

# 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](mailto:tei@timcoengr.com)

## Test Report

Product Name: MARINE RADIO

FCC ID: BBOMRF80

### Applicant:

COBRA ELECTRONICS CORPORATION  
6500 WEST CORTLAND STREET  
CHICAGO IL 60707  
USA

**Date Receipt:** 11/16/2006

**Date Tested:** 12/8/2006

APPLICANT: COBRA ELECTRONICS CORPORATION  
FCC ID: BBOMRF80  
REPORT #: C\COBRA\3159AUT6\3159AUT6TestReport.doc

COVER SHEET

# 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](mailto:tei@timcoengr.com)

## TABLE OF CONTENTS LIST

**APPLICANT:** COBRA ELECTRONICS CORPORATION

**FCC ID:** BBOMRF80

### TEST REPORT:

PAGE 1.....	GENERAL INFORMATION & TECHNICAL DESCRIPTION
PAGE 2.....	TECHNICAL DESCRIPTION CONTINUED RF POWER OUTPUT
PAGE 3.....	TECHNICAL DATA
PAGE 4.....	VOICE MODULATION CHARACTERISITICS AUDIO FREQUENCY RESPONSE
PAGE 5.....	AUDIO LOW PASS FILTER
PAGE 6.....	MODULATION LIMITING
PAGE 7.....	OCCUPIED BANDWIDTH
PAGE 8.....	OCCUPIED BANDWIDTH PLOT
PAGE 9.....	SPURIOUS EMISSIONS AT ANTENNA TERMINALS
PAGE 10.....	METHOD OF MEASURING CONDUCTED SPURIOUS EMISS
PAGE 11.....	FIELD STRENGTH OF SPURIOUS EMISSIONS
PAGE 12.....	METHOD OF MEASURING RADIATED SPURIOUS EMISSIONS
PAGE 13.....	FREQUENCY STABILITY
PAGE 14.....	LIST OF TEST EQUIPMENT

### EXHIBITS INCLUDING:

CONFIDENTIALITY REQUEST LETTER  
BLOCK DIAGRAM  
SCHEMATIC  
PARTS LIST  
USERS MANUAL  
LABEL SAMPLE  
LABEL LOCATION  
EXTERNAL PHOTOGRAPHS  
INTERNAL PHOTOGRAPHS  
OPERATIONAL DESCRIPTION  
TUNING PROCEDURE  
TEST SET UP PHOTOGRAPHS

APPLICANT: COBRA ELECTRONICS CORPORATION  
FCC ID: BBOMRF80  
REPORT #: C\COBRA\3159AUT6\3159AUT6TestReport.doc

TABLE OF CONTENTS

# 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](mailto:tei@timcoengr.com)

## GENERAL INFORMATION

2.1033(c) COBRA ELECTRONICS CORPORATION will sell the FCC ID:  
BBOMRF80 VHF Marine transmitter in quantity, for use  
under FCC RULES PART 80.

## 2.1033(c) TECHNICAL DESCRIPTION

(4) Type of Emission: 15K2F3E/15K2G3E

$$B_n = 2M + 2DK$$

$$M = 3000$$

$$D = 4.6 \text{ kHz (Peak Deviation)}$$

$$K = 1$$

$$B_n = 2(3K) + 2(4.6K)(1) = 6.0K + 9.2K = 15.2k$$

80.205 (a) ALLOWED AUTHORIZED BANDWIDTH = 20.00 kHz

2.1033(c)(6) Frequency Range: 156.025 - 157.425 MHz

2.1033(c)(7) Power Range and Controls: There is a user Power  
switch for High/Low Power. Maximum Output Power  
Rating: High (25.0) Watts, low (1.0) Watt into a  
50 ohm resistive load.

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

POWER INPUT

FINAL AMPLIFIER ONLY

FOR LOW POWER SETTING INPUT POWER: (13.8V)(1.3A) = 17.94 Watts

FOR HIGH POWER SETTING INPUT POWER: (13.8V)(5.7A) = 78.66Watts

Function of each electron tube or semiconductor  
device or other active circuit device is included  
in the parts list exhibit.

