



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

## FCC PART 90

## TEST REPORT

APPLICANT	VERTEX STANDARD USA, INC.
	8000 WEST SUNRISE BLVD.
	FT. LAUDERDALE FL 33322 USA
FCC ID	AXI11144630
MODEL NUMBER	EVX-5300-G6-25, EVX-5400-G6-25
PRODUCT DESCRIPTION	UHF MOBILE TRANSCEIVER
DATE SAMPLE RECEIVED	9/11/2013
DATE TESTED	9/16/2013
TESTED BY	NAM NGUYEN
APPROVED BY	NAM NGUYEN
TIMCO REPORT NO.	1563AUT13TestReport.docx
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL  
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**





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Applicant: VERTEX STANDARD USA, INC.

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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
- 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.



Testing Certificate # 0955-01

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:**

Nam Nguyen  
Project Manager / Testing Technician

**Date: Sept 24, 2013**

Applicant: VERTEX STANDARD USA, INC.

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## GENERAL INFORMATION

### DUT Specification

<b>DUT Description</b>	UHF MOBILE TRANSCEIVER
<b>FCC ID</b>	AXI11144630
<b>Model Number</b>	EVX-5300-G6-25, EVX-5400-G6-25
<b>Operating Frequency</b>	406.1 – 470.0 MHz
<b>No. of Channels</b>	8 (EXV-5300), 512 (EXV-5400)
<b>Type of Emission</b>	11K0F3E, 7K60F1D, 7K60F1E 7K60FXD, 7K60FXE, 7K60F1W
<b>Modulation</b>	FM
<b>DUT Power Source</b>	<input type="checkbox"/> 110–120Vac/50– 60Hz
	<input checked="" type="checkbox"/> DC Power 12V
	<input type="checkbox"/> Battery Operated Exclusively
<b>Test Item</b>	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
<b>Type of Equipment</b>	<input type="checkbox"/> Fixed
	<input checked="" type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
<b>Test Conditions</b>	The temperature was 26°C with a relative humidity of 50%.
<b>Modification to the DUT</b>	None
<b>Test Exercise</b>	The DUT was placed in continuous transmit mode.
<b>Applicable Standards</b>	ANSI/TIA 603-C:2004, FCC CFR 47 Part 90
<b>Test Facility</b>	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

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**EQUIPMENT LIST**

<b>Device</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Cal/Char Date</b>	<b>Due Date</b>
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	10/28/11	10/28/13
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	10/28/11	10/28/13
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
Frequency Counter	HP	5352B	2632A00165	06/26/13	06/26/15
Frequency Counter	HP	5385A	2730A03025	08/22/13	08/22/15
Signal Generator	HP	8640B	2308A21464	02/23/12	02/23/14
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	07/03/12	07/03/14
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	12/07/11	12/07/13
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	10/28/11	10/28/13
Analyzer Silver Tower RF Preselector	HP	85685A	2926A00983	06/05/13	06/05/15
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	10/28/11	10/28/13
Temperature Chamber	Tenney Engineering	TTRC	11717-7	07/03/12	07/03/14
Frequency Counter	HP	5385A	3242A07460	06/16/13	06/16/15
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13
EMI Receiver	Rohde & Schwarz	ESIB40	100274	3/16/12	3/16/14
Notch Filter	Microlab	HA-10N		5/17/13	5/17/15
Notch Filter	Microlab	HA-20N		5/17/13	5/17/15
Power Meter	Boonton Electronics	4531	11793	1/9/13	1/9/15
Sensor	Boonton	51072A	34647	01/19/13	01/19/15
Attenuator	Narda	769-30	10267	3/15/13	3/15/15

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## 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<sup>th</sup> 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

### Test Requirements:

**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: RF power of the EUT can be set at 5W to 25W. For the model: EVX-5300-G6-25, EVX-5400-G6-25 can be set at 5W to 25W.**

OUTPUT POWER:

Tuned Frequency (MHz)	RF POWER (W)	
	HI	LOW
406.25	25.9	5.1
418.00	24.0	4.8
429.75	24.4	4.7
450.25	23.4	5.2
460.00	24.5	5.5
469.75	24.4	5.0

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

FOR LOW POWER SETTING INPUT POWER:  $(12.0V)(3.0A) = 36.00$  Watts

FOR HIGH POWER SETTING INPUT POWER:  $(12.0V)(5.9A) = 70.80$  Watts

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## MODULATION CHARACTERISTICS

**Part 2.1033(c)**

**Part 2.1033(c) (4)** Type of Emission: 11K2F1D , 11K2F2D, and 11K2F3E

**FCC Part 90.209**

**FCC Part 90.207**

DMR TDMA

Type of Emission: 11K2F3E, 11K2F3D

$$B_n = 2M + 2DK$$

$$M = 3000$$

$$D = 2100$$

$$K=1$$

$$B_n = 2(3000) + 2(2100) = 10.2k$$

The EVX-5300-G6-25, EVX-5400-G6-25 Digital functions comply with DMR (Digital Mobile Radio).

Format: 2-slot TDMA

Modulation: 4FSK

Bandwidth: 12.5kHz

Data rate: 9,600bps (bit per second)

Voice: AMBE+2 Vocoder (digitized) 3,600bps

Applicant: VERTEX STANDARD USA, INC.

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## MODULATION CHARACTERISTICS

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

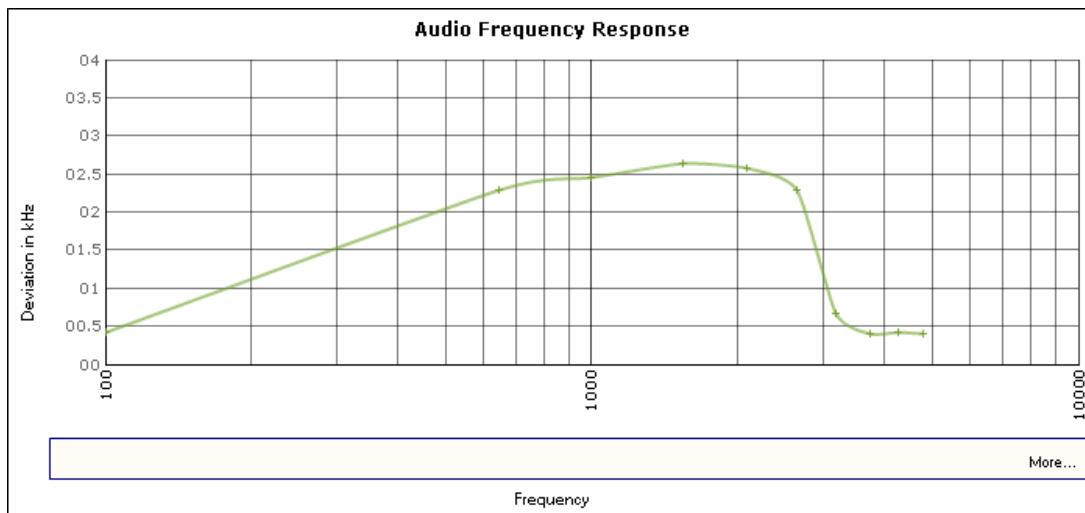
**Test Requirements:**

**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



Applicant: VERTEX STANDARD USA, INC.

