

SECTION I GENERAL INFORMATION

1.1 INTRODUCTION

This manual provides information on servicing Bendix/King L Series portable VHF radios. It details the physical, mechanical, and electrical characteristics of the various models. The original LPH Series of portable VHF radios has been expanded to include additional models and features. For your convenience, the L Series service manual encompasses the following radios:

- LPH Series radios Early and later models
- MPH Series radios LPH in a metal case
- LPI Series radios LPH downbanded to a lower frequency

Information in this manual is valid for LPH, MPH, and LPI Series radios except where noted.

1.2 INTRINSICALLY SAFE MODELS

LQH and MQH Series radios are certified intrinsically safe for hazardous environments. Intrinsically safe radios are not covered in this manual. To preserve the intrinsically safe certification of LQH AND MQH Series radios, it is recommended that you send units in need of repair to the Bendix/King factory.

WARNING

MODIFICATION OR IMPROPER REPAIR OF INTRINSICALLY SAFE RADIOS
WILL MAKE THEM UNSAFE FOR OPERATION IN HAZARDOUS
ENVIRONMENTS AND WILL VOID THEIR INTRINSICALLY SAFE RATING.

1.3 DESCRIPTION

The L Series radios are self-contained VHF FM Transceivers covering the frequency range of 148MHz to 174MHz (LPI 136MHz to 160MHz). Models are available with a 2 watt or 5 watt transmitter, and 2 or 14 channels. Most 5 watt models have a HI/LO switch to reduce transmitter power and increase battery life. The units are multi-channel, digitally synthesized radios using a single crystal for frequency control, and an EEPROM for the storage of frequency and CODE GUARD™ information. Keyboard/Display models show status and channel information on a liquid crystal display. Connectors are provided on the side of the unit for external antenna, microphone, speaker, and optional accessories. A variety of twist-off battery packs are also available. Unit features are listed in the chart below.

MODEL NUMBER	CHANNEL CAPACITY	CHANNEL INCREMENT	WATTS	SCAN	KEYBOARD DISPLAY
2023	2	5k/12.5k	2	—	—
2142	14	5k/12.5k	2	✓	✓
5023	2	5k/12.5k	5/1	—	—
5140	14	5k	5	✓	—
5141	14	5k	5/1	✓	✓
5142	14	5k/12.5k	5/1	✓	✓
5143	14	5k/12.5k	5	—	—

Code Guard is a trademark of King Radio Corporation.

1.4 TECHNICAL CHARACTERISTICS

GENERAL

FREQUENCY: LPH/MPH LPI	148-174MHz 136-160MHz
POWER SUPPLY:	One rechargeable nickel cadmium battery with temperature sensor or alkaline battery pack.
OPERATING VOLTAGE:	10 VDC nominal
CODE GUARD™ (CTCSS)	Included
CODE GUARD™ (CDCSS)	Included
MULTIPLE CODE GUARD™ SQUELCH	Included
TIME OUT TIMER	Included
FREQUENCY SPREAD: LPH/LQH/MPH/MQH LPI	26MHz with no degradation 24MHz with no degradation
OPERATING TEMPERATURE:	-30° to +60°C
PHYSICAL DIMENSIONS: Weight:	20 oz (0.6 kg) 24 oz (0.7 kg) with large battery
Width:	2.55 in (64.8 mm)
Depth:	1.50 in (38.1 mm)
Height:	6.6 in (167.6 mm) 7.8 in (198.1 mm) with large battery
STANDBY CURRENT DRAIN:	15 mA (battery saver on)
ANTENNA:	Helical Wound Rubber Flex
CHANNEL SPACING:	30 kHz.
FCC IDENTIFICATION NUMBER: 5 Watt 2 Watt	ASY90Q LT20001 ASY90Q LT20002
MAXIMUM CURRENT DRAIN: Transmit 5 watts: Transmit 2 watts: Transmit 1.5 watts: Receive 500 milliwatts audio: Receive standby:	1.55 amps 625 mA 500 mA 165 mA 45 mA (battery saver off) 15 mA (battery saver on)

