EFJohnson®

98xx LOW TIER LTR®/CONVENTIONAL OPERATING MANUAL

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

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.

DO NOT operate the transmitter of a mobile radio when a person outside the vehicle is within one (1) meter of the antenna.

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 the E.F. Johnson Company 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)

(A) Limits For Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm2^2)	Averaging Time $|E|^2$, $|H|^2$, S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f^2)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

(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/cm2^2)	Averaging Time $|E|^2$, $|H|^2$, S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f^2)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

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 4-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: If the installer or user changes the type or location of the antenna, they should be aware of the MPE guidelines shown in Table 1 and take measures to comply with those guidelines.

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

TABLE OF CONTENTS

QUICK REFERENCE GUIDE

Power On/Off - Press the PWR switch.

Set Volume Level - Press VOL up/down switches.

Change Channel - Press the CHL up/down switches.

Scan On/Off - Press SCAN switch. Scan on = Green LED on, Scanning occurring = "+" displayed (see page 25).

Program Channel Scan List - Select desired channel and then press the A/D switch. The displayed channel is *not* in the scan list when "–" is displayed (see page 26).

Turn Call Indicator Off - Press any button or cycle power.

Monitor Before Transmitting (Conventional Only) - Take microphone off-hook to enable monitor mode (or press AUX1/AUX2 if programmed for monitor). The channel is busy if someone is talking (see page 30).

The AUX1 and AUX2 switches can each be programmed to control one of the following. The "on" indicator for each switch is shown in the above illustration.

- Squelch adj. (conv. only) - Press switch and then CHL up/down switches
- Horn alert
- Monitor

- Home channel select
- Priority sampling (conv. only)
- Encryption (optional)
- Talk-around select
- Option select

FEATURES

General Features

- Up to 16 channels (system/groups) selectable
- LTR® and conventional operation
- Channel scan
- User programmable channel scan list
- Proceed (clear-to-talk) tone
- Call indicator
- Time-out timer
- Horn alert available
- Two programmable option switches (AUX1, AUX2)
- Receive-only channels
- Companding (optional)
- Encryption (optional)

LTR Features

- Busy queuing (telephone calls only)
- System search (telephone calls only)
- Transpond
- Transmit inhibit
- Receive priority calls

Conventional Features

- User-adjustable squelch level
- Call Guard squelch control
- Talk-around
- First and second priority channel sampling
- Transmit disable on busy
- Monitor mode
- Repeater talk-around

NOTE: Some of the preceding features are available only if they have been programmed by your dealer.

CONTROLS AND DISPLAY

Power Switch   Display/Indicators   Option Switches   Speaker

Microphone   Volume Up/Down   Channel Up/Down
Jack   Switch   Switch
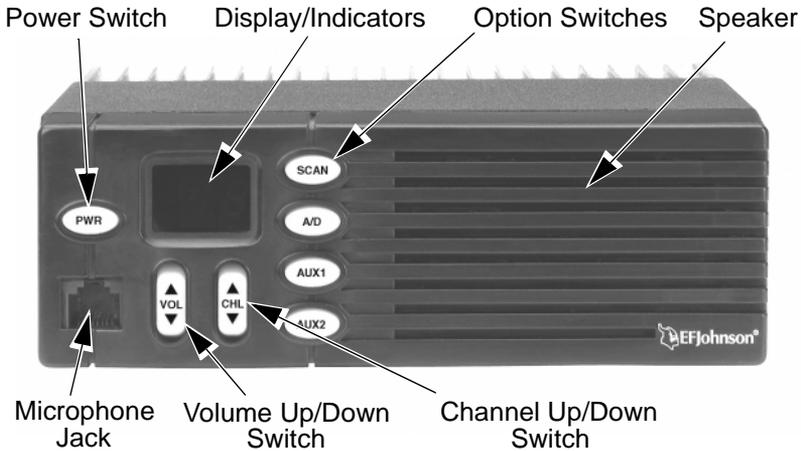
Front Panel Controls

Power Switch - Pressing this switch turns power on and off. The vehicle ignition switch may also control power (see "Power Turn-Off Delay" on page 23).

VOL Up/Down - Pressing the upper part of the switch increases the volume by one step, and pressing the lower part decreases it by one step. Holding the switch down causes the function to repeat.

CHL Up/Down - Pressing the upper part of the switch increases the selected channel by one, and pressing the lower part decreases the channel by one. Holding the switch down causes the function to repeat.

SCAN Switch - Turns scanning on and off (see page 25).

A/D (Add/Delete) Switch - Programs the channel scan list. The displayed channel is deleted from the scan list and not scanned when "–" is displayed (see page 26).

AUX1/AUX2 (Auxiliary) Switches - These switches can be programmed to control various functions. Refer to page 20 for more information.

Microphone Jack - Connection point for the microphone.

Microphone Push-To-Talk (PTT) Switch (Not Shown) - Button on the microphone which keys the transmitter.

Speaker - The internal speaker is located behind the grille. An optional external speaker can be connected to the speaker jack located on the rear panel.