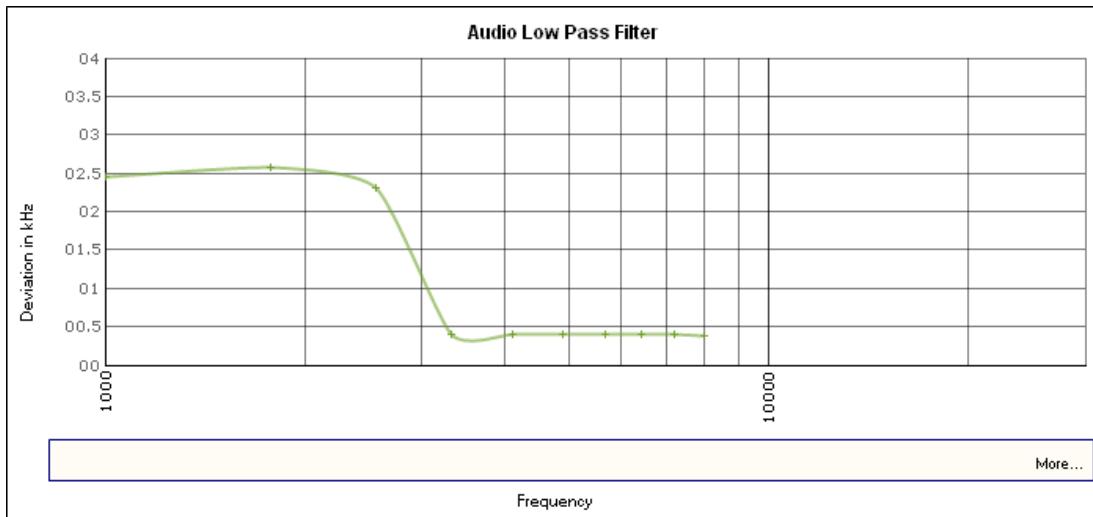
FCC ID: AXI11144630

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## 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.



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## AUDIO INPUT VERSUS MODULATION

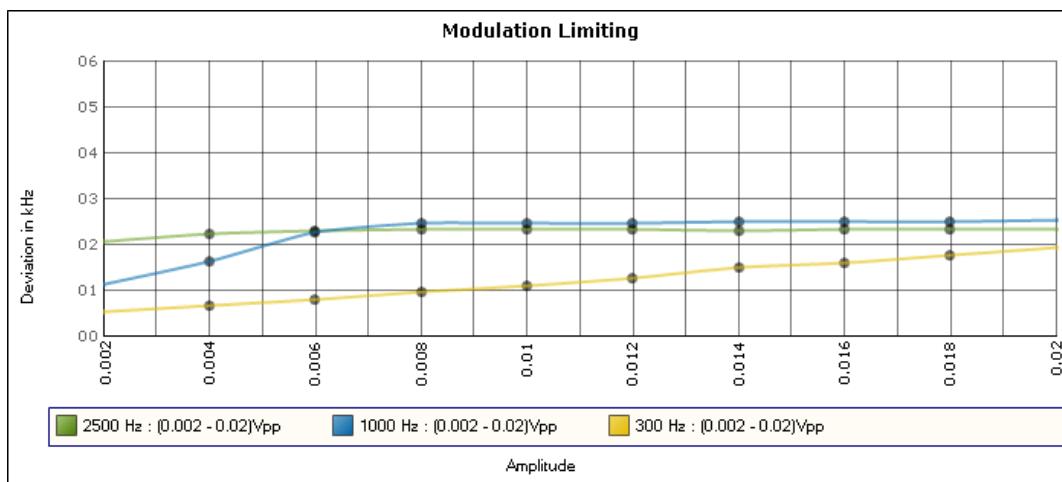
**Rule Part No.:** Part 2.1047(b) & 90

### 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**



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## 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  $43 + 10\log(P)$ 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 than 10 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  $29 \log(fd^2/11)$ 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  $7.27(fd - 2.88)$  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  $50 + 10\log(P)$  dB or 70 dB, whichever is the lesser attenuation.

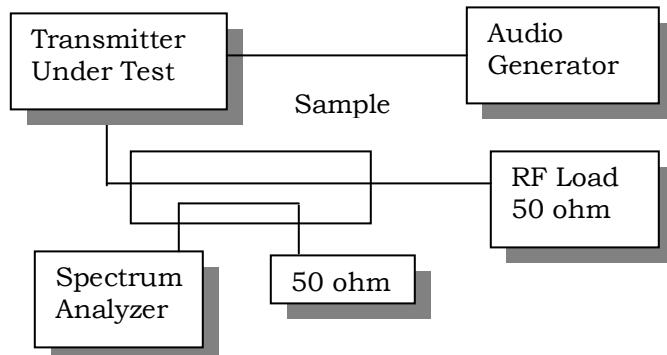
**Part 90.210(e) Emission Mask E - 6.25 kHz channel BW equipment.**

For transmitters designed to operate with a 6.25 kHz 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 3.0 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 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(fd - 3.0)$  or  $55 + 10 \log(P)$  or 65, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6kHz: At least  $55 + 10\log(P)$  dB or 65 dB, whichever is the lesser attenuation.

