

SECTION 3

OPERATION

3.1 INTRODUCTION

This section completely covers all operational aspects of the RF-590. All operational controls and procedures are detailed and explained. Section 2 (Installation) and 5 (Maintenance) are referenced in this section regarding I/O connections and BITE TEST failure codes.

3.2 OPERATIONAL CONTROLS AND I/O CONNECTIONS

All operating controls are located on the RF-590 front panel, as shown and described in figure 3-1. Detailed operational procedures for front panel control are given in paragraphs 3.6 through 3.9.

All interfacing connections are located on the RF-590 rear panel (except for headphones). Rear panel connector locations are shown in figure 2-4, and connector pinouts are listed in tables 2-3, 2-4, and 2-5.

3.3 POWER UP DEFAULT CONDITIONS

Radio power up always places the receiver in the Receive mode of operation that existed at power off, either Local or Remote. (If no Remote option has been installed, the receiver will always power up in the Local Receive mode.) The display will show the last frequency, AGC, bandwidth, etc. that was in use by the receiver at power off.

3.4 LOCAL/REMOTE SELECTION

Local/Remote selection is accomplished with a single alternate action pushbutton. If the LED indicator is off, depressing the Remote button will place the receiver in the Remote mode, assuming that the Remote option is installed.

3.5 TEST FUNCTION

The Test function is entered by pressing the TEST button on the receiver front panel. The receiver immediately enters a self-test mode and performs the following checks.

- Processor EPROM validity
- Processor RAM memory validity
- Synthesizer lock tests
- RF signal path checks

- IF signal path checks
- Remote option tests (if installed)

When the tests are complete the alphanumeric display is used to inform the operator of test results by displaying the failed module code number or the message TEST PASSED.

A complete table of failed module code numbers, as well as a comprehensive description of this Built In Test Equipment (BITE) may be found in the maintenance section of this manual.

3.6 OPERATIONAL MODES

The RF-590 Receiver can be selected to function in four basic ways:

- Receive
- Scan
- Program
- Test

3.6.1 Receive Function

The Receive function is entered by pressing the RECEIVE button on the receiver front panel. The receiver will tune to the parameters that were used in the previous Receive function, and will show those parameters on the front panel display. The Receive LED will also light. The radio is now under manual control and the following conditions apply.

3.6.1.1 Frequency Entry

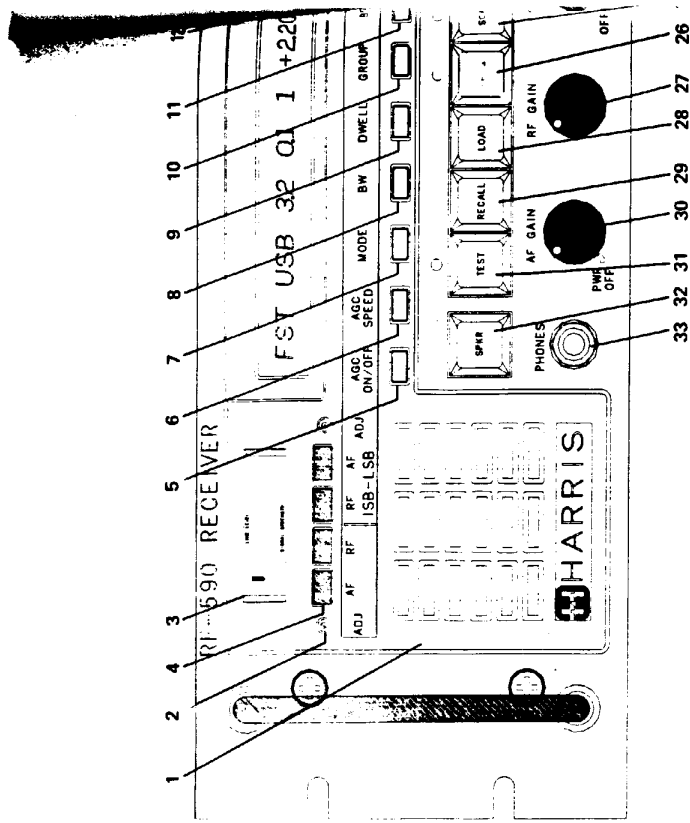
3.6.1.1.1 Entering a Complete Frequency

Pressing the FREQUENCY button causes subsequent digit entries to begin at the 10 MHz position and proceed to the right as the frequency is entered. All changed digits are dimmed to half brilliance. Pressing the ENTER button causes the receiver to tune to the new frequency and the digits are returned to full brilliance. In general, if the FREQUENCY button is pressed before keypad entries, the digits start in the 10 MHz position. If the FREQUENCY button is not pressed before keypad entries, then the digits are entered starting at the position of the cursor (underline).

