

# TIMCO ENGINEERING INC.

849 NW State Road 45

Newberry, Florida 32669

<http://www.timcoengr.com>

888.472.2424 F 352.472.2030 email: [sid@timcoengr.com](mailto:sid@timcoengr.com)



## Test Report

Product Name: FRS/GMRS TRANSCEIVER

FCC ID: BBOPR150

Applicant:

**COBRA ELECTRONICS CORPORATION  
6500 WEST CORTLAND STREET  
CHICAGO, IL 60707**

**Date Receipt: NOVEMBER 23, 2004**

**Date Tested: JANUARY 10, 2004**

**APPLICANT: COBRA ELECTRONICS CORPORATION**

**FCC ID: BBOPR150**

**REPORT #: C\COBRA\1937UT4\1937UT4TestReport.doc**

**COVER SHEET**

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## TABLE OF CONTENTS LIST

### TEST REPORT:

PAGE 1.....	GENERAL INFORMATION & TECHNICAL DESCRIPTION
PAGE 2.....	TECHNICAL DESCRIPTION CONTINUED
	RF POWER OUTPUT
PAGE 3.....	MODULATION CHARACTERISTICS
	AUDIO FREQUENCY RESPONSE GRAPH
PAGE 4.....	MODULATION LIMITING GRAPH
PAGE 5.....	AUDIO LOW PASS FILTER GRAPH
PAGE 6.....	OCCUPIED BANDWIDTH
PAGE 7.....	OCCUPIED BANDWIDTH PLOT
PAGE 8.....	SPURIOUS EMISSIONS AT ANTENNA TERMINALS
PAGE 9.....	UNWANTED RADIATION - GMRS
PAGE 10.....	UNWANTED RADIATION - FRS
PAGE 11.....	METHOD OF MEASURING RADIATED SPURIOUS EMISSIONS
PAGE 12.....	FREQUENCY STABILITY
PAGE 13-18....	LIST OF TEST EQUIPMENT

### EXHIBITS INCLUDED:

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

**APPLICANT:** COBRA ELECTRONICS CORPORATION  
**FCC ID:** BBOPR150  
**REPORT #:** C\COBRA\1937UT4\1937UT4TestReport.doc

**TABLE OF CONTENTS**

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## GENERAL INFORMATION REQUIRED FOR CERTIFICATION

2.1033(c)(1)(2) COBRA ELECTRONICS CORPORATION will manufacture the FCCID: BBOPR150 GMRS/FRS COMBINATION TRANSCEIVER in quantity, for use under FCC RULES PART 95.

**COBRA ELECTRONICS CORPORATION  
6500 WEST CORTLAND STREET  
CHICAGO, IL 60707**

### 2.1033 (c) TECHNICAL DESCRIPTION

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

2.1033(c)(4) Type of Emission: 10K5F3E  
95.631

Bn = 2M + 2DK

M = 3000

D = 2250

Bn = 2(3000) + 2(2250) = 10.5K

GMRS Authorized Bandwidth 20.0 kHz  
FRS Authorized Bandwidth 12.5KHz

2.1033(c)(5) GMRS Frequency Range: 1. 462.5500 13. 462.7000  
95.621 2. 462.5625 14. 462.7125  
3. 462.5750 15. 462.7250  
4. 462.5875 16. 467.5500  
5. 462.6000 17. 467.5750  
6. 462.6125 18. 467.6000  
7. 462.6250 19. 467.6250  
8. 462.6375 20. 467.6500  
9. 462.6500 21. 467.6750  
10. 462.6625 22. 467.7000  
11. 462.6750 23. 467.7250  
12. 462.6875

2.1033(c)(5) FRS Frequency Range: 1. 462.5625 8. 467.5625  
95.627 2. 462.5875 9. 467.5875  
3. 462.6125 10. 467.6125  
4. 462.6375 11. 467.6375  
5. 462.6625 12. 467.6625  
6. 462.6875 13. 467.6875  
7. 462.7125 14. 467.7125 MHz

2.1033(c)(6)(7) Power Output shall not exceed 0.50 Watts effective  
95.639 radiated power. There can be no provisions for  
95.649 increasing the power or varying the power.

