



An IIA Company

## Test Report - FCC PART 90 Booster Class A (B9A)

Prepared For: Fiplex Communications Inc.

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature

(YYYY-MM-DD): 2021-01-18

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## Table of Contents

|        |                                                  |    |
|--------|--------------------------------------------------|----|
| 1.     | CUSTOMER INFORMATION.....                        | 4  |
| 1.1    | TEST RESULT SUMMARY .....                        | 4  |
| 2.     | LOCATION OF TESTING .....                        | 7  |
| 2.1    | TEST LABORATORY.....                             | 7  |
| 2.2    | TESTING WAS PERFORMED, REVIEWED BY .....         | 7  |
| 3.     | TEST SAMPLE(S) (EUT/DUT) .....                   | 8  |
| 3.1    | DEFINITIONS .....                                | 8  |
| 3.2    | DESCRIPTION OF THE EUT .....                     | 9  |
| 3.3    | CONFIGURATION OF EUT .....                       | 10 |
| 3.4    | TEST SETUP OF EUT .....                          | 10 |
| 4.     | TEST METHODS & APPLICABLE REGULATORY LIMITS..... | 11 |
| 4.1    | TEST METHODS/STANDARDS/GUIDANCE:.....            | 11 |
| 4.2    | APPLIED LIMITS AND REGULATORY LIMITS:.....       | 11 |
| 5.     | MEASUREMENT UNCERTAINTY.....                     | 11 |
| 6.     | ENVIRONMENTAL CONDITIONS .....                   | 11 |
| 6.1    | TEMPERATURE & HUMIDITY .....                     | 11 |
| 7.     | LIST OF TEST EQUIPMENT AND TEST FACILITY.....    | 12 |
| 7.1    | LIST OF TEST EQUIPMENT .....                     | 12 |
| 8.     | TEST RESULTS .....                               | 13 |
| 8.1    | POWER AT THE FINAL AMPLIFIER.....                | 14 |
| 8.2    | RF OUTPUT POWER & GAIN.....                      | 15 |
| 8.3    | OUT-OF-BAND REJECTION.....                       | 17 |
| 8.3.1  | 700 Band, Downlink .....                         | 18 |
| 8.3.1  | 800 Band, Downlink .....                         | 19 |
| 8.4    | BANDWIDTH & EMISSION .....                       | 20 |
| 8.5    | INPUT VS OUTPUT SIGNAL COMPARISON .....          | 21 |
| 8.5.1  | 12.5 kHz FM .....                                | 22 |
| 8.5.2  | C4FM .....                                       | 23 |
| 8.5.3  | H-CPM.....                                       | 24 |
| 8.5.4  | H-DQPSK .....                                    | 25 |
| 8.5.5  | AWGN.....                                        | 26 |
| 8.5.6  | 12.5 kHz FM, Downlink, AGC .....                 | 27 |
| 8.5.7  | 12.5 kHz FM, Downlink, AGC +3dB.....             | 28 |
| 8.5.8  | C4FM, Downlink, AGC.....                         | 29 |
| 8.5.9  | C4FM, Downlink, AGC +3dB.....                    | 30 |
| 8.5.10 | H-CPM, Downlink, AGC.....                        | 31 |
| 8.5.11 | H-CPM, Downlink, AGC +3dB .....                  | 32 |
| 8.5.12 | H-DQPSK, Downlink, AGC.....                      | 33 |



|        |                                                                     |    |
|--------|---------------------------------------------------------------------|----|
| 8.5.13 | H-DQPSK, Downlink, AGC +3dB.....                                    | 34 |
| 8.5.14 | AWGN, Downlink, AGC.....                                            | 35 |
| 8.5.15 | AWGN, Downlink, AGC +3.....                                         | 36 |
| 8.5.16 | 12.5 kHz FM, Downlink, AGC .....                                    | 37 |
| 8.5.17 | 12.5 kHz FM, Downlink, AGC +3dB.....                                | 39 |
| 8.5.18 | C4FM, Downlink, AGC.....                                            | 41 |
| 8.5.19 | C4FM, Downlink, AGC +3dB.....                                       | 43 |
| 8.5.20 | H-CPM, Downlink, AGC.....                                           | 45 |
| 8.5.21 | H-CPM, Downlink, AGC +3dB .....                                     | 47 |
| 8.5.22 | H-DQPSK, Downlink, AGC.....                                         | 49 |
| 8.5.23 | H-DQPSK, Downlink, AGC +3dB.....                                    | 51 |
| 8.6    | NOISE FIGURE .....                                                  | 53 |
| 8.7    | OUT-OF-BAND/OUT-OF-BLOCK EMISSIONS (INTERMODULATION PRODUCTS) ..... | 54 |
| 8.7.1  | 12.5 kHz Signal, Downlink, AGC .....                                | 55 |
| 8.7.2  | 12.5 kHz Signal, Downlink, AGC +3dB.....                            | 56 |
| 8.7.3  | 12.5 kHz Signal, Downlink, AGC .....                                | 57 |
| 8.7.4  | 12.5 kHz Signal, Downlink, AGC +3dB.....                            | 58 |
| 8.8    | EMISSION MASK, OUT-OF-BAND.....                                     | 59 |
| 8.8.1  | 30 MHz to 1 GHz, 700 Band Downlink.....                             | 60 |
| 8.8.2  | 1 GHz to 10 <sup>th</sup> Harmonic, 700 Band Downlink.....          | 61 |
| 8.8.3  | 30 MHz to 1 GHz, 800 Band Downlink.....                             | 62 |
| 8.8.4  | 1 GHz to 10 <sup>th</sup> Harmonic, 800 Band Downlink.....          | 63 |
| 8.9    | SPURIOUS RADIATED EMISSIONS .....                                   | 64 |
| 8.9.1  | 700 Downlink.....                                                   | 65 |
| 8.9.2  | 800 Downlink.....                                                   | 65 |
| 8.10   | MODULATION CHARACTERISTICS.....                                     | 66 |
| 8.11   | FREQUENCY STABILITY .....                                           | 67 |
| 8.12   | TRANSIENT FREQUENCY BEHAVIOR.....                                   | 68 |
| 8.13   | ADJACENT CHANNEL POWER LIMITS.....                                  | 69 |
| 9.     | PHOTOGRAPHS OF THE EUT.....                                         | 70 |
| 10.    | TEST SETUP PHOTOGRAPHS .....                                        | 70 |
| 11.    | HISTORY OF TEST REPORT CHANGES.....                                 | 70 |



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## 1. Customer Information

**Applicant:** Fiplex Communications Inc.  
**Address:** 2101 NW 79th Ave.  
MIAMI FL 33122  
  
**Contact:** Mr. Fernando Sommariva  
**Telephone:** 305-884-8991  
**Email address:** fernando.sommariva@fiplex.com

### 1.1 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 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters. Full test results are available in this report.

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.

The Following is for Test item FCC ID: P3TDH7S-5A

| Applicable Clauses from Part 2 |                                         |                           |
|--------------------------------|-----------------------------------------|---------------------------|
| FCC Part 2 Clauses             | Description of the requirements         | Result: (Pass, Fail, N/A) |
| 2.202                          | Bandwidth & Emission                    | Pass                      |
| 2.1033 (c)(8)                  | Power at the Final Amplifier            | Pass                      |
| 2.1046 (a)                     | RF Output Power                         | Pass                      |
| 2.1047                         | Modulation characteristics              | n/a                       |
| 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                     | n/a                       |



| Applicable Clauses from Part 90 Subpart I |                                                          |                           |
|-------------------------------------------|----------------------------------------------------------|---------------------------|
| FCC Part 90 Clauses                       | Description of the requirements                          | Result: (Pass, Fail, N/A) |
| 90.205                                    | Transmitter Power                                        | Pass                      |
| 90.207                                    | Types of Emissions                                       | Pass                      |
| 90.209                                    | Bandwidth limitations                                    | Pass                      |
| 90.210                                    | Emission masks, In-band                                  | Pass                      |
| 90.210                                    | Emission masks, Out-of-band                              | Pass                      |
| 90.213                                    | Frequency stability                                      | n/a                       |
| 90.214                                    | Transient Frequency Behavior                             | n/a                       |
| 90.219 (d)(6)(i)                          | ERP of intermodulation products                          | n/a <sup>1</sup>          |
| 90.219 (d)(6)(ii)                         | ERP of noise within the passband                         | n/a <sup>1</sup>          |
| 90.219 (d)(6)(iii)                        | ERP of noise on spectrum < 1 MHz outside of the passband | n/a <sup>1</sup>          |
| 90.219 (d)(3)(i), (e)(1)                  | ERP of Radiated Power                                    | n/a <sup>1</sup>          |
| 90.219 (e)(2)                             | Noise figure                                             | Pass                      |
| 90.219 (e)(3)                             | Spurious emissions                                       | Pass                      |
| 90.219 (e)(4)(i)(ii)(iii)                 | Retransmitted Signals                                    | Pass                      |
| 90.221                                    | Adjacent channel power limits                            | Pass                      |

**Note 1:** Requirements in Part 90.219 (d) apply at deployment of this EUT, therefore are not applicable at certification.

| KDB 935210 D05 v01r04      |                                                                         |                           |
|----------------------------|-------------------------------------------------------------------------|---------------------------|
| FCC KDB 935210 D05 Clauses | Description of the requirements                                         | Result: (Pass, Fail, N/A) |
| 4.1                        | Test Signals for PLMRS (Input Signals)                                  | Pass                      |
| 4.2                        | AGC Threshold                                                           | Reported                  |
| 4.3                        | Out-of-Band Rejection                                                   | Reported                  |
| 4.4                        | Input-versus-Output Signal Comparison                                   | Pass                      |
| 4.5                        | Output Power                                                            | Pass                      |
| 4.5                        | Amplifier/Booster Gain (optional)                                       | Reported                  |
| 4.6                        | Noise Figure                                                            | Pass                      |
| 4.7.2                      | Out-of-band/Out-of-block Conducted Emissions (Intermodulation Products) | Pass                      |
| 4.7.3                      | EUT Spurious Conducted Emissions                                        | Pass                      |
| 4.8                        | Frequency Stability                                                     | n/a                       |
| 4.9                        | Spurious Radiated Emissions                                             | Pass                      |



| KDB 484596 D01 v01            |                                 |                              |
|-------------------------------|---------------------------------|------------------------------|
| FCC KDB 935210 D05<br>Clauses | Description of the requirements | Result: (Pass,<br>Fail, N/A) |
| 3 a                           | Introduction                    | Reported                     |
| 3 b                           | Explain the Differences         | Reported                     |
| 3 c                           | Spot-check Verification Data    | Pass                         |
| 3 d                           | Reference Section               | Reported                     |

## Introduction

Equipment classes B9A and B9B are not allowed to be filed under the same FCC ID. However, FCC ID P3TDH7S-5A is electrically identical to FCC ID P3TDH7S-5B. The EUT uses software to limit the passband, converting the EUT from a Class B Industrial Signal Booster into a Class A Industrial Signal Booster. The test data is valid to be re-used due to the Class B operation of the EUT being worst-case in all aspects. The Class A operation represented in this filing was equal or more compliant with FCC Part 90 in all respects. Therefore all testing is to be considered identical, and has been re-used following the guidelines of KDB 484596.

## Explain the Differences

FCC ID P3TDH7S-5A is electrically identical to FCC ID P3TDH7S-5B and has no difference in hardware. The EUT uses software to limit the passband from widths equal to or greater than 75 kHz to widths less than 75 kHz.

## Spot-Check Verification Data

Please see sections Out-of-Band Rejection and Spurious Radiated Emissions in this report for Spot-Check data.

## Reference Section

All original test data is from FCC ID P3TDH7S-5B, test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".



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## 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

### 2.2 Testing was performed, reviewed by

Dates of Testing: October 6, 2020 – November 5, 2020

Signature:

Name & Title: Franklin Rose, EMC Specialist

Date of Signature

(YYYY-MM-DD): 2021-01-18

Signature:

Sr. EMC Engineer  
EMC-003838-NE



Name & Title: Tim Royer, EMC Engineer

Date of Signature

(YYYY-MM-DD): 2021-01-18



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

The test sample was received: January 6, 2021

#### 3.1 Definitions

***Signal booster:*** A device or system that automatically receives, amplifies, and retransmits signals from wireless stations into and out of building interiors, tunnels, shielded outdoor areas and other locations where these signals would otherwise be too weak for reliable communications. Signal booster systems may contain both Class A and Class B signal boosters as components.

***Class A signal booster:*** A signal booster designed to retransmit signals on one or more specific channels. A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75 kHz.

***Class B signal booster:*** A signal booster designed to retransmit any signals within a wide frequency band. A signal booster is deemed to be a Class B signal booster if it has a passband that exceeds 75 kHz.



### 3.2 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:           | P3TDH7S-5A                     |
| Brief Description | 700/800 MHZ Remote Unit        |
| Type of Modular   | n/a                            |
| Model(s) #        | DH7S-A-7S33AR1, DH7S-D-7S33AR1 |
| Trade name        | n/a                            |
| Serial Number     | 20066162FU                     |

| Technical Characteristics    |                                                                                                                                       |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Technology                   | Bi-Directional Industrial Signal Booster                                                                                              |
| Frequency Range              | 758 - 775 MHz; and 851 - 869 MHz                                                                                                      |
| RF O/P Power (Max.)          | 37 dBm (5 W)                                                                                                                          |
| Modulation                   | n/a                                                                                                                                   |
| Bandwidth & Emission Class   | 11K3F3E, 8K10F1D, 8K10F1E, 8K10F1W, 9K80F1D, 9K80F1E, 9K80D7W, 5M00G7D, 10M0G7D, 5M00D7W, 10M0D7W, 5M00W7D, 10M0W7D, 5M00F9W, 10M0F9W |
| Number of Channels           | Variable.                                                                                                                             |
| Duty Cycle                   | 100%                                                                                                                                  |
| Antenna Connector            | N                                                                                                                                     |
| Voltage Rating (AC or Batt.) | 120 V AC or 28 V DC (internally)                                                                                                      |

| Antenna Characteristics |                 |              |            |              |
|-------------------------|-----------------|--------------|------------|--------------|
| Antenna Name            | Frequency Range | Antenna Type | Dimensions | Antenna Gain |
| n/a                     | n/a             | n/a          | n/a        | n/a          |

**Note:** This EUT does not include antenna(s).



### 3.3 Configuration of EUT

| Test Modes    |                |                  |
|---------------|----------------|------------------|
| Band          | Link Direction | Test Frequencies |
| 758 – 775 MHz | Downlink       | 758.0125 MHz     |
|               |                | 763.0000 MHz     |
|               |                | 774.9875 MHz     |
| 851 – 869 MHz | Downlink       | 788.0125 MHz     |
|               |                | 793.0000 MHz     |
|               |                | 804.9875 MHz     |

**Note:** The Remote Unit does not transmit Uplink frequencies over the air.

#### Operating conditions during Testing:

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 control the EUT.

### 3.4 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
- 2) FCC KDB 935210 D05 v01r04 Industrial Signal Boosters

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

- 1) FCC CFR 47 Part 90 Subpart I, 90.219

#### 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:

|                                                                                                                                 |             |
|---------------------------------------------------------------------------------------------------------------------------------|-------------|
| Temperature                                                                                                                     | 23 C +/- 5% |
| Humidity                                                                                                                        | 55% +/- 5%  |
| <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

| Device                                            | Manufacturer    | Model   | SN #       | Current Cal | Cal Due    |
|---------------------------------------------------|-----------------|---------|------------|-------------|------------|
| <a href="#">Signal Generator HP 8648C</a>         | HP              | 8648C   | 3847A04696 | 9/11/20     | 9/11/2023  |
| <a href="#">Signal Generator R&amp;S SMU-200A</a> | Rohde & Schwarz | SMU200A | 103195     | 4/23/18     | 4/22/2021  |
| <a href="#">Digital Multimeter</a>                | Fluke           | 77      | 35053830   | 9/9/20      | 9/9/2023   |
| <a href="#">Active Loop</a>                       | ETS-Lindgren    | 6502    | 00062529   | 10/20/20    | 10/20/2023 |
| <a href="#">Biconical 1057</a>                    | Eaton           | 94455-1 | 1057       | 10/16/20    | 10/16/2023 |
| <a href="#">Log-Periodic 1243</a>                 | Eaton           | 96005   | 1243       | 4/20/18     | 4/19/2021  |
| <a href="#">Double-Ridged Horn/ETS Horn 1</a>     | ETS-Lindgren    | 3117    | 00035923   | 2/25/20     | 2/24/2023  |
| <a href="#">CHAMBER</a>                           | Panashield      | 3M      | N/A        | 3/12/19     | 3/11/2021  |
| <a href="#">EMI Test Receiver R&amp;S ESU 40</a>  | Rohde & Schwarz | ESU 40  | 100320     | 8/28/18     | 8/27/2021  |

| Type                   | Device                       | Manufacturer  | Model                        | SN #                       | Last Verified |
|------------------------|------------------------------|---------------|------------------------------|----------------------------|---------------|
| Attenuator             | N 20dB 20W DC-4G             | Narda         | 766-20                       | 0605                       | 1/6/21        |
| Attenuator             | N 20dB 2W DC-13G             | Narda         | 757C                         | 30201                      | 1/6/21        |
| Coaxial Cable          | BMBM-0061-01 RG400           | Pasternack    | PE3582LF-24                  | BMBM-0061-01               | 1/6/21        |
| Coaxial Cable          | BMBM-0061-02 RG400           | Pasternack    | PE3582LF-24                  | BMBM-0061-02               | 1/6/21        |
| Coaxial Cable          | BMBM-0061-03 RG400           | Pasternack    | PE3582LF-24                  | BMBM-0061-03               | 1/6/21        |
| Coaxial Cable          | BMBM-0061-04 RG400           | Pasternack    | PE3582LF-24                  | BMBM-0061-04               | 1/6/21        |
| Coaxial Cable          | BMBM-0122-01 RG400           | Pasternack    | PE3582LF-48                  | BMBM-0122-01               | 1/6/21        |
| Coaxial Cable          | BMBM-0122-02 RG400           | Pasternack    | PE3582LF-48                  | BMBM-0122-02               | 1/6/21        |
| Coaxial Cable          | BMBM-0122-03 RG400           | Pasternack    | PE3582LF-48                  | BMBM-0122-03               | 1/6/21        |
| Coaxial Cable          | BMBM-0122-04 RG400           | Pasternack    | PE3582LF-48                  | BMBM-0122-04               | 1/6/21        |
| Coaxial Cable          | Chamber 3 cable set (backup) | Micro-Coax    | Chamber 3 cable set (backup) | KMKM-0244-02 ; KMKM-0670-0 | 1/6/21        |
| Combiner               | Splitter/Combiner 1-1000MHz  | Mini-Circuits | ZFSC-4-1-BNC+                | U115700825                 | 1/6/21        |
| Combiner               | Splitter/Combiner 1-1000MHz  | Mini-Circuits | ZFSC-4-1-BNC+                | U115700826                 | 1/6/21        |
| Noise Source           | Noise Source 10MHz - 18GHz   | Agilent       | 346B                         | MY44421884                 | 1/6/21        |
| Terminator             | Terminator N 20W DC-18G      | Narda         | 8205                         | #14                        | 1/6/21        |
| Test Equipment Adapter | Type R&S to NF               |               |                              | Test Equipment Adapter 04  | 1/6/21        |

| Software       | Author          | Version                  |
|----------------|-----------------|--------------------------|
| ESU Firmware   | Rohde & Schwarz | 4.43 SP3; BIOS v5.1-24-3 |
| RSCommander    | Rohde & Schwarz | 1.6.4                    |
| Field Strength | Timco           | v4.10.7.0                |



## 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

*Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".*

Limits from FCC Part 2.1033 (c)(8).

No method of measurement is specified. The result has been calculated based on all available information.

