ENGINEERING STATEMENT

For Certification of

HONG JIN CROWN AMERICA INC.

Model No. GMRS-X1
FCC ID: KA9HJC-X1

I am an Electronics Engineer, a principal in the firm of Hyak Laboratories, Inc., Springfield, Virginia. My education and experience are a matter of record with the Federal Communications Commission.

Hyak Laboratories, Inc. has been authorized by Hong Jin Crown America Inc. to make certification measurements on the GMRS-X1 transceiver. These tests were made by me or under my supervision in our Springfield laboratory.

Test data and documentation required by the FCC for certification are included in this report. The data verifies that the above mentioned transceiver meets FCC requirements and certification is requested.

_____
Rowland S. Johnson

Dated: January 19, 2001

A. INTRODUCTION

The following data are submitted in connection with this request for type acceptance of the GMRS-X1 transceiver in accordance with Part

2, Subpart J of the FCC Rules.

The GMRS-X1 is a hand-held, battery operated, UHF, frequency modulated, transceiver intended for voice communications applications in the 462.5500 - 462.7250 MHz band under Part 95 in the GMRS service. (ERP (d) was 1.2 W.)

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

1. Name of applicant: Hong Jin Crown America Inc.

2. Identification of equipment: FCC ID: KA9HJC-X1

   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 1.2 watts ERP(d).
   d. Maximum power permitted under FCC Part 95 (interstitial) is 5 watts ERP. The GMRS-X1 fully complied with that power limitation.
   d. The dc voltage and dc currents at final amplifier:

      Collector voltage: 4.7 Vdc
      Collector current: 0.87 A

   f. Function of each active semiconductor device: See Parts List Exhibit.
   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 1.
   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 2.985 through 2.997 follow this section.

C. RF POWER OUTPUT (Paragraph 2.985(a) of the Rules)

ERP (d) was determined by substitution as 1.2 watts.

D. MODULATION CHARACTERISTICS

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 paragraphs 2.987(b) 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 (Paragraphs 2.989(c), 90.209(b)(4), 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 2.989(c)(1) and consisted of a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50% modulation at 2493 Hz, the frequency of maximum response.

C. MODULATION CHARACTERISTICS (continued)

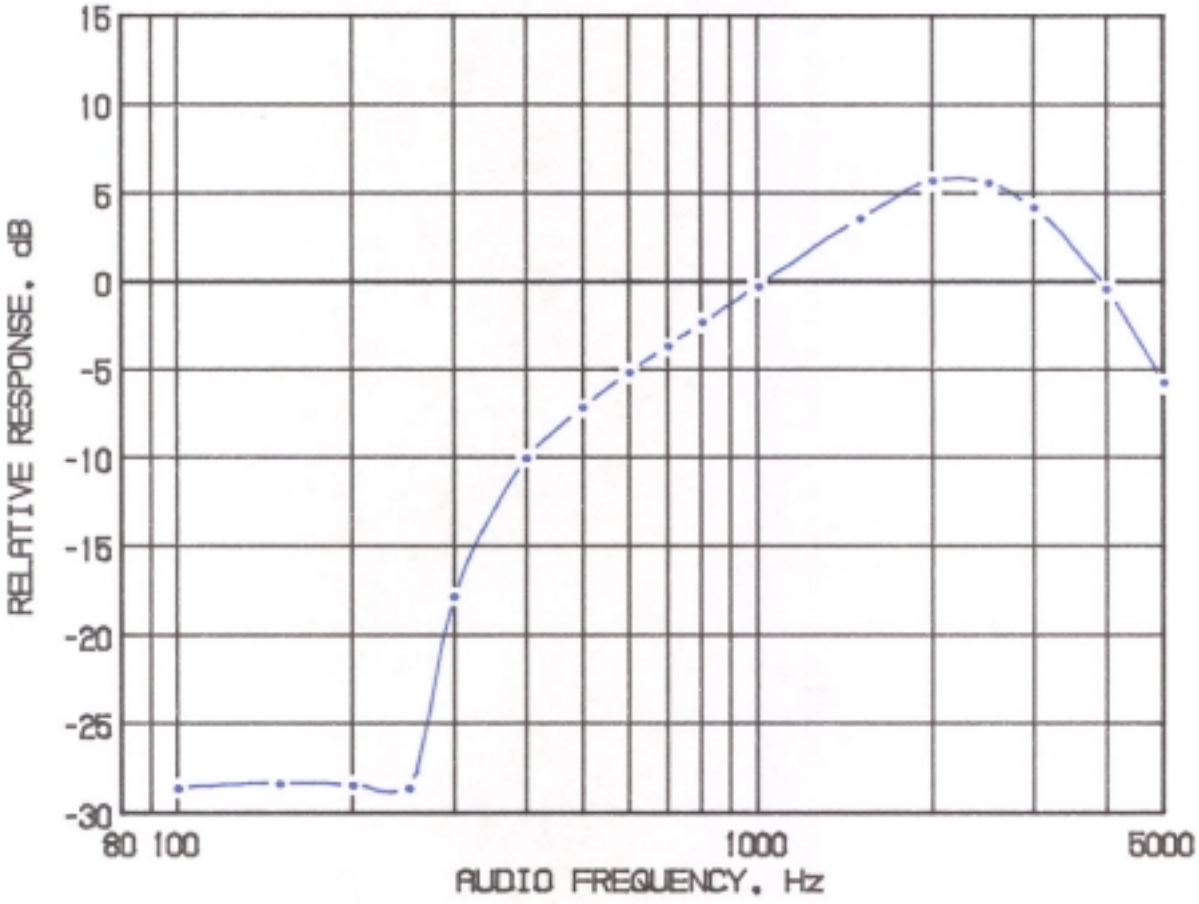
The plot is within the limits imposed by Paragraph 90.211(h) for frequency modulation. The horizontal scale (frequency) is 10 kHz per division and the vertical scale (amplitude) is a logarithmic presentation equal to 10 dB per division.

