



Test Report - FCC PART 90 Booster Class B (B9B)

Prepared For: Fiplex Communications Inc.

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature

(YYYY-MM-DD): 2020-11-14

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1. Customer Information

Applicant: Fiplex Communications Inc.
Address: 2101 NW 79th Ave.
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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-2B

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 ¹
90.219 (d)(6)(ii)	ERP of noise within the passband	n/a ¹
90.219 (d)(6)(iii)	ERP of noise on spectrum < 1 MHz outside of the passband	n/a ¹
90.219 (d)(3)(i), (e)(1)	ERP of Radiated Power	n/a ¹
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



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(352) 472-5500 / testing@timcoengr.com

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): 2020-11-14

Signature:

Sr. EMC Engineer
EMC-003838-NE



Name & Title: Tim Royer, EMC Engineer

Date of Signature

(YYYY-MM-DD): 2020-11-14



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

The test sample was received: October 19, 2020

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-2B
Brief Description	700/800 MHZ Master Unit
Type of Modular	n/a
Model(s) #	DH7S2
Trade name	n/a
Firmware version	1.02-01
Software version	1.01
Serial Number	20096077FU

Technical Characteristics	
Technology	Bi-Directional Industrial Signal Booster
Frequency Range	700 MHz UL: 788 - 805 MHz / DL: 758 - 775 800 MHz UL: 806 - 824 MHz / DL: 851 - 869
RF O/P Power (Max.)	UL: 24 dBm (0.25 W) DL: 33 dBm (2 W)
Modulation	n/a
Bandwidth & Emission Class	16K0F3E, 11K3F3E, 4K00F1E, 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
788 – 805 MHz	Uplink	788.0125 MHz
		793.0000 MHz
		804.9875 MHz
806 – 824 MHz	Uplink	806.0125 MHz
		816.9875 MHz
		823.9875 MHz
851 – 869 MHz	Downlink	788.0125 MHz
		793.0000 MHz
		804.9875 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	± 3.14 dB
Radiated Emissions (9kHz – 30 MHz)	± 3.08 dB
Radiated Emissions (30 – 200 MHz)	± 2.16 dB
Radiated Emissions (200 – 1000 MHz)	± 2.15 dB
Radiated Emissions (1 GHz – 18 GHz)	± 2.14 dB
Radiated Emissions (18 GHz – 40 GHz)	± 2.31 dB
Note: 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%
Note: 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
Signal Generator R&S SMU-200A	Rohde & Schwarz	SMU200A	103195	4/23/18	4/22/2021
Sweep/Signal Generator	Anritsu	68369B	985112	11/8/17	11/7/2020
Digital Multimeter	Fluke	77	35053830	11/6/17	11/5/2020
R&S 18 GHz USB Peak Power Sensor	Rohde & Schwarz	NRP-Z85	1411.7501.02-102085-W	2/4/19	2/3/2022
Active Loop	ETS-Lindgren	6502	00062529	12/11/17	12/10/2020
Biconical 1057	Eaton	94455-1	1057	12/13/17	12/12/2020
Log-Periodic 1243	Eaton	96005	1243	4/20/18	4/19/2021
Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	2/25/20	2/24/2023
CHAMBER	Panashield	3M	N/A	3/12/19	3/11/2021
EMI Test Receiver R&S ESU 40	Rohde & Schwarz	ESU 40	100320	8/28/18	8/27/2021
Frequency Counter Small	HP	5385A	3242A07460	9/9/20	9/9/2023
Type K J Thermometer	Martel	303	080504494	11/6/17	11/5/2020

Device	Manufacturer	Model	SN #	Verified On
Splitter/Combiner 1-1000MHz	Mini-Circuits	ZFSC-4-1-BNC+	U115700825	10/21/20
Splitter/Combiner 1-1000MHz	Mini-Circuits	ZFSC-4-1-BNC+	U115700826	10/21/20

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 μ 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 μ 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 μ V if the impedance of the measuring instrument is also reported. Otherwise, antenna-conducted power will be reported in units of decibels referenced to one milliwatt (dBm). All formulas for data conversions and conversion factors, if used, will be included in this measurement report.



8.1 Power at the Final Amplifier

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

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

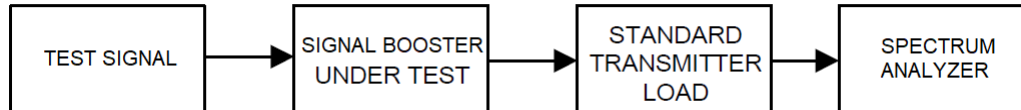
Test Results		
EUT Operating Voltage (V)	EUT Current (A)	Power at the Final Amplifier
24 V DC	3.33	80 W



8.2 RF Output Power & Gain

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 Setup



Test Results, Power Output

Link Direction	Max Power Output (dBm)	Max Power Output (W)
Uplink	24.0	0.25
Downlink	33.0	2.00



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	-34	32.52	78.52
		AGC+3	-31	32.50	75.50
		Maximum	-20	32.44	52.44
	763.0	AGC	-34	32.52	78.52
		AGC+3	-31	32.50	75.50
		Maximum	-20	32.44	52.44
	774.9875	AGC	-34	32.52	78.52
		AGC+3	-31	32.50	75.50
		Maximum	-20	32.44	52.44
Uplink	788.0125	AGC	-57	24.25	81.25
		AGC+3	-54	24.23	78.23
		Maximum	-47	24.23	71.23
	793.0	AGC	-57	24.25	81.25
		AGC+3	-54	24.23	78.23
		Maximum	-47	24.23	71.23
	804.9875	AGC	-57	24.25	81.25
		AGC+3	-54	24.23	78.23
		Maximum	-47	24.23	71.23

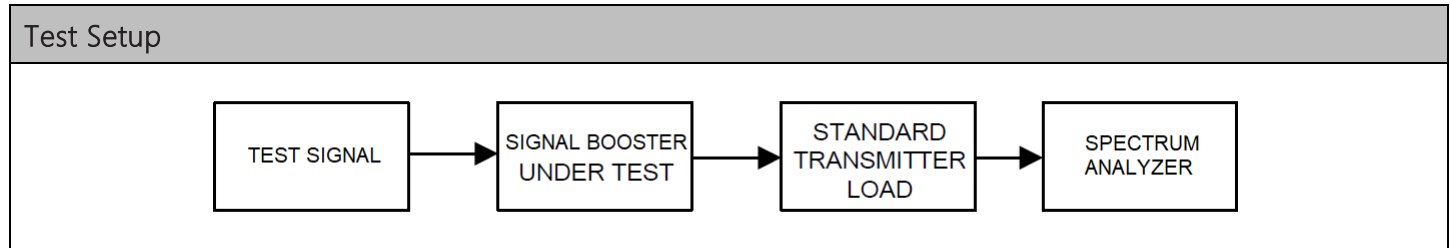


800 Band Gain

Test Results, Gain					
Link Direction	Tuned Frequency (MHz)	Input Level	Power Input (dBm)	Power Output (dBm)	Gain (dB)
Uplink	806.0125	AGC	-56	24.80	80.80
		AGC+3	-53	24.83	77.83
		Maximum	-47	24.83	71.83
	816.9875	AGC	-56	24.80	80.80
		AGC+3	-53	24.83	77.83
		Maximum	-47	24.83	71.83
	823.9875	AGC	-56	24.80	80.80
		AGC+3	-53	24.83	77.83
		Maximum	-47	24.83	71.83
Downlink	851.0125	AGC	-34	33.00	67.00
		AGC+3	-31	32.92	63.92
		Maximum	-20	32.89	52.89
	861.9875	AGC	-34	33.00	67.00
		AGC+3	-31	32.92	63.92
		Maximum	-20	32.89	52.89
	868.9875	AGC	-34	33.00	67.00
		AGC+3	-31	32.92	63.92
		Maximum	-20	32.89	52.89

8.3 Out-of-band Rejection

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

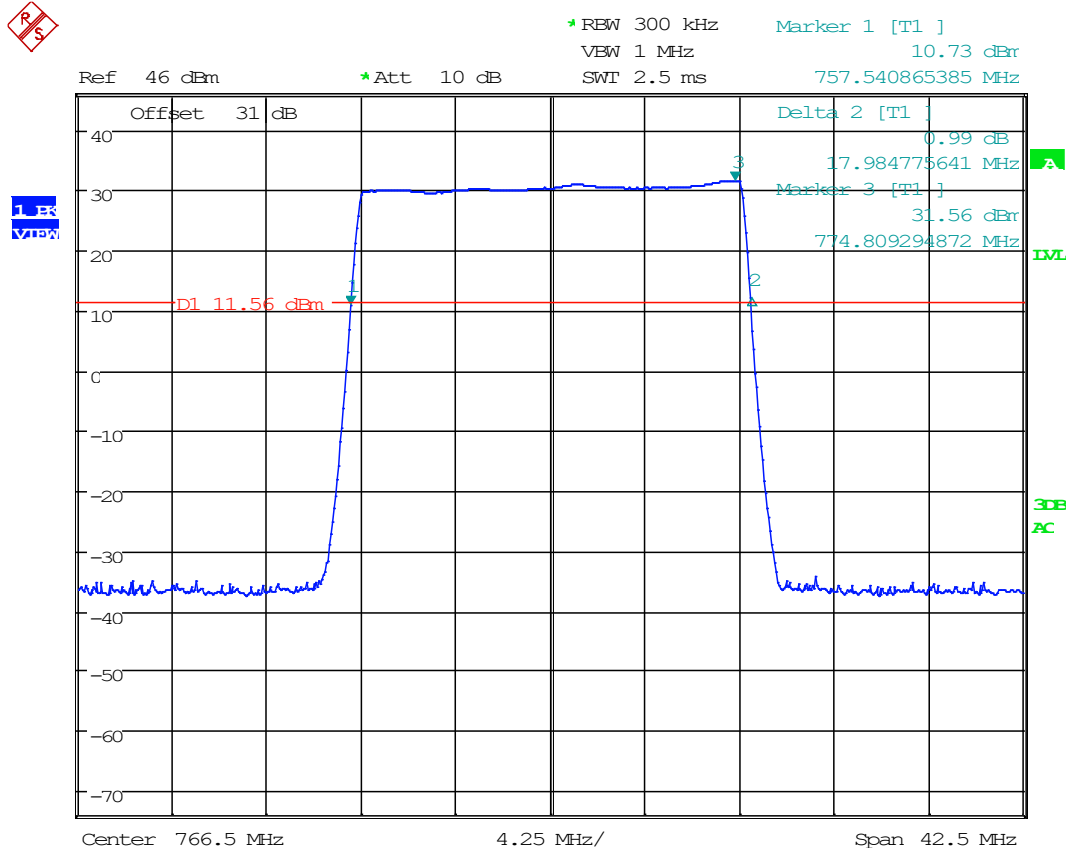


Test Results, Out-of-band Rejection and Class of Operation			
Operating Band	Link Direction	Passband (kHz)	Class of Operation
758 – 775 MHz	Downlink	> 75 kHz	Class B
788 – 805 MHz	Uplink	> 75 kHz	Class B
806 – 824 MHz	Uplink	> 75 kHz	Class B
851 – 869 MHz	Downlink	> 75 kHz	Class B



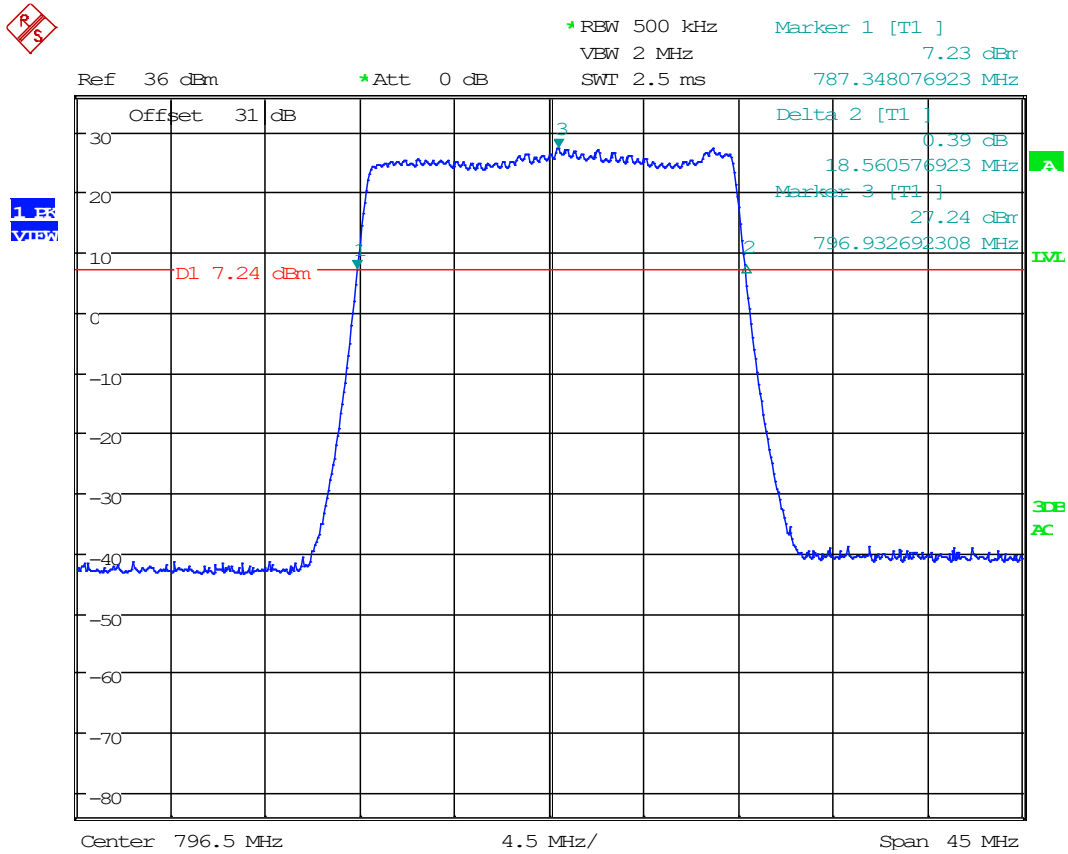
Out-of-band Rejection, Spectrum Plots

8.3.1 700 Band, Downlink



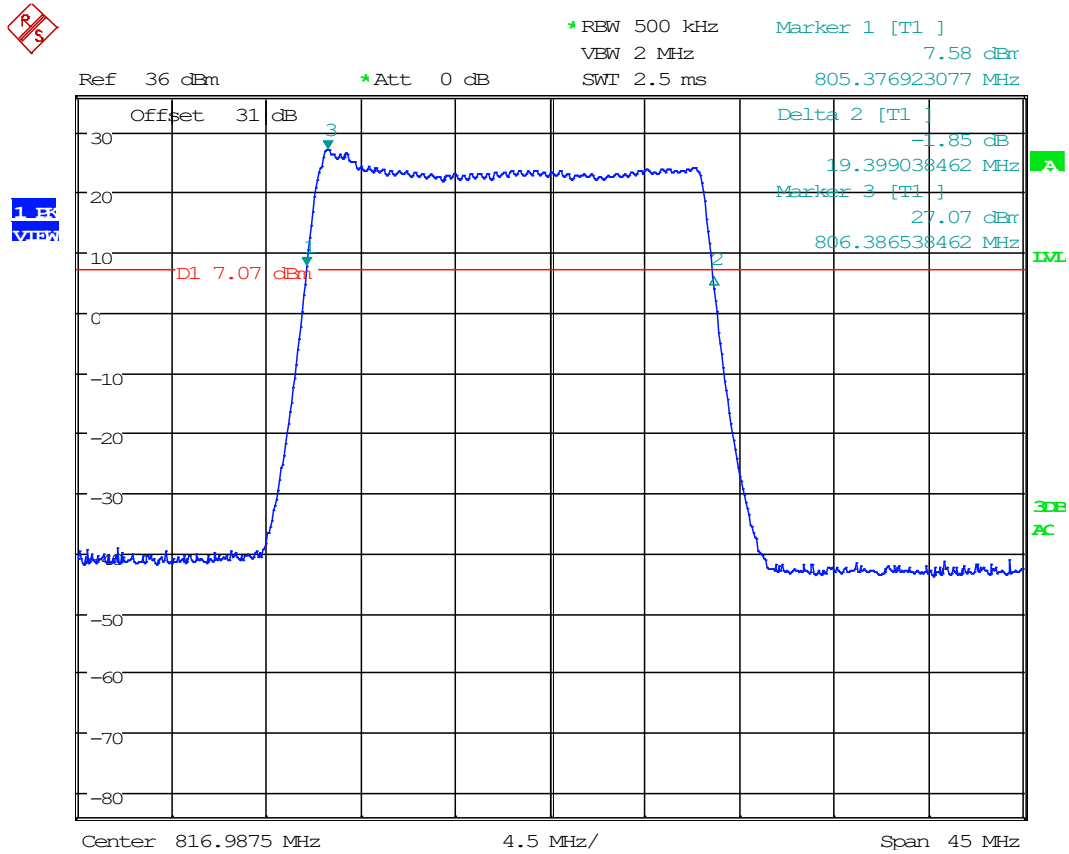
Date: 2.NOV.2020 17:46:18

8.3.1 700 Band, Uplink



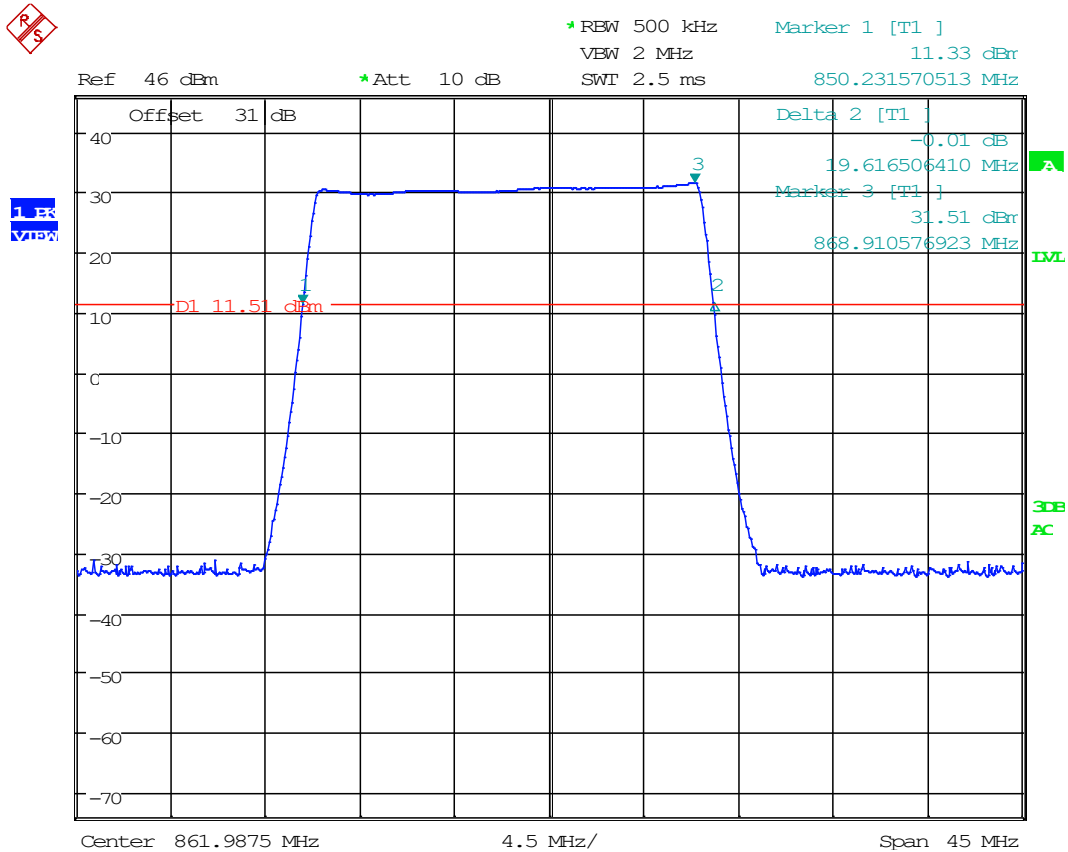
Date: 5.NOV.2020 12:18:48

8.3.2 800 Band, Uplink



Date: 5.NOV.2020 12:08:37

8.3.1 800 Band, Downlink



Date: 2.NOV.2020 17:21:04



8.4 Bandwidth & Emission

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

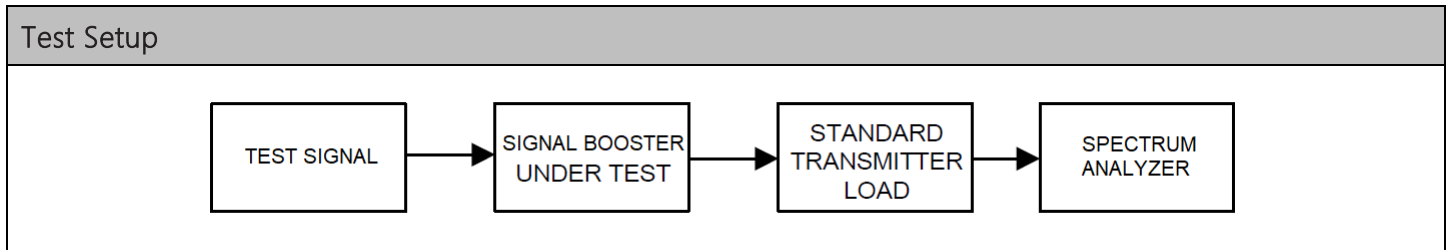
Authorized Bandwidth		
Rule Part	Operating Range	Authorized Bandwidth
Part 90	758 – 775 MHz	Unspecified.
Part 90	806 – 809 MHz, 851 – 854 MHz	20 kHz
Part 90	809 – 817 MHz, 854 – 862 MHz	20 kHz, 11.25 kHz
Part 90	817 – 824 MHz, 862 – 869 MHz	20 kHz

Applicable Input Signals		
Signal	Occupied Bandwidth (kHz)	Representative Emission Designator(s)
CW	n/a	n/a
25 kHz FM	16.0	16K0F3E
12.5 kHz FM	11.3	11K3F3E
6.25 kHz FM	4.0	4K00F1E
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, 10M0D7W, 5M00W7D, 10M0W7D, 5M00F9W, 10M0F9W



8.5 Input VS Output Signal Comparison

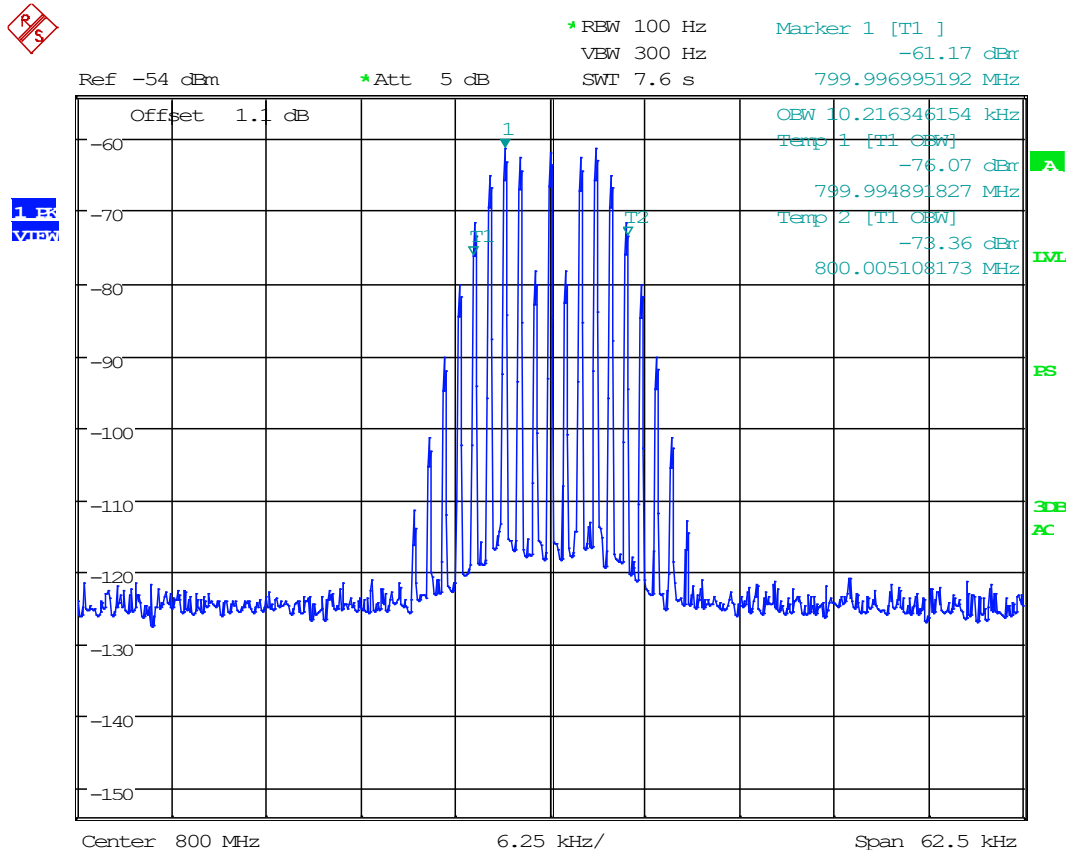
Limits from FCC Parts 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





Input VS Output, Input Spectrum Plots

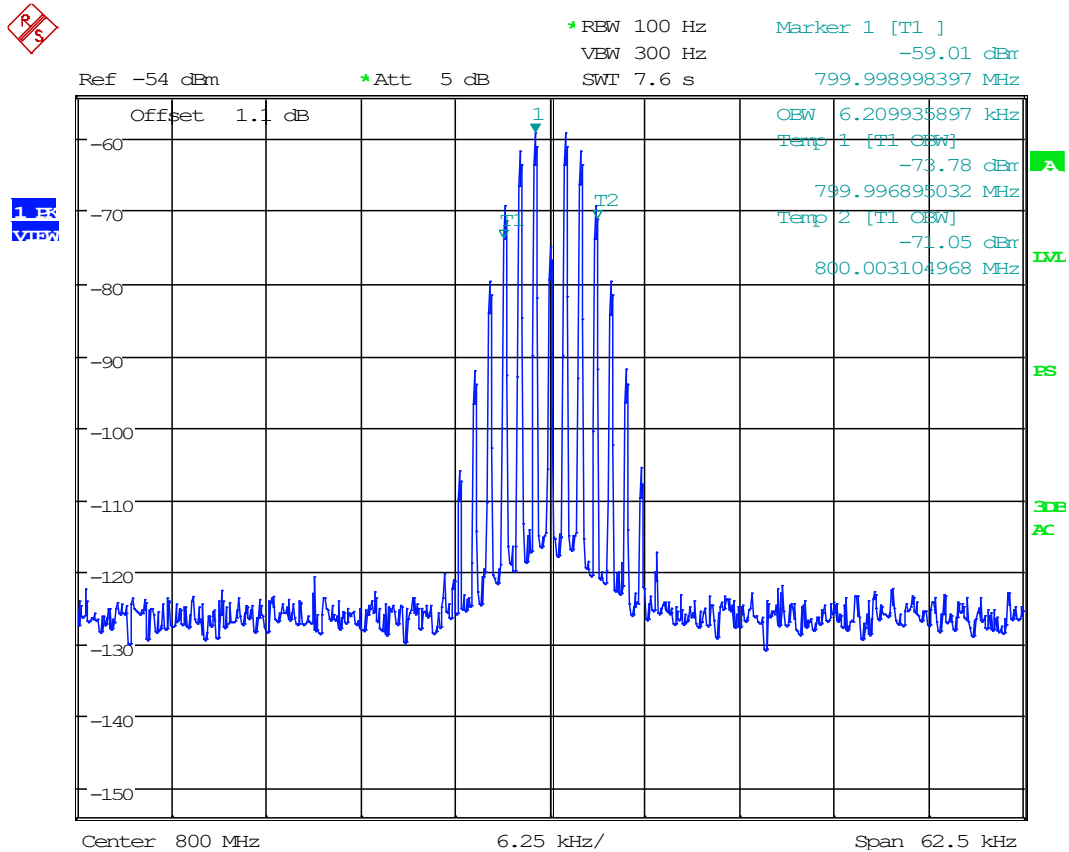
8.5.1 25 kHz FM



Date: 30.JAN.2019 14:23:14

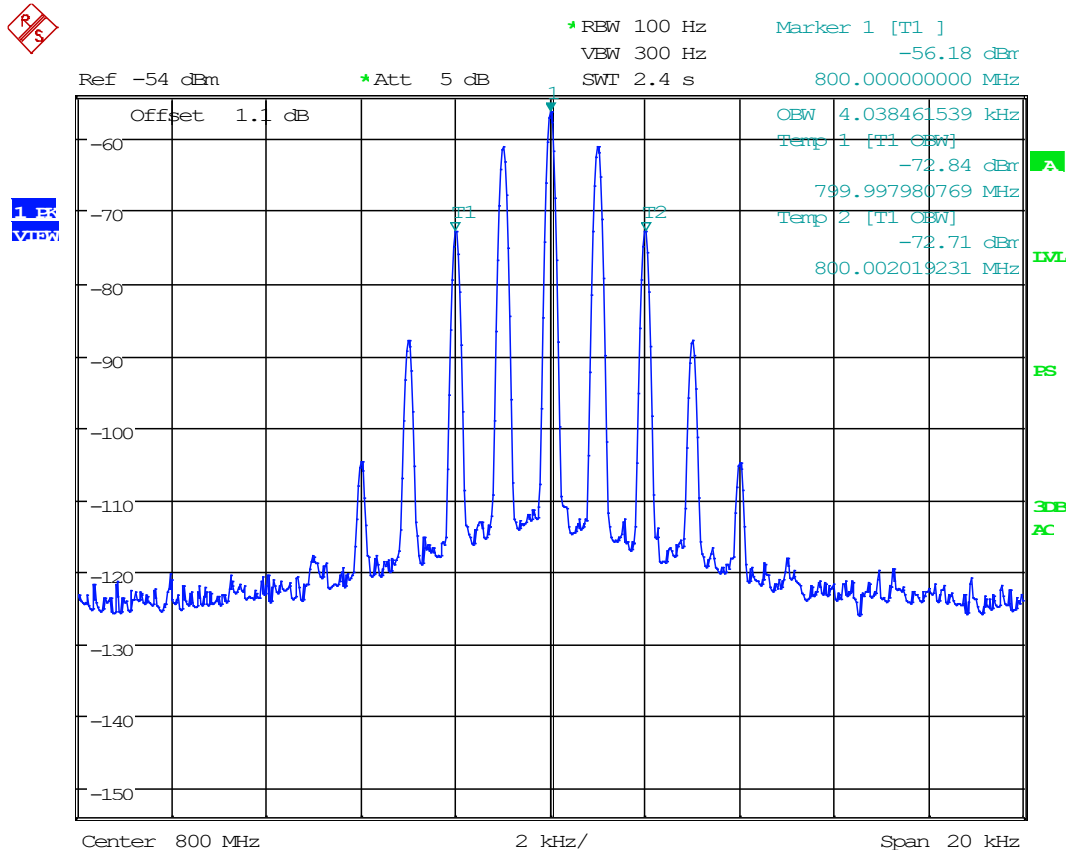


8.5.2 12.5 kHz FM



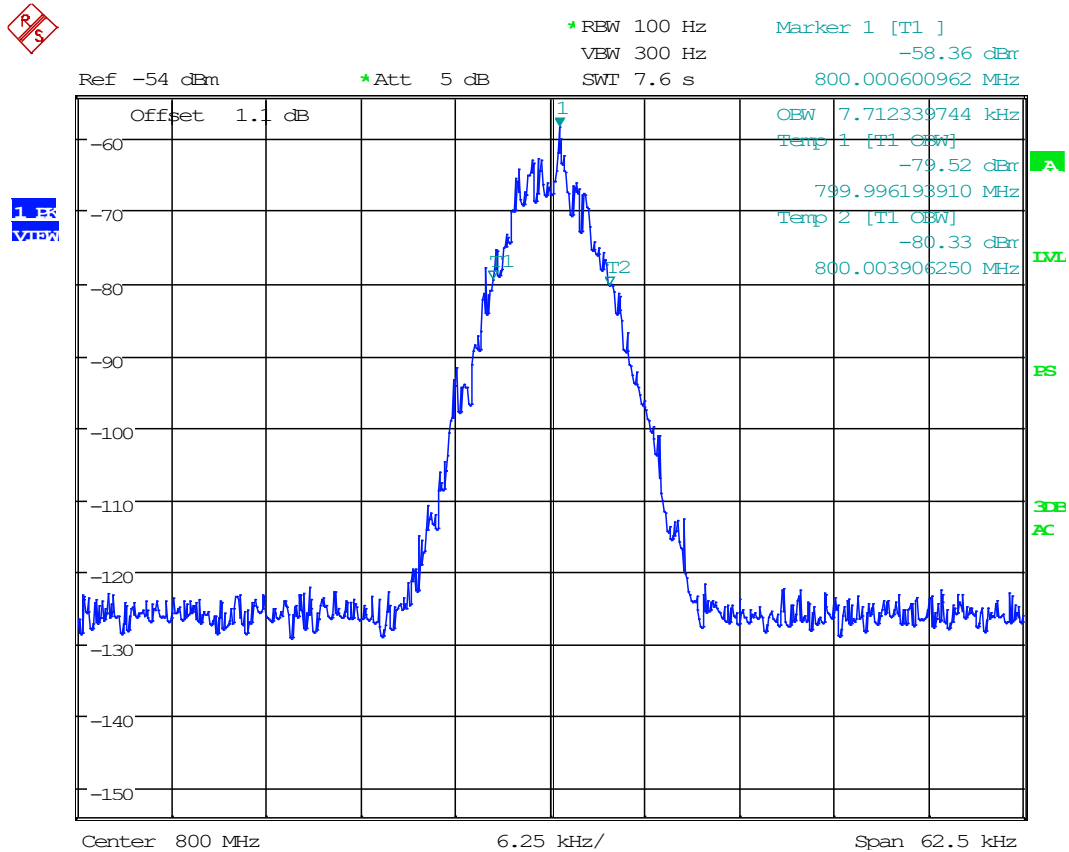
Date: 30.JAN.2019 14:19:45

8.5.3 6.25 kHz FM



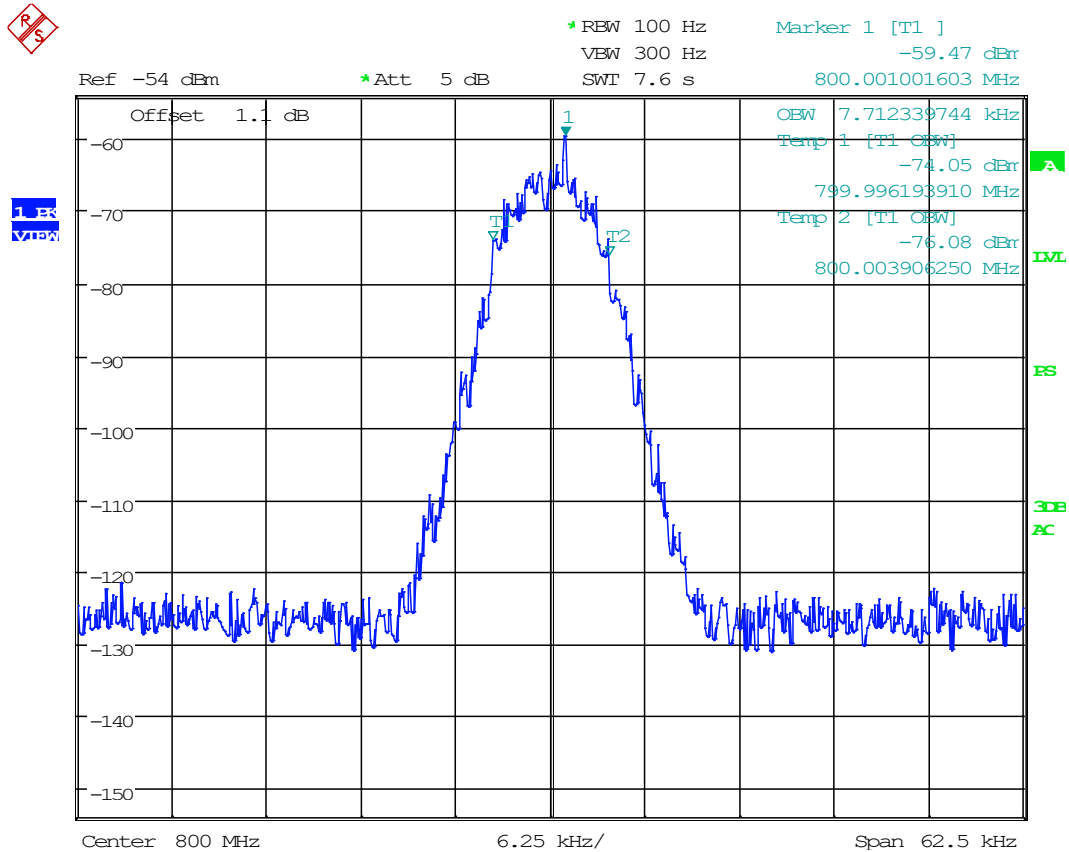
Date: 30.JAN.2019 13:10:11

8.5.4 C4FM



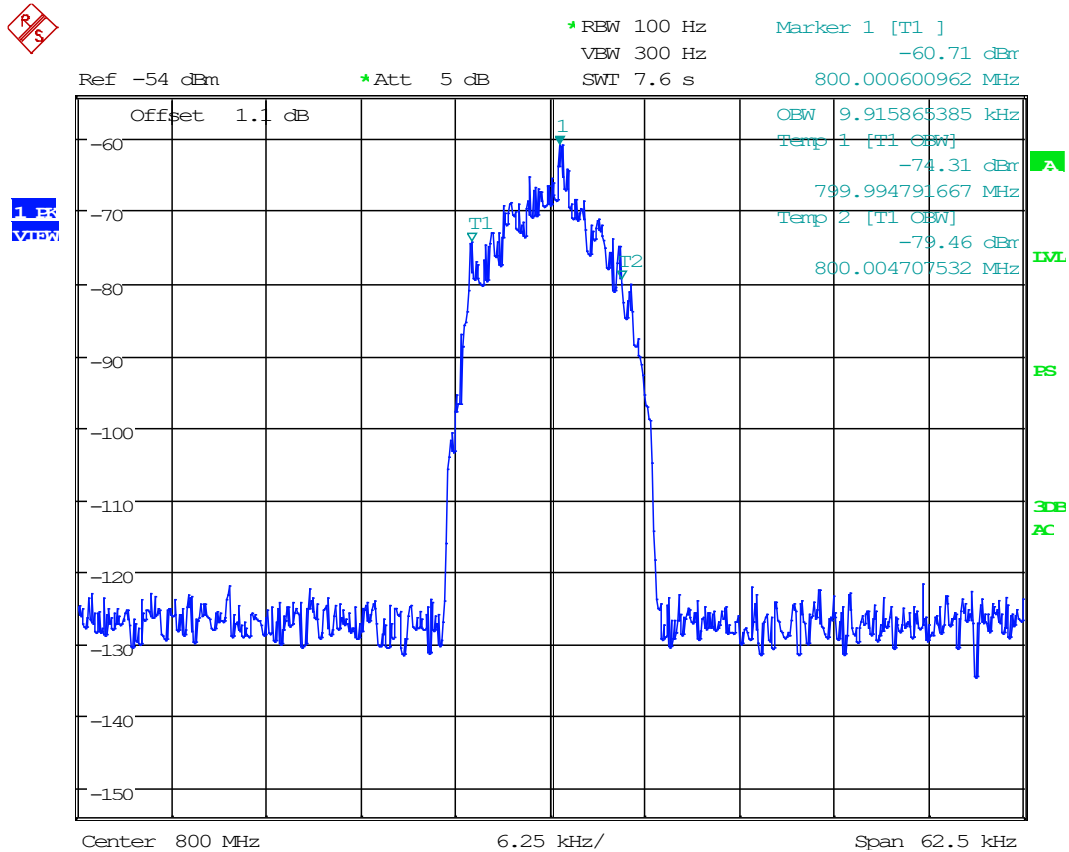
Date: 30.JAN.2019 14:28:58

8.5.5 H-CPM



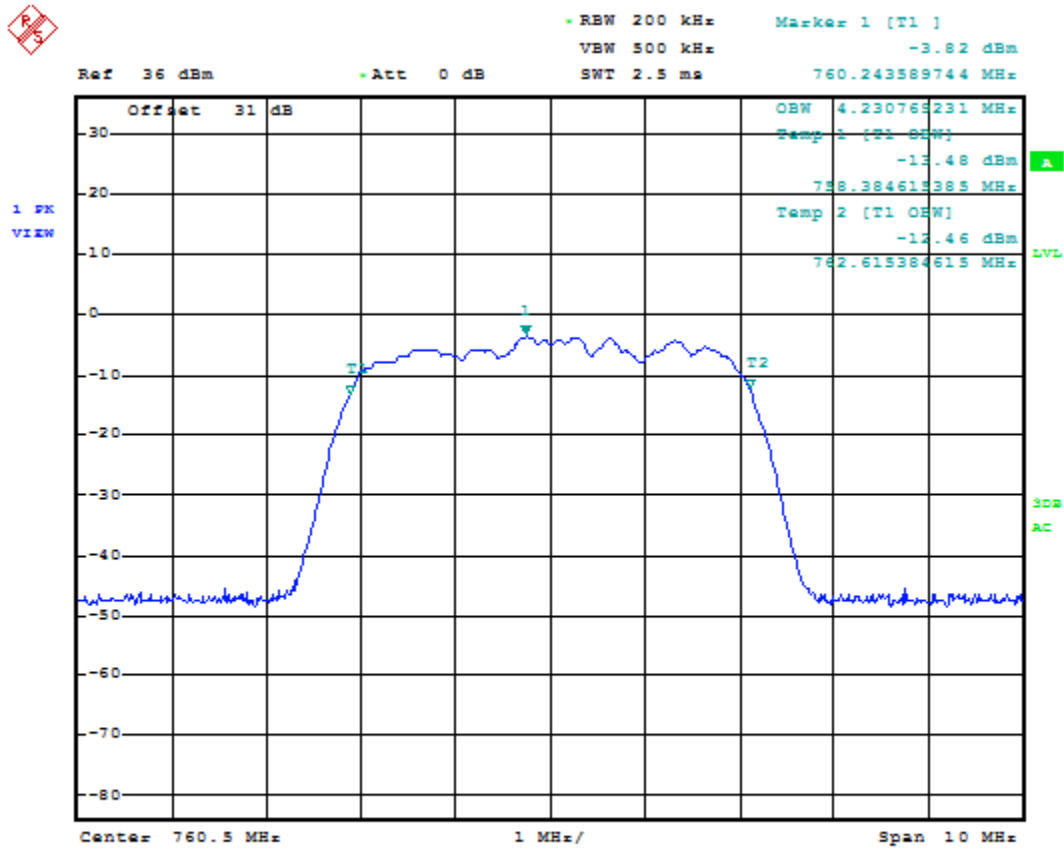
Date: 30.JAN.2019 14:30:47

8.5.6 H-DQPSK



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

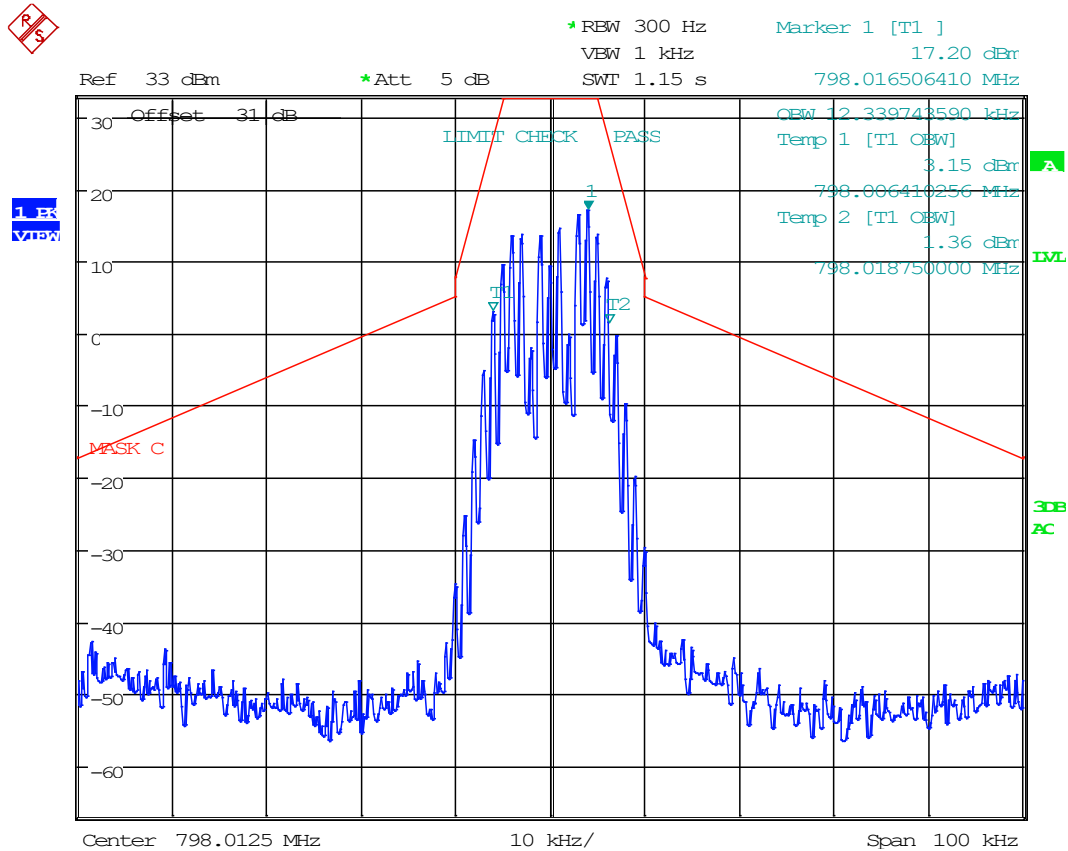
8.5.7 AWGN



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

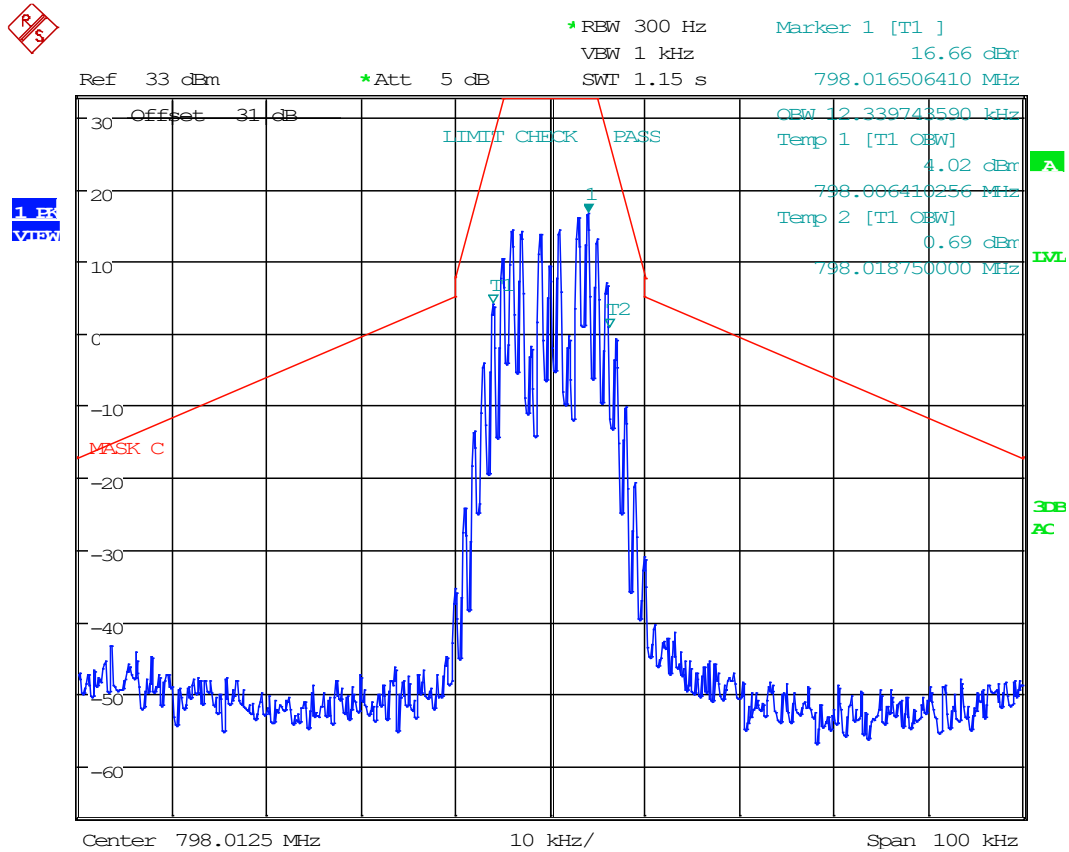
Input VS Output, Output Spectrum Plots, 700 Band

