TIMCO ENGINEERING, Inc.

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CLASS B INDUSTRIAL BOOSTER

FCC PART 90 TEST REPORT

Applicant	FIPLEX COMMUNICATIONS INC.
Address	2101 NW 79th Ave. MIAMI FL 33122 USA
FCC ID	P3TDHS37-R-DU
Model Number	DHS37-R-DU
Product Description	800 Band Digital Remote Unit
Date Sample Received	2/6/2018
Date Tested	02/26/2018
Tested By	Franklin Rose
Approved By	Tim Royer
Test Results	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
208AUT18_Testreport	Rev1	Initial Issue	02/27/2018
208AUT18_Testreport	Rev2	Update RF Power Output Measurement Tables	03/01/2018
208AUT18_Testreport	Rev3	Added test site designation #, update RF Power Output measurement tables	03/12/2018

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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, Project Manager / Testing Technician

Date: 02/27/2018

Sr. EMC Engineer
EMC-003838-NE

Tested by:
Name and Title: Tim Royer, Project Manager/Testing Engineer

Date: 2/27/2018

EUT DESCRIPTION

EUT Description	800 Band Digital Remote Unit
EUT Detailed Description	Dual-output* 800 Band Digital Fiber Optic DAS employing a non-transmitting Host (Master)
FCC ID	P3TDHS37-R-DU
Model Number	DHS37-R-DU
Operating Frequency	Downlink: 851 - 869 MHz (TX) Uplink: 806 - 824 MHz (RX)
Type of Emission(s)	16K0F3E, 11K2F3E, 8K10F1E, 8K10F1D, 8K10F1W, 8K30F1E, 8K30F1D, 8K30F1W, 8K70D1W, 4K00F1E, 4K00F1D, 4K00F1W, 4K00F2D, 5K76G1E, 7K60FXE, 7K60FXD, 9K70F1E, 9K70F1D, 9K80D7W, 9K80F1D, 9K80F1E
EUT Power Source	☒ 110–120Vac/50– 60Hz
	☐ DC Power
	☐ 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%.
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. Designation #: US1070

Notes: *This equipment has two separate outputs meant to be used as SISO for different service areas. For such equipment, FCC KDB 935210 D02 asks for the following grant condition to be used:
"This filing has compliance demonstration information and test data only for SISO (single-input single-output) booster system configurations; additional equipment authorization is required to allow this device to be used in MIMO (multiple-input multiple-output) industrial booster systems."

TEST RESULTS SUMMARY

FCC RULE PART	Limit	TEST DESCRIPTION	RESULT PASS/FAIL
90.219(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**
90.219(e)(4) AND KDB 935210-D05 v01r01 §4.4	Reporting Only	Input-versus-output signal comparison	**PASS**
90.219(e)(2) AND KDB 935210-D05 v01r01 §4.6	9 dB	Noise Figure	**PASS**
90.219(e)(3) AND KDB 935210-D05 v01r01 §4.7.2	-13 dBm	Out-of-band/out-of-block Intermodulation	**PASS**
90.219(e)(3) AND KDB 935210-D05 v01r01 §4.7.3	-13 dBm	Spurious Emissions Conducted	**PASS**
90.213 AND KDB 935210-D05 v01r01 §4.8	N/A	Frequency Stability	**NOT REQUIRED**
90.219(e)(3) 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:

$$\text{Gain}_{dB} = \text{Output Power}_{dBm} - \text{Input Power}_{dBm}$$

Test Data: Downlink Output 1 Measurement Table

Input Freq. (MHz)	AGC	Input Power (dBm)	Output Power (dBm)	Ant. System Loss (dB)	ERP (dBm)	ERP (W)	Final Gain (dB)
851.0900	+0	-40.3	37.92	2.00	35.92	3.91	76.22
	+3	-43.3	37.73	2.00	35.73	3.74	79.03
860.0000	+0	-40.3	38.68	2.00	36.68	4.66	76.98
	+3	-43.3	38.91	2.00	36.91	4.91	80.21
868.9100	+0	-40.3	38.11	2.00	36.11	4.08	76.41
	+3	-43.3	38.02	2.00	36.02	4.00	79.32

Test Data: Downlink Output 2 Measurement Table

Input Freq. (MHz)	AGC	Input Power (dBm)	Output Power (dBm)	Ant. System Loss (dB)	ERP (dBm)	ERP (W)	Final Gain (dB)
851.0900	+0	-42.6	37.09	2.00	35.09	3.23	77.69
	+3	-39.6	37.56	2.00	35.56	3.60	75.16
860.0000	+0	-42.6	35.07	2.00	33.07	2.03	75.67
	+3	-39.6	35.81	2.00	33.81	2.40	73.41
868.9100	+0	-42.6	37.41	2.00	35.41	3.48	78.01
	+3	-39.6	38.02	2.00	36.02	4.00	75.62

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

INPUT POWER: (110 VAC) (2.18 A) = **240 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: Downlink Output 1 Measurement Table

Gen Freq (MHz)	Gen Output (dBm)	Insertion Loss (dB)	Booster Input (dBm)	Booster Output (dBm)
860.00	-46.6	0.3	-46.3	34.58
860.00	-45.6	0.3	-45.3	35.39
860.00	-44.6	0.3	-44.3	36.43
860.00	-43.6	0.3	-43.3	37.46
860.00	-42.6	0.3	-42.3	37.46
860.00	-41.6	0.3	-41.3	37.46
860.00	-40.6	0.3	-40.3	37.46

Test Data: Downlink Output 2 Measurement Table

Gen Freq (MHz)	Gen Output (dBm)	Insertion Loss (dB)	Booster Input (dBm)	Booster Output (dBm)
860.00	-45.9	0.3	-45.6	33.75
860.00	-44.9	0.3	-44.6	34.73
860.00	-43.9	0.3	-43.6	35.83
860.00	-42.9	0.3	-42.6	37.04
860.00	-41.9	0.3	-41.6	37.04
860.00	-40.9	0.3	-40.6	37.04
860.00	-39.9	0.3	-39.6	37.04

OUT-OF-BAND REJECTION § 4.3

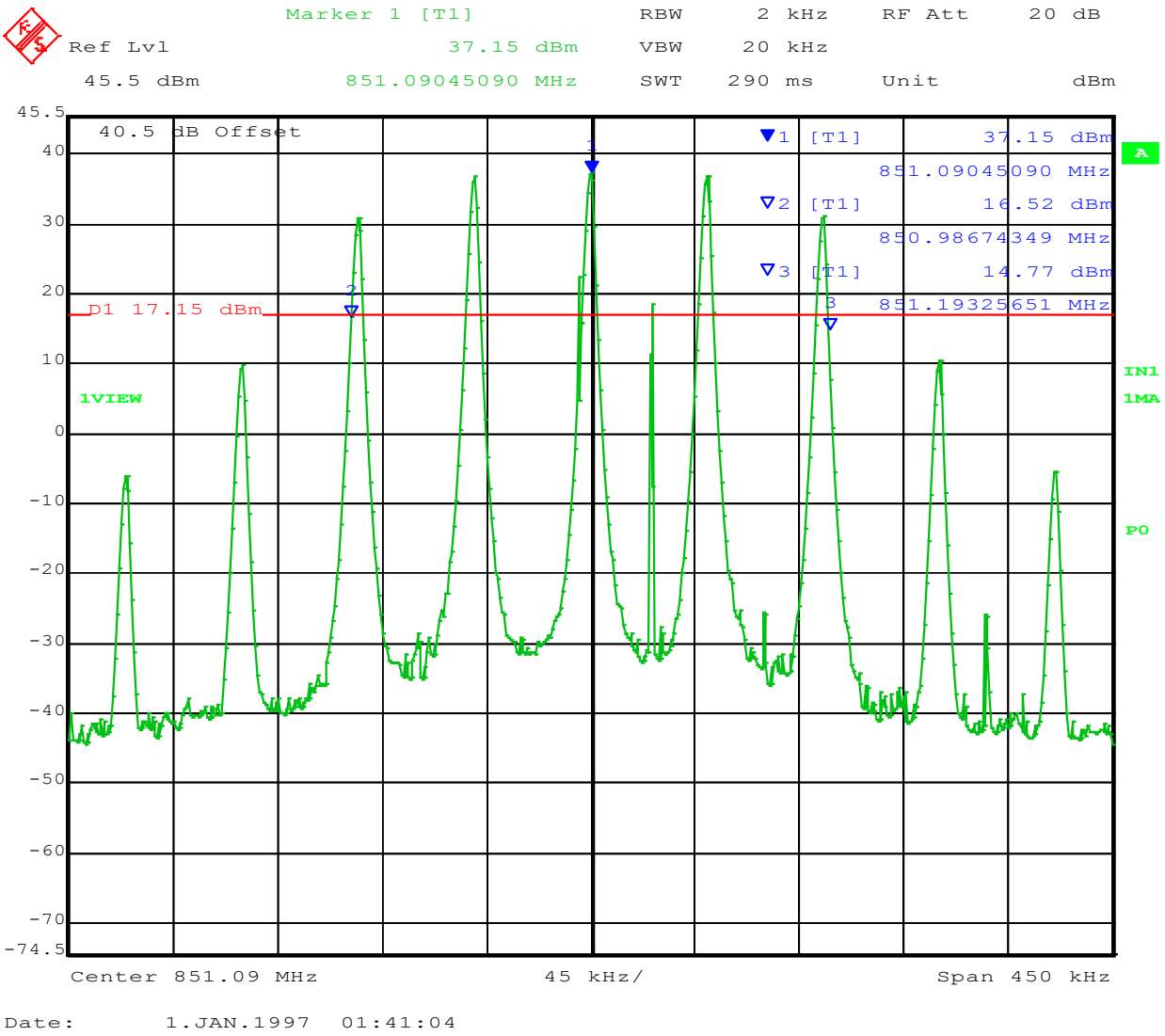
Rule Part No.: KDB 935210 §4.3 Out of band rejection

Requirements: Reporting Only

Procedure: KDB 935210 §4.3 Out of band rejection

OUT-OF-BAND REJECTION § 4.3 – OUTPUT 1

Test Data: Downlink Output 1 - 851.09 MHz

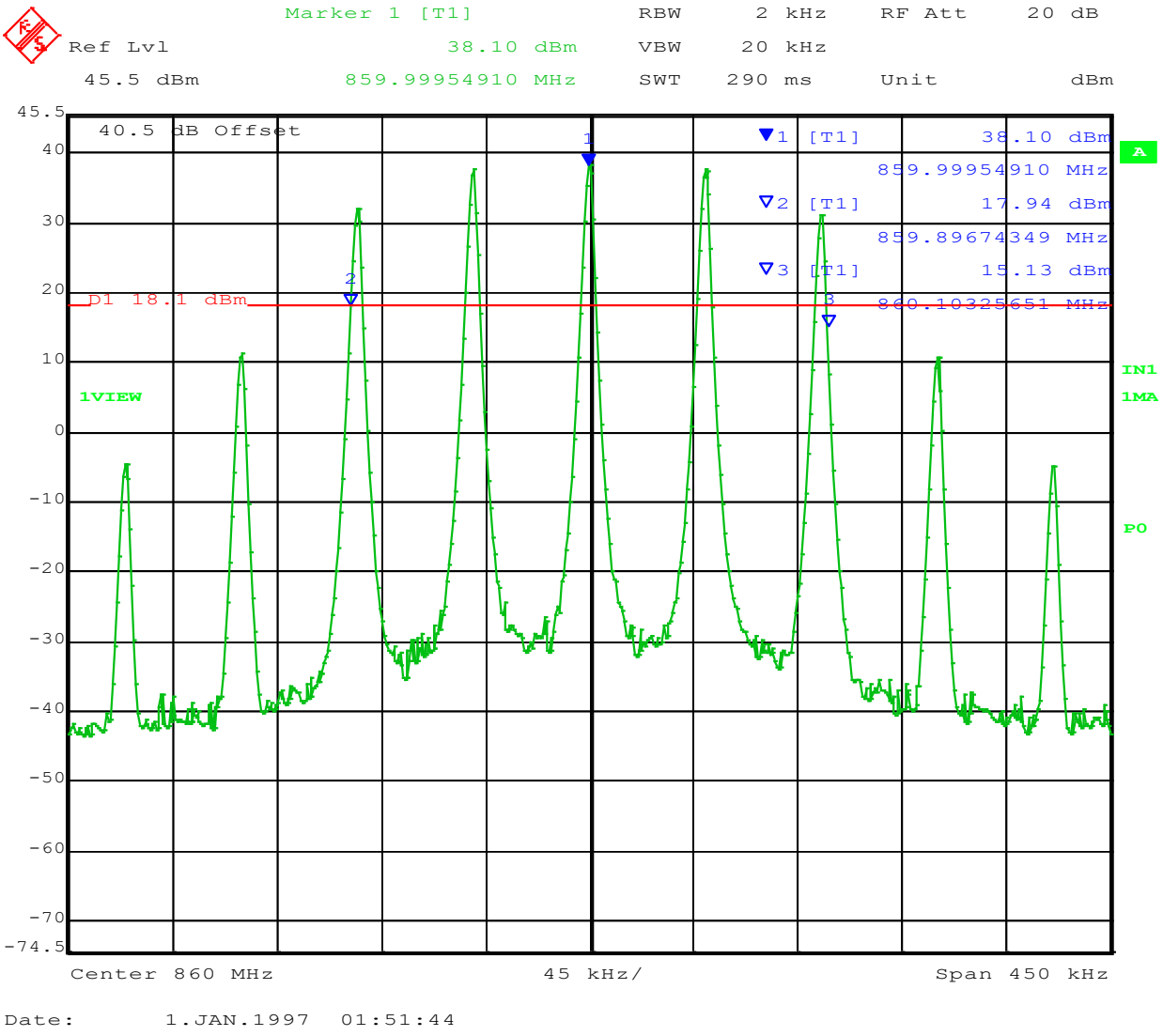


System Rated Max Passband: 180 kHz

Low End of Band 20 dB Passband = **206.51 kHz**

Out-of-Band Rejection §4.3

Test Data: Downlink Output 1 - 860.00 MHz

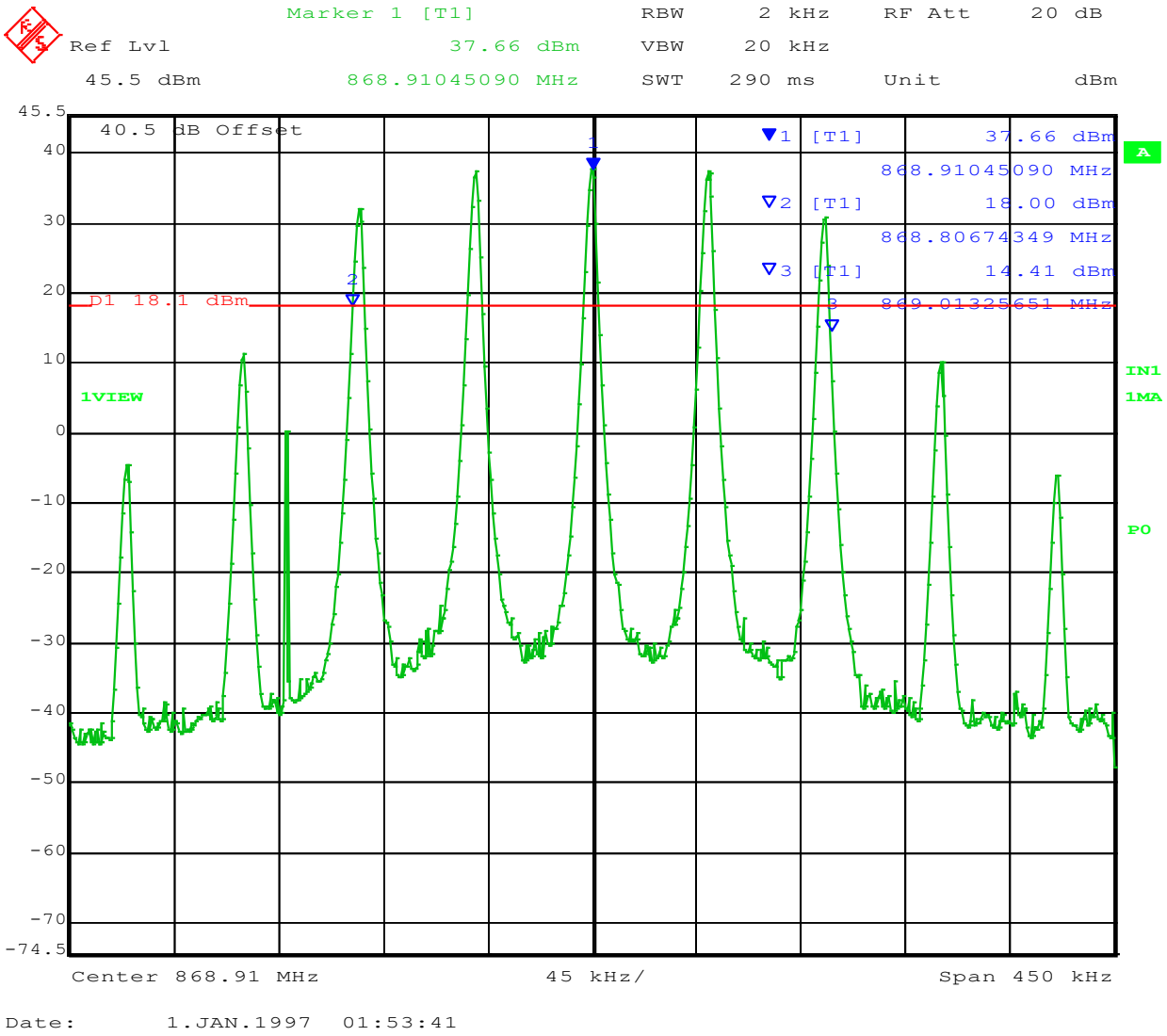


System Rated Max Passband: 180 kHz

Middle of Band 20 dB Passband = **206.51 kHz**

Out-of-Band Rejection §4.3

Test Data: Downlink Output 1 – 868.91 MHz



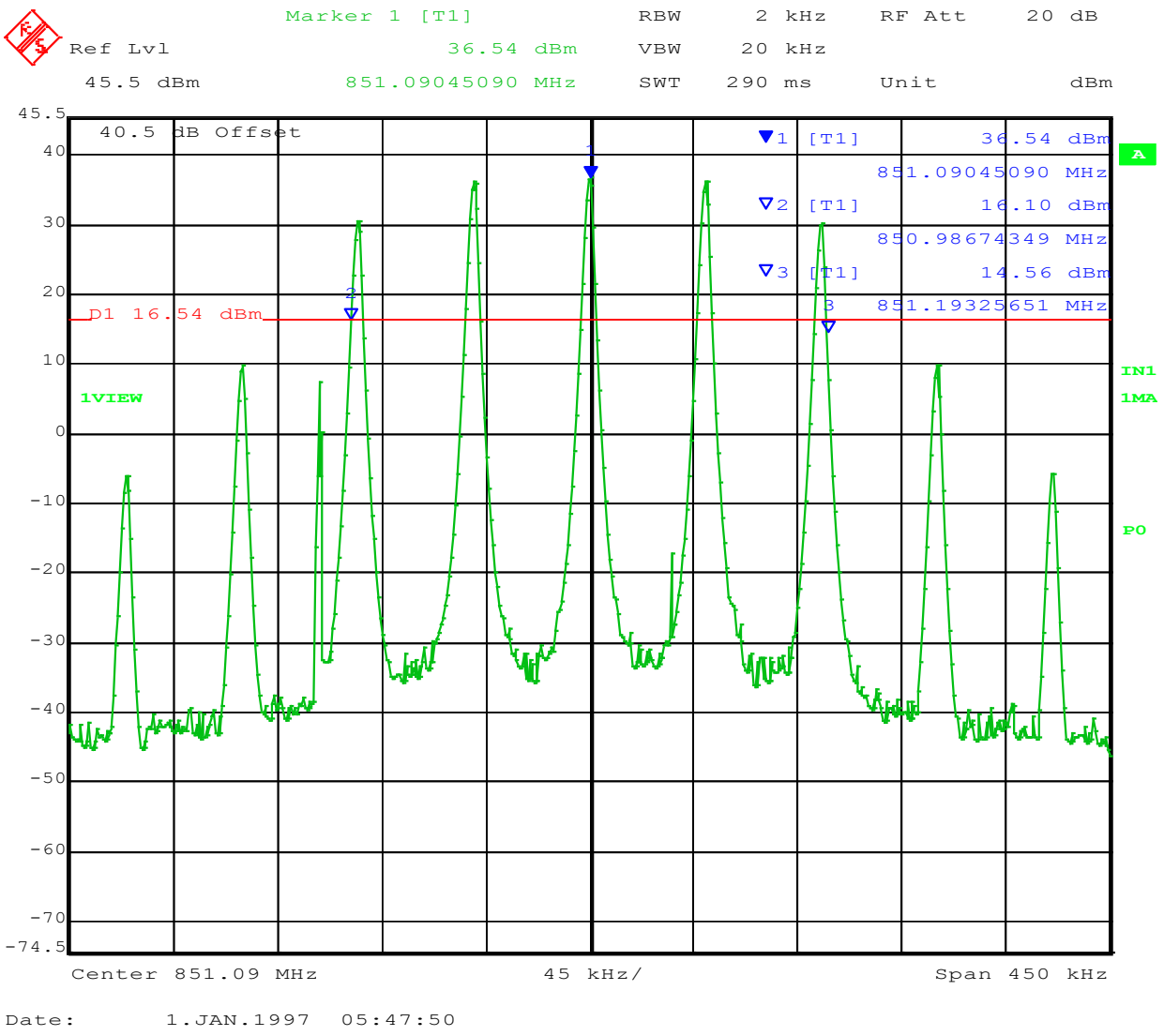
System Rated Max Passband: 180 kHz

High End of Band 20 dB Passband = **206.51 kHz**

Result: Output 1 Max 20 dB Passband = 206.51 kHz

OUT-OF-BAND REJECTION § 4.3 – OUTPUT 2

Test Data: Downlink Output 2 - 851.09 MHz

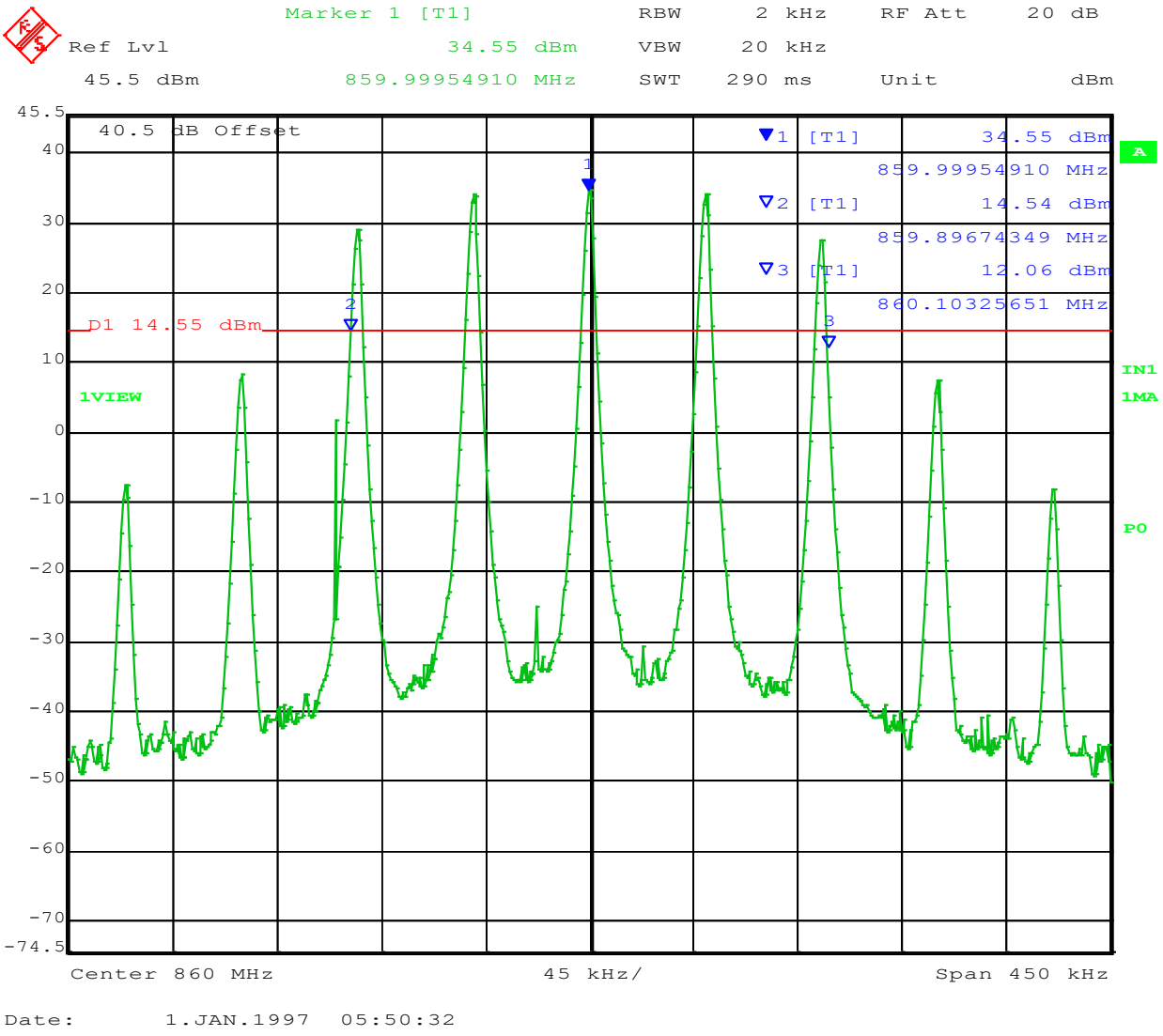


System Rated Max Passband: 180 kHz

Low End of Band 20 dB Passband = **206.51 kHz**

Out-of-Band Rejection §4.3

Test Data: Downlink Output 2 - 860.00 MHz

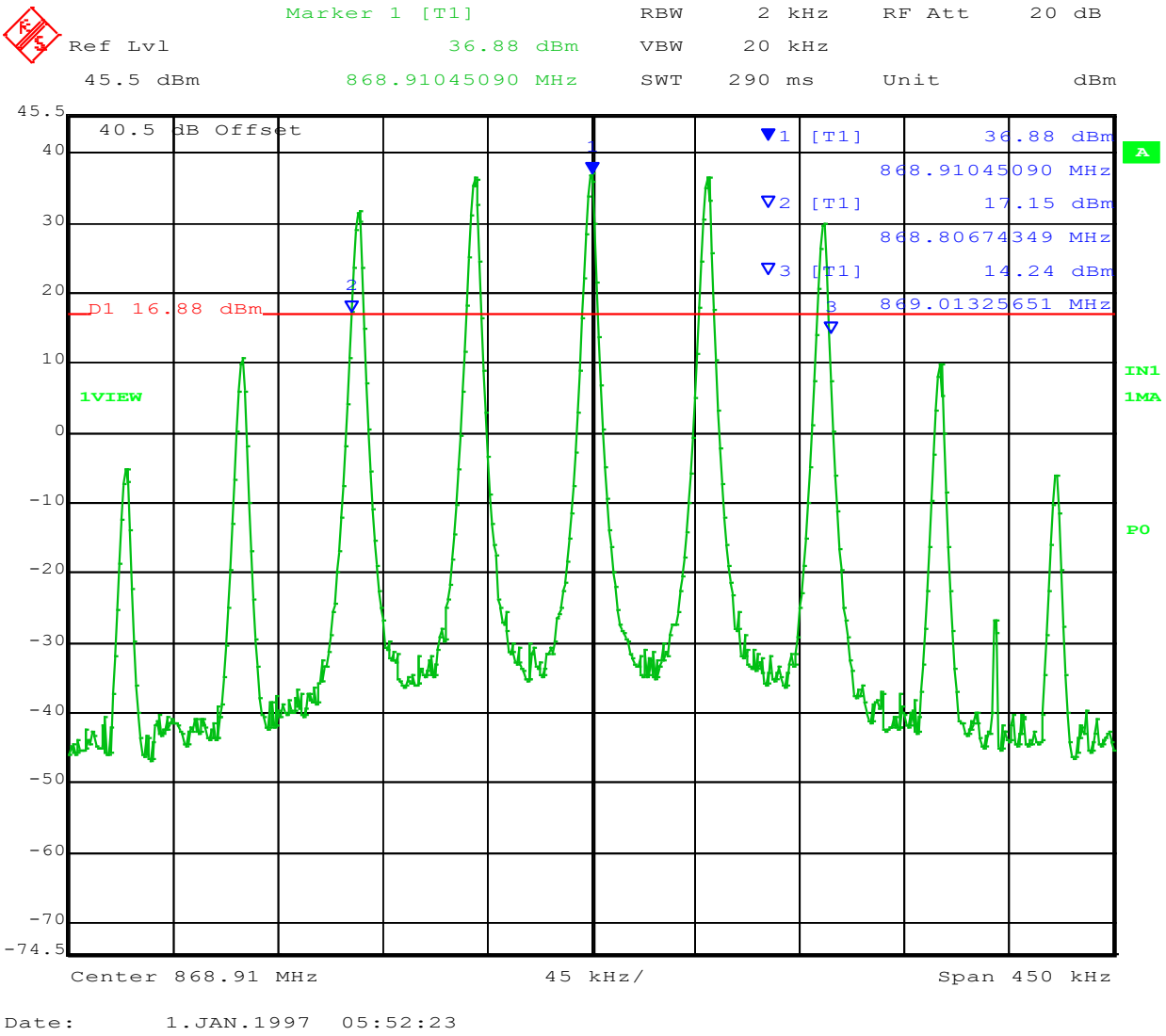


System Rated Max Passband: 180 kHz

Middle of Band 20 dB Passband = **206.51 kHz**

Out-of-Band Rejection §4.3

Test Data: Downlink Output 2 – 868.91 MHz



System Rated Max Passband: 180 kHz

High End of Band 20 dB Passband = **206.51 kHz**

Result: Output 2 Max 20 dB Passband = 206.51 kHz

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

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.

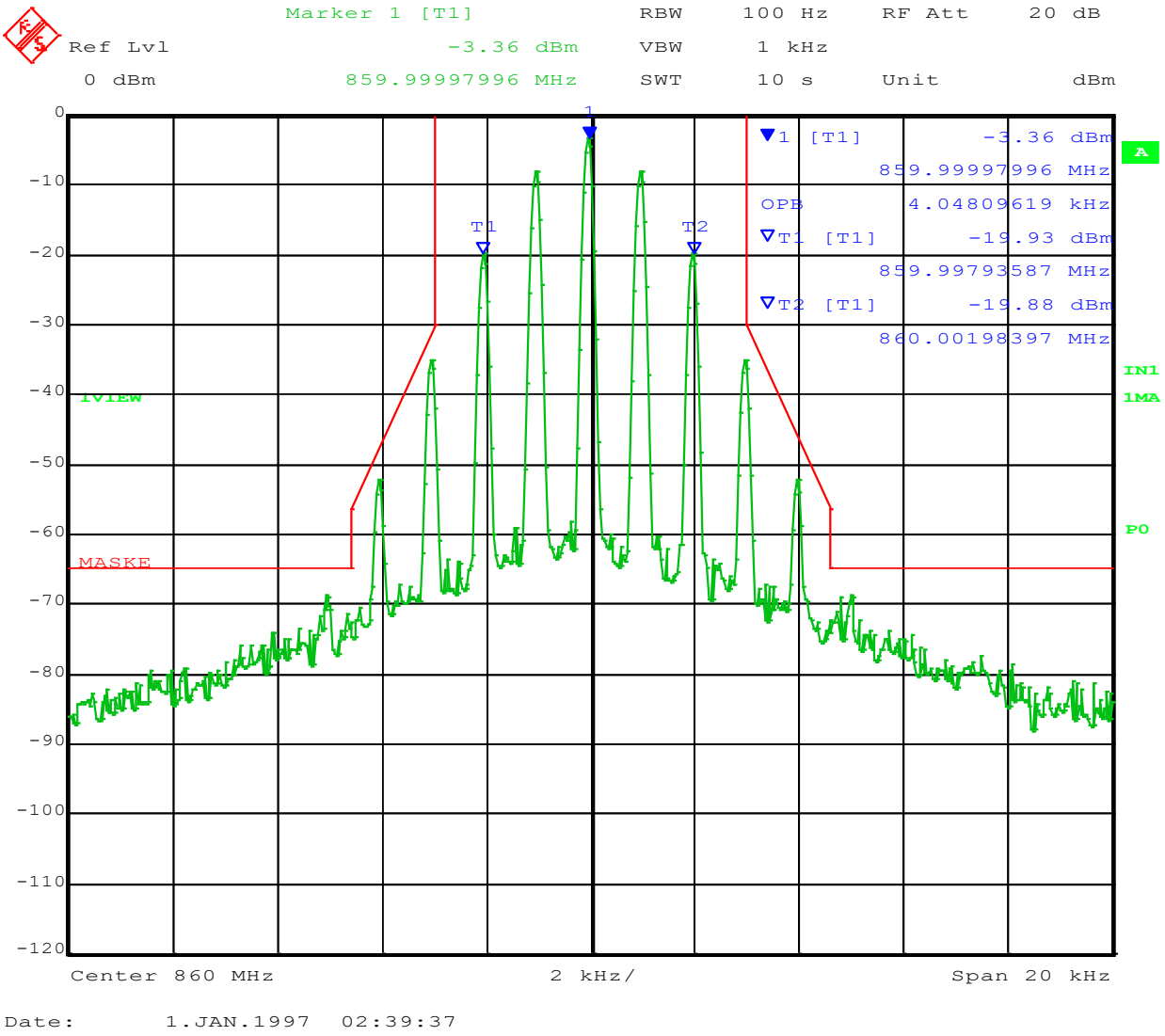
The retransmitted signals continue to meet the unwanted emissions limits of §90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

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.