5. Emission Designator Calculation:

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

FIGURE 1

MODULATION FREQUENCY RESPONSE

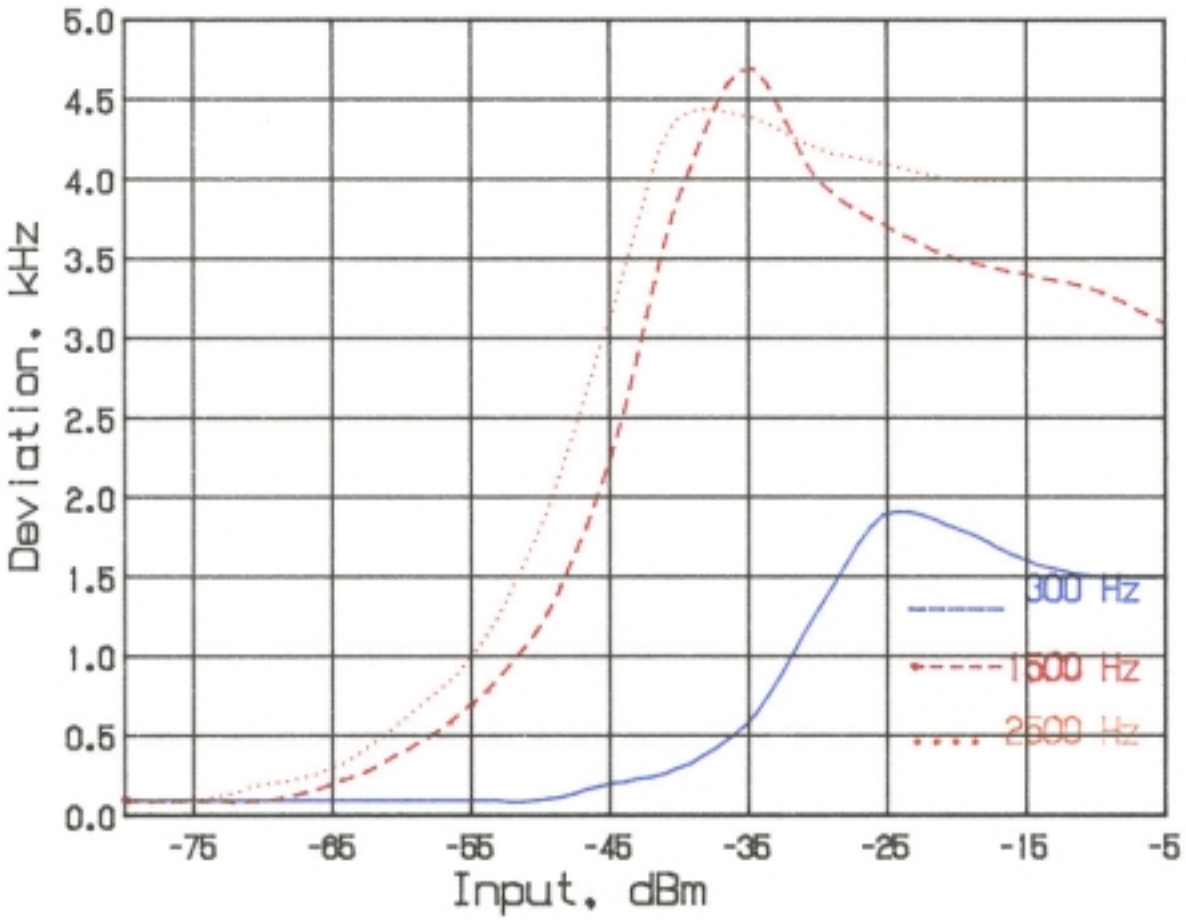


MODULATION FREQUENCY RESPONSE
