849 NW STATE ROAD 45
NEWBERRY, FL 32669 USA
PH: 888.472.2424 OR
352.472.5500
FAX: 352.472.2030
EMAIL: INFO@TIMCOENGR.COM
HTTP://WWW.TIMCOENGR.COM

CLASS B INDUSTRIAL BOOSTER

FCC PART 90 TEST REPORT

Applicant	RADIO SOLUTIONS, INC.
Address	55 ACCORD PARK DRIVE NORWELL, MA. 02061 USA
FCC ID	2AHVPSB400M2A
Model Number	SB400M2A
Product Description	UHF SIGNAL BOOSTER
Date Sample Received	9/21/2017
Date Tested	11/27/2017
Tested By	Franklin Rose
Approved By	Sid Sanders
Test Results	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
1702AUT17TestReport	Rev1	Initial Issue	11/27/2017
1702AUT17TestReport	Rev2	Updated Input Vs Output Plots	12/4/2017

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

Summary

The device under test does:

☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.

☐ Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669

Tested by:
Name and Title: Franklin Rose, Testing Technician/Project Manager

Date: 11/27/2017

Reviewed and approved by: _____
Name and Title: Sid Sanders , Engineer

Date: 11/28/2017

EUT DESCRIPTION

EUT Description	UHF SIGNAL BOOSTER
FCC ID	2AHVPSB400M2A
Model Number	SB400M2A
Operating Frequency	450.00, 462.00, 470.00, 490.00 MHz
Type of Emission	16K0F3E, 11K3F3E, 8K10F1E, 8K10F1W, 4K00F1E
EUT Power Source	☒ 110–120Vac/50– 60Hz
	☐ DC Power 27V
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☒ Fixed
	☐ Mobile
	☐ Portable
Test Conditions	The temperature was 26ºC with a relative humidity of 50%.
Revision History to the EUT	None
Test Exercise	The EUT was operated in a normal mode.
Applicable Standards	FCC CFR 47 Part 90.219, KDB 935210 D05 v01r01, 971168 D01 v02r02
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

EUT Notes: The EUT is pre-programmed with discreet frequencies from the factory which cannot be altered by the user. In the case of this testing, the EUT was pre-programmed with Downlinks 450 and 470 MHz, and Uplinks 462 and 490 MHz.

TEST RESULTS SUMMARY

FCC RULE PART	Limit	TEST DESCRIPTION	RESULT PASS/FAIL
47CFR90.219(e)(1) AND KDB 935210-D05 v01r01 §4.5	Reporting Only	Input/output power	**PASS**
KDB 935210-D05 v01r01 §4.2	Reporting Only	AGC Threshold	**PASS**
KDB 935210-D05 v01r01 §4.3	Reporting Only	Out-Of-band rejection	**PASS**
47CFR90.219(e)(4) AND KDB 935210-D05 v01r01 §4.4	Reporting Only	Input-versus-output signal comparison	**PASS**
47CFR90.219(e)(2) AND KDB 935210-D05 v01r01 §4.6	9 dB	Noise Figure	**PASS**
47CFR90.210 AND KDB 935210-D05 v01r01 §4.7.2	-13 dBm	Out-of-band/out-of-block Intermodulation	**PASS**
47CFR90.219(e)(3) AND KDB 935210-D05 v01r01 §4.7.3	-13 dBm	Spurious Emissions Conducted	**PASS**
47CFR90.213 AND KDB 935210-D05 v01r01 §4.8	Refer to Table	Frequency Stability	**NOT REQUIRED**
47CFR90.210 AND KDB 935210-D05 v01r01 §4.9	-13 dBm	Spurious emissions radiated	**PASS**

RF POWER OUTPUT and AMPLIFIER GAIN. §4.5

Rule Part No.: Part 2.1046(a), Part 90.219 (e) (1)

Requirements: 5.0Watts ERP

Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.5.1 General
§ 4.5.2 Determining Amplifier/Booster Gain
§ 4.5.4 Power Measurement Method 2: Using a power meter

The Input and Output power levels were recorded and the gain calculated using the following formula:

$Gain_{dB} = Output\ Power_{dBm} - Input\ Power_{dBm}$

Test Data: Power Output Measurement Table

Mode	AGC	Input Freq (MHz)	Input Power (dBm)	Output Power (dBm)	Limit (dBm)	Margin (dB)	Gain (dB)
CW	Below	450.00	-20.90	32.05	36.99	4.94	52.95
CW	+3 dB	450.00	-17.90	32.21	36.99	4.78	50.11
CW	Below	462.00	-20.90	31.22	36.99	5.77	52.12
CW	+3 dB	462.00	-17.90	31.52	36.99	5.47	49.42
CW	Below	470.00	-20.90	31.81	36.99	5.18	52.71
CW	+3 dB	470.00	-17.90	32.04	36.99	4.95	49.94
CW	Below	490.00	-20.90	32.03	36.99	4.96	52.93
CW	+3 dB	490.00	-17.90	32.26	36.99	4.73	50.16

Part 2.1033 (C) (8) DC Input into the final amplifier

INPUT POWER: (110 VAC) (2.1 A) = **231 Watts Maximum**

AGC THRESHOLD §4.2

Rule Part No.: KDB935210 § 4.2

Requirements: Reporting only, used to determine test input levels

Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.2 Measuring AGC threshold

Test Data: AGC Table

Frequency (MHz)	Input Level (dBm)	Booster Output (dBm)
470	-22.9	-9.23
470	-21.9	-8.24
470	-20.9	-7.64
470	-19.9	-7.65
470	-18.9	-7.66
470	-17.9	-7.67

Note: Yellow denotes level below AGC; green denotes AGC level +3 dB

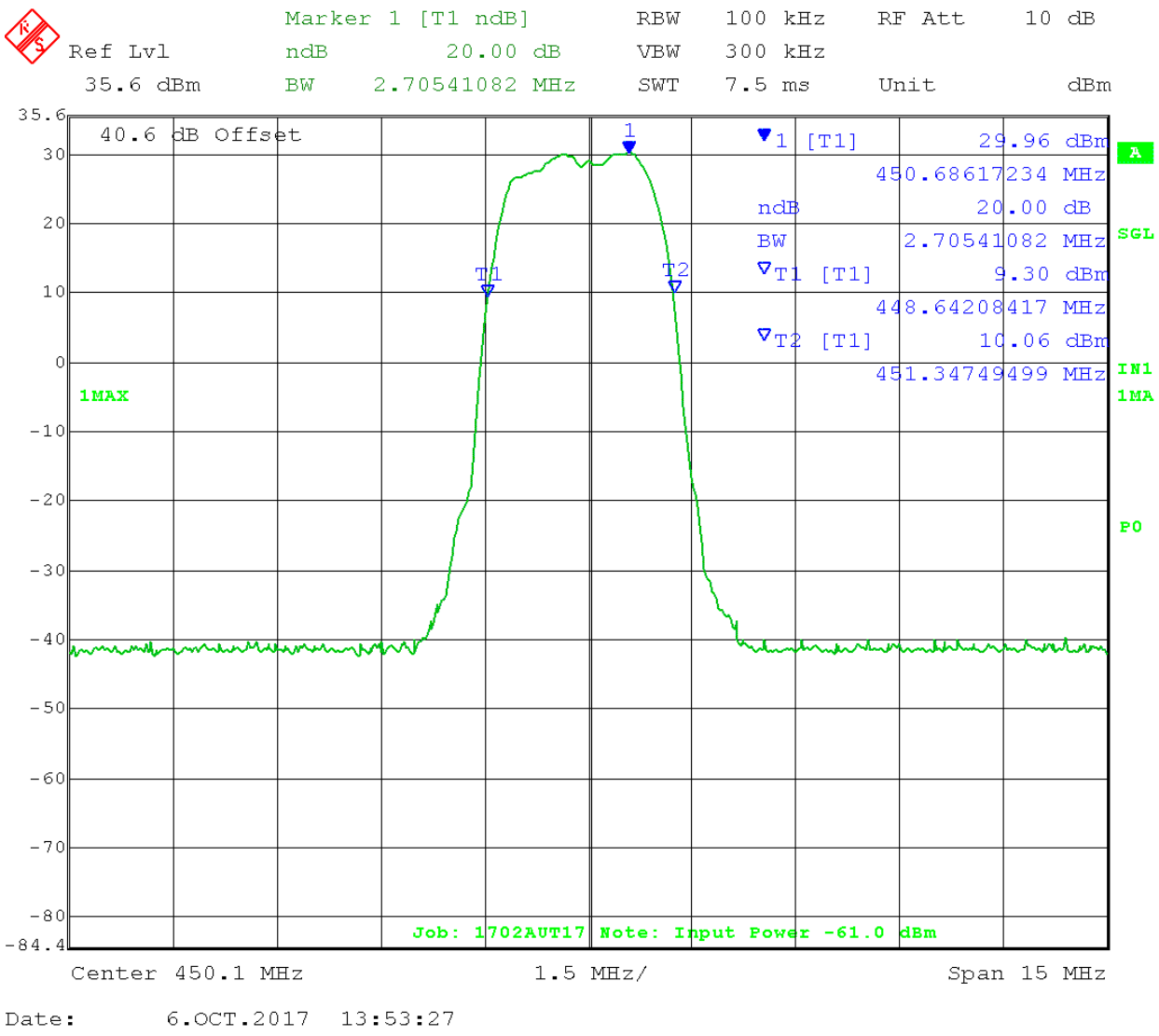
OUT-OF-BAND REJECTION § 4.3

Rule Part No.: KDB 935210 §4.3 Out of band rejection

Requirements: Reporting Only

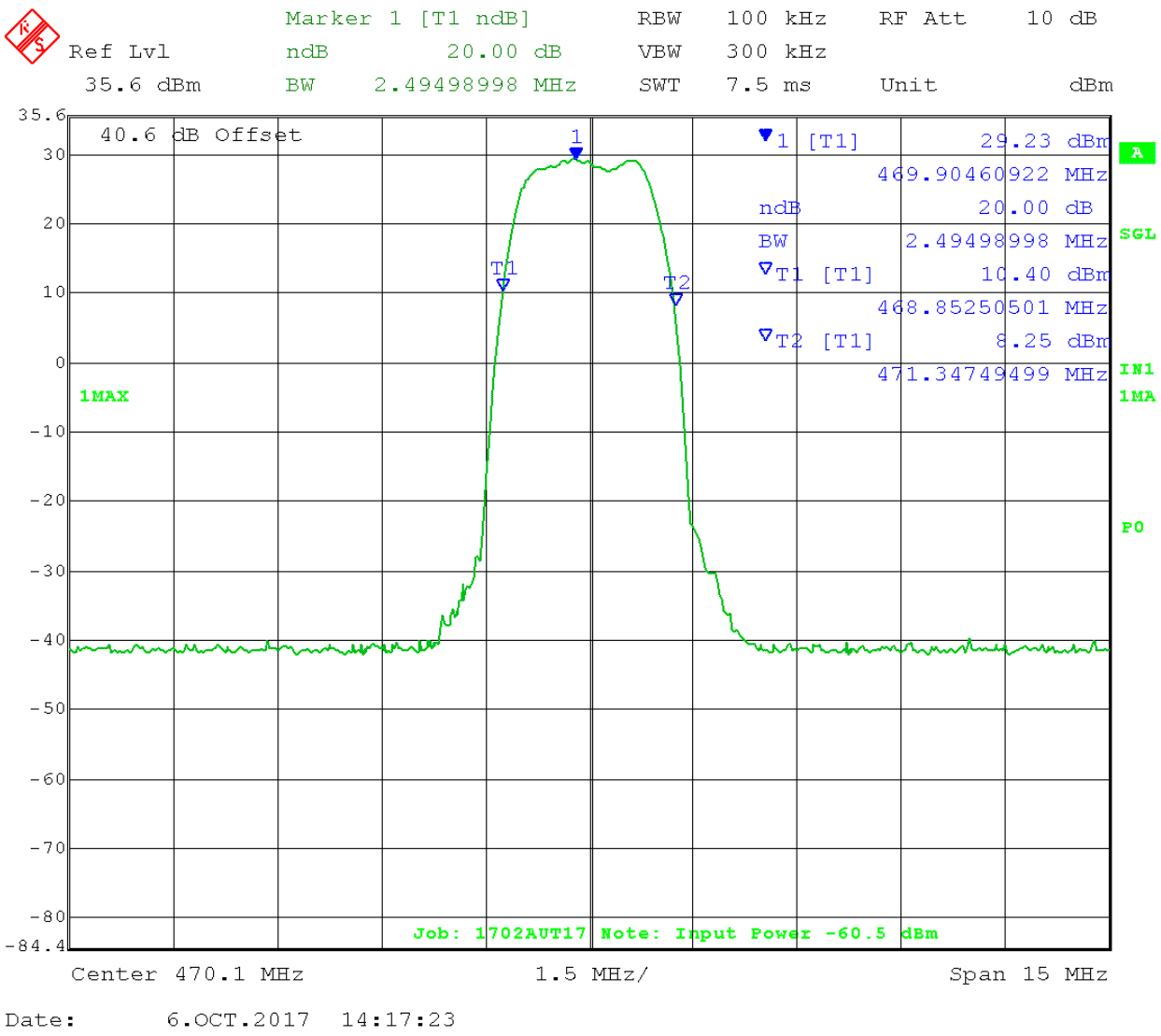
Procedure: KDB 935210 §4.3 Out of band rejection

Test Data: Downlink 450.00 MHz



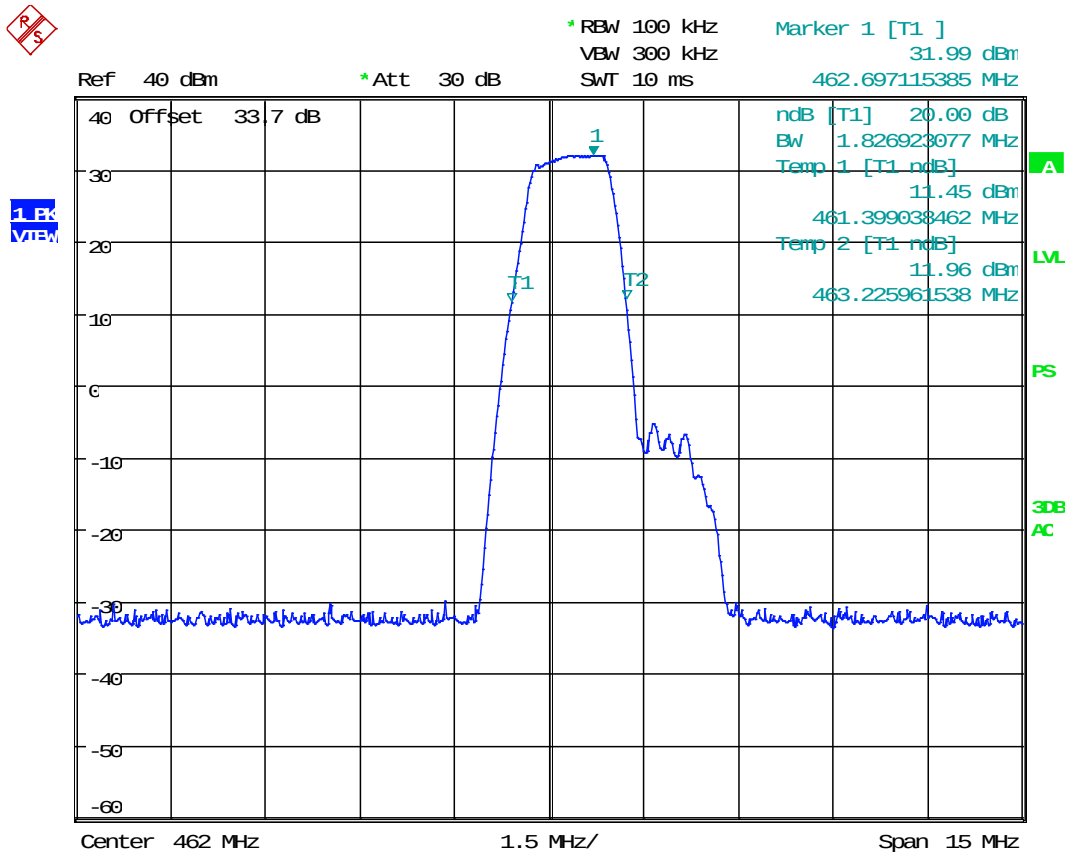
Out-of-Band Rejection §4.3

Test Data: Downlink 470.00 MHz



Out-of-Band Rejection §4.3

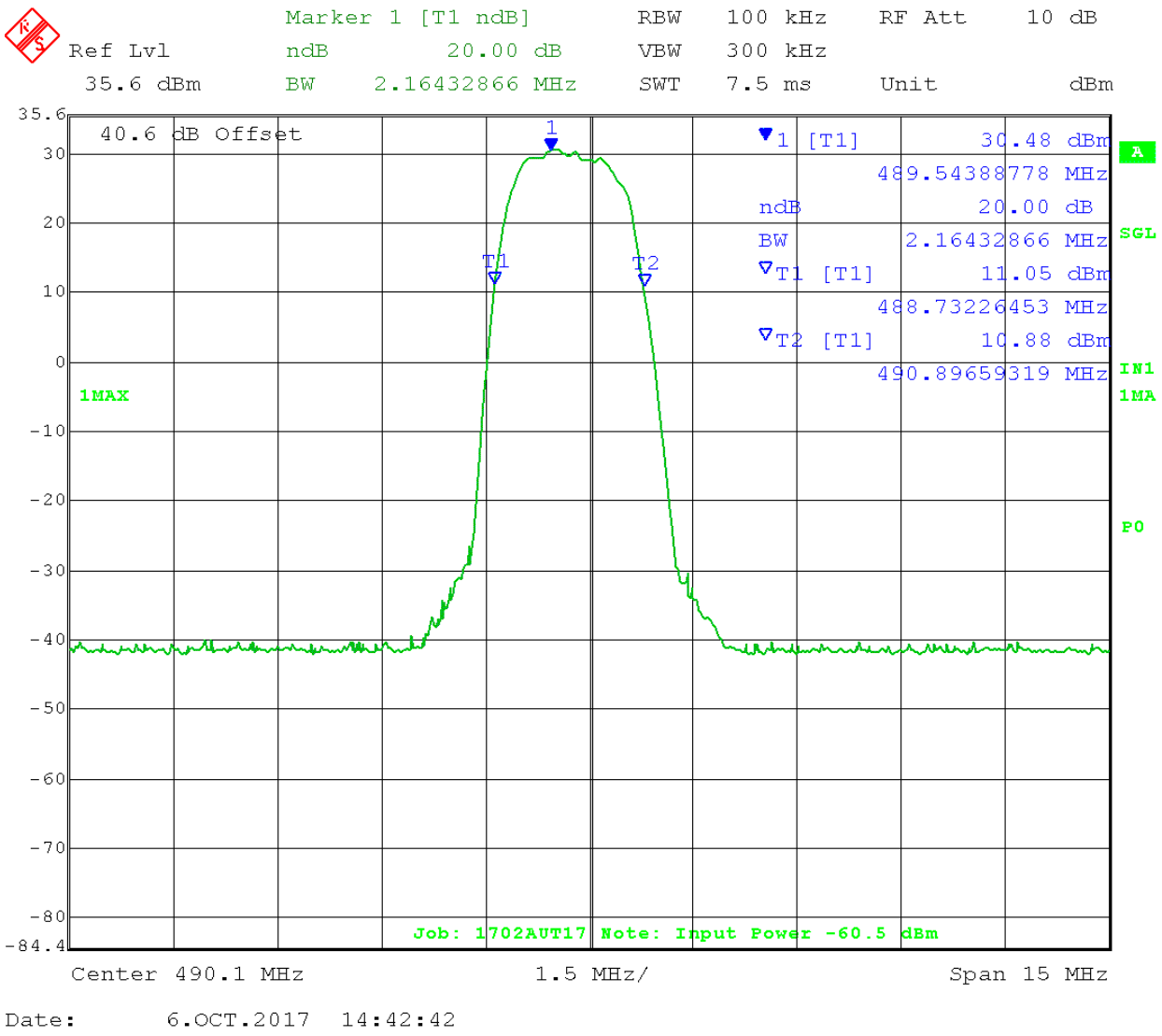
Test Data: Uplink 462.00 MHz



Date: 22.NOV.2017 15:49:34

Out-of-Band Rejection §4.3

Test Data: Uplink 490.00 MHz



INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4, DOWNLINK 450 MHz

Rule Part No.: 47CFR90.219(e)(4)
KDB 935210-D05 v01r01 §4.4

Requirements: A signal booster must be designed such that all signals that it retransmits meet the following requirements:

The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, provided that the retransmitted signals meet the requirements of §90.213.

There is no change in the occupied bandwidth of the retransmitted signals.

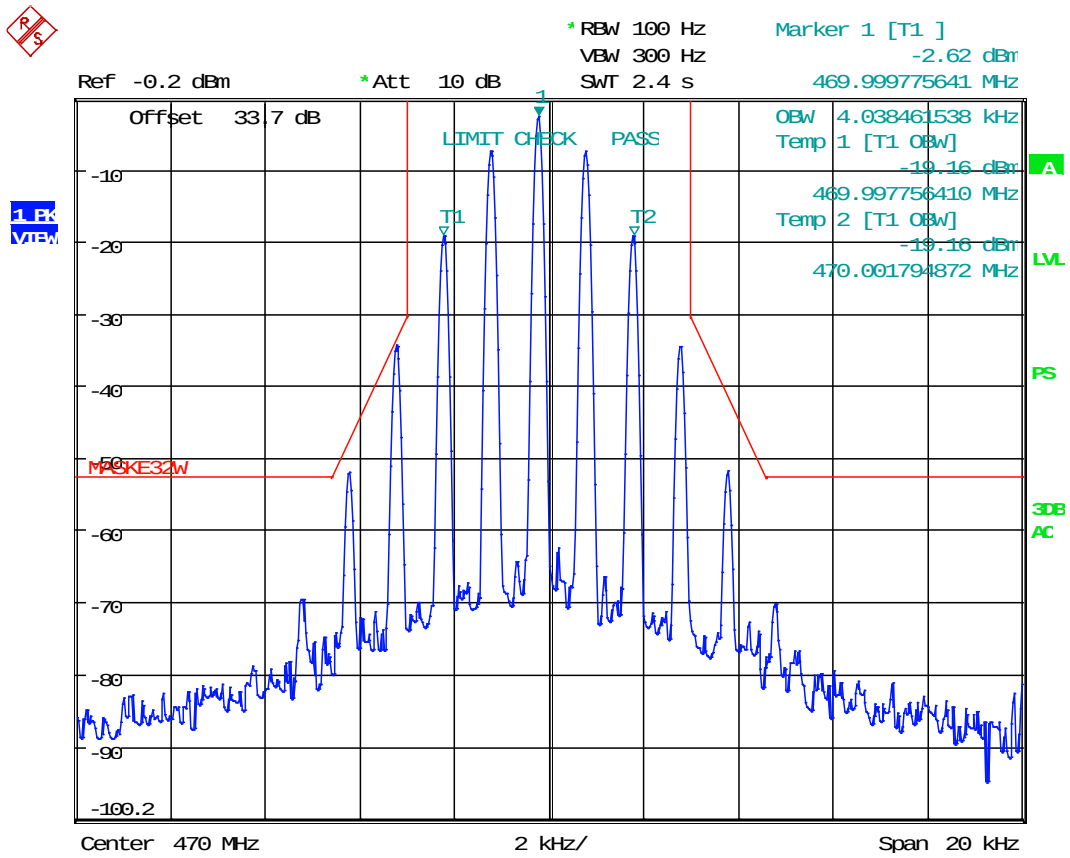
The retransmitted signals continue to meet the unwanted emissions limits of §90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

Procedure: KDB935210 § 4.4 Input versus output signal comparison

The EUT was test for this requirement at 3 places in the band and the data below represents the worst case.

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

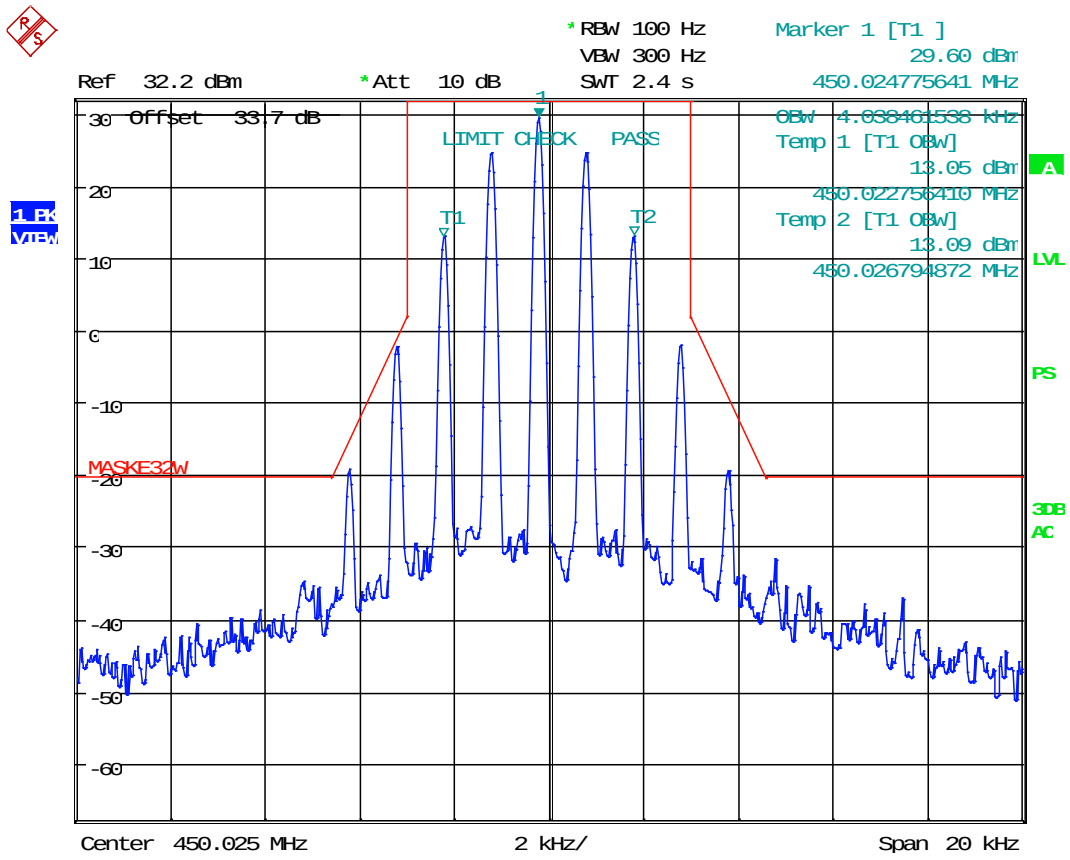
Test Data: Downlink 450.025 MHz – 6.25 kHz Test Signal



Date: 29.NOV.2017 09:44:20

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 450.025 MHz – 6.25 kHz Below AGC Threshold



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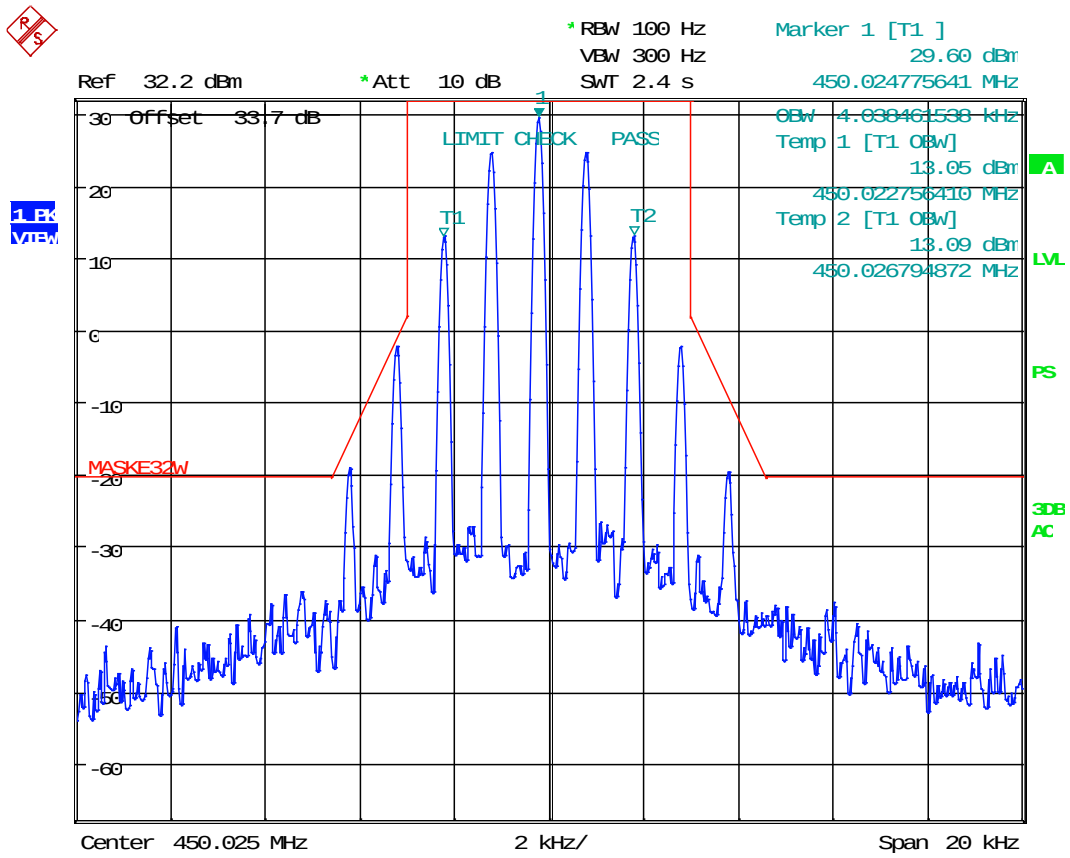
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

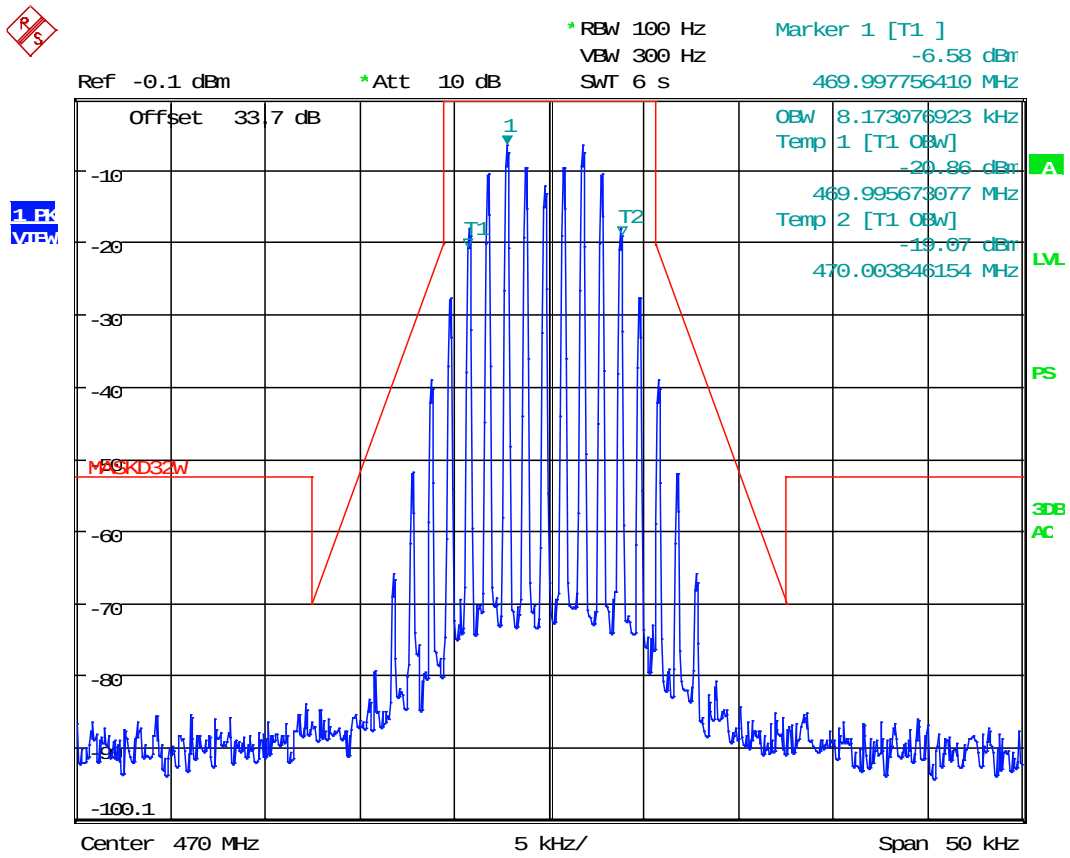
Test Data: Downlink 450.025 MHz – 6.25 kHz +3 dBm Above AGC Threshold



Date: 29.NOV.2017 09:34:23

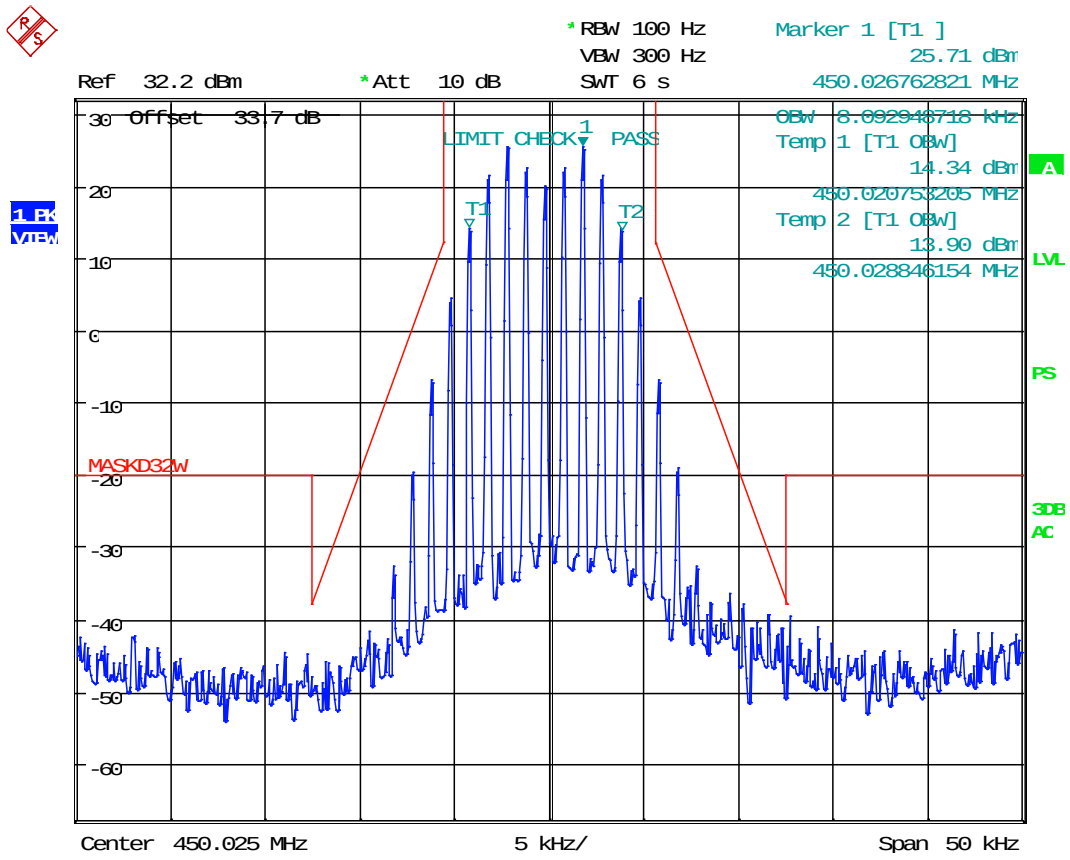
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 450.025 MHz – 12.5 kHz Test Signal



INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

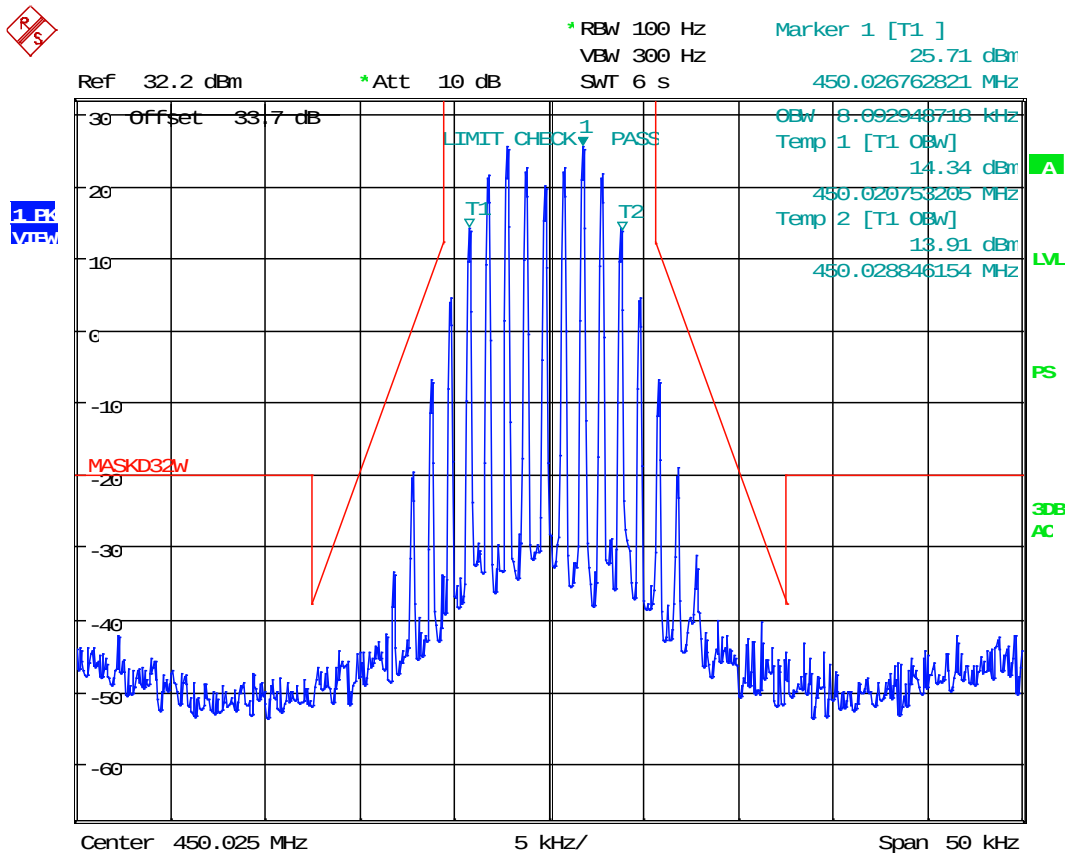
Test Data: Downlink 450.025 MHz – 12.5 kHz Below AGC Threshold