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**REPORT #:** C\COBRA\1937UT4\1937UT4TestReport.doc

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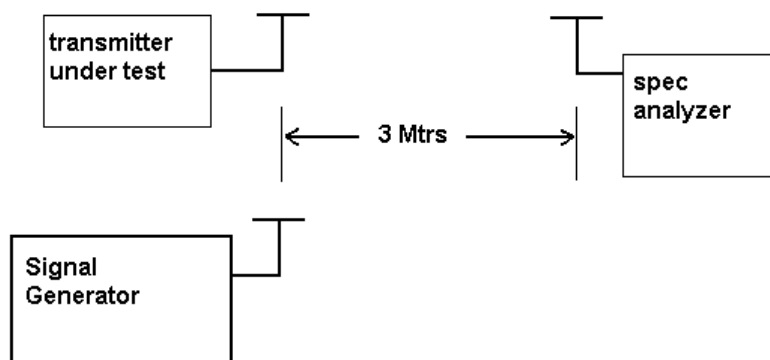
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- 2.1033(c)(8) DC Voltages and Current into Final Amplifier:  
FINAL AMPLIFIER ONLY
- INPUT POWER:  $(4.5V)(.251A) = 1.13 \text{ Watts}$
- 2.1033(c)(9) Tune-up procedure. The tune-up procedure is included in the exhibits.
- 2.1033(c)(10) Complete Circuit Diagrams: The circuit diagram and block diagram are included in the exhibits.
- 2.1033(c)(11) A photograph or a drawing of the equipment identification label is included in the exhibits.
- 2.1033(c)(12) Photographs(8"X10") of the equipment of sufficient clarity to reveal equipment construction and layout, including meters, labels for controls, including any view under shields.
- 2.1033(c)(13) Digital modulation is not allowed.
- 2.1033(c)(14) The data required by 2.1046 through 2.1057 is submitted below.
- 2.10311c)(6)(7) RF power is measured by the substitution method as outlined in TIA/EIA - 603. With a nominal battery voltage of 4.5 V, and the transmitter properly adjusted the RF output measures:
- 2.1046(a)
- GMRS - 0.72 Watts  
FRS - 0.5 Watts



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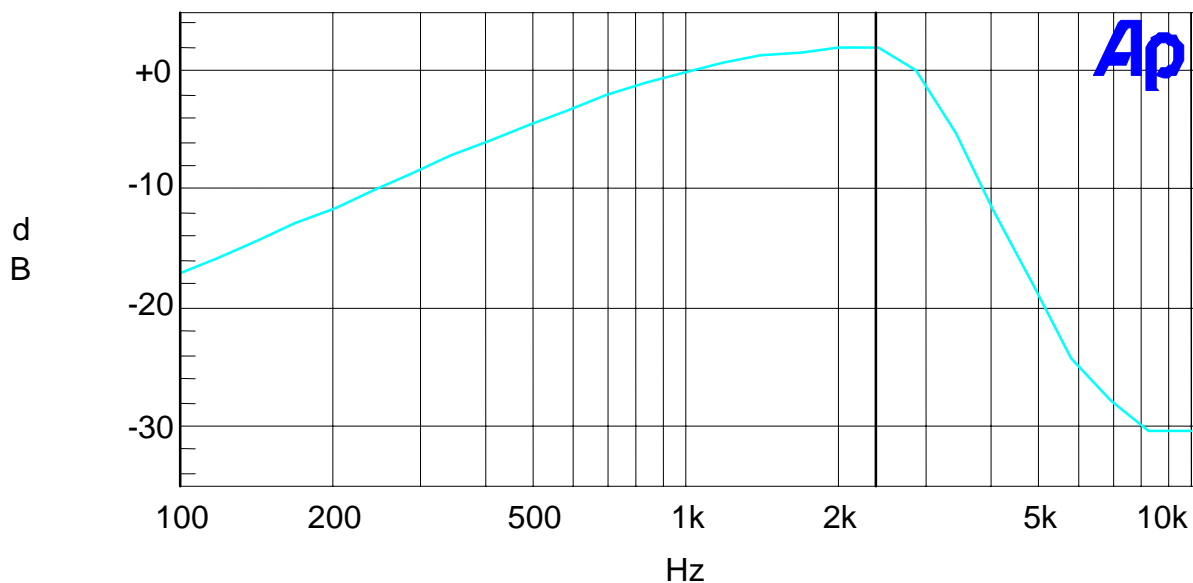
2.1047(a)(b)

## Modulation characteristics:

### AUDIO FREQUENCY RESPONSE

The audio frequency response was measured in accordance with TIA/EIA Specification 603. The audio frequency response curve is shown on the next page. The audio signal was fed into a dummy microphone circuit and into the microphone connector. The input required to produce 30 percent modulation level was measured. See plot below.

