A. INTRODUCTION

The following certification data are submitted in connection with this request for type certification of the GE3-5822 transceiver in accordance with Section 2, of FCC Rules.

The GE3-5822 is a hand-held, battery operated, UHF, frequency modulated, transceiver intended for voice communications applications under Part 95 GMRS (channels 1-7 or 15-22)* or Part 95 FRS (channels 8-14)*.

*See Appendix A for frequency assignment.

1. The unit's antenna meets 95.647, (i.e. is integral to the transmitter).

2. Except for power, the technical parameters for operating on all the channels (both FRS and GMRS) are the same as those for FRS, (i.e. 12.5 kHz bandwidth, 2.5 ppm frequency tolerance, maximum 2.5 kHz deviation, etc).

3. A notice is included in the user instructions that clearly informs the consumer (buyer/owner) when the radio is transmitting on GMRS frequencies, that operation on GMRS frequencies requires an FCC license and such operation is subject to additional rules specified in 47 CFR Part 95.

B. GENERAL INFORMATION REQUIRED FOR TYPE CERTIFICATION (Section 2.1033 of the Rules)

1. Name of applicant: Atlinks USA Inc.

2. Identification of equipment: FCC ID: G9H3-5822

   a. The equipment identification label is submitted as a separate exhibit.
   b. Photographs of the equipment are submitted as separate exhibits.

3. Quantity production is planned.

4. Technical description:

   a. 11k0F3E emission (FRS and GMRS)
   b. Frequency range: 462.5500-467.7125 MHz.
   c. Operating power ERP(d):
      FRS 0.48 W
      GMRS 0.49 W

B. GENERAL INFORMATION (Cont.)

   d. Maximum power permitted under FCC Part 95 (interstitial) is 5 watts ERP. The GE3-5822

fully complied with that power limitation.

e. The dc voltage and dc currents at final amplifier:

	GMRS	FRS
Collector voltage:	4.4	4.4 Vdc
Collector current:	0.41	0.39 A

f. Function of each active semiconductor device: See Appendix 1.

g. Complete circuit diagram is submitted as a separate exhibit.

h. A draft instruction book is submitted as a separate exhibit.

i. The transmitter tune-up procedure is submitted as a separate exhibit.

j. A description of circuits for stabilizing frequency is included in Appendix 2.

k. A description of circuits and devices employed for suppression of spurious radiation and for limiting modulation is included in Appendix 3.

l. Not applicable.

5. Data for 2.1046 through 2.1057 follow this section.

C. RF POWER OUTPUT (Section 2.1046 of the Rules)

ERP(d) by substitution: FRS 0.48 W
GMRS 0.49 W

D. MODULATION CHARACTERISTICS (Section 2.1047)

1. A curve showing frequency response of the transmitter is shown in Figure 1. Reference level was audio signal output from a Boonton 8220 modulation meter with one kHz deviation. Audio output was measured with an Audio Precision System One TRMS voltmeter and tracking generator.

2. Modulation limiting curves are shown in Figure 2, using a Boonton 8220 modulation meter. Signal level was established with an Audio Precision System One. The curves show compliance with Section 2.1047 and 95.633(b).

D. MODULATION CHARACTERISTICS (Cont.)

3. Figure 3 is a graph of the post-limiter low pass filter which meets the requirements of paragraph 95.633(b) in providing a roll-off of 60Logf/3 dB where f is audio frequency in kHz. Measurements were made following EIA RS-152B with an Audio Precision System One on the Boonton 8220 modulation meter audio output.

4. Occupied Bandwidth (Section 2.1047 and 95.629(a) of the Rules)

Figure 4a is a plot of the sideband envelope of the transmitter output taken with a Tektronix 494P spectrum analyzer on GMRS Channel 1. Modulation corresponded to conditions of 2.1049(c)(1) and consisted of a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50% modulation at 1998 Hz, the frequency of maximum response.

Figure 4b is a plot under the same conditions for FRS Channel 8.

