A. INTRODUCTION

The following data are submitted in connection with this request for type certification of the PR330 transceiver in accordance with Part 2, Subpart J of the FCC Rules.

The PR330 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).

1. 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).

1. Information is included in the user instruction manual 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 (Paragraph 2.983 of the Rules)

1. Name of applicant: Cobra Electronics Corporation

2. Identification of equipment: FCC ID: BBOPR330C

   a. The equipment identification label is submitted as a separate exhibit.
   a. 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.
   a. Operating power ERP(d):
      FRS 0.311 W
      GMRS 0.304 W

B. GENERAL INFORMATION (Cont.)

   d. Maximum power permitted under FCC Part 95 (interstitial) is 5 watts ERP. The PR330

fully complied with that power limitation.

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

	GMRS	FRS
Collector voltage:	5.9	5.9 Vdc
Collector current:	0.30	0.27 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 2.985 through 2.997 follow this section.

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

ERP(d) by substitution: FRS 0.311 W
GMRS 0.304 W

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).

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 (Paragraphs 2.989(c), 90.209(b)(4), 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 2.989(c)(1) and consisted of 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50% modulation at 2996 Hz, the frequency of maximum response.

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

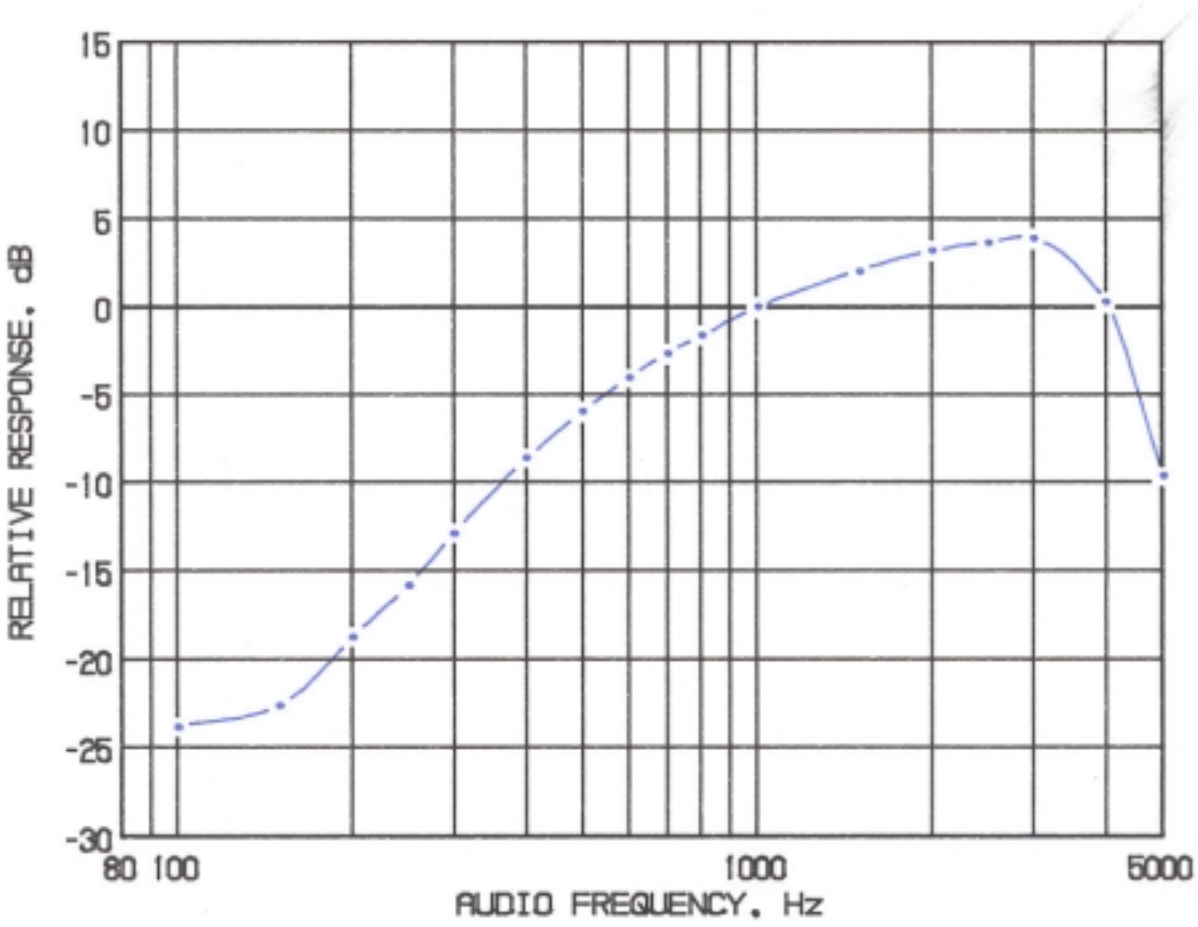
The plots are within the limits imposed by Part 95 for frequency modulation. The horizontal scale (frequency) is 10 kHz per division and the vertical scale (amplitude) is a logarithmic presentation equal to 10 dB per division.

