# 5300 Series

# OPERATING MANUAL

DIGITAL/ANALOG MOBILE RADIO

**PRELIMINARY**

# 5300 SERIES MOBILE RADIO

## VHF/UHF/800 MHz Analog and PROJECT 25 (DIGITAL) Conventional SMARTNET®/SMARTZONE® and Project 25 Trunked

*13.6 VDC*
*10-50 or 50-100 Watts (VHF);*
*15 Watts (UHF); 10-35 Watts (800 MHz)*
*Part No.: 242-53xx-xxx*


EFJohnson®

August 2002
Part Number: 002-5300-007CD

# SAFETY INFORMATION

The FCC has adopted a safety standard for human exposure to RF energy. Proper operation of this radio under normal conditions results in user exposure to RF energy below the Occupational Safety and Health Act and Federal Communication Commission limits.

## *WARNING*

DO NOT allow the antenna to touch or come in very close proximity with the eyes, face, or any exposed body parts while the radio is transmitting.

To comply with FCC RF exposure limits, DO NOT operate the transmitter of a mobile radio when a person outside the vehicle is within one (1) meter of the antenna.

To comply with FCC RF exposure limits, DO NOT operate the transmitter of a stationary radio (base station or marine radio) when a person is within one (1) meter of the antenna.

DO NOT operate the radio in explosive or flammable atmospheres. The transmitted radio energy could trigger blasting caps or cause an explosion.

DO NOT operate the radio without the proper antenna installed.

DO NOT allow children to operate or play with this radio.

*NOTE: The above warning list is not intended to include all hazards that may be encountered when using this radio.*

This device complies with Part 15 of the FCC rules. Operation is subject to the condition that this device does not cause harmful interference. In addition, changes or modifications to this equipment not expressly approved by EFJohnson could void the user's authority to operate this equipment (FCC rules, 47CFR Part 15.19).

### FCC EXPOSURE LIMITS

This mobile radio transceiver was tested by the manufacturer with an appropriate antenna in order to verify compliance with Maximum Permissible Exposure (MPE) limits set under Section 2.1091 of the FCC Rules and Regulations. The guidelines used in the evaluation are derived from Table 1 (B) titled "Limits For General Population/Uncontrolled Exposure" which is from FCC report OET bulletin #65.

**Table 1**
**FCC Limits for Maximum Permissible Exposure (MPE)**

| **(B) Limits For General Population/Uncontrolled Exposure** | | | |
|---|---|---|---|
| **Frequency Range (MHz)** | **Electric Field Strength (E) (V/m)** | **Magnetic Field Strength (H) (A/m)** | **Power Density (S) ($mW/cm^2$)** |
| 0.3-1.34 | 614 | 1.63 | (100)* |
| 1.34-30 | 824/f | 2.19/f | $(180/f^2)$* |
| 30-300 | 27.5 | 0.073 | 0.2 |
| 300-1500 | -- | -- | f/1500 |
| 1500-100,000 | -- | -- | 1.0 |
| f = Frequency in MHz | | *Plane-wave equivalent power density | |

Table 2 lists the antenna whips and bases recommended for use in each frequency range. Each model of this radio was tested with the appropriate antenna listed. The antenna was mounted in the center of the roof of a domestically manufactured four-door passenger sedan. The radio manufacturer has determined that the user and service personnel should remain one (1) meter in distance away from the antenna when transmitting. By maintaining this distance, these individuals are not exposed to radio frequency energy or magnetic fields in excess of the guidelines set forth in Table 1.

*NOTE: Other antennas or installation configurations that have not been tested may not comply with FCC RF exposure limits and therefore are not recommended.*

**Table 2**
**Recommended Antenna Whips and Bases (Antenna Manufacturer - Antenna Specialists)**

| Frequency | Whip Model No. | Base Model No. |
|---|---|---|
| 136-144 MHz | ASPJ1415 | KM220 |
| 144-152 MHz | ASPA1415 | KM220 |
| 152-162 MHz | ASPB1415 | KM220 |
| 162-174 MHz | ASPC1415 | KM220 |
| 400-430 MHz | ASPE1615 | KM220 |
| 430-470 MHz | ASPD1615 | KM220 |
| 470--512 MHz | ASPF1615 | KM220 |
| 806-869 MHz | ASPA1855 | KM220 |
| 890-960 MHz | ASPG1865 | KM220 |

# 53xx SERIES MOBILE OPERATING MANUAL

## VHF/UHF/800 MHz

## ANALOG CONVENTIONAL
## PROJECT 25 (DIGITAL) CONVENTIONAL AND TRUNKED SMARTNET®/SMARTZONE® ANALOG AND DIGITAL



The E.F. Johnson Company, which was founded in 1923, provides wireless communication systems solutions for public safety, government, and commercial customers. The company designs, manufactures, and markets conventional and trunked radio systems, mobile and portable subscriber radios, repeaters, and Project 25 digital radio products. E.F. Johnson is a wholly owned subsidiary of EFJ, Inc., formerly Transcrypt International, Inc.



**LAND MOBILE PRODUCT WARRANTY -** The manufacturer's warranty statement for this product is available from your product supplier or from E.F. Johnson Company, 299 Johnson Avenue, Box 1249, Waseca, MN 56093-0514. Phone (507) 835-6222.

Information in this manual is subject to change without notice.

# TABLE OF CONTENTS

# TABLE OF CONTENTS (CONT'D)

## 5 SMARTNET/SMARTZONE/P25 TRUNKED FEATURES



## 6 MISCELLANEOUS





Revised August 2002
Part No. 001-5300-007CD-NR

# SECTION 1 FEATURES

## 1.1 GENERAL FEATURES

- Programmable for the following modes of operation:
  - – Conventional analog
  - – Conventional Project 25 (digital)
  - – Trunked Project 25 (digital)
  - – SMARTNET™/SmartZone® trunked (analog or digital)
- Up to 16 zones with up to 16 channels each programmable (256 channels total)
- Large liquid crystal display (LCD) with backlight.
- Six programmable option switches
- User selectable high and low power output
- Standard and radio wide scan modes
- Time-out timer
- Operates and both narrow and wide band channels
- SecureNet™ DES/DES-XL encryption available on analog channels, DES-OFB on digital channels

## 1.2 CONVENTIONAL FEATURES

- Up to 256 channels or talk groups programmable
- Repeater talk-around
- Carrier or Call Guard® controlled squelch on analog channels, NAC and talk group IDs on P25 channels
- Normal/Selective squelch selectable by option switch.
- Monitor mode selected by microphone hanger or option switch
- Penalty and conversation timers
- Priority channel sampling when scanning
- Busy channel lockout (transmit disable on busy)
- Unit calls on Project 25 channels
- Emergency calls (Project 25 channels only)
- ANI (Automatic Number Identification)
- Keypad programming (Federal Government users only)

## 1.3 SMARTNET™ II/SMARTZONE® FEATURES

- Channels select talk groups. Up to 256 talk groups programmable
- Group, Enhanced Private Conversation™, standard Private Conversation, and Telephone Calls
- Emergency alarms to alert dispatcher of emergency conditions
- Emergency calling for high priority system access
- Failsoft operation on a predefined conventional channel if trunked system fails
- Priority group calls detected while listening to other group calls when scanning
- Call Alert™ (send and receive pages)
- Predefined messages (up to 16) can be sent to a dispatcher
- Predefined status conditions (up to 8) can be sent to a dispatcher
- Dynamic regrouping (dispatcher can automatically gather users on a channel to receive a message)
- Roaming (SmartZone only)

## 1.4 PROJECT 25 TRUNKED FEATURES

- Up to 256 talk groups programmable
- Group, Unit, and Telephone Calls
- Emergency alarms to alert dispatcher of emergency conditions
- Emergency calling for high priority system access
- Failsoft operation on a predefined conventional channel if trunked system fails
- When scanning, priority group calls detected while listening to other group calls
- Call Alert™ (send and receive pages)
- Predefined status conditions (up to 8) can be sent to a dispatcher
- Dynamic regrouping (dispatcher can automatically gather users on a channel to receive a message)
- Roaming

*NOTE: The availability of many of the preceding features is controlled by system operator programming of your transceiver, installed options, and the capabilities of the radio system being accessed.*



Revised August 2002
Part No. 001-5300-007CD-NR

# SECTION 2 CONTROLS AND DISPLAY

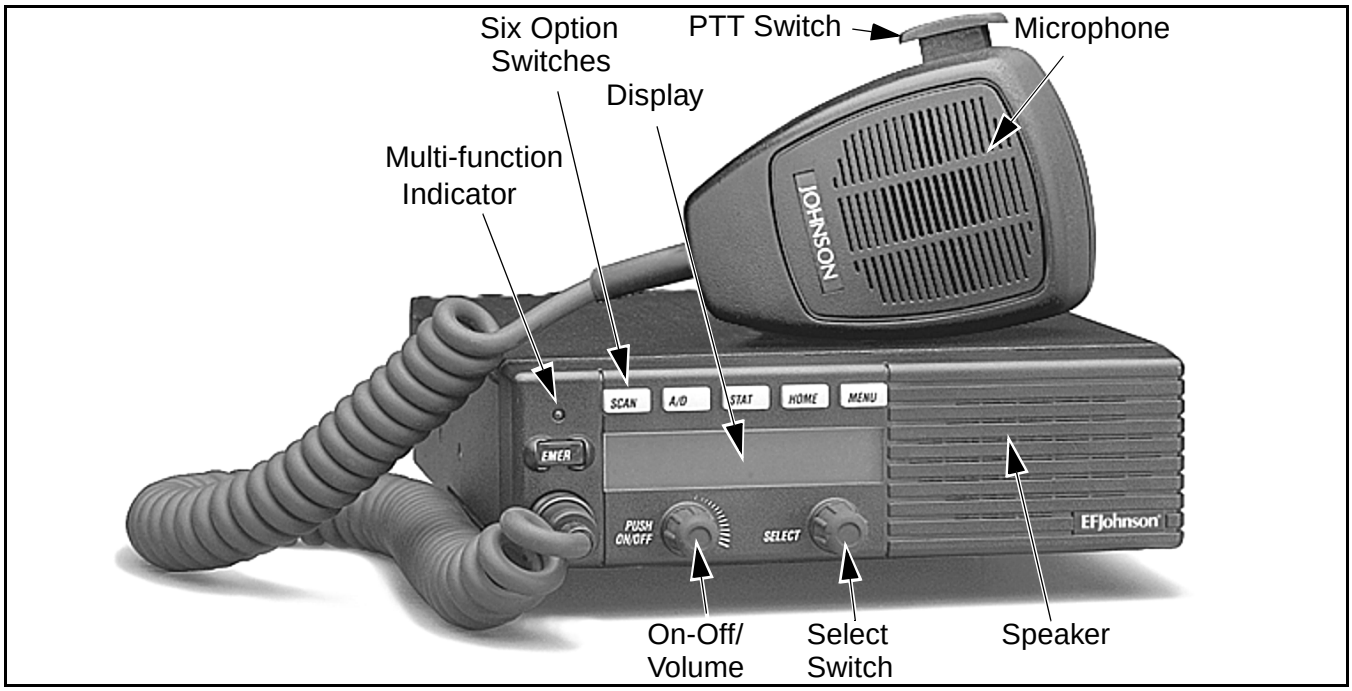



**Figure 2-1 Front Panel Controls**

## 2.1 FRONT PANEL CONTROLS

**On-Off/Volume -** Pressing this control turns power on and off, and rotating it sets the volume level.

**Select Switch -** Selects zones/channels and is also used for other functions such as selecting names from a call list. When selecting zones/channels, a bar above the zone or channel display (see Figure 2-3) indicates which is being changed. This bar is switched between displays by pressing this switch, and zone and channels are selected by rotating it (see "Zone/Channel Select" on page 10).

**Multi-function Indicator -** This is a two-color LED that indicates the following:

**Red (constant) -** Transmitter keyed (PTT switch pressed).

**Green (constant) -** Busy condition (carrier detected in receive mode).

**Option Switches -** Each of the six options switches on the front panel (including the one located to the left of the display) can be programmed by your system operator to control some function. The switch functions can be different for each operating mode (conventional, SMARTNET/SmartZone, and Project 25 Trunked). Therefore, up to 18 functions can be controlled by these switches. Refer to Section 3.8 for more information on option switch functions.

**Speaker -** An internal 16-ohm, 5-watt speaker is located behind the grille. An optional 4-ohm, 12-watt external speaker may be used if desired. The internal speaker is disabled when an external speaker is used.

**PTT Switch -** This push-button switch on the microphone is pressed to talk (key the transmitter) and released to listen.