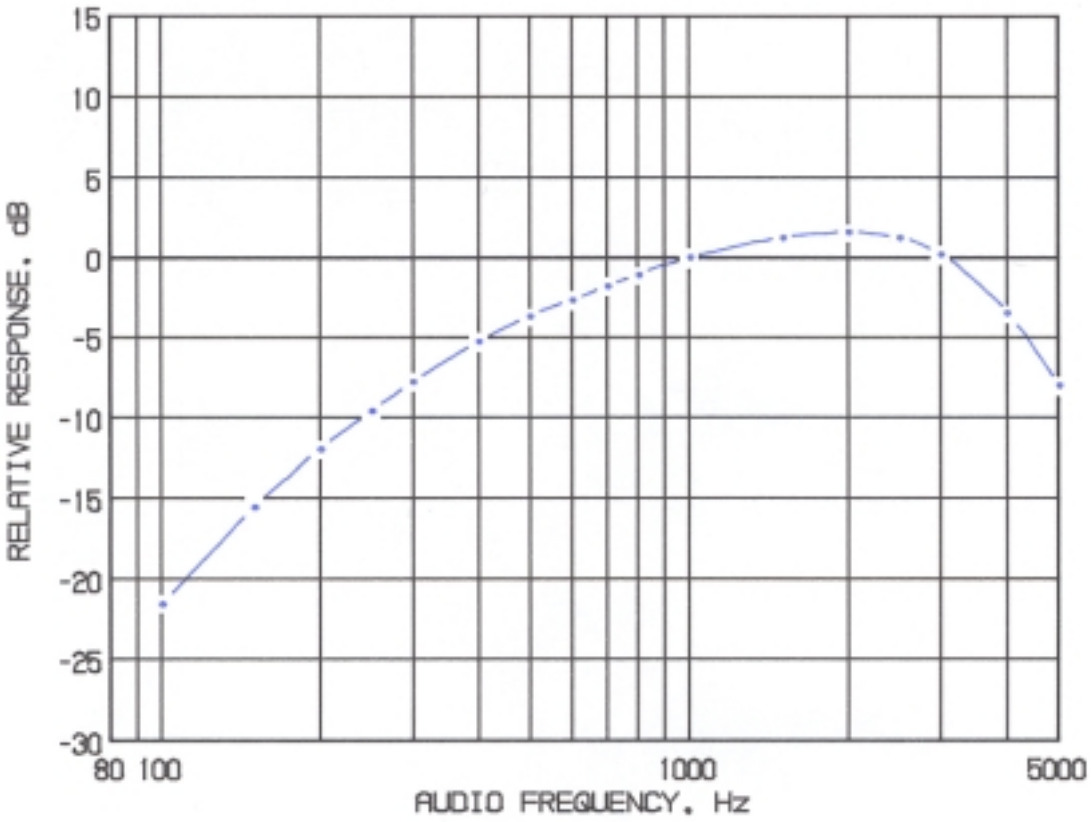
The plots are within the limits imposed by Section 2.1049 and 95.635(b)(1)(3)(7)for frequency modulation. The horizontal scale (frequency) is 10 kHz per division and the vertical scale (amplitude) is a logarithmic presentation equal to 10 dB per division.

