A. INTRODUCTION

The following data are submitted in connection with this request for type acceptance of the GR-1000 transceiver in accordance with Part 2, Subpart J of the FCC Rules.

The GR-1000 is a hand-held, battery operated, UHF, frequency modulated, 2 W transceiver intended for voice communications applications in the 462.5500 - 462.7250 MHz band under Part 95 in the GMRS service.

B. GENERAL INFORMATION REQUIRED FOR TYPE ACCEPTANCE (Paragraph 2.983 of the Rules)

1. Name of applicant: Wireless Marketing Corporation

2. Identification of equipment: FCC ID: MGPGR-1000

   a. The equipment identification label is shown in Appendix 1.
   b. Photographs of the equipment are included in Appendix 2.

3. Quantity production is planned.

4. Technical description:

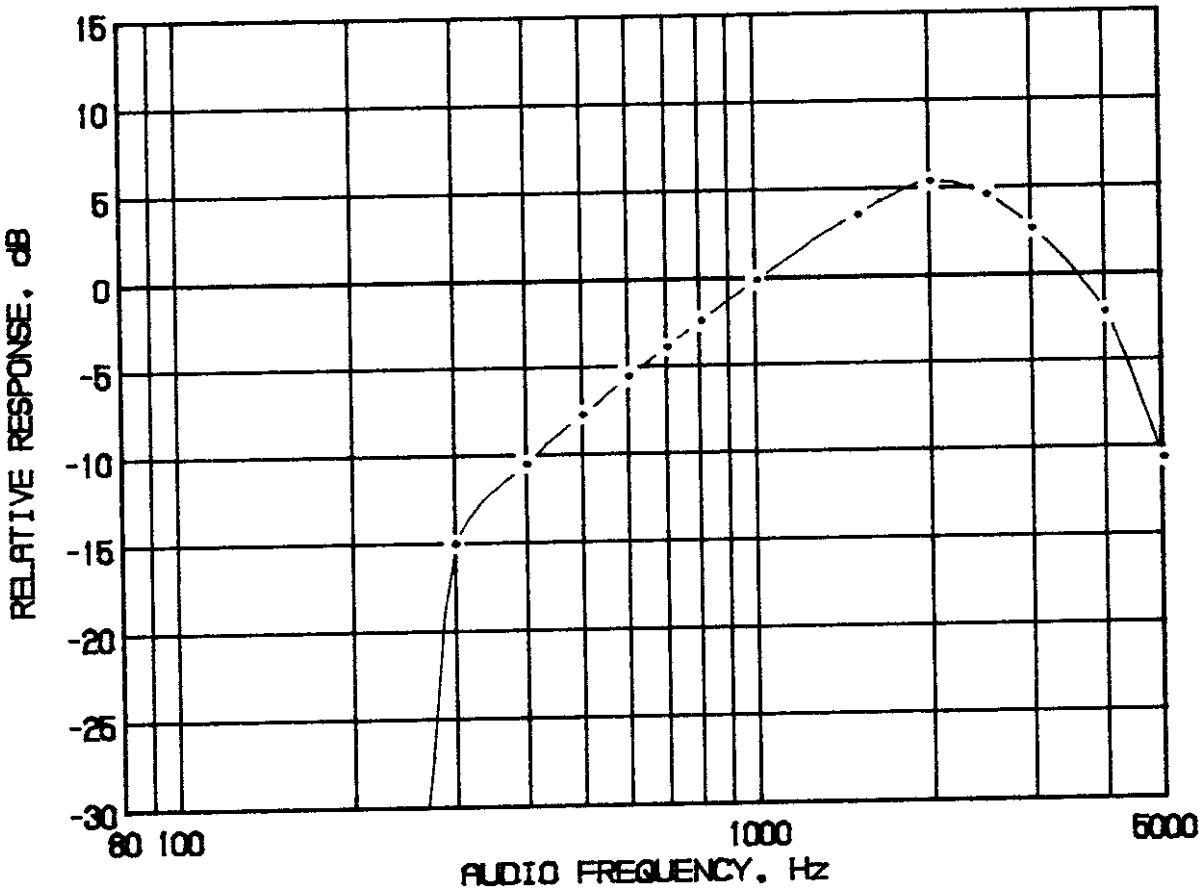
   a. 16k0F3E emission
   b. Frequency range: 462.5500-462.7250 MHz.
   c. Operating power of transmitter is fixed at the factory at 2 watts.
   d. Maximum power permitted under FCC Part 95 (interstitial) is 5 watts ERP. The GR-1000 fully complied with that power limitation.
   e. The dc voltage and dc currents at final amplifier:

