



# 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): 2021-06-10

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## 1. Customer Information

Applicant: Fiplex Communications Inc.  
Address: 2101 NW 79th Ave.  
Miami FL 33122

### 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: P3TDH14-9A

| 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                       |



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| 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                            | n/a                       |

**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 P3TDH14-9A is electrically identical to FCC ID P3TDH14-9B. 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 P3TDH14-9A is electrically identical to FCC ID P3TDH14-9B 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 P3TDH14-9B, test report "TR\_2117-21\_FCC\_UL\_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: May 03, 2021 – June 07, 2021

Signature: Terri Allen

Name & Title: Terri Allen, Technical Assistant

Date of Signature

(YYYY-MM-DD): 2021-06-10

Signature: 

Sr. EMC Engineer  
EMC-003838-NE



Name & Title: Tim Royer, EMC Engineer

Date of Signature

(YYYY-MM-DD): 2021-06-10



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

The test sample was received: February 12, 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:           | P3TDH14-9A                              |
| Brief Description | Enterprise DAS VHF/UHF HP - Master Unit |
| Type of Modular   | n/a                                     |
| Model(s) #        | DH14EA-E4-AVUT-NDND-3037                |
| Serial Number     | 20213254FU                              |

| Technical Characteristics    |   |
|------------------------------|---|
| Technology                   | DAS Industrial Signal Booster Master Unit                     |
| Frequency Range              | 150 – 174 MHz; and 450 - 470 MHz                              |
| RF O/P Power (Max.)          | VHF UL: 22.26 dBm (0.16 W)<br>UHF UL: 25.69 dBm (0.37 W)      |
| Modulation                   | n/a   |
| Bandwidth & Emission Class   | 11K3F3E, 8K10F1D, 8K10F1E, 8K10F1W, 9K80F1D, 9K80F1E, 9K81D7W |
| Number of Channels           | Variable.   |
| Duty Cycle                   | 100%  |
| Antenna Connector            | n/a   |
| Voltage Rating (AC or Batt.) | 0 dBi   |

| 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 |
| 150.0 – 173.4 MHz | Uplink         | 150.80625 MHz    |
|                   |                | 162.1 MHz        |
|                   |                | 173.39375 MHz    |
| 450 – 512 MHz     | Uplink         | 450.0125 MHz     |
|                   |                | 460 MHz          |
|                   |                | 511.9875 MHz     |

#### 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 R&amp;S SMU-200A</a>    | Rohde & Schwarz | SMU200A | 103195                 | 4/23/19     | 4/22/2022  |
| <a href="#">Sweep/Signal Generator</a>               | Anritsu         | 68369B  | 985112                 | 1/19/21     | 1/19/2024  |
| <a href="#">Digital Multimeter</a>                   | Fluke           | 77      | 35053830               | 9/9/20      | 9/9/2023   |
| <a href="#">R&amp;S 18 GHz USB Peak Power Sensor</a> | Rohde & Schwarz | NRP-Z85 | 1411.7501.02-102085-VV | 2/4/19      | 2/3/2022   |
| <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                   | 5/4/21      | 5/3/2024   |
| <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     | 3/11/2022  |
| <a href="#">Frequency Counter Small</a>              | HP              | 5385A   | 3242A07460             | 9/9/20      | 9/9/2023   |
| <a href="#">Type K J Thermometer</a>                 | Martel          | 303     | 080504494              | 1/18/20     | 1/17/2023  |
| <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 |
| RSCCommander   | Rohde & Schwarz | 1.6.4                    |
| Field Strength | Timco           | v4.10.7.0                |

\*\*The EMI Test Receiver R&S ESU 40 used to take plots for this report the date was not setup within the equipment. All plots below were taken in May and June of 2021. \*\*



## 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).

*Referenced from test report "TR\_2117-21\_FCC\_UL\_PT90\_Booster Class B\_".*

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

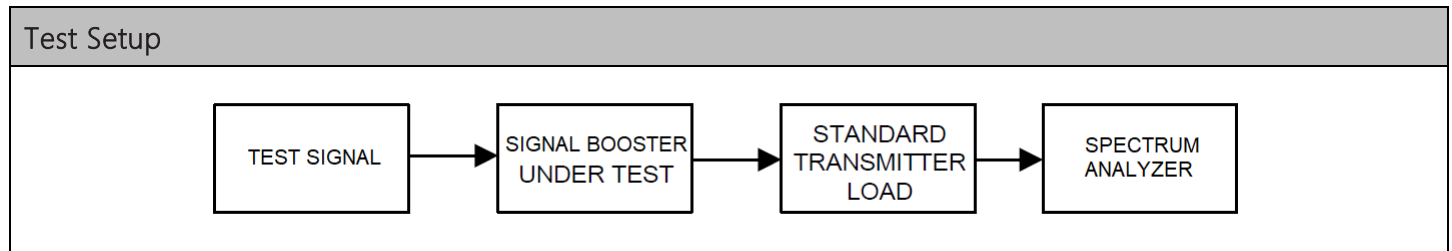
| Test Results              |                 |                              |
|---------------------------|-----------------|------------------------------|
| EUT Operating Voltage (V) | EUT Current (A) | Power at the Final Amplifier |
| 28 V DC                   | 2.86            | 80 W                         |
| 120 V AC                  | 0.67            | 80 W                         |



## 8.2 RF Output Power & Gain

Referenced from test report "TR\_2117-21\_FCC\_UL\_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) |
| Uplink (VHF)               | 22.26                  | 0.16                 |
| Uplink (UHF)               | 25.69                  | 0.37                 |



### VHF Band Gain

| Test Results, Gain |                       |             |                   |                    |           |
|--------------------|-----------------------|-------------|-------------------|--------------------|-----------|
| Link Direction     | Tuned Frequency (MHz) | Input Level | Power Input (dBm) | Power Output (dBm) | Gain (dB) |
| Uplink             | 150.8125 MHz          | AGC         | -63.3             | 20.72              | 84.02     |
|                    |                       | AGC+3       | -60.3             | 21.37              | 81.67     |
|                    |                       | Maximum     | 0                 | 22.26              | 22.26     |
| Uplink             | 160 MHz               | AGC         | -63.4             | 21.87              | 85.27     |
|                    |                       | AGC+3       | -60.4             | 22.16              | 82.56     |
|                    |                       | Maximum     | 0                 | 21.98              | 21.98     |
| Uplink             | 173.9875 MHz          | AGC         | -61.8             | 22.23              | 84.03     |
|                    |                       | AGC+3       | -58.8             | 22.06              | 80.86     |
|                    |                       | Maximum     | 0                 | 21.89              | 21.89     |

### UHF Band Gain

| Test Results, Gain |                       |             |                   |                    |           |
|--------------------|-----------------------|-------------|-------------------|--------------------|-----------|
| Link Direction     | Tuned Frequency (MHz) | Input Level | Power Input (dBm) | Power Output (dBm) | Gain (dB) |
| Uplink             | 450 MHz               | AGC         | -48.5             | 24.23              | 72.73     |
|                    |                       | AGC +3      | -45.5             | 24.42              | 69.92     |
|                    |                       | Maximum     | 0                 | 24.27              | 24.27     |
| Uplink             | 469.9975 MHz          | AGC         | -51.6             | 22.6               | 74.2      |
|                    |                       | AGC+3       | -48.6             | 25.69              | 74.29     |
|                    |                       | Maximum     | 0                 | 25.51              | 25.51     |
| Uplink             | 511.9975 MHz          | AGC         | -47.6             | 18.89              | 66.49     |
|                    |                       | AGC+3       | -44.6             | 19.11              | 63.71     |
|                    |                       | Maximum     | 0                 | 18.97              | 18.97     |

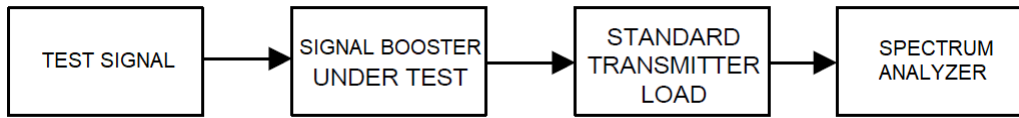
## 8.3 Out-of-band Rejection

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





## Test Setup



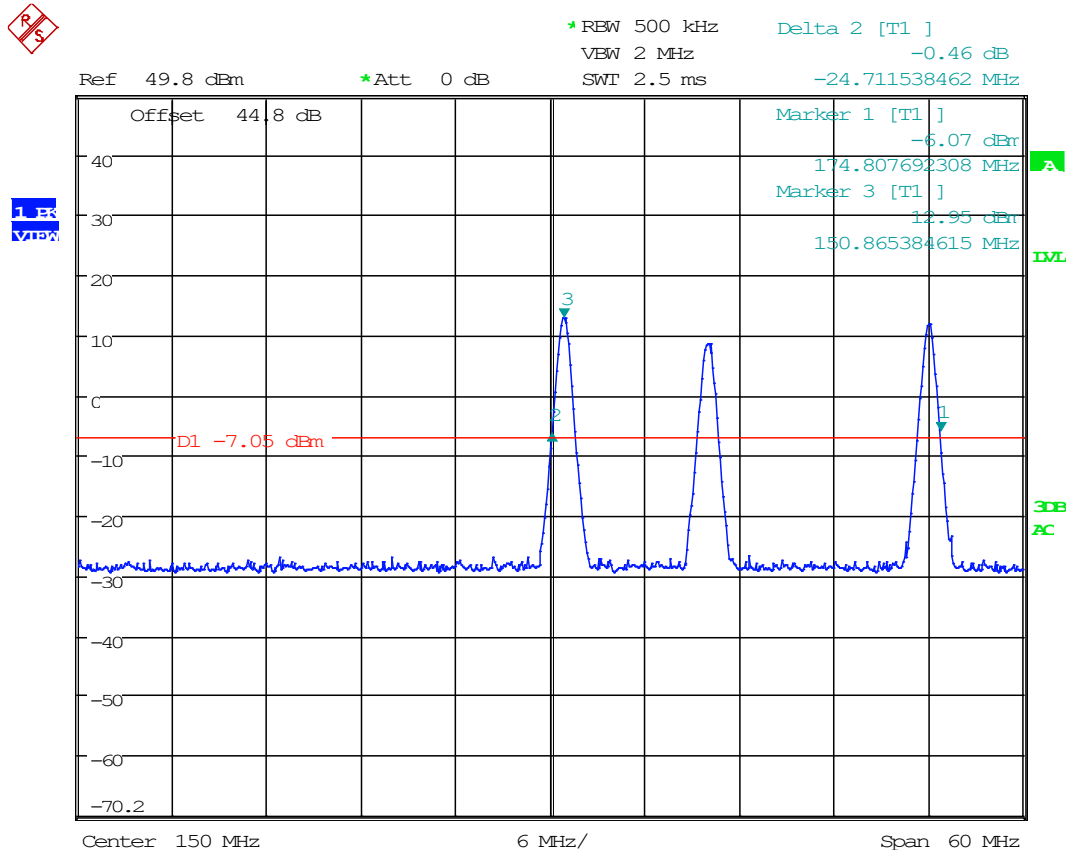
## Test Results, Out-of-band Rejection and Class of Operation

| Operating Band      | Link Direction | Passband (kHz) | Class of Operation |
|---------------------|----------------|----------------|--------------------|
| VHF 150.8-173.4 MHz | Uplink         | > 75 kHz       | Class A            |
| UHF 450-512 MHz     | Uplink         | > 75 kHz       | Class A            |



## Out-of-band Rejection, Spectrum Plots

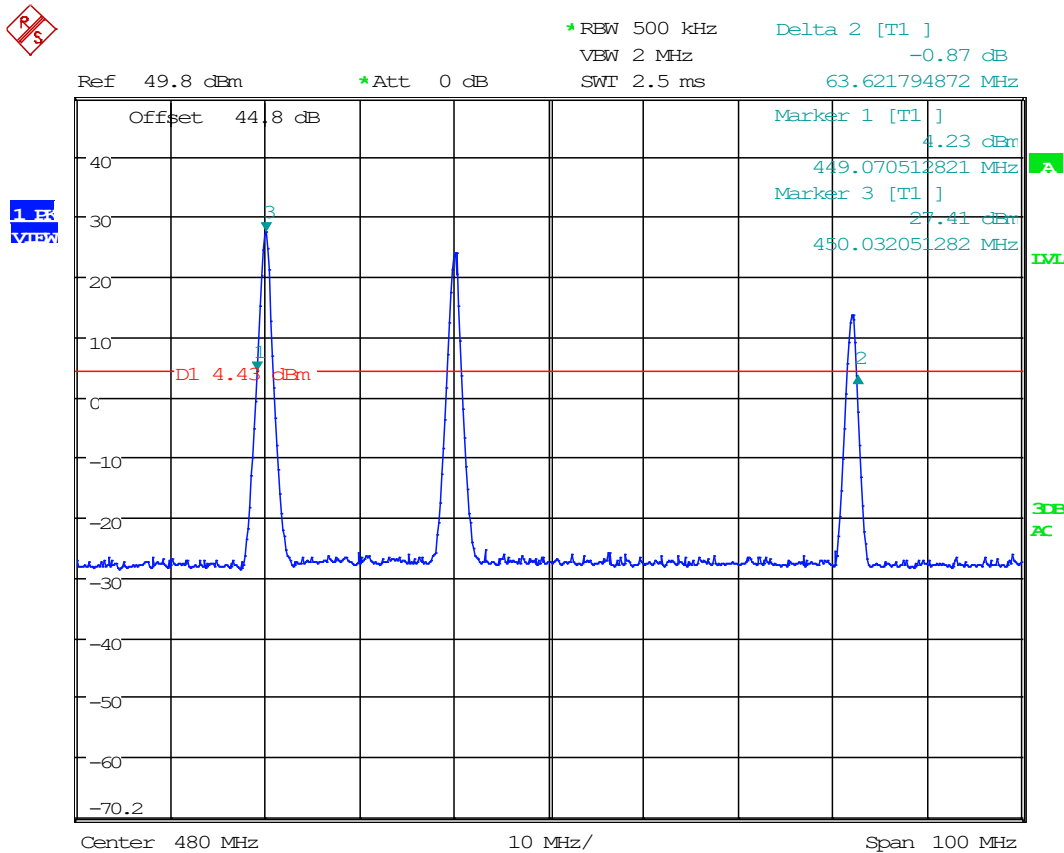
### 8.3.1 VHF Band, Uplink



Date: 8.JAN.2003 06:52:57



### 8.3.1 UHF Band, Uplink



Date: 8.JAN.2003 07:12:35



## 8.4 Bandwidth & Emission

Referenced from test report "TR\_2117-21\_FCC\_UL\_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              | 150-174 MHz     | 20 kHz, 11.25 kHz, 6.0 kHz |
| Part 90              | 406-512 MHz     | 20 kHz, 11.25 kHz, 6.0 kHz |

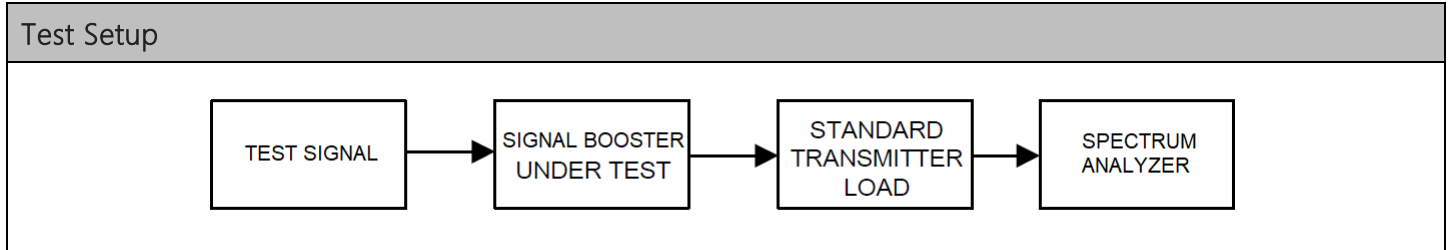
| Applicable Input Signals |                          |                                       |
|--------------------------|--------------------------|---------------------------------------|
| Signal                   | Occupied Bandwidth (kHz) | Representative Emission Designator(s) |
| CW                       | n/a                      | n/a                                   |
| 12.5 kHz FM              | 7.89                     | 7K89F3E                               |
| 25 kHz FM                | 12.5                     | 12K5F3E                               |
| C4FM (P25 Phase I)       | 7.97                     | 7K97F1D, 7K97F1E                      |
| HCPM (P25 Phase II SU)   | 8.13                     | 8K13F1W                               |
| HDQPSK (P25 Phase II BS) | 9.89                     | 9K89F1D, 9K89F1E                      |