Antenna Jack   Power Jack   External Speaker Jack
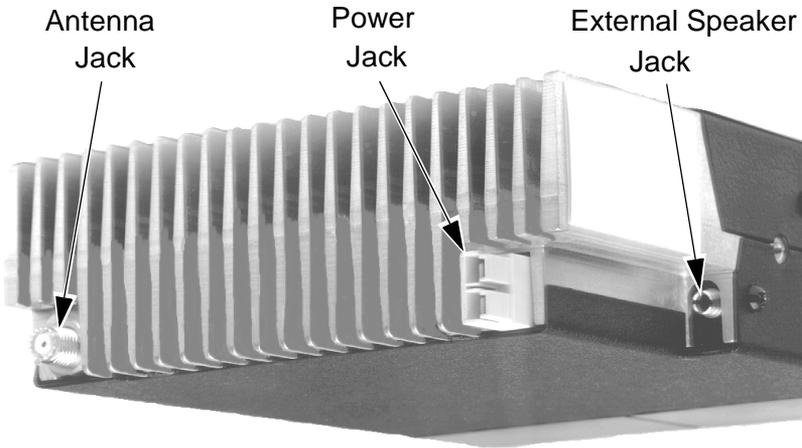
Rear Panel Jacks and Connectors

Antenna Jack - Miniature UHF jack for connecting the 50-ohm antenna.

Power Jack - Connection point for the power cable which attaches to the vehicle battery. A nominal 12-volt DC, negative ground power source is required.

Speaker Jack - Connection point for an optional 4-ohm, 5-watt external speaker. The front panel speaker is automatically disabled when a speaker is connected to this jack.

Accessory Cable (Not Shown) - This optional cable installs in the external speaker jack opening, and is used for connecting such things as the ignition switch and horn alert to the transceiver.
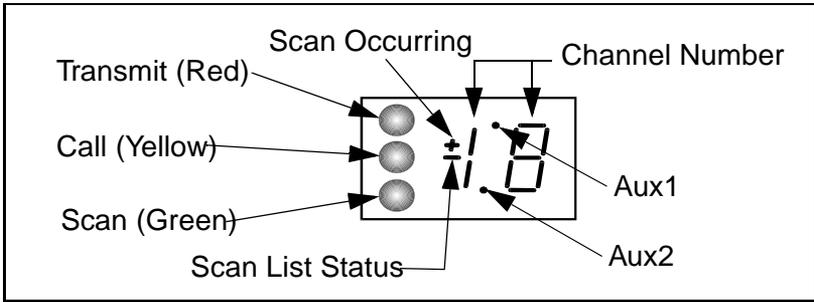
Front Panel Display

Channel Number Display - Indicates the selected channel number. Up to sixteen channels can be selected using the CHL switch (see "Channel Select and Display" on page 14).

Transmit Indicator (Red) - Indicates that the transmitter is keyed.

Call Indicator (Yellow) - Indicates that a call has been received on a channel programmed for a call indicator (see page 21). To turn this indication off, press any key.

Scan Indicator (Green) - Indicates that scanning has been enabled (see page 25).

" + "- Indicates that scanning is occurring.

" ─ " - Indicates that the displayed channel is <u>not</u> in the scan list (not scanned).

Upper Decimal Point - Indicates that the function controlled by the AUX1 key is enabled.

Lower Decimal Point - Indicates that the function controlled by the AUX2 key is enabled.

GENERAL OPERATION

Power-Up Sequence

When power is turned on, all segments and indicators in the display are momentarily enabled, a beep sounds (if tones are enabled), and the transceiver is ready for service.

Determining Volume Level

The relative volume setting may be determined by enabling a reference tone using one of the following methods:

- If key press tones are enabled, a short tone sounds when front panel keys are pressed.

- If a conventional channel is selected, take the microphone off-hook and if someone is talking, audio is heard. If no one is talking, the squelch control can be adjusted as described in "Setting Squelch Level" on page 14 and noise should be heard. When an LTR channel (system) is selected, the receiver cannot be manually unsquelched.

Channel Select and Display

Channels are selected by pressing the CHL up/down switches. The channel number displayed is actually one of up to sixteen system/group combinations that can be programmed. If the selected system/group is programmed for LTR operation, an encode and decode ID code and other information are selected, and if it is programmed for conventional operation, a specific radio channel is selected. Refer to page 29 for more information on LTR and conventional operation.

Setting Squelch Level

NOTE: This adjustment sets the squelch level for conventional channels only. With LTR channels (systems), the squelch level is preset and this adjustment has no effect.

When conventional channels are programmed, the squelch level can be set the AUX1 or AUX2 switch programmed to select the squelch adjust function. If this switch is not programmed, the squelch level is fixed at a default setting. Proceed as follows:

1. Select a conventional channel that is not busy. Take the microphone off-hook to enable monitoring.

2. Press the AUX1 or AUX2 switch (whichever is programmed for squelch adjust) and the appropriate decimal point lights to indicate that the squelch adjust mode is enabled.

3. Within 8 seconds, press the CHL down switch until noise is heard and then press the CHL up switch until the noise just mutes.

4. To select the current level and exit this mode, press the AUX1/AUX2 switch again. This also occurs automatically 2 seconds after a change is made or 8 seconds after no activity.

