

SECTION III OPERATION

3.1 INTRODUCTION

This section contains information concerning the operation procedures for the EPH Series radio. Information on programming and installation is contained in Section 2 of this manual.

WARNING

DO NOT OPERATE THE
TRANSMITTER IN CLOSE PROXIMITY
TO BLASTING CAPS.

WARNING

DO NOT OPERATE THE RADIO IN AN
EXPLOSIVE ATMOSPHERE
(PETROLEUM FUELS, SOLVENTS,
DUST, ETC.) UNLESS IT IS AN
INTRINSICALLY SAFE MODEL
DESIGNED FOR SUCH USE.

3.1.1 DISPLAY OPTIONS

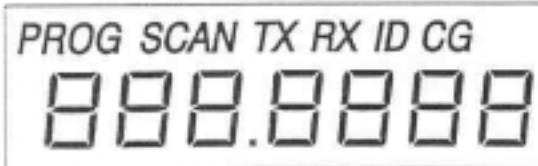
EPH Series radios can be equipped with a standard 7-Segment Display, an Alphanumeric Display, or no display at all. Radios with either a 7-Segment Display or an Alphanumeric Display are also equipped with a keyboard.

An Alphanumeric Display shows channel and scanning information in a different way from a 7-Segment Display. The annunciators across the top of the display are arranged differently, but convey the same meaning. An Alphanumeric Display can also show letters, instead of just numbers.

Radios with Alphanumeric Display can be programmed to operate one or more groups in 7-Segment mode (see Section 2.3.6.5). The channel and scanning information will appear in the same way as a 7-Segment Display, but the annunciators are still different.

Display annunciators indicate the following information:

<u>7- Segment</u>	<u>Alpha- Numeric</u>	<u>Indication</u>
PR	PR	Priority Channel
PROG	PRG	Programming Mode (includes PR)
SCAN	SCN	Scan List Channel (On Alphanumeric Display, flashing SCN indicates Scanning in progress, and RX SCN indicates Receiving on a Scanned channel.)
TX	TX	Transmit
RX	RX	Receive- programming mode only
ID	ID	Automatic Number Identification (ANI) - programming mode only
CG	CG	User Code Guard- programming mode only
	GRP	Group Label (Alphanumeric Display only)



7-SEGMENT DISPLAY



ALPHA NUMERIC DISPLAY

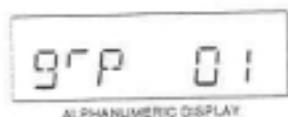
FIGURE 3-1 LIQUID CRYSTAL DISPLAYS

3.2 OPERATION

Operating procedures are basically the same for all three display types (7-Segment, Alphanumeric, and no display), with some obvious differences. For example, a radio with no display or keyboard has no keys to press. The actual display on the radio may appear different from the illustrations, depending on the features installed and programmed in the radio.

3.2.1 BASIC OPERATION

A. Receive



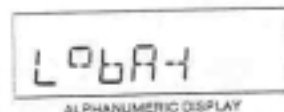
Turn power on by rotating the Volume knob clockwise past the OFF detent. The yellow LED will flash, the Display will show the current group number, then the channel number (7-Segment display) or channel label (Alphanumeric display). A beep will sound, indicating the radio is operational.

See channel label programming instructions on pages 2-13 and 2-10.

Rotate the Channel Selector knob to select the appropriate channel. Rotate the Squelch knob clockwise until a rushing noise is heard. Set the volume to a comfortable level, then rotate the Squelch knob backwards (counterclockwise) until the noise stops. This is called the threshold squelch setting.

Further rotation counterclockwise tightens the squelch setting, allowing only stronger signals to open the squelch and be heard. Full rotation counterclockwise past the detent places the receiver in Code Guard operation mode. A message will be heard only when the proper Code Guard is received.

B. Transmit



Press and hold the side Push To Talk (PTT) switch. The Display will show the TX annunciator and the red Transmit Indicator will glow when the transmitter is on. Talk in a normal voice with the microphone one to two inches from your lips. Make each transmission as brief as possible. Release the PTT switch to end transmission.