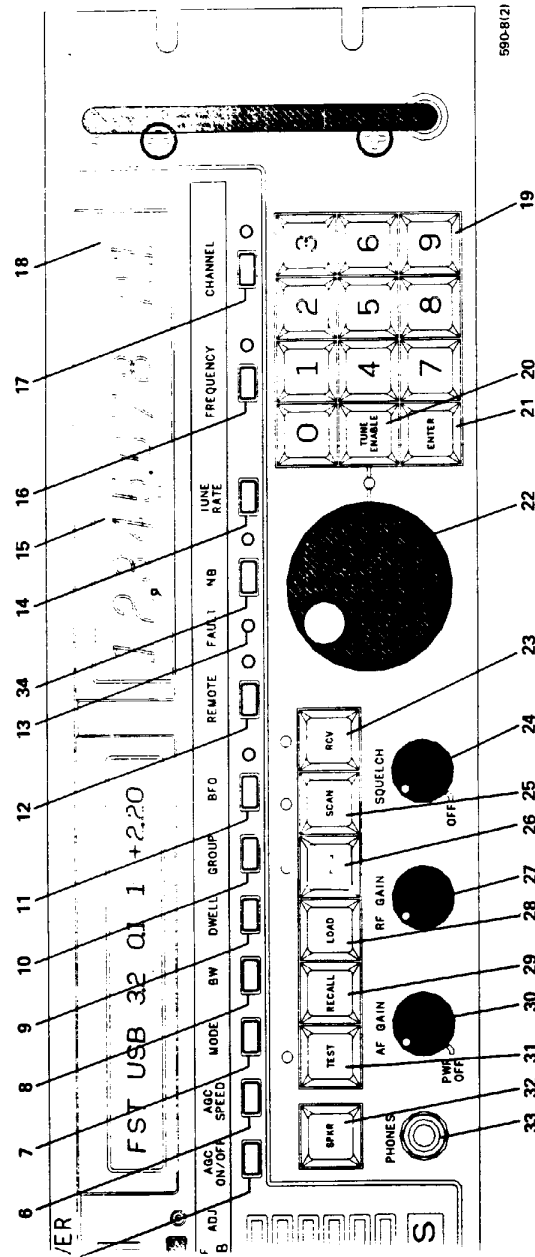
METER PUSHBUTTON FUNCTION TABLE

	SPEAKER OUTPUT	METER FUNCTION
AF	MONITORS: AF IN ALL MODES EXCEPT 2-ISB (USB, WHEN IN 2-ISB MODE)	INDICATES: USB LINE AUDIO LEVEL
RF	MONITORS: AF IN ALL MODES EXCEPT 2-ISB (USB, WHEN IN 2-ISB MODE)	INDICATES: RF LEVEL (OF USB ONLY WHEN IN 2-ISB MODE)
ISB-LSB RF	MONITORS: LSB AF WHEN IN 2-ISB MODE	INDICATES: RF LEVEL OF LSB CHANNEL (WHEN IN 2-ISB)
ISB-LSB AF	MONITORS: LSB AF WHEN IN 2-ISB MODE	INDICATES: LSB LINE AUDIO LEVEL (WHEN IN 2-ISB)

NOTE: THE ISB-LSB RF AND ISB-LSB AF BUTTONS FUNCTION ONLY WHEN RF-590 IS IN 2-ISB MODE. (OPTIONAL)



