

# **THRU Lab & Engineering.**

RM302,Bokjo,29-15 , Chongpa3-Dong

Yongsan-Gu, Seoul, Korea

81221095059F81221095056 email thrukang@kornet.net



## **Test Report**

Product Name: GMRS/FRS Combination

MODEL NO:LXT420

FCC ID:MMALXT420

## **Applicant:**

Midland Radio Corporation.

1120 Clay St. North Kansas City,

MO 64116

Date Receipt:12/09/2005

Date Tested: 12/15/2005

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## GENERAL INFORMATION REQUIRED FOR CERTIFICATION

2.1033 (c) (1) (2) MidLand Radio Corporation. will manufacture

the FCCID: MMALXT420 GMRS/FRS COMBINATION TRANSCEIVER  
in quantity, for use under FCC RULES PART 95.  
MidLand Radio Corporation.  
1120 Clay St.  
North Kansas City, MO 64116

2.1033 (c) TECHNICAL DESCRIPTION

2.1033 (c) (3) Instruction book. A draft copy of the instruction  
manual is included as EXHIBIT 7.

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

$B_n = 2M + 2DK$   
 $M = 3000$   
 $D = 2.25k$   
 $B_n = 2(3000) + 2(2250) = 10.5k$

GMRS Frequency Range :20.0kHz

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

2.10311c)(6)(7) RF power is measured by the substitution method as  
2.1046(a) outlined in TIA/EIA - 603. With a nominal battery  
voltage of 6V, and the transmitter properly  
adjusted the RF output measures:

power supply : Roket batteries (1.5VDC) 4

GMRS (High) - 1.024 Watts  
GMRS (Low) - 0.275 Watts  
FRS - 0.444 Watts

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2.1033(c)(6)(7) FRS 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.

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

FOR GMRS HIGH POWER SETTING INPUT POWER: (6V)(0.450 A)=2.7 Watts

FOR GMRS LOW POWER SETTING INPUT POWER: (6V)(0.315 A)=1.89 Watts

FOR FRS POWER SETTING INPUT POWER: (6V)(0.320 A)=1.92 Watts

2.1033(c)(9) Tune-up procedure. The tune-up procedure is included as EXHIBIT # 9.

2.1033(c)(10) Complete Circuit Diagrams: The circuit diagram is included as EXHIBIT 6 of this report. The block diagrams are included as EXHIBIT 5 of this report.

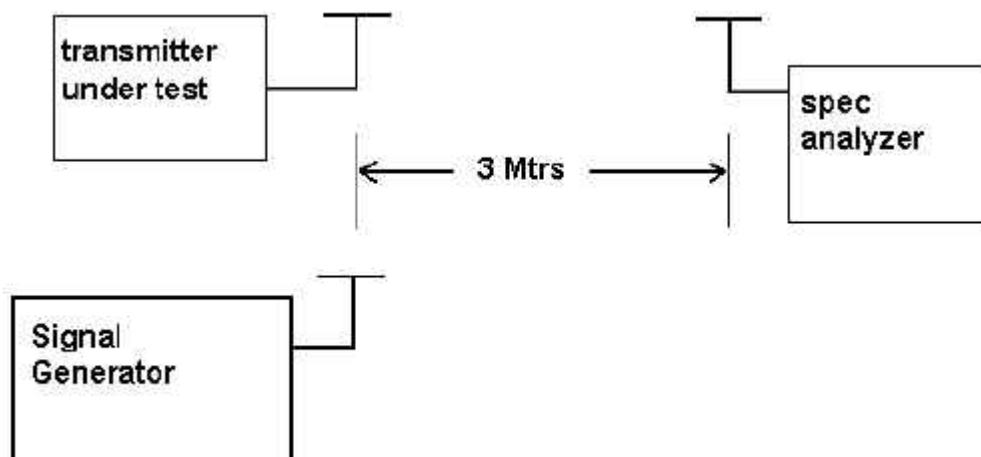
2.1033(c)(11) A photograph or a drawing of the equipment identification label is included as exhibit No. 1.

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. See exhibits 3-4.

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.

2.1046(a) RF power output. The test procedure used was TIA/EIA-603.



