



## Test Report - FCC PART 90

### Applicant: Ritron, Inc.

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature 10/27/2021

This test report shall not be reproduced except in full without the written and signed permission of Timco Engineering Inc. (IIA). This test report relates only to the items tested as identified and is not valid for any subsequent changes or modifications made to the equipment under test.

## Table of Contents

---

|           |                                                             |           |
|-----------|-------------------------------------------------------------|-----------|
| <b>1.</b> | <b>CUSTOMER INFORMATION.....</b>                            | <b>4</b>  |
| 1.1       | PART 90 TEST RESULT SUMMARY .....                           | 5         |
| <b>2.</b> | <b>LOCATION OF TESTING .....</b>                            | <b>6</b>  |
| 2.1       | TEST LABORATORY .....                                       | 6         |
| 2.1       | TESTING WAS PERFORMED, REVIEWED BY .....                    | 6         |
| <b>3.</b> | <b>TEST SAMPLE(S) (EUT/DUT) .....</b>                       | <b>7</b>  |
| 3.1       | DESCRIPTION OF THE EUT .....                                | 7         |
| 3.2       | CONFIGURATION OF EUT .....                                  | 8         |
| 3.3       | TEST SETUP OF EUT .....                                     | 8         |
| <b>4.</b> | <b>TEST METHODS &amp; APPLICABLE REGULATORY LIMITS.....</b> | <b>9</b>  |
| 4.1       | TEST METHODS/STANDARDS/GUIDANCE: .....                      | 9         |
| 4.2       | APPLIED LIMITS AND REGULATORY LIMITS:.....                  | 9         |
| <b>5.</b> | <b>MEASUREMENT UNCERTAINTY.....</b>                         | <b>9</b>  |
| <b>6.</b> | <b>ENVIRONMENTAL CONDITIONS .....</b>                       | <b>9</b>  |
| 6.1       | TEMPERATURE & HUMIDITY .....                                | 9         |
| <b>7.</b> | <b>LIST OF TEST EQUIPMENT AND TEST FACILITY.....</b>        | <b>10</b> |
| 7.1       | LIST OF TEST EQUIPMENT .....                                | 10        |
| <b>8.</b> | <b>TEST RESULTS .....</b>                                   | <b>11</b> |
| 8.1       | POWER AT THE FINAL AMPLIFIER.....                           | 12        |
| 8.2       | RF OUTPUT POWER .....                                       | 13        |
| 8.2.1     | Test Plot, Power Output, 450.025 MHz .....                  | 14        |
| 8.2.2     | Test Plot, Power Output, 460.025 MHz.....                   | 15        |
| 8.2.3     | Test Plot, Power Output, 464.5 MHz .....                    | 16        |
| 8.2.4     | Test Plot, Power Output, 469.975 MHz.....                   | 17        |
| 8.3       | BANDWIDTH & EMISSION .....                                  | 18        |
| 8.3.1     | Bandwidth Plot, 99%, 12.5 kHz FM, 450.025 MHz .....         | 20        |
| 8.3.2     | Bandwidth Plot, 99%, 12.5 kHz NXDN, 450.025 MHz .....       | 21        |
| 8.3.3     | Bandwidth Plot, 99%, 6.25 kHz NXDNSN, 450.025 MHz .....     | 22        |
| 8.3.4     | Bandwidth Plot, 99%, 12.5 kHz FM, 460.025 MHz .....         | 23        |
| 8.3.5     | Bandwidth Plot, 99%, 12.5 kHz NXDN, 460.025 MHz.....        | 24        |
| 8.3.6     | Bandwidth Plot, 99%, 6.25 kHz NXDNSN, 460.025 MHz.....      | 25        |
| 8.3.7     | Bandwidth Plot, 99%, 12.5 kHz FM, 464.5 MHz.....            | 26        |
| 8.3.8     | Bandwidth Plot, 99%, 12.5 kHz NXDN, 464.5 MHz .....         | 27        |
| 8.3.9     | Bandwidth Plot, 99%, 6.25 kHz NXDNSN, 464.5 MHz .....       | 28        |
| 8.3.10    | Bandwidth Plot, 99%, 12.5 kHz FM, 469.975 MHz .....         | 29        |
| 8.3.11    | Bandwidth Plot, 99%, 12.5 kHz NXDN, 469.975 MHz.....        | 30        |
| 8.3.12    | Bandwidth Plot, 99%, 6.25 NXDNSN, 469.975 MHz .....         | 31        |

|        |                                                           |    |
|--------|-----------------------------------------------------------|----|
| 8.4    | EMISSION LIMITATIONS, IN-BAND.....                        | 32 |
| 8.4.1  | Emission Mask, 12.5 kHz FM, 450.025 MHz.....              | 33 |
| 8.4.2  | Emission Mask, 12.5 kHz NXDN, 450.025 MHz.....            | 34 |
| 8.4.3  | Emission Mask, 6.25 kHz NXDNSN, 450.025 MHz.....          | 35 |
| 8.4.4  | Emission Mask, 12.5 kHz FM, 460.025 MHz.....              | 36 |
| 8.4.5  | Emission Mask, 12.5 kHz NXDN, 460.025 MHz.....            | 37 |
| 8.4.6  | Emission Mask, 6.25 kHz NXDNSN, 460.025 MHz.....          | 38 |
| 8.4.7  | Emission Mask, 12.5 kHz FM, 464.5 MHz.....                | 39 |
| 8.4.8  | Emission Mask, 12.5 kHz NXDN, 464.5 MHz.....              | 40 |
| 8.4.9  | Emission Mask, 6.25 kHz NXDNSN, 464.5 MHz.....            | 41 |
| 8.4.10 | Emission Mask, 12.5 kHz FM, 469.975 MHz.....              | 42 |
| 8.4.11 | Emission Mask, 12.5 kHz NXDN, 469.975 MHz.....            | 43 |
| 8.4.12 | Emission Mask, 6.25 kHz NXDNSN, 469.975 MHz.....          | 44 |
| 8.5    | EMISSION LIMITATIONS, OUT-OF-BAND.....                    | 45 |
| 8.5.1  | Conducted Emissions, Below 1GHz, 450.025 MHz.....         | 46 |
| 8.5.2  | Conducted Emissions Above 1GHz, 450.025 MHz.....          | 47 |
| 8.5.3  | Conducted Emissions Below 1GHz, 460.025 MHz.....          | 48 |
| 8.5.4  | Conducted Emissions Above 1GHz, 460.025 MHz.....          | 49 |
| 8.5.5  | Conducted Emissions Below 1GHz, 464.5 MHz.....            | 50 |
| 8.5.6  | Conducted Emissions Above 1GHz, 464.5 MHz.....            | 51 |
| 8.5.7  | Conducted Emissions Below 1GHz, 469.975 MHz.....          | 52 |
| 8.5.8  | Conducted Emissions Above 1GHz, 469.975 MHz.....          | 53 |
| 8.6    | RADIATED EMISSIONS.....                                   | 54 |
| 8.6.1  | Radiated Emissions, 450.025 MHz.....                      | 55 |
| 8.6.2  | Radiated Emissions, 460.025 MHz.....                      | 56 |
| 8.6.3  | Radiated Emissions, 464.5 MHz.....                        | 57 |
| 8.6.4  | Radiated Emissions, 469.975 MHz.....                      | 58 |
| 8.7    | MODULATION CHARACTERISTICS.....                           | 59 |
| 8.7.1  | Audio Frequency Response.....                             | 60 |
| 8.7.2  | Low Pass Filter Response.....                             | 61 |
| 8.7.3  | Modulation Limiting.....                                  | 62 |
| 8.8    | FREQUENCY STABILITY.....                                  | 63 |
| 8.8.1  | Frequency Stability Data.....                             | 64 |
| 8.8.2  | Frequency Stability Plot.....                             | 65 |
| 8.9    | TRANSIENT FREQUENCY BEHAVIOR.....                         | 66 |
| 8.9.1  | Transient Frequency Behavior, 12.5 kHz FM, Keyed-on.....  | 67 |
| 8.9.2  | Transient Frequency Behavior, 12.5 kHz FM, Keyed-off..... | 68 |
| 8.9.3  | Transient Frequency Behavior, 6.25 kHz FM, Keyed-on.....  | 69 |
| 8.9.4  | Transient Frequency Behavior, 6.25 kHz FM, Keyed-off..... | 70 |
| 8.10   | ADJACENT CHANNEL POWER LIMITS.....                        | 71 |
| 9.     | ANNEX-A - PHOTOGRAPHS OF THE EUT.....                     | 72 |
| 10.    | ANNEX-B – TEST SETUP PHOTOGRAPHS.....                     | 72 |
| 11.    | HISTORY OF TEST REPORT CHANGES.....                       | 72 |

## 1. Customer Information

Applicant: Ritron, Inc.  
Address: 505 West Carmel Drive  
P.O. Box 1998  
Carmel, IN 46032, United States

## 1.1 Part 90 Test Result Summary

The following test procedure and guidance were used for measuring FCC PART 90 (PRIVATE LAND MOBILE RADIO SERVICES) known as Licensed Land Mobile; ANSI C63.26-2015. Full test results are available in this report.

| Applicable Clauses from Part 2 |                                         |                           |
|--------------------------------|-----------------------------------------|---------------------------|
| FCC Clauses                    | Description of the requirements         | Result: (Pass, Fail, N/A) |
| 2.202                          | Bandwidth & Emission                    | Pass                      |
| 2.1033 (c)(8)                  | Power at the Final Amplifier            | Reported                  |
| 2.1046 (a)                     | RF Output Power                         | Pass                      |
| 2.1047                         | Modulation characteristics              | Reported                  |
| 2.1049                         | Occupied Bandwidth                      | Pass                      |
| 2.1051                         | Spurious emissions at antenna terminals | Pass                      |
| 2.1053                         | Field strength of spurious radiation    | Pass                      |
| 2.1055                         | Frequency stability                     | Pass                      |

| Applicable Clauses from Part 90 |                                 |                           |
|---------------------------------|---------------------------------|---------------------------|
| FCC Clauses                     | Description of the requirements | Result: (Pass, Fail, N/A) |
| 90.205 (r)                      | Transmitter Power               | Pass                      |
| 90.207 (n)                      | Emission designator             | Reported                  |
| 90.209 (b) (5) footnote 2       | Bandwidth limitations           | Pass                      |
| 90.210 (n)                      | Emission masks, In-band         | Pass                      |
| 90.210 (n)                      | Emission masks, Out-of-band     | Pass                      |
| 90.213 (a) footnote 10          | Frequency stability             | Pass                      |
| 90.214                          | Transient Frequency Behavior    | Pass                      |
| 90.221                          | Adjacent channel power limits   | n/a                       |

No additions to the test methods were needed. There were no deviations, or exclusions from the test methods. No test results are from external providers or from the customer. The test results relate only to the items tested. Timco does not offer opinions and interpretations, only a pass/fail statement.

## 2. Location of Testing

### 2.1 Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA").

Testing was performed at Timco's permanent laboratory located at 849 NW State Road 45, Newberry, Florida 32669

FCC test firm # 578780

FCC Designation # US1070

FCC site registration is under A2LA certificate # 0955.01

ISED Canada test site registration # 2056A

EU Notified Body # 1177

For all designations see A2LA scope # 0955.01

### 2.1 Testing was performed, reviewed by

Dates of Testing: 10/20/2021

Signature:



Sr. EMC Engineer  
EMC-003838-NE



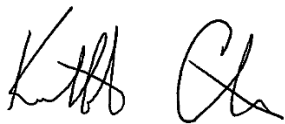
Name & Title:

Tim Royer, EMC Engineer

Date of Signature

10/27/2021

Signature:



Name & Title:

Kristoffer Costa, EMC Technician

Date of Signature

10/27/2021

### 3. Test Sample(s) (EUT/DUT)

The test sample was received: 10/20/2021

#### 3.1 Description of the EUT

A description as well as unambiguous identification of the EUT(s) tested. Where more than one sample is required for technical reasons (such as the use of connected units for the purpose of conducted output power testing where the product units will have integral antennas), each specific test shall identify which unit was tested.

| Identification    |                                           |
|-------------------|-------------------------------------------|
| FCC ID:           | AIERIT51-46006                            |
| Brief Description | UHF Transceiver                           |
| Type of Modular   | n/a                                       |
| Model(s) #        | DTXM-460-0BN6I-M-FIPS DTXM-460-0BN6I-NXDN |
| Firmware version  | n/a                                       |
| Software version  | n/a                                       |
| Serial Number     | A100849948                                |

| Technical Characteristics    |                                                               |
|------------------------------|---------------------------------------------------------------|
| Technology                   | UHF Transceiver                                               |
| Frequency Range              | 450 MHz-470 MHz                                               |
| RF O/P Power (Max.)          | 6W                                                            |
| Modulation                   | n/a                                                           |
| Bandwidth & Emission Class   | 10K0F3E, 4K00F1E, 8K30F1E, 4K00F1D, 8K30F1D, 4K00F7W, 8K30F7W |
| Duty Cycle                   | 100%                                                          |
| Antenna Connector            | BNC                                                           |
| Voltage Rating (AC or Batt.) | 11-16VDC                                                      |

| Antenna Characteristics |                 |           |              |
|-------------------------|-----------------|-----------|--------------|
| Antenna                 | Frequency Range | Mode / BW | Antenna Gain |
| 1                       | 450 MHz-470 MHz | Transmit  | 0 dBi        |

### 3.2 Configuration of EUT

| Test Modes |             |                                                        |                     |                                                                        |
|------------|-------------|--------------------------------------------------------|---------------------|------------------------------------------------------------------------|
| Mode (#)   | Mode (Type) | Test Frequencies (MHz)                                 | BW (nominal) (kHz)  | Emission Designator                                                    |
| 1          | Transmit    | 450.025 MHz<br>460.025 MHz<br>464.5 MHz<br>469.975 MHz | 6.25kHz<br>12.5 kHz | 10K0F3E, 4K00F1E,<br>8K30F1E, 4K00F1D,<br>8K30F1D, 4K00F7W,<br>8K30F7W |

#### Operating conditions during Testing:

The device was operated without the provided antenna(s).

No other modifications of the device under test (including firmware, specific software settings, and input/output signal levels to the EUT) were made.

#### Peripherals used during Testing:

A laptop was used to program the EUT.

### 3.3 Test Setup of EUT

Equipment, antenna, and cable arrangement. The setup of the equipment and cable or wire placement on the test site that produces the highest radiated and the highest ac power line conducted emissions shall be shown clearly and described. Information on the orientation of portable equipment during testing shall be included. Drawings or photographs may be used for this purpose.

Test Setups are included in the test report.

#### 4. Test methods & Applicable Regulatory Limits

##### 4.1 Test methods/Standards/Guidance:

Test procedures and guidance for measuring Licensed Part 90 Licensed device:

- 1) ANSI C63.26-2015

##### 4.2 Applied Limits and Regulatory Limits:

- 1) FCC CFR 47 Part 90

#### 5. Measurement Uncertainty

| Parameter                                                                                                                                                                   | Uncertainty (dB) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Conducted Emissions                                                                                                                                                         | $\pm 3.14$ dB    |
| Radiated Emissions (9kHz – 30 MHz)                                                                                                                                          | $\pm 3.08$ dB    |
| Radiated Emissions (30 – 200 MHz)                                                                                                                                           | $\pm 2.16$ dB    |
| Radiated Emissions (200 – 1000 MHz)                                                                                                                                         | $\pm 2.15$ dB    |
| Radiated Emissions (1 GHz – 18 GHz)                                                                                                                                         | $\pm 2.14$ dB    |
| Radiated Emissions (18 GHz – 40 GHz)                                                                                                                                        | $\pm 2.31$ dB    |
| <b>Note:</b> The uncertainties provided in this table represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of K=2. |                  |

#### 6. Environmental Conditions

##### 6.1 Temperature & Humidity

Measurements performed at the test site did not exceed the following:

| Parameter                                                                                                                       | Measurement |
|---------------------------------------------------------------------------------------------------------------------------------|-------------|
| Temperature                                                                                                                     | 23 C +/- 5% |
| Humidity                                                                                                                        | 55% +/- 5%  |
| Barometric Pressure                                                                                                             | 30.05 in Hg |
| <b>Note:</b> Specific environmental conditions that are applicable to a specific test are available in the test result section. |             |

## 7. List of Test Equipment and Test Facility

The test equipment used identified by type, manufacturer, serial number, or other identification and the date on which the next calibration or service check is due.

Description of the firmware or software used to operate EUT for testing purposes.

A complete list of all test equipment used shall be included with the test report. The manufacturer's model and serial numbers, and date of last calibration, and calibration interval shall be included. Measurement cable loss, measuring instrument bandwidth and detector function, video bandwidth, if appropriate, and antenna factors shall also be included where applicable.

### 7.1 List of Test Equipment

| Test Equipment     |                                         |                 |        |            |             |           |
|--------------------|-----------------------------------------|-----------------|--------|------------|-------------|-----------|
| Type               | Device                                  | Manufacturer    | Model  | SN#        | Current Cal | Cal Due   |
| Antenna, NSA       | Log-Periodic 1243                       | Eaton           | 96005  | 1243       | 5/4/21      | 5/3/2024  |
| Antenna            | <u>Double-Ridged Horn/ETS Horn 1</u>    | ETS-Lindgren    | 3117   | 00035923   | 2/25/20     | 2/24/2023 |
| CHAMBER            | <u>CHAMBER</u>                          | Panashield      | 3M     | N/A        | 3/12/19     | 3/11/2022 |
| Receiver           | <u>EMI Test Receiver R&amp;S ESU 40</u> | Rohde & Schwarz | ESU 40 | 100320     | 5/27/21     | 5/26/2024 |
| Function Generator | <u>Function Generator</u>               | Standford       | DS340  | 25200      | 1/13/21     | 1/13/2024 |
| Signal Generator   | <u>Signal Generator HP 8648C</u>        | HP              | 8648C  | 3847A04696 | 3/31/21     | 3/30/2024 |
| Thermometer        | <u>Type K J Thermometer</u>             | Martel          | 303    | 080504494  | 1/18/20     | 1/17/2023 |
| Oscilloscope       | <u>Oscilloscope</u>                     | LeCroy          | LT364  | 00414      | 3/28/19     | 3/27/2022 |
| Frequency Counter  | <u>Frequency Counter Small</u>          | HP              | 5385A  | 3242A07460 | 9/9/20      | 9/9/2023  |

| Software       |                 |                          |               |
|----------------|-----------------|--------------------------|---------------|
| Software       | Author          | Version                  | Validation on |
| ESU Firmware   | Rohde & Schwarz | 4.43 SP3; BIOS v5.1-24-3 | 2018          |
| RSCommander    | Rohde & Schwarz | 1.6.4                    | 2014          |
| ScopeExplorer  | LeCroy          | v2.25.0.0                | 2009          |
| Field Strength | Timco           | v4.10.7.0                | 2016          |

## 8. Test Results

The results of the test are usually indicated in the form of tables, spectrum analyzer plots, charts, sample calculations, as appropriate for each test procedure.

A description and/or a block diagram of the test setup is usually provided.

The measurement results, along with the appropriate limits for comparison, may be presented in tabular or graphical form. In addition, any variation in the measurement environment may be reported if applicable (e.g., a significant change of temperature that could affect the cable loss and amplifier response).

Unless noted otherwise in the referenced standard, the measurements of **ac power-line conducted emissions and conducted power output** will be reported in units of dB $\mu$ V. Unless noted otherwise in the referenced standard, the measurements of **radiated emissions** will be reported in units of decibels, referenced to one microvolt per meter (dB $\mu$ V/m) for electric fields, or to one ampere per meter (dBA/m) for magnetic fields, at the distance specified in the appropriate standards or requirements. The measurements of antenna-conducted power for receivers may be reported in units of dB $\mu$ V if the impedance of the measuring instrument is also reported. Otherwise, antenna-conducted power will be reported in units of decibels referenced to one milliwatt (dBm). All formulas for data conversions and conversion factors, if used, will be included in this measurement report.

## 8.1 Power at the Final Amplifier

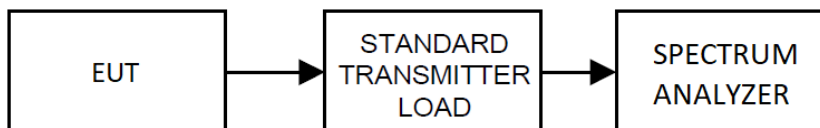
Limits from FCC Part 2.1033 (c)(8). No method of measurement is specified.

| Test Results              |                 |                                  |
|---------------------------|-----------------|----------------------------------|
| EUT Operating Voltage (V) | EUT Current (A) | Power at the Final Amplifier (W) |
| 12                        | 6               | 75                               |

## 8.2 RF Output Power

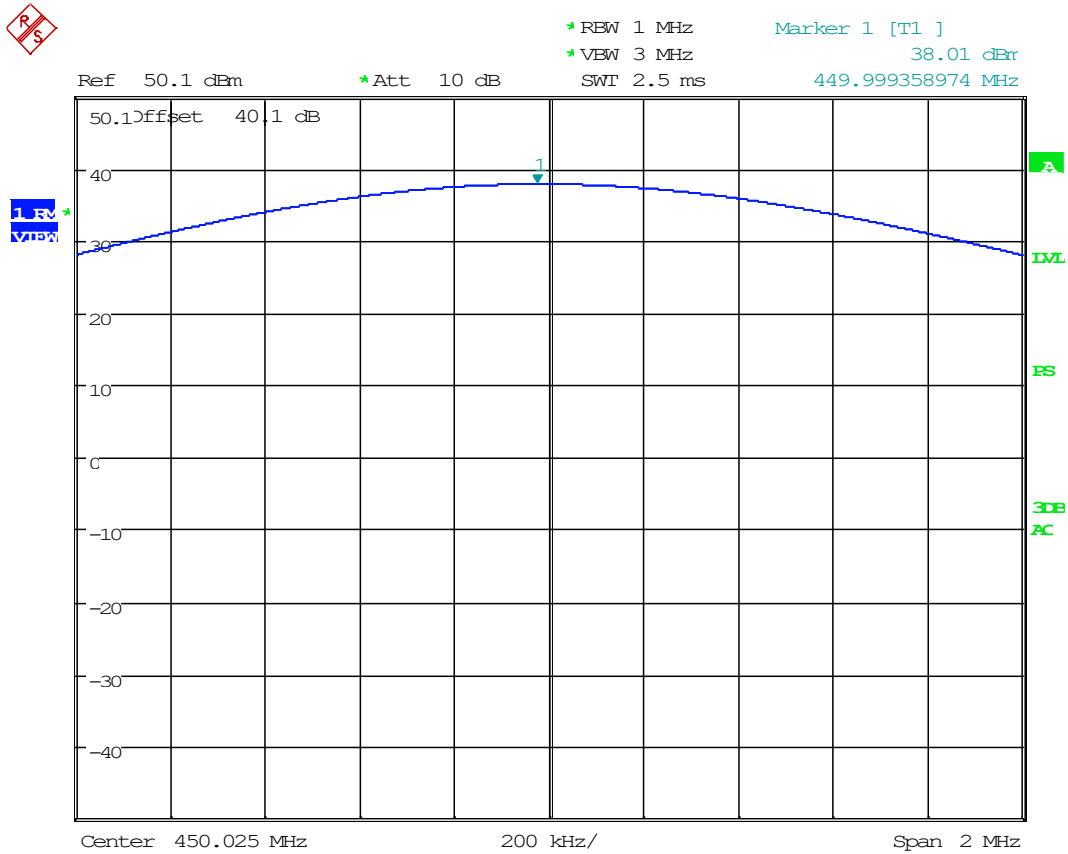
Limits from FCC Parts 2.1046(a), and 90.205 (r); and test procedure from ANSI C63.26-2015.

