

# TEST REPORT

Applicant Name : Seeed Technology Co., Ltd  
Address : 9F, G3 Building, TCL International E City, Zhongshanyuan Road,  
Nanshan District, Shenzhen, China  
Report Number : SZNS1220114-02178E-07A

## Test Standard (s)

Japan item 19 of Article 2 Paragraph 1


## Sample Description

Product Type: XIAO nRF52840 Sense  
Tested Model: XIAO-nRF52840 Sense  
Multiple Product: XIAO nRF52840  
Multiple Model: XIAO-nRF52840  
Date Received: 2022-01-14  
Date of Test: 2022-02-07 to 2022-04-12  
Report Date: 2022-04-13

|              |       |
|--------------|-------|
| Test Result: | Pass* |
|--------------|-------|

\* In the configuration tested, the EUT complied with the standards above.

## Prepared and Checked By:



Ting Lü  
Engineer

## Approved By:



Candy Li  
Engineer

**Note:** This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

|                                      |                      |  |
|--------------------------------------|----------------------|--|
| Equipment Name                       |                      | XIAO nRF52840 Sense  |
| Tested Model                         |                      | XIAO-nRF52840 Sense  |
| Multiple Product                     |                      | XIAO nRF52840  |
| Multiple Model                       |                      | XIAO-nRF52840  |
| Radio Type                           |                      | Bluetooth LE 1M, LE 2M   |
| Bluetooth<br>Technical<br>Parameters | Modulation Type      | GFSK   |
|                                      | Frequency Range      | 2402-2480 MHz  |
|                                      | Maximum Output Power | LE 1M: 6mW<br>LE 2M: 3mW   |
|                                      | Antenna Gain*        | 2dBi (provided by the applicant)   |
| Nominal Power Supply:                |                      | DC 5V From USB Port  |
| Sample serial number                 |                      | SZNS1220114-02178E-RF-S1 (XIAO-nRF52840 Sense)<br>SZNS1220114-02178E-RF-S1 (XIAO-nRF52840) |
| Sample/EUT Status                    |                      | Good condition   |

### Objective

The objective of the manufacturer is to demonstrate compliance with Radio Law of Japan item 19 of Article 2 Paragraph 1, rules and limits for this device including:

- Frequency Error
- Occupied Bandwidth
- Transmitter Spurious Emission and Unwanted Emission Intensity
- Antenna Output Power And Output Power Tolerance
- Receiver Spurious Emission Strength
- Interference Prevention Function
- Construction Protection Confirmation

### Test Methodology

All measurements contained in this report were conducted with technical regulations of the Radio Law of Japan.

## EUT TEST CONFIGURATION

### Description of Test Configuration

For BLE mode, 40 channels are provided to testing:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 0       | 2402            | 20      | 2442            |
| 1       | 2404            | 21      | 2444            |
| 2       | 2406            | 22      | 2446            |
| 3       | 2408            | 23      | 2448            |
| 4       | 2410            | 24      | 2450            |
| 5       | 2412            | 25      | 2452            |
| 6       | 2414            | 26      | 2454            |
| 7       | 2416            | 27      | 2456            |
| 8       | 2418            | 28      | 2458            |
| 9       | 2420            | 29      | 2460            |
| 10      | 2422            | 30      | 2462            |
| 11      | 2424            | 31      | 2464            |
| 12      | 2426            | 32      | 2466            |
| 13      | 2428            | 33      | 2468            |
| 14      | 2430            | 34      | 2470            |
| 15      | 2432            | 35      | 2472            |
| 16      | 2434            | 36      | 2474            |
| 17      | 2436            | 37      | 2476            |
| 18      | 2438            | 38      | 2478            |
| 19      | 2440            | 39      | 2480            |

EUT was tested with Channel 0, 19 and 39.

### EUT Exercise Software

“PUTY” exercise software was used for testing and the power level was default\*. The software and power level was provided by the applicant.

### Test Voltage

The EUT has a voltage regulator chip: SGM2040-3.3YUDH4G/TR, the output voltage of the chip is 3.3V and the fluctuation of power supply to the RF circuit of EUT is equal to or less than +/- 1%. So exempt extremely high and low supply voltage condition tests, EUT only operated in normal voltage to test all regulations.

### Equipment Modifications

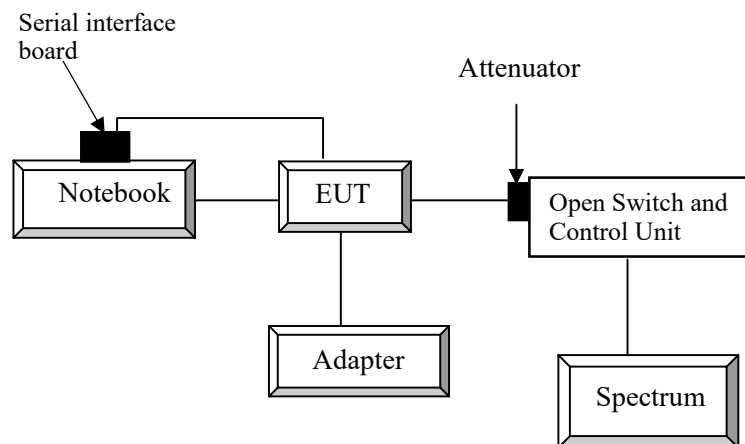
No modification was made to the EUT tested.

**Support Equipment List and Details**

| Manufacturer | Description            | Model   | Serial Number |
|--------------|------------------------|---------|---------------|
| Apple        | Adapter                | A1357   | Unknown       |
| Lenovo       | Notebook               | T430    | Unknown       |
| Unknown      | Serial interface board | Unknown | Unknown       |

**External I/O Cable**

| Cable Description                | Length (m) | From Port | To                     |
|----------------------------------|------------|-----------|------------------------|
| Unshielded Detachable USB Cable  | 0.75       | EUT       | Adapter                |
| Unshielded Detachable Data Cable | 0.2        | EUT       | Serial interface board |
| RF Coaxial Cable                 | 0.4        | EUT       | Attenuator             |

**Configuration of Test Setup**

## SUMMARY OF TEST RESULTS

| MIC Notice No.88 Appendix No.43<br>Article 2, Paragraph 1, Item 19<br>Rules Section | Description of Test   | Result           |
|---|---|------------------|
| 3   | Frequency Error   | Compliant        |
| 4   | Occupied Bandwidth  | Compliant        |
| 5   | Transmitter Spurious Emission and Unwanted Emission Intensity | Compliant        |
| 6   | Antenna Output Power and Output Power Tolerance               | Compliant        |
| 7   | Receiver Spurious Emission and Unwanted Emission Intensity    | Compliant        |
| 8 & 9   | Carrier sense capability                                      | Not Applicable** |
| 10  | Transmission Antenna Gain                                     | Not Applicable   |
| 11  | Transmission Radiation Angle Width                            | Not Applicable   |
| 12  | Interference Prevention Function                              | Compliant        |
| 13  | Frequency Hopping Dwell Time                                  | Not Applicable*  |
| Note 1  | Construction Protection Confirmation                          | Compliant        |

Not Applicable\* -Testing is only required for FHSS system devices.

Not Applicable\*\*-The OBW of EUT is less than 26 MHz and the EUT is not radio control model aircraft.

Not Applicable - This test item was not required for the output power less than 12.14 dBm (E.I.R.P)

## TEST EQUIPMENT LIST

| Manufacturer    | Description                         | Model             | Serial Number   | Calibration Date | Calibration Due Date | Calibration Authority | Calibration Method |
|-----------------|-------------------------------------|-------------------|-----------------|------------------|----------------------|-----------------------|--------------------|
| Rohde & Schwarz | Spectrum Analyzer                   | FSV-40            | 101495          | 2021/12/13       | 2022/12/12           | CICC                  | C                  |
| Rohde & Schwarz | Wideband Radio Communication Tester | CMW500            | 154606          | 2021/12/13       | 2022/12/12           | CICC                  | C                  |
| Rohde & Schwarz | Open Switch and Control Unit        | OSP120 + OSP-B157 | 101244 + 100866 | 2021/12/13       | 2022/12/12           | CCIC                  | C                  |
| Agilent         | Signal Generator                    | N5182A            | MY5014 3401     | 2021/12/13       | 2022/12/12           | CCIC                  | C                  |
| WEINSCHEL       | 10dB Attenuator                     | 5324              | AU 3842         | Each Time        |                      | /                     | /                  |

**\* Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

### Note

- A. Calibration conducted by the National Institute of Information and Communications Technology (NICT) (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1)
- B. Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992)
- C. Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1)
- D. Calibration conducted by using measuring instruments and other equipment which shall have been given any of calibration, etc. listed above from A to C.

## FREQUENCY ERROR

### Limit

50ppm or below

### Test Procedure

Set the EUT to the measurement frequency without modulation.  
Setting of SA is following as:

- Center Frequency: Frequency to measure
- RBW: 1 kHz, VBW: 30 kHz
- Span: 200 kHz
- Sweep time: Auto
- Log scale: 10dB/Div, Data points: 400 points or more
- Reference level: Enough level for maximum dynamic range
- Detection: Positive Peak
- Sweep mode: Single Sweep
- Marker: Spot

Record the peak spot frequency.

### Test Data

#### Environmental Conditions

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25 °C     |
| <b>Relative Humidity:</b> | 56 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

The testing was performed by Paul Liu from 2022-02-07 to 2022-04-12.

**Test Result:** Compliant

Test Mode: Transmitting



For model of XIAO-nRF52840 Sense

Normal Voltage

| Frequency (MHz) | Measure frequency (MHz) | Frequency tolerance (ppm) | Limit (ppm) |
|-----------------|-------------------------|---------------------------|-------------|
| 2402            | 2402.03792              | 15.79                     | < 50        |
| 2440            | 2440.03792              | 15.54                     |             |
| 2480            | 2480.03907              | 15.75                     |             |

For model of XIAO-nRF52840

Normal Voltage

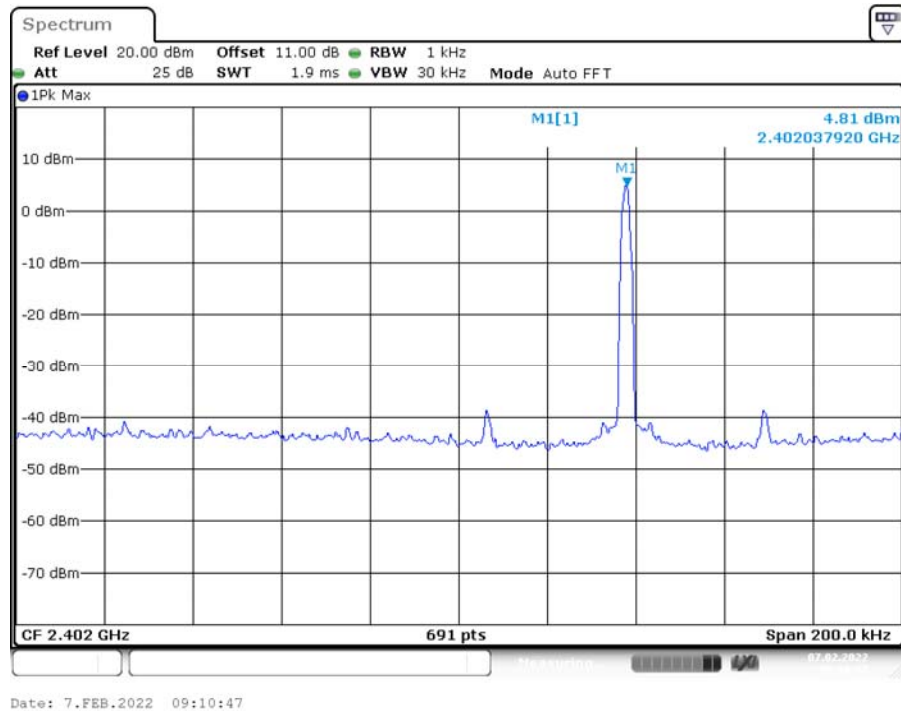
| Frequency (MHz) | Measure frequency (MHz) | Frequency tolerance (ppm) | Limit (ppm) |
|-----------------|-------------------------|---------------------------|-------------|
| 2402            | 2402.03444              | 14.33                     | < 50        |
| 2440            | 2440.03589              | 14.71                     |             |
| 2480            | 2480.03589              | 14.47                     |             |

Please refer to the plots as below.

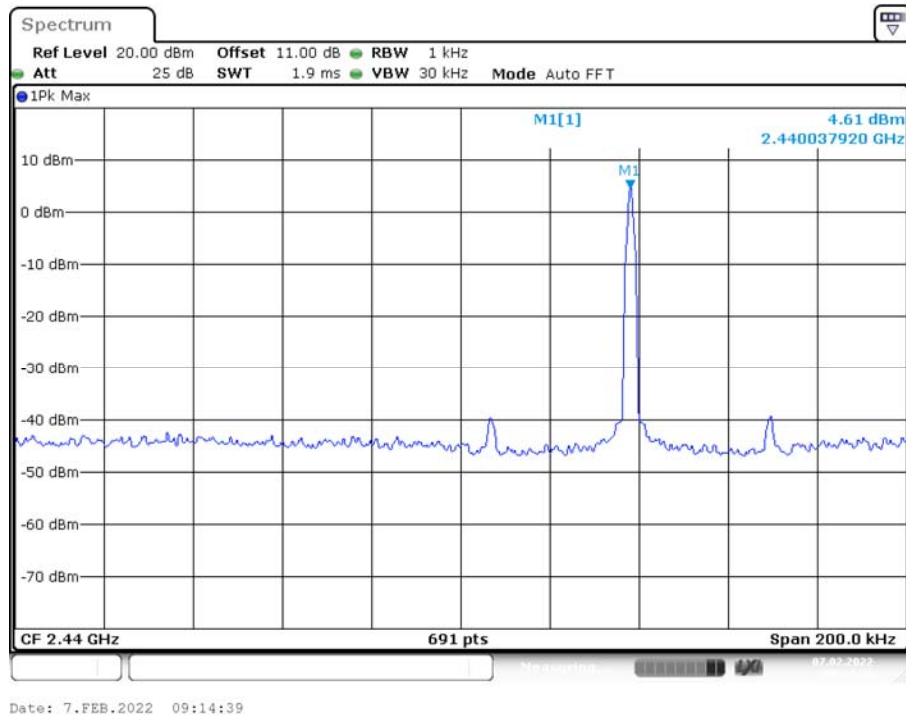
For model XIAO-nRF52840 Sense

Normal Voltage

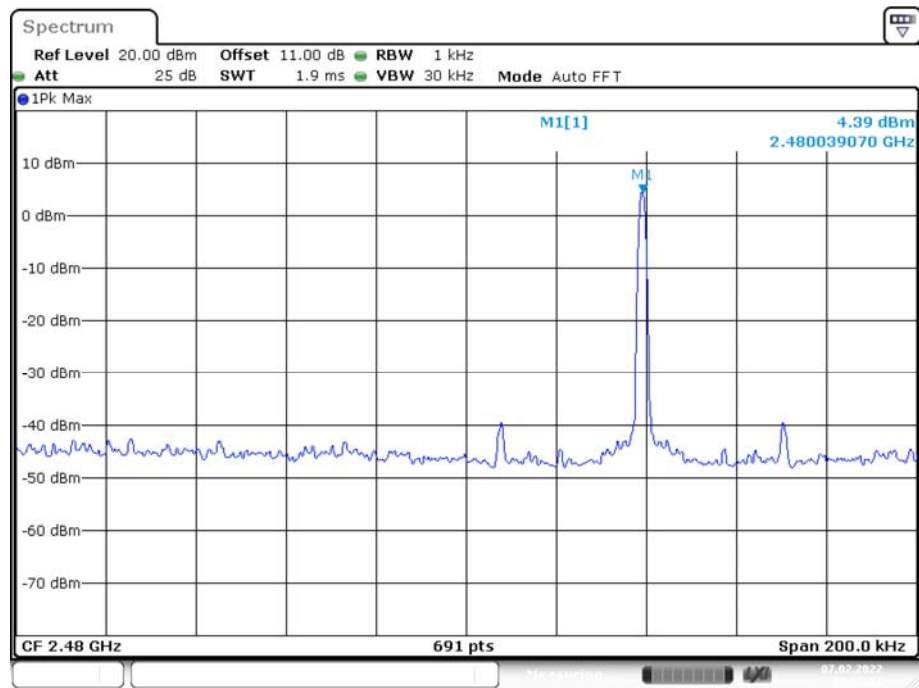
Low Channel



Middle Channel



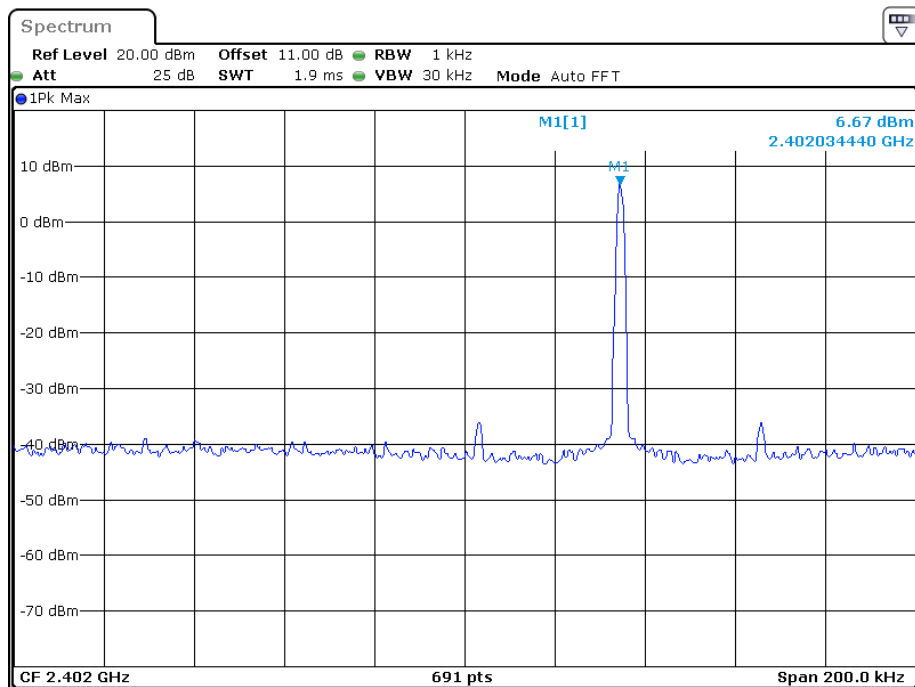
## High Channel



## For model of XIAO-nRF52840

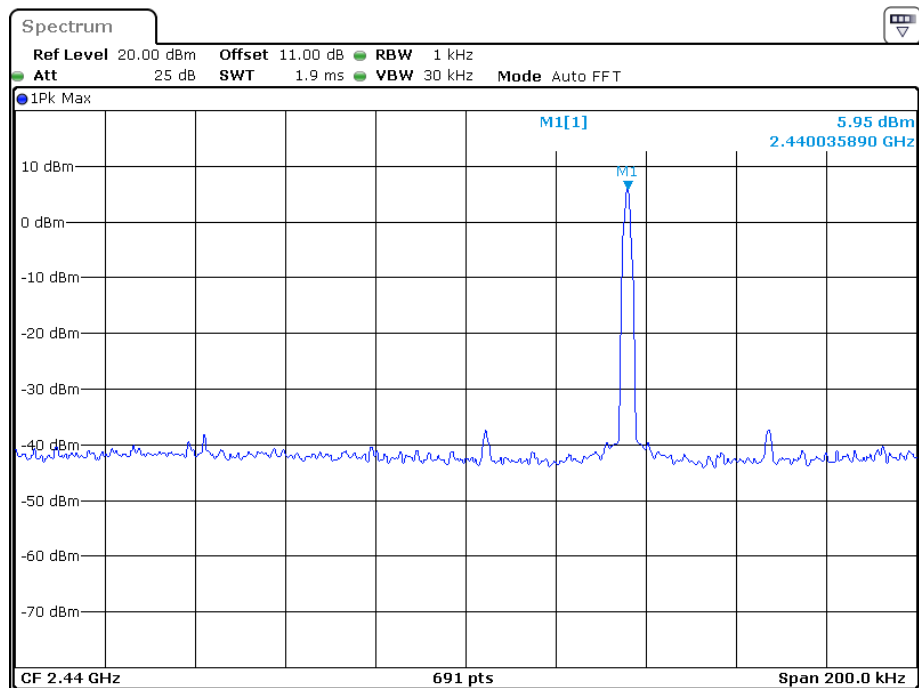
Normal Voltage

## Low Channel



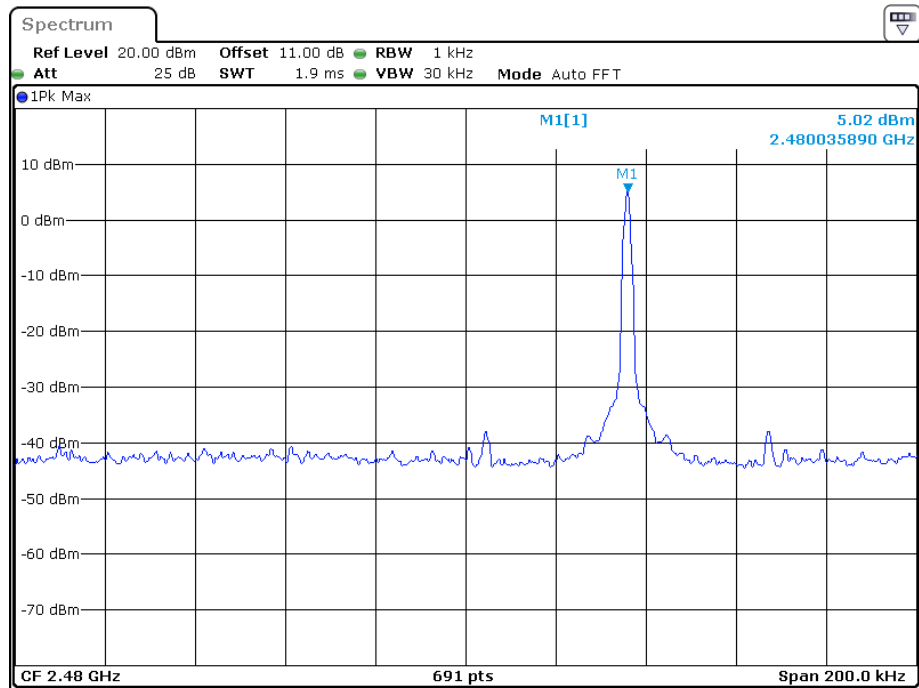
Date: 12.APR.2022 17:20:23

## Middle Channel



Date: 12.APR.2022 17:25:20

## High Channel



Date: 12.APR.2022 17:26:33

## OCCUPIED BANDWIDTH

### Limit

- Occupied bandwidth: FH $\leq$ 83.5 MHz; OFDM, DS $\leq$ 26 MHz; Others $\leq$ 26 MHz

### Test Procedure

- Setting of SA is following as:
  - Center Frequency: Frequency to measure
  - RBW: 30 kHz, VBW: 30 kHz
  - Span: 5MHz
  - Sweep time: Auto
  - Log scale: 10dB/Div, Data points: 400 points or more
  - Reference level: Enough level for maximum dynamic range
  - Detection: Positive Peak
  - Sweep mode: Continuous Sweep
  - Marker: Spot
- EUT have transmitted the maximum modulation signal and fixed channelize. SA set to 99% of occupied bandwidth to measure occupied bandwidth.

### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25°C      |
| Relative Humidity: | 53%       |
| ATM Pressure:      | 101.0 kPa |

The testing was performed by Paul Liu from 2022-02-07 to 2022-04-12.

**Test Result:** Compliant

Test Mode: Transmitting

For model of XIAO-nRF52840 Sense

Normal Voltage

| Modulation mode | Frequency                | 2402 MHz | 2440 MHz | 2480 MHz | Limit               |
|-----------------|--------------------------|----------|----------|----------|---------------------|
| GFSK(1M)        | Occupied bandwidth (MHz) | 1.071    | 1.085    | 1.071    | $\leq 26\text{MHz}$ |
| GFSK(2M)        | Occupied bandwidth (MHz) | 2.077    | 2.084    | 2.084    | $\leq 26\text{MHz}$ |

For model of XIAO-nRF52840

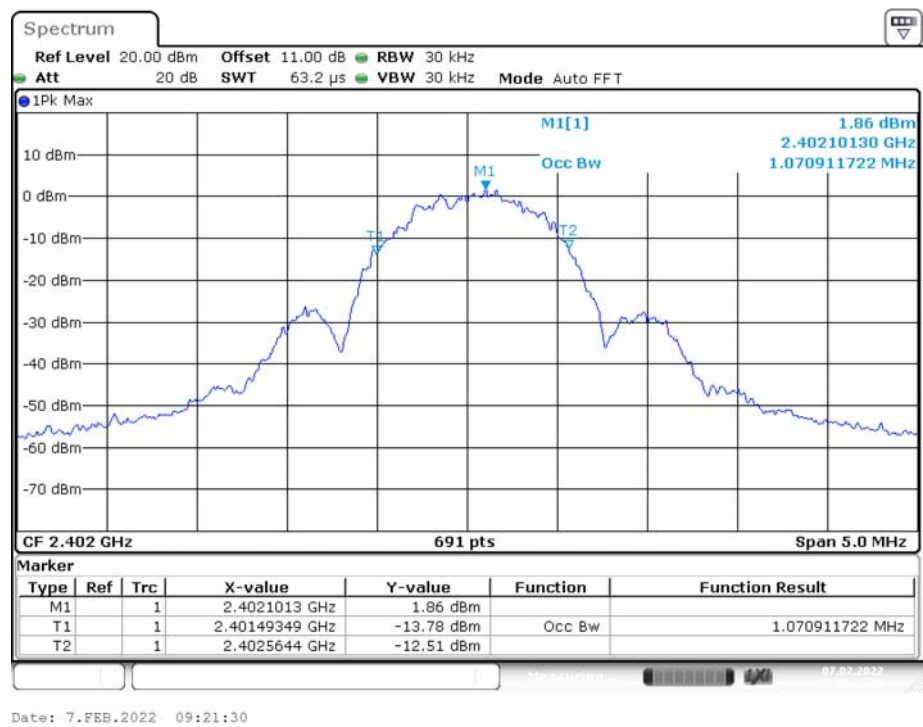
| Modulation mode | Frequency                | 2402 MHz | 2440 MHz | 2480 MHz | Limit               |
|-----------------|--------------------------|----------|----------|----------|---------------------|
| GFSK(1M)        | Occupied bandwidth (MHz) | 1.078    | 1.071    | 1.071    | $\leq 26\text{MHz}$ |
| GFSK(2M)        | Occupied bandwidth (MHz) | 2.084    | 2.106    | 2.106    | $\leq 26\text{MHz}$ |

Please refer to the plots for normal voltage test.