      Collector voltage: 7.1 Vdc
      Collector current: 0.056 A

   f. Function of each active semiconductor device: See Appendix 3.
   g. Complete circuit diagram is included in Appendix 4.
   h. A draft instruction book is submitted as Appendix 5.
   i. The transmitter tune-up procedure is included in Appendix 6.
   j. A description of circuits for stabilizing frequency is included in Appendix 7.
   k. A description of circuits and devices employed for suppression of spurious radiation and for limiting modulation is included in Appendix 8.
   l. Not applicable.

FIGURE 1

MODULATION FREQUENCY RESPONSE

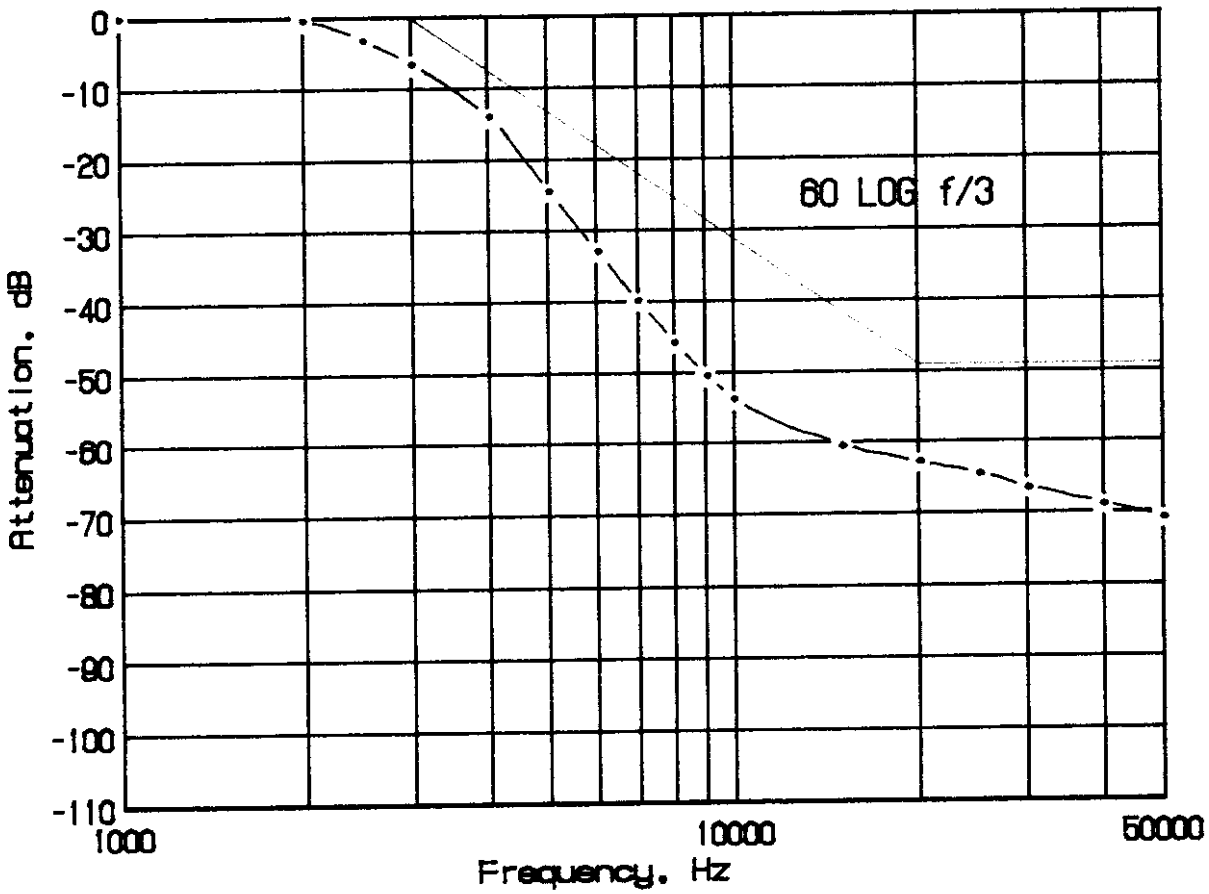


MODULATION FREQUENCY RESPONSE
FCC ID: MGPGR-1000

FIGURE 1

FIGURE 3

AUDIO LOW PASS FILTER RESPONSE



AUDIO LOW PASS FILTER RESPONSE
FCC ID: MGPGR-1000

FIGURE 3

E. SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS
(Paragraph 2.991 of the Rules)

The GR-1000 transmitter was tested for spurious emissions at the antenna terminals while the equipment was modulated with a 2500 Hz signal, 16 dB above minimum input signal for 50% (2.5 kHz deviation) modulation at 2788 Hz, the frequency of highest sensitivity.

Measurements were made with Tektronix 494P spectrum analyzer coupled to the transmitter output terminal through Narda 765-20 microwave power attenuator.

During the tests, the transmitter was terminated in the 50 ohm attenuator. Power was monitored on a Bird 43 Thru-Line wattmeter; dc supply was 7.2 volts throughout the tests.

Spurious emissions were measured throughout the RF spectrum from 12.8 MHz (lowest frequency generated in the transmitter) to 4.7 GHz. Any emissions that were between the required attenuation and the noise floor of the spectrum analyzer were recorded. Data are shown in Table 1.

TABLE 1

TRANSMITTER CONDUCTED SPURIOUS
462.625 MHz, 7.2 Vdc, 1.8 W