# 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](mailto:tei@timcoengr.com)

- 2.1033(c)(9) Complete Circuit Diagrams: The circuit and block diagrams are included.
- 2.1033(c)(10) Instruction book. The instruction manual is included.
- 2.1033(c)(11) Tune-up procedure. The tune-up procedure is included.

Description of all circuitry and devices provided for determining and stabilizing frequency is included in the circuit description

- 2.1033(c)(11) Digital modulation. This unit does NOT use digital modulation.

The data required by 2.1046 through 2.1055 is submitted below.

- 2.1046(a)
- 80.215 (e)(1)

### RF power output.

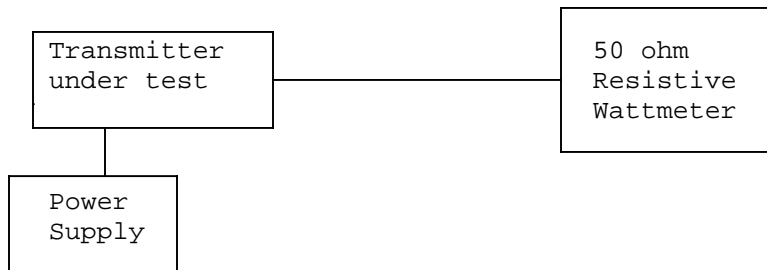
RF power is measured by connecting a 50 ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

OUTPUT POWER: HIGH: 25 W CONDUCTED  
LOW: 1 W CONDUCTED

- 80.911 (d)(5) For primary supply voltages, measured in accordance with the procedures in this paragraph, greater than 11.5 volts, but less than 12.6 volts, the required transmitter output power shall be equal or greater than the value calculated below

$P = 4.375(v) - 35.313$  (For 12V this equals 17.2W)  
At no time did the output power exceed the limits.

### METHOD OF MEASURING RF POWER OUTPUT



# 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](mailto:tei@timcoengr.com)

## TECHNICAL DATA:

- 80.203 (b) **External Controls:** The transmitter is capable of changing frequency between 156.05 - 157.425 MHz by external control. The available channels are shown in the User Manual description Channel List. These channels are preprogrammed by the manufacturer and change of frequency is inaccessible to the station operator.
- 80.203 (c) Five minutes continuous transmission test. The antenna was connected to a dummy load and the radio was locked in a transmit PTT mode. An external timer digital clock was used to observe the duration of the un-modulated transmission. The transmitter turned off and the radio went to receive mode at 4 minutes, 58 seconds as displayed by the external digital clock.
- 80.203 (n) This radio complies with the requirement for DSC capability in the 156 - 162 MHz band and in accordance with 80.225.
- 80.873; 80.956 Transmitter G3E emission capability: The transmitter was connected to 50 ohm resistive wattmeter and the frequency was set to 156.300 and to 156.800 MHz. With normal modulation, the output power displayed was 25 Watts at the high power setting and 1 watt at low power setting, consistent with previous measurements.
- The transmitter has been demonstrated to be capable, with normal operating voltages applied, of delivering 25 watts of carrier power into a 50 ohm resistive load over the specified frequencies.
- 80.911 (a) 80.956 G3E Transmissions: This radio is capable of G3E emission on 156.300 and 156.800 MHz
- 80.911 (c) With 13.6 VDC applied and with the radio connected to a 50 ohm resistive wattmeter, the output power was measured at 156.300 and 156.800 MHz with a measured reading of 25 Watts under normal speech modulation.
- 80.911 (d)(2) 80.959 With the power supply set to 13.6 VDC, and the output of the transmitter terminated in a 50 ohm matching artificial load, the transmitter output power was monitored over a 10 minute continuous operational period while in full power. The output power varied from the nominal 25 Watts output power to 24.8 Watts output power

