TIMCO ENGINEERING, Inc.
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FCC PART 90

136-174 MHz VHF PORTABLE

REPORT

APPLICANT	VERTEX STANDARD USA, INC.
	8000 WEST SUNRISE BLVD. FT. LAUDERDALE FL 33322 USA
FCC ID	AXI11373020
MODEL NUMBER	EVX-261-D0-5
PRODUCT DESCRIPTION	VHF 2 WAY PORTABLE TANSCEIVER
STANDARD APPLIED	CFR 47 Part 90
DATE SAMPLE RECEIVED	6/29/2016
FINAL TEST DATE	9/01/2016
TESTED BY	Cory Leverett
APPROVED BY	Sid Sanders
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
1235AUT16TestReport_	Rev1	Initial Issue	8/16/16
	Rev2	Added A2LA Accredited Symbol	8/18/16
	Rev3	Updated Freq Stability Tech Data	9/06/16

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

A2LA ACCREDITED
Testing Cert. # 0955.01

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GENERAL REMARKS

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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.

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: 9/06/2016

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

Date: 9/06/16

GENERAL INFORMATION

EUT Specification

EUT Description	VHF 2 WAY PORTABLE TANSCEIVER
FCC ID	AXI11373020
Model Number	EVX-261-D0-5
Operating Frequency	136 – 174 MHz
Test Frequencies	150.8500, 158.5500, 173.3875MHz,
Type of Emission	11K0F3E, 7K60F1D, 7K60F1E ,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-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 spectrum analyzer.

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

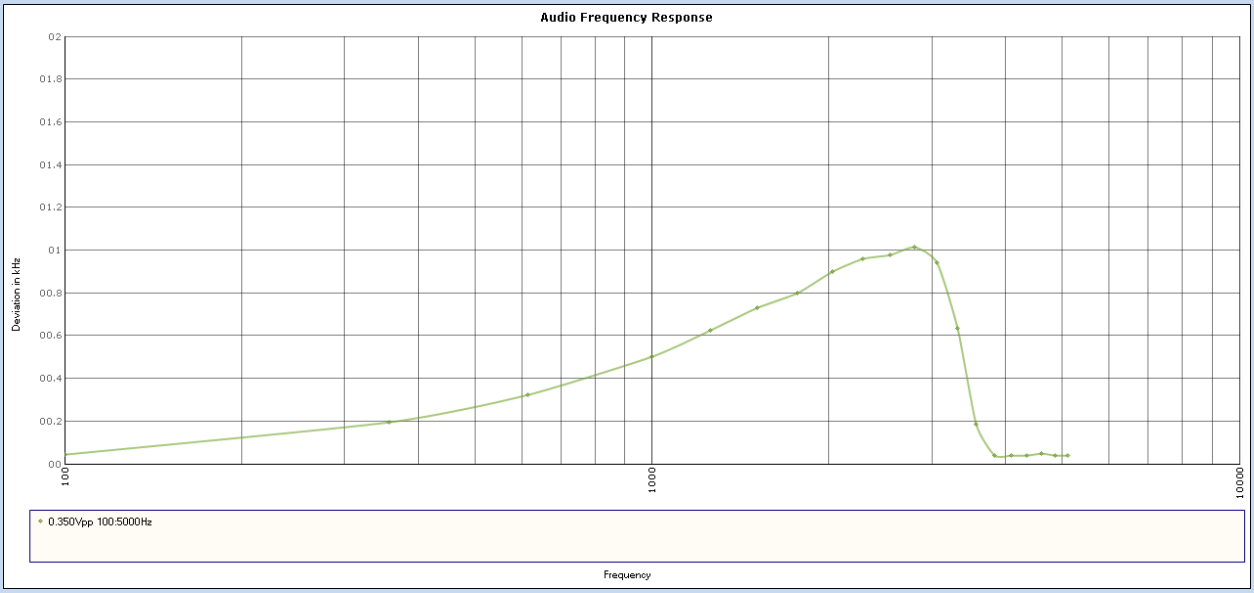
Part 2.1033(c) (4) Type of Emission: 7K60F1D, 7K60F1E, 7K60F1W, 7K60FXE, 7K60FXD

Digital functions comply with DMR (Digital Mobile Radio).

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.