### Test Setup



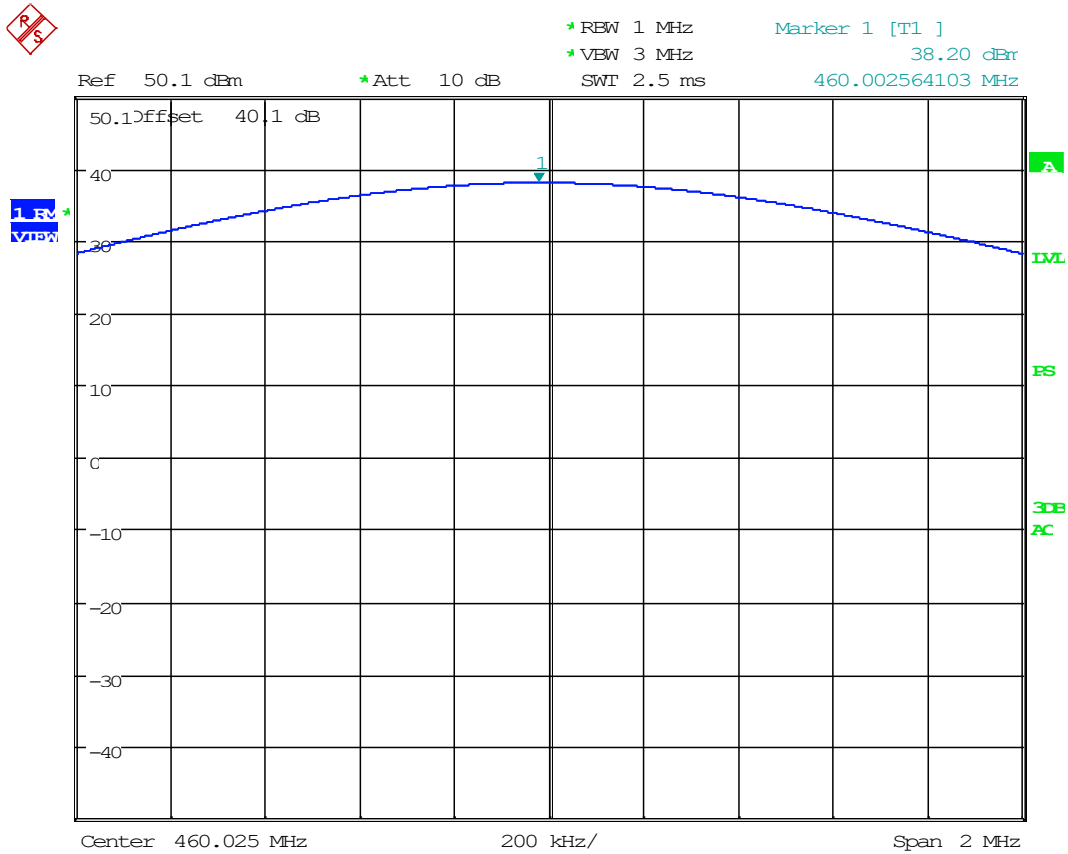
| Test Results, Mode 1  |                    |                  |
|-----------------------|--------------------|------------------|
| Tuned Frequency (MHz) | Power Output (dBm) | Power Output (W) |
| 450.025               | 38.01              | 6.32             |
| 460.025               | 38.2               | 6.6              |
| 464.5                 | 38.2               | 6.6              |
| 469.975               | 38.13              | 6.5              |

## 8.2.1 Test Plot, Power Output, 450.025 MHz



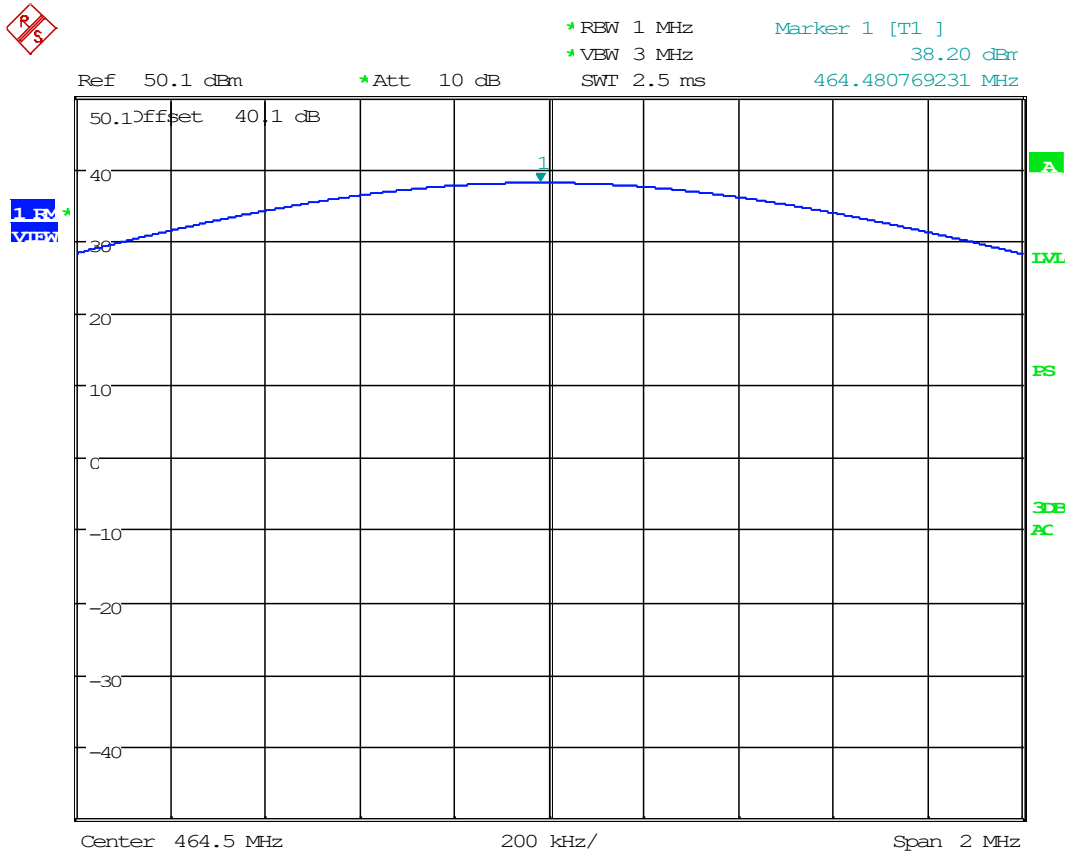
Date: 21.OCT.2021 09:41:09

## 8.2.2 Test Plot, Power Output, 460.025 MHz



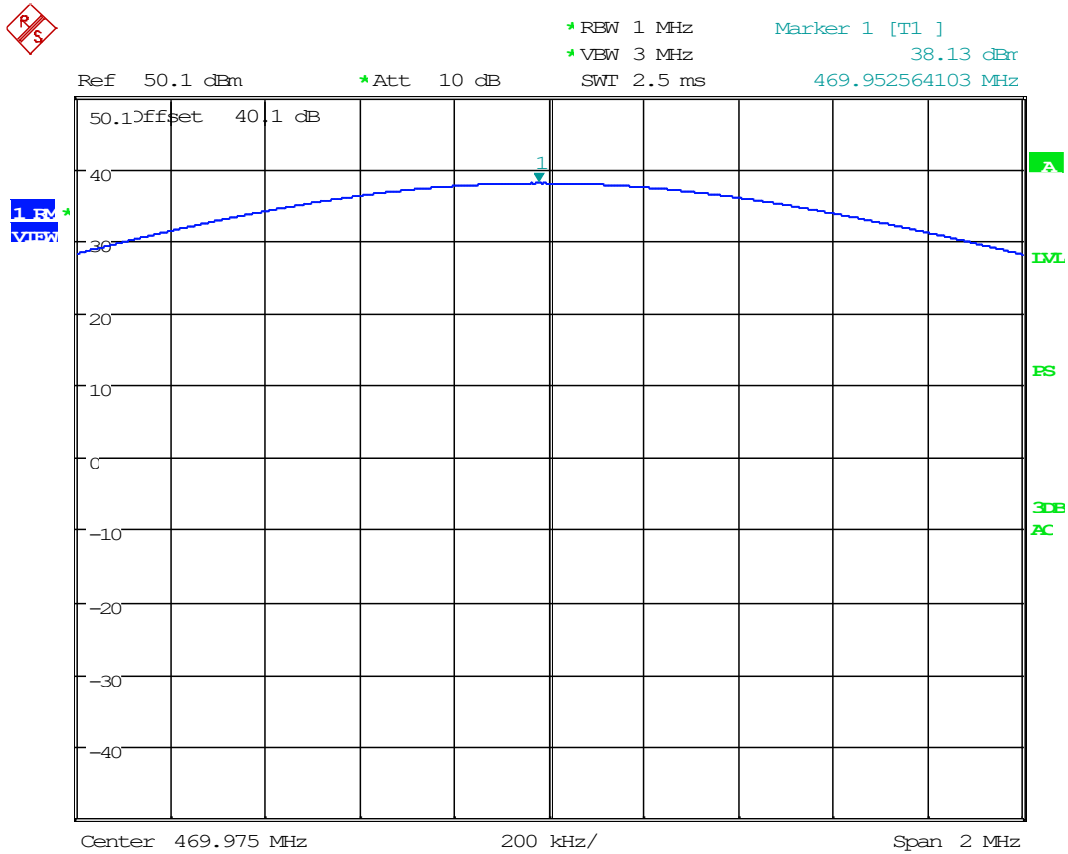
Date: 21.OCT.2021 09:41:54

### 8.2.3 Test Plot, Power Output, 464.5 MHz



Date: 21.OCT.2021 09:43:21

## 8.2.4 Test Plot, Power Output, 469.975 MHz

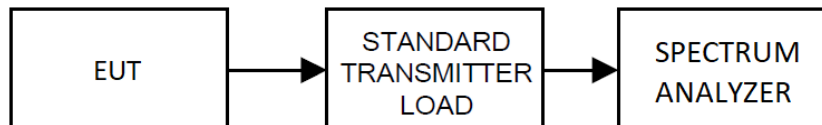


Date: 21.OCT.2021 09:42:40

### 8.3 Bandwidth & Emission

Limits from FCC Parts 2.1049, and 90.207 & 90.209, and test procedure from ANSI C63.26-2015.

#### Test Setup



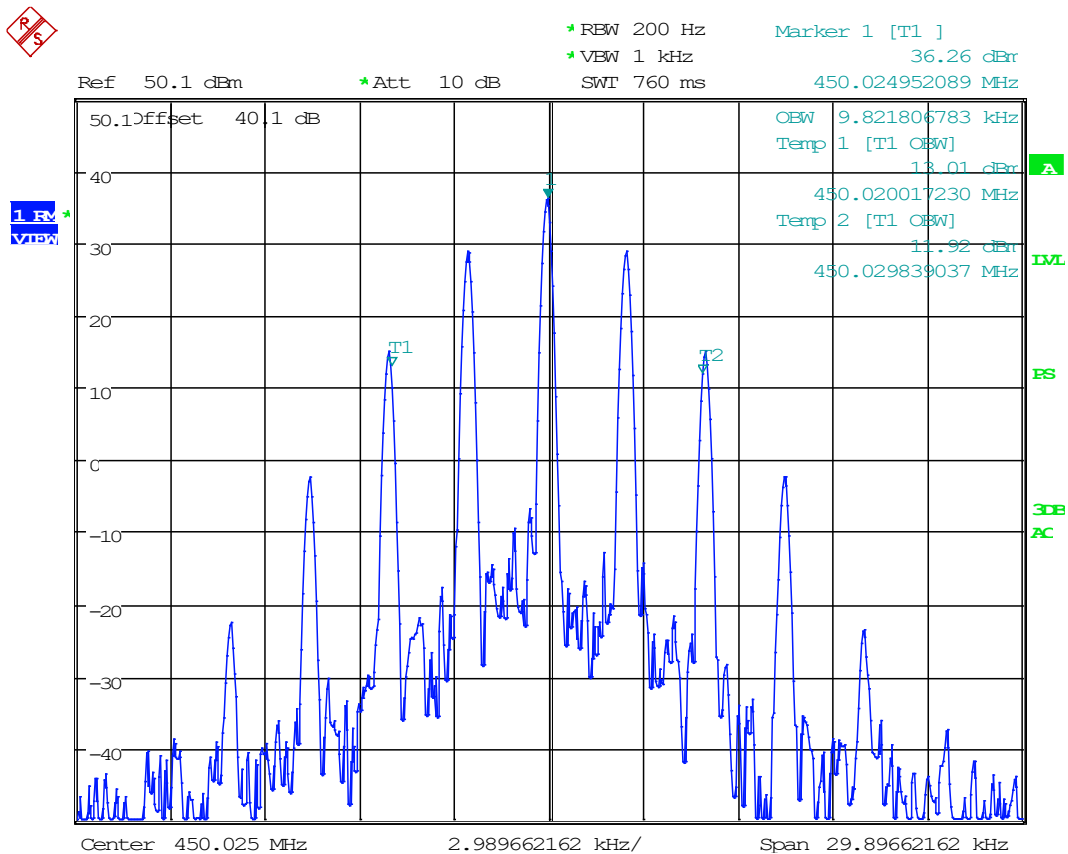
#### Test Results, Authorized Bandwidth

| Rule Part | Operating Range (MHz) | Authorized Bandwidth (kHz) |
|-----------|-----------------------|----------------------------|
| Part 90   | 450-470               | 12.5                       |
| Part 90   | 450-470               | 6.25                       |

| Test Results, Occupied Bandwidth |                 |                     |                          |                |
|----------------------------------|-----------------|---------------------|--------------------------|----------------|
| Tuned Frequency (MHz)            | Mode            | Emission Designator | Occupied Bandwidth (kHz) | Bandwidth Type |
| 450.025                          | 12.5 kHz Analog | 10K0F3E             | 9.822                    | 99%            |
|                                  | 12.5 kHz NXDN   | 8K30F1E, F1D, F7W   | 7.465                    | 99%            |
|                                  | 6.25 NXDNSN     | 4K00F1E, F1D, F7W   | 3.713                    | 99%            |
| 460.025                          | 12.5 kHz Analog | 10K0F3E             | 9.774                    | 99%            |
|                                  | 12.5 kHz NXDN   | 8K30F1E, F1D, F7W   | 7.618                    | 99%            |
|                                  | 6.25 NXDNSN     | 4K00F1E, F1D, F7W   | 3.677                    | 99%            |
| 464.5                            | 12.5 kHz Analog | 10K0F3E             | 9.87                     | 99%            |
|                                  | 12.5 kHz NXDN   | 8K30F1E, F1D, F7W   | 7.81                     | 99%            |
|                                  | 6.25 NXDNSN     | 4K00F1E, F1D, F7W   | 3.75                     | 99%            |
| 469.975                          | 12.5 kHz Analog | 10K0F3E             | 9.87                     | 99%            |
|                                  | 12.5 kHz NXDN   | 8K30F1E, F1D, F7W   | 7.58                     | 99%            |
|                                  | 6.25 NXDNSN     | 4K00F1E, F1D, F7W   | 3.731                    | 99%            |