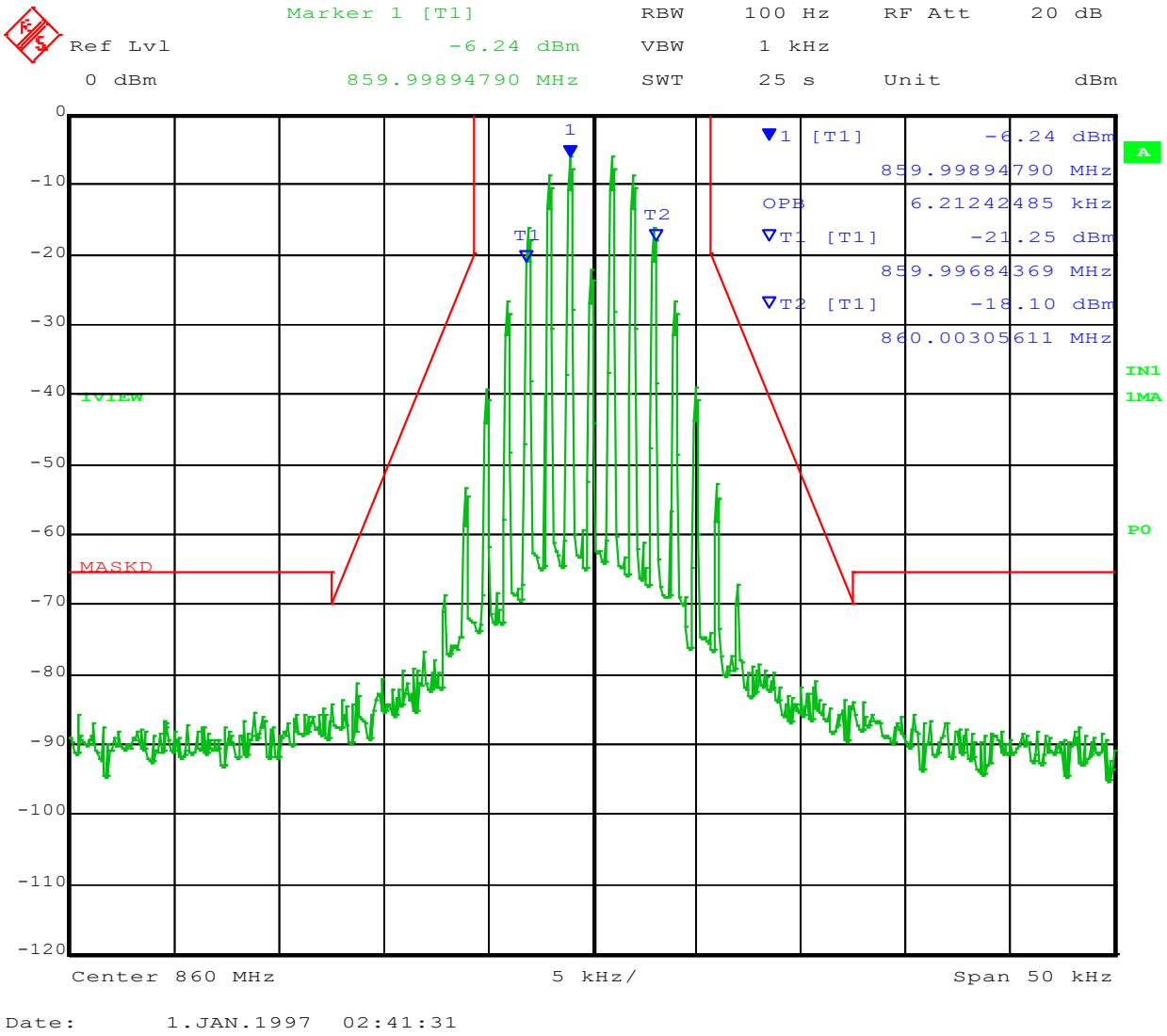
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON – TEST (INPUT) SIGNALS

Test Data: 6.25 kHz FM Test Signal



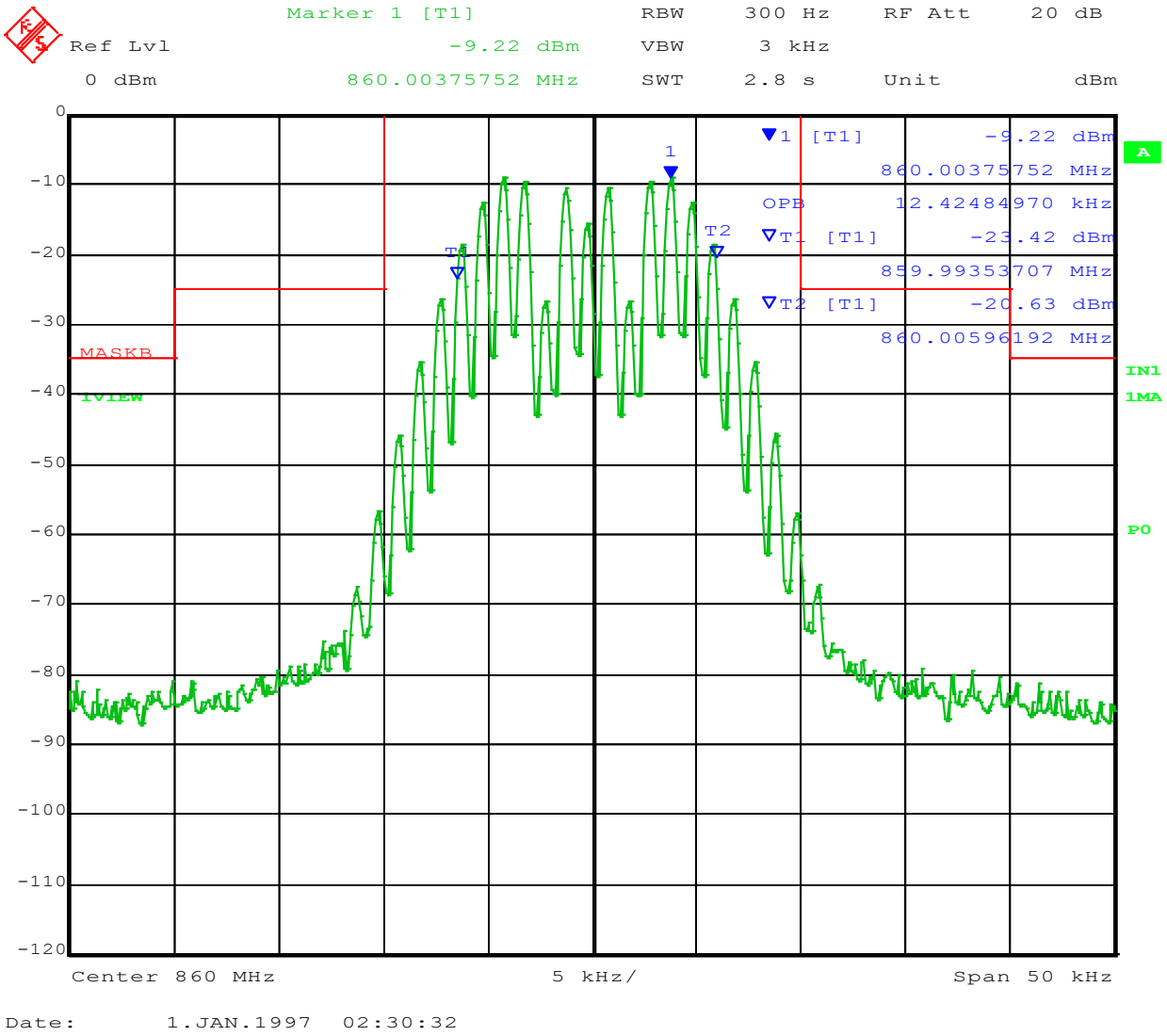
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 12.5 kHz FM Test Signal



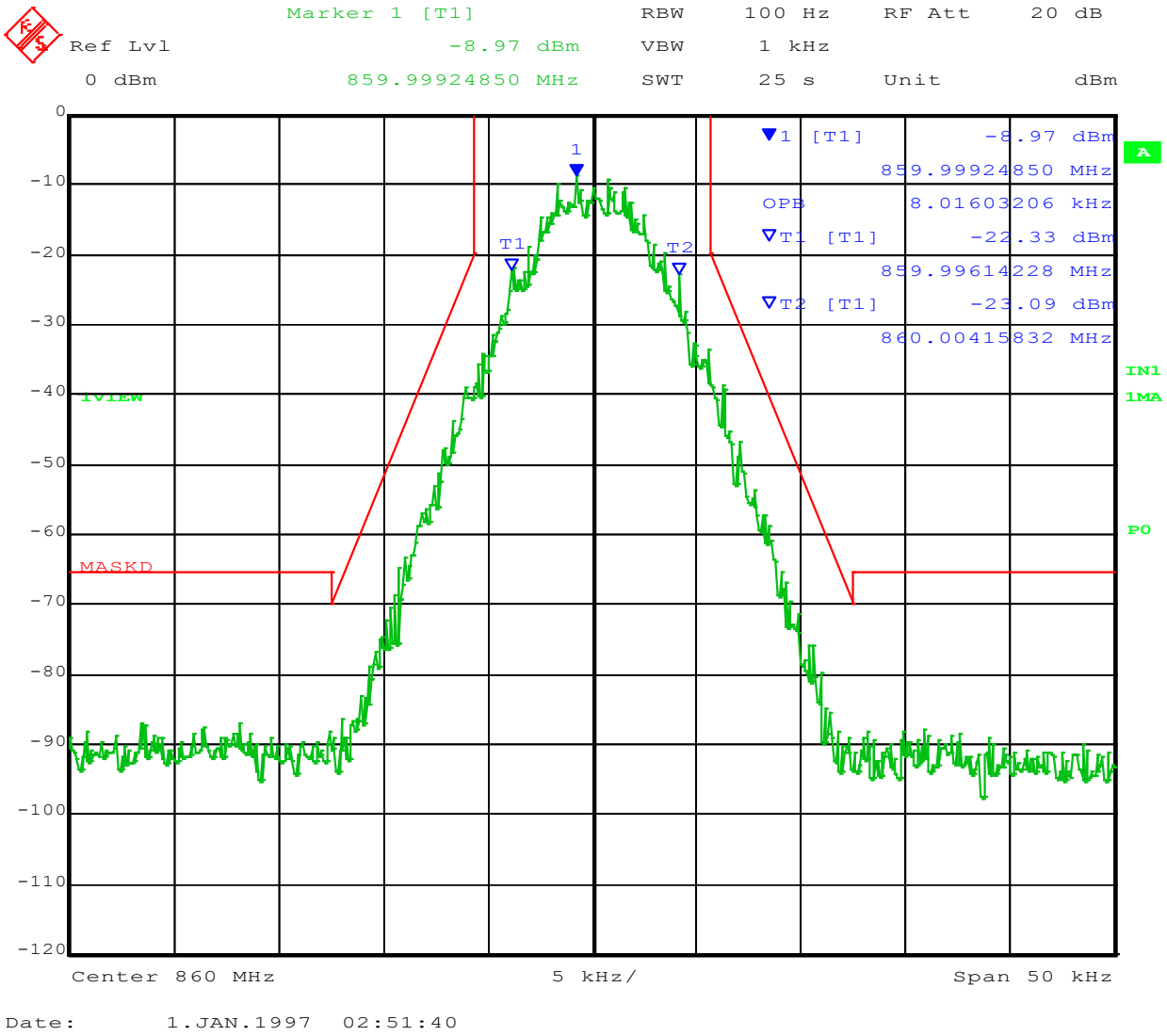
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 25 kHz FM Test Signal



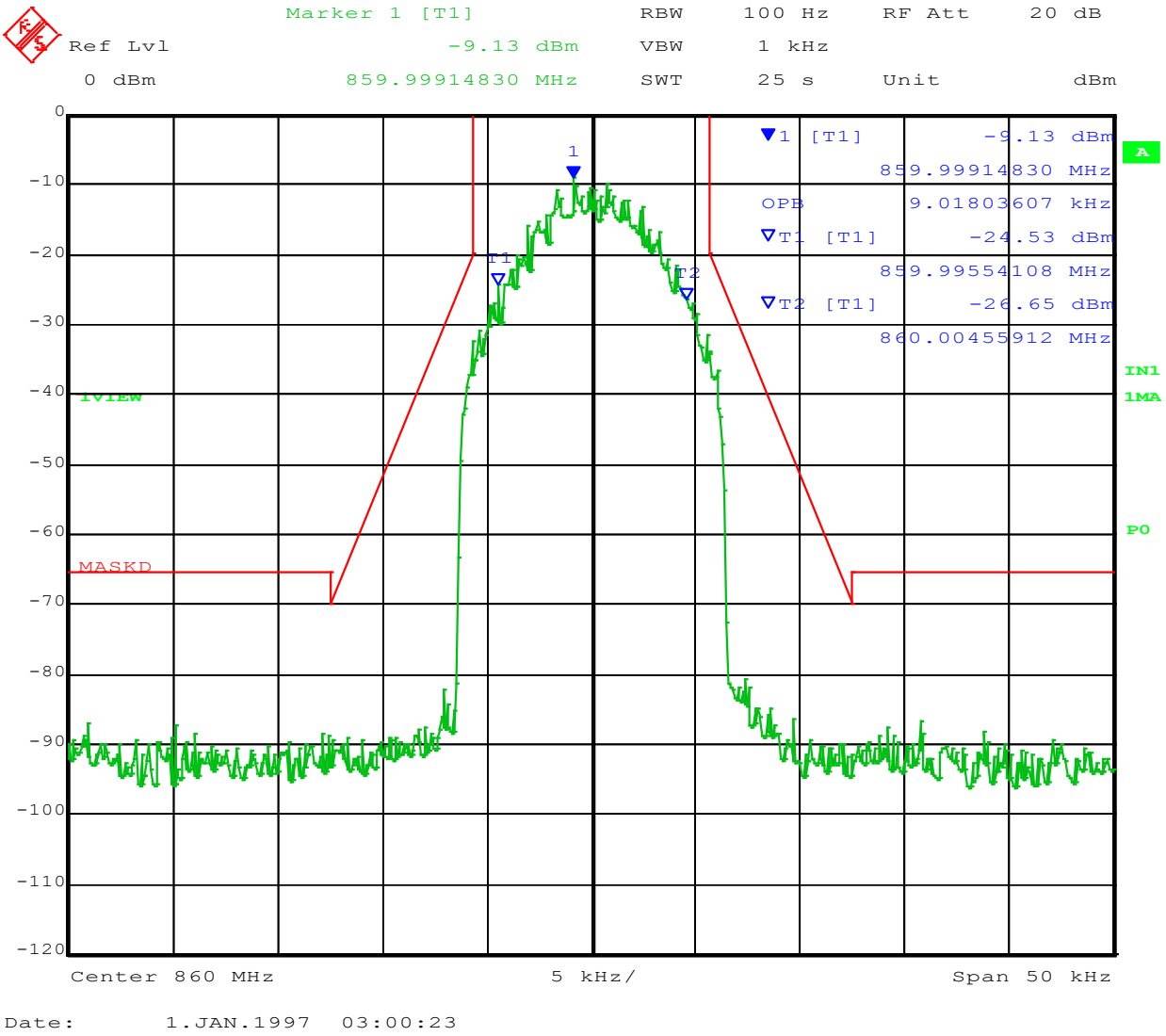
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 1 C4FM Test Signal



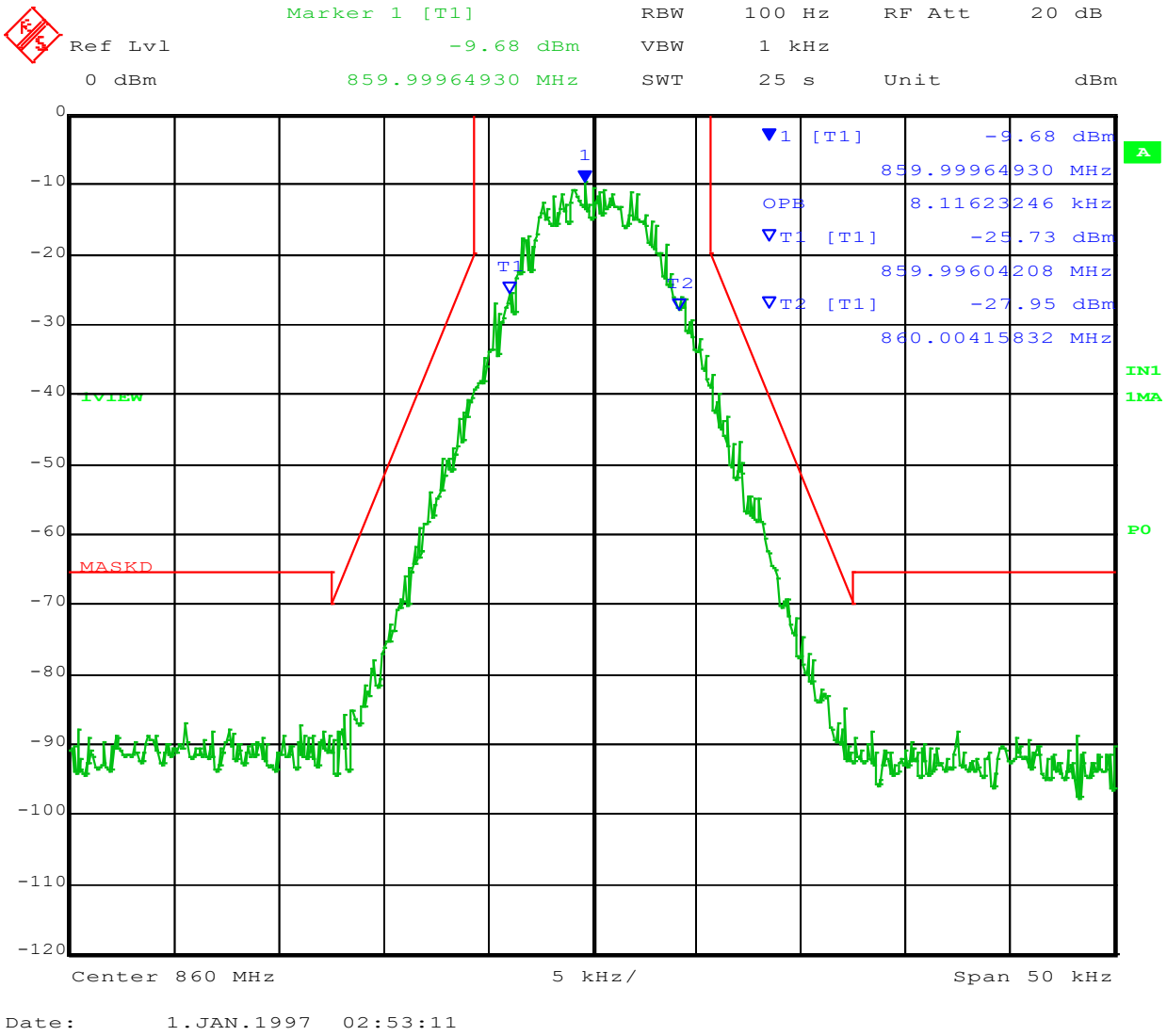
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 1 LSM Test Signal



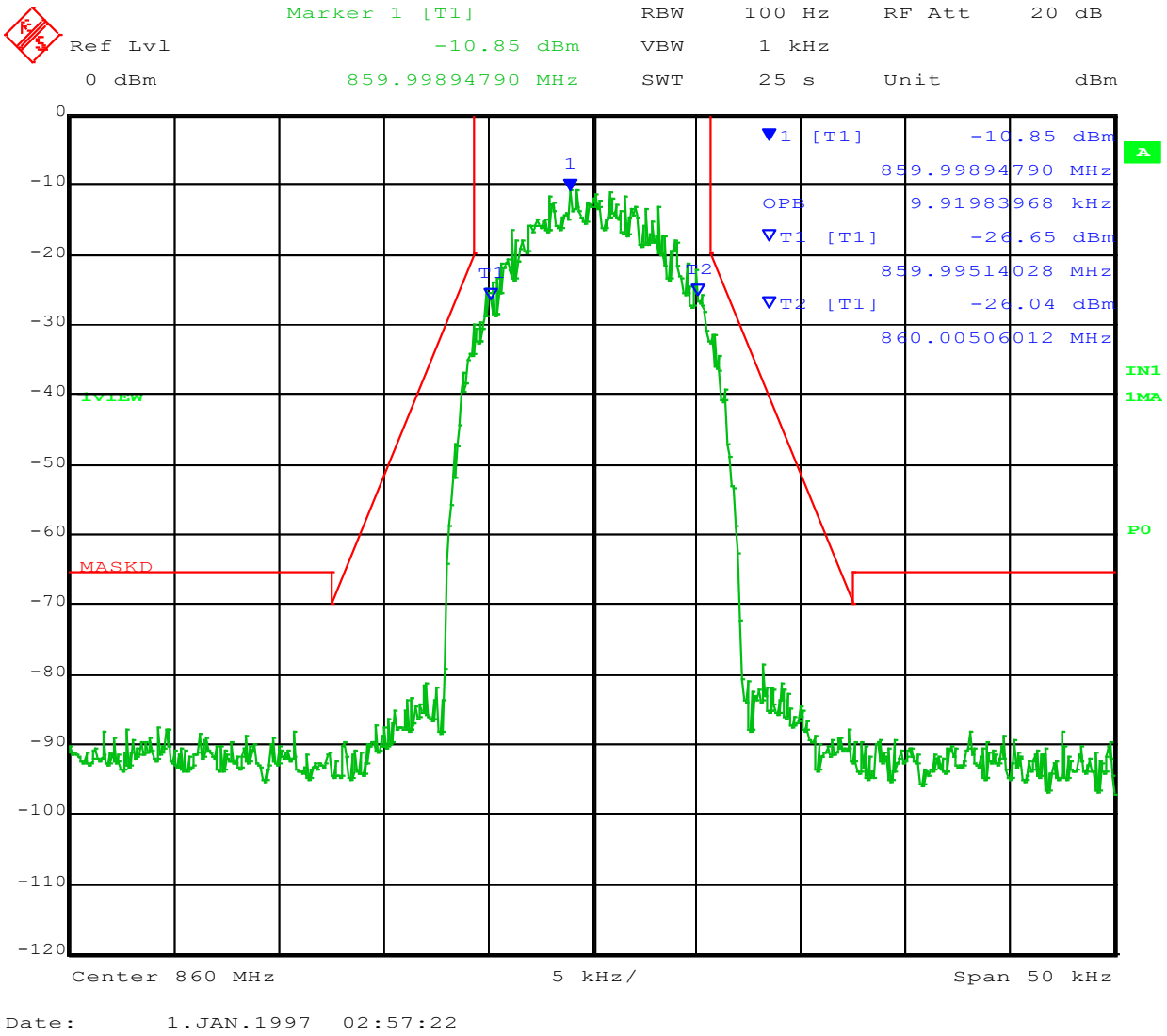
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 2 H-CPM Test Signal



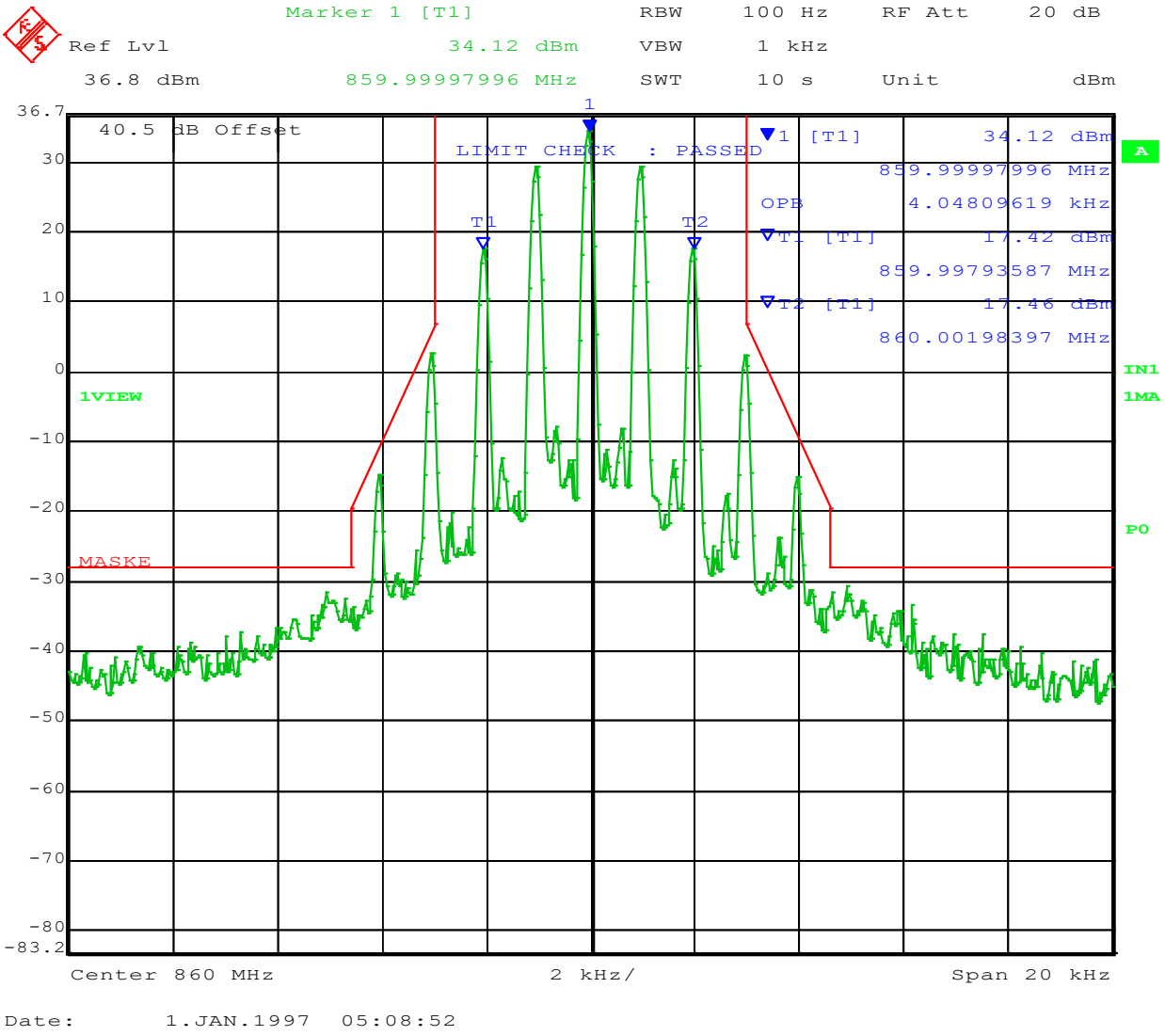
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 2 H-DQPSK Test Signal



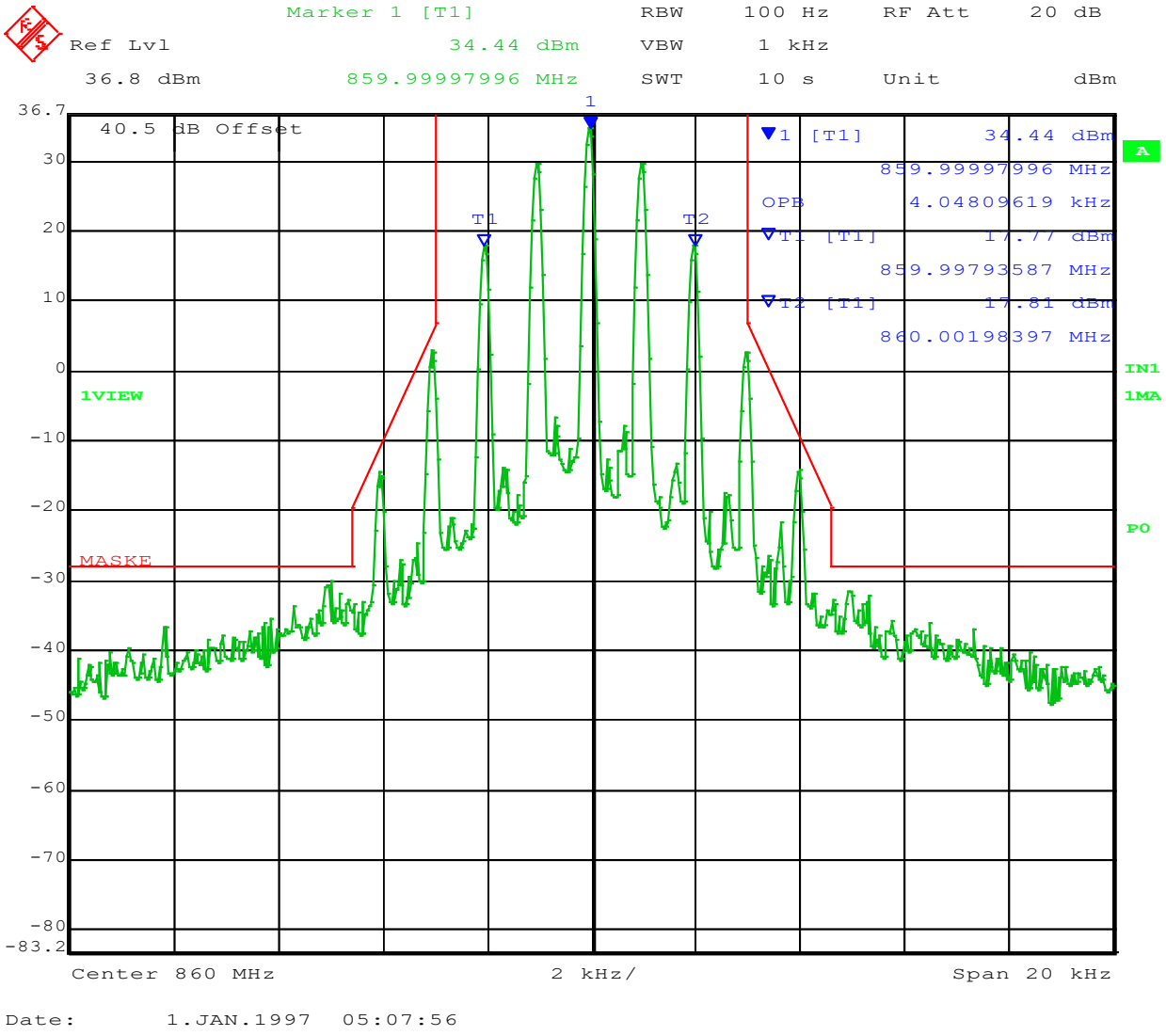
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON – OUTPUT 1

Test Data: 6.25 kHz FM, at AGC Threshold - Output 1



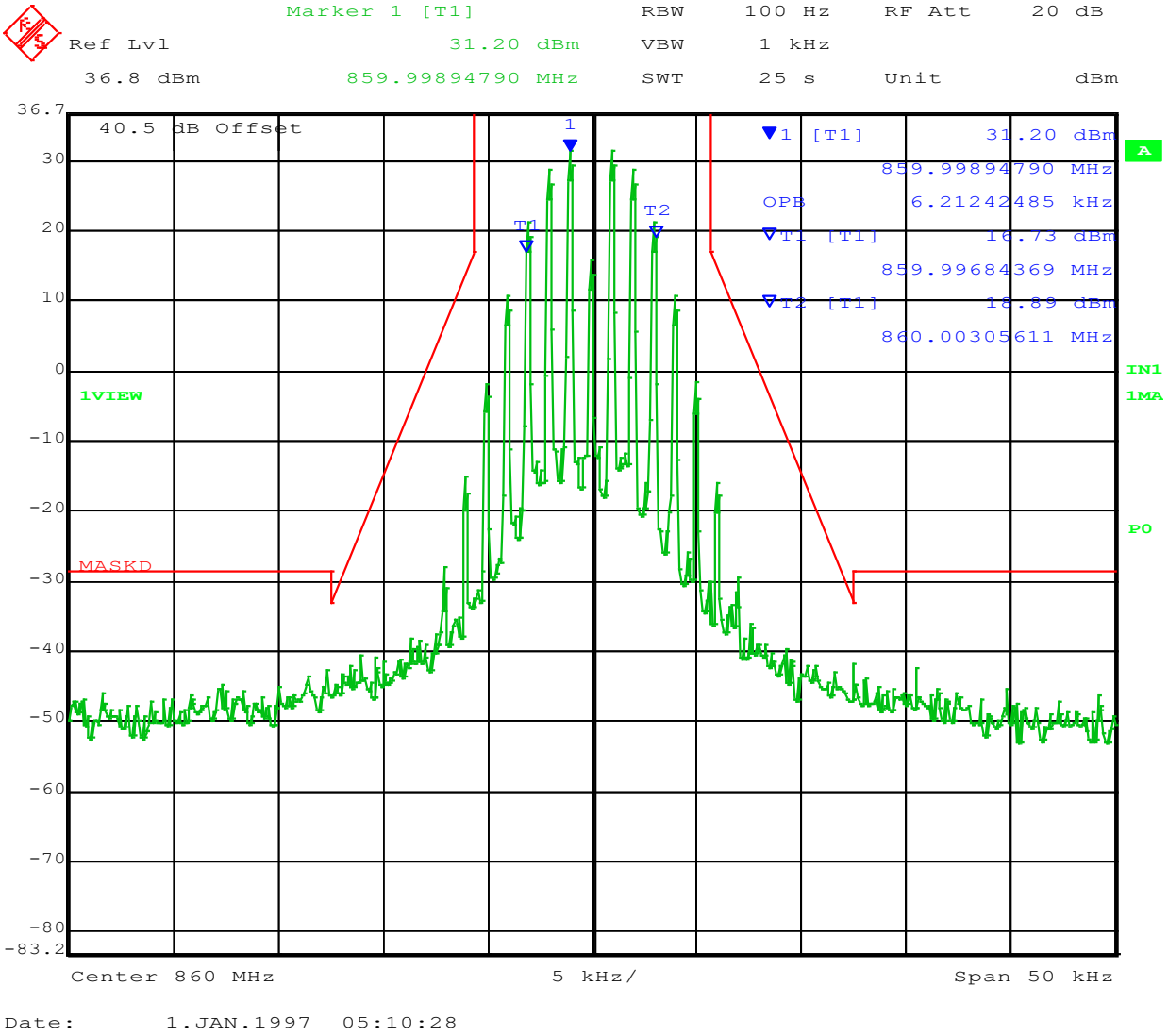
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 6.25 kHz FM, +3 dBm Above AGC Threshold - Output 1



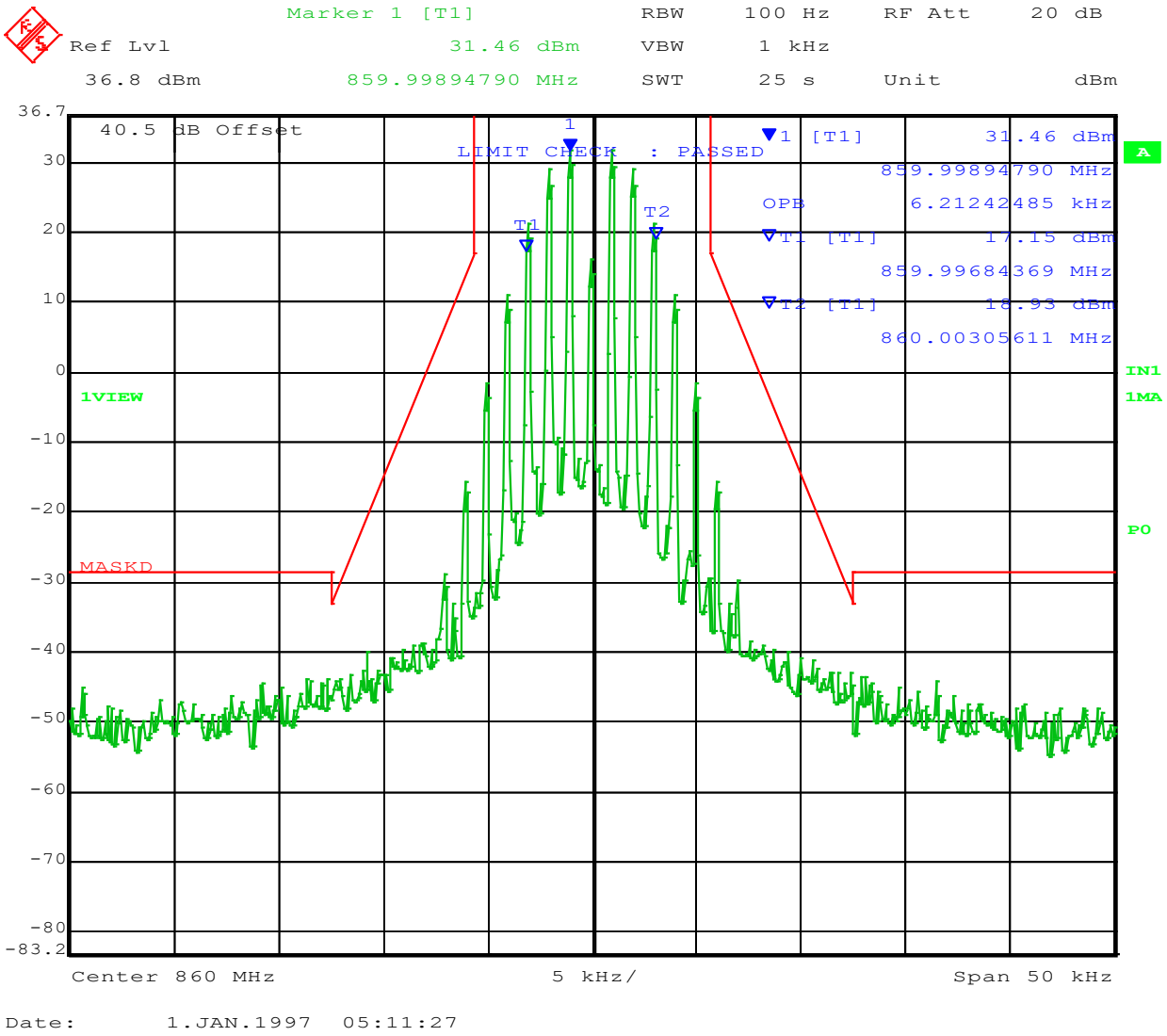
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 12.5 kHz FM, at AGC Threshold - Output 1



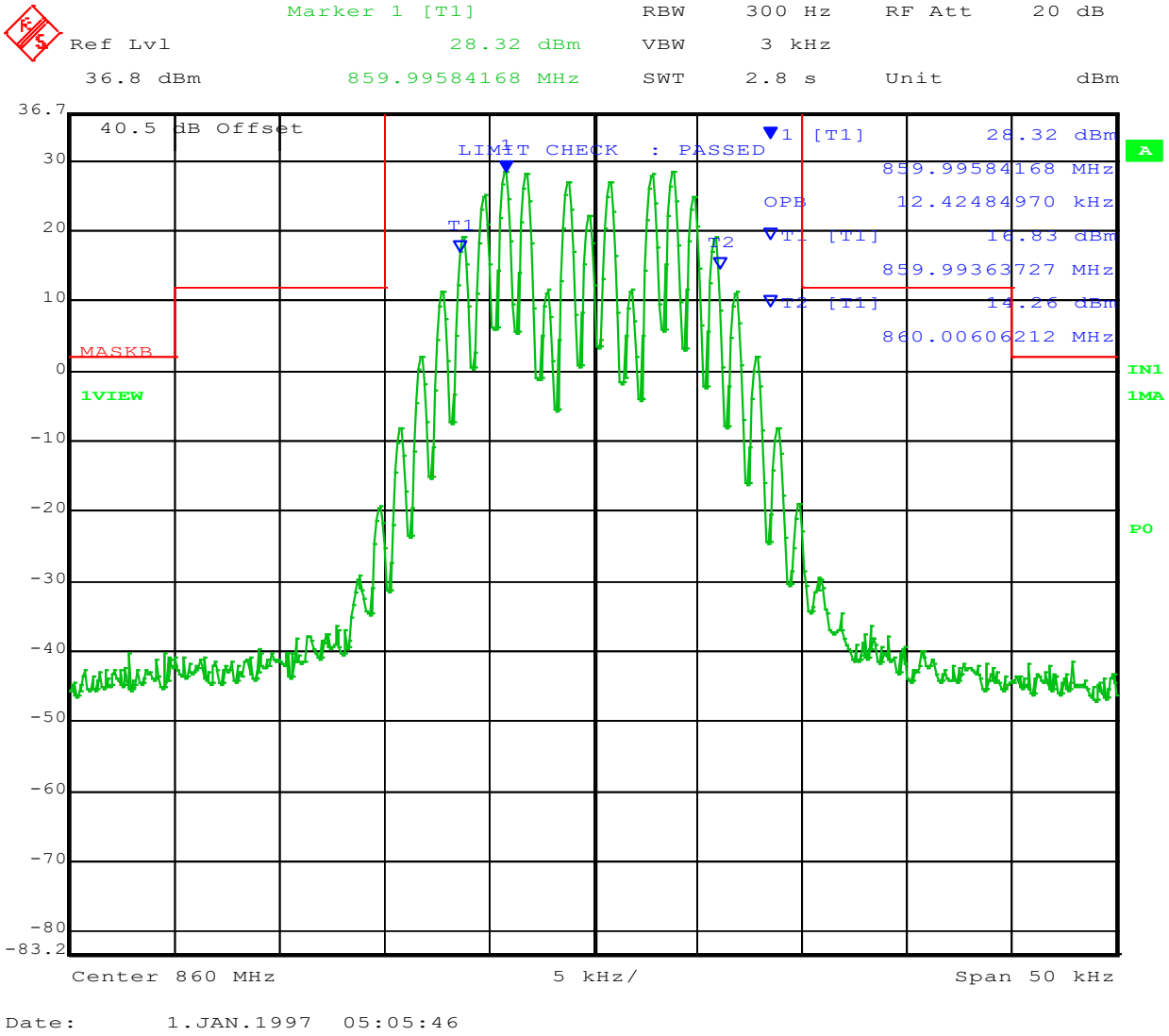
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 12.5 kHz FM, +3 dBm Above AGC Threshold - Output 1



