



**UHF TEST REPORT**  
**FCC ID: 2A34K-ERTK20**

On Behalf of  
Shanghai eSurvey GNSS Co., Ltd.  
High Precision GNSS Receiver  
Model No.: eRTK20

Prepared for : Shanghai eSurvey GNSS Co., Ltd.  
Address : Lianhang Rd, Pujiang Town, Minhang District, Shanghai, China

Prepared By : Shenzhen Alpha Product Testing Co., Ltd.  
Address : Building i, No.2, Lixin Road, Fuyong Street, Bao'an District,  
518103, Shenzhen, Guangdong, China

Report Number : A2412321-C01-R12  
Date of Receipt : December 24, 2024  
Date of Test : December 24, 2024 – April 10, 2025  
Date of Report : April 10, 2025  
Version Number : V0  
**Result** **Pass**

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## TEST REPORT DECLARATION

Applicant : Shanghai eSurvey GNSS Co., Ltd.  
Address : Lianhang Rd, Pujiang Town, Minhang District, Shanghai, China  
Manufacturer : Shanghai eSurvey GNSS Co., Ltd.  
Address : Lianhang Rd, Pujiang Town, Minhang District, Shanghai, China  
EUT Description : High Precision GNSS Receiver  
(A) Model No. : eRTK20  
(B) Trademark : 

Measurement Standard Used:

**FCC CFR Title 47 Part 90, FCC CFR Title 47 Part 2**

**ANSI TIA-603-E:2016**

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 2, Part 90 limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....: Yannis Wen  
Project Engineer



Approved by (name + signature).....: Jack Xu  
Project Manager



Date of issue.....: April 10, 2025

**Revision History**

| Revision | Issue Date     | Revisions              | Revised By |
|----------|----------------|------------------------|------------|
| V0       | April 10, 2025 | Initial released Issue | Yannis Wen |

## 1. Summary of Standards and Results

### 1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

| Test Item                                                                                                                                                                                                                                                            | Test Requirement          | Standards Paragraph   | Result |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------|--------|
| Transmitter Power(Conducted)                                                                                                                                                                                                                                         | FCC PART 90               | § 90.205,             | P      |
| Occupied Bandwidth & Emission Mask                                                                                                                                                                                                                                   | FCC PART 90               | § 90.209, § 90.210    | P      |
| Spurious Emissions(conducted)                                                                                                                                                                                                                                        | FCC PART 90               | § 90.210,             | P      |
| Spurious Emissions(Radiated)                                                                                                                                                                                                                                         | FCC PART 90               | § 90.210,             | P      |
| Transient Frequency Behavior                                                                                                                                                                                                                                         | FCC PART 90               | § 90.214,             | P      |
| Frequency Stability                                                                                                                                                                                                                                                  | FCC PART 90               | § 90.213,             | P      |
| Modulation Characteristics - Audio Frequency Response                                                                                                                                                                                                                | FCC PART 2<br>FCC PART 90 | § 2.1047(a), § 90.207 | N/A    |
| Modulation Characteristics - Modulation Limiting                                                                                                                                                                                                                     | FCC PART 2<br>FCC PART 90 | § 2.1047(b), § 90.207 | N/A    |
| Adjacent channel power                                                                                                                                                                                                                                               | FCC PART 90               | §90.221               | P      |
| <p>Note: 1. P is an abbreviation for Pass.</p> <p>2. F is an abbreviation for Fail.</p> <p>3. N/A is an abbreviation for Not Applicable.</p> <p>4. The conclusion of this test report is judged by actual test data without considering measurement uncertainty.</p> |                           |                       |        |

## 2. General Information

### 2.1. Description of Device (EUT)

|              |                                                                                                                                        |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Description  | : High Precision GNSS Receiver                                                                                                         |
| Model Number | : eRTK20                                                                                                                               |
| DIFF.        | : N/A                                                                                                                                  |
| Test Voltage | : Input 1: 12V DC---1.5A (supplied by external approved adapter)(Type-C port)<br>Built-in lithium battery rating:3.6V 13400mAh 48.24Wh |

#### UHF

|                        |                                                                                          |
|------------------------|------------------------------------------------------------------------------------------|
| Operation frequency    | : 410MHz-470MHz                                                                          |
| Conducted Power        | : 2W(33.01±1dBm), 1W(30.00±1dBm)                                                         |
| Channel spacing        | : 12.5KHz, 25KHz                                                                         |
| Modulation type        | : GMSK                                                                                   |
| Antenna Type           | : Whip Antenna, Maximum Gain is 4dBi.<br>(Antenna information is provided by applicant.) |
| Software version       | : 0.27.250212                                                                            |
| Hardware version       | : AR21-V1.0                                                                              |
| Intend use environment | : Residential, commercial and light industrial environment                               |

*Note: All Conducted Power have been tested, and recorded the worst case 2W(33.01±1dBm) results in this report.*

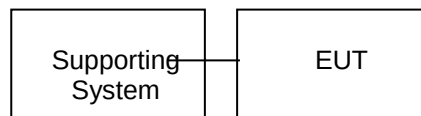
## 2.2. Accessories of Device (EUT)

|              |   |                                                                                                                                         |
|--------------|---|-----------------------------------------------------------------------------------------------------------------------------------------|
| Accessories  | : | Switching Adapter                                                                                                                       |
| Manufacturer | : | DEE VAN ENTERPRISE CO., LTD.                                                                                                            |
| Model        | : | DSA-45PDH                                                                                                                               |
| Ratings      | : | Input: 100-240V~50/60Hz 1.5A<br>Output: 5.0V=3.0A, 15.0W; 9.0V=3.0A, 27.0W; 12.0V=3.0A, 36.0W;<br>15.0V=3.0A, 45.0W; 20.0V=2.25A, 45.0W |

## 2.3. Tested Supporting System Details

| No. | Description | Manufacturer | Model | Serial Number | Certification or SDOC |
|-----|-------------|--------------|-------|---------------|-----------------------|
| 1.  | Notebook PC | Lenovo       | T430  | /             | /                     |

## 2.4. Block Diagram of Connection between EUT and Simulators



The sample was placed 0.8m & 1.5m for the measurement below & above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

## 2.5. Test Mode

All modes and data rates and positions were investigated.

Test modes are chosen to be reported as the worst case configuration below:

| Test Mode |                               |                                        |
|-----------|-------------------------------|----------------------------------------|
| Item      | Description of operation mode | Note                                   |
| 1         | GMSK+CS12.5KHz+TX             | at maximum rated power for transmitter |
| 2         | GMSK+CS25KHz+TX               | at maximum rated power for transmitter |

Note: The worst case modes for all test are the item 1 and item 2.

### Description Operation Frequency

| GMSK         |                       |                |
|--------------|-----------------------|----------------|
| Test Channel | Channel spacing (KHz) | Frequency(MHz) |
| Low          | 12.5                  | 410.050        |
|              | 25                    | 410.050        |
| Mid          | 12.5                  | 440.000        |
|              | 25                    | 440.000        |
| High         | 12.5                  | 469.950        |
|              | 25                    | 469.950        |



## 2.6. Test Conditions

| Items              | Required  | Actual |
|--------------------|-----------|--------|
| Temperature range: | 15-35℃    | 24℃    |
| Humidity range:    | 25-75%    | 56%    |
| Pressure range:    | 86-106kPa | 98kPa  |

## 2.7. Test Facility

Shenzhen Alpha Product Testing Co., Ltd  
Building i, No.2, Lixin Road, Fuyong Street, Bao'an District,  
518103, Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission  
Registration Number: 293631

July 15, 2019 Certificated by IC  
Registration Number: 12135A

SHENZHEN STS TEST SERVICES CO., LTD

101, Building B, Zhouke Science Park, No. 190 Chongqing Road, Zhancheng Shequ, Fuhai Sub-District,  
Ban'an District, Shenzhen, Guangdong, China

FCC Registration No.: 625569; A2LA Certificate No.:4338.01.

Note: Except for the Transient Frequency Behavior projects that were completed in SHENZHEN STS TEST SERVICES CO., LTD, all other projects were completed in Shenzhen Alpha Product Testing Co., Ltd

## 2.8. Measurement Uncertainty

(95% confidence levels, k=2)

| Item                                                                   | Uncertainty               |
|------------------------------------------------------------------------|---------------------------|
| Uncertainty for Power point Conducted Emissions Test                   | 1.63dB                    |
| Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)    | 3.5dB                     |
| Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)  | 3.74dB(Polarize: V)       |
|                                                                        | 3.76dB(Polarize: H)       |
| Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)  | 3.77dB(Polarize: V)       |
|                                                                        | 3.80dB(Polarize: H)       |
| Uncertainty for Radiation Emission test in 3m chamber (18GHz to 40GHz) | 4.31 dB(Polarize: V)      |
|                                                                        | 4.30 dB(Polarize: H)      |
| Uncertainty for radio frequency                                        | $5.06 \times 10^{-8}$ GHz |
| Uncertainty for conducted RF Power                                     | 0.40dB                    |
| Uncertainty for temperature                                            | 0.2°C                     |
| Uncertainty for humidity                                               | 1%                        |
| Uncertainty for DC and low frequency voltages                          | 0.06%                     |

## 2.9. Test Equipment List

Shenzhen Alpha Product Testing Co., Ltd

| Equipment                    | Manufacture   | Model No.        | Firmware version | Serial No.                 | Last cal.  | Cal Interval |
|------------------------------|---------------|------------------|------------------|----------------------------|------------|--------------|
| 9*6*6 anechoic chamber       | CHENYU        | 9*6*6            | /                | N/A                        | 2025.03.09 | 4Year        |
| 4*4*3 Shielded room          | CHENYU        | 4*4*3            | /                | N/A                        | 2025.03.09 | 4Year        |
| Spectrum analyzer            | ROHDE&SCHWARZ | FSV40-N          | 2.3              | 102137                     | 2024.08.08 | 1Year        |
| Spectrum analyzer            | Agilent       | N9020A           | A.14.16          | MY499100060                | 2024.08.08 | 1Year        |
| Receiver                     | ROHDE&SCHWARZ | ESR              | 2.28 SP1         | 1316.3003K03-10<br>2082-Wa | 2024.08.08 | 1Year        |
| Receiver                     | R&S           | ESCI             | 4.42 SP1         | 101165                     | 2024.08.08 | 1Year        |
| Bilog Antenna                | Schwarzbeck   | VULB 9168        | /                | VULB 9168#627              | 2023.08.28 | 2Year        |
| Horn Antenna                 | SCHWARZBECK   | BBHA 9120<br>D   | /                | 2106                       | 2023.08.19 | 2Year        |
| Loop Antenna                 | SCHWARZBECK   | FMZB<br>1519B    | /                | 00128                      | 2023.08.19 | 2Year        |
| RF Cable                     | Resenberger   | Cable 1          | /                | RE1                        | 2024.08.08 | 1Year        |
| RF Cable                     | Resenberger   | Cable 2          | /                | RE2                        | 2024.08.08 | 1Year        |
| RF Cable                     | Resenberger   | Cable 3          | /                | CE1                        | 2024.08.08 | 1Year        |
| Pre-amplifier                | HP            | HP8347A          | /                | 2834A00455                 | 2024.08.08 | 1Year        |
| Pre-amplifier                | Agilent       | 8449B            | /                | 3008A02664                 | 2024.08.08 | 1Year        |
| L.I.S.N.#1                   | Schwarzbeck   | NSLK8126         | /                | 8126-466                   | 2024.08.08 | 1Year        |
| L.I.S.N.#2                   | ROHDE&SCHWARZ | ENV216           | /                | 101043                     | 2024.08.08 | 1Year        |
| Horn Antenna                 | SCHWARZBECK   | BBHA 9170        | /                | 00946                      | 2023.08.19 | 2Year        |
| Preamplifier                 | SKET          | LNPA_1840<br>-50 | /                | SK2018101801               | 2024.08.08 | 1 Year       |
| Power Meter                  | Agilent       | E9300A           | /                | MY41496628                 | 2024.08.08 | 1 Year       |
| Power Sensor                 | DARE          | RPR3006W         | /                | 15100041SNO91              | 2024.08.08 | 1 Year       |
| Temp. & Humid. Chamber       | Teelong       | TL-HW408S        | /                | TL-20191205-01             | 2024.07.15 | 1 Year       |
| Electronic Thermo-Hygrometer | S.H.Qixiang   | HTC-1            | /                | N/A                        | 2024.08.11 | 1 Year       |
| Switching Mode Power Supply  | JUNKE         | JK12010S         | /                | 20140927-6                 | 2024.08.08 | 1 Year       |
| Adjustable attenuator        | MWRFTest      | N/A              | /                | N/A                        | N/A        | N/A          |
| 10dB Attenuator              | Mini-Circuits | DC-6G            | /                | N/A                        | N/A        | N/A          |