For model of XIAO-nRF52840 Sense

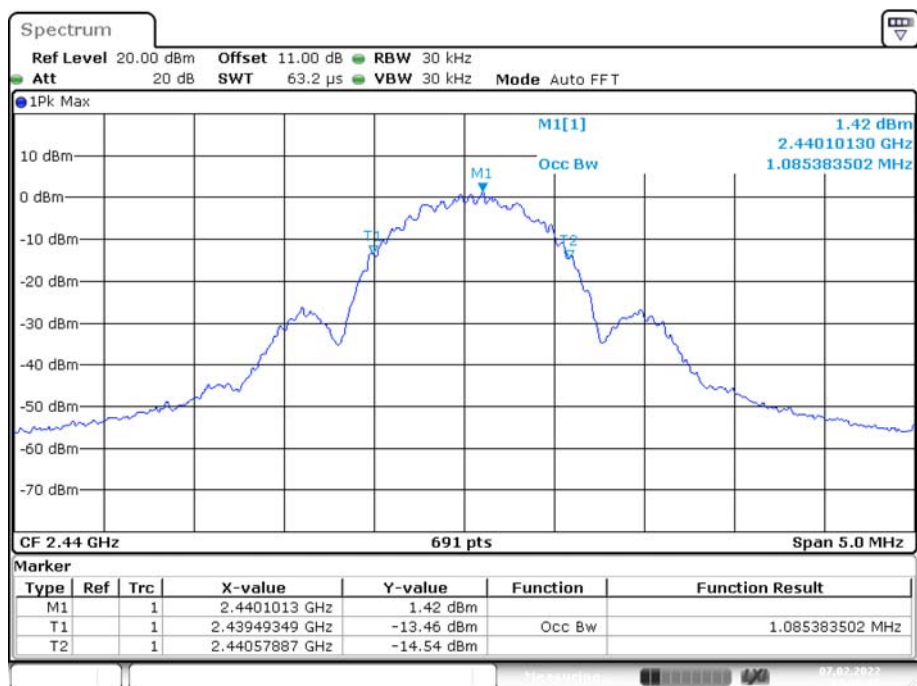
Normal Voltage  
GFSK (1M)  
Occupied Bandwidth:

Low Channel



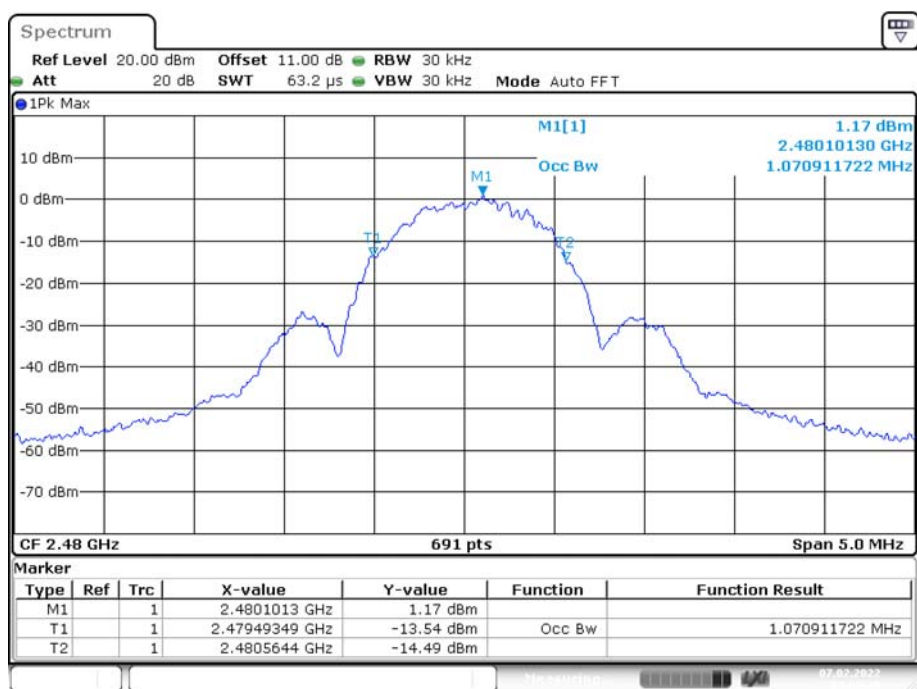


## Middle Channel

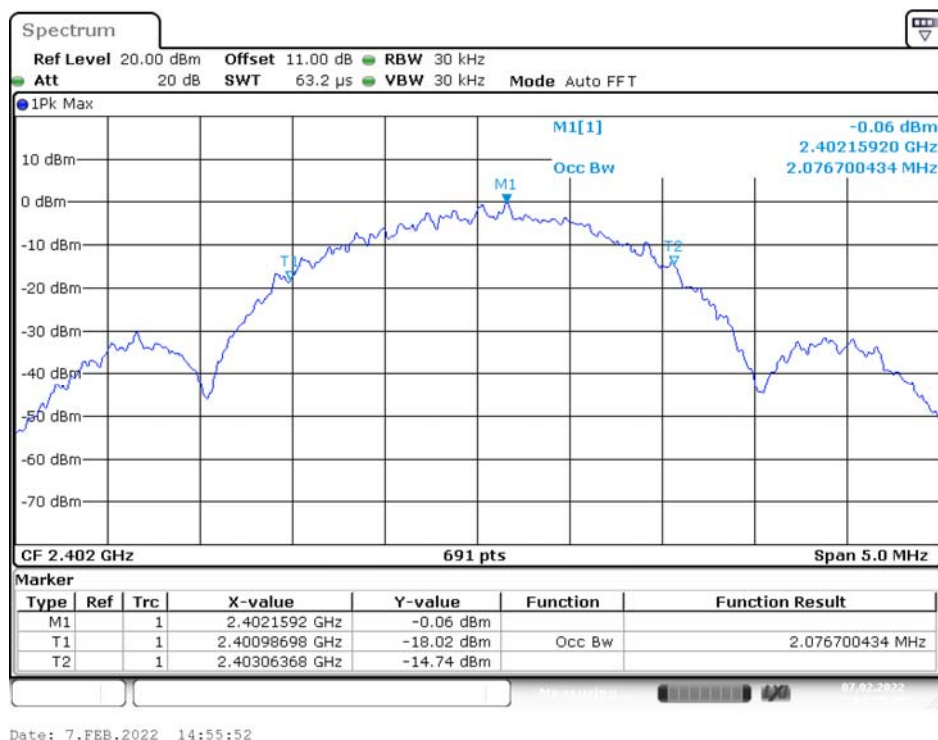
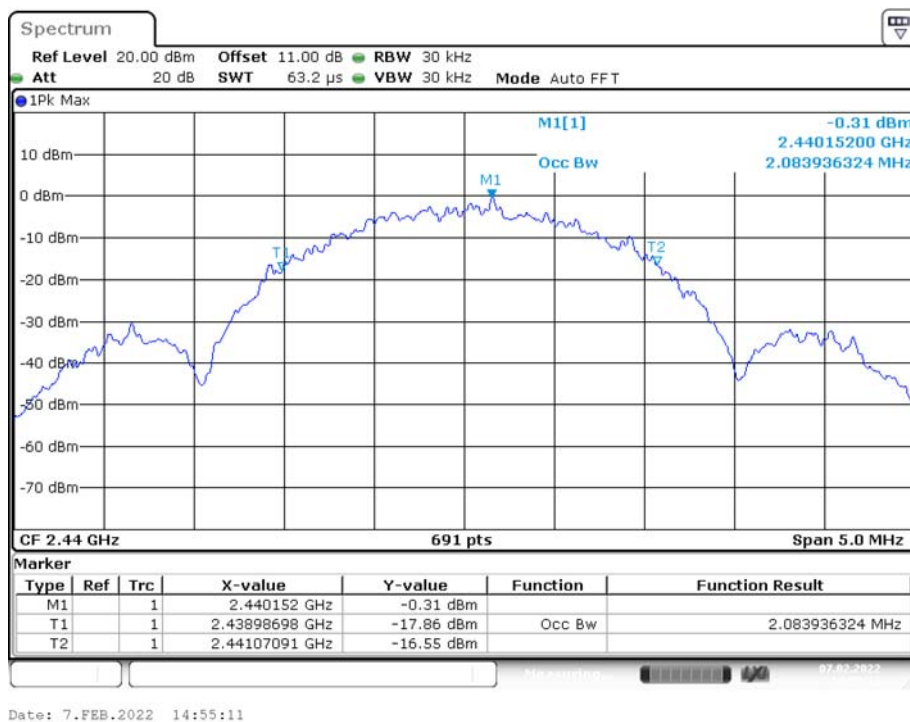


Date: 7.FEB.2022 09:33:05

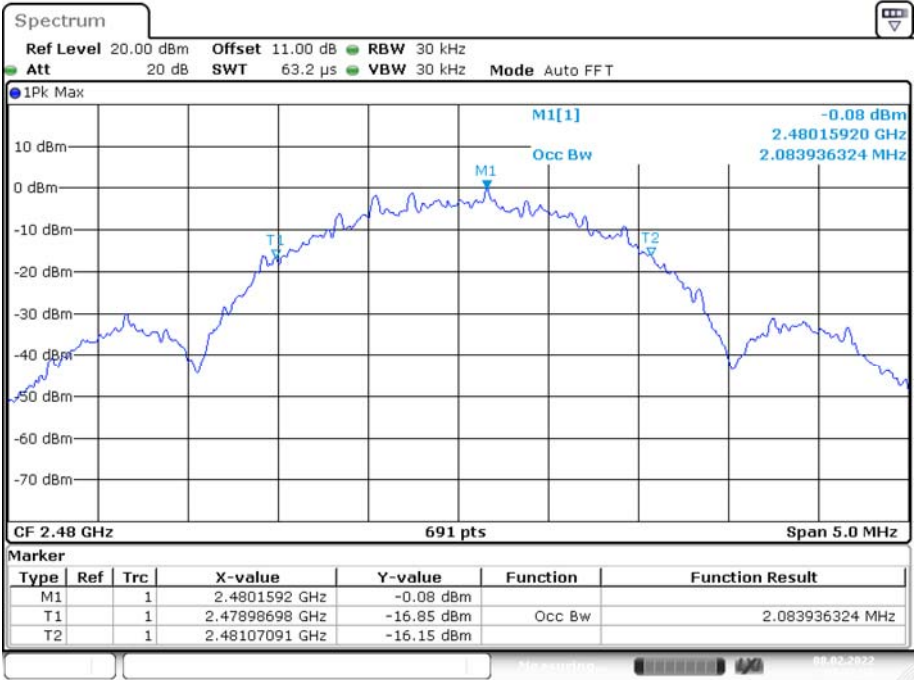
## High Channel



Date: 7.FEB.2022 09:38:46

**GFSK (2M)  
Occupied Bandwidth:****Low Channel****Middle Channel**

High Channel

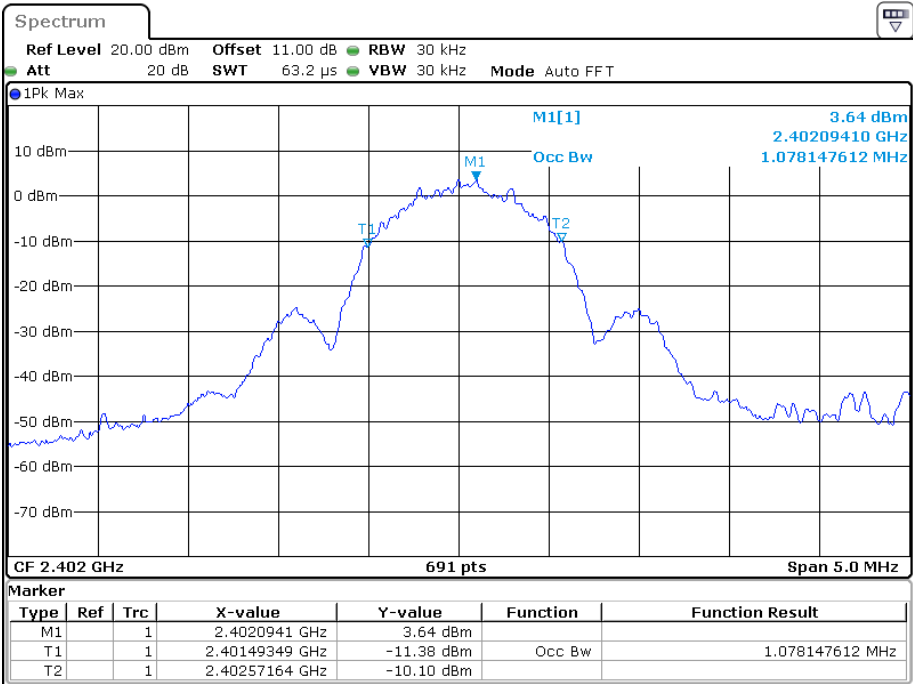


Date: 7.FEB.2022 08:41:15

For model XIAO-nRF52840

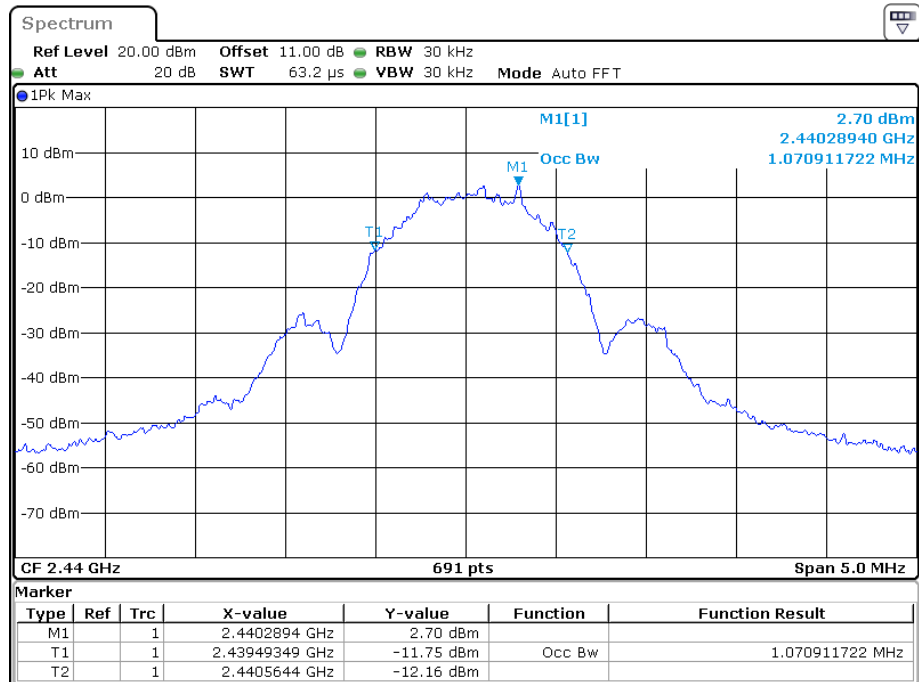
Normal Voltage  
GFSK (1M)  
Occupied Bandwidth:

Low Channel



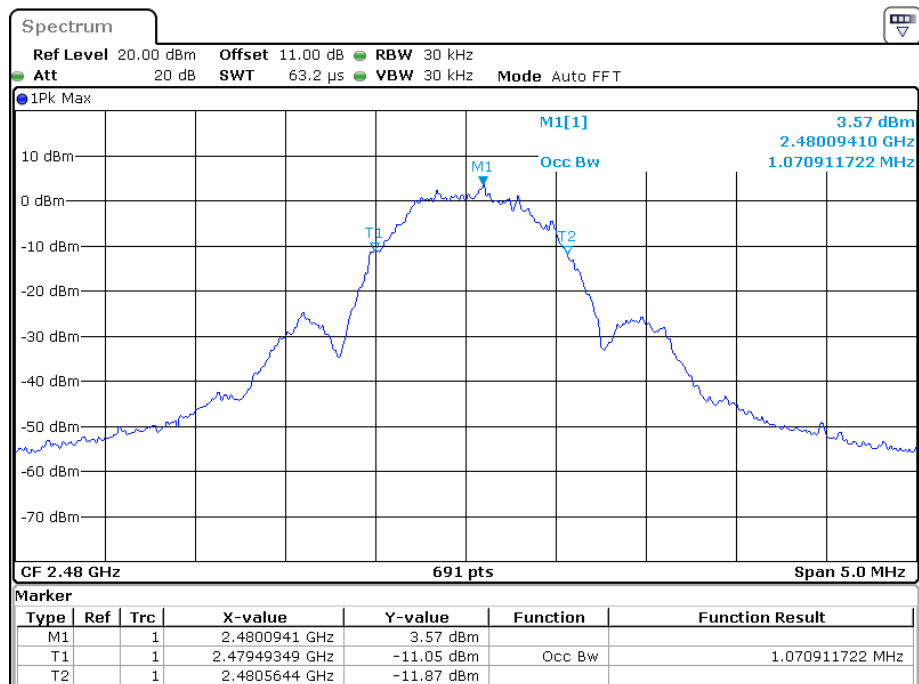
Date: 12.APR.2022 15:37:40

## Middle Channel

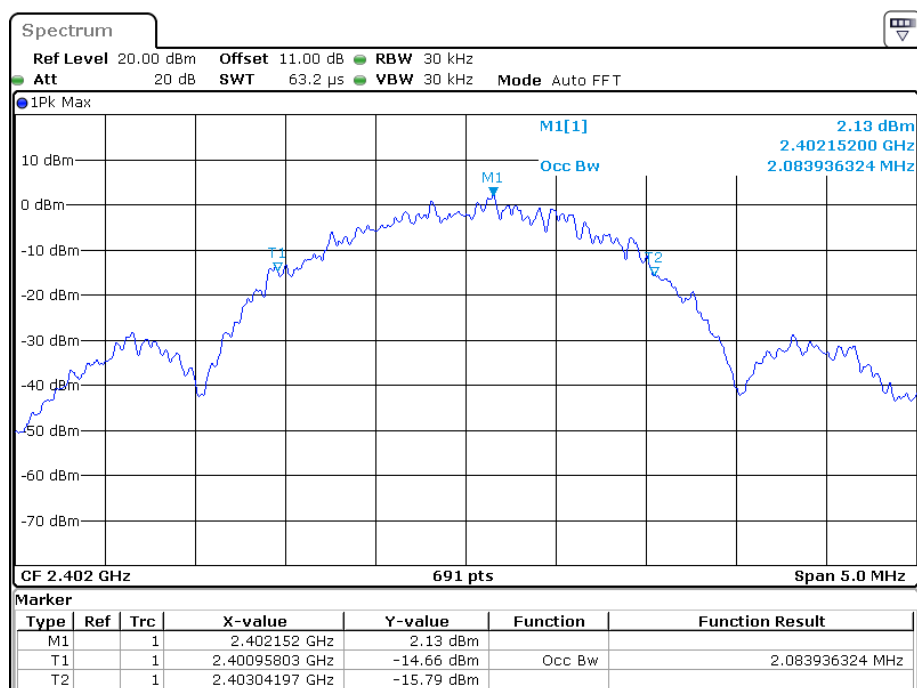


Date: 12.APR.2022 15:48:47

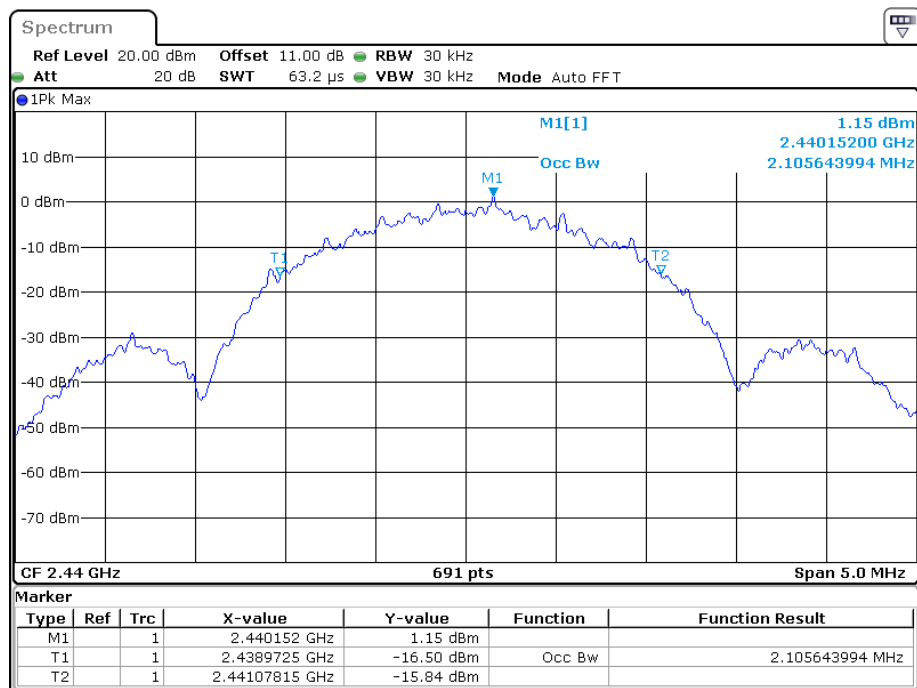
## High Channel



Date: 12.APR.2022 15:33:54

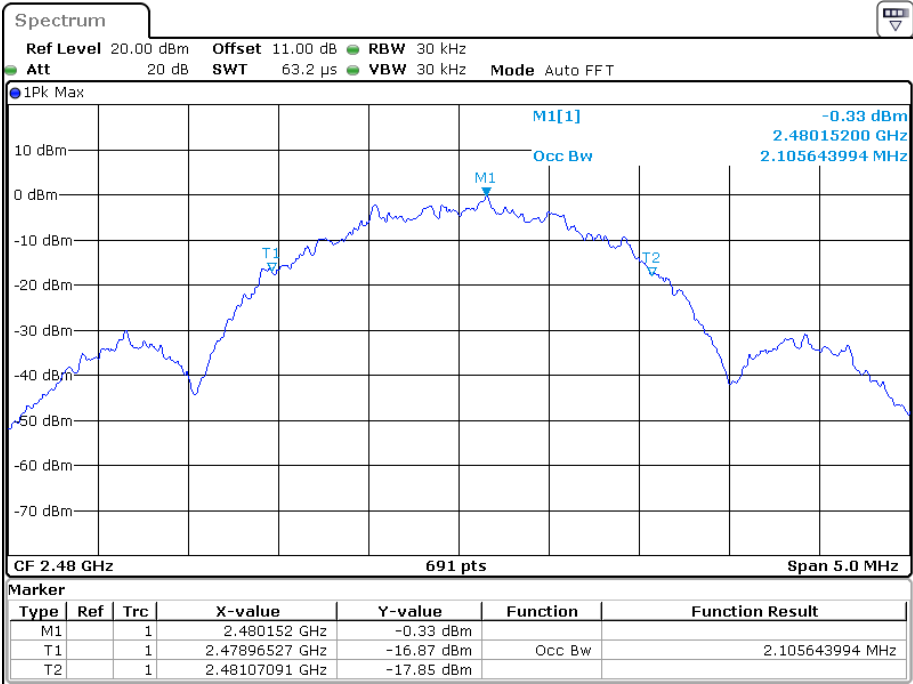
**GFSK (2M)  
Occupied Bandwidth:****Low Channel**

Date: 12.APR.2022 15:50:48

**Middle Channel**

Date: 12.APR.2022 15:58:44

High Channel



Date: 12.APR.2022 16:00:03

## TRANSMITTER SPURIOUS EMISSION STRENGTH AND UNWANTED EMISSION INTENSITY

### Limit

- $f < 2387 \text{ MHz}$ ,  $f > 2496.5 \text{ MHz}$ :  $\leq 2.5 \mu\text{W/MHz}$
- $2387 \text{ MHz} \leq f \leq 2400 \text{ MHz}$ ;  $2483.5 \text{ MHz} < f \leq 2496.5 \text{ MHz}$ :  $\leq 25 \mu\text{W/MHz}$

### Test Procedure

#### Conditions of Application Equipment (EUT)

- The modulation state shall be in continuously transmitting mode.

#### Spectrum Analyzer Conditions

- Span: Measuring Frequency Range
- RBW: 1MHz (frequency range; 1GHz over), 100kHz (frequency range; 30MHz to 1GHz)
- VBW: Same as RBW (1MHz or 100kHz)
- Sweep time: Auto (Minimum time to ensure measurement accuracy.)
- Data points : 400 points or more
- Reference level: Enough level for maximum dynamic range
- Detection: Positive Peak

If the measured value is under the technical standard value, do not need to measure more detail.

### Test Data

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25°C      |
| Relative Humidity: | 53%       |
| ATM Pressure:      | 101.0 kPa |

The testing was performed by Paul Liu from 2022-02-07 to 2022-04-12.

**Test Result:** Compliant

*Please refer to the below plots and table.*



For model of XIAO-nRF52840 Sense

Normal Voltage

| GFSK(1M) | Frequency Band      | 2402MHz | 2440MHz | 2480MHz | Limit |
|----------|---------------------|---------|---------|---------|-------|
| Raw data | Band I (dBm/100kHz) | -56.69  | -57.32  | -56.60  | -36   |
|          | Band II (dBm/MHz)   | -47.28  | -35.25  | -46.24  | -26   |
|          | Band III (dBm/MHz)  | -30.39  | -45.55  | -45.92  | -16   |
|          | Band IV (dBm/MHz)   | -46.18  | -46.83  | -44.14  | -16   |
|          | Band V (dBm/MHz)    | -35.96  | -36.83  | -38.62  | -26   |

| GFSK(2M) | Frequency Band      | 2402MHz | 2440MHz | 2480MHz | Limit |
|----------|---------------------|---------|---------|---------|-------|
| Raw data | Band I (dBm/100kHz) | -56.72  | -55.46  | -56.70  | -36   |
|          | Band II (dBm/MHz)   | -46.21  | -47.57  | -46.82  | -26   |
|          | Band III (dBm/MHz)  | -17.36  | -47.01  | -46.38  | -16   |
|          | Band IV (dBm/MHz)   | -45.82  | -46.46  | -39.47  | -16   |
|          | Band V (dBm/MHz)    | -35.76  | -37.39  | -38.75  | -26   |

For model of XIAO-nRF52840

Normal Voltage

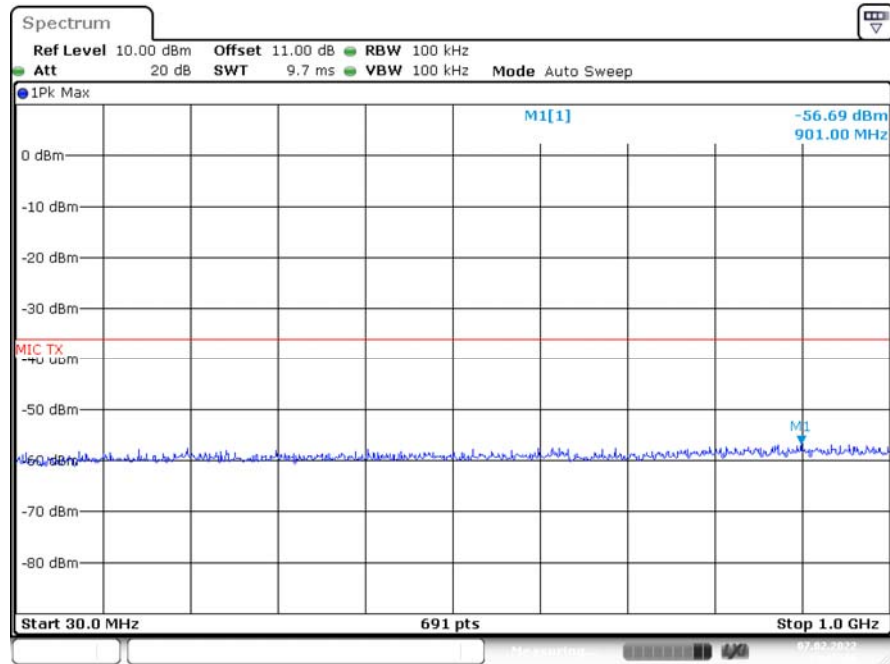
| GFSK(1M) | Frequency Band      | 2402MHz | 2440MHz | 2480MHz | Limit |
|----------|---------------------|---------|---------|---------|-------|
| Raw data | Band I (dBm/100kHz) | -55.70  | -56.44  | -56.17  | -36   |
|          | Band II (dBm/MHz)   | -39.41  | -41.88  | -42.41  | -26   |
|          | Band III (dBm/MHz)  | -28.48  | -44.50  | -45.91  | -16   |
|          | Band IV (dBm/MHz)   | -45.66  | -45.93  | -43.24  | -16   |
|          | Band V (dBm/MHz)    | -31.52  | -29.96  | -30.33  | -26   |

| GFSK(2M) | Frequency Band      | 2402MHz | 2440MHz | 2480MHz | Limit |
|----------|---------------------|---------|---------|---------|-------|
| Raw data | Band I (dBm/100kHz) | -56.38  | -56.45  | -56.34  | -36   |
|          | Band II (dBm/MHz)   | -43.11  | -43.57  | -46.54  | -26   |
|          | Band III (dBm/MHz)  | -30.57  | -45.82  | -46.91  | -16   |
|          | Band IV (dBm/MHz)   | -45.76  | -45.49  | -38.85  | -16   |
|          | Band V (dBm/MHz)    | -32.04  | -30.26  | -30.81  | -26   |