1937ut4 audio frequency response



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REPORT #: C\COBRA\1937UT4\1937UT4TestReport.doc

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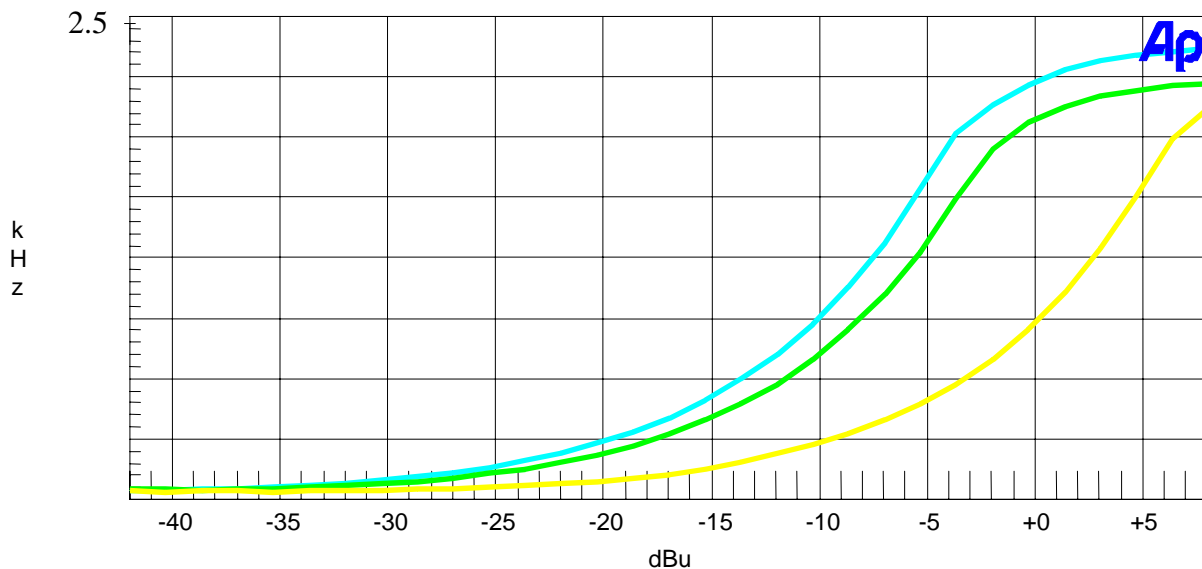
## 2.1047(b)

### 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 on the following pages. Curves are provided for audio input frequencies of 300, 1000, and 2500 Hz. See the plot below.

### 1937UT4 Modulation Limiting

blue 2.5kHz green 1 kHz yellow 300 Hz



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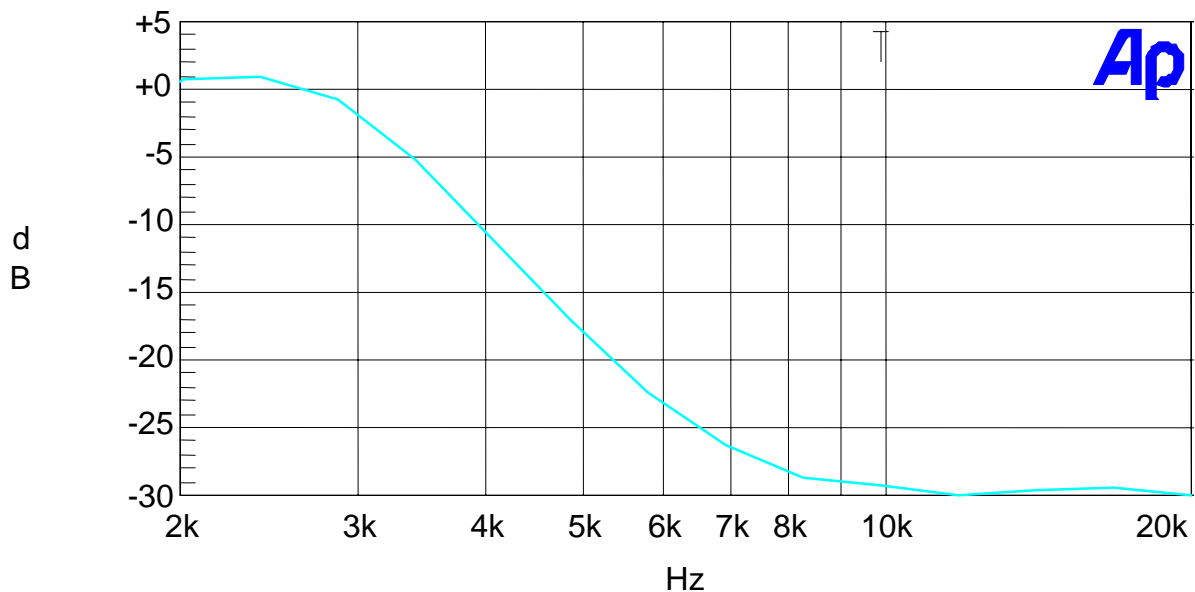
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95.637