1. LOUSPEAKER
2. LINE LEVEL ADJUST
SEPARATE SCREWDRIVER ADJUSTMENTS ALLOW ADJUSTMENT OF USB AND LSB LINE LEVELS.
3. METER
DISPLAYS RF SIGNAL STRENGTH (MICROVOLTS OR MILLIVOLTS RMS) OR LINE AUDIO OUTPUT LEVEL (DBM/600 OHMS).
4. METER SELECT SWITCHES
SELECTS AF-USB, RF-USB, AF-LSB, OR RF-LSB FOR METER DISPLAY. ALSO SELECTS USB OR LSB AUDIO (WHEN USB OPERATION IS USED) TO SPEAKER AND HEADPHONES. (SEE ABOVE: METER PUSHBUTTON FUNCTION TABLE.)
5. MANUAL RF GAIN PUSHBUTTON
SELECTS AGC ON OR OFF.
6. AGC PUSHBUTTON AND DISPLAY
SWITCHES THROUGH AGC TIME CONSTANTS SINGLE STEP, OR SCROLLS WHEN HELD DOWN.
7. MODE PUSHBUTTON AND DISPLAY
SWITCHES THROUGH AVAILABLE MODES (AM, FM, CW, LSB, OR USB) SINGLE STEP, OR SCROLLS THEM WHEN HELD DOWN. ALSO CAUSES AUTOMATIC RESELECTION OF IF BANDWIDTH WHEN NECESSARY.
8. BANDWIDTH PUSHBUTTON AND DISPLAY
SINGLE STEP OR SCROLLS THROUGH IF FILTER BANDWIDTHS AVAILABLE IN THE SELECTED MODE. THE DISPLAY SHOWS BANDWIDTH IN KHZ.
9. DWELL PUSHBUTTON AND DISPLAY
SINGLE STEP OR SCROLLS THROUGH DWELL TIMES AVAILABLE IN SCAN MODE. DISPLAY SHOWS DWELL TIME IN SECONDS.
10. GROUP PUSHBUTTON AND DISPLAY
PUSHBUTTON IS USED TO SELECT OR PROGRAM ONE OF TEN GROUPS OF CHANNELS WHILE SCANNING. DISPLAY SHOWS GROUP NUMBER.
11. BFO PUSHBUTTON, DISPLAY, AND INDICATOR
PUSHBUTTON ALLOWS ENTRY OF BFO FREQUENCY IN 10 HZ STEPS WITH EITHER THE MAIN TUNING KNOB OR KEY PAD. BFO SIGN IS CHANGED BY RE-PRESSING BFO BUTTON. LED TO THE RIGHT OF THE PUSHBUTTON INDICATES WHEN BFO ADJUSTMENTS ARE ENABLED.
12. REMOTE PUSHBUTTON AND INDICATOR
ALLOWS SELECTION OF REMOTE OR LOCAL CONTROL. LED ILLUMINATES IN REMOTE MODE.
13. FAULT INDICATOR
INDICATES SYNTHESIZER OUT OF LOCK, POWER SUPPLY FAULT, RF INPUT OVERLOAD OR BITE TEST FAILURE.
14. TUNE RATE PUSHBUTTON
SINGLE STEP OR SCROLLS THE CURSOR (UNDERLINE) POSITION FOR FREQUENCY TUNING.
15. FREQUENCY DISPLAY
DISPLAYS FREQUENCY BEING USED, PROGRAMMED, OR SCANNED.
16. FREQUENCY PUSHBUTTON AND INDICATOR
PLACES RECEIVER IN FREQUENCY MODE. FREQUENCY AND OTHER OPERATING PARAMETERS ARE ENTERED DIRECTLY, USING EITHER THE KEY PAD OR TUNING KNOB. LED INDICATES WHEN IN FREQUENCY MODE.
17. CHANNEL PUSHBUTTON AND INDICATOR
PLACES RECEIVER IN CHANNEL MODE. FREQUENCY AND OPERATING PARAMETERS MAY BE PREPROGRAMMED FOR 100 CHANNELS. CHANNEL IS SELECTED EITHER BY KEY PAD OR TUNING KNOB. LED INDICATES WHEN IN CHANNEL MODE.
18. CHANNEL
DISPLAYS CHANNEL PROGRAMMED, OR CHANNEL NUMBER.
19. NUMERIC
USED FOR NUMERICAL SET, OR CHANNEL NUMBER.
20. TUNE PUS
ENABLES TUNING FREQUENCY OF TUNING KNOB IS ENABLED.
21. ENTER PUS
INITIATES EXECUTION OF BFO OFFSET.
22. TUNING K
WHEN ENABLED, INDICATES CHANNEL QUENCY, CHANNEL



