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TEST REPORT

FOR FCC PART 90 CLASS B INDUSTRIAL BOOSTER

for

FCC ID: 2AHVPSB400M1A

APPLICANT	RADIO SOLUTIONS, INC.
	70 ACCORD PARK DRIVE NORWELLMA02061USA
MODEL NUMBER	SB400M1A
PRODUCT DESCRIPTION	UHF INDUSTRIAL BOOSTER
DATE SAMPLE RECEIVED	4/22/2016
DATE TESTED	5/10/2016
TESTED BY	Cory Leverett
APPROVED BY	Sid Sanders
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
673AUT16TestReport	Rev.1	Initial Issue	5/12/2016
673AUT16TestReport	Rev.2	Added Reviewer signature	5/13/2016
673AUT16TestReport	Rev. 3	Corrected Freq. Range	5/20/2016

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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: _____

Cory Leverett, Project Manager/Testing Technician

Date: 5/20/16

Reviewed by: _____

Sid Sanders, Engineer

5/20/16

GENERAL INFORMATION

EUT Specification

EUT Description	UHF INDUSTRIAL BOOSTER
FCC ID	2AHVPSB400M1A
Model Number	SB400M1A
Operating Frequency	450-454, 456-462.5375, 462.7375 – 467.5375, 467.7375 – 490.00 MHz
Test Frequencies	450.900, 470.900, 474.900, 485.100, 489.100MHz
Type of Emission	F3E
Modulation	FM
EUT Power Source	☒ 110–120Vac/50– 60Hz
	☐ DC Power 12V
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☒ Fixed
	☐ Mobile
	☐ Portable
Test Conditions	Temperature: 24-26ºC Relative Humidity: 50 - 65%. Barometer 1023.2mb
Modification to the EUT	None
Test Exercise	The EUT was operated per KDB 935210 D05 v01r01.
Applicable Standards	FCC CFR 47 Part 90.219, FCC Part 2, KDB 935210 DO 02 v03 02, DO5 v01r01, ANSI/TIA 603-E:2016,
Test Facility	**Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.**

RF EXPOSURE INFORMATION: 47CFR 2.1093

The requirements for this equipment are covered in the included MPE report.

TEST RESULTS SUMMARY

FCC RULE PART	Limit	TEST DESCRIPTION	RESULT PASS/FAIL
KDB 935210-DO3 §	Per Frequency Table	Authorized Frequency Band	**OK**
90.219(e)(1)	5.0Watts ERP	4.5.4 RF Gain & Power Output	**Pass**
KDB 935210-DO3 § 4.2	Reporting Only	4.2 AGC Threshold	**Pass**
KDB 935210-DO3 § 4.3	Reporting Only	4.3 Out-Of-band rejection	**Pass**
90.219(e)(4) 90.210	per rule part	4.4 Input-versus-output signal comparison	**Pass**
90.219(e)(2)	≤ 9 dB	4.6 Noise Figure	**Pass**
90.219(e)(3)	-13 dBm	4.7.2 Out-of-band/out-of-block Intermodulation	**Pass**
2.1051(a), 90.219(e)(3)	-13 dBm	4.7.3 Spurious Emissions Conducted	**Pass**
2.1055	NA	4.8 Frequency Stability	**NA**
2.1053, 90.219(e)(3)	-13 dBm	4.9 Spurious emissions radiated	**Pass**

RF POWER OUTPUT and AMPLIFIER GAIN. §4.5

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

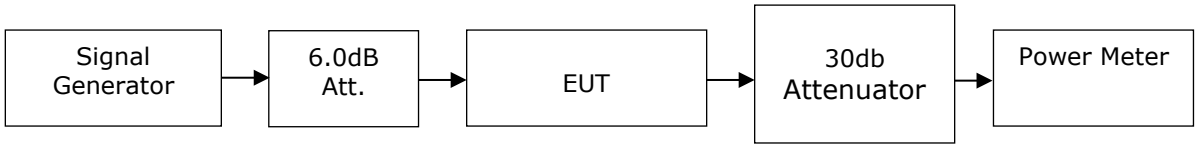
Requirements: 5.0Watts ERP

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:

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

Setup Diagram:



Test Data: Conducted Output Power and Gain Measurement Table

Mode	Tuned Frequency MHz	Input Power dBm	Output Power dBm	Gain dB
CW	450.9	-56.0	32.3	88.3
CW	470.9	-56.0	32.01	88.01
CW	474.9	-56.0	31.6	87.6
CW	485.1	-56.0	31.14	87.14
CW	489.1	-56.0	31.3	87.3

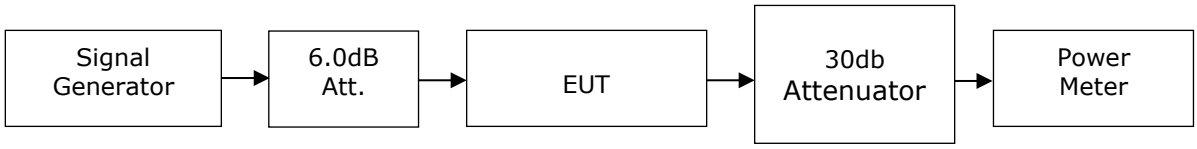
AGC THRESHOLD §4.2

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

Setup Diagram:



Test Data: Low End of Band AGC Threshold Measurement Table

450.900 MHz Low Side AGC Threshold = -60.35

Sig Gen Output (dBm)	Cable & Att Insertion Loss (dB)	Input Power To Ampl. dBm	Output Power dBm (29.15 dB offset)	Difference dB
-57.1	5.25	-63.35	28.2	1
-56.1	5.25	-62.35	29.2	1
-55.1	5.25	-61.35	30.2	1
-54.1	5.25	-60.35	30.5	0.3

AGC THRESHOLD §4.2

Test Data: Middle of Band AGC Threshold Measurement Table

470.900 MHz Low Side AGC Threshold = -57.15

Sig Gen Output (dBm)	Cable & Att Insertion Loss (dB)	Input Power To Ampl. dBm	Output Power dBm (29.15 dB offset)	Difference dB
-54.9	5.25	-60.15	28.1	
-53.9	5.25	-59.15	29.1	1
-52.9	5.25	-58.15	30.1	1
-51.9	5.25	-57.15	30.5	0.4

474.900 MHz High Side AGC Threshold = -56.55

Sig Gen Output (dBm)	Cable & Att Insertion Loss (dB)	Input Power To Ampl. dBm	Output Power dBm (29.15 dB offset)	Difference dB
-54.3	5.25	-59.55	27.9	
-53.3	5.25	-58.55	28.9	1
-52.3	5.25	-57.55	29.9	1
-51.3	5.25	-56.55	30.2	0.3

Test Data: High End of Band AGC Threshold Measurement Table

485.100 MHz Low Side AGC Threshold = -57.95

Sig Gen Output (dBm)	Cable & Att Insertion Loss (dB)	Input Power To Ampl. dBm	Output Power dBm (29.15 dB offset)	Difference dB
-55.7	5.25	-60.95	27.4	
-54.7	5.25	-59.95	28.4	1
-53.7	5.25	-58.95	29.4	1
-52.7	5.25	-57.95	29.6	0.2

489.100 MHz High Side AGC Threshold = -58.75

Sig Gen Output (dBm)	Cable & Att Insertion Loss (dB)	Input Power To Ampl. dBm	Output Power dBm (29.15 dB offset)	Difference dB
-56.5	5.25	-61.75	27.4	
-55.5	5.25	-60.75	28.4	1
-54.5	5.25	-59.75	29.4	1
-53.5	5.25	-58.75	29.7	0.3

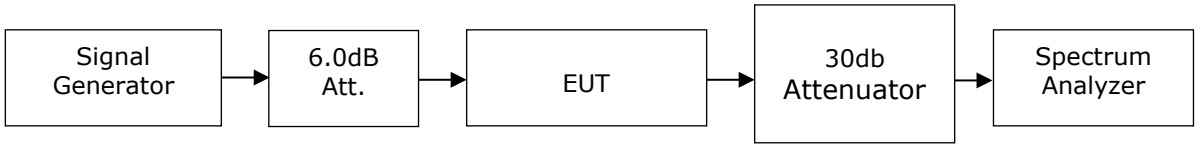
OUT-OF-BAND REJECTION § 4.3

Rule Part No.: KDB935210 § 4.3

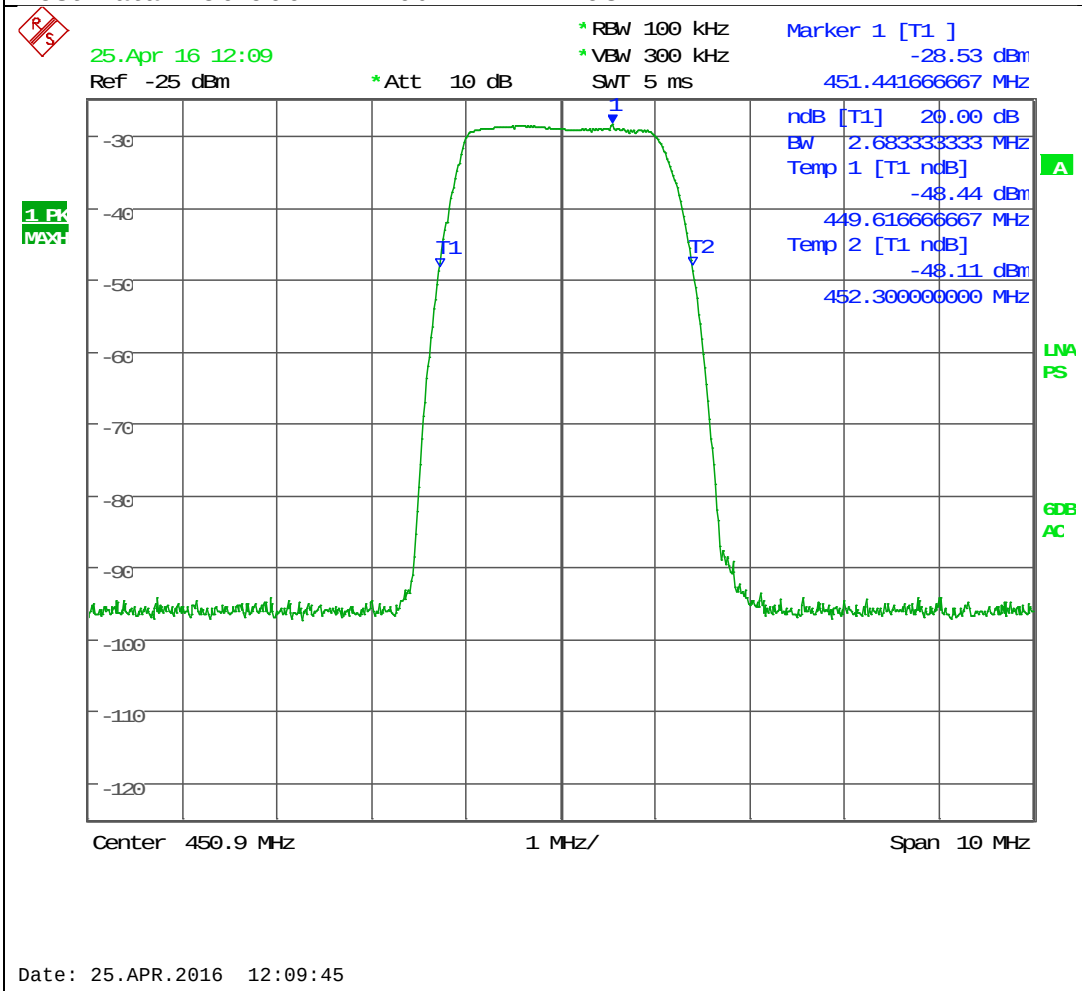
Requirements: Reporting of the 20 dB Bandwidth Only

Procedure: KDB935210 § 4.3 Out of band rejection

Setup Diagram:



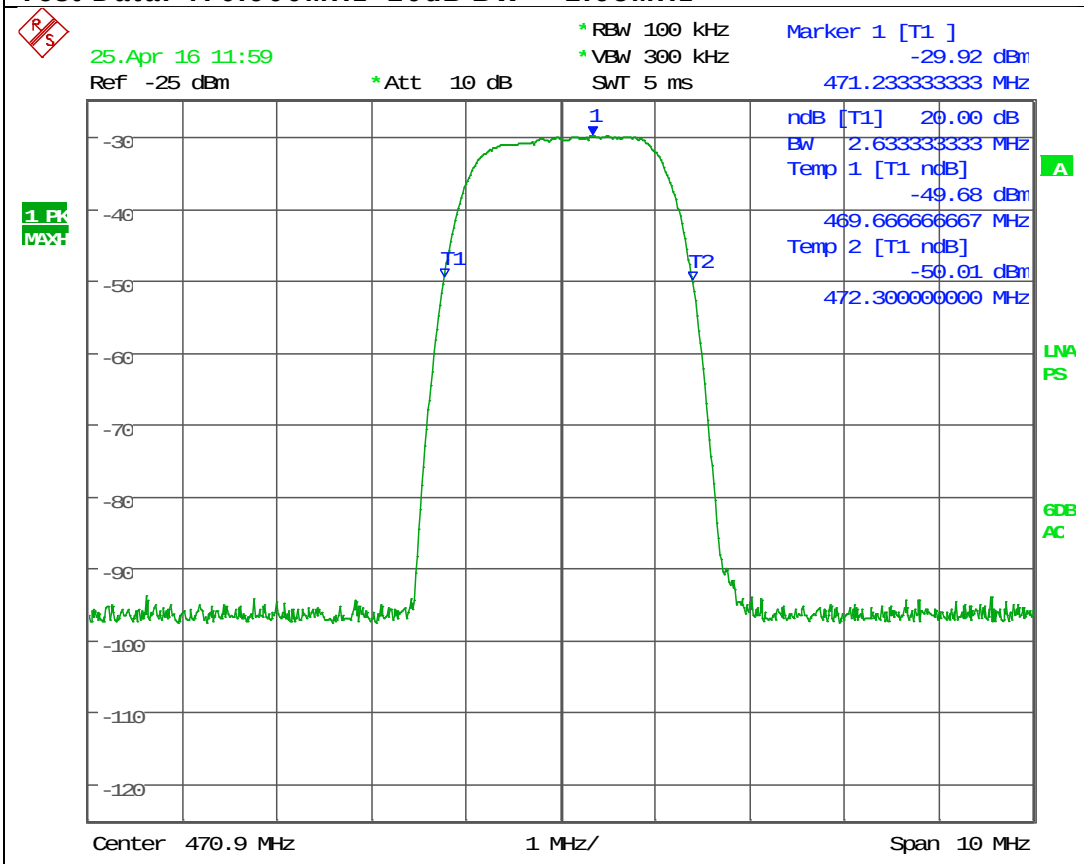
Test Data: 450.900MHz 20dB BW = 2.68MHz



Date: 25.APR.2016 12:09:45

Out-of-Band Rejection §4.3

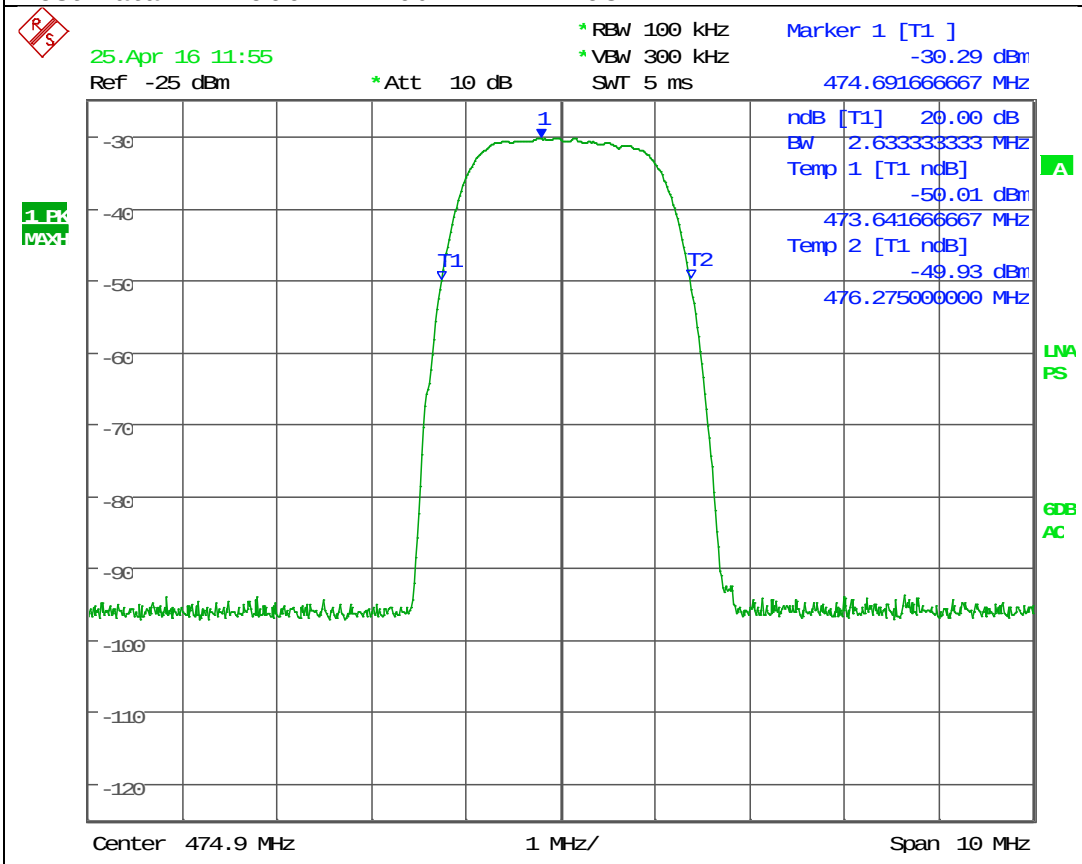
Test Data: 470.900MHz 20dB BW = 2.63MHz



Date: 25.APR.2016 11:59:29

Out-of-Band Rejection §4.3

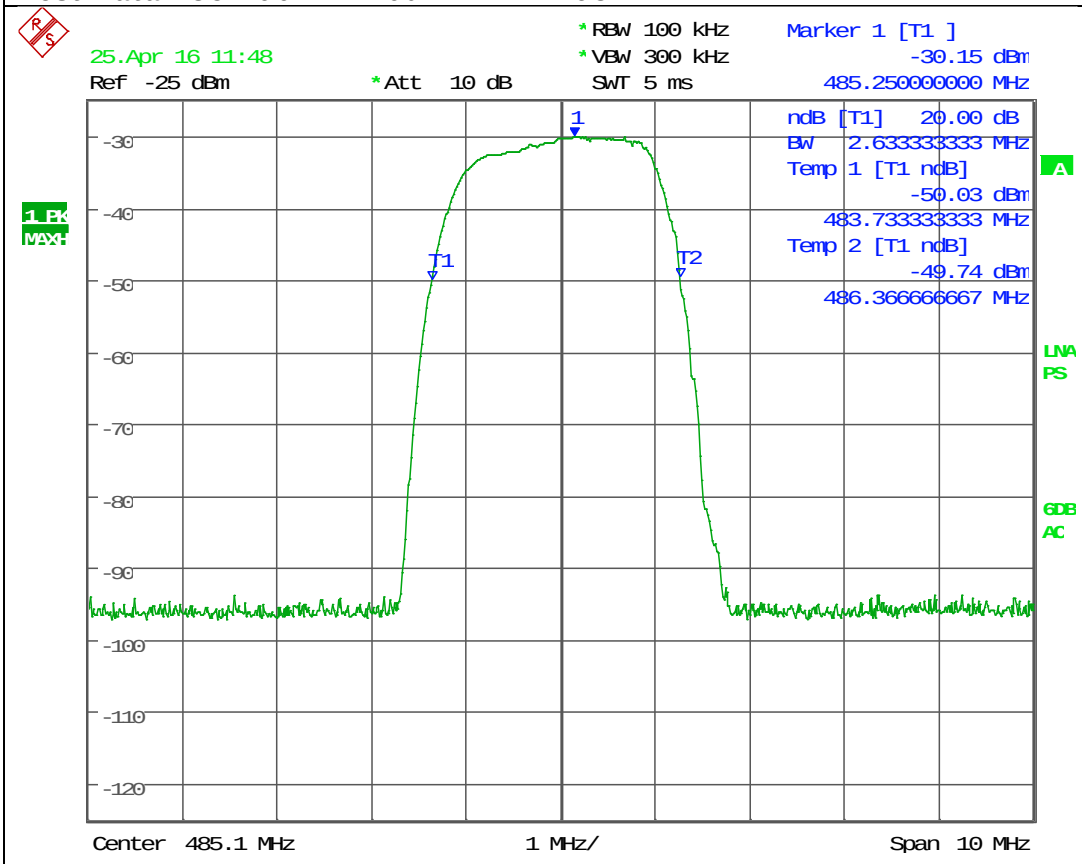
Test Data: 474.900MHz 20dB BW = 2.63MHz



Date: 25.APR.2016 11:55:41

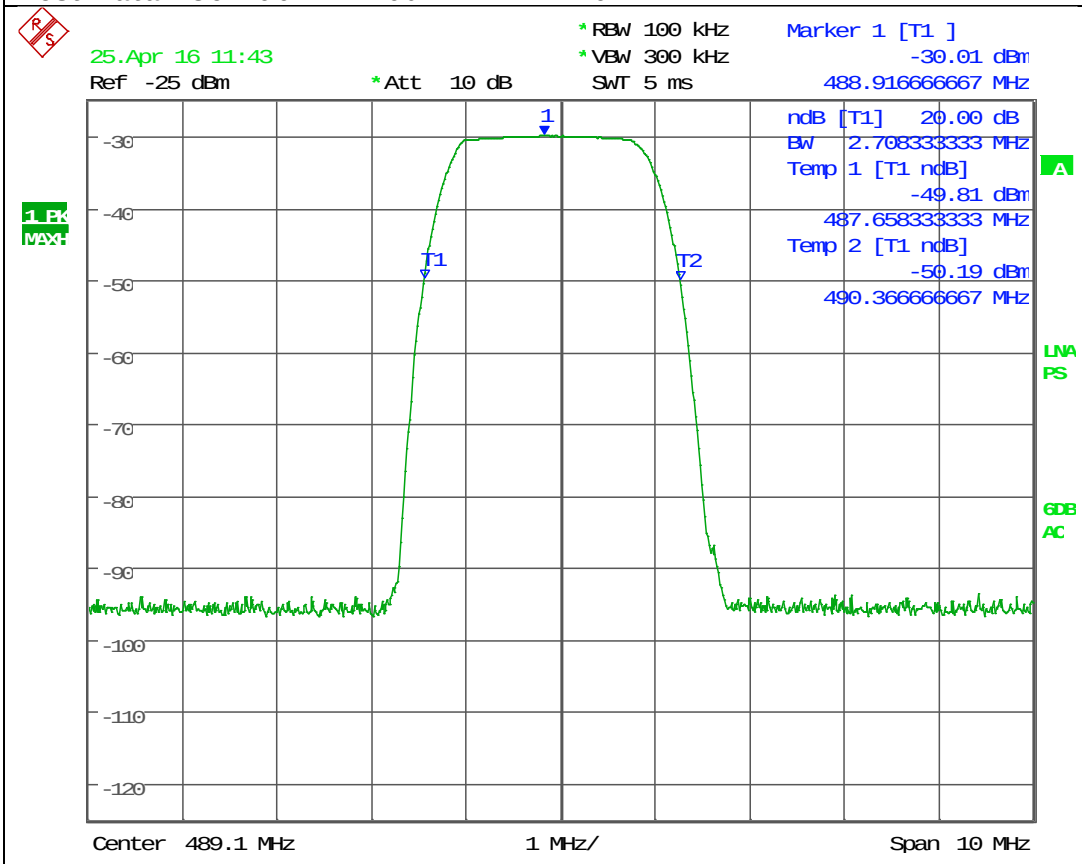
Out-of-Band Rejection §4.3

Test Data 485.100MHz 20dB BW = 2.63MHz



Out-of-Band Rejection §4.3

Test Data 489.100MHz 20dB BW = 2.70MHz



Date: 25.APR.2016 11:43:20

INPUT-VERSUS-OUTPUT SIGNAL COMPARISON §4.4

Rule Part No.: FCC Part 90.219(e)(4), 90.210 (b)(d)(e)

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

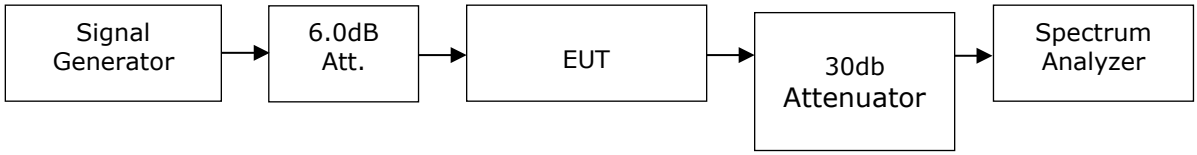
The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, provided that the retransmitted signals meet the requirements of §90.213.

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).

