TIMCO ENGINEERING, Inc.
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FCC PART 90, 22

TEST REPORT

APPLICANT	VERTEX STANDARD USA, INC.
	8000 WEST SUNRISE BLVD.
	FT. LAUDERDALE FL 33322 USA
FCC ID	AXI11144730
MODEL NUMBER	EVX-5300-G7-25, EVX-5400-G7-25
PRODUCT DESCRIPTION	UHF MOBILE RADIO
Standard Applied	CFR 47 Part 22 & 90
DATE SAMPLE RECEIVED	4/1/2014
DATE TESTED	11/21/2014
TESTED BY	Cory Leverett
APPROVED BY	Sid Sanders
TIMCO REPORT NO.	502AUT14TestReport_Rev2
TEST RESULTS	☒ PASS ☐ FAIL

Table of Contents

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
☐ 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, under my supervision, at:

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

Authorized Signatory Name:

Cory Douglas Leverett
Engineering Project Manager

Date: **May 5, 2014**

GENERAL INFORMATION

EUT Specification

EUT Description	UHF MOBILE RADIO
FCC ID	AXI11144730
Model Number	EVX-5300-G7-25, EVX-5400-G7-25
Operating Frequency	450-512MHz
No. of Channels	EVX-5300 : 8ch / 1 group
	EVX5400 : 512ch / 32 Group
Type of Emission	Analog: 16K0F3E/11K0F3E/ 7K60F1D/ 7K60F1E Digital: 7K60FXD/ 7K60FXE/ 7K60F1W
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	The temperature was 26ºC with a relative humidity of 50%.
Revision History to the EUT	None
Test Exercise	The EUT was placed in continuous transmit mode.
Applicable Standards	ANSI/TIA 603-C:2004, FCC CFR 47 Part 90
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

TEST PROCEDURE

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-C:2004, using a 50uH LISN. Both lines were observed with the UUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

Bandwidth 20 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

Power Output: The RF power output was measured at the antenna feed point using a peak power meter.

Antenna Conducted Emissions: The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10^{th} harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz
and the span to 50 MHz.

Radiation Interference: The test procedure used was ANSI/TIA 603-C:2004, using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum ANSI/TIA 603-C:2004, receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The ambient temperature of the UUT was 76°F with a humidity of 55%.

RF POWER OUTPUT

Rule Part No.: Part 2.1046(a), Part 90, 22

Test Requirements: Manufacturer's Specification

Method of Measurement: RF power is measured by using a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage (if battery operated), or a properly adjusted power supply (if not battery operated), and the transmitter properly adjusted the RF output measures:

For the device with a fixed or integral antenna, the RF power is measured as ERP. The substitution method was used. The RF output measures:

Test Setup Diagram:

Test Data:

OUTPUT POWER: HIGH – 24.83 Watts
LOW - 5 Watts

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

FOR LOW POWER SETTING INPUT POWER: (13.8V)(2.5A) = 34.5 Watts
FOR HIGH POWER SETTING INPUT POWER: (13.8V)(5.5A) = 75.9Watts

MODULATION CHARACTERISTICS

Rule Part No.: Part 2.1047(a)(b)

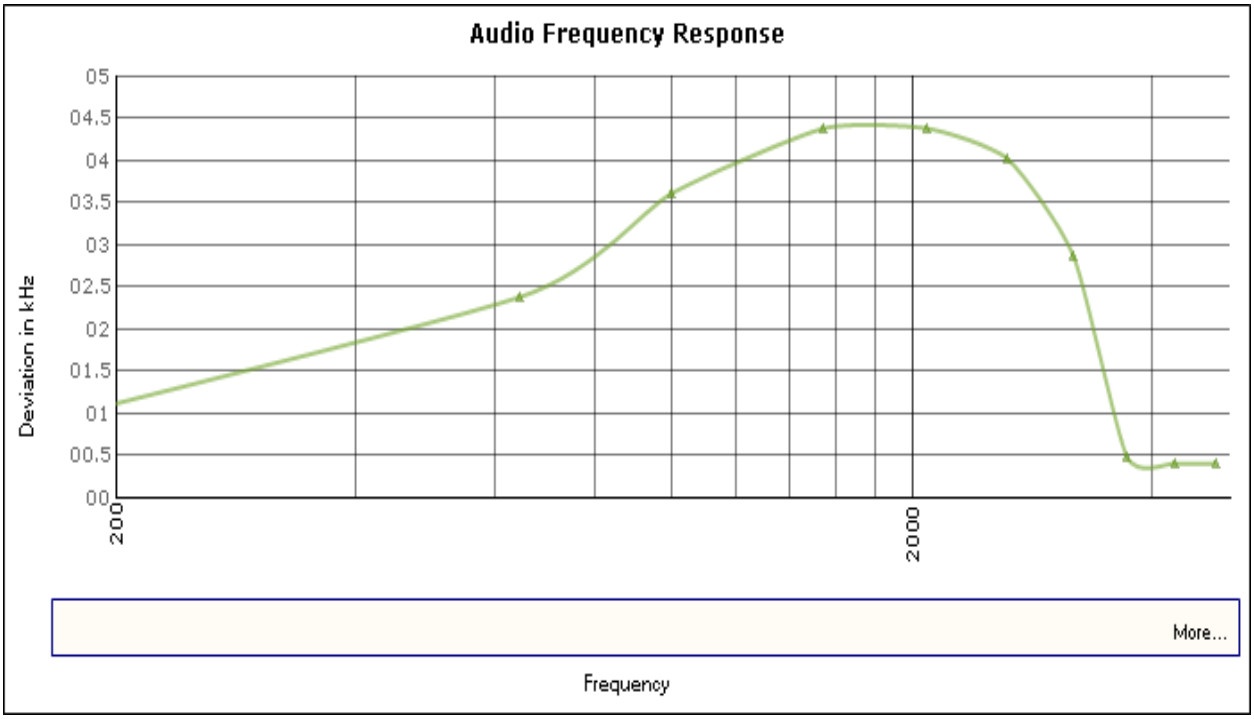
Test Requirements:

Method of Measurement:

Audio frequency response

The audio frequency response was measured in accordance with TIA/EIA Specification 603 with no exception. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted. The audio frequency response curve is shown below.

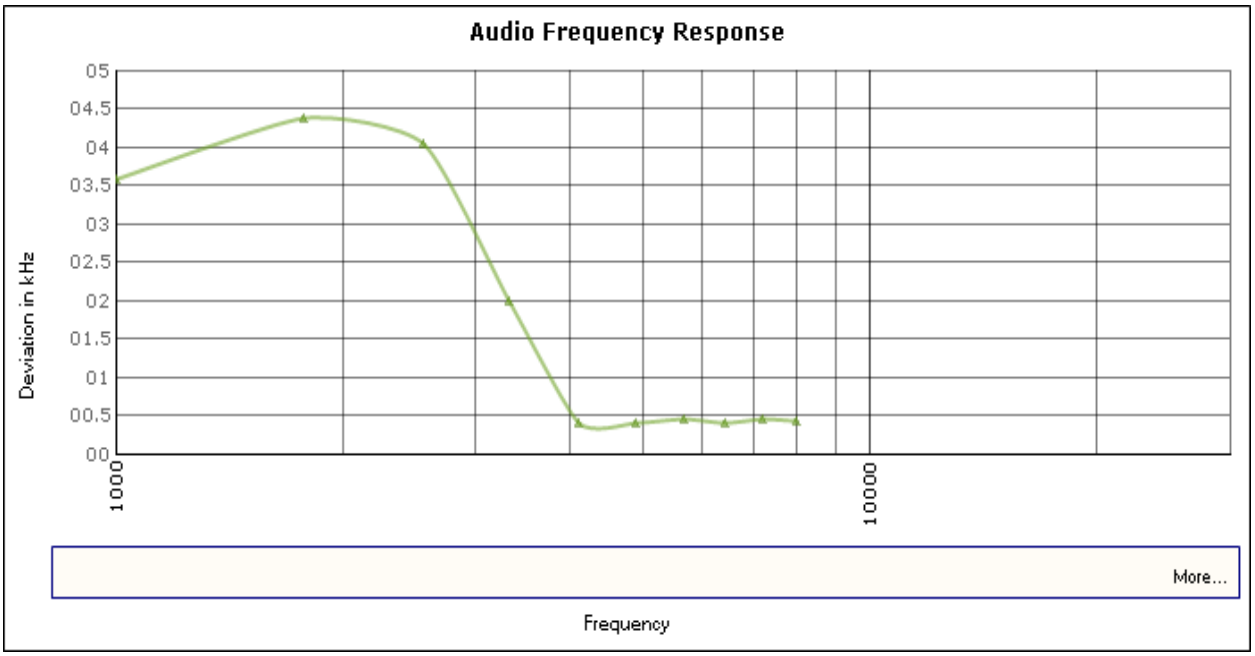
AUDIO FREQUENCY RESPONSE PLOT



VOICE MODULATED COMMUNICATION EQUIPMENT

Part 2.1047(a): For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all the circuitry installed between the modulation limiter and the modulated stage shall be submitted.