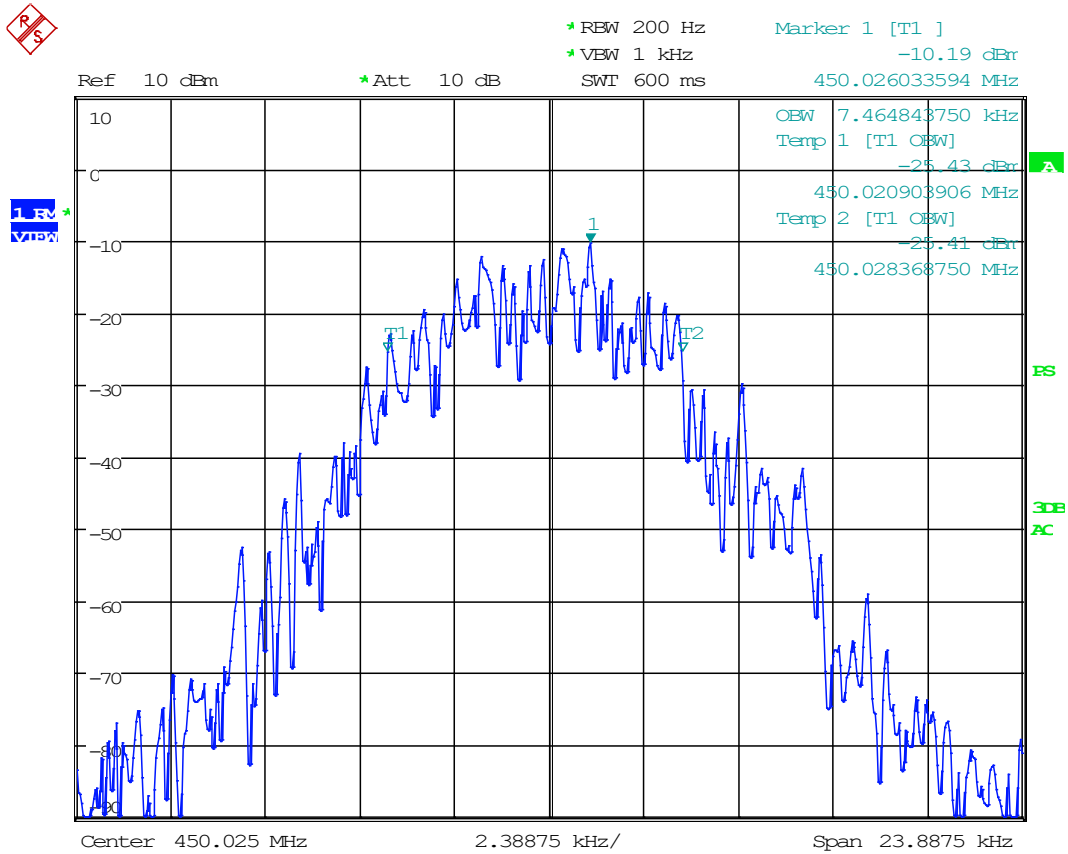
## Occupied Bandwidth, Spectrum Plots

### 8.3.1 Bandwidth Plot, 99%, 12.5 kHz FM, 450.025 MHz



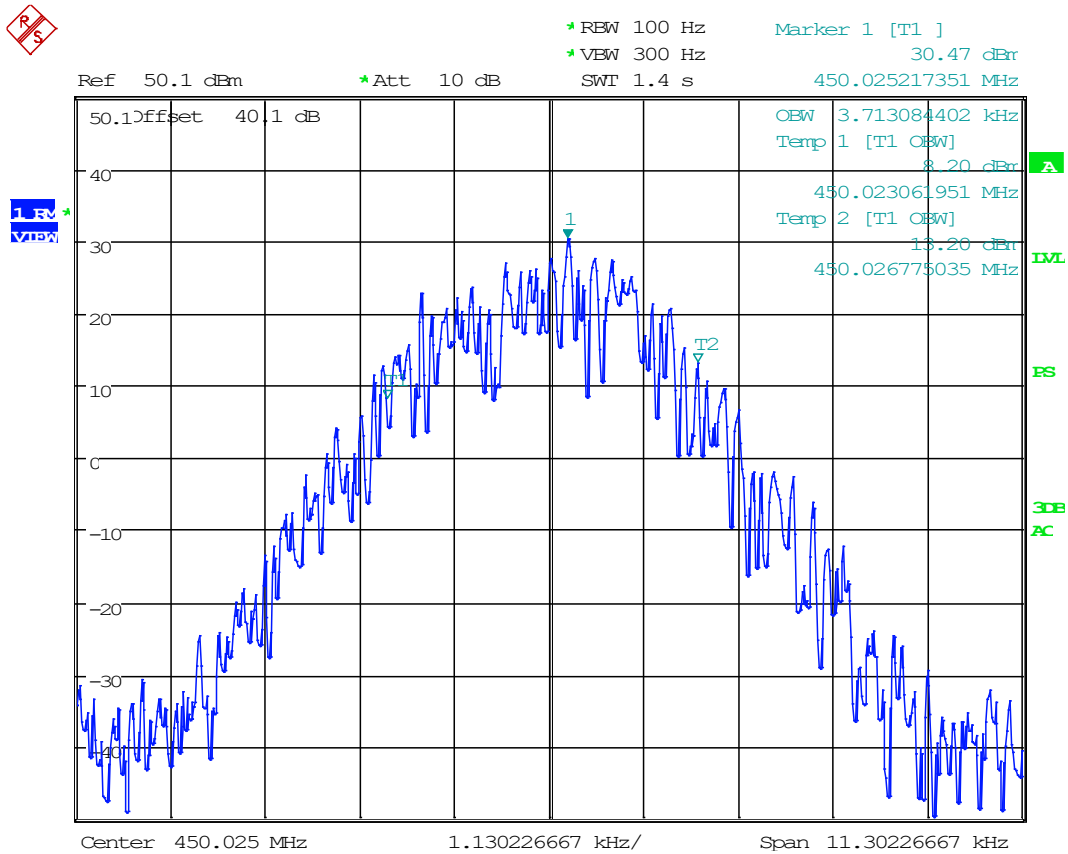
Date: 21.OCT.2021 10:03:45

### 8.3.2 Bandwidth Plot, 99%, 12.5 kHz NXDN, 450.025 MHz



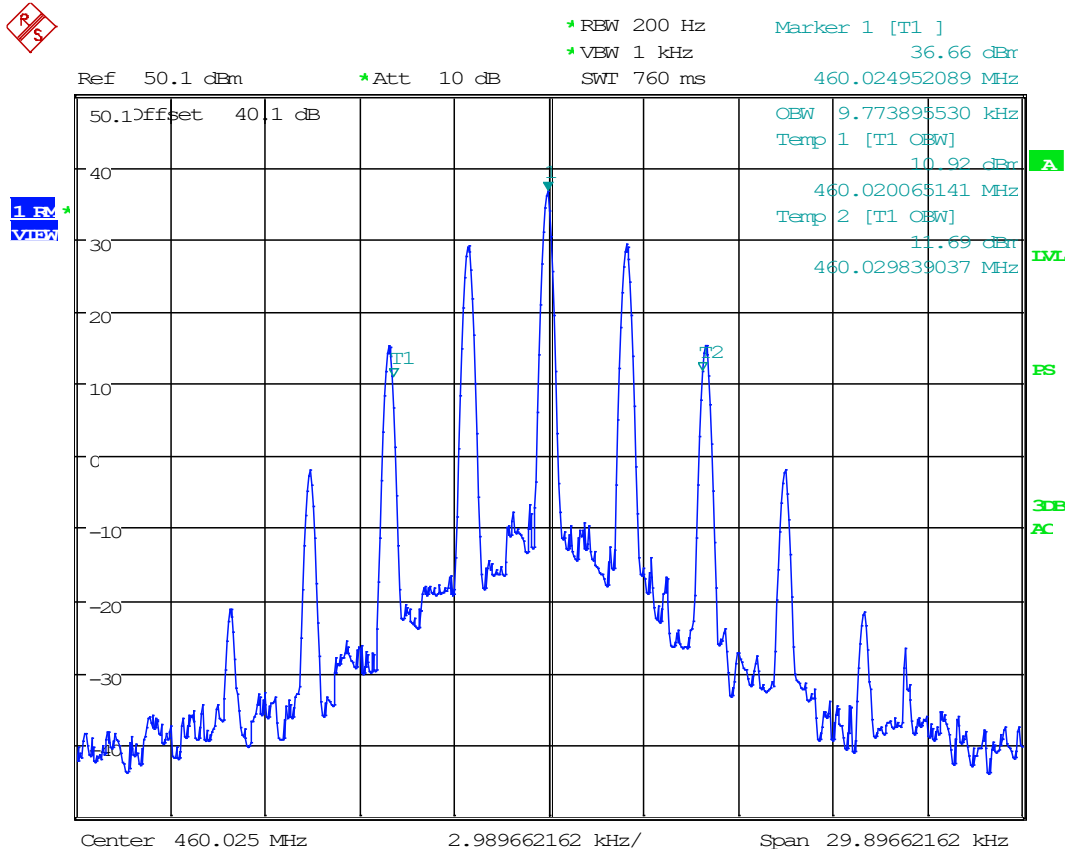
Date: 21.OCT.2021 09:25:03

### 8.3.3 Bandwidth Plot, 99%, 6.25 kHz NXDNSN, 450.025 MHz



Date: 21.OCT.2021 10:08:41

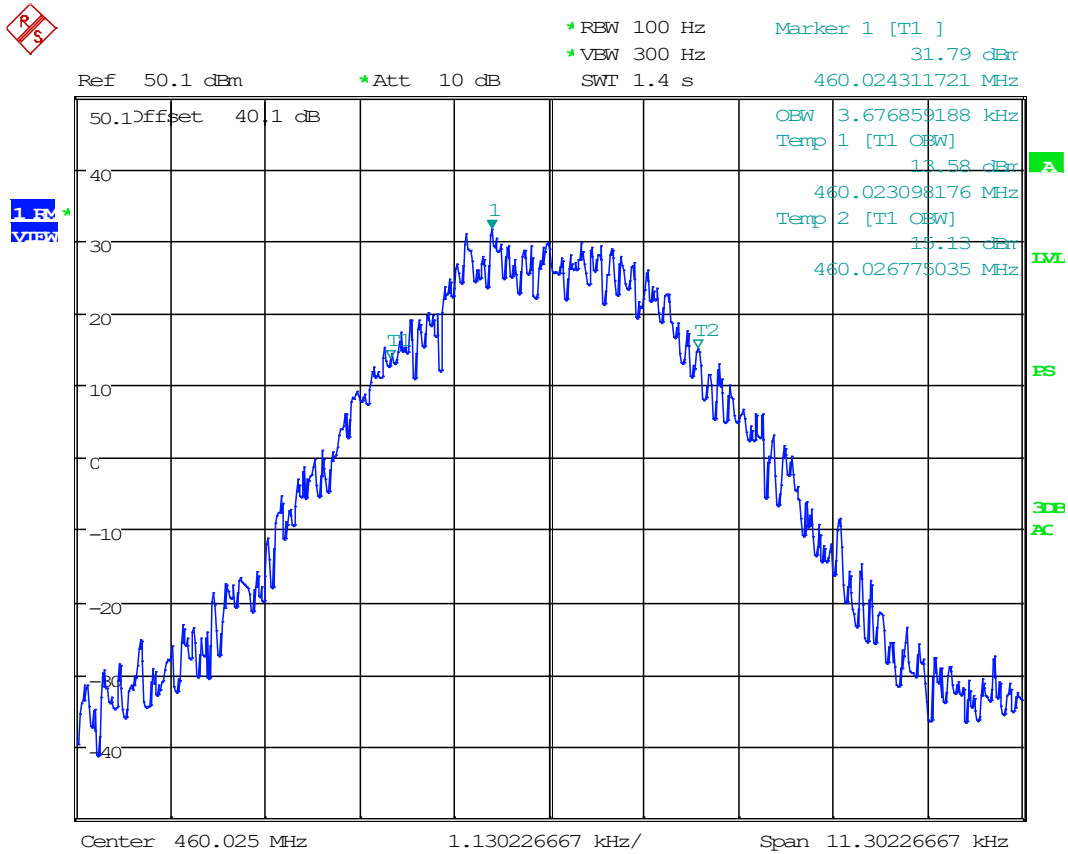
### 8.3.4 Bandwidth Plot, 99%, 12.5 kHz FM, 460.025 MHz



Date: 21.OCT.2021 10:04:54

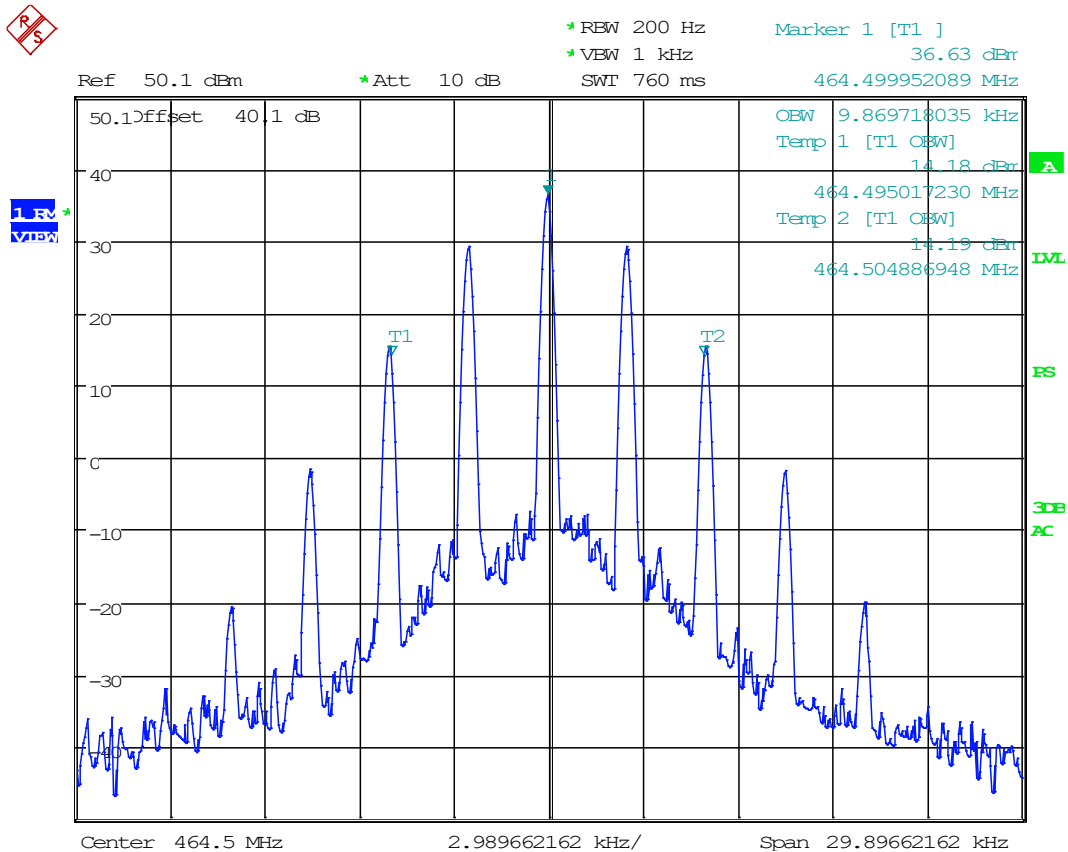


### 8.3.6 Bandwidth Plot, 99%, 6.25 kHz NXDNSN, 460.025 MHz



Date: 21.OCT.2021 10:10:40

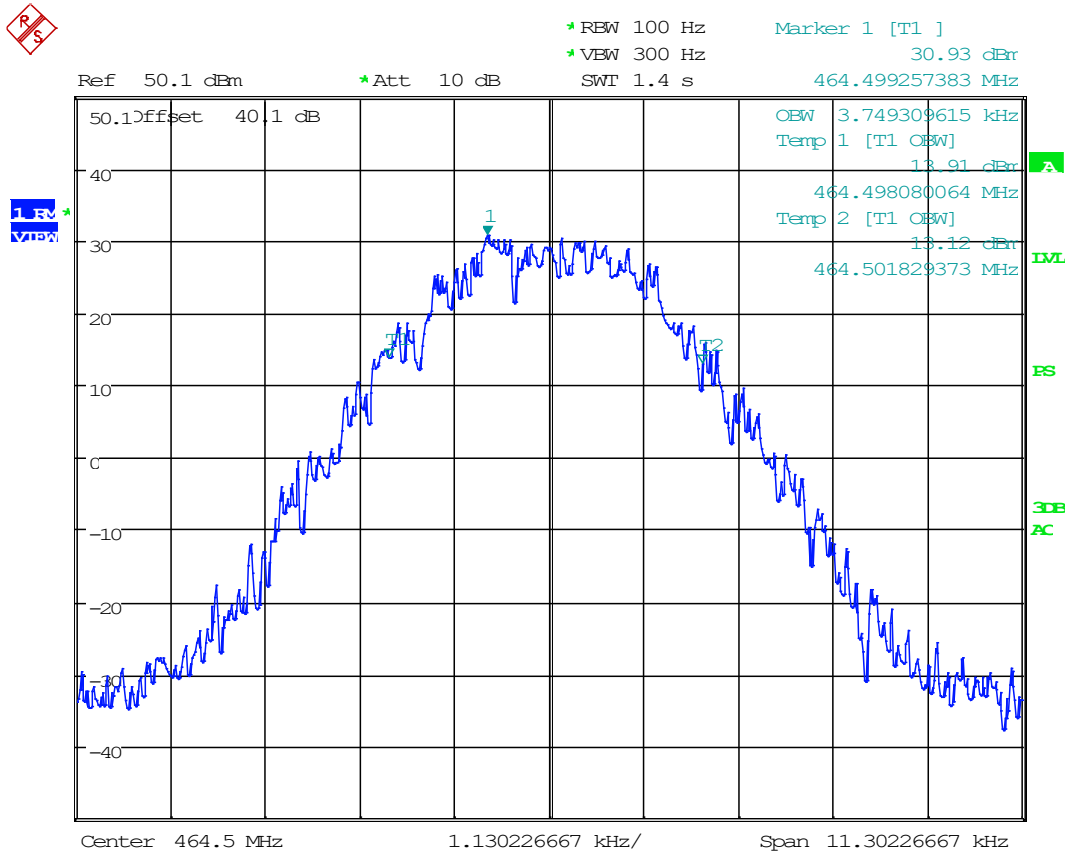
### 8.3.7 Bandwidth Plot, 99%, 12.5 kHz FM, 464.5 MHz



Date: 21.OCT.2021 10:06:27

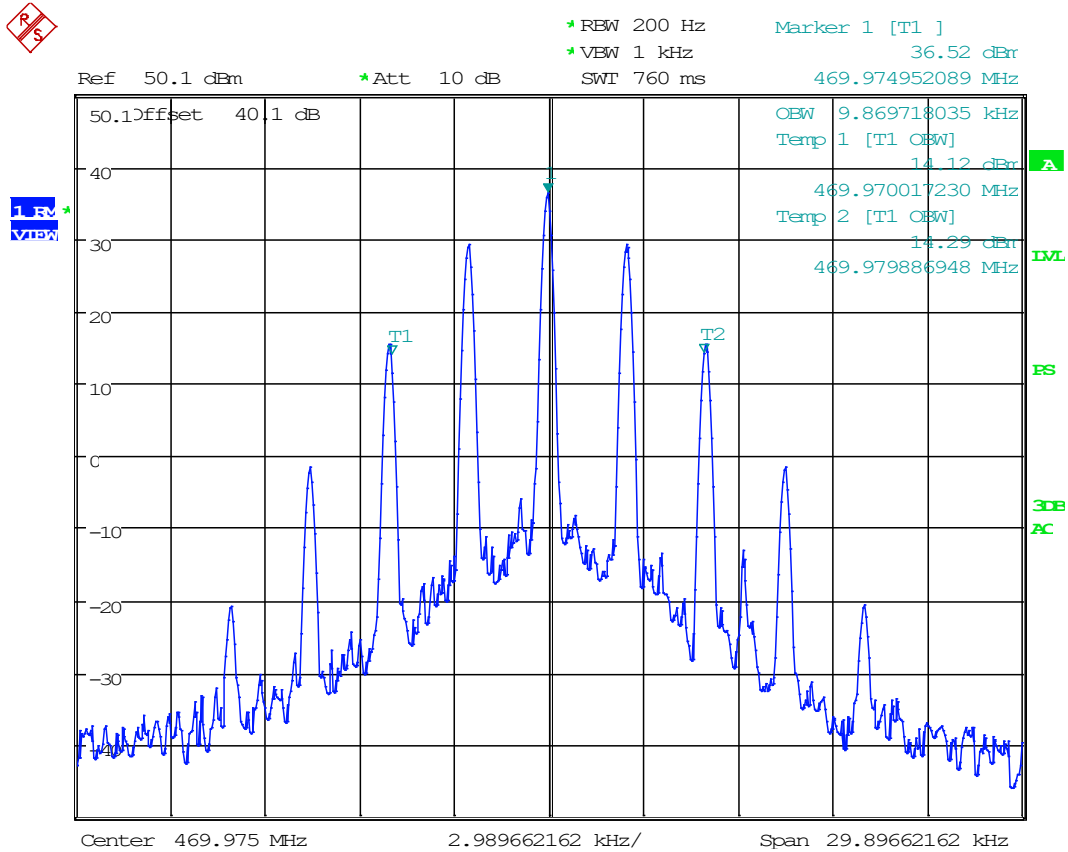


### 8.3.9 Bandwidth Plot, 99%, 6.25 kHz NXDNSN, 464.5 MHz



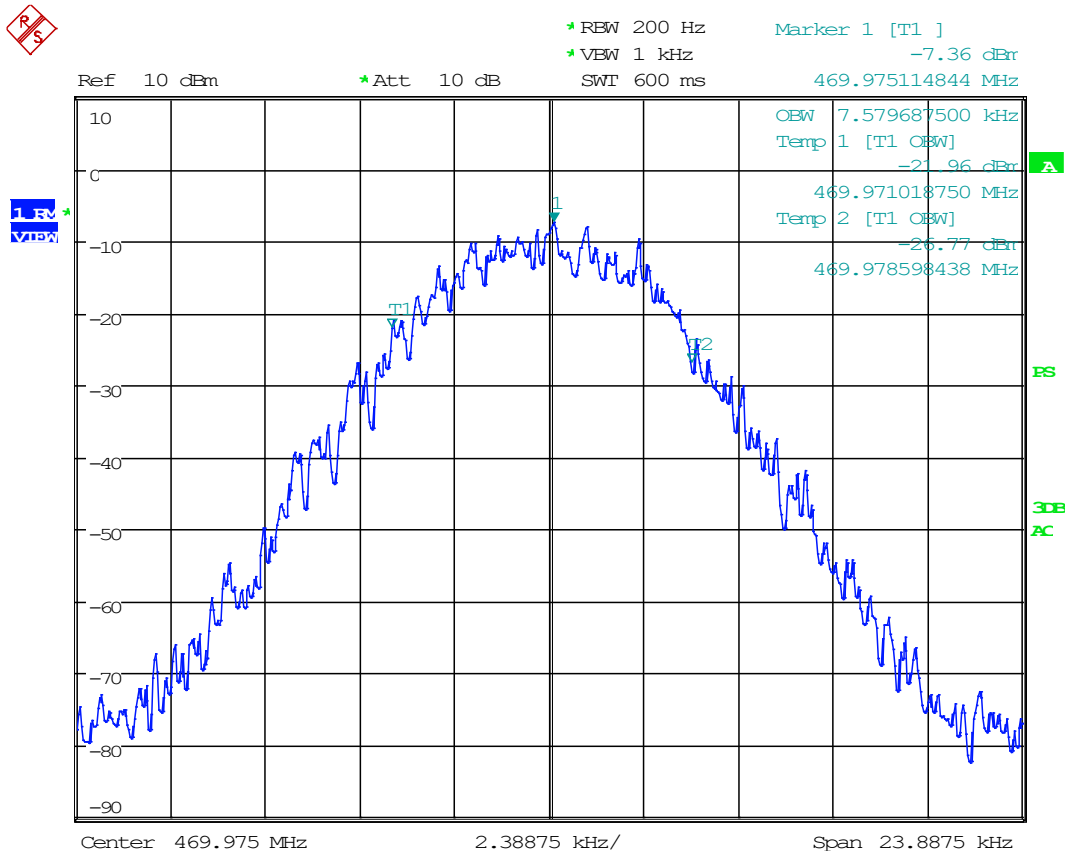
Date: 21.OCT.2021 10:11:56

### 8.3.10 Bandwidth Plot, 99%, 12.5 kHz FM, 469.975 MHz



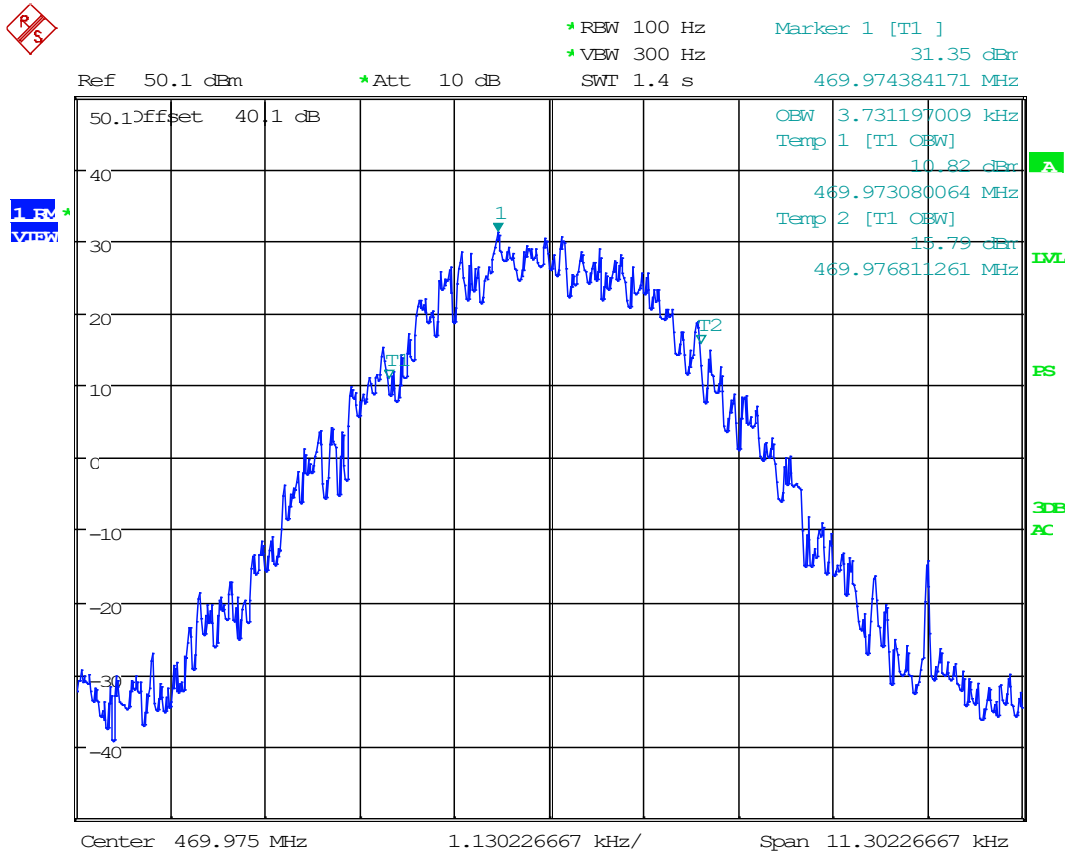
Date: 21.OCT.2021 10:05:55

### 8.3.11 Bandwidth Plot, 99%, 12.5 kHz NXDN, 469.975 MHz



Date: 21.OCT.2021 09:27:33

### 8.3.12 Bandwidth Plot, 99%, 6.25 NXDNSN, 469.975 MHz

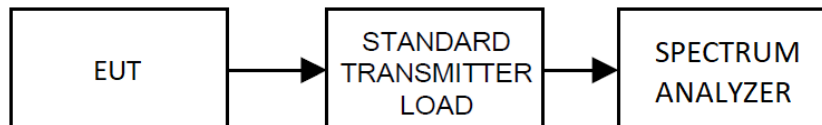


Date: 21.OCT.2021 10:11:15

## 8.4 Emission Limitations, In-Band

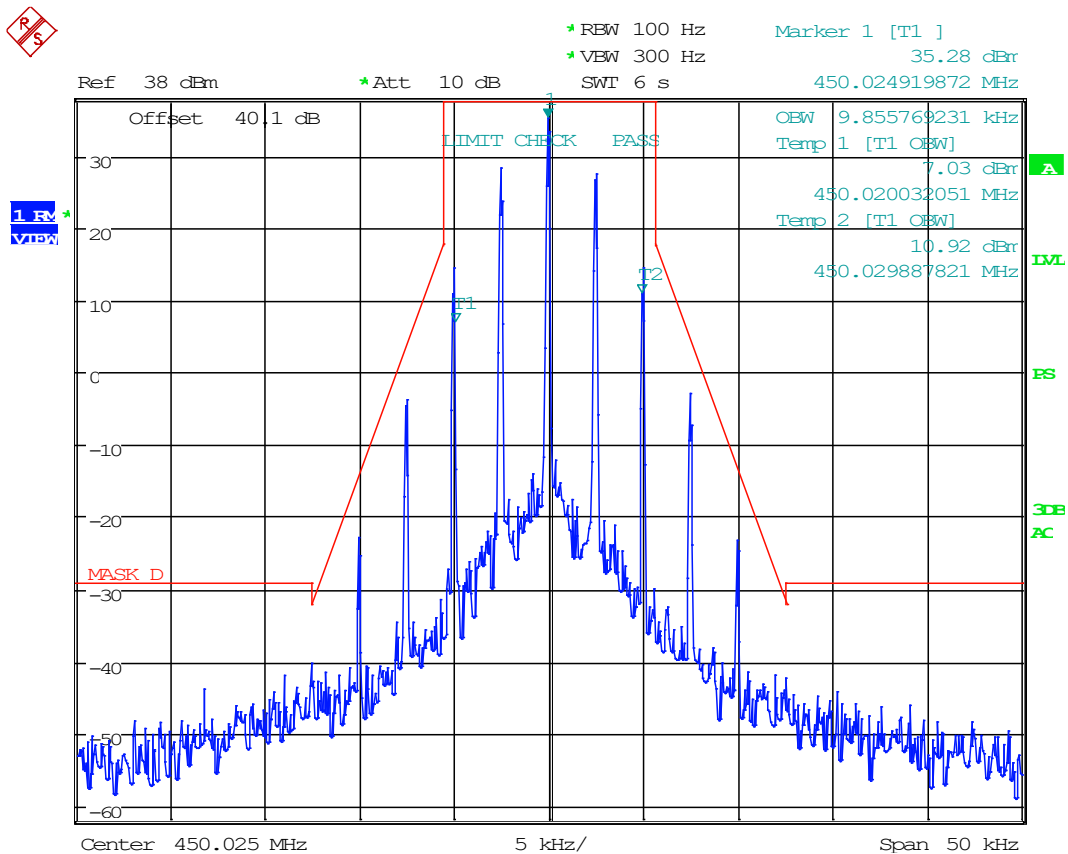
Limits from FCC Part 90.210; and test procedure from ANSI C63.26-2015.