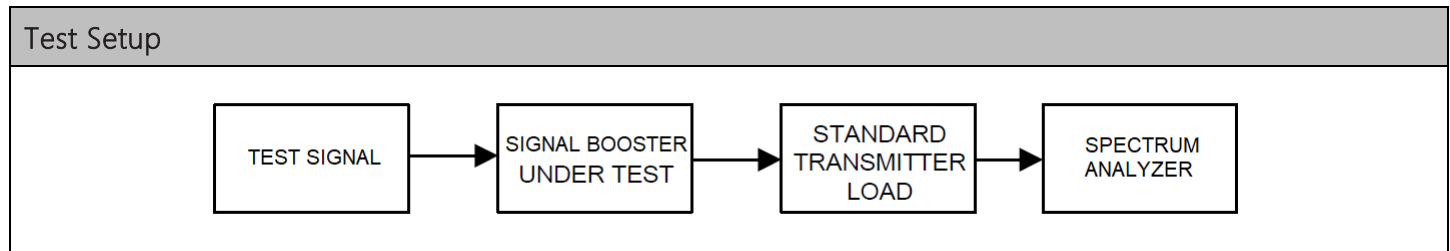
| Test Results              |                 |                              |
|---------------------------|-----------------|------------------------------|
| EUT Operating Voltage (V) | EUT Current (A) | Power at the Final Amplifier |
| 24 V DC                   | 3.33            | 80 W                         |



## 8.2 RF Output Power & Gain

*Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".*

Limits from FCC Parts 2.1046(a), and 90.205 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.



| Test Results, Power Output |                        |                      |
|----------------------------|------------------------|----------------------|
| Link Direction             | Max Power Output (dBm) | Max Power Output (W) |
| Downlink                   | 37.0                   | 5.00                 |



## 700 Band Gain

| Test Results, Gain |                       |             |                   |                    |           |
|--------------------|-----------------------|-------------|-------------------|--------------------|-----------|
| Link Direction     | Tuned Frequency (MHz) | Input Level | Power Input (dBm) | Power Output (dBm) | Gain (dB) |
| Downlink           | 758.0125              | AGC         | -40.62            | 38.06              | 78.68     |
|                    |                       | AGC+3       | -37.62            | 38.05              | 75.67     |
|                    |                       | Maximum     | 0.00              | 38.07              | 38.07     |
|                    | 763.0                 | AGC         | -40.62            | 38.06              | 78.68     |
|                    |                       | AGC+3       | -37.62            | 38.05              | 75.67     |
|                    |                       | Maximum     | 0.00              | 38.07              | 38.07     |
|                    | 774.9875              | AGC         | -40.62            | 38.06              | 78.68     |
|                    |                       | AGC+3       | -37.62            | 38.05              | 75.67     |
|                    |                       | Maximum     | 0.00              | 38.07              | 38.07     |

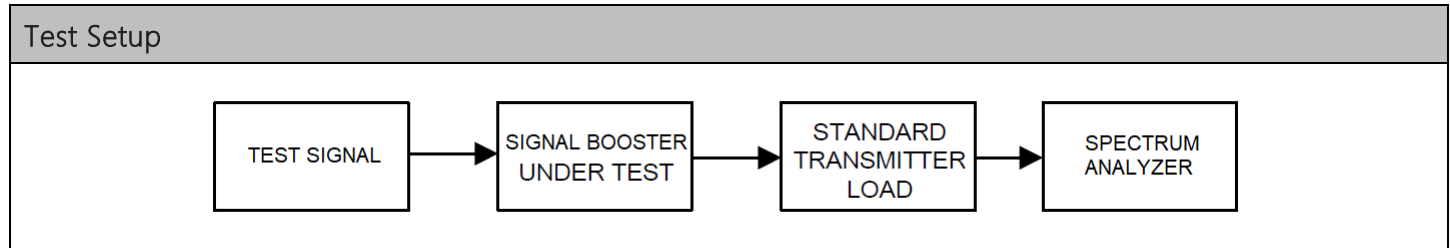
## 800 Band Gain

| Test Results, Gain |                       |             |                   |                    |           |
|--------------------|-----------------------|-------------|-------------------|--------------------|-----------|
| Link Direction     | Tuned Frequency (MHz) | Input Level | Power Input (dBm) | Power Output (dBm) | Gain (dB) |
| Downlink           | 851.0125              | AGC         | -40.62            | 38.06              | 78.68     |
|                    |                       | AGC+3       | -37.62            | 38.05              | 75.67     |
|                    |                       | Maximum     | 0.00              | 38.07              | 38.07     |
|                    | 861.9875              | AGC         | -40.62            | 38.06              | 78.68     |
|                    |                       | AGC+3       | -37.62            | 38.05              | 75.67     |
|                    |                       | Maximum     | 0.00              | 38.07              | 38.07     |
|                    | 868.9875              | AGC         | -40.62            | 38.06              | 78.68     |
|                    |                       | AGC+3       | -37.62            | 38.05              | 75.67     |
|                    |                       | Maximum     | 0.00              | 38.07              | 38.07     |



### 8.3 Out-of-band Rejection

Limits and test method from FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.

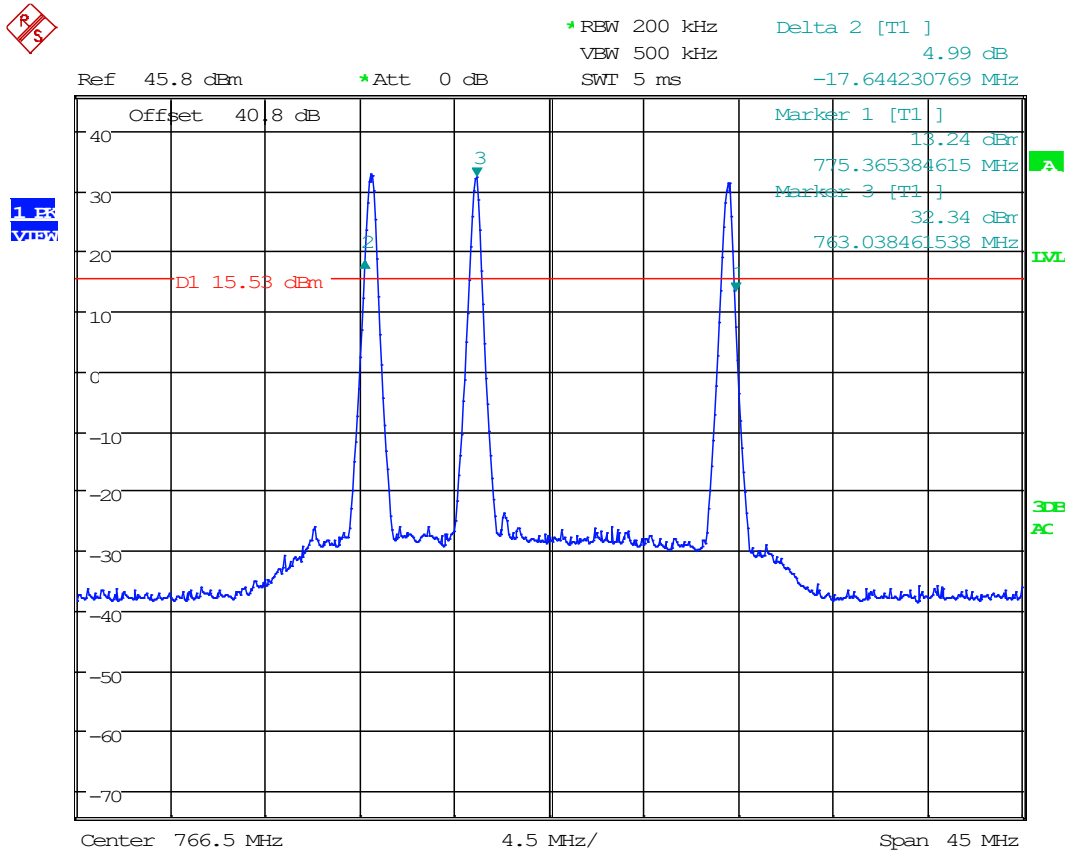


| Test Results, Out-of-band Rejection and Class of Operation |                |                |                    |
|------------------------------------------------------------|----------------|----------------|--------------------|
| Operating Band                                             | Link Direction | Passband (kHz) | Class of Operation |
| 758 – 775 MHz                                              | Downlink       | < 75 kHz       | Class A            |
| 851 – 869 MHz                                              | Downlink       | < 75 kHz       | Class A            |



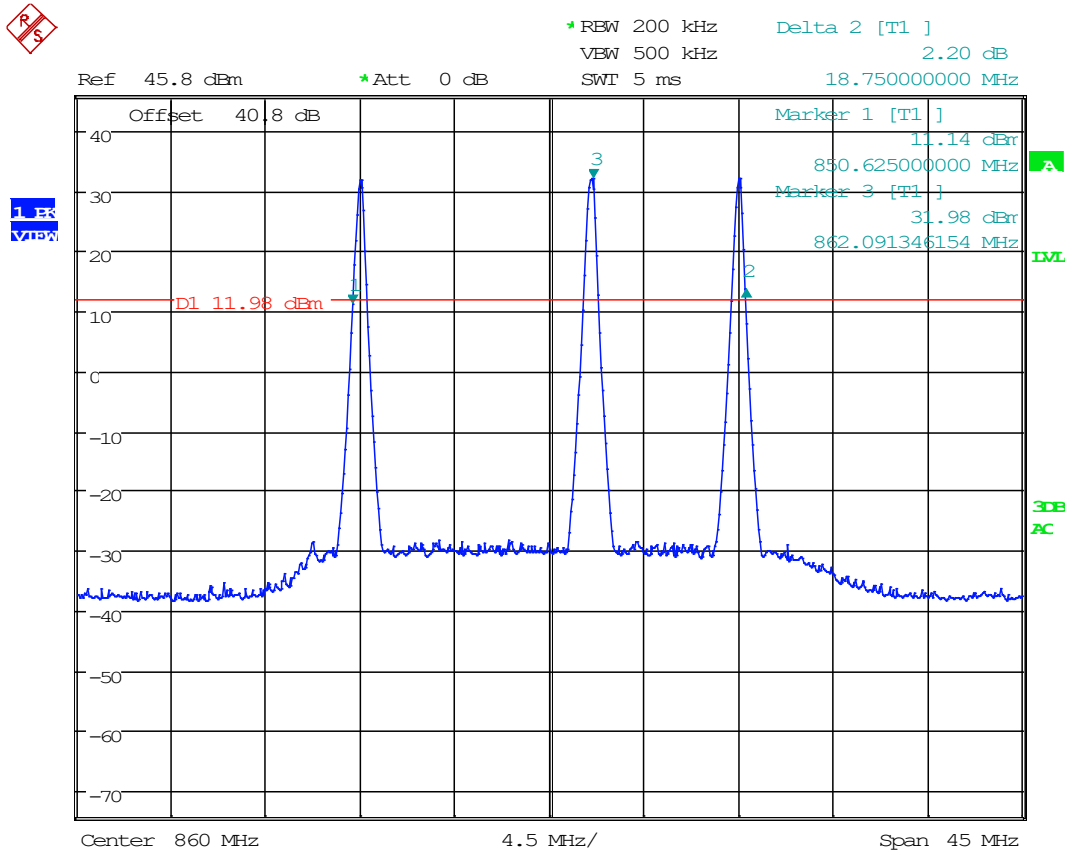
## Out-of-band Rejection, Spectrum Plots

### 8.3.1 700 Band, Downlink



Date: 14.JAN.2021 18:26:31

### 8.3.1 800 Band, Downlink



Date: 14.JAN.2021 18:41:20



## 8.4 Bandwidth & Emission

Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".

Limits from FCC Parts 90.209 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.

| Authorized Bandwidth |                 |                      |
|----------------------|-----------------|----------------------|
| Rule Part            | Operating Range | Authorized Bandwidth |
| Part 90              | 758 – 775 MHz   | Unspecified.         |
| Part 90              | 851 – 854 MHz   | 20 kHz               |
| Part 90              | 854 – 862 MHz   | 20 kHz, 11.25 kHz    |
| Part 90              | 862 – 869 MHz   | 20 kHz               |

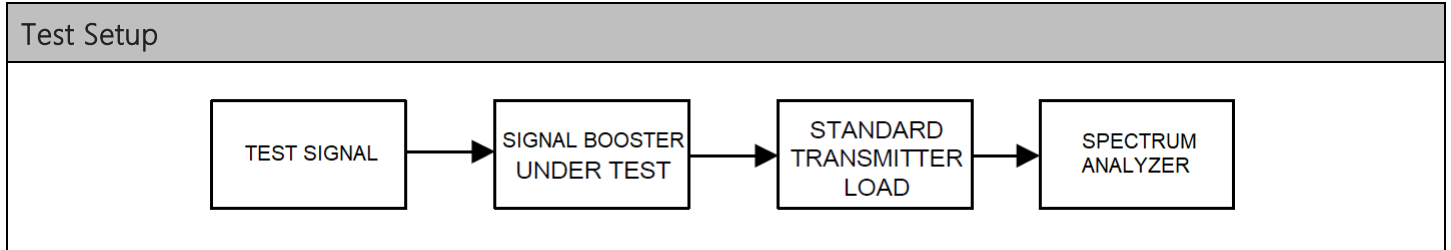
| Applicable Input Signals |                          |                                                                              |
|--------------------------|--------------------------|------------------------------------------------------------------------------|
| Signal                   | Occupied Bandwidth (kHz) | Representative Emission Designator(s)                                        |
| CW                       | n/a                      | n/a                                                                          |
| 12.5 kHz FM              | 11.3                     | 11K3F3E                                                                      |
| C4FM (P25 Phase I)       | 8.1                      | 8K10F1D, 8K10F1E                                                             |
| HCPM (P25 Phase II SU)   | 8.1                      | 8K10F1W                                                                      |
| HDQPSK (P25 Phase II BS) | 9.8                      | 9K80F1D, 9K80F1E, 9K80D7W                                                    |
| AWGN                     | 4230.77                  | 5M00G7D, 10M0G7D, 5M00D7W,<br>10M0D7W, 5M00W7D, 10M0W7D,<br>5M00F9W, 10M0F9W |



## 8.5 Input VS Output Signal Comparison

*Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".*

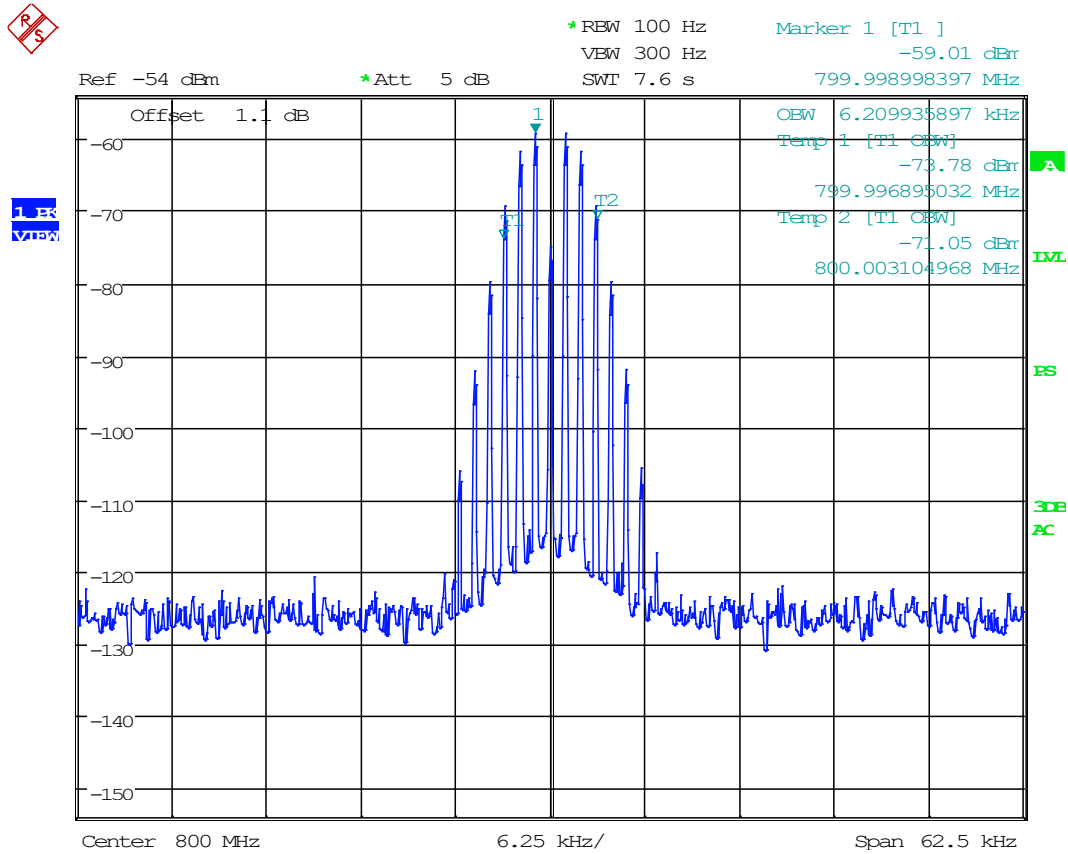
Limits from FCC Parts 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





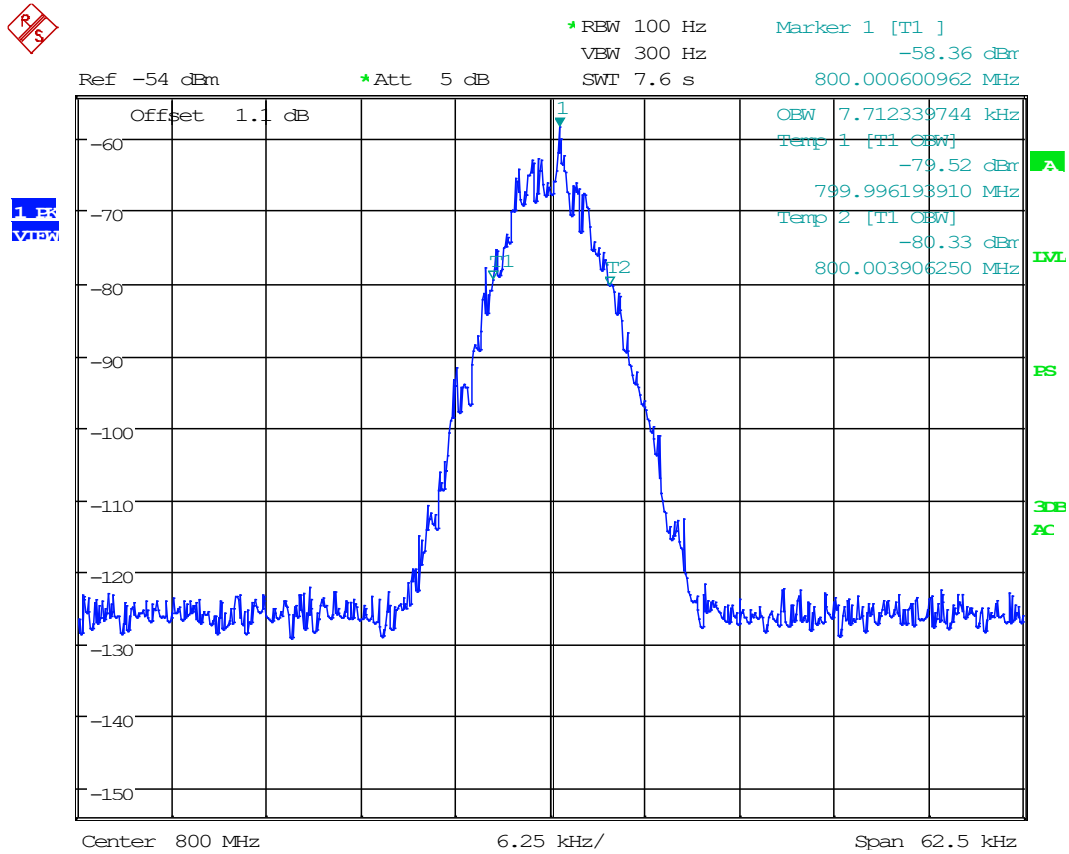
## Input VS Output, Input Spectrum Plots

