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PURPOSE

This manual contains very important information on the installation, operation, and maintenance of your new equipment. To get the best results in operation and performance, please take the time to read this manual thoroughly.

*******IMPORTANT NOTICE*******

This device is only an aid to navigation. Its performance can be affected by many factors including equipment failure or defect, environmental conditions, and improper handling or use. It is the user's responsibility to exercise common prudence and navigational judgment, and this device should not be relied upon as a substitute for such prudence and judgment.

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TABLE OF CONTENTS

GLOSSARY OF TERMS

VHF……………………………… Very High Frequency (30 MHz to 300 MHz)

FM.……………………………… Frequency Modulation.

MODULATION.……………………… To vary a carrier wave.

CARRIER WAVE.……………….... A radio frequency on which intelligence is superimposed.

DUAL WATCH.……………………... Monitors channel 16 while working on another channel.

USA CHANNELS.……………….... Channel designations as defined by the FCC.

INTERNATIONAL CHANNELS…..… Channel designations as defined by the International Telecommunication Union.

CANADIAN CHANNELS.…………… Channel designations as defined by the Canadian Govt.

WEATHER CHANNELS.…………… Channels for routine and emergency weather information broadcast by NOAA.

SIMPLEX.………………………….. Transmit and receive on the same frequency.

DUPLEX.………………………….. Transmit and receive on different frequencies.

SQUELCH.…………………………... To suppress totally.

LCD.……………………………….. Liquid Crystal Display.

TX.………………………………….. Transmit.

RX.………………………………… Receive.

RF.………………………………… Radio Frequency.

CPU.……………………………….. Control Processor Unit.

PLL.………………………………… Phase Locked Loop (A type of Frequency Synthesizer).

VCO.………………………………. Voltage Controlled Oscillator.

PTT.……………………………….. Microphone Push-To-Talk switch.

SECTION 1

GENERAL DESCRIPTION

1.1   INTRODUCTION

Congratulations on your purchase of Raytheon's RAY106 handheld marine radiotelephone. The RAY106 is a CPU-controlled, digitally synthesized, compact handheld transceiver, that provides reliable simplex and duplex (two-frequency) communications between ships at sea and from ships at sea to public or private shore stations. The RAY106 provides two-way communications on all U.S., International, and Canadian channel Marine band frequencies, plus reception on 10 separate weather channels.

This manual describes the physical and functional characteristics of the radiotelephone.

1.2   EQUIPMENT FEATURES

The RAY106 is designed and manufactured to provide ease of operation with excellent reliability. Some important built-in features of this radio are listed below:

- Totally submersible industrial design.

- All solid-state circuitry for low current drain (longer battery life) and maximum reliability.

- High-performance receiver section with optimum selectivity.

- Access to all available U.S., International, and Canadian VHF Marine band channels.

- Exclusive circuit that automatically selects 16 PLUS (priority) channel when the radio is turned on.

- Exclusive weather alert feature (when in Monitor Mode).

- Memory channels can be programmed for Memory Scan and Memory Seek operations.

- Selected channel number is always shown on the digital LCD display.

- Aluminum die cast housing to prevent interference of offending RF.

- "Quick" 16 PLUS, for instant selection of the emergency calling channel CH16, or an alternate priority channel.

- Easy direct mode access to 10 weather channels WX 0 through WX 9.

SECTION 2

INSTALLATION

2.1   UNPACKING AND INSPECTION

Use care when unpacking your new RAY106 from the shipping carton to prevent damage to the contents. It is also good practice to save the carton and the interior packing material. The original packing material should be used in the unlikely event it becomes necessary to return the unit for service.

2.2   EQUIPMENT SUPPLIED

The following is a list of the standard equipment included with your RAY106.

Description	Part No.
RAY106 Radiotelephone	M56800
Wall Charger Adapter110VAC	G624700-2
1200mAh NiCad Battery Pack	G264696-3
Desktop/Wall Charger	G624696-4
Instruction Manual	G264696-5
AA Battery Holder	G624700-5
Rubber Helical Antenna	G624696-6
Leatherette Carrying Case	G624696-7
Belt Clip w/Screws	G624700-8
Wrist Strap	G624700-9
NiCad Battery Safety Message	G263695-1

Table 2-1 Equipment Supplied

2.2.1   Optional Accessories

Description	Part No.
Universal Drop-In Charger (12VDC, 110VAC, 220 VAC)	M56791C
12V Cigarette Lighter Adapter	M99-134
High Gain Antenna	M56809
Leather Holster/Carrying Case	M56810
Soft Carrying Case	M56811

Table 2-2 Optional Accessories

These optional accessories may be ordered by calling our Customer Service Department directly at (603) 647-7530 ext.2333 Monday through Friday 8:30 am-5:00 pm E.S.T.

2.3 ASSEMBLY

2.3.1 AA Battery Holder

Your radio was shipped from the factory with the AA battery holder attached. Removal of this battery holder is as follows:

1) Using a coin or screwdriver, turn the screw at the base of the AA battery holder counterclockwise. This will allow you to remove the holder from the radio.

AA Battery Holder Removal
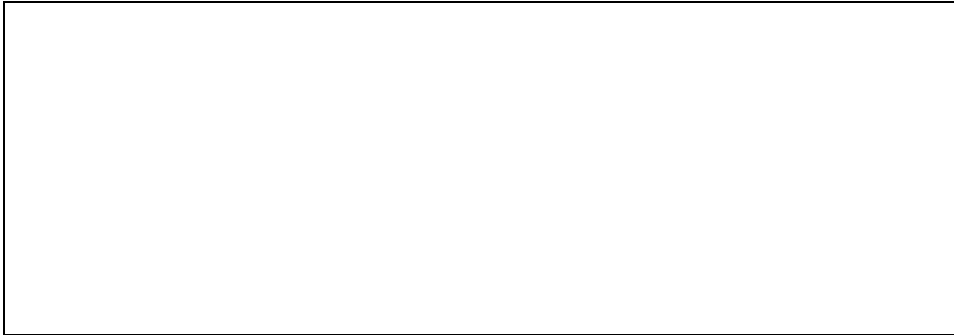
2) There are no batteries installed in the AA battery holder from the factory. To install batteries, carefully follow the battery insertion drawing found on the door of the battery holder.

Installation of AA Batteries
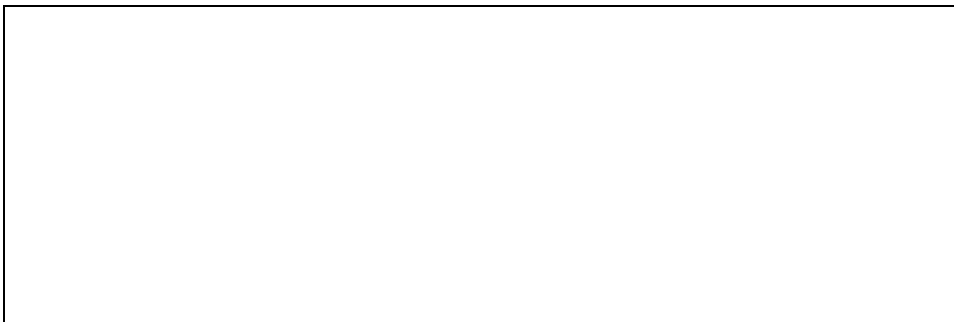
AA BATTERY HOLDER USAGE

- **Always carefully note the correct installation of batteries into the battery holder.**

- **Only use Alkaline or NiCad AA batteries in the AA battery holder.**

- **If rechargeable alkalines or NiCads are used, they must be removed from the AA battery holder to be recharged. The AA battery holder cannot be used with the desktop/wall charger included with your radio.**

- **Always note the safety, handling, and storage instructions that is included with AA batteries you may purchase. Especially when storing batteries inside the AA battery holder for extended periods of time, or emergency use.**

2.3.2 NiCad Battery Pack

Although some voltage may be measured on the NiCad battery pack initially, it must be fully charged before normal use. Remove the battery pack from the poly bag, and attach it to the radio housing. Using a coin or screwdriver, turn the screw at the base of the NiCad battery pack clockwise to secure the battery to the radio housing.

Installing the NiCad Battery Pack
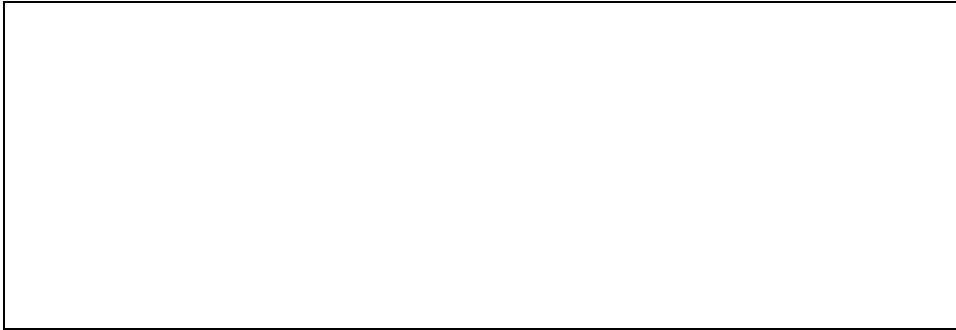
2.3.3 NiCad Battery Charger

The NiCad battery charger can be used as a desktop charger, or can be wall mounted in a convenient location. To attach the battery charger to a wall or other vertical surface:

1) Remove the two screws from the base of the charger.