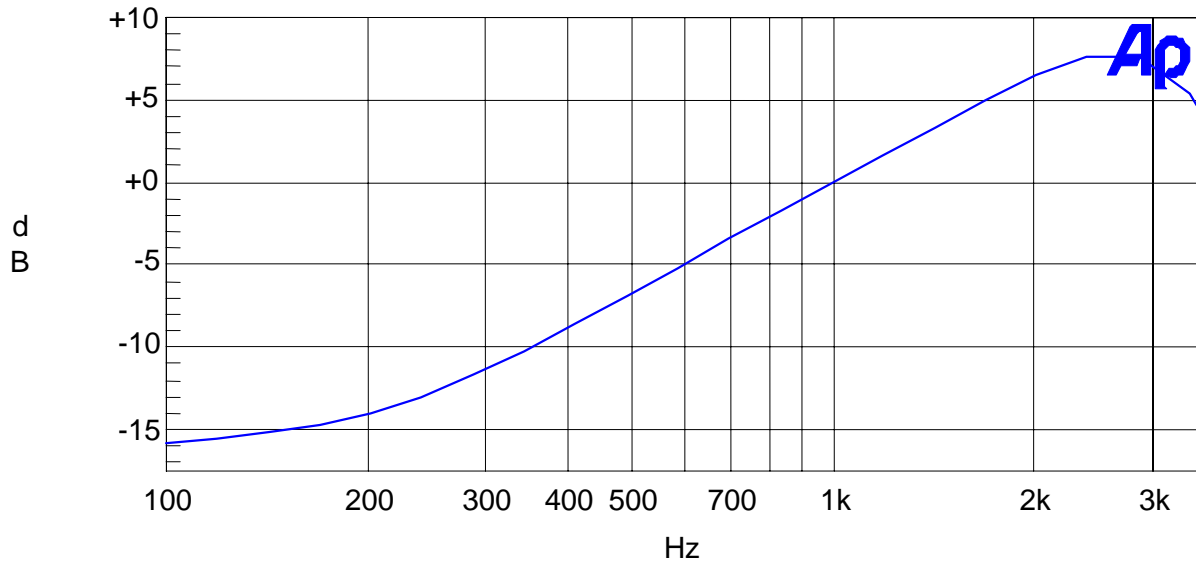
# TIMCO ENGINEERING INC.

849 NW State Road 45  
Newberry, Florida 32669  
<http://www.timcoengr.com>  
888.472.2424 F 352.472.2030 email: [tei@timcoengr.com](mailto:tei@timcoengr.com)

2.1047(a) Voice Modulation\_characteristics:

(b) AUDIO\_FREQUENCY\_RESPONSE

## Audio Frequency Response Plot



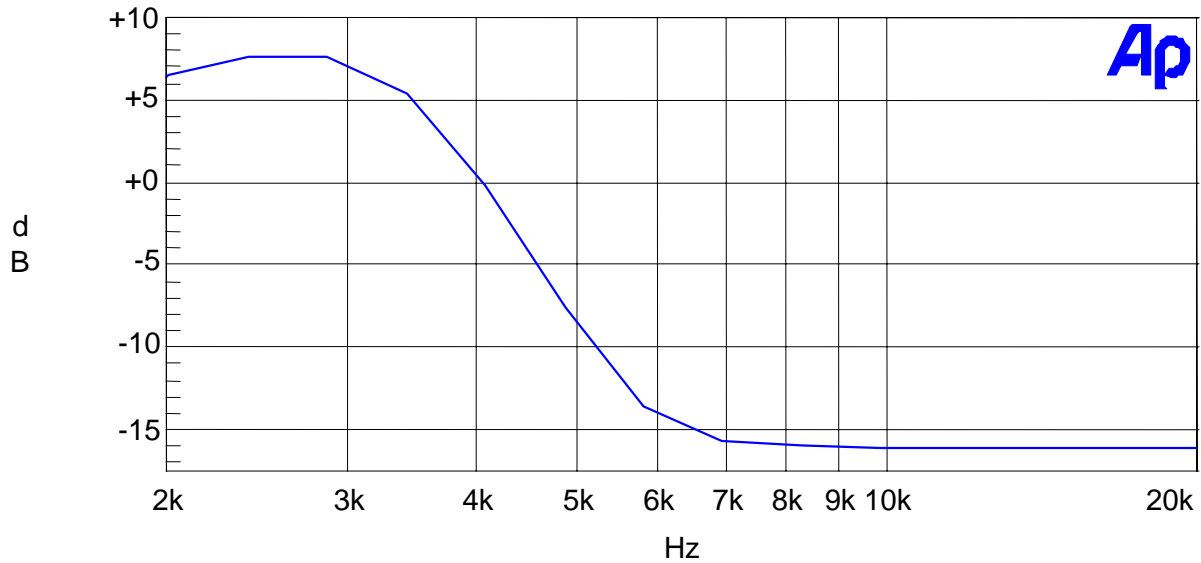
Color	Line Style	Thick	Data	Axis
Blue	Solid	1	Anlr.Level	Left

