



OPERATOR'S MANUAL



UV-3

FM TRANSCEIVER

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CHAPTER I

INTRODUCTION

1-1. DESCRIPTION.

The UV-3™ transceiver is a solid state FM device which provides coverage of three bands: the entire 2 meter amateur band, 220 to 225 MHz, and 440 to 450 MHz. The UV-3 covers these ranges with a unique synthesizer scheme which provides 5 kHz steps and does not utilize mixers, thereby producing a clean operating frequency free of synthesizer or mixer spurious emissions.

The UV-3 has been designed so that any combination of the three bands may be obtained. The basic design consists of the front panel and the controls with the synthesizer, programming facilities, IF, and audio system. To this system may be added any single, or any combination, of three RF sections; the 2 meter, 220 MHz, or 440 MHz sections. These add-on sections consist of the local oscillator and amplifiers that provide the power output to the antenna as well as the front end, RF, and mixer circuitry.

The UV-3 offers many unique features not found on other amateur FM transceivers. The operator may program four favorite frequencies and offsets (for repeaters) on each of the three amateur bands. These channels may be selected by means of a front panel CHANNEL selector. Each channel and offset are programmed with diodes on a plug-in program board. When the 220 MHz and/or 440 MHz bands are used, an additional program board is provided to allow programming of four channels, and respective offsets for each of these bands.

Three programmable offsets in addition to the standard offsets for each band, may be selected by means of the front panel OFFSET selector switch. Offsets "X, Y, and Z" are diode programmable and may be used to provide transmitter offsets other than the standard (+) or (-) offset when using the dial for frequency selection. These offsets are programmable to 5 kHz, positive or negative, relative to the receive frequency. Offsets "X, Y, and Z" are the same for the 140 MHz, 220 MHz, and 440 MHz bands. The standard (+) and (-) offsets are de-

scribed in the specifications and are selected automatically when changing bands. Also, these offsets are in addition to the offsets which are programmed for any of the preprogrammed channels, selected by the Channel switch in positions 1 through 4.

The UV-3 provides the attractive feature of offering two modes of priority scanning operation. A front panel toggle switch selects the desired mode of operation, which may be SCAN DIAL or SCAN CH 4. A complete description of each scan mode is provided in section 3-7.

A front panel toggle switch allows selection of high or low power output. The low power output is factory set, but may be varied anywhere from zero to full output by changing one resistor for each band.

The receiver portion of the UV-3 uses multisection filters in the front end to insure high rejection of out-of-band signals. The IF section incorporates a six pole monolithic crystal filter at 10.7 MHz, and an eight pole ceramic filter at 455 kHz to provide excellent adjacent channel selectivity and negligible spurious response. A wide dynamic range field-effect-transistor is used as the first mixer, and is biased to reduce intermodulation distortion to a minimum.

The transmitter section features excellent transmitted audio quality due to direct frequency modulation. Freedom from spurious radiation is obtained since no mixers are used to develop the desired transmitted signals.

The modular construction of the UV-3 allows for ease of program changes and reduces service time to a minimum. Each board may be serviced and aligned individually, thus reducing repair time. The use of extruded aluminum side frames make the UV-3 exceptionally rugged and tolerant of mechanical vibration as well as providing additional heat sinking for the transmitter power amplifiers.

CHAPTER 1
INTRODUCTION



Figure 1-1. UV-3 FM Transceiver

SPECIFICATIONS

GENERAL

Frequency Coverage:	
140 Band:	144 – 148 MHz*
220 Band:	220 – 225 MHz
440 Band:	440 – 450 MHz
Mode:	FM (5 kHz deviation)
Supply Voltage:	11.5 – 15.0 V DC negative ground
Supply Current:	
Receive:	0.9 A Standby
Transmit:	6 A High Power 1.3 A Low Power

Semiconductor Complement:

Field-effect-transistors:	8
Bipolar transistors:	42
Integrated circuits:	37
**Diodes:	16

Accessory Receptacle: 10 pin socket with mating plug

Power Receptacle: P-302-AB

External Speaker Receptacle: RCA phono plug

Dimensions:

Length (one band):	9 in. (22.86 cm.)
(two band):	11-1/2 in. (29.2 cm.)
(three band):	14 in. (35.56 cm.)
Width:	8-1/8 in. (20.6 cm.)
Height:	3-1/2 in. (8.9 cm.)

Weight:

(one band):	7.0 lbs. (3.17 kg.)
(two band):	7.3 lbs. (3.31 kg.)
(three band):	7.6 lbs. (3.45 kg.)

Operating Temperature: 0° C to 60° C

FREQUENCY SYNTHESIZER

Type: Directly programmable, digital phase-locked loop.

Reference: 5 MHz crystal oscillator.

Frequency Accuracy: $\pm 0.0005\%$ over a temperature range of 0° C to 60° C with a supply voltage variation of 11.5 to 15 V DC.

RECEIVER

Type: Double conversion, 1st IF @ 10.7 MHz. 2nd IF @ 455 kHz. 6 pole crystal filter @ 10.7 MHz and 8 pole ceramic filter at 455 kHz.

Sensitivity:

146 - 148 MHz	Typically better than 0.35 μ V for 12 dB SINAD
222 - 225 MHz	
442 - 447 MHz	
144 - 148 MHz	0.50 μ V (max.) for 12 dB SINAD
220 - 225 MHz	
440 - 450 MHz	

*Band overlap allows tuning of most MARS frequencies.
**Not including 50 program diodes that are furnished.

SPECIFICATIONS (continued)

Selectivity:	12 kHz @ -3 dB
Adjacent Channel Rejection:	
140 Band:	Greater than 80 dB @ ±30 kHz
220, 440 Bands:	Greater than 70 dB @ ±30 kHz
140, 220, 440 Bands:	Greater than 60 dB @ ±15 kHz
Modulation Acceptance Bandwidth:	±6 kHz
Intermodulation Attenuation:	
140 Band:	80 dB (referenced to 12 dB SINAD)
220 Band:	75 dB (referenced to 12 dB SINAD)
440 Band:	65 dB (referenced to 12 dB SINAD) (EIA RS-204-A procedure)
Image Rejection:	
140 Band:	80dB
220 Band:	60dB
440 Band:	55dB
IF Rejection:	Greater than 95 dB
Audio Output:	2.5 watts @ less than 10% THD 2 watts @ less than 5% THD (3.2 ohm load)
Squelch Sensitivity:	Less than 0.20 μ V
Meter:	Indicates relative signal level.
TRANSMITTER	
Power Output (13.8 V DC):	
High Power:	
140 Band:	25 watts min. (146 – 148 MHz) 20 watts min. (144 – 146 MHz)
220 Band:	10 watts min. (220 – 225 MHz)
440 Band:	10 watts min. (440 – 450 MHz)
Low Power:	Approx. 10% of high power (internally adjustable)
Harmonic and out-of-band spurious:	
140 Band:	-60 dB (min.) referenced to carrier
220 Band:	-60 dB (min.) referenced to carrier
440 Band:	-40 dB (min.) referenced to carrier
Spurious in-band:	-75 dB (min.) referenced to carrier
Modulation:	Direct FM, factory-set to ±5 kHz deviation. Separate microphone gain and deviation limit adjustments. Deviation separately adjustable for each band.
Hum and Noise:	Greater than 40 dB below maximum deviation.
Microphone:	500 ohm dynamic.
Meter:	Indicates relative RF output.

1-2. ACCESSORIES.

The following items provide additional features to the UV-3 and are available as options through R. L. Drake Company dealers.

REMOTE MOUNTING KIT UMK-3, MODEL 1355
Provides necessary mounting hardware, brackets, cable, and remote control enclosures for ready installation of the UV-3 mainframe in the trunk compartment of a vehicle. The purpose of the UMK-3 is to protect the most expensive parts of the UV-3 from theft and yet allow the operator to have all controls available in the passenger compartment. The front panel, or control head, of the UV-3 is removed from the unit and placed in the remote mounting enclosure which is near the driver's seat (usually beneath the dash). The mainframe is mounted in a mobile mounting bracket located in the trunk. A 42 conductor cable is supplied to provide connection between the control head and mainframe of the UV-3. An external speaker is required when mounting the UV-3 mainframe in the trunk. The remote mounting kit has provisions to allow use of an external speaker in the passenger compartment. Complete installation instructions are included with the UMK-3 Remote Mounting Kit.

EXTERNAL SPEAKER MS-3, MODEL 1510

Using the UV-3 transceiver as a mobile unit with the mainframe installed in a trunk or other remote location, will require the use of an external speaker in the passenger compartment. The MS-3 external speaker is intended for use in installations requiring a compact speaker with ample power handling ability. In mobile installations, the MS-3 is small

enough to mount below the dashboard near the operator. The impedance of the MS-3 is 4 ohms. Complete installation instructions are supplied with the unit.

POWER SUPPLY PS-3, MODEL 1504

Fixed or base station operation of the UV-3 transceiver will require a power supply capable of delivering 13.8 volts at 7 amps. The PS-3 is such a power supply and is packaged in a matching enclosure similar to the UV-3. The PS-3 offers load regulation better than 0.1% and has less than 50 millivolts ripple, at full load. Additionally, the PS-3 offers shutdown protection if the current exceeds 8 amps. An auxiliary output on the rear panel allows the user to supply up to 1 amp to other equipment if desired. A complete operator's manual, listing specifications and recommended operating procedures is supplied with the PS-3 power supply.

ENCODING MICROPHONE 1525 EM, MODEL 1525

Autopatch operation using the UV-3 may be greatly simplified by using the 1525 EM tone encoding microphone. This unit combines a high reliability keyboard and encoder circuitry with a high quality dynamic microphone element. The UV-3 microphone connector comes wired for use with the 1525 EM. The 1525 EM incorporates the Motorola MC14410CP tone encoder integrated circuit to produce the necessary signals required by most autopatch equipment. The tone encoder IC derives all tones from a high accuracy, 1.0 megahertz crystal. Complete specifications for the 1525 EM are available. The microphone comes complete with connector and operating instructions.

CHAPTER II INSTALLATION

2-1. UNPACKING.

Carefully remove the UV-3 from the shipping carton and examine it for evidence of damage. If there is damage, immediately contact the transportation company responsible for delivery of the unit or return the unit to the dealer where the unit was purchased. Keep the shipping carton and all packing material for the transportation company to inspect. If it is necessary to return the unit, it will be much easier to ship, using the original carton and packing material. Inspect the packing material for any accessories or printed material before storing. Locate the registration card, fill out immediately and return to the R. L. Drake Company to insure registration and validation of the warranty.

2-2. POWER REQUIREMENTS.

Operating voltage for the transceiver is 11.5 to 15 volts DC. Voltages in excess of 15 volts may permanently damage the transceiver and will void the warranty. The nominal recommended operating voltage is 13.8 volts DC at a current of 0.9 amp during receive and 6.0 amps during transmit. The unit comes with a power cord five feet in length, with an in-line fuse rated for eight amps. When installing the transceiver, make sure the above voltage range is applied to the power cable. Use #14 stranded wire for long runs between supply and transceiver. The rear panel power connector (P-302-AB) has a mating receptacle (S-302-CCT), which has the wide pin attached to the *red* cable lead. Always connect the *red* lead to the *positive* terminal of the power source and connect the *black* lead to the *negative* supply terminal.

In mobile installations, it is recommended that #14 stranded wire be used if the transceiver is mounted remotely in the trunk. Do not use cigarette lighter adapters to supply power since these units are not designed to provide high current. Assure that the automotive supply has an electrical system that is in proper working order. A defective regulator may generate excessive voltage transients which may

damage the UV-3. A defective generator or alternator diode may cause excessive alternator whine or generator noise. Defective or aged ignition wiring may result in an undesirable level of ignition noise when receiving weak signals. The power connections to the automotive electrical system should be made to the battery terminals, if possible. This type of connection will require turning the radio "off" manually, instead of using the ignition switch. Using the ignition switch to provide switching to the transceiver power requires connection to a switched terminal, powered by the ignition switch. The negative supply lead to the transceiver should still be connected to the negative battery terminal, if possible.