5. Emission Designator Calculation:

(2D + 2F) 2x2.5 + 2x3.0 = 11k0F3E

FIGURE 1

MODULATION FREQUENCY RESPONSE

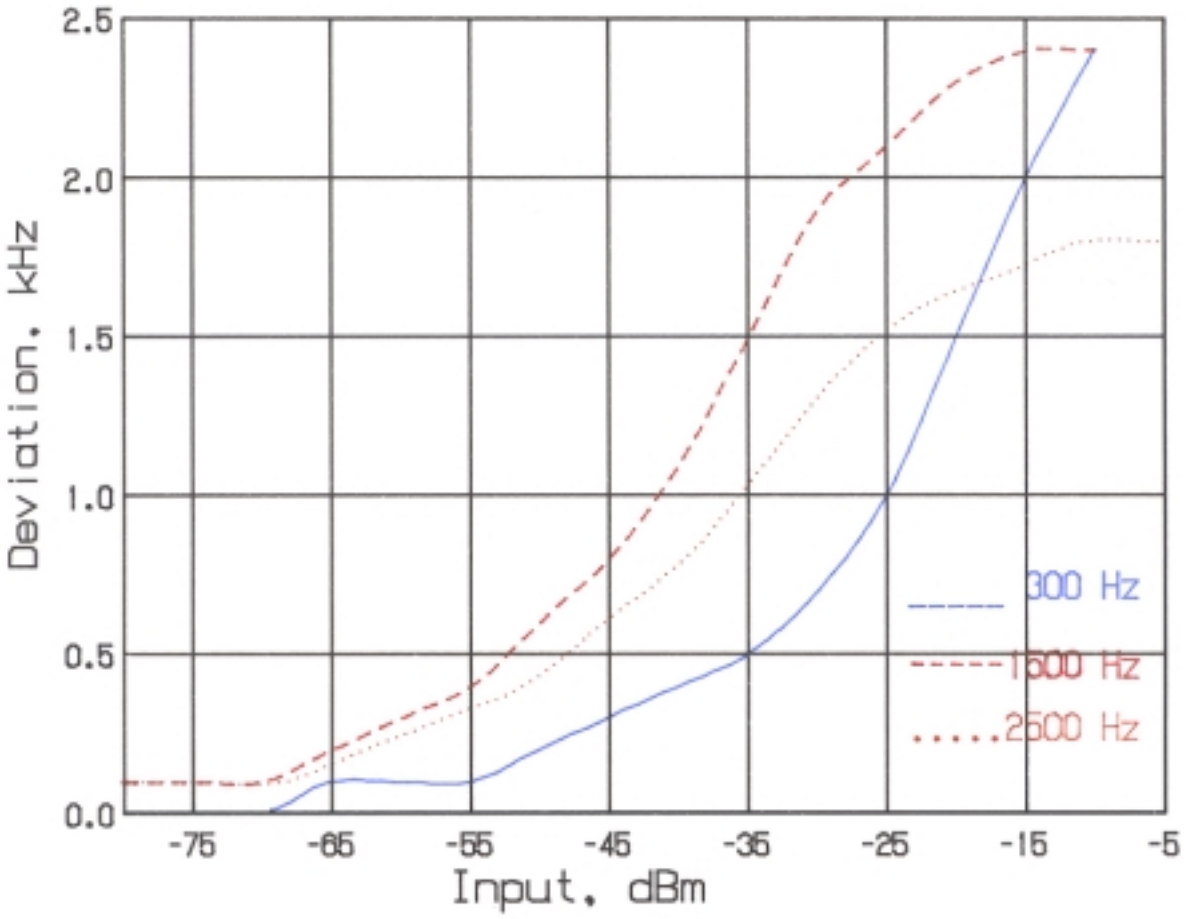


MODULATION FREQUENCY RESPONSE
FCC ID: G9H3-5822

FIGURE 1

FIGURE 2

AUDIO LIMITER CHARACTERISTICS

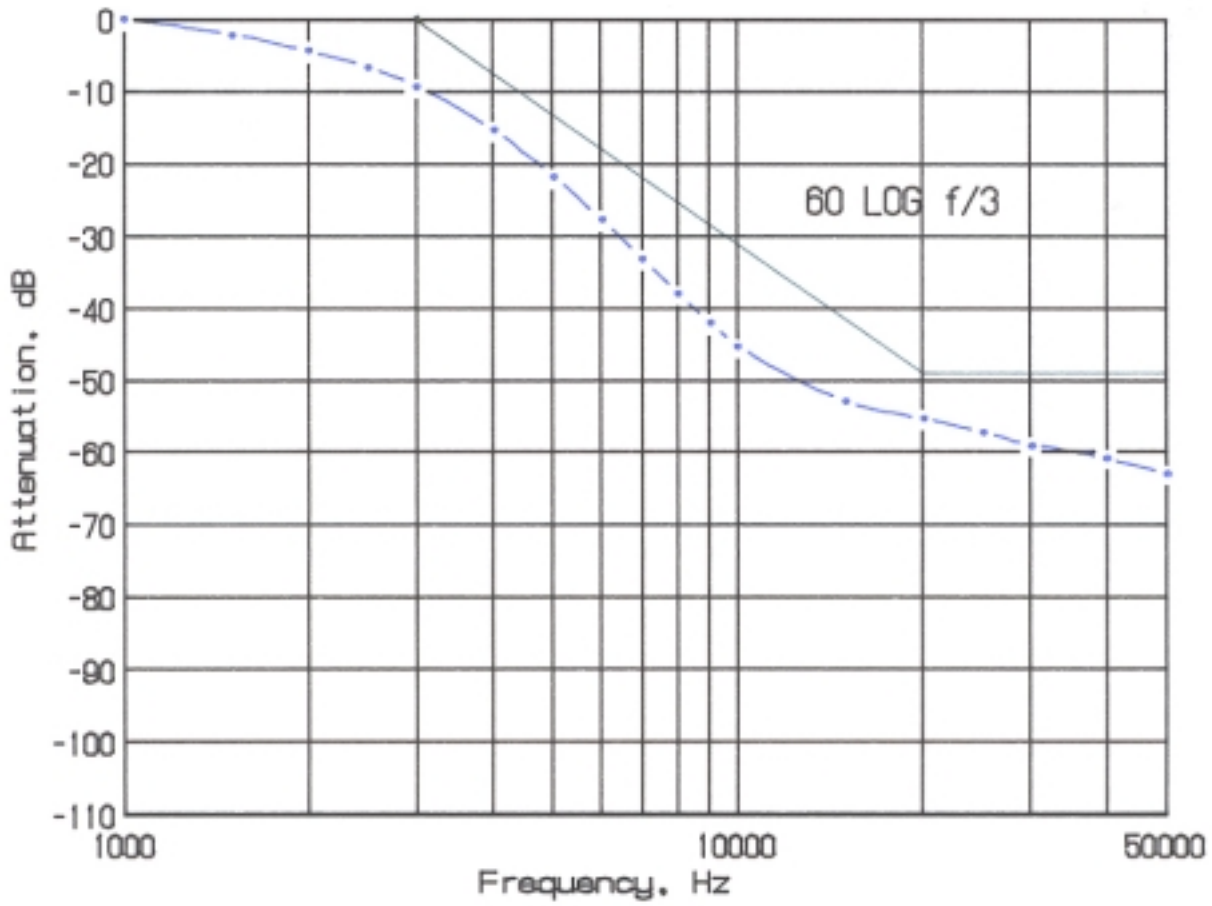