If the Transmit Indicator does not glow when you press the PTT Switch, the battery pack may need to be charged; if so, the Display will show Lobat and the yellow Low Battery Indicator will flash. If the Transmit Indicator does not glow and a tone sounds, you are on a receive-only channel, or the channel is busy (if Busy Channel Lockout is installed). Rotate the Channel Selector knob to an authorized transmit channel.

If the length of your message exceeds the preset time out timer setting, the Transmitter will automatically shut off and a tone will sound. If you wish to continue this transmission, release the PTT switch, then press it again and continue talking.

3.2.2 CODE GUARD OPERATION

Code Guard™ allows one radio or group of radios to be selectively called within a system. If the radio has been programmed with Code Guard, use the following receive and transmit instructions.

A. Receive

Turn power on by rotating the Volume knob clockwise past the OFF detent. Rotate the Squelch knob clockwise until a rushing noise is heard. Set the volume to a comfortable level, then rotate the Squelch knob completely counterclockwise, past the detent for Code Guard operation. A message will be heard only when the proper Code Guard is received.

B. Transmit

Before transmitting on Code Guard channels, monitor the channel by turning the Squelch knob clockwise, off the detent. If the channel is not busy, press and hold the PTT switch. The red Transmit Indicator will glow when the transmitter is on. Release the PTT switch to end transmission. Reset the Squelch knob to the Code Guard position to receive only the transmissions with the proper Code Guard. During extended transmissions the squelch can be left open until the exchange has ended.

3.2.3 HI/LO TRANSMIT POWER

Placing the HI/LO toggle switch in the HI position enables full transmitter power. The LO position reduces power to the programmed low power setting, thereby reducing current drain and increasing battery life.

3.2.4 BUILT IN FEATURES

BENDIX/KING EPH Series radios are based on a microprocessor core that allows extra features and operational characteristics to be built into the radio. Dealers can help define the best operational settings for a system and program them into the radio.

Additional transmit and receive frequencies can be added. To monitor other local radio systems that fall anywhere in the band, a frequency with or without Code Guard can be added to the radio.

The radio comes equipped with a time out timer. This is used to limit the duration of calls and to guard against accidentally locking on the transmitter and tying up the radio system. The duration of the time out timer can be set from 0 to 225 seconds, in 15-second increments.

A DTMF/ANI encoding feature is also available on all keyboard/display models. If enabled, a sequence of DTMF tones similar to the tones used by a standard pushbutton telephone will be transmitted each time the transmit PTT switch is activated. If DTMF and ANI are both enabled, the ANI tone sequence will be transmitted only after the [ENT] key is pressed while the transmit PTT switch is activated. A sidetone of the ANI number transmitted will also be heard through the speaker. Dealers can program or change the ANI number to be sent.

A SCAN delay is included to allow a response to a transmission to be received before the scanner moves on to search for new activity. If the scanner is restarting before message replies are heard, the scan delay time can be increased. (0-7.5 seconds)

Radios equipped with the Alphanumeric Display can be programmed with custom channel labels and group labels. See "Group Label" on page 2-10, and channel label instructions on page 2-13, step 7.

Alphanumeric Display radios can also be programmed for LCD backlighting when a message is received or a key is pressed. See "Channel 0 Group Three Functions" on page 2-8.

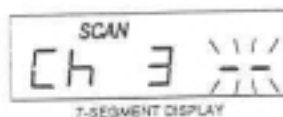
There are three different priority modes available. These are discussed in the section Priority Operation on page 3-5. Dealers can help choose the best priority mode for a system.

Code Guard is a trademark of King Radio Corp.

3.2.5 OPERATIONAL FEATURES AVAILABLE

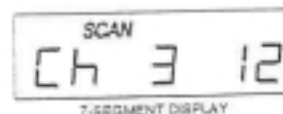
A. Scan Operation With Carrier Squelch

When in the Scan mode with carrier squelch set (not Code Guard), the radio receiver samples channels in a predetermined list (scan list) looking for activity. If an active channel is found, the scanning action stops and the message on that channel is heard. Once the message stops, the receiver will wait for a response before scanning resumes. This waiting period, called the "scan delay time," can be preset from 0 seconds to 7.5 seconds, in .5 second increments. The scan list can also be preset. On some radios the user will be able to add or delete channels from the scan list. The channel to which the Channel Selector knob is set is always included in the scan list, whether it is programmed for scan or not.