5. Emission Designator Calculation:

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

FIGURE 1

MODULATION FREQUENCY RESPONSE



MODULATION FREQUENCY RESPONSE
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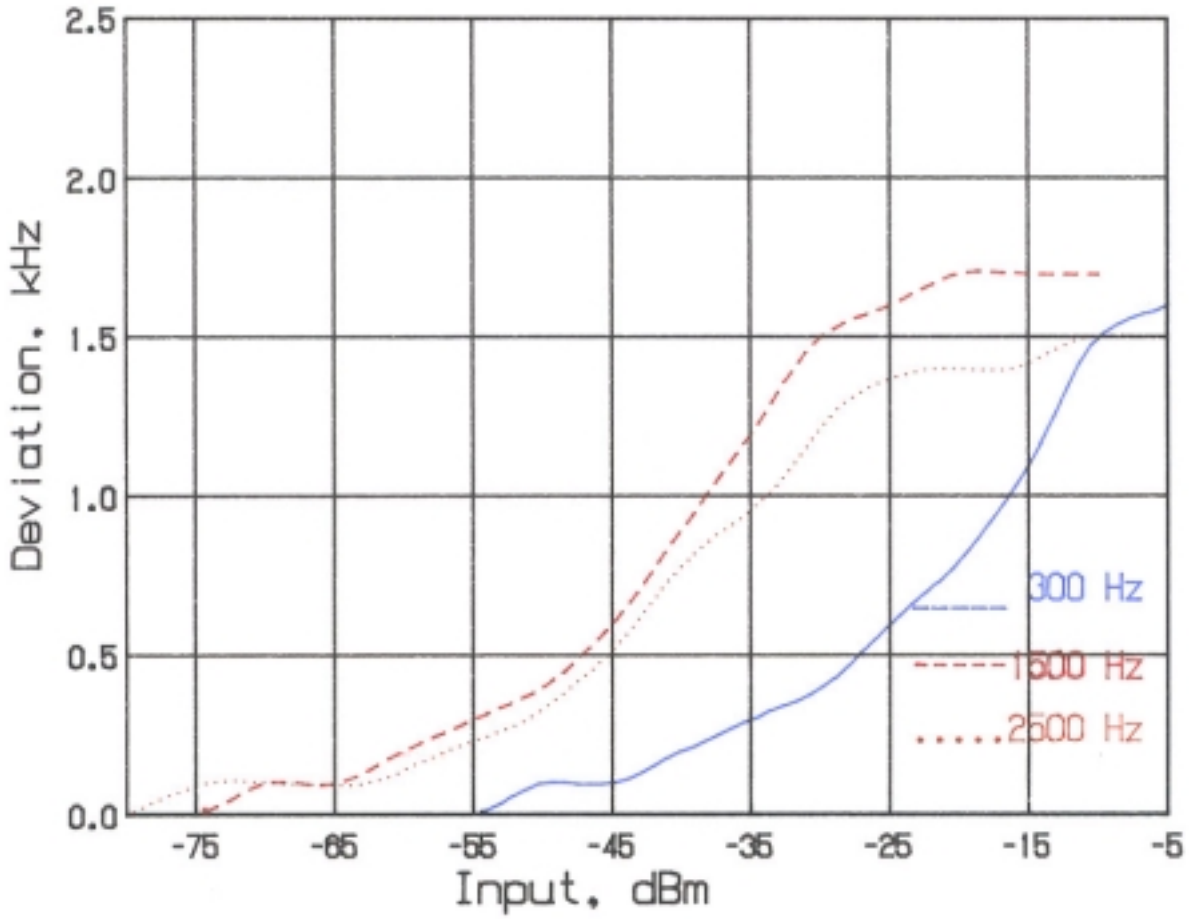
FIGURE 1