# 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](mailto:tei@timcoengr.com)

2.1047(a) AUDIO\_LOW\_PASS\_FILTER  
 The audio low pass filter shown in the following plot.

## Audio Low Pass Filter



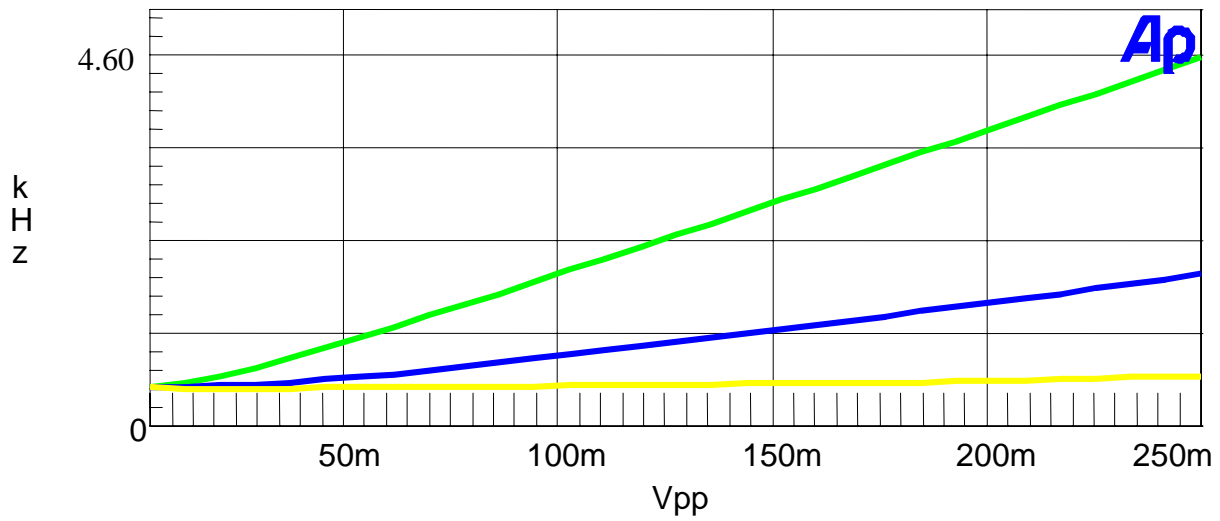
Color	Line Style	Thick	Data	Axis
Blue	Solid	1	Anlr.Level	Left

# 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](mailto:tei@timcoengr.com)

2.1047(b)                      Audio\_input\_versus\_modulation  
80.213 (d)                      A plot of the audio input versus deviation is  
shown in the following plot.