## SHENZHEN STS TEST SERVICES CO., LTD

| RF Radiation Test Equipment |                                  |                   |                 |                 |                  |                  |
|-----------------------------|----------------------------------|-------------------|-----------------|-----------------|------------------|------------------|
| Item                        | Kind of Equipment                | Manufacturer      | Type No.        | Serial No.      | Last Calibration | Calibrated Until |
| 1                           | Temperature & Humidity           | SW-108            | SuWei           | N/A             | 2025.02.24       | 2026.02.23       |
| 2                           | Wireless Communications Test Set | R&S               | CMW 500         | 117239          | 2024.09.23       | 2025.09.22       |
| 3                           | Pre-Amplifier(0.1 M-3GHz)        | EM                | EM330           | 060665          | 2025.02.22       | 2026.02.21       |
| 4                           | Pre-Amplifier (1G-18GHz)         | SKET              | LNPA-01018 G-45 | SK2018080901    | 2024.09.23       | 2025.09.22       |
| 5                           | Positioning Controller           | MF                | MF-7802         | MF-780208587    | N/A              | N/A              |
| 6                           | Signal Analyzer                  | R&S               | FSV 40-N        | 101823          | 2024.09.23       | 2025.09.22       |
| 7                           | Switch Control Box               | N/A               | N/A             | N/A             | N/A              | N/A              |
| 8                           | Filter Box                       | BALUN Technology  | SU319E          | BL-SZ1530051    | N/A              | N/A              |
| 9                           | Video Controller                 | SKET              | FCS C-3         | N/A             | N/A              | N/A              |
| 10                          | Bilog Antenna                    | TESEQ             | CBL6111D        | 34678           | 2024.09.30       | 2025.09.29       |
| 11                          | Horn Antenna                     | SCHWARZBECK       | BBHA 9120D      | 02014           | 2024.09.25       | 2025.09.24       |
| 12                          | Antenna Mast                     | MF                | MFA-440H        | N/A             | N/A              | N/A              |
| 13                          | Turn Table                       | MF                | N/A             | N/A             | N/A              | N/A              |
| 14                          | AC Power Source                  | APC               | KDF-11010G      | F214050035      | N/A              | N/A              |
| 15                          | DC Power Supply                  | Zhaoxin           | RXN 605D        | 20R605D11010081 | N/A              | N/A              |
| 16                          | Test SW                          | EMC Test Software | 15.2.0.339      |                 |                  |                  |

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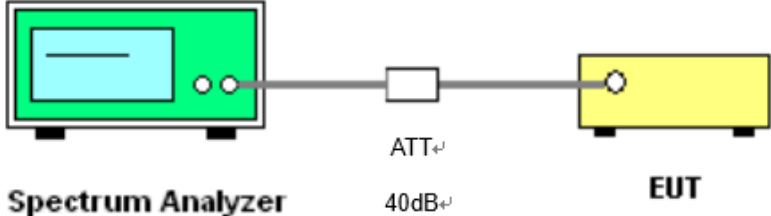
| RF Connected Test Equipment |                                      |              |            |            |                  |                  |
|-----------------------------|--------------------------------------|--------------|------------|------------|------------------|------------------|
| Item                        | Kind of Equipment                    | Manufacturer | Type No.   | Serial No. | Last Calibration | Calibrated Until |
| 1                           | Temperature & Humidity               | SW-108       | SuWei      | N/A        | 2025.02.24       | 2026.02.23       |
| 2                           | Universal Radio Communication Tester | R&S          | CMU200     | 119907     | 2025.02.22       | 2026.02.21       |
| 3                           | MXG Vector Signal Generator          | Keysight     | N5182B     | MY57301448 | 2024.09.23       | 2025.09.22       |
| 4                           | Signal Analyzer                      | Keysight     | N9020A     | MY52440124 | 2025.02.22       | 2026.02.21       |
| 5                           | Intercom comprehensive tester        | HP           | 8920A      | 348A05658  | 2025.02.22       | 2026.02.21       |
| 6                           | Temperature& Humidity test chamber   | Safety test  | AG80L      | 171200018  | 2025.02.22       | 2026.02.21       |
| 7                           | Attenuator                           | HP           | 8494B      | DC-18G     | 2025.02.25       | 2026.02.24       |
| 8                           | AC Power Source                      | APC          | KDF-11010G | F214050035 | N/A              | N/A              |
| 9                           | DC Power Supply                      | Agilent      | E3642A     | MY40002025 | N/A              | N/A              |

| Software Information |               |              |           |
|----------------------|---------------|--------------|-----------|
| Test Item            | Software Name | Manufacturer | Version   |
| RE                   | EZ-EMC        | farad        | Alpha-3A1 |
| CE                   | EZ-EMC        | farad        | Alpha-3A1 |
| RF-CE                | MTS 8310      | MW           | V2.0.0.0  |

### 3. Test Results and Measurement Data

#### 3.1. Transmitter Power (Conducted)

##### 3.1.1. Test Specification

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirement:</b> | Part 90.205                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Test Method:</b>      | FCC part 2.1046                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Limits:</b>           | Please refer section FCC Part 90.205                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Test Setup:</b>       |  <p>The diagram illustrates the test setup for measuring conducted transmitter power. It shows a green Spectrum Analyzer connected to a yellow Equipment Under Test (EUT) via a white attenuator (ATT) labeled 40dB. The Spectrum Analyzer is on the left, the ATT is in the middle, and the EUT is on the right. All three components are connected in a series line.</p> |
| <b>Test Procedure:</b>   | <ul style="list-style-type: none"><li>a) Connect the equipment as illustrated.</li><li>b) Turn on the Spectrum Analyzer</li><li>c) Record value</li></ul>                                                                                                                                                                                                                                                                                                    |
| <b>Test Result:</b>      | PASS                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## 3.1.2. Test Results

| GMSK mode (2W):       |                 |                                            |                   |                        |                                    |        |
|-----------------------|-----------------|--------------------------------------------|-------------------|------------------------|------------------------------------|--------|
| Channel spacing (KHz) | Frequency (MHz) | Maximum Conducted Output Power(Peak) (dBm) | Maximum ERP (dBm) | Stated ERP Power (dBm) | Conducted Output Power Limit (dBm) | Result |
| 12.5                  | 410.050         | 32.995                                     | 34.845            | 36                     | 33.01±1                            | PASS   |
| 25                    | 410.050         | 33.431                                     | 35.281            | 36                     | 33.01±1                            | PASS   |
| 12.5                  | 440.000         | 33.158                                     | 35.008            | 36                     | 33.01±1                            | PASS   |
| 25                    | 440.000         | 33.843                                     | 35.693            | 36                     | 33.01±1                            | PASS   |
| 12.5                  | 469.950         | 32.447                                     | 34.297            | 36                     | 33.01±1                            | PASS   |
| 25                    | 469.950         | 32.915                                     | 34.765            | 36                     | 33.01±1                            | PASS   |

Note: 1. Maximum ERP= Maximum Conducted Output Power(Peak) + Antenna Gain – 2.15dB

| GMSK mode (1W):       |                 |                                            |                   |                        |                                    |        |
|-----------------------|-----------------|--------------------------------------------|-------------------|------------------------|------------------------------------|--------|
| Channel spacing (KHz) | Frequency (MHz) | Maximum Conducted Output Power(Peak) (dBm) | Maximum ERP (dBm) | Stated ERP Power (dBm) | Conducted Output Power Limit (dBm) | Result |
| 12.5                  | 410.050         | 30.474                                     | 32.324            | 33                     | 30±1                               | PASS   |
| 25                    | 410.050         | 30.410                                     | 32.260            | 33                     | 30±1                               | PASS   |
| 12.5                  | 440.000         | 30.907                                     | 32.757            | 33                     | 30±1                               | PASS   |
| 25                    | 440.000         | 30.864                                     | 32.714            | 33                     | 30±1                               | PASS   |
| 12.5                  | 469.950         | 29.941                                     | 31.791            | 33                     | 30±1                               | PASS   |
| 25                    | 469.950         | 29.888                                     | 31.738            | 33                     | 30±1                               | PASS   |

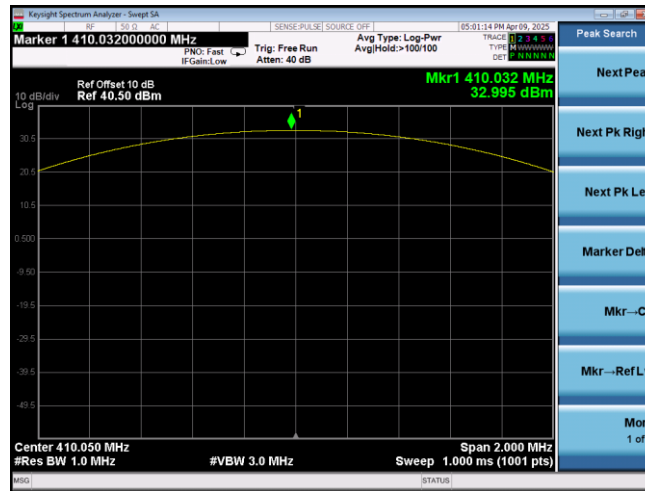
Note: 1. Maximum ERP= Maximum Conducted Output Power(Peak) + Antenna Gain – 2.15dB



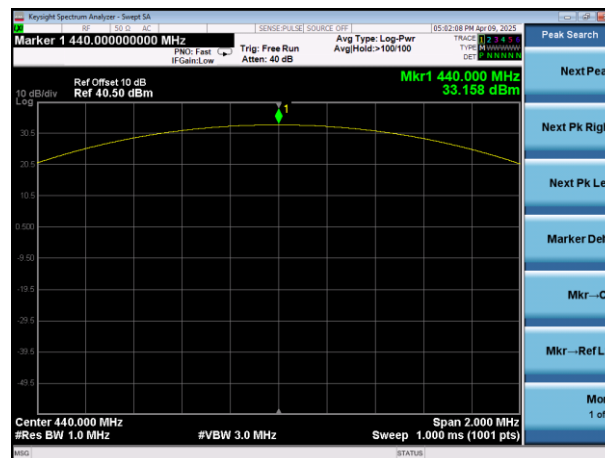
Test plots as follows:

### GMSK 2W 12.5KHz Channel Spacing: Transmitter Power

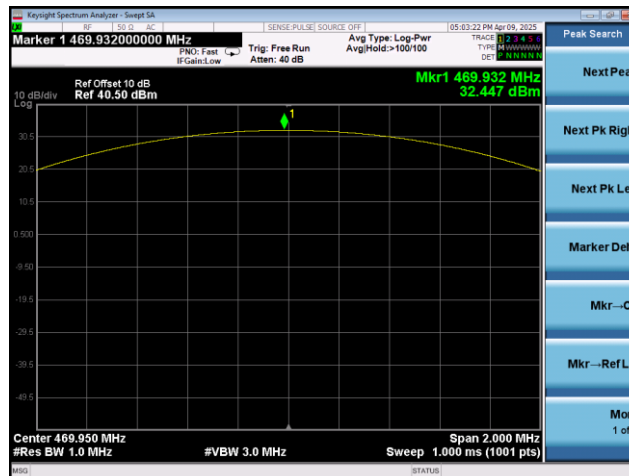
Low: 410.050MHz



Mid: 440.000MHz

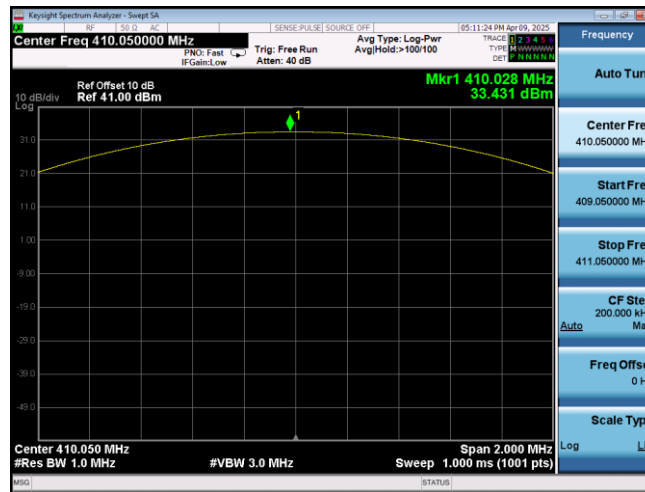


High: 470.00MHz

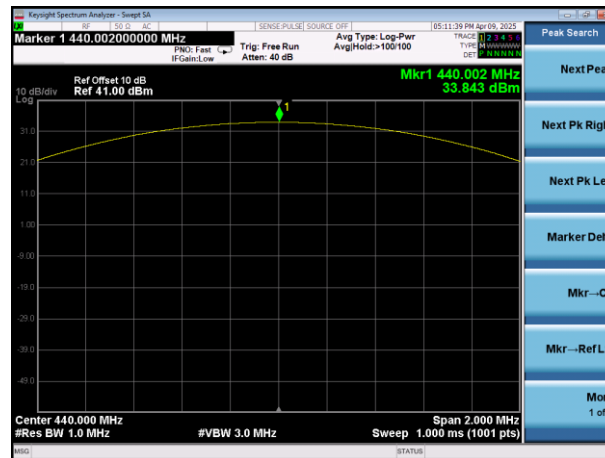


**GMSK 2W 25KHz Channel Spacing: Transmitter Power**

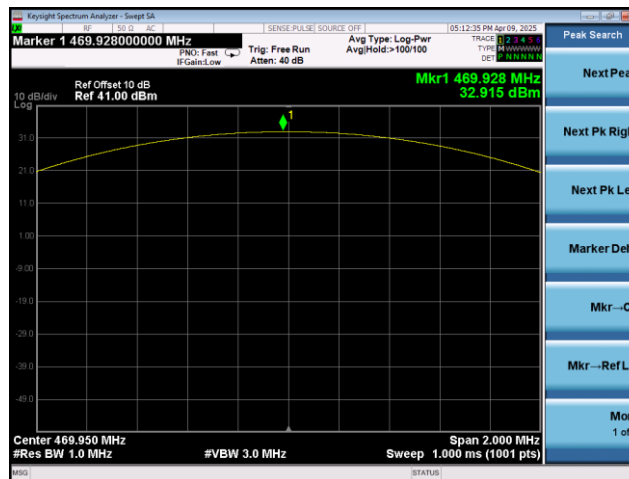
Low: 410.050MHz



Mid: 440.000MHz

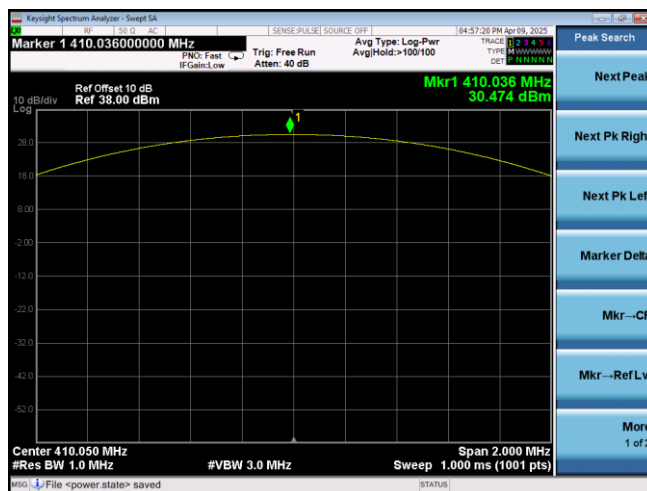


High: 470.00MHz

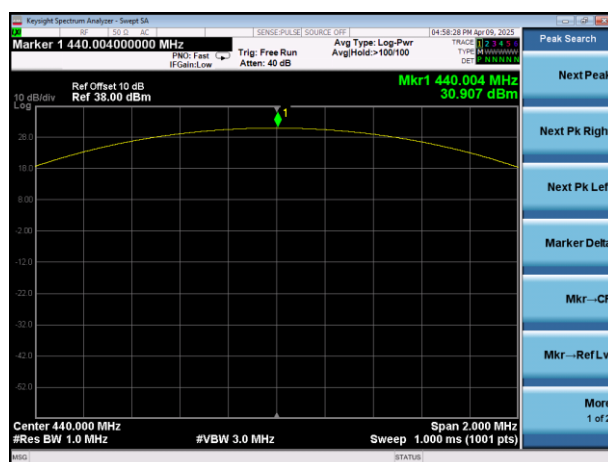


**GMSK 1W 12.5KHz Channel Spacing: Transmitter Power**

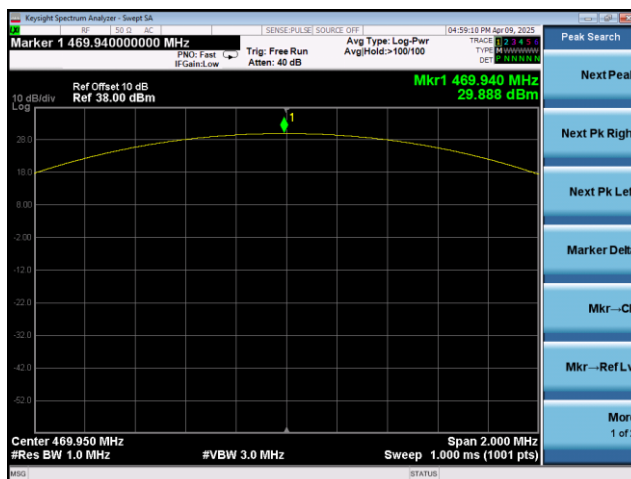
Low: 410.050MHz



Mid: 440.000MHz

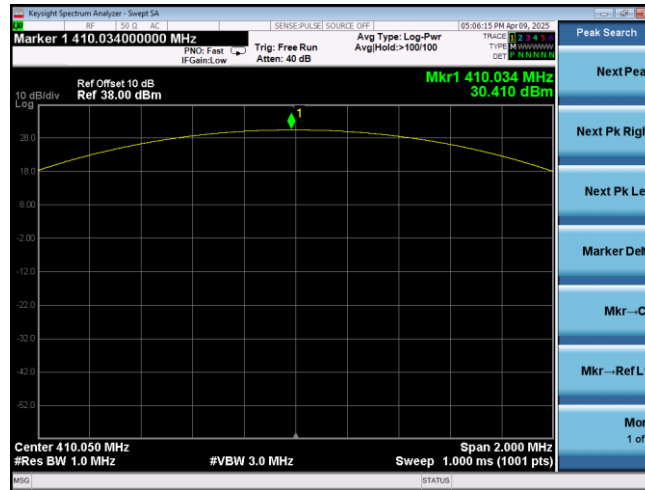


High: 470.00MHz

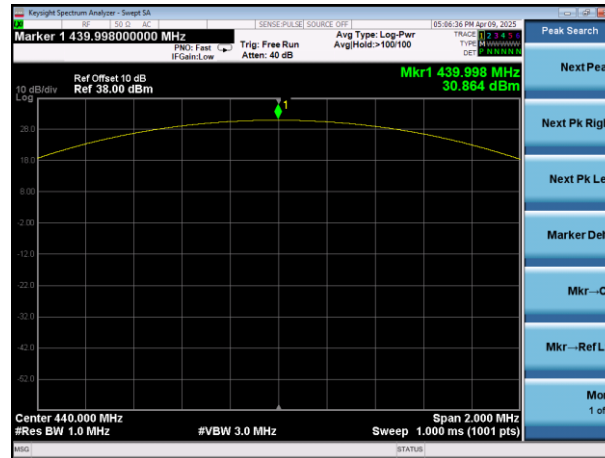


**GMSK 1W 25KHz Channel Spacing: Transmitter Power**

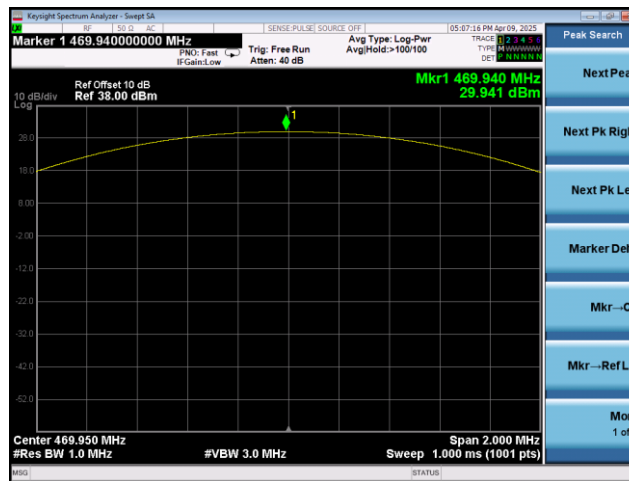
Low: 410.050MHz



Mid: 440.000MHz



High: 470.00MHz



### 3.2. Occupied Bandwidth and Emission Mask

#### 3.2.1. Test Specification

|                          |                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirement:</b> | FCC Part 90.209, FCC Part 90.210                                                                                                                                                                                                                                                                                                                                                        |
| <b>Test Setup:</b>       | <br>The diagram shows a green Spectrum Analyzer on the left connected by a grey cable to a yellow EUT (Equipment Under Test) on the right. A small white box is located in the middle of the cable. Labels 'Spectrum Analyzer' and 'EUT' are placed below their respective devices.                   |
| <b>Test Procedure:</b>   | The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the Frequency band $\pm 50\text{KHz}$ from the carrier frequency for Occupied Bandwidth, the resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the Frequency band $\pm 100\text{KHz}$ from the carrier frequency for Emission Mask. |
| <b>Test Result:</b>      | PASS                                                                                                                                                                                                                                                                                                                                                                                    |

## 3.2.2. Test Data

**Occupied Bandwidth:**

GMSK mode (2W) 12.5KHz Channel Spacing:

| Channel | Frequency (MHz) | 26dB Bandwidth (KHz) | 99% Occupied Bandwidth (KHz) | 99% Occupied Bandwidth Limit (KHz) | Result |
|---------|-----------------|----------------------|------------------------------|------------------------------------|--------|
| Low     | 410.050         | 6.300                | 4.922                        | 11.25                              | PASS   |
| Mid     | 440.000         | 6.289                | 4.918                        | 11.25                              | PASS   |
| High    | 469.950         | 6.292                | 4.925                        | 11.25                              | PASS   |

GMSK mode (2W) 25KHz Channel Spacing:

| Channel | Frequency (MHz) | 26dB Bandwidth (KHz) | 99% Occupied Bandwidth (KHz) | 99% Occupied Bandwidth Limit (KHz) | Result |
|---------|-----------------|----------------------|------------------------------|------------------------------------|--------|
| Low     | 410.050         | 12.35                | 9.874                        | 20                                 | PASS   |
| Mid     | 440.000         | 12.34                | 9.870                        | 20                                 | PASS   |
| High    | 469.950         | 12.34                | 9.870                        | 20                                 | PASS   |

## GMSK mode (1W) 12.5KHz Channel Spacing:

| Channel | Frequency (MHz) | 26dB Bandwidth (KHz) | 99% Occupied Bandwidth (KHz) | 99% Occupied Bandwidth Limit (KHz) | Result |
|---------|-----------------|----------------------|------------------------------|------------------------------------|--------|
| Low     | 410.050         | 6.295                | 4.917                        | 11.25                              | PASS   |
| Mid     | 440.000         | 6.281                | 4.918                        | 11.25                              | PASS   |
| High    | 469.950         | 6.296                | 4.921                        | 11.25                              | PASS   |

## GMSK mode (1W) 25KHz Channel Spacing:

| Channel | Frequency (MHz) | 26dB Bandwidth (KHz) | 99% Occupied Bandwidth (KHz) | 99% Occupied Bandwidth Limit (KHz) | Result |
|---------|-----------------|----------------------|------------------------------|------------------------------------|--------|
| Low     | 410.050         | 12.32                | 9.866                        | 20                                 | PASS   |
| Mid     | 440.000         | 12.35                | 9.881                        | 20                                 | PASS   |
| High    | 469.950         | 12.34                | 9.863                        | 20                                 | PASS   |

**Emission Mask:**

| GMSK mode (2W) 12.5KHz Channel Spacing: |                 |                 |       |        |
|-----------------------------------------|-----------------|-----------------|-------|--------|
| Channel                                 | Frequency (MHz) | Applicable Mask | RBW   | Result |
| Low                                     | 410.050         | D               | 100Hz | PASS   |
| Mid                                     | 440.000         | D               | 100Hz | PASS   |
| High                                    | 469.950         | D               | 100Hz | PASS   |

| GMSK mode (2W) 25KHz Channel Spacing: |                 |                 |       |        |
|---------------------------------------|-----------------|-----------------|-------|--------|
| Channel                               | Frequency (MHz) | Applicable Mask | RBW   | Result |
| Low                                   | 410.050         | C               | 300Hz | PASS   |
| Mid                                   | 440.000         | C               | 300Hz | PASS   |
| High                                  | 469.950         | C               | 300Hz | PASS   |



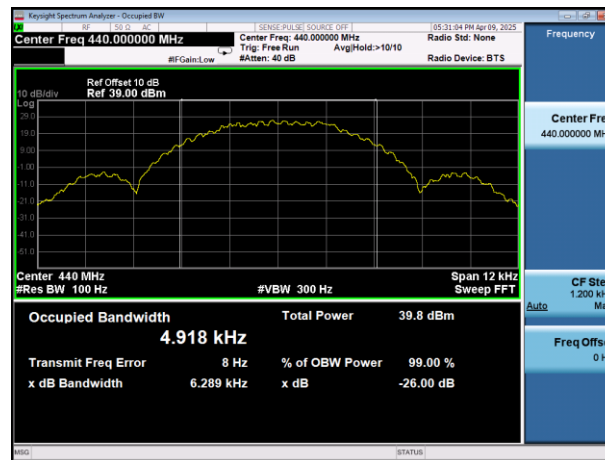
Test plots as follows:

### GMSK mode (2W) 12.5KHz Channel Spacing: Occupied Bandwidth

Low: 410.050MHz



Mid: 440.000MHz

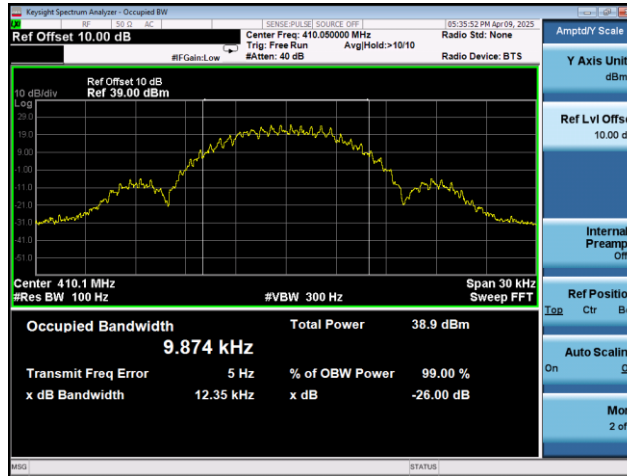


High: 470.00MHz



**GMSK mode (2W) 25KHz Channel Spacing: Occupied Bandwidth**

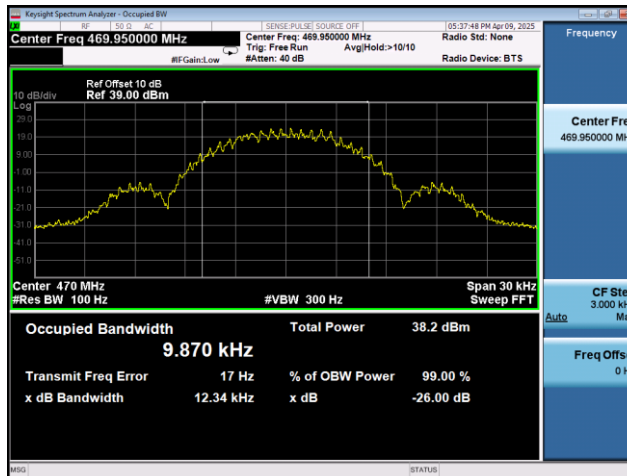
Low: 410.050MHz



Mid: 440.000MHz



High: 469.850MHz



**GMSK mode (1W) 12.5KHz Channel Spacing: Occupied Bandwidth**

Low: 410.050MHz



Mid: 440.000MHz

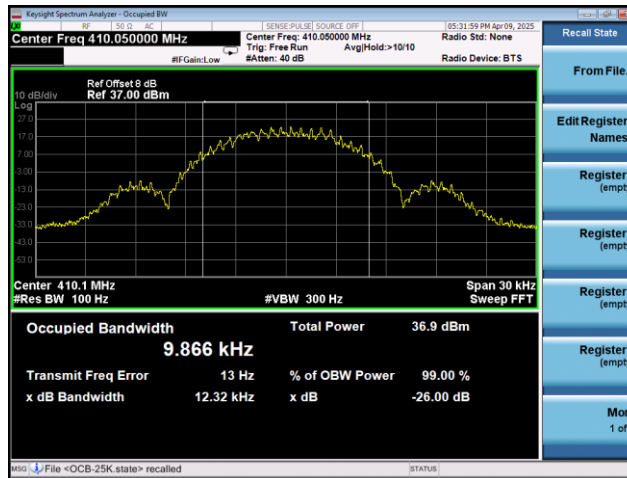


High: 470.00MHz

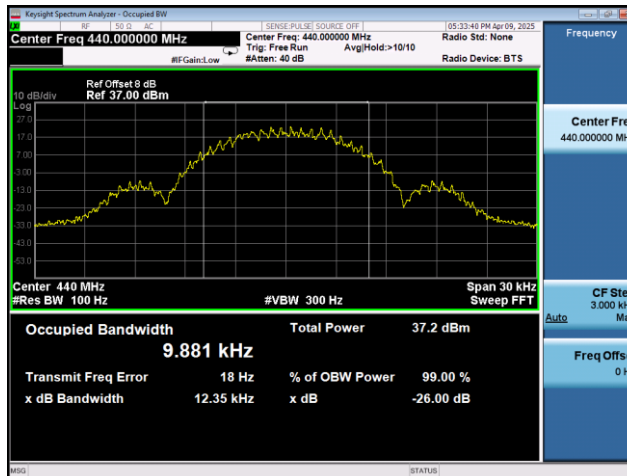


**GMSK mode (1W) 25KHz Channel Spacing: Occupied Bandwidth**

Low: 410.050MHz



Mid: 440.000MHz

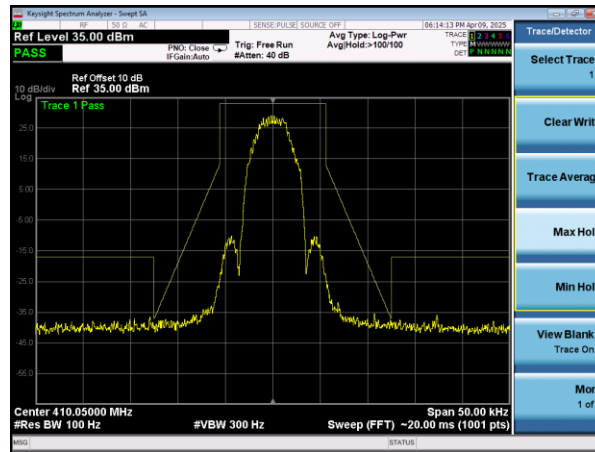


High: 469.850MHz

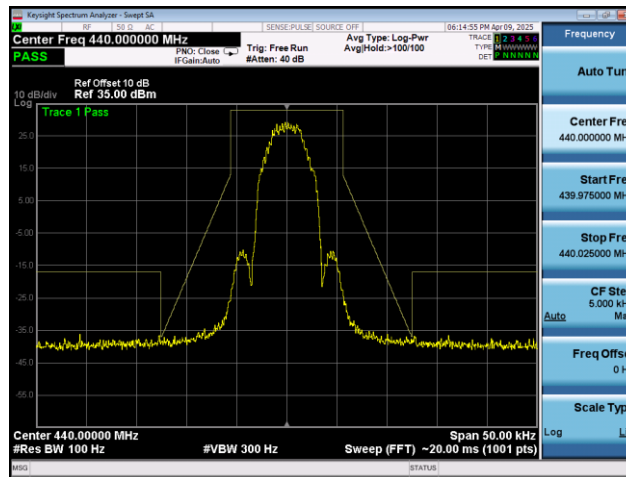


**GMSK mode (2W) 12.5KHz Channel Spacing: Emission Mask**

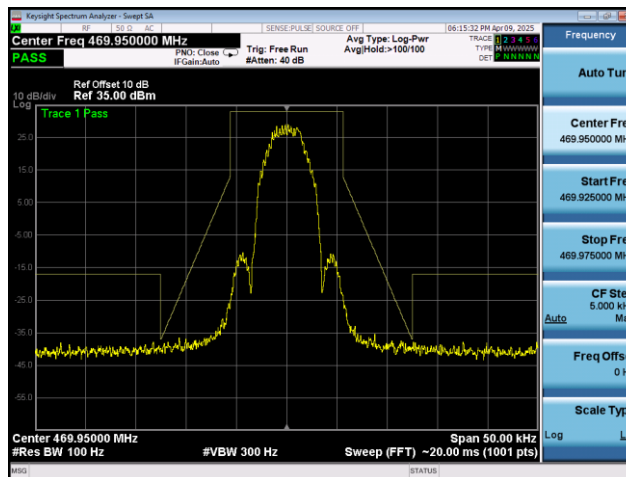
Low: 410.050MHz



Mid: 440.000MHz

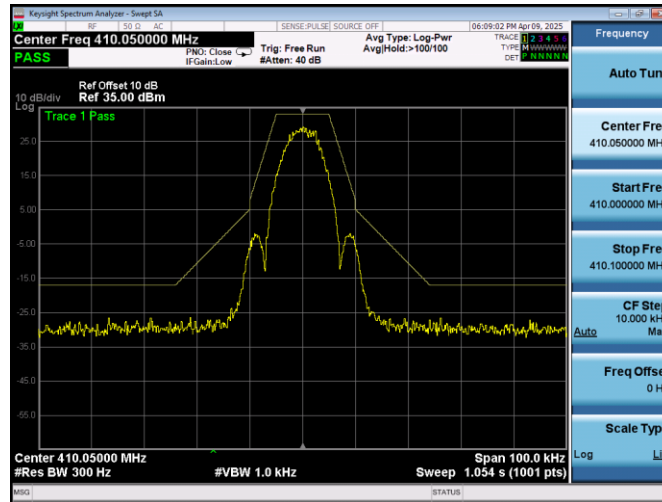


High: 469.950MHz

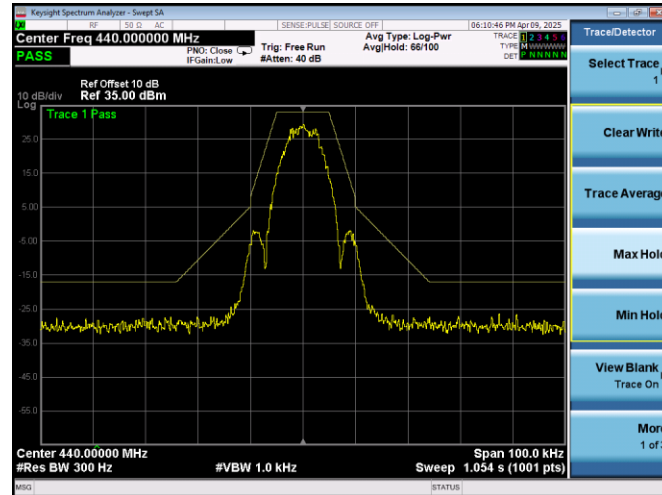


**GMSK mode (2W) 25KHz Channel Spacing: Emission Mask**

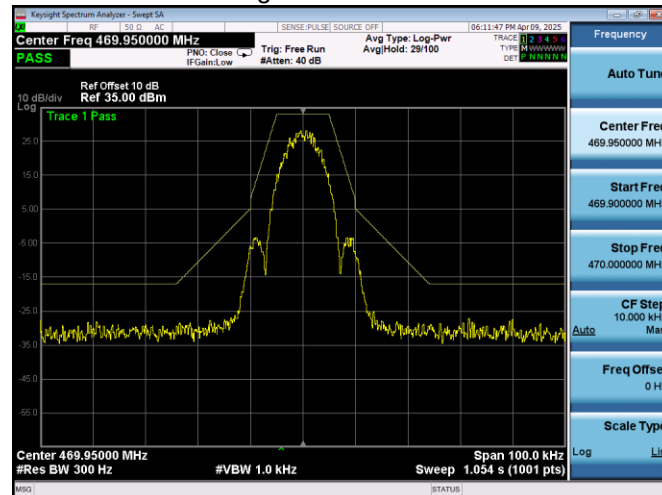
Low: 410.050MHz



Mid: 440.000MHz

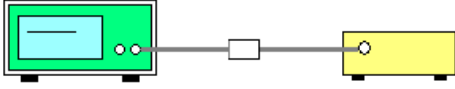


High: 469.950MHz



### 3.3. Spurious Emissions(conducted)

#### 3.3.1. Test Specification

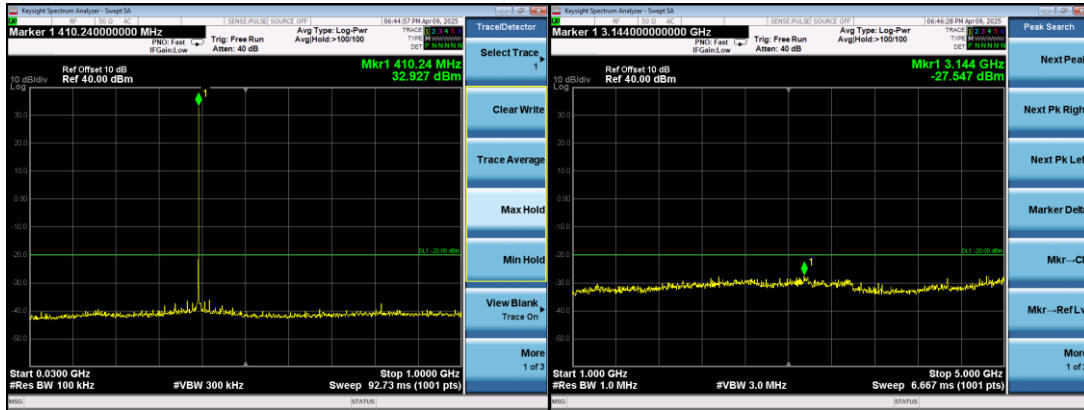
|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirement:</b> | FCC Part 90.210                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Test Setup:</b>       |  <p style="text-align: center;">Spectrum Analyzer                      EUT</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Test Limit:</b>       | <p>Modulation Type: GMSK<br/> FCC Part 22.359, 74.462, 80.211 and 90.210:<br/> For 6.25 bandwidth:<br/> On any frequency removed from the center of the authorized bandwidth by a displacement frequency (<math>f_d</math> in kHz) of more than 4.6 kHz at least: <math>55 + 10 \log(P)</math> or 65 dB, whichever is the lesser attenuation.<br/> Calculation: Limit (dBm) = <math>EL - 55 - 10 \log_{10}(TP)</math><br/> Notes: EL is the emission level of the Output Power expressed in dBm,<br/> For 12.5 bandwidth:<br/> On any frequency removed from the center of the authorized bandwidth by a displacement frequency (<math>f_d</math> in kHz) of more than 12.5 kHz at least: <math>50 + 10 \log(P)</math> dB or 70 dB, whichever is the lesser attenuation.<br/> <math>50 + 10 \log(P_{watts}) = 50 + 10 \log(2) = 53.010</math> dB<br/> Note: In general, the worst case attenuation requirement shown above was applied.<br/> Calculation: Limit (dBm) = <math>EL - 50 - 10 \log_{10}(TP)</math><br/> Notes: EL is the emission level of the Output Power expressed in dBm,<br/> In this application, the EL is 33.01 dBm for High rated power.<br/> Limit (dBm) = <math>33.01 - 50 - 10 \log(2) = -20</math> dBm<br/> For 25 kHz bandwidth:<br/> On any frequency removed from the center of the authorized bandwidth by a displacement frequency (<math>f_d</math> in kHz) of more than 62.5 kHz at least:<br/> <math>43 + 10 \log(P_{watts}) = 43 + 10 \log(2) = 46.010</math> dB<br/> Note: In general, the worst case attenuation requirement shown above was applied.<br/> Calculation: Limit (dBm) = <math>EL - 43 - 10 \log_{10}(TP)</math><br/> In this application, the EL is 33.01 dBm for High rated power.<br/> Limit (dBm) = <math>33.01 - 43 - 10 \log(2) = -13</math> dBm<br/> Note: 1. In general, the worst case attenuation requirement shown above was applied.<br/> For emission inside from the center of the authorized bandwidth by a displacement frequency (<math>f_d</math> in kHz) of channel spacing, emission mask limit should be compliant.<br/> 2. The measurement frequency range from 9 KHz to 5 GHz.<br/> 3. *** means that the emission level is too low to be measured or at least 20 dB down than the limit.<br/> 4. ERP for below 1GHz and EIRP above 1GHz.</p> |
| <b>Test Result:</b>      | PASS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## 3.3.2. Test Data