Date: 29.NOV.2017 09:50:19

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 450.025 MHz – 12.5 kHz +3 dBm Above AGC Threshold



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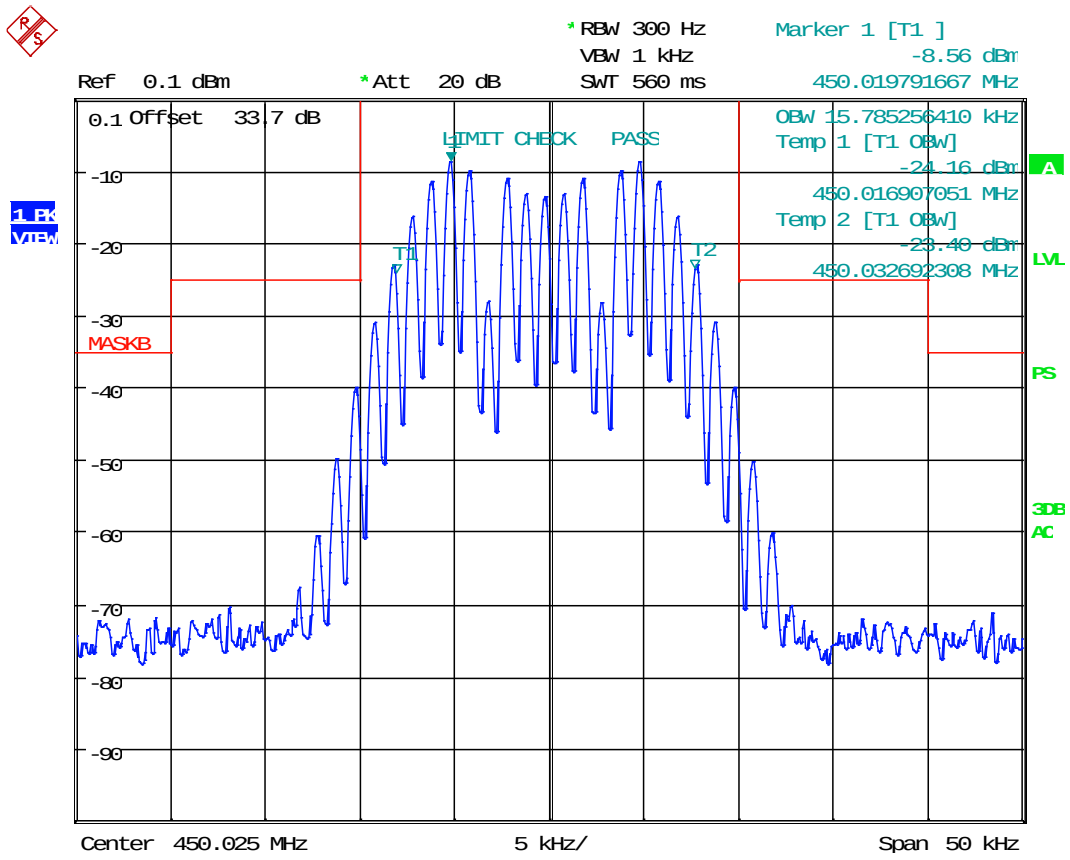
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

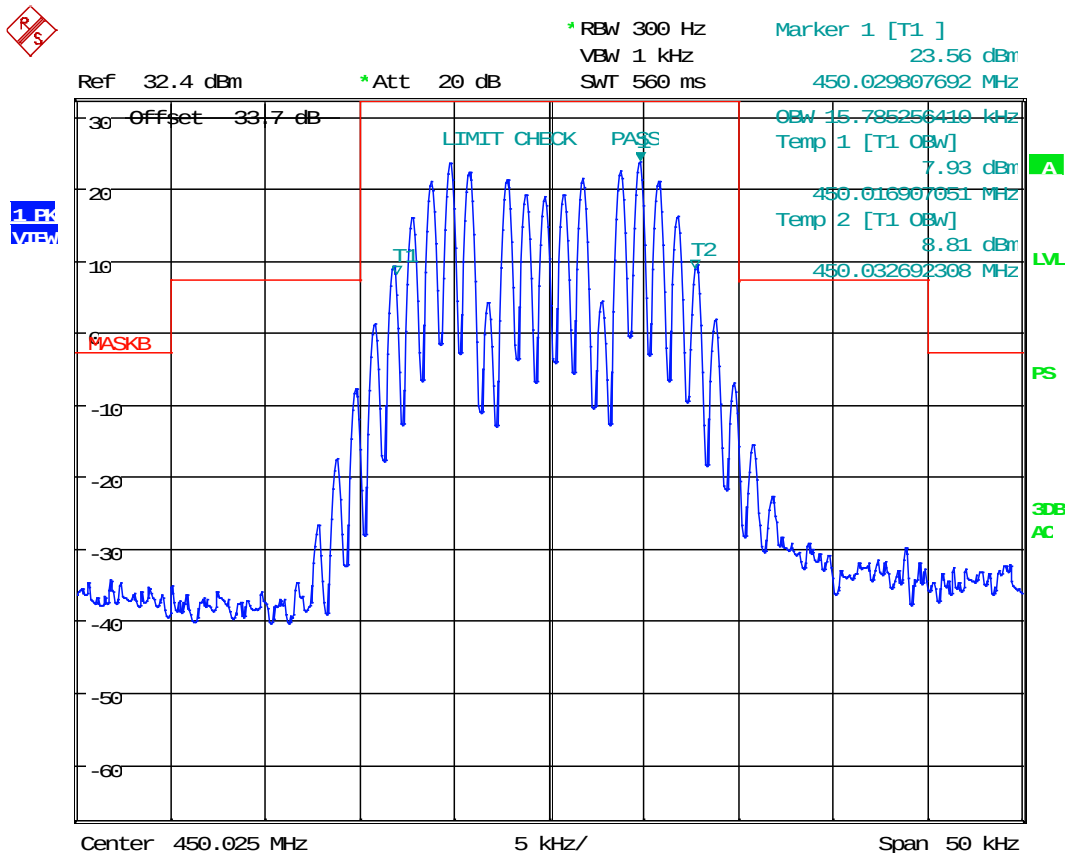
Test Data: Downlink 450.025 MHz – 25 kHz Test Signal



Date: 29.NOV.2017 11:29:16

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

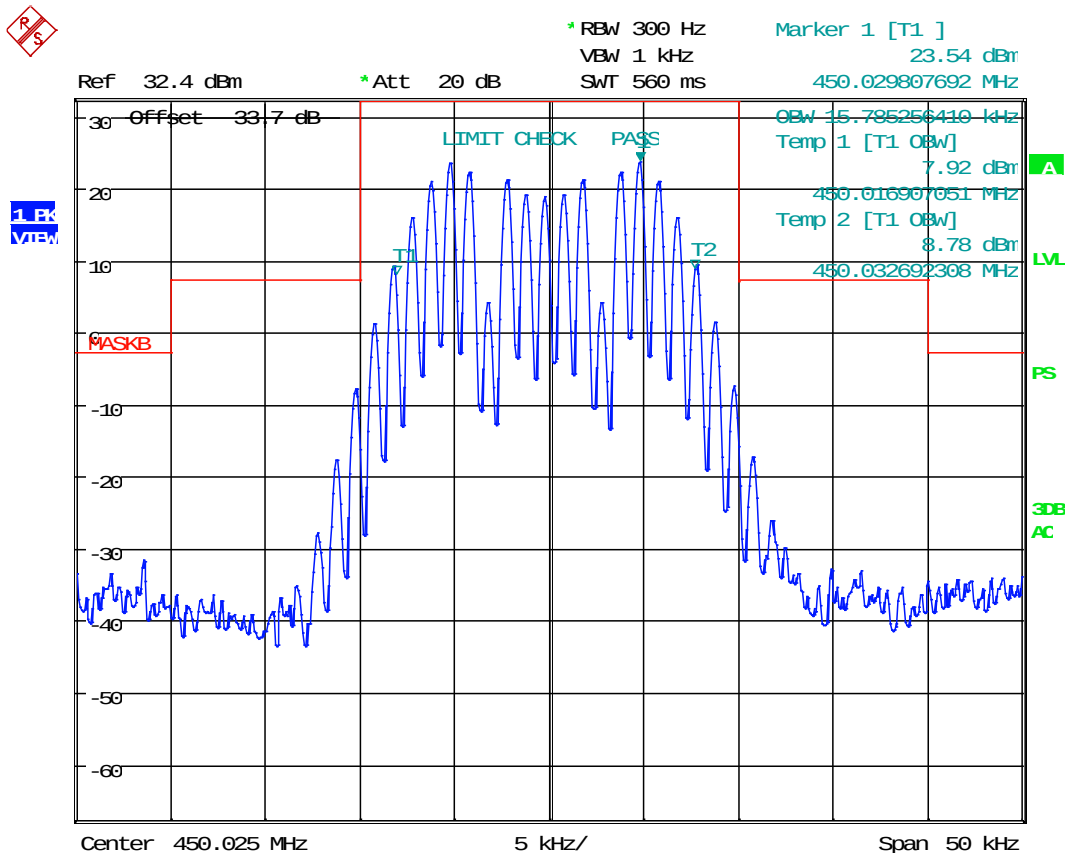
Test Data: Downlink 450.025 MHz – 25 kHz Below AGC Threshold



Date: 29.NOV.2017 11:21:16

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 450.025 MHz – 25 kHz +3 dBm Above AGC Threshold



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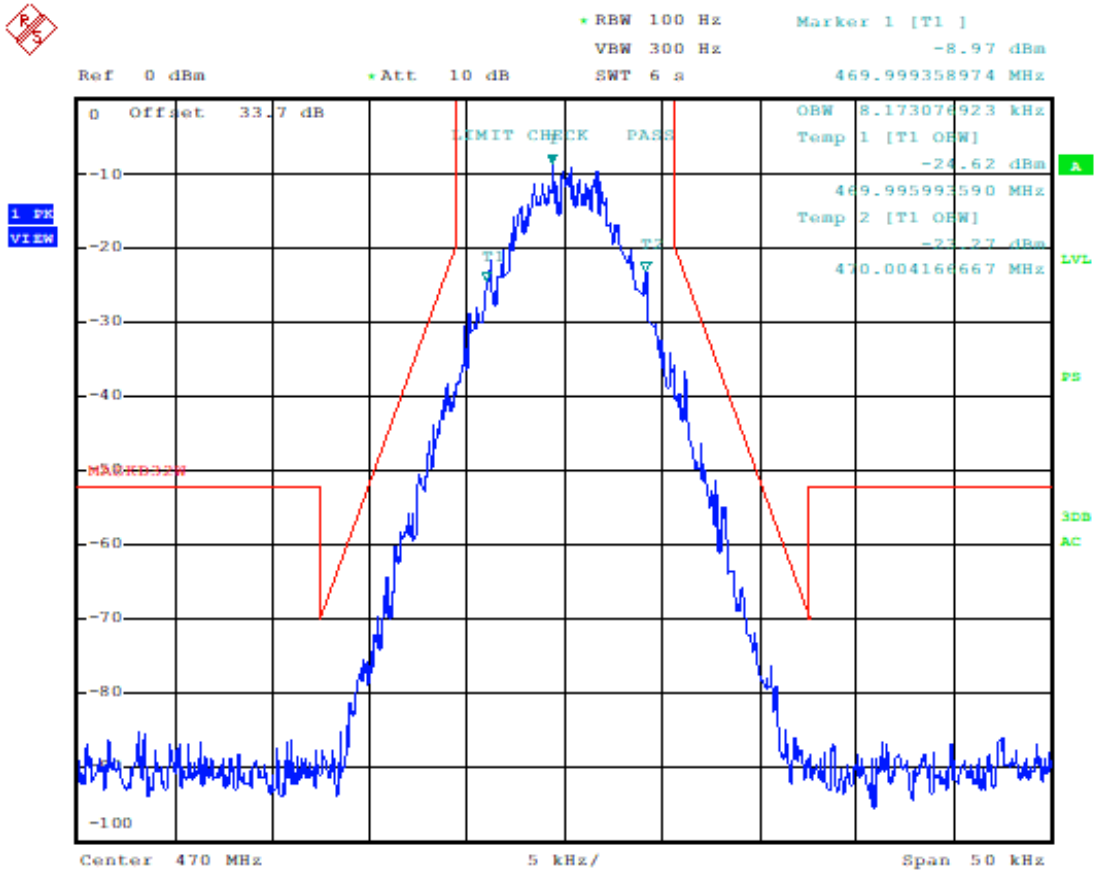
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

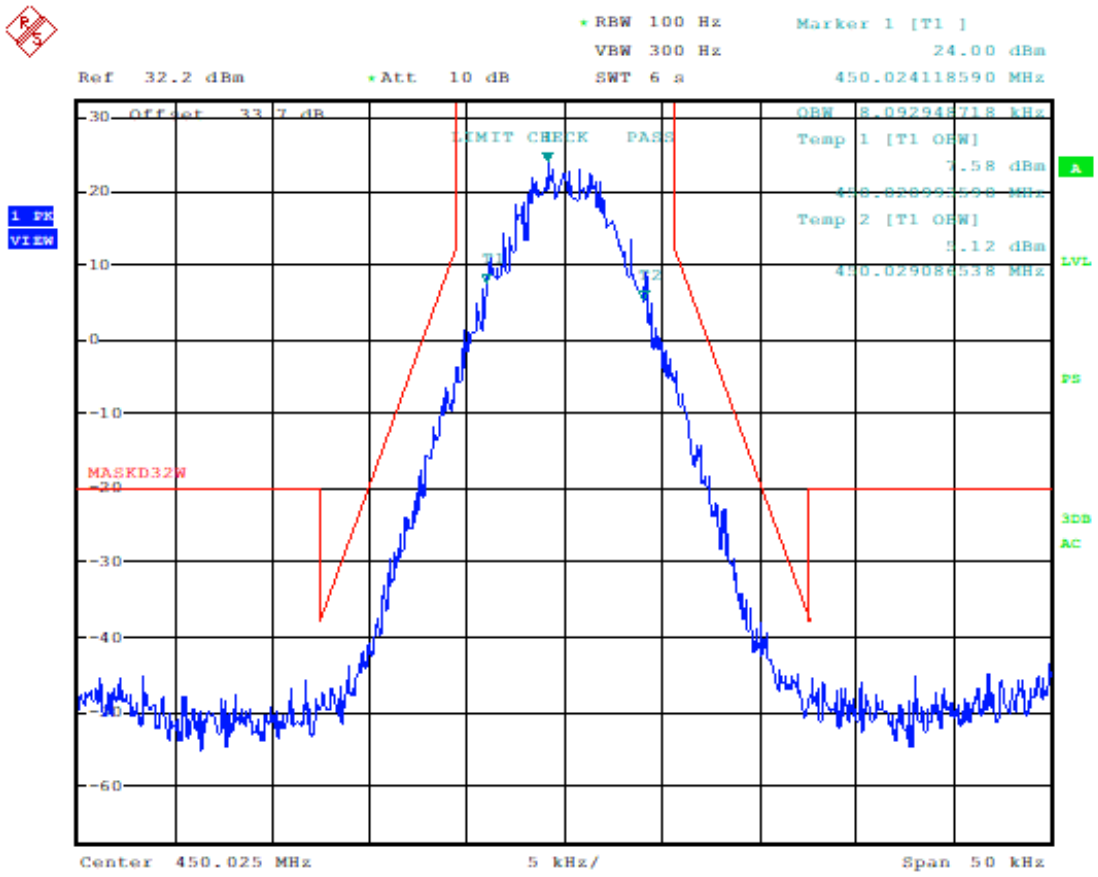
Test Data: Downlink 450.025 MHz – P25 Phase 1 C4FM Test Signal



Date: 29.NOV.2017 10:24:12

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

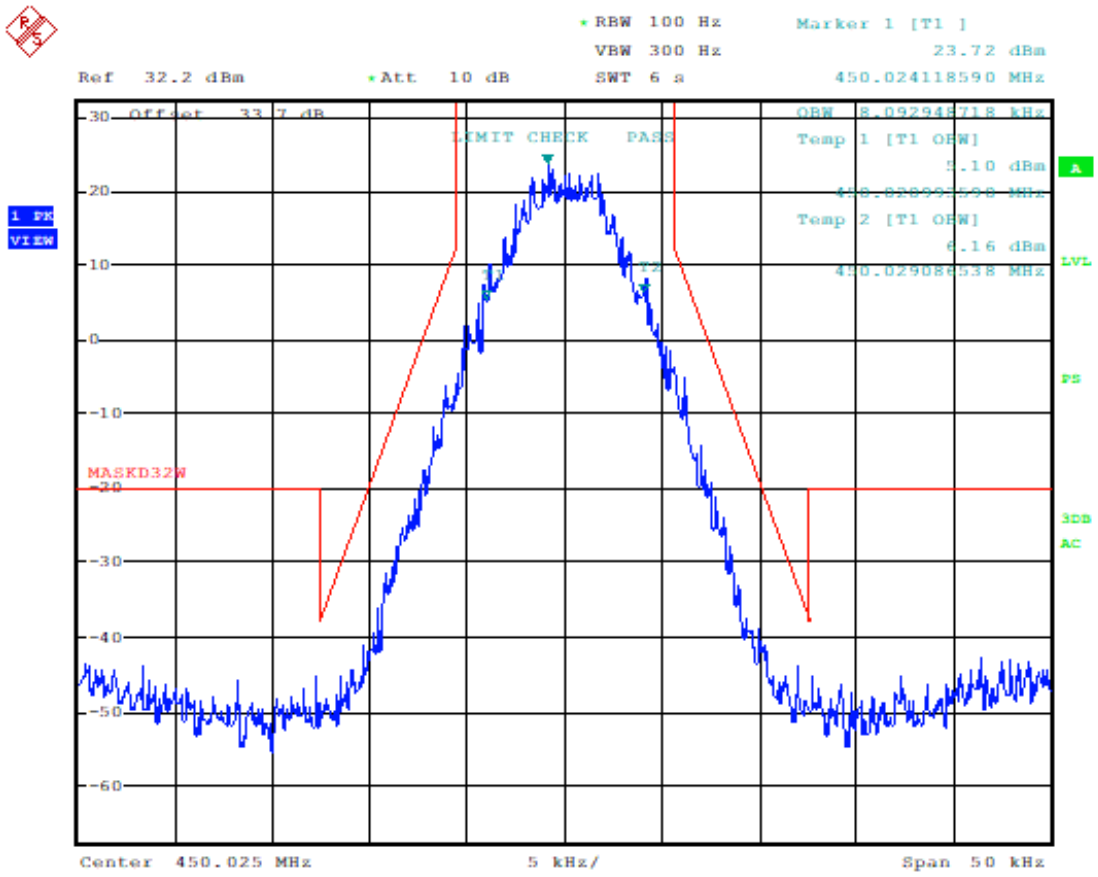
Test Data: Downlink 450.025 MHz – P25 Phase 1 C4FM Below AGC Threshold



Date: 29.NOV.2017 10:36:28

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

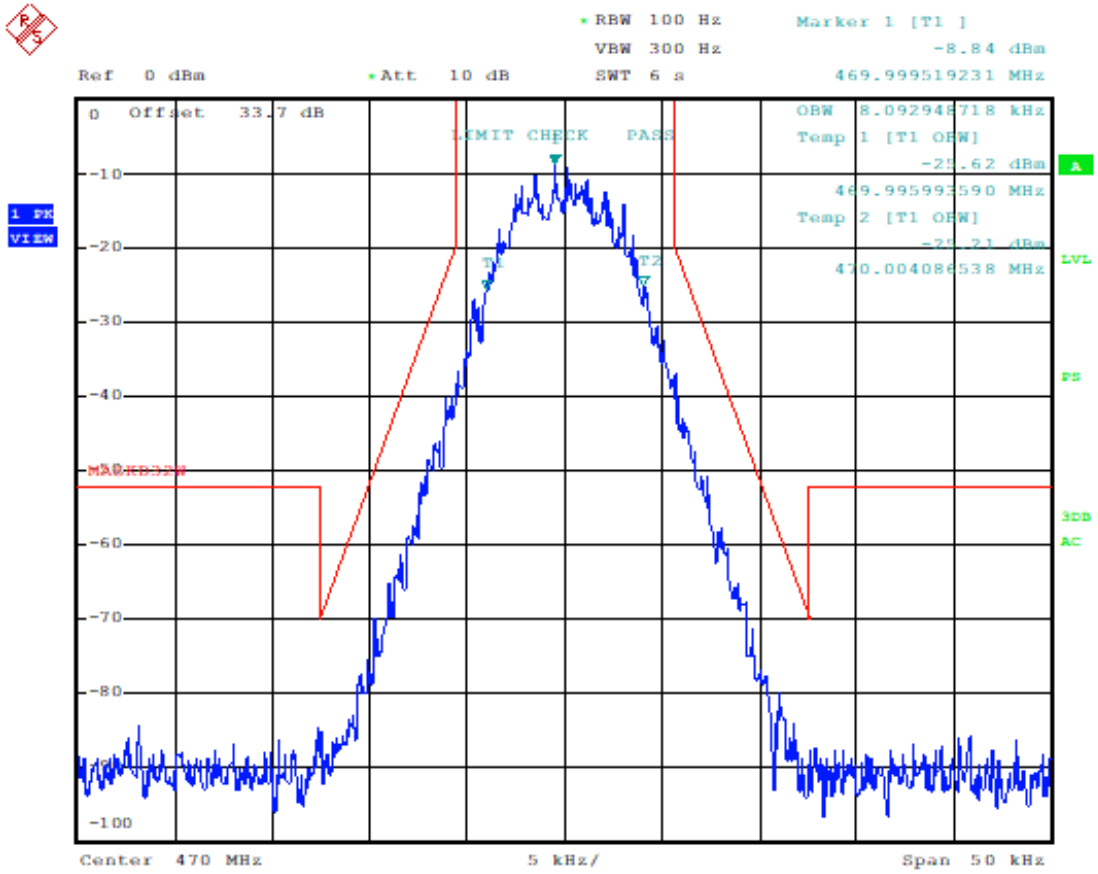
Test Data: Downlink 450.025 MHz – P25 Phase 1 C4FM +3 dBm Above AGC Threshold



Date: 29.NOV.2017 10:43:46

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

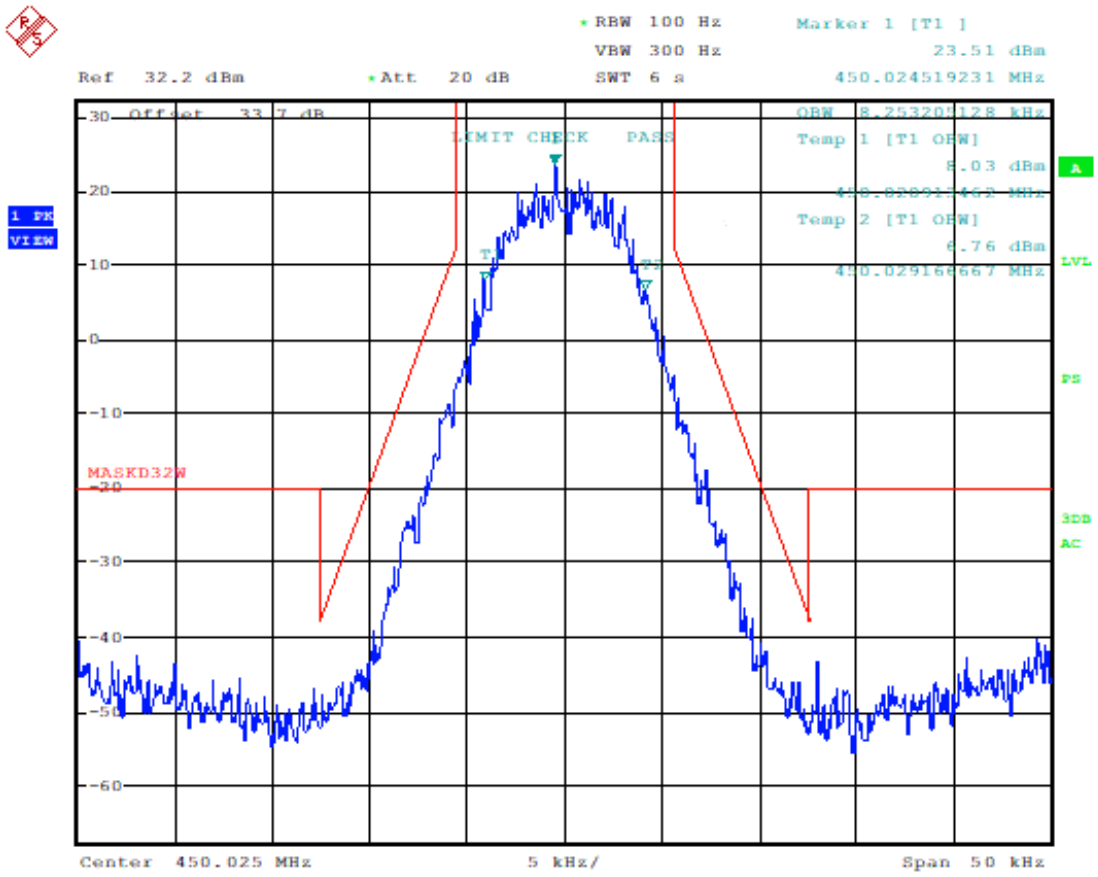
Test Data: Downlink 450.025 MHz – P25 Phase 2 H-CPM Test Signal



Date: 29.NOV.2017 10:25:34

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

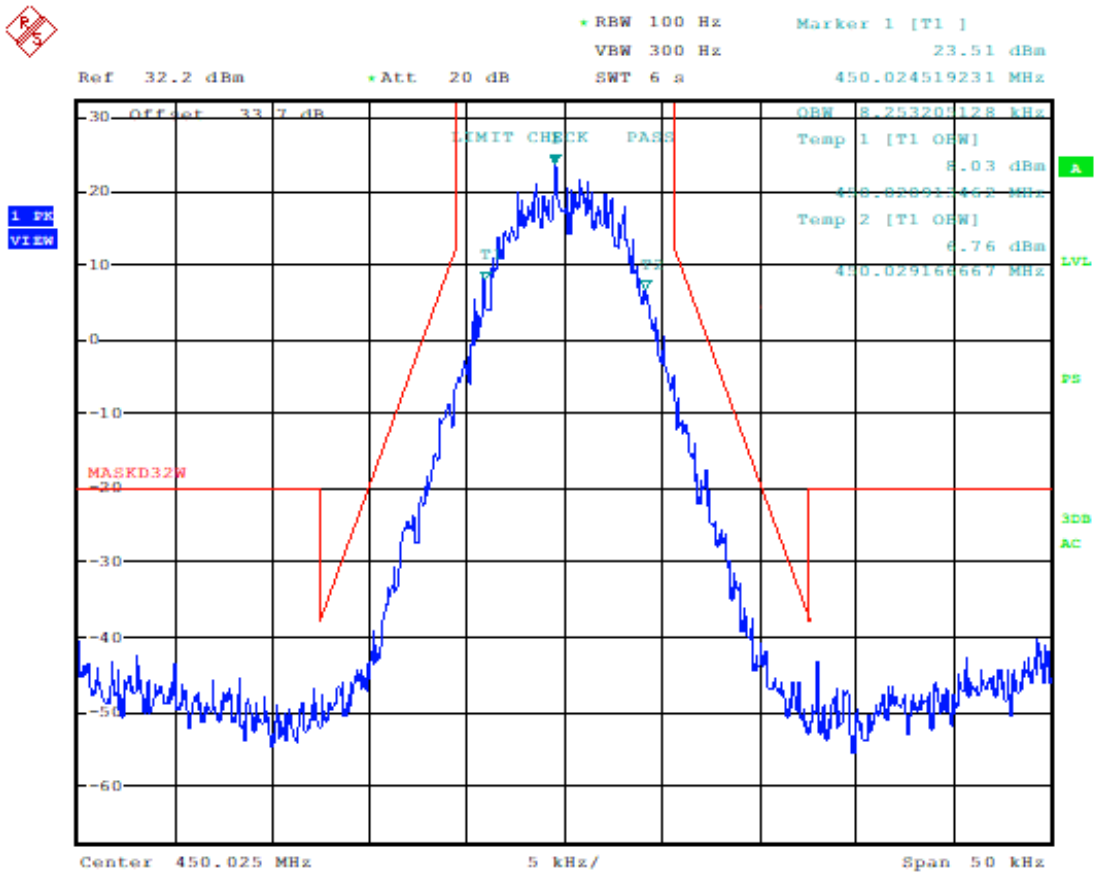
Test Data: Downlink 450.025 MHz – P25 Phase 2 H-CPM Below AGC Threshold



Date: 29.NOV.2017 10:48:10

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 450.025 MHz – P25 Phase 2 H-CPM +3 dBm Above AGC Threshold

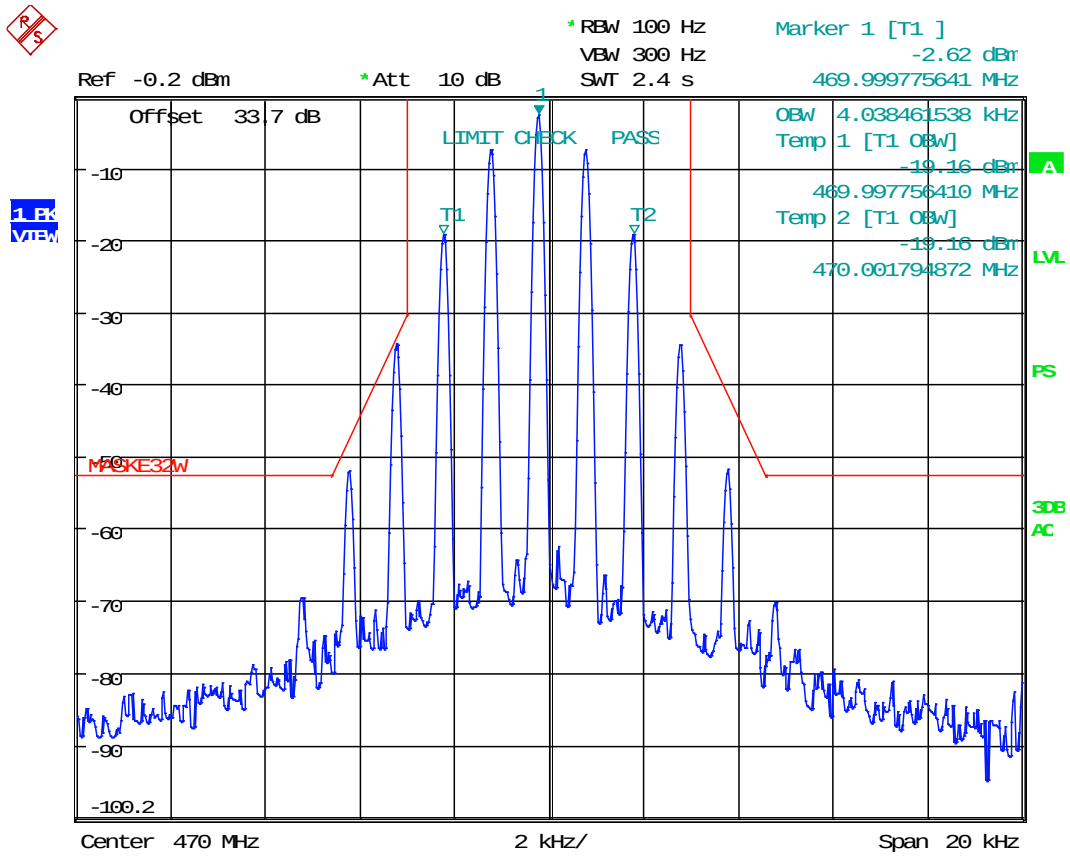


Date: 29.NOV.2017 10:48:10

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4, DOWNLINK 470 MHz

Test Data: Downlink 470.00 MHz – 6.25 kHz Test Signal



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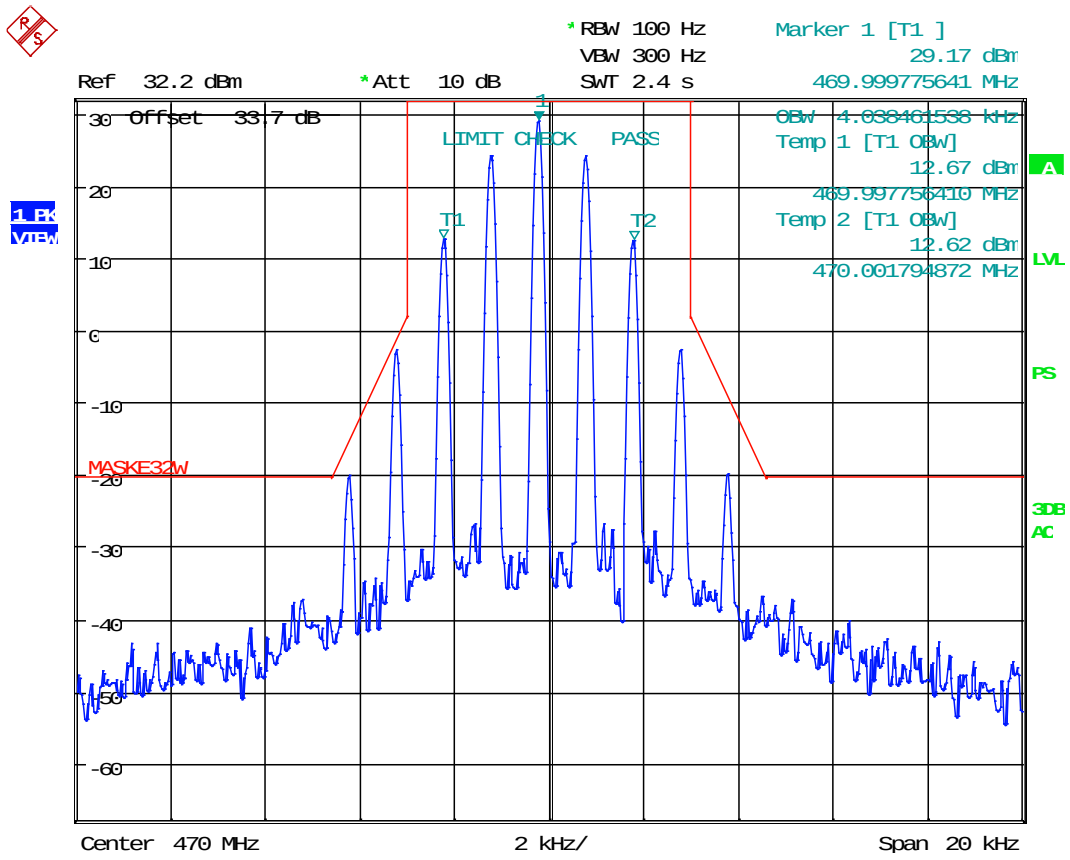
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

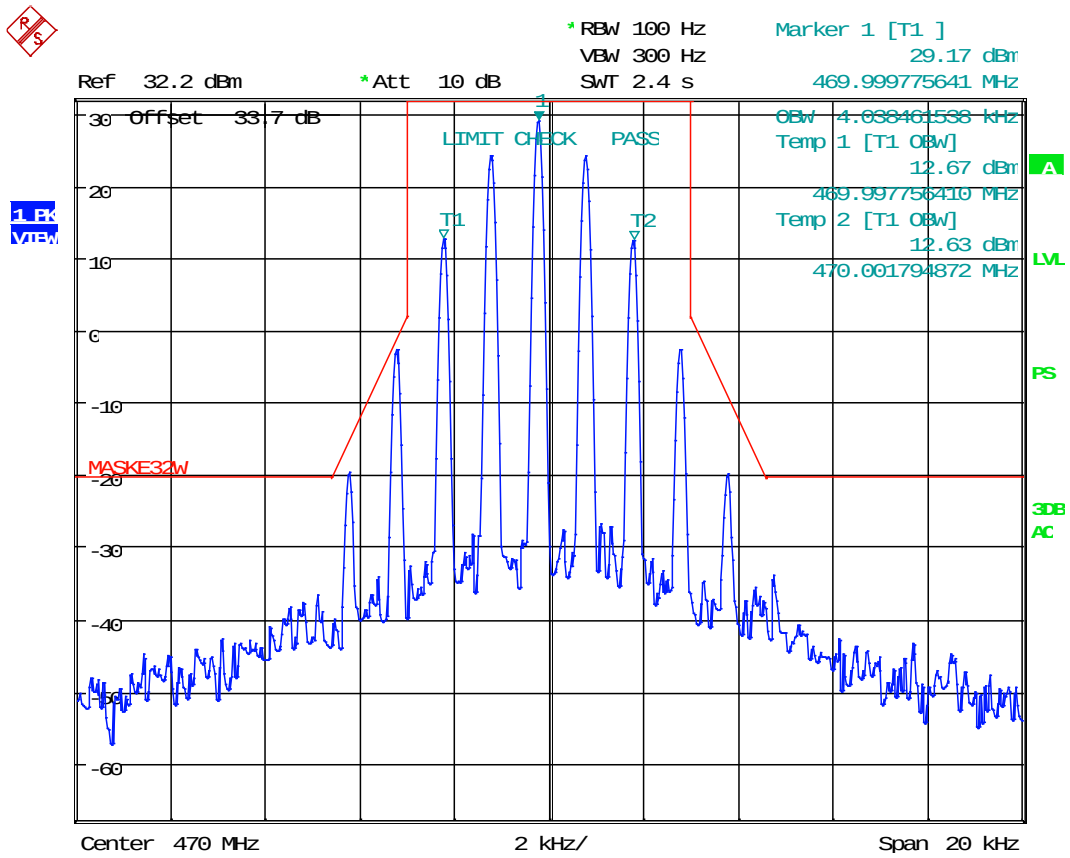
Test Data: Downlink 470.00 MHz – 6.25 kHz Below AGC Threshold



Date: 29.NOV.2017 09:35:30

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 470.00 MHz – 6.25 kHz +3 dBm Above AGC Threshold



