TIMCO ENGINEERING INC.
849 NW State Road 45
Newberry, Florida 32669
http://www.timcoengr.com
888.472.2424 F 352.472.2030 email: tei@timcoengr.com

Test Report

Product Name: VHF TRANSCIEVER

FCC ID: EFOIC-F521

Applicant:

Tactical Electronics Corporation
4000 Dow Road
Melbourne Fl. 32934

Date Receipt: NOVEMBER 16, 2004

Date Tested: DECEMBER 7, 2004

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APPLICANT: Tactical Electronics Corporation

FCC ID: EFOIC-F521

TABLE OF CONTENTS LIST

TEST REPORT:

EXHIBITS CONTAINING:

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GENERAL INFORMATION REQUIRED
FOR CERTIFICATION OF A LICENSED TRANSMITTER

2.1033(c)(1)(2) Tactical Electronics Corporation will manufacture the FCCID: EFOIC-F521 VHF TRANSCEIVER in quantity, for use under FCC RULES PART 90.

Tactical Electronics Corporation
4000 Dow Road
Melbourne, Fl 32934

2.1033(c) **TECHNICAL DESCRIPTION**

2.1033(c)(3) Instruction book. A draft copy of the instruction manual is included.

2.1033(c) (4) Type of Emission: 11K0F3E
90.209
90.207

Bn = 2M + 2DK
M = 3000
D = 2500
Bn = 2(3000)+ 2(2500) = 11k

2.1033(c)(5) Frequency Range: 136 - 174 MHz
90.209 (b)(5)

2.1033(c) (4) Type of Emission: 16K0F3E
90.209
90.207

Bn = 2M + 2DK
M = 3000
D = 5000
Bn = 2(3000)+ 2(5000) = 16k

2.1033(c)(5) Frequency Range: 136 - 174 MHz
90.209 (b)(5)

2.1033(c)(6)(7) Power Output shall not exceed 59 Watts into a 50 ohm
90.205 resistive load. There are no user power controls.

2.1033(c)(8) DC Voltages and Current into Final Amplifier:
POWER INPUT:

FINAL AMPLIFIER ONLY
INPUT POWER – HIGH: (13.6V)(8.9A) = 121.04 Watts
INPUT POWER – LOW: (13.6V)(4.4A) = 59.84 Watts

2.1033(c)(9) **Tune-up procedure.** The tune-up procedure is included.

2.1033(c)(10) **Complete Circuit Diagrams:** The circuit diagram is included. The block diagram is included.

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2.1033(c)(10) Description of all circuitry and devices provided for determining and stabilizing frequency is included in the circuit description.

2.1033(c)(11) A photograph or drawing of the equipment identification label is included.

2.1033(c)(12) Photographs of the equipment of sufficient clarity to reveal equipment construction and layout and label location are included.

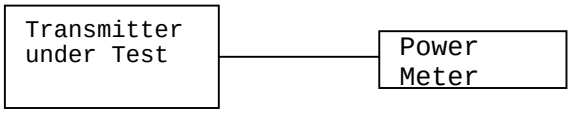
2.1033(c)(13) Digital Modulation is not allowed.

2.1033(c)(14) The data required for 2.1046 through 2.1057 is submitted below.

2.1046(a) **RF POWER OUTPUT**

RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

OUTPUT POWER: HIGH – 50 Watts
LOW - 5 Watts



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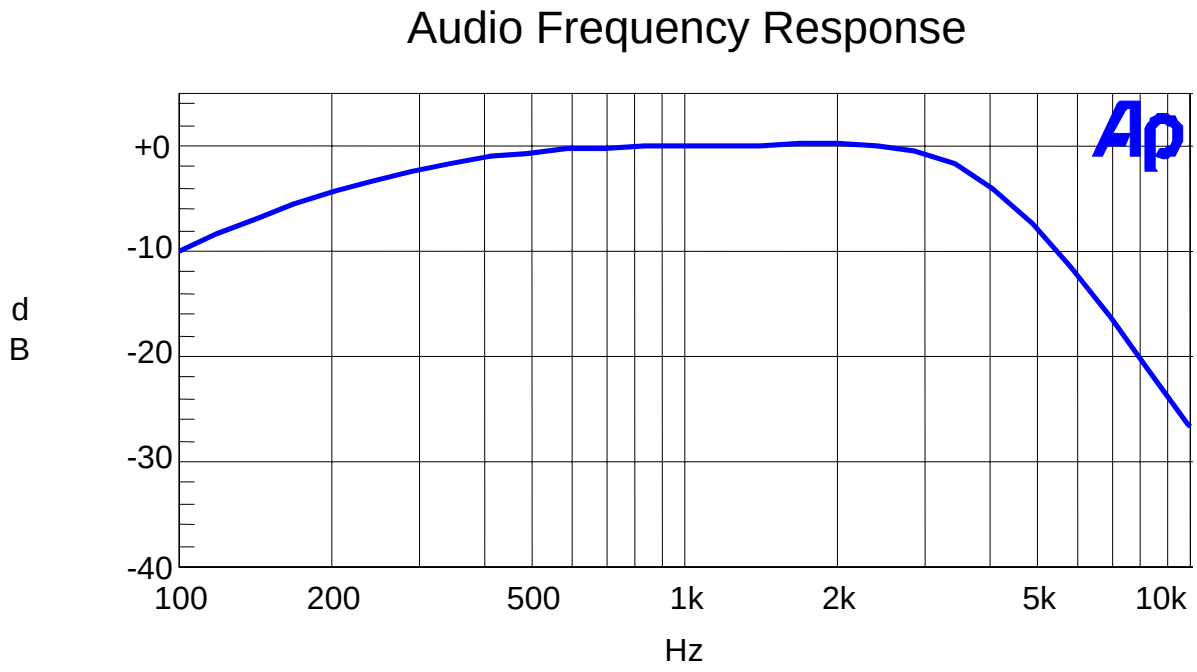
2.1047(a)(b) **Modulation characteristics:**

AUDIO FREQUENCY RESPONSE

The audio frequency response was measured in accordance with TIA/EIA Specification 603. 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.



