

# 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 COMBO RADIO

FCC ID: BBOPR3500

Applicant:

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

**Date Receipt: OCTOBER 28, 2004**

**Date Tested: NOVEMBER 16, 2004**

**APPLICANT: COBRA ELECTRONICS CORPORATION**

**FCC ID: BBOPR3500**

**REPORT #: C\COBRA\1788ZUT4\1788ZUT4TestReport.doc**

**COVER SHEET**

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### 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

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## GENERAL INFORMATION REQUIRED FOR CERTIFICATION

2.1033(c)(1)(2) COBRA ELECTRONICS CORPORATION will manufacture the  
FCCID: BBOPR3500 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: 9K0F3E  
95.631

$B_n = 2M + 2DK$

$M = 3000$

$D = 1.5 K$

$B_n = 2(3000) + 2(1500) = 9K$

GMRS Authorized Bandwidth 20.0 kHz

|                                    |              |              |
|------------------------------------|--------------|--------------|
| 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 |              |

FRS Authorized Bandwidth 12.5KHz

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

**FINAL AMPLIFIER ONLY**

INPUT POWER - HIGH: (6 V)(0.7 A) = 4.20 Watts

INPUT POWER - LOW: (6 V)(0.4 A) = 2.40 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.

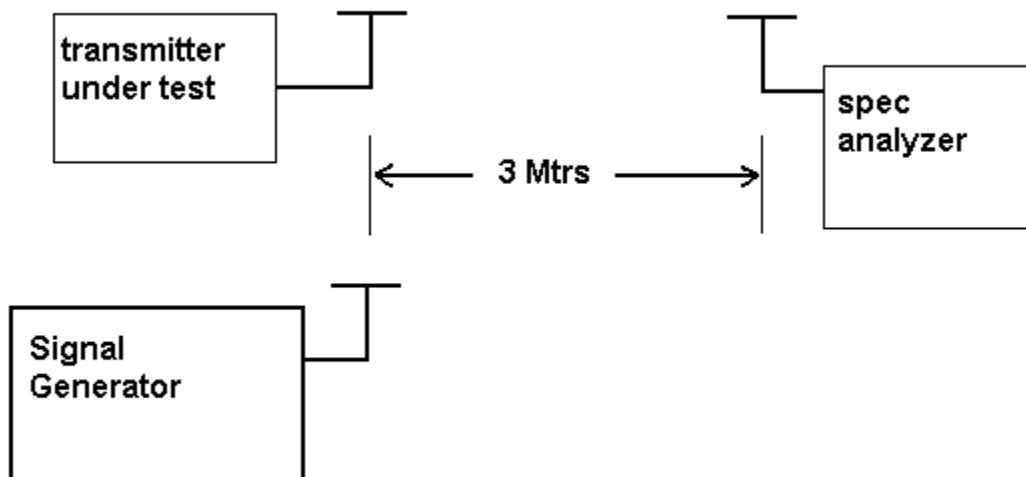
2.1033(c)(13) Digital modulation is not allowed.

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 6.0 V, and the transmitter properly adjusted the RF output measures:

**GMRS - 1.2 Watts ERP**

**FRS - .5 Watts ERP**



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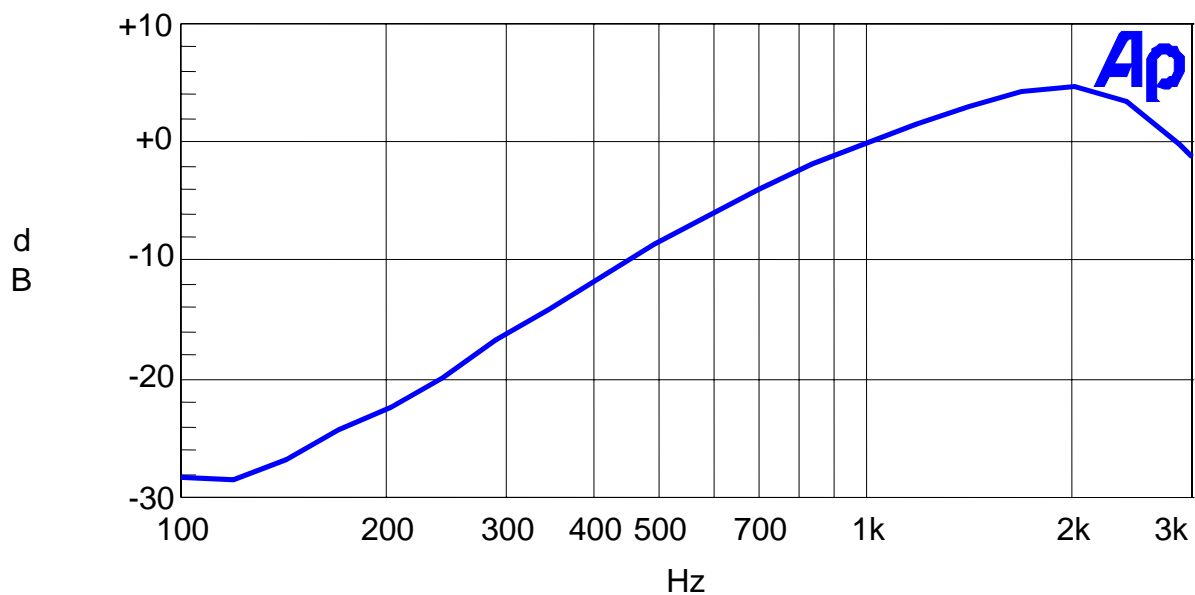
888.472.2424 F 352.472.2030 email: [sid@timcoengr.com](mailto:sid@timcoengr.com)

## 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.

Audio Frequency Response Plot



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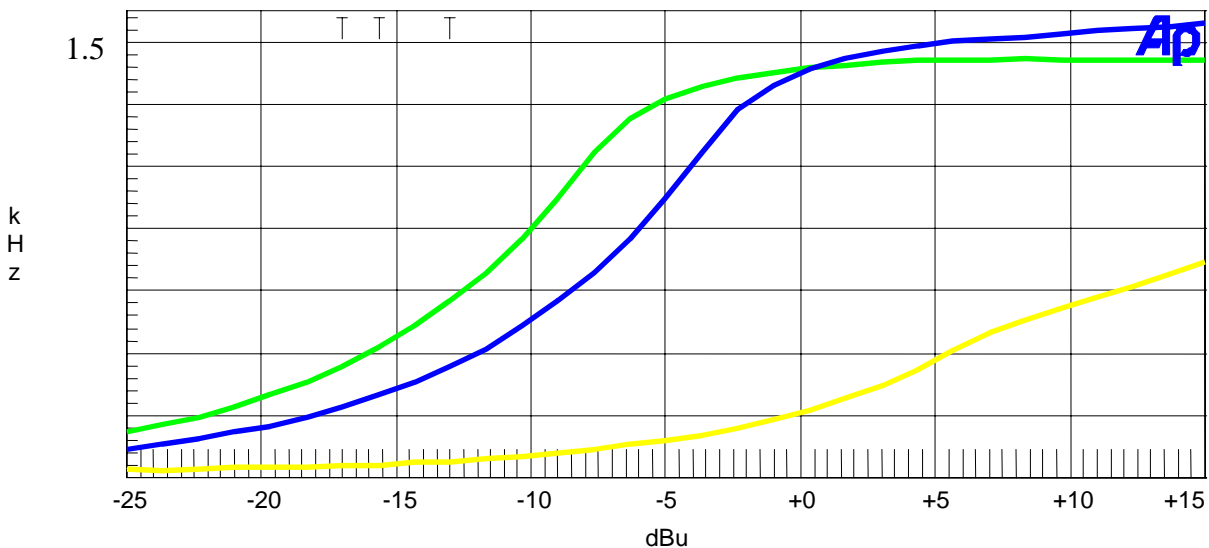
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## 2.1047(b) Audio input versus modulation

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.