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

**Test Setup Diagram:**



**Test Data:** See the plots below

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**OCCUPIED BANDWIDTH PLOTS**  
**Part 90.210(d) Emission Mask D - 12.5 kHz channel**

**12.5kHz: ANALOG**

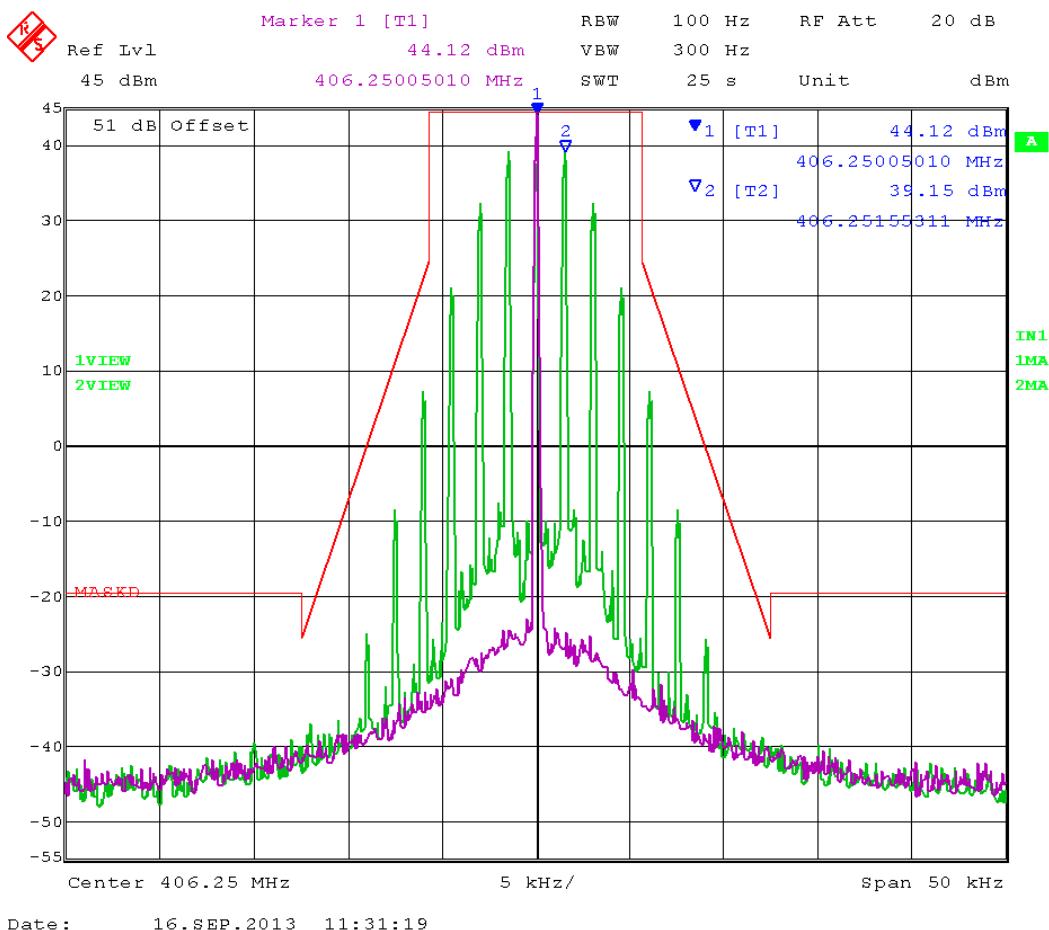


Figure 1: Occupied bandwidth 406.25 MHz (12.5 kHz)

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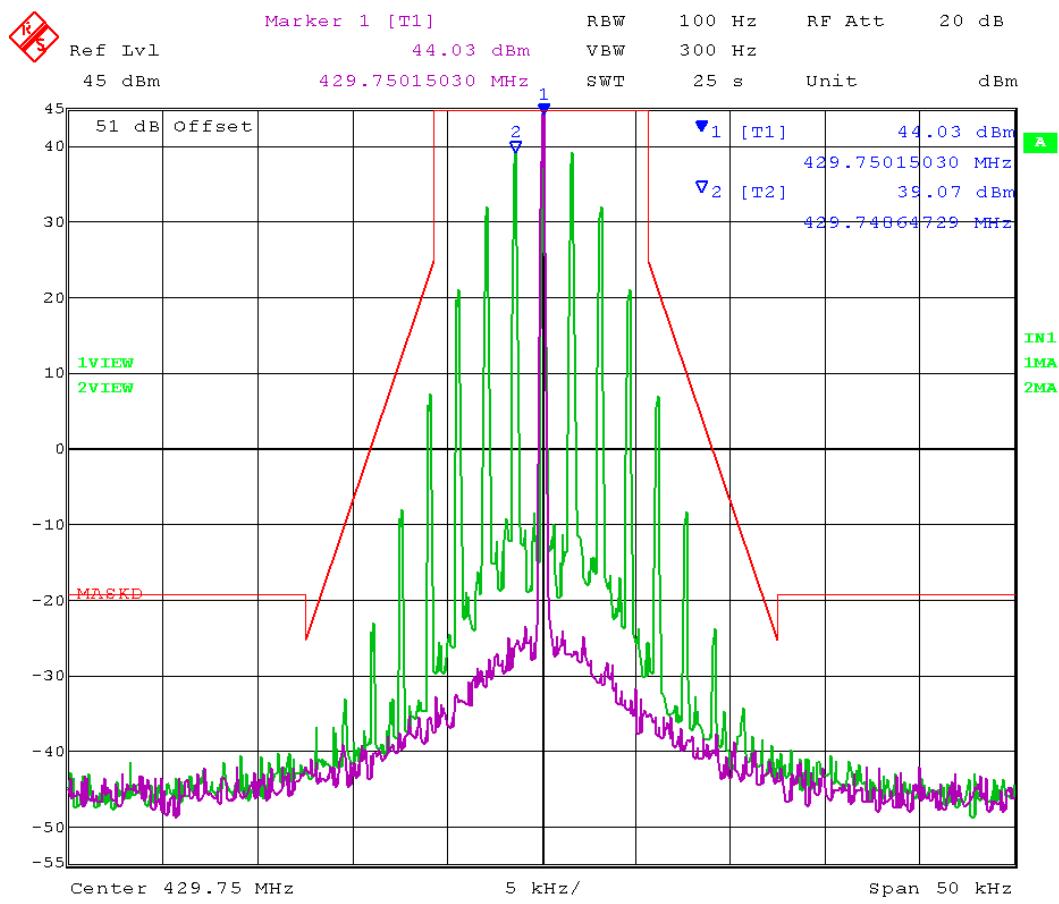


Figure 2: Occupied bandwidth 429.75 MHz (12.5 kHz)