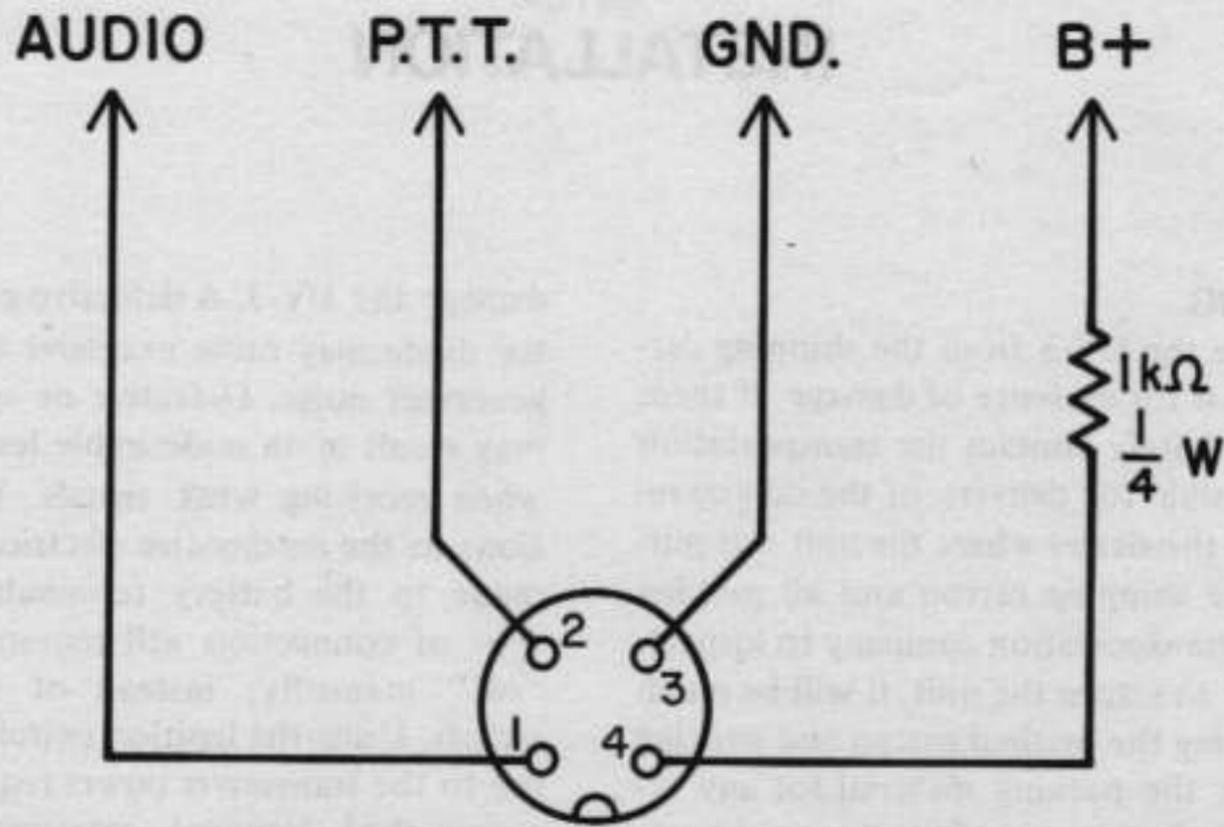
NOTE

The UV-3 was designed for use on negative ground electrical systems only. **DO NOT USE ON POSITIVE GROUND AUTOMOBILES.**

If fixed station operation is desired, use a power supply which is capable of providing 13.8 volts at eight amps with less than 100 millivolts ripple. Regulation should be better than 1/2 volt from no load to full load. It is also desirable that the supply have short circuit limit to protect the transceiver in case of device failure in the unit. The Drake PS-3 is designed for this application.

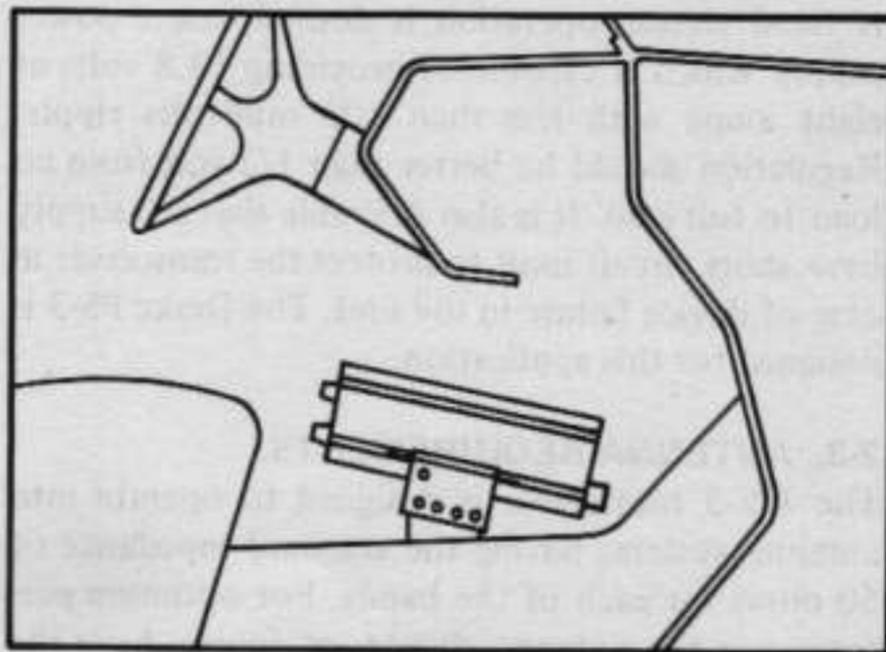
2-3. ANTENNA REQUIREMENTS.

The UV-3 transceiver is designed to operate into antenna systems having the standard impedance of 50 ohms for each of the bands. For optimum performance the antenna should, of course, have the lowest possible SWR. The transceiver output amplifiers are designed to tolerate any SWR at any phase angle, but performance may be seriously impaired if the SWR exceeds 2 to 1. Do not transmit for extended periods at high SWR or overheating may result.

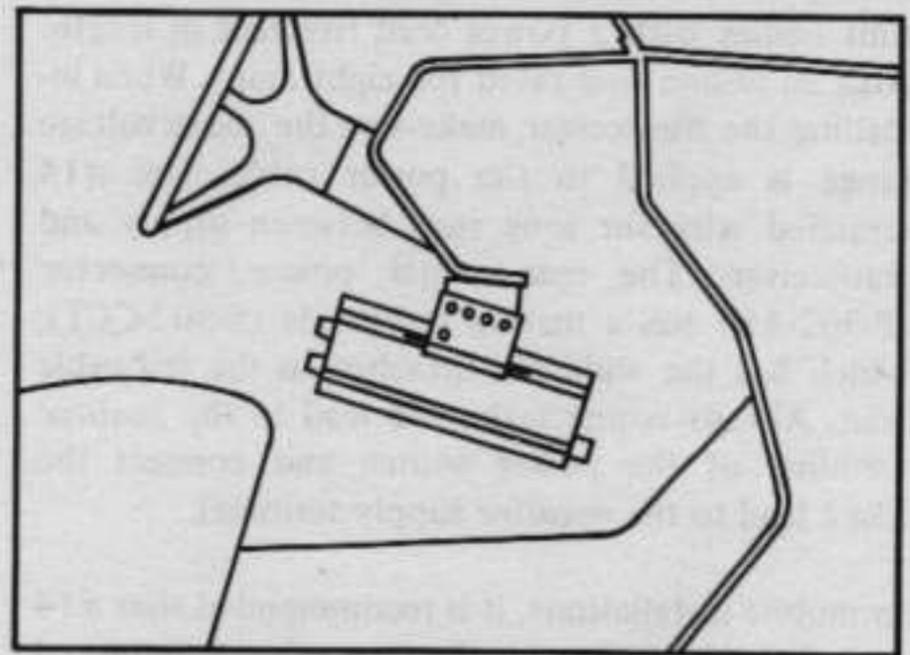


THIS CONNECTOR (# 328-1735) IS LOCATED ON THE LOWER RIGHT OF THE TRANSCEIVER FRONT PANEL.

Figure 2-1. Microphone Connector Wiring



FLOOR MOUNTING



UNDER DASH MOUNTING

Figure 2-2. Mobile Installation

SO-239 receptacles are provided for connection to PL-259 connectors and are located on the rear panel. There will be one SO-239 receptacle for each band, and it will be labeled accordingly.

2.4. MICROPHONE REQUIREMENTS.

A standard 500 ohm dynamic microphone is supplied with the UV-3. The microphone is equipped with a #329-1055 connector which mates with the transceiver input receptacle located at the lower right of the front panel. Other microphones may be used with the UV-3, but it is highly recommended that a low impedance (less than 1 kΩ) dynamic microphone be used since the audio processing circuitry is designed for dynamic elements. The use of other microphones may necessitate readjustment of the "mic gain" control located on the "Phase Det/Ref" board. See figure 3-2 for placement of the "mic gain" pot. If readjustment is required, it is easily performed by having other stations give reports on microphone level. Do not adjust any controls other than the "mic gain" pot when attempting to readjust microphone level. Refer to the drawing in figure 2-1, when wiring other microphones for use with the UV-3. Make sure ground and shield connections are made exactly as shown. Note that pin 4 is supplied with a DC voltage through a 1 kΩ resistor. This arrangement provides operating voltage for a Drake 1525 EM encoder microphone, and is not used with other microphones.

2.5. EXTERNAL SPEAKER.

A phono receptacle is mounted on the transceiver rear panel to allow connection of an external

speaker. The speaker should have an impedance of 3.2 to 8 ohms and should be able to handle 2 watts continuous power. Be sure speaker leads do not short. The audio amplifier in the UV-3 has short circuit protection, but indefinite short circuits should be avoided. To disable the internal speaker, remove the jumper between pins 1 and 10 of the auxiliary connector located on the bottom cover. See Figure 3-5. Auxiliary Connector, for placement of the jumper.

2.6. MOBILE INSTALLATION.

When installing the UV-3 in a vehicle, care must be taken to rigidly secure the unit. The Drake UMK-3 remote mounting kit provides a means of securely mounting the unit and still allowing ease of removal. As with any mobile installation, it is preferable to keep all power supply and antenna runs as short as possible. The power supply connections must be able to provide 8 amps to the unit at a voltage of 11.5 to 15.0 volts. If a long cable is required for the power connection, use #14 wire for the cable.

If possible, use RG-8A/U or larger coaxial cable for the antenna, and keep the feedline as short and direct as possible.

Do not mount the transceiver directly against heater vents, if possible, and try to keep the unit clear of the gear shift lever and hand brakes. It is desirable to mount the unit in a position where direct sunlight will not fall on the readouts, and in a position that will not allow the microphone cable to become entangled with the gear shift lever, etc. See Figure 2-2. Mobile Installation.

CHAPTER III OPERATION

3-1. FRONT PANEL CONTROLS AND CONNECTIONS.

Figure 3-1 shows a view of the UV-3 front panel controls and connections. The function and operation of each control will be described opposite the illustration.

3-2. NORMAL OPERATION.

