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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.**



Certificate # 0955-01



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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:



GENERAL INFORMATION

DUT Specification

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

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 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-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

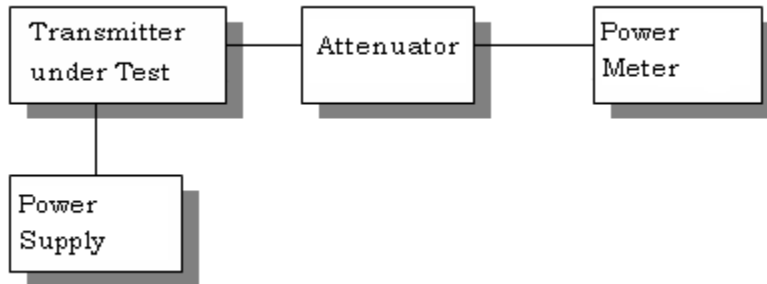
Rule Part No.: Part 2.1046(a), Part 90

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

Applicant: CATTRON-THEIMEG INCORPORATED

FCC ID: CN27700L

Report: C\CATTRON\533UT13\533UT13TestReport.doc

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 (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10\log(P)$ dB or 70 dB, whichever is the lesser attenuation.

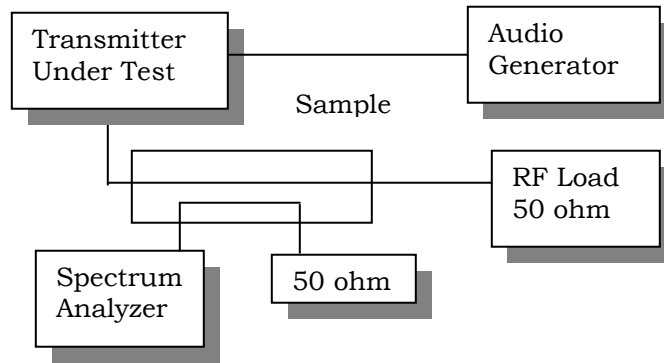
Part 90.210(e) **Emission Mask E - 6.25 kHz channel BW equipment.**

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 (f_d in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(f_d - 3.0 \text{ kHz})$ 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