FCC ID: KA9HJC-X1

FIGURE 1

FIGURE 2

AUDIO LIMITER CHARACTERISTICS

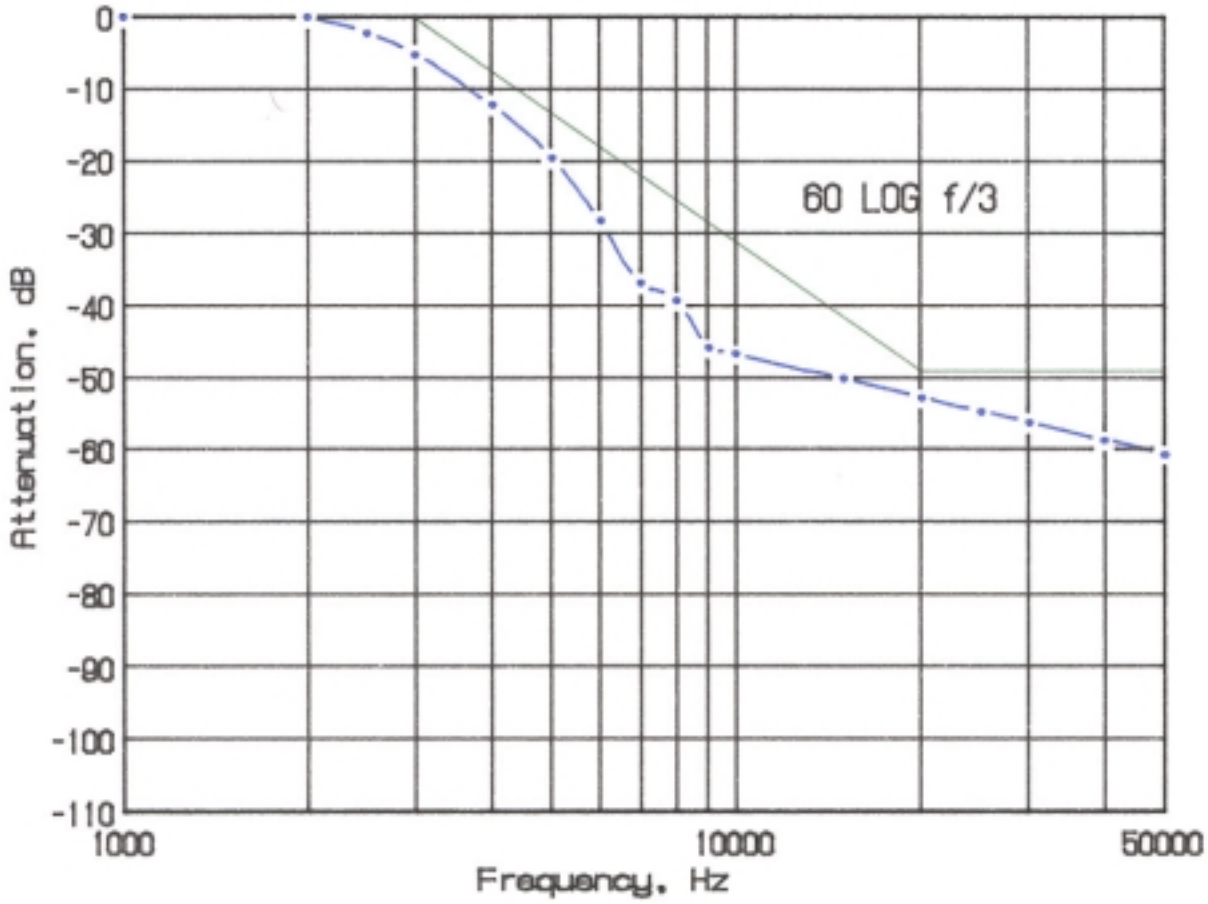


AUDIO LIMITER CHARACTERISTICS
FCC ID: KA9HJC-X1

FIGURE 2

FIGURE 3

AUDIO LOW PASS FILTER RESPONSE