In normal operation, the receive frequency is selected by adjusting the frequency selector switches (Items 2, 3, 4, and 5 in figure 3-1) until the desired frequency is shown on the transceiver readout. The term "Normal Operation" refers to operating the transceiver with the CHANNEL selector in the "Dial" position, and the SCAN switch in the center or "off" position. The BAND switch must be correctly set in order to obtain the desired receive frequency. For example, in the "140" position, the BAND switch actually programs 140 into the frequency synthesizer. The remaining digits of the desired receive frequency are then selected by adjusting the three rotary switches beneath the display window. If 5 kilohertz is required, it is added to the value shown on the readout by selecting a "5" on the ADD switch.

To obtain the desired transmit offset, position the OFFSET switch to the appropriate setting as described below. Position "S" refers to simplex operation, that is, the transmit offset is zero, and the transceiver receives *and* transmits on the frequency indicated by the frequency readout. The (-) or negative offset provides a -600 kilohertz transmit offset on the 140 band, -1.6 megahertz transmit offset on the 220 band, and a -5.0 megahertz transmit offset on the 440 band. The negative sign means the transmitted signal will be lower in frequency than the receive frequency by the amounts indicated above. The positive sign means the transmitted signal will be higher in frequency than the received frequency by the amounts shown above.

The remaining three positions "X", "Y", and "Z" provide offsets which are diode programmed on the OFFSET board. See figure 3-2 for location of the OFFSET board. "X", "Y", and "Z" offsets may be positive or negative as desired and are the same value on all three bands. Complete programming instructions are provided in section 3-5, Programming the Offset Board.

3-3. PROGRAMMING THE 140 PROGRAM BOARD.

The CHANNEL selector switch allows selection of four diode programmable channels which are programmed for receive frequency and transmit offset frequency. Refer to Figure 3-3, 140 Program Board, for diode placement and diode direction. Follow the listed procedure exactly; carefully note the exact location and direction of every diode. Incorrect placement will result in erroneous receive *and* transmit frequencies with perhaps even out-of-band operation. Incorrect diode polarity has the effect of programming a "zero" for that position, just as omission of a diode programs a zero. The UV-3 comes with 50 diodes for programming on the 140 MHz band. Although this supply will be adequate in most cases, additional diodes may be necessary; use any high quality silicon diode such as a 1N4148, 1N914, or equivalent. Do not use rectifier or power supply diodes. Diodes are available from the R. L. Drake Company in packages of 50 at a nominal price.

Refer to Figure 3-2, Board Locations, for exact placement of the 140 PROGRAM BOARD. Remove the board using the board puller, and position with the edge connector at bottom as shown on the 140 PROGRAM BOARD. There are 6 columns of integrated circuit sockets labeled A through G. Each column is made of two (2) IC sockets; each socket will accommodate eight (8) diodes. The top four (4) rows of each column are used to program Channel 1. The BAND switch programs 140 megahertz into the synthesizer in the

(continued on page 3-5)

CHAPTER III
OPERATION

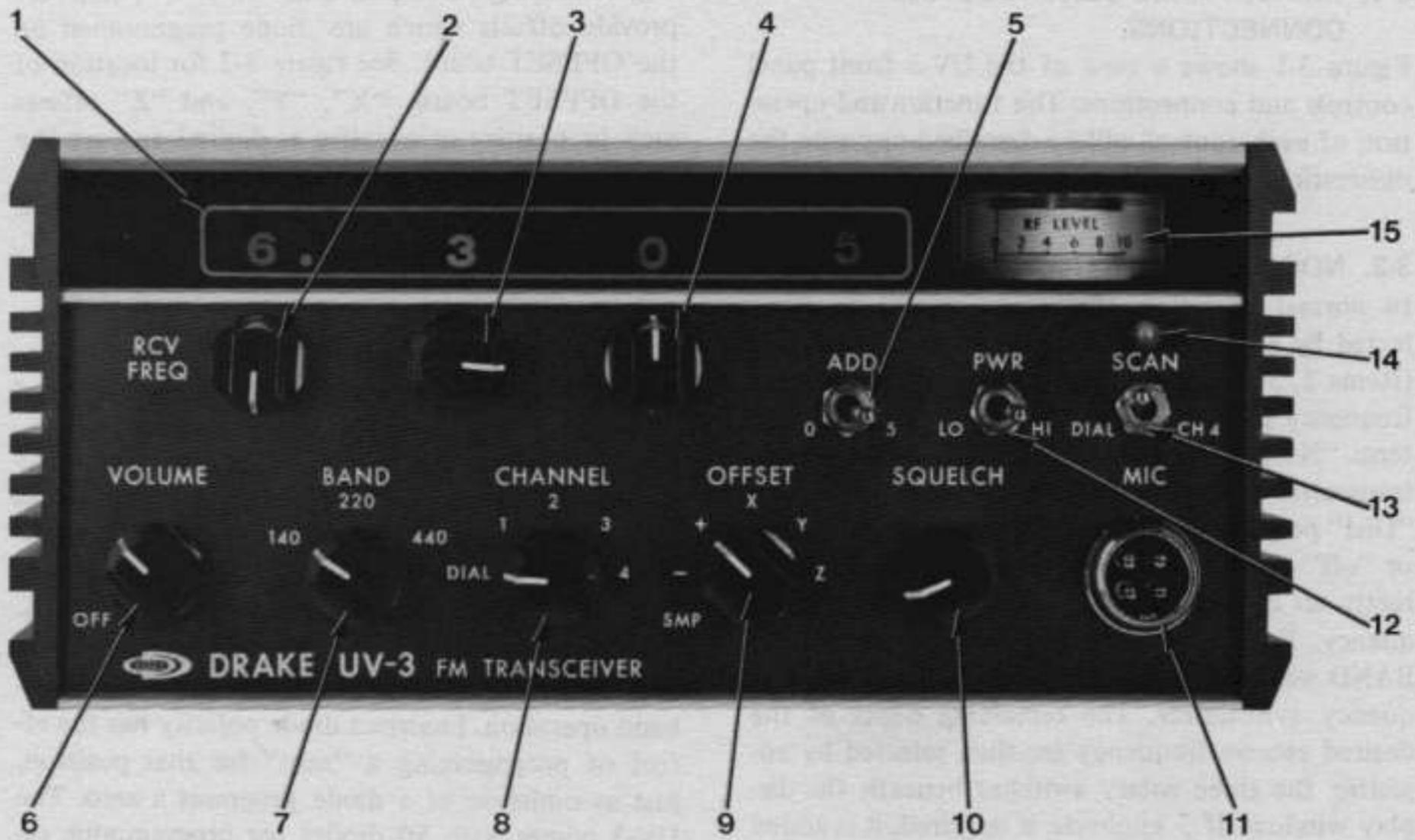


Figure 3-1. Front Panel Controls

FRONT PANEL CONTROLS

1. READOUT for receiver frequency. The units megahertz, hundreds kilohertz, tens kilohertz, and 5 kilohertz values are displayed. The BAND switch, Item (7) selects 140 megahertz, 220 megahertz, or 440 megahertz.
2. SELECTOR switch for the units megahertz value of receive frequency. 10 position rotary switch.
3. SELECTOR switch for hundred kilohertz value of receive frequency. 10 position rotary switch.
4. SELECTOR switch for ten kilohertz value of receive frequency. 10 position rotary switch.
5. SELECTOR switch for 0 or 5 kilohertz value of receive frequency. 2 position toggle switch.
6. VOLUME CONTROL/POWER switch. The transceiver is off when control is in the maximum counterclockwise position. Audio volume increases with clockwise rotation.
7. BAND switch selector. Selects 140, 220, or 440 megahertz band.
8. CHANNEL selector switch. Selects the receive frequency from READOUT (1), or from the 140 PROGRAM BOARD located inside the transceiver. Section 3-3. describes the use and programming of the 140 PROGRAM BOARD.
9. OFFSET selector switch. Selects desired transmit offset. Selects S (simplex), - (negative), + (positive), X, Y, and Z. Complete operation is covered in section 3-5.
10. SQUELCH control. Quiets receiver when no signal is being received.
11. MICROPHONE connector. Provides connection to the microphone and push-to-talk switch. It is factory wired to provide voltage for the 1525 EM encoder microphone. Figure 2-1 illustrates wiring of connector.
12. POWER SELECTOR. Selector switch for high or low transmitter power. In "high" position, power output is rated power output (see specifications). In "low" position, power output is approximately 1 watt, but may be varied from less than 1 watt to nearly full output by selection of one resistor for each band.
13. SCAN switch. Selects the mode of scanning. In "Dial" position, the transceiver normally receives the frequency selected by the CHANNEL switch. Approximately every 3 seconds the receiver checks the frequency indicated by the readout. If there is activity on the frequency being scanned, the receiver will lock and continue to monitor this frequency until the carrier drops for 2 seconds. When the SCAN switch is in the "CH 4" position, the transceiver receives on the frequency selected by the CHANNEL selector, and scans the frequency programmed in "Channel 4". If there is activity present on "Ch 4", the receiver will lock and monitor that channel until the carrier drops for 2 seconds. The scanning operation is described more fully in section 3-7.
14. SCAN LED. The Scan light-emitting-diode indicates when the transceiver is operating in a scan mode. The LED flashes when the receiver goes to the scanned frequency to check for activity. If activity exists on the scanned channel, the LED remains lighted to indicate the receiver has locked on an active frequency.
15. METER. Meter indicates relative signal strength on receive and relative output power on transmit.