## 8.5 Input VS Output Signal Comparison

*Referenced from test report "TR\_2117-21\_FCC\_UL\_PT90\_Booster Class B\_".*

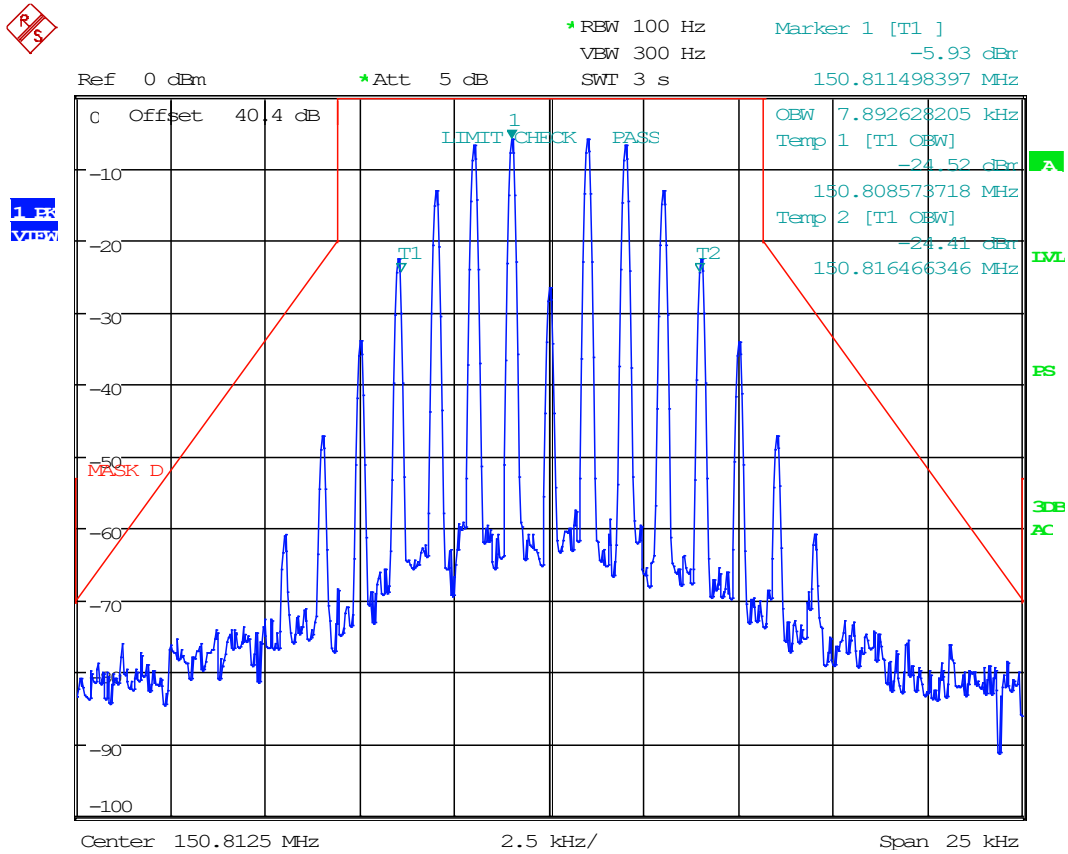
Limits from FCC Parts 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





## Input VS Output, Input Spectrum Plots

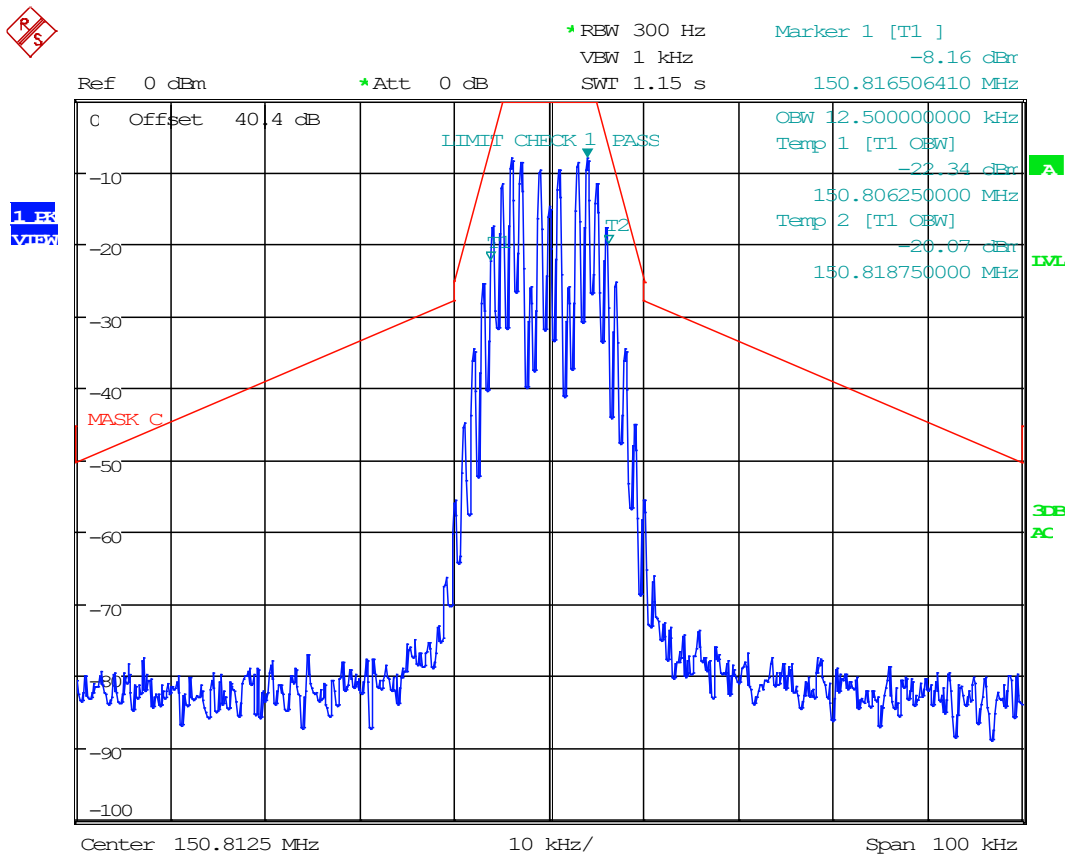
### 8.5.1 12.5 kHz FM



Date: 6.OCT.2020 20:08:30

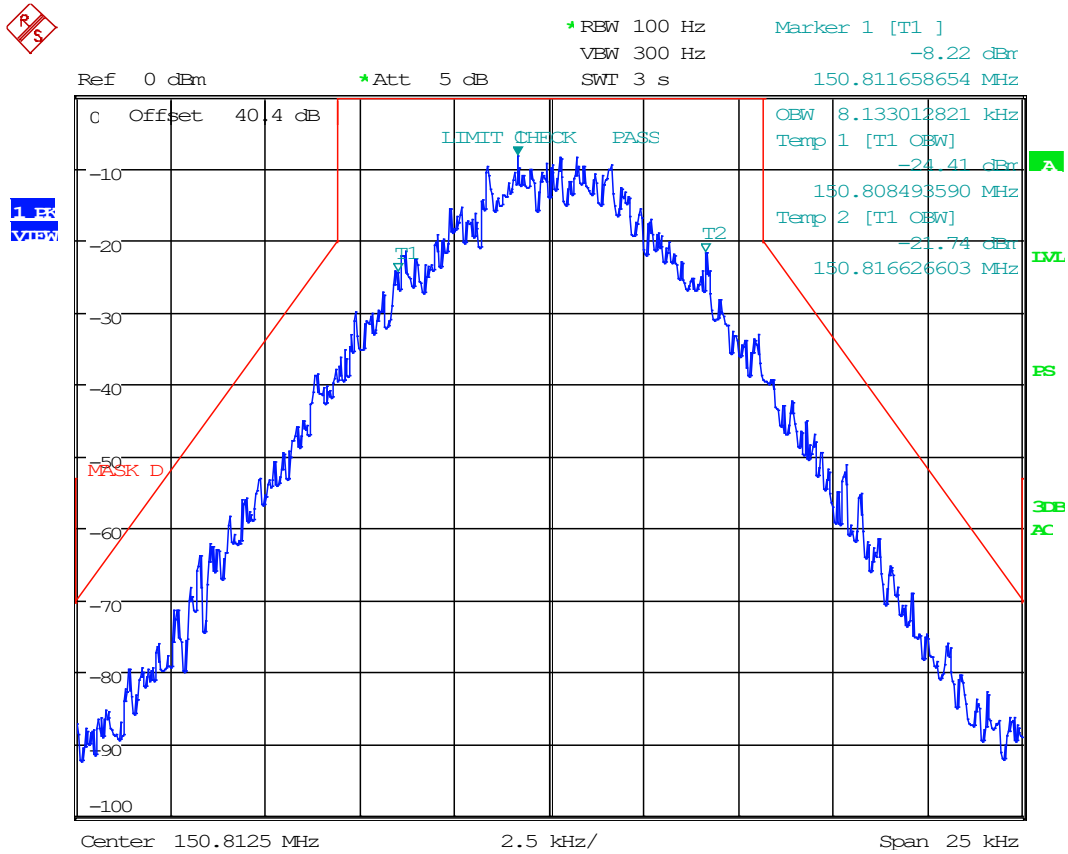


## 8.5.2 25 kHz FM



Date: 6.OCT.2020 20:01:25

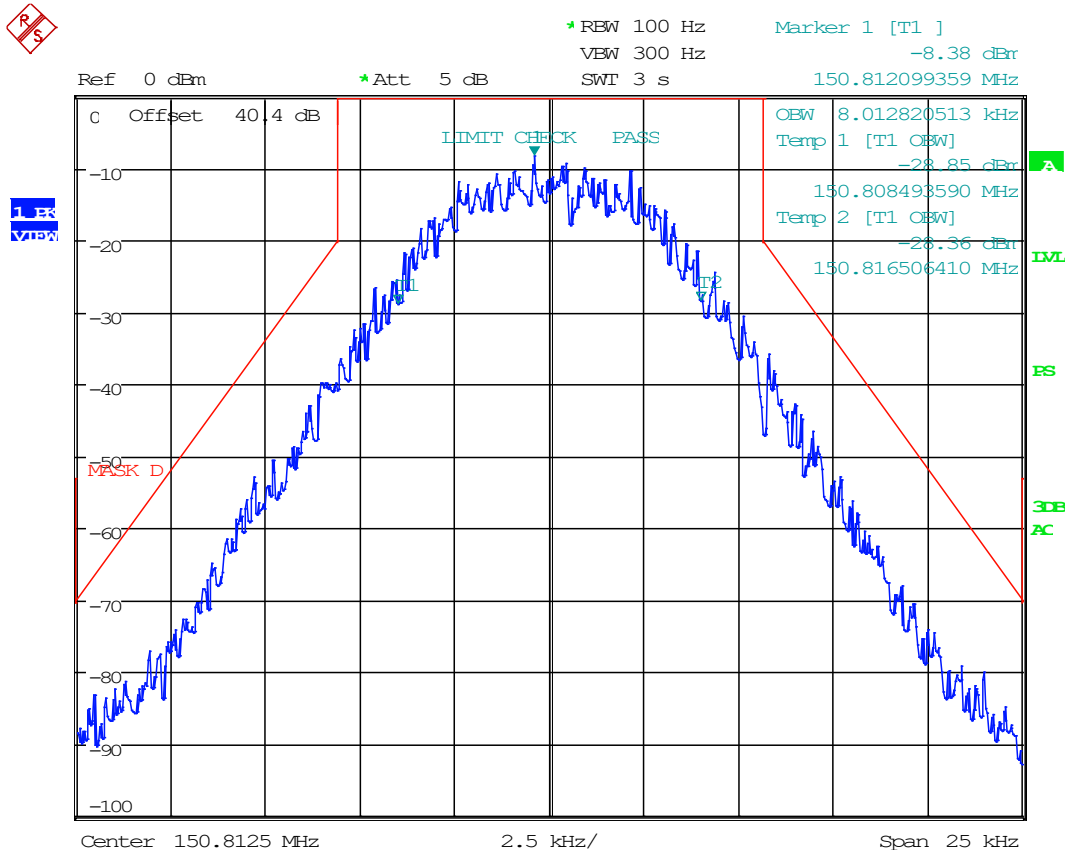
### 8.5.3 C4FM



Date: 6.OCT.2020 20:10:17

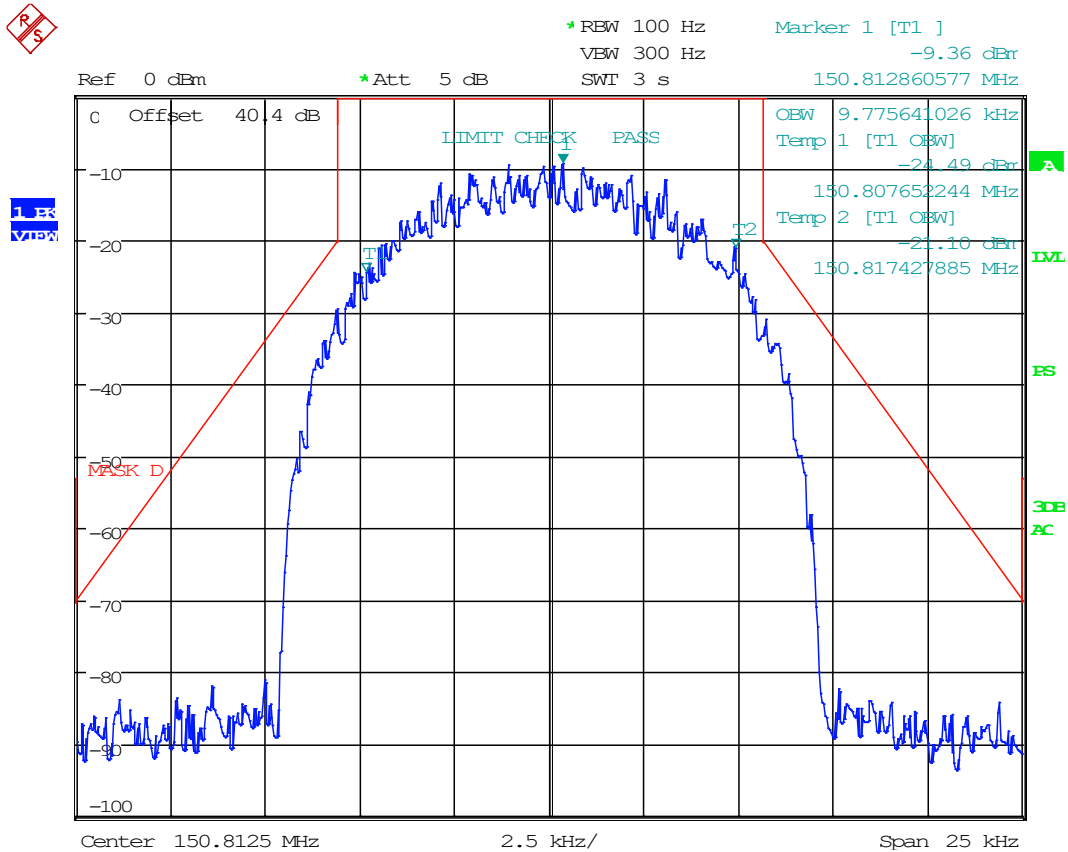


## 8.5.4 H-CPM



Date: 6.OCT.2020 20:11:03

## 8.5.5 H-DQPSK



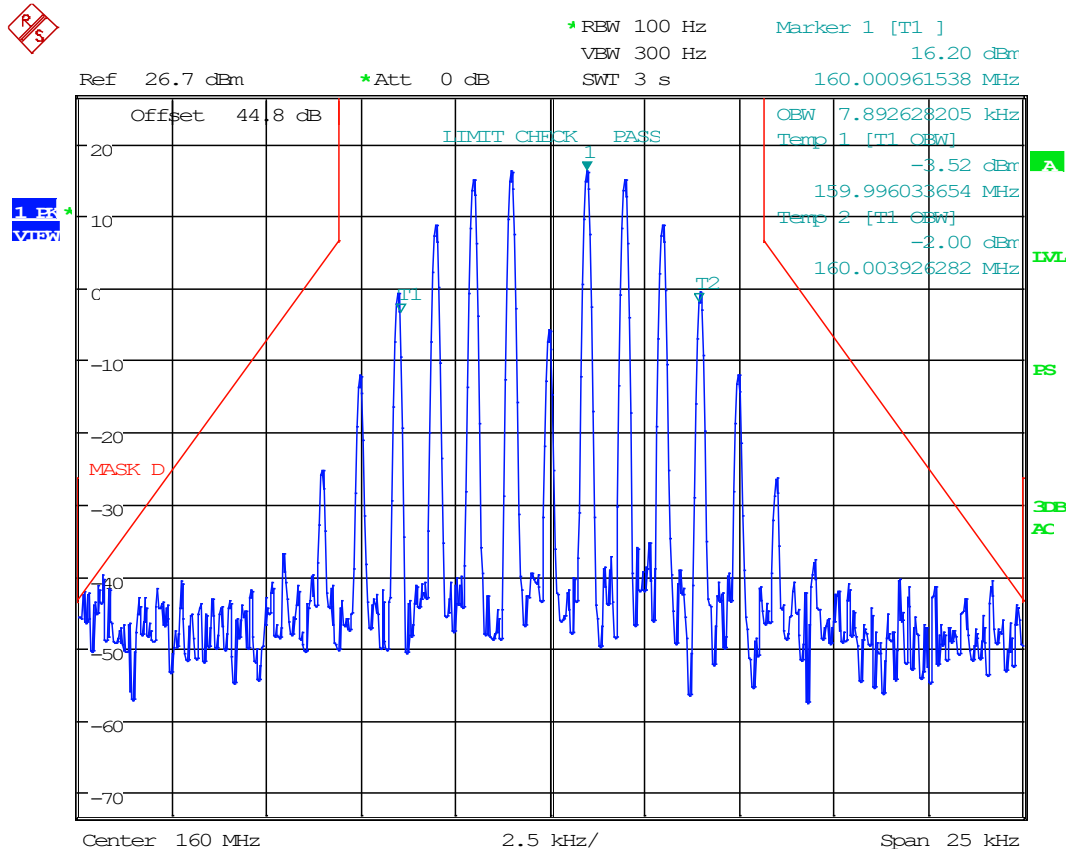
Date: 6.OCT.2020 20:12:07



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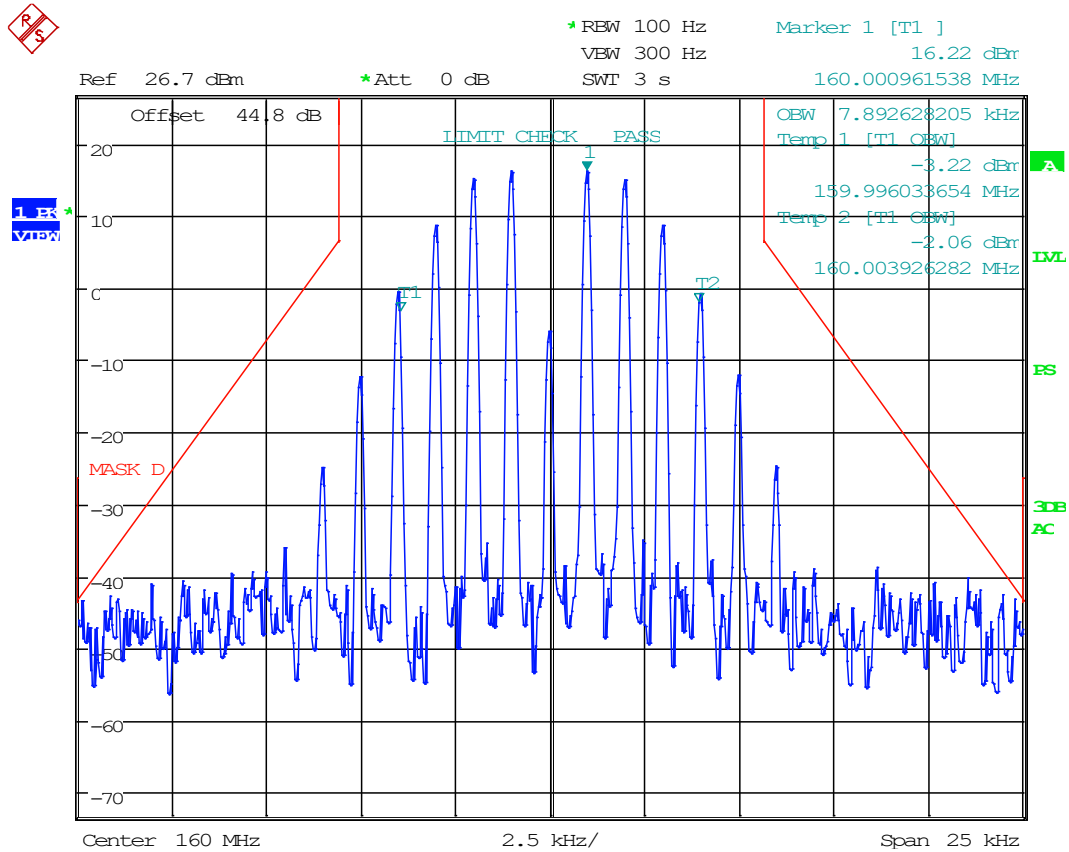
Input VS Output, Output Spectrum Plots, VHF Band