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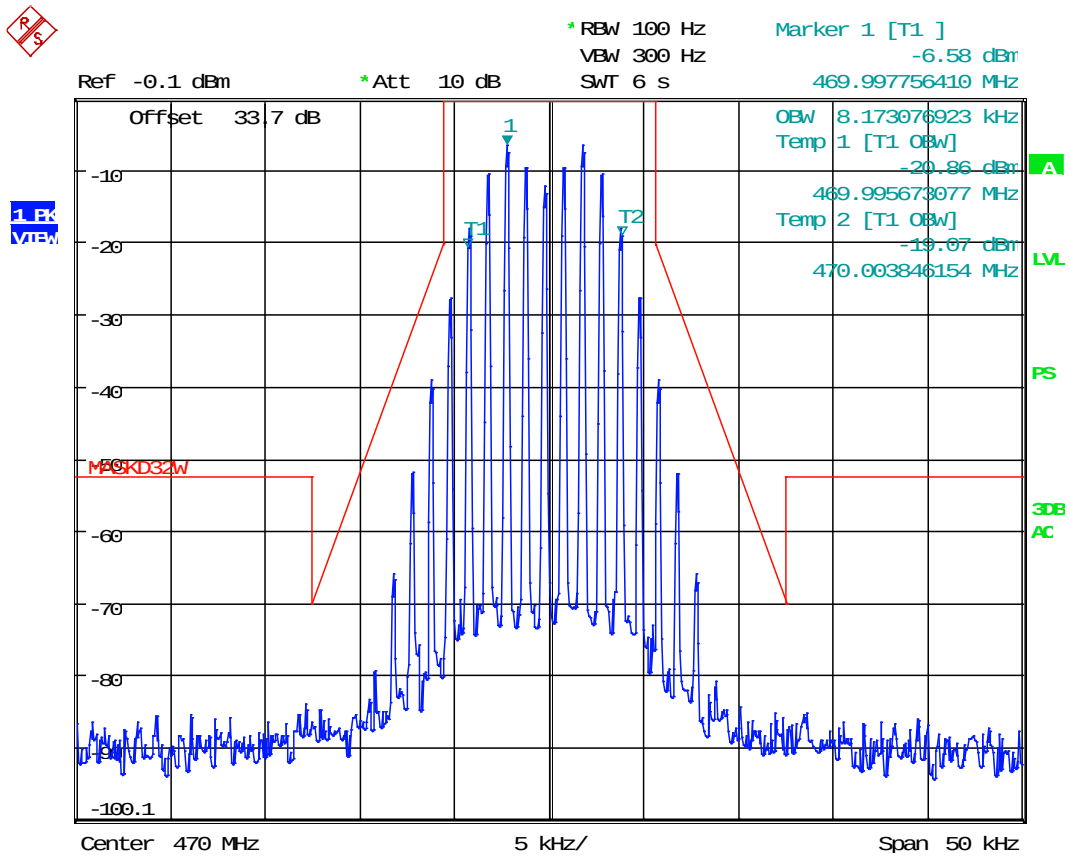
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 470.00 MHz – 12.5 kHz Test Signal



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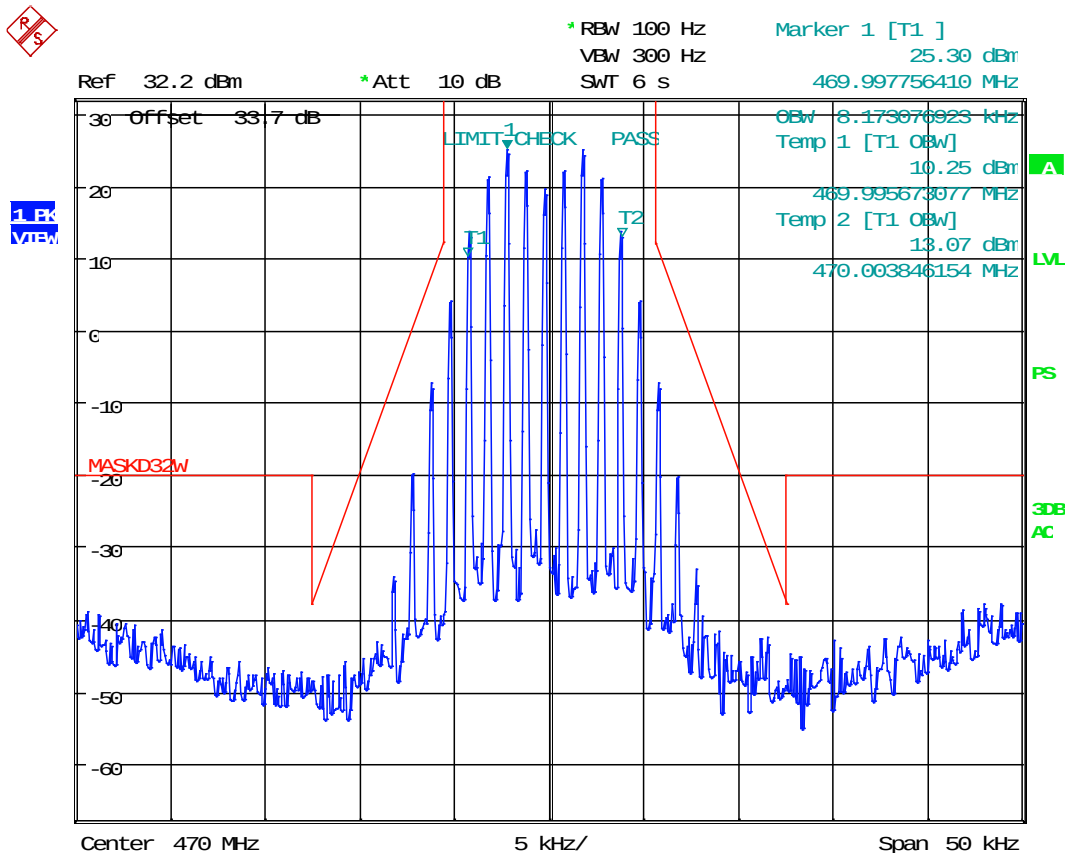
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

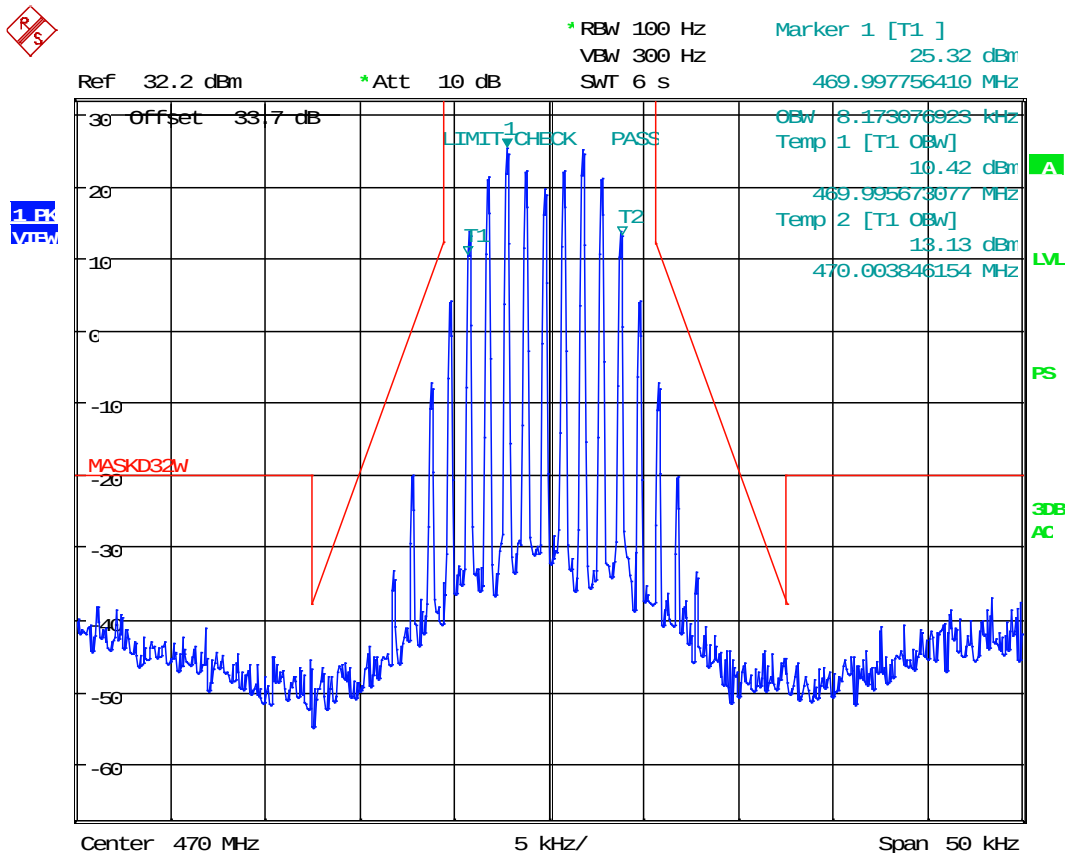
Test Data: Downlink 470.00 MHz – 12.5 kHz Below AGC Threshold



Date: 29.NOV.2017 09:55:49

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 470.00 MHz – 12.5 kHz +3 dBm Above AGC Threshold



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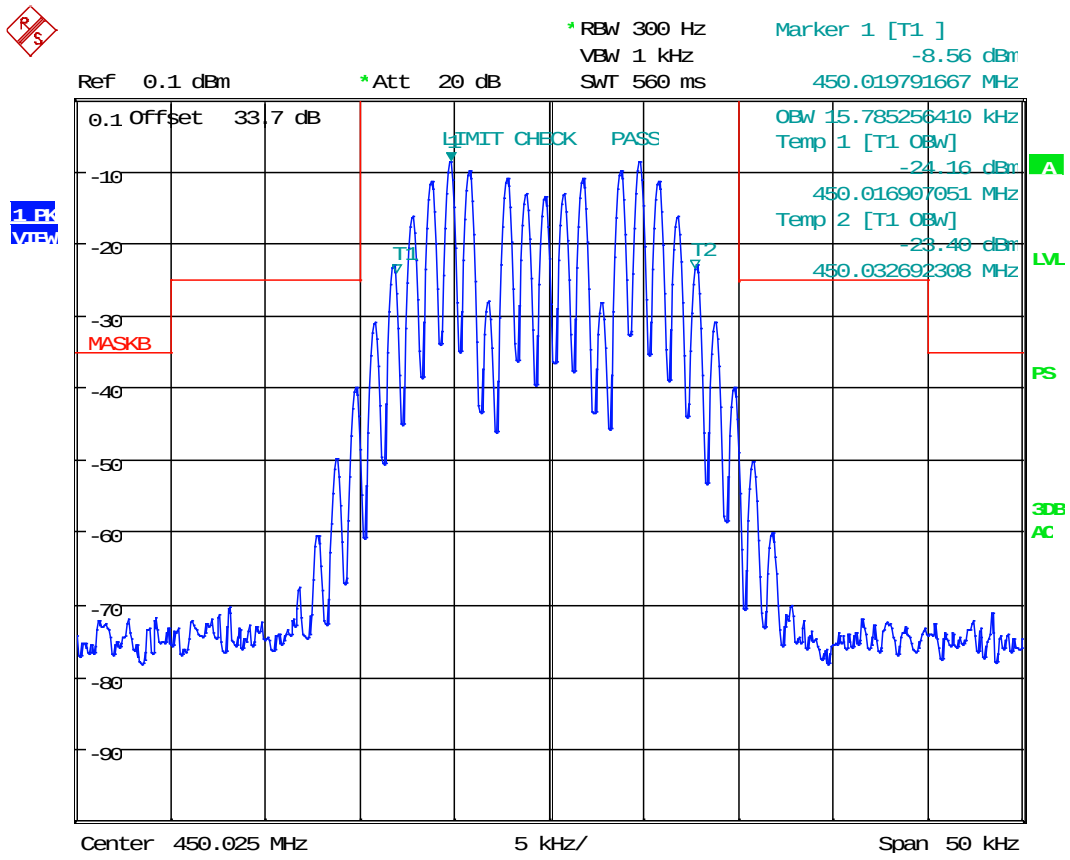
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 470.00 MHz – 25 kHz Test Signal



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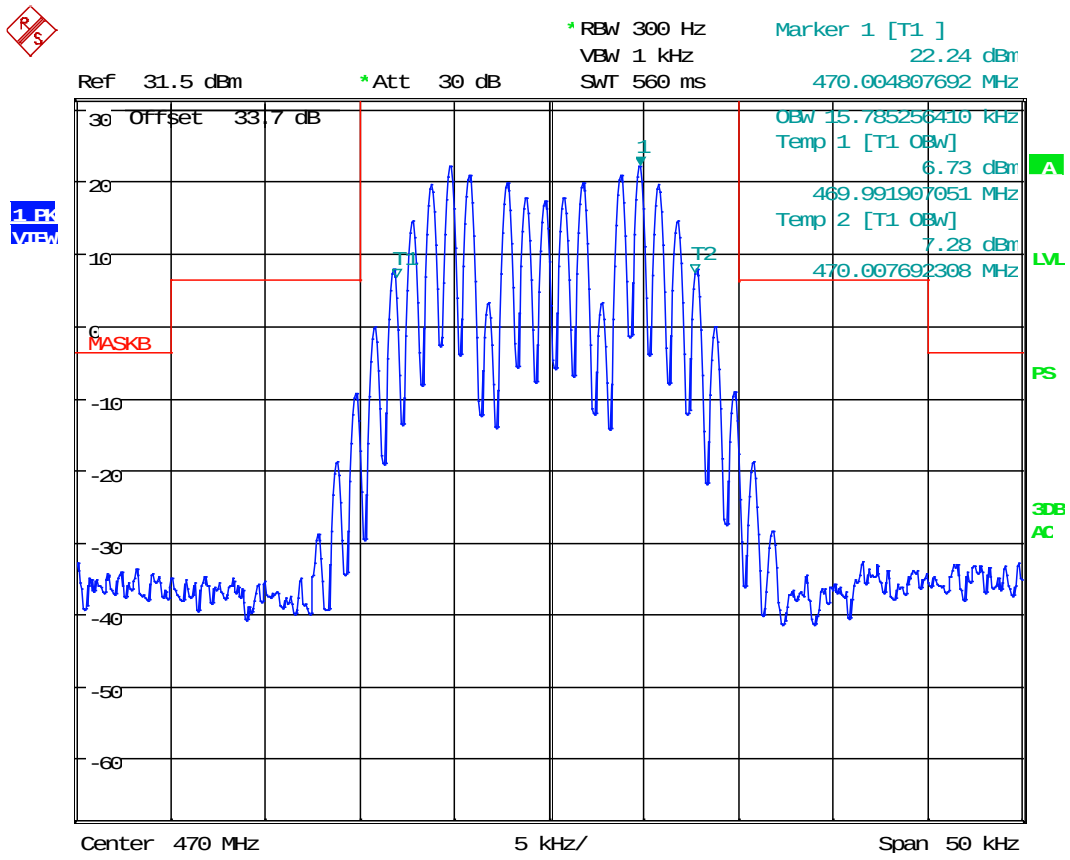
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 470.00 MHz – 25 kHz Below AGC Threshold



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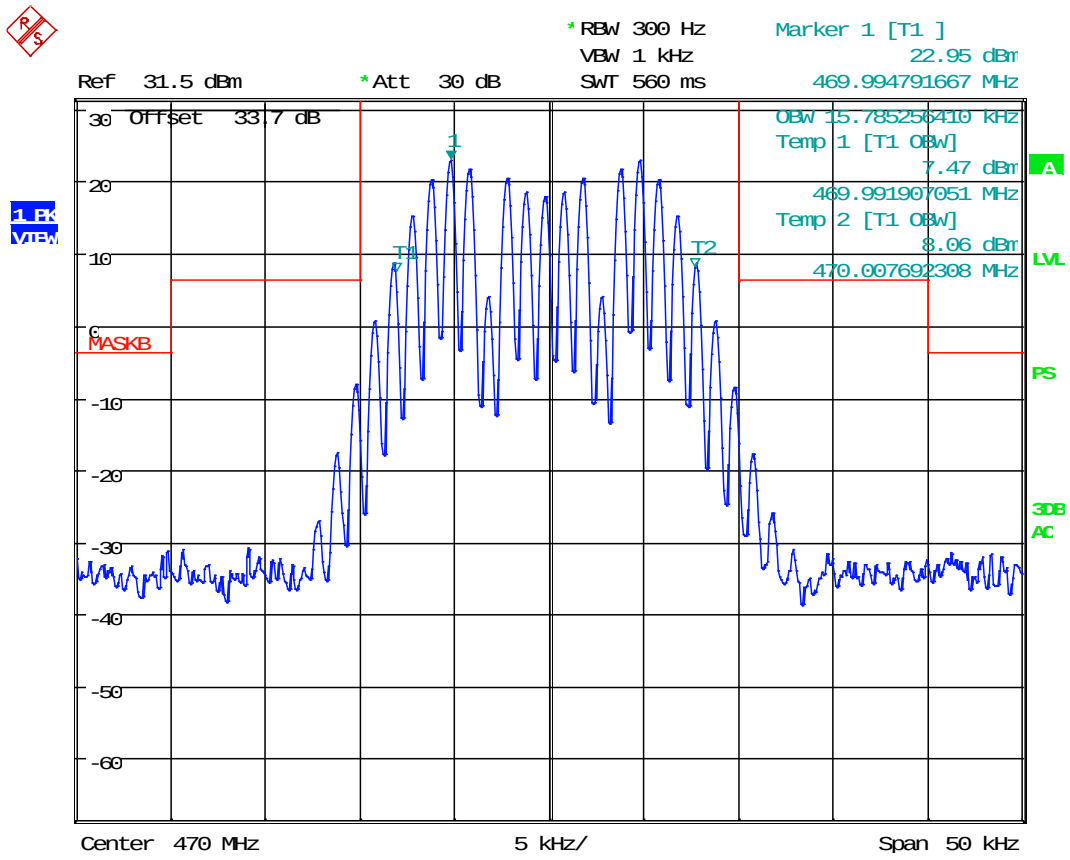
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 470.00 MHz – 25 kHz +3 dBm Above AGC Threshold



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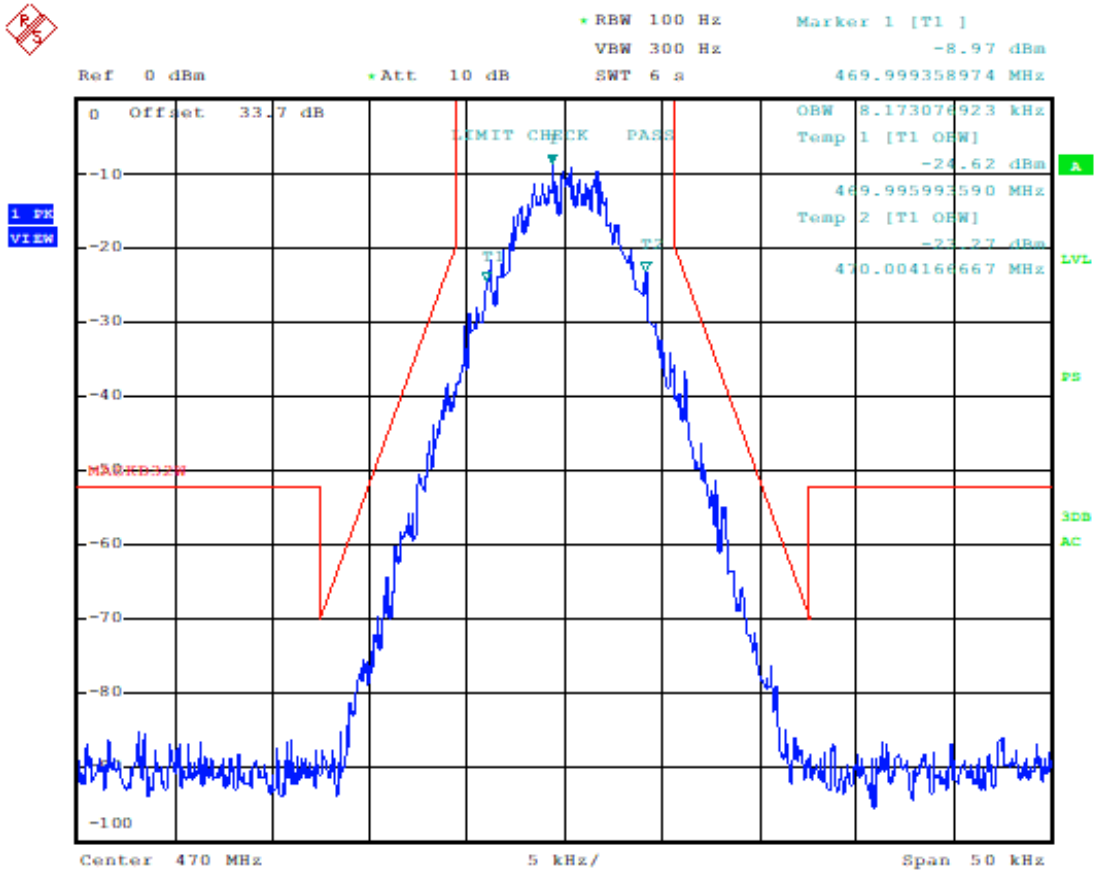
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 470.00 MHz – P25 Phase 1 C4FM Test Signal



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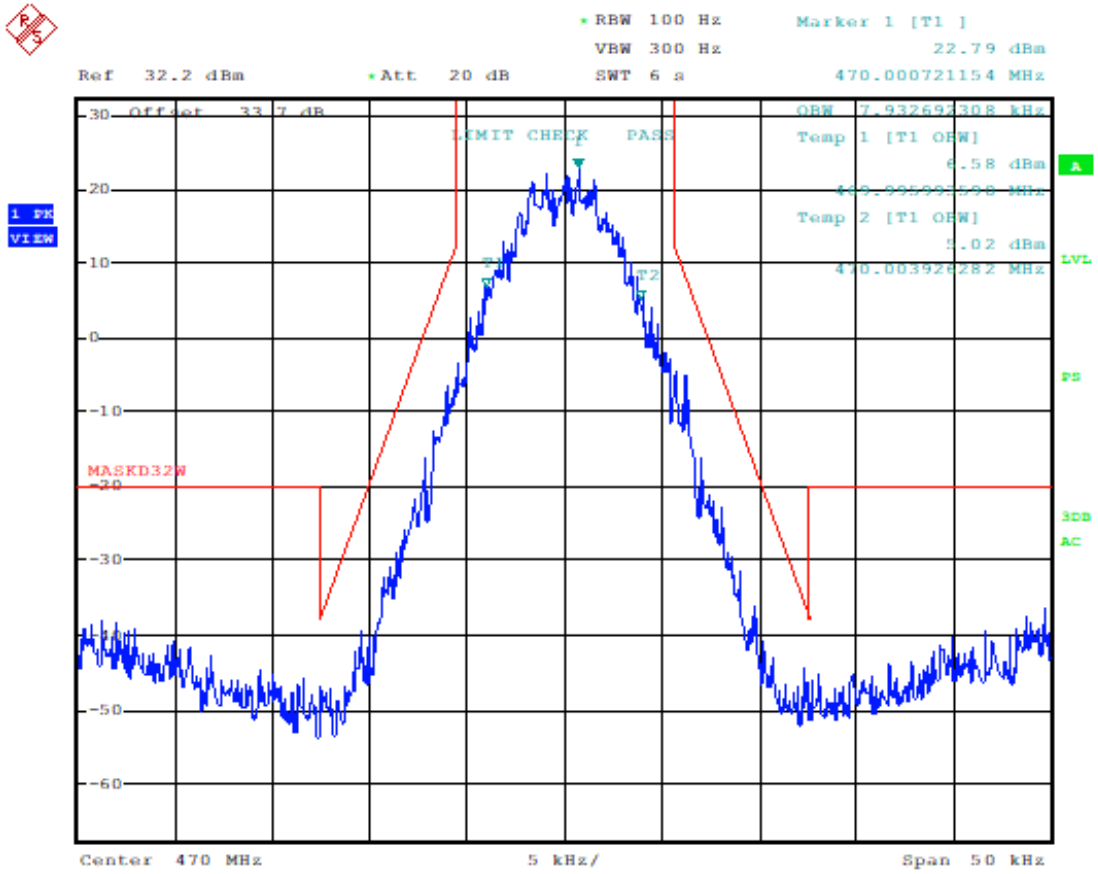
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

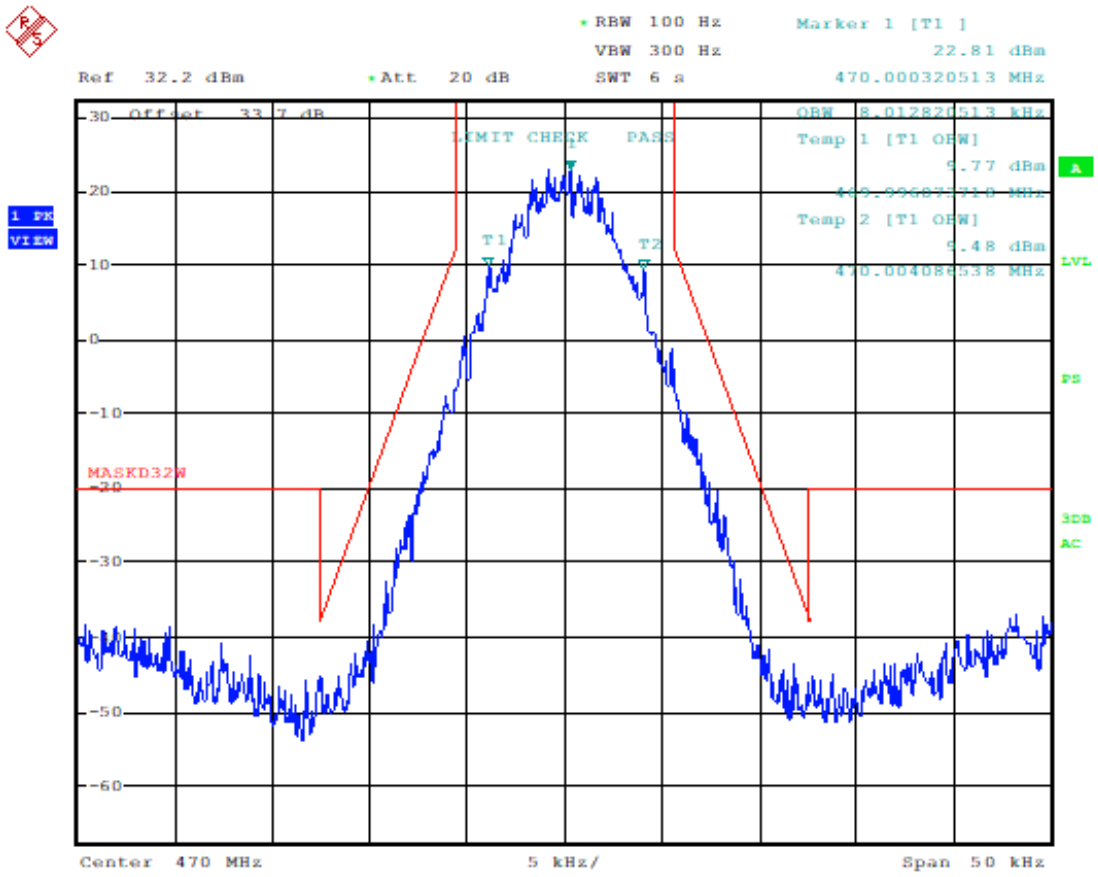
Test Data: Downlink 470.00 MHz – P25 Phase 1 C4FM Below AGC Threshold



Date: 29.NOV.2017 10:53:17

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

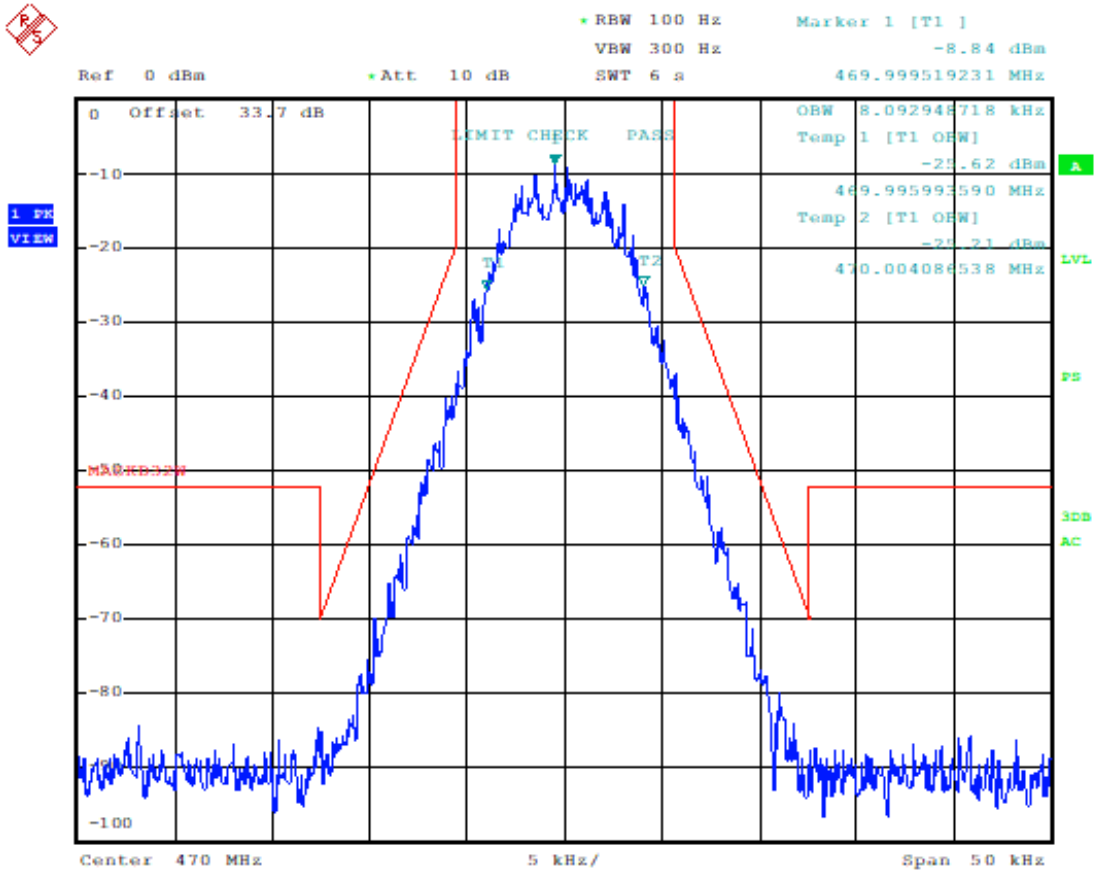
Test Data: Downlink 470.00 MHz – P25 Phase 1 C4FM +3 dBm Above AGC Threshold



Date: 29.NOV.2017 10:57:13

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

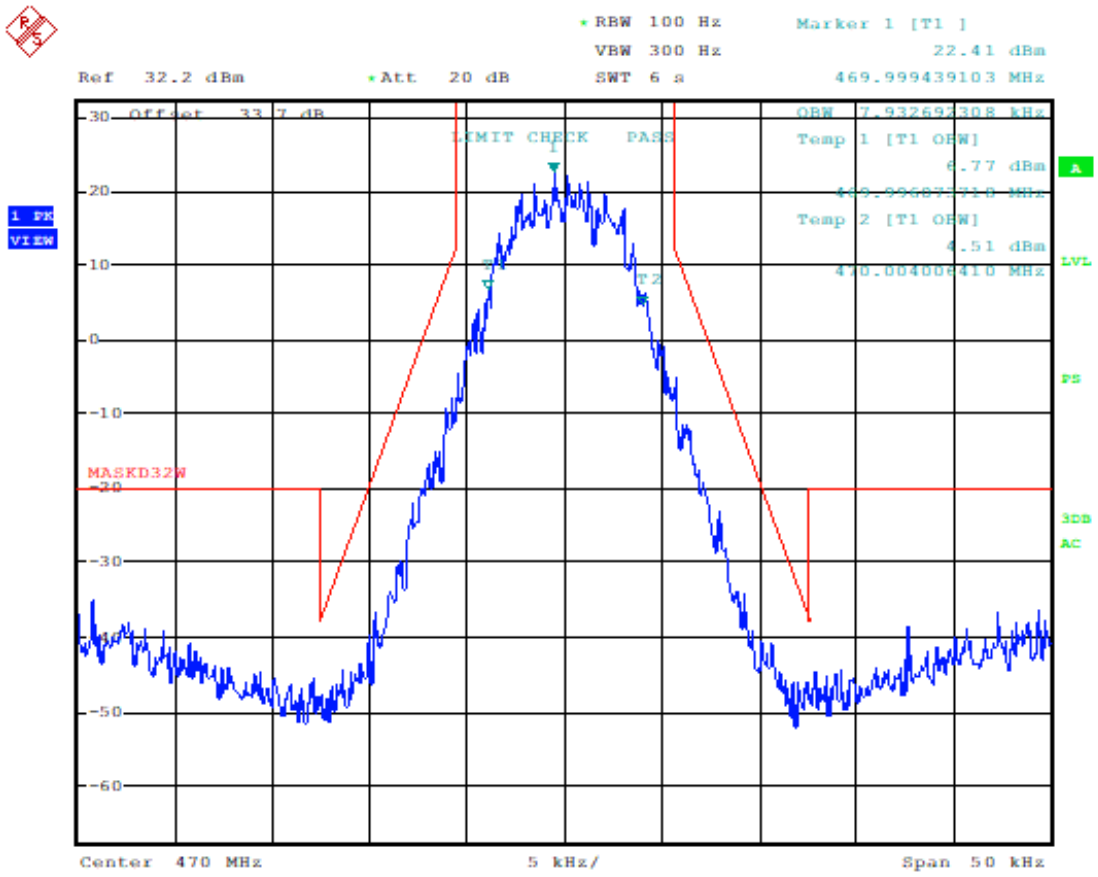
Test Data: Downlink 470.00 MHz – P25 Phase 2 H-CPM Test Signal



Date: 29.NOV.2017 10:25:34

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

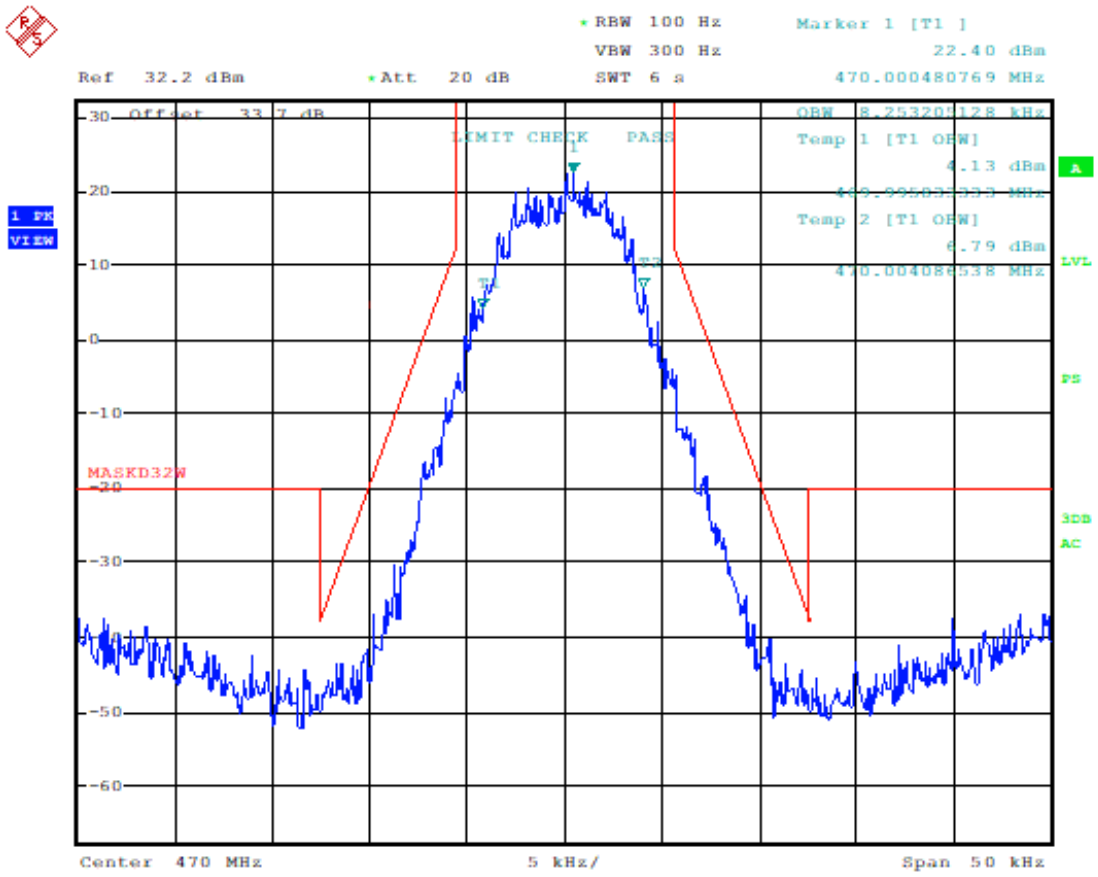
Test Data: Downlink 470.00 MHz – P25 Phase 2 H-CPM Below AGC Threshold



Date: 29.NOV.2017 10:54:18

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Downlink 470.00 MHz – P25 Phase 2 H-CPM +3 dBm Above AGC Threshold