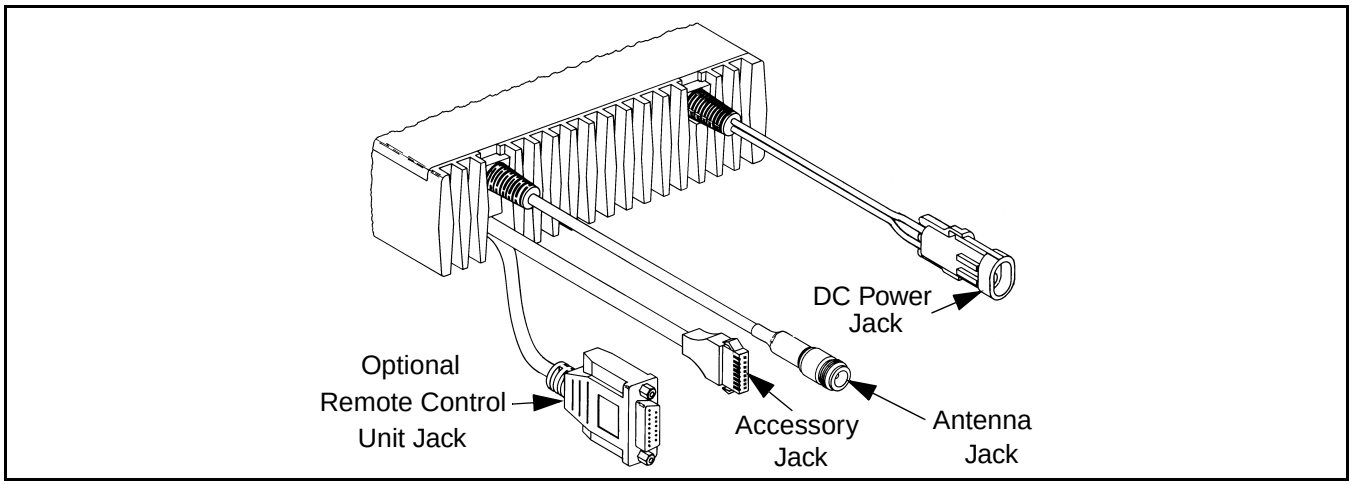



**Figure 2-2 Rear Panel Jacks**

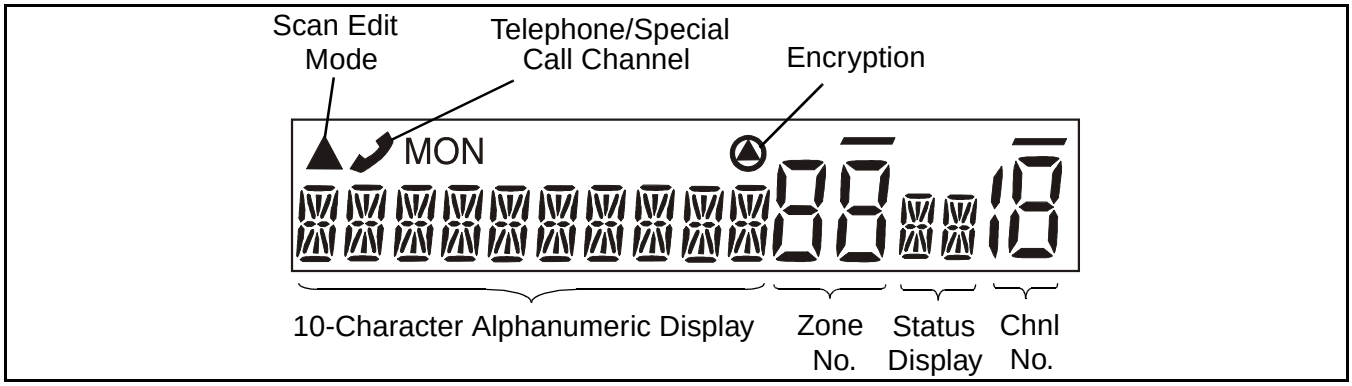



**Figure 2-3 Front Panel Display**

## 2.2 REAR PANEL JACKS

**DC Power Jack -** Connection point for the nominal 12-volt, negative ground power source (see Figure 2-2).

**Antenna Jack -** Type N jack for connecting the antenna.

**Accessory Jack -** Black connector for connecting optional accessories such as an external speaker (4-ohm, 12-watt), horn alert, and ignition sense line.

**Remote Control Unit Jack -** Connection point for a remote control unit if used. This cable is optional with front-mount models.

**Siren Control Jack (Not Shown) -** Yellow/orange connector similar to the accessory jack for connecting the optional siren controller.

## 2.3 DISPLAY

**Alphanumeric Display -** This 10-character area of the display indicates the alias (unique identification) for the selected zone or channel, depending on which select mode is active. It may also indicate such things as the channel frequency, ID numbers, and status and error messages.

**Zone Number -** Indicates the currently selected zone from 1 up to 16. A zone is a collection of channels that can be any combination of the conventional, P25 Trunked, and SMARTNET/SmartZone types.

**Channel Number -** Indicates the currently selected channel (conventional) or talk group (other modes).



Revised August 2002
Part No. 001-5300-007CD-NR

**Status Display** - These two characters indicate the following status information:

- This symbol in the left position indicates that the displayed channel is in the scan list (scanned normally).

- A “P” in the left position indicates that the selected conventional channel is a priority channel.

- This rotating clock-like symbol in the right position indicates that scanning is enabled.

- When this triangle is displayed, the scan list edit or keypad programming mode is indicated (see Section 3.17.5 or Section 4.14).

- Indicates a SMARTNET/SmartZone telephone call has been initiated. It is non-functional in the conventional mode.

- Indicates that voice encryption is enabled.

**MON** - Indicates that the conventional monitor mode is enabled by taking the microphone off-hook or pressing the Monitor option switch. This disables squelch control features so that all messages on the channel are heard. Refer to Sections 4.2 and 4.3 for more information.

- The lines above the zone and channel displays indicate which display is changed if the Select switch is turned. To switch between displays, press the Select switch (see Section 3.6).

# SECTION 3 GENERAL OPERATION

## 3.1 TURNING POWER ON

When power is turned on by pressing the On-Off/Volume knob, the radio goes through a self test. When that is successfully completed, the unit ID is displayed if applicable, a tone sounds (if tones are enabled), and the radio is ready for normal operation. If “ENTER PSWD” is briefly displayed, refer to the next section. Programming determines if the last selected or a home zone/channel is selected at power up.

## 3.2 POWER-UP PASSWORD

The power-up password feature prevents unauthorized use of the radio by requiring that an 8-digit password be entered to make it operational. This feature is enabled or disabled by the PCConfigure radio programmer.

When this feature is enabled, “ENTER PSWD” is briefly displayed when power is turned on. The 8-digit password must then entered by rotating and pressing the Select switch. In addition, since the logic resets whenever data is read or written using the PCConfigure programmer, this password must be entered after performing those functions.

This password can be changed only by the PCConfigure programmer. It cannot be changed by the user. If it is lost, all programming must be erased to make the transceiver operational again. This is done using the “EEPROM Erase” function of the PCTune program. Refer to the Alignment Procedure section in the 5300 Service Manual for more information.

## 3.3 BACKLIGHT CONTROL AND DISPLAY VIEWING ANGLE ADJUST

If the BKLHT option switch is programmed, it can be used to select high, medium, or off backlight modes. Otherwise, the keypad and display backlight is fixed in one of these modes by programming.

If the display is difficult to read from the angle you normally view it, the viewing angle can be adjusted as follows: Press and hold the last option switch above the display and then press the first option switch above the display. Then release both switches and turn the Select switch until the best contrast is obtained. This function times out in 3-5 seconds.

*NOTE: If the display appears blank or all icons are continuously displayed, the viewing angle is probably improperly adjusted.*

### 3.4 SETTING VOLUME LEVEL

The relative volume setting can be determined by noting the position of the index on the On-Off/Volume knob. Otherwise, enable a reference tone for use in setting the volume as follows:

- If the key press tones are enabled (see Section 3.12 on page 12), a short tone sounds when an option switch is pressed or the Select switch is pressed or rotated.

- If a conventional channel is selected, take the microphone off-hook and if someone is talking, voice may be heard. If the MON (Monitor) option switch is programmed (see Section 4.3 on page 19), pressing it unsquelches the transceiver and either voice or background noise is heard. If a SMARTNET/SmartZone or P25 trunked channel is selected, the transceiver cannot be manually unsquelched.

### 3.5 ZONE/CHANNEL DISPLAY

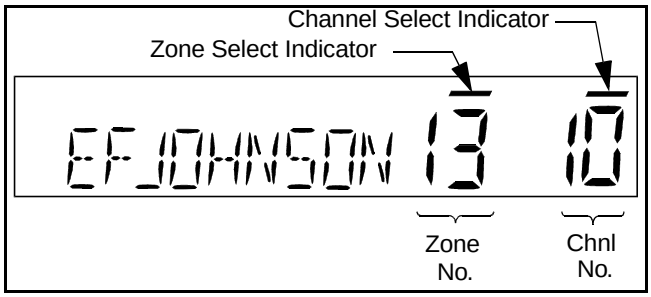
The selected zone and channel numbers are displayed by the zone and channel displays shown in Figure 2-3 on page 8. In addition, the programmed zone or channel identification (alias) is displayed in the alphanumeric display area. The zone alias is displayed when the zone select mode is enabled, and the channel alias is displayed when the channel select mode is enabled (see next section). With conventional channels, the channel frequency may be displayed instead of the alias (see Section 4.9).

A zone can include any mix of up to 16 channels, and up to 16 zones can be programmed. Therefore, up to 256 channels can be selected. Zones may be used for operation in different geographical areas or radio systems.

### 3.6 ZONE/CHANNEL SELECT

The front panel Select switch is used to change the zone and channel. Pressing this switch toggles between the zone and channel select modes, and rotating it changes the zone or channel.

The current mode is indicated by the bar over the zone or channel display. For example, when the bar is over the zone display (see following illustration), the zone select mode is enabled.




Rotating the Select switch clockwise increases the zone or channel and rotating it counterclockwise decreases the zone or channel number. After the highest zone or channel is displayed, wrap-around to the lowest zone or channel occurs and vice versa. If an unprogrammed channel is selected, "UNPROGRAMD" is displayed and a tone sounds. The transceiver may also be programmed so that only programmed channels are selected.

The transceiver can be programmed so that the bar defaults to either the zone or channel display when power is turned on and after a change is made. The delay that occurs before it returns is programmed for 1-15 seconds. It can also be programmed to remain in the last selected mode.

### 3.7 SETTING SQUELCH CONTROL

This transceiver does not have a squelch control. The squelch level is preset and usually does not require readjustment. However, if the squelch level needs to be changed on a conventional analog channel, it can be changed using keypad programming if available (see Section 4.14 on page 25).

### 3.8 OPTION SWITCHES

The six option switches on the front panel (one is located to the left of the display) can be programmed by the PCConfigure programmer to control a different set of functions for each of the three operating modes. Therefore, up to 18 different functions can be controlled by these switches (six each for conventional, SMARTNET/SmartZone, and P25 Trunking). The available functions in each mode and the section in which each is described are shown in Table 3-1 which follows.

**Table 3-1 Programmable Option Switch Functions**

| Suggested Key Label | Function | Available in Mode: | | | | See Descript. in Section: |
|---|---|---|---|---|---|---|
| | | Conv. | Proj 25 Trk | SMARTNET | SmartZone | |
| TONES | Alert tones On-Off | X | X | X | X | 3.12 |
| BKLHT | Backlight On-Off | X | X | X | X | 3.3 |
| ALERT | Call Alert Select | | X | X | X | 5.6 |
| RESP | Call Response Select | | X | X | X | 5.4.4 |
| C/S | Clear/Secure Select | X | X | X | X | 3.18 |
| DISP | Displayed Information Select | X | | | | 4.9 |
| EMER | Emergency Select | X | X | X | X | 4.10, 5.9 |
| | Horn Alert Select | X | X | X | X | 3.14 |
| HOME | Home Zone Select | X | X | X | X | 3.10 |
| | Hardware (Encrypt) Key Select | X | | | | 3.18 |
| PROG | Keypad Programming Select | X | | | | 4.14 |
| MSG | Messaging | | | X | X | 5.7 |
| MON | Monitor Mode Select | X | | | | 4.3 |
| SEL SQ | Normal/Selective Select | X | | | | 4.5 |
| PHONE | Phone Call Select* | | | X | X | 5.5 |
| CALL | Private Call Select | | | X | X | 5.4 |
| | Priority Channel Select | X | | | | 4.11.4 |
| | Remote Access (Pyramid Reptr) | | | | | |
| RWS | Radio Wide Scan Select | X | X | X | X | 3.16.3 |
| RTA | Repeater Talk-Around Select | X | | | | 4.8 |
| SCAN | Scan Select | X | X | X | X | 3.16.2 |
| SCN ED | Scan Edit Select | X | X | X | X | 3.17.5 |
| | Scan List Select | | X | X | X | 3.17.4 |
| SEL SQ | Selective Squelch Code Select | X | | | | 4.5 |
| LOCK | Site Lock Select | | X | | X | 5.13.4 |
| SEARCH | Site Search Select | | X | | X | 5.13.3 |
| STATUS | Status Select | | X | X | X | 5.8 |
| TG SEL | Talk Group Select | X | | | | 4.13.4 |
| TX PWR | Transmit Power Select | X | X | X | X | 3.11 |
| CALL | Unit Call Select | X | X | | | 4.13.5 |
| (Blank) | Unprogrammed (not used) | X | X | X | X | |

## 3.9 TIME-OUT TIMER

The time-out timer disables the transmitter if it is keyed for longer than the programmed time. It can be programmed on each channel for times from 15 seconds up to 3 minutes, 45 seconds or it can be disabled. If the transmitter is keyed continuously for longer than the programmed time, the transmitter is disabled, a continuous tone sounds, and "TX TIMEOUT" is displayed. Five seconds before time-out occurs, a warning beep sounds to indicate that time-out is approaching. The timer and tone are reset by releasing the PTT switch. A different time can be programmed for each system, and the timer can be enabled or disabled on each channel.

