TIMCO ENGINEERING, Inc.

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FCC PART 90

TEST REPORT

APPLICANT	Tactical Electronics Corporation
	4000 Dow Road
	Melbourne Fl. 32934 USA
FCC ID	EFOSX450G
MODEL NUMBER	SX450G
PRODUCT DESCRIPTION	UHF TRANSCEIVER
DATE SAMPLE RECEIVED	10/9/2006
DATE TESTED	10/25/2006
TESTED BY	RICHARD BLOCK
APPROVED BY	MARO DE ARANZETA
TIMCO REPORT NO.	2828AUT6TestReport.doc
TOTAL PAGES	
TEST RESULTS	☒ PASS ☐ FAIL

ACCREDITED
Certificate # 0955-01

TABLE OF CONTENTS

STATEMENT OF COMPLIANCE

This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards. No modifications were made to the equipment during testing in order to demonstrate compliance with these standards.

I attest that the necessary measurements were made by me or under my supervision, at Timco Engineering, Inc. located at 849 N.W. State Road 45, Newberry, Florida 32669 USA.

All Timco instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

ACCREDITED
Certificate #0955-01

Authorized by: Mario de Aranzeta

Signature: <*Mario de Aranzeta*>

Function: Engineer

Date: 12/22/2006

Tested by: Richard Block

Date: 10/26/2006

GENERAL INFORMATION

DUT Specification

The test results relate only to the items tested.	
DUT Description	UHF TRANSCEIVER
FCC ID	EFOSX450G
Model Number	SX450G
Operating Frequency	450-470 MHz
No. of Channels	Single
Type of Emission	F3E, F1D
Modulation	FM
DUT Power Source	☐ 110–120Vac/50– 60Hz
	☒ DC Power
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☒ Fixed
	☐ Mobile
	☐ Portable
Test Facility	Timco Engineering, Inc. 849 NW State Road 45, Newberry, FL 32669
Test Condition	The temperature was 26ºC with a relative humidity of 50%.
Modification to the DUT	None
Test Exercise (e.g software description, test signal, etc.)	The DUT was in continuous transmit mode.
Antenna	N/A
Antenna Connector	SMB

EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 12/7/05	12/7/07
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 12/7/05	12/7/07
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 12/8/05	12/8/07
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 12/8/05	12/8/07
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	CAL 4/29/05	4/29/07
Antenna: Double-Ridged Horn	Electro-Metrics	RGA-180	2319	CAL 12/29/04	12/29/06

TEST PROCEDURE

Power Line Conducted Interference: The procedure used was ANSI C63.4-2003 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 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 standard TIA/EIA-603 using an Agilent spectrum receiver with pre-selector. 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.

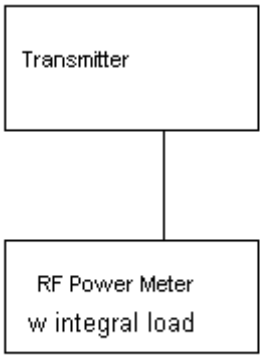
RF POWER OUTPUT

Rule Part No.: Part 2.1046(a)

Test Requirements:

Method of Measurement: RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector.

Test Setup Diagram:



Test Data:

