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## FCC PART 90

### TEST REPORT

APPLICANT	CATTRON-THEIMEG INCORPORATED
	58 W. SHENANGO STREET
	SHARPSVILLE PA 16150-1198 USA
FCC ID	CN27700L
MODEL NUMBER	MRM 7700L
PRODUCT DESCRIPTION	UHF TRANSMITTER
DATE SAMPLE RECEIVED	3/27/2013
DATE TESTED	4/1/2013
TESTED BY	Nam Nguyen
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	533UT13TestReport.doc
TOTAL PAGES	21 Pages
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

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





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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 requirements.



Testing Certificate # 0955-01

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:** *Mario de Aranzeta*

Mario de Aranzeta C.E.T.  
Compliance Engineer/ Lab. Supervisor

**Date:**

**Tested by:** Nam Nguyen / Testing Technician

**Signature:**



Applicant: CATTRON-THEIMEG INCORPORATED  
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## GENERAL INFORMATION

### DUT Specification

<b>DUT Description</b>	UHF TRANSMITTER
<b>FCC ID</b>	CN27700L
<b>Model Number</b>	MRM 7700L
<b>Operating Frequency</b>	406.1125 to 419.9875 MHz
<b>Type of Emission</b>	11K2F1D
<b>Modulation</b>	2GFSK
<b>DUT Power Source</b>	<input type="checkbox"/> 110-120Vac/50- 60Hz
	<input checked="" type="checkbox"/> DC Power 12V
	<input type="checkbox"/> Battery Operated Exclusively
<b>Test Item</b>	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
<b>Type of Equipment</b>	<input checked="" type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
<b>Test Conditions</b>	The temperature was 26°C relative humidity of 50%.
<b>Modification to the DUT</b>	None
<b>Test Exercise</b>	The DUT was placed in continuous transmit mode.
<b>Applicable Standards</b>	ANSI/TIA 603-C:2004, FCC CFR 47 Part 90
<b>Test Facility</b>	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

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## EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	10/28/11	10/28/13
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	10/28/11	10/28/13
Analyzer Silver Tower Spectrum Analyzer	HP	8566B Opt 462	3552A22064 3638A08608	01/02/13	01/02/15
Horn Antenna	ETS	3117	35923	12/7/11	12/7/13
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/04/11	05/04/13
Antenna	Electro-metrics	BIA-25	1096	5/04/11	5/04/13
Frequency Counter	HP	5385A	2730A03025	08/17/11	08/17/13
Signal Generator	HP	8640B	2308A21464	02/23/12	02/23/14
Hygro-Thermometer	Extech	445703	0602	06/15/11	06/15/13
Power Meter	Boonton Electronics	4531	11793	1/9/13	1/9/15
Digital Multimeter	Fluke	77	35053830	09/09/11	09/09/13
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	10/28/11	10/28/13
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	10/28/11	10/28/13
Temperature Chamber	Tenney Engineering	TTRC	11717-7	07/03/12	07/03/14
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13
Attenuator	NARDA	768-20	111	12/31/11	12/31/13



## TEST PROCEDURE

**Power Line Conducted Interference:** The procedure used was ANSI/TIA 603-C: 2004, using a 50uH LISN. Both lines were observed with the DUT 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 10<sup>th</sup> 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-C: 2004, using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum ANSI/TIA 603-C: 2004, 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

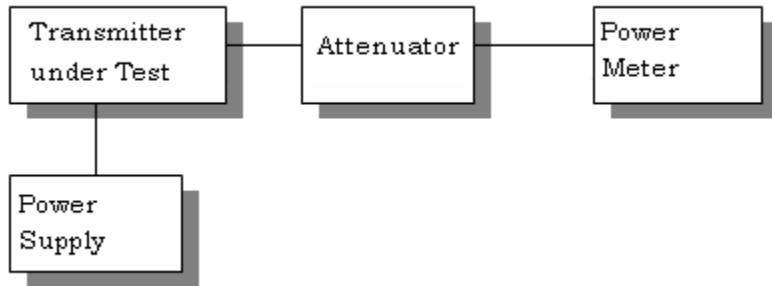
**Rule Part No.:** Part 2.1046(a), Part 90