5. If both narrow band and wideband channels are programmed, perform this adjustment with each channel type selected because separate settings are maintained for each.

NOTE: If weak messages are not heard or if unsquelching occurs when no messages are present, slight readjustment may be required.

STANDARD CALLS

Introduction

Most calls you make will probably be the standard type described in this section. These calls are between you and another mobile or control station. The main difference between these calls and telephone calls (the other type that can be placed) is that no number is dialed using a keypad. The following procedure applies to both LTR and conventional operation.

Placing a Standard Call

1. Turn transceiver power on and set the volume as described starting on page 14. With conventional operation, also set the squelch as described on page 14.

2. Select the channel of the mobile being called as described in "Channel Select and Display" on page 14.

3. If a conventional call is being placed, monitor the channel manually or automatically as described on page 30.

4. Press (and hold) the microphone PTT (push-to-talk) switch to talk and release it to listen. Operation with LTR and conventional channels is as follows:

LTR Operation

- If the proceed tone is enabled (see page 24), it sounds shortly after the PTT switch is pressed and it indicates that the radio system was successfully accessed. If the proceed tone is not enabled, no tone sounds when the system is successfully accessed. (The proceed and other tones may have been disabled as described in "Tone Select" on page 25.)

- If the radio system is busy, the busy tone sounds (see page 35). If you continue to press the PTT switch, the system is accessed when it becomes available.

- If an out-of-range condition exists, the intercept tone sounds and no more access attempts are made until the PTT switch is released. Drive closer to the radio system or away from shielding structures and try again.

- When responding to a call, busy or out-of-range conditions may also occur as when placing a call because the system is re-accessed for each transmission.

Conventional Operation

- If the channel is busy and the Transmit Disable On Busy feature is programmed, the busy tone sounds and the transmitter is disabled (see page 33).

- Otherwise, busy and out-of-range conditions are not indicated and speaking can begin when the PTT switch is pressed. If the proceed tone is enabled on conventional channels, it indicates when speaking can begin but does not indicate that the radio system has been successfully accessed.

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

Receiving a Standard Call

1. Turn transceiver power on and set the volume as described starting on page 14. With conventional operation, also set the squelch as described on page 14.

2. Select or scan the channel programmed for the call you want to receive (see page 25 for more information on scanning).

3. When the message is received, take the microphone off-hook and press the PTT switch to talk and release it to listen. If scanning, a response may not automatically occur on the channel of the call and the channel may have to be selected manually.

TELEPHONE CALLS

Introduction

NOTE: Telephone calls can be placed and received only if your system operator provides that service to you and your transceiver has been programmed for those calls. Also, an optional microphone with a telephone keypad is required to dial the number.

The telephone calling feature allows you to place and receive telephone calls using your transceiver. When placing a call, the number of the person you are calling is dialed after the radio system is accessed. The following information describes how calls are placed and received with an LTR channel (system) selected. If you can place and receive calls on conventional channels, the procedure may be different. Your dealer will provide more information if necessary.

Placing a Telephone Call

1. Turn transceiver power on and set the volume as described starting on page 14.

2. Select the channel programmed for telephone calls.

3. Briefly press the PTT switch to obtain a dial tone. A successful access and busy or out-of-range conditions are indicated as described in "Placing a Standard Call" on page 16. The following additional features are available when making telephone calls:

   Busy - If the radio system is busy (busy tone sounding) and the Busy Queuing feature is programmed on the selected channel, it is automatically selected when the PTT switch is released. Refer to page 31 for more information on busy queuing.

   Out-of-Range - An out-of-range condition is indicated by an intercept tone. If the System Search feature has been enabled by programming, it is automatically selected when the PTT switch is released. Refer to page 31 for more information on the system search feature.

4. When a dial tone is heard, dial the number to be called in one of the following ways:

   - Enter it directly using the 0-9 keys on the microphone keypad. If too much time elapses between digits, the call is terminated.

   - If you have a microphone with a memory, you can recall it from memory if it has been stored.

5. After the number is dialed, release the PTT switch (if applicable) and landside ringing (or a landside busy condition) should be heard. When the other party answers, press the PTT switch and respond. The PTT switch must be pressed to talk and released to listen the same as with standard calls.

6. When the call is finished, press the # key and three beeps should sound to indicate that the call has been terminated. Terminating the call in this manner prevents extra billing that may occur for the time required for the system to automatically detect the end of the call. (The terminate procedure may be different on your system.)

Receiving a Telephone Call

1. Turn transceiver power on and set the volume as described starting on page 14.

2. Select or scan the channel programmed for telephone calls.

3. When "ringing" is heard, press the PTT switch and respond. The PTT switch must be pressed to talk and released to listen as with standard calls.

