ncee labs
Product Compliance Solutions

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# FCC/ISED TEST REPORT

| | |
|---|---|
| **Prepared for:** | **Xetawave LLC** |
| **Address:** | **258 S Taylor Ave,<br>Louisville, CO 80027, USA** |
| **Product:** | **Xeta 8** |
| **FCC ID:**<br>**IC ID:** | **PEJ-9283080**<br>**11169A-08001** |
| **Test Report No:** | **R230711-20-E1B** |
| **Approved By:** |  <br>**Fox Lane,<br>EMC Test Engineer** |
| **DATE:** | **January 8, 2024** |
| **Total Pages:** | **48** |



ilac-MRA A2LA ACCREDITED TESTING LABORATORY CERTIFICATE NO. 1953.01

## REVISION PAGE

| Rev. No. | Date | Description |
|---|---|---|
| 0 | 27 December 2023 | Issued by FLane<br>Reviewed by KVepuri<br>Prepared by FLane |
| A | 2 January 2024 | Added EUT FCC/IC ID's - FL |
| B | 8 January 2024 | Updated EUT information, added conducted spurious emissions - FL |

## CONTENTS

## 1.0 SUMMARY OF TEST RESULTS

The worst-case measurements were reported in this report. The EUT has been tested according to the following specifications:

**US Code of Federal Regulations, Title 47, Part 90**
**RSS-119 Issue 12 - Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz**

| APPLIED STANDARDS AND REGULATIONS | | |
|---|---|---|
| **Standard Section** | **Test Type** | **Result** |
| FCC Part 2.1046<br>FCC Part 90.205<br>RSS-119 Section 4.1 | RF Output Power | Complies |
| FCC Part 90.207<br>FCC Part 2.1047<br>RSS-119 Section 5.2 | Modulation characteristics | Complies |
| FCC Part 2.1049<br>FCC Part 90.209 (b) (5)<br>FCC Part 90.210<br>RSS-119 Section 5.5 | Occupied bandwidth | Complies |
| FCC Part 90.1051<br>FCC Part 90.210 (g); (j)<br>RSS-119 Section 4.1/5.8 | Spurious emissions at antenna terminals | Complies |
| FCC Part 90.1053<br>FCC Part 90.215<br>RSS-119 Section 4.1/5.8 | Field strength of spurious emission | Complies |
| FCC Part 2.1055<br>FCC Part 90.213 (a)<br>RSS-119 Section 5.3 | Frequency Stability | Complies |
| FCC Part 90.214<br>RSS-119 Section 5.9 | Transient Frequency Behavior | NA* |

See Section 4 for details on the test methods used for each test.
*Not applicable for the frequency range of the device.

# 2.0 EUT DESCRIPTION

## 2.1 EQUIPMENT UNDER TEST

| | |
|---|---|
| **Model** | Xeta 8 |
| **EUT Received** | 20 November 2023 |
| **EUT Tested** | 20 November 2023- 22 November 2023 |
| **Serial No.** | E5035D69 |
| **FCC ID:** | PEJ-9283080 |
| **IC ID:** | 11169A-08001 |
| **Operating Band** | 896–901MHz / 935-940MHz |
| **Device Type** | Licensed Radio |
| **Power Supply** | 10VDC |

NOTE: For more detailed features description, please refer to the manufacturer's specifications or user's manual.

## 2.2 DESCRIPTION OF TEST MODES

The EUT operates on, and was tested at the frequencies below:

| CHANNEL FREQUENCY (MHz) | Modulation | Bandwidth (kHz) |
|---|---|---|
| 896 | MSK | 12.5 |
| 896 | MSK | 25.0 |
| 896 | 64QAM | 12.5 |
| 896 | 64QAM | 25.0 |
| 901 | MSK | 12.5 |
| 901 | MSK | 25.0 |
| 901 | 64QAM | 12.5 |
| 901 | 64QAM | 25.0 |
| 935 | MSK | 12.5 |
| 935 | MSK | 25.0 |
| 935 | 64QAM | 12.5 |
| 935 | 64QAM | 25.0 |
| 940 | MSK | 12.5 |
| 940 | MSK | 25.0 |
| 940 | 64QAM | 12.5 |
| 940 | 64QAM | 25.0 |

See the manufacturer’s operational description/manual for a list of all channel frequencies and designations.

### 2.3 DESCRIPTION OF SUPPORT UNITS

NA

## 3.0 LABORATORY DESCRIPTION

### 3.1 LABORATORY DESCRIPTION

All testing was performed at the following Facility:

The Nebraska Center for Excellence in Electronics (NCEE Labs)
4740 Discovery Drive
Lincoln, NE 68521

| | |
|---|---|
| A2LA Certificate Number: | 1953.01 |
| FCC Accredited Test Site Designation No: | US1060 |
| Industry Canada Test Site Registration No: | 4294A-1 |
| NCC CAB Identification No: | US0177 |

Environmental conditions varied slightly throughout the tests:

Relative humidity of 35 ± 4%
Temperature of 22 ± 3° Celsius

### 3.2 TEST PERSONNEL

All testing was performed by Fox Lane of NCEE Labs. The results were reviewed by Karthik Vepuri.

## 3.3 TEST EQUIPMENT

| DESCRIPTION AND MANUFACTURER | MODEL NO. | SERIAL NO. | LAST CALIBRATION DATE | CALIBRATION DUE DATE |
|---|---|---|---|---|
| Keysight MXE Signal Analyzer (44GHz) | N9038A | MY59050109 | July 17, 2023 | July 17, 2025 |
| Keysight MXE Signal Analyzer (26.5GHz) | N9038A | MY56400083 | July 17, 2023 | July 17, 2025 |
| Keysight EXA Signal Analyzer | N9010A | MY56070862 | July 18, 2023 | July 17, 2025 |
| SunAR RF Motion | JB1 | A091418 | July 27, 2023 | July 26, 2024 |
| ETS-Lindgren Red Horn Antenna | 3115 | 218576 | July 31, 2023 | July 30, 2024 |
| Agilent Preamp* | 87405A | 3950M00669 | June 5, 2023 | June 5, 2025 |
| Rohde & Schwarz Preamplifier* | TS-PR18 | 3545700803 | June 5, 2023 | June 5, 2025 |
| Trilithic High Pass Filter* | 6HC330 | 23042 | June 5, 2023 | June 5, 2025 |
| MiniCircuits 8000+ High Pass Filter* | ZHSSM-8G-S+ | 32240 | April 7, 2023 | April 7, 2025 |
| RF Cable (preamplifier to antenna)* | MFR-57500 | 01-07-002 | June 5, 2023 | June 5, 2025 |
| ETS – Lindgren- VSWR on 10m Chamber | 10m Semi-anechoic chamber-VSWR | 4740 Discovery Drive | July 30, 2020 | July 30, 2023 |
| NCEE Labs-NSA on 10m Chamber* | 10m Semi-anechoic chamber-NSA | NCEE-001 | May 25, 2022 | May 25, 2025 |
| RF Cable (antenna to 10m chamber bulkhead) | FSCM 64639 | 01E3872 | June 5, 2023 | June 5, 2025 |
| RF Cable (10m chamber bulkhead to control room bulkhead) | FSCM 64639 | 01E3874 | June 5, 2023 | June 5, 2025 |
| RF Cable (control room bulkhead to test receiver) | FSCM 64639 | 01F1206 | June 5, 2023 | June 5, 2025 |
| N connector bulkhead (10m chamber) | PE9128 | NCEEBH1 | June 5, 2023 | June 5, 2025 |
| N connector bulkhead (control room) | PE9128 | NCEEBH2 | June 5, 2023 | June 5, 2025 |
| TDK Emissions Lab Software | V11.25 | 700307 | NA | NA |

*Internal Characterization

# 4.0 DETAILED RESULTS

## 4.1 CONDUCTED SPURIOUS EMISSIONS AND EMISSION MASKS

**Test Method**: ANSI C63.26:2015:
Section 5.5, “Radiated Emissions Testing”

**Limits:**
**47 CFR 90.210 Emission masks:**
**RSS-119 Sec 5.8:**

**Emission Mask G:**
For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows: (Used for 25kHz Modulations)

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 10 kHz, but no more than 250 percent of the authorized bandwidth: At least 116 log ($f_d$ /6.1) dB, or 50 + 10 log (P) dB, or 70 dB, whichever is the lesser attenuation.

(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

**Emission Mask J**:
For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) as follows: (Used for 12.5kHz Modulations)

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 2.5 kHz, but no more than 6.25 kHz: At least 53 log ($f_d$/2.5) dB;

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 6.25 kHz, but no more than 9.5 kHz: At least 103 log ($f_d$/3.9) dB;

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 9.5 kHz: At least 157 log ($f_d$/5.3) dB, or 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

**Test procedures:**
The EUT was connected directly to a spectrum analyzer using attenuators to protect the test equipment, Corrections due to attenuators was accounted for. Analyzer measurement settings can be found in the plots below.

**Deviations from test standard:**
No deviation.

**Test setup:**

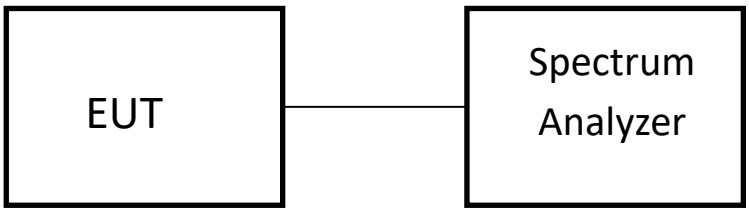


**Figure 1 - Conducted Spurious Test Setup**

**EUT operating conditions**
See Section 2.1 & 2.2

**Test results:**
Conducted spurious emissions expanding beyond the emission masks below were investigated and found to have at least 6dB of margin compared to the applicable limit. Worst case spurious emissions for both 896-901 and 935-940 are shown below, all other conducted spurious emissions had at least 6dB of margin to the applicable limit.

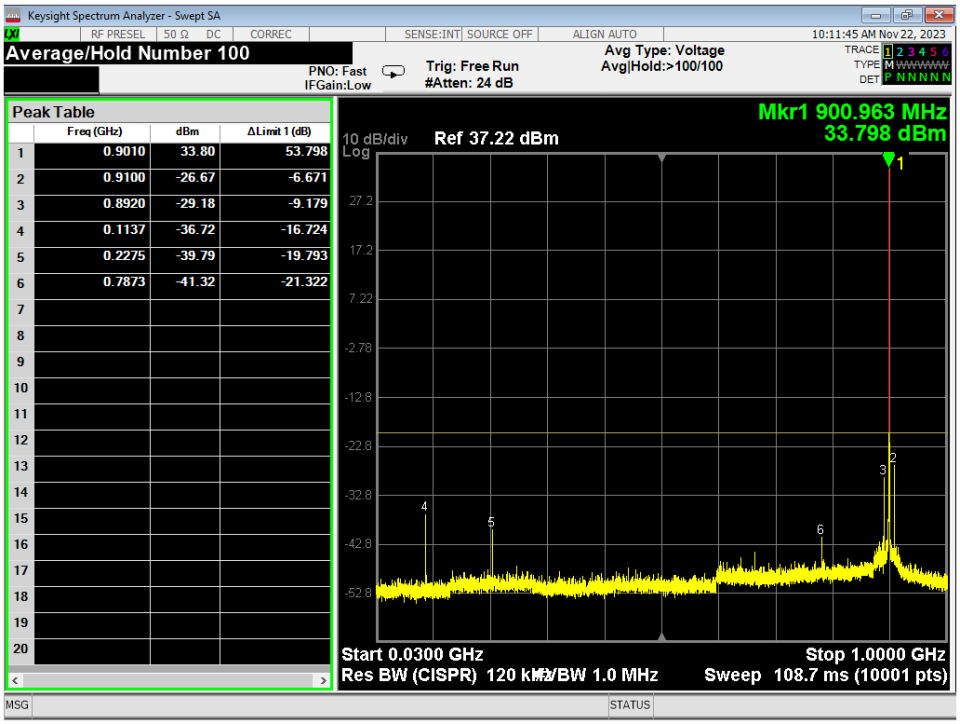


**Figure 2 - Conducted Spurious Emissions Plot, 30 MHz -1 GHz, 901MHz, MSK, 12.5kHz**

The large spike depicted on graph is due to the fundamental, see emission masks for emissions closer to fundamental.

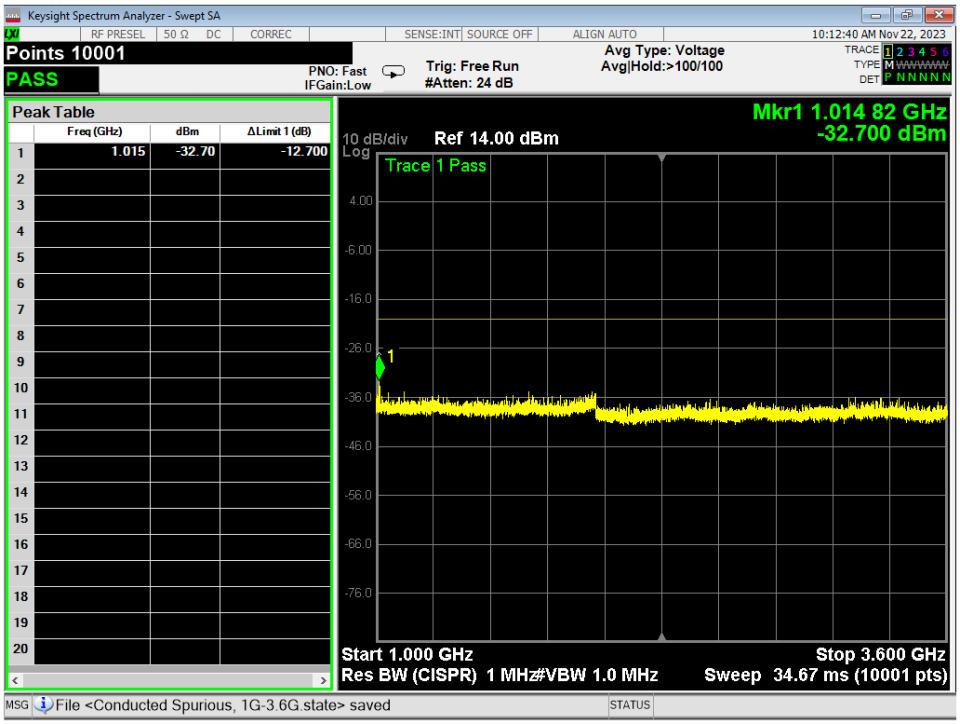


**Figure 3 - Conducted Spurious Emissions Plot, 1 GHz - 3.6 GHz, 901MHz, MSK, 12.5kHz**

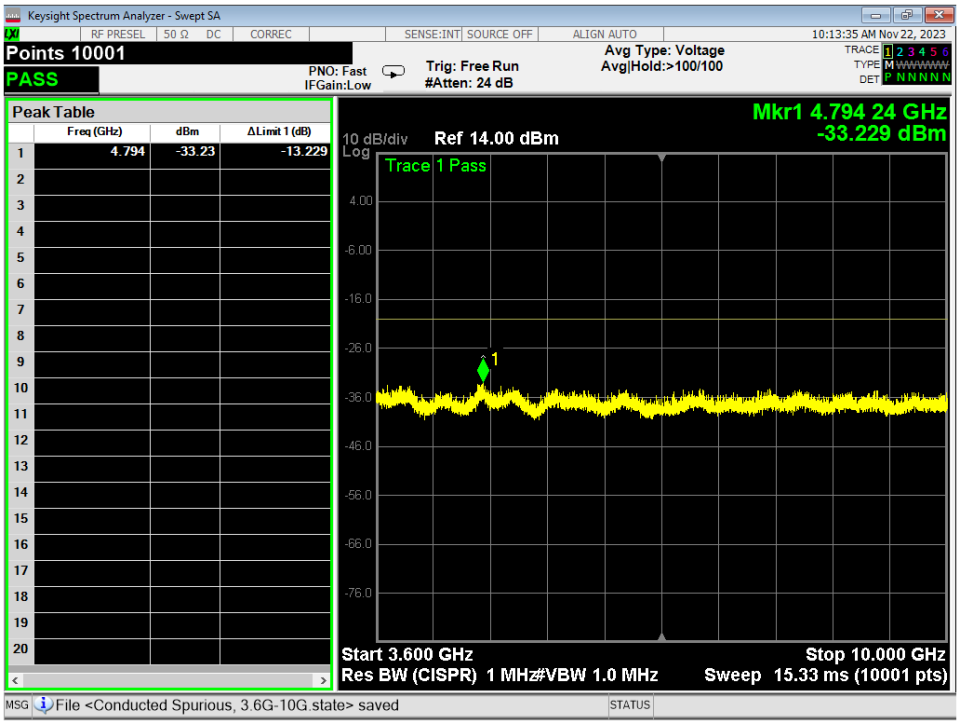


**Figure 4 - Conducted Spurious Emissions Plot, 3.6 GHz - 10 GHz, 901MHz, MSK, 12.5kHz**

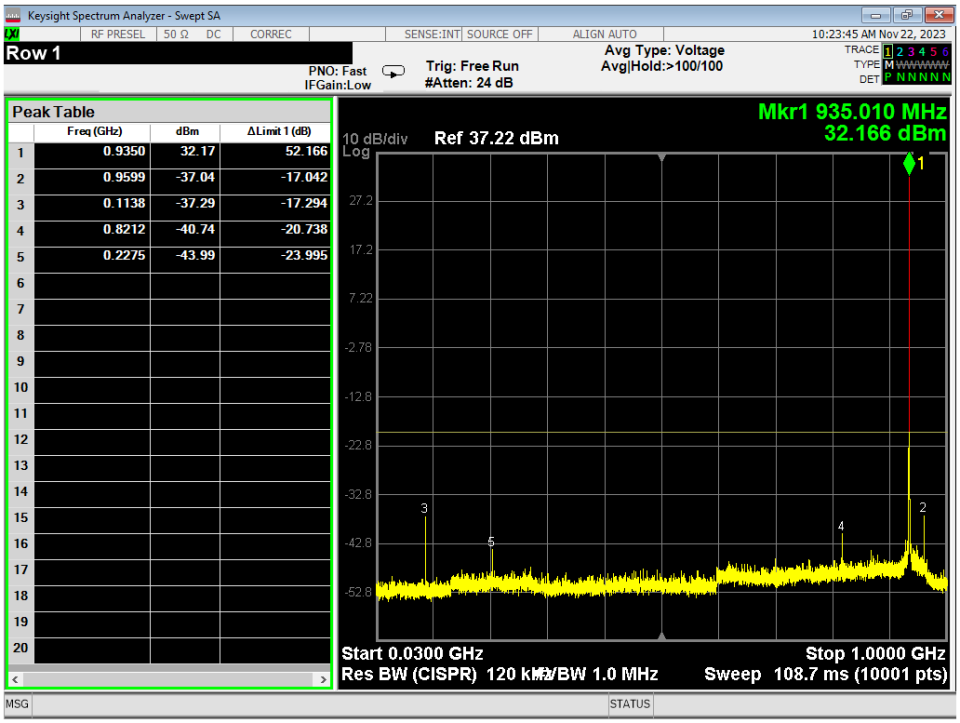


**Figure 5 - Conducted Spurious Emissions Plot, 30 MHz -1 GHz, 935MHz, MSK, 12.5kHz**

The large spike depicted on graph is due to the fundamental, see emission masks for emissions closer to fundamental.