2) Remove the wall mounting plate, and attach it to the wall using the screws provided.

3) Reassemble the charger by sliding the charger body down into the wall mounting plate.

4) Replace the two screws in to the base of the wall mounted charger.

Wall Mounting the NiCad Battery Charger

2.3.4 Charging the NiCad Battery Pack

Although some voltage may be measured on the NiCad battery pack initially, it must be fully charged before normal use.

1) Insert the radio with the battery pack attached into the battery charger.

2) Connect the AC wall adapter into a standard 110VAC wall outlet, and insert the molded plug into the connector on the side of the NiCad battery charger. The "CHARGE" indicator on the front of the charger will illuminate when the it is receiving voltage from the AC adapter.

3) A typical time to recharge the battery pack can be up to 15 hours. Normal operating time will be an average of 6 to 8 hours on a fully charged battery. To conserve battery life, use the low (1W) power setting when using the radio for primarily short range communications.

Charging the NiCad Battery Pack

2.3.5 Getting the most out of your Nicad Battery Pack

To extend the life of your NiCad Battery Pack and maintain its best performance during the use of your radio, follow the guidelines listed below.

- **To recharge the radio's battery pack safely, always use only the AC adapter that comes with your radio or an equivalent replacement.**

- **The radio should always be turned OFF while recharging the battery pack.**

- **Avoid short charging cycles. In general, the battery should only be recharged when fully discharged. The optional Universal Drop-In Charger (M56791C) features a discharge key and a rapid recharge for fully automatic discharge/recharge battery cycles.**

- **Avoid high ambient temperatures (over 110° F) while recharging the battery pack.**

- **When the battery pack becomes warm to the touch, it is fully charged and should be removed from the charger.**

- **If the radio is to be stored for an extended period of time, remove the battery pack to avoid possible damage and/or resultant battery failure.**

- **When it is determined that the battery is no longer useful, it should be disposed of properly.**

2.3.6 Attaching the Antenna

Securely fasten the rubber helical antenna to the SMA type connector on the top of the radio.

Attaching the Antenna

2.3.7 Attaching the Belt Clip and Wrist Strap

1) Put the radio into the supplied leatherette carrying case if desired.

2) Remove the belt clip and hardware from the packing materials. Using the two screws provided attach the belt clip to the rear housing of the radio.

3) Attach the wrist strap by looping it through the mounting hole.

Belt Clip and Wrist Strap Installation
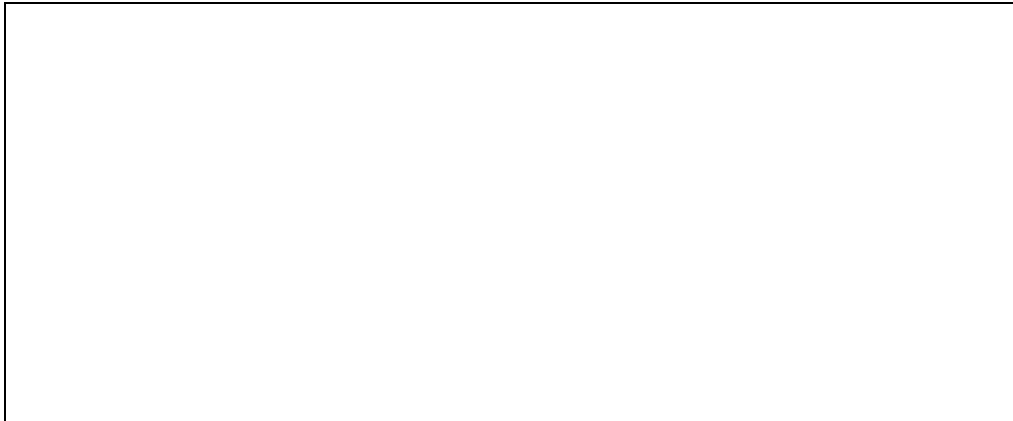
2.3.8 RAY106 Dimensions
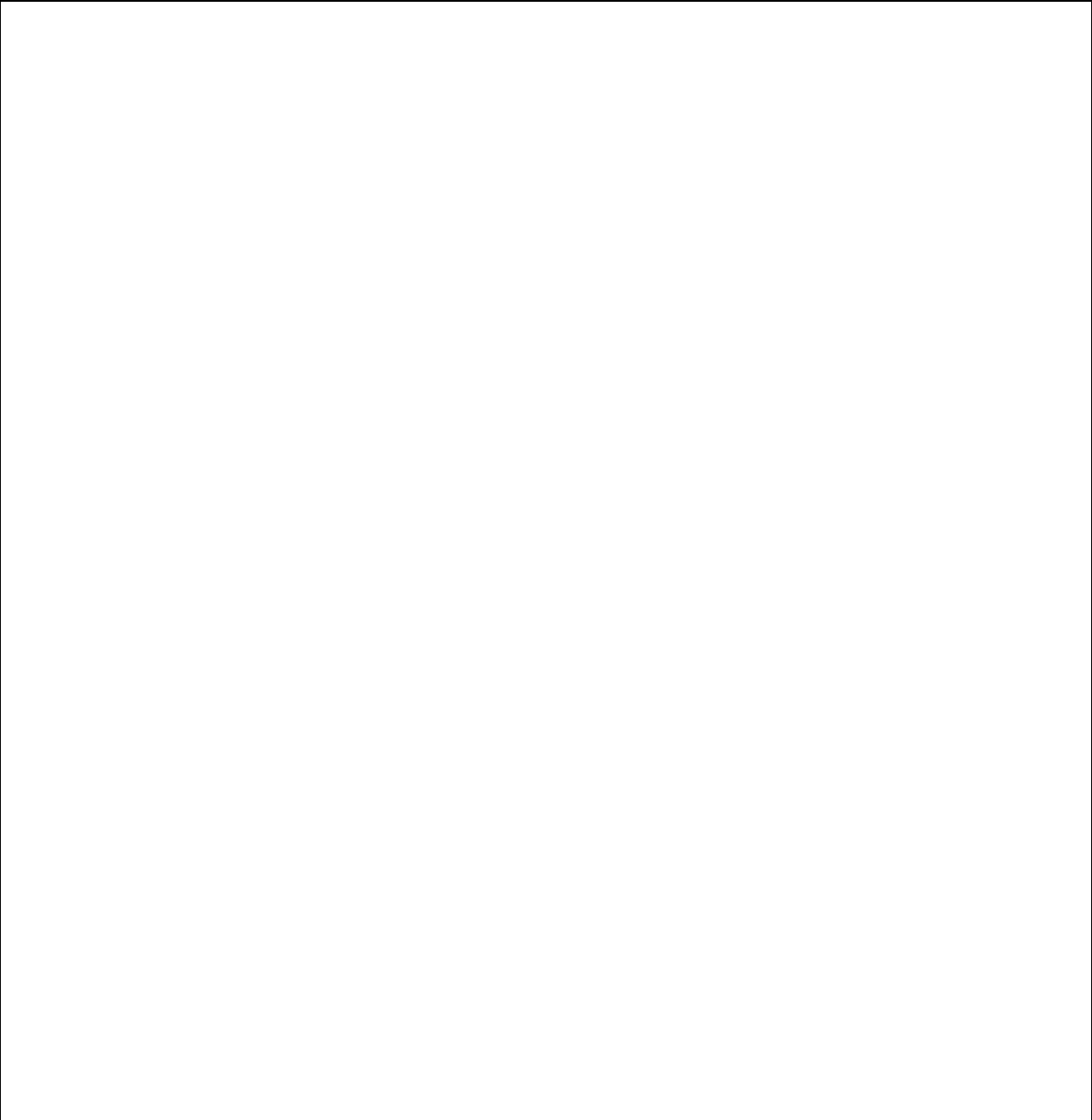
Fig. 2-1 OUTLINE DIMENSIONS

SECTION 3

OPERATIONS

3.1   INTRODUCTION

Your RAY106 has the capability to transmit on all legally available Marine VHF radiotelephone channels. There are channels that are FCC approved but may only be used by authorized stations for specific purposes, depending on the type of vessel (commercial or non-commercial). Carefully review section 3.3.8 which lists all of the marine VHF channels available in your RAY106 for U.S., International, and Canadian radiotelephone use. Full familiarization with this table is essential when selecting your channels. The U.S. channels are those channels authorized for use in the U.S. by the FCC. The international frequencies were agreed upon by the attending countries at the 1968 International Telecommunication Union meeting in Geneva and are in active use around the world.

3.2   CONTROLS AND LCD DISPLAY

Refer to Figure 3-1 for familiarization with the controls and display modes.

3.2.1   Controls

1) VOLUME Control (On/Off)
    Turns the radio On and controls the Volume of the audio output from the speaker.

2) SQUELCH Control
    Allows the user to "quiet" the receiver when no signals are being received.