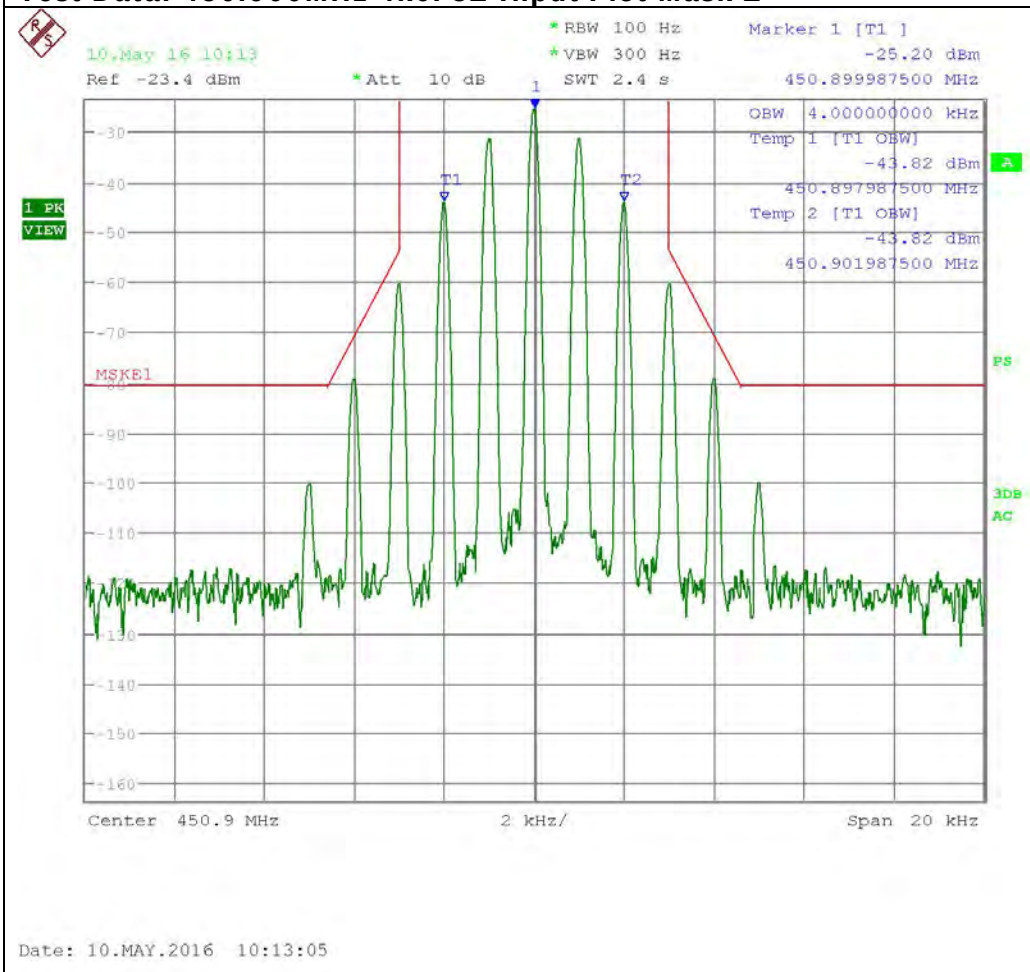
Procedure: KDB935210 § 4.4 Input versus output signal comparison

Setup Diagram:



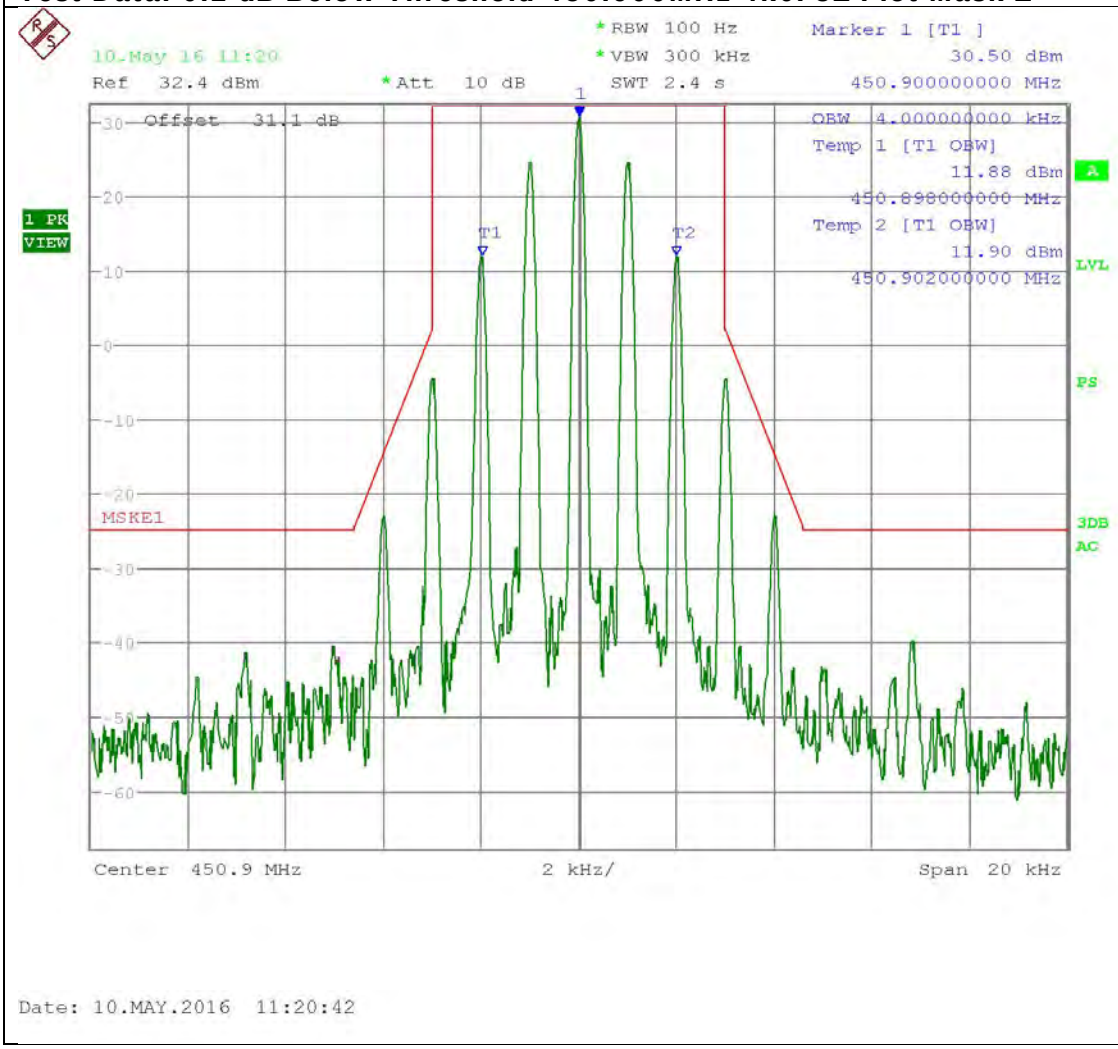
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 450.900MHz 4k0F3E Input Plot Mask E



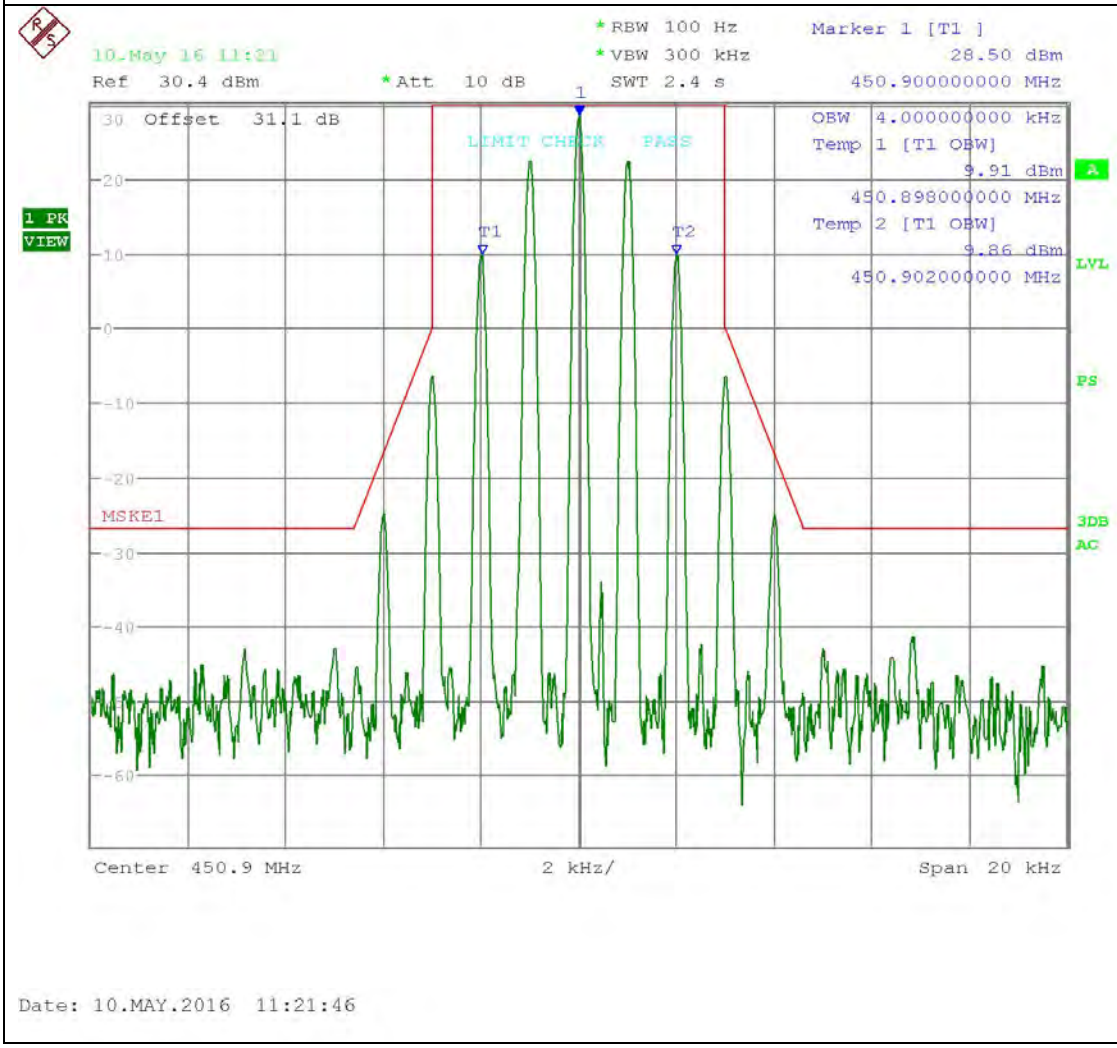
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 0.2 dB Below Threshold 450.900MHz 4k0F3E Plot Mask E



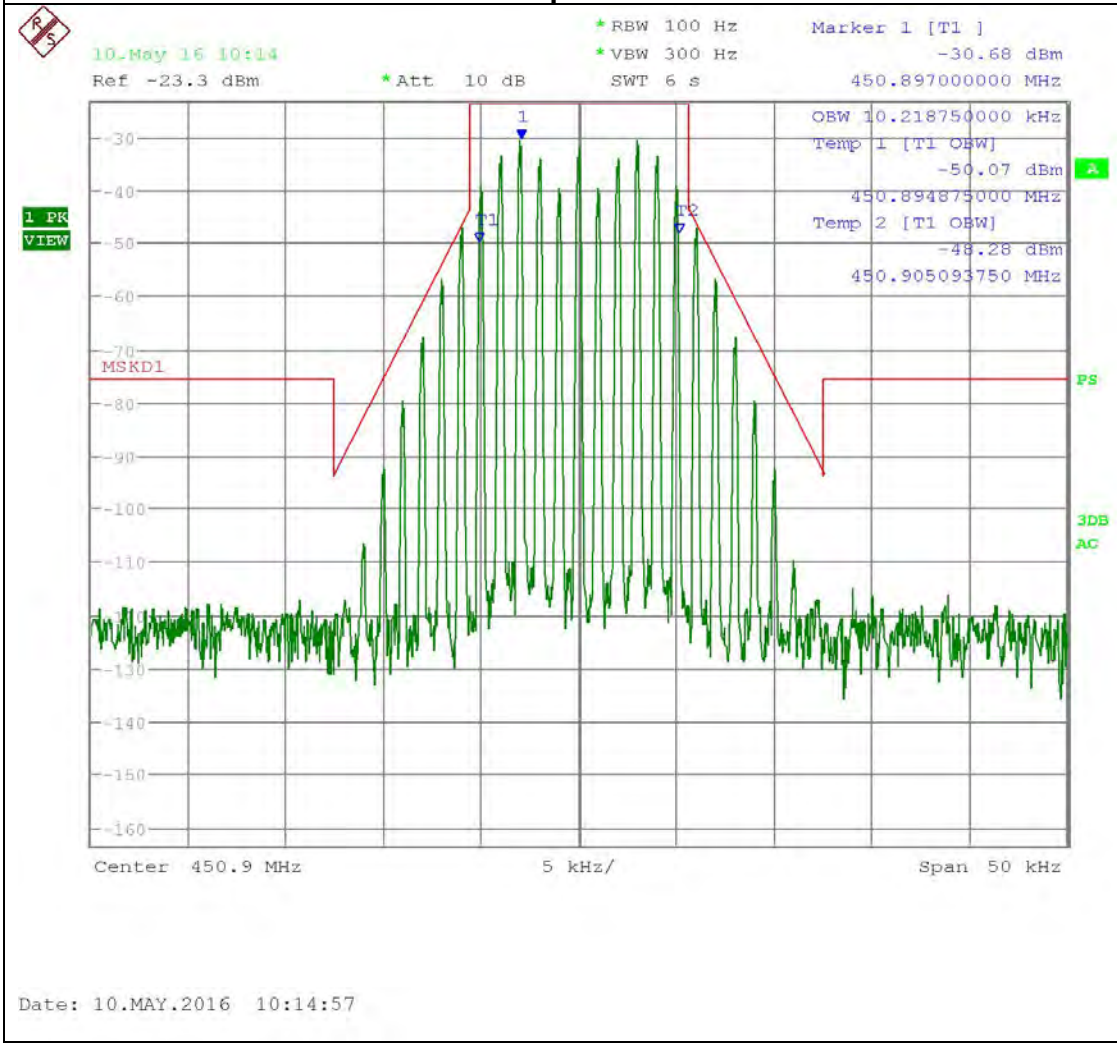
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 3.0dB Above Threshold 450.900MHz 4k0F3E Plot Mask E



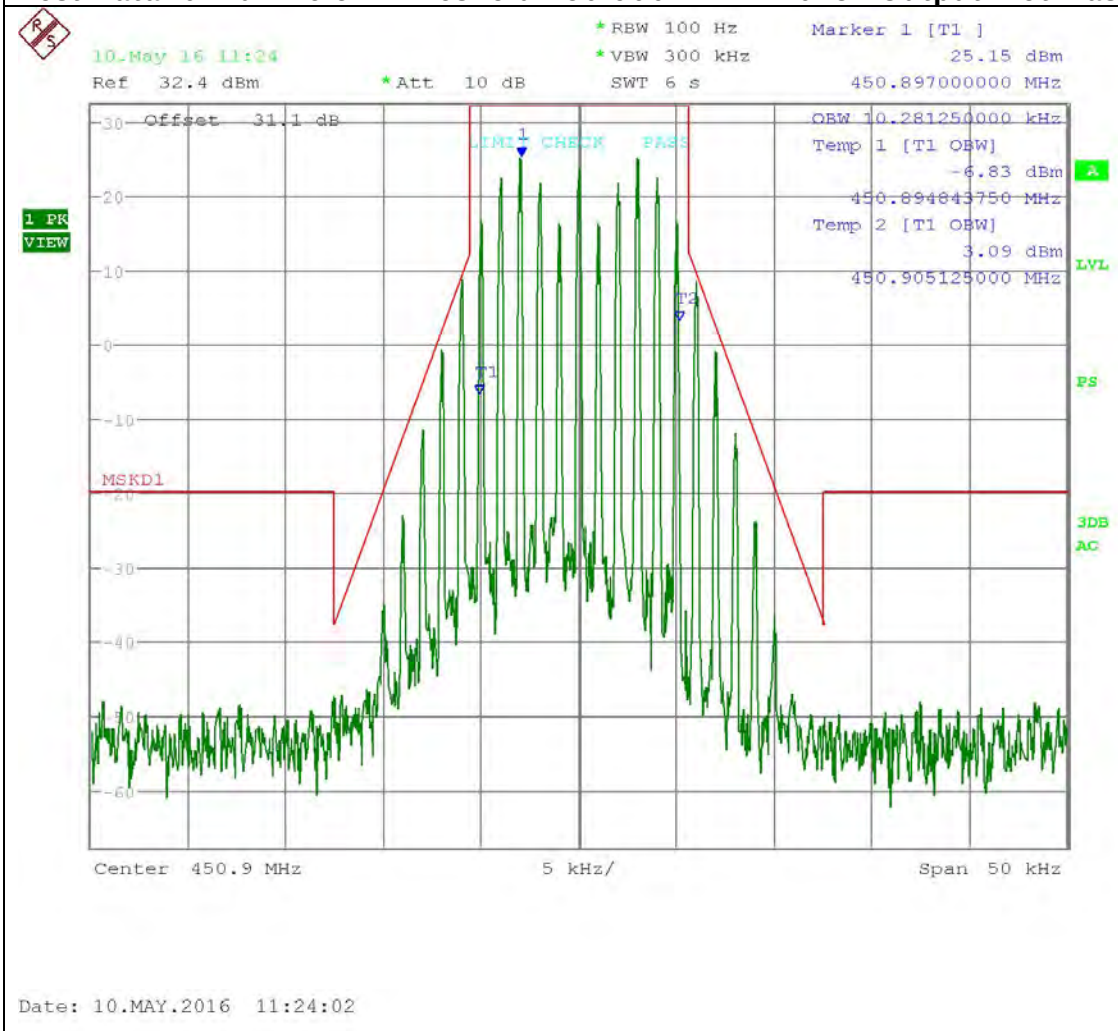
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 450.900MHz 11k0F3E Input Plot Mask D



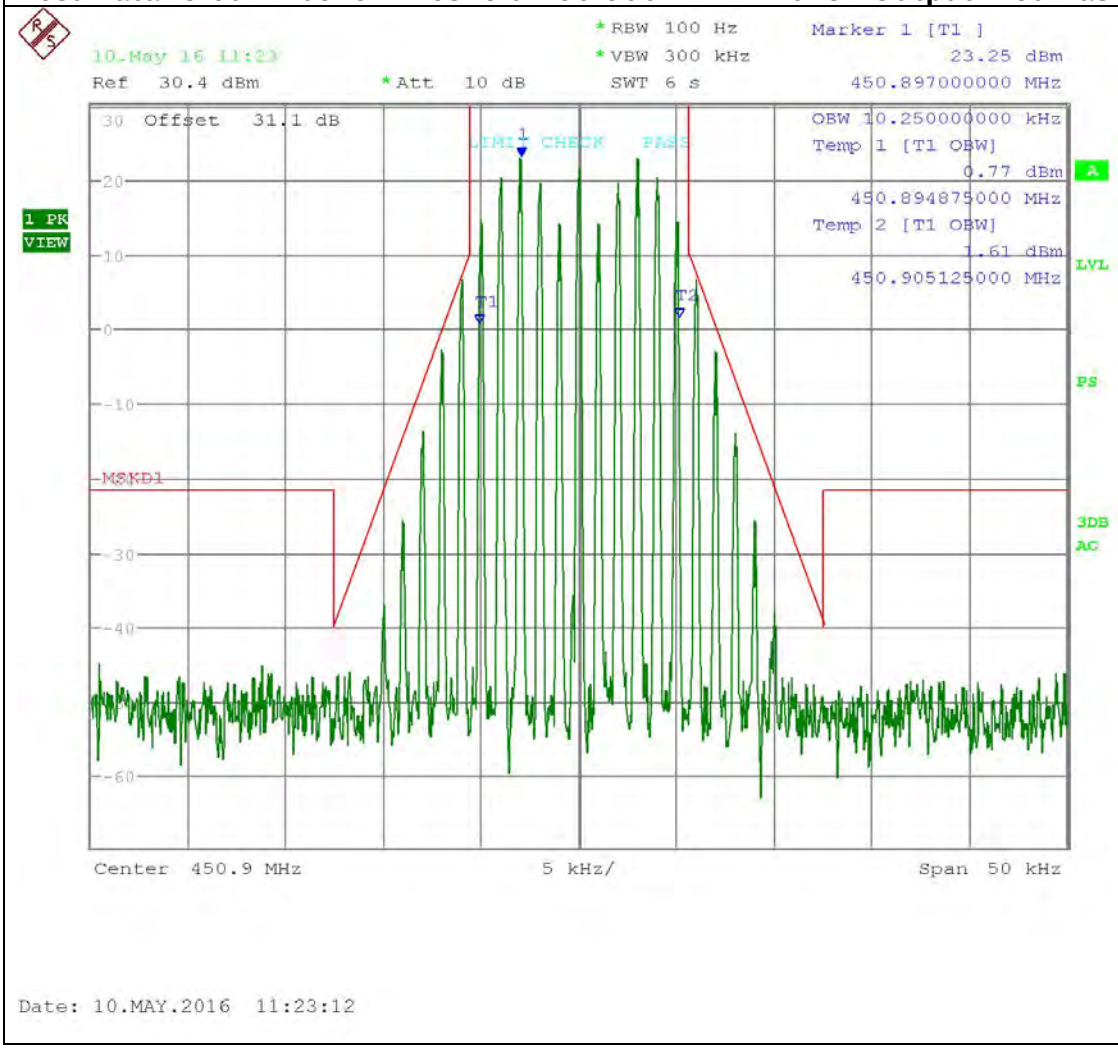
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 0.2 dB Below Threshold 450.900MHz 11k0F3E Output Plot Mask D



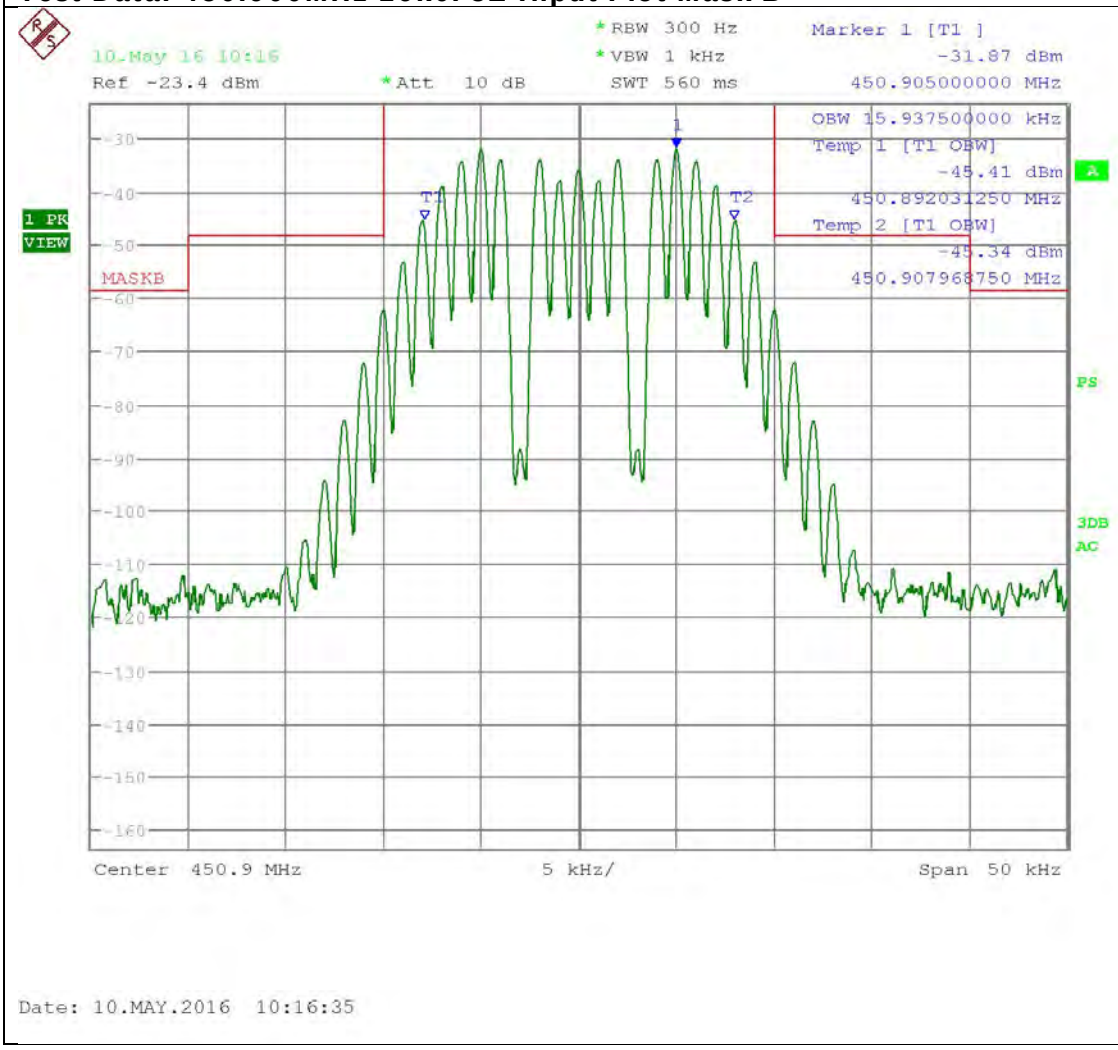
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 3.0dB Above Threshold 450.900MHz 11k0F3E Output Plot Mask D



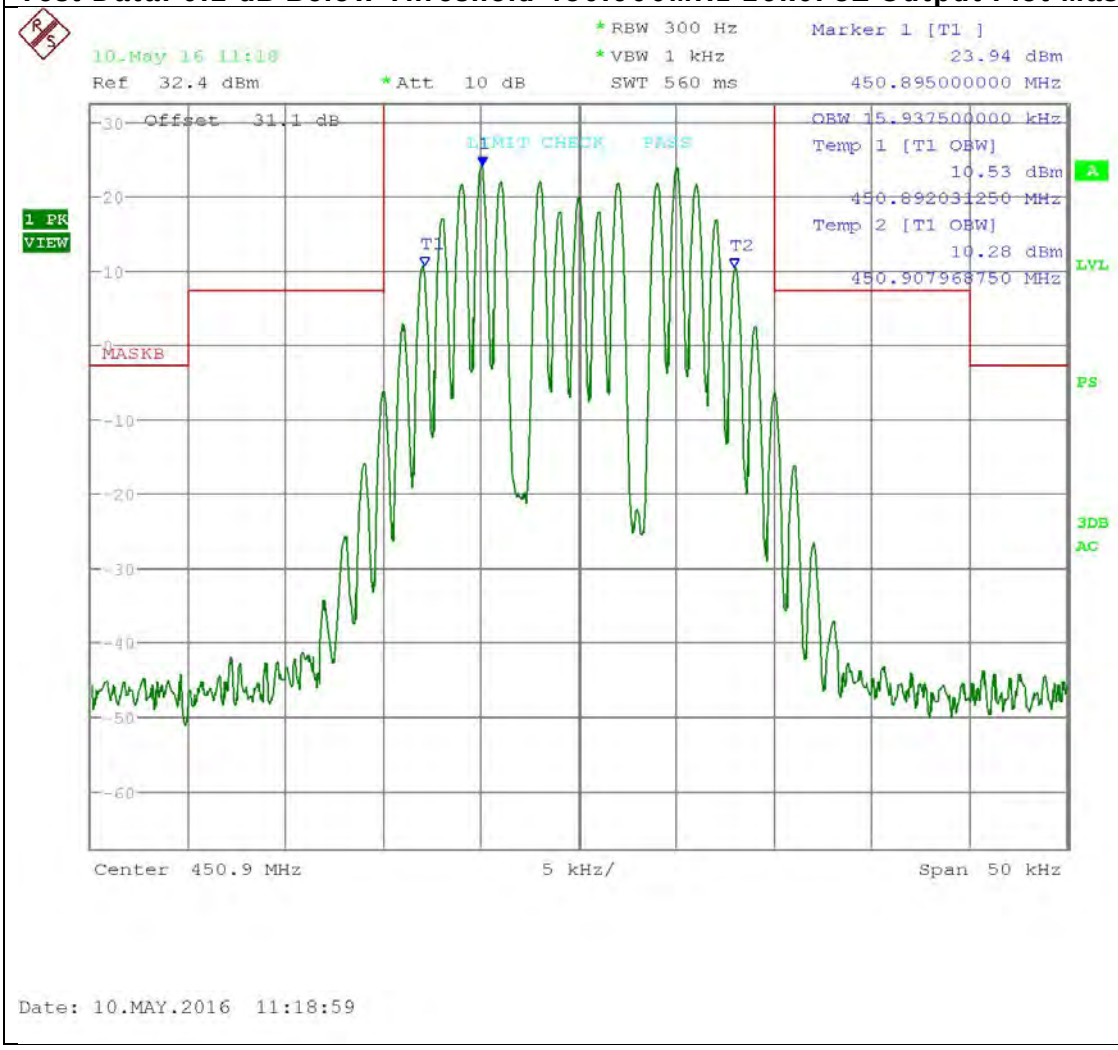
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 450.900MHz 16k0F3E Input Plot Mask B



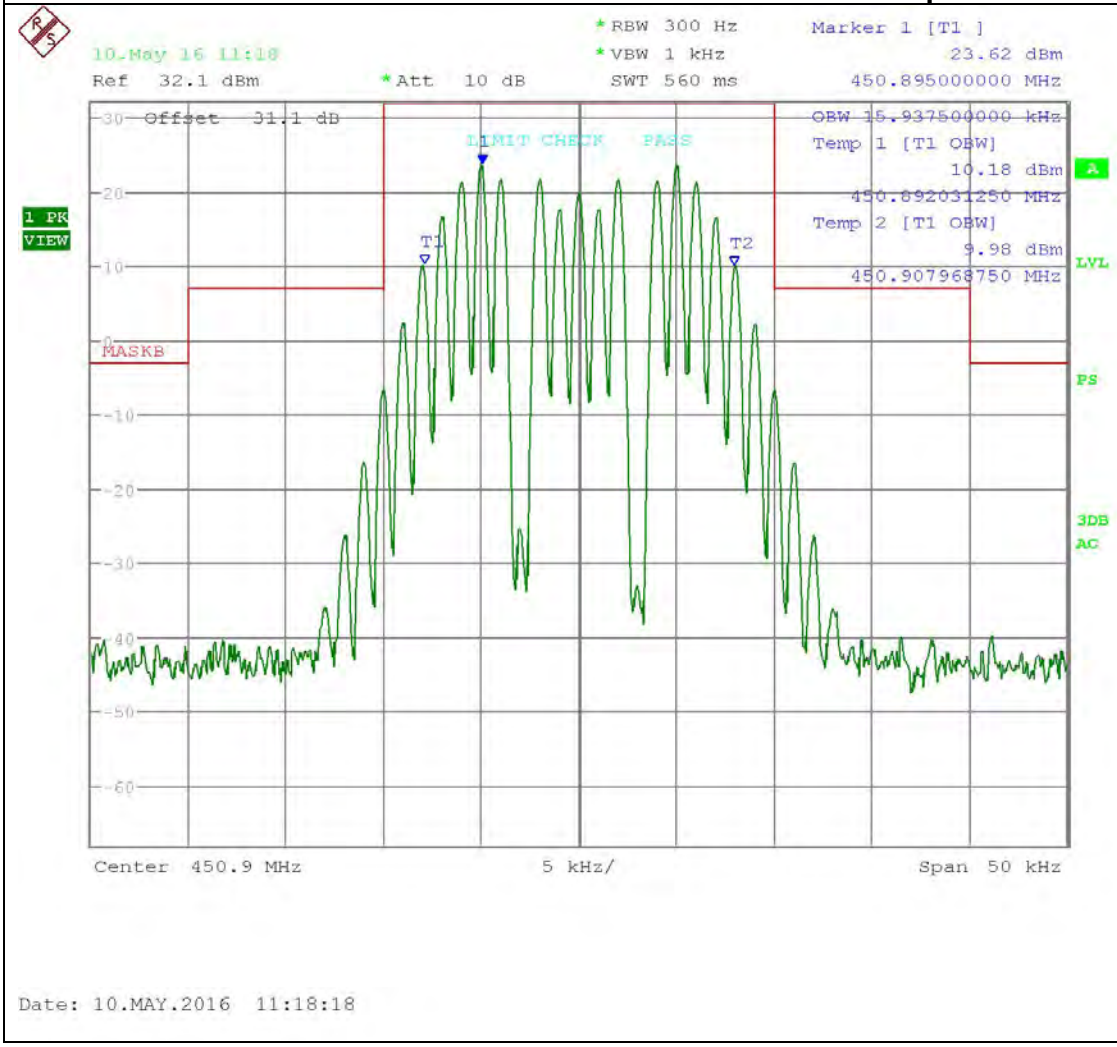
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 0.2 dB Below Threshold 450.900MHz 16k0F3E Output Plot Mask B