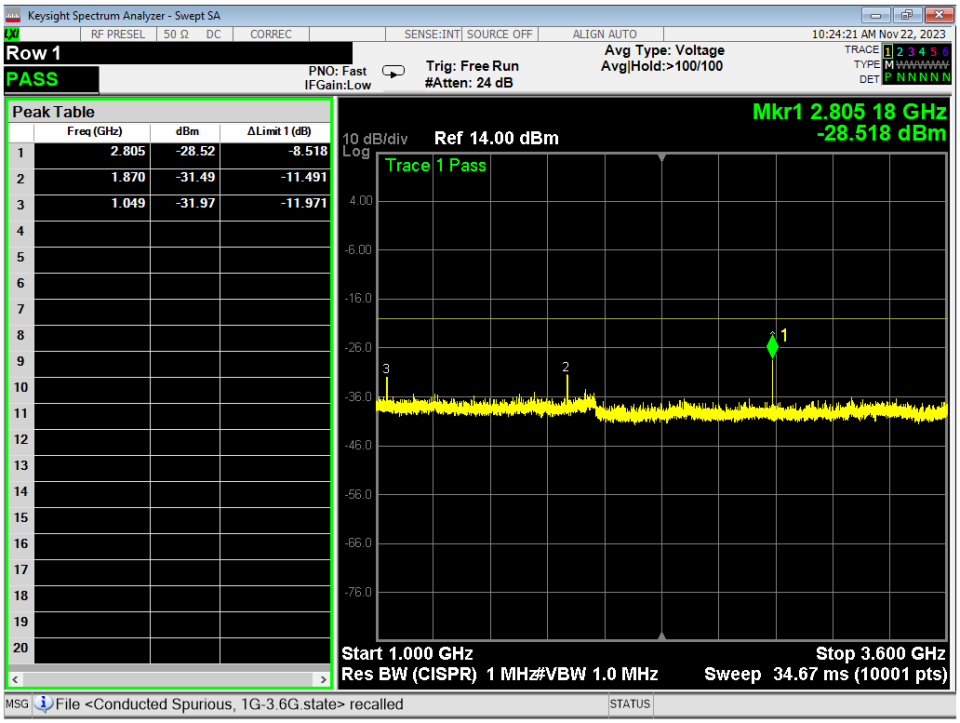


Figure 6 - Conducted Spurious Emissions Plot, 1 GHz - 3.6 GHz, 935MHz, MSK, 12.5kHz

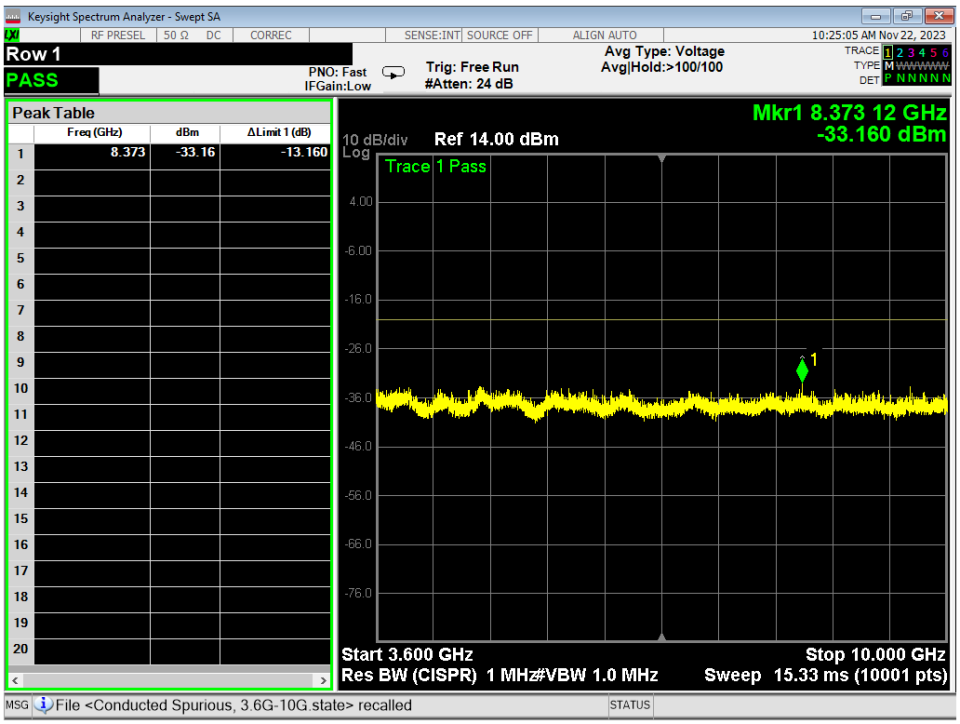


Figure 7 - Conducted Spurious Emissions Plot, 3.6 GHz - 10 GHz, 935MHz, MSK, 12.5kHz