3) PTT (Push-To-Talk) Switch
    When pressed puts the radio into the transmit mode, and "TX" is displayed on the LCD.

4) LIGHT Key (LCD backlight and Keypad Lock functions)

    - Backlight - When pressed turns on the backlighting of the LCD display for five seconds. When the backlight is on, any other keypress will extend the backlight for an additional five seconds.

    - Key Lock - Press and hold the LIGHT key for 3. Seconds. An audible beep will be heard and an "**L**" will be displayed in the small channel indicator section of the LCD, to confirm the key lock mode. In this mode, only the channel number and battery level indicator is displayed, and all keys are disabled except the PTT and LIGHT keys.

    - To exit the Key Lock mode, press and hold the LIGHT key for 3 seconds. A beep will be heard when the key lock mode is canceled. The Key Lock mode is automatically disabled when the unit is turned off.

5) SCAN / SEEK Key

- When pressed, puts the radio into the All scan or Memory scan mode. In this mode, the radio scans through the channels, stopping when radio traffic is detected, then resumes scanning after the traffic ceases. If the scanning has stopped on a particular channel, and you wish to continue, press the SCAN key again to continue scanning.

- When pressed and held for 1 second, a beep will be heard and the All seek or Memory seek mode is activated. In this mode, the radio will stop on channels on which radio traffic is detected, monitor the traffic for about 7 seconds, then continue to the next channel with traffic.

6) MEM Key

This key is used to program channels into memory, or to clear channels from memory. The radio will beep to confirm when channels are being stored into memory.

7) WX / INT Key

- When pressed, selects the Weather mode. "**WX**" is displayed on the LCD along with a weather channel number (0 - 9). Use the ▲/▼ channel keys to select your local NOAA weather channel. In the WX mode, the transmitter is disabled.

- Press and hold for 1 second, to change from U.S. mode to INT (international) or CA (Canada) mode. The U.S. mode is the default operating mode.

> **IMPORTANT NOTE**
> **The INT and CA modes are not legal for use while operating in US waters.**

8) MON / TX Key

- When pressed, selects the Monitor (Dual Watch) mode and "**MON"** appears on the LCD. In this mode, the radio will monitor the currently selected working channel and the priority channel (16plus).

- While in the Monitor (Dual Watch) mode, press the MEM key to activate the Tri-Watch mode. In the Tri-Watch mode, the last used weather channel is also monitored for severe weather alert broadcasts.

- When pressed, and held for 1 second, a beep will be heard and the transmit output power setting alternately changes between 5, 3, and 1 Watt.

9) 16PLUS Key

This key is used to instantly select the priority channel (16plus). CH16 is the default priority channel from the factory. However an alternate channel can be programmed as the priority channel if desired.

10) ▲/▼ Channel Keys

The up and down arrow keys are used to change the currently selected channel. The channel number is increased or decreased once with each keypress or if held, will continue scrolling through the channels until released.

3.2.2 LCD Display

A number of indicators appear on the LCD display in different locations. The following list describes each indicator and when it will appear.
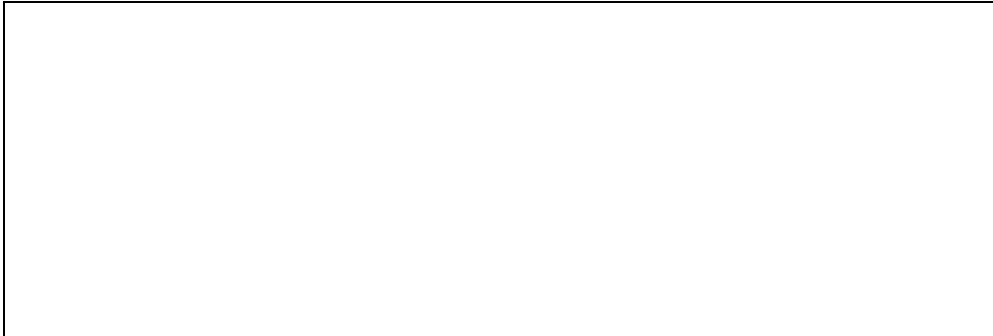
Fig. 3-2 LCD DISPLAY

① **MEM** (Memory) : will be displayed when the current channel is a memory channel, and in Memory Scan/Seek mode.

② **SCAN** (All Scan/Memory Scan) : will be displayed when the radio is in the All Scan or Memory Scan mode.

③ **MON** (Monitor) : will be displayed when the radio is in the Monitor mode.

④ **WX** (Weather) : will be displayed when a weather channel is selected. The "WX" indicator will blink when a severe weather alert tone is received (in Monitor mode).

⑤ **SEEK** (All Seek/Memory Seek) : will be displayed when the radio is in the All Seek or Memory Seek mode.

⑥ **INT** (International) : will be displayed when International channels are programmed for use.

⑦ **5 / 3 / 1** : will be displayed to indicate the current TX power setting.

⑧ **TX** (Transmit) : will be displayed on the LCD when the Push-To-Talk (PTT) switch on the radio is engaged and the transmitter circuits are providing RF signals to the antenna.

⑨ **BATT** : is always shown on the display along with the battery voltage bar indicators to provide a battery level status. The "BATT" indicator will blink when the battery voltage is low, and the battery needs charging. If a low battery condition is detected during transmission, "LO" will be shown and the radio will stop transmitting. The battery level is shown on the LCD as follows:

Battery condition	LCD Indicator
Fully charged	**BATT**
Normal operation	**BATT**
Needs charging	**BATT**

⑩ **LARGE CHANNEL #** : displays the channel number currently in use.

⑪ **SMALL CHANNEL #** : displays the channel number of the priority channel in Monitor mode.

Other indicators shown in the Small Channel segment area:
L : indicates Key Lock mode.
C : indicates Canada mode.
P : indicates Priority mode.

3.3   OPERATING PROCEDURES

Specific operating procedures for the 106 are presented in this section. General information regarding correct marine channel usage may be found in the Appendix section. Refer to the Control section 3.2.1 beginning on page 9 for a thorough description of all 106 functions.

3.3.1   Turning the Power On

1) Rotate the ON/OFF/Volume control clockwise to turn the radio on. Continue rotating the knob clockwise and set it at approximately the midpoint of it's range.

2) Rotate the SQUELCH control fully counterclockwise. (Background noise will be heard.)

3) Set the VOLUME control to the desired listening level.

4) Rotate the SQUELCH control slowly clockwise until the background noise in the speaker ceases.

5) When the power is initially turned on, the priority channel (16plus) will be selected. Press the ▲/▼ channel keys to select the desired working channel. Refer to section 3.3.8 on pages _ _ - _ _ for the available VHF Marine channels and their frequencies.

To Select A Weather Channel

1) Press the WX key, then the ▲/▼ channel keys to select your local NOAA weather channel (0 to 9). When the WX mode is selected, the transmitter is inhibited.

To Transmit

1) To select or change the transmitter output power, press and hold the TX key for 1 second. There are three output power settings; 5 Watts, 3 Watts, and 1 Watt. The appropriate power setting depends on the distance the message is to be transmitted, transmitting conditions, and desired battery life.

2) Press the Push-To Talk (PTT) switch and speak into the microphone using a clear normal voice.

> **NOTES:**
>
> - **Initial communication contacts are usually made over channel 16 as all ships and shore stations monitor this channel, then a shift to a working channel will be necessary.**
>
> - **In certain US harbors and on certain channels, the FCC requires the power to be limited to 1 watt. On these "required" channels, the radio automatically selects the 1 watt power output setting when the channel is selected.**
>
> - **The RAY106 is designed to meet the new FCC Rules Part 80.203, which states, if the Push-To Talk (PTT) switch is pressed for over five minutes continuously, the transmitter will disengage. If this occurs, audible beeps will sound continuously until the PTT switch is released. Upon release of the PTT switch, normal radio operation will resume.**

3.3.2 The 16PLUS (priority) Channel

The 16plus priority channel has been preset to CH16 prior to shipment from the factory. However, an alternate working channel can be selected as the priority channel if desired, using the procedure below.

1) Press the ▲/▼ channel keys to select the desired channel.

2) Press and hold the 16plus key for three seconds. An audible beep tone will confirm that the selected channel is stored in memory as the new priority channel.

3) To reprogram CH16 as the 16plus channel, repeat steps 1 and 2 for CH16. WX channels cannot be programmed as the priority channel.

3.3.3 Memory Key Functions

The MEM key is used to program channels into memory for Memory Scan and Memory seek functions, and for the Memory Recall function.

- **To program a channel into memory**, select the channel to be stored using the ▲/▼ channel keys. Press and hold the MEM key for about 2 seconds. The **MEM** indicator will appear on the display, and a beep tone will confirm that the channel has been stored to memory. There is no limit to how many channels can be stored to memory.

- **To clear a channel from memory**, select the channel to be cleared using the ▲/▼ channel keys. Press and hold the MEM key for about 1 second. The **MEM** indicator will no longer be shown on the display and a beep tone will confirm that the channel has been erased from memory.