### Test Requirements:

**Method of Measurement:** 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:

For the device has a fixed antenna, RF power is measured as ERP as the antenna is permanently attached. The substitution method was used. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

### Test Setup Diagram:



### Test Data:

#### OUTPUT POWER:

Tuned Frequency (MHz)	RF POWER (W)	
	HI	LOW
406.50	0.23	0.10
413.50	0.25	0.10
419.50	0.24	0.10

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

$$(3.30V)(0.50A) = 1.65 \text{ Watts}$$



## 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 ANSI/TIA 603-C: 2004. 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

Not applicable, Data radio only

## 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.

Not applicable  
Data radio only

## 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 ANSI/TIA 603-C: 2004. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

### Modulation Limiting Plot

Not applicable  
Data radio only

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## OTHER MODULATION CHARACTERISTICS

### **Part 2.1033(c)**

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

**Part 90.209**

**Part 90.207**

$$B_n = 2M + 2DK$$

$$M = B/2 = 9600/2 = 4800$$

$$D = 800$$

$$K=1$$

$$B_n = 2(4800) + 2(800) = 11.2k$$

Transceiver uses 2GFSK modulation.



## 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  $f_0$  to 5.625 kHz removed from  $f_0$ : 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  $7.27 (fd - 2.88)$  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  $50 + 10\log(P)$  dB or 70 dB, whichever is the lesser attenuation.

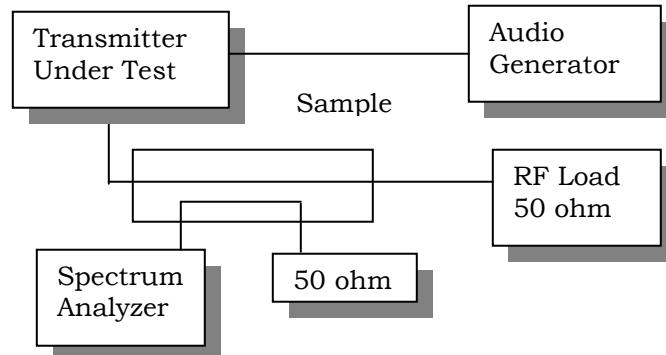
**Part 90.210(e)      Emission Mask E - 6.25 kHz channel BW equipment.**

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  $f_0$  to 3.0 kHz removed from  $f_0$ : 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  $30 + 16.67(fd - 3.0)$  dB or 55 + 10 Log(P) or 65, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10\log(P)$  dB or 65 dB, whichever is the lesser attenuation.