### Modulation Limiting Plots:

2.5 KHz (Green), 1.0 KHz (Blue), and 300 Hz (Yellow)



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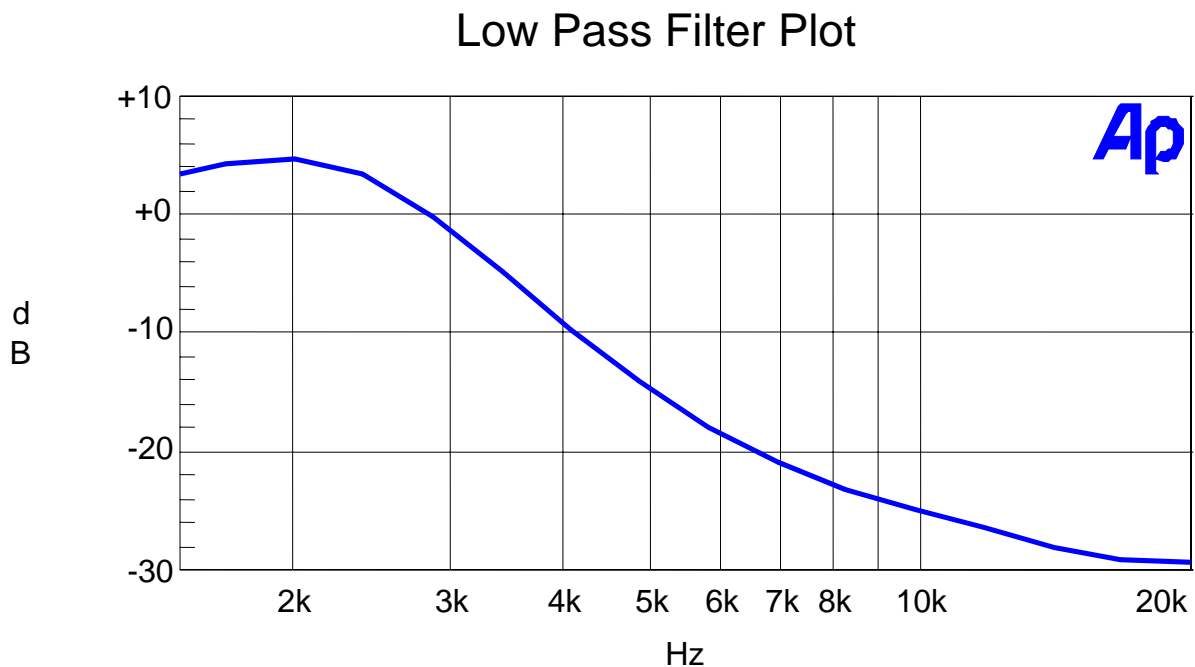
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95.637

## Post Limiter Filter Plot

Post Limiter Filter Each GMRS transmitter, except a mobile station transmitter with a power of 2.5Watts 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.



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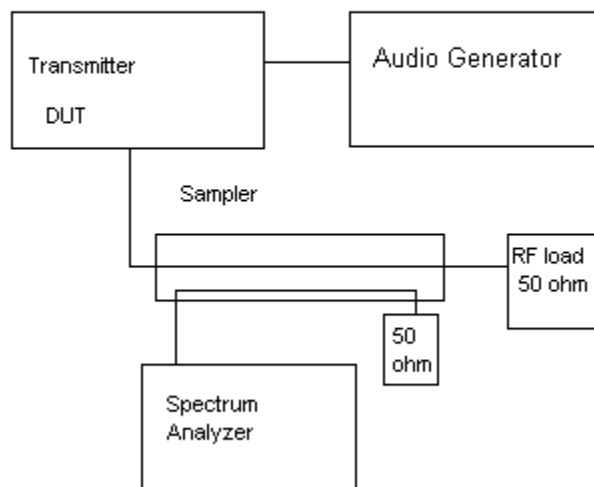
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## 2.1049 Occupied bandwidth: 95.635(b)(1)(3)(7)

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 plots on the next page.