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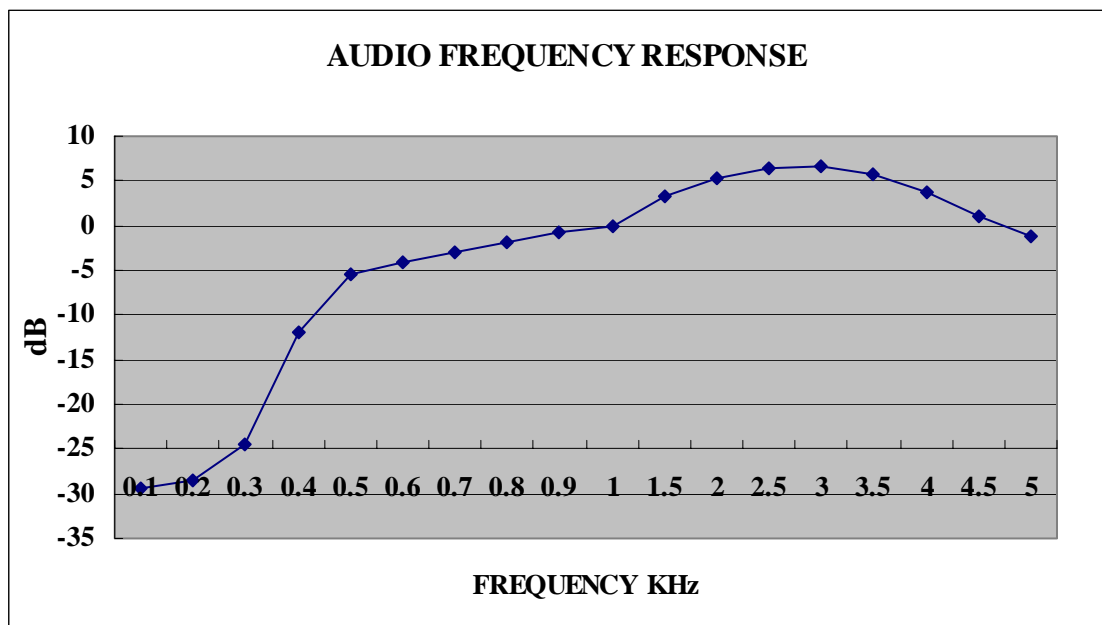
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2.1047 (a) (b) Modulation characteristics :

## 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.

AUDIO FREQUENCY RESPONSE PLOT GOES HERE



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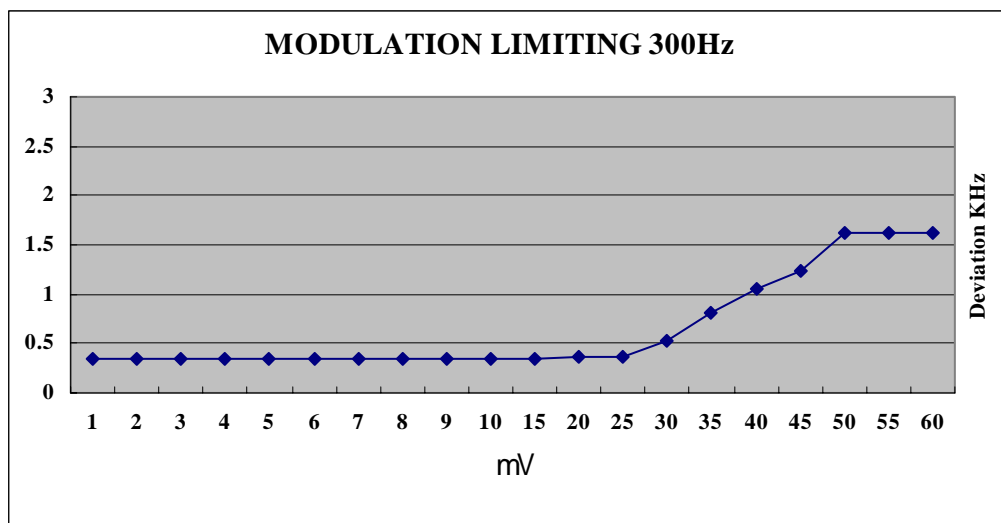
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2.1047 (b)

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 Pages 6 and 7 of report.