- **To review the memorized channels** (Memory Recall), press the MEM key twice. The channels that have been stored into memory will be displayed in sequence on the LCD for review.

3.3.4 Memory Reset

To clear all channels from memory, and reset the 16plus key to it's factory default channel (CH16), hold the MEM key down while turning the radio ON.

3.3.5 All Scan and Memory Scan Modes

1) All Scan

   Press the SCAN/SEEK key, to activate the All Scan mode. The **SCAN** indicator will appear on the display and the RAY106 will sequentially scan all of the channels in the selected frequency mode (U.S., INT, or Canada).

   - If a signal is received, the scanning will stop until the station clears. After 5 seconds, scanning will resume. If the scanning has stopped on a received signal, press the SCAN key again to continue. To cancel the SCAN mode, press the SCAN key.

   - If the scanning has stopped on a channel with traffic, and you wish to communicate with the other party, press the PTT switch to cancel the SCAN mode and remain on that channel.

2) Memory Scan

- To scan only the channels that have been stored to memory, press the MEM key and then press the SCAN key while "**MEM**" is blinking (within 2 seconds).

3.3.6 All Seek and Memory Seek Modes

1) All Seek

Press and hold the SCAN/SEEK key for 1 second, to activate the All Seek mode. The **SEEK** indicator will appear on the display and the RAY106 will seek through all of the channels in the selected frequency mode, stopping for 7 seconds on any channel with traffic.

- If a signal is received, the seek function will stop temporarily, but will resume after 7 seconds <u>regardless of whether or not the station has cleared</u>. To cancel the SEEK mode, press the SEEK key.

- If the SEEK mode has found a channel with traffic, and you wish to communicate with the other party, press the PTT switch to cancel the SEEK mode and remain on that channel.

2) Memory Seek

- To seek only the channels that have been stored to memory, press the MEM key and then press the SEEK key while "**MEM**" is blinking (within 2 seconds).

3.3.7 Monitor Mode

The monitor mode consists of the Dual Watch and Tri-Watch functions.

1) Dual Watch Mode

To start the Dual Watch mode, select the desired working channel and press the MON key. The **MON** indicator will appear on the display, and the working channel and the 16plus (priority) channel will be monitored. In the Dual Watch mode, the current channel being monitored will be shown in the large LCD channel segments, and the channel in standby mode will be shown in the small LCD channel segments.

2) Tri-Watch mode

To start the Tri-Watch mode, you must first be in the Dual Watch mode, then press the MEM key. In addition to the two channels already being monitored, the last used WX channel will also be monitored for severe weather alert broadcasts.

- If a weather alert broadcast is detected, the RAY106 will emit an alarm and the **WX** indicator will begin to blink. The Tri-Watch mode will then be canceled and the radio will switch to the WX channel to monitor the severe weather broadcast.

3.3.8 RAY106 Marine Channels and Their Usage

- **Caution : Operation on channels not designated for use by your classification of craft, or in International or Canadian frequency mode while operating in US territorial waters is a violation of FCC Rules and Regulations and may result in severe penalties.**

USA Mode Frequency Table for the RAY106 VHF Radiotelephone

CH	TX	RX	Type of Traffic	Ship to Ship	Ship To Shore
01	156.050	156.050	VTS, Port Operations	✓	
03 4	156.150	156.150	Port Operations	✓	
05	156.250	156.250	Port Operations	✓	
06	156.300	156.300	Intership Safety	✓	
07	156.350	156.350	Commercial	✓	
08	156.400	156.400	Commercial	✓	
09	156.450	156.450	Calling	✓	
10	156.500	156.500	Commercial	✓	
11	156.550	156.550	Commercial	✓	
12	156.600	156.600	Port Operations	✓	
13 2	156.650	156.650	Navigation, Bridge to Bridge	✓	
14	156.700	156.700	Port Operations	✓	
15 1	–	156.750	Environmental	–	–
16	156.800	156.800	Emergency, Calling	✓	
17 3	156.850	156.850	State Controlled	✓	
18	156.900	156.900	Commercial	✓	
19	156.950	156.950	Commercial	✓	
20	157.000	157.000	Port Operations	✓	
21 4	157.050	157.050	Coast Guard	✓	
22 4	157.100	157.100	Coast Guard	✓	
23 4	157.150	157.150	Coast Guard	✓	
24	157.200	161.800	Marine Operator		✓
25	157.250	161.850	Marine Operator		✓
26	157.300	161.900	Marine Operator		✓
27	157.350	161.950	Marine Operator		✓
28	157.400	162.000	Marine Operator		✓
61 4	156.075	156.075	Canadian Coast Guard	✓	
63	156.175	156.175	Canadian Coast Guard	✓	
64 4	156.225	156.225	Canadian Coast Guard	✓	
65	156.275	156.275	Port Operations	✓	
66	156.325	156.325	Port Operations	✓	
67 2	156.375	156.375	Commercial	✓	
68	156.425	156.425	Boat Operations, Recreational	✓	
69	156.475	156.475	Boat Operations, Recreational	✓	
70 5	–	156.525	Digital Selective Calling	–	–
71	156.575	156.575	Boat Operations, Recreational	✓	
72	156.625	156.625	Boat Operations, Recreational	✓	
73	156.675	156.675	Port Operations	✓	
74	156.725	156.725	Port Operations	✓	
75 1	–	156.775	CH16 Guard Band	–	–
76 1	–	156.825	CH16 Guard Band	–	–
77 3	156.875	156.875	Port Operations	✓	
78	156.925	156.925	Boat Operations, Recreational	✓	
79	156.975	156.975	Commercial	✓	
80	157.025	157.025	Commercial	✓	
81	157.075	157.075	Coast Guard	✓	
82	157.125	157.125	Coast Guard	✓	
83	157.175	157.175	Coast Guard	✓	
84	157.225	161.825	Marine Operator		✓
85	157.275	161.875	Marine Operator		✓
86	157.325	161.925	Marine Operator		✓
87	157.375	161.975	Marine Operator		✓
88	157.425	157.425	Commercial	✓	

Notes:

1 : Transmitter is automatically disabled on channels 15, 75, and 76 in USA mode.

2 : 1 Watt initially. User can override to high power setting via front panel controls.

3 : 1 Watt only.

4 : Not for use by general public. Requires special authorization from the U.S. Coast Guard, or under private land mobile license.

5 : Channel 70 is now used for Digital Selective Calling only, therefore transmission is disabled on channel 70 in this radio.

IMPORTANT NOTICE

*SHADING

Channels 3, 21, 23, 61, 64, 81, 82, and 83, (shaded) are not for use by the general public in U.S. waters. These frequencies may be used only under authorization by the U.S. Coast Guard, or under private land mobile license.

International Mode Frequency Table for the RAY106 VHF Radiotelephone

CH	TX	RX	Type of Traffic	Ship to Ship	Ship To Shore
	INT (International) Mode			**Function**	
	Freq. (MHz)			Ship to Ship	Ship To Shore
01	156.050	160.650	VTS, Port Operations		✓
02	156.100	160.700	Port Operations		✓
03	156.150	160.750	Port Operations		✓
04	156.200	160.800	Port Operations		✓
05	156.250	160.850	Port Operations		✓
06	156.300	156.300	Intership Safety	✓	
07	156.350	160.950	Commercial		✓
08	156.400	156.400	Commercial	✓	
09	156.450	156.450	Calling	✓	
10	156.500	156.500	Commercial	✓	
11	156.550	156.550	Commercial	✓	
12	156.600	156.600	Port Operations	✓	
13 2	156.650	156.650	Navigation, Bridge to Bridge	✓	
14	156.700	156.700	Port Operations	✓	
15 1	–	156.750	Environmental	–	–
16	156.800	156.800	Emergency, Calling	✓	
17 3	156.850	156.850	State Controlled	✓	
18	156.900	161.500	Commercial		✓
19	156.950	161.550	Commercial		✓
20	157.000	161.600	Port Operations		✓
21	157.050	161.650	Coast Guard		✓
22	157.100	161.700	Coast Guard		✓
23	157.150	161.750	Coast Guard		✓
24	157.200	161.800	Marine Operator		✓
25	157.250	161.850	Marine Operator		✓
26	157.300	161.900	Marine Operator		✓
27	157.350	161.950	Marine Operator		✓
28	157.400	162.000	Marine Operator		✓
60	156.025	160.625	Canadian Coast Guard		✓
61	156.075	160.675	Canadian Coast Guard		✓
62	156.125	160.725	Canadian Coast Guard		✓
63	156.175	160.775	Canadian Coast Guard		✓
64	156.225	160.825	Port Operations		✓
65	156.275	160.875	Port Operations		✓
66	156.325	160.925	Port Operations		✓
67 2	156.375	156.375	Commercial	✓	
68	156.425	156.425	Boat Operations, Recreational	✓	
69	156.475	156.475	Boat Operations, Recreational	✓	
70 4	–	156.525	Digital Selective Calling Only	–	–
71	156.575	156.575	Boat Operations, Recreational	✓	
72	156.625	156.625	Boat Operations, Recreational	✓	
73	156.675	156.675	Port Operations	✓	
74	156.725	156.725	Port Operations	✓	
75 1	–	156.775	CH16 Guard Band	–	–
76 1	–	156.825	CH16 Guard Band	–	–
77 3	156.875	156.875	Port Operations	✓	
78	156.925	161.525	Boat Operations, Recreational		✓
79	156.975	161.575	Commercial		✓
80	157.025	161.625	Commercial		✓
81	157.075	161.675	Coast Guard		✓
82	157.125	161.725	Coast Guard		✓
83	157.175	161.775	Coast Guard		✓
84	157.225	161.825	Marine Operator		✓
85	157.275	161.875	Marine Operator		✓
86	157.325	161.925	Marine Operator		✓
87	157.375	161.975	Marine Operator		✓
88	157.425	162.025	Commercial		✓

Notes:

1 : Transmitter is automatically disabled on channels 15, 75, and 76 in INT mode.

