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FCC PART 90

406.1-480MHz UHF PORTABLE

TEST REPORT

APPLICANT	VERTEX STANDARD USA, INC.
	8000 WEST SUNRISE BLVD. FT. LAUDERDALE FL 33322 USA
FCC ID	AXI11464620
MODEL NUMBER	EVX-S24-G6-3
PRODUCT DESCRIPTION	UHF 2 WAY PORTABLE TANSCEIVER
STANDARD APPLIED	CFR 47 Part 90
DATE SAMPLE RECEIVED	6/29/2016
FINAL TEST DATE	7/26/2016
TESTED BY	Cory Leverett
APPROVED BY	Sid Sanders
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
1233AUT16TestReport_	Rev1	Initial Issue	7/27/2016
1233AUT16TestReport_	Rev2	Added A2LA Accredited Symbol	8/18/2016

A2LA ACCREDITED
Testing Cert. # 0955.01

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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.

ACCREDITED

Testing Cert. # 0955.01

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: Cory Leverett, Project Manager/Testing Technician

Date: 7/27/2016

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

Date: 7/27/2016

GENERAL INFORMATION

EUT Specification

EUT Description	UHF 2 WAY POTABLE TANSCEIVER
FCC ID	AXI11464620
Model Number	EVX-S24-G6-3
Operating Frequency	406.1-480 MHz
Test Frequencies	406.2, 459.125, 469.9875, 479.9875 MHz
Type of Emission	11K0F3E, 7K60F1D, 7K60F1E 7K60F1W, 7K60FXE, 7K60FXD
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%. Barometer: 1012.8mb
Revision History to the EUT	None
Test Exercise	The EUT was placed in continuous transmit mode.
Applicable Standards	ANSI/TIA 603-D:2010, FCC CFR 47 Part 90
Test Facility	**Timco Engineering Inc.** **849 NW State Road 45** **Newberry, FL 32669 USA.**

TEST REPORT SUMMARY

Rule Part No.	Scope of Work	Status Pass/Fail/NA
Part 2.1033(c)(8), Part 2.1046(a), Part 90	RF Power Output	Pass
Part 2.1033(c) (4) Part 2.1047(a)(6)	Modulation Characteristics	Pass
2.1049(c), 90.210	Emission Mask and Occupied Bandwidths	Pass
2.1051(a), 90.210	Antenna Conducted Emissions	Pass
2.1053, Part 90.210	Field Strength Spurious Emissions	Pass
Part 2.1055, Part 90.213	Frequency Stability	Pass
Part 90.214	Transient Frequency Behavior	Pass

TEST PROCEDURE

Power Line Conducted Interference: The procedure used was in accordance with test procedures detailed in the standard list above, using a 50uH LISN. Both lines were observed with the EUT 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 10th 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 in accordance with test procedures detailed in the standard list above, using a Rohde & Schwarz – EMI test receiver. The bandwidth (RBW) of the spectrum 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.

MODULATION CHARACTERISTICS

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

Test Requirements:

Method of Measurement:
Part 2.1033(c)
Part 90.209
Part 90.207

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

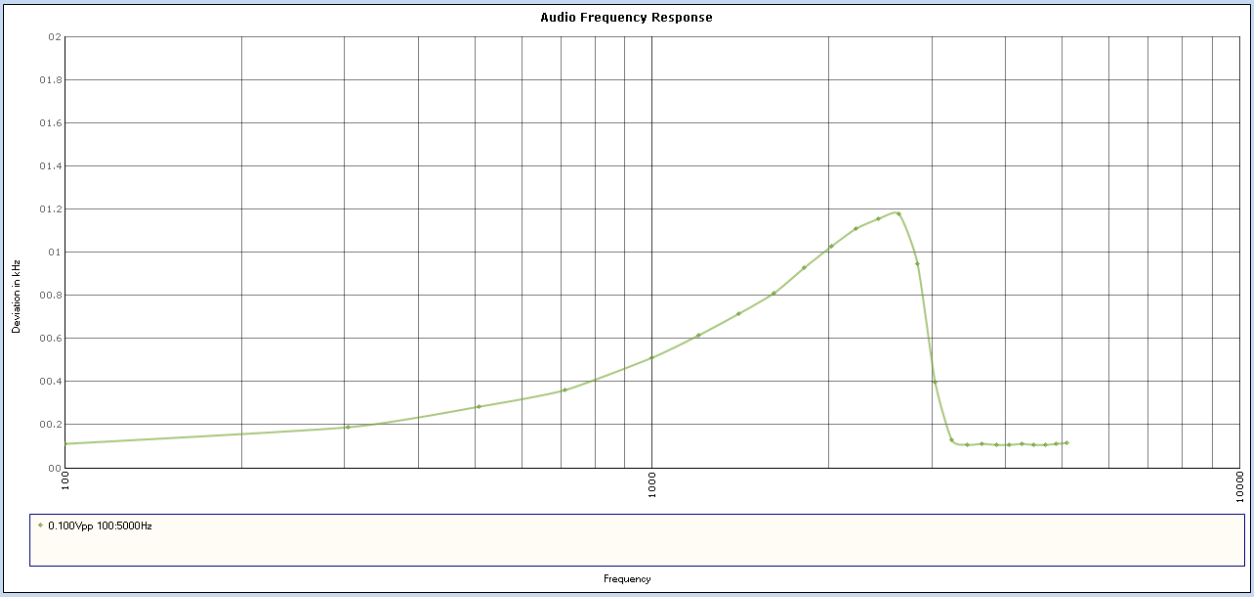
Part 2.1033(c) (4) Type of Emission: 7K60F1D, 7K60F1E, 7K60F1W, 7K60FXE, 7K60FXD

Digital functions comply with DMR (Digital Mobile Radio).

Format:
Modulation:
Bandwidth:
Data rate: 9,600bps (bit per second)
Voice:

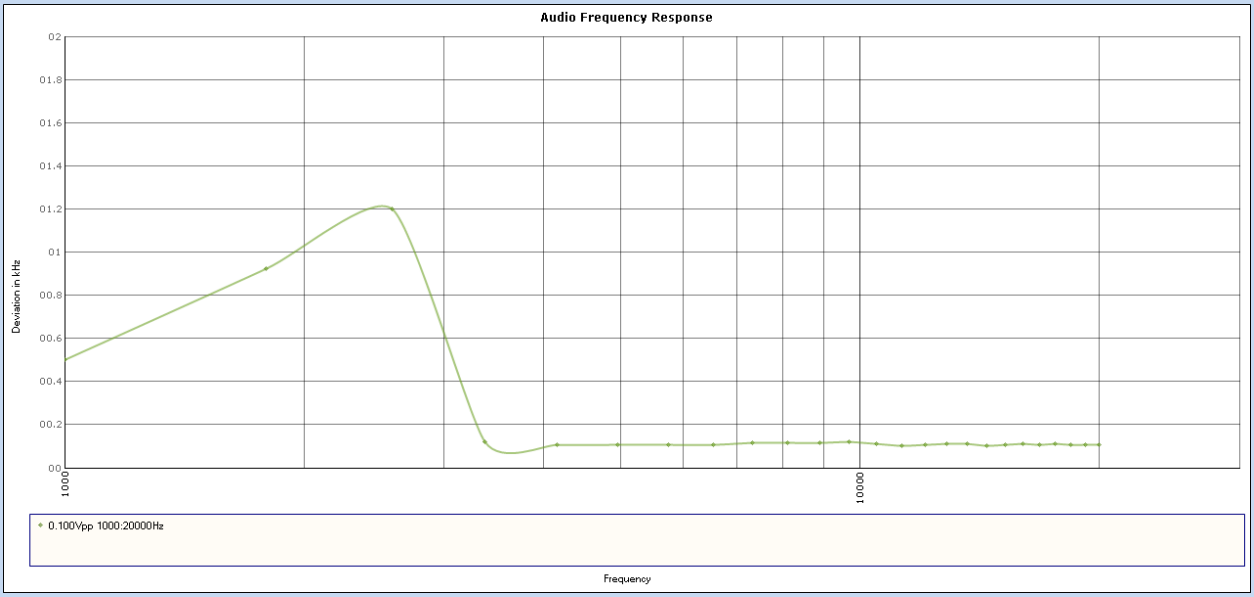
Audio frequency response

The audio frequency response was measured in accordance with test procedures detailed in the standard list above. 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