With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

OUTPUT POWER: HIGH – 0.500 Watts Conducted
LOW - 0.005 Watts Conducted

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

DC Voltage: 7.2 Vdc DC Current: 0.4A
DC Power: 2.88 Watts

MODULATION CHARACTERISTICS

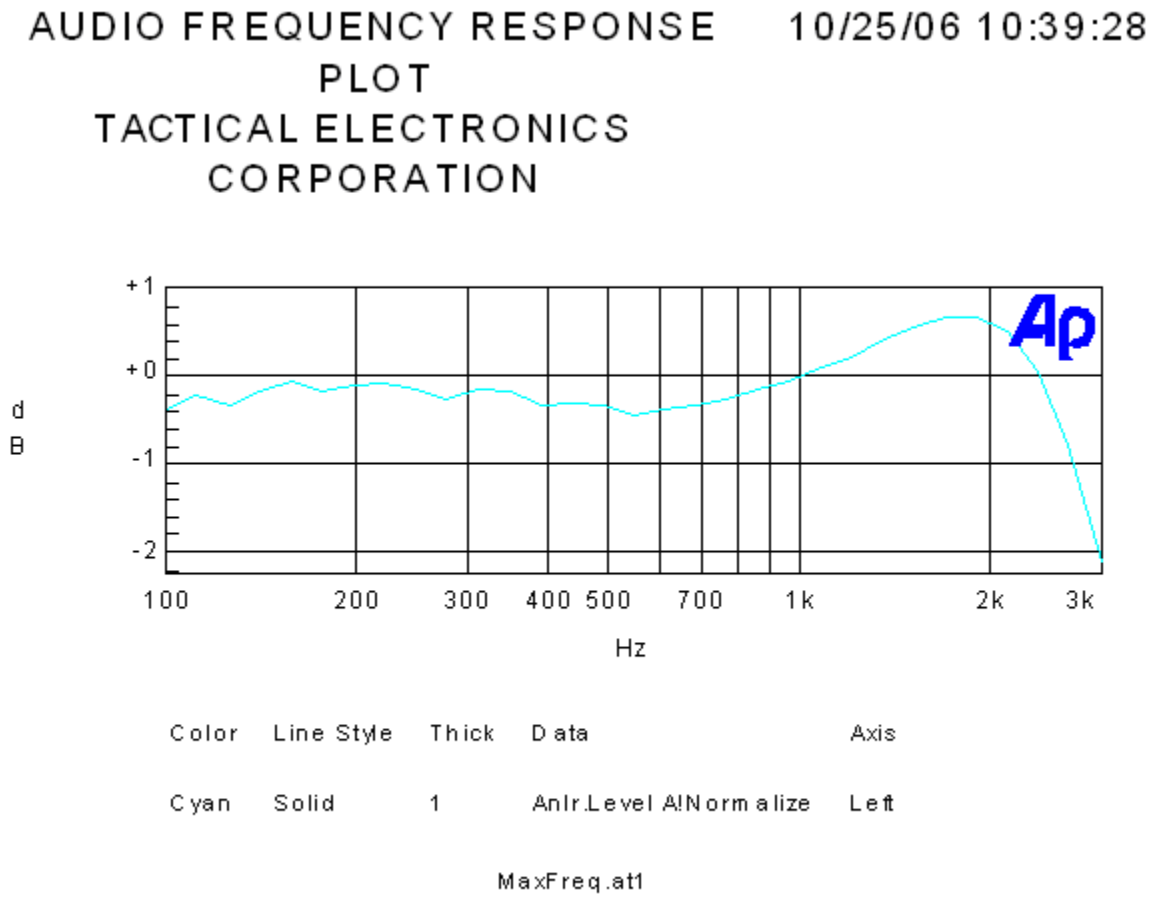
Rule Part No.: Part 2.1047(a)(b)

Test Requirements:

Method of Measurement:

Audio frequency response

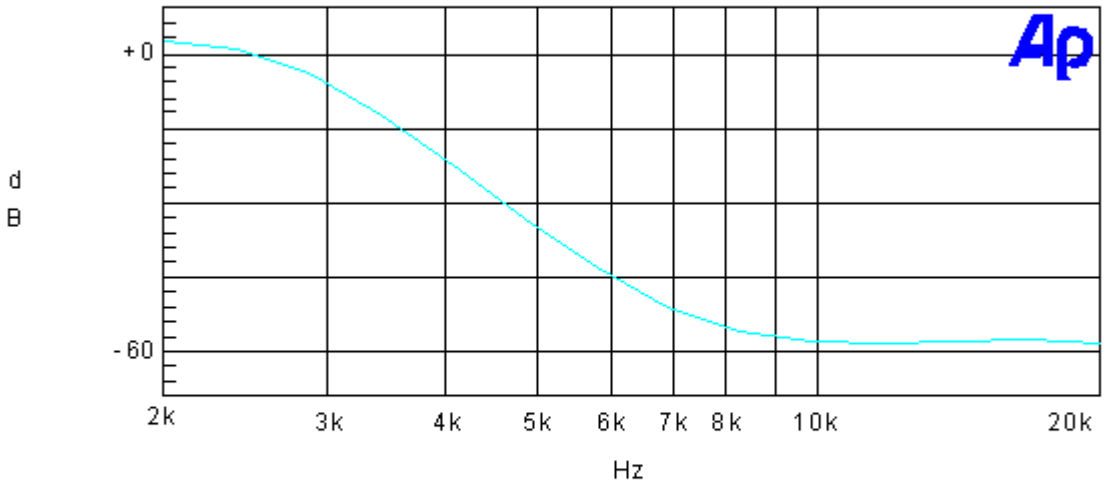
The audio frequency response was measured in accordance with TIA/EIA Specification 603. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 3000Hz shall be submitted. The audio frequency response curve is shown below.