2 : 1 Watt initially. User can override to high power setting via front panel controls.

3 : 1 Watt only.

4 : Channel 70 is now used for Digital Selective Calling only, therefore transmission is disabled on channel 70 in this radio.

IMPORTANT NOTICE

The INT mode is not legal for use while operating in U.S. waters. The TX/RX frequencies available in the INT mode were agreed upon by the attending countries at the 1968 ITU - International Telecommunication Union meeting in Geneva, and are legal for use in International waters only.

Canada Mode Frequency Table for the RAY106 VHF Radiotelephone

CH	TX	RX	Type of Traffic	Ship to Ship	Ship To Shore
01	156.050	156.050	VTS, Port Operations	✔	
02	156.100	156.100	Port Operations	✔	
03	156.150	156.150	Port Operations	✔	
04 $_4$	156.200	156.200	Canadian Coast Guard, SAR	✔	
05	156.250	156.250	Port Operations	✔	
06	156.300	156.300	Intership Safety	✔	
07	156.350	156.350	Commercial	✔	
08	156.400	156.400	Commercial	✔	
09	156.450	156.450	Calling	✔	
10	156.500	156.500	Commercial	✔	
11	156.550	156.550	Commercial	✔	
12	156.600	156.600	Port Operations	✔	
13 $_2$	156.650	156.650	Navigation, Bridge to Bridge	✔	
14	156.700	156.700	Port Operations	✔	
15 $_1$	–	156.750	Environmental	–	–
16	156.800	156.800	Emergency, Calling	✔	
17 $_3$	156.850	156.850	State Controlled	✔	
18	156.900	156.900	Commercial	✔	
19	156.950	156.950	Commercial	✔	
20	157.000	157.000	Port Operations	✔	
21 $_4$	157.050	157.050	Coast Guard	✔	
22 $_4$	157.100	157.100	Coast Guard	✔	
23 $_4$	157.150	157.150	Coast Guard	✔	
24	157.200	161.800	Marine Operator		✔
25	157.250	161.850	Marine Operator		✔
26	157.300	161.900	Marine Operator		✔
27	157.350	161.950	Marine Operator		✔
28	157.400	162.000	Marine Operator		✔
60 $_4$	156.025	156.025	Canadian Coast Guard	✔	
61 $_4$	156.075	156.075	Canadian Coast Guard	✔	
62 $_4$	156.125	156.125	Canadian Coast Guard	✔	
63	156.175	156.175	Canadian Coast Guard	✔	
64 $_4$	156.225	156.225	Canadian Coast Guard	✔	
65	156.275	156.275	Port Operations	✔	
66	156.325	156.325	Port Operations	✔	
67 $_2$	156.375	156.375	Commercial	✔	
68	156.425	156.425	Boat Operations, Recreational	✔	
69	156.475	156.475	Boat Operations, Recreational	✔	
70 $_5$	–	156.525	Digital Selective Calling Only	–	–
71	156.575	156.575	Boat Operations, Recreational	✔	
72	156.625	156.625	Boat Operations, Recreational	✔	
73	156.675	156.675	Port Operations	✔	
74	156.725	156.725	Port Operations	✔	
75 $_1$	–	156.775	CH16 Guard Band	–	–
76 $_1$	–	156.825	CH16 Guard Band	–	–
77 $_3$	156.875	156.875	Port Operations	✔	
78	156.925	156.925	Boat Operations, Recreational	✔	
79	156.975	156.975	Commercial	✔	
80	157.025	157.025	Commercial	✔	
81	157.075	157.075	Coast Guard	✔	
82	157.125	157.125	Coast Guard	✔	
83	157.175	157.175	Coast Guard	✔	
84	157.225	161.825	Marine Operator		✔
85	157.275	161.875	Marine Operator		✔
86	157.325	161.925	Marine Operator		✔
87	157.375	161.975	Marine Operator		✔
88	157.425	157.425	Commercial	✔	

Notes:

1 : Transmitter is automatically disabled on channels 15, 75, and 76 in Canada mode.

2 : 1 Watt initially. User can override to high power setting via front panel controls.

3 : 1 Watt only.

4 : Not for use by general public. Requires special authorization from the Canadian Coast Guard, or under private land mobile license.

5 : Channel 70 is now used for Digital Selective Calling only, therefore transmission is disabled on channel 70 in this radio.

IMPORTANT NOTICE

Canada mode is not legal for use while operating in U.S. waters.

SECTION 4

TECHNICAL DESCRIPTION

4.1 GENERAL

The RAY106 can be considered as consisting of two major sections.

- The Control Section (consisting of the front panel controls, LCD display, and CPU).

- The Transmitter/Receiver / PLL Section.

4.2 THE CONTROL SECTION

The heart of the control section is the CPU, which is IC101 located on the CPU PCB. The CPU controls all of the following items :

- Controls the Squelch circuit by detecting a busy signal from the 2nd IF circuit IC101 on the Main PCB.

- Generates a beep tone when a key is activated on the keyboard.

- Mutes the transmitter modulation circuit when receiving.

- Controls the output power of the transmitter High/Low.

- Controls the dividing ratio N of the PLL circuit.

- Switches ON/Off the transmitter power.

- Mutes AF audio.

- Detects a weather alert signal (when in Monitor Mode).

- Controls the LCD display.

4.3 THE TRANSMITTER/RECEIVER/PLL SECTIONS

In reading through the following circuit descriptions, it may be helpful to refer to Figure 4-1 Block Diagram of the TX/RX/PLL circuits.

4.3.1 PLL (Phase Lock Loop) Circuit

The PLL circuit is oscillating the standard frequency with the PLL IC (IC3) and 12.8MHz crystal filter XTL1. This is divided into 1/512 in the IC3 to make 25KHz reference frequency. RF output from VCO unit (VCO1) will be input to PLL IC (IC3) pin8 via buffer amplifier Q10. The dividing ratio data stored in the CPU IC101 will be output to pin10 and clock signal will be output to pin9 of the PLL IC (IC3). And when the chip enable signal is input to pin11 of PLL IC (IC3) the dividing ratio data will be latched to the PLL IC (IC3). The phase of the frequency which is a input frequency to the PLL IC (IC3) divided by the CPU stored dividing radio and the 25KHz reference frequency is compared correlated to control voltage by charge pump transistors Q11, Q12. That is input to the pin of VCO unit (VCO1).

4.3.2 Transmitter Circuit

1) Microphone Amplifier Circuit

   Voice signal from the microphone goes through pre-emphasis circuit consisting of C109, R110 and operational amplifier IC103 - 1/2. The level of the signal is limited by the D101 and adjusted in the RV101 and amplified in the IC103 - 2/2. Then it goes through the active 4-stage LPF consisting of IC102 etc., and modulated in the VCO unit (VCO1).

2) High Frequency Power Amplifier Circuit

   RF signal from the VCO unit (VCO1) goes through the 10dB attenuator consisting of R27 - 29 and will be amplified by Q6. Output from Q6 will amplify drive power necessary for the FET power module (IC1) in the Q5. FET power module (IC1) will be amplified and the RF signal will be output to the antenna switching circuit. RF output from the FET power module (IC1) can be changed by changing the voltage of IC1 pin 2.

3) APC Circuit

   Diode D3 is monitoring a part of the FET power module's (IC1) output. The monitoring signal will be output to IC101 via switching transistor Q1 and displays the "TX ON" on the LCD. Voltage of monitoring signal will be compared and amplified between the set standard voltage and IC2. Then the output voltage goes through buffer amplifier transistor Q4 and will be connected to the pin 2 of FET power module (IC1) and make it a APC control loop. Output power can be changed by controlling transistors Q2, Q3, and Q7 with the CPU IC101 to change the set standard voltage.

4.3.3 Receiver Circuit

1) Antenna Switching Circuit

   Signal received at the antenna connector J201 goes to high frequency amplifier circuit via the 3 stage low pass filter consisting of coils L1-3.

2) High Frequency Amplifier Circuit

   RF signal goes to the 1st mixer circuit through 2-stage BPF (consisting of coil L9, 10 and L11, 12), and will be high frequency amplified by Q8 and then 2-stage BPF (consisting of L14, 15 and L16, 17). The 1st image spurious frequency will be rejected to the adequate level in the 4-stage BPF inside the high frequency amplifier circuit.