To begin scanning, place the SCAN toggle switch in the SCAN position. Place the Priority Scan toggle switch (PRI) in the off position (down). See "Priority Operation" on page 3-5.

Scan operation occurs only while the radio is not transmitting. SCAN operation is indicated by two flashing bars (7-Segment display) or a flashing SCN annunciator (Alphanumeric display).



When a signal is detected, scanning stops and the signal being received is heard. The active channel is shown on the right side of the display (7-Segment display) or in place of the transmit channel (Alphanumeric display). The radio receiver stays on that channel until activity ceases and resumes scanning after the "scan delay" time.

If you wish to transmit on the last active scan channel, turn the Channel Selector knob to that channel. Turn OFF the SCAN toggle switch for normal transmit/receive operation.

When the PTT is pressed while in the scan mode, the radio transmits on the channel selected by the Channel Selector knob. Upon release of PTT, the radio receiver will hold on that channel. If no reply occurs during the "scan delay" time, the radio resumes scanning.

B. Scanning Code Guard Channels

To scan for channels with programmed Code Guard, rotate the Squelch knob completely counterclockwise, past the detent. When a signal is detected, scanning stops and the Code Guard for that channel is checked. If the proper Code Guard is present, the radio receives that channel until Code Guard ceases. If the proper Code Guard is not present the radio receiver will resume scanning immediately.

C. Changing the Scan List

The radio can be programmed with a permanent or changeable scan list. If the scan list can be changed, use the following steps to enter or clear channels.

To avoid confusion, turn OFF the PRI and SCAN toggle switches on the top of the radio.

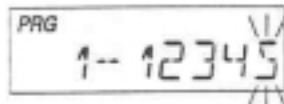
Turn the Channel Selector knob to the channel to be entered or cleared.



To ENTER a channel into the scan list, press the [ENT] key on the keyboard. A short beep will be heard. The display will show the annunciator "SCAN" (7-Segment display) or "SCN" (Alphanumeric display).

To CLEAR a channel from the scan list, press the [CLR] key. A short beep will be heard, and the "SCAN" or "SCN" annunciator in the display will disappear.

D. Permanent Scan List



To make the scan list permanent or changeable, program the function to either enabled or disabled. See "Scan List Lockout" on page 2-6.

E. Priority Operation



Priority operation consists of receiving on any channel while still monitoring for a message on the priority channel. Priority can also be used in combination with Scan operation. When scanning a priority channel that uses Code Guard, the radio will lock on to that channel, but a message will be heard only when the correct code has been detected. The radio will resume scanning after the signal has ended and the scan delay time has expired.

When the PRI (priority) toggle switch is turned ON, the channel designated "priority" is sampled at a preset rate (.25 to 3.75 seconds) regardless of activity on any other channel. The display flashes two bars (7-Segment display) or "SCN" (Alphanumeric display) to indicate that the radio is sampling the priority channel. If a signal is received on the priority channel, the radio receiver will lock on to that channel for the duration of the transmission.

When the SCAN toggle switch is ON and the PRI toggle switch is OFF, normal scanning will occur but the priority channel will not be sampled. If both scan and priority toggles are off, the radio will function as in basic operation.

Priority Modes

Priority Mode A -- The priority channel is tied to the Channel Selector knob. When the selector is set on channel 5, this is the priority channel. If the selector is switched to channel 8, this becomes the priority channel. You will transmit on the frequency chosen by the Channel Selector knob.

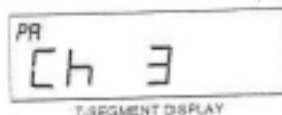
Priority Mode B -- The priority channel is fixed. You will transmit on the frequency chosen by the Channel Selector knob.