**Method of Measurement: ANSI/TIA 603-C: 2004**

**Test Setup Diagram:**



**Test Data:** See the plots below

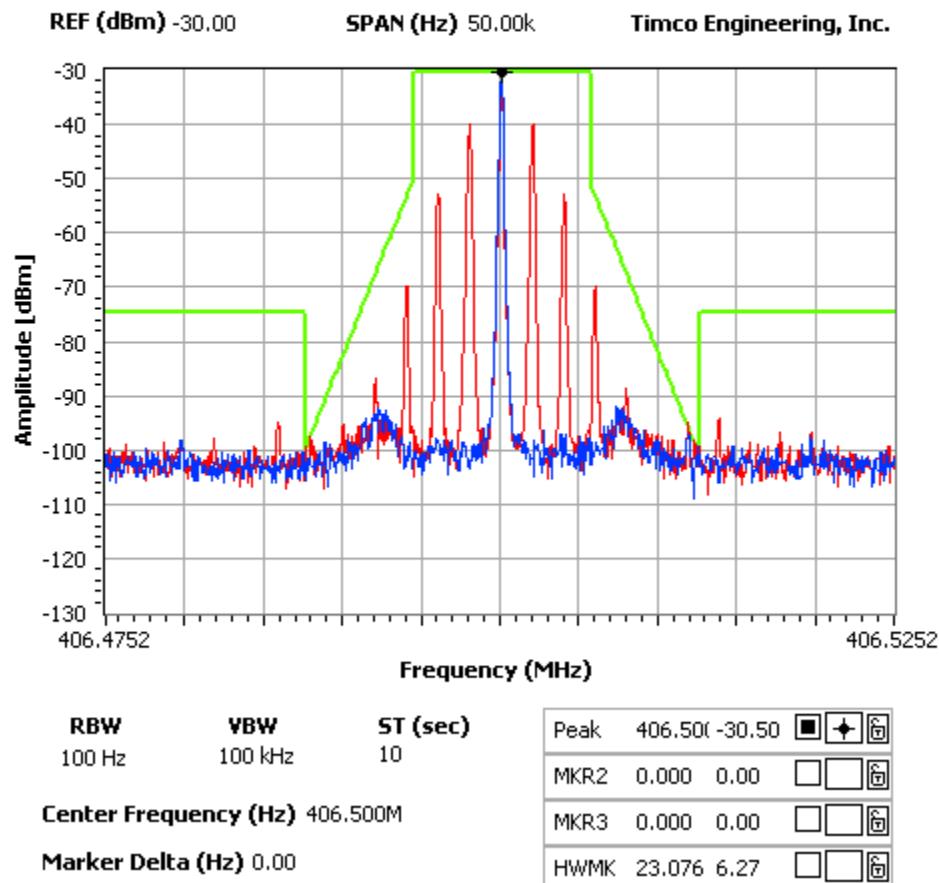
## OCCUPIED BANDWIDTH PLOTS

### Part 90.210(d) Emission Mask D - 12.5 kHz channel 406.5 MHz plot

#### NOTES:

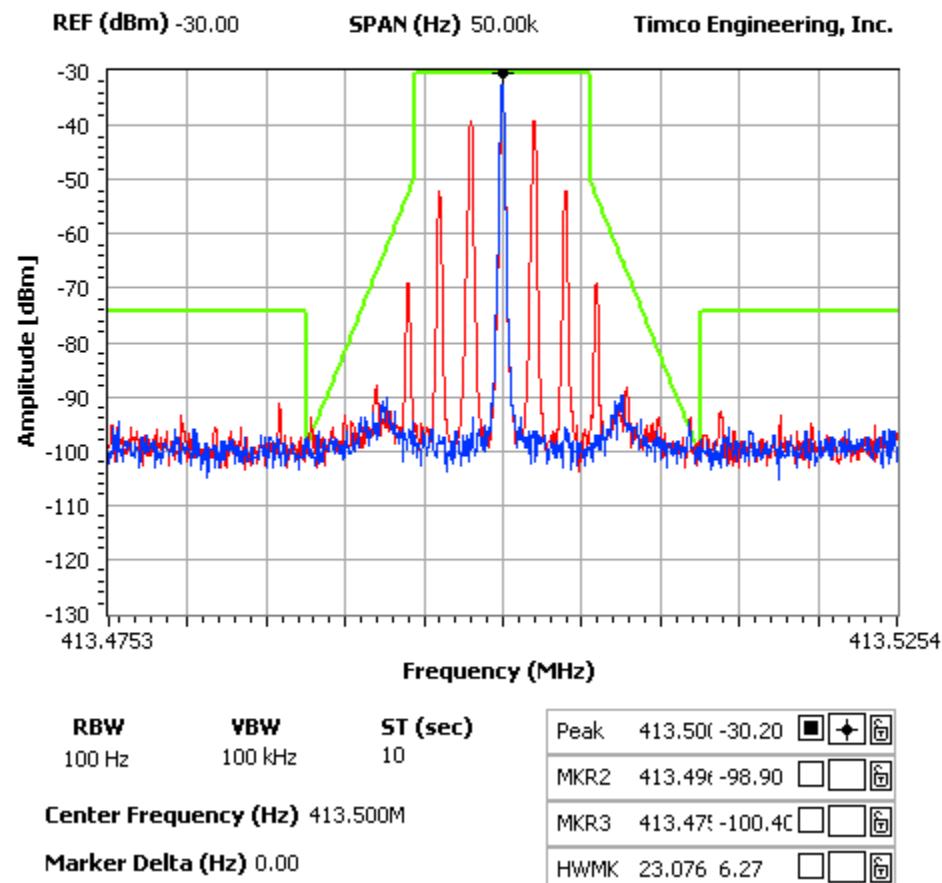
CATTRON-THEIMEG INCORPORATED - MODEL NUMBER: MRM 7700L  
 OCCUPIED BANDWIDTH PLOT