### 8.5.1 12.5 kHz FM



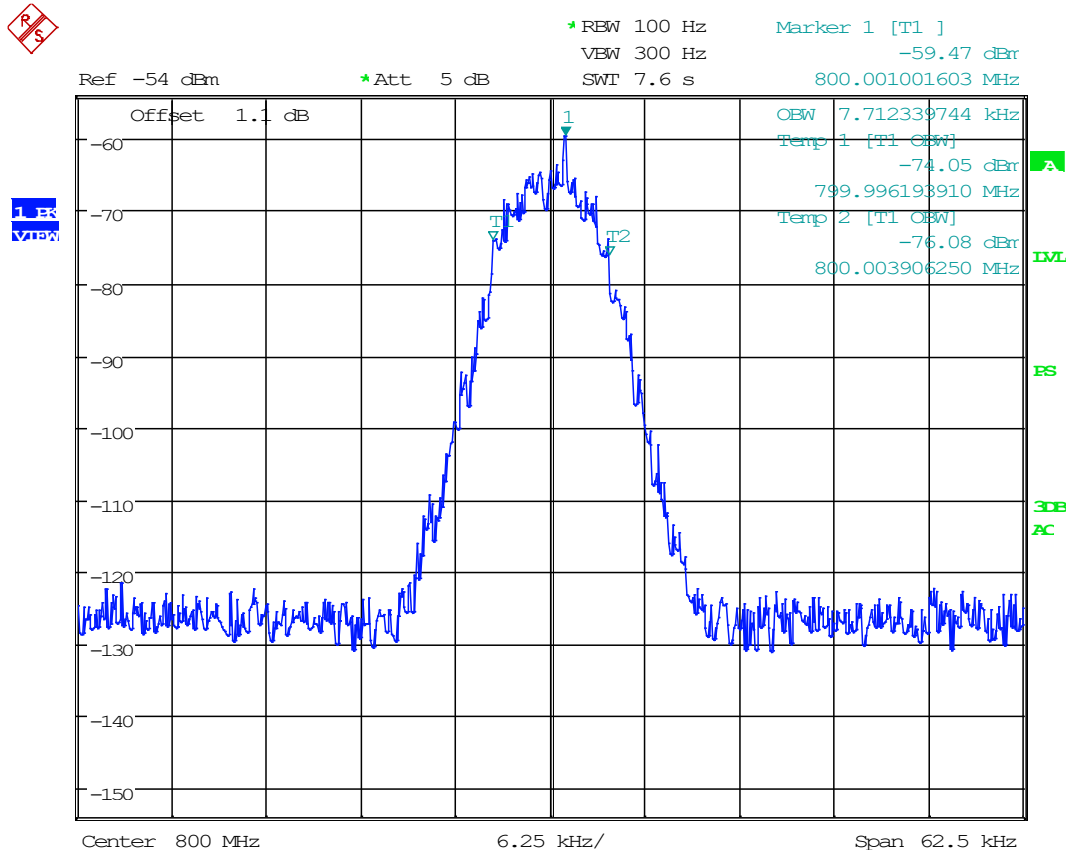
Date: 30.JAN.2019 14:19:45

## 8.5.2 C4FM



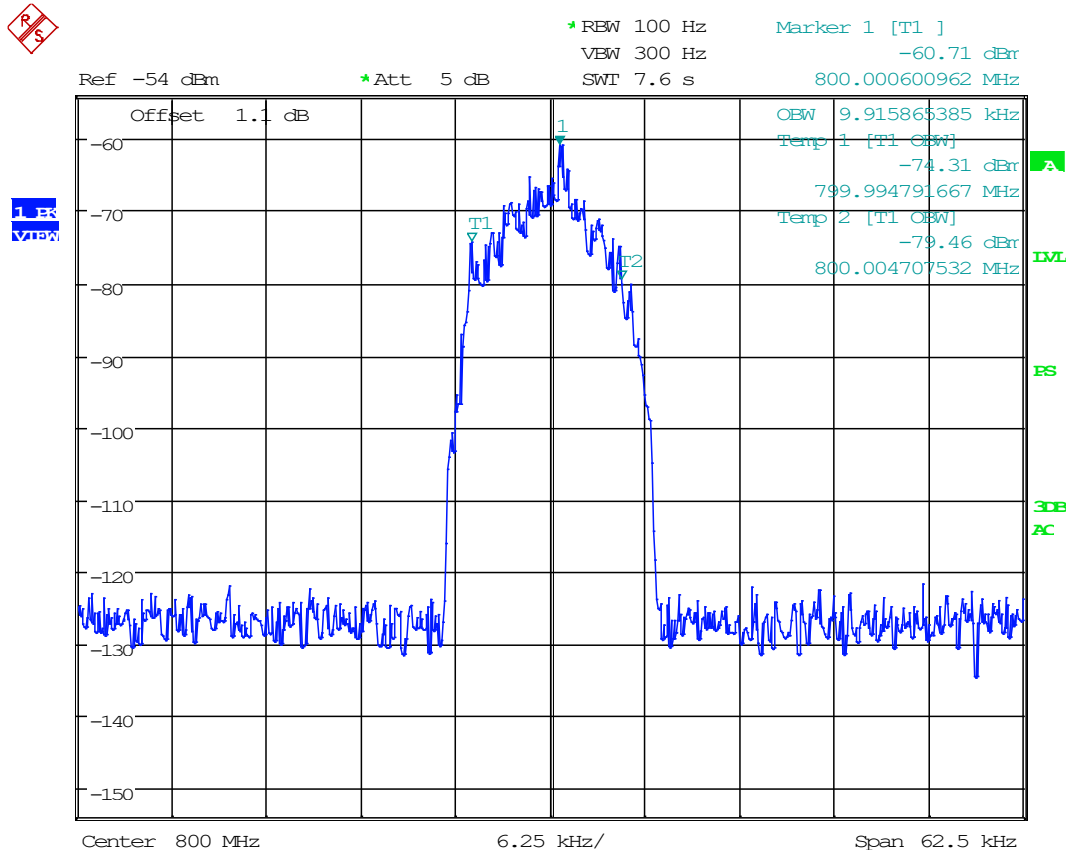
Date: 30.JAN.2019 14:28:58

### 8.5.3 H-CPM



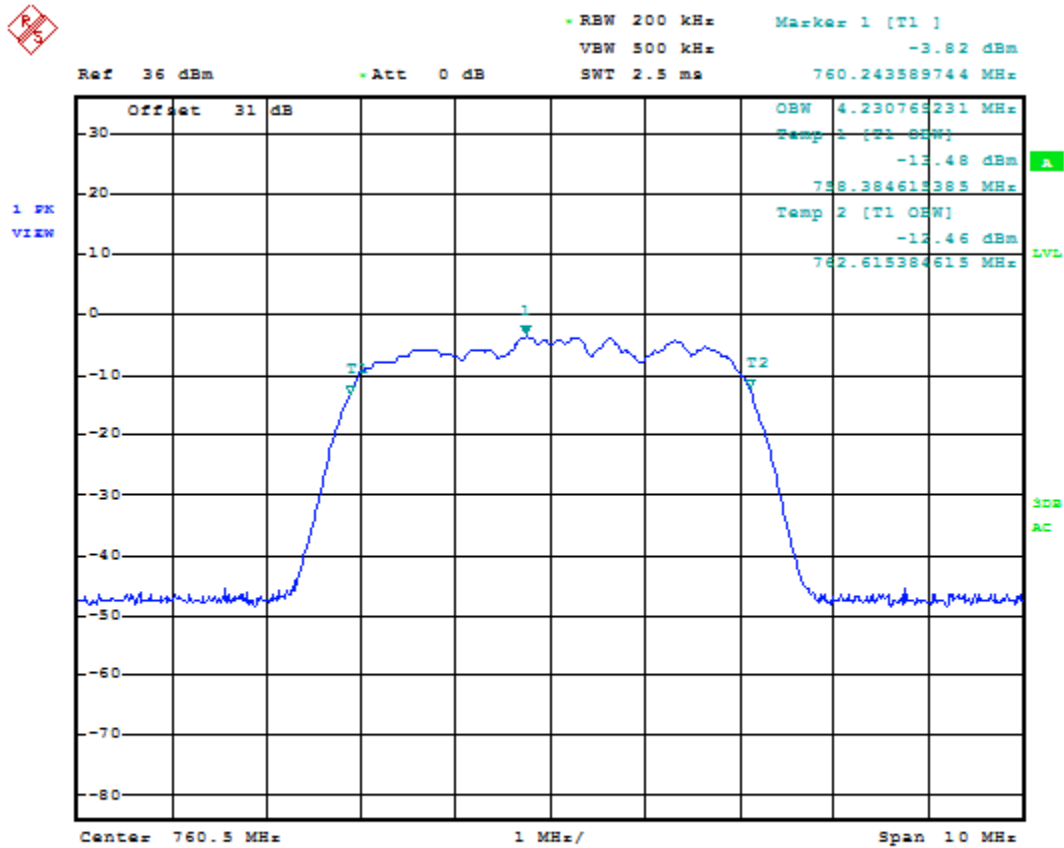
Date: 30.JAN.2019 14:30:47

## 8.5.4 H-DQPSK



Date: 30.JAN.2019 14:32:35

## 8.5.5 AWGN

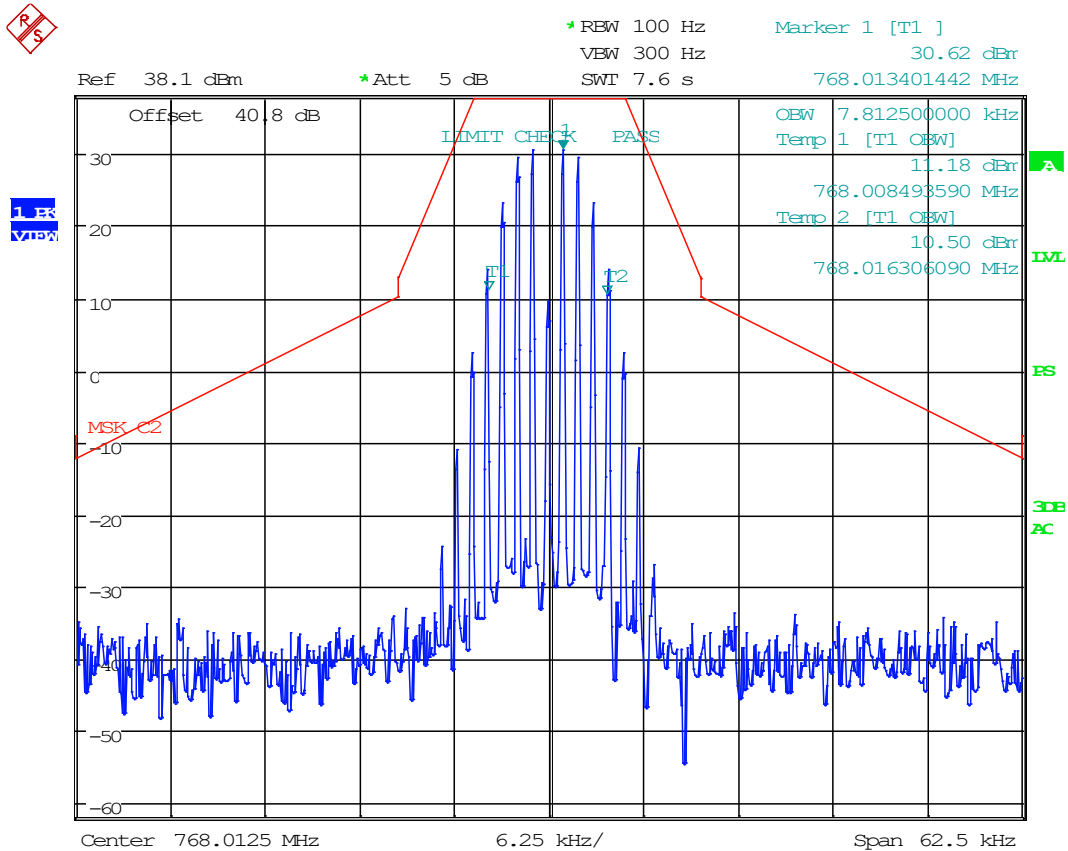


Date: 16.NOV.2020 11:50:15



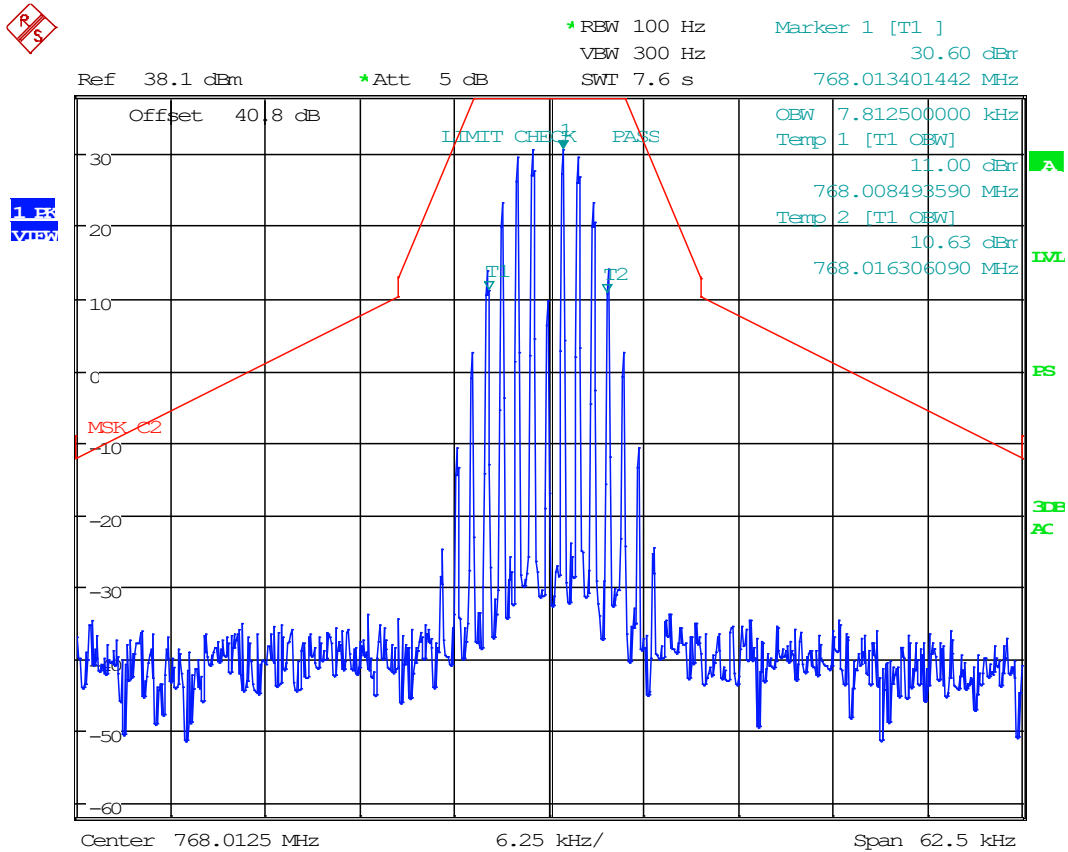
## Input VS Output, Output Spectrum Plots, 700 Band