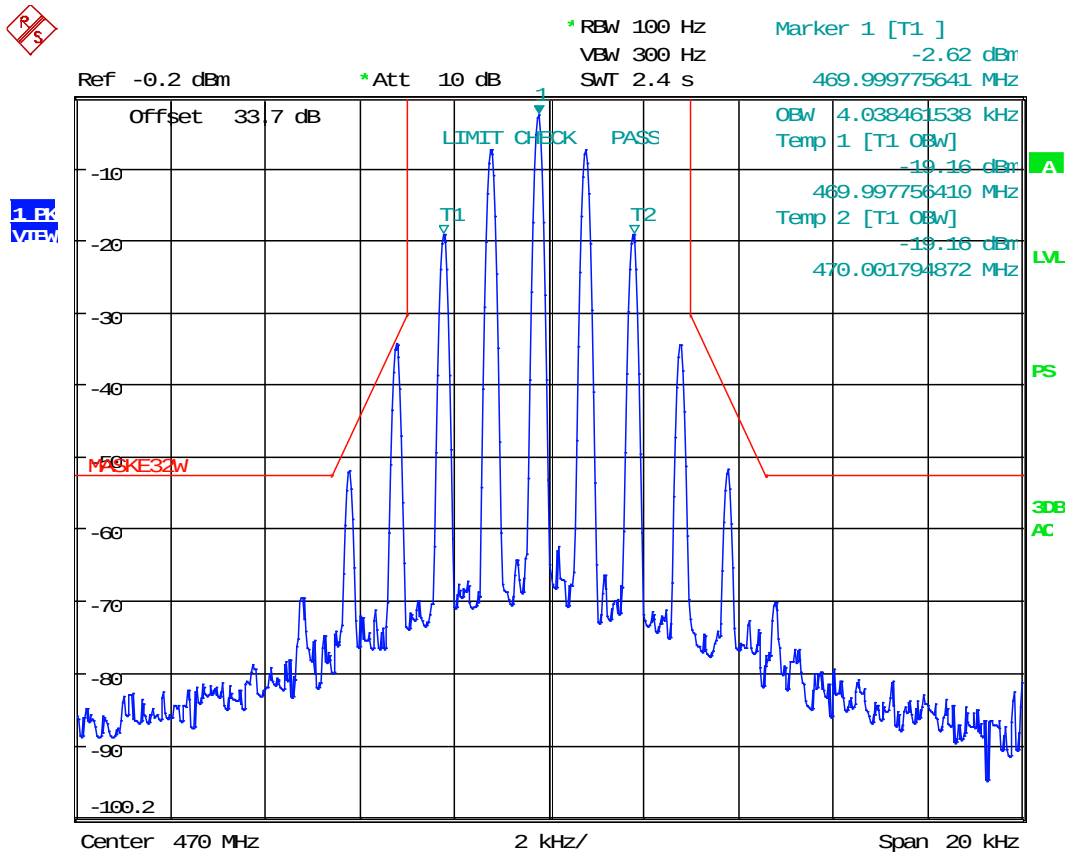


Date: 29.NOV.2017 10:58:18

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4, UPLINK 462 MHz

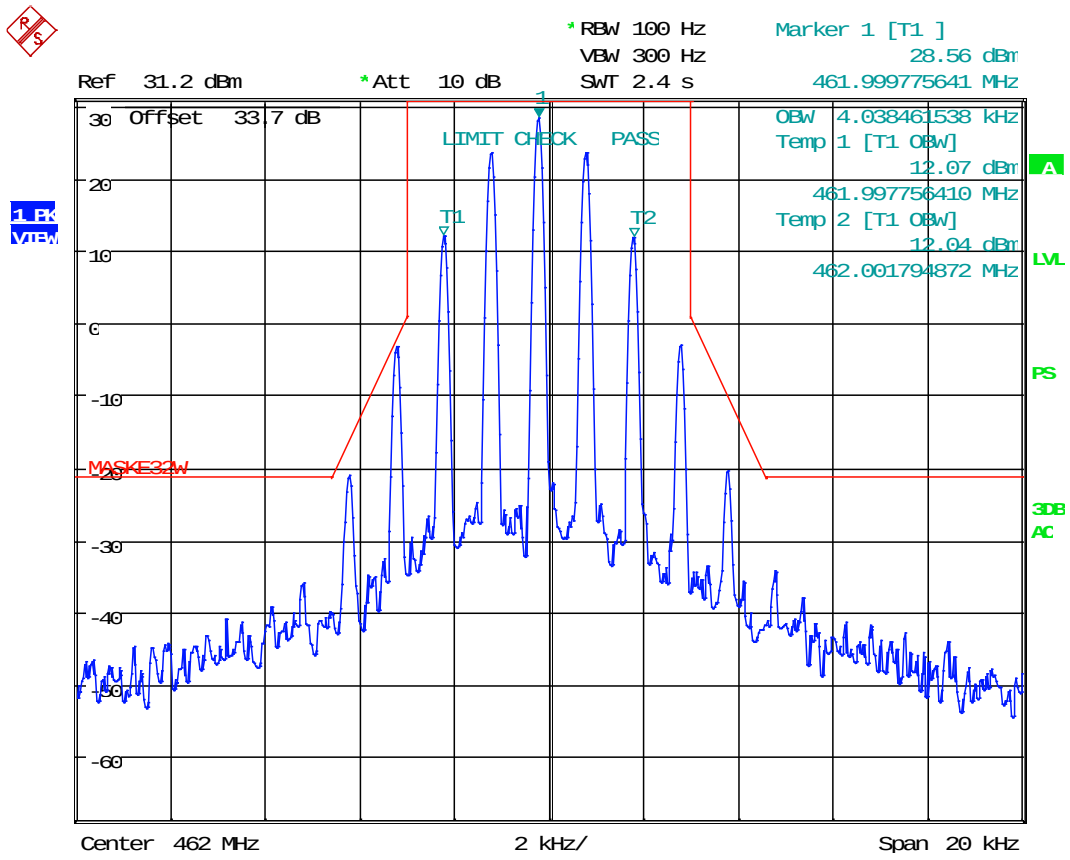
Test Data: Uplink 462.00 MHz – 6.25 kHz Test Signal



Date: 29.NOV.2017 09:44:20

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

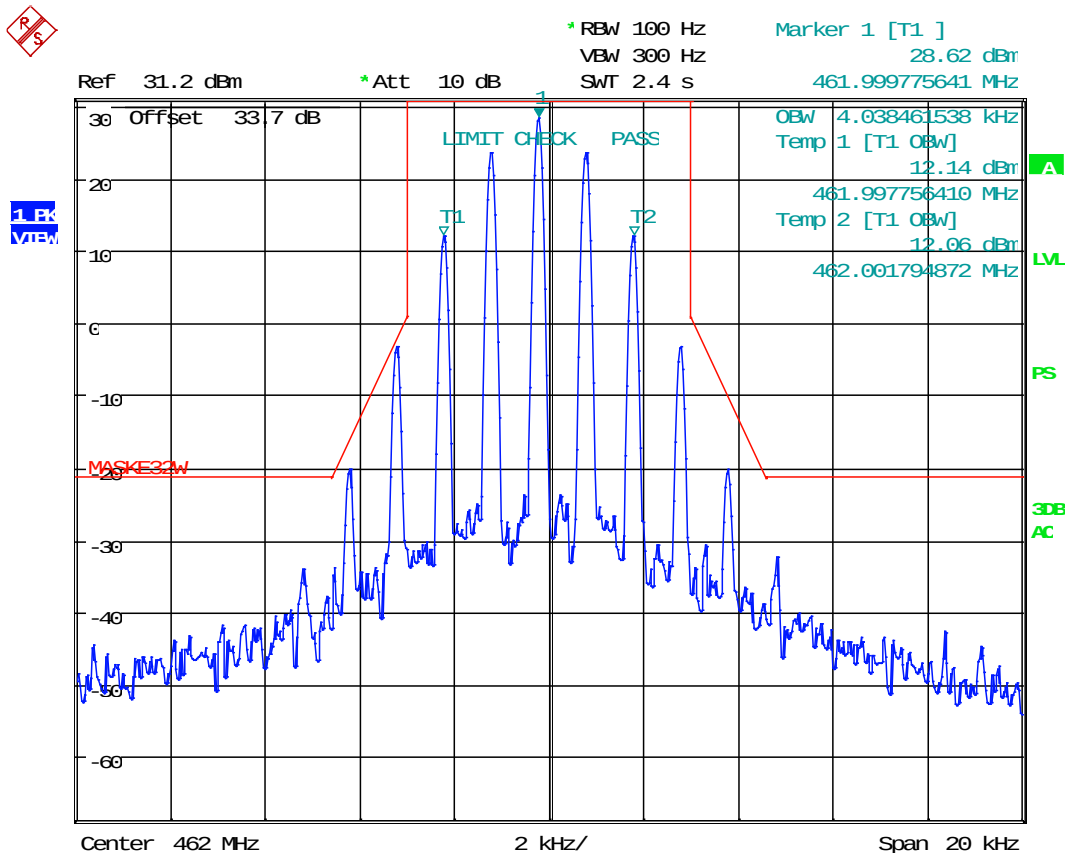
Test Data: Uplink 462.00 MHz – 6.25 kHz Below AGC Threshold



Date: 29.NOV.2017 09:39:21

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

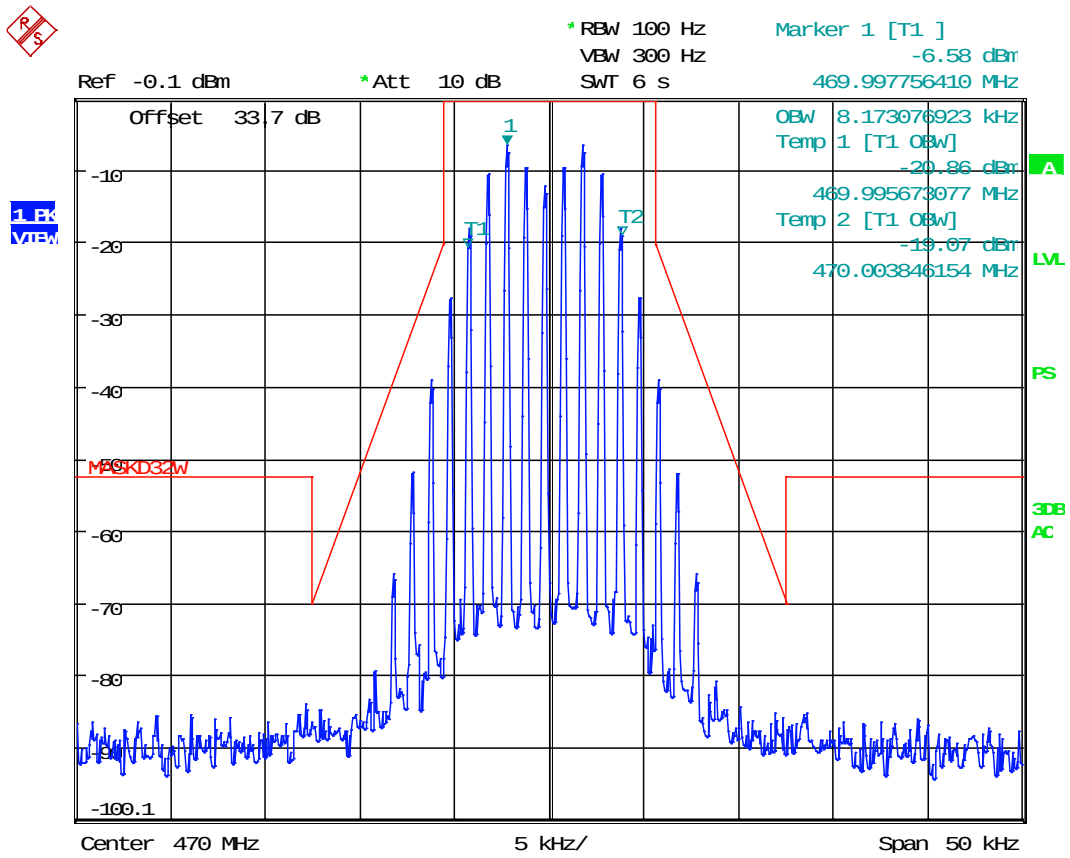
Test Data: Uplink 462.00 MHz – 6.25 kHz +3 dBm Above AGC Threshold



Date: 29.NOV.2017 09:38:36

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

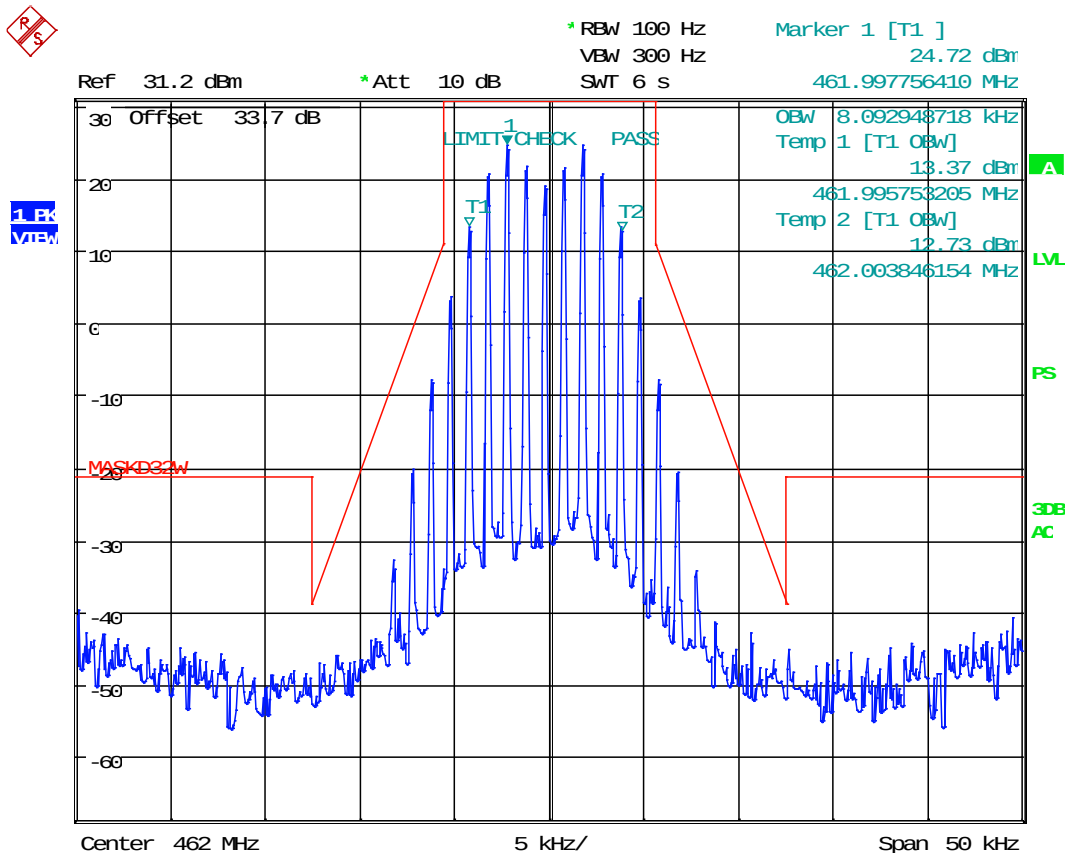
Test Data: Uplink 462.00 MHz – 12.5 kHz Test Signal



Date: 29.NOV.2017 10:20:45

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

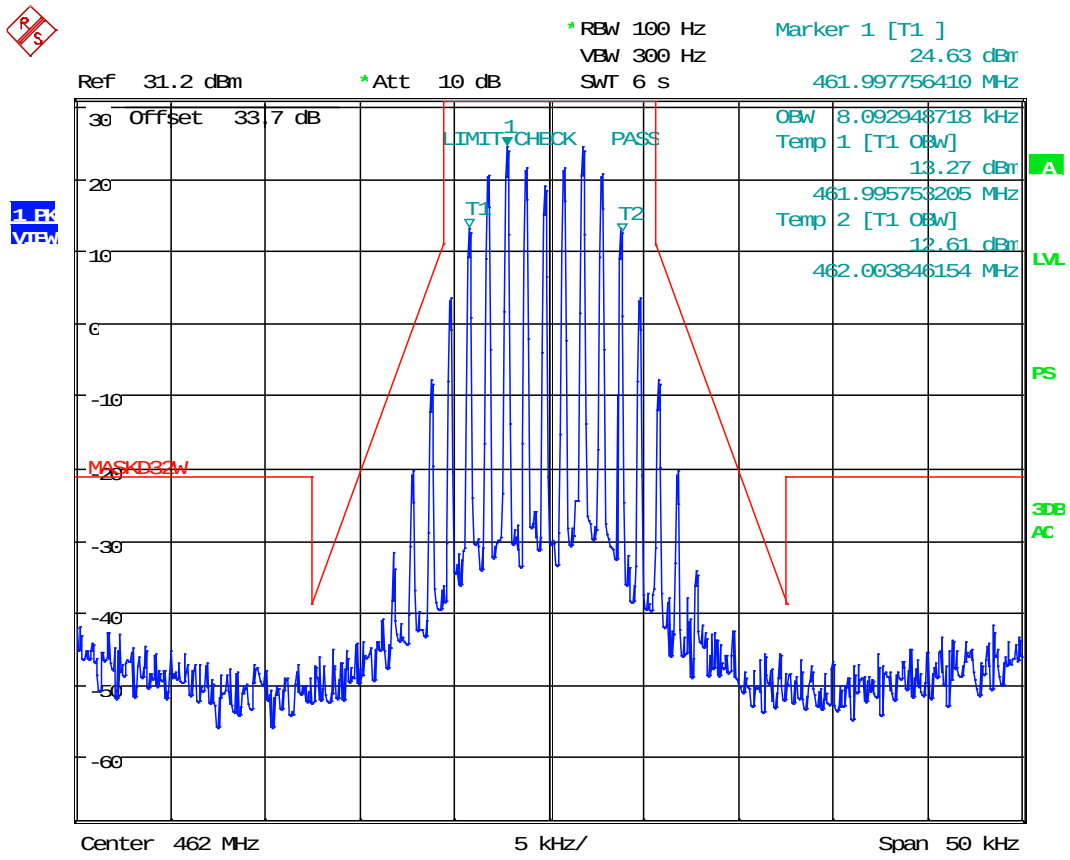
Test Data: Uplink 462.00 MHz – 12.5 kHz Below AGC Threshold



Date: 29.NOV.2017 09:59:48

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

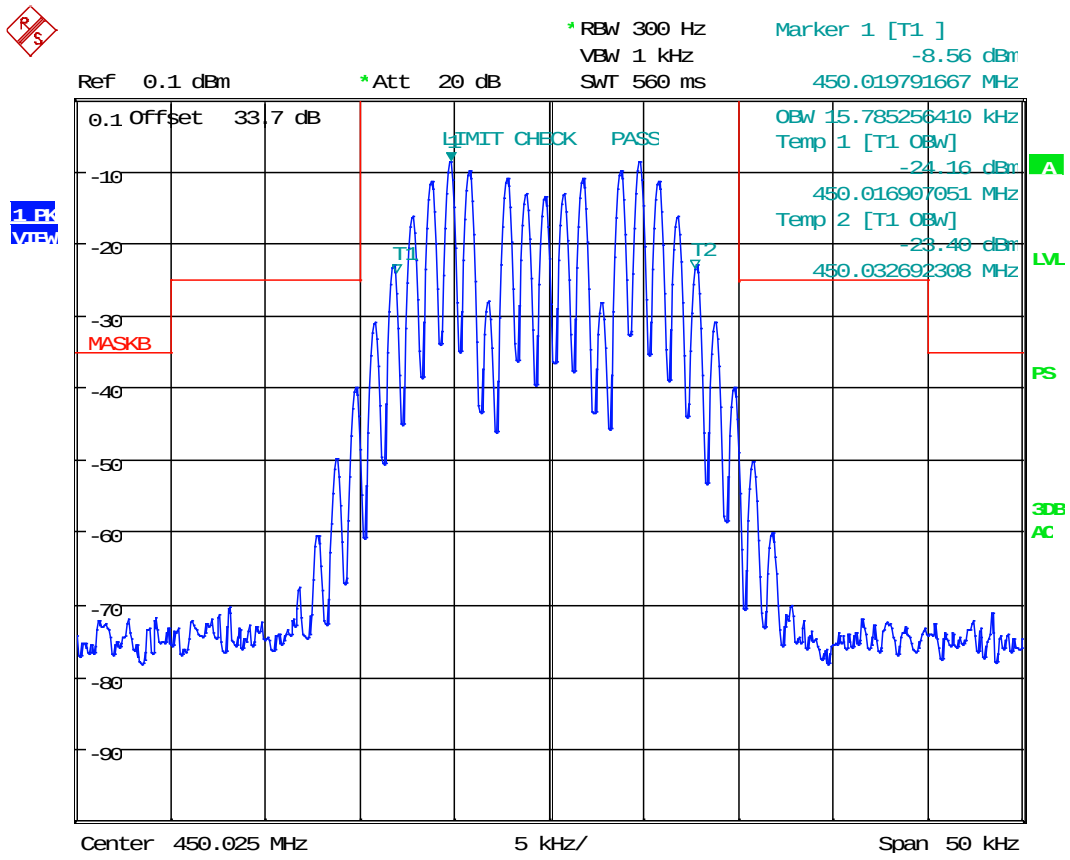
Test Data: Uplink 462.00 MHz – 12.5 kHz +3 dBm Above AGC Threshold



Date: 29.NOV.2017 09:58:59

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

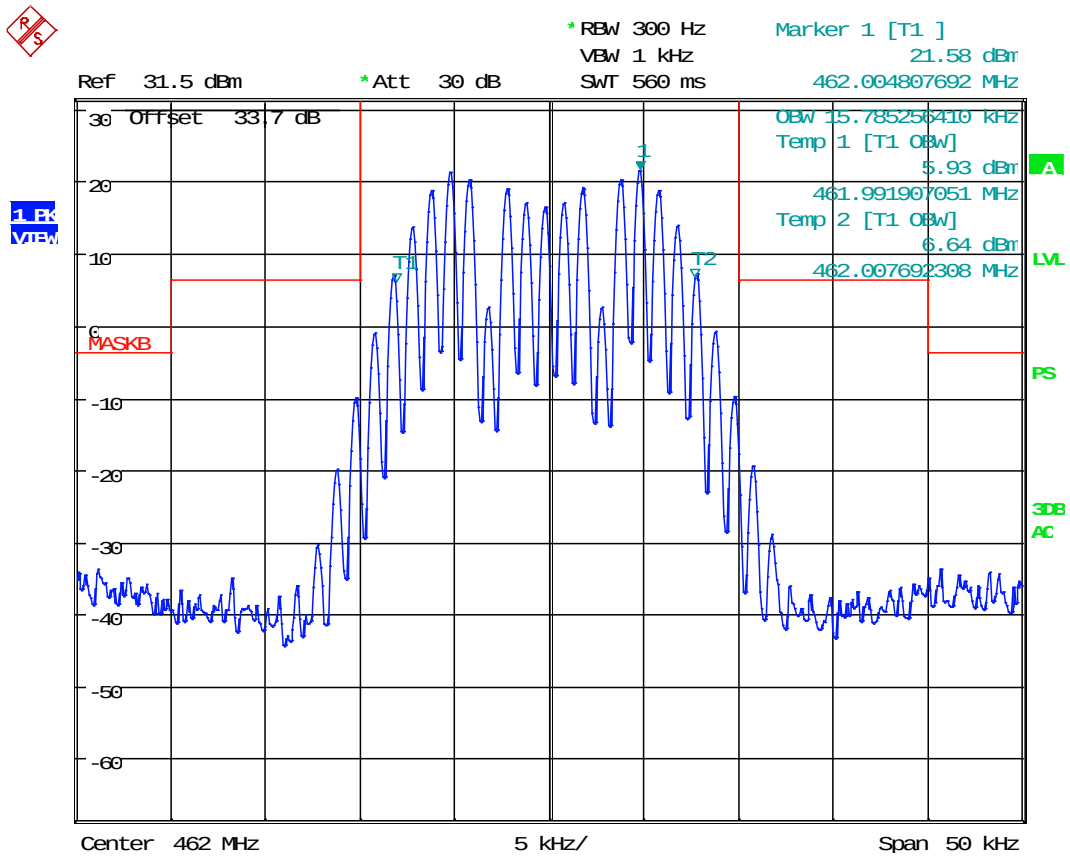
Test Data: Uplink 462.00 MHz – 25 kHz Test Signal



Date: 29.NOV.2017 11:29:16

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

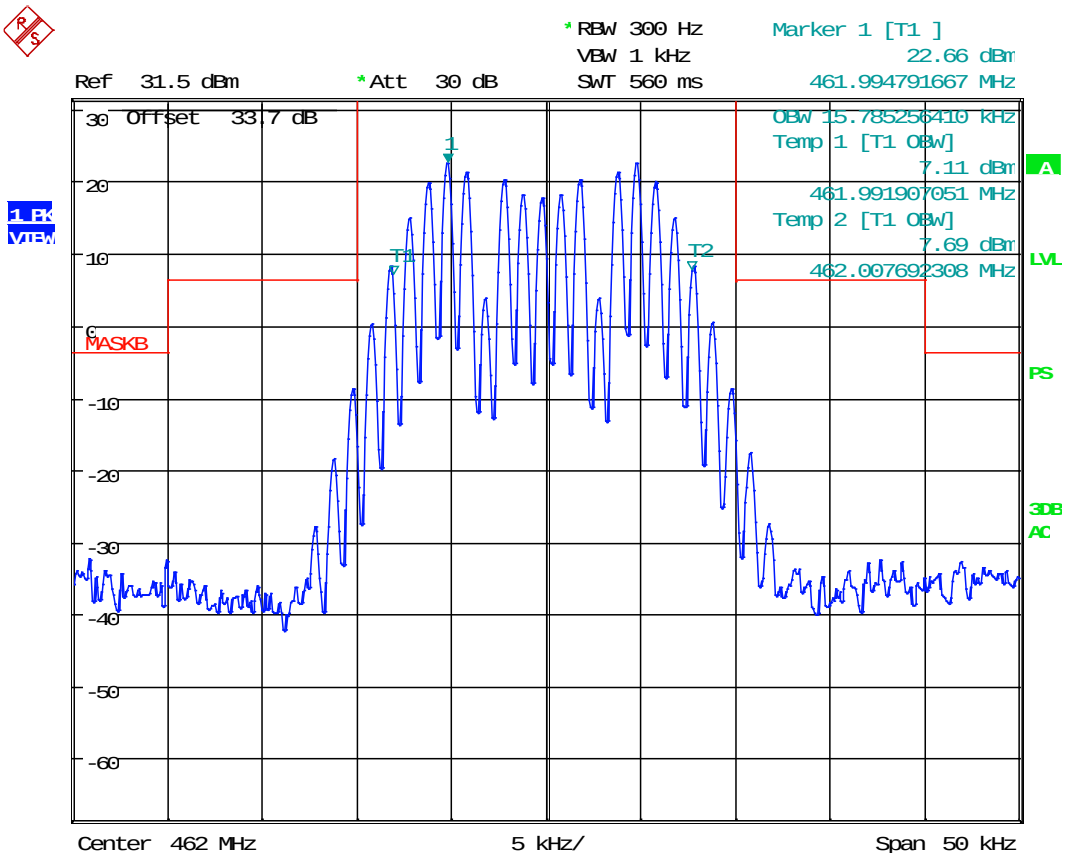
Test Data: Uplink 462.00 MHz – 25 kHz Below AGC Threshold



Date: 22.NOV.2017 12:02:40

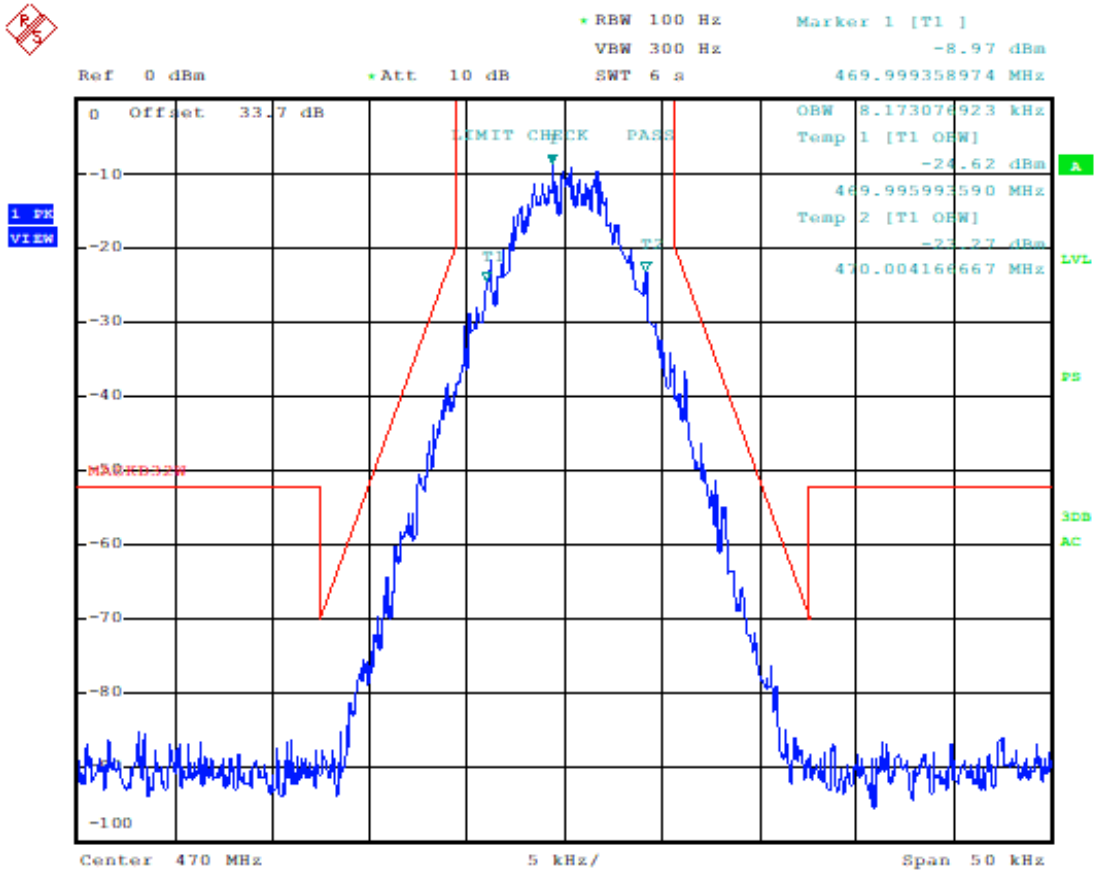
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Uplink 462.00 MHz – 25 kHz +3 dBm Above AGC Threshold



INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

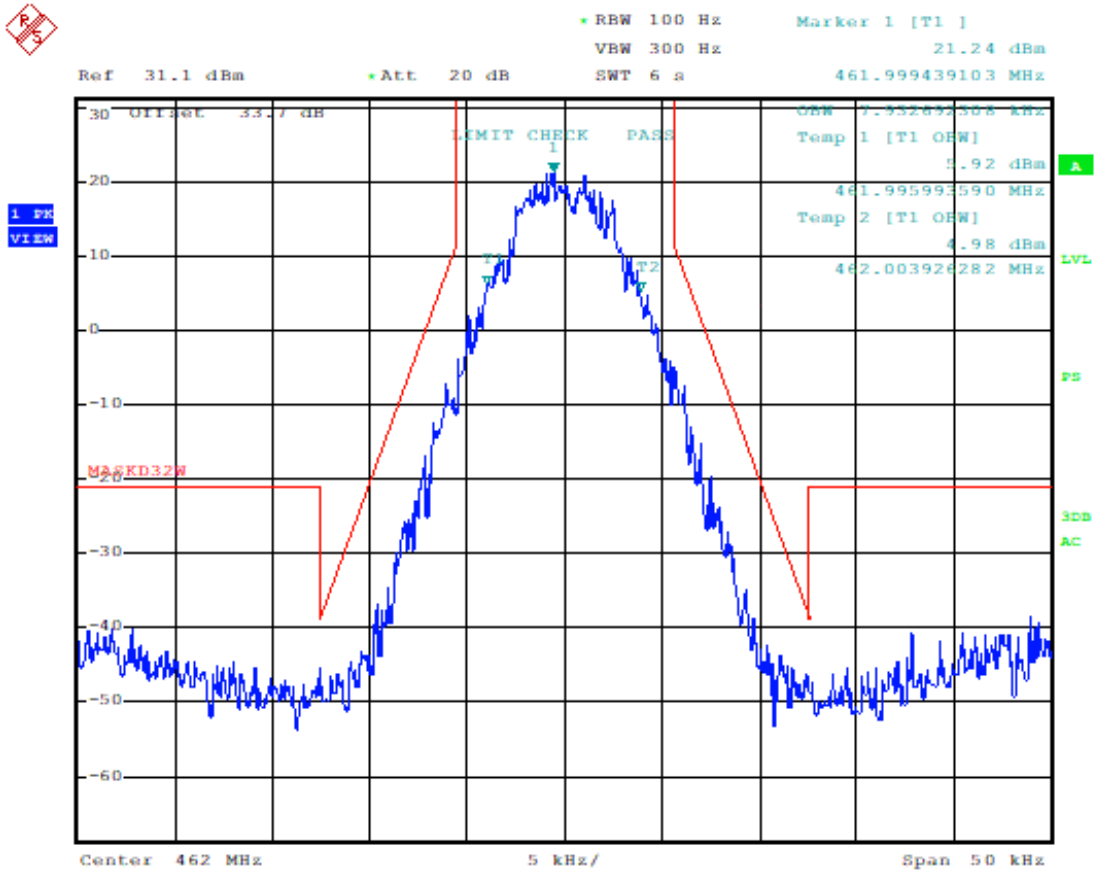
Test Data: Uplink 462.00 MHz – P25 Phase 1 C4FM Test Signal



Date: 29.NOV.2017 10:24:12

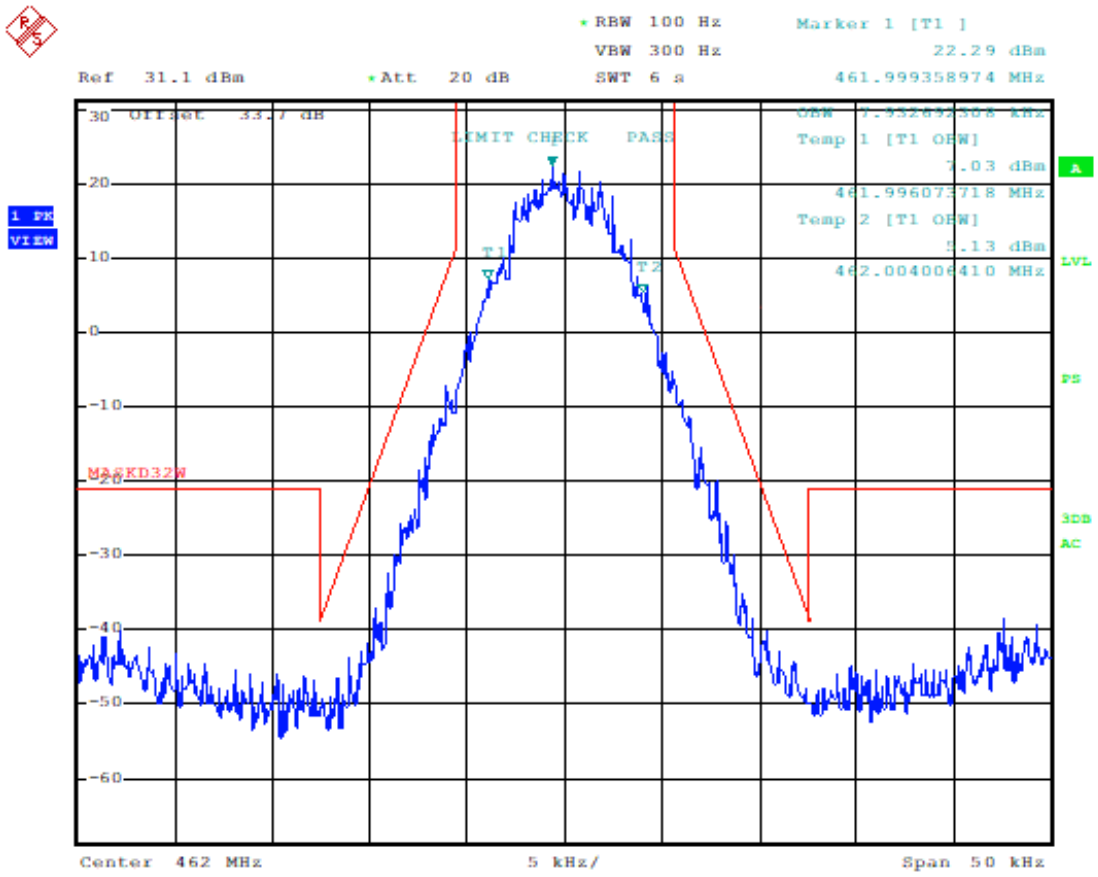
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Uplink 462.00 MHz – P25 Phase 1 C4FM Below AGC Threshold



INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

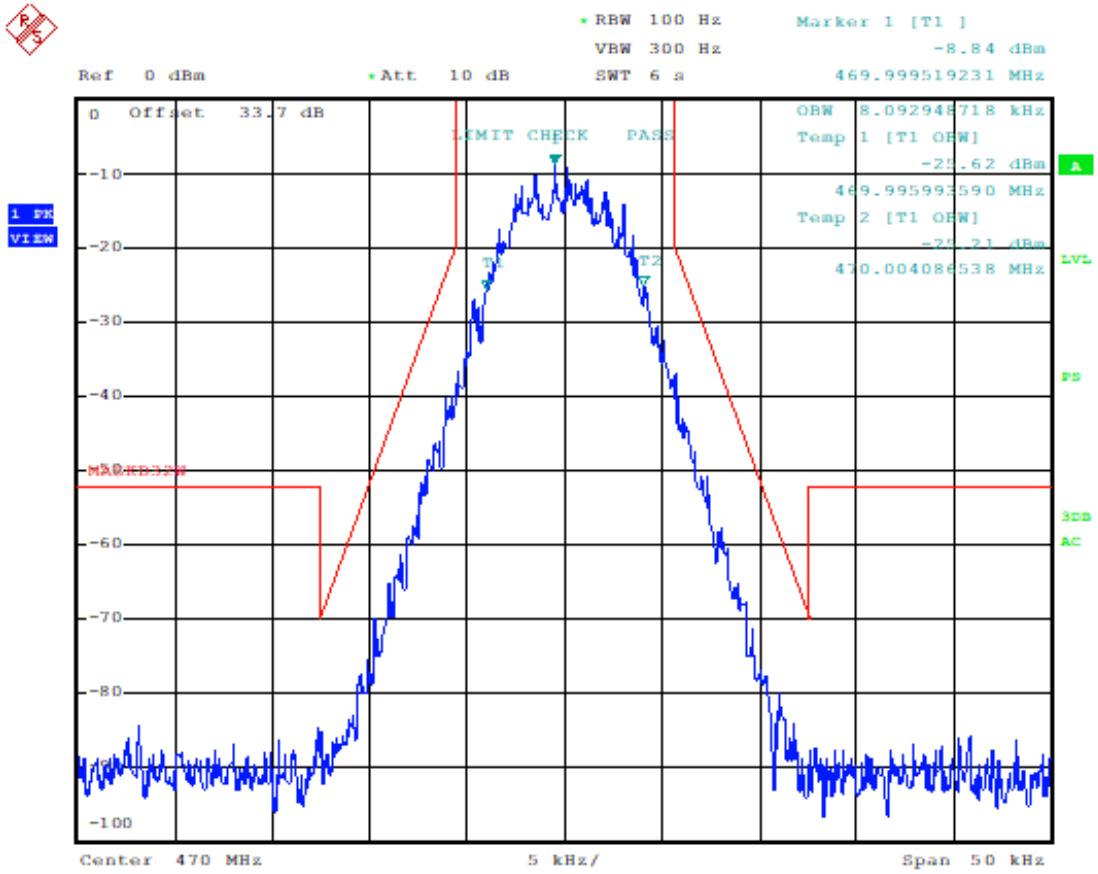
Test Data: Uplink 462.00 MHz – P25 Phase 1 C4FM +3 dBm Above AGC Threshold