8.5.8 25 kHz FM, Uplink, AGC



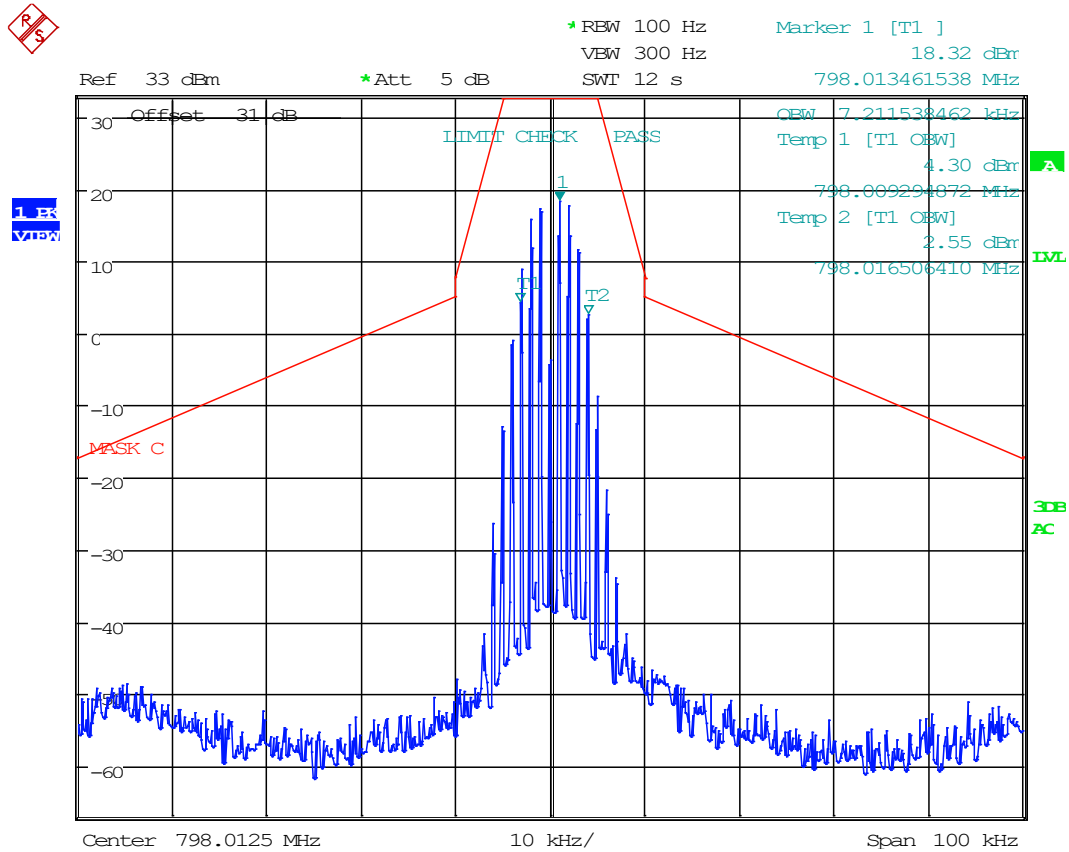
Date: 5.NOV.2020 15:38:18

8.5.9 25 kHz FM, Uplink, AGC +3dB



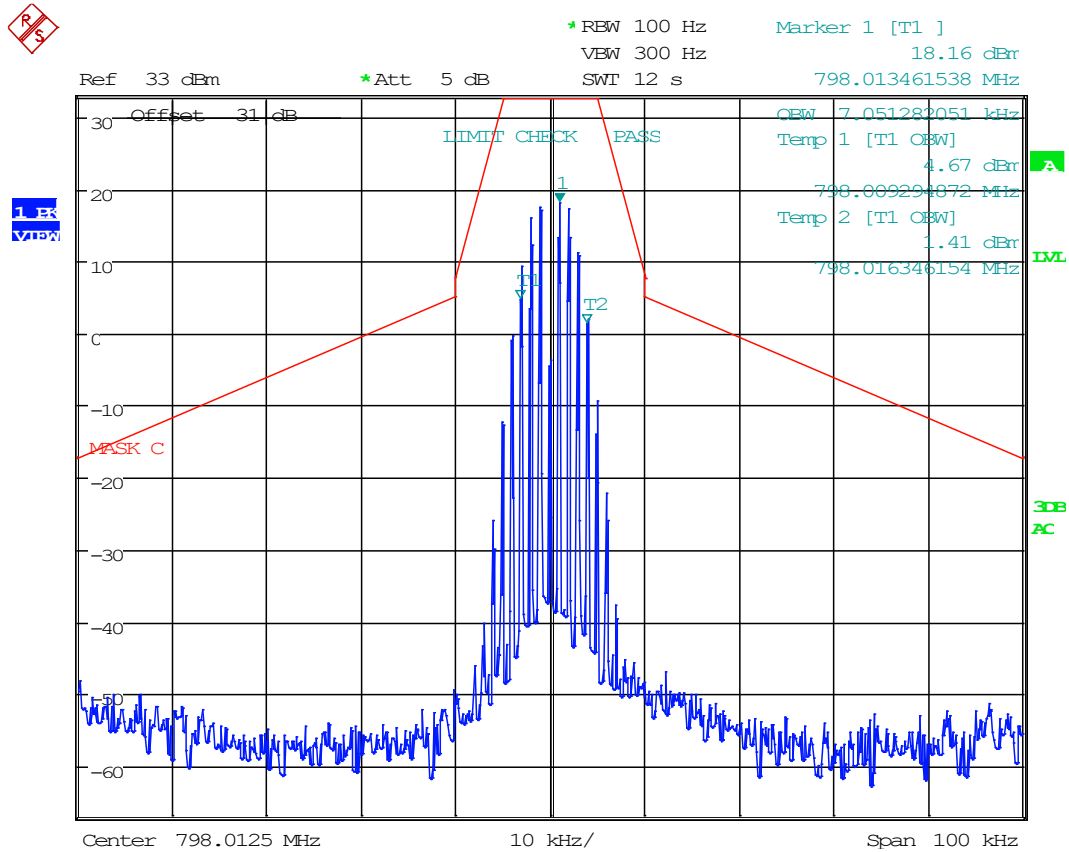
Date: 5.NOV.2020 15:38:45

8.5.10 12.5 kHz FM, Uplink, AGC



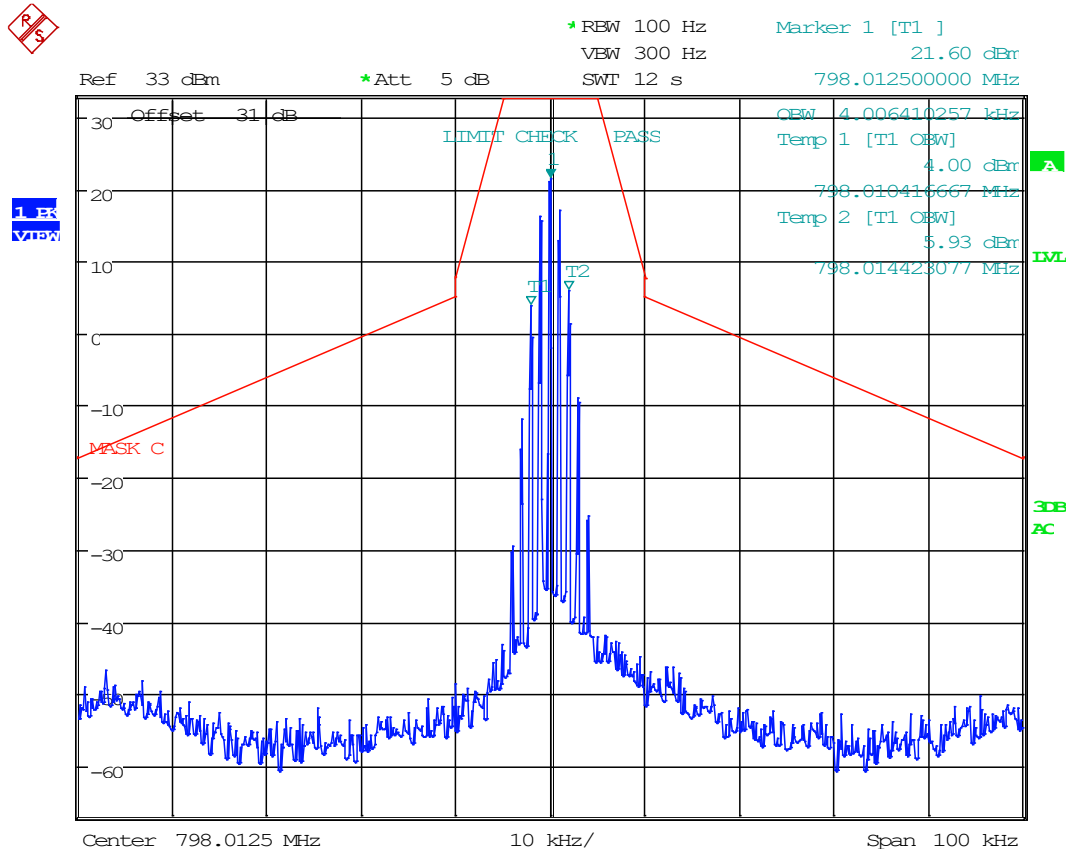
Date: 5.NOV.2020 15:39:47

8.5.11 12.5 kHz FM, Uplink, AGC +3dB



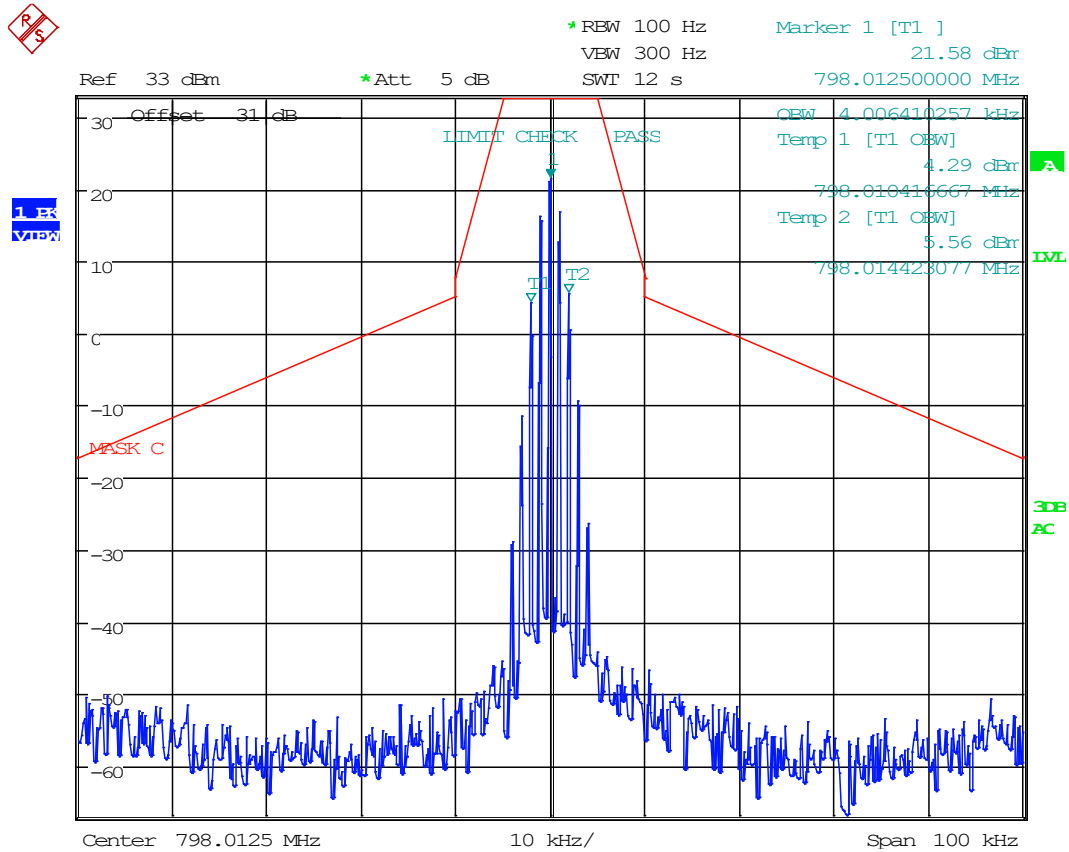
Date: 5.NOV.2020 15:40:29

8.5.12 6.25 kHz FM, Uplink, AGC



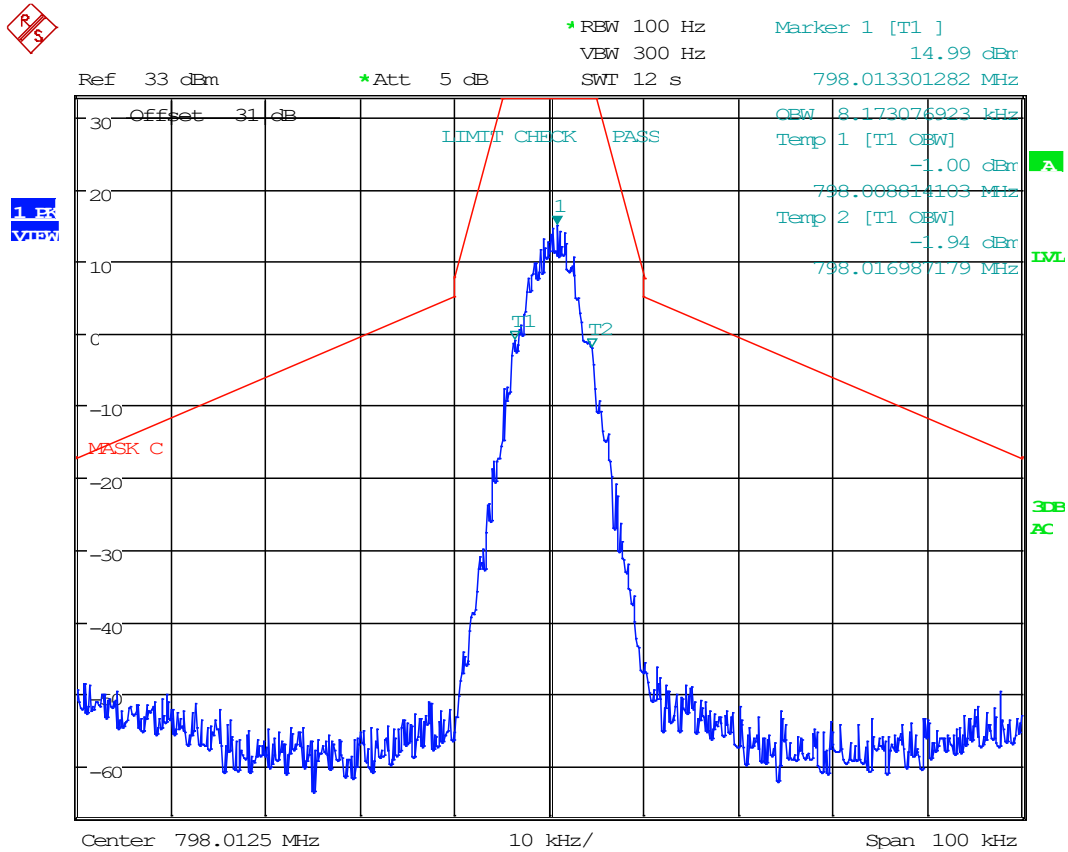
Date: 5.NOV.2020 15:36:40

8.5.13 6.25 kHz FM, Uplink, AGC +3dB



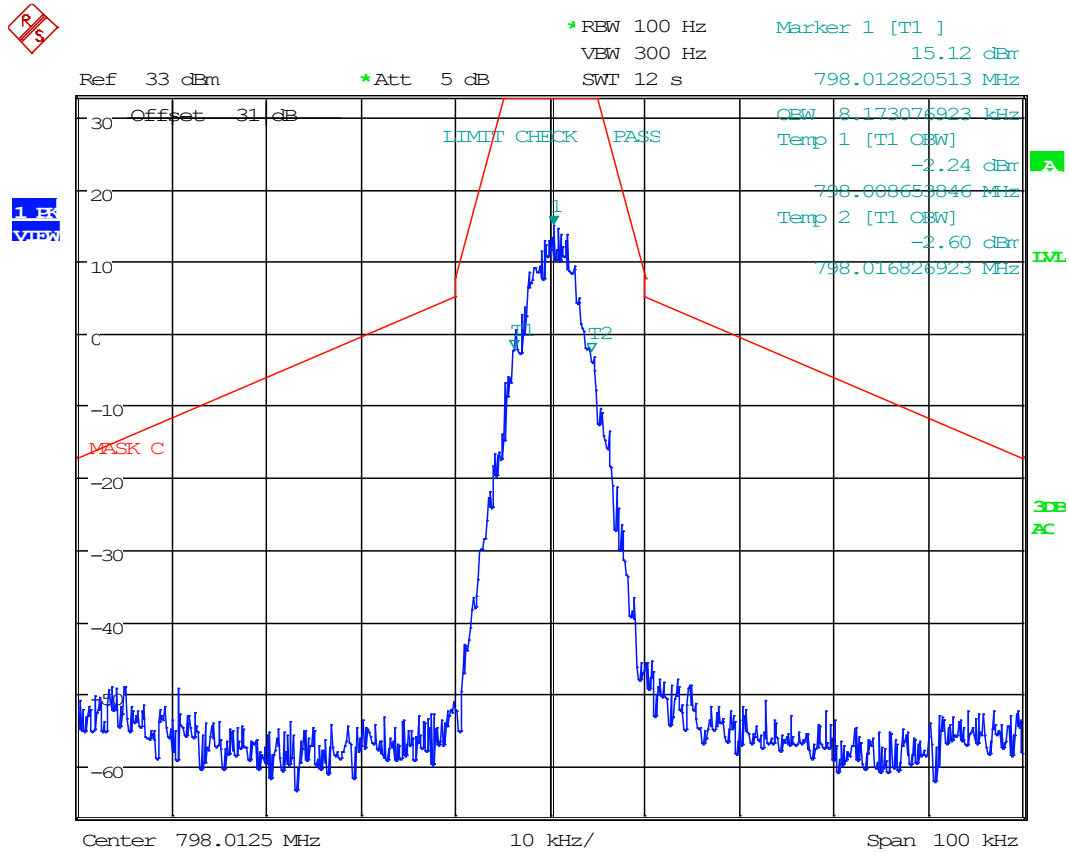
Date: 5.NOV.2020 15:37:09

8.5.14 C4FM, Uplink, AGC



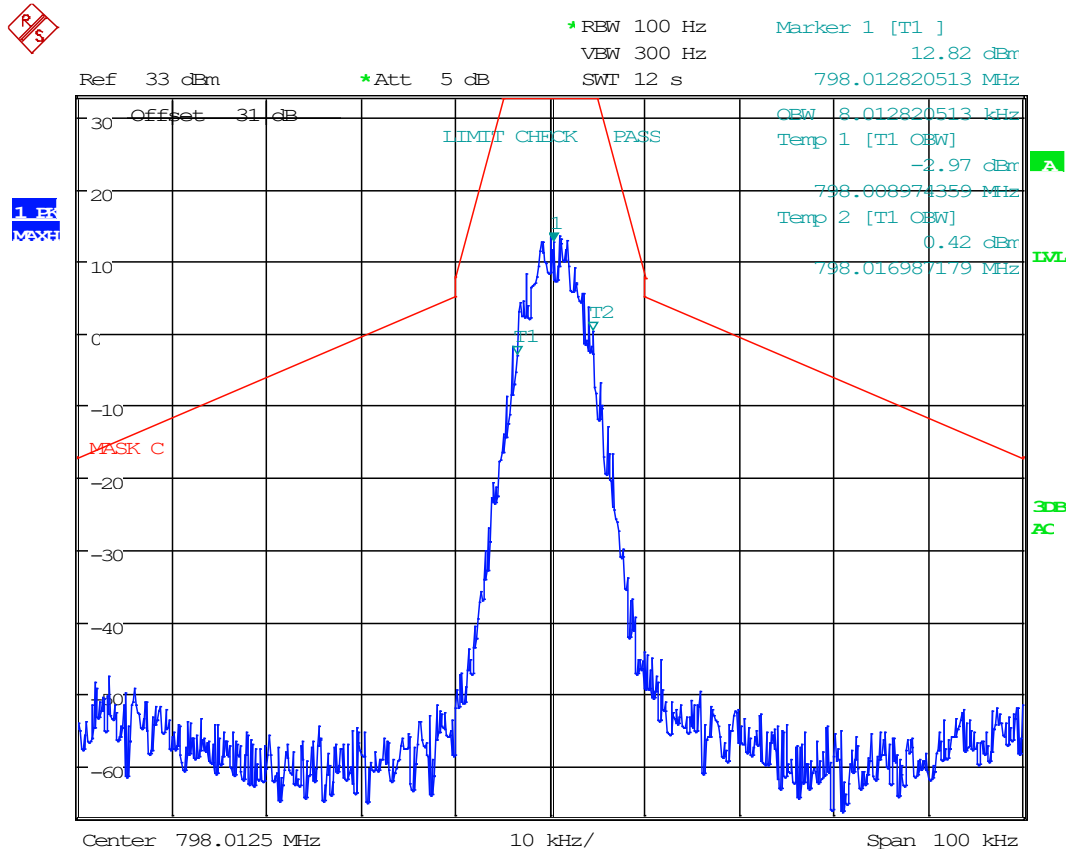
Date: 5.NOV.2020 15:41:37

8.5.15 C4FM, Uplink, AGC +3dB



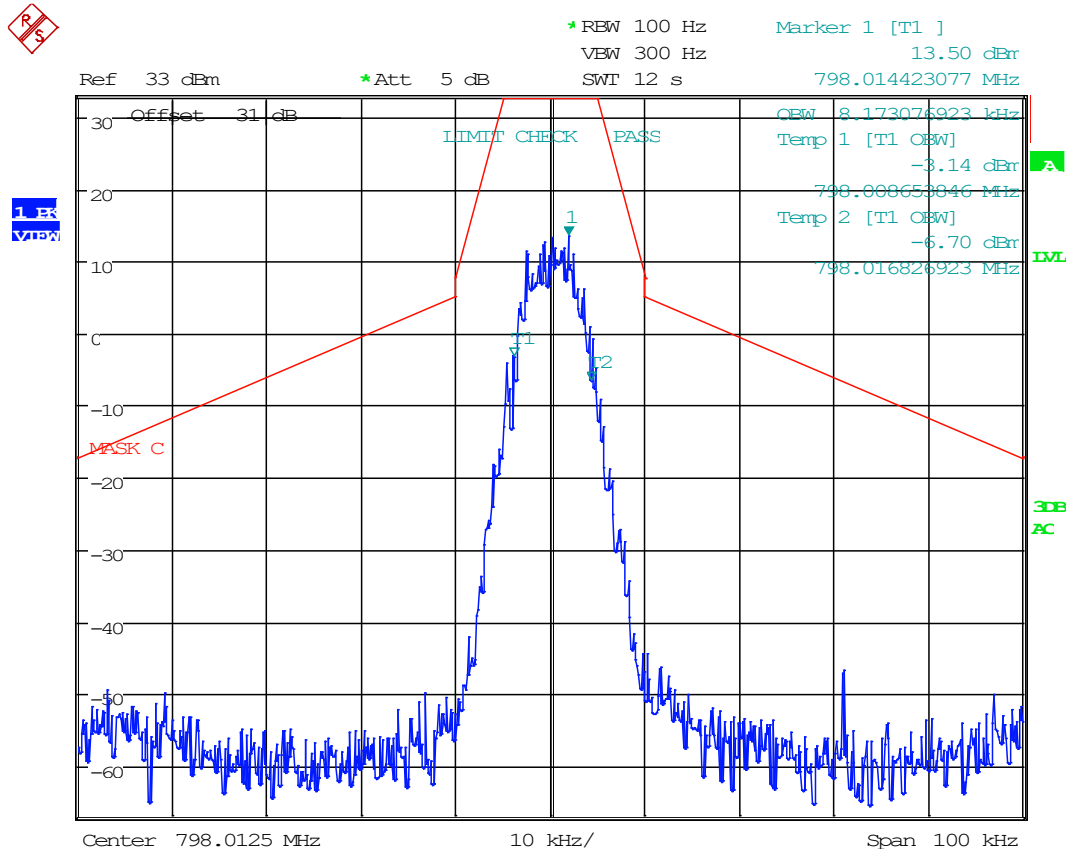
Date: 5.NOV.2020 15:42:40

8.5.16 H-CPM, Uplink, AGC



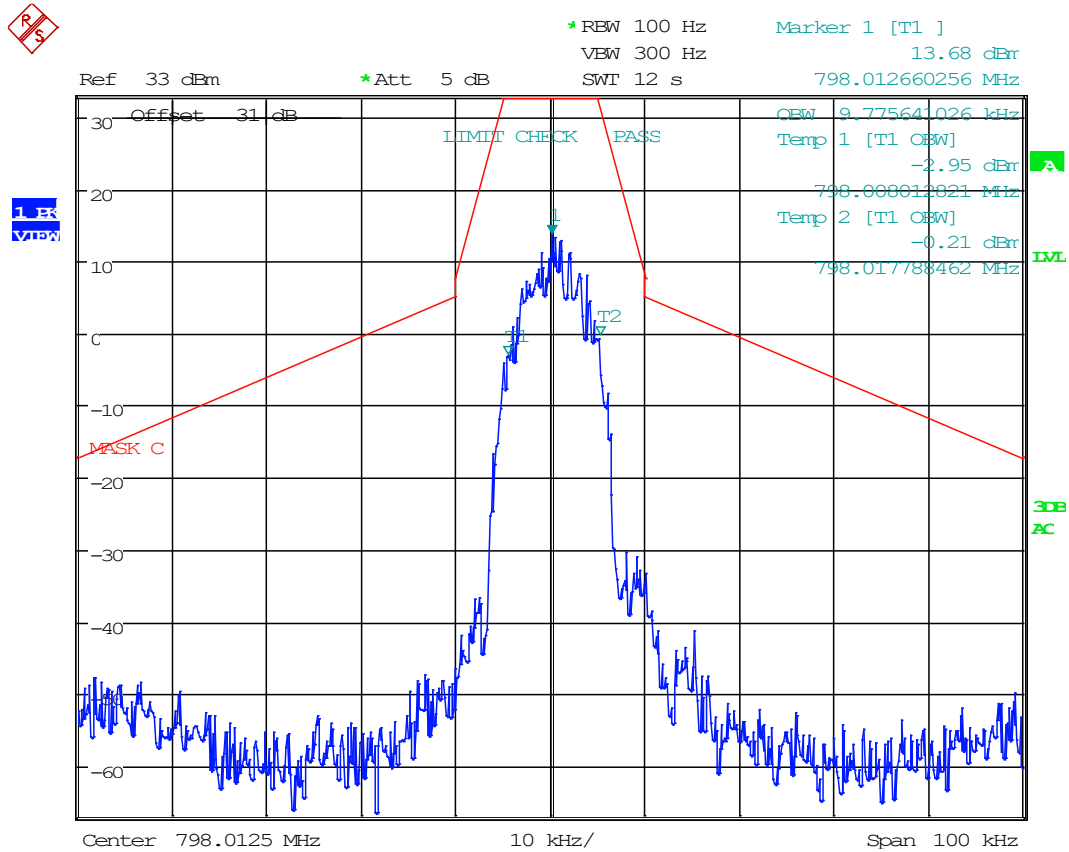
Date: 5.NOV.2020 15:43:34

8.5.17 H-CPM, Uplink, AGC +3dB



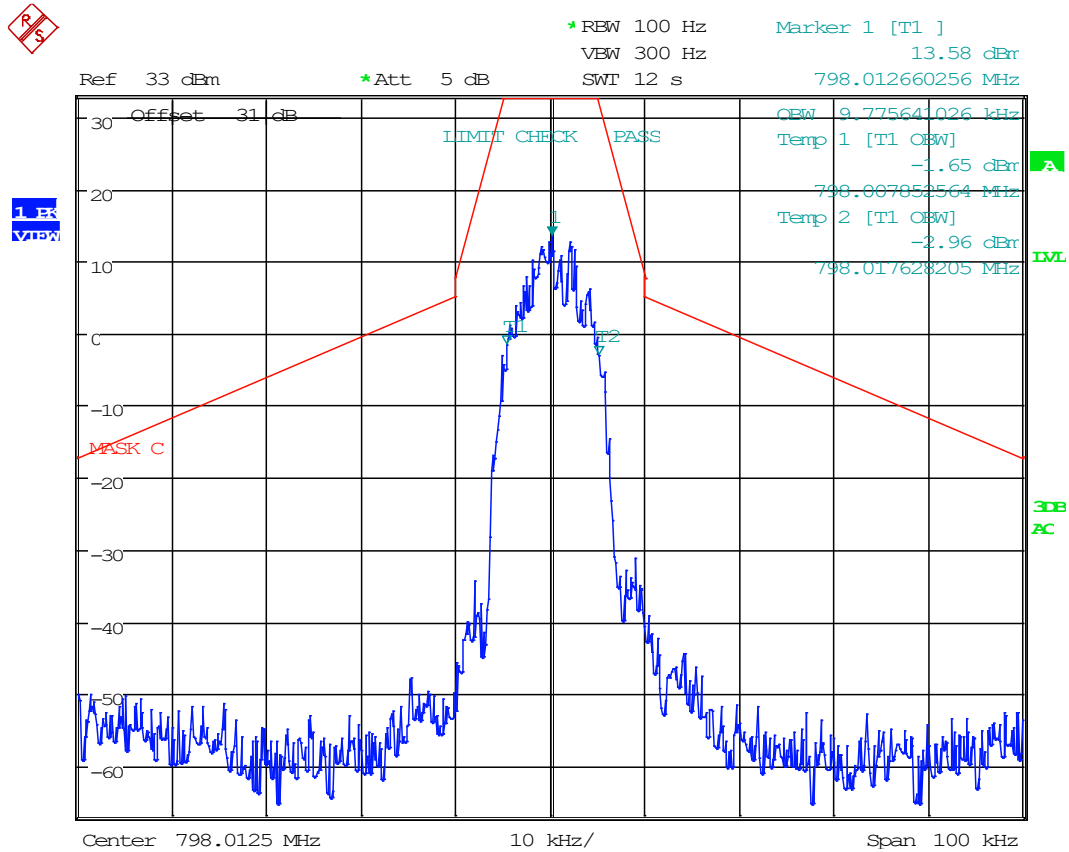
Date: 5.NOV.2020 15:44:05

8.5.18 H-DQPSK, Uplink, AGC



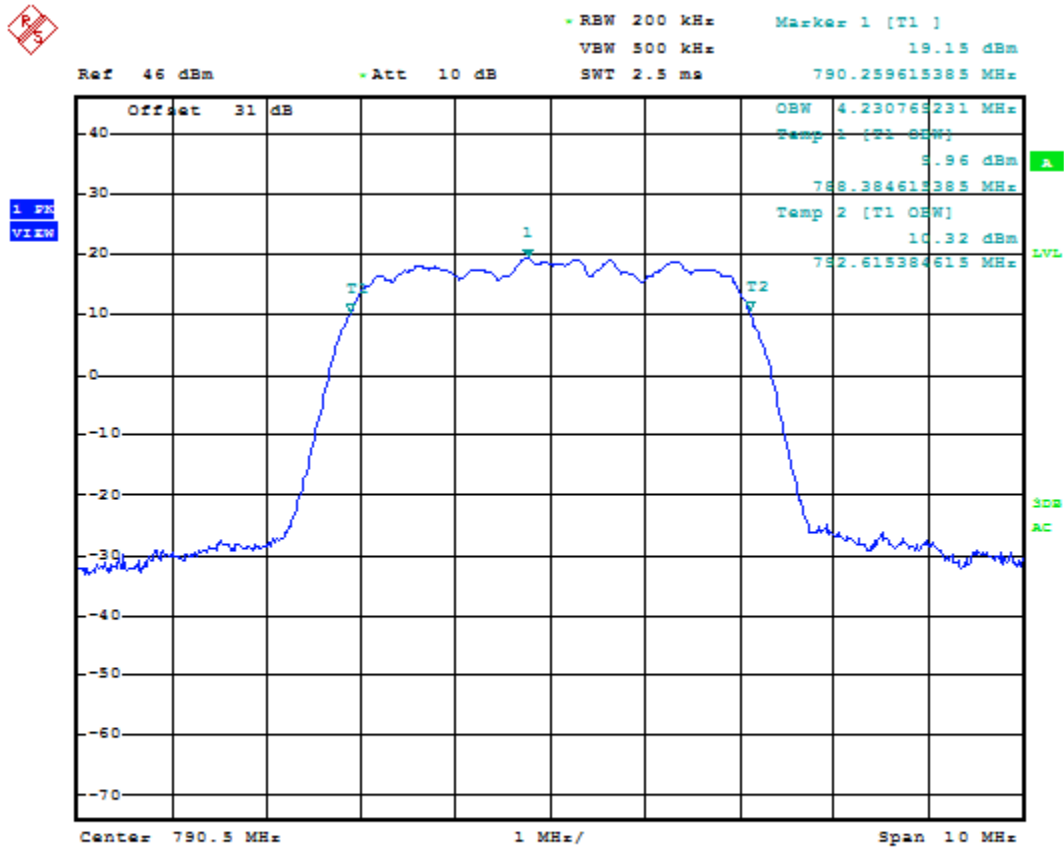
Date: 5.NOV.2020 15:45:19

8.5.19 H-DQPSK, Uplink, AGC +3dB



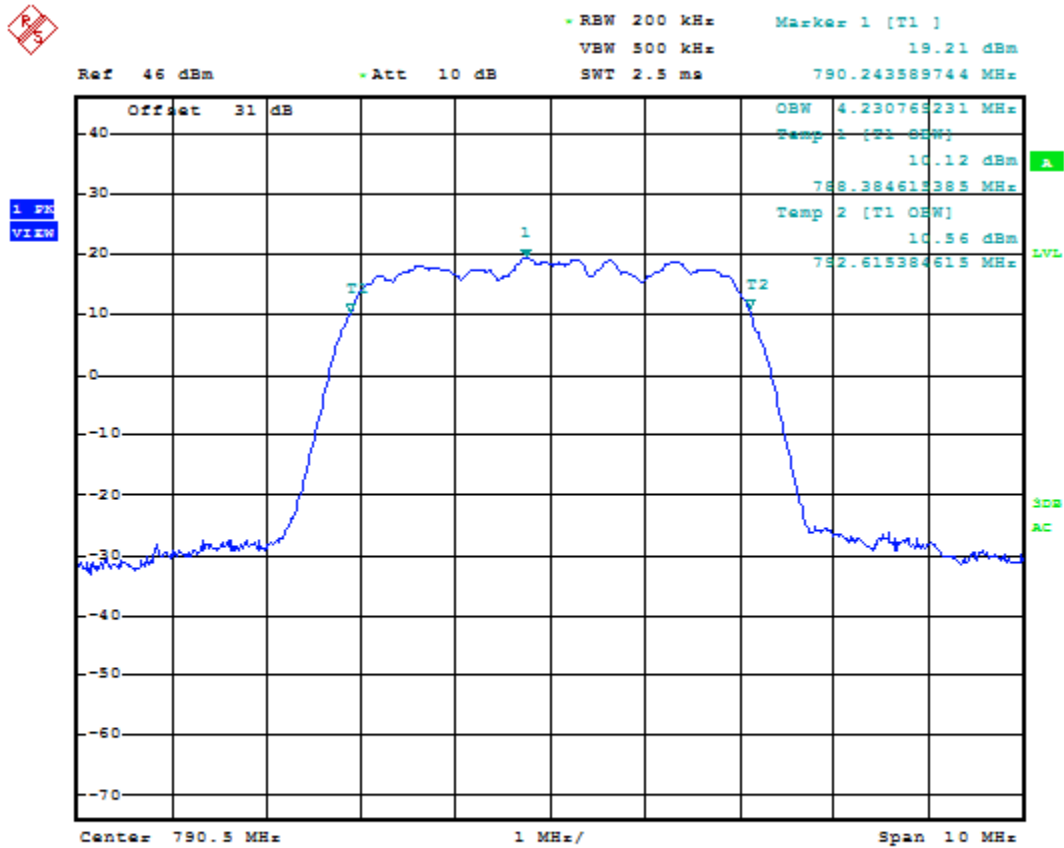
Date: 5.NOV.2020 15:44:41

8.5.20 AWGN, Uplink, AGC



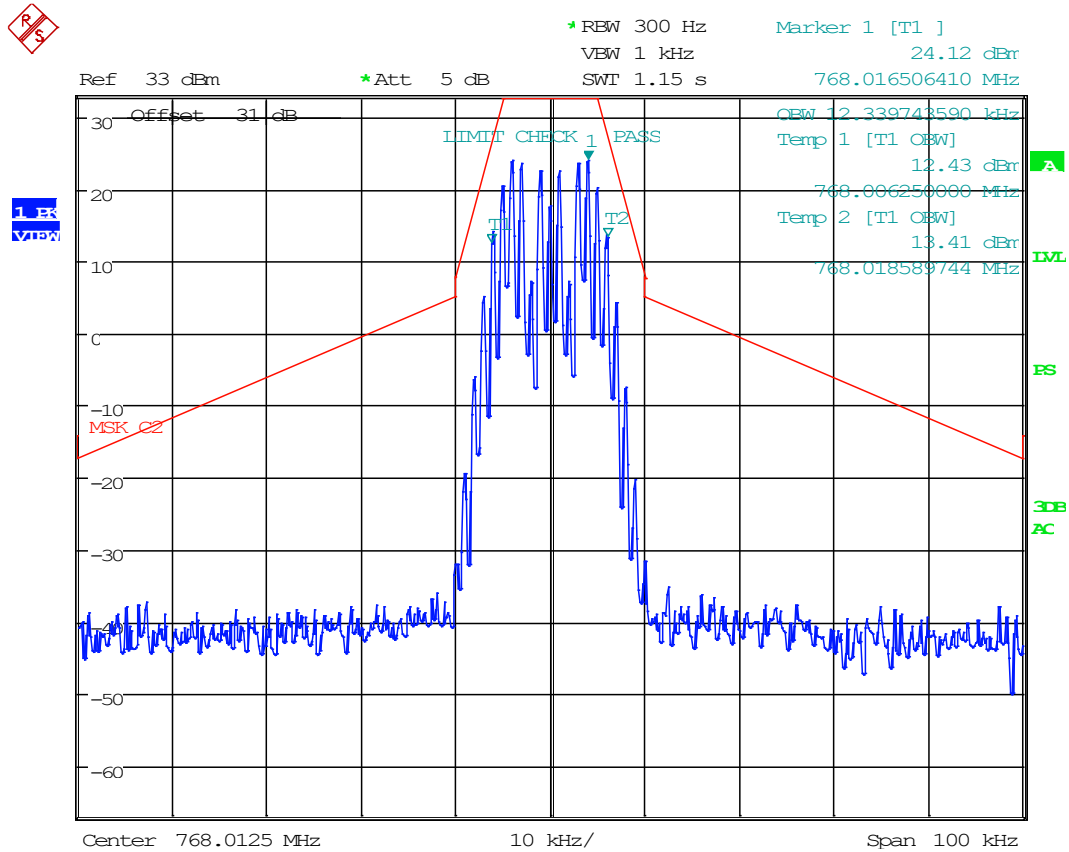
Date: 16.NOV.2020 12:31:23

8.5.21 AWGN, Uplink, AGC +3



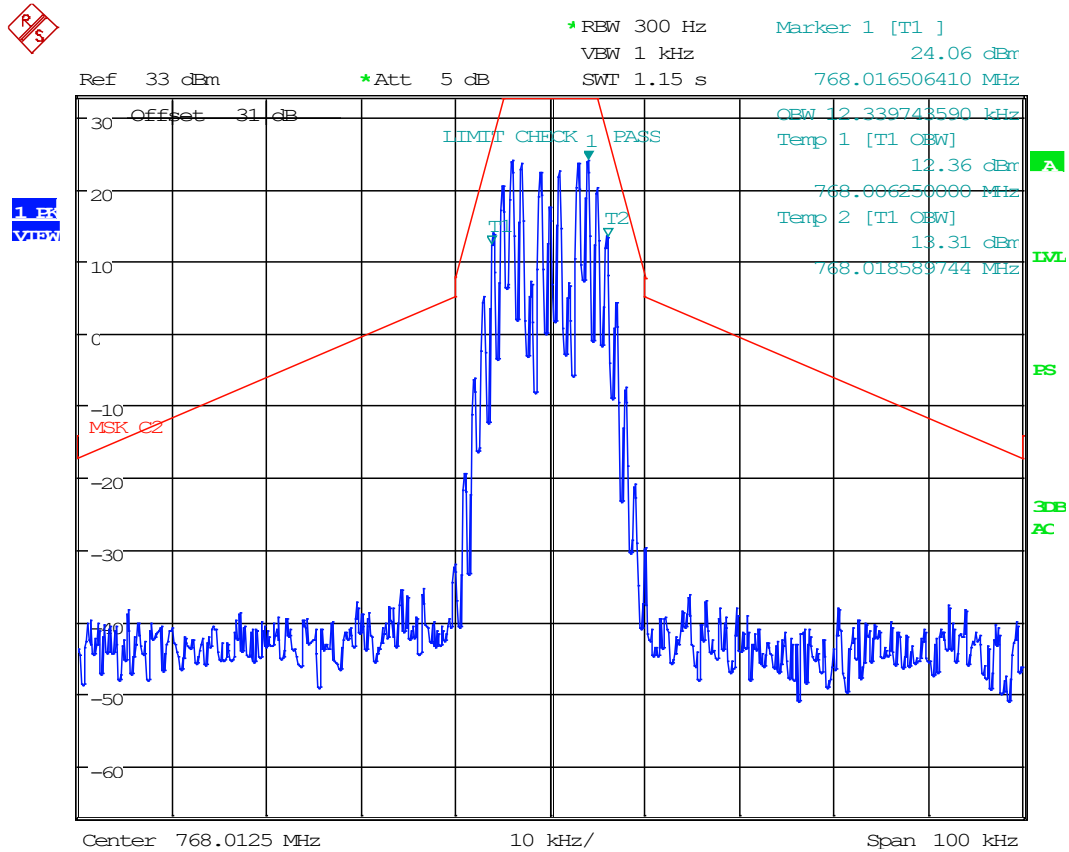
Date: 16.NOV.2020 12:32:09

8.5.22 25 kHz FM, Downlink, AGC



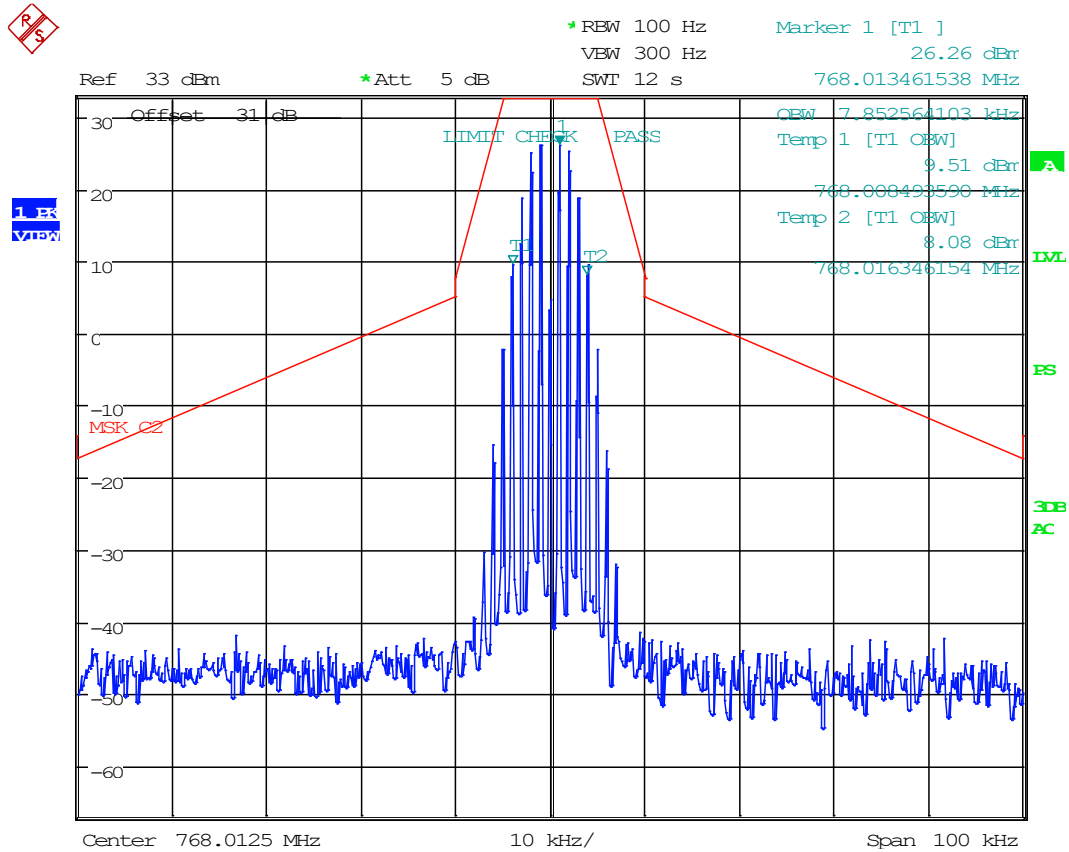
Date: 4.NOV.2020 16:06:46

8.5.23 25 kHz FM, Downlink, AGC +3dB



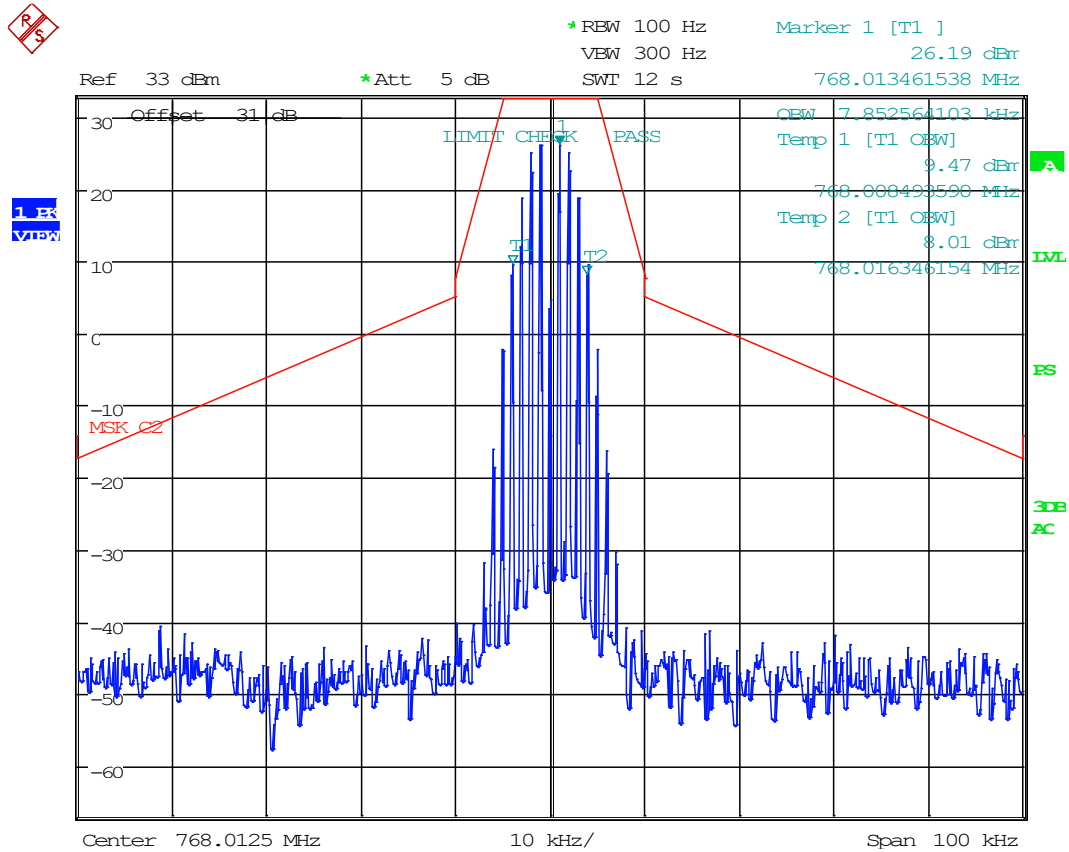
Date: 4.NOV.2020 16:06:31

8.5.24 12.5 kHz FM, Downlink, AGC



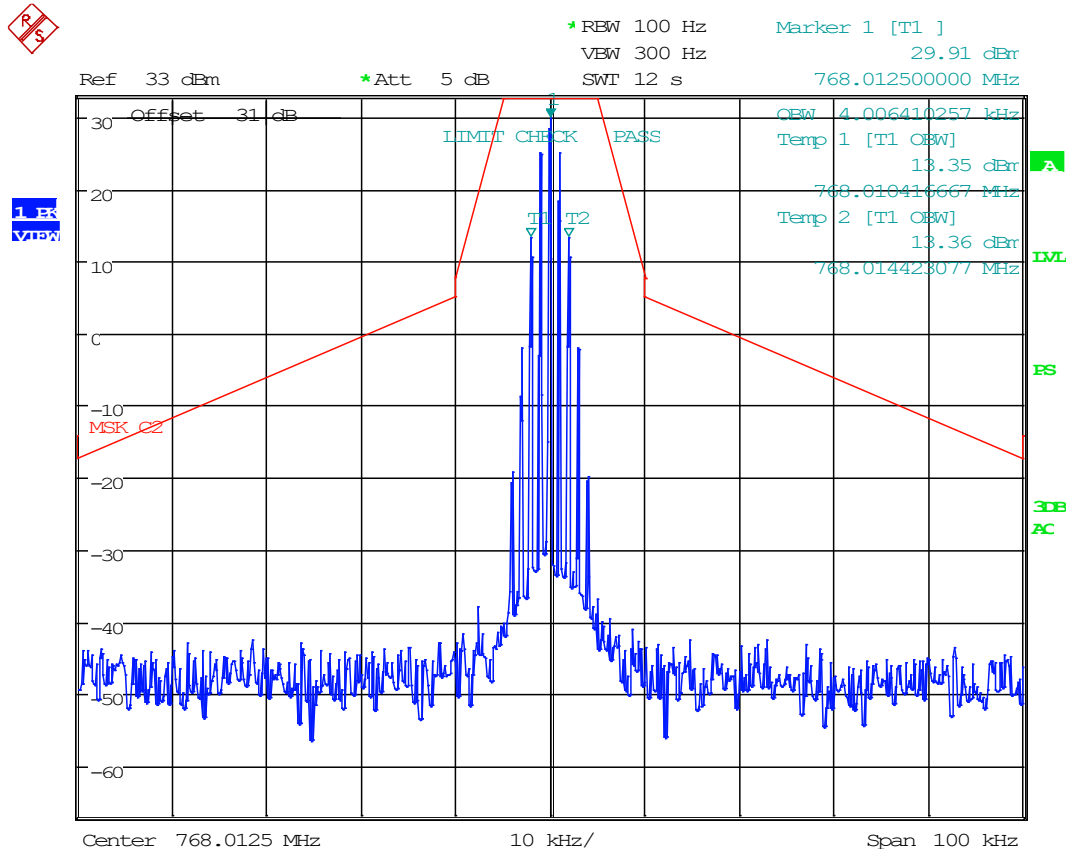
Date: 4.NOV.2020 16:08:59

8.5.25 12.5 kHz FM, Downlink, AGC +3dB