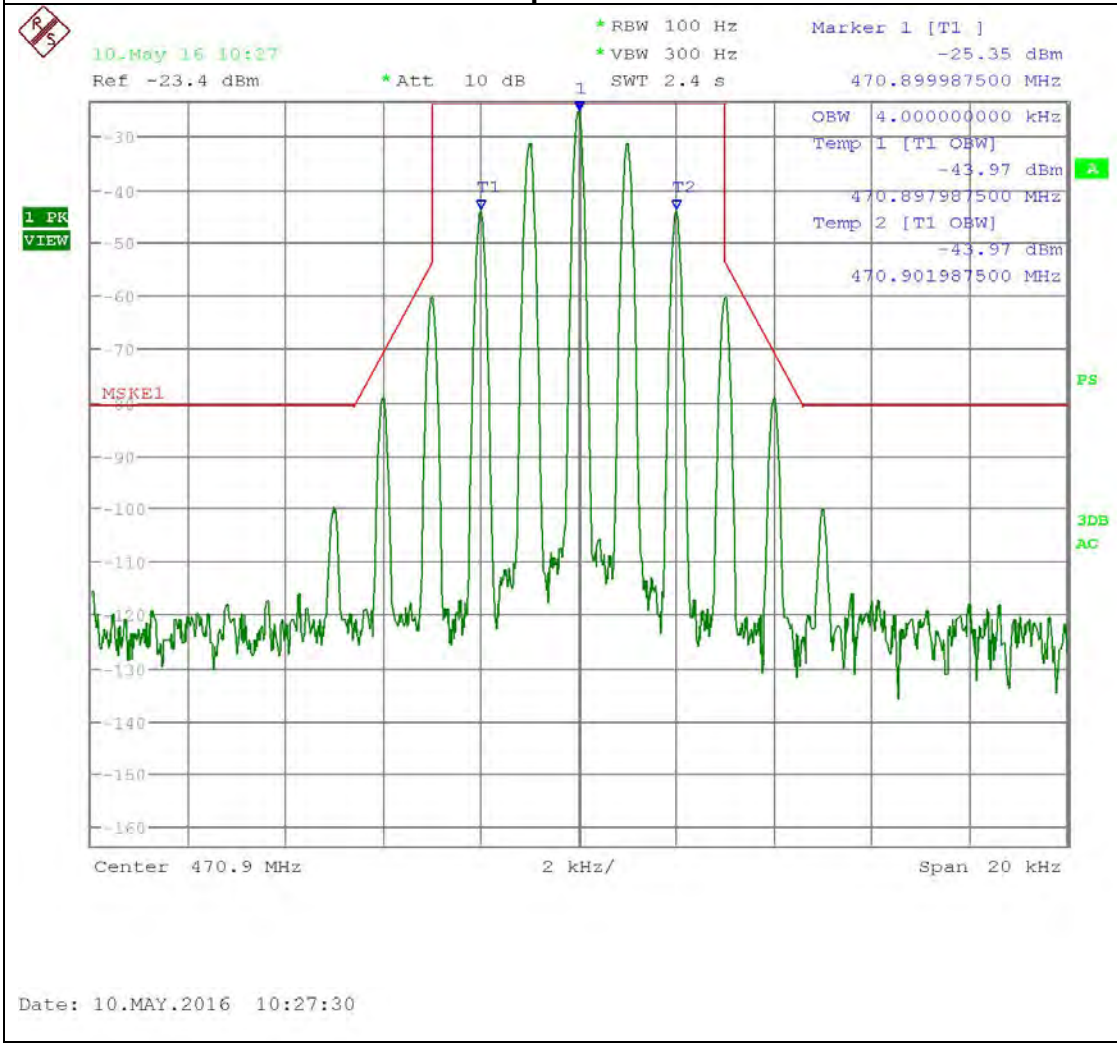
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 3.0dB Above Threshold 450.900MHz 16k0F3E Output Plot Mask B



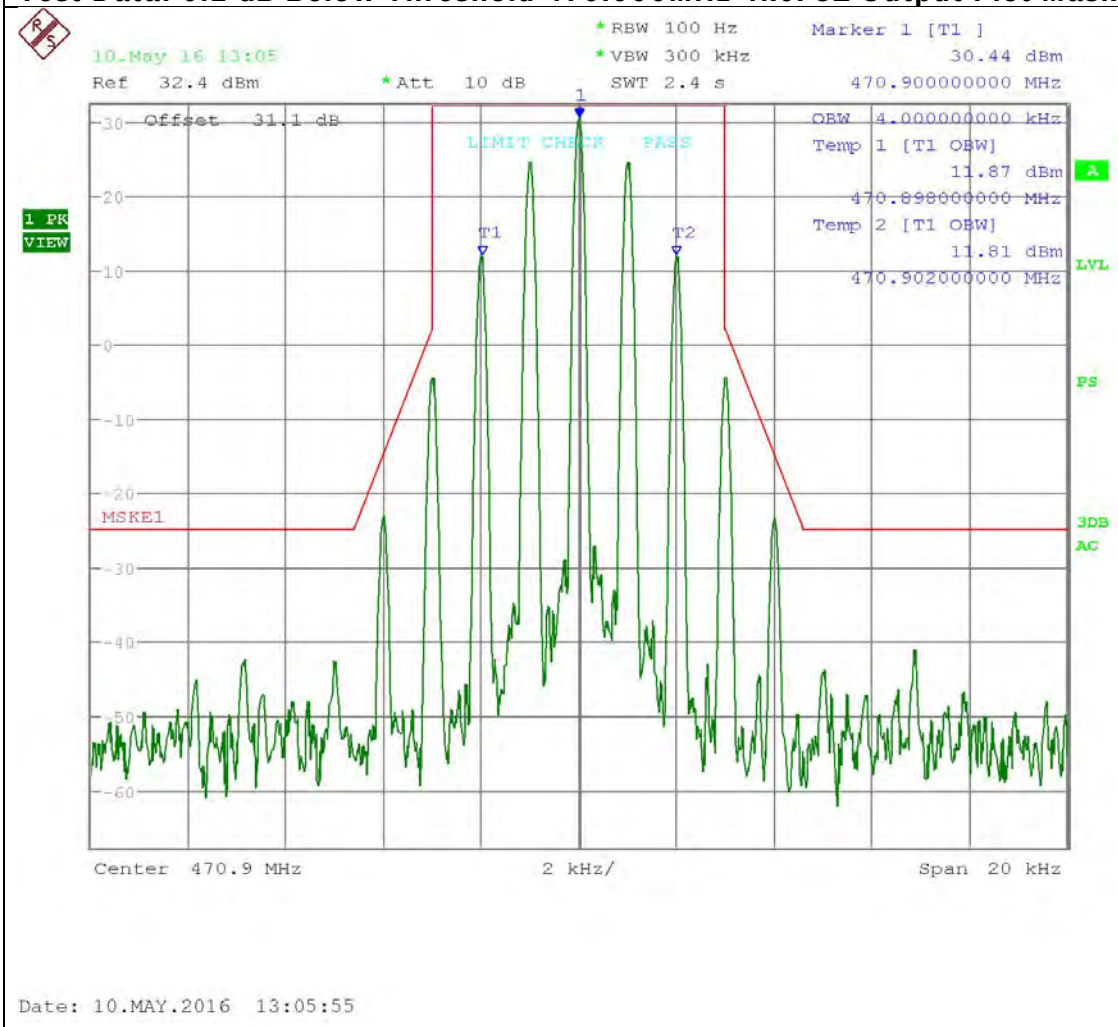
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 470.900MHz 4k0F3E Input Plot Mask E



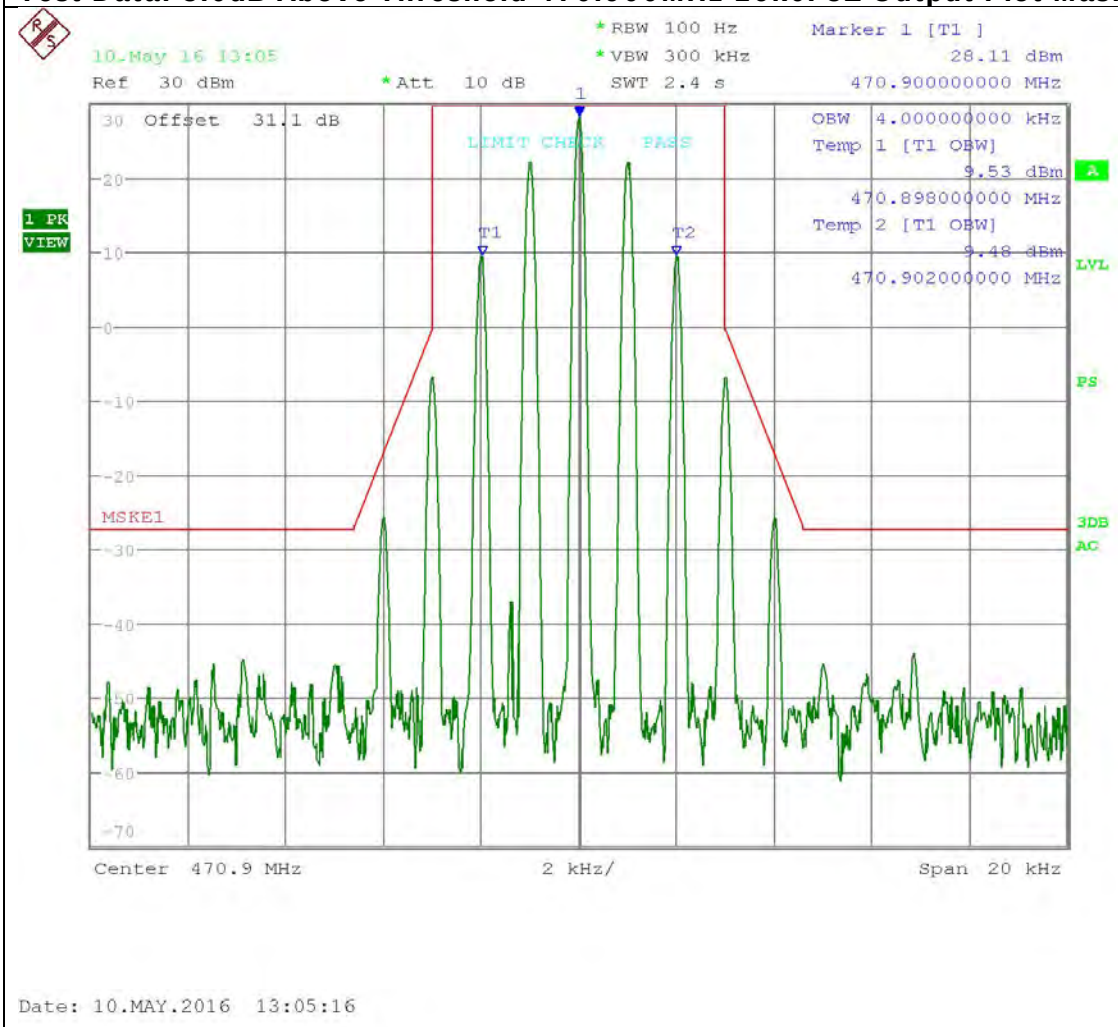
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 0.2 dB Below Threshold 470.900MHz 4k0F3E Output Plot Mask E



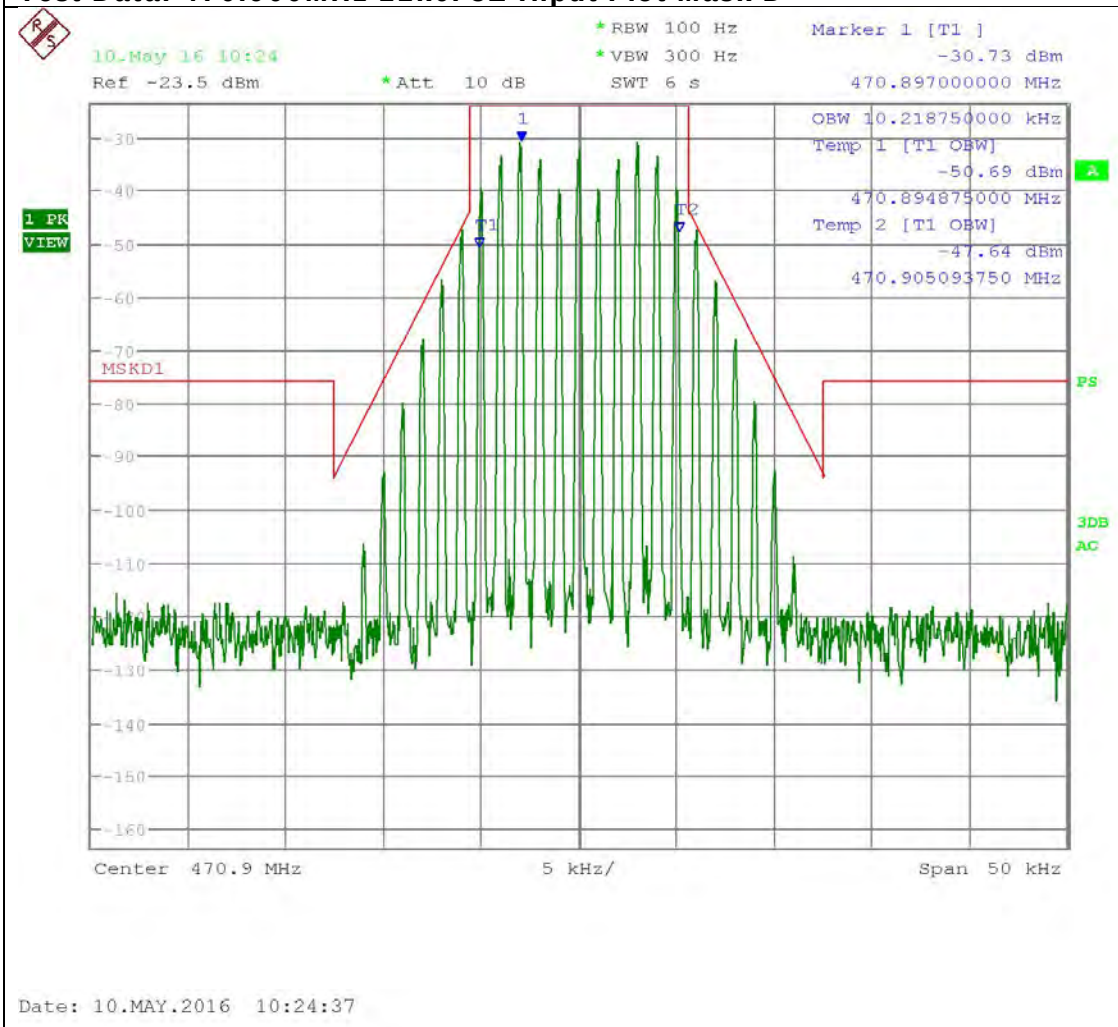
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 3.0dB Above Threshold 470.900MHz 16k0F3E Output Plot Mask E



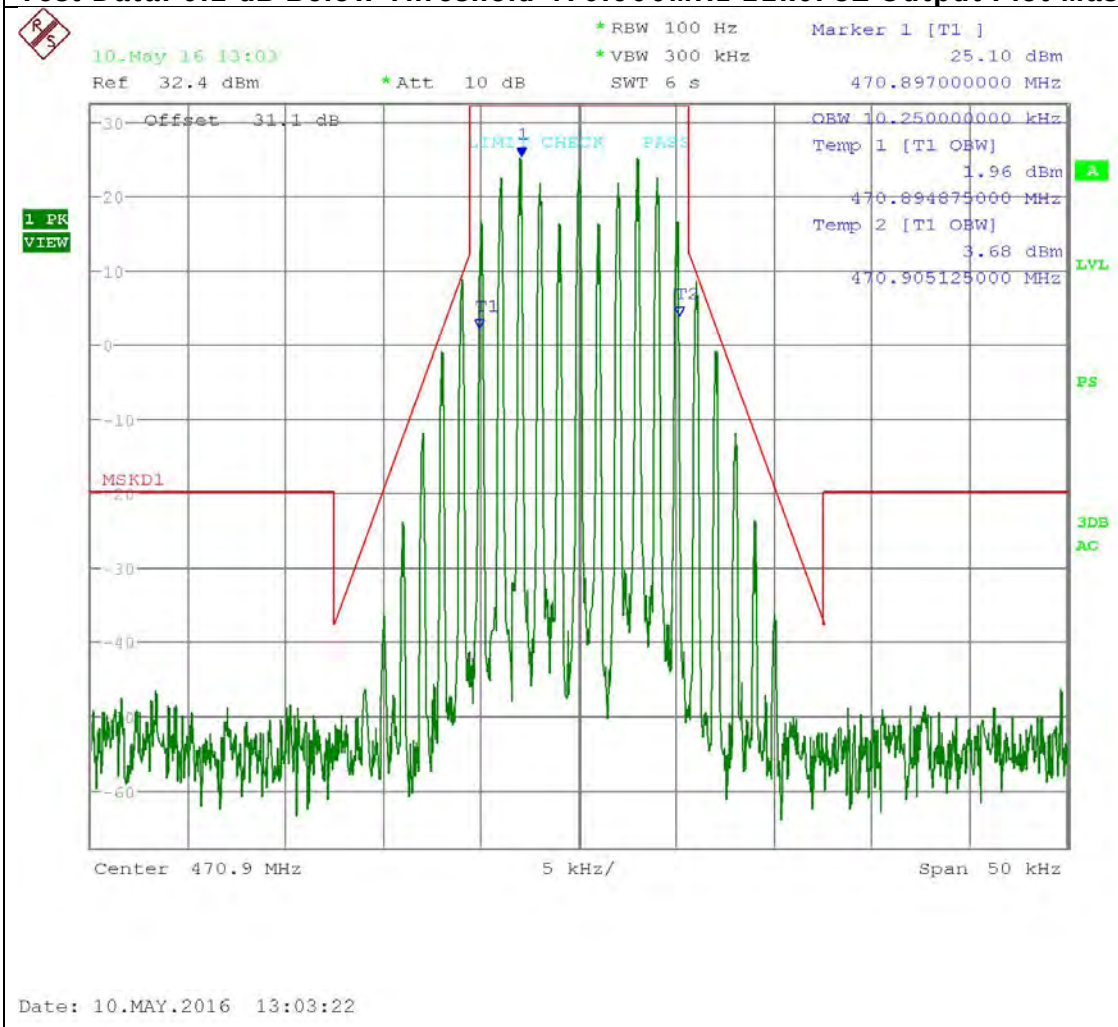
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 470.900MHz 11k0F3E Input Plot Mask D



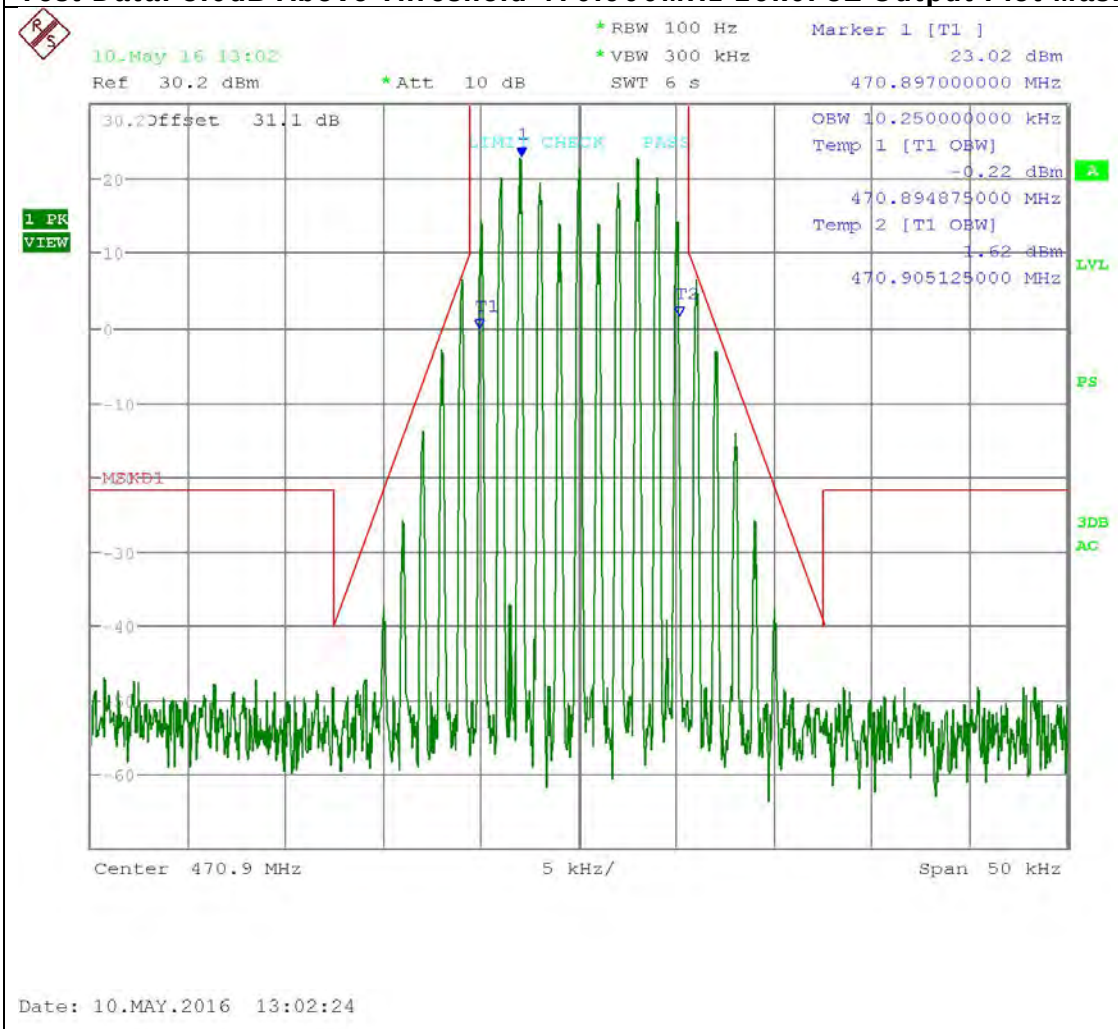
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 0.2 dB Below Threshold 470.900MHz 11k0F3E Output Plot Mask D



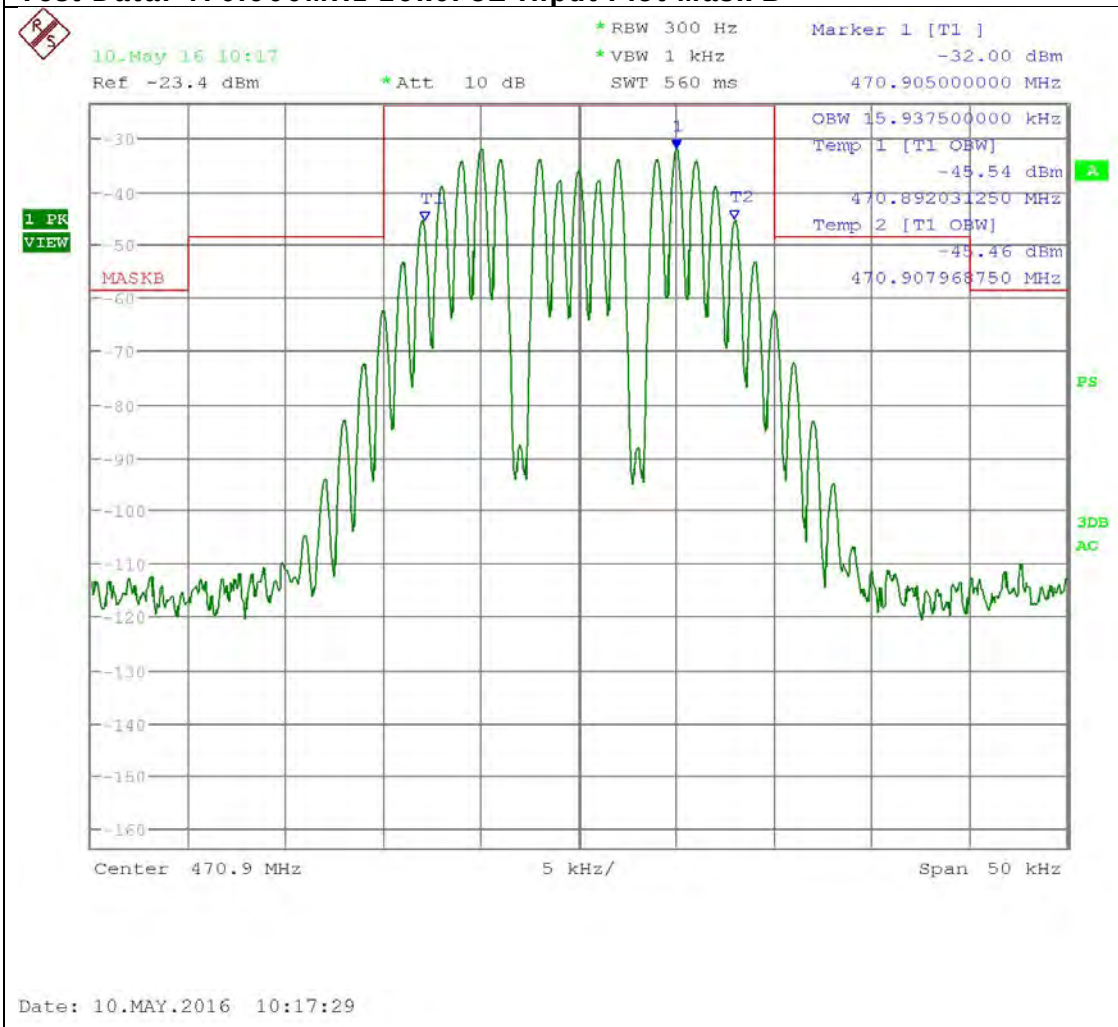
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 3.0dB Above Threshold 470.900MHz 16k0F3E Output Plot Mask D



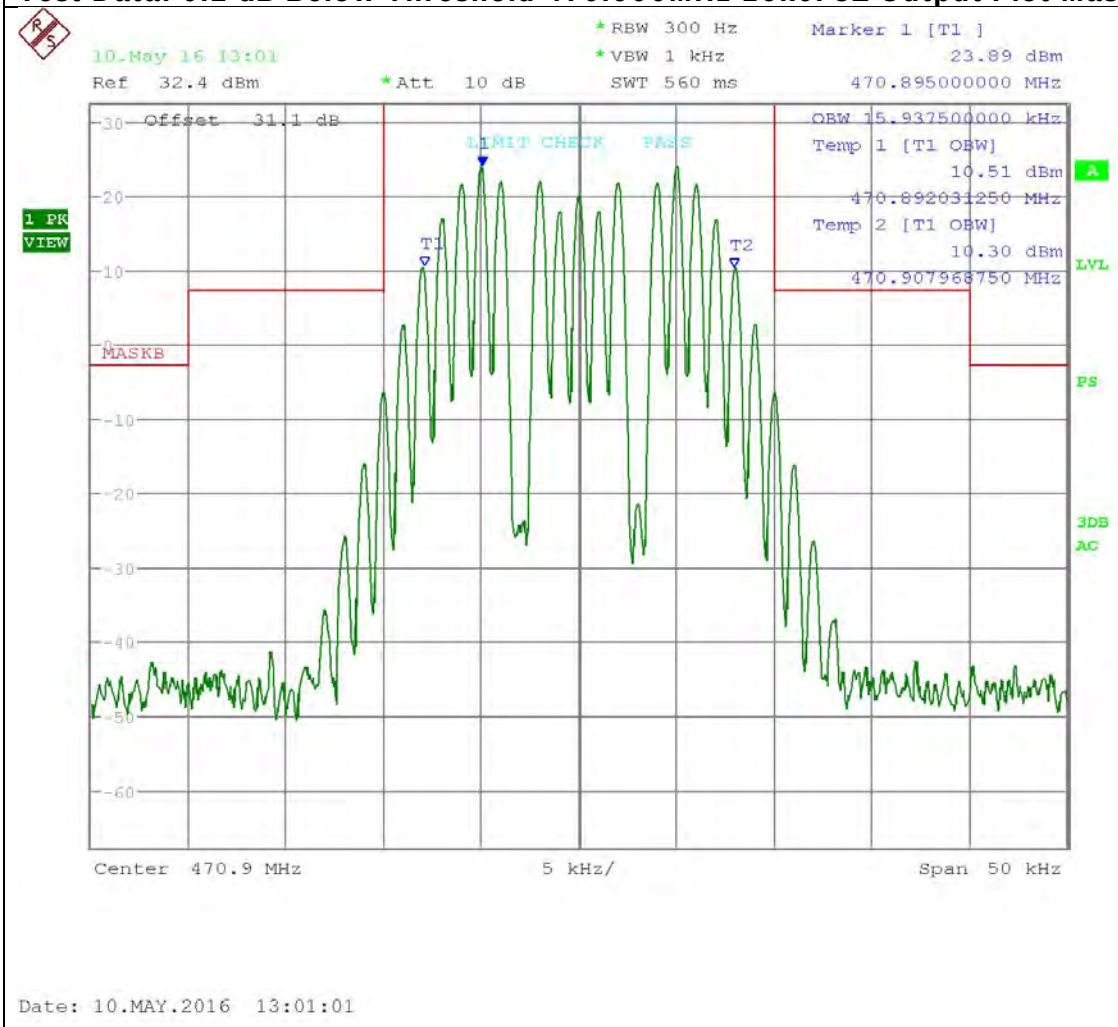
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 470.900MHz 16k0F3E Input Plot Mask B