Spurious Frequency MHz	dB Below Carrier Reference
925.250	67
1387.875	95
1850.500	96
2313.125	90
2775.750	94
3238.375	97
3701.000	>100
4163.625	99
4626.250	>102
Required: 43+10Log(P)	46

All other emissions from 12.8 MHz to 4.7 GHz were 20 dB or more below FCC limit.

F. DESCRIPTION OF MEASUREMENT FACILITIES

A description of the Hyak Laboratories' radiation test facility is a matter of record with the FCC. The facility was approved for radiation measurements from 25 to 1000 MHz on October 1, 1976 and is currently listed as an acceptable site.

G. FIELD STRENGTH MEASUREMENTS OF SPURIOUS RADIATION

Field intensity measurements of radiated spurious emissions from the GR-1000 were made with a Tektronix 494P spectrum analyzer using Singer DM-105A calibrated test antennae for the measurements to 1 GHz, Polarad CA-L for 1-2.4 GHz, Polarad CA-S for 2.4-4.3 GHz, and Polarad CA-M for 4.3-7 GHz. The transmitter and dummy load were located in an open field 3 meters from the test antenna. Supply voltage was a power supply with a terminal voltage under load of 7.2 Vdc. Output power was 1.8 watts at the 462.625 MHz operating frequency. The transmitter and test antennae were arranged to maximize pickup. Both vertical and horizontal test antenna polarization were employed.

G. FIELD STRENGTH MEASUREMENTS (Continued)

Reference level for the spurious radiations was taken as an ideal dipole excited by 1.8 watts, the output power of the transmitter according to the following relationship:*

$$E = \frac{(49.2P_t)^{1/2}}{R}$$

where E = electric-field intensity in volts/meter

P_t = transmitter power in watts

R = distance in meters

for this case $E = \frac{(49.2 \times 1.8)^{1/2}}{3} = 3.1$ V/m

Since the spectrum analyzer is calibrated in decibels above one milliwatt (dBm), a conversion, for convenience, was made from dBu to dBm.