## Post Limiter Filter

Each GMRS transmitter, except a mobile station transmitter with a power of 2.5 Watts or less, must be equipped with an audio low pass filter. At any frequency between 3 & 20 kHz the filter must have an attenuation of  $60\log(f/3)$  greater than the attenuation at 1KHz. See below.

## 1937UT4 Audio Low Pass Filter



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**2.1049**

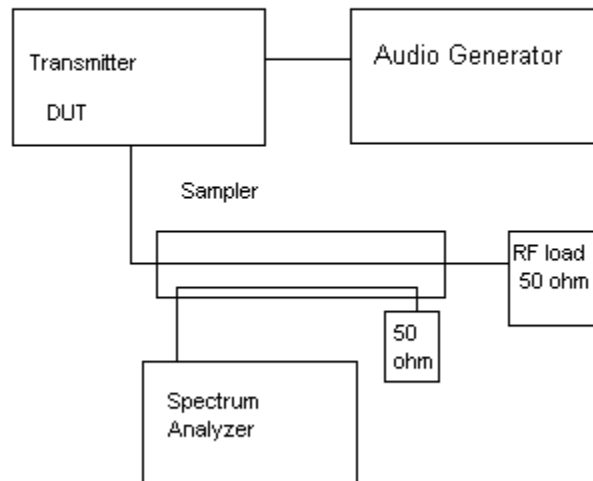
## Occupied bandwidth:

**95.635(b)(1)(3)(7)**

At least 25dB on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.

At least 35 dB on any frequency removed from the center of the authorized BW by more than 100% up to and including 250% of the authorized BW. At least  $43 + \log_{10}(TP)$  dB on any frequency removed from the center of the authorized bandwidth by more than 250%. See the following plot.

Occupied BW Test Equipment Setup



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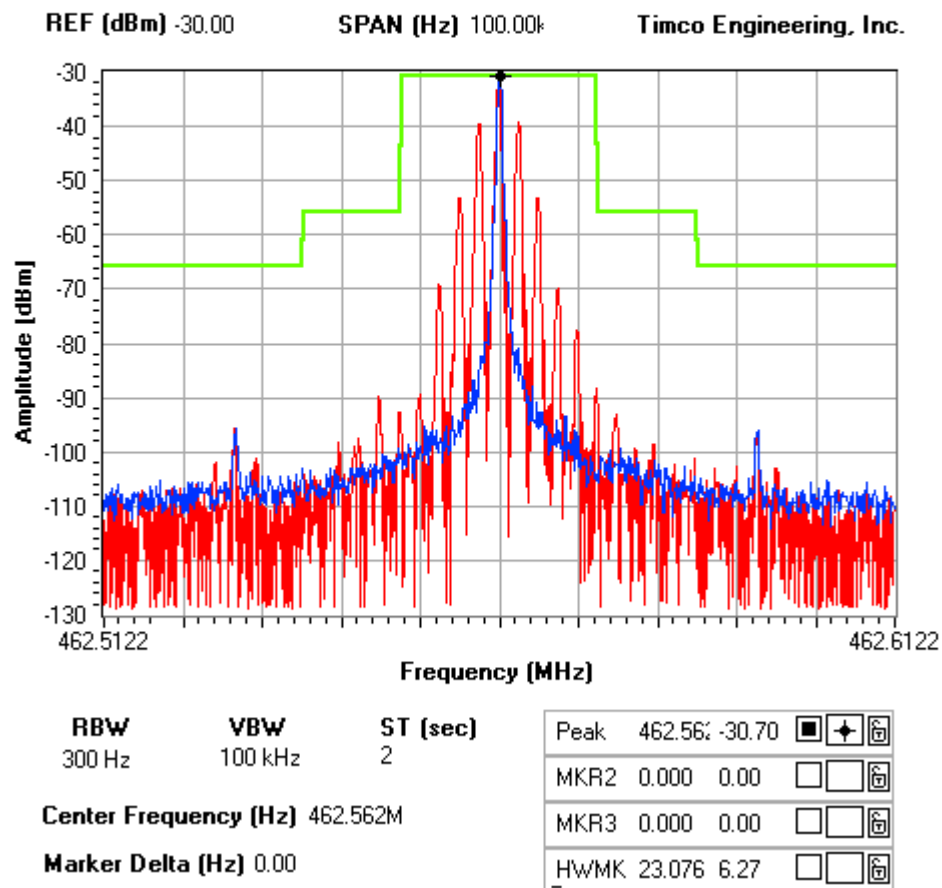
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## OCCUPIED BANDWIDTH PLOT