FIGURE 2

AUDIO LIMITER CHARACTERISTICS

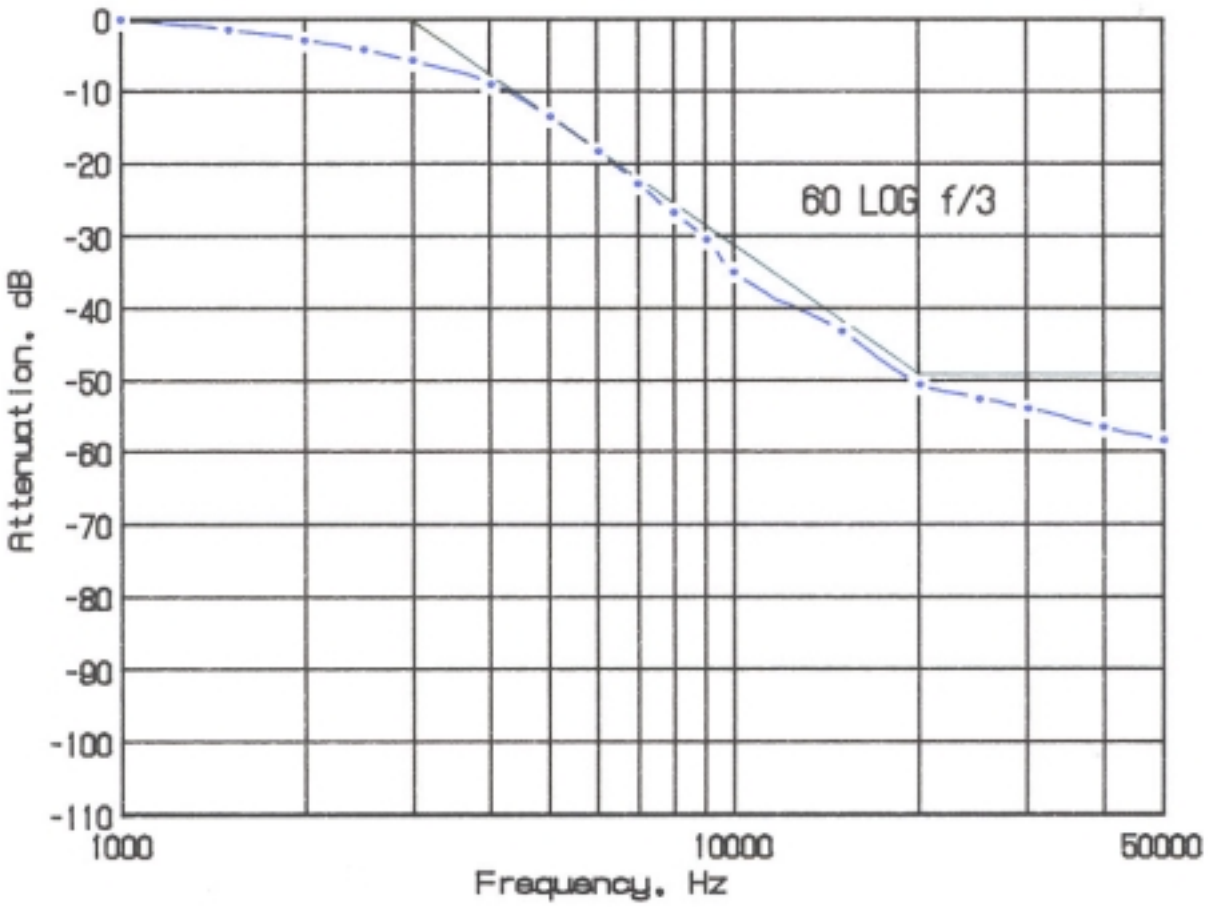


AUDIO LIMITER CHARACTERISTICS
FCC ID: BBOPR330C

FIGURE 2

FIGURE 3

AUDIO LOW PASS FILTER RESPONSE

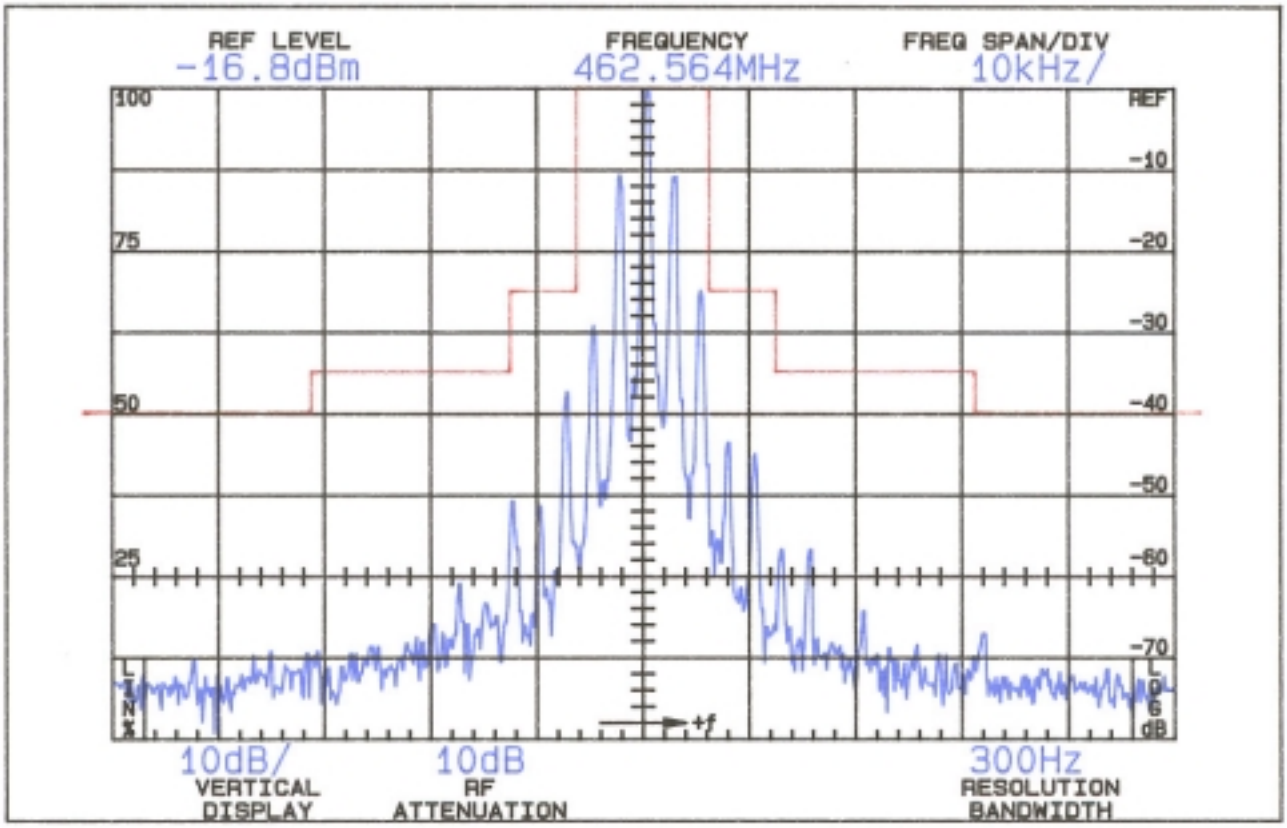


AUDIO LOW PASS FILTER RESPONSE
FCC ID: BBOPR330C

FIGURE 3

FIGURE 4a

OCCUPIED BANDWIDTH



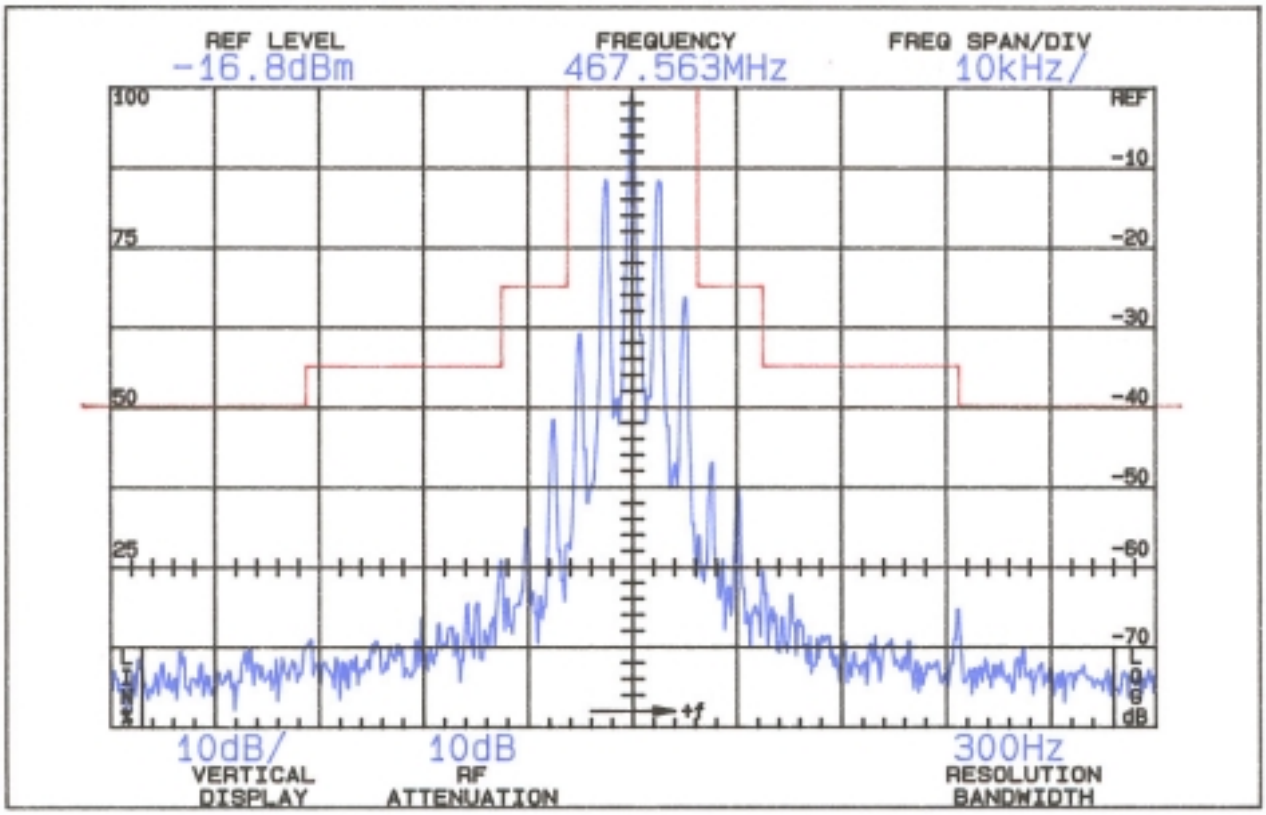
	ATTENUATION IN dB BELOW MEAN OUTPUT POWER Required
On any frequency more than 50% up to and including 100% of the authorized bandwidth, 20 kHz (10-20 kHz)	25
On any frequency more than 100%, up to and including 250% of the authorized bandwidth (20-50 kHz)	35
On any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth (over 50 kHz)	43+10LogP = 38 (P = 0.304 W)

OCCUPIED BANDWIDTH
FCC ID: BBOPR330C

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 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 than 250% of the authorized bandwidth (over 50 kHz)	43+10LogP = 38 (P = 0.311 W)

OCCUPIED BANDWIDTH
FCC ID: BBOPR330C

FIGURE 4b, (FRS)

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

Not Applicable, integral antenna.