### 8.5.6 12.5 kHz FM, Downlink, AGC



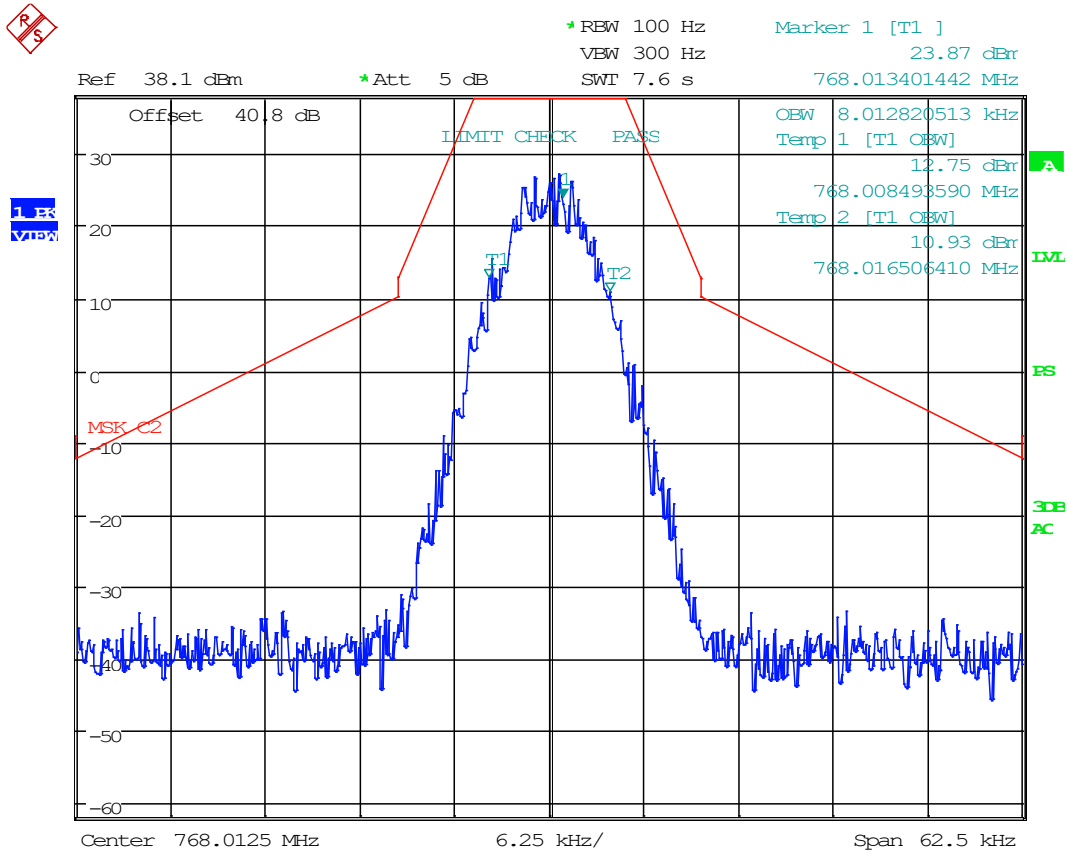
Date: 15.JAN.2021 11:39:40

### 8.5.7 12.5 kHz FM, Downlink, AGC +3dB



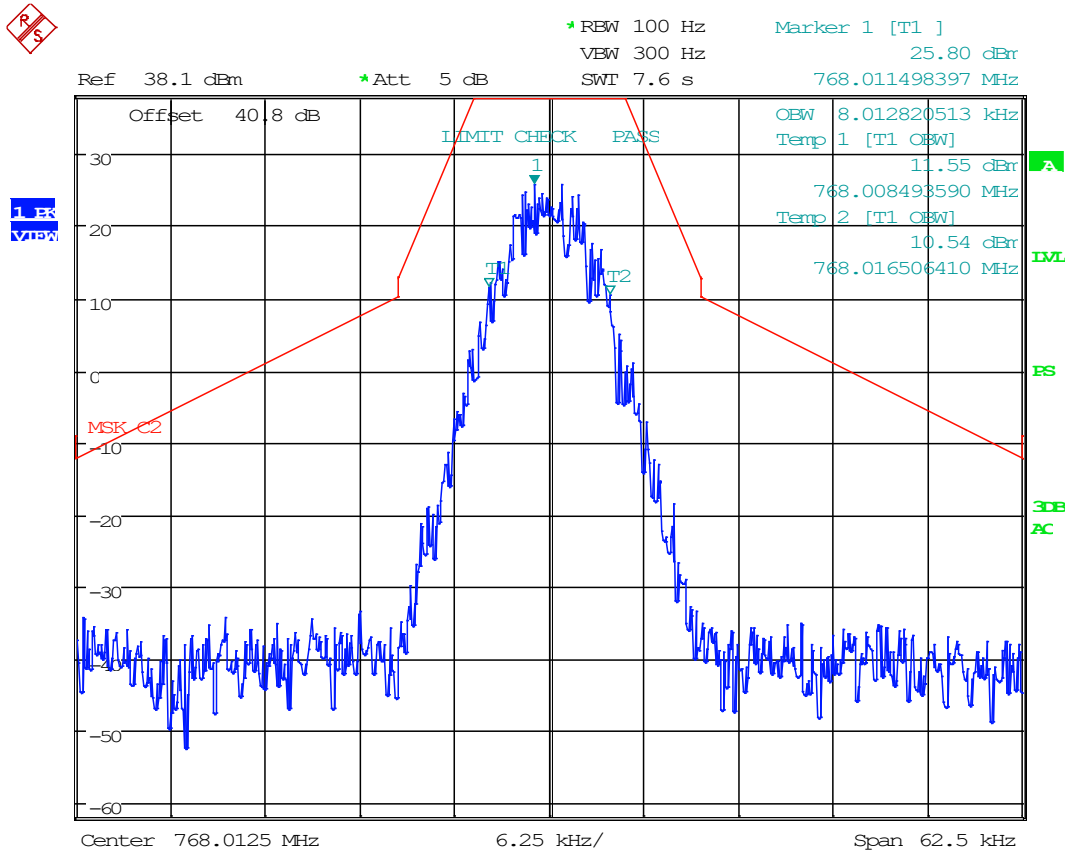
Date: 15.JAN.2021 11:40:00

## 8.5.8 C4FM, Downlink, AGC



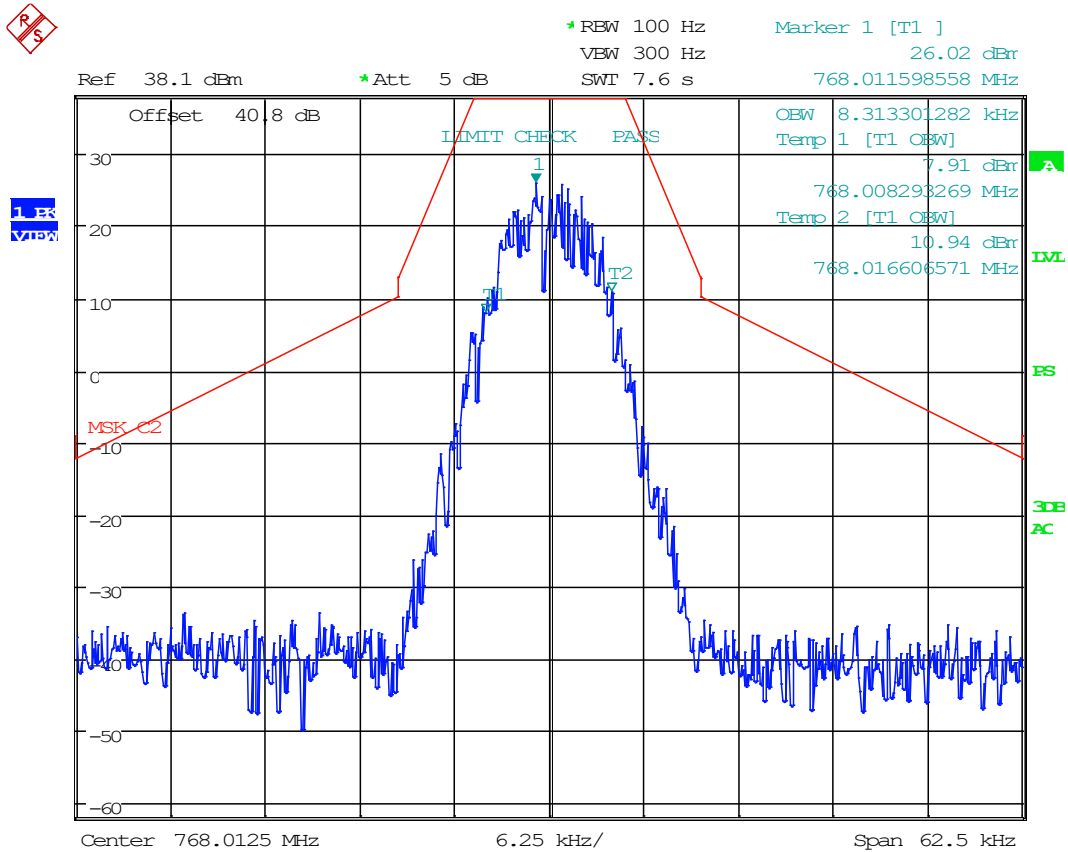
Date: 15.JAN.2021 11:40:45

### 8.5.9 C4FM, Downlink, AGC +3dB



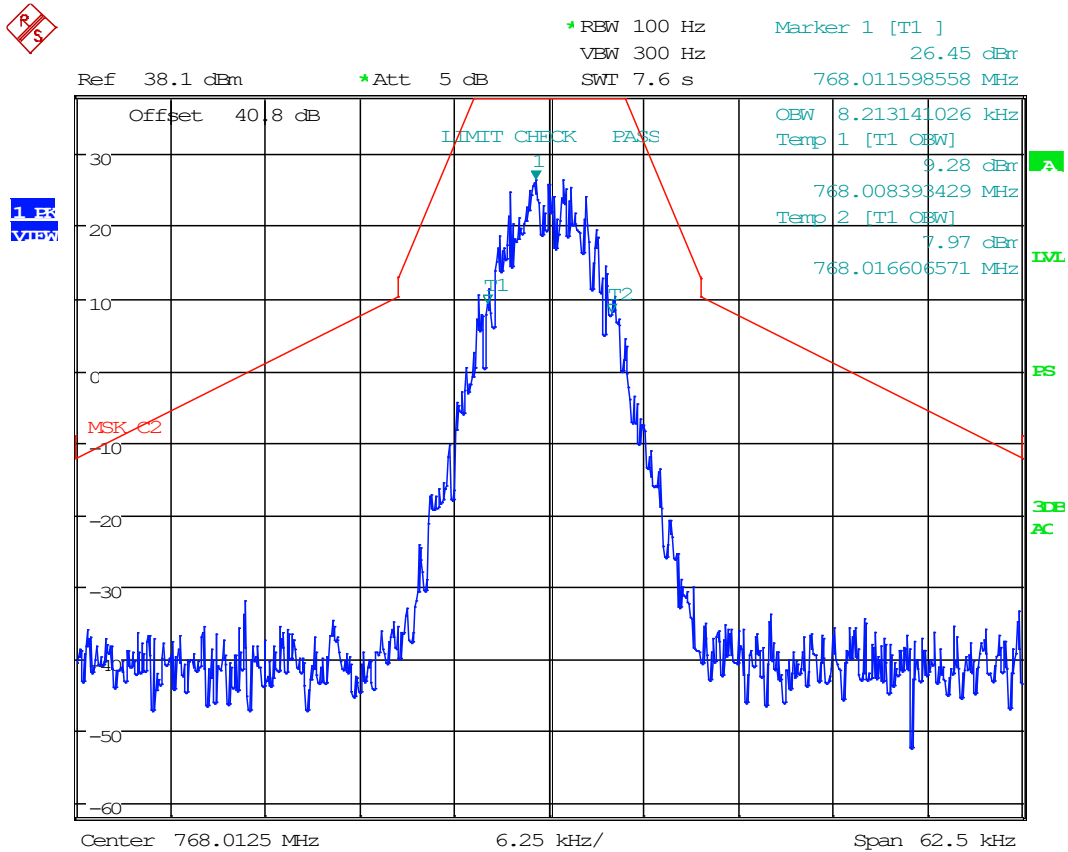
Date: 15.JAN.2021 11:41:04

### 8.5.10 H-CPM, Downlink, AGC



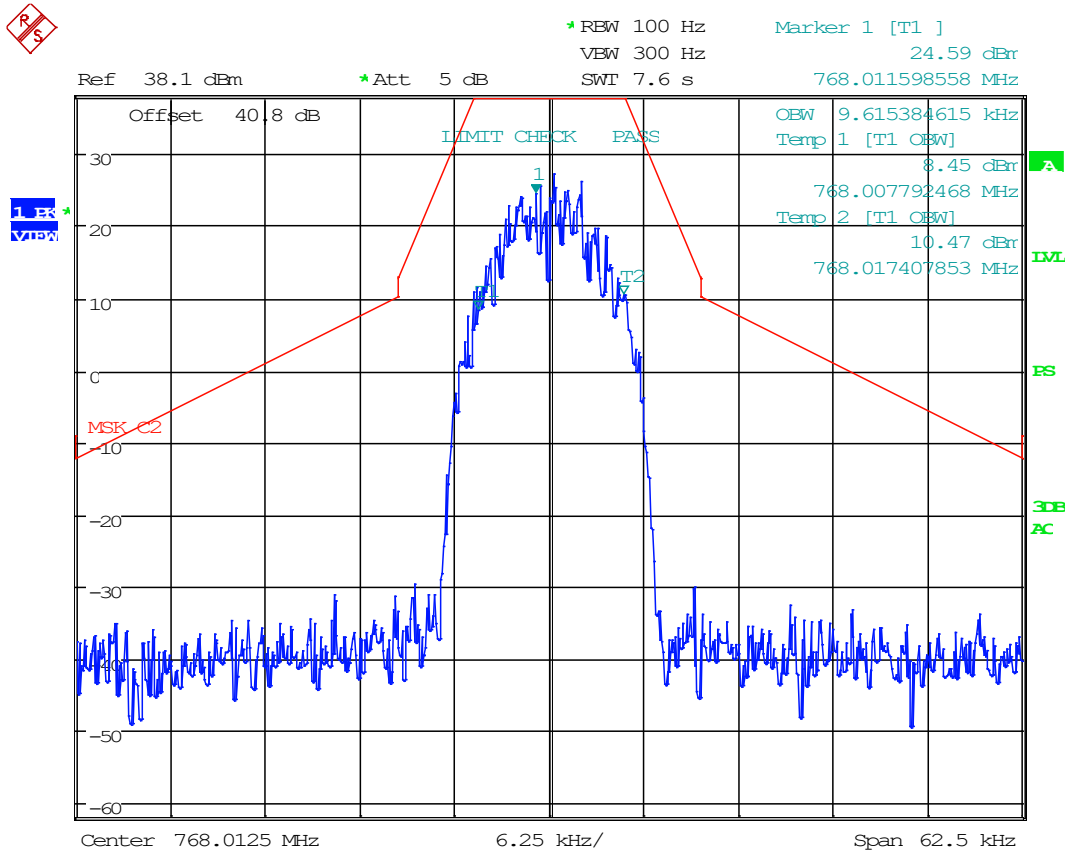
Date: 15.JAN.2021 11:41:32

### 8.5.11 H-CPM, Downlink, AGC +3dB



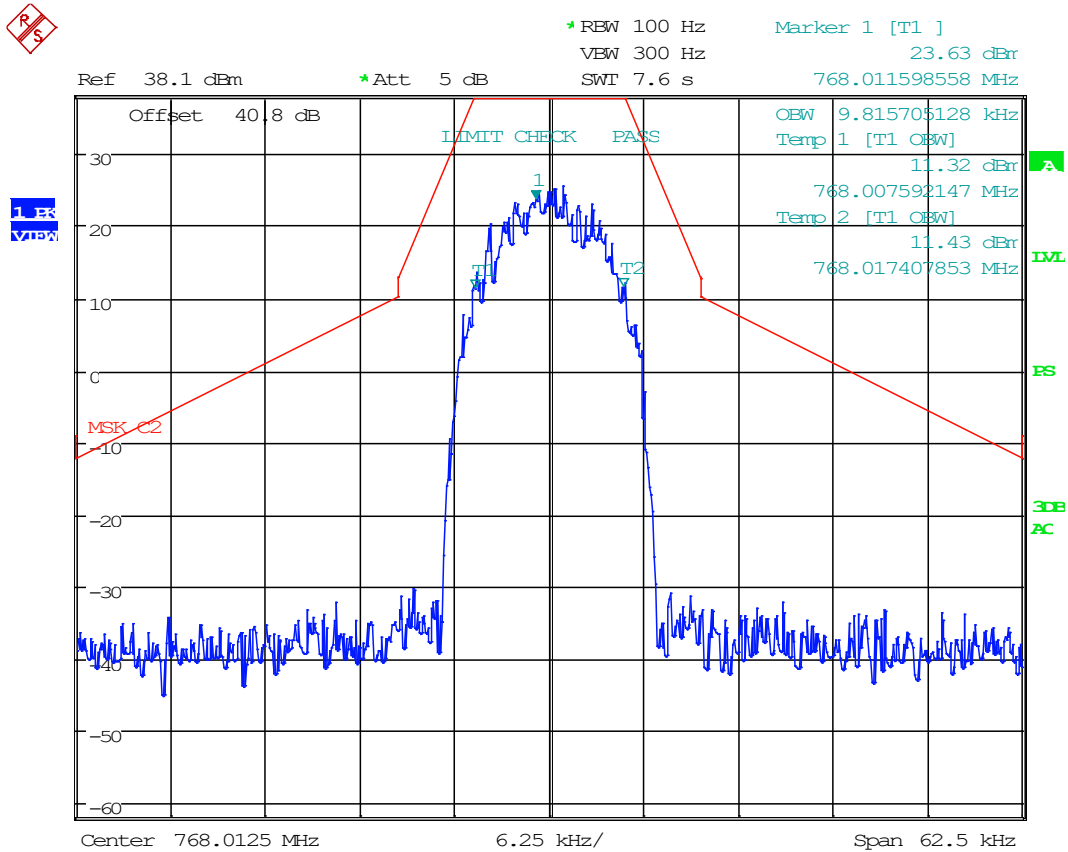
Date: 15.JAN.2021 11:41:52

## 8.5.12 H-DQPSK, Downlink, AGC



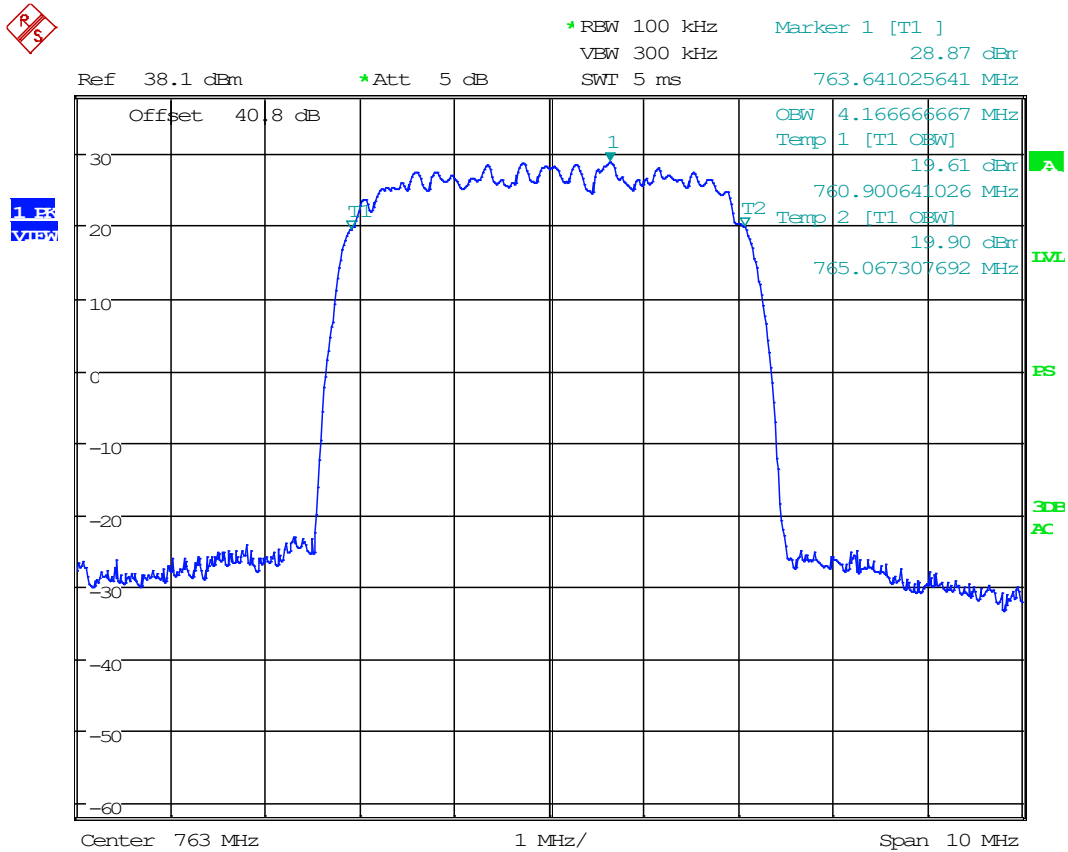
Date: 15.JAN.2021 11:42:16

### 8.5.13 H-DQPSK, Downlink, AGC +3dB



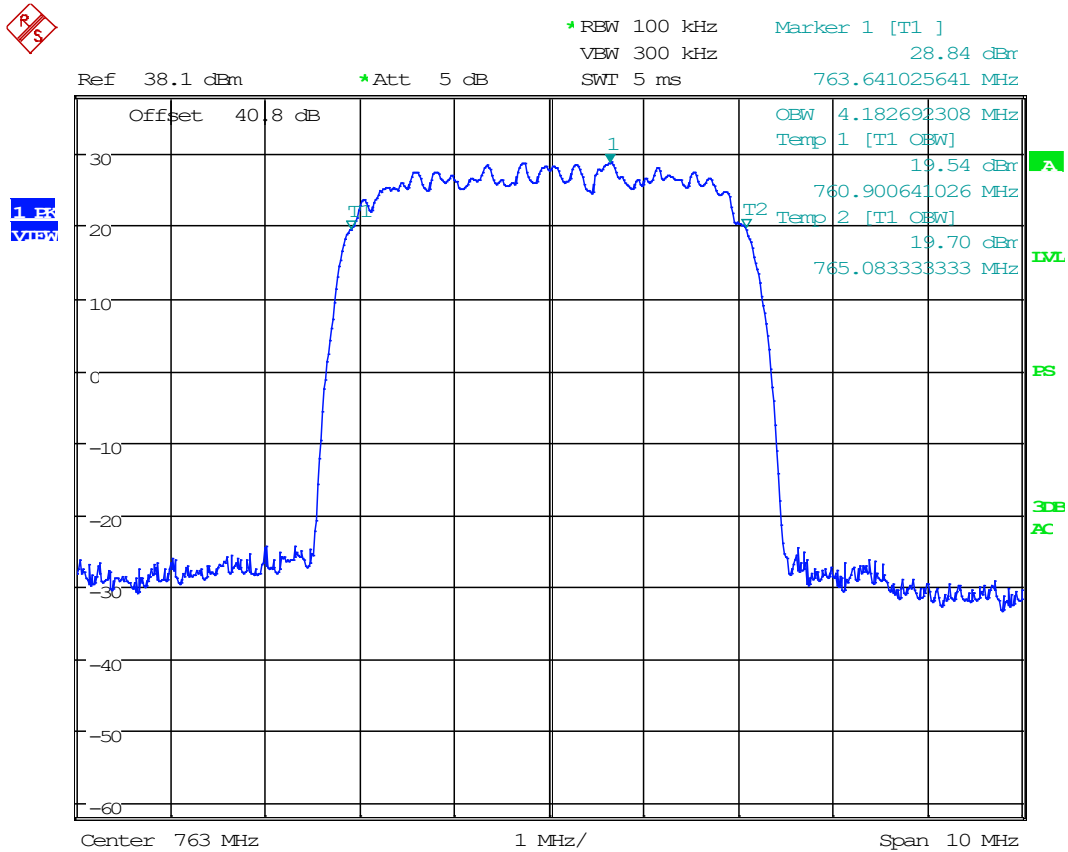
Date: 15.JAN.2021 11:42:42

### 8.5.14 AWGN, Downlink, AGC



Date: 15.JAN.2021 11:50:04

### 8.5.15 AWGN, Downlink, AGC +3

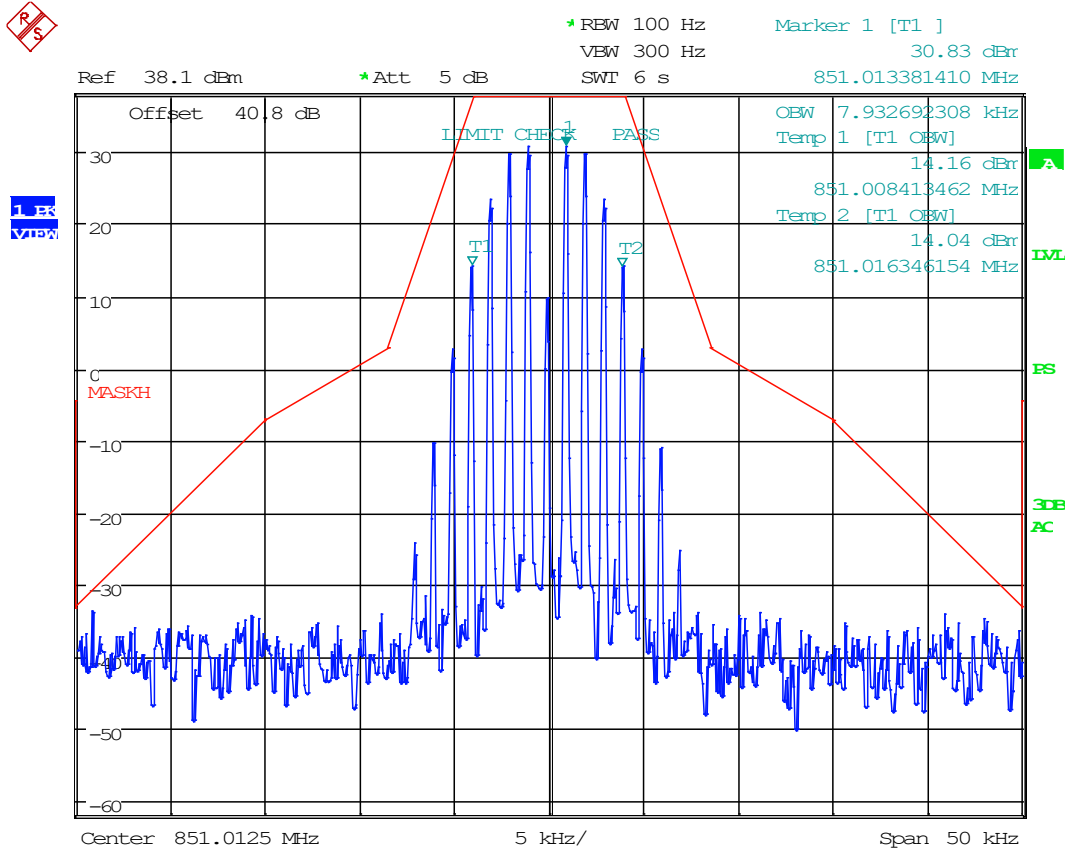