Occupied BW Test Equipment Setup



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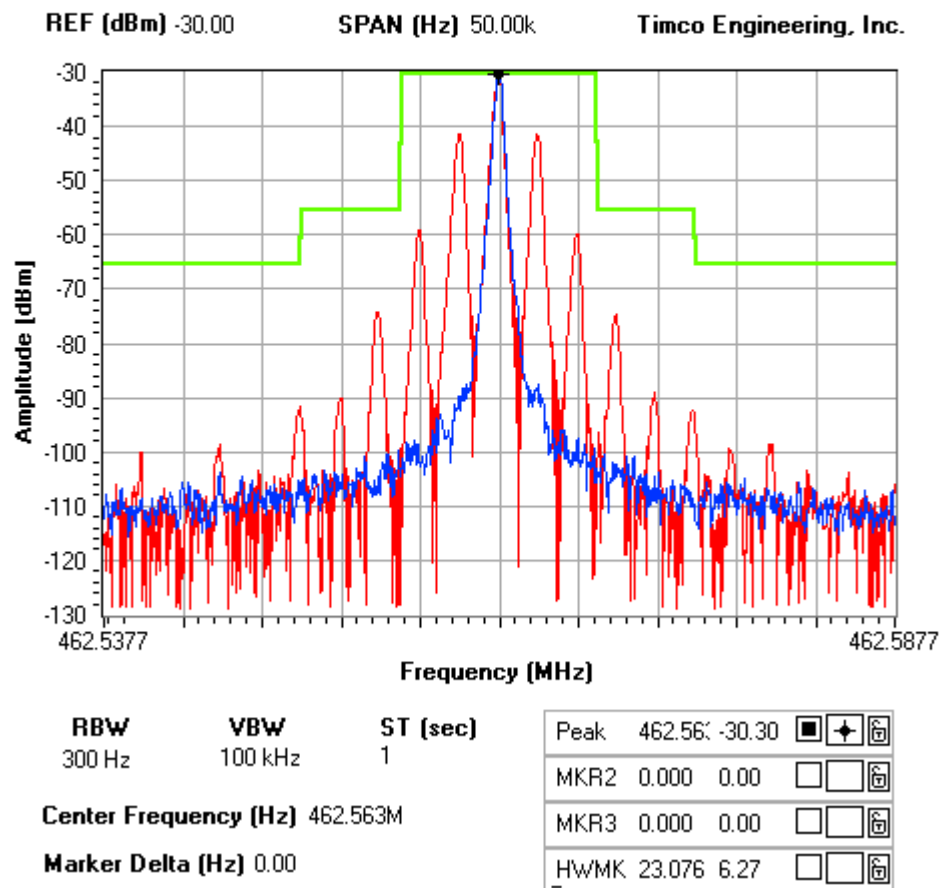
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## OCCUPIED BANDWIDTH PLOT

### NOTES:

COBRA ELECTRONICS CORPORATION - FCC ID: BBOPR3500  
OCCUPIED BANDWIDTH PLOT

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



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2.1051

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

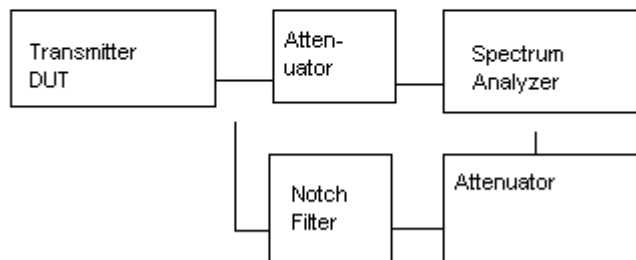
The following data shows the level of conducted Spurious responses at the antenna terminal. The test Procedure used was TIA/EIA 603 S2.2.13 with the exception that the emissions were recorded in dBc. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental.

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

**TEST RESULTS:** 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 (GMRS):

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:  $43 + 10\log(1.2) = 43.8 \text{ dB}$

### TEST DATA:

| Emission Frequency MHz | Ant. Polarity | Corrected EUT Signal Reading | Coax Loss (dB) | Substitution Antenna (dBd) | dB Below Carrier (dBc) |
|------------------------|---------------|------------------------------|----------------|----------------------------|------------------------|
| 462.70                 | V             | 30.70                        | 0              | -0.5                       | 0                      |
| 925.40                 | V             | -19.60                       | 0              | -0.85                      | 50.65                  |
| 1388.20                | V             | -36.60                       | 1.08           | 4.5                        | 63.38                  |
| 1850.90                | V             | -30.20                       | 1.17           | 5.16                       | 56.41                  |
| 2313.60                | V             | -52.00                       | 1.26           | 6.25                       | 77.21                  |
| 2776.40                | H             | -49.40                       | 1.33           | 7.07                       | 73.86                  |
| 3239.00                | V             | -39.70                       | 1.37           | 7.39                       | 63.88                  |
| 3701.70                | H             | -49.70                       | 1.42           | 7.55                       | 73.77                  |
| 4164.40                | H             | -47.00                       | 1.47           | 7.81                       | 70.86                  |
| 4627.20                | H             | -52.40                       | 1.53           | 8.2                        | 75.93                  |

