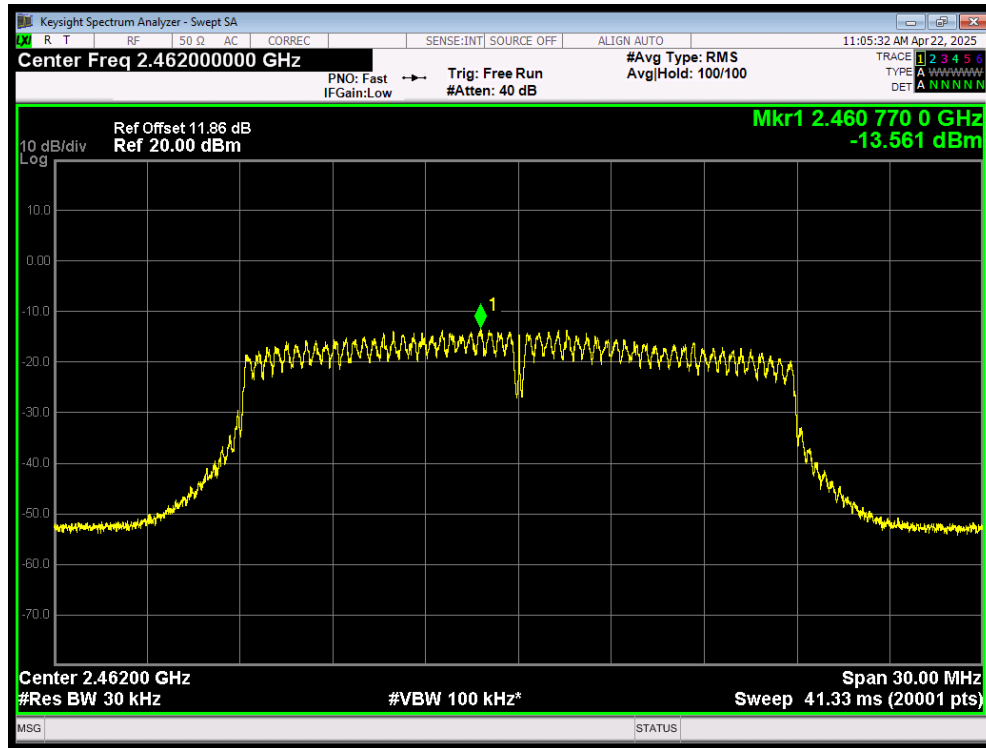
PSD 802.11n(HT20) 2412MHz



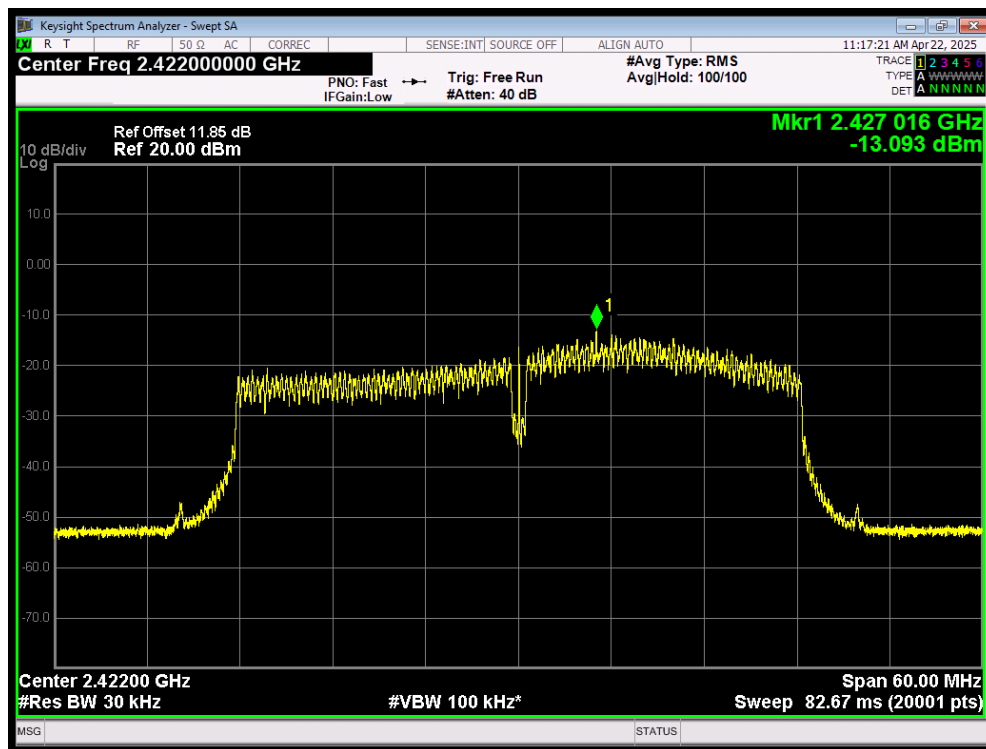
PSD 802.11n(HT20) 2437MHz



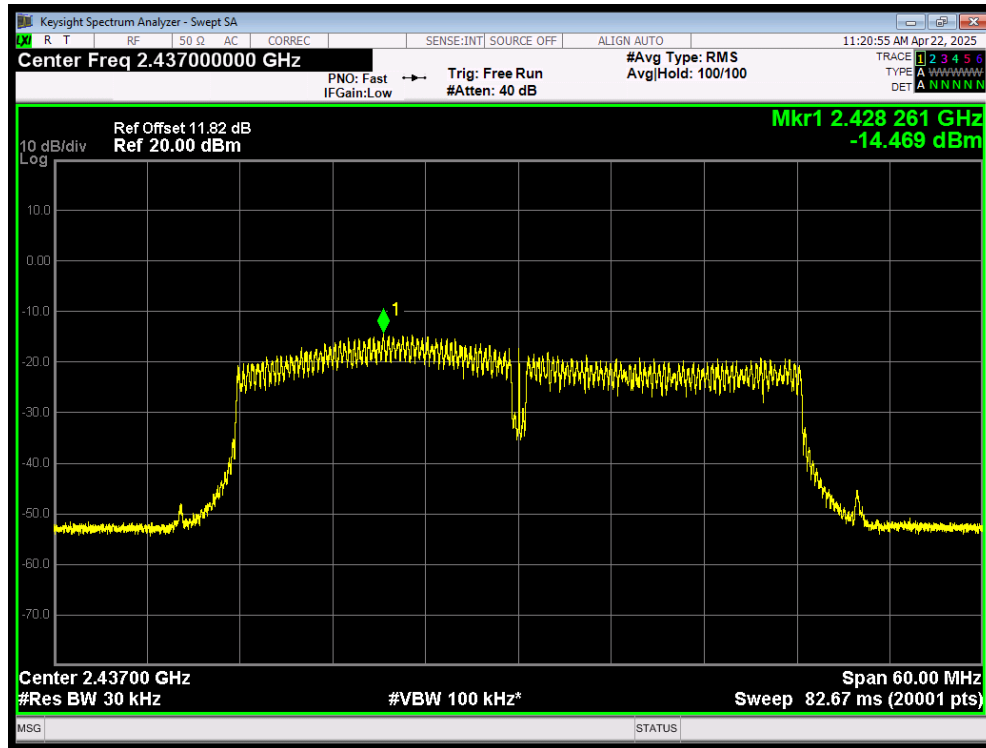
PSD 802.11n(HT20) 2462MHz