3) 1st Mixer Intermediate Frequency Amplifier Circuit

   A single balanced mixer type consisting of transformer T1 and diode D5 is used in this radio. The 1st IF signal from the mixer circuit goes to the 2nd mixer circuit through 2-stage crystal filter (F1 and F2) and amplified in Q15 of the 1st IF amplifier circuit.

4) 2nd Intermediate Frequency Circuit

   The 1st IF signal is added to IC201 and converted to 2nd IF signal. The 2nd IF signal goes through FIL201 and amplified in the IC201 and then through FIL202 and the re-modulated AF signal is output from IC201.

5) Low Frequency Circuit

The AF signal re-modulated in the IC201 goes through the de-emphasis circuit consisting of R204 and C209 and will be amplified in the Q201. A 2-stage HPF consisting of Q202, C210, R212, C220 and R211 is used to reject AF signal below 300Hz. The AF signal from the HPF goes through variable resistor RV202 and is input to the speaker amplifier circuit IC104 and amplified to the set output level.

6) Audio Muting Circuit

The Q105 to mute the audio is controlled by input of squelch's BUSY signal and the mute output of the CPU IC101.

7) WX Alert Detection

The tone selector IC105 detects the 1050Hz alert tone if it is contained in the re-modulated AF and the WX alert tone will be output from the speaker.

4.4   SPECIFICATIONS

4.4.1   Transmitter

Channels	All available US,INT, Canada VHF Marine band
Frequency Stability	10 PPM (0.001%) from -20°C to +50°C
Frequency Range	156.025 to 157.425 MHz
Channel Spacing	25 KHz increments
Power Output	Switchable 5W, 3W, 1W into 50 Ohms at 6.0 VDC
Modulation	Frequency. Modulated 16F3 (4.5 KHz at 1000Hz)
Modulation Audio	Shall not vary1/3 dB from true 6 dB pre-emphasis response from 300 to 2500 Hz, reference 1000 Hz. Audio frequencies 3-20 KHz shall be attenuated (at 1 KHz by 60 log f/3 dB. Above 20 KHz by 50 dB)
FM Hum & Noise	Level greater than-40 dB below audio
Audio Distortion	Less than 10% at 1 KHz for3 KHz deviation
Spurious & Harmonic	Attenuated at least 4310 log Po (below rated radiated carrier power) per FCC Rules Parts 2 & 80
Antenna Impedance	50 Ohms
Transmitter Protection	Shall survive open or short circuit of antenna system without damage (10 min. test)

4.4.2   Receiver

Channels	All available US,INT, Canada VHF Marine band
Frequency Range	156.025 to 163.275 MHz in 25 KHz increments
Frequency Stability	10 PPM (0.001%) from -20°C to +50°C

Usable Sensitivity	0.3 V for 12 dB (SINAD); 0.5 V for 20 dB quieting
Squelch Sensitivity	0.3 V or better
Squelch Threshold	1.0uV @ 50 Ohms
Modulation Acceptance	Not less than 7.0 KHz
Adjacent Channel Rejection	Greater than 70 dB
Spurious Image Rejection	Greater than 70 dB
Intermodulation Rejection	Greater than 60 dB
Audio Output	0.3 Watt or more at 10% or less distortion into 4 Ohm load
Hum & Noise in Audio	Less than -40 dB

4.3.3 Operating Requirements

Input Voltage	6.0 VDC NiCad rechargeable battery
Battery Capacity	1200mA/H
Current Required	
Transmit	Less than 2.0 amps at 6W; and 1.0 amp at 1W
Receiving (squelched)	Less than 40mA; 150mA at 0.3 Watt audio output (1 KHz)
Operating Temperature	-20°C to +50°C
Duty Cycle	Continuous, 80% receive, 20% transmit (max. 10 min. @25)
Humidity	100% at +50°C for 8 hours

4.3.4 Radio Dimensions

Height (radio body w/batt.)	145.5mm
Width	50.5mm
Depth	36mm
Weight	Approx. 0.5kg. (1 lb)

NOTE:
**The RAY106 VHF FM Radiotelephone meets all applicable sections
of FCC Rules Parts 2, 15 and 80.**

SECTION 5

MAINTENANCE

5.1   GENERAL

The purpose of this section is to provide servicing instructions for the service technician. The RAY106 is designed to provide long periods of trouble-free operation. It is recognized, however, that environmental and other factors may result in a need for occasional service.

5.1.1   How to contact Raytheon

<u>Technical Support</u> 1-800-539-5539 ext. 2444 or (603) 647-7530 ext. 2444

You may reach our Technical Support Department Monday to Friday 8: 15 AM to 5: 00 PM Eastern Standard Time. Our Technical Support Specialists are available to answer installation, operation, and trouble-shooting questions about your Raytheon unit. Our Technical Support Department may also be reached via the Internet.

- Questions may be addressed directly to:

  rmc_tech_raytheon @raymarine. com.

- Or visit the Raytheon Electronics World Wide Web site:

  www. raymarine. com

<u>Accessories and Parts</u> 1-800-539-5539 ext. 2333 or (603) 647-7530 ext. 2333

Many Raytheon accessory items and parts are available through your authorized Raytheon dealer. However if you are in need of an item not available through your retailer feel free to contact our Customer Service department Monday to Friday 8:15 AM to 5:00 PM Eastern Standard Time. If you are uncertain about what item to choose for your Raytheon unit please contact our Technical Support Department prior to placing your order at 1-800-539-5539 ext. 2065.

<u>Product Repair and Service</u>

In the unlikely event your Raytheon unit should develop a problem please contact the Raytheon dealer from where the unit was purchased. Your Raytheon dealer is best equipped to handle your service needs. Service may also be obtained by returning your unit to Raytheon's Product Repair Center at the address below.

> Raytheon Product Repair Center
> 676 Island Pond Road
> Manchester NH 03109-5420

A postcard to acknowledge that we have received your unit will be mailed to you upon arrival

at our Product Repair Center. We will do everything possible to return your unit as quickly as possible. To inquire about the status of your unit our Product Repair Center may be reached at the number below. Please keep a record of the serial number of your unit and have this number ready when you call.

- Product Repair Center :   1-800-539-5539 ext. 2118.

In Europe, Raytheon equipment may be returned for service at the following address:

> Raytheon Marine Europe Limited
> Anchorage Park, Portsmouth
> PO3 5TD. England
> ATT. Service Department
> Phone (01705) 693611
> Fax   (01705) 694642

5.2   PREVENTATIVE MAINTENANCE

The RAY106 has been constructed to be virtually maintenance free. Your attention to a few basic points should assure many years of service.

- Although the unit is waterproof, always keep the unit as dry as reasonably possible.

- Clean the exterior of the unit with a tissue or soft non-abrasive cloth. Do not use solvents or other chemicals.

- Inspect the radio case, battery pack, and antenna for any physical damage.

- Check the antenna connector for any dirt or corrosion.

> **NOTE:**
> **The following alignment procedures have been provided in this manual to aid FCC licensed technicians and service personnel only.**

5.3   ALIGNMENTS AND SERVICE

This transceiver is completely aligned at the factory and does not require any adjustments at installation.

The test equipments listed are used for the test setup shown in Fig. 5-1. This test setup is used either in part or in total during the following adjustments.

TEST EQUIPMENT
1. DC Power Supply (0-20 V variable, 3A max.) set at 7.2 VDC
2. RF Power Meter (10 W, 50 ohm, 150-200 MHz)
3. RF Signal Generator (50 ohm Output, 150-200 MHz)
4. FM Linear Detector (FMLD) or Deviation Monitor 150-200 MHz
5. Frequency Counter
6. Digital Voltmeter
7. Oscilloscope (any oscilloscope accurate for audio signal tracing)
8. SINAD Meter
9. Distortion Meter
10. Toggle Switch (for use as a PTT twitch)
11. Coaxial Switch for TX/RX Antenna switching
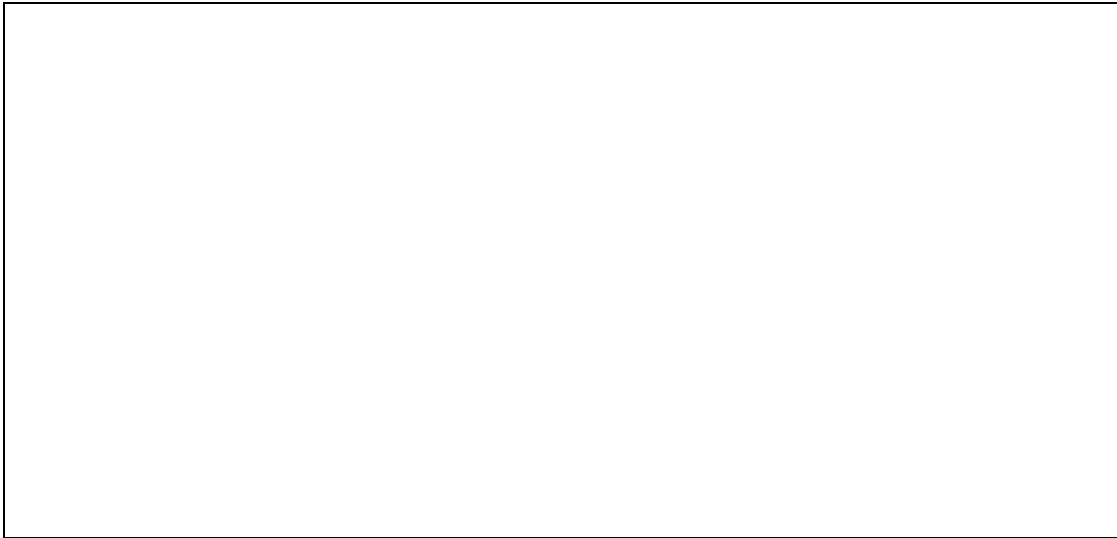
Figure 5-1

5.3.1 PLL Adjustment (TRANSMITTER/RECEIVER)

1) Connect the power supply (6.0V, 3A) to the power line and the PTT switch to the microphone terminal.