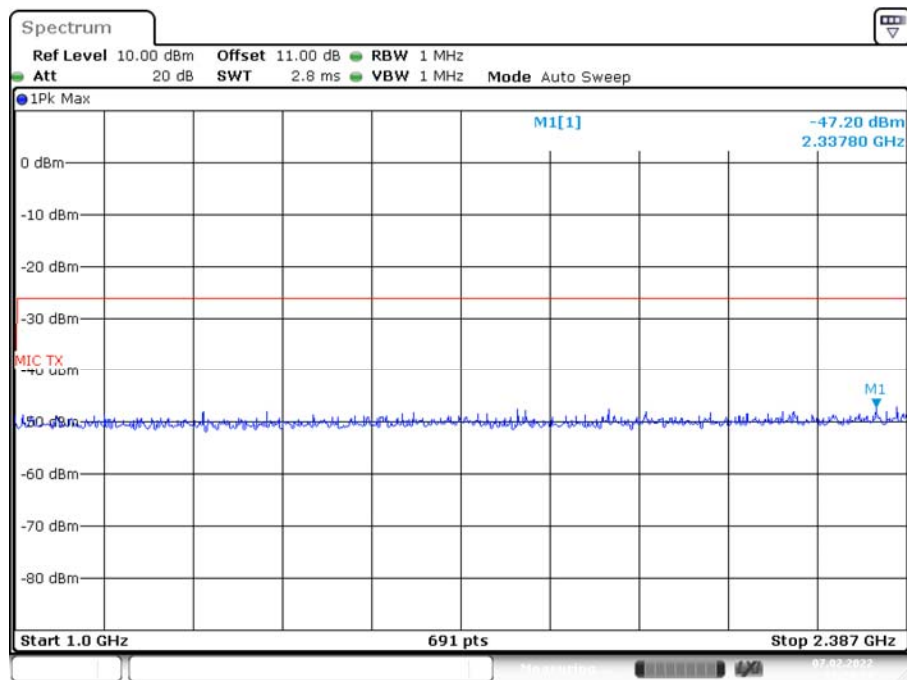
**Note:**2.5  $\mu$ W/MHz = -26dBm/MHz = -36dBm/100kHz25  $\mu$ W/MHz = -16dBm/MHz**Band I: 30MHz-1000MHz****Band II: 1000MHz-2387MHz****Band III: 2387MHz-2400MHz****Band IV: 2483.5MHz-2496.5MHz****Band V: 2496.5MHz-12500MHz**

For model of XIAO-nRF52840 Sense

Normal Voltage  
GFSK (1M)  
Low Channel:

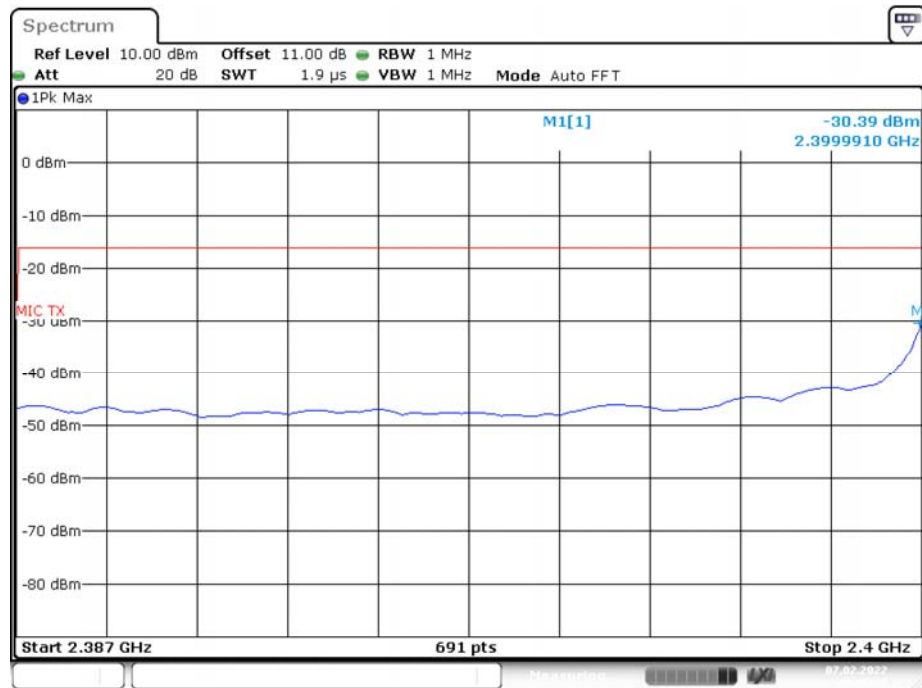
**30MHz - 1000MHz**

Date: 7.FEB.2022 13:15:17

**1000MHz - 2387MHz**

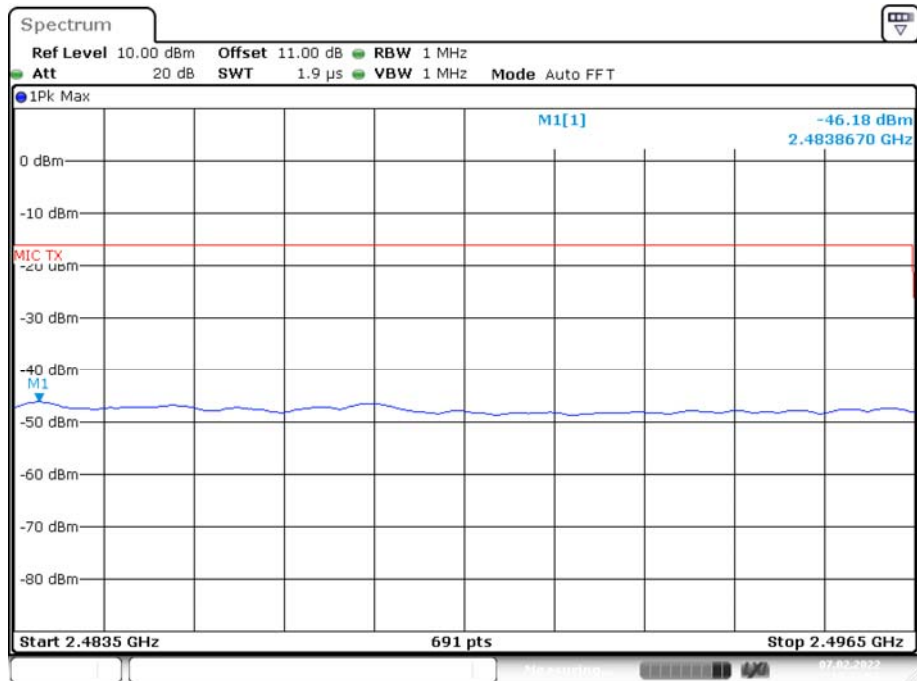
Date: 7.FEB.2022 13:29:14

## 2387MHz - 2400MHz

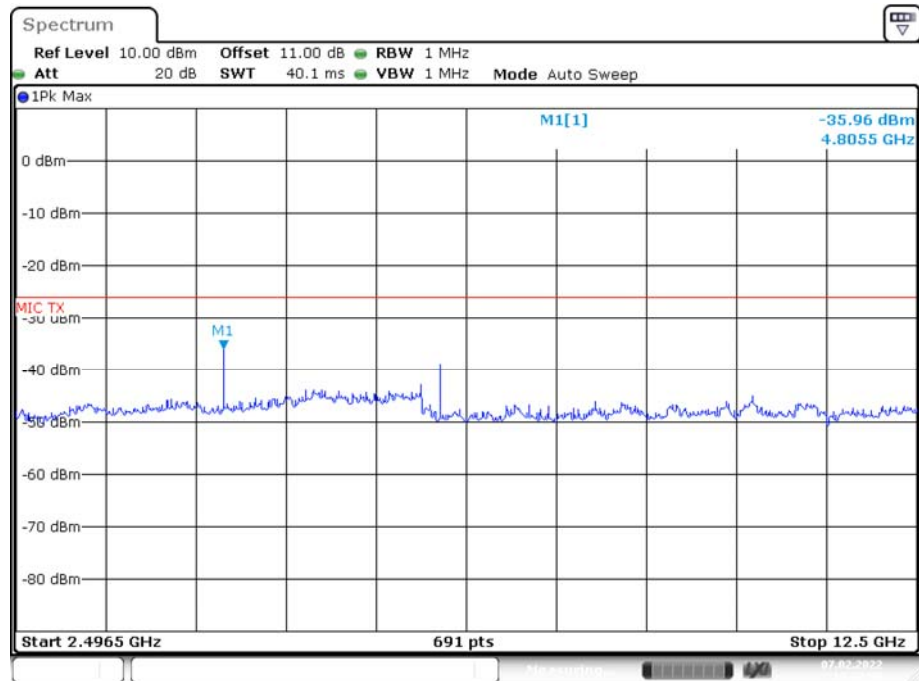


Date: 7.FEB.2022 13:30:50

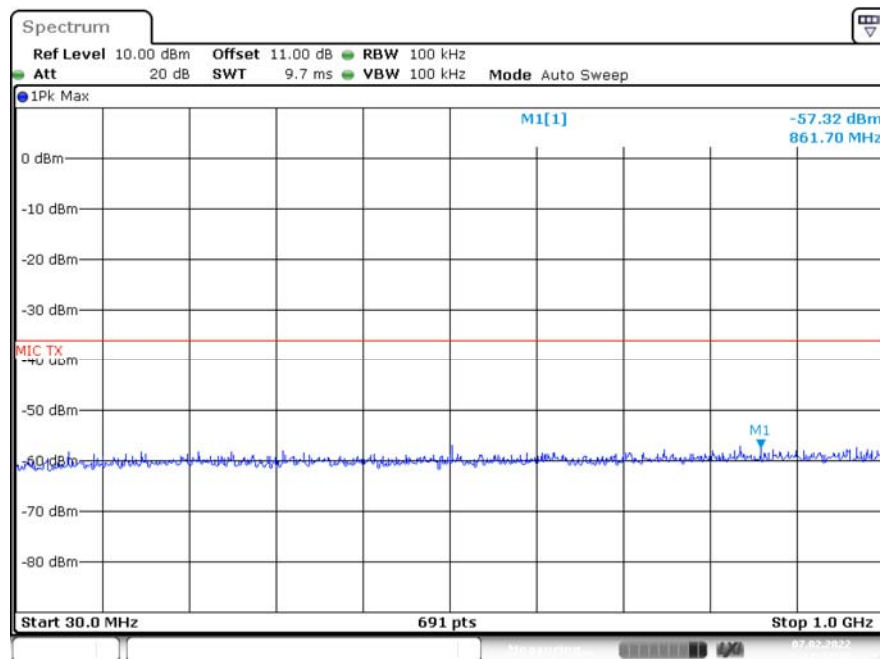
## 2483.5MHz - 2496.5MHz



Date: 7.FEB.2022 13:31:57

**2496.5MHz - 12500MHz**

Date: 7.FEB.2022 13:32:59

**Middle Channel:****30MHz - 1000MHz**

Date: 7.FEB.2022 13:44:47

**Spectrum**

Ref Level 10.00 dBm Offset 11.00 dB RBW 1 MHz  
 Att 20 dB SWT 2.8 ms VBW 1 MHz Mode Auto Sweep

1Pk Max

M1[1] -35.25 dBm  
 1.71160 GHz

MIC TX  
 → uom

Start 1.0 GHz 691 pts Stop 2.387 GHz

**Spectrum**

Ref Level 10.00 dBm Offset 11.00 dB RBW 1 MHz  
 Att 20 dB SWT 1.9  $\mu$ s VBW 1 MHz Mode Auto FFT

1Pk Max

M1[1] -45.55 dBm  
 2.3918630 GHz

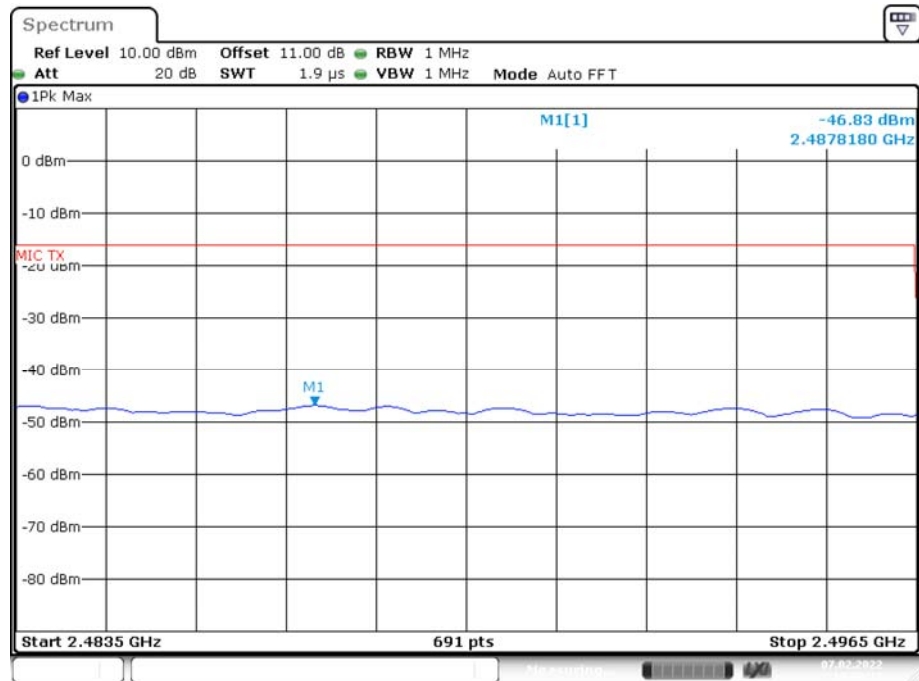
MIC TX -30 dBm

M1

Start 2.387 GHz 691 pts Stop 2.4 GHz

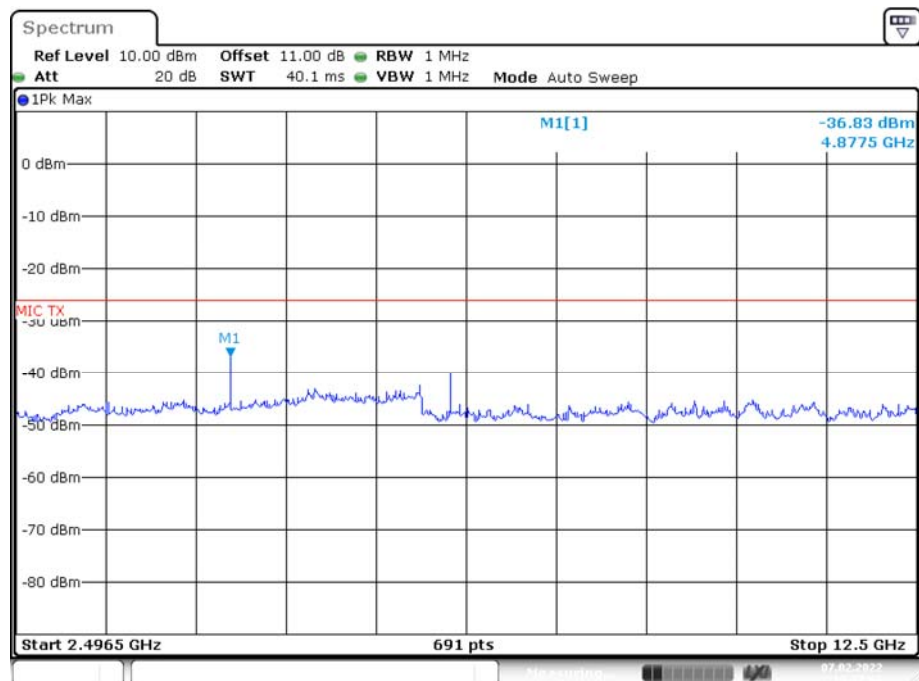
MIC-BLE

## 2483.5MHz - 2496.5MHz

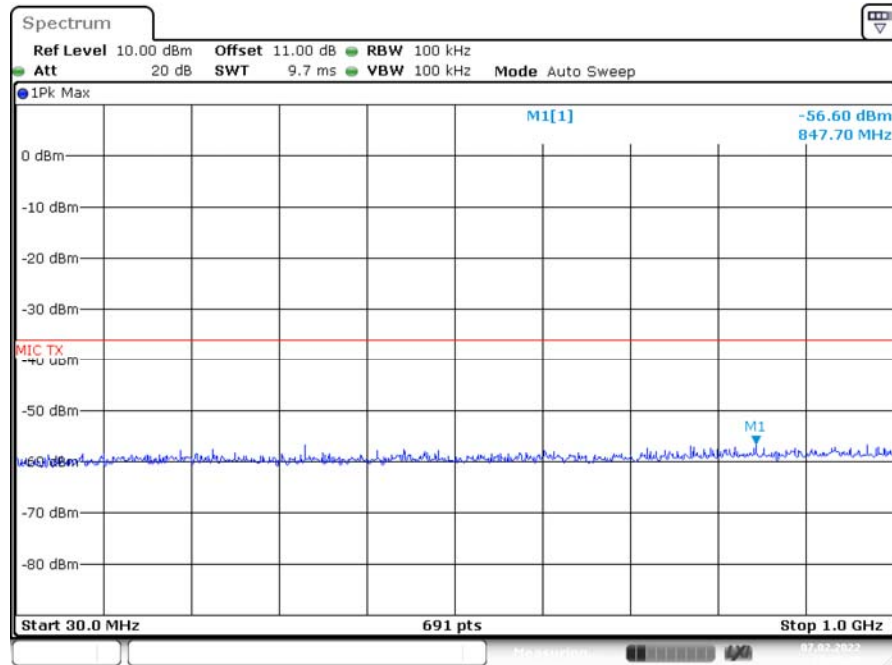


Date: 7.FEB.2022 13:43:18

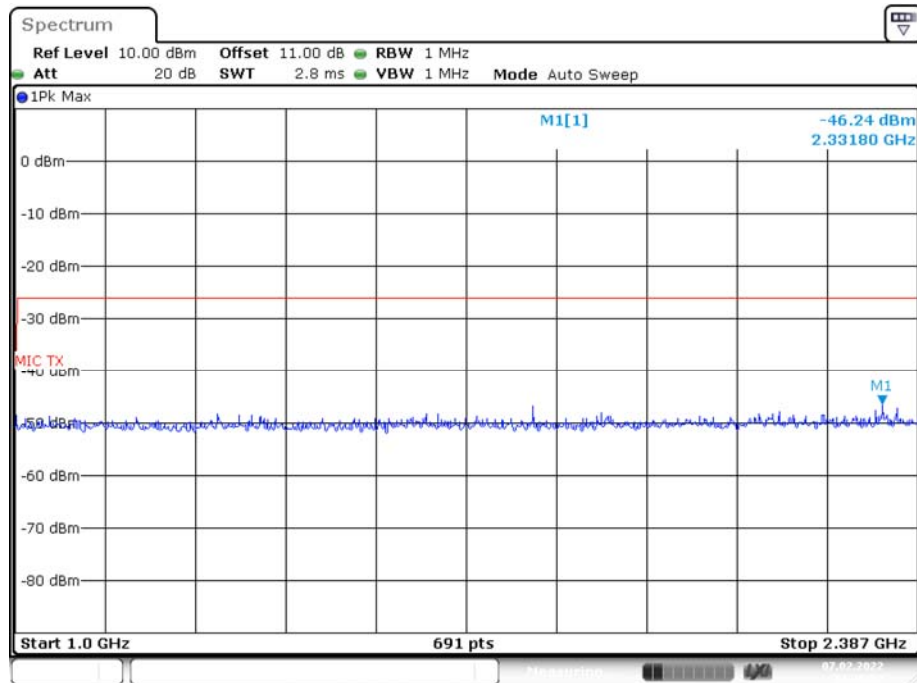
## 2496.5MHz - 12500MHz



Date: 7.FEB.2022 13:37:07

**High Channel:****30MHz - 1000MHz**

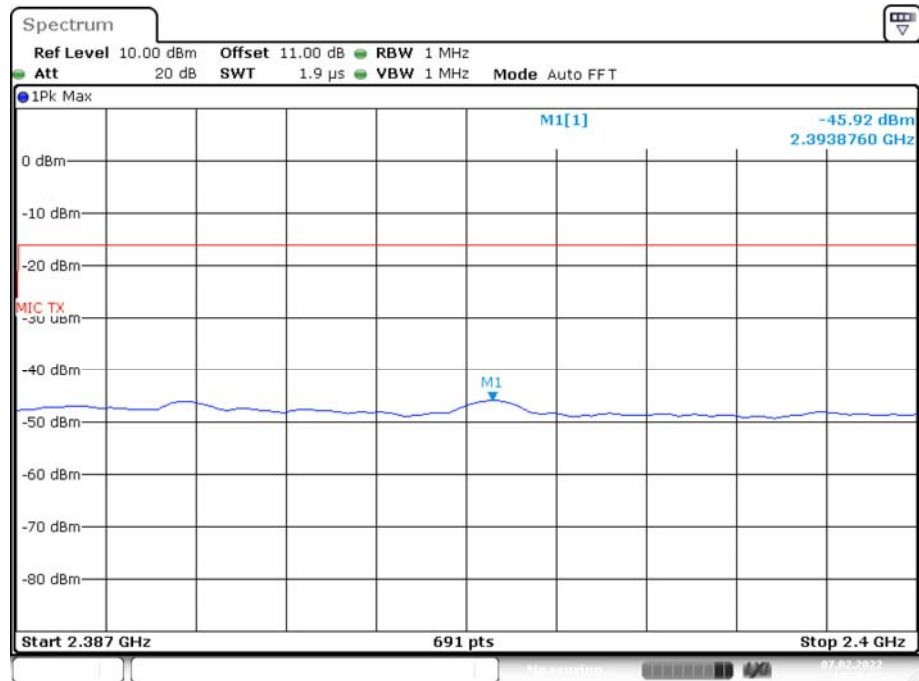
Date: 7.FEB.2022 13:46:20

**1000MHz - 2387MHz**

Date: 7.FEB.2022 13:46:58

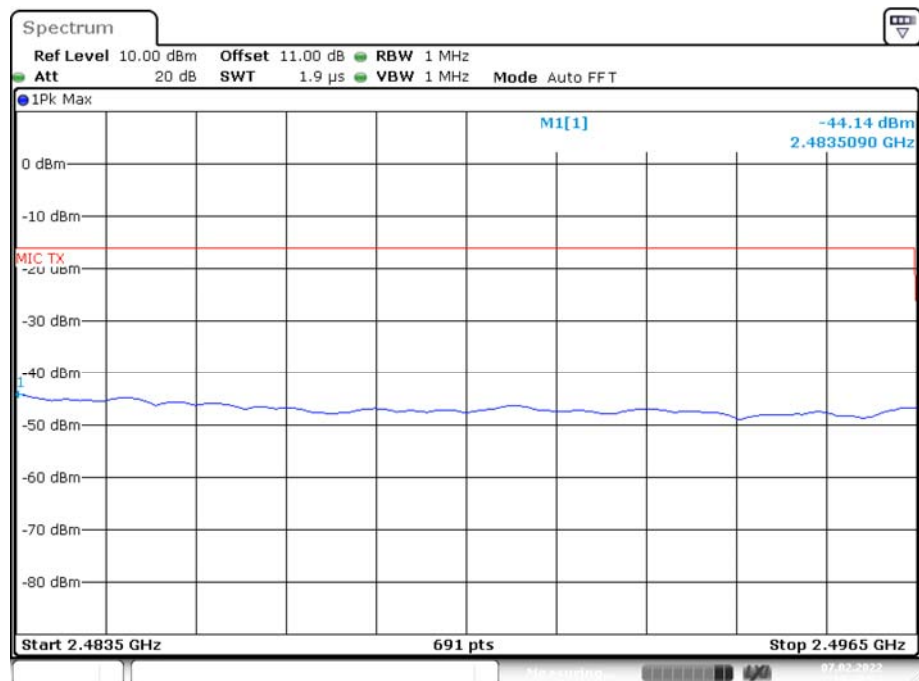


## 2387MHz - 2400MHz



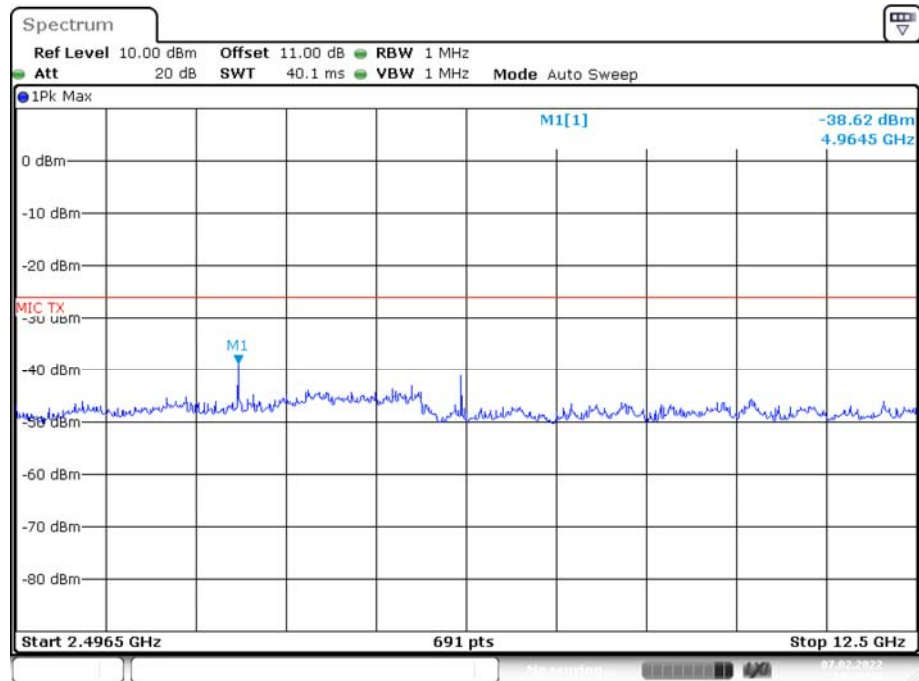
Date: 7.FEB.2022 13:47:58

## 2483.5MHz - 2496.5MHz

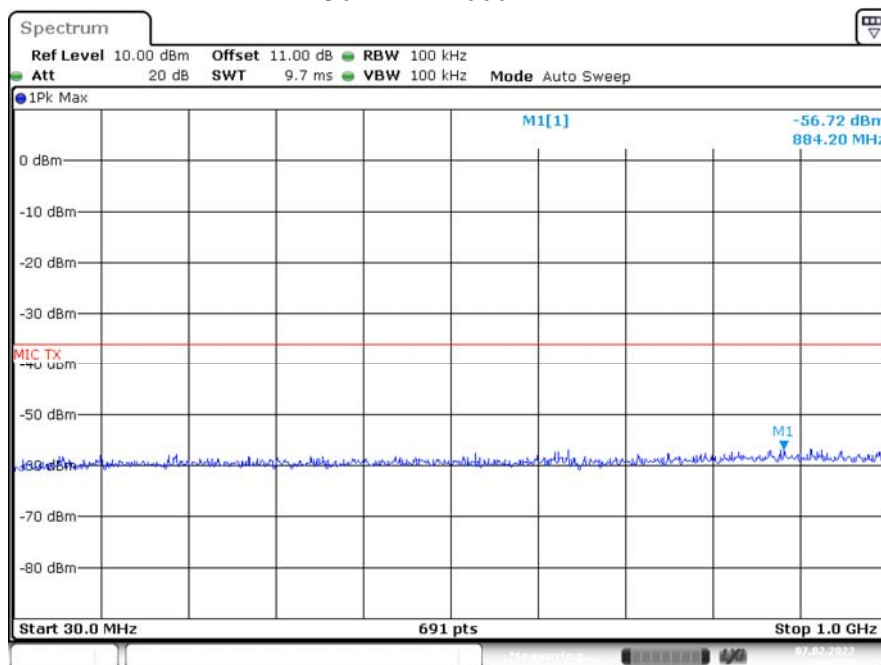


Date: 7.FEB.2022 13:48:54

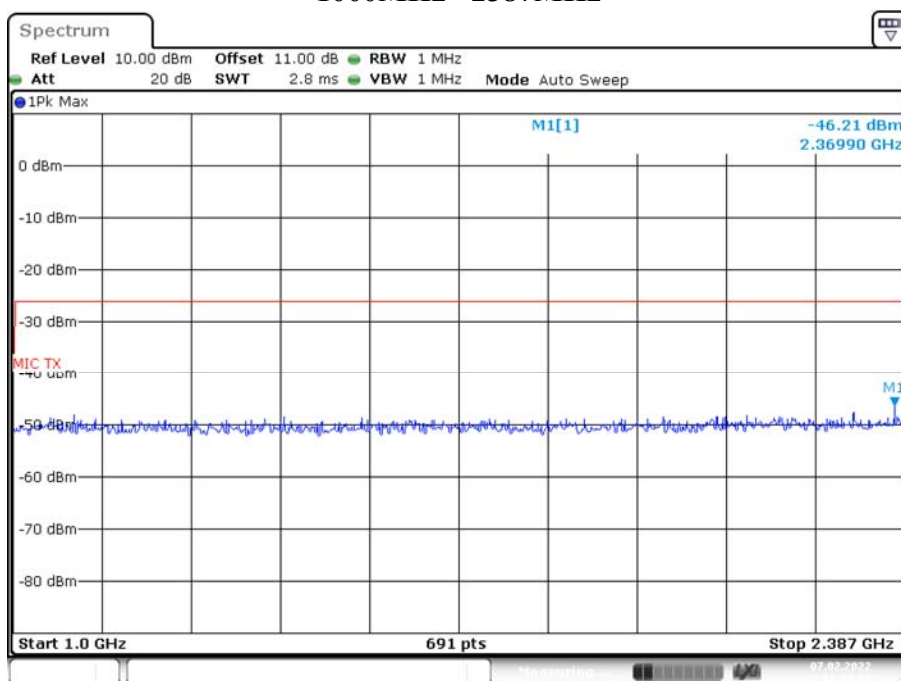
## 2496.5MHz - 12500MHz



Date: 7.FEB.2022 13:49:34

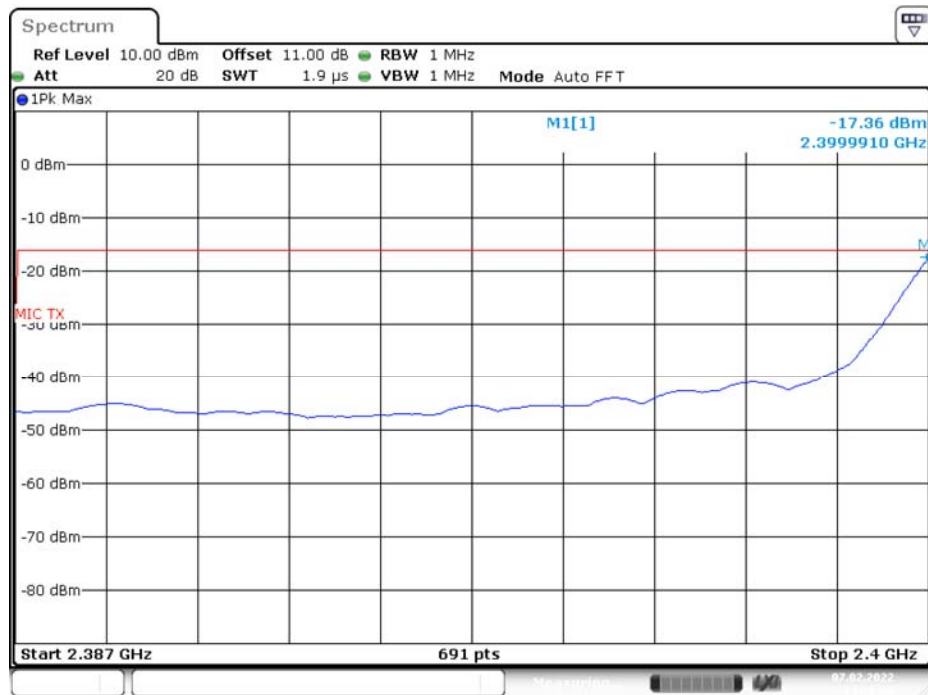
**GFSK (2M)  
Low Channel:****30MHz - 1000MHz**