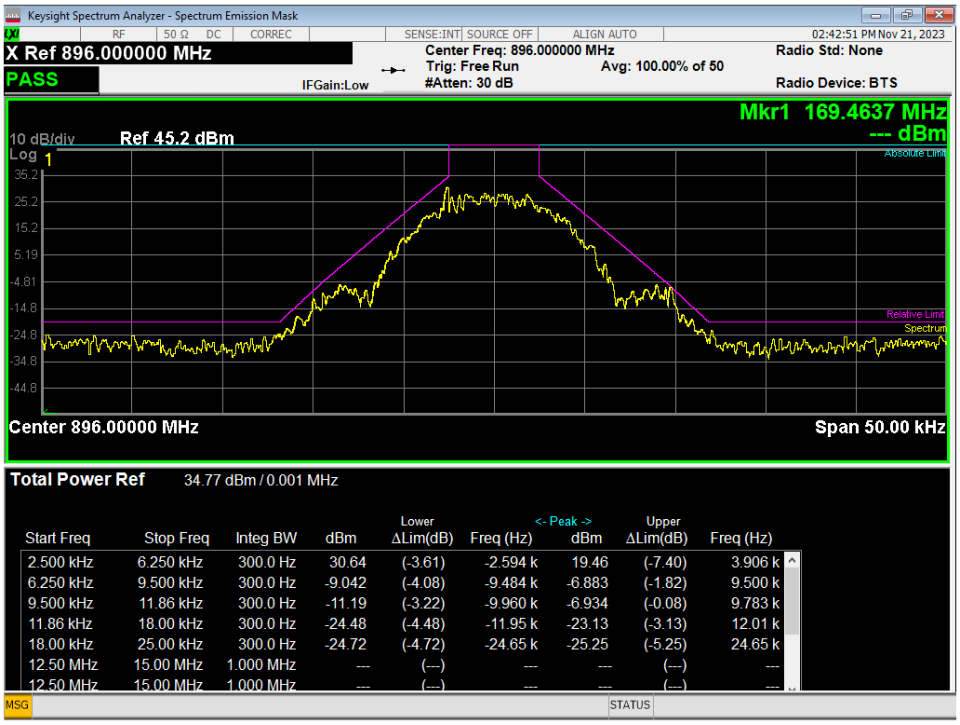


Figure 8 – Emission Mask J, 896MHz, MSK, 12.5kHz

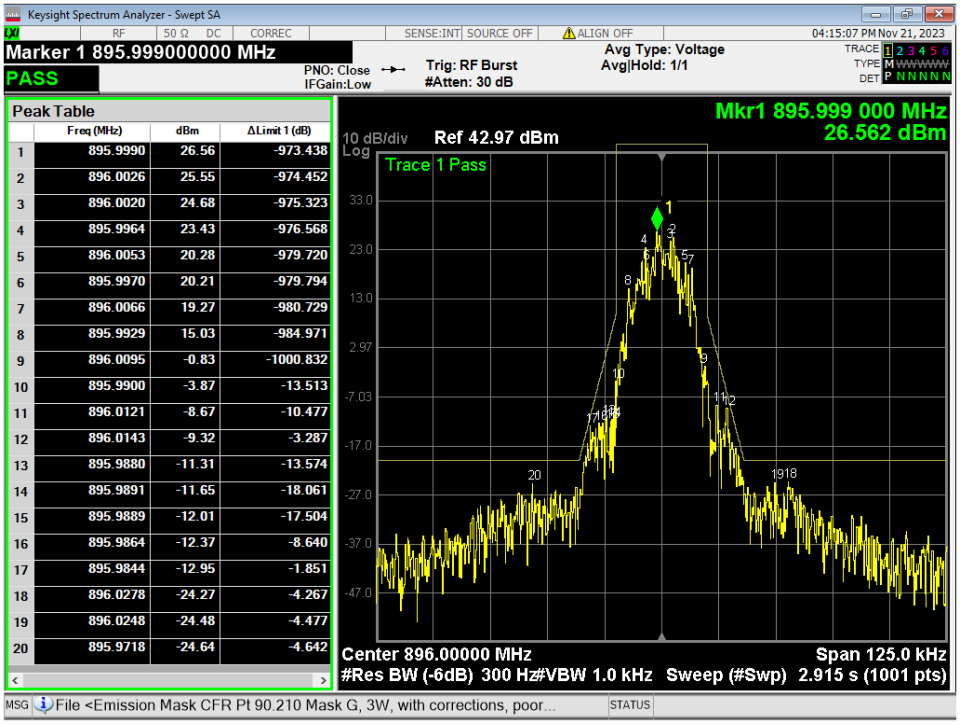


Figure 9 – Emission Mask G, 896MHz, MSK, 25kHz

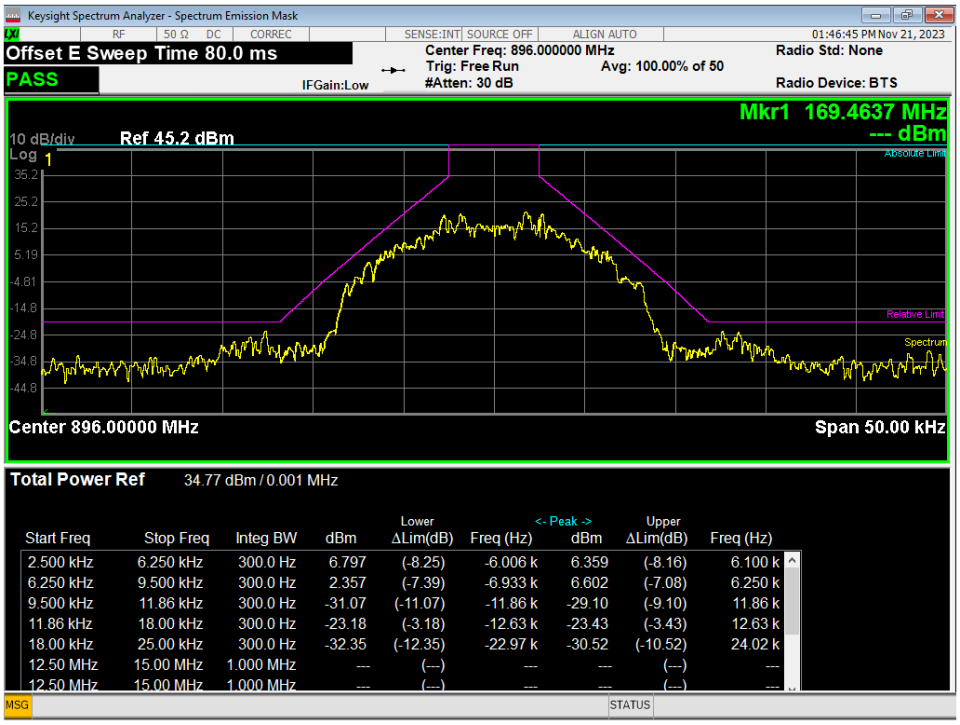


Figure 10 – Emission Mask J, 896MHz, 64QAM, 12.5kHz

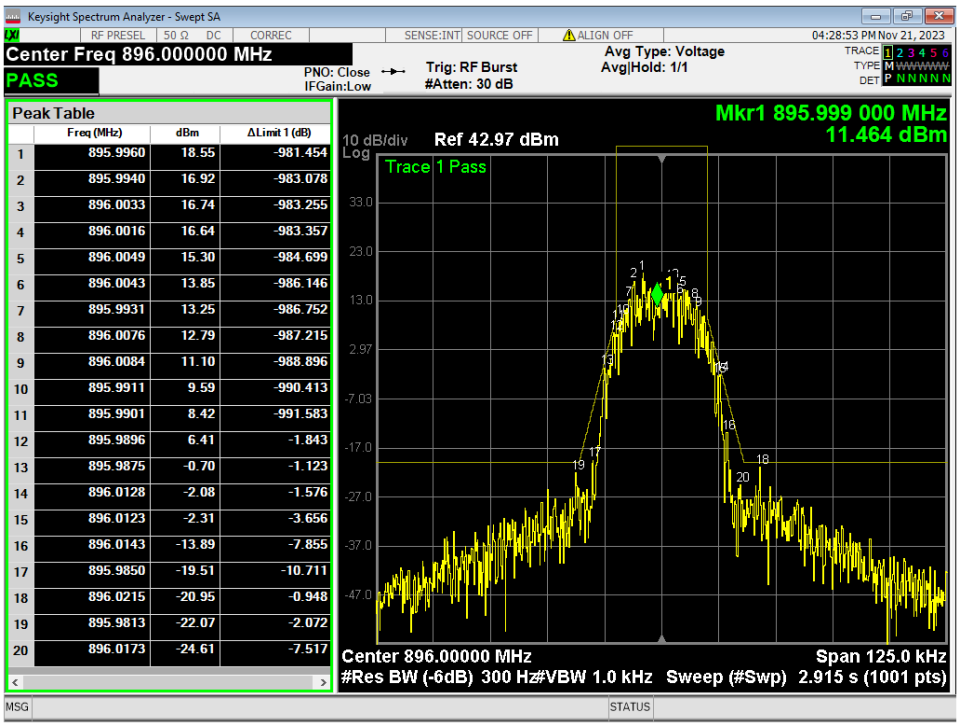


Figure 11 – Emission Mask G, 896MHz, 64QAM, 25kHz

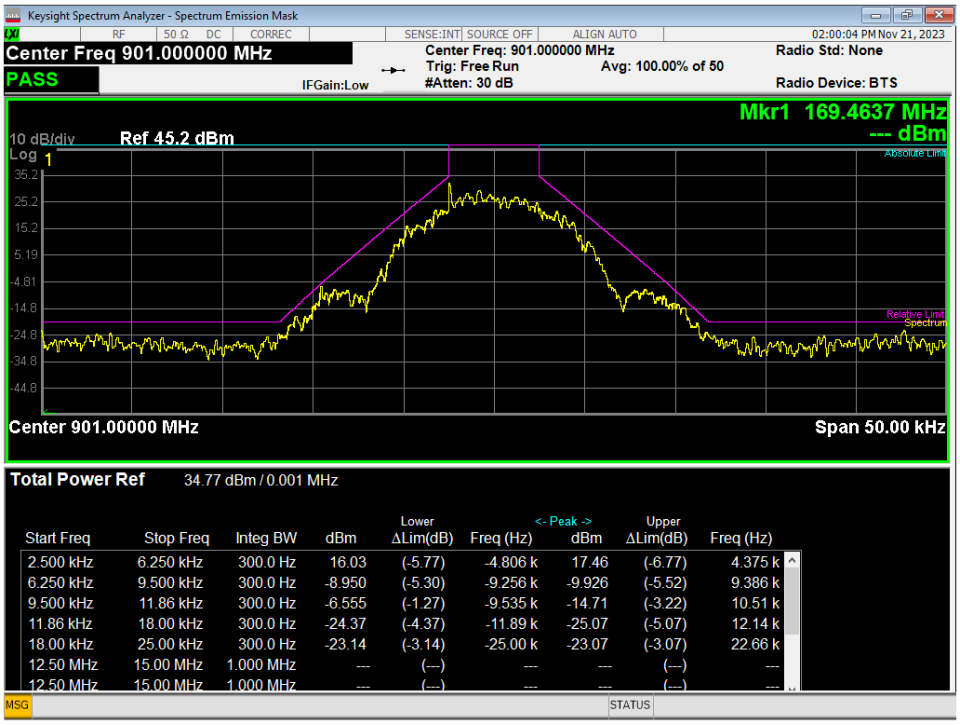


Figure 12 – Emission Mask J, 901MHz, MSK, 12.5kHz

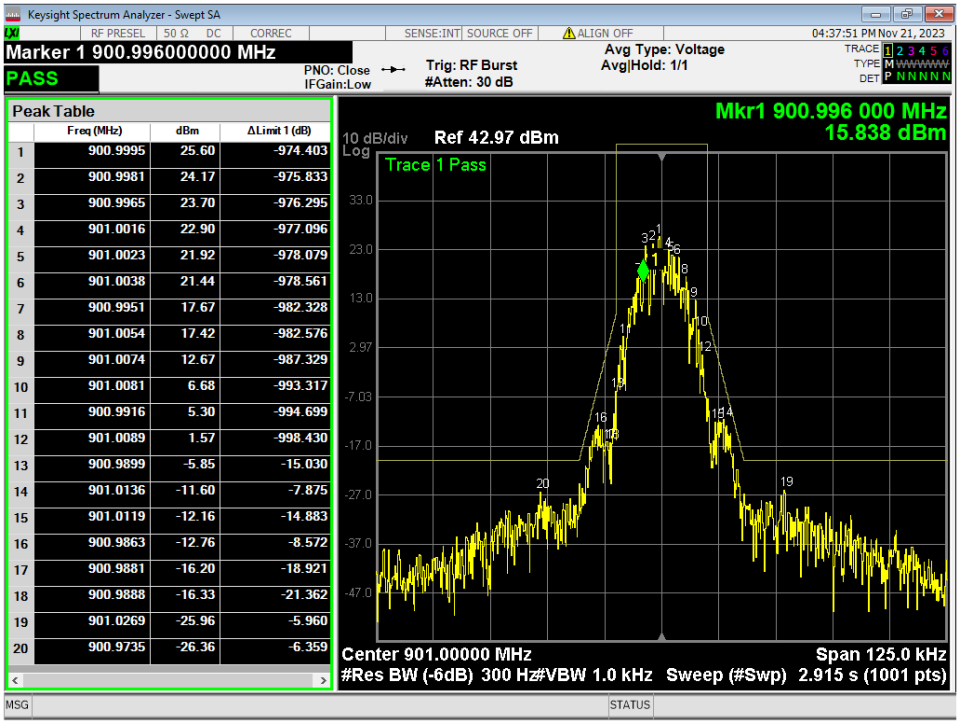


Figure 13 – Emission Mask G, 901MHz, MSK, 25kHz

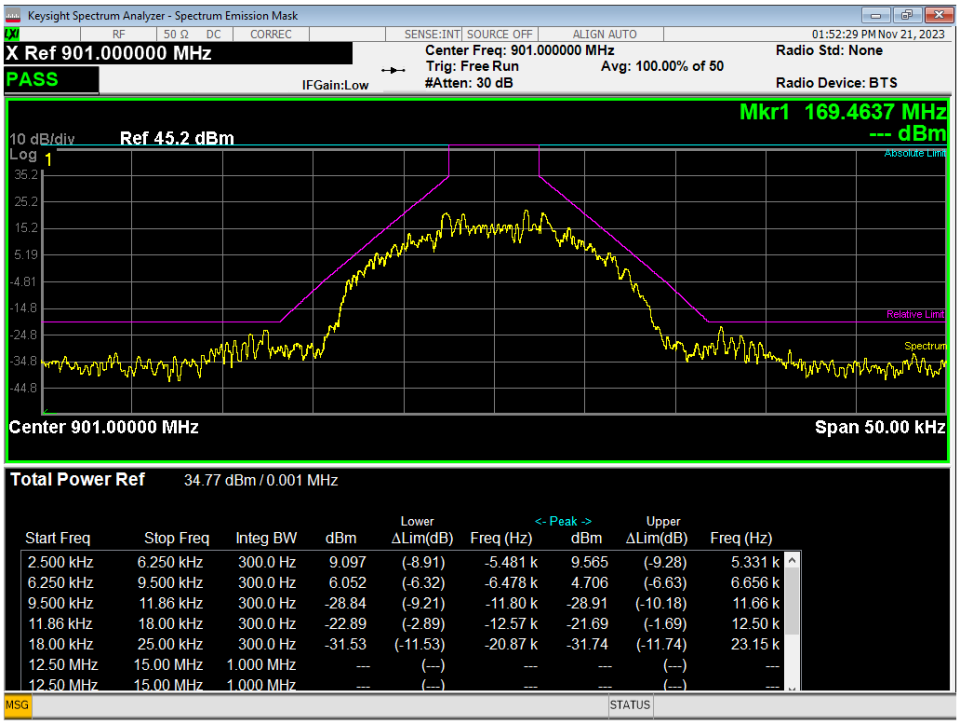


Figure 14 – Emission Mask J, 901MHz, 64QAM, 12.5kHz

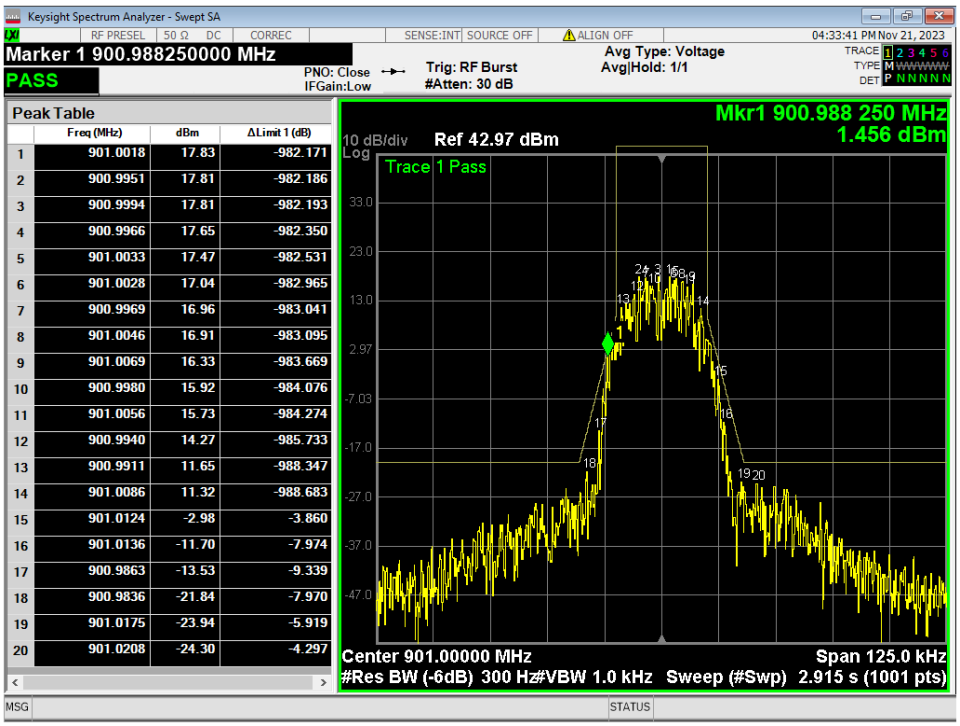


Figure 15 – Emission Mask G, 901MHz, 64QAM, 25kHz

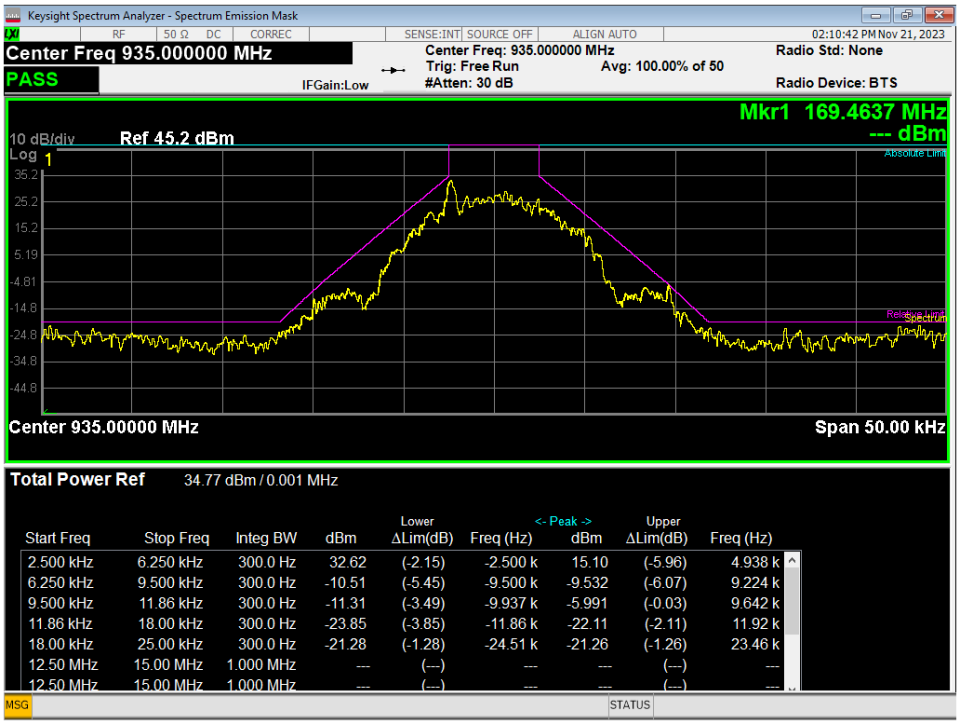


Figure 16 – Emission Mask J, 935MHz, MSK, 12.5kHz

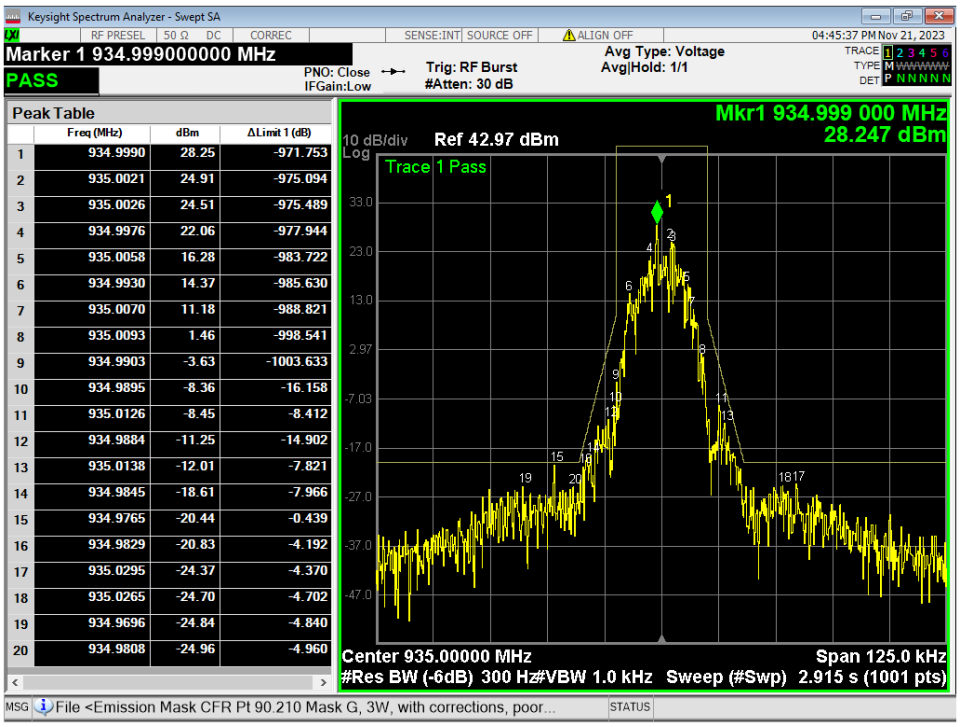


Figure 17 – Emission Mask G, 935MHz, MSK, 25kHz

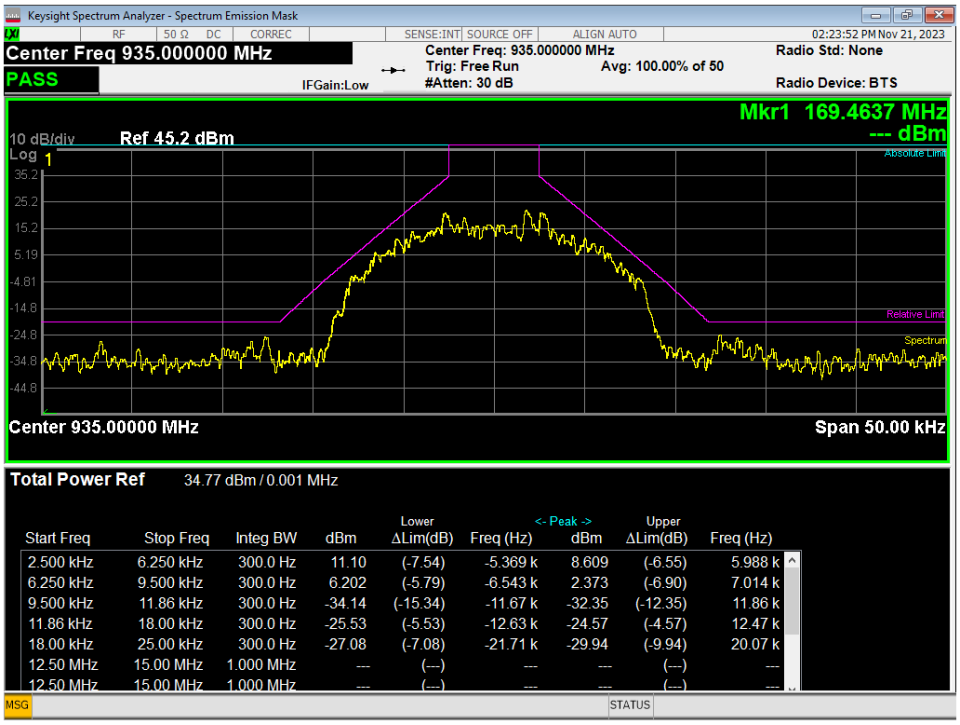


Figure 18 – Emission Mask J, 935MHz, 64QAM, 12.5kHz

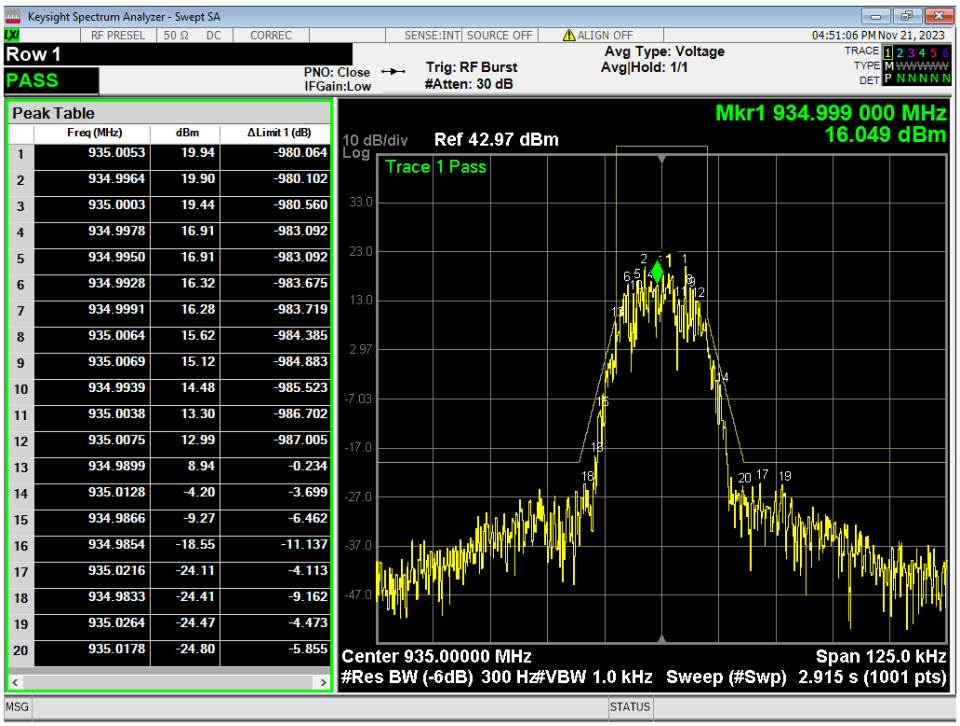


Figure 19 – Emission Mask G, 935MHz, 64QAM, 25kHz

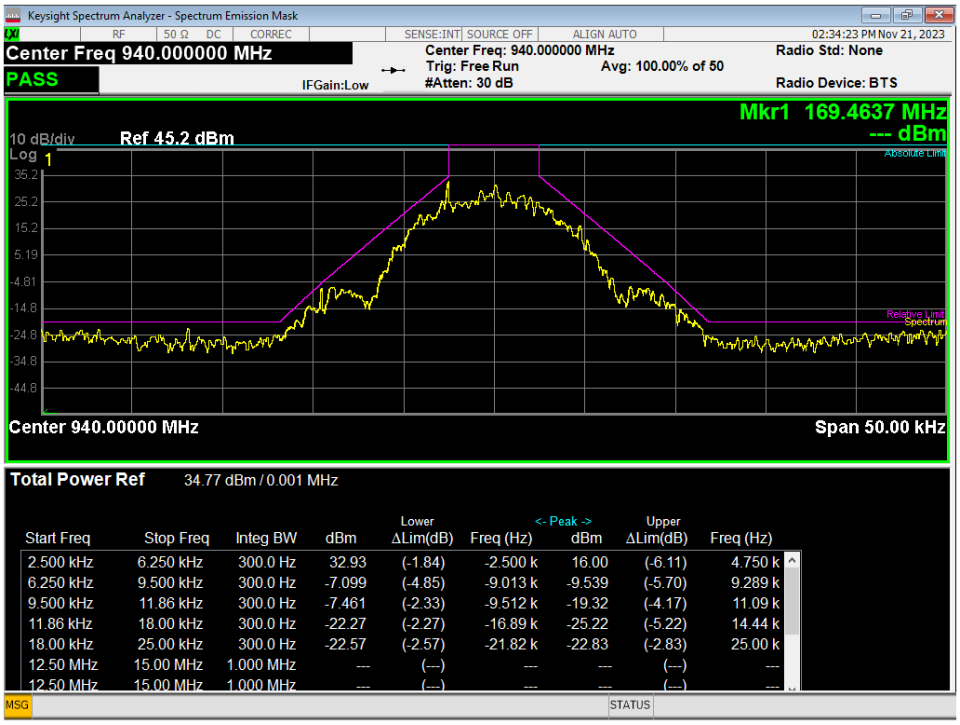


Figure 20 – Emission Mask J, 940MHz, MSK, 12.5kHz

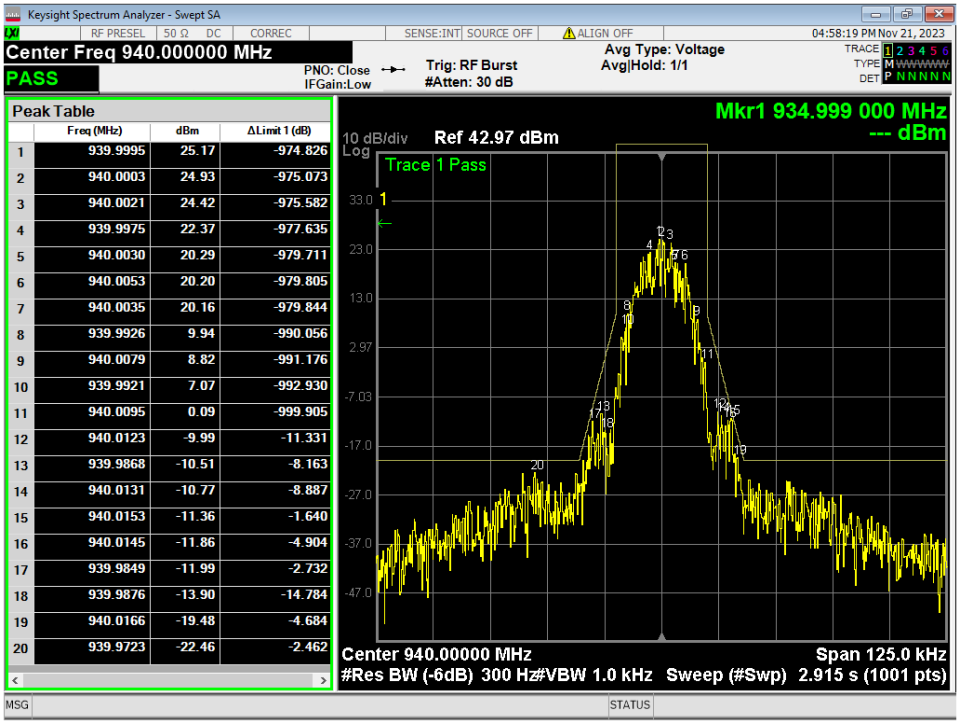


Figure 21 – Emission Mask G, 940MHz, MSK, 25kHz

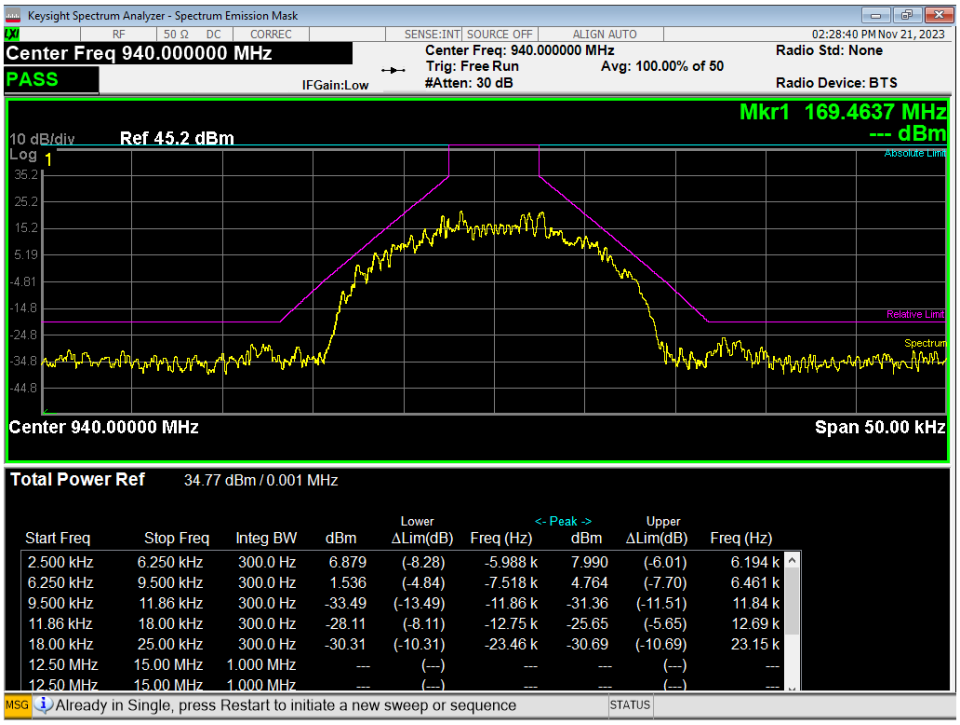


Figure 22 – Emission Mask J, 940MHz, 64QAM, 12.5kHz

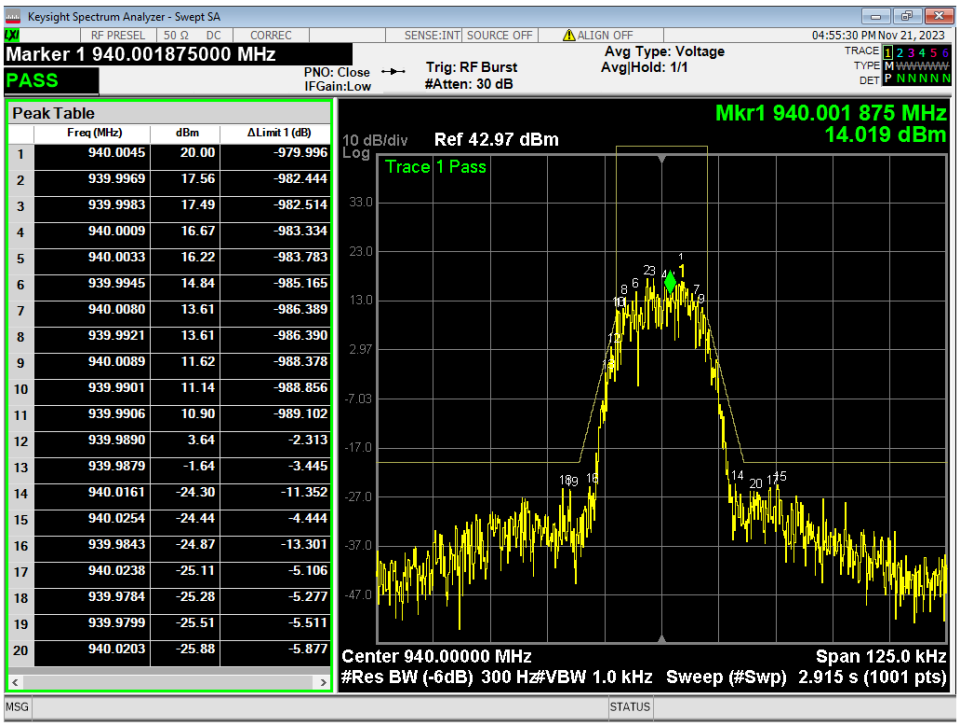


Figure 23 – Emission Mask G, 940MHz, 64QAM, 25kHz