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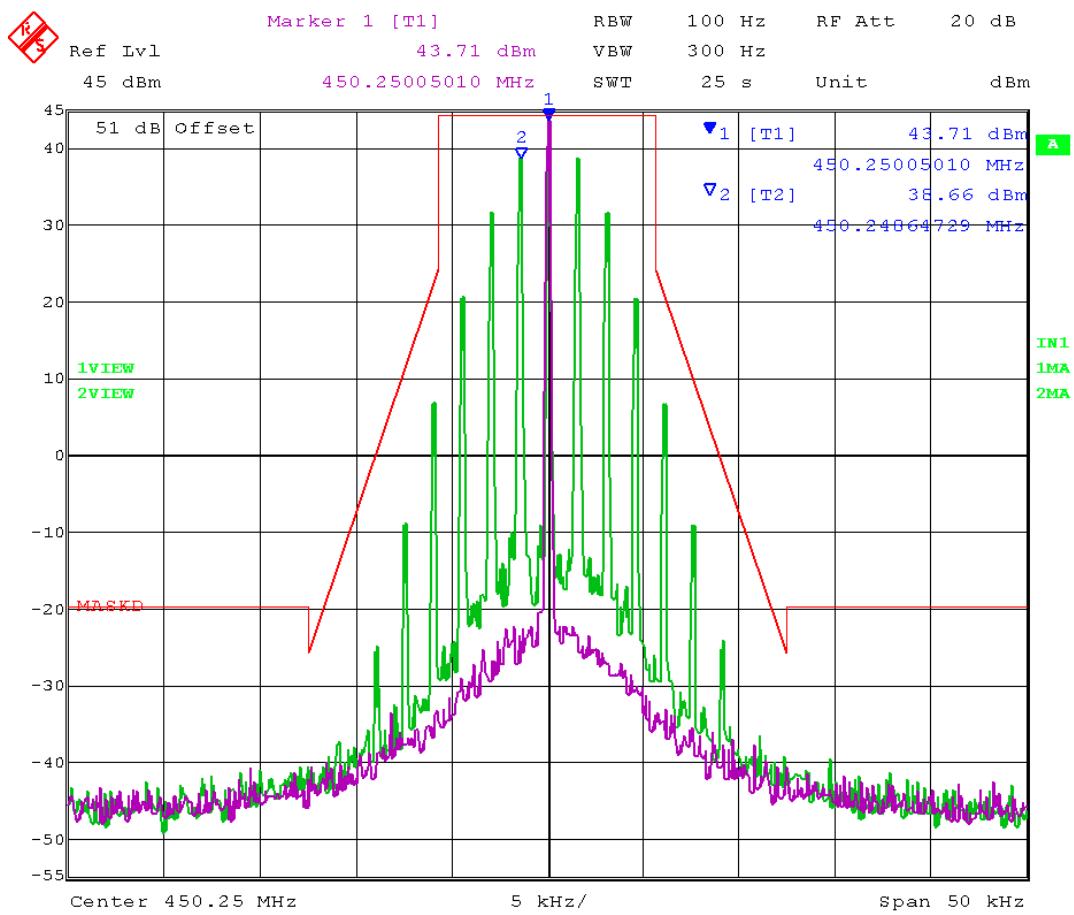


Figure 3: Occupied bandwidth 450.25 MHz (12.5 kHz)

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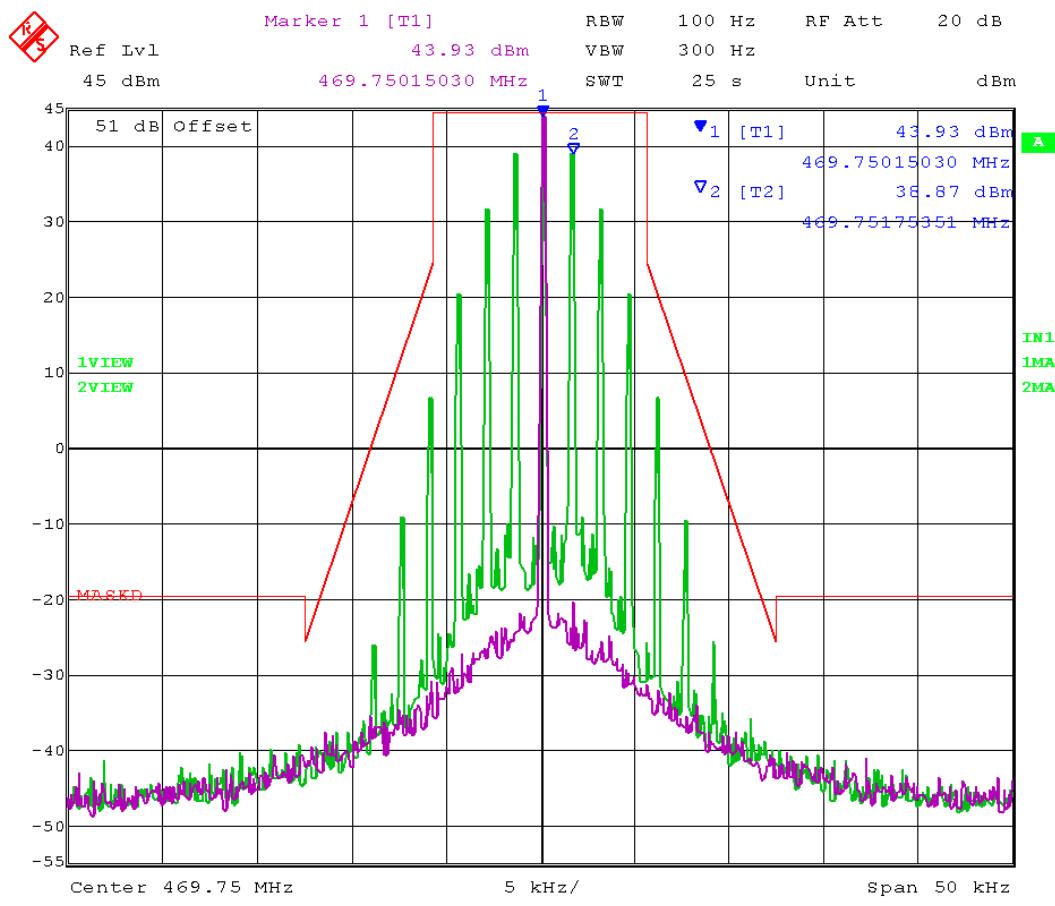


Figure 4: Occupied bandwidth 469.75 MHz (12.5 kHz)