4. When the call is finished, it should be terminated as in step 6 of the preceding section.

Landside-Originate Telephone Call

Calls can be placed from a landside telephone to a mobile transceiver (if the radio system and transceiver have that capability). With most systems, a mobile user can be called directly (each has a unique telephone number). With others, the mobile being called must be specified as follows:

1. Dial the number of the radio system in which the mobile transceiver is operating.

2. When the system answers, a short tone sounds to indicate that the number of the mobile being called should be dialed. This number is

usually five digits long and it must be dialed using a tone-type tele-phone. The first two digits are the home repeater number of the mobile, and the last three digits are a telephone ID code of that mobile. With LTR interconnect equipment, the first digit must be dialed within 5 seconds of hearing the tone, and no more than 5 seconds must elapse between digits or the call is terminated.

3. Ringing is then heard by the landside caller while the mobile is being rung.

NOTE: The preceding procedure may vary, depending on the type of interconnect equipment in use in your system.

GENERAL FEATURES

AUX1 and AUX2 Switches

The front panel AUX1 and AUX2 (Auxiliary) switches can each be programmed to control one of the features listed below. The other two option switches (SCAN and A/D) have fixed functions or are disabled.

- Squelch adjust (see page 14)
- Horn alert (see page 22)
- Monitor (see page 33)
- Home channel select (see page 22)
- Priority channel sampling (see page 34)
- Talk-around (see page 34)
- Encryption (see page 21)
- Option select (see page 23)

When the function controlled by AUX1 is enabled, the upper decimal point in the display is lighted, and when AUX2 is enabled, the lower decimal point is lighted (see following illustration).
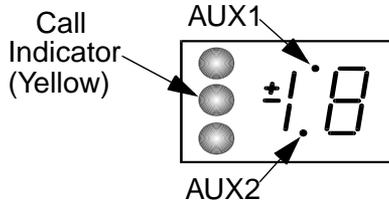
Call Indicator

The call indicator is the yellow LED to the left of the channel display (see preceding illustration). The purpose of this indication is to show that a call was received while you were away from the vehicle. Each channel can be programmed for this feature, and it then turns on when a call is received on one of those channels. This indicator is turned off by pressing any switch or turning transceiver power off and then on. If scanning and the "last received" configuration is programmed (see "Transmitting In The Scan Mode" on page 27), the channel of the last call is displayed.

Encryption

Voice encryption is an optional feature that prevents conversations from being monitored by casual eavesdropping and analog scanners. It does this by encrypting your voice so that it can be understood only by someone using a transceiver equipped with a similar encryption device. Each LTR and conventional channel can be programmed for encryption. Then when one of these channels is selected, encryption is automatically enabled.

Encryption can be manually enabled or disabled if the AUX1 or AUX2 option switch is programmed for encryption. This allows the channel programming to be overridden. Selecting another channel causes encryption to revert to the status programmed for that channel. When encryption is controlled by an AUX switch in this manner, the decimal point for that switch indicates when encryption is enabled.

Encrypted calls are received even if encryption is not enabled. However, encryption must be enabled to transmit an encrypted call.

When transmitting an encrypted call, wait approximately 1 second before speaking. This gives the receiving encryption device time to establish synchronization which ensures that all of the first word is received. If the proceed tone is used (see page 24), two beeps sound instead of one to indicate that an encrypted call is being placed, and speaking can begin as soon as it sounds because it is delayed for the required time.

Home Channel Select

This feature is available if AUX1 or AUX2 is programmed for Home Select. To quickly select the preprogrammed Home channel, simply press the AUX switch programmed for that feature. The Home channel is then displayed and it becomes the selected channel.

Horn Alert

If this feature has been installed by your dealer, it activates an external alert such as the vehicle horn or lights when a call is received on a channel programmed for horn alert. When the alert is enabled and the proper call received, it turns on once per second for 3 seconds and then goes back to the disabled state.

If the AUX1 or AUX2 switch is programmed to control horn alert as described later, the decimal point indicator for that switch indicates when the horn alert is enabled.

The horn alert is programmed to operate in one of the two modes which are described below. Ignition switch control of power is described in "Power Turn-Off Delay" on page 23. If the ignition switch does not control transceiver power, only the front panel power switch affects operation of these modes.

Manual Off/On Mode

The current horn alert mode does not change when power is turned on and off by either the ignition switch or power switch. Therefore, the horn alert is entirely controlled by the AUX1/AUX2 switch if applicable.

Auto Off/On Mode

Ignition Switch **-** The horn alert always turns off when the ignition switch is turned on, and always turns on when the ignition switch is turned off (if there is a turn-off delay).

Power Switch - The horn alert always reverts to the off condition when power is turned on by the power switch.

NOTE: This automatic operation overrides any mode that may have been selected by the AUX1/AUX2 switch (see following).

An AUX1/AUX2 switch programmed to control the horn alert can be used to change the currently selected mode. For example, this switch could be used to turn the horn alert on in the Auto Off/On Mode after the ignition switch is turned on. If this switch is not available, the current mode cannot be changed.

Option Select

The AUX1 or AUX2 switch can be programmed to control some type of dealer-installed accessory. The decimal point indicator for the switch indicates when the accessory is enabled.

Power Turn-Off Delay

If the transceiver is equipped with the optional accessory cable, the vehicle ignition switch as well as the front-panel power switch can control transceiver power. Then for transceiver power to turn on, both the front panel power switch and the vehicle ignition switch must be on. When the ignition switch controls power, turn-off delays of Immediate, 10, 20, 30, 40, or 50 minutes, 1, 2, 4, 8, 10, 12, or 16 hours or Forever can be programmed. 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.