## Modulation Limiting Plots: 2.5 KHz (Green), 1.0 KHz (Blue), and 300 Hz (Yellow)





# 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](mailto:tei@timcoengr.com)

2.1049(c) **Occupied bandwidth:**

80.213 (b)

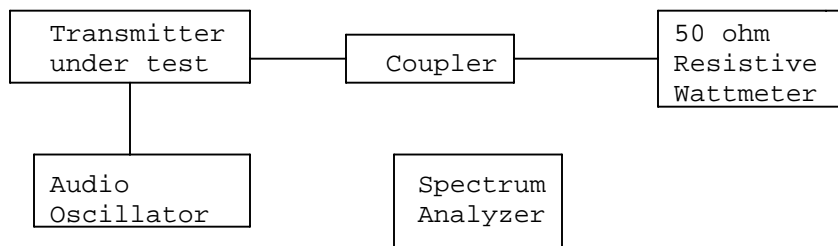
Data in the plots shows that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth:  
At least  $43 + \log(P)$ dB.

## **Radiotelephone transmitter with modulation limiter.**

Test procedure: TIA/EIA-603 para 2.2.11, with the exception that various tones were used.

Test procedure diagram

### **OCCUPIED BANDWIDTH MEASUREMENT**



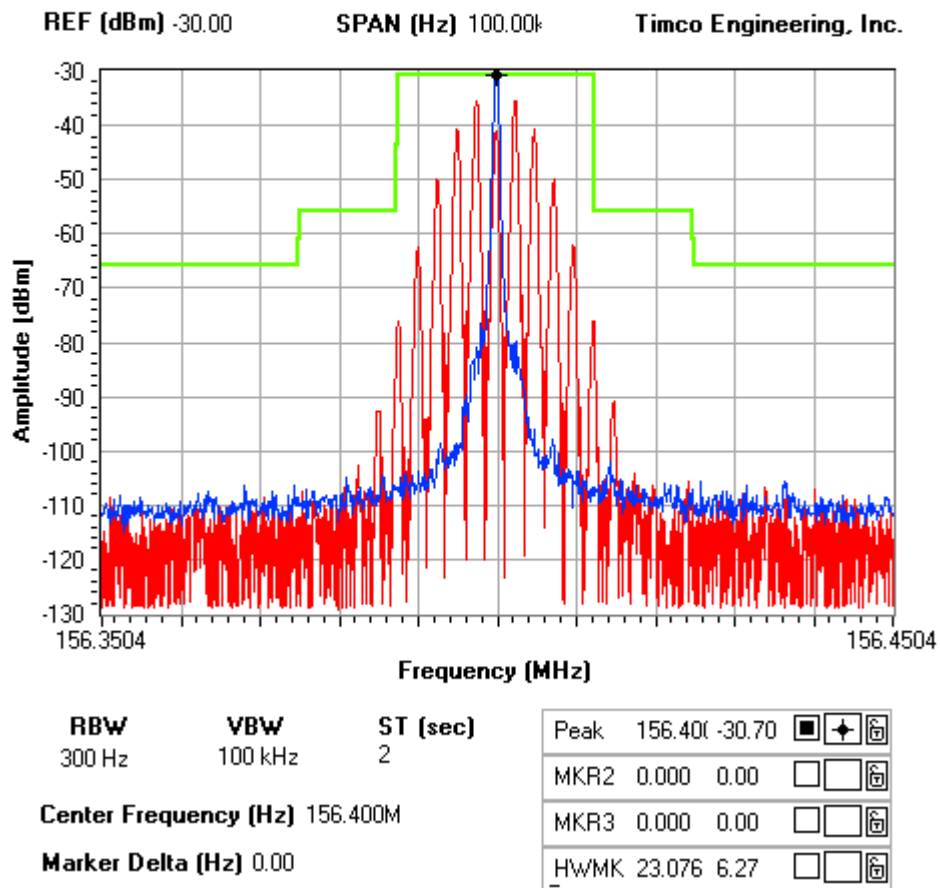
# TIMCO ENGINEERING INC.