TRANSMITTER

RF POWER OUT:	2 or 5 watts (HI/LO switch reduces 5 watts to about 1 watt) (LPH 5140 does not have a HI/LO switch)
FCC EMISSION DESIGNATORS:	15KØF2D, 16KØF3E, 16KØFXE
SPURIOUS AND HARMONICS:	-60dBc
MAXIMUM DEVIATION:	±5kHz
FM HUM AND NOISE: (Companion RX)	-43dB
FREQUENCY STABILITY:	±5 parts per million
AUDIO DISTORTION:	3% maximum with 3kHz deviation
AUDIO RESPONSE:	+1 to -3dB from 6dB/octave pre-emphasis
DUTY CYCLE:	EIA (5-5-90)

RECEIVER

SENSITIVITY:	
12dB SINAD:	.25 μ V
NOISE SQUELCH:	.18 μ V
SELECTIVITY:	-70dBm
IMAGE AND SPURIOUS RESPONSES:	-75dBm
INTERMODULATION:	-70dBm
AUDIO RESPONSE:	+2dB to -4dB from 6dB/octave de-emphasis
AUDIO OUTPUT:	
LPH/MPH/LPI:	500mW with 5% maximum distortion into an 8 ohm load
LOH/MQH:	250mW with 5% maximum distortion into an 8 ohm load

1.5 ACCESSORIES

A wide variety of batteries and other accessories can be added to L Series radios. Your BENDIX/KING dealer price list will list all available accessories.

WARNING

FOR INTRINSICALLY SAFE RADIOS DESIGNED FOR USE IN HAZARDOUS ENVIRONMENTS, ACCESSORIES AND REPLACEMENT BATTERIES MUST BE APPROVED BY FACTORY MUTUAL RESEARCH FOR USE WITH BENDIX/KING RADIOS.

1.6 LICENSE REQUIREMENTS

This equipment must be licensed by the Federal Communications Commission prior to use. Your BENDIX/KING dealer can assist you in meeting these requirements. Your dealer will program each radio with your authorized frequencies and signaling codes.

1.7 SERVICE INFORMATION

If you have questions regarding service you may contact the factory at this address:

BENDIX/KING
Mobile Communications Division
2920 Haskell Avenue
Lawrence, Kansas 66046
(913) 842-0402