### 8.5.1 12.5 kHz FM, Uplink, AGC



Date: 8.JAN.2003 03:40:54

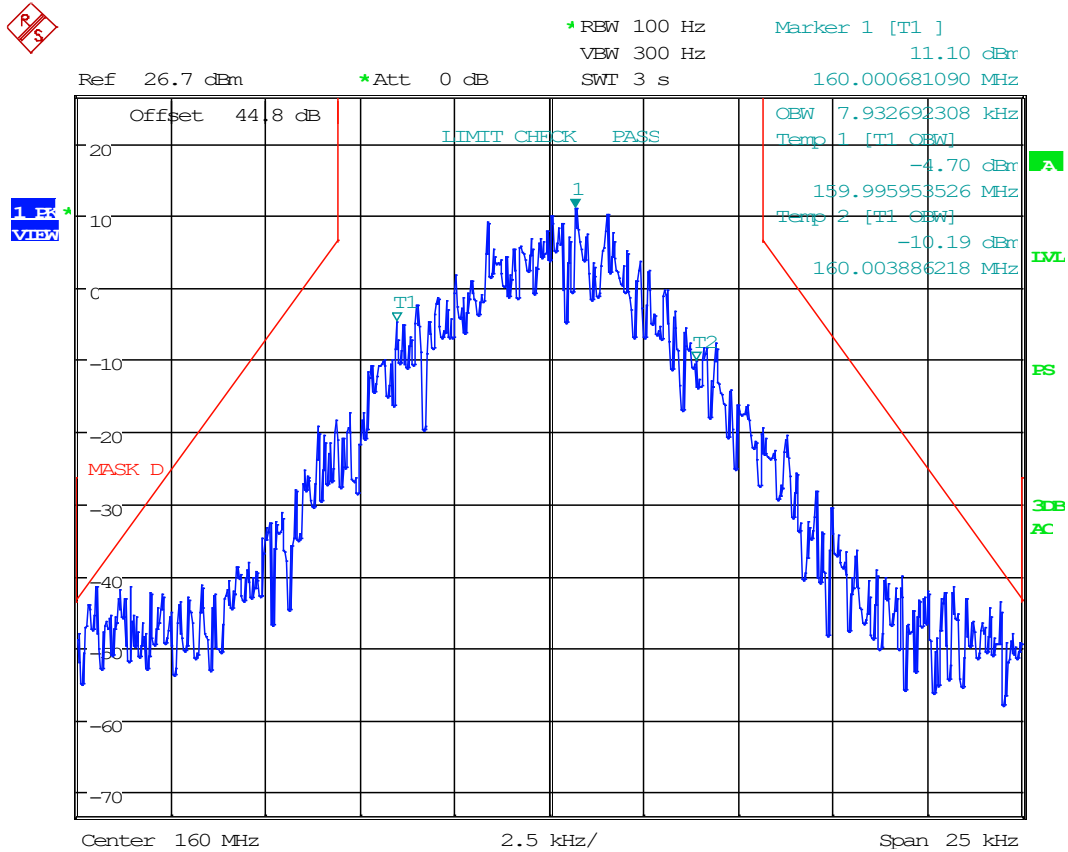
## 8.5.2 12.5 kHz FM, Uplink, AGC +3dB



Date: 8.JAN.2003 03:40:26

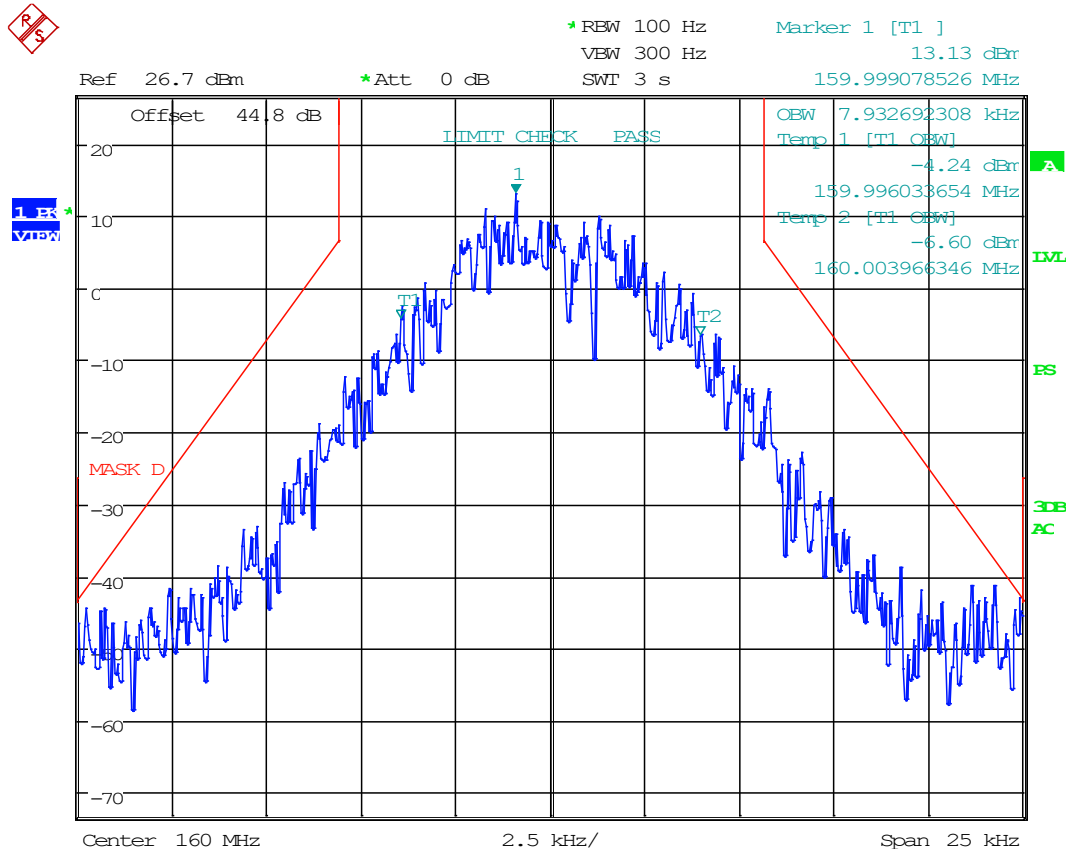


### 8.5.3 C4FM, Uplink, AGC



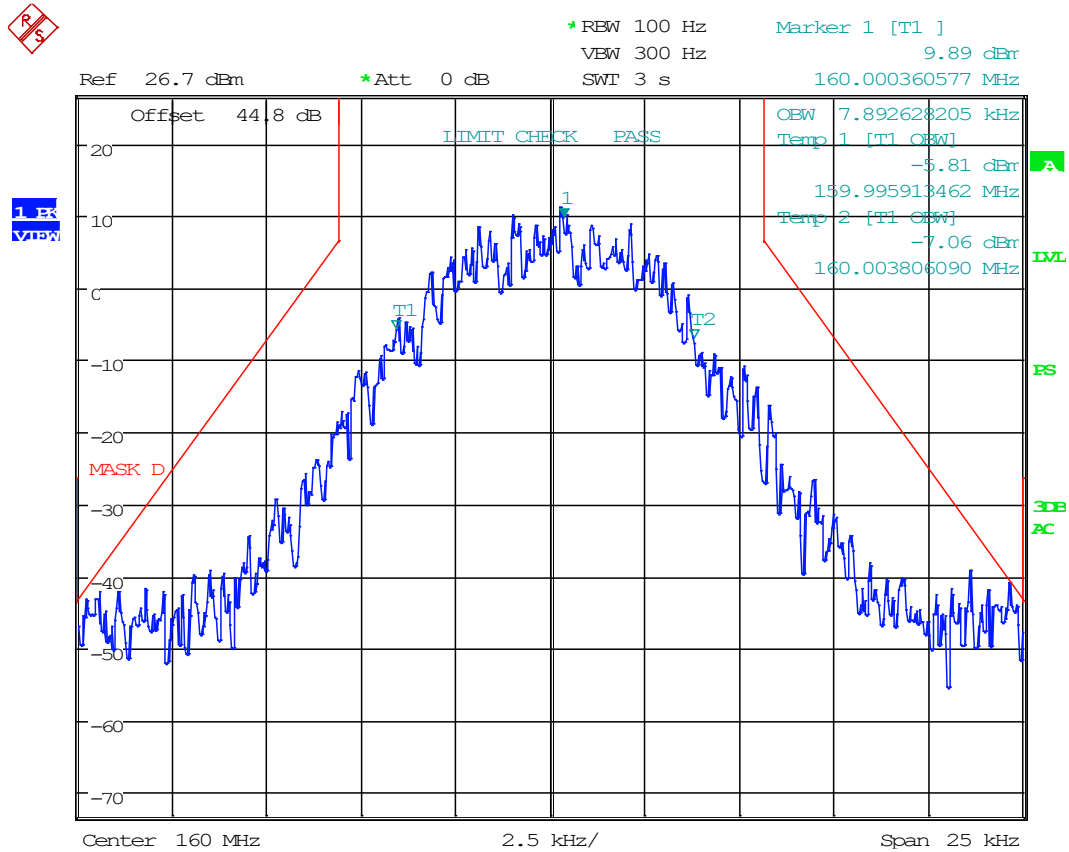
Date: 8.JAN.2003 03:38:08

#### 8.5.4 C4FM, Uplink, AGC +3dB



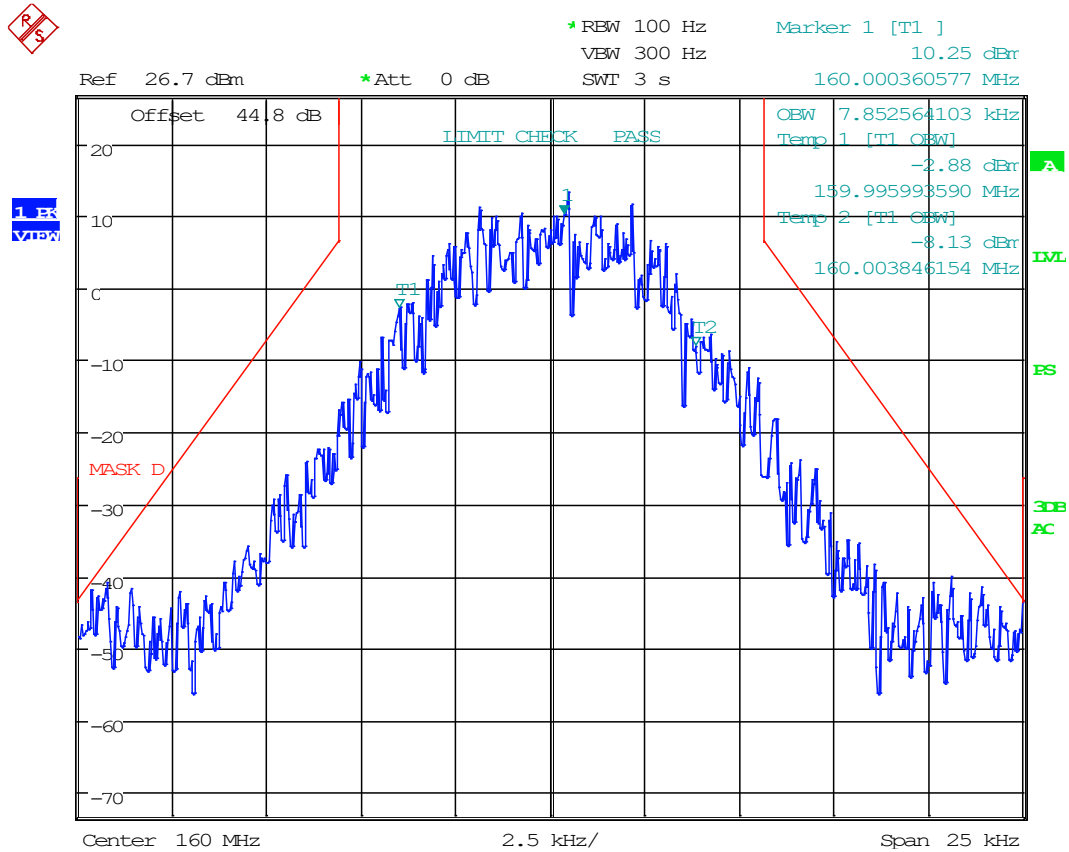
Date: 8.JAN.2003 03:39:45

### 8.5.5 H-CPM, Uplink, AGC



Date: 8.JAN.2003 03:35:56

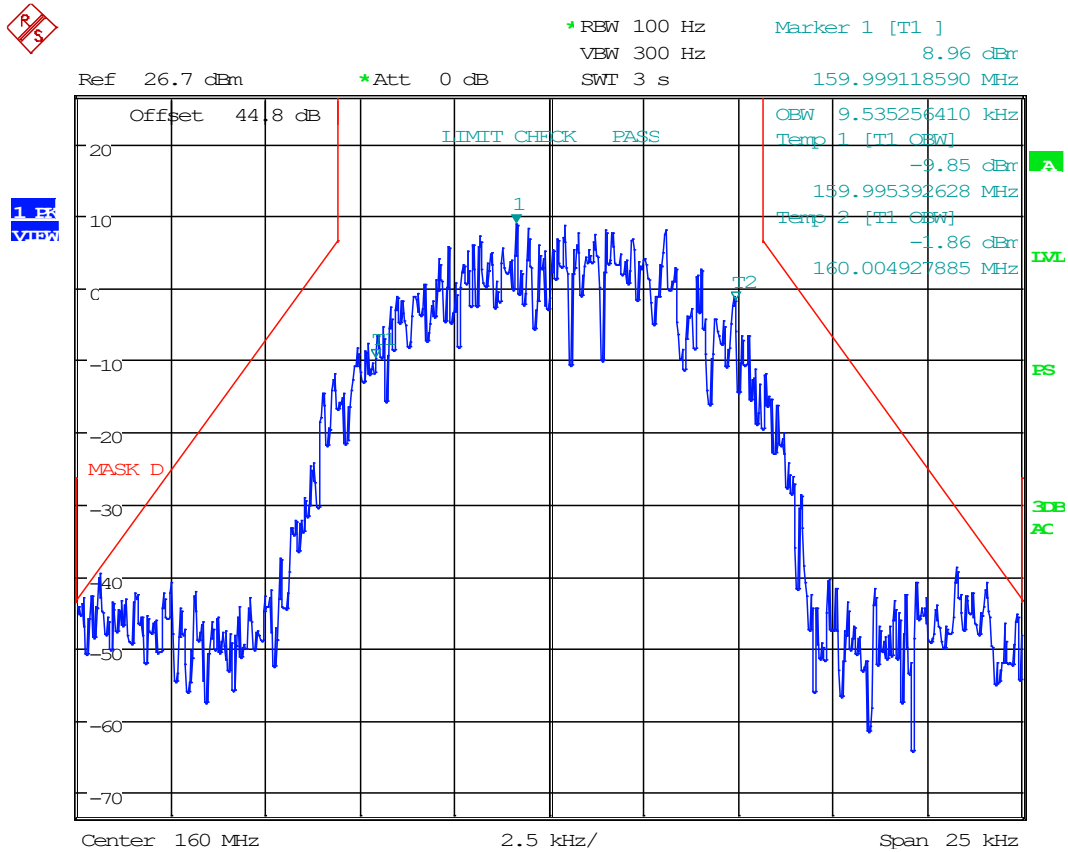