## 4.2 OUTPUT POWER

**Test Method:** ANSI C63.26:
Section(s) 5.2.4.4.2

**Limits of power measurements:**
§ 90.635 Limitations on power and antenna height.
(b) The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

RSS-119 Section 4.1

**Test procedures:**
All the measurements were done with RBW greater than OBW of the signal.

**Deviations from test standard:**
No deviation.

**Test setup:**


Figure 24 – Output Power Measurements Test Setup

**EUT operating conditions:**
See Section 2.1 & 2.2

**Test results:**

**Complies**

Figure 25 – Peak Output Power

| CHANNEL FREQUENCY (MHz) | Modulation | Bandwidth (kHz) | Peak Output Power (dBm) | Method | RESULT |
|---|---|---|---|---|---|
| 896.0 | MSK | 12.5 | 34.598 | Conducted | PASS |
| 896.0 | MSK | 25 | 34.693 | Conducted | PASS |
| 896.0 | 64QAM | 12.5 | 34.533 | Conducted | PASS |
| 896.0 | 64QAM | 25 | 34.760 | Conducted | PASS |
| 901.0 | MSK | 12.5 | 34.562 | Conducted | PASS |
| 901.0 | MSK | 25 | 34.617 | Conducted | PASS |
| 901.0 | 64QAM | 12.5 | 34.670 | Conducted | PASS |
| 901.0 | 64QAM | 25 | 34.722 | Conducted | PASS |
| 935.0 | MSK | 12.5 | 34.447 | Conducted | PASS |
| 935.0 | MSK | 25 | 34.712 | Conducted | PASS |
| 935.0 | 64QAM | 12.5 | 34.620 | Conducted | PASS |
| 935.0 | 64QAM | 25 | 34.570 | Conducted | PASS |
| 940.0 | MSK | 12.5 | 34.745 | Conducted | PASS |
| 940.0 | MSK | 25 | 34.722 | Conducted | PASS |
| 940.0 | 64QAM | 12.5 | 34.629 | Conducted | PASS |
| 940.0 | 64QAM | 25 | 34.626 | Conducted | PASS |