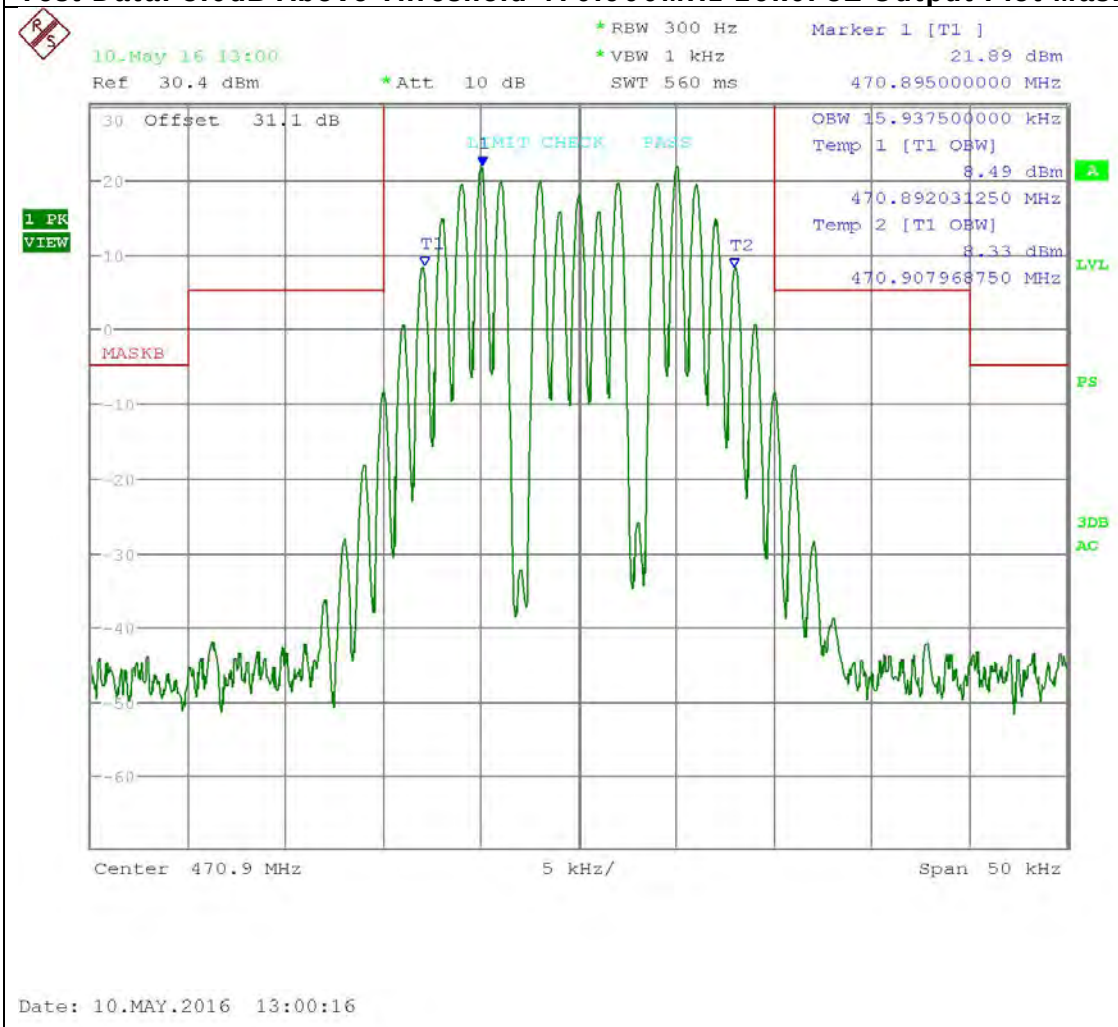
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 0.2 dB Below Threshold 470.900MHz 16k0F3E Output Plot Mask B



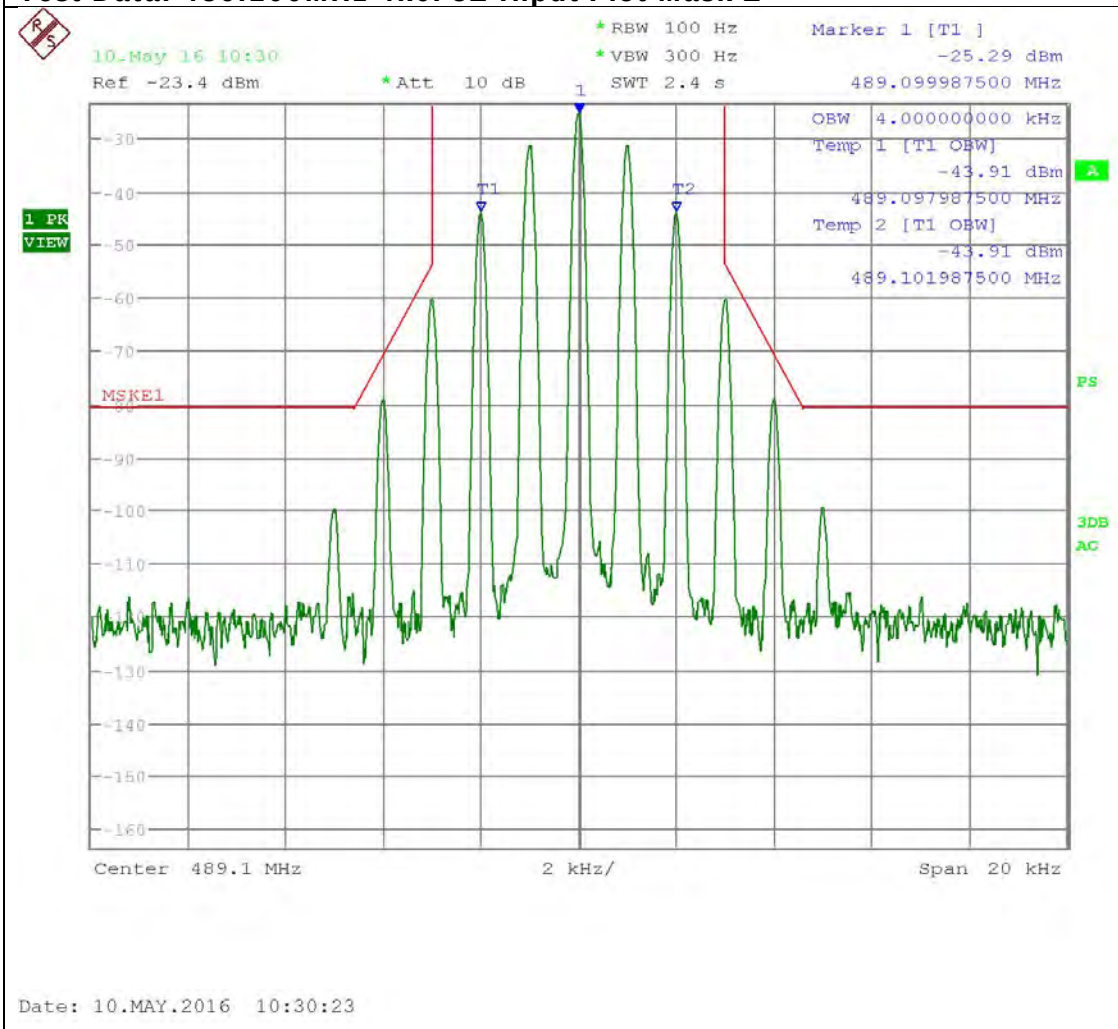
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 3.0dB Above Threshold 470.900MHz 16k0F3E Output Plot Mask B



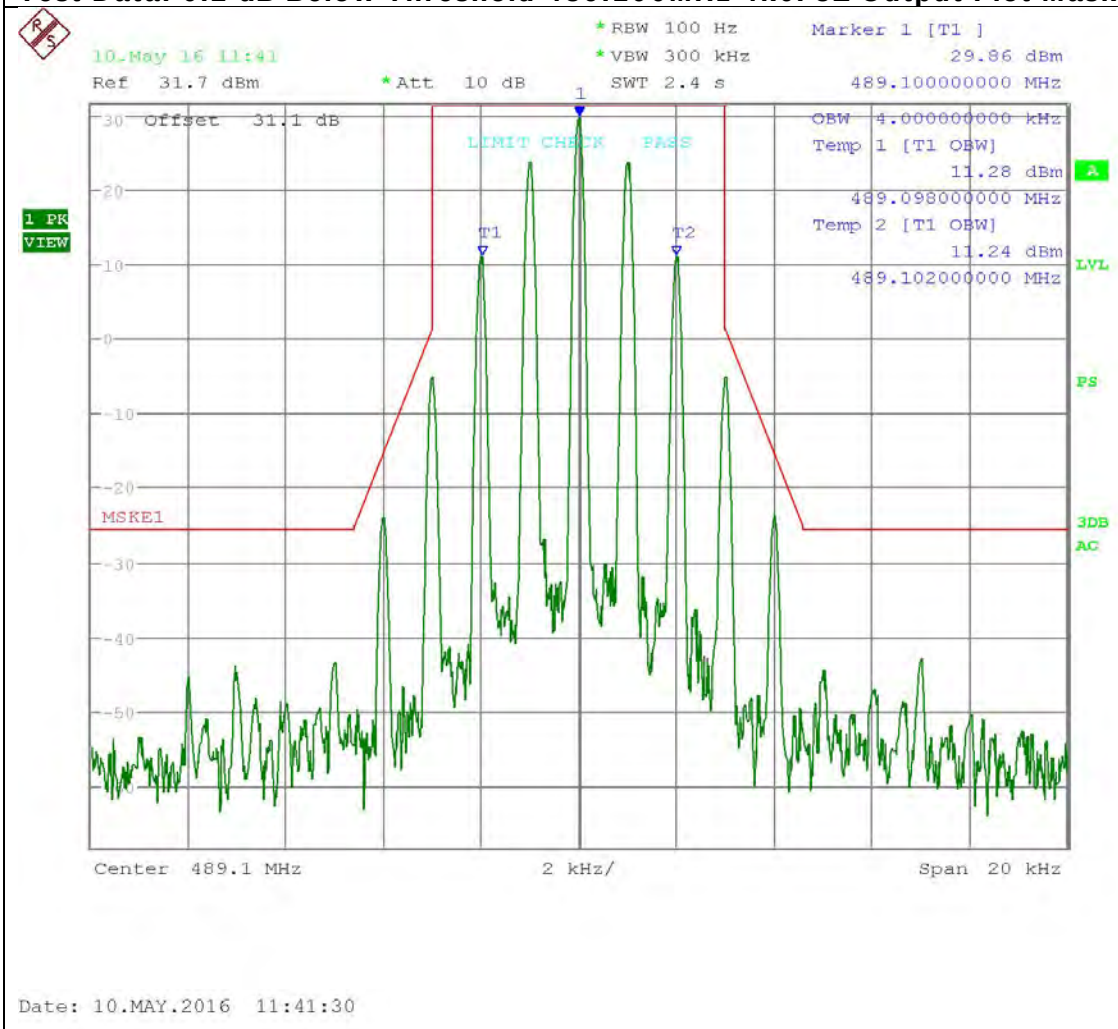
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 489.100MHz 4k0F3E Input Plot Mask E



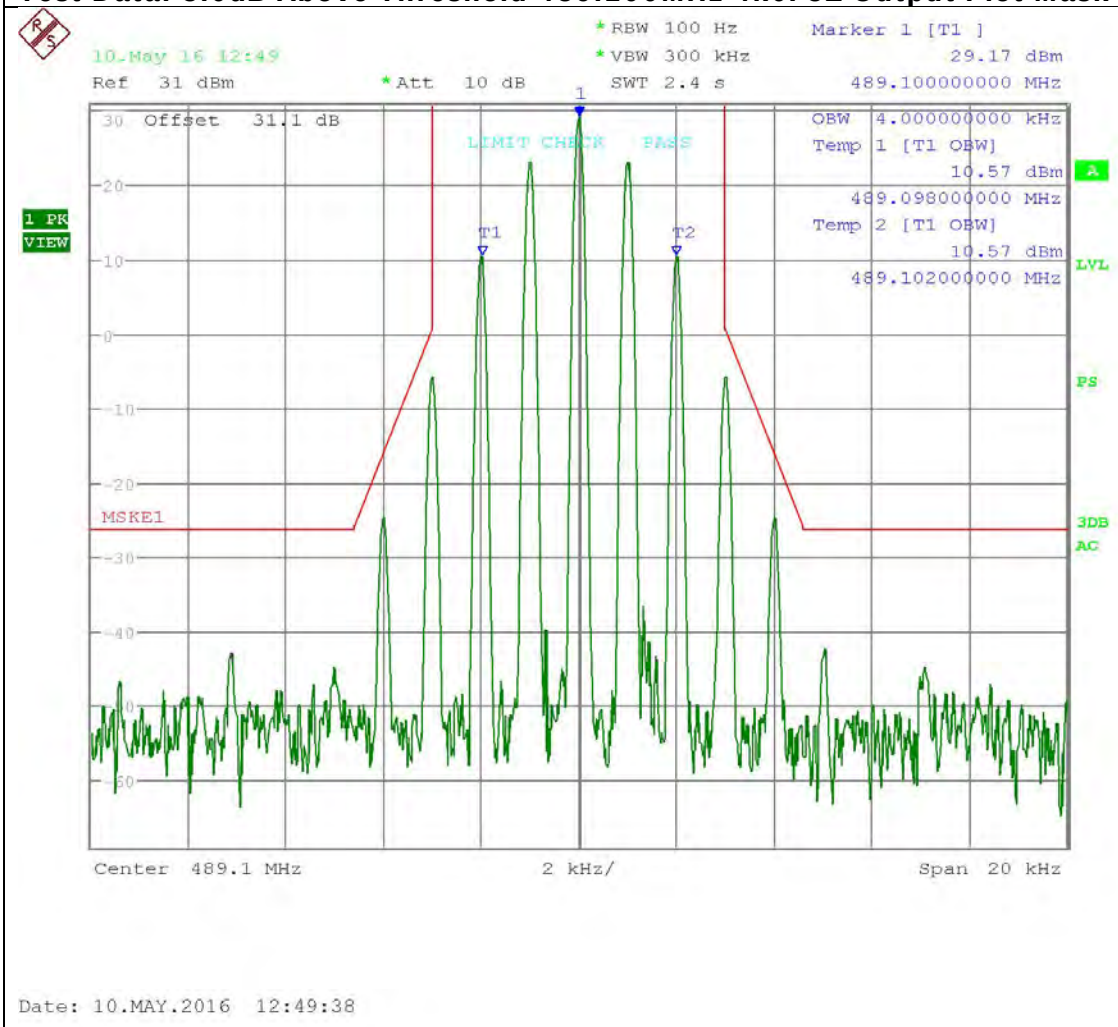
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 0.2 dB Below Threshold 489.100MHz 4k0F3E Output Plot Mask E



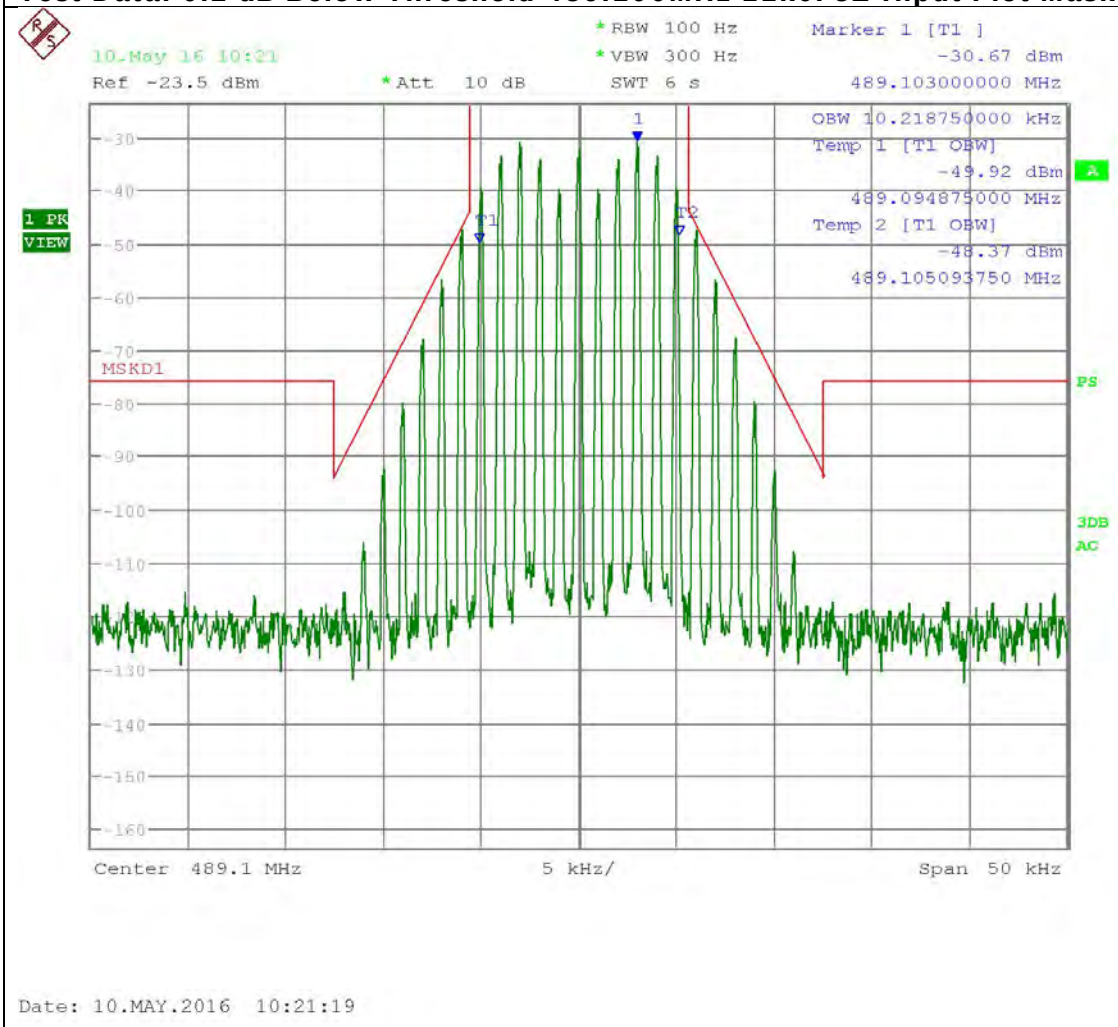
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 3.0dB Above Threshold 489.100MHz 4k0F3E Output Plot Mask E



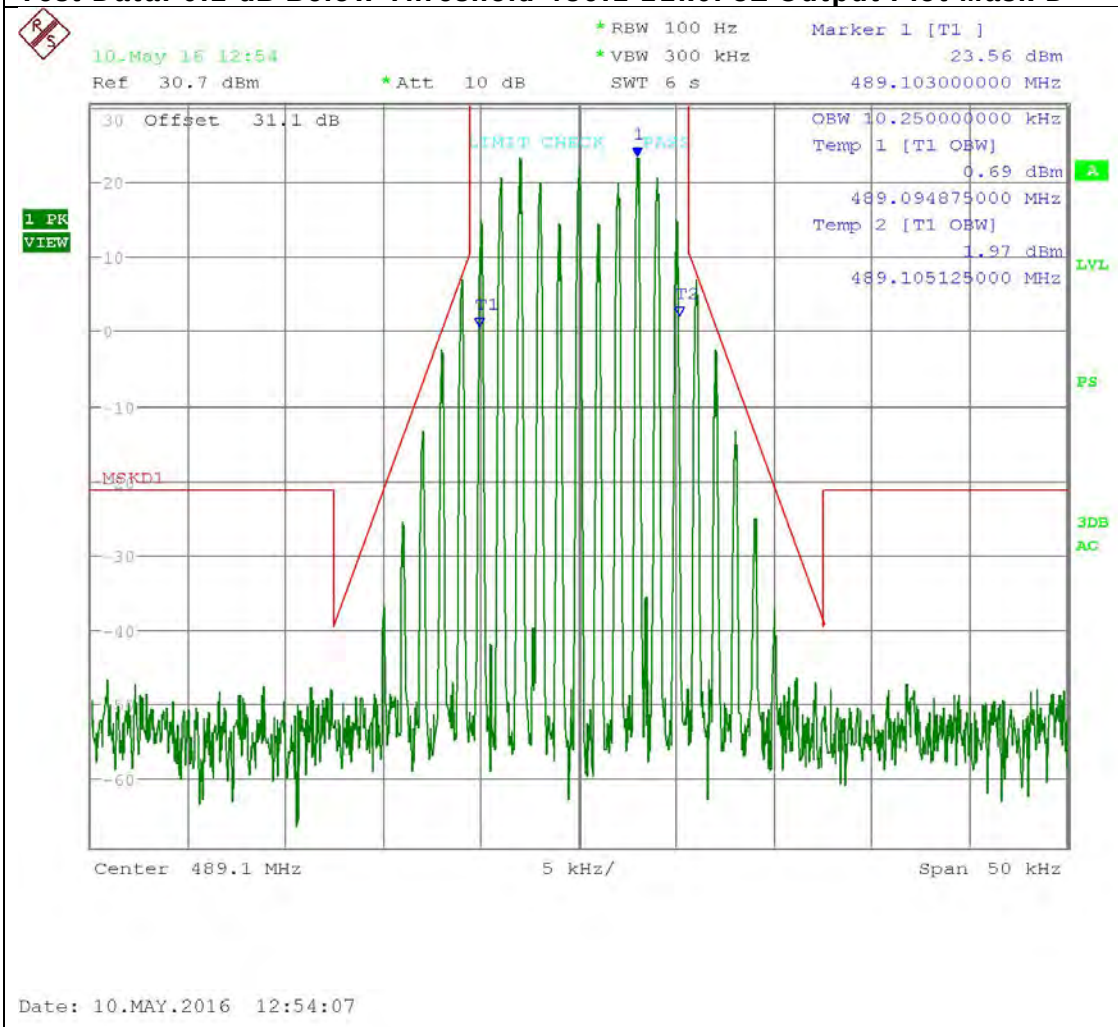
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 0.2 dB Below Threshold 489.100MHz 11k0F3E Input Plot Mask D



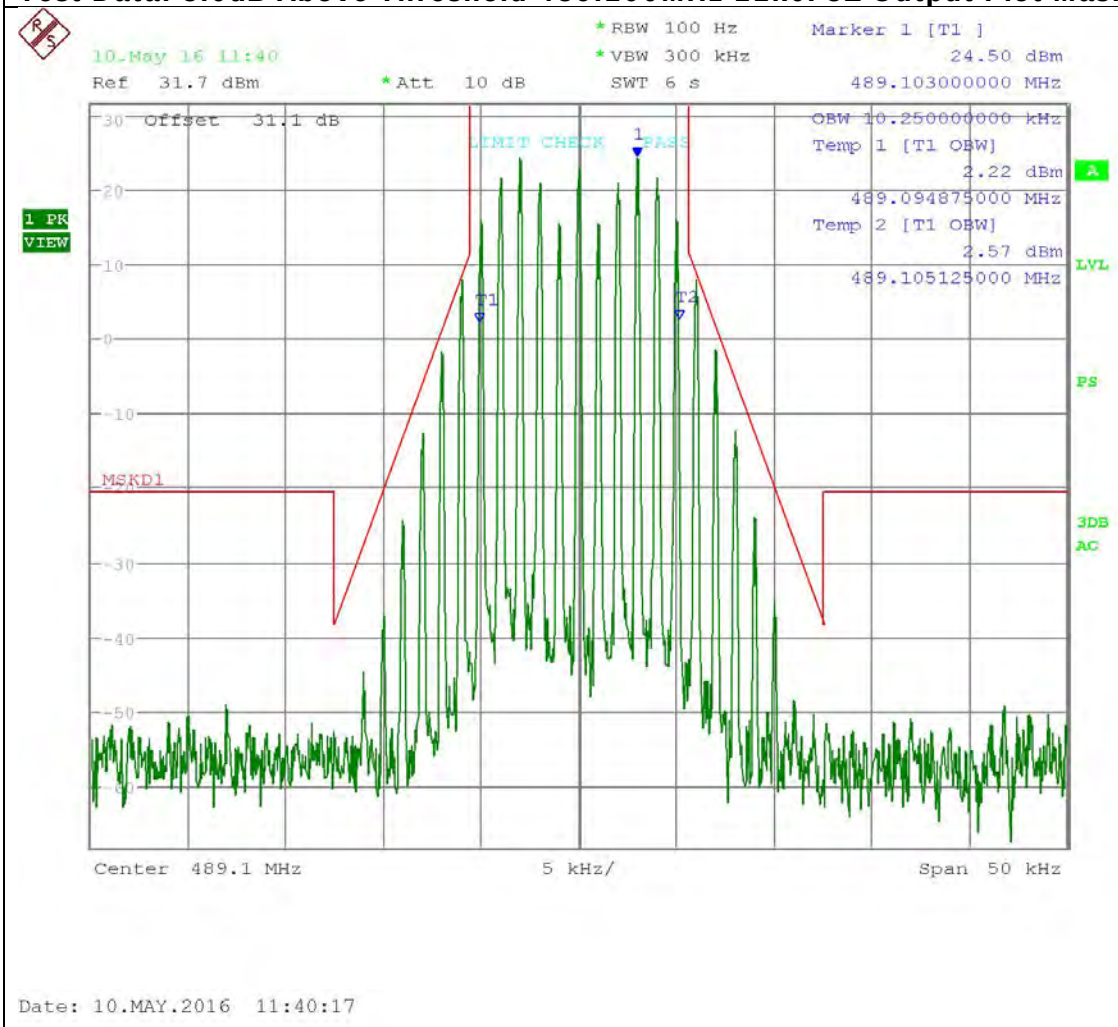
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 0.2 dB Below Threshold 489.1 11k0F3E Output Plot Mask D



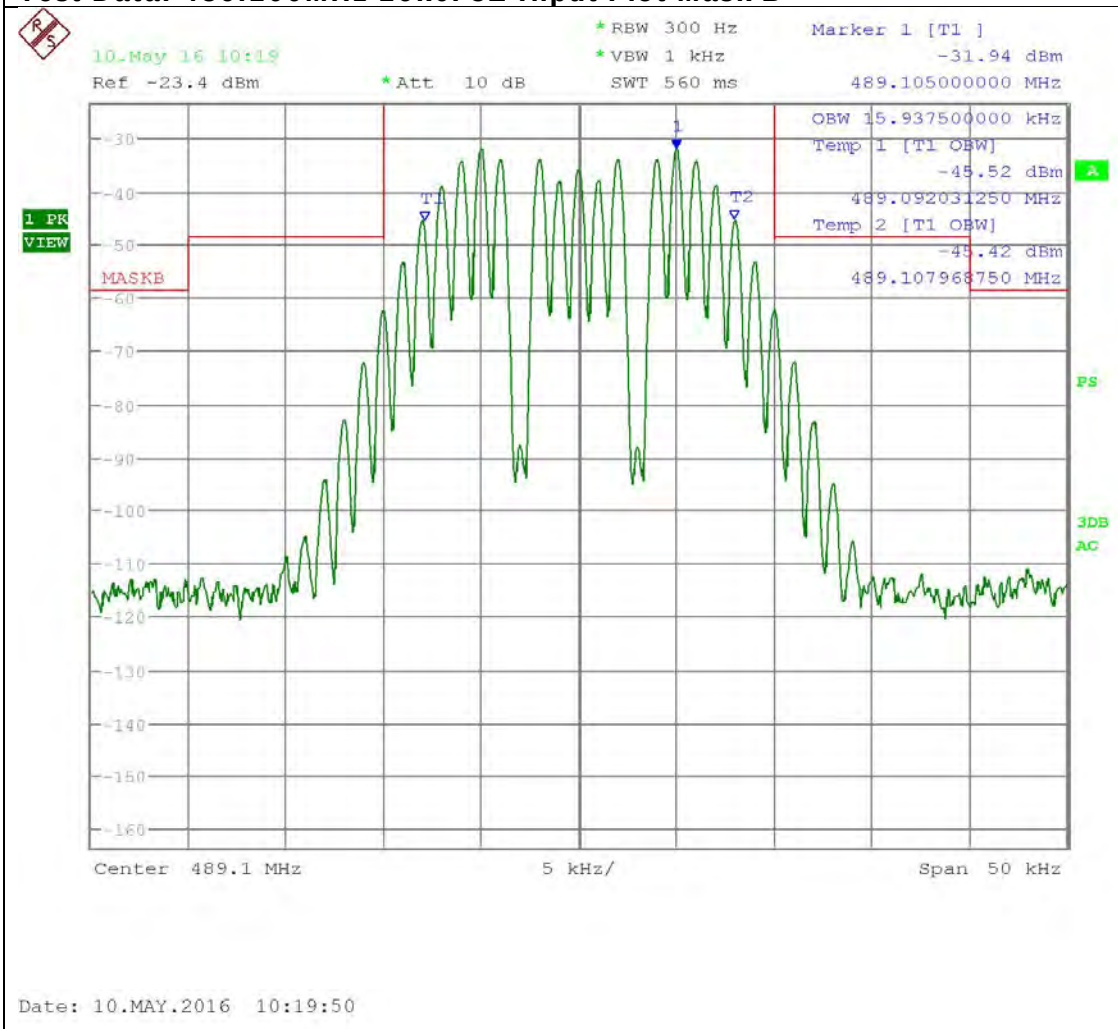
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 3.0dB Above Threshold 489.100MHz 11k0F3E Output Plot Mask D



INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

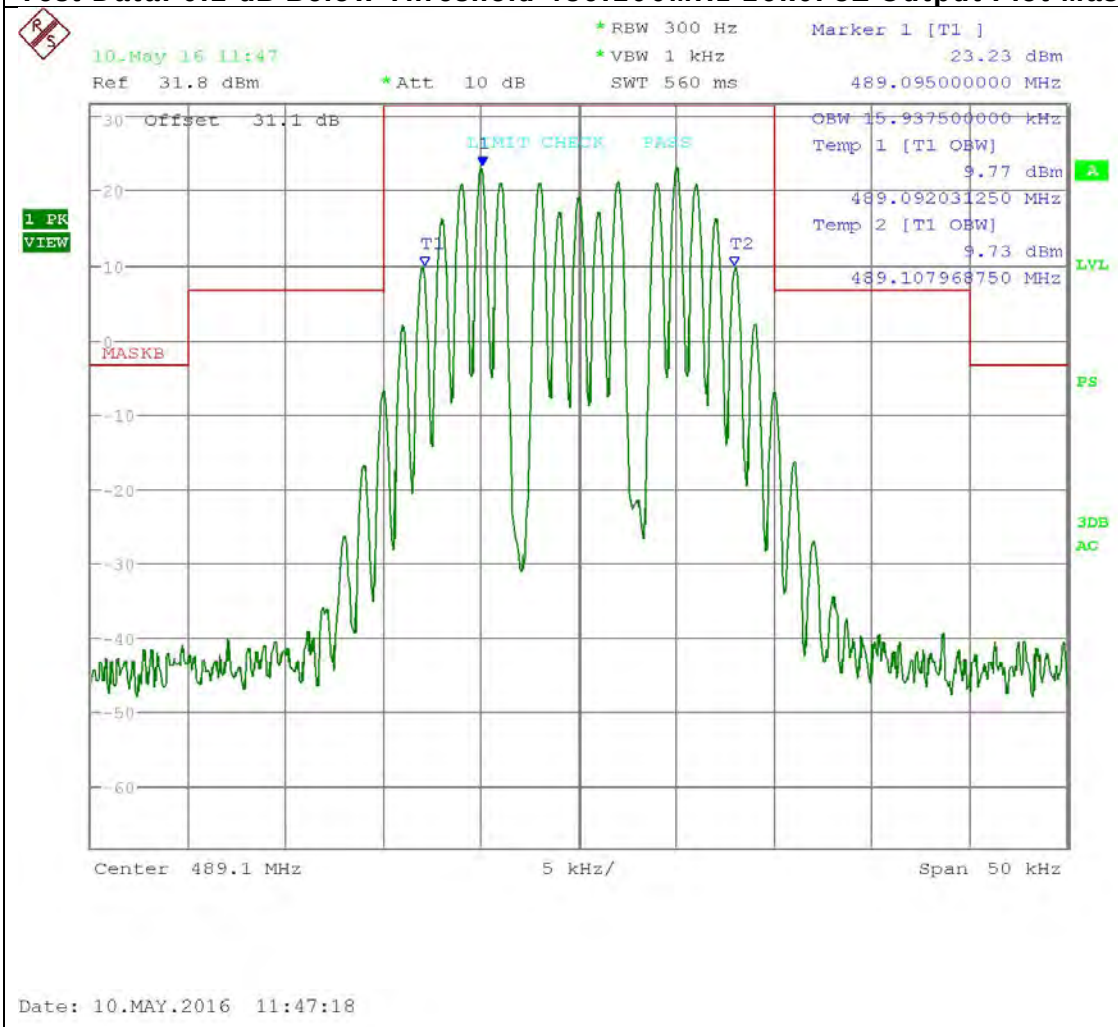
Test Data: 489.100MHz 16k0F3E Input Plot Mask B



Date: 10.MAY.2016 10:19:50

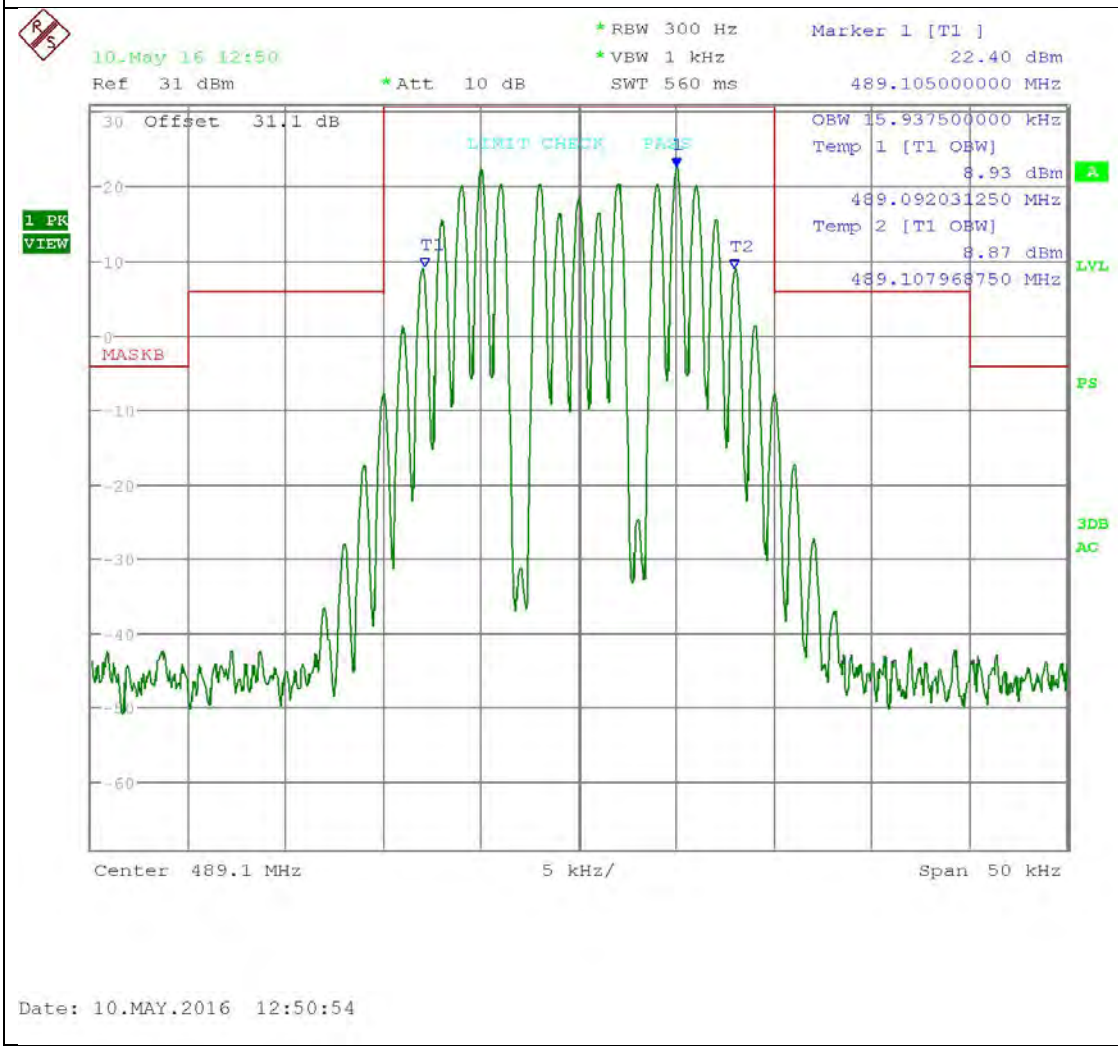
INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 0.2 dB Below Threshold 489.100MHz 16k0F3E Output Plot Mask B



INPUT-VERSUS-OUTPUT SIGNAL COMPARISON

Test Data: 3.0dB Above Threshold 489.100MHz 16k0F3E Output Plot Mask B



NOISE FIGURE §4.6

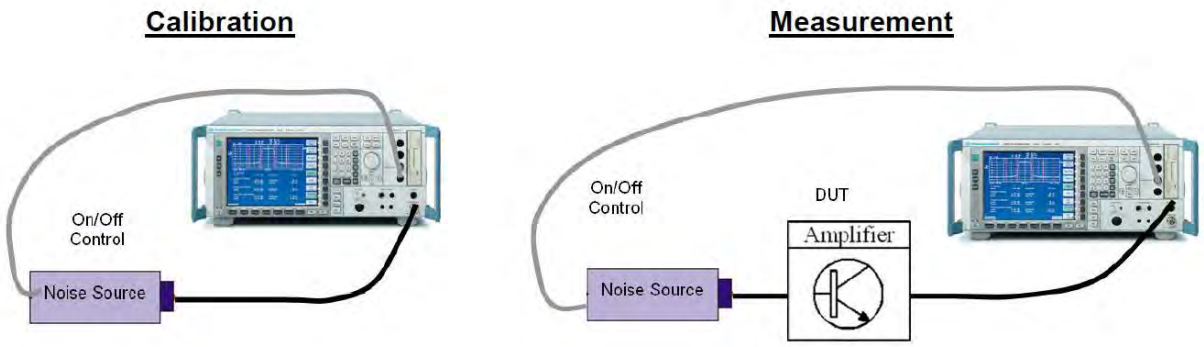
Rule Part No.: Part 90.219 (e)(2)

Requirements: The noise figure of a signal booster must not exceed 9 dB in either direction.

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: Noise Figure Measurement Table

$T^{ON\ source}$ (K)	$T^{OFF\ source}$ (K)	Source ENR (dB)
9674.216051	290	15.1

Step 1 Calibration of Noise Source with ESU 40							
Direction	$N^{SA\ off}$		$N^{SA\ on}$		Y^{SA}	T^{SA}	NF^{SA}
UP/Down	dBm	fW	dBm	fW	Linear	Analyzer	dB
Down	-102.58	55.21	-97.24	188.80	3.42	3588.10	11.26
Up	-102.29	59.02	-97.24	188.80	3.20	3977.70	11.68

Step 2 Noise Measurement with EUT							
Direction	$N^{EUT\ \&\ SA\ off}$		$N^{EUT\ \&\ SA\ on}$		$Y^{EUT\ \&\ SA}$	$T^{EUT\ \&\ SA}$	NF
UP/Down	dBm	fW	dBm	fW	Linear	Cascade	dB
Down	-14.18	38194427084.00	-4.43	360578643021.64	9.44	821.79	5.84
Up	-15.8	26302679918.95	-6.72	212813904598.27	8.09	1033.41	6.59

Step 3 Noise Figure Calcualtion for EUT						
Direction	Gain	Gain	T^{EUT}	NF	Limit	Margin
UP/Down	Num	dB	EUT	dB	dB	dB
Down	2413211013	93.83	821.79	5.84	≤ 9	3.16
Up	1437144577	91.58	1033.41	6.59	≤ 9	2.41

Results Meet Requirements

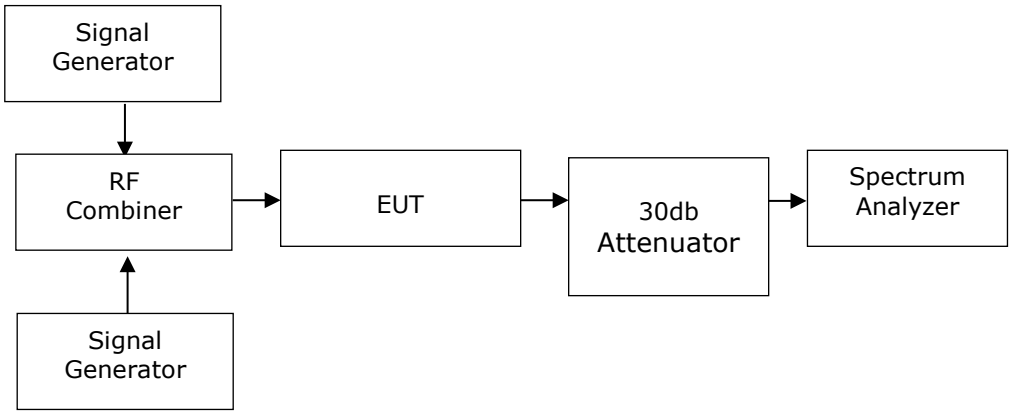
OUT OF BAND / OUT OF BLOCK EMISSIONS (including intermodulation) §4.7

Rule Part No.: 90.219 (e)(3)

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

Setup Diagram:



Test Data: Low End of Band 0.2 dB Below Threshold Measurement Table

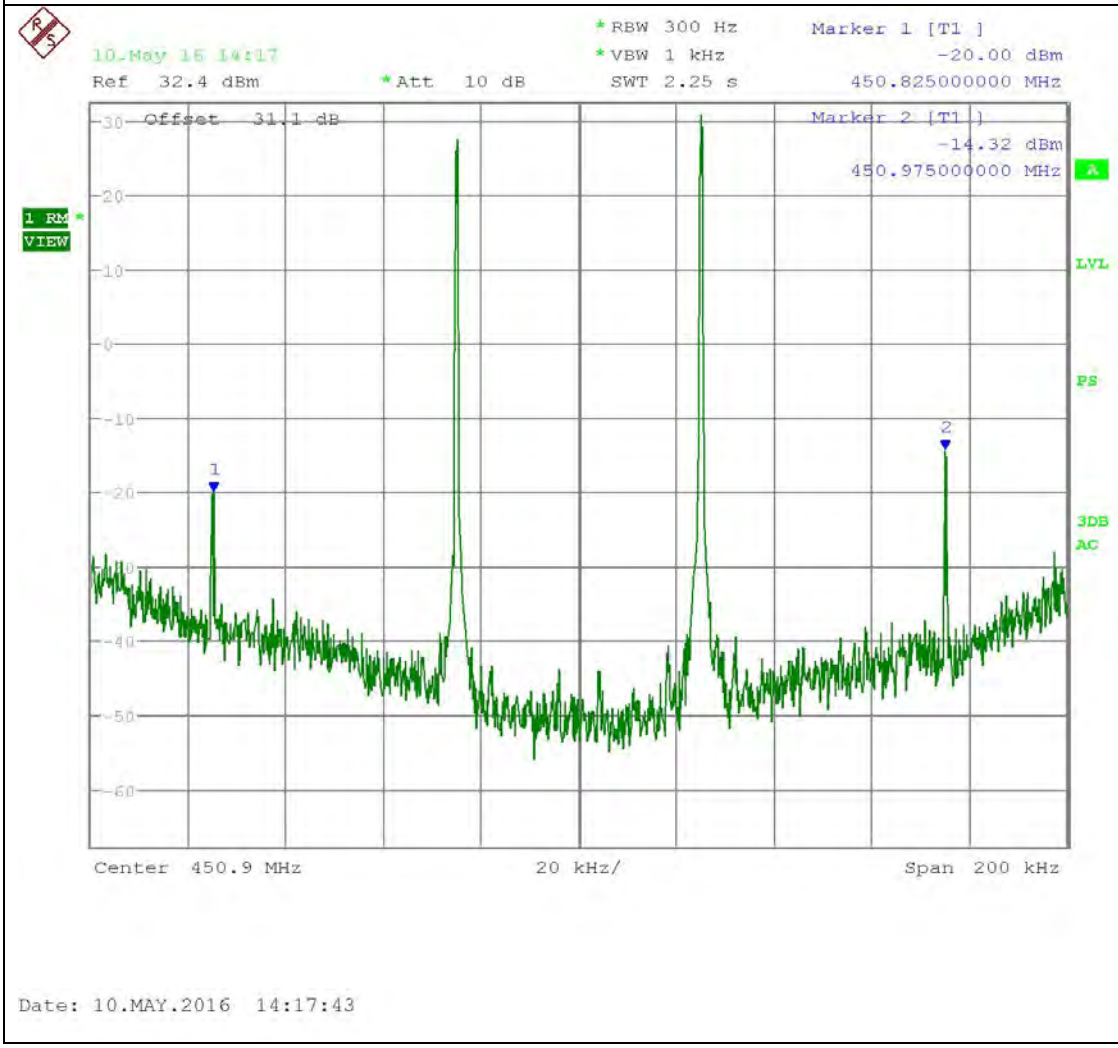
Center Frequency 450.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
450.875	450.925	25	-14.3

Center Frequency 450.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
450.8875	450.9125	12.5	-15.0

Center Frequency 450.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
450.89375	450.90625	6.25	-18.2

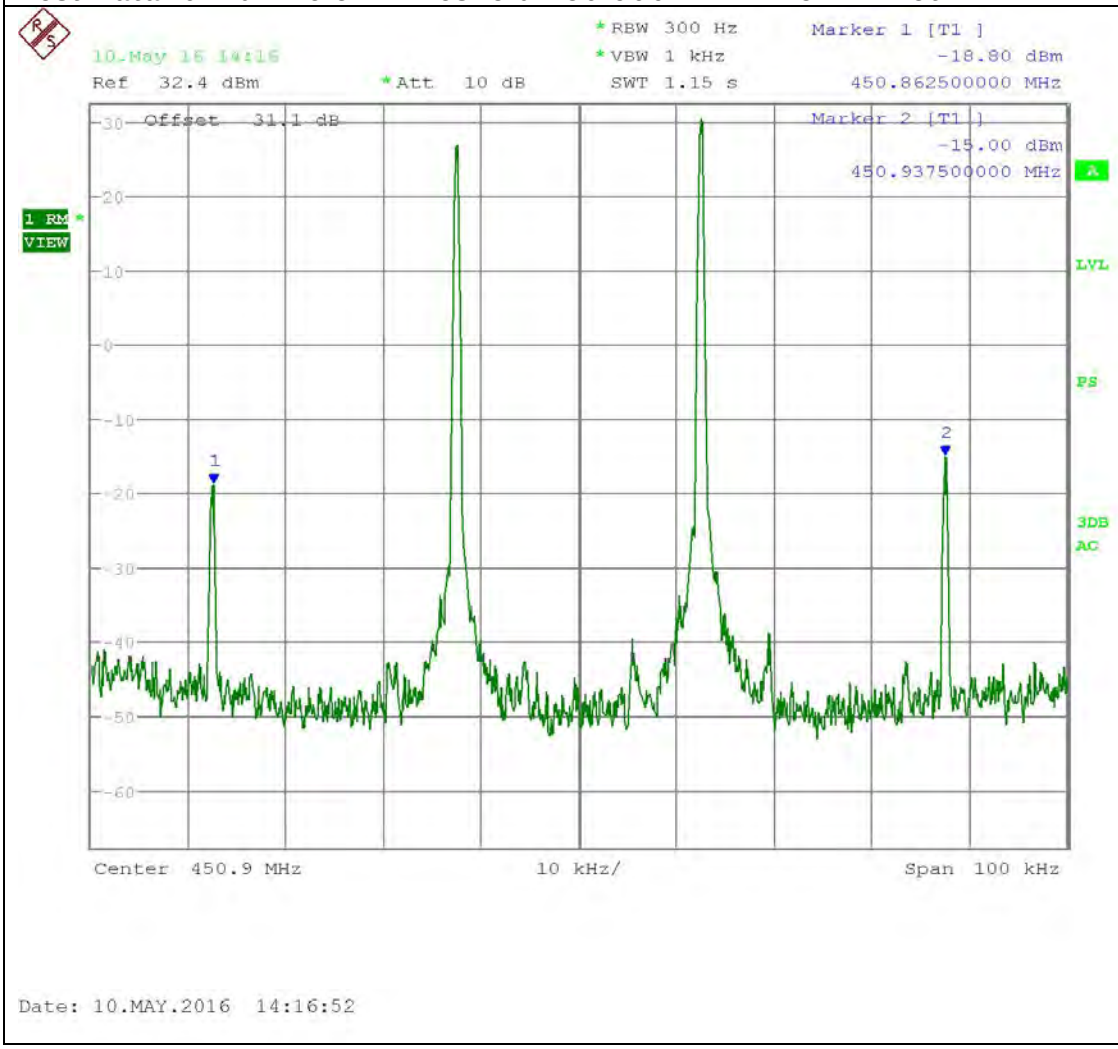
Out-of-band / out-of-block (including intermodulation) §4.7.2

Test Data: 0.2 dB Below Threshold 450.900MHz 25kHz Plot



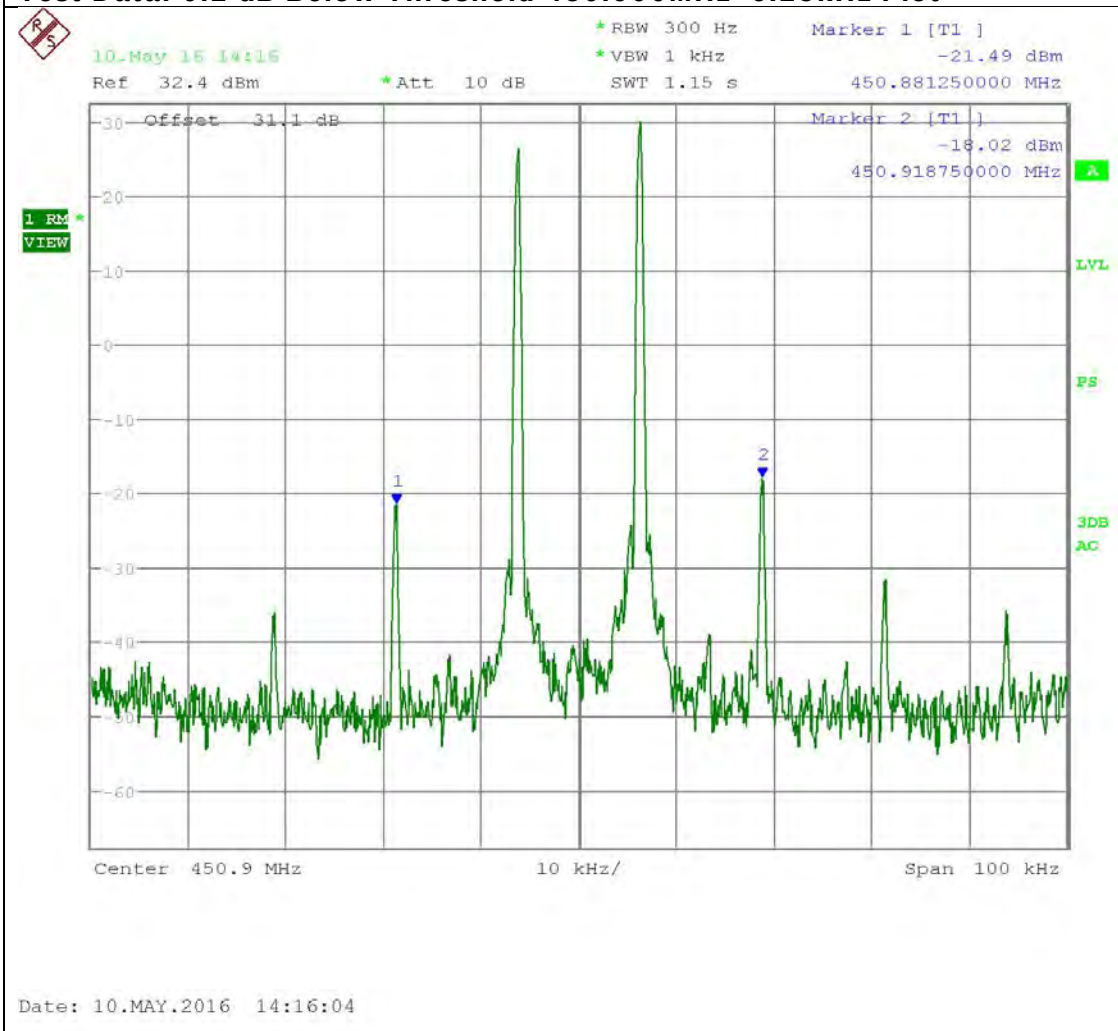
Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 0.2 dB Below Threshold 450.900MHz 12.5kHz Plot



Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 0.2 dB Below Threshold 450.900MHz 6.25kHz Plot



Measuring out-of-band/out-of-block (including intermodulation) §4.7

Test Data: Low End of Band 3.0 dB Above Threshold Measurement Table

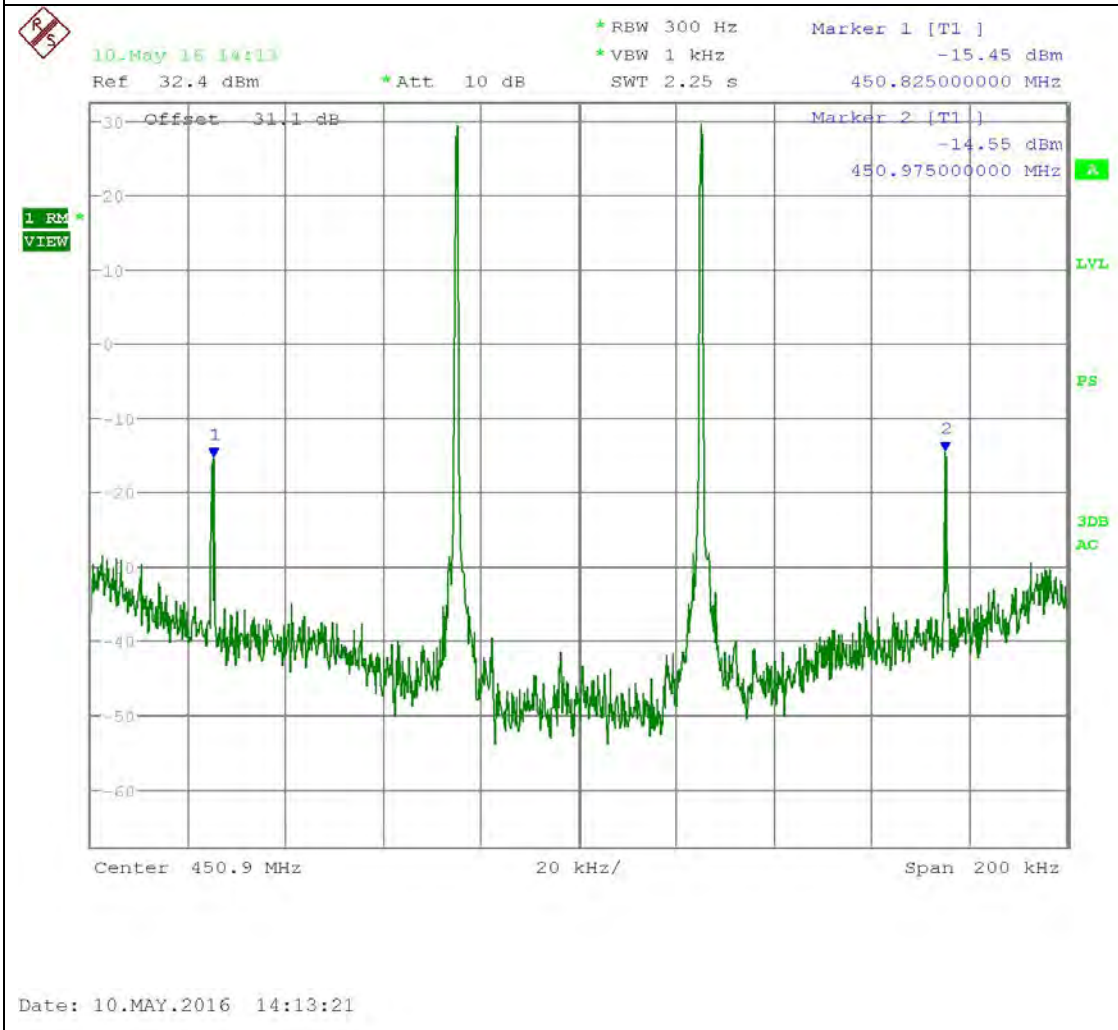
Center Frequency 450.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
450.875	450.925	25	-14.55

Center Frequency 450.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
450.8875	450.9125	12.5	-15.6

Center Frequency 450.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
450.89375	450.90625	6.25	-19.3

Measuring out-of-band / out-of-block (including intermodulation) §4.7

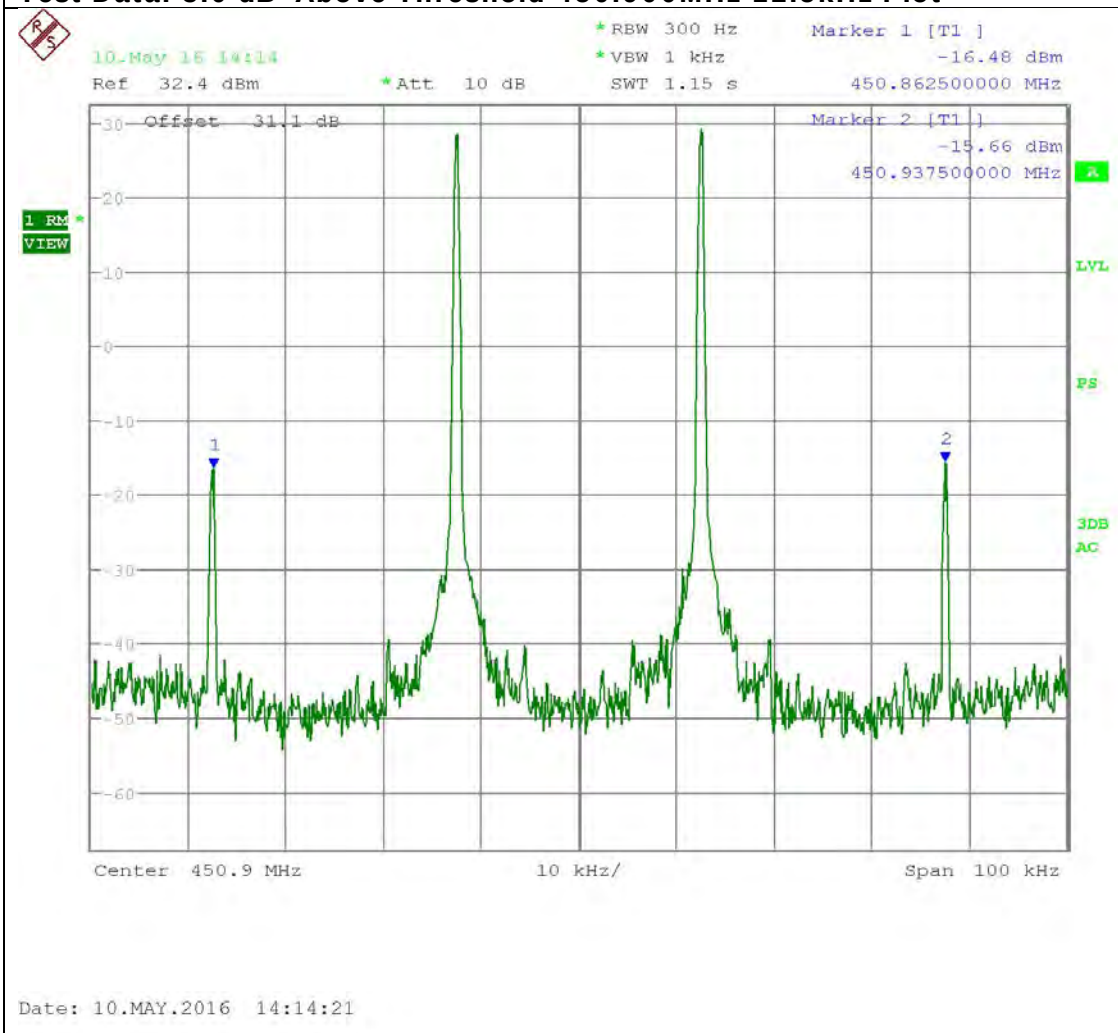
Test Data: 3.0 dB Above Threshold 450.900MHz 25kHz Plot