VOICE MODULATED COMMUNICATION EQUIPMENT

Part 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
TACTICAL ELECTRONICS CORPORATION



Color	Line Style	Thick	Data	Axis	Cursor1
Cyan	Solid	1	Anlr.Level A!Normalize	Left	..

MaxFreq.at1

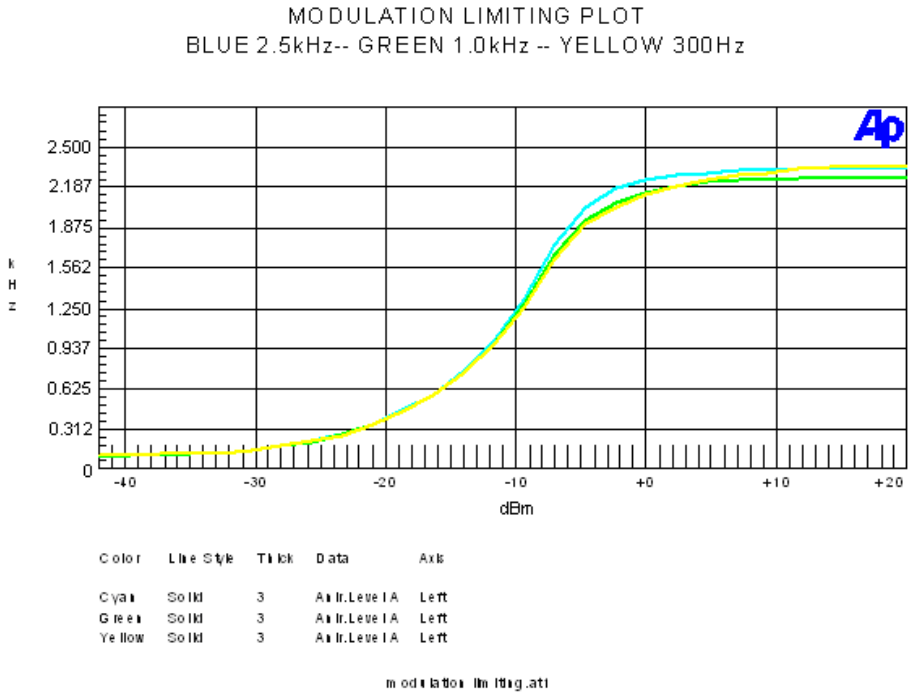
AUDIO INPUT VERSUS MODULATION

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 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.

Test data:



Part 2.1033(c) (4) Type of Emission: 11K2F1D 9K4F3E

Part 90.209

Part 90.207 Bn = 2M + 2DK
M = B/2 = 9600/2
D = 825
K=1
Bn = 2(4800)+2(825) = 11.2k

Part 90.207 Bn = 2M + 2DK
M = 2500
D = 2200
K=1
Bn = 2(2500)+2(2200) = 9400

Occupied Bandwidth

Part 2.1049(c) EMISSION BANDWIDTH:
Part 90.210(b) For equipment equipped with a low pass filter.
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.

Part 90.210(c) For transmitters 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.

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:

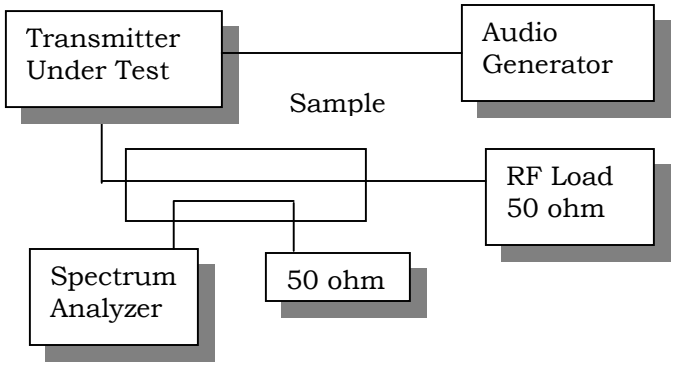
(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.
(2) On any frequency from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27 (fd - 2.88 kHz) dB.
(3) On 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.

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 4.6kHz: At least 55 + 10log(P) dB or 65 dB, whichever is the lesser attenuation.

