A. INTRODUCTION

The following data are submitted in connection with this request for type acceptance of the G-9 transceiver in accordance with Section 2, of FCC Rules.

The G-9 is a hand-held, battery operated, UHF, frequency modulated, 1.4 W ERP(d) 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 (Section 2.1033 of the Rules)

1. Name of applicant: Midland Consumer Radio

2. Identification of equipment: FCC ID: MMAG9

   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. 16k0F3E emission
   b. Frequency range: 462.5500-462.7250 MHz.
   c. Operating power of transmitter is fixed at the factory at 2 watts (conducted).
   d. Maximum power permitted under FCC Part 95 (interstitial) is 5 watts ERP. The G-9 fully complied with that power limitation.
   d. The dc voltage and dc currents at final amplifier:

      Collector voltage: 5.8 Vdc
      Collector current: 0.82 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.

B. GENERAL INFORMATION (continuted)

   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 2.

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), determined by substitution, was 1.4 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).

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 4 is a plot of the sideband envelope of the transmitter output taken with a Tektronix 494P spectrum analyzer. 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 2697 Hz, the frequency of maximum response.

C. MODULATION CHARACTERISTICS (continued)

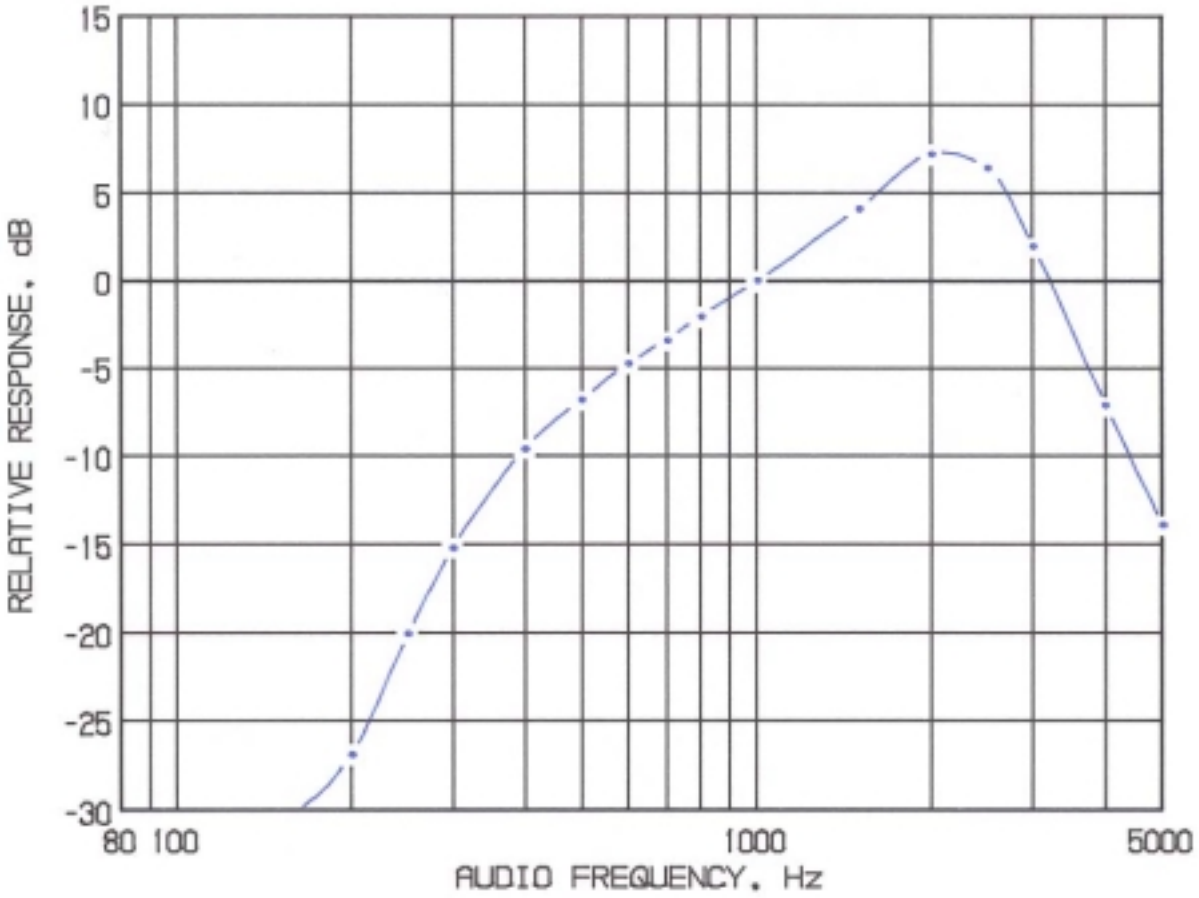
The plot is within the limits imposed by Section 2.1049 and 95.635(b)(1)(3)(7) for frequency modulation. The horizontal scale (frequency) is 10 kHz per division and the vertical scale (amplitude) is a logarithmic presentation equal to 10 dB per division.