### NOTES:

1937ut4 occupied bandwidth

### FCC 95.635 Mask (1) (3) (7)



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2.1051

## Spurious emissions at antenna terminals(conducted):

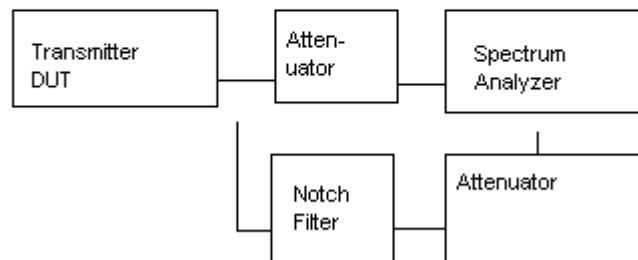
The following data shows the level of conducted Spurious responses at the antenna terminal. The test Procedure used was TIA/EIA 603 S2.2.13 with the exception that the emissions were recorded in dBc. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental.

**NAME OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS**

2.1051 Not Applicable, no antenna terminal allowed.

## Method of Measuring Conducted Spurious Emissions

Spurious Emissions at  
Antenna Terminals



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2.1053  
95.635(b)(7)

## UNWANTED RADIATION:

The tabulated Data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the fundamental. This test was conducted per ANSI C63.4-2003.

REQUIREMENTS: GMRS:  $43 + 10\log(0.72) = 41.55$  dB

## TEST DATA (GMRS):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
462.70	V	29.05	0	-0.5	0
925.40	H	-20.60	0	-0.85	50
1388.10	V	-34.90	1.08	4.5	60.03
1850.80	V	-31.70	1.17	5.16	56.26
2313.50	V	-33.80	1.26	6.25	57.36
2776.20	H	-31.60	1.33	7.07	54.41
3238.90	H	-35.80	1.37	7.39	58.33
3701.60	H	-33.70	1.42	7.55	56.12
4164.30	H	-43.30	1.47	7.81	65.51
4627.00	H	-25.40	1.53	8.2	47.28

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2.1053

UNWANTED RADIATION:

95.635(b)(7)

The tabulated Data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the fundamental. This test was conducted per ANSI C63.4-1992.

REQUIREMENTS: FRS:  $43 + 10\log(0.5) = 40$  dB

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
467.50	V	27.51	0	-0.52	0
935.10	V	-23.50	0	-0.97	51.46
1402.70	V	-31.80	1.08	4.56	55.31
1870.20	H	-36.60	1.17	5.17	59.59
2337.80	H	-34.90	1.27	6.33	56.83
2805.40	V	-37.70	1.33	7.09	58.93
3273.00	H	-33.80	1.38	7.41	54.76
3740.50	H	-36.40	1.42	7.55	57.26
4208.10	H	-45.50	1.47	7.88	66.08
4675.70	H	-30.00	1.54	8.14	50.39

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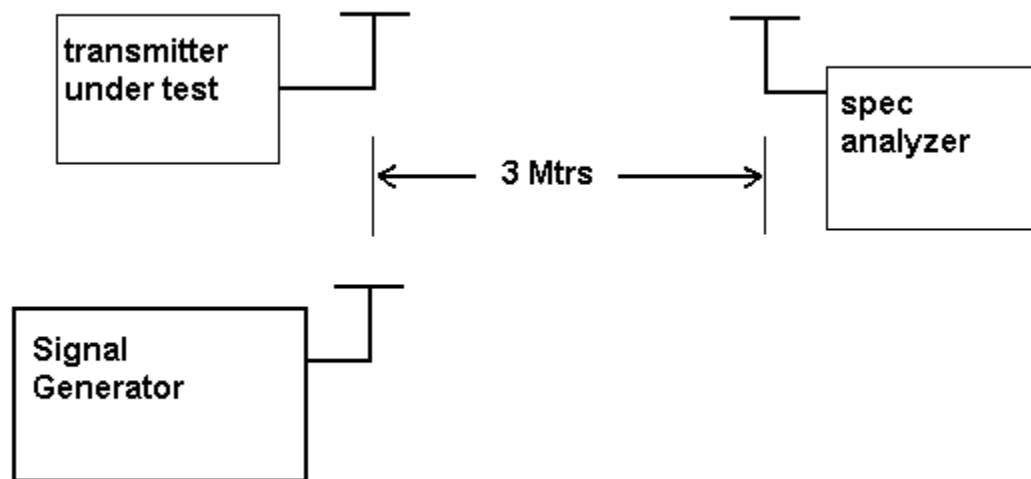
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## Method of Measuring Radiated Spurious Emissions



Equipment placed 80 cm above ground  
on a rotatable platform.