AUDIO LOW PASS FILTER.



AUDIO INPUT VERSUS MODULATION

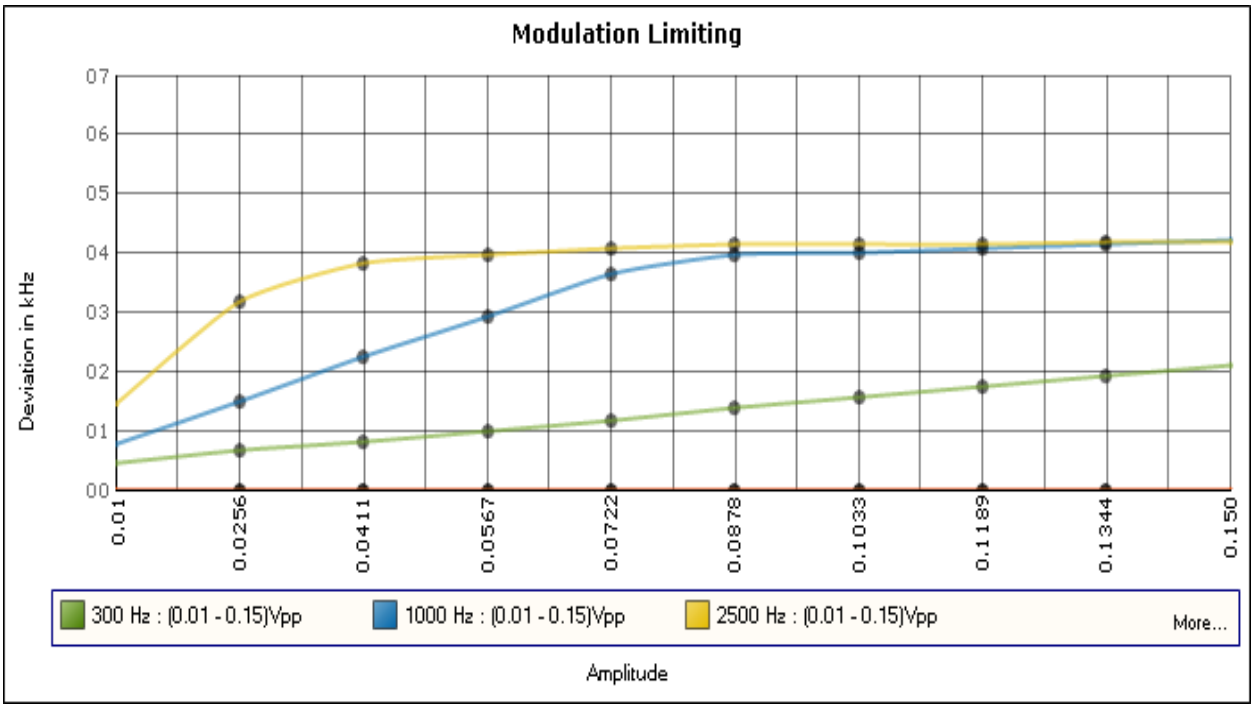
Rule Part No.: Part 2.1047(b) & 90

Test Requirements:

Method of Measurement: Modulation cannot exceed 100%, The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA 603-C: 2004. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

Test data:

Modulation Limiting Plot



OTHER MODULATION CHARACTERISTICS

Part 2.1033(c)
Part 90.209
Part 90.207
Part 22

Part 2.1033(c) (4) Type of Emission: 16K0F3E

Bn = 2M + 2DK
M = 5500
D = 2500
K=1

Bn = 2(5500)+2(2500) = 16.0k

Part 2.1033(c) (4) Type of Emission: 11K0F3E

Bn = 2M + 2DK
M = 3000
D = 2500
K=1

Bn = 2(3000)+2(2500) = 11.0k

Part 2.1033(c) (4) Type of Emission: 7K60F1D, 7K60F1E, 7K60F1W, 7K60FXE, 7K60FXD

The EVX-5300-G7-25, EVX-5400-G7-25 Digital functions comply with DMR (Digital Mobile Radio).

Type of Emission: 16K0F3E

Bn = 2M + 2DK
M = 3000
D = 5000
K=1
Bn = 2(3000)+2(5000) = 16.0k

OCCUPIED BANDWIDTH

Part 2.1049(c) EMISSION BANDWIDTH:

Part 90.210(b) 25kHz Channel Spacing

Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least 43 + 10log(P)dB.

Part 90.210(c) 12.5kHz Channel Spacing Not Equipped with a Low Pass Filter

For transmitters that are not equipped with an audio low pass filter pursuant to S90.211 (b), the power of any emission must be attenuated below the un-modulated carrier output power as follows; (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz but not more than10 kHz: At least 83 log (fd/5) dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least 29 log(fd2/11)dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: At least 43+10 log(Po)dB.

Part 90.210(d) Emission Mask D - 12.5 kHz channel BW equipment.

For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.

(2) On any frequency from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27 (fd - 2.88 kHz) dB.

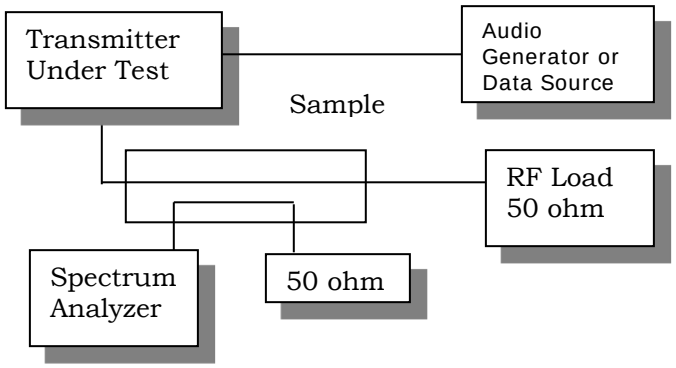
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10log(P) dB or 70 dB, whichever is the lesser attenuation.

OCCUPIED BANDWIDTH

Method of Measurement: ANSI/TIA 603-C: 2004

Three places in the band were checked, only the worst case was presented in this report.

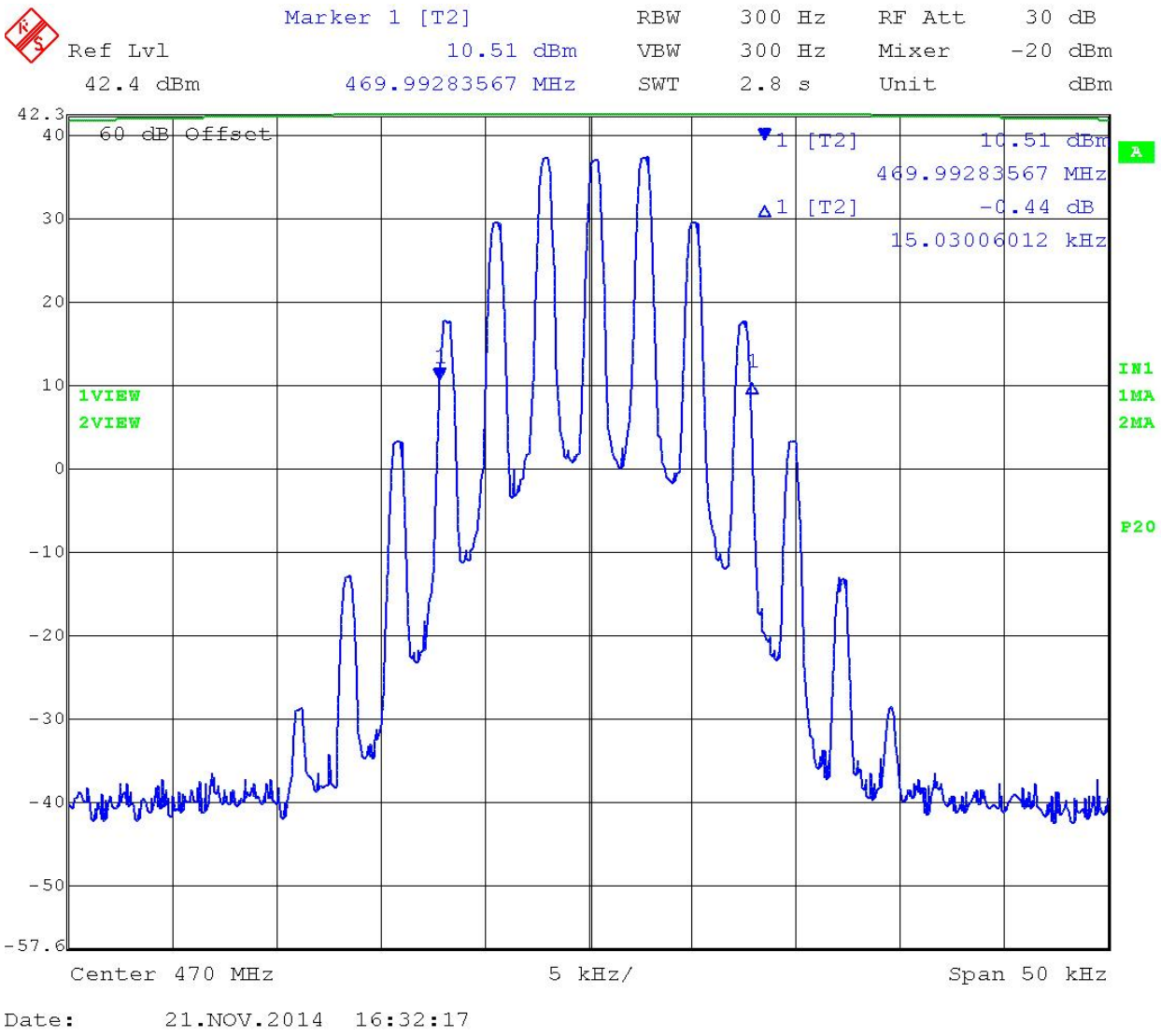
Test Setup Diagram:



Test Data: See the plots below

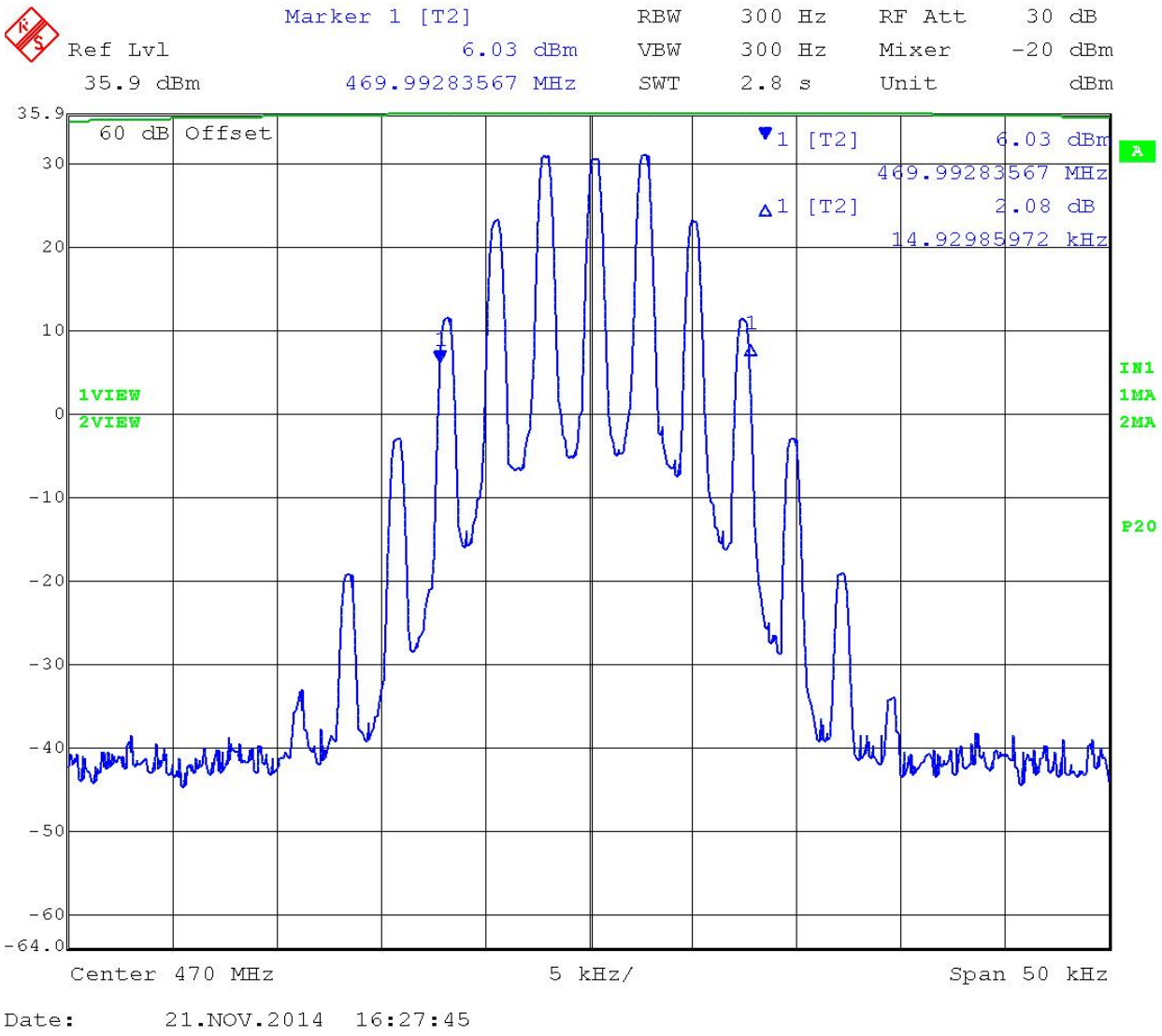
OCCUPIED BANDWIDTH

Part 22 16K0F3E Designator High Power Setting



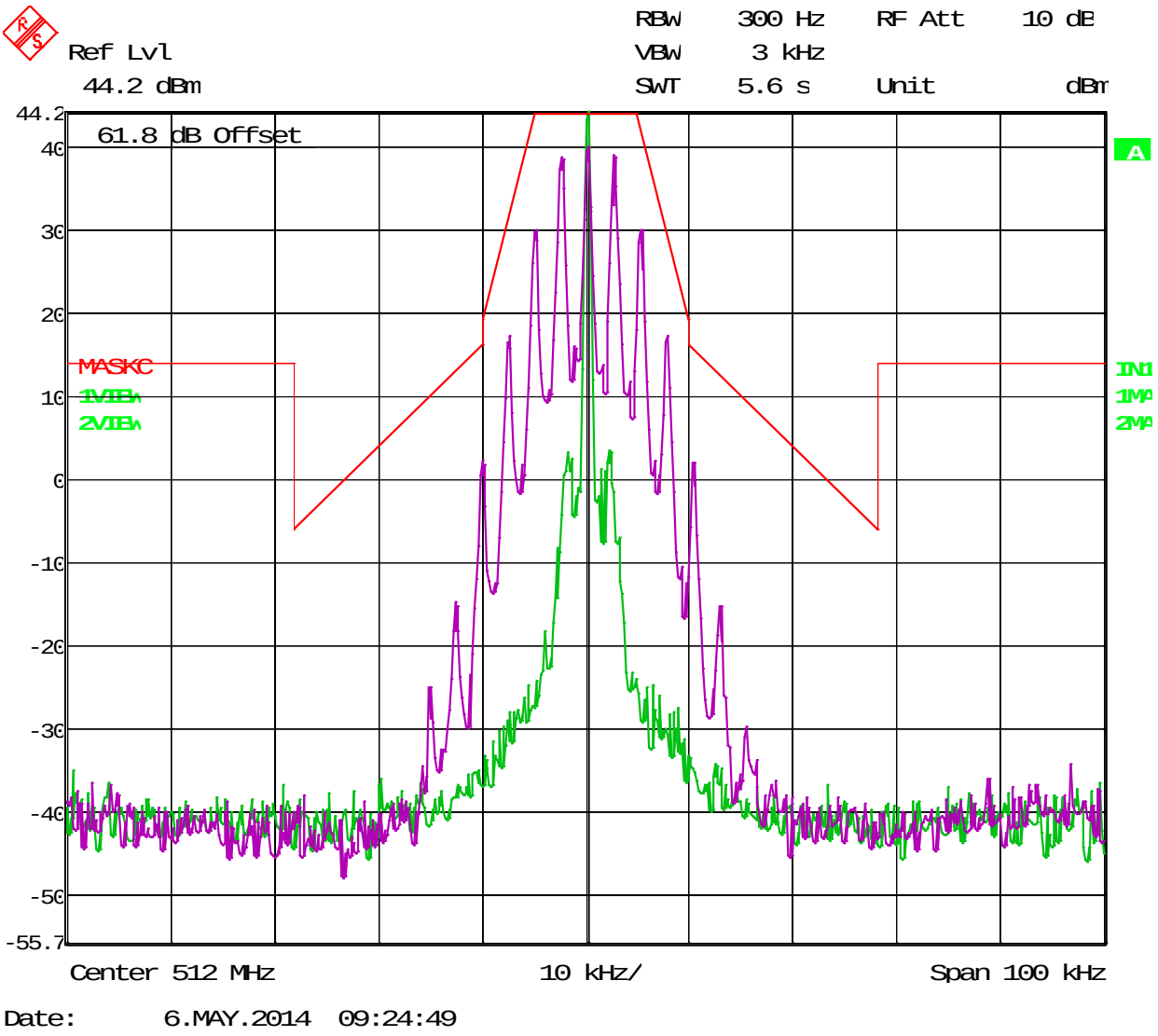
OCCUPIED BANDWIDTH

Part 22 16K0F3E Designator Low Power Setting



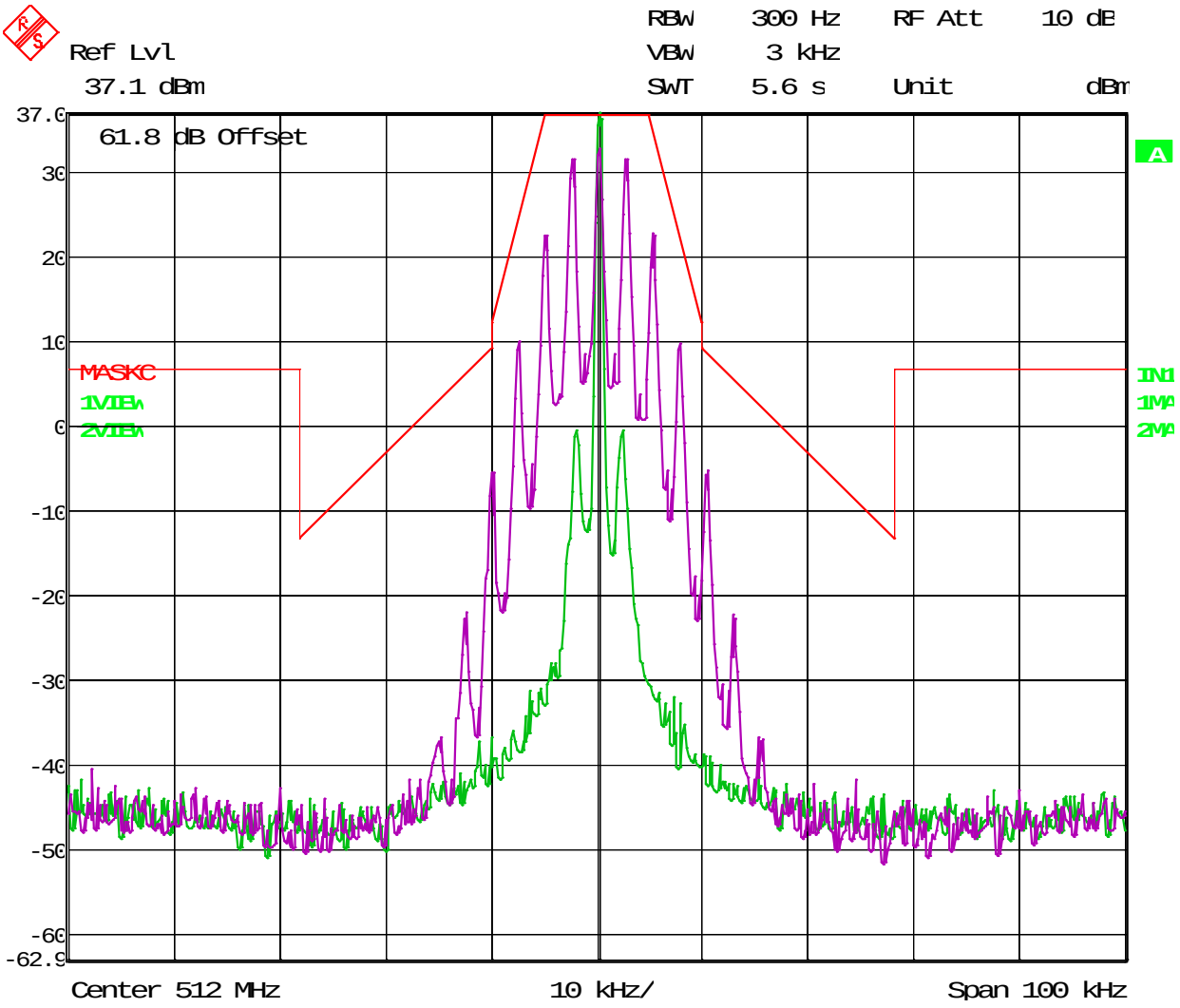
OCCUPIED BANDWIDTH

Part 90.210(c) Emission Mask C 25 kHz Analog Channel High Power



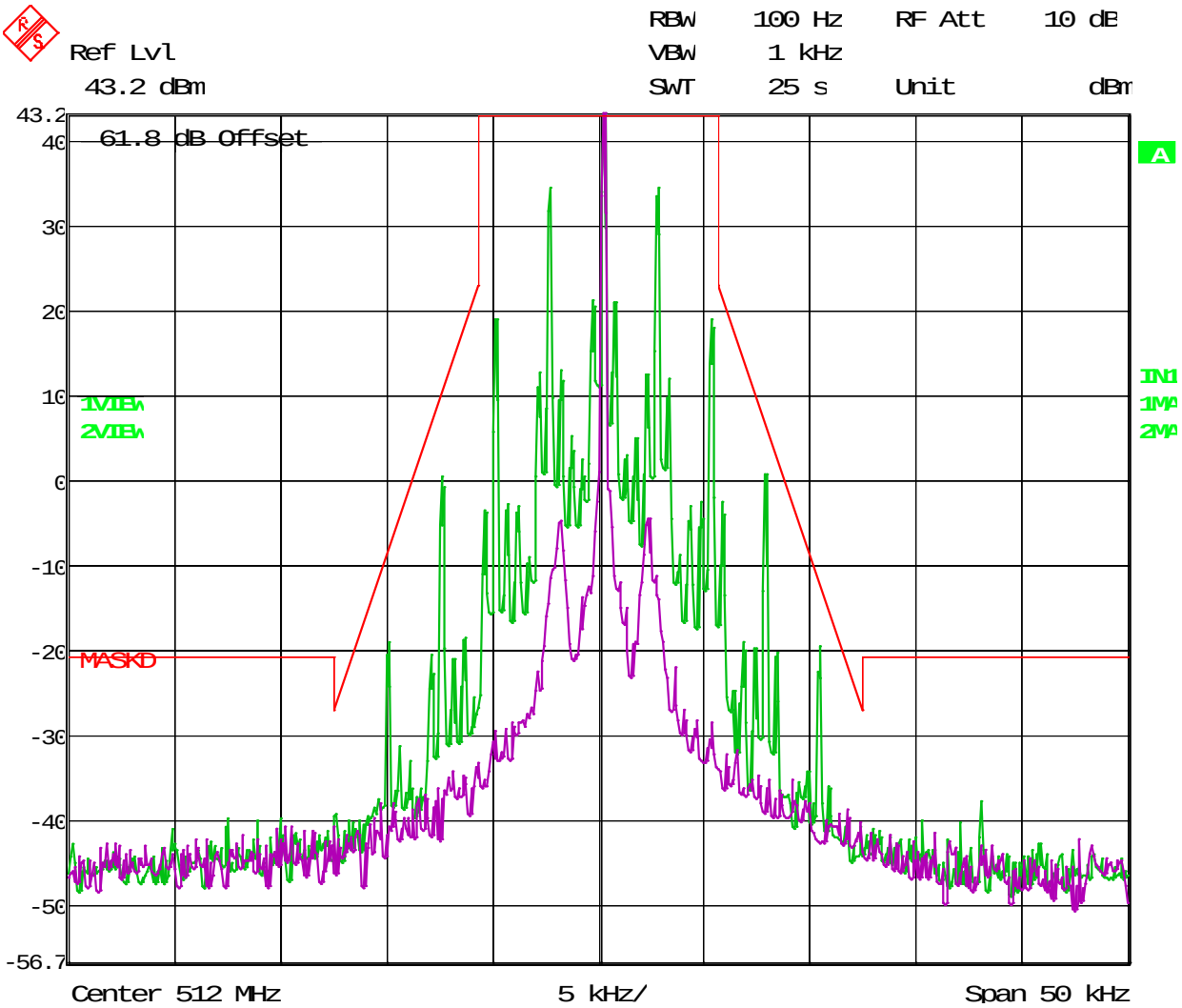