### 8.5.6 H-CPM, Uplink, AGC +3dB



Date: 8.JAN.2003 03:35:28



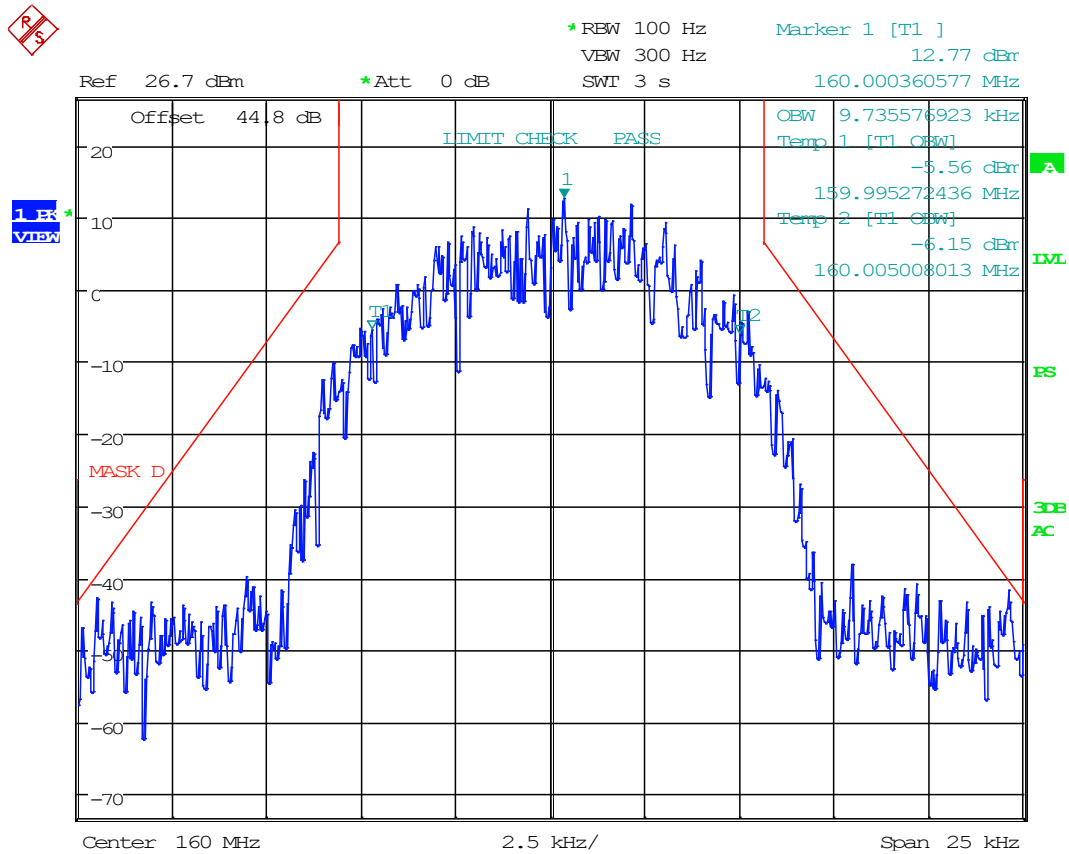
## 8.5.7 H-DQPSK, Uplink, AGC



Date: 8.JAN.2003 03:33:22



## 8.5.8 H-DQPSK, Uplink, AGC +3dB

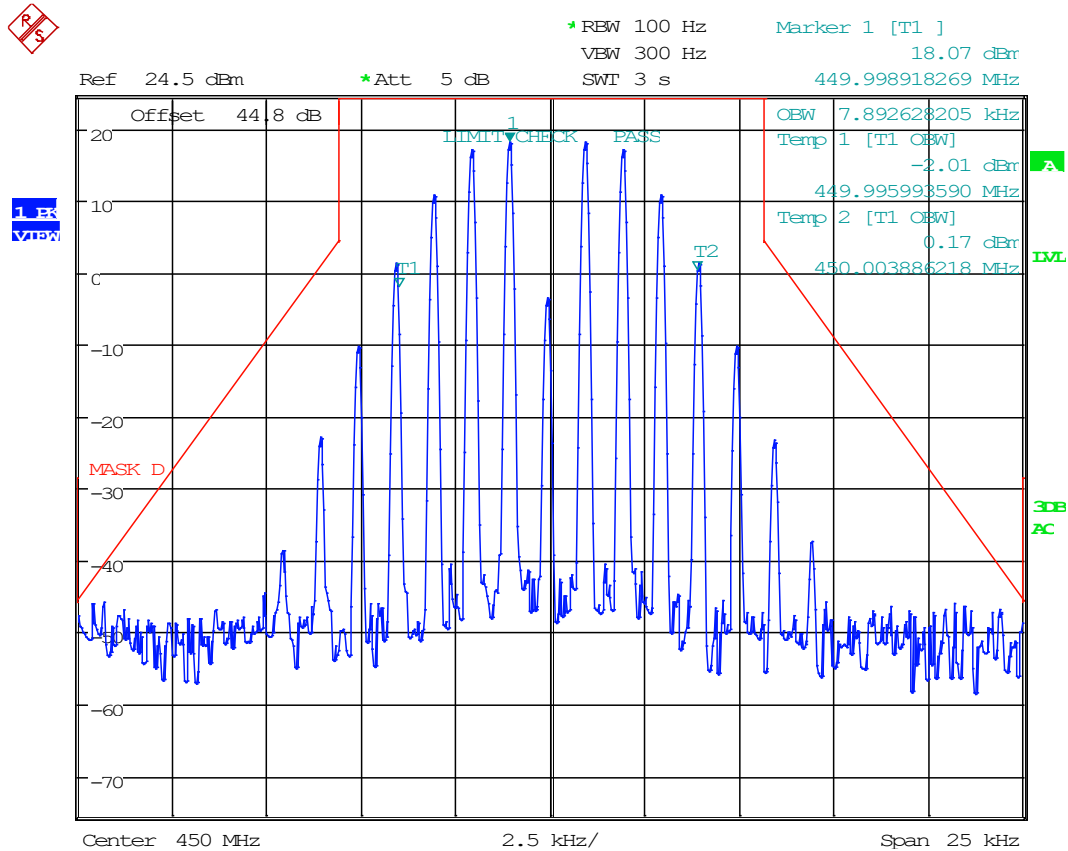


Date: 8.JAN.2003 03:34:59



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

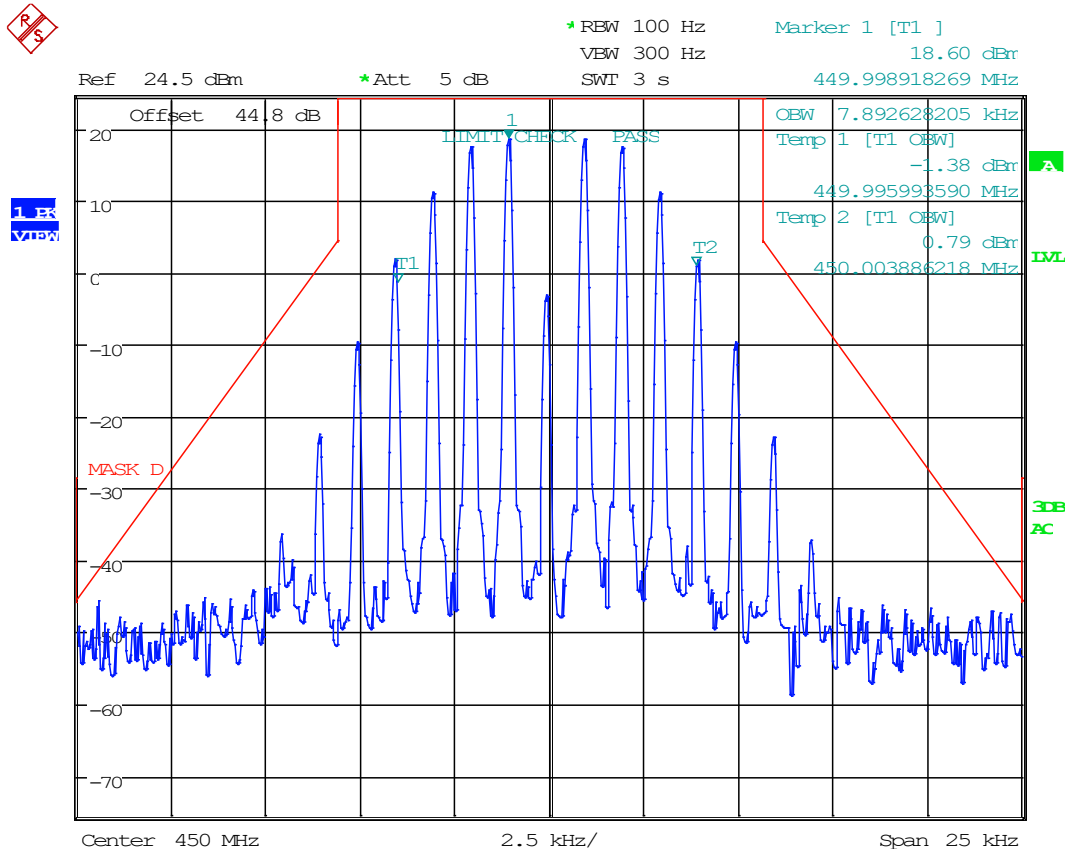
### 8.5.9 12.5 kHz FM, Uplink, AGC



Date: 8.JAN.2003 03:19:28



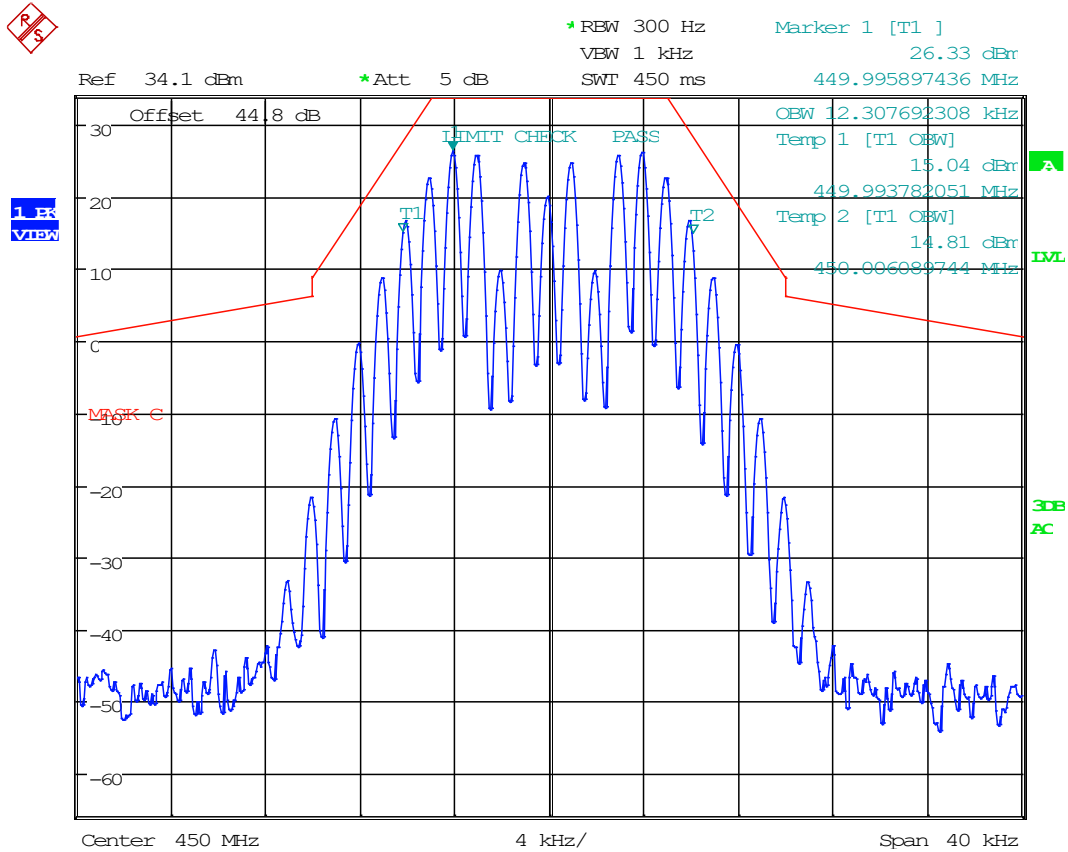
### 8.5.10 12.5 kHz FM, Uplink, AGC +3dB