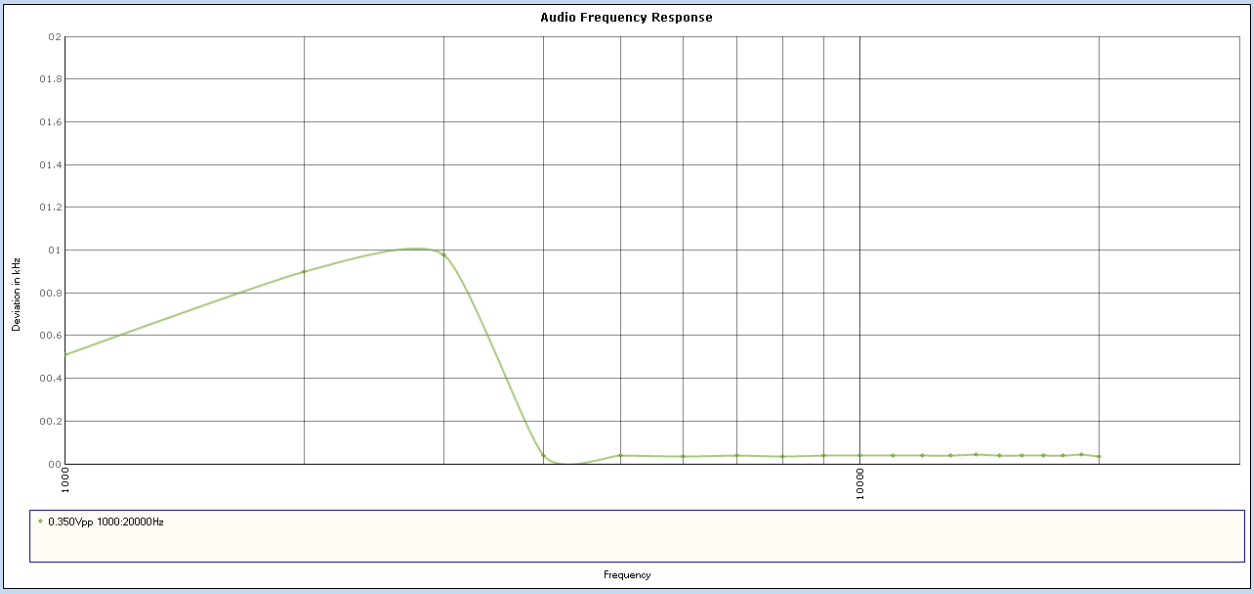
Audio Frequency Response Plot



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

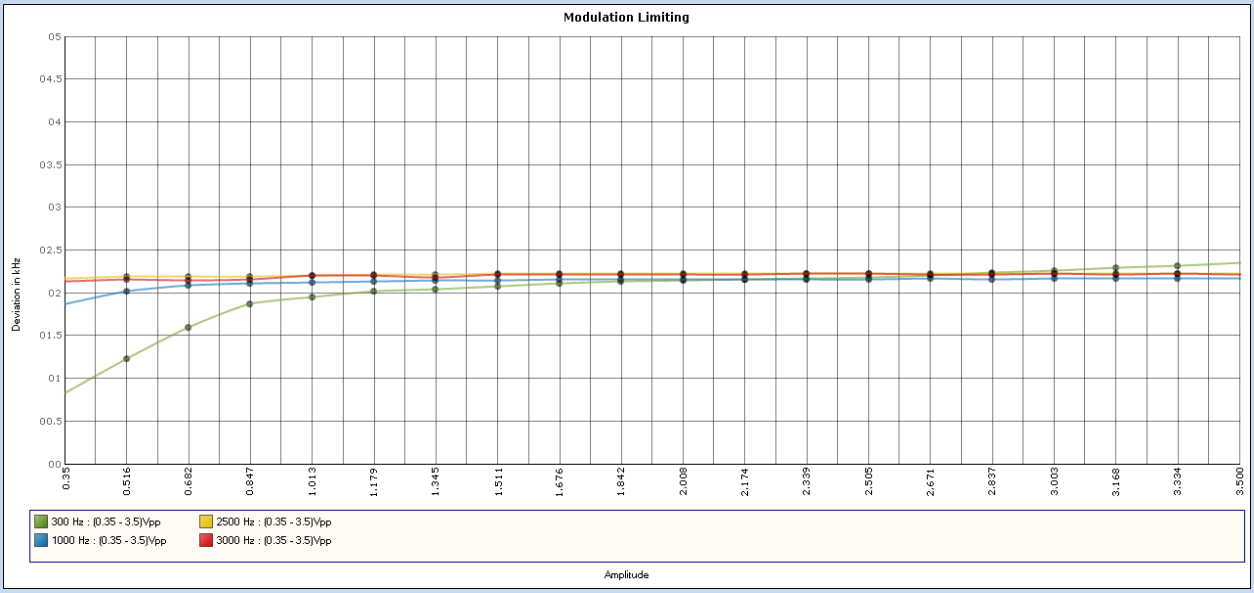
Rule Part No.: Part 2.1047(b) & 90

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

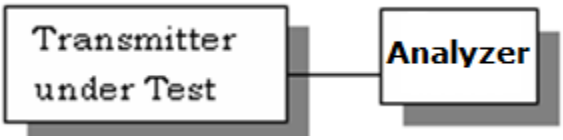
RF POWER OUTPUT

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

Test Requirements: Manufacturer's Specification

Method of Measurement: RF power is measured by using a spectrum analyzer connected to the rf output connecter through a 50 Ohm attenuator and cable. 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
150.8500	37.01	5.02	28.83	0.76
158.5500	36.89	4.89	29.67	0.93
173.3875	36.89	4.89	29.35	0.86

Test Data: Digital Mode Power Output Measurement Table

Tuned Freq. MHz	Power Output			
	High		Low	
	dBm	Watts	dBm	Watts
150.8500	37.02	5.04	28.95	0.79
158.5500	36.87	4.86	29.65	0.92
173.3875	36.88	4.88	29.31	0.85

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

FOR HIGH POWER SETTING INPUT POWER: (7.40V) (2.0A) = 14.8Watts
FOR LOW POWER SETTING INPUT POWER: (7.40V) (0.4A) = 2.96 Watts

99% OCCUPIED BANDWIDTH

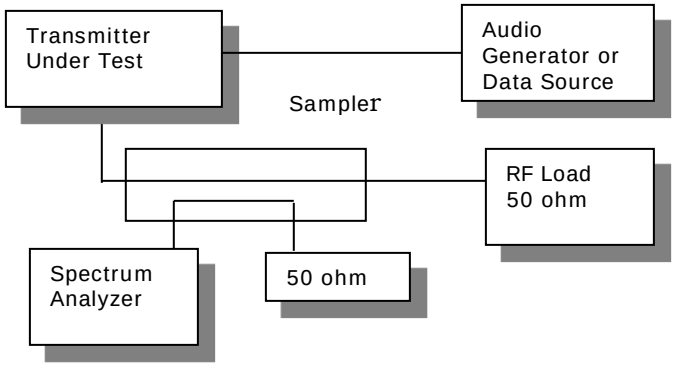
Part 2.1049(c) EMISSION BANDWIDTH:

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:

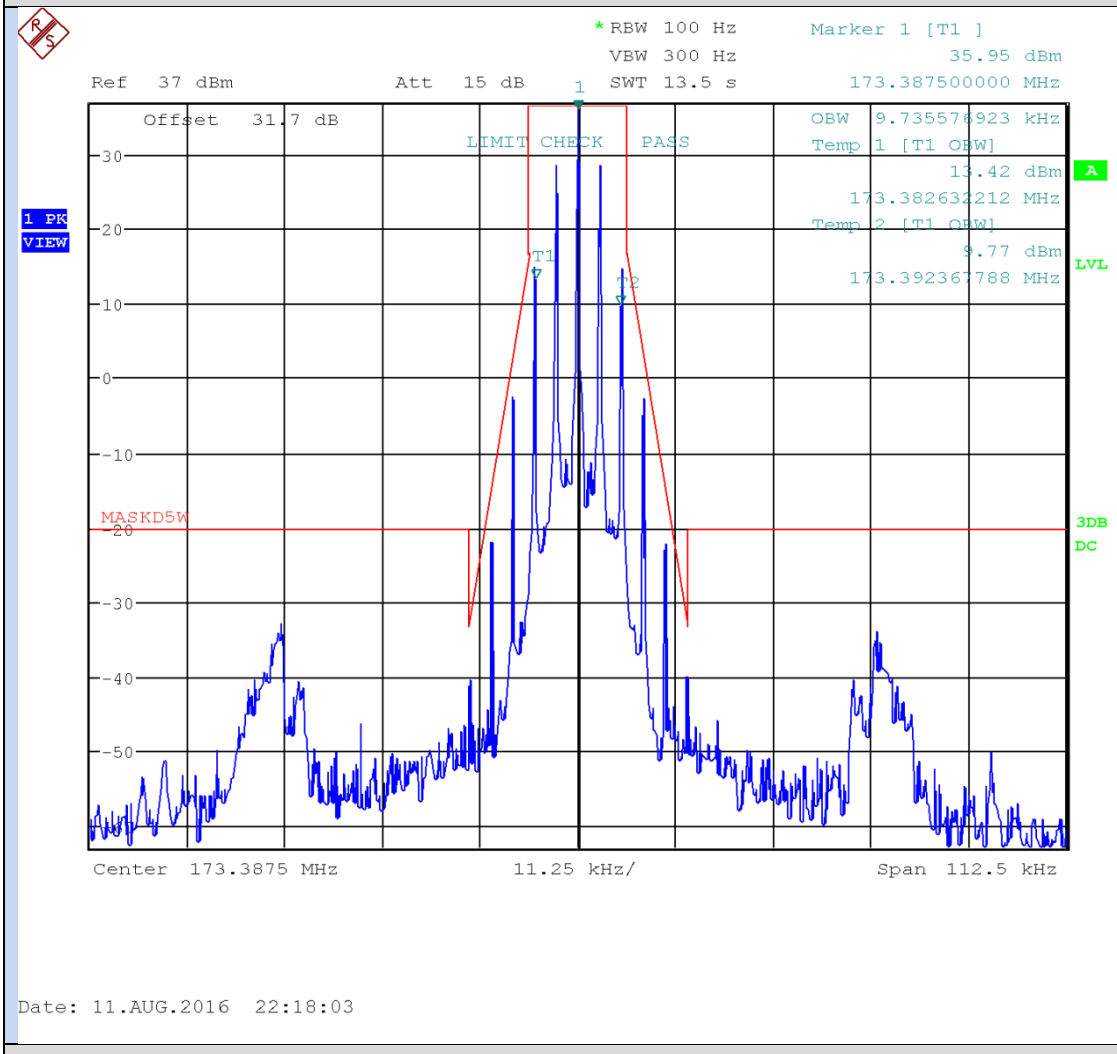


Note:

99% OCCUPIED BANDWIDTH

Test Data: 11K0F3E Mask D

Occupied Bandwidth Plot

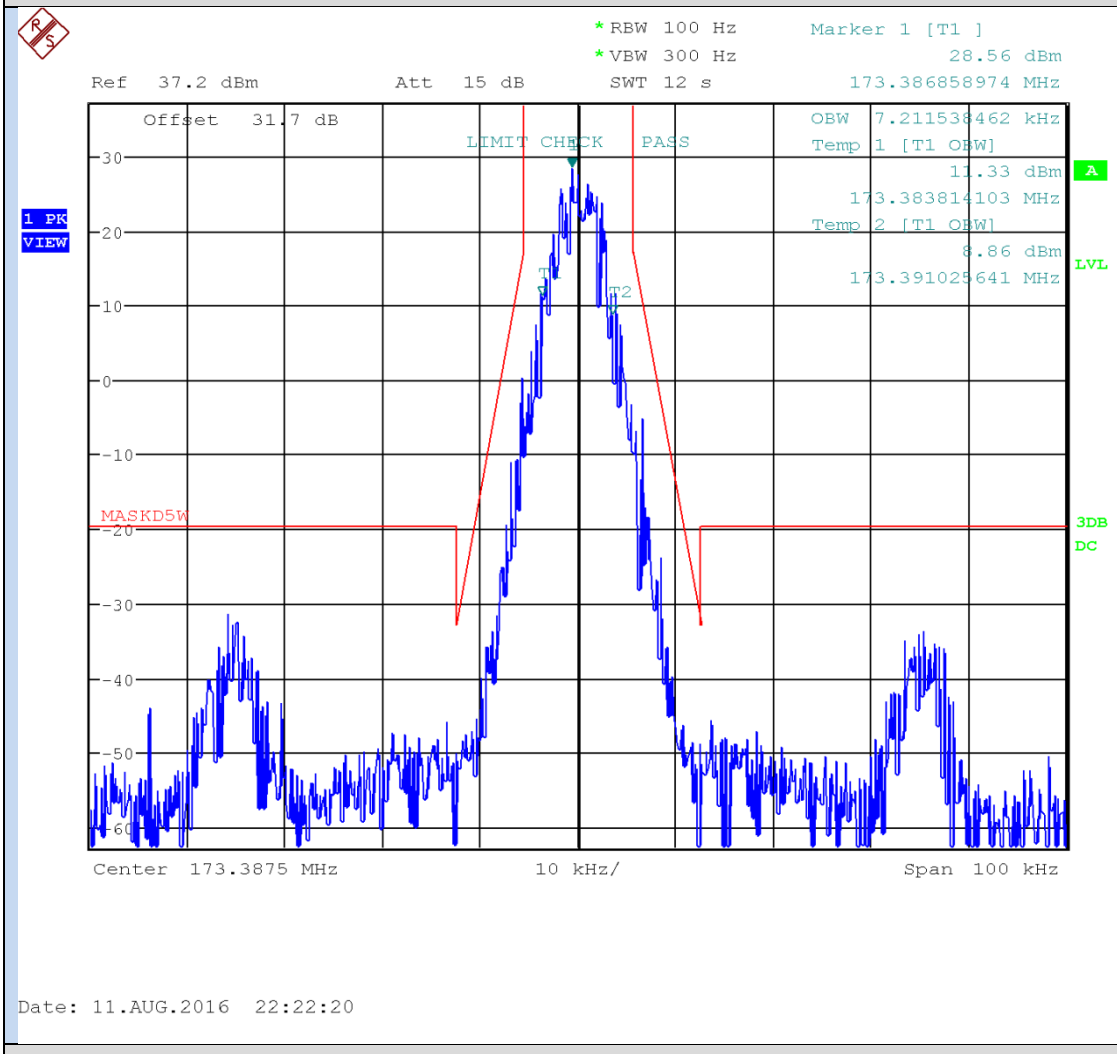


Result Meets The Requirement

99% OCCUPIED BANDWIDTH

Test Data: 7K60F1D/7K60F1E Mask D

Occupied Bandwidth Plot

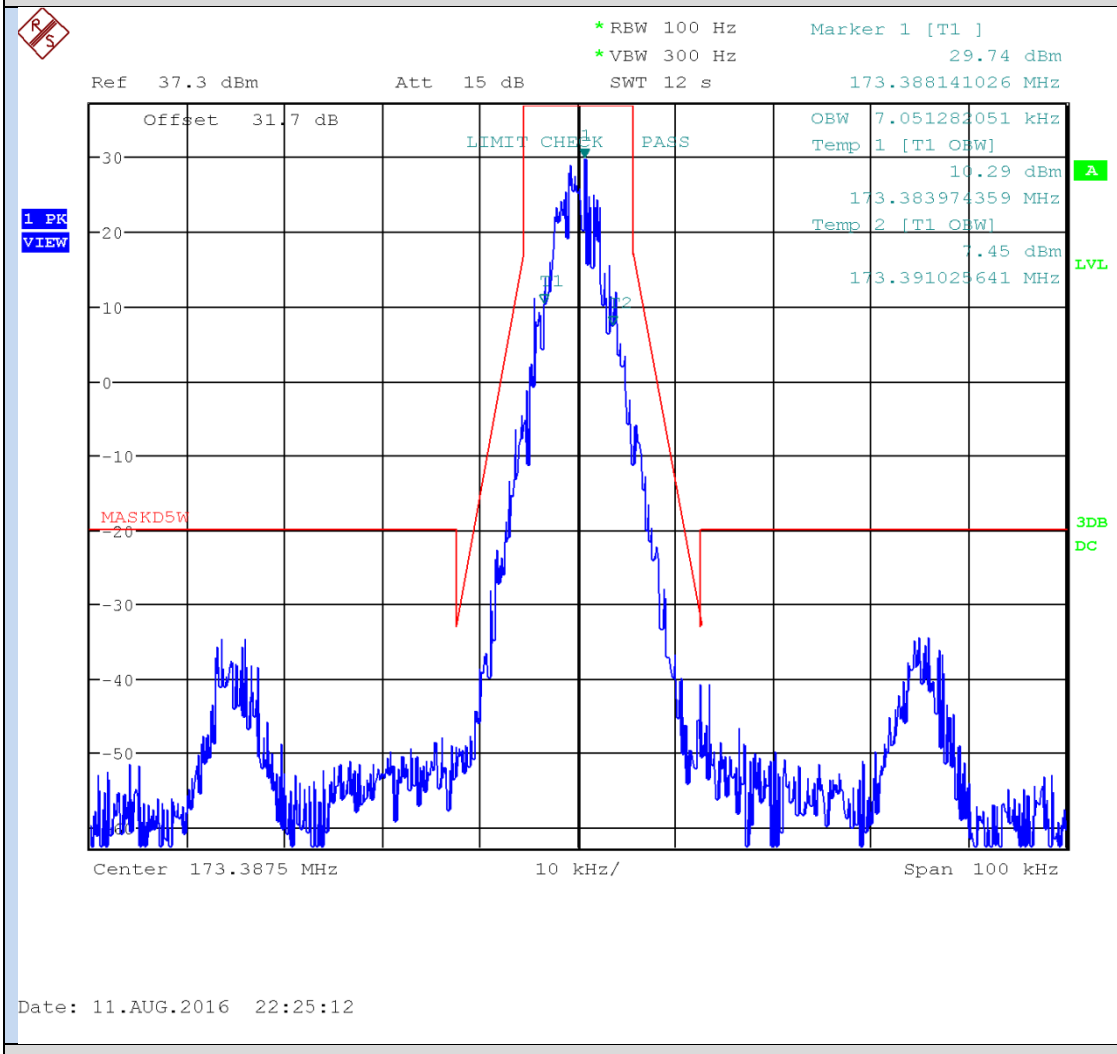


Result Meets The Requirement

99% OCCUPIED BANDWIDTH

Test Data: 7K60FXE/FXD Mask D