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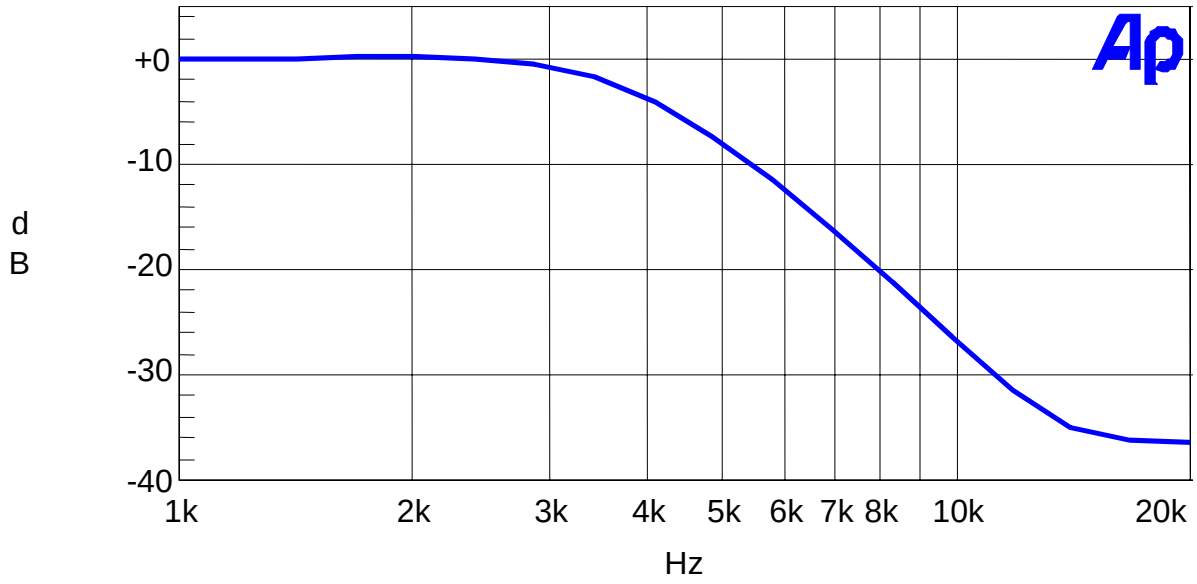
2.1047(a) **Voice modulated communication equipment:**

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



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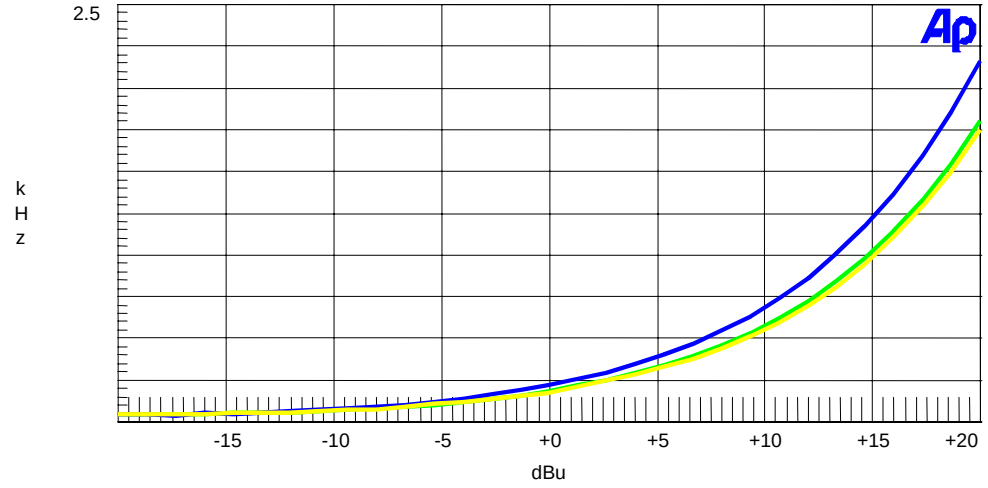
2.1047(b) **Audio input versus modulation**

The audio input level needed for a particular percentage of modulation was measured in accordance with TIA/EIA Specification 603. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

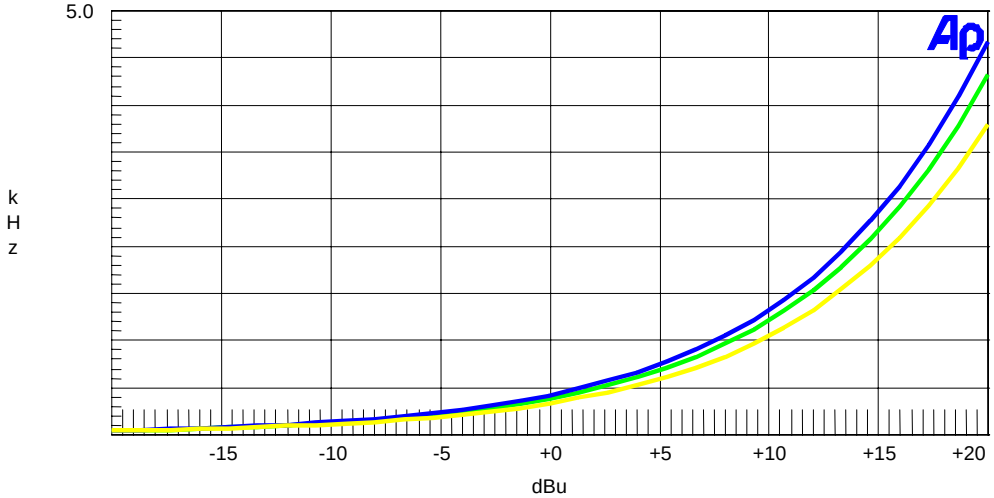
Modulation Limiting Plots:

2.5 KHz (Green), 1.0 KHz (Blue), and 300 Hz



Modulation Limiting Plots:

2.5 KHz (Green), 1.0 KHz (Blue), and 300 Hz



2.1049 Occupied bandwidth:

2.1049(c) EMISSION BANDWIDTH:

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.

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.

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.

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.