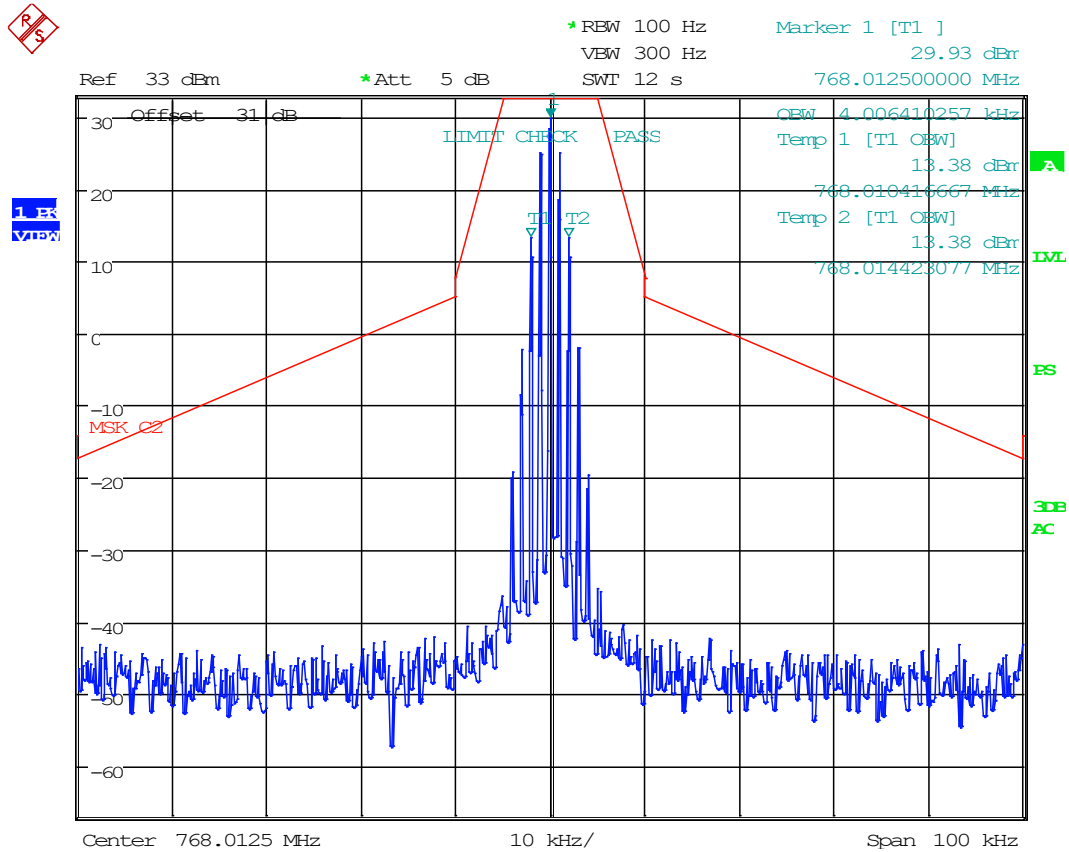
Date: 4.NOV.2020 16:09:21

8.5.26 6.25 kHz FM, Downlink, AGC



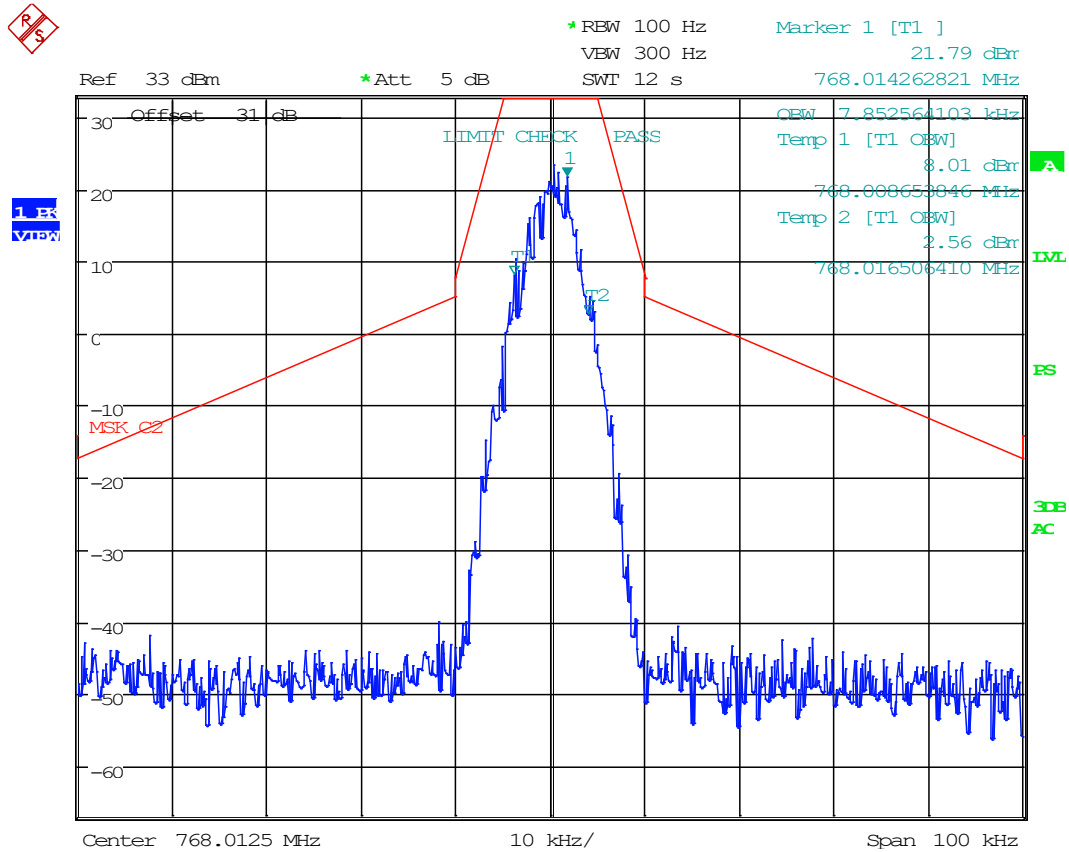
Date: 4.NOV.2020 16:10:05

8.5.27 6.25 kHz FM, Downlink, AGC +3dB



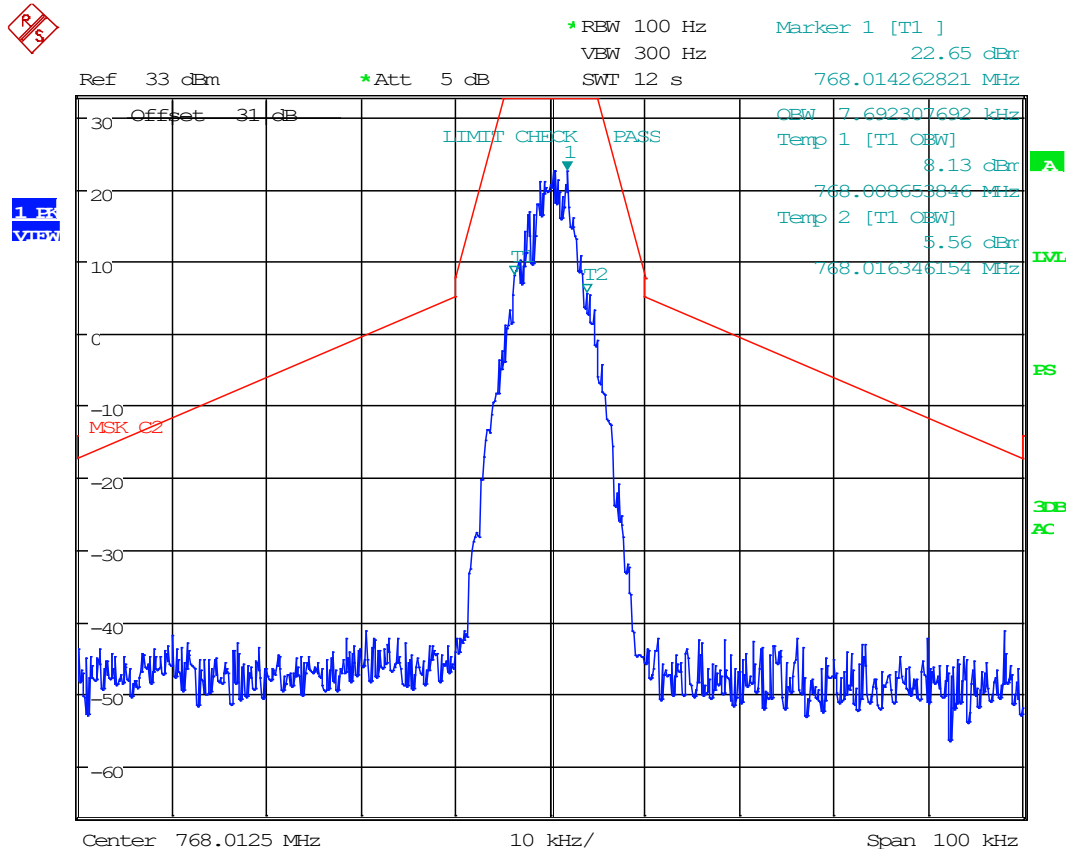
Date: 4.NOV.2020 16:09:42

8.5.28 C4FM, Downlink, AGC



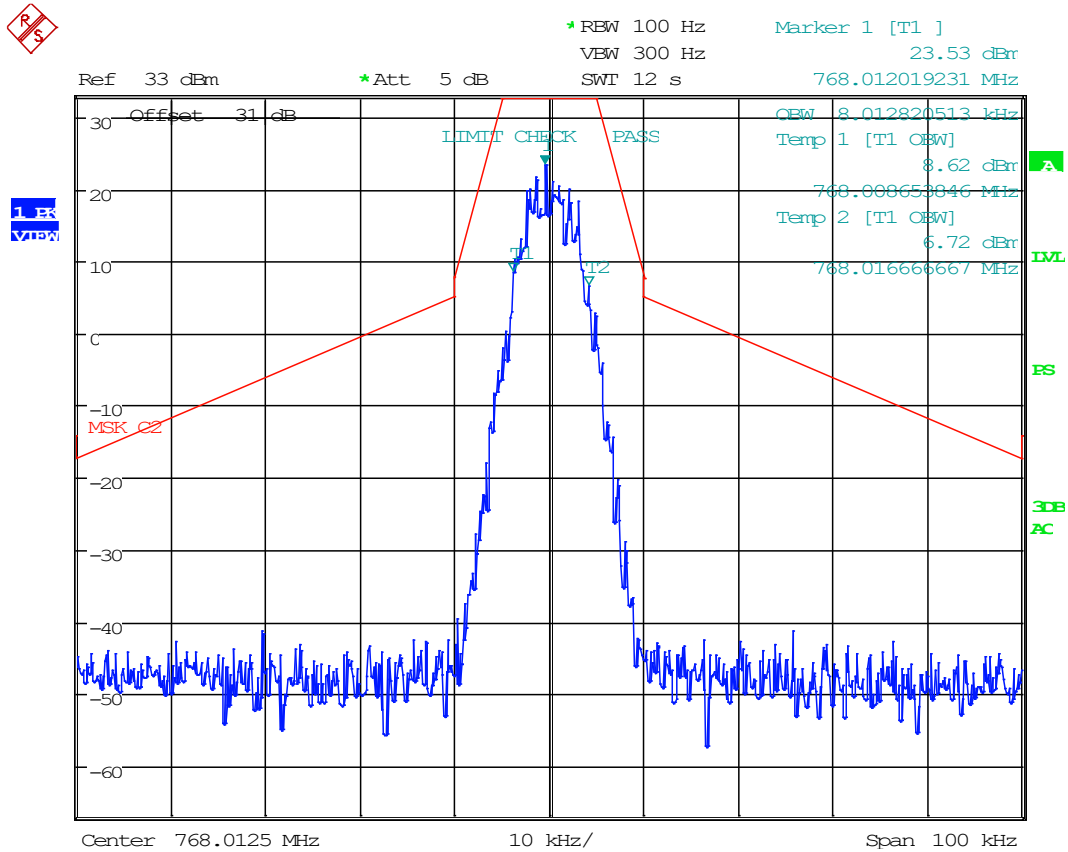
Date: 4.NOV.2020 16:17:18

8.5.29 C4FM, Downlink, AGC +3dB



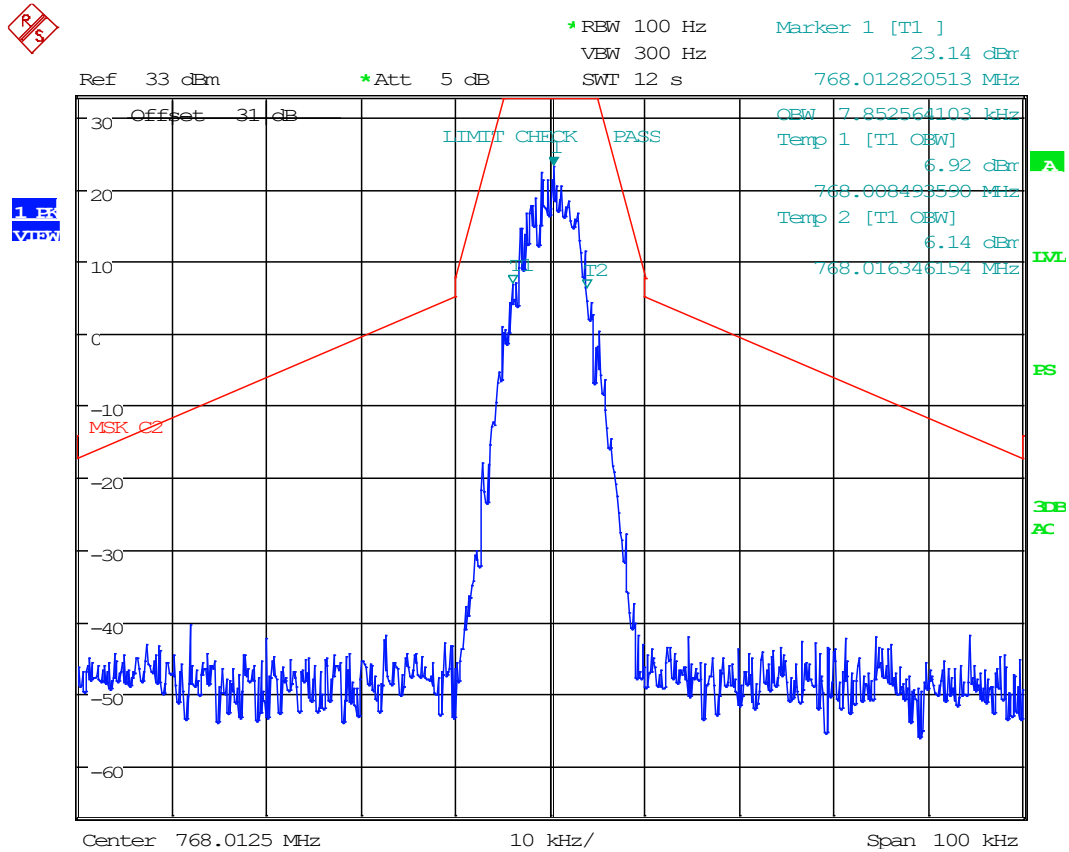
Date: 4.NOV.2020 16:16:56

8.5.30 H-CPM, Downlink, AGC



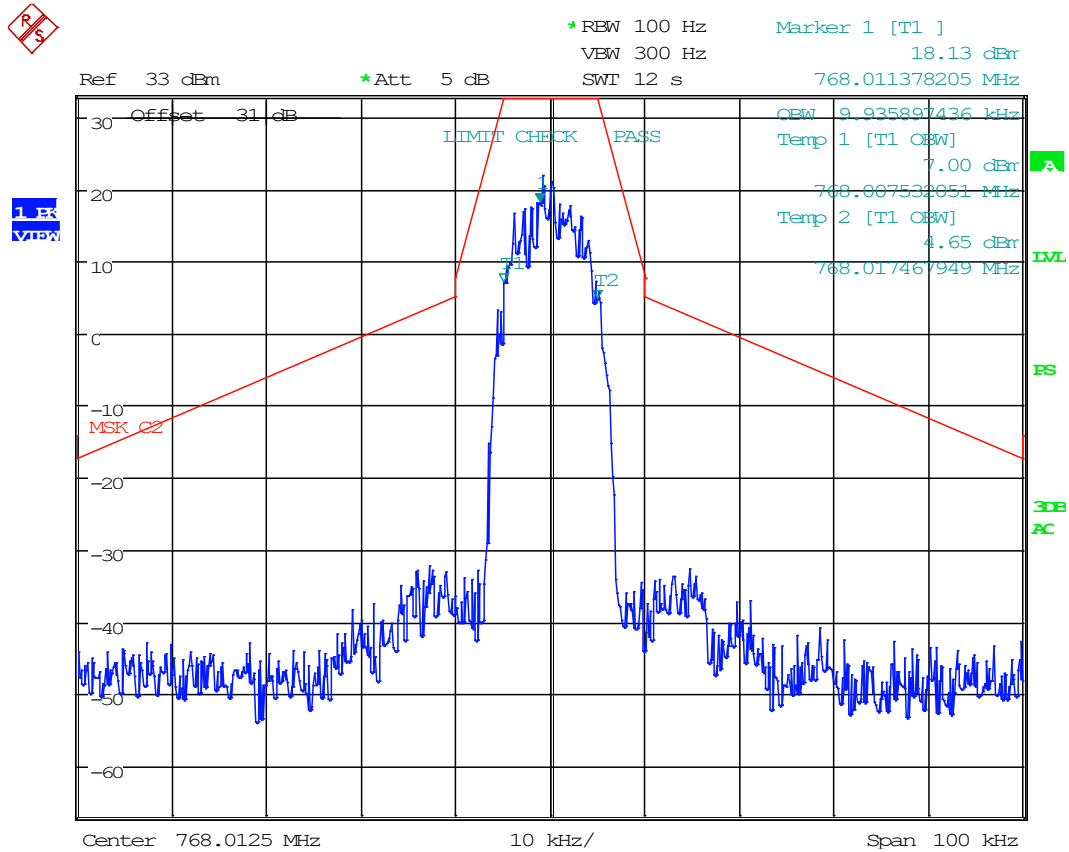
Date: 4.NOV.2020 16:16:01

8.5.31 H-CPM, Downlink, AGC +3dB



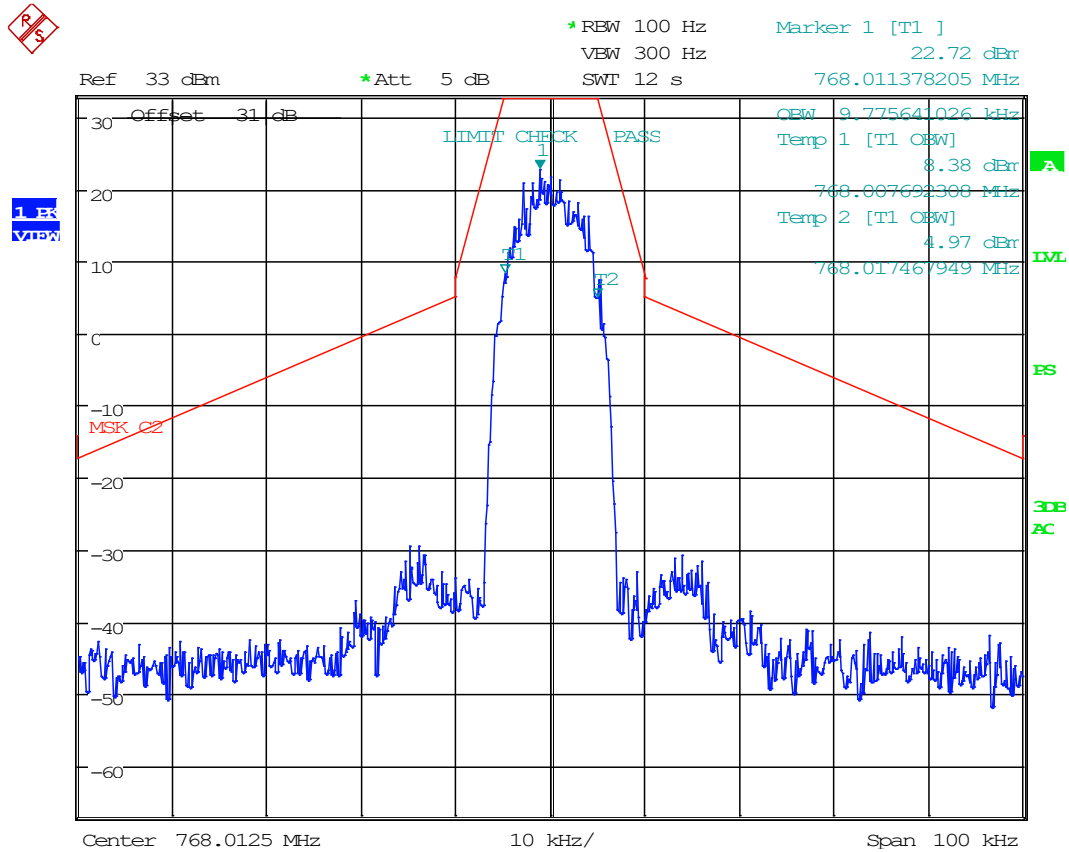
Date: 4.NOV.2020 16:16:26

8.5.32 H-DQPSK, Downlink, AGC



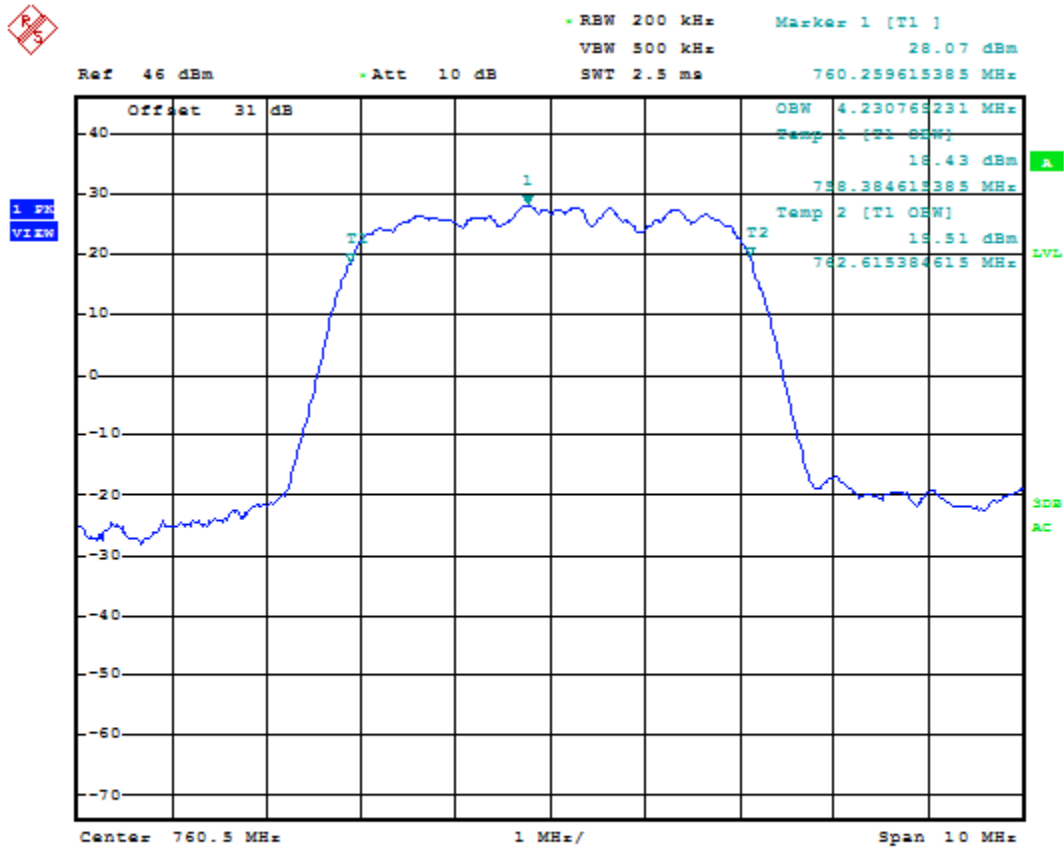
Date: 4.NOV.2020 16:15:28

8.5.33 H-DQPSK, Downlink, AGC +3dB



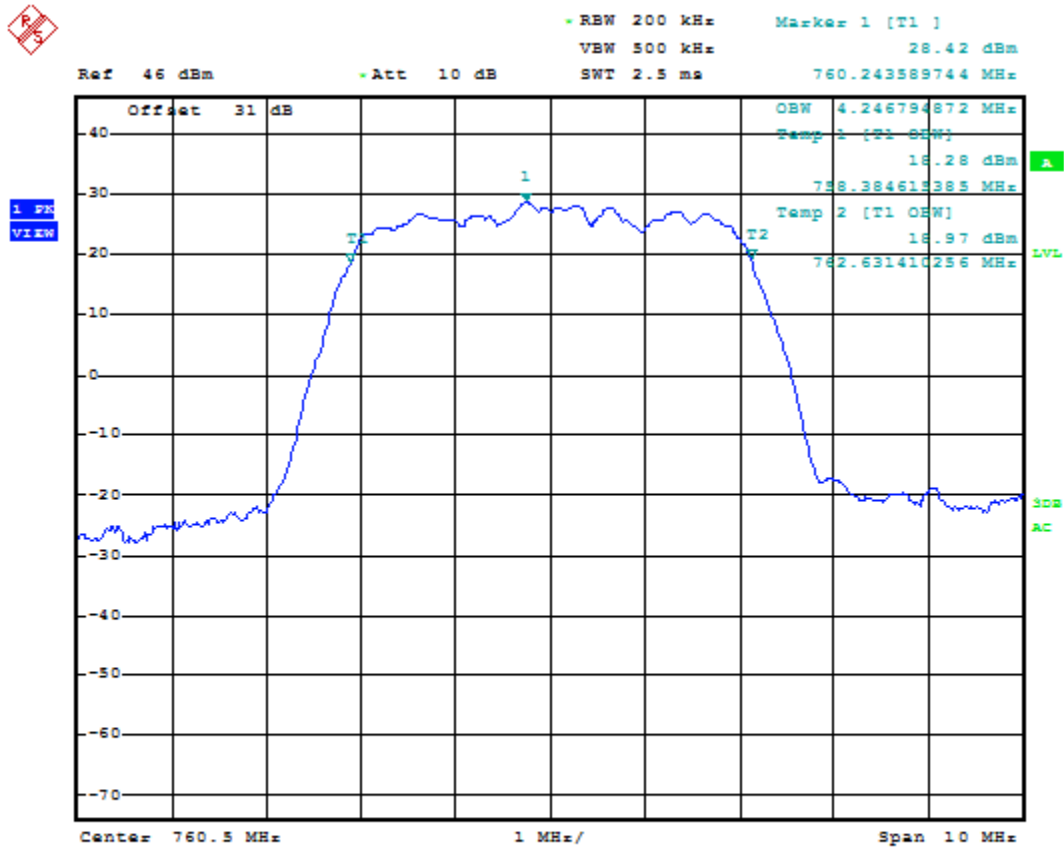
Date: 4.NOV.2020 16:14:59

8.5.34 AWGN, Downlink, AGC



Date: 16.NOV.2020 12:29:42

8.5.35 AWGN, Downlink, AGC +3

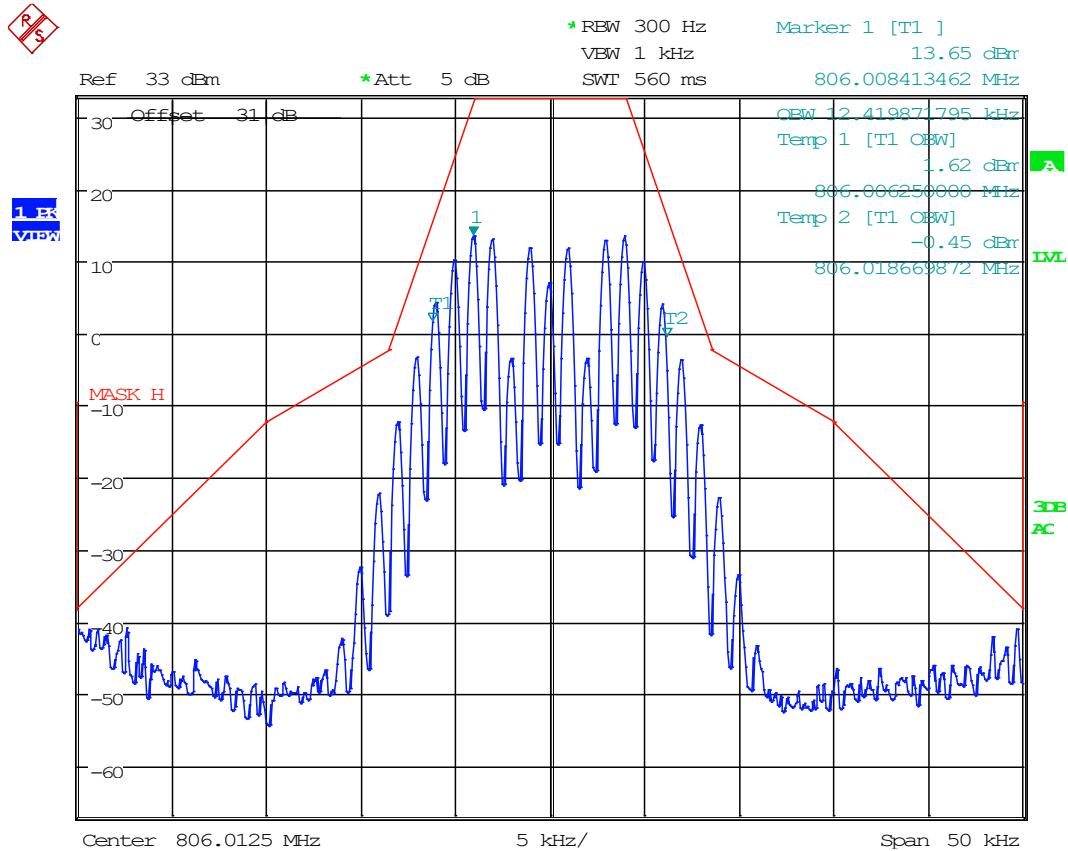


Date: 16.NOV.2020 12:28:13



Input VS Output, Output Spectrum Plots, 800 Band

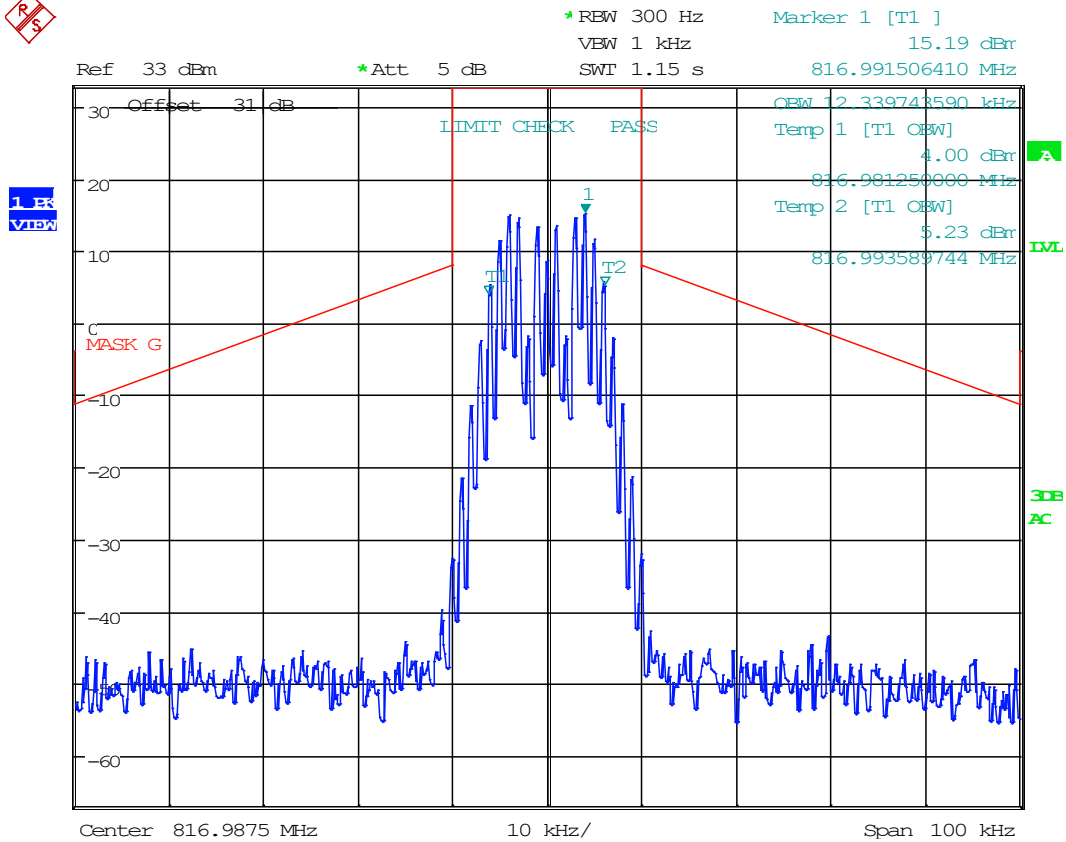
8.5.36 25 kHz FM, Uplink, AGC



Date: 5.NOV.2020 15:54:45

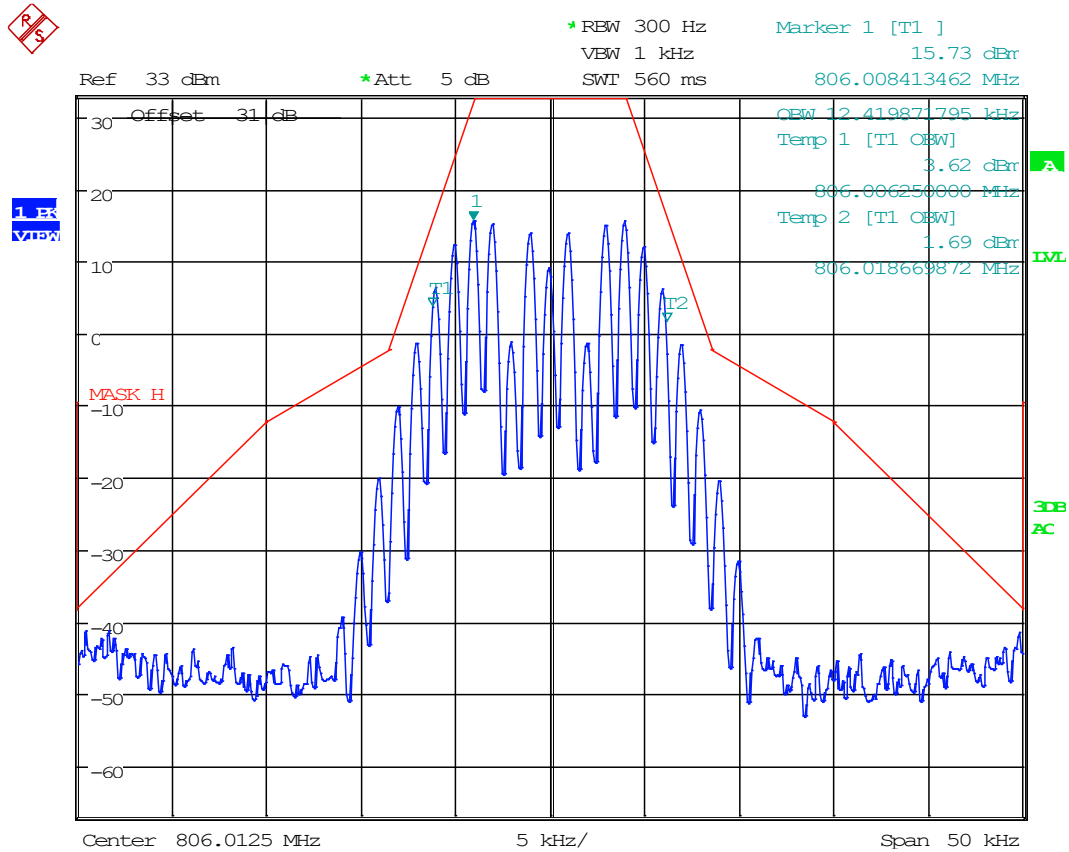


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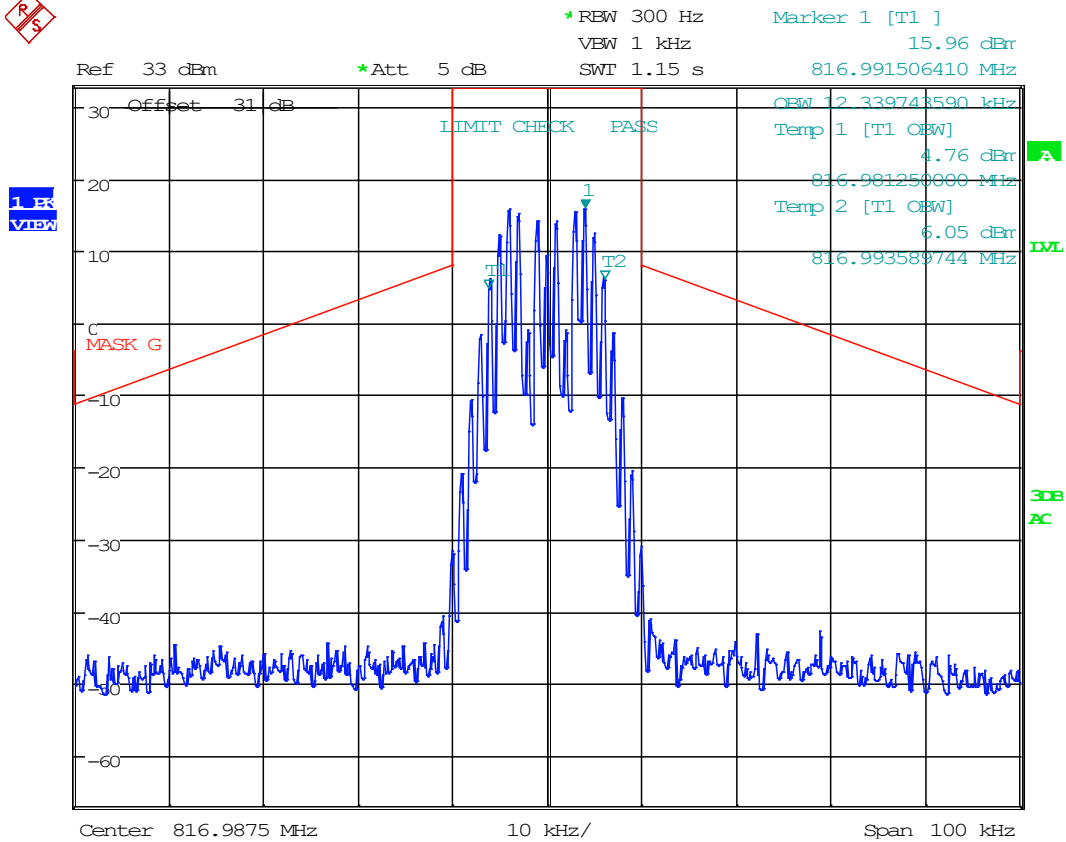


Date: 5.NOV.2020 16:18:25

8.5.37 25 kHz FM, Uplink, AGC +3dB

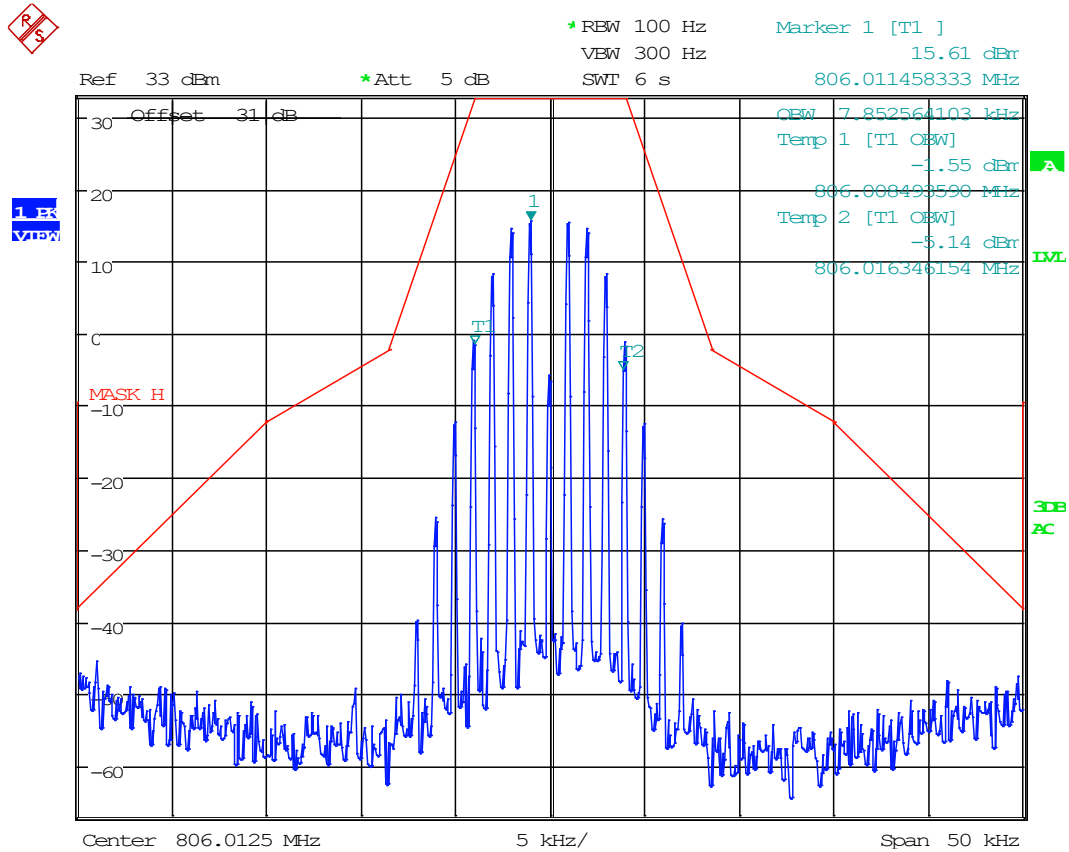


Date: 5.NOV.2020 15:54:28



Date: 5.NOV.2020 16:18:50

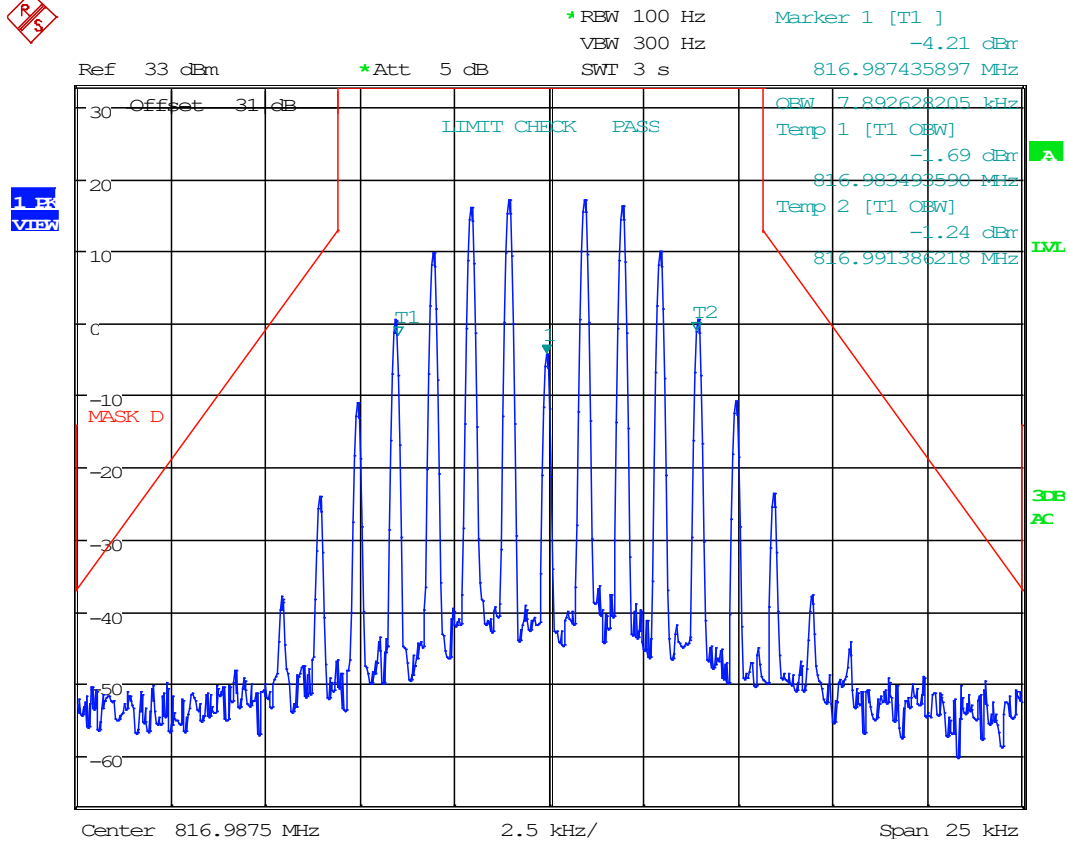
8.5.38 12.5 kHz FM, Uplink, AGC



Date: 5.NOV.2020 15:52:59

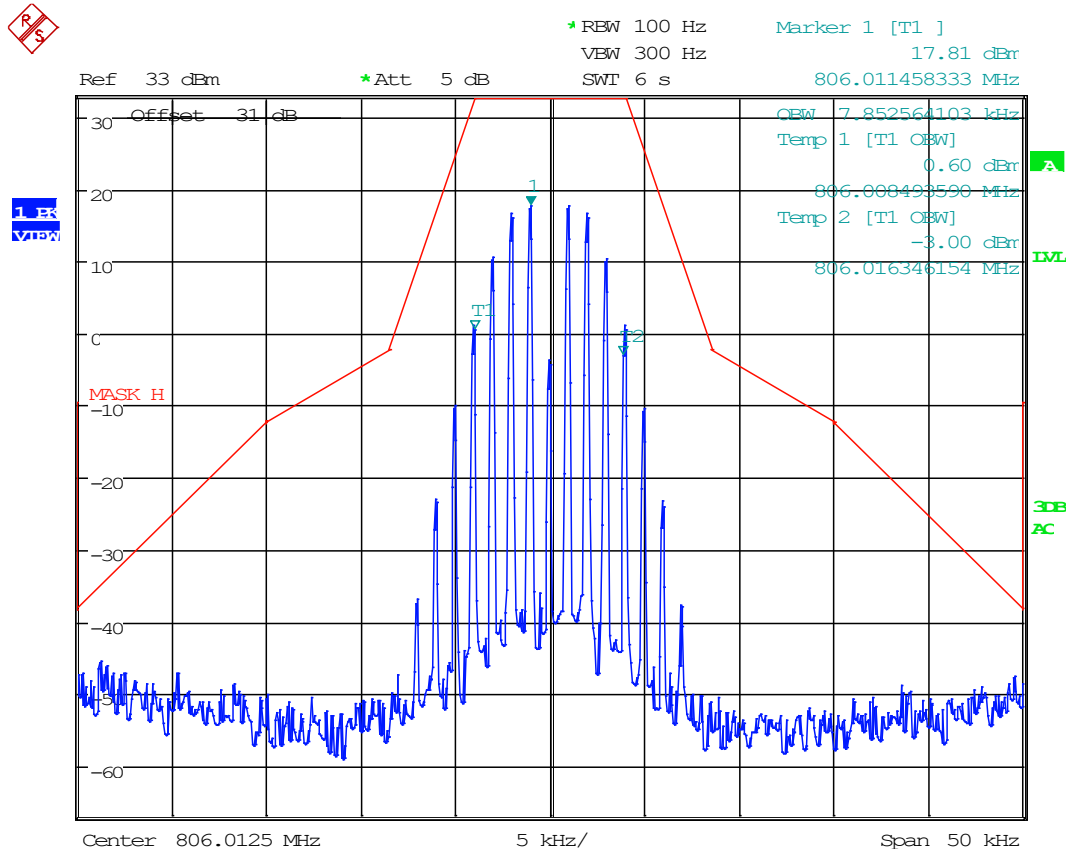


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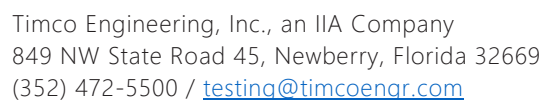