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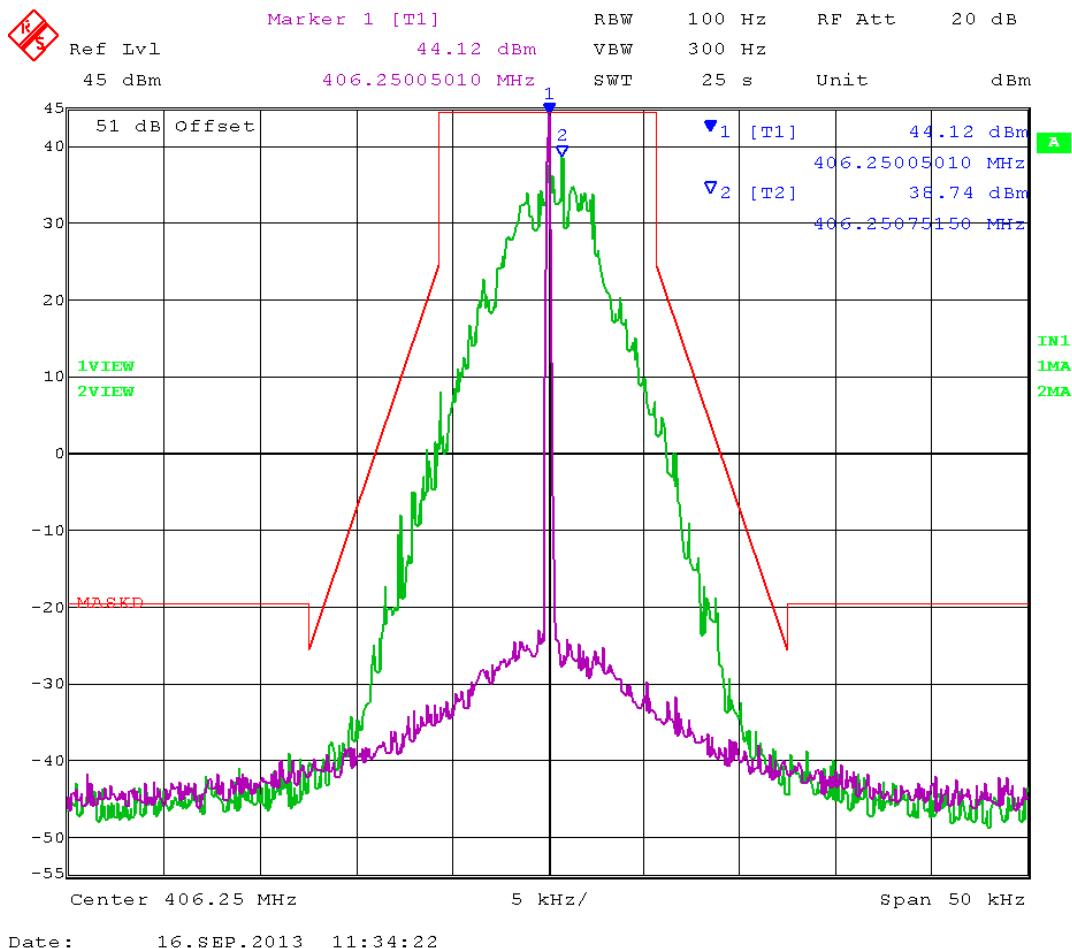
**12.5kHz - DIGITAL**


Figure 5: Occupied bandwidth 406.25 MHz (12.5 kHz-digital)

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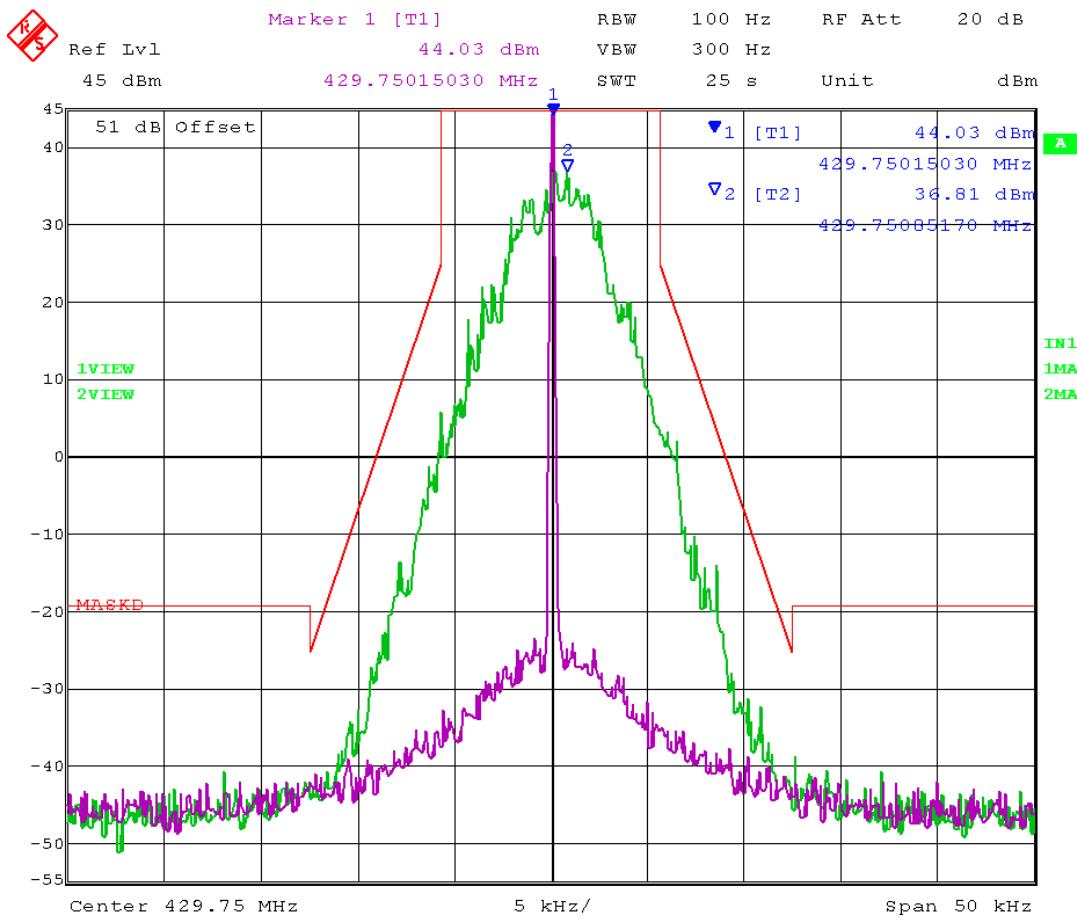


Figure 6: Occupied bandwidth 429.75 MHz (12.5 kHz-digital)