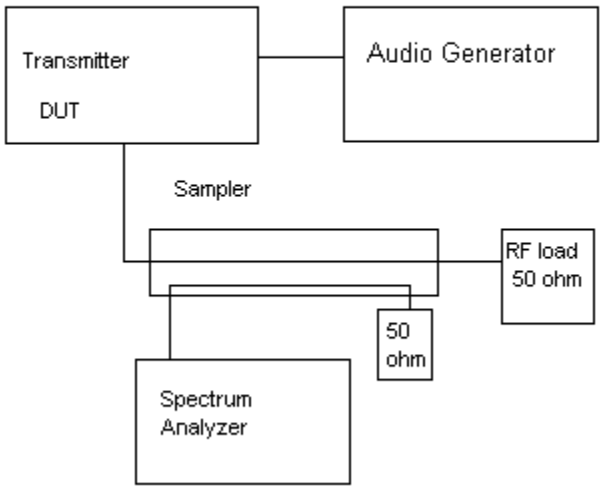
(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6kHz: At least 55 + 10log(P) dB or 65 dB, whichever is the lesser attenuation.

Radiotelephone transmitter with modulation limiter:

Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT

Occupied BW Test Equipment Setup



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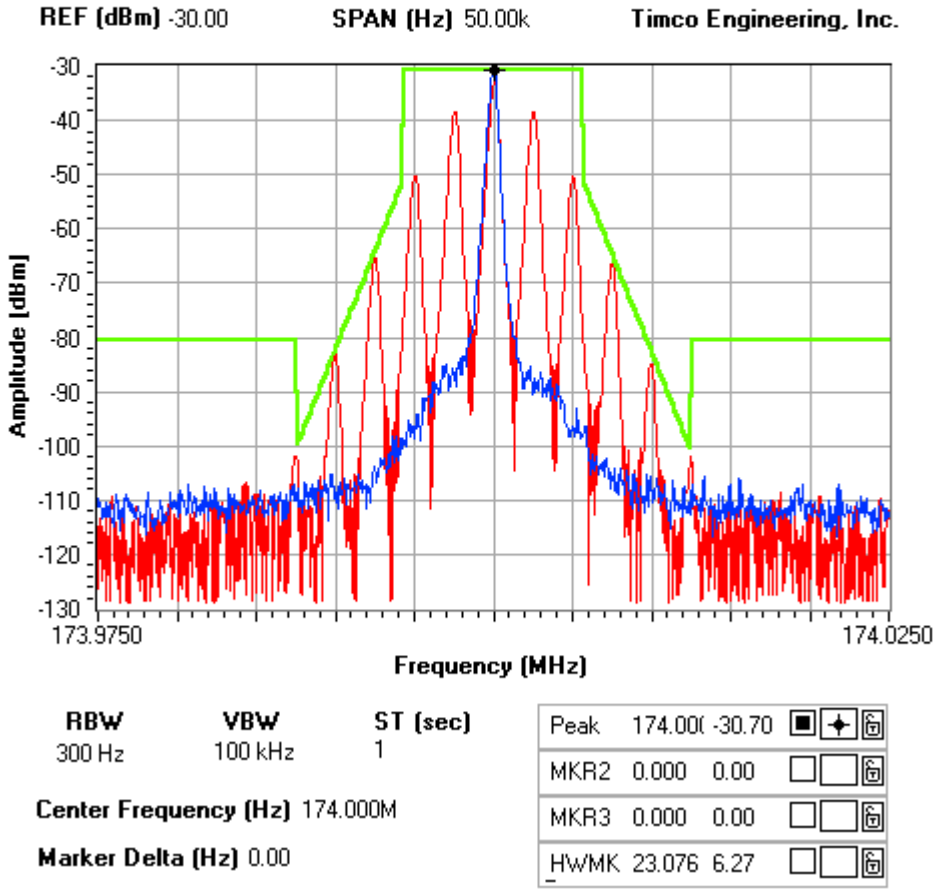
OCCUPIED BANDWIDTH
12.5 kHz

NOTES:
Tactical Electronics Corporation - FCC ID: AFJ IC-F521
OCCUPIED BANDWIDTH PLOT

FCC 90.210 Mask D



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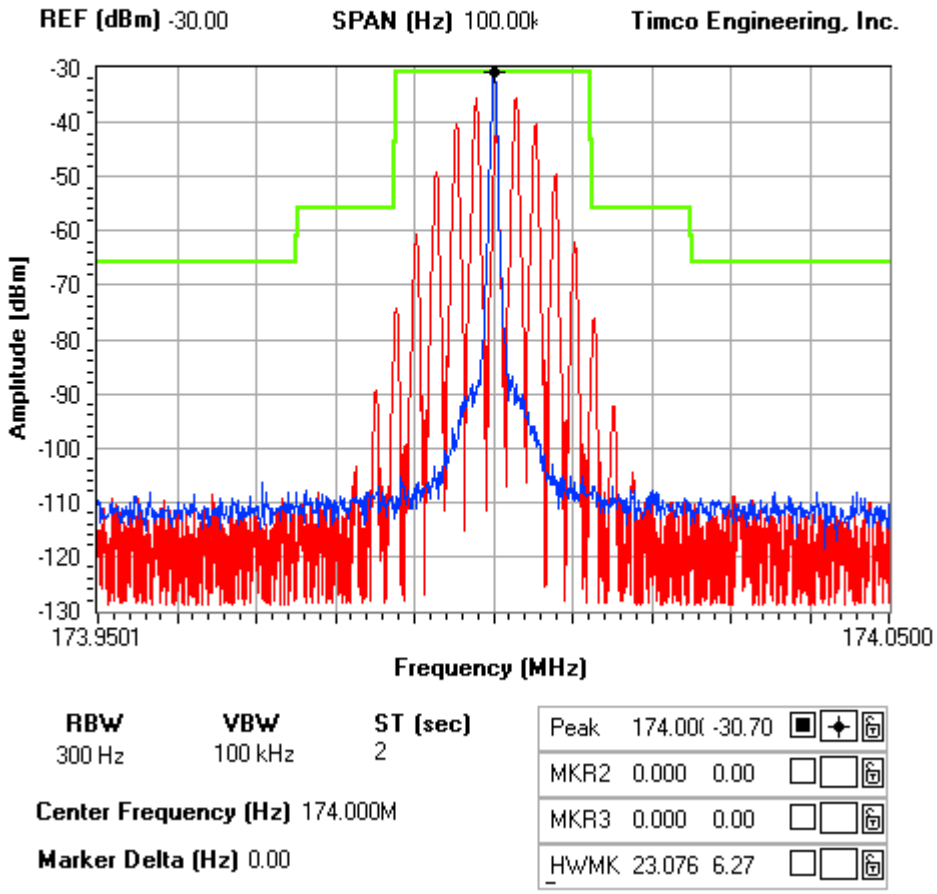
OCCUPIED BANDWIDTH
25 kHz

NOTES:
Tactical Electronics Corporation - FCC ID: AFJ IC-F521
OCCUPIED BANDWIDTH PLOT

FCC 90.210 Mask B



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2.1051(a) **Spurious emissions at antenna terminals (conducted):**

Data below shows the level of conducted spurious responses. 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 TIA/EIA-603.