#### FCC 90.210 Mask D



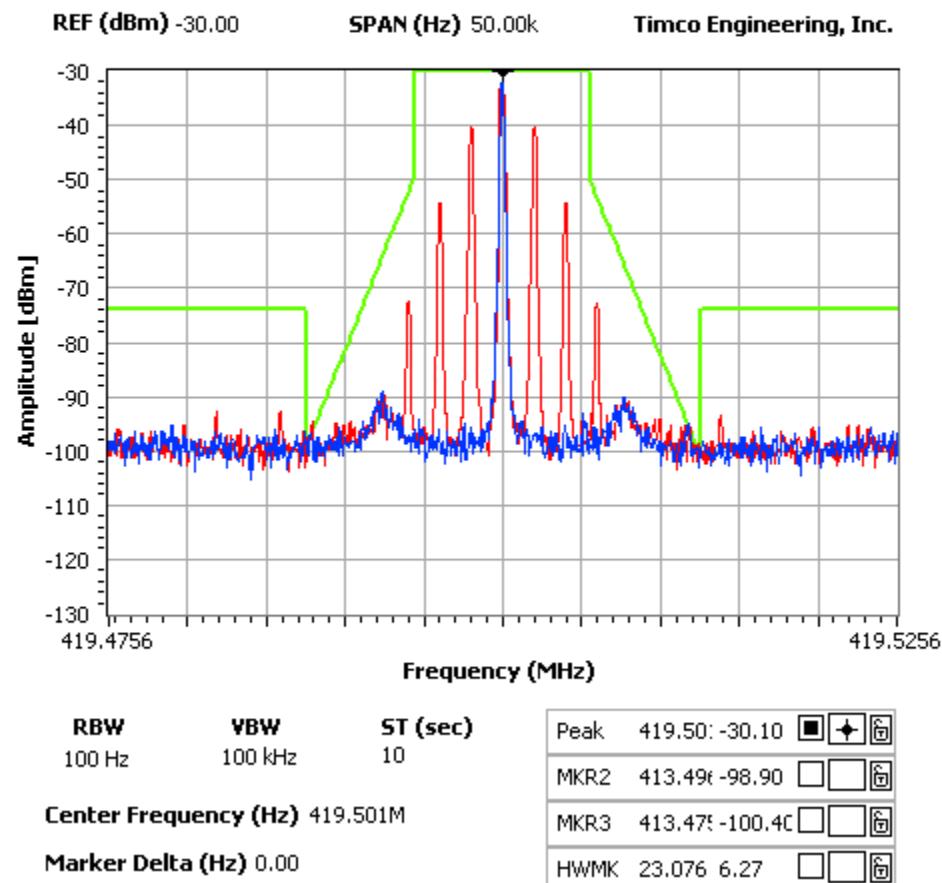
**Part 90.210(d) Emission Mask D - 12.5 kHz channel  
 413.5 MHz plot**
**NOTES:**