A power turn-off delay allows features such as the horn alert and call indicator to remain active for the programmed delay time after the igni-

tion switch is turned off. At the same time, advantages of ignition switch control can be utilized, such as preventing battery discharge that may occur if the transceiver is accidentally left on for an extended period (see "Preventing Battery Discharge" on page 38).

Proceed (Clear-To-Talk) Tone

This is a short tone that sounds when the PTT switch is pressed to indicate that the radio system has been accessed and speaking can begin. This tone can be programmed so that it sounds on LTR channels but not conventional channels. This and other tones can also be disabled by dealer programming. In addition, either a standard or loud (two-pitch) tone can be programmed.

On LTR channels, if the radio system is busy when making a call, the busy tone sounds instead of the proceed tone. If the PTT switch is held down, the system is accessed and the proceed tone sounds when it is no longer busy. If an out-of-range condition occurs, the intercept tone sounds and the PTT switch must be released to make another call attempt. Refer to page 35 for more information on the busy and intercept tones.

On conventional channels, the Transmit Disable On Busy feature can be used to automatically perform monitoring (see page 33). If the channel is then busy, the proceed tone does not sound unless the transmitter is keyed by quickly releasing and then pressing the PTT switch. Otherwise, the proceed tone sounds (if enabled) even if the channel is busy.

If encryption is used, a 1-second delay occurs before this tone sounds and two beeps are heard instead of one (to indicate that an encrypted call is being transmitted). With conventional operation, a short delay also occurs if Call Guard squelch is used. These delays ensure that the person you are calling hears the entire first word of your message.

Receive-Only Channels

Channels can be programmed for monitoring only (transmitting is disabled). If the PTT switch is pressed with one of these channels selected, the intercept tone sounds and the transmitter does not key.

Time-Out Timer

The time-out timer disables the transmitter if it is keyed continuously for longer than the programmed time. It can be programmed for 0.5 - 5.0 minutes or disabled entirely. If the transmitter is keyed continuously for longer than the programmed time, the transmitter is disabled and the intercept tone sounds. The timer and tone are reset by releasing the PTT switch. Ten seconds before time-out occurs, a beep sounds to indicate that time-out is approaching.

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

Tone Select

The supervisory tones that sound are selected by dealer programming. One of the following configurations are programmed.

Silent - All tones are disabled.
Key Beep - Only the key press tones are enabled.
Alert - All tones except the preceding key beep tones are enabled.
All Tones - All tones (both Key Beep and Alert) are enabled.

CHANNEL SCAN

Introduction

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

Scanning is turned on and off by the SCAN option switch (it is fixed in the on or off mode if this switch is disabled). When scanning is enabled by this switch, the green LED to the left of the channel display

lights (see following illustration). Then when scanning is actually occurring, "+" is indicated. The microphone must be on-hook for scanning to occur (unless off-hook detection has been disabled by programming).

Scan Occurring

Scan Enabled (Green)

Scan List Status
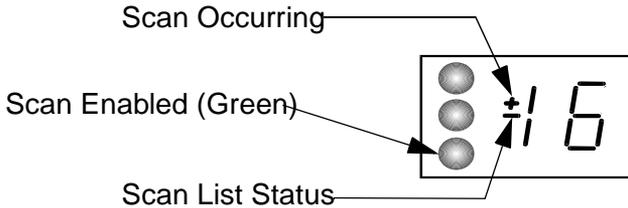
The selected channel can be changed while scanning using the CHL up/down switches in the normal manner. Scanning resumes shortly after the change is made. When a message is received while scanning, the channel of the message is displayed (see "Priority and Block ID Codes" on page 32 for a possible exception). When responding to a message in the scan mode, the transmission may not occur on the displayed channel. Refer to "Transmitting In The Scan Mode" on page 27 for more information.

Scan List Programming

General

NOTE: The selected channel is always scanned, even if it is deleted from the scan list.

The channel scan list is programmed using the front panel A/D switch. Pressing this switch changes the status of the displayed channel. The displayed channel is *not* in the scan list (not scanned) when "–" is displayed (see preceding illustration). A channel can be deleted from the scan list while listening to a message (if it is not the selected channel) by pressing the A/D switch in the normal manner. Scanning resumes shortly after it is deleted. If the A/D switch is disabled, scan list programming is not available.

<u>Saving Scan List</u>

Dealer programming determines if changes made to the scan list are saved when power is turned off. If changes are saved, no change occurs when power is turned off; and if they are not saved, the scan list reverts to the programmed default status.

Scan Delay and Continue Timers

When a message is received or transmitted while scanning, there is a short delay before scanning resumes (unless scanning has been disabled such as by taking the microphone off-hook). The delay after receiving a call prevents another message from being received before a response can be made. Likewise, the delay after transmitting a call ensures that you hear a response to your call instead of another message occurring on some other channel.