Date: 5.NOV.2020 16:01:15

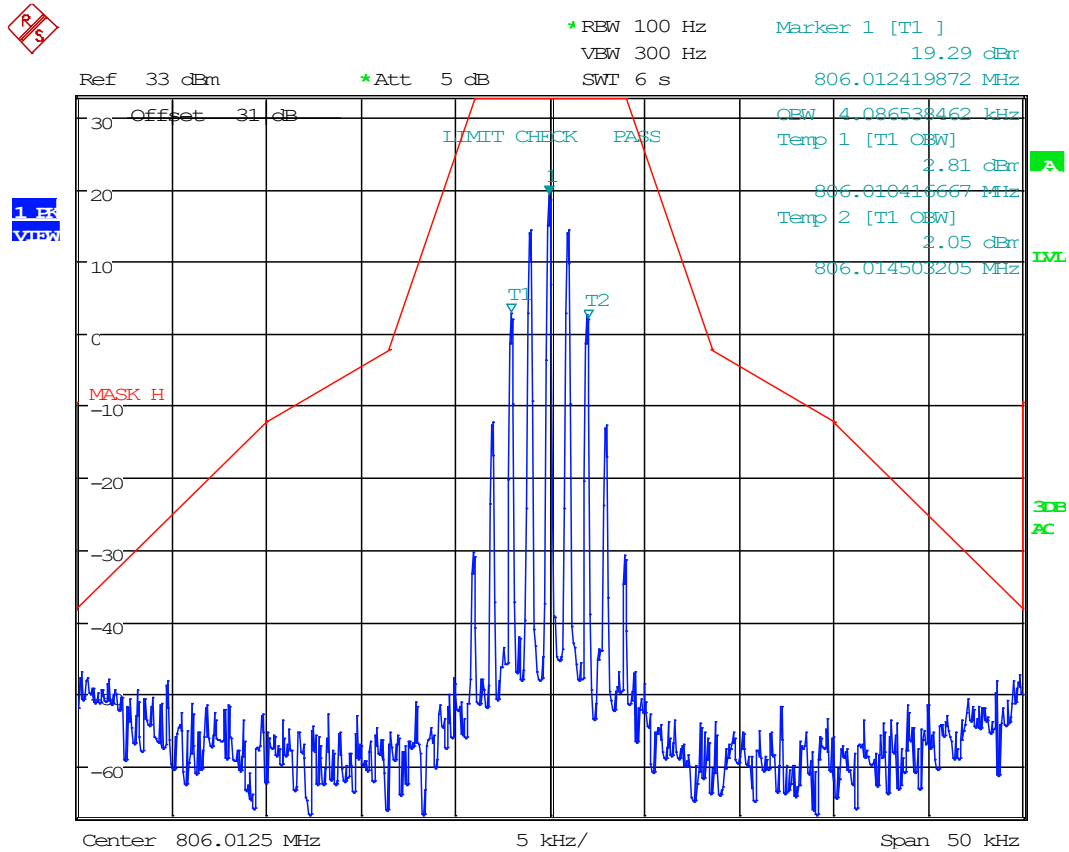
8.5.39 12.5 kHz FM, Uplink, AGC +3dB



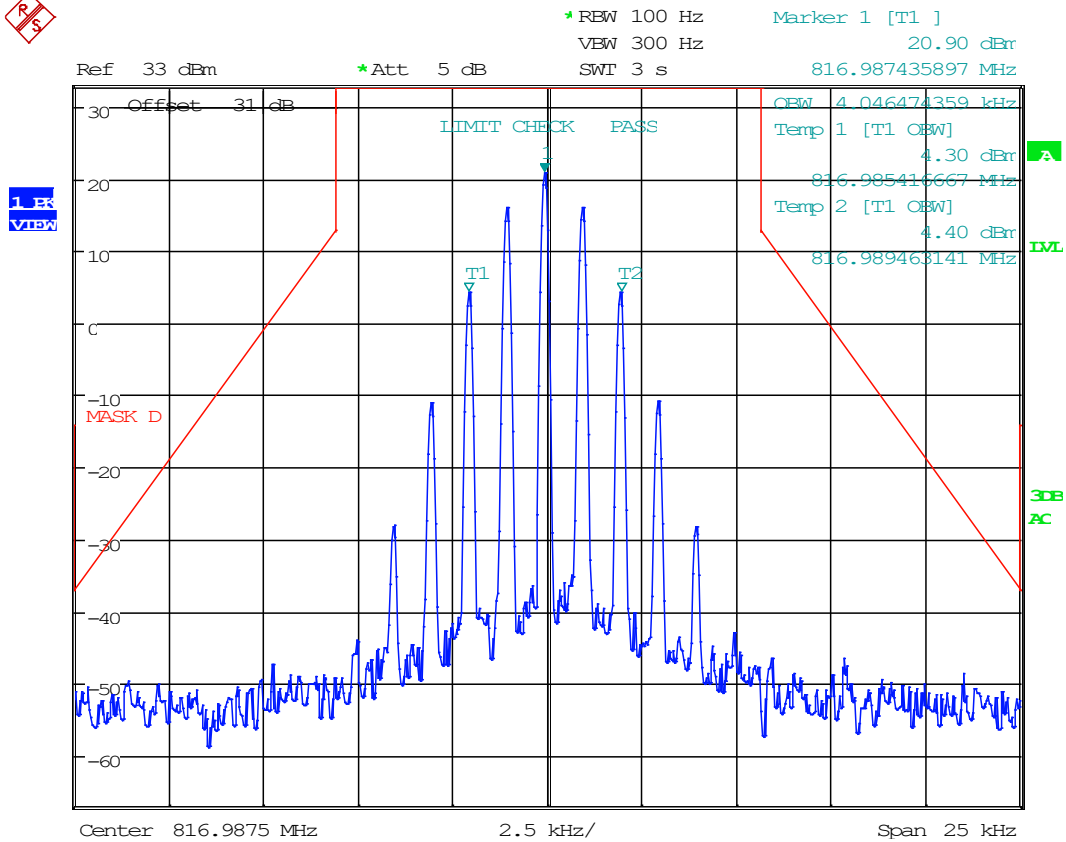
Date: 5.NOV.2020 15:53:56



8.5.40 6.25 kHz FM, Uplink, AGC

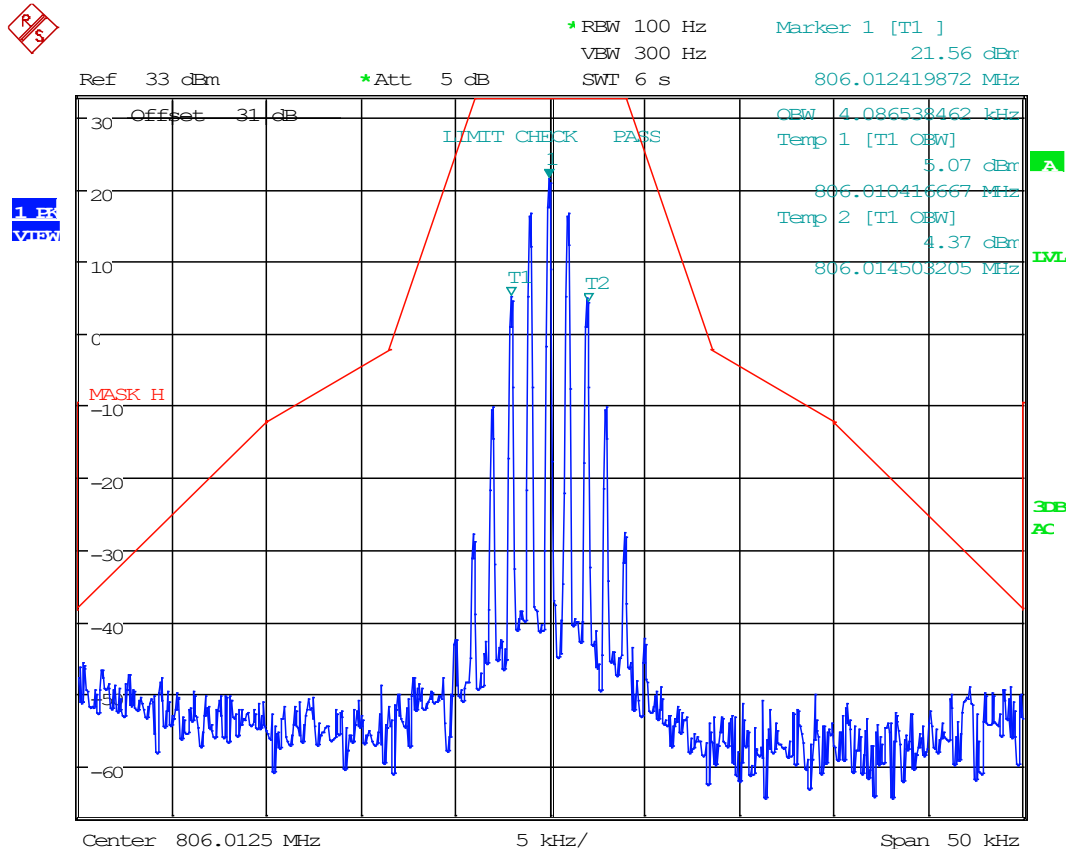


Date: 5.NOV.2020 15:48:04

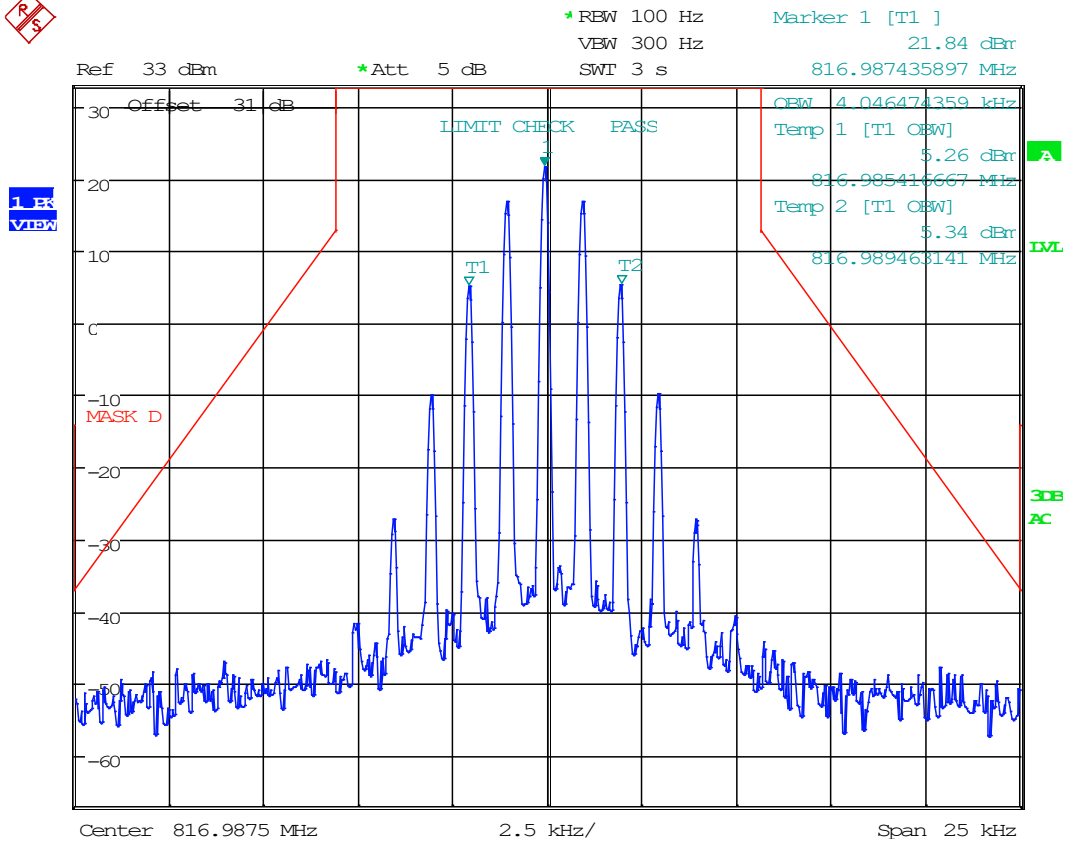


Date: 5.NOV.2020 15:59:55

8.5.41 6.25 kHz FM, Uplink, AGC +3dB

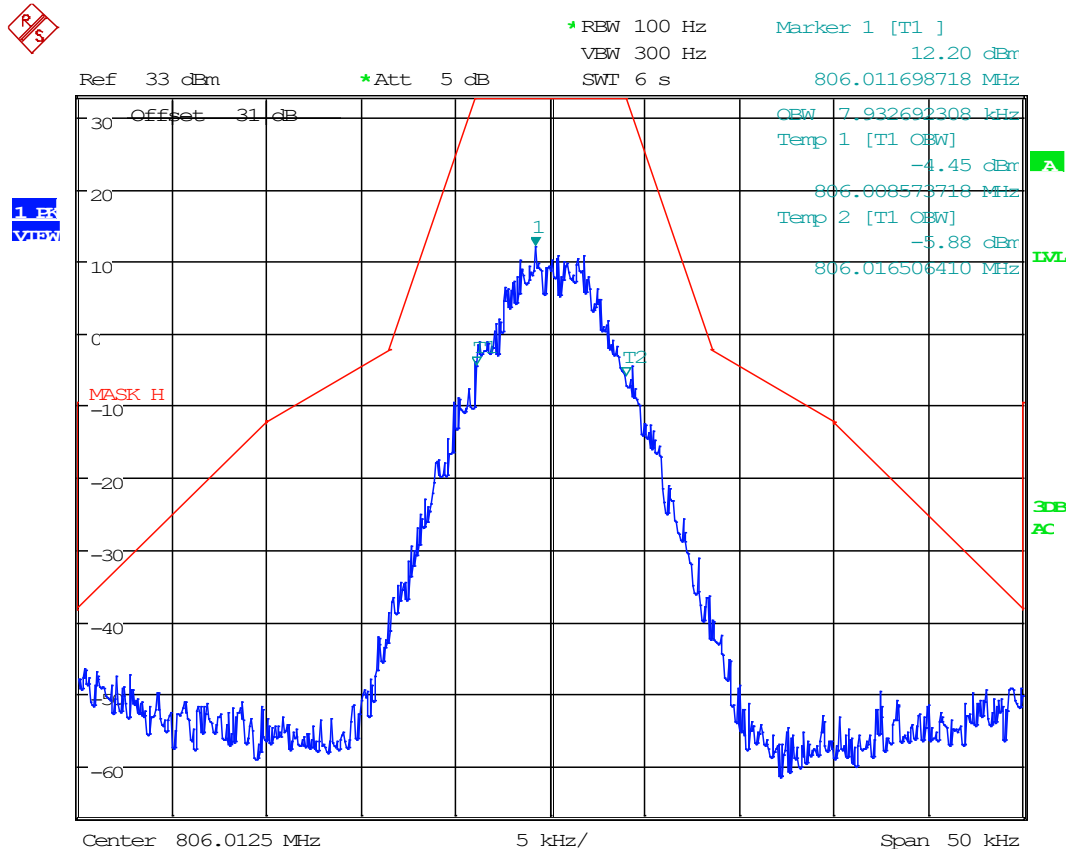


Date: 5.NOV.2020 15:48:28

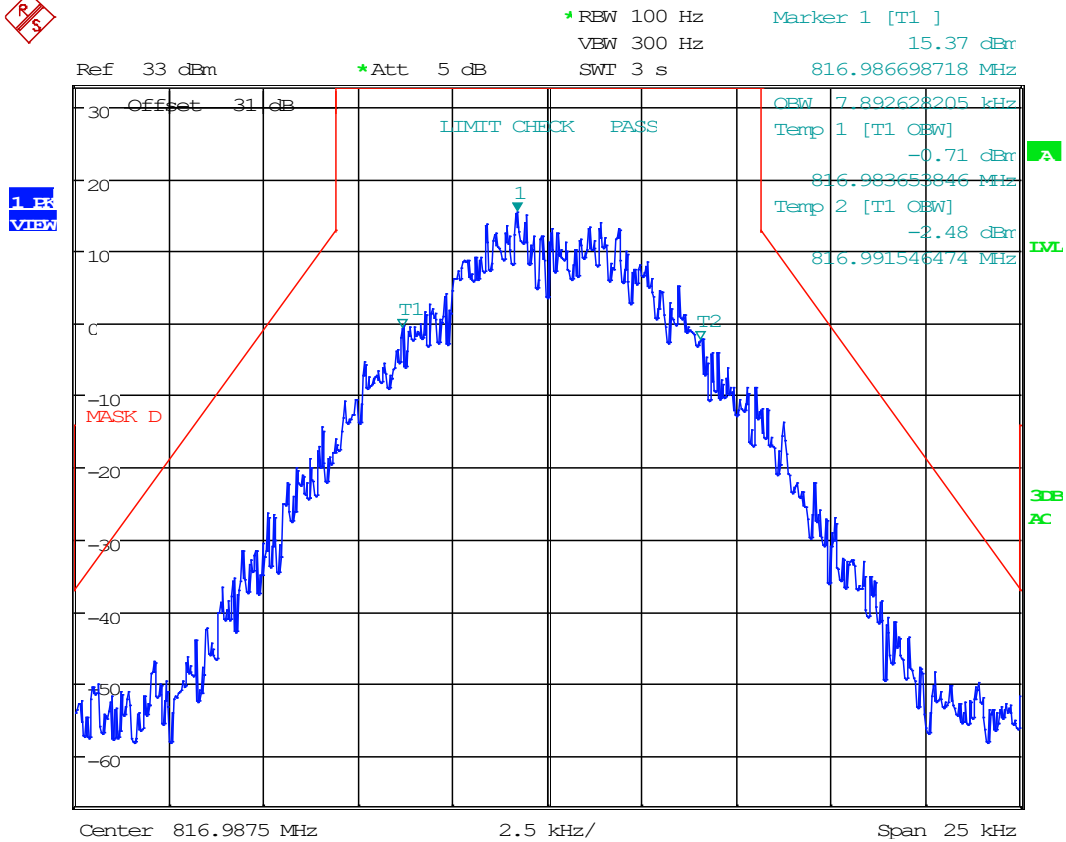


Date: 5.NOV.2020 16:00:18

8.5.42 C4FM, Uplink, AGC

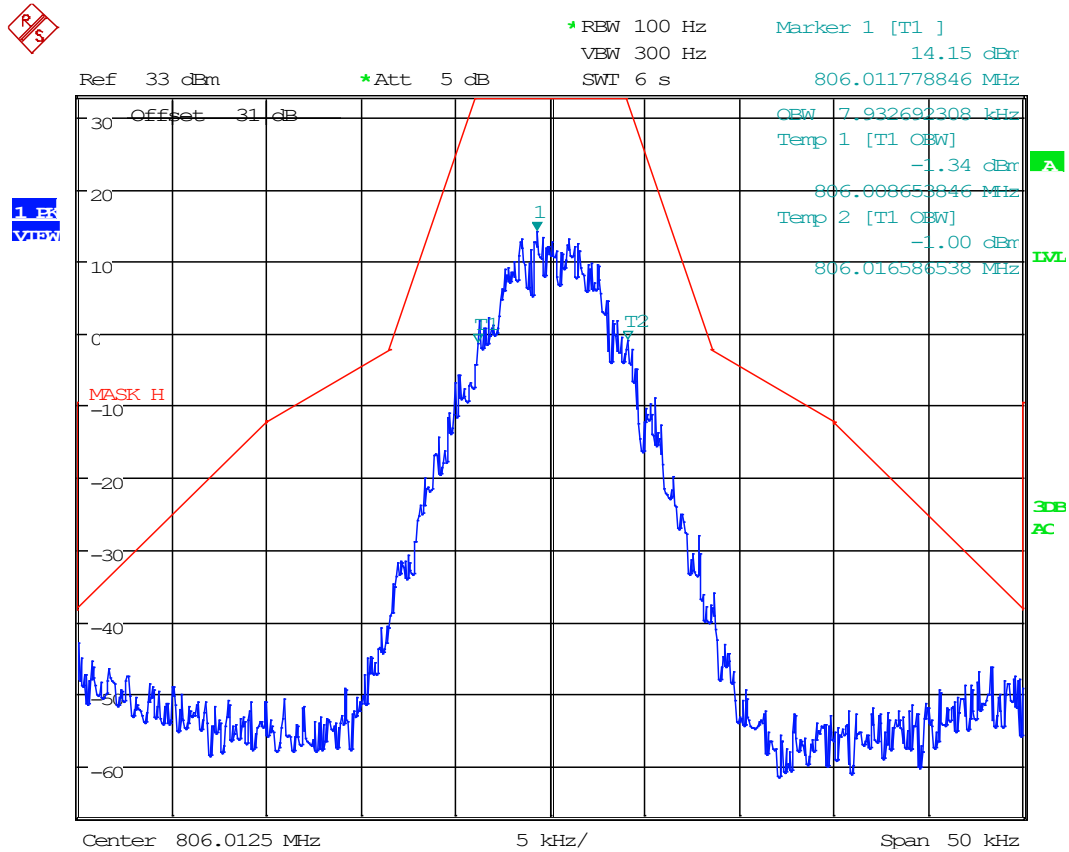


Date: 5.NOV.2020 15:55:49



Date: 5.NOV.2020 16:02:04

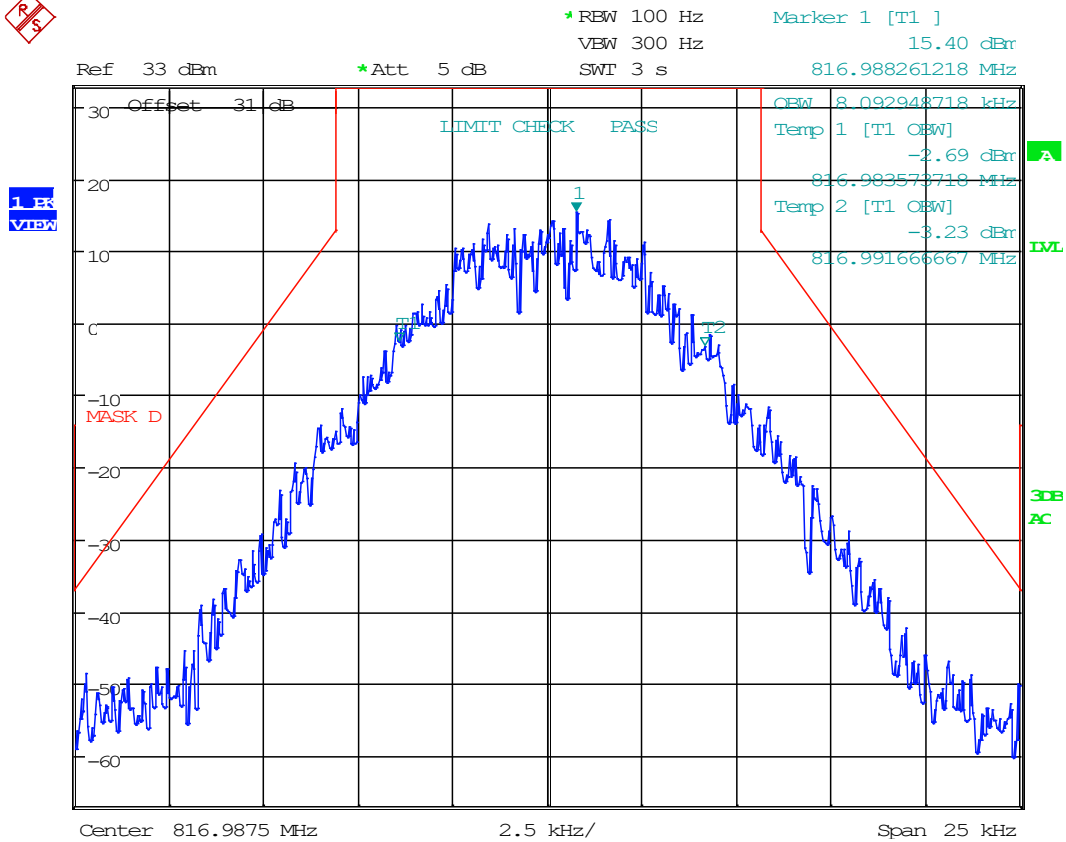
8.5.43 C4FM, Uplink, AGC +3dB



Date: 5.NOV.2020 15:56:14

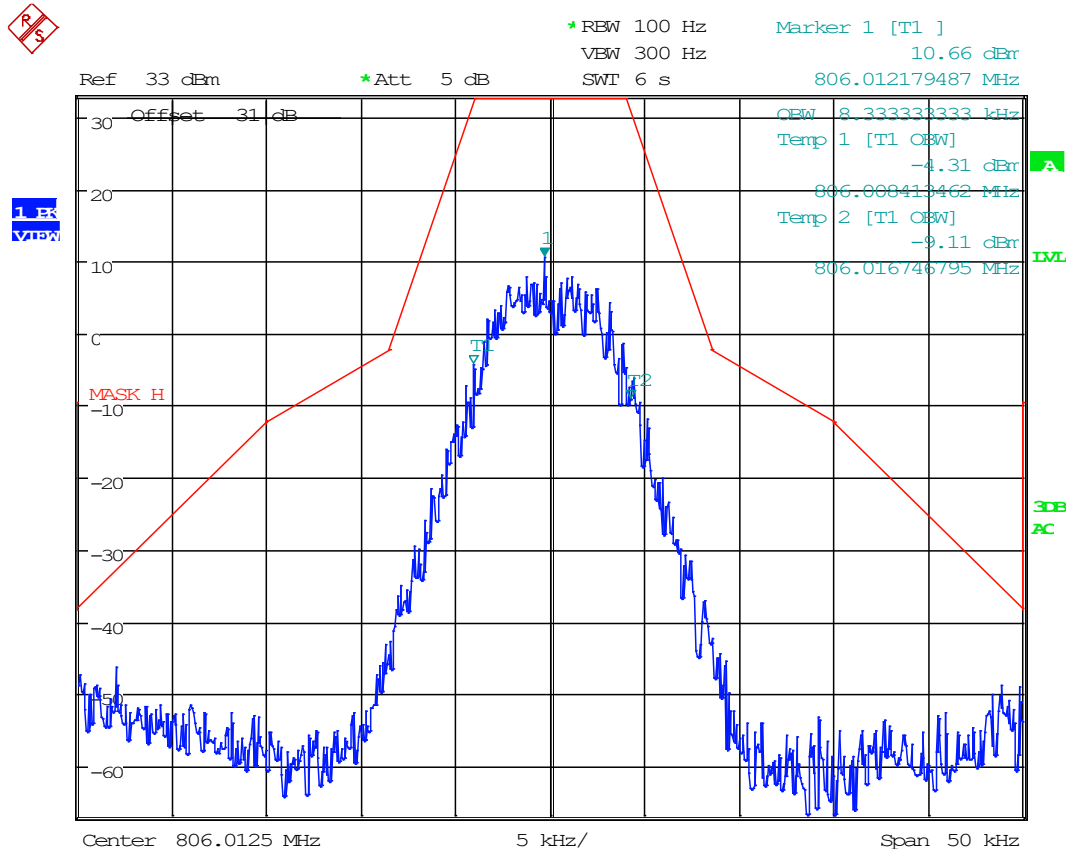


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Date: 5.NOV.2020 16:01:47

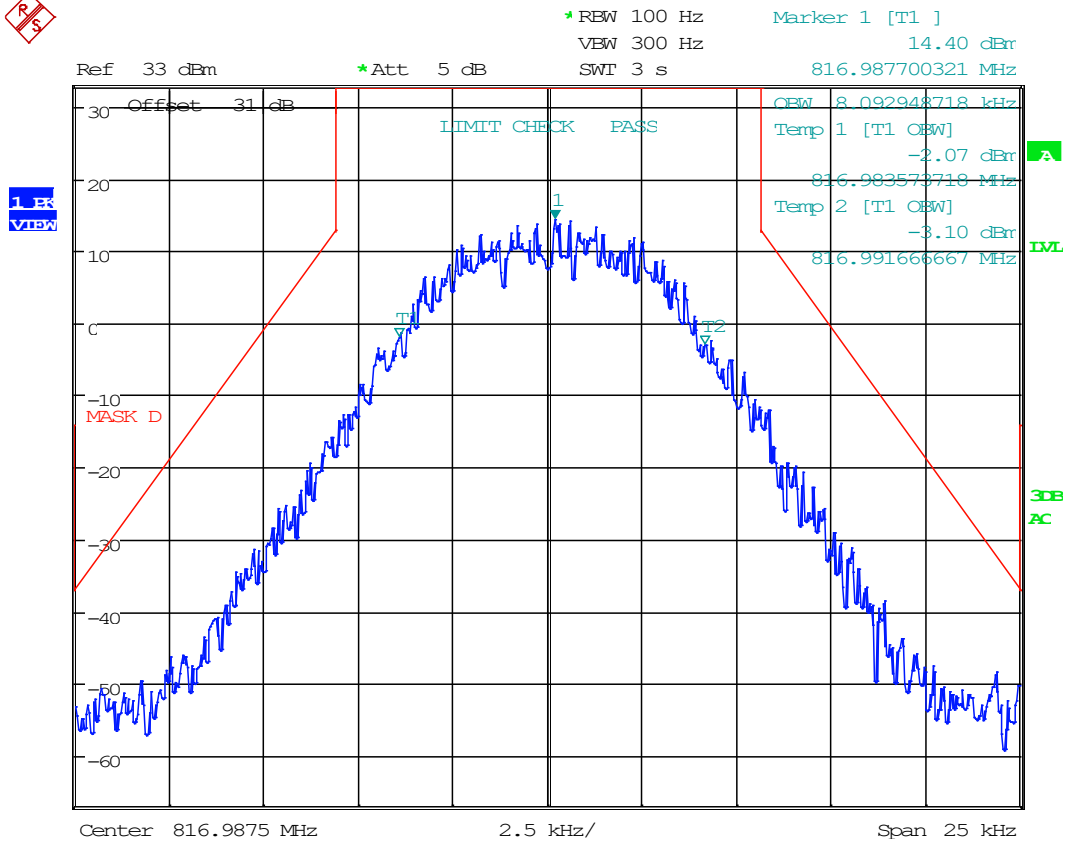
8.5.44 H-CPM, Uplink, AGC