Date: 7.FEB.2022 14:35:57

**1000MHz - 2387MHz**

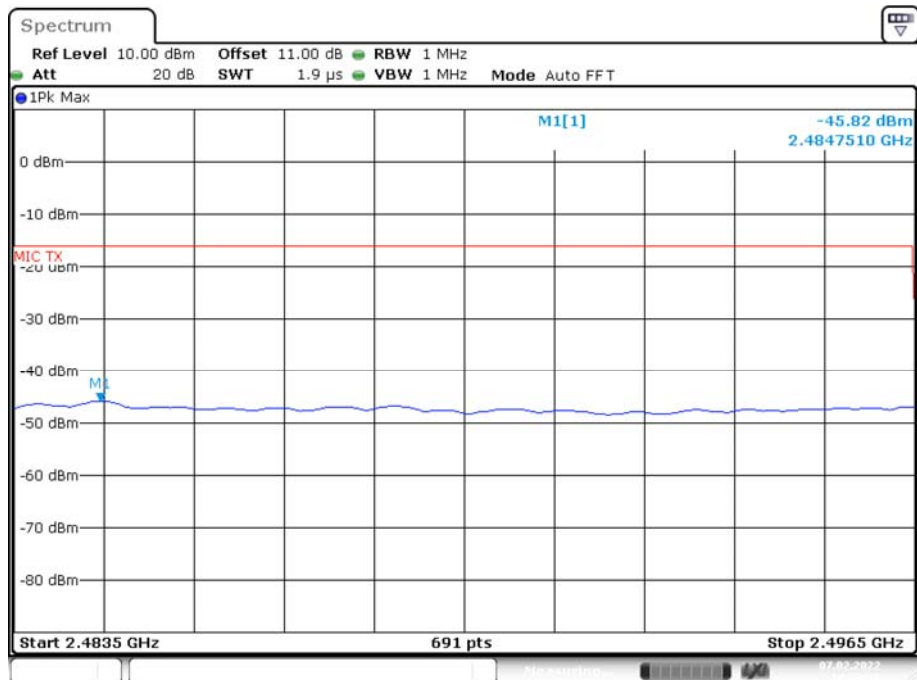
Date: 7.FEB.2022 14:37:33

## 2387MHz - 2400MHz



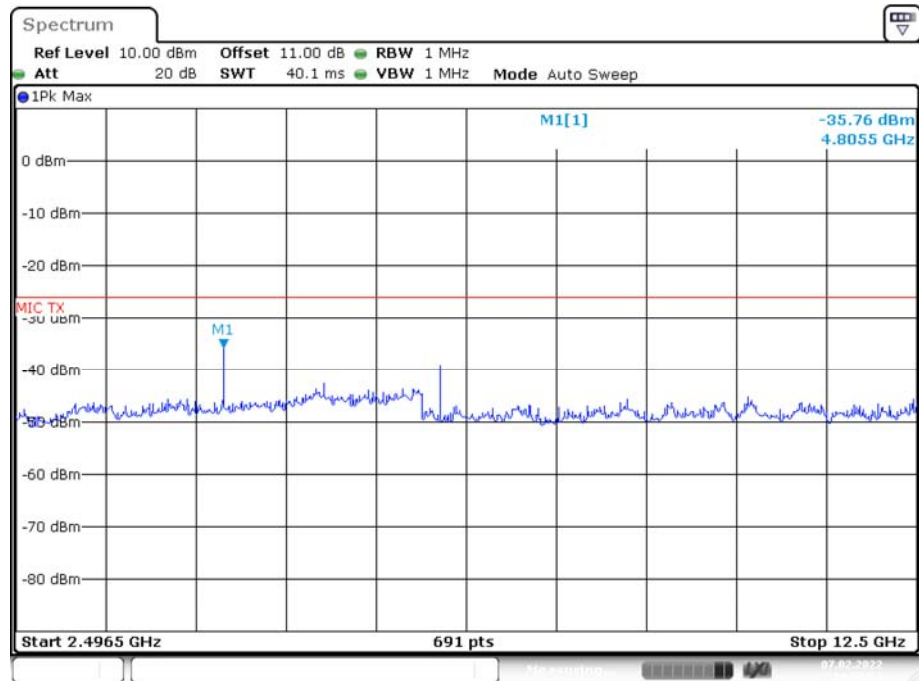
Date: 7.FEB.2022 14:38:20

## 2483.5MHz - 2496.5MHz



Date: 7.FEB.2022 14:39:28

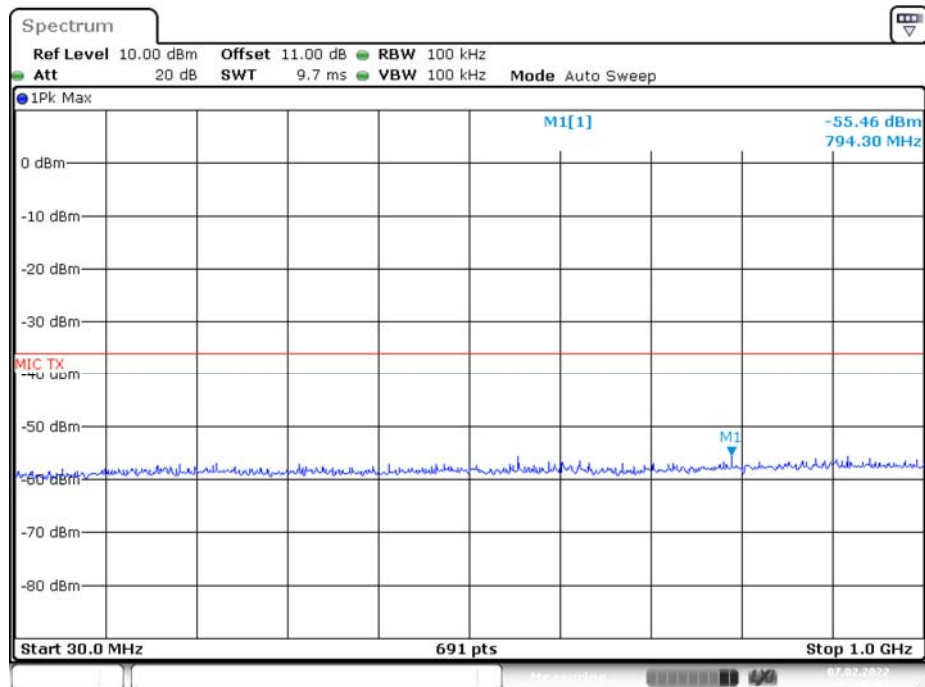
## 2496.5MHz - 12500MHz



Date: 7.FEB.2022 14:39:51

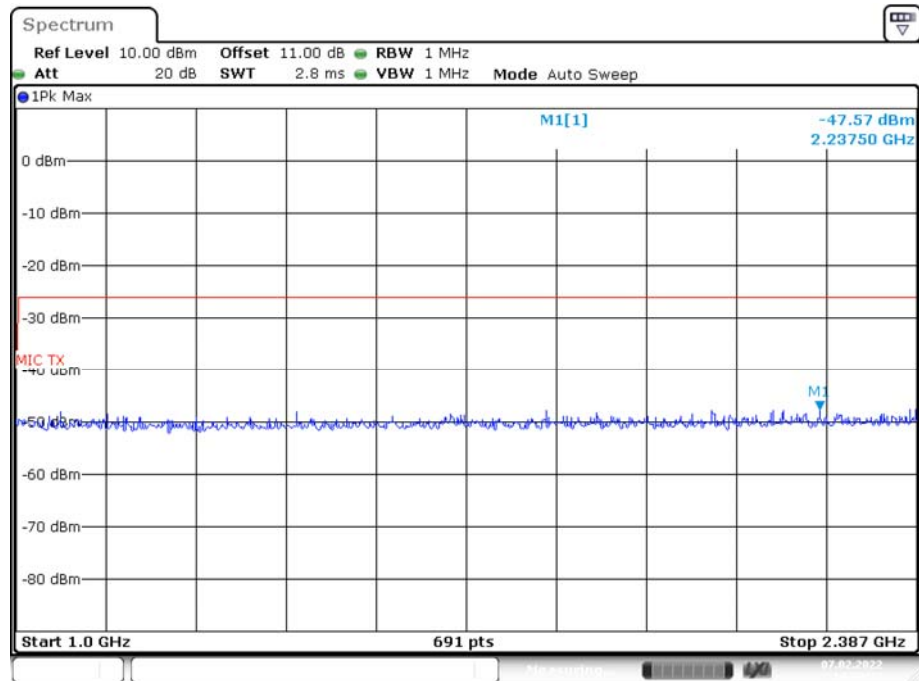
## Middle Channel:

## 30MHz - 1000MHz



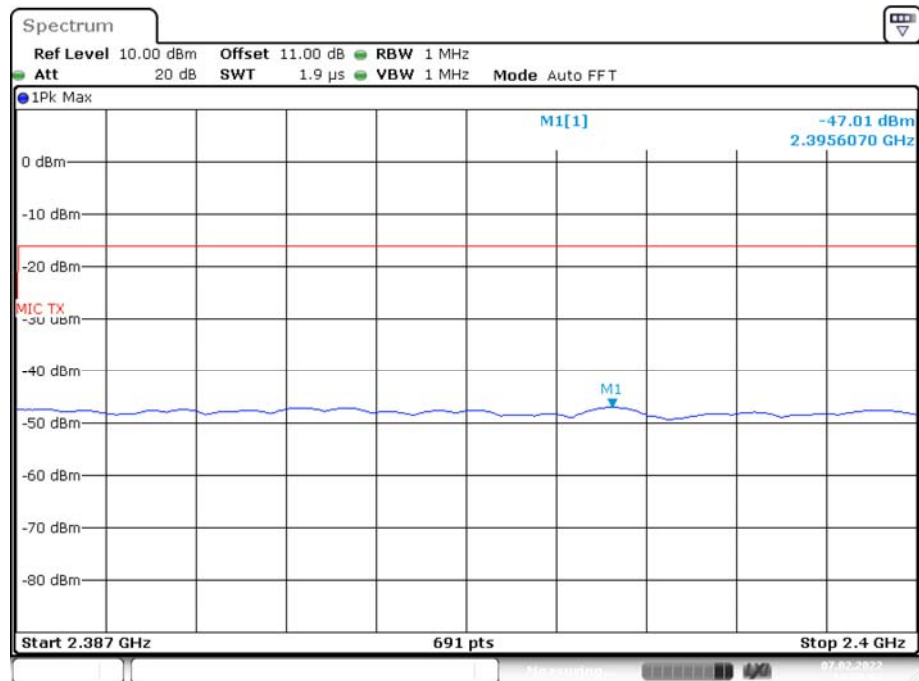
Date: 7.FEB.2022 14:46:05

## 1000MHz - 2387MHz



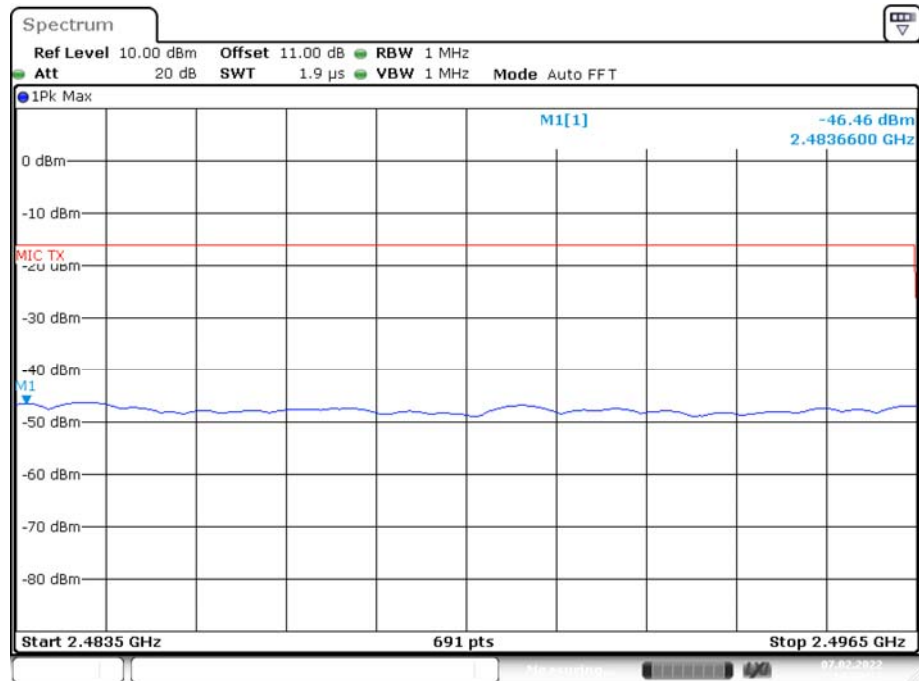
Date: 7.FEB.2022 14:43:27

## 2387MHz - 2400MHz



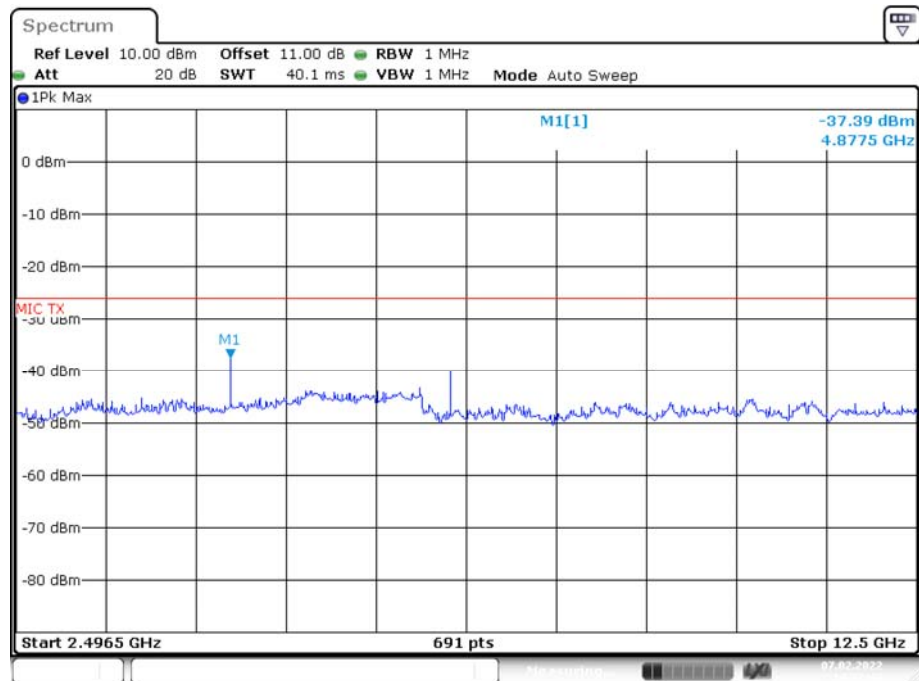
Date: 7.FEB.2022 14:43:04

## 2483.5MHz - 2496.5MHz

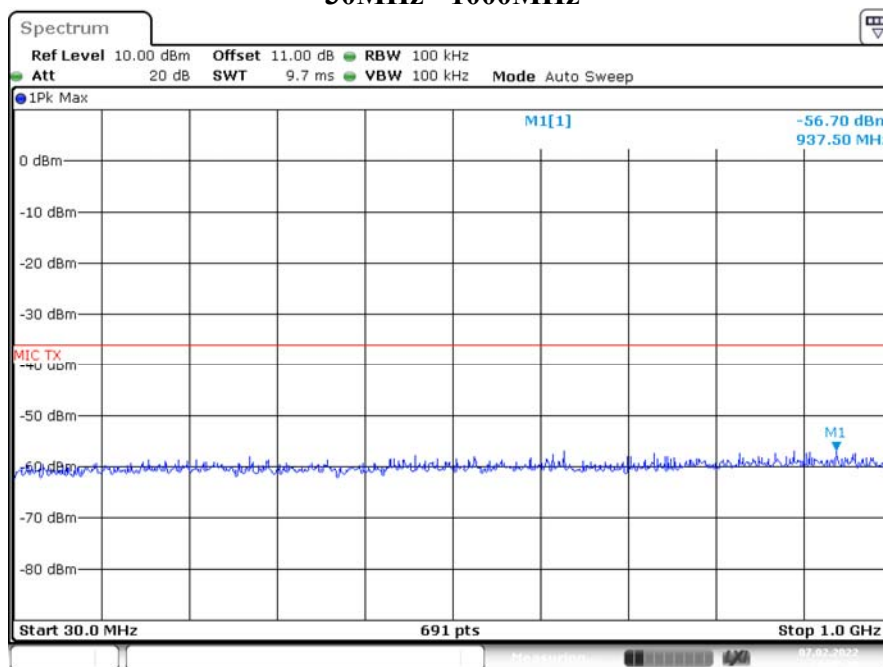


Date: 7.FEB.2022 14:42:21

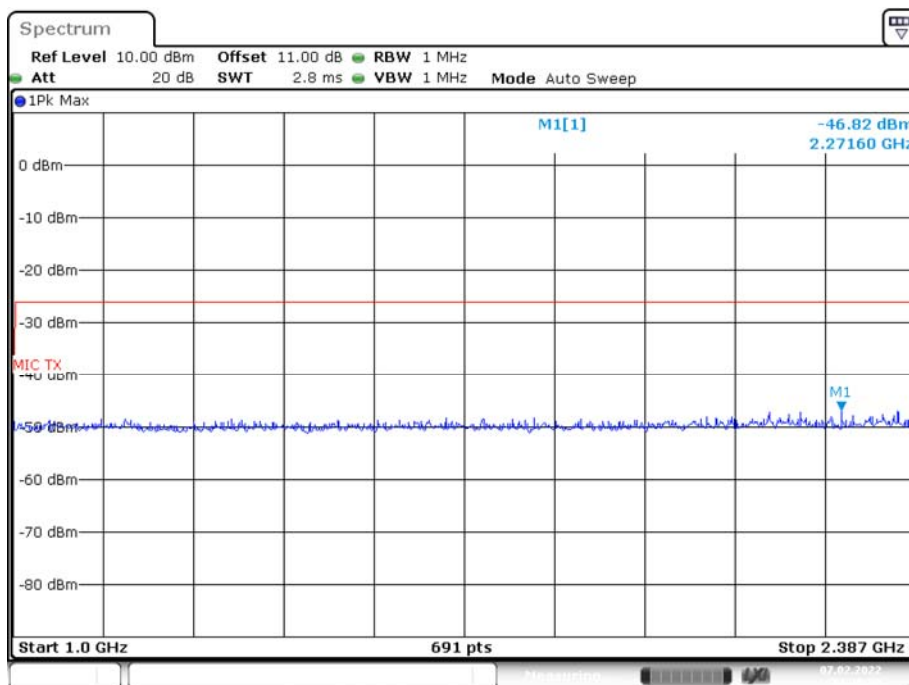
## 2496.5MHz - 12500MHz



Date: 7.FEB.2022 14:41:44

**High Channel:****30MHz - 1000MHz**

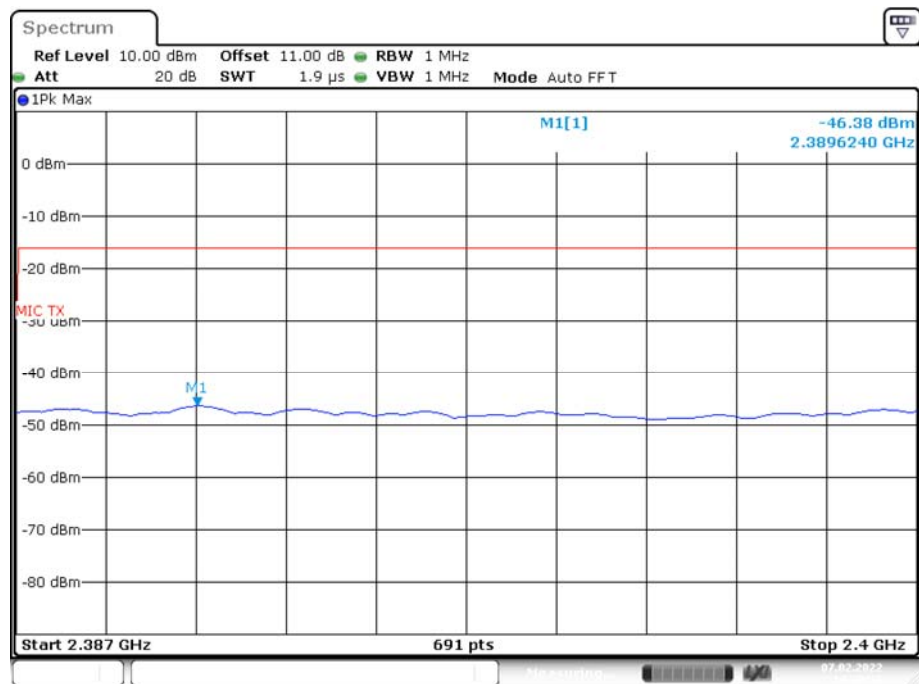
Date: 7.FEB.2022 14:47:20

**1000MHz - 2387MHz**

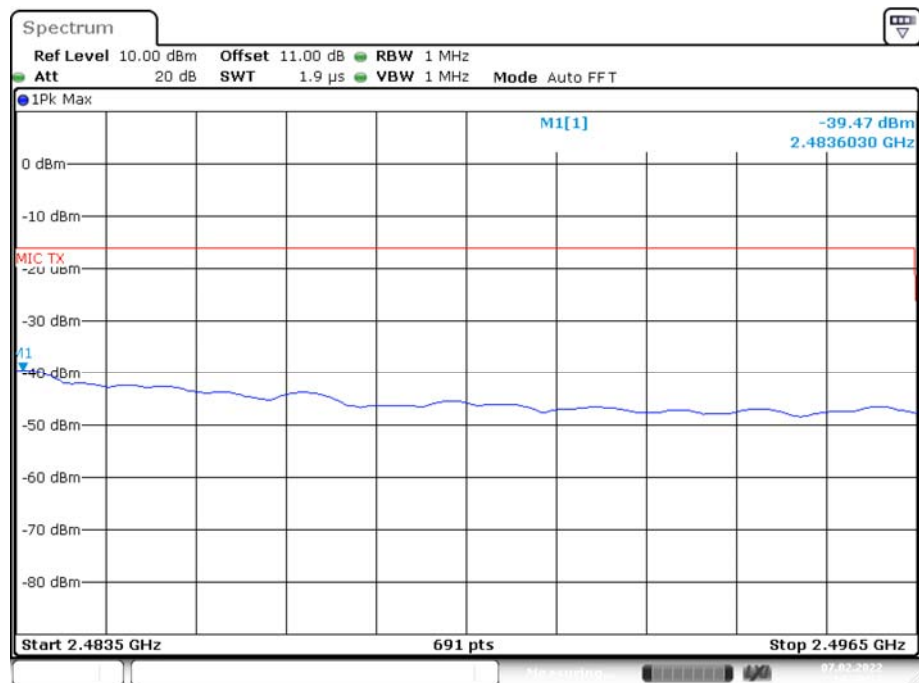
Date: 7.FEB.2022 14:48:00



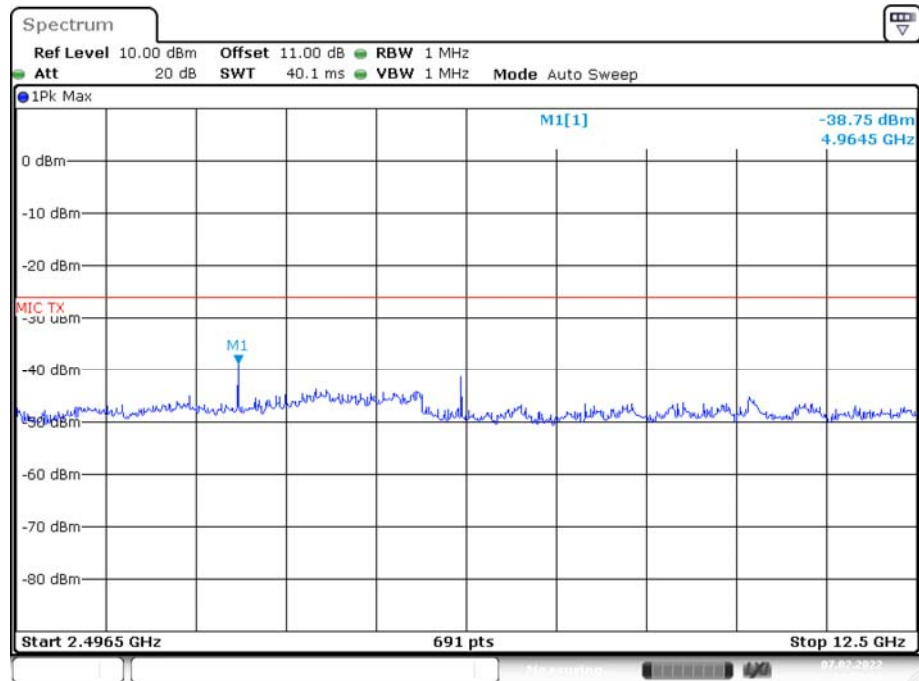
## 2387MHz - 2400MHz



## 2483.5MHz - 2496.5MHz

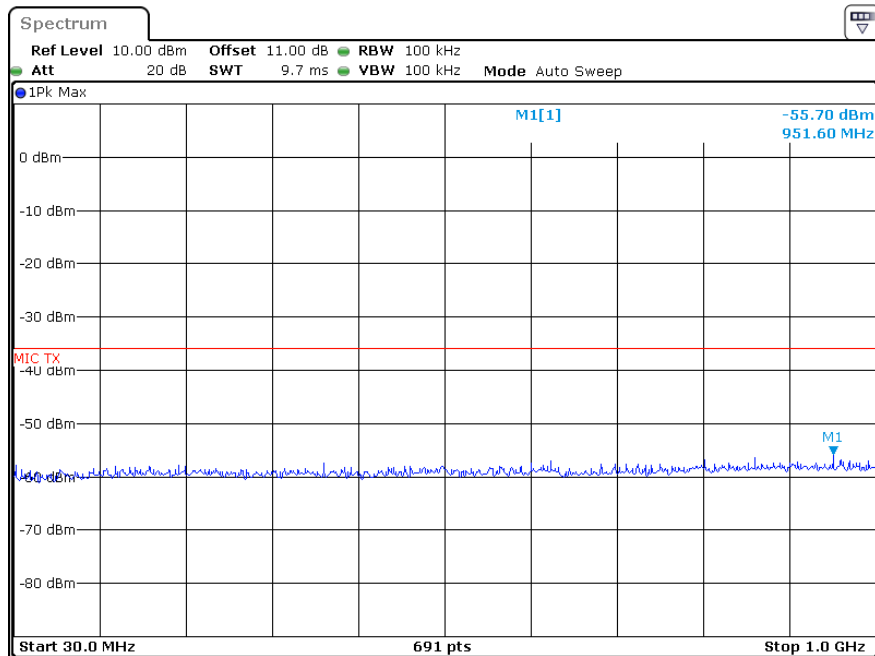


## 2496.5MHz - 12500MHz

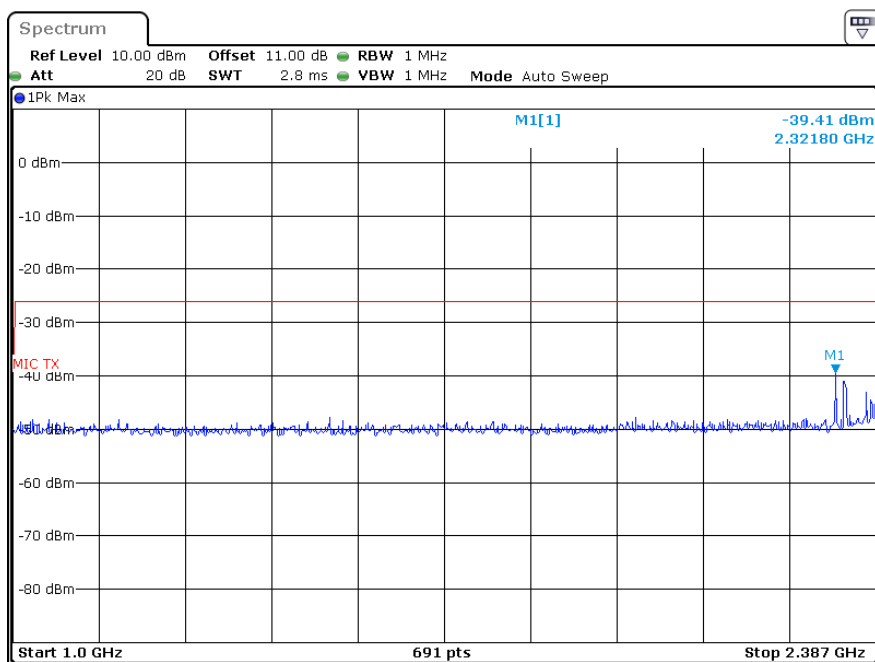


For model of XIAO-nRF52840

Normal Voltage  
GFSK (1M)  
Low Channel:

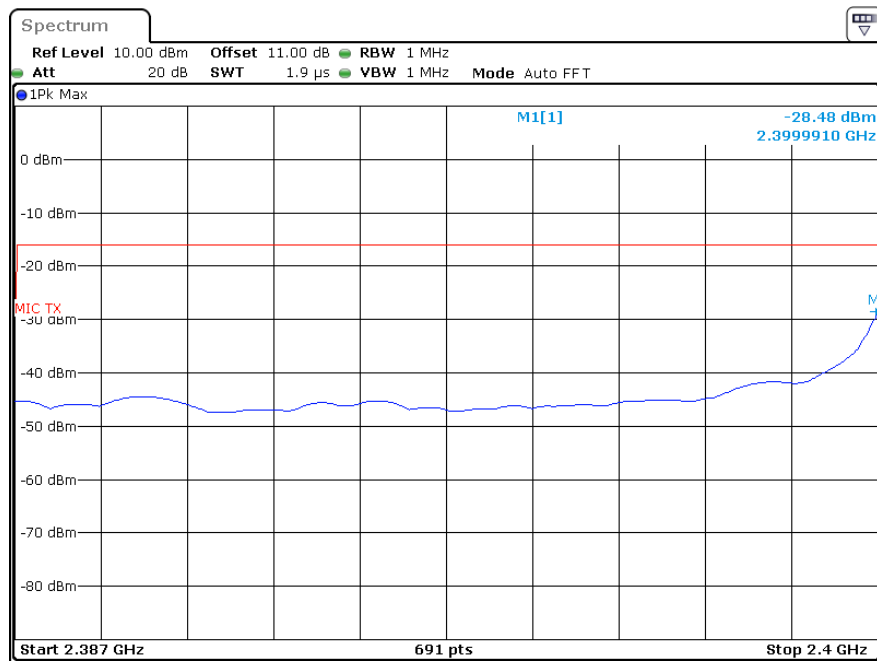
**30MHz - 1000MHz**

Date: 12.APR.2022 16:04:55

**1000MHz - 2387MHz**

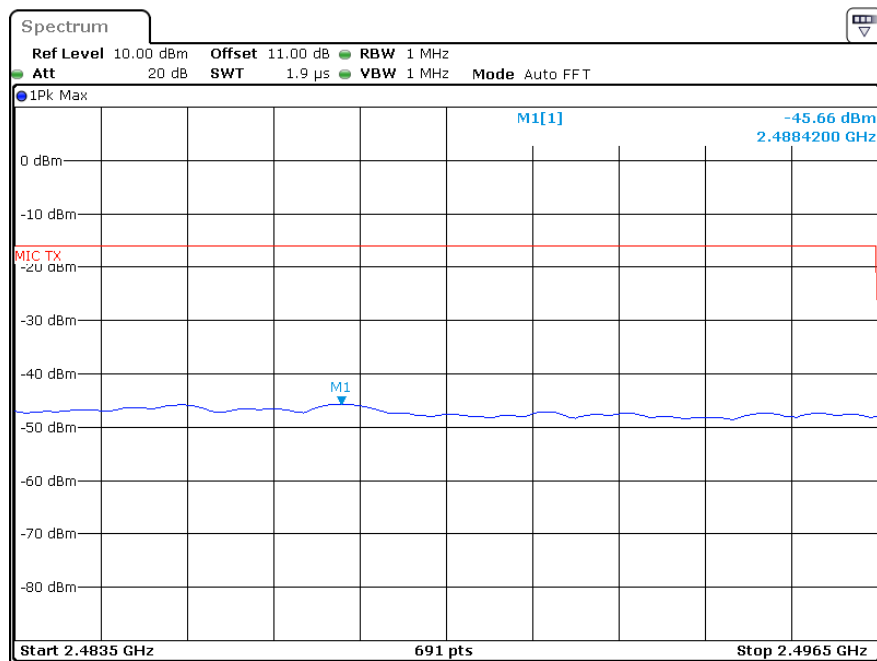
Date: 12.APR.2022 16:07:29

## 2387MHz - 2400MHz

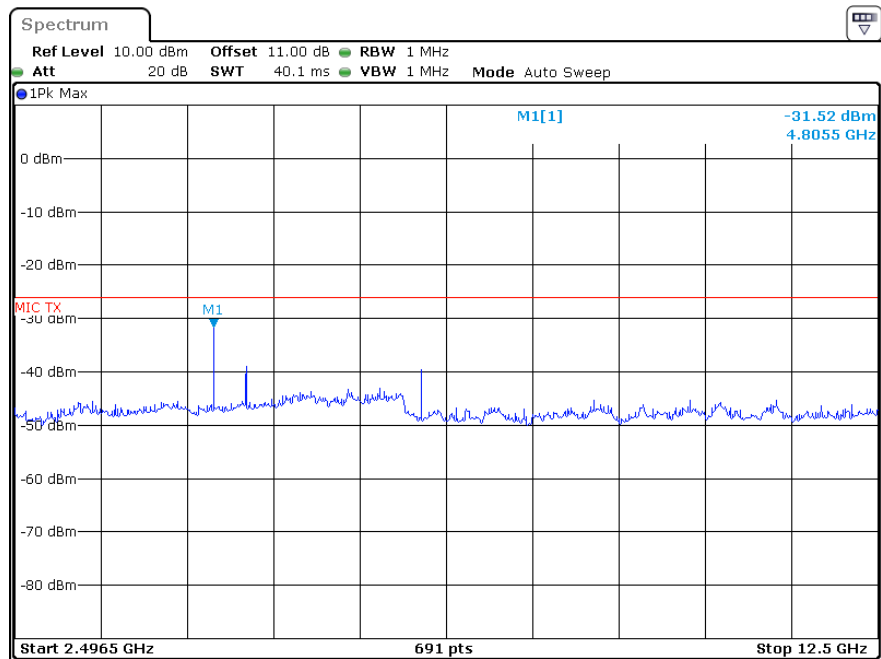


Date: 12.APR.2022 16:08:48

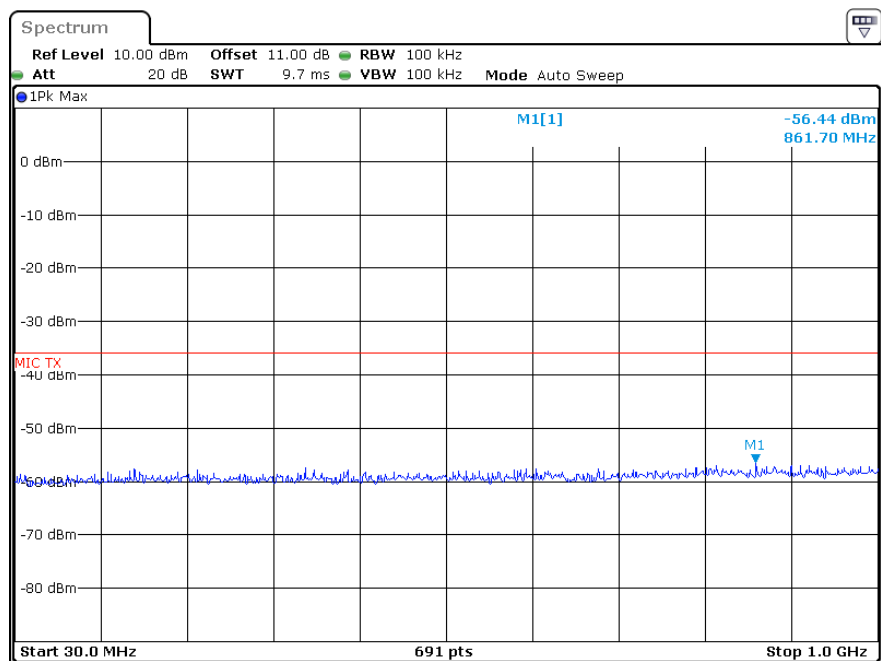
## 2483.5MHz - 2496.5MHz



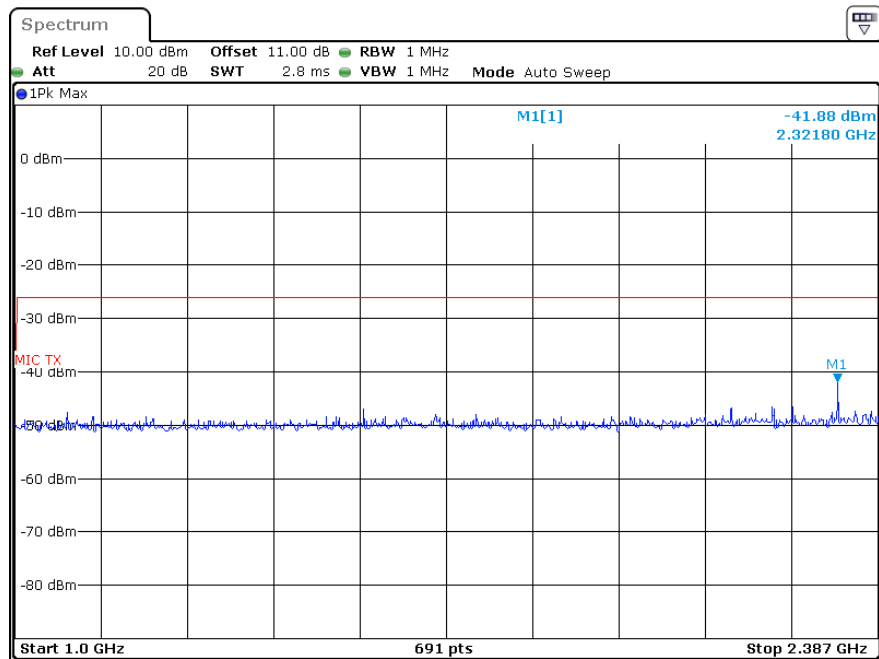
Date: 12.APR.2022 16:09:56

**2496.5MHz - 12500MHz**

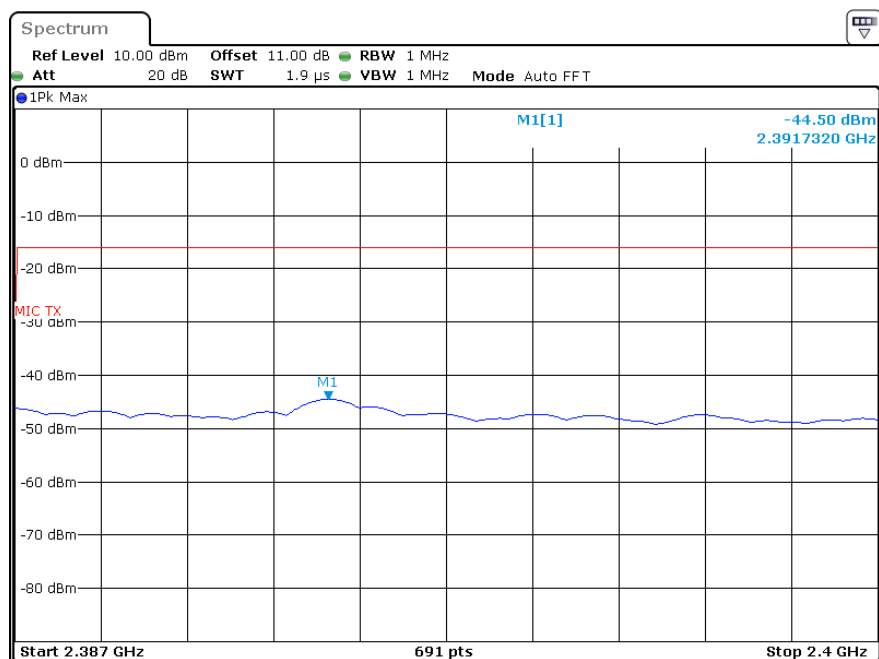
Date: 12.APR.2022 16:11:29

**Middle Channel:****30MHz - 1000MHz**

Date: 12.APR.2022 16:16:15

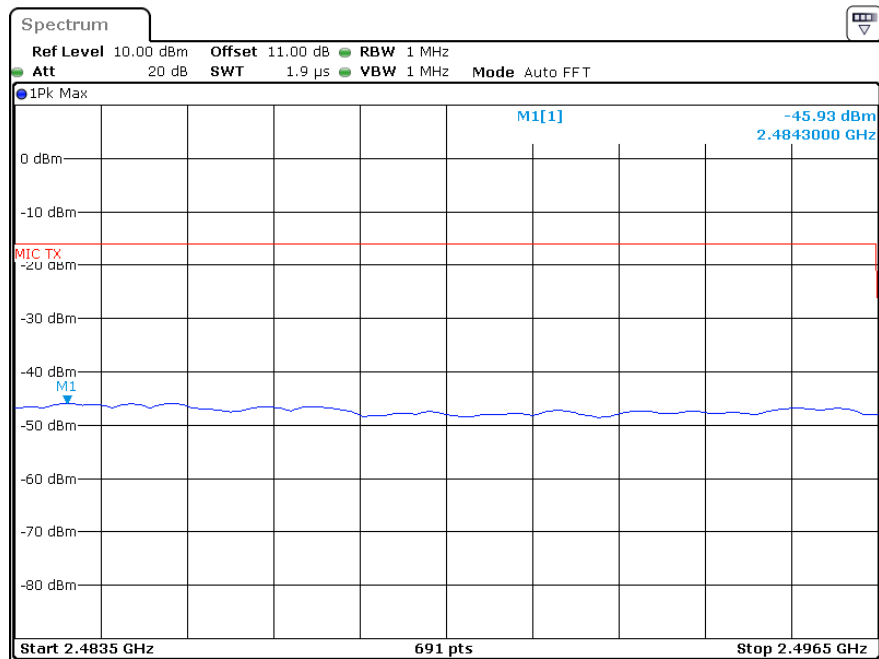
**1000MHz - 2387MHz**

Date: 12.APR.2022 16:17:53

**2387MHz - 2400MHz**

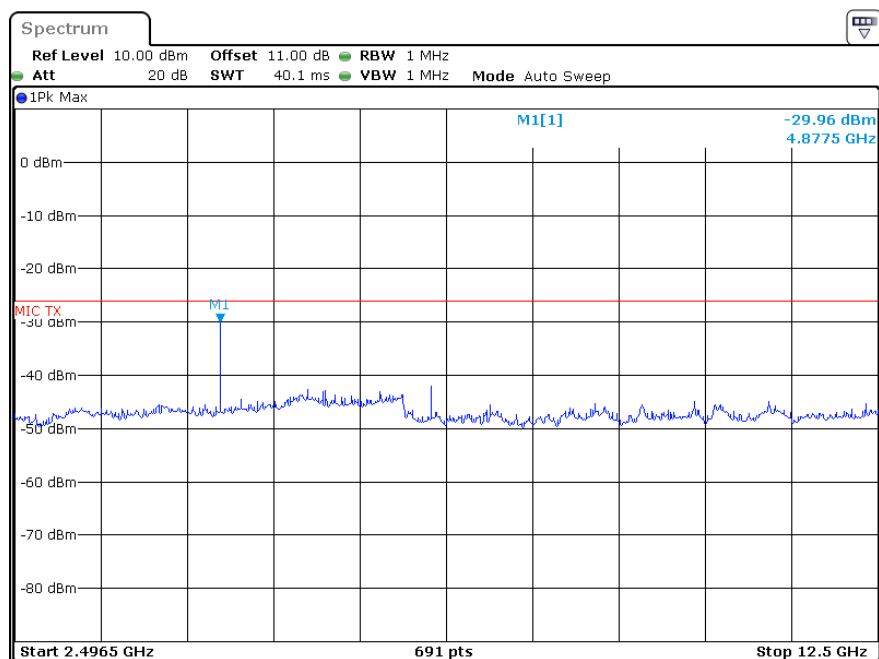
Date: 12.APR.2022 16:18:53

## 2483.5MHz - 2496.5MHz

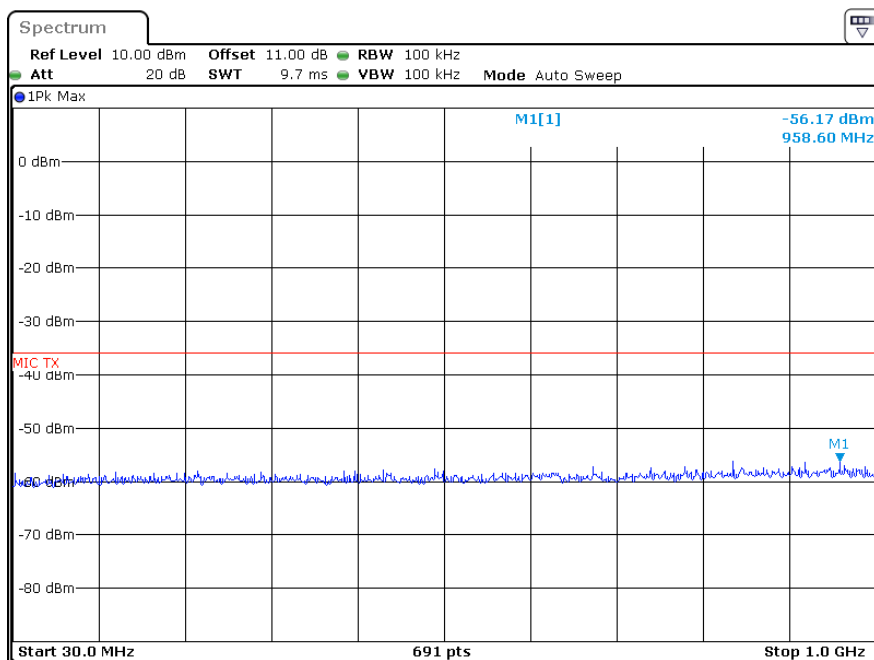


Date: 12.APR.2022 16:20:30

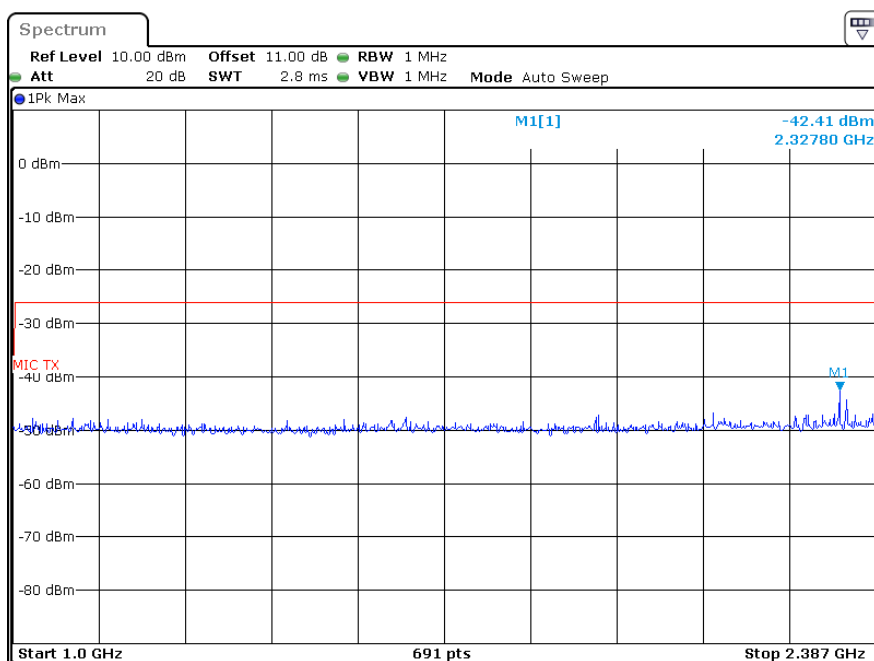
## 2496.5MHz - 12500MHz



Date: 12.APR.2022 16:21:21

**High Channel:****30MHz - 1000MHz**

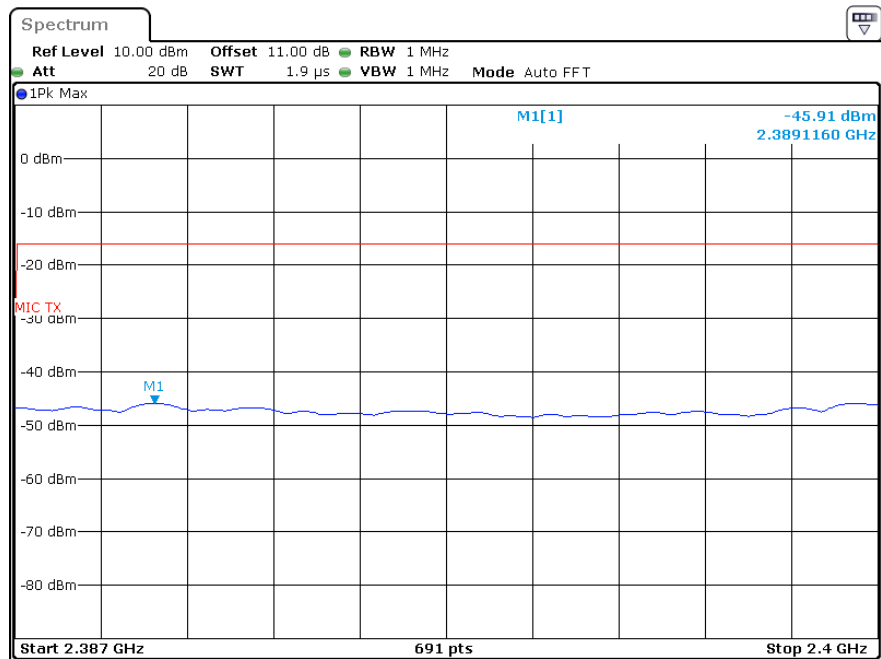
Date: 12.APR.2022 16:22:54

**1000MHz - 2387MHz**

Date: 12.APR.2022 16:24:58

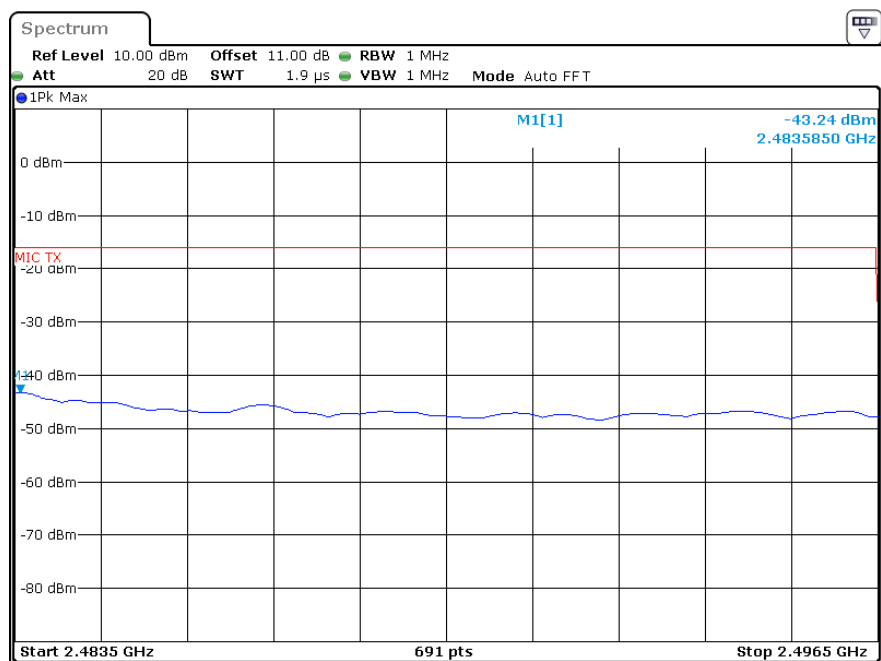


## 2387MHz - 2400MHz



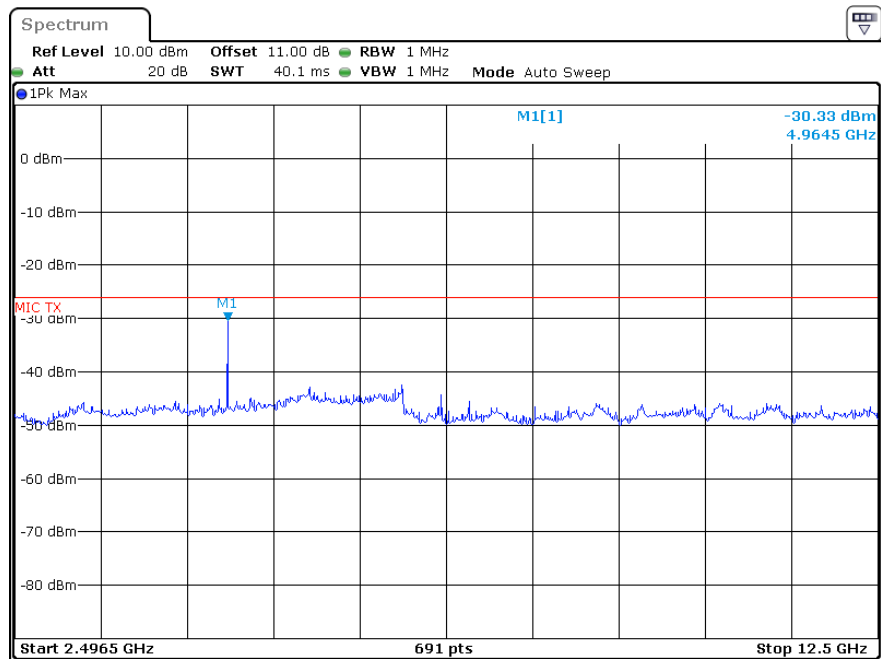
Date: 12.APR.2022 16:26:34

## 2483.5MHz - 2496.5MHz

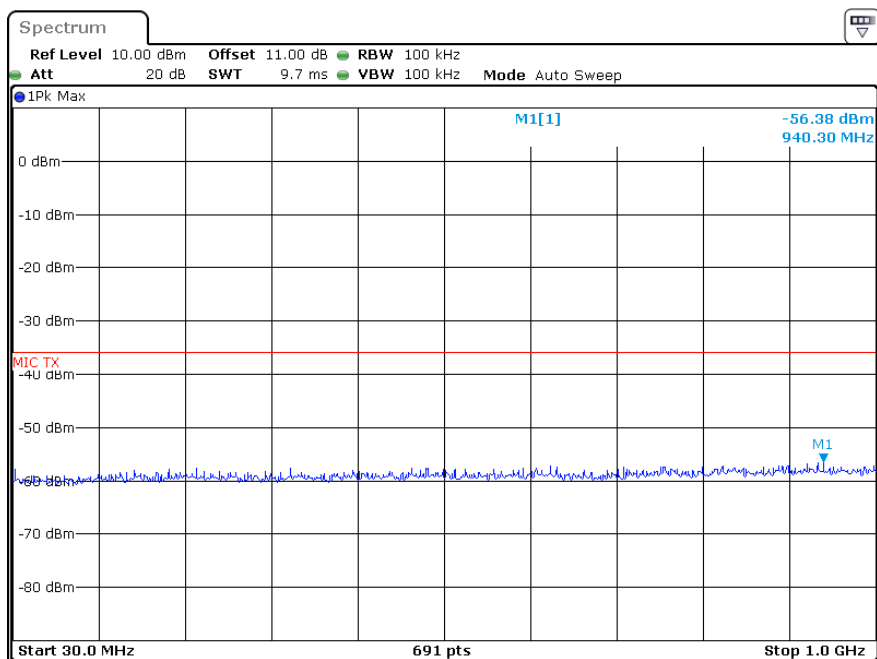


Date: 12.APR.2022 16:27:40

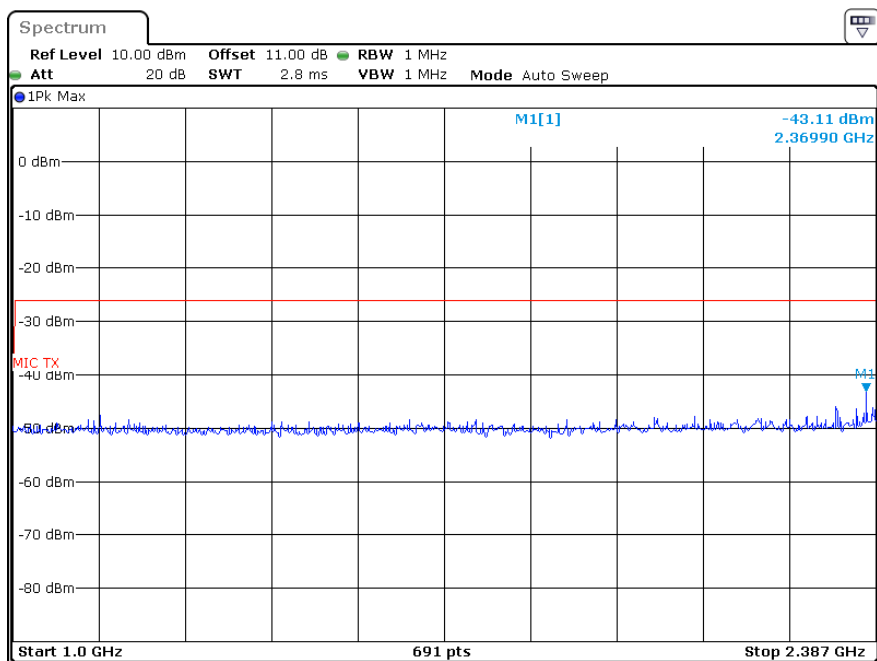
## 2496.5MHz - 12500MHz



Date: 12.APR.2022 16:29:14

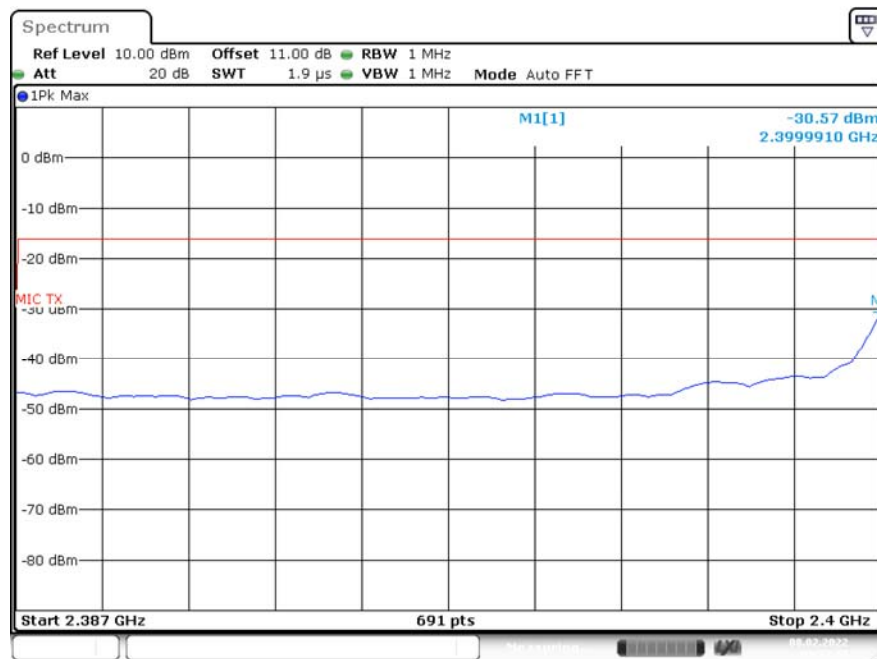
**GFSK (2M)  
Low Channel:****30MHz - 1000MHz**

Date: 12.APR.2022 16:33:21