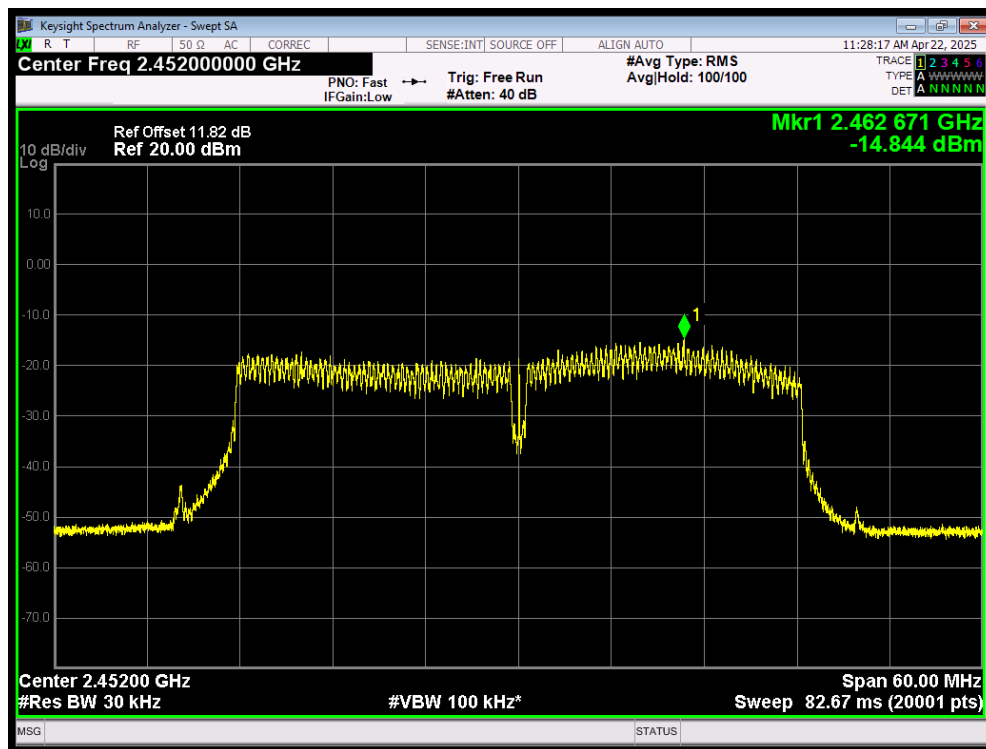
PSD 802.11n(HT40) 2422MHz



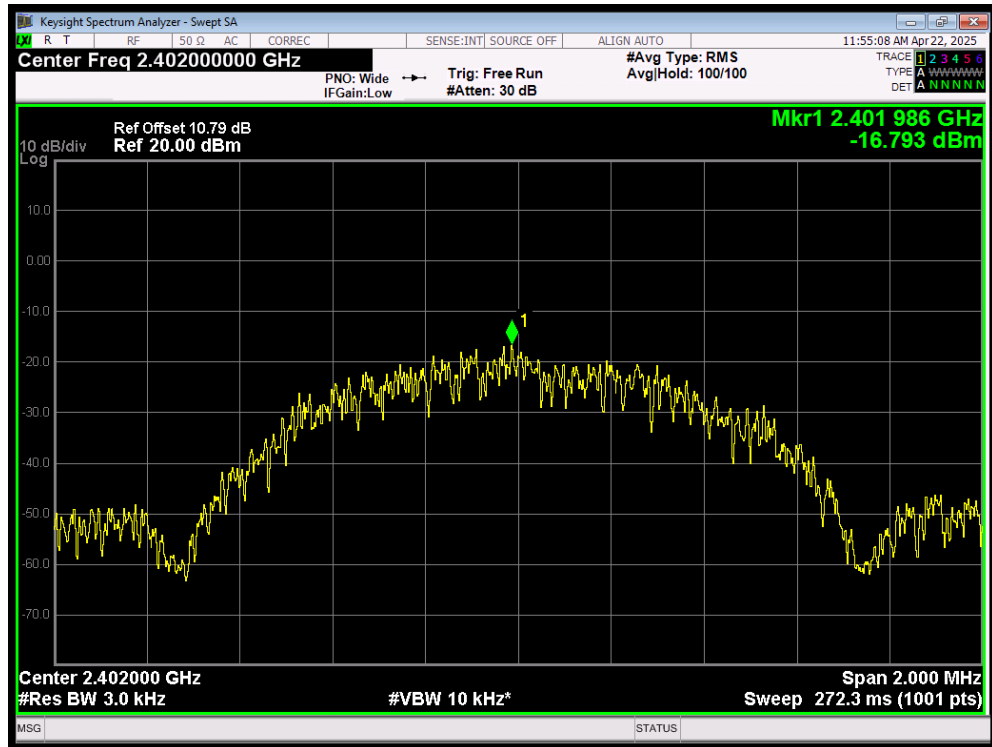
PSD 802.11n(HT40) 2437MHz



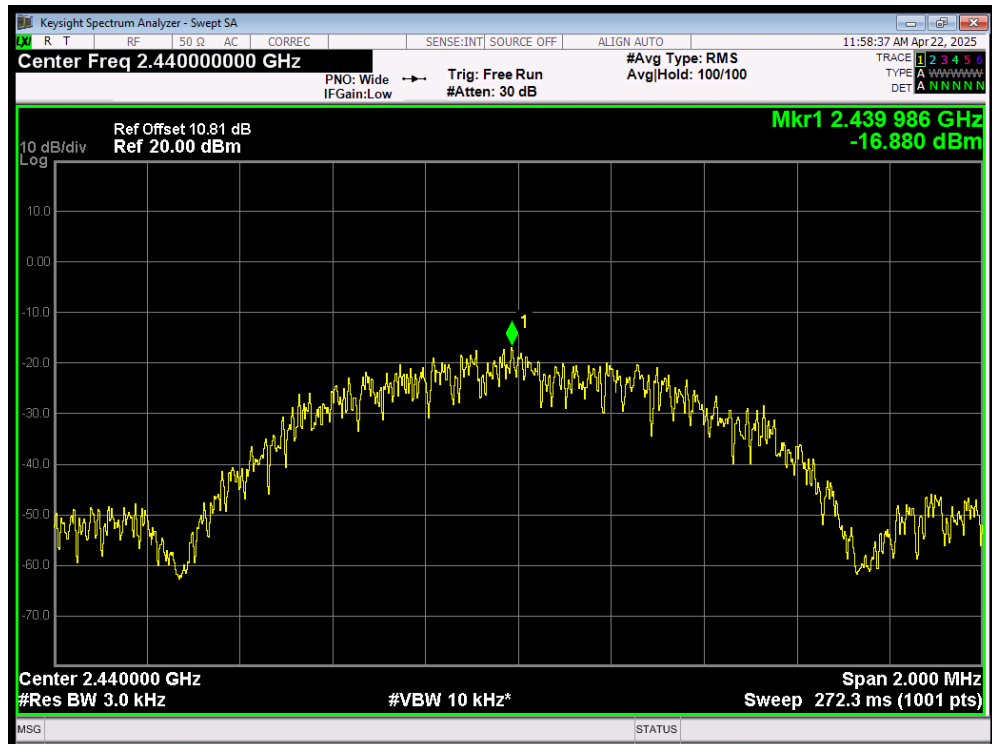