Date: 8.JAN.2003 03:19:56

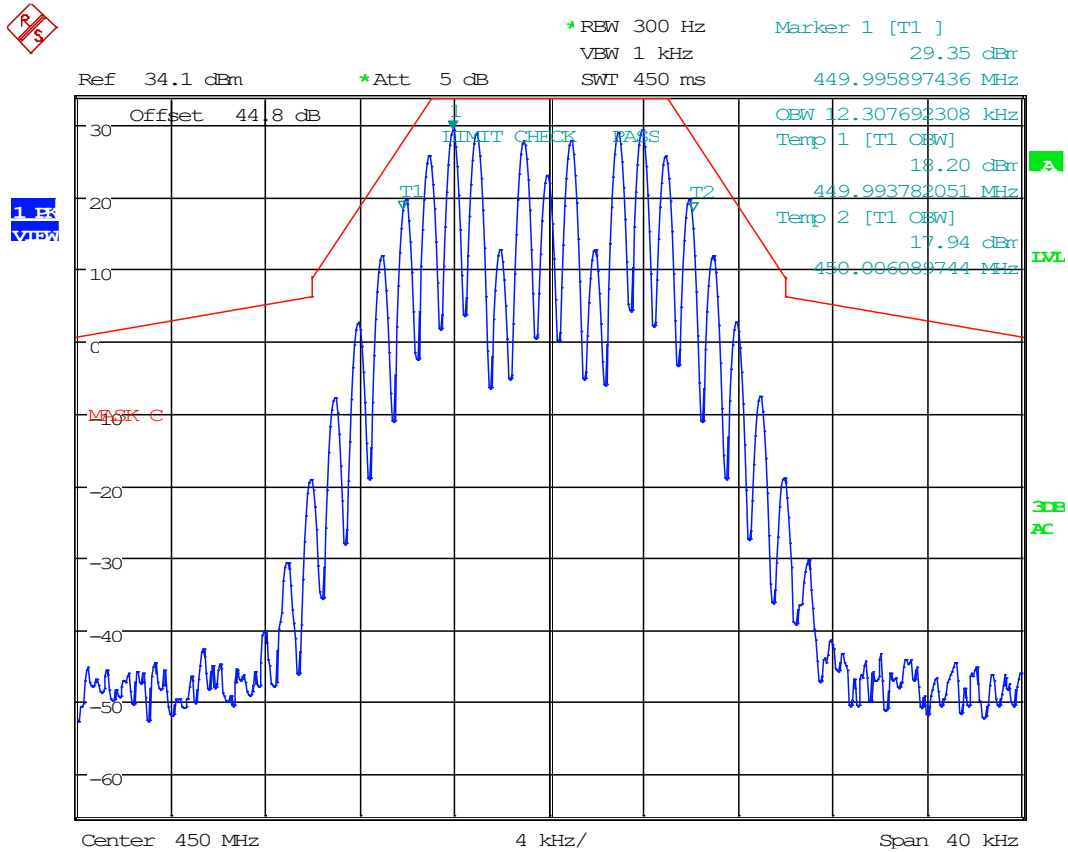


### 8.5.11 25 kHz FM, Uplink, AGC



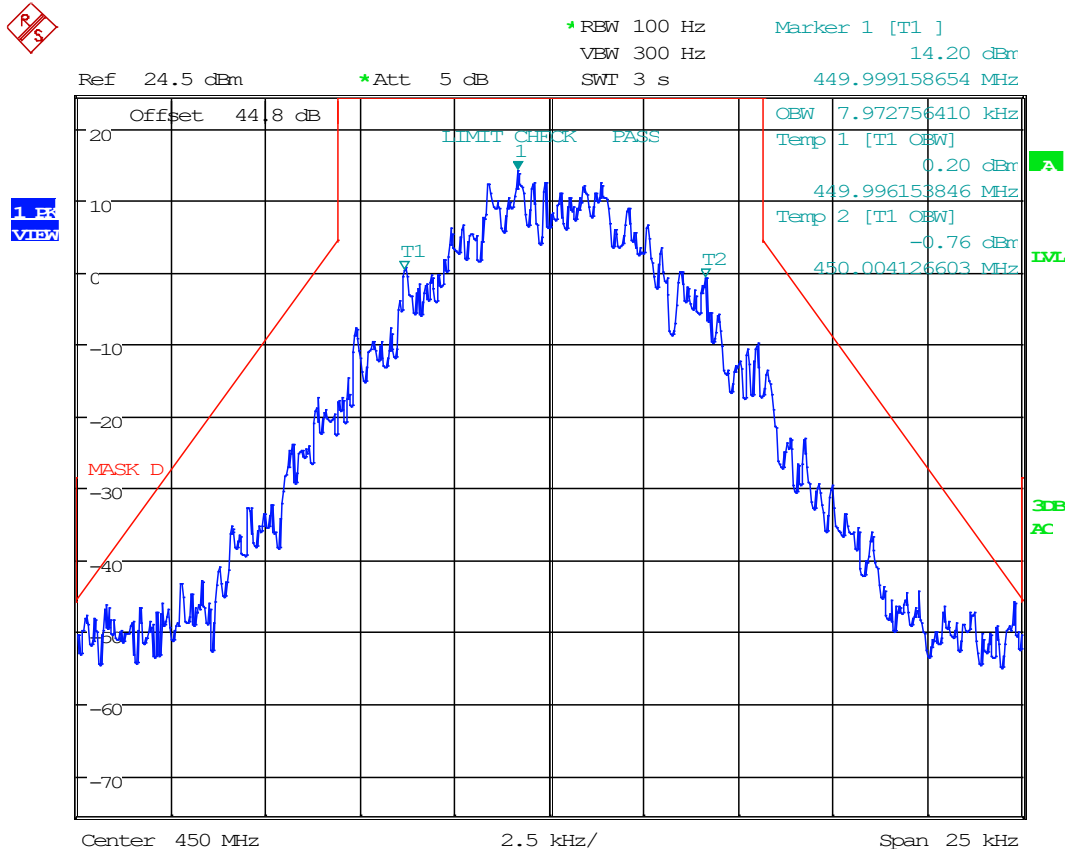
Date: 11.JAN.2003 01:30:49

## 8.5.12 25 kHz FM, Uplink, AGC +3dB



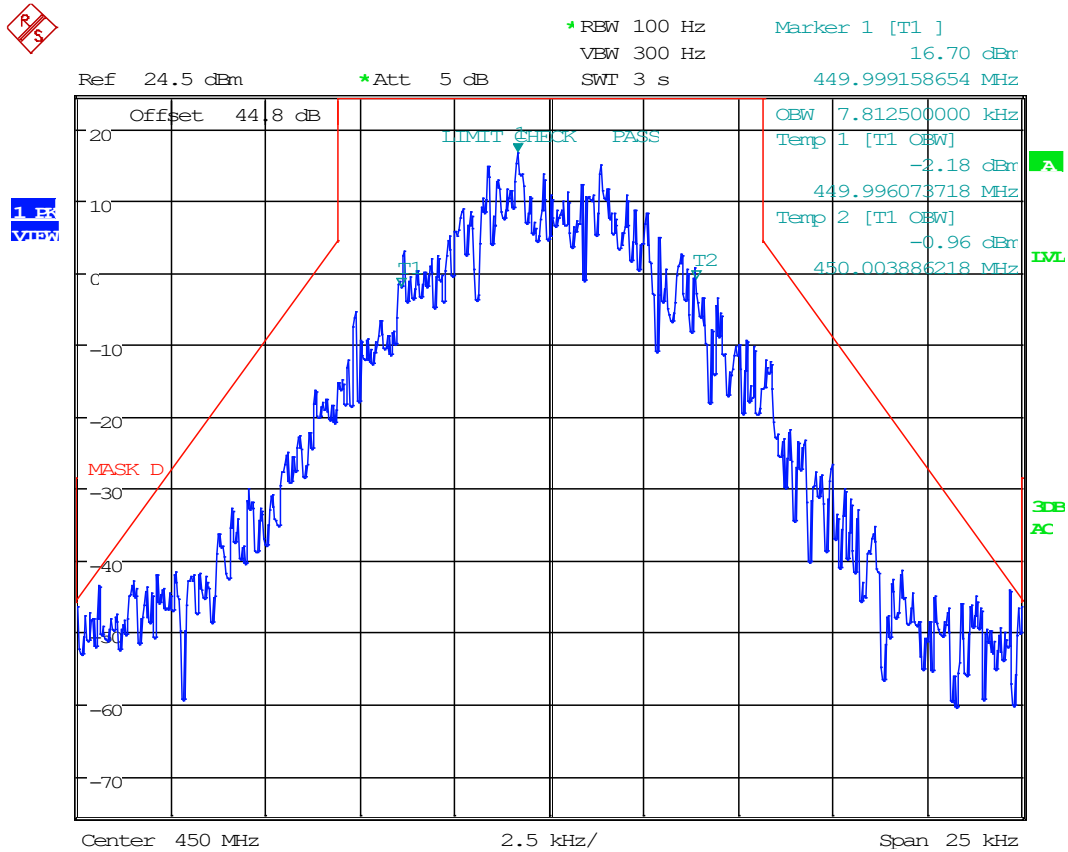
Date: 11.JAN.2003 01:31:12

### 8.5.13 C4FM, Uplink, AGC



Date: 8.JAN.2003 03:18:15

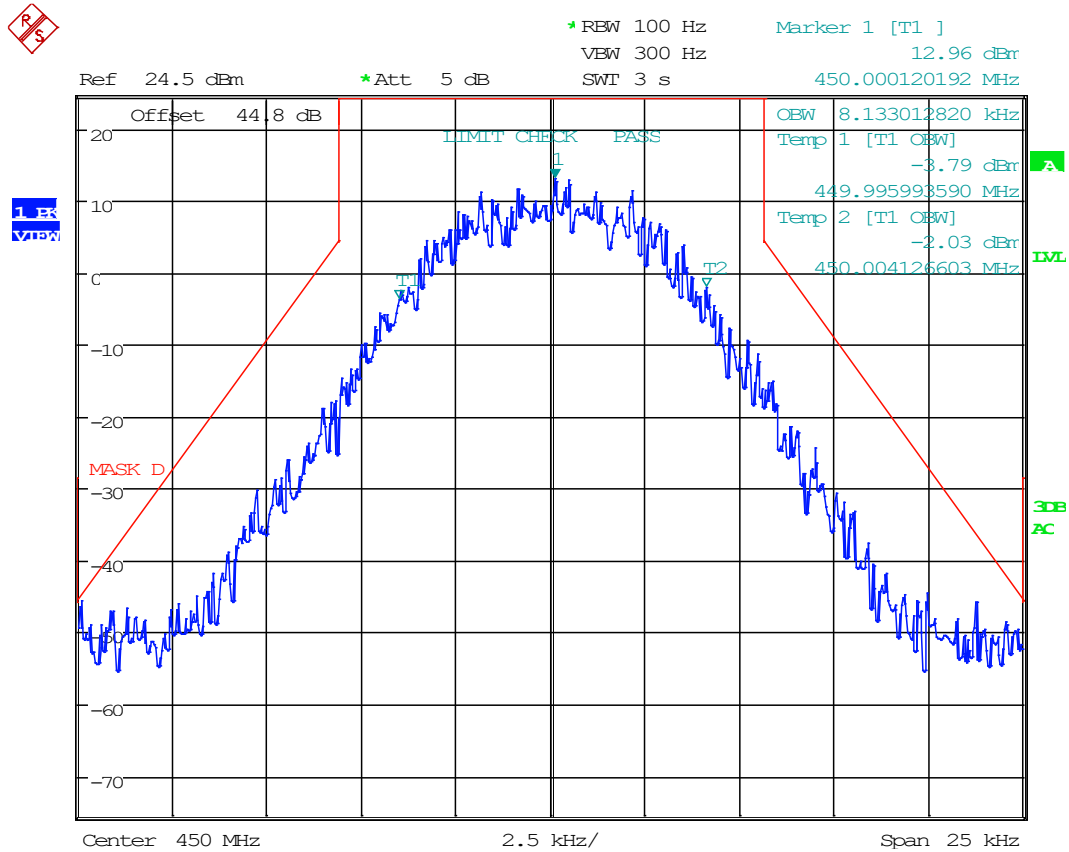
### 8.5.14 C4FM, Uplink, AGC +3dB



Date: 8.JAN.2003 03:18:54

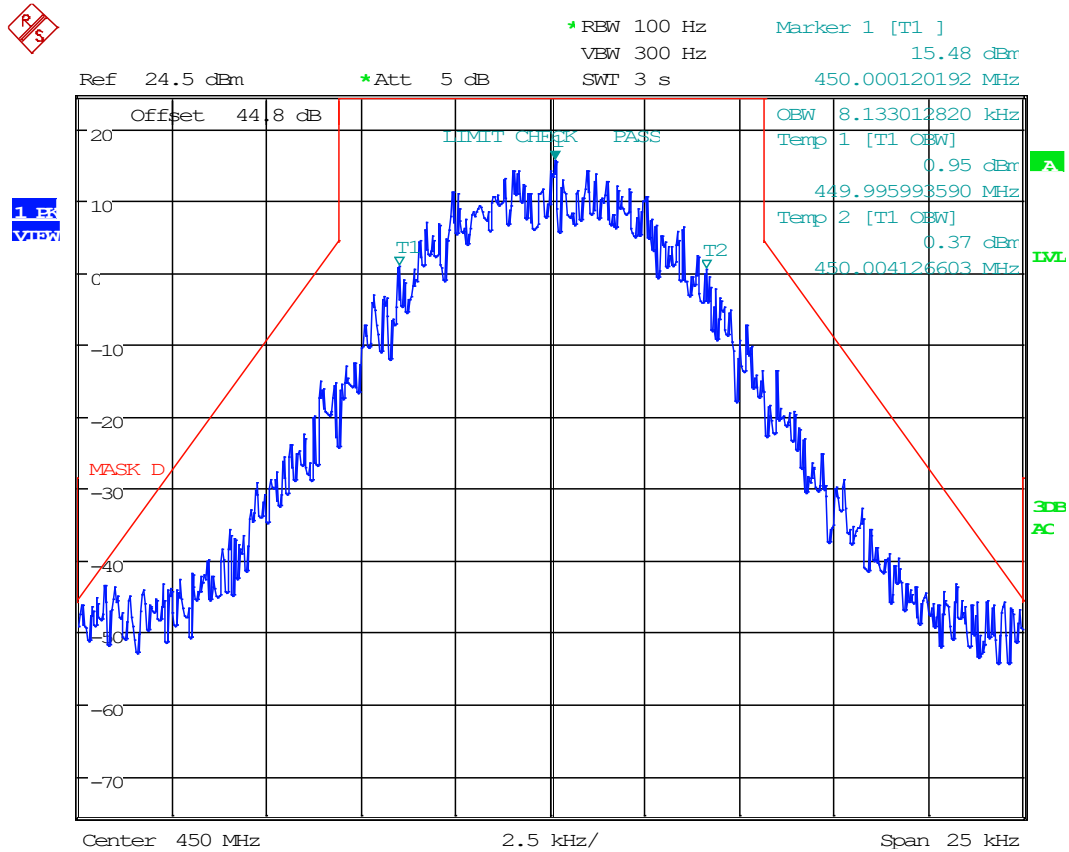


### 8.5.15 H-CPM, Uplink, AGC



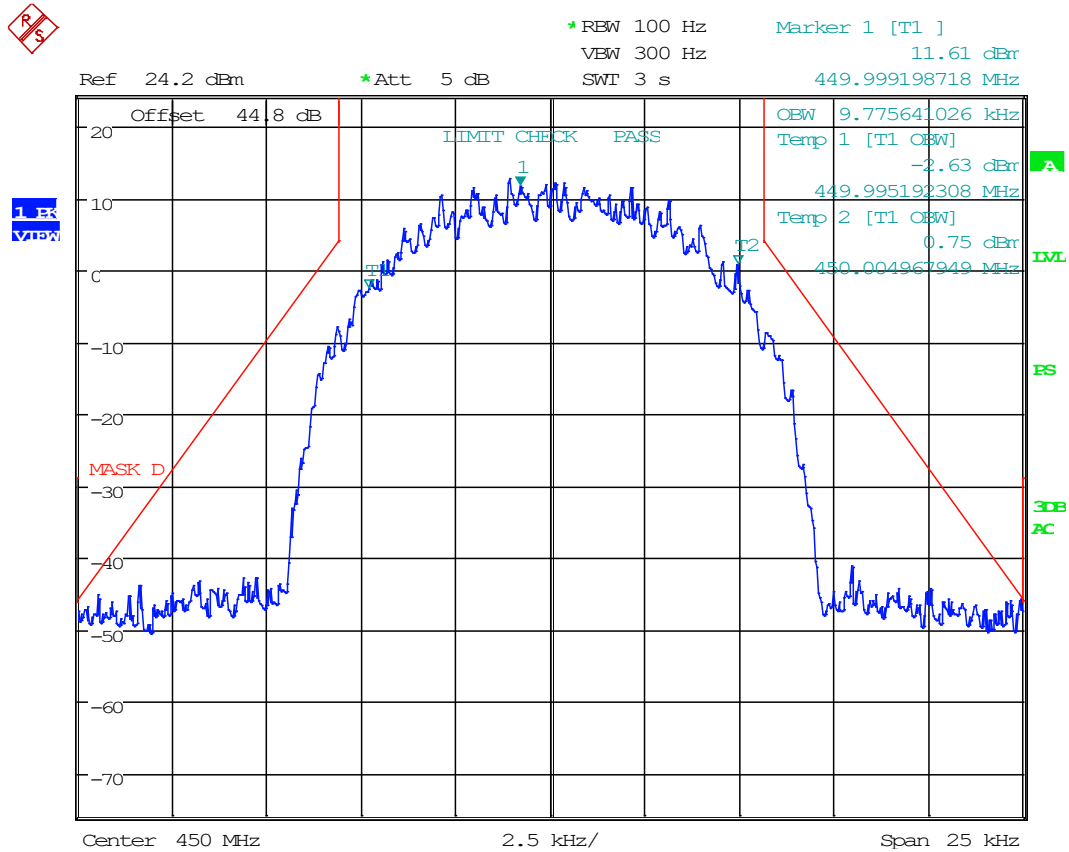
Date: 8.JAN.2003 03:16:34

### 8.5.16 H-CPM, Uplink, AGC +3dB



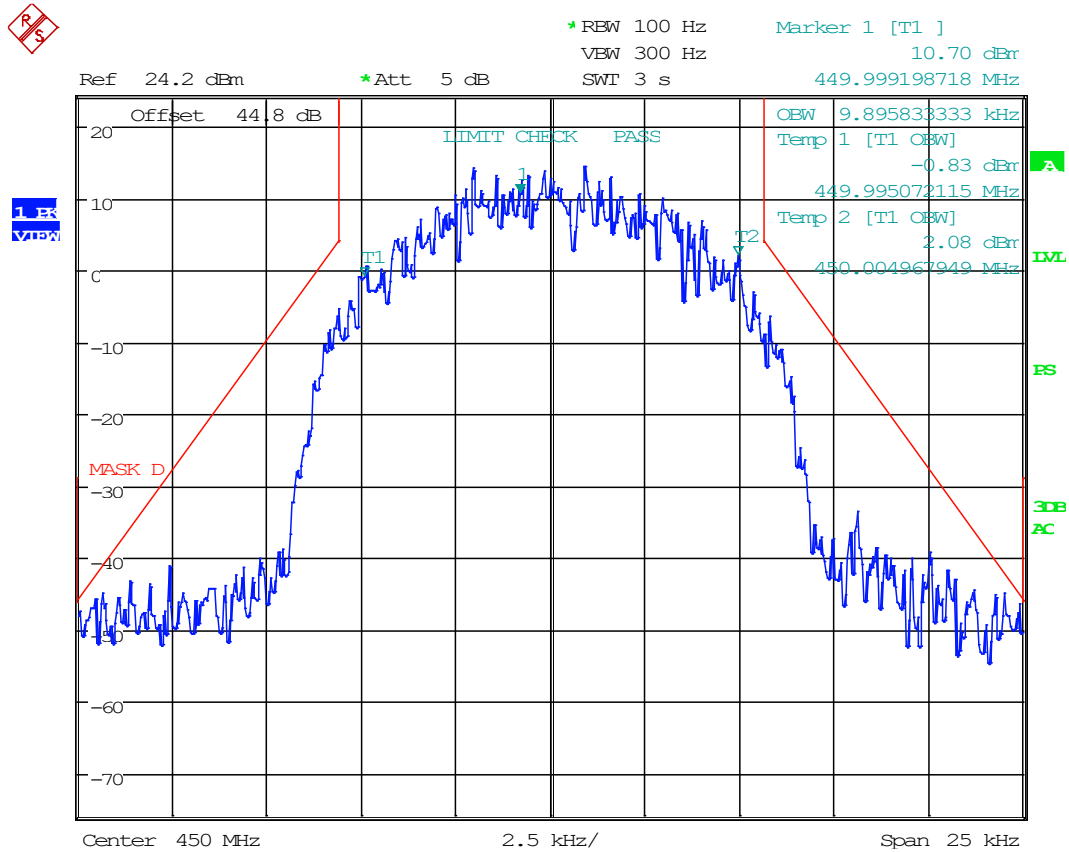
Date: 8.JAN.2003 03:15:59

### 8.5.17 H-DQPSK, Uplink, AGC



Date: 8.JAN.2003 03:14:11

### 8.5.18 H-DQPSK, Uplink, AGC +3dB



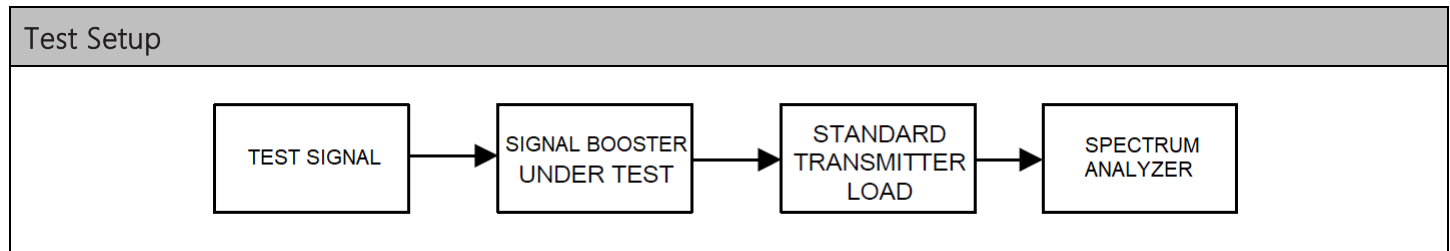
Date: 8.JAN.2003 03:14:53



## 8.6 Noise Figure

*Referenced from test report "TR-2117-21\_FCC\_UL\_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 (dB) | Limit  |
| 150-174 MHz  | Uplink         | 8.17              | < 9 dB |
| 450-512 MHz  | Uplink         | 6.69              | < 9 dB |