### Conducted Test Setup



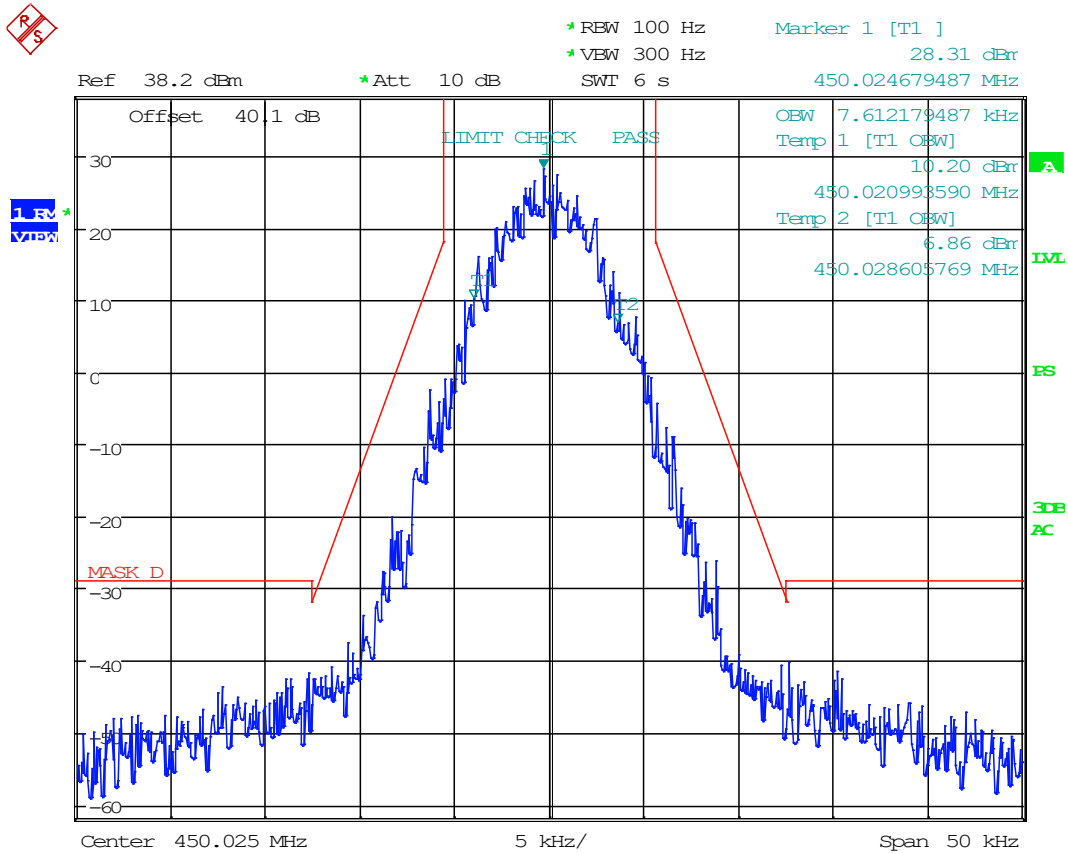
## Conducted Emissions Mask, Spectrum Plots

### 8.4.1 Emission Mask, 12.5 kHz FM, 450.025 MHz



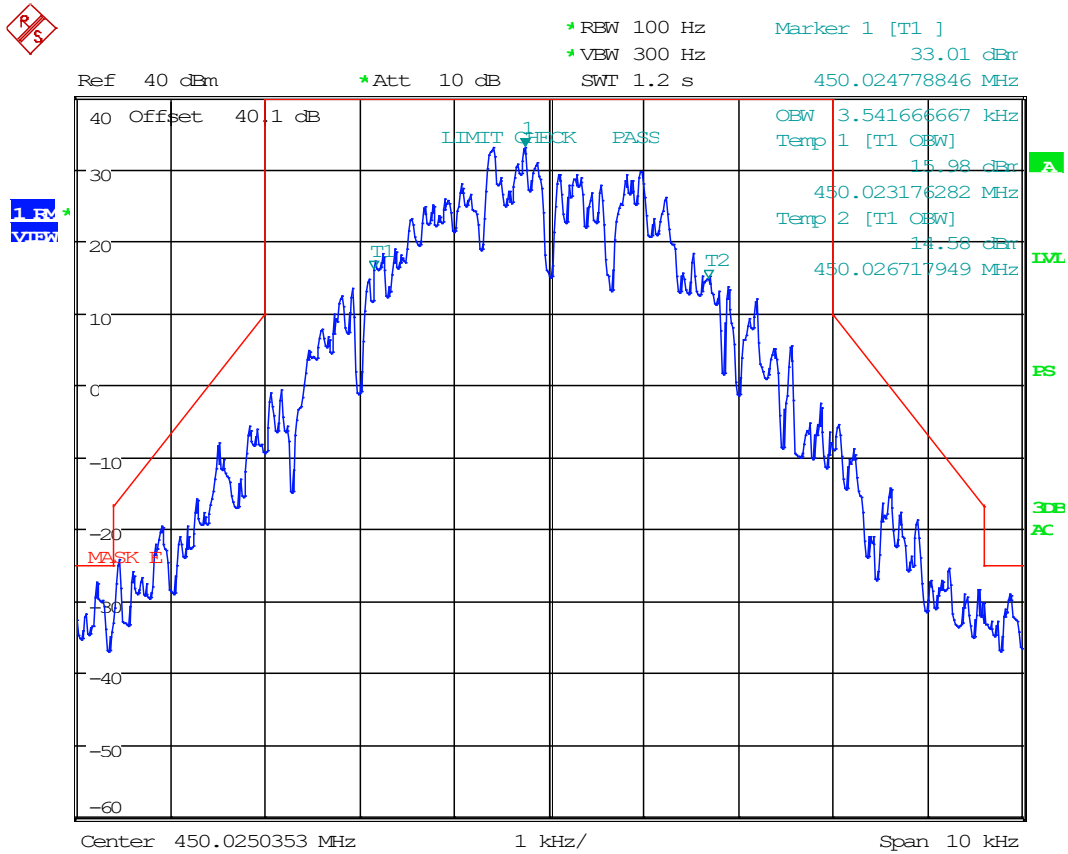
Date: 21.OCT.2021 10:20:33

## 8.4.2 Emission Mask, 12.5 kHz NXDN, 450.025 MHz



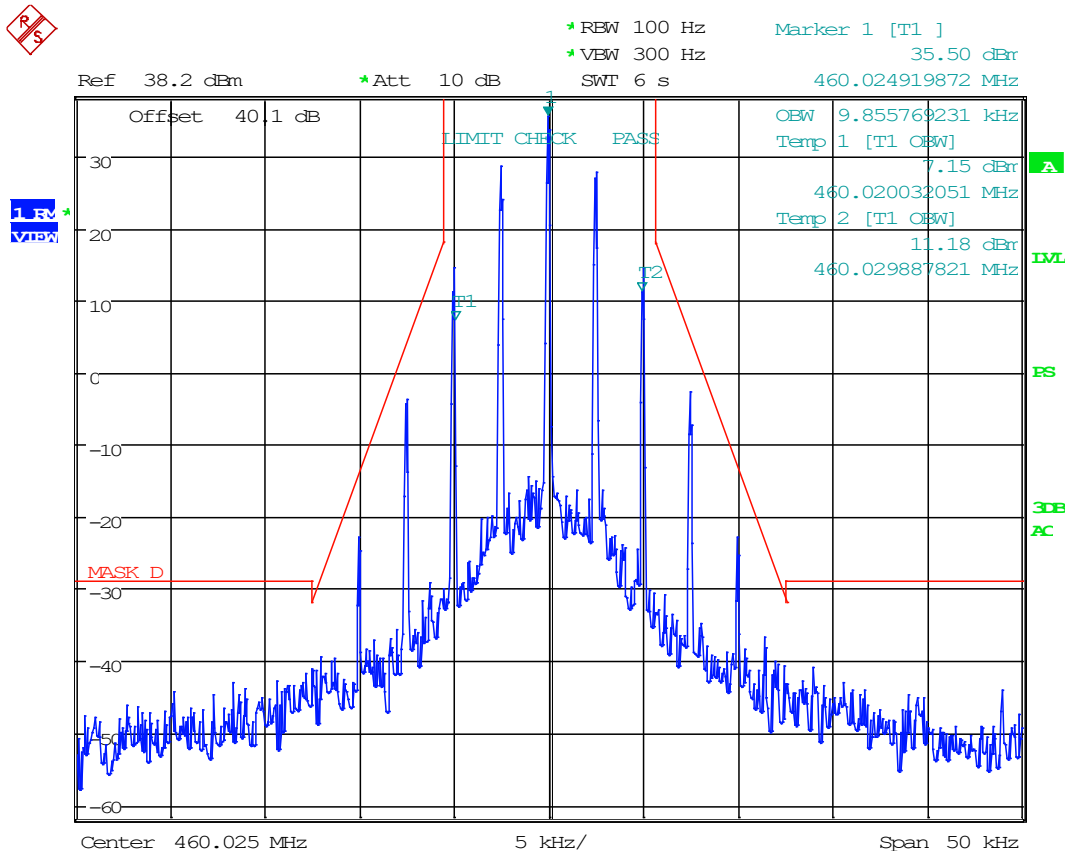
Date: 21.OCT.2021 10:39:16

### 8.4.3 Emission Mask, 6.25 kHz NXDNSN, 450.025 MHz



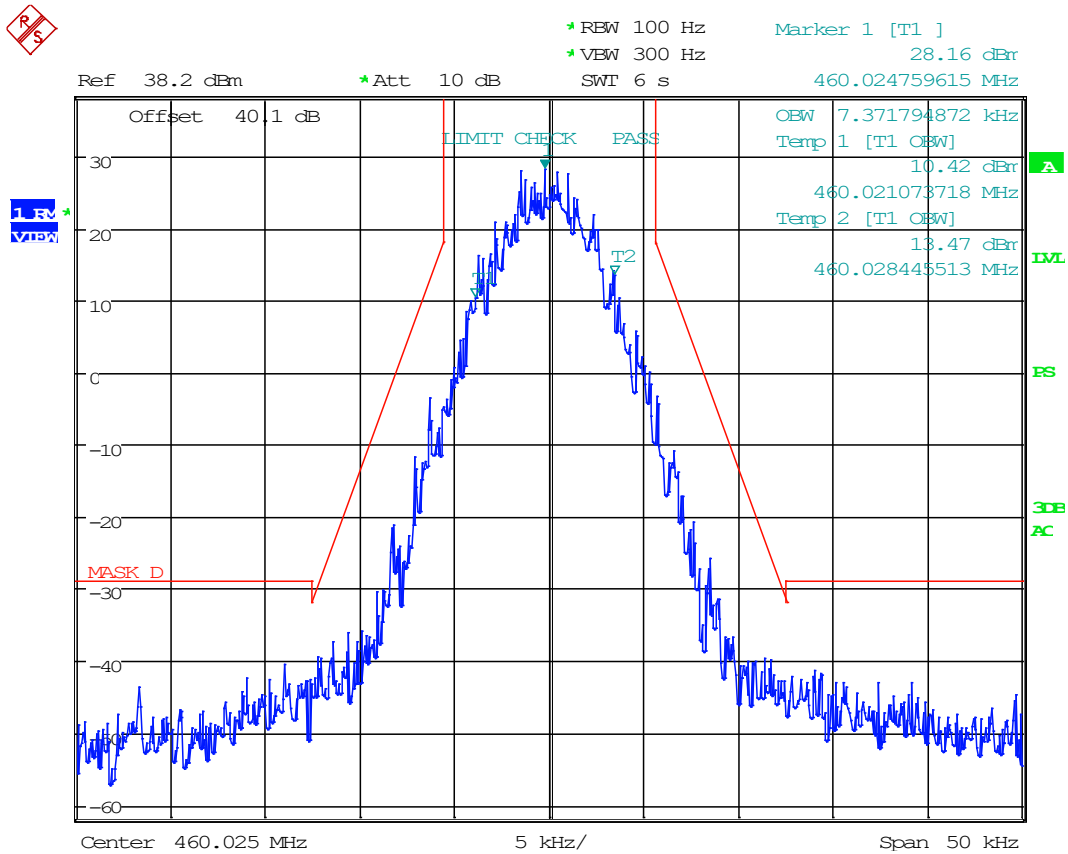
Date: 21.OCT.2021 10:51:38

#### 8.4.4 Emission Mask, 12.5 kHz FM, 460.025 MHz



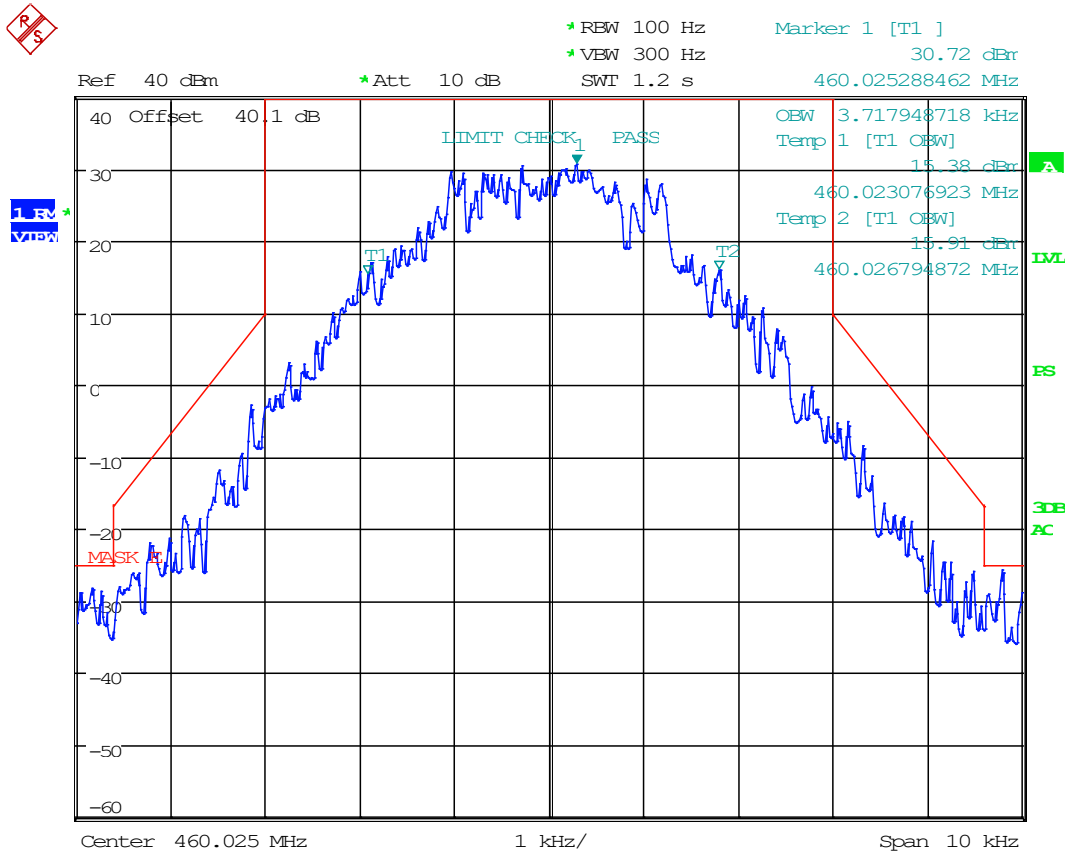
Date: 21.OCT.2021 10:22:40

#### 8.4.5 Emission Mask, 12.5 kHz NXDN, 460.025 MHz



Date: 21.OCT.2021 10:43:15

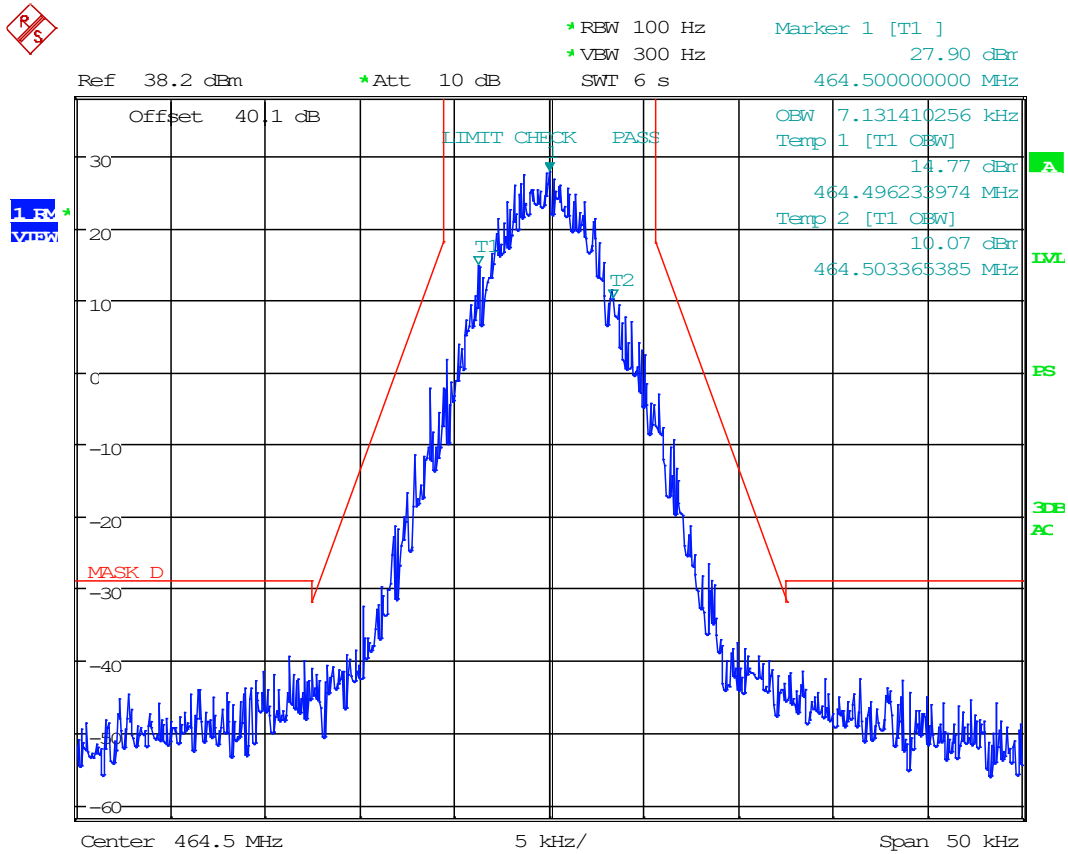
#### 8.4.6 Emission Mask, 6.25 kHz NXDNSN, 460.025 MHz