- 32. **SPEAKER (SPKR) PUSHBUTTON**
ALTERNATE ACTION ENABLES AND DISABLES LOUDSPEAKER.
- 33. **HEADPHONE (PHONES) JACK**
USE OF HEADPHONES AUTOMATICALLY DISABLES LOUDSPEAKER.
- 34. **NOISE BLANKER (NB) (OPTIONAL)**
SELECTS NOISE BLANKER OPERATION.
- 27. **RF GAIN CONTROL**
ALLOWS MANUAL CONTROL OF RF GAIN.
- 28. **LOAD PUSHBUTTON**
ENTERS RECEIVE PARAMETERS INTO CHANNEL AND GROUP MEMORY DURING PROGRAMMING.
- 29. **RECALL PUSHBUTTON**
ALLOWS INSTANT RECALL OF PARAMETERS IN THE AUXILIARY (MOST-USED) CHANNEL.
- 30. **AF GAIN CONTROL**
VOLUME CONTROL FOR LOUDSPEAKER AND HEADPHONES. ALSO CONTAINS MAIN POWER SWITCH.
- 31. **TEST PUSHBUTTON AND INDICATOR**
PLACES RECEIVER IN TEST MODE IN WHICH RECEIVER COMPLETES A COMPREHENSIVE SERIES OF TESTS. RESULTS APPEAR ON ALPHANUMERIC DISPLAY. INDICATOR ILLUMINATES DURING TEST.
- 23. **RECEIVE (RCV) PUSHBUTTON AND INDICATOR**
PLACES RECEIVER IN THE RECEIVE MODE. ALL FUNCTIONS ARE CONTROLLED EITHER DIRECTLY OR BY INFORMATION PREPROGRAMMED FOR CHANNELS. INDICATOR ILLUMINATES WHEN IN THE RECEIVE MODE.
- 24. **SQUELCH CONTROL**
ADJUSTS THRESHOLD FOR VOICE ACTIVATED SQUELCH (CW, SB, OR AM) OR CARRIER ACTIVATED SQUELCH (FM).
- 25. **SCAN PUSHBUTTON AND INDICATOR**
PLACES RECEIVER IN SCAN MODE IN WHICH CHANNELS ARE SCANNED IN EITHER CHANNEL OR GROUP MODE. DWELL TIME IS ADJUSTABLE.
- 26. **PROGRAM (PROG) PUSHBUTTON AND INDICATOR**
PLACES RECEIVER IN PROGRAM MODE TO ALLOW PREPROGRAMMING OF CHANNELS AND GROUPS. LED INDICATES WHEN IN PROGRAM MODE.
- 18. **CHANNEL DISPLAY**
DISPLAYS CHANNEL NUMBER BEING USED, PROGRAMMED, OR SCANNED.
- 19. **NUMERIC KEY PAD**
USED FOR NUMERIC ENTRY OF FREQUENCY, BFO OFFSET, OR CHANNEL.
- 20. **TUNE PUSHDOWN AND INDICATOR**
ENABLES TUNING KNOB FOR SELECTION OF CHANNEL, FREQUENCY, OR BFO OFFSET. LED INDICATES WHEN KNOB IS ENABLED.
- 21. **ENTER PUSHDOWN AND INDICATOR**
INITIATES EXECUTION OF FREQUENCY, CHANNEL, OR BFO OFFSET.
- 22. **TUNING KNOB**
WHEN ENABLED PROVIDES TUNING CONTROL OF FREQUENCY, CHANNEL, OR BFO OFFSET.