Date: 15.JAN.2021 11:50:16

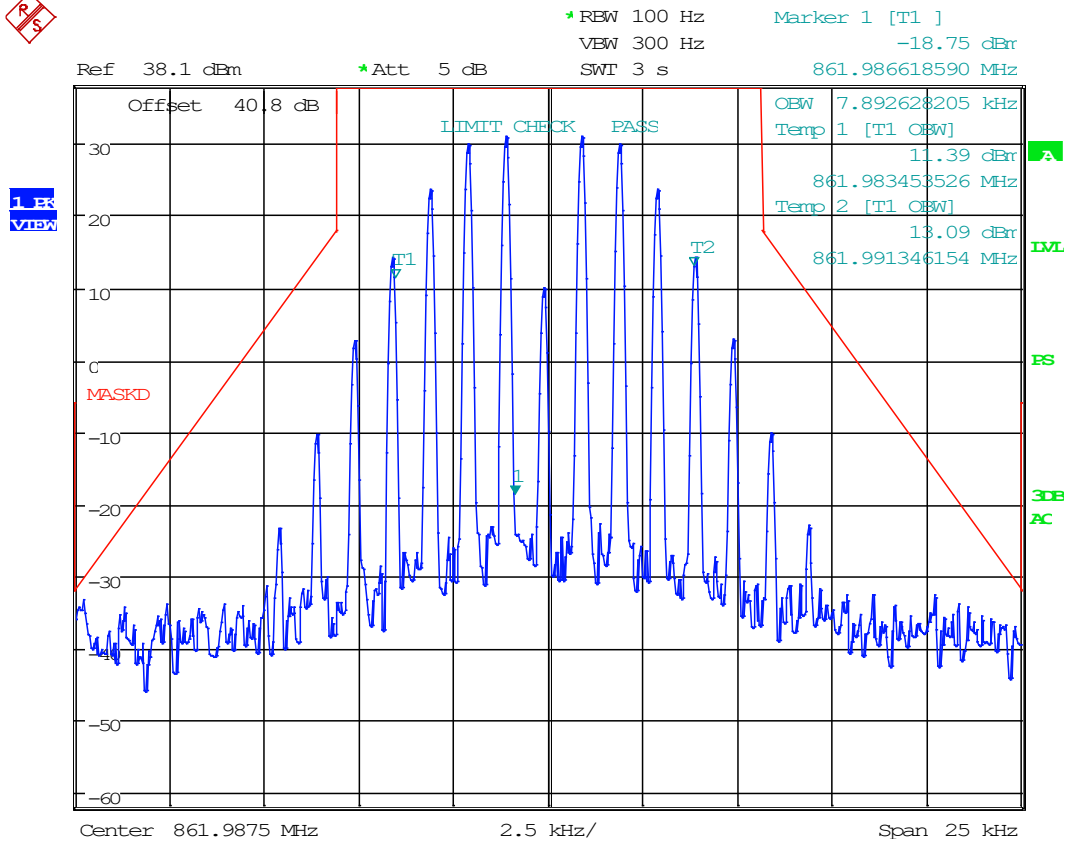


## Input VS Output, Output Spectrum Plots, 800 Band

### 8.5.16 12.5 kHz FM, Downlink, AGC

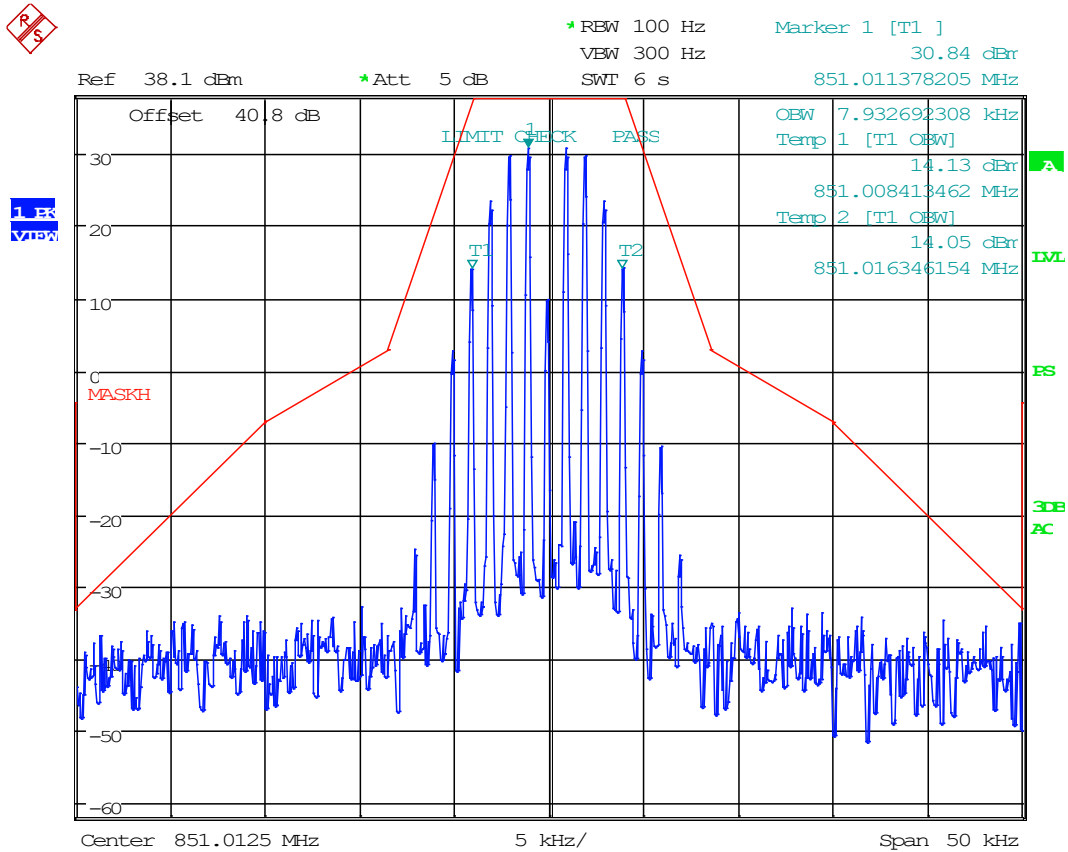


Date: 15.JAN.2021 11:55:01

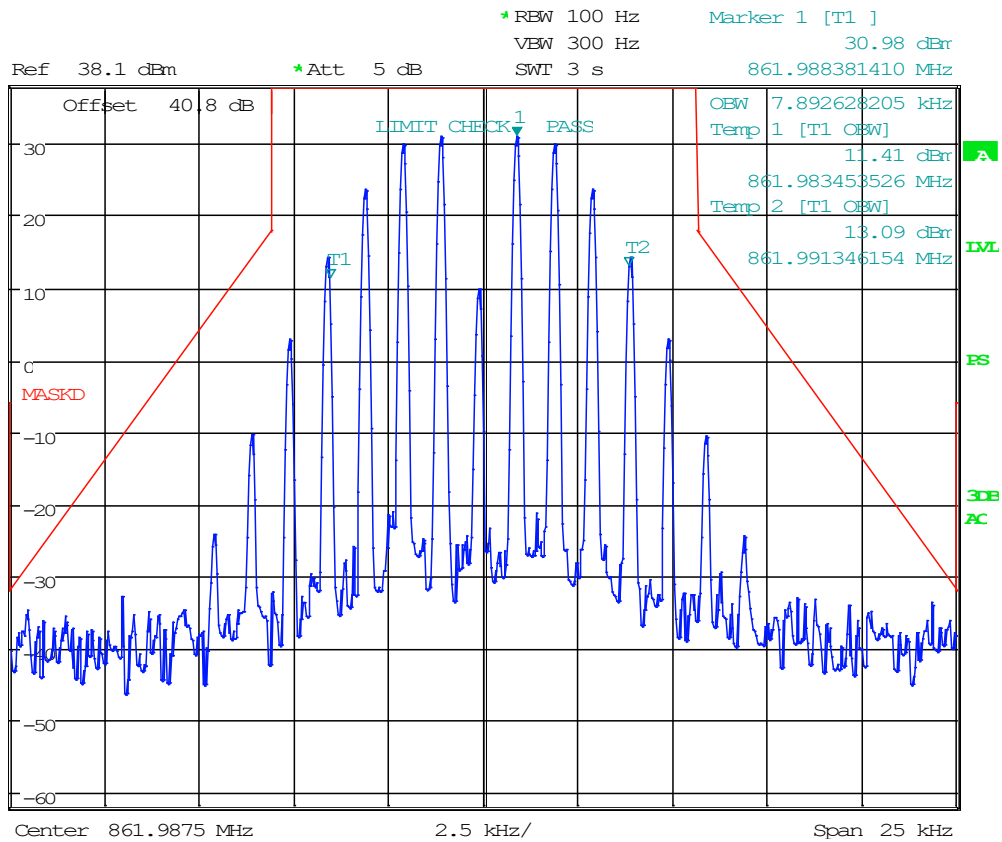


Date: 15.JAN.2021 12:09:15

### 8.5.17 12.5 kHz FM, Downlink, AGC +3dB

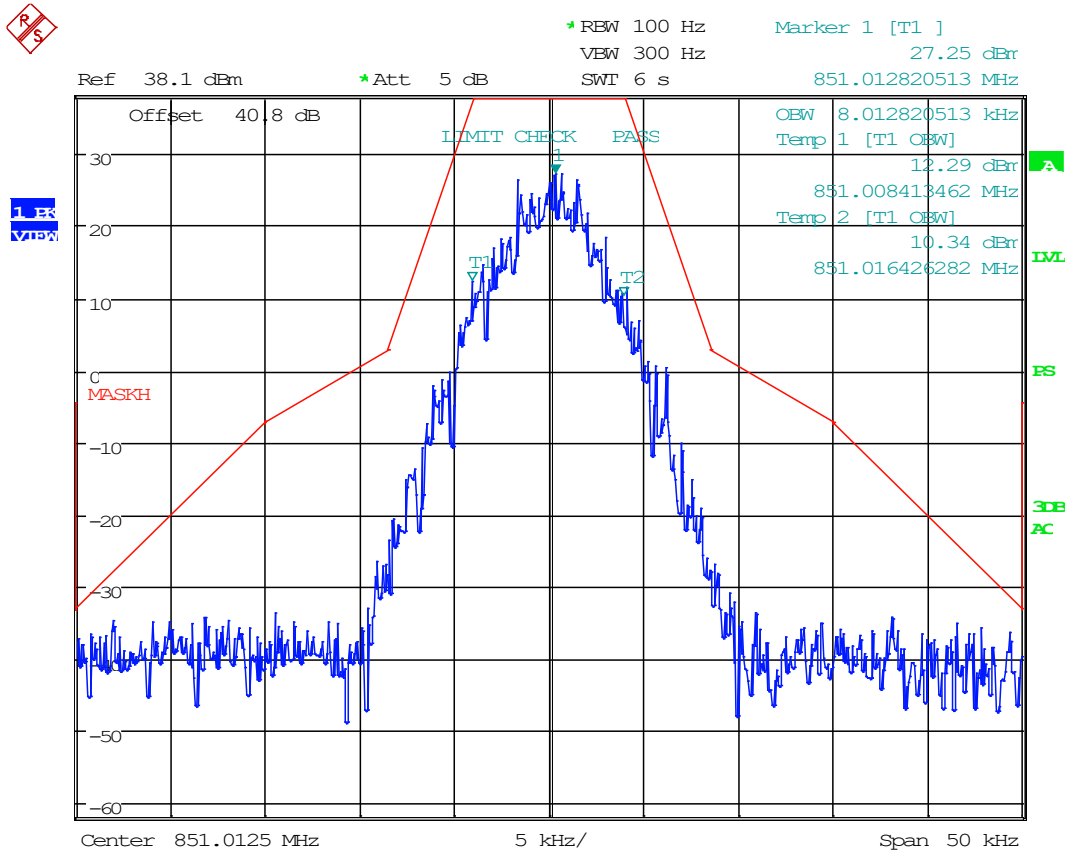


Date: 15.JAN.2021 11:55:58

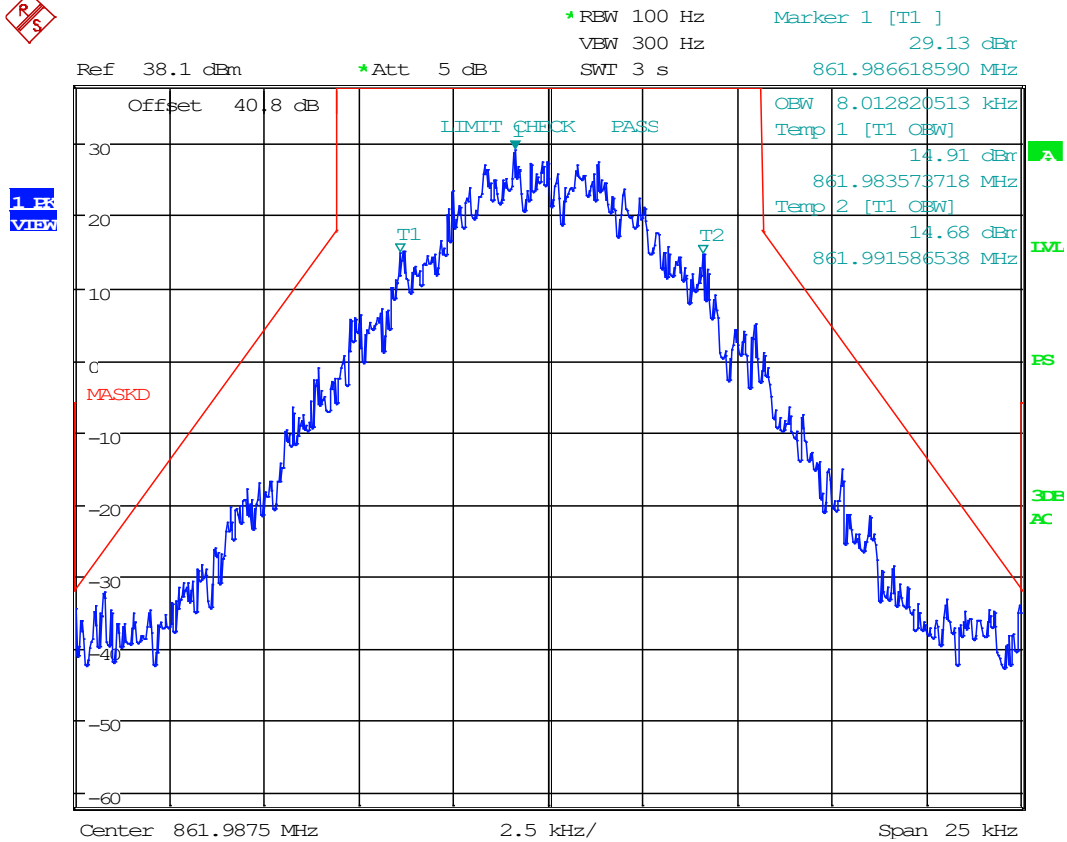


Date: 15.JAN.2021 12:09:31

### 8.5.18 C4FM, Downlink, AGC

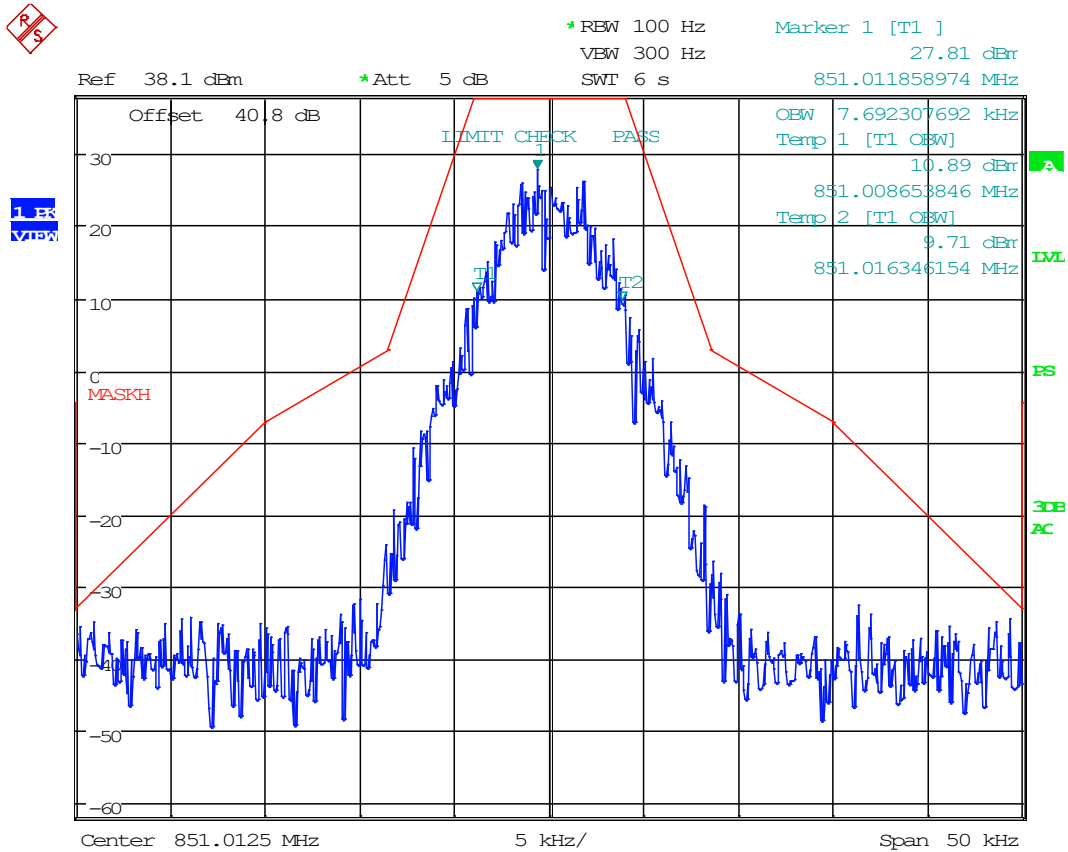


Date: 15.JAN.2021 11:56:46

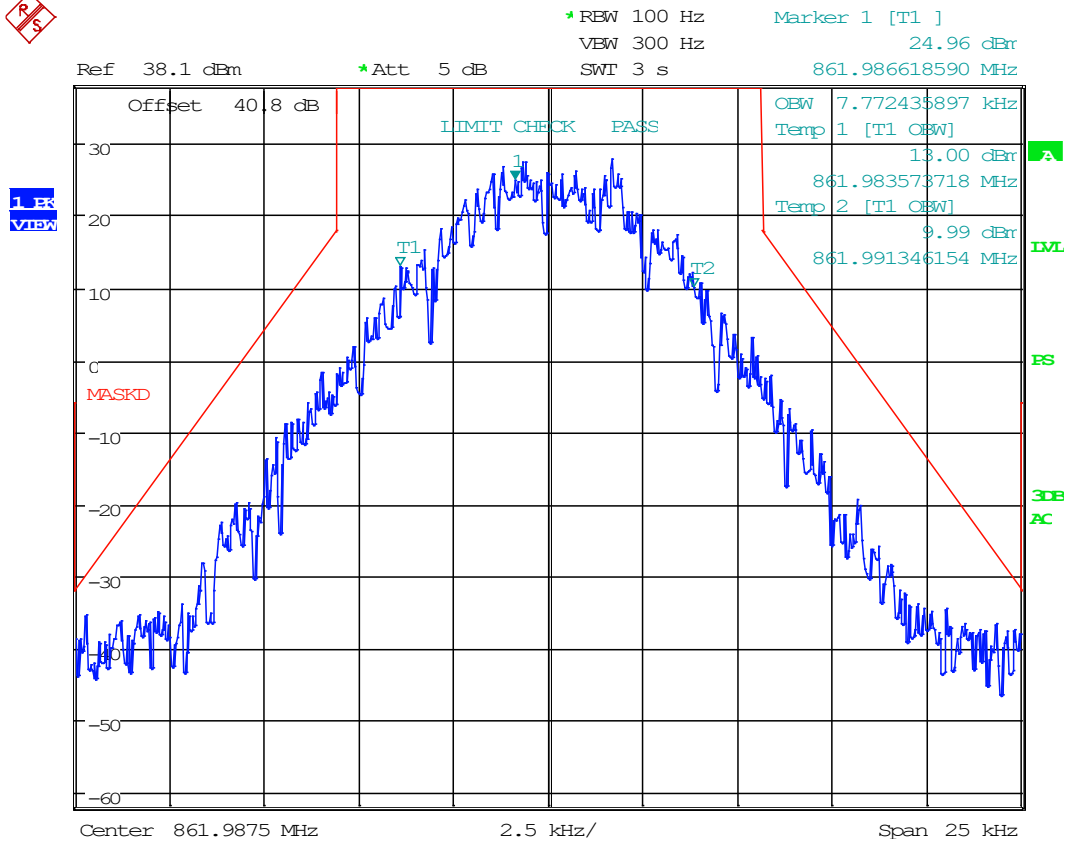


Date: 15.JAN.2021 12:09:49

### 8.5.19 C4FM, Downlink, AGC +3dB

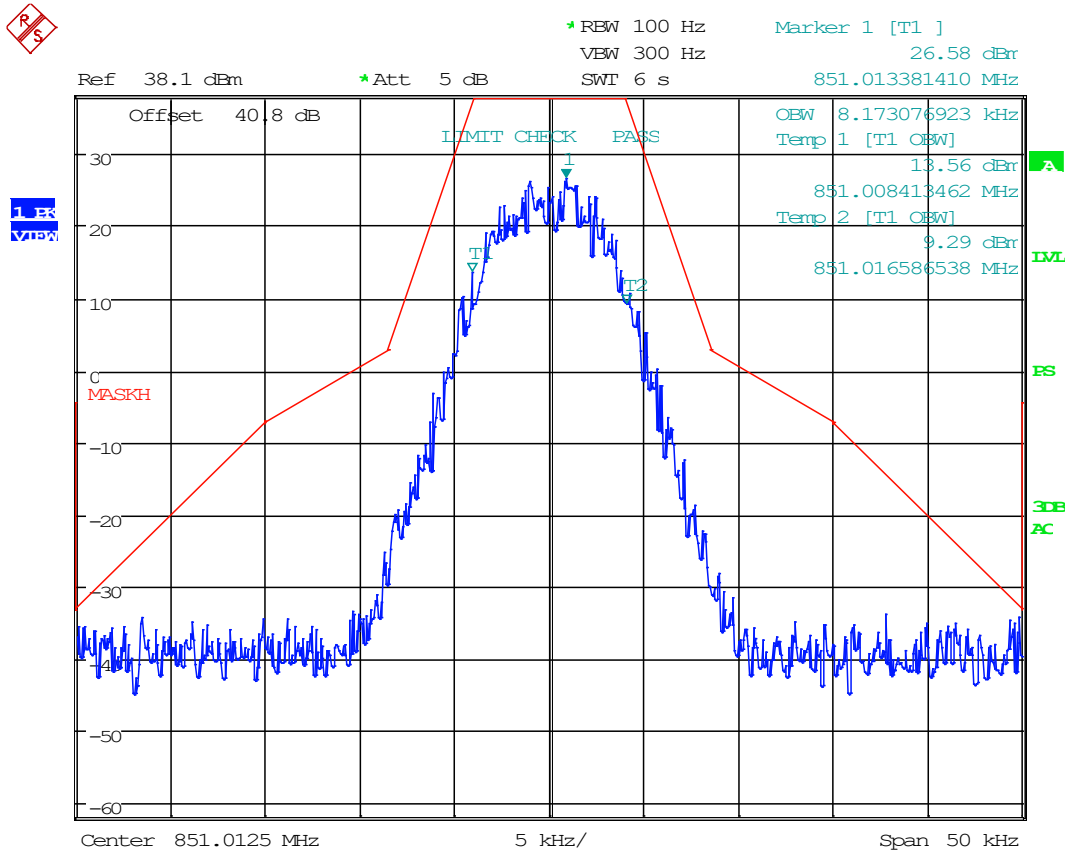


Date: 15.JAN.2021 11:57:03

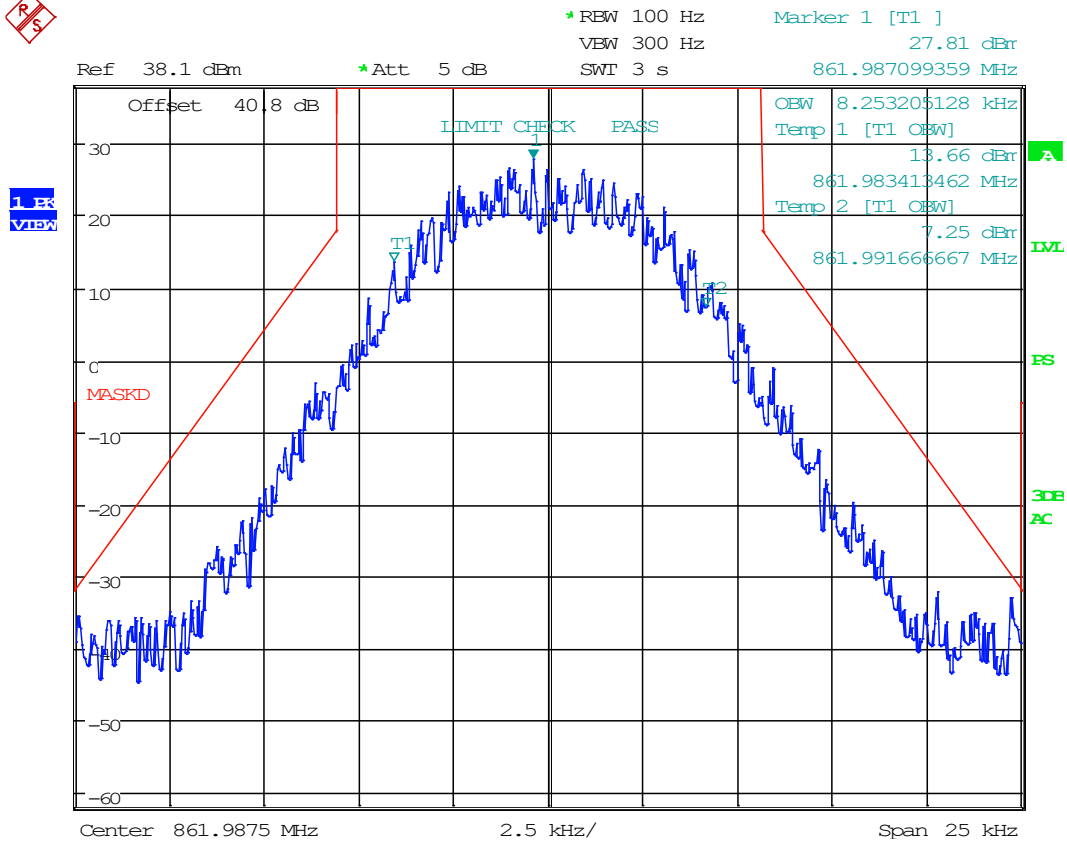


Date: 15.JAN.2021 12:10:06

## 8.5.20 H-CPM, Downlink, AGC

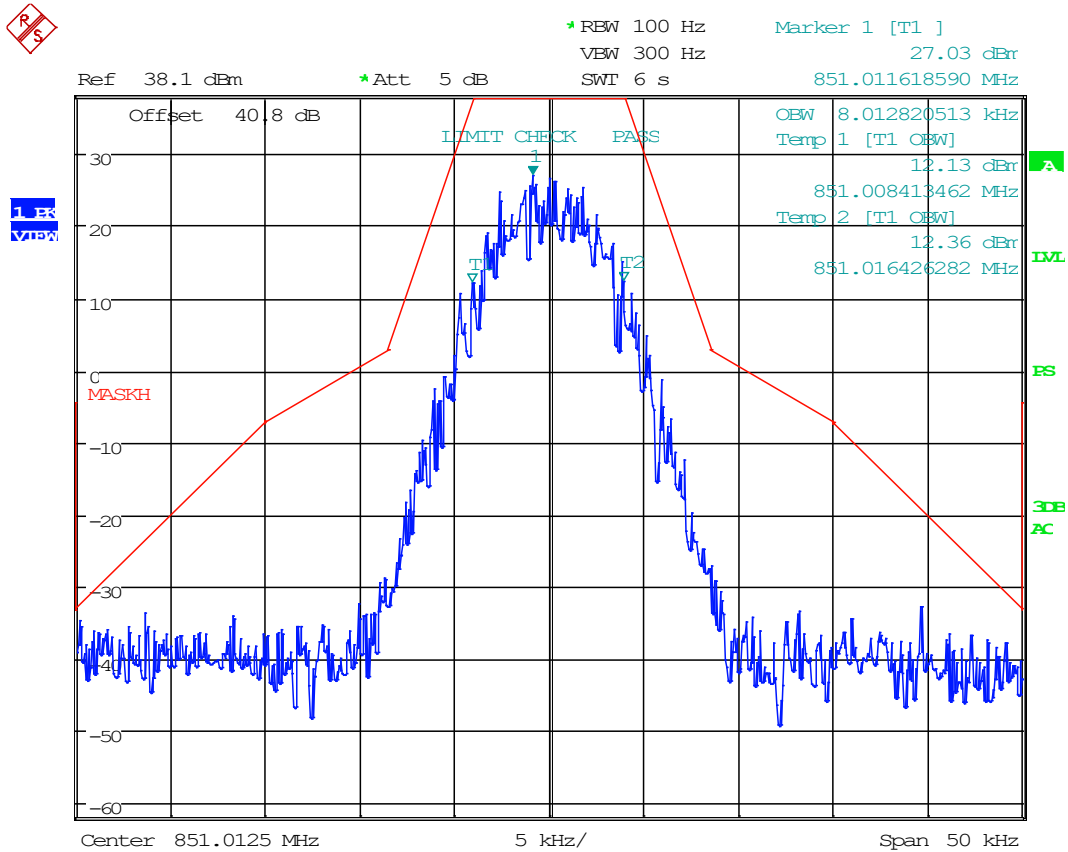