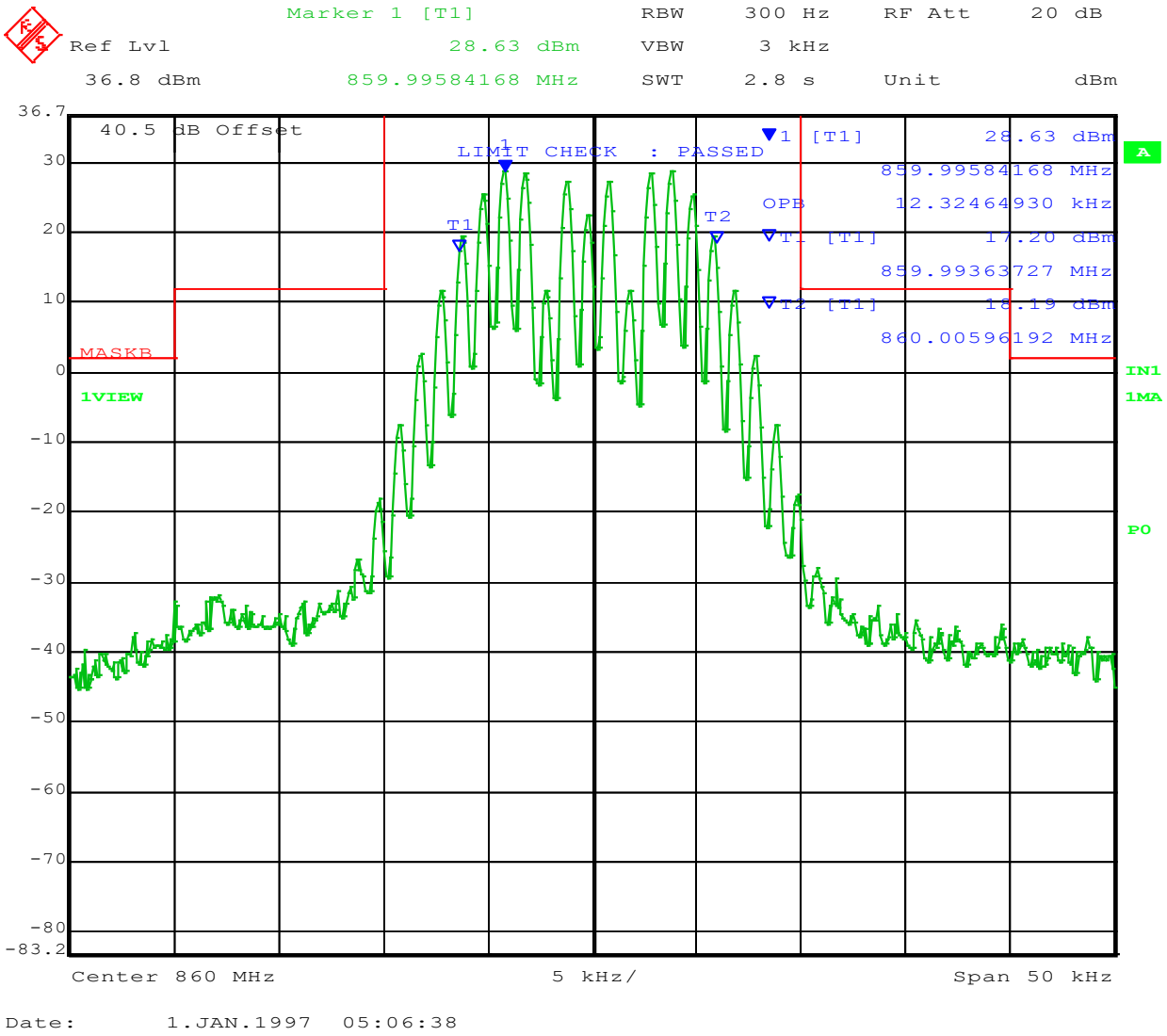
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 25 kHz FM, at AGC Threshold - Output 1



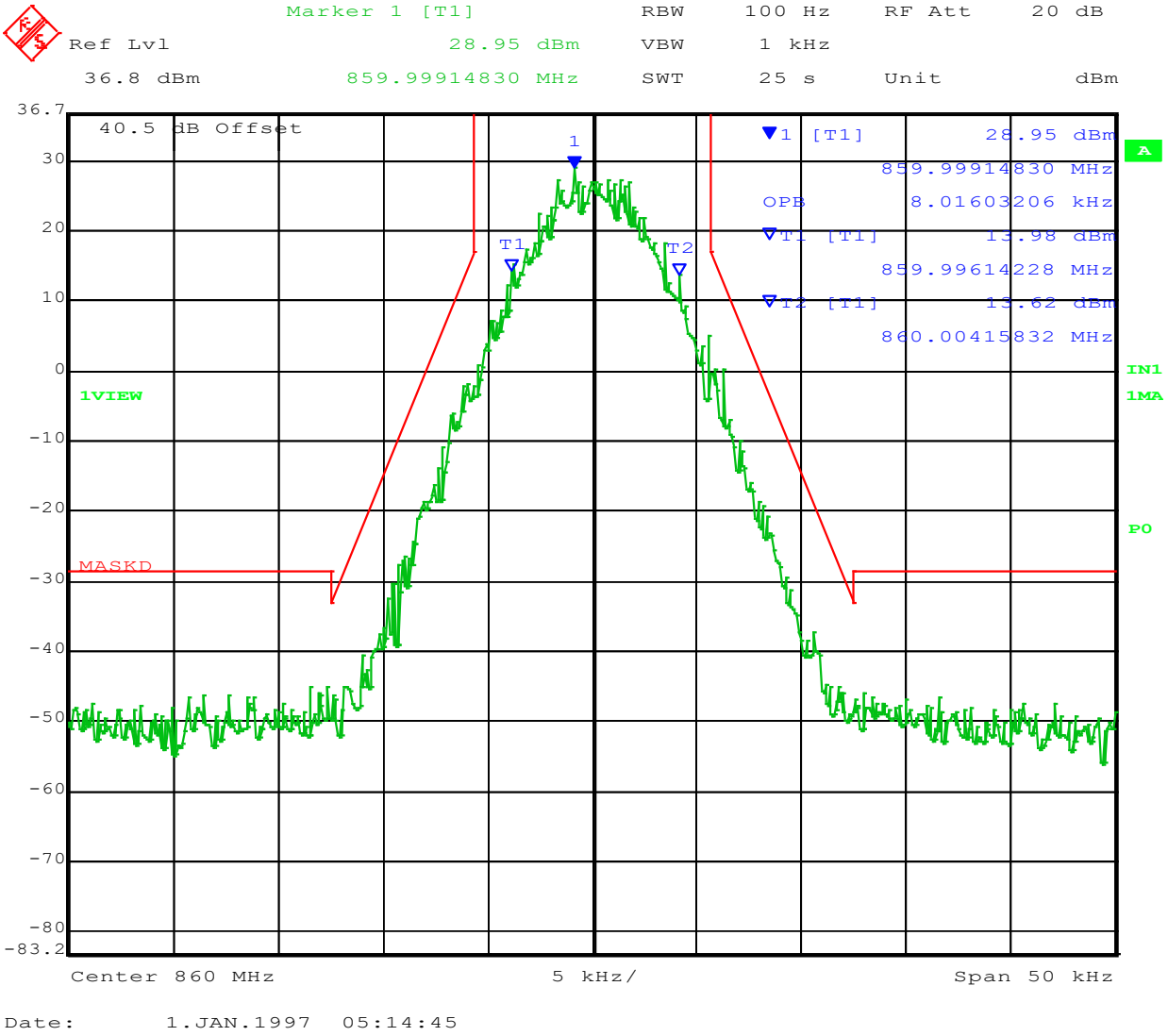
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 25 kHz FM, +3 dBm Above AGC Threshold - Output 1



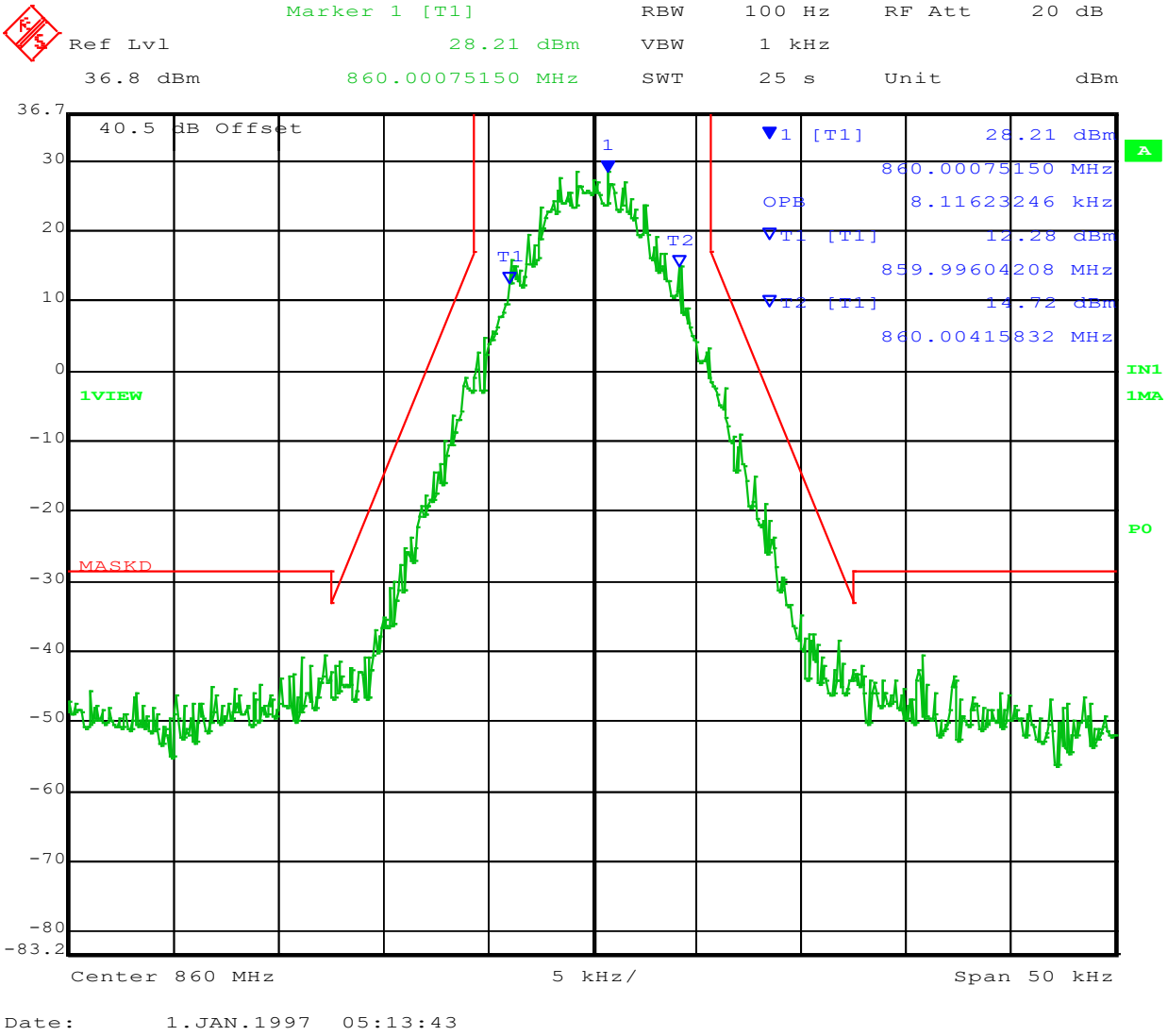
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 1 C4FM, at AGC Threshold - Output 1



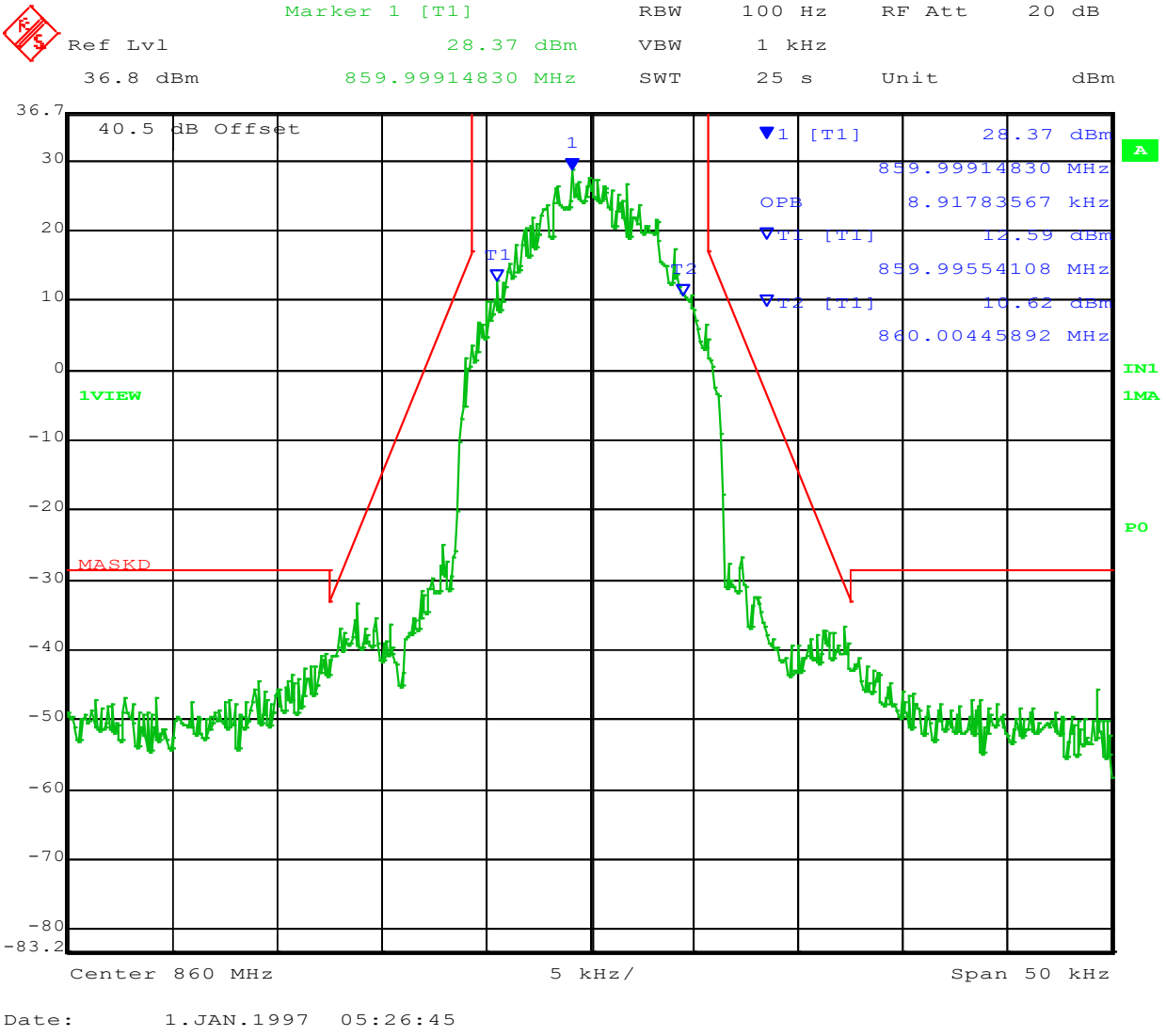
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 1 C4FM, +3 dBm Above AGC Threshold - Output 1



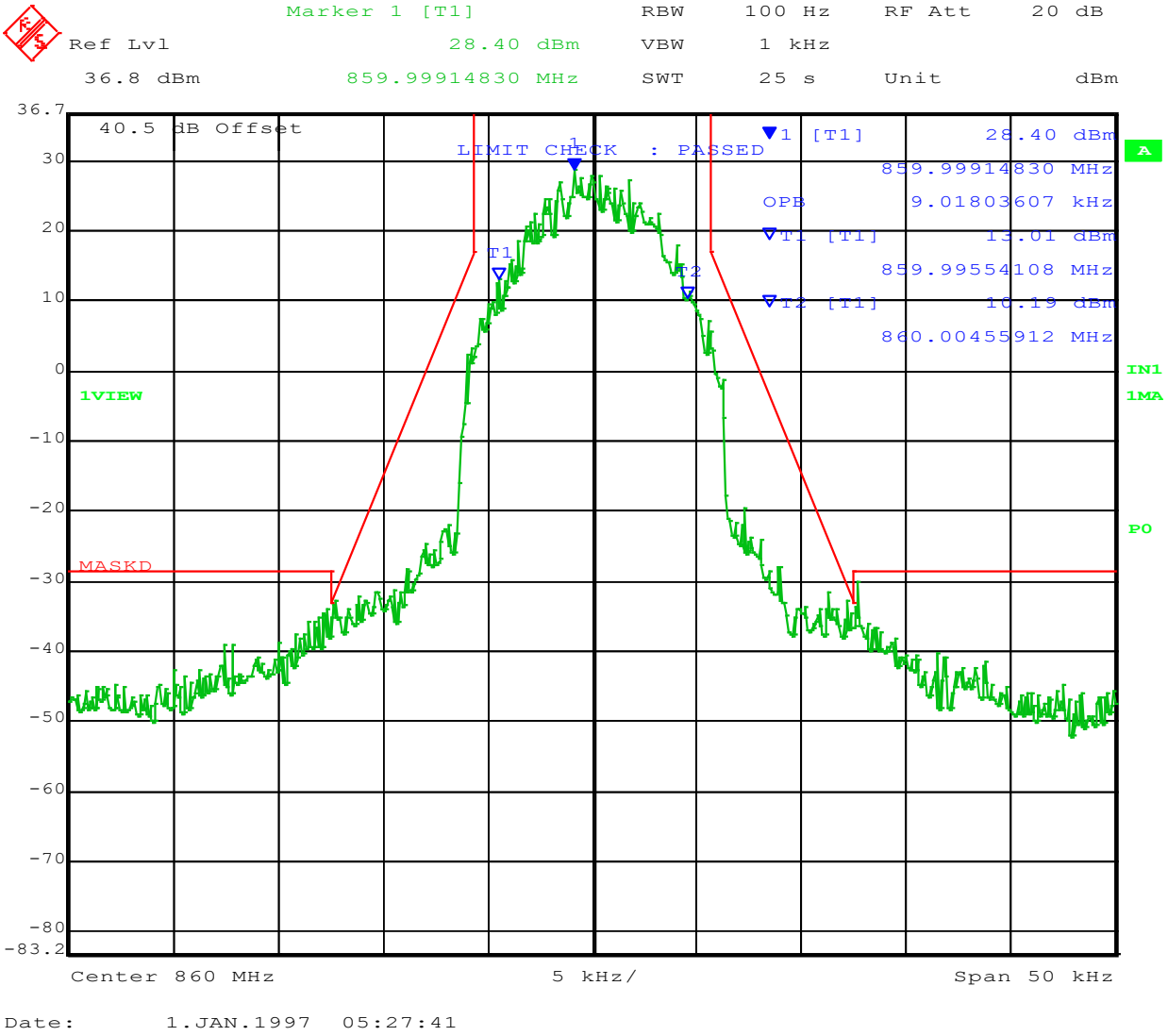
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 1 LSM, at AGC Threshold - Output 1



INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

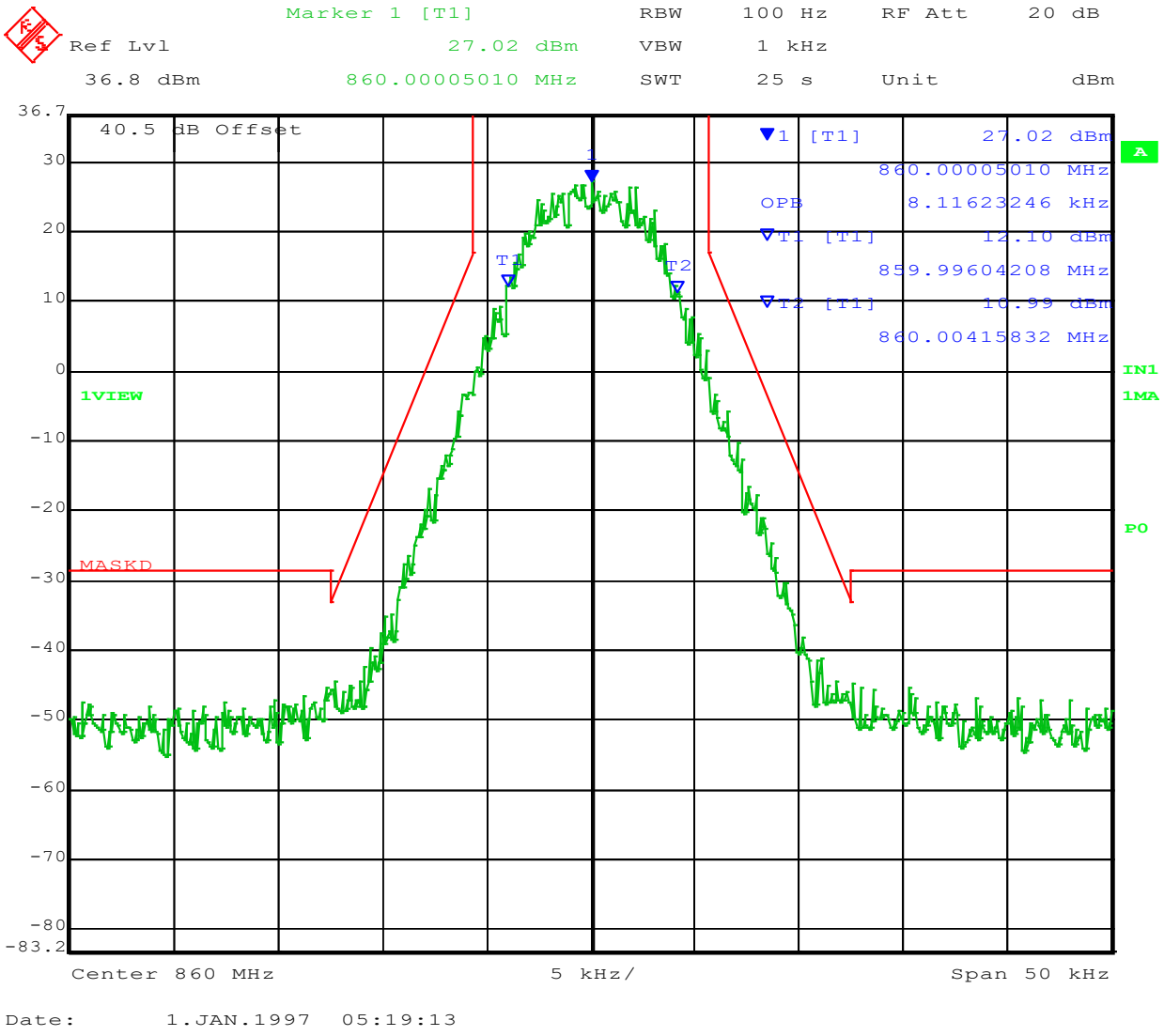
Test Data: P25 Phase 1 LSM, +3 dBm Above AGC Threshold - Output 1



Additional findings: The retransmitted Linear Simulcast Modulation signal passes FCC 90.210(d). Emissions were <1 dB under the emission mask at/near the 250% points.

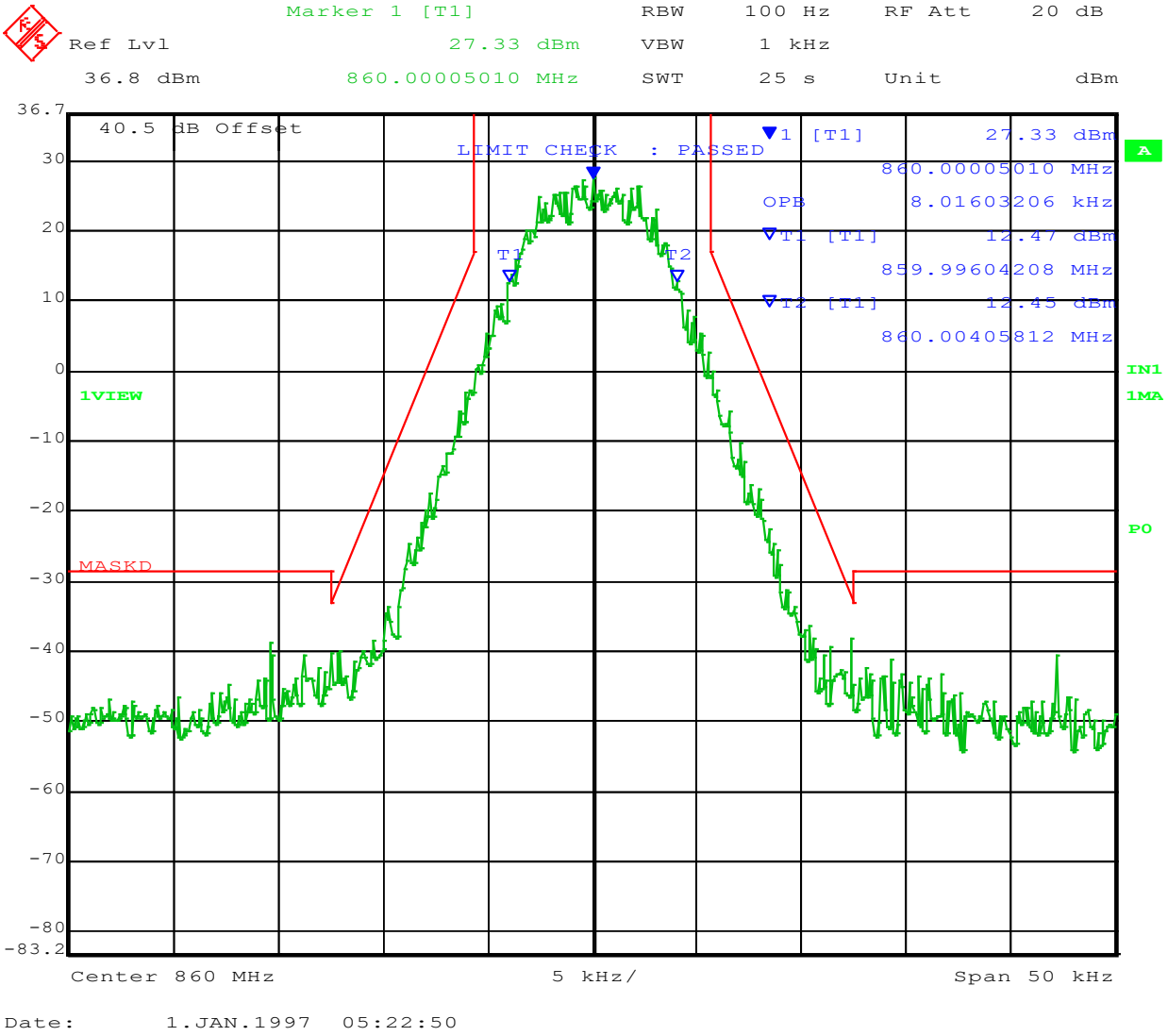
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 2 H-CPM, at AGC Threshold - Output 1



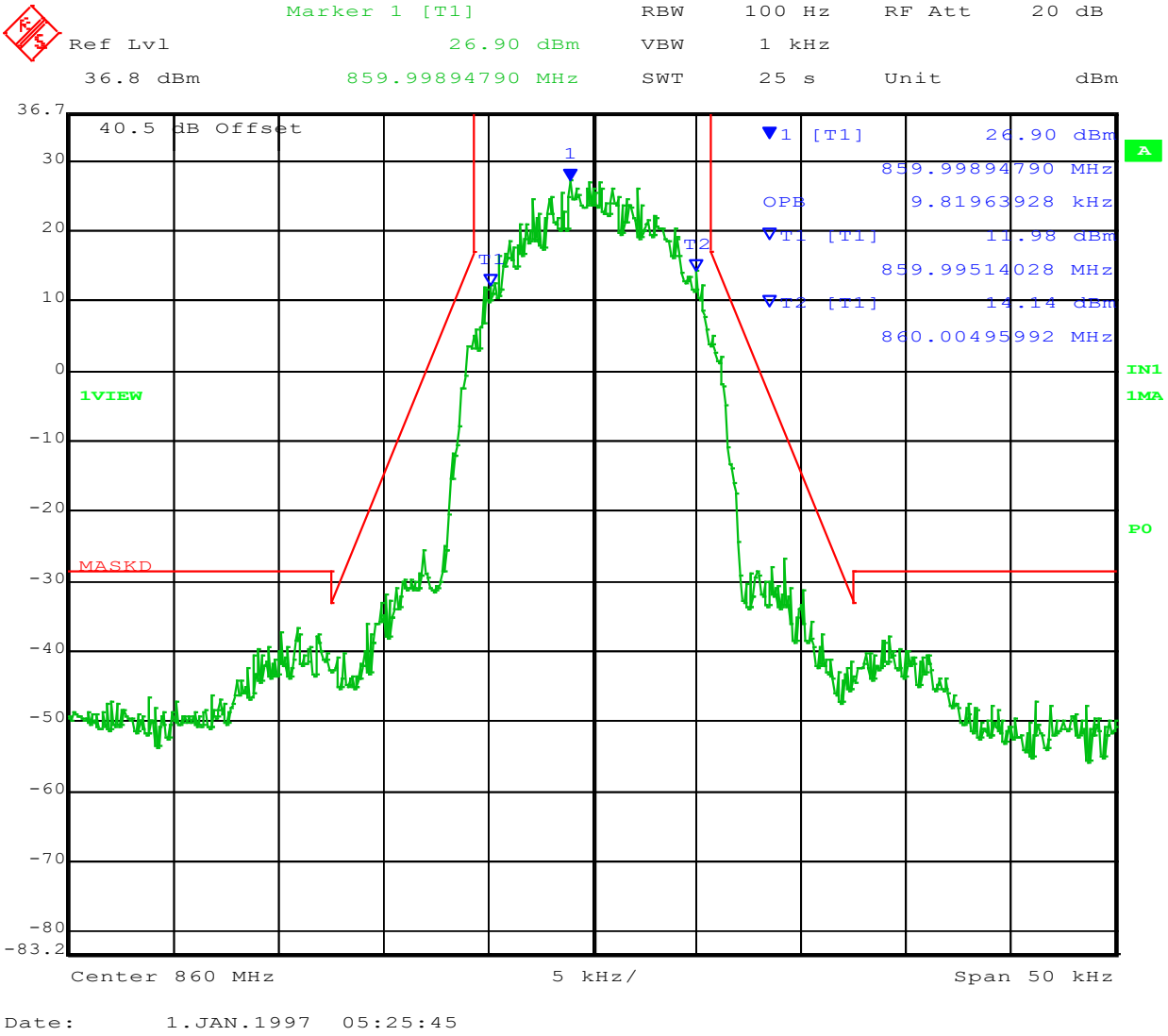
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 2 H-CPM, +3 dBm Above AGC Threshold - Output 1



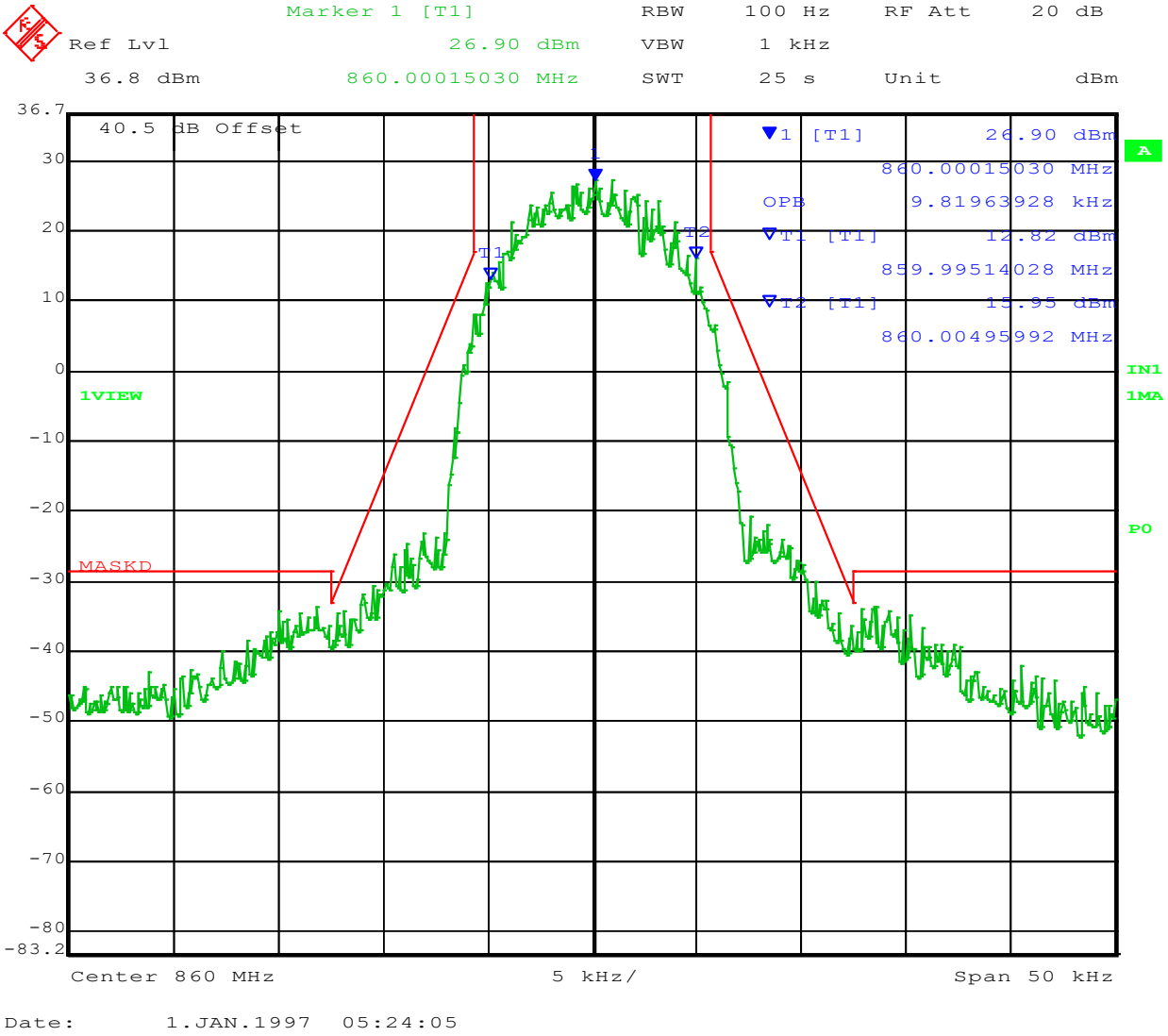
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 2 H-DQPSK, at AGC Threshold - Output 1



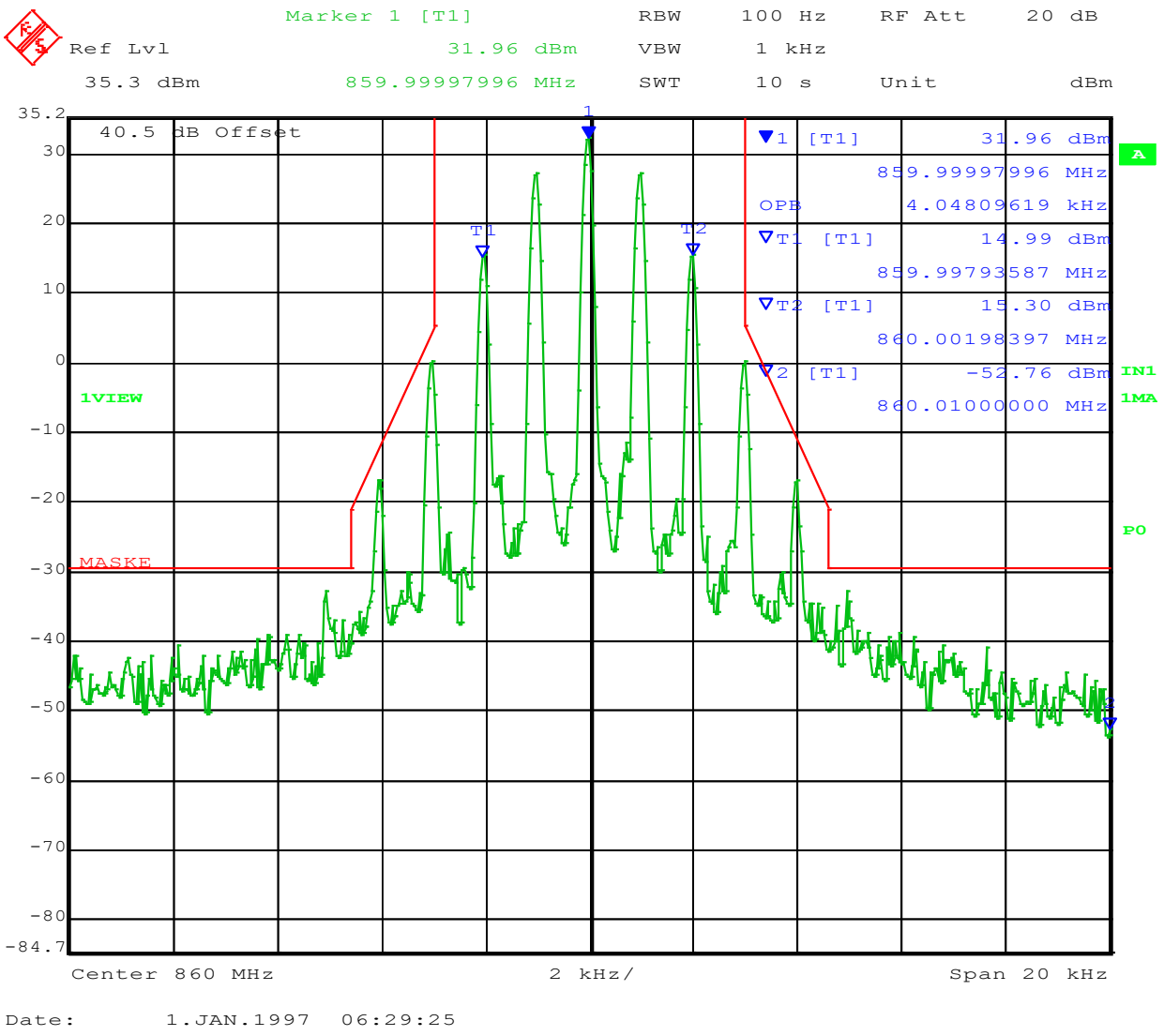
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 2 H-DQPSK, +3 dBm Above AGC Threshold - Output 1