One use of this feature is to prevent a channel from being kept busy for an extended period by an accidentally keyed transmitter. It can also prevent possible transmitter damage caused by transmitting for an excessively long period.

### 3.10 HOME ZONE/CHANNEL SELECT

If the HOME zone option switch is programmed, pressing it selects the preprogrammed home zone and channel. This provides a quick way of returning to a frequently used zone and channel. The transceiver is also programmed so that either the home or last selected zone/channel is automatically selected when power is turned on.

### 3.11 POWER OUTPUT SELECT

Each conventional channel and SMARTNET/ SmartZone and P25 Trunked system can be programmed for High, Low, or Switchable transmit power. If Switchable power is programmed on the channel, the Tx PWR option switch can then be used to select high or low transmitter power. All models support switchable power.

Pressing the TX PWR switch toggles the power setting. The new level is flashed in the display when this switch is pressed as “HI POWER” or “LOW POWER”. If selectable power is not permitted on the current channel, the fixed power level is flashed as “FIXED HIGH” or “FIXED LOW” and no power change occurs. The selected power level for a channel is permanent until it is manually changed again.

### 3.12 ALERT TONE SELECT

The various alert tones that sound are described in Section 6.1 on page 35. These tones can be enabled and disabled if the TONE option switch is programmed. To turn all tones off, press this switch and “TONE OFF” is displayed. Then to turn all tones on again, press it and “TONE ON” is displayed. If this switch is not programmed, tones are fixed in the on or off condition by programming.

### 3.13 POWER TURN-OFF DELAY

The transceiver can be installed so that the vehicle ignition switch as well as the front panel power switch of the transceiver control power. This is done by connecting the accessory cable ignition switch input to the vehicle ignition switch. Refer to the Installation section of the 5300 Service Manual for more information. A power-off delay of up to 254 minutes or forever can then be programmed.

Both the ignition switch and the power switch must then be on for transceiver power to turn on. The delay can be overridden at any time by turning power off using the front panel power switch or turning the ignition switch back on.

This turn-off delay can allow calls to be received or the horn alert to be active for a time after the ignition switch is turned off. At the same time, advantages of ignition switch control are utilized such as preventing the battery discharge that may occur if the transceiver is left on for an extended period (see Section 6.5).

### 3.14 HORN ALERT

The horn alert feature sounds an external alert such as the vehicle horn when certain calls are received. It is available if a Horn option switch is programmed and the proper connection has been made to the external alert. The horn alert output is pin 4 of the accessory cable, and an external driver circuit of some type is usually required. Refer to the Installation section of the 5300 Service Manual for more information on how to install this feature.

Additional information on the horn alert feature follows:

- It activates when receiving any Unit call in the conventional mode and any Private/Unit and Call Alert (paging) call in the SMARTNET/SmartZone and P25 Trunked modes. It does not sound when receiving standard Group or Telephone calls, and is not programmable on a per call basis.
- It must be manually enabled and disabled by the Horn option switch. It is not controlled by the vehicle ignition switch. When it is enabled, “HORN ON” is briefly displayed, and when it is disabled, “HORN OFF” is briefly displayed. It defaults to the off mode whenever power is turned on.
- If a power turn-off delay is programmed as just described, it is functional during that delay.
- When activated, it can be programmed to sound for three 1-second beeps or continuously for 2-90 seconds. It then turns off until another call is received.

## 3.15 MICROPHONE OFF-HOOK DETECT

The microphone hanger can be connected to chassis ground and the radio programmed to detect an off-hook condition (Hangup Box Monitor selected). The following operation then occurs when the microphone is taken off-hook:

Conventional Channel Selected - Scanning temporarily halts (if applicable) and the Monitor Mode described in Section 4.3 is enabled. However, the receiver unsquelches only if a carrier is detected.

SMARTNET/SmartZone/P25 Trunked Channel Selected - Scanning temporarily halts if applicable.

If the off-hook condition is not detected (Hangup Box Monitor not selected), the microphone hook state has no affect on radio operation.

## 3.16 SCANNING

### 3.16.1 INTRODUCTION

Scanning monitors the channels in the scan list for messages the transceiver is programmed to receive. When a message is detected, scanning stops and the message is received. Shortly after the message is complete, scanning resumes (unless it has been disabled).

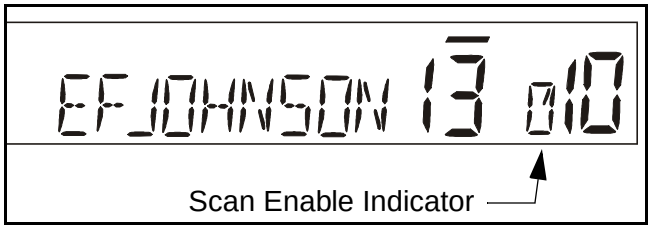
If the microphone off-hook condition is detected (Hangup Box Monitor selected by programming), scanning stops and selective squelch (such as Call Guard CTCSS or NAC/group ID detect) is disabled on conventional channels. If the off-hook condition is not detected, taking the microphone off-hook has no affect on transceiver operation.

There are two scan modes available: Standard and Radio Wide. The standard type is unique to the type of channel selected, and the Radio Wide type is the same for all channel types. Only one type of scanning can be enabled at a time. Therefore, if standard scanning is enabled when the Radio Wide Scan switch is pressed, standard scanning is automatically disabled and vice versa. Refer to the following for more information.

### 3.16.2 STANDARD SCANNING

Standard scanning monitors only channels that are the same type as that currently selected. For example, if a conventional channel is selected, only conventional channels are scanned and likewise for SMARTNET/SmartZone and Project 25 trunked channels. For more information on scanning functions unique to these operating modes, refer to Sections 4.11 and 5.11. Standard scanning operates as follows.

- To turn standard scanning on, press the SCAN option switch. Scanning is enabled when a rotating 7 is indicated in the right status display as follows and “SCAN ON” is briefly displayed.




- To turn scanning off, press the SCAN option switch again. On conventional channels, this may also select another list, so several presses may be required (see Section 4.11). Scanning is disabled when “SCAN OFF” is briefly displayed and 7 is no longer indicated in the status display.

- If the zone or channel is changed while scanning is selected, scanning continues on the same or a different scan list (see Section 3.17.1).

*NOTE: Each SMARTNET/SmartZone and P25 trunked channel can be programmed so that scanning is automatically enabled when the channel is selected.*

### 3.16.3 RADIO WIDE SCANNING

*NOTE: Use radio wide scanning only if two types of channels need to be scanned at the same time such as conventional and SMARTNET/SmartZone. Otherwise, use the more efficient standard scanning because there is less chance of missed calls.*

Radio wide scanning monitors the channels in the preprogrammed radio wide scan list. This list may contain up to 16 channels of any type assigned to any

zone (see scan list description in Section 3.17.1). Radio wide scanning is turned on and off by the RWS option switch as follows. If this switch is not programmed, radio wide scanning is not available.

- To turn radio wide scanning on, press the RWS option switch and "RSCN ON" is briefly displayed. In addition, is displayed the same as with standard scanning.

- To turn radio wide scanning off, press the RWS option switch again and "RSCN OFF" is briefly displayed and is no longer displayed.

- If the zone or channel is changed while radio wide scanning, scanning continues normally.

### 3.16.4 SCAN RESUME DELAY

When a message is received or transmitted while scanning, there is a delay before scanning resumes. The delay after receiving a call prevents another message from being received before a response can be made. The delay after transmitting a call ensures that a response is heard instead of another message occurring on some other channel.

Separate delay times are programmable for radio wide and standard scanning. With radio wide and conventional standard scanning, delays of 0-7.5 seconds are programmable in 0.5-second steps. With SMARTNET/SmartZone standard scanning, a delay of 2-10 seconds can be programmed in 0.5-second steps.

### 3.16.5 TRANSMITTING IN THE SCAN MODE

If the transmitter is keyed while scanning is enabled, transmissions occur on various channels as follows.

Conventional Operation - Transmissions can occur on the priority, selected, or receive channel. Refer to Section 4.11 for more information.

SMARTNET/SmartZone Operation - If scanning is halted to receive a message, programming determines if transmissions occur on the selected or receive channel. Transmissions at other times occur on the selected channel.

### 3.16.6 NUISANCE CHANNEL DELETE

With standard scanning, channels can be temporarily deleted from the scan list, for example, if messages on a channel become annoying. This feature is not available with radio wide scanning. Channels can also be permanently added or deleted by editing the scan list as described in Section 3.17.5. Proceed as follows to temporarily delete a channel:

*NOTE: The selected channel and also conventional priority channels cannot be deleted from the scan list.*

1. While receiving a message on the channel to be deleted, press and hold the SCAN option switch until a tone sounds (approximately 2 seconds).

2. The channel is then deleted and scanning of the remaining channels in the scan list resumes.

3. Deleted channels are added back into the scan list if any of the following events occur:

   - Scanning is turned off and then on again using the SCAN switch.
   - Transceiver power is turned off and then on again.
   - The scan list is reselected by changing channels (SMARTNET/SmartZone) or using the SCAN option switch (conventional).

## 3.17 SCAN LISTS

*NOTE: A scan list is simply the channels that are scanned when scanning is enabled.*

### 3.17.1 STANDARD MODE SCAN LISTS

*NOTE: The selected channel is always scanned.*

With all operating modes, as many standard scan lists as are required can usually be programmed (up to 256). The only limitation is the available memory. Each list can include up to 256 channels/talk groups.

Scan List Select - Refer to "Selecting a Scan List" which follows for information on selecting a scan list.

Scan List Edit - Refer to "Programming a Scan List" which follows for information on editing a scan list.

### 3.17.2 RADIO WIDE SCAN LIST

With radio wide scanning, there is only one scan list and it can include up to 16 channels of any type. For example, it could include six conventional channels and ten SMARTNET/SmartZone channels. The channels in this list are not user programmable.

### 3.17.3 DETERMINING WHICH CHANNELS ARE IN SCAN LIST

Channels in the radio wide and conventional standard scan lists are determined as follows. Channels in the SMARTNET/SmartZone and P25 Trunked standard scan lists are indicated only when editing a list.

1. Enable Standard scanning to view the standard list or Radio Wide scanning to view the radio wide scan list (the procedure is on page 13). Also select the scan list if applicable as described in the following "Selecting a Scan List" description.

2. Select the desired zone and then scroll through the channels by rotating the Select switch. When the displayed channel is in the scan list (scanned normally), the symbol is displayed next to the zone number as shown in the following illustration.


### 3.17.4 SELECTING A SCAN LIST

Conventional Operation - The scan list is user selectable by the SCAN option switch. Refer to Section 4.11 for more information.

SMARTNET/SmartZone/P25 Trunked Operation - The scan list can be temporarily changed if the Scan (List) Select option switch is programmed. Refer to Section 5.11 for more information.

### 3.17.5 EDITING A SCAN LIST

If the SCN ED (Scan Edit) option switch is programmed, standard scan lists can be user edited as follows (all operating modes):

1. Make sure that both standard and radio wide scanning are off (the rotating icon is not indicated in the right status display). Select a conventional, SMARTNET/SmartZone, or P25 Trunked channel corresponding to the scan list being edited.

2. Select the scan list edit mode by pressing the SCN ED option switch. This mode is indicated by a triangle in the upper left corner of the display (see Figure 2-3 on page 8.).