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2.1053  
95.635(b)(7)

## UNWANTED RADIATION (FRS):

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:  $43 + 10\log(.5) = 40 \text{ dB}$

## TEST DATA:

| Emission Frequency<br>MHz | Ant. Polarity | Corrected EUT<br>Signal<br>Reading | Coax Loss<br>(dB) | Substitution Antenna<br>(dBd) | dB Below Carrier<br>(dBc) |
|---------------------------|---------------|------------------------------------|-------------------|-------------------------------|---------------------------|
| 467.50                    | V             | 27.60                              | 0                 | -0.52                         | 0                         |
| 935.00                    | V             | -15.90                             | 0                 | -0.97                         | 43.95                     |
| 1402.60                   | V             | -33.40                             | 1.08              | 4.56                          | 57                        |
| 1870.10                   | V             | -37.70                             | 1.17              | 5.17                          | 60.78                     |
| 2337.70                   | H             | -50.50                             | 1.27              | 6.33                          | 72.52                     |
| 2803.30                   | H             | -48.00                             | 1.33              | 7.08                          | 69.33                     |
| 3272.90                   | V             | -37.10                             | 1.38              | 7.41                          | 58.15                     |
| 3740.40                   | V             | -50.10                             | 1.42              | 7.55                          | 71.05                     |
| 4208.10                   | H             | -50.10                             | 1.47              | 7.88                          | 70.77                     |
| 4675.60                   | V             | -50.10                             | 1.54              | 8.14                          | 70.58                     |

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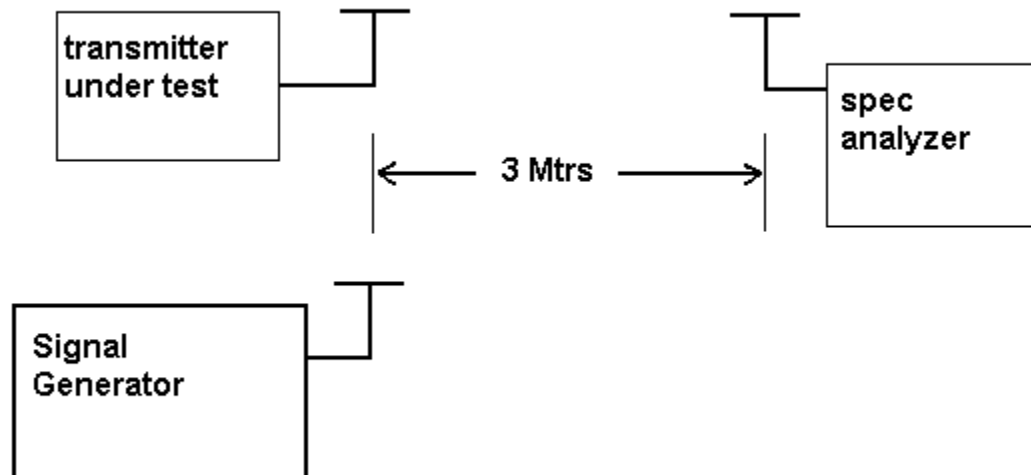
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## Method of Measuring Radiated Spurious Emissions



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 Frequency stability:

95.621(b)

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 6.0 VDC.

### MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 467.713 138 MHz

| TEMPERATURE_ °C | FREQUENCY_MHz | PPM    |
|-----------------|---------------|--------|
| REFERENCE_____  | 467.713 138   | 00.00  |
| -30_____        | 467.712 117   | - 2.18 |
| -20_____        | 467.713 169   | + 0.07 |
| -10_____        | 467.713 594   | + 0.97 |
| 0_____          | 467.713 846   | + 1.51 |
| +10_____        | 467.713 670   | + 1.14 |
| +20_____        | 467.713 138   | 0.00   |
| +30_____        | 467.712 568   | - 1.22 |
| +40_____        | 467.712 116   | - 2.19 |
| +50_____        | 467.712 077   | - 2.27 |

| <u>BATT</u> | <u>%BATT. DATA</u> | <u>VOLTS</u> | <u>BATT. PPM</u> |
|-------------|--------------------|--------------|------------------|
| -15%        | 467.713 252        | 5.10         | + 0.24           |