Date: 15.JAN.2021 11:59:52

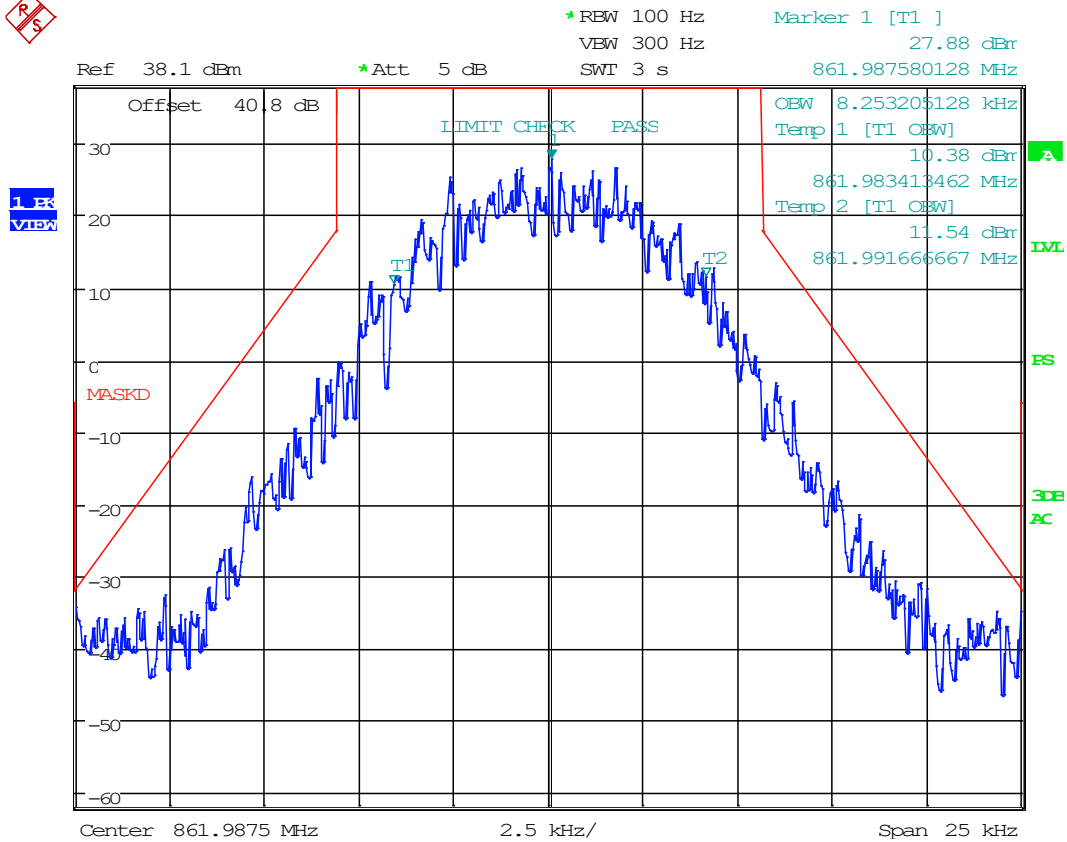


Date: 15.JAN.2021 12:10:27

### 8.5.21 H-CPM, Downlink, AGC +3dB



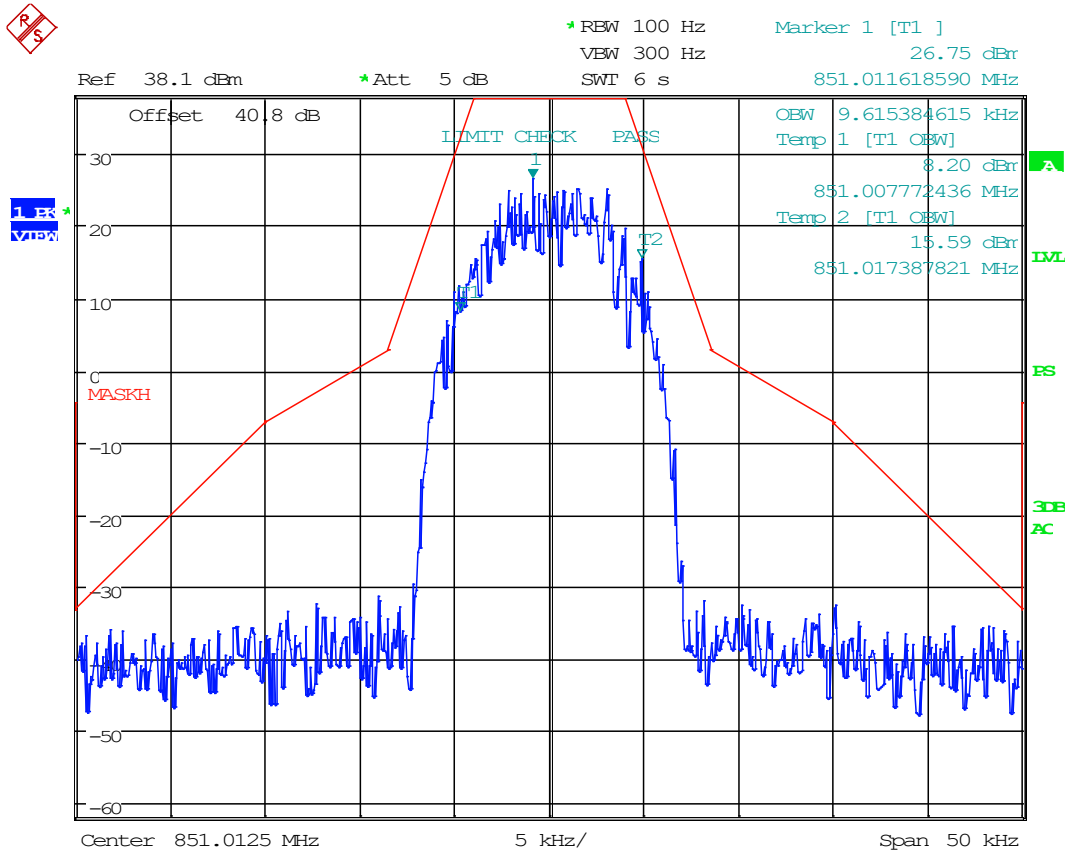
Date: 15.JAN.2021 12:00:07



Date: 15.JAN.2021 12:10:40



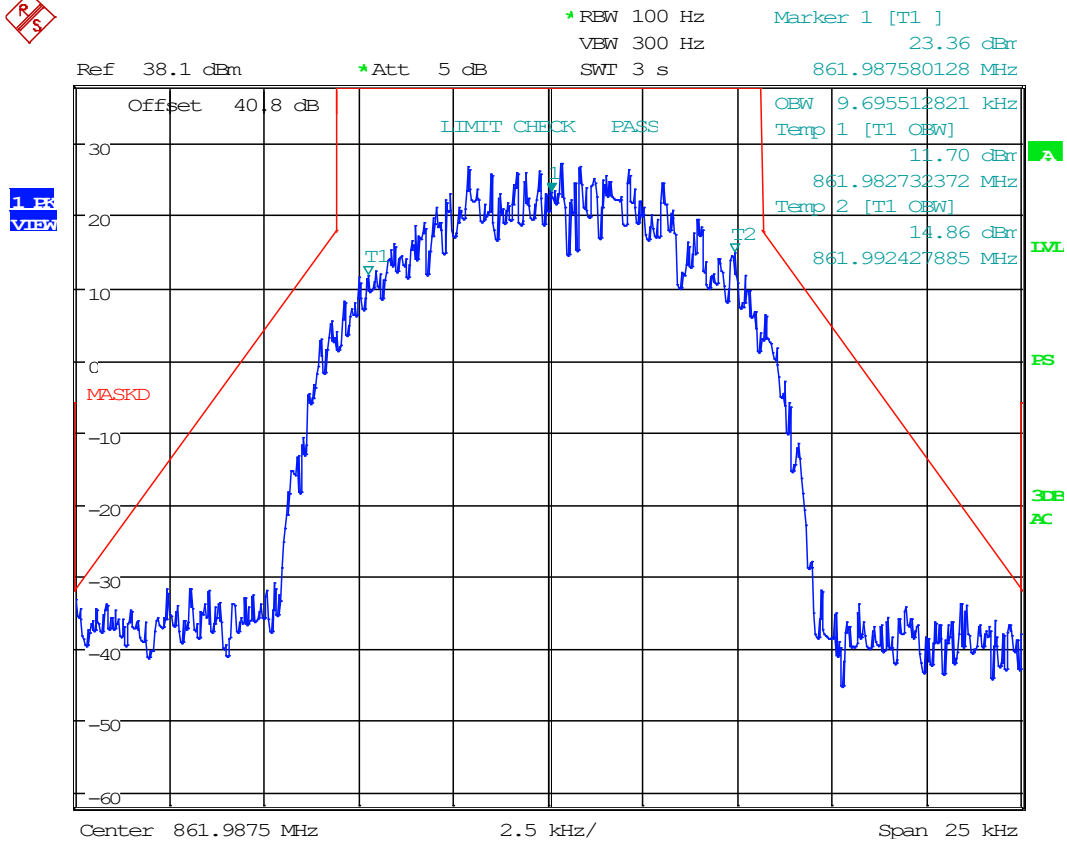
## 8.5.22 H-DQPSK, Downlink, AGC



Date: 15.JAN.2021 12:00:30

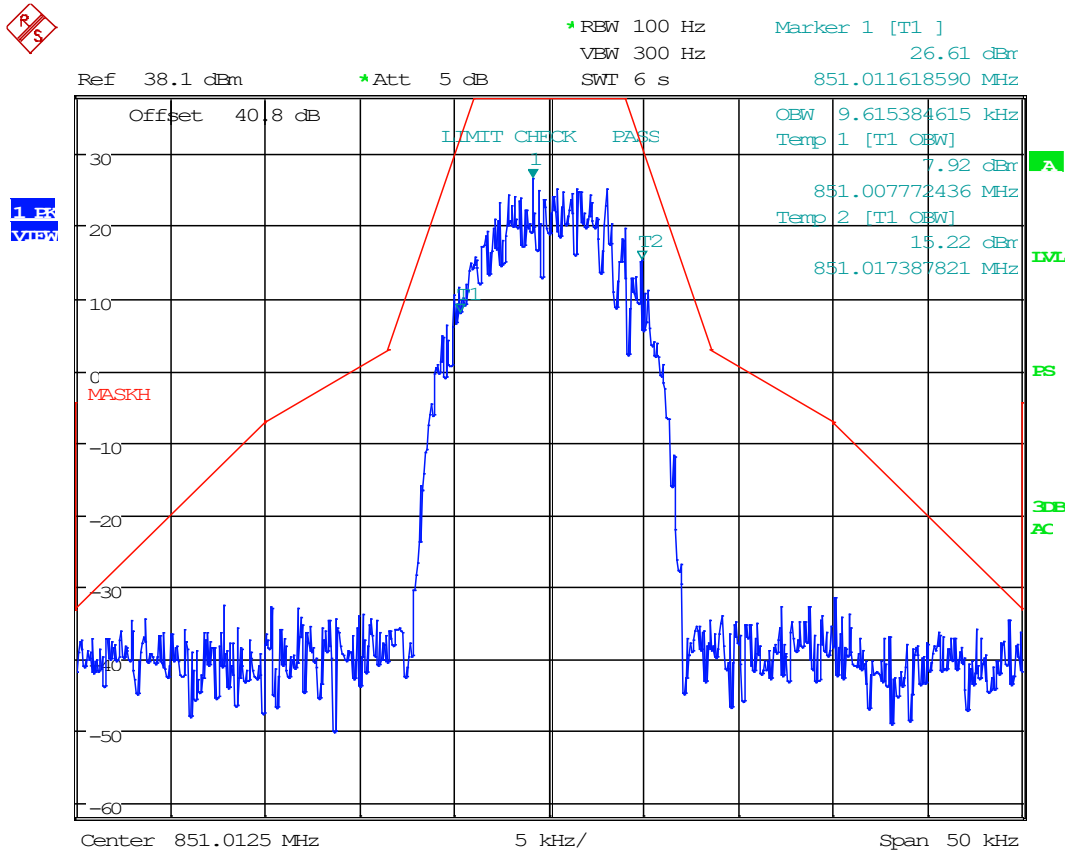


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(352) 472-5500 / [testing@timcoengr.com](mailto:testing@timcoengr.com)

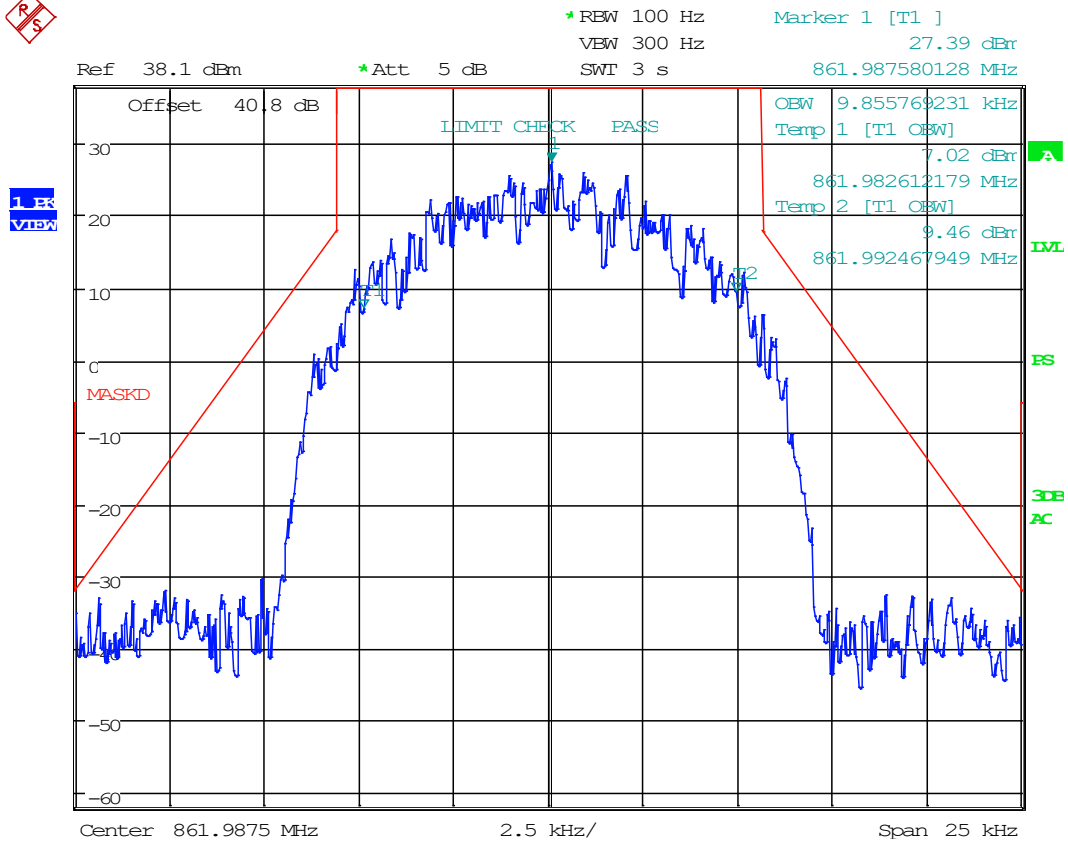


Date: 15.JAN.2021 12:10:58

### 8.5.23 H-DQPSK, Downlink, AGC +3dB



Date: 15.JAN.2021 12:00:51



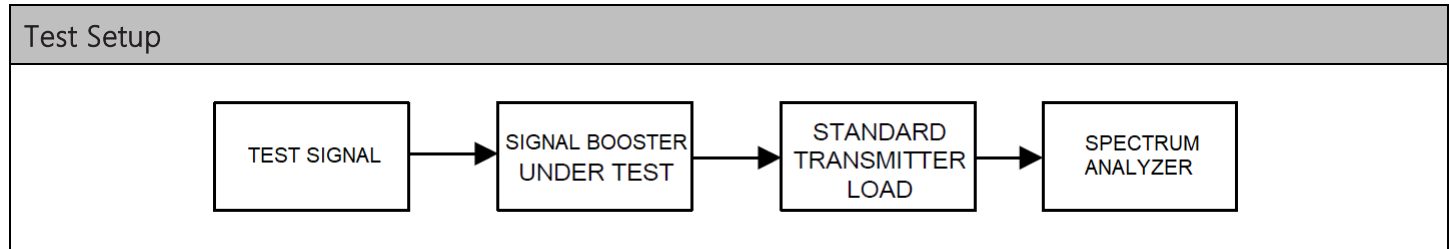
Date: 15.JAN.2021 12:11:13



## 8.6 Noise Figure

*Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".*

Limits from FCC KDB 935210 D05 v01r04 Industrial Signal Boosters. Test method from "Noise Figure Measurement Accuracy: The Y-Factor Method" by Keysight Technologies.