Occupied Bandwidth Plot

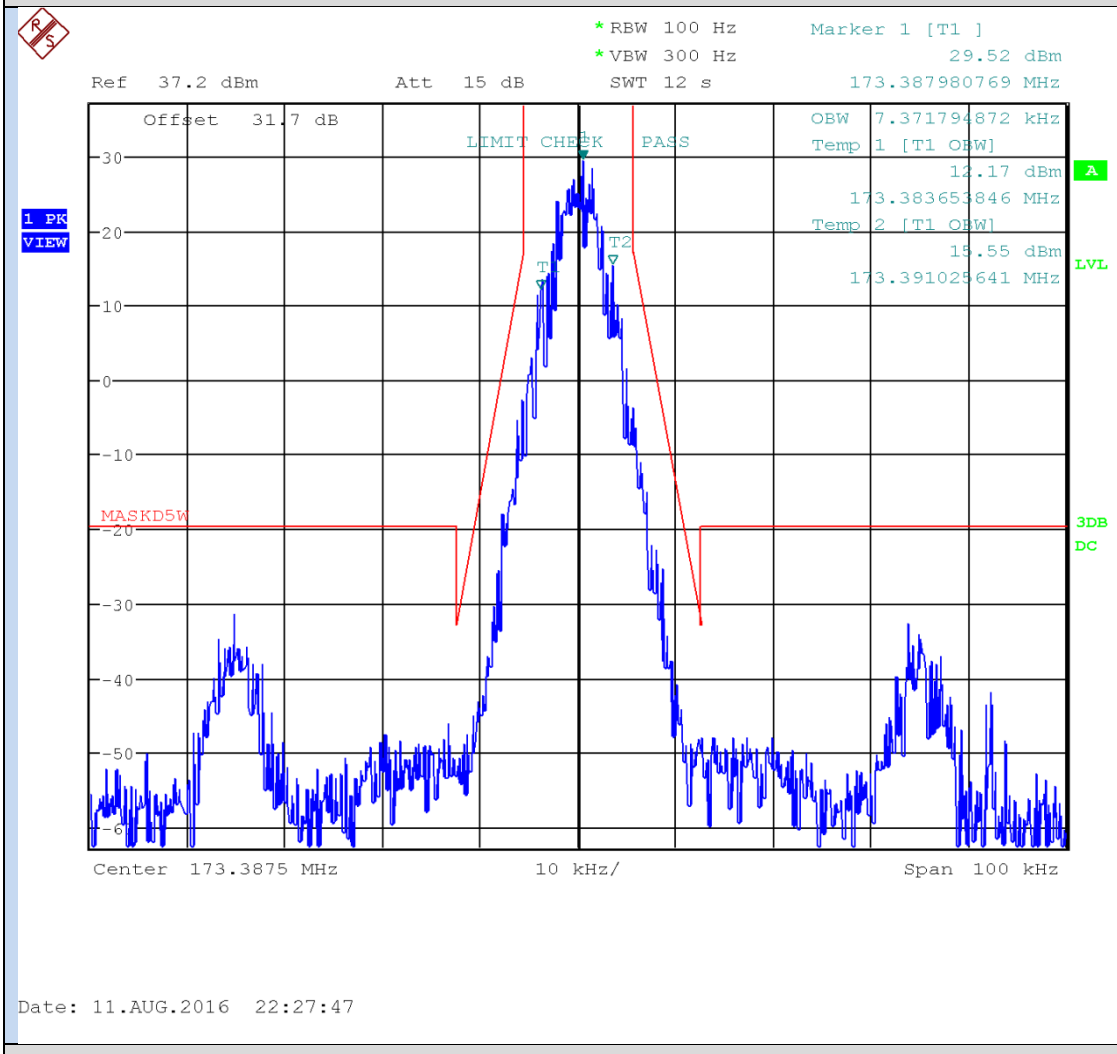


Result Meets The Requirement

99% OCCUPIED BANDWIDTH

Test Data: 7K60F1W Mask D

Occupied Bandwidth Plot



Result Meets The Requirement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

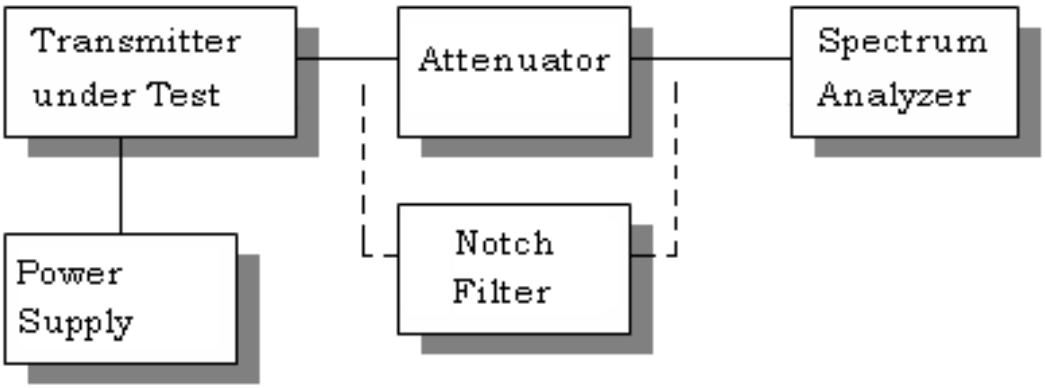
Rule Part No.: Part 2.1051(a), Part 90.210