Figure 3-1. RF-590 Front Panel Control

3.6.1.1.2 Tune Rate Cursor Movements

Pressing the TUNE RATE button causes the cursor to move one place to the right. When held down, the cursor moves to the right at one step each half second. Release the button and the movement stops. If the cursor goes off the end it reappears in the most significant position. Note that the cursor does not move with digit entries. Only the TUNE RATE button changes the cursor position. The cursor may be considered as a starting point for frequency entries.

3.6.1.1.3 TUNE Knob Operation

If the LED adjacent to the TUNE knob is not lit, press TUNE, which will enable the TUNE knob and light the LED. The knob is now used to select the digits at and to the left of the cursor. The frequency tuning stops at minimum and maximum frequencies and will not roll around to the opposite end of the range (e.g., it stays at 29.999999 despite efforts to increase it). Press TUNE a second time and the tune LED goes off and further rotation has no effect (Tune knob disabled).

NOTE

The tune knob rate is fixed at 100 changes per revolution for frequency and 25 per revolution for channels.
The knob cannot be used in the 10 MHz position.

3.6.1.1.4 Partial Frequency Entry

Partial frequency entries simply start at the cursor position and enter to the right when keyed entry is used. Selected digits are dimmed to half brilliance until the ENTER button is pressed. Note again that the cursor position does not move, so multiple entries can be made from the same starting point. It is therefore easy to change from 17.2053 to 17.2018 and back to 17.2053 again.

Pressing the FREQUENCY button will clear any pending (dimmed) digits entered in error, and restore the cursor to the 10 MHz position.

3.6.1.2 Channel Entry

3.6.1.2.1 Entering a New Channel

Pressing the CHANNEL button causes the CHANNEL LED to light indicating channelized operation. Digits are entered first in the tens position, then in the ones position. Digits selected are dimmed to half brilliance until the ENTER button is pushed, at which time the receiver tunes to the new channel and the digits return to full brilliance.

3.6.1.2.2 Tune Knob Operation in Channel Entry

To operate the TUNE knob in the channel field, press CHANNEL and then activate the TUNE knob. (CHANNEL and TUNE LEDs will light.) Rotation of the TUNE knob will cause the receiver to automatically select a new operating channel.

3.6.1.3 BFO Entry

The BFO offset range is -9.99 kHz to +9.99 kHz. Pressing the BFO button causes subsequent keypad or tune knob entries to be made in the BFO section of the alphanumeric display. Keypad BFO entries are still terminated by the ENTER button. Enable the TUNE knob to allow BFO change by knob rotation. The knob selects up to +9.99 and stops or down to -9.99 and stops. There is no roll around in the tune knob function. The cursor is not relevant in BFO operation. The plus (+) or minus (-) sign is changed by alternate presses of the BFO button when BFO operation has been selected.

3.6.1.4 Automatic Gain Control (AGC) and RF GAIN Control

Two basic modes of RF gain control are possible:

- Automatic Gain Control (AGC) – with selectable time constants.
- Manual RF Gain – variable using the front panel RF GAIN Control.

Additionally, there are four choices for AGC speed.

3.6.1.4.1 AGC Time Constant Selection

The AGC ON/OFF pushbutton turns the AGC ON or OFF. When turned on, the last used AGC speed is enabled until changed.

Automatic Gain Control (AGC) time constant selection is accomplished by the AGC button. Pressing this button will scroll the AGC portion of the alphanumeric display through the possible AGC speeds: slow, medium, fast, and data. Releasing the button causes the receiver to operate using the selected AGC speed.

3.6.1.4.2 Manual GAIN Control

The RF GAIN control is always active and may override the AGC if so desired. It provides up to approximately 125 dB of gain reduction.

3.6.1.5 Demodulation Mode Selection

Pressing and holding down the MODE button causes the receiver to scroll through the available modes (AM, CW, LSB, USB, or FM) in the alphanumeric display. While the modes are scrolling they are displayed

at half brilliance. Release of the button causes the receiver to operate in the selected mode and the display returns to full brilliance. When the mode change has been completed the BW display changes to the bandwidth that was last used for that mode.

3.6.1.6 Bandwidth Selection

Pressing and holding the BW button causes the receiver to scroll through the bandwidth selections that are available and valid for the selected mode. Release of the button causes the receiver to switch to the selected bandwidth. Bandwidths used are normally customer specified, and usually only CW or AM will have more than one filter.