3. If applicable, select the list to be edited by rotating and then pressing the Select switch. The selected scan list is indicated as "LIST x" as described in the preceding section. If user programming is disabled on a list, "NO EDIT" is momentarily displayed and it cannot be edited (conventional channels only).

4. Select the channel you want to add or delete by rotating the Select switch. After the last channel in the current zone is displayed, the first valid channel in the next zone is displayed and vice versa. Lists are limited to 256 channels. If an attempt is made to add more than 256, "LIST FULL" is displayed and a channel must be deleted before another can be added.

   *NOTE: A conventional priority channel cannot be deleted (see Section 4.11.4).*

5. If the selected channel is in the scan list (scanned), the symbol is displayed next to the zone number as described on page 15. To change the scan list status of the displayed channel, press the Select switch.

   With conventional channels only, if the selected scan list is programmed with a fixed priority channel (see Section 4.11.4), the next press of the Select switch makes the current channel the priority channel. The "**P**" is then indicated in the left status display next to the zone number to indicate that it is a priority channel. Pressing the Select switch again takes the channel out of the scan list.

6. To exit this mode and save the changes, press the SCN ED option switch again.

## 3.18 SECURE COMMUNICATION

### 3.18.1 INTRODUCTION

This transceiver may be equipped to provide secure communication on some or all channels. This feature encrypts the voice so that it can be understood only by someone using a transceiver equipped with a similar encryption device and encryption codes.

When a secure call is received or transmitted, is indicated in the display. If equipped with the Clear/Secure option switch and the current channel is programmed to allow switch selection, secure communication can be manually enabled and disabled by that switch. Otherwise, channels are strapped to Clear or Coded operation. Secure communication can be programmed on a per channel basis to operate in various ways. Refer to the following for more information:

### 3.18.2 CONVENTIONAL CHANNELS

On conventional analog channels, the protocol that can be used to provide secure communication is SecureNet™ DES or DES-XL encryption.

On conventional digital (Project 25) channels, the SecureNet DES-OFB protocol is used. In the receive mode, clear and secure messages are always automatically detected.

### 3.18.3 SMARTNET/SMARTZONE AND P25 TRUNKED CHANNELS

On SMARTNET/SmartZone analog channels, SecureNet DES or DES-XL protocol can be selected. On SMARTNET/SmartZone and P25 Trunked digital channels, only the DES-OFB protocol is available. Talk groups can be strapped to Clear, Coded, or Switch selectable, and clear and secure messages are always autodetected.

The following calls require their own encryption key selection: emergency, failsoft, patch, telephone, private, and system-wide.

### 3.18.4 SECURENET

SecureNet is a proprietary Motorola protocol that digitizes the voice and then encrypts it using the DES or DVP algorithm. The SecureNet protocols include the following:

- DVP (Digital Voice Privacy) is an earlier encryption method that is self synchronizing using cipher feedback. It was originally designed to be used by anyone needing protection from unauthorized eavesdropping.

- DES (Data Encryption Standard) provides the highest level of security, and also uses cipher feedback. It was originally designed to be used only by the Federal government.

- DVP-XL/DES-XL - A disadvantage of the DVP and DES encryption types is reduced communication range when compared to clear voice. The DES-XL and DVP-XL methods were designed to provide better range but at the cost of lower voice quality. They use a different type of feedback called counter addressing.

- DES-OFB - A form of DES encryption for digital channels that uses output feedback. This protocol does not result in the degraded range that occurs with analog channels.

The transmission mode (DES/DES-XL) is selected by the programming software for each SecureNet analog channel. If a channel is programmed for DES-XL, it will also receive DES, but transmissions always occur in DES-XL.

### 3.18.5 HARDWARE (ENCRYPTION) KEYS

General

*NOTE: A constant power supply must be connected to the transceiver to maintain the encryption keys in memory. Therefore, if equipped with these keys, do not remove the radio from battery power or disconnect the battery for extended periods (typically 8 hours or more).*

Each SecureNet channel is assigned a hardware key from 0-15. This is the hardware location of the encryption key to be used. The keys in these locations are loaded into the radio using the Motorola or PC key loader. The keyloader converts an input of approximately 20 characters into the “key” that is loaded into

the radio. There is a maximum of 16 keys that can be loaded into the radio at one time.

*NOTE: There is a security feature that automatically erases the encryption keys when the bottom cover is removed. This function is performed by a push button switch S1 on the logic board.*

As stated in the above "NOTE", the transceiver must be connected to an unswitched power source to preserve the encryption keys in memory. However, there is a storage capacitor (C173, 0.22 µF) which maintains the 5-volt supply (and the encryption keys) for a minimum of approximately 8 hours if power is temporarily lost.

If an attempt is made to transmit a secure message without loading the corresponding key, "KEYFAIL" is displayed. The message must then be transmitted in the clear mode (this is possible only if the channel is strapped to "switchable" as described below) or the key must be loaded.

SecureNet Key Selection

*NOTE: This feature is available on conventional channels only.*

When multiple hardware keys are programmed (see preceding information), the Hardware Key Select option switch can be programmed to allow selection of another key for the channel. This feature permanently selects another key for the channel (cycling power or selecting a different channel does not reselect the original key). Therefore, to switch back to the original key, it must be manually reselected. Proceed as follows to select a key:

1. Press the Hardware Key Select switch and HWKEY x is displayed. The "x" indicates the current key selection from 0-15.

2. Rotate the Select switch to display the desired key and then press the Select switch to select it. Press the Hardware Key Select switch again to return the display to normal operation.

### 3.18.6 CLEAR/SECURE STRAPPING

Transmissions on an analog channel are in the clear mode if the channel has been strapped to the clear mode by programming, and in the SecureNet mode if it has been strapped (fixed) to SecureNet. If the channel has been strapped to "switched", the mode is selected by the Clear/Secure option switch. When a message is received or transmitted in the secure mode, is displayed.

If the channel has been strapped "Clear" and the option button selects the "Secure" mode on power up and a transmission is attempted, "Clear Only" is displayed and transmitting is disabled. Conversely, if the channel is strapped "Secure" and the option button selects the "Clear" mode on power up and a transmission is attempted, "Secure Only" is displayed and the transmitter is disabled.

### 3.18.7 460 SCRAMBLING

The 460 Scrambling protocol is a proprietary Transcrypt protocol that is compatible with the stand-alone scrambling option from Transcrypt. The 460 type of scrambling is no longer available with 5300 transceivers.

### 3.18.8 TRANSMIT MODE OPTIONS

The following transmit options are available when SecureNet encryption is selected:

**Clear -** All calls are in the clear mode unless responding to a secure call. If the response is then made within the delay time (see Section 3.16), it occurs in the secure mode.

**Coded -** All calls are made in the selected secure mode.

**Switched -** The mode is selected by the Clear/Secure switch. When the clear mode is selected by this switch, "CLEAR" is flashed, and when the secure mode is selected, "SECURE" is flashed.

### 3.18.9 RECEIVE MODE OPTIONS

With the SecureNet protocol, the following receive options can be programmed:

**No Autodetect -** Only signals coded like the transmit signals are received.

**Secure Autodetect -** Both clear and SecureNet signals are automatically detected. This mode is automatically selected if the transmit mode is switch selectable.

**Proper Key Autodetect -** An incoming SecureNet call is compared against all of the available keys programmed into the radio. If a match is found, the call is decrypted using matched key.

## 3.19 TRANSCEIVER OPERATING MODES

### 3.19.1 GENERAL

Each selectable channel can be programmed for the conventional, SMARTNET/SmartZone, or Project 25 (digital) trunked operating mode. For example, Zone 1/Channel 1 could be a conventional channel, Zone 1/Channel 2 a SMARTNET channel, and so on. Consult your system operator to determine the type or types of operation programmed in your transceiver. More information on these modes follows.

### 3.19.2 CONVENTIONAL MODE

This is a non-trunked operating mode which accesses independent radio channels (there is no automatic access to several channels). Selecting a conventional channel selects a transmit and receive frequency and other channel parameters such as squelch control coding.

Conventional channels can be either standard (analog) or Project 25 (digital). With digital operation, the DSP (Digital Signal Processor) converts the audio signal to digital data which is sent over the air as complex tones. Another difference is that analog channels use Call Guard (CTCSS/DCS) squelch control and Project 25 channels use a NAC (Network Access Code) and talk group ID codes.

With NAC, a number similar to an ID code is transmitted, and for communication to occur, it must match one programmed in the base equipment and the mobile(s) being called. In addition, to receive standard group calls, the receiving mobile(s) must be programmed to detect the transmitted ID code.

With conventional operation, a busy channel condition is detected automatically if the busy channel lockout (transmit disable on busy) feature is programmed. Otherwise, it must be detected manually. An out-of-range condition is not indicated by special tones or messages as with SMARTNET operation because there is no initial data exchange with the repeater that allows this condition to be detected. Operating features unique to conventional channels are described in Section 4.

### 3.19.3 SMARTNET/SMARTZONE MODE

This is a trunked operating mode in which automatic access is provided to several RF channels. ID codes are used to select what mobiles are being called and what calls are received. Monitoring is performed automatically and special messages and tones indicate busy and out-of-range conditions.

SMARTNET and SmartZone operation and programming is very similar. Basically, SMARTNET operation is limited to a single repeater site and SmartZone operation allows automatic roaming between sites. Enhanced features include roaming (SmartZone only), telephone, private, and emergency calls, Call Alert™, and messaging. Either analog or digital signaling may be used.

When a SMARTNET or SmartZone channel is selected or the radio is powered up on one of those channels, it searches for a control channel. Once a control channel is found, the alias (name) of the selected channel is displayed and the radio attempts to register on the radio system. If a control channel could not be found (because of an out of range condition or the system ID is not correct, for example), “NO SYS” is displayed and the radio continues to search for a control channel.

The control channel transmits and receives system information to and from all radios registered on the system. Therefore, once a control channel is found, it is continuously monitored for incoming call information and is used to make call requests. The radio automatically changes to a traffic channel to place and receive calls and then returns to the control channel when the call is complete.

Operating features unique to SMARTNET/SmartZone channels are described in Section 5.

### 3.19.4 P25 TRUNKED MODE

The P25 Trunked operating features are very similar to the SmartZone type just described. Therefore, these modes plus SMARTNET are all described in the same section (Section 5). Some diffferences between the P25 Trunking and SmartZone modes are as follows:

- Digital signaling is always used with P25 calls. Either analog or digital signaling may be used for SmartZone calls.
- Calls made to a specific mobile in the P25 mode are called Unit Calls. In the SmartZone mode they are called Private Calls.
- Messaging is not available with P25 calls.
- P25 Trunked telephone calls are not be available until a future release.
- The P25 control channel data rate is 9600 baud and the digital voice data rate is also 9600 baud. With SmartZone operation, the control channel data rate is 3600 baud (both digital and analog calls) and the narrowband digital voice data rate is 9600 baud.
- The P25 mode uses a system ID, a Wide Area Communications Network (WACN) ID, and an RF Subsystem ID (RFSS). The SmartZone mode does not use the WACN and RFSS IDs.
- P25 Unit IDs can be 1-16,777,215 (000001-FFFFFF hex) and SmartZone Unit IDs can be 1-65,535 (0001-FFFF hex).

# SECTION 4 CONVENTIONAL FEATURES

## 4.1 INTRODUCTION

An overview of the conventional operating mode is located in Section 3.19.2. The following information describes the features unique to conventional standard (analog) and Project 25 (digital) operation. Refer to the preceding “General Operation” section (Section 3) for information on features common to all operating modes.

## 4.2 MONITORING BEFORE TRANSMITTING

With conventional operation, you may need to manually monitor the channel before transmitting to make sure that it is not being used by someone else. If you were to transmit while someone else was using the channel, you would probably disrupt their conversation. With the trunked operating modes, channel monitoring is performed automatically. Monitor conventional channels automatically or manually as follows:

Automatic Channel Monitoring

If the selected channel is programmed for Busy Channel Lockout (also called Transmit Disable On Busy) feature, monitoring is performed automatically. Refer to Section 4.4 for more information on this feature.

Manual Channel Monitoring

The automatic monitoring just described may occasionally disable the transmitter when the channel is not in use, such as when the repeater has extended hang time. In this case, you may not want to use it and the channel must then be monitored manually as follows:

**Busy Indicator** - With scanning disabled, note if the multi-function indicator on the front panel is steady green. If it is not, the channel is not being used and you can transmit your call. If it is green, a carrier is being detected, so the channel may be busy (see next paragraph).

**Monitor Mode** - There may be times when the busy indication is displayed even though no one is using the channel. Monitoring should then be performed by disabling Call Guard squelch (or group ID detect on P25 channels). This is usually done by selecting the Monitor Mode (see following).