| Test Results, Out-of-band Rejection and Class of Operation |                |              |        |
|------------------------------------------------------------|----------------|--------------|--------|
| Operating Band                                             | Link Direction | Noise Figure | Limit  |
| 758 – 775 MHz                                              | Downlink       | 6.65 dB      | < 9 dB |
| 851 – 869 MHz                                              | Downlink       | 6.82 dB      | < 9 dB |

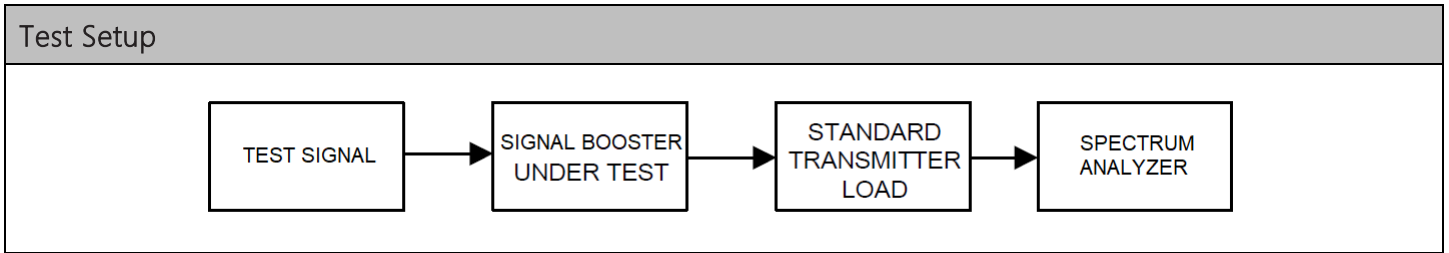


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## 8.7 Out-of-Band/Out-of-Block Emissions (Intermodulation Products)

*Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".*

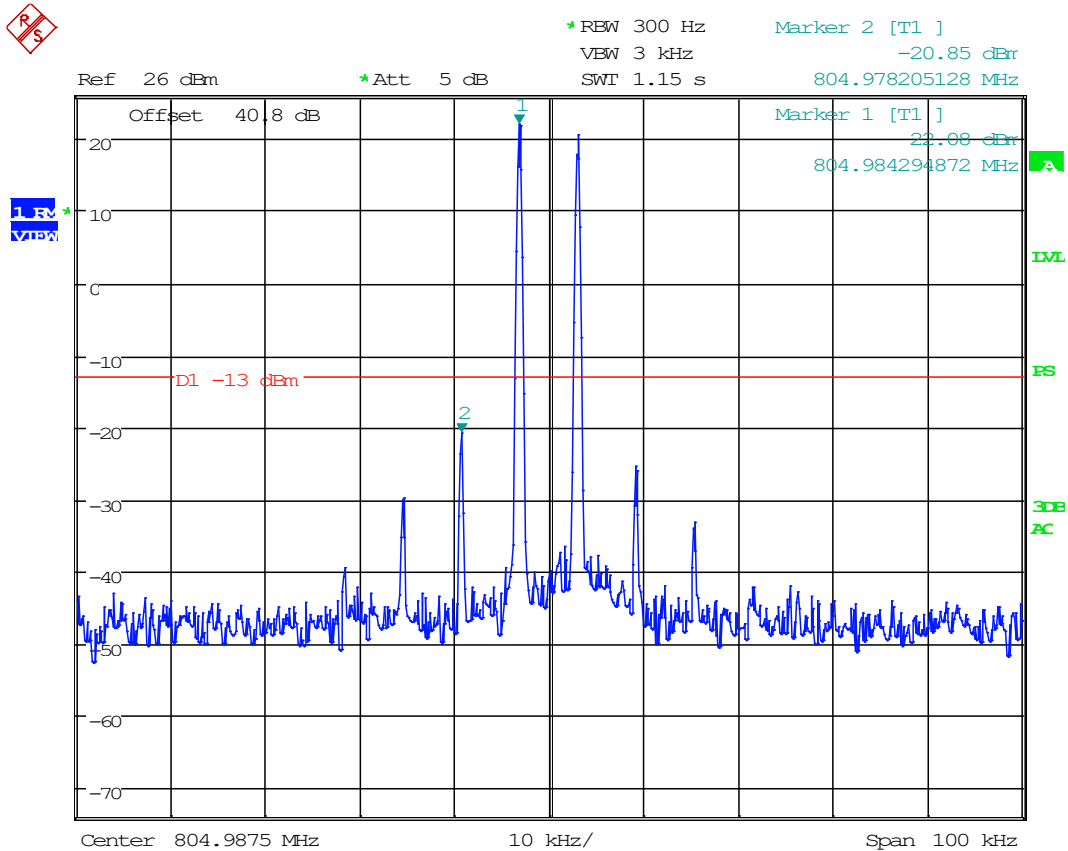
Limits from FCC Parts 2.1051, 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





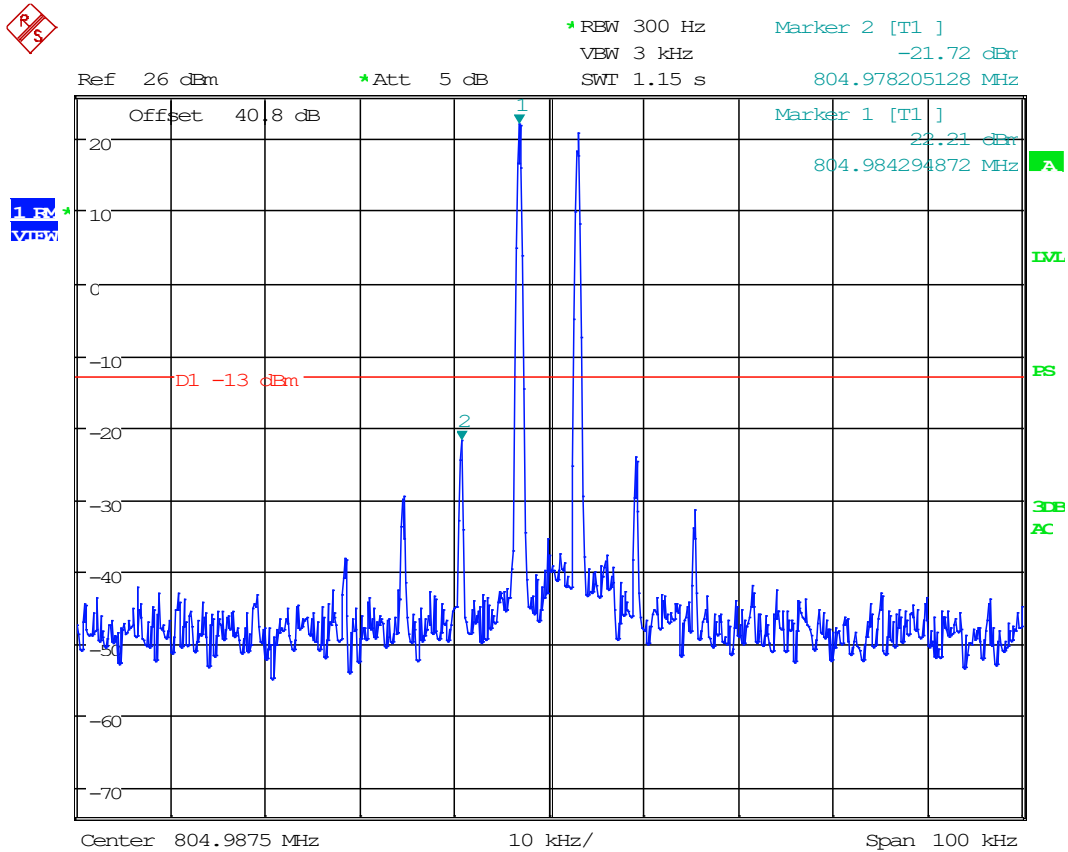
## Intermodulation Products Spectrum Plots, 700 Band

### 8.7.1 12.5 kHz Signal, Downlink, AGC



Date: 14.JAN.2021 13:30:24

## 8.7.2 12.5 kHz Signal, Downlink, AGC +3dB

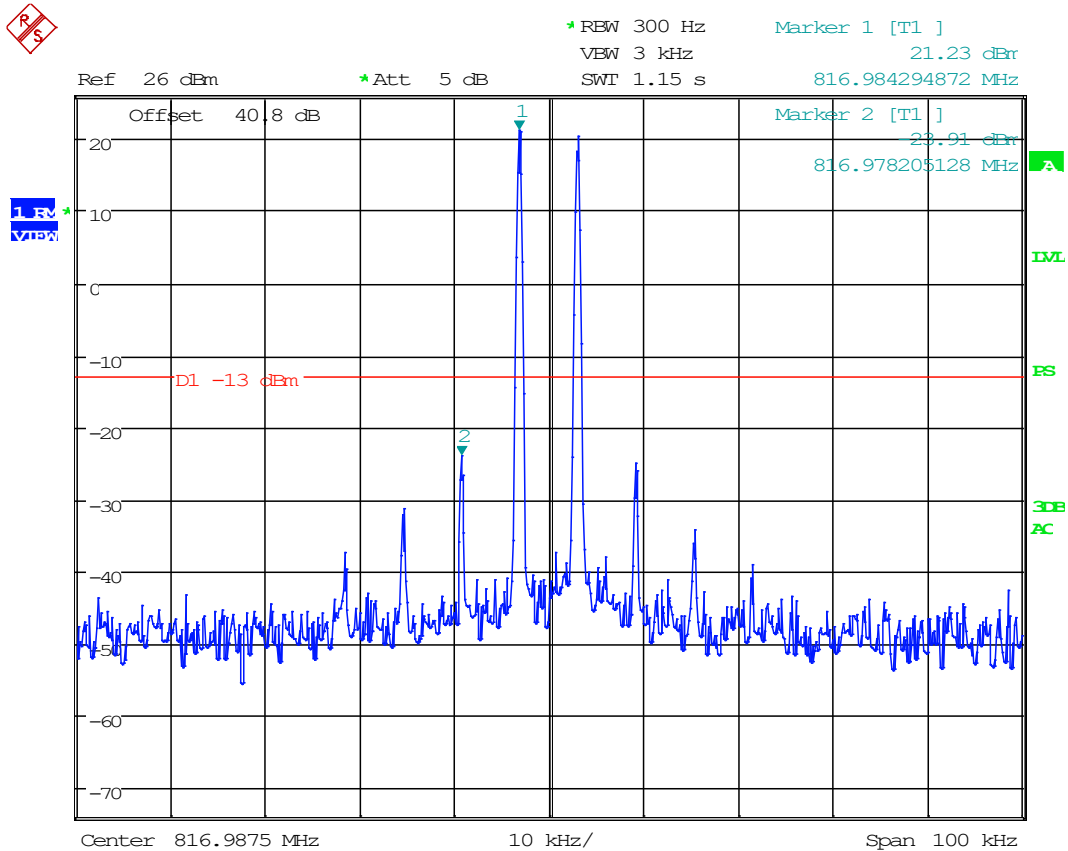


Date: 14.JAN.2021 13:30:43



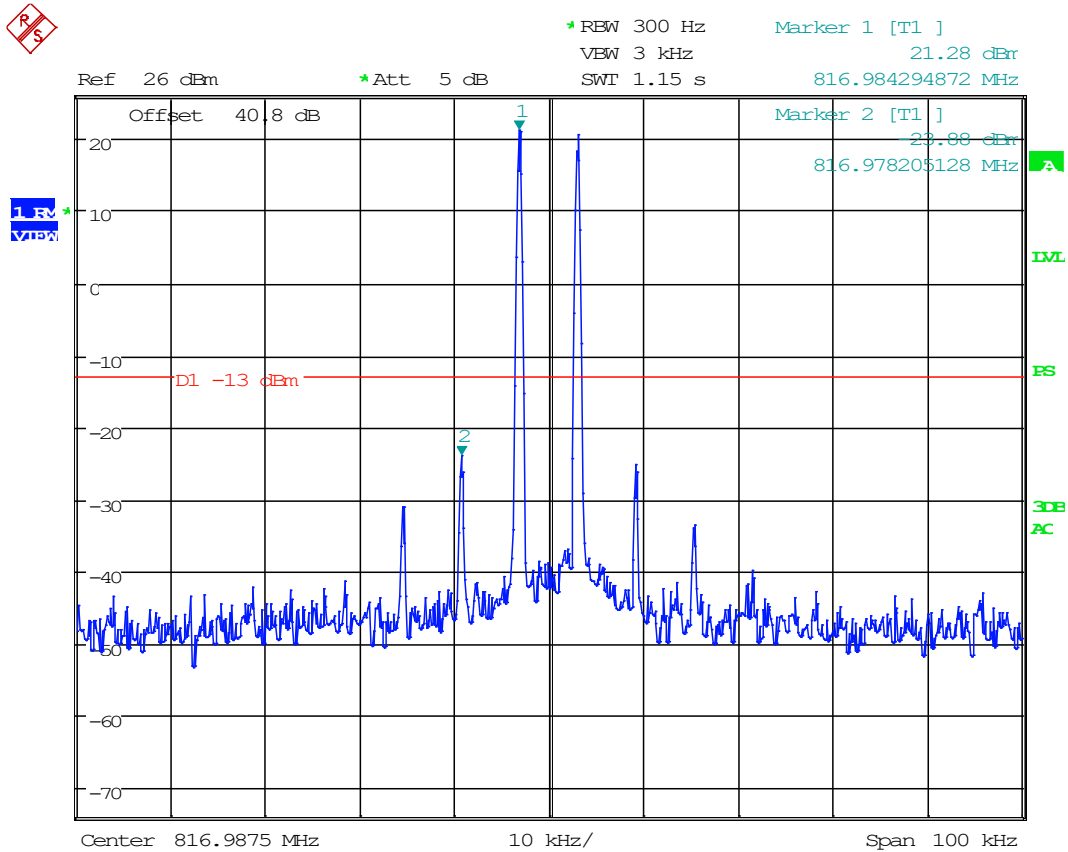
## Intermodulation Products Spectrum Plots, 800 Band

### 8.7.3 12.5 kHz Signal, Downlink, AGC



Date: 14.JAN.2021 13:28:23

#### 8.7.4 12.5 kHz Signal, Downlink, AGC +3dB



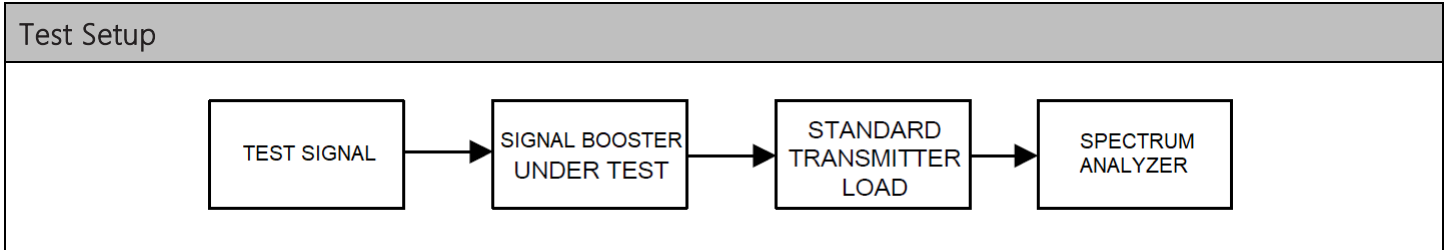
Date: 14.JAN.2021 13:27:35



## 8.8 Emission Mask, Out-of-Band

*Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".*

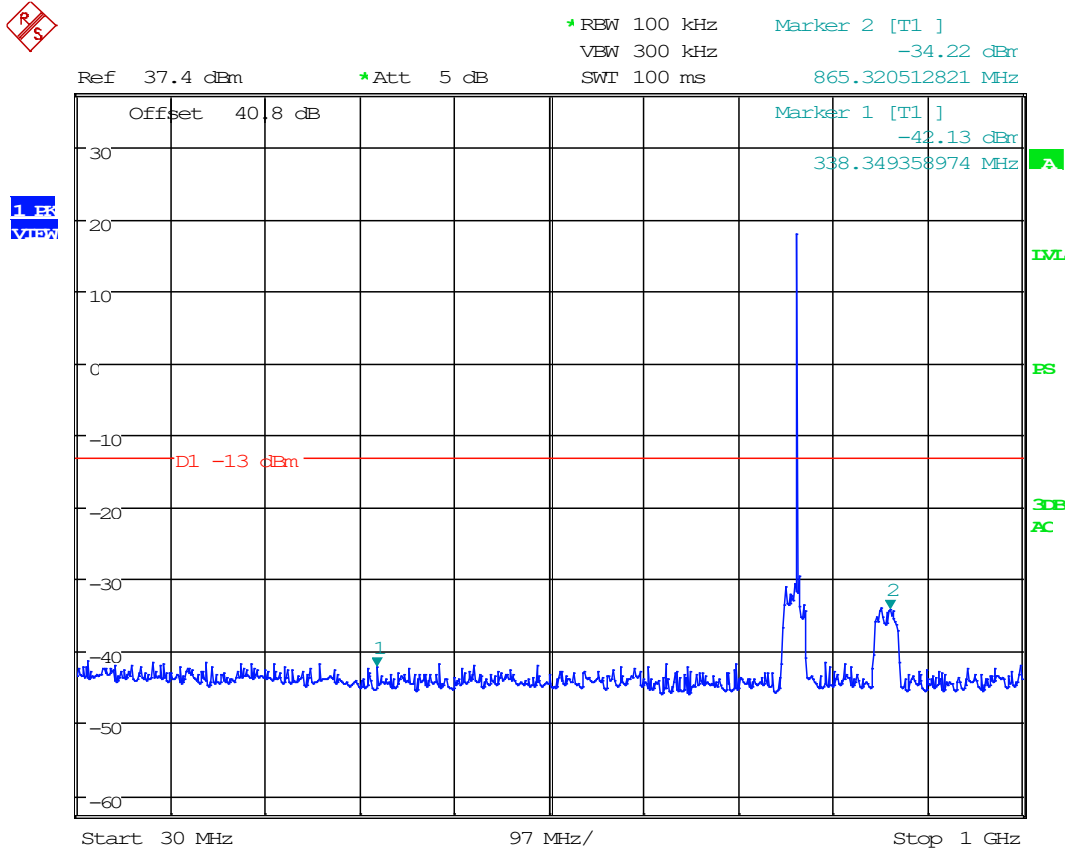
Limits from FCC Parts 2.1051, 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