PSD 802.11n(HT40) 2452MHz



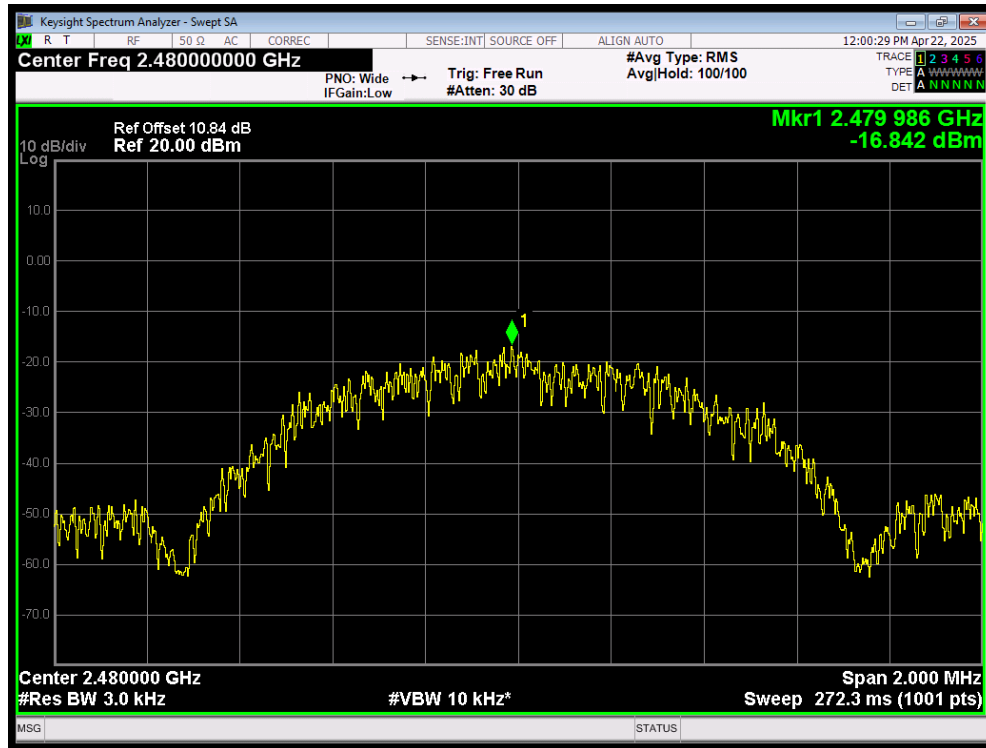
PSD Bluetooth LE (1M) 2402MHz



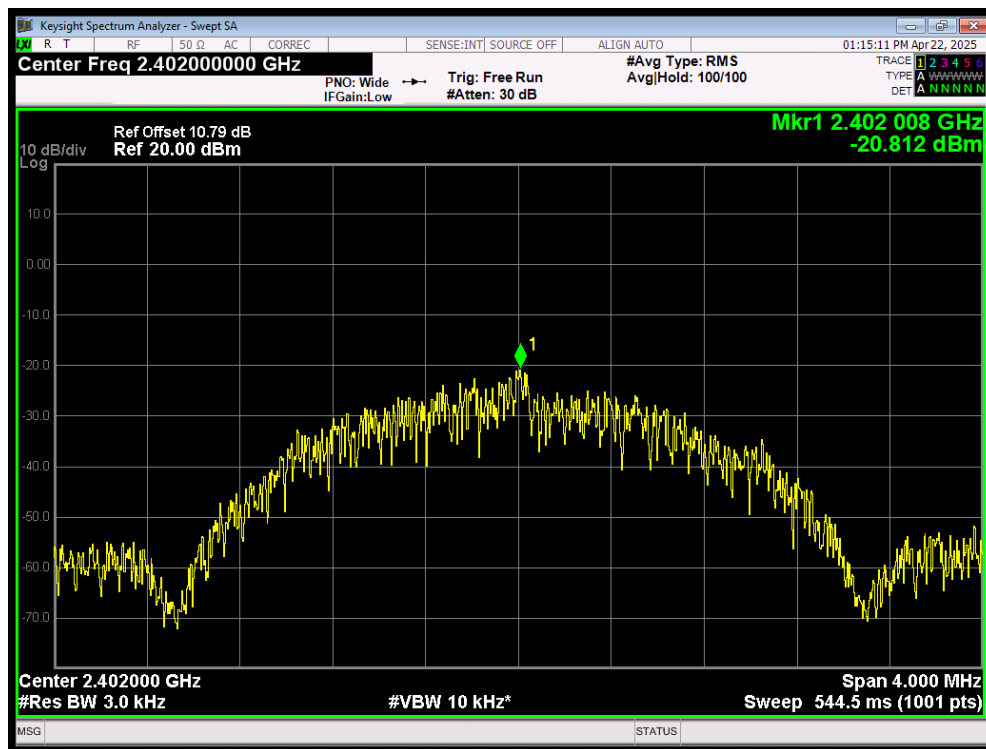
PSD Bluetooth LE (1M) 2440MHz



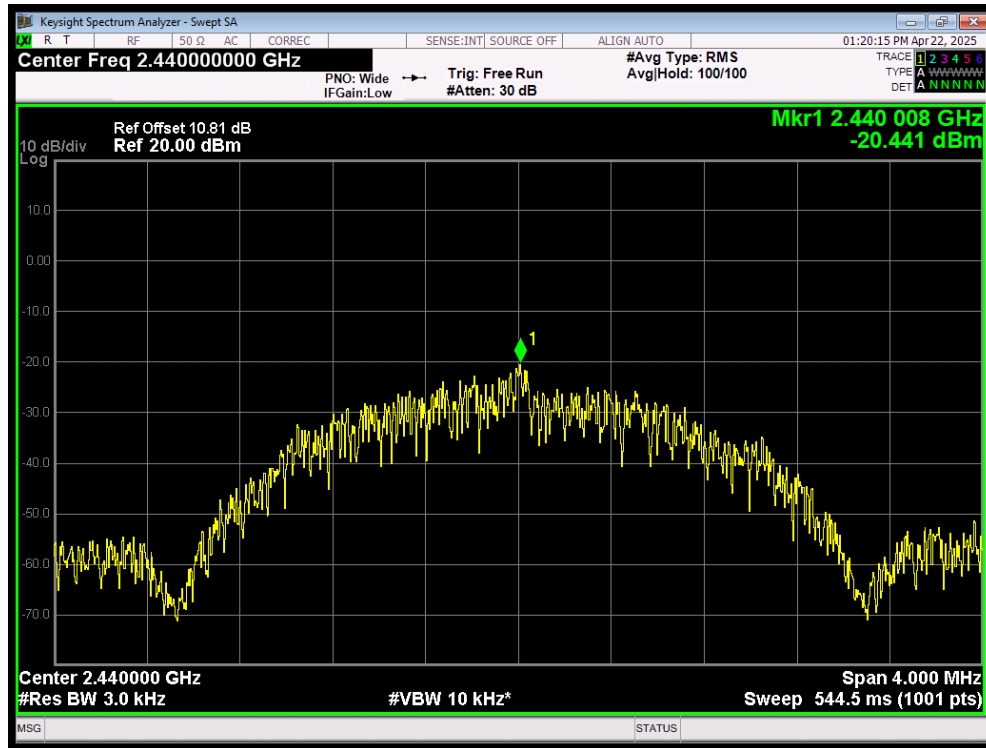