2) Connect a digital voltmeter or high impedance tester (positive lead to VCO pin2, negative to ground) and check as shown in Table 5-1. (See Fig. 5-2.)
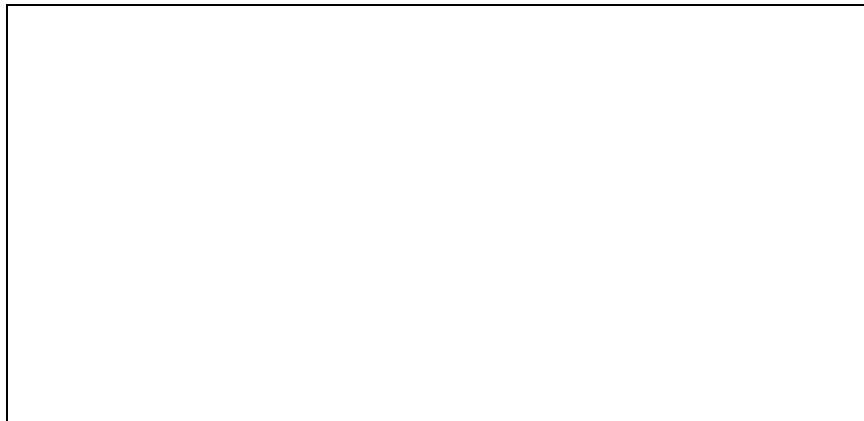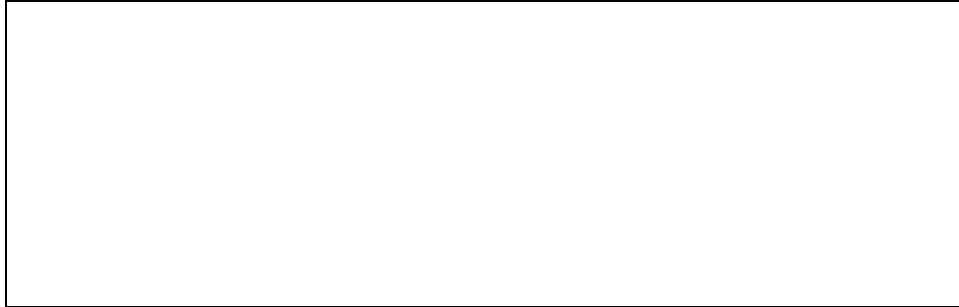

Figure 5-2

Sequence	Item	Condition	Adj. point	Adj. volt
1	TX	TX CH16 USA		Approx. 2.3Vdc
2	RX	RX CH16 USA		Approx. 1.8Vdc
3	RX	RX CH88 USA		less than 4.2Vdc

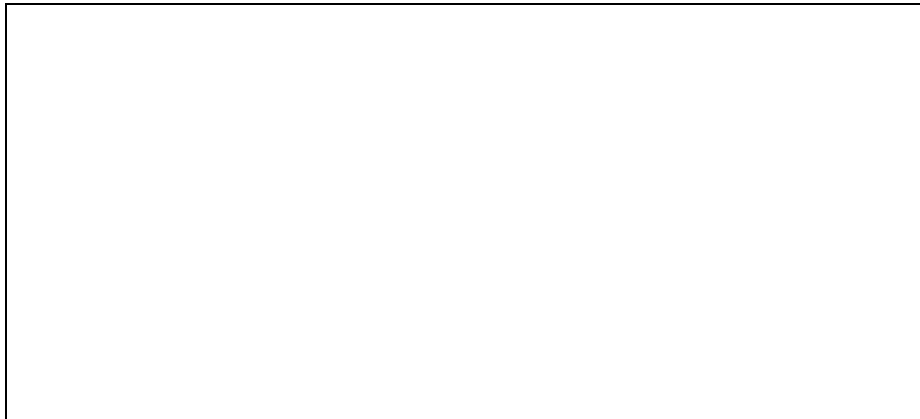**Table 5-1**

5.3.2 Frequency Adjustment (TRANSMITTER)

1) Connect the coupler output to a frequency counter, set the radio on CH16 (156.800 MHz), key to transmit, and read the indication on the frequency counter.

2) Adjust trimmer capacitor CV1 on the RF PCB for the desired frequency (156.800 MHz) on the frequency counter.

Figure 5-3

5.3.3 Modulation Adjustment (TRANSMITTER)

1) Connect the coupler output to an FM linear detector. Connect an audio oscillator to the microphone connector and key to transmit.

2) Set the audio oscillator output to-25 dBm, 300Hz and adjust RV101 on the CPU PCB for a deviation of 4.5 KHz +/-300 Hz. (See Fig. 5-4.)

3) Set the audio oscillator output to-43 dBm, 1 KHz and read the deviation meter (2.5KHz - 3KHz)
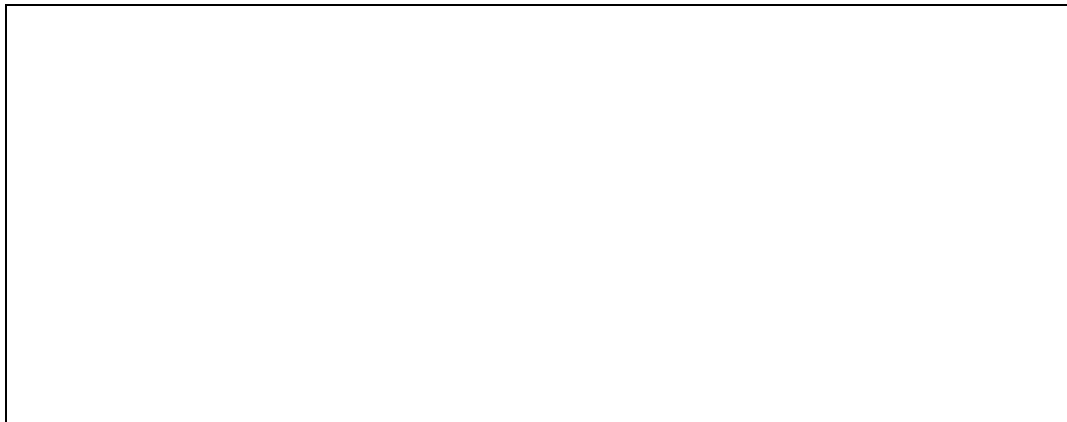
Figure 5-4

5.3.4 Power Output Adjustment (TRANSMITTER)

1) Connect an RF power meter to the antenna connector. Key to transmit and adjust RV1 for the low power on the RF PCB as shown in Table 5-2. (See Fig. 5-5.) The high power will be adjusted automatically.

Sequence	Condition	Adj. Point	Target power
1	6.0 Vdc H/L	LRV1 low power	0.9W +/- 0.05W (limit1.0W)

| 2 | 6.0 Vdc H/L :H | check | 2 - 3W, 5W (Po 0.5W) |

Table 5-2

Figure 5-5

5.3.5 Weather Alert Frequency Adjustment (RECEIVER)

1) Connect an RF signal generator to the antenna connector. Set the RF signal generator as follows:

> Frequency :   162.550 MHz with no modulation
> Output level :   60 dB

2) Select the weather channel WX1.

3) Connect a frequency counter to TP1 on the CPU PCB and adjust RV102 to obtain 2100 Hz10 Hz on the frequency counter. (See Fig. 5-6.)

5.4   TROUBLESHOOTING GUIDE

Table 5-4 provides a general troubleshooting chart for use by a technician to isolate circuitry failures to specific functional areas within the RAY106.

The first step in attempting to clear a problem associated with the general operation of this radio is to perform a MASTER RESET. This can be done by simply holding down the 16PLUS key while turning the radio on. This should be performed anytime a component or PCB within the radio is replaced. This function will clear the memory of the 106 and return it to the original factory settings, 16PLUS will automatically be reprogrammed to channel 16.

NOTE:

Micro-components within the radio are generally not field replaceable, therefore, repairs to the radio typically go down to the PC board level only. A replacement parts list for the RAY106 can be found in Section 6.

