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FCC

VHF PORTABLE PART 90

TEST REPORT

APPLICANT	**KP ELECTRONIC SYSTEMS LTD.**
	P.O. BOX 42 TEFEN INDUSTRIAL PARK 24959 ISRAEL
FCC ID	**H78KPMT2W**
MODEL NUMBER	MT2W
PRODUCT DESCRIPTION	VHF AUTOMATIC METER READING TRANSCEIVER W/ 2.4 GHZ TX.
STANDARD APPLIED	CFR 47 Part 90
DATE SAMPLE RECEIVED	9/25/2015
FINAL TEST DATE	9/28/2015
TESTED BY	Cory Leverett
APPROVED BY	Sid Sanders
TEST RESULTS	☒ PASS ☐ FAIL

Report Number	Version Number	Description	Issue Date
2010AUT15TestReport.docx	Rev1	Initial Issue	9/28/2015

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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: 2005 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 Leverett
Engineering Project Manager

Date: 9/28/2015

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GENERAL INFORMATION

EUT Specification

EUT Description	VHF AUTOMATIC METER READING TRANSCEIVER W/ 2.4 GHZ TX.
FCC ID	H78MT2W
Model Number	MT2W
Operating Frequency Range	172.5 – 173.5 MHz
Test Frequencies	173 MHz
Type of Emission	2K55F1D
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 24-26ºC with a relative humidity of 50-65%.
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**.

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TEST REPORT SUMMARY

Rule Part No.	Scope of Work	Status Pass/Fail/NA
2.1033(c)(8), 2.1046(a), 90.205	RF Power Output	Pass
2.1033(c) (4) 2.1047(a)(6)	Modulation Characteristics	Pass
2.1049(c), 90.210(e)	Emission Mask and Occupied Bandwidths	Pass
2.1051(a), 90.210(e)	Antenna Conducted Emissions	Pass
2.1053, 90.210(e)	Field Strength Spurious Emissions	Pass
2.1055, 90.213	Frequency Stability	Pass
90.214	Transient Frequency Behavior	Pass

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TEST PROCEDURE

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-D: 2010, 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 ANSI/TIA 603-D: 2010, 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.

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RF POWER OUTPUT

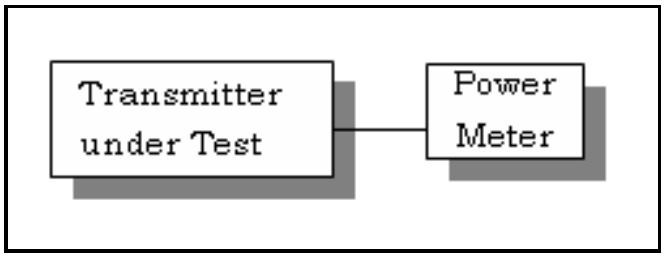
Rule Part No.: Part 2.1046(a), Part 90

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:

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:

	RF POWER	
Tuned Frequency (MHz)	dBm	Watts
173	32.92	1.95

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

INPUT POWER: (12.5VDC) (.65A) = 8.125Watts

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OCCUPIED BANDWIDTH

Part 2.1049(c) EMISSION BANDWIDTH:

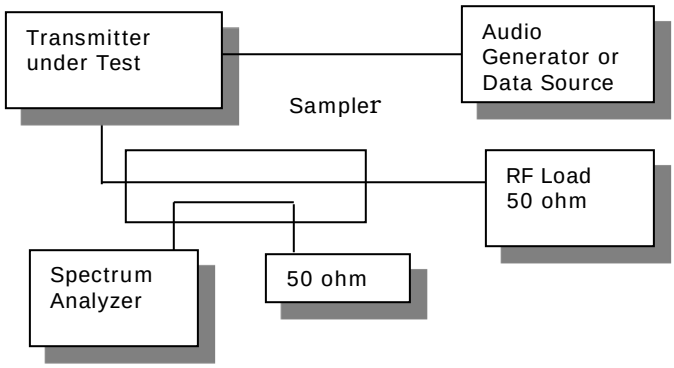
Part 90.210(e) Emission Mask E – 6.25 kHz channel BW equipment.
For transmitters designed to operate with a 6.25 kHz bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(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 kHz) or 55 + 10 Log (P) or 65, whichever us the lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10log (P) dB or 65 dB, whichever is the lesser attenuation.

Method of Measurement: ANSI/TIA 603-D:
Test Setup Diagram:



Test Data: See the plots below

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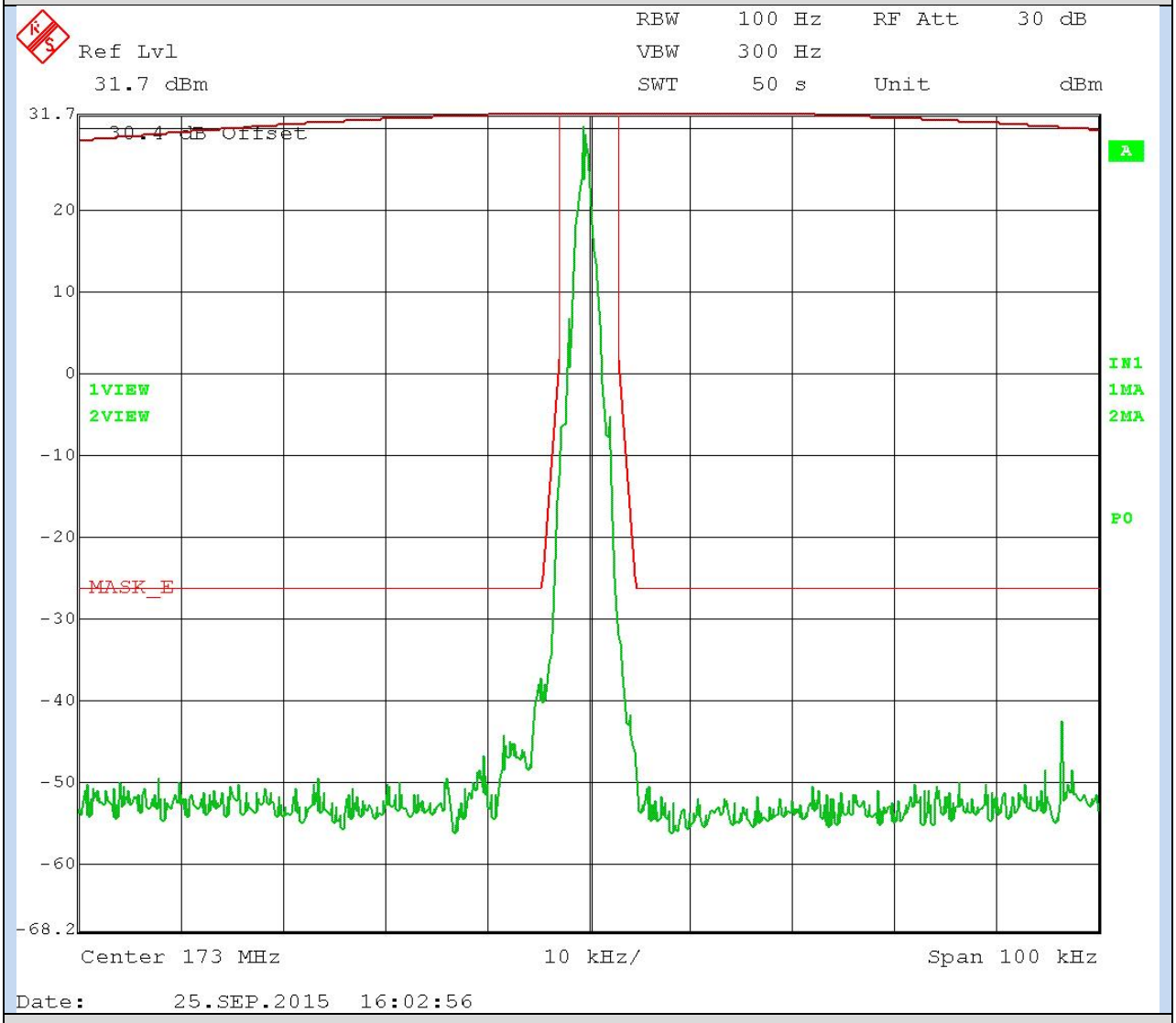
OCCUPIED BANDWIDTH PLOTS:

Part 90.210(e) Emission Mask E – 6.25 kHz Channel Bandwidth -

Occupied Bandwidth Plot



Result Meets The Requirement

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

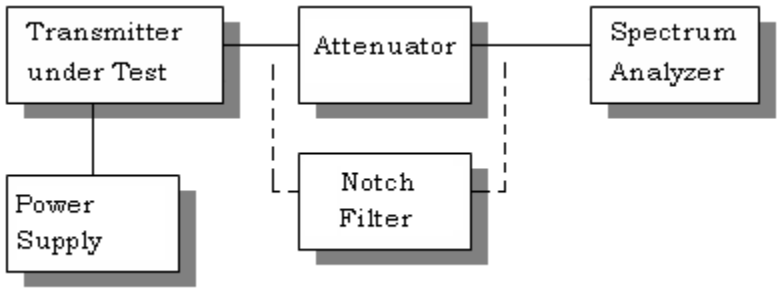
Rule Part No.: Part 2.1051(a)

Requirements:

6.25 kHz Channel Spacing = on any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10log (P) dB or 65 dB, whichever is the lesser attenuation.

Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. 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 ANSI/TIA 603-D: 2010.

Method of Measuring Conducted Spurious Emissions



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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Test Data: High Power Low end of Band

	dBm	Watts	Margin
Power Output	32.95	2	
LIMIT	43		
	Frequency	dBc	dB
	173	0	0
	346	75.55	17.54
	519	91.46	33.45
	692	91.05	33.04
*	865	94.56	36.55
*	1038	94.08	36.07
*	1211	85.1	27.09
*	1384	84.83	26.82
*	1557	86.62	28.61
*	1730	84.58	26.57

*** = Denotes Noise Floor**

RESULTS: PASS

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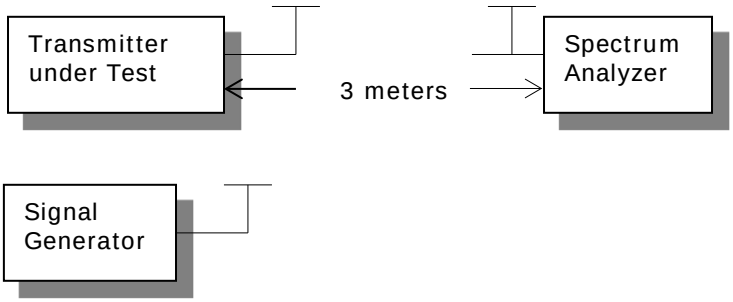
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053

(4) **Requirements:** 6.25 kHz Channel Spacing On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least 55 + 10log (P) dB or 65 dB, whichever is the lesser attenuation.

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-D: 2010 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: Low End of the Band

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
173.00	Hi	32.92	1.96	57.92	6.25

Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)	Margin
346.00	H	89.37	31.45
519.00	V	88.60	30.68
692.00	H	95.93	38.01
865.00	H	93.22	35.30
1,038.00	H	82.78	24.86
1,211.00	H	86.86	28.94
1,384.00	H	86.83	28.91
*1,557.00	V	91.60	33.68
*1,730.00	H	88.90	30.98

*** = Denotes Noise Floor**

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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-D: 2010.

Test Data:

Temperature	Frequency MHz	PPM
25°C (reference)	172.999975	
-30°C	172.999848	-0.73
-20°C	172.999897	-0.45
-10°C	172.999981	0.03
0°C	172.999995	0.12
10°C	172.999980	0.03
20°C	172.999967	-0.05
30°C	172.999925	-0.29
40°C	172.999928	-0.27
50°C	172.999921	-0.31
Battery Voltage	Frequency	PPM
-15%	172.999963	-0.07
15%	172.999945	-0.17

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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:

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

Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz
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

[1] $_{on}$ is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t_1 is the time period immediately following t_{on}.

t_2 is the time period immediately following t_1.

t_3 is the time period from the instant when the transmitter is turned off until t_{off}.

t_{off} is the instant when the 1 kHz test signal starts to rise.

[2] During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in §90.213.

[3] Difference between the actual transmitter frequency and the assigned transmitter frequency.

[4] If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

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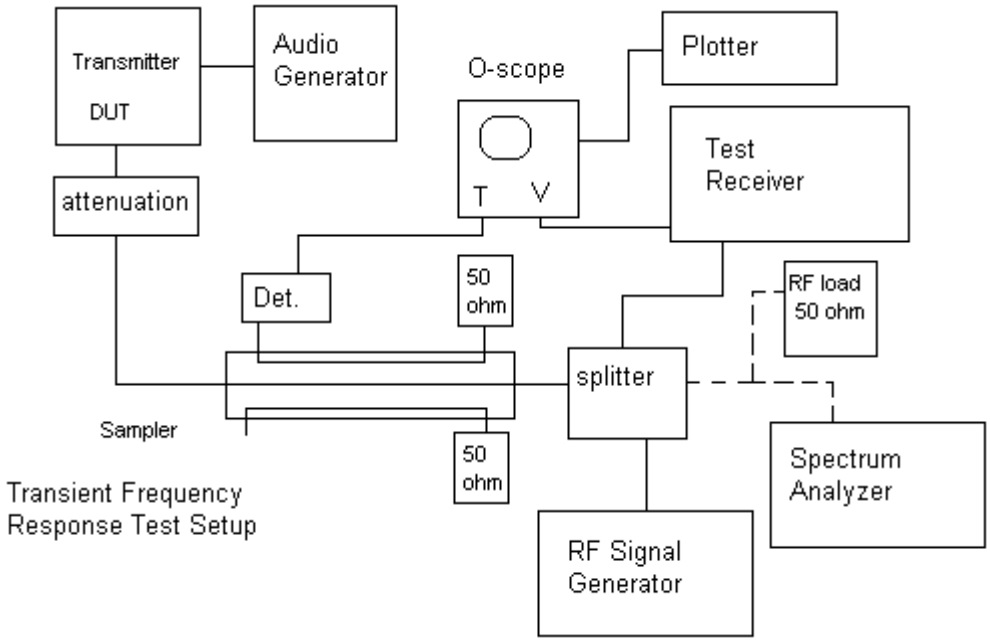
TEST PROCEEDURE: ANSI/TIA 603-D: 2010, the levels were set as follows:

1. Using the variable attenuator the transmitter level was set to 40 dB below the test receivers maximum input level, and 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

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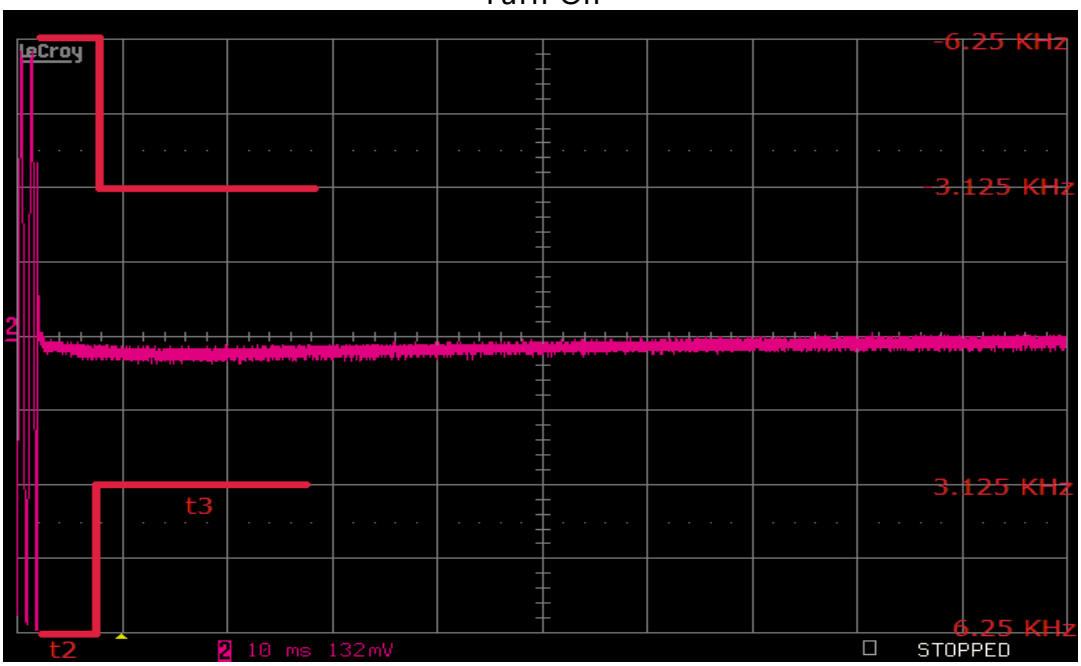
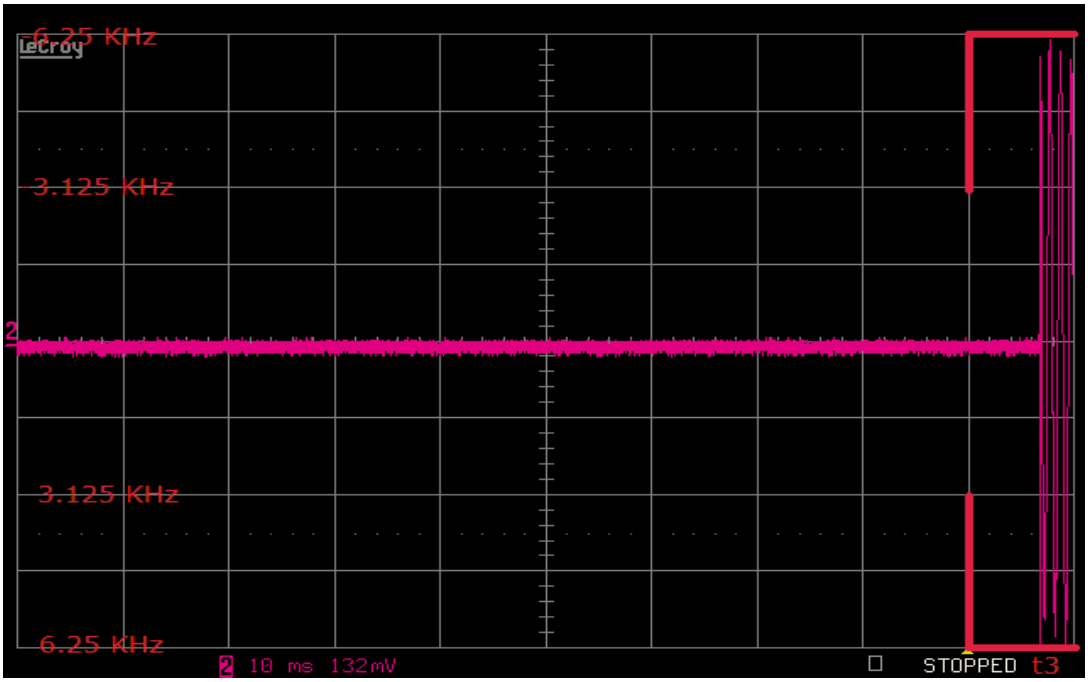
Test Data:

Turn On



Turn Off



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EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
DC Power Supply	HP	6286A	1744A03842	NA	NA
Biconnical Chamber	Eaton Chamber	94455-1	1057	06/14/13	12/14/15
Log-Periodic Chamber	Eaton	96005	1243	05/31/13	11/30/15
Digital Multimeter	Fluke	77	35053830	08/22/13	12/22/15
Frequency Counter Small Chamber	HP	5385A	3242A07460	07/01/15	07/01/17
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
Double-Ridged Horn/ETS Horn 1	ETS-Lindgren Chamber	3117	00035923	06/13/14	06/13/16
Temperature Chamber Small	Thermotron Corp.	S1.2 Mini Max	25-1420-09	08/20/14	08/20/16
EMI Test Receiver R & S ESIB 40 Screen Room	Rohde & Schwarz	ESIB 40	100274	08/12/14	08/12/16
Software: Field Strength Program	Timco	N/A	Version 4.0	NA	NA
Antenna: Active Loop	ETS-Lindgren	6502	00062529	10/09/13	10/09/15
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	03/11/14	03/11/16
Signal Generator HP 8648C	HP	8648C	3623A02898	08/29/13	11/29/15

***EMI RECEIVER SOFTWARE VERSION**

The receiver firmware used was version 4.43 Service Pack 3

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