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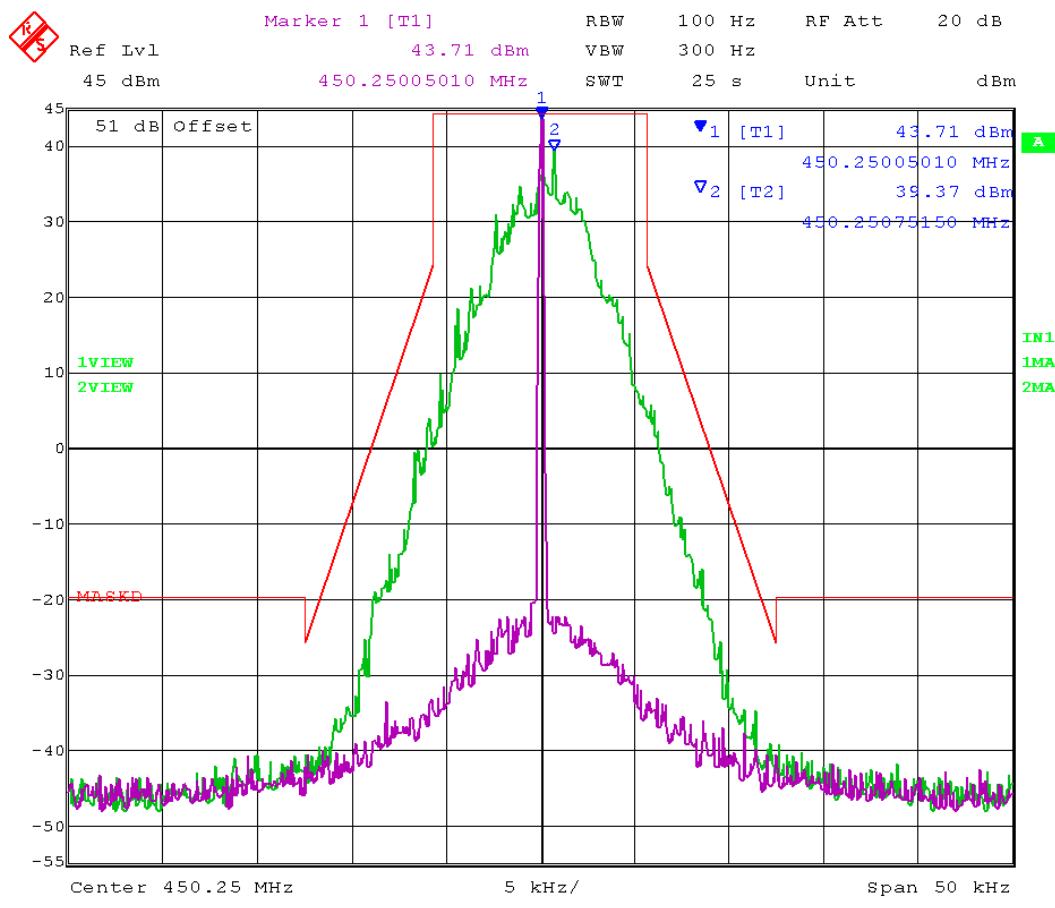
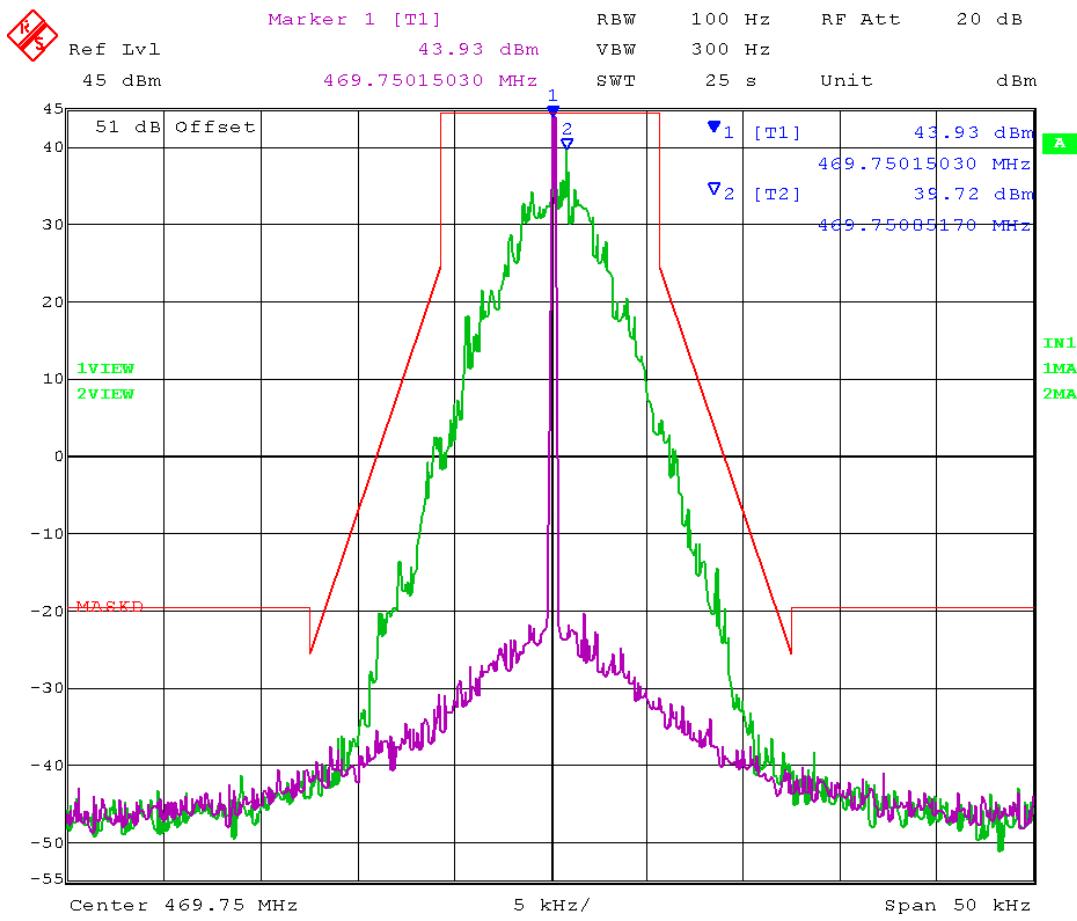


Figure 7: Occupied bandwidth 450.25 MHz (12.5 kHz-digital)

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Figure 8: Occupied bandwidth 469.75 MHz (12.5 kHz-digital)

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**SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)**
**Rule Part No.:** Part 2.1051(a)