Priority Mode C -- The priority channel is fixed. When the PRI toggle switch is ON, you will transmit on the priority channel regardless of the Channel Selector knob setting.

Which Priority Mode is Installed

Follow these steps to determine which priority mode is set in a radio equipped with a keyboard and display.

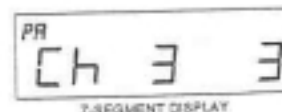
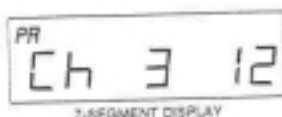
1. Set the PRI and SCAN toggle switches to OFF.
2. Rotate the Channel Selector knob, stopping at each detent to view the LCD Display.
3. If a "PR" symbol (in the upper left of the LCD Display) does not appear for any channel, you have priority Mode A.
4. If "PR" is displayed, rotate the Channel Selector knob to a different channel, then turn the PRI toggle ON.



If the LCD channel stays on the selected channel, you have priority Mode B.

If the LCD channel changes to the priority channel, you have priority Mode C.

Priority Mode A Details



In this mode, the priority channel is tied to the Channel Selector knob. When the SCAN and PRI (priority) Toggle Switches are ON, scanning will occur until an active scan channel is found. The radio will receive the active channel while continuing to sample the priority channel. If during this sampling the priority channel becomes active, the Priority Indicator will light. The radio receiver will go to the priority channel and hold for the duration of the transmission. The priority channel will be shown the display (on the right hand side of 7 Segment displays).

If you wish to reply to a message on the priority channel, press the PTT and you will transmit on the priority channel. Once activity ceases on the priority channel, the radio returns to scan operation.

Priority Mode B Details

This mode fixes one channel in the radio as the priority channel. With the SCAN toggle switch OFF and PRI (priority) toggle switch ON, the radio can receive on the knob-selected channel while still sampling the priority channel. If the priority channel becomes active, the Priority Indicator goes on and the radio holds on the priority channel for the duration of the transmission. If you wish to reply to a message on the priority channel, you must rotate the Channel Selector knob to the priority channel, then transmit.

With both SCAN and PRI toggle switches ON, the radio will scan until it locks on to an active channel. The radio continues to sample the priority channel while listening to the active channel. If activity occurs on the priority channel, the radio will override the active scan channel, go to the priority channel, and hold for the duration of the transmission. If you wish to reply to a message on the priority channel, rotate the Channel Selector knob to the priority channel, then transmit. Once activity has ceased on the priority channel, the radio returns to scan operation.

Priority Mode C Details

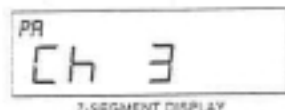
With the PRI toggle switch ON and SCAN switch OFF, radio operation is much the same as in Mode B. The fixed priority channel is sampled at the preset rate. If activity occurs on the priority channel, the radio will go to the priority channel and hold for the duration of the transmission. If you wish to reply to a message heard on the priority channel, press the PTT switch and the radio will automatically transmit on the priority channel regardless of the setting of the Channel Selector knob. In Priority Mode C the radio will always transmit on the priority channel if the PRI toggle switch is ON. The Priority Indicator will come on as a reminder that you are transmitting on the priority channel. Once activity has ceased on the priority channel, the radio will return to the Channel Selector knob receive channel.

With both SCAN and PRI toggle switches ON, the radio will scan until it locks on to an active channel. The radio continues to sample the priority channel while listening to the active channel. If activity occurs on the priority channel, the radio will override the active scan channel, go to the priority channel and hold for the duration of the transmission. If you wish to reply to a message on the priority channel, press the PTT switch and the radio will automatically transmit on the priority channel, regardless of the setting of the Channel Selector knob. In Priority Mode C the radio will always transmit on the priority channel if the PRI toggle switch is on. The Priority Indicator will come on to remind you that you are transmitting on the priority channel. Once activity ceases on the priority channel, the radio returns to scan operation.

F. Changing the Priority Channel

The fixed priority channel used in Priority Modes B and C may be permanently set or may be changeable. See "PRI Key Lockout" on page 2-6. If the radio has a changeable priority channel, use the following steps to make this change.