Result Meets The Requirement

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 Plot

Result Meets The Requirement

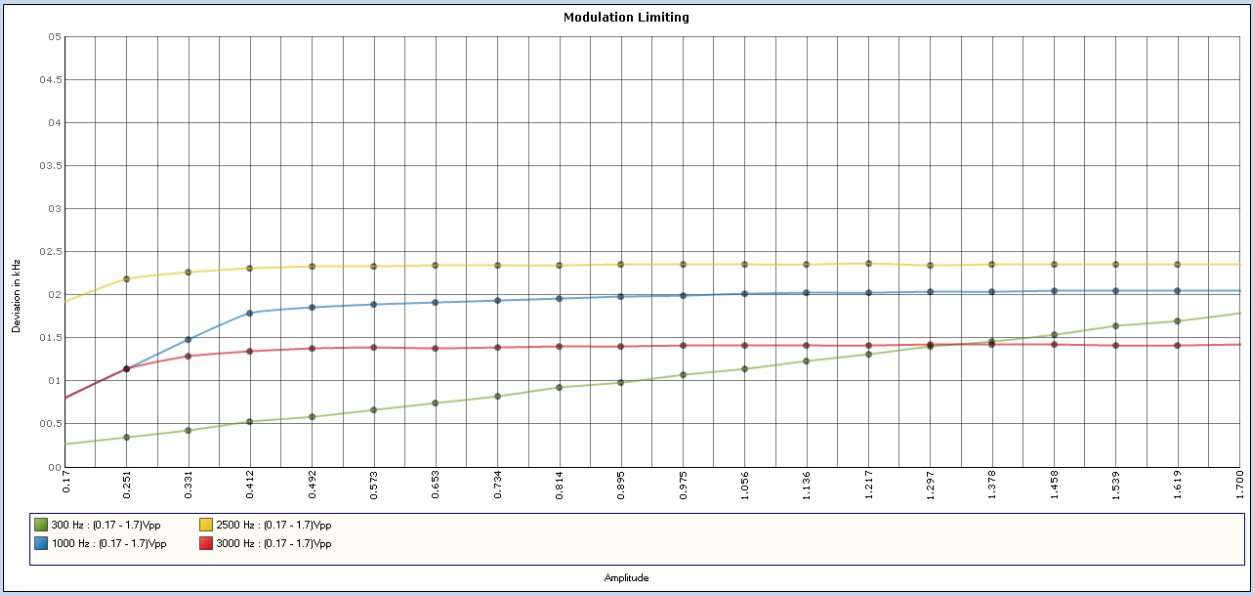
AUDIO INPUT VERSUS MODULATION

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 test procedures detailed in the standard list above. 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

Result Meets The Requirement

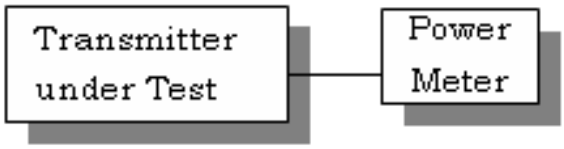
RF POWER OUTPUT

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

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:

Test Setup Diagram:



Test Data: Analog Mode Power Output Measurement Table

Tuned Freq. MHz	Power Output			
	High		Low	
	dBm	Watts	dBm	Watts
406.2000	34.98	3.15	26.42	0.44
459.1250	35.00	3.16	26.45	0.44
469.9875	34.97	3.14	26.27	0.42
479.9875	34.93	3.11	26.22	0.42

Test Data: Digital Mode Power Output Measurement Table

Tuned Freq. MHz	Power Output			
	High		Low	
	dBm	Watts	dBm	Watts
406.2000	35.17	3.29	26.30	0.43
459.1250	35.05	3.20	26.34	0.43
469.9875	35.06	3.21	26.22	0.42
479.9875	35.04	3.19	26.06	0.40

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

FOR HIGH POWER SETTING INPUT POWER: (3.70) (2.2A) = 8.14Watts
FOR LOW POWER SETTING INPUT POWER: (3.70V) (0.8A) = 2.96Watts

OCCUPIED BANDWIDTH

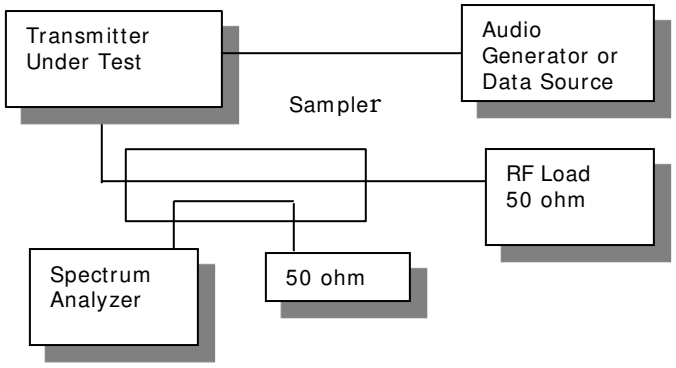
Part 2.1049(c) EMISSION BANDWIDTH:

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.

Method of Measurement: Were in accordance with test procedures detailed in the standard list above.

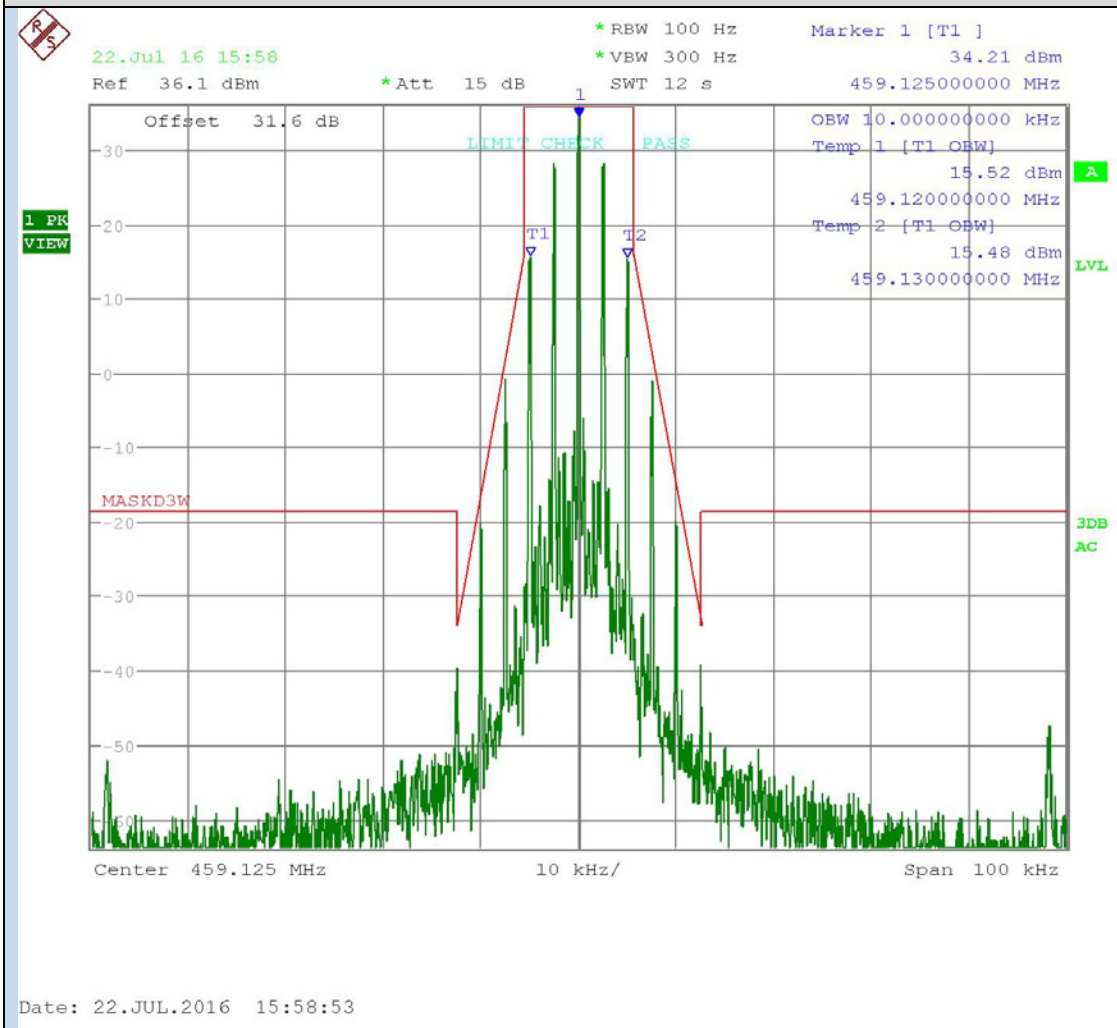
Test Setup Diagram:



OCCUPIED BANDWIDTH

Test Data: 11K0F3E Mask D

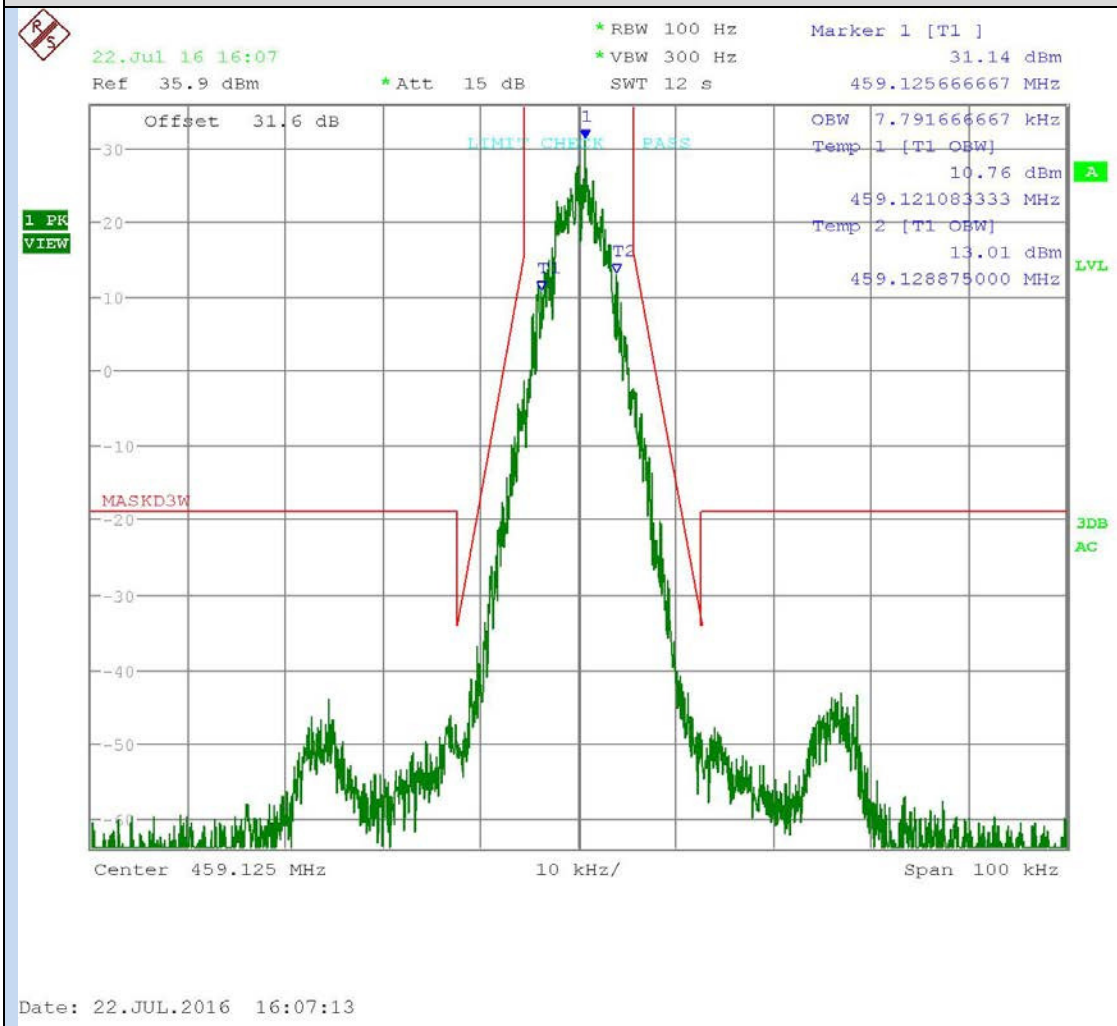
Occupied Bandwidth Plot



Result Meets The Requirement

OCCUPIED BANDWIDTH

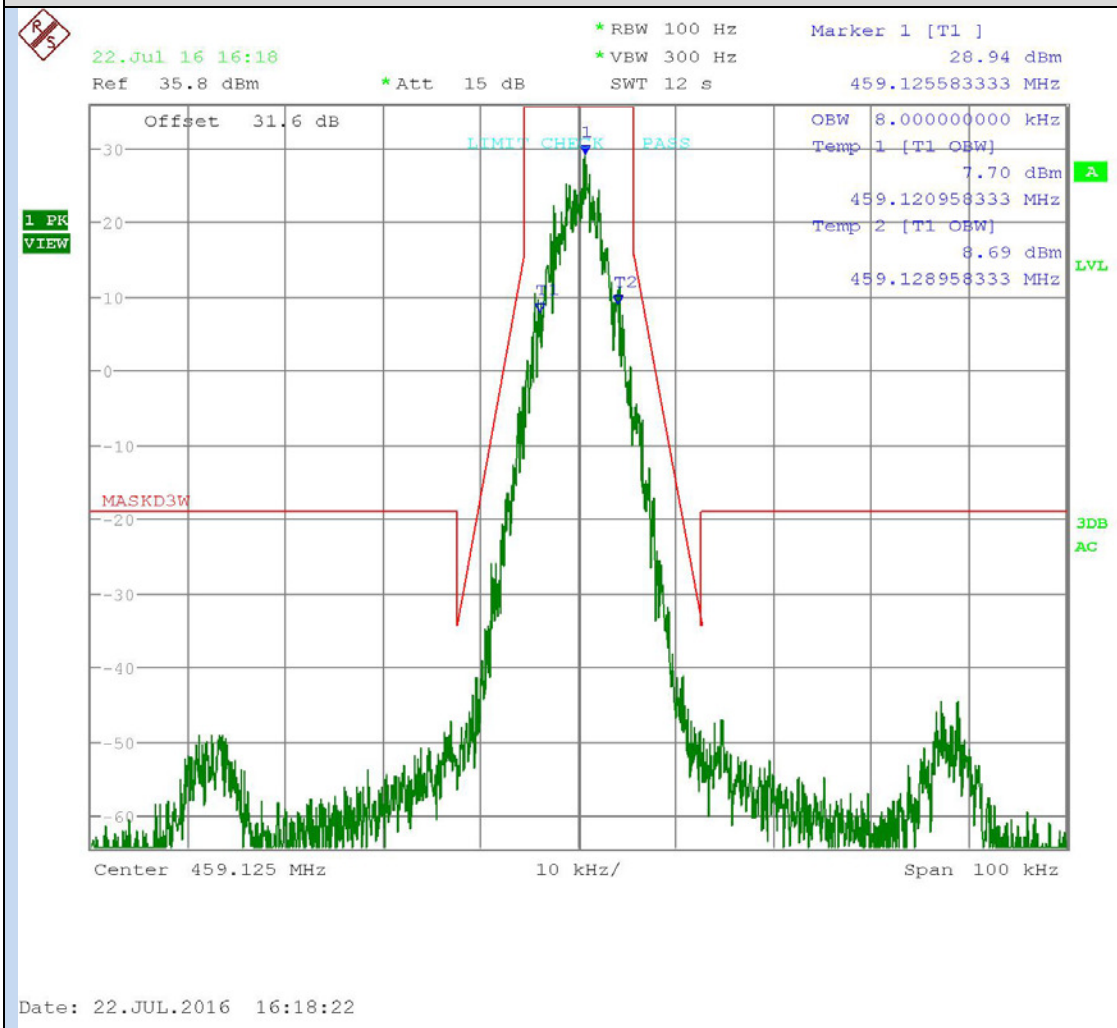
Test Data: 7K60F1D/7K60F1E Mask D

Occupied Bandwidth Plot

Result Meets The Requirement

OCCUPIED BANDWIDTH

Test Data: 7K60FXE/ FXD Mask D

Occupied Bandwidth Plot

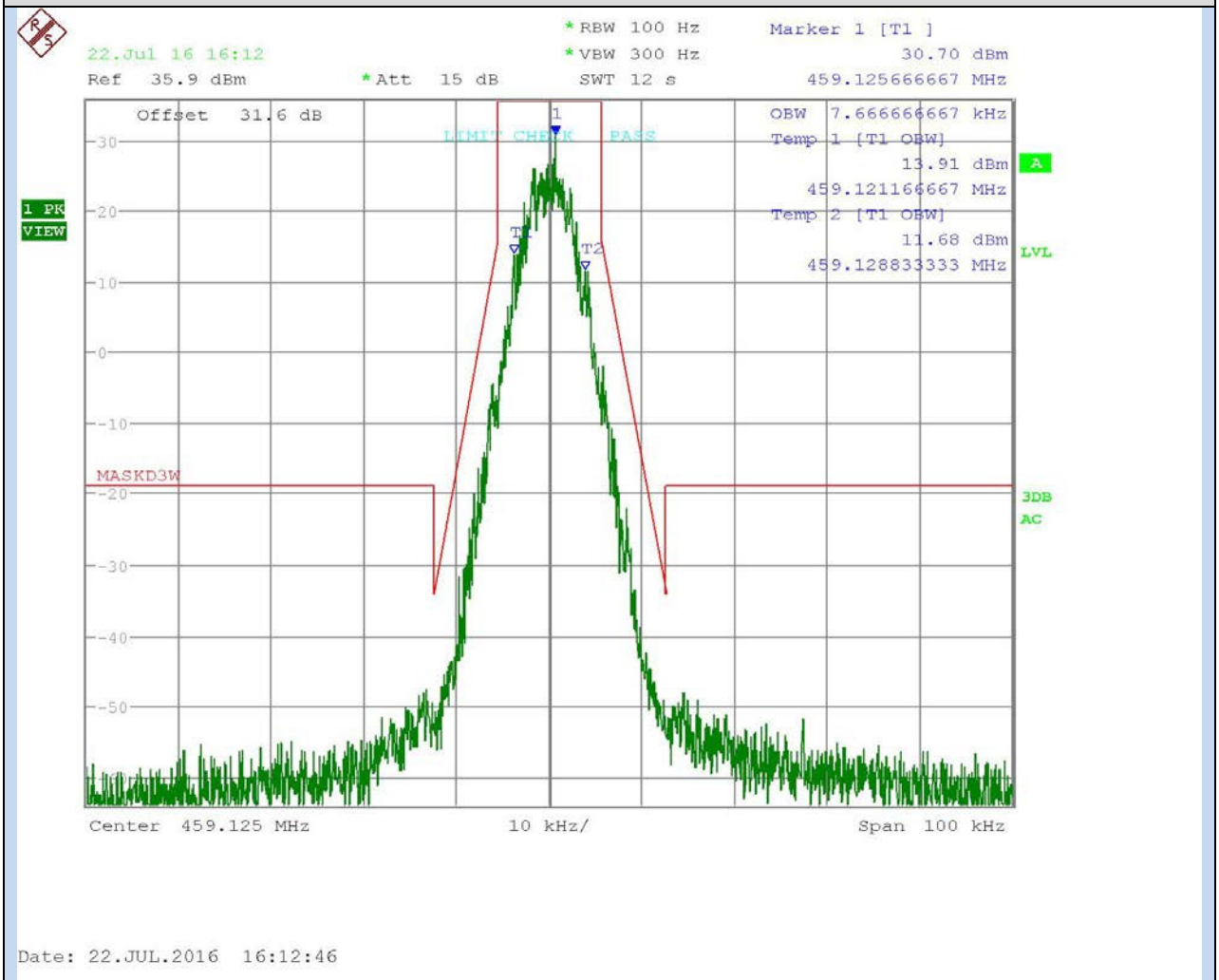


Result Meets The Requirement

OCCUPIED BANDWIDTH

Test Data: 7K60F1W Mask D

Occupied Bandwidth Plot



Result Meets The Requirement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

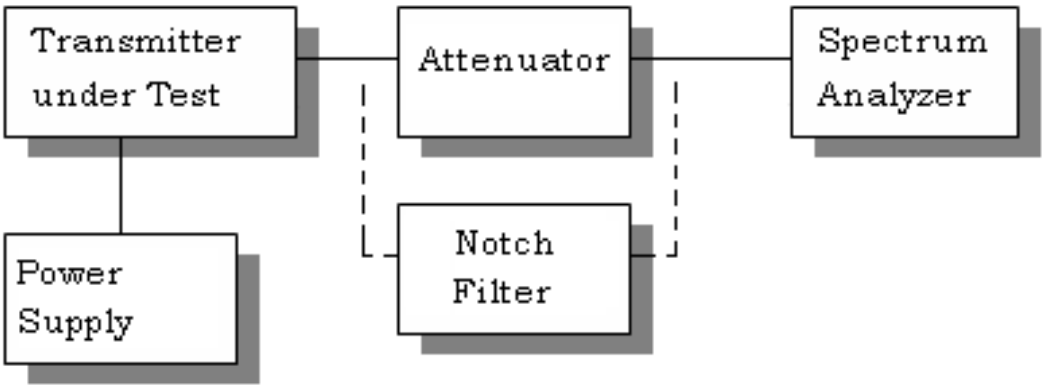
Rule Part No.: Part 2.1051(a), Part 90.210

Requirements:

12.5 kHz Channel Spacing = 50+10 log (P) = dBc
25 kHz Channel Spacing = 50+10 log (P) = dBc

Method of Measurement: For Analog modulations the carrier was modulated using a 2.5 KHz tone at a level 16 dB above the level required for 50% modulation. For Digital modulations the carrier is modulated as specified by the