There is also a scan continue timer that can be programmed. This timer controls the maximum time that a call is received before scanning resumes. Times up to 60 seconds can be programmed. This prevents scanning from being delayed for long periods by lengthy calls.

Transmitting In The Scan Mode

When the transmitter is keyed in the scan mode, programming by your dealer determines if the transmission occurs on the last selected or last received channel. In addition, if the selected channel changes, it controls which channel is selected when the scan mode is exited by pressing the SCAN switch. The three programmable configurations are as follows:

Last Selected - Transmissions always occur on the channel that was last selected by the CHL up/down switches. To respond to a call not on the selected channel, one of the following methods can be used:

- Select the channel of the call manually using the CHL up/down switches.

- Before scanning resumes, exit the scan mode by pressing the SCAN option switch. The channel of the call then becomes the selected channel and it is not necessary to change it manually.

Note that with this configuration programmed, when a call is received on a channel other than the selected, the display does not indicate the channel of a transmission until scanning resumes.

Last Received - The selected channel changes to that of a call. Therefore, you can always respond to a call without having to manually change the channel. To return to the previously selected channel, it must be manually selected using the CHL up/down switches.

Temporary Last Received - The channel changes to that of a call for only the duration of the scan delay period described on page 27. Then when the delay expires and scanning resumes (if not disabled, for example, by taking the microphone off-hook), the selected channel is again displayed. Therefore, you can respond to a call without changing the selected channel as long as you do so before scanning resumes.

Fixed Transmit While Scanning

The transceiver can be programmed so that transmissions made while scanning is occurring take place on a preprogrammed channel. Note that the transmitter must be keyed with scanning occurring. Since taking the microphone off-hook normally halts scanning, the transmitter may have to be keyed with the microphone on-hook (unless off-hook detection is disabled by programming). This feature also changes the selected channel if it is used. If the transmitter is keyed with scanning halted or if this feature is not enabled, the programming described in the preceding section is in effect.

LTR AND CONVENTIONAL OPERATING MODES

General

Each selectable channel can be programmed for LTR or conventional operation by your system operator. The operation that is programmed is determined by the type of radio equipment being used in your radio system. There are only a few differences in operation, and they are described in the following information and elsewhere in this manual as required.

LTR Operation

The LTR mode provides automatic channel selection (trunking) and monitoring before transmitting. In addition, special tones indicate busy and out-of-range conditions. Selecting an LTR channel actually selects an encode and decode ID code and other information which may include priority, block, and telephone ID codes. The encode and decode ID codes control the mobile or group of mobiles being called and also what calls are received. LTR features are described starting on page 30.

Conventional Operation

In the conventional mode, selecting a channel selects an actual radio channel and the squelch coding (if any) used on that channel. A busy channel is detected manually or automatically as described in the following information. An out-of-range condition cannot be detected automatically in this mode but may exist if you cannot get a response to any of your messages. Refer to "Operation At Extended Range" on page 38 for more information.

To properly receive calls in the conventional mode, the squelch control must be set as described in "Setting Squelch Level" on page 14. If this control is not set properly, weak messages could be missed or noise could be heard when no message is present. In the LTR mode, the squelch

level is fixed and setting this control has no affect. Conventional features are described starting on page 33.

Monitoring Conventional Channels Before Transmitting

Regulations require that the channel be monitored before transmitting to make sure that it is not being used by someone else. If you were to transmit when someone else is talking, you would probably disrupt their conversation. In the LTR mode, monitoring is performed automatically. However, in the conventional mode, it must be performed automatically or manually as follows.

Automatic Channel Monitoring

If the selected channel is programmed for the Transmit Disable On Busy feature, monitoring is performed automatically. Refer to page 33 for more information on this feature.

Manual Channel Monitoring

If the preceding feature is not used, monitoring must be performed manually using the monitor mode. This mode is enabled by taking the microphone off-hook (unless off-hook detection has been disabled by programming). It may also be enabled by the AUX1 or AUX2 switch if either is programmed for the monitor function. The monitor mode temporarily disables Call Guard squelch (see page 34) and scanning so that all messages on the channel are heard. Refer to the monitor mode description on page 33 for more information.

LTR FEATURES

Transmit Inhibit

This feature automatically prevents the transmitter from keying if the mobile you are calling is busy with another call. When the transmitter is disabled by this feature, the intercept tone sounds when the PTT switch is pressed. To make another call attempt, the PTT switch must be released

and then pressed again. However, you may want to wait a few seconds before making another attempt to allow the other call time to finish.

This feature can prevent the accidental interruption of a call in progress. This could happen when the other transmitting party unkeys or if an ID code with a higher priority is transmitted. It also provides an indication that the mobile you are calling is busy. Each LTR channel (group) can be programmed for this feature.

Busy Queuing

NOTE: This feature replaces Free System Ringback used in some earlier LTR transceivers.

The busy queuing feature places a telephone call in a queue if the radio system is busy when it is placed. Then when the channel becomes available, the call is automatically placed. Standard (mobile-to-mobile) calls are not queued by this feature. If queuing is programmed and a busy condition is encountered, the queue mode is entered automatically when the PTT switch is released. Then when the radio system becomes available, the call is automatically placed. If the access is successful, a beep sounds and a dial tone is heard. The queue mode is exited before the call is placed if any of the following occur.