Date: 21.OCT.2021 10:52:51

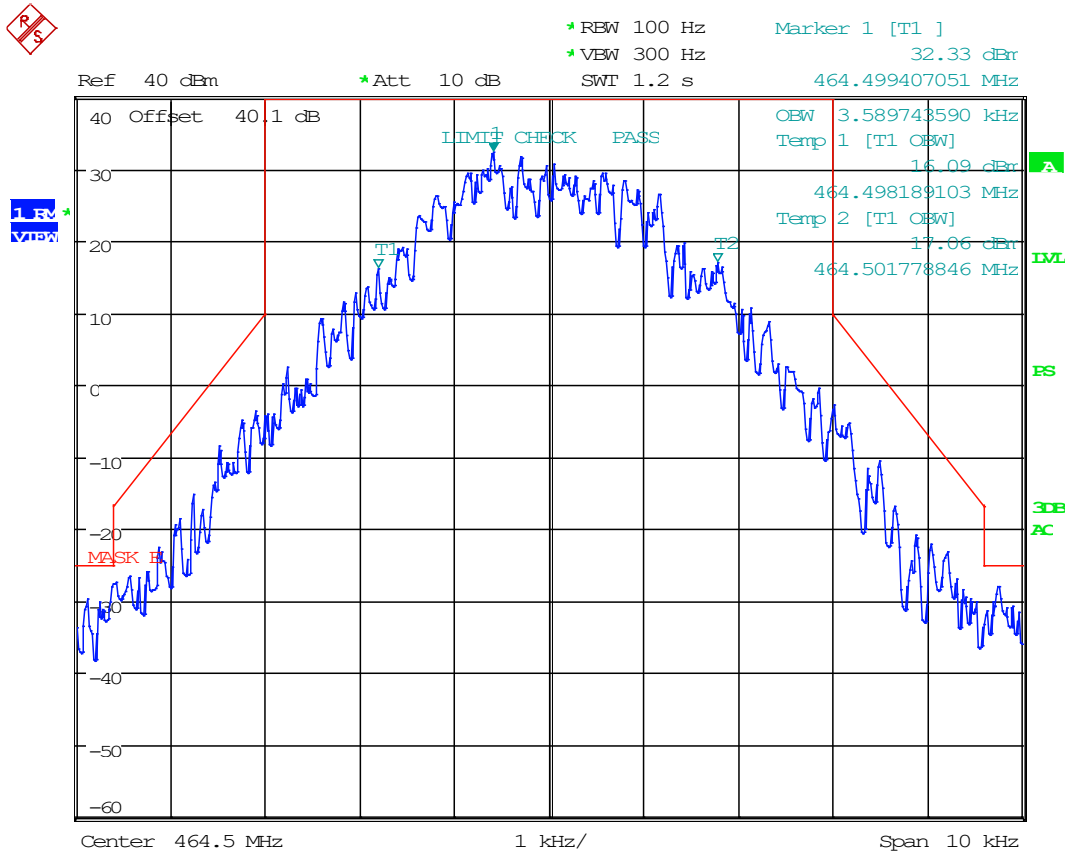


#### 8.4.8 Emission Mask, 12.5 kHz NXDN, 464.5 MHz



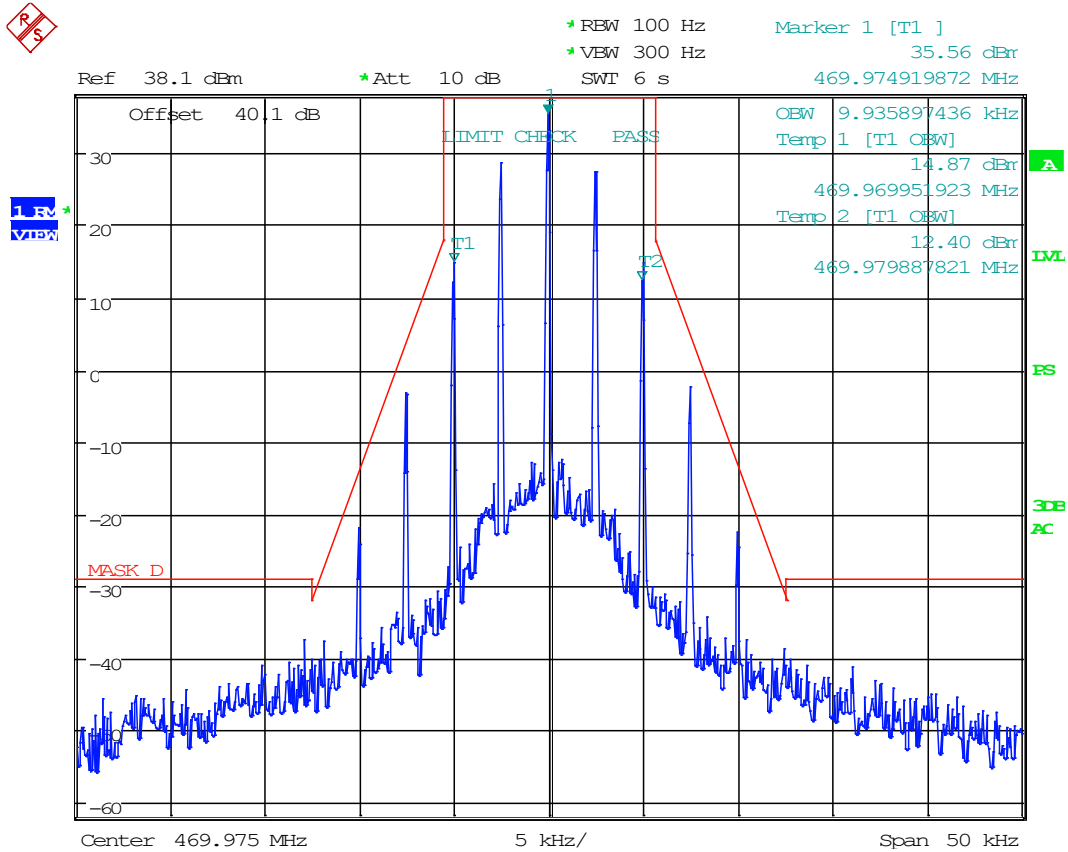
Date: 21.OCT.2021 10:45:38

#### 8.4.9 Emission Mask, 6.25 kHz NXDNSN, 464.5 MHz



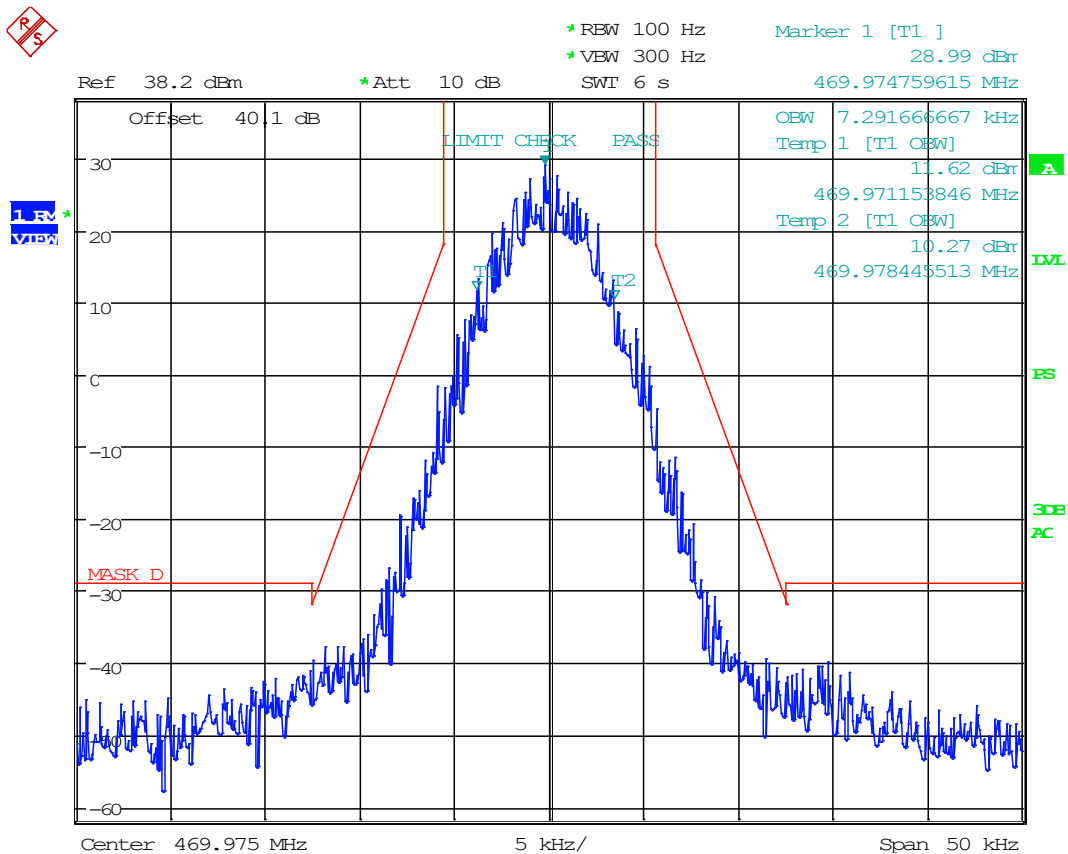
Date: 21.OCT.2021 10:55:32

#### 8.4.10 Emission Mask, 12.5 kHz FM, 469.975 MHz



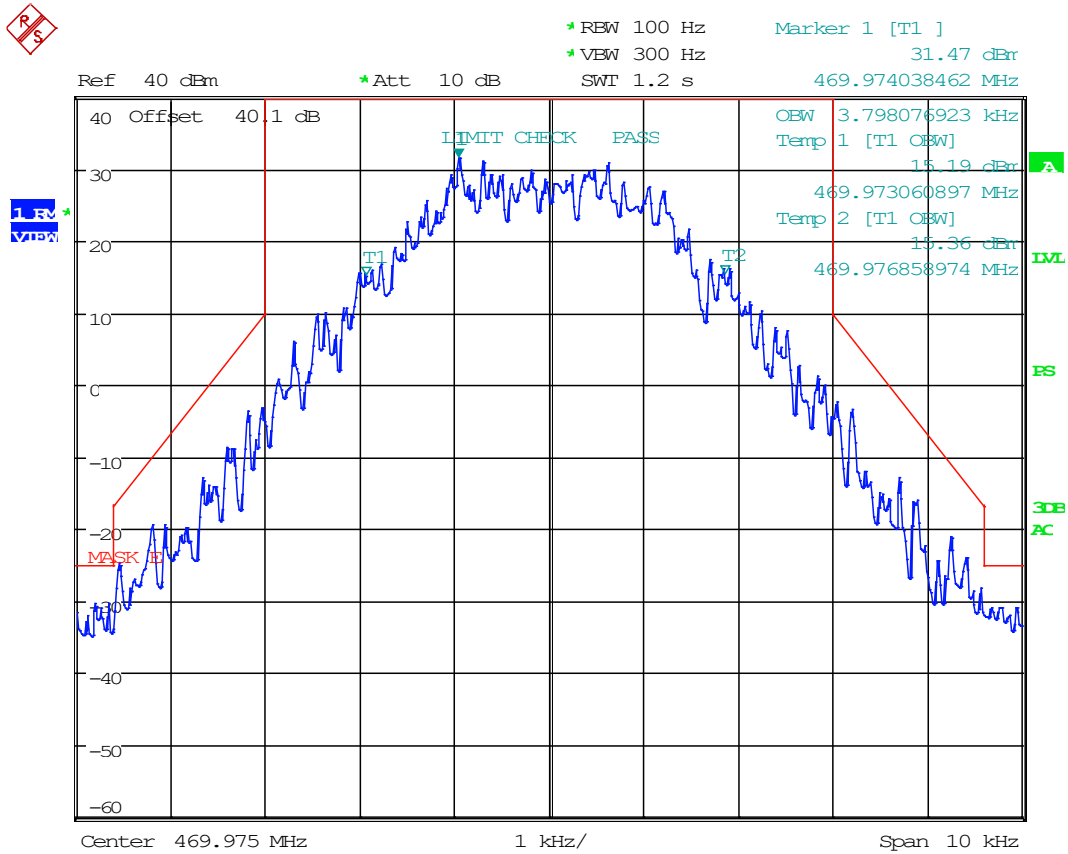
Date: 21.OCT.2021 10:25:37

### 8.4.11 Emission Mask, 12.5 kHz NXDN, 469.975 MHz



Date: 21.OCT.2021 10:44:41

#### 8.4.12 Emission Mask, 6.25 kHz NXDNSN, 469.975 MHz

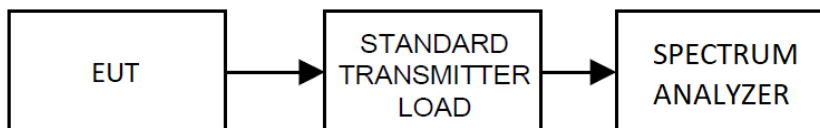


Date: 21.OCT.2021 10:54:44

## 8.5 Emission Limitations, Out-of-Band

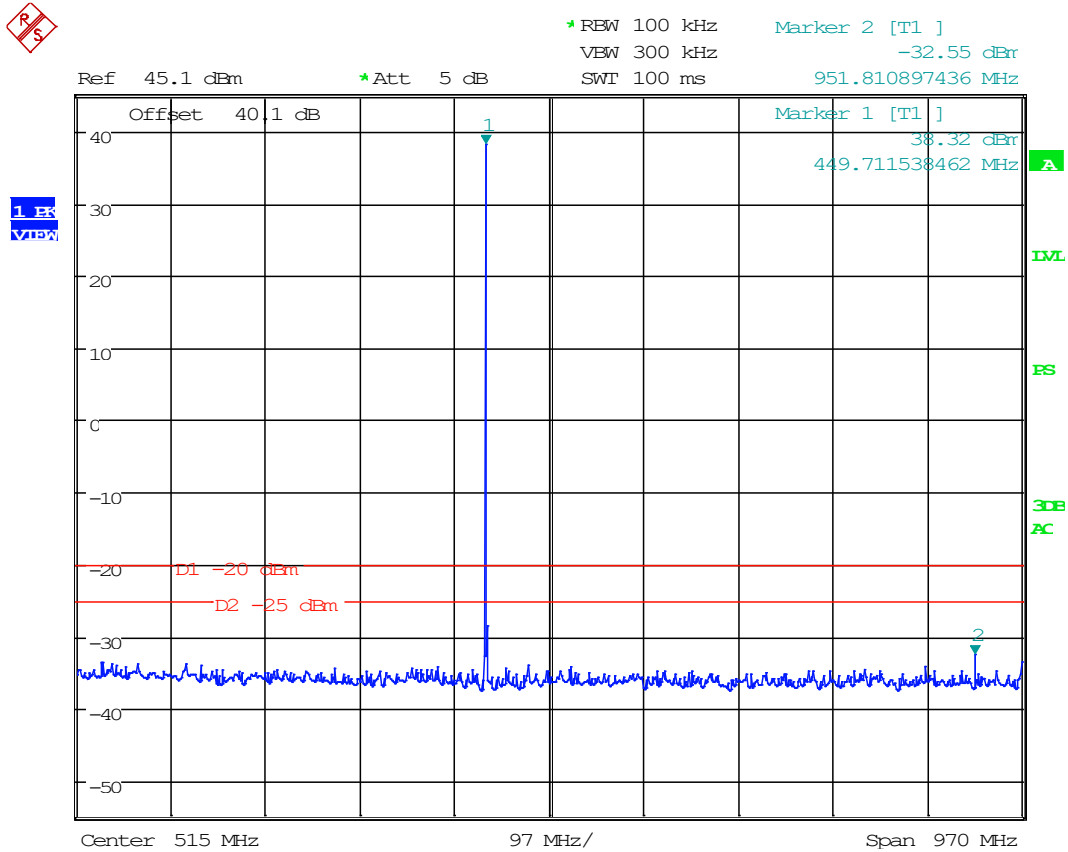
Limits from FCC Parts 2.1051, and 90.210; and test procedure from ANSI C63.26-2015.