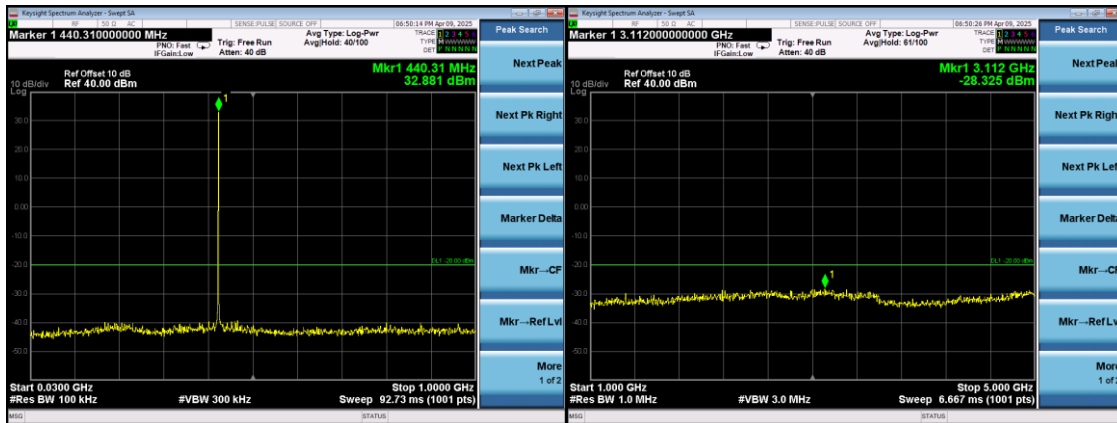
Test plots as follows:

## GMSK 12.5KHz Channel Spacing:

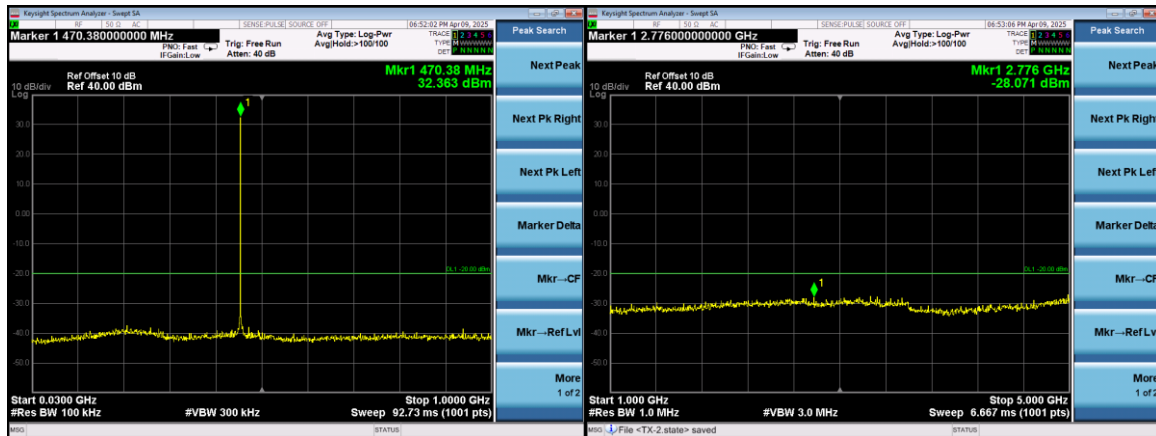
Low: 410.050MHz



Mid: 440.000MHz



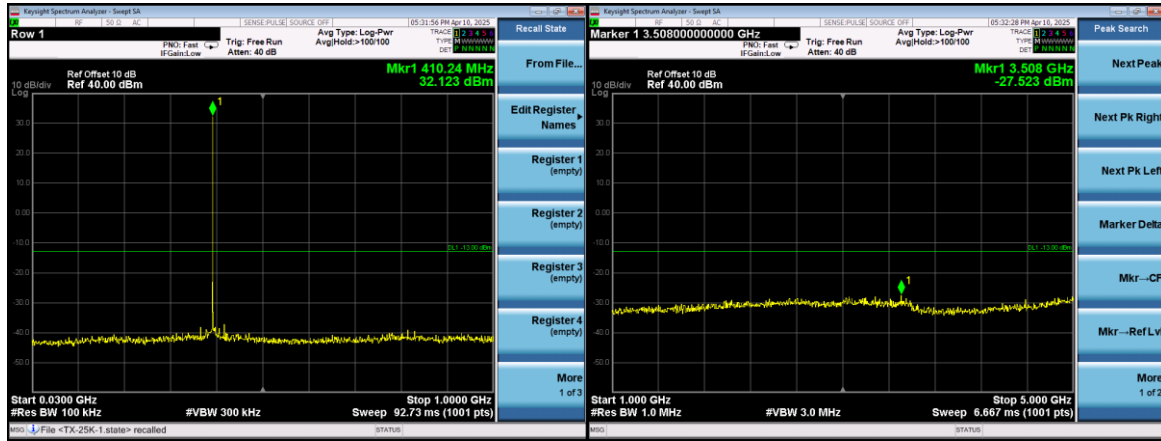
High: 469.950MHz



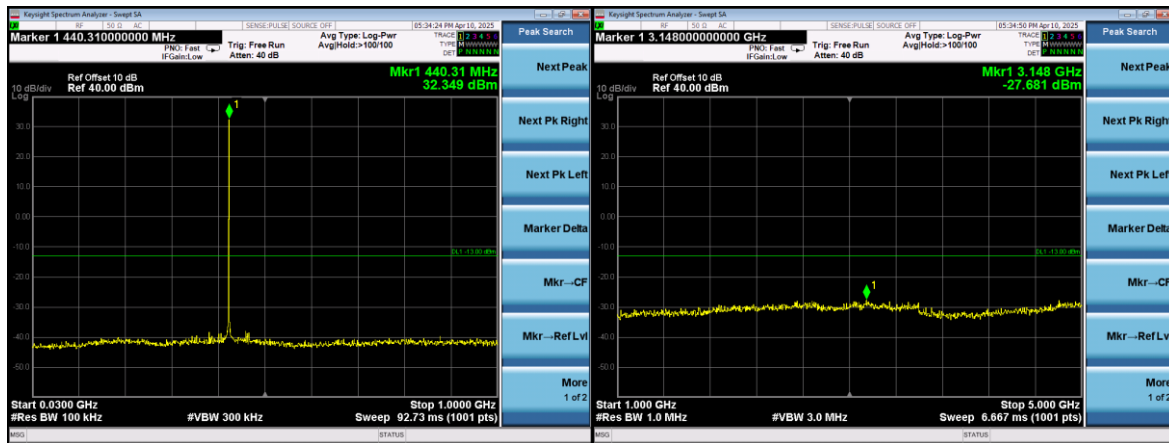


## GMSK 25KHz Channel Spacing:

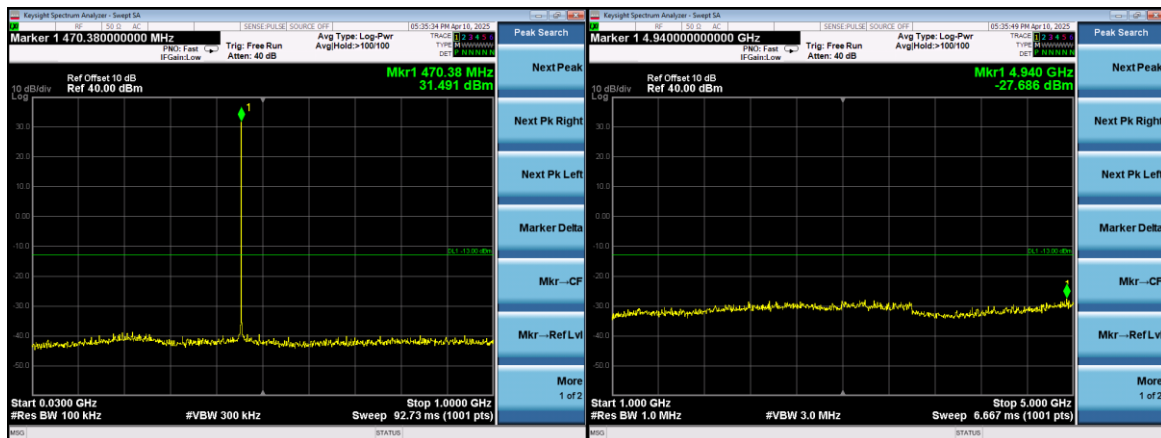
Low: 410.050MHz



Mid: 440.000MHz

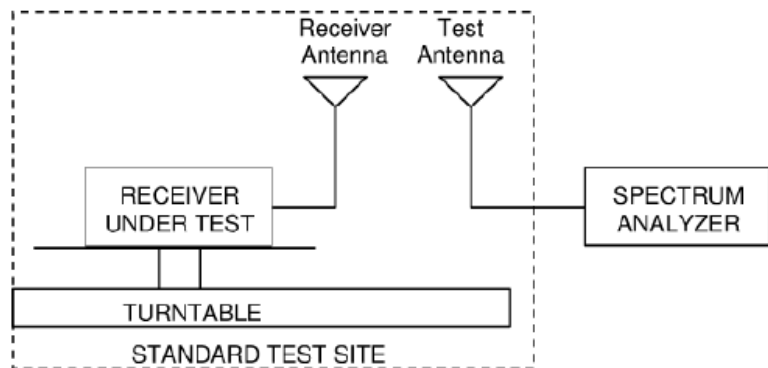


High: 469.950MHz



### 3.4. Radiated Spurious Emission

#### 3.4.1. Test Specification

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|-----|--------------|-------|------|---------------|------|-------|------------|--------|--------|------------|------|------|
| Test Requirement:     | FCC Part 90.210                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| Test Method:          | ANSI C63.26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| Measurement Distance: | 3 m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| Antenna Polarization: | Horizontal & Vertical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| Operation mode:       | Refer to item 4.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| Receiver Setup:       | <table><tr><td>Frequency</td><td>RBW</td><td>VBW</td></tr><tr><td>9kHz- 150kHz</td><td>200Hz</td><td>1kHz</td></tr><tr><td>150kHz- 30MHz</td><td>9kHz</td><td>30kHz</td></tr><tr><td>30MHz-1GHz</td><td>100KHz</td><td>300KHz</td></tr><tr><td>Above 1GHz</td><td>1MHz</td><td>3MHz</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Frequency | RBW | VBW | 9kHz- 150kHz | 200Hz | 1kHz | 150kHz- 30MHz | 9kHz | 30kHz | 30MHz-1GHz | 100KHz | 300KHz | Above 1GHz | 1MHz | 3MHz |
| Frequency             | RBW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | VBW       |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| 9kHz- 150kHz          | 200Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1kHz      |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| 150kHz- 30MHz         | 9kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 30kHz     |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| 30MHz-1GHz            | 100KHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 300KHz    |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| Above 1GHz            | 1MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3MHz      |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| Limit:                | <p>For equipment using 25 kHz channel spacing, on any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least <math>43 + 10\log (P)</math> dB.</p> <p>For equipment using 12.5 kHz channel spacing, on any frequency removed from the center of</p> <p>The authorized bandwidth by a displacement frequency (<math>f_d</math> in kHz) of more than 12.5 kHz: At least <math>50 + 10 \log(P)</math> dB or 70 dB, whichever is the lesser attenuation.</p> <p>For equipment using 6.25 kHz channel spacing, On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least <math>55 + 10 \log (P)</math> or 65 dB, whichever is the lesser attenuation.</p> |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| Test setup:           |  <p>The diagram illustrates the test setup within a 'STANDARD TEST SITE' (indicated by a dashed box). A 'RECEIVER UNDER TEST' is positioned on a 'TURNTABLE'. A 'Receiver Antenna' is connected to the receiver, and a 'Test Antenna' is connected to a 'SPECTRUM ANALYZER'. The receiver and antenna are connected by a line, and the test antenna is also connected to the spectrum analyzer.</p>                                                                                                                                                                                                                                                                             |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |
| Test Procedure:       | <p>The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.</p> <p>The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT .The test was performed by placing the EUT on 3-orthogonal axis.</p>                                                                                                                                                                                                                                                                                                    |           |     |     |              |       |      |               |      |       |            |        |        |            |      |      |