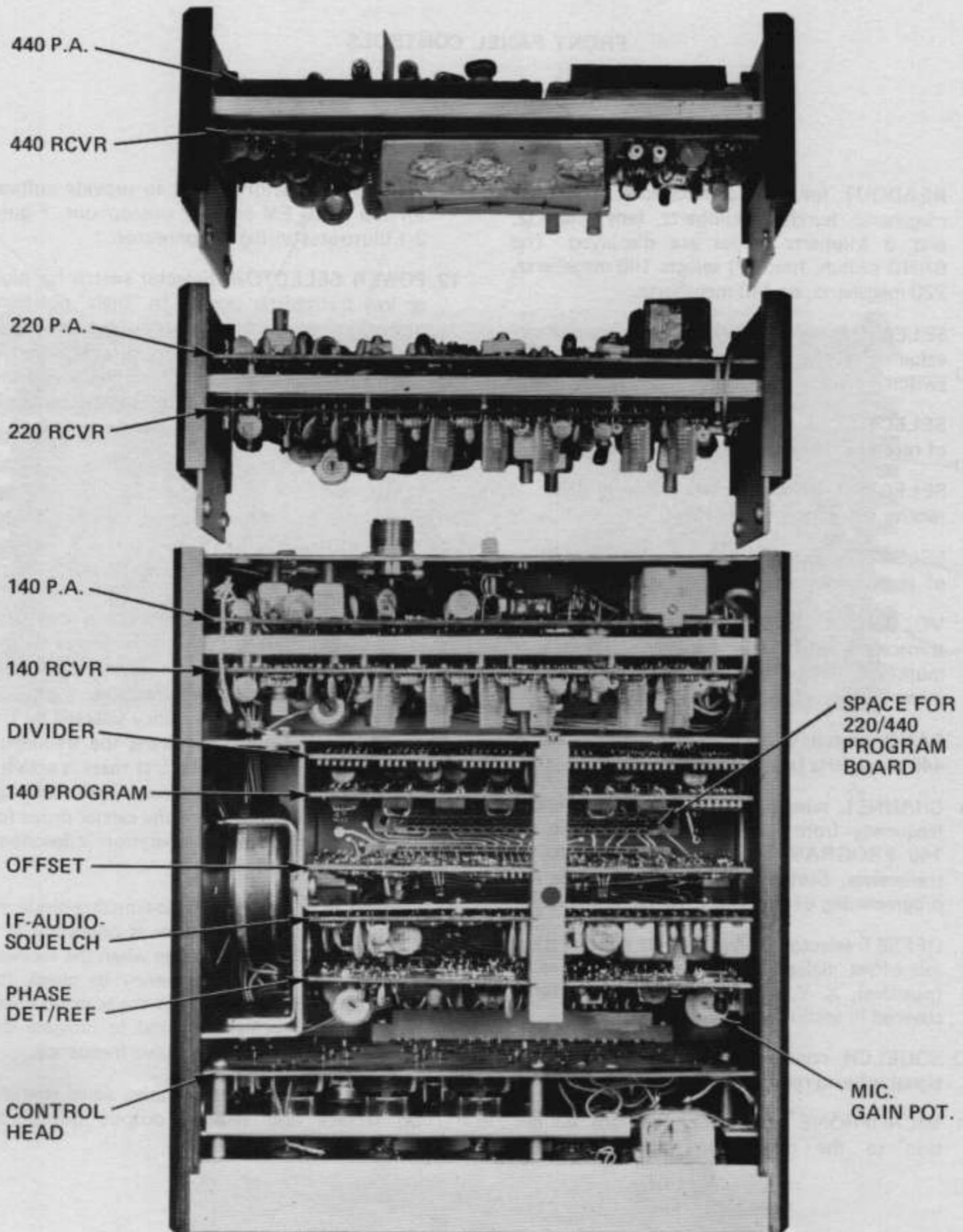


Figure 3-2. Board Locations

"140" position. It is necessary only to program the remainder of the desired receive frequency for Channel 1 and the offset. Program the units megahertz in Column A, normally a six (6) or seven (7) as in 146 or 147 megahertz. A six requires two diodes; a diode in the (2) position and a diode in the (4) position. A seven requires three diodes; a diode in the (1), (2), and (4) positions. The 100 kilohertz frequency is programmed into Column C in a similar manner to Column A. Any number may be programmed into the remaining columns by choosing a combination of (1), (2), (4), and (8) diodes. The desired number to be programmed is the sum of the diode values. If only a 1 is to be programmed, use a diode only in the (1) position. If an 8 is desired, use a diode only in the (8) position. To program a 5, use a (1) and (4) diode. To program a 5 kilohertz value, use only *one* diode in the channel desired. Carefully note the position of the IC socket for programming the 5 kHz values for each of the four channels. The upper four diode positions add 5 kHz to the receive frequency; the lower four diode positions add 5 kHz to the transmit offset. Do not use these positions unless a 5 kHz value is required in the receive frequency or the transmit offset.

Columns B, D, and F are used to program the transmit offset. Again, the lower four diode positions of the 5 kHz IC socket are used to add 5 kHz to the transmit offset. Column B is used for programming the megahertz value of transmit offset. This column is not normally used for 2 meter operation since most repeater offsets are ± 600 kHz. This column is provided in case repeater offsets greater than 1 megahertz are required. Column D allows programming of the 100 kHz value of transmit offset and column F programs the 10 kHz value. Use only a single diode to add 5 kHz to the offset. The values programmed into columns B, D, F, and the 5 kHz socket are determined exactly as described for programming the receive frequency. The most common value of transmitter offset is ± 600 kHz, and for this offset a (2) and (4) diode is used in column D. Column F and the 5 kHz socket are not programmed since their values are zero for the 10 kHz value and zero for the 5 kHz value.

The direction of transmit offset is determined by

placing a diode in the proper channel position of the Offset Direction socket, located in the upper left corner of the 140 PROGRAM BOARD. A diode is used for a negative offset; no diode is used for a positive offset. When a diode is used in the Offset Direction socket, it must be oriented with the cathode or banded end to the left. If the diode is positioned with the cathode to the right it will be reversed biased in the circuit, and will result in a positive rather than negative offset.

The rows marked Channel 2, Channel 3, Channel 4, and the associated offsets are programmed exactly as described for Channel 1. There are four diodes located on the lower right side of the program board which are used to inhibit the transceiver until channels 1 through 4 are programmed. As these channels are programmed the corresponding Inhibit Diode must be removed. These diodes are to be removed *only* after a channel is programmed. If a diode is removed and the channel is left unprogrammed, the transceiver will operate on 140.000 MHz. Transmitting on this frequency is *illegal*, since it is below the 2 meter band.

The 140 Program Chart, on page 3-7, lists the common 2 meter simplex and repeater frequencies and the required diode placement on the 140 PROGRAM BOARD. The *letter* represents the *column*; the *number* indicates diode *value*. For example, A-2 locates a diode in column A, position 2. This location may refer to a diode in any of the four channels.

3-4. PROGRAMMING THE 220/440 PROGRAM BOARD.

The CHANNEL selector switch allows selection of four diode programmable channels each, for the 220 MHz and 440 MHz bands. Programming the 220/440 PROGRAM BOARD is similar to programming the 140 PROGRAM BOARD, that is, the *receive frequency and transmit offset frequency* are programmed. Refer to Figure 3-2, Board Locations, for exact placement of the 220/440 PROGRAM BOARD. Figure 3-6 and figure 3-7 are both concerned with programming the 220/440 PROGRAM BOARD. For purposes of clarity, only 220 MHz programming is shown in figure 3-6 and 440 MHz programming is shown in figure 3-7.

(continued on page 3-8)

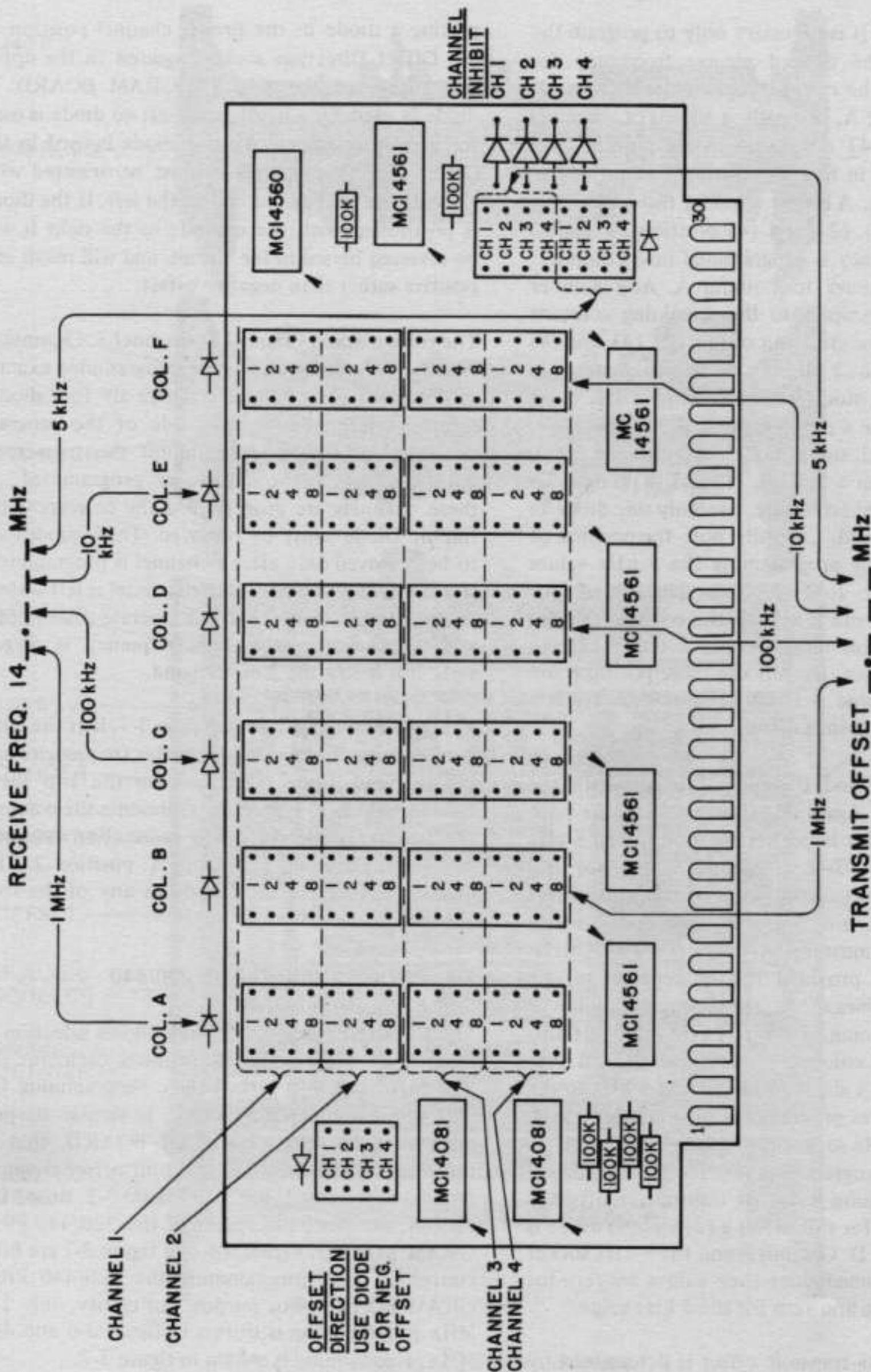


Figure 3-3. 140 Program Board

140 PROGRAM CHART

RECEIVE FREQUENCY MHz	DIODE LOCATION AND VALUE	OFFSET FREQUENCY	DIODE LOCATION AND VALUE	OFFSET DIRECTION
146.40	A-2, A-4, C-4	0	None	
146.43	A-2, A-4, C-4, E-1, E-2	0	None	
146.46	A-2, A-4, C-4, E-2, E-4	0	None	
146.49	A-2, A-4, C-4, E-1, E-8	0	None	
146.52	A-2, A-4, C-1, C-4, E-2	0	None	
146.55	A-2, A-4, C-1, C-4, E-1, E-4	0	None	
146.58	A-2, A-4, C-1, C-4, E-8	0	None	
146.61/01	A-2, A-4, C-2, C-4, E-1	-600 kHz	D-2, D-4	use diode
146.64/04	A-2, A-4, C-2, C-4, E-4	-600 kHz	D-2, D-4	use diode
146.67/07	A-2, A-4, C-2, C-4, E-1, E-2, E-4	-600 kHz	D-2, D-4	use diode
146.70/10	A-2, A-4, C-1, C-2, C-4	-600 kHz	D-2, D-4	use diode
146.73/13	A-2, A-4, C-1, C-2, C-4, E-1, E-2	-600 kHz	D-2, D-4	use diode
146.76/16	A-2, A-4, C-1, C-2, C-4, E-2, E-4	-600 kHz	D-2, D-4	use diode
146.79/19	A-2, A-4, C-1, C-2, C-4, E-1, E-8	-600 kHz	D-2, D-4	use diode
146.82/22	A-2, A-4, C-8, E-2	-600 kHz	D-2, D-4	use diode
146.85/25	A-2, A-4, C-8, E-1, E-4	-600 kHz	D-2, D-4	use diode
146.88/28	A-2, A-4, C-8, E-8	-600 kHz	D-2, D-4	use diode
146.91/31	A-2, A-4, C-1, C-8, E-1	-600 kHz	D-2, D-4	use diode
146.94/34	A-2, A-4, C-1, C-8, E-4	-600 kHz	D-2, D-4	use diode
146.97/37	A-2, A-4, C-1, C-8, E-1, E-2, E-4	-600 kHz	D-2, D-4	use diode
147.39/99	A-1, A-2, A-4, C-1, C-2, E-1, E-8	+600 kHz	D-2, D-4	no diode
147.36/96	A-1, A-2, A-4, C-1, C-2, E-2, E-4	+600 kHz	D-2, D-4	no diode
147.33/93	A-1, A-2, A-4, C-1, C-2, E-1, E-2	+600 kHz	D-2, D-4	no diode
147.30/90	A-1, A-2, A-4, C-1, C-2	+600 kHz	D-2, D-4	no diode
147.27/87	A-1, A-2, A-4, C-2, E-1, E-2, E-4	+600 kHz	D-2, D-4	no diode
147.24/84	A-1, A-2, A-4, C-2, E-4	+600 kHz	D-2, D-4	no diode
147.21/81	A-1, A-2, A-4, C-2, E-1	+600 kHz	D-2, D-4	no diode
147.18/78	A-1, A-2, A-4, C-1, E-8	+600 kHz	D-2, D-4	no diode
147.15/75	A-1, A-2, A-4, C-1, E-1, E-4	+600 kHz	D-2, D-4	no diode
147.12/72	A-1, A-2, A-4, C-1, E-2	+600 kHz	D-2, D-4	no diode
147.09/69	A-1, A-2, A-4, E-1, E-8	+600 kHz	D-2, D-4	no diode
147.06/66	A-1, A-2, A-4, E-2, E-4	+600 kHz	D-2, D-4	no diode
147.03/63	A-1, A-2, A-4, E-1, E-2	+600 kHz	D-2, D-4	no diode
147.00/60	A-1, A-2, A-4	+600 kHz	D-2, D-4	no diode
147.57	A-1, A-2, A-4, C-1, C-4, E-1, E-2, E-4	0	None	
147.54	A-1, A-2, A-4, C-1, C-4, E-4	0	None	
147.51	A-1, A-2, A-4, C-1, C-4, E-1	0	None	
147.48	A-1, A-2, A-4, C-4, E-8	0	None	
147.45	A-1, A-2, A-4, C-4, E-1, E-4	0	None	
147.42	A-1, A-2, A-4, C-4, E-2	0	None	