OCCUPIED BANDWIDTH

Test Setup Diagram:

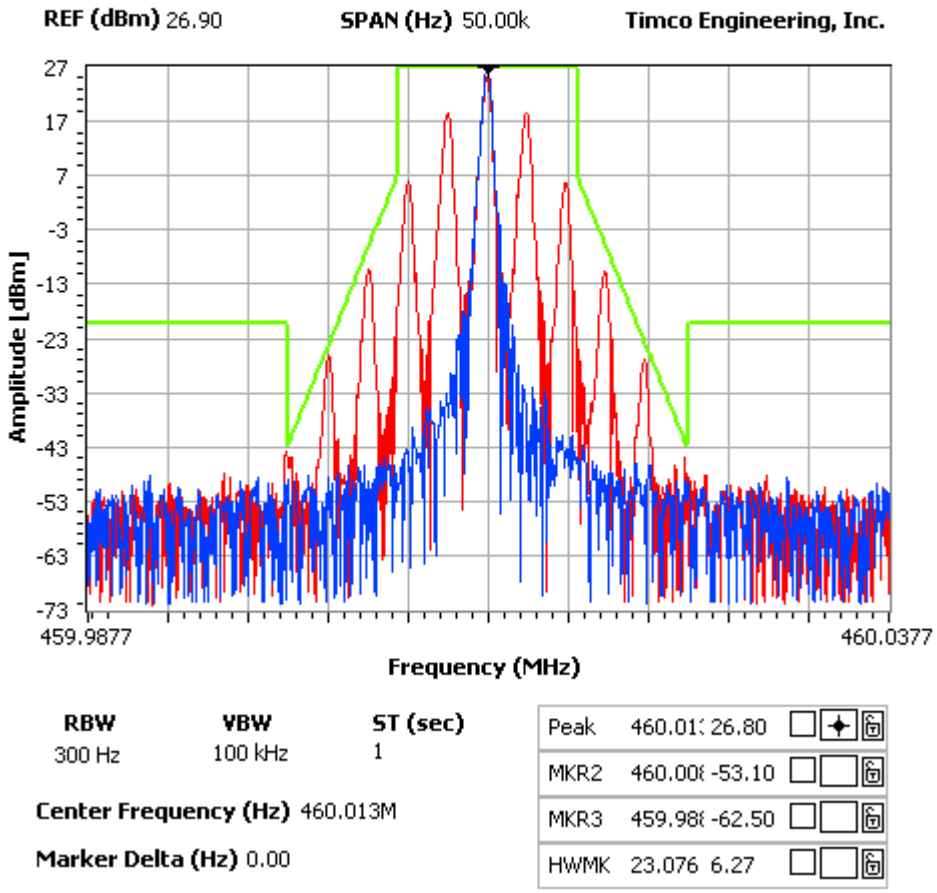


Test Data:

NOTES:

OCCUPIED BANDWIDTH -- 2.5 kHz TONE
TACTICAL ELECTRONICS CORPORATION -- FCC ID: EFOSX450G

FCC 90.210 Mask D



Part 90.210(d) Emission Mask D - 12.5 kHz channel

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a)

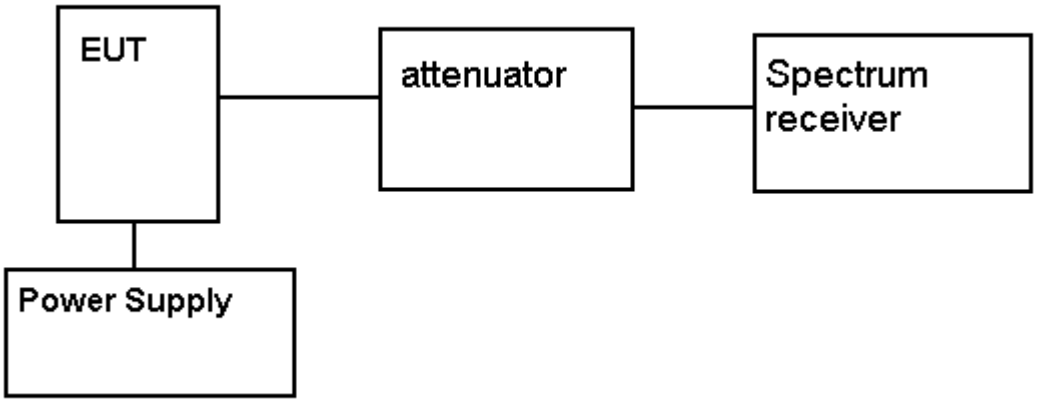
Requirements: FCC Limit for 12.5 kHz Spacing = 50+10LOG(0.5) = 44

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 TIA/EIA-603.