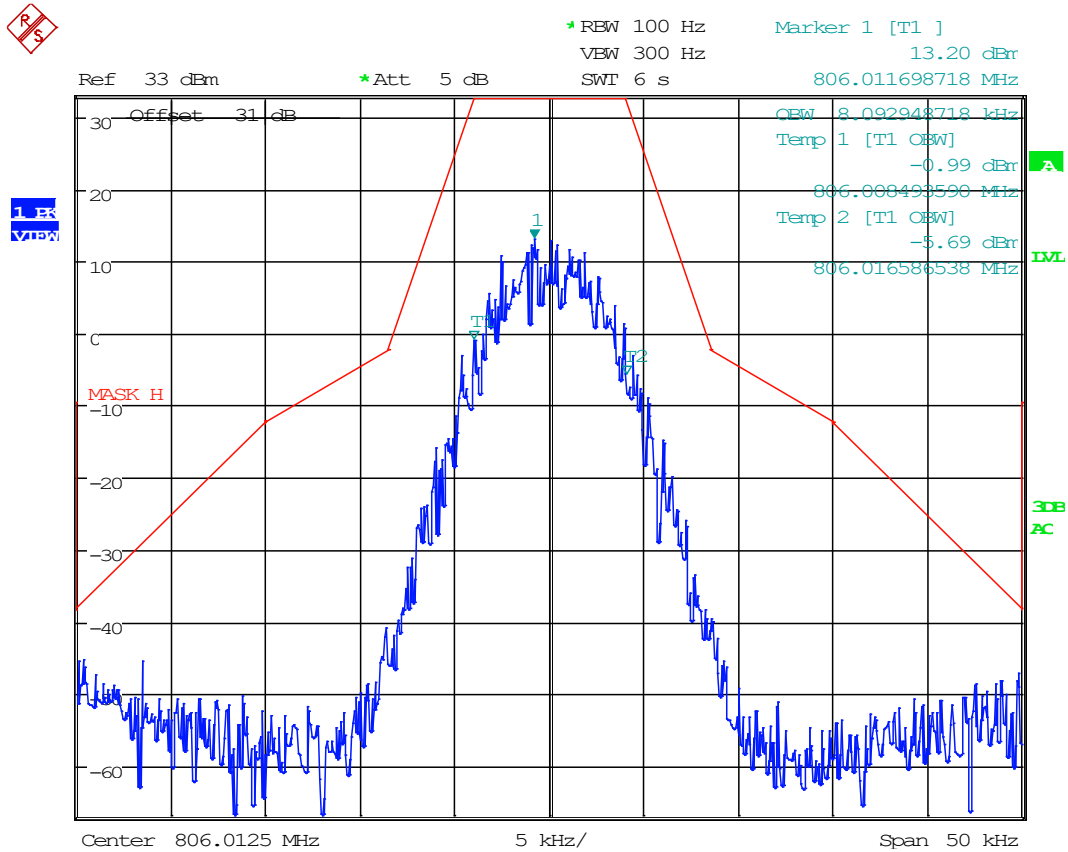
Date: 5.NOV.2020 15:57:17



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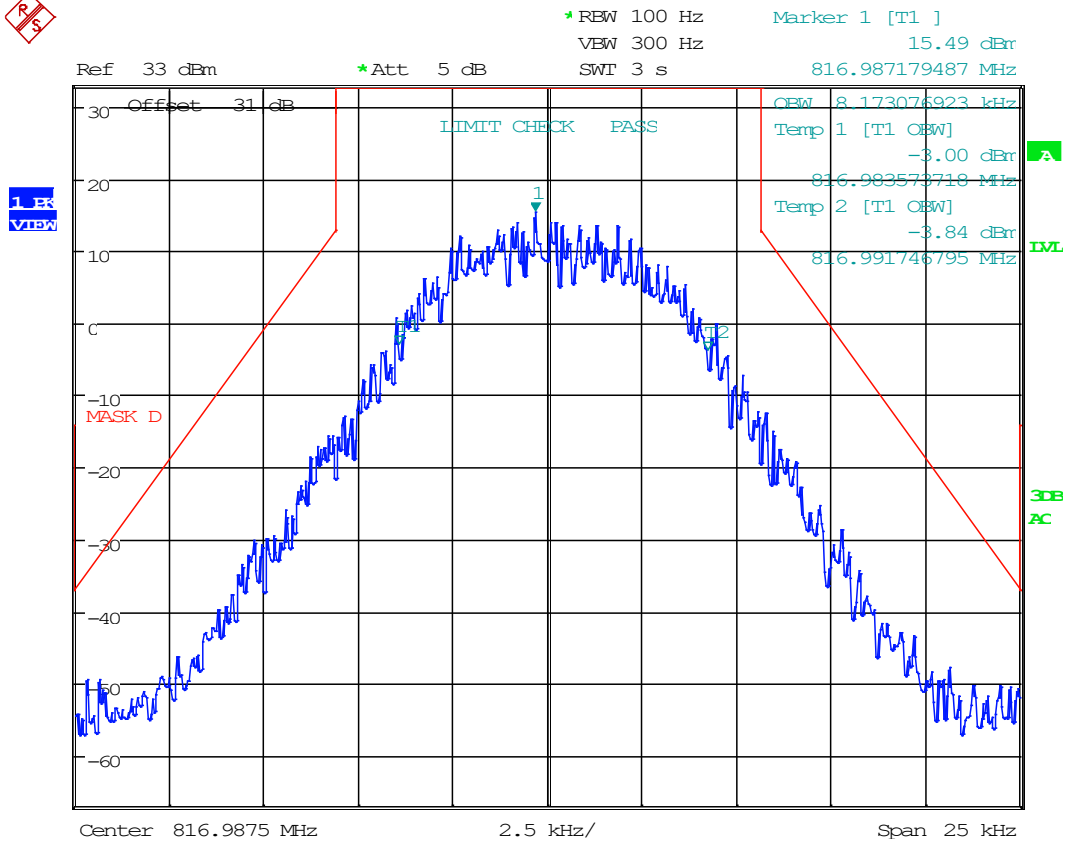
8.5.45 H-CPM, Uplink, AGC +3dB



Date: 5.NOV.2020 15:57:02

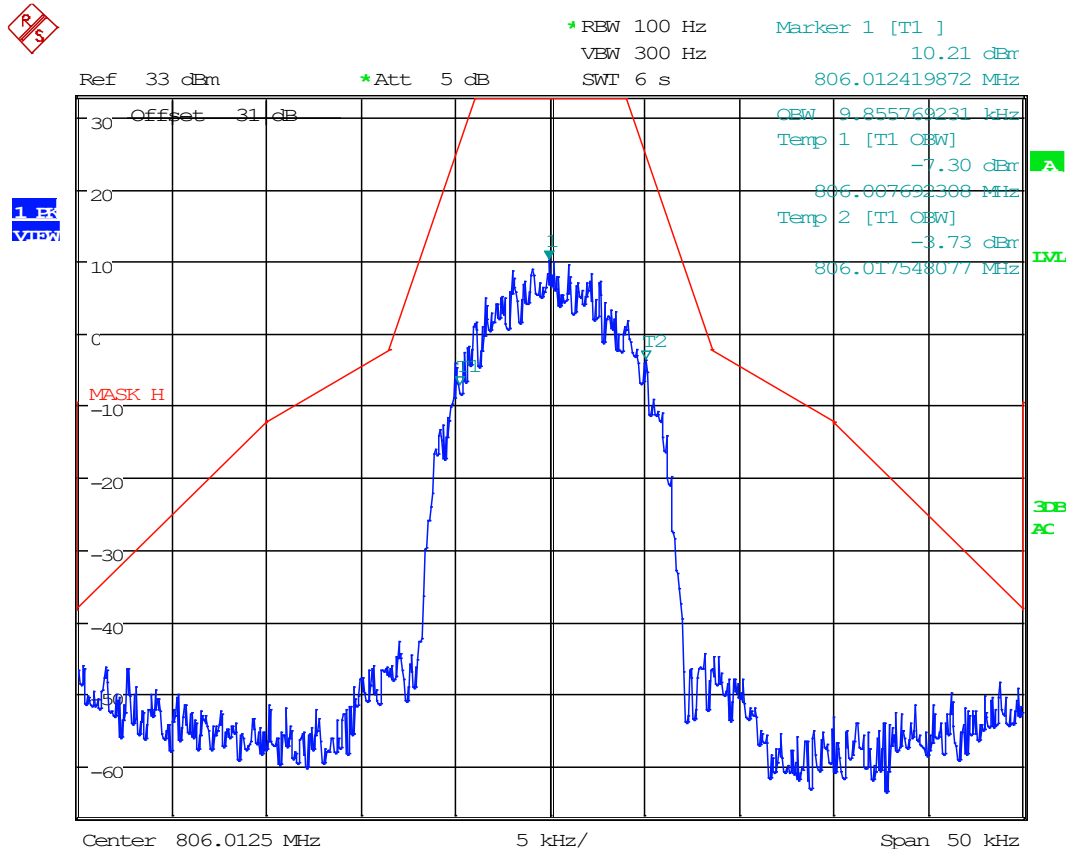


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Date: 5.NOV.2020 16:02:49

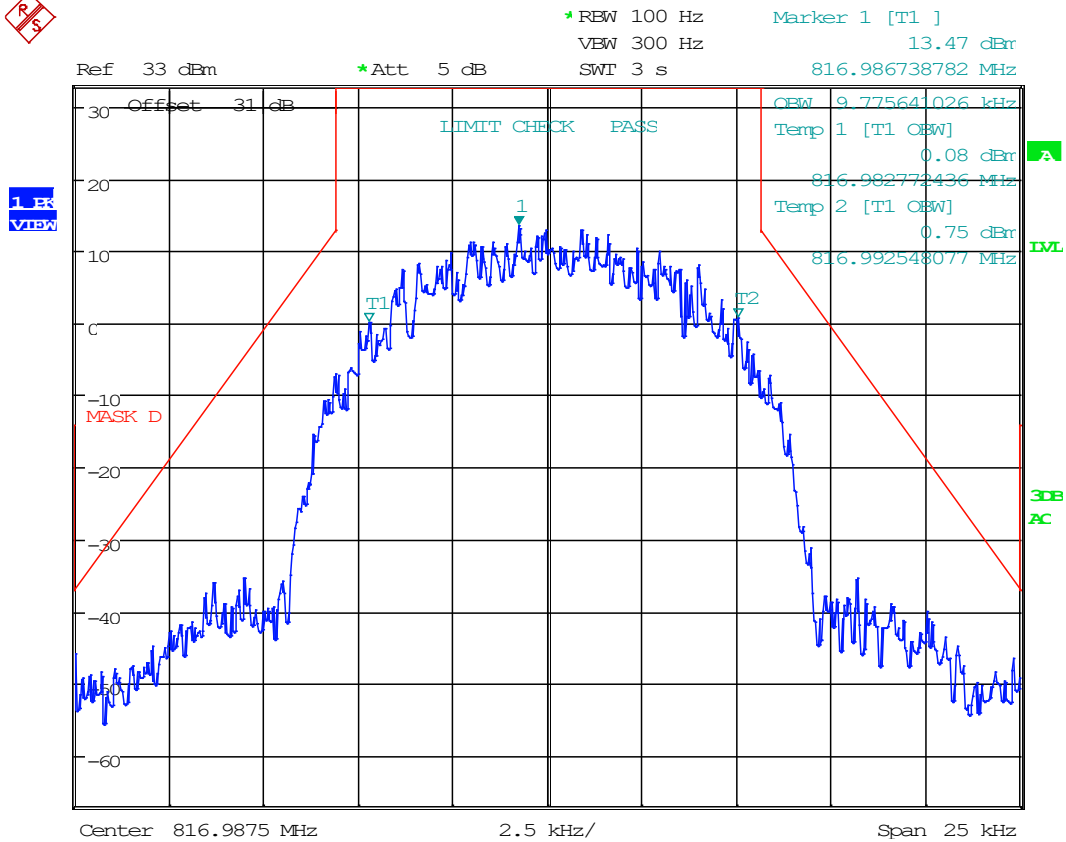
8.5.46 H-DQPSK, Uplink, AGC



Date: 5.NOV.2020 15:57:40

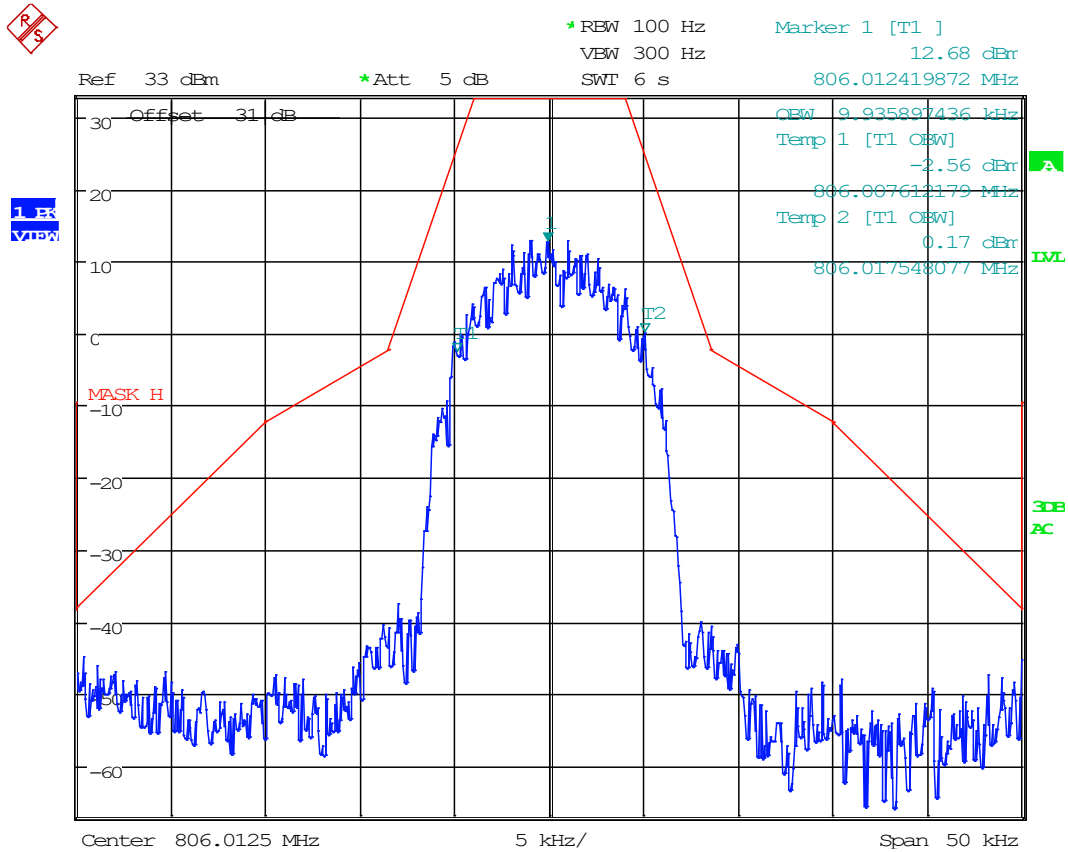


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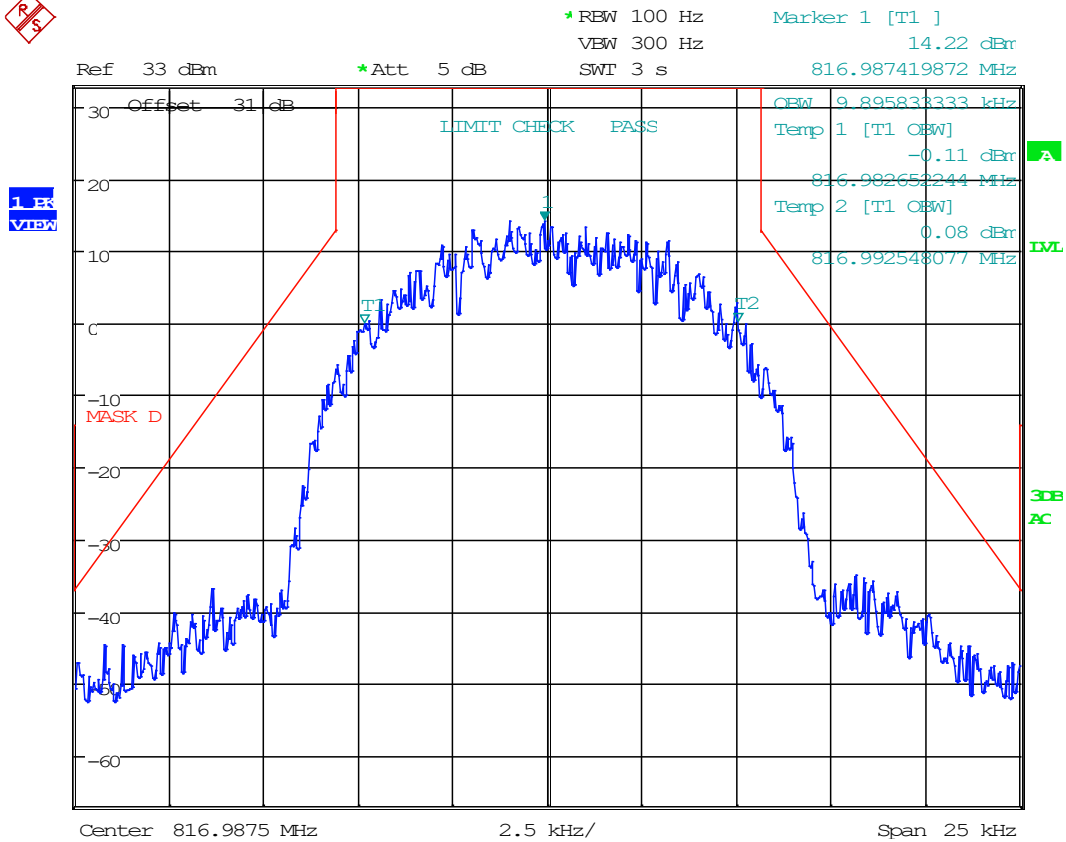


Date: 5.NOV.2020 16:03:33

8.5.47 H-DQPSK, Uplink, AGC +3dB

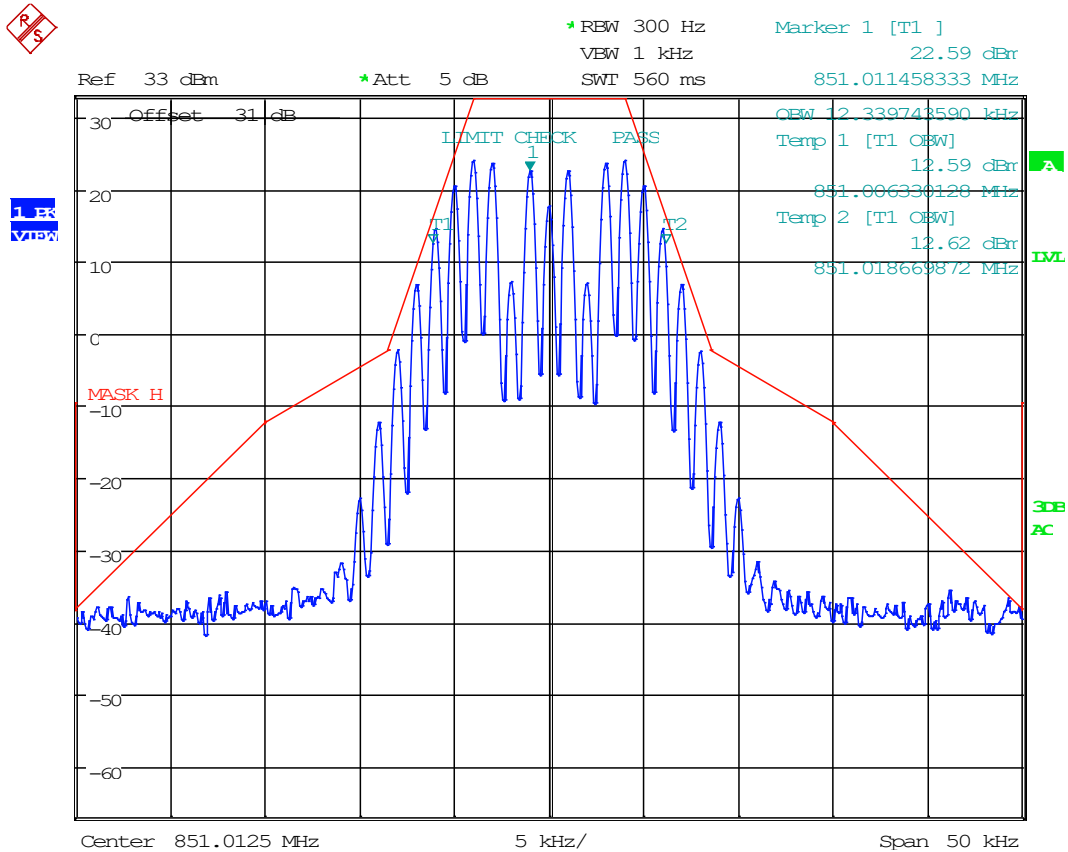


Date: 5.NOV.2020 15:58:01



Date: 5.NOV.2020 16:03:13

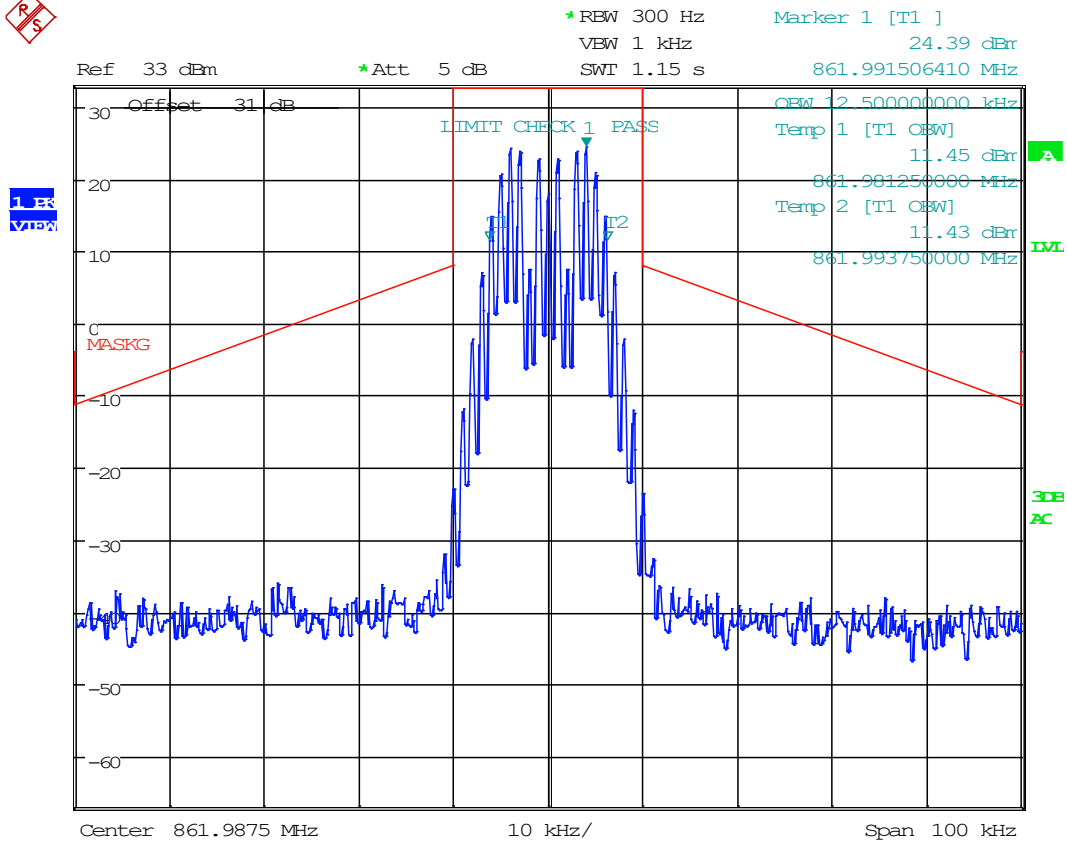
8.5.48 25 kHz FM, Downlink, AGC



Date: 4.NOV.2020 12:52:08

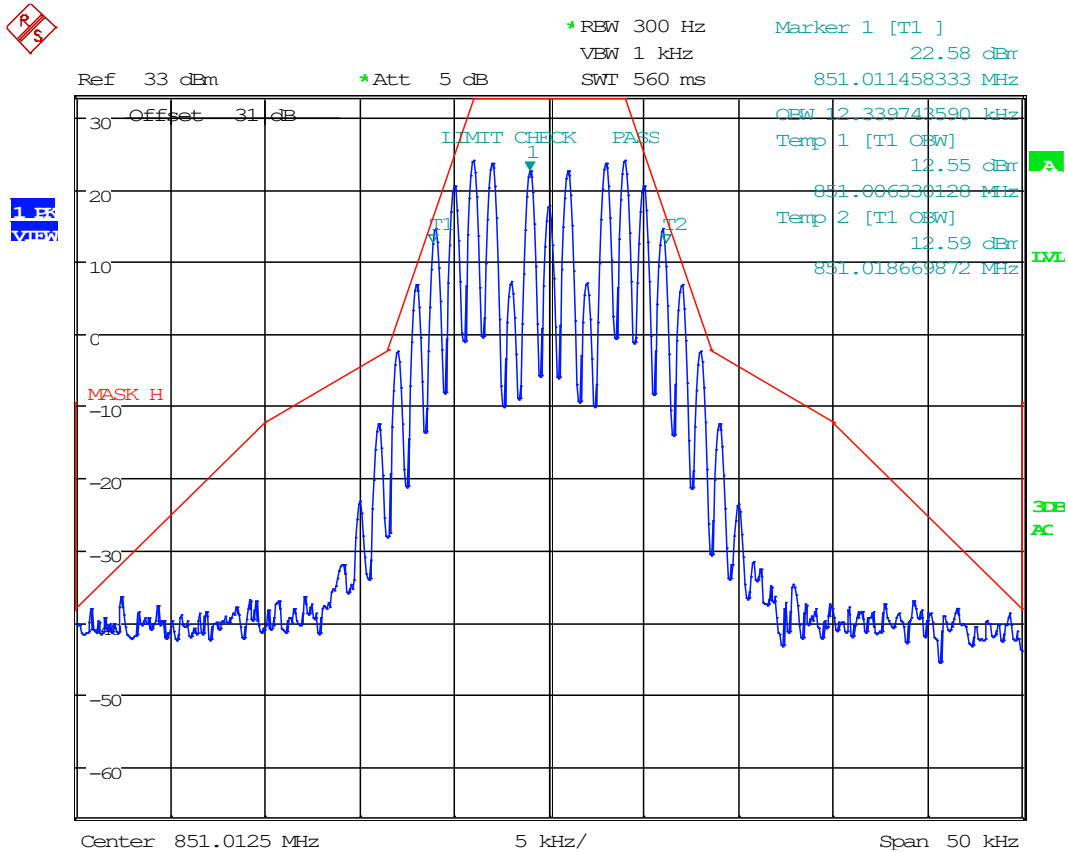


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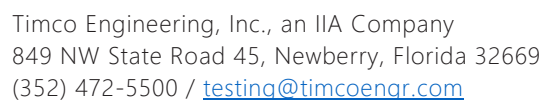