**1000MHz - 2387MHz**

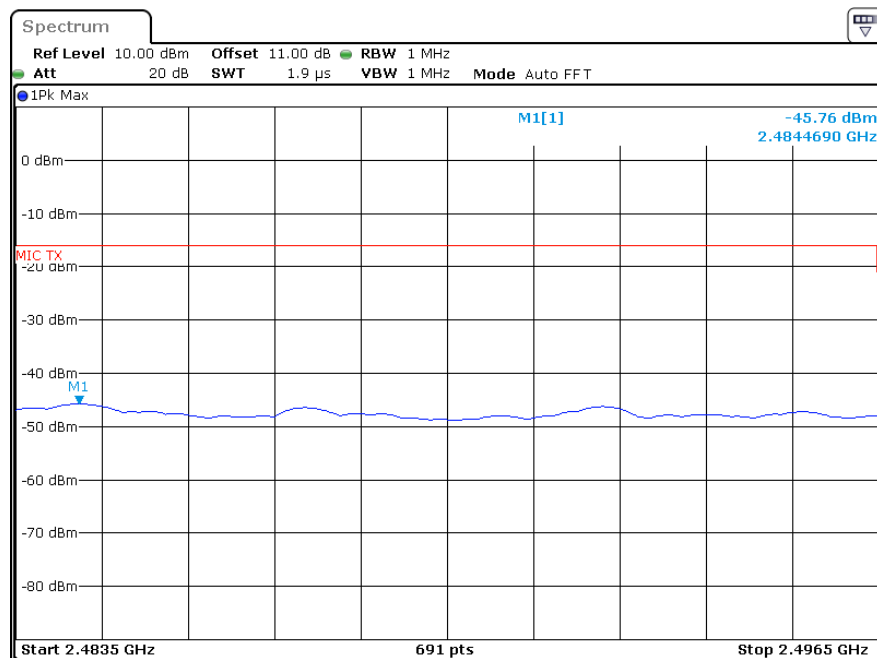
Date: 12.APR.2022 16:35:18

## 2387MHz - 2400MHz

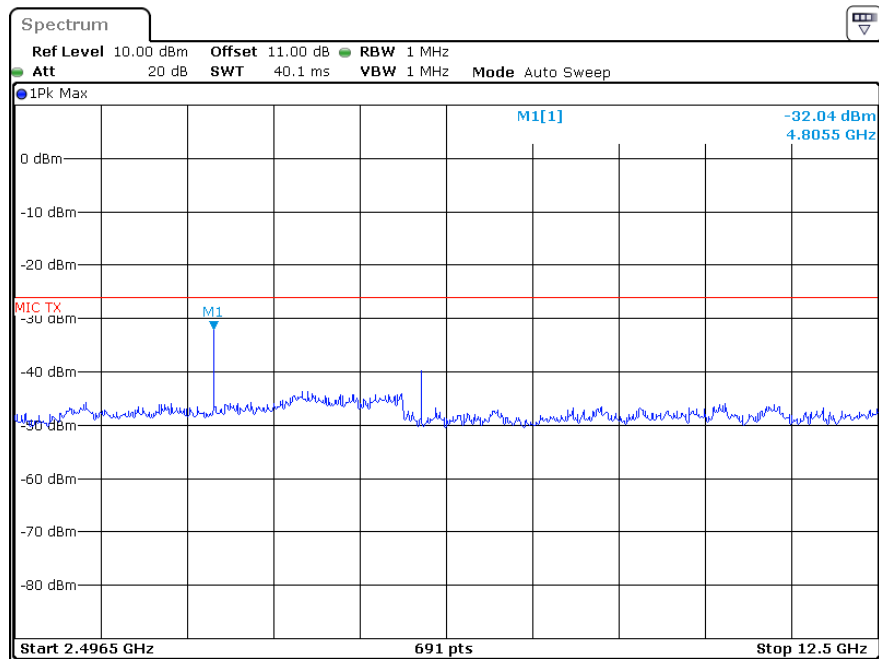


Date: 12.APR.2022 16:37:17

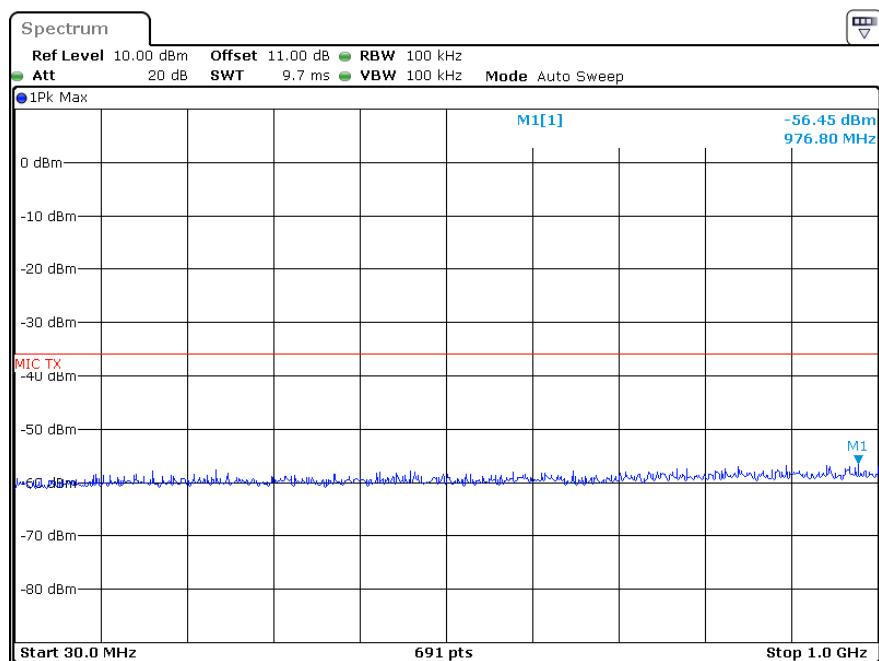
## 2483.5MHz - 2496.5MHz



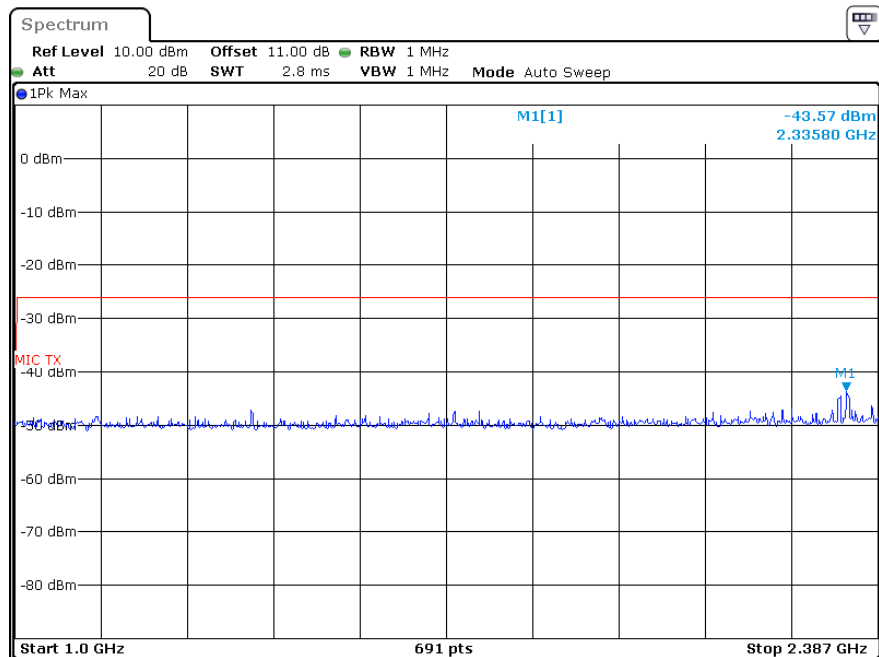
Date: 12.APR.2022 16:38:11

**2496.5MHz - 12500MHz**

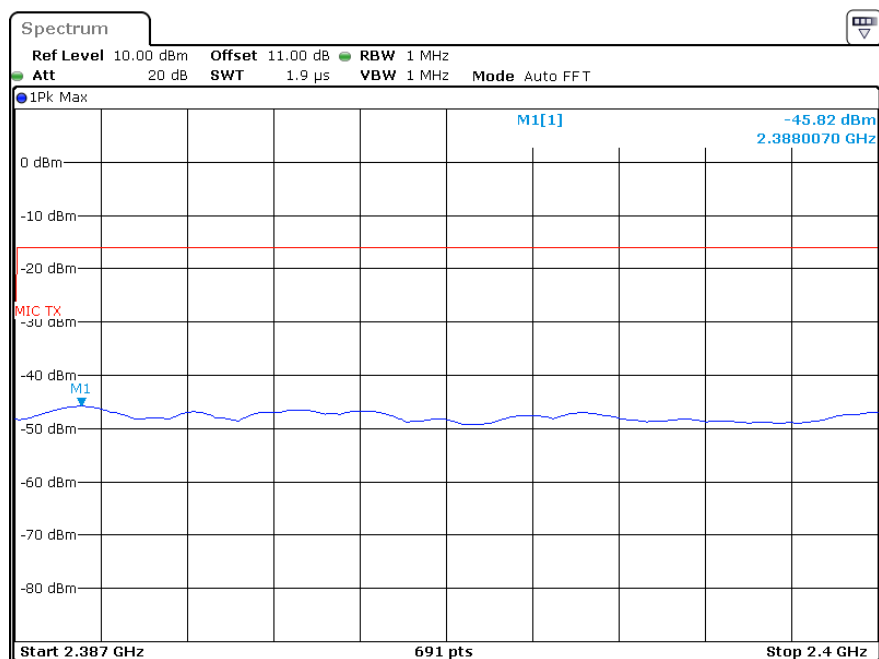
Date: 12.APR.2022 16:39:09

**Middle Channel:****30MHz - 1000MHz**

Date: 12.APR.2022 16:44:46

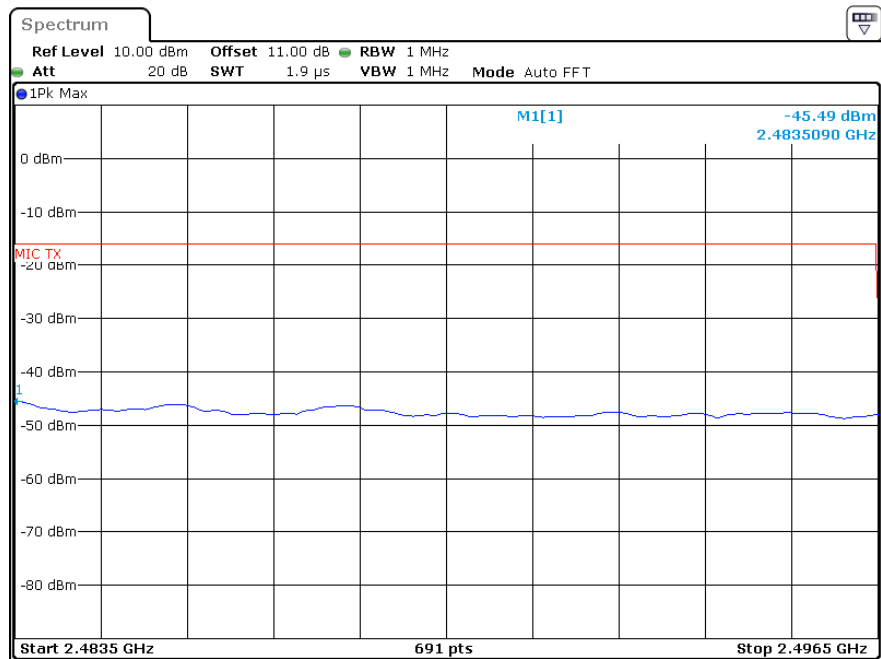
**1000MHz - 2387MHz**

Date: 12.APR.2022 16:43:48

**2387MHz - 2400MHz**

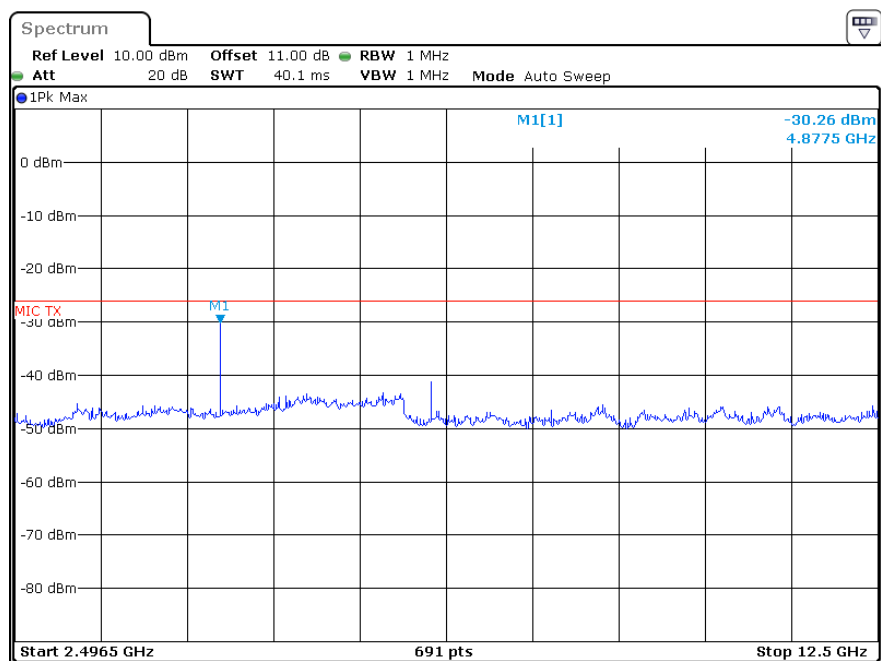
Date: 12.APR.2022 16:42:18

## 2483.5MHz - 2496.5MHz

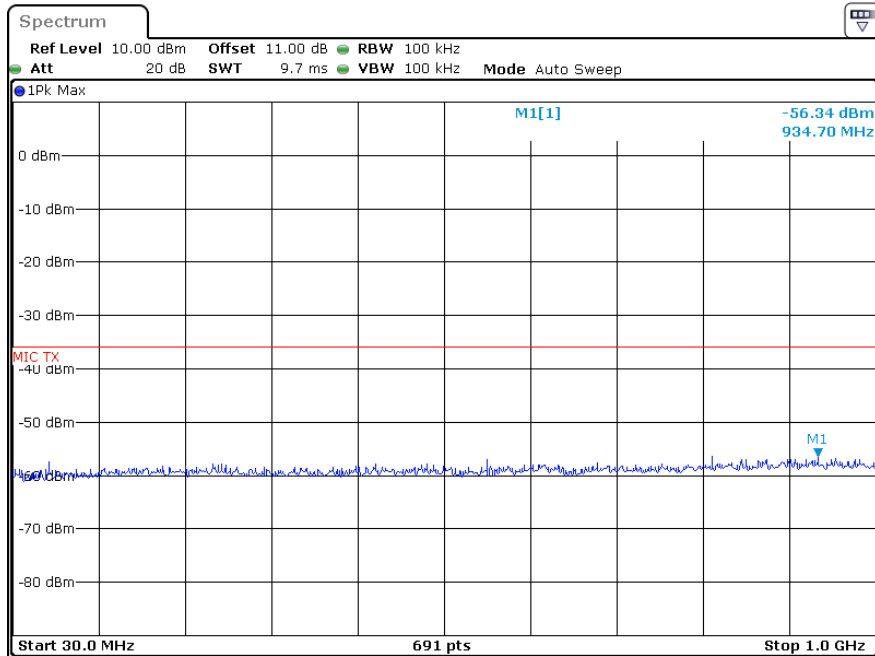


Date: 12.APR.2022 16:41:26

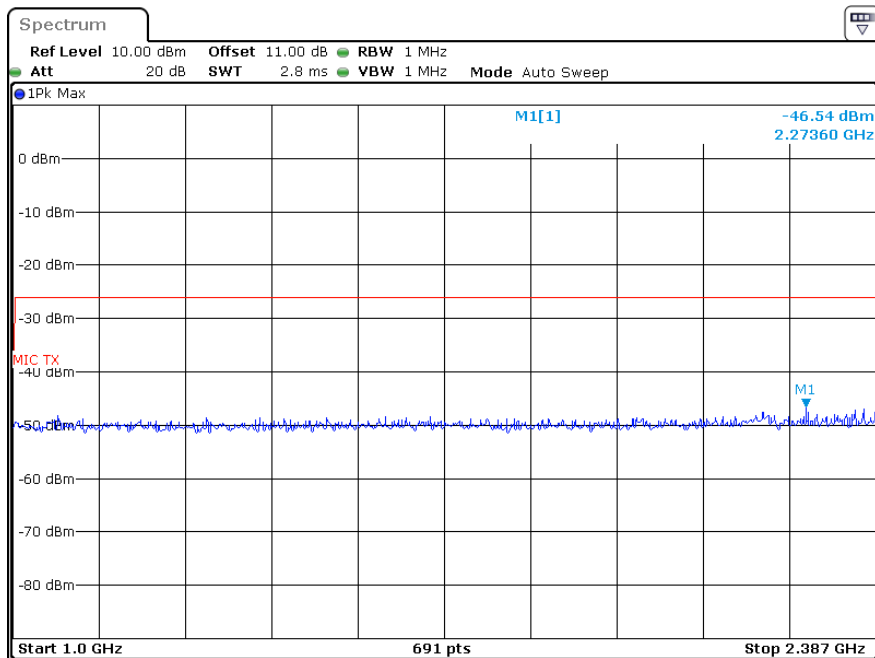
## 2496.5MHz - 12500MHz



Date: 12.APR.2022 16:40:16

**High Channel:****30MHz - 1000MHz**

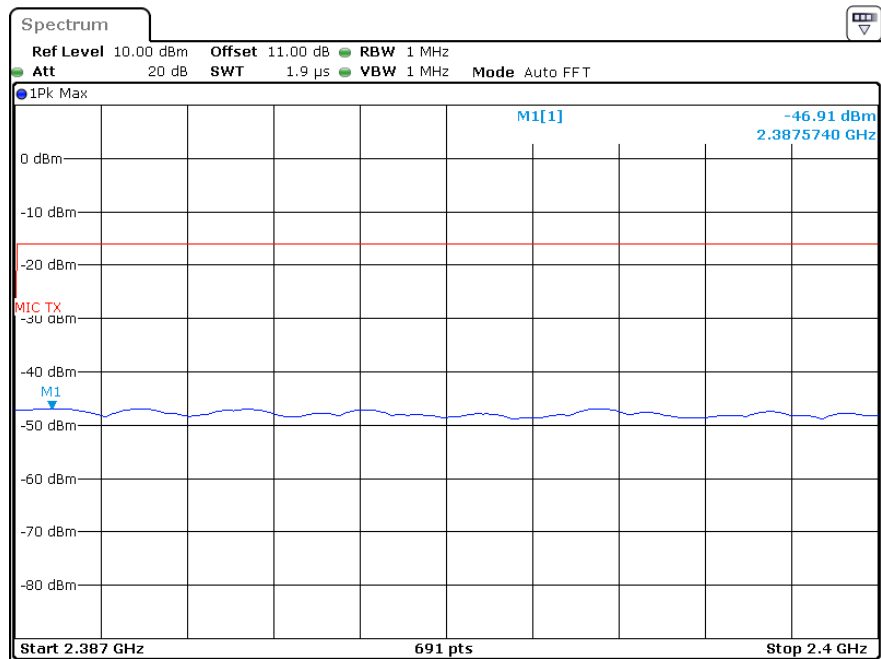
Date: 12.APR.2022 16:46:10

**1000MHz - 2387MHz**

Date: 12.APR.2022 16:47:24

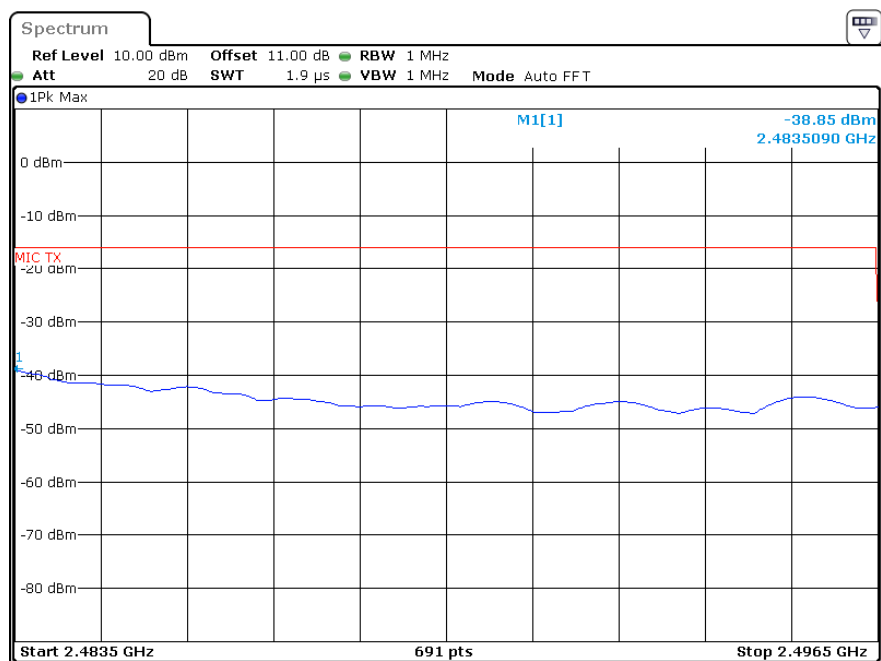


## 2387MHz - 2400MHz



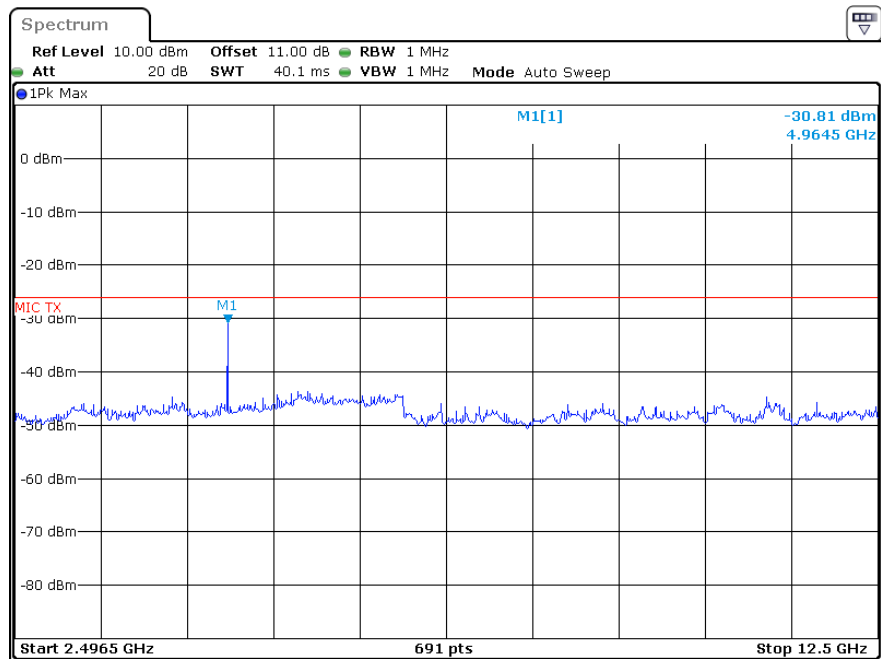
Date: 12.APR.2022 16:48:12

## 2483.5MHz - 2496.5MHz



Date: 12.APR.2022 16:49:08

## 2496.5MHz - 12500MHz



Date: 12.APR.2022 16:49:48

**ANTENNA OUTPUT POWER AND ANTENNA POWER TOLERANCE****Limit**

- $\leq 3$  mW /MHz(FHSS from 2402-2480 MHz)
- $\leq 10$  mW/MHz (OFDM, DSSS from 2400-2483.5 MHz)
- $\leq 10$  mW (other from 2400-2483.5 MHz)

The Output Power Tolerance must be within +20%, -80%.