FCC Limit for:

12.5kHz Spacing = HIGH: 67 dB
LOW: 57 dB

TF HIGH POWER	EF	dB below carrier	TF LOW POWER	EF	dB below carrier
136	136	0.0	136	136	0.0
	272	82.0		272	77.4
	408	71.1		408	63.3
	544	92.6		544	101.7
	680	82.0		680	73.8
	816	105.0		816	94.7
	952	97.6		952	87.5
	1088	111.3		1088	702.8
	1224	101.9		1224	92.7
	1360	115.1		1360	103.7

TF HIGH POWER	EF	dB below carrier	TF LOW POWER	EF	dB below carrier
174	174	0.0	174	174	0.0
	348	89.4		348	93.0
	522	80.1		522	73.0
	696	111.7		696	101.8
	870	108.5		870	90.9
	1044	105.6		1044	95.5
	1218	94.2		1218	93.5
	1392	104.4		1392	96.3
	1566	94.9		1566	92.4
	1740	104.1		1740	95.6

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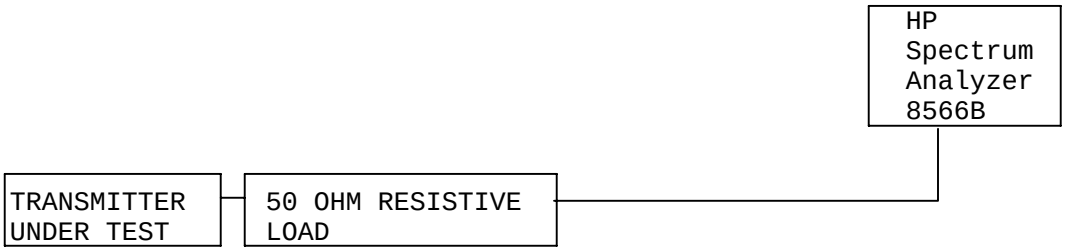
Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 STANDARD without any exceptions. The measurements were made at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

2.1053 **Field strength of spurious emissions:**

NAME OF TEST: **RADIATED SPURIOUS EMISSIONS**

REQUIREMENTS: The FCC Limits for radiated emissions are the same as previously stated for the conducted emissions.

TEST DATA (HIGH):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
136.00	0	46.99	0	0	0
272.00	H	-43.80	0	-1.15	91.94
408.00	H	-52.70	0	-0.38	100.07
544.00	H	-57.80	0	-0.55	105.34
680.00	H	-55.80	0	0.07	102.72
816.00	H	-48.50	0	-1.22	96.71
952.00	H	-56.00	0	-1.17	104.16
1088.00	H	-45.30	1.02	3.3	90.01
1224.00	V	-53.40	1.04	3.85	97.58
1360.00	V	-51.40	1.07	4.39	95.07

TEST DATA (LOW):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
136.00	V	37.00	0	0	0
272.00	H	-39.00	0	-1.15	77.15
408.00	H	-57.30	0	-0.38	94.68
544.00	H	-62.10	0	-0.55	99.65
680.00	H	-61.30	0	0.07	98.23
816.00	H	-54.90	0	-1.22	93.12
952.00	V	-55.60	0	-1.17	93.77
1088.00	H	-52.60	1.02	3.3	87.32
1224.00	V	-52.30	1.04	3.85	86.49
1360.00	V	-51.00	1.07	4.39	84.68

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2.1053 **Field strength of spurious emissions:**

NAME OF TEST: **RADIATED SPURIOUS EMISSIONS**

REQUIREMENTS: The FCC Limits for radiated emissions are the same as previously stated for the conducted emissions.

TEST DATA (HIGH):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
174.00	0	46.99	0	0	0
348.00	H	-37.50	0	-1.15	85.64
522.00	H	-45.50	0	-0.56	93.05
696.00	H	-58.60	0	0.13	105.46
870.00	V	-50.50	0	-0.79	98.28
1044.00	H	-49.70	1.01	3.13	94.57
1218.00	V	-43.00	1.04	3.82	87.21
1392.00	V	-58.00	1.08	4.52	101.55
1566.00	H	-51.80	1.11	4.99	94.91
1740.00	V	-46.60	1.15	5.09	89.65

TEST DATA (LOW):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
174.00	0	37.00	0	0	0
348.00	H	-47.60	0	-1.15	85.75
522.00	H	-54.10	0	-0.56	91.66
696.00	H	-62.00	0	0.13	98.87
870.00	V	-54.80	0	-0.79	92.59
1044.00	V	-48.10	1.01	3.13	82.98
1218.00	V	-45.10	1.04	3.82	79.32
1392.00	H	-53.20	1.08	4.52	86.76
1566.00	H	-53.10	1.11	4.99	86.22
1740.00	H	-52.30	1.15	5.09	85.36