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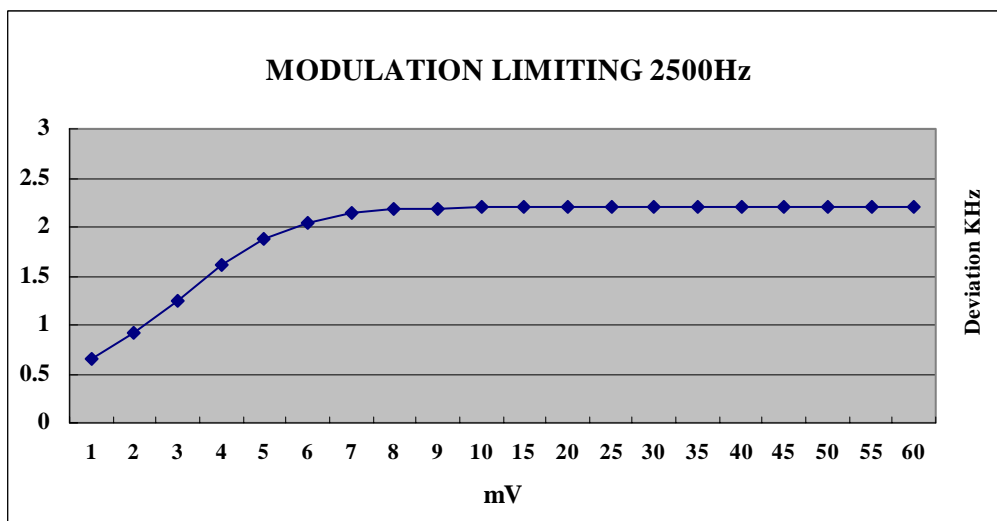
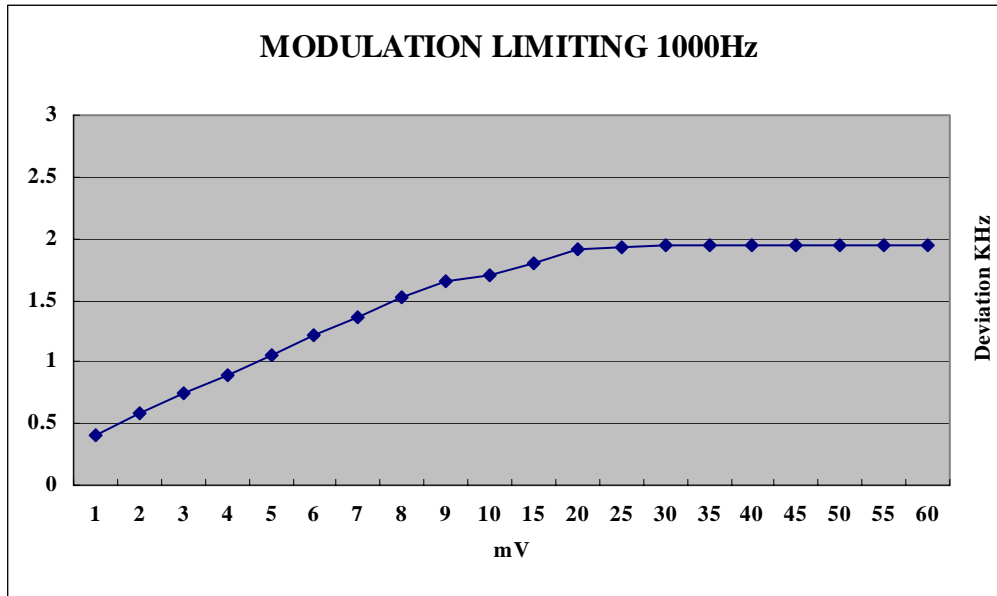