Remove the 220/440 PROGRAM BOARD using the board puller (located in the speaker compartment), and position the board with the edge connector at the bottom as shown in figure 3-6. There are 13 columns of integrated circuit (IC) sockets labeled A through M. Each column is made of two IC sockets and each socket will accommodate eight diodes. The top four rows of each column are used to program Channel 1 for both the 220 MHz and 440 MHz bands. The BAND switch programs 220 megahertz into the synthesizer in the "220" position. It is necessary only to program the remainder of the desired receive frequencies for Channel 1 and the Channel 1 transmit offset frequency. Program the units megahertz value of receive frequency into column A, using the required combination of (1), (2), (4), and (8) diodes. The value programmed is the sum of the diode values, for example, 6 megahertz is the sum of a (2) and (4) diode. The 100 kilohertz value is similarly programmed into column E, and the 10 kilohertz value is programmed into column J. If a 5 kilohertz value is desired, use only a single diode in column G. A diode in position 201 adds 5 kHz to the receive frequency of Channel 1. A single diode in position 205, 210, or 213 adds 5 kHz to the receive frequency of Channel 2, 3 or 4 respectively. Refer to figure 3-6 for the exact location of positions 201, 205, 210, and 213 in column G.

To program the transmit offset frequency, again refer to figure 3-6 and note that columns C, H, and L are used. The megahertz value of transmit offset is programmed into column C using the required combination of (1), (2), (4), and (8) diodes. Program column H for the 100 kHz value and column L for the 10 kHz value of transmit offset. Again, a single diode is used for programming a 5 kHz value of offset. Diode position 202 adds 5 kHz to the transmit offset frequency for Channel 1. Diode positions 206, 209, and 214 add 5 kHz to Channels 2, 3, and 4 respectively.

Offset direction, if negative, is determined by placing a diode in position 193 for Channel 1. Diode positions 194, 195, and 196 are used for negative offsets of Channels 2, 3, and 4 respectively.

Inhibit diodes ID1, ID2, ID3, and ID4 are removed

from the board once a channel is programmed. These diodes are used to inhibit transmitting on 220.000 MHz when a channel is not programmed.

Figure 3-6 shows a diode symbol above or near all columns used for programming the 220 MHz band. Reversal of a diode will be the same as using no diode at all, and a "zero" will be entered for that position. Incorrect diode direction will result in an erroneous receive *and* transmit frequency.

Programming the 440 MHz band is performed in the same manner as described above for the 220 MHz band. The BAND switch programs 440 megahertz into the synthesizer in the "440" position. Refer to figure 3-7, again, it is only necessary to program the remainder of the desired receive frequency for each of the channels, and the corresponding offset for that channel. Program the units megahertz value of receive frequency into column B (note direction of diode), using the required combination of (1), (2), (4), and (8) diodes. The 100 kilohertz value is likewise programmed into column F, and the 10 kHz value is programmed into column K. A single diode in position 203 of column G, adds 5 kHz to Channel 1. A 5 kHz value is programmed into Channels 2, 3, or 4 by placing a single diode in position 207, 211, or 215 respectively.

The transmit offset frequency is programmed into columns D, I, and M. Refer to figure 3-7, for the location of columns D, I, M, and the direction of diodes for these columns. The megahertz value of offset is programmed into column D using a (1), (2), (4), or (8) diode value. Column I is similarly programmed to provide the desired 100 kHz value and column M is programmed for the desired 10 kHz value. A single diode adds 5 kHz to Channel 1 in position 204 of column G (note diode direction). Diode positions 208, 212, and 216 may be programmed to add 5 kHz to Channels 2, 3, and 4 as required. Offset direction for Channel 1 is negative if a diode is used in position 197. Diode positions 198, 199, and 200 may be programmed for negative offset for Channels 2, 3, and 4 respectively.

Inhibit diodes ID5, ID6, ID7, and ID8 are removed when Channels 1, 2, 3, and 4 are programmed.

These diodes are used to disable the transmitter until a channel is programmed. *Do not* remove an *Inhibit Diode* until the channel associated with that diode is programmed.

3-5. PROGRAMMING THE OFFSET BOARD.

The OFFSET selector may be adjusted to select six different transmitter offsets. The S, (-), and (+) positions are preprogrammed for simplex (S) and the standard negative and positive offsets for each band. The positions, "X", "Y", and "Z" may be programmed as desired and are the same for all bands. If the X offset is programmed for -1.5 MHz, for example, the transceiver will transmit 1.5 MHz below the receive frequency for the 140, 220, and 440 MHz bands. Positions "Y" and "Z" function in the same manner.

Refer to Figure 3-2. Board Locations, to determine the location of the OFFSET BOARD. Remove the OFFSET BOARD only with the board puller. Figure 3-4. Offset Board, shows the program sockets used for programming the X, Y, and Z values of offset. Diodes are plugged into integrated circuit sockets exactly as on the 140 PROGRAM BOARD. Figure 3-4 shows three sections of IC socket positions that correspond to X, Y, and Z offsets. A single four position IC socket is used to program the 5 kHz value of offset (one position is not used). Also, a single four position IC socket is used to program the direction of the transmit offset.

Program the direction of the offset by inserting a *diode for negative offset* into the direction IC socket. Position the cathode or banded end of the diode upward. Do not use a diode if offset is to be positive. Program the megahertz value of offset by inserting a combination of diodes (1), (2), (4), and (8) diodes into the column marked "1 MHz". To program a 1 MHz offset use only a (1) diode. For a 3 MHz value of offset use a (1) and (2) diode, and so on. The value programmed is the sum of diode values, just as described for the 140 PROGRAM BOARD. Continue in a similar manner for the 100 kHz value and the 10 kHz value. For the 5 kHz value, use only a single diode in the X, Y, or Z position of the 5 kHz IC socket. Orient all diodes with the cathode to the right. Do not use rectifier or power supply diodes since the leads of these diodes are thick, and using them may damage the

IC sockets. Use only small signal silicon diodes such as 1N4148, 1N914, or other high quality diodes.

As an example for programming the OFFSET BOARD, consider an offset of -2.735 MHz for position Y. For the negative (-) direction, place a diode in the Y position of the offset direction IC socket. The 2 megahertz value is programmed by placing a diode in the (2) position of the 1 MHz column in the Y offset row. A seven (7) is programmed into the 100 kHz column by using a (1), (2), and (4) diode. These diodes must also be placed in the Y offset row. Program a 3 by placing a (1) and (2) diode in the 10 kHz column and Y offset row. The 5 kHz value is added to the Y offset by placing a single diode in the Y position of the 5 kHz socket. Programming an offset in the X and Z positions is performed in a similar manner.

3-6. OPERATING THE CHANNEL SELECTOR.

Figure 3-1 shows the front panel controls of the UV-3. Item (8) indicates the CHANNEL selector which allows selection of the receive frequency shown on the readout, or a receive frequency as programmed on the 140 PROGRAM BOARD or 220/440 PROGRAM BOARD. With the CHANNEL selector in the "DIAL" position the transceiver will *receive* the frequency indicated by the BAND switch and the readout. The proper transmit offset is then selected by the OFFSET switch. *The OFFSET switch selects an offset only when the CHANNEL selector is in the "DIAL" position.* When the CHANNEL selector is in "1", "2", "3", or "4" the receive frequency *and* transmit offset are determined by the diode programming on the program boards. Selecting the transmit offset from the program boards allows operation of repeaters having nonstandard offsets.

3-7. SCANNING OPERATION-SETTING SCAN INTERVAL.

Figure 3-1 shows the front panel controls of the UV-3. Item (13) denotes the SCAN selector which is used to determine the mode of scanning. When the switch is in the center position all scan operations are disabled and operation of the UV-3 is described above. With the SCAN switch in the "DIAL" position the transceiver receives the frequency as determined by the setting of the BAND

and CHANNEL selectors. Approximately every 3 seconds the transceiver internally switches to the frequency selected by the BAND switch and DIAL readout. If activity is present on the frequency indicated by the DIAL, the transceiver continues to receive that frequency until the activity ceases for 2 seconds. After the 2 second delay, the transceiver switches back to the frequency selected by the BAND and CHANNEL selectors. If no activity is present on the DIAL frequency, the transceiver only receives that frequency for approximately 50 milliseconds and returns to the original receive frequency. The SCAN LED indicator, Item (14) of figure 3-1, indicates when the transceiver is receiving the DIAL frequency. If no activity is present on the DIAL frequency, the SCAN LED indicator flashes briefly every 3 seconds. If there is activity on the scanned frequency, the SCAN indicator remains lighted to indicate the activity on that frequency.

The SCAN switch may also select scanning to CHANNEL 4 from a frequency determined by the BAND and CHANNEL selectors. The CHANNEL selector may select the DIAL frequency or Channel 1, 2, or 3; then every 3 seconds (approximately) the receiver switches to Channel 4. The presence of activity on Channel 4 will result in the receiver monitoring that frequency until activity ceases for 2 seconds. After the 2 second delay, the transceiver switches back to the frequency determined by the BAND and CHANNEL selectors. The SCAN LED indicator stays lighted to indicate activity on Channel 4, and flashes briefly to indicate transceiver scanning to Channel 4. If the transmitter is energized when the SCAN switch is in either SCAN position, the transmitter will always transmit on the frequency selected by the Channel switch. In other words, the SCAN function is disabled in the transmit mode. When returning to receive, the SCAN function will operate as described above.

The scanning interval is preset to approximately 3 seconds, but may be changed if desired. Figure 3-4. Offset Board, shows an adjustment resistor for the scan interval, located in the extreme upper left corner of the board. The normal value of the resistor is 470 kilohm and it is this value that determines the 3 second interval. This resistor may be

carefully removed and replaced with a smaller value resistor for more frequent scanning. A resistance value greater than 470 kilohm will increase the scan interval. The chart below lists various resistance values and the corresponding scan interval.

RESISTANCE	SCAN INTERVAL (approx.)
100 k Ω	2.0 sec.
220 k Ω	2.6 sec.
330 k Ω	3.1 sec.
470 k Ω	3.6 sec.
680 k Ω	4.1 sec.
820 k Ω	4.5 sec.
1 M Ω	4.8 sec.
No Resistor	8.3 sec.