\* Appropriate antenna raised from 1 to 4 M.

**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 open field test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

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2.1055  
95.621(b)

## Frequency stability:

Temperature and voltage tests were performed to verify that the frequency remains within the 0.0005%, 5 ppm specification limit. 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 second 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 plus and minus 15% of the battery voltage of 4.5 VDC.

## MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 462.562 784

TEMPERATURE C	FREQUENCY MHz	PPM
REFERENCE	462.462 784	00.00
-30C	462.563	+ 0.47
-20C	462.562 565	- 0.47
-10C	462.562 939	+ 0.34
0C	462.563 231	+ 0.97
10C	462.563 205	+ 0.91
20C	462.562 784	0.00
30C	462.562 29	- 1.07
40C	462.561 876	- 1.96
50C	462.561 889	- 1.93

	VOLTS	Batt. Data	Batt. PPM
-15%	3.825	462.562 828	+ 0.10

**RESULTS OF MEASUREMENTS:** This EUT meets the frequency stability requirement for an FRS: +/- 2.5ppm over temp range of -20 degrees C to +50 degrees C. It also meets the GMRS frequency stability requirements: +/- 5ppm over the temp range -30 degrees C to +50 degrees C.

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## EMC Equipment List

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date or Status
3-Meter OATS	TEI	N/A	N/A	Listed 1/13/03	1/12/06
3/10-Meter OATS	TEI	N/A	N/A	Listed 3/27/04	3/26/07
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
Blue Tower Spectrum Analyzer	HP	8568B	2928A04729 2848A18049	CAL 4/15/03	4/15/05
Blue Tower RF Preselector	HP	85685A	2620A00294	CAL 4/27/04	4/27/06
Blue Tower Quasi-Peak Adapter	HP	85650A	2811A01279	CAL 4/15/03	4/15/05
Silver Tower Spectrum Analyzer	HP	8566B Opt 462	3552A22064 3638A08608	CAL 3/22/04	3/22/06
Silver Tower RF Preselector	HP	85685A	2926A00983	CAL 3/22/04	3/22/06
Silver Tower Quasi-Peak Adapter	HP	85650A	3303A01844	CAL 3/22/04	3/22/06
Silver Tower Preamplifier	HP	8449B	3008A01075	CAL 3/22/04	3/22/06
Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/26/01	4/26/03
Biconnical Antenna	Eaton	94455-1	1096	CAL 8/17/04	8/17/06
Biconnical Antenna	Eaton	94455-1	1057	CAL 3/18/03	3/18/05
BiconiLog Antenna	EMCO	3143	9409-1043	No Cal Required	
Log-Periodic Antenna	Electro-Metrics	LPA-25	1122	CAL 8/26/04	8/26/06
Log-Periodic Antenna	Electro-Metrics	LPA-30	409	CAL 3/4/03	3/4/05

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Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date or Status
Log-Periodic Antenna	Eaton	96005	1243	CAL 5/8/03	5/8/05
Dipole Antenna Kit	Electro-Metrics	TDA-30/1-4	152	CAL 3/21/01	3/21/04
Dipole Antenna Kit	Electro-Metrics	TDA-30/1-4	153	CAL 9/26/02	9/26/05
Double-Ridged Horn Antenna	Electro-Metrics	RGA-180	2319	CAL 2/17/03	2/17/05
Horn Antenna *(at 3 meters)	Electro-Metrics	EM-6961	6246	CAL 3/31/03	3/31/05
Horn Antenna *(at 10 meters)	Electro-Metrics	EM-6961	6246	CAL 6/4/03	6/4/05
Passive Loop Antenna	EMC Test Systems	EMCO 6512	9706-1211	CHAR 7/10/01	7/10/03
Harmonic Mixer with Horn Antenna	Oleson Microwave Labs	M08HW/A	F30425-1	CHAR 4/25/03	4/25/05
Harmonic Mixer with Horn Antenna	Oleson Microwave Labs	M12HW/A	E30425-1	CHAR 4/25/03	4/25/05
LISN	Electro-Metrics	ANS-25/2	2604	CAL 8/27/04	8/27/06
LISN	Electro-Metrics	EM-7820	2682	CAL 3/12/03	3/12/05
Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 7/16/04	7/16/06
Termaline Wattmeter	Bird Electronic Corporation	6104	1926	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
AC Voltmeter	HP	400FL	2213A14499	CAL 7/19/04	7/19/06
AC Voltmeter	HP	400FL	2213A14261	CHAR 10/15/01	10/15/03
AC Voltmeter	HP	400FL	2213A14728	CHAR 10/15/01	10/15/03
Digital Multimeter	Fluke	77	35053830	CHAR 1/8/02	1/8/04
Digital Multimeter	Fluke	77	43850817	CHAR	1/8/04