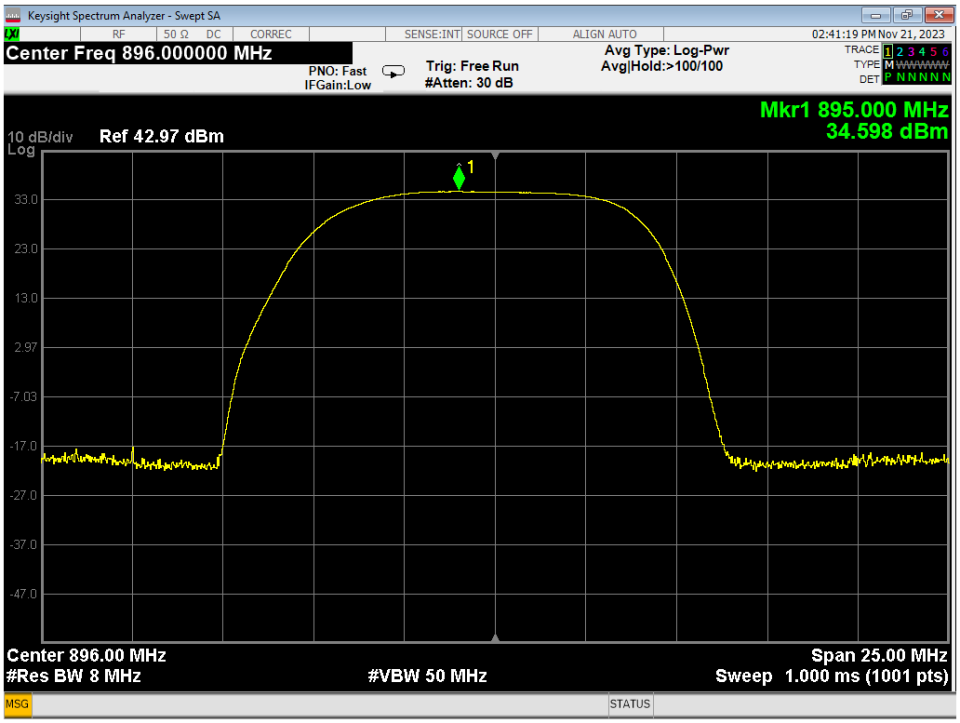


Figure 26 – Average Power, 896MHz, MSK, 12.5kHz

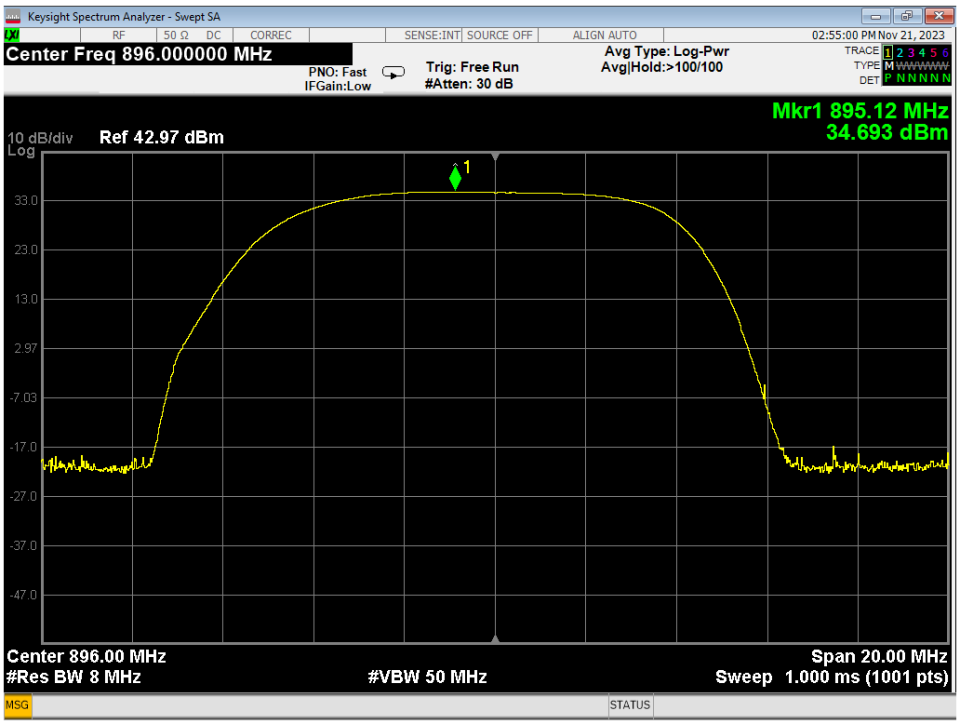


Figure 27 – Average Power, 896MHz, MSK, 25kHz

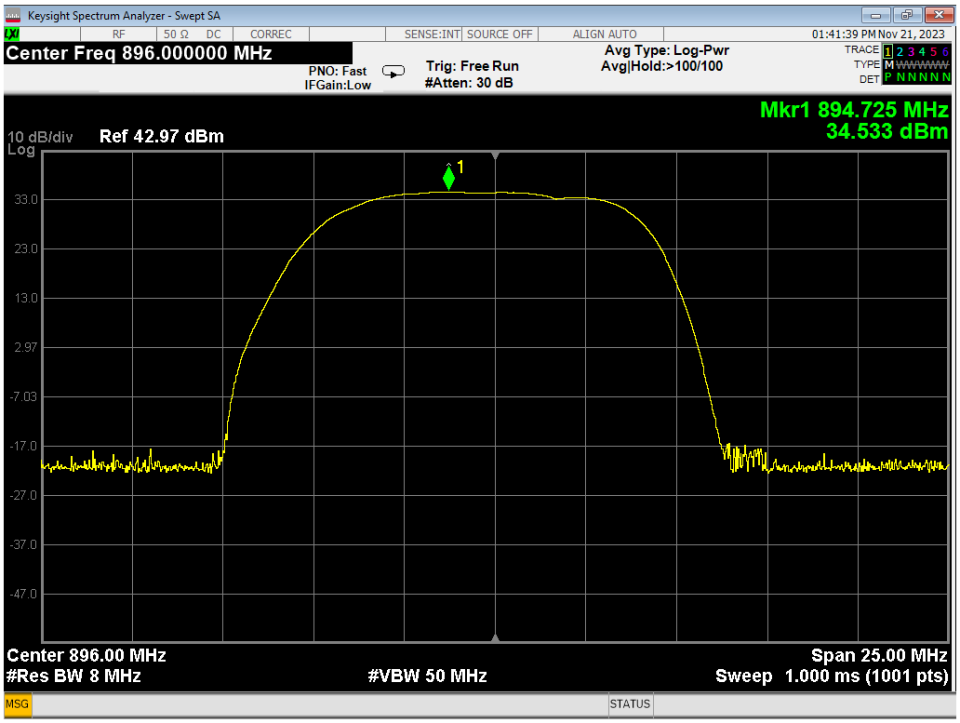


Figure 28 – Average Power, 896MHz, 64QAM, 12.5kHz

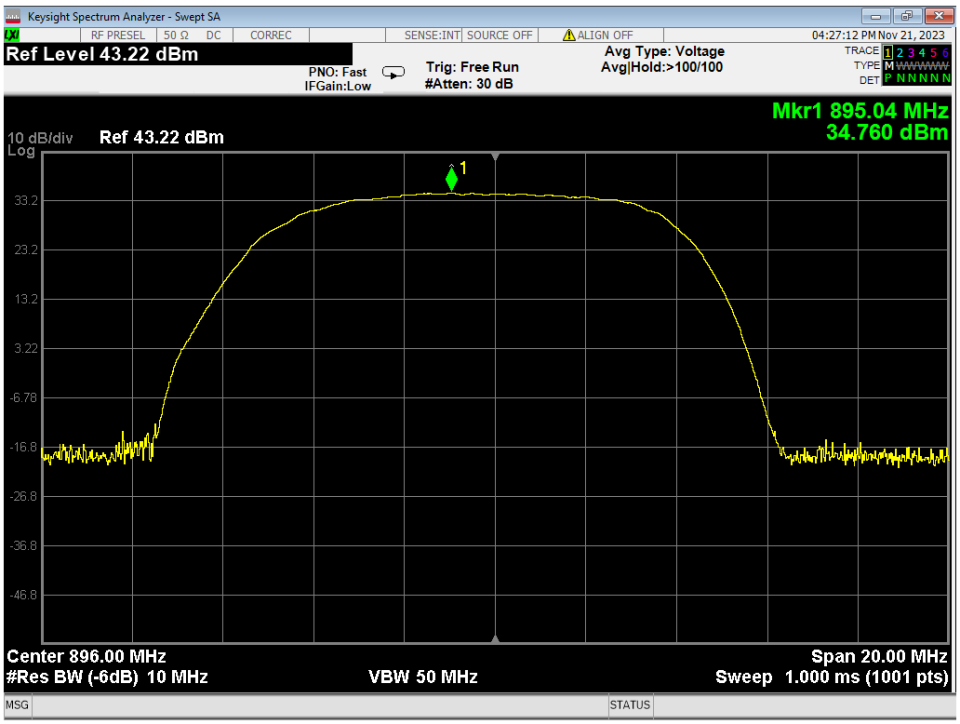


Figure 29 – Average Power, 896MHz, 64QAM, 25kHz

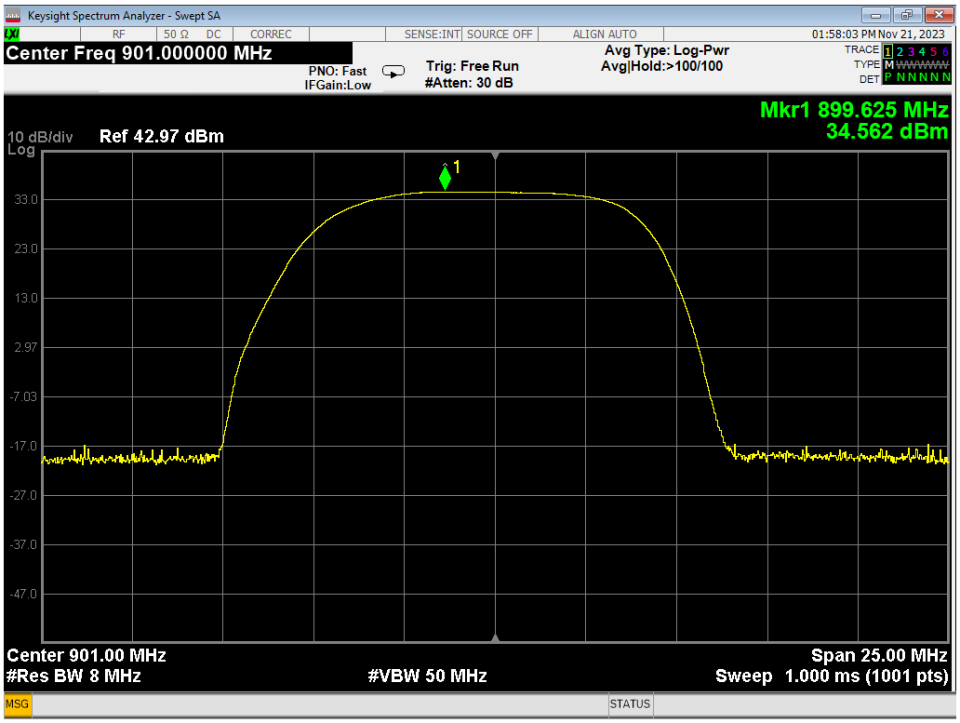


Figure 30 – Average Power, 901MHz, MSK, 12.5kHz

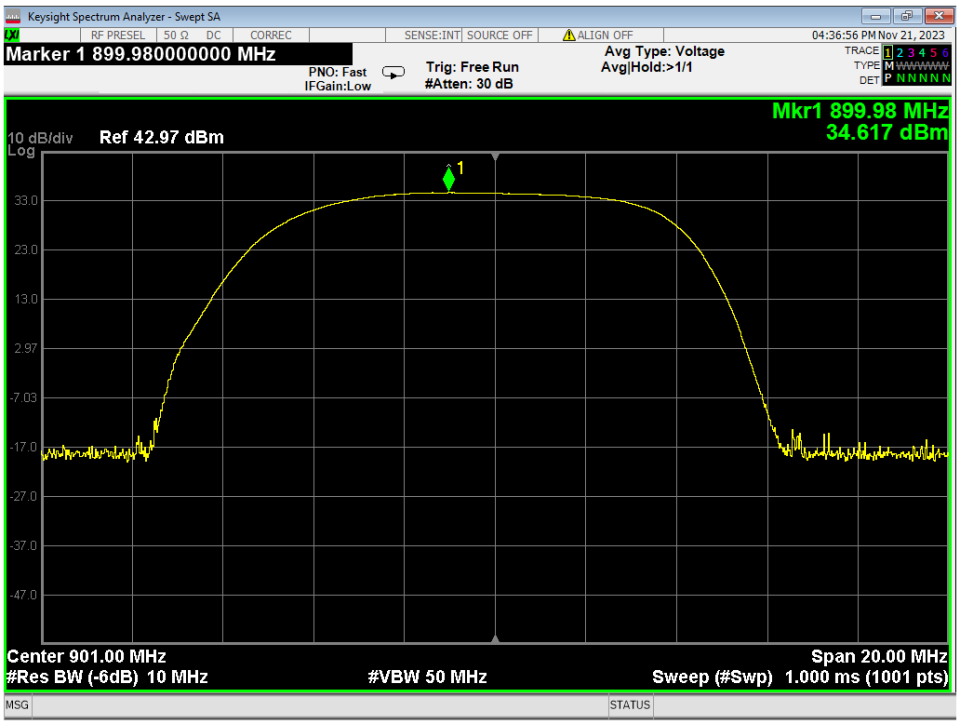


Figure 31 – Average Power, 901MHz, MSK, 25kHz

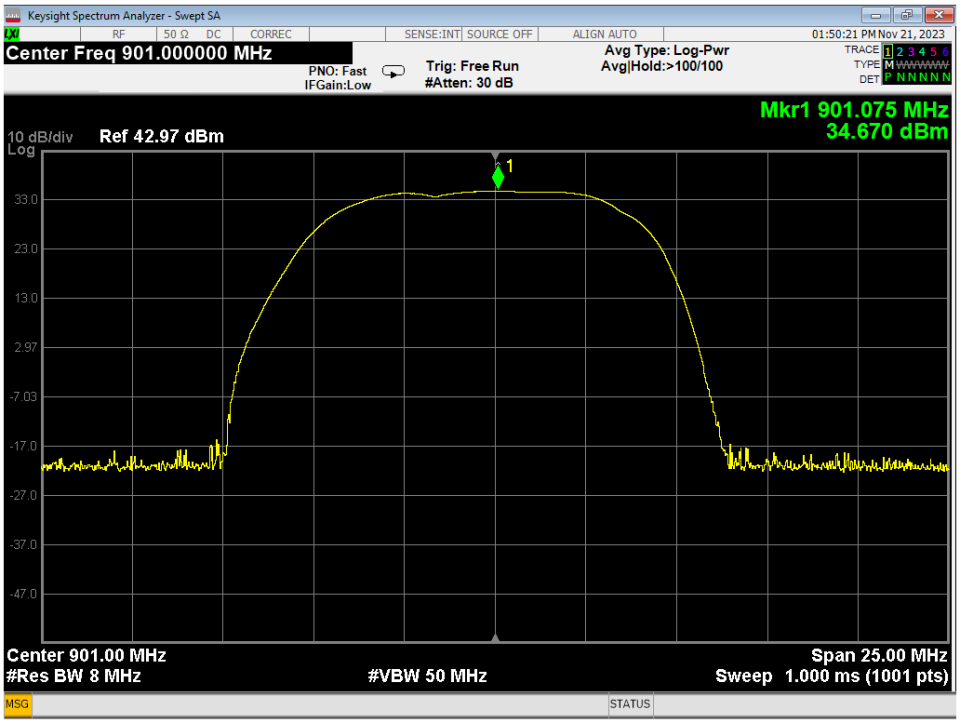


Figure 32 – Average Power, 901MHz, 64QAM, 12.5kHz

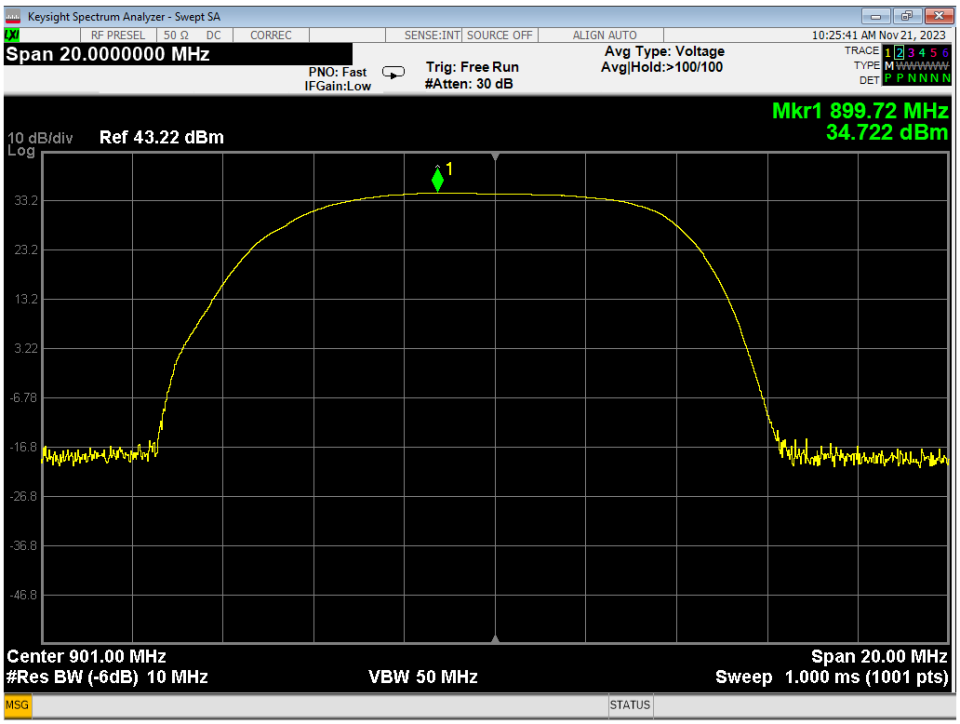


Figure 33 – Average Power, 901MHz, 64QAM, 25kHz

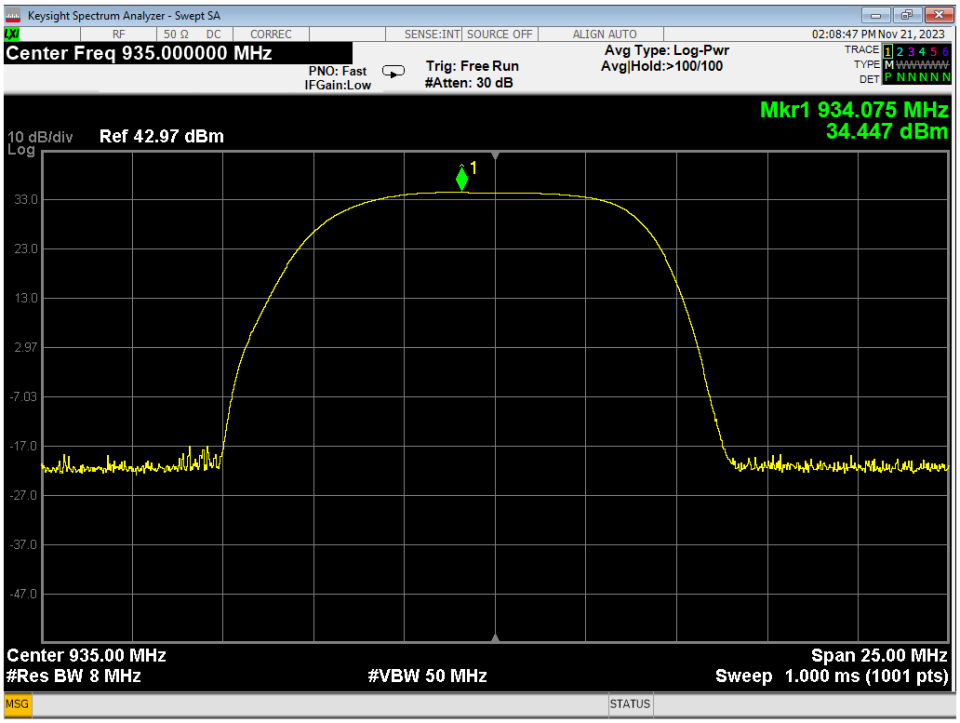


Figure 34 – Average Power, 935MHz, MSK, 12.5kHz

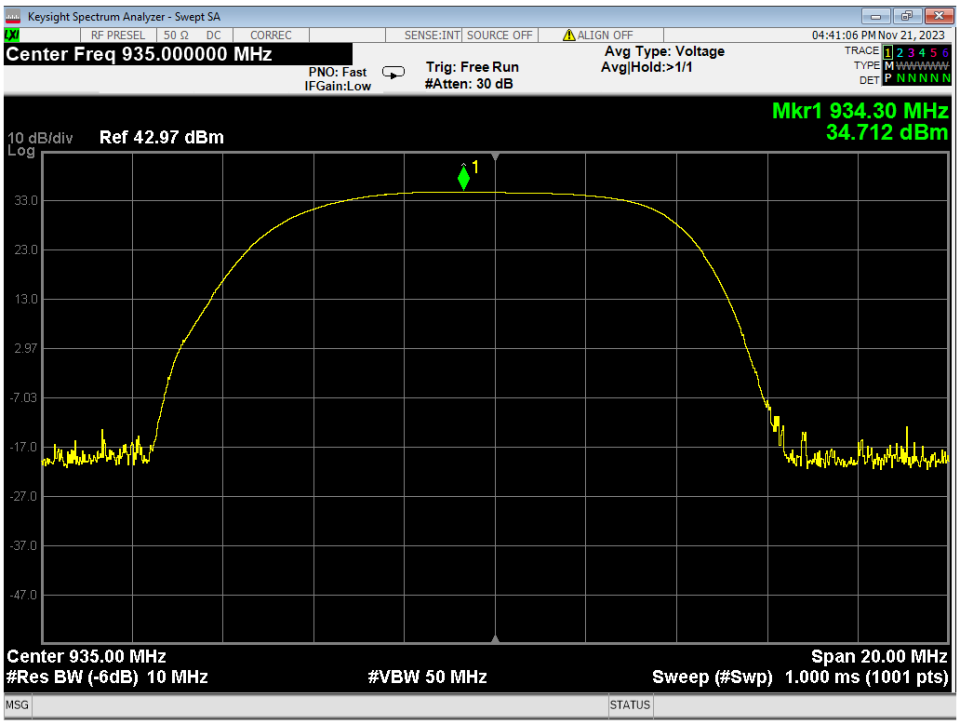


Figure 35 – Average Power, 935MHz, MSK, 25kHz

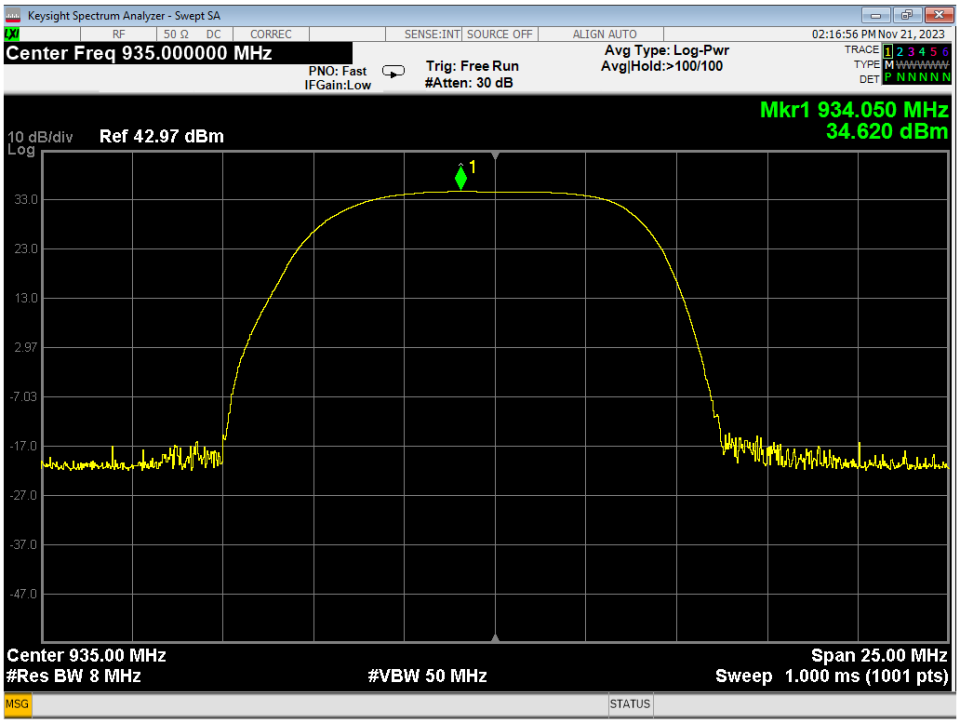


Figure 36 – Average Power, 935MHz, 64QAM, 12.5kHz

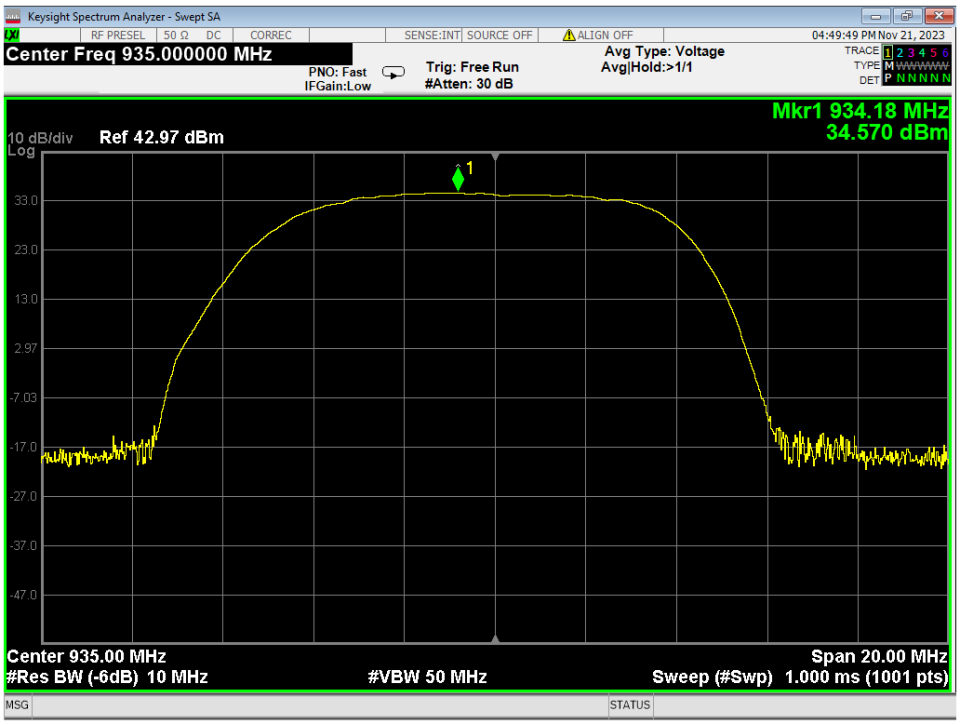


Figure 37 – Average Power, 935MHz, 64QAM, 25kHz

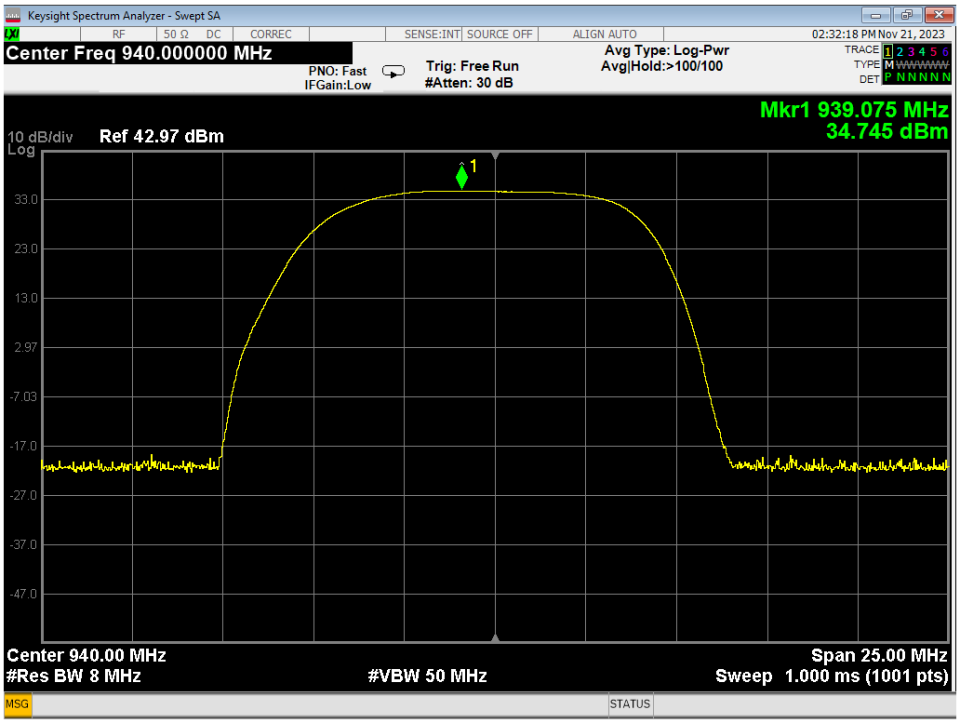


Figure 38 – Average Power, 940MHz, MSK, 12.5kHz

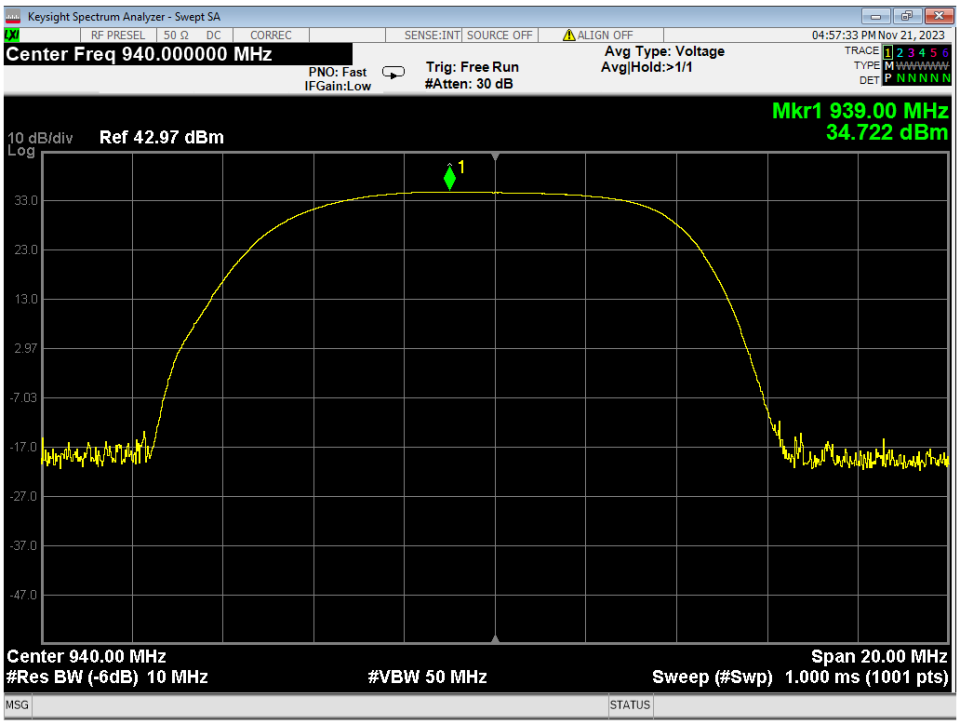


Figure 39 – Average Power, 940MHz, MSK, 25kHz

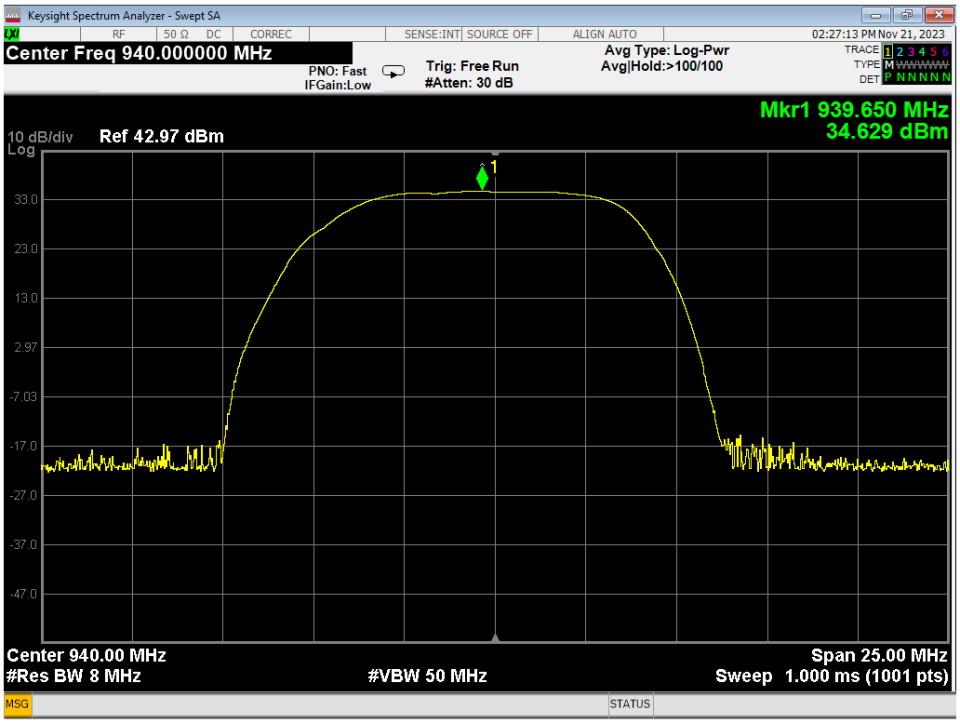


Figure 40 – Average Power, 940MHz, 64QAM, 12.5kHz

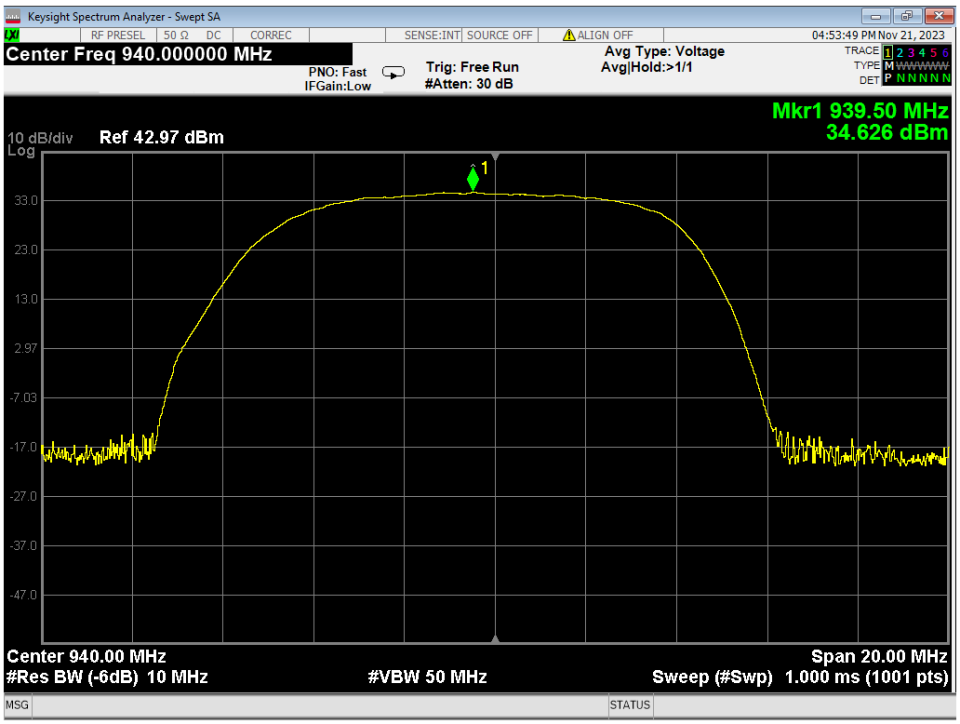


Figure 41 – Average Power, 940MHz, 64QAM, 25kHz

## 4.2 RADIATED EMISSIONS

**Test Method**:
ANSI C63.10-2013, Section 6.5, 6.6

**Limits for radiated emissions measurements:**
Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

| FREQUENCIES (MHz) | FIELD STRENGTH (µV/m) | MEASUREMENT DISTANCE (m) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 3 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

**NOTE:**
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBµV/m) = 20 * log * Emission level (µV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.