Date: 29.NOV.2017 11:03:05

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

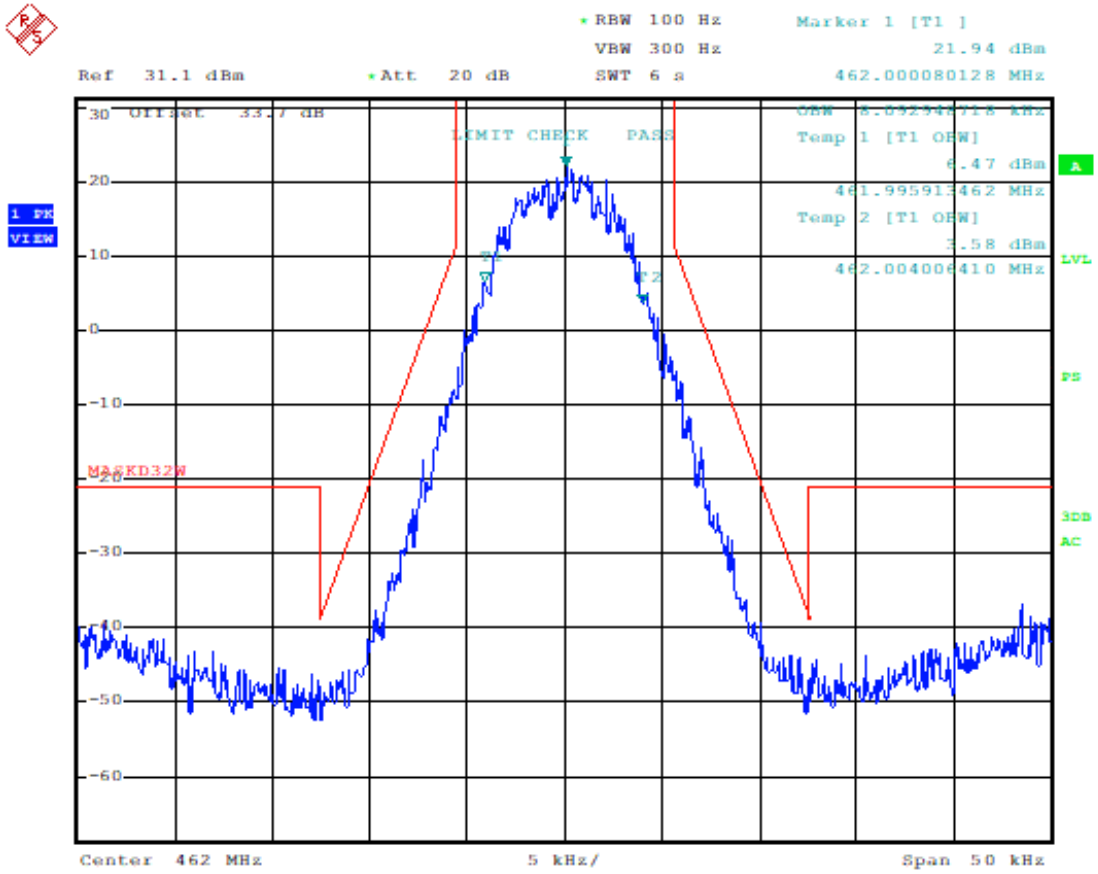
Test Data: Uplink 462.00 MHz – P25 Phase 2 H-CPM Test Signal



Date: 29.NOV.2017 10:25:34

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

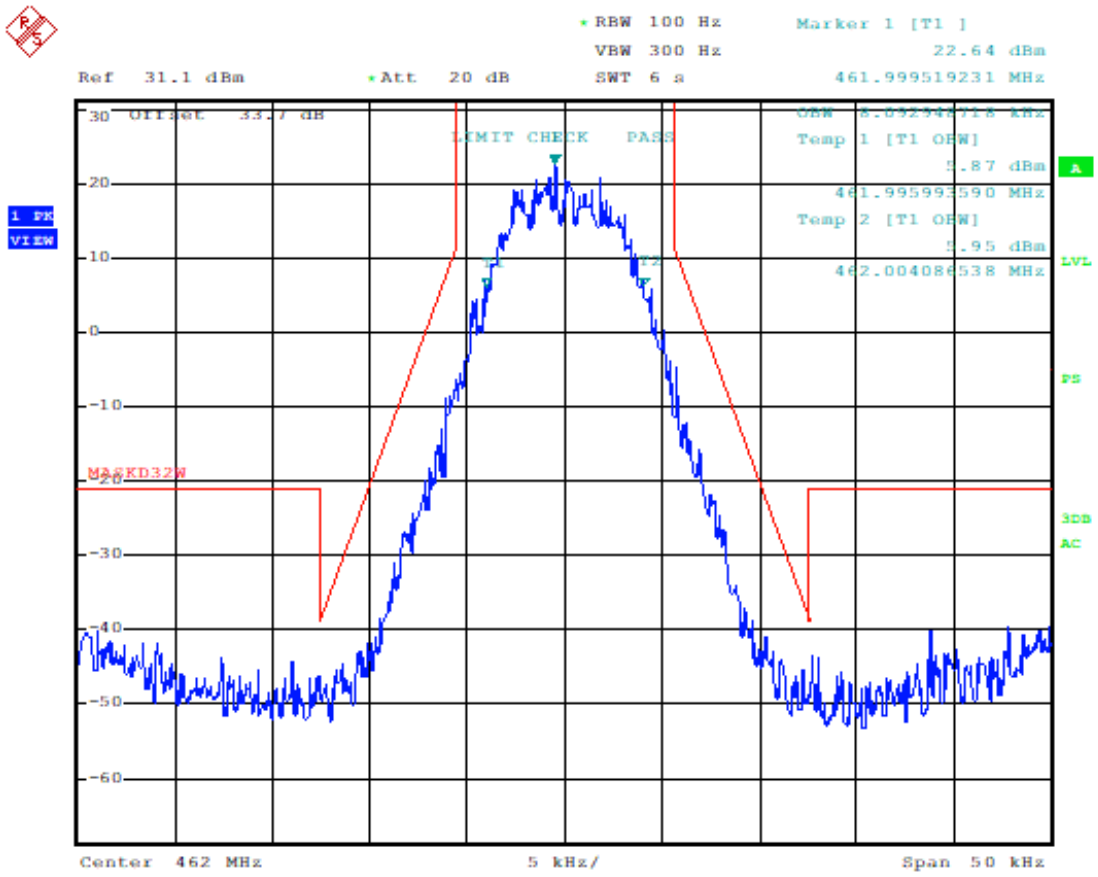
Test Data: Uplink 462.00 MHz – P25 Phase 2 H-CPM Below AGC Threshold



Date: 29.NOV.2017 11:08:03

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Uplink 462.00 MHz – P25 Phase 2 H-CPM +3 dBm Above AGC Threshold

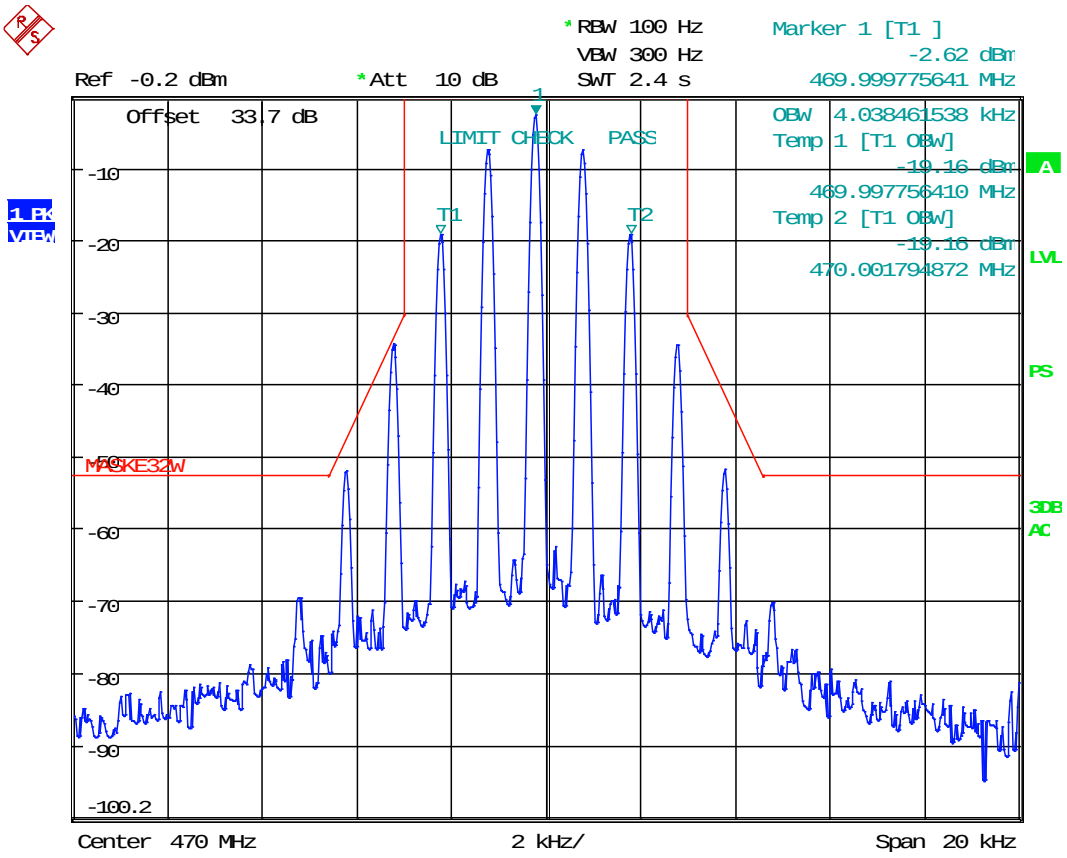


Date: 29.NOV.2017 11:03:53

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4, UPLINK 490 MHz

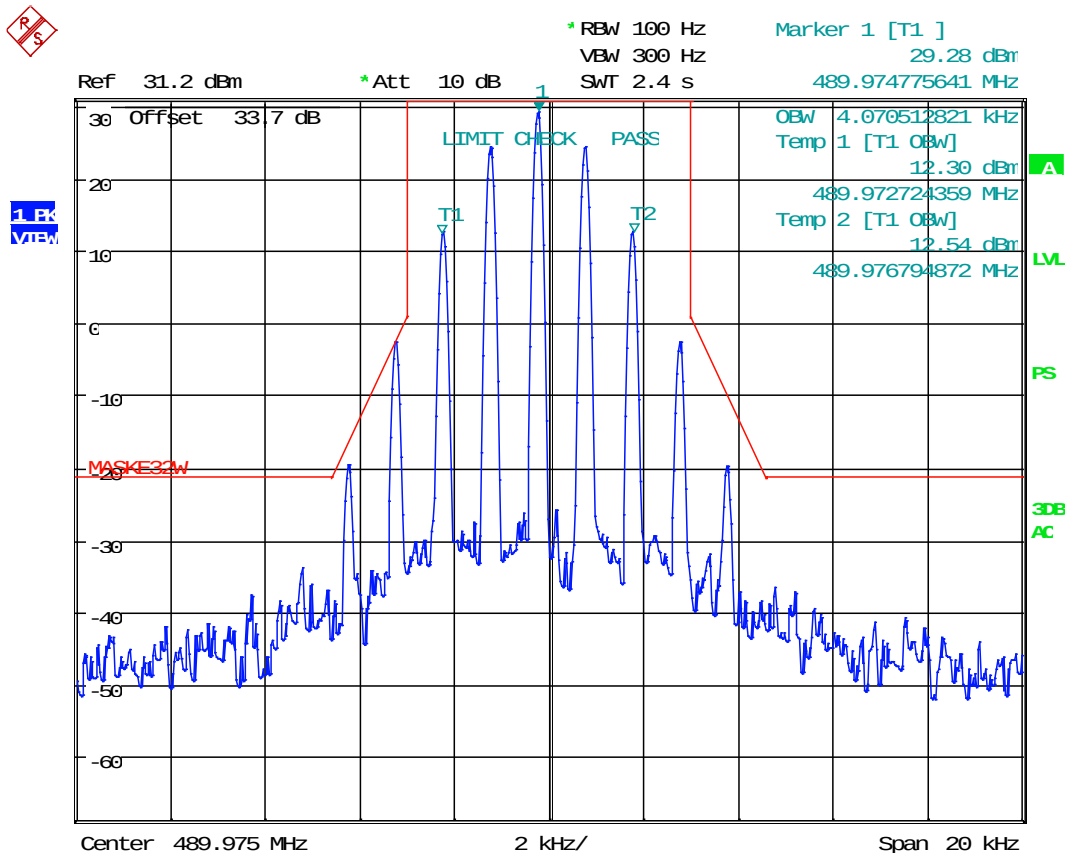
Test Data: Uplink 489.975 MHz – 6.25 kHz Test Signal



Date: 29.NOV.2017 09:44:20

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

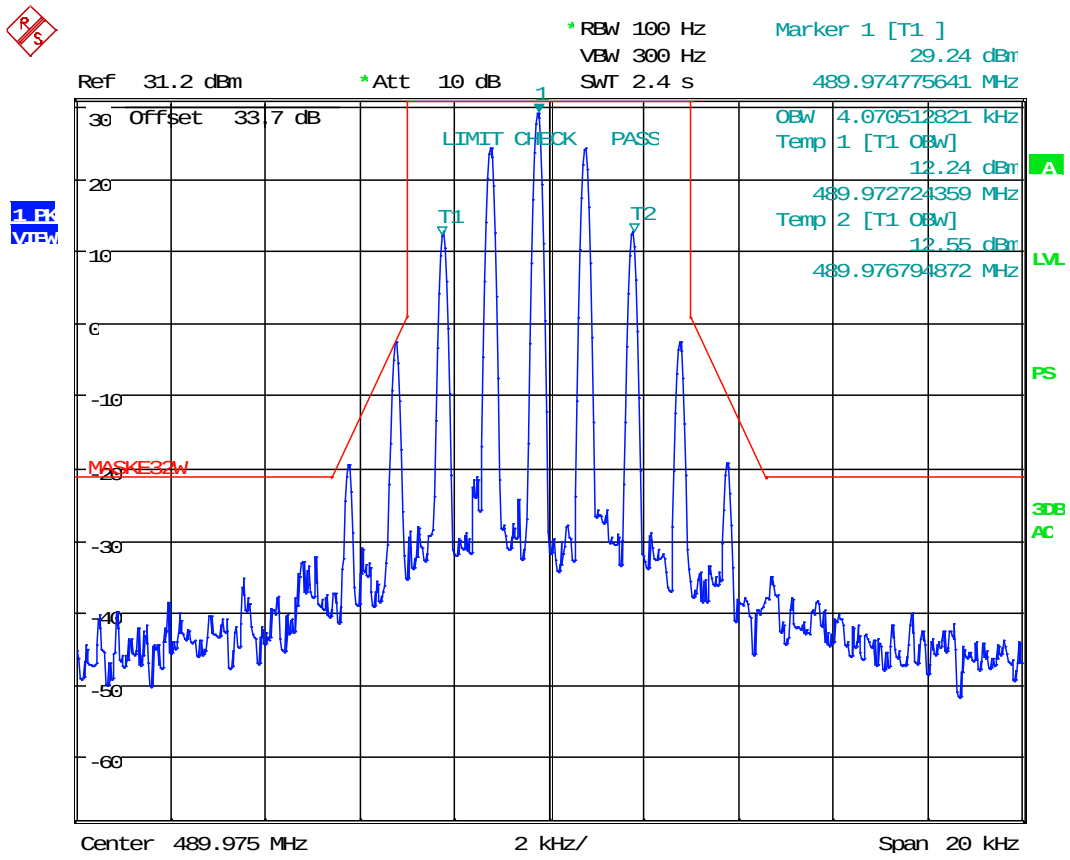
Test Data: Uplink 489.975 MHz – 6.25 kHz Below AGC Threshold



Date: 29.NOV.2017 09:40:13

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

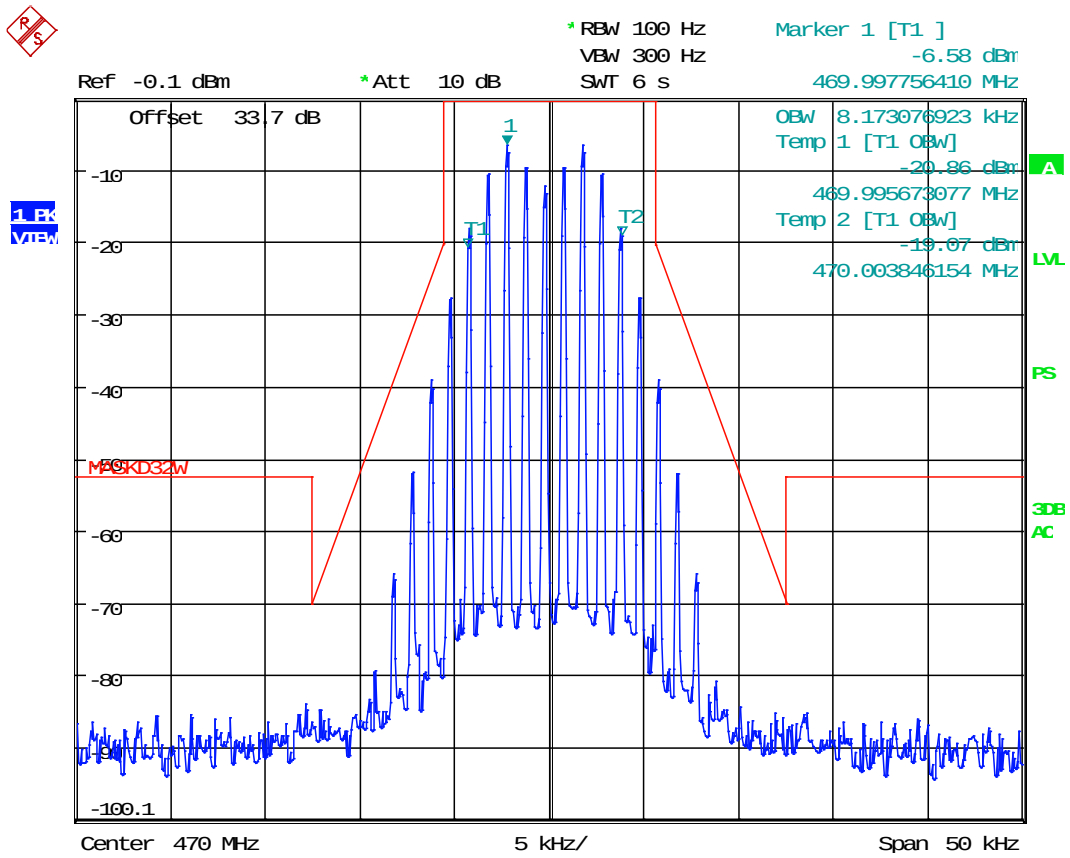
Test Data: Uplink 489.975 MHz – 6.25 kHz +3 dBm Above AGC Threshold



Date: 29.NOV.2017 09:41:57

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

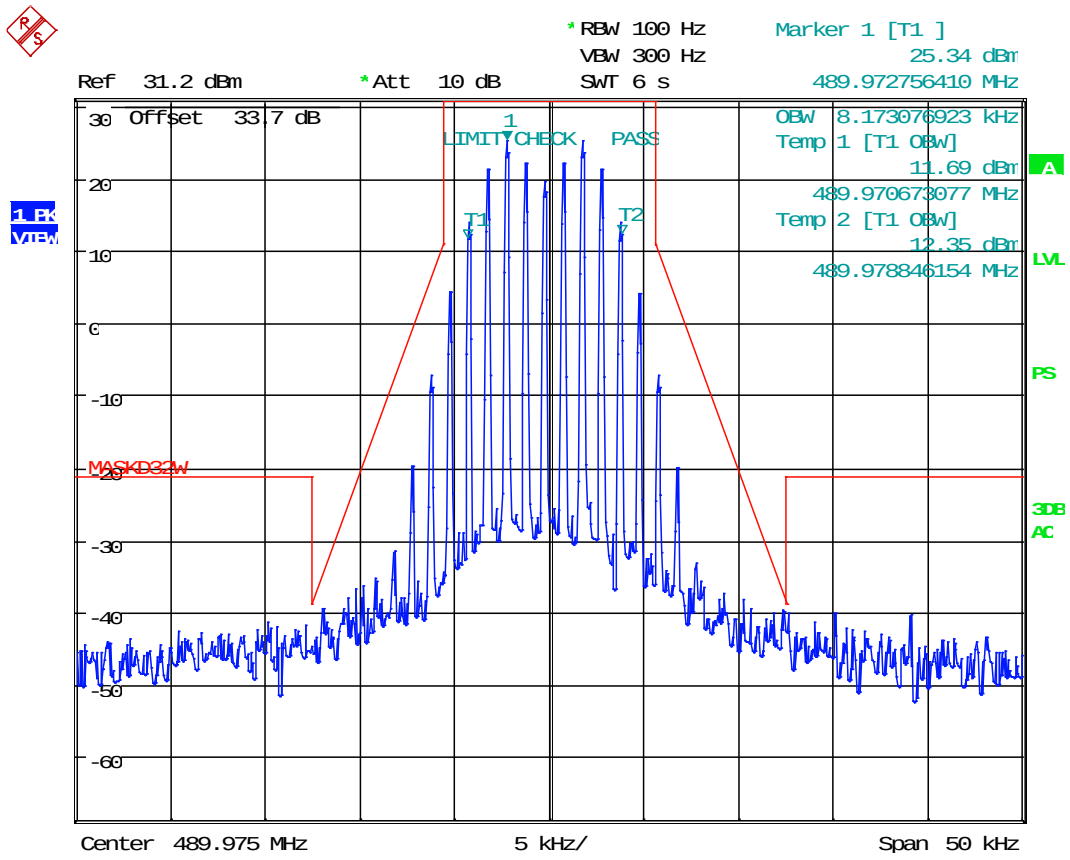
Test Data: Uplink 489.975 MHz – 12.5 kHz Test Signal



Date: 29.NOV.2017 10:20:45

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

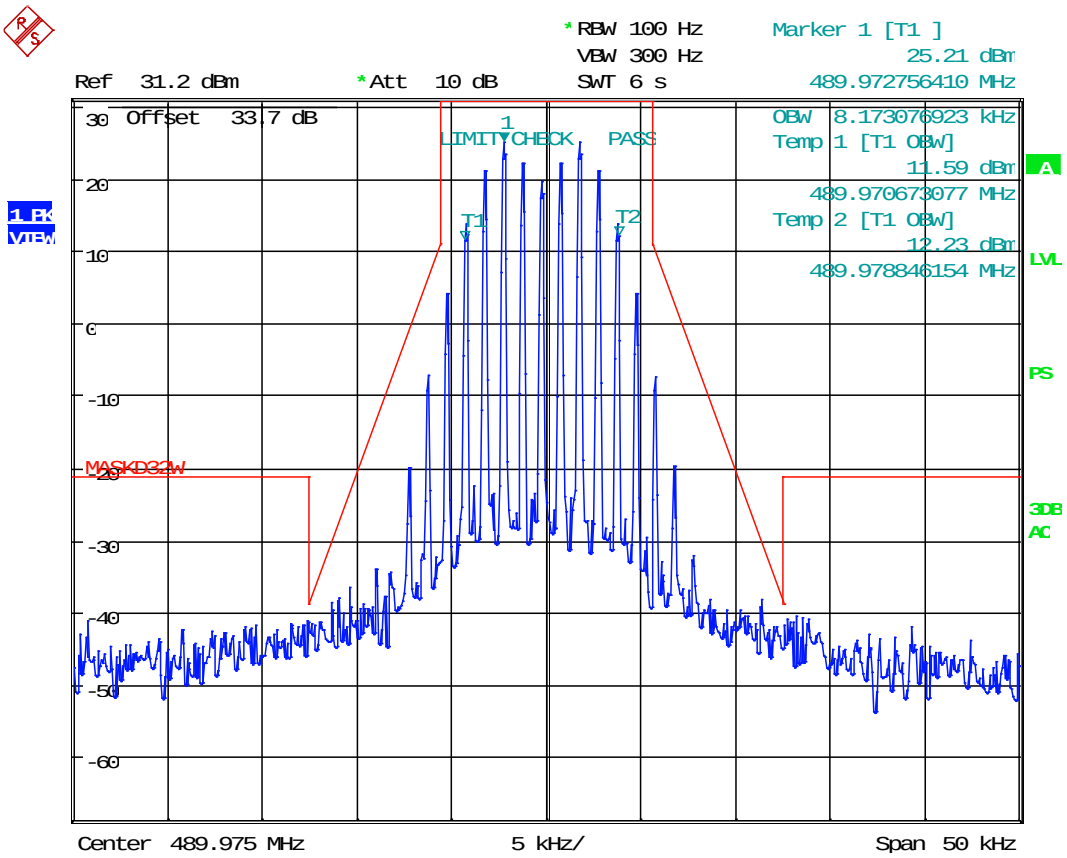
Test Data: Uplink 489.975 MHz – 12.5 kHz Below AGC Threshold



Date: 29.NOV.2017 10:01:23

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

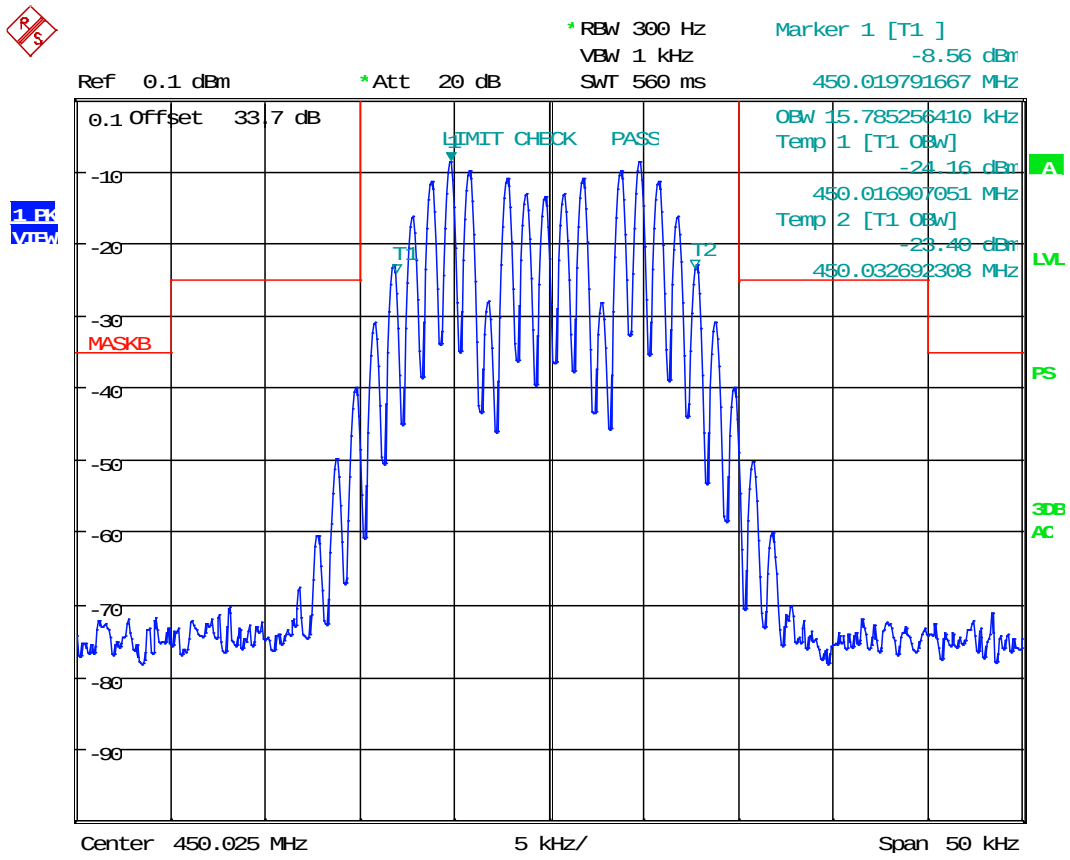
Test Data: Uplink 489.975 MHz – 12.5 kHz +3 dBm Above AGC Threshold



Date: 29.NOV.2017 10:02:22

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

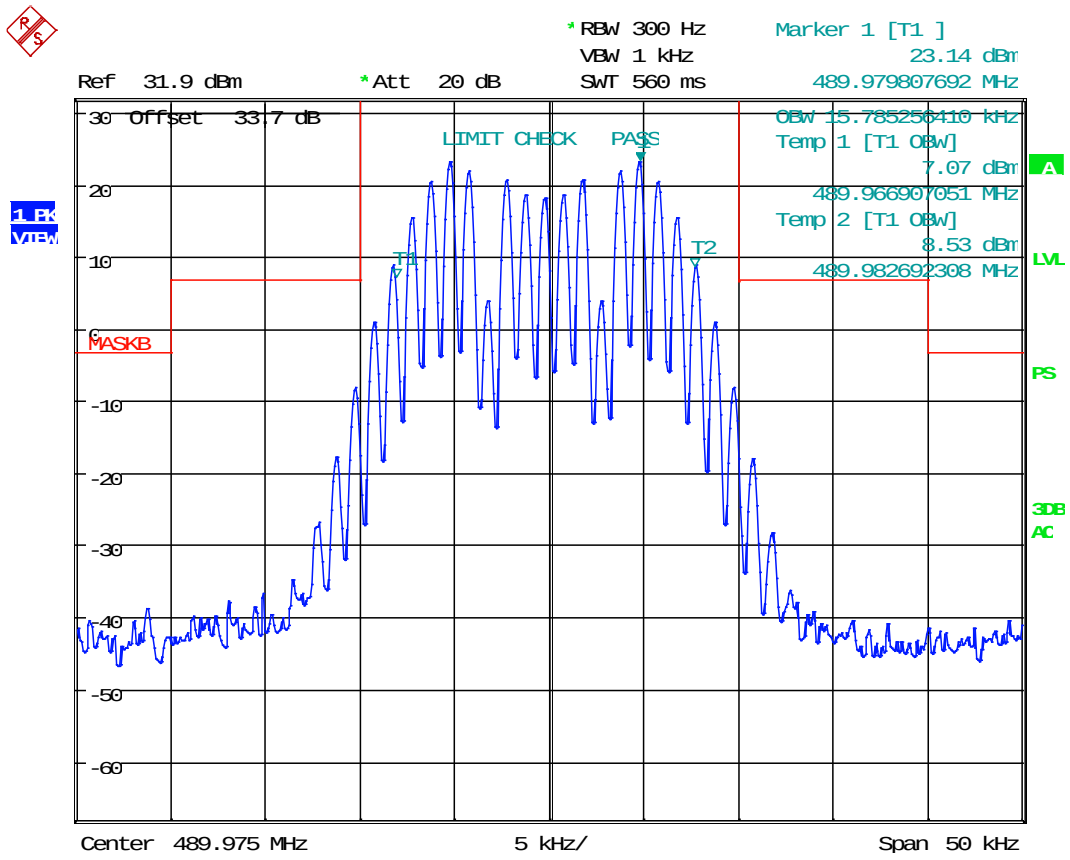
Test Data: Uplink 489.975 MHz – 25 kHz Test Signal



Date: 29.NOV.2017 11:29:16

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

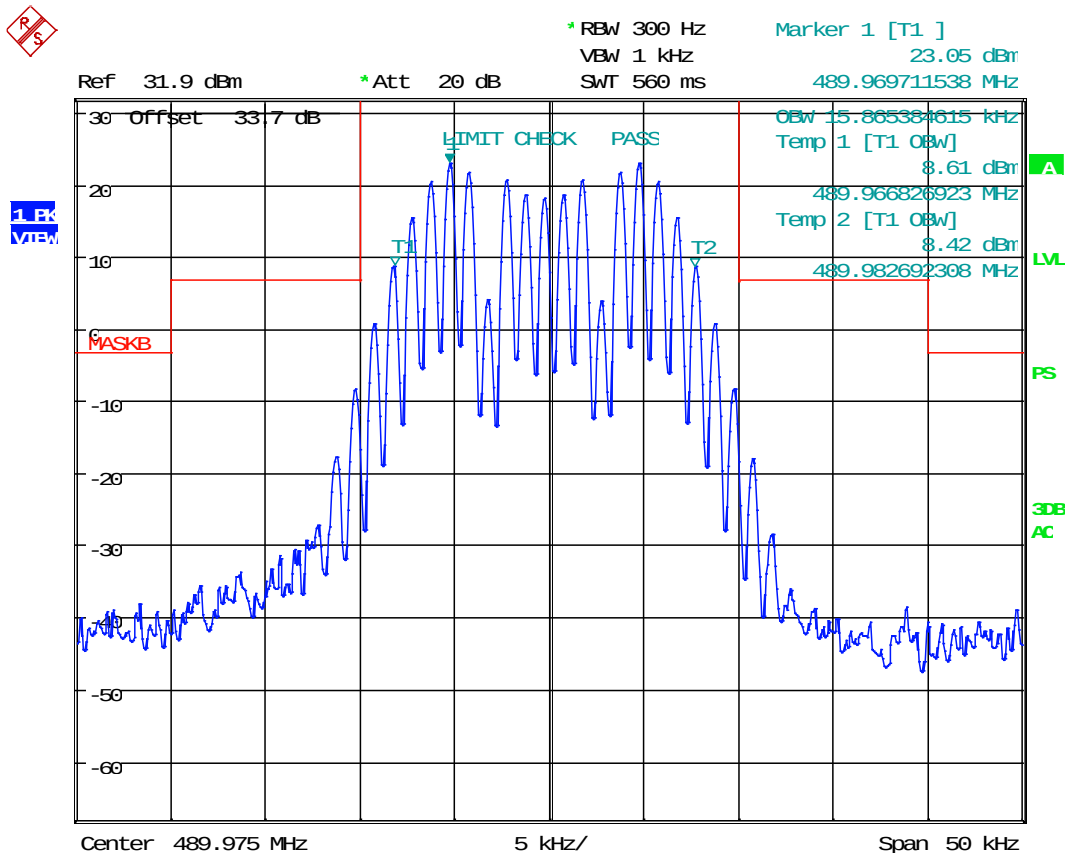
Test Data: Uplink 489.975 MHz – 25 kHz Below AGC Threshold



Date: 29.NOV.2017 11:31:26

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

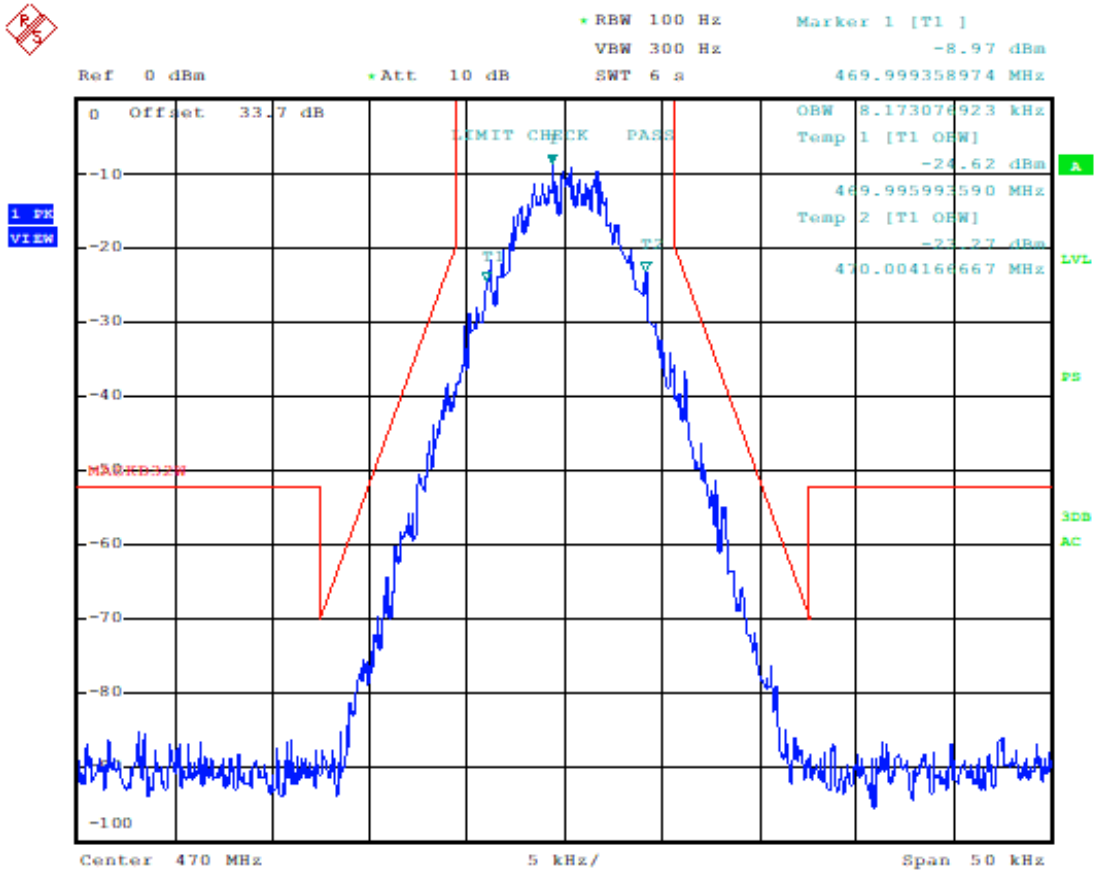
Test Data: Uplink 489.975 MHz – 25 kHz +3 dBm Above AGC Threshold