5. Emission Designator Calculation:

(2D + 2F) 2x5.0 + 2x3.0 = 16k0F3E

FIGURE 1

MODULATION FREQUENCY RESPONSE

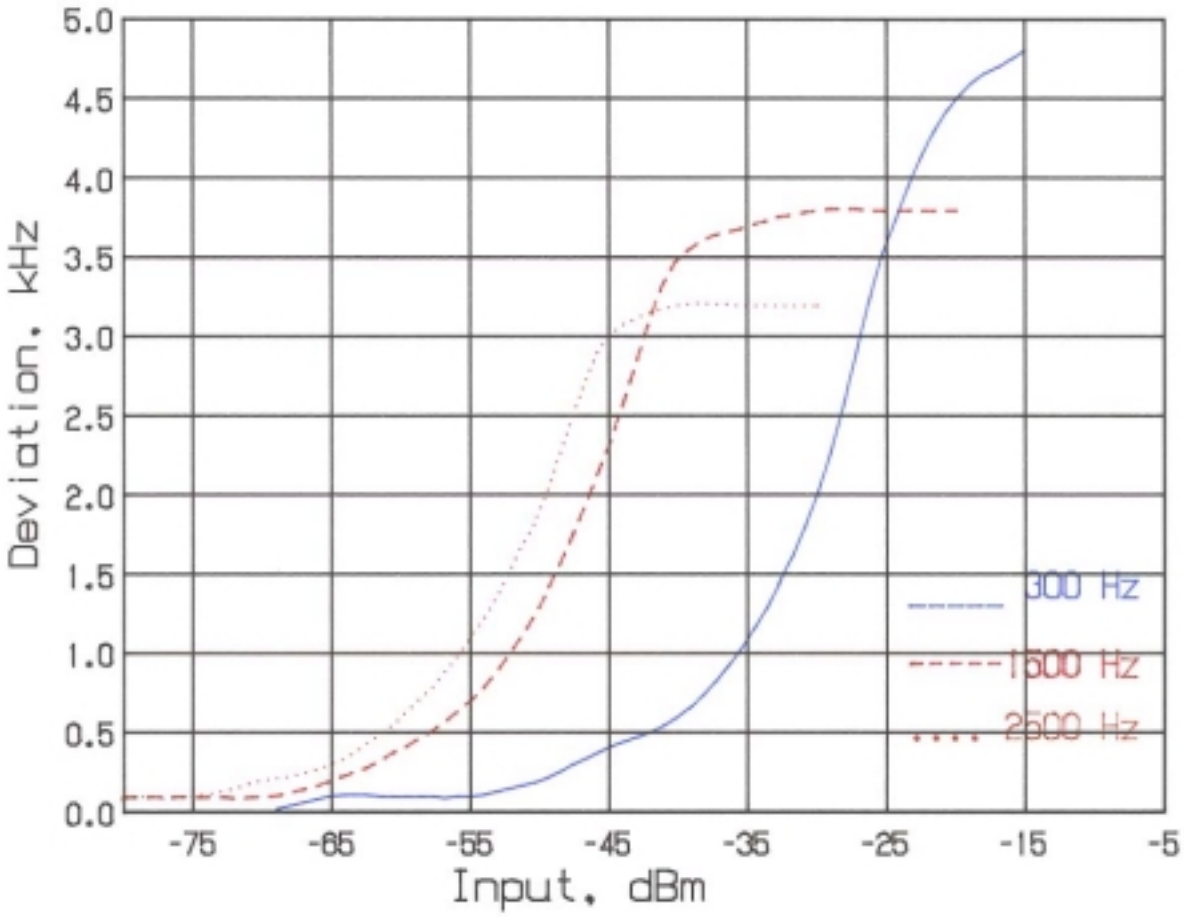


MODULATION FREQUENCY RESPONSE
FCC ID: MMAG9

FIGURE 1

FIGURE 2

AUDIO LIMITER CHARACTERISTICS

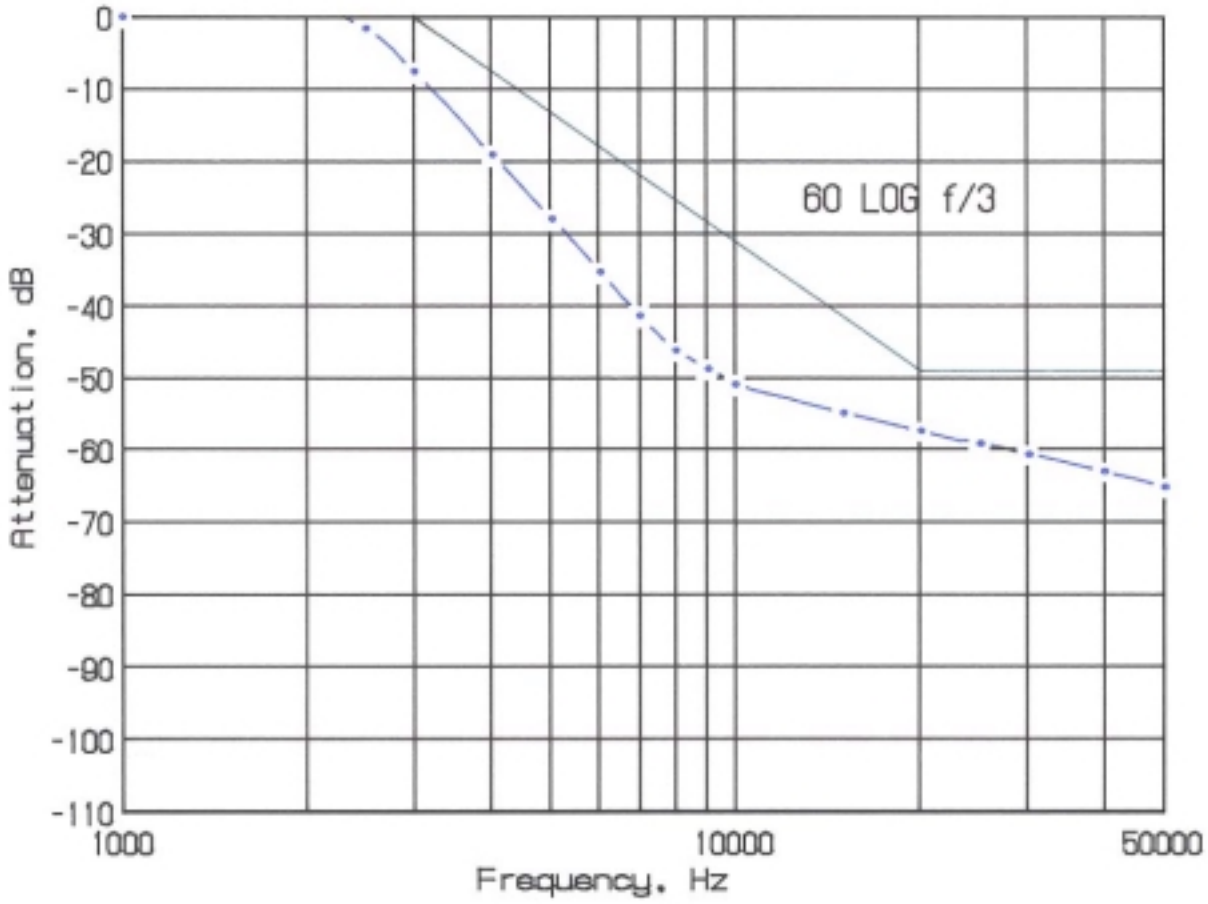


AUDIO LIMITER CHARACTERISTICS
FCC ID: MMAG9

FIGURE 2

FIGURE 3

AUDIO LOW PASS FILTER RESPONSE

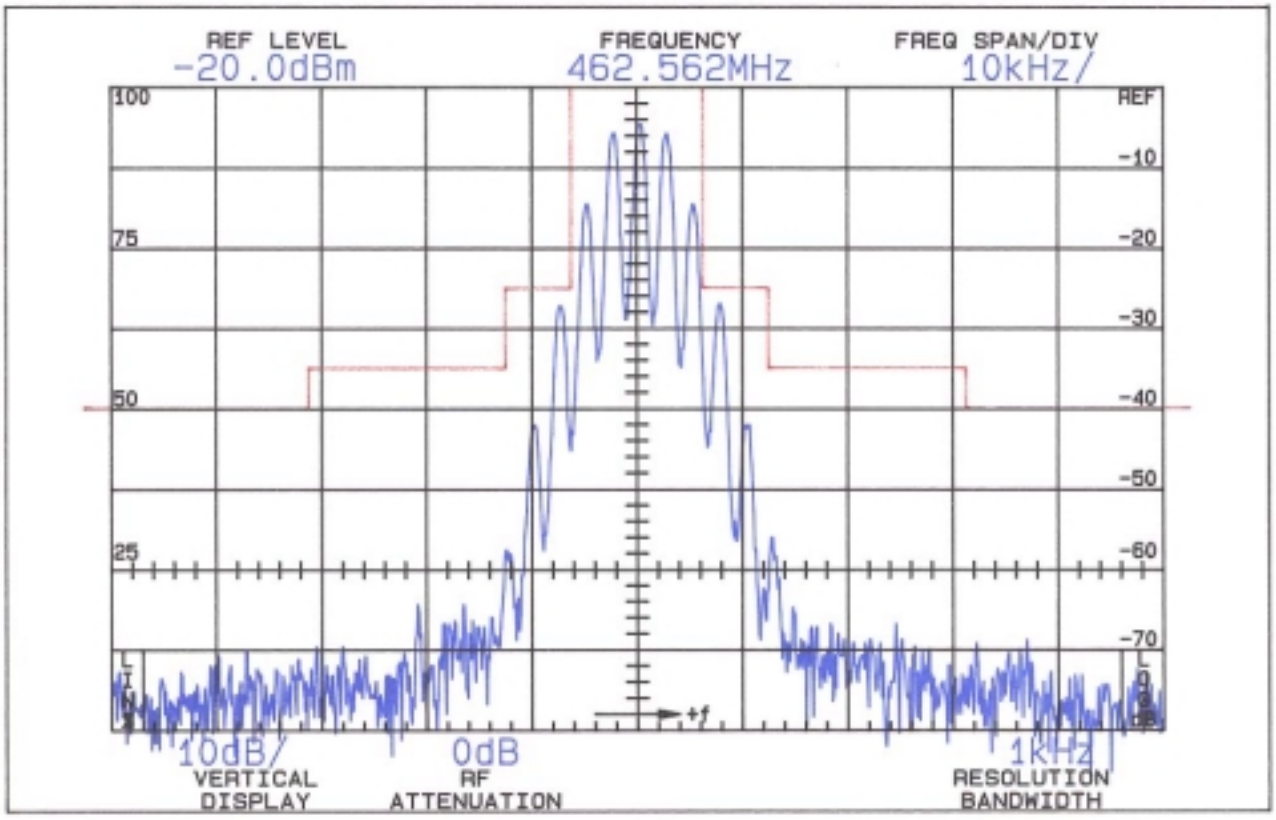


AUDIO LOW PASS FILTER RESPONSE
FCC ID: MMAG9

FIGURE 3

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 = 44 (P = 1.4W ERP(d))

OCCUPIED BANDWIDTH
FCC ID: MMAG9

FIGURE 4

E. SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS

Not applicable, permanently attached antenna.

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

Field intensity measurements of radiated spurious emissions from the G-9 were by substitution made with a Tektronix 494P spectrum analyzer using Singer DM-105A calibrated test antennae for the measurements to l GHz, and EMCO 3115 horn from 1 GHz to 5 GHz.

The transmitter with the normally supplied antenna was located on an open area test site 3 meters from the test antenna. Supply voltage was a power supply with a terminal voltage under load of 6.0 Vdc. The transmitter and test antenna were arranged to maximize pickup. Both vertical and horizontal test antenna polarization were employed.