OCCUPIED BANDWIDTH

Part 90.210(c) Emission Mask C 25 kHz Analog Channel low Power



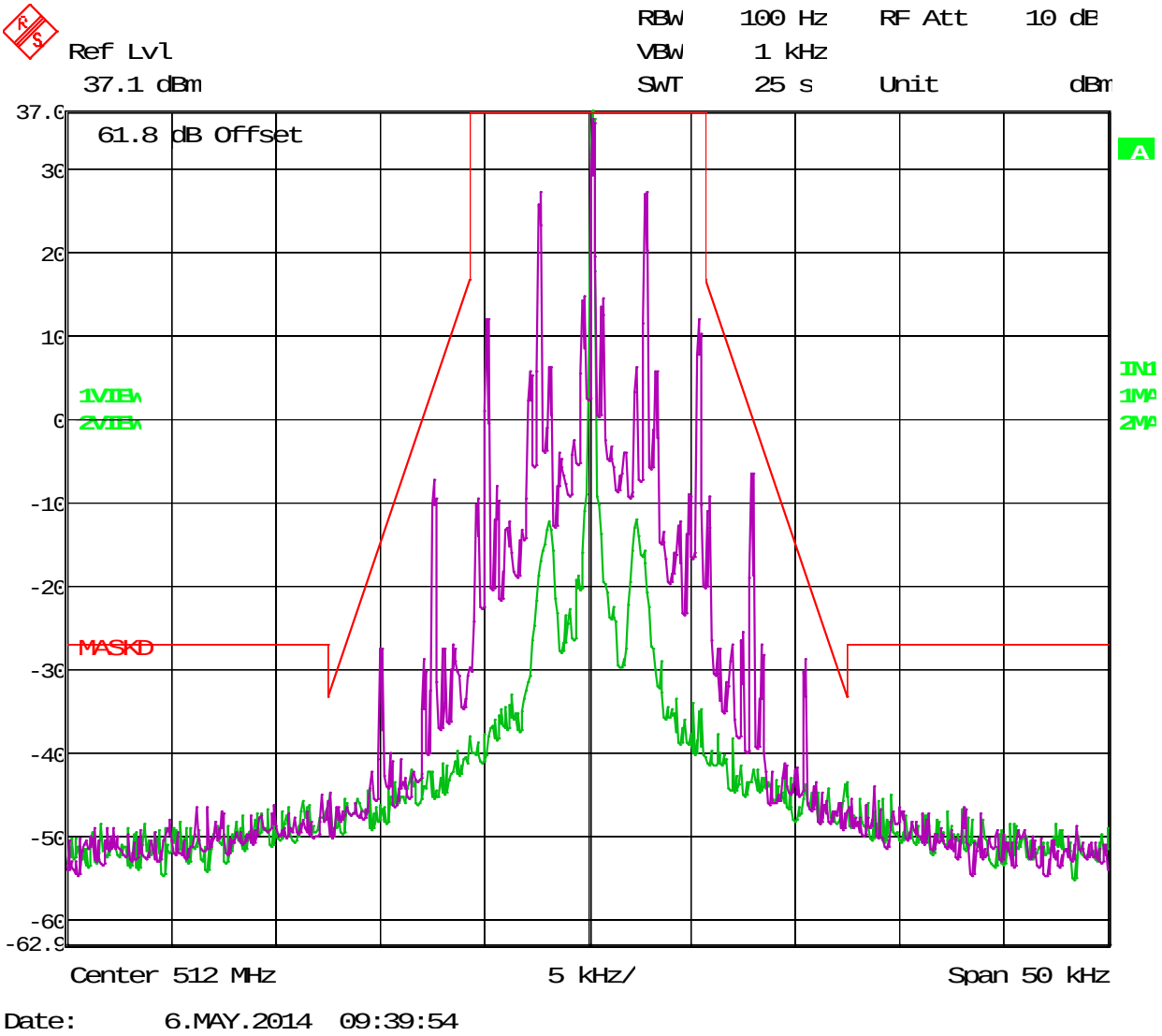
OCCUPIED BANDWIDTH PLOTS

Part 90.210(d) Emmision Mask D 12.5 kHz Analog Channel High Power



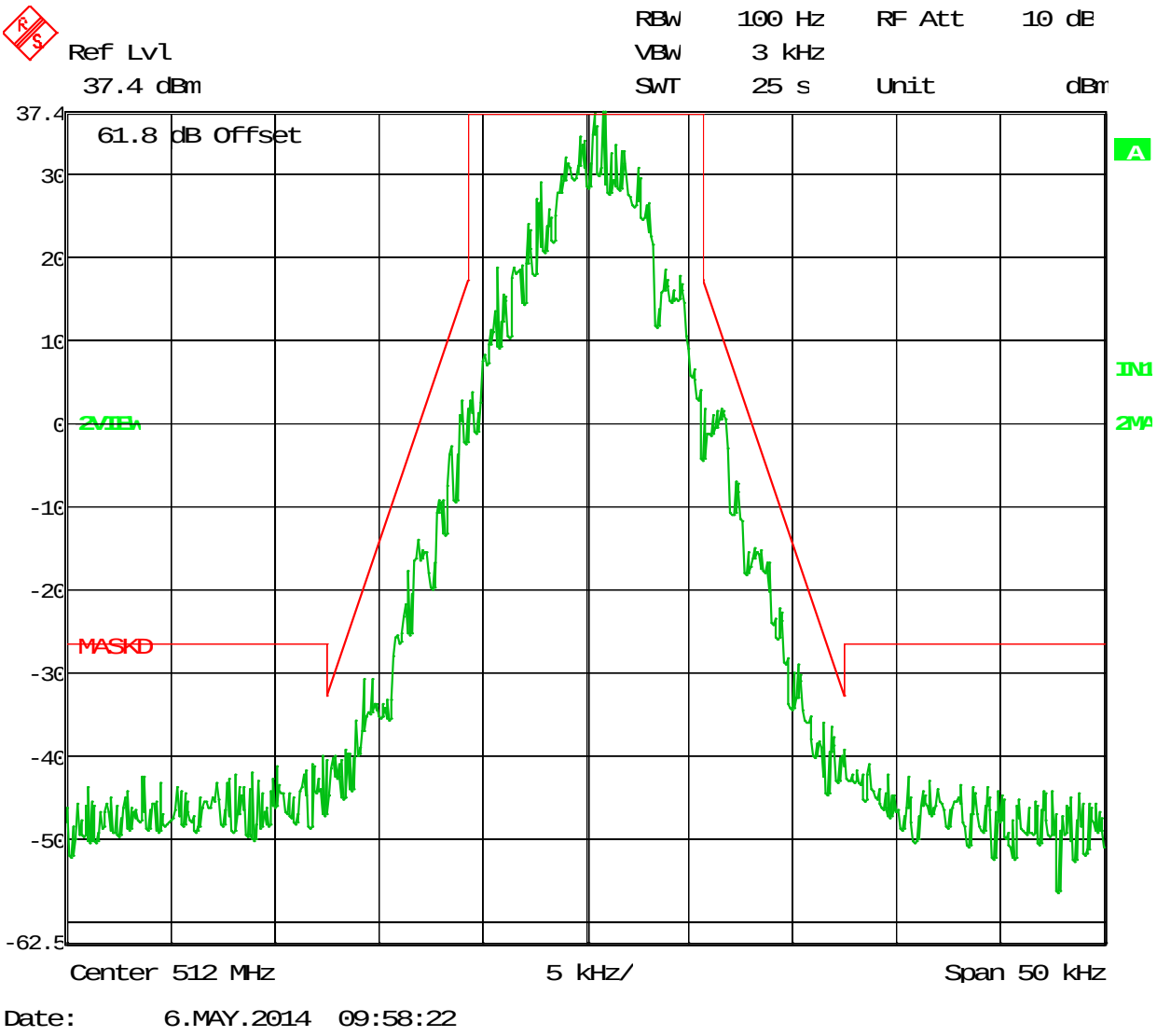
OCCUPIED BANDWIDTH

Part 90.210(d) Emmision Mask D 12.5 kHz Analog Channel Low Power



OCCUPIED BANDWIDTH

Part 90.210(d) Emission Mask D - 12.5 kHz Digital channel Low Power



SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

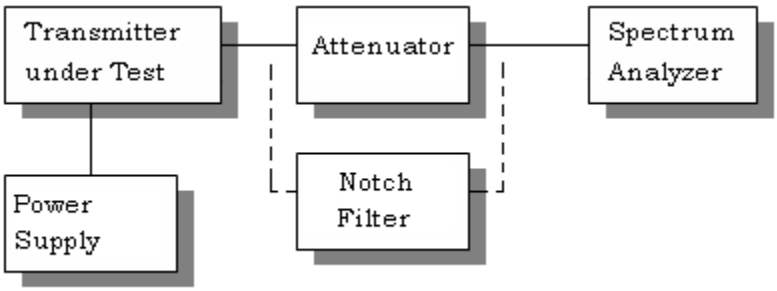
Rule Part No.: Part 2.1051(a)

Requirements:

12.5 kHz Channel Spacing = 50+10 log (25.0) = 64.0 dBc (high power)
12.5 kHz Channel Spacing = 50+10 log (5.0) = 57.0 dBc (low power)

Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-C: 2004.