**Test Procedure**

Step 1: Measure the total power by Power Meter in a state of hopping mode or non-hopping mode (with Average Sensor)

Step 2: If it's the burst wave, please measure the burst ratio. Then calculate the real total power by burst ratio.

Step 3: Calculate the mean power.

Antenna output power (mW) = Antenna output power Reading (mW) / Burst Ratio

Note: The burst ratio has been calculated to result by power meter, so the equation updated as below:

Antenna output power (mW) = Antenna output power Reading (mW)

**Test Data****Environmental Conditions**

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25°C      |
| <b>Relative Humidity:</b> | 53%       |
| <b>ATM Pressure:</b>      | 101.0 kPa |

The testing was performed by Pual Liu from 2022-02-07 to 2022-04-12.

**Test Result:** Compliant

Test Mode: Transmitting

For model of XIAO-nRF52840 Sense

Normal voltage

**GFSK BLE 1M**

(Nominal Output power is 6.0mW):

| Frequency                          | Low channel | Middle channel | High channel | Limit     |
|------------------------------------|-------------|----------------|--------------|-----------|
| Antenna Output Power Reading(dBm)  | 8.20        | 7.83           | 7.68         |           |
| Antenna Output Power (mW)          | 6.61        | 6.07           | 5.86         | 10        |
| Antenna Output Power Tolerance (%) | 10.12       | 1.12           | -2.31        | -80 ~ +20 |
| EIRP(dBm)                          | 10.20       | 9.83           | 9.68         | 12.14     |

**GFSK BLE 2M**

(Nominal Output power is 3.0mW):

| Frequency                          | Low channel | Middle channel | High channel | Limit     |
|------------------------------------|-------------|----------------|--------------|-----------|
| Antenna Output Power Reading(dBm)  | 4.97        | 4.54           | 4.31         |           |
| Antenna Output Power (mW)          | 3.14        | 2.84           | 2.70         | 10        |
| Antenna Output Power Tolerance (%) | 4.68        | -5.18          | -10.08       | -80 ~ +20 |
| EIRP(dBm)                          | 6.97        | 6.54           | 6.31         | 12.14     |

For model of XIAO-nRF52840

**GFSK BLE 1M**

(Nominal Output power is 6.0mW):

| Frequency                          | Low channel | Middle channel | High channel | Limit     |
|------------------------------------|-------------|----------------|--------------|-----------|
| Antenna Output Power Reading(dBm)  | 8.24        | 7.40           | 6.72         |           |
| Antenna Output Power (mW)          | 6.67        | 5.50           | 4.70         | 10        |
| Antenna Output Power Tolerance (%) | 11.17       | -8.33          | -6.00        | -80 ~ +20 |
| EIRP(dBm)                          | 10.24       | 9.40           | 8.72         | 12.14     |

**GFSK BLE 2M**

(Nominal Output power is 3.0mW):

| Frequency                          | Low channel | Middle channel | High channel | Limit     |
|------------------------------------|-------------|----------------|--------------|-----------|
| Antenna Output Power Reading(dBm)  | 4.48        | 4.10           | 3.44         |           |
| Antenna Output Power (mW)          | 2.81        | 2.57           | 2.21         | 10        |
| Antenna Output Power Tolerance (%) | -6.33       | -14.33         | -26.33       | -80 ~ +20 |
| EIRP(dBm)                          | 6.48        | 6.10           | 5.44         | 12.14     |

Note :

Antenna output power tolerance(%) = (Antenna output power - declared power)/declared power\*100

EIRP(dBm)= Antenna Output Power Reading(dBm)+ Antenna gain

Antenna gain is 2dBi.

## RECEIVER SPURIOUS EMISSION AND UNWANTED EMISSION INTENSITY

### Limit

- $\leq 4 \text{ nW}$  ( $30 \text{ MHz} \leq f \leq 1000 \text{ MHz}$ )
- $\leq 20 \text{ nW}$  ( $1 \text{ GHz} \leq f \leq 12.5 \text{ GHz}$ )

### Test Procedure

#### Conditions of Application Equipment (EUT)

- The modulation state shall be “continuous receiving mode”.

#### Spectrum Analyzer Conditions

- Start Frequency: Start Frequency of frequency range to measure (30MHz or 1GHz)
- Stop Frequency: Stop Frequency of frequency range to measure (1GHz or 12.5GHz)
- Span: AUTO (Measurement Range)
- RBW: 100 kHz, VBW: 100 kHz for Frequency < 1 GHz
- RBW: 1MHz, VBW: 1MHz for Frequency > 1 GHz
- Sweep time: AUTO or more
- Sweep mode: Auto Sweep
- Detection: Positive Peak
- Reference Level: Enough level for maximum dynamic range

### Measurement Result

#### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25°C      |
| Relative Humidity: | 53%       |
| ATM Pressure:      | 101.0 kPa |

The testing was performed by Paul Liu from 2022-02-07 to 2022-04-12.

**Test Result:** Compliant, please see the below tables and plots

*Test Mode: Receiving*

For model of XIAO-nRF52840 Sense

Normal voltage

| GFSK(1M) | Frequency Band | 2402MHz | 2440MHz | 2480MHz | Limit |
|----------|----------------|---------|---------|---------|-------|
| Raw data | Band VI (dBm)  | -66.79  | -66.68  | -67.03  | -54   |
|          | Band VI I(dBm) | -63.03  | -63.42  | -63.39  | -47   |

| GFSK(2M) | Frequency Band | 2402MHz | 2440MHz | 2480MHz | Limit |
|----------|----------------|---------|---------|---------|-------|
| Raw data | Band VI (dBm)  | -66.62  | -67.08  | -66.10  | -54   |
|          | Band VI I(dBm) | -61.81  | -63.53  | -63.54  | -47   |

For model of XIAO-nRF52840

Normal voltage

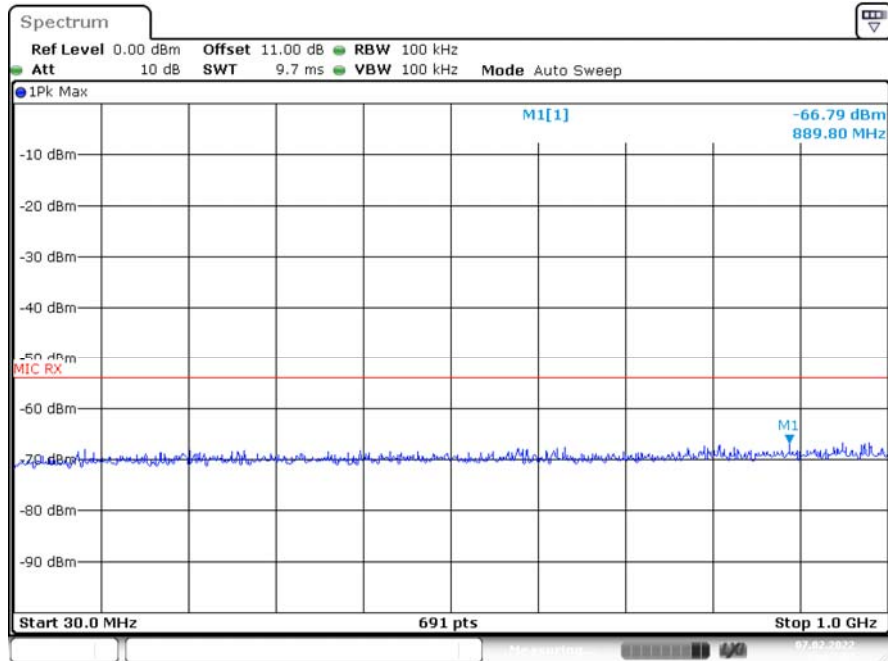
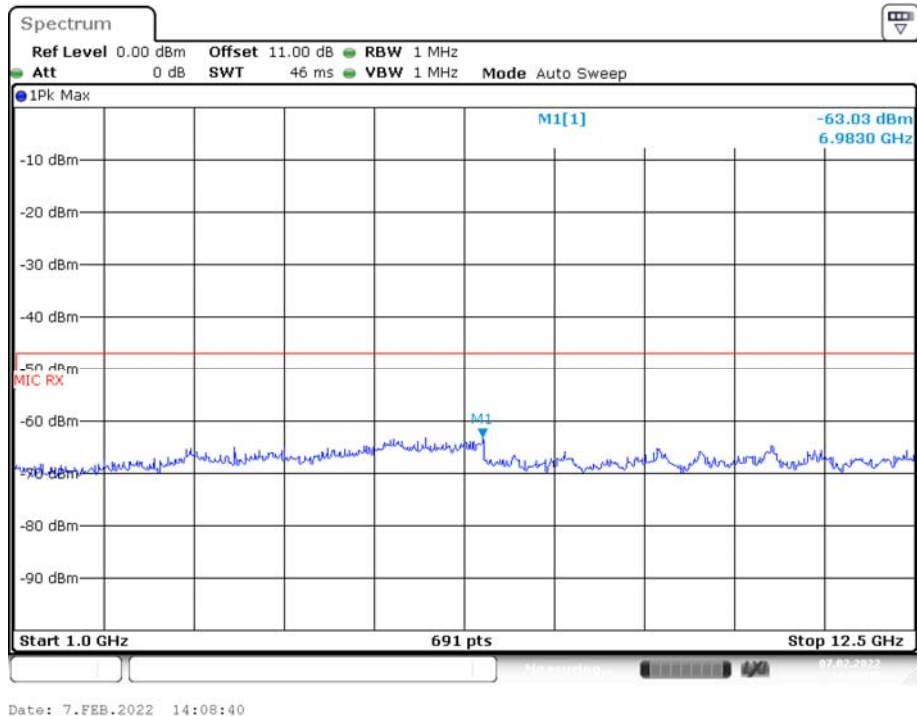
| GFSK(1M) | Frequency Band | 2402MHz | 2440MHz | 2480MHz | Limit |
|----------|----------------|---------|---------|---------|-------|
| Raw data | Band VI (dBm)  | -66.05  | -66.23  | -66.86  | -54   |
|          | Band VI I(dBm) | -63.98  | -62.84  | -62.17  | -47   |

| GFSK(2M) | Frequency Band | 2402MHz | 2440MHz | 2480MHz | Limit |
|----------|----------------|---------|---------|---------|-------|
| Raw data | Band VI (dBm)  | -66.05  | -66.58  | -65.68  | -54   |
|          | Band VI I(dBm) | -64.10  | -63.25  | -64.13  | -47   |

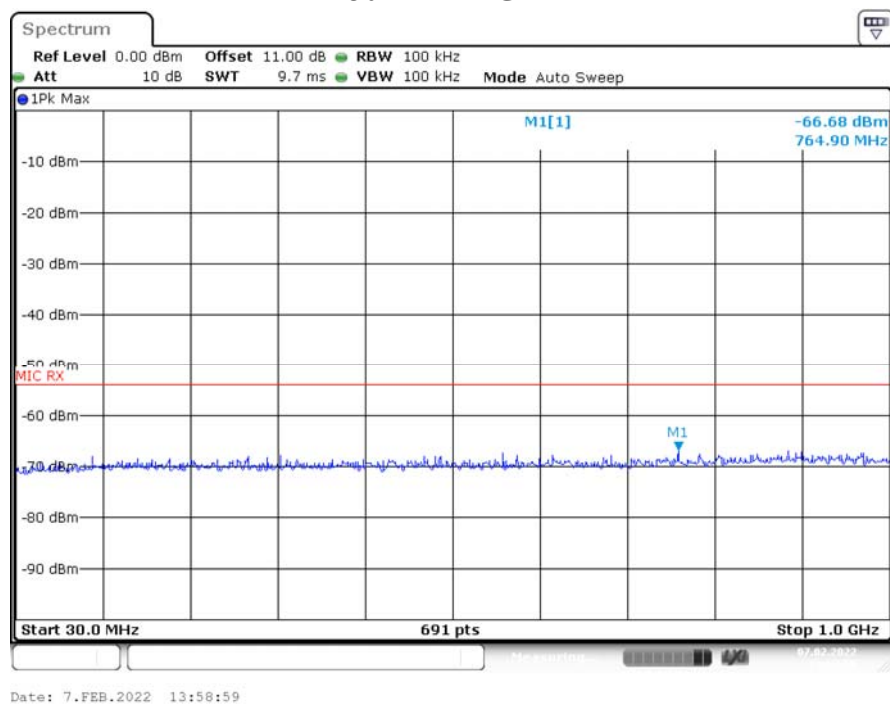
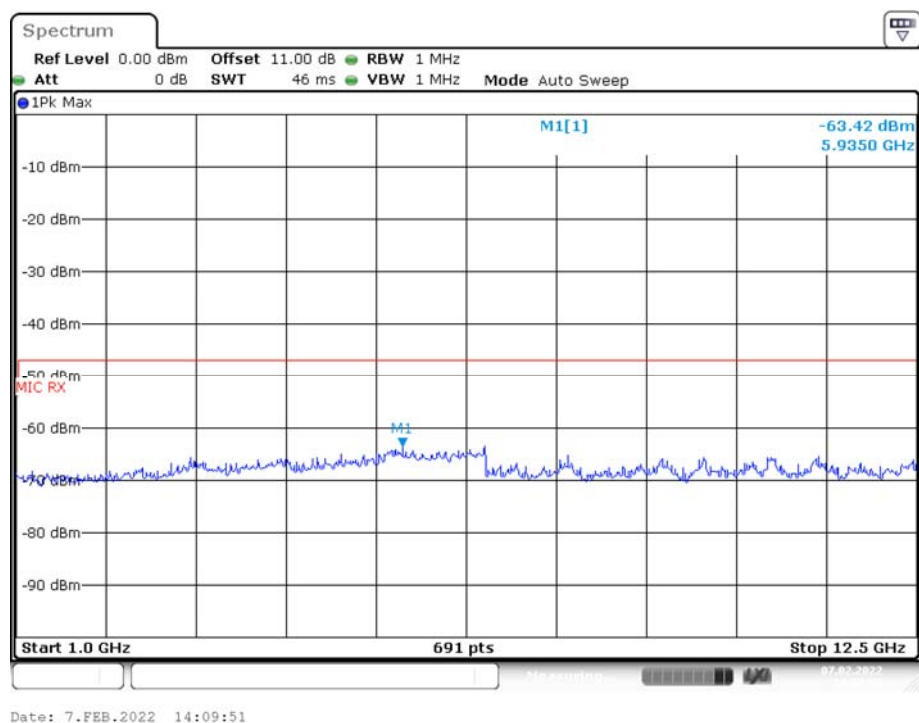
Note: 30 MHz~1000 MHz, Limit is 4 nW = -54 dBm;  
1000 MHz~12500 MHz, Limit is 20 nW = -47 dBm;

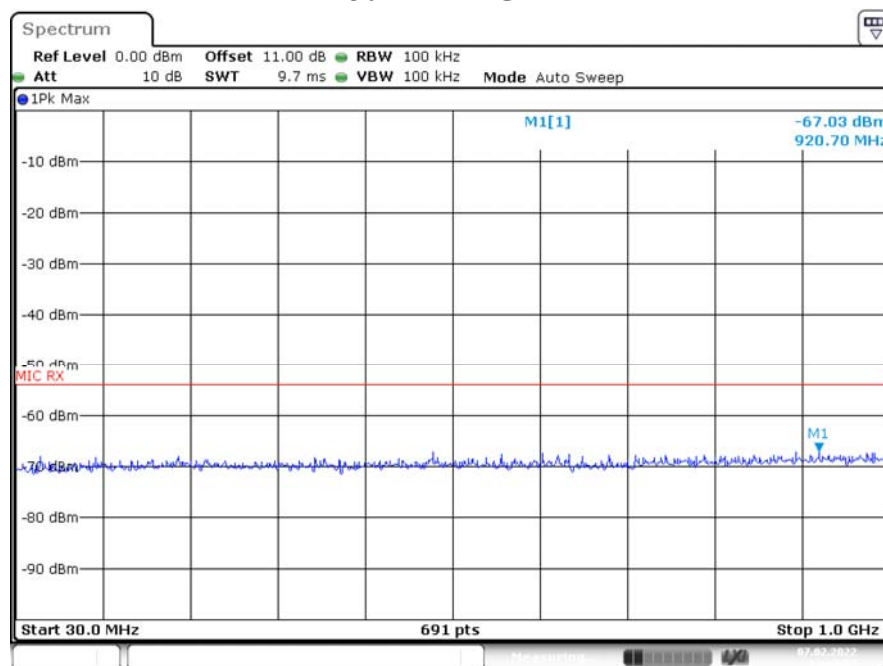
If searched value is under the technical standard value, do not need to measure more detail.

For model of XIAO-nRF52840 Sense

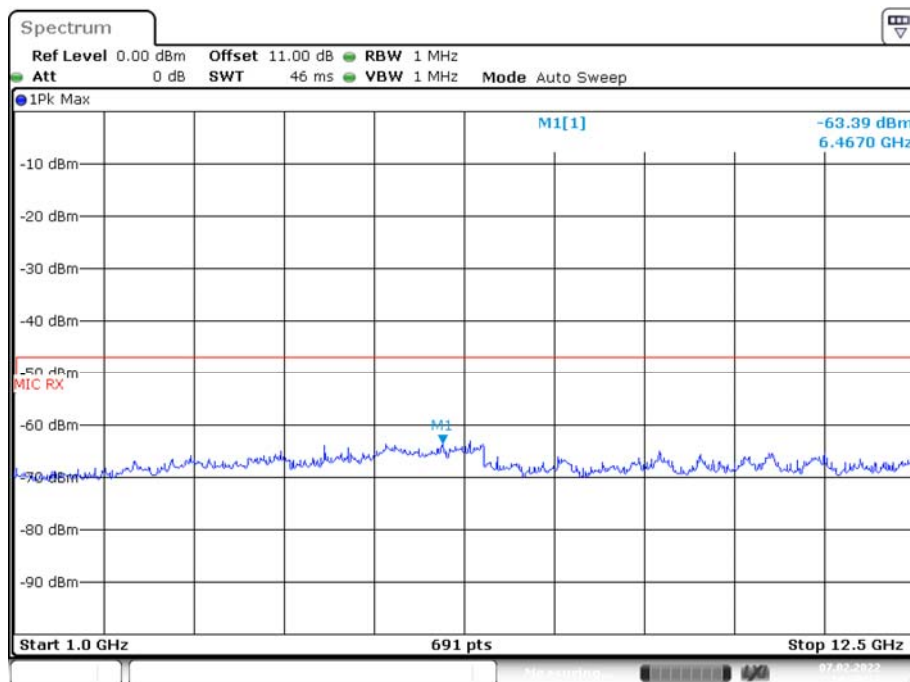
**GFSK (1M)  
Low Channel:****30 MHz~1 GHz****1 GHz~12.5 GHz**



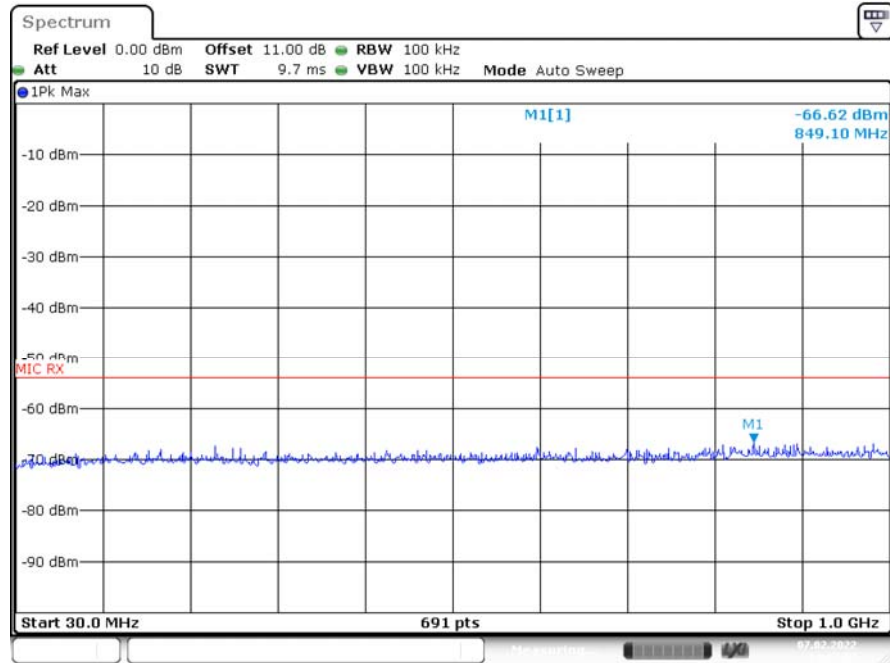
**Middle Channel:****30 MHz~1 GHz****1 GHz~12.5 GHz**