**Requirements:**

 12.5kHz Channel Spacing =  $50+10\log(25.0) = 64.0$  dBc

 12.5kHz Channel Spacing =  $50+10\log(5.0) = 57.0$  dBc

**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.

**Test Data:**

TF <b>HIGH POWER</b>	EF	dB below carrier		TF <b>LOW POWER</b>	EF	dB below carrier
406.25	812.50	98.9		406.25	812.50	95
	1218.75	76.1			1218.75	80.3
	1625.00	99.5			1625.00	91.5
	2031.25	75.4			2031.25	80.1
	2437.50	97.8			2437.50	92.2
	2843.75	85.1			2843.75	89.5
	3250.00	99.8			3250.00	93
	3656.25	92.7			3656.25	94.7
	4062.50	92.1			4062.50	91

TF <b>HIGH POWER</b>	EF	dB below carrier		TF <b>LOW POWER</b>	EF	dB below carrier
429.75	859.50	97.9		429.75	859.50	94.7
	1289.25	73.4			1289.25	79.2
	1719.00	98.2			1719.00	91
	2148.75	81.3			2148.75	84.2
	2578.50	102.3			2578.50	95.6
	3008.25	85.5			3008.25	88.1
	3438.00	105			3438.00	95.1
	3867.75	96.7			3867.75	96.9
	4297.50	100.9			4297.50	94.9

Applicant: VERTEX STANDARD USA, INC.

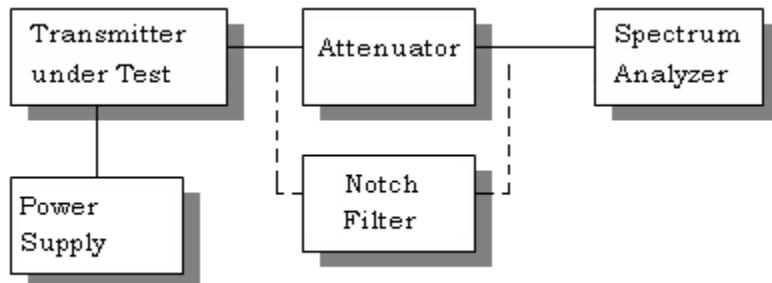
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<b>TF HIGH POWER</b>	<b>EF</b>	<b>dB below carrier</b>		<b>TF LOW POWER</b>	<b>EF</b>	<b>dB below carrier</b>
450.25	900.50	98.6		450.25	900.50	98.1
	1350.75	73.6			1350.75	78.2
	1801.00	99			1801.00	91.6
	2251.25	78.6			2251.25	83.3
	2701.50	101.1			2701.50	96
	3151.75	85			3151.75	91.7
	3602.00	105.3			3602.00	94.7
	4052.25	93.3			4052.25	85.7
	4502.50	99.1			4502.50	95.7

<b>TF HIGH POWER</b>	<b>EF</b>	<b>dB below carrier</b>		<b>TF LOW POWER</b>	<b>EF</b>	<b>dB below carrier</b>
469.75	939.50	99.2		469.75	939.50	98.2
	1409.25	70.6			1409.25	75.6
	1879.00	98.2			1879.00	91.6
	2348.75	77.8			2348.75	79
	2818.50	103.4			2818.50	95.5
	3288.25	88.6			3288.25	92.5
	3758.00	102.5			3758.00	96
	4227.75	91.4			4227.75	89.1
	4697.50	98.9			4697.50	97.2

### Method of Measuring Conducted Spurious Emissions



Applicant: VERTEX STANDARD USA, INC.

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## FIELD STRENGTH OF SPURIOUS EMISSIONS

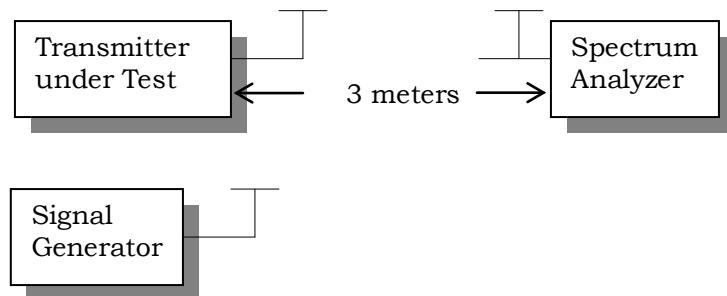
**Rule Parts. No.:** Part 2.1053

**Requirements:**

$$12.5\text{kHz Channel Spacing} = 50 + 10\log(\text{OP}) = \text{dBc}$$

**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:**

**High Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
406.25	0	0
812.50	H	84.3
1218.75	H	97.3
1625.00	H	97.6
2031.25	H	92.5
2437.50	H	91.2
2843.75	H	101.6
3250.00	H	99.6
3656.25	H	98.2
4062.50	H	97.1

**Low Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
406.25	0	0
812.50	H	78.9
1218.75	H	89.9
1625.00	H	90.7
2031.25	H	88.0
2437.50	H	77.8
2843.75	H	92.3
3250.00	H	92.5
3656.25	H	92.5
4062.50	H	92.0

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**High Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
429.75	0	0
859.50	H	98.2
1289.25	H	99.6
1719.00	H	95.1
2148.75	H	93.6
2578.50	H	98.1
3008.25	H	97.6
3438.00	H	99.9
3867.75	H	96.9
4297.50	H	97.8

**Low Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
429.75	0	0
859.50	H	93.0
1289.25	H	92.8
1719.00	H	88.6
2148.75	H	92.4
2578.50	H	93.3
3008.25	H	91.4
3438.00	H	93.4
3867.75	H	89.1
4297.50	H	90.1

**High Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
450.25	0	0
900.50	H	85.7
1350.75	H	94.0
1801.00	H	79.3
2251.25	H	88.7
2701.50	H	101.2
3151.75	H	97.0
3602.00	H	99.7
4052.25	H	97.5
4502.50	H	97.3

**Low Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
450.25	0	0
900.50	H	80.9
1350.75	H	86.7
1801.00	H	79.0
2251.25	H	83.8
2701.50	H	93.7
3151.75	H	93.3
3602.00	H	92.5
4052.25	H	89.2
4502.50	H	89.9

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**High Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
469.75	0	0
939.50	H	86.0
1409.25	H	100.7
1879.00	H	85.5
2348.75	H	84.6
2818.50	H	104.4
3288.25	H	96.6
3758.00	H	98.9
4227.75	H	95.7
4697.50	H	97.2

**Low Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
469.75	0	0
939.50	H	80.2
1409.25	H	92.2
1879.00	H	84.0
2348.75	H	79.8
2818.50	H	95.8
3288.25	H	92.3
3758.00	H	90.7
4227.75	H	91.9
4697.50	H	91.5