 CATTRON-THEIMEG INCORPORATED - MODEL NUMBER: MRM 7700L  
 OCCUPIED BANDWIDTH PLOT

**FCC 90.210 Mask D**


**Part 90.210(d) Emission Mask D - 12.5 kHz channel  
 419.5 MHz plot**
**NOTES:**

 CATTRON-THEIMEG INCORPORATED - MODEL NUMBER: MRM 7700L  
 OCCUPIED BANDWIDTH PLOT

**FCC 90.210 Mask D**




## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

**Rule Part No.:** Part 2.1051(a)

**Requirements:** 12.5kHz Channel Spacing =  $50 + 10\log(0.25) = 44.0 \text{ dBc}$   
12.5kHz Channel Spacing =  $50 + 10\log(0.10) = 40.0 \text{ dBc}$

**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 ANSI/TIA 603-C: 2004.

### Test Data:

TF <b>HIGH POWER</b>	EF	dB below carrier		TF <b>LOW POWER</b>	EF	dB below carrier
406.50	813.00	47.3		406.50	813.00	48.4
	1219.50	79.1			1219.50	77.1
	1626.00	82.2			1626.00	81.2
	2032.50	69.2			2032.50	77.2
	2439.00	77.3			2439.00	79
	2845.50	89.6			2845.50	87.1
	3252.00	93			3252.00	91.8
	3658.50	96			3658.50	91.9
	4065.00	98.5			4065.00	95.7

TF <b>HIGH POWER</b>	EF	dB below carrier		TF <b>LOW POWER</b>	EF	dB below carrier
413.50	827.00	47.3		413.50	827.00	49.9
	1240.50	79.6			1240.50	78.1
	1654.00	80.5			1654.00	80.3
	2067.50	68.5			2067.50	75
	2481.00	85.7			2481.00	79.7
	2894.50	86.1			2894.50	86.6
	3308.00	96.8			3308.00	92.5
	3721.50	88.6			3721.50	84.4
	4135.00	97.6			4135.00	91.9

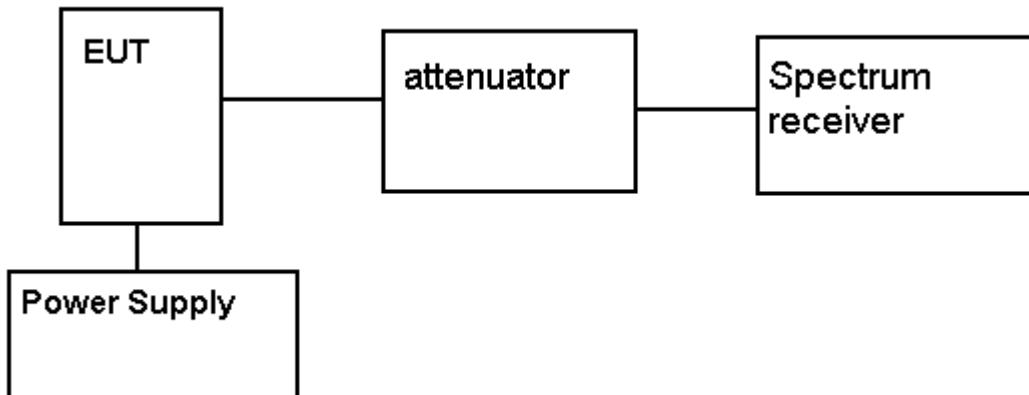
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<b>TF HIGH POWER</b>	<b>EF</b>	<b>dB below carrier</b>		<b>TF LOW POWER</b>	<b>EF</b>	<b>dB below carrier</b>
419.50	839.00	47.2		419.50	839.00	51.2
	1258.50	79.5			1258.50	79.3
	1678.00	80.2			1678.00	80.3
	2097.50	67.6			2097.50	75.7
	2517.00	87.6			2517.00	94.1
	2936.50	81.9			2936.50	84.8
	3356.00	88.6			3356.00	88.5
	3775.50	91.7			3775.50	92.3
	4195.00	96.2			4195.00	93.9