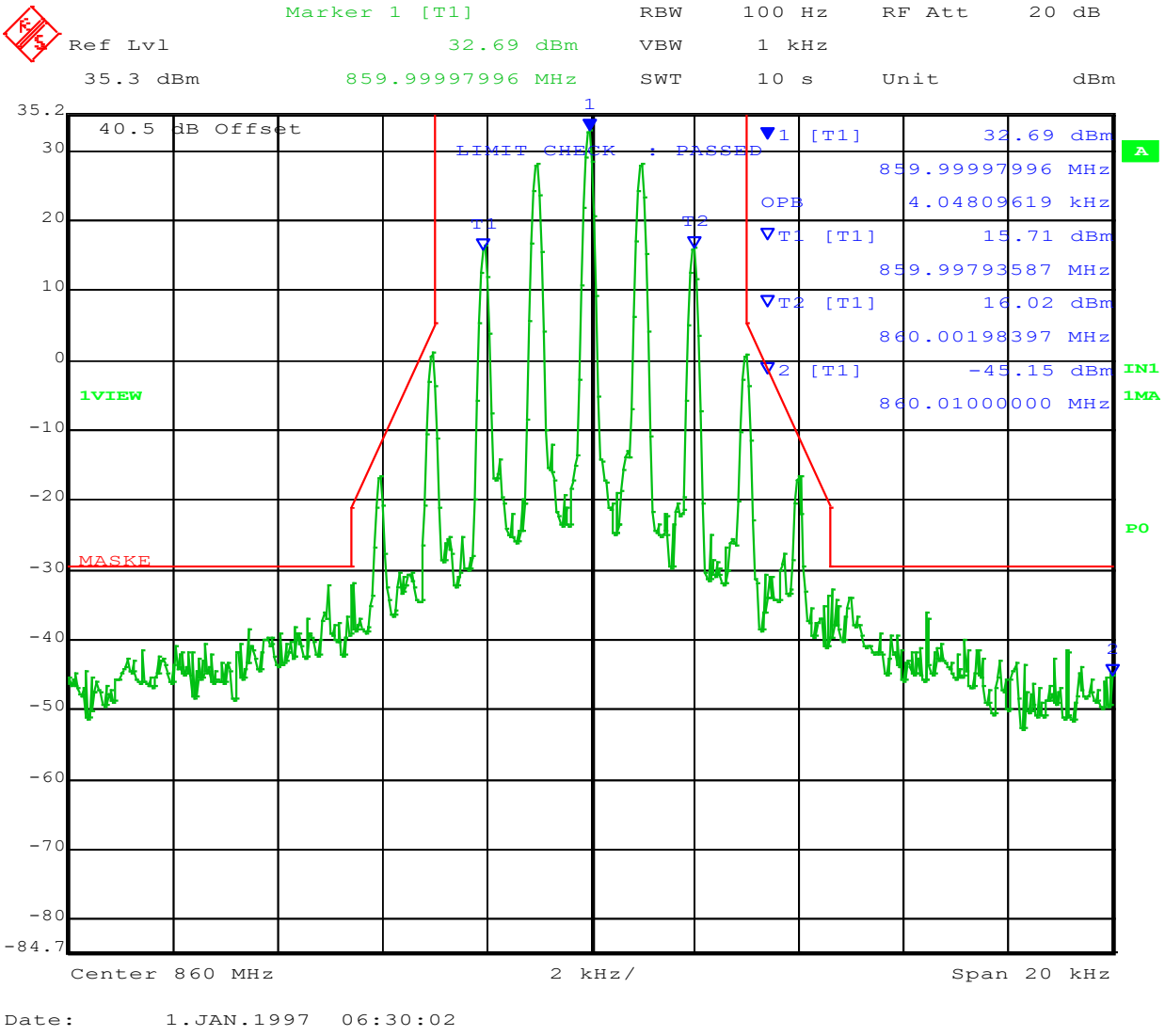
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON – OUTPUT 2

Test Data: 6.25 kHz FM, at AGC Threshold - Output 2



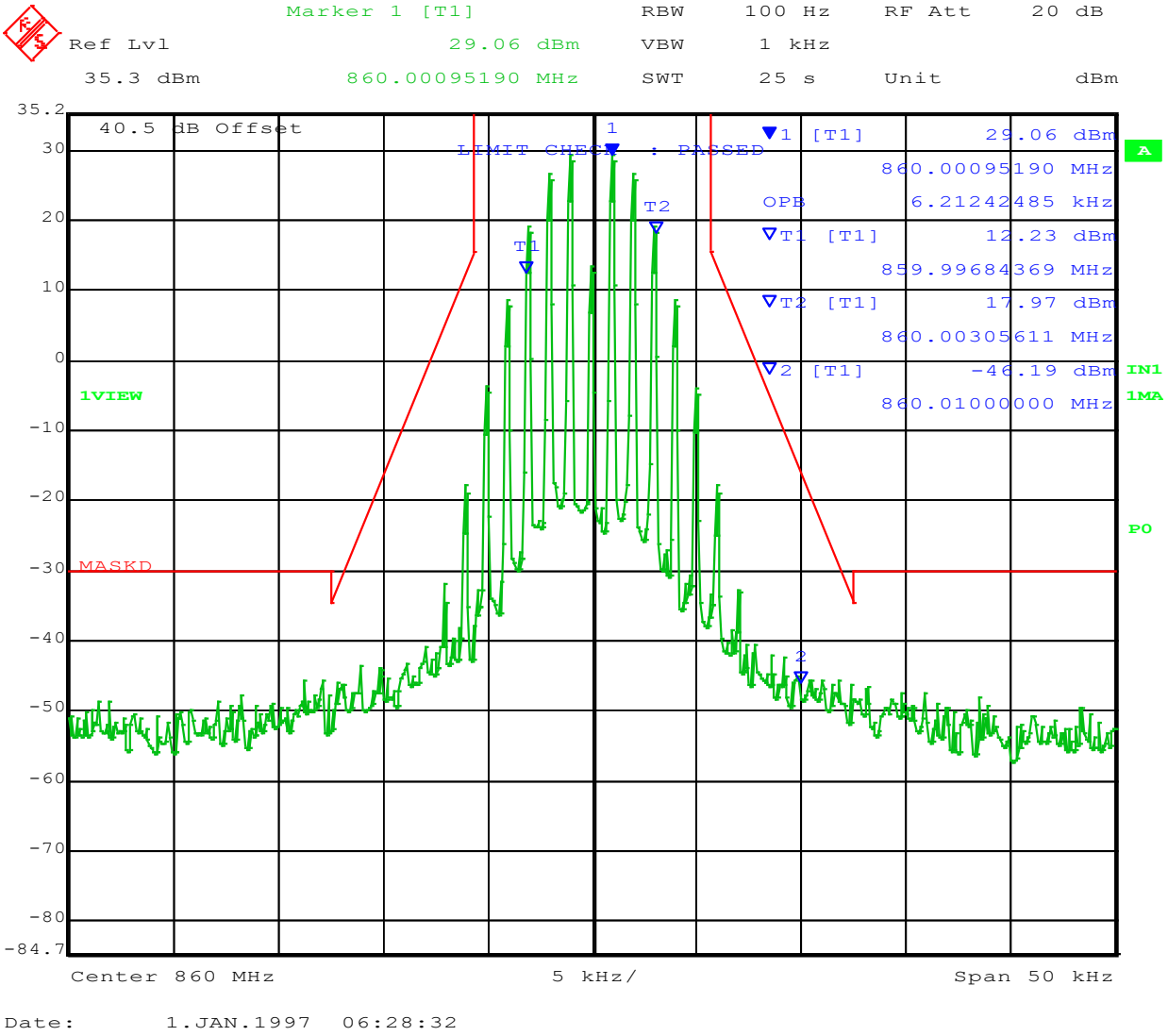
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 6.25 kHz FM, +3 dBm Above AGC Threshold - Output 2



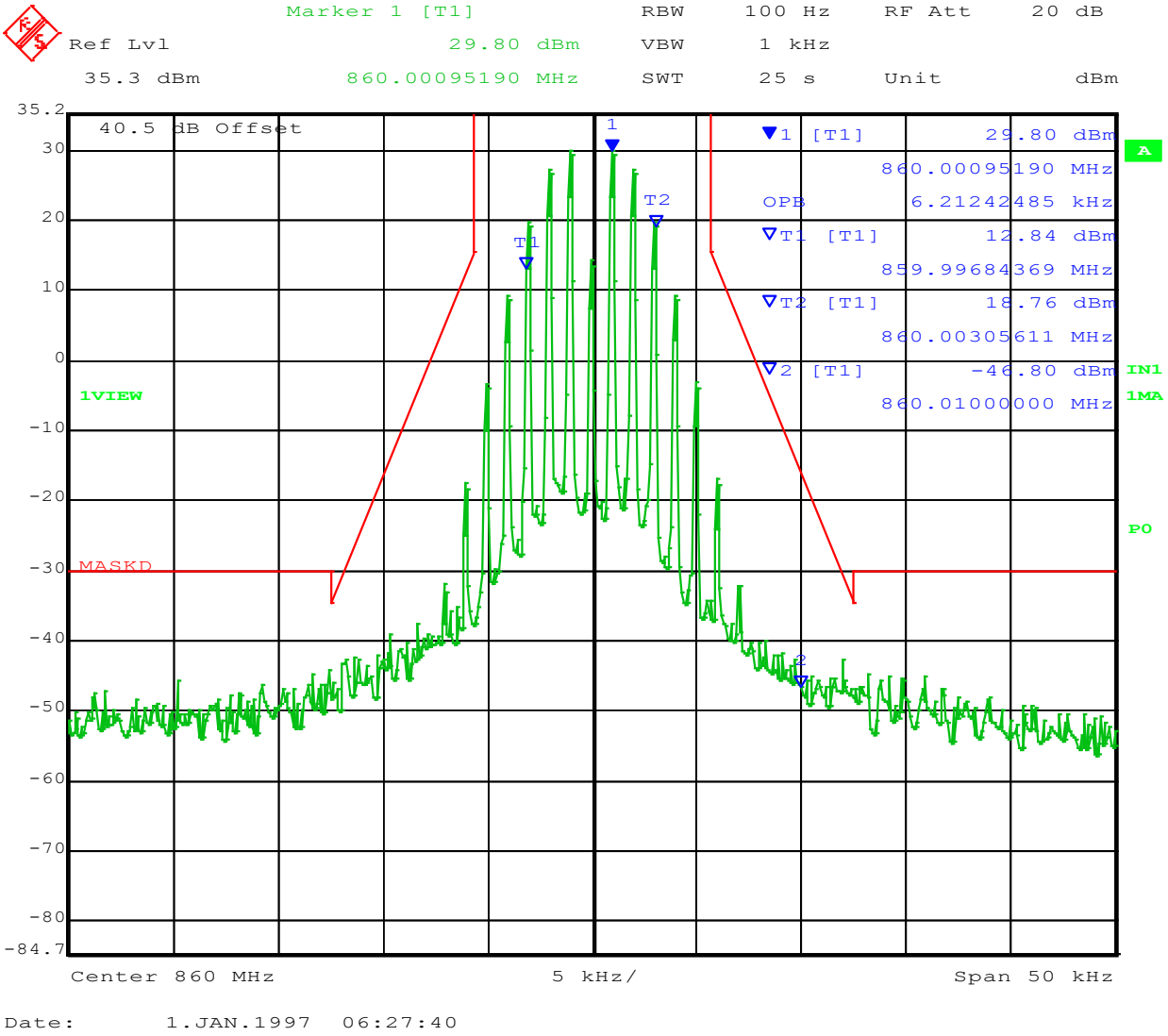
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 12.5 kHz FM, at AGC Threshold - Output 2



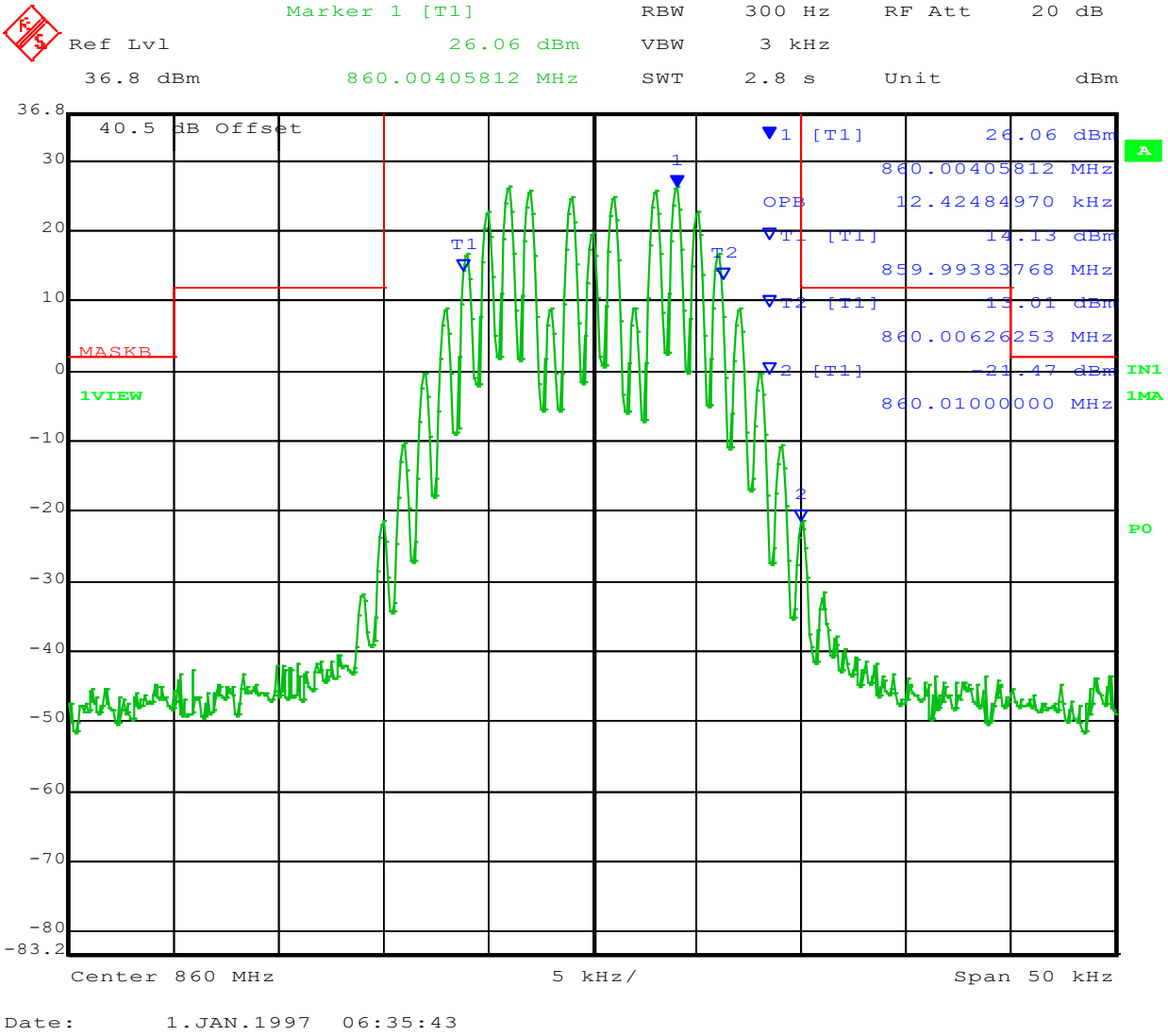
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 12.5 kHz FM, +3 dBm Above AGC Threshold - Output 2



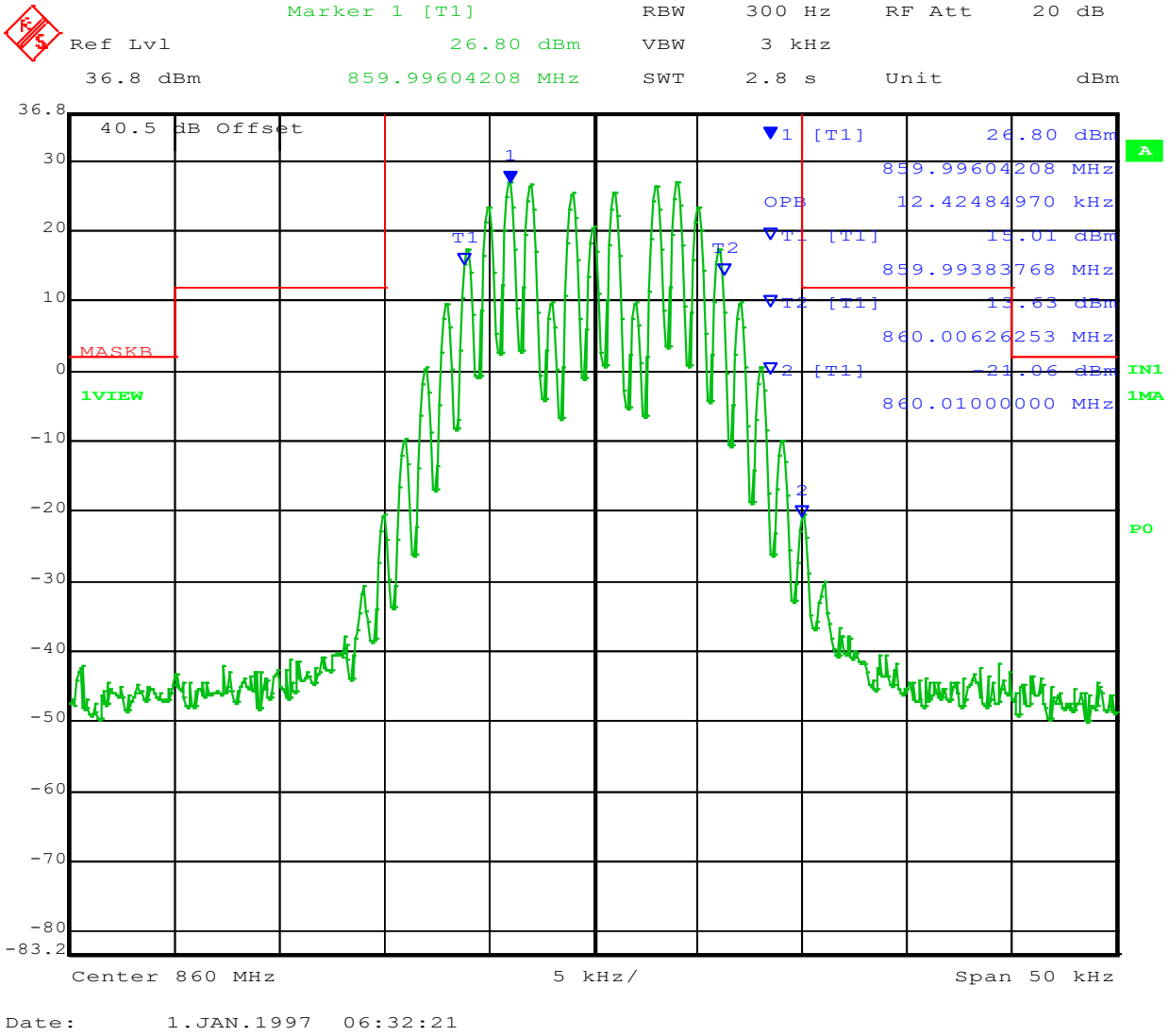
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 25 kHz FM, at AGC Threshold - Output 2



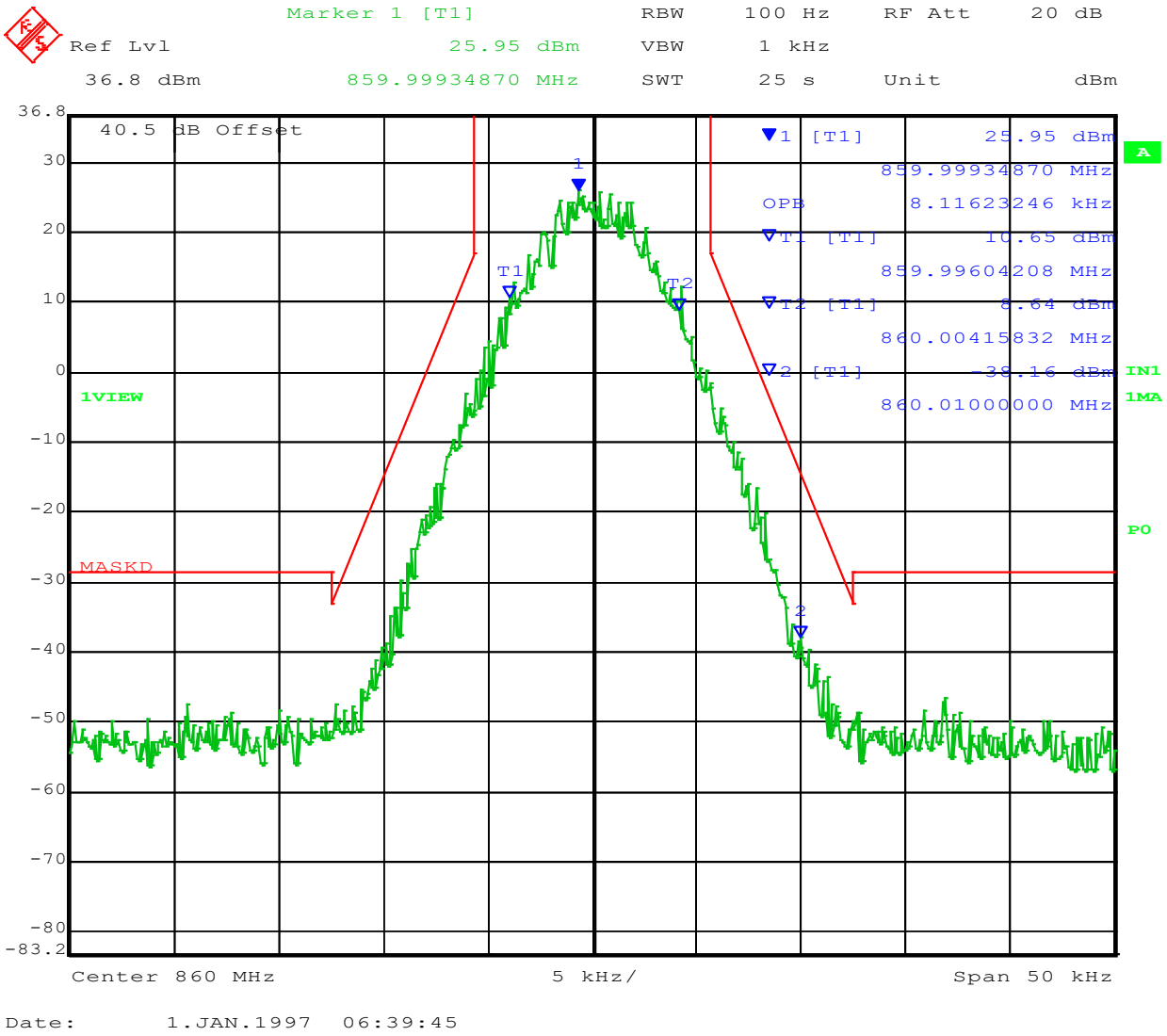
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: 25 kHz FM, +3 dBm Above AGC Threshold - Output 2



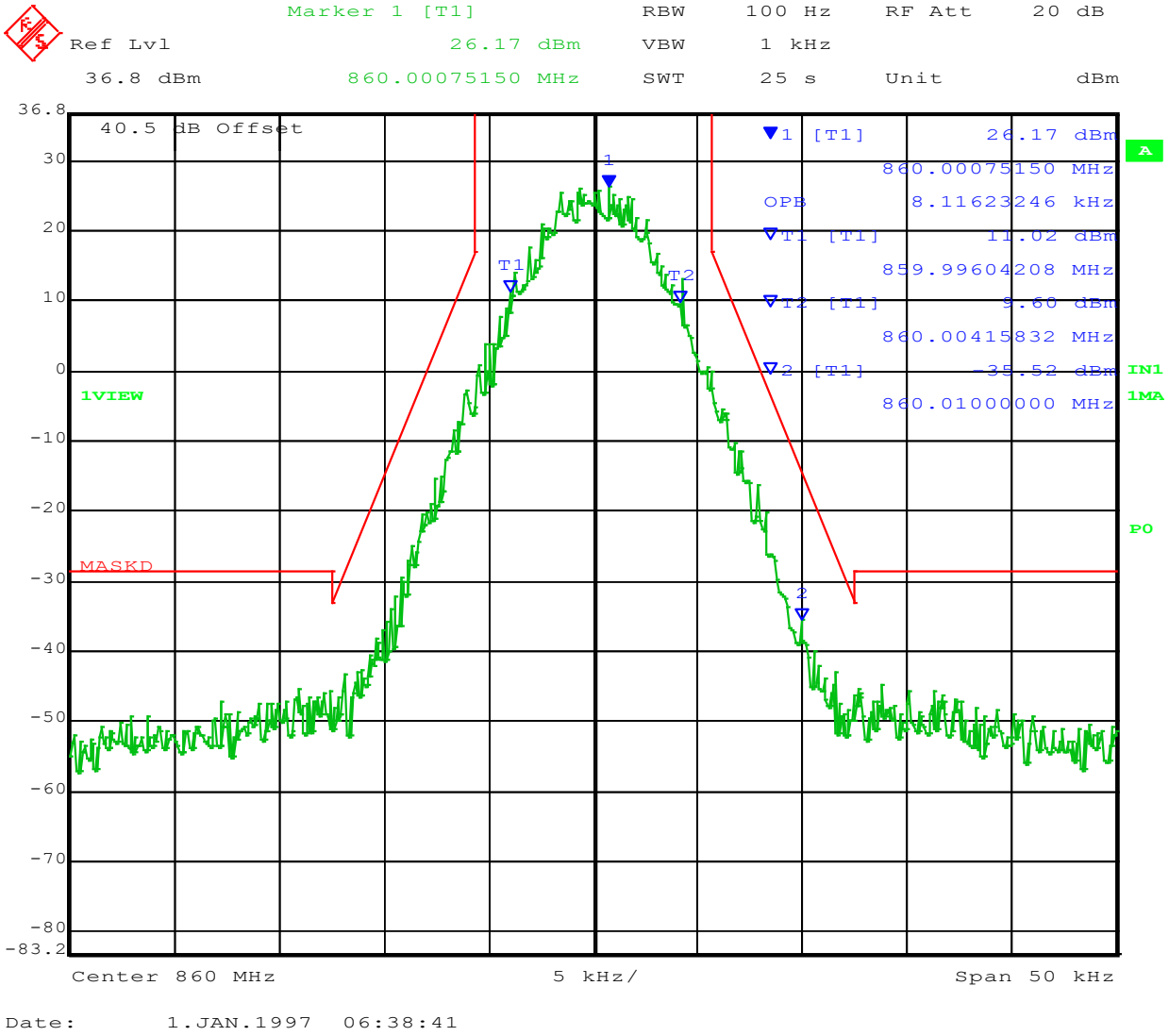
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 1 C4FM, at AGC Threshold - Output 2



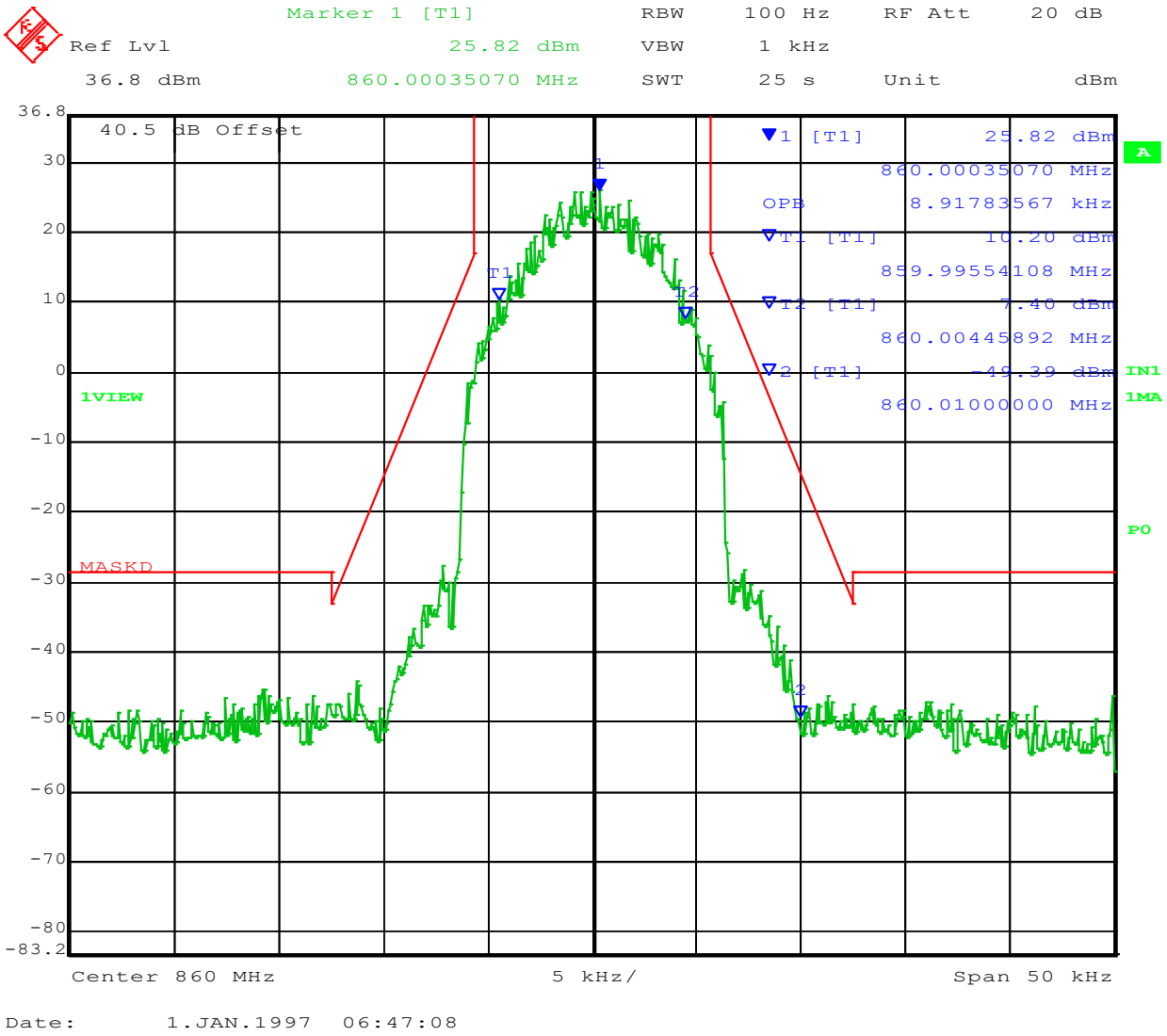
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 1 C4FM, +3 dBm Above AGC Threshold - Output 2



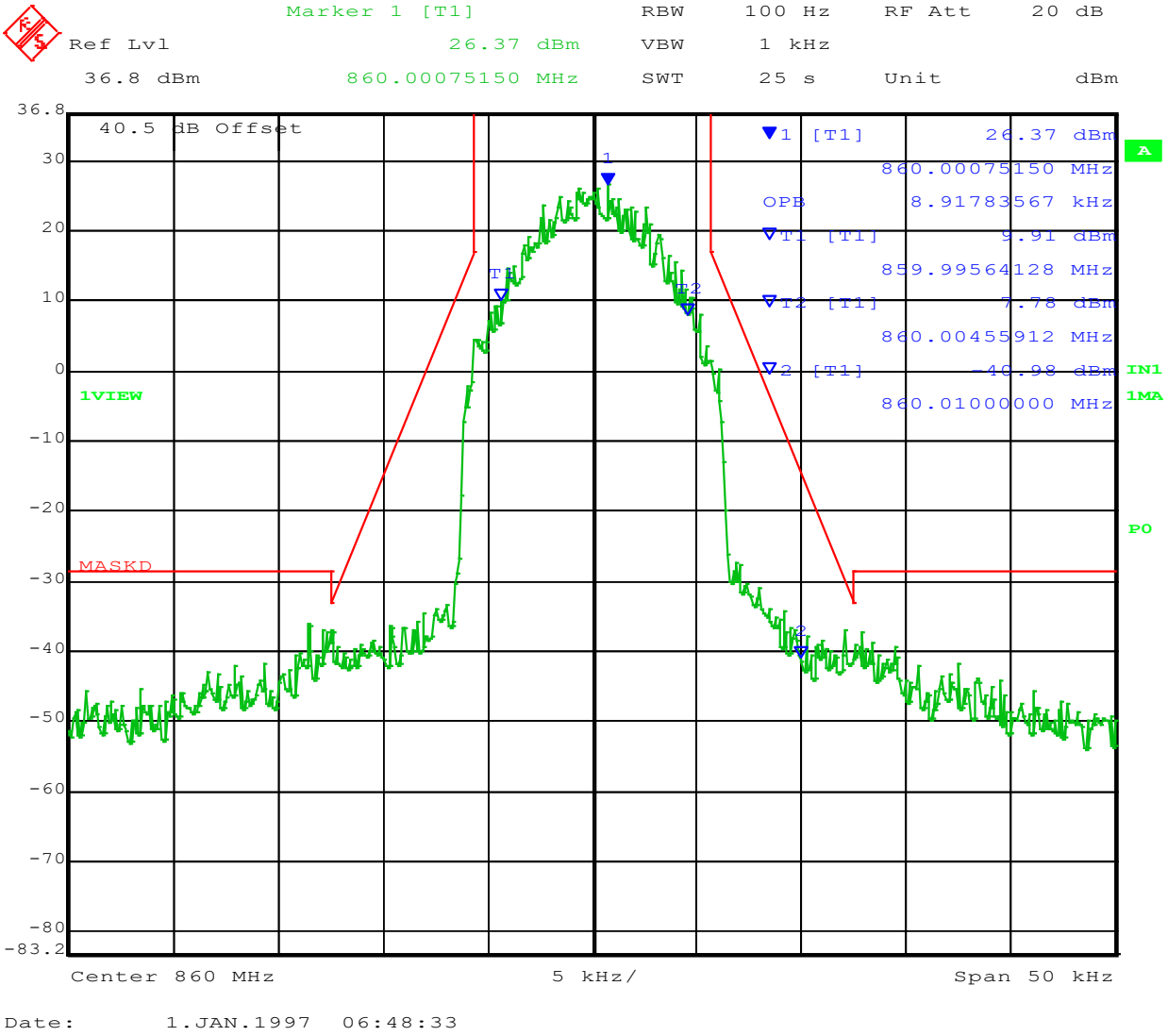
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 1 LSM, at AGC Threshold - Output 2



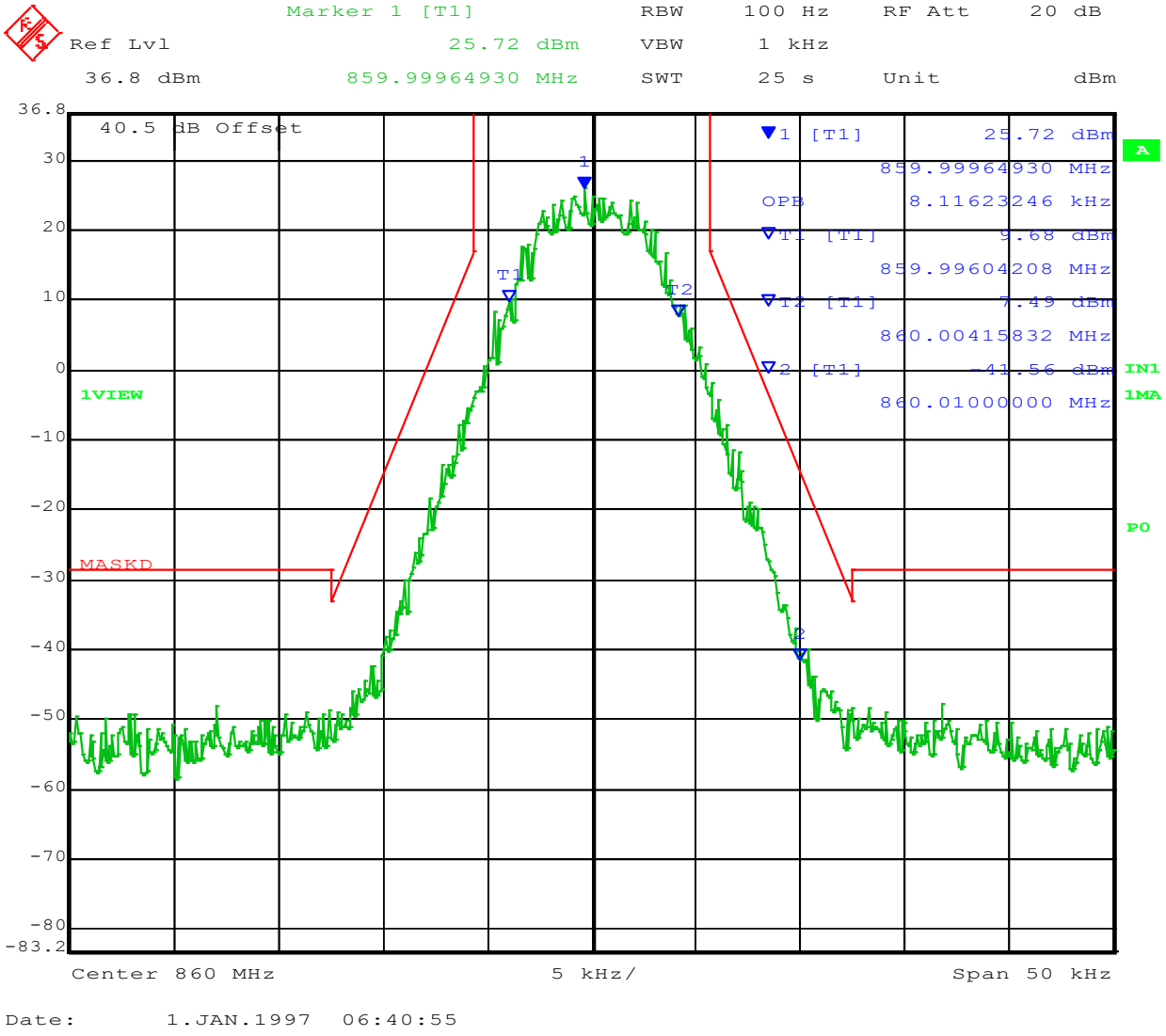
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 1 LSM, +3 dBm Above AGC Threshold - Output 2