TABLE 1

TRANSMITTER CABINET RADIATED SPURIOUS
462.5625 MHz, 6.0 Vdc, 1.4 W ERP(d)

Frequency MHz	dB Below Carrier Reference[1]
462.563	0
925.126	52V
1387.689	49V
1850.252	45V
2312.811	50V

Required: 43+10Log(1.4) = 44

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

All other spurious from 21.25 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. The transmitter output stage was terminated in a dummy load. Primary supply was 6.0 volts. Frequency was measured with a HP 5385A digital frequency counter connected to the transmitter through a power attenuator. Measurements were made at 462.5625 MHz. No transient keying effects were observed.

TABLE 2

462.5625 MHz, 6.0 V Nominal, 1.4 watts ERP(d)

Temperature, °C	Output Frequency, MHz	p.p.m.
-29.7	462.562257	-0.5
-20.1	462.562514	0.0
-10.2	462.562798	0.6
0.3	462.562873	0.8
10.9	462.562771	0.6
20.7	462.562472	-0.1
29.8	462.562365	-0.3
40.2	462.562261	-0.5
50.5	462.563092	1.3

Maximum frequency error:

462.563092
462.562500

\+ .000592 MHz

FCC Rule 95 specifies .0005% or a maximum of ± .002313 MHz, which corresponds to:

High Limit	462.564813 MHz
Low Limit	462.560187 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 6.0 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, 6.0 V Nominal, 1.4 watts ERP(d)

%	Supply_Voltage	Output_Frequency,_MHz	p.p.m.
115	6.9	462.562814	0.7
110	6.6	462.562651	0.3
105	6.3	462.562541	0.1
100	6.0	462.562472	-0.1
95	5.7	462.562434	-0.1
90	5.4	462.562418	-0.2
85	5.1	462.562414	-0.2
80	4.8*	462.562425	-0.2

Maximum frequency error: 462.562814
462.562500

*Low battery limit + .000314 MHz

FCC Rule 95 specifies .0005% or a maximum of ±.002313 MHz, corresponding to:

High Limit 462.564813 MHz
Low Limit 462.560187 MHz

APPENDIX 1

ΣΕΜΙΧΟΝΔΥΧΤΟΡΣ ΑΝΔ ΦΥΝΧΤΙΟΝΣ

ΤΡΑΝΣΙΣΤΟΡ

ΘΡ1	2ΣΧ4226	Ν.Ε.Χ	ΡΞ ΡΦ ΑΜΠ.
ΘΡ2	2ΣΧ4226	Ν.Ε.Χ	1϶ΣΤ ΜΙΞΕΡ.

ΘΡ3	ΚΤΧ3880Σ	Κ.Ε.Χ	1ǝΣΤ ΙΦ ΑΜΠ.
ΘΡ5	ΚΡΧ104Σ	Κ.Ε.Χ	ΤΟΝΕ ΔΕΤ.
ΘΡ6	ΚΤΑ1504Σ	Κ.Ε.Χ	ΣΘΥΕΛΧΗ ΜΥΤΕ.
ΘΤ1	2ΣΧ4226	Ν.Ε.Χ	ΤΞ ΒΥΦΦΕΡ.
ΘΤ2	2ΣΧ4226	Ν.Ε.Χ	ΤΞ ΠΟΩΕΡ ΔΡΙçΕ ΑΜΠ.
ΘΤ3	ΝΕ5510279Α	Ν.Ε.Χ	ΤΞ ΠΟΩΕΡ ΦΙΝΑΛ ΑΜΠ.
ΘΦ1	2ΣΧ4226	Ν.Ε.Χ	ΒΥΦΦΕΡ.
ΘΦ2	ΚΡΧ110Σ	Κ.Ε.Χ	ΡΞ Β+ ΣΩΙΤΧΗΙΝΓ ΑΤ ΤΞ.
ΘΣ1	ΚΡΑ105Σ	Κ Ε.Χ	ΡΞ Β+ ΣΩΙΤΧΗΙΝΓ.
ΘΣ2	ΚΡΑ105Σ	Κ.Ε.Χ	ΠΟΩΕΡ ΣΑçΕ ΧΟΝΤΡΟΛ.
ΘΣ3	ΚΡΑ105Σ	Κ.Ε.Χ	ΤΞ Β+ ΣΩΙΤΧΗΙΝΓ.
ΘΣ4	ΚΡΧ104Σ	Κ.Ε.Χ	ΤΞ Β+ ΣΩΙΤΧΗΙΝΓ.
ΘΣ5	ΚΡΑ110Σ	Κ.Ε.Χ	ΒΑΧΚ ΛΙΓΗΤ ΛΕΔ ΣΩΙΤΧΗΙΝΓ.
ΘΣ7	ΚΡΑ101Σ	Κ.Ε.Χ	ΠΤΤ Σ/Ω
ΘΣ9	ΚΡΧ110Σ	Κ.Ε.Χ	ΧΑΛΛ ΜΥΤΕ
Θ1	2ΣΧ4226	Ν.Ε.Χ	ΡΞ ΒΥΦΦΕΡ.
Θç1	ΚΡΧ104Σ	Κ.Ε.Χ	ΡΞ/ΤΞ çΧΟ ΣΩΙΤΧΗΙΝΓ.
Θç2	2ΣΧ4226	Ν.Ε.Χ	Ο.Σ.Χ
ΘΒ1	ΚΤΧ3875Σ	Κ.Ε.Χ	ΛΟΩ ΒΑΤΤ. ΔΕΤ.
ΘΒ1	ΚΤΧ3875Σ	Κ.Ε.Χ	ΠΟΩΕΡ Η/Λ ΧΟΝΤΡΟΛ