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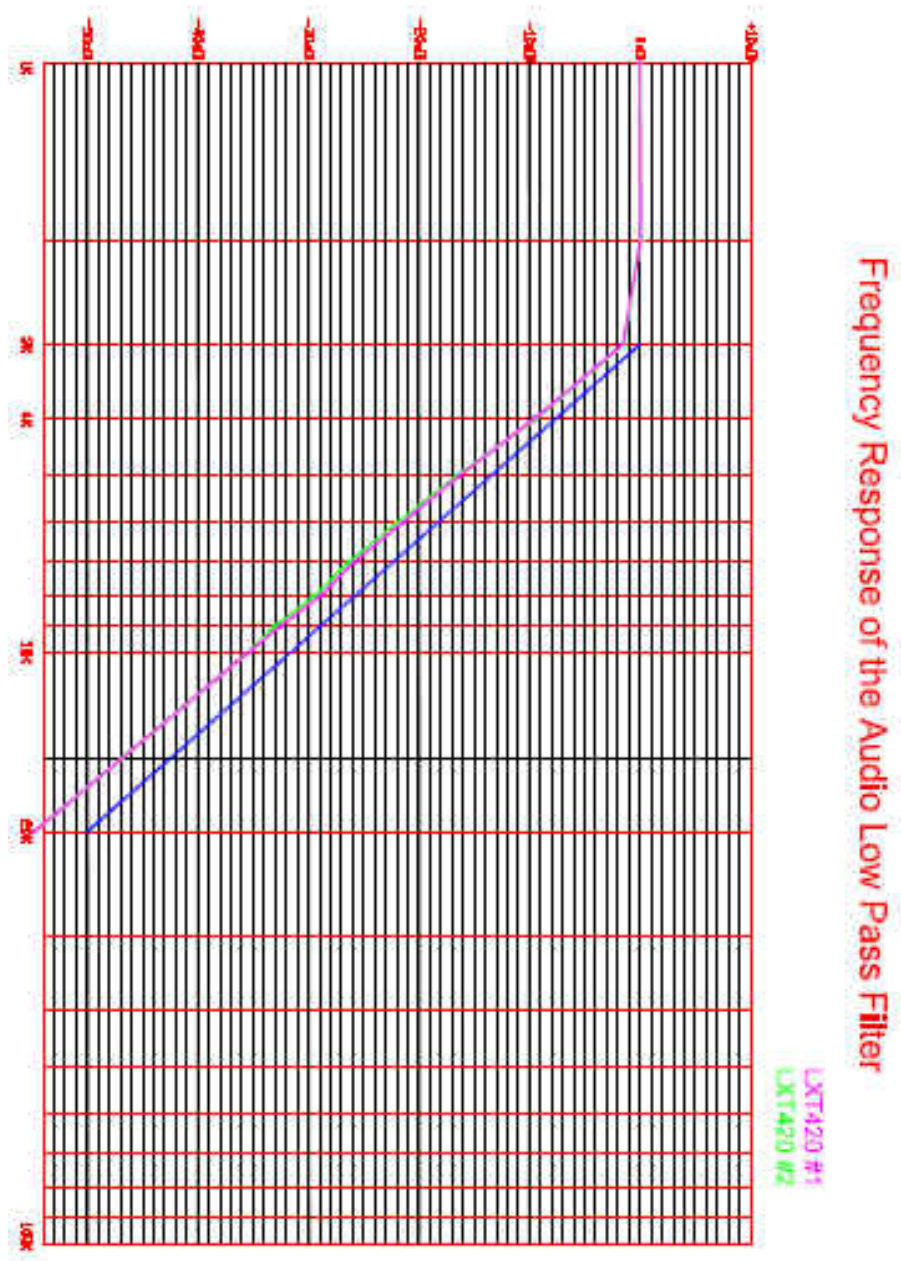
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## AUDIO LOW PASS FILTER GRAPH