## 4.3 MONITOR MODE

The monitor mode unsquelches the receiver even if a carrier is not detected. Therefore, it can be used for such things as monitoring a channel for all activity

before transmitting or improving reception when intermittent squelching makes messages hard to understand. Other Monitor mode features are as follows:

- Call Guard (CTCSS/DCS) squelch is disabled on analog channels and NAC and group ID detect are disabled on P25 (conventional) channels.
- Busy Channel Lockout is overridden (see next section)
- Scanning temporarily halts

The Monitor Mode is selected as follows:

1. Briefly press the MON option switch (if available). The display then indicates “MON” (see Figure 2-3 on page 8) and the receiver unsquelches.

2. To disable the monitor mode and return to normal operation, press the MON option switch again.

3. In the scan mode, pressing and holding the MON option switch monitors the scanned channel instead of the selected channel (if it is different).

Taking the microphone off-hook also selects the Monitor mode if off-hook detection is enabled (see Section 3.15). Pressing the SEL SQ option switch disables Call Guard squelch/P25 group ID detect but not scanning and P25 NAC detect (see Section 4.5).

## 4.4 BUSY CHANNEL LOCKOUT

The Busy Channel Lockout (also called Transmit Disable on Busy) feature automatically disables the transmitter if the channel is busy when the PTT switch is pressed. When the transmitter is disabled by this feature, “BUSY” is displayed, a busy tone sounds, and the transmitter is disabled.

The Busy Channel Lockout feature can be programmed to operate as follows. Each conventional channel can be programmed differently.

**Off -** Busy channel lockout is disabled and the transmitter keys even if the channel is busy.

**Noise -** If a carrier is detected on the channel, the transmitter is disabled when the PTT switch is pressed.

**Tone (NAC) -** If an incorrect Call Guard (CTCSS/DCS) or P25 NAC code (see Section 1.4) is detected, the transmitter is disabled when the PTT switch is pressed. An incorrect code is any code other than the one programmed for the current channel.

If Busy Channel Override is permitted by programming, it is possible to transmit even when the transmitter is disabled by this feature. Simply release the PTT switch and then quickly press it again.

## 4.5 CALL GUARD SQUELCH

### 4.5.1 INTRODUCTION

Tone or digital Call Guard squelch (also called CTCSS/DCS signaling) can be programmed on each conventional analog transmit and receive channel in any order desired. The reverse burst and turn-off code are always transmitted and also detected on channels programmed with Call Guard squelch.

The Call Guard squelch feature eliminates distracting messages intended for others using the channel. This is done by using a subaudible tone or digital code to control the squelch. This tone or code is unique to a user or a group on that channel. This tone or code is transmitted with the voice signal but is not heard because it is in the subaudible range and is attenuated by a filter. Call Guard squelch must be used in both the transmitting and receiving transceiver to be functional.

### 4.5.2 CALL GUARD SQUELCH ENABLE/ DISABLE

The SEL SQ option switch (if programmed) can be used to disable receive Call Guard squelch on analog channels or group ID code detect on P25 channels. When selective squelch is disabled, “NORMAL” is flashed in the display, and when it is enabled, “SELECTIVE” is flashed.

When “Normal” is selected, the receiver unsquelches only if a carrier is detected, and scanning and P25 NAC detection are not disabled. The selected mode remains in effect until it is manually changed. Selecting another channel or cycling power does not reselect a default condition.

### 4.5.3 TONE CALL GUARD SQUELCH

Tone-type Call Guard squelch utilizes subaudible CTCSS tones from 67-254.1 Hz. Although there are 42 tones assigned, those above 33 (210.7 Hz) are normally not used because of their close proximity to the voice band which starts at 300 Hz. In addition, tones 11 (97.4 Hz), 39 (69.3 Hz), 40 (206.5 Hz), 41 229.1 Hz), and 42 (254.1 Hz) are normally not used because they may cause interference with adjacent tones.

A reverse burst is transmitted when the push-to-talk switch is released and also detected when calls are received. It is a 180-degree phase reversal for a period of time determined by the tone frequency, and it eliminates the squelch tail (noise burst) in the receiving transceiver. Both the transmitting and receiving transceiver must be equipped with this feature for it to be utilized.

### 4.5.4 DIGITAL CALL GUARD SQUELCH

Digital Call Guard squelch (CDCSS) uses digital data instead of subaudible tones to control the squelch. This data consists of continuous repetitions of 23-bit words. No bit or word synchronization information is used. When the push-to-talk switch is released, a turn-off code is transmitted which eliminates the squelch tail similar to the reverse burst.

Although there are thousands of possible code combinations with 23 bits, only 83 are unique with the data scheme used. The number specified when the code is programmed is actually a seed for a special algorithm used to generate the 23-bit data word. The data is transmitted at a rate of 134.4 bits per second. Therefore, approximately six words are transmitted each second. When the data is decoded, 23-bit samples are taken and then the bits are rotated to determine if a valid code was received.

### 4.5.5 SELECTING CALL GUARD CODE

*NOTE: Call Guard codes may be permanently reprogrammed by keypad programming (see Section 4.14).*

A different CTCSS/DCS/NAC squelch code can be temporarily selected if the Squelch Code Select option switch and a CTCSS/NAC code list have been programmed. This feature allows the normal transmit and receive Call Guard programming to be temporarily overridden with a code selected from this list.

The CTCSS/DCS/NAC list is programmed with up to sixteen tone (CTCSS) or digital (DCS) Call Guard codes. In addition, for operation on Project 25 channels, each position can be programmed with an NAC code.

When the Call Guard code is changed using this feature, it remains selected even if other channels are selected. When scanning, the selected code also applies to all scanned channels. If both analog and digital (Project 25) channels can be selected or scanned, the CTCSS/DCS code for the selected position is used for analog channels and the NAC code for the selected position is used for P25 channels. If a channel is programmed for mixed mode operation, the selective squelch type (analog or digital) programmed for the transmit mode determines the selective squelch type used.

Proceed as follows to select a preprogrammed Call Guard code:

1. Press the Squelch Code Select option switch and then rotate the Select switch to select the desired position. The display indicates “SEL SQ xx” where, “xx” is the selected code from 1-16.

2. To select the displayed code and return to the normal display, press the Squelch Code Select switch again.

3. To check which code is selected, press the Squelch Code Select switch once to display the current selection and then again to return to normal operation.

4. To return to the normal selective squelch codes, select “DEFAULT” in this mode. The normal codes are also automatically reselected whenever transceiver power is cycled or a talk-around channel is selected.

## 4.6 PENALTY TIMER

A penalty timer may be programmed on conventional channels to prevent transmissions for a short period of time after the time-out timer disables the

transmitter (see Section 3.9). The penalty timer starts when the PTT switch is released after the transmitter has been disabled. If the PTT switch is pressed during the penalty time, the time-out indication occurs again. When the penalty timer expires, a beep sounds and the transmitter can then be keyed.

## 4.7 CONVERSATION TIMER

A conversation timer can be programmed on conventional systems in addition to the time-out timer (see Section 3.9). This timer limits that total length of a conversation rather than just the length of each transmission as with the time-out timer. The following is more information on this timer.

- It can be programmed for times up to 7.5 minutes.
- It is reset when the time between transmissions exceeds the time programmed for the penalty timer.
- A warning beep sounds 5 seconds before this timer disables the transmitter.
- When this timer disables the transmitter, a continuous tone sounds and the red transmit indicator turns off. The PTT switch must then be released until the penalty timer expires (indicated by a beep).

## 4.8 REPEATER TALK-AROUND

Normally, all transmissions go through a repeater which usually increases range. However, there may be times when a mobile is out of range of the repeater and therefore unable to talk to anyone even though the mobile being called is only a short distance away. To allow communication in this situation, repeater talk-around can be selected. Transmissions then occur on the receive frequency which permits direct mobile-to-mobile communication.

Repeater talk-around can be selected if the RTA option switch is programmed. When talk-around is enabled by this switch, “RTA ON” is flashed in the display, and when it is disabled, “RTA OFF” is flashed. This feature remains enabled during scanning, and changing channels or turning power off does not change the selected condition. Talk-around is available on conventional channels only.

## 4.9 DISPLAYING TRANSMIT/RECEIVE FREQUENCY

If the DISP option switch is programmed, it can be used to display the channel frequency in megahertz. Pressing this switch toggles between displaying the standard channel alias and the frequency. The receive frequency is displayed while receiving and the transmit frequency is displayed while transmitting. This feature is available on conventional channels only.

## 4.10 EMERGENCY MODE

An EMER option switch may be programmed on conventional channels to alert a dispatcher or someone else of an emergency condition.

When this switch is pressed with a Project 25 (digital) channel selected, all transmissions have the emergency flag set. Scanning is disabled and the transceiver remains in the emergency mode until power is cycled.

Emergency conditions are not transmitted when an analog channel is selected. However, if it is pressed on an analog channel and a Project 25 channel is selected before power is turned off, the emergency condition is transmitted on the Project 25 channel as just described.

## 4.11 CONVENTIONAL MODE SCANNING

### 4.11.1 GENERAL

Channel scanning features common to all operating modes are described in Sections 3.16 and 3.17. The following information describes features unique to conventional operation.

### 4.11.2 SELECTING A SCAN LIST

Conventional mode scan lists are selected by repeatedly pressing the Scan option switch. For example, if three scan lists are programmed, the first press of the Scan switch activates scanning and scan list 1, the second press activates scan list 2, the third press activates scan list 3, and the fourth press disables scanning and then the cycle repeats. The currently selected scan list is flashed in the display as “SCAN

LIST x", where "x" is the scan list number. Scanning is disabled when "SCAN OFF" is displayed and the scanning indicator turns off.

### 4.11.3 TRANSMITTING IN SCAN MODE

Each conventional scan list can be programmed for one of the following modes. These modes determine if priority sampling occurs and also the channel on which transmissions occur while scanning. Refer to the next section for more information.

**No Priority -** No priority channel sampling occurs when the list is selected. The radio transmits on the selected channel.

**Priority/Tx Priority -** Priority sampling occurs and the priority channel is the one programmed in the selected scan list. The radio transmits on the priority channel.

**Priority/Tx Selected -** Priority sampling occurs and the priority channel is the one programmed in the selected scan list. The radio transmits on the selected channel.

**Priority on Selected -** The priority channel is always the selected channel. The radio transmits on the selected channel.

**Talkback -** No priority sampling occurs. The radio transmits on the channel of a call while scanning is halted. Then once scanning resumes, it transmits on the selected channel.

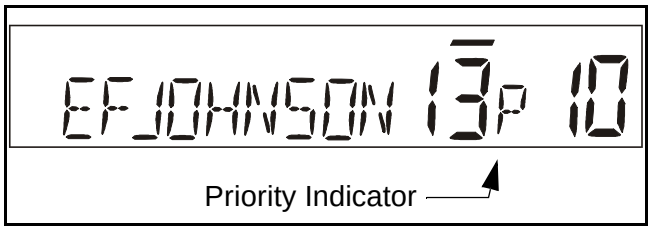
### 4.11.4 PRIORITY CHANNEL SAMPLING

*NOTE: The following describes priority sampling when scanning conventional channels. Priority sampling when scanning SMARTNET/SmartZone/P25 Trunked channels is described in Section 5.11.2.*

General

The priority channel sampling feature ensures that when listening to messages on a non-priority channel when standard scanning, messages on the priority channel are not missed. The transceiver can be programmed as just described so that the priority channel is a fixed channel programmed in the current scan list, the currently selected channel, or not used.

When scanning and the selected channel is a priority channel, (***selected and preprogrammed??***)"**P**" is indicated in the left status display next to the zone number as follows:




The conventional priority channel is sampled only when scanning conventional channels. It does not occur with radio-wide scanning, when listening to a SMARTNET/SmartZone/P25 Trunked call, or when transmitting. A series of "ticks" may be heard when the priority channel is sampled while listening to a message on some other conventional channel.

The priority sampling times are programmed by the following parameters:

**Lookback Time A -** This time determines how often the priority channel is checked for activity. Times of 0.25-4.00 seconds in 0.25-second steps can be programmed.

**Lookback Time B -** This time determines how often the priority channel is checked once an incorrect Call Guard (CTCSS/DCS) or NAC code is detected. Since it takes much longer to detect an incorrect Call Guard signal than a carrier, this time should be relatively long to prevent the interruptions from making a message difficult to understand. Times of 0.5-8.0 seconds can be programmed in 0.5-second steps.

Changing The Priority Channel

*NOTE: The priority channel can also be changed when editing a scan list as described on Section 3.17.5.*

If a specific priority channel is associated with the current scan list, it can be changed if the PRI SEL option switch is programmed. Proceed as follows:

1. Make sure that both standard and radio wide scanning are off (the rotating icon is not indicated in the right status display).