3.1 volts/meter $= 3.1 \times 10^6$ uV/m

dBu/m $= 20 \text{ Log}_{10} (3.1 \times 10)^6$

$= 130$ dBu/m

Since 1 uV/m $= -107$ dBm, the reference becomes

$130 - 107 = 23$ dBm

The measurement system was capable of detecting signals 90 dB or more below the reference level. Measurements were made from the lowest frequency generated within the unit (12.8 MHz), to 10 times operating frequency, 4.7 GHz. Data after application of antenna factors and line loss corrections are shown in Table 2.

*Reference Data for Radio Engineers, Fourth Edition, International Telephone and Telegraph Corp., p. 676.

TABLE 2

TRANSMITTER CABINET RADIATED SPURIOUS
462.625 MHz, 7.2 Vdc, 1.8 Watts

Frequency MHz	dB Below Carrier Reference[1]
925.250	64H
1387.875	60V
1850.500	71H*
2313.125	64V
2775.750	62V
3238.375	64H
3701.000	79V*
4163.625	81H*
4626.250	89H*

Required: 43+10Log(1.8) = 46

[1]Worst-case polarization, H-Horizontal, V-Vertical.

*Reference data only, more than 20 dB below FCC limit.

All other spurious from 12.8 MHz to 4.7 GHz were 20 dB or more below FCC limit.

H. FREQUENCY STABILITY
(Paragraph 2.995(a)(2) and 95.621(b) of the Rules)

Measurement of frequency stability versus temperature was made at temperatures from -30°C to +50°C. At each temperature, the unit was exposed to test chamber ambient a minimum of 60 minutes after indicated chamber temperature ambient had stabilized to within ±2° of the desired test temperature. Following the 1 hour soak at each temperature, the unit was turned on, keyed and frequency measured within 2 minutes. Test temperature was sequenced in the order shown in Table 3, starting with -30°C.

A Thermotron S1.2 temperature chamber was used. Temperature was monitored with a Keithley 871 digital temperature probe. The transmitter output stage was terminated in a dummy load. Primary supply was 7.2 volts. Frequency was measured with a HP 5385A digital frequency counter connected to the transmitter through a power attenuator. Measurements were made at 462.625 MHz. No transient keying effects were observed.

TABLE 3

462.625 MHz, 7.2 V Nominal, 1.8 watts

Temperature, °C	Output Frequency, MHz	p.p.m.
-29.2	462.624150	-1.8
-19.9	462.624206	-1.7
- 9.9	462.624390	-1.3
0.6	462.624640	-0.8
9.8	462.624850	-0.3
19.8	462.624927	-0.2
30.6	462.624941	-0.1
40.6	462.624807	-0.4
50.3	462.624578	-0.9

Maximum frequency error: 462.624150
462.625000

- .000850 MHz

FCC Rule 95.621(b) specifies .0005% (<2 W) or a maximum of ± .002313 MHz, which corresponds to:

High Limit	462.627313 MHz
Low Limit	462.622687 MHz

I. FREQUENCY STABILITY AS A FUNCTION OF SUPPLY VOLTAGE (Paragraph 2.995(d)(2) of the Rules)

Oscillator frequency as a function of power supply voltage was measured with a HP 5385A digital frequency counter as supply voltage provided by an HP 6264B variable dc power supply was varied from ±15% above the nominal 7.2 volt rating to below the battery end point. A Keithley 197 digital voltmeter was used to measure supply voltage at transmitter primary input terminals. Measurements were made at 20 ^{o}C ambient.