**Method of Measuring Conducted Spurious Emissions**



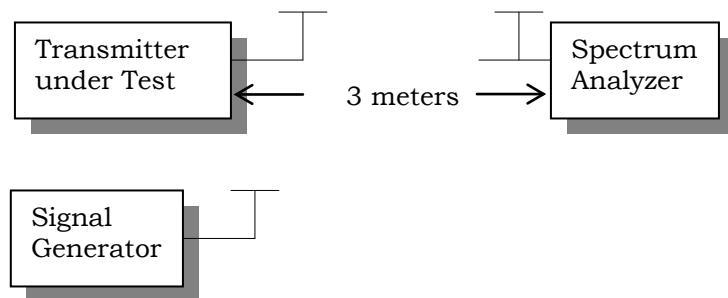
## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Rule Parts. No.:** Part 2.1053

**Requirements:** 12.5kHz Channel Spacing =  $50+10\log(0.25) = 44.0 \text{ dBc}$   
 12.5kHz Channel Spacing =  $50+10\log(0.10) = 40.0 \text{ dBc}$

**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 per ANSI/TIA 603-C: 2004 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

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
406.50	0	0
813.00	H	61.9
1219.50	V	76.9
1626.00	V	63.6
2032.50	V	68.5
2439.00	V	55.1
2845.50	V	56.0
3252.00	V	69.7
3658.50	V	68.7
4065.00	V	73.8

#### Low Power

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
406.50	0	0
813.00	H	63.8
1219.50	V	72.2
1626.00	V	65.1
2032.50	V	70.0
2439.00	V	71.3
2845.50	V	63.0
3252.00	V	65.7
3658.50	V	66.5
4065.00	V	69.8



**High Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
413.50	0	0
827.00	H	62.7
1240.50	V	74.8
1654.00	V	60.8
2067.50	V	74.1
2481.00	V	59.7
2894.50	V	58.6
3308.00	V	67.0
3721.50	V	73.7
4135.00	V	75.9

**Low Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
413.50	0	0
827.00	H	65.3
1240.50	V	71.6
1654.00	V	63.5
2067.50	V	74.1
2481.00	V	72.8
2894.50	V	62.1
3308.00	V	66.0
3721.50	V	68.6
4135.00	V	72.6

**High Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
419.50	0	0
839.00	H	64.4
1258.50	V	78.5
1678.00	V	59.4
2097.50	V	70.4
2517.00	V	53.4
2936.50	V	55.4
3356.00	V	61.5
3775.50	V	70.6
4195.00	V	70.0

**Low Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
419.50	0	0
839.00	H	66.4
1258.50	V	73.7
1678.00	V	62.5
2097.50	V	76.0
2517.00	V	70.3
2936.50	V	63.2
3356.00	V	66.6
3775.50	V	66.3
4195.00	V	74.4

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## 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:** ANSI/TIA 603-C: 2004.

**Test Data:**

<b>Assigned Frequency (Ref. Frequency) (MHz)</b>		406.497981
<b>Temperature (°C)</b>	<b>Frequency (MHz)</b>	<b>Frequency Stability (PPM)</b>
-30	406.498109	0.31
-20	406.498093	0.28
-10	406.497879	-0.25
0	406.497795	-0.46
+10	406.497883	-0.24
+20	406.497936	-0.11
+30	406.497942	-0.10
+40	406.497962	-0.05
+50	406.497994	0.03

<b>Assigned Frequency (Ref. Frequency) (MHz)</b>		
<b>% Battery</b>	<b>Frequency (MHz)</b>	<b>Frequency Stability (PPM)</b>
-15%	406.497964	-0.04
0	406.497981	0.0
+15%	406.497955	-0.06