ΙΝΤΕΓΡΑΤΕΔ ΧΙΡΧΥΙΤ

ΙΧ1	ΚΑ3361	ΣΑΜΣΥΝΓ	2ǝΝΔ ΜΙΞΕΡ ΙΦ ΑΝΔ ΦΜ ΔΕΤΕΧΤ
ΙΧ2	ΤΜΠ87Χ807Υ	ΤΟΣΗΙΒΑ	ΧΠΥ
ΙΧ3	Νϑ̈Μ2070	ϑ.Ρ.Χ	ΑΥΔΙΟ ΠΟΩΕΡ ΑΜΠ.
ΙΧ4	ΤΒ31202ΦΝ	ΤΟΣΗΙΒΑ	ΠΛΛ ΦΡΕΘΥΕΝΧΨ ΣΨΝΤΗΕΣΙΖΕΡ
ΙΧ5	ΤΚ71530	ΤΟΚΟ	ΡΕΓΥΛΑΤΟΡ
ΙΧ6	ΛΜ324	ΝΑΤΙΟΝΑΛ	ΠΡΕ–ΕΜΠΑΣΙΣ ΛΙΜΙΤΤΕΡ ΑΝΔ ΜΙΧ
ΙΧ8	ΛΜ324	ΝΑΤΙΟΝΑΛ	ΧΤΧΣΣ ΤΟΝΕ ΔΕΤ.
IC10	LM324	NATIONAL	DE-EMPASIS TONE FILTER

APPENDIX 2

CIRCUITS AND DEVICES TO STABILIZE FREQUENCY,

SUPPRESS SPURIOUS EMISSIONS AND LIMIT MODULATION

The PLL synthesizer of the G-9 (GMRS) consists of the signal loop PLL circuit with the reference of 6.25 kHz. The IC4 PLL IC includes all the functions such as the reference oscillator, the driver, the phase detector, the lock detector, and the programmable divider.

At the reference oscillator, the 21.25 MHz TCXO of the CTX1 is connected to the pin 11 of the IC4 to oscillate the frequency of 21.25 MHz. The TCXO (21.25 MHz) is the temperature compensation circuit to maintain the frequency within the allowable error range even under a low temperature of –30.

The phase detectors send out the output power to the loop filter through 3 pin of the IC4. If the oscillation frequency of the VCO is low compared to the reference frequency, the phase detector sends out the output power in positive pulse. If the oscillation frequency of the VCO is high, phase detector sends out the output power in negative pulse. Therefore, the VCO can maintain the frequency set.

The transmitted signal of approximately 7 mW, combined at the PLL module, is supplied to the base of the QT3 amplifier. The transmitted signal amplified to 2 watts here passes the TX LPF of the 2^{nd} characteristic of the LT4 and the LT5, and RX/TX switching takes place by the DT2. After this, the signal is provided to the antenna the TX LPF of the 1^{st} characteristics, consisted of the LT7.

CIRCUITS AND DEVICES TO
STABILIZE FREQUENCY, etc.
FCC ID: MMAG9

APPENDIX 2