NOTE: Only one channel can be designated as the priority channel.

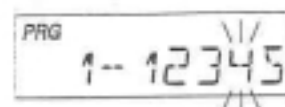


1. To avoid possible confusion, turn OFF the PRI and SCAN toggle switches on the top of the radio.
2. Rotate the Channel Selector knob to the channel that you wish to enter as the new priority channel.
3. Press the [PRI] key. A short beep will sound, and the "PR" annunciator will be displayed, indicating that the displayed channel is now the priority channel.

A channel can be both a priority and a scanned channel. Due to multiple sampling of the same channel, maximum performance occurs when the priority channel is not also a scan channel.

G. Setting Priority Channel Lockout

1. To lockout a priority channel setting the radio must first be programmed for priority mode B or C.
2. With the radio in normal operation mode set the channel select knob to the desired priority channel.
3. Press the [PRI] key on the keyboard. If the PR annunciator appears on the display, the PRI Key Lockout function is disabled. If the PR annunciator does not appear on the display, the PRI Key Lockout function is enabled.



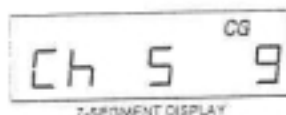
4. Program the PRI Key Lockout function to either enabled or disabled. See "PRI Key Lockout" on page 2-6.

H. User Code Guard Selection

Certain Bendix/King Radio models with keyboard and display allow user selection of Code Guard values independent of the Channel Selector knob setting. This is accomplished using the keyboard. The radio can be programmed to enable or disable this feature. The programming has also assigned a transmit frequency and Code Guard and a receive frequency and Code Guard to each position shown on the Channel Selector knob. The Code Guard values for Channels 1-9 can be pulled away from their normal pairing and matched with any of the other frequencies in the radio.

For example, to use the Code Guard values of Channel 9 with the frequencies of Channel 5:

1. Turn OFF the PRI and SCAN toggle switches on the top of the radio.
2. Set the Channel Selector knob to Channel 5.



3. Press the [9] key on the radio keyboard. The CG annunciator will be displayed.

The radio will now operate on the frequencies of Channel 5 with Channel 9 Code Guard values.

The 7 Segment display will show the selected channel on the left (5) and the Code Guard value channel on the right (9).

The Alphanumeric display will show the Code Guard value channel, then the selected channel. To see the Code Guard value channel again, press the [#] key on the keyboard. The group number will be displayed, followed briefly by the Code Guard value channel, then the selected channel.

4. Press the [0] key to reset all values to the original programming, or press a different digit key (1-9) to select a new set of Code Guard values.

NOTE: In scan or priority scan mode, the display will not show selected user Code Guard values, nor will it use operator-selected Code Guard values in scan mode.

NOTE: Once a Code Guard value has been selected by the keyboard it will not change even if power is interrupted or if the Channel Selector knob is changed.

I. Busy Channel Operation

If the radio has been programmed for busy channel operation, it will operate in one of the following three modes.

Busy Channel Indication

The yellow Busy Channel Indicator will glow if there is carrier activity on the channel selected. If the channel selected is a Code Guard channel and the correct code is not detected, the Busy Channel Indicator will remain on for the duration of the carrier activity and no messages will be heard. During Scan and Priority Scan operation, the Busy Channel Indicator will glow when activity is detected on any channel that is in the scan list. When scanning Code Guard channels, with the Squelch knob set to the Code Guard position, and the activity has been detected, the Busy Channel Indicator will glow for the time period necessary to determine if the proper Code Guard has been received, causing the LED to "flash" at various rates. In Priority Scan operation, the Busy Channel Indicator will remain on for the duration of the carrier activity on the priority channel whether the correct Code Guard is detected or not.

Busy Channel Lockout

The Busy Channel Lockout feature applies only to those channels programmed for receive Code Guard operation. When carrier activity has been detected on the channel selected, the receive Code Guard is checked. If the proper code is present, you will be able to transmit on that channel. If an incorrect code or carrier activity only is detected, even if the Squelch knob is not in the Code Guard position, the transmitter is disabled, an alert tone is heard, and the LCD displays the word "Busy" when the radio's PTT is depressed.