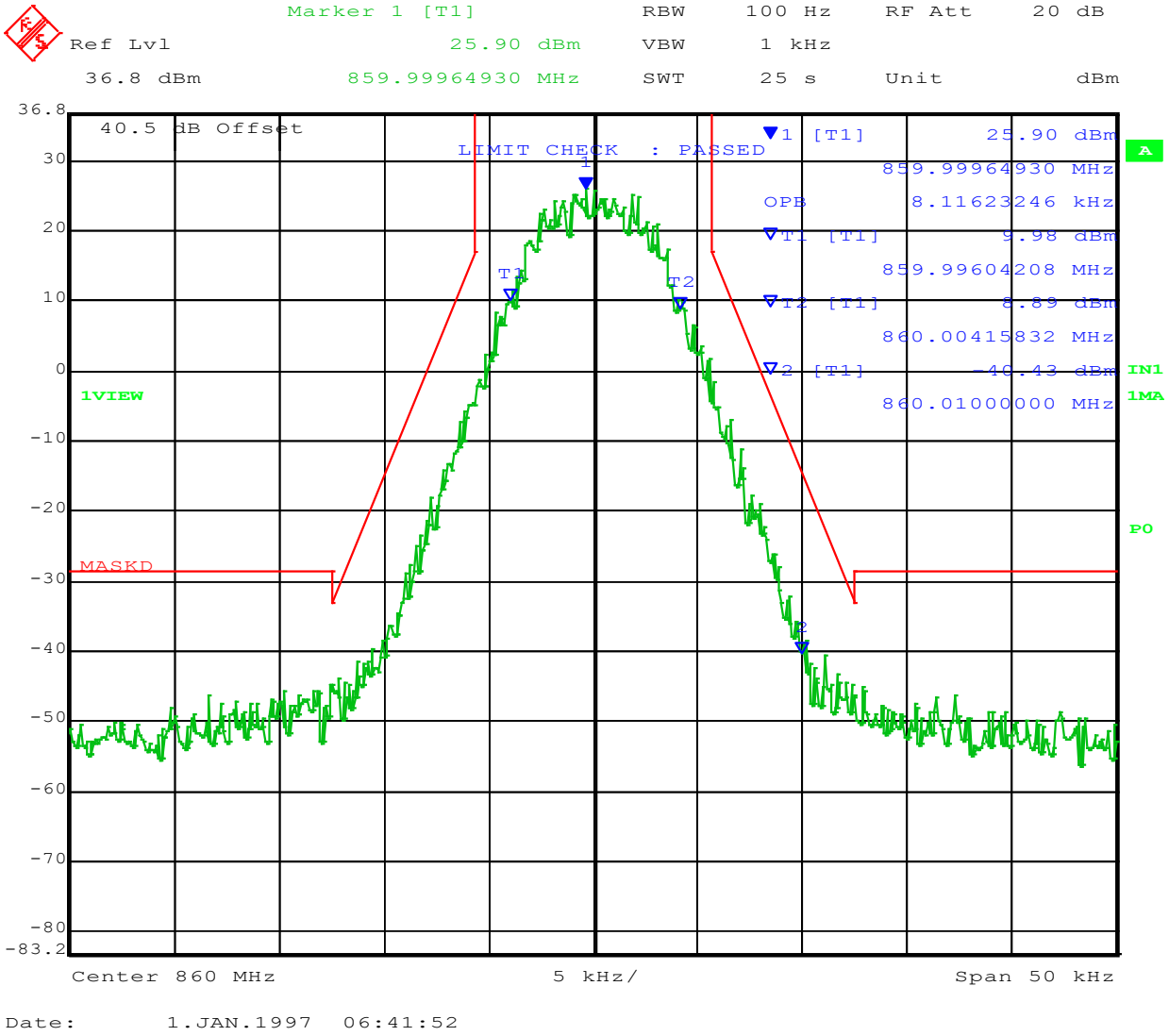
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 2 H-CPM, at AGC Threshold - Output 2



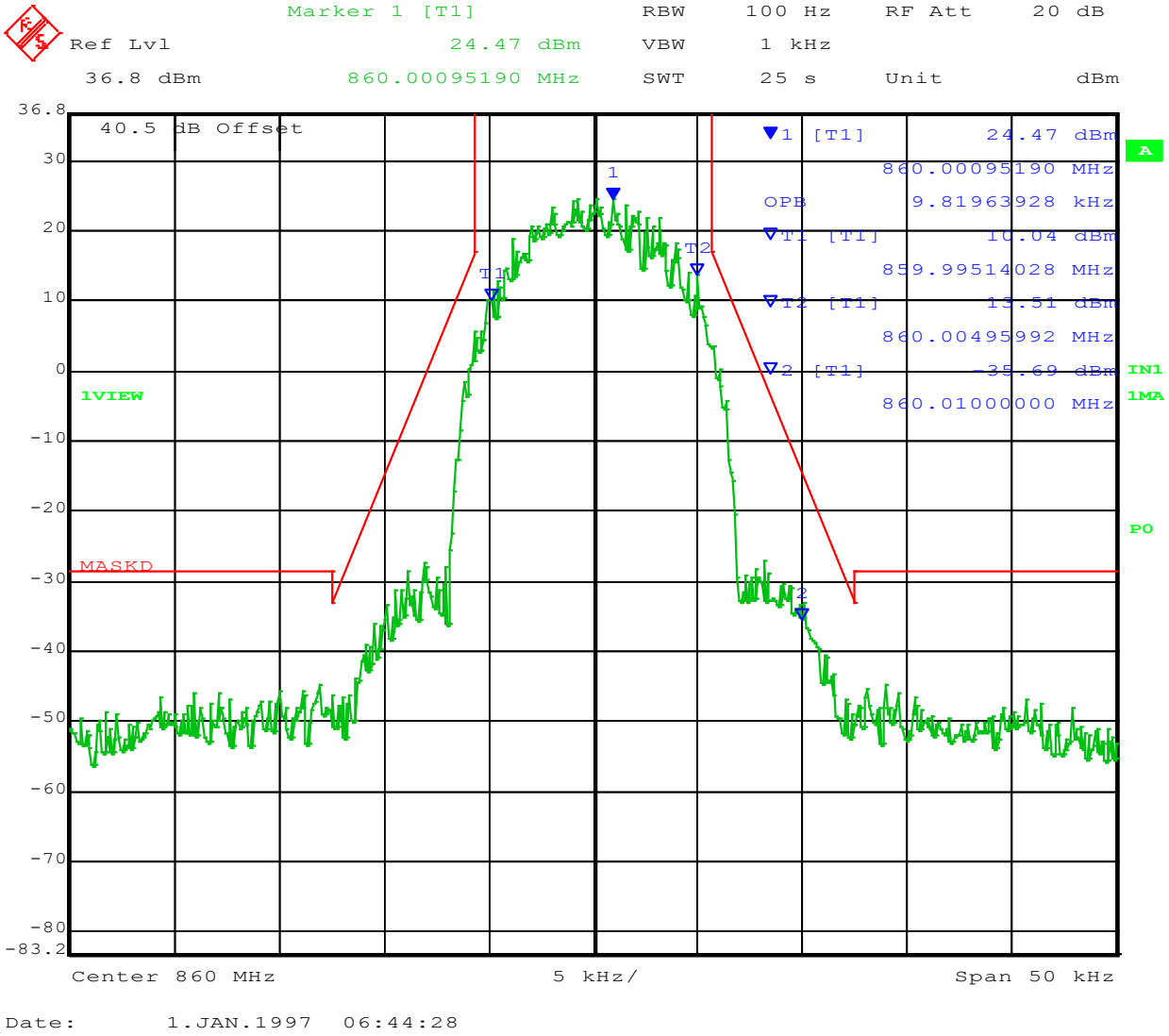
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 2 H-CPM, +3 dBm Above AGC Threshold - Output 2



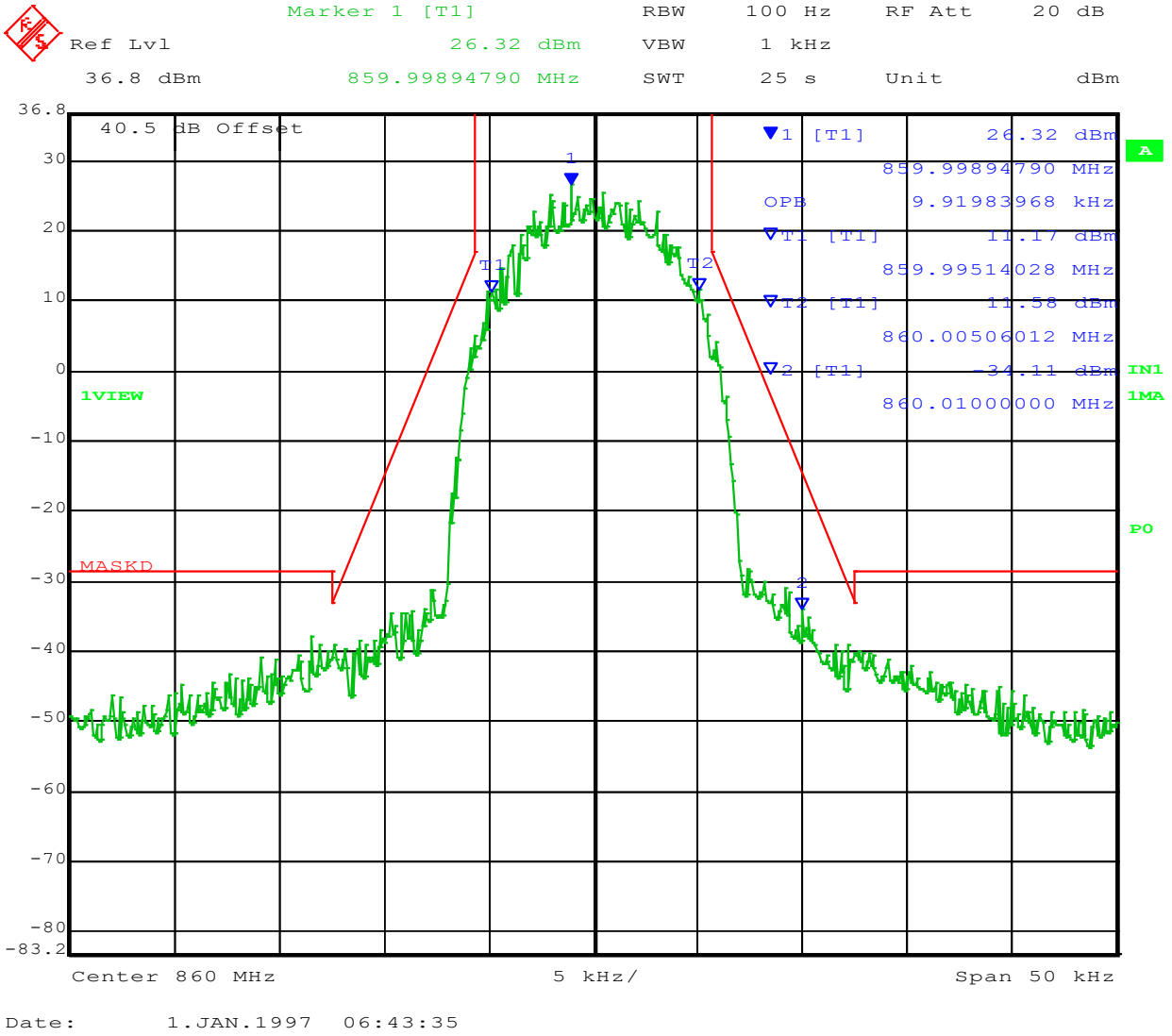
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 2 H-DQPSK, at AGC Threshold - Output 2



INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Test Data: P25 Phase 2 H-DQPSK, +3 dBm Above AGC Threshold - Output 2



NOISE FIGURE §4.6

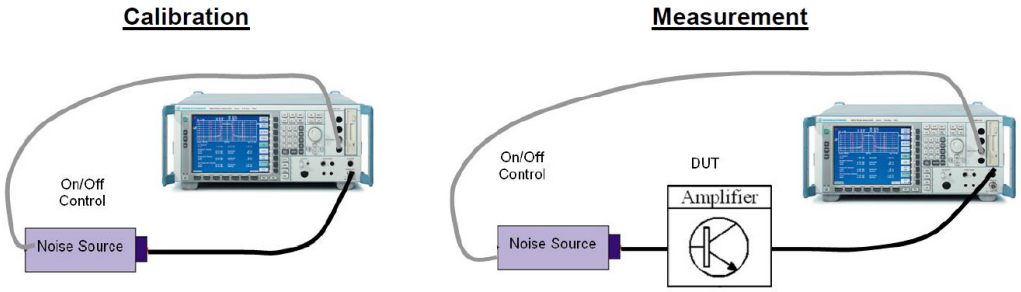
Rule Part No.: 47CFR90.219(e)(2)
KDB 935210-D05 v01r01 §4.6

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:



NOISE FIGURE §4.6

Test Data: Downlink Output 1 Noise Measurement

Fc (MHz)	Source ENR (dB)	$T^{ON\ source}$ (K)	$T^{OFF\ source}$ (K)
860	15.15	9782.880151	290

Step 1 Calibration of Noise Source with ESU 40

$N^{SA\ off}$		$N^{SA\ on}$		Y^{SA}	T^{SA}	NF^{SA}
dBm	fW	dBm	fW	Linear	Analyzer	dB
-135.72	0.03	-128.29	0.15	5.53	1803.94	8.59

Step 2 Noise Measurement with EUT

$N^{EUT\ \&\ SA\ off}$		$N^{EUT\ \&\ SA\ on}$		$Y^{EUT\ \&\ SA}$	$T^{EUT\ \&\ SA}$	NF
dBm	fW	dBm	fW	Linear	Cascade	dB
-64.56	349945.17	-34.09	389941986.68	1114.29	-281.47	-15.32

Step 3 Noise Figure Calcualtion for EUT

Gain	Gain	T^{EUT}
Num	dB	EUT
3207571544	95.06	-281.47

NF	Limit	Margin
dB	≤ dB	dB
-15.32	9.00	24.32

Test Data: Downlink Output 2 Noise Measurement

Fc (MHz)	Source ENR (dB)	$T^{ON\ source}$ (K)	$T^{OFF\ source}$ (K)
860	15.15	9782.880151	290

Step 1 Calibration of Noise Source with ESU 40

$N^{SA\ off}$		$N^{SA\ on}$		Y^{SA}	T^{SA}	NF^{SA}
dBm	fW	dBm	fW	Linear	Analyzer	dB
-135.72	0.03	-128.29	0.15	5.53	1803.94	8.59

Step 2 Noise Measurement with EUT

$N^{EUT\ \&\ SA\ off}$		$N^{EUT\ \&\ SA\ on}$		$Y^{EUT\ \&\ SA}$	$T^{EUT\ \&\ SA}$	NF
dBm	fW	dBm	fW	Linear	Cascade	dB
-56.35	2317394.65	-46.09	24603676.04	10.62	697.10	5.32

Step 3 Noise Figure Calcualtion for EUT

Gain	Gain	T^{EUT}
Num	dB	EUT
183486402.2	82.64	697.10

NF	Limit	Margin
dB	≤ dB	dB
5.32	9.00	3.68

Result: Meets Requirements

OUT OF BAND / OUT OF BLOCK EMISSIONS §4.7

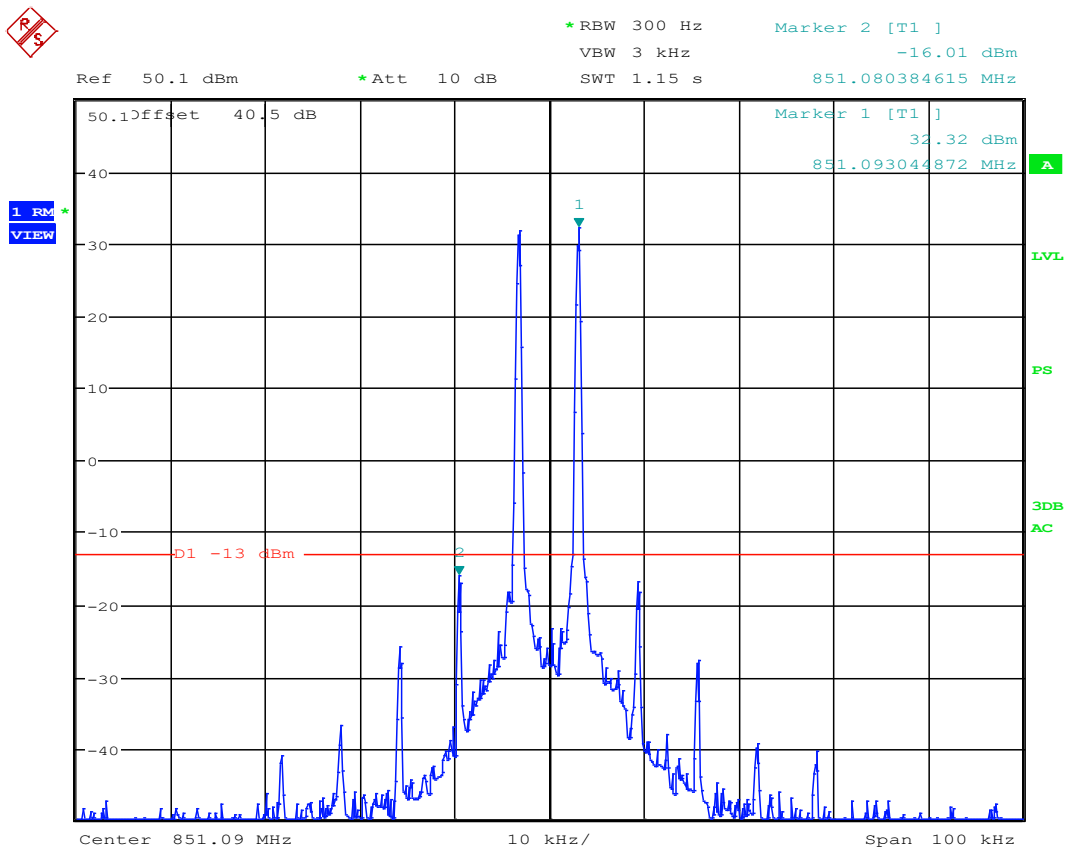
Rule Part No.: 47CFR90.210
KDB 935210-D05 v01r01 §4.7.2

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

INTERMODULATION §4.7.2 – OUTPUT 1

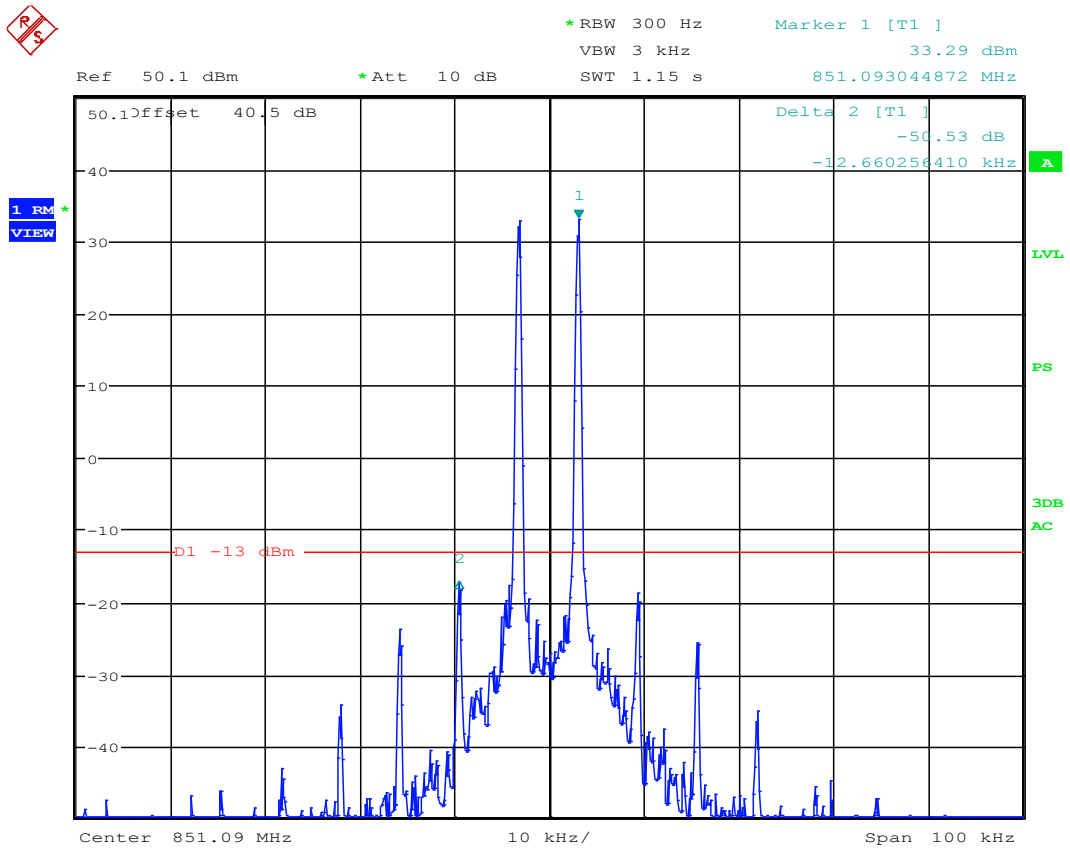
Test Data: 851.09 MHz, 6.25 kHz Intermodulation at AGC - Output 1



Date: 8.FEB.2018 16:26:17

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

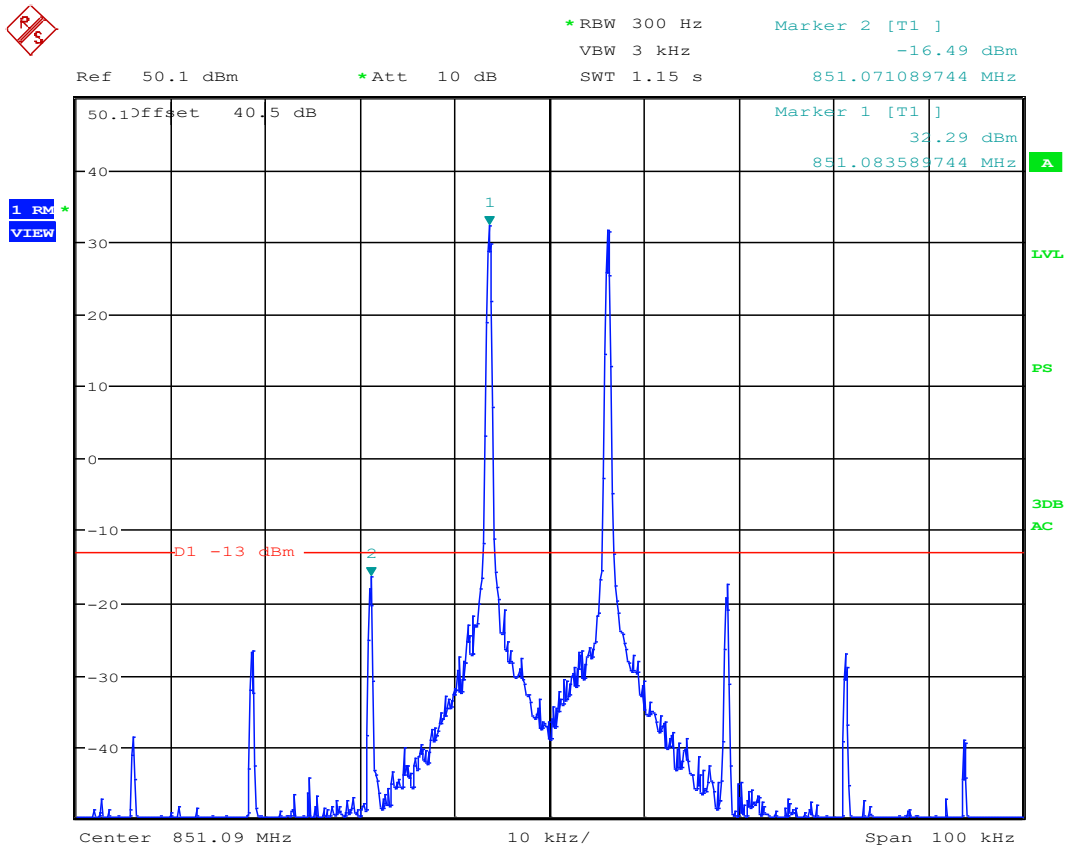
Test Data: 851.09 MHz, 6.25 kHz Intermodulation at +3 dBm Above AGC - Output 1



Date: 8.FEB.2018 16:24:31

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

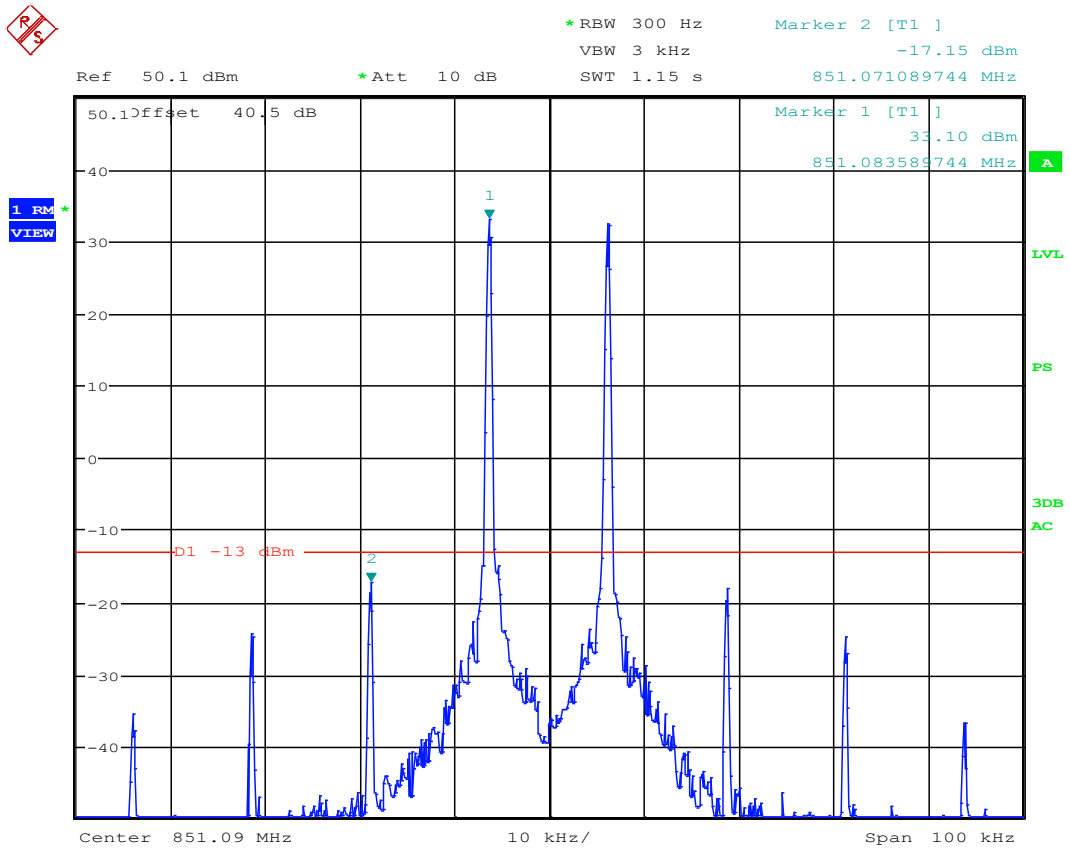
Test Data: 851.09 MHz, 12.5 kHz Intermodulation at AGC - Output 1



Date: 8.FEB.2018 16:27:08

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

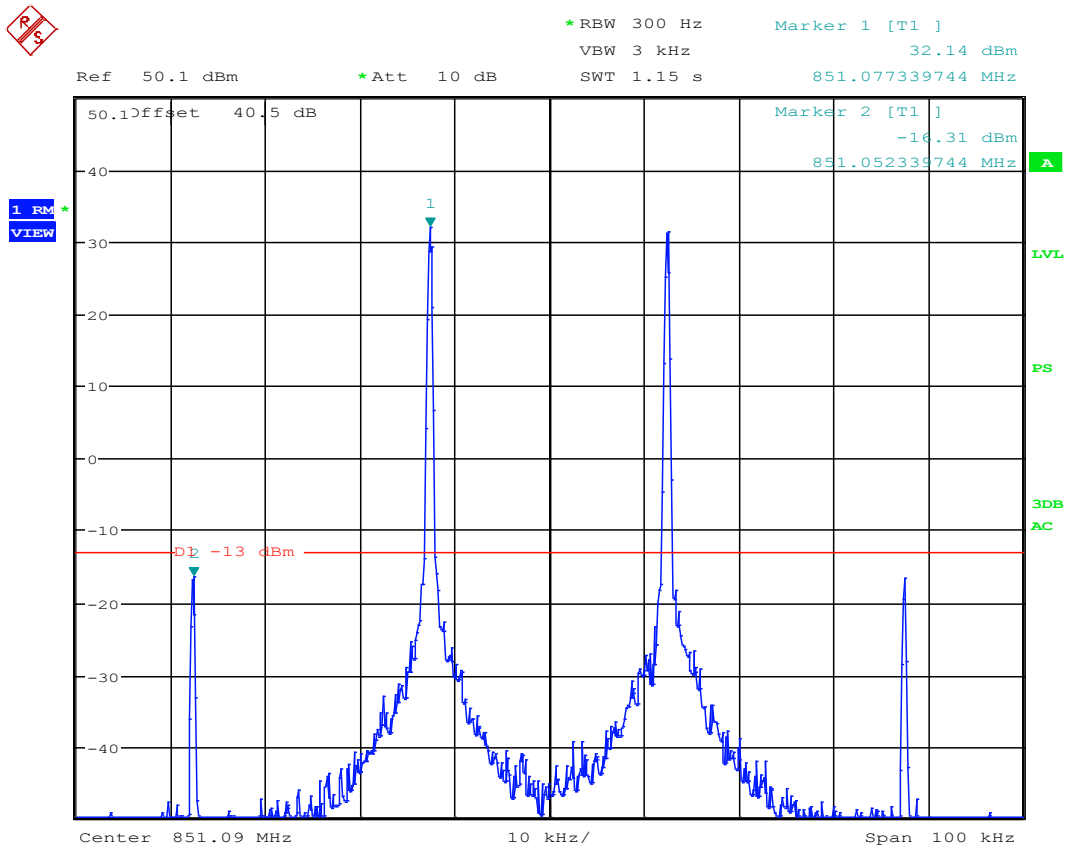
Test Data: 851.09 MHz, 12.5 kHz Intermodulation at +3 dBm Above AGC - Output 1



Date: 8.FEB.2018 16:27:44

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

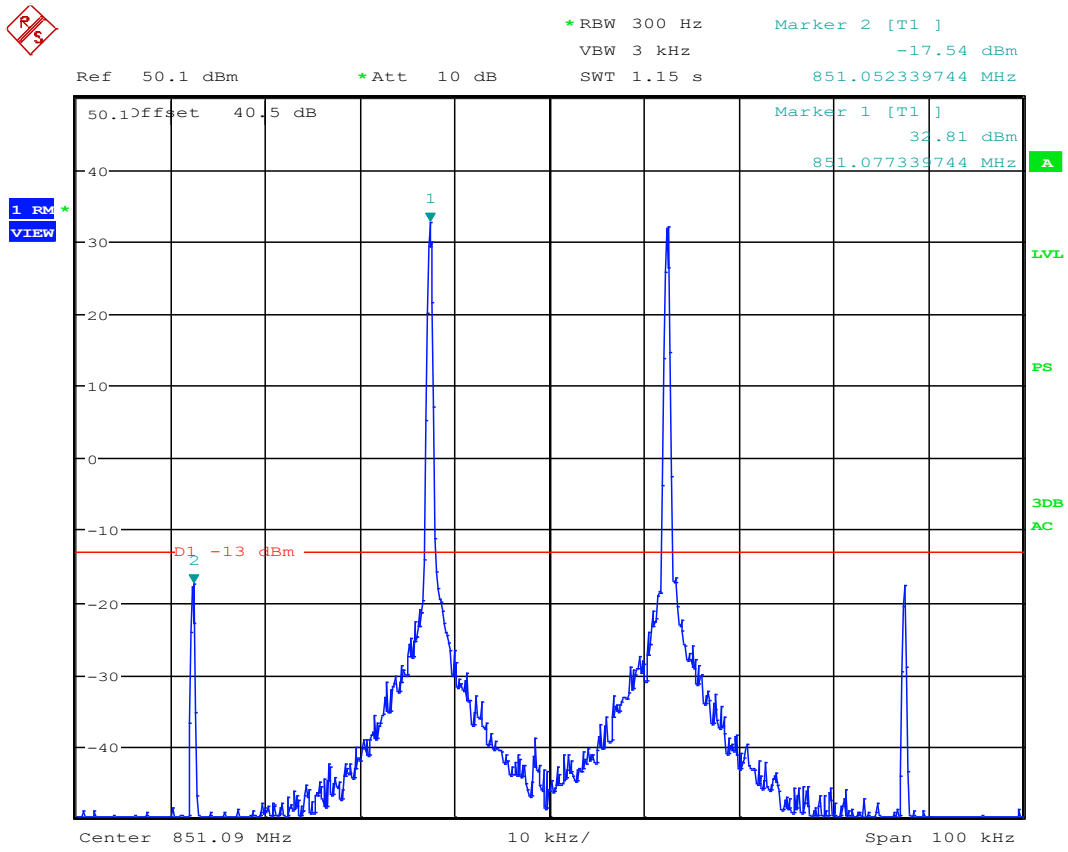
Test Data: 851.09 MHz, 25 kHz Intermodulation at AGC - Output 1



Date: 8.FEB.2018 16:29:43

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

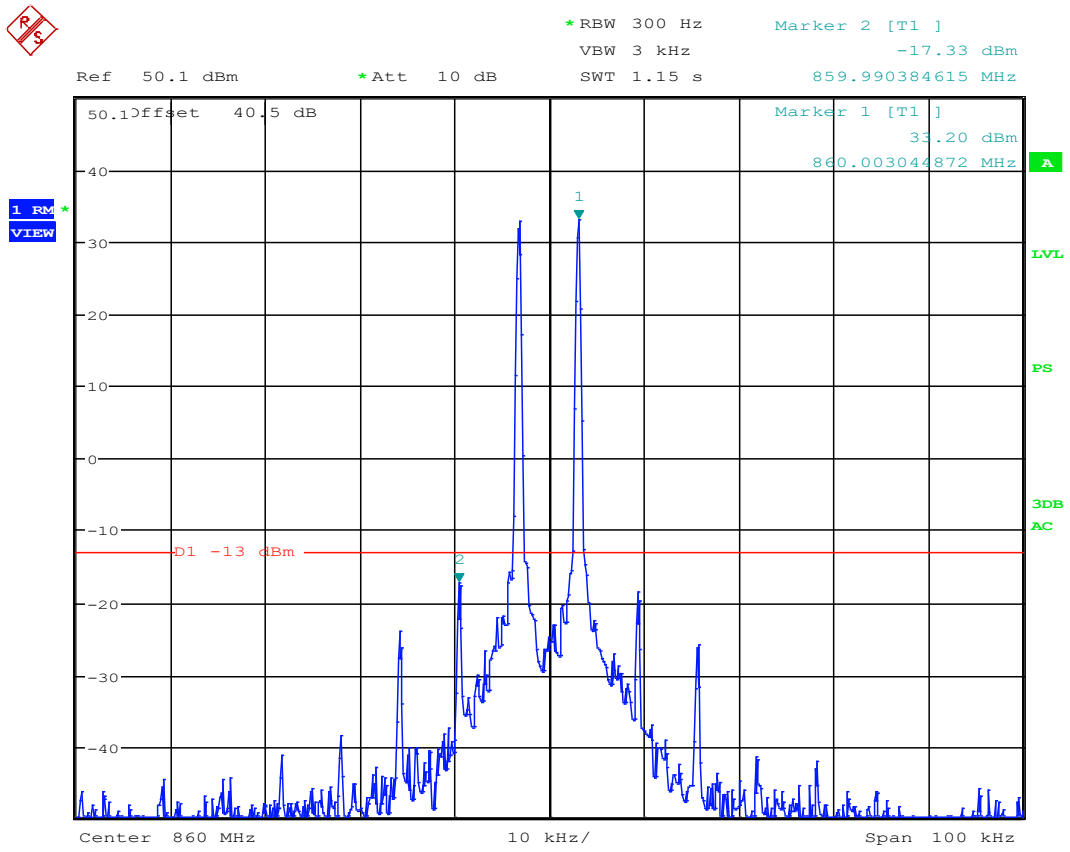
Test Data: 851.09 MHz, 25 kHz Intermodulation at +3 dBm Above AGC - Output 1