Date: 29.NOV.2017 11:32:17

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

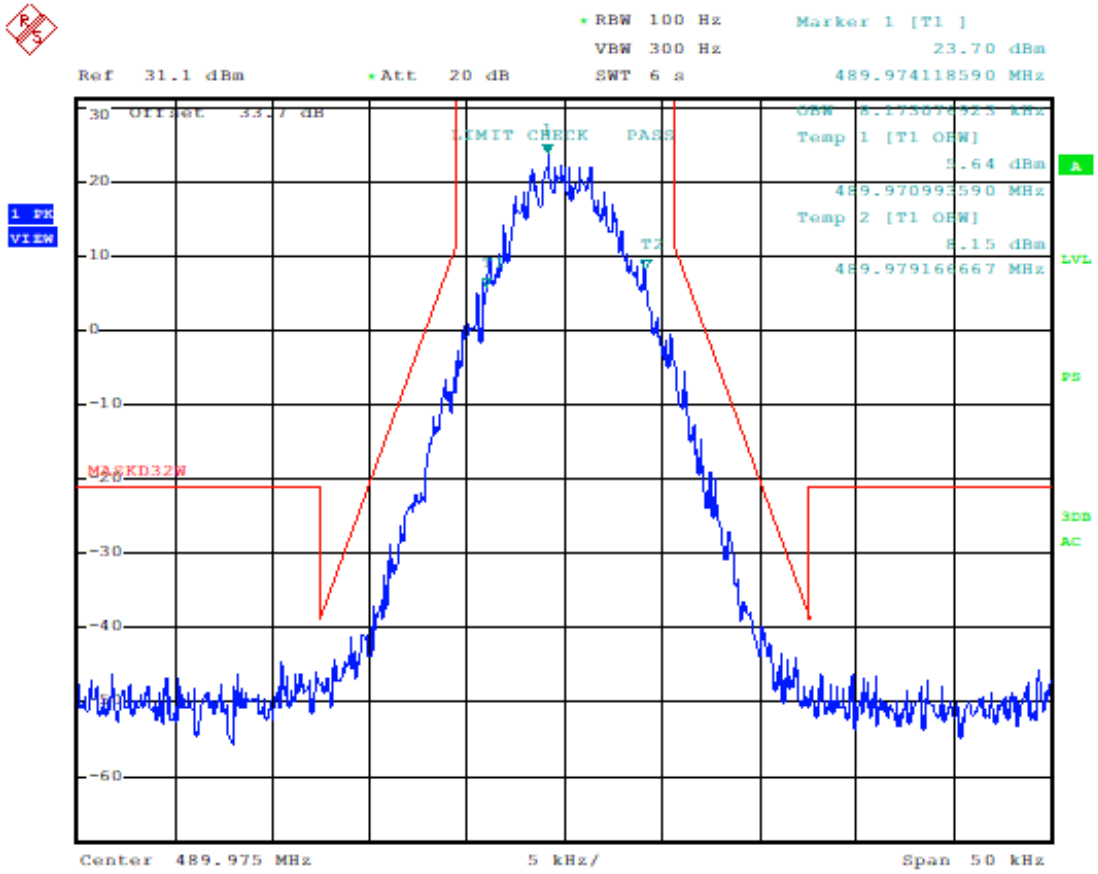
Test Data: Uplink 489.975 MHz – P25 Phase 1 C4FM Test Signal



Date: 29.NOV.2017 10:24:12

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

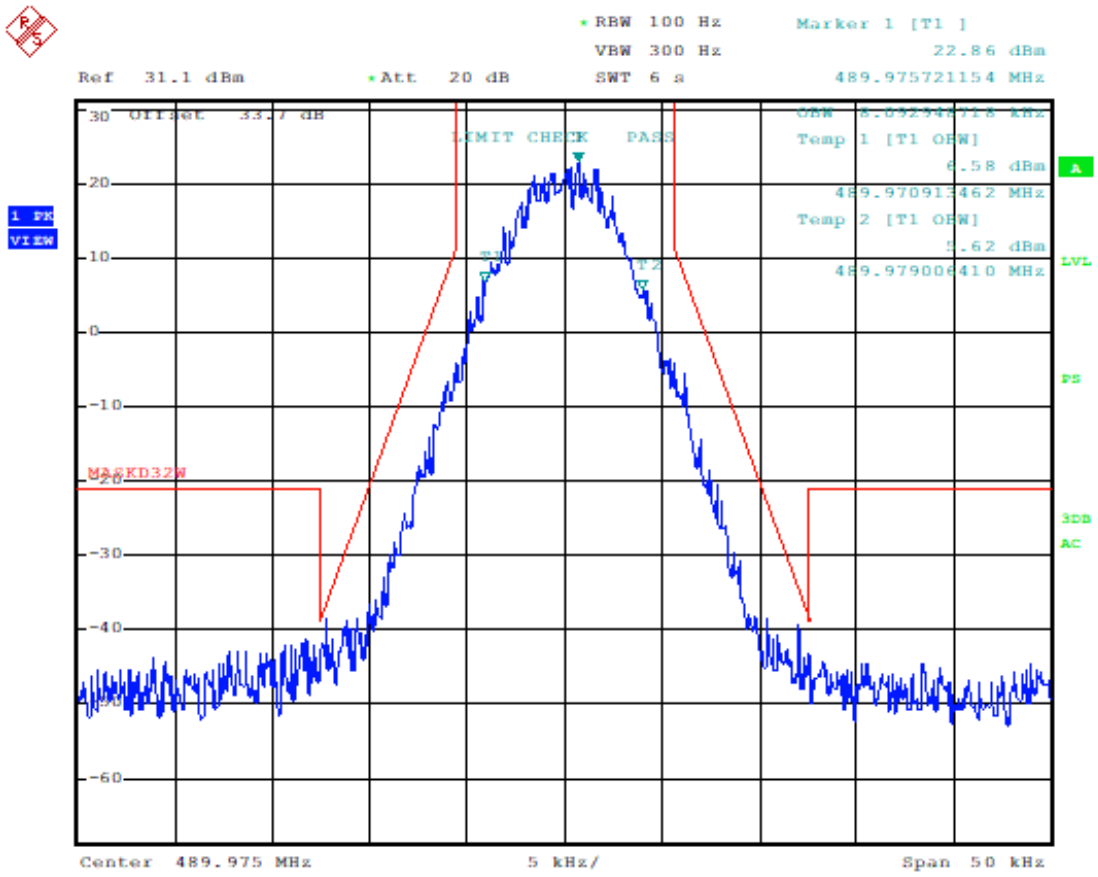
Test Data: Uplink 489.975 MHz – P25 Phase 1 C4FM Below AGC Threshold



Date: 29.NOV.2017 11:11:36

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

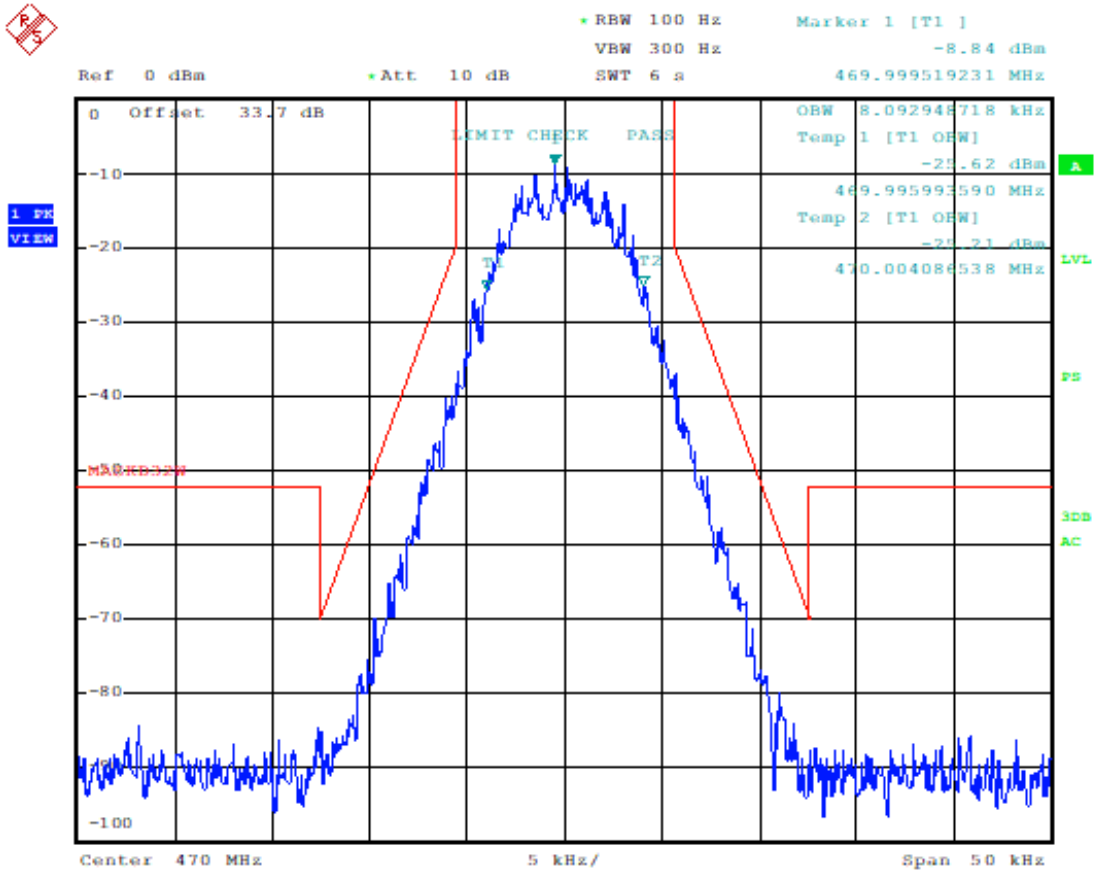
Test Data: Uplink 489.975 MHz – P25 Phase 1 C4FM +3 dBm Above AGC Threshold



Date: 29.NOV.2017 11:16:04

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

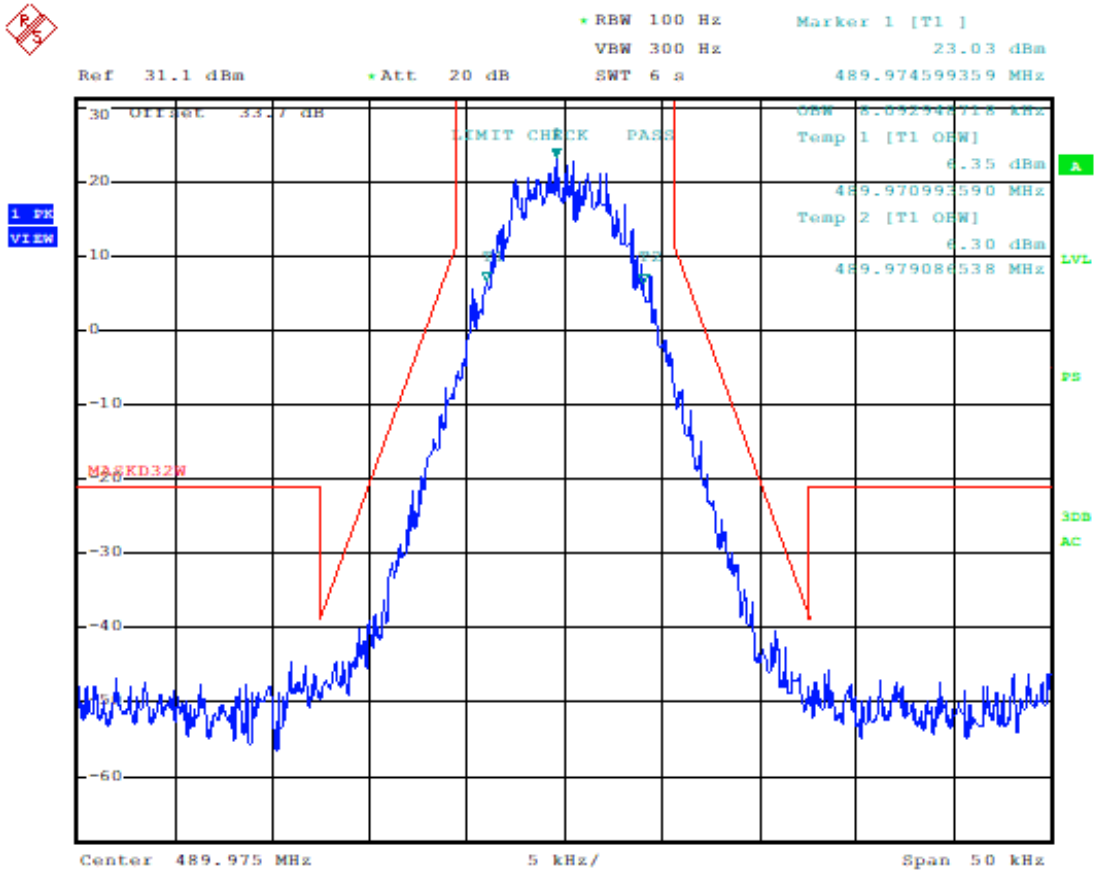
Test Data: Uplink 489.975 MHz – P25 Phase 2 H-CPM Test Signal



Date: 29.NOV.2017 10:25:34

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

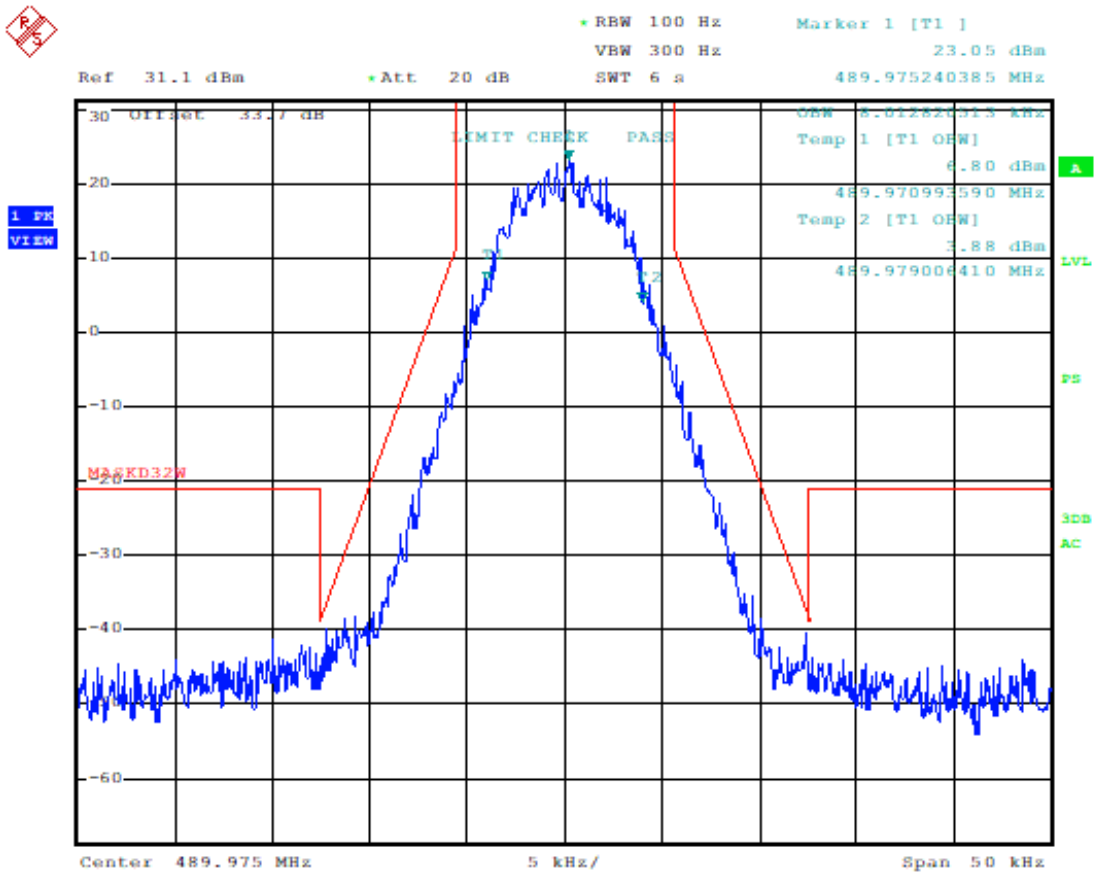
Test Data: Uplink 489.975 MHz – P25 Phase 2 H-CPM Below AGC Threshold



Date: 29.NOV.2017 11:12:31

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: Uplink 489.975 MHz – P25 Phase 2 H-CPM +3 dBm Above AGC Threshold



Date: 29.NOV.2017 11:17:02

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

NOISE FIGURE §4.6

Rule Part No.: 47CFR90.219(e)(2)
KDB 935210-D05 v01r01 §4.6

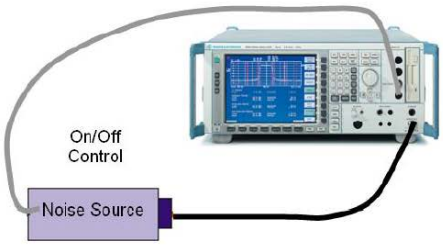
Requirements: 9 dB

Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.6 Noise Figure Measurements

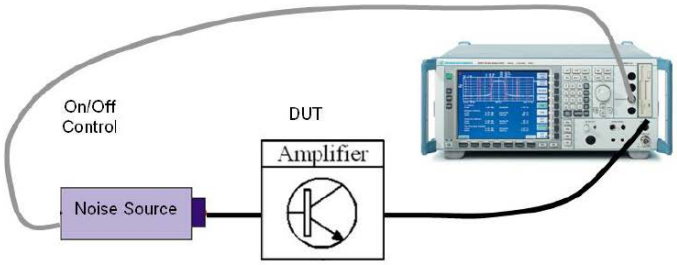
1MA178_2e R&S Application Note the Y Factor Technique Noise Figure
§ 2 Background Theory and Equations
§ 3 Detailed Measurement Steps

Setup Diagram:

Calibration



Measurement



Test Data: Noise Measurement Table

$T^{ON\ source}$ (K)	$T^{OFF\ source}$ (K)	Source ENR (dB)
9545.45978	290	15.04

Step 1 Calibration of Noise Source with ESU 40							
F_c	$N^{SA\ off}$		$N^{SA\ on}$		Y^{SA}	T^{SA}	NF^{SA}
MHz	dBm	fW	dBm	fW	Linear	Analyzer	dB
490	-114.41	3.62	-107.01	19.91	5.50	1768.87	8.51

Step 2 Noise Measurement with EUT							
F_c	$N^{EUT\ \&\ SA\ off}$		$N^{EUT\ \&\ SA\ on}$		$Y^{EUT\ \&\ SA}$	$T^{EUT\ \&\ SA}$	NF
MHz	dBm	fW	dBm	fW	Linear	Cascade	dB
490	-13.39	45814188671.45	-5.28	296483138952.43	6.47	1401.60	7.66

Step 3 Noise Figure Calcualtion for EUT						
F_c	Gain	Gain	T^{EUT}	NF	Limit	Margin
MHz	Num	dB	EUT	dB	≤dB	dB
490	15393286654	101.87	1401.60	7.66	9.00	1.34

Results Meet Requirements

OUT OF BAND / OUT OF BLOCK EMISSIONS §4.7, DOWNLINK 450 MHz

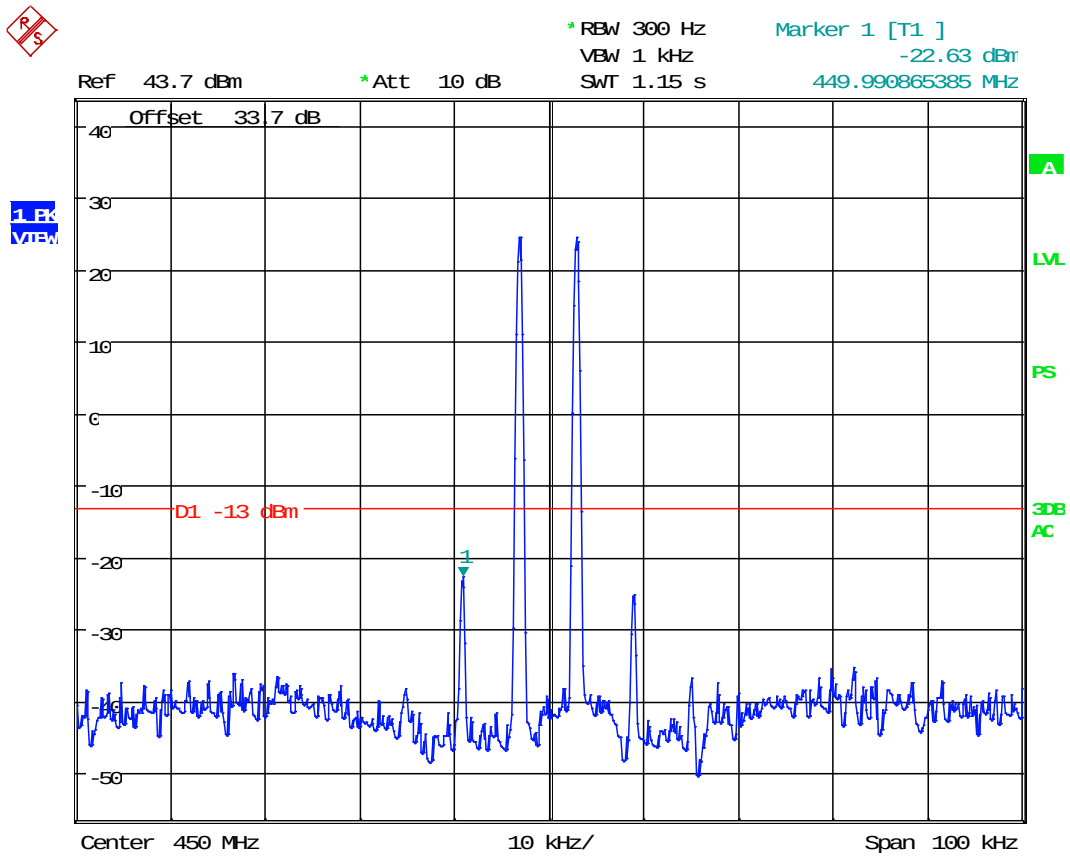
Rule Part No.: 47CFR90.210
KDB 935210-D05 v01r01 §4.7.2

Requirements: -13 dBm

Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.7.1 General
§ 4.7.2 Out of Band/ Out of block emissions conducted measurements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 450.00 MHz

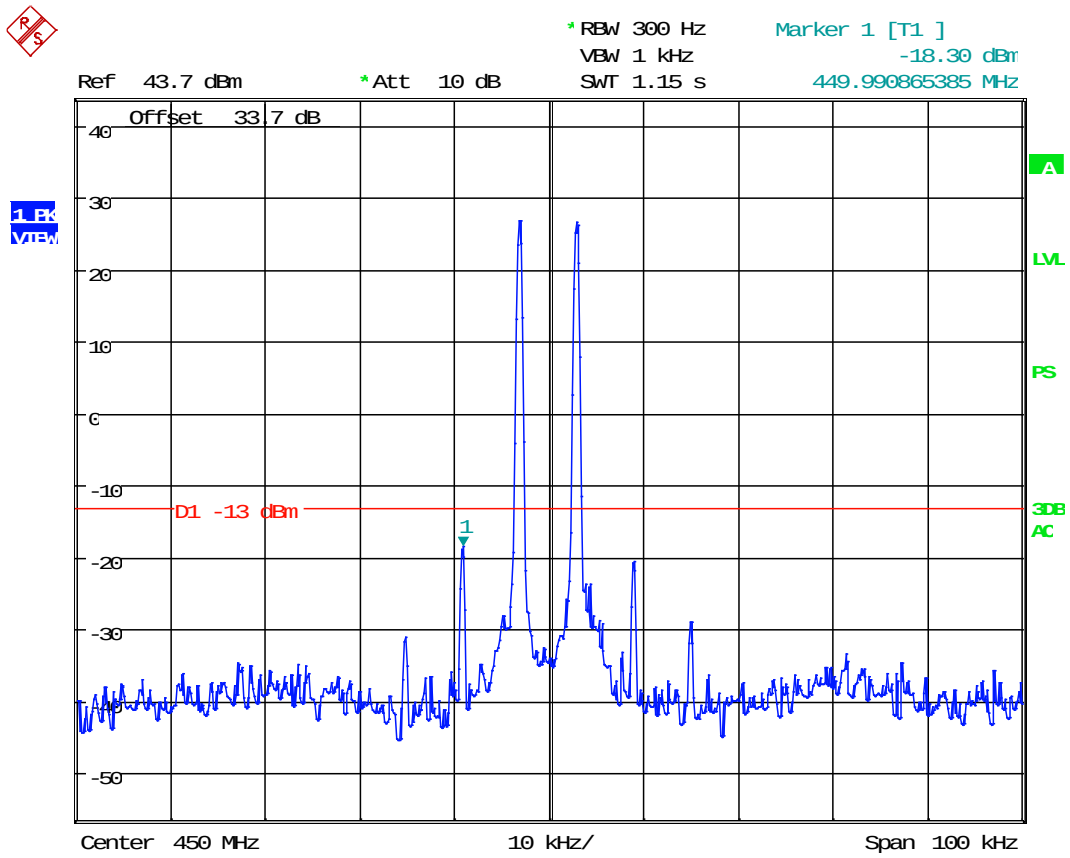
Test Data: 6.25 kHz Intermodulation without AGC



Date: 22.NOV.2017 09:43:37

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 450.00 MHz

Test Data: 6.25 kHz Intermodulation AGC +3 dB

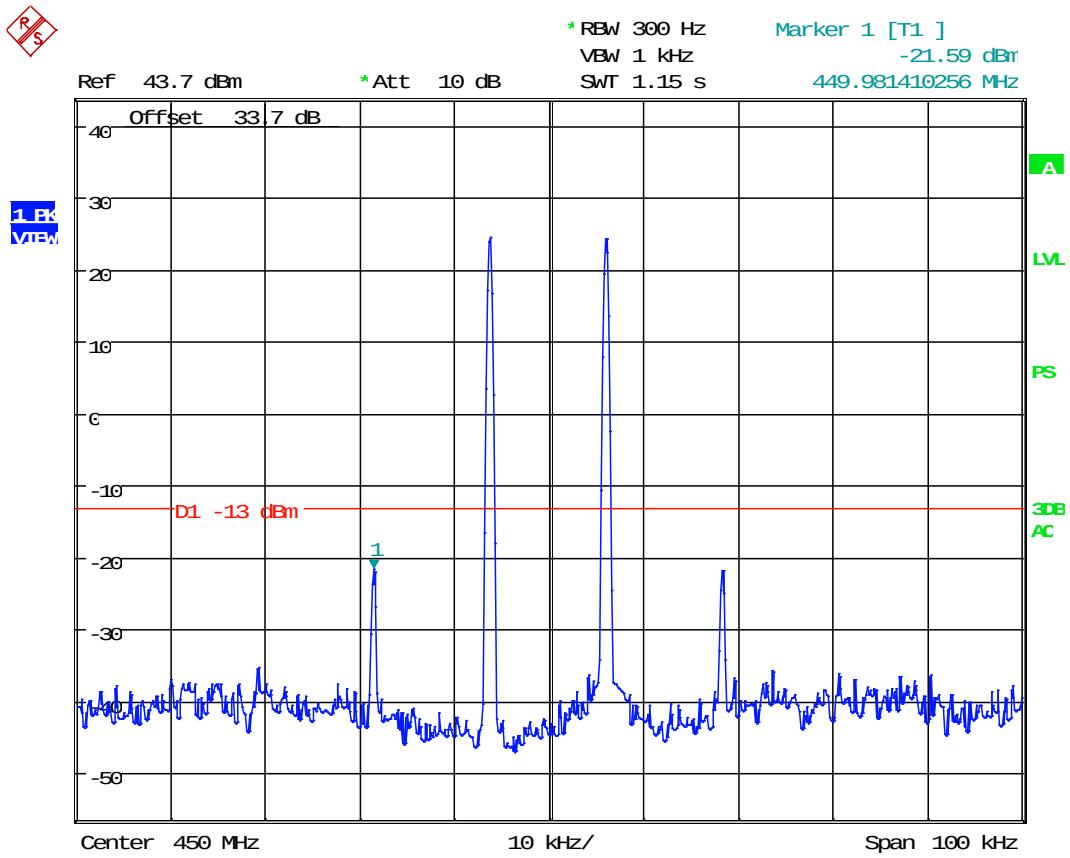


Date: 22.NOV.2017 09:44:11

Results Meet Requirements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 450.00 MHz

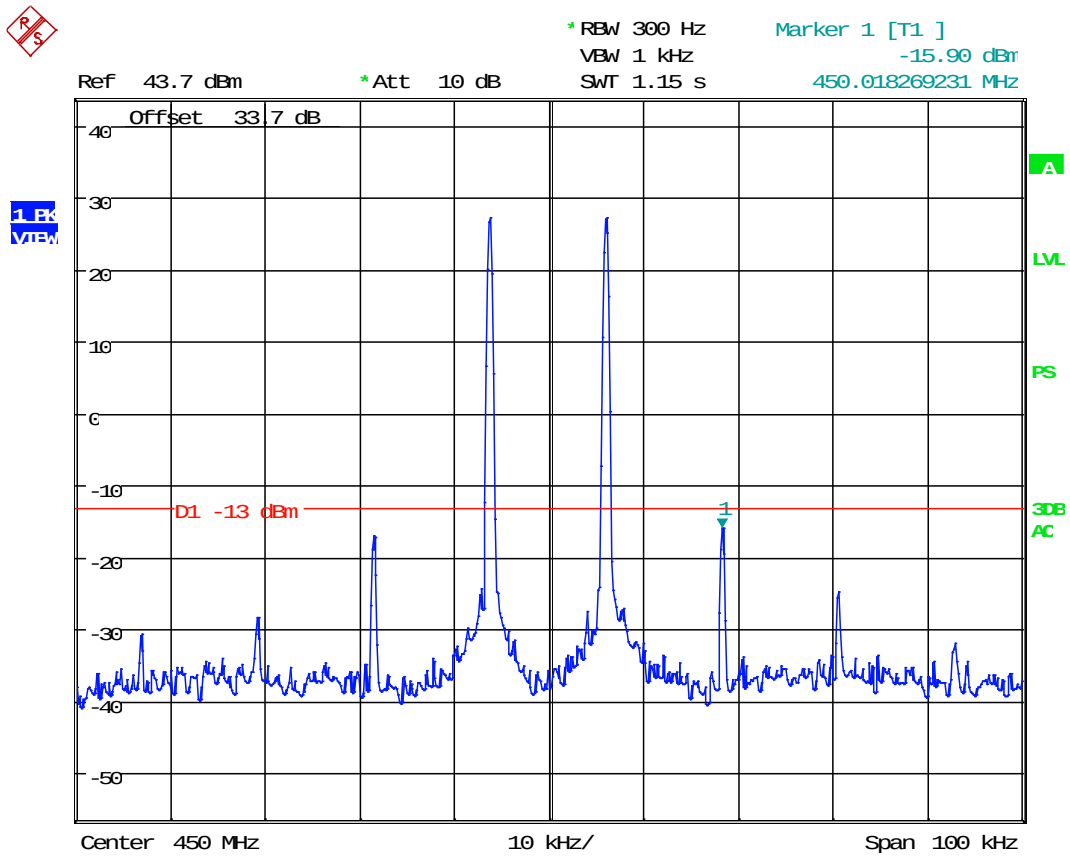
Test Data: 12.5 kHz Intermodulation without AGC



Date: 22.NOV.2017 09:45:23

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 450.00 MHz

Test Data: 12.5 kHz Intermodulation AGC +3 dB

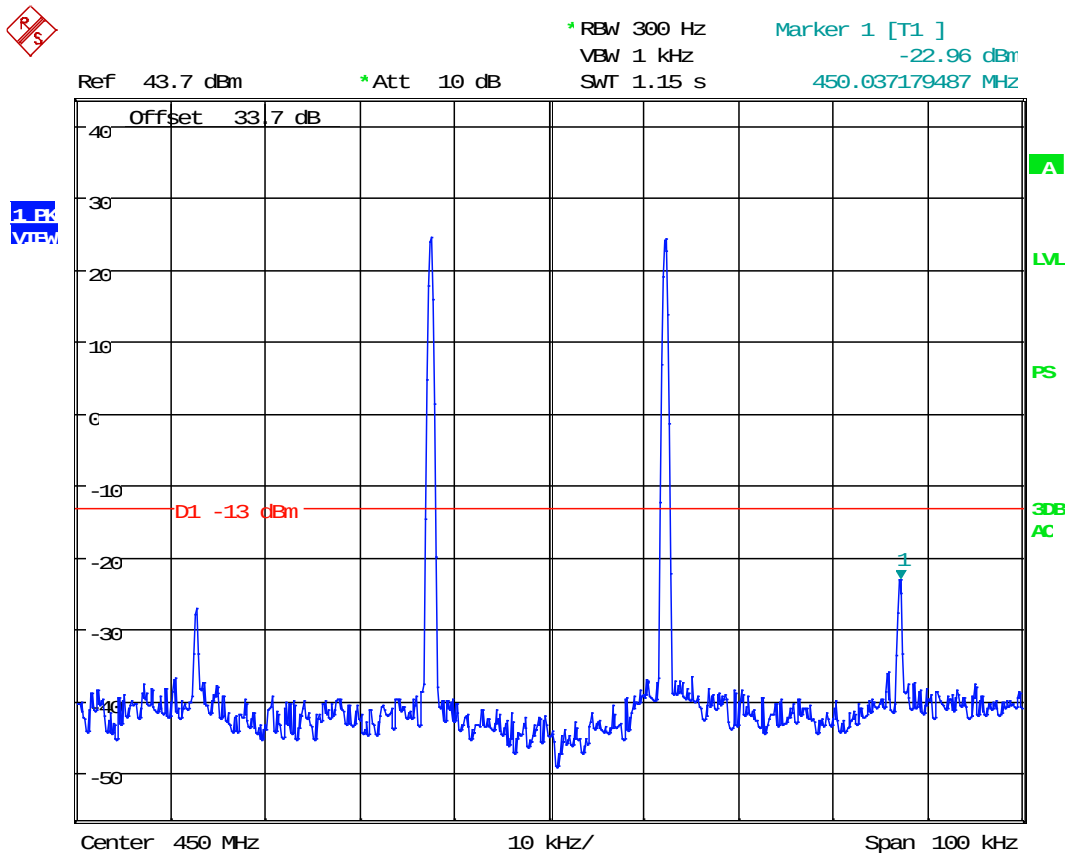


Date: 22.NOV.2017 09:46:15

Results Meet Requirements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 450.00 MHz

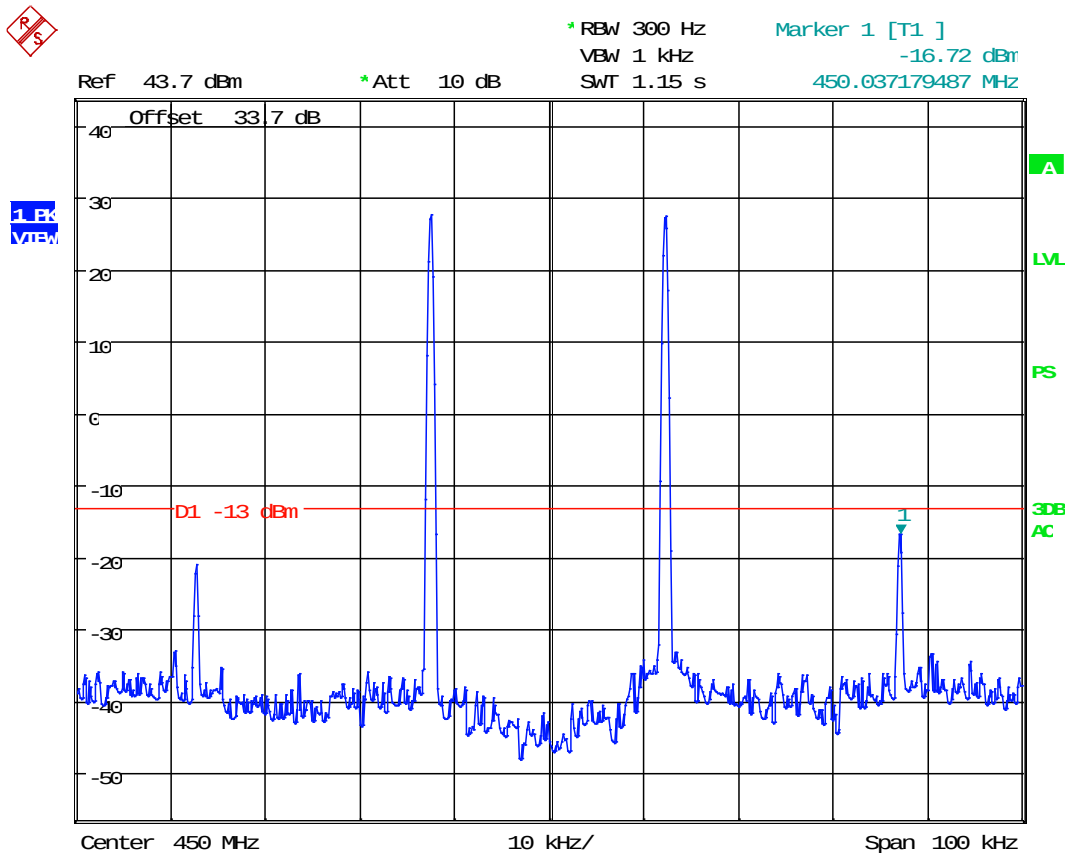
Test Data: 25 kHz Intermodulation without AGC



Date: 22.NOV.2017 09:47:32

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 450.00 MHz

Test Data: 25 kHz Intermodulation AGC +3 dB



Date: 22.NOV.2017 09:47:59

Results Meet Requirements

OUT OF BAND / OUT OF BLOCK EMISSIONS §4.7, DOWNLINK 470 MHz

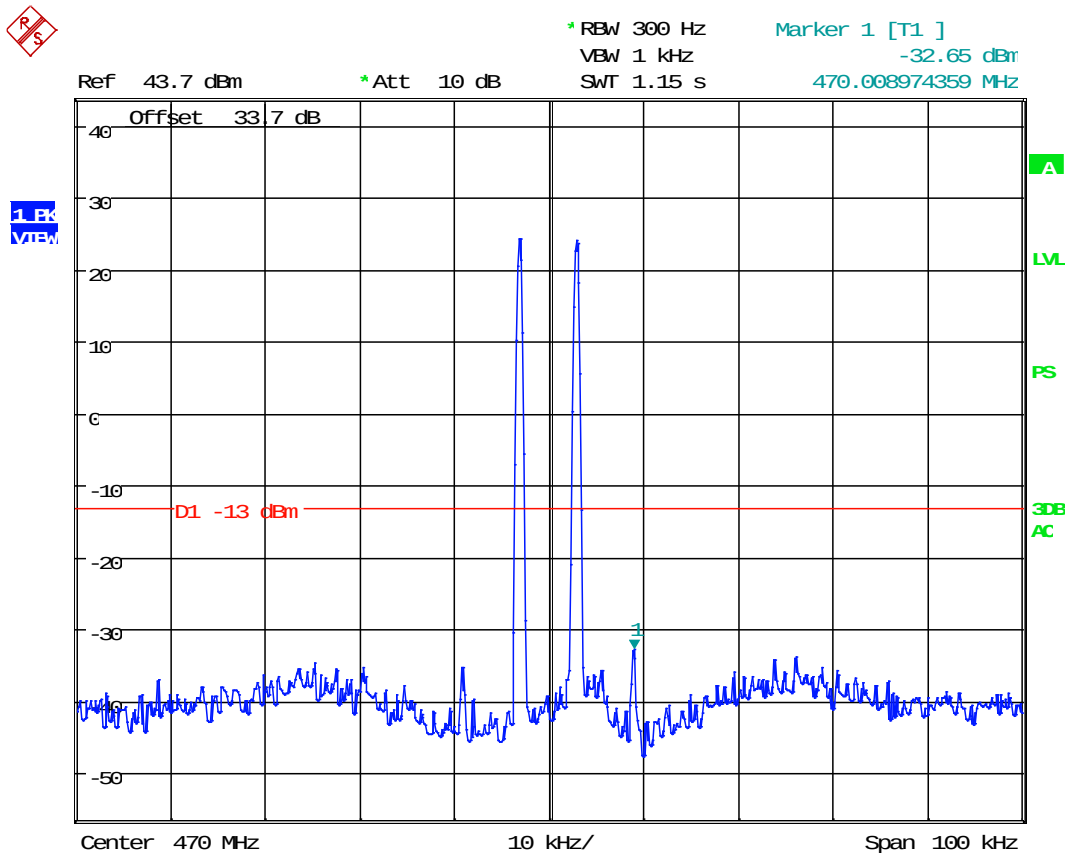
Rule Part No.: 47CFR90.210
KDB 935210-D05 v01r01 §4.7.2