Channels not programmed for receive Code Guard operation will transmit regardless of carrier activity.

Busy Channel Lockout Override

This mode operates in the same manner as Busy Channel Lockout except that the user can override and transmit by turning the Squelch knob off the Code Guard detent. The transmitter is locked out only if the Squelch knob is set to the Code Guard detent.

J. ANI Operation

A DTMF/ANI encoding feature is also available on all models. If enabled, a sequence of DTMF tones similar to the tones used by a standard pushbutton telephone will be transmitted each time the transmit PTT switch is activated. A sidetone of the ANI number transmitted will also be heard through the front speaker.

When DTMF and ANI are both enabled the ANI tone sequence will be transmitted only after the [ENT] key is pressed while the transmit PTT switch is activated. A sidetone of the ANI number transmitted will also be heard through the speaker.

K. DTMF Operation

Portable radios equipped with a keypad can be used for DTMF encoding. The radio can be programmed to enable or disable this feature. To operate the DTMF function simply press and hold the PTT switch and press any of the 12 keys desired. An audible sidetone will be heard through the front speaker.

The [FCN], [PRI], [ENT], and [CLR] keys respond as DTMF tones A, B, C, and D respectively.

3.2.6 GROUP OPERATION

A. Group Description

The Channel Selector knob has 14 positions. Radios with more than 14 channels are separated into "groups" of 14 channels each.

For simplification purposes each group should be looked at as an individual 14-channel radio. Each group can be programmed to have an "individual personality" with the operational features described earlier.

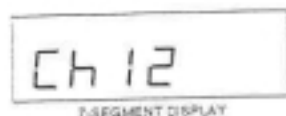
Radios with an Alphanumeric display can be programmed with group labels. See "Group Label" on page 2-10.

B. Group Selection



To avoid confusion, switch the SCAN and PRI switches to the OFF position. By pressing the [#] key on the keypad, the display shows you which group you are operating in. For example, this illustration shows the display indicating **grp 05**. Press the [ENT] key or wait approximately 5 seconds; the radio reverts to normal operation and the display shows the channel selected.

With an Alphanumeric display pressing the [#] key a second time shows the group label. Press the [ENT] key or wait approximately 5 seconds; the radio briefly displays the User Code Guard channel label (if any) then reverts to normal operation and displays the label of the channel selected.



To change groups, press the [#] key followed by the group number desired. Press the [ENT] key or wait approximately 5 seconds; the radio reverts to normal operation for that group and the selected channel appears in the display. All scanning and priority functions selected affect only the channels in the group you are operating in.



When changing groups, if a non-programmed or invalid number is selected (05, for example), the display will show **nogrP05** and the radio will return to the previously selected group.

SECTION IV THEORY OF OPERATION

4.1 INTRODUCTION

This section contains the theory of operation for the EPH Series transceivers. To aid in understanding the operation of the equipment, schematic diagrams are found in Section VI of this manual.

4.2 EQUIPMENT DESCRIPTION

The EPH series radios are self-contained VHF FM Transceivers operating in the 148MHz to 174MHz band. EPH radios are digitally synthesized and use a single crystal for frequency control. An EEPROM is incorporated for the storage of channel frequency, Code Guard, and Dual Tone Multiple Frequency/Automatic Numeric Identifier (DTMF/ANI) encode information. LEDs indicate transmit, priority, low battery, and busy channel.

Toggle switches control high/low transmit power, priority scan, and multi-channel scan. Status and channel information is displayed over a liquid crystal display (LCD) on Keyboard/Display models. Connectors are provided on the side of the unit for external antenna, microphone, speaker, and other optional accessories. A variety of twist-off battery packs are also available. Usable channels are dealer programmable.

4.3 THEORY OF OPERATION

Circuitry for the EPH series transceivers is comprised of four major circuits:

The RECEIVER consists of RF preselectors, RF amplifier, mixer, IF filters, IF amplifiers, FM IF chip, and noise squelch circuitry.