Requirements:

12.5 kHz Channel Spacing = 50+10 log (P) = 57.01dBc

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 60% modulation with a 1 KHz tone. 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: High Power Low end of Band

	dBm	Watts	Limit
Power Output	37.01	5.02	57.01
	Frequency	dBc	Margin
	150.85	0	0.0
	301.70	83.0	26.0
	452.55	94.9	37.9
	603.40	102.9	45.9
	754.25	100.5	43.5
*	905.10	104.8	47.8
*	1055.95	93.7	36.7
*	1206.80	91.0	34.0
*	1357.65	94.4	37.4
*	1508.50	94.2	37.2

*Indicates Noise Floor

Test Data: Low Power Low end of Band

	dBm	Watts	Limit
Power Output	28.83	0.76	48.83
	Frequency	dBc	Margin
	150.85	0	0.0
	301.70	79.6	30.7
	452.55	87.8	39.0
*	603.40	89.0	40.2
	754.25	88.1	39.3
*	905.10	87.7	38.9
*	1055.95	88.0	39.1
*	1206.80	89.0	40.2
*	1357.65	89.0	40.2
*	1508.50	88.7	39.9

*Indicates Noise Floor

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Test Data: High Power Middle of Band

	dBm	Watts	Limit
Power Output	36.89	4.89	56.89
	Frequency	dBc	Margin
	158.55	0	0.0
	317.10	83.0	26.1
	475.65	104.0	47.1
	634.20	106.4	49.5
*	792.75	109.9	53.0
*	951.30	116.9	60.0
*	1109.85	110.9	54.0
*	1268.40	111.4	54.5
*	1426.95	115.3	58.4
*	1585.50	116.9	60.0

*Indicates Noise Floor

Test Data: Low Power Middle of Band

	dBm	Watts	Limit
Power Output	29.67	0.93	49.67
	Frequency	dBc	Margin
	158.55	0	0.0
	317.10	84.6	35.0
*	475.65	101.2	51.5
*	634.20	104.7	55.0
*	792.75	104.7	55.0
*	951.30	105.3	55.6
*	1109.85	106.0	56.3
*	1268.40	106.0	56.3
*	1426.95	105.5	55.8
*	1585.50	105.6	55.9

*Indicates Noise Floor

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Test Data: High Power High End of Band

	dBm	Watts	Limit
Power Output	36.89	4.89	56.89
	Frequency	dBc	Margin
	173.3875	0	0.0
	346.7750	89.0	32.1
	520.1625	105.7	48.8
	693.5500	118.9	62.0
*	866.9375	118.9	62.0
*	1040.3250	117.5	60.6
*	1213.7125	117.2	60.3
*	1387.1000	113.7	56.8
*	1560.4875	118.4	61.5
*	1733.8750	118.9	62.0

*Indicates Noise Floor

Test Data: low Power High End of Band

	dBm	Watts	Limit
Power Output	29.35	0.86	49.35
	Frequency	dBc	Margin
	173.3875	0	0.0
	346.7750	93.6	44.2
	520.1625	103.0	53.6
	693.5500	103.0	53.6
*	866.9375	99.2	49.8
*	1040.3250	98.8	49.4
*	1213.7125	104.4	55.0
*	1387.1000	107.1	57.7
*	1560.4875	107.1	57.7
*	1733.8750	106.9	57.5

*Indicates Noise Floor

RESULTS: PASS

FIELD STRENGTH OF SPURIOUS EMISSIONS

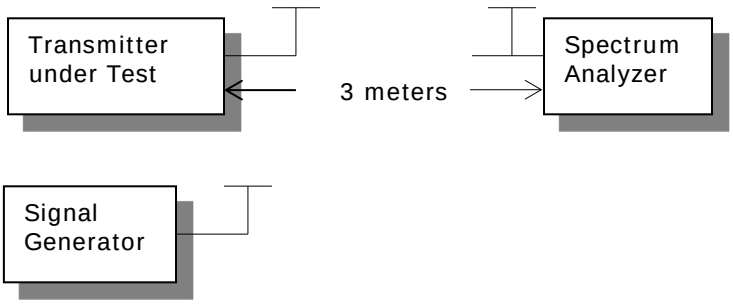
Rule Parts. No.: Part 2.1053

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 and all of the test frequencies.

Test Data: High Power High End of Band

Emission Frequency (MHz)	Power Mode	Power Output (dBm)	Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
173.38	Hi	36.89	4.89	56.89	12.50

Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)	Margin
346.78	V	78.85	21.96
520.16	V	93.46	36.57
693.55	V	103.00	46.11
866.94	V	107.66	50.77
1,040.33	V	97.17	40.28
1,213.71	V	98.27	41.38
1,387.10	H	97.62	40.73
1,560.49	H	98.21	41.32
1,733.88	H	95.25	38.36

Results Meet Requirements

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: High End of Band

Temperature	Frequency MHz	Cycles	PPM
25°C (reference)	**173.38753**		
-30°C	173.387425	-105	-0.606
-20°C	173.387515	-15	-0.087
-10°C	173.387528	-2	-0.012
0°C	173.387519	-11	-0.063
10°C	173.38751	-20	-0.115
20°C	173.387524	-6	-0.035
30°C	173.387522	-8	-0.046
40°C	173.387515	-15	-0.087
50°C	173.387517	-13	-0.075
Battery Voltage	Frequency	Cycles	PPM
-15%	173.38753	0	0.000
15%	173.38753	0	0.000