Test Data:

TF HIGH POWER	EF	dB below carrier	TF HIGH POWER	EF	dB below carrier	TF HIGH POWER	EF	dB below carrier
450	450	0	460	460	0	470	470	0
	900	94.7		920	97.6		940	107.3
	1350	93.5		1380	88.8		1410	92.9
	1800	91.8		1840	89.4		1880	91.4
	2250	92.6		2300	95.1		2350	101
	2700	101.1		2760	99.3		2820	98.1
	3150	95.1		3220	95.8		3290	95.3
	3600	98.6		3680	99.2		3760	102.7
	4050	102.8		4140	101.1		4230	103.8
	4500	102.6		4600	104.1		4700	103.9

Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603.

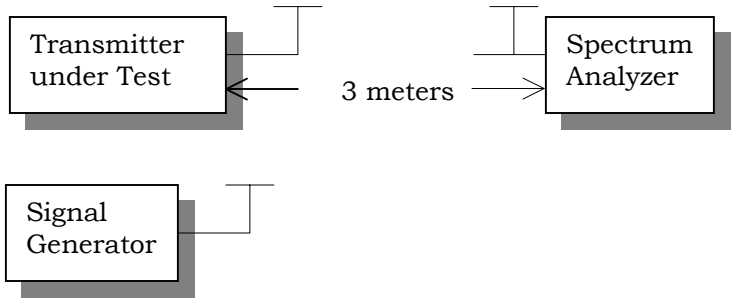
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053

Requirements: The FCC limits for radiated emissions are the same as previously stated for the conducted emissions.

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 TIA/EIA standard 603 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:

Rule Parts. No.: Part 2.1053

Requirements: The FCC limits for radiated emissions are the same as previously stated for the conducted emissions.

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
450.00	0	0
900.00	H	90.45
1350.00	V	79.57
1800.00	V	75.30
2250.00	V	77.92
2700.00	H	80.84
3150.00	V	77.25
3600.00	V	79.63
4050.00	V	79.16
4500.00	V	77.30

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
460.00	0	0
920.00	V	88.47
1380.00	H	80.26
1840.00	V	71.05
2300.00	H	83.84
2760.00	H	81.79
3220.00	V	77.37
3680.00	V	77.73
4140.00	H	81.6
4600.00	H	78.62

Rule Parts. No.: Part 2.1053

Requirements: The FCC limits for radiated emissions are the same as previously stated for the conducted emissions.

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
470.00	0	0
940.00	V	84.13
1410.00	V	77.59
1880.00	V	69.53
2350.00	H	82.84
2820.00	H	80.02
3290.00	V	76.2
3760.00	H	80.93
4230.00	V	76.94
4700.00	V	77.43

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: TIA/EIA 603.

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		
Temperature (°C)	**Frequency (MHz)**	**Frequency Stability (PPM)**
-30	460.012360	-0.66
-20	460.012543	-0.27
-10	460.012665	0.00
0	460.012665	0.00
+10	460.012665	0.00
+20	460.012665	0.00
+30	460.012573	-0.20
+40	460.012482	-0.40
+50	460.012451	-0.47

Assigned Frequency (Ref. Frequency) (MHz)		
% Battery	**Frequency (MHz)**	**Frequency Stability (PPM)**
-15%	460.012665	0.00
0	460.012665	0.00
+15%	460.012665	0.00

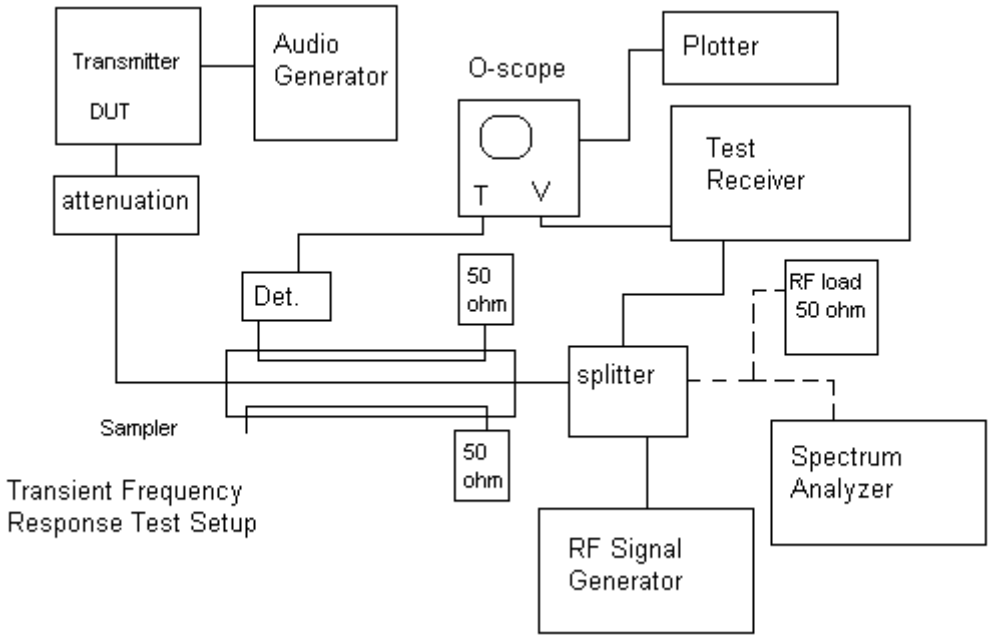
Part 90.214 Transient Frequency Behavior
Part 2.1055(a)(1) Frequency stability:

REQUIREMENTS: Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

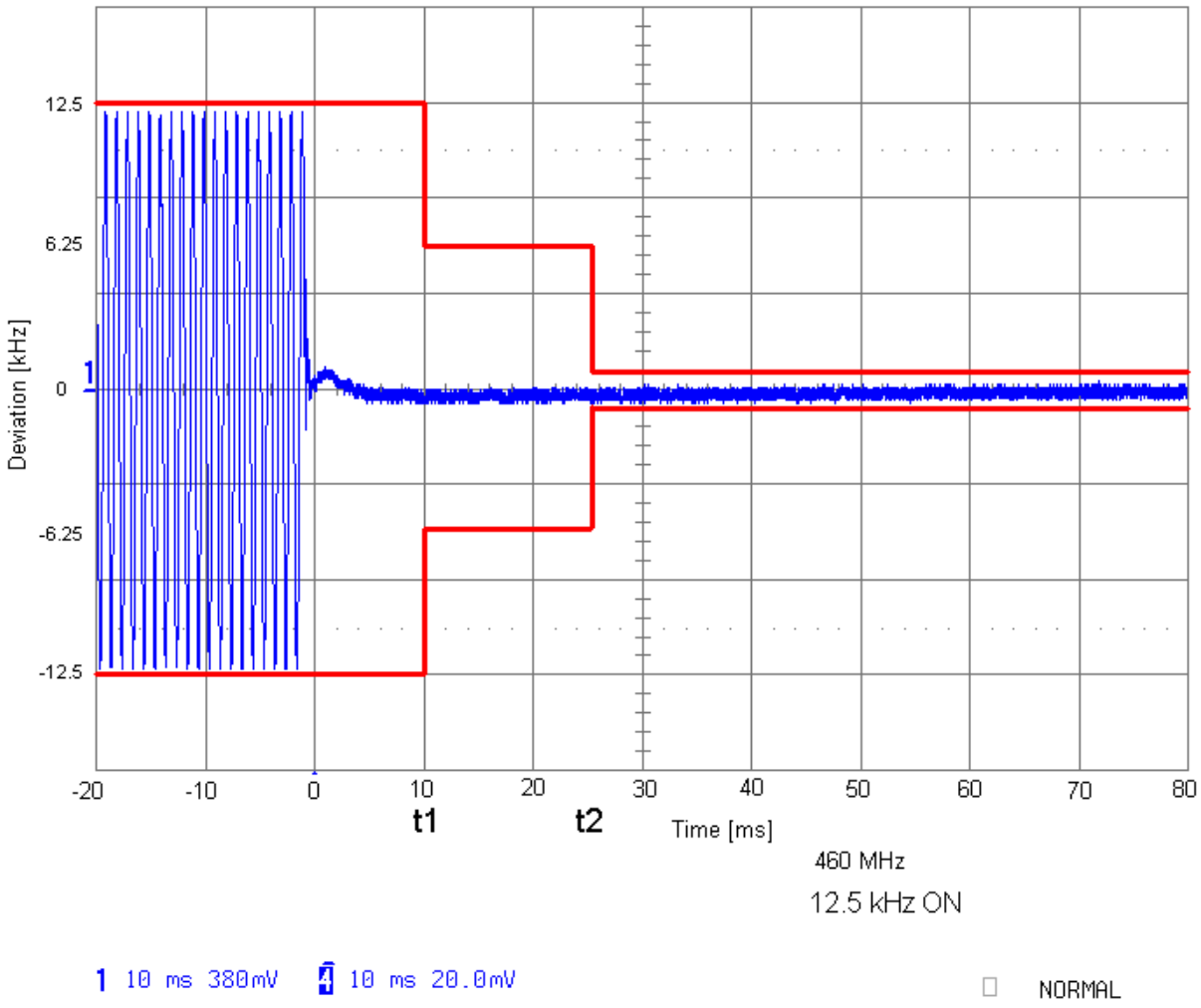
Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1[4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3[4]	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment 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