The TRANSMITTER consists of power amplifier, harmonic filter, antenna switch, and power control circuitry.

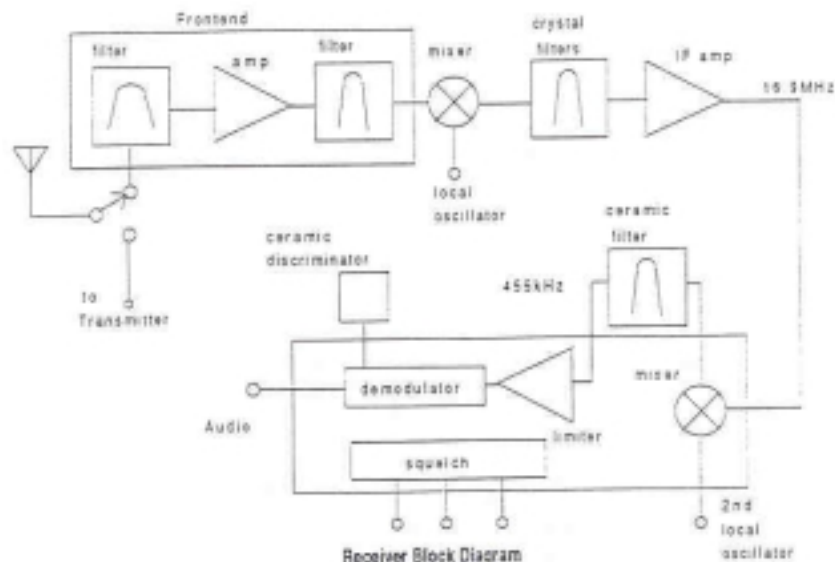
The SYNTHESIZER consists of voltage controlled oscillator (VCO), VCO buffer, prescaler buffer, prescaler, synthesizer IC, reference oscillator, loop filter, and acquisition aid bit circuitry.

The SYSTEMS AREA consists of microprocessor, microprocessor oscillator, EEPROM, signaling and switching, front end tuning, 5V and 8.2V regulators, transmitter audio, deviation compensation, squelch threshold circuitry, and receiver audio.

4.3.1 RECEIVER

The receiver is a dual conversion design with intermediate frequencies of 16.9MHz and 455kHz. RF signals received at the antenna pass through the antenna switch and front end. The front end consists of an amplifier and 2 microprocessor tuned bandpass filters. The front end amplifies the receive frequency and attenuates image, half IF and other frequencies that degrade receiver performance.

RF signals from the front end enter a mixer which converts them to 16.9MHz. The 16.9MHz IF signal passes through 2 crystal filters which provide adjacent channel selectivity. The IF amplifier then amplifies the signal and couples it to the 455kHz IF integrated circuit. The 455kHz IF chip consists of a mixer, limiter, demodulator, and squelch circuit. The 16.9MHz signal enters the mixer and is converted to a 455kHz IF signal. A ceramic filter at 455kHz provides more adjacent channel selectivity. The signal is then amplified by the limiter and demodulated. Audio processing is then done on the options board. Filtered audio noise is used to provide a squelch indication.



A. RF PRESELECTORS

The preselectors provide greater than 75db of attenuation at the image frequency. Both bandpass filters are varactor tuned which allows a wide frequency spread. Overall the preselectors exhibit a bandwidth of 4.5Mhz. The preselectors consist of L2, L3, L4, L5, and associated circuitry.

B. RF AMPLIFIER

The RF amplifier is a single transistor amplifier providing 22db of gain. The amplifier consists of Q1 and associated circuitry.

C. MIXER

The balanced diode mixer converts the RF frequency to 16.9MHz. The mixer consists of CR6, CR7, CR8, CR9, and associated circuitry.

D. IF FILTERS AND IF AMPLIFIERS

The crystal filters FL1A and FL1B are centered at 16.9MHz and provide attenuation to frequencies adjacent to the receive frequency. The bandwidth of the filters is 15kHz. The IF amplifier provides 26db of gain at 16.9MHz. The amplifier consists of Q4 and associated circuitry.