3-8. AUXILIARY CONNECTOR.

An auxiliary connector is located on the left side of the bottom cover. This connector allows certain external connections to be made to the UV-3. Figure 3-5. Auxiliary Connector, shows the pin-out and location of the connector.

Pin 1 is the chassis ground and must be used as the ground terminal for all external connections. The unit is supplied with a jumper between Pin 1 and Pin 10, the speaker ground. Removing this jumper disconnects the speaker from ground. Always remove the jumper when using an external speaker.

Pin 2 supplies +12 volts to any required external circuitry and is switched by the front panel POWER/VOLUME control. Maximum current available is 250 milliamps.

Pin 3 is a low level audio input suitable for auto-patch encoders or another microphone. This input is the same input line that goes to the front panel microphone connector. DO NOT use this input for continuous tone generators since the audio response of this input is greatly reduced for low frequency audio signals. An audio level of 3 to 6 millivolts is recommended for this input.

Pin 4 provides an audio input that has no frequency compensation and therefore, is suitable for use with continuous tone or subaudible tone generators. A level of 1.0 volt will produce approximate-

ly 1 kHz deviation (on two meters). This input is not affected by the "mic gain" adjustment.

Pin 5 has an output level of approximately +12 volts in the receive mode and zero voltage in the transmit mode. Maximum output current from this pin is approximately 10 milliamps.

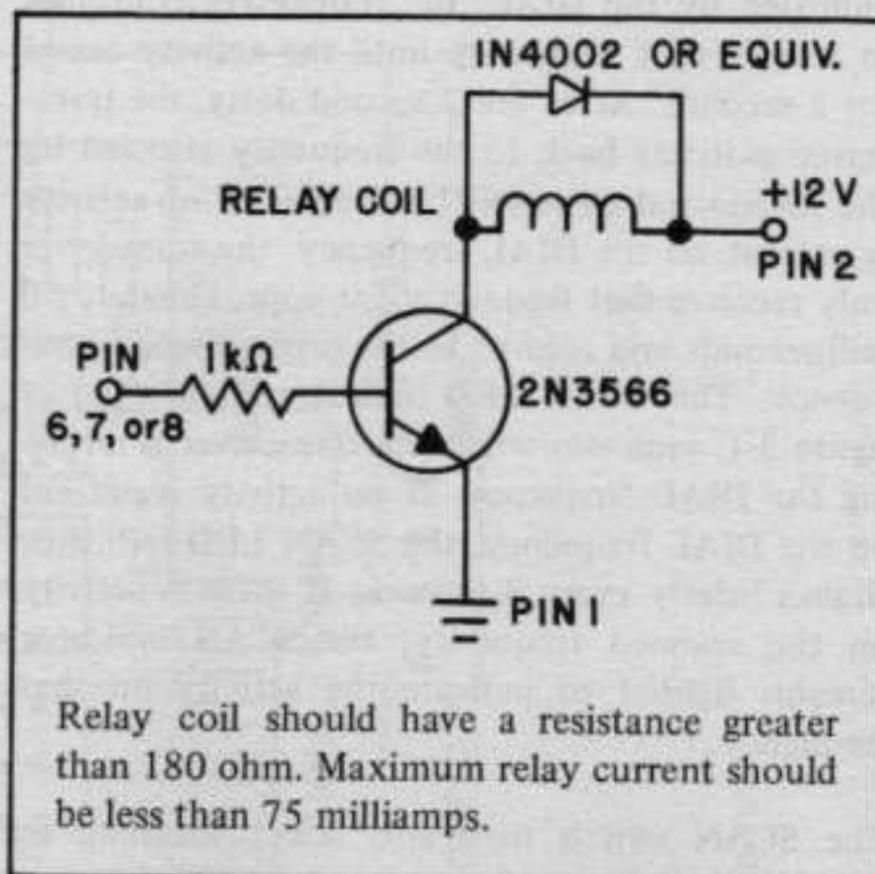
Pin 6 has an output level of approximately +5 volts when the BAND switch is in the "140" position. It has approximately zero voltage output in the other BAND switch positions. Maximum current available from Pin 6 is 10 milliamps.

Pin 7 has an output of approximately 5 volts only when the BAND switch is in the "220" position. The output voltage is approximately zero otherwise. Ten (10) milliamps of current may be supplied by Pin 7.

Pin 8 has an output voltage of approximately +5 volts only when the BAND switch is in the "440" position and approximately zero voltage in the other positions. Again, the maximum current available from Pin 8 is 10 milliamps.

The outputs of Pins 6, 7, and 8 are provided as control signals to operate antenna switching relays, if a single antenna and feedline are used for more than one band. The voltages and currents available from Pins 6, 7, and 8 will usually not be adequate

to operate relays directly, so some buffering or additional switching devices will be required. If such a circuit is required, the circuit shown below should prove to be adequate.



Pin 9 has no connection.

Pin 10 is the speaker ground connection. This pin must be connected to Pin 1 if the internal speaker is to be used. Remove the jumper between Pins 1 and 10 to disable the internal speaker when using an external speaker.

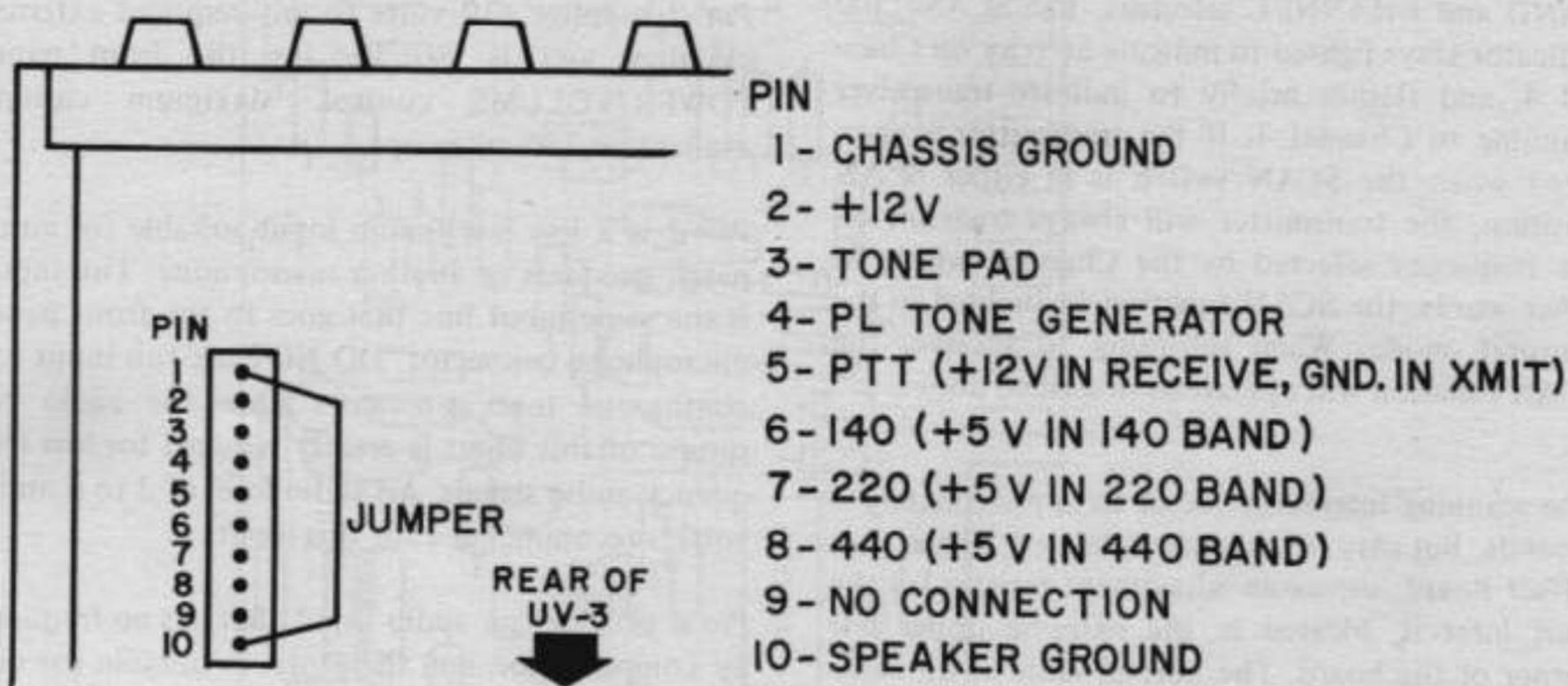


Figure 3-5. Auxiliary Connector

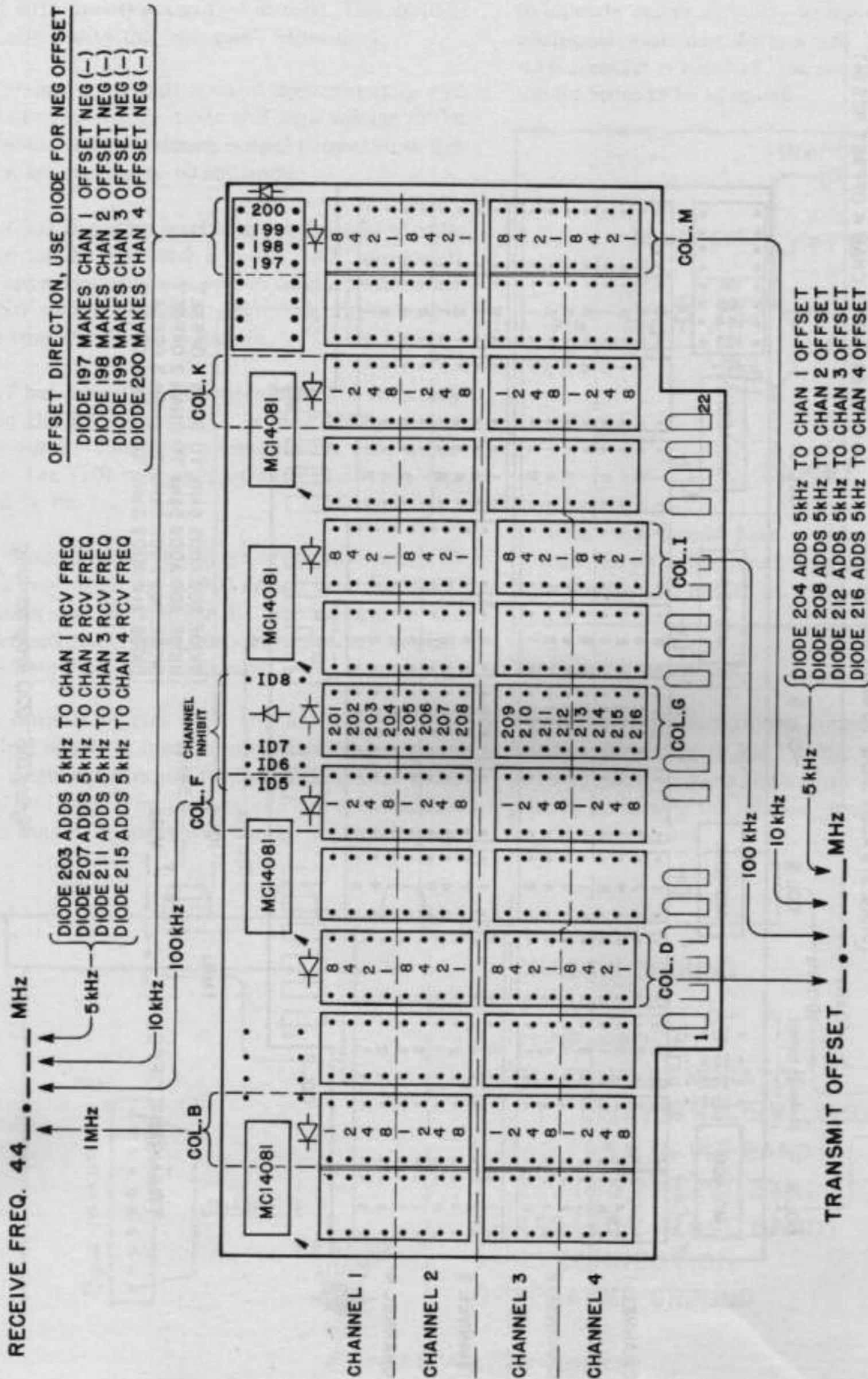


Figure 3-7. 440 Programming

3-9. CONTINUOUS DUTY TRANSMISSION.