TABLE 4

462.625 MHz, 20^{o}C, 7.2 V Nominal, 1.8 watts

%	Supply Voltage	Output Frequency, MHz	p.p.m.
115	8.28	462.625078	0.2
110	7.92	462.624969	-0.1
105	7.56	462.624928	-0.2
100	7.20	462.624927	-0.2
95	6.84	462.624937	-0.1
90	6.48	462.624952	-0.1
85	6.12	462.624970	-0.1
*	5.76	462.624991	0.0

Maximum frequency error: 462.625078
462.625000

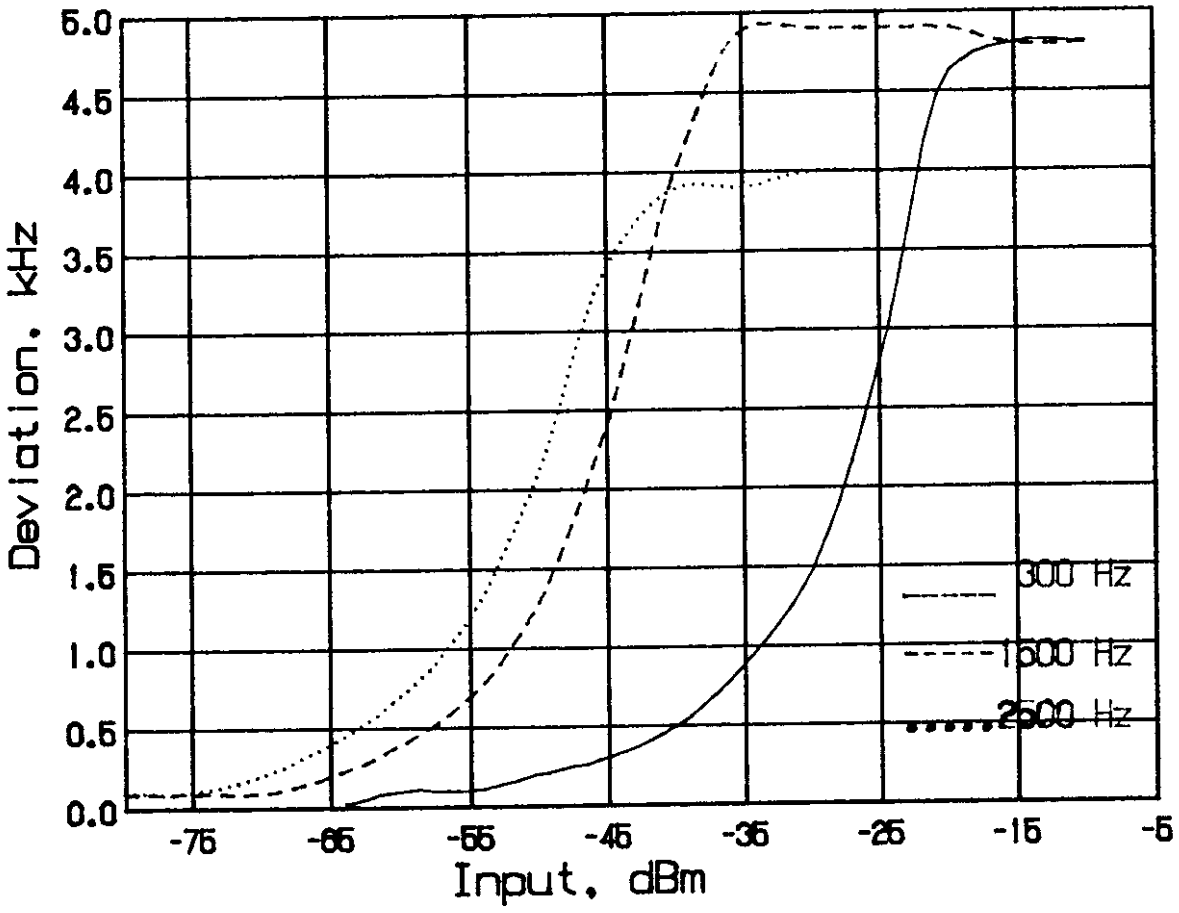
*Low Battery Indicator Threshold + .000078 MHz

FCC Rule 95.621(b) specifies .0005% (<2 W) or a maximum of ± .002313 MHz, corresponding to:

High Limit 462.627313 MHz
Low Limit 462.622687 MHz

FIGURE 2

AUDIO LIMITER CHARACTERISTICS



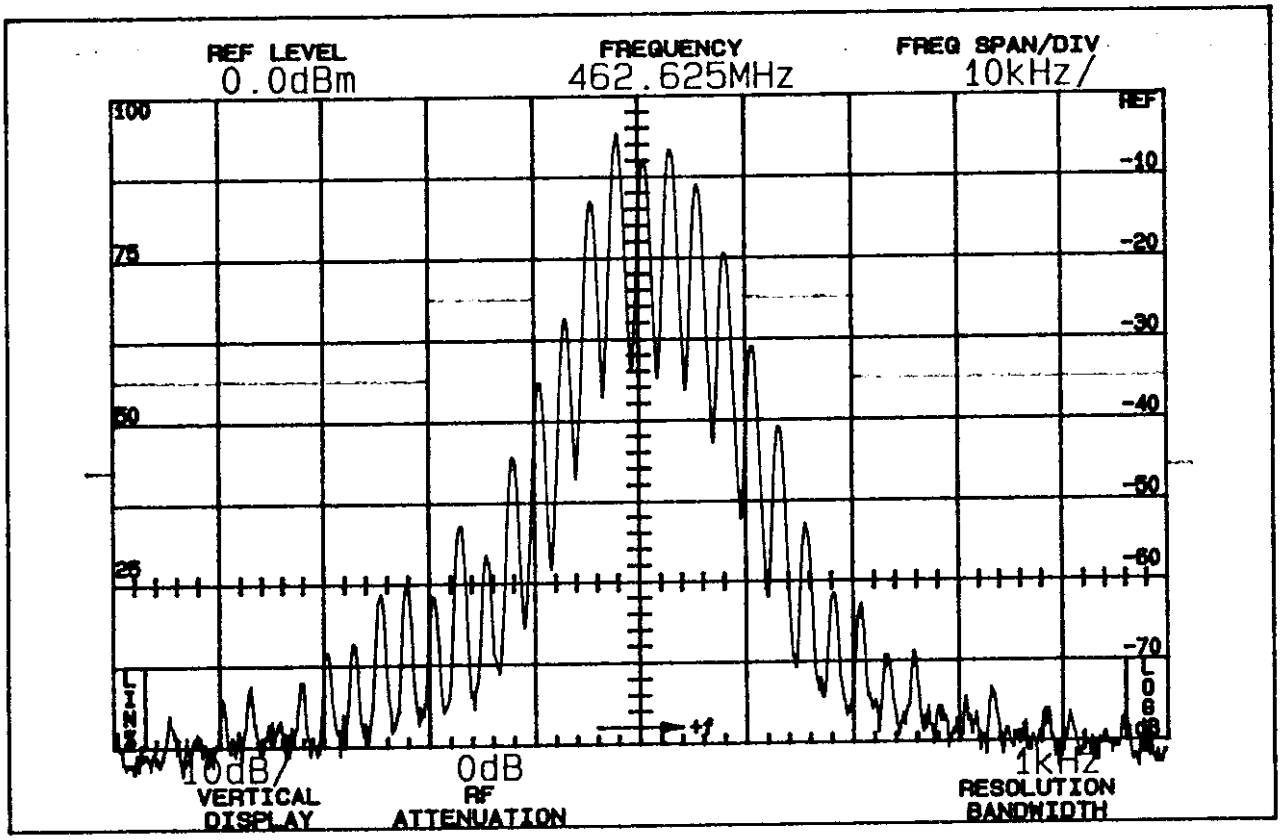
AUDIO LIMITER CHARACTERISTICS
FCC ID: MGPGR-1000

FIGURE 2

A: \GR1000GB.GBW

FIGURE 4

OCCUPIED BANDWIDTH



	ATTENUATION IN dB BELOW MEAN OUTPUT POWER Required
On any frequency more than 50% up to and including 100% of the authorized bandwidth, 20 kHz (10-20 kHz)	25
On any frequency more than 100%, up to and including 250% of the authorized bandwidth (20-50 kHz)	35
On any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth (over 50 kHz)	43+10LogP = 46 (P = 1.8W)

OCCUPIED BANDWIDTH
FCC ID: MGPGR-1000

FIGURE 4