E. FM IF CHIP

The FM IF chip I2 provides a 2nd mixer, a high gain limiter, a demodulator, an OP-AMP and a schmitt trigger. The mixer converts the 16.9Mhz signal to 455kHz. The Local oscillator for the mixer consists of a 17.355Mhz crystal (Y1) and associated circuitry. The 455kHz signal is filtered by a ceramic filter FL2. A limiter inside I2 provides most of the gain for the receiver. The FM signal is demodulated by the demodulator in I2, the ceramic discriminator FL3 and associated circuitry.

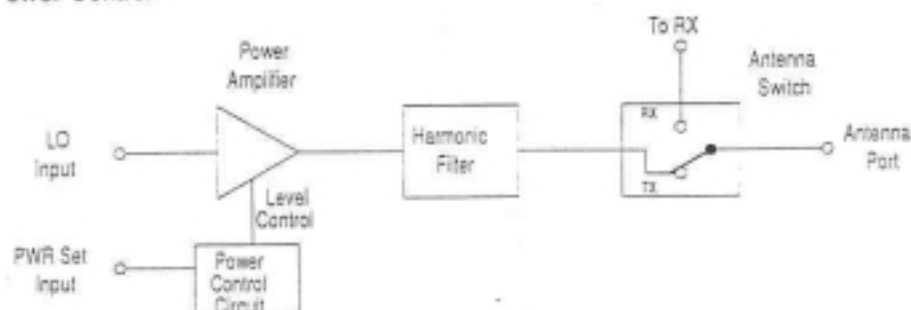
F. NOISE SQUELCH

The demodulated audio is bandpass filtered with an active filter consisting of I2's internal OP-AMP and external circuitry. Squelch gain control is provided by Q6 and associated circuitry. The squelch noise is detected by I2's internal schmitt trigger. The microprocessor samples the schmitt trigger output to determine signal level and squelch information.

4.3.2 TRANSMITTER

The transmitter consists of four major blocks (see figure). These are:

- (1) Power Amplifier
- (2) Harmonic Filter
- (3) Antenna Switch
- (4) Power Control



Transmitter Block Diagram

The power amplifier provides the necessary gain to amplify the low level 1st local oscillator signal to a level of 5 watts (2 watts for 2 Watt models).

The harmonic filter is a seven pole lowpass filter which provides rejection of the transmit frequency's harmonics.

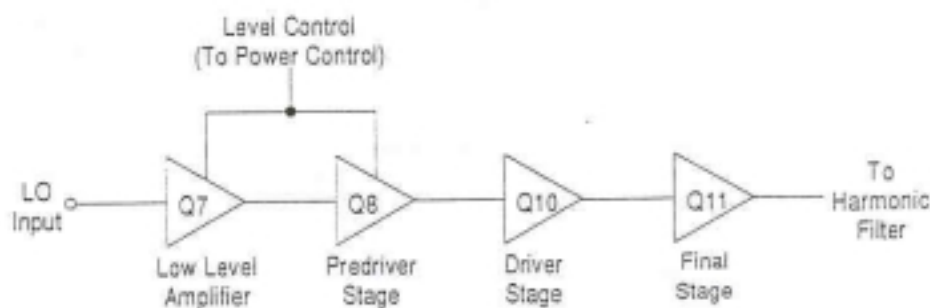
The antenna switch switches the RF signal path from the antenna port to the transmitter while in transmit mode. In receive mode the path is made from the antenna port to the receiver.

The power control circuit uses feedback control to level the RF power out of the transmitter. The desired transmitter output power is adjusted by means of the PWR SET line voltage for levels between 1 watt and 5 watts (1.5 watts and 2 watts for 2 Watt models).

A. POWER AMPLIFIER

The power amplifier is comprised of four RF amplifier stages(see figure). These are:

- (1) Low Level Amplifier
- (2) Predriver Stage
- (3) Driver Stage
- (4) Final Stage



Power Amplifier Block Diagram