Requirements: -13 dBm

Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.7.1 General
§ 4.7.2 Out of Band/ Out of block emissions conducted measurements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 470.00 MHz

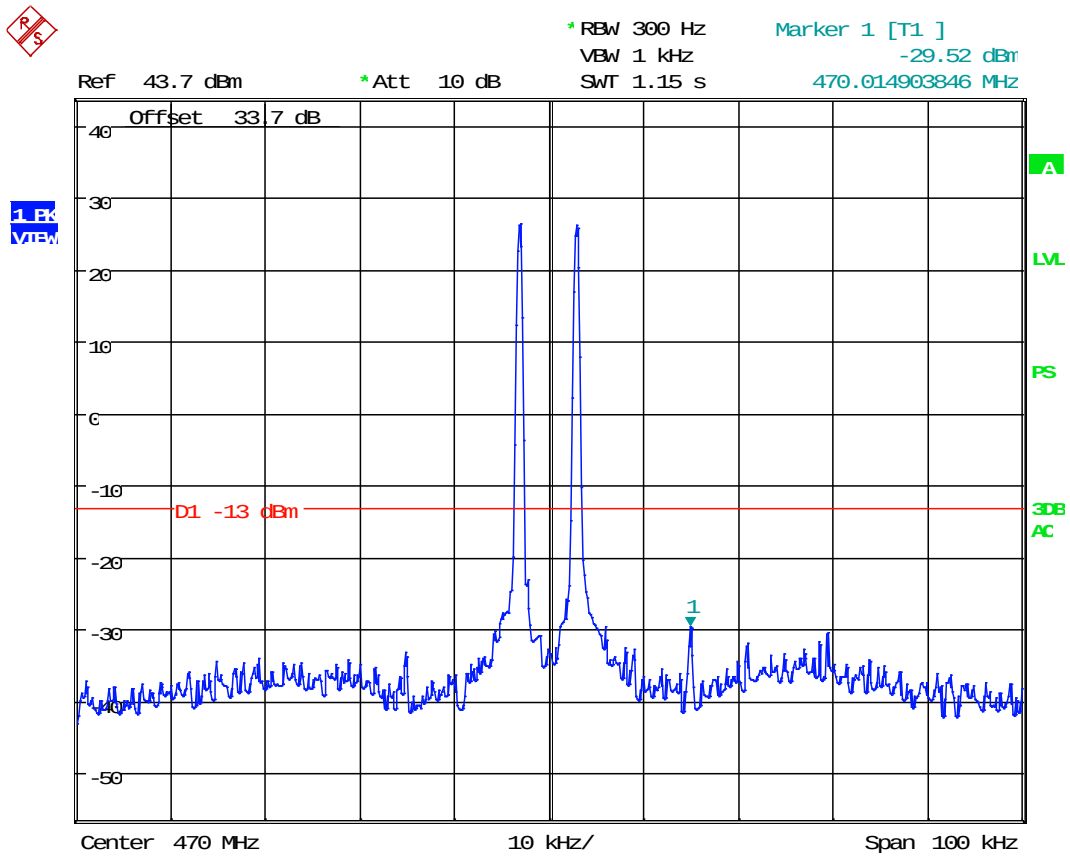
Test Data: 6.25 kHz Intermodulation without AGC



Date: 22.NOV.2017 09:50:48

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 470.00 MHz

Test Data: 6.25 kHz Intermodulation AGC +3 dB

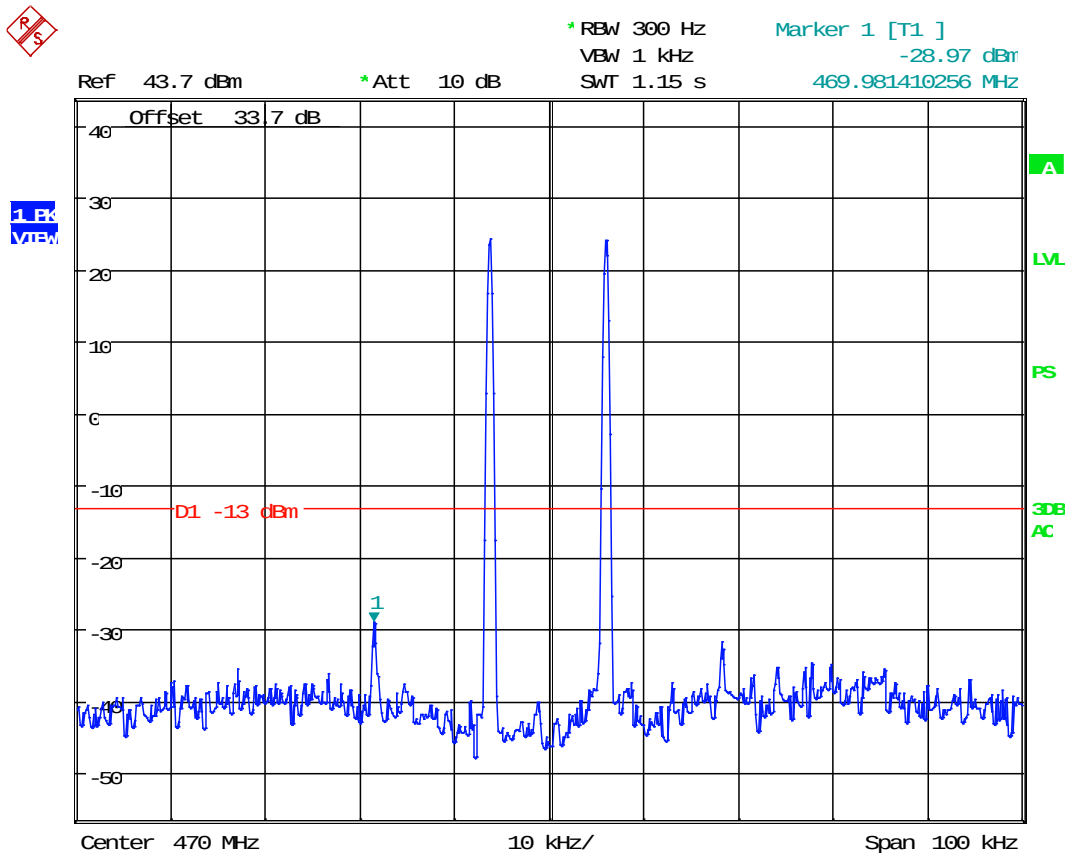


Date: 22.NOV.2017 09:51:26

Results Meet Requirements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 470.00 MHz

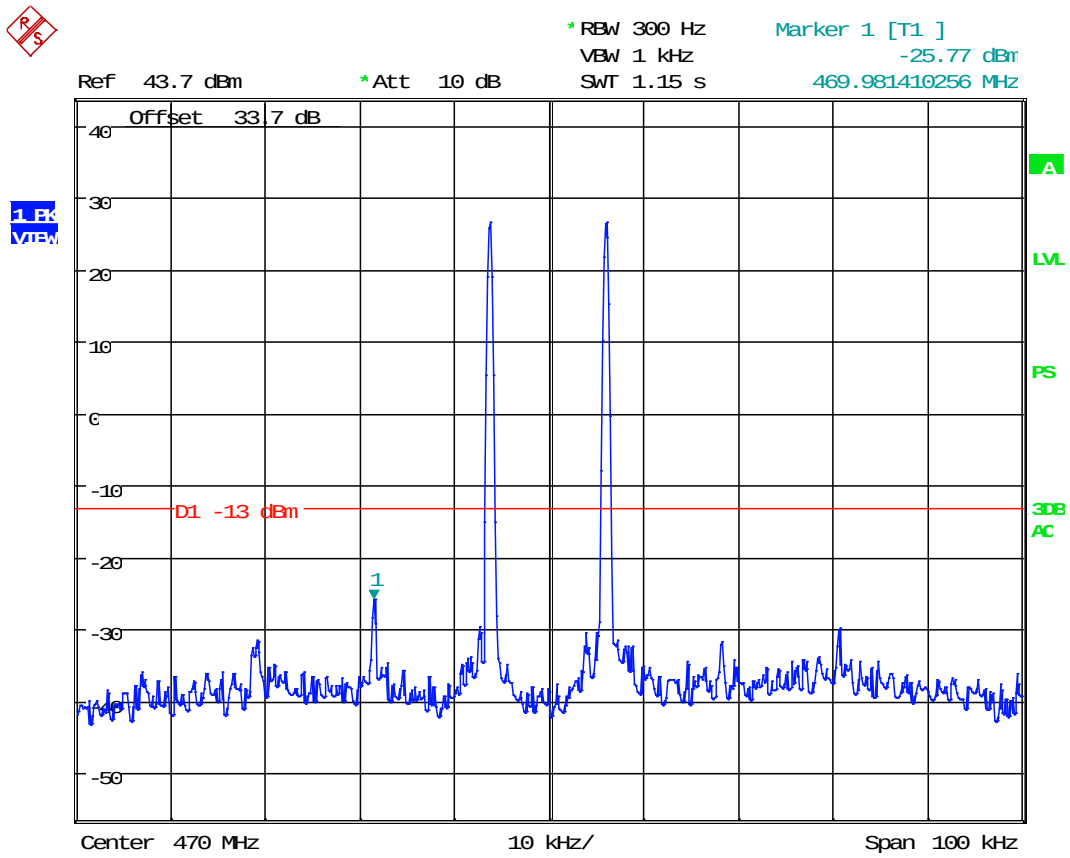
Test Data: 12.5 kHz Intermodulation without AGC



Date: 22.NOV.2017 09:52:37

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 470.00 MHz

Test Data: 12.5 kHz Intermodulation AGC +3 dB

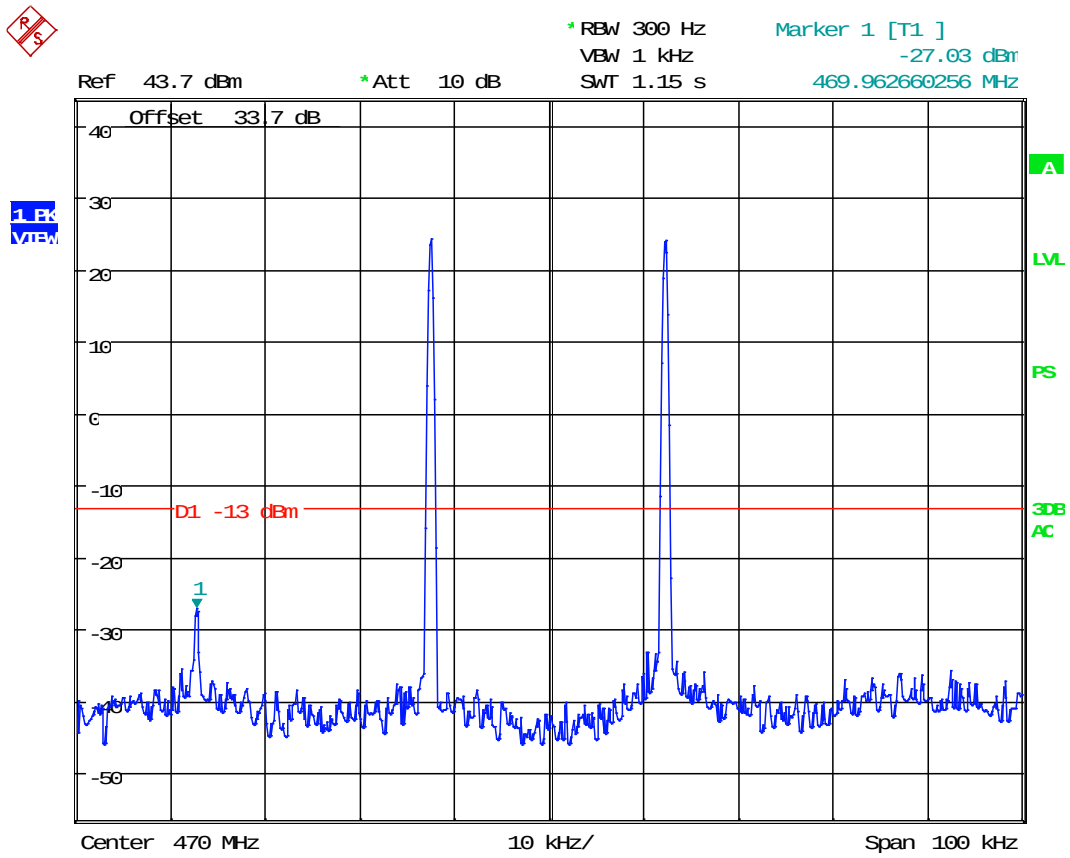


Date: 22.NOV.2017 09:53:15

Results Meet Requirements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 470.00 MHz

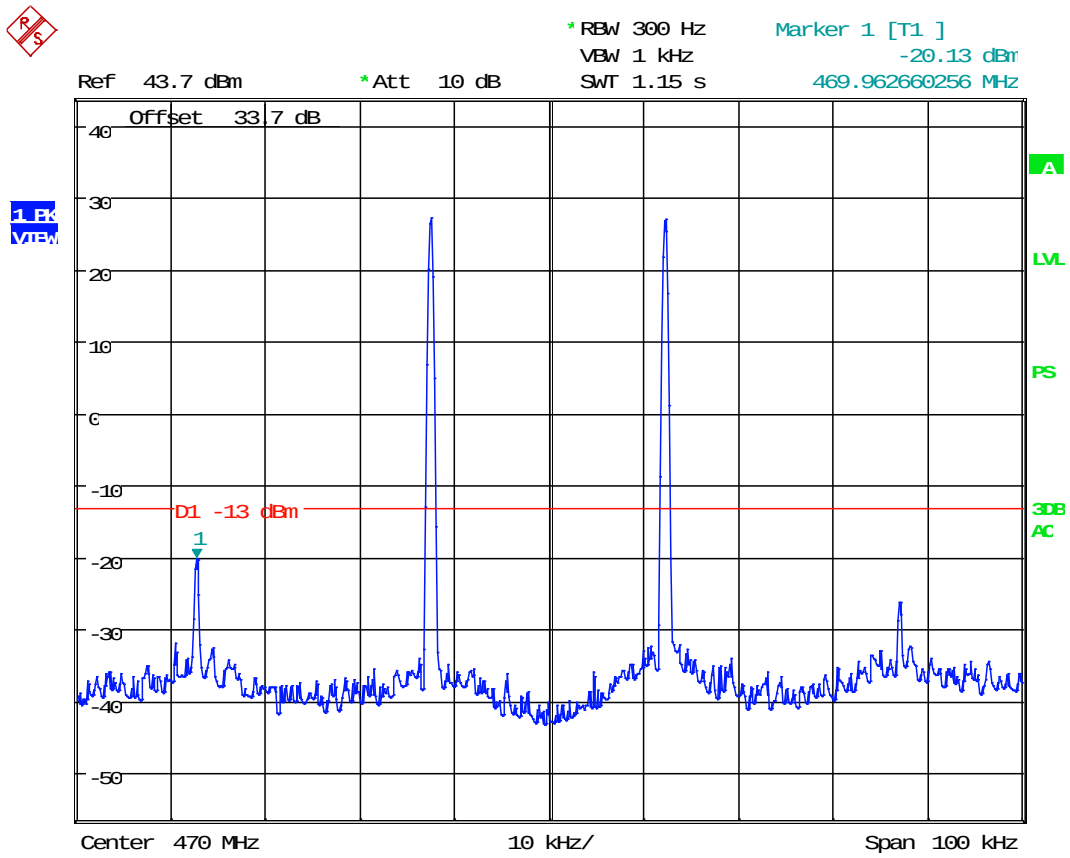
Test Data: 25 kHz Intermodulation without AGC



Date: 22.NOV.2017 09:54:14

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Downlink 470.00 MHz

Test Data: 25 kHz Intermodulation AGC +3 dB



Date: 22.NOV.2017 09:56:09

Results Meet Requirements

OUT OF BAND / OUT OF BLOCK EMISSIONS §4.7, UPLINK 462 MHz

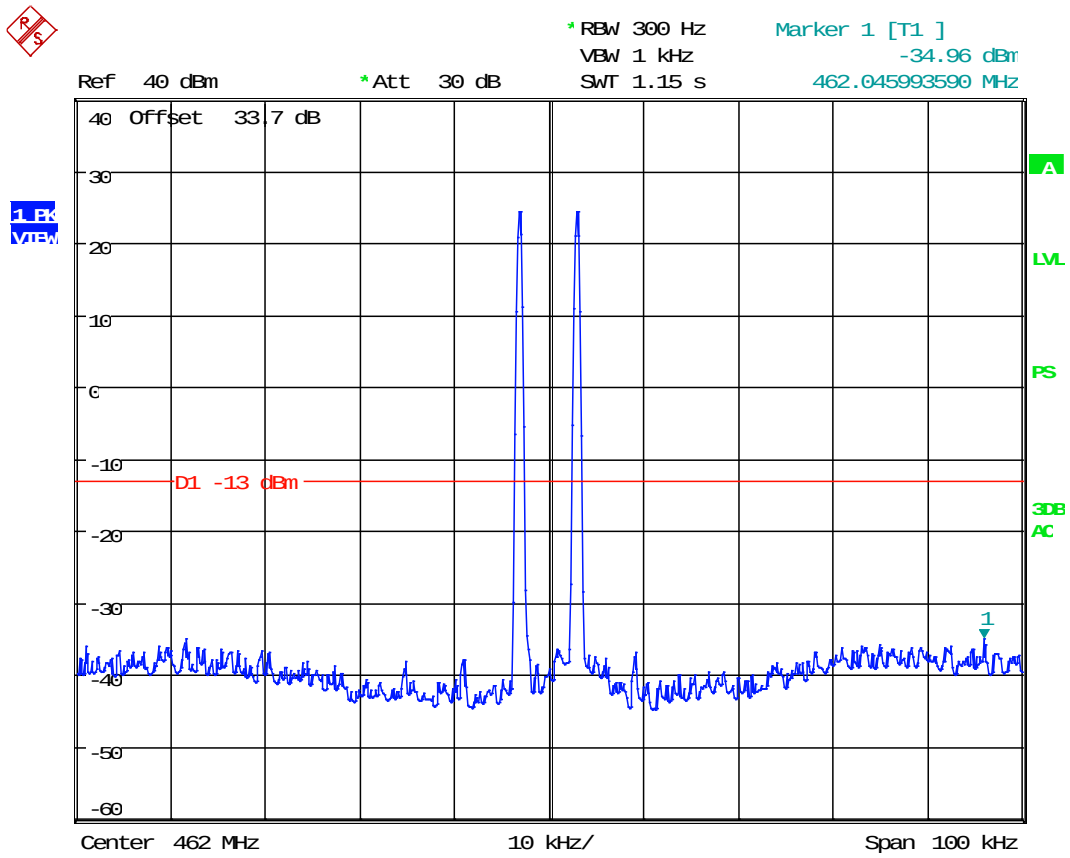
Rule Part No.: 47CFR90.210
KDB 935210-D05 v01r01 §4.7.2

Requirements: -13 dBm

Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.7.1 General
§ 4.7.2 Out of Band/ Out of block emissions conducted measurements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, UPLINK 462 MHz

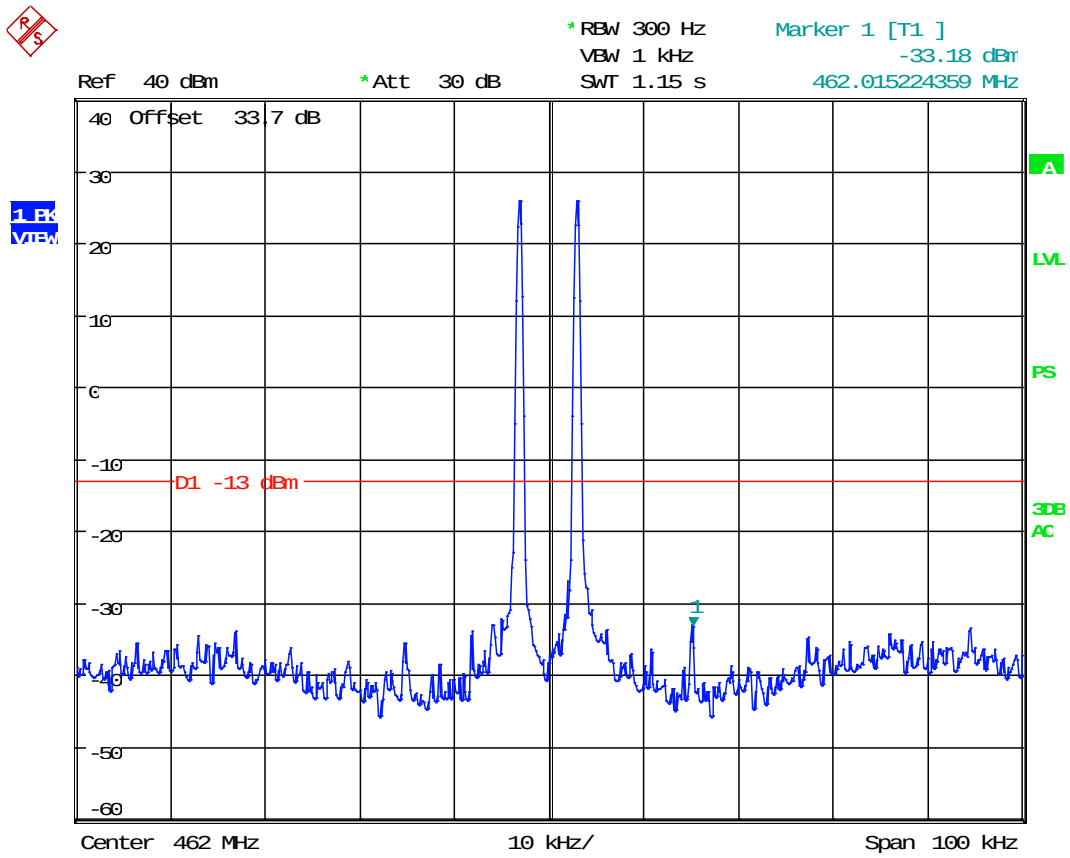
Test Data: 6.25 kHz Intermodulation without AGC



Date: 22.NOV.2017 15:36:04

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 462.00 MHz

Test Data: 6.25 kHz Intermodulation AGC +3 dB

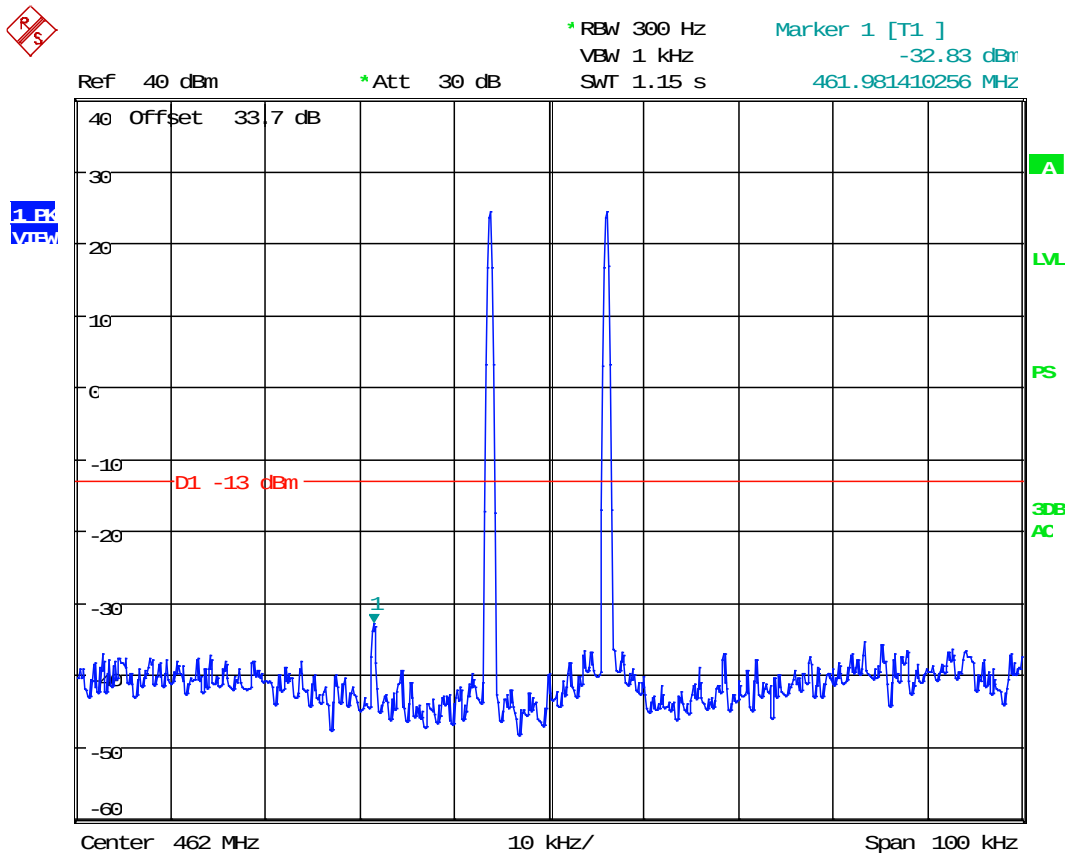


Date: 22.NOV.2017 15:36:59

Results Meet Requirements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 462.00 MHz

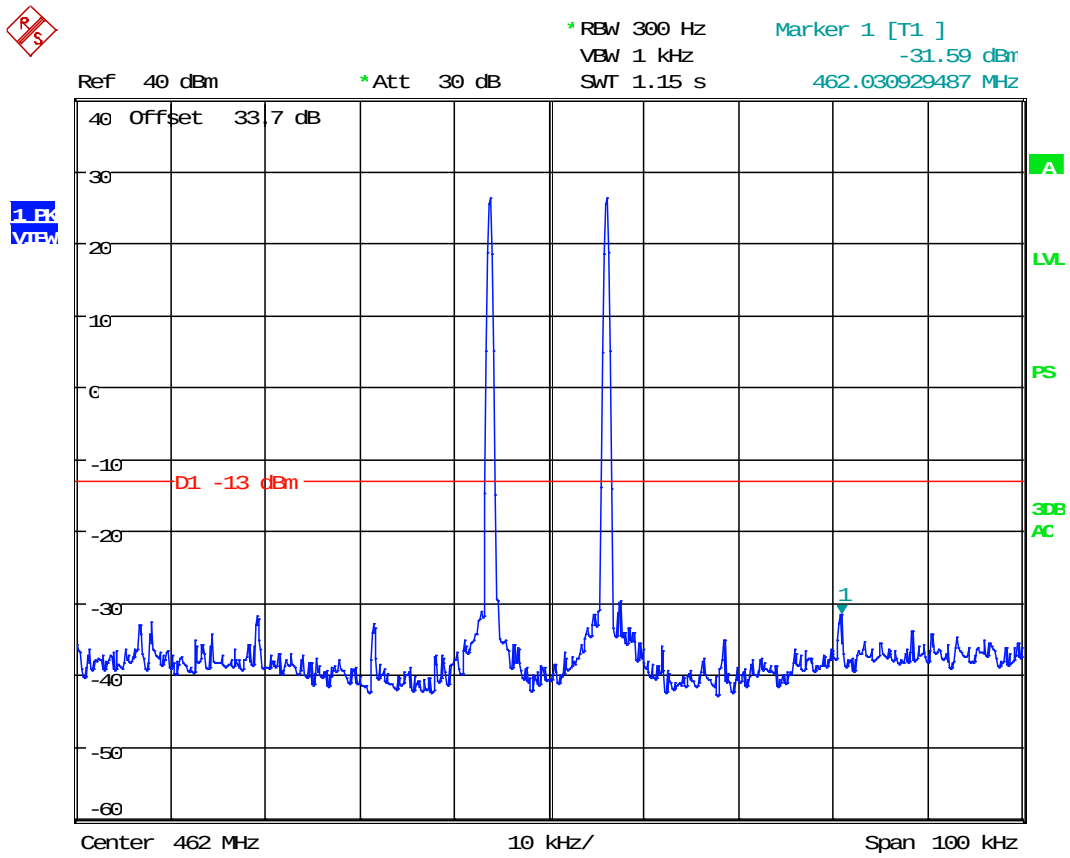
Test Data: 12.5 kHz Intermodulation without AGC



Date: 22.NOV.2017 15:38:07

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 462.00 MHz

Test Data: 12.5 kHz Intermodulation AGC +3 dB

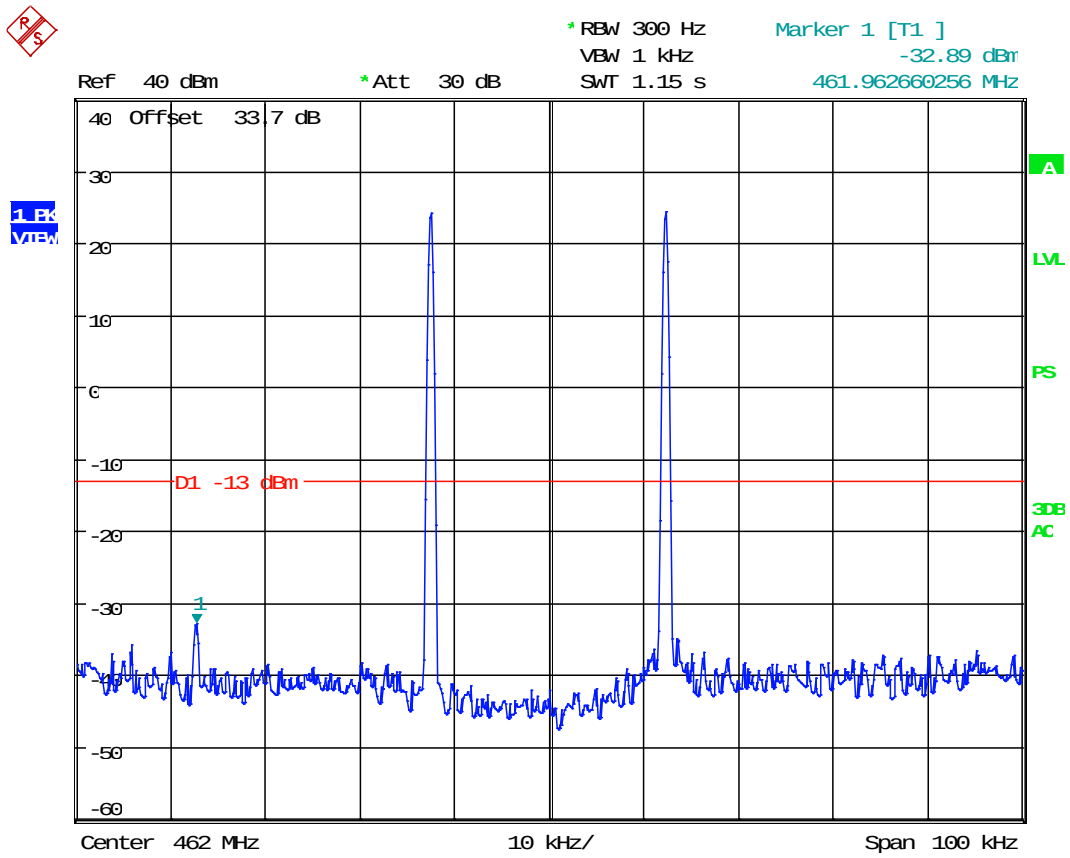


Date: 22.NOV.2017 15:39:06

Results Meet Requirements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 462.00 MHz

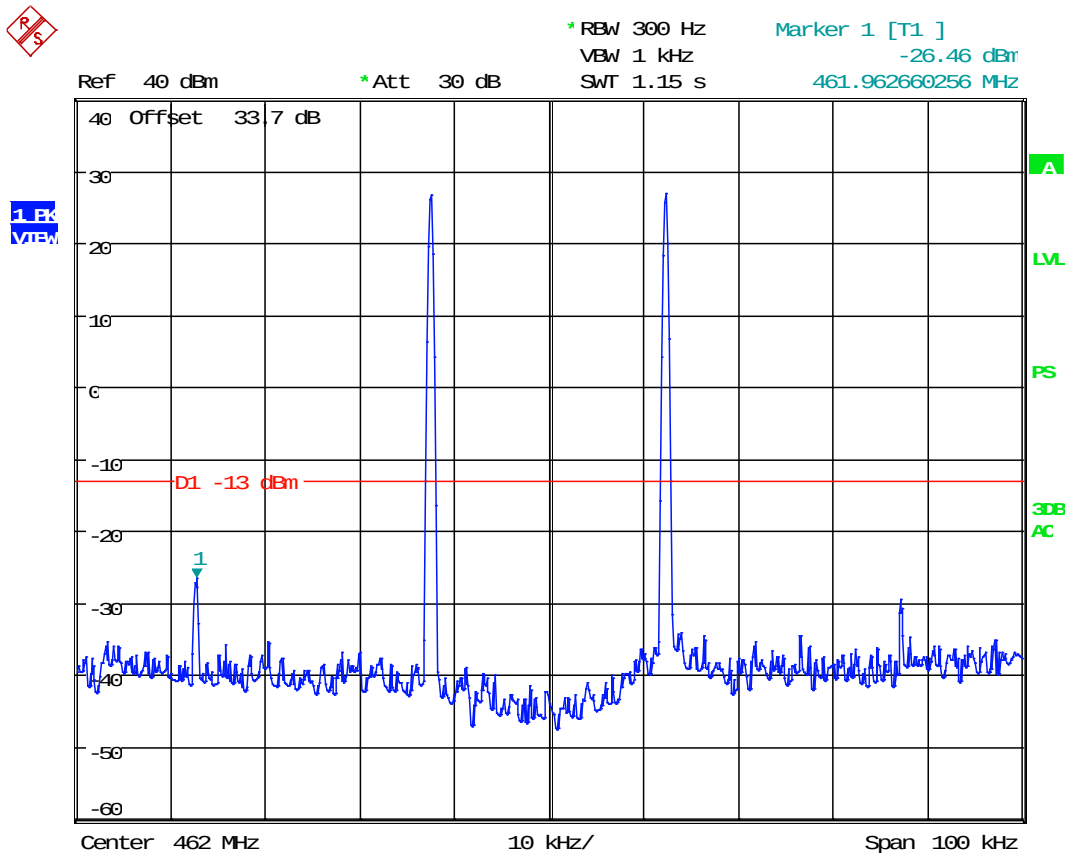
Test Data: 25 kHz Intermodulation without AGC



Date: 22.NOV.2017 15:40:10

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 462.00 MHz

Test Data: 25 kHz Intermodulation AGC +3 dB



Date: 22.NOV.2017 15:40:39

Results Meet Requirements

OUT OF BAND / OUT OF BLOCK EMISSIONS §4.7, UPLINK 490 MHz

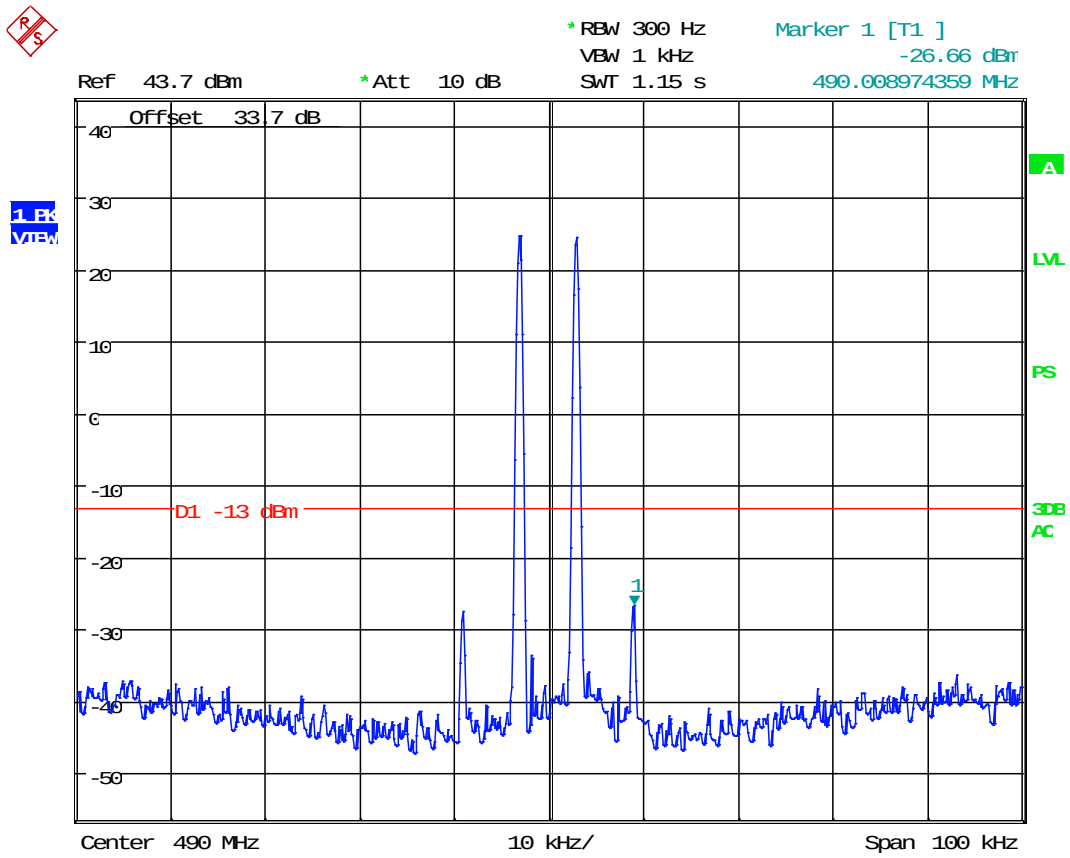
Rule Part No.: 47CFR90.210
KDB 935210-D05 v01r01 §4.7.2

Requirements: -13 dBm

Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.7.1 General
§ 4.7.2 Out of Band/ Out of block emissions conducted measurements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 490.00 MHz