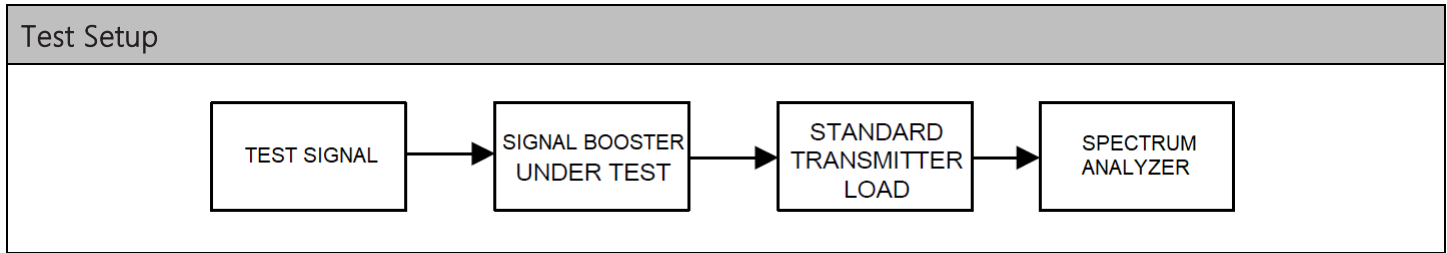


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## 8.7 Out-of-Band/Out-of-Block Emissions (Intermodulation Products)

*Referenced from test report "TR\_2117-21\_FCC\_UL\_PT90\_Booster Class B\_".*

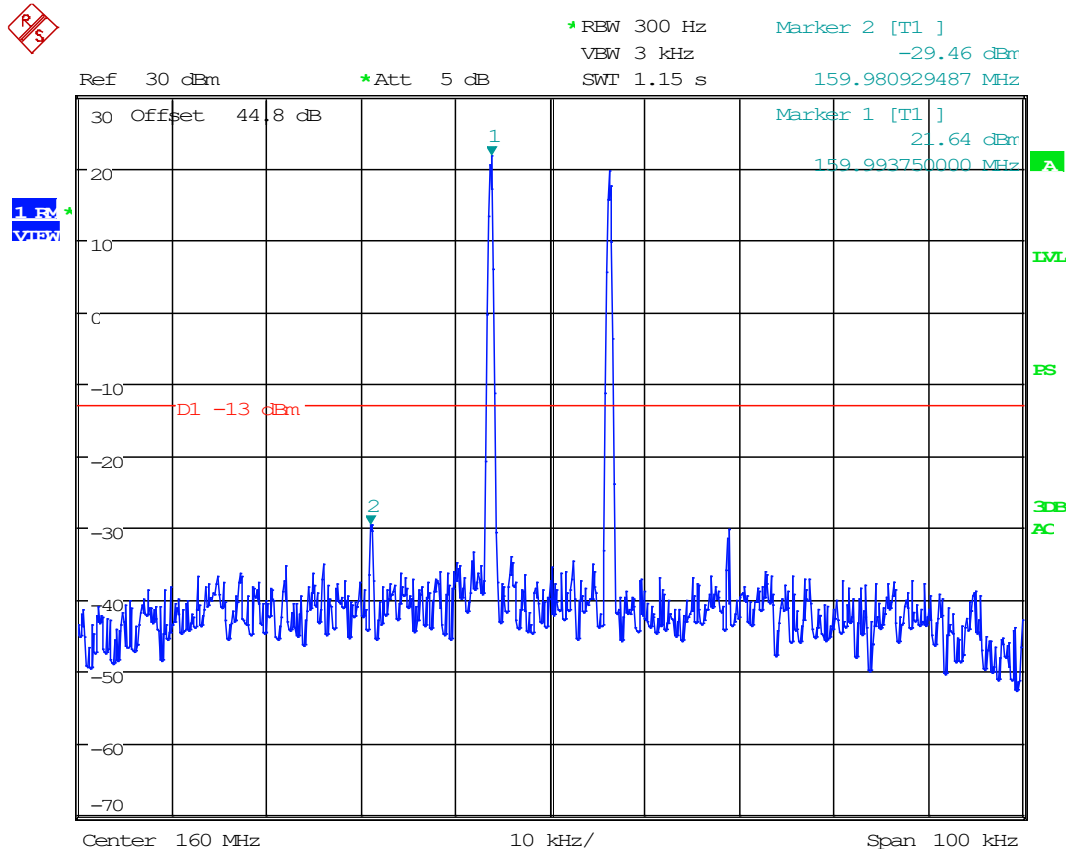
Limits from FCC Parts 2.1051, 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





## Intermodulation Products Spectrum Plots, VHF Band

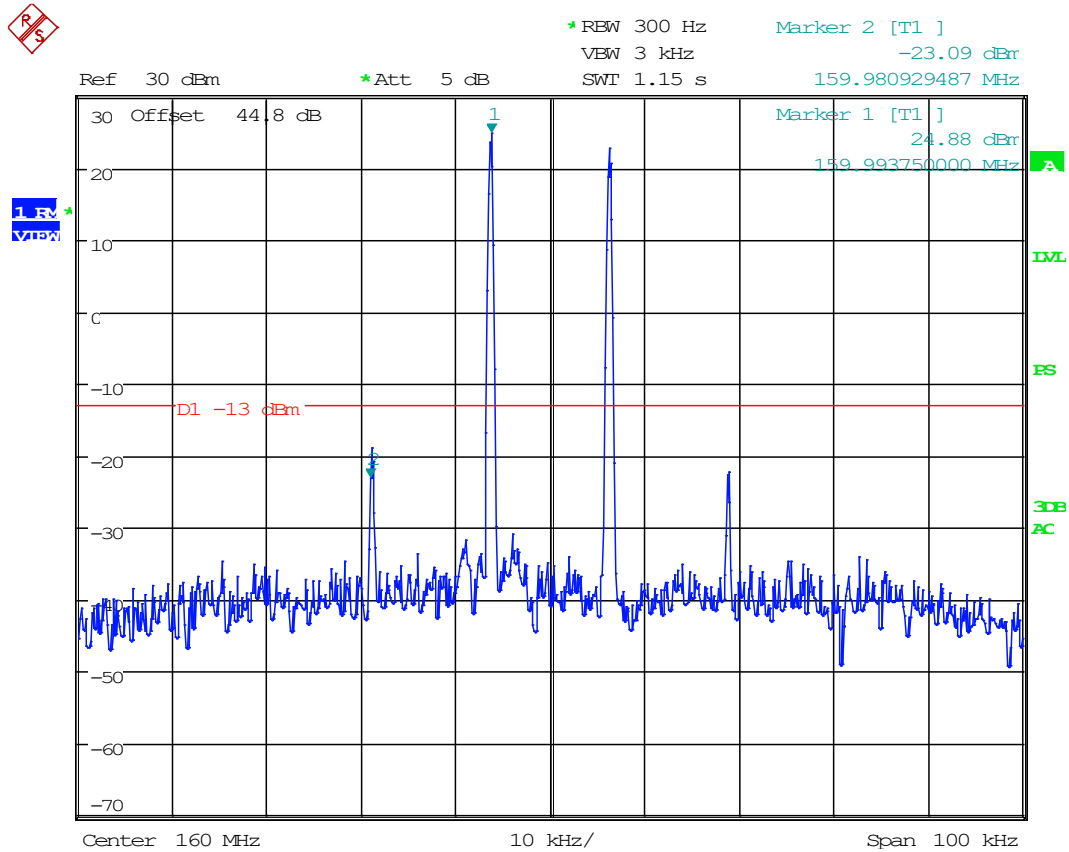
### 8.7.1 12.5 kHz Signal, Uplink, AGC



Date: 11.JAN.2003 01:19:09



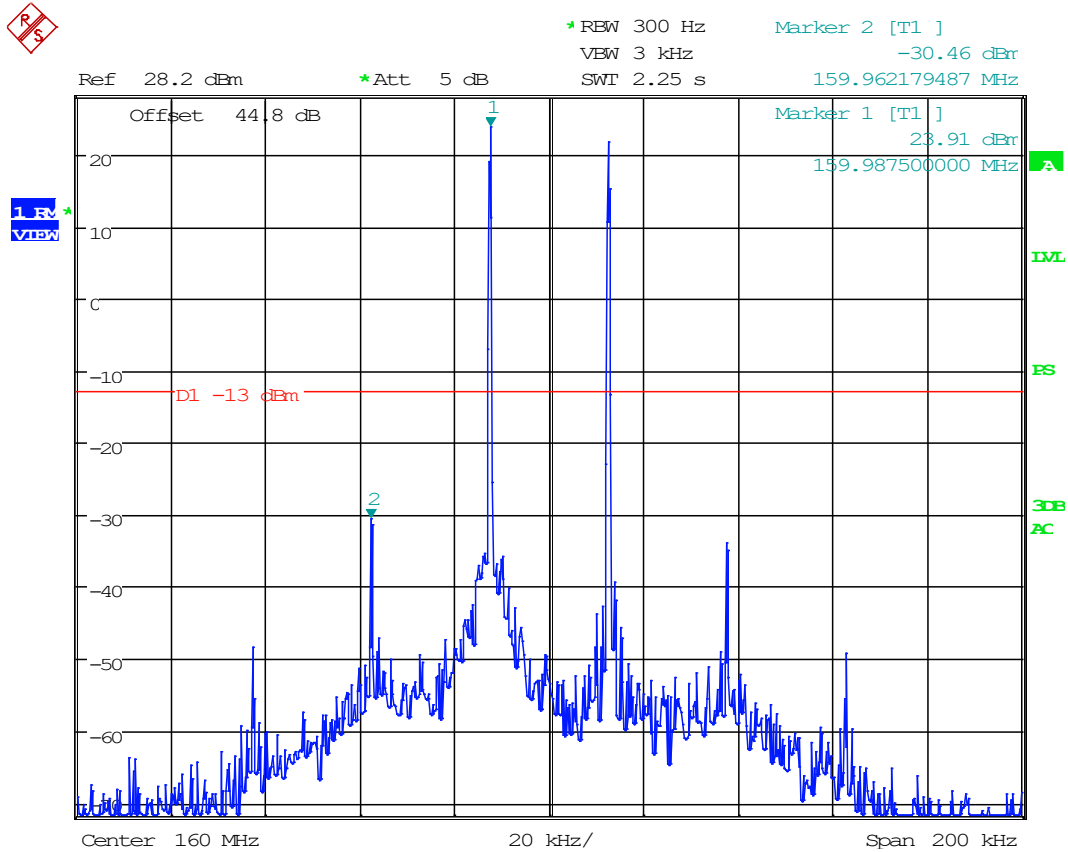
## 8.7.2 12.5 kHz Signal, Uplink, AGC +3dB



Date: 11.JAN.2003 01:20:18

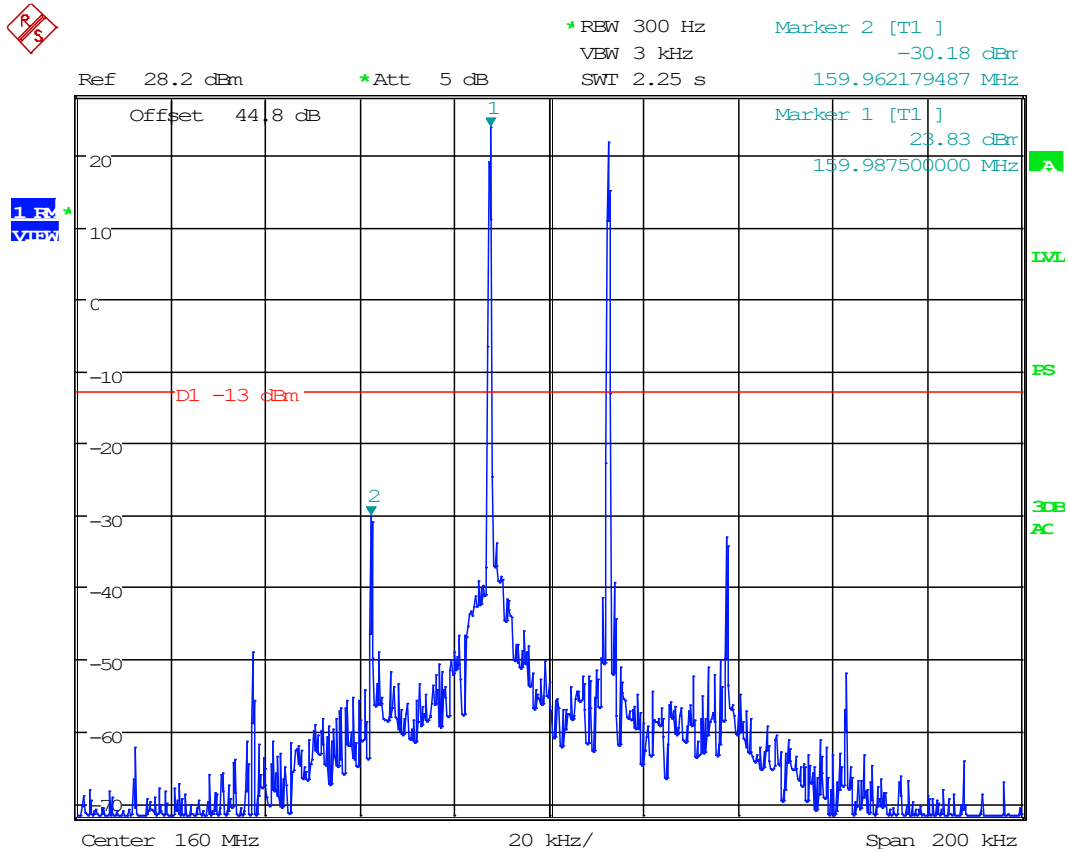


### 8.7.3 25 kHz Signal, Uplink, AGC



Date: 8.JAN.2003 06:05:36

#### 8.7.4 25 kHz Signal, Uplink, AGC +3dB

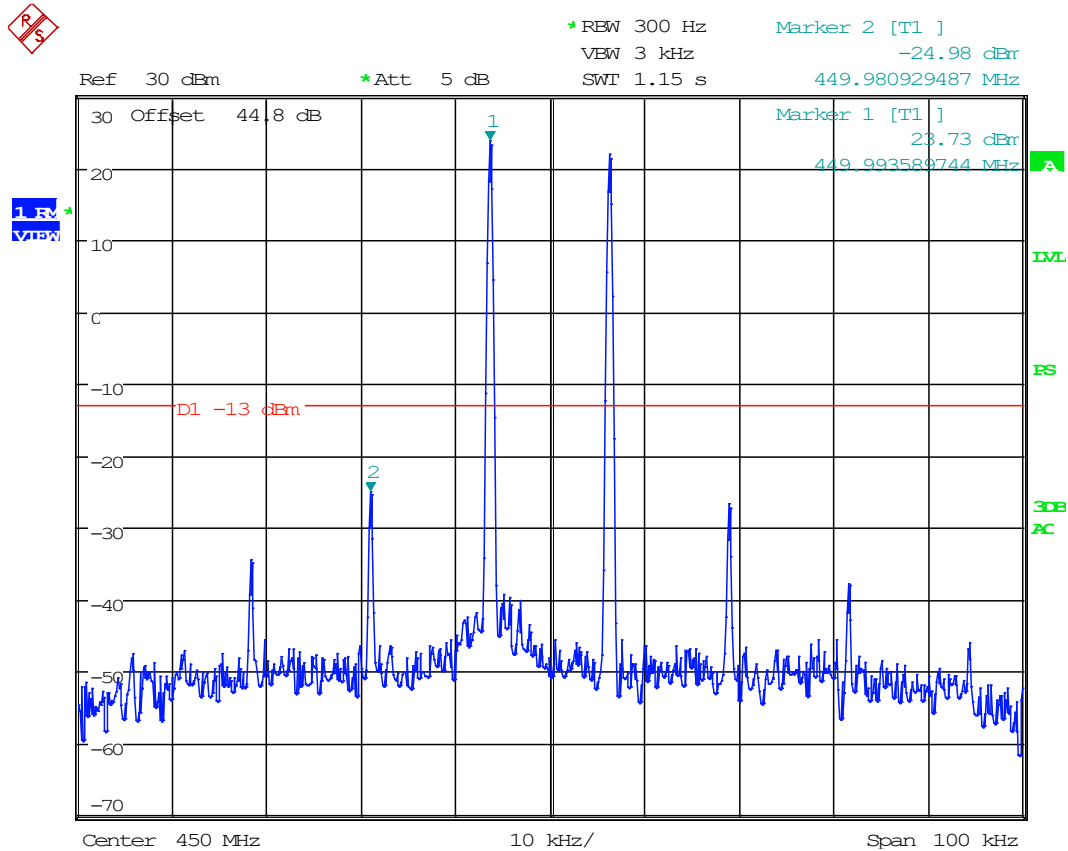


Date: 8.JAN.2003 06:06:05



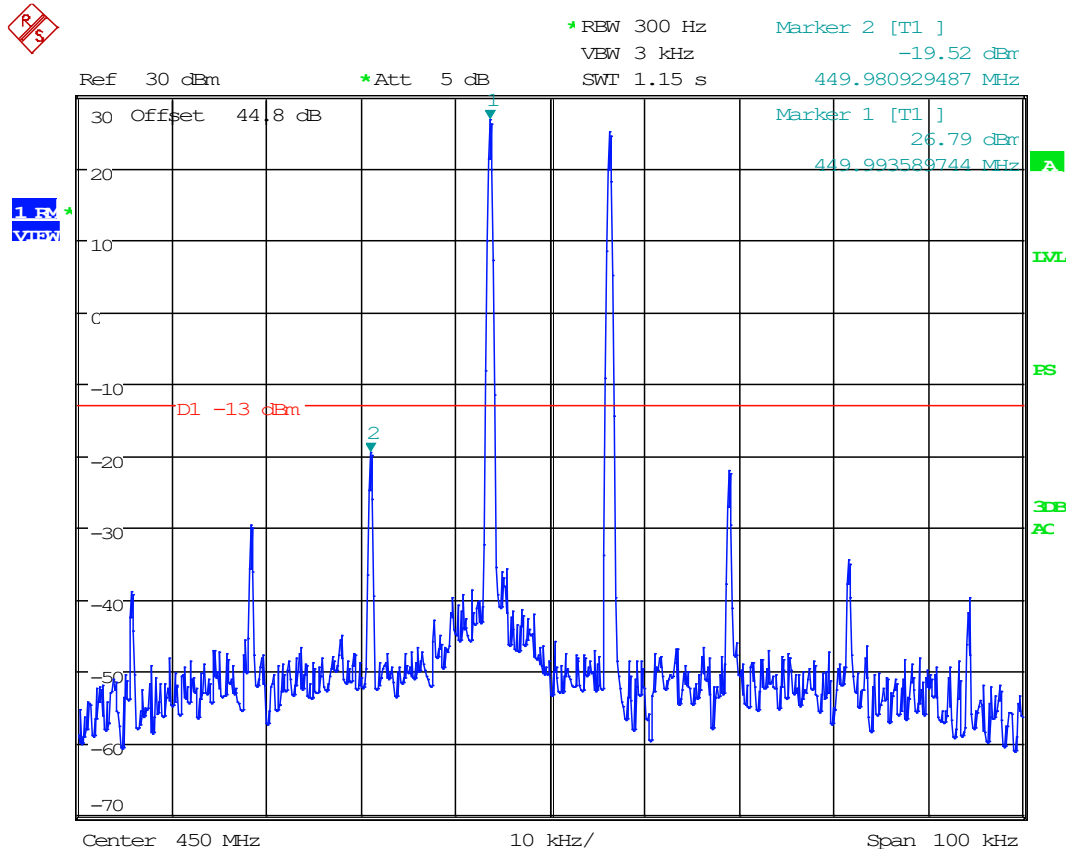
## Intermodulation Products Spectrum Plots, UHF Band