2. Select the channel that you want to be the priority channel using the Select switch in the normal manner. If the channel is in a different zone, also select the appropriate zone.

3. Press the PRI SEL option switch and "P" is indicated in the left status display as just described to indicate that the selected channel is now the priority channel.

## 4.12 STANDARD CONVENTIONAL CALLS

Standard conventional calls can be placed to other mobile units monitoring the selected channel. The proper coded Call Guard squelch tone or code may need to be transmitted by your transceiver for them to receive your call (see Section 4.5).

Placing a Standard Conventional Call

1. Turn power on and set the volume as described in Section 3.1 on page 9. Select the channel programmed for the mobile you want to call (see Section 3.6 on page 10).

2. Monitor the channel automatically or manually as described in Section 4.2 on page 19.

3. Press the PTT switch and the call proceeds as follows:

   - If the Busy Channel Lockout feature is programmed on the channel, the transmitter is automatically disabled if the channel is busy (see Section 4.4).

   - Otherwise, busy and out-of-range conditions are not indicated and speaking can begin after monitoring the channel.

4. Press (and hold) the PTT switch to talk and release it to listen. When the call is finished, place the microphone back on-hook.

Receiving a Standard Conventional Call

1. Select or scan the channel programmed for the call you want to receive (refer to Section 4.11 for more scanning information).

2. When the call is received, take the microphone off-hook and press the PTT switch to talk and release it to listen. If scanning, you may have to respond before scanning resumes to ensure that the response occurs on the channel of the call.

3. When the call is finished, place the microphone back on-hook.

## 4.13 PROJECT 25 MODE FEATURES

### 4.13.1 VIEWING INDIVIDUAL ID

Each transceiver which operates on Project 25 (digital) channels is assigned an eight-digit individual ID. This number is unique for each transceiver and can be any number from 1-16,777,216. When power is turned on with a Project 25 channel selected, this ID is briefly displayed.

### 4.13.2 GROUP IDS

Each Project 25 channel is programmed with a group ID that determines which group of mobiles will receive the call. A call is received on a channel if a selected or scanned channel is programmed with that group ID and the correct NAC is detected (see following). Group IDs can be any number from 0-65,535. Group ID detect can be disabled by the Normal/Selective squelch function described in Section 4.5.

### 4.13.3 CODED SQUELCH

Project 25 conventional channels also use a NAC (Network Access Code) to control which calls are received on a channel. The NAC can be 0-4095, and each transmit and receive channel can be programmed for a different code. Other operation, such as monitoring before transmitting, is similar to that of standard analog channels. NAC (and group ID) detect can be disabled by the monitor mode described in Section 4.3.

### 4.13.4 CHANGING TALK GROUP ASSIGNED TO A CHANNEL

Group calls are placed by simply selecting the channel programmed for the desired group, monitoring the channel if required, and transmitting. If the TG SEL option switch is programmed, the talk group assigned to a channel can be changed by the user. The new talk group continues to be assigned to the channel even after radio power is cycled or another channel is selected. To change a channel talk group, proceed as follows:

1. Select the channel to be changed and then press the TG SEL option switch.

2. Rotate the Select switch to display the talk group to be assigned to that channel. Talk groups are indicated by a unique identification in the alphanumeric display.

3. To select that talk group and return to normal operation, press the TG SEL switch again or press the Select switch. If talk group selection has been disabled on the channel by programming, the talk group does not change, "NO LIST" is displayed, and a tone sounds.

### 4.13.5 UNIT (INDIVIDUAL) CALLS

Unit calls (also called Individual Calls) can be placed to a specific radio on Project 25 channels If the CALL option switch is programmed. Only the individual ID of the target radio is sent (a talk group ID is not sent). The mobiles that can be called are preprogrammed in the unit call list.

To receive a unit call, the RF channel of the call must be selected or scanned and the correct NAC and unit ID must be detected. The ID of the calling radio is then transmitted back. To respond to the call, the transceiver must be programmed with the unit ID option switch, and have a Unit Call programmed with the ID of the calling mobile.

Place and receive a Unit Call as follows:

1. To transmit a unit call, press the CALL option key. The alias (tag) of the last Unit Call is displayed.

2. If required, rotate the Select switch to display the desired call. The alias and ID of the unit calls that have been programmed are alternately displayed.

3. Press and then release the PTT switch. Ringing is then heard and "WAIT" displayed to indicate that the mobile is being rung. To disable this ringing but not the call, briefly press the PTT switch again. Ringing occurs for 20 seconds or until the call is answered, whichever occurs first.

4. When a unit ID call is received, two beeps sound (if tones are enabled), and "Call Rcvd" and the alias or frequency of the currently selected talk group are alternately flashed.

   The transceiver may also be programmed to display the alias of the channel on which the call is being received (if it is not the same as the selected channel) and/or the ID of the mobile placing the call.

5. To respond, select the Unit Call mode by pressing the CALL option key. The following operation then occurs:

   - If a unit call has been programmed with the ID of the calling mobile, it is automatically selected. A response can then be made without changing the selected channel.

   - If no Unit Call has been programmed with the ID of the calling mobile, a response may have to be made in the standard mode.

If the call timer times out (set by programming) or the channel is changed before a response is made, the unit call mode is exited.

## 4.14 KEYPAD PROGRAMMING

*NOTE: The Keypad programming feature is available to Federal Government users only. Users regulated by the Federal Communications Commission are not allowed to have this feature.*

### Introduction

Keypad programming is available on Federal radios if the PROG option key is programmed. It is

then selected by simply pressing that switch (password entry is not required). The keypad programming mode is indicated by “CHNG ZONE” and a triangle in the display as follows:


Keypad programming allows conventional channel parameters such as the transmit and receive frequency and Call Guard squelch code to be changed. In addition, several conventional mode timers can be changed. It cannot be used to reprogram disabled channels or P25 Trunked and SMARTNET/SmartZone information.

### 4.14.1 MENU STRUCTURE

A menu system is used to select parameters to be changed in the keypad programming mode. Rotate and press the Select switch to scroll through and select the available parameters which are as follows. Refer to the descriptions which follow for more information:

- **CHNG ZONE**
- **CHNG CHAN**
- **SYS PARMS**
- **CHAN PARMS**

Press the Select switch to select the displayed parameter. Pressing the Keypad Programming option switch from one of the main menus exits keypad programming. Pressing it from other menus returns to the previous menu. A flowchart showing the keypad programming mode menu structure follows.

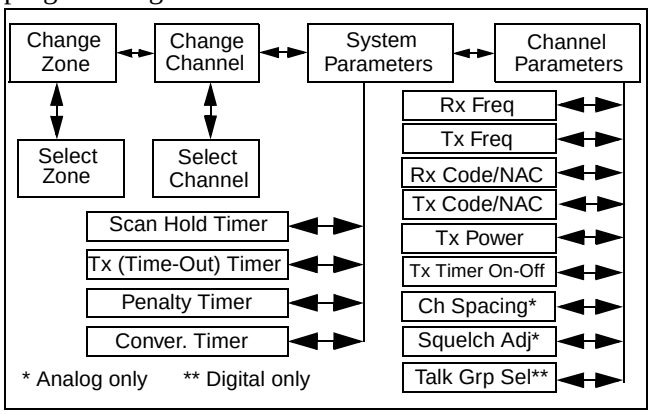



**Figure 1 Keypad Programming Menu Flowchart**

### 4.14.2 ZONE PASSWORD

Your transceiver may be programmed so that a special password must be entered before the system and channel parameters of a particular zone can be changed. A different password may be required for each zone. The first time a system or channel parameter of a password-protected zone is selected by keypad programming, “ENTER PSWD” is flashed. The eight-digit password must then be entered by rotating and pressing the Select switch. After the correct password is entered, the parameters for that zone can be reprogrammed normally.

### 4.14.3 ZONE CHANGE PARAMETER

The “CHNG ZONE” menu parameter selects the zone containing the conventional channel to be reprogrammed. It does not change the zone selected for normal operation.

Press the Select switch to select the “CHNG ZONE” parameter and then scroll through the programmed zones by rotating that switch. When the desired zone is displayed, select it by pressing the Select switch.

### 4.14.4 CHANNEL CHANGE PARAMETER

The “CHNG CHAN” menu parameter selects the conventional channel to be reprogrammed. Disabled or P25 Trunked/SMARTNET/SmartZone channels cannot be selected. This does not change the channel selected for normal operation.

Press the Select switch to display “CHAN CHG” and then scroll through the programmed channels by rotating that switch. When the desired channel is displayed, select it by pressing the Select switch.

### 4.14.5 SYSTEM PARAMETERS

*NOTE: If “ENTER PSWD” is displayed, the zone password must be entered as described in the preceding “Zone Password” description before parameters can be selected.*

The “SYS PARMS” menu parameter selects the conventional mode timer to be reprogrammed (see following). Press the Select switch to select “SYS PARMS” and then rotate that switch to display the

desired parameter. Then press the Select switch again to select it.

**SCAN TIMER -** Selects the Scan Hold timer. Rotate the Select switch to decrement/increment the timer in 0.5-second steps ("0" disables it). When the desired value is displayed, store it by pressing the Select switch.

**TX TIMER -** Selects the transmit time-out timer. Rotate the Select switch to decrement/increment the timer in 15-second steps ("0" disables it). When the desired value is displayed, store it by pressing the Select switch.

**PEN TIMER -** Selects the penalty timer. Rotate the Select switch to decrement/increment the timer in 15-second steps ("0" disables it). When the desired value is displayed, store it by pressing the Select switch.

**CONV TIMER -** Selects the conversation timer. Rotate the Select switch to decrement/increment the timer in 30-second steps ("0" disables it). When the desired value is displayed, store it by pressing the Select switch.

### 4.14.6 CHANNEL PARAMETERS

*NOTE: If "ENTER PSWD" is displayed, the zone password must be entered as described in the preceding "Zone Password" description before parameters can be selected.*

The "CHAN PARMS" menu parameter selects the following conventional channel parameters that can be reprogrammed. Press Select switch to select the "CHAN PARMS" parameter and then rotate that switch to display the desired parameter. Then press the Select switch again to select it.

**RX FREQ -** Sets the receive channel frequency. To select the digit to change or move the cursor to the right, press the Select switch. Then to display the desired digit, rotate the Select switch. The frequency is stored after programming the last digit. If an invalid frequency is entered, a beep sounds, "INVALID" is briefly displayed, and the frequency editing mode continues to be selected.

**TX FREQ -** Selects the transmit frequency the same as RX FREQ above.

**Squelch Control (Analog Channel)**

**RX CODE -** Sets the receive Call Guard (CTCSS/DCS) code. Rotate the Select switch to select the desired type (CTCSS and DCS). Then press and rotate the Select switch to select the desired code. The displayed code is stored after the last digit is programmed. If an invalid code is entered, a beep sounds, "INVALID" is briefly displayed, and the editing mode continues to be selected.

**TX CODE -** Selects the transmit codes the same as RX CODE above.

**Squelch Control (Project 25 Channel)**

**RX NAC -** Selects the Network Access Code (NAC) which can be any number from 0-4095. Rotate and press the Select switch to enter the desired code. The displayed code is stored after the last digit is programmed. If an invalid code is entered, a beep sounds, "INVALID" is briefly displayed, and the NAC editing mode continues to be selected.

**TX NAC -** Selects the transmit NAC the same as RX NAC above.

**TX POWER -** Selects the desired power output level. Rotate the Select switch to scroll through the following choices. When the desired setting is displayed, store it by pressing the Select switch.

- POWER HI - High transmit power
- POWER LO - Low transmit power
- POWER SW - Switchable power selectable by the High/Low power switch. This choice is not available if that switch is not programmed.

**TX TIMER -** Enables or disables the time-out timer on the current channel. Rotate the Select switch to toggle between the on and off mode, and when the desired setting is displayed, store it by pressing the Select switch.

**CHAN SPACE (Analog Only) -** Selects either wide or narrow band channel spacing on analog channels

only. Rotate the Select switch to toggle between "WIDE" and "NARROW", and when the desired setting is displayed, store it by pressing the Select switch.

**SQ ADJUST (Analog Only) -** Changes the preset squelch setting on that channel. The default setting is "0" and values of –7 to +7 can be selected. Increasing this setting toward +7 causes the squelch to open sooner so that weaker signals can be received, and decreasing it toward –7 causes the opposite to occur.

**TG ID (P25 Only) -** Selects the talk group for the selected channel. Rotate the Select switch to display the alias of each preprogrammed talk group and then press it to store the desired talk group.

# SECTION 5 SMARTNET/SMARTZONE/P25 TRUNKED FEATURES

## 5.1 INTRODUCTION

An overview of the SMARTNET/SmartZone and P25 trunked operating modes is located in Section 3.19.3. The following information describes the features unique to these modes of operation. Refer to the "General Operation" section starting on page 9 for information on features common to all operating modes.