**Test procedures:**

a. The EUT was placed on the top of a rotating table above the ground plane in a 10-meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The table was 0.8m high for measurements from 30MHz-1Ghz and 1.5m for measurements from 1GHz and higher.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.

d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.

e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise, the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak, or average method as specified and then reported in a data sheet.

g. The EUT was maximized in all 3 orthogonal positions. The results are presented for the axis that had the highest emissions.

**Test setup:**

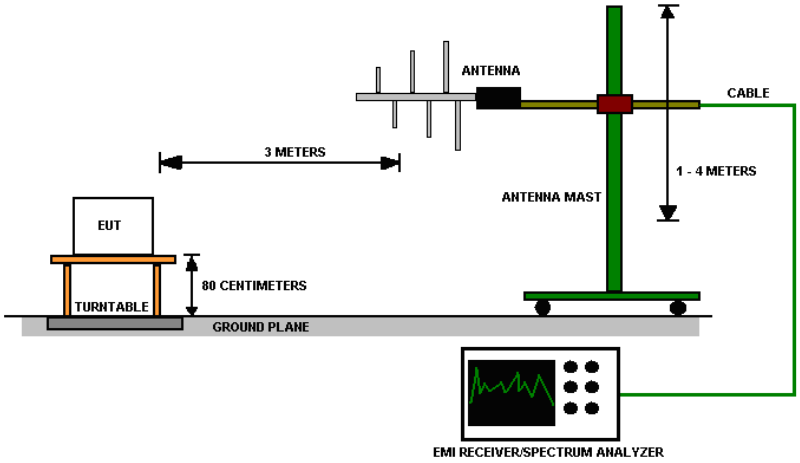


**Figure 42 - Radiated Emissions Test Setup**

**NOTE:**
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.

2. The resolution bandwidth 1 MHz for all measurements and at frequencies above 1GHz, A peak detector was used for all measurements above 1GHz. Measurements were made with an EMI Receiver.

**Deviations from test standard:**
No deviation.

**EUT operating conditions**
Details can be found in section 2.1 of this report.

**Test results:**

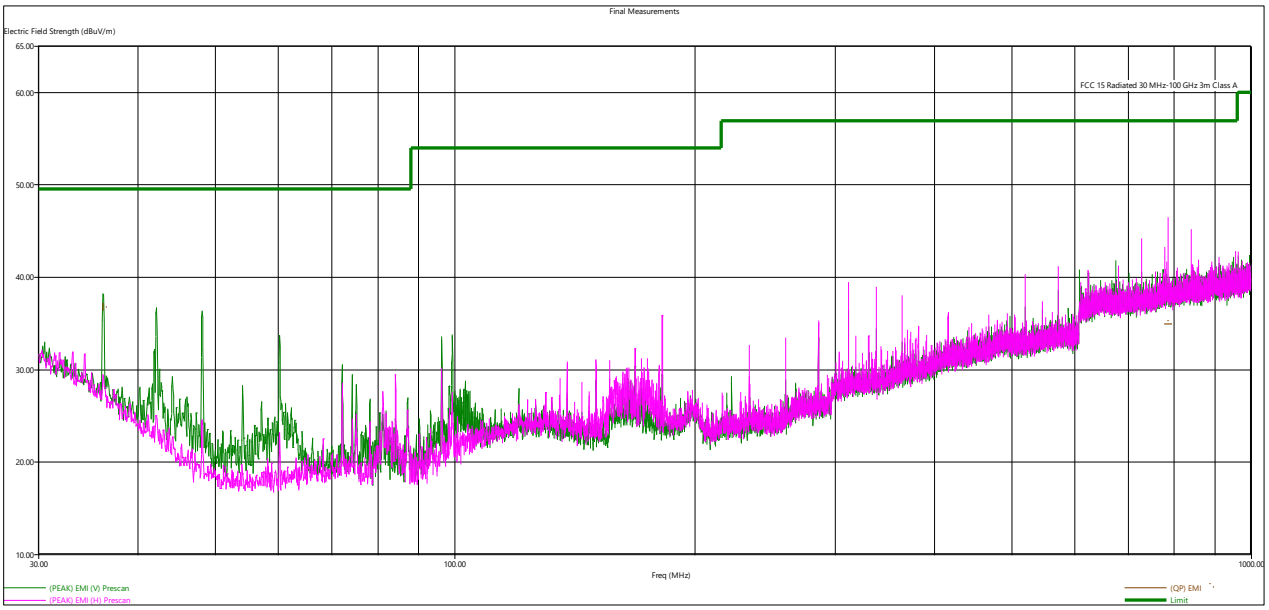


**Figure 43 – Radiated Emissions, 30MHz – 1GHz, Receive Mode**

| Quasi-Peak Emissions, 30MHz – 1GHz, Receive Mode | | | | | | |
|---|---|---|---|---|---|---|
| **Freq (Max)** | **(QP) EMI** | **Limit** | **Margin** | **Twr Ht** | **Ttbl Ang** | **Pol** |
| **(MHz)** | **(dBuV/m)** | **(dBuV/m)** | **(dB)** | **(cm)** | **(deg)** | |
| 786.130320 | 34.83 | 56.90 | 22.07 | 355.61 | 193.00 | H |
| 36.150000 | 36.74 | 49.54 | 12.80 | 104.38 | 241.25 | V |

All other Emissions were found to be at least 6dB below the limit

## 4.3 BANDWIDTH AND MODULATION CHARACTERISTICS

**Test Method:** ANSI C63.26,
Section(s) 5.4.3, 5.4.4

**Limits of bandwidth measurements:**
§ 90.209(b)(5)
RSS-119 Section 5.2

**Test procedures:**
The EUT was connected to the spectrum analyzer directly with a low loss shielded coaxial cable and an attenuator to protect measurement equipment.