95.637

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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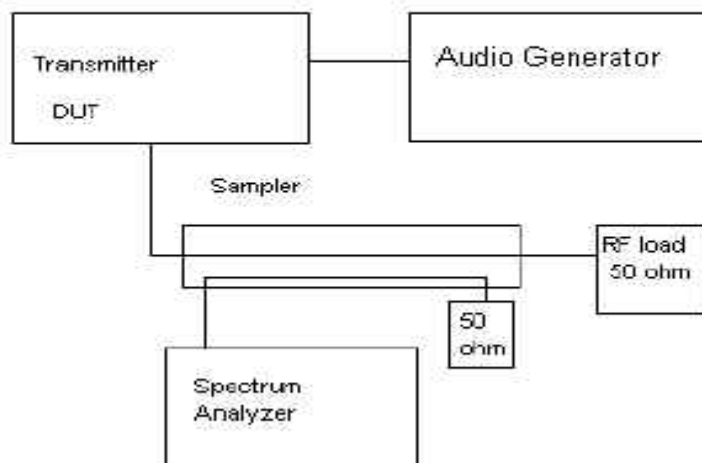
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2.1049 Occupied bandwidth :

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 35dB 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 1 pages.

Occupied BW Test Equipment Setup



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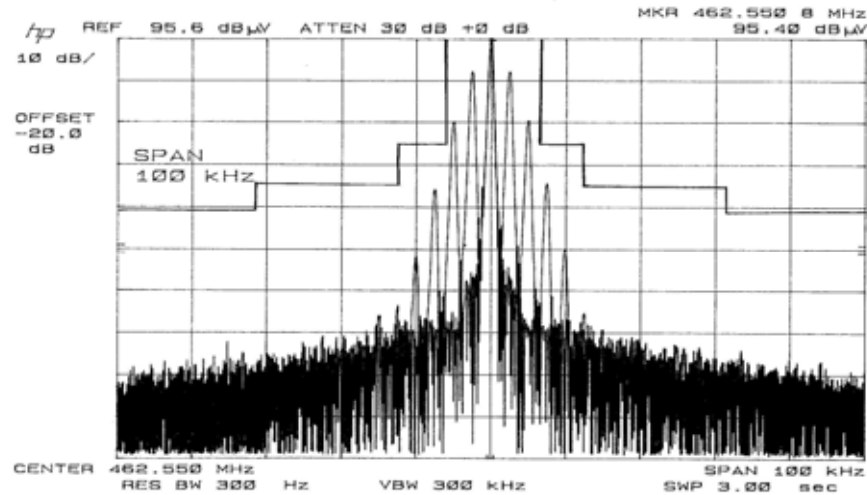
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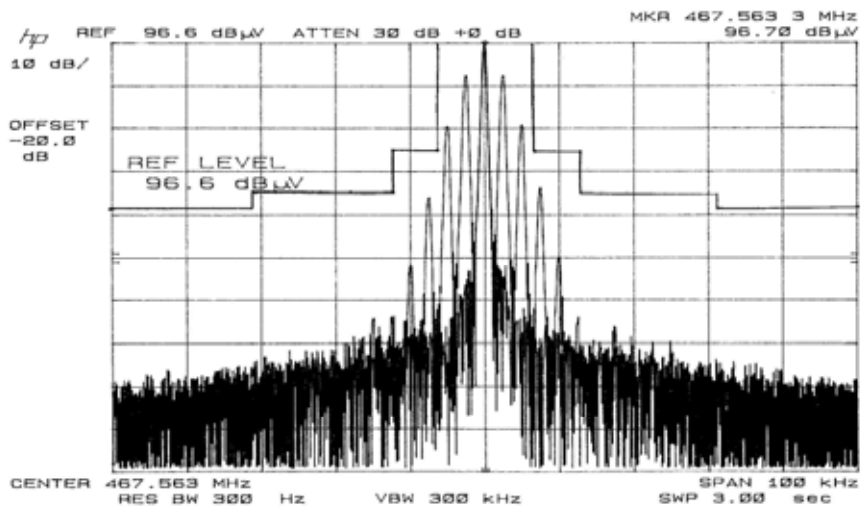
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15ch GMRS



8ch FRS



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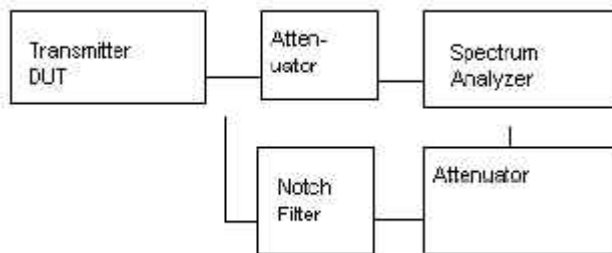
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2.1051 Spurious emissions at antenna terminals (conducted) :

The following data shows the level of conducted spurious responses at the antenna terminal. The test procedure used was TIS/EIA 603 S2.2.13 with the exception that the emissions were recorded in dBc. The spectrum was the fundamental.

spurious Emission at  
antenna Terminals



Method of Measuring Conducted Spurious Emissions

2.1051 Spurious emissions at the Antenna Terminals

NAME OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

2.1051 Not Applicable, no antenna terminal allowed.

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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 10<sup>th</sup> harmonic of The fundamental. This test was conducted per ANSI C63.4 - 2003.