AUDIO LIMITER CHARACTERISTICS
FCC ID: G9H3-5822

FIGURE 2

FIGURE 3

AUDIO LOW PASS FILTER RESPONSE

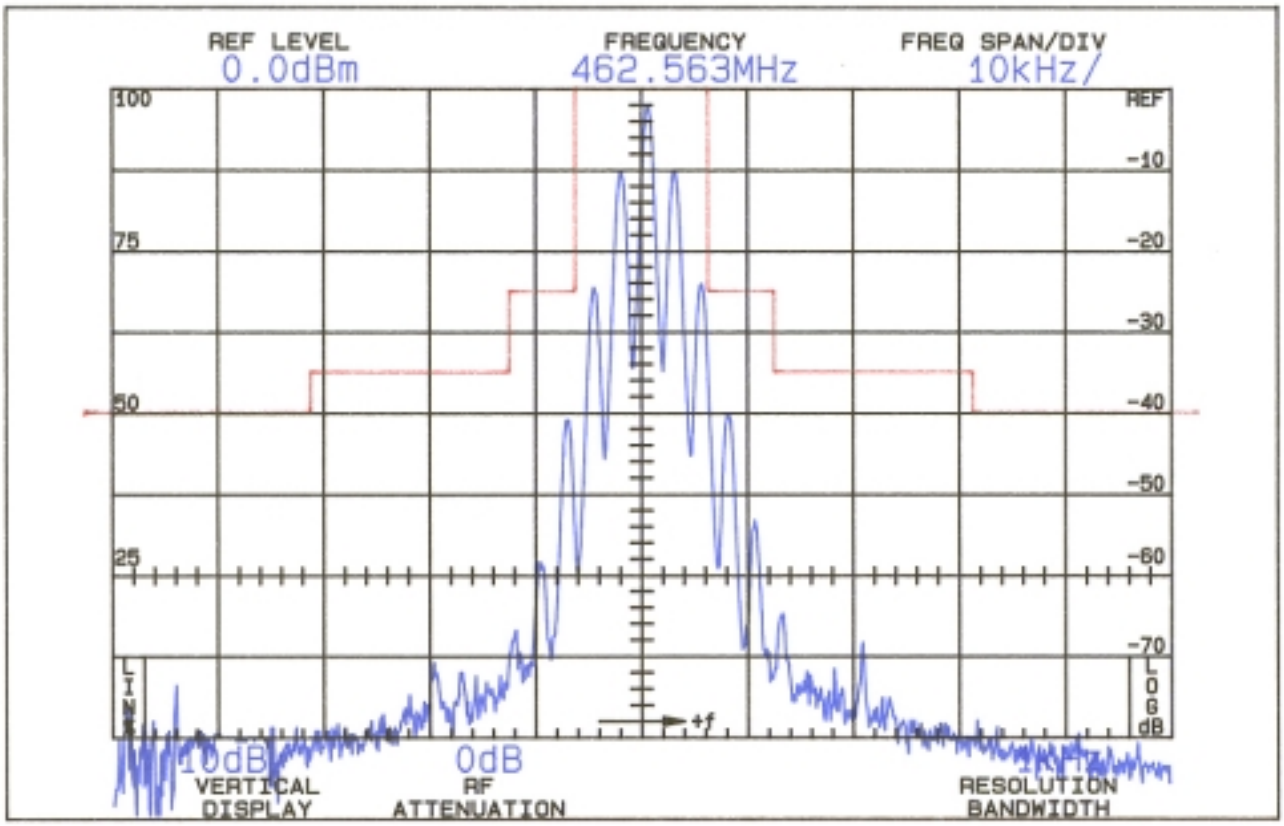


AUDIO LOW PASS FILTER RESPONSE
FCC ID: G9H3-5822

FIGURE 3

FIGURE 4a

OCCUPIED BANDWIDTH



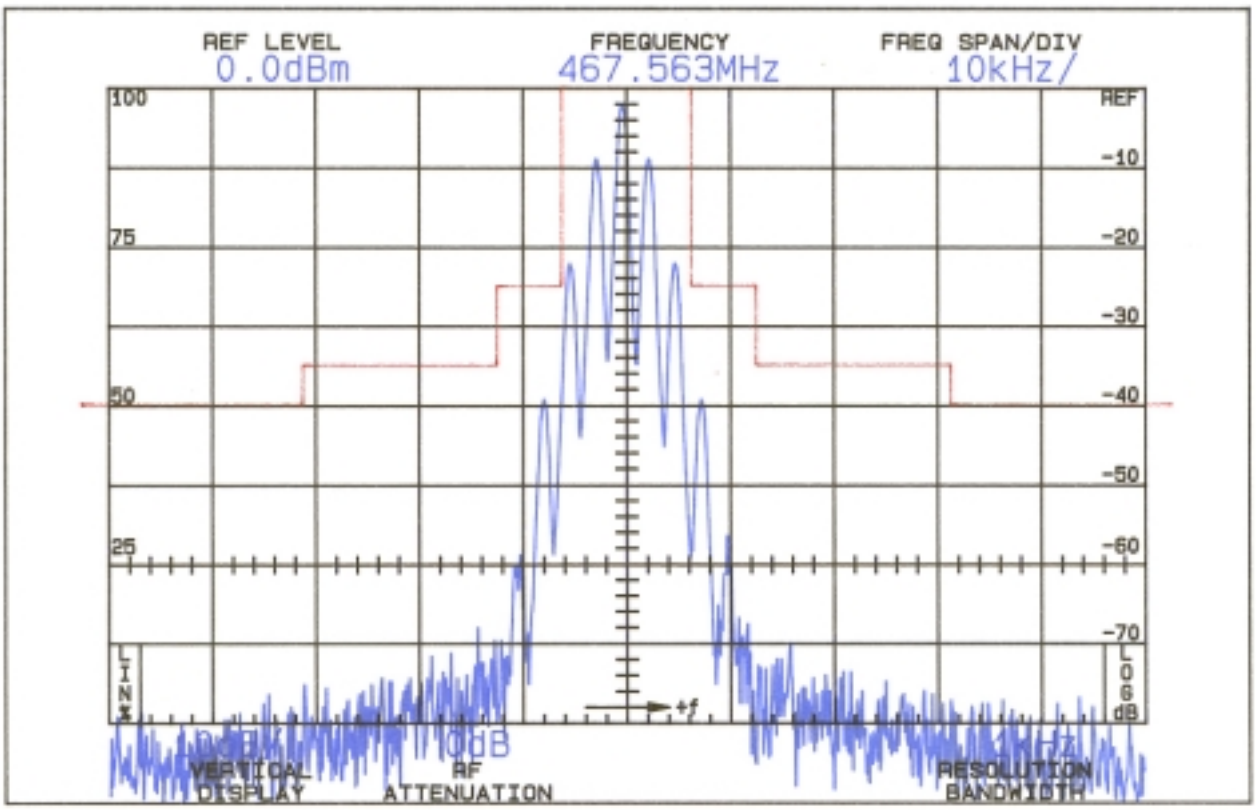
	ATTENUATION IN dB BELOW MEAN OUTPUT POWER Required
On any frequency more than 50% up to and including 100% of the authorized bandwidth, 20 kHz (10-20 kHz)	25
On any frequency more than 100%, up to and including 250% of the authorized bandwidth (20-50 kHz)	35
On any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth (over 50 kHz)	43+10LogP = 40 (P = 0.49 W)