**Deviations from test standard:**
No deviation

**Test setup:**

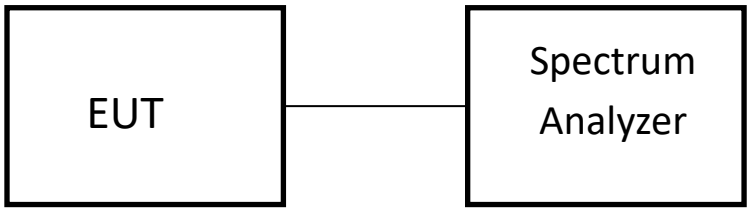


Figure 44 –Measurements Test Setup

**EUT operating conditions:**
See Section 2.1 & 2.2

**Test results:**

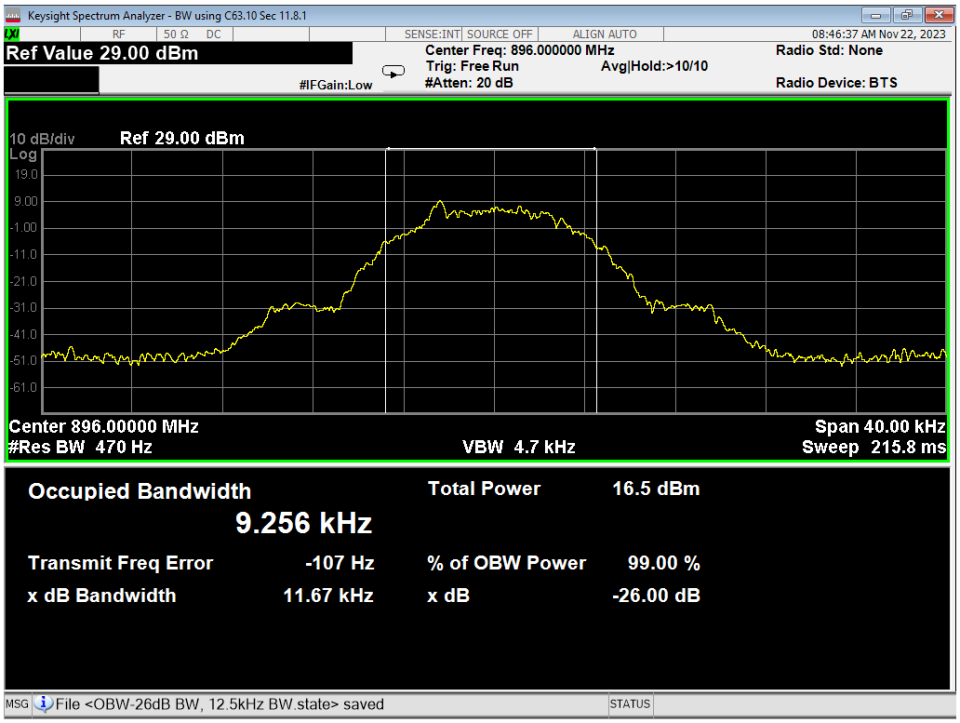


Figure 45 – Bandwidth, 896MHz, MSK, 12.5kHz

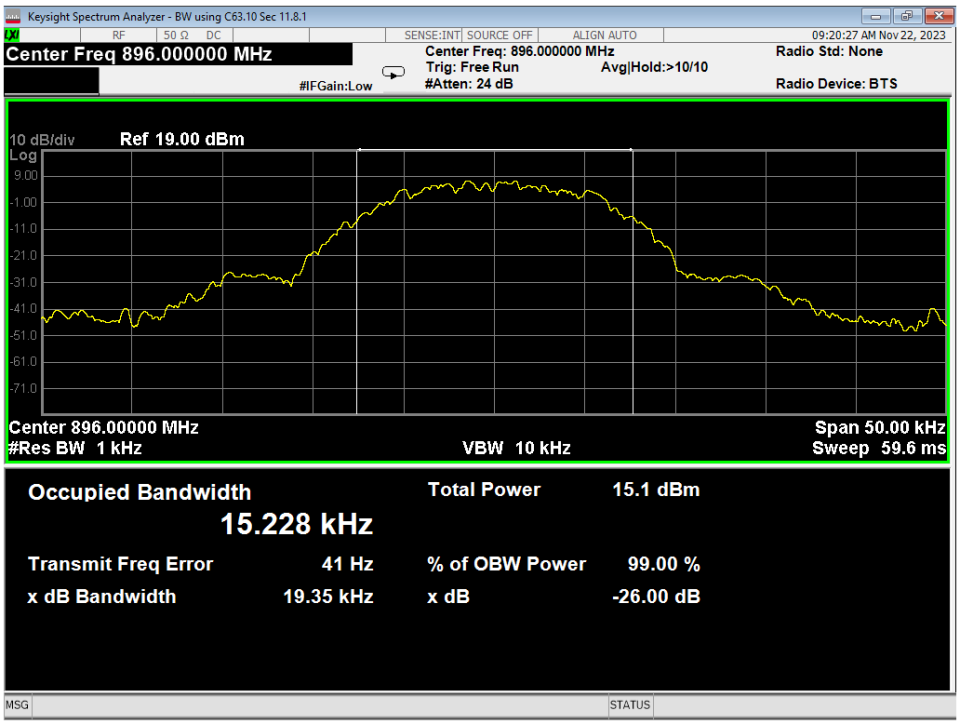


Figure 46 – Bandwidth, 896MHz, MSK, 25kHz

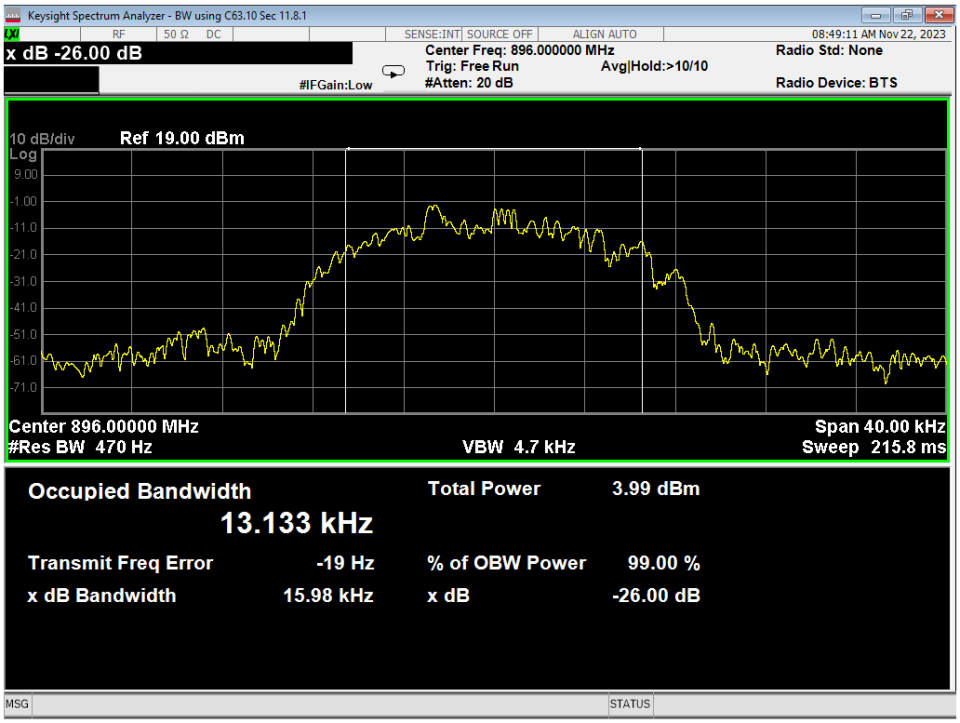


Figure 47 – Bandwidth, 896MHz, 64QAM, 12.5kHz

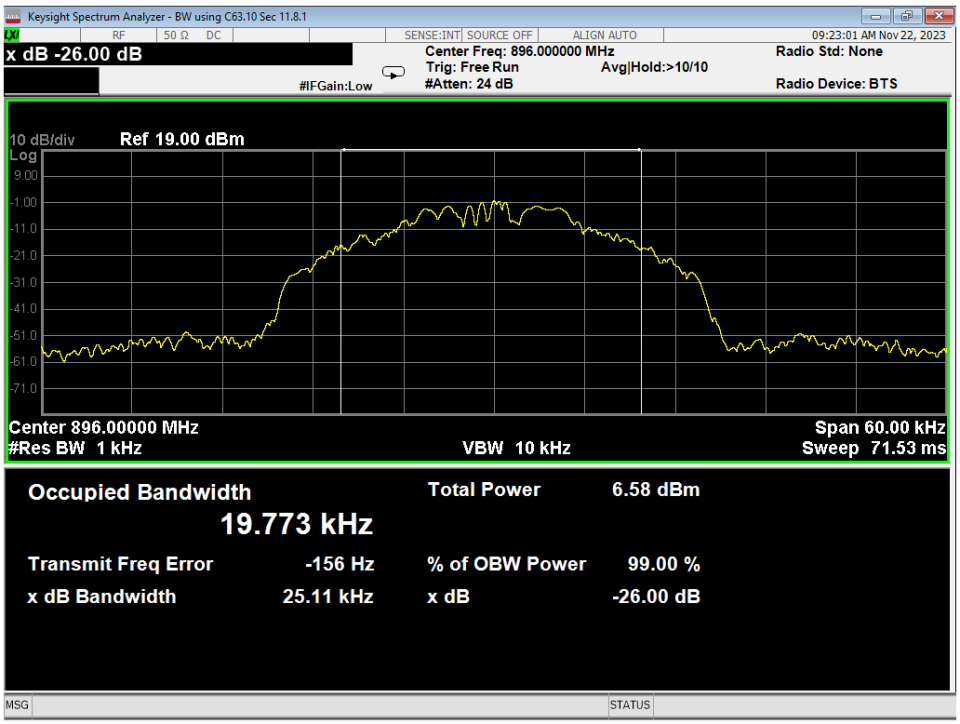


Figure 48 – Bandwidth, 896MHz, 64QAM, 25kHz

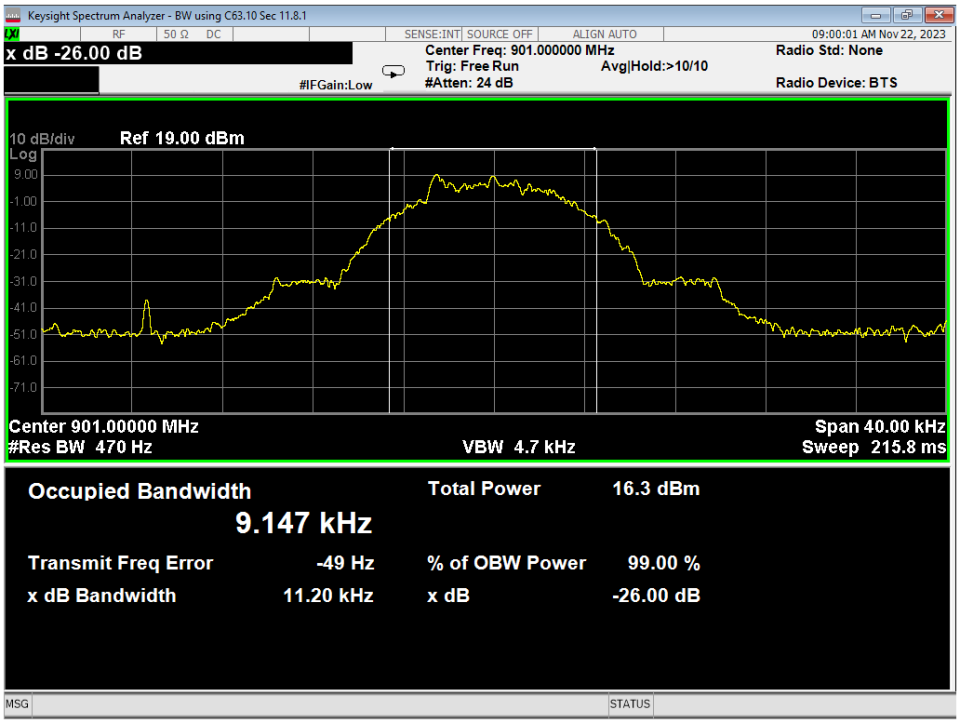


Figure 49 – Bandwidth, 901MHz, MSK, 12.5kHz

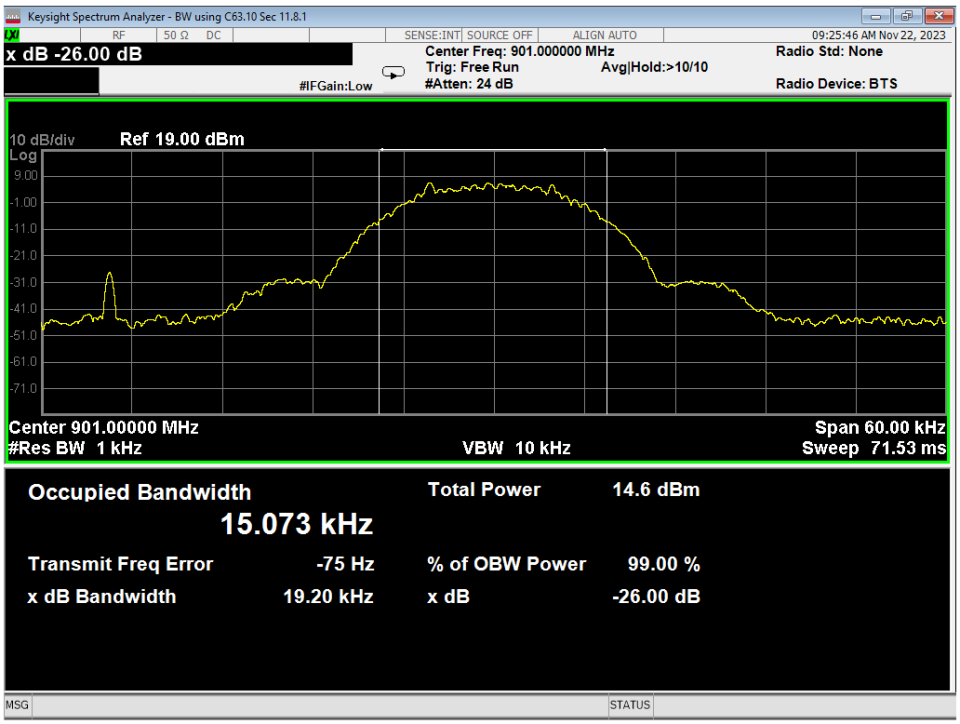


Figure 50 – Bandwidth, 901MHz, MSK, 25kHz

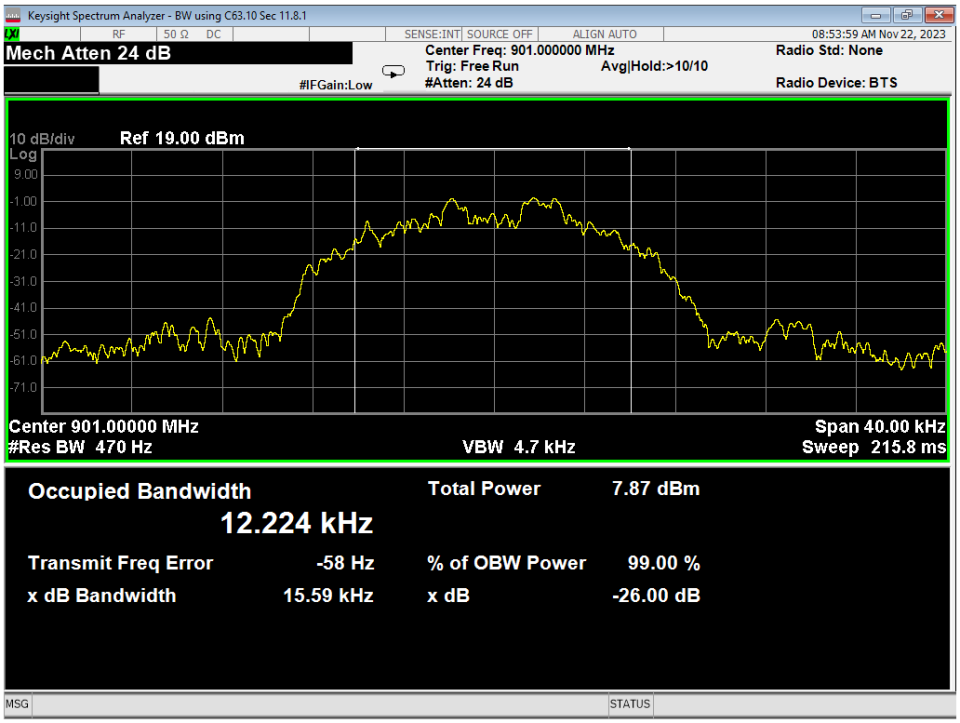


Figure 51 – Bandwidth, 901MHz, 64QAM, 12.5kHz

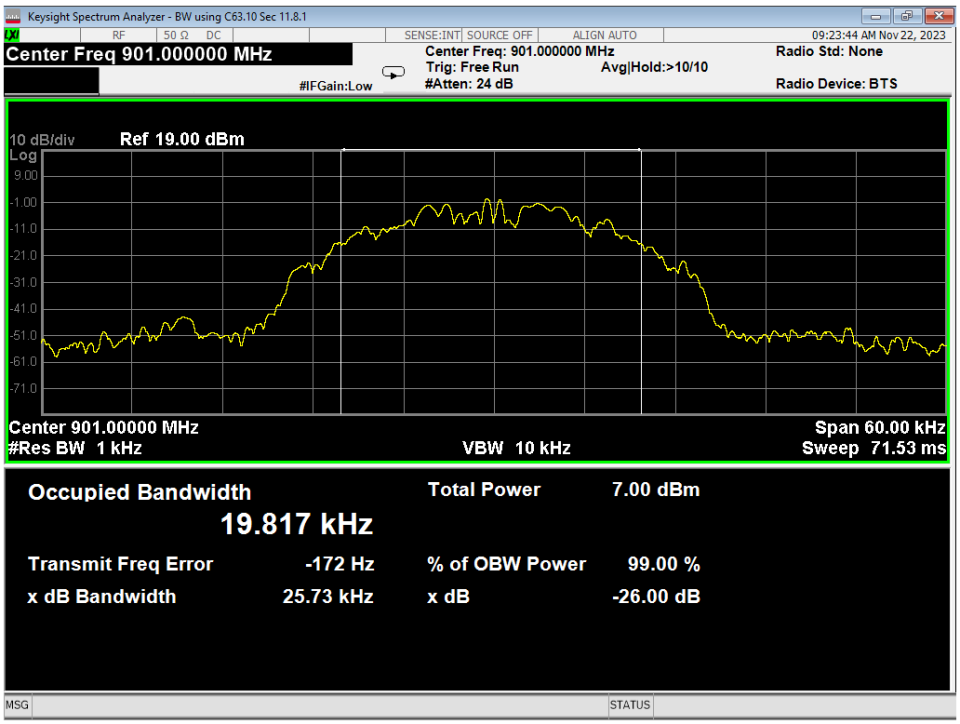


Figure 52 – Bandwidth, 901MHz, 64QAM, 25kHz

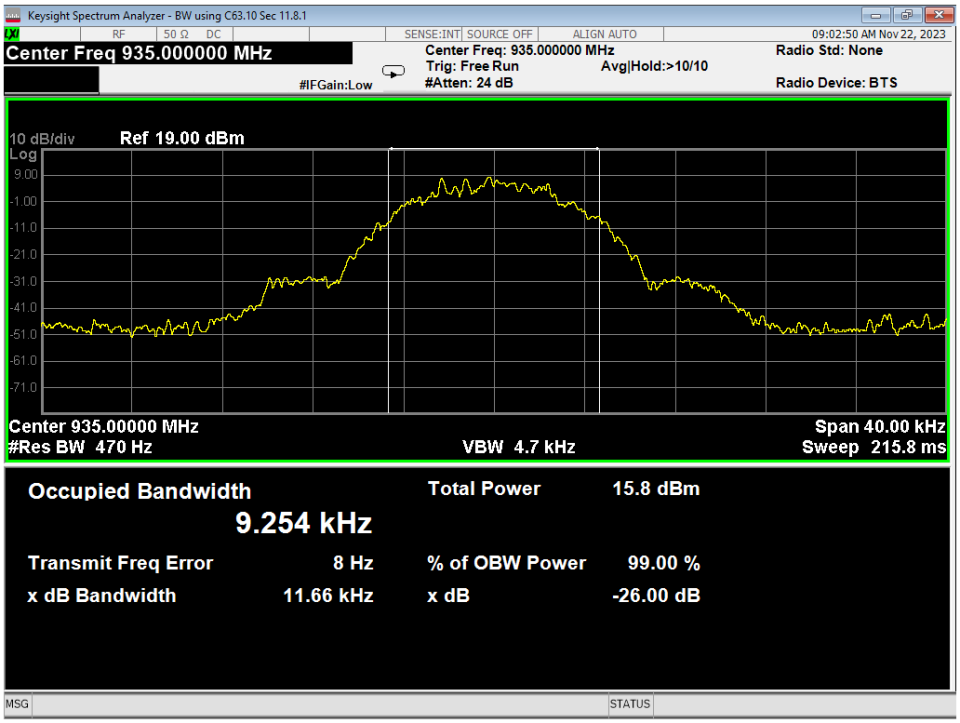


Figure 53 – Bandwidth, 935MHz, MSK, 12.5kHz

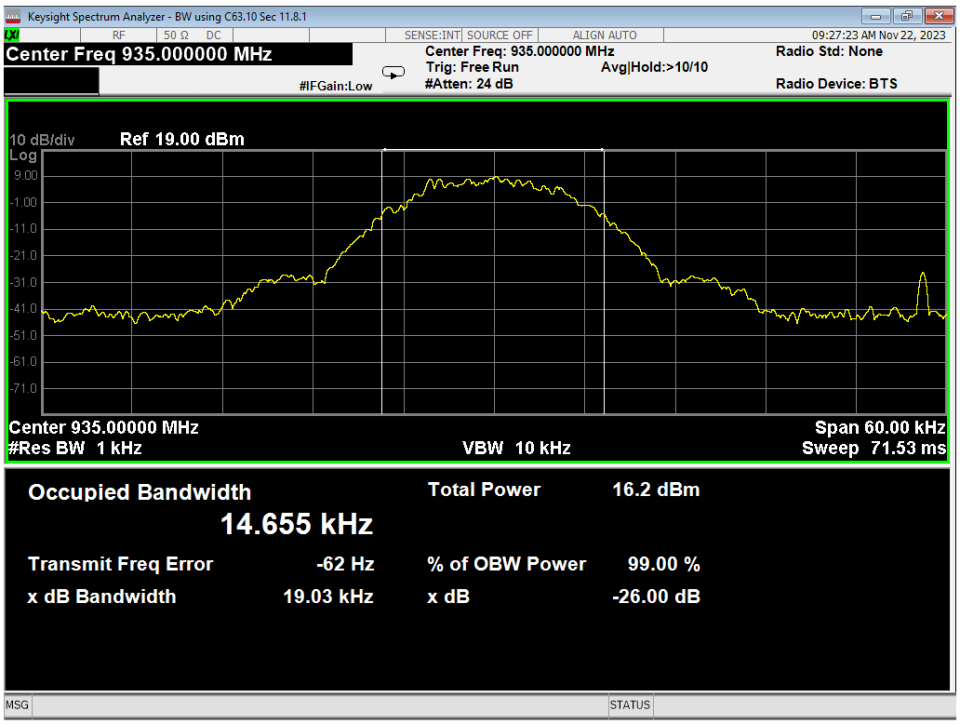


Figure 54 – Bandwidth, 935MHz, MSK, 25kHz

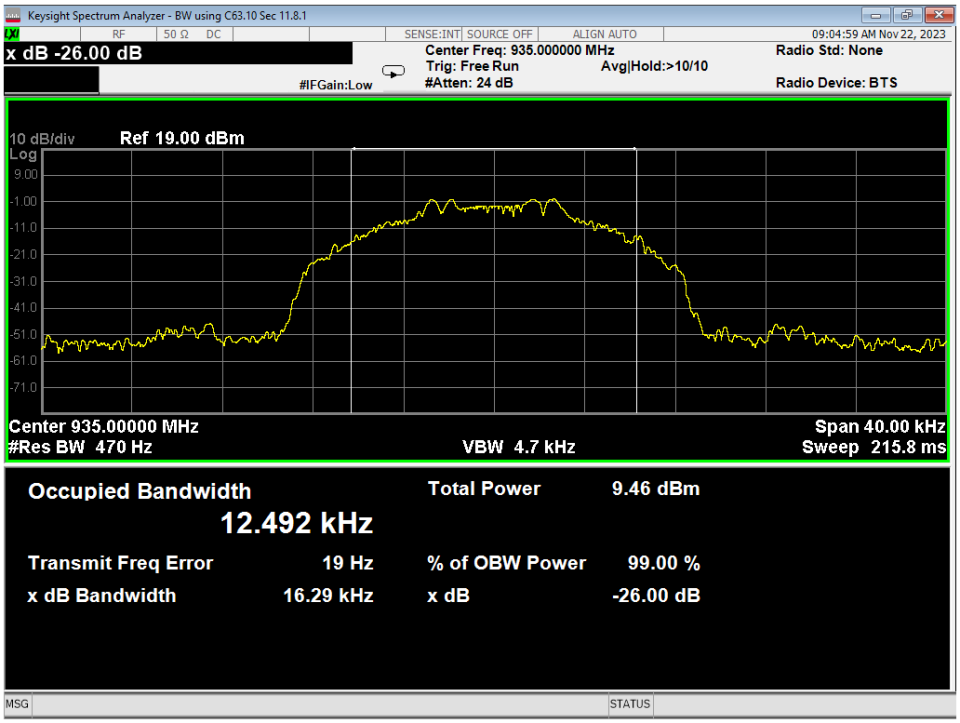


Figure 55 – Bandwidth, 935MHz, 64QAM, 12.5kHz

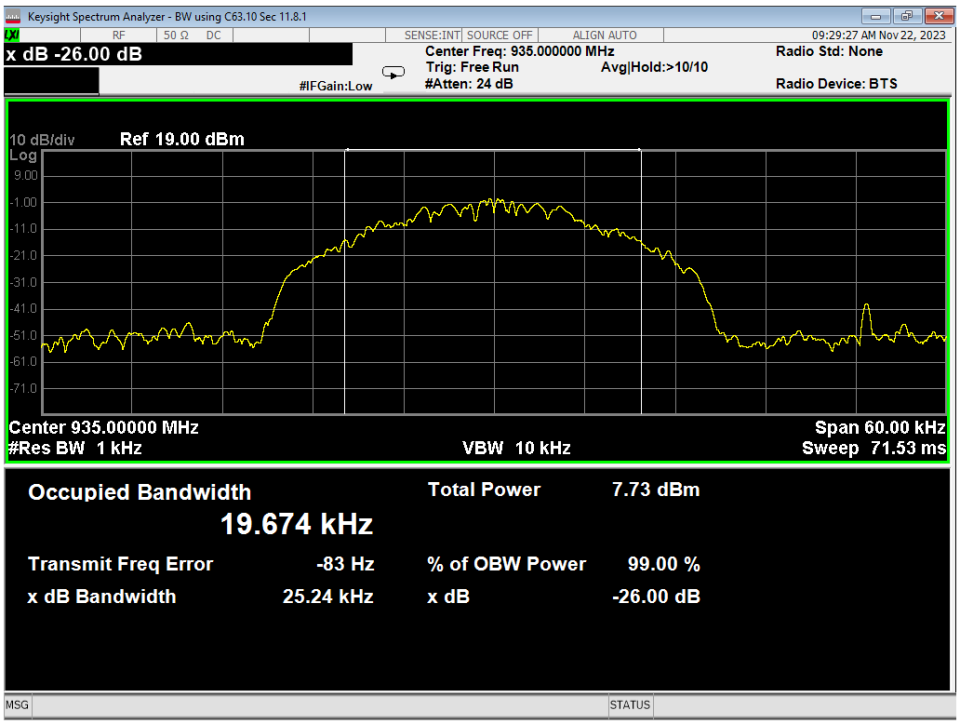


Figure 56 – Bandwidth, 935MHz, 64QAM, 25kHz

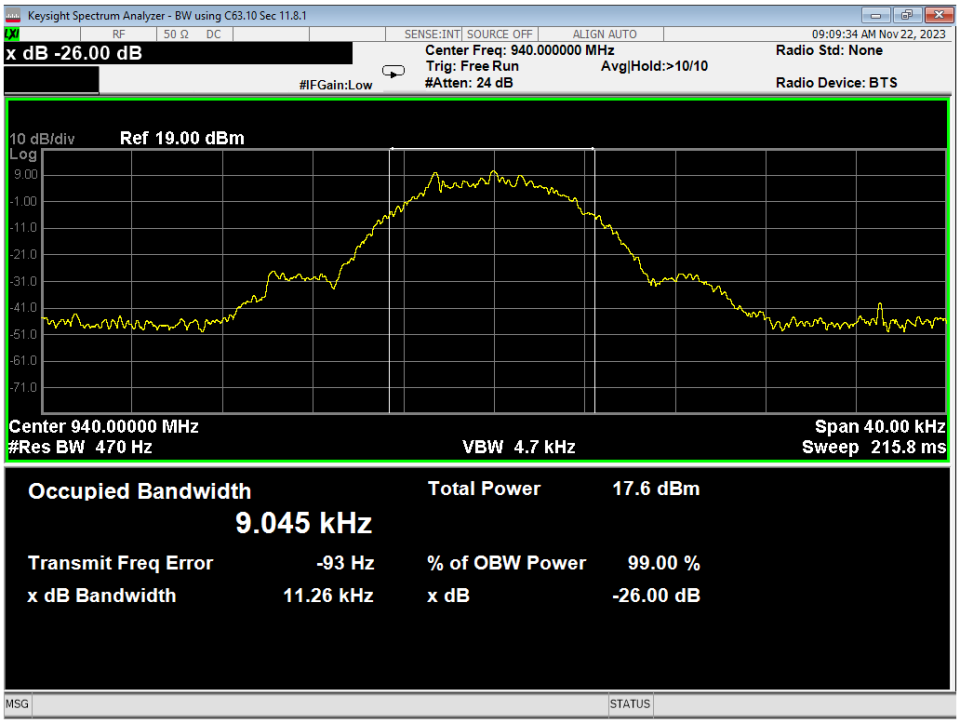


Figure 57 – Bandwidth, 940MHz, MSK, 12.5kHz

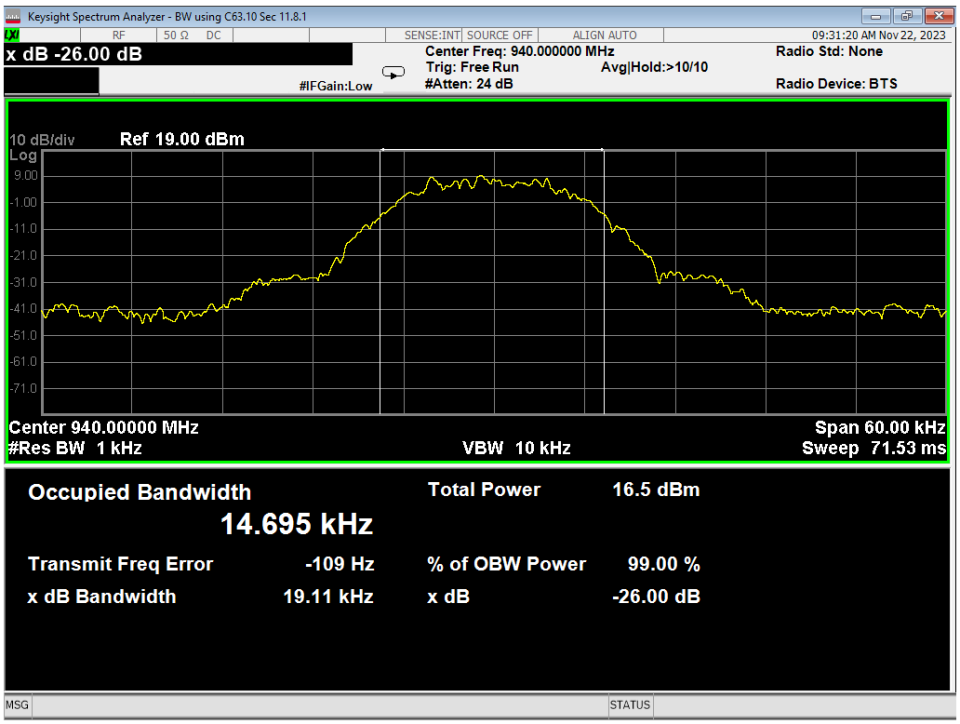


Figure 58 – Bandwidth, 940MHz, MSK, 25kHz

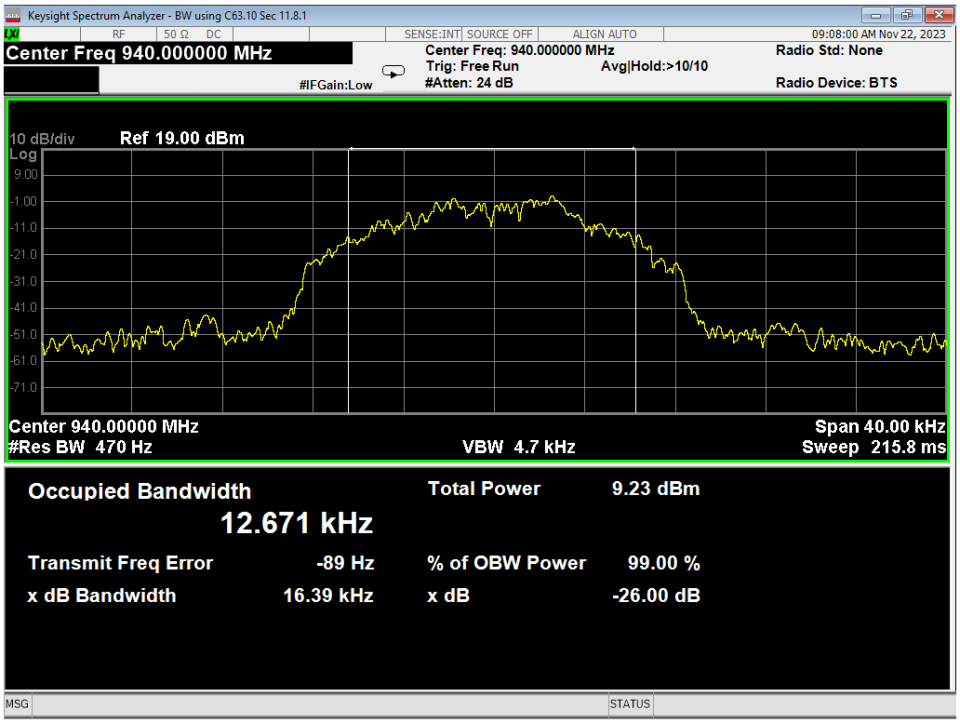


Figure 59 – Bandwidth, 940MHz, 64QAM, 12.5kHz

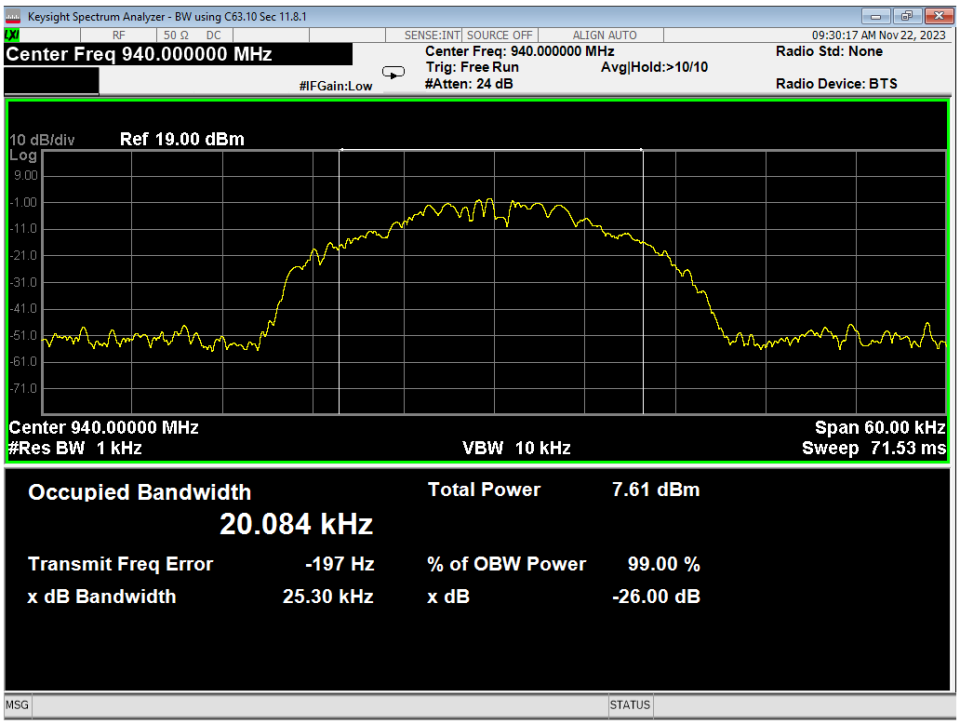


Figure 60 – Bandwidth, 940MHz, 64QAM, 25kHz

## 4.4 FREQUENCY STABILITY MEASUREMENTS

**Test Method:** ANSI C63.26,
Section(s) 5.6.3 “Procedures for frequency stability testing”

**Limits:**
**47 CFR 90.213 (a)**

**Test procedures:**
Radiated power was measured on a spectrum analyzer with resolution bandwidth and video bandwidth set to 10Hz and 1kHz respectively. The frequency error functionality on the receiver was used. The temperature was varied from -40°C to +70°C.

**Deviations from test standard:**
No deviation

**Test setup:**

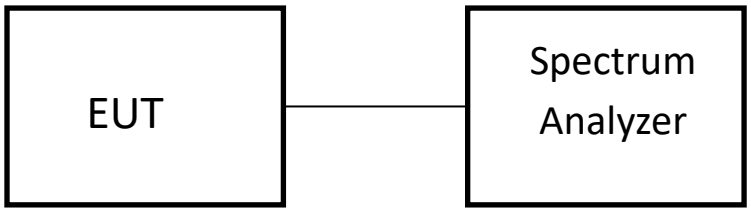


**Figure 61 –Measurements Test Setup**

**EUT operating conditions:**
See Section 2.1 & 2.2

**Test results:**

Figure 62 – Frequency Stability, Temperature

| Lower Band (896-901M) | | | |
|---|---|---|---|
| | Voltage | Frequency Error (Hz) | |
| Temp (°C) | (VDC) | Low | High |
| | | Nominal = 896MHz | Nominal = 901MHz |
| -40°C | 10V | -5.8 | -21.6 |
| -30°C | 10V | -12 | 1.4 |
| -20°C | 10V | 15.4 | -1.2 |
| -10°C | 10V | 31 | 46.6 |
| 0°C | 10V | 2 | -3.2 |
| +10°C | 10V | -22 | -3.4 |
| +20°C | 10V | -36 | -34 |
| +30°C | 10V | 3.2 | 8.8 |
| +40°C | 10V | 62.6 | 52.8 |
| +50°C | 10V | 49.8 | 59 |
| +60°C | 10V | 85.8 | 82.6 |
| +70°C | 10V | 60.2 | 64.2 |
| Limit = 0.1ppm | | | |

| Upper Band (935-940M) | | | |
|---|---|---|---|