### 8.7.5 12.5 kHz Signal, Uplink, AGC



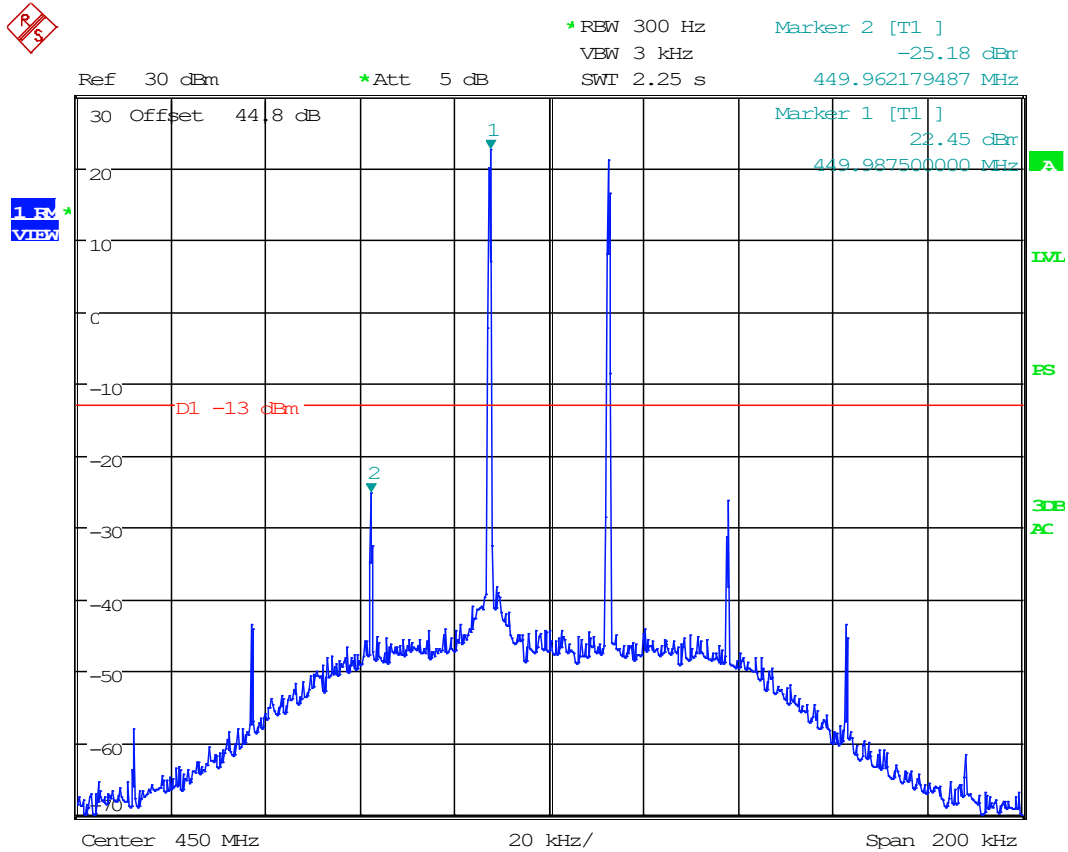
Date: 11.JAN.2003 01:07:35

### 8.7.6 12.5 kHz Signal, Uplink, AGC +3dB



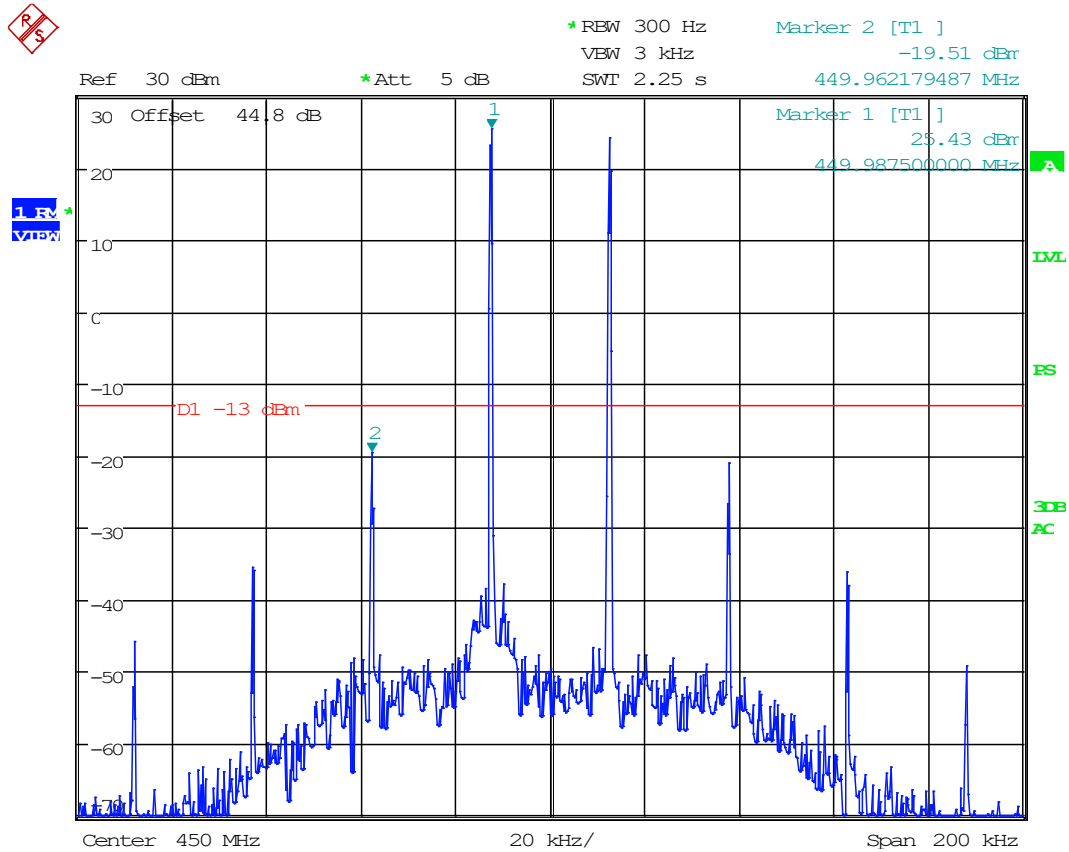
Date: 11.JAN.2003 01:08:33

### 8.7.7 25 kHz Signal, Uplink, AGC



Date: 11.JAN.2003 01:15:28

### 8.7.8 25 kHz Signal, Uplink, AGC +3dB



Date: 11.JAN.2003 01:11:36

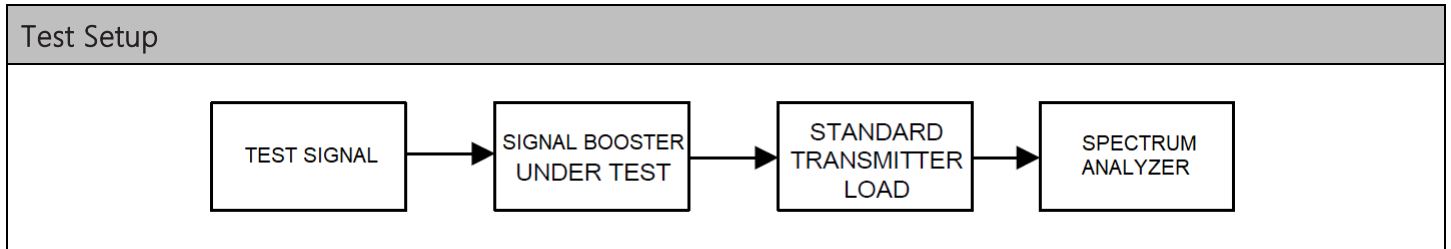


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## 8.8 Emission Mask, Out-of-Band

*Referenced from test report ""TR\_2117-21\_FCC\_UL\_PT90\_Booster Class B\_".*

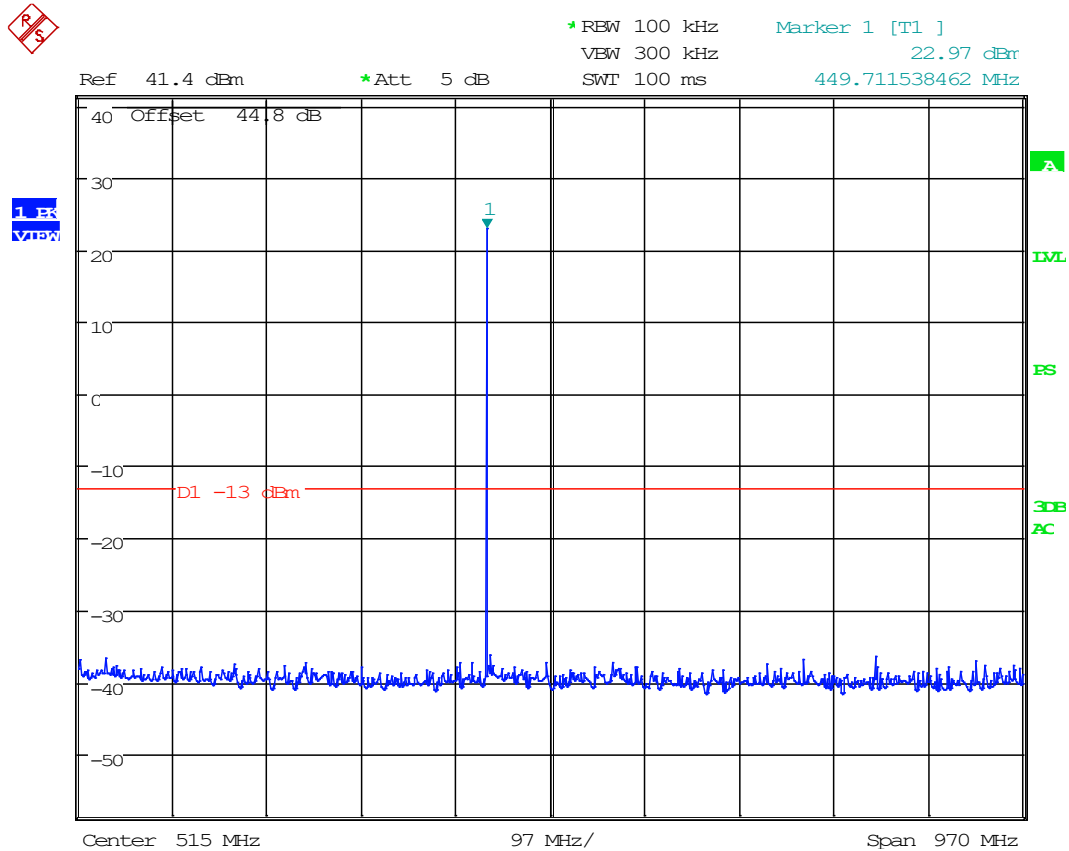
Limits from FCC Parts 2.1051, 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





## Conducted Emissions Spectrum Plots

### 8.8.1 30 MHz to 1 GHz, VHF Band Uplink

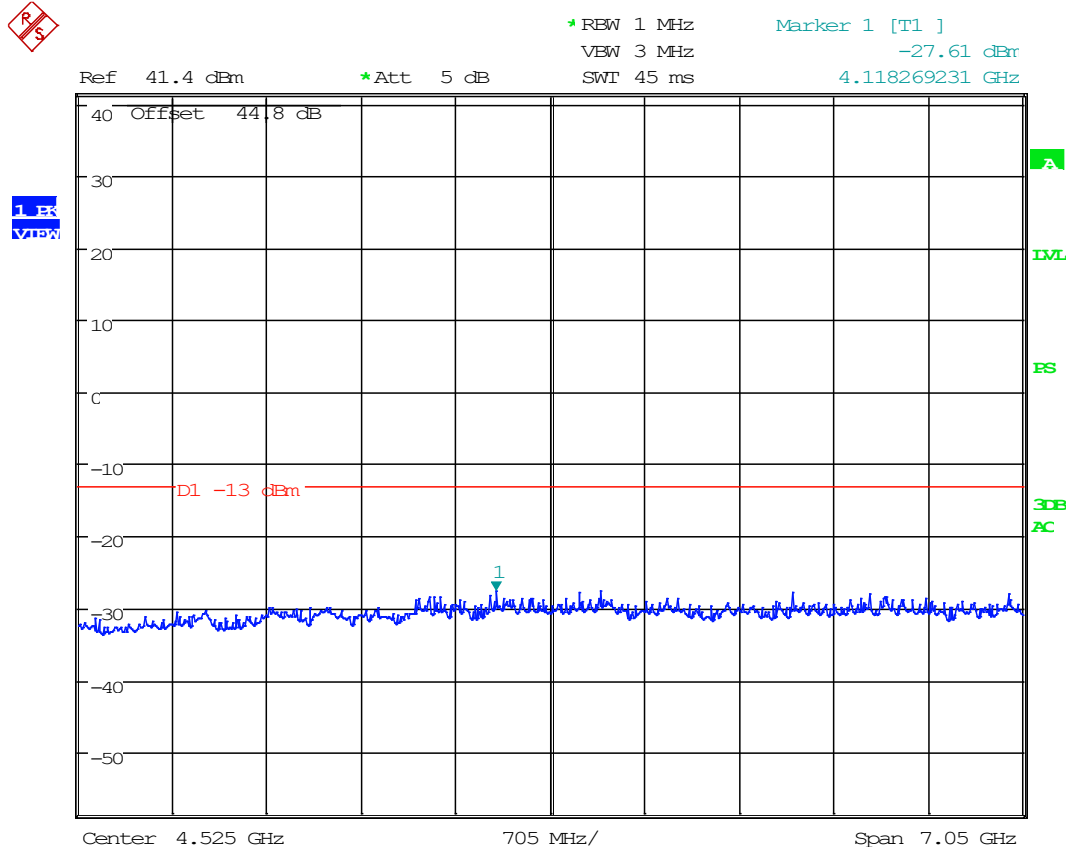


Date: 11.JAN.2003 00:25:24





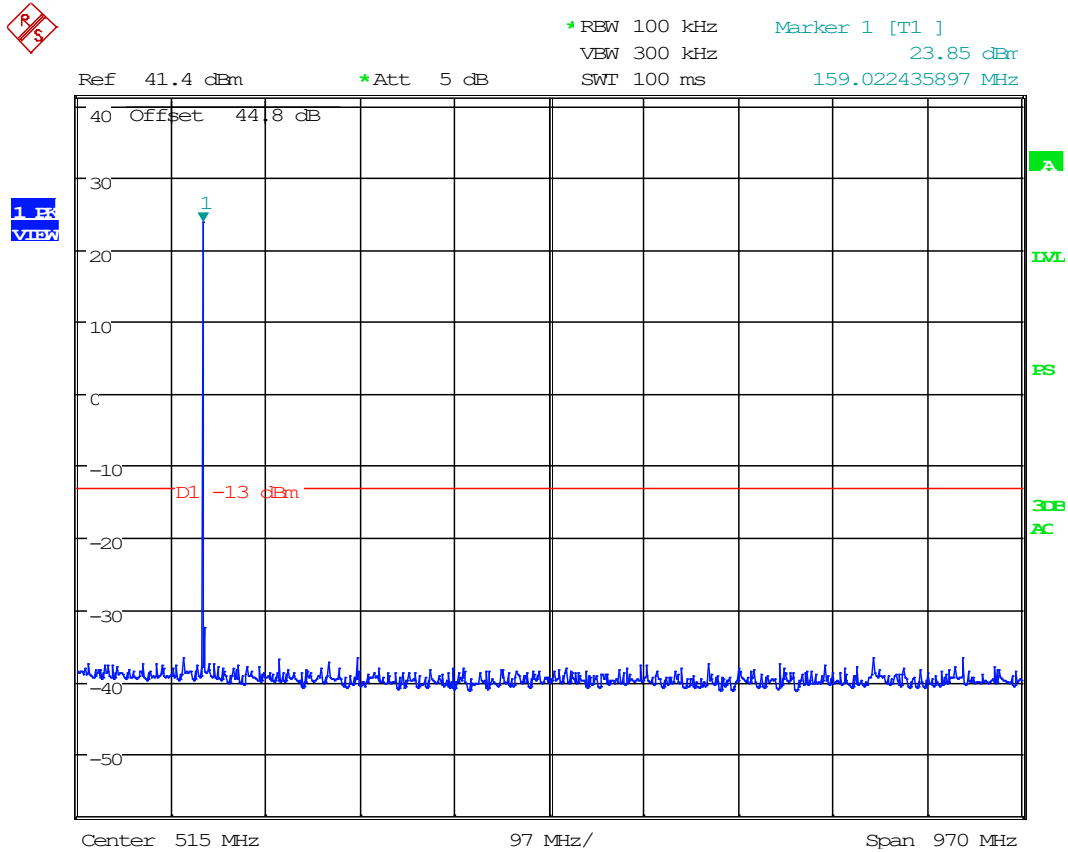
## 8.8.2 1 GHz to 10<sup>th</sup> Harmonic, VHF Band Uplink