manufacturer The spectrum was scanned from the lowest frequency generated to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard test procedures detailed in the standard list above.

Method of Measuring Conducted Spurious Emissions



SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Note: All modes of modulation were tested; the Results shown are for the worst case modulation 11K0F3E

Test Data: 406.2000 MHz 11K0F3E

	dBm	Watts	Limit
Power Output	34.98	3.15	54.98
	Frequency	dBc	Margin
	406.20	0	0.0
	812.40	77.4	22.4
*	1218.60	81.8	26.8
*	1624.80	80.9	25.9
*	2031.00	80.1	25.1
*	2437.20	80.4	25.4
*	2843.40	79.5	24.5
*	3249.60	79.4	24.5
*	3655.80	77.6	22.6
*	4062.00	77.2	22.2

Test Data: 406.2000 MHz 11K0F3E Low

	dBm	Watts	Limit
Power Output	26.42	0.44	46.42
	Frequency	dBc	Margin
	406.20	0	0.0
	812.40	69.1	22.7
*	1218.60	70.3	23.9
*	1624.80	74.3	27.9
*	2031.00	71.9	25.5
*	2437.20	74.2	27.8
*	2843.40	73.9	27.5
*	3249.60	72.1	25.6
*	3655.80	69.7	23.3
*	4062.00	69.6	23.2

Note: "*" Indicates the noise floor.