**High Channel:****30 MHz~1 GHz**

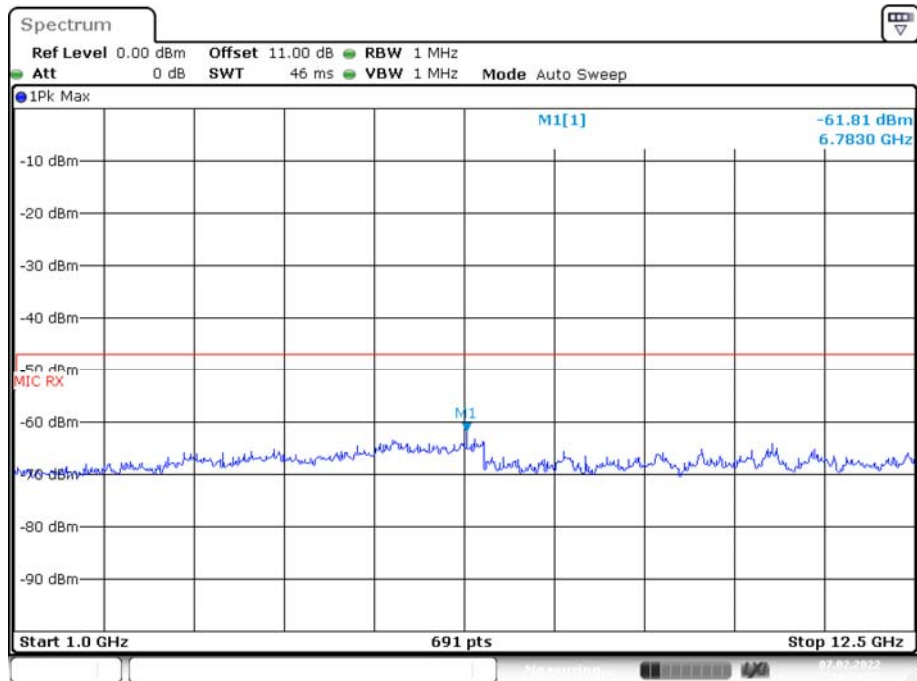
Date: 7.FEB.2022 14:03:08

**1 GHz~12.5 GHz**

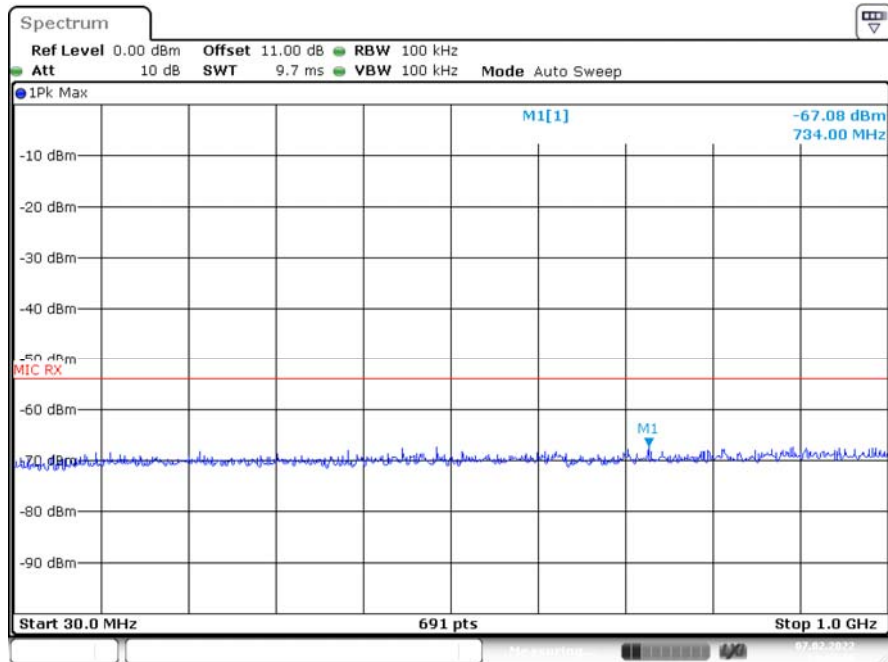
Date: 7.FEB.2022 14:10:12

**GFSK (2M)  
Low Channel:****30 MHz~1 GHz**

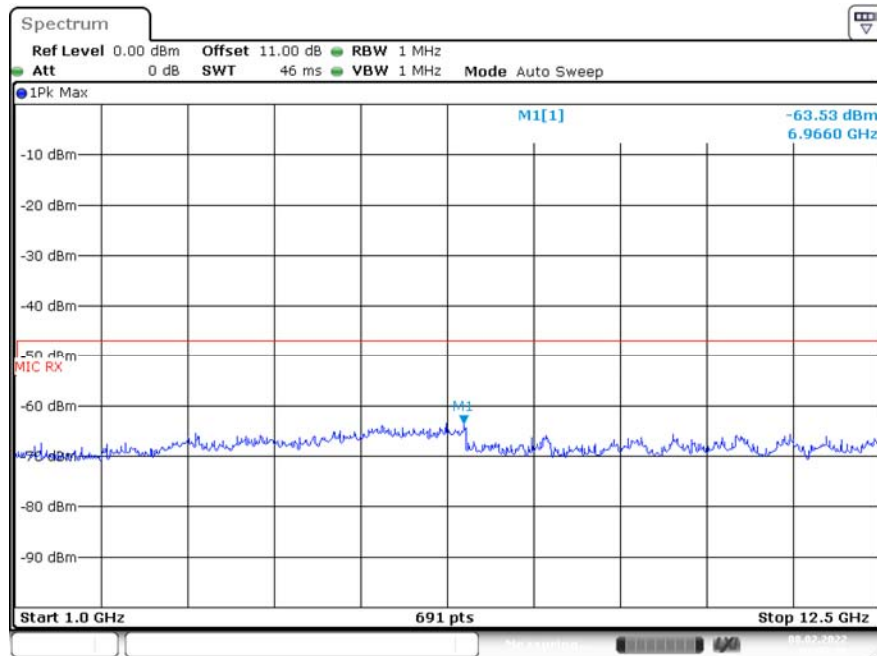
Date: 7.FEB.2022 14:27:28

**1 GHz~12.5 GHz**

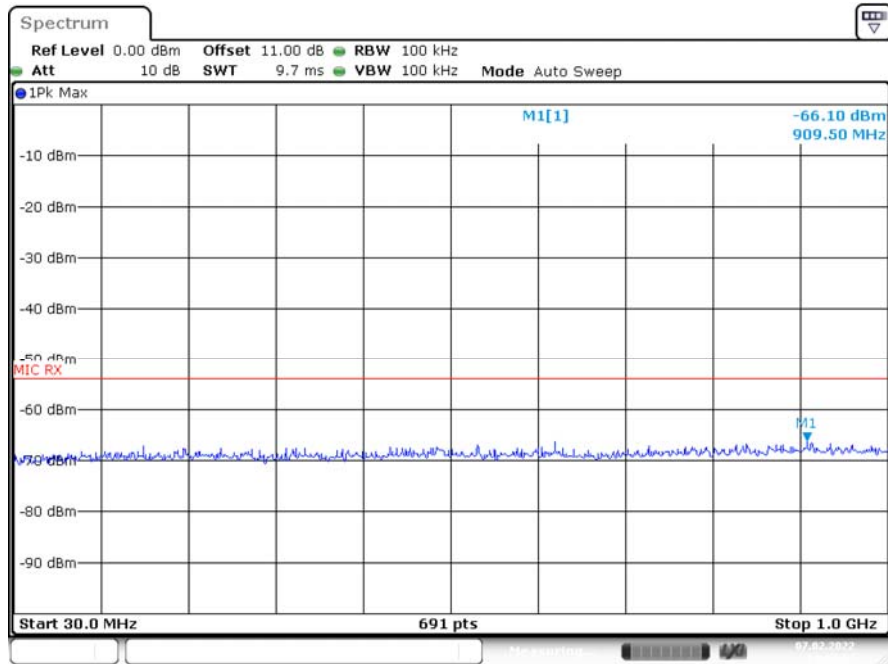
Date: 7.FEB.2022 14:24:23

**Middle Channel:****30 MHz~1 GHz**

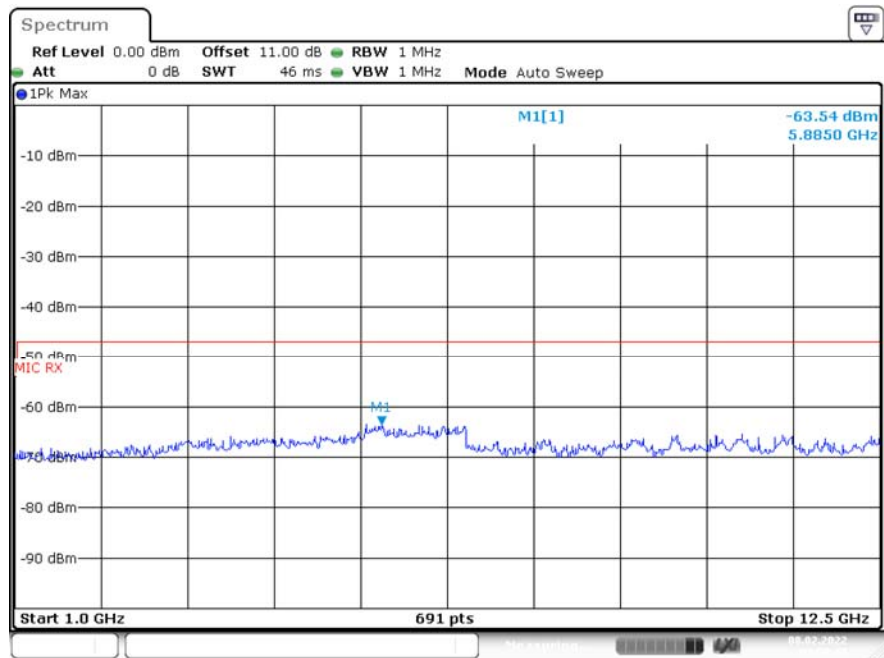
Date: 7.FEB.2022 14:30:11

**1 GHz~12.5 GHz**

Date: 8.FEB.2022 09:48:23

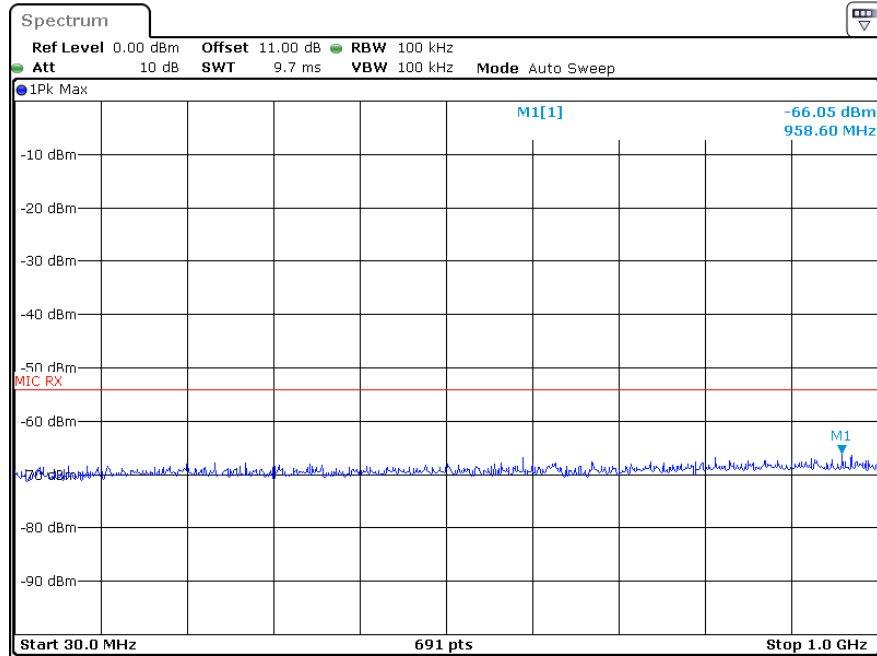
**High Channel:****30 MHz~1 GHz**

Date: 7.FEB.2022 14:33:34

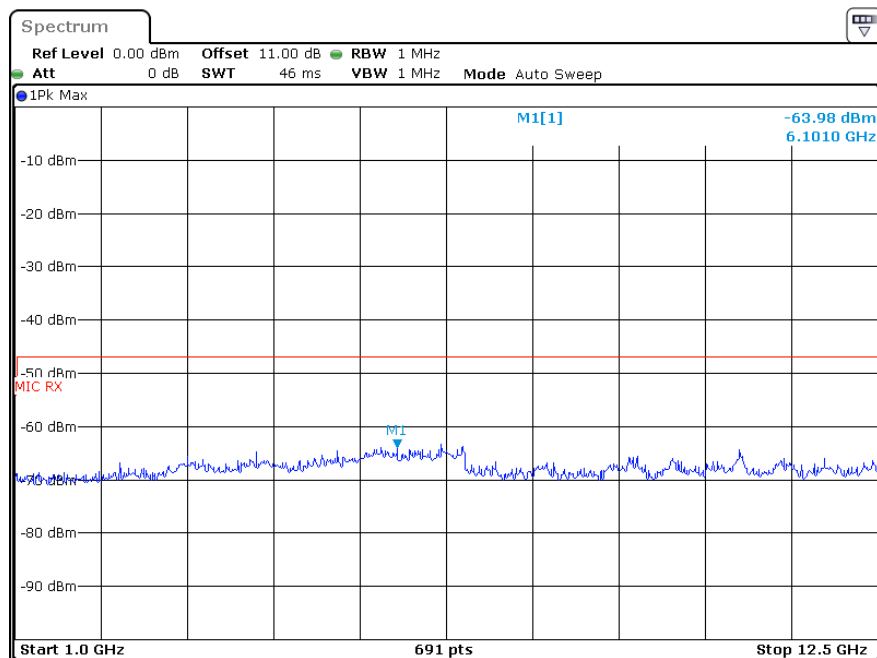
**1 GHz~12.5 GHz**

Date: 8.FEB.2022 09:50:47

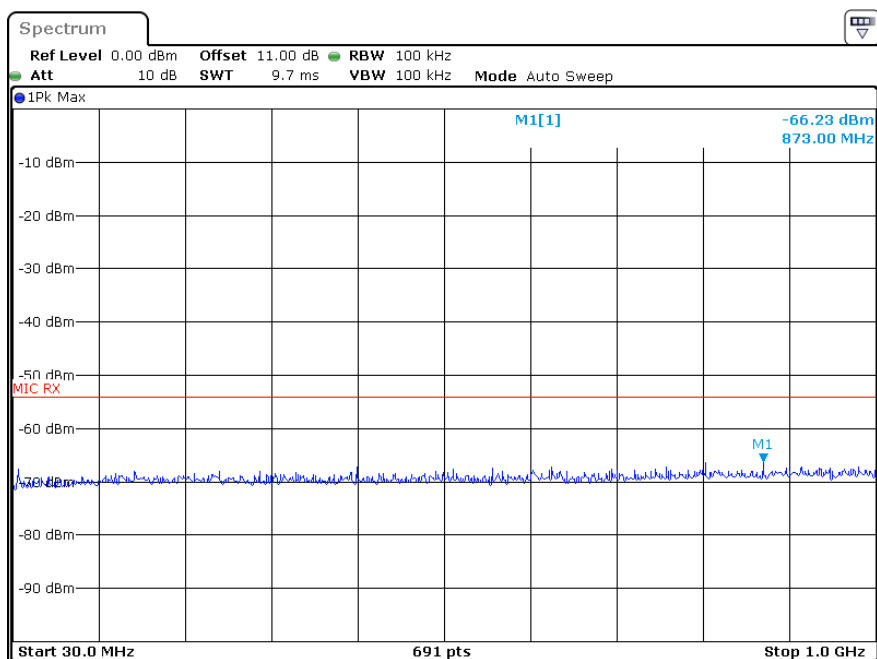
For model of XIAO-nRF52840

**GFSK (1M)**  
**Low Channel:****30 MHz~1 GHz**

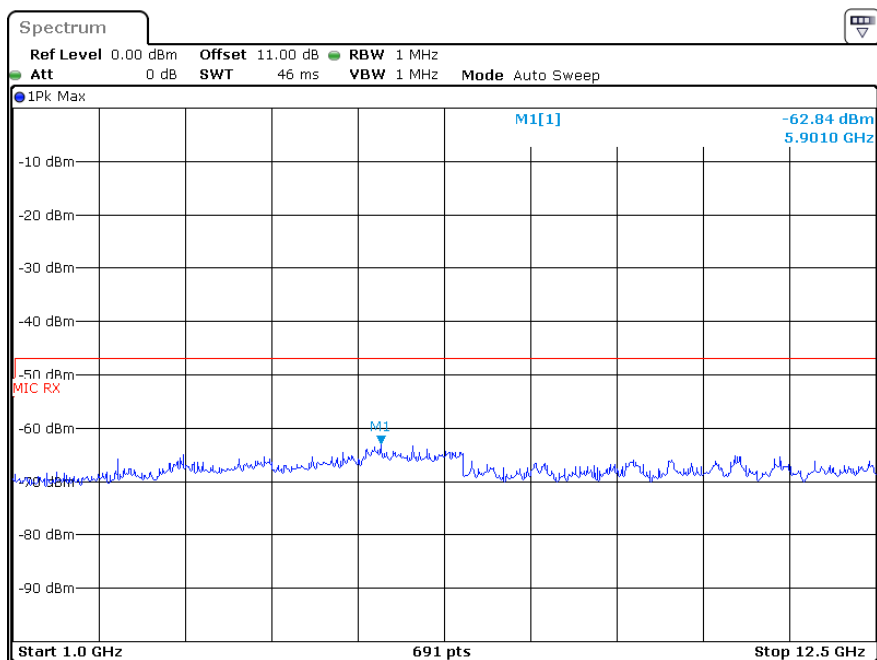
Date: 12.APR.2022 17:03:33

**1 GHz~12.5 GHz**

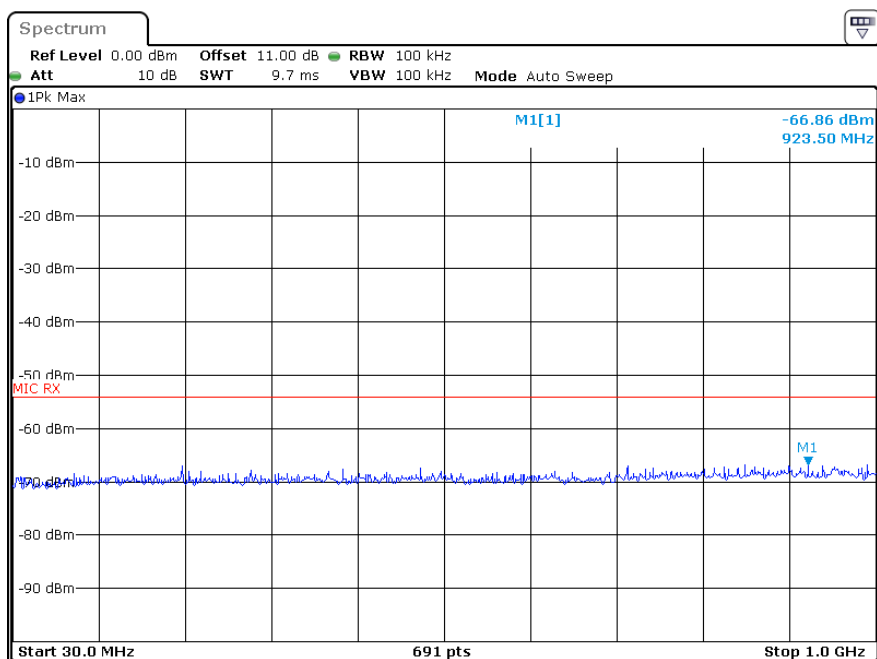
Date: 12.APR.2022 17:08:13

**Middle Channel:****30 MHz~1 GHz**

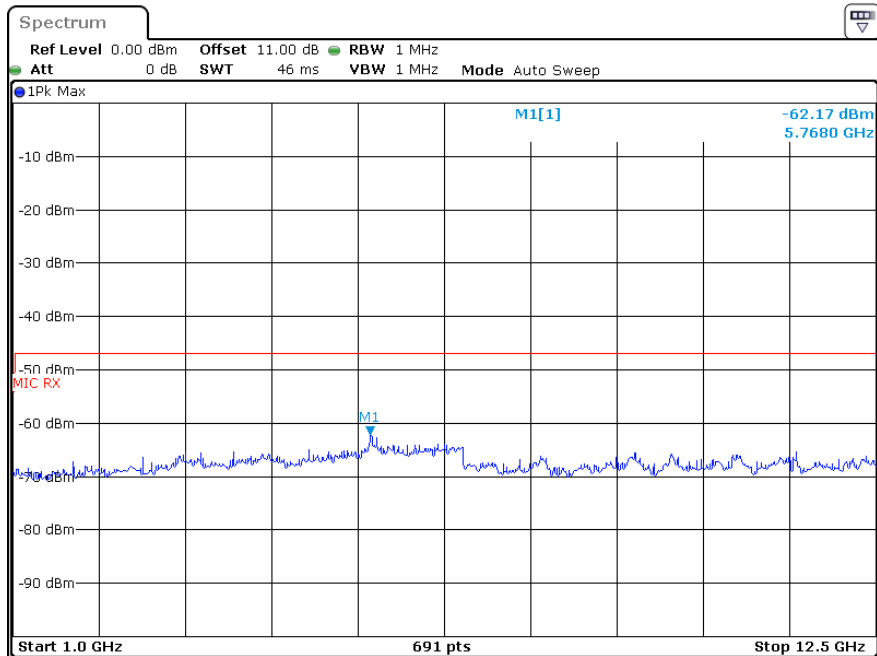
Date: 12.APR.2022 17:02:35

**1 GHz~12.5 GHz**

Date: 12.APR.2022 17:09:25

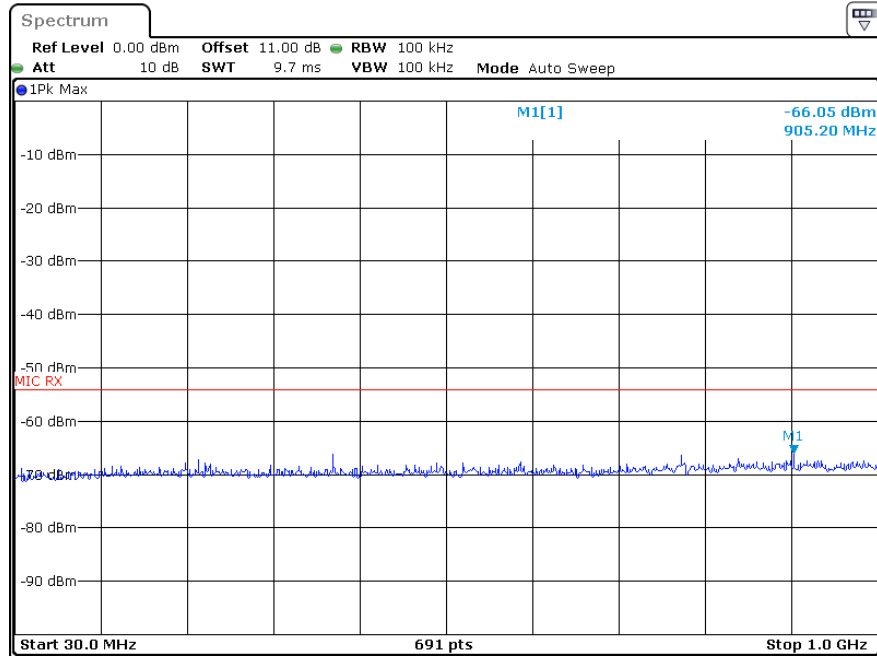
**High Channel:****30 MHz~1 GHz**

Date: 12.APR.2022 17:03:05

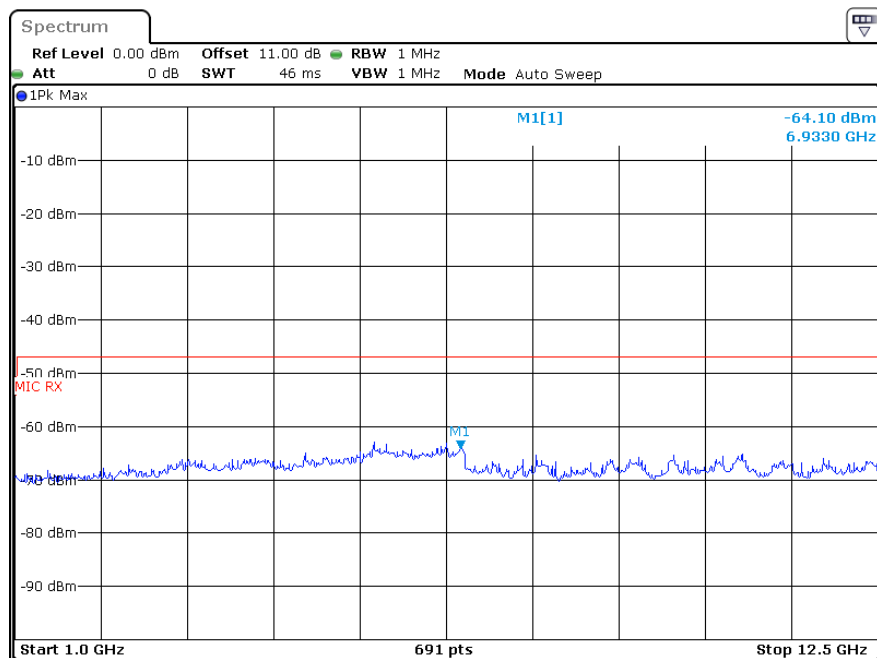
**1 GHz~12.5 GHz**

Date: 12.APR.2022 17:01:21

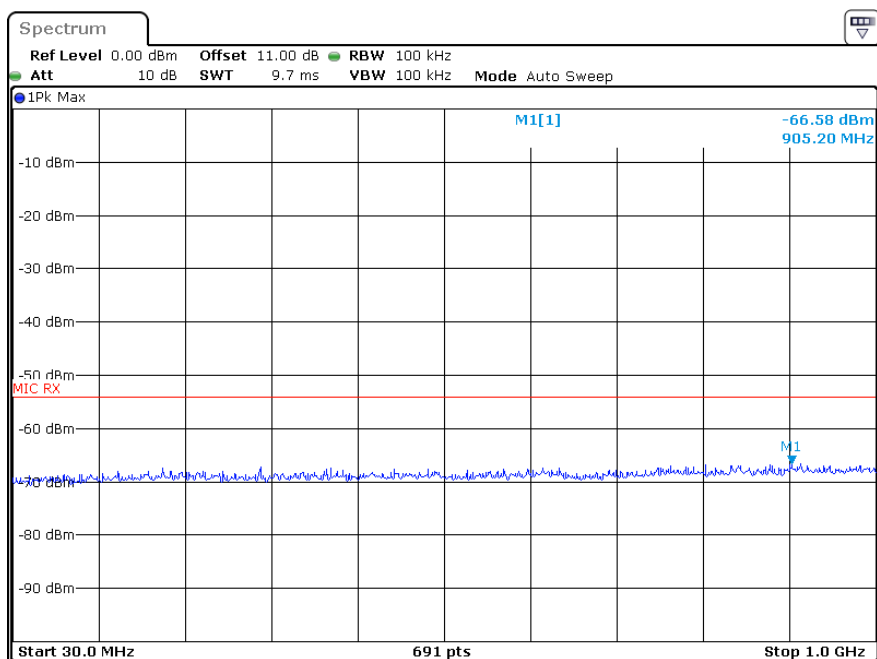


**GFSK (2M)  
Low Channel:****30 MHz~1 GHz**

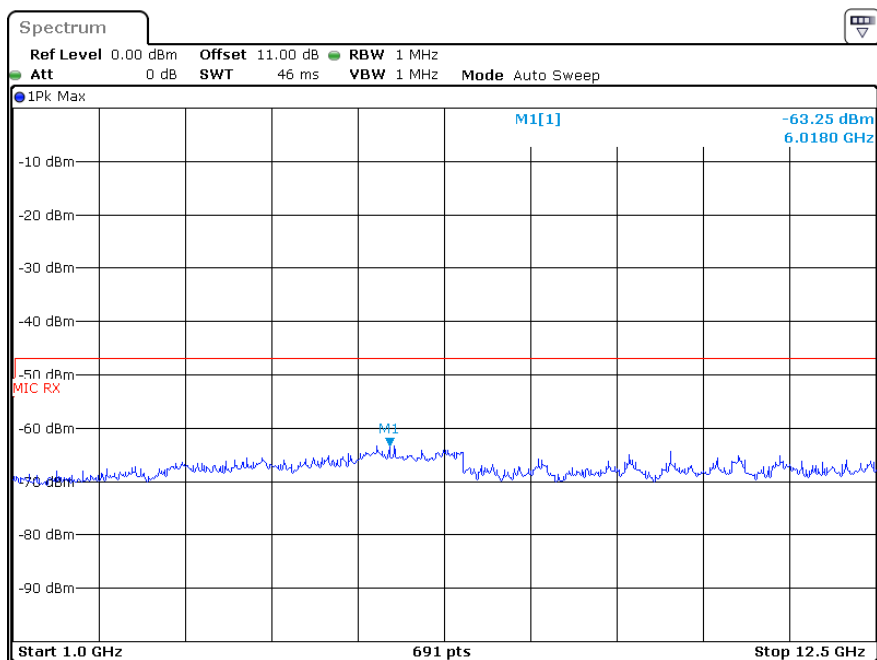
Date: 12.APR.2022 17:12:44

**1 GHz~12.5 GHz**

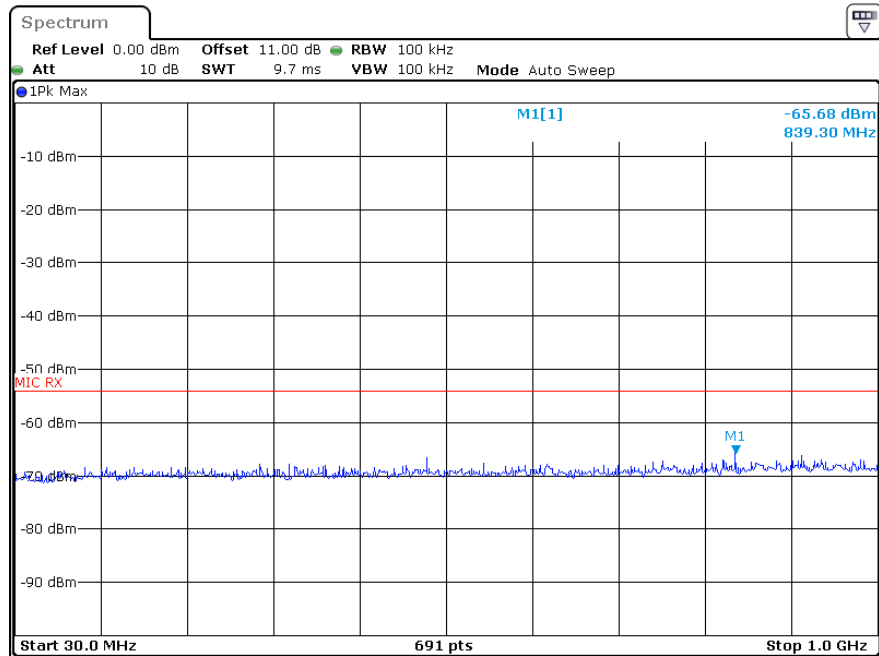
Date: 12.APR.2022 17:06:42

**Middle Channel:****30 MHz~1 GHz**

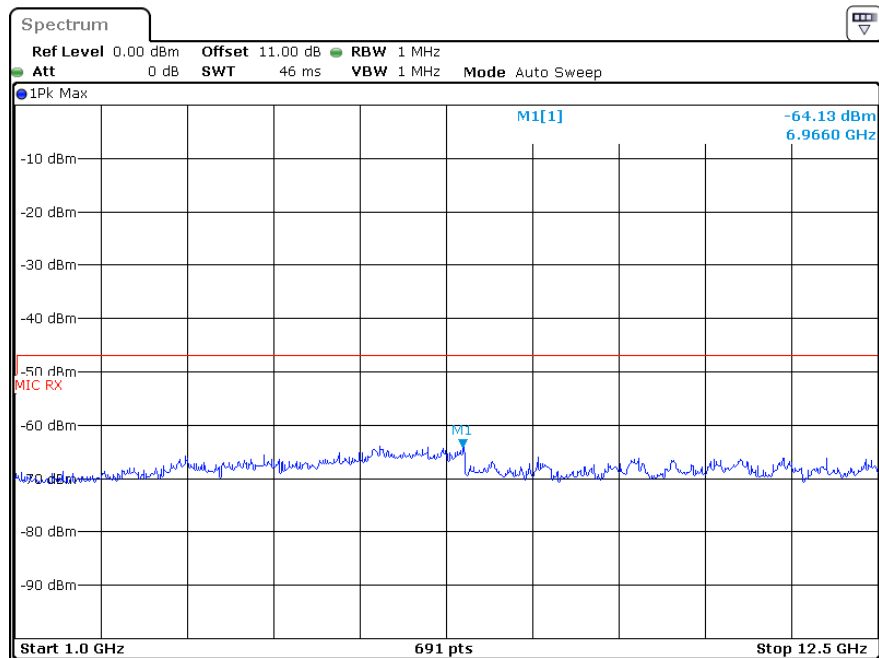
Date: 12.APR.2022 17:13:40

**1 GHz~12.5 GHz**

Date: 12.APR.2022 17:10:29

**High Channel:****30 MHz~1 GHz**

Date: 12.APR.2022 17:12:17

**1 GHz~12.5 GHz**

Date: 12.APR.2022 17:11:13

## INTERFERENCE PREVENTION FUNCTION

### Requirement

The EUT shall have the interference prevention capability to transmit or to receive the identification automatically, so that sender and receiver shall exclude other equipment.

### Test Procedure

In the case that the EUT has the function of automatically transmitting the identification code:

1. Transmit the predetermined identification codes from EUT
2. Check the transmitted identification codes with the demodulator.

In the case of receiving the identification codes:

1. Transmit the predetermined identification codes from the counterpart.
2. Check if communication is normal
3. Transmit the signal other than predetermined ID codes from the counterpart.
4. Check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones.

### Measurement Result

#### Environmental Conditions

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25°C      |
| <b>Relative Humidity:</b> | 53%       |
| <b>ATM Pressure:</b>      | 101.0 kPa |

The testing was performed by Paul Liu on 2022-02-07 to 2022-04-12.

**Test Result:** Good.

## **CONSTRUCTION PROTECTION CONFIRMATION**

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### **Limit**

The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

### **Confirmation Method**

The EUT has shielding cover the high-frequency section except for the antenna system, the shielding can't be opened easily. Please refer to the EUT photos.

**\*\*\*\*END OF REPORT\*\*\*\***