Method of Measuring Conducted Spurious Emissions



Test Data:

HIGH POWER, Low End of the Band LOW POWER, Low End of the Band

TF MHz HIGH POWER	EF MHz	dB below carrier		TF LOW POWER	EF	dB below carrier
450	900	83		450	900	76.1
	1350	83.7			1350	76.2
	1800	82			1800	73.9
	2250	83.3			2250	74.1
	2700	82.1			2700	73.9
	3150	81.9			3150	75
	3600	81.4			3600	74.5
	4050	81			4050	75.2
	4500	81.8			4500	75.8

HIGH POWER Middle of the Band. LOW POWER Middle of the Band.

TF MHz HIGH POWER	EF MHz	dB below carrier		TF MHz LOW POWER	EF MHz	dB below carrier
471	940	82.6		471	940	75.9
	1410	82.5			1410	77
	1880	81.2			1880	75.1
	2350	82.1			2350	75.9
	2820	81.7			2820	74.8
	3290	81.3			3290	74.6
	3760	81.1			3760	75.3
	4230	81.8			4230	74.8
	4700	81.8			4700	74

HIGH POWER Middle of the Band. LOW POWER Middle of the Band.

TF MHz HIGH POWER	EF MHz	dB below carrier		TF MHz LOW POWER	EF MHz	dB below carrier
512	1024	83.3		512	1024	76.3
	1536	83.2			1536	75.9
	2048	81.2			2048	74
	2560	82.7			2560	75.9
	3072	81.8			3072	75.1
	3584	81.4			3584	75.5
	4096	82.3			4096	75.7
	4608	81.9			4608	75.6
	5120	81.6			5120	76

FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053

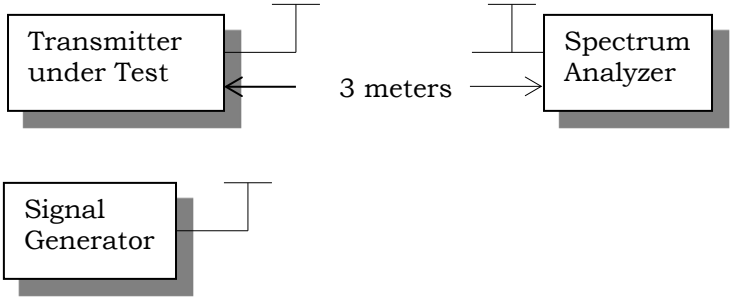
Requirements:

12.5 kHz Channel Spacing = 50+10 log (25.0) = 64.0 dBc (high power)

12.5 kHz Channel Spacing = 50+10 log (5.0) = 57.0 dBc (low power)

METHOD OF MEASUREMENT: 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-C: 2004 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:



Test Data: Measurements were made up to the tenth harmonic of the fundamental frequency tested. When only the noise floor was present, NE is stated in the table to represent that No Emission was found.

HIGH POWER: Low End of the Band

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
450.00	**H/V**	**0.00**
900.00	**V**	**90.74**
1350.00	**H**	**86.94**
1800.00	**H**	**84.22**
2250.00	**H/V**	**NE**
2700.00	**H/V**	**NE**
3150.00	**H/V**	**NE**
3600.00	**H/V**	**NE**
4050.00	**H/V**	**NE**
4500.00	**H/V**	**NE**

LOW POWER: Low End of the Band

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
450.00	**H/V**	**0.00**
900.00	**H**	**89.40**
1350.00	**H**	**81.19**
1800.00	**H**	**78.26**
2250.00	**H/V**	**NE**
2700.00	**H/V**	**NE**
3150.00	**H/V**	**NE**
3600.00	**H/V**	**NE**
4050.00	**H/V**	**NE**
4500.00	**H/V**	**NE**

HIGH POWER: Middle of the Band

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
470.00	H/V	0.00
940.00	H	95.05
1410.00	H	88.98
1880.00	H	83.91
2350.00	H/V	NE
2820.00	H/V	NE
3290.00	H/V	NE
3760.00	H/V	NE
4230.00	H/V	NE
4700.00	H/V	NE

LOW POWER: Middle of the Band

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
470.00	H/V	0.00
940.00	H	86.25
1410.00	H	82.14
1880.00	V	78.34
2350.00	H/V	NE
2820.00	H/V	NE
3290.00	H/V	NE
3760.00	H/V	NE
4230.00	H/V	NE
4700.00	H/V	NE

HIGH POWER: High End of the Band

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
512.00	0	0.00
1024.00	H	85.91
1536.00	H	86.26
2048.00	V	78.25
2560.00	H/V	NE
3072.00	H/V	NE
3584.00	H/V	NE
4096.00	H/V	NE
4608.00	H/V	NE
5120.00	H/V	NE

LOW POWER: High End of the Band

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
512.00	0	0.00
1024.00	H	80.70
1536.00	H	79.24
2048.00	H	75.10
2560.00	H/V	NE
3072.00	H/V	NE
3584.00	H/V	NE
4096.00	H/V	NE
4608.00	H/V	NE
5120.00	H/V	NE

FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055, Part 90.213

Requirements: Temperature range requirements: -30 to +50º C.
Voltage Variation +, -15%
±2.5 PPM

Method of Measurements: ANSI/TIA 603-C: 2004.

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		470
Temperature (ºC)	Frequency (MHz)	Frequency Stability (PPM)
-30	469.999778	-0.39
-20	469.999791	-0.36
-10	469.999874	-0.18
0	469.99991	-0.11
+10	469.999877	-0.18
+20	469.999897	-0.13
+30	469.999962	0
+40	470.000006	0.1
+50	469.999984	0.05

Assigned Frequency (Ref. Frequency) (MHz)		470
% Battery	Frequency (MHz)	Frequency Stability (PPM)
-15%	470	0
0	470	0
+15%	470	0.01

TRANSIENT FREQUENCY BEHAVIOR

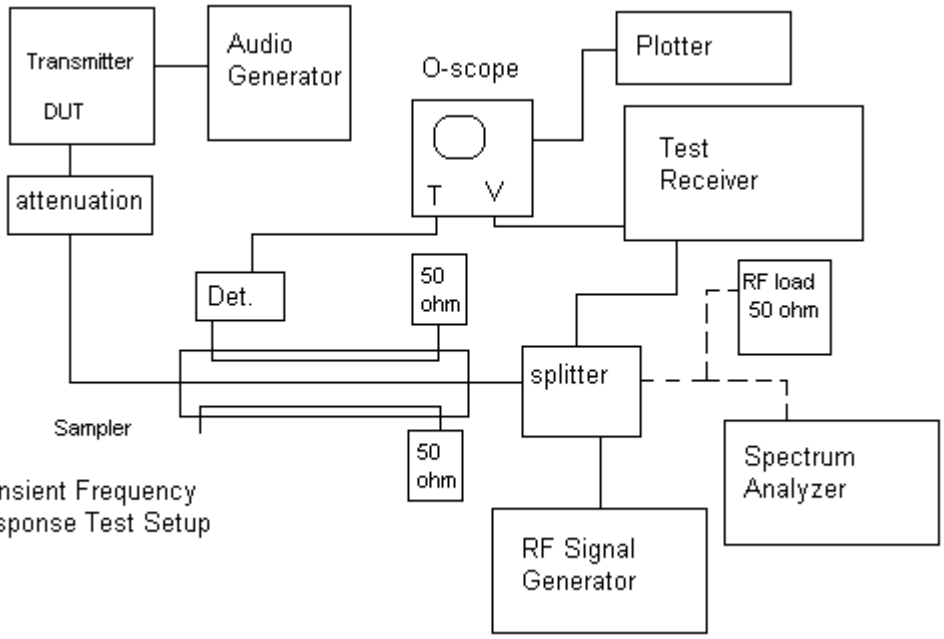
Part 90.214 Transient Frequency Behavior