OCCUPIED BANDWIDTH
FCC ID: G9H3-5822

FIGURE 4a, (GMRS)

FIGURE 4b

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 = 40 (P = 0.48 W)

OCCUPIED BANDWIDTH
FCC ID: G9H3-5822

FIGURE 4b, (FRS)

E. SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS

Not Applicable, integral antenna.

F. MEASUREMENTS OF SPURIOUS RADIATION
(Section 2.1053, 95.635(b)(7) of the Rules)

Measurement of radiated spurious emissions from the GE3-5822 were made by substitution with a Tektronix 494P spectrum analyzer using Singer DM-105A calibrated test antennae for the measurements to l GHz, Polarad CA-L, CA-S, CA-M and/or EMCO 3115. The transmitter was located in an OATS 3 meters from the test antenna. Supply voltage was a power supply with a terminal voltage under load of 4.5 Vdc. The transmitter and test antennae were arranged to maximize pickup. Both vertical and horizontal test antenna polarization were employed.

TABLE 1a

TRANSMITTER RADIATED SPURIOUS
462.5625 MHz, 4.5 Vdc, GMRS, Channel 1

Frequency MHz	dB Below Carrier Reference[1]
462.563	0
925.125	53H
1387.688	38V
1850.250	43V
2312.813	43V
2775.375	44H
3237.938	41V
3700.500	42V
4163.063	53H
4625.625	47V

Required: 43+10Log(0.49) = 40

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

All other spurious from 10.25 MHz to 4.7 GHz were 20 dB or more below FCC limit.

F. MEASUREMENTS OF SPURIOUS RADIATION (Cont.)

TABLE 1b

TRANSMITTER RADIATED SPURIOUS
467.5625 MHz, 4.5 Vdc, FRS, Channel 8

Frequency	dB Below Carrier

MHz	Reference[1]
467.565	0
935.125	50H
1402.688	41V
1870.250	45V
2337.813	51V
2805.375	42V
3272.938	43H
3740.500	53V
4208.063	53H
4675.625	49H

Required: 43+Log(0.48) = 40

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

All other spurious from 10.25 MHz to 4.7 GHz were 20 dB or more below FCC limit.

G. FREQUENCY STABILITY
(Section 2.1055 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 2, starting with -30°C.

A Thermotron S1.2 temperature chamber was used. Temperature was monitored with a Keithley 871 digital temperature probe. Primary supply was 4.5 volts. Frequency was measured with a HP 5385A digital frequency counter. Measurements were made at 462.5625 MHz. No transient keying effects were observed.

TABLE 2

462.5625 MHz, 4.5 V Nominal

Temperature, °C	Output Frequency, MHz	p.p.m.
-29.1	462.561369	-2.4
-19.9	462.561388	-2.4

-10.0	462.562518	0.0
0.1	462.563212	1.5
10.5	462.563323	1.8
20.1	462.562991	1.1
30.3	462.562453	-0.1
39.3	462.562045	-1.0
50.0	462.561983	-1.1

Maximum frequency error: 462.561369
462.562500

- .001131 MHz

FCC Part 95 specifies .00025% or a maximum of ± .001156 MHz, which corresponds to:

High Limit	462.563656 MHz
Low Limit	462.561344 MHz

H. FREQUENCY STABILITY AS A FUNCTION OF SUPPLY VOLTAGE
(Section 2.1055 and 95.621(b) 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 4.5 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 °C ambient.

TABLE 3

462.5625 MHz, 20°C, 4.5 V Nominal

%	Supply_Voltage	Output_Frequency,_MHz	p.p.m.
115	5.17	462.562994	1.1
110	4.95	462.562997	1.1
105	4.73	462.562982	1.0

100	4.50	462.562991	1.1
95	4.28	462.562982	1.0
90	4.05	462.562981	1.0
85	3.83	462.562994	1.1
*	3.60	462.563003	1.1

Maximum frequency error: 462.563003
462.562500

*MFR rated battery endpoint. + .000503 MHz
**Processor shut-down.