Date: 4.NOV.2020 13:52:47

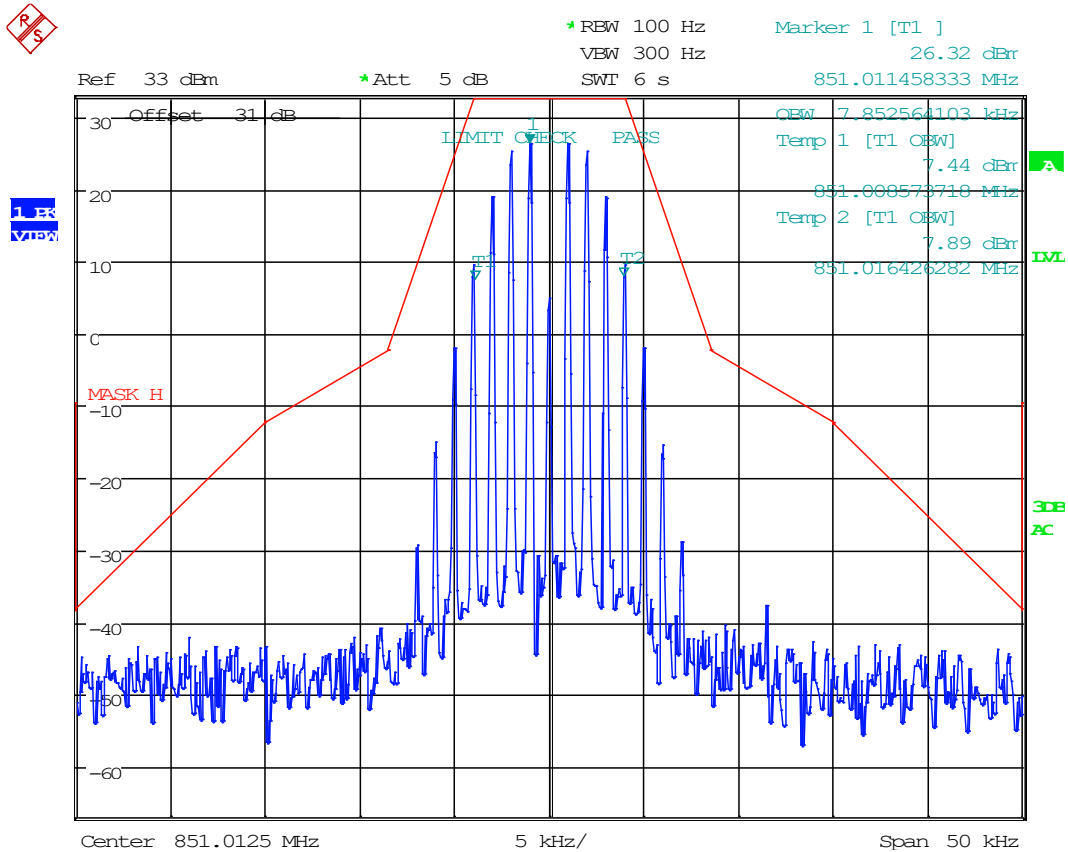
8.5.49 25 kHz FM, Downlink, AGC +3dB



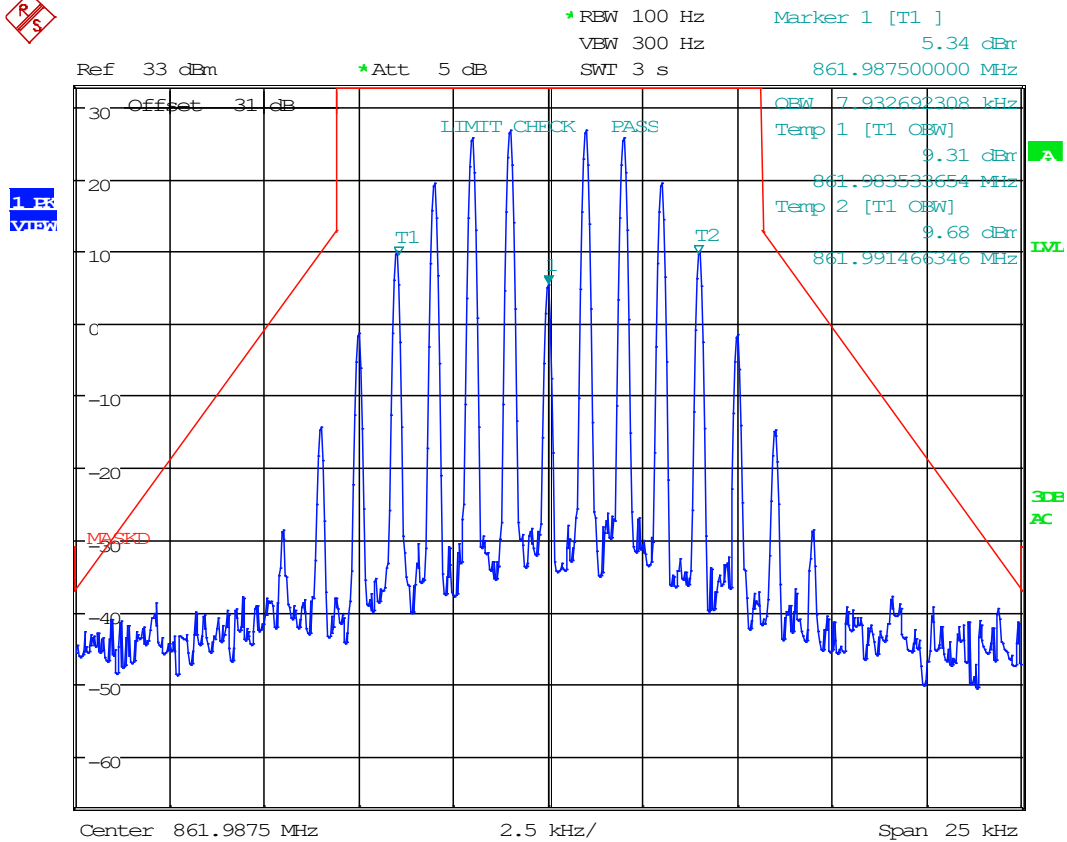
Date: 4.NOV.2020 12:52:41



8.5.50 12.5 kHz FM, Downlink, AGC

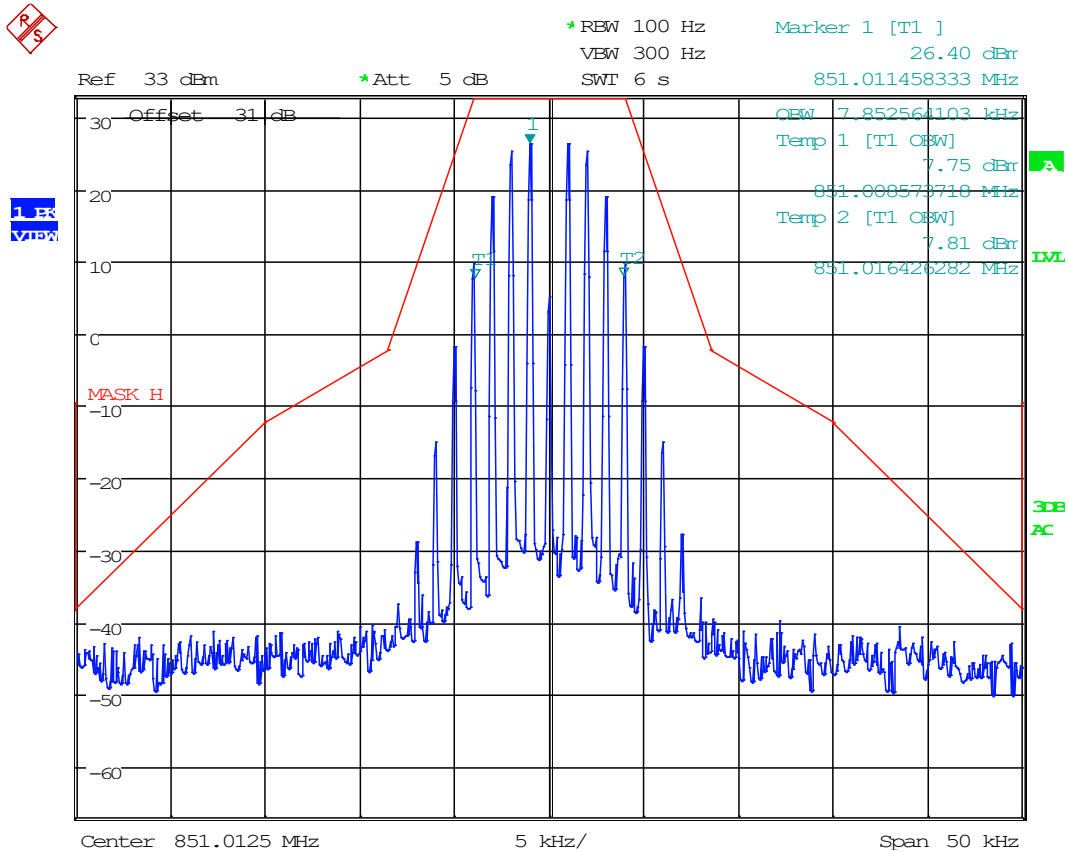


Date: 4.NOV.2020 13:25:44

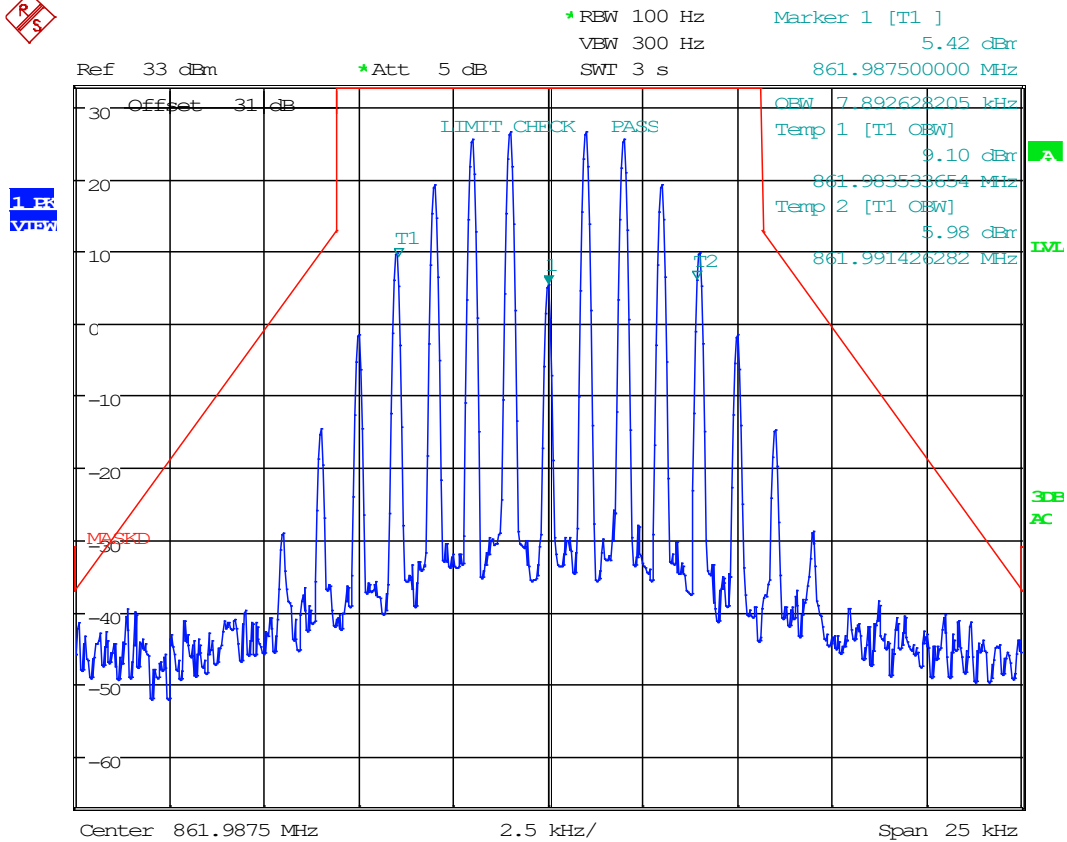


Date: 4.NOV.2020 13:44:49

8.5.51 12.5 kHz FM, Downlink, AGC +3dB

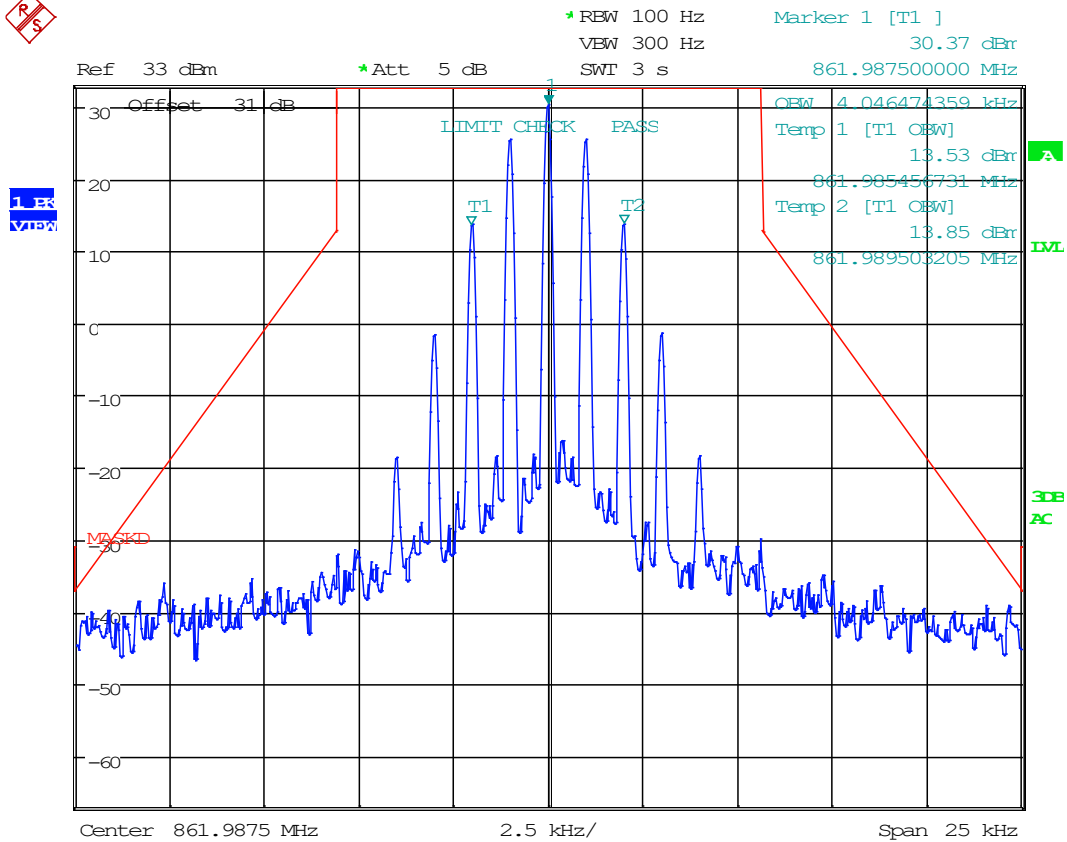


Date: 4.NOV.2020 12:50:47



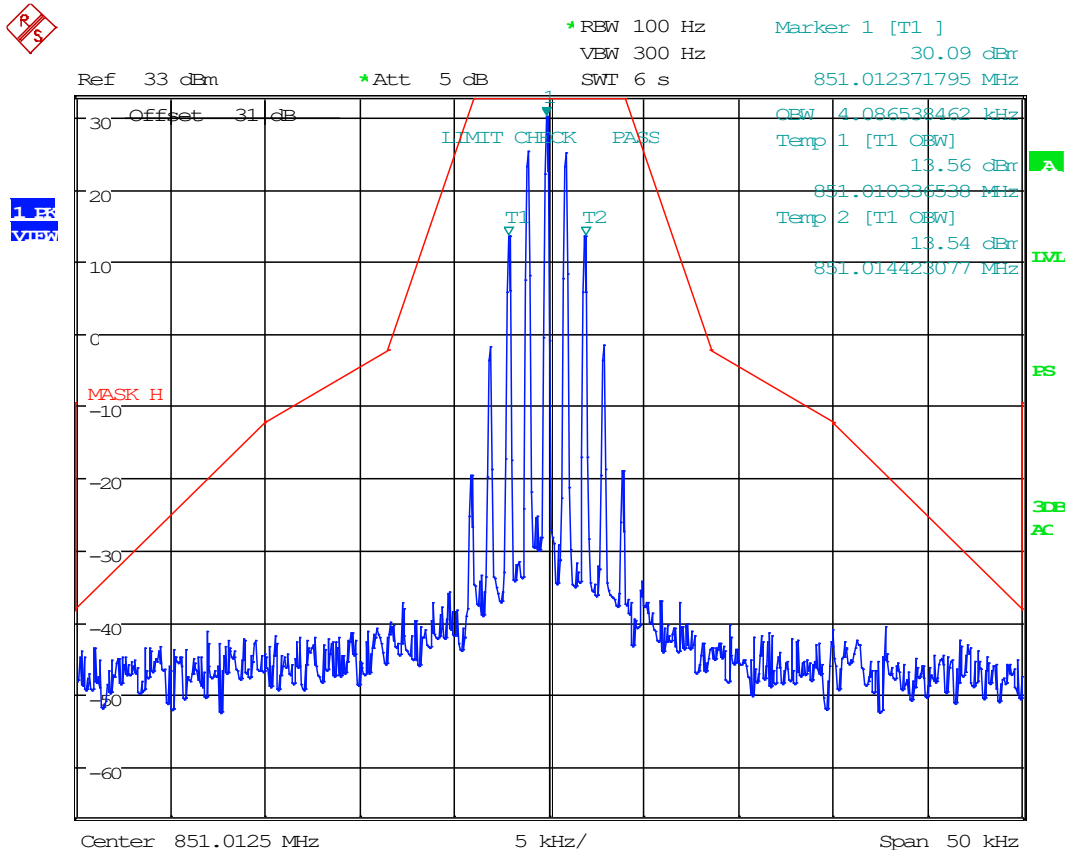
Date: 4.NOV.2020 13:45:10



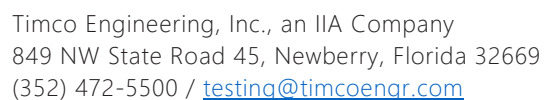


Date: 4.NOV.2020 13:45:50

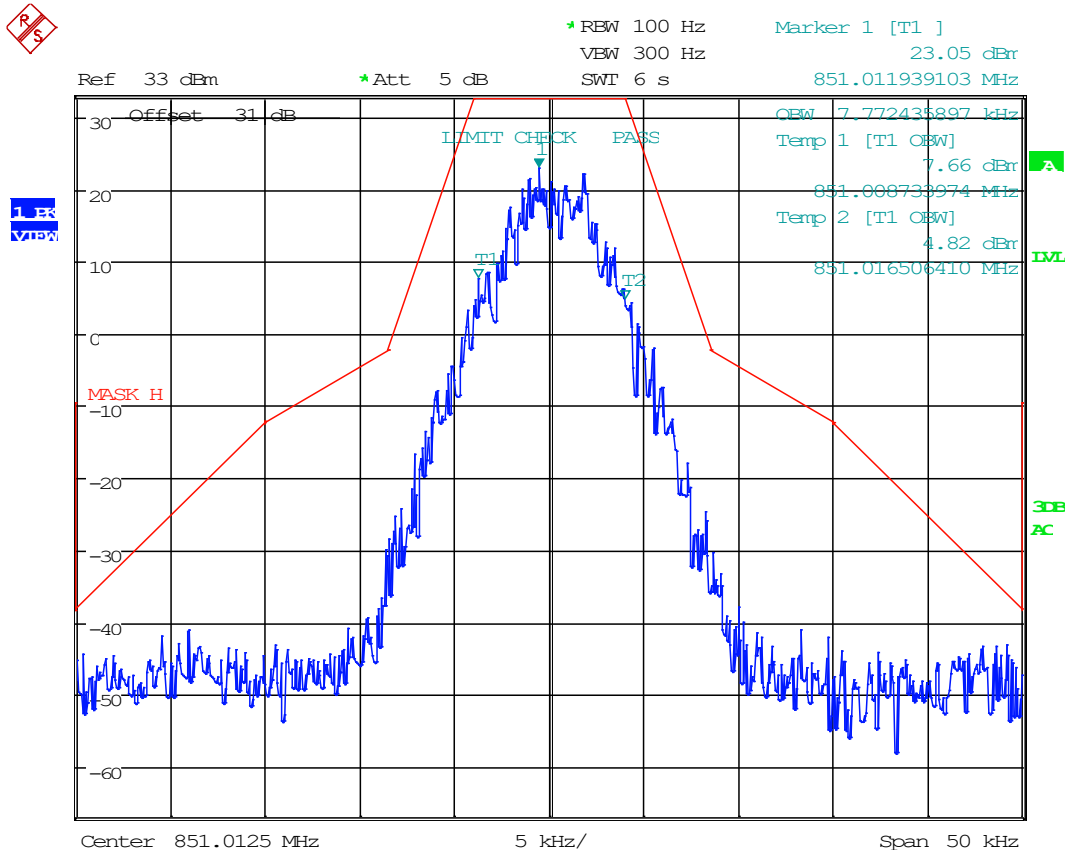
8.5.53 6.25 kHz FM, Downlink, AGC +3dB



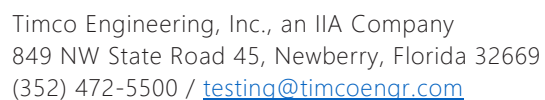
Date: 4.NOV.2020 12:31:21



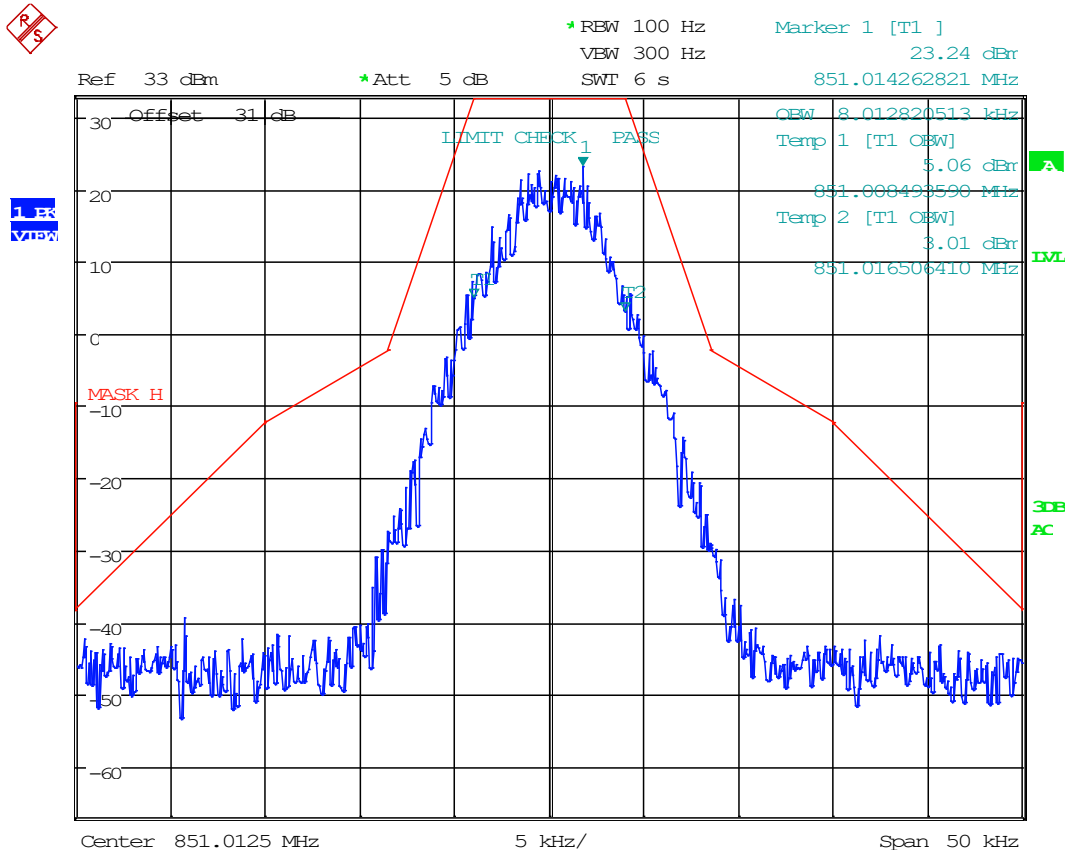
8.5.54 C4FM, Downlink, AGC



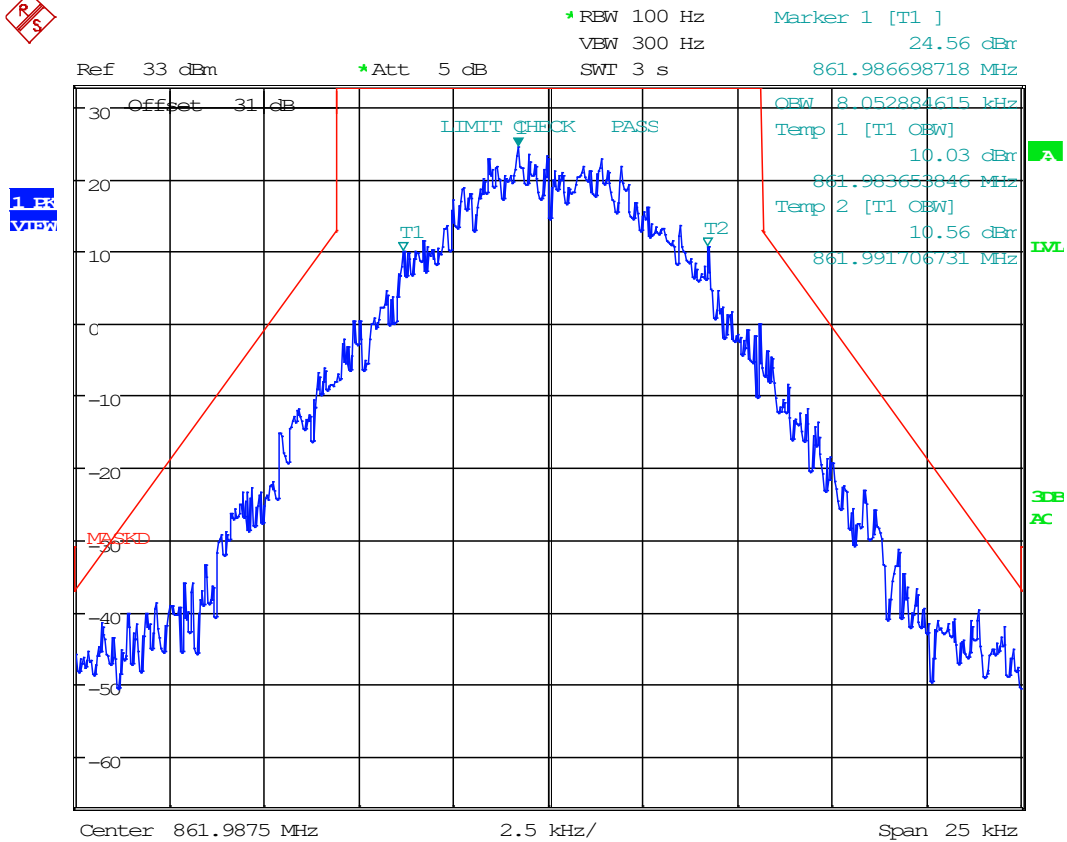
Date: 4.NOV.2020 13:08:59



8.5.55 C4FM, Downlink, AGC +3dB

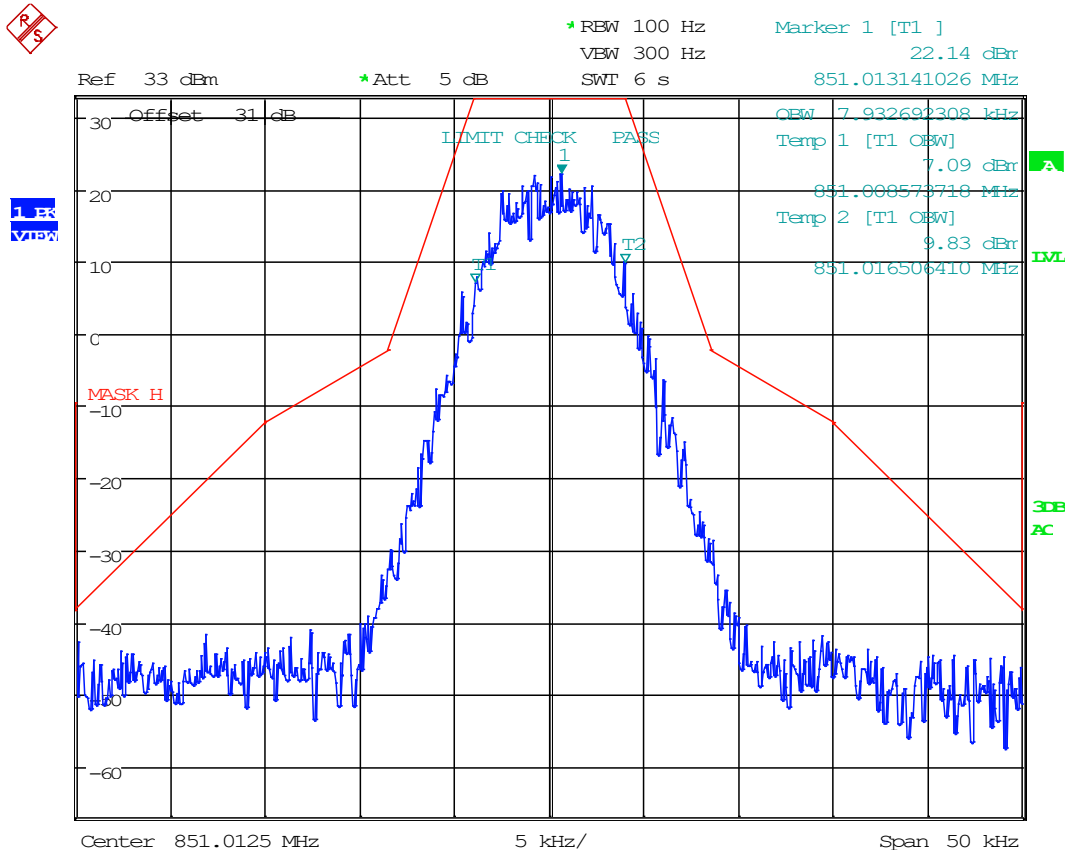


Date: 4.NOV.2020 13:08:39

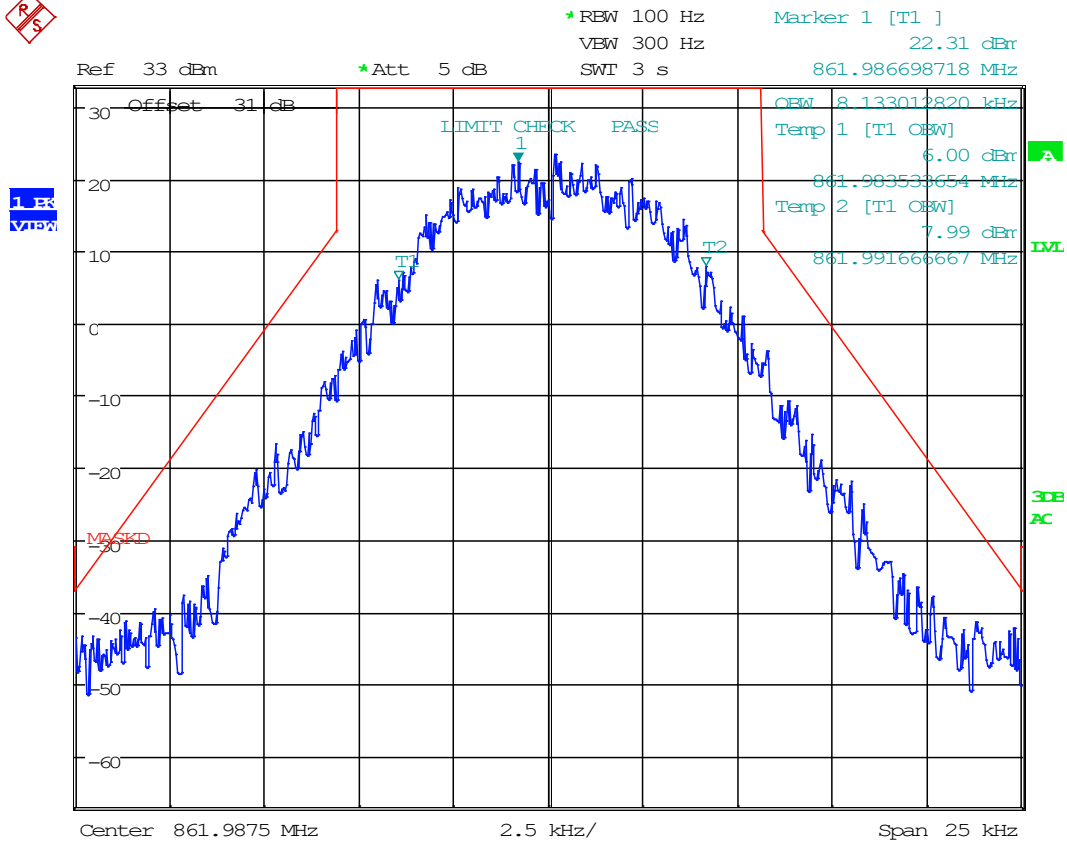


Date: 4.NOV.2020 13:46:18

8.5.56 H-CPM, Downlink, AGC

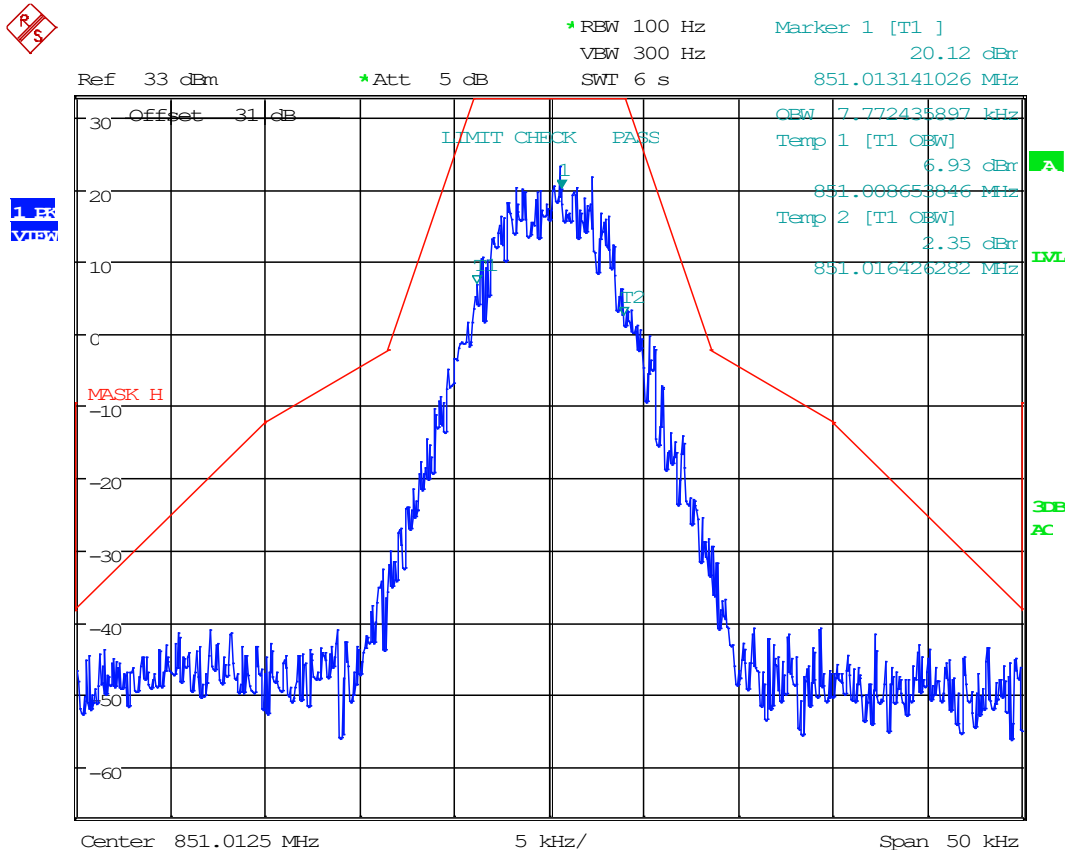


Date: 4.NOV.2020 13:07:48

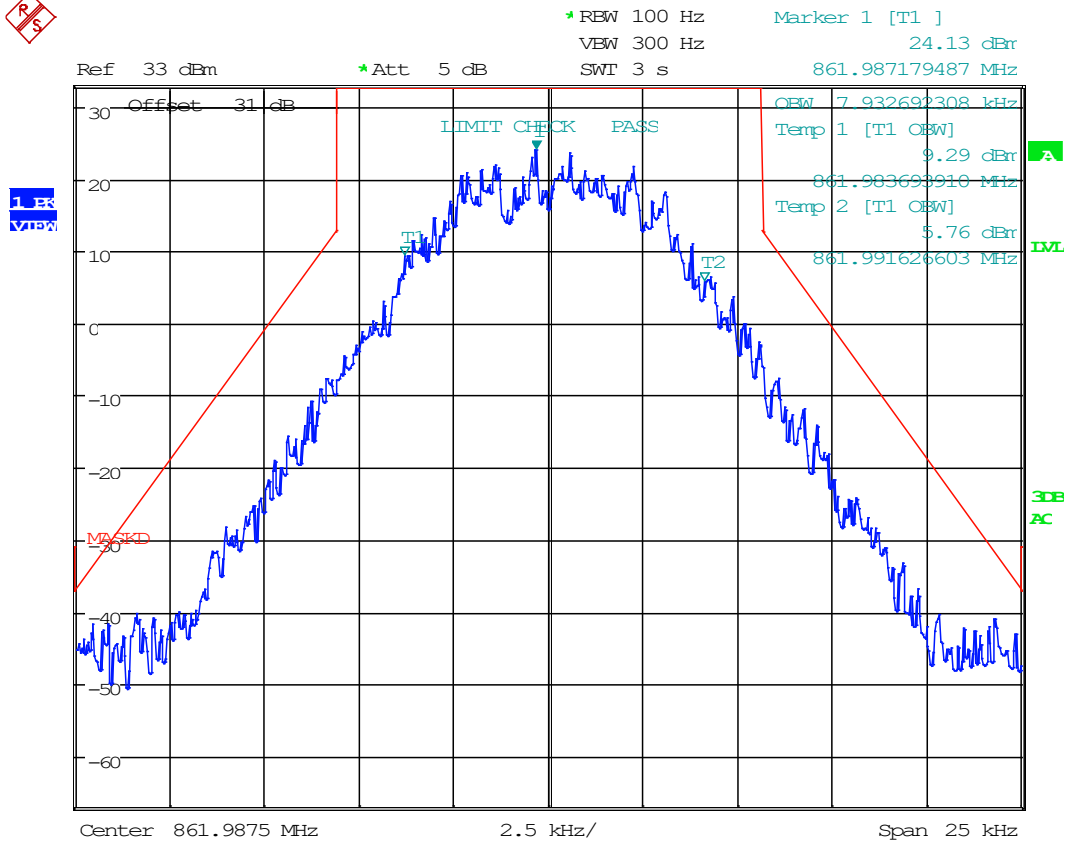


Date: 4.NOV.2020 13:46:59

8.5.57 H-CPM, Downlink, AGC +3dB

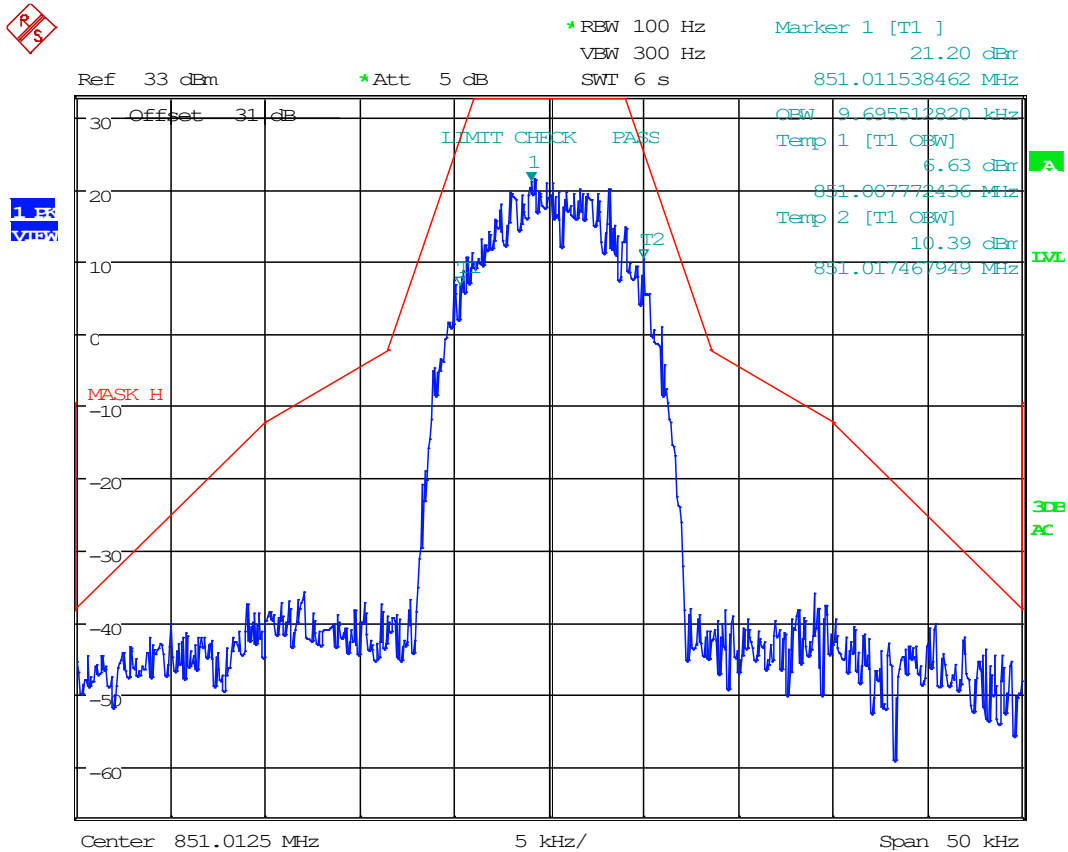


Date: 4.NOV.2020 13:08:06



Date: 4.NOV.2020 13:47:15

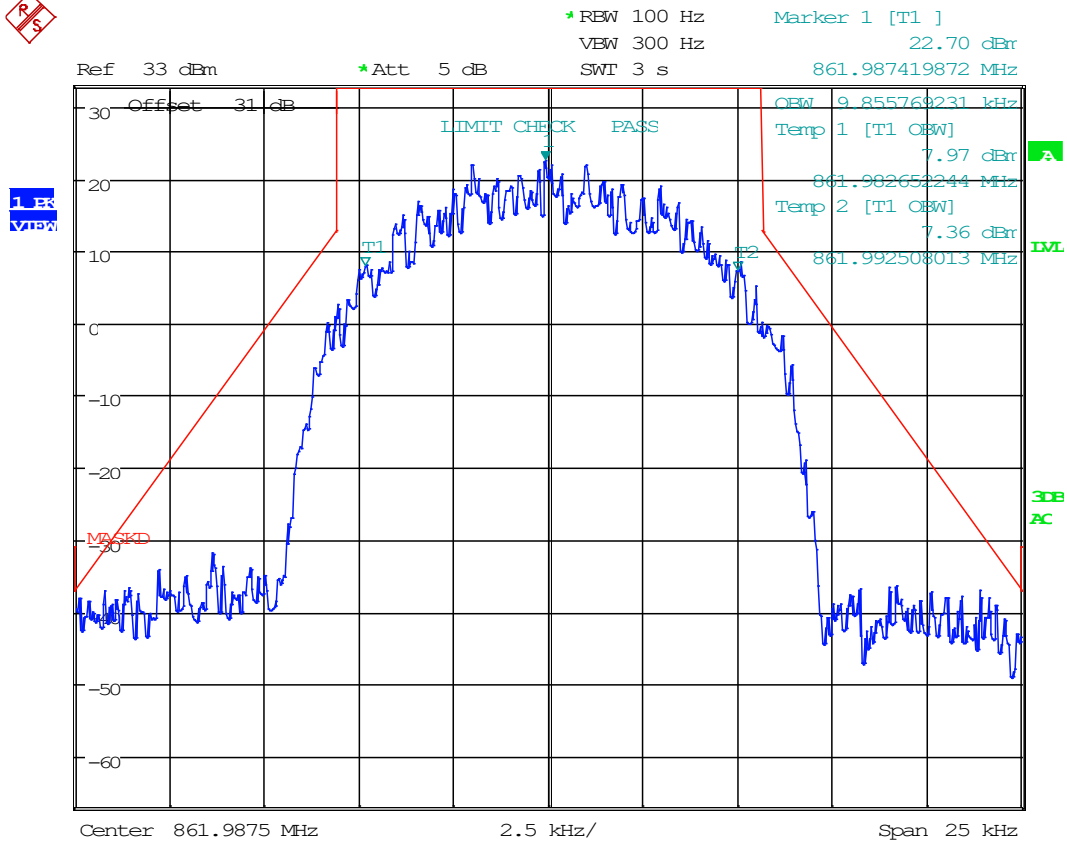
8.5.58 H-DQPSK, Downlink, AGC



Date: 4.NOV.2020 13:07:25

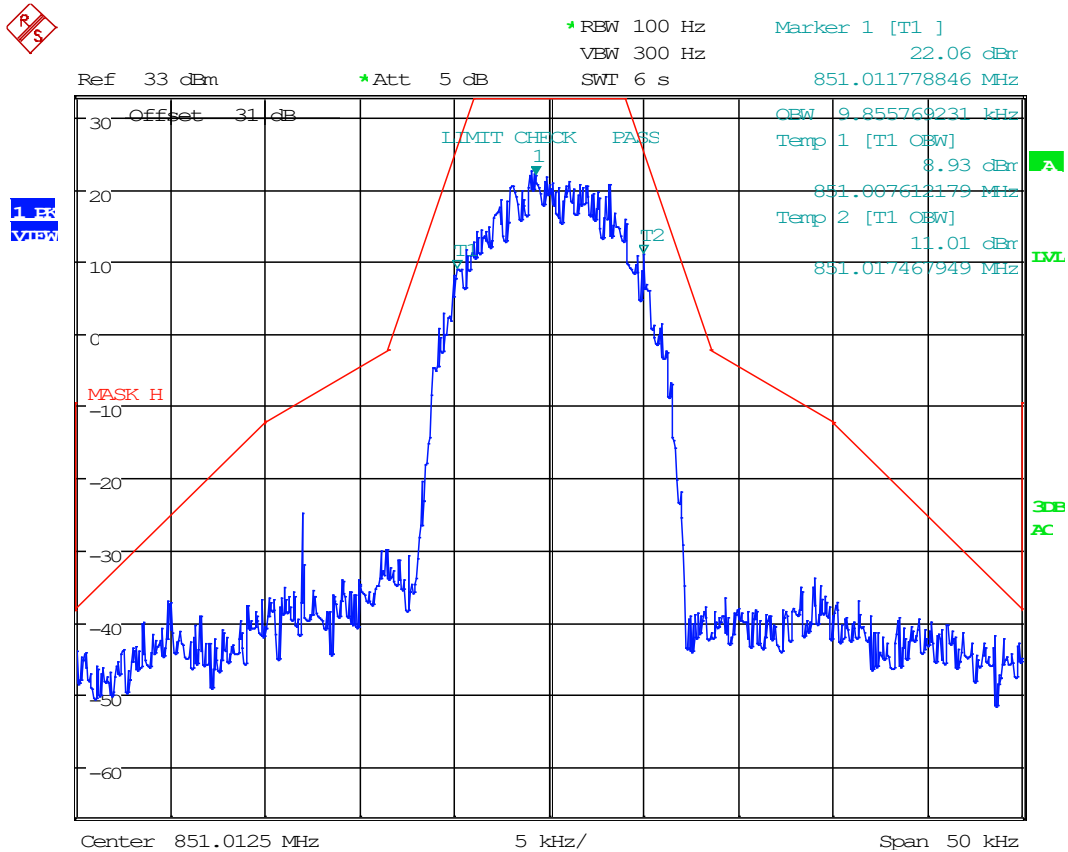


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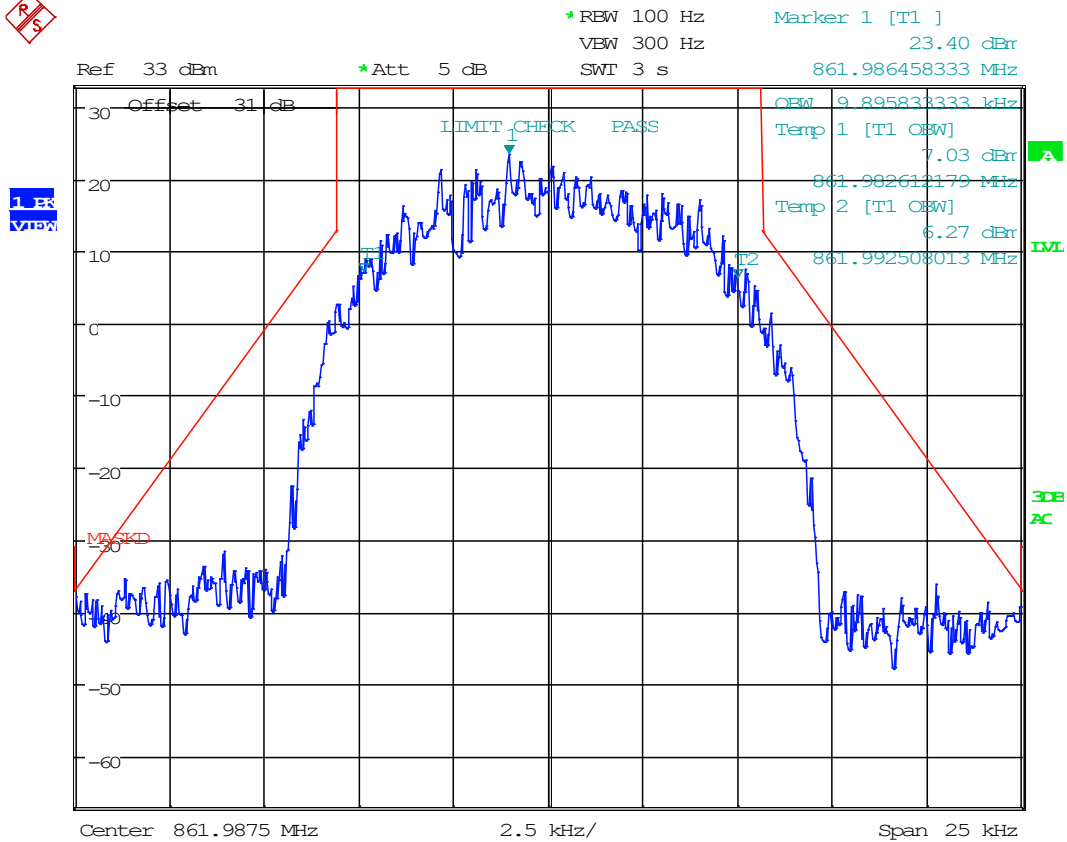


Date: 4.NOV.2020 13:48:01

8.5.59 H-DQPSK, Downlink, AGC +3dB



Date: 4.NOV.2020 13:07:08



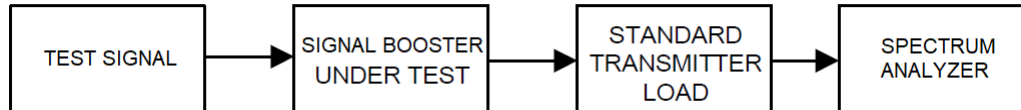
Date: 4.NOV.2020 13:47:38



8.6 Noise Figure

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 Setup



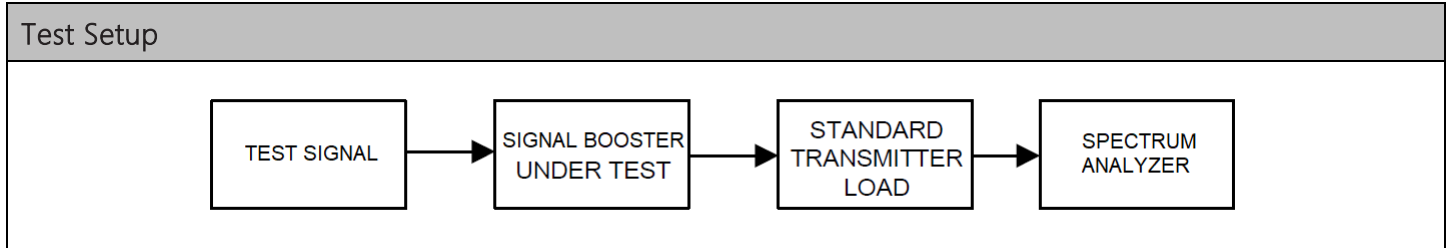
Test Results, Out-of-band Rejection and Class of Operation

Operating Band	Link Direction	Noise Figure	Limit
758 – 775 MHz	Downlink	2.65	< 9 dB
788 – 805 MHz	Uplink	3.71	< 9 dB
806 – 824 MHz	Uplink	3.22	< 9 dB
851 – 869 MHz	Downlink	4.04	< 9 dB



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

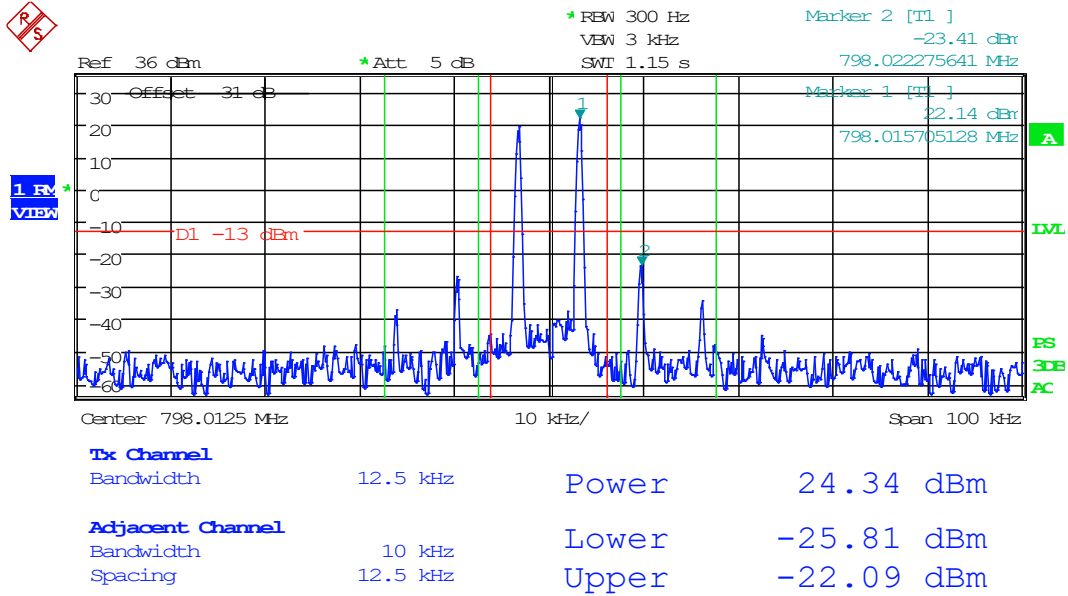
Limits from FCC Parts 2.1051, 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