Date: 8.FEB.2018 16:28:47

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

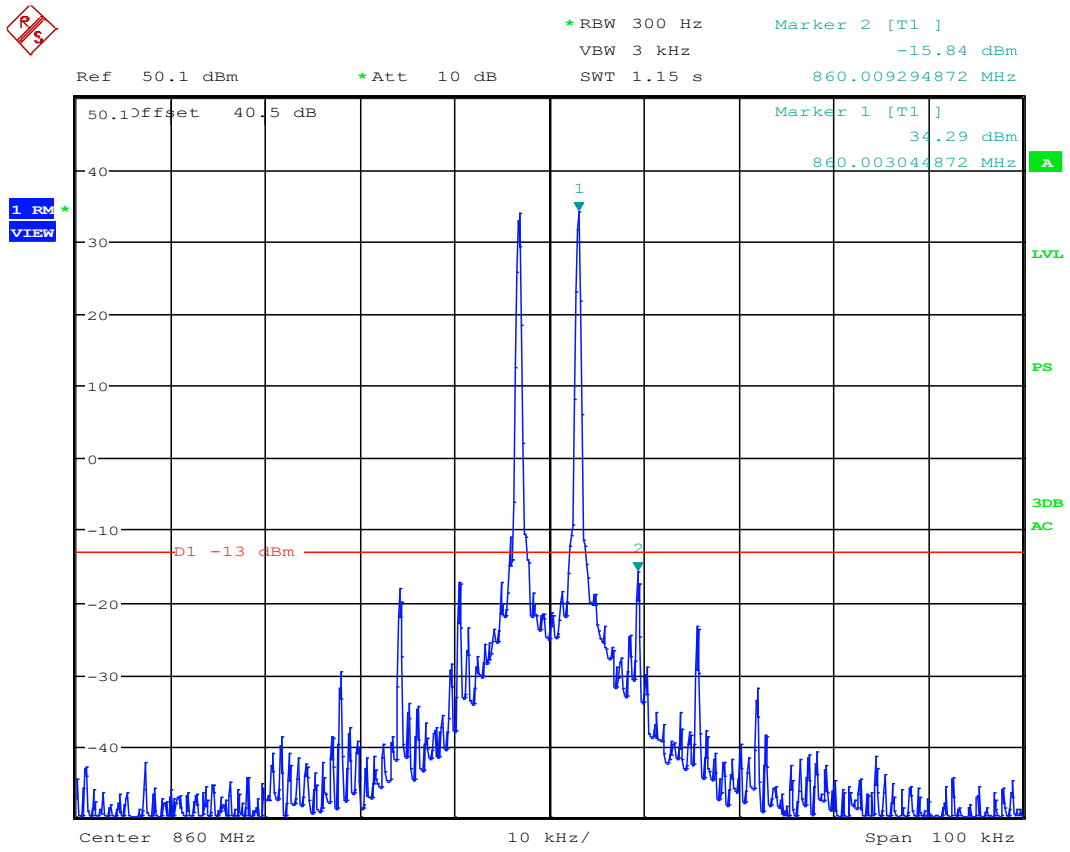
Test Data: 860.00 MHz, 6.25 kHz Intermodulation at AGC - Output 1



Date: 8.FEB.2018 16:31:29

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

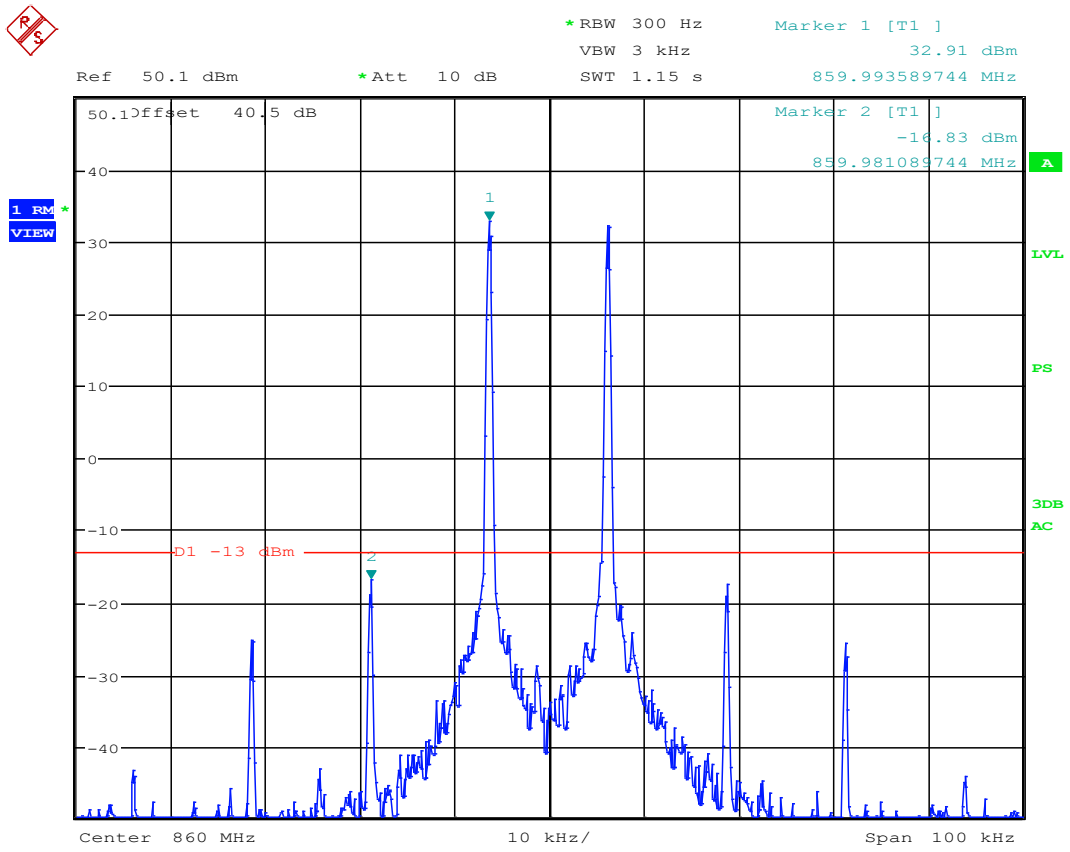
Test Data: 860.00 MHz, 6.25 kHz Intermodulation at +3 dBm Above AGC - Output 1



Date: 8.FEB.2018 16:32:32

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

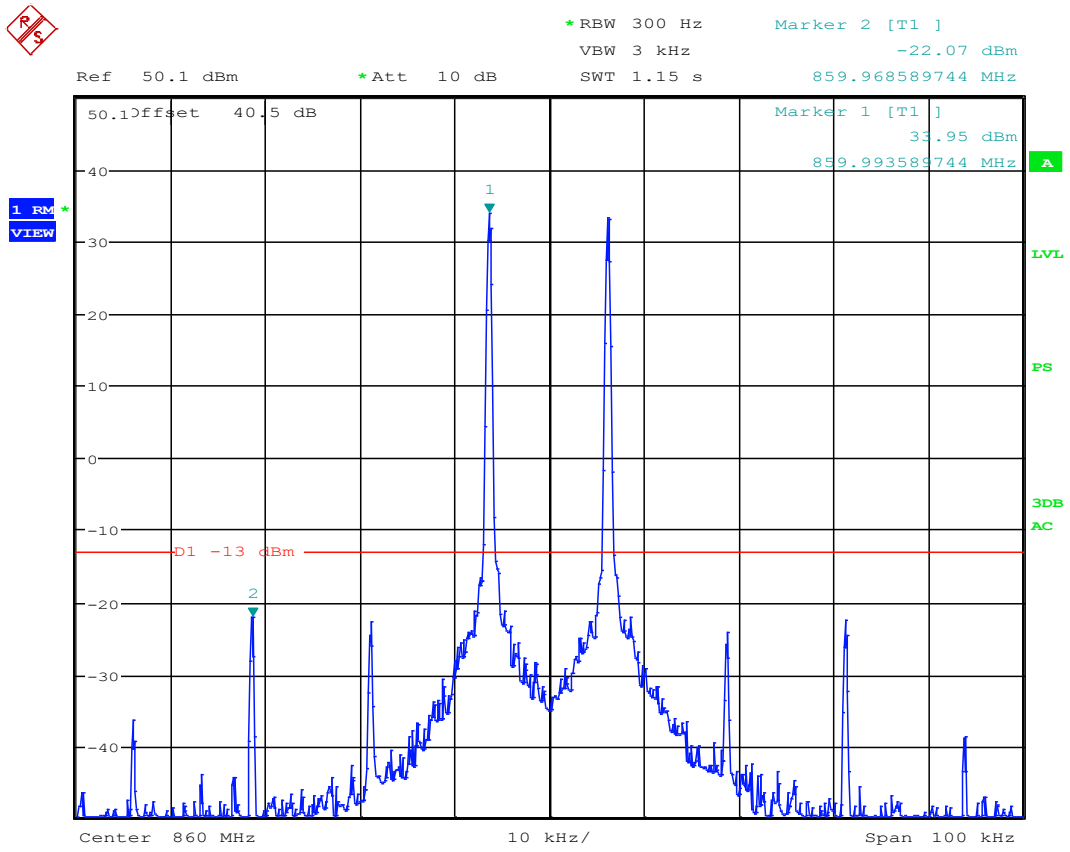
Test Data: 860.00 MHz, 12.5 kHz Intermodulation at AGC - Output 1



Date: 8.FEB.2018 16:34:33

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

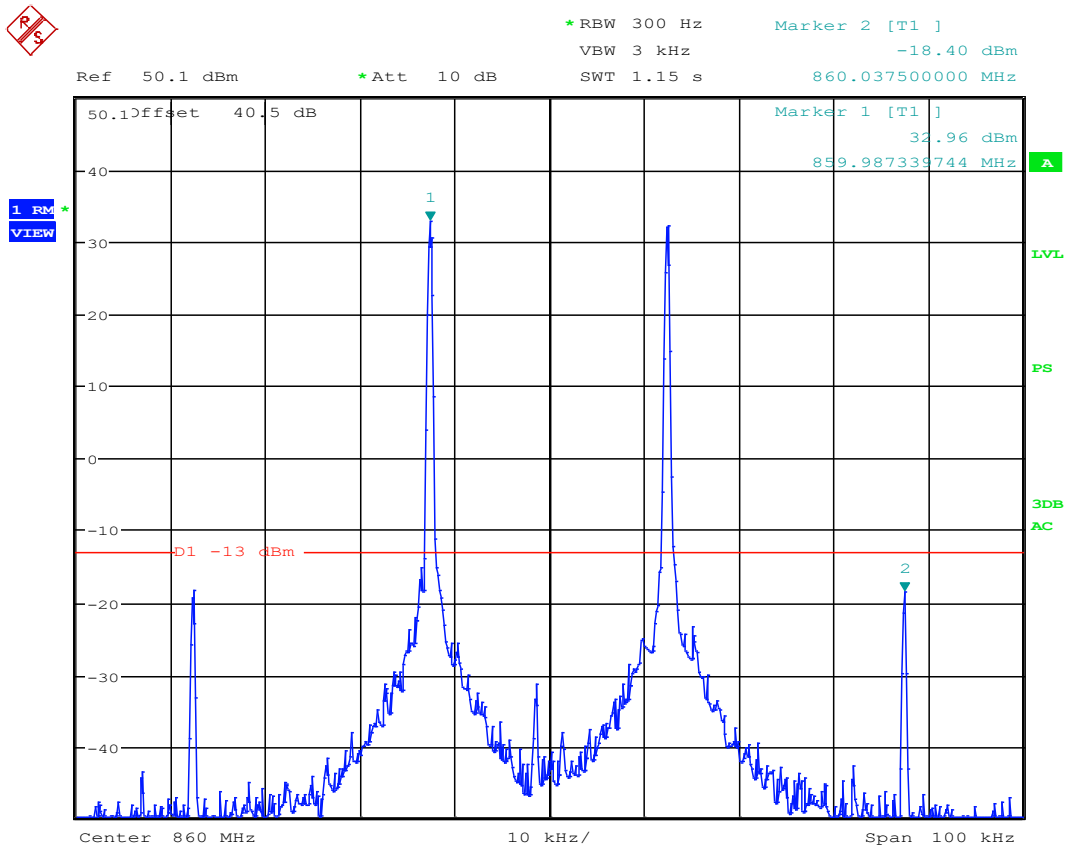
Test Data: 860.00 MHz, 12.5 kHz Intermodulation at +3 dBm Above AGC - Output 1



Date: 8.FEB.2018 16:33:44

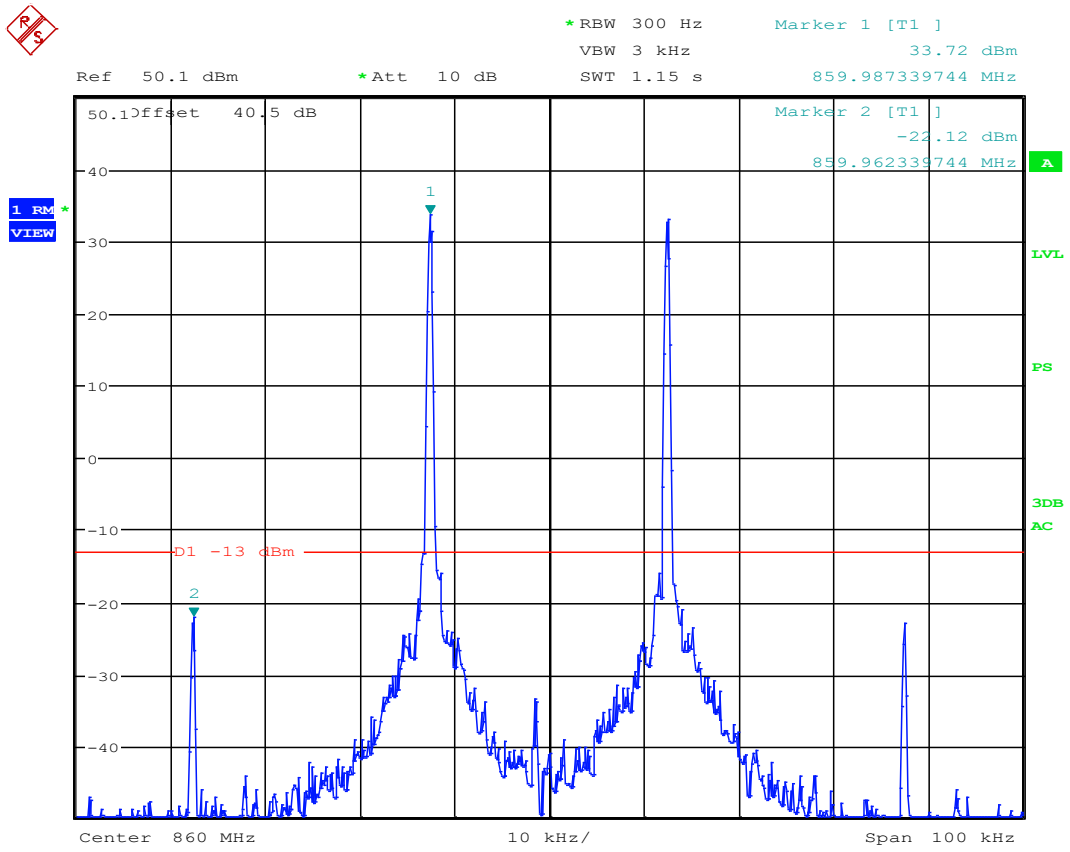
Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

Test Data: 860.00 MHz, 25 kHz Intermodulation at AGC - Output 1



Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

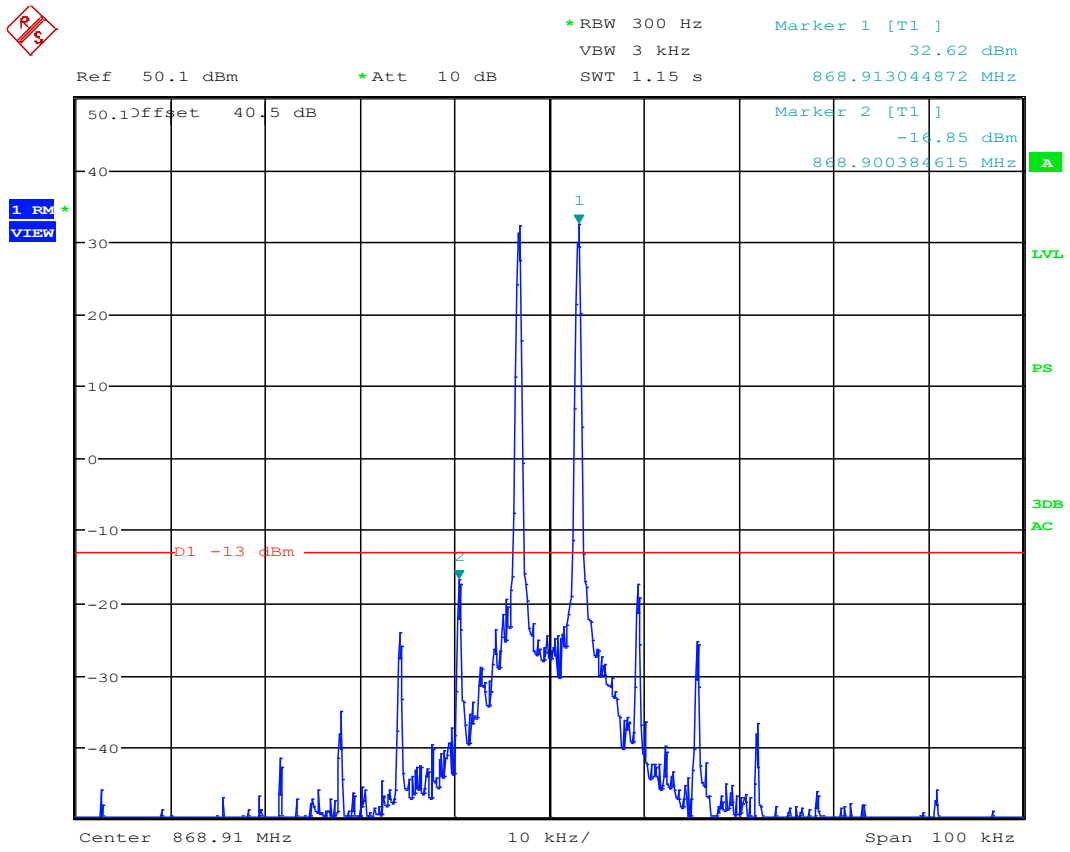
Test Data: 860.00 MHz, 25 kHz Intermodulation at +3 dBm Above AGC - Output 1



Date: 8.FEB.2018 16:36:41

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

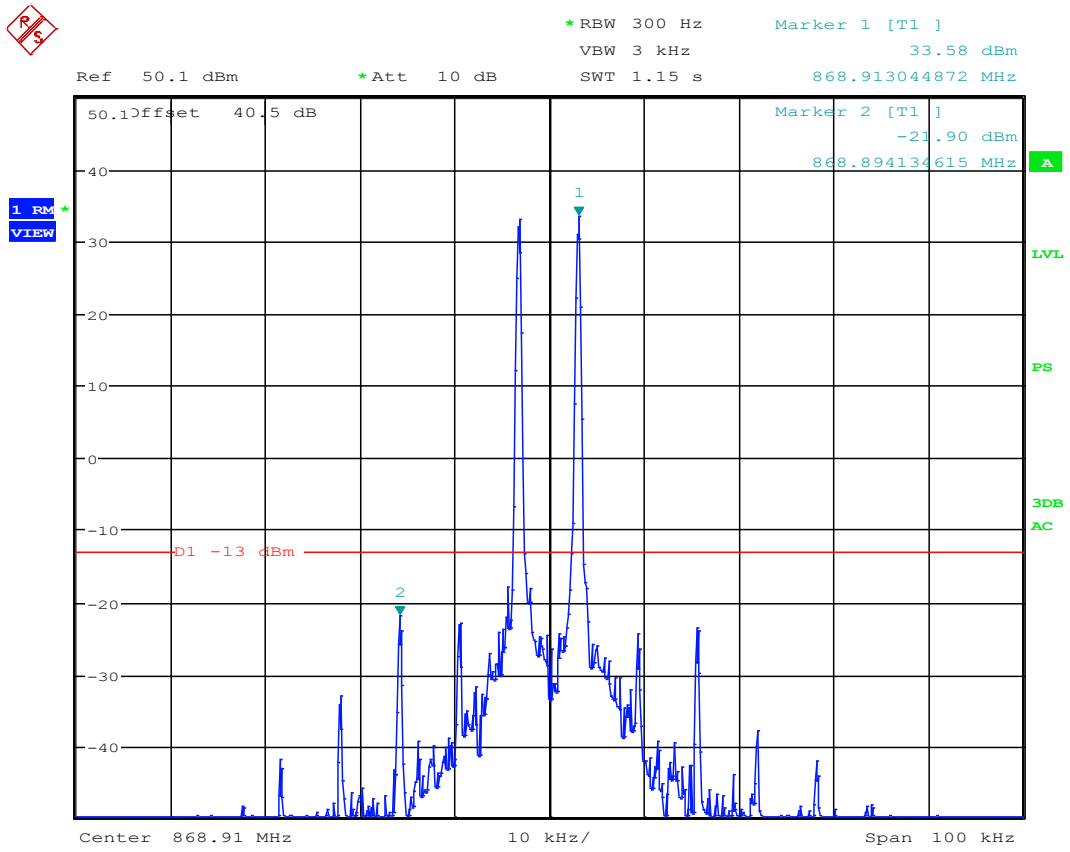
Test Data: 868.91 MHz, 6.25 kHz Intermodulation at AGC - Output 1



Date: 8.FEB.2018 16:38:55

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

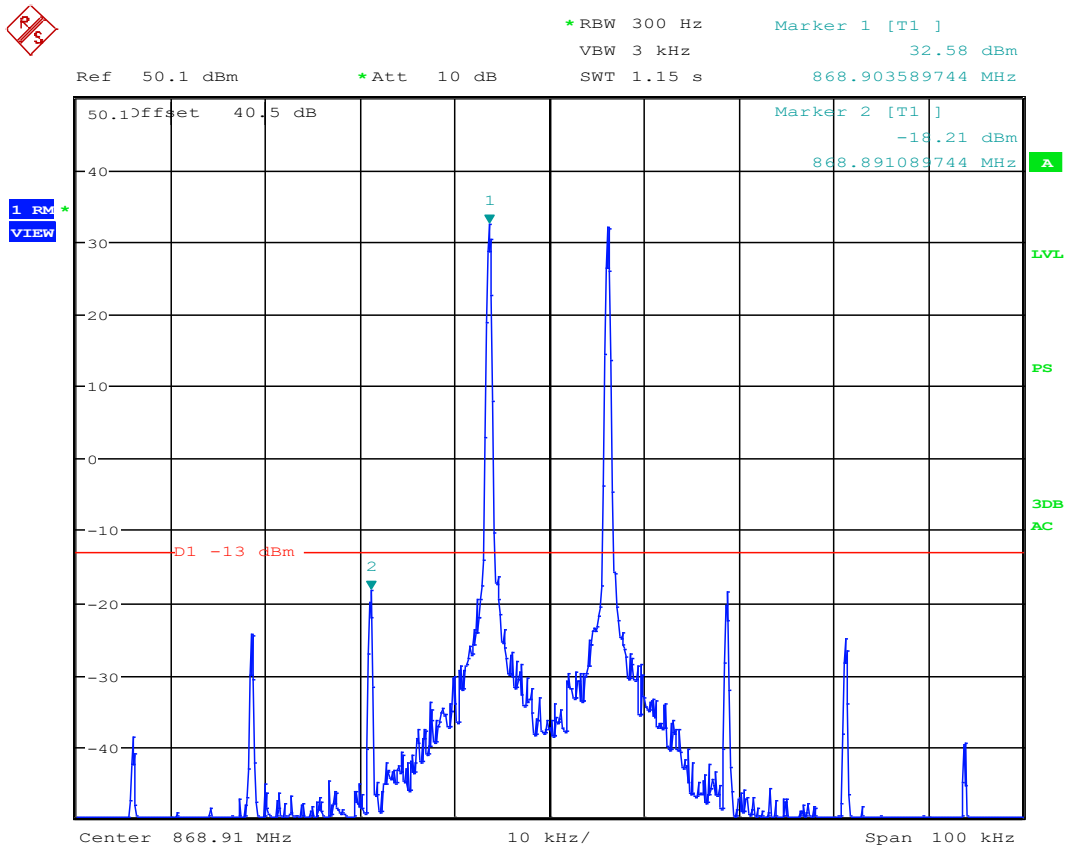
Test Data: 868.91 MHz, 6.25 kHz Intermodulation at +3 dBm Above AGC - Output 1



Date: 8.FEB.2018 16:38:03

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

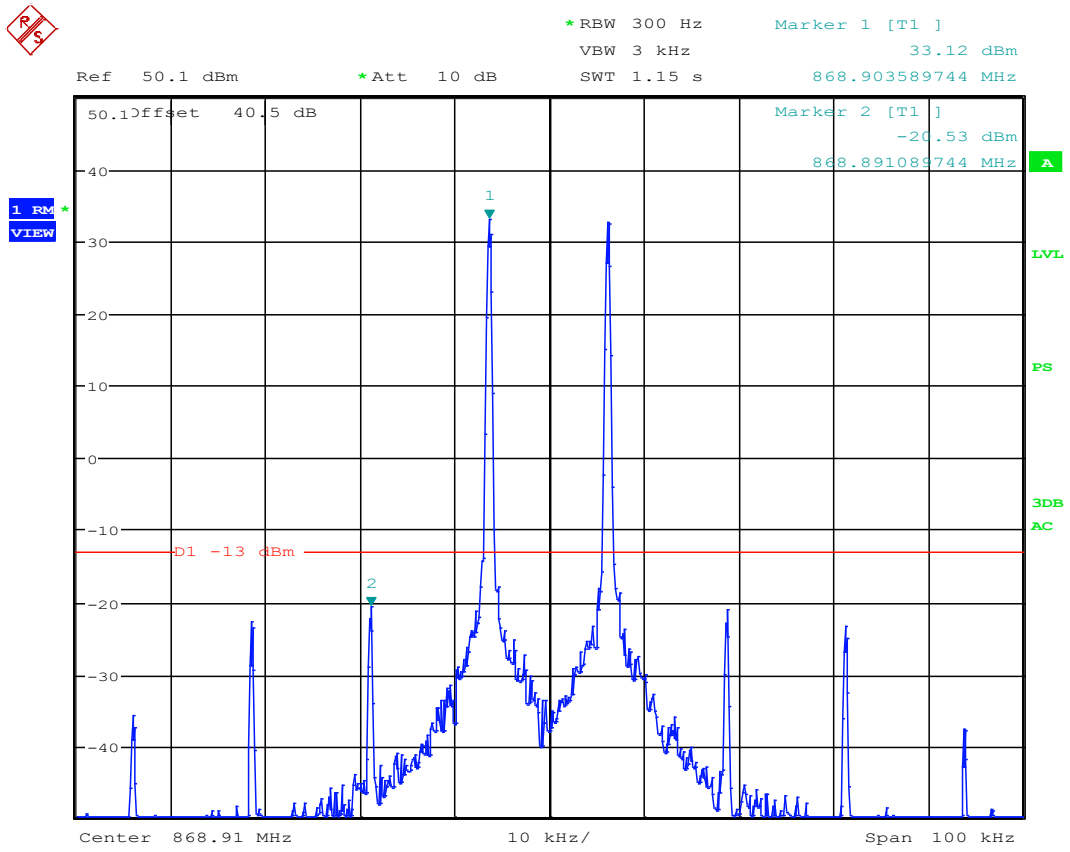
Test Data: 868.91 MHz, 12.5 kHz Intermodulation at AGC - Output 1



Date: 8.FEB.2018 16:39:46

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

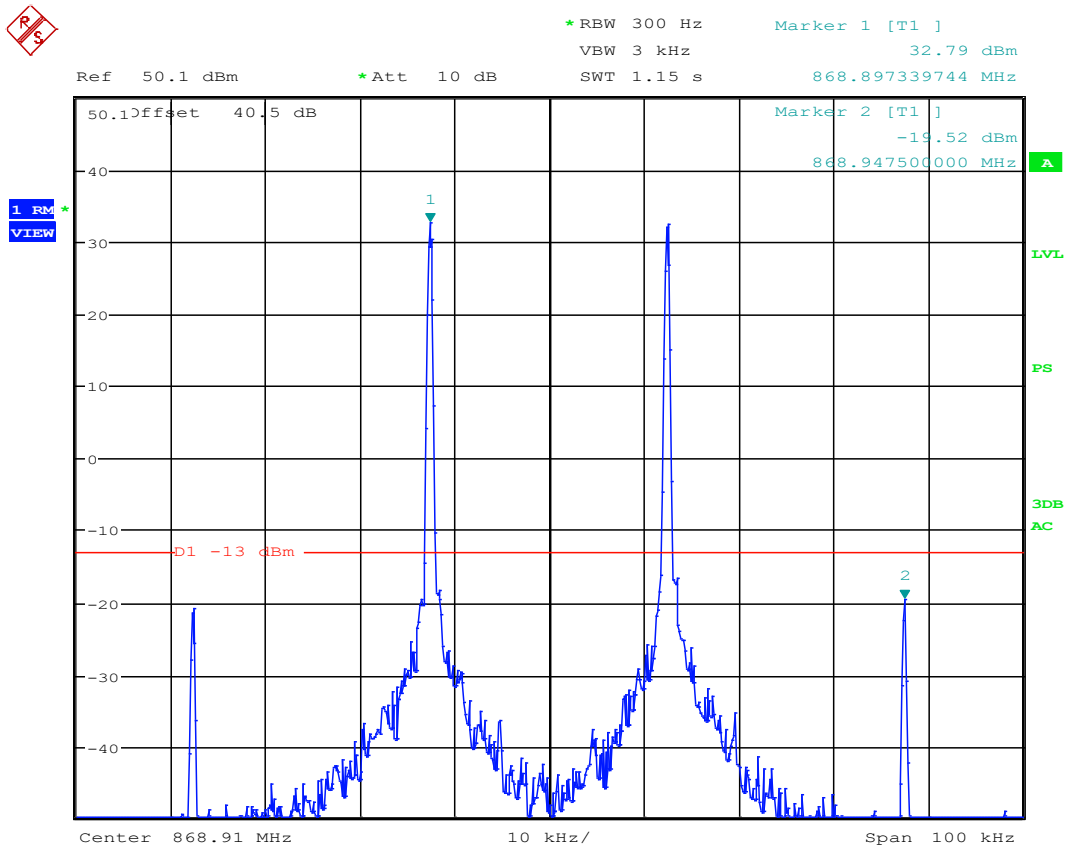
Test Data: 868.91 MHz, 12.5 kHz Intermodulation at +3 dBm Above AGC - Output 1



Date: 8.FEB.2018 16:40:28

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

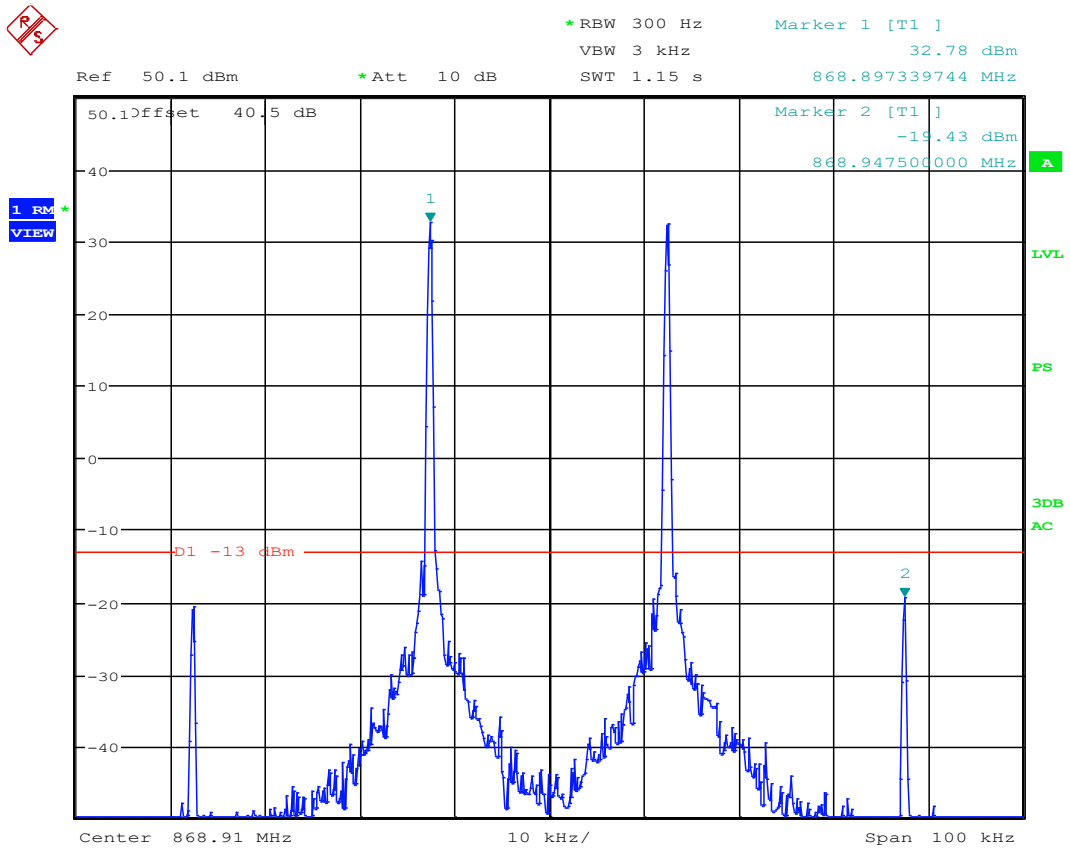
Test Data: 868.91 MHz, 25 kHz Intermodulation at AGC - Output 1



Date: 8.FEB.2018 16:41:56

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

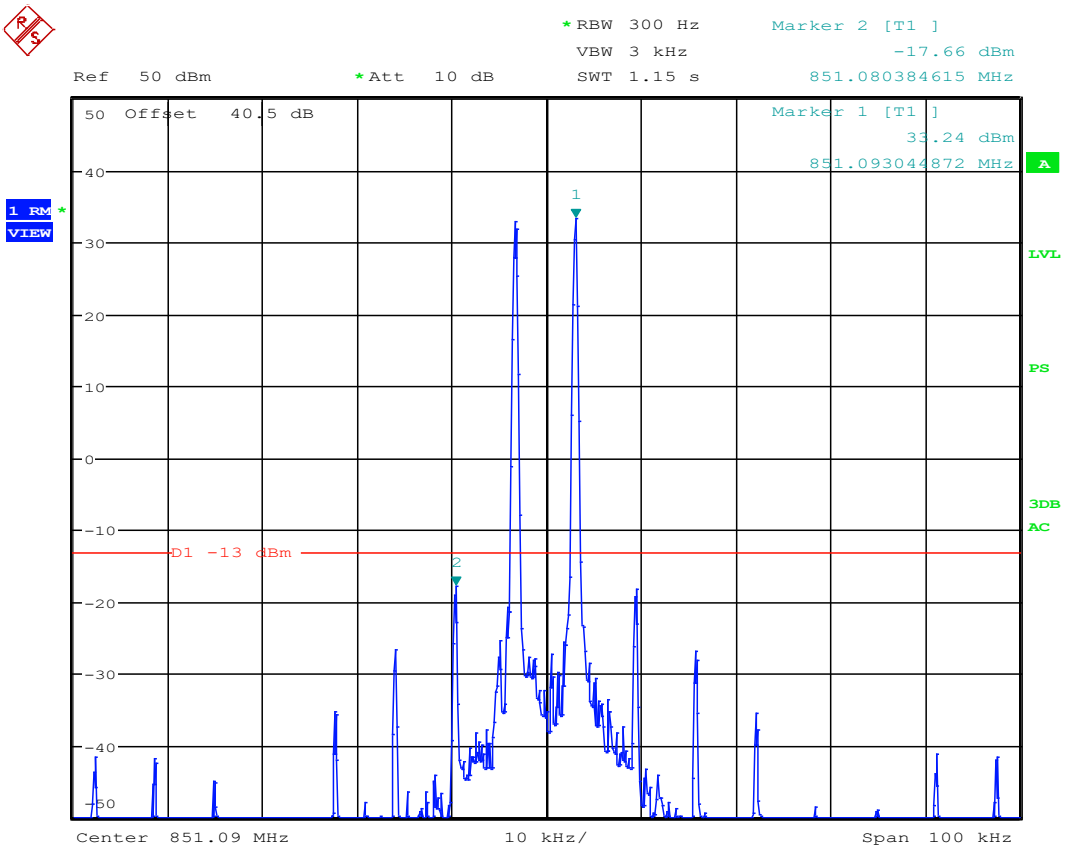
Test Data: 868.91 MHz, 25 kHz Intermodulation at +3 dBm Above AGC - Output 1



Date: 8.FEB.2018 16:41:11

INTERMODULATION §4.7.2 – OUTPUT 2

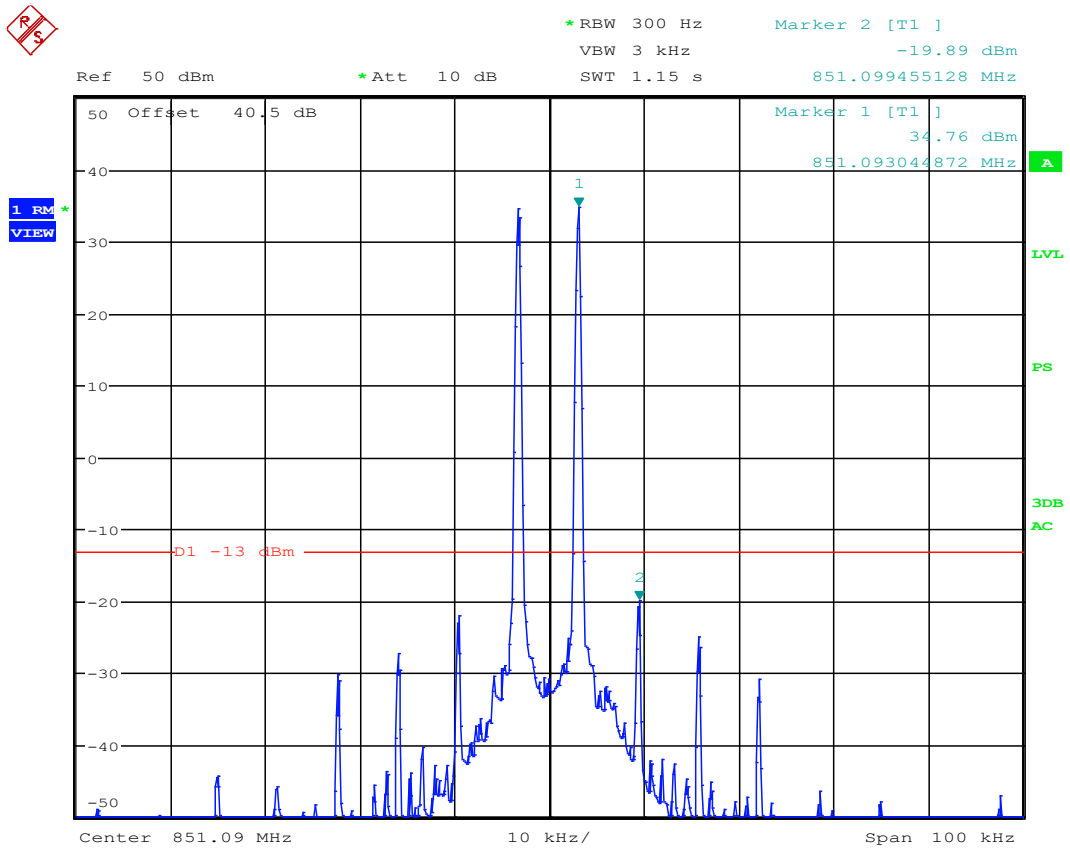
Test Data: 851.09 MHz, 6.25 kHz Intermodulation at AGC - Output 2