**REQUIREMENTS: GMRS High :  $43 + 10\log(1.024) = 43.10299$  dB**

**GMRS Low :  $43 + 10\log(0.275) = 37.39332$  dB**

| Test Data :        | GMRS-    | High Power |  | Test Data :        | GMRS -   | Low Power |
|--------------------|----------|------------|--|--------------------|----------|-----------|
|                    |          |            |  |                    |          |           |
| Emission Frequency | ATTN dBc | Margin dB  |  | Emission Frequency | ATTN dBc | Margin dB |
| 462.55             | 0.00     | 0.00       |  | 462.55             | 0.00     | 0.00      |
| 925.10             | 49.28    | 6.18       |  | 925.10             | 40.92    | 3.52      |
| 1387.65            | 48.43    | 5.33       |  | 1387.65            | 54.40    | 17.00     |
| 1850.20            | 60.30    | 17.20      |  | 1850.20            | 45.77    | 8.37      |
| 2312.75            | 45.12    | 2.02       |  | 2312.75            | 39.95    | 2.55      |
| 2775.30            | 45.17    | 2.07       |  | 2775.30            | 43.97    | 6.57      |
| 3237.85            | 47.70    | 4.59       |  | 3237.85            | 45.20    | 7.79      |
| 3700.40            | 46.26    | 3.16       |  | 3700.40            | 46.26    | 8.86      |
| 4162.95            | 54.19    | 11.08      |  | 4162.95            | 48.69    | 11.28     |
| 4625.50            | 54.61    | 11.51      |  | 4625.50            | 50.01    | 12.61     |

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 ThruLab & ENGINEERING. located at 389 JeAm-Rhi HyangNam-Myun, HwaSung-Shi, KyoungKi-Do Korea.

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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 10<sup>th</sup> harmonic of The fundamental. This test was conducted per ANSI C63.4 - 2003.

**REQUIREMENTS: FRS:  $43 + 10\log(0.444) = 39.47382$  dB**

| Test Data :        | FRS      |           |
|--------------------|----------|-----------|
|                    |          |           |
| Emission Frequency | ATTN dBc | Margin dB |
| 467.56             | 0.00     | 0.00      |
| 935.13             | 42.02    | 2.55      |
| 1402.69            | 55.94    | 16.47     |
| 1870.25            | 50.34    | 10.86     |
| 2337.81            | 41.79    | 2.32      |
| 2805.38            | 49.71    | 10.24     |
| 3272.94            | 50.23    | 10.76     |
| 3740.50            | 48.91    | 9.44      |
| 4208.06            | 50.62    | 11.15     |
| 4675.63            | 49.31    | 9.83      |

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 ThruLab & ENGINEERING. located at 389 JeAm-Rhi HyangNam-Myun, HwaSung-Shi, KyoungKi-Do Korea.

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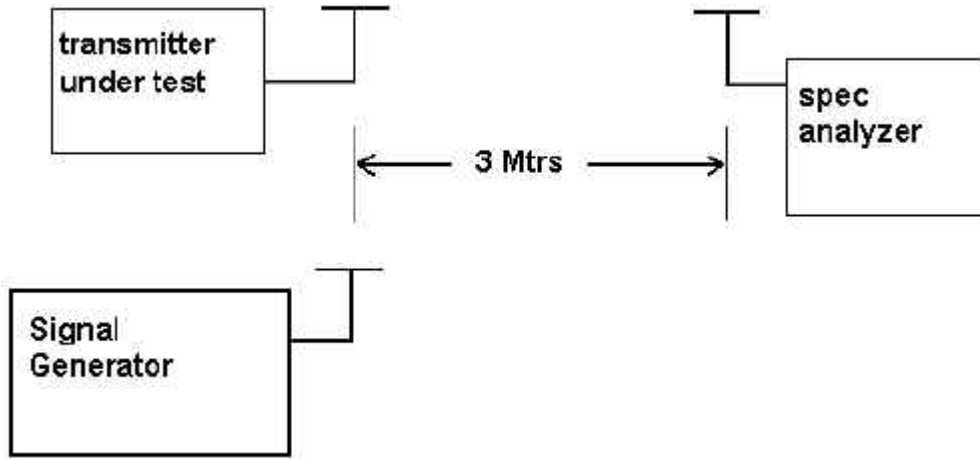
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Method of Measuring Radiated Spurious Emissions