**RESULTS OF MEASUREMENTS:** The test results indicates that the EUT meets the requirements.

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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<br>1/13/03 | 1/12/06            |
| 3/10-Meter OATS                 | TEI             | N/A           | N/A                   | Listed<br>3/27/04 | 3/26/07            |
| Tan Tower Spectrum Analyzer     | HP              | 8566B Opt 462 | 3138A07786 3144A20661 | CAL<br>9/23/03    | 9/23/05            |
| Tan Tower RF Preselector        | HP              | 85685A        | 3221A01400            | CAL<br>9/23/03    | 9/23/05            |
| Tan Tower Quasi-Peak Adapter    | HP              | 85650A        | 3303A01690            | CAL<br>9/23/03    | 9/23/05            |
| Tan Tower Preamplifier          | HP              | 8449B-H02     | 3008A00372            | CAL<br>9/23/03    | 9/23/05            |
| Blue Tower Spectrum Analyzer    | HP              | 8568B         | 2928A04729 2848A18049 | CAL<br>4/15/03    | 4/15/05            |
| Blue Tower RF Preselector       | HP              | 85685A        | 2620A00294            | CAL<br>4/27/04    | 4/27/06            |
| Blue Tower Quasi-Peak Adapter   | HP              | 85650A        | 2811A01279            | CAL<br>4/15/03    | 4/15/05            |
| Silver Tower Spectrum Analyzer  | HP              | 8566B Opt 462 | 3552A22064 3638A08608 | CAL<br>3/22/04    | 3/22/06            |
| Silver Tower RF Preselector     | HP              | 85685A        | 2926A00983            | CAL<br>3/22/04    | 3/22/06            |
| Silver Tower Quasi-Peak Adapter | HP              | 85650A        | 3303A01844            | CAL<br>3/22/04    | 3/22/06            |
| Silver Tower Preamplifier       | HP              | 8449B         | 3008A01075            | CAL<br>3/22/04    | 3/22/06            |
| Biconnical Antenna              | Electro-Metrics | BIA-25        | 1171                  | CAL<br>4/26/01    | 4/26/03            |
| Biconnical Antenna              | Eaton           | 94455-1       | 1096                  | CAL<br>8/17/04    | 8/17/06            |
| Biconnical Antenna              | Eaton           | 94455-1       | 1057                  | CAL<br>3/18/03    | 3/18/05            |
| BiconiLog Antenna               | EMCO            | 3143          | 9409-1043             | No Cal Required   |                    |
| Log-Periodic Antenna            | Electro-Metrics | LPA-25        | 1122                  | CAL<br>8/26/04    | 8/26/06            |
| Log-Periodic Antenna            | Electro-Metrics | LPA-30        | 409                   | CAL<br>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<br>5/8/03    | 5/8/05             |
| Dipole Antenna Kit               | Electro-Metrics             | TDA-30/1-4 | 152           | CAL<br>3/21/01   | 3/21/04            |
| Dipole Antenna Kit               | Electro-Metrics             | TDA-30/1-4 | 153           | CAL<br>9/26/02   | 9/26/05            |
| Double-Ridged Horn Antenna       | Electro-Metrics             | RGA-180    | 2319          | CAL<br>2/17/03   | 2/17/05            |
| Horn Antenna *(at 3 meters)      | Electro-Metrics             | EM-6961    | 6246          | CAL<br>3/31/03   | 3/31/05            |
| Horn Antenna *(at 10 meters)     | Electro-Metrics             | EM-6961    | 6246          | CAL<br>6/4/03    | 6/4/05             |
| Passive Loop Antenna             | EMC Test Systems            | EMCO 6512  | 9706-1211     | CHAR<br>7/10/01  | 7/10/03            |
| Harmonic Mixer with Horn Antenna | Oleson Microwave Labs       | M08HW/A    | F30425-1      | CHAR<br>4/25/03  | 4/25/05            |
| Harmonic Mixer with Horn Antenna | Oleson Microwave Labs       | M12HW/A    | E30425-1      | CHAR<br>4/25/03  | 4/25/05            |
| LISN                             | Electro-Metrics             | ANS-25/2   | 2604          | CAL<br>8/27/04   | 8/27/06            |
| LISN                             | Electro-Metrics             | EM-7820    | 2682          | CAL<br>3/12/03   | 3/12/05            |
| Termaline Wattmeter              | Bird Electronic Corporation | 611        | 16405         | CAL<br>7/16/04   | 7/16/06            |
| Termaline Wattmeter              | Bird Electronic Corporation | 6104       | 1926          | CAL<br>7/16/04   | 7/16/06            |