Date: 9.FEB.2018 09:33:46

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

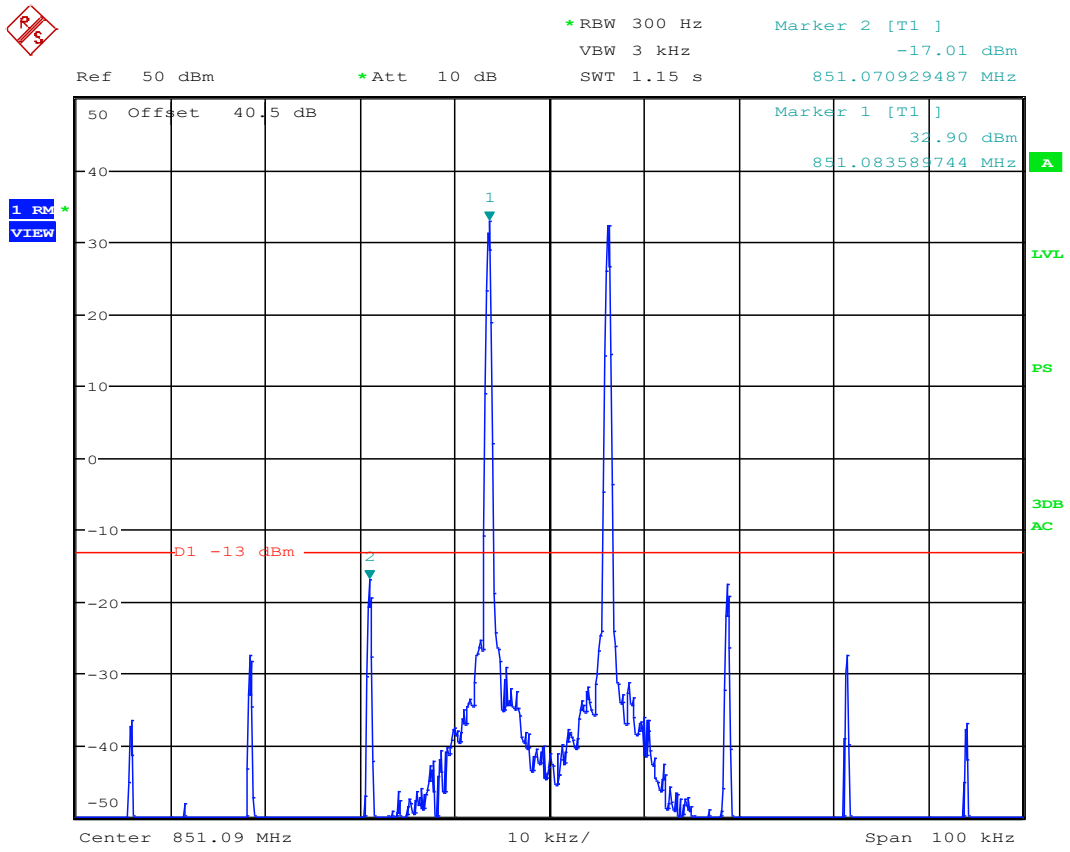
Test Data: 851.09 MHz, 6.25 kHz Intermodulation at +3 dBm Above AGC - Output 2



Date: 9.FEB.2018 09:38:37

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

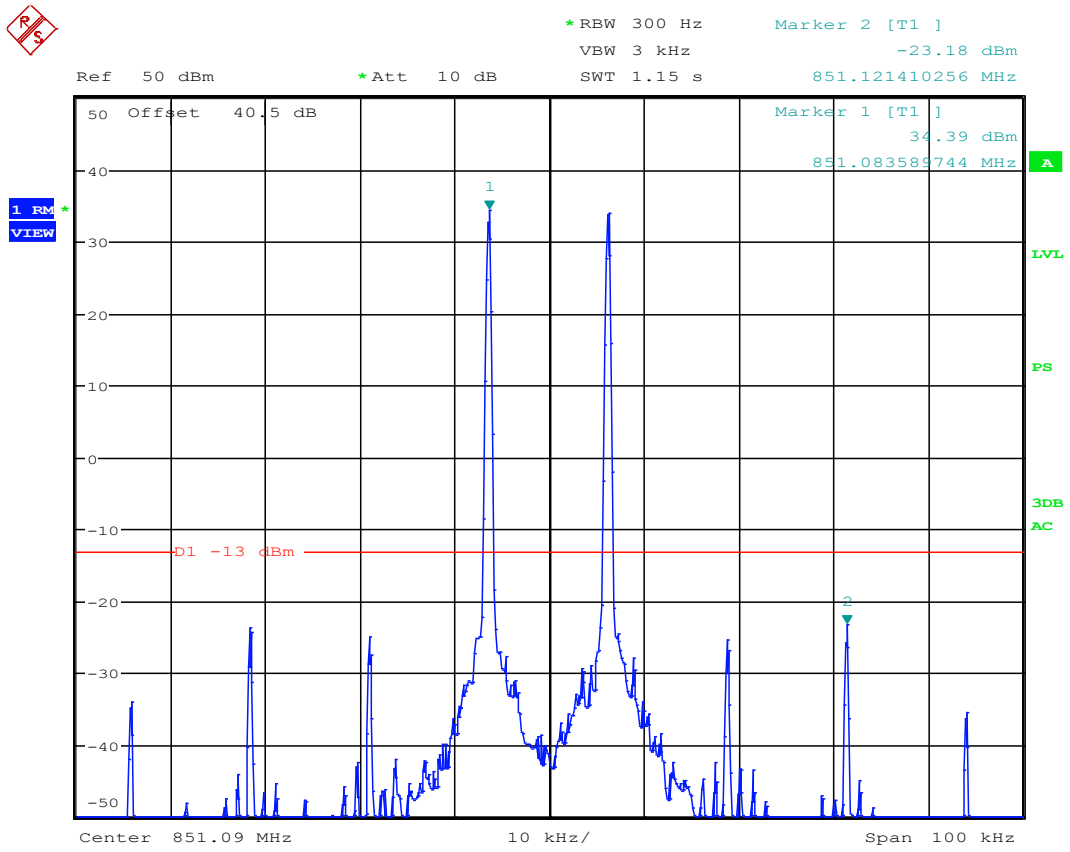
Test Data: 851.09 MHz, 12.5 kHz Intermodulation at AGC - Output 2



Date: 9.FEB.2018 09:40:14

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

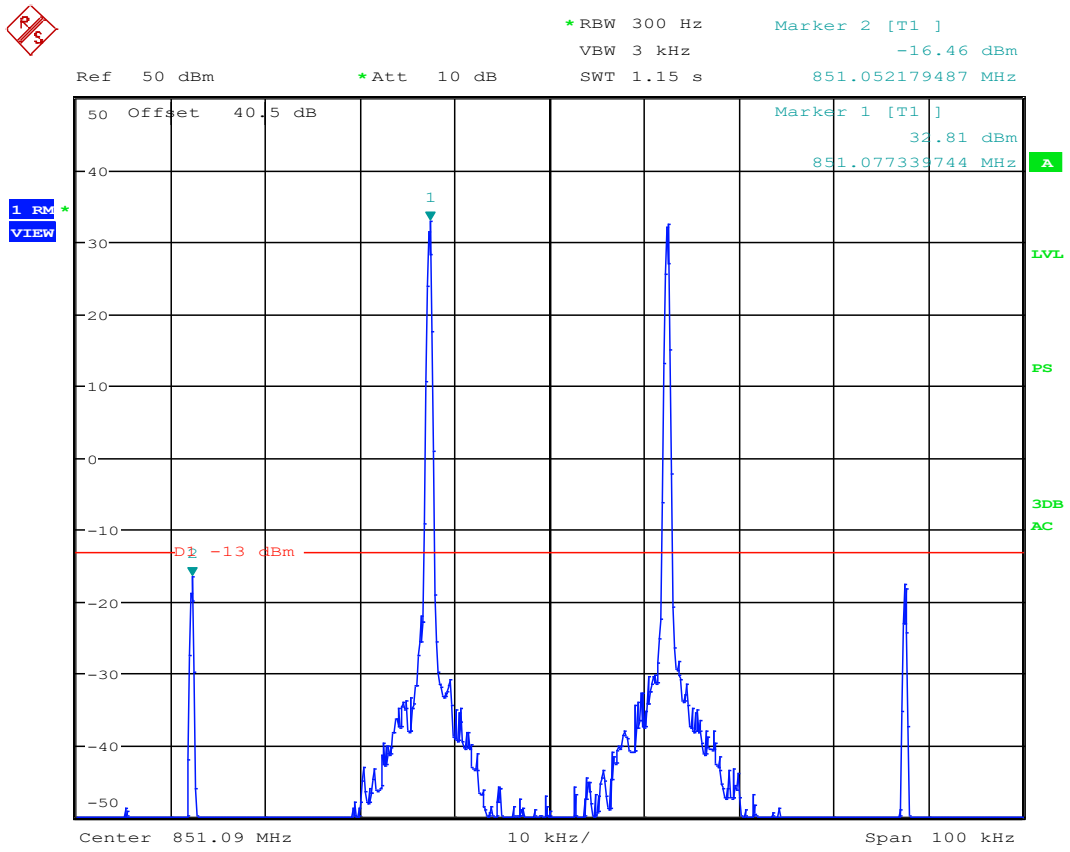
Test Data: 851.09 MHz, 12.5 kHz Intermodulation at +3 dBm Above AGC - Output 2



Date: 9.FEB.2018 09:39:32

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

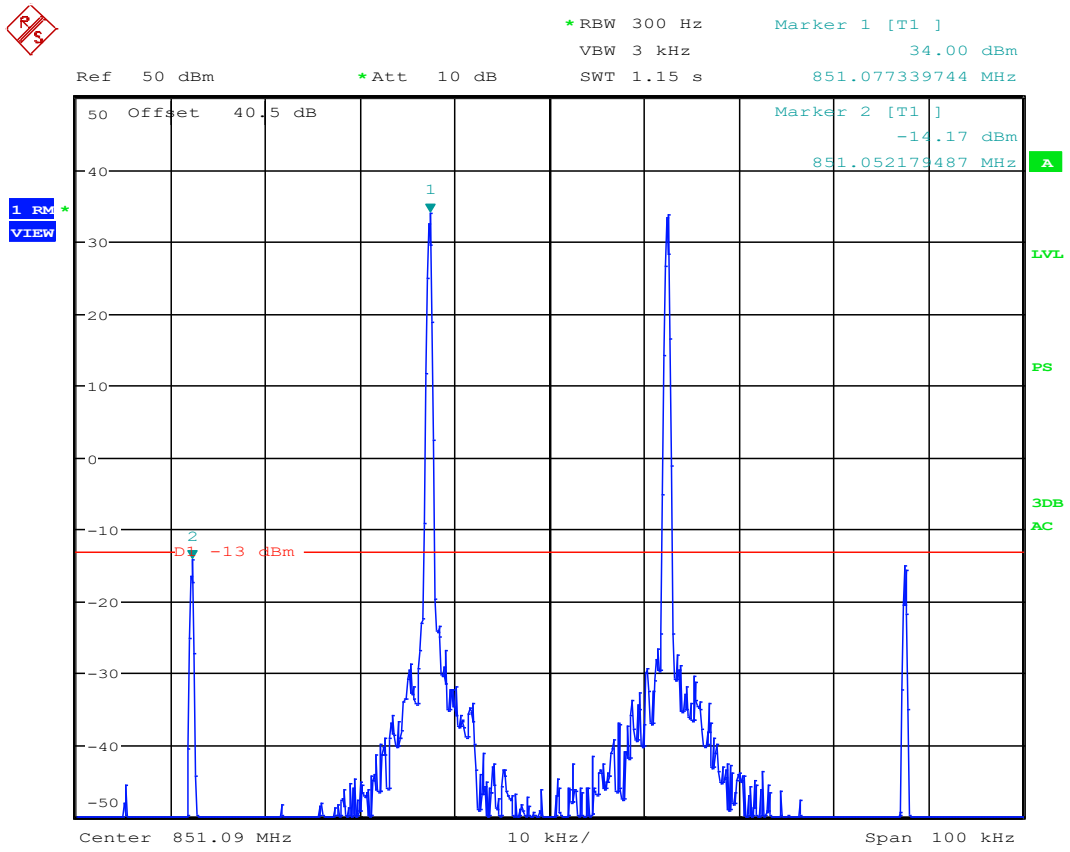
Test Data: 851.09 MHz, 25 kHz Intermodulation at AGC - Output 2



Date: 9.FEB.2018 09:40:53

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

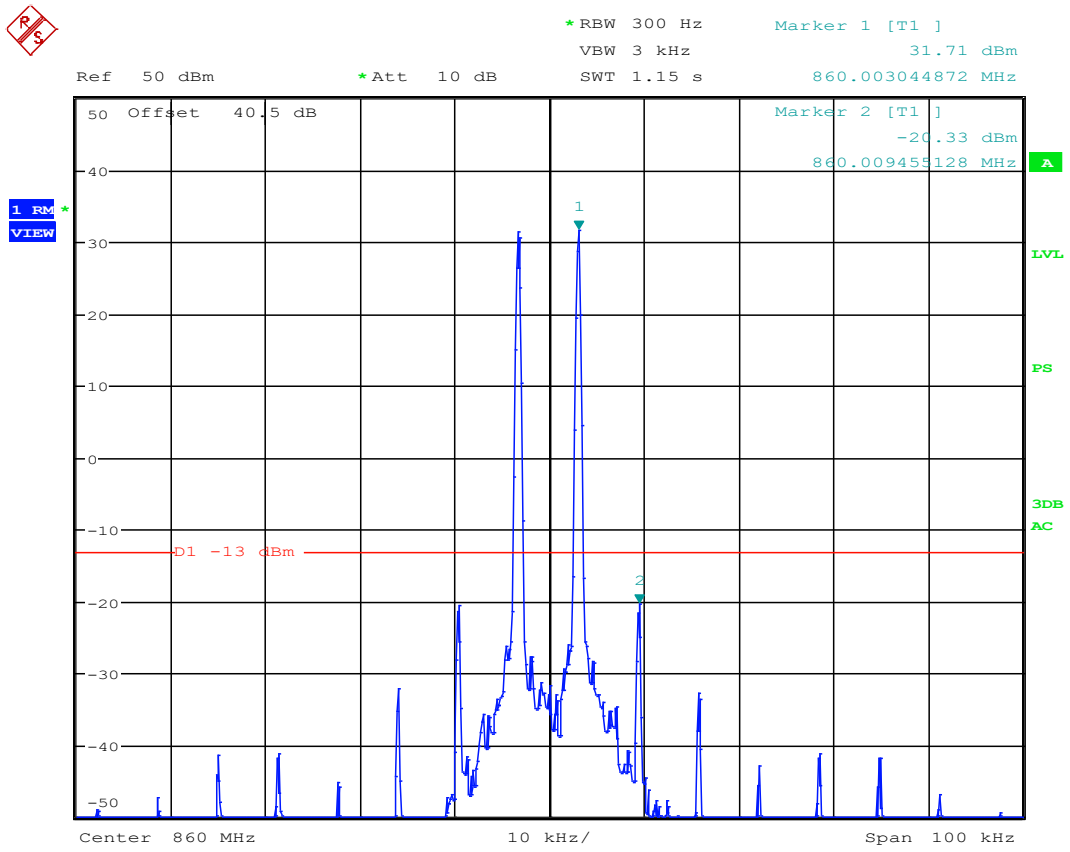
Test Data: 851.09 MHz, 25 kHz Intermodulation at +3 dBm Above AGC - Output 2



Date: 9.FEB.2018 09:42:05

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

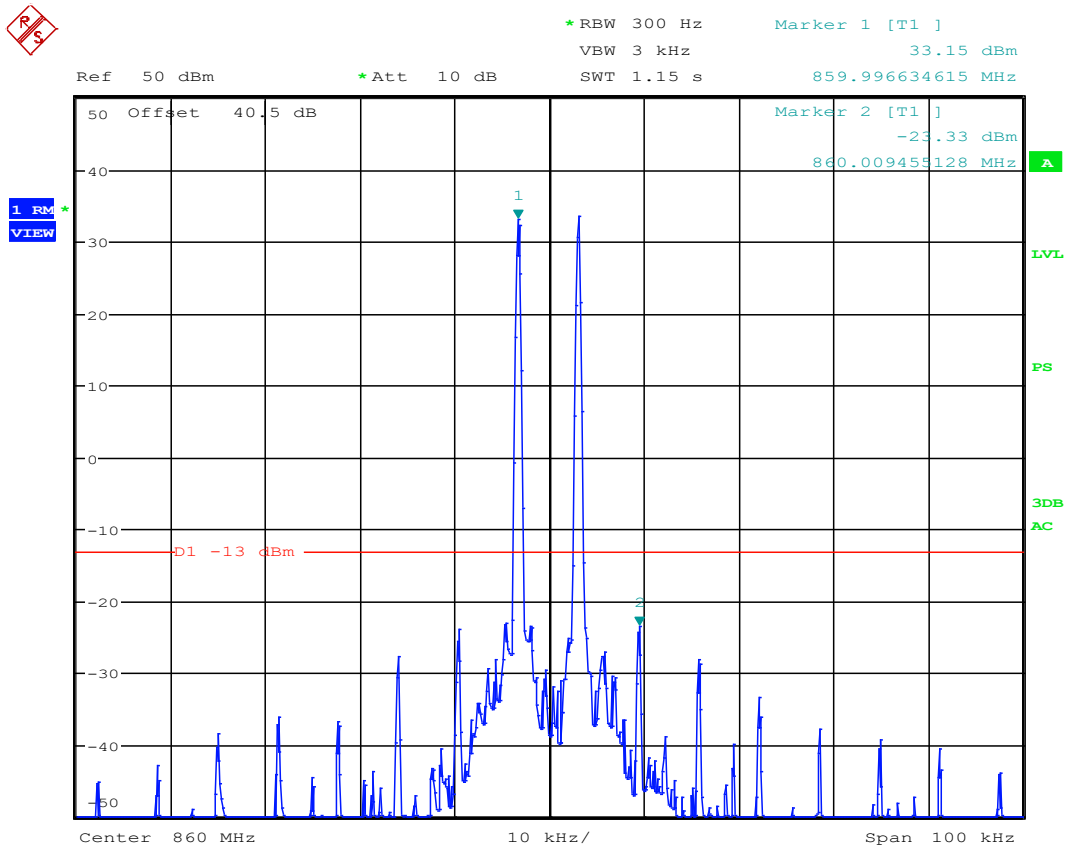
Test Data: 860.00 MHz, 6.25 kHz Intermodulation at AGC - Output 2



Date: 9.FEB.2018 09:24:43

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

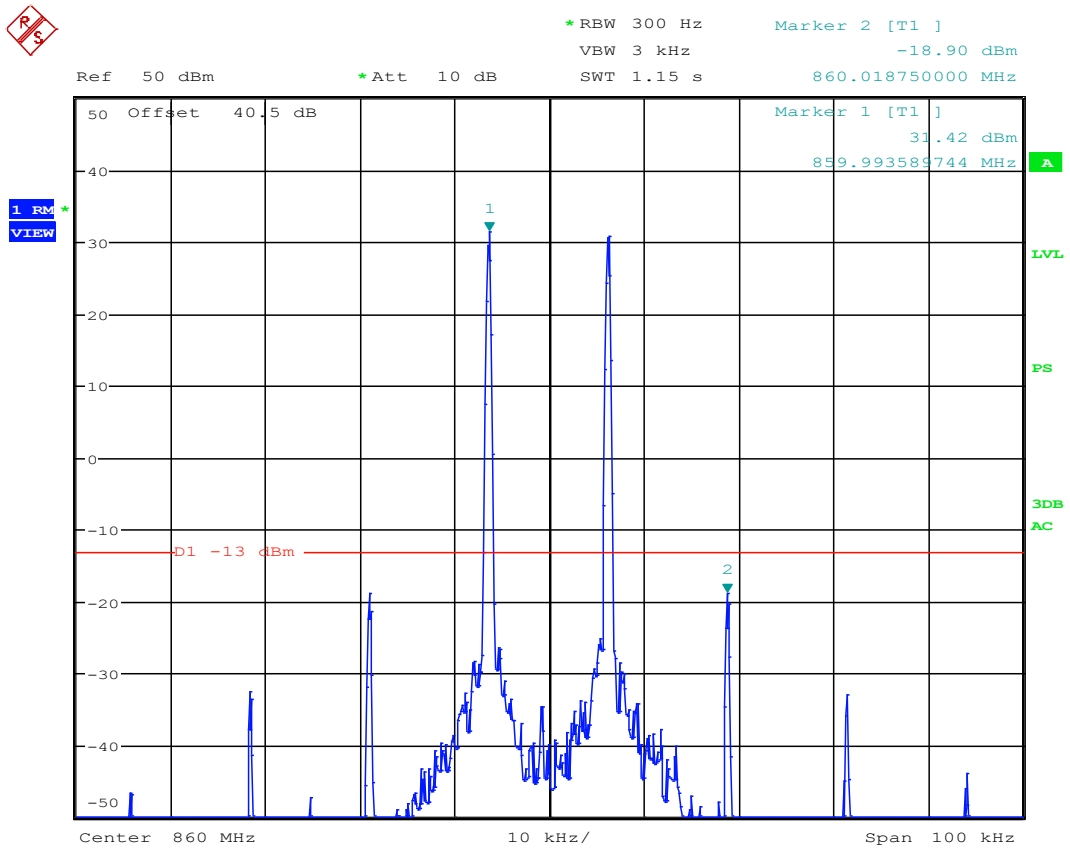
Test Data: 860.00 MHz, 6.25 kHz Intermodulation at +3 dBm Above AGC - Output 2



Date: 9.FEB.2018 09:19:55

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

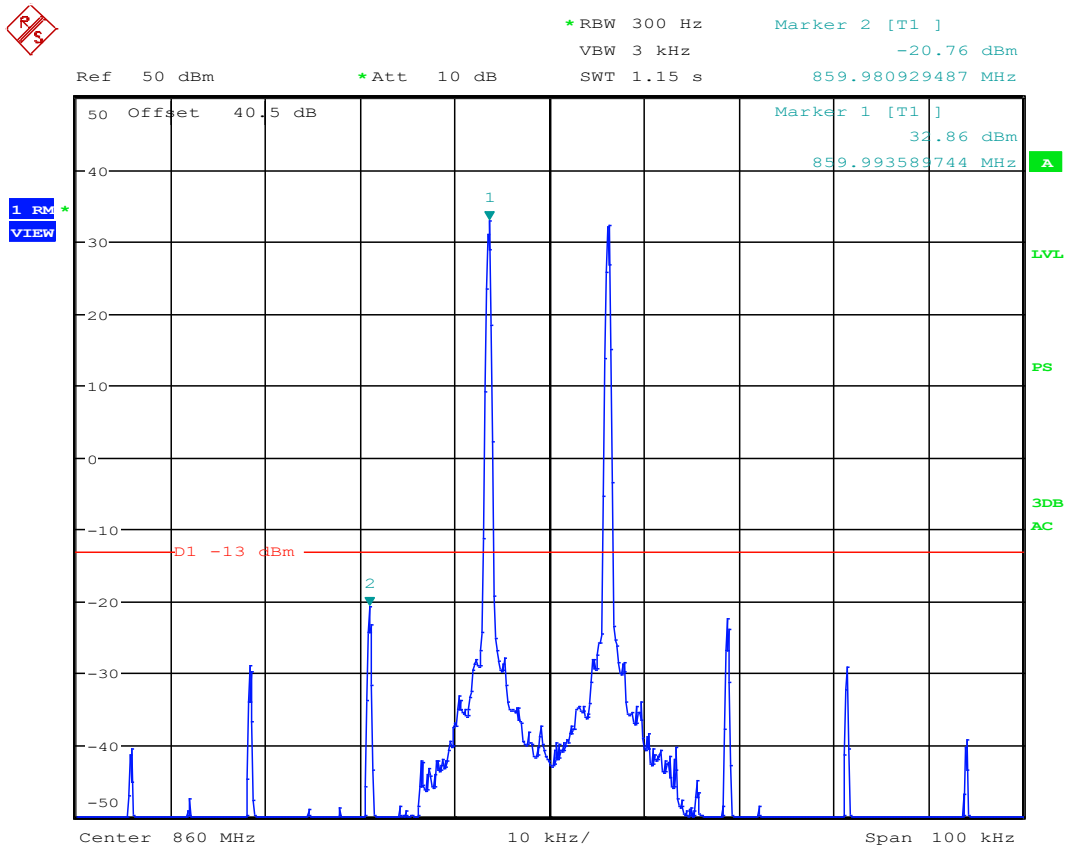
Test Data: 860.00 MHz, 12.5 kHz Intermodulation at AGC - Output 2



Date: 9.FEB.2018 09:25:53

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

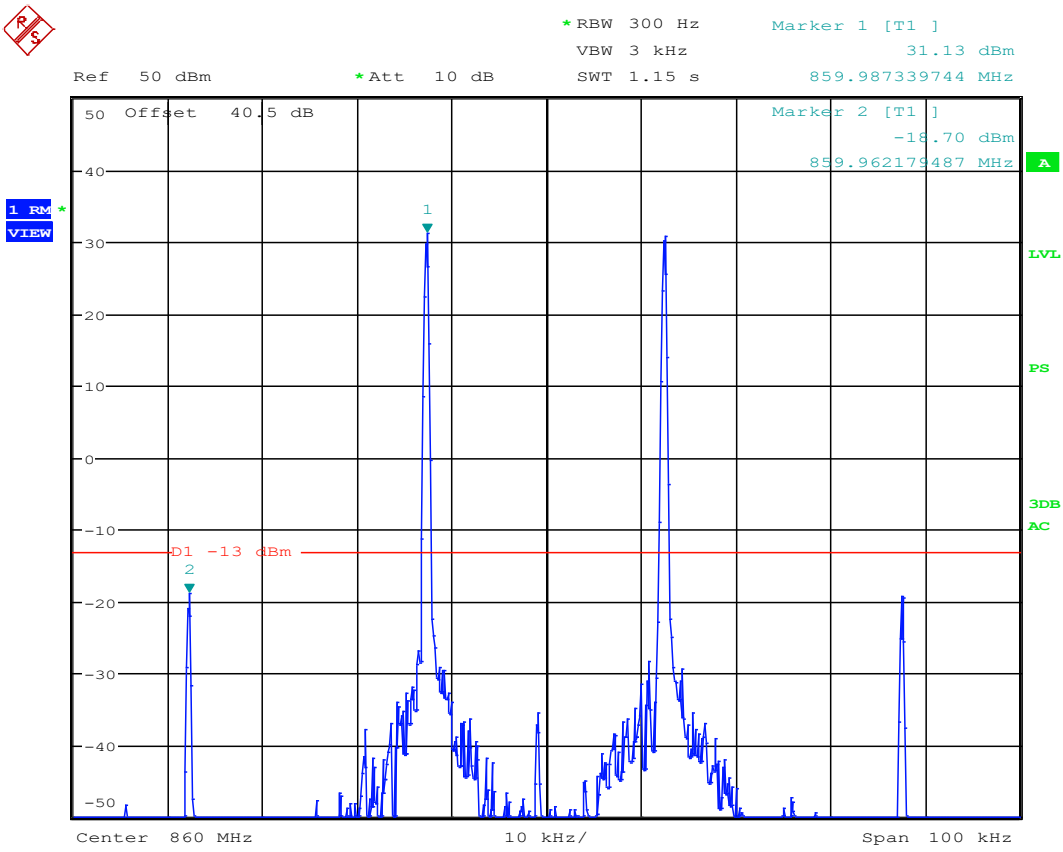
Test Data: 860.00 MHz, 12.5 kHz Intermodulation at +3 dBm Above AGC - Output 2



Date: 9.FEB.2018 09:29:36

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

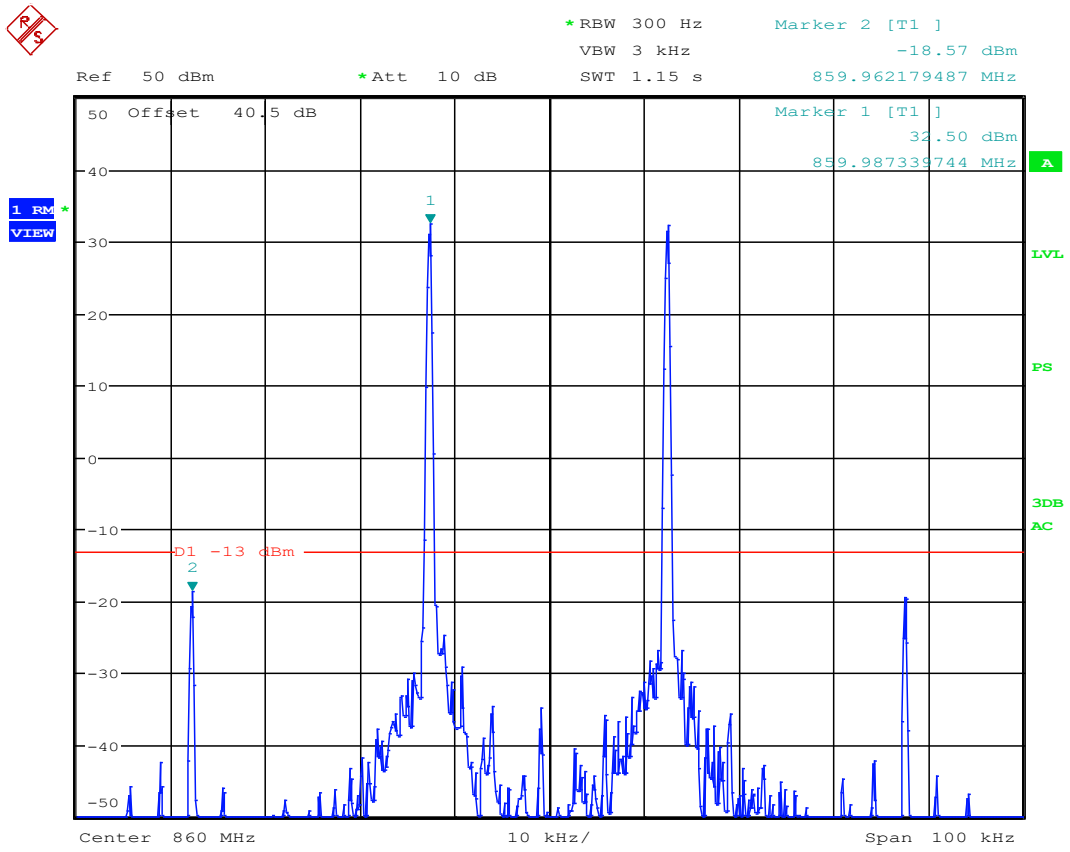
Test Data: 860.00 MHz, 25 kHz Intermodulation at AGC - Output 2



Date: 9.FEB.2018 09:31:06

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

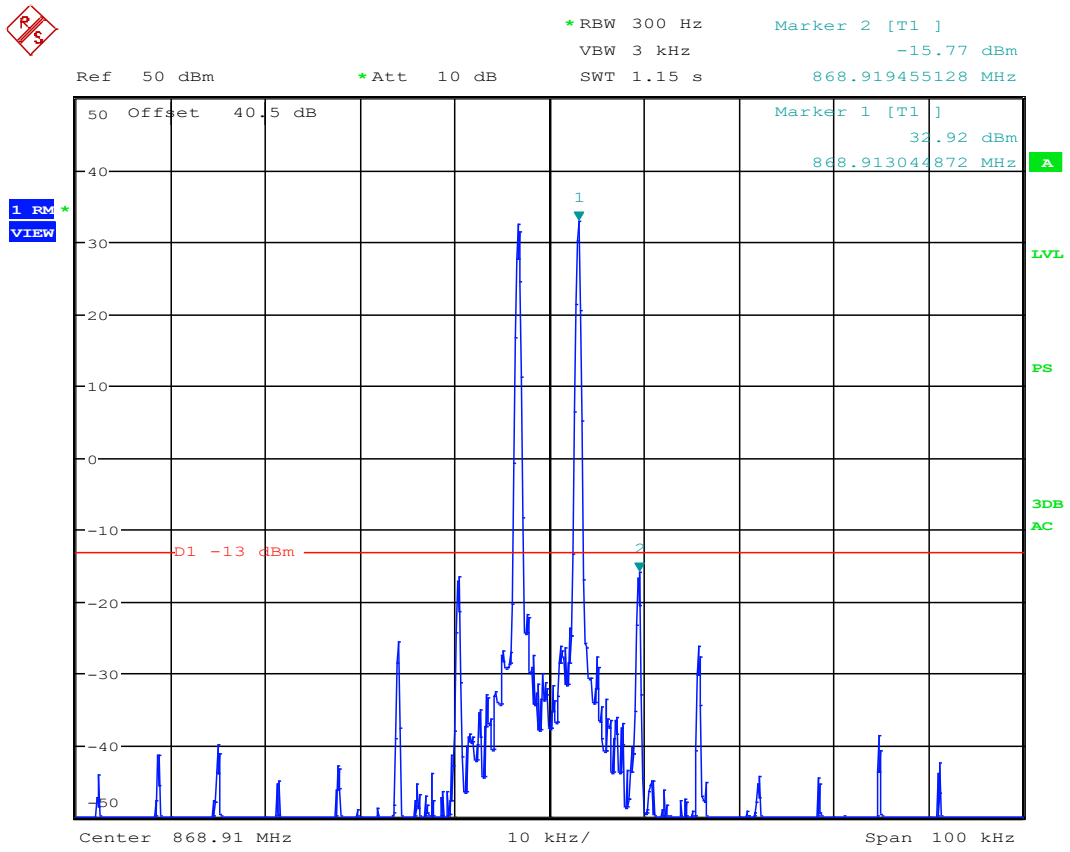
Test Data: 860.00 MHz, 25 kHz Intermodulation at +3 dBm Above AGC - Output 2



Date: 9.FEB.2018 09:30:20

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

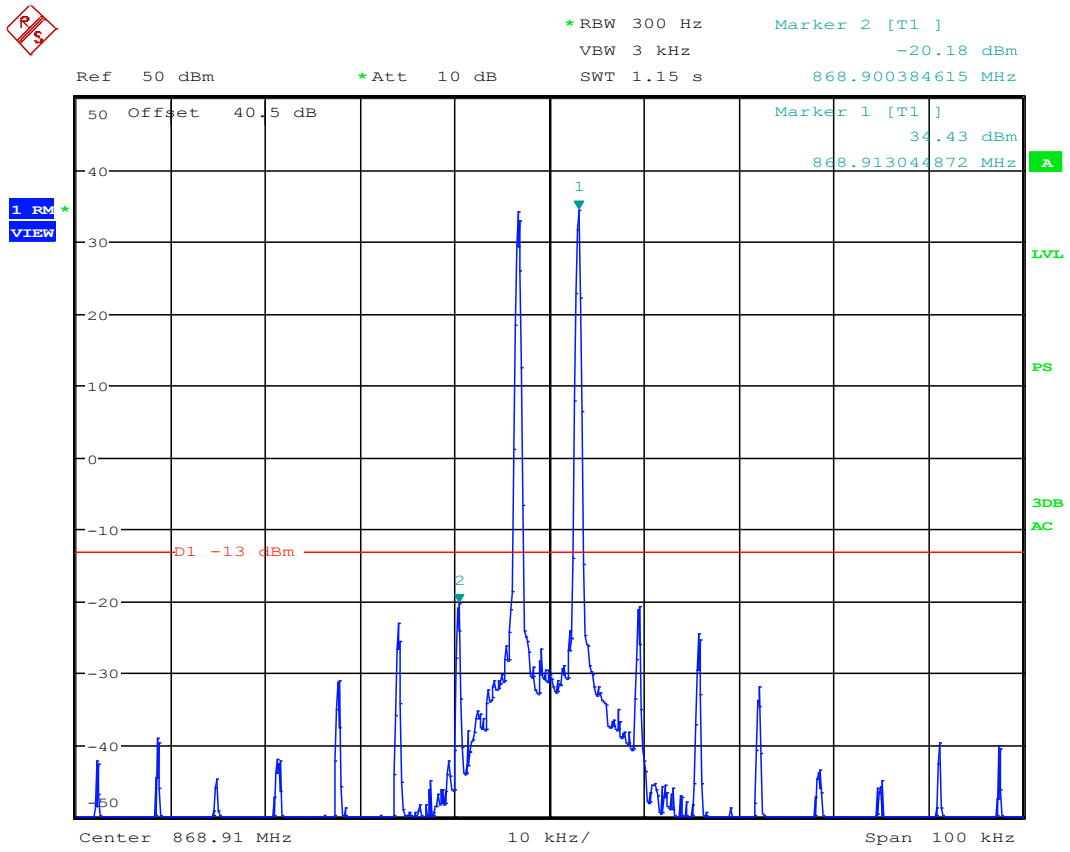
Test Data: 868.91 MHz, 6.25 kHz Intermodulation at AGC - Output 2