FCC Part 95 specifies .00025% or a maximum of ±.001156 MHz, corresponding to:

High Limit 462.563656 MHz
Low Limit 462.561344 MHz

APPENDIX A

CHANNEL ASSIGNMENT

GMRS Channels:

CH1: 462.5625 MHz
CH2: 462.5875 MHz
CH3: 462.6125 MHz
CH4: 462.6375 MHz

CH5: 462.6625 MHz
CH6: 462.6875 MHz
CH7: 462.7125 MHz

CH15: 462.5500 MHz
CH16: 462.5750 MHz
CH17: 462.6000 MHz
CH18: 462.6250 MHz
CH19: 462.6500 MHz
CH20: 462.6750 MHz
CH21: 462.7000 MHz
CH22: 462.7250 MHz

FRS Channels:

CH8: 467.5625 MHz
CH9: 467.5875 MHz
CH10: 467.6125 MHz
CH11: 467.6375 MHz
CH12: 467.6625 MHz
CH13: 467.6875 MHz
CH14: 467.7125 MHz

APPENDIX 1

FUNCTION OF DEVICES

SEMICONDUCTOR DESIGNATIONS AND FUNCTIONS

Model 3-5822

FCC ID: G9H3-5822

Designator	Description	Function
U300	Multi-function Radio IC	Frequency synthesizing, RX amplification and mixing, audio amplification and filtering
U30	3V Regulator	3V Regulator Circuit
U150	Audio Amplifier	Final stage audio amplifier for 200mW output & low pass (3Khz) audio filter
U400	8 Bit Microcontroller	Transmit/Receive control, key decode, power control
D100	PIN Diode	Transmit/Receive antenna switch
D200	PIN Diode	Transmit/Receive band switch
D50	Varactor Diode	VCO tuning
Q50/Q51	RF Transistor	VCO – fundamental transmit and LO
Q52	Bias Transistor	Receive/Transmit band switch for VCO
Q200	RF Power Transistor	PA final stage amplifier – class AB
Q201	RF Transistor	PA 1st stage amplifier – class A

APPENDIX 2

CIRCUITS AND DEVICES TO STABILIZE FREQUENCY

The fundamental frequency for both the transmitter and the receiver local oscillators are controlled by a phase lock loop (PLL) circuit internal to U300. The frequency of operation of the voltage controlled oscillator (VCO), composed of Q50 and Q51 operating in cascode, is phase locked to a voltage controlled crystal reference (VCXO) operating at 10.25 MHz (X300). Compensation for temperature

variations on the crystal reference is accomplished using thermister (TH300) to change the reactance of the reference crystal circuitry. Compensation for voltage variations on the crystal reference is accomplished through a supply voltage regulator.

The VCO is locked to the fundamental of the transmit signal in the transmit mode and is locked to the receive 1st LO (fundamental channel frequency plus 10.7 MHz) in the receive mode. The crystal reference frequency is used as the second LO connected internally in U300 to the second mixer to produce the second IF of 450 kHz.

CIRCUITS AND DEVICES TO
STABILIZE FREQUENCY, etc.
FCC ID: G9H3-5822

APPENDIX 2
APPENDIX 3

CIRCUITS AND DEVICES TO
SUPPRESS SPURIOUS EMISSIONS, ETC.

The transmitter amplifies the 0 dBm signal from the VCO to approximately 27 dBm that is fed to the antenna. The transmitter is a two stage amplifier composed of Q200 and Q201. The first stage is operated Class A, and the final is operated Class AB. The

fundamental transmit signal is fed through a low pass filter in order to suppress the harmonics to below –60 dBc.

The desired frequency modulation of the carrier is accomplished by modulating the current in the VCO directly with the microphone audio signal. The microphone audio is conditioned with a high pass filter at 300 Hz, a hard clipper circuit (internal to U300) to limit maximum deviation to +/- 2.5 kHz and a three-pole low pass or splatter filter at 2.8 kHz (internal to U300). The low pass filter insures that the occupied bandwidth of the FM modulated signal meets FCC requirements under all input conditions.

CIRCUITS AND DEVICES TO
SUPPRESS SPURIOUS EMISSIONS, etc.
FCC ID: G9H3-5822

APPENDIX 3