- The PTT switch is pressed
- Any call is received
- Any front panel option switch is pressed
- Power is turned off

Calls are received normally in the queue mode; however, the queue mode is exited as indicated above. Scanning is temporarily disabled when in the queue mode. This feature is enabled on individual channels by programming and is not selectable by the user.

System Search

If an out-of-range condition exists when attempting an LTR telephone call, the system search feature automatically searches for a radio

system within range. This feature is either enabled or disabled with all LTR telephone calls by programming (it is not user selectable). If this feature is enabled and an out-of-range condition is encountered, it is automatically selected when the PTT switch is released. A short tone sounds to indicate that this mode is selected.

The transceiver then attempts to access, in succession, other LTR channels (systems) that are programmed for telephone calls. A beep sounds as each is accessed, and each is accessed only once. If a channel is successfully accessed, it is selected and a dial tone sounds. The telephone call must then be placed within a few seconds or normal operation resumes. If no channel could be accessed, the intercept tone sounds, the displayed channel does not change, and the feature deactivates. This mode can also be canceled at any time by pressing any front panel switch.

Transpond

The transpond feature indicates if the mobile being called is in service. To be available, it must be programmed in the transceiver you are calling. Each selectable LTR channel (group) can be programmed for this feature. If a call is received on one of these channels, the transceiver automatically transmits a response. This causes the transceiver placing the call to briefly unsquelch and the call indicator to turn on (if it is programmed on the selected channel).

Priority and Block ID Codes

Fixed priority and block receive ID codes may be programmed with LTR operation. Calls on these ID codes are received in addition to calls on the selected decode ID code (see "LTR Operation" on page 29). If a call is detected on a priority ID code, it interrupts other calls. For example, if a call is detected on a priority code while listening to a call on the selectable decode code, the transceiver immediately switches to the priority call. Telephone calls are not interrupted by priority calls.

When a call is detected on a priority ID code, the transceiver checks the other LTR channels to see if any have the same ID code. If a match is found, it temporarily or permanently changes to that channel, depending

on the programming described in "Transmitting In The Scan Mode" on page 27. If no match is found, the channel number does not change and you cannot respond to the call on that ID code. When a call is detected on a block ID, the displayed channel never changes.

CONVENTIONAL FEATURES

Monitor Mode

The monitor mode is used to monitor a channel before transmitting. When this mode is selected, it temporarily disables scanning and Call Guard or other squelch control techniques so that all messages occurring on the selected channel are heard. The monitor mode is enabled by taking the microphone off-hook (unless off-hook detection is disabled by programming). It may also be enabled by the AUX1 or AUX2 switch if it is programmed to select the monitor mode.

A conventional channel must be selected to enable monitoring. If the microphone is taken off-hook with an LTR channel selected, scanning halts (unless off-hook detection is disabled), but monitoring is not selected. If an AUX switch is used, it is not detected when scanning. In addition, if it is pressed with an LTR channel selected, an error tone sounds and monitoring is not selected.

If the Transmit Disable On Busy feature is used (see description which follows), monitoring is performed automatically and the monitor mode may not need to be used. Refer to "Monitoring Conventional Channels Before Transmitting" on page 30 for more information.

Transmit Disable On Busy

The Transmit Disable On Busy feature automatically disables the transmitter if the selected channel is busy when the PTT switch is pressed. When the transmitter is disabled by this feature, the busy tone sounds briefly. The monitor mode (see preceding section) is then enabled while the PTT switch is pressed so that activity on the channel can be monitored. However, it is not possible to access a channel by holding

down the PTT switch (it must be released to make another attempt). The Transmit Disable On Busy feature can be enabled or disabled on each channel by programming.

Occasionally, a busy condition may be detected even though no one is talking. To key the transmitter in this case, release the PTT switch and then immediately press it again. There is also a programmable option to allow transmitting with a busy channel if the correct Call Guard signal is detected.

Talk-Around

Normally, all transmissions go through a repeater. Therefore, if you are out of radio range of the repeater, you cannot talk to anyone, even if you are only a short distance away from the mobile you are calling. To allow communication if this occurs, talk-around can be enabled to allow direct mobile-to-mobile communication without going through a repeater. Each selectable conventional channel can be programmed for talk-around. It is then automatically enabled when the channel is selected. There is no talk-around indicator, and it cannot be manually selected.

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. It is transmitted with the voice signal but is not heard because it is in the subaudible range and attenuated by a filter. Call Guard squelch can be programmed on each conventional channel. LTR operation uses ID codes to perform a similar function.

Priority Channel Sampling

The priority channel sampling feature ensures that messages on priority conventional channels are not missed while listening to a message on a non-priority conventional channel. A fixed first and second priority channel can be designated by programming or either priority channel can be the selected channel.

When a message is detected on a priority channel while listening to a non-priority message, a tone sounds (unless tones have been disabled) and the transceiver changes to that channel to receive the message. When the priority message is complete, the transceiver returns to the previous channel, and if a message is still present, it is received.