849 NW State Road 45  
 Newberry, Florida 32669  
 http://www.timcoengr.com  
 888.472.2424 F 352.472.2030 email: [tei@timcoengr.com](mailto:tei@timcoengr.com)

## OCCUPIED BANDWIDTH PLOT

### NOTES:

COBRA ELECTRONICS CORPORATION - FCC ID: BBOMRF80  
 OCCUPIED BANDWIDTH PLOT



APPLICANT: COBRA ELECTRONICS CORPORATION  
 FCC ID: BBOMRF80  
 REPORT #: C\COBRA\3159AUT6\3159AUT6TestReport.doc

# 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](mailto:tei@timcoengr.com)

2.1051  
 80.211

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

The data on the following page shows the level of conducted spurious responses. The carrier was modulated 100% using a 2500Hz 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.

REQUIREMENTS: Emissions must be  $43 + 10\log(P_o)$  dB below the mean power output of the transmitter.

$43 + 10\log(25) = 57$

$43 + 10\log(1) = 43$

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
156.400	312.80	94.8		156.400	312.80	83.6
	469.20	77.7			469.20	95.3
	625.60	90.9			625.60	90.1
	782.00	96.1			782.00	94.8
	938.40	98.5			938.40	95.7
	1094.80	97.1			1094.80	88.9
	1251.20	85.9			1251.20	86.5
	1407.60	97.8			1407.60	83.7
	1564.00	94.6			1564.00	80.9

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
157.425	314.85	93.7		157.425	314.85	83.2
	472.28	78.1			472.28	94
	629.70	91.6			629.70	90.4
	787.13	95			787.13	95.2
	944.55	103			944.55	99.2
	1101.98	96			1101.98	88.4
	1259.40	85.4			1259.40	84.9
	1416.83	94.7			1416.83	82.8
	1574.25	94.2			1574.25	80.4

# 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](mailto:tei@timcoengr.com)

## Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 Standard without any exceptions. The measurements were made using the shielded room located at TIMCO ENGINEERING INC. 849 STATE ROAD 45, NEWBERRY FLORIDA 32669.

# 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](mailto:tei@timcoengr.com)

2.1053(a) Field strength of spurious emissions:

**NAME OF TEST:** RADIATED SPURIOUS EMISSIONS

**REQUIREMENTS:** Emissions must be 43 + 10log(Po) dB below the mean power output of the transmitter.

**TEST DATA:**

**High power: 43 + 10log(25) = 57**

Tuned Frequency (MHz)	Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)		Tuned Frequency (MHz)	Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
156.400	312.80	H	85.73		157.425	314.85	H	86.53
	469.20	H	93			472.28	V	90.32
	625.60	H	80.44			629.70	H	78.61
	782.00	H	82.01			787.13	H	85.22
	938.40	H	93.07			944.55	H	91.06
	1094.80	H	84.18			1101.98	H	88.74
	1251.20	H	82.79			1259.40	H	82.34
	1407.60	V	74.69			1416.83	H	80.34
	1564.00	V	71.8			1574.25	V	72.5