Test Data: 459.125 MHz 11K0F3E High

	dBm	Watts	Limit
Power Output	35	3.16	55
	Frequency	dBc	Margin
	459.125	0	0.0
*	918.250	79.6	24.6
*	1377.375	81.9	26.9
*	1836.500	82.5	27.5
*	2295.625	81.7	26.7
*	2754.750	81.3	26.3
*	3213.875	82.3	27.3
*	3673.000	77.8	22.8
*	4132.125	77.7	22.7
*	4591.250	76.1	21.1

Test Data: 459.125 MHz 11K0F3E Low

	dBm	Watts	Limit
Power Output	26.45	0.44	46.45
	Frequency	dBc	Margin
	459.125	0	0.0
	918.250	74.9	28.4
*	1377.375	74.6	28.1
*	1836.500	75.2	28.8
*	2295.625	74.3	27.9
*	2754.750	74.1	27.6
*	3213.875	72.9	26.5
*	3673.000	70.8	24.3
*	4132.125	67.9	21.5
*	4591.250	66.7	20.2

Note: "*" Indicates the noise floor.

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 469.9875 MHz 11K0F3E High

	dBm	Watts	Limit
Power Output	34.97	3.14	54.97
	Frequency	dBc	Margin
	469.9875	0	0.0
*	939.9750	82.0	27.0
*	1409.9625	82.9	27.9
*	1879.9500	82.4	27.4
*	2349.9375	83.9	28.9
*	2819.9250	82.8	27.8
*	3289.9125	82.2	27.2
*	3759.9000	78.0	23.1
*	4229.8875	76.3	21.4
*	4699.8750	77.1	22.1

Test Data: 469.9875 MHz 11K0F3E Low

	dBm	Watts	Limit
Power Output	26.27	0.42	46.27
	Frequency	dBc	Margin
	469.9875	0	0.0
*	939.9750	75.2	28.9
*	1409.9625	75.4	29.2
*	1879.9500	72.9	26.6
*	2349.9375	73.0	26.8
*	2819.9250	73.1	26.8
*	3289.9125	70.6	24.4
*	3759.9000	67.0	20.8
*	4229.8875	66.4	20.1
*	4699.8750	66.3	20.1

Note: "*" Indicates the noise floor.

Test Data: 479.9875 MHz 11K0F3E High

	dBm	Watts	Limit
Power Output	34.93	3.11	54.93
	Frequency	dBc	Margin
	479.9875	0	0.0
*	959.9750	81.3	26.4
*	1439.9625	83.7	28.8
*	1919.9500	83.0	28.0
*	2399.9375	80.9	25.9
*	2879.9250	82.3	27.4
*	3359.9125	82.1	27.1
*	3839.9000	78.9	24.0
*	4319.8875	75.1	20.1
*	4799.8750	75.9	21.0

33.

Test Data: 479.9875 MHz 11K0F3ELow

	dBm	Watts	Limit
Power Output	26.22	0.42	46.22
	Frequency	dBc	Margin
	479.9875	0	0.0
*	959.9750	73.2	26.9
*	1439.9625	75.4	29.2
*	1919.9500	75.0	28.8
*	2399.9375	74.7	28.5
*	2879.9250	73.2	27.0
*	3359.9125	73.4	27.1
*	3839.9000	70.0	23.8
*	4319.8875	68.2	22.0
*	4799.8750	68.4	22.2

Note: "*" Indicates the noise floor.

FIELD STRENGTH OF SPURIOUS EMISSIONS

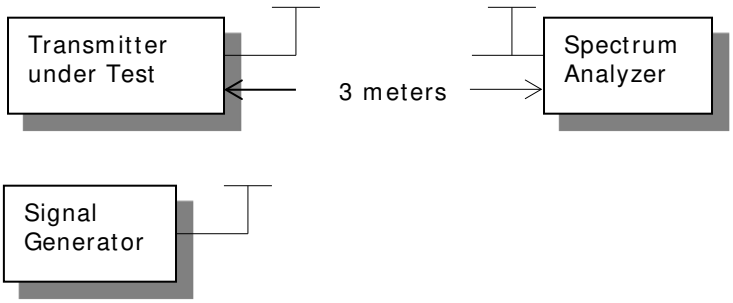
Rule Parts. No.: Part 2.1053

Requirements:

12.5kHz Channel Spacing = 50+10log (OP) = 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 in accordance with test procedures detailed in the standard list above 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:



Note: The following results are from the worst case modulation for all modes of operation

Test Data: 469.9875 MHz 11K0F3E

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
469.98	Hi	34.97	3.14	54.97	12.50

Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)	Margin
939.98	H	87.08	32.11
1,409.96	H	82.43	27.46
1,879.95	H	78.98	24.01
2,349.94	V	78.10	23.13
2,819.93	V	83.19	28.22
3,289.91	V	77.45	22.48
3,759.90	V	57.58	2.61
4,229.89	H	64.19	9.22
4,699.88	V	66.15	11.18

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: Were in accordance with test procedures detailed in the standard list above.

Test Data: 469.9875 11K0F3E

Temperature	Frequency MHz	Cycles	PPM
25°C (reference)	469.987559		
-30°C	469.987507	-52	-0.111
-20°C	469.987601	42	0.089
-10°C	469.987629	70	0.149
0°C	469.987541	-18	-0.038
10°C	469.987576	17	0.036
20°C	469.987587	28	0.060
30°C	469.987552	-7	-0.015
40°C	469.987544	-15	-0.032
50°C	469.987542	-17	-0.036
Battery Voltage	Frequency	Cycles	PPM
-15%	469.987556	-3	-0.006
15%	469.987558	-1	-0.002

TRANSIENT FREQUENCY BEHAVIOR

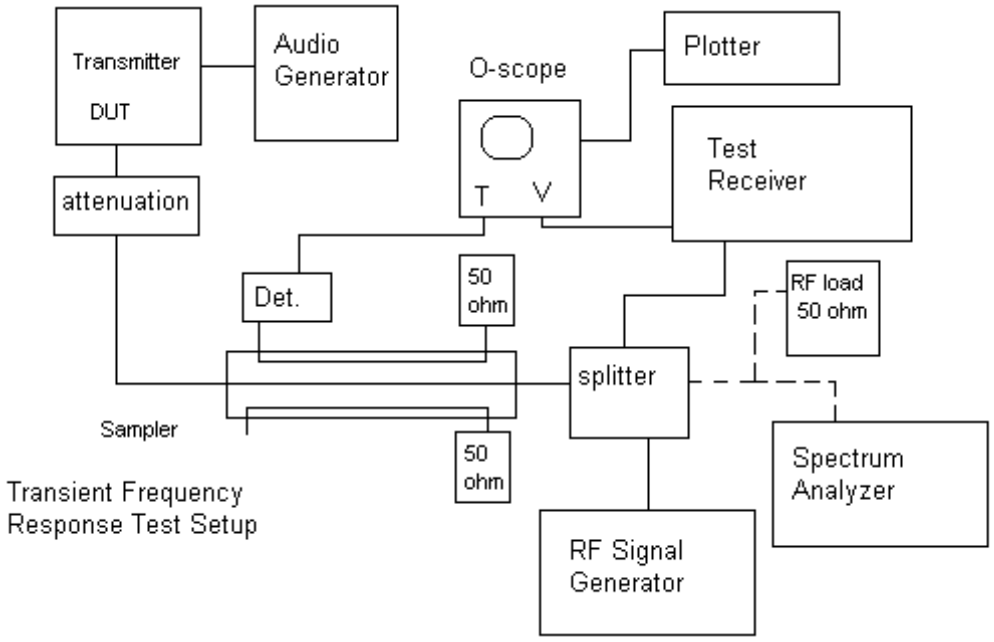
Part 90.214 Transient Frequency Behavior