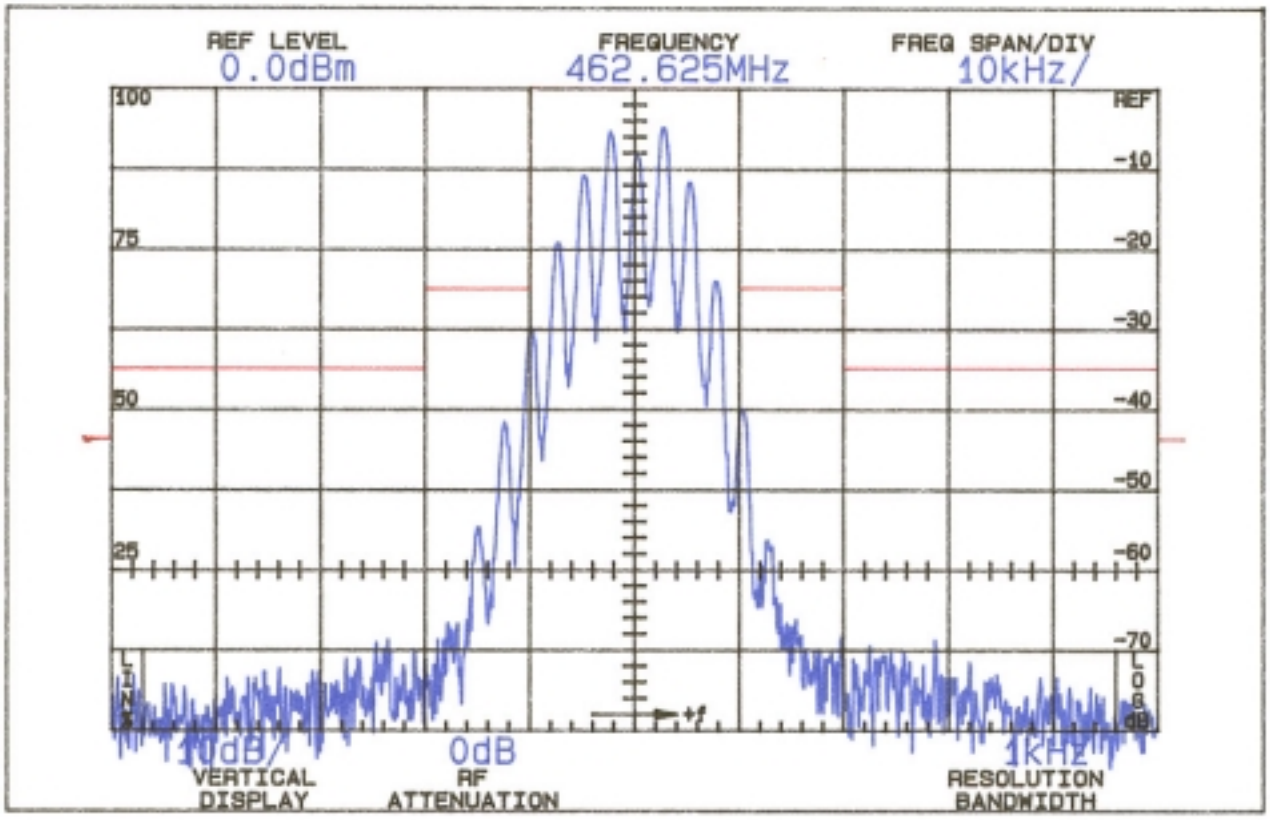


AUDIO LOW PASS FILTER RESPONSE
FCC ID: KA9HJC-X1

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 25
authorized bandwidth, 20 kHz
(10-20 kHz)