Date: 9.FEB.2018 09:45:23

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

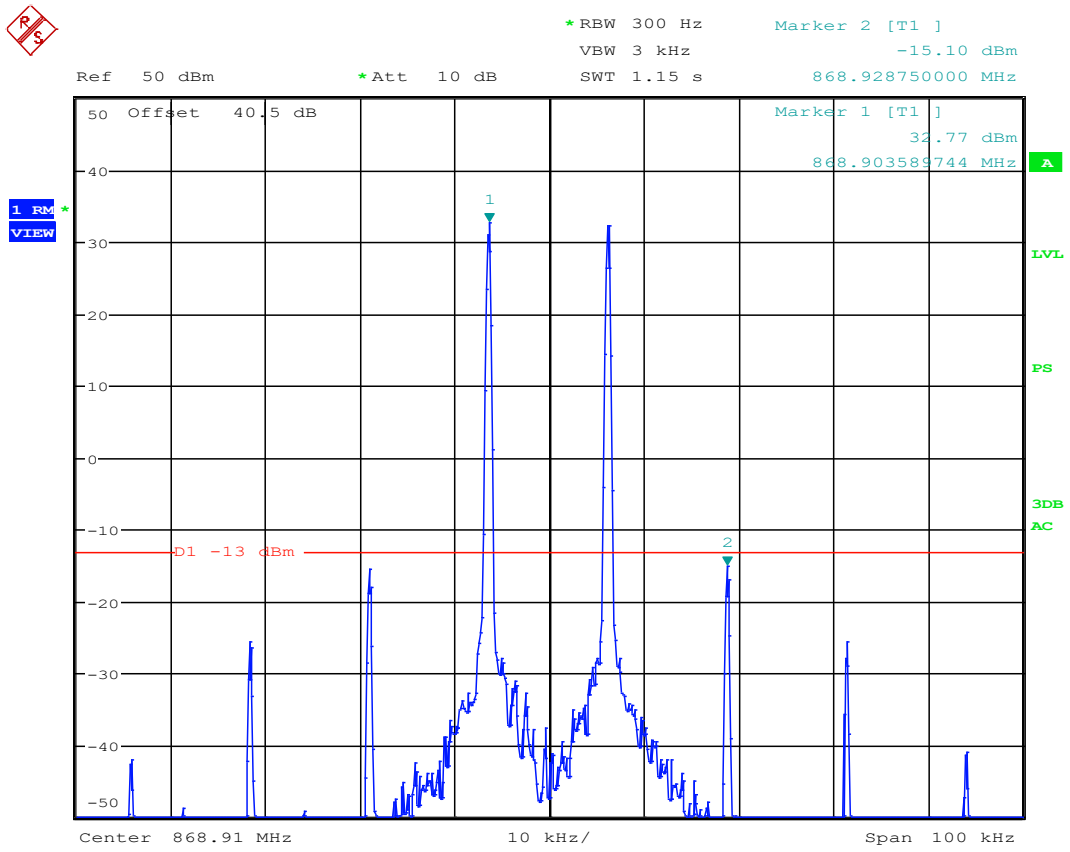
Test Data: 868.91 MHz, 6.25 kHz Intermodulation at +3 dBm Above AGC - Output 2



Date: 9.FEB.2018 09:44:00

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

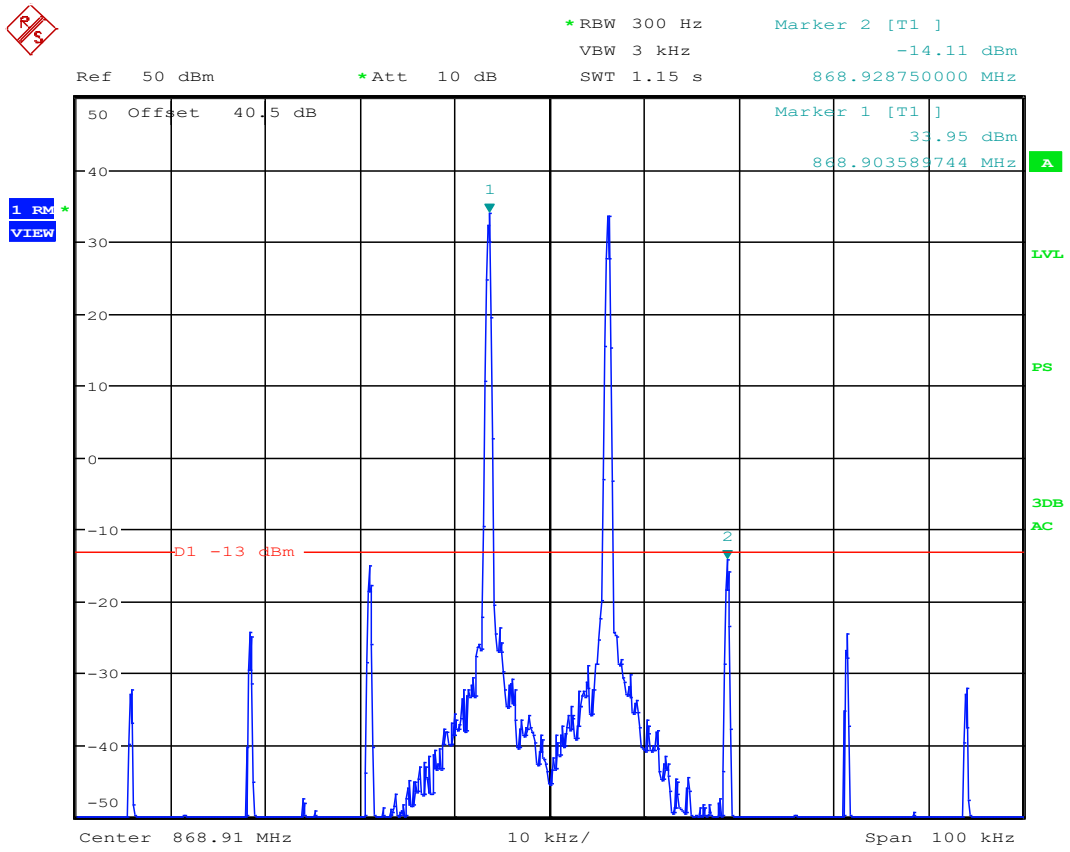
Test Data: 868.91 MHz, 12.5 kHz Intermodulation at AGC - Output 2



Date: 9.FEB.2018 09:46:16

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

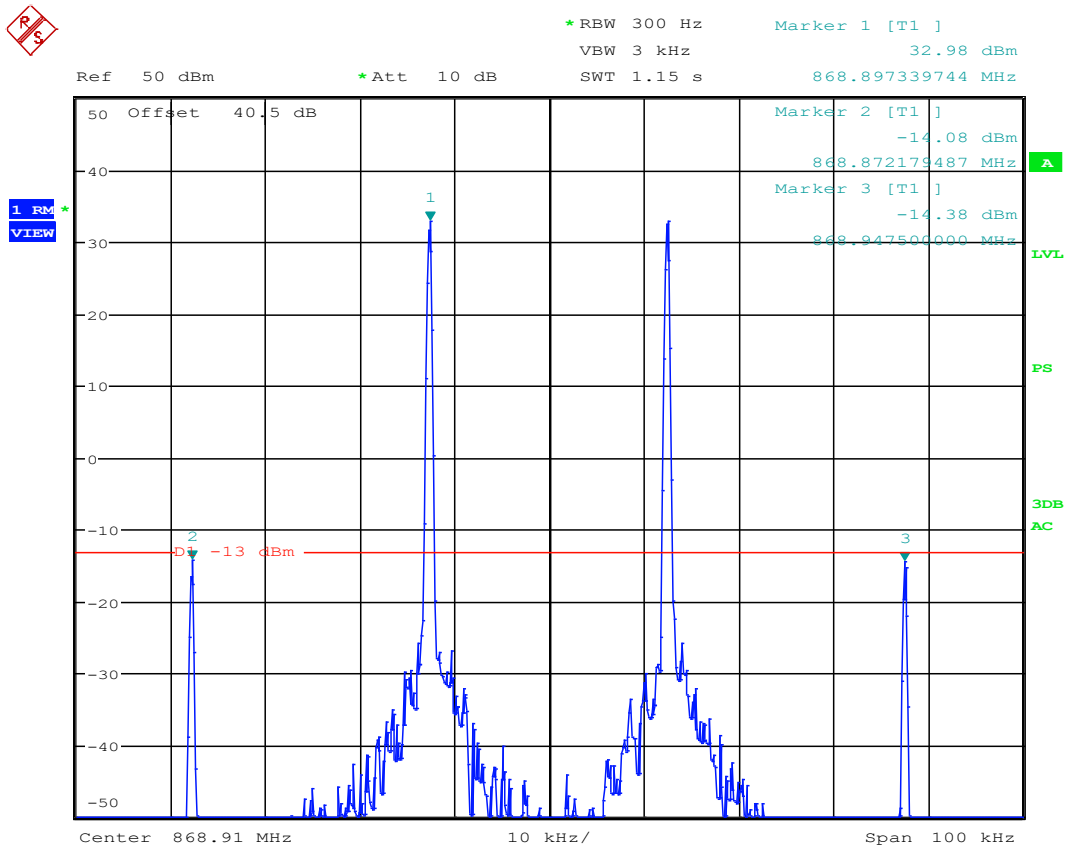
Test Data: 868.91 MHz, 12.5 kHz Intermodulation at +3 dBm Above AGC - Output 2



Date: 9.FEB.2018 09:47:18

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

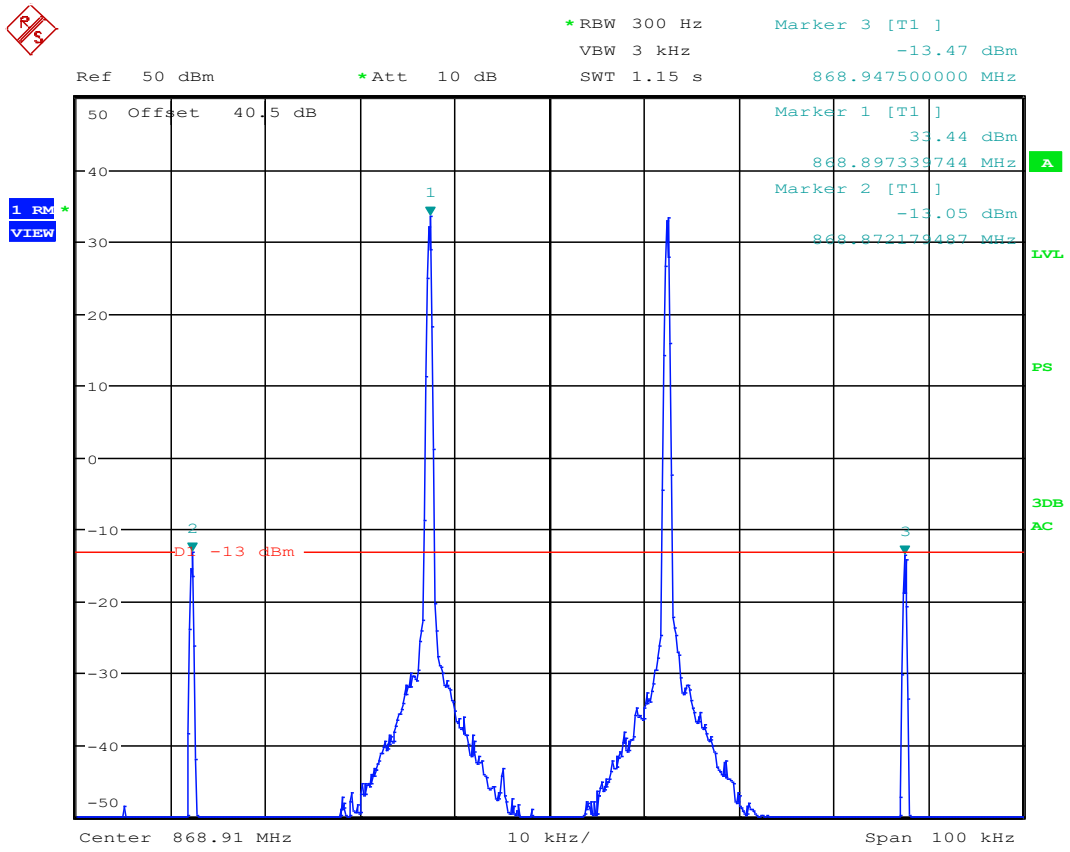
Test Data: 868.91 MHz, 25 kHz Intermodulation at AGC - Output 2



Date: 9.FEB.2018 09:49:53

Out-of-band/out-of-block Emissions(including intermodulation) §4.7.2

Test Data: 868.91 MHz, 25 kHz Intermodulation at +3 dBm Above AGC - Output 2



Date: 9.FEB.2018 09:48:56

ANTENNA CONDUCTED EMISSIONS §4.7

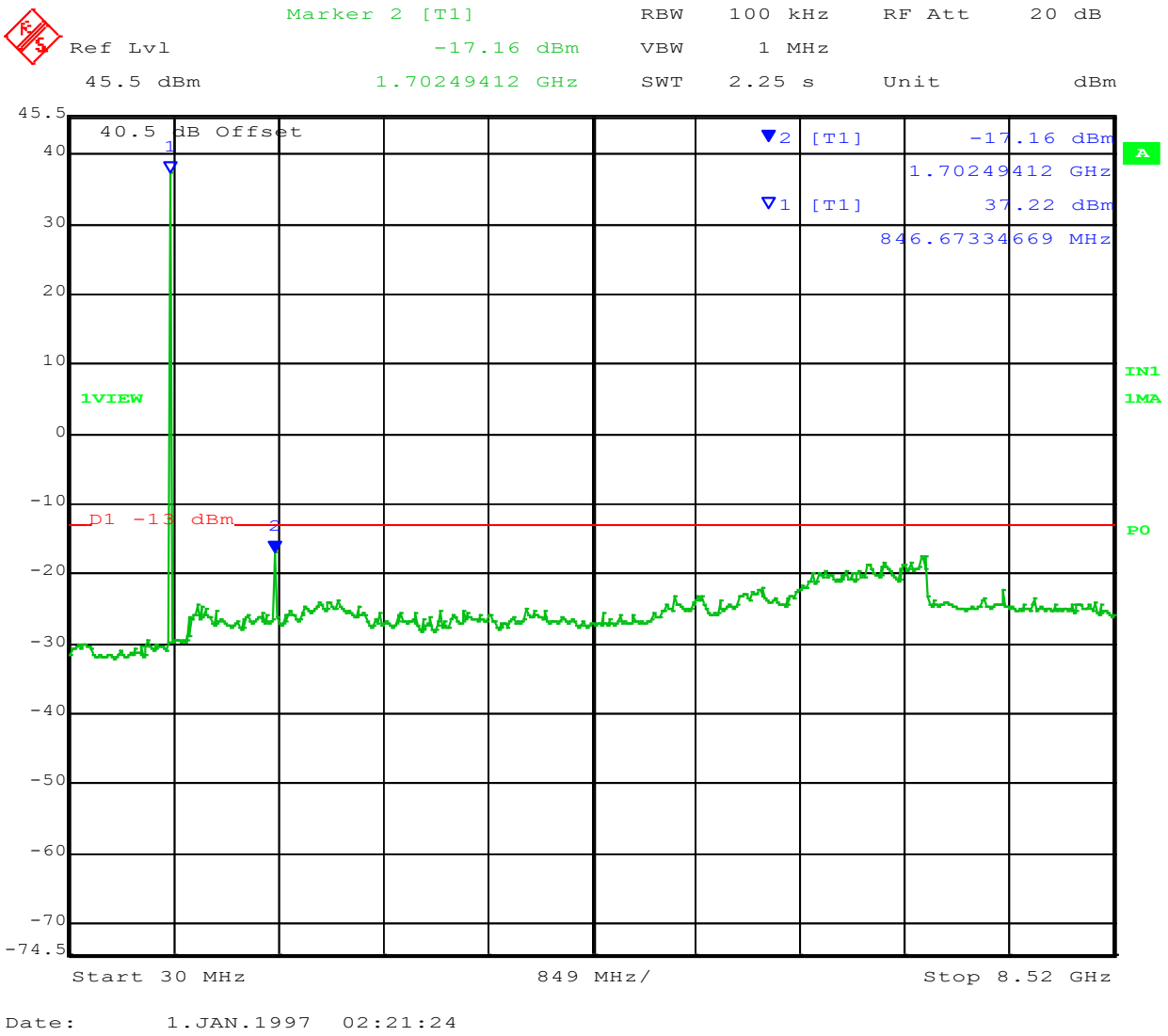
Rule Part No.: 47CFR90.219(e)(3)
KDB 935210-D05 v01r01 §4.7.3

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

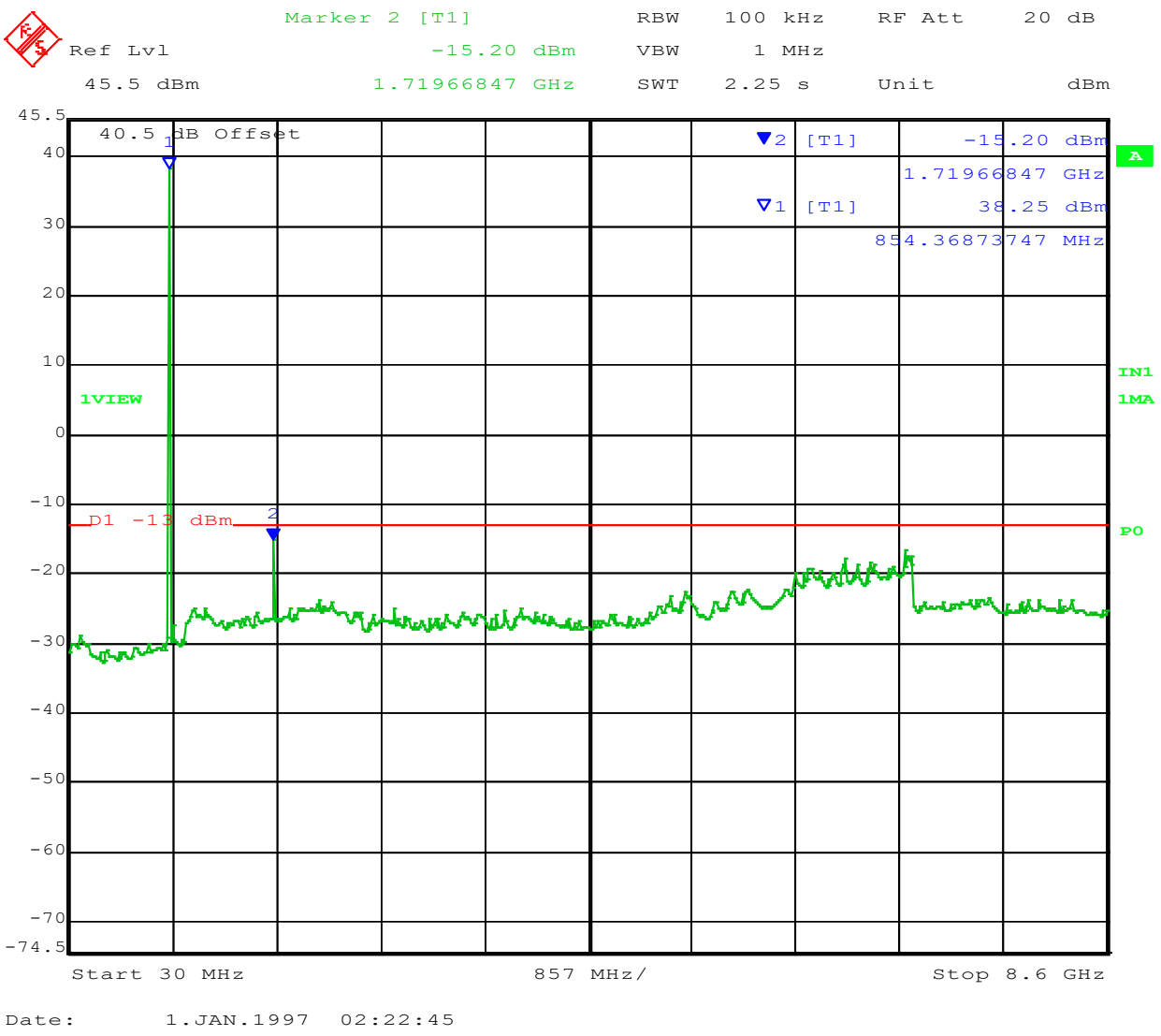
ANTENNA CONDUCTED EMISSIONS §4.7 – Output 1

Test Data: 851.09 MHz, Output 1



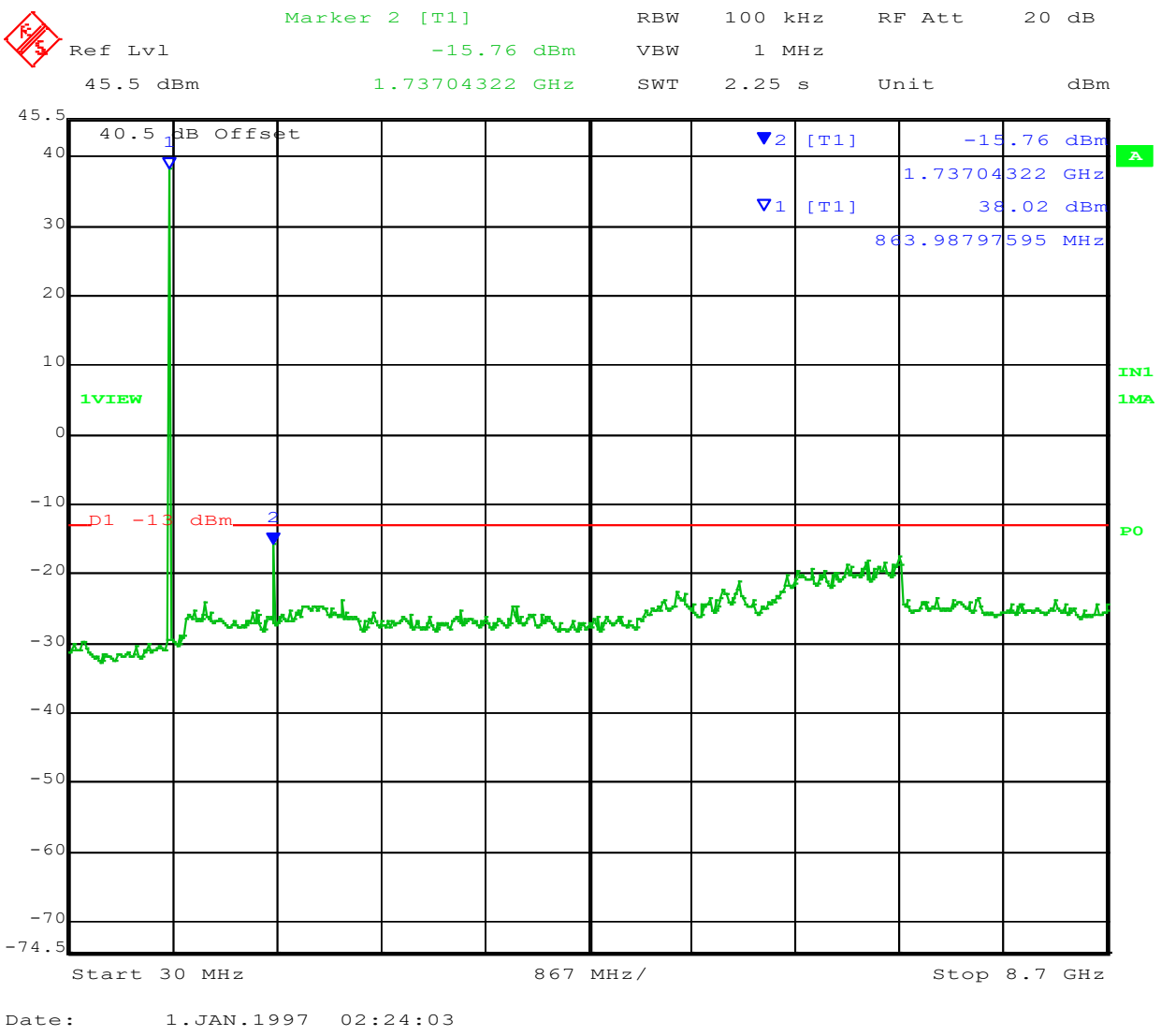
ANTENNA CONDUCTED EMISSIONS §4.7

Test Data: 860.00 MHz, Output 1



ANTENNA CONDUCTED EMISSIONS §4.7

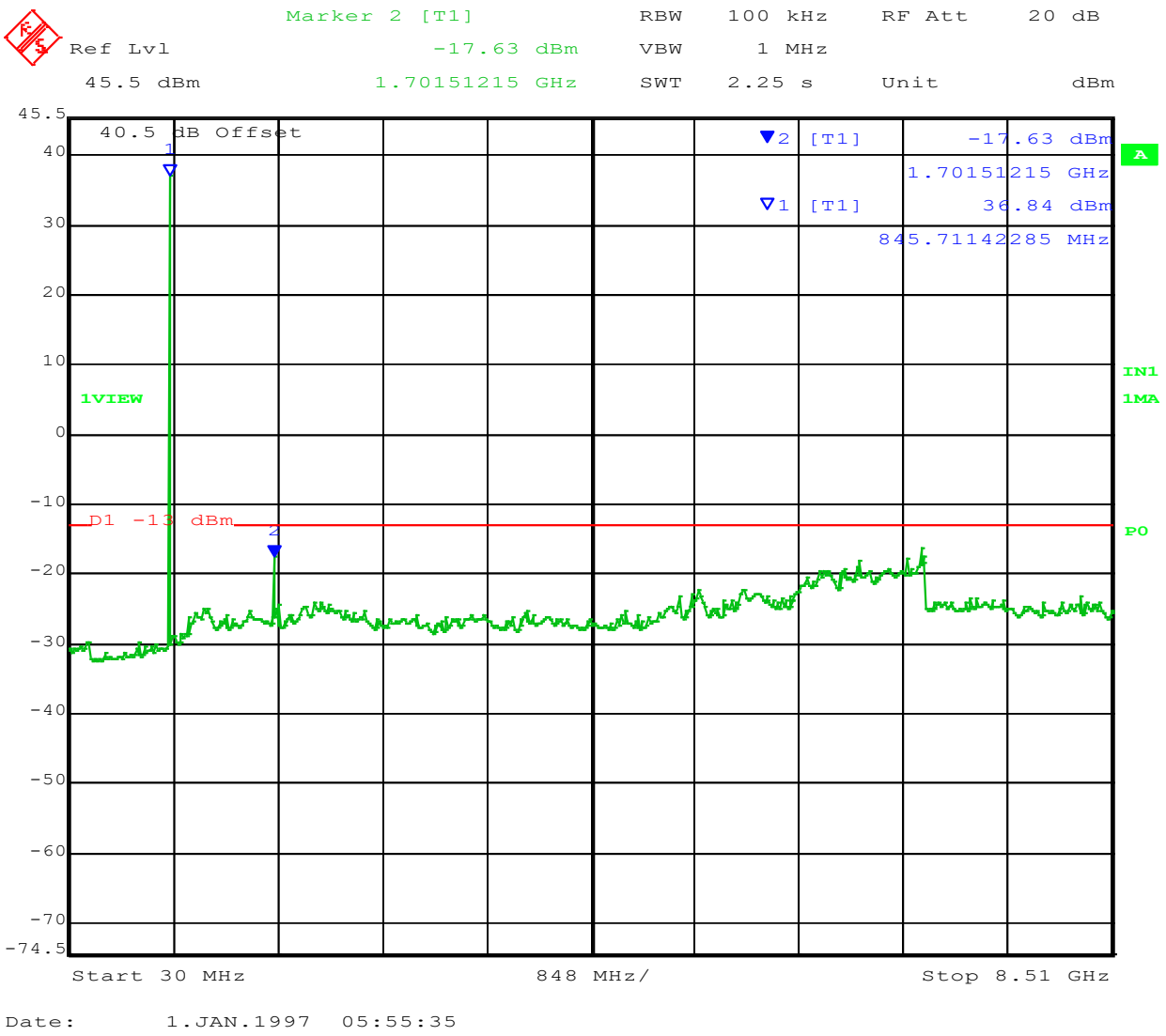
Test Data: 868.91 MHz, Output 1



Result: Meets Requirements

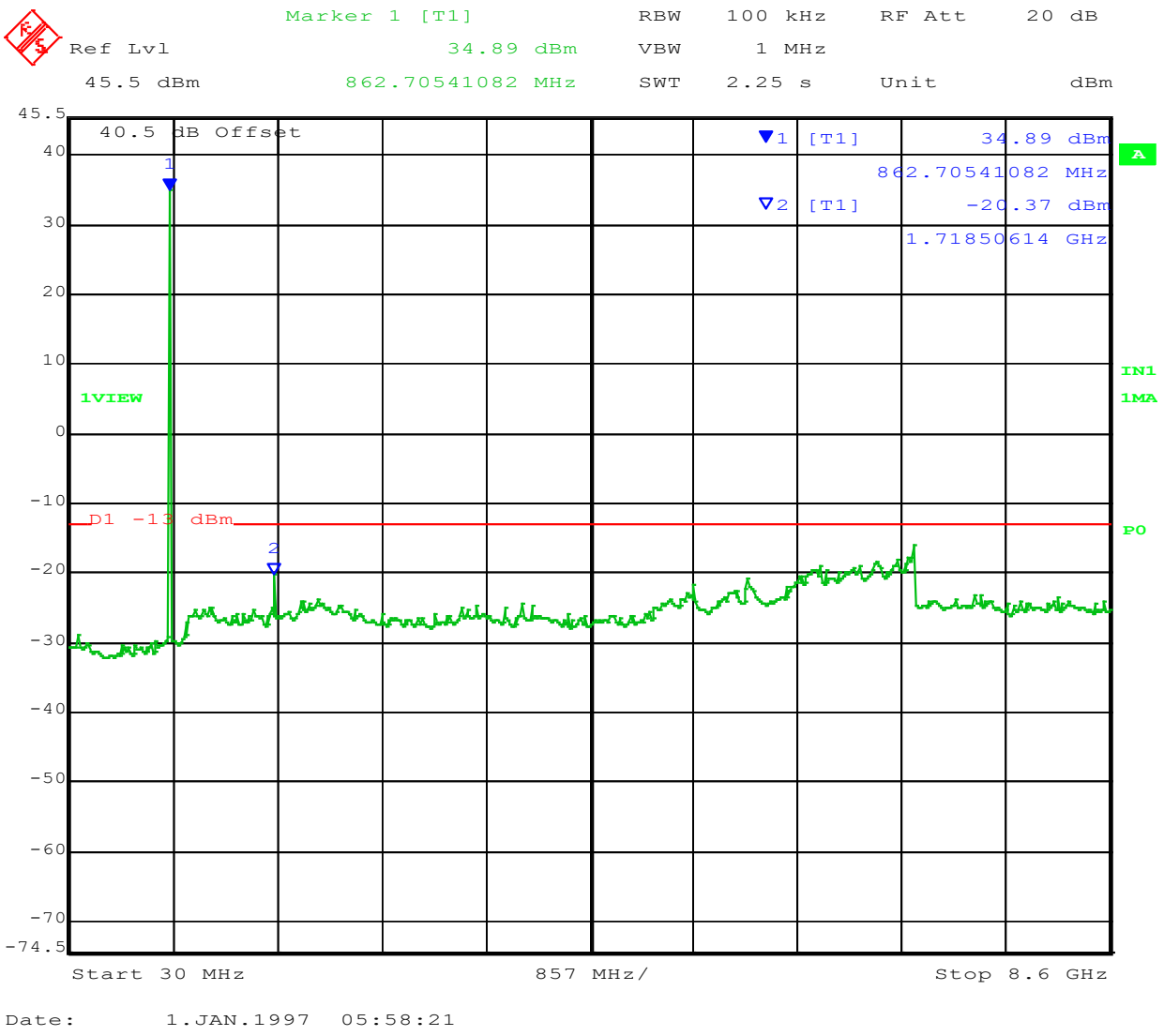
ANTENNA CONDUCTED EMISSIONS §4.7 – Output 2

Test Data: 851.09 MHz, Output 2



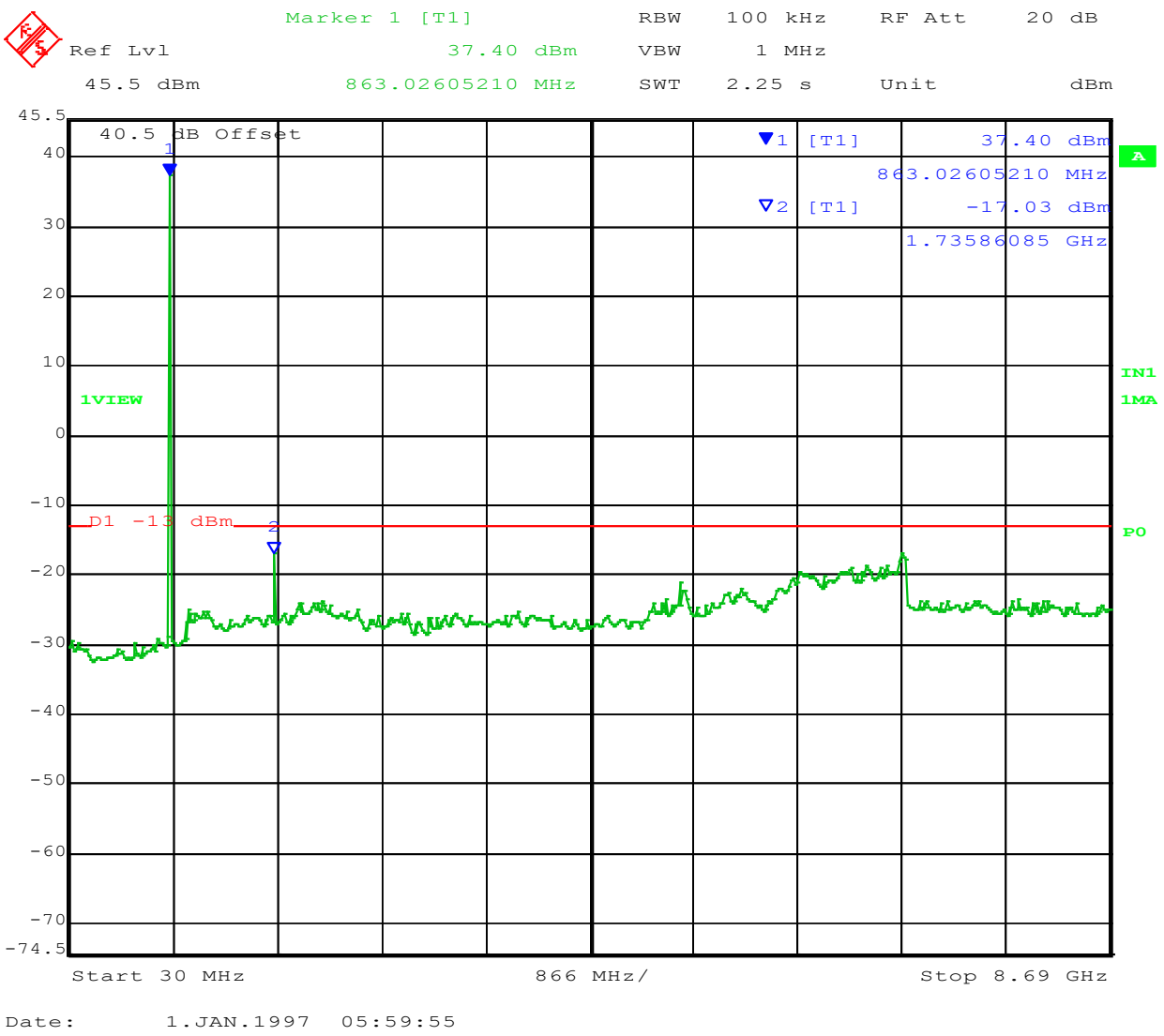
ANTENNA CONDUCTED EMISSIONS §4.7

Test Data: 860.00 MHz, Output 2



ANTENNA CONDUCTED EMISSIONS §4.7

Test Data: 868.91 MHz, Output 2



Result: Meets 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: Radiated Emission Table

Emission Frequency (MHz)	Antenna Polarity	ERP (dBm)	Limit (dBm)	Margin (dBm)
0.02	V	-37.03	-13.00	24.03
0.13	V	-46.74	-13.00	33.74
0.15	V	-39.95	-13.00	26.95
28.41	V	-79.99	-13.00	66.99
65.96	H	-60.80	-13.00	47.80
74.41	V	-57.88	-13.00	44.88
159.95	V	-47.08	-13.00	34.08
161.59	H	-49.95	-13.00	36.95
201.28	H	-67.04	-13.00	54.04
201.28	V	-64.45	-13.00	51.45
319.23	V	-64.34	-13.00	51.34
479.49	H	-56.35	-13.00	43.35
479.49	V	-49.51	-13.00	36.51
639.74	H	-49.59	-13.00	36.59
639.74	V	-47.90	-13.00	34.90
960.26	V	-50.51	-13.00	37.51
1076.92	V	-43.22	-13.00	30.22
1179.49	H	-41.54	-13.00	28.54
1910.26	V	-35.72	-13.00	22.72
2794.87	H	-32.79	-13.00	19.79
4410.26	V	-27.99	-13.00	14.99
5115.39	H	-26.17	-13.00	13.17
5730.77	V	-24.80	-13.00	11.80
7038.46	H	-23.10	-13.00	10.10
7217.95	V	-21.83	-13.00	8.83
8294.87	H	-22.03	-13.00	9.03
8641.03	V	-23.32	-13.00	10.32

Note: EUT does not change operation based on tuned frequency.

Result: Meets 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 1057	Eaton	94455-1	1057	12/13/17	12/13/19
Antenna: Log-Periodic 1243	Eaton	96005	1243	02/09/16	03/09/18
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	03/31/18
Sweep/Signal Generator	Anritsu	68369B	985112	11/08/17	11/08/19
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	01/30/17	01/30/19
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	04/13/17	04/13/19
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
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	777C	36124	05/24/17	05/23/19
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	N/A	N/A
Attenuator N 30dB 100W DC-6G	Pasternack	PE7214-30	#109	05/24/2017	05/24/2019
Attenuator N 20dB 100W DC-6G	Pasternack	PE7214-20	#112	05/30/2017	05/30/2019

***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%	

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

END OF REPORT