Results Meet Requirements

TRANSIENT FREQUENCY BEHAVIOR

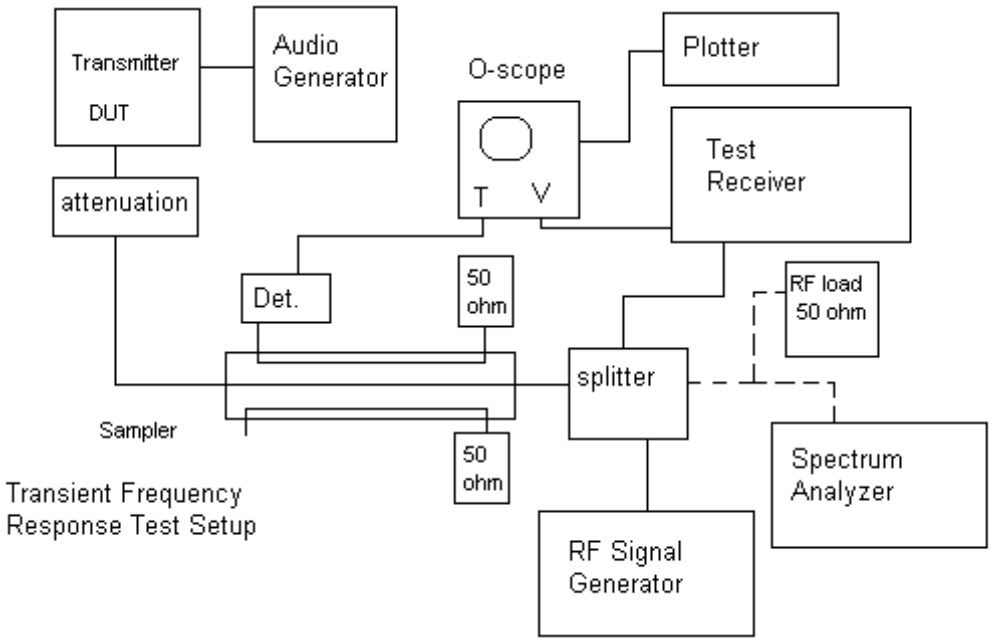
Part 90.214 Transient Frequency Behavior

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

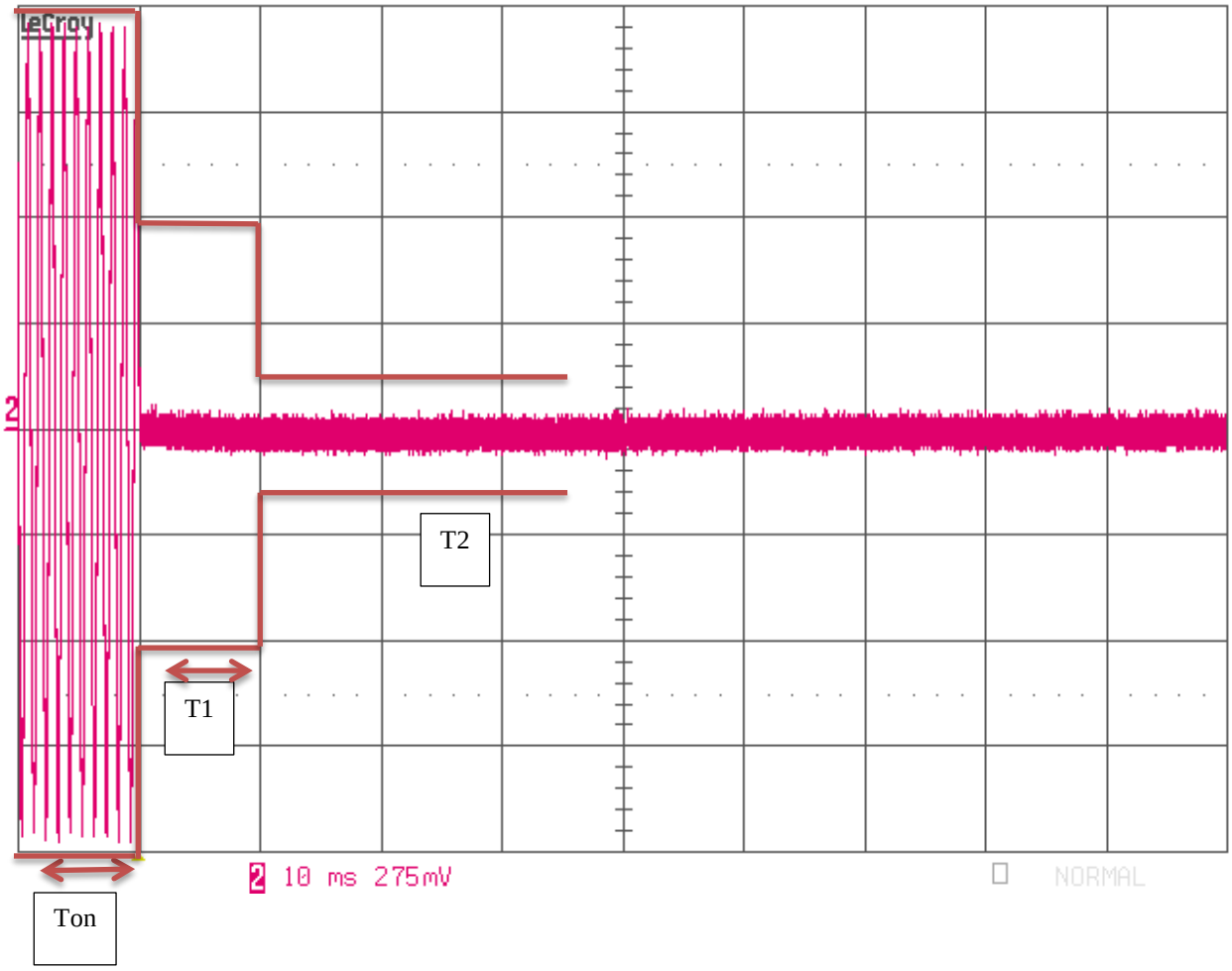
TEST PROCEEDURE: Was in accordance with test procedures detailed in the standard list above, the levels were set as follows:

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.