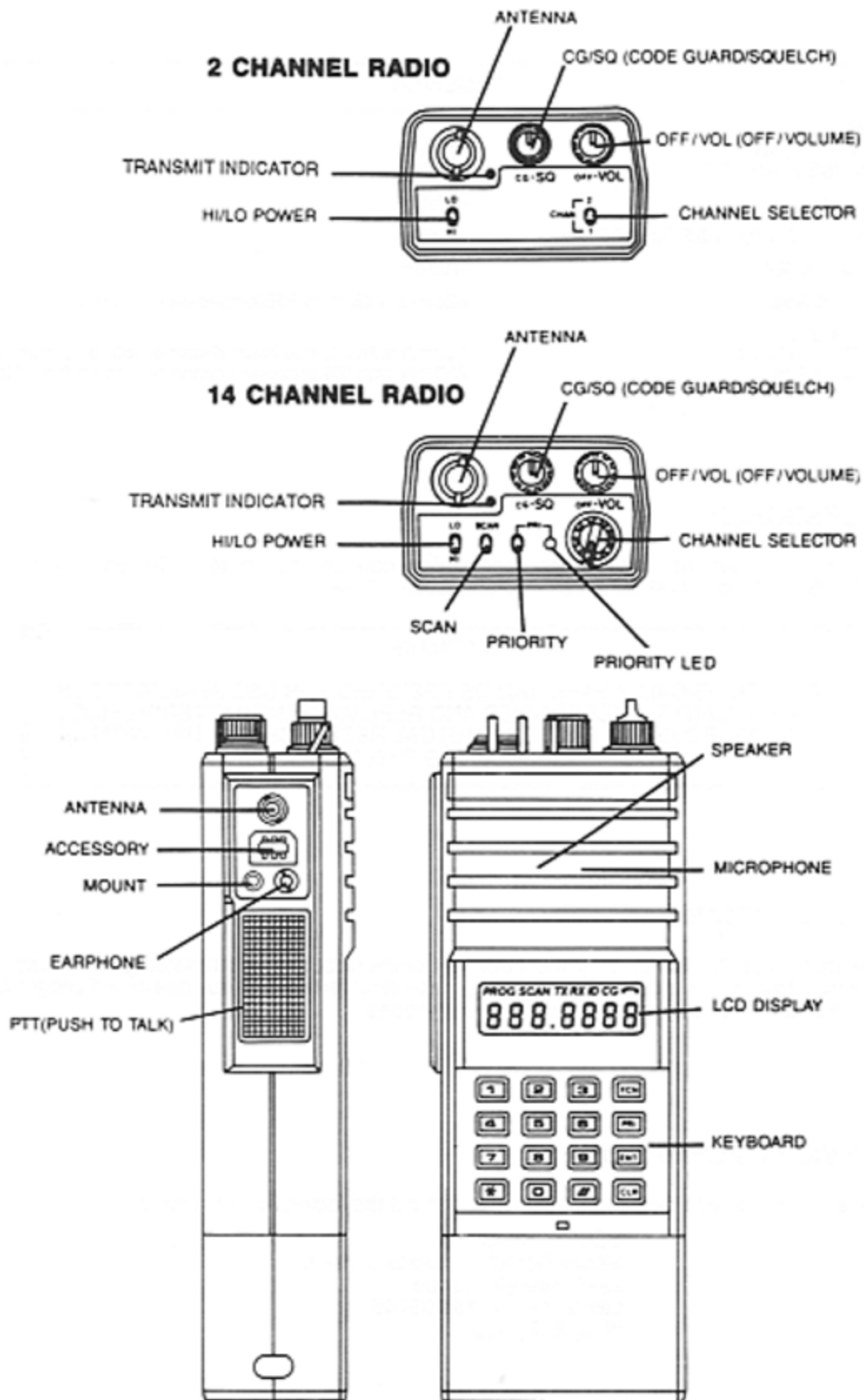


FIGURE 1-1 CONTROLS

SECTION III OPERATION

3.1 INTRODUCTION

This section contains operation procedures for Bendix/King L Series VHF radios. Information on installation and programming is contained in Section II 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.

3.2 OPERATION

3.2.1 BASIC OPERATION

A. Receive

Turn power on by rotating the Volume knob clockwise past the OFF detent. Select the appropriate channel using the Channel Select knob (14 channel) or toggle switch (2 channel).

Rotate the Squelch knob clockwise until a rushing noise is heard. Set the volume to a comfortable level, then rotate the Squelch knob counter-clockwise until the noise stops. This is called the squelch threshold setting. Further rotation counter-clockwise tightens the squelch setting, allowing only stronger signals to open the squelch and be heard.

B. Transmit

Press and hold the side Push To Talk (PTT) switch. 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 the transmission.

If the Transmit Indicator does not glow when you press the PTT switch, the battery pack may need to be charged. If the Transmit Indicator does not glow and a tone is heard, you are on a receive-only channel. Switch the channel selector 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 be heard. If you wish to continue the 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. Code Guard 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 counter-clockwise, past the detent for Code Guard operation. A message will be heard only when the programmed Code Guard is received.

B. Code Guard Transmit

Before transmitting on Code Guard channels, monitor the channel by rotating the Squelch knob clockwise, off the Code Guard detent. If the channel is not busy, press and hold the PTT switch. The red Transmit Indicator will glow when the transmitter is on. Talk in a normal voice with the microphone one to two inches away from your lips. Make each transmission as brief as possible. Release the PTT switch to end transmission. Reset the Squelch knob to the Code Guard position.

If the Transmit Indicator does not glow when you press the PTT switch, the battery pack may need to be charged. If the Transmit Indicator does not glow and a tone is heard, you are on a receive-only channel. Switch the channel selector 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 be heard. If you wish to continue this transmission, release the PTT then press it again and continue talking.