REQUIREMENTS: Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1[4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3[4]	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t_1[4]	±12.5 kHz	5.0 ms	10.0 ms
t_2	±6.25 kHz	20.0 ms	25.0 ms
t_3[4]	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t_1[4]	±6.25 kHz	5.0 ms	10.0 ms
t_2	±3.125 kHz	20.0 ms	25.0 ms
t_3[4]	±6.25 kHz	5.0 ms	10.0 ms

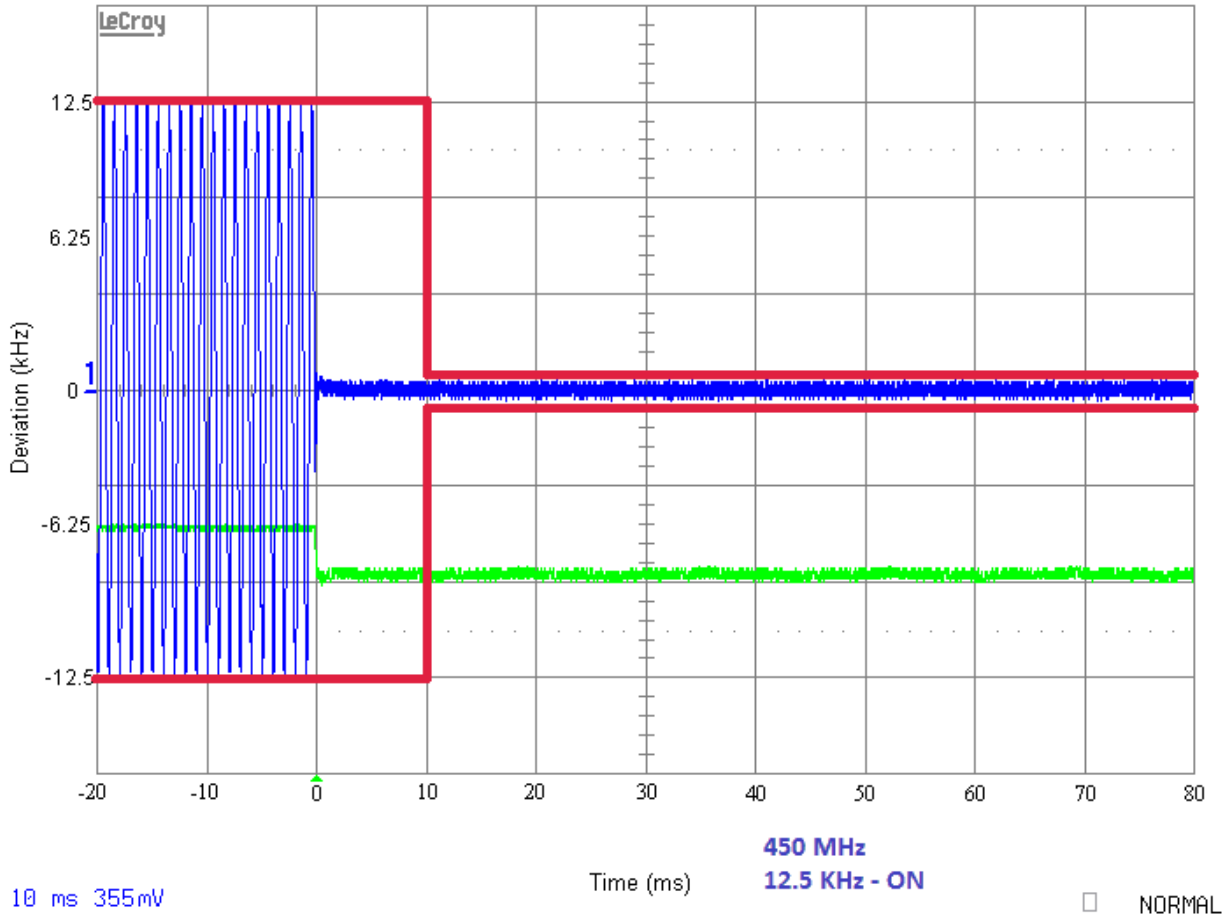
TEST PROCEEDURE: ANSI/TIA 603-C:2004, the levels were set as follows:

1. Using the variable attenuator the transmitter level was set to 40 dB below the test receivers maximum input level, then the transmitter was turned off.
2. With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained with the signal generator through-out the test.
3. Reduce the attenuation between the transmitter and the RF detector by 30 dB.
4. With the levels set as above, the transient frequency behavior was observed and recorded.