NOTE

After any Receive function parameter (MODE, BW, AGC, BFO, or FREQUENCY) is changed by release of a scrolling button, depression of ENTER or rotation of the TUNE knob, the new RECEIVE set up is stored and would be reused upon later entry into the Receive function from some other function, such as SCAN. Note that such a parameter change will also cause the previously displayed CHANNEL number to be blanked, since the new setups no longer correspond to that channel's setup parameters.

3.6.1.7 Meter Monitoring Selection

A meter on the front panel of the RF-590 monitors the RF and AF signal levels. Pushbutton switches allow the operator to monitor the LSB (in the ISB mode) RF signal strength, USB RF signal strength, USB line audio output level, and LSB (in the ISB mode) line audio output level. The meter scale is calibrated in μV_{rms} or mV_{rms} for RF signals (1 μV to 100 mV) and dBm for AF signals (-15 dBm to +10 dBm , +4 dBm center scale). In ISB mode, the meter switches also select USB or LSB input to loudspeaker and headphones.

3.6.1.8 Audio Output Selection and Control

The RF-590 provides the four following audio output sources:

- Internal Speaker
- Headphone
- External Speaker
- Line Audio

3.6.1.8.1 Internal Speaker and Headphone Output

A front panel speaker capable of delivering 2.0 watts of audio power is provided in the RF-590. A front panel 600 ohm Headphone Output jack compatible with a PL-55 type connector is also provided.

The AF GAIN Control adjusts the speaker and headphone volume level. This control has no effect upon the Line Audio Output.

Use of the headphone jack automatically disables the speaker. Speaker disabling is also provided by the speaker ON/OFF switch.

3.6.1.8.2 External Speaker Output

A rear panel output (listed in table 2-3) allows connection of an external 8 ohm speaker. This external speaker is controlled in the same manner as the internal speaker (paragraph 3.6.1.8.1), and will deliver 2.0 watts of audio power.

3.6.1.8.3 Line Audio Outputs

The 600 ohm line audio outputs for USB and ISB (LSB) audio signals are provided on the RF-590 rear panel (listed in tables 2-3 and 2-4). All outputs are balanced, with an ungrounded center tap.

Line audio output levels are continuously variable via front panel screwdriver adjustments. Either output (USB or ISB) is independently adjustable from -16 dBm to +10 dBm (600 ohm). Line audio level monitoring is provided by a front panel meter and meter select switches (see paragraph 3.6.1.7 and figure 3-1).

3.6.1.9 Squelch Control

Front panel SQUELCH control adjusts a threshold for carrier activated squelch (FM mode) or voice activated squelch (all other modes). The SQUELCH control is continuously variable.

3.7 PROGRAM FUNCTION

The RF-590 program function allows an operator to store up to 100 channels of frequency, modulation mode, filter bandwidth, AGC mode, and BFO offset.

3.7.1 Programming Channels

The program function is entered by pushing the PROGRAM button on the receiver front panel. The CHANNEL LED will light, indicating that the receiver is set up to accept channel programming. To program channels in the RF-590, proceed with the following steps.

- a. Select the desired two digit channel number.
- b. Press the FREQUENCY pushbutton, and enter the desired frequency. (Note that for both steps a and b, the digits will dim to half brilliance once entered.)
- c. Press ENTER. (Digits will return to full brilliance.)
- d. Select desired AGC speed, modulation mode, filter bandwidth, and/or BFO offset. (Only BFO offset entry must be terminated by ENTER button.)
- e. Press LOAD button once all parameters (steps a through d) have been selected.
- f. Push CHANNEL button and repeat steps a through e to program the next channel.
- g. Press RECEIVE or any other function button to get out of the program function.

Programmed channels are stored in battery back-up CMOS RAM. At power up, the microprocessor checks the validity of the RAM. If the RAM fails the validity check the channels are defaulted to 10.000000 MHz, AGC-fast, Mode-USB, and BFO-0.00 kHz.

3.7.2 Programming Groups

In addition to incremental channel scan, the receiver has the capability of scanning predefined subsets of channels organized as groups (zero to nine). Each of these ten groups may have between zero and twenty channels in it. Any channel may be assigned to any group and the same channel can be assigned to several groups if desired.