3.2.3 HI/LO TRANSMIT POWER (5 WATT MODELS ONLY)

Placing the HI/LO toggle switch in the HI position enables full transmitter power. The LO position reduces power to about one watt thereby reducing current drain and increasing battery life.

3.2.4 BUILT IN FEATURES

Bendix/King radios are based on a microprocessor core that allows extra features and operational characteristics to be built in to the radio. You should define the best operational settings for your customer's system and program them into the radio.

You can add extra transmit and receive frequencies. If the customer wishes to monitor other local radio systems that fall anywhere in the band, you can add a frequency with or without Code Guard to the program.

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 changed from 0 - 225 seconds as required.

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 you find that the scanner is restarting before message replies are heard, increase the scan delay time (0-7.5 seconds).

There are three different priority modes available. These are described later in this section of the manual. System needs and suggestions should be discussed with the customer.

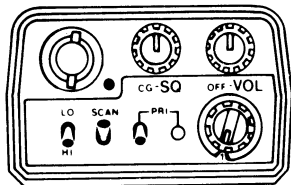
3.2.5 OPERATIONAL FEATURES AVAILABLE ON SELECT MODELS

A. Scan Operation

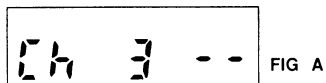
When in the scan mode, the radio receiver samples channels in a predetermined list (scan list) looking for activity. If an active channel is found, the scanning action stops and the message on that channel is heard.

The radio will resume scanning once the received signal has ended and the scan delay time has expired. You can preset the scan delay time from 0 to 7.5 seconds, in 0.5 second increments.

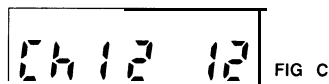
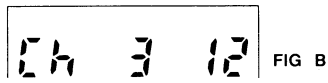
You can also preset the scan list. On some radios you will be able to add or delete channels from the scan list. The channel to which the Channel Select knob is set is always included in the scan list.



To begin scanning, place the SCAN toggle switch in the SCAN position. Scan operation occurs only while the radio is receiving. After SCAN is enabled, two flashing bars on the right side of the LCD (Figure A) indicate that the radio is scanning the channels in the Scan List.



When a signal is detected, scanning stops and the signal being received is heard, with the active channel shown on the right side of the LCD. (Figure B) The radio receiver stays on that channel until activity ceases and resumes scanning after the scan delay expires.



To transmit on the last active scan channel (right side of display), rotate the Channel Select knob to match that channel. (Figure C) Turn OFF the SCAN toggle switch for normal transmit/receive operation.

B. Scanning Code Guard Channels

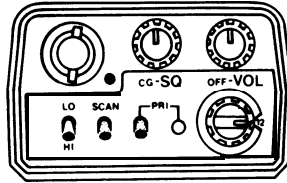
To scan for channels with programmed Code Guard, rotate the Squelch knob completely counter-clockwise, past the Code Guard detent. Place the SCAN toggle switch in the SCAN position. Place the PRI switch in the OFF position.

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 on that channel until Code Guard ceases. If the proper Code Guard is not present the radio receiver will resume scanning immediately.

When the PTT switch is pressed while in the scan mode, the radio transmits on the transmit channel (left side of the LCD). Upon release of the PTT switch, the radio receiver will hold on that channel. If no activity occurs during the scan delay time, the radio resumes scanning.

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.

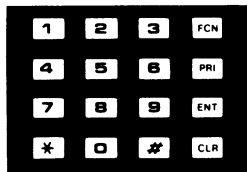


To avoid confusion, turn OFF the PRI and SCAN toggle switches on the top of the radio.

Rotate the Channel Select 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, and "SCAN" will appear in the LCD (Figure D).



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

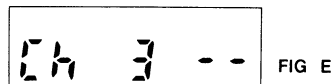
D. Permanent Scan List

When Scan List Lockout is enabled, the user will not be able to change the channels in the scan list. To make the scan list permanent enter the programming mode CHO. Press the FCN key until Group 1 functions appear (I-1 2345). Press the digit 5 so it begins to flash, then press (ENT). The scan list is now permanent in the normal operation mode and cannot be changed until the scan lockout function has been reversed. See Section 2.3.3 G for further information on programming mode.