PSD Bluetooth LE (1M) 2480MHz



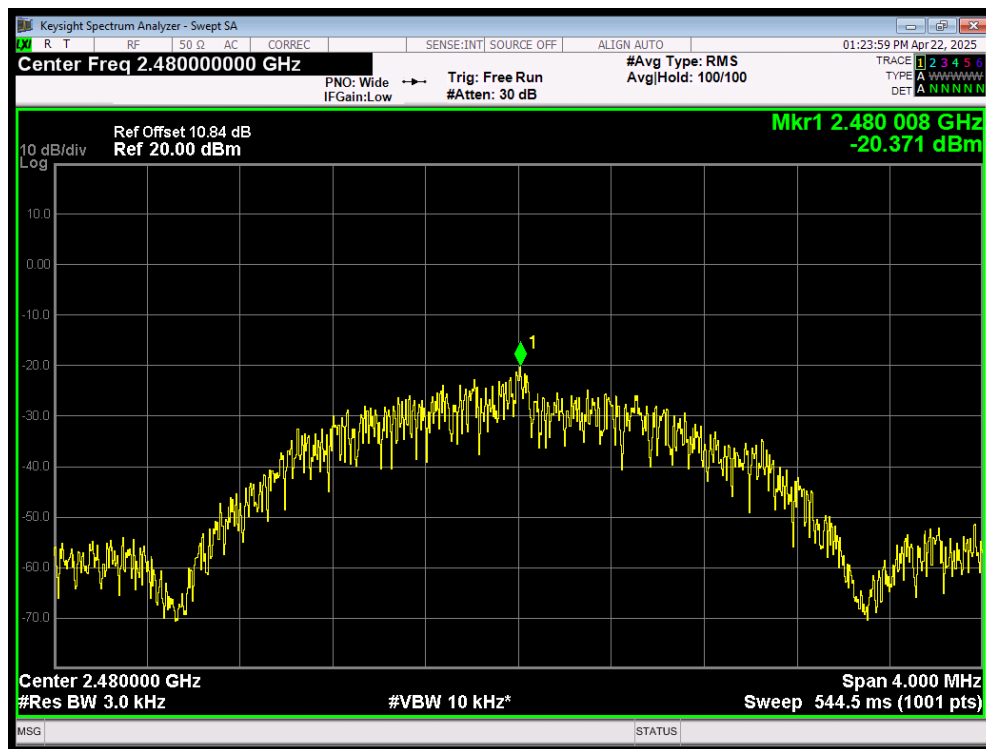
PSD Bluetooth LE (2M) 2402MHz



PSD Bluetooth LE (2M) 2440MHz



PSD Bluetooth LE (2M) 2480MHz



## 5.5. Spurious RF Conducted Emissions

### Ambient Condition

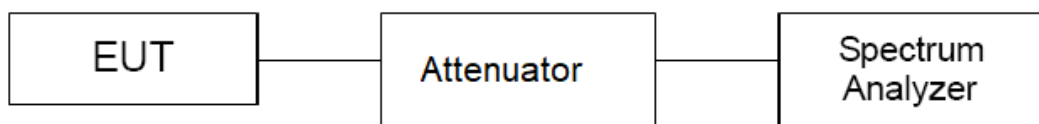
| Temperature | Relative humidity |
|-------------|-------------------|
| 15°C ~ 35°C | 20% ~ 80%         |