Measuring out-of-band / out-of-block (including intermodulation) §4.7

3.0dB Above Threshold

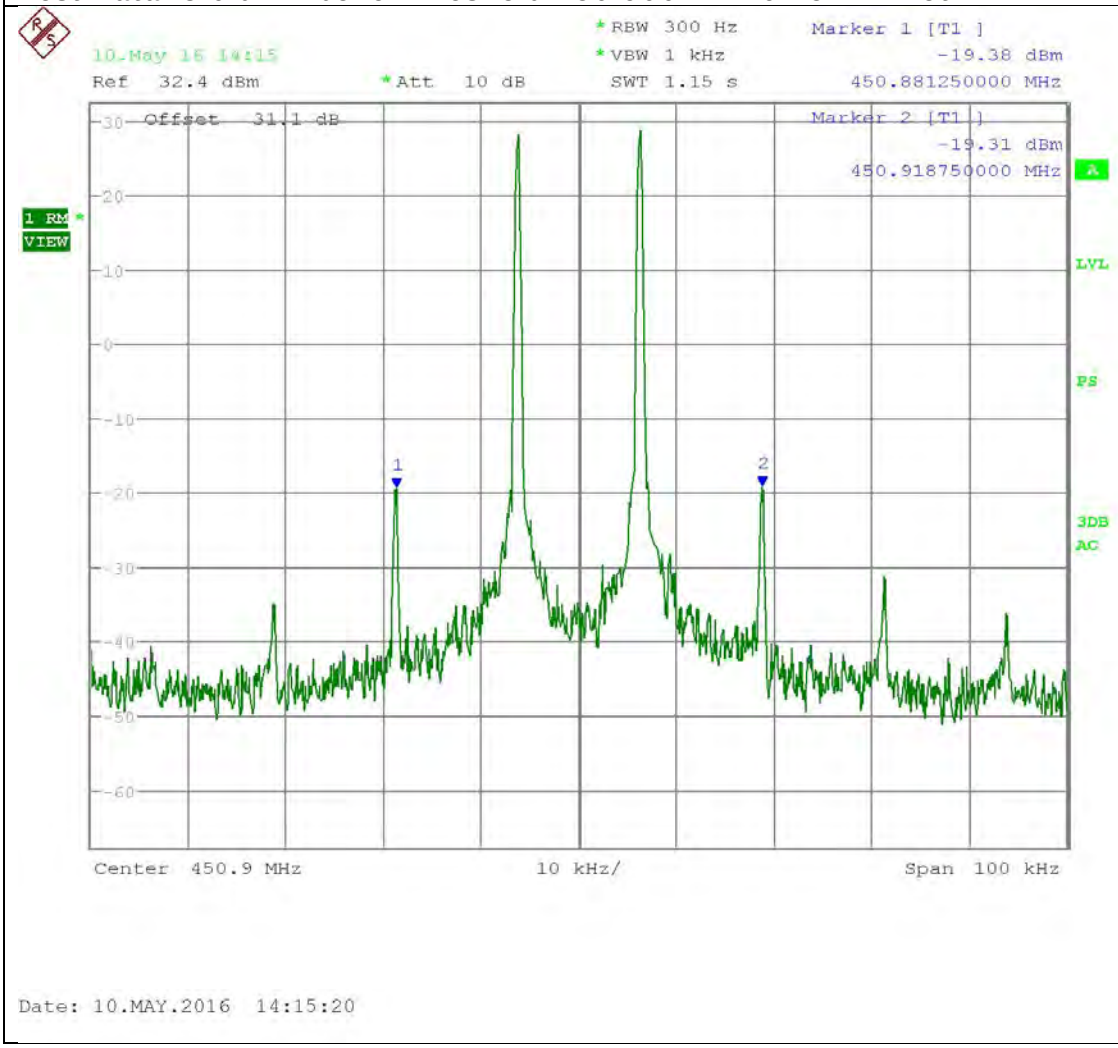
Test Data: 3.0 dB Above Threshold 450.900MHz 12.5kHz Plot



Measuring out-of-band / out-of-block (including intermodulation) §4.7

3.0dB Above Threshold

Test Data: 3.0 dB Above Threshold 450.900MHz 6.25kHz Plot



Measuring out-of-band/out-of-block (including intermodulation) §4.7

Test Data: Middle of Band 0.2 dB Below Threshold Measurement Table

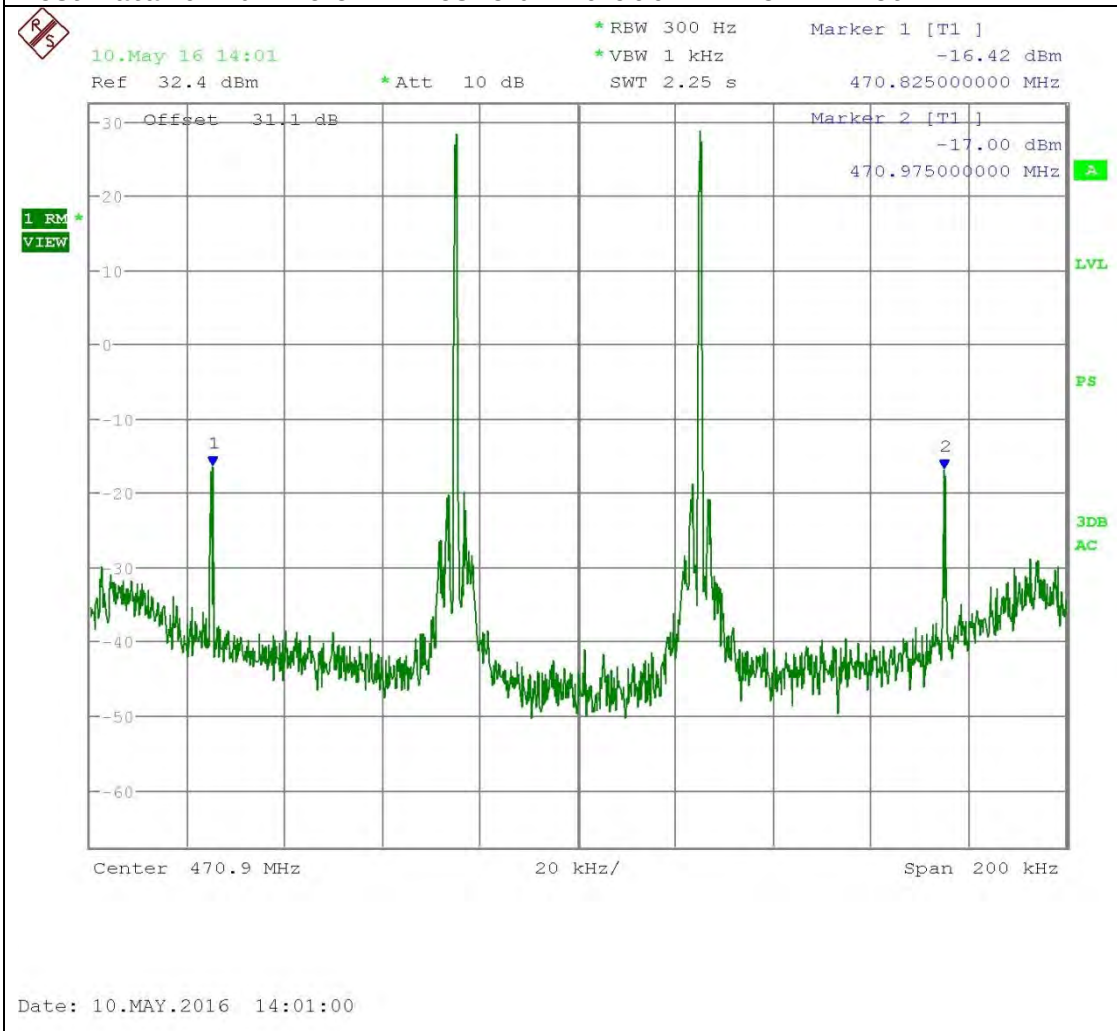
Center Frequency 470.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
470.875	470.925	25	-16.4

Center Frequency 470.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
470.8875	470.9125	12.5	-19.9

Center Frequency 470.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
470.89375	470.90625	6.25	-22.94

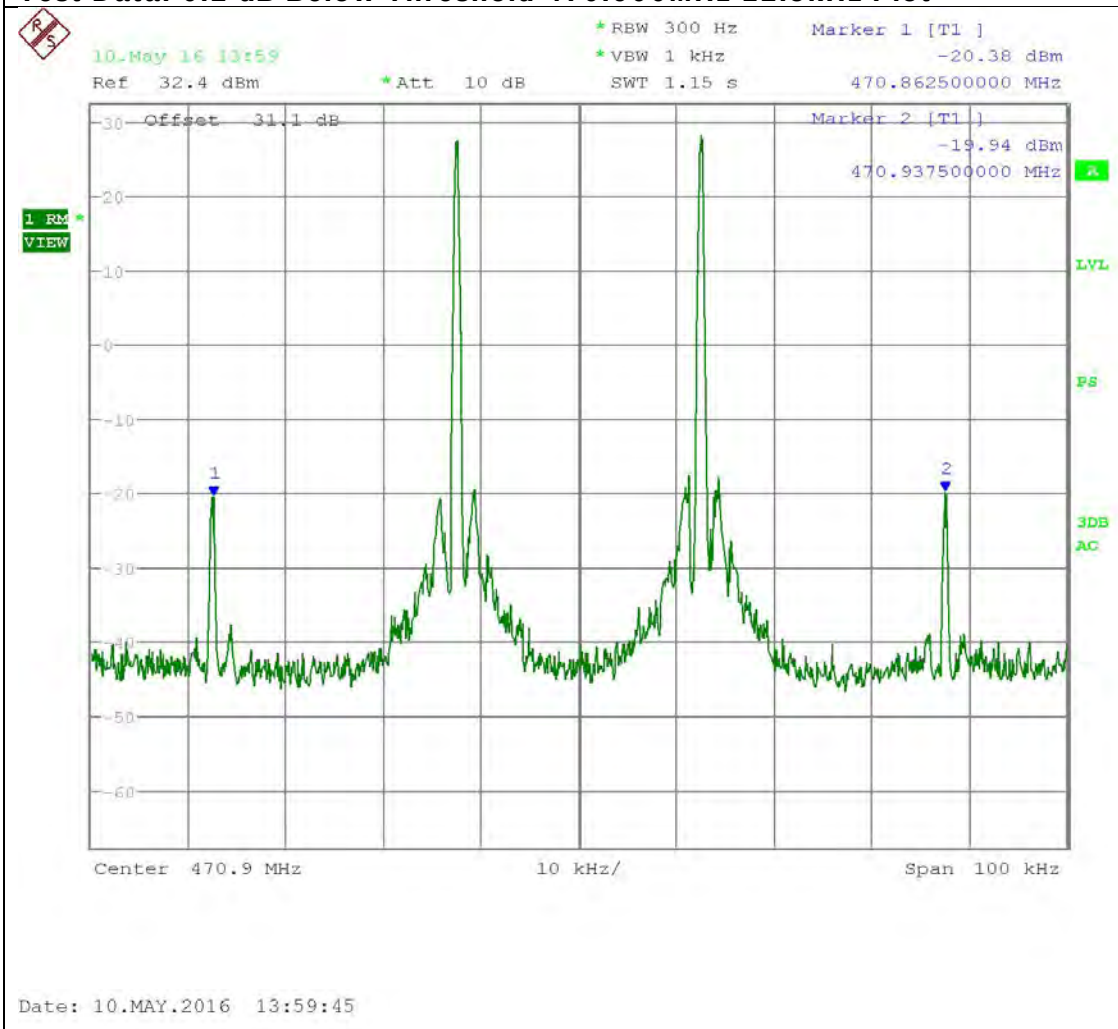
Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 0.2 dB Below Threshold 470.900MHz 25kHz Plot



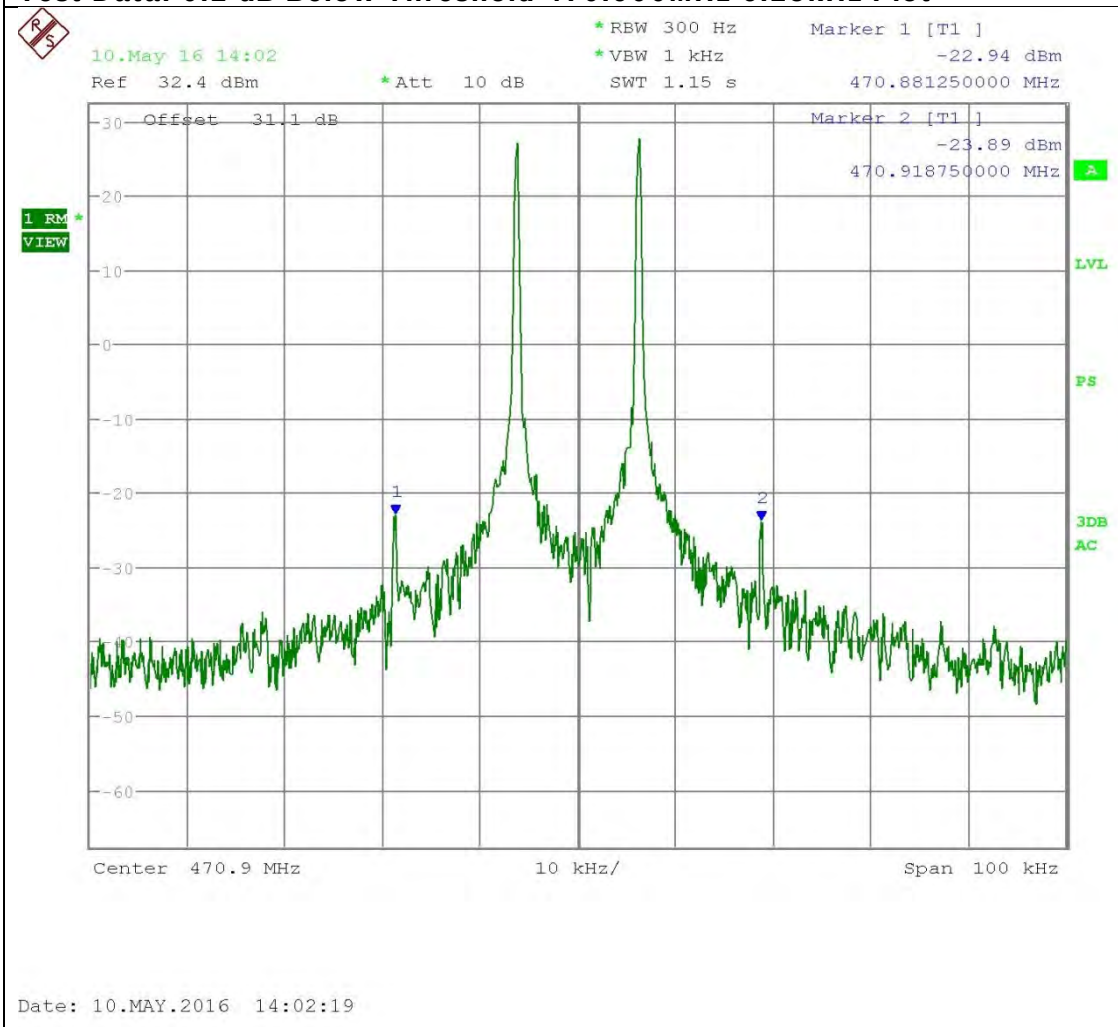
Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 0.2 dB Below Threshold 470.900MHz 12.5kHz Plot



Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 0.2 dB Below Threshold 470.900MHz 6.25kHz Plot



Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: Middle of Band 3.0dB Above Threshold Measurement Table

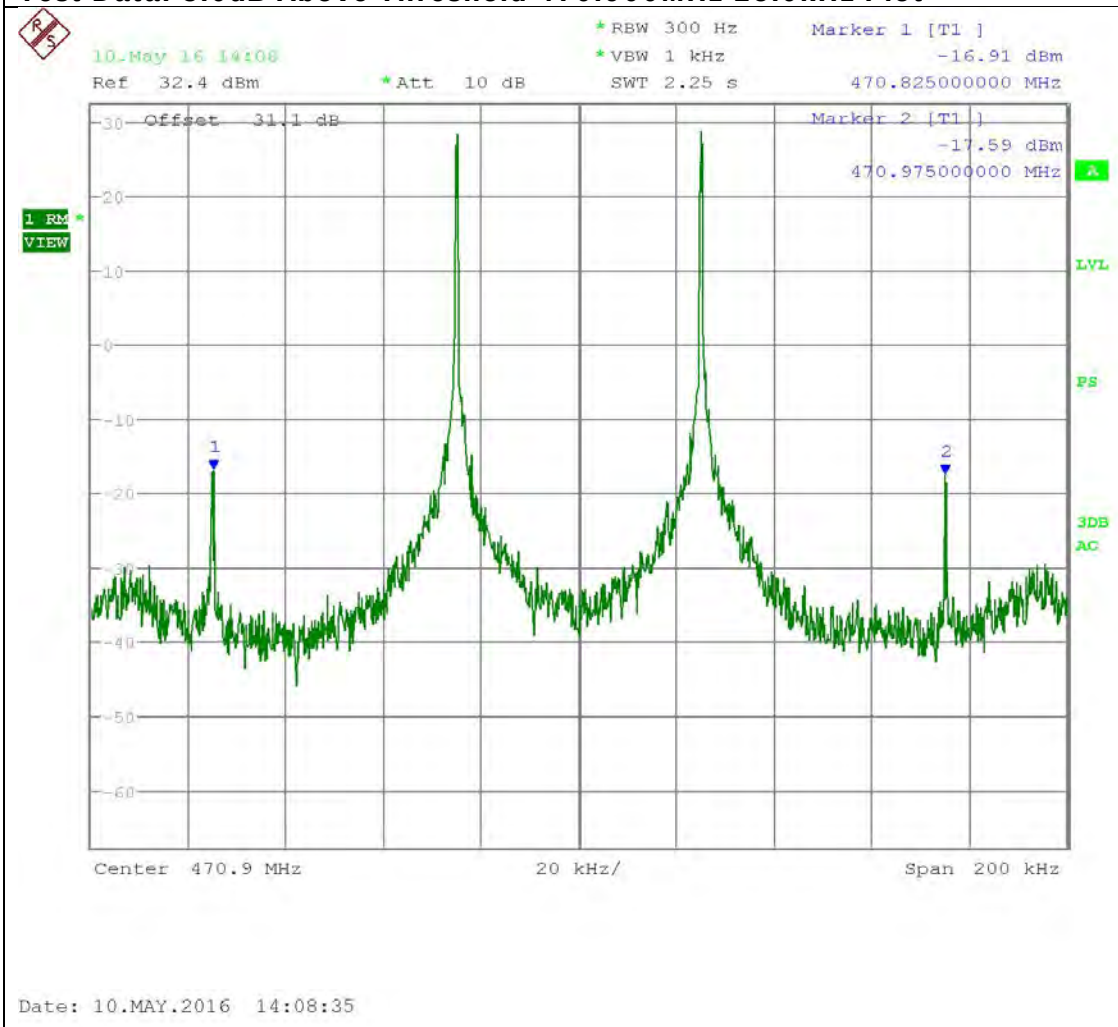
Center Frequency 470.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
470.875	470.925	25	-16.91

Center Frequency 470.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
470.8875	470.9125	12.5	-21.2

Center Frequency 470.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
470.89375	470.90625	6.25	-25.3

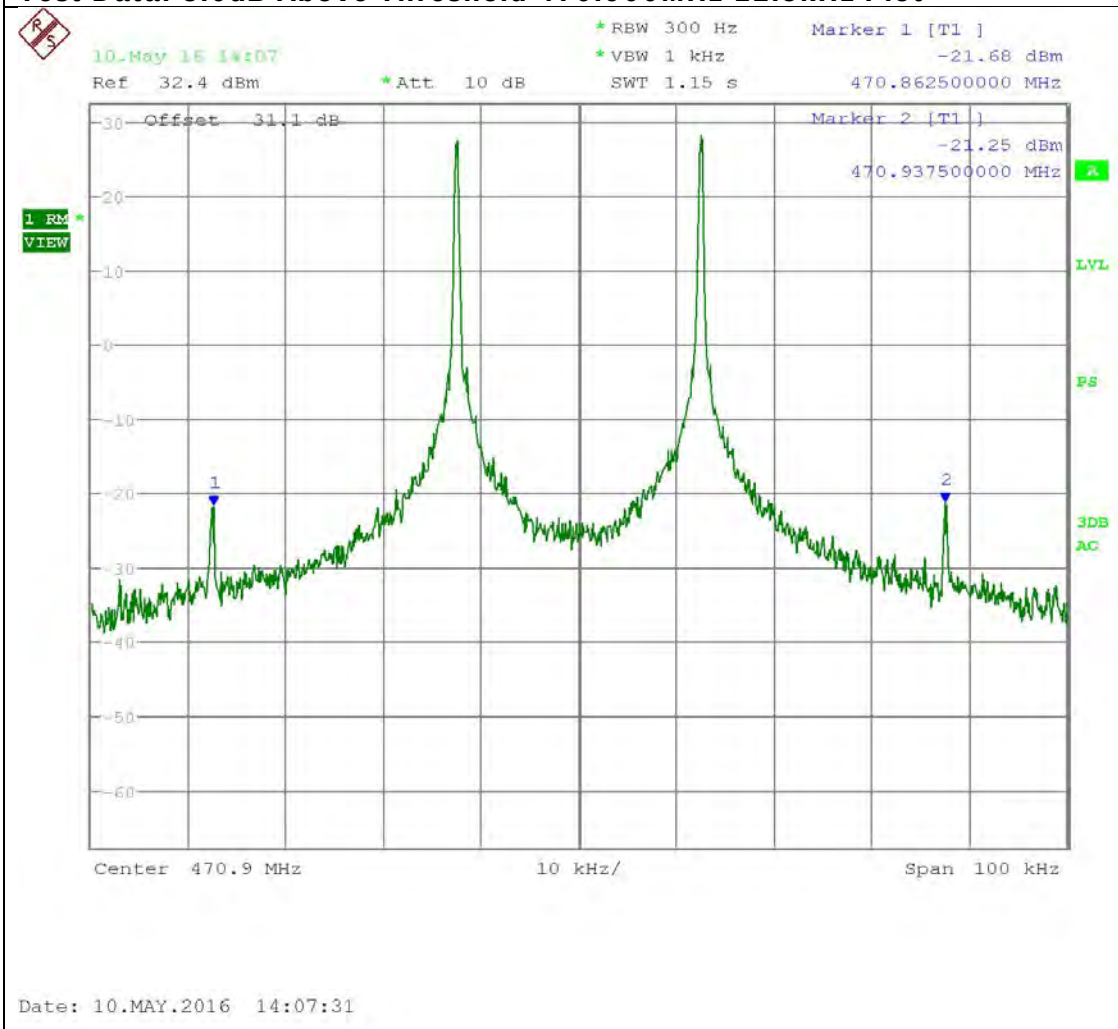
Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 3.0dB Above Threshold 470.900MHz 25.0kHz Plot



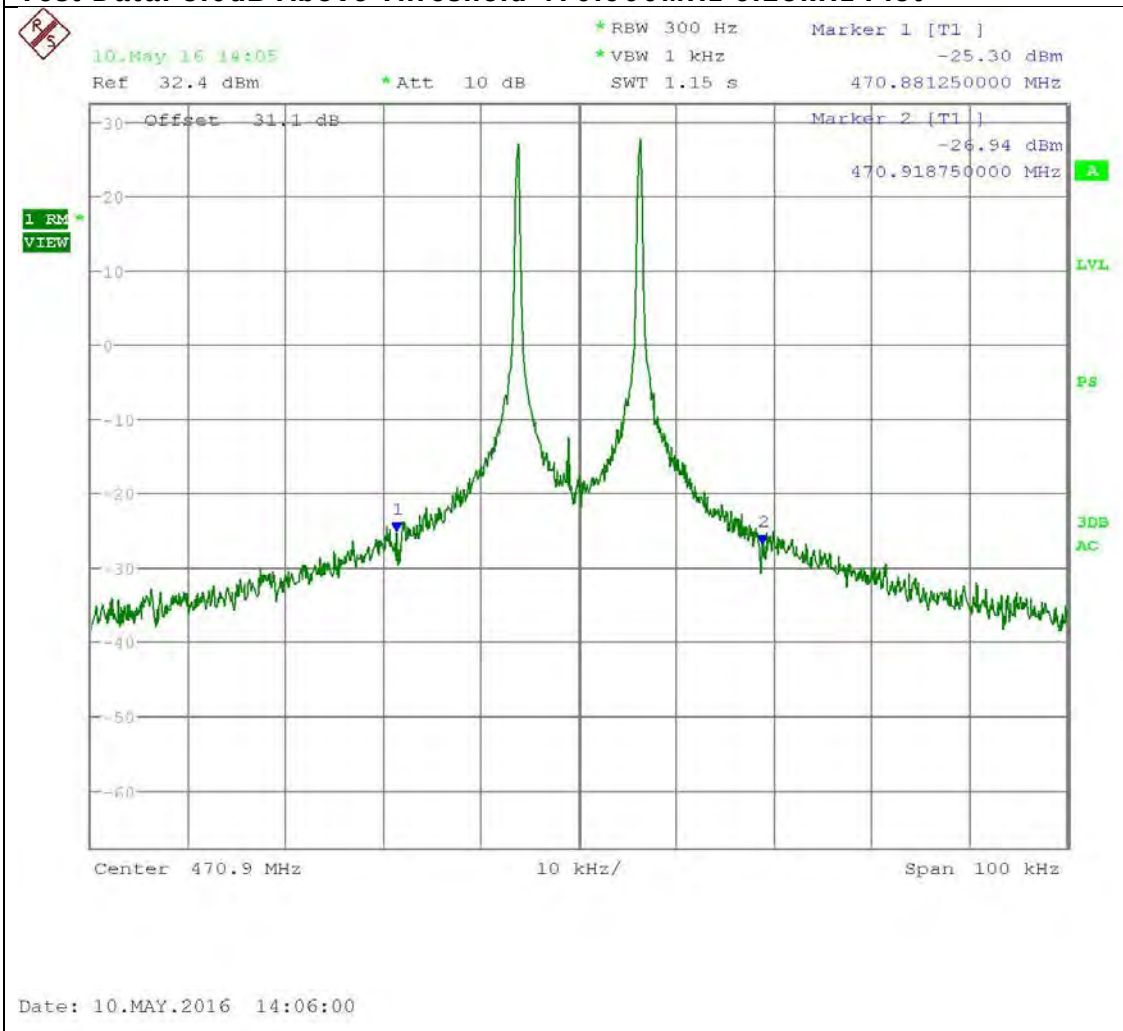
Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 3.0dB Above Threshold 470.900MHz 12.5kHz Plot



Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 3.0dB Above Threshold 470.900MHz 6.25kHz Plot