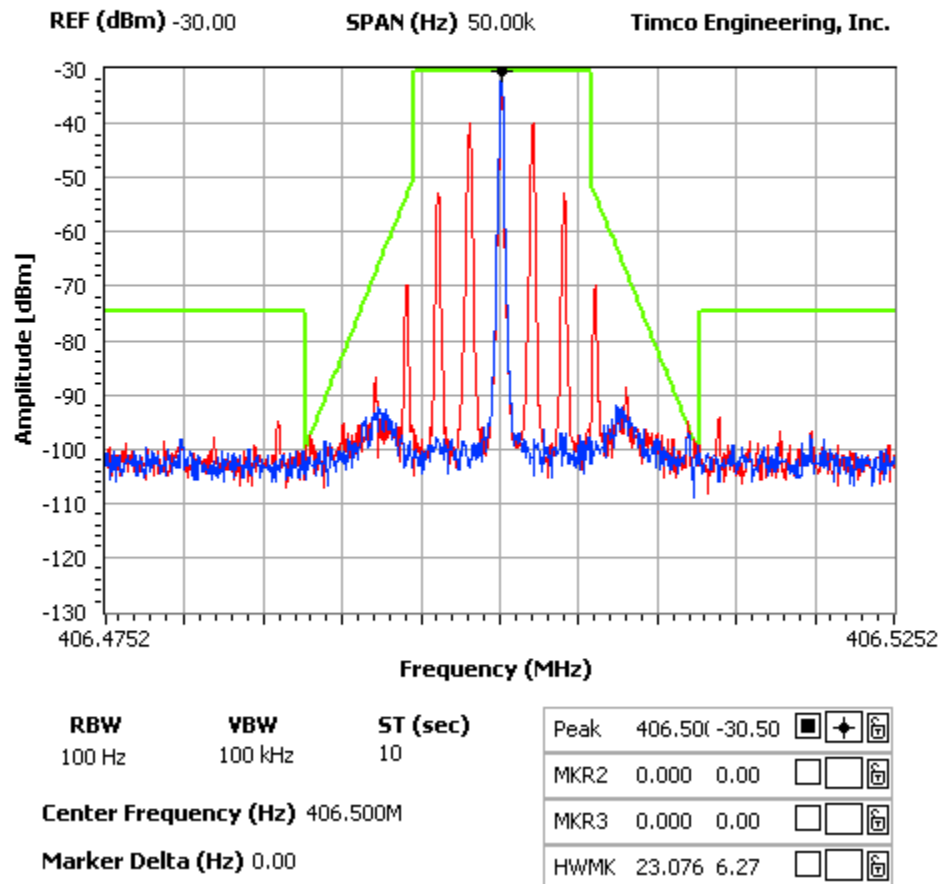
OCCUPIED BANDWIDTH PLOTS

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

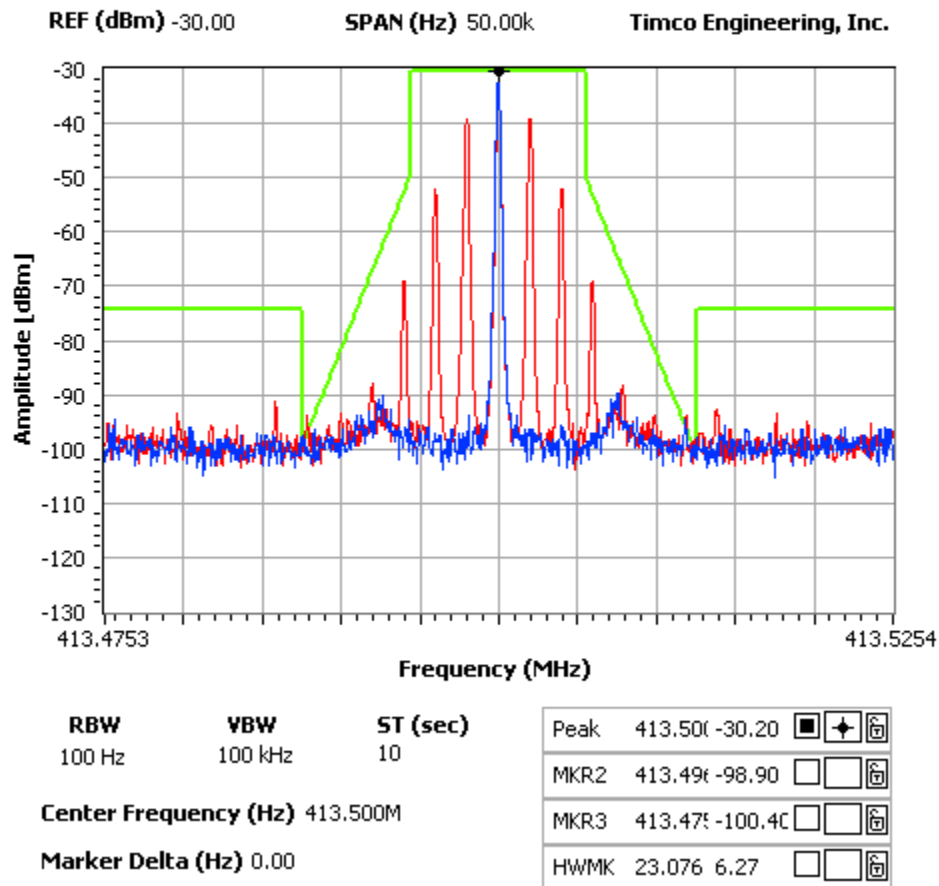


**Part 90.210(d) Emission Mask D - 12.5 kHz channel
413.5 MHz plot**

NOTES:

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

FCC 90.210 Mask D

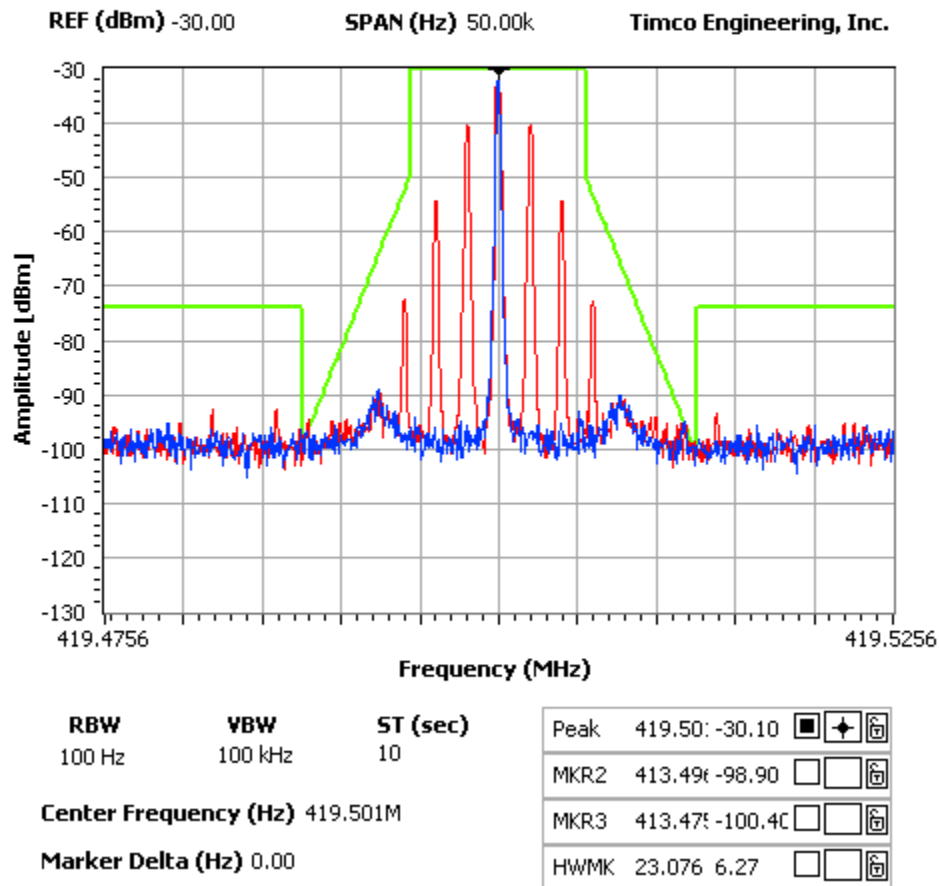


**Part 90.210(d) Emission Mask D - 12.5 kHz channel
419.5 MHz plot**

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 = $50 + 10 \log(0.25) = 44.0$ dBc
 12.5kHz Channel Spacing = $50 + 10 \log(0.10) = 40.0$ 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.

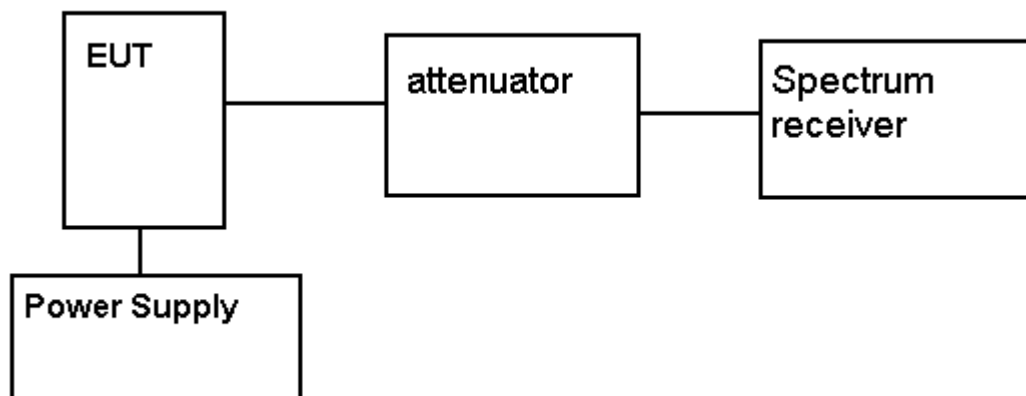
Test Data:

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	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 HIGH POWER	EF	dB below carrier		TF LOW POWER	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

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
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



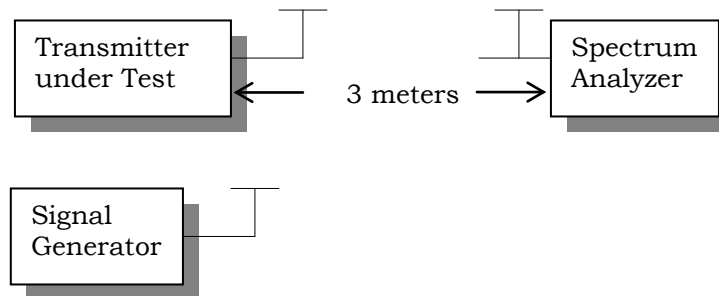
FIELD STRENGTH OF SPURIOUS EMISSIONS

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

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:

Assigned Frequency (Ref. Frequency) (MHz)		406.497981
Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)
-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

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