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.

NOTE: The Priority Scan feature samples only the carrier frequency and does not sample the Code Guard signal. When scanning a priority channel that uses Code Guard, the radio will lock on to that channel and messages will be heard whether the correct Code Guard signal is detected or not.



When the PRI (priority) toggle switch is turned ON, the designated priority channel is sampled 4 times per second, regardless of activity on any other channel. Two flashing bars on the right side of the LCD indicate that the radio is sampling the priority channel. (Figure E) If a signal is received on the priority channel, the 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 the SCAN and PRI toggle switches are both off, the radio will function as in basic operation.

F. Priority Modes

Priority Mode A - The priority channel is tied to the Channel Select knob. When the Channel Select knob is set on channel 5, this is the priority channel. If the Channel Select knob is switched to channel 8, this becomes the priority channel. The radio will transmit on the frequency selected with the Channel Select knob.

Priority Mode B - The priority channel is fixed. The radio will transmit on the frequency selected with the Channel Select knob.

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

If you do not know which priority mode is preset for the radio, use the following steps to identify it.

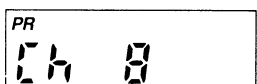
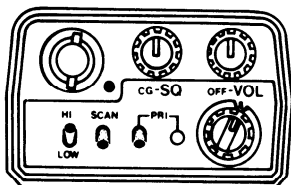


FIG F

1. Set the PRI and SCAN toggle switches to OFF.
2. Rotate the Channel Select 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. (Figure F)

4. If "PR" is displayed, rotate the Channel Select knob to a different channel, then turn the PRI toggle ON.

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

If the LCD displays the priority channel, you have priority Mode C.

Mode A Details

In this mode, the priority channel is tied to the Channel Select knob. When the SCAN and PRI toggle switches are both ON, scanning will occur until an active scan channel is found.

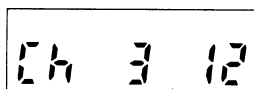


FIG G

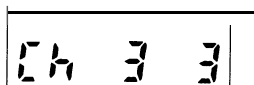


FIG H

The radio will receive the active channel (Figure G) while continuing to sample the priority channel 4 times per second. If during this sampling the priority channel becomes active, the Priority Indicator on the top of the radio will glow. The receiver will go to the priority channel and hold for the duration of the transmission. (Figure H) The priority channel will be shown on the right side of the display.

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.

NOTE: On certain models the "PR" symbol will not show in the display when the PRI toggle switch is on.

Mode B Details

This mode fixes one channel in the radio as the priority channel. With the SCAN toggle switch OFF and PRI 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 will glow; the receiver will go to the priority channel and hold for the duration of the transmission. To reply to a message on the priority channel, rotate the Channel Select knob to the priority channel, then transmit.

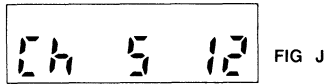


FIG J

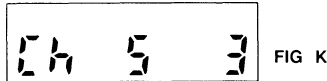


FIG K

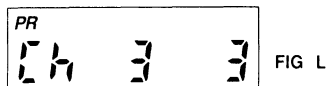


FIG L

With both SCAN and PRI toggle switches ON, normal scanning operation will occur until the scanner locks on to an active channel. (Figure J) The receiver will continue to sample the priority channel 4 times per second while the radio is listening to this active channel. If activity occurs on the priority channel, the radio will override the active channel, go to the priority channel, and hold for the duration of the transmission. (Figure K)

To reply to a message on the priority channel, rotate the Channel Select knob to the priority channel, then transmit. (Figure L) Once activity has ceased on the priority channel, the radio returns to scan operation.

Mode C Details

With the PRI toggle switch ON and the SCAN toggle switch OFF, radio operation is almost the same as in Mode B. The fixed priority channel is sampled 4 times per second. If activity occurs on the priority channel, the radio will go to the priority channel and hold for the duration of the transmission. To reply to a message received 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 Select 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 glow 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 Select knob receive channel.