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | <p>The frequency range up to teeth harmonic of the fundamental frequency was investigated.</p> <p>Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.</p> <p>Spurious emissions in dB =10, 1g (TXpwr in Watts/0.001)-the absolute level</p> |
| <b>Test results:</b> | PASS                                                                                                                                                                                                                                                                                                                                                                                                                     |

## 3.4.2.Test Data

**GMSK:**

Test Mode: Low: 410.050MHz, Channel Spacing 12.5KHz

| Frequency<br>(MHz) | Reading<br>level<br>(dBm) | Antenna<br>Polarization | Cable loss<br>(dB) | Ant.Gain<br>(dBi) | Emission<br>level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|---------------------------|-------------------------|--------------------|-------------------|----------------------------|----------------|----------------|
| 151.128            | -93.734                   | V                       | 0.24               | 31.35             | -62.624                    | -20            | -42.624        |
| 359.162            | -89.452                   | V                       | 0.26               | 31.34             | -58.372                    | -20            | -38.372        |
| 673.583            | -93.685                   | V                       | 0.42               | 31.24             | -62.865                    | -20            | -42.865        |
| 820.701            | -96.531                   | V                       | 0.58               | 30.71             | -66.401                    | -20            | -46.401        |
| 1229.149           | -86.696                   | V                       | 1.23               | 26.38             | -61.546                    | -20            | -41.546        |
| 3863.648           | -79.531                   | V                       | 1.68               | 25.47             | -55.741                    | -20            | -35.741        |
| 283.933            | -94.761                   | H                       | 0.43               | 31.24             | -63.951                    | -20            | -43.951        |
| 397.648            | -94.516                   | H                       | 0.45               | 30.68             | -64.286                    | -20            | -44.286        |
| 674.671            | -97.053                   | H                       | 0.64               | 30.85             | -66.843                    | -20            | -46.843        |
| 820.859            | -101.063                  | H                       | 0.79               | 31.12             | -70.733                    | -20            | -50.733        |
| 1230.847           | -85.177                   | H                       | 1.29               | 26.12             | -60.347                    | -20            | -40.347        |
| 3258.142           | -80.887                   | H                       | 1.62               | 25.41             | -57.097                    | -20            | -37.097        |

Test Mode: Mid: 440.000MHz, Channel Spacing 12.5KHz

| Frequency<br>(MHz) | Reading<br>level<br>(dBm) | Antenna<br>Polarization | Cable loss<br>(dB) | Ant.Gain<br>(dBi) | Emission<br>level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|---------------------------|-------------------------|--------------------|-------------------|----------------------------|----------------|----------------|
| 153.202            | -97.515                   | V                       | 0.24               | 31.35             | -66.405                    | -20            | -46.405        |
| 364.390            | -94.420                   | V                       | 0.26               | 31.34             | -63.340                    | -20            | -43.340        |
| 670.475            | -96.202                   | V                       | 0.42               | 31.24             | -65.382                    | -20            | -45.382        |
| 882.227            | -94.698                   | V                       | 0.58               | 30.71             | -64.568                    | -20            | -44.568        |
| 1320.118           | -83.934                   | V                       | 1.23               | 26.38             | -58.784                    | -20            | -38.784        |
| 3858.896           | -77.066                   | V                       | 1.68               | 25.47             | -53.276                    | -20            | -33.276        |
| 289.362            | -95.840                   | H                       | 0.43               | 31.24             | -65.030                    | -20            | -45.030        |
| 397.590            | -96.267                   | H                       | 0.45               | 30.68             | -66.037                    | -20            | -46.037        |
| 685.032            | -102.075                  | H                       | 0.64               | 30.85             | -71.865                    | -20            | -51.865        |
| 878.958            | -100.806                  | H                       | 0.79               | 31.12             | -70.476                    | -20            | -50.476        |
| 1319.100           | -80.650                   | H                       | 1.29               | 26.12             | -55.820                    | -20            | -35.820        |
| 3262.627           | -81.886                   | H                       | 1.62               | 25.41             | -58.096                    | -20            | -38.096        |

Test Mode: High: 469.950MHz, Channel Spacing 12.5KHz

| Frequency<br>(MHz) | Reading<br>level<br>(dBm) | Antenna<br>Polarization | Cable loss<br>(dB) | Ant.Gain<br>(dBi) | Emission<br>level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|---------------------------|-------------------------|--------------------|-------------------|----------------------------|----------------|----------------|
| 152.841            | -92.790                   | V                       | 0.24               | 31.35             | -61.680                    | -20            | -41.680        |
| 362.970            | -94.090                   | V                       | 0.26               | 31.34             | -63.010                    | -20            | -43.010        |
| 672.530            | -98.389                   | V                       | 0.42               | 31.24             | -67.569                    | -20            | -47.569        |
| 939.266            | -97.334                   | V                       | 0.58               | 30.71             | -67.204                    | -20            | -47.204        |
| 1410.473           | -86.925                   | V                       | 1.23               | 26.38             | -61.775                    | -20            | -41.775        |
| 3858.938           | -81.367                   | V                       | 1.68               | 25.47             | -57.577                    | -20            | -37.577        |
| 293.506            | -97.324                   | H                       | 0.43               | 31.24             | -66.514                    | -20            | -46.514        |
| 404.037            | -95.274                   | H                       | 0.45               | 30.68             | -65.044                    | -20            | -45.044        |
| 678.666            | -98.121                   | H                       | 0.64               | 30.85             | -67.911                    | -20            | -47.911        |
| 938.617            | -97.228                   | H                       | 0.79               | 31.12             | -66.898                    | -20            | -46.898        |
| 1412.424           | -84.262                   | H                       | 1.29               | 26.12             | -59.432                    | -20            | -39.432        |
| 3265.993           | -80.684                   | H                       | 1.62               | 25.41             | -56.894                    | -20            | -36.894        |

Test Mode: Low: 410.050MHz, Channel Spacing 25KHz

| Frequency<br>(MHz) | Reading<br>level<br>(dBm) | Antenna<br>Polarization | Cable loss<br>(dB) | Ant.Gain<br>(dBi) | Emission<br>level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|---------------------------|-------------------------|--------------------|-------------------|----------------------------|----------------|----------------|
| 150.319            | -96.812                   | V                       | 0.24               | 31.35             | -65.702                    | -13            | -52.702        |
| 363.064            | -89.500                   | V                       | 0.26               | 31.34             | -58.420                    | -13            | -45.420        |
| 673.109            | -94.514                   | V                       | 0.42               | 31.24             | -63.694                    | -13            | -50.694        |
| 823.295            | -96.289                   | V                       | 0.58               | 30.71             | -66.159                    | -13            | -53.159        |
| 1233.429           | -83.241                   | V                       | 1.23               | 26.38             | -58.091                    | -13            | -45.091        |
| 3858.867           | -83.179                   | V                       | 1.68               | 25.47             | -59.389                    | -13            | -46.389        |
| 287.590            | -95.954                   | H                       | 0.43               | 31.24             | -65.144                    | -13            | -52.144        |
| 400.394            | -95.184                   | H                       | 0.45               | 30.68             | -64.954                    | -13            | -51.954        |
| 680.461            | -95.738                   | H                       | 0.64               | 30.85             | -65.528                    | -13            | -52.528        |
| 822.239            | -94.402                   | H                       | 0.79               | 31.12             | -64.072                    | -13            | -51.072        |
| 1231.196           | -82.499                   | H                       | 1.29               | 26.12             | -57.669                    | -13            | -44.669        |
| 3259.233           | -79.874                   | H                       | 1.62               | 25.41             | -56.084                    | -13            | -43.084        |

Test Mode; Mid: 440.000MHz, Channel Spacing 25KHz

| Frequency<br>(MHz) | Reading<br>level<br>(dBm) | Antenna<br>Polarization | Cable loss<br>(dB) | Ant.Gain<br>(dBi) | Emission<br>level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|---------------------------|-------------------------|--------------------|-------------------|----------------------------|----------------|----------------|
| 159.234            | -97.818                   | V                       | 0.24               | 31.35             | -66.708                    | -13            | -53.708        |
| 360.472            | -93.957                   | V                       | 0.26               | 31.34             | -62.877                    | -13            | -49.877        |
| 669.505            | -95.077                   | V                       | 0.42               | 31.24             | -64.257                    | -13            | -51.257        |
| 878.975            | -93.760                   | V                       | 0.58               | 30.71             | -63.630                    | -13            | -50.630        |
| 1321.296           | -82.319                   | V                       | 1.23               | 26.38             | -57.169                    | -13            | -44.169        |
| 3861.709           | -80.924                   | V                       | 1.68               | 25.47             | -57.134                    | -13            | -44.134        |
| 284.968            | -96.779                   | H                       | 0.43               | 31.24             | -65.969                    | -13            | -52.969        |
| 404.300            | -97.089                   | H                       | 0.45               | 30.68             | -66.859                    | -13            | -53.859        |
| 683.604            | -95.950                   | H                       | 0.64               | 30.85             | -65.740                    | -13            | -52.740        |
| 880.190            | -96.235                   | H                       | 0.79               | 31.12             | -65.905                    | -13            | -52.905        |
| 1320.709           | -84.552                   | H                       | 1.29               | 26.12             | -59.722                    | -13            | -46.722        |
| 3263.840           | -80.207                   | H                       | 1.62               | 25.41             | -56.417                    | -13            | -42.260        |

Test Mode: High: 469.950MHz, Channel Spacing 25KHz

| Frequency<br>(MHz) | Reading<br>level<br>(dBm) | Antenna<br>Polarization | Cable loss<br>(dB) | Ant.Gain<br>(dBi) | Emission<br>level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------|---------------------------|-------------------------|--------------------|-------------------|----------------------------|----------------|----------------|
| 154.471            | -98.253                   | V                       | 0.24               | 31.35             | -67.143                    | -13            | -54.143        |
| 363.672            | -94.859                   | V                       | 0.26               | 31.34             | -63.779                    | -13            | -50.779        |
| 669.312            | -94.952                   | V                       | 0.42               | 31.24             | -64.132                    | -13            | -51.132        |
| 938.826            | -98.097                   | V                       | 0.58               | 30.71             | -67.967                    | -13            | -54.967        |
| 1406.656           | -81.324                   | V                       | 1.23               | 26.38             | -56.174                    | -13            | -43.174        |
| 3858.609           | -78.738                   | V                       | 1.68               | 25.47             | -54.948                    | -13            | -41.948        |
| 286.906            | -97.897                   | H                       | 0.43               | 31.24             | -67.087                    | -13            | -54.087        |
| 400.898            | -99.750                   | H                       | 0.45               | 30.68             | -69.520                    | -13            | -56.520        |
| 679.428            | -95.694                   | H                       | 0.64               | 30.85             | -65.484                    | -13            | -52.484        |
| 937.527            | -102.071                  | H                       | 0.79               | 31.12             | -71.741                    | -13            | -58.741        |
| 1407.343           | -83.322                   | H                       | 1.29               | 26.12             | -58.492                    | -13            | -45.492        |
| 3261.449           | -79.651                   | H                       | 1.62               | 25.41             | -55.861                    | -13            | -42.861        |