## 5.2 VIEWING UNIT ID

When power is turned on with a SMARTNET/ SmartZone trunked channel selected, the 5-digit Unit ID is briefly displayed as IDxxxxx. When a P25 channel selected, the 8-digit unit ID from 1-16,777,216 is displayed (see Section 4.13.1).

## 5.3 STANDARD GROUP CALLS

Standard calls are between you and another mobile, group of mobiles, or a control station (a radio in a fixed location). Most calls are probably this type. Proceed as follows to place and receive these calls.

A SMARTNET/SmartZone channel may be programmed with a Talk Group and/or Announcement Group ID plus an Emergency ID. When a call is received on a channel programmed with both Talk and Announcement groups, only the Talk and Announcement group IDs are detected. Other IDs in the Announcement group are detected only if no talk group is programmed. The emergency ID is used for the emergency alarm and call (see Section 5.9). Proceed as follows to place and receive group calls:

Placing a Standard Group Call

1. Turn power on and set the volume as described in Section 3.1 on page 9. Select the channel programmed for the talk group you want to call (see Section 3.6 on page 10). A regular or announcement talk group can be selected.

2. If the talk group is programmed for encryption and is not strapped to Clear or Coded, select the desired mode by pressing the Clear/Secure option switch. The status of that switch is ignored if the talk group is strapped to Clear or Coded. Refer to "Secure Communication" on page 16 for more information.

3. Press the PTT switch and begin talking. A talk permit tone may sound to indicate when talking can begin. Other indications that may occur are as follows:

- If in the secure mode and your transceiver is not programmed with the proper encryption key, "KEYFAIL" is displayed and the call must be made in the clear mode or the proper key must be programmed.

- If the busy tone sounds and "BUSY" is displayed, the system is busy. Release the PTT switch and wait for the call back tone to sound. Then press the PTT switch within 3 seconds.

- If a continuous tone sounds and "NO SYS" is displayed, you may be out-of-range. Drive closer or away from shielding objects and try again.

- If your unit ID is invalid, the call is being made to an invalid group ID, or group calls are not enabled, “DISABLED ID” is displayed and an alert tone sounds.

- If an attempt is made to change an analog channel from the clear to the secure mode and there is no available secure channel, “NO SEC” is flashed and the call continues in the clear mode.

- If an attempt is made to change and analog channel from the secure to the clear mode, “SEC ONLY” is displayed and the call continues in the secure mode. (Calls on digital channels can be changed if they are not fixed in the clear or secure mode.)

- If the Secure mode is selected by the Secure/Clear option switch and an attempt is made to transmit on a channel fixed as Clear, “Clear Only” is displayed and the transmitter is disabled. Likewise, “Secure Only” is displayed when attempting to transmit in the Clear mode on a channel fixed as Secure.

Receiving a Standard Group Call

Group calls are automatically received if a SMARTNET/SmartZone channel is selected. The display alternates between the selected channel tag (alias) and the received talk group tag. The transceiver may also be programmed so that the individual ID of the mobile placing the call is briefly displayed before this information.

## 5.4 PRIVATE (UNIT) CALLS

*NOTE: With P25 Trunked operation, these calls are called Unit Calls.*

### 5.4.1 GENERAL

Private calls allow you to place a call to a specific mobile unit. With SMARTNET/SmartZone operation, Either the Enhanced Private Conversation™ or Standard Private Conversation mode may be programmed depending on the capabilities of the radio system. ***With P25 Trunked operation, Unit Calls operate the same as the Enhanced Private Conversation mode.???***

Operation in both the standard and enhanced modes is described in the following information. The CALL option switch is required to place these calls, and either that switch or the RESP (Response) switch is required to receive them. Proceed as follows.

### 5.4.2 PLACING AN ENHANCED PRIVATE CONVERSATION CALL AND P25 UNIT CALL

1. Momentarily press the CALL (Private/Unit Call) option switch. The tag (alias) of the last called mobile is displayed.

2. To select another mobile, rotate the Select switch until the alias for the desired mobile is displayed.

3. Press the PTT switch and one of the following events then occurs:

   - If the mobile being called is on the air, “WAIT” is displayed and ringing is heard until the called party answers or for 20 seconds, whichever occurs first. Pressing the PTT or an option switch stops the ringing but not the call. When the call is answered, the voice of the called party is heard.

   - If the called mobile does not answer within 20 seconds, a continuous tone sounds and “NO ANS” is displayed.

   - If the called mobile is not on the air, a continuous tone sounds instead of the ringing tone and “NO ACK” is displayed.

   - If the busy tone sounds and “BUSY” is displayed, the called mobile has answered the call but the system is busy. When the system is no longer busy, the call back tone sounds.

   - If your transceiver or the called transceiver is inhibited or not programmed to make this type of call or for the requested secure mode, “RSPNS ONLY” is displayed and an alert tone sounds.

   - If your transceiver does not have the proper encryption key, “KEYFAIL” is displayed and the call must be made in the clear mode by pressing the C/S (Clear/Secure) option switch (if encryption is selectable on the channel). Otherwise, the correct key must be loaded.

4. When the call is finished or is not answered, end it by pressing the CALL option switch and placing the microphone back on-hook.

### 5.4.3 PLACING A STANDARD PRIVATE CONVERSATION CALL

1. Momentarily press the CALL (Private Call) option switch. The tag (alias) of the last called mobile is displayed.

2. To select another mobile, rotate the Select switch until the tag for the desired mobile is displayed.

3. Press the PTT switch and one of the following events then occurs:

   - The called party answers the call.

   - The called party does not answer. Press the CALL option switch to end the call.

   - If the selected mobile ID is not valid, “INVALID ID” is displayed and an alert tone sounds.

   - If the radio system is busy, four low tones sound and “BUSY” is displayed. When the system is no longer busy, the call back tone (four beeps) is heard and the channel is automatically acquired. Press the PTT switch to continue the call.

   - If the call is in the secure mode and your transceiver does not have the proper encryption key, “KEYFAIL” is displayed and the call must be made in the clear mode by pressing the C/S (Clear/Secure) option switch (if encryption is selectable on the channel). Otherwise, the correct key must be loaded.

4. When the call is finished or if it is not answered, end it by pressing the CALL option switch and placing the microphone on-hook.

### 5.4.4 RECEIVING A PRIVATE OR UNIT CALL (ALL TYPES)

1. When a private call or P25 Trunked unit call is received, “CALL RCVD” is displayed and a recurring call tone sounds.

2. To answer the call, press the CALL (Private/Unit Call) option switch and then the PTT switch and begin speaking. The unit ID of the calling mobile is displayed. More information follows:

   - If the PTT switch is pressed before the CALL switch, the call is transmitted as a group call.

   - If private calls are not permitted (CALL switch not programmed) press the RESP (Call Response) option switch to respond.

   - The call must be answered within 20 seconds or it is automatically terminated.

   - If the system is busy when a response is made, “BUSY” is displayed and the busy tone sounds.

## 5.5 TELEPHONE CALLS

### 5.5.1 GENERAL

*NOTE: Telephone calls are currently not available in the P25 Trunked mode.*

Telephone calls allow you to place and receive calls over the public telephone system using your transceiver. The type of call (secure/clear) is determined by the mode selected by the C/S (Clear/Secure) option switch. Telephone calling is programmed to operate in one of the following modes:

- Disabled (telephone calls not available)
- Answer-only capability
- Telephone numbers can be selected from a preprogrammed list only (direct dialing is not available)

### 5.5.2 PLACING A TELEPHONE CALL

1. With a SMARTNET/SmartZone channel selected, momentarily press the PHONE option switch. The tag (alias) of the last called telephone number is displayed.

2. If required, rotate the Select switch to display the desired number. The tag of each number is displayed.

3. Press and then release the PTT switch and “DIALING” is displayed. One of the following conditions then occur:

- If the access is successful, a dial tone sounds and the dialed number is displayed and sent. Either ringing or a busy signal is then heard as with a standard telephone call. When the called party answers, press the PTT switch to talk and release it to listen (since the transceiver operates half-duplex, it is not possible to talk and listen at the same time).

  Each time the PTT switch is released, a go-ahead tone is sent to the landside party to indicate when they can respond. To dial a number after the connection is made, press the PTT switch and dial the number using the microphone keypad (if available).

- If the selected telephone number is not valid, "INVALID" is displayed and an alert tone sounds. Select a valid number.

- If the system is busy, "BUSY" is displayed and the busy tone sounds. The call will automatically proceed when the system becomes available.

- If you are out-of-range or the radio cannot be accessed for some reason, "NO PHONE" is displayed and an alert tone sounds.

- If the interconnect call you are making or the selected secure mode is not authorized, "REJECT" is displayed and an alert tone sounds.

- If your transceiver does not have the proper encryption key, "KEYFAIL" is displayed and the call must be made in the clear mode by pressing the C/S (Clear/Secure) option switch (if encryption is selectable on the channel). Otherwise, the correct key must be loaded.

4. When the telephone call is finished or it could not be completed for some reason, end it by pressing the PHONE option switch and placing the microphone back on-hook.

### 5.5.3 RECEIVING A TELEPHONE CALL

1. When a telephone call is received, "ringing" similar to a standard telephone is heard and "PHONE" is displayed.

2. To answer the call, press the PHONE option switch and press the PTT switch to talk and release it to listen (since the transceiver operates half duplex, it is not possible to talk and listen at the same time).

3. When the call is finished, end it by pressing the PHONE option switch and placing the microphone back on-hook.

## 5.6 CALL ALERT

The Call Alert™ feature allows pages to be sent and received. With SMARTNET/SmartZone operation, either the Enhanced Private Conversation™ or Standard Private Conversation mode may be programmed depending on the capabilities of the radio system. With P25 Trunked operation, operation is similar to the enhanced mode.

Answering a Page

1. When a page is received, four beeps sound and "PAGE" is displayed. The ID of the mobile paging you is stored as the last ID received.

2. To clear or ignore the page, press any option switch. If the PTT switch is pressed, a group call is placed on the selected channel.

3. To answer the page as a private or unit call (see page 29), press the CALL (Private/Unit Call) option switch and the tag (alias) of the mobile paging you is displayed. Press the PTT switch and respond. One of the conditions that follow may also occur:

*NOTE: P25 trunked pages operate the same as this enhanced mode.*

Enhanced Private Conversation™ Mode

- If the mobile being called is on the air, ringing is heard until the called party answers or for 20 seconds, whichever occurs first. If no answer occurs within 20 seconds, "NO ANS" is displayed.
- If the mobile being called is not on the air, no ringing is heard and "NO ACK" is displayed.

Standard Private Conversation Mode

- If the mobile being called is not on the air or does not answer, you will simply not hear a response.

4. When the call is finished or it could not be completed for some reason, end it by pressing the CALL option switch and placing the microphone back on-hook.

Initiating a Page

1. With a SMARTNET/SmartZone or P25 trunked channel selected, momentarily press the ALERT option switch. The tag (alias) of the last ID called is displayed.

2. If required, rotate the Select switch to display the desired mobile. The tag of each number is displayed.

3. Press the PTT switch and one of the following then occur:

   - If a continuous tone sounds, the system received the page but the called mobile is not on the air. Try again later or cancel the page by pressing the ALERT switch again.

   - If the called mobile does not answer within 6 seconds, a continuous tone sounds and "NO ACK" is displayed. Try again later or cancel the page by pressing the ALERT switch again.

   - If five beeps sound, the system received the page and the paged mobile is on the air and received it. The normal mode is automatically reselected.

## 5.7 MESSAGING

*NOTE: This feature is not available with P25 trunked operation.*

The messaging feature allows preprogrammed messages to be sent to your dispatcher. Up to 16 messages can be preprogrammed, and they are identified by a tag (alias). If an MSG option switch is programmed, messages are sent as follows:

1. Momentarily press the MSG option switch. The alias of the last message sent is displayed.

2. If required, rotate the Select switch to display the desired message. Then send the message by momentarily pressing the PTT switch. One of the following then occurs:

   - If five beeps sound and "ACK RCVD" is displayed, the message was received and automatically acknowledged by the system.

   - If after five tries the message is not acknowledged, a tone sounds and "Unknown Message" is displayed.

## 5.8 SENDING STATUS CONDITIONS

The status feature allows you to manually or automatically send your current status to your dispatcher. Up to eight status conditions can be preprogrammed, and they are identified by a tag (alias). If the STATUS option switch is programmed, status conditions are sent as follows:

1. Momentarily press the STATUS option switch. The tag of the current status condition is displayed.

2. To change the current status, rotate the Select switch until the desired status is displayed. Then press the Select switch to accept that status. One of the following conditions then occurs:

   - If five beeps sound and "ACK RCVD" is displayed, the status was received and acknowledged by the system.