On any frequency more than 100%,
up to and including 250% of the 35
authorized bandwidth (20-50 kHz)

On any frequency removed from
the assigned frequency by more 43+10LogP = 44
than 250% of the authorized (P = 1.2W)
bandwidth (over 50 kHz)

OCCUPIED BANDWIDTH
FCC ID: KA9HJC-X1

FIGURE 4

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

Not applicable, permanently attached antenna.

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 GMRS-X1 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 in an open field 3 meters from the test antenna. Supply voltage was a power supply with a terminal voltage under load of 4.8 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
462.6250 MHz, 4.8 Vdc, 1.2 watts

Frequency	dB Below Carrier

MHz	Reference[1]
462.626	0
925.252	51V
1387.878	58V
1850.502	57V
2313.126	51V
2775.750	49H
3238.374	57H
3701.000	73H
4163.626	70V
4626.248	61V

Required: 43+10Log(1.2) = 44

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

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 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 4.8 volts. Frequency was measured with a HP 5385A digital frequency counter connected to the transmitter through a power attenuator. Measurements were made at 462.6250 MHz. No transient keying effects were observed.

TABLE 2

462.6250 MHz, 4.8 V Nominal, 1.2 watts

Temperature, °C	Output Frequency, MHz	p.p.m.
-29.5	462.625558	1.2
-19.9	462.625587	1.3
- 9.9	462.625378	0.8
0.3	462.625208	0.4
10.2	462.625079	0.2
20.0	462.624953	-0.1
30.6	462.624915	-0.2
39.7	462.624938	-0.1
49.7	462.624977	0.0

Maximum frequency error: 462.625587
462.625500

+ .000587 MHz

FCC Rule 95.621(b) specifies .0005% 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 4.8 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

462.6250 MHz, 20°C, 4.8 V Nominal, 1.2 watts

%	Supply Voltage	Output Frequency, MHz	p.p.m.
115	5.52	462.624972	-0.1
110	5.28	462.624966	-0.1
105	5.04	462.624959	-0.1
100	4.80	462.624953	-0.1
95	4.56	462.624949	-0.1
90	4.32	462.624946	-0.1
85	4.08	462.624944	-0.1
*	3.84	462.624941	-0.1

Maximum frequency error: 462.624941
462.625000

*Rated battery end-point. - .000059 MHz

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

High Limit 462.627313 MHz
Low Limit 462.622687 MHz

APPENDIX 1

CIRCUITS AND DEVICES TO STABILIZE FREQUENCY

SYNTHESIZER

A phase locked loop (PLL) circuit establishes and stabilizes operating frequency.

The data for producing necessary frequencies is established by the CPU on the digital board.

The frequency stability of the TX/RX is maintained by the TCXO, which generates a stable frequency of 12.8 MHz.

CIRCUITS AND DEVICES TO
STABILIZE FREQUENCY
FCC ID: KA9HJC-X1

APPENDIX 1

APPENDIX 2

CIRCUITS TO SUPPRESS SPURIOUS RADIATION
AND LIMIT MODULATION

Circuitry to Suppress Spurious Emissions

Q201 provides approximately 4.8 V dc power source. Signals from Q201 is supplied through antenna switch D201 to a low-pass filter made up of L204, L203, L202 and C201-C207, then applied to antenna jack.

Circuitry to Limit Modulation and Audio Low Pass Filter

Voice signal from the microphone is applied to microphone amplifier U506 contains a high-pass filter, low-pass filter that has a 6 dB/oct response between 300 Hz and 3 kHz, and eliminates harmonics above 3 kHz. The pre-emphasized audio signal is applied to VR501 to adjust maximum frequency deviation.

CIRCUITS TO SUPPRESS SPURIOUS
RADIATION AND LIMIT MODULATION

FCC ID: KA9HJC-X1
APPENDIX 2