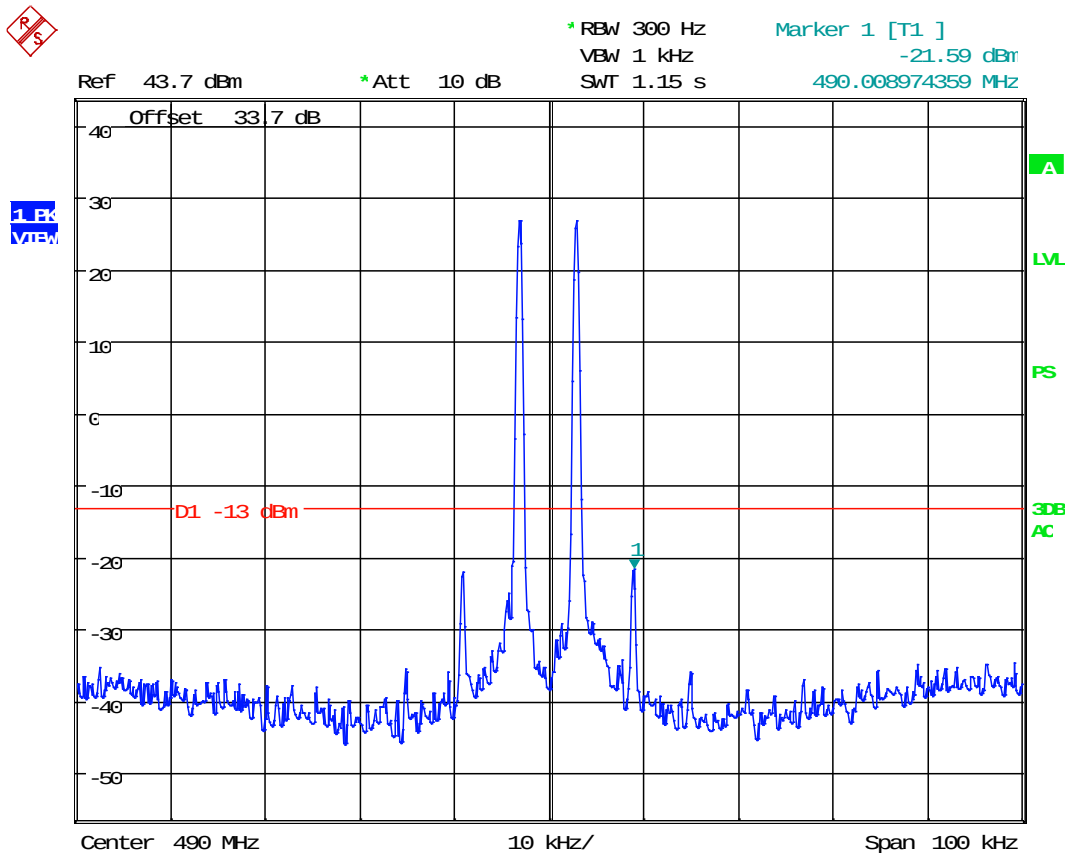
Test Data: 6.25 kHz Intermodulation without AGC



Date: 22.NOV.2017 09:33:25

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 490.00 MHz

Test Data: 6.25 kHz Intermodulation AGC +3 dB

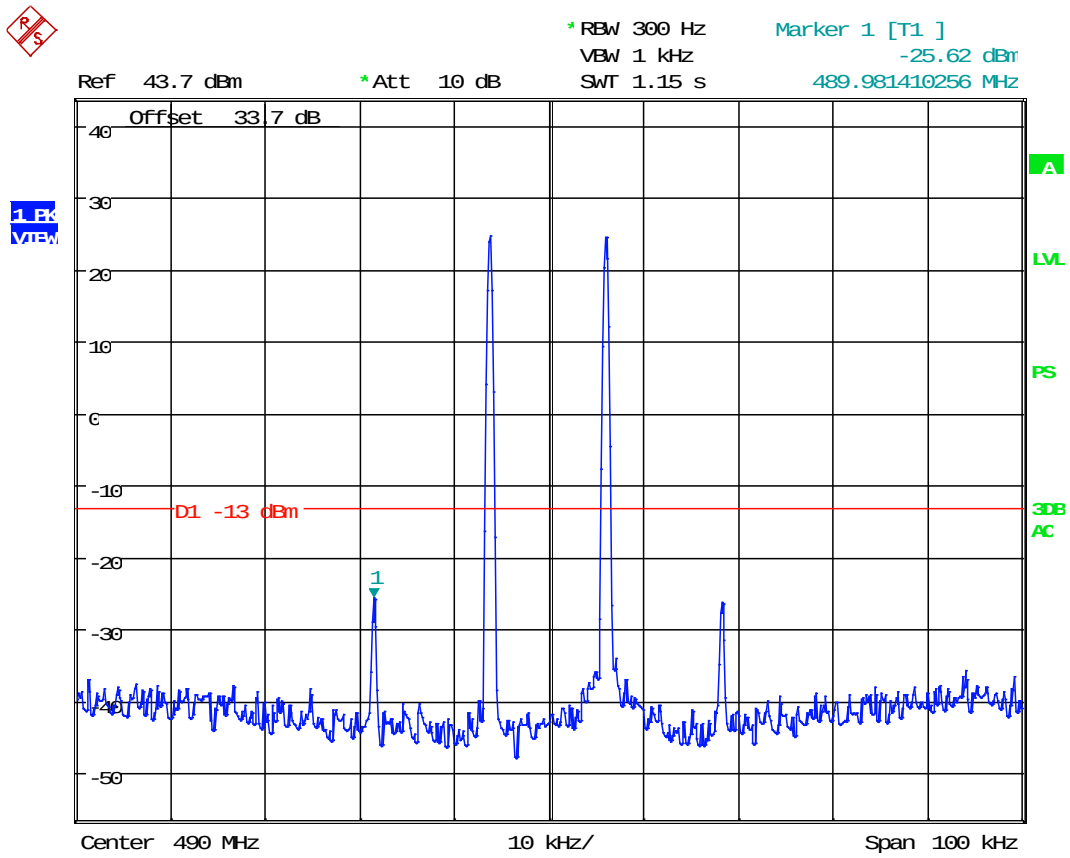


Date: 22.NOV.2017 09:34:20

Results Meet Requirements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 490.00 MHz

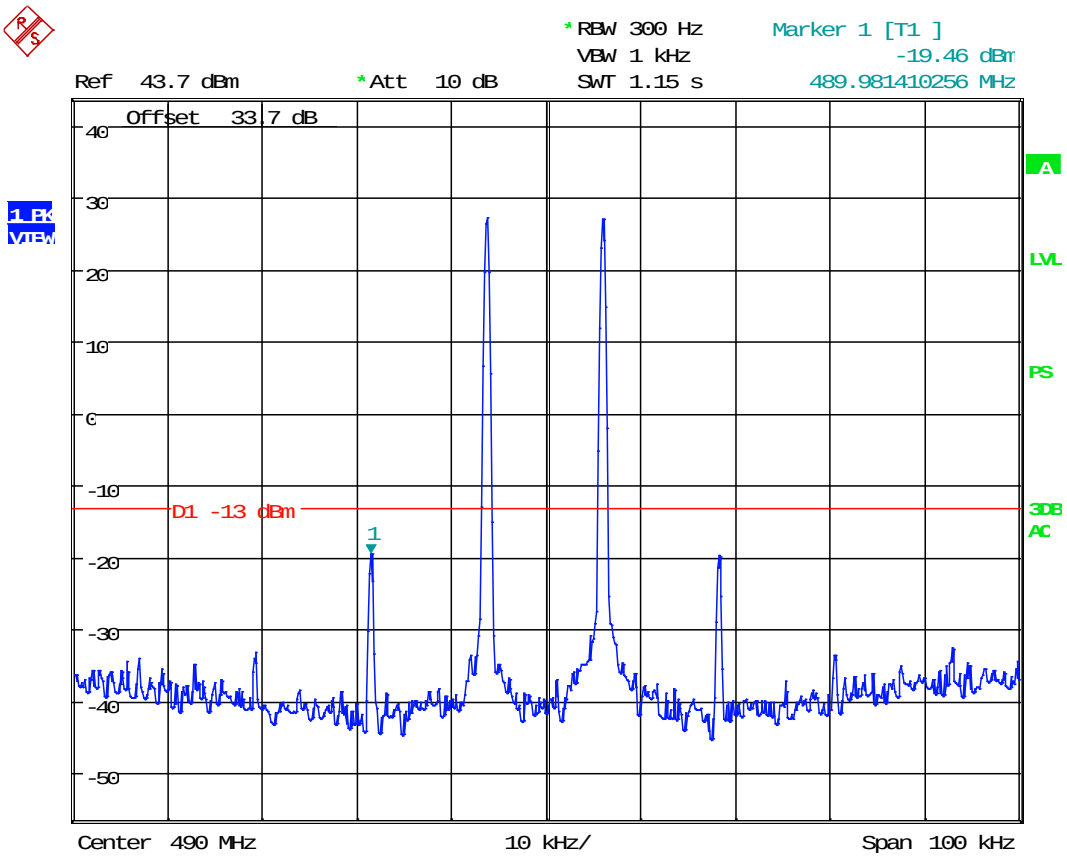
Test Data: 12.5 kHz Intermodulation without AGC



Date: 22.NOV.2017 09:35:59

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 490.00 MHz

Test Data: 12.5 kHz Intermodulation AGC +3 dB

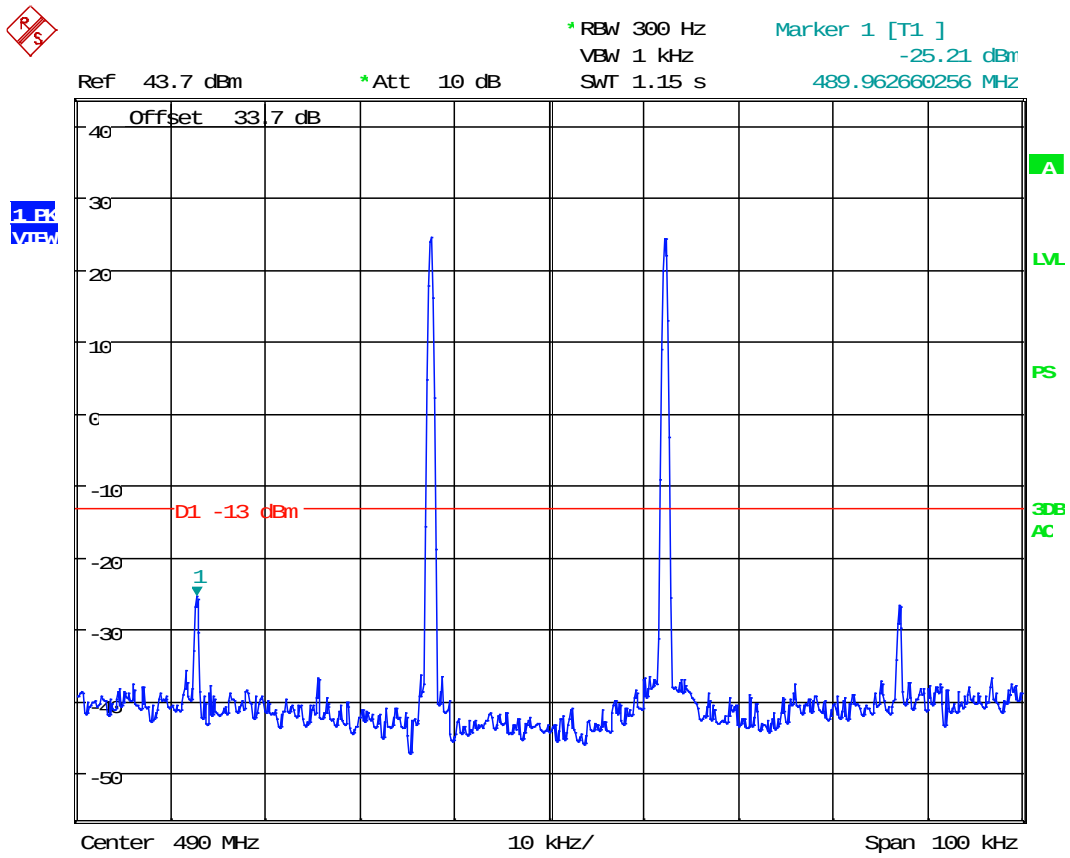


Date: 22.NOV.2017 09:36:52

Results Meet Requirements

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 490.00 MHz

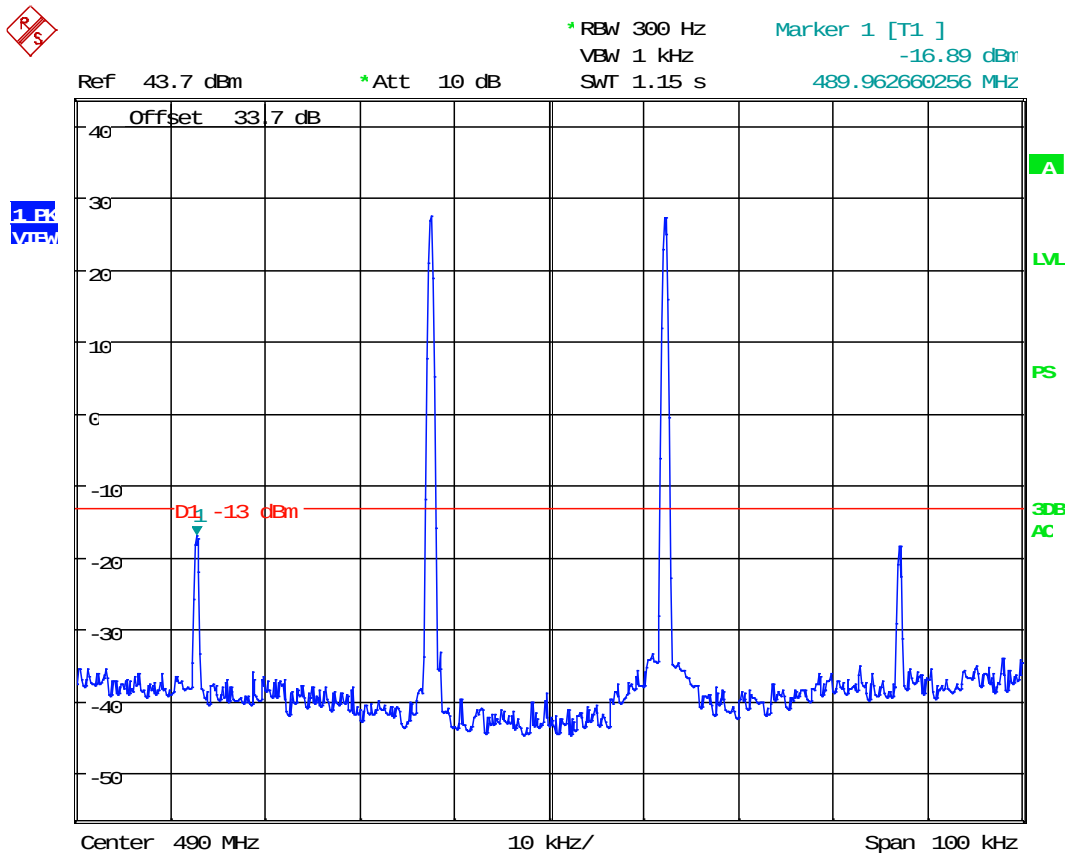
Test Data: 25 kHz Intermodulation without AGC



Date: 22.NOV.2017 09:39:23

Out-of-band/out-of-block Emissions (Intermodulation) §4.7.2, Uplink 490.00 MHz

Test Data: 25 kHz Intermodulation AGC +3 dB



Date: 22.NOV.2017 09:40:18

Results Meet Requirements

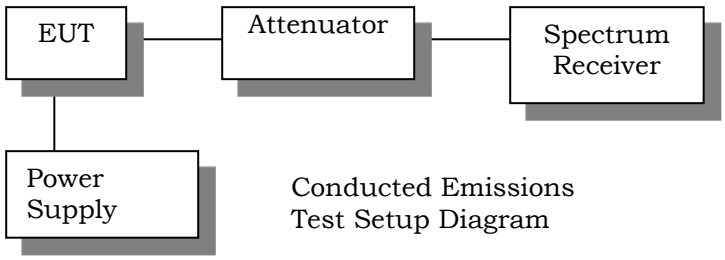
ANTENNA CONDUCTED EMISSIONS §4.7

Rule Part No.: 47CFR90.219(e)(3)
KDB 935210-D05 v01r01 §4.7.3

Requirements: -13 dBm in any 100 kHz bandwidth

Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.7.1 General
§ 4.7.3 EUT Spurious emissions conducted measurements

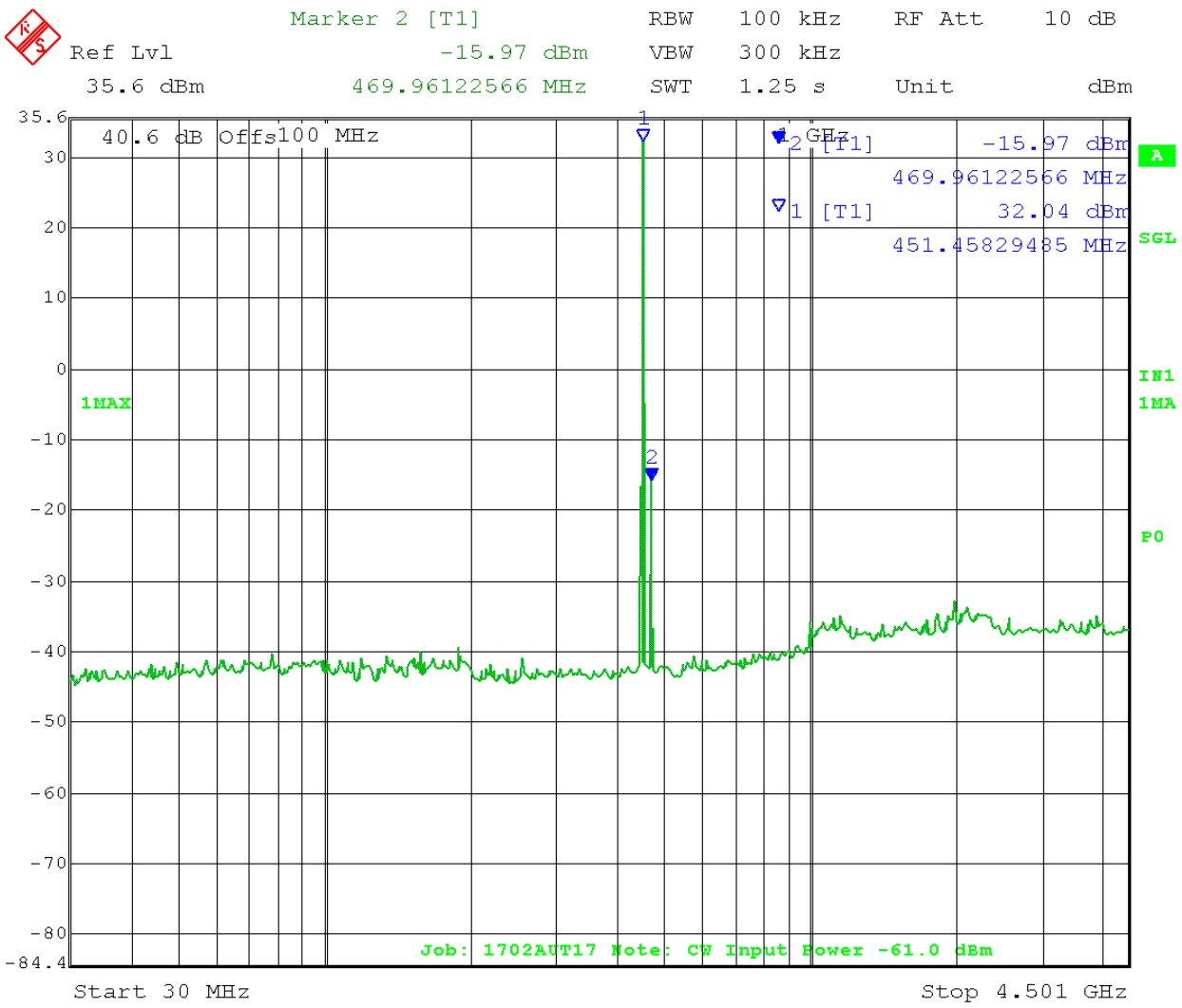
Test Setup Diagram:



Conducted Emissions
Test Setup Diagram

ANTENNA CONDUCTED EMISSIONS §4.7

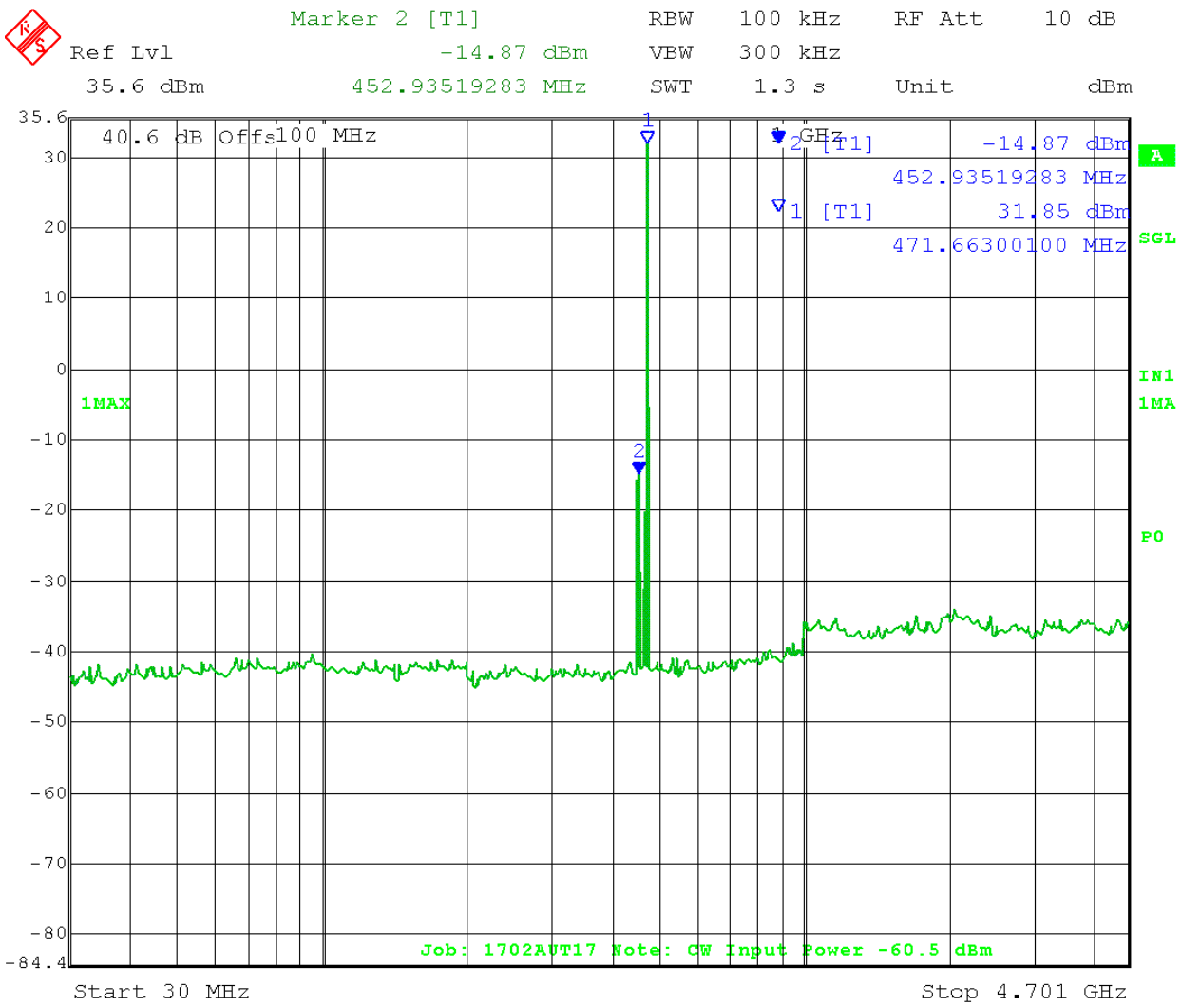
Test Data: Downlink 450.025 MHz



Results Meet Requirements

ANTENNA CONDUCTED EMISSIONS §4.7

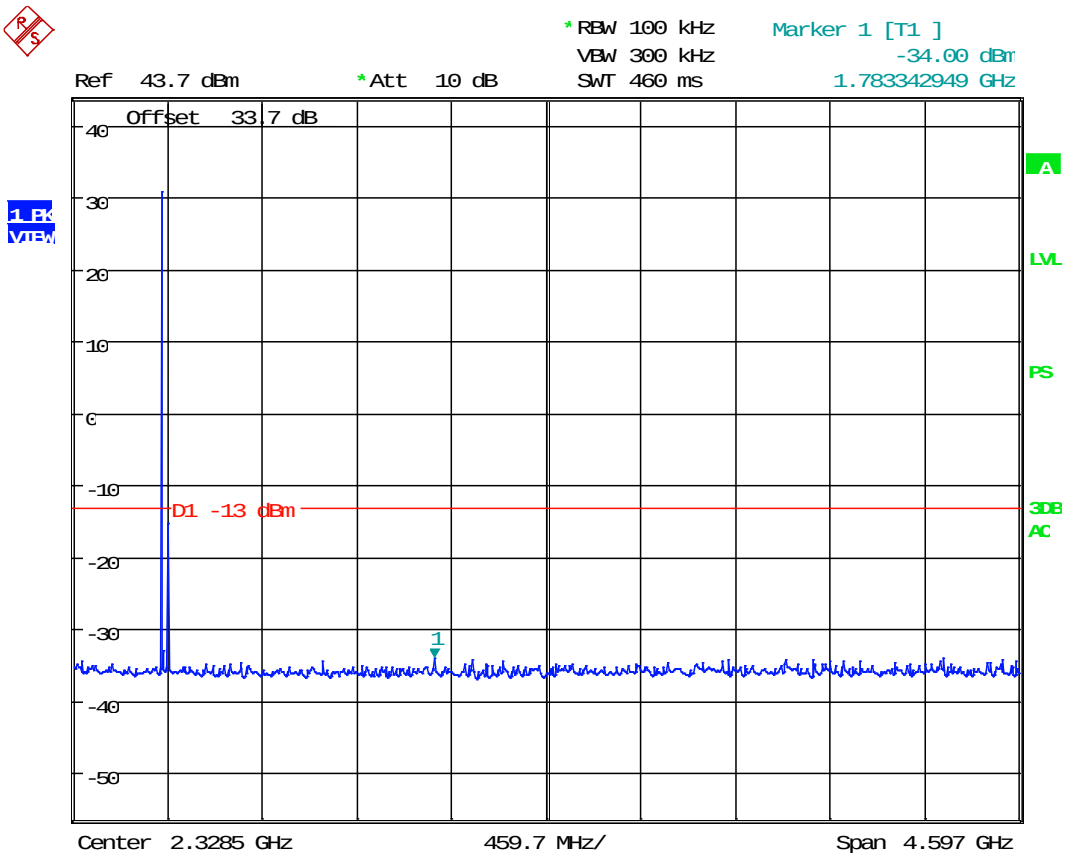
Test Data: Downlink 470.00 MHz



Results Meet Requirements

ANTENNA CONDUCTED EMISSIONS §4.7

Test Data: Uplink 462.00 MHz

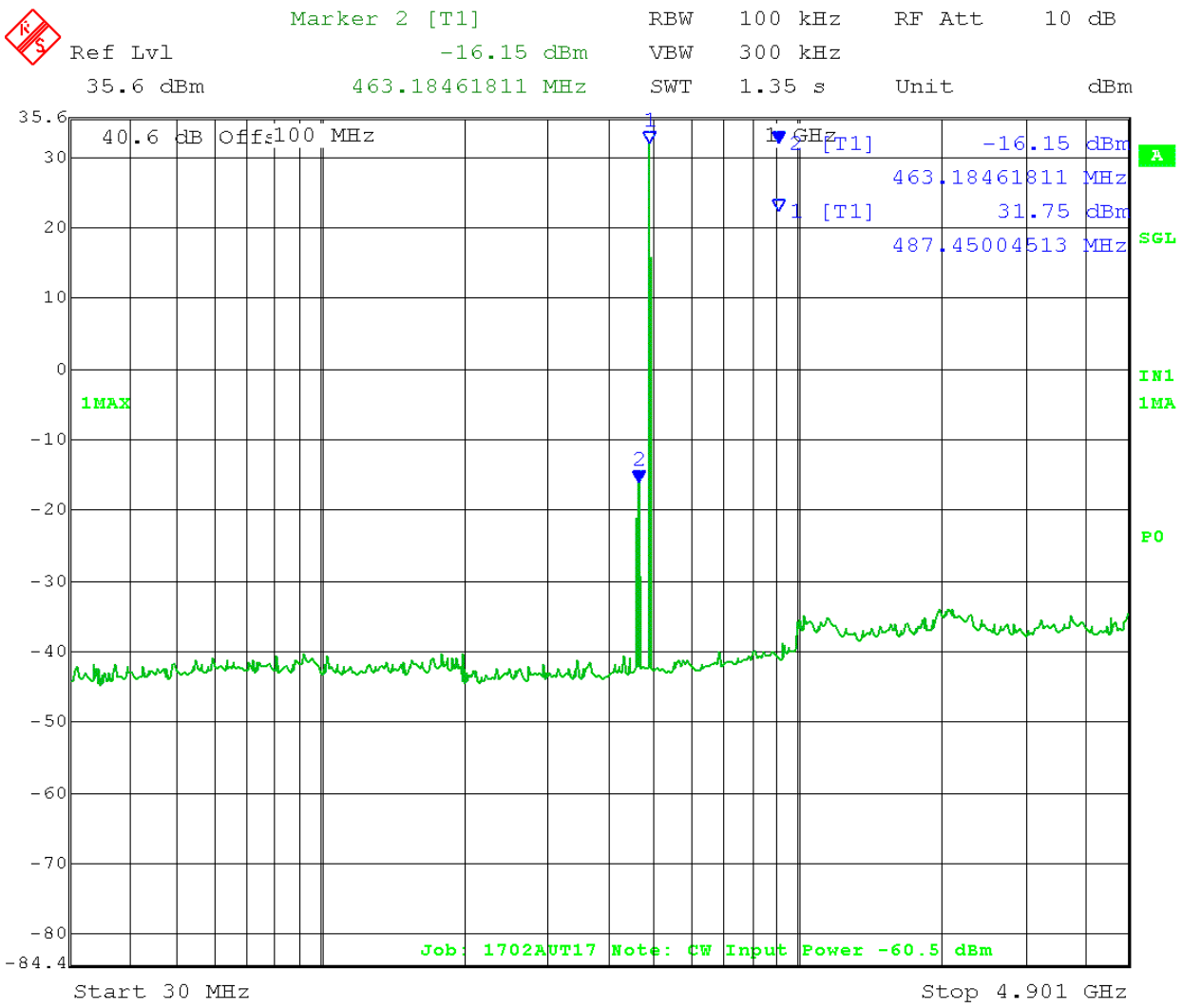


Date: 22.NOV.2017 11:09:04

Results Meet Requirements

ANTENNA CONDUCTED EMISSIONS §4.7

Test Data: Uplink 490.00 MHz



Date: 6.OCT.2017 14:47:32

Results Meet Requirements

FREQUENCY STABILITY MEASUREMENTS §4.8

Rule Part No.: FCC 90.219(e)(4)(i), FCC 90.213
KDB 935210-D05 v01r01 §4.9

Requirements: Reporting Only

Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.8 Frequency Stability Measurements

Section 90.219(e)(4)(i) requires that a signal being retransmitted by an amplifier, repeater, or industrial booster meets the frequency stability requirements of Section 90.213. However, this requirement presumes that the EUT processes an input signal in ways that can influence the output signal frequency/frequencies; however, most signal boosters do not incorporate an oscillator). If the amplifier, booster, or repeater does not alter the input signal in any way, then a frequency stability test may not be required.

Result: Not required.

FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS §4.9

Rule Part No.: 47CFR90.210
KDB 935210-D05 v01r01 §4.9

Requirements: -13 dBm in any 100 kHz bandwidth

Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.7.1 General
§ 4.9 Spurious emissions radiated measurements

The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 9 KHz to at least the tenth harmonic of the fundamental. The EUT was oriented in the worst-case polarity, and was scanned in the worst-case emission range as determined in prior testing. Measurements were made at the test site of **TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.**

Test Data: Downlink 450.00 MHz Radiated Emission Table

Tuned Frequency (MHz)					
Downlink - 450.00 MHz					
Emission Frequency (MHz)	**Antenna Polarity**	**Field Strength (dBuV/m)**	**ERP (dBm)**	**Limit (dBm)**	**Margin (dBm)**
4500.00	V	59.660	-37.717	-13.000	-24.717
4500.00	H	59.450	-37.927	-13.000	-24.927
4050.00	V	59.285	-38.092	-13.000	-25.092
4050.00	H	58.595	-38.782	-13.000	-25.782
3600.00	V	57.810	-39.567	-13.000	-26.567
3600.00	H	56.860	-40.517	-13.000	-27.517

NOTE: The highest six (6) emissions are tabulated above. Emissions under 20 dB within the applicable limit(s) are not required to be shown.

Test Data: Downlink 470.00 MHz Radiated Emission Table

Tuned Frequency (MHz)					
Downlink - 470.00 MHz					
Emission Frequency (MHz)	**Antenna Polarity**	**Field Strength (dBuV/m)**	**ERP (dBm)**	**Limit (dBm)**	**Margin (dBm)**
4700.00	V	59.940	-37.437	-13.000	-24.437
4700.00	H	59.690	-37.687	-13.000	-24.687
4230.00	H	58.557	-38.820	-13.000	-25.820
4230.00	V	58.527	-38.850	-13.000	-25.850
3760.00	V	57.562	-39.815	-13.000	-26.815
3760.00	H	57.362	-40.015	-13.000	-27.015

NOTE: The highest six (6) emissions are tabulated above. Emissions under 20 dB within the applicable limit(s) are not required to be shown.

FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS §4.9

Test Data: Uplink 462.00 MHz Radiated Emission Table

Tuned Frequency (MHz)					
Uplink - 462.00 MHz					
Emission Frequency (MHz)	**Antenna Polarity**	**Field Strength (dBuV/m)**	**ERP (dBm)**	**Limit (dBm)**	**Margin (dBm)**
4620.00	H	59.604	-37.773	-13.000	-24.773
4620.00	V	59.474	-37.903	-13.000	-24.903
4158.00	H	59.062	-38.315	-13.000	-25.315
4158.00	V	58.672	-38.705	-13.000	-25.705
3696.00	V	58.287	-39.090	-13.000	-26.090
3696.00	H	57.757	-39.620	-13.000	-26.620

NOTE: The highest six (6) emissions are tabulated above. Emissions under 20 dB within the applicable limit(s) are not required to be shown.

Test Data: Uplink 490.00 MHz Radiated Emission Table

Tuned Frequency (MHz)					
Uplink - 490.00 MHz					
Emission Frequency (MHz)	**Antenna Polarity**	**Field Strength (dBuV/m)**	**ERP (dBm)**	**Limit (dBm)**	**Margin (dBm)**
4410.00	H	59.810	-37.567	-13.000	-24.567
4900.00	V	59.460	-37.917	-13.000	-24.917
4410.00	V	59.430	-37.947	-13.000	-24.947
4900.00	H	58.970	-38.407	-13.000	-25.407
3920.00	V	58.506	-38.871	-13.000	-25.871
3920.00	H	58.206	-39.171	-13.000	-26.171

NOTE: The highest six (6) emissions are tabulated above. Emissions under 20 dB within the applicable limit(s) are not required to be shown.

Results meet requirements

EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Coaxial Cable - BMBM-0065-01 Black DC-2G	Belden		BMBM-0065-01	07/18/16	07/18/18
Antenna: Biconical 1096	Eaton	94455-1	1096	08/01/17	08/01/19
Antenna: Log-Periodic 1243	Eaton	96005	1243	02/09/16	02/09/18
Coaxial Cable - Chamber 3 cable set (backup)	Micro-Coax	Chamber 3 cable set (backup)	KMKM-0244-02 ; KMKM-0670-01; KFKF-0197-00	N/A	N/A
CHAMBER	Panashield	3M	N/A	04/25/16	12/31/17
HP Signal Generator	HP	8648C	3847A04696	04/05/2017	04/05/2019
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	03/01/17	03/01/19
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/16/16	08/16/18
Software: Field Strength Program	Timco	N/A	Version 4.10.7.0	N/A	N/A
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	12/18/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Coaxial Cable - BMBM-0130-00 Black	Alpha Wire		BMBM-0130-00	05/24/16	05/24/18
Coaxial Cable - BMBM-0155-01 Black	BELDEN		BMBM-0155-01	06/01/16	06/01/18
Coaxial Cable - BMBM-0065-00 Black	Belden		BMBM-0065-00	06/08/16	06/08/18
Coaxial Cable - BMBM-0155-00 Black	MIYAZAKI		BMBM-0155-00	05/24/16	05/24/18
Splitter 1-1000MHz	Mini-Circuits	ZFSC-4-1-BNC+	U115700825	N/A	N/A
Signal Generator R & S SMU 200A	Rohde & Schwarz	SMU200A	103195	02/29/16	02/28/18
Non Radiating 50 OHM Load	Sierra Elec	160B-600X	1038	09/13/16	09/13/18
Attenuator N 20dB 2W DC-13G	Narda	757C	30201	05/24/17	05/24/19
Attenuator N 20dB 2W DC-13G	Narda	777C	36124	05/24/17	05/23/19
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A
Noise Source 10MHz - 18GHz	Agilent	346B	MY44421884	N/A	N/A

***EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: "Uncertainty in EMC Measurements" and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.
Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

Test Items	Measurement Uncertainty	Notes
RF Frequency Accuracy	± 49.5 Hz	(1)
RF Conducted Power	±0.93dB	(1)
Conducted spurious emission of transmitter valid up to 40GHz	±1.86dB	
Occupied Bandwidth	±2.65%	
Audio Frequency Response	±1.86dB	
Modulation limiting	±1.88%	
Radiated RF Power	±1.4dB	
Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq. Within 6kHz and 25kHz of audio Freq.	 ±1.88% ±2.04%	
Rad Emissions Sub Meth up to 26.5GHz	±2.14dB	
Rad Emissions Sub Meth up to 18-40 GHz	±2.04%	
Adjacent channel power	±1.47dB	(1)
Transient Frequency Response	±1.88%	
Temperature	±1.0°C	(1)
Humidity	±5.0%	

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

END OF REPORT