Continuous duty transmissions, such as radiotele-type, should be limited to ten minutes, especially on the 140 MHz band. Transmissions for intervals greater than ten minutes should be at a power output of 10 watts or less. The small physical dimensions of the UV-3 do not permit the use of heat sinks large enough to dissipate the heat developed by the 25 watt power amplifier when operated continuously. Continuous duty operation on the 220 MHz and 440 MHz bands may be at full output. Section 3-10 describes the procedure for selecting the LOW POWER SET RESISTOR for each band. This resistor determines the power output for each band, with the front panel PWR switch in the "LO" power position.

3-10. SETTING THE LOW POWER OUTPUT.

Each of the power amplifier modules contains a resistor or potentiometer which may be adjusted to provide any level of output power from 10% of rated output to near full rated output power. Operation in the "HI" power mode is not affected by selection of the low power output level. The chart below gives APPROXIMATE power output values for different resistances in those models that have the resistor, Rx.

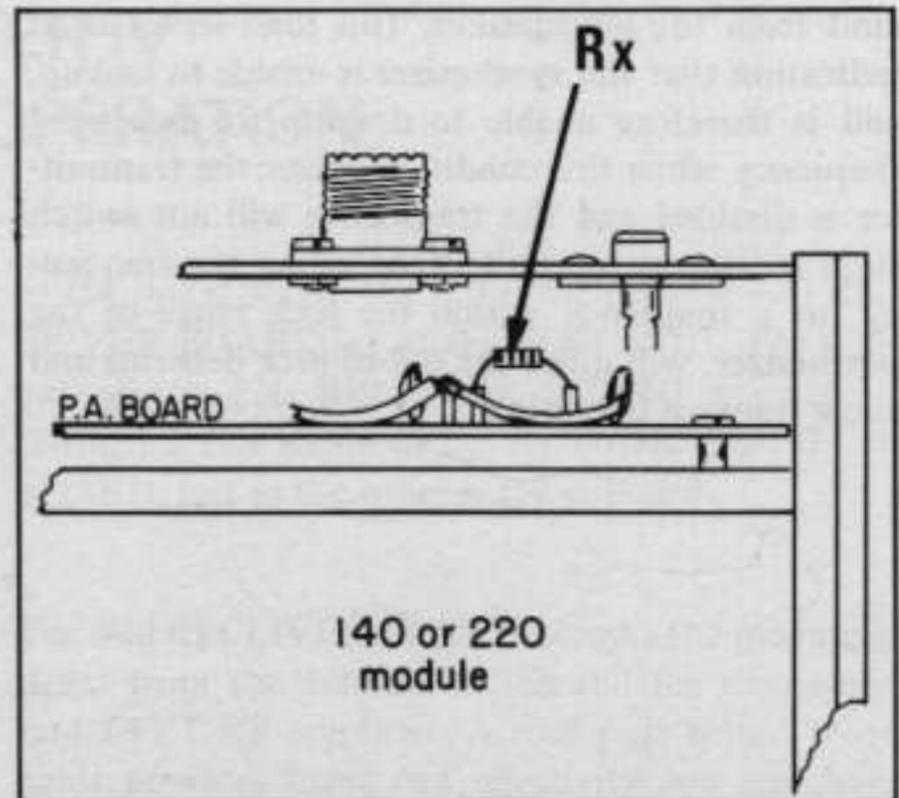
POWER OUTPUT	140 MHz	220 MHz	440 MHz
1 watt	—	3 k	1 k
2.5 watts	1.2 k	1.5 k	470 Ω
5 watts	820 Ω	470 Ω	270 Ω
10 watts	470 Ω	150 Ω	47 Ω

Each module is factory set to provide approximately 10% of rated output power in the "LO" power position.

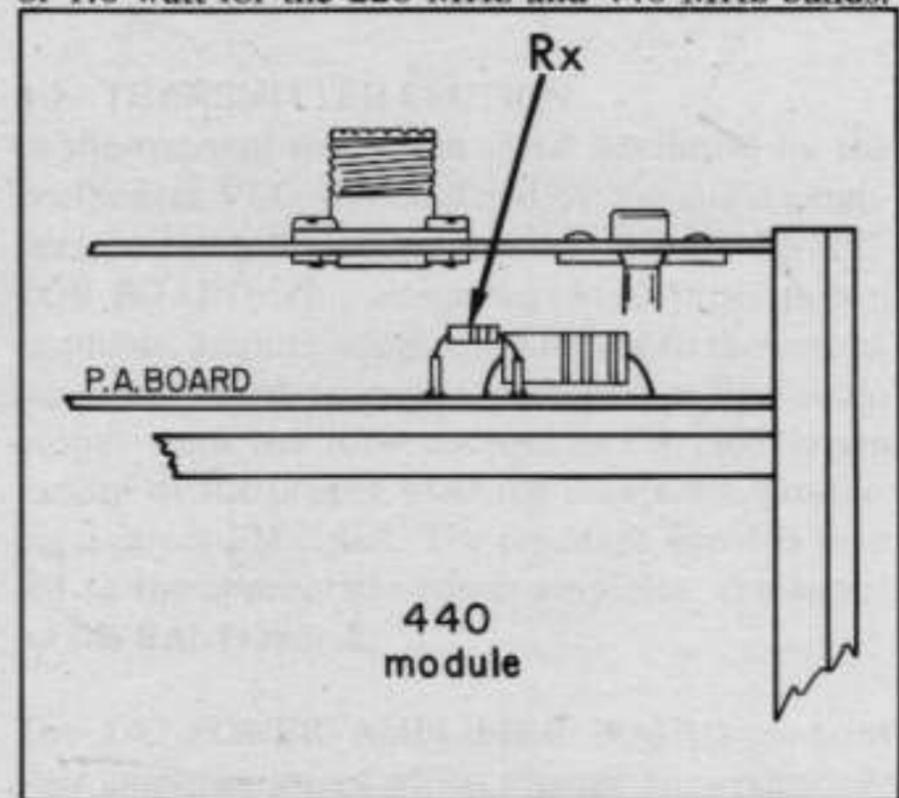
In order to change the resistor, Rx, it is necessary to remove the top and bottom covers of the transceiver. Refer to the following drawings for the placement of the low power set (Rx) for the 140 MHz or 220 MHz module. The resistor is easily noticed since it is mounted off the printed circuit board on solder posts. Heat each solder post separately and remove one resistor lead at a time. Replace with a resistor of the desired value as determined from the chart. Do not overheat the solder posts and avoid contacting the printed circuit board with the soldering iron. Use a soldering iron with a small tip, and a wattage rating of less than 50 watts.

The low power set resistor for the 440 MHz module may be replaced exactly as described above. Refer to the drawing for the exact location of Rx on the 440 MHz module.

Resetting the low power level on models that have a



potentiometer is simply a matter of adjusting the potentiometer until the desired output power is acquired. Connect a wattmeter between the unit and a dummy load or antenna. (Make sure the wattmeter is accurate on the desired band.) Do not set the low power level less than 2.5 watts on the 140 MHz band, or 1.0 watt for the 220 MHz and 440 MHz bands.



3-11. OUT-OF-LOCK INDICATION.

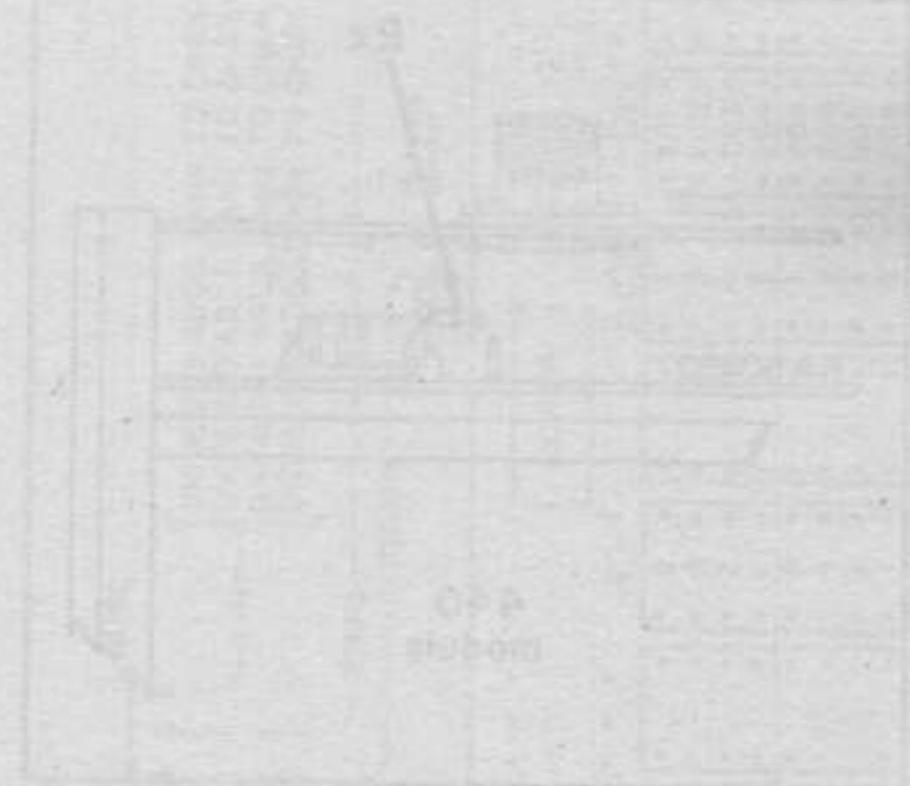
The frequency synthesizer used in the UV-3, allows additional frequency coverage on each of the three bands. It is possible, however, to select a frequency which is beyond the range of coverage of the synthesizer. This is especially true for the low frequency end of the 140 MHz band. If a frequency is selected which is beyond the lock range of the synthesizer, a tone of approximately 1 kHz, will

emit from the loudspeaker. This tone serves as an indication that the synthesizer is unable to lockup, and is therefore unable to develop the necessary frequency when this condition exists; the transmitter is disabled and the transceiver will not switch from receive to transmit. Readjusting the frequency, to a frequency within the lock range of the synthesizer, will quiet the out-of-lock detector and allow transmit operation.

The out-of-lock indicator is also used to give an indication of operation on an unprogrammed channel. The inhibit diodes that are used to program the 140 PROGRAM BOARD, and the 220/440 PROGRAM BOARD, are also used to operate the out-of-lock tone generator. The inhibit diodes should only be removed after a channel is programmed. The tone will then serve as a reminder to the operator that the channel is unprogrammed.



The out-of-lock indicator is connected to the transmitter control circuit. When the synthesizer is unable to lock up, the indicator generates a tone that is heard through the loudspeaker. This tone serves as a reminder to the operator that the channel is unprogrammed. The tone will then serve as a reminder to the operator that the channel is unprogrammed.



The out-of-lock indicator is connected to the transmitter control circuit. When the synthesizer is unable to lock up, the indicator generates a tone that is heard through the loudspeaker. This tone serves as a reminder to the operator that the channel is unprogrammed. The tone will then serve as a reminder to the operator that the channel is unprogrammed.