Measuring out-of-band/out-of-block (including intermodulation) §4.7

Test Data: High End of Band 0.2 dB Below Threshold Measurement Table

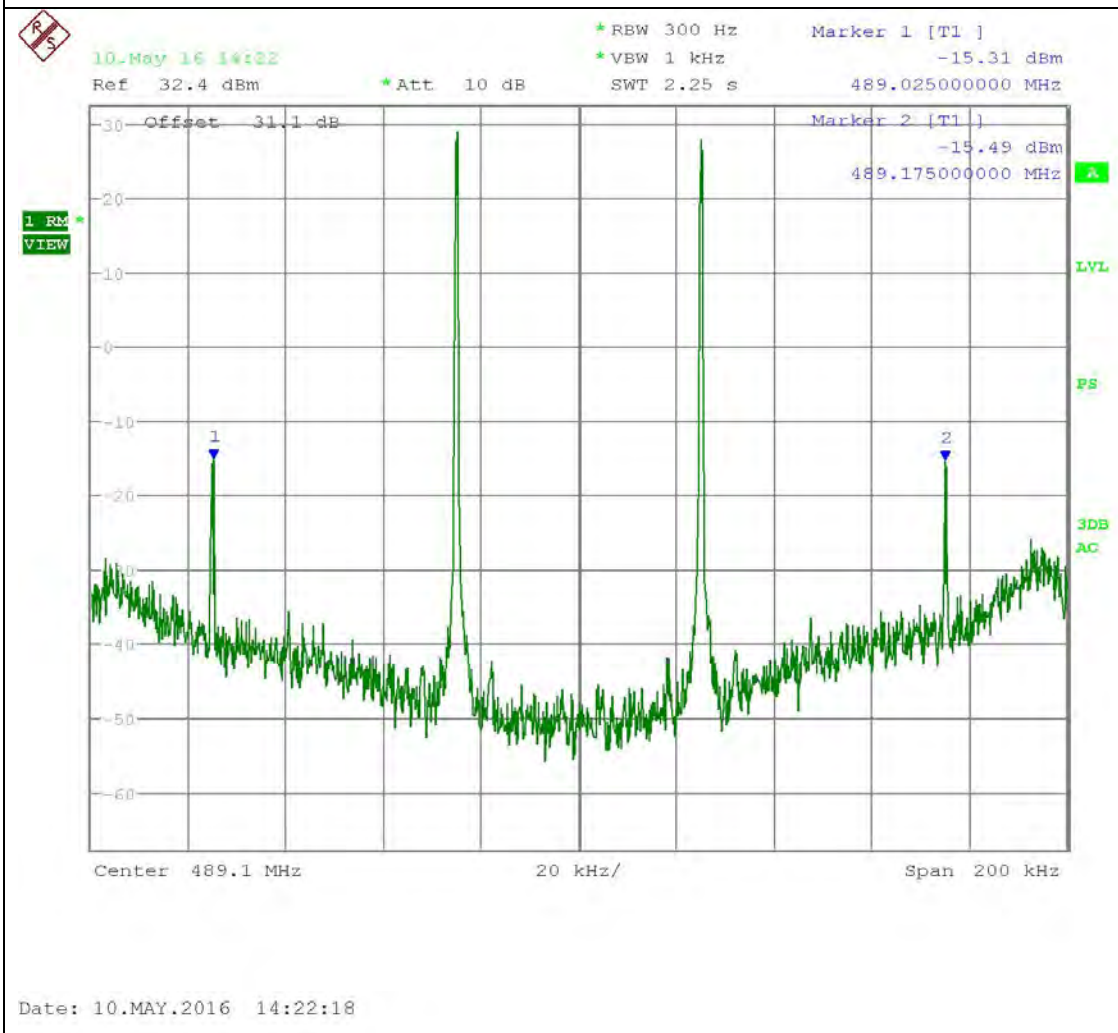
Center Frequency 489.10MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
489.075	489.125	25	-15.3

Center Frequency 470.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
489.0875	489.1125	12.5	-16.8

Center Frequency 489.10MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
489.09375	489.10625	6.25	-19.1

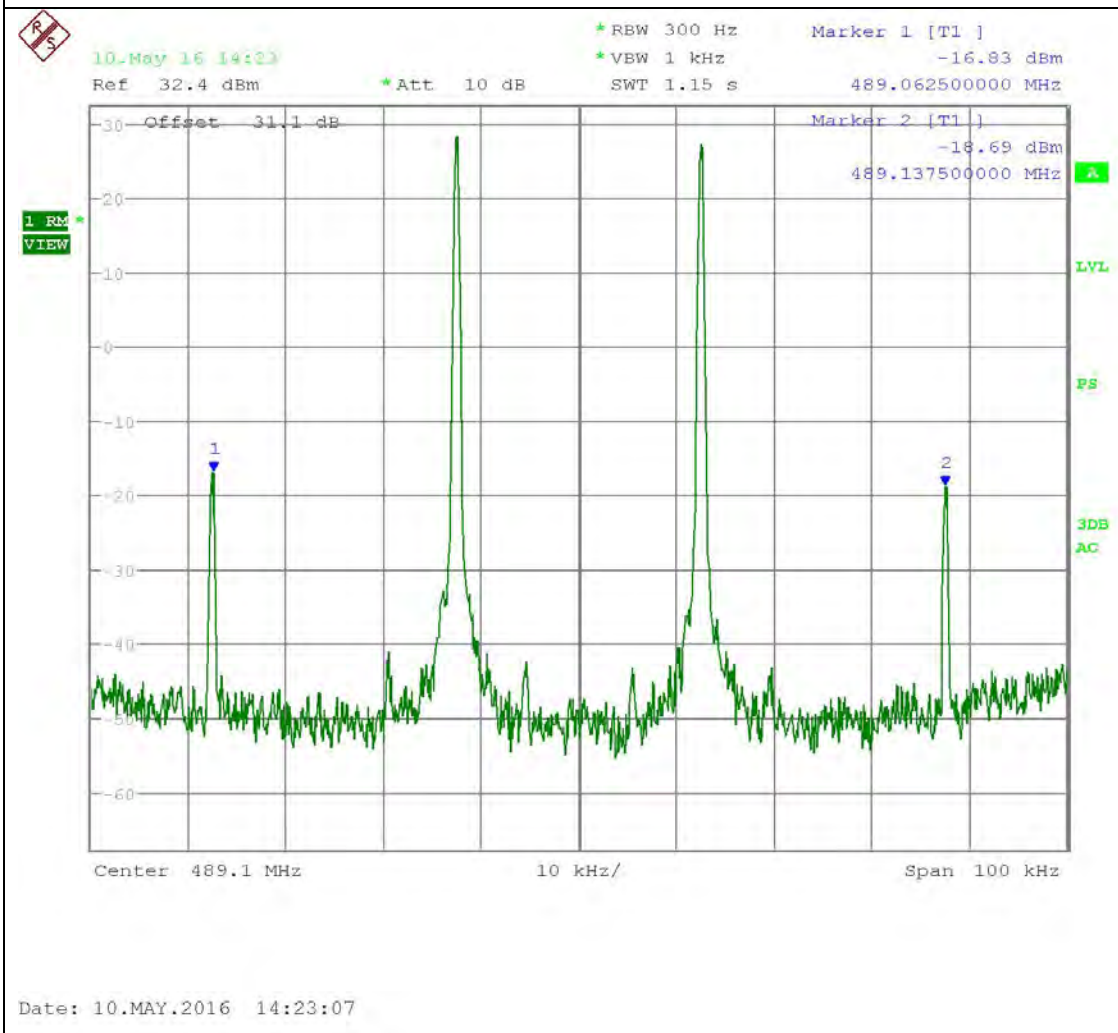
Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 0.2 dB Below Threshold 489.100MHz 25kHz Plot



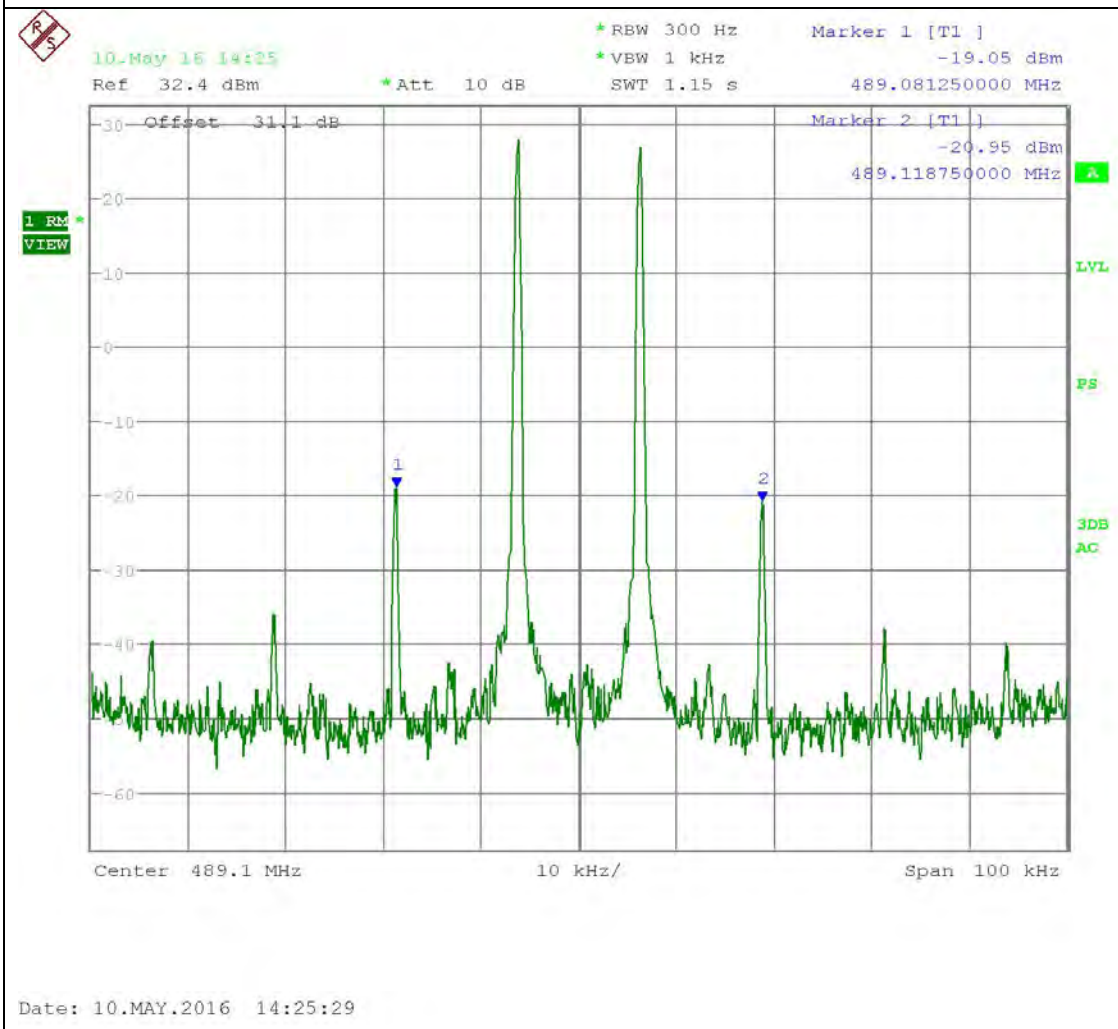
Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 0.2 dB Below Threshold 489.100MHz 12.5Hz Plot



Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 0.2 dB Below Threshold 489.100MHz 6.25Hz Plot



Measuring out-of-band/out-of-block (including intermodulation) §4.7

Test Data: High End of Band 3.0dB Above Threshold Measurement Table

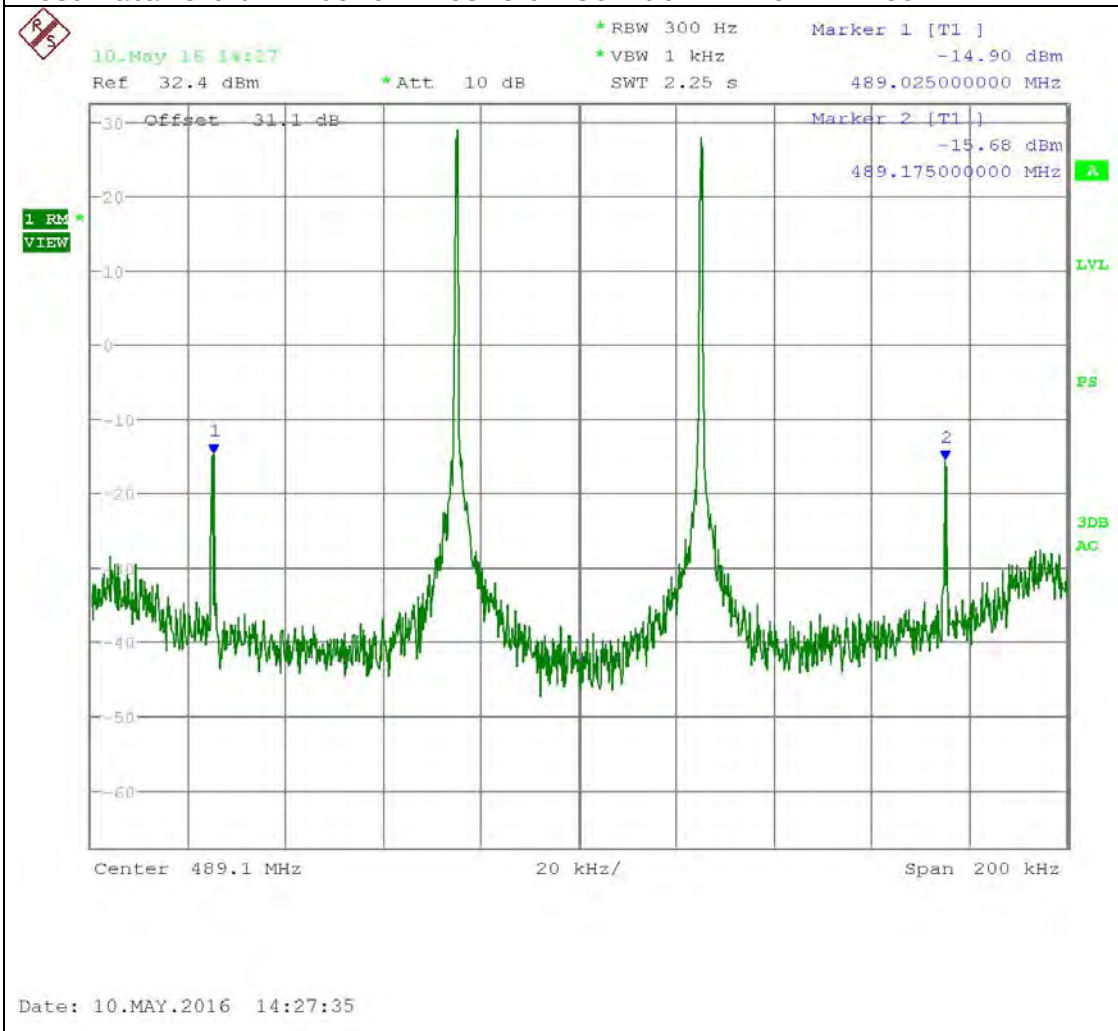
Center Frequency 489.10MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
489.875	489.125	25	-14.9

Center Frequency 470.90MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
489.0875	489.1125	12.5	-16.7

Center Frequency 489.10MHz			
Input Frequencies MHz		Ch Spacing kHz	Intermodulation Level dBm
489.09375	489.10625	6.25	-19.6

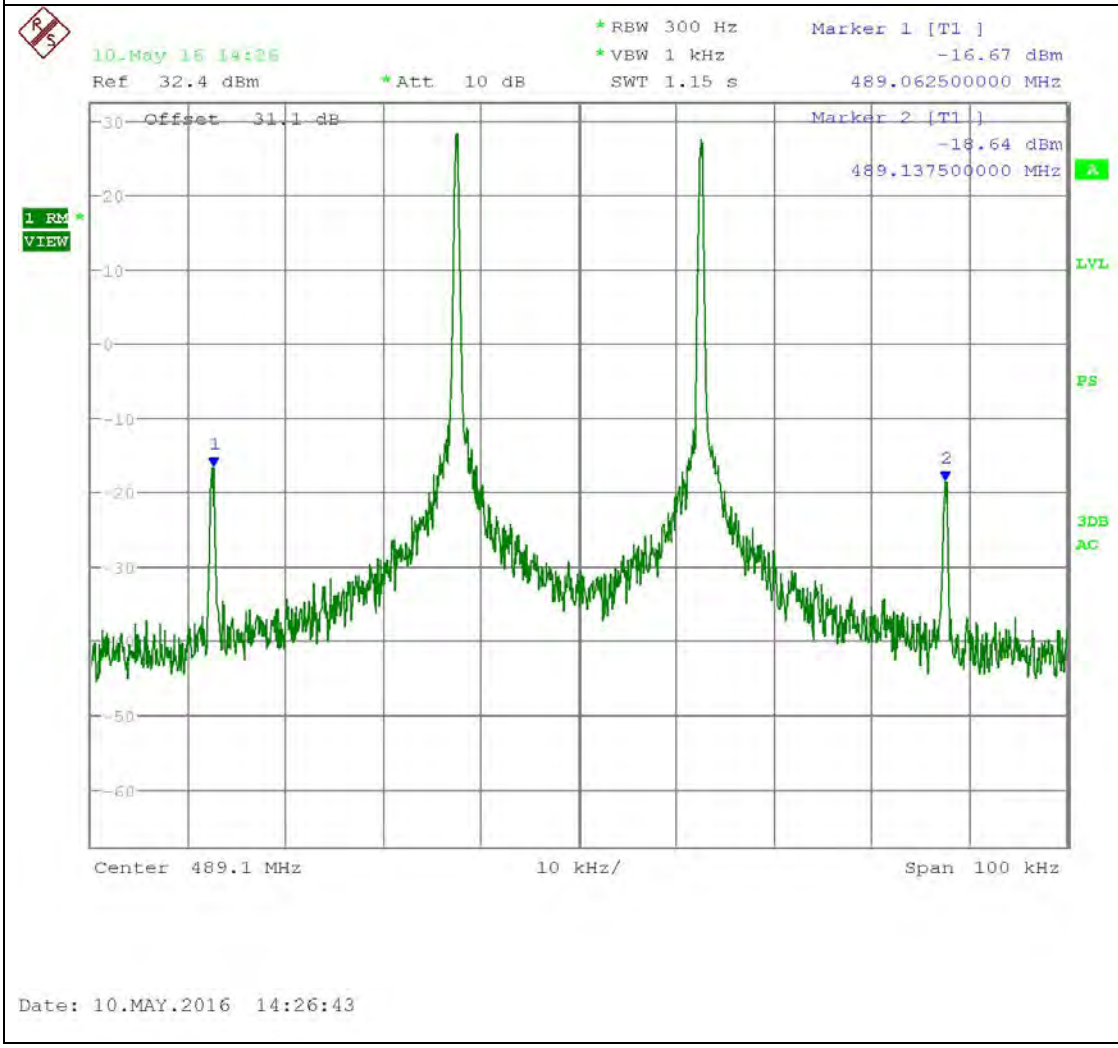
Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 3.0 dB Above Threshold 489.100MHz 25kHz Plot



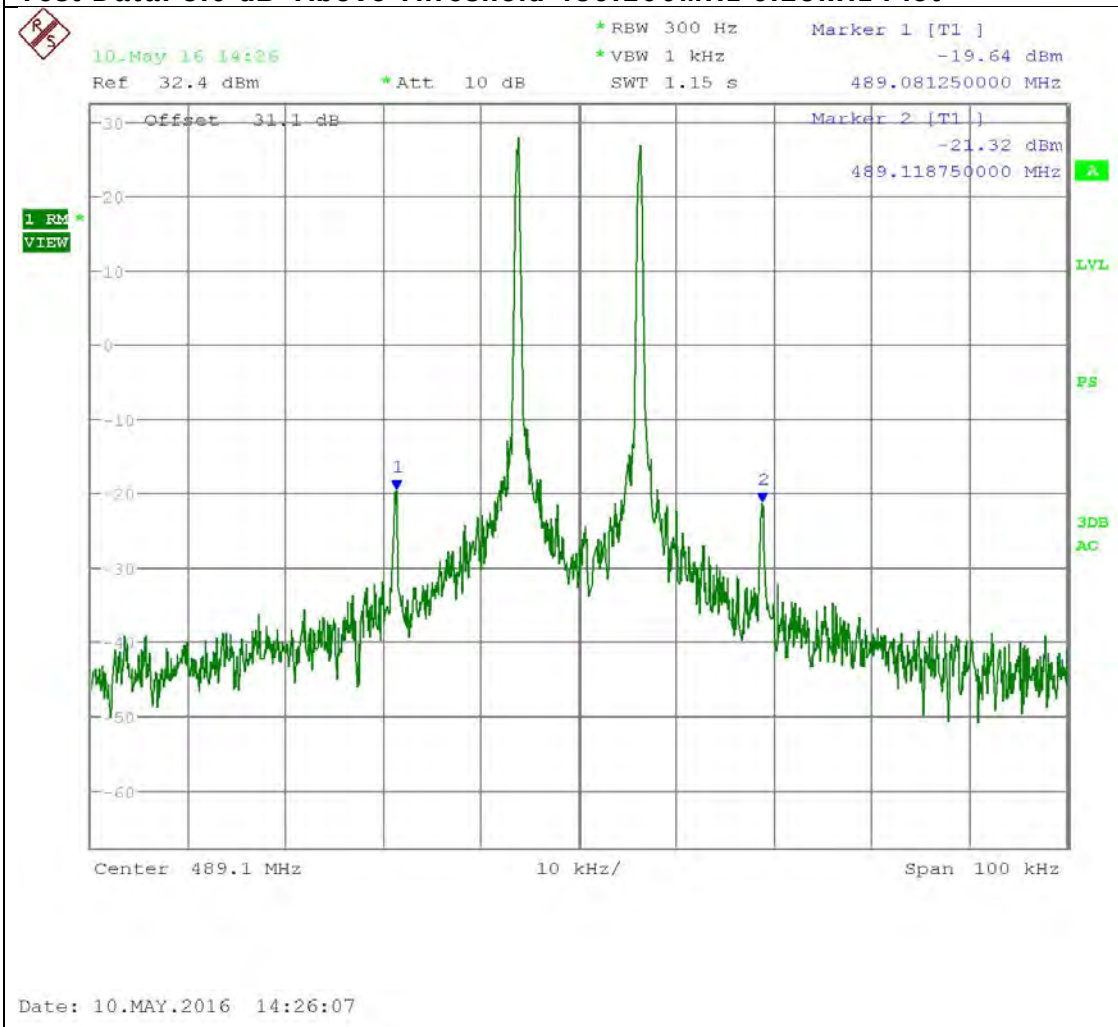
Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 3.0 dB Above Threshold 489.100MHz 12.5kHz Plot



Measuring out-of-band / out-of-block (including intermodulation) §4.7

Test Data: 3.0 dB Above Threshold 489.100MHz 6.25kHz Plot



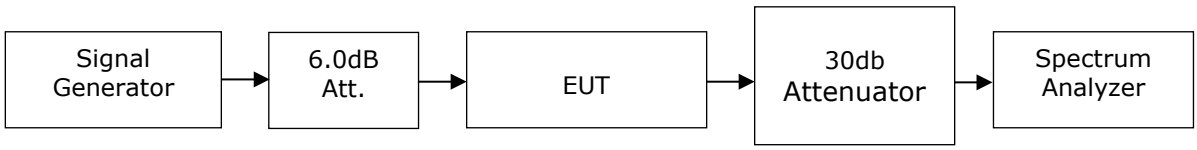
ANTENNA CONDUCTED EMISSIONS §4.7

Rule Parts. No.: Part 2.1053, 90.219 (e)(3)

Requirements: - 13 dBm in any 100 KHz Bandwidth

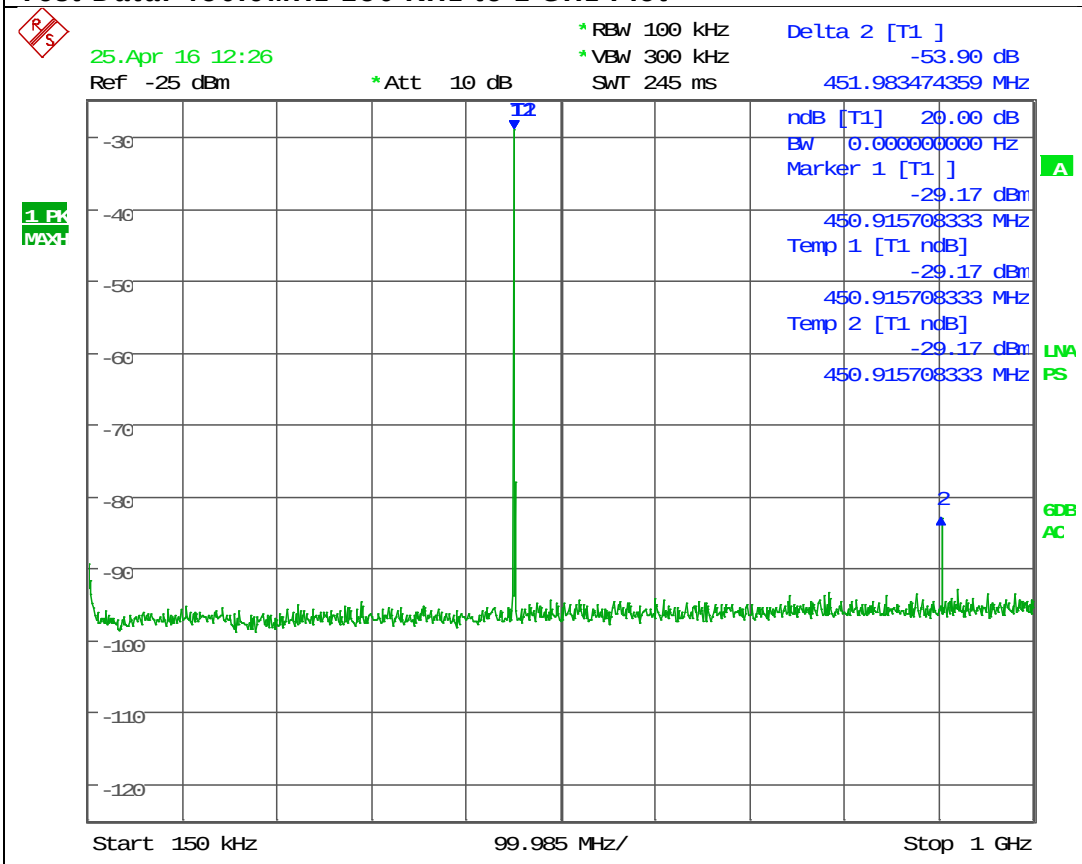
Procedure: KDB935210 Measurement Guidance for Industrial Boosters
§ 4.7.1 General
§ 4.7.3 EUT Spurious emissions conducted measurements

Test Setup Diagram:



ANTENNA CONDUCTED EMISSIONS §4.7

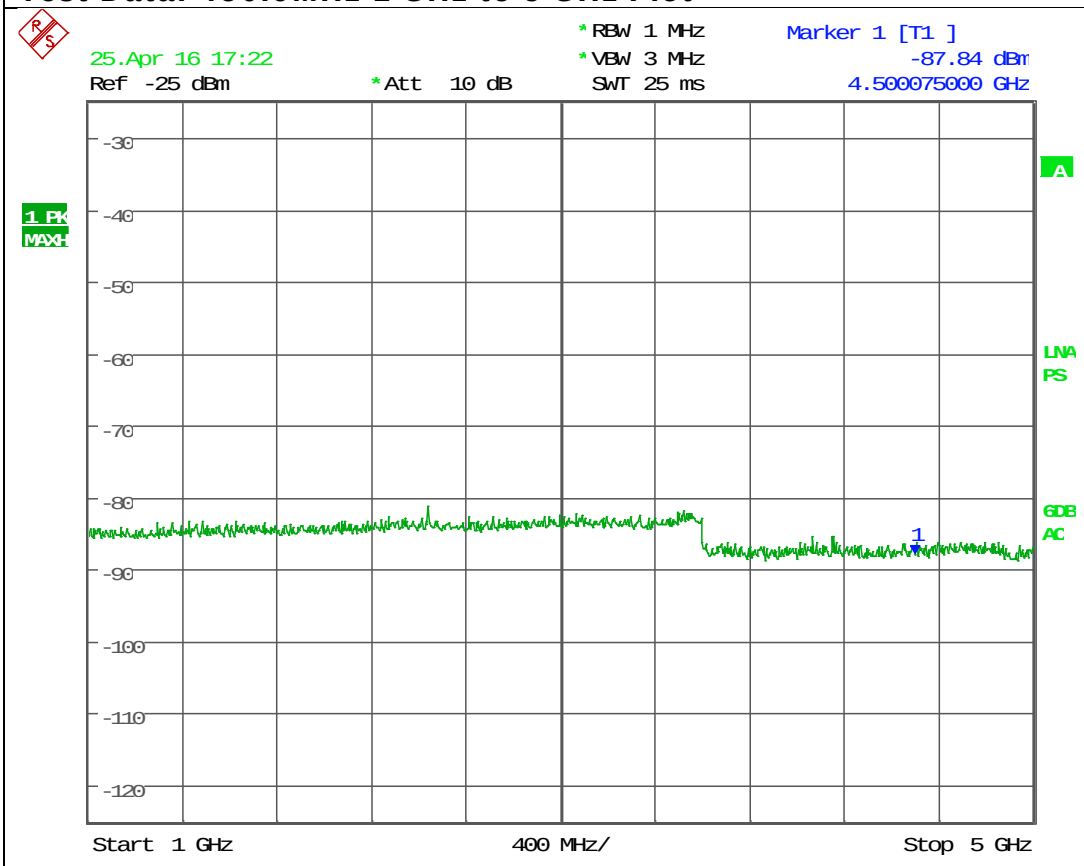
Test Data: 450.9MHz 150 KHz to 1 GHz Plot