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

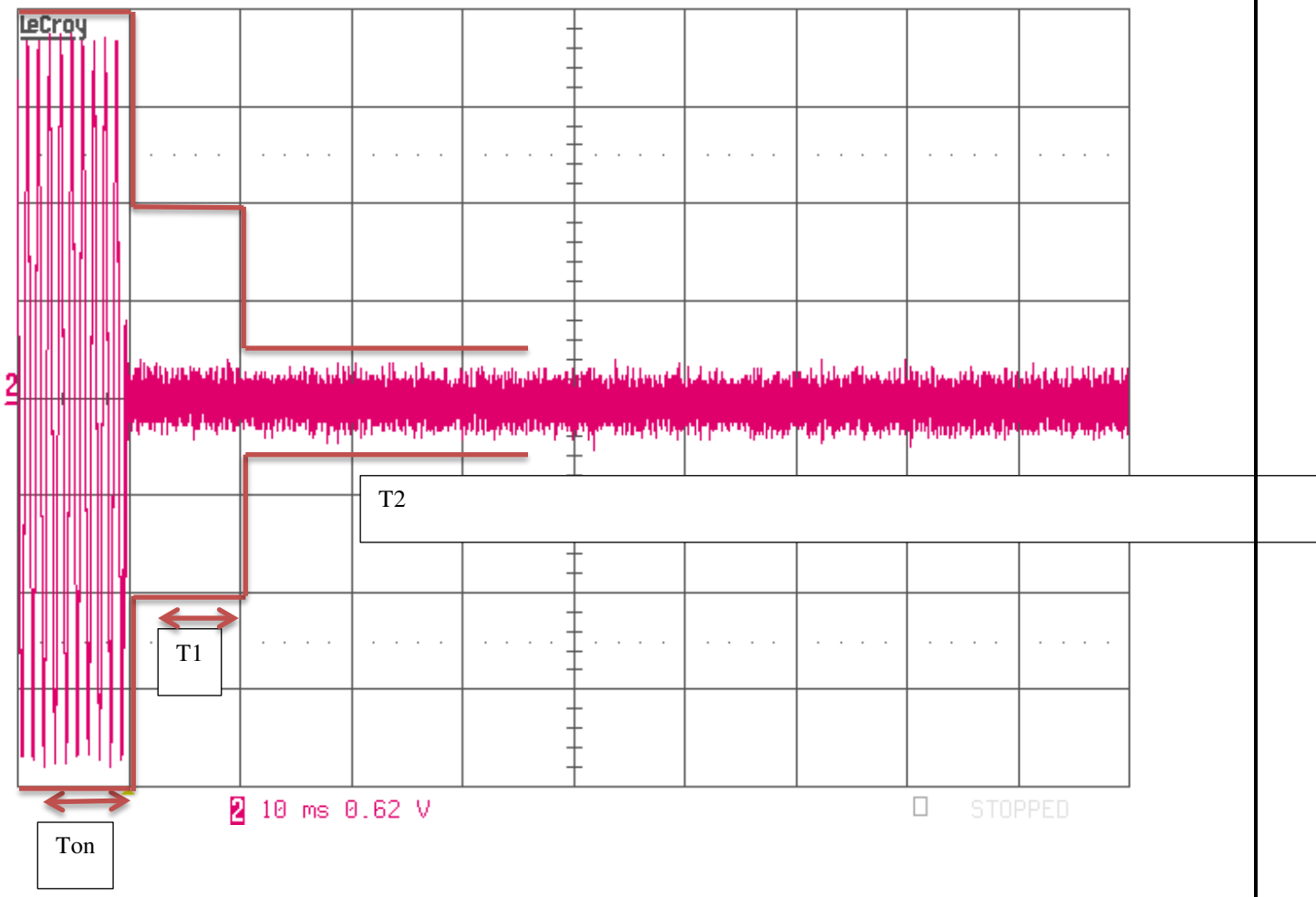
TEST PROCEEDURE: Was in accordance with test procedures detailed in the standard list above, the levels were set as follows:

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.

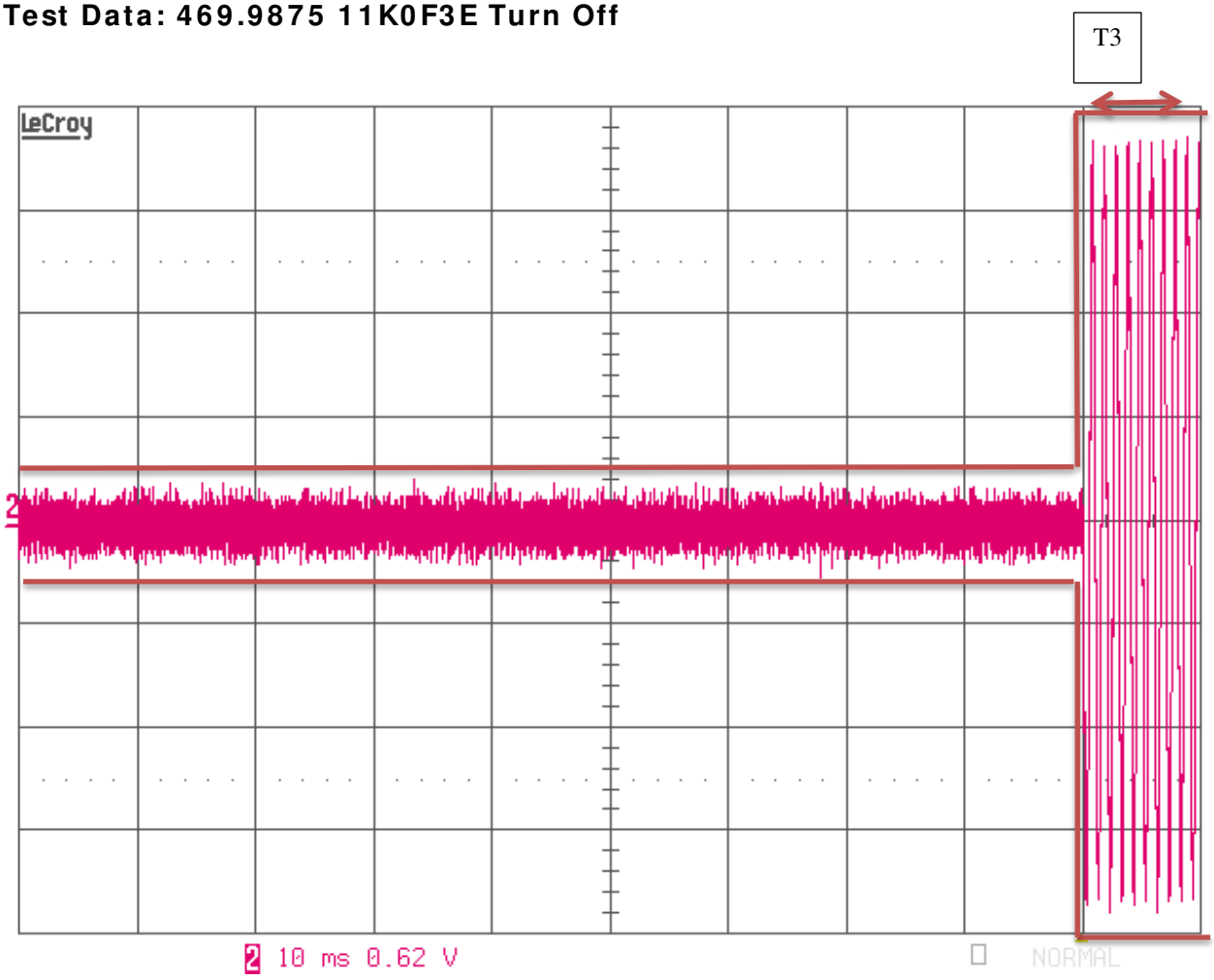


Transient Frequency Response Test Setup

Test Data: 469.9875 11K0F3E Turn On



Test Data: 469.9875 11K0F3E Turn Off



EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/ Char Date	Due Date
DC Power Supply	HP	6286A	1744A03842	NA	NA
Antenna: Biconical 1096 Chamber	Eaton	94455-1	1096	07/14/15	07/14/17
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/14/15	07/14/17
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	08/19/14	08/19/16
AC Voltmeter	HP	400FL	2213A14728	10/24/15	10/24/17
Digital Multimeter	Fluke	77	35053830	10/21/15	10/21/17
Bi-Directional Coupler - 30MHz to 2GHz	HP	778D	1144A01731 (#46)	09/15/15	09/15/17
Frequency Counter Large Chamber	HP	5352B	2632A00165	07/01/15	07/01/17
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren Chamber	3117	00041534	02/25/15	02/25/17
Software: Field Strength Program	Timco	N/A	Version 4.0 NO	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
RF Combiner	Edison Elect.	M530		05/18/15	05/18/17
Type K J Thermometer	Martel	303	080504494	10/26/15	10/26/17
Attenuator N 30dB 20W DC-11G	Narda	766-30	DC-11G	08/01/15	08/01/17
Modulation Analyzer	HP	8901A	3050A05856	04/16/15	04/16/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	04/01/16	04/01/18
Signal Generator HP 8648C	HP	8648C	3623A02898	02/08/16	02/08/18
Waverunner Digital Scope	LeCroy	LT364L	00543	10/23/15	10/23/17
Attenuator 6dB 50OHM DC-2G	Mini-Circuits	HAT-6+	#52 NO	06/25/15	06/25/17
Coaxial Cable - Chamber 3 cable set	Micro-Coax	Chamber 3 cable set	KMKM-0244-00; KMKM-0670-00; KFKF-0198-00	12/05/15	12/05/17
Function Generator	Standford	DS340	25200	02/02/16	02/02/18
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	NA	NA
Tuneable Notch Filter 250-850 MHz	Eagle	TNF-200	250-850 MHz	06/26/15	06/26/17
3M Chamber	Panashield	N/A	N/A	04/25/16	12/31/17