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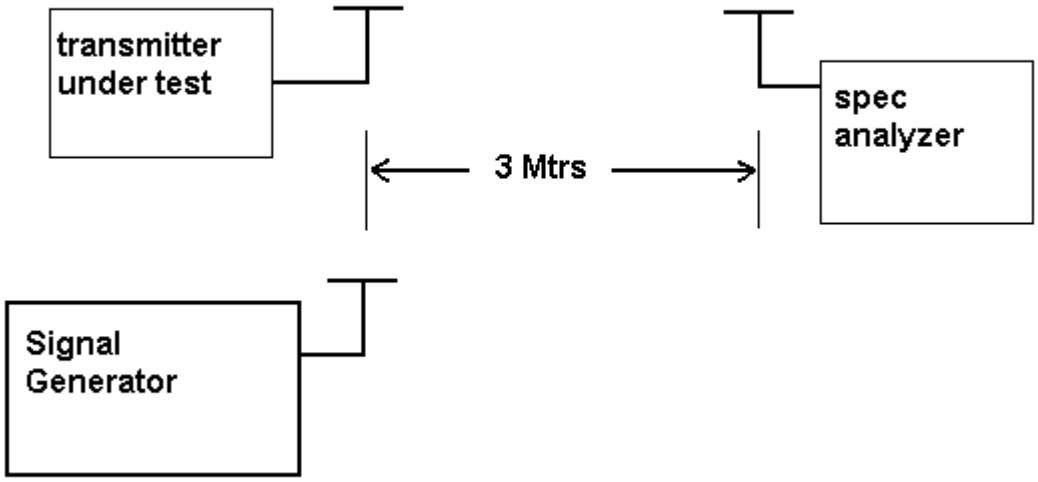
Method of Measuring Radiated Spurious Emissions



METHOD OF MEASUREMENTS: 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 TIA/EIA STANDARD 603 using the substitution method. Measurements were made at the open field test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

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2.1055
90.213 (a)(1)
90.266 (b)(3)

Frequency stability:

Frequency Stability Requirement: 5 ppm

Temperature range requirements: -30 to +50° C.

Voltage Variation +,- 15%.

Measurement procedure per TIA/EIA 603.

MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 173.999 927 MHz

TEMPERATURE_°C	FREQUENCY_MHz	PPM
REFERENCE	173.999 927	00.0
-30	173.999 669	- 1.48
-20	173.999 635	- 1.68
-10	173.999 660	- 1.53
0	173.999 719	- 1.20
+10	173.999 813	- 0.66
+20	173.999 927	0.00
+30	174.000 020	+ 0.53
+40	174.000 167	+ 1.38
+50	174.000 288	+ 2.07

BATT	%BATT.	BATT DATA	BATT. PPM
-15%	11.56	173.999 958	+ 0.18

RESULTS OF MEASUREMENTS: The test results indicates that the EUT meets the requirements.

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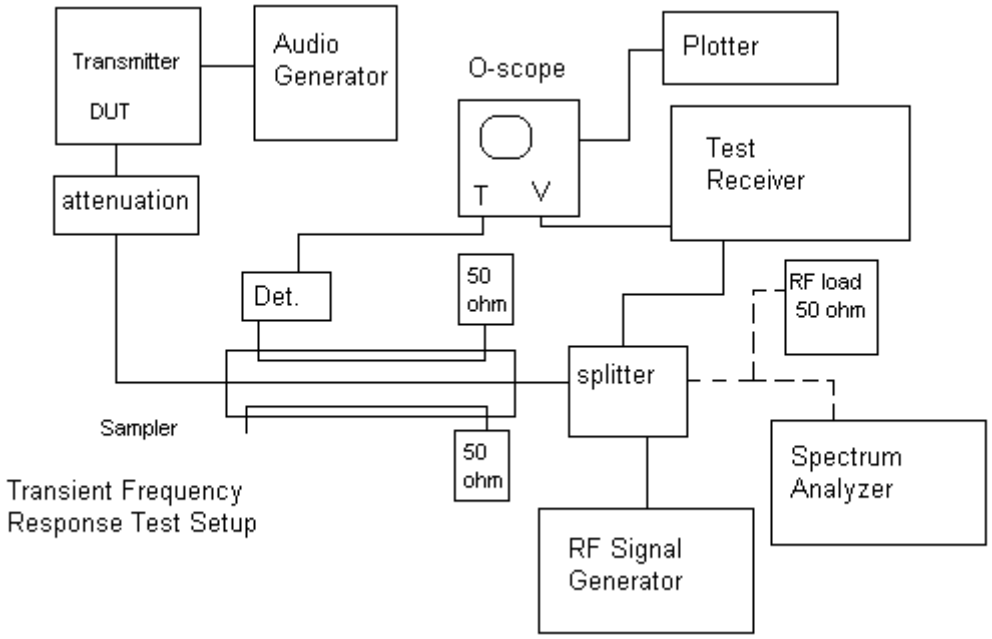
2.1055(a)(1) **Frequency stability:**
90.214 **Transient Frequency Behavior**

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: TIA/EIA TS603 PARA 2.2.19, 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 & recorded.