Date: 25.APR.2016 12:26:58

ANTENNA CONDUCTED EMISSIONS §4.7

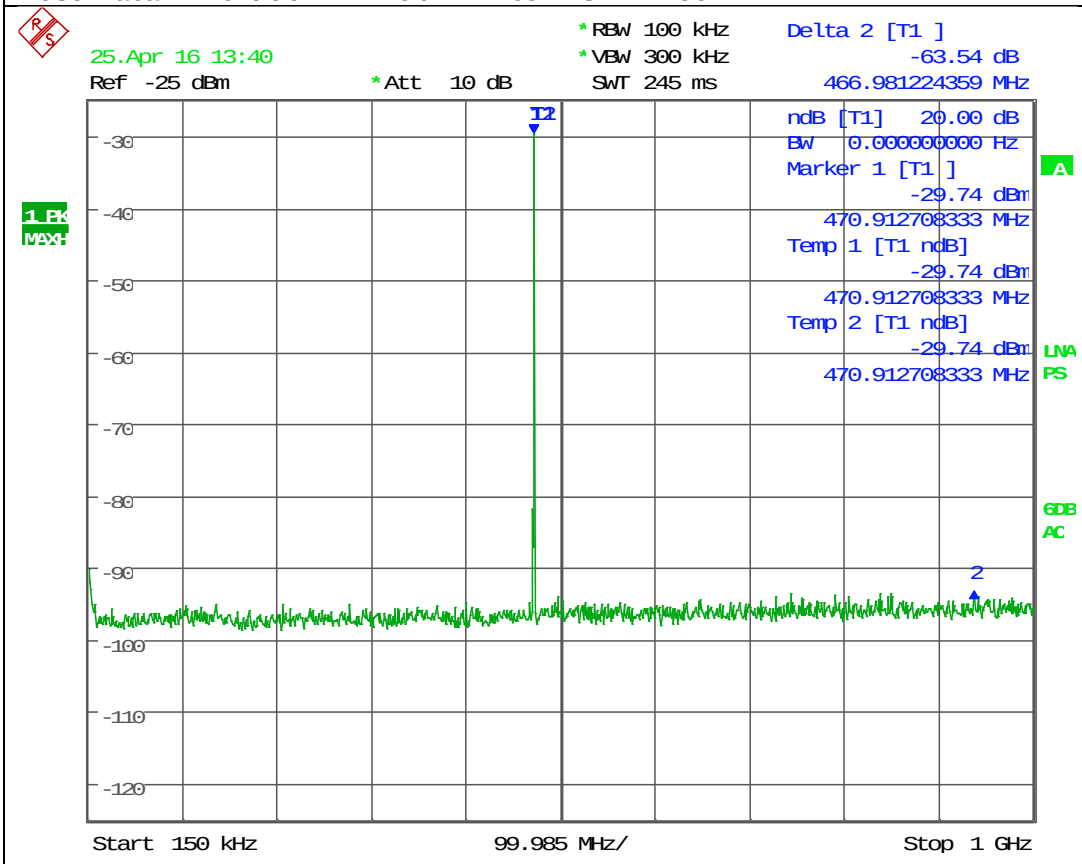
Test Data: 450.9MHz 1 GHz to 5 GHz Plot



Date: 25.APR.2016 17:22:43

ANTENNA CONDUCTED EMISSIONS §4.7

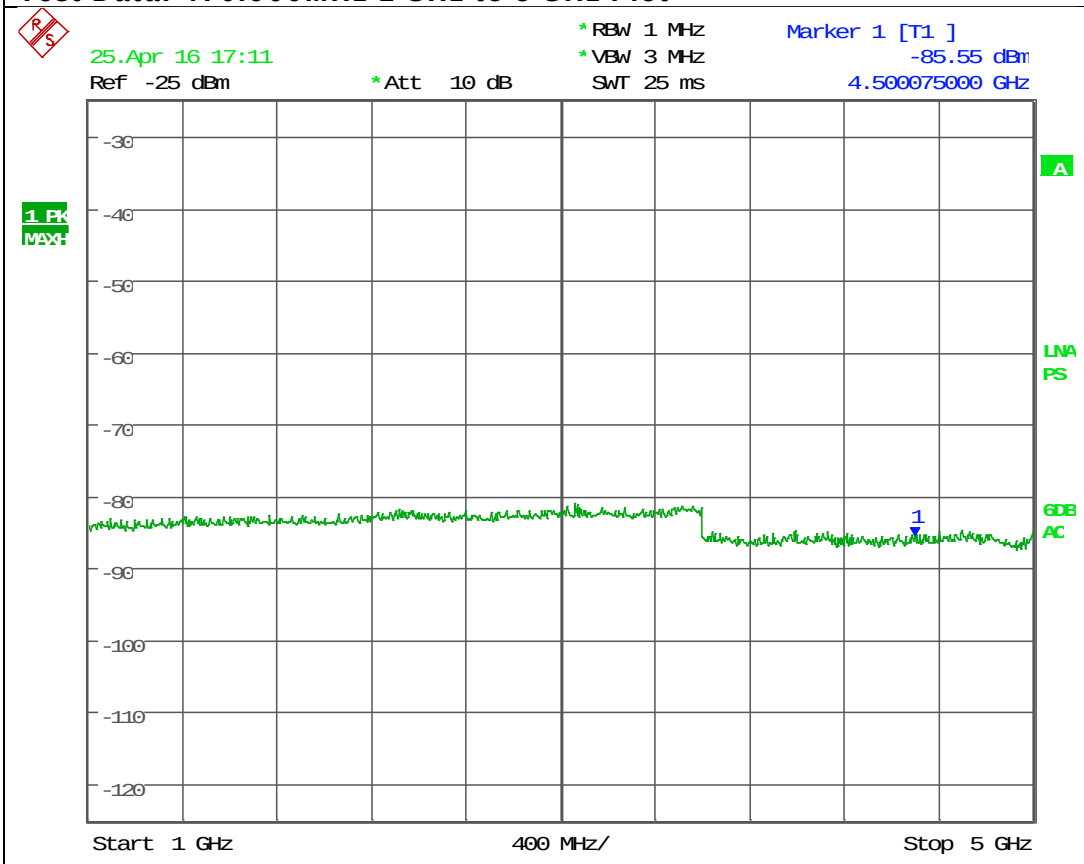
Test Data: 470.900MHz 150 KHz to 1 GHz Plot



Date: 25.APR.2016 13:40:46

ANTENNA CONDUCTED EMISSIONS §4.7

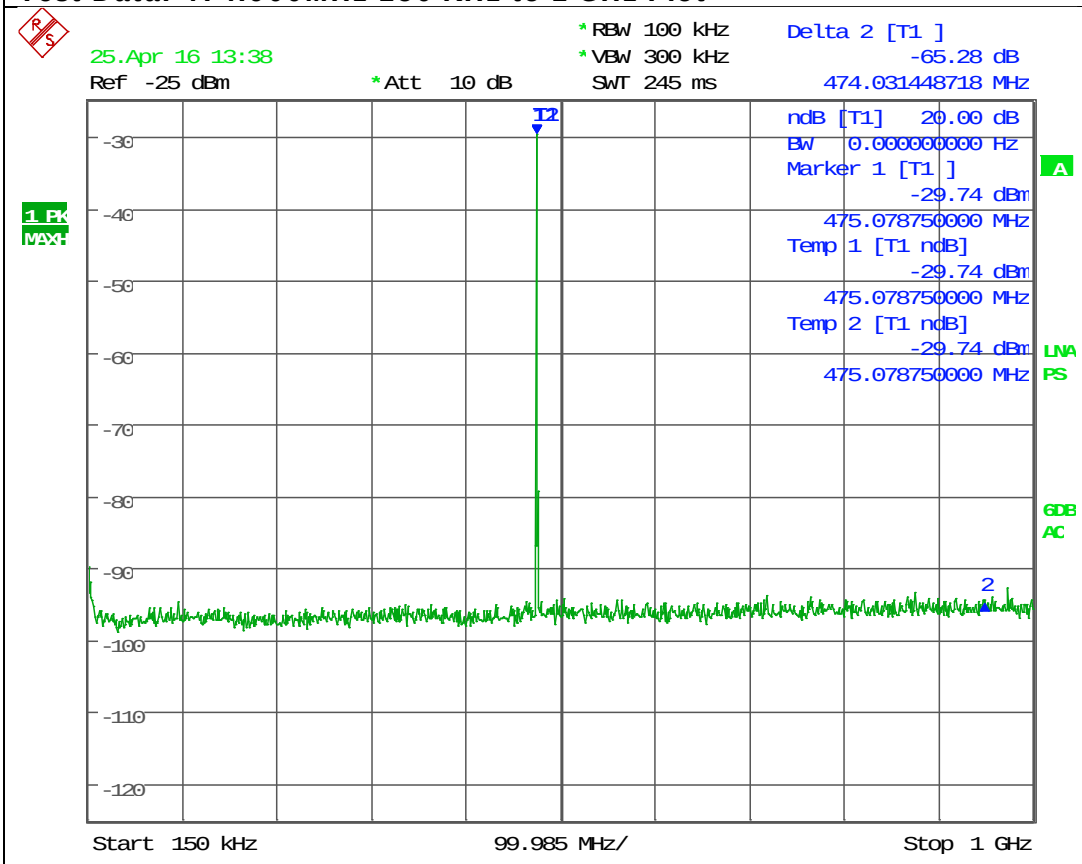
Test Data: 470.900MHz 1 GHz to 5 GHz Plot



Date: 25.APR.2016 17:11:28

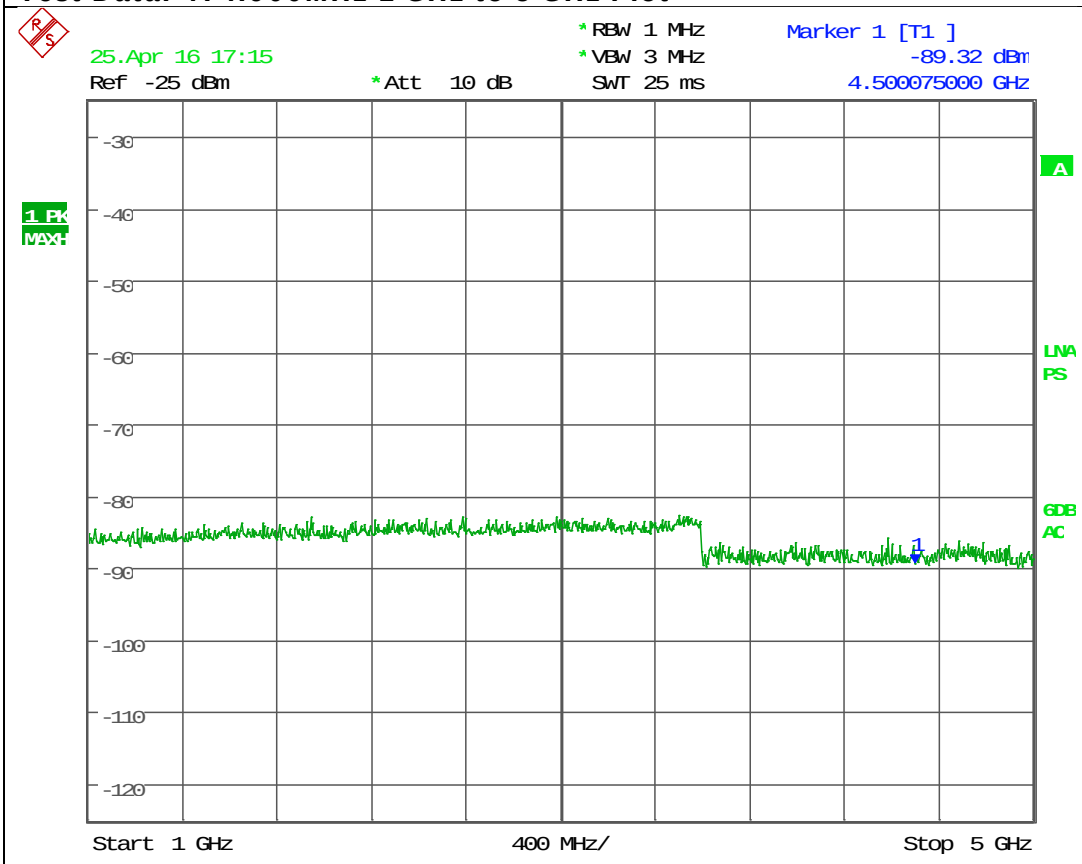
ANTENNA CONDUCTED EMISSIONS §4.7

Test Data: 474.900MHz 150 KHz to 1 GHz Plot



ANTENNA CONDUCTED EMISSIONS §4.7

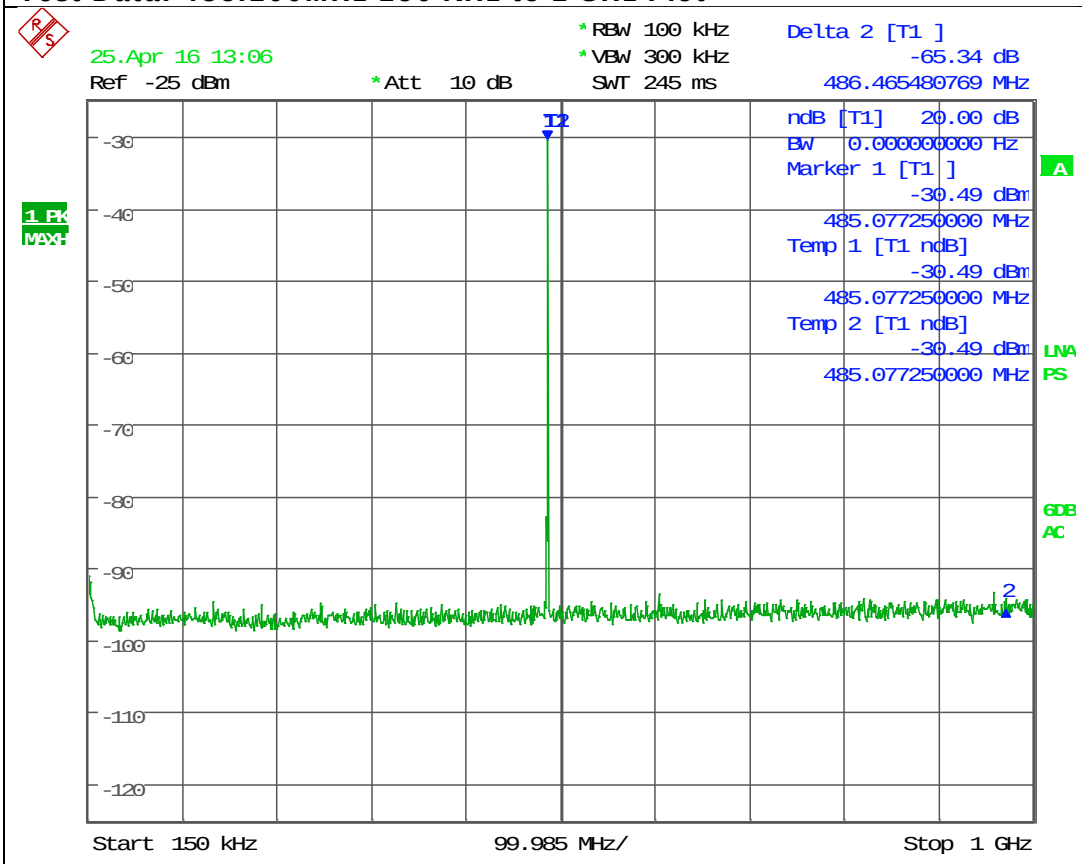
Test Data: 474.900MHz 1 GHz to 5 GHz Plot



Date: 25.APR.2016 17:15:31

ANTENNA CONDUCTED EMISSIONS §4.7

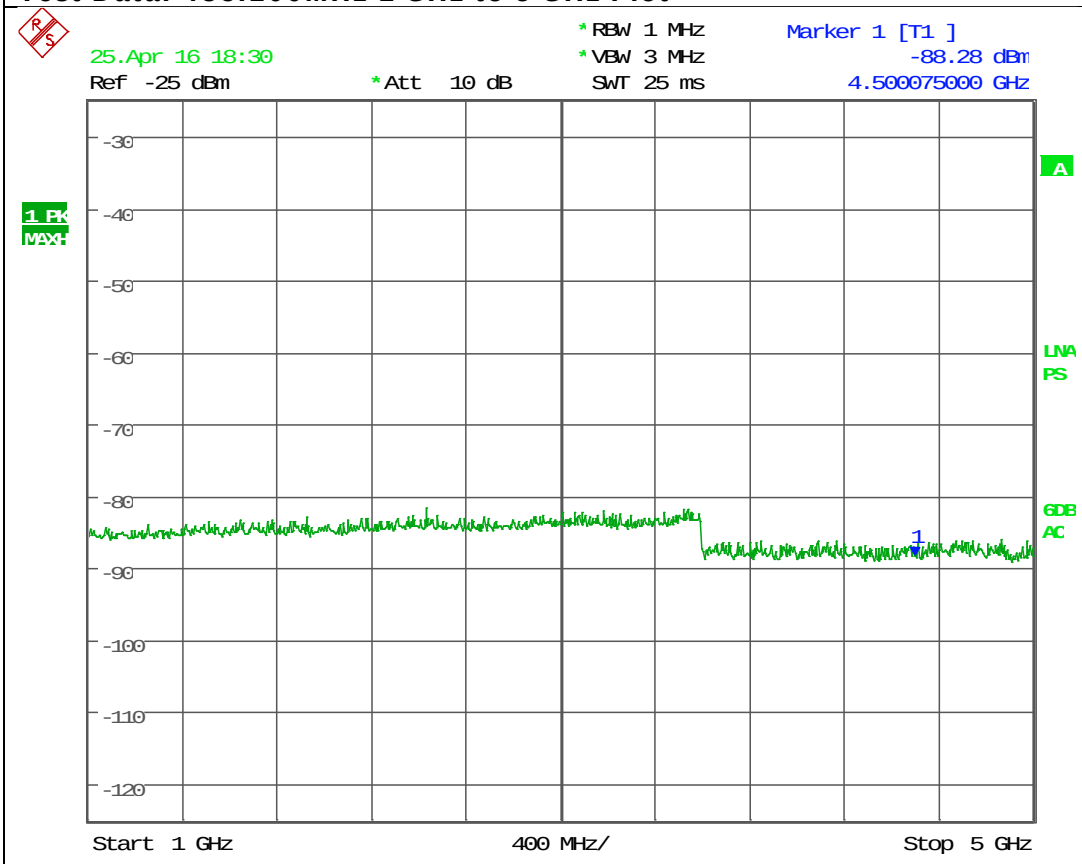
Test Data: 485.100MHz 150 KHz to 1 GHz Plot



Date: 25.APR.2016 13:06:49

ANTENNA CONDUCTED EMISSIONS §4.7

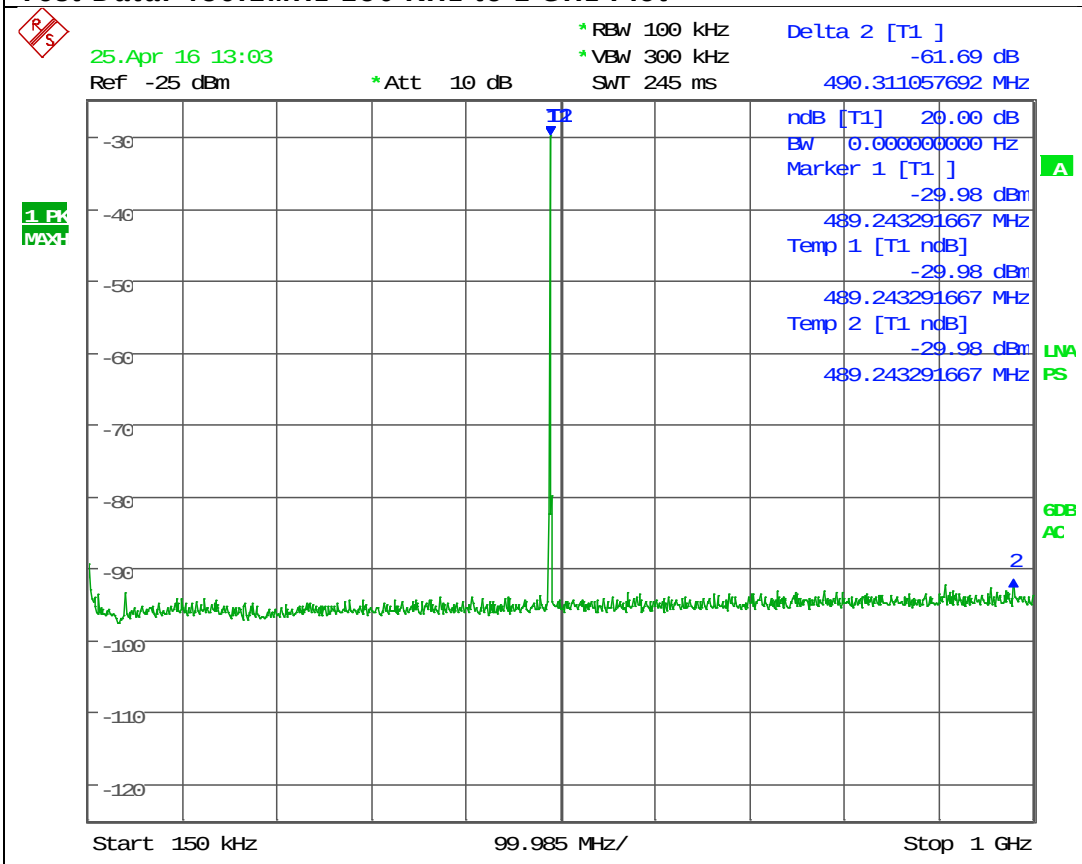
Test Data: 485.100MHz 1 GHz to 5 GHz Plot



Date: 25.APR.2016 18:30:37

ANTENNA CONDUCTED EMISSIONS §4.7

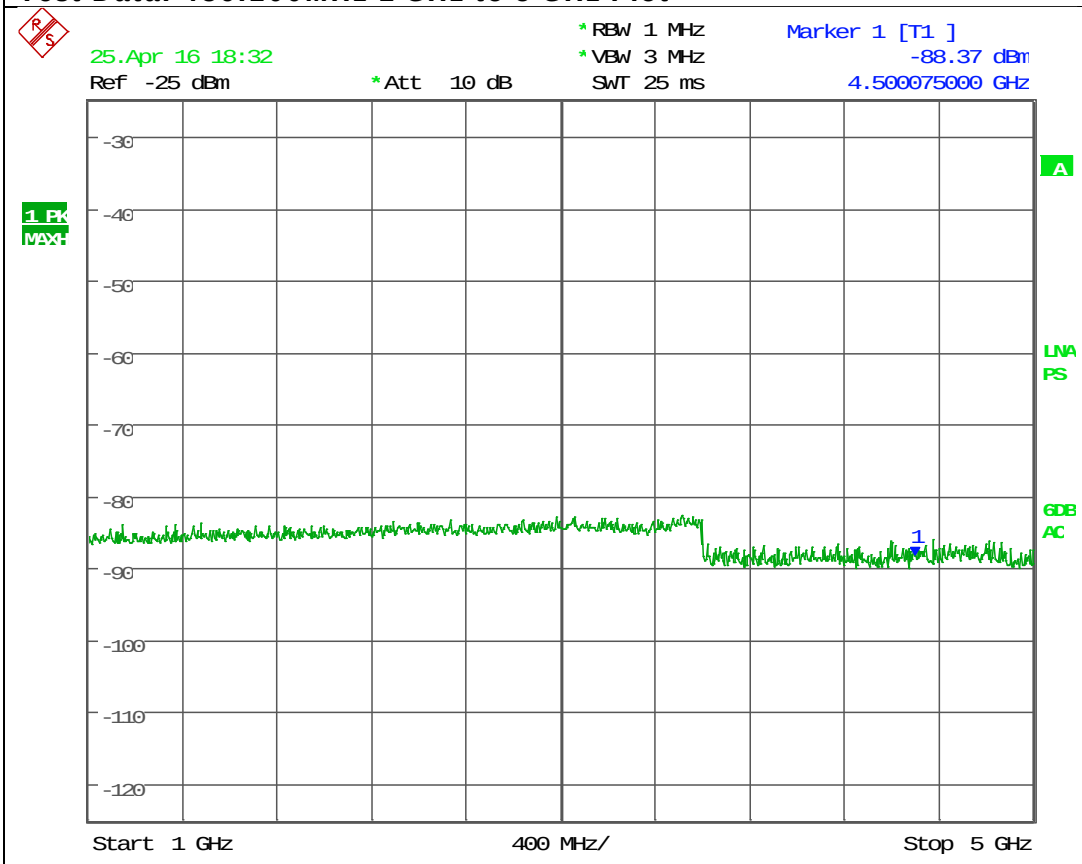
Test Data: 489.1MHz 150 KHz to 1 GHz Plot



Date: 25.APR.2016 13:03:05

ANTENNA CONDUCTED EMISSIONS §4.7

Test Data: 489.100MHz 1 GHz to 5 GHz Plot



Date: 25.APR.2016 18:32:48

FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS §4.9

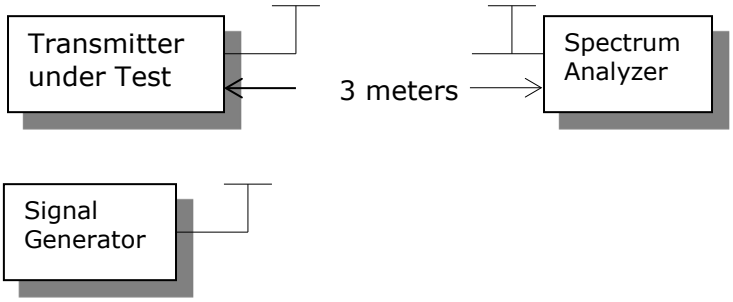
Rule Parts. No.: Part 2.1053, 90.219 (e)(3)

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 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA 603 using the substitution method. Measurements were made at the test site of **TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.**

Test Setup Diagram:



FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS

Test Data: Radiated Spurious Emissions Measurement Table

Tuned Frequency (MHz)	Power Mode	Power Output (dBm)	Power Output (Watts)	Requirement (dBm)	Modulation Type
450.9	Hi	32	1.58	-13	CW

Emission Frequency (MHz)	Ant. Polarity	ERP (dBm)	Margin (dB)
901.80 *	V	-68.59	55.59
1,352.70 *	V	-57.25	57.25
1,803.60 *	V	-53.97	53.97
2,254.50 *	V	-51.7	51.7
2,705.40 *	V	-49.52	49.52
3,156.30 *	V	-47.38	47.38

Tuned Frequency (MHz)	Power Mode	Power Output (dBm)	Power Output (Watts)	Requirement (dBm)	Modulation Type
470.90	Hi	32	1.58	-13	CW

Emission Frequency (MHz)	Ant. Polarity	ERP (dBm)	Margin (dB)
941.80 *	V	-69.50	56.50
1412.70 *	V	-56.45	56.45
1883.60 *	V	-53.91	53.91
2354.50 *	V	-46.86	46.86
2825.40 *	V	-49.91	49.91
3296.30 *	V	-46.96	46.96

Tuned Frequency (MHz)	Power Mode	Power Output (dBm)	Power Output (Watts)	Requirement (dBm)	Modulation Type
489.10	Hi	32	1.58	-13	CW

Emission Frequency (MHz)	Ant. Polarity	ERP (dBm)	Margin (dB)
978.20 *	V	-74.22	61.22
1467.30 *	V	-56.53	56.53
1956.40 *	V	-53.44	53.44
2445.50 *	V	-43.19	43.19
2934.60 *	V	-48.53	48.53
3423.70 *	V	-47.90	47.90

*** Indicates noise floor Only**

STATE OF THE MEASUREMENT UNCERTAINTY – 160419

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 Conducted Power	±1.4dB	(1)
RF Antenna Conducted Emissions	± 2.4 dB	(1)
Maximum Deviation	± 1.3%	(1)
Occupied Bandwidth	± 2.5%	(1)
Adjacent Channel Power	± 1.5dB	(1)
Frequency Stability	± 69.5 Hz	(1)
Transmitter power Radiated Substitution Method	±4.0 dB	(1)
Transmitter Transient Frequency Response	±2.0 dB	(1)

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

EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical 1057	Eaton	94455-1	1057	11/18/15	11/18/17
Antenna: Log-Periodic 1243	Eaton	96005	1243	02/09/16	02/09/18
CHAMBER	Panashield	3M	N/A	01/05/16	12/31/17
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	06/13/14	06/13/16
Software: Field Strength Program	Timco	N/A	Version 4.0	NA	NA
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	11/18/17
RF Power Meter	Boonton	4531	11793	04/08/16	04/08/18
Hygro-Thermometer	Extech	445703	0602	06/30/15	06/30/17
Signal Generator R & S SMIQ 02	Rohde & Schwarz	SMIQ02	DE24678	01/09/16	01/09/18
RF Combiner	Edison Elect.	M530	1	05/18/15	05/18/17
Attenuator N 30dB 20W DC-11G	Narda	766-30	DC-11G	08/01/15	08/01/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Attenuator 6dB 50OHM DC-2G	Mini-Circuits	HAT-6+	#52	06/25/15	06/25/17
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	CHMBR3PC	Chamber 3 cable set (Primary)	12/05/15	12/05/17
Signal Generator R & S SMU 200A	Rohde & Schwarz	SMU200A	103195	02/29/16	02/28/18
Noise Source 10MHz - 18GHz	Agilent	346B	MY44421884	05/04/16	05/04/18

***EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

END OF REPORT