   - If after five tries the message is not acknowledged, a tone sounds and "Unknown Message" is displayed.

## 5.9 EMERGENCY ALARM AND EMERGENCY CALL

### Introduction

Emergency Alarms and Calls are separate functions that can be individually enabled or disabled on each SMARTNET/SmartZone system. The Emergency option switch is also required for these functions. Emergency Alarms are transmitted on the last selected talk group, and Emergency Calls are transmitted on the emergency talk group programmed on the selected system.

### Emergency Alarms

An emergency alarm is a special data transmission on the selected talk group that alerts a dispatcher of an emergency situation. It is transmitted on the currently selected talk group. Proceed as follows to activate an emergency alarm:

1. Select a SMARTNET/SmartZone or P25 Trunked channel that has this feature enabled and then press the Emergency option switch. The radio then begins automatically transmitting an emergency alarm data message and "EMERGNCY" is indicated in the display for 3 seconds.

2. When the emergency alarm is acknowledged by the system, "ACK RCVD" is briefly displayed and the emergency acknowledge tone (two beeps) sounds. Silent operation may also be programmed in which case no tone sounds and there is no indication that an acknowledgment occurred.

3. The radio continues to transmit this message until an acknowledgment is received or the programmed number of attempts have been made. To exit this mode, power must be turned off.

### Emergency Calls

An emergency call urgently requests access to a voice channel. It is transmitted on the preprogrammed emergency talk group. To place this call, proceed as follows:

1. Select a SMARTNET/SmartZone channel that has this feature enabled and press the Emergency option switch. The emergency mode is indicated when "ACK RCVD" is briefly displayed and then "EMERGNCY" and the emergency talk group are alternately displayed.

2. To place the emergency call, manually press the PTT switch and begin speaking as with a standard call. All group calls which follow are then emergency calls (private/unit and call alert calls are not allowed). If the channel is changed, the call is made on the emergency talk group programmed for the new channel.

3. To exit this mode, power must be turned off.

## 5.10 FAILSOFT OPERATION

If a failure occurs in the SMARTNET/SmartZone or P25 Trunked system so that it cannot be used, the transceiver automatically enters the failsoft mode. When in this mode, "FAILSOFT" and the tag (alias) of the selected channel are alternately displayed.

When in the failsoft mode, operation is in the conventional mode on a preprogrammed failsoft channel. A different failsoft channel can be programmed for each talk group. If a transmission is attempted before a failsoft channel is located, a continuous tone sounds until the PTT switch is released. When the radio system returns to normal operation, this condition is automatically detected and normal operation resumes.

## 5.11 SMARTNET/SMARTZONE/P25 TRUNKED SCANNING FEATURES

### 5.11.1 GENERAL

Scanning on a SMARTNET/Smartzone or P25 Trunked system is called Priority Monitor Scan. The following are unique features of this type of scanning. For general scanning information applicable to all operating modes, refer to Sections 3.16 and 3.17

- Scanning is turned on and off by the SCAN option switch. Talk groups (channels) can be programmed so that scanning automatically starts whenever the talk group is selected (Autoscan).

- When responding to calls in the scan mode, the programming of the Talkback Scan parameter determines if a response always occurs on the talk group of the call (Active Group) or the Selected Group if they are different. Transmissions at other times always occur on the selected talk group.

- Up to 256 scan lists or the number that fit in available memory can be programmed. Each list can include up to 256 talk groups from the same system, one of which can be a priority group as described in the next section.

- If the SCN ED option key is programmed, scan lists are user programmable (see Section 5.11.3). In addition, nuisance channels can be temporarily deleted as described in Section 3.16.6.

- Each talk group is programmed to select one of the programmed scan lists or "No List" (scanning is disabled). If scanning is enabled and the selected channel does not permit scanning, it is automatically enabled again when a channel is selected that permits scanning.

- The selected scan list can be temporarily changed if the Scan (List) Select option switch is programmed. The procedure is described in Section 5.11.3.

- In addition to calls on channels in the scan list, pages, private/unit calls, and telephone calls are received while scanning. Private and telephone calls are not interrupted by priority messages.

### 5.11.2 PRIORITY TALK GROUP SAMPLING

One talk group in the scan list can be designated a priority talk group by programming or it can be the selected talk group. When scanning, messages on a non-priority talk group are interrupted by messages on the priority talk group.

### 5.11.3 SCAN LIST EDITING AND SELECTION

SMARTNET/SmartZone and P25 Trunked scan lists are user programmable if the SCN ED option switch is programmed. The procedure is described in Section 3.17.5 on page 15.

SMARTNET/SmartZone and P25 Trunked scan lists are user selectable if the Scan (List) Select option switch is programmed. This switch can be used to temporarily select another scan list for all talk and announcement groups in the current system.

"No List" (scanning disabled) or "Programmed" (default list) can also be selected if desired. Cycling power returns to the default scan list programmed for each group. Proceed as follows:

1. With scanning disabled (the rotating icon is not indicated in the right status display), press the Scan List option switch.

2. The currently selected list is displayed as "List x", with "x" the currently selected list. To exit without changing the selected list, simply press the Scan List option switch again.

3. To select another list, "Programmed", or "No List", rotate the Select switch. When the desired list is displayed, select it and exit this mode by pressing the Scan List option switch again.

## 5.12 DYNAMIC REGROUPING

***NOTE: This feature is not available with P25 trunked operation.??***

The dynamic regrouping feature allows a dispatcher to switch mobiles to a newly defined channel to receive an important message. Dynamic regrouping operates as follows:

1. When this command is received, an alternating tone and the transceiver automatically changes to the regrouping channel and "DYN REGRP" is displayed.

2. Manually select the channel corresponding to that tag. If this is not done, transmission still occurs on the new channel, but the alternating tones sound each time the PTT switch is pressed.

3. Talk and listen as usual. The dispatcher will cancel dynamic regrouping as indicated by a short tone. If a standard channel is not selected after this occurs, an error tone periodically sounds.

## 5.13 SMARTZONE AND P25 TRUNKING UNIQUE FEATURES

### 5.13.1 INTRODUCTION

As described on page 18, the SmartZone® mode provides wide area coverage by allowing roaming between SMARTNET and conventional sites. The P25 Trunked mode can provide access to a single trunked site or roaming between several trunked sites. Operation in these modes is the same as just described in the preceding sections (5.1-5.12) with the following additional features:

### 5.13.2 BUSY OVERRIDE

The busy override feature allows a call to be placed even if all of the sites you are calling do not have a free traffic channel. This feature is enabled and disabled by the system manager, and it operates as follows:

1. Assume that you have attempted to place a call and the system was busy ("BUSY" displayed and busy tone sounded).

2. Release the PTT switch and then press it for 5 seconds or more. If a chirp-like tone sounds with the PTT switch pressed, busy override is occurring.

   *NOTE: Remember that not all members of the talk group are receiving your message. Missing members will start receiving your message as channels become available.*

### 5.13.3 DETERMINING CURRENT SITE AND SEARCHING FOR A NEW SITE

To determine the current radio site and the signal level of that site, press the SEARCH option switch. The display then indicates the current site number as "SITE xx" and the RSSI (Receive Signal Strength Indicator) signal level as "RSSI xx". This mode is then automatically exited.

To scroll through the other programmed sites, rotate the Select switch while "Site xx" or "RSSI xx" is displayed (holding the button down causes the function to repeat). To select the displayed site, press the SEARCH option switch again. If site lock is on when site search is entered (see following), the radio will be locked on the new site when this function is exited.

### 5.13.4 LOCKING/UNLOCKING A SITE

It is sometimes desirable to stay on a site. To prevent the transceiver from searching for a new site, it can be locked on the current site. To lock on the current site, press the LOCK option switch and the display then momentarily indicates the site alias which indicates that it is locked. To unlock the site, press the LOCK option switch again and "UNLOCK" is momentarily displayed.

# SECTION 6 MISCELLANEOUS

## 6.1 SUPERVISORY TONES

Single Beep (Alert Tone)

- Power was turned on and a successful power-up sequence occurred (see "Turning Power On" on page 9).
- The time-out timer is about to expire or the penalty timer has expired (page 11).
- The conversation timer is about to expire (page 22).
- The system received your page but the paged mobile is not on the air (page 31).
- Telephone interconnect is not operational (page 30).

Continuous Tone (Invalid Condition)

- A transmission is being attempted on a conventional channel programmed as receive-only.
- The transmitter is disabled by the transmit disable on busy feature (page 20).
- The transmitter has been disabled by the time-out timer feature (page 11).
- The transmitter has been disabled by the conversation timer (page 22).
- An out-of-range condition exists (SMARTNET/SmartZone only).
- A transmission is being attempted before the penalty timer has expired (page 11).
- Dynamic regrouping has been exited but the dynamic regrouping channel is still selected (page 34).

Single Short Medium-Pitch Tone

- A valid key has been pressed.

Single Short Low-Pitch Tone

- An invalid key has been pressed.

Medium Tone (No Acknowledge)

- The paged mobile did not acknowledge the page (page 31).
- The message that was sent has not been acknowledged (page 32).
- The status condition that was sent has not been acknowledged (page 32).

Five Beeps (Recurring)

- The page was received (page 31).

Two Short Tones

- A unit-to-unit call was received (page 29).

Five Beeps

- The paged mobile received the page and acknowledged it (page 31).
- The message that was sent has been received and acknowledged (page 32).
- The status condition that was sent has been received and acknowledged (page 32).

Four Beeps

- The emergency alarm condition was acknowledged (page 32).

Gurgle-Like Tone

- Dynamic regrouping has occurred (page 34).
- Dynamic regrouping has occurred but the regrouping channel is not selected (page 34).

Busy Signal

- The radio system is busy or a busy condition exists when making a telephone call.

Three Medium Pitch Tones

- A channel is available after a busy condition occurred (SMARTNET/SmartZone only).

## 6.2 SYSTEM OPERATOR PROGRAMMING

As noted several times in this manual, programming determines the availability and specific operation of many features. This usually refers to the programming performed by your system operator when the radio was set up, not to any programming that a user can perform. If a feature is controlled by a front panel option switch and that switch is not available, it is probably not available.

An exception is Keypad Programming which can allow the user to reprogram several conventional channel parameters. Refer to Section 4.14 on page 25 for more information.

## 6.3 SPEAKING INTO MICROPHONE

For best results, hold the microphone about 1-2 inches from your mouth and speak at a normal conversational level. Do not shout since it distorts your voice and does not increase range. Make sure that the PTT (push-to-talk) switch is pressed before you begin to speak and released as soon as the message is complete.

## 6.4 OPERATION AT EXTENDED RANGE

When approaching the limits of radio range, the other party may not be able to hear your transmissions and there may be an increase in background noise when messages are received. You may still be out of range even though you can hear a message. The reason for this is that the signal you are receiving is usually transmitted at a higher power level than the one transmitted by your transceiver. Communication may be improved by moving to higher ground or away from shielding objects such as tall buildings or hills.

## 6.5 PREVENTING BATTERY DISCHARGE

In the standby mode (power on, not transmitting), transceiver power consumption is relatively low. Therefore, you can probably leave the transceiver on for one or two days without operating the vehicle and the battery should not become seriously discharged. However, if the outdoor temperature is low enough to significantly decrease battery capacity, the transceiver should be turned off when not in use.

Since power consumption is significantly higher when transmitting, it is good practice to have the vehicle running while transmitting. This ensures that optimum power is being delivered to the transceiver and that the battery does not become discharged.

## 6.6 LICENSING

A government license is usually required to operate this transceiver on the air.

## 6.7 TRANSCEIVER SERVICE

If "UNPROGRAMD" is displayed, the cause could be any of the following:

- An unprogrammed channel is selected. Select a programmed channel.
- The selected channel is programmed for an option that is not installed or an error in programming was detected. Contact your system operator for service.

If no characters or all characters appear in the display, the viewing angle may be improperly adjusted. Refer to Section 3.3 on page 9 for more information.

If some other problem is occurring, turn power off and then on again to reset the control logic. Also make sure that the controls are properly set and that the power, external speaker, and accessory cables (if used) are securely plugged into the back of the transceiver.

If the transceiver is completely inoperative, check the power cable fuse that is usually located near the vehicle battery. If it is blown, remedy the cause if possible and replace it with the same type (15A). If the transceiver still does not operate properly, return it to your system operator for service.

*NOTE: There are no user-serviceable components in the transceiver. Altering internal adjustments can cause illegal emissions, void the warranty, and result in improper operation that can seriously damage the transceiver.*

Part Number 002-5300-007CD
8-02 Printed in U.S.A.