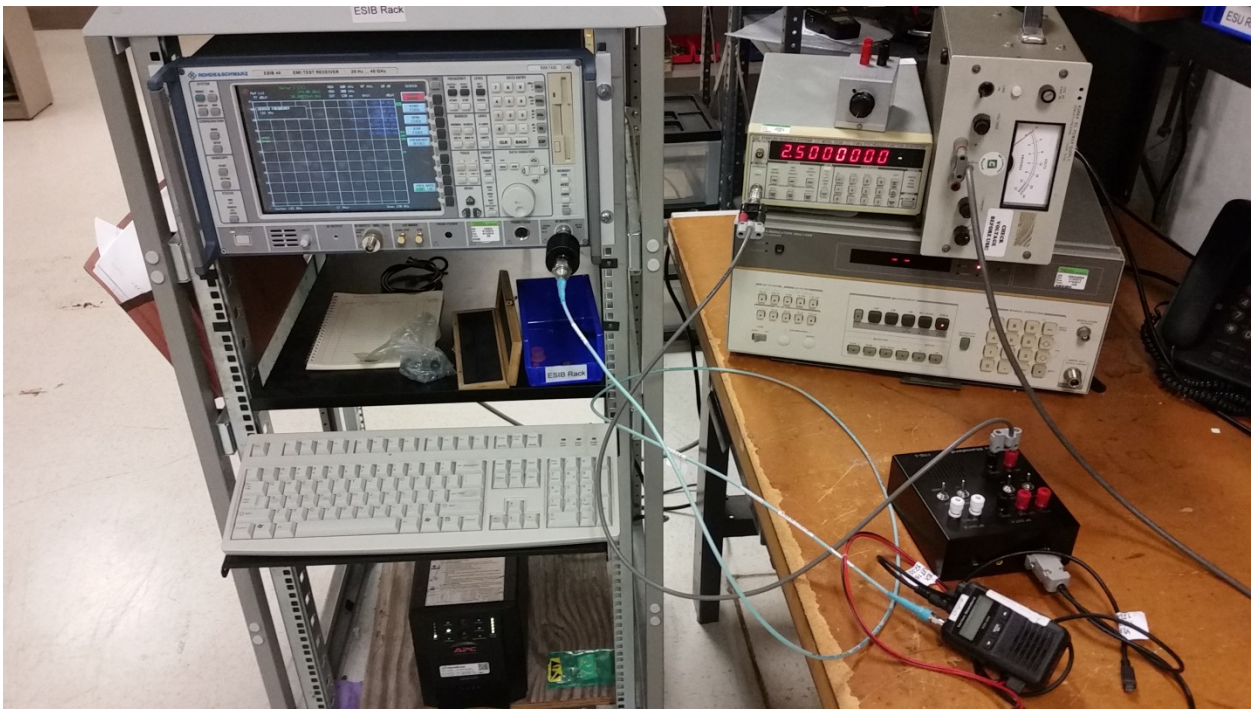
*** EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