Transient Frequency Response Test Setup

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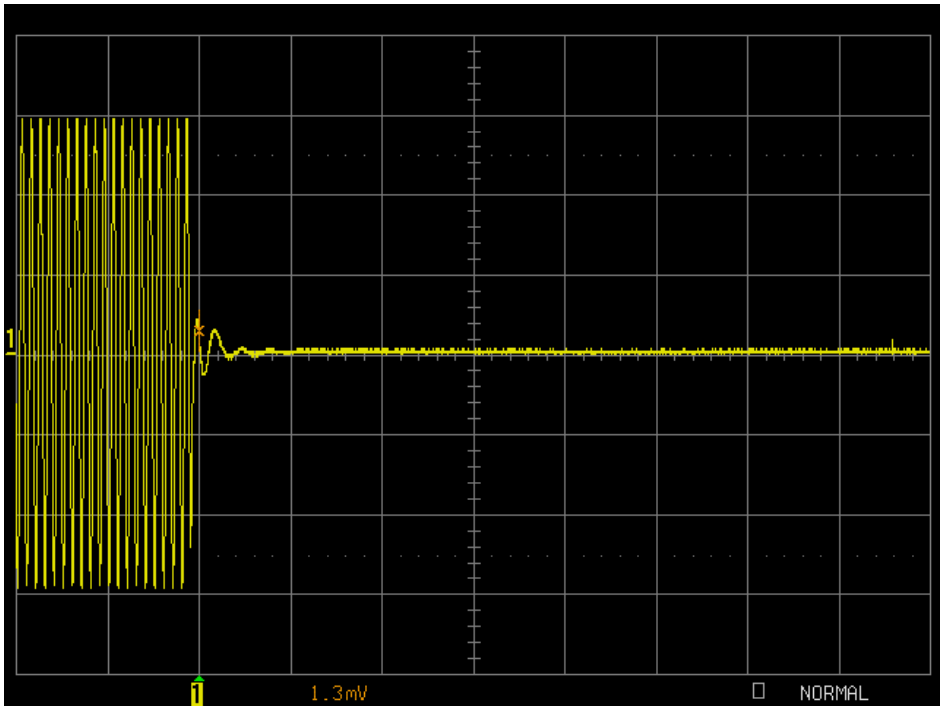
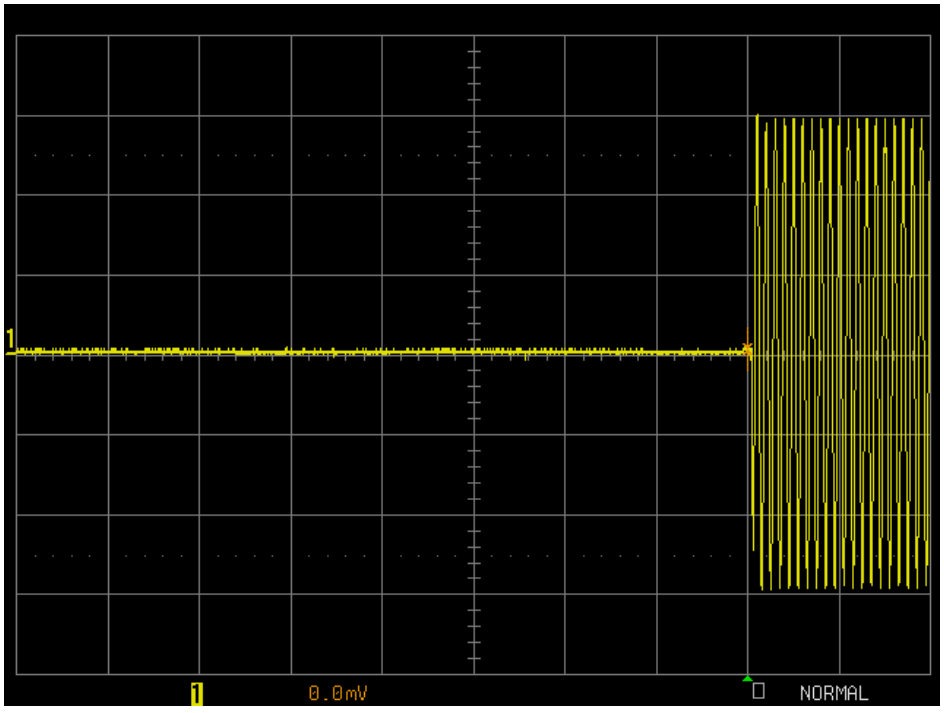
TRANSIENT FREQUENCY RESPONSE PLOT
12.5 kHz – LOW POWER





APPLICANT: TACTICAL ELECTRONICS CORPORATION
FCC ID: EFOIC-F521
REPORT #: T\Tactical_EFO\1892UT4\1892UT4TestReport.doc

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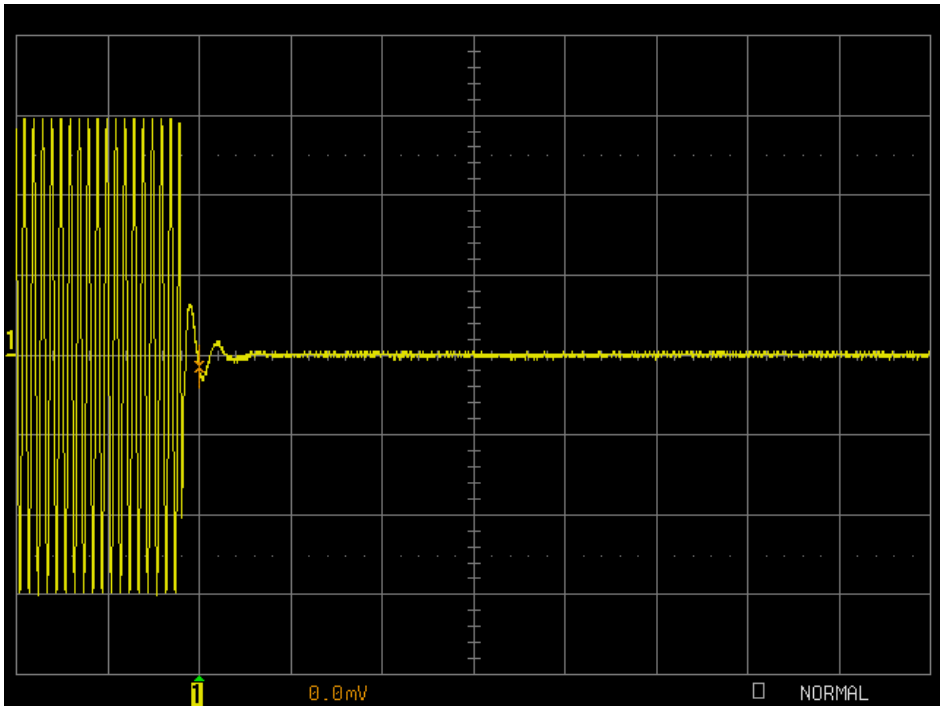
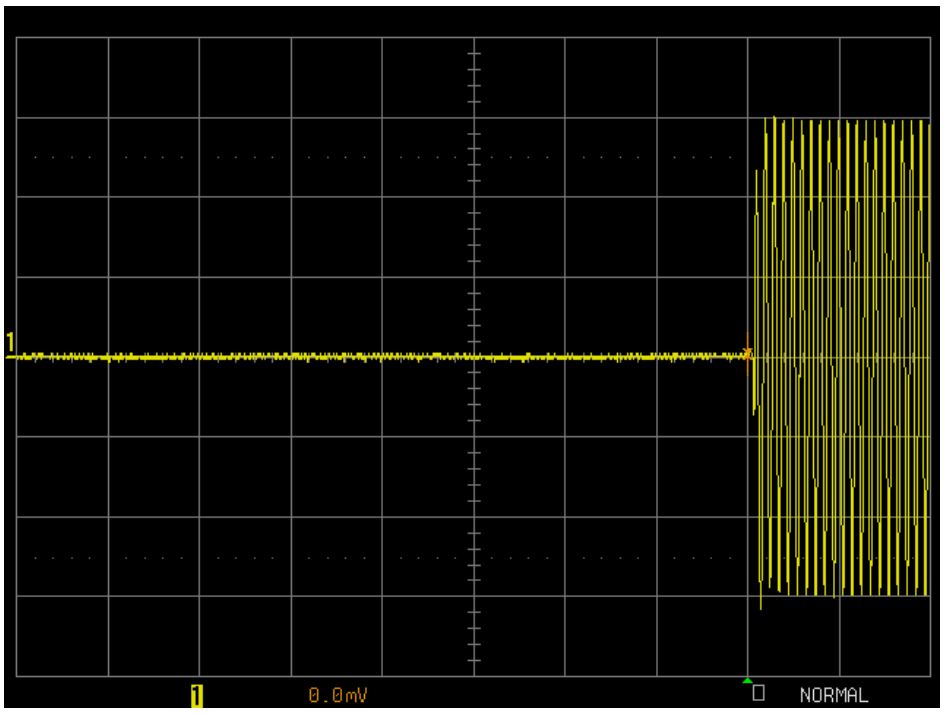
TRANSIENT FREQUENCY RESPONSE PLOTS
12.5 kHz – HIGH POWER