### Conducted Test Setup



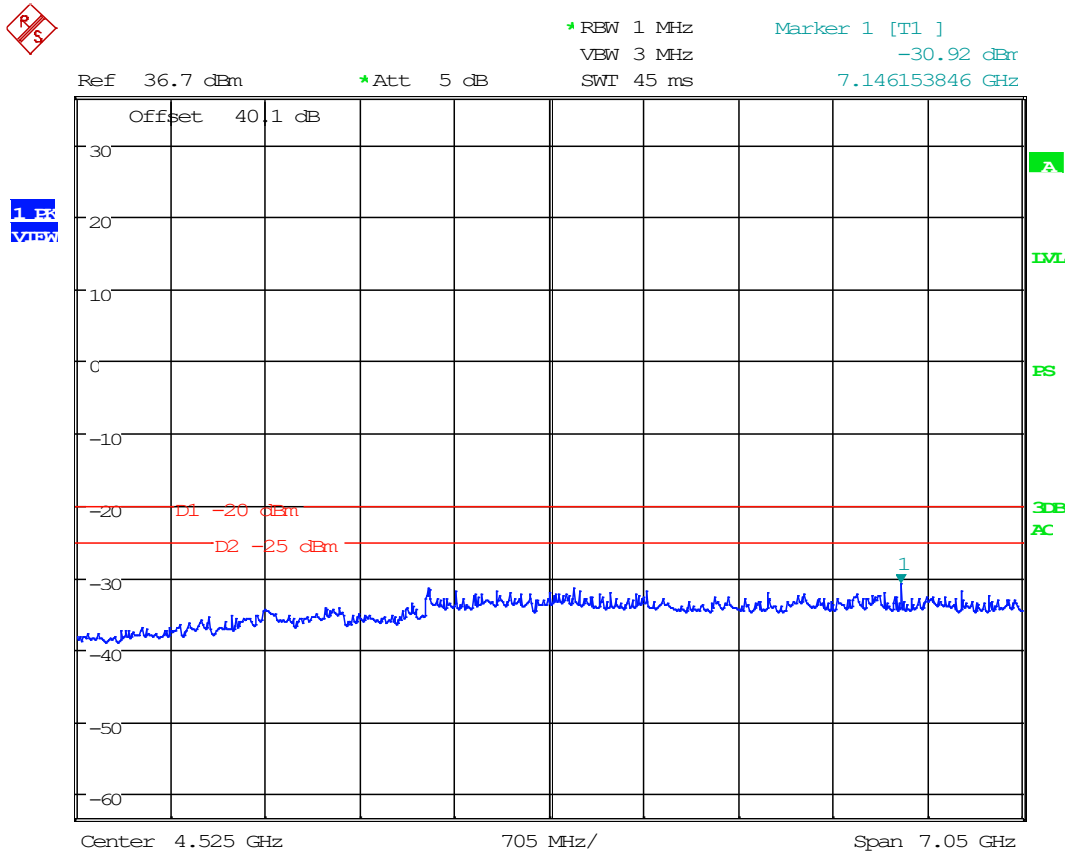
## Conducted Emissions Spectrum Plots

### 8.5.1 Conducted Emissions, Below 1GHz, 450.025 MHz



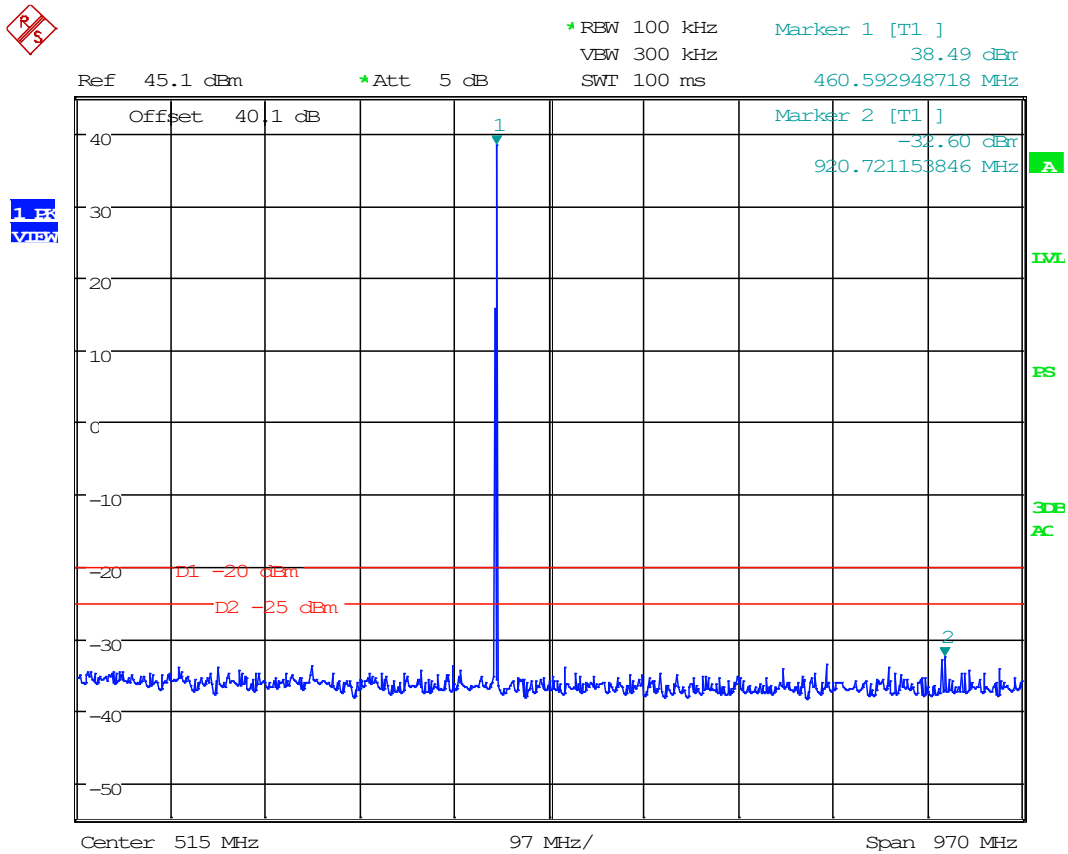
Date: 21.OCT.2021 11:21:37

## 8.5.2 Conducted Emissions Above 1GHz, 450.025 MHz



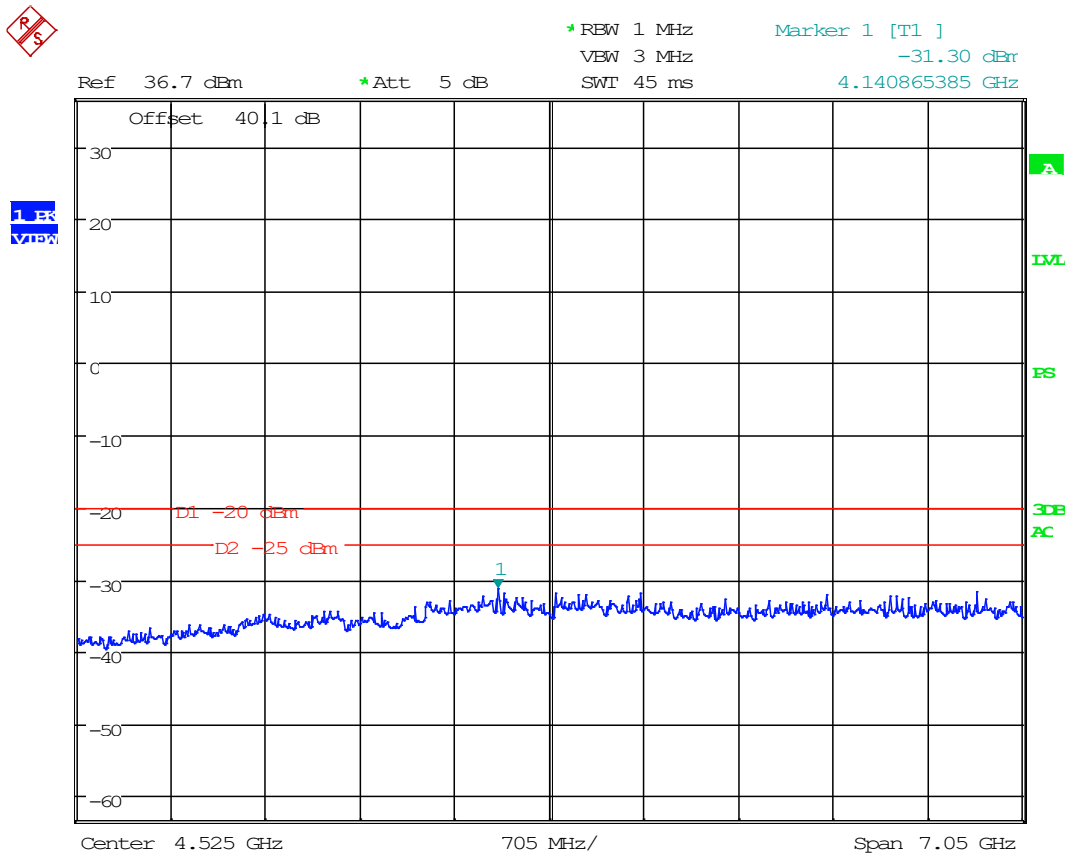
Date: 21.OCT.2021 11:24:16

### 8.5.3 Conducted Emissions Below 1GHz, 460.025 MHz



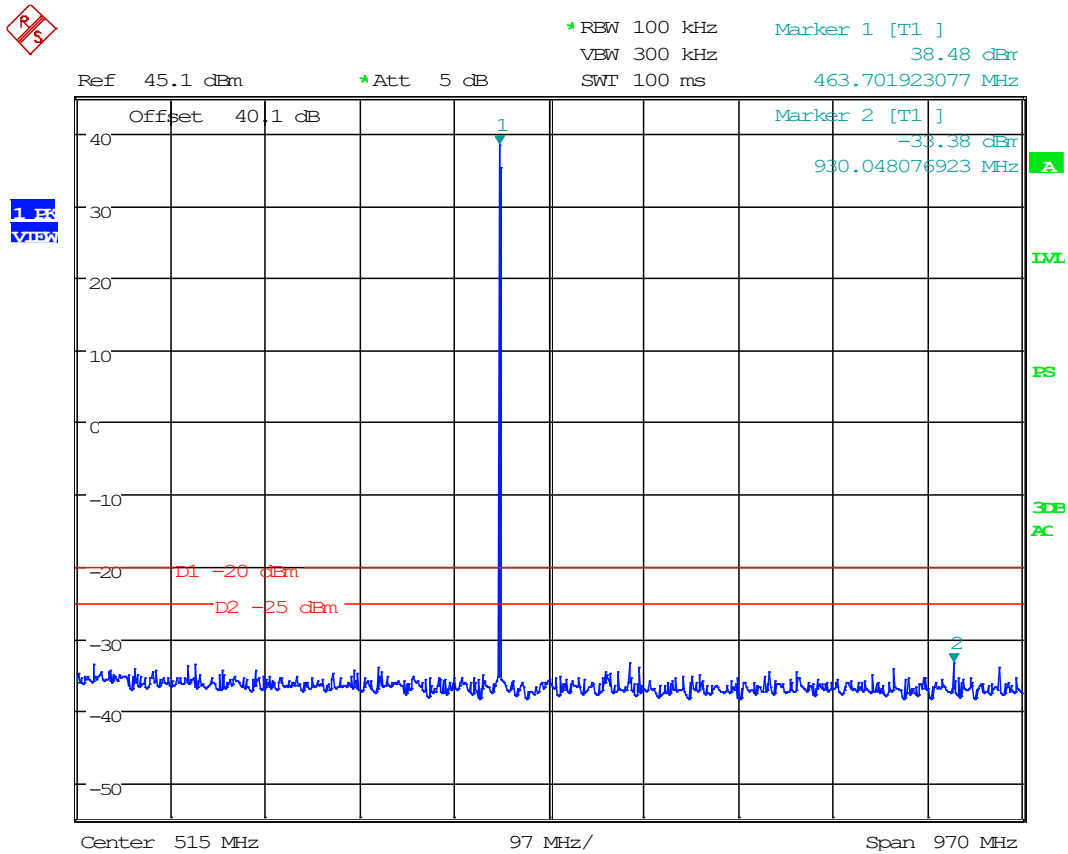
Date: 21.OCT.2021 11:22:12

## 8.5.4 Conducted Emissions Above 1GHz, 460.025 MHz



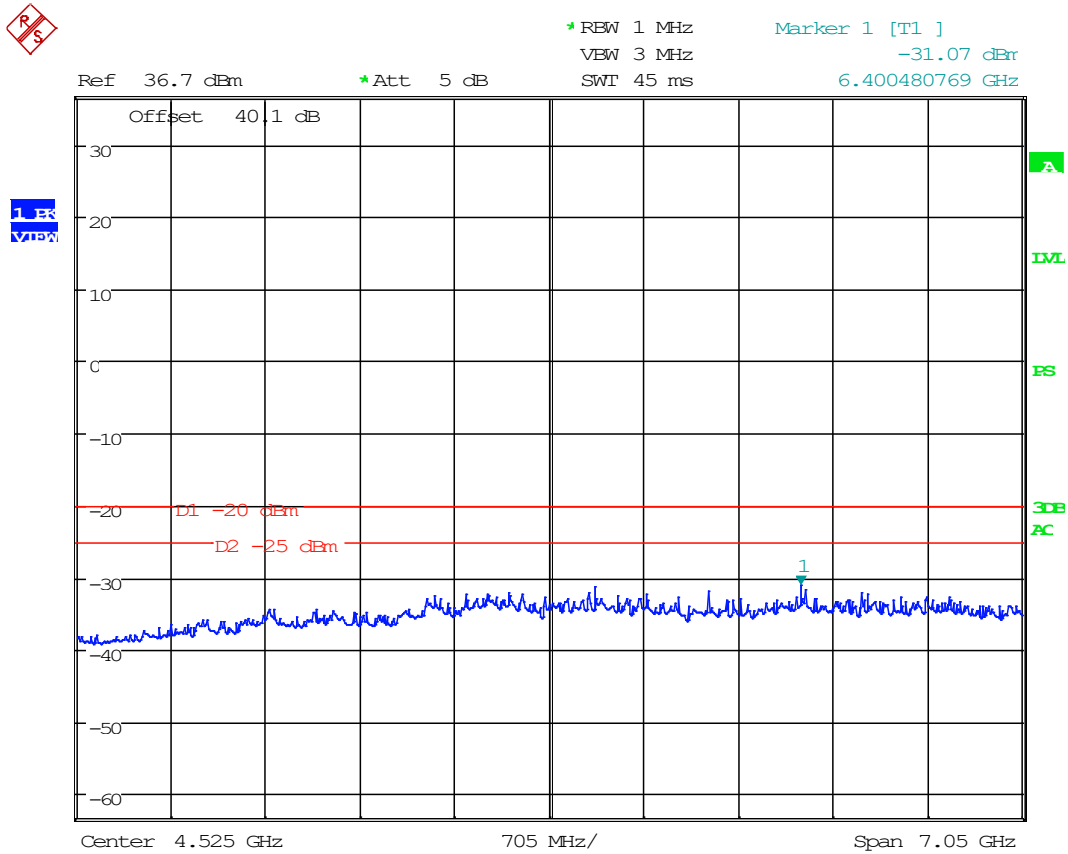
Date: 21.OCT.2021 11:24:41

### 8.5.5 Conducted Emissions Below 1GHz, 464.5 MHz



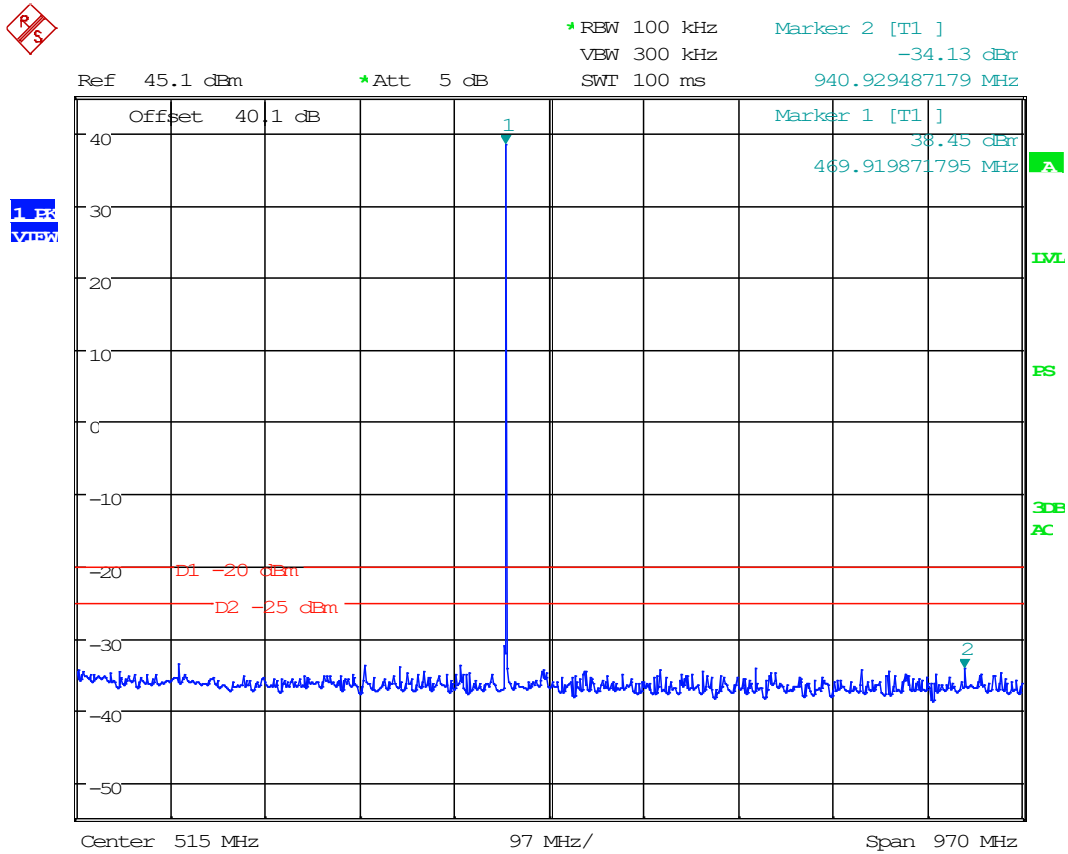
Date: 21.OCT.2021 11:23:15

## 8.5.6 Conducted Emissions Above 1GHz, 464.5 MHz



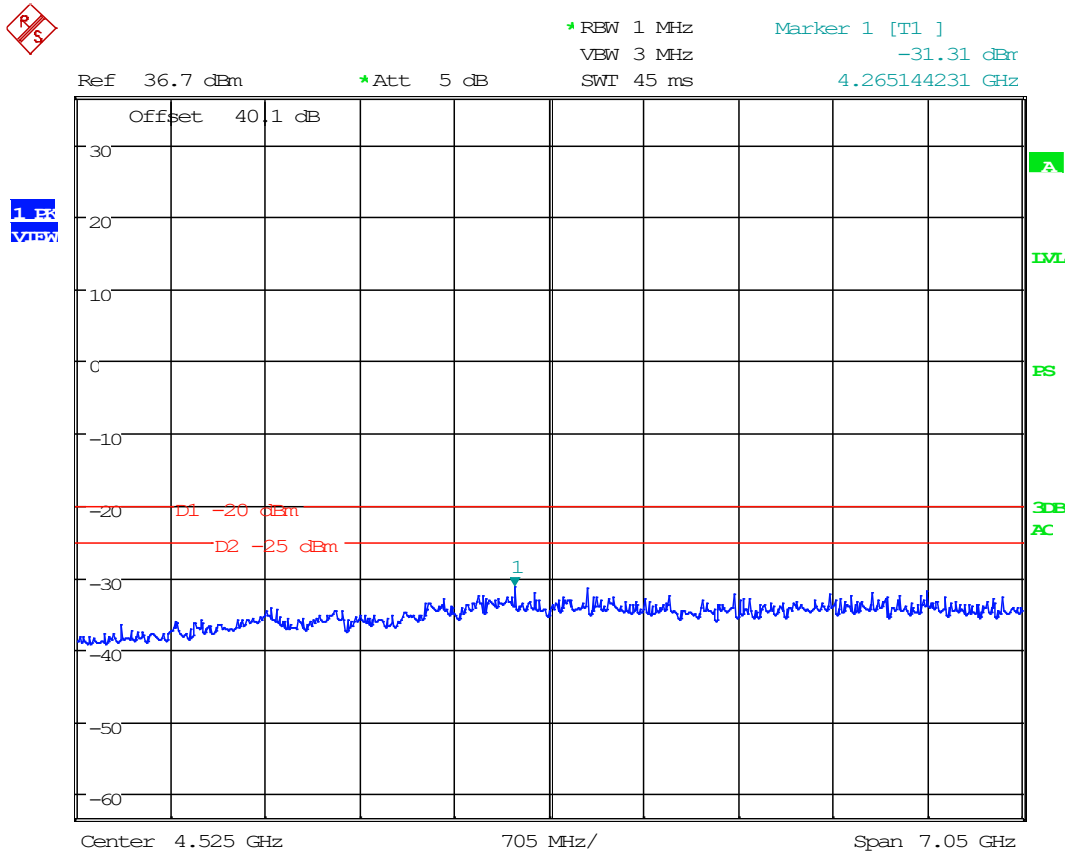
Date: 21.OCT.2021 11:25:28

## 8.5.7 Conducted Emissions Below 1GHz, 469.975 MHz



Date: 21.OCT.2021 11:22:48

## 8.5.8 Conducted Emissions Above 1GHz, 469.975 MHz

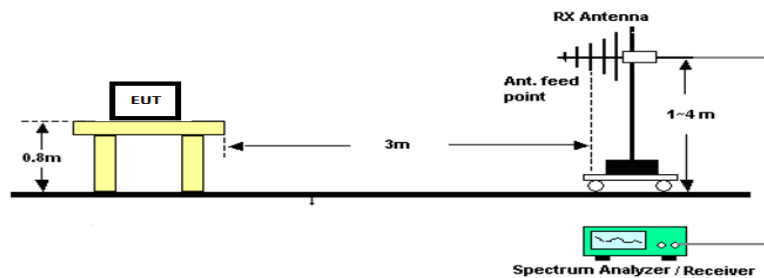


Date: 21.OCT.2021 11:25:04

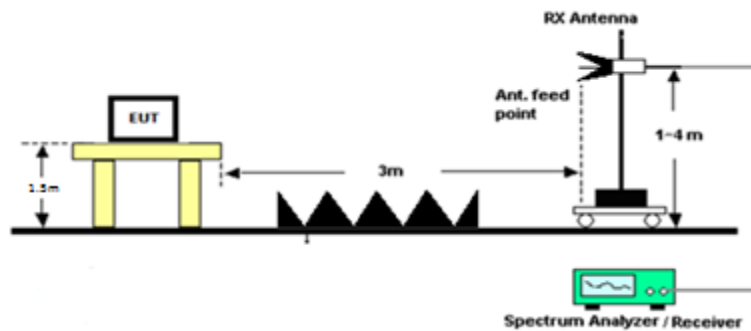
## 8.6 Radiated Emissions

Limits from FCC Parts 2.1053, 80.211 (f), 87.139 (a), and 90.210 (n); and test procedure from ANSI C63.26-2015.

### Radiated Test Setup, 30 – 1000 MHz



### Radiated Test Setup, Above 1000 MHz



## Radiated Emissions, Tabular Data

### 8.6.1 Radiated Emissions, 450.025 MHz

| Tuned Frequency (MHz) | Emission Frequency (MHz) | Detector | Meter Reading (dBuV) | Antenna Polarity | Coax Loss (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBuV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|-----------------------|--------------------------|----------|----------------------|------------------|----------------|----------------------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 450.03                | 900.05                   | PK       | 21.64                | H                | 3.54           | 21.71                            | 3.00         | 46.89                   | -50.49    | -25.00               | 25.49       |
| 450.03                | 900.05                   | PK       | 13.50                | V                | 3.54           | 21.71                            | 3.00         | 38.75                   | -58.63    | -25.00               | 33.63       |
| 450.03                | 1350.08                  | PK       | 15.70                | H                | 4.26           | 28.76                            | 3.00         | 48.72                   | -48.66    | -25.00               | 23.66       |
| 450.03                | 1350.08                  | PK       | 15.44                | V                | 4.26           | 28.76                            | 3.00         | 48.46                   | -48.92    | -25.00               | 23.92       |
| 450.03                | 1800.10                  | PK       | 15.27                | H                | 4.90           | 30.29                            | 3.00         | 50.46                   | -46.92    | -25.00               | 21.92       |
| 450.03                | 1800.10                  | PK       | 15.86                | V                | 4.90           | 30.29                            | 3.00         | 51.05                   | -46.33    | -25.00               | 21.33       |
| 450.03                | 2250.13                  | PK       | 19.67                | H                | 5.43           | 31.23                            | 3.00         | 56.33                   | -41.05    | -25.00               | 16.05       |
| 450.03                | 2250.13                  | PK       | 16.10                | V                | 5.43           | 31.23                            | 3.00         | 52.76                   | -44.62    | -25.00               | 19.62       |
| 450.03                | 2700.15                  | PK       | 15.24                | H                | 5.98           | 32.51                            | 3.00         | 53.72                   | -43.65    | -25.00               | 18.65       |
| 450.03                | 2700.15                  | PK       | 18.53                | V                | 5.98           | 32.51                            | 3.00         | 57.01                   | -40.36    | -25.00               | 15.36       |
| 450.03                | 3150.18                  | PK       | 16.22                | H                | 6.53           | 32.77                            | 3.00         | 55.52                   | -41.86    | -25.00               | 16.86       |
| 450.03                | 3150.18                  | PK       | 16.50                | V                | 6.53           | 32.77                            | 3.00         | 55.80                   | -41.58    | -25.00               | 16.58       |
| 450.03                | 3600.20                  | PK       | 14.91                | H                | 6.67           | 33.11                            | 3.00         | 54.68                   | -42.69    | -25.00               | 17.69       |
| 450.03                | 3600.20                  | PK       | 16.91                | V                | 6.67           | 33.11                            | 3.00         | 56.68                   | -40.69    | -25.00               | 15.69       |
| 450.03                | 4050.23                  | PK       | 13.87                | H                | 7.19           | 33.38                            | 3.00         | 54.43                   | -42.94    | -25.00               | 17.94       |
| 450.03                | 4050.23                  | PK       | 15.07                | V                | 7.19           | 33.38                            | 3.00         | 55.63                   | -41.74    | -25.00               | 16.74       |
| 450.03                | 4500.25                  | PK       | 13.75                | H                | 7.33           | 33.89                            | 3.00         | 54.96                   | -42.41    | -25.00               | 17.41       |
| 450.03                | 4500.25                  | PK       | 15.15                | V                | 7.33           | 33.89                            | 3.00         | 56.36                   | -41.01    | -25.00               | 16.01       |

## 8.6.2 Radiated Emissions, 460.025 MHz

| Tuned Frequency (MHz) | Emission Frequency (MHz) | Detector | Meter Reading (dBuV) | Antenna Polarity | Coax Loss (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBuV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|-----------------------|--------------------------|----------|----------------------|------------------|----------------|----------------------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 460.03                | 920.05                   | PK       | 18.71                | H                | 3.58           | 22.30                            | 3.00         | 44.59                   | -52.79    | -25.00               | 27.79       |
| 460.03                | 920.05                   | PK       | 9.47                 | V                | 3.58           | 22.30                            | 3.00         | 35.35                   | -62.03    | -25.00               | 37.03       |
| 460.03                | 1380.08                  | PK       | 17.92                | H                | 4.30           | 28.58                            | 3.00         | 50.80                   | -46.57    | -25.00               | 21.57       |
| 460.03                | 1380.08                  | PK       | 19.57                | V                | 4.30           | 28.58                            | 3.00         | 52.45                   | -44.92    | -25.00               | 19.92       |
| 460.03                | 1840.10                  | PK       | 15.45                | H                | 4.96           | 30.77                            | 3.00         | 51.17                   | -46.20    | -25.00               | 21.20       |
| 460.03                | 1840.10                  | PK       | 17.52                | V                | 4.96           | 30.77                            | 3.00         | 53.24                   | -44.13    | -25.00               | 19.13       |
| 460.03                | 2300.13                  | PK       | 20.30                | H                | 5.49           | 31.52                            | 3.00         | 57.31                   | -40.06    | -25.00               | 15.06       |
| 460.03                | 2300.13                  | PK       | 15.72                | V                | 5.49           | 31.52                            | 3.00         | 52.73                   | -44.64    | -25.00               | 19.64       |
| 460.03                | 2760.15                  | PK       | 15.05                | H                | 6.11           | 32.41                            | 3.00         | 53.57                   | -43.80    | -25.00               | 18.80       |
| 460.03                | 2760.15                  | PK       | 15.80                | V                | 6.11           | 32.41                            | 3.00         | 54.32                   | -43.05    | -25.00               | 18.05       |
| 460.03                | 3220.18                  | PK       | 17.68                | H                | 6.63           | 32.68                            | 3.00         | 56.99                   | -40.39    | -25.00               | 15.39       |
| 460.03                | 3220.18                  | PK       | 17.97                | V                | 6.63           | 32.68                            | 3.00         | 57.28                   | -40.10    | -25.00               | 15.10       |
| 460.03                | 3680.20                  | PK       | 13.76                | H                | 6.62           | 33.19                            | 3.00         | 53.58                   | -43.80    | -25.00               | 18.80       |
| 460.03                | 3680.20                  | PK       | 13.30                | V                | 6.62           | 33.19                            | 3.00         | 53.12                   | -44.26    | -25.00               | 19.26       |
| 460.03                | 4140.23                  | PK       | 14.78                | H                | 7.04           | 33.42                            | 3.00         | 55.24                   | -42.14    | -25.00               | 17.14       |
| 460.03                | 4140.23                  | PK       | 14.70                | V                | 7.04           | 33.42                            | 3.00         | 55.16                   | -42.22    | -25.00               | 17.22       |
| 460.03                | 4600.25                  | PK       | 13.25                | H                | 7.55           | 34.06                            | 3.00         | 54.85                   | -42.52    | -25.00               | 17.52       |
| 460.03                | 4600.25                  | PK       | 14.21                | V                | 7.55           | 34.06                            | 3.00         | 55.81                   | -41.56    | -25.00               | 16.56       |

### 8.6.3 Radiated Emissions, 464.5 MHz

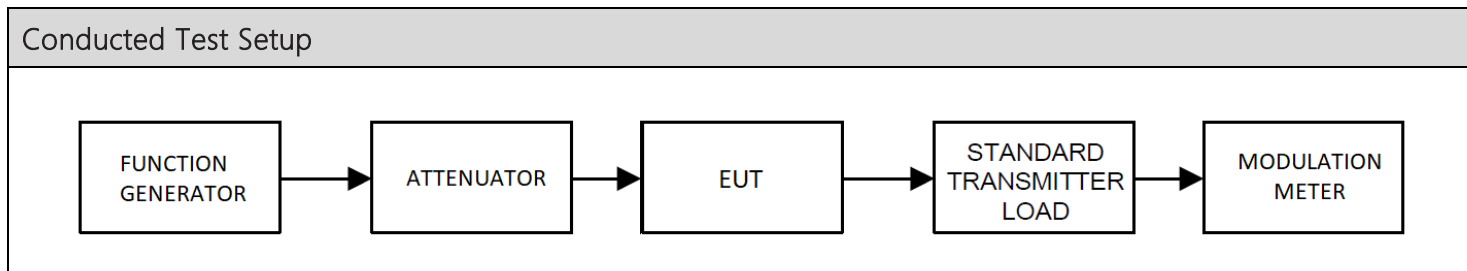
| Tuned Frequency (MHz) | Emission Frequency (MHz) | Detector | Meter Reading (dBuV) | Antenna Polarity | Coax Loss (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBuV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|-----------------------|--------------------------|----------|----------------------|------------------|----------------|----------------------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 464.50                | 929.00                   | PK       | 14.49                | H                | 3.58           | 22.28                            | 3.00         | 40.35                   | -57.03    | -25.00               | 32.03       |
| 464.50                | 929.00                   | PK       | 11.75                | V                | 3.58           | 22.28                            | 3.00         | 37.61                   | -59.77    | -25.00               | 34.77       |
| 464.50                | 1393.50                  | PK       | 22.44                | H                | 4.31           | 28.50                            | 3.00         | 55.25                   | -42.13    | -25.00               | 17.13       |
| 464.50                | 1393.50                  | PK       | 19.11                | V                | 4.31           | 28.50                            | 3.00         | 51.92                   | -45.46    | -25.00               | 20.46       |
| 464.50                | 1858.00                  | PK       | 17.88                | H                | 4.99           | 30.90                            | 3.00         | 53.77                   | -43.61    | -25.00               | 18.61       |
| 464.50                | 1858.00                  | PK       | 18.01                | V                | 4.99           | 30.90                            | 3.00         | 53.90                   | -43.48    | -25.00               | 18.48       |
| 464.50                | 2322.50                  | PK       | 20.50                | H                | 5.53           | 31.70                            | 3.00         | 57.73                   | -39.65    | -25.00               | 14.65       |
| 464.50                | 2322.50                  | PK       | 16.66                | V                | 5.53           | 31.70                            | 3.00         | 53.89                   | -43.49    | -25.00               | 18.49       |
| 464.50                | 2787.00                  | PK       | 15.24                | H                | 6.16           | 32.48                            | 3.00         | 53.88                   | -43.50    | -25.00               | 18.50       |
| 464.50                | 2787.00                  | PK       | 15.68                | V                | 6.16           | 32.48                            | 3.00         | 54.32                   | -43.06    | -25.00               | 18.06       |
| 464.50                | 3251.50                  | PK       | 20.65                | H                | 6.65           | 32.68                            | 3.00         | 59.98                   | -37.40    | -25.00               | 12.40       |
| 464.50                | 3251.50                  | PK       | 17.59                | V                | 6.65           | 32.68                            | 3.00         | 56.92                   | -40.46    | -25.00               | 15.46       |
| 464.50                | 3716.00                  | PK       | 13.95                | H                | 6.55           | 33.17                            | 3.00         | 53.67                   | -43.71    | -25.00               | 18.71       |
| 464.50                | 3716.00                  | PK       | 14.14                | V                | 6.55           | 33.17                            | 3.00         | 53.86                   | -43.52    | -25.00               | 18.52       |
| 464.50                | 4180.50                  | PK       | 14.38                | H                | 6.94           | 33.36                            | 3.00         | 54.67                   | -42.70    | -25.00               | 17.70       |
| 464.50                | 4180.50                  | PK       | 14.69                | V                | 6.94           | 33.36                            | 3.00         | 54.98                   | -42.39    | -25.00               | 17.39       |
| 464.50                | 4645.00                  | PK       | 15.02                | H                | 7.47           | 33.92                            | 3.00         | 56.41                   | -40.97    | -25.00               | 15.97       |
| 464.50                | 4645.00                  | PK       | 15.90                | V                | 7.47           | 33.92                            | 3.00         | 57.29                   | -40.09    | -25.00               | 15.09       |