F. MEASUREMENTS OF SPURIOUS RADIATION

Measurement of radiated spurious emissions from the PR330 were made by substitution with a Tektronix 494P spectrum analyzer using Singer DM-105A calibrated or Emco 3121 test antennae for the measurements to l GHz, Polarad CA-L, CA-S, CA-M and/or EMCO 3115. 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 6.0 Vdc. The transmitter and test antennae were arranged to maximize pickup. Both vertical and horizontal test antenna polarization were employed.

TABLE 2a
TRANSMITTER RADIATED SPURIOUS
462.5625 MHz, 6.0 Vdc, GMRS, Channel 1

Frequency MHz	dB Below Carrier Reference[1]
462.563	0
925.125	49V
1387.688	39V
1850.250	40V
2312.813	45H
2775.375	49H
3237.938	50H
3700.500	39H
4163.063	51H
4625.625	60H

Required: 43+10Log(0.304) = 38

TABLE 2b
TRANSMITTER RADIATED SPURIOUS
467.5625 MHz, 6.0 Vdc, FRS, Channel 8

Frequency MHz	dB Below Carrier Reference[1]
467.563	0

935.125	52V
1402.688	39V
1870.250	42V
2337.813	46H
2805.375	50H
3272.938	54V
3740.500	40H
4208.063	56V
4675.625	65H

Required: 43+Log(0.311) = 38

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

All other spurious from 21.5 MHz to 4.7 GHz were 20 dB or more below FCC limit.

G. 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. Primary supply was 6.0 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 3

462.5625 MHz, 6.0 V Nominal

Temperature, °C	Output Frequency, MHz	p.p.m.
-29.9	462.561919	-1.3
-19.7	462.561581	-2.0
-10.2	462.561436	-2.3
0.6	462.562127	-0.8
10.0	462.561999	-1.1
20.1	462.562576	0.2
30.2	462.562208	-0.6
40.9	462.561705	-1.7
49.9	462.561767	-1.6

Maximum frequency error: 462.561436
462.562500

\- .001094 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
(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 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 4

462.5625 MHz, 20°C, 6.0 V Nominal

%	Supply Voltage	Output Frequency, MHz	p.p.m.
115	6.9	462.562626	0.3
110	6.6	462.562602	0.2
105	6.3	462.562581	0.2
100	6.0	462.562576	0.2
95	5.7	462.562569	0.1
90	5.4	462.562550	0.1
85	5.1	462.562524	0.1
*	4.8	462.562499	0.0
	Maximum frequency error:	462.562626	
		462.562500	
*MFR rated battery endpoint.		+ .000126 MHz	

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

Q9	2SK3078	TX RF Power Amplifier
Q13	2SC4226	TX RF Buffer Amplifier
Q1		RX LNA
Q6	HN3C10FT	VCO
Q2	3SK320	RX Mixer
U4	AN6311	PLL + IF + Audio IC

FLT2	XF2112A	21.4 MHz Crystal Filter
X2	W-205-67	20.95 MHz Crystal Oscillator

APPENDIX 2

CIRCUITS AND DEVICES TO STABILIZE FREQUENCY

The PLL synthesizer of the signal loop PLL circuit with the reference of 6.25 kHz. The U4 PLL part 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 20.95 MHz crystal of the X2 is connected to the pin 52 & 53 of U4 to oscillate the frequency of 20.950 MHz.

The phase detector sends out the output power to the loop filter through pin 46 of the U4. If the oscillation frequency of the VCO is low compared to the referenced frequency, the phase detector sends out the output power in positive pulse. If the oscillation frequency of the VCO is high, phase detector send out can maintain the frequency set.

CIRCUITS AND DEVICES TO
STABILIZE FREQUENCY, etc.
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APPENDIX 2

APPENDIX 3

CIRCUITS AND DEVICES TO
SUPPRESS SPURIOUS EMISSIONS, ETC.

The transmitted signal of approximately 7 mW, combined at the driver TR is supplied to the base of the Q9 amplifier. The transmitted signal amplified to 0.5 W here passes the TX LPF of the 2nd characteristic of the L13 and the L15, and RX/TX switching takes

place by the D5. After this, the signal is provided to the antenna directly.

CIRCUITS AND DEVICES TO
SUPPRESS SPURIOUS EMISSIONS, etc.
FCC ID: BBOPR330C

APPENDIX 3