CHAPTER IV

THEORY OF OPERATION

4-1. RECEIVER SECTION.

Figure 4-1. UV-3 Block Diagram, illustrates a complete UV-3 transceiver with all three bands. The receiver section for 140 MHz will be described first.

The 140 RECEIVER BOARD accepts the incoming RF signals from the antenna through a low-pass filter and antenna relay located on the 140 POWER AMPLIFIER BOARD. This signal is applied to a two pole, band-pass filter to reject out-of-band signals. An FET amplifier provides 15 dB of front end gain and drives a four pole, band-pass filter which provides additional out-of-band rejection. The output of this filter is coupled to a junction-FET (J-FET) mixer where the signal is mixed with the voltage-controlled-oscillator (VCO) output to provide a resultant 10.7 MHz intermediate frequency (IF). The J-FET is used as a mixer because of the superior intermodulation characteristics. The IF signal from the 140 RECEIVER BOARD is coupled through a PIN diode to the IF-AUDIO-SQUELCH BOARD. Each of the three receiver boards has a DC voltage present at the output to turn on a PIN diode and couple the IF signal to the IF amplifier. The IF signal is first passed through a six pole monolithic crystal filter of 13 kHz bandwidth and then to a dual-gate MOSFET amplifier with a gain of 15 dB. The signal is then fed to an integrated circuit where it is mixed down to 455 kHz, filtered, limited, and demodulated. Eight poles of filtering are used at 455 kHz to provide additional adjacent channel rejection, and to produce exceptional ultimate rejection. The recovered audio from the demodulator output drives a noise amplifier and an audio amplifier through the front panel squelch and volume controls. The noise amplifier provides drive to the squelch gate which controls the input to the audio amplifier, and operates the scan control circuitry. The output of the audio amplifier is finally coupled to the internal speaker.

The 220 RECEIVER BOARD functions exactly as the 140 RECEIVER BOARD, with the exception

of the mixer stage. The mixer used on the 220 RECEIVER BOARD is a dual-gate MOSFET. The output of the 220 RECEIVER BOARD is coupled through a PIN diode to the IF-AUDIO-SQUELCH BOARD, just as the other receiver boards.

The 440 RECEIVER BOARD accepts the incoming signal from the antenna switch and the grounded-gate J-FET RF amplifier. A four pole helical resonator provides front end selectivity and rejection of out-of-band signals. Another J-FET provides additional gain and drives one gate of a dual-gate D-MOS mixer. As in the 140 and 220 MHz receiver boards, the resultant 10.7 MHz IF is coupled to the IF-AUDIO-SQUELCH BOARD through a PIN diode.

4-2. TRANSMITTER SECTION.

In the transmit mode, the signal developed by the synthesizer VCO is modulated by the audio amplifier/processor IC located on the PHASE DETECTOR BOARD. This integrated circuit provides pre-emphasis, amplification, and limiting to the incoming audio signal from the microphone. The audio output from the IC is coupled to the modulation varicap of the proper VCO for each band, producing a direct FM signal. The resultant signal is then fed to the appropriate power amplifier, as selected by the BAND switch.

The 140 POWER AMPLIFIER BOARD contains four amplifier stages which provide approximately 37 dB gain, and 25 watts output power. The final amplifier stage drives a low-pass filter to remove harmonics, and is connected to the antenna through the antenna relay and a second low-pass filter. The XMTR/RCVR CONTROL section energizes the antenna relay and supplies each of the amplifier stages with power during transmit. The HI/LO power control section reduces the supply voltage to the last two stages of the Power Amplifier for operation at low power.

The 220 POWER AMPLIFIER BOARD contains an arrangement of amplifier stages similar to the 140 P.A. BOARD, except that different transistors are used. The total gain for the 220 P.A. BOARD is approximately 33 dB, with the output power rated at a minimum of 10 watts. The HI/LO POWER CONTROL circuitry functions exactly as described above for the 140 P.A. BOARD.

The 440 POWER AMPLIFIER BOARD receives input from the 440 Receiver Board and provides an overall gain of approximately 36 dB. Output power is rated at 10 watts minimum for the 440 MHz power amplifier. The input signal is fed to a two stage amplifier consisting of a grounded-gate J-FET amplifier, and a conventional grounded emitter amplifier. The total gain for these two stages is approximately 17 dB. The signal then drives a three stage RF module of 10 watts minimum output power. Again, the HI/LO POWER CONTROL and XMTR/RCVR CONTROL sections operate as described for the other power amplifier sections.

4-3. SYNTHESIZER SECTION.

Figure 4-1. UV-3 Block Diagram, shows three additional sections, the DIVIDER BOARD, PROGRAM BOARD, and OFFSET BOARD. These three boards are concerned with the development of the divide-by-N numbers which are loaded into the phase-locked-loop (PLL) divider chain. The number developed by these three boards, causes the VCO of the phase-locked-loop to operate at the correct frequency for receiver injection, and for transmitter drive.

The 140 PROGRAM BOARD and DIVIDER BOARD contain an adder/complementer stage that develops the divide-by-N numbers to be loaded into the PLL divider chain. The adder/complementer stage adds or subtracts an offset *and* a receive frequency to derive the correct frequency for the VCO in both the receive and transmit modes. In the receive mode, with the CHANNEL selector in the DIAL position, the adder/complementer stage is loaded with the receive frequency (from the front panel switches) and the number 10.7 from the OFFSET BOARD. In the 140 MHz and 440 MHz bands, 10.7 MHz is subtracted from the receive frequency, and the VCO runs 10.7 MHz lower to provide low side injection to the appropri-

ate mixer. On the 220 MHz band, 10.7 MHz is added to the receive frequency, and the VCO runs 10.7 MHz higher to provide high side injection. This arrangement of high and low side injection helps optimize image rejection.

In the transmit mode, the receive frequency is loaded into the adder/complementer stage and a transmit offset value is selected from the OFFSET BOARD. A positive (+) setting of the OFFSET selector *adds* 600 kHz to the receive frequency for the 140 MHz band, 1.6 MHz for the 220 MHz band, and 5.0 MHz for the 440 MHz band. A negative (-) setting of the OFFSET selector subtracts 600 kHz from the receive frequency for the 140 MHz band, 1.6 MHz for the 220 MHz band, and 5.0 MHz for the 440 MHz band. Offsets X, Y, and Z may be any positive or negative value up to 9.995 MHz, for any band. The values programmed into X, Y, and Z are the same for any band of operation, whereas the values of the positive (+) and negative (-) offsets are selected for each of the bands.

Operation with the CHANNEL selector in the "1", "2", "3", or "4" position disables the OFFSET BOARD in the transmit mode. The receive frequency, programmed on the 140 PROGRAM BOARD or the 220/440 PROGRAM BOARD, is loaded into the adder/complementer stage. In the receive mode, the OFFSET BOARD provides 10.7 MHz to be added or subtracted from the programmed receive frequency. Again, the 10.7 MHz value is added or subtracted, depending upon the band, and the VCO runs higher or lower than the receive frequency by 10.7 MHz to provide the correct injection frequency.

In the transmit mode, the OFFSET BOARD is disabled, and the transmit offset frequency is selected from the appropriate Program Board. The direction of transmit offset is also programmed, and determines whether the adder/complementer stage adds or subtracts, in order to determine the desired transmit frequency.

The SCAN control alternately loads an "N" number from the DIAL and a selected programmed channel, or from "Channel 4" and a selected pro-

grammed channel. The CHANNEL selector and SCAN control, work together to select the desired mode of priority scanning. If activity is present on a scanned frequency, a signal is generated on the OFFSET BOARD to latch the "N" number into the divider chain, until activity on that frequency

ceases. In the receive mode, the scan function provides the 10.7 MHz addition or subtraction, as required, to develop low or high side injection. In the transmit mode, the scan circuit develops the correct transmit offset frequency, just as described above.

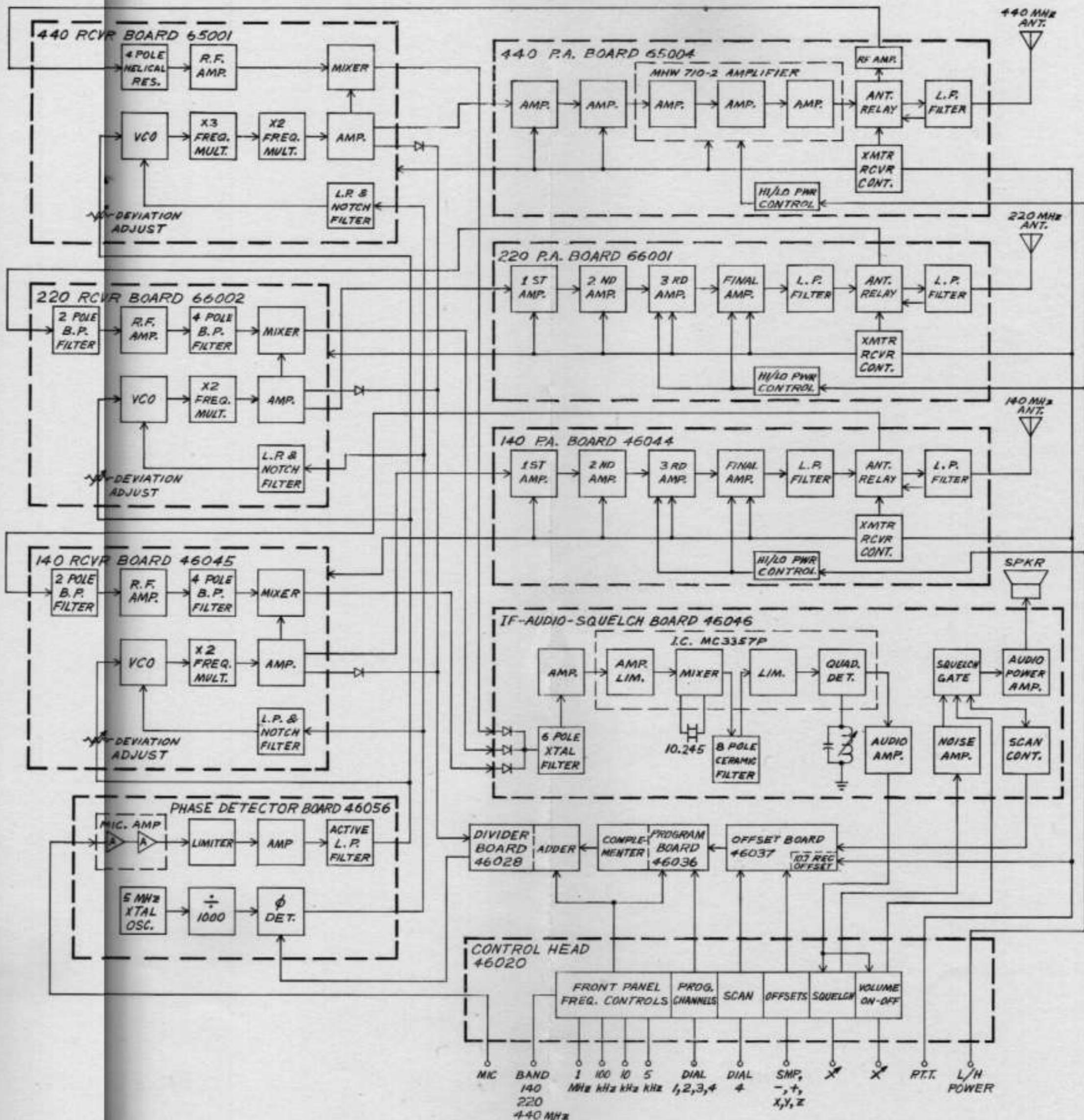


Figure 4-1. UV-3 Block Diagram