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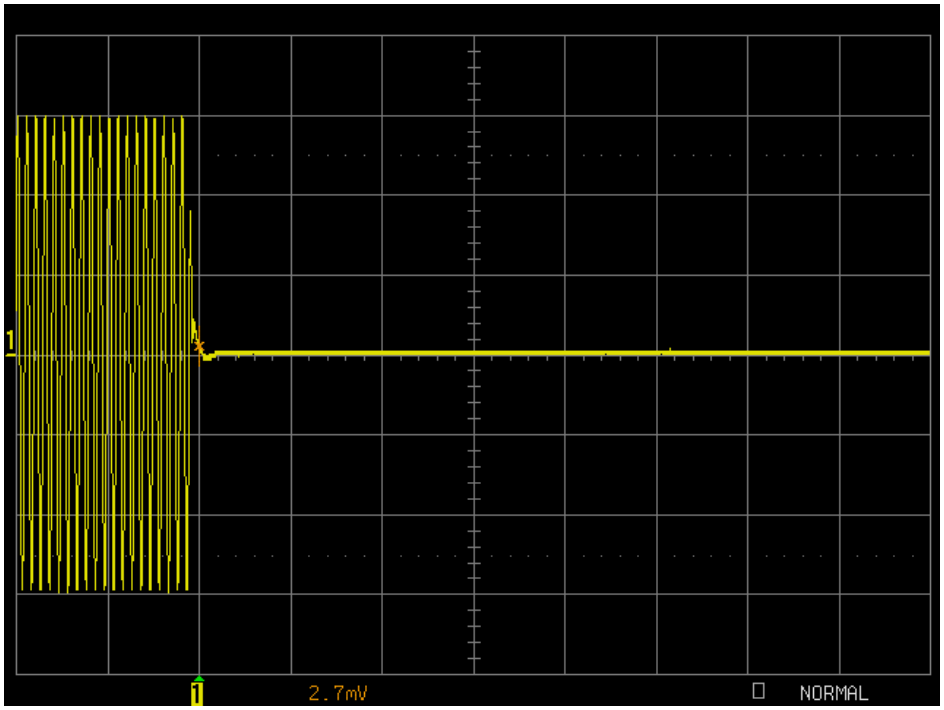
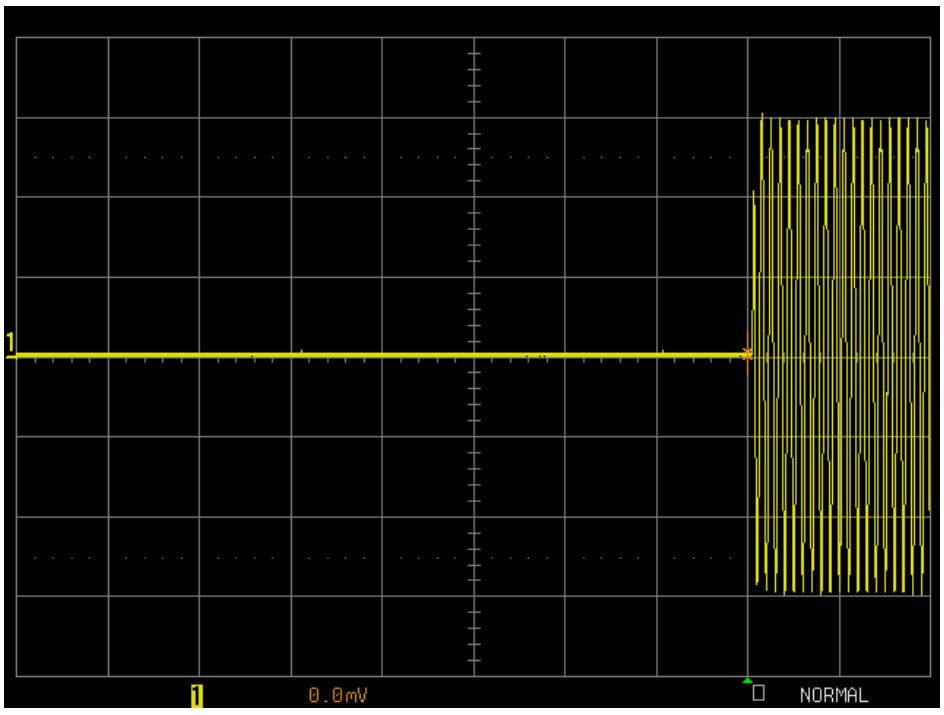
TRANSIENT FREQUENCY RESPONSE PLOTS
25 kHz – LOW POWER