Date: 11.JAN.2003 00:55:39



### 8.8.3 30 MHz to 1 GHz, UHF Band Uplink

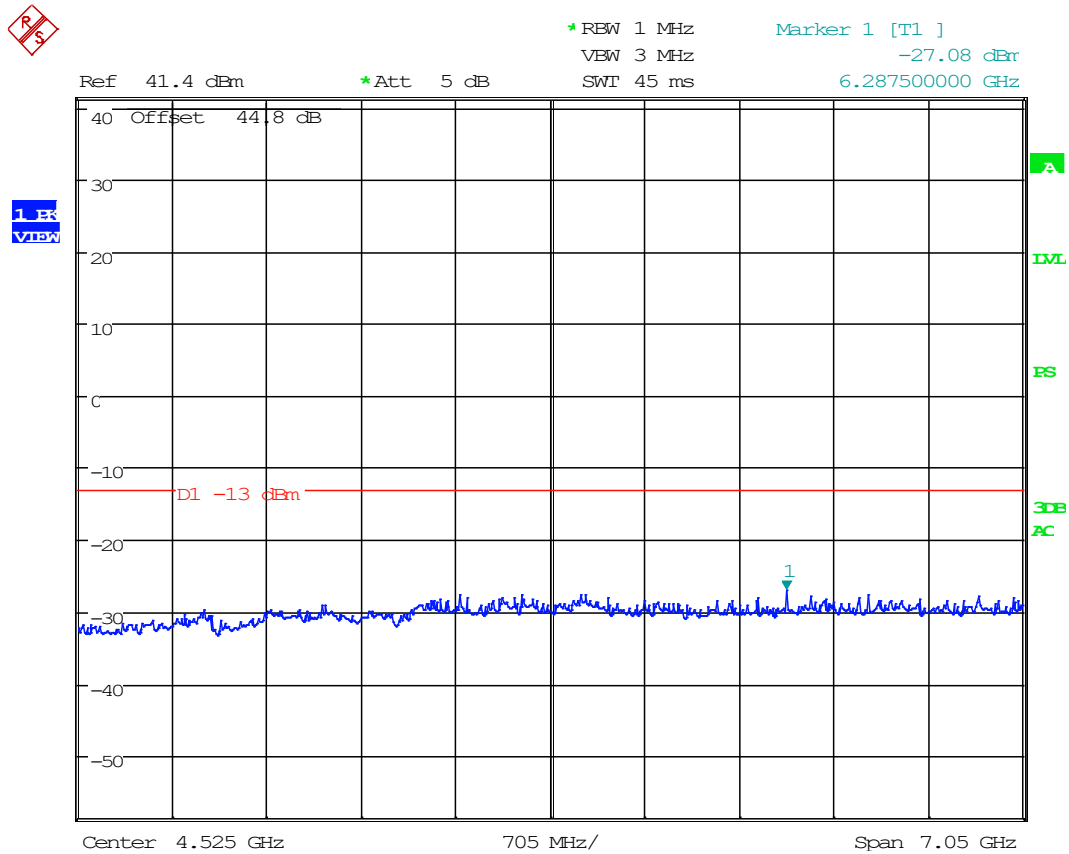


Date: 11.JAN.2003 00:26:44



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#### 8.8.4 1 GHz to 10<sup>th</sup> Harmonic, UHF Band Uplink

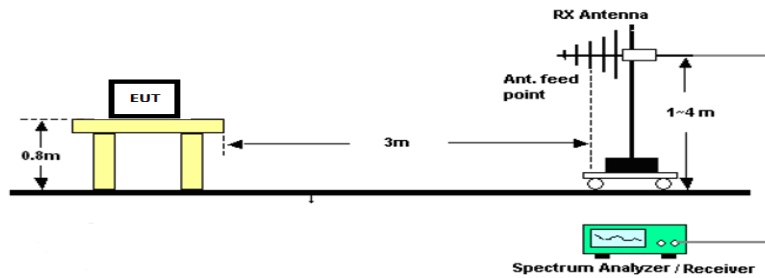


Date: 11.JAN.2003 00:56:46

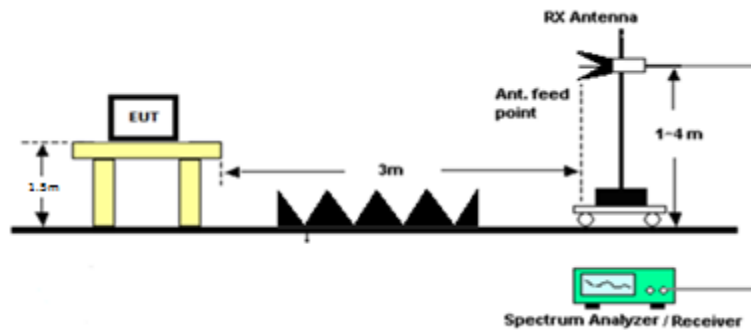
## 8.9 Spurious Radiated Emissions

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, VHF Band

### 8.9.1 VHF Uplink

| 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) |
|-----------------------|--------------------------|----------|----------------------|------------------|----------------|----------------------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 160.00                | 320.00                   | PK       | 2.83                 | H                | 2.09           | 13.90                            | 3.00         | 18.82                   | -78.56    | -13.00               | 65.56       |
| 160.00                | 320.00                   | PK       | -0.70                | V                | 2.09           | 13.90                            | 3.00         | 15.29                   | -82.09    | -13.00               | 69.09       |
| 160.00                | 480.00                   | PK       | 1.98                 | H                | 2.59           | 16.90                            | 3.00         | 21.47                   | -75.91    | -13.00               | 62.91       |
| 160.00                | 480.00                   | PK       | 2.18                 | V                | 2.59           | 16.90                            | 3.00         | 21.67                   | -75.71    | -13.00               | 62.71       |
| 160.00                | 640.00                   | PK       | -0.30                | H                | 2.96           | 19.50                            | 3.00         | 22.16                   | -75.22    | -13.00               | 62.22       |
| 160.00                | 640.00                   | PK       | 0.25                 | V                | 2.96           | 19.50                            | 3.00         | 22.71                   | -74.67    | -13.00               | 61.67       |
| 160.00                | 800.00                   | PK       | 1.14                 | H                | 3.34           | 20.30                            | 3.00         | 24.78                   | -72.60    | -13.00               | 59.60       |
| 160.00                | 800.00                   | PK       | -0.96                | V                | 3.34           | 20.30                            | 3.00         | 22.68                   | -74.70    | -13.00               | 61.70       |
| 160.00                | 960.00                   | PK       | -1.88                | H                | 3.64           | 23.20                            | 3.00         | 24.96                   | -72.42    | -13.00               | 59.42       |
| 160.00                | 960.00                   | PK       | -0.38                | V                | 3.64           | 23.20                            | 3.00         | 26.46                   | -70.92    | -13.00               | 57.92       |
| 160.00                | 1120.00                  | PK       | 21.47                | H                | 3.87           | 27.24                            | 3.00         | 52.58                   | -44.80    | -13.00               | 31.80       |
| 160.00                | 1120.00                  | PK       | 21.28                | V                | 3.87           | 27.24                            | 3.00         | 52.39                   | -44.99    | -13.00               | 31.99       |
| 160.00                | 1280.00                  | PK       | 22.04                | H                | 4.13           | 28.57                            | 3.00         | 54.75                   | -42.63    | -13.00               | 29.63       |
| 160.00                | 1280.00                  | PK       | 21.63                | V                | 4.13           | 28.57                            | 3.00         | 54.34                   | -43.04    | -13.00               | 30.04       |
| 160.00                | 1440.00                  | PK       | 20.89                | H                | 4.33           | 28.16                            | 3.00         | 53.38                   | -44.00    | -13.00               | 31.00       |
| 160.00                | 1440.00                  | PK       | 21.47                | V                | 4.33           | 28.16                            | 3.00         | 53.96                   | -43.42    | -13.00               | 30.42       |
| 160.00                | 1600.00                  | PK       | 20.94                | H                | 4.65           | 28.07                            | 3.00         | 53.67                   | -43.71    | -13.00               | 30.71       |
| 160.00                | 1600.00                  | PK       | 20.91                | V                | 4.65           | 28.07                            | 3.00         | 53.64                   | -43.74    | -13.00               | 30.74       |

## Radiated Emissions, Tabular Data, UHF Band

### 8.9.2 UHF Uplink

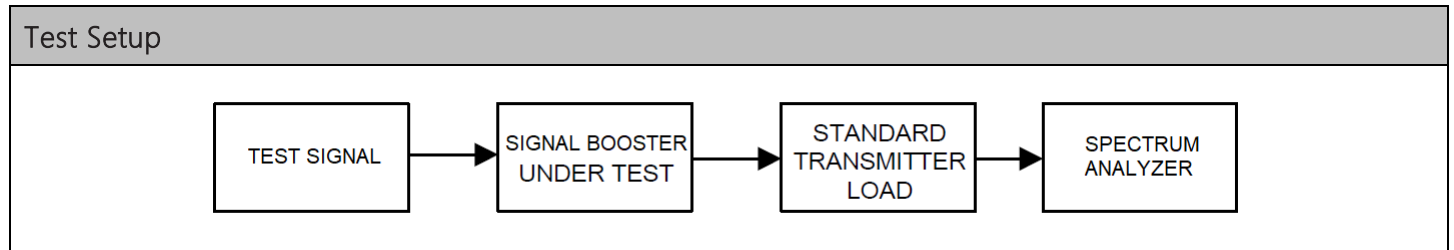
| Tuned Frequency (MHz) | Emission Frequency (MHz) | Detector | Meter Reading (dBuV) | Antenna Polarity | Coax Loss (dB) | Antenna Correction Factor (dB/m) | Distance (m) | Field Strength (dBuV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|-----------------------|--------------------------|----------|----------------------|------------------|----------------|----------------------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 450.00                | 900.00                   | PK       | 0.81                 | H                | 3.54           | 21.70                            | 3.00         | 26.05                   | -71.33    | -13.00               | 58.33       |
| 450.00                | 900.00                   | PK       | 2.00                 | V                | 3.54           | 21.70                            | 3.00         | 27.24                   | -70.14    | -13.00               | 57.14       |
| 450.00                | 1350.00                  | PK       | 11.89                | H                | 4.26           | 28.76                            | 3.00         | 44.91                   | -52.47    | -13.00               | 39.47       |
| 450.00                | 1350.00                  | PK       | 11.18                | V                | 4.26           | 28.76                            | 3.00         | 44.20                   | -53.18    | -13.00               | 40.18       |
| 450.00                | 1800.00                  | PK       | 10.55                | H                | 4.90           | 30.29                            | 3.00         | 45.74                   | -51.64    | -13.00               | 38.64       |
| 450.00                | 1800.00                  | PK       | 12.10                | V                | 4.90           | 30.29                            | 3.00         | 47.29                   | -50.09    | -13.00               | 37.09       |
| 450.00                | 2250.00                  | PK       | 11.65                | H                | 5.43           | 31.23                            | 3.00         | 48.31                   | -49.07    | -13.00               | 36.07       |
| 450.00                | 2250.00                  | PK       | 12.24                | V                | 5.43           | 31.23                            | 3.00         | 48.90                   | -48.48    | -13.00               | 35.48       |
| 450.00                | 2700.00                  | PK       | 13.04                | H                | 5.98           | 32.51                            | 3.00         | 51.52                   | -45.85    | -13.00               | 32.85       |
| 450.00                | 2700.00                  | PK       | 12.36                | V                | 5.98           | 32.51                            | 3.00         | 50.84                   | -46.53    | -13.00               | 33.53       |
| 450.00                | 3150.00                  | PK       | 12.77                | H                | 6.53           | 32.78                            | 3.00         | 52.07                   | -45.31    | -13.00               | 32.31       |
| 450.00                | 3150.00                  | PK       | 13.03                | V                | 6.53           | 32.78                            | 3.00         | 52.33                   | -45.05    | -13.00               | 32.05       |
| 450.00                | 3600.00                  | PK       | 12.75                | H                | 6.67           | 33.11                            | 3.00         | 52.52                   | -44.85    | -13.00               | 31.85       |
| 450.00                | 3600.00                  | PK       | 13.77                | V                | 6.67           | 33.11                            | 3.00         | 53.54                   | -43.83    | -13.00               | 30.83       |
| 450.00                | 4050.00                  | PK       | 9.66                 | H                | 7.19           | 33.38                            | 3.00         | 50.22                   | -47.15    | -13.00               | 34.15       |
| 450.00                | 4050.00                  | PK       | 10.78                | V                | 7.19           | 33.38                            | 3.00         | 51.34                   | -46.03    | -13.00               | 33.03       |
| 450.00                | 4500.00                  | PK       | 9.69                 | H                | 7.33           | 33.89                            | 3.00         | 50.90                   | -46.47    | -13.00               | 33.47       |
| 450.00                | 4500.00                  | PK       | 9.85                 | V                | 7.33           | 33.89                            | 3.00         | 51.06                   | -46.31    | -13.00               | 33.31       |



## 8.10 Modulation Characteristics

*Referenced from test report "TR\_1361-21\_FCC\_DL\_PT90\_Booster Class B\_".*

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

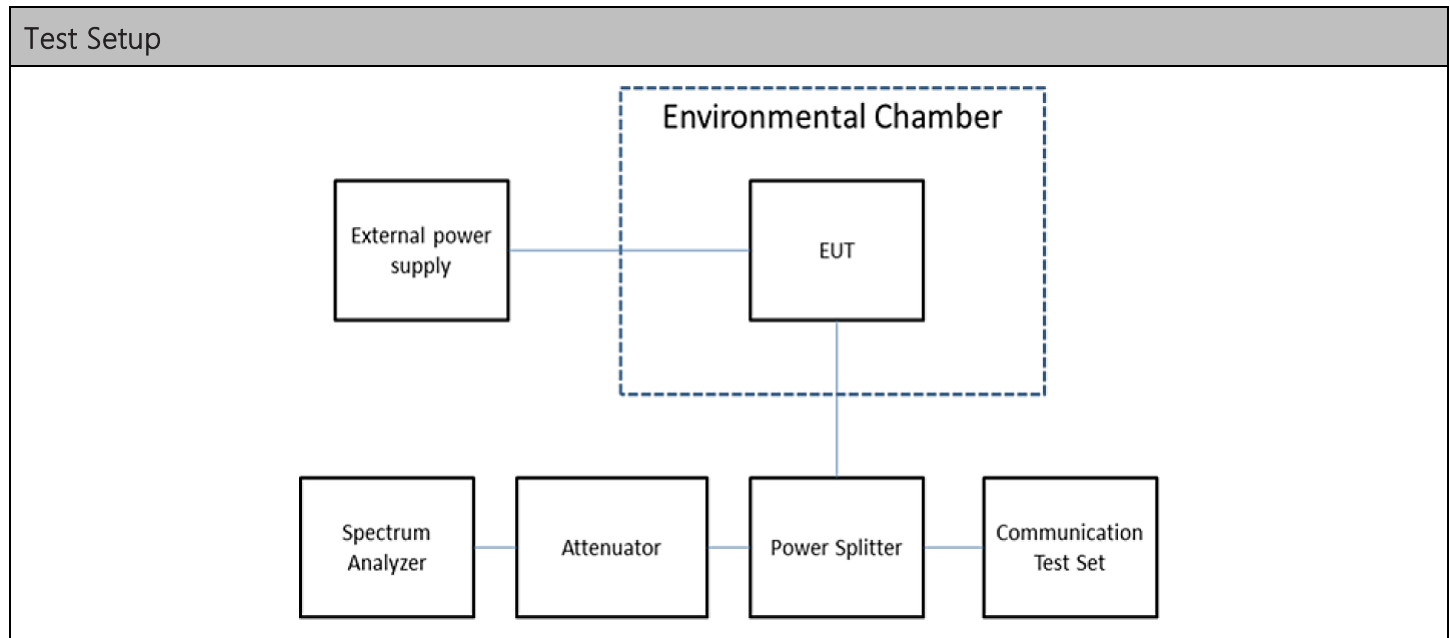


N/A. The EUT does not have any means to modulate the incoming signal.

## 8.11 Frequency Stability

Referenced from test report "TR\_1361-21\_FCC\_DL\_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\_1361-21\_FCC\_DL\_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\_1361-21\_FCC\_DL\_PT90\_Booster Class B\_"..*

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

N/A. Testing Not Applicable.



## 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 document labelled TEST SETUP PHOTOS.

## 11. History of Test Report Changes

| Test Report #                            | Revision # | Description     | Date of Issue |
|--|------------|-----------------|---------------|
| TR_2122-21_FCC_PT90_UL_Booster Class A_1 | 1          | Initial release | June 10, 2021 |
|  |            |                 |               |
|  |            |                 |               |
|  |            |                 |               |



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END OF TEST REPORT

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