| Oscilloscope                     | Tektronix                   | 2230       | 300572        | CAL<br>7/3/03    | 7/3/05             |
| System One                       | Audio Precision             | System One | SYS1-45868    | CHAR<br>4/25/02  | 4/25/04            |
| Temperature Chamber              | Tenney Engineering          | TTRC       | 11717-7       | CHAR<br>1/22/02  | 1/22/04            |
| AC Voltmeter                     | HP                          | 400FL      | 2213A14499    | CAL<br>7/19/04   | 7/19/06            |
| AC Voltmeter                     | HP                          | 400FL      | 2213A14261    | CHAR<br>10/15/01 | 10/15/03           |
| AC Voltmeter                     | HP                          | 400FL      | 2213A14728    | CHAR<br>10/15/01 | 10/15/03           |
| Digital Multimeter               | Fluke                       | 77         | 35053830      | CHAR<br>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<br>1/8/02  | 1/8/04             |
| Multimeter             | Fluke                | FLUKE-77-3      | 79510405      | CHAR<br>9/26/01 | 9/26/03            |
| Peak Power Meter       | HP                   | 8900C           | 2131A00545    | CAL<br>7/2/03   | 7/2/05             |
| Power Sensor           | Agilent Technologies | 84811A          | 2551A02705    | CAL<br>7/2/03   | 7/2/05             |
| Power Meter            | HP                   | 432A            | 1141A07655    | CAL<br>4/15/03  | 4/15/05            |
| Power Sensor           | HP                   | 478A            | 72129         | CAL<br>4/15/03  | 4/15/05            |
| Power Meter And Sensor | Bird                 | 4421-107 & 4022 | 0166 & 0218   | CAL<br>4/16/03  | 4/16/05            |
| Digital Thermometer    | Fluke                | 2166A           | 42032         | CAL<br>7/19/04  | 7/19/06            |
| Thermometer            | Traulsen             | SK-128          |               | CHAR<br>1/22/02 | 1/22/04            |
| Thermometer            | Extech               | 4028            | 14871-2       | CAL<br>3/7/03   | 3/7/05             |
| Hygro-Thermometer      | Extech               | 445703          | 0602          | CAL<br>10/4/02  | 10/4/04            |
| Frequency Counter      | HP                   | 5352B           | 2632A00165    | CAL<br>8/3/04   | 8/3/06             |
| Frequency Counter      | HP                   | 5385A           | 2730A03025    | CAL<br>3/7/03   | 3/7/05             |
| Service Monitor        | IFR                  | FM/AM 500A      | 5182          | CAL<br>11/22/00 | Out of Service     |
| Comm. Serv. Monitor    | IFR                  | FM/AM 1200S     | 6593          | CAL<br>5/12/02  | 5/12/04            |
| Signal Generator       | HP                   | 8640B           | 2308A21464    | CAL<br>8/26/04  | 8/26/06            |
| Sweep Generator        | Wiltron              | 6648            | 101009        | CAL<br>4/15/03  | 4/15/05            |
| Sweep Generator        | Wiltron              | 6669M           | 007005        | CAL<br>3/3/03   | 3/3/05             |
| Modulation Analyzer    | HP                   | 8901A           | 3435A06868    | CAL<br>9/5/01   | 9/5/03             |
| Modulation Meter       | Boonton              | 8220            | 10901AB       | CAL<br>4/15/03  | 4/15/05            |
| Near Field Probe       | HP                   | HP11940A        | 2650A02748    | CHAR<br>2/1/01  | Out of Service     |

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| 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 RG233/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 Network | 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 |
|--|-------------------------------|----------------------|----------------|-----------------|--------------------|
| 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 40.0-60.0 GHz         | ATM                           | 19-443-6R            | Not Serialized | No Cal Required |                    |

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|-------------------------------------|-----------------------|--------------|-----------------------|-----------------|--------------------|
| 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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