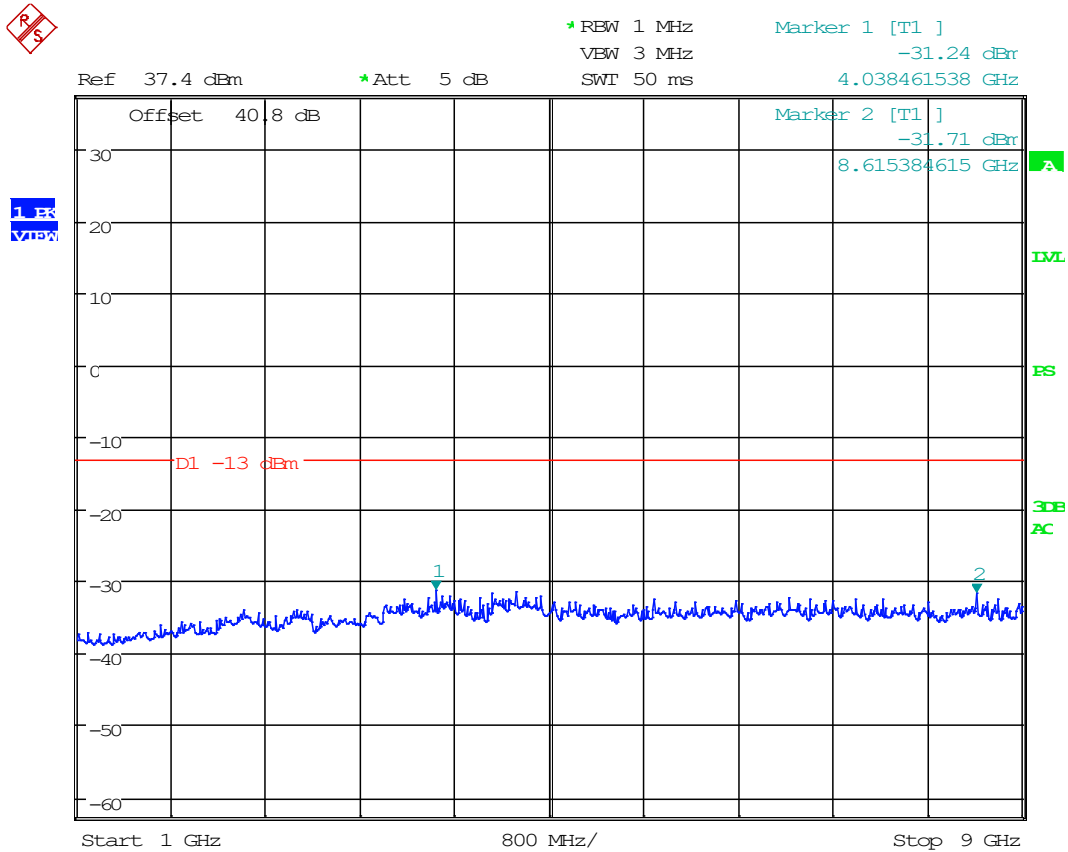
## Conducted Emissions Spectrum Plots

### 8.8.1 30 MHz to 1 GHz, 700 Band Downlink



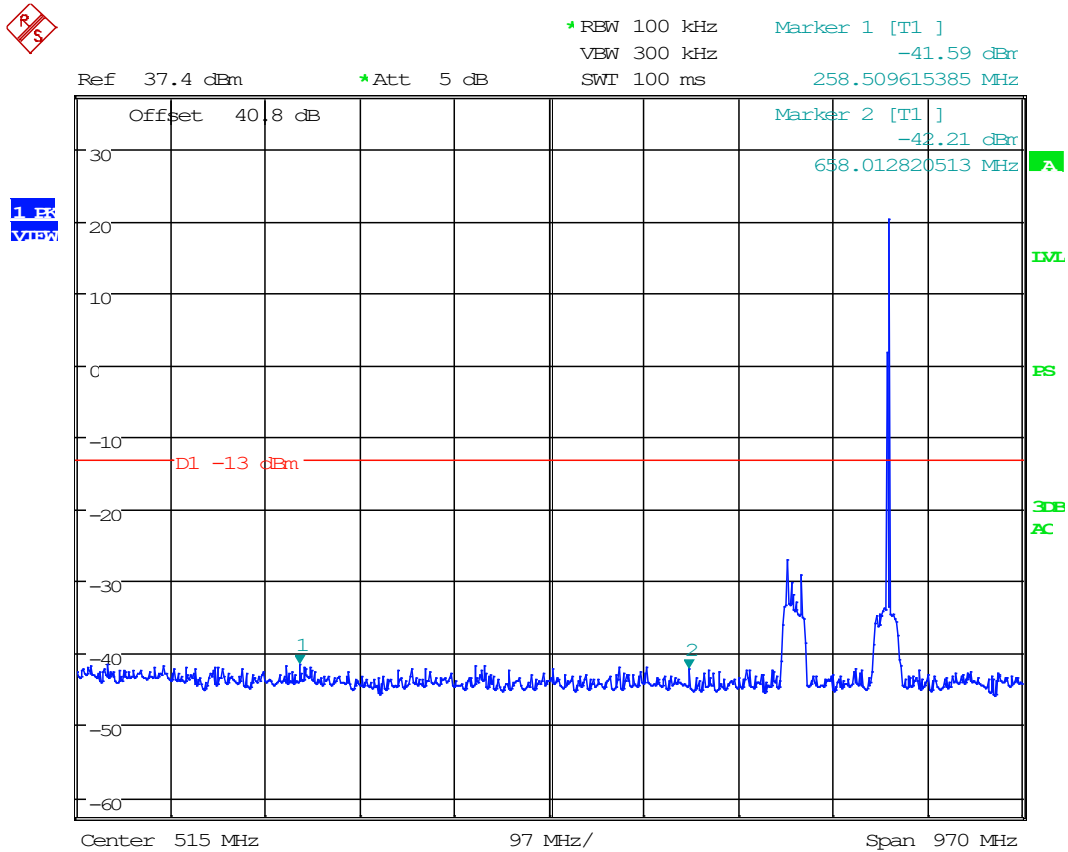
Date: 14.JAN.2021 16:57:20

## 8.8.2 1 GHz to 10<sup>th</sup> Harmonic, 700 Band Downlink



Date: 14.JAN.2021 16:56:52

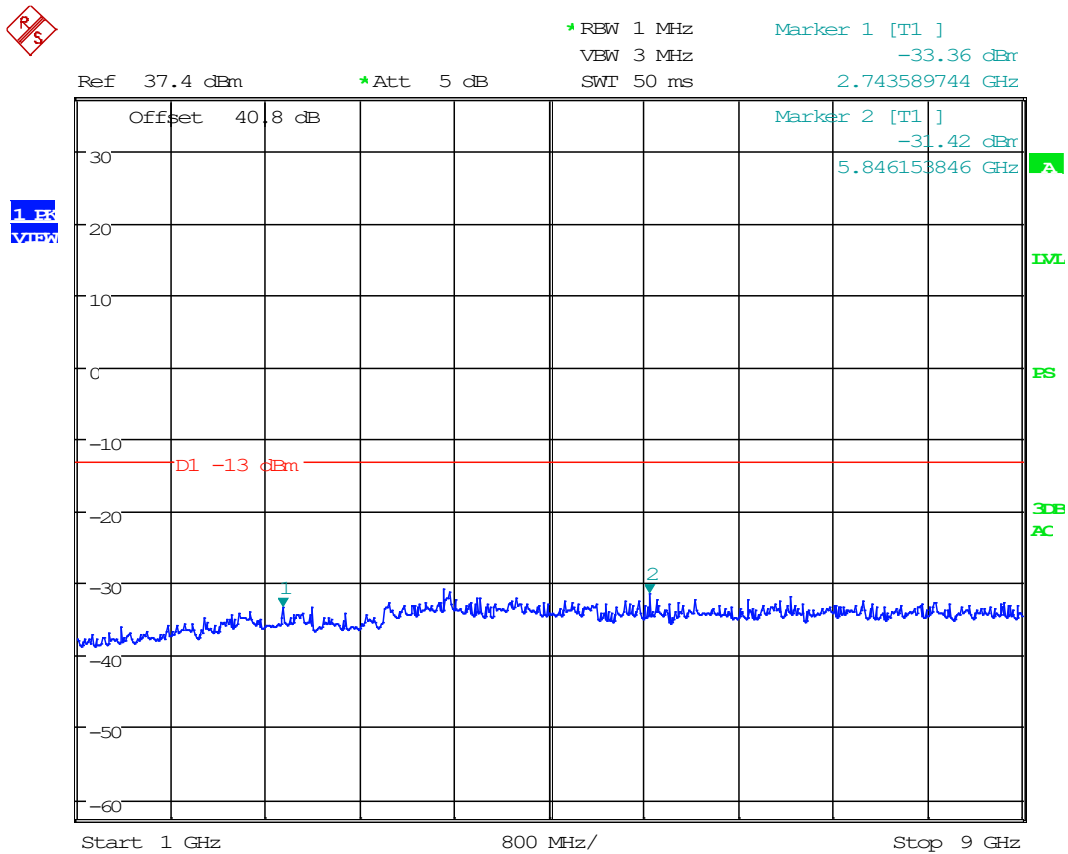
### 8.8.3 30 MHz to 1 GHz, 800 Band Downlink



Date: 14.JAN.2021 16:48:23



#### 8.8.4 1 GHz to 10<sup>th</sup> Harmonic, 800 Band Downlink

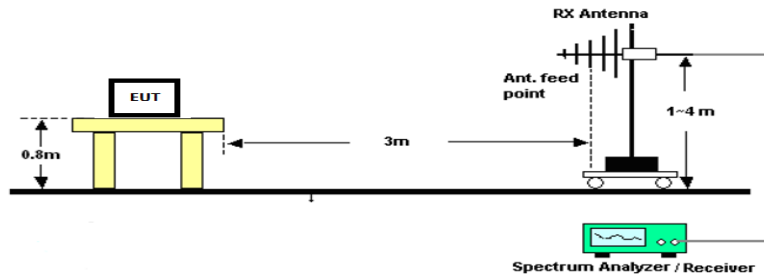


Date: 14.JAN.2021 16:48:46

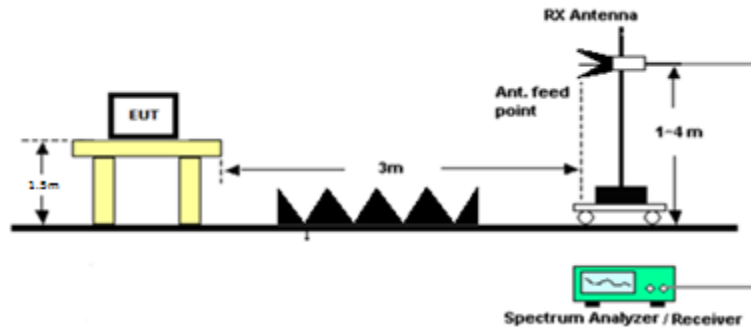
## 8.9 Spurious Radiated Emissions

Limits from FCC Parts 2.1053, 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.

### Radiated Test Setup, 30 – 1000 MHz



### Radiated Test Setup, Above 1000 MHz





## Radiated Emissions, Tabular Data, 700 Band

### 8.9.1 700 Downlink

| 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) |
|-----------------------|--------------------------|----------|----------------------|------------------|----------------|----------------------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 768.01                | 466.30                   | PK       | 35.74                | H                | 2.52           | 16.28                            | 3.00         | 54.54                   | -42.84    | -13.00               | 29.84       |
| 768.01                | 556.00                   | PK       | 37.85                | H                | 2.84           | 18.32                            | 3.00         | 59.01                   | -38.37    | -13.00               | 25.37       |
| 768.01                | 402.20                   | PK       | 40.55                | V                | 2.29           | 14.70                            | 3.00         | 57.54                   | -39.83    | -13.00               | 26.83       |
| 768.01                | 550.90                   | PK       | 41.64                | V                | 2.84           | 17.89                            | 3.00         | 62.37                   | -35.01    | -13.00               | 22.01       |
| 768.01                | 1536.03                  | PK       | 18.50                | H                | 4.55           | 27.76                            | 3.00         | 50.81                   | -46.57    | -13.00               | 33.57       |
| 768.01                | 1536.03                  | PK       | 19.57                | V                | 4.55           | 27.76                            | 3.00         | 51.88                   | -45.50    | -13.00               | 32.50       |
| 768.01                | 2304.04                  | PK       | 16.79                | H                | 5.50           | 31.55                            | 3.00         | 53.84                   | -43.54    | -13.00               | 30.54       |
| 768.01                | 2304.04                  | PK       | 12.12                | V                | 5.50           | 31.55                            | 3.00         | 49.17                   | -48.21    | -13.00               | 35.21       |
| 768.01                | 3072.05                  | PK       | 12.88                | H                | 6.43           | 32.69                            | 3.00         | 52.00                   | -45.38    | -13.00               | 32.38       |
| 768.01                | 3072.05                  | PK       | 14.57                | V                | 6.43           | 32.69                            | 3.00         | 53.69                   | -43.69    | -13.00               | 30.69       |
| 768.01                | 3840.06                  | PK       | 10.71                | H                | 6.53           | 33.19                            | 3.00         | 50.43                   | -46.95    | -13.00               | 33.95       |
| 768.01                | 3840.06                  | PK       | 10.87                | V                | 6.53           | 33.19                            | 3.00         | 50.59                   | -46.79    | -13.00               | 33.79       |
| 768.01                | 4608.08                  | PK       | 11.34                | H                | 7.55           | 34.03                            | 3.00         | 52.93                   | -44.45    | -13.00               | 31.45       |
| 768.01                | 4608.08                  | PK       | 10.06                | V                | 7.55           | 34.03                            | 3.00         | 51.65                   | -45.73    | -13.00               | 32.73       |
| 768.01                | 5376.09                  | PK       | 9.84                 | H                | 8.17           | 34.32                            | 3.00         | 52.33                   | -45.05    | -13.00               | 32.05       |
| 768.01                | 5376.09                  | PK       | 10.45                | V                | 8.17           | 34.32                            | 3.00         | 52.94                   | -44.44    | -13.00               | 31.44       |
| 768.01                | 6144.10                  | PK       | 10.33                | H                | 8.62           | 35.33                            | 3.00         | 54.28                   | -43.10    | -13.00               | 30.10       |
| 768.01                | 6144.10                  | PK       | 9.73                 | V                | 8.62           | 35.33                            | 3.00         | 53.68                   | -43.70    | -13.00               | 30.70       |
| 768.01                | 6912.11                  | PK       | 10.55                | H                | 9.21           | 35.98                            | 3.00         | 55.75                   | -41.63    | -13.00               | 28.63       |
| 768.01                | 6912.11                  | PK       | 10.25                | V                | 9.21           | 35.98                            | 3.00         | 55.45                   | -41.93    | -13.00               | 28.93       |
| 768.01                | 7680.13                  | PK       | 9.94                 | H                | 10.10          | 35.90                            | 3.00         | 55.93                   | -41.44    | -13.00               | 28.44       |
| 768.01                | 7680.13                  | PK       | 10.98                | V                | 10.10          | 35.90                            | 3.00         | 56.97                   | -40.40    | -13.00               | 27.40       |

## Radiated Emissions, Tabular Data, 800 Band

### 8.9.2 800 Downlink

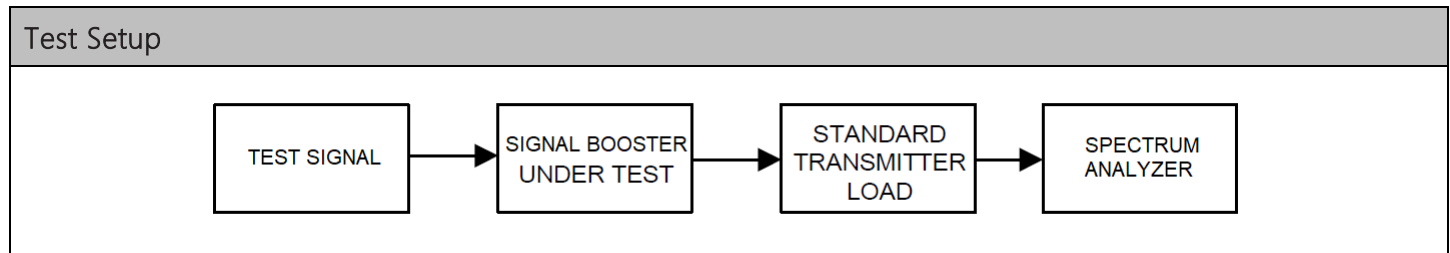
| Tuned Frequency (MHz) | Emission Frequency (MHz) | Detector | Meter Reading (dBuV) | Antenna Polarity | Coax Loss (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBuV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|-----------------------|--------------------------|----------|----------------------|------------------|----------------|----------------------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 861.99                | 556.00                   | PK       | 5.14                 | V                | 2.84           | 18.32                            | 3.00         | 26.30                   | -71.08    | -20.00               | 51.08       |
| 861.99                | 415.00                   | PK       | 16.90                | H                | 2.33           | 15.00                            | 3.00         | 34.23                   | -63.15    | -20.00               | 43.15       |
| 861.99                | 1723.98                  | PK       | 14.97                | H                | 4.81           | 29.38                            | 3.00         | 49.17                   | -48.21    | -20.00               | 28.21       |
| 861.99                | 1723.98                  | PK       | 15.70                | V                | 4.81           | 29.38                            | 3.00         | 49.90                   | -47.48    | -20.00               | 27.48       |
| 861.99                | 2585.96                  | PK       | 13.06                | H                | 5.76           | 32.46                            | 3.00         | 51.28                   | -46.09    | -20.00               | 26.09       |
| 861.99                | 2585.96                  | PK       | 12.23                | V                | 5.76           | 32.46                            | 3.00         | 50.45                   | -46.92    | -20.00               | 26.92       |
| 861.99                | 3447.95                  | PK       | 19.51                | H                | 6.88           | 32.60                            | 3.00         | 58.99                   | -38.39    | -20.00               | 18.39       |
| 861.99                | 3447.95                  | PK       | 18.48                | V                | 6.88           | 32.60                            | 3.00         | 57.96                   | -39.42    | -20.00               | 19.42       |
| 861.99                | 4309.94                  | PK       | 10.21                | H                | 7.54           | 33.48                            | 3.00         | 51.23                   | -46.15    | -20.00               | 26.15       |
| 861.99                | 4309.94                  | PK       | 11.36                | V                | 7.54           | 33.48                            | 3.00         | 52.38                   | -45.00    | -20.00               | 25.00       |
| 861.99                | 5171.93                  | PK       | 10.67                | H                | 7.88           | 34.13                            | 3.00         | 52.68                   | -44.70    | -20.00               | 24.70       |
| 861.99                | 5171.93                  | PK       | 11.18                | V                | 7.88           | 34.13                            | 3.00         | 53.19                   | -44.19    | -20.00               | 24.19       |
| 861.99                | 6033.91                  | PK       | 9.76                 | H                | 8.66           | 35.16                            | 3.00         | 53.58                   | -43.80    | -20.00               | 23.80       |
| 861.99                | 6033.91                  | PK       | 9.40                 | V                | 8.66           | 35.16                            | 3.00         | 53.22                   | -44.16    | -20.00               | 24.16       |
| 861.99                | 6895.90                  | PK       | 11.15                | H                | 9.22           | 35.93                            | 3.00         | 56.30                   | -41.08    | -20.00               | 21.08       |
| 861.99                | 6895.90                  | PK       | 9.83                 | V                | 9.22           | 35.93                            | 3.00         | 54.98                   | -42.40    | -20.00               | 22.40       |
| 861.99                | 7757.89                  | PK       | 11.94                | H                | 10.12          | 35.87                            | 3.00         | 57.93                   | -39.45    | -20.00               | 19.45       |
| 861.99                | 7757.89                  | PK       | 10.45                | V                | 10.12          | 35.87                            | 3.00         | 56.44                   | -40.94    | -20.00               | 20.94       |
| 861.99                | 8619.88                  | PK       | 9.30                 | H                | 10.17          | 36.03                            | 3.00         | 55.50                   | -41.88    | -20.00               | 21.88       |
| 861.99                | 8619.88                  | PK       | 9.47                 | V                | 10.17          | 36.03                            | 3.00         | 55.67                   | -41.71    | -20.00               | 21.71       |



## 8.10 Modulation Characteristics

*Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".*

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

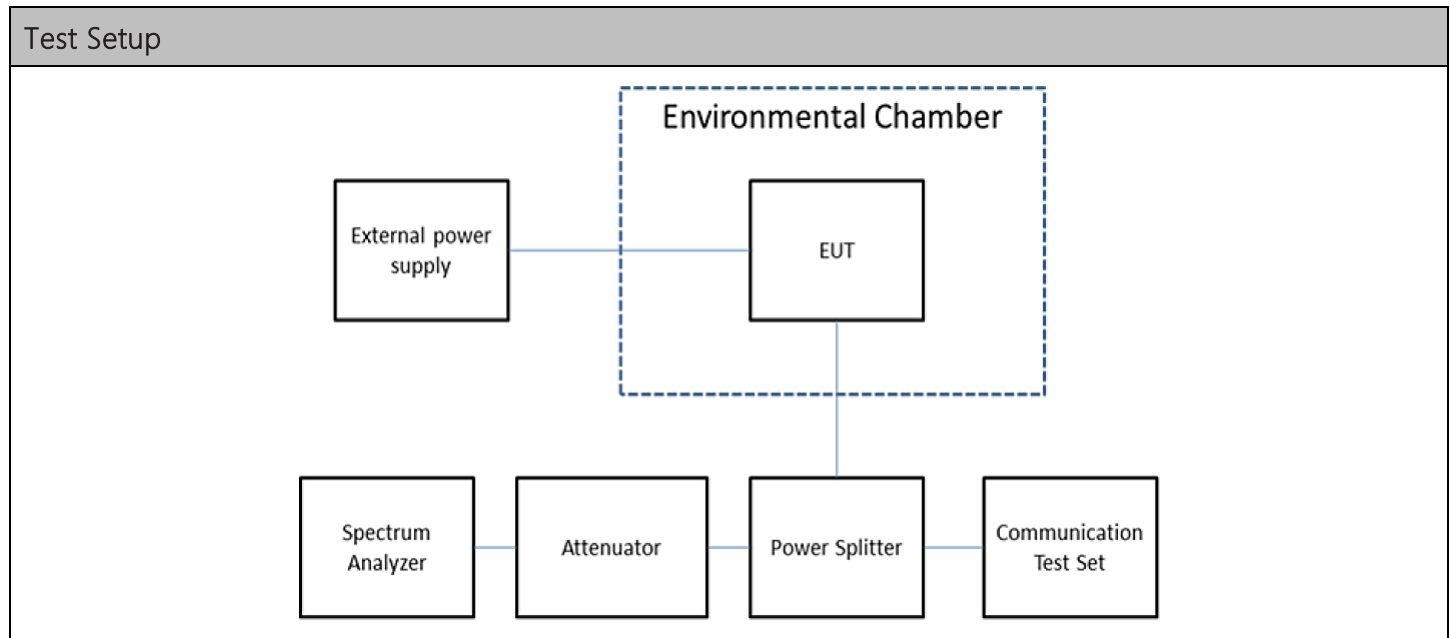


N/A. The EUT does not have any means to modulate the incoming signal.

## 8.11 Frequency Stability

Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".

Limits from FCC Parts 2.1055, 90.213 (a); and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.



| Test Results, Mode 1  |                     |             |
|-----------------------|---------------------|-------------|
| Tuned Frequency (MHz) | Max Deviation (ppm) | Limit (ppm) |
| n/a                   | n/a                 | n/a         |

N/A. The EUT does not alter the input signal in any way.



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## 8.12 Transient Frequency Behavior

*Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".*

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

N/A. The EUT does not "key-on" or "key off", and instead transmits indefinitely.



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### 8.13 Adjacent channel power limits

*Referenced from test report "TR\_0072-21\_FCC\_PT90\_Booster Class B".*

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

N/A. Device 800 MHz Band does not accommodate >25 kHz signals.



## 9. 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. 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_0076-21_FCC_PT90_Booster Class A_1 | 1          | Initial release | January 6, 2021 |
|                                       |            |                 |                 |
|                                       |            |                 |                 |
|                                       |            |                 |                 |



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END OF TEST REPORT

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