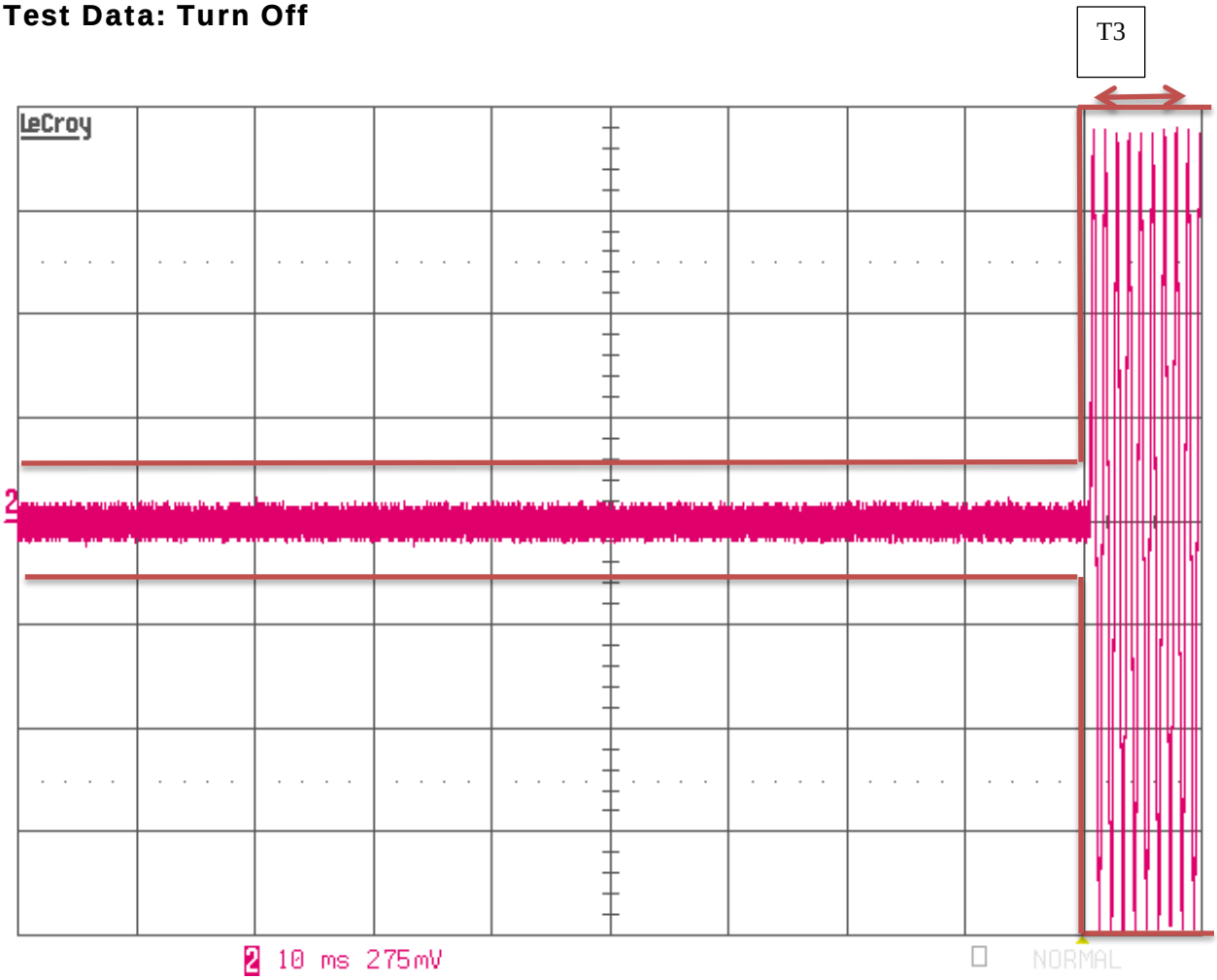
Transient Frequency Response Test Setup

Test Data: Turn On



Results Meet Requirements

Test Data: Turn Off



Results Meet Requirements

EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
12 Volt Power Supply	Astron	RS-12A	9312779	NA	NA
Antenna: Biconical 1096 Chamber	Eaton	94455-1	1096	07/14/15	07/14/17
Antenna: Biconical 1057	Eaton	94455-1	1057	11/18/15	11/18/17
Antenna: Log-Periodic 1122	Electro-Metrics	LPA-25	1122	07/14/15	07/14/17
Antenna: Log-Periodic 1243	Eaton	96005	1243	02/09/16	02/09/18
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
Sweep/Signal Generator	Anritsu	68369B	985112	10/28/15	10/28/17
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	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-4G	CLASS III	34078	M3933/10-5 (#76)	05/19/15	05/19/17

Modulation Analyzer	HP	8901A	3050A05856	04/16/15	04/16/17
Attenuator N 30dB 150W DC-6G	Narda	769-30	10267	06/26/15	06/26/17
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
Coaxial Cable - Chamber 3 cable set (Primary)	Micro-Coax	Chamber 3 cable set (Primary)	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
Tunable Notch Filter 100-350 MHz	Eagle	220BFBF	100-350 MHz (#43)	07/01/15	07/01/17
Bore-sight Antenna Positioning Tower	Sunol Sciences	TLT2	N/A	NA	NA
Chamber	Panashield	3M	N/A	4/25/16	12/31/17

***EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

MEASUREMENT UNCERTAINTY

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.

END OF REPORT