| | Voltage | Frequency Error (Hz) | |
| Temp (°C) | (VDC) | Low | High |
| | | Nominal = 935MHz | Nominal = 940MHz |
| -40°C | 10V | -41.4 | -43.8 |
| -30°C | 10V | 2.2 | 11 |
| -20°C | 10V | -27.6 | -45.4 |
| -10°C | 10V | 44.6 | 44 |
| 0°C | 10V | -6.6 | -6.4 |
| +10°C | 10V | -5.8 | 2.4 |
| +20°C | 10V | -44.6 | -47 |
| +30°C | 10V | 14.6 | 24.6 |
| +40°C | 10V | 41.2 | 30.8 |
| +50°C | 10V | 72.6 | 70.6 |
| +60°C | 10V | 75.4 | 77 |
| +70°C | 10V | 73.4 | 85 |
| Limit = 0.1ppm | | | |

Figure 63 – Frequency Stability, Voltage

| Lower Band (896-901M) | | | |
|---|---|---|---|
| | Voltage | Frequency Error (Hz) | |
| Temp (°C) | (VDC) | Low | High |
| | | Nom = 896MHz | Nom = 901MHz |
| +20°C | 9.5 | -15.8 | 8 |
| +20°C | 10 | 9.8 | 2 |
| +20°C | 10.5 | -7.2 | -4.2 |
| Limit = 0.1ppm | | | |

| Upper Band (935-940M) | | | |
|---|---|---|---|
| | Voltage | Frequency Error (Hz) | |
| Temp (°C) | (VDC) | Low | High |
| | | Nom = 935MHz | Nom = 940MHz |
| +20°C | 9.5 | 7 | 53.6 |
| +20°C | 10 | 12.4 | 46 |
| +20°C | 10.5 | 22.4 | 41.6 |
| Limit = 0.1ppm | | | |

# APPENDIX A: SAMPLE CALCULATION

**Field Strength Calculation**

The field strength is calculated by adding the antenna factor, cable factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:
FS = RA + AF – (-CF + AG) + AV

where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dBμV is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBμV/m.
FS = 55 + 12 – (-1.1 + 20) + 0 = 48.1 dBμV/m
The 48.1 dBμV/m value can be mathematically converted to its corresponding level in μV/m.
Level in μV/m = Common Antilogarithm [(48.1 dBμV/m)/20]= 254.1 μV/m
AV is calculated by taking 20*log($T_{on}$/100) where $T_{on}$ is the maximum transmission time in any 100ms window.

**EIRP Calculations**

In cases where direct antenna port measurement is not possible or would be inaccurate, output power is measured in EIRP. The maximum field strength is measured at a specified distance and the EIRP is calculated using the following equation;

*EIRP (Watts) = [Field Strength (V/m) x antenna distance (m)]$^2$ / 30*
*Power (watts) = 10^[Power (dBm)/10] / 1000*
*Voltage (dBμV) = Power (dBm) + 107 (for 50Ω measurement systems)*
*Field Strength (V/m) = 10^[Field Strength (dBμV/m) / 20] / 10^6*
*Gain = 1 (numeric gain for isotropic radiator)*
*Conversion from 3m field strength to EIRP (d=3):*
*EIRP = [FS(V/m) x d^2]/30 = FS [0.3] for d = 3*
*EIRP(dBm) = FS(dBμV/m) – 10(log 10^9)+ 10log[0.3] = FS(dBμV/m) - 95.23*
*10log(10^9) is the conversion from micro to milli*

# APPENDIX B – MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been for tests performed in this test report:

| Test | Frequency Range | Uncertainty Value (dB) |
|---|---|---|
| Radiated Emissions, 3m | 30MHz - 1GHz | ±4.31 |
| Radiated Emissions, 3m | 1GHz - 18GHz | ±5.08 |

Expanded uncertainty values are calculated to a confidence level of 95%.

REPORT END