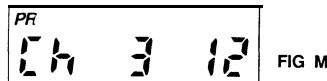


FIG M

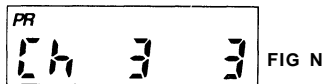


FIG N

With both SCAN and PRI toggle switches ON, the radio will scan until it locks on to an active channel. (Figure M) The receiver will continue to sample the priority channel 4 times per second while the radio is listening to this 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, (Figure N)

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 Select knob.

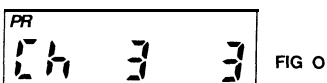
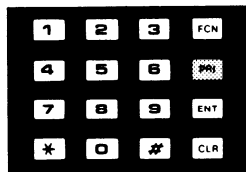
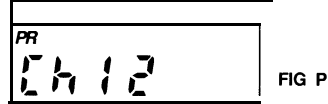
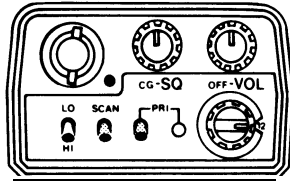


FIG O

In priority Mode C the radio will always transmit on the priority channel if the PRI toggle switch is on. (Figure O) The priority channel number appears in the left side of the display, regardless of the position of the Channel Select knob. The priority Indicator will glow 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 if the radio has a keyboard and is not protected against priority channel changes. If the radio has changeable priority, 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 Select knob to the channel that you wish to enter as the new priority channel.

Press the [PRI] key. A short beep, with letters "PR" displayed, indicates that the displayed channel is now the priority channel. (Figure P)

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

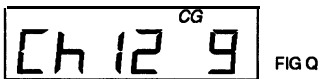
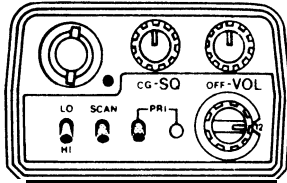
When Priority Channel Lockout is enabled, the user will not be able to change the designation of the Priority Channel. See Section 2.3.3 G for further information on programming mode.

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. PR should appear on the display.
4. Enter the programming mode. While in CH 0, repeatedly press and release the [FCN] key until Group 1 functions appear (1-12345).
5. Press the digit 4 on the keyboard. The 4 in the display should now be flashing.
6. Press ENT. Return the radio to normal operation mode by turning the radio off then back on again. The channel selected as priority channel should show PR on the upper portion of the display.
7. To verify priority channel lockout set the Channel Select knob to a different channel and press the [PRI] key. The PR symbol should not appear in the display.

H. User Code Guard Selection

Certain LPH models allow user selection of Code Guard values independent of the Channel Select knob setting. This is accomplished using the keyboard. The dealer can pre-program the radio to enable or disable this feature. The programming also assigns a transmit frequency and Code Guard, and a receive frequency and Code Guard, to each position shown on the Channel Select 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 12:



1. Turn OFF the PRI and SCAN toggle switches on the top of the radio.
2. Set the Channel Select Knob to Channel 12.
3. Press the 9 key on the front panel keyboard. The radio will now operate on the frequencies of Channel 12 with Channel 9 Code Guard values. During normal operation, the LCD will show 2 numbers: the transmit/receive channel on the left (5) and the selected Code Guard values on the right (9) with the CG symbol. (Figure Q)
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 Select Knob is changed.

I. DTM F Operation

The DTMF Telephone Tone Encoder (LAA 0510) can be installed as an option. Pressing the PTT switch enables the DTMF tone encoder. With the PTT pressed, pressing any of the 12 keys on the keypad will transmit the key's associated tone pair. An audible side-tone is also generated.

J. Programming Errors (Radios with keyboard microprocessors, KPN 122-00058-0001)

If the Channel Select knob is set to a channel containing an invalid receive frequency there will be no display indications after power up. If this should occur, rotate the Channel Select knob to a channel with a valid receive frequency. The display should then come on and normal radio operation will resume.

Another indication of an invalid frequency programmed into a channel is when the Channel Select knob is rotated and the channel shown in the display does not change.

NOTE: Valid frequencies are from 148MHz to 174MHz (136MHz to 160MHz for LPI radios).