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Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date or Status
				1/8/02	
Digital Multimeter	HP	E2377A	2927J05849	CHAR 1/8/02	1/8/04
Multimeter	Fluke	FLUKE-77-3	79510405	CHAR 9/26/01	9/26/03
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
Power Sensor	HP	478A	72129	CAL 4/15/03	4/15/05
Power Meter And Sensor	Bird	4421-107 & 4022	0166 & 0218	CAL 4/16/03	4/16/05
Digital Thermometer	Fluke	2166A	42032	CAL 7/19/04	7/19/06
Thermometer	Traulsen	SK-128		CHAR 1/22/02	1/22/04
Thermometer	Extech	4028	14871-2	CAL 3/7/03	3/7/05
Hygro-Thermometer	Extech	445703	0602	CAL 10/4/02	10/4/04
Frequency Counter	HP	5352B	2632A00165	CAL 8/3/04	8/3/06
Frequency Counter	HP	5385A	2730A03025	CAL 3/7/03	3/7/05
Service Monitor	IFR	FM/AM 500A	5182	CAL 11/22/00	Out of Service
Comm. Serv. Monitor	IFR	FM/AM 1200S	6593	CAL 5/12/02	5/12/04
Signal Generator	HP	8640B	2308A21464	CAL 8/26/04	8/26/06
Sweep Generator	Wiltron	6648	101009	CAL 4/15/03	4/15/05
Sweep Generator	Wiltron	6669M	007005	CAL 3/3/03	3/3/05
Modulation Analyzer	HP	8901A	3435A06868	CAL 9/5/01	9/5/03
Modulation Meter	Boonton	8220	10901AB	CAL 4/15/03	4/15/05
Near Field Probe	HP	HP11940A	2650A02748	CHAR 2/1/01	Out of Service

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# TIMCO ENGINEERING INC.

849 NW State Road 45

Newberry, Florida 32669

<http://www.timcoengr.com>

888.472.2424 F 352.472.2030 email: [sid@timcoengr.com](mailto:sid@timcoengr.com)

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date or Status
BandReject Filter	Lorch Microwave	5BR4-2400/60-N	Z1	CHAR 4/17/03	4/17/05
BandReject Filter	Lorch Microwave	6BR6-2442/300-N	Z1	CHAR 4/17/03	4/17/05
BandReject Filter	Lorch Microwave	5BR4-10525/900-S	Z1	CHAR 4/12/03	4/12/05
Notch Filter	Lorch Microwave	5BRX-850/X100-N	AD-1	CHAR 4/17/03	4/17/05
High Pass Filter	Unk	3768(5)-400	041	CHAR 12/17/02	12/17/04
High Pass Filter	Microlab	HA-10N		CHAR 11/17/02	11/17/04
High Pass Filter	Microlab	HA-20N		CHAR 12/17/02	12/17/04
Audio Oscillator	HP	653A	832-00260	CHAR 12/1/02	12/1/04
Audio Generator	B&K Precision	3010	8739686	CHAR 12/1/02	12/1/04
Frequency Counter	HP	5382A	1620A03535	CHAR 3/2/01	Out of Service
Frequency Counter	HP	5385A	3242A07460	CAL 3/7/03	3/7/05
Amplifier	HP	11975A	2738A01969	No Cal Required	
Egg Timer	Unk			CHAR 2/1/02	2/1/04
Measuring Tape-20M	Kraftixx	0631-20		CHAR 2/1/02	2/1/04
Measuring Tape-7.5M	Kraftixx	7.5M PROFI		CHAR 2/1/02	2/1/04
Coaxial Cable #51	Insulated Wire Inc.	NPS 2251-2880	Timco #51	CHAR 1/23/02	1/23/04
Coaxial Cable #64	Semflex Inc.	60637	Timco #64	CHAR 1/24/02	1/24/04
Coaxial Cable #65	General Cable Co.	E9917 REGATTA II33/U	Timco #65	CHAR 1/23/02	1/23/04
Coaxial Cable #106	Unknown	Unknown	Timco #106	CHAR 1/23/02	1/23/04
Injection Probe	Fischer Custom Communications	F-120-9A	270	CAL 6/1/01	6/1/03
Power Line Coupling/Decoupling	Fischer Custom Communications	FCC-801-M2-16A	01048	CAL 8/29/01	8/29/03