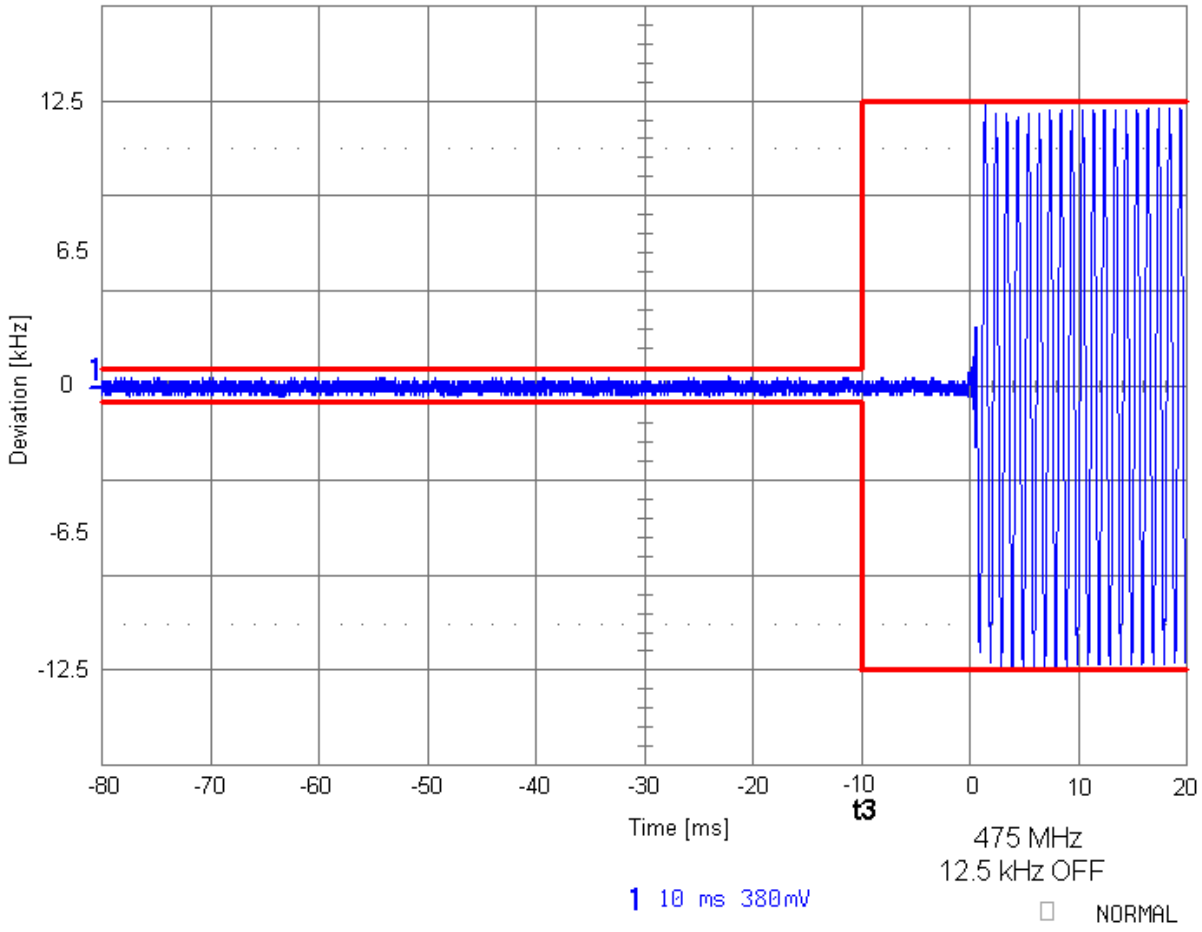
TEST PROCEEDURE: TIA/EIA 603 PARA 2.2.19, the levels were set as follows:

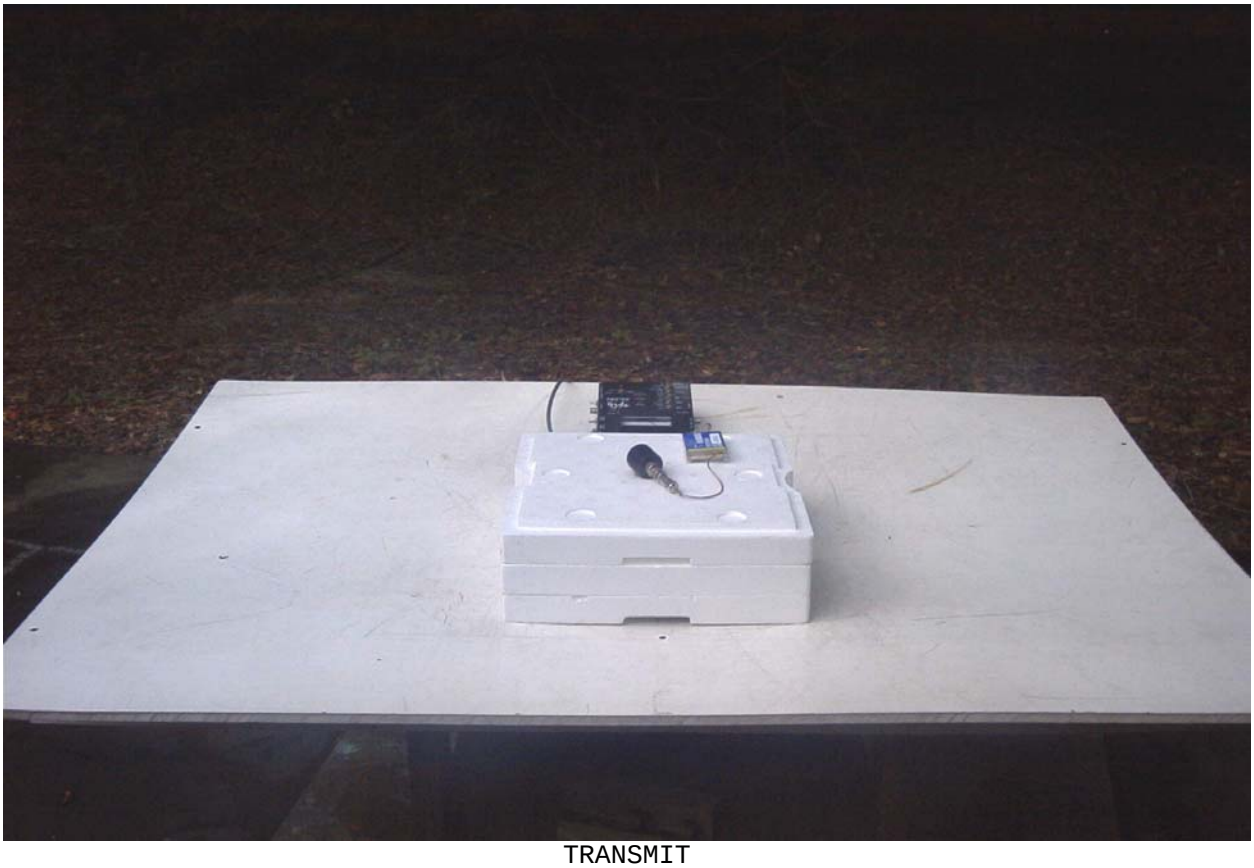
1. Using the variable attenuator the transmitter level was set to 40 dB below the test receivers maximum input level, then the transmitter was turned off.
2. With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained 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


12.5
6.25
0
-6.25
-12.5
Deviation [kHz]
1
-20
-10
0
10
20
30
40
50
60
70
80
t1
t2
Time [ms]
460 MHz
12.5 kHz ON
1 10 ms 380mV
4 10 ms 20.0mV
NORMAL


12.5
6.5
0
-6.5
-12.5
Deviation [kHz]
1
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
t3
Time [ms]
475 MHz
12.5 kHz OFF
1 10 ms 380mV
NORMAL



TRANSMIT

RECEIVE


Tactical Electronics Corp
Tel (321) 253 0845
MODULE
01108 1404 A
SX450G A 51 A 450-470MHz
450 - 470 MHz
S/N: 239647
W/O: 34221
09/08/2006
Tel: +44 (0)118 981 1444
Fax: +44 (0)118 981 1567
e-mail: info@woodanddouglas.co.uk
http://www.woodanddouglas.co.uk
Designed and Manufactured in the UK.
WOOD & DOUGLAS


APPL: Tactical Electronics Corporation
FCC ID: EFO SX-TB1
JOB: 2828AUT6
DATE: 10/09/2006
PART: 90_RSS119_LM