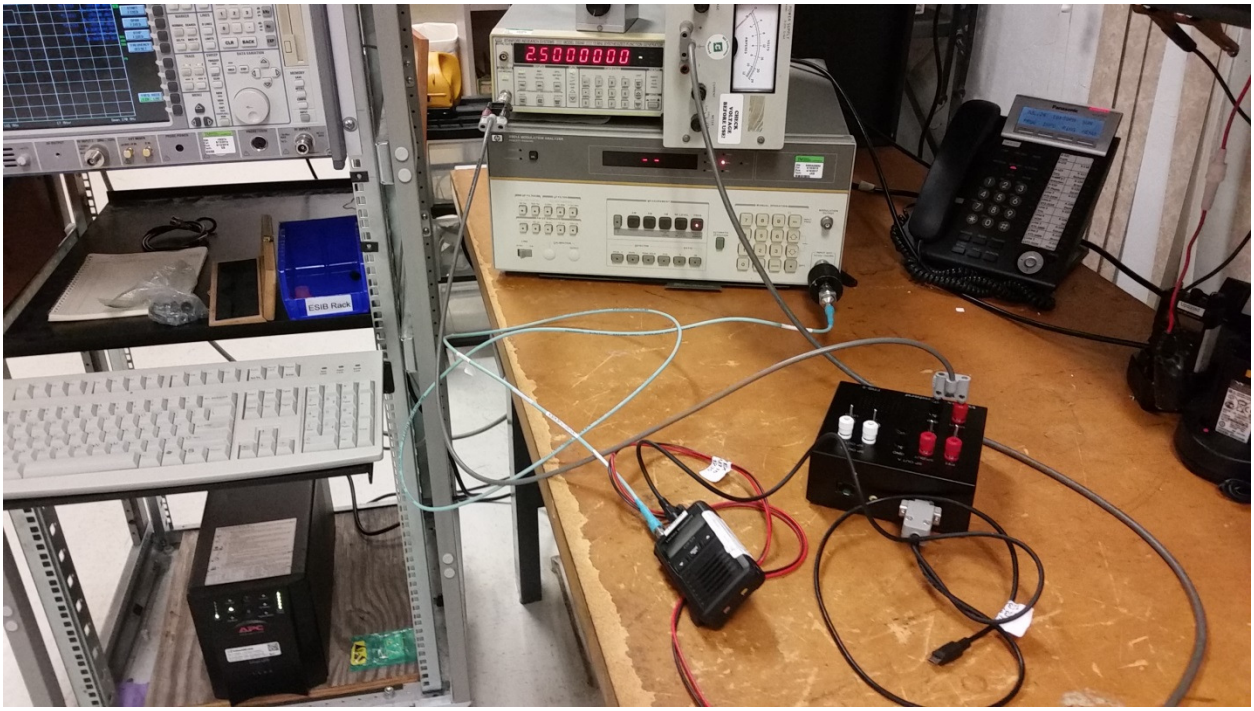
END OF REPORT

APPLICANT: VERTEX STANDARD USA, INC.
FCC ID: AXI11464620
TEST SET UP PHOTOS

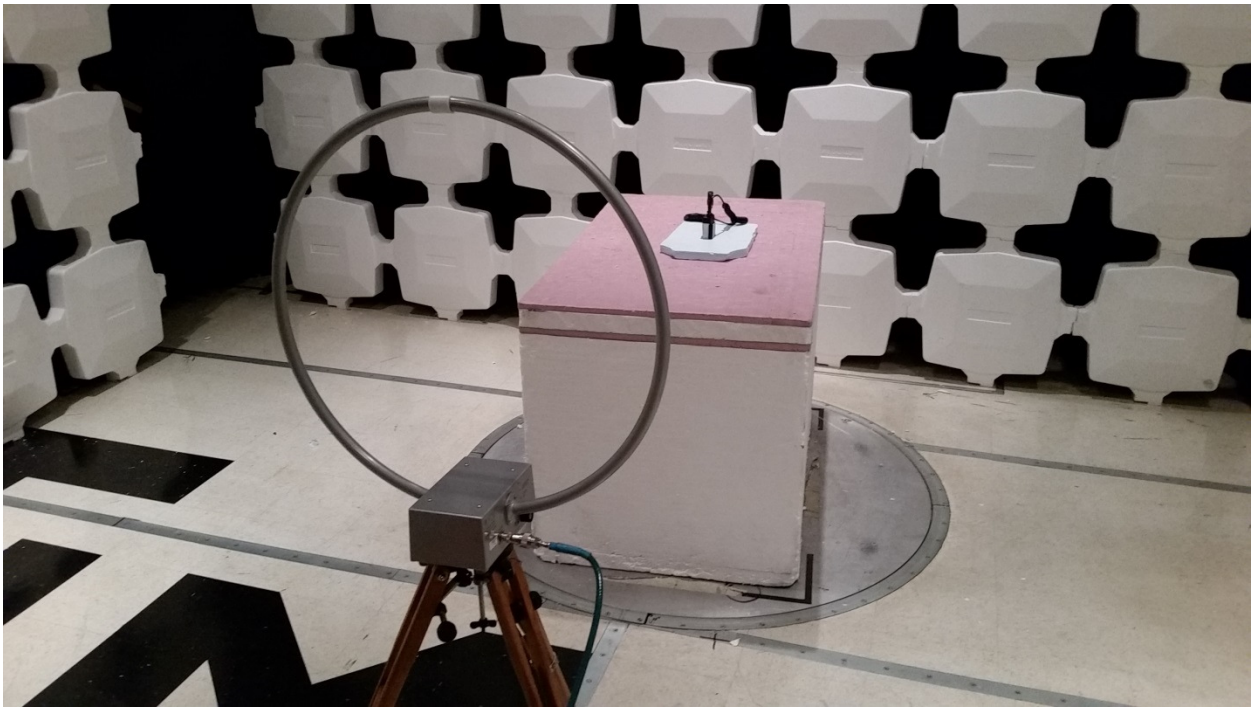
OUTPUT POWER/ OCCUPIED BW/ ANT COND EMISSONS



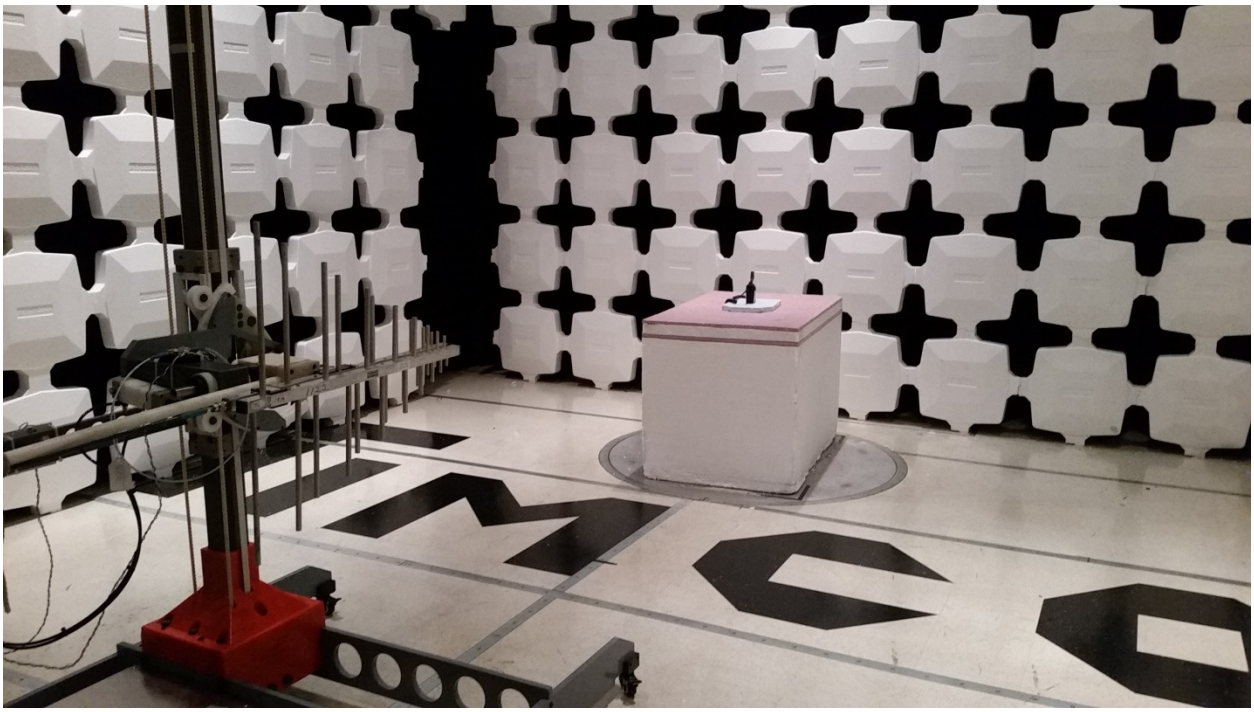
MODULATION CHARACTERSISTICS



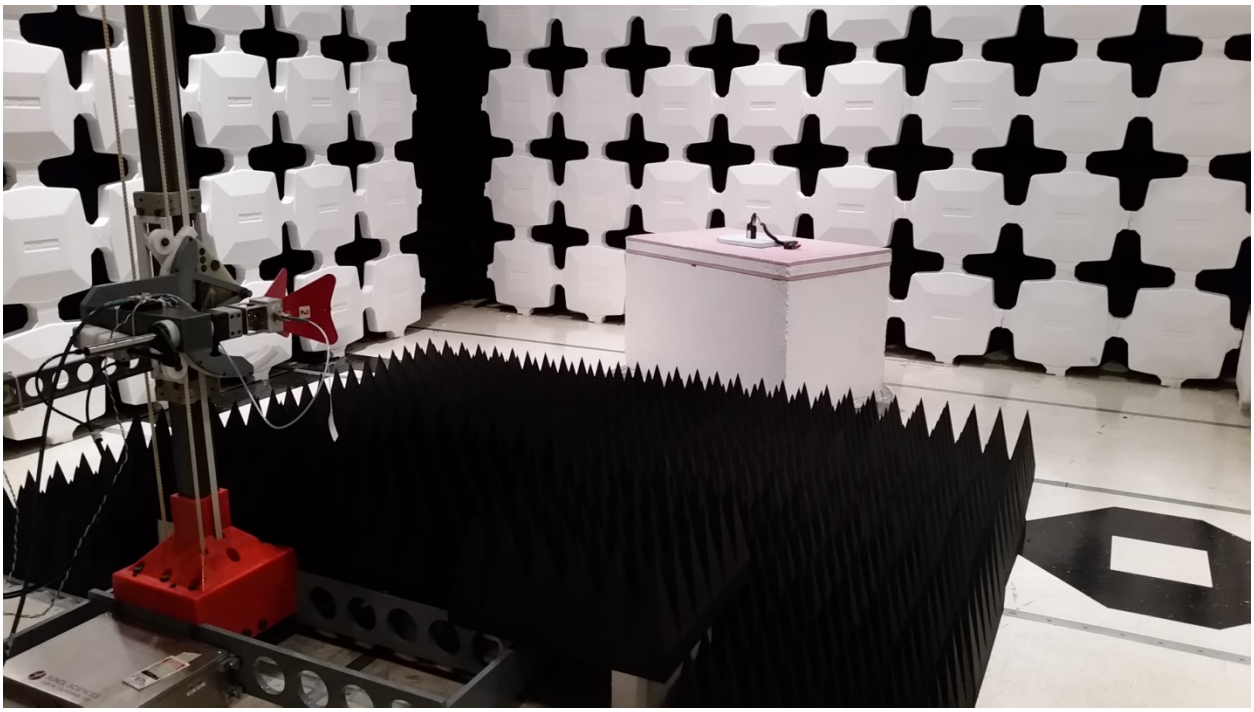
FIELD STRENGTH SPURIOUS EMISSIONS BELOW 30 MHz



FIELD STRENGTH SPURIOUS EMISSIONS BELOW 1000 MHz



FIELD STRENGTH SPURIOUS EMISSIONS ABOVE 1 GHz



FREQUENCY STABILITY

TRANSIENT FREQUENCY BEHAVIOR