To program these groups the operator should:

- a. Press PROGRAM and then GROUP. The receiver responds by prompting GROUP NUMBER?.
- b. Select the single digit group number via the keypad. Press ENTER. The receiver responds by clearing the group of previous channels and prompts CHANNEL NUMBER?.
- c. Select a two digit channel number. Press ENTER and LOAD. (Channel numbers will appear at half brilliance until the ENTER button is pushed. The receiver responds with the channel number followed by OK when the LOAD button is pushed.)
- d. Select the next two digit channel number. Press ENTER and LOAD. Channels are entered in this fashion, until all the desired channels in this group (up to 20) have been entered.
- e. Press GROUP to select another Group to program. The receiver responds again with the prompt GROUP NUMBER?.

- f. Repeat steps b through e for up to nine more groups.
- g. Press RECEIVE or any other function button to get out of the Program function.

Since the operator can manually scan through a group in the Scan function using the Tune knob, no special provision has been provided for reviewing the groups in the Program function. Also, the RECALL button has no effect in Group programming.

3.7.3 Program Function – Effect on Receiver Operation

In general, the receiver operating frequency is changed only in Receive or Scan. Entries made in Program function do not change the frequency of operation. Because Program function does affect the front panel display, return to the Receive function from the Program function will restore the display to the true parameters that are presently in use.

3.8 SCAN FUNCTION

The Scan function of the receiver is entered by pressing the SCAN button. The message prompt GROUP OR CHANNEL SCAN?, then appears in the alphanumeric display field. The operator responds by pressing either the GROUP button for group scan or the CHANNEL button for sequential channel scan.

3.8.1 Dwell Selection in Scan Function

Dwell time per channel is a front panel scroll function that is selected for scan operation. It is not preprogrammed with channels or groups. There are ten internal dwell selections. They are 0.1, 0.2, 0.4, 0.5, 0.8, 1.0, 2.0, 4.0, 5.0, and 8.0 seconds. Additionally, the scroll includes the selection of EXT for external channel change timing. Note that the dwell times scroll is from minimum to maximum and back down to minimum without rolling around.

3.8.2 Channel Scan

If the operator presses the CHANNEL button after entering the Scan function, the receiver prompts FIRST CHANNEL?. The operator responds by selecting 2 digit channel number at the keypad followed by ENTER. The receiver responds by prompting LAST CHANNEL? and the operator selects another channel at the keypad and presses ENTER. The keypad selections are the lower and upper limits on an incremental Channel Scan. If the last limits used (displayed with the prompt) are desired, the number need not be reentered. Pressing ENTER alone will reuse the previous SCAN channels.

3.8.3 Group Scan

If the operator pressed GROUP after entering Scan mode, the receiver responds by prompting GROUP NUMBER?. The operator selects a group by pressing a digit followed by ENTER. (The number of the last group scanned or programmed will appear with the prompt. To reuse this group number, press ENTER alone.) The receiver automatically scans the channels in the indicated group in the same order that they were entered using the dwell selected at the front panel. If the group has not been programmed, the receiver responds by displaying ANOTHER GROUP? and the operator should select an alternate group.

3.8.4 Additional Scan Details

The scan may be stopped by:

- Pressing the SCAN button while scanning (a second push will restart it).
- Pressing TUNE to stop automatic Scan and press CHANNEL to allow Manual scan via the TUNE knob (CHANNEL and TUNE LEDs will be on).
- Providing an external Stop Scan signal (see table 2-4).

3.9 AUXILIARY CHANNEL

Operators will frequently have a preferred (most widely used) frequency or channel. The receiver provides a method to instantly call up this favorite setting while tuned to some other frequency in the Receive function. To program this auxiliary channel, update the display to the desired frequency, modulation mode, etc (while in the Receive function) and press LOAD. To use the auxiliary channel, simply press RECALL at any time while in the Receive function. The receiver will tune to the auxiliary channel and will update the displays accordingly.

The auxiliary channel information is also stored in the battery backup RAM, so the favorite channel data is stored during power off.