#### 8.6.4 Radiated Emissions, 469.975 MHz

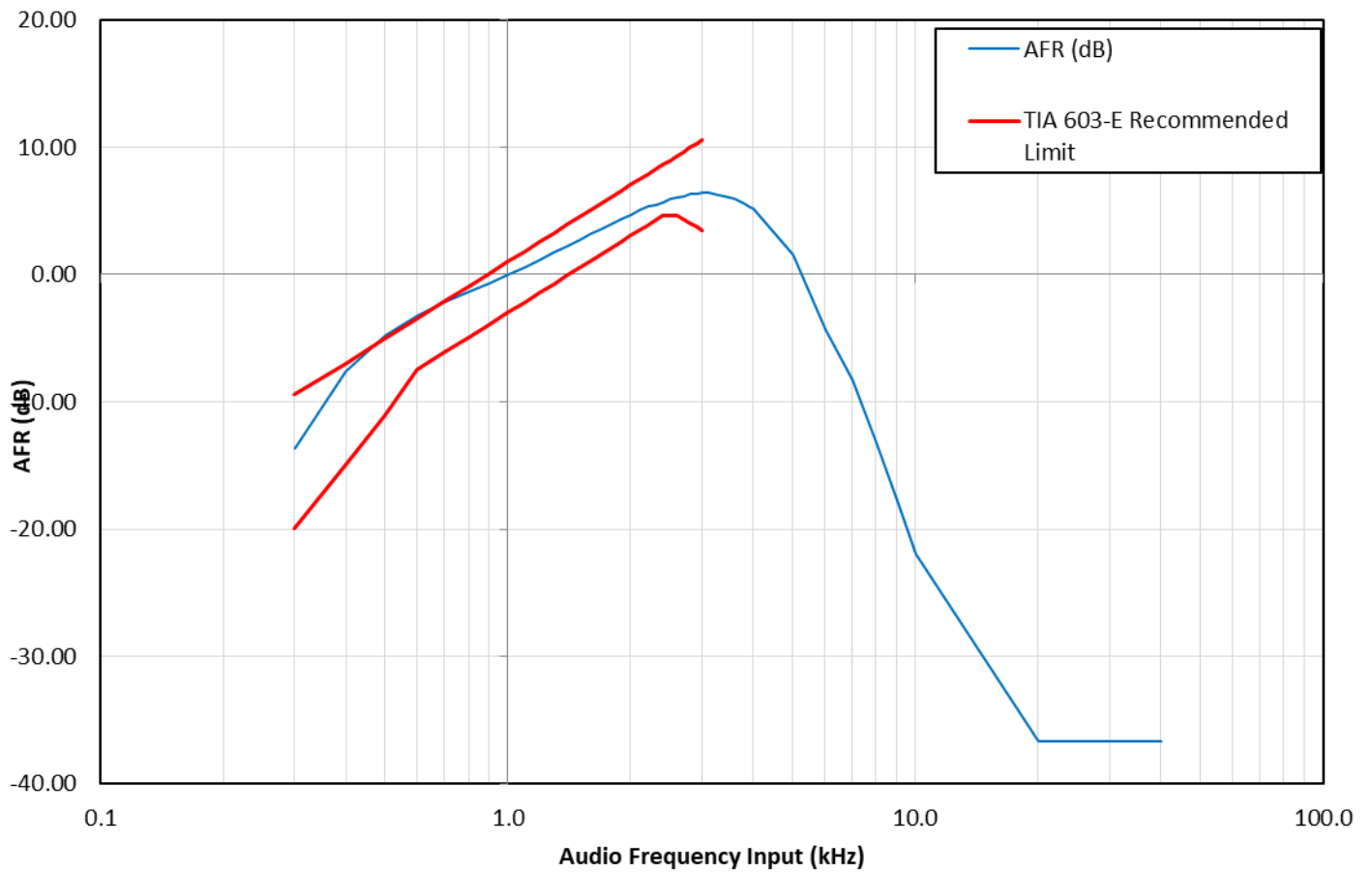
| Tuned Frequency (MHz) | Emission Frequency (MHz) | Detector | Meter Reading (dBuV) | Antenna Polarity | Coax Loss (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBuV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|-----------------------|--------------------------|----------|----------------------|------------------|----------------|----------------------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 469.98                | 939.95                   | PK       | 20.39                | H                | 3.59           | 22.60                            | 3.00         | 46.58                   | -50.80    | -25.00               | 25.80       |
| 469.98                | 939.95                   | PK       | 15.03                | V                | 3.59           | 22.60                            | 3.00         | 41.22                   | -56.16    | -25.00               | 31.16       |
| 469.98                | 1409.93                  | PK       | 19.55                | H                | 4.31           | 28.39                            | 3.00         | 52.25                   | -45.13    | -25.00               | 20.13       |
| 469.98                | 1409.93                  | PK       | 18.53                | V                | 4.31           | 28.39                            | 3.00         | 51.23                   | -46.15    | -25.00               | 21.15       |
| 469.98                | 1879.90                  | PK       | 15.63                | H                | 5.03           | 30.94                            | 3.00         | 51.60                   | -45.77    | -25.00               | 20.77       |
| 469.98                | 1879.90                  | PK       | 17.28                | V                | 5.03           | 30.94                            | 3.00         | 53.25                   | -44.12    | -25.00               | 19.12       |
| 469.98                | 2349.88                  | PK       | 16.54                | H                | 5.58           | 31.92                            | 3.00         | 54.04                   | -43.34    | -25.00               | 18.34       |
| 469.98                | 2349.88                  | PK       | 21.07                | V                | 5.58           | 31.92                            | 3.00         | 58.57                   | -38.81    | -25.00               | 13.81       |
| 469.98                | 2819.85                  | PK       | 14.99                | H                | 6.21           | 32.43                            | 3.00         | 53.63                   | -43.75    | -25.00               | 18.75       |
| 469.98                | 2819.85                  | PK       | 15.60                | V                | 6.21           | 32.43                            | 3.00         | 54.24                   | -43.14    | -25.00               | 18.14       |
| 469.98                | 3289.83                  | PK       | 14.77                | H                | 6.70           | 32.63                            | 3.00         | 54.10                   | -43.28    | -25.00               | 18.28       |
| 469.98                | 3289.83                  | PK       | 18.41                | V                | 6.70           | 32.63                            | 3.00         | 57.74                   | -39.64    | -25.00               | 14.64       |
| 469.98                | 3759.80                  | PK       | 13.85                | H                | 6.45           | 33.13                            | 3.00         | 53.43                   | -43.95    | -25.00               | 18.95       |
| 469.98                | 3759.80                  | PK       | 14.87                | V                | 6.45           | 33.13                            | 3.00         | 54.45                   | -42.93    | -25.00               | 17.93       |
| 469.98                | 4229.78                  | PK       | 13.59                | H                | 7.10           | 33.33                            | 3.00         | 54.02                   | -43.36    | -25.00               | 18.36       |
| 469.98                | 4229.78                  | PK       | 16.08                | V                | 7.10           | 33.33                            | 3.00         | 56.51                   | -40.87    | -25.00               | 15.87       |
| 469.98                | 4699.75                  | PK       | 13.34                | H                | 7.20           | 33.88                            | 3.00         | 54.42                   | -42.96    | -25.00               | 17.96       |
| 469.98                | 4699.75                  | PK       | 15.52                | V                | 7.20           | 33.88                            | 3.00         | 56.60                   | -40.78    | -25.00               | 15.78       |

## 8.7 Modulation Characteristics

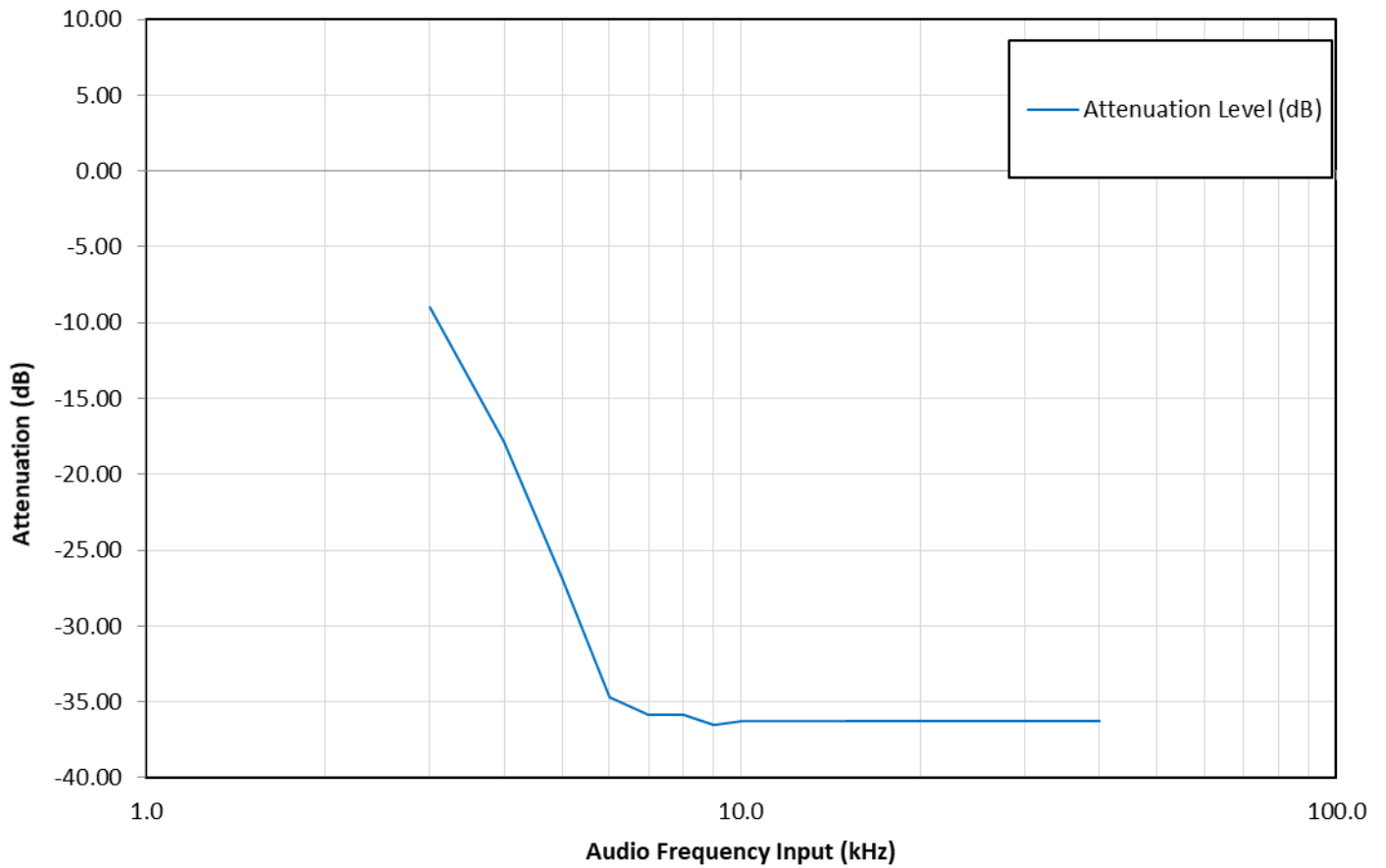
Limits from FCC Parts 2.1047 and test procedure from ANSI C63.26-2015



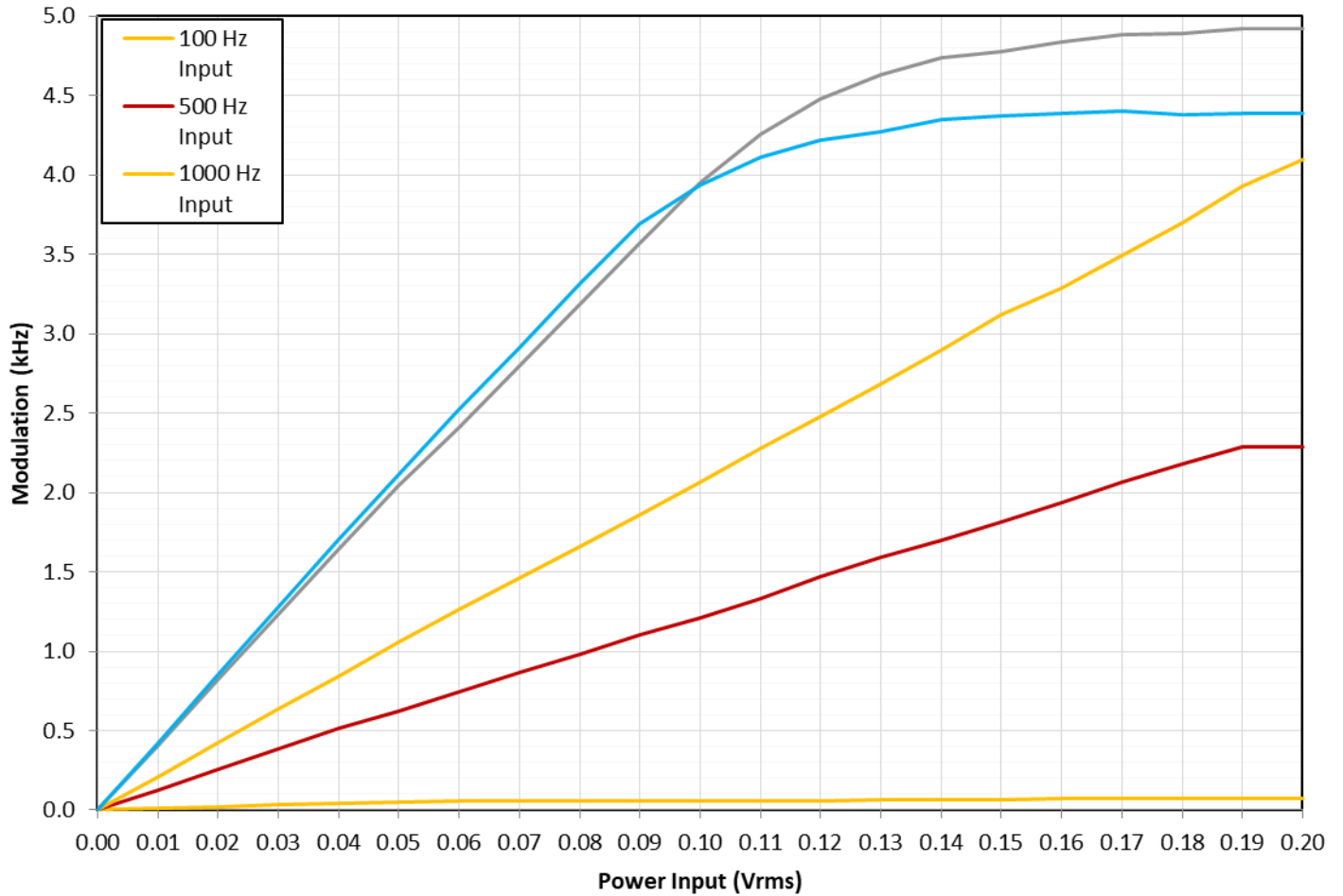
### 8.7.1 Audio Frequency Response



### 8.7.2 Low Pass Filter Response

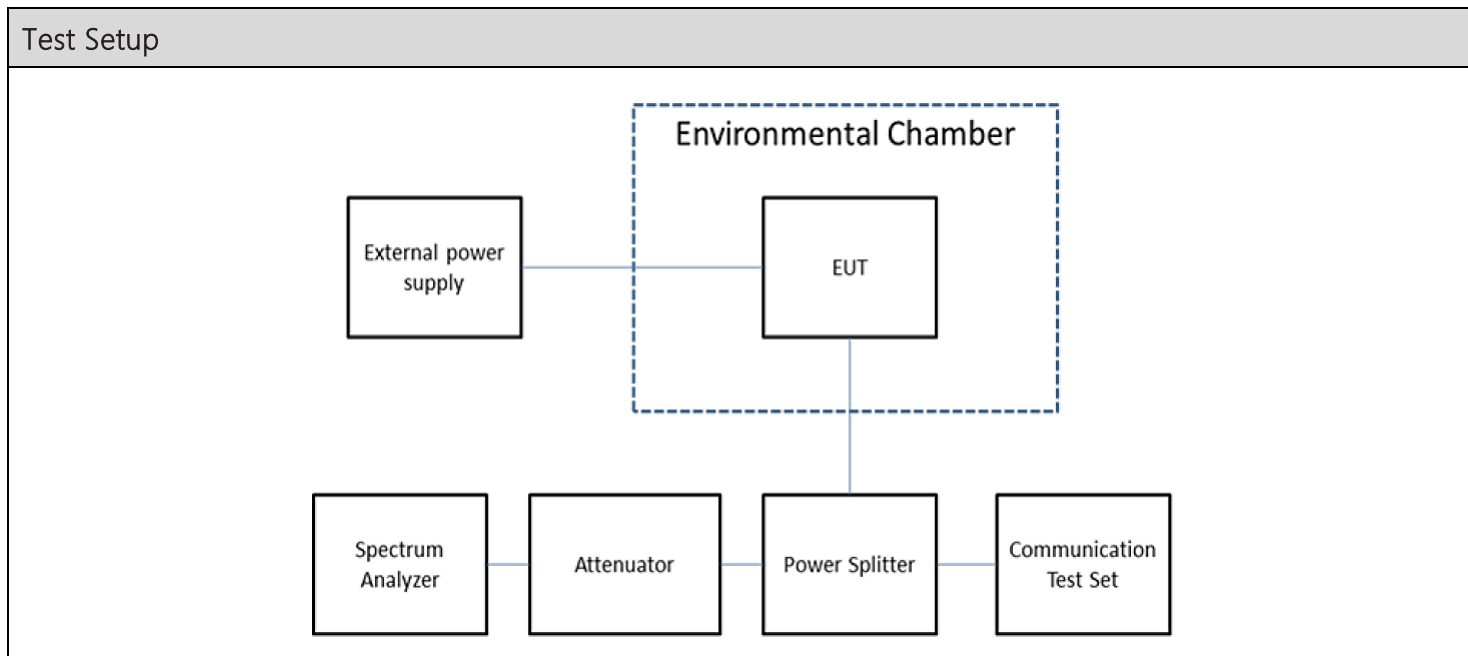


### 8.7.3 Modulation Limiting



## 8.8 Frequency Stability

Limits from FCC Parts 2.1055, and 90.213; and test procedure from ANSI C63.26-2015.



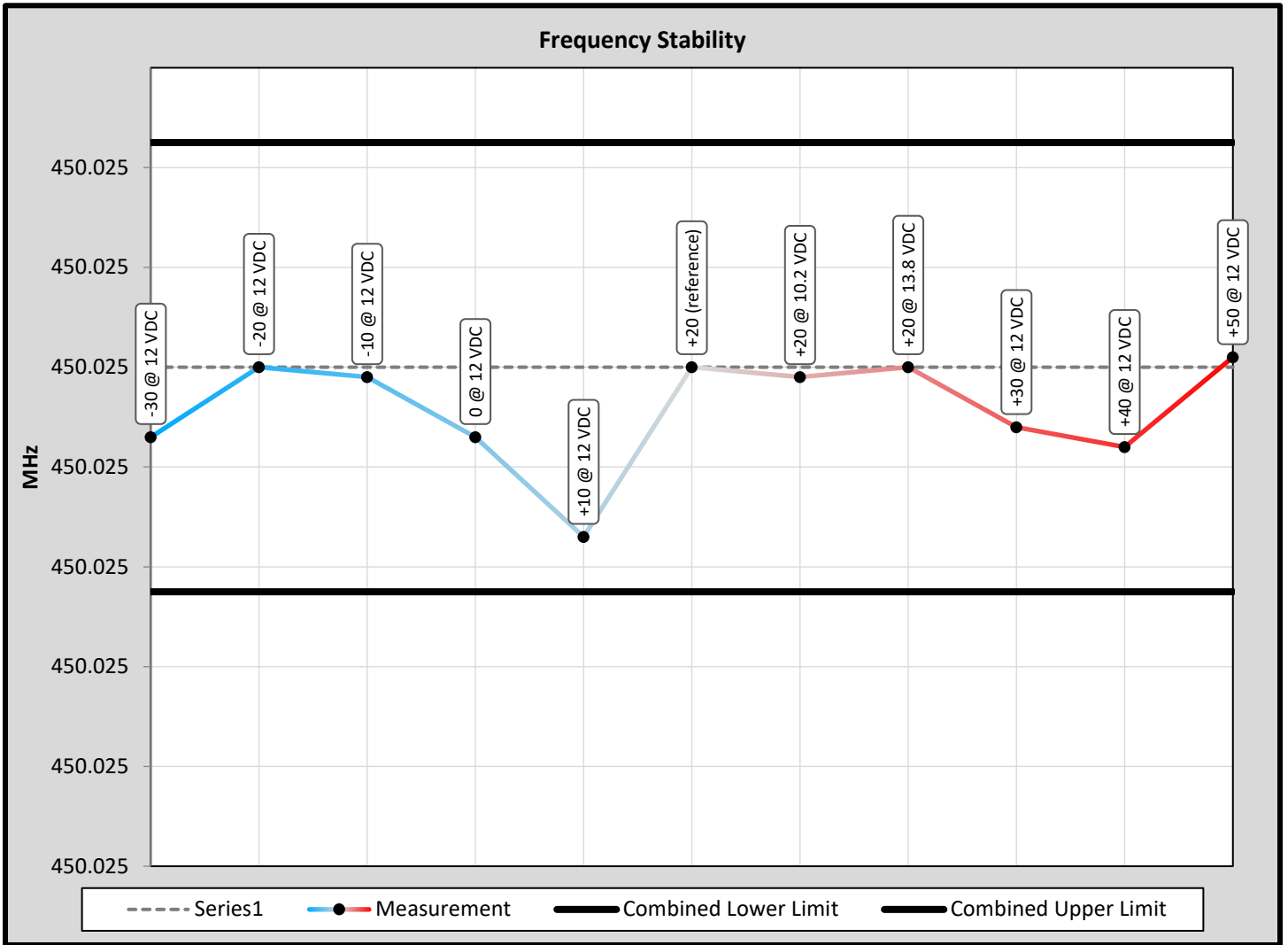
| Test Results, Mode 1  |                     |             |
|-----------------------|---------------------|-------------|
| Tuned Frequency (MHz) | Max Deviation (kHz) | Limit (ppm) |
| 450.025               | 0.170               | 0.5         |