Item	Symptom	Possible Cause
1	Unit does not turn on.	a. Defective power switch.

		b. Check the battery voltage.
		c. Check the connector connection.
		d. Defective regulator IC106.
2	NO sound from speaker	a. Defective speaker (SP101).
		b. Defective IC104 and/or assoc. components(C118, etc)
		c. Defective speaker ON control circuit (Q102, Q103).
		d. Defective volume control.
		e. Defective mute circuitry (Q105).
3.	Squelch circuit inop	a. Check squelch control.
		b. Defective IC201 and/or associated circuitry between pins 7 and 9.
4.	No receive (RX)	a. Defective regulator IC106.
		b. Defective Q110 (RX+B).
		c. Check IC201 audio output voltage at pin 9.
		d. Defective audio signal buffer Q201,Q202.
		e. Check XTL201 output for 21.145 MHz signal.
		f. Check 21.6 MHz output of X'tal filters F301and F302.
		g. Check 21.6 MHz output of first IF amplifier Q15.
		h. Check 455 KHz signal form ceramic filter F20.
		i. Failure of VCO circuit (VCO1, PLL IC, IC3, Q9, Q10, Q11, Q12 and/or other associated circuitry.
		j. Defective CPU.
5.	Low receiver sensitivity	a. Check antenna and connector for possible corrosion or bad connection.
		b. BPF, Q8 and/or associated circuitry.
		c. Output of Q9 and/or associated circuitry.
		d. Output of VCO1 Pin 3.
6	CPU inoperative	a. Turn off the power once, and try again.
		b. Check CPU clock frequencies (pins 70 and 71 of IC101).
		c. If clock frequency is not present, check for+5 Vdc line.
7	Display malfunction	a. check the interconnection to the LCD display.
		b. Inoperative CPU.
8	No transmit (TX)	a. Defective PTT switch.
		b. Defective regulator IC106.
		c. Defective Q108 (TX+B).
		d. Check power transmit circuit (Q6, Q5, and/or IC1)
		e. Failure of VCO circuit (VCO1) or PLL IC3.
		f. Check PLL control voltage for 2.3 V at Pin 2 of VCO1 on channel 16.
		g. Failure of TX mute circuit (IC2 and/or associated circuit).
		h. Failure of talk detection circuit (D3).

Table 5-3 TROUBLESHOOTING CHART

Item	Symptom	Possible Cause
9	Low RF power output	a. Check RF power output from IC1 pin 4.. If it checks

		good, then check the triple Pi type network components (C1 - C4 and L1 - L4) and antenna switching diode (D112). If not good, then check the voltage level outputs of the drive amplifiers Q5 and Q6 as well as the associated circuitry. b. Check power control circuit (IC2 and/or associated circuitry)
10	Poor or no modulation	a. Defective microphone or microphone connection. b. Defective IC103, IC102 and/or its associated components.
11	Deviation of transmit frequency	a. Check VCO output frequency at pin 8 of PLL IC3, PLL phase detector output at pin 16, 15 of PLL IC3, Q11, Q12 and associated circuitry. b. Check 12.8 MHz crystal (XTL1).
12	PLL output frequency or level	a. Check frequency of 12.8 MHz crystal (XTL1). b. Check the frequency output at pin 8 of IC 3 and verify the transmit frequency.

Table 5-4 TROUBLESHOOTING CHART (Continued)

SECTION 6

PARTS LIST AND DRAWINGS

6.1 PARTS LOCATION LIST

COMPONENT UNIT
LOCATIONREFERENCEDESCRIPTION
No.No.
14CR039G90CHARGER(VHF)UNIT
FACE PLATE ASS'Y
1FACE PLATE
2COVERGLASS
ACCESSORIES
LOCATIONREFERENCEDESCRIPTION
No.No.
128A4128M.LABEL VHF510
22893516M.KIT VHF510
329X0053AC ADAPTOR DC12200
429X1197SCREW KIT
529X1199SCREW KIT
62171013HOLDER (CLIP)
7100006100ANT-AP-156
828A0001CARRYING STRAP
92272054C.CASE (VHF)
102821019PLASTIC BAG 100X250
112821000PLASTIC BAG 100X250
122871302STYROFOAM
132858194GIFT BOX VHF510
142854867MASTER CARTON (4)
1528A9122S.NO LABEL
1628A9123S.NO LABEL

RF CIRCUIT BOARD (35L9710/36C9810)
LOCATIONREFERENCEDESCRIPTION
No.No.
C301,C30715711800JCAPACITOR,CHIP,18PF 50V
C302,C30315713900JCAPACITOR,CHIP,39PF 50V
C304,C30915713900JCAPACITOR,CHIP,39PF 50V
C30515712R00JCAPACITOR,CHIP,2PF 50V
C306,C310157A1020JCAPACITOR,CHIP,1000PF 50V
C308,C32715714700JCAPACITOR,CHIP,47PF 50V
C311,C313157A1020JCAPACITOR,CHIP,1000PF 50V
C3121553106Z1CAPACITOR,ELECTROLYTIC,10UF 16V
C314,C315157A1020JCAPACITOR,CHIP,1000PF 50V
C316,C322157A1020JCAPACITOR,CHIP,1000PF 50V
C317,C38015831050DCAPACITOR,CHIP,TANTALUM 1UF
C319,C36215821060HCAPACITOR,CHIP,TANTALUM,10UF 10V

C320,C356157M1040JCAPACITOR,CHIP,104 7S
C32115822250DCAPACITOR,CHIP,TANTALUM,2.2UF 10V
C323,C325157A1020JCAPACITOR,CHIP,1000PF 50V
C32615716800JCAPACITOR,CHIP,68PF 50V
C329,C33015713000JCAPACITOR,CHIP,30PF
C331,C332157A1020JCAPACITOR,CHIP,1000PF 50V
C333,C334157A1020JCAPACITOR,CHIP,1000PF 50V
C335,C338157A1020JCAPACITOR,CHIP,1000PF 50V
C339,C340157A1020JCAPACITOR,CHIP,100PF 50V
C331,C332157A1020JCAPACITOR,CHIP,1000PF 50V
C341,C36115718R00JCAPACITOR,CHIP,8PF 50V
C342,C34415713300JCAPACITOR,CHIP,33PF 50V
C343,C345157A1020JCAPACITOR,CHIP,1000PF 50V
C346,C34715713R00JCAPACITOR,CHIP,3PF 50V
C34815711200JCAPACITOR,CHIP,12PF 50V
C349,C38515711000JCAPACITOR,CHIP,10PF 50V
C35015714R00JCAPACITOR,CHIP,4PF 50V
C351,C353157A1020JCAPACITOR,CHIP,1000PF 50V
C35215716R00JCAPACITOR,CHIP,6PF 50V
C354,C357157A1020JCAPACITOR,CHIP,1000PF 50V
C358,C365157M1040JCAPACITOR,CHIP,104 X7S
C359,C336015713000JCAPACITOR,CHIP,30PF
C363,C379157A1030JCAPACITOR,CHIP,0.01UF 50V
C364,C371157A1020JCAPACITOR,CHIP,1000PF 50V
C366,C315713900JCAPACITOR,CHIP,39PF 50V
C367,C315715600JCAPACITOR,CHIP,56PF 50V
C368,C373157M1040JCAPACITOR,CHIP,104 X7S
C369,C37015712210JCAPACITOR,CHIP,220PF 50V
C372,C381157A1020JCAPACITOR,CHIP,1000PF 50V
C374,C315821060HCAPACITOR,CHIP,TANTALUM,10UF10V
C375157M1040JCAPACITOR,CHIP,104 X7S
C37615719100JCAPACITOR,CHIP,910
C377157C1540JCAPACITOR,CHIP,154

RF CIRCUIT BOARD (35L9710/36C9810)

LOCATIONREFERENCEDESCRIPTION
No.No.

C378,157A2230JCAPACITOR,CHIP,0.022UF 25V
C382,C383157A1020JCAPACITOR,CHIP,1000PF 50V
C384,157A1020JCAPACITOR,CHIP,1000PF 50V
D301,D302135004700DI-MI301
C303,131002703DIODE,1SS226T
C304,D305132007103DIODE,DA204KT
D306,D307135002700DIODE,ISV156
D308132003203DIODE,DAN202KT
F301,F302176200200X'TAL,MF-21.6-RB
F303175106160CF-CDBM455C24
F304176410200X'TAL,21.145MHz

F304176410200X'TAL,21.145MHz
F305175106060CERAMIC FILTER,CFWM455E
LC301111666203IC,TA31136FN-CT
L301,L302170021700COIL,1R5-5TL
L303,L304170021700COIL,IR5-5TL
L305,L316172113566COIL,LQH1N6R8M04-CT
L306,L307170021800COIL,IR25-5TL
L308,L310170021900L-1R25-4TL
L309,L314172113666COIL,LQH1N1ROM04-CT
L312,L313170021900L-1R25-4TL
L315172113766COIL,LQH1N1R2M04-CT
L317171052906COIL,ANT-VHF510-CT
L318171053006COIL,RF1-VHF510-CT
L319171053106COIL,RF2-VHF510-CT
L320171053706COIL,RF3-VHF510-CT
N301192001130COAXIAL 0.8D-2V
N30219161