### 3.5. Transient Frequency Behavior

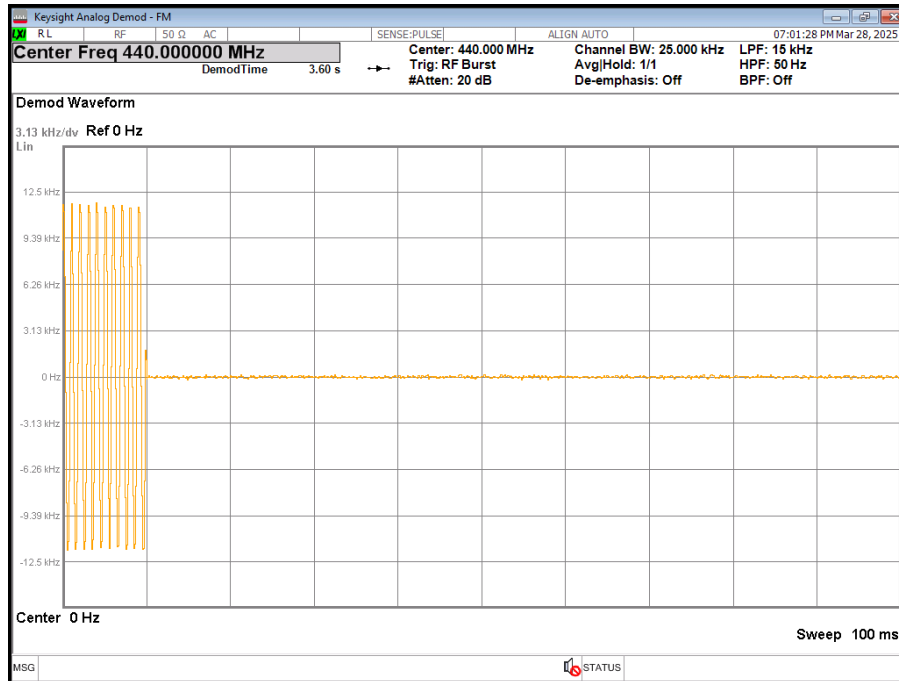
#### 3.5.1. Test Specification

|                          |                                                                                                                                                                                                                                                                                                |                             |                                    |                               |               |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------|-------------------------------|---------------|
| <b>Test Requirement:</b> | FCC Part 90.214                                                                                                                                                                                                                                                                                |                             |                                    |                               |               |
| <b>Test Setup:</b>       |  <p style="text-align: center;">Oscilloscope                      EUT</p>                                                                                                                                    |                             |                                    |                               |               |
| <b>Test Limit</b>        | Channel Bandwidth (kHz)                                                                                                                                                                                                                                                                        | Time Intervals (Notes 1, 2) | Maximum Frequency Difference (kHz) | Transient Duration Limit (ms) |               |
|                          |                                                                                                                                                                                                                                                                                                |                             |                                    | 138-174 MHz                   | 406.1-512 MHz |
| 25                       | t <sub>1</sub>                                                                                                                                                                                                                                                                                 |                             | ±25                                | 5                             | 10            |
|                          |                                                                                                                                                                                                                                                                                                | t <sub>2</sub>              | ±12.5                              | 20                            | 25            |
|                          |                                                                                                                                                                                                                                                                                                | t <sub>3</sub>              | ±25                                | 5                             | 10            |
|                          | 12.5                                                                                                                                                                                                                                                                                           | t <sub>1</sub>              | ±12.5                              | 5                             | 10            |
|                          |                                                                                                                                                                                                                                                                                                | t <sub>2</sub>              | ±6.25                              | 20                            | 25            |
|                          |                                                                                                                                                                                                                                                                                                | t <sub>3</sub>              | ±12.5                              | 5                             | 10            |
|                          | 6.25                                                                                                                                                                                                                                                                                           | t <sub>1</sub>              | ±6.25                              | 5                             | 10            |
|                          |                                                                                                                                                                                                                                                                                                | t <sub>2</sub>              | ±3.125                             | 20                            | 25            |
|                          |                                                                                                                                                                                                                                                                                                | t <sub>3</sub>              | ±6.25                              | 5                             | 10            |
| <b>Test Procedure:</b>   | The EUT was set in the climate chamber and connected to an external DC power supply and AC power supply. The RF output was directly connected to Oscilloscope. The coupling loss of the additional cables was recorded and taken in account for all the measurements. The result was recorded. |                             |                                    |                               |               |
| <b>Test Result:</b>      | PASS                                                                                                                                                                                                                                                                                           |                             |                                    |                               |               |

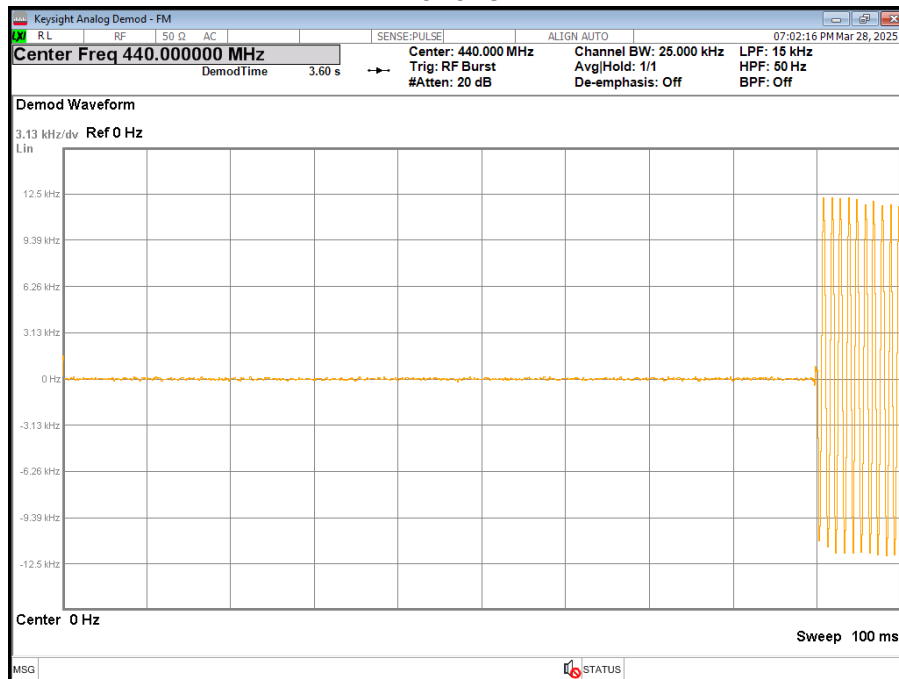


## 3.5.2. Test Data

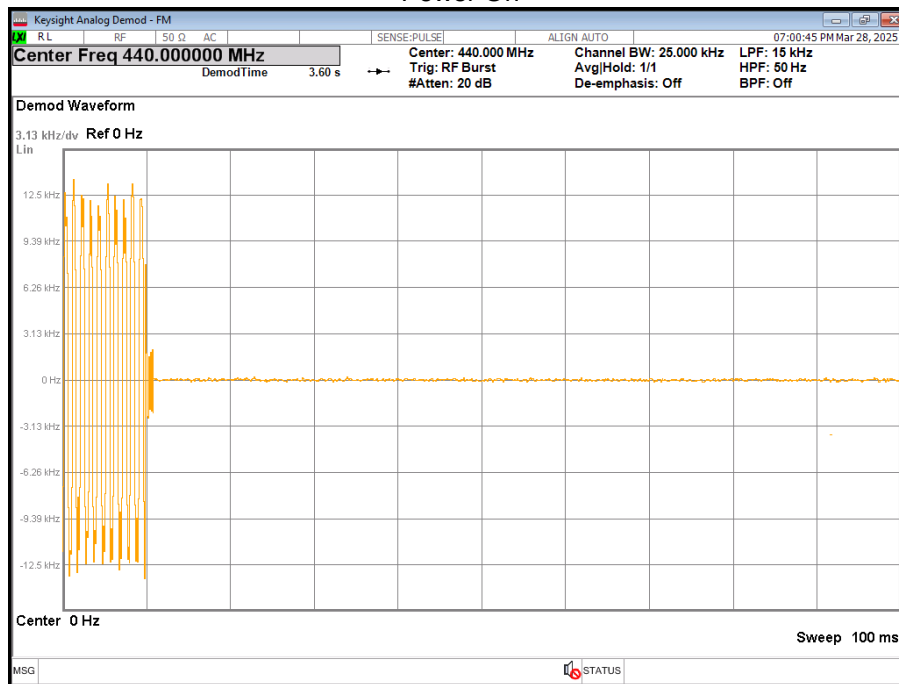
Test Plots for channel spacing 12.5KHz, EUT power setting: Maximum.  
Power On



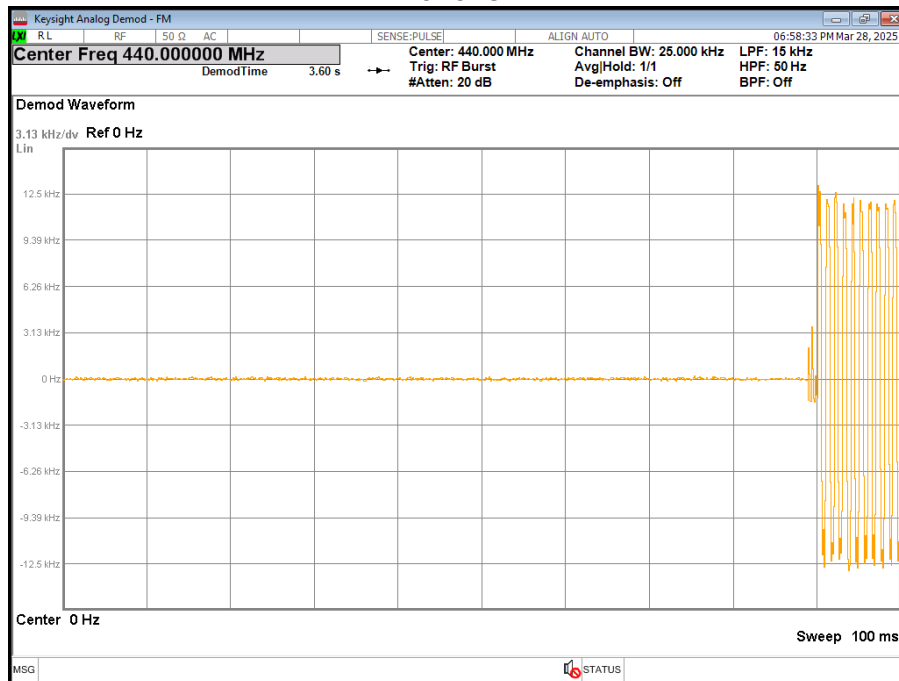
Power Off



Test Plots for channel spacing 25KHz, EUT power setting: Maximum.  
Power On



Power Off



### 3.6. Behavior Frequency Stability

#### 3.6.1. Test Specification

|                          |                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirement:</b> | FCC Part 90.213                                                                                                                                                                                                                                                                                                                                       |
| <b>Test Method:</b>      | ANSI C63.26                                                                                                                                                                                                                                                                                                                                           |
| <b>Test Setup:</b>       | <pre> graph LR     Laptop[Laptop] --- EUT[Equipment Under Test]     EUT --- ACDC[AC/DC Adapter]     EUT --- Att[Attenuator(s)]     Att --- MC[Mini-Circuit Combiner]     MC --- RFCS[RF Communication Test Set]     MC --- MA[Modulation Analyzer]     MA --- RF[RF Detector]     RF --- HPO[Hewlett Packard Infinium Digitizing Oscilloscope] </pre> |
| <b>Test Procedure:</b>   | <p>Method of Measurement:</p> <p>After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded. For Frequency stability Vs. Voltage the EUT was connected to a DC power supply or AC power supply and the voltage was adjusted in the required ranges.</p>    |
| <b>Test Result:</b>      | PASS                                                                                                                                                                                                                                                                                                                                                  |

## 3.6.2. Test Data

| Conclusion: PASS                             |             |                      |                       |
|----------------------------------------------|-------------|----------------------|-----------------------|
| Mode                                         | Voltage (V) | Frequency error (Hz) | frequency error (ppm) |
| Middle Channel<br>12.5KHz Channel<br>Spacing | 10          | -0.84                | -0.002                |
|                                              | 11          | 25.30                | 0.058                 |
|                                              | 12          | 5.70                 | 0.013                 |
|                                              | 13          | 29.57                | 0.067                 |
|                                              | 14          | -5.04                | -0.011                |
|                                              | 15          | 7.49                 | 0.017                 |
| Limit                                        | 2.5ppm      |                      |                       |
| Middle Channel<br>25KHz Channel<br>Spacing   | 10          | -1.24                | -0.003                |
|                                              | 11          | -0.49                | -0.001                |
|                                              | 12          | 7.07                 | 0.016                 |
|                                              | 13          | 14.87                | 0.034                 |
|                                              | 14          | 14.66                | 0.033                 |
|                                              | 15          | 19.99                | 0.045                 |
| Limit                                        | 5ppm        |                      |                       |

| Mode                                         | Temperature (°C) | Frequency error (Hz) | frequency error (ppm) |
|----------------------------------------------|------------------|----------------------|-----------------------|
| Middle Channel<br>12.5KHz<br>Channel Spacing | -20              | 9.56                 | 0.022                 |
|                                              | -10              | 29.89                | 0.068                 |
|                                              | 0                | 13.36                | 0.030                 |
|                                              | 10               | 20.86                | 0.047                 |
|                                              | 20               | 2.00                 | 0.005                 |
|                                              | 30               | -1.80                | -0.004                |
|                                              | 40               | -7.46                | -0.017                |
|                                              | 50               | 13.04                | 0.030                 |
| Limit                                        | 2.5ppm           |                      |                       |
| Middle Channel<br>25KHz<br>Channel Spacing   | -20              | 12.24                | 0.028                 |
|                                              | -10              | 21.75                | 0.049                 |
|                                              | 0                | 17.94                | 0.041                 |
|                                              | 10               | 15.09                | 0.034                 |
|                                              | 20               | 15.68                | 0.036                 |
|                                              | 30               | 24.37                | 0.055                 |
|                                              | 40               | -9.52                | -0.022                |
|                                              | 50               | -7.21                | -0.016                |
| Limit                                        | 5ppm             |                      |                       |

### 3.7. Modulation Characteristic

|                          |                                                                                                                                                              |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Requirement:</b> | FCC Part 90.207                                                                                                                                              |
| <b>Test Result:</b>      | According to FCC § 2.1047(d), Part 22, 74, 90 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented. |