## Frequency Stability, Tabular Data

### 8.8.1 Frequency Stability Data

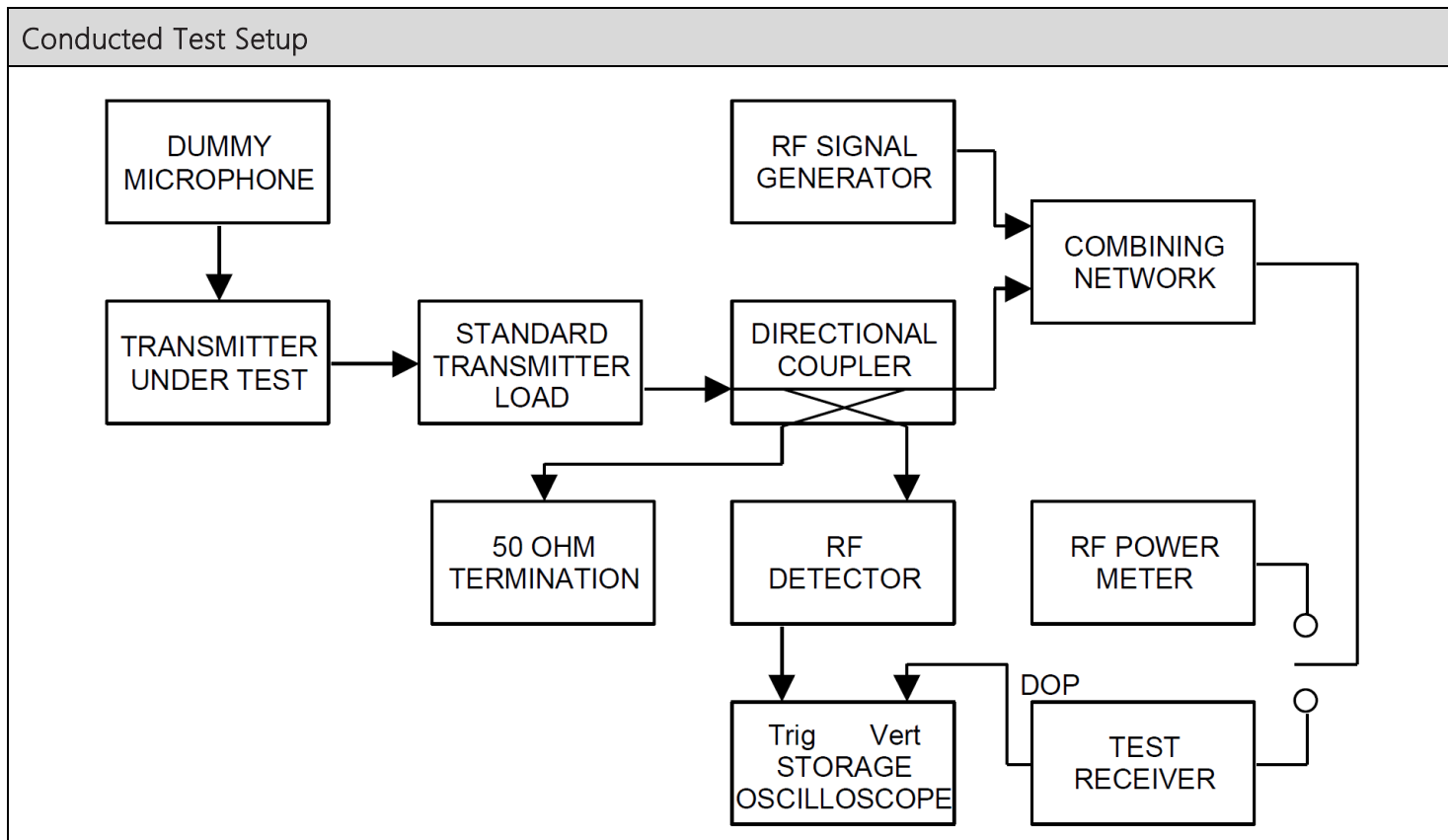
|                                 |                      |                                                                                                                                                                               |                 |
|---------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| FCC Part 90 Limit               | 0.5                  | ppm                                                                                                                                                                           |                 |
| FCC Part 90 Limit, as ppb       | 500                  | ppb (Parts per Billion)                                                                                                                                                       |                 |
| FCC Part 90 Limit, as %         | 0.00005              | %                                                                                                                                                                             |                 |
| Strictest Combined Limit, as Hz | 225.013              | Hz                                                                                                                                                                            |                 |
| Combined Lower Limit            | 450.024775           | MHz                                                                                                                                                                           |                 |
| Combined Upper Limit            | 450.025225           | MHz                                                                                                                                                                           |                 |
| Rated Supply Voltage            | 12.0                 |  AC  DC |                 |
| Temperature / Voltage Variation |                      |                                                                                                                                                                               |                 |
| Temperature (°C)                | Supplied Voltage (V) | Frequency (MHz)                                                                                                                                                               | Deviation (kHz) |
| -30                             | 12.0                 | 450.024930                                                                                                                                                                    | 0.070           |
| -20                             | 12.0                 | 450.025000                                                                                                                                                                    | 0.000           |
| -10                             | 12.0                 | 450.024990                                                                                                                                                                    | 0.010           |
| 0                               | 12.0                 | 450.024930                                                                                                                                                                    | 0.070           |
| +10                             | 12.0                 | 450.024830                                                                                                                                                                    | 0.170           |
| +20 (reference)                 | 12.0                 | 450.025000                                                                                                                                                                    | 0.000           |
| +20                             | 10.2                 | 450.024990                                                                                                                                                                    | 0.010           |
| +20                             | 13.8                 | 450.025000                                                                                                                                                                    | 0.000           |
| +30                             | 12.0                 | 450.024940                                                                                                                                                                    | 0.060           |
| +40                             | 12.0                 | 450.024920                                                                                                                                                                    | 0.080           |
| +50                             | 12.0                 | 450.025010                                                                                                                                                                    | -0.010          |

## 8.8.2 Frequency Stability Plot



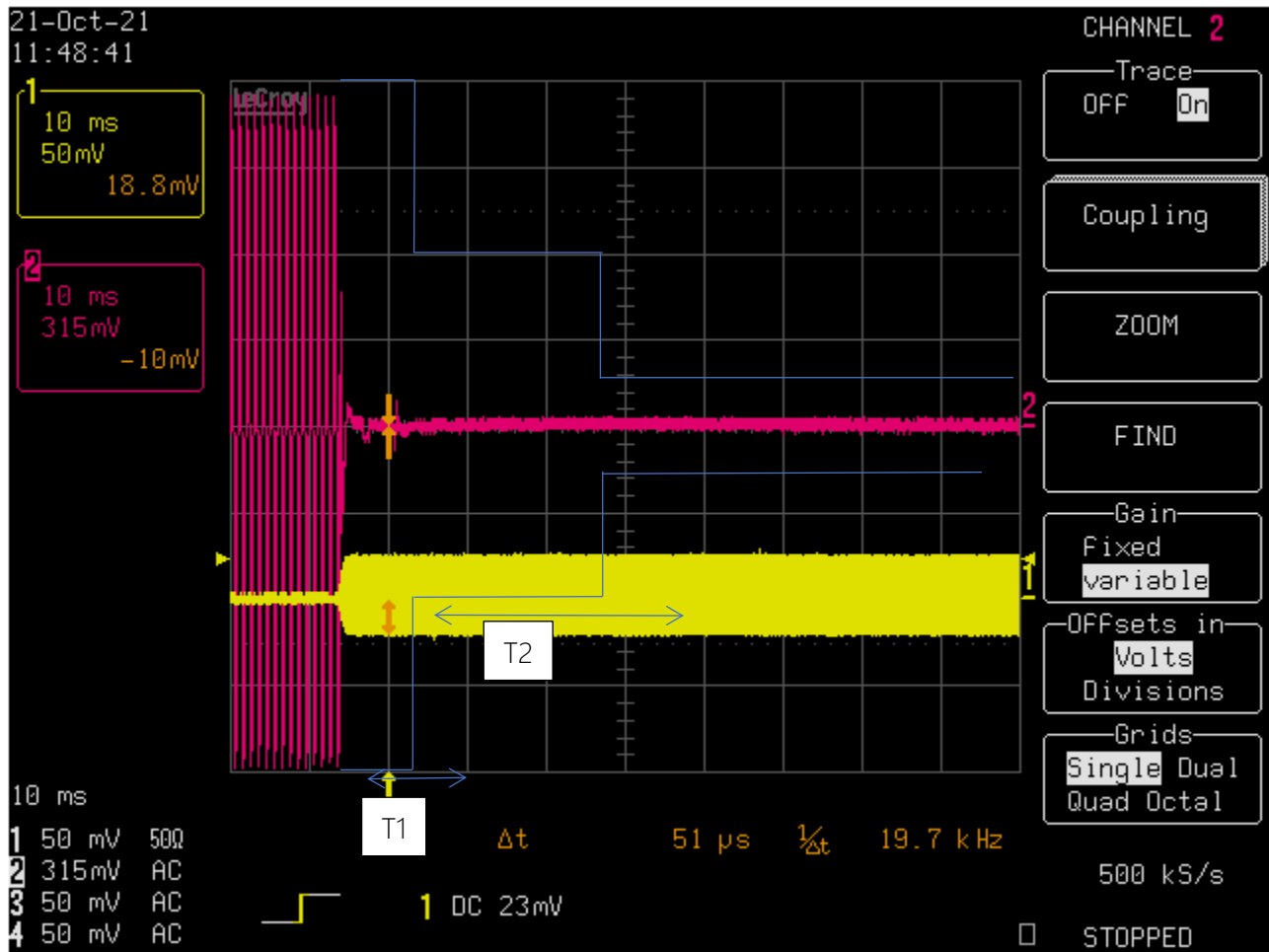
## 8.9 Transient Frequency Behavior

Limits from FCC Part 90.214; and test procedure from ANSI C63.26-2015.

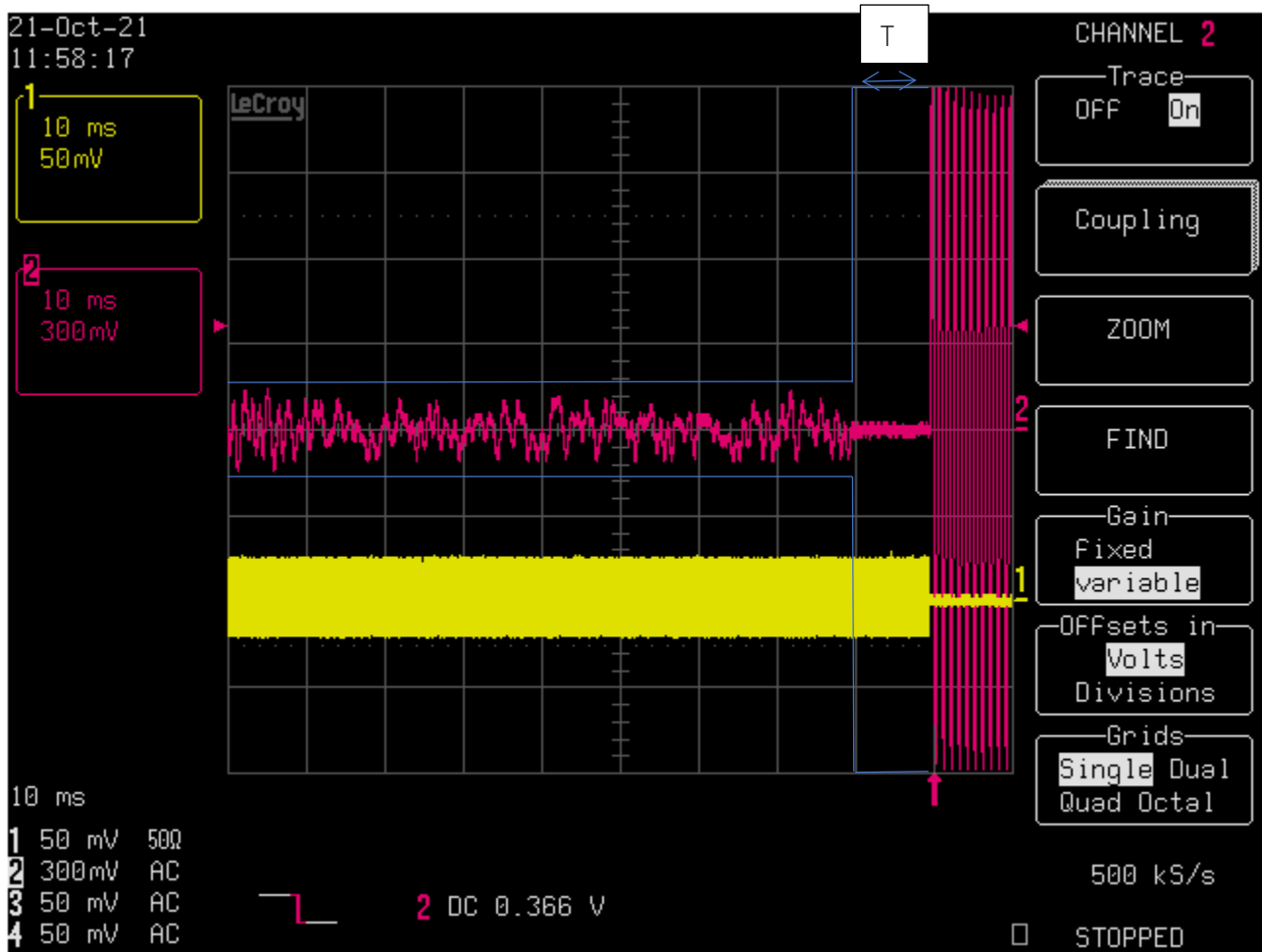


Test Result: Pass

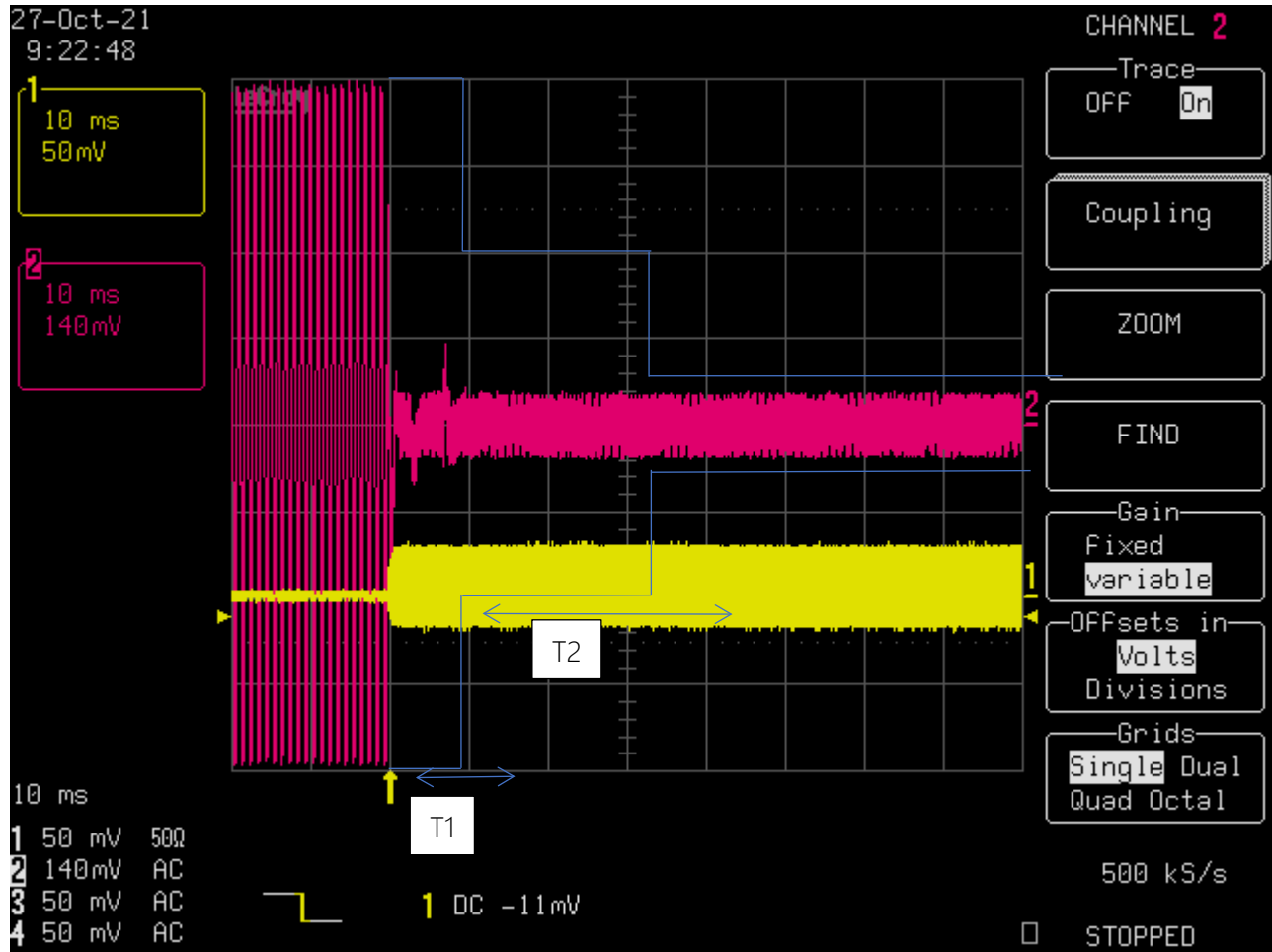
### 8.9.1 Transient Frequency Behavior, 12.5 kHz FM, Keyed-on



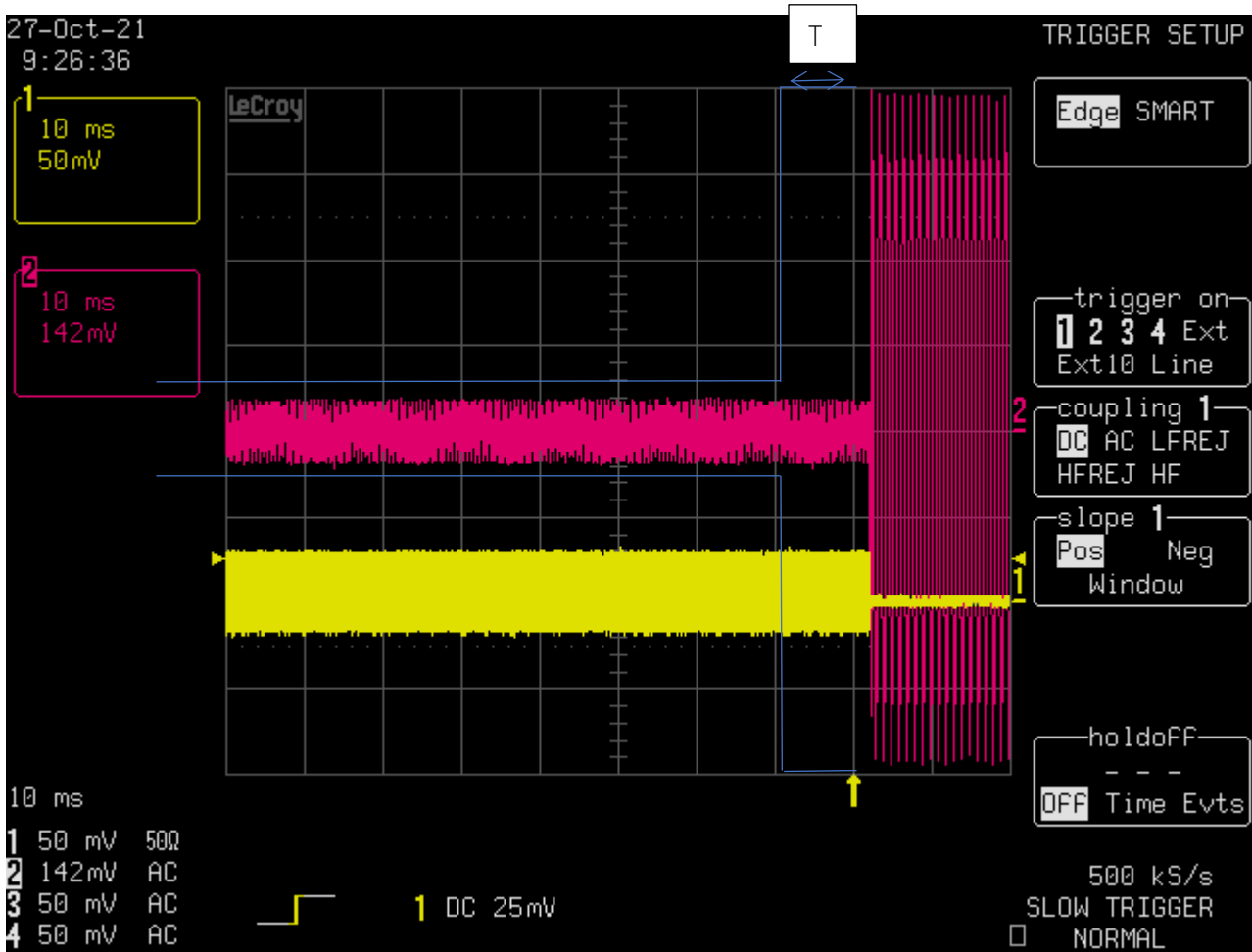
## 8.9.2 Transient Frequency Behavior, 12.5 kHz FM, Keyed-off



### 8.9.3 Transient Frequency Behavior, 6.25 kHz FM, Keyed-on



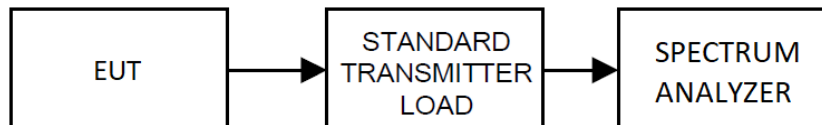
#### 8.9.4 Transient Frequency Behavior, 6.25 kHz FM, Keyed-off



## 8.10 Adjacent channel power limits

Limits from FCC Part 90.221, and test procedure from ANSI C63.26-2015.

### Conducted Test Setup



*n/a. The EUT does not operate in a band requiring ACP.*

## 9. ANNEX-A - Photographs of the EUT

Photographs of the EUT and any manufacturer supplied accessories to be used with the EUT are in separate supplementary documents labelled EXTERNAL PHOTOS and INTERNAL PHOTOS.

## 10. ANNEX-B – Test Setup Photographs

Test setup photographs are located in a separate supplementary ANNEX-B document.

## 11. History of Test Report Changes

| Test Report #        | Revision # | Description     | Date of Issue |
|----------------------|------------|-----------------|---------------|
| TR_5278-21_FCC_PT90_ | 1          | Initial release | 10/27/2021    |
|                      |            |                 |               |
|                      |            |                 |               |

---

END OF TEST REPORT

---