### Method of Measurement

The EUT was connected to the spectrum analyzer with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW to 100 kHz and VBW to 300 kHz, Sweep is set to AUTO.

The test is in transmitting mode.

### Test Setup



### Limits

Rule Part 15.247(d) pacifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. ”

| Test Mode    | Carrier frequency (MHz) | Reference value (dBm) | Limit  |
|--------------|-------------------------|-----------------------|--------|
| 802.11b      | 2412                    | 4.45                  | -25.55 |
|              | 2437                    | 4.79                  | -25.21 |
|              | 2462                    | 5.08                  | -24.92 |
| 802.11g      | 2412                    | 0.29                  | -29.71 |
|              | 2437                    | 2.39                  | -27.61 |
|              | 2462                    | 0.24                  | -29.76 |
| 802.11n HT20 | 2412                    | 0.23                  | -29.77 |
|              | 2437                    | 1.29                  | -28.71 |
|              | 2462                    | -0.69                 | -30.69 |

|                                   |      |       |        |
|-----------------------------------|------|-------|--------|
| 802.11n<br>HT40                   | 2422 | -1.05 | -31.05 |
|                                   | 2437 | -0.33 | -30.33 |
|                                   | 2452 | -1.94 | -31.94 |
| Bluetooth<br>(Low Energy)<br>(1M) | 2402 | 2.83  | -27.17 |
|                                   | 2440 | 3.21  | -26.79 |
|                                   | 2480 | 3.31  | -26.69 |
| Bluetooth<br>(Low Energy)<br>(2M) | 2402 | 3.19  | -26.81 |
|                                   | 2440 | 3.25  | -26.75 |
|                                   | 2480 | 3.29  | -26.71 |

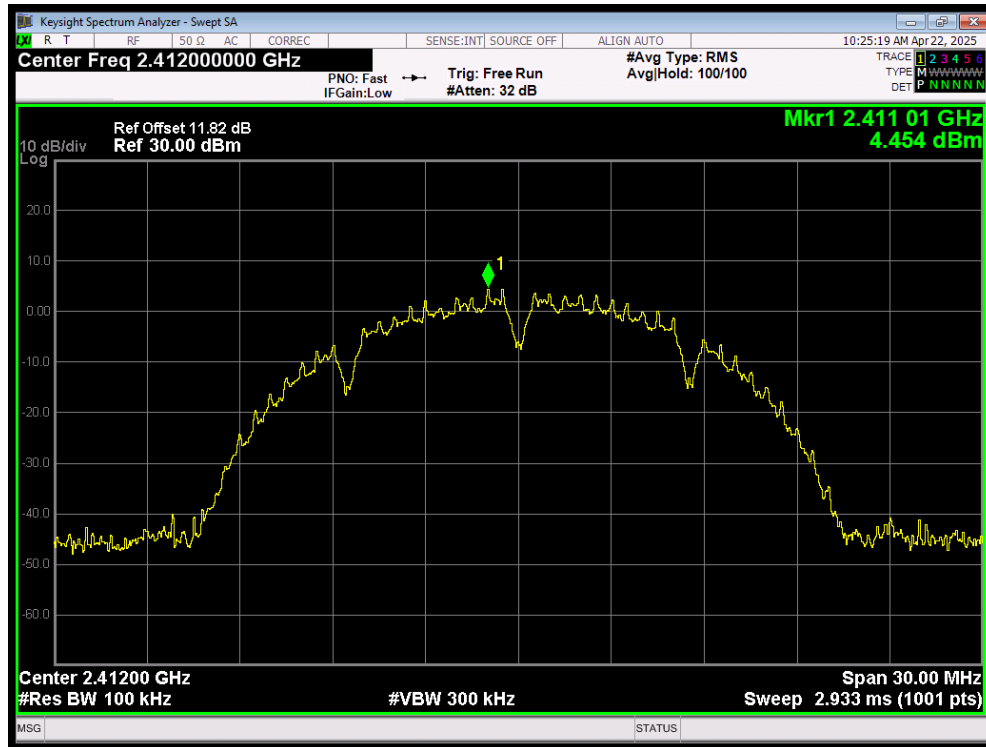
### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ .

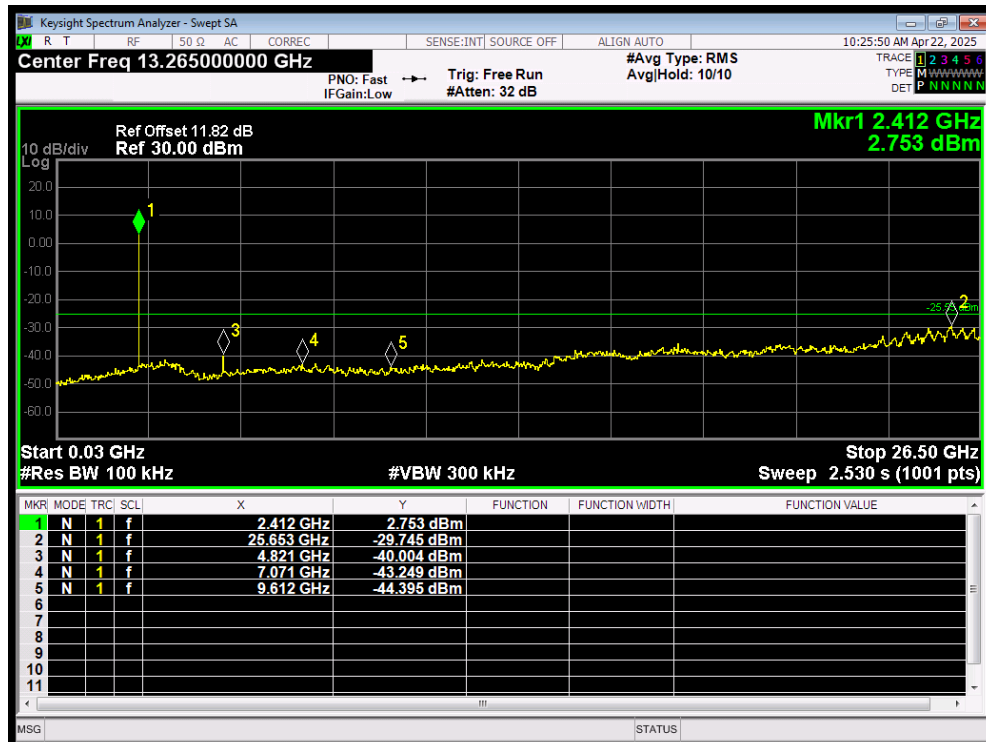
| Frequency   | Uncertainty |
|-------------|-------------|
| 100kHz-2GHz | 0.684 dB    |
| 2GHz-26GHz  | 1.407 dB    |

Test Results:

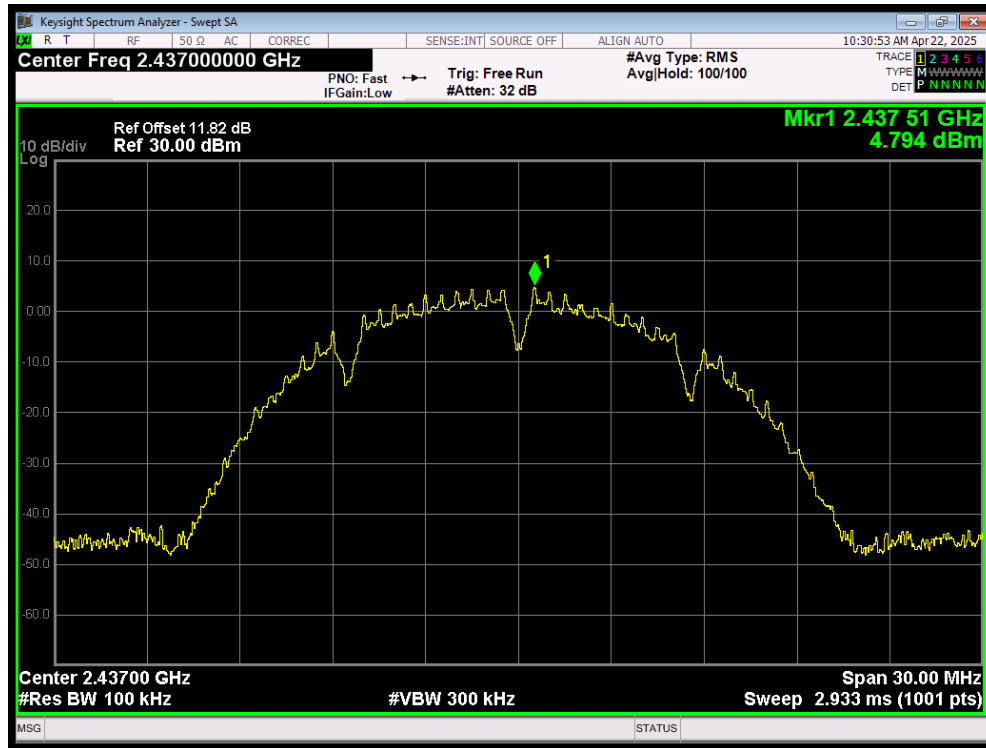
Tx. Spurious 802.11b 2412MHz Ref



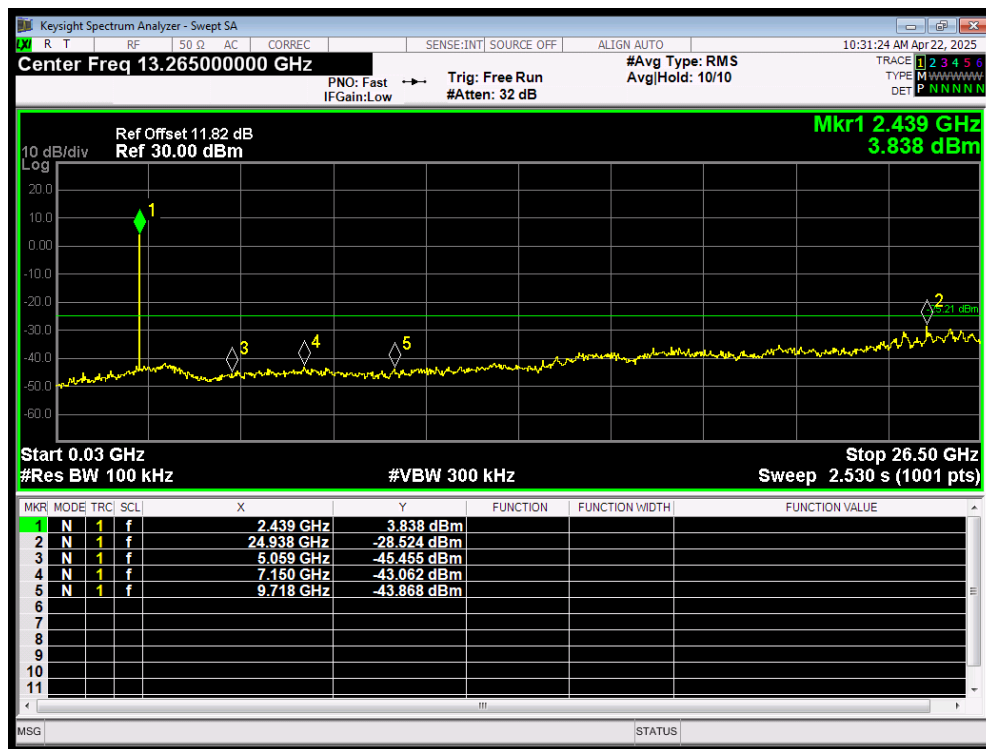
Tx. Spurious 802.11b 2412MHz Emission



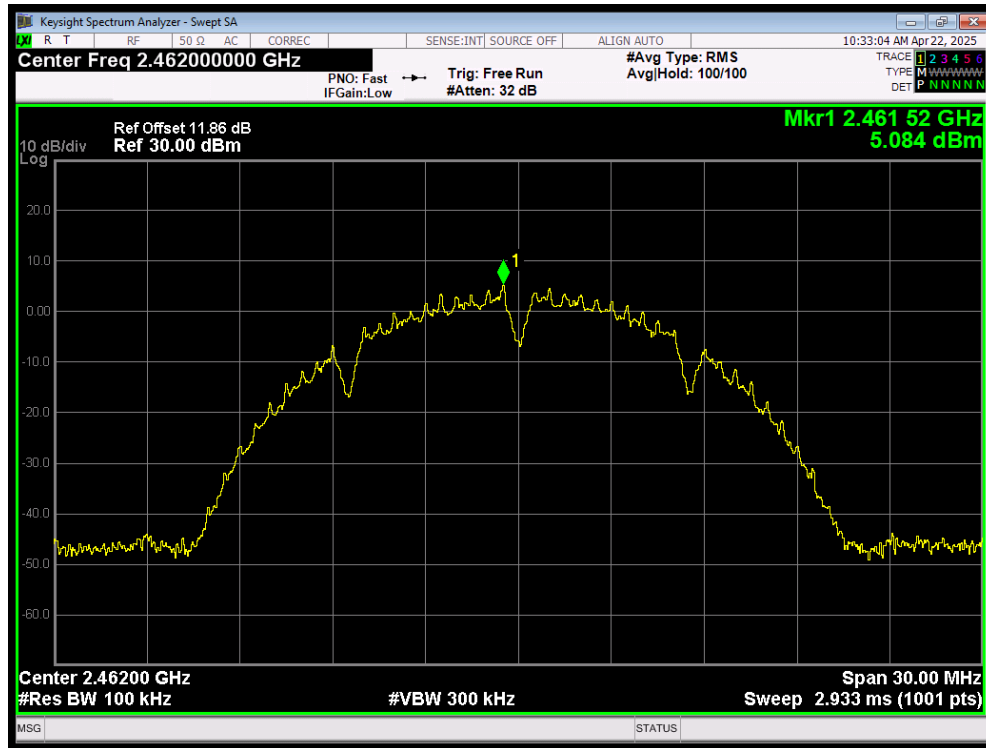
Tx. Spurious 802.11b 2437MHz Ref



Tx. Spurious 802.11b 2437MHz Emission



Tx. Spurious 802.11b 2462MHz Ref



Tx. Spurious 802.11b 2462MHz Emission