When a priority channel is sampled while listening to a message on some other channel, a series of "ticks" may be heard. These ticks are brief interruptions of the audio signal that occur when sampling takes place. If an AUX option switch is programmed for this feature, priority sampling can be turned on and off. When it is enabled by the switch, the decimal point indicator for that switch is lighted. If this switch is not available, priority sampling is either enabled or disabled on all conventional channels by programming.

NOTE: Priority sampling occurs only when scanning is enabled by the SCAN switch and when listening to a message on a conventional non-priority channel. It does not occur when listening to an LTR call or when transmitting.

MISCELLANEOUS

Supervisory Tones

The following tones are heard at various times when operating this transceiver. Some or all of these tones can be disabled by programming as described in "Tone Select" on page 25.

Busy Tone - This tone is similar to the standard telephone busy tone, and it indicates that the radio system is currently busy. It sounds with all LTR calls, but not conventional calls. Repeated access attempts are made while the PTT switch is pressed with this tone sounding. Therefore, it is not necessary to release the PTT switch to access the system.

Intercept Tone - This is a siren-like tone (alternating high and low tones) which indicates the following out-of-range and error conditions:

- Out-Of-Range - If this tone sounds shortly after pressing the PTT switch, the transceiver may be unable to contact a repeater. The usual cause for this is an out-of-range condition (see "Operation At Extended Range" on page 38). Once this tone sounds, no more access attempts are made until the PTT switch is released and then pressed again. This condition is not indicated with conventional operation.

- Time-Out Timer - If this tone sounds after the transmitter has been keyed for an extended period, the transmitter may have been disabled by the Time-Out Timer feature (see page 25). This tone sounds with both LTR and conventional operation. Ten seconds before this tone sounds, a single beep sounds to indicate that time-out will soon occur.

- Transmit Inhibit - If this tone sounds as soon as the PTT switch is pressed with an LTR channel selected, the transmitter may have been disabled by the Transmit Inhibit feature (see page 30).

- Transmit Disable On Busy - If this tone sounds as soon as the push-to-talk switch is pressed with a conventional channel selected, the channel may be busy and the transmitter may have been disabled by the Transmit Disable On Busy feature (see page 33).

- Receive-Only Channel - If this tone sounds as soon as the push-to-talk switch is pressed with a conventional channel selected, the channel may be programmed as receive-only (see page 24).

- Tx While Receiving Call - If the push-to-talk switch is pressed while receiving an LTR call, this tone sounds.

Proceed (Clear-To-Talk) Tone - This is a short tone which sounds after the push-to-talk switch is pressed to indicate when talking can begin (see page 24). A loud (two-pitch) tone may also be programmed.

Key Press Tone - This is a short tone that indicates when an option switch is pressed (all modes).

Priority Call Tone - This is a short tone that sounds when a call is received on a conventional first or second priority channel (see page 34).

Wrap-Around Tone - This is a two-tone beep that indicates that the highest or lowest channel was displayed and wrap-around has occurred.

Error Tone - This is a two-tone beep that indicates that an error condition has occurred.

LTR Telephone Call Tones

The following tones are generated by LTR interconnect equipment and are heard when making LTR telephone calls. Therefore, if some other type of interconnect equipment is being used, these tones may vary.

Reorder Tone - Three beeps which indicate that the call has been terminated by the system.

Return Time Warning Tone - Two beeps which warn that you have not transmitted for an extended period. If you do not transmit within 5 seconds, the call is automatically terminated by the system. The time between transmissions is one of the parameters used by the system to detect the end of a call when the # character is not sent.

Conversation Time-Out Tone - Calls are limited to a certain length by the system. Thirty seconds before this time is reached, a "tick" begins sounding each second. When the 30-second time expires, the call is automatically terminated by the system.

Turn-Around Tone - This is a single beep which may be used to indicate to the landside party when to respond to your transmission. It sounds when you release the PTT switch, and you may partially hear this tone.

Proceed Tone - This tone consists of two beeps and it tells the landside caller when to enter the five-digit number specifying the mobile being called. Dialing of this number must be started within 5 seconds of hearing this tone, and a tone-type telephone must be used.

Dealer Programming

As noted several times in this manual, programming determines the availability and specific operation of some features. This refers to the

programming performed by your dealer when the radio was set up, not to any programming that you can perform. If a feature is not controlled by a front panel option switch, it is fixed in the mode set by dealer programming or not available. If you require additional information on the operation of a feature, contact your dealer.

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 you 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. If the proceed tone is used, wait for that tone to sound before speaking (see description on page 24).

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.

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.

Licensing

A government license is usually required to operate this transceiver on the air. Your system operator will normally handle the licensing requirements.

Transceiver Service

If your transceiver is not operating properly, only the middle segment "–" of the right display may be indicated. To attempt to clear this condition, turn power off and then on again to reset the control logic. A "U" may be indicated in the right display when receiving a call. This indicates improper programming. Select a numbered channel and report this error to your dealer.

Also make sure that the controls are properly set and that the power, external speaker (if used), and accessory (if used), cables are securely plugged into the back of the transceiver. If the transceiver still does not operate properly, take it to your dealer 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.

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