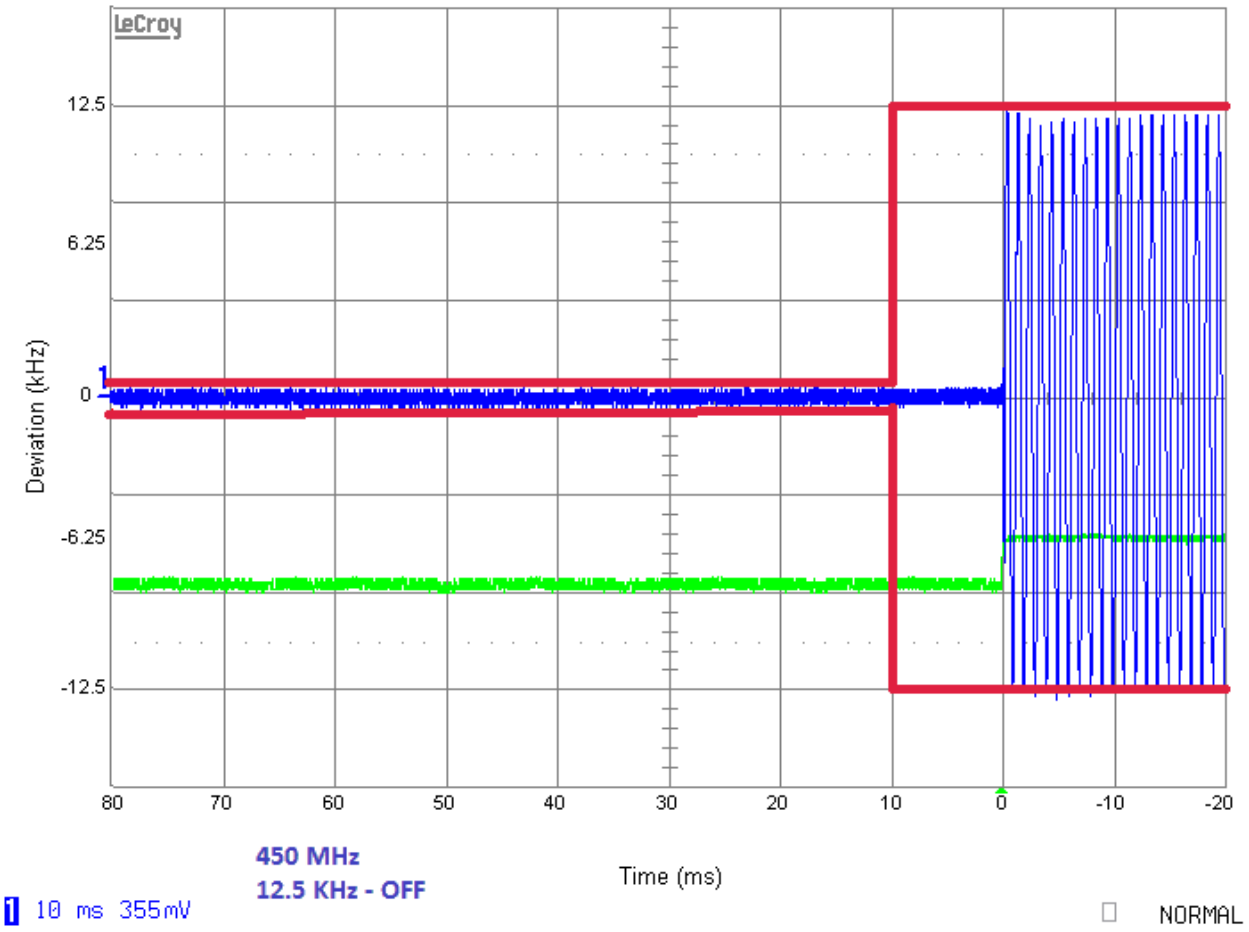


Transient Frequency Response Test Setup

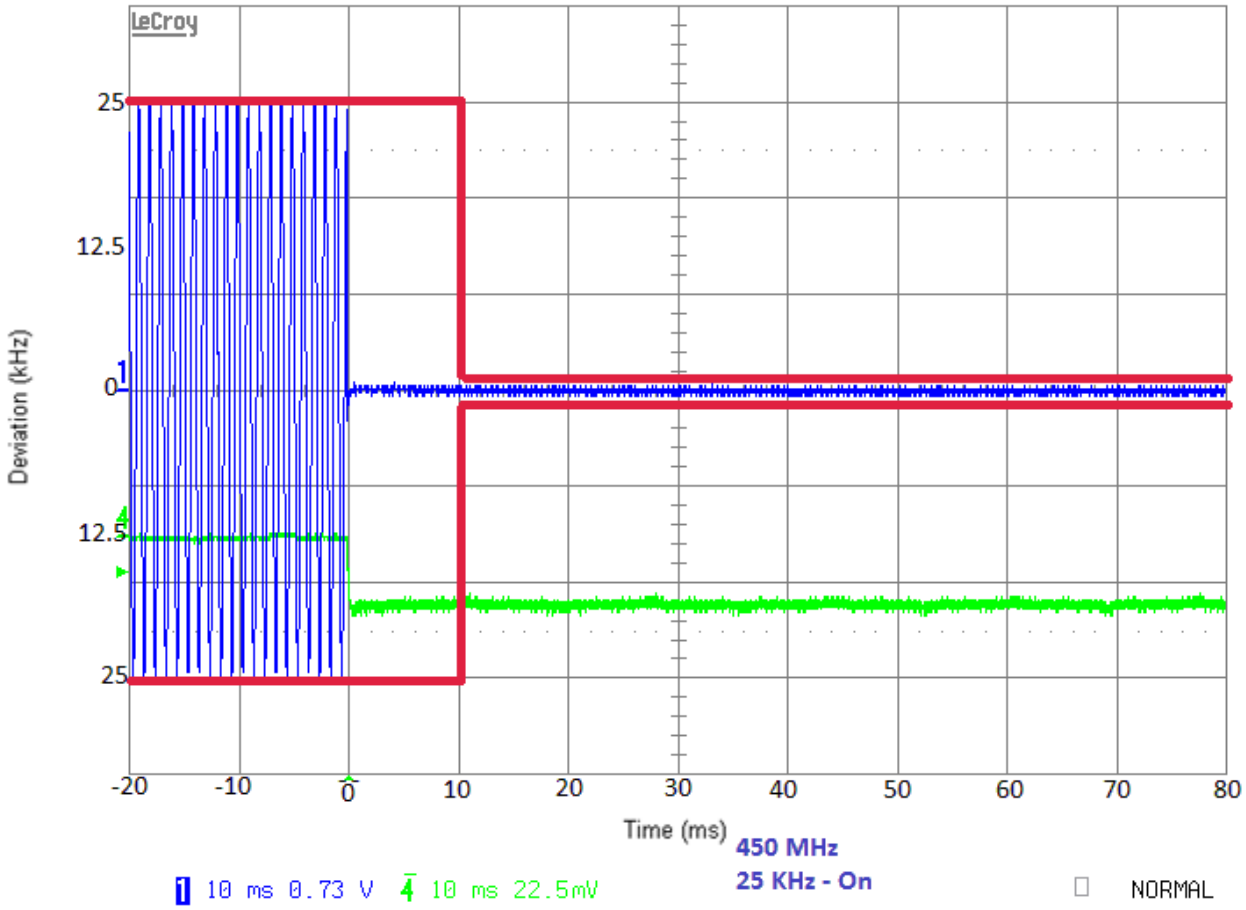
12.5 KHz Turn On Plot:



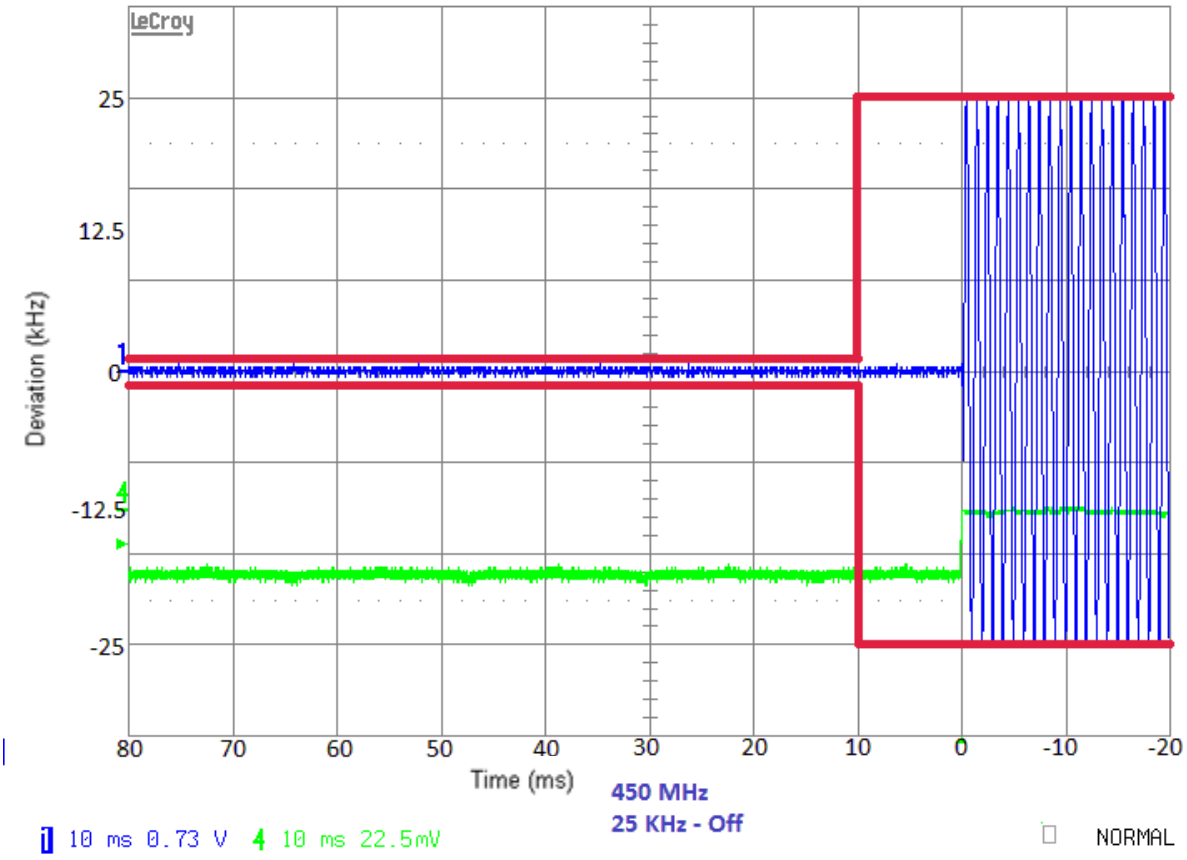
12.5 KHz Turn Off Plot:



25 KHz Turn On Plot:



25 KHz Turn Off Plot:



EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical	Eaton	94455-1	1096	05/10/13	05/10/15
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/09/13	05/09/15
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	152	N/A	N/A
Frequency Counter	HP	5385A	2730A03025	08/22/13	08/22/15
Signal Generator	HP	8648C	3847A04696	09/18/13	09/18/15
Hygro-Thermometer	Extech	445703	0602	06/20/13	06/20/15
Digital Multimeter	Fluke	77	35053830	08/22/13	08/22/15
Temperature Chamber	Thermotron Corp.	S1.2 Mini Max	25-1420-09	08/20/14	08/20/16
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	12/07/13	12/07/15
Software: Field Strength Program	Timco	N/A	Version 4.0	N/A	N/A
EMI Test Receiver	Rhode & Schwarz	ESU 40	100320	03/21/13	03/21/15
Frequency Counter	HP	5385A	3242A07460	06/16/13	06/16/15
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
DC Power Supply	HP	6286A	1744A03842	N/A	N/A
Attenuator	Narda	766-30	N/A	8/1/13	8/1/15
Coaxial Cable # 65	N/A	E9917 RG233/U	Timco # 65	6/26/13	6/26/15
Coaxial Cable Chamber 3 pc Set	Semiflex	N/A	Chamber 3pc set	1/13/14	1/13/16