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Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date or Status
Network					
Power Line Coupling/Decoupling Network	Fischer Custom Communications	FCC-801-M3-16A	01060	CAL 8/29/01	8/29/03
VHF/UHF Current Probe	Fischer Custom Communications	F-52	130	CAL 8/30/01	8/30/03
Passive Impedance Adapter	Fischer Custom Communications	FCC-801-150-50-CDN	01117 & 01118	CAL 8/29/01	8/29/03
Radiating Field Coil	Fischer Custom Communications	F-1000-4-8/9/10-L-1M	9859	CAL 10/15/98	10/15/00
EMC Immunity Test System	Keytek	CEMASTER	9810210	CAL 2/1/02	2/1/04
Compliance Test System - AC Power Source	California Instruments	1251RP	L05865	CAL 2/25/04	2/25/06
Compliance Test System - PACS-1 Module	California Instruments	PACS-1	X71484	CAL 2/25/04	2/25/06
Isotropic Field Probe	Amplifier Research	FP5000	22839		
Isotropic Field Probe	Amplifier Research	FP5000	300103		
Capacitor Clamp	Keytek	CM-CCL	9811359	No Cal Required	
Amplifier	Amplifier Research	10W1000B	23117	No Cal Required	
Field Monitor	Amplifier Research	FM5004	22288	No Cal Required	
ELF Meter	F. W. Bell	4060	Not Serialized		Out of Service
Standard Gain Horn 1.0-2.4 GHz	Polarad	CA-L	235	No Cal Required	
Standard Gain Horn 2.14-4.34 GHz	Polarad	CA-S	203	No Cal Required	
Standard Gain Horn 3.95-5.85 GHz	Scientific-Atlanta Inc.	11A-3.9	8448CG	No Cal Required	
Standard Gain Horn 8.2-12.5 GHz	Systron Donner	DBG-520-20	Not Serialized	No Cal Required	
Standard Gain Horn 18.0-26.3 GHz	Systron Donner	DBE-520-20	Not Serialized	No Cal Required	
Standard Gain Horn 26.5-40.2 GHz	Systron Donner	DBD-520-20	Not Serialized	No Cal Required	
Standard Gain Horn	ATM	19-443-6R	Not Serialized	No Cal	

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Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date or Status
40.0-60.0 GHz				Required	
Double-Ridged Horn Antenna	EMCO	3116	9011-2145		Out of Service
Standard Gain Horn 12.4-18.0 GHz	ATM	62-442-6	D262108-01	No Cal Required	
Standard Gain Horn 5.85-8.2 GHz	ATM	137-442-2	D261908-01	No Cal Required	
AC Voltmeter	HP	400F	0950A05433	CAL 8/13/03	8/13/05
RF Power Amplifier	Ophir RF	5150F	1041 'X1'	No Cal Required	
Electric Field Sensor	Amplifier Research	FP6001	302504		
Electric Field Sensor	Amplifier Research	FP6001	302510	CAL 6/1/04	6/1/06
Surge Generator	Com-Power Corporation	SG-168	25802	CAL 2/27/04	2/27/06
RF Power Amplifier	Ophir RF, Inc.	5150F	1041	CHAR 10/31/03	10/31/05
3-Meter Anechoic Chamber	Panashield	N/A	N/A	Listed 5/12/04	5/11/07
Digital Multimeter	Fluke	77III	79510408	CAL 7/19/04	7/19/06
Open-Frame Tower Spectrum Analyzer	HP	8566B/85662A	2627A03154/2648A14276	CAL 7/9/04	7/9/06
Open-Frame Tower RF Preselector	HP	85685A	3107A01282	CAL 7/9/04	7/9/06
Open-Frame Tower Quasi-Peak Adapter	HP	85650A	2046A00305	CAL 7/9/04	7/9/06
Signal Generator	HP	8648C	3847A04696	CAL 9/27/04	9/27/06

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