Equipment placed 80 cm above ground

on a rotatable platform.

\* Appropriate antenna raised from 1 to 4 M.

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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 degrees 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 acssigned channel frequency was considered to be the reference frequency. The temperature was then reduced to - 30 degress 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 degrees C.

Reading were also taken at the end point of the battery voltage of 6 V/dc

## MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 462.5500

| TEMPERATURE               | FREQUENCY (MHz ) | ppm   | LIMIT (ppm) |
|---------------------------|------------------|-------|-------------|
| REFERENCE                 | 462.55000        | 0     |             |
| -30                       | 462.54900        | -2.16 | 5.0         |
| -20                       | 462.54898        | -2.21 | 2.5         |
| -10                       | 462.54938        | -1.34 | 2.5         |
| 0                         | 462.54994        | -0.13 | 2.5         |
| 10                        | 462.55010        | 0.22  | 2.5         |
| 20                        | 462.55013        | 0.28  | 2.5         |
| 30                        | 462.55002        | 0.04  | 2.5         |
| 40                        | 462.54970        | -0.65 | 2.5         |
| 50                        | 462.55009        | 0.19  | 2.5         |
| END POINT OF BATTERY:3.1V | 462.55029        | 0.63  | 2.5         |

Note: This EUT meets the frequency stability requirement for a FRS: +/-2.5ppm over temp range of -20 degress 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               | MODEL        | MFGR            | SERNO          | DUE.CAL      |
|----------------------|--------------|-----------------|----------------|--------------|
| EMI Test Receiver    | ESVS 10      | Rohde & Schwarz | 830489/001     | 2006.04.23.  |
| Spectrum Analyzer    | 8566B        | Hewlett Packard | 2311A02394     | 2006.04.23   |
| Spectrum Display     | 85662A       | Hewlett Packard | 2542A12429     | 2006.04.23.  |
| Quasi-Peak Adapter   | 85650A       | Hewlett Packard | 2521A00887     | 2006.04.23.  |
| RF Preselector       | 85685A       | Hewlett Packard | 2648A00504     | 2006.04.23   |
| Pre-Amplifier        | 8449B        | Hewlett Packard | 3008A00375     | 2006.04.23.  |
| Pre-Amplifier        | 8447F        | Hewlett Packard | 3113A05367     | 2006.04.23.  |
| Spectrum Monitor     | EZM          | Rohde & Schwarz | 862304/007     | 2006.04.23.  |
| Bico-Antenna         | 94455-1      | Eaton           | 977            | 2007.04.01.  |
| Log-Periodic Antenna | 3146         | EMCO            | 2051           | 2007.04.01.  |
| Dipole Antenna       | TDA25/1/2    | Electro Metrics | 176/200/200    | 2007.04.01.  |
| Horn Antenna         | SAS-571      | A.H Systems     | 414            | 2007.04.01.  |
| Spectrum Analyzer    | R3261C       | Advantest       | 71720189       | 2006.04.23   |
| LISN                 | KNW-242      | Kyoritsu        | 8-923-2        | 2007.04.25.  |
| LISN                 | 8012-50-R-24 | Solar           | 8379121        | 2007.04.25.. |
| Loop Ant             | 6507         | EMCO            | 1435           | 2005.10.06.  |
| Signal Generator     | SMS          | Rohde & Schwarz | 872165/100     | 2006.04.23.  |
| Modulation Analyzer  | 8901B        | Hewlett Packard | 3438A05094     | 2006.04.23.  |
| Frequency Counter    | CMC251       | Tektronic       | CMC-251TW52489 | 2006.04.23.  |

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