**Low power: 43 + 10log(1) = 43**

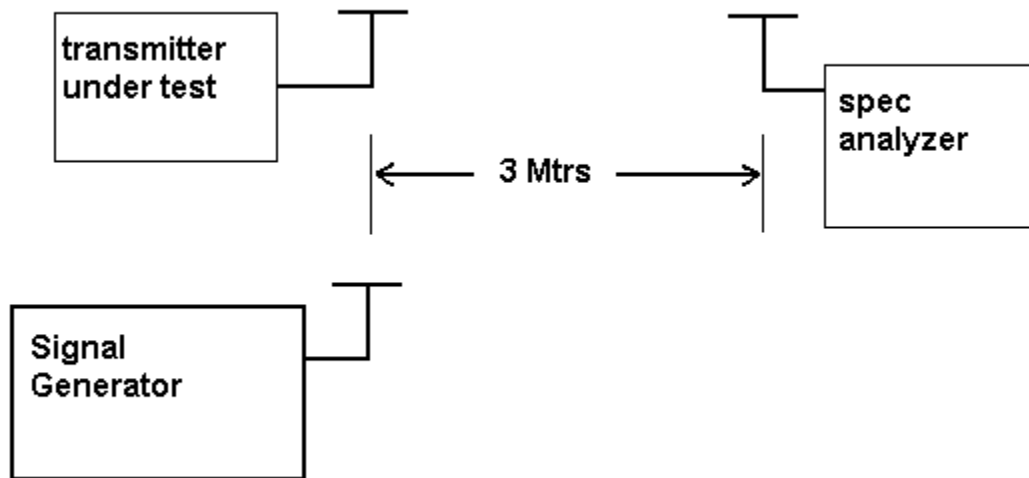
Tuned Frequency (MHz)	Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)		Tuned Frequency (MHz)	Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
156.400	312.80	H	70.85		157.425	314.85	H	71.45
	469.20	V	79.92			472.28	H	81.04
	625.60	H	76.46			629.70	H	70.23
	782.00	H	78.13			787.13	H	81.94
	938.40	H	83.89			944.55	H	82.38
	1094.80	H	70.8			1101.98	H	75.86
	1251.20	H	69.91			1259.40	H	69.66
	1407.60	V	60.71			1416.83	H	67.66
	1564.00	H	58.82			1574.25	H	62.92

# 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](mailto:tei@timcoengr.com)

2.1053(a) Continued Field\_strength\_of\_spurious\_emissions:

Method of Measuring Radiated Spurious Emissions



METHOD OF MEASUREMENT: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 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 N.W. State Road 45, Newberry, FL 32669.

# 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](mailto:tei@timcoengr.com)

## Frequency stability:

2.1055(a)(2)

80.209 (a)

Temperature and voltage tests were performed to verify that the frequency remains within the .0010%, 10.0ppm specification limit, for 20kHz spacing. The test was conducted as follows: The transmitter was placed in the temperature chamber at 25° C and allowed to stabilize for one hour. The transmitter was keyed ON for one minute during which four frequency readings were recorded at 15 second intervals. The worse case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -30° C after which the transmitter was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute, and again frequency readings were noted at 15 sec intervals. The worst-case number was recorded for temperature plotting. This procedure was repeated in 10-degree increments up to + 50° C.

Readings were also taken at minus 15% of the battery voltage, which we estimate to be the battery endpoint.

## **MEASUREMENT DATA:**

	Ref. Freq.	
	156.400059	
TEMPERATURE °C	FREQUENCY MHz	PPM
-30°C	156.399824	-1.50
-20°C	156.400055	-0.03
-10°C	156.400166	0.68
0°C	156.400210	0.97
10°C	156.400152	0.59
20°C	156.400059	0.00
30°C	156.399979	-0.51
40°C	156.400011	-0.31
50°C	156.400275	1.38
Batt. Volts	Batt. Data	PPM
-15%	156.400055	-0.03
+15%	156.400064	0.03

# 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](mailto:tei@timcoengr.com)

## EMC Equipment List

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	Listed 3/27/04	3/26/07
3-Meter OATS	TEI	N/A	N/A	Listed 1/11/06	1/10/09
Antenna: Biconnical	Eaton	94455-1	1057	CAL 12/12/05	12/12/07
Antenna: Biconnical	Eaton	94455-1	1096	CAL 10/11/06	10/11/08
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	CAL 4/29/05	4/29/07
Analyzer Blue Tower Quasi-Peak Adapter	HP	85650A	2811A01279	CAL 4/13/05	4/13/07
Analyzer Blue Tower RF Preselector	HP	85685A	2926A00983	CAL 9/5/05	9/5/07
Analyzer Blue Tower Spectrum Analyzer	HP	8568B	2928A04729 2848A18049	CAL 4/13/05	4/13/07
LISN	Electro-Metrics	ANS-25/2	2604	CAL 10/5/06	10/5/08
LISN	Electro-Metrics	EM-7820	2682	CAL 4/28/05	4/28/07
Antenna: Log-Periodic	Eaton	96005	1243	CAL 12/14/05	12/14/07