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## FREQUENCY STABILITY

**Rule Parts. No.:** Part 2.1055, Part 90.213

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

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

**Test Data:**

<b>Assigned Frequency (Ref. Frequency) (MHz)</b>		<b>460.000107</b>
<b>Temperature (°C)</b>	<b>Frequency (MHz)</b>	<b>Frequency Stability (PPM)</b>
-30	459.999840	-0.58
-20	459.999918	-0.41
-10	460.000080	-0.06
0	460.000103	-0.01
+10	460.000045	-0.13
+20	460.000035	-0.16
+30	460.000063	-0.10
+40	460.000077	-0.07
+50	460.000027	-0.17

<b>Assigned Frequency (Ref. Frequency) (MHz)</b>		
<b>% Battery</b>	<b>Frequency (MHz)</b>	<b>Frequency Stability (PPM)</b>
-15%	460.000107	0.00
0	460.000107	0.00
+15%	460.000111	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

$t_1^4$	$\pm 25.0$ kHz	5.0 ms	10.0 ms
$t_2$	$\pm 12.5$ kHz	20.0 ms	25.0 ms
$t_3^4$	$\pm 25.0$ kHz	5.0 ms	10.0 ms

#### Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels

$t_1^4$	$\pm 12.5$ kHz	5.0 ms	10.0 ms
$t_2$	$\pm 6.25$ kHz	20.0 ms	25.0 ms
$t_3^4$	$\pm 12.5$ kHz	5.0 ms	10.0 ms

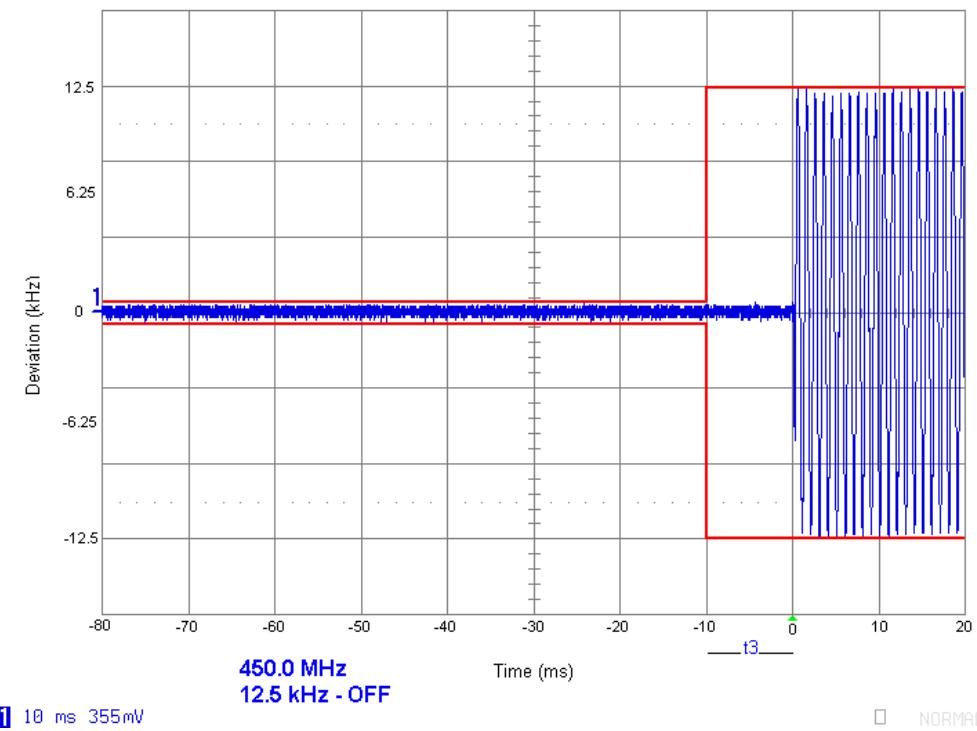
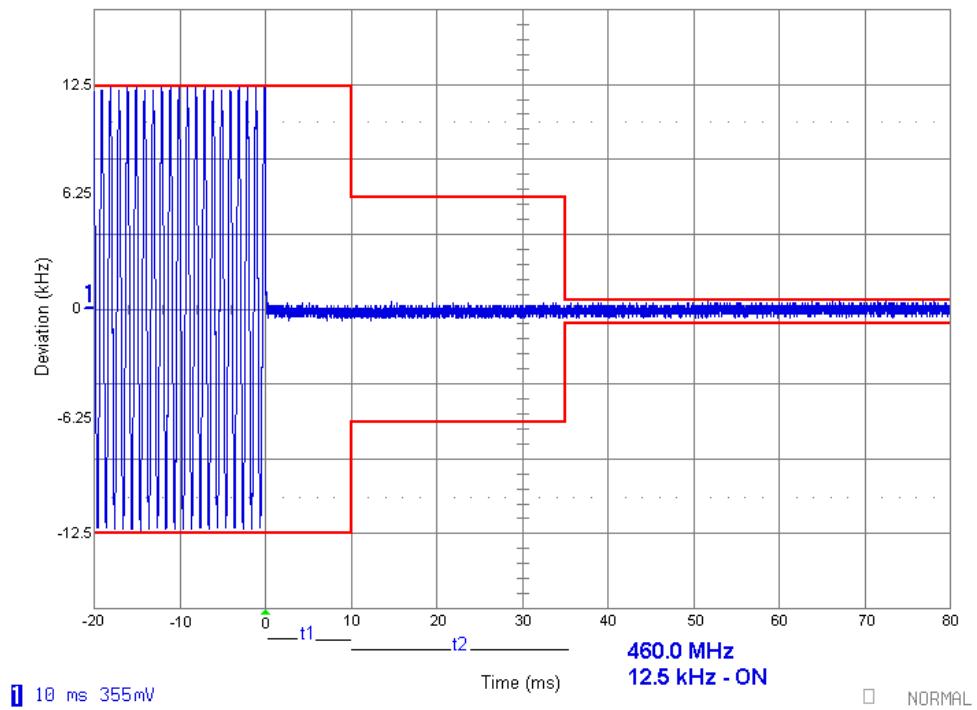
#### Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels

$t_1^4$	$\pm 6.25$ kHz	5.0 ms	10.0 ms
$t_2$	$\pm 3.125$ kHz	20.0 ms	25.0 ms
$t_3^4$	$\pm 6.25$ kHz	5.0 ms	10.0 ms

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**TEST PROCEDURE:** 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.