Intermodulation Products Spectrum Plots, 700 Band

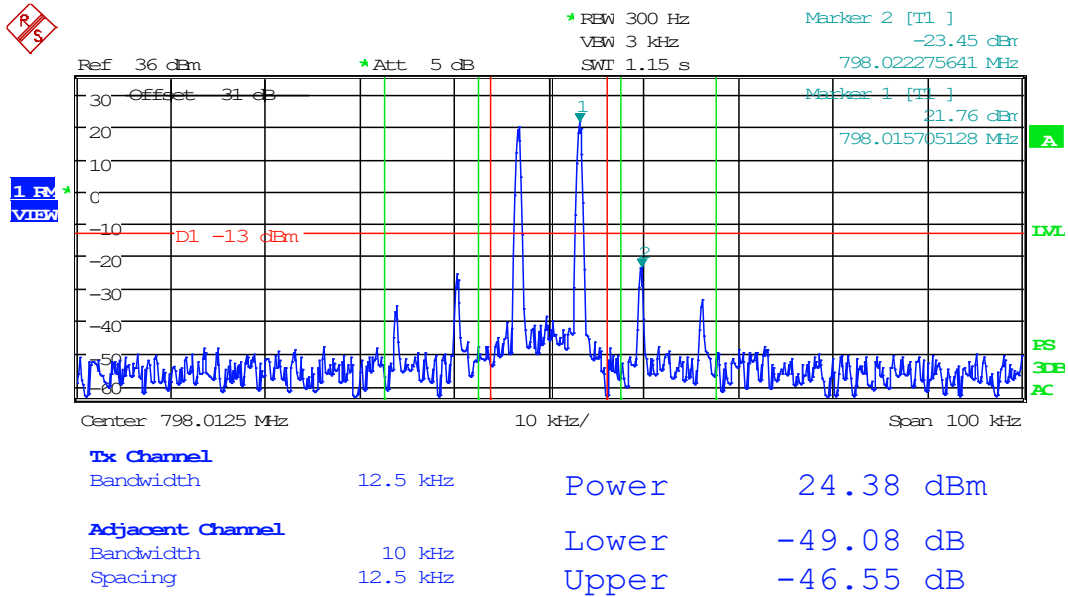
8.7.1 6.25 kHz Signal, Uplink, AGC



Date: 5.NOV.2020 13:34:06

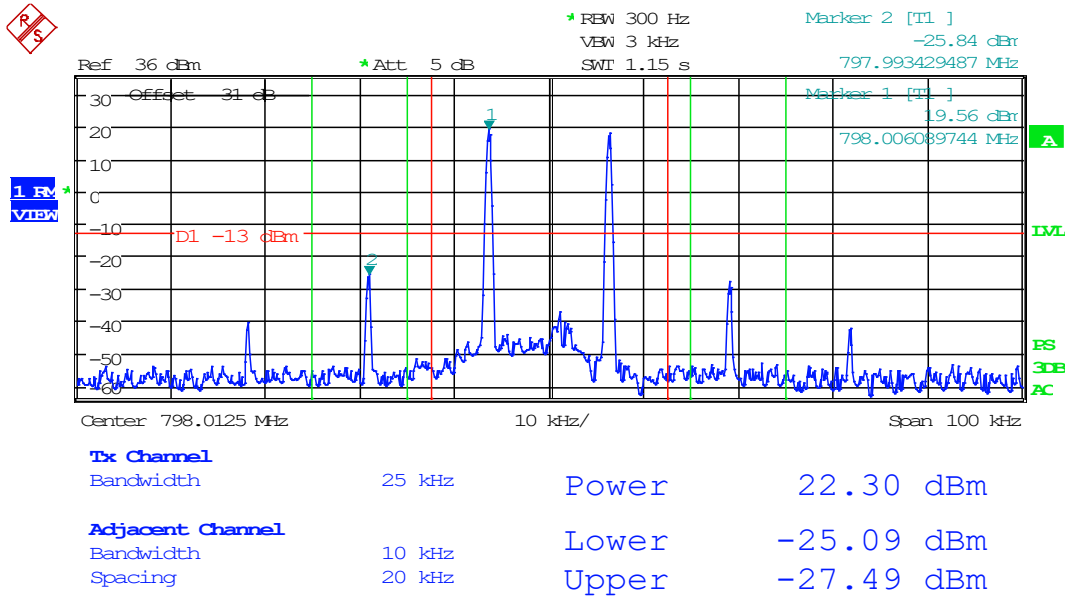


8.7.2 6.25 kHz Signal, Uplink, AGC +3dB



Date: 5.NOV.2020 13:35:21

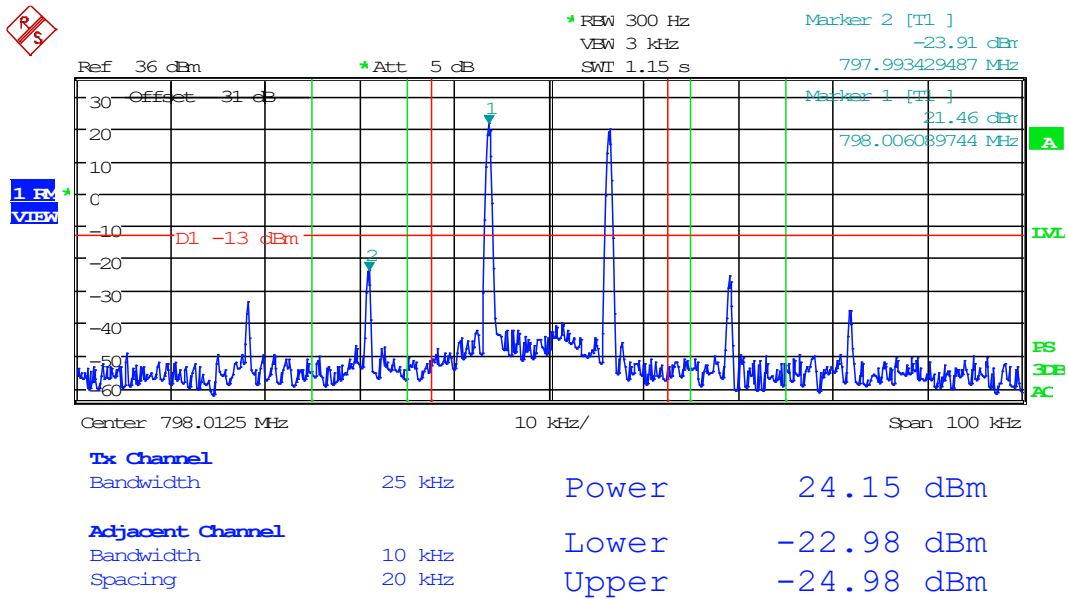
8.7.3 12.5 kHz Signal, Uplink, AGC



Date: 5.NOV.2020 13:36:25



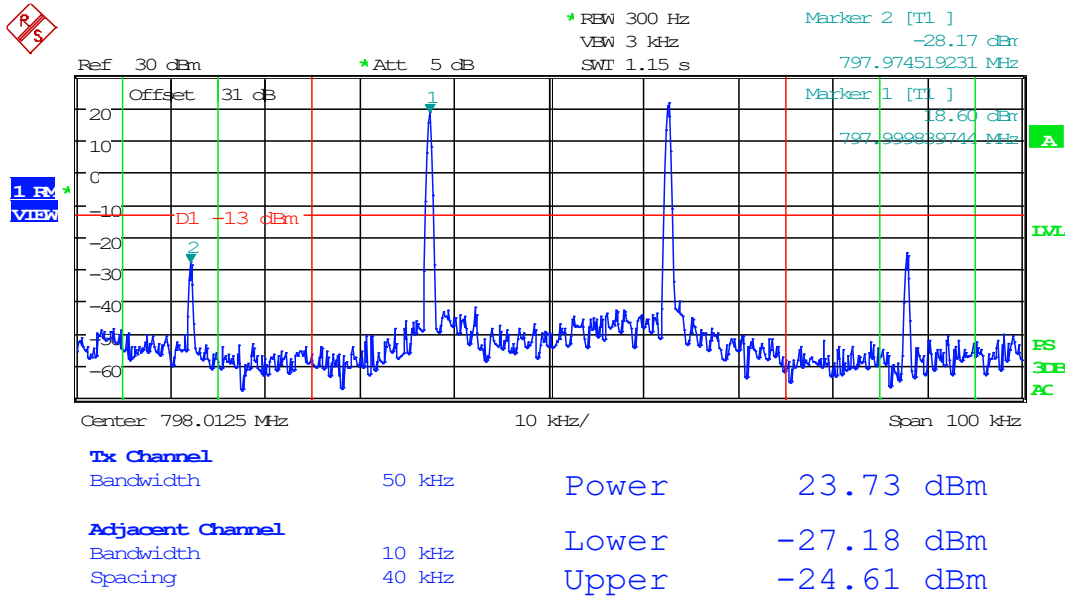
8.7.4 12.5 kHz Signal, Uplink, AGC +3dB



Date: 5.NOV.2020 13:36:47

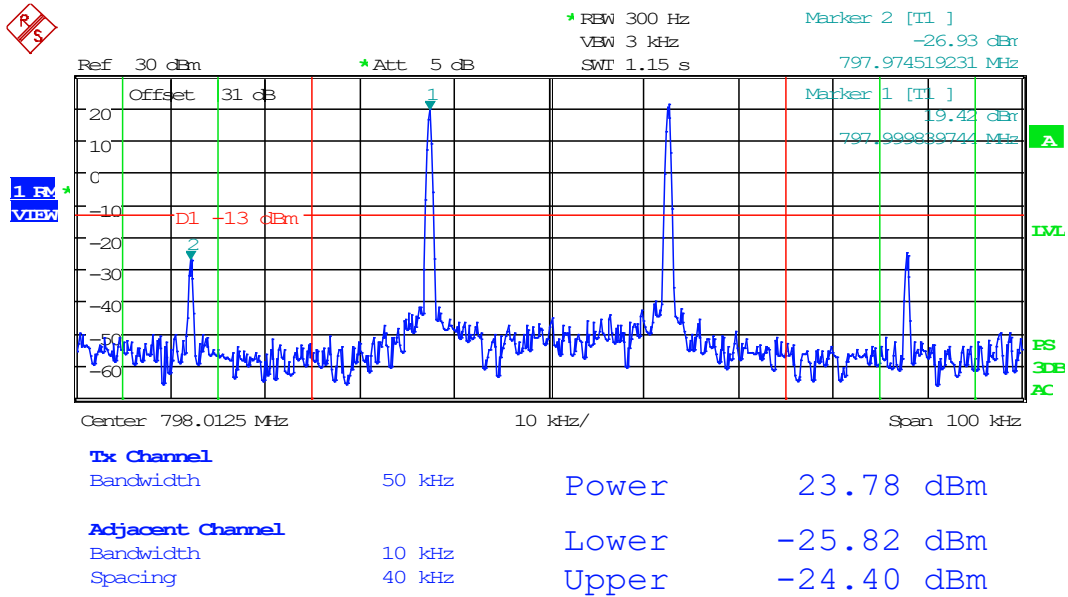


8.7.5 25 kHz Signal, Uplink, AGC



Date: 5.NOV.2020 13:43:28

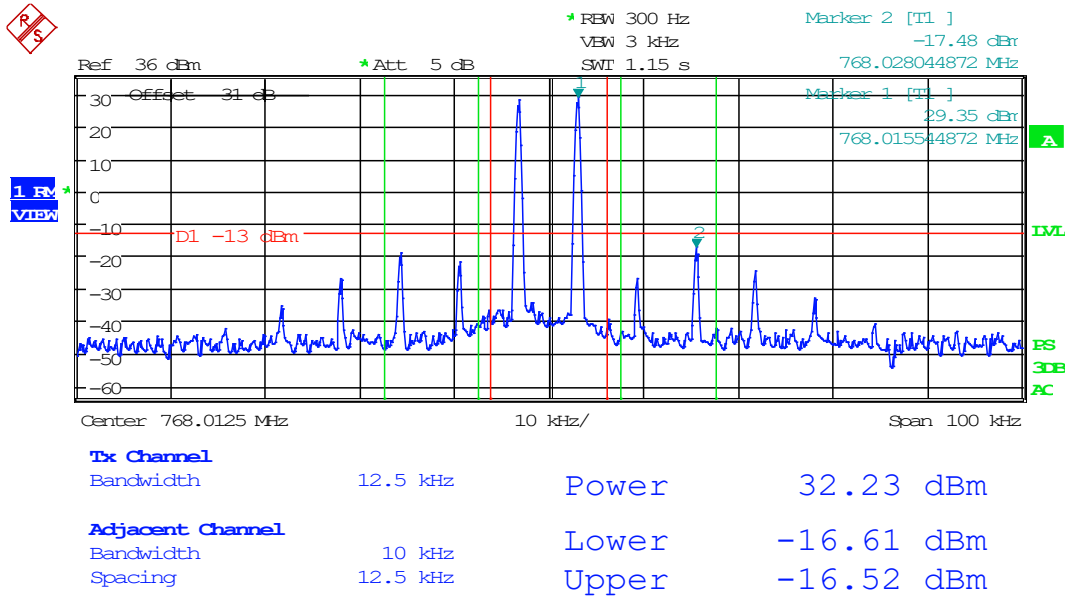
8.7.6 25 kHz Signal, Uplink, AGC +3dB



Date: 5.NOV.2020 13:43:44



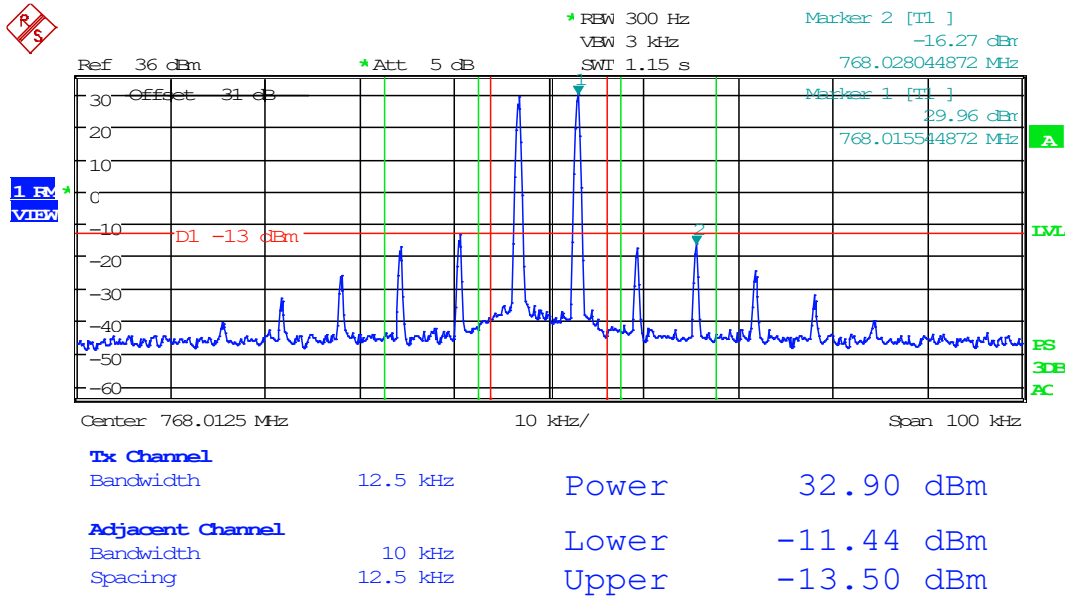
8.7.7 6.25 kHz Signal, Downlink, AGC



Date: 4.NOV.2020 11:34:54

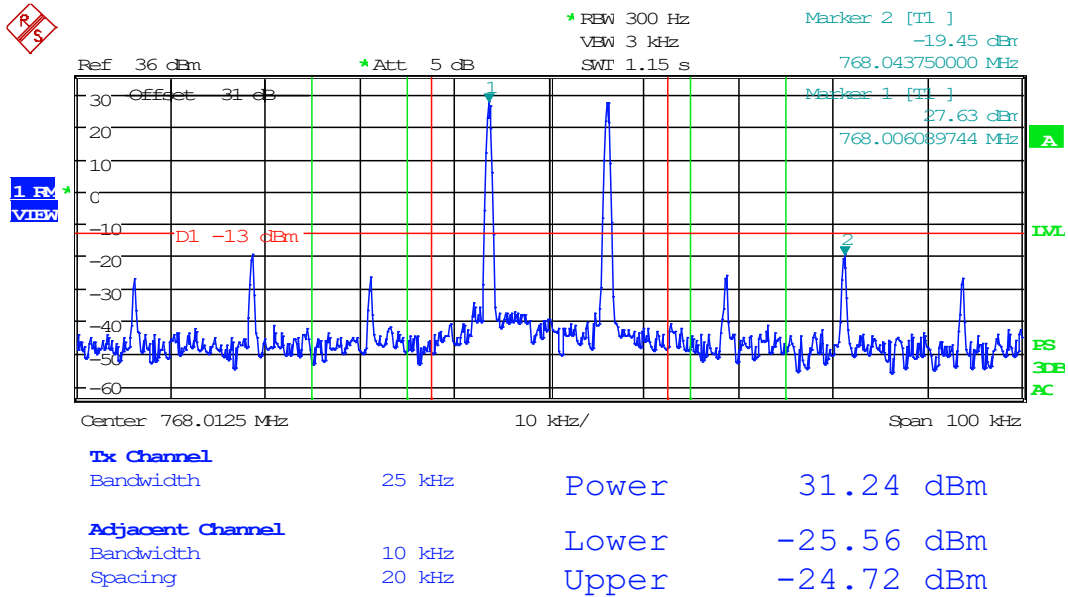


8.7.8 6.25 kHz Signal, Downlink, AGC +3dB



Date: 4.NOV.2020 11:38:00

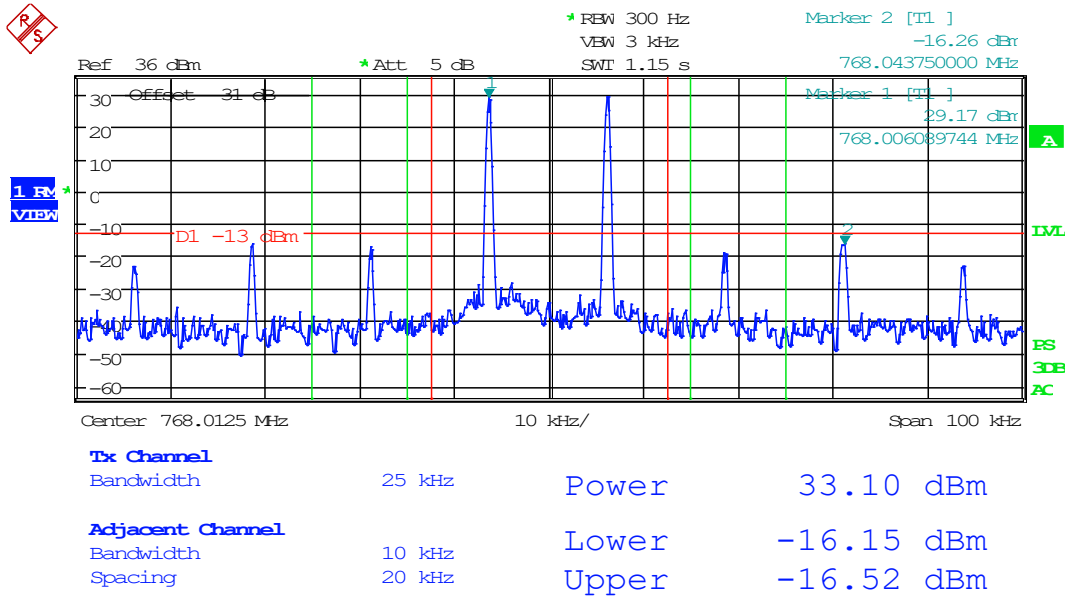
8.7.9 12.5 kHz Signal, Downlink, AGC



Date: 4.NOV.2020 11:39:51

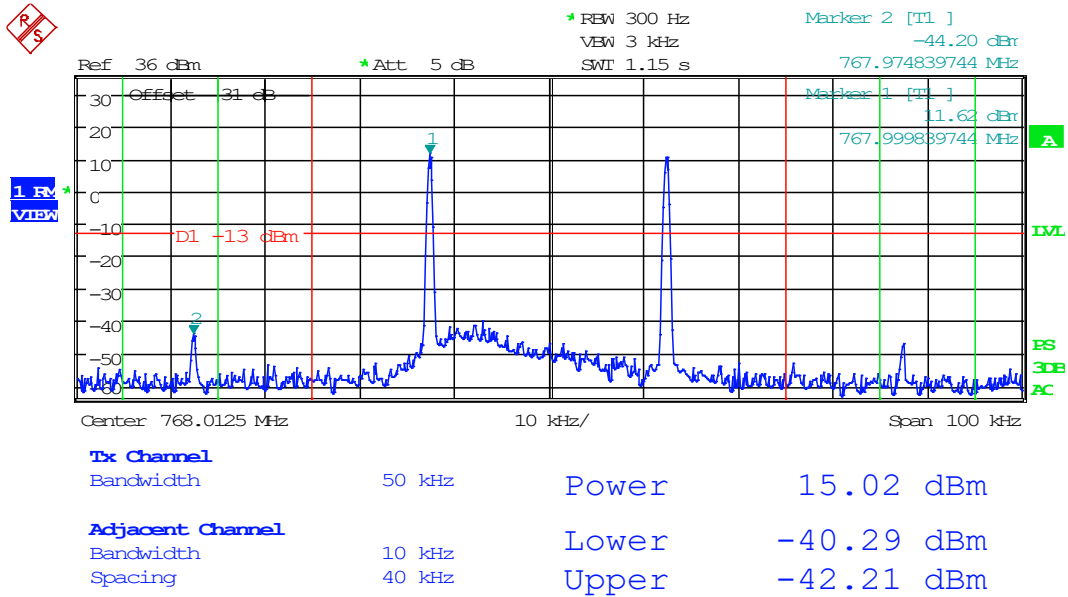


8.7.10 12.5 kHz Signal, Downlink, AGC +3dB



Date: 4.NOV.2020 11:40:11

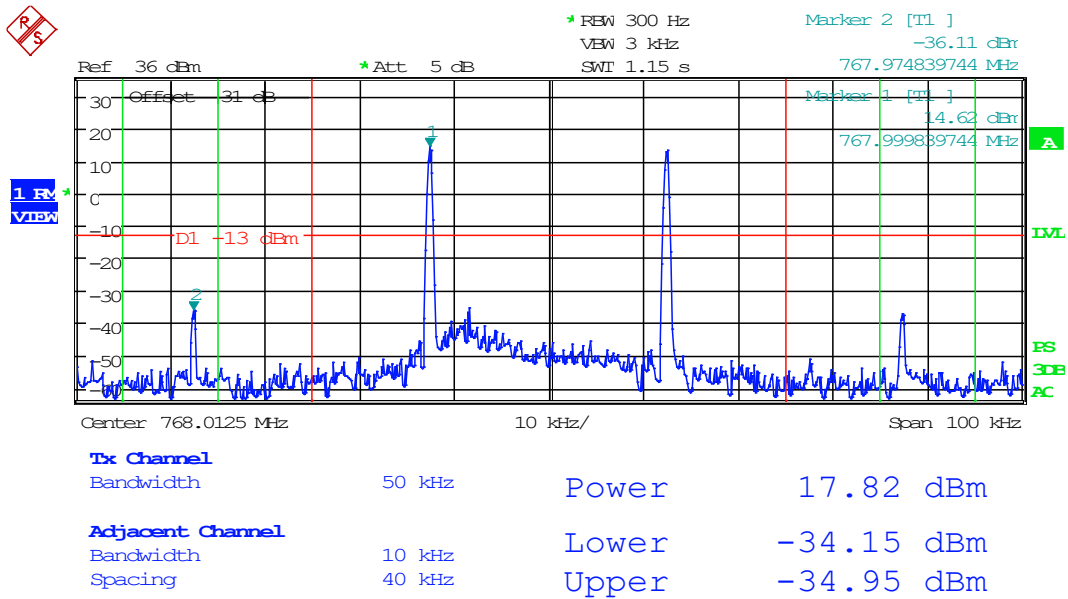
8.7.11 25 kHz Signal, Downlink, AGC



Date: 4.NOV.2020 11:41:38



8.7.12 25 kHz Signal, Downlink, AGC +3dB



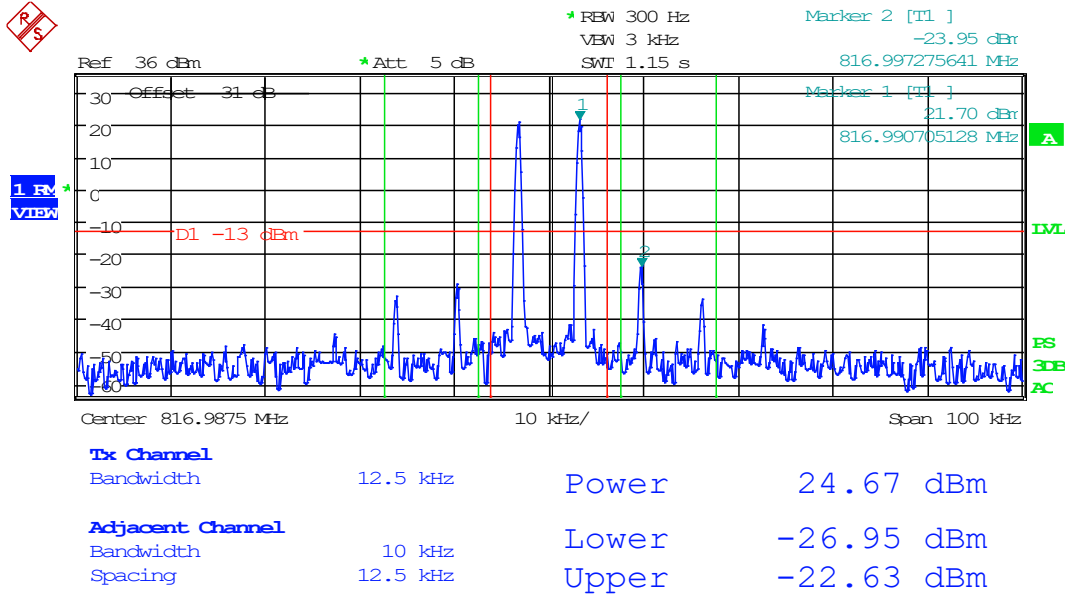
Date: 4.NOV.2020 11:41:52



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Intermodulation Products Spectrum Plots, 800 Band

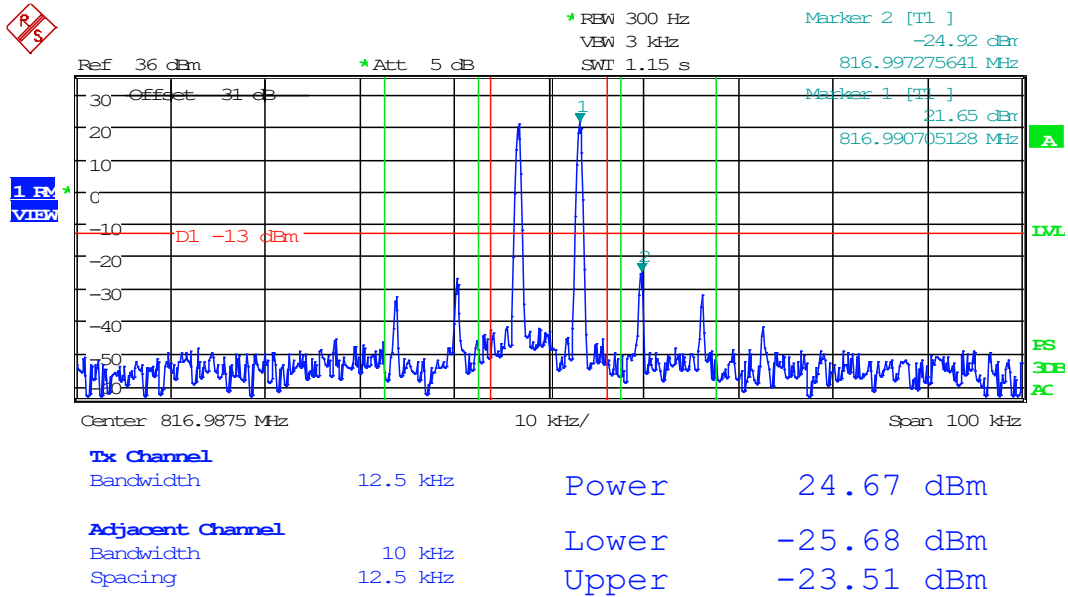
8.7.13 6.25 kHz Signal, Uplink, AGC



Date: 5.NOV.2020 13:28:01



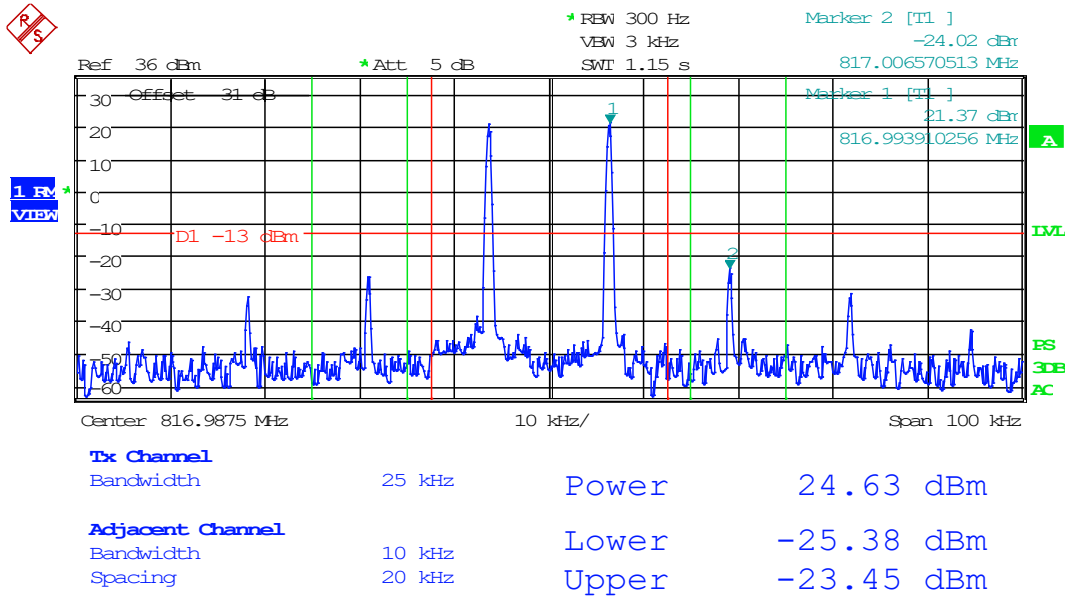
8.7.14 6.25 kHz Signal, Uplink, AGC +3dB



Date: 5.NOV.2020 13:28:42



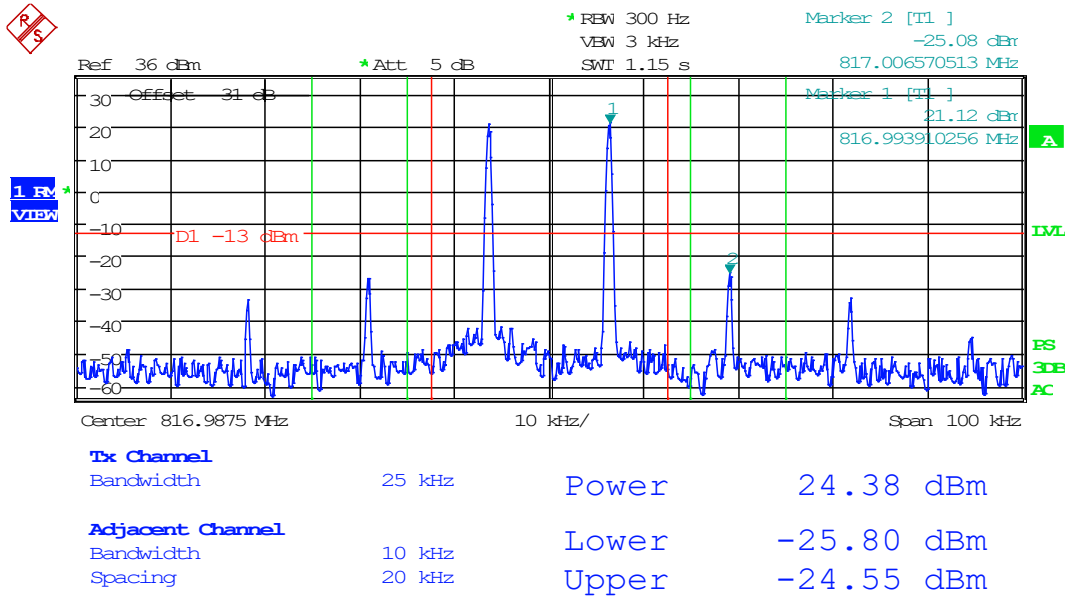
8.7.15 12.5 kHz Signal, Uplink, AGC



Date: 5.NOV.2020 13:37:58

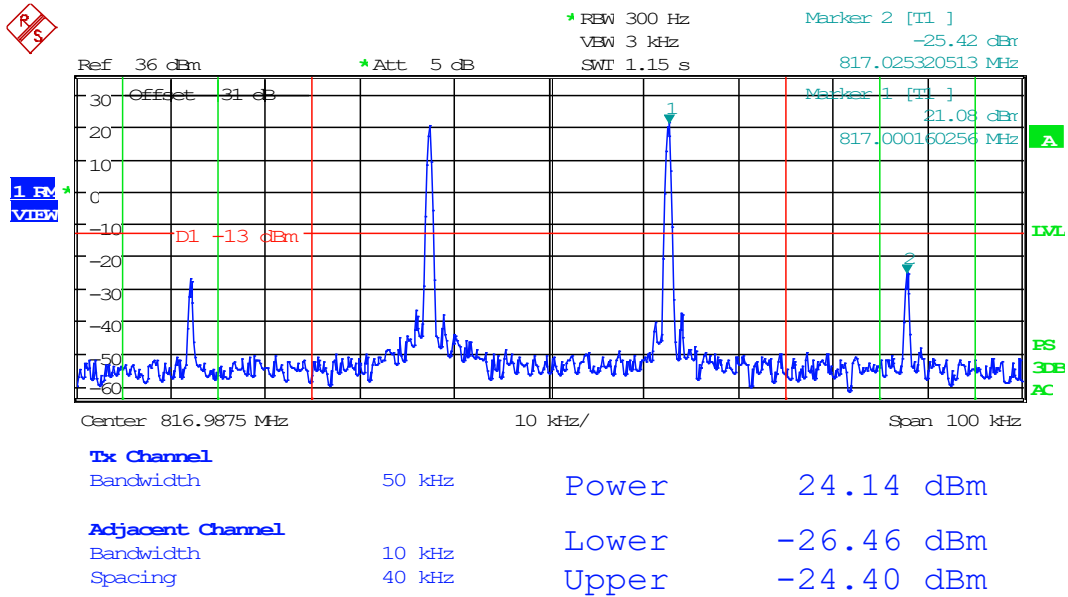


8.7.16 12.5 kHz Signal, Uplink, AGC +3dB



Date: 5.NOV.2020 13:38:17

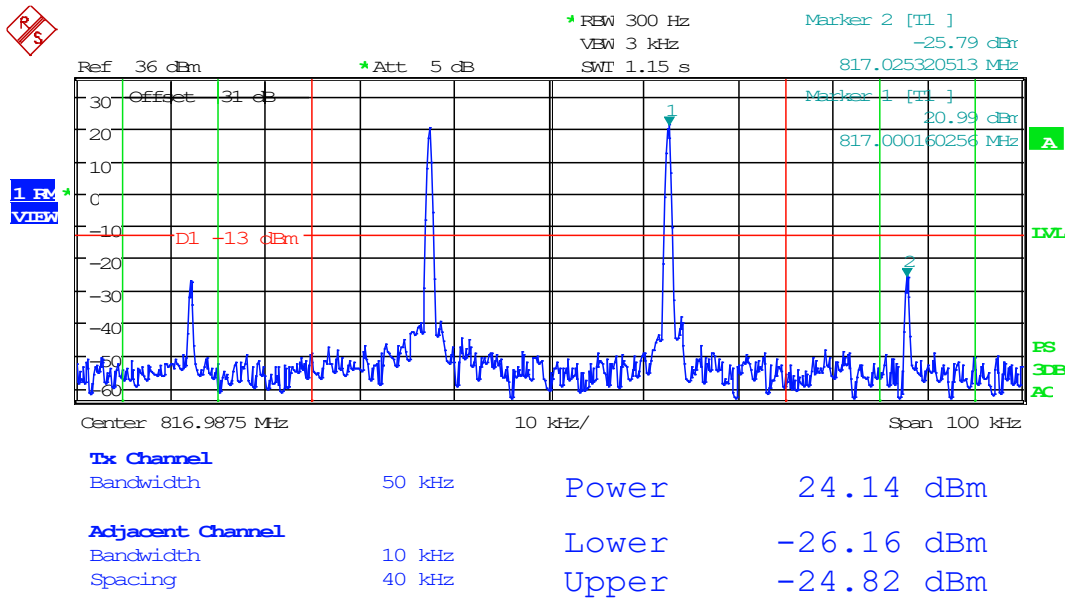
8.7.17 25 kHz Signal, Uplink, AGC



Date: 5.NOV.2020 13:40:22



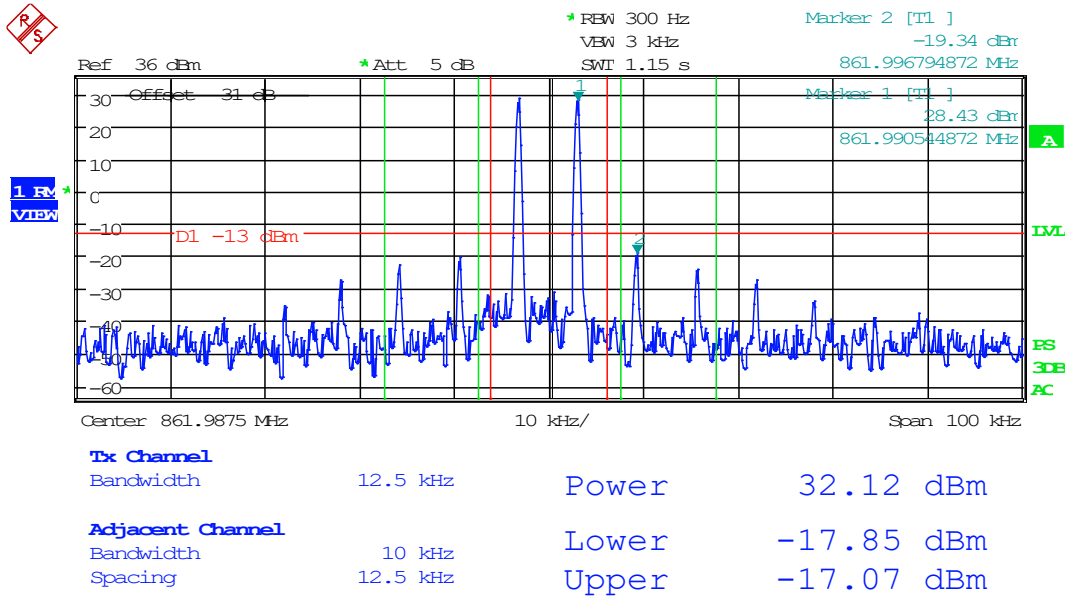
8.7.18 25 kHz Signal, Uplink, AGC +3dB



Date: 5.NOV.2020 13:40:37



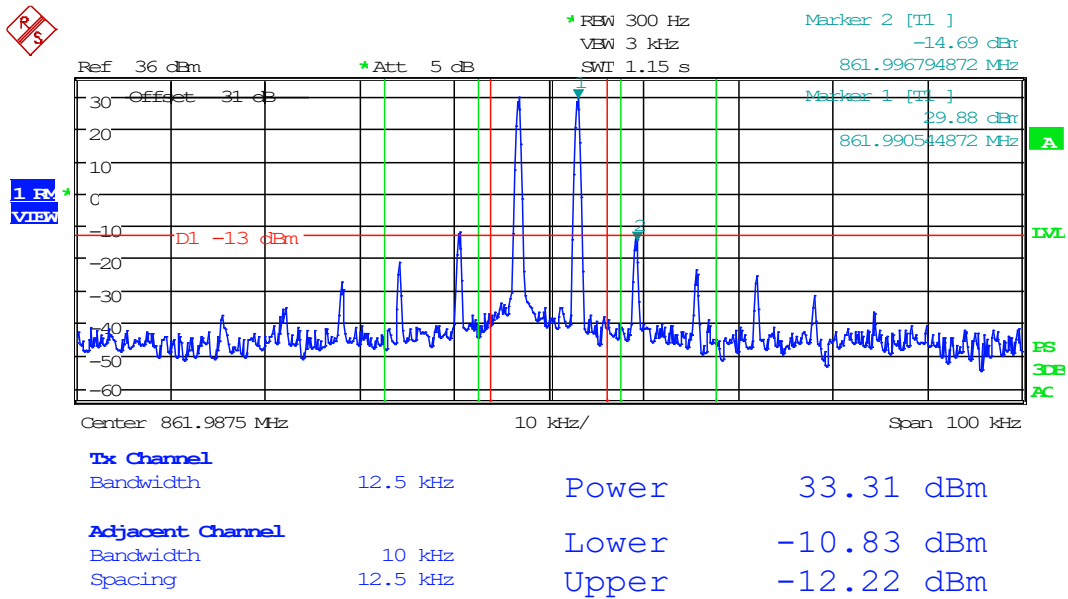
8.7.19 6.25 kHz Signal, Downlink, AGC



Date: 4.NOV.2020 11:52:59



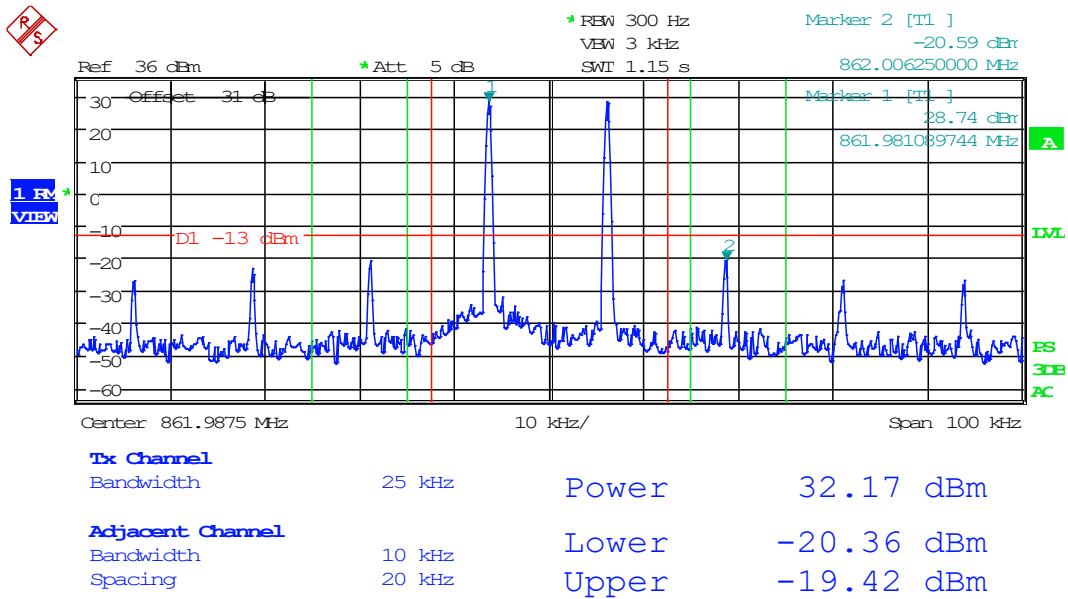
8.7.20 6.25 kHz Signal, Downlink, AGC +3dB



Date: 4.NOV.2020 11:53:20

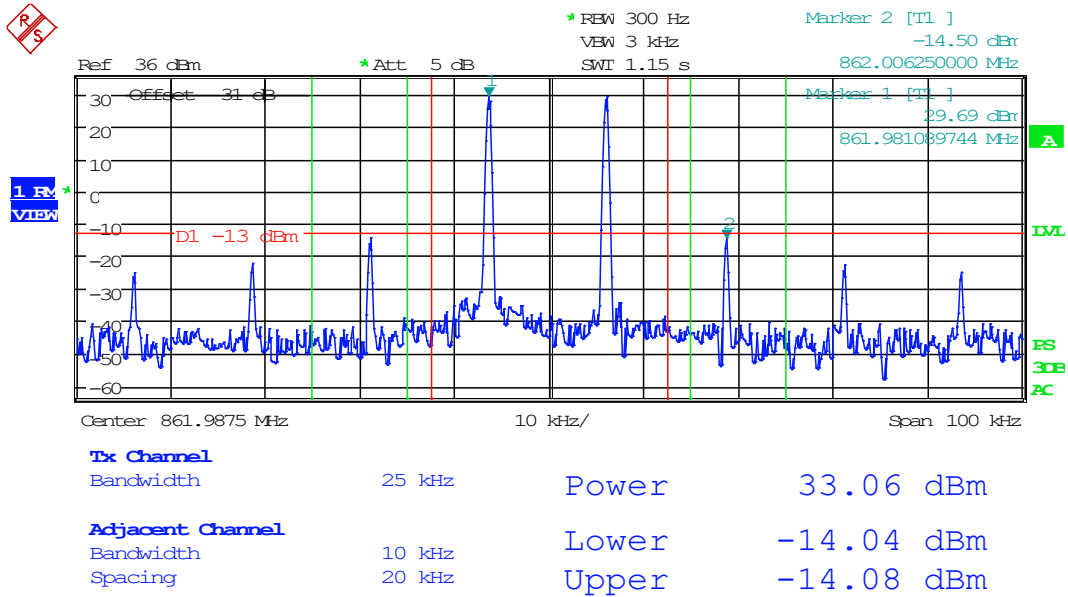


8.7.21 12.5 kHz Signal, Downlink, AGC

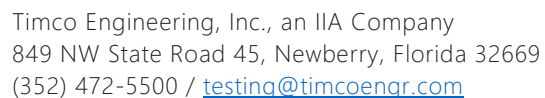


Date: 4.NOV.2020 11:54:25

8.7.22 12.5 kHz Signal, Downlink, AGC +3dB



Date: 4.NOV.2020 11:54:38



Ref 36 dBm * Att 5 dB REW 300 Hz VEW 3 kHz SWI 1.15 s Marker 2 [T1.] -20.41 dBm 862.02500000 MHz

Offset 31 dB Marker 1 [T1.] 28.76 dBm 861.974839744 MHz

D1 -13 dBm

Center 861.9875 MHz 10 kHz/ Span 100 kHz

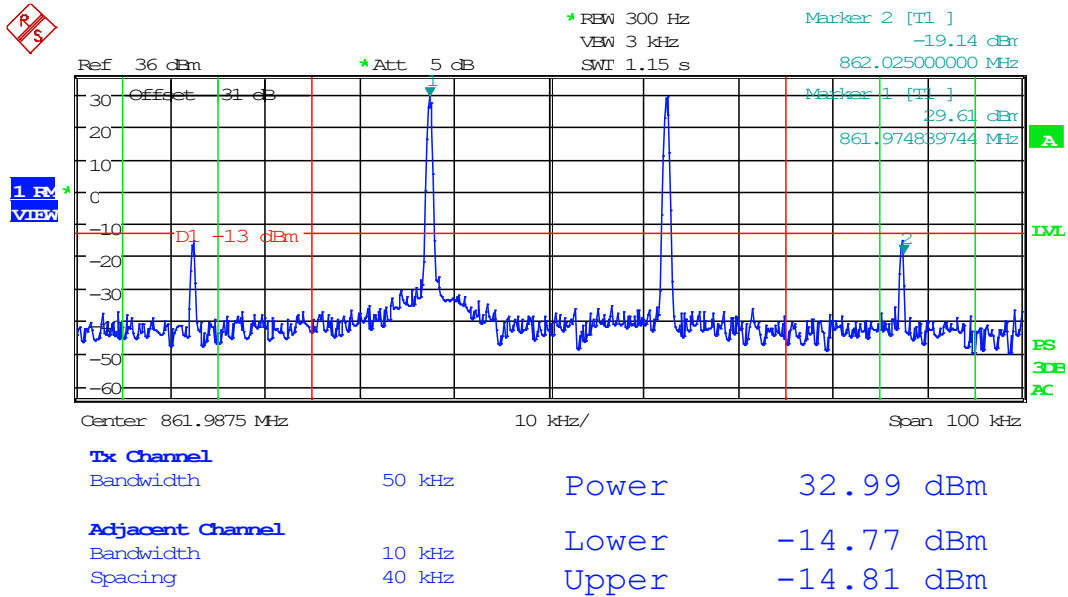
Tx Channel
 Bandwidth 50 kHz Power 32.15 dBm

Adjacent Channel
 Bandwidth 10 kHz Lower -19.91 dBm
 Spacing 40 kHz Upper -20.03 dBm

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8.7.24 25 kHz Signal, Downlink, AGC +3dB

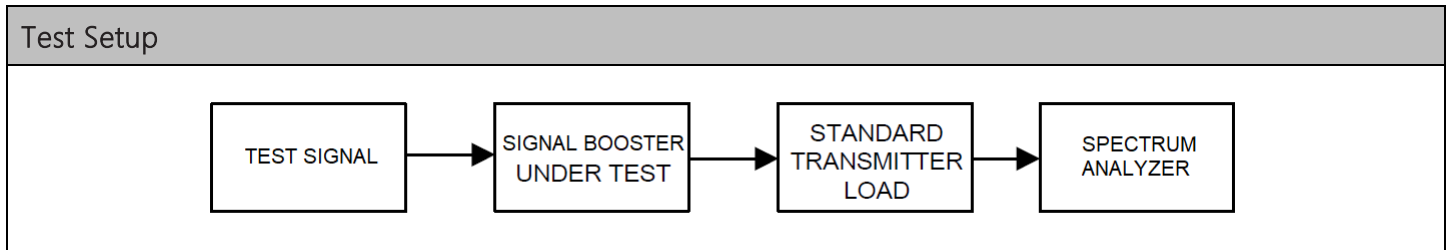


Date: 4.NOV.2020 11:56:51



8.8 Emission Mask, Out-of-Band

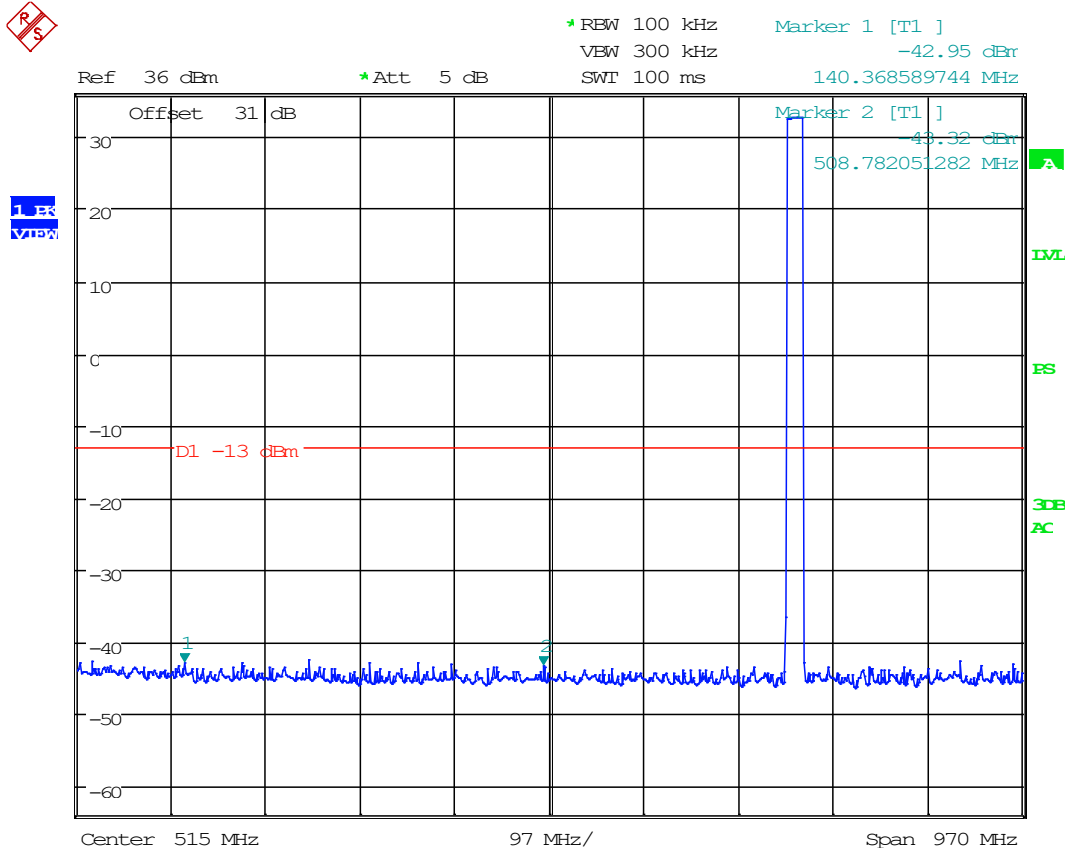
Limits from FCC Parts 2.1051, 90.210 and test procedure from ANSI C63.26-2015 and FCC KDB 935210 D05 v01r04 Industrial Signal Boosters.





Conducted Emissions Spectrum Plots

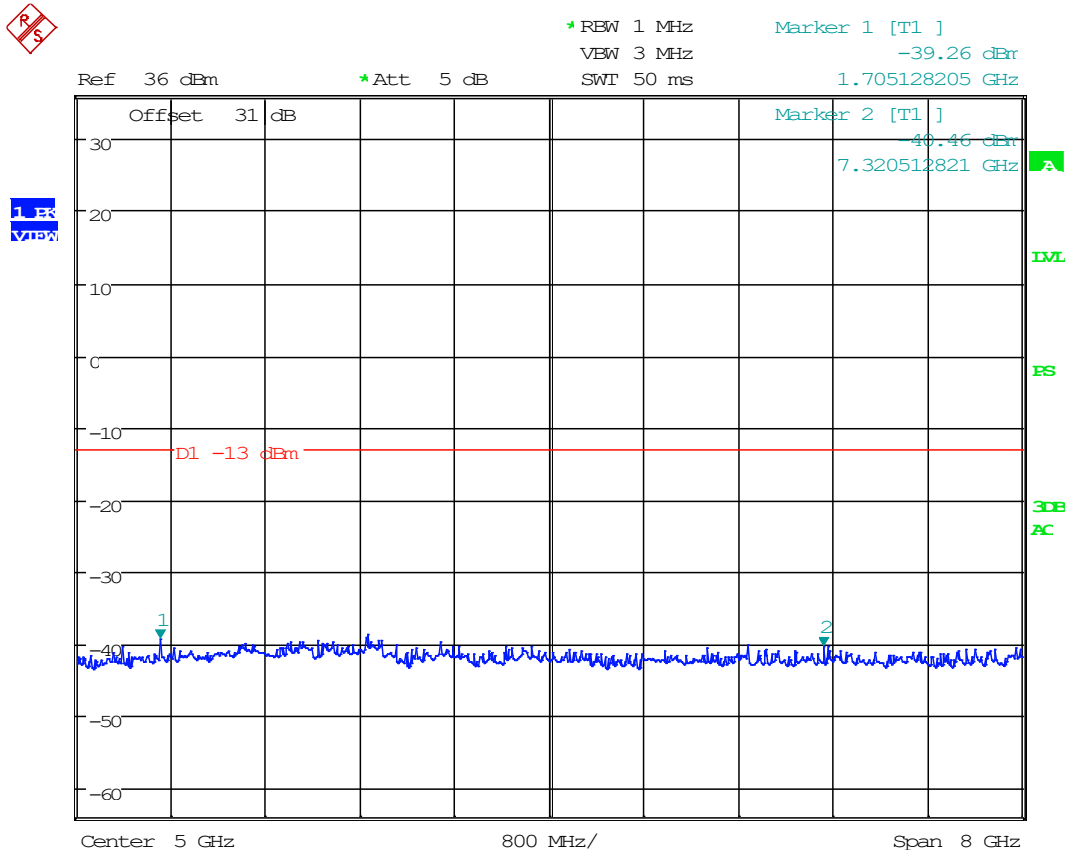
8.8.1 30 MHz to 1 GHz, 700 Band Downlink



Date: 5.NOV.2020 11:04:16

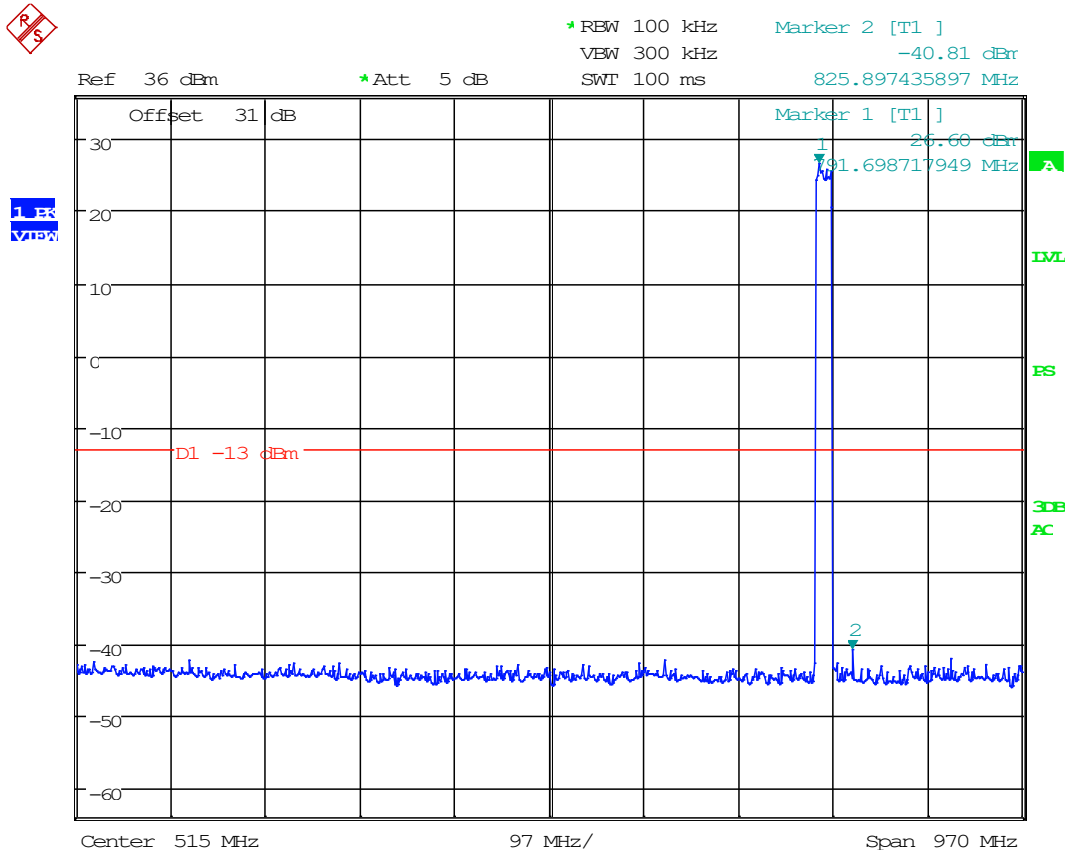


8.8.2 1 GHz to 10th Harmonic, 700 Band Downlink



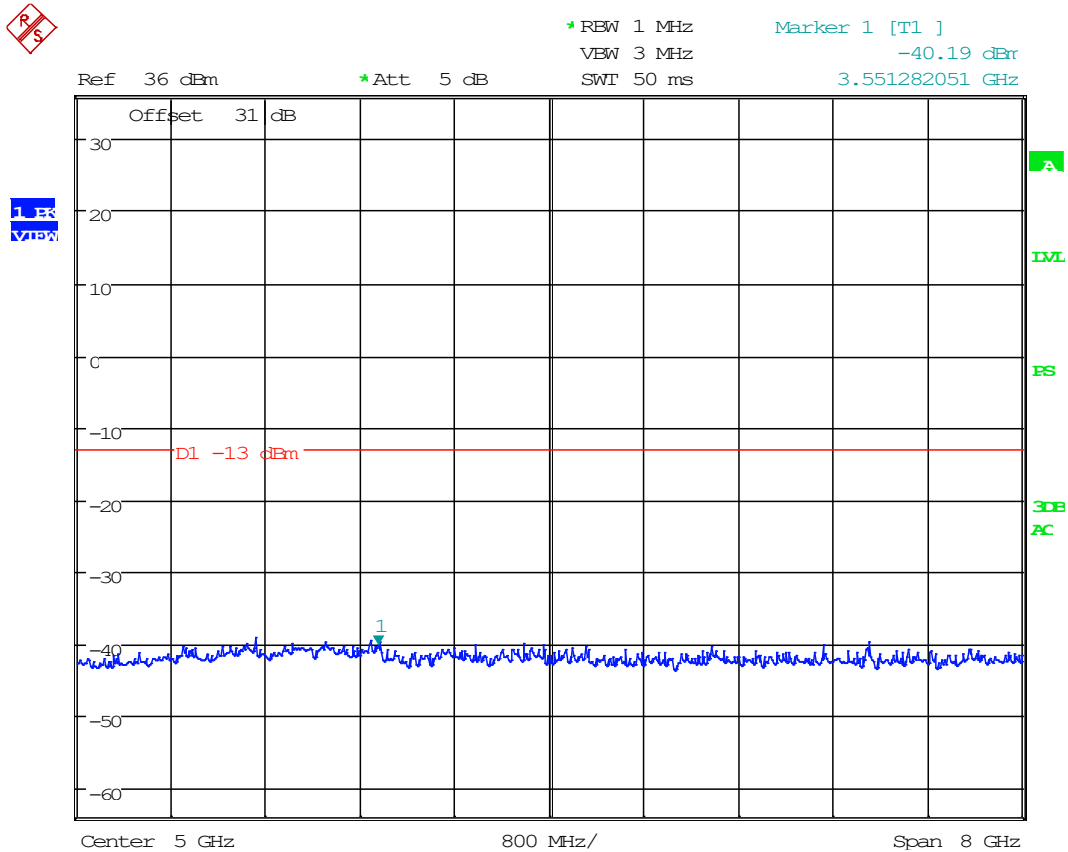
Date: 5.NOV.2020 11:00:59

8.8.3 30 MHz to 1 GHz, 700 Band Uplink



Date: 5.NOV.2020 17:03:00

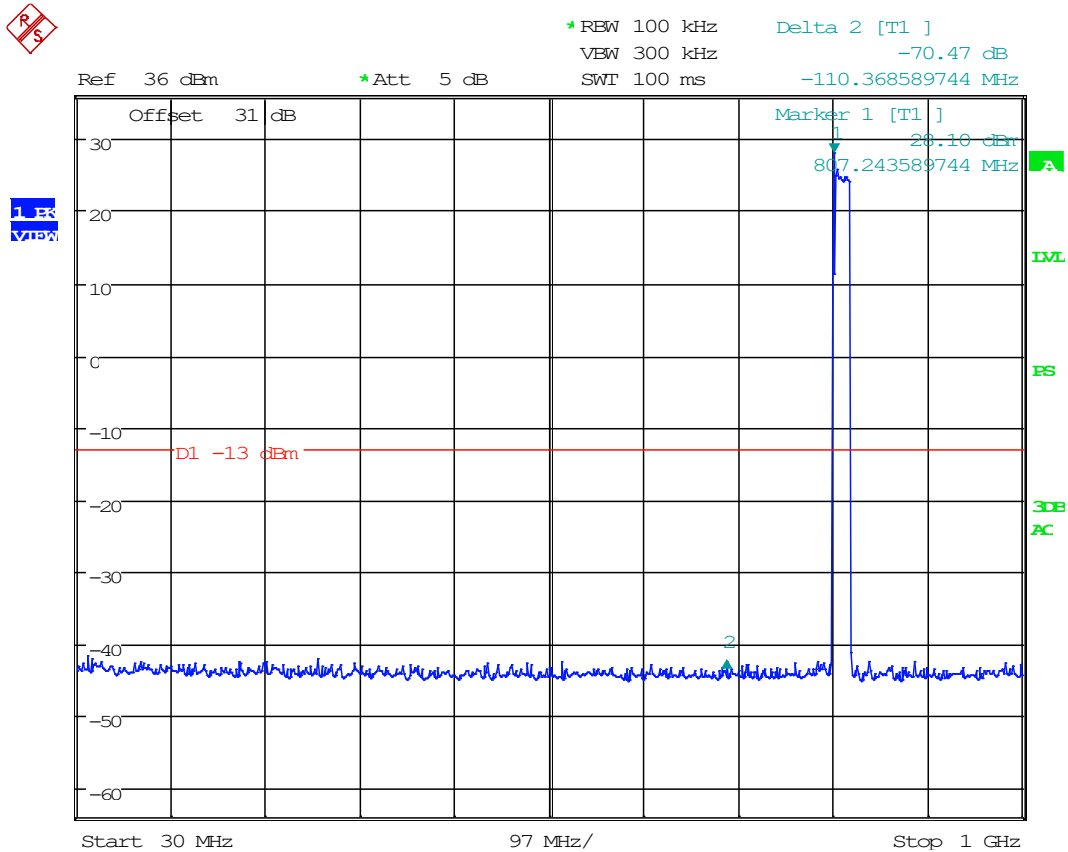
8.8.4 1 GHz to 10th Harmonic, 700 Band Uplink



Date: 5.NOV.2020 17:05:44



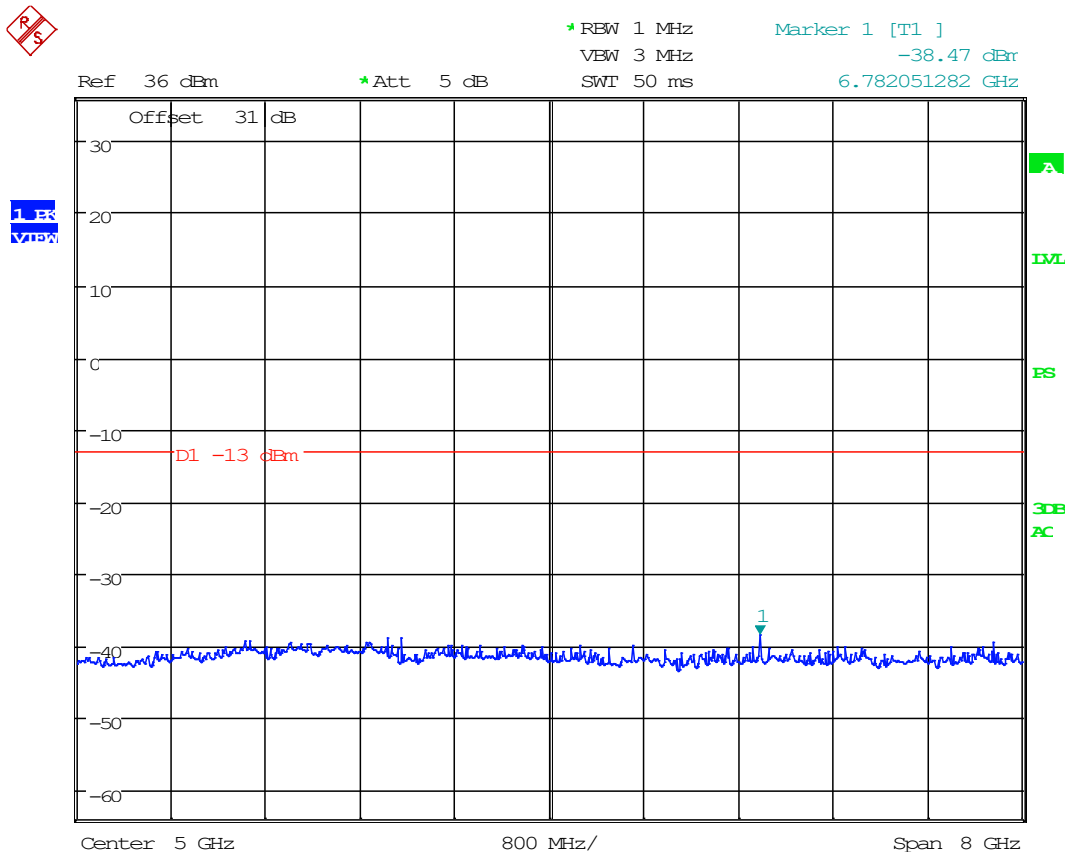
8.8.1 30 MHz to 1 GHz, 800 Band Uplink



Date: 5.NOV.2020 17:08:27



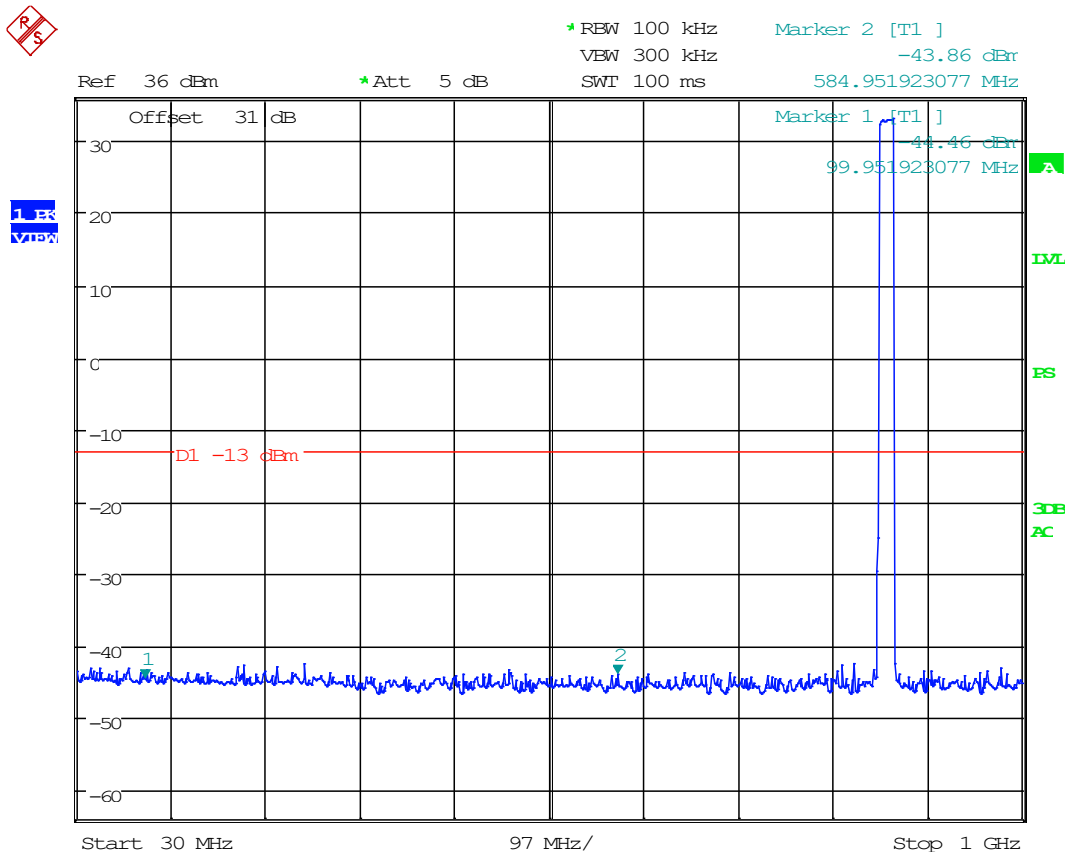
8.8.2 1 GHz to 10th Harmonic, 800 Band Uplink



Date: 5.NOV.2020 17:07:01



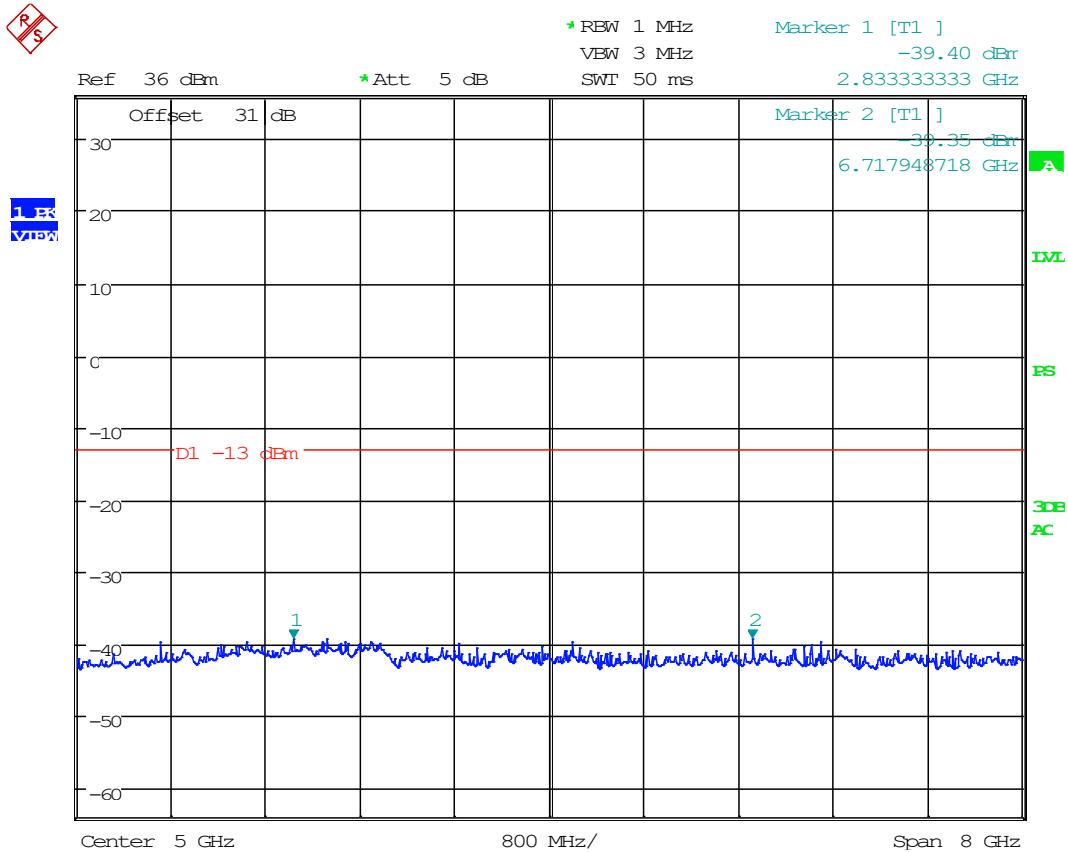
8.8.3 30 MHz to 1 GHz, 800 Band Downlink



Date: 5.NOV.2020 11:02:41



8.8.4 1 GHz to 10th Harmonic, 800 Band Downlink

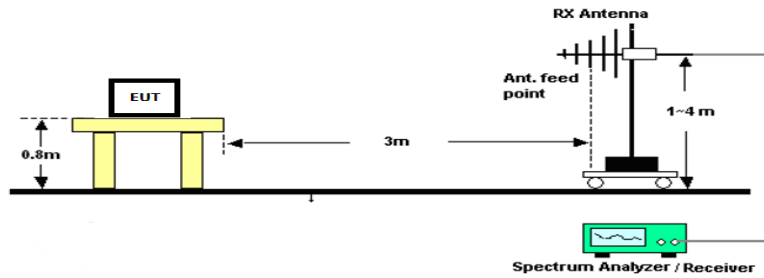


Date: 5.NOV.2020 11:01:27

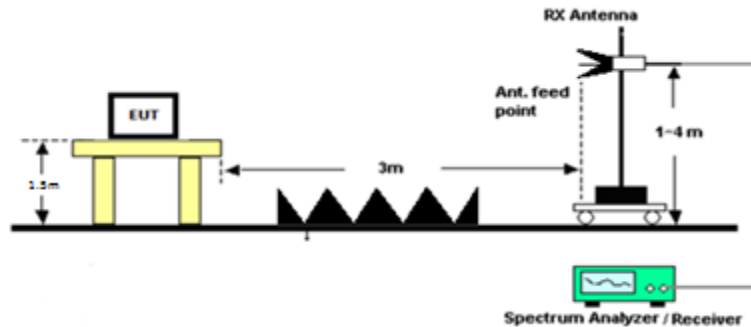
8.9 Spurious Radiated Emissions

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 Uplink

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBm)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
798.01	973.00	PK	24.03	H	3.66	22.68	3.00	50.37	-47.01	-13.00	34.01
798.01	211.50	PK	32.10	H	1.64	10.47	3.00	44.21	-53.17	-13.00	40.17
798.01	212.80	PK	33.21	V	1.65	10.44	3.00	45.30	-52.07	-13.00	39.07
798.01	580.70	PK	23.34	V	2.86	18.26	3.00	44.46	-52.92	-13.00	39.92
798.01	168.90	PK	31.67	H	1.51	15.41	3.00	48.59	-48.78	-13.00	35.78
798.01	168.90	PK	25.68	V	1.51	15.41	3.00	42.60	-54.77	-13.00	41.77
798.01	1596.03	PK	10.52	H	4.65	28.05	3.00	43.21	-54.16	-13.00	41.16
798.01	1596.03	PK	12.33	V	4.65	28.05	3.00	45.02	-52.35	-13.00	39.35
798.01	2394.04	PK	14.11	H	5.62	31.89	3.00	51.61	-45.77	-13.00	32.77
798.01	2394.04	PK	12.38	V	5.62	31.89	3.00	49.88	-47.50	-13.00	34.50
798.01	3192.05	PK	12.56	H	6.62	32.69	3.00	51.87	-45.51	-13.00	32.51
798.01	3192.05	PK	12.10	V	6.62	32.69	3.00	51.41	-45.97	-13.00	32.97
798.01	3990.06	PK	11.09	H	7.26	33.39	3.00	51.75	-45.63	-13.00	32.63
798.01	3990.06	PK	10.98	V	7.26	33.39	3.00	51.64	-45.74	-13.00	32.74
798.01	4788.08	PK	10.75	H	7.05	33.93	3.00	51.72	-45.65	-13.00	32.65
798.01	4788.08	PK	10.48	V	7.05	33.93	3.00	51.45	-45.92	-13.00	32.92
798.01	5586.09	PK	9.77	H	8.13	34.43	3.00	52.33	-45.05	-13.00	32.05
798.01	5586.09	PK	10.69	V	8.13	34.43	3.00	53.25	-44.13	-13.00	31.13
798.01	6384.10	PK	9.51	H	8.95	35.43	3.00	53.90	-43.48	-13.00	30.48
798.01	6384.10	PK	11.61	V	8.95	35.43	3.00	56.00	-41.38	-13.00	28.38
798.01	7182.11	PK	10.90	H	9.54	36.39	3.00	56.83	-40.54	-13.00	27.54
798.01	7182.11	PK	10.68	V	9.54	36.39	3.00	56.61	-40.76	-13.00	27.76
798.01	7980.13	PK	9.97	H	9.89	35.72	3.00	55.58	-41.80	-13.00	28.80
798.01	7980.13	PK	9.85	V	9.89	35.72	3.00	55.46	-41.92	-13.00	28.92

8.9.2 700 Downlink

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBm)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
768.01	212.80	PK	33.25	H	1.65	10.44	3.00	45.34	-52.03	-13.00	39.03
768.01	212.80	PK	30.51	H	1.65	10.44	3.00	42.60	-54.77	-13.00	41.77
768.01	91.50	PK	30.15	V	1.14	10.65	3.00	41.94	-55.43	-13.00	42.43
768.01	91.50	PK	28.70	H	1.14	10.65	3.00	40.49	-56.88	-13.00	43.88
768.01	1536.03	PK	14.66	H	4.55	27.76	3.00	46.97	-50.41	-13.00	37.41
768.01	1536.03	PK	17.35	V	4.55	27.76	3.00	49.66	-47.72	-13.00	34.72
768.01	2304.04	PK	16.30	H	5.50	31.55	3.00	53.35	-44.03	-13.00	31.03
768.01	2304.04	PK	18.65	V	5.50	31.55	3.00	55.70	-41.68	-13.00	28.68
768.01	3072.05	PK	11.57	H	6.43	32.69	3.00	50.69	-46.69	-13.00	33.69
768.01	3072.05	PK	12.07	V	6.43	32.69	3.00	51.19	-46.19	-13.00	33.19
768.01	3840.06	PK	10.28	H	6.53	33.19	3.00	50.00	-47.38	-13.00	34.38
768.01	3840.06	PK	11.54	V	6.53	33.19	3.00	51.26	-46.12	-13.00	33.12
768.01	4608.08	PK	9.60	H	7.55	34.03	3.00	51.19	-46.19	-13.00	33.19
768.01	4608.08	PK	10.85	V	7.55	34.03	3.00	52.44	-44.94	-13.00	31.94
768.01	5376.09	PK	9.91	H	8.17	34.32	3.00	52.40	-44.98	-13.00	31.98
768.01	5376.09	PK	11.46	V	8.17	34.32	3.00	53.95	-43.43	-13.00	30.43
768.01	6144.10	PK	9.92	H	8.62	35.33	3.00	53.87	-43.51	-13.00	30.51
768.01	6144.10	PK	10.02	V	8.62	35.33	3.00	53.97	-43.41	-13.00	30.41
768.01	6912.11	PK	10.53	H	9.21	35.98	3.00	55.73	-41.65	-13.00	28.65
768.01	6912.11	PK	10.30	V	9.21	35.98	3.00	55.50	-41.88	-13.00	28.88
768.01	7680.13	PK	10.86	H	10.10	35.90	3.00	56.85	-40.52	-13.00	27.52
768.01	7680.13	PK	9.43	V	10.10	35.90	3.00	55.42	-41.95	-13.00	28.95



Radiated Emissions, Tabular Data, 800 Band

8.9.3 800 Uplink

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBm)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
816.99	810.11	PK	22.44	V	3.38	20.40	3.00	46.22	-51.15	-13.00	38.15
816.99	211.40	PK	27.11	V	1.64	10.47	3.00	39.22	-58.16	-13.00	45.16
816.99	211.40	PK	31.60	H	1.64	10.47	3.00	43.71	-53.67	-13.00	40.67
816.99	749.80	PK	23.85	H	3.22	20.89	3.00	47.96	-49.42	-13.00	36.42
816.99	167.80	PK	30.15	V	1.50	15.52	3.00	47.17	-50.20	-13.00	37.20
816.99	39.80	PK	25.78	H	0.70	13.30	3.00	39.78	-57.60	-13.00	44.60
816.99	1633.98	PK	12.19	H	4.71	28.44	3.00	45.33	-52.04	-13.00	39.04
816.99	1633.98	PK	11.71	V	4.71	28.44	3.00	44.85	-52.52	-13.00	39.52
816.99	2450.96	PK	12.99	H	5.61	31.85	3.00	50.45	-46.93	-13.00	33.93
816.99	2450.96	PK	12.13	V	5.61	31.85	3.00	49.59	-47.79	-13.00	34.79
816.99	3267.95	PK	13.14	H	6.67	32.66	3.00	52.47	-44.91	-13.00	31.91
816.99	3267.95	PK	12.18	V	6.67	32.66	3.00	51.51	-45.87	-13.00	32.87
816.99	4084.94	PK	10.81	H	7.14	33.39	3.00	51.34	-46.04	-13.00	33.04
816.99	4084.94	PK	11.12	V	7.14	33.39	3.00	51.65	-45.73	-13.00	32.73
816.99	4901.93	PK	10.54	H	7.51	33.92	3.00	51.96	-45.42	-13.00	32.42
816.99	4901.93	PK	10.72	V	7.51	33.92	3.00	52.14	-45.24	-13.00	32.24
816.99	5718.91	PK	11.43	H	8.09	34.62	3.00	54.14	-43.24	-13.00	30.24
816.99	5718.91	PK	9.73	V	8.09	34.62	3.00	52.44	-44.94	-13.00	31.94
816.99	6535.90	PK	10.61	H	9.16	35.55	3.00	55.33	-42.05	-13.00	29.05
816.99	6535.90	PK	10.68	V	9.16	35.55	3.00	55.40	-41.98	-13.00	28.98
816.99	7352.89	PK	10.81	H	9.51	36.16	3.00	56.48	-40.90	-13.00	27.90
816.99	7352.89	PK	11.24	V	9.51	36.16	3.00	56.91	-40.47	-13.00	27.47
816.99	8169.88	PK	9.46	H	9.87	35.80	3.00	55.13	-42.25	-13.00	29.25
816.99	8169.88	PK	9.36	V	9.87	35.80	3.00	55.03	-42.35	-13.00	29.35

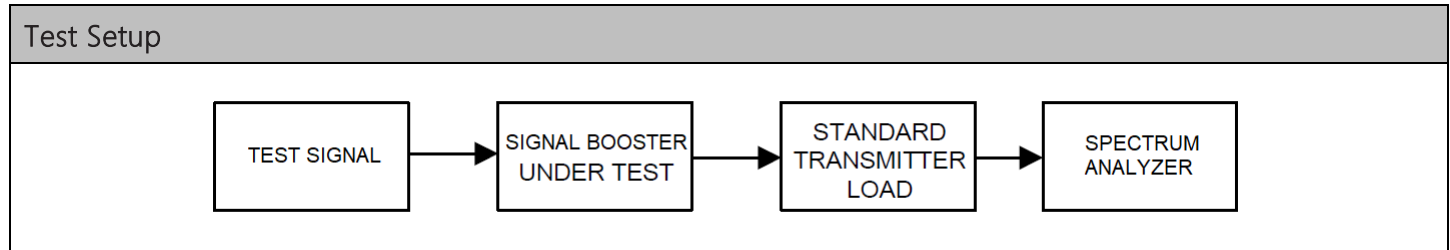
8.9.4 800 Downlink

Tuned Frequency (MHz)	Emission Frequency (MHz)	Detector	Meter Reading (dBm)	Antenna Polarity	Coax Loss (dB)	Antenna Correction Factor (dB/m)	Distance (m)	Field Strength (dBμV/m)	ERP (dBm)	Spurious Limit (dBm)	Margin (dB)
861.99	211.50	PK	32.90	V	1.64	10.47	3.00	45.01	-52.37	-13.00	39.37
861.99	211.50	PK	31.70	H	1.64	10.47	3.00	43.81	-53.57	-13.00	40.57
861.99	91.50	PK	31.12	V	1.14	10.65	3.00	42.91	-54.46	-13.00	41.46
861.99	164.50	PK	21.68	H	1.48	15.95	3.00	39.11	-58.27	-13.00	45.27
861.99	1723.98	PK	14.32	H	4.81	29.38	3.00	48.52	-48.86	-13.00	35.86
861.99	1723.98	PK	11.85	V	4.81	29.38	3.00	46.05	-51.33	-13.00	38.33
861.99	2585.96	PK	11.40	H	5.76	32.46	3.00	49.62	-47.75	-13.00	34.75
861.99	2585.96	PK	13.07	V	5.76	32.46	3.00	51.29	-46.08	-13.00	33.08
861.99	3447.95	PK	12.82	H	6.88	32.60	3.00	52.30	-45.08	-13.00	32.08
861.99	3447.95	PK	12.32	V	6.88	32.60	3.00	51.80	-45.58	-13.00	32.58
861.99	4309.94	PK	10.76	H	7.54	33.48	3.00	51.78	-45.60	-13.00	32.60
861.99	4309.94	PK	10.52	V	7.54	33.48	3.00	51.54	-45.84	-13.00	32.84
861.99	5171.93	PK	10.40	H	7.88	34.13	3.00	52.41	-44.97	-13.00	31.97
861.99	5171.93	PK	10.58	V	7.88	34.13	3.00	52.59	-44.79	-13.00	31.79
861.99	6033.91	PK	10.73	H	8.66	35.16	3.00	54.55	-42.83	-13.00	29.83
861.99	6033.91	PK	9.83	V	8.66	35.16	3.00	53.65	-43.73	-13.00	30.73
861.99	6895.90	PK	10.46	H	9.22	35.93	3.00	55.61	-41.77	-13.00	28.77
861.99	6895.90	PK	10.44	V	9.22	35.93	3.00	55.59	-41.79	-13.00	28.79
861.99	7757.89	PK	9.93	H	10.12	35.87	3.00	55.92	-41.46	-13.00	28.46
861.99	7757.89	PK	9.88	V	10.12	35.87	3.00	55.87	-41.51	-13.00	28.51
861.99	8619.88	PK	9.74	H	10.17	36.03	3.00	55.94	-41.44	-13.00	28.44
861.99	8619.88	PK	9.89	V	10.17	36.03	3.00	56.09	-41.29	-13.00	28.29



8.10 Modulation Characteristics

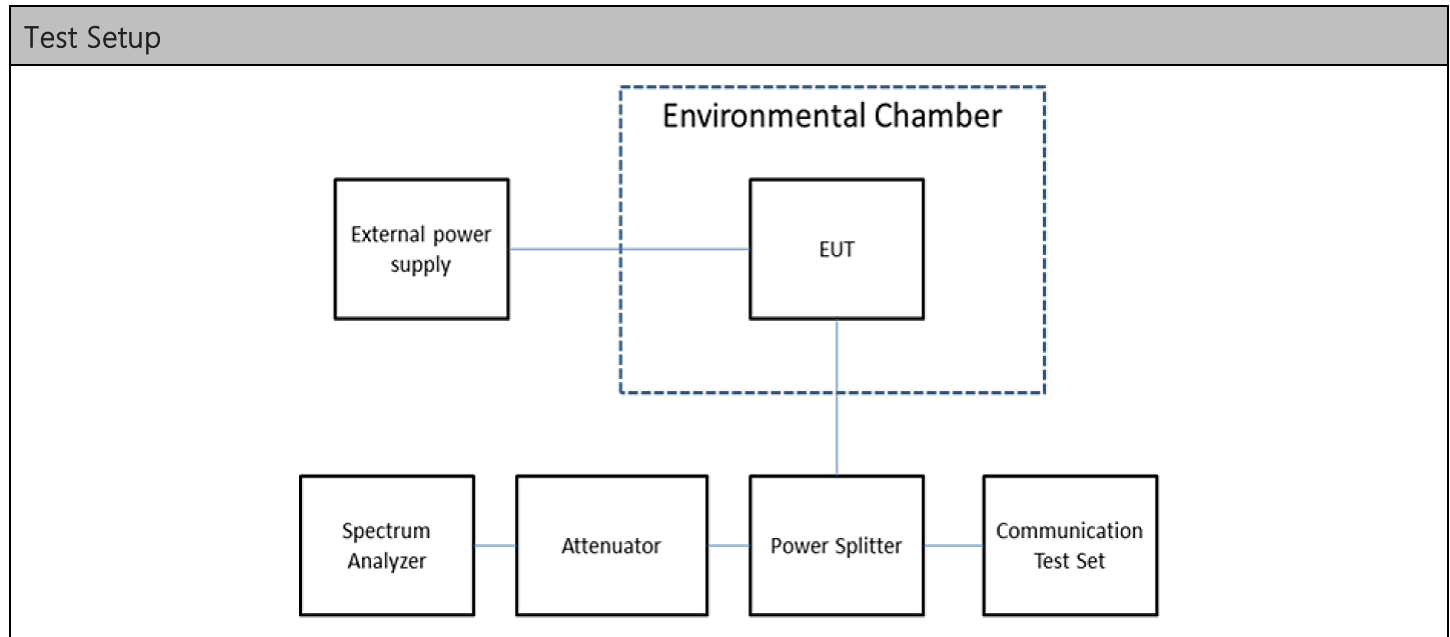
Limits from FCC Parts 2.1047, and test procedure from ANSI C63.26-2015.



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

8.11 Frequency Stability

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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(352) 472-5500 / testing@timcoengr.com

8.12 Transient Frequency Behavior

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

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. ANNEX-A - Photographs of the EUT

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

10. ANNEX-B – Test Setup Photographs

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

11. History of Test Report Changes

Test Report #	Revision #	Description	Date of Issue
TR_3913-20_FCC_PT90_Booster Class B_1	1	Initial release	November 14, 2020
TR_3913-20_FCC_PT90_Booster Class B_2	2	Clerical Updates	November 30, 2020



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END OF TEST REPORT