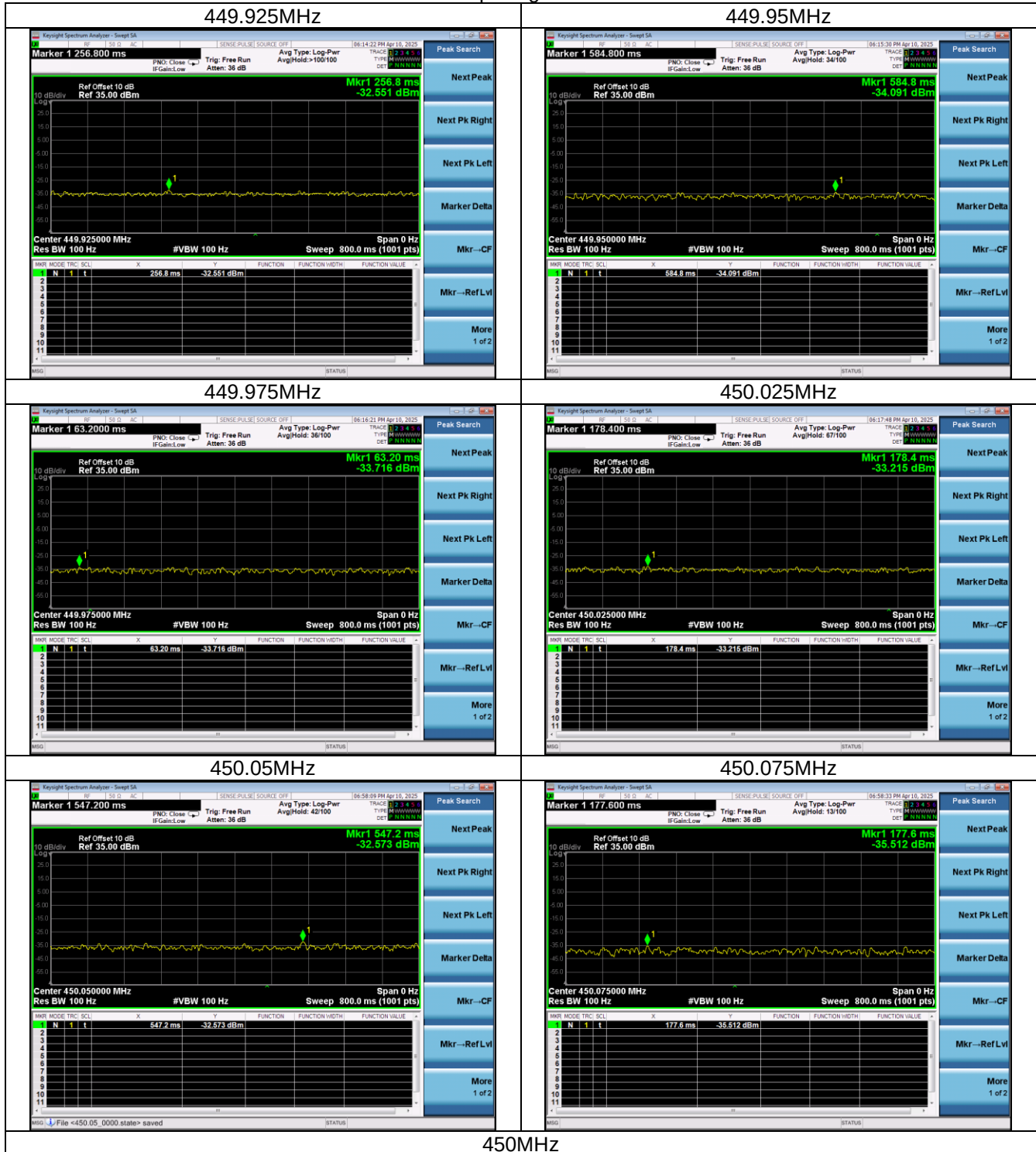
## 3.8. Adjacent Channel Power

| Test Requirement: | FCC Part 90.221                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                            |                                               |                                            |              |          |          |              |          |          |              |          |          |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-----------------------------------------------|--------------------------------------------|--------------|----------|----------|--------------|----------|----------|--------------|----------|----------|
| Test Setup:       | <div></div> <div>Spectrum AnalyzerEUT</div>                                                                                                                                                                                                                                                                                                                                                                                    |                                            |                                               |                                            |              |          |          |              |          |          |              |          |          |
| Test Limit:       | <div>Maximum adjacent power levels for frequencies in the 450–470 MHz band, no need compliance with below -36dBm:</div> <table><thead><tr><th>Frequency offset</th><th>Maximum ACP (dBc) for devices 1 watt and less</th><th>Maximum ACP (dBc) for devices above 1 watt</th></tr></thead><tbody><tr><td>25 kHz .....</td><td>– 55 dBc</td><td>– 60 dBc</td></tr><tr><td>50 kHz .....</td><td>– 70 dBc</td><td>– 70 dBc</td></tr><tr><td>75 kHz .....</td><td>– 70 dBc</td><td>– 70 dBc</td></tr></tbody></table> | Frequency offset                           | Maximum ACP (dBc) for devices 1 watt and less | Maximum ACP (dBc) for devices above 1 watt | 25 kHz ..... | – 55 dBc | – 60 dBc | 50 kHz ..... | – 70 dBc | – 70 dBc | 75 kHz ..... | – 70 dBc | – 70 dBc |
| Frequency offset  | Maximum ACP (dBc) for devices 1 watt and less                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Maximum ACP (dBc) for devices above 1 watt |                                               |                                            |              |          |          |              |          |          |              |          |          |
| 25 kHz .....      | – 55 dBc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | – 60 dBc                                   |                                               |                                            |              |          |          |              |          |          |              |          |          |
| 50 kHz .....      | – 70 dBc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | – 70 dBc                                   |                                               |                                            |              |          |          |              |          |          |              |          |          |
| 75 kHz .....      | – 70 dBc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | – 70 dBc                                   |                                               |                                            |              |          |          |              |          |          |              |          |          |
| Test method:      | The resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the Frequency band 0Kz from the wanted frequency                                                                                                                                                                                                                                                                                                                                                            |                                            |                                               |                                            |              |          |          |              |          |          |              |          |          |
| Test result:      | Pass.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                            |                                               |                                            |              |          |          |              |          |          |              |          |          |

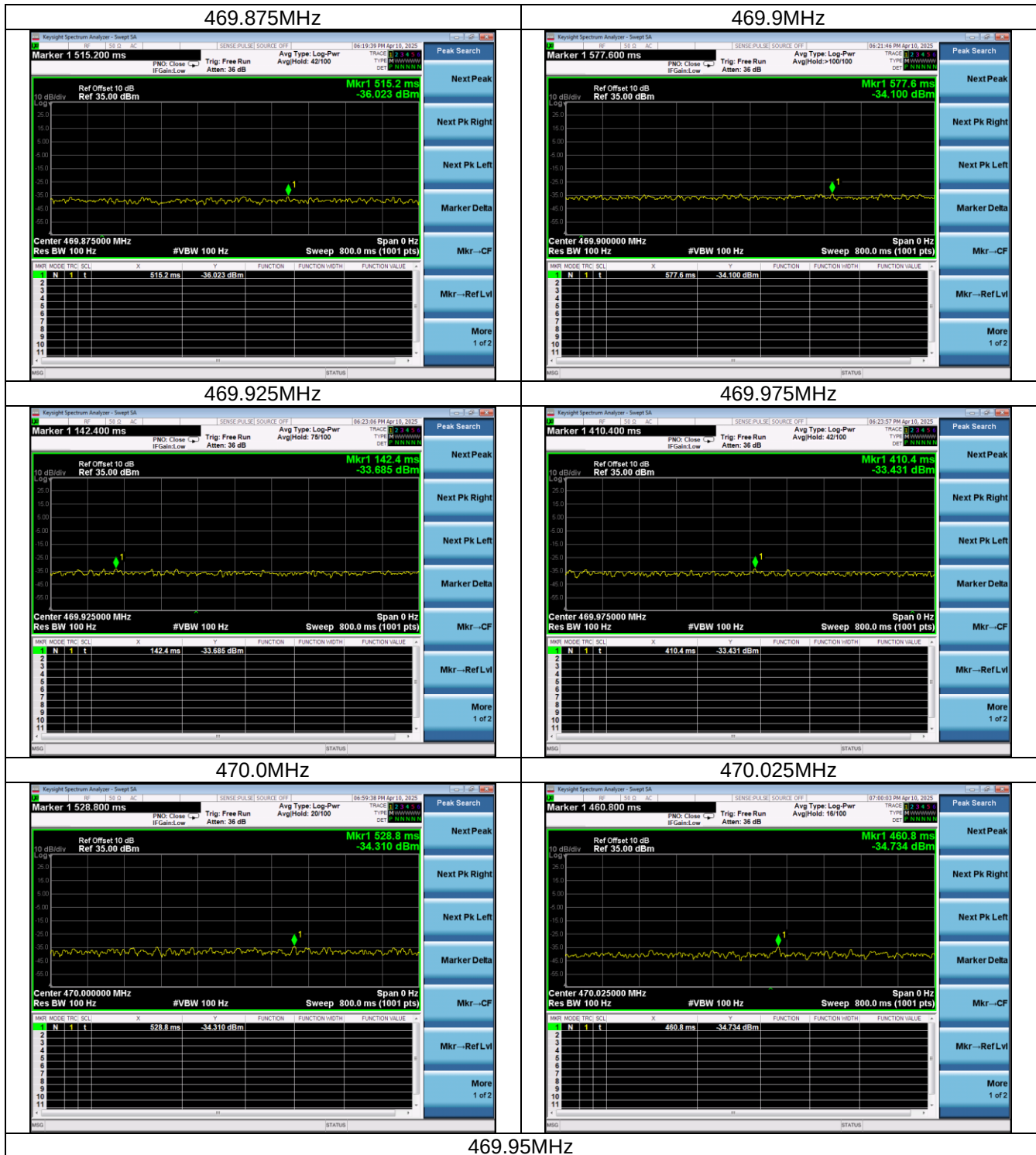
GMSK 25KHz spacing 450MHz-470MHz

| Carrier frequency (MHz) | Test Frequency (MHz) | Test Value (dBm) | Limit (dBm) | Result |
|-------------------------|----------------------|------------------|-------------|--------|
| 450.000                 | 449.925              | -32.551          | 44-70=-26   | PASS   |
|                         | 449.95               | -34.091          | 44-70=-26   | PASS   |
|                         | 449.975              | -33.716          | 44-60=-16   | PASS   |
|                         | 450.025              | -33.215          | 44-60=-16   | PASS   |
|                         | 450.05               | -32.573          | 44-70=-26   | PASS   |
|                         | 450.075              | -35.512          | 44-70=-26   | PASS   |
| 469.950                 | 469.875              | -36.023          | 44-70=-26   | PASS   |
|                         | 469.900              | -34.100          | 44-70=-26   | PASS   |
|                         | 469.925              | -33.685          | 44-60=-16   | PASS   |
|                         | 469.975              | -33.431          | 44-60=-16   | PASS   |
|                         | 470.000              | -34.310          | 44-70=-26   | PASS   |
|                         | 470.025              | -34.734          | 44-70=-26   | PASS   |

## GMSK 25KHz spacing 450MHz-470MHz

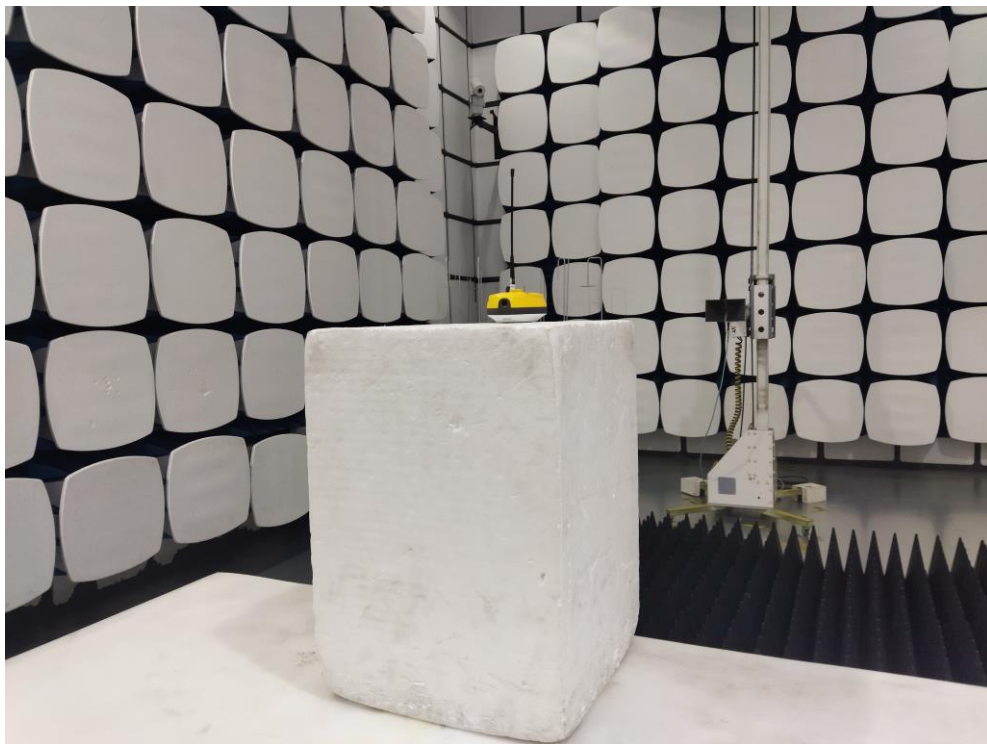






## 4. Test Setup Photo

### 4.1. Photos of Radiated Emission



----- END OF REPORT-----