TIMCO ENGINEERING INC.
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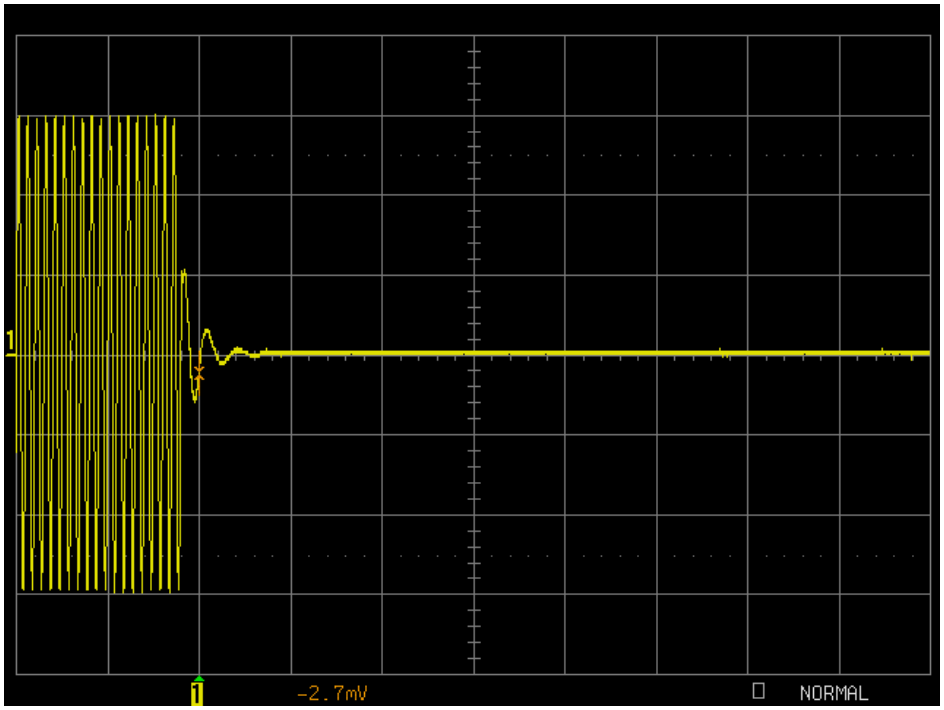
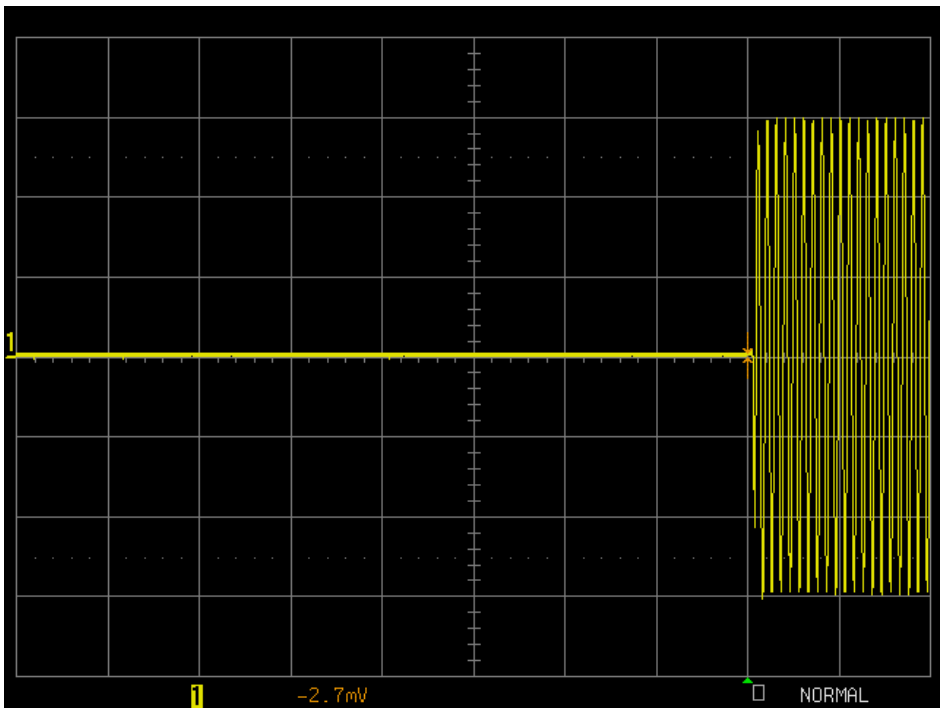
TRANSIENT FREQUENCY RESPONSE PLOTS
25 kHz – HIGH POWER





APPLICANT: TACTICAL ELECTRONICS CORPORATION
FCC ID: EFOIC-F521
REPORT #: T\Tactical_EFO\1892UT4\1892UT4TestReport.doc

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EMC Equipment List

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 9/23/03	9/23/05
Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 9/23/03	9/23/05
Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 9/23/03	9/23/05
Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 9/23/03	9/23/05
Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/26/01	4/26/03
Log-Periodic Antenna	Electro-Metrics	LPA-25	1122	CAL 8/26/04	8/26/06
Double-Ridged Horn Antenna	Electro-Metrics	RGA-180	2319	CAL 2/17/03	2/17/05
LISN	Electro-Metrics	ANS-25/2	2604	CAL 8/27/04	8/27/06
Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 7/16/04	7/16/06
Oscilloscope	Tektronix	2230	300572	CAL 7/3/03	7/3/05
System One	Audio Precision	System One	SYS1-45868	CHAR 4/25/02	4/25/04
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 1/22/02	1/22/04
Digital Multimeter	Fluke	77	35053830	CHAR 1/8/02	1/8/04
Peak Power Meter	HP	8900C	2131A00545	CAL 7/2/03	7/2/05
Power Sensor	Agilent Technologies	84811A	2551A02705	CAL 7/2/03	7/2/05
Power Meter	HP	432A	1141A07655	CAL 4/15/03	4/15/05
Digital Thermometer	Fluke	2166A	42032	CAL 7/19/04	7/19/06
Frequency Counter	HP	5352B	2632A00165	CAL 8/3/04	8/3/06
Service Monitor	IFR	FM/AM 500A	5182	CAL 11/22/00	Out of Service
Signal Generator	HP	8640B	2308A21464	CAL 8/26/04	8/26/06
Modulation Analyzer	HP	8901A	3435A06868	CAL 9/5/01	9/5/03
Egg Timer	Unk			CHAR 2/1/02	2/1/04
Measuring Tape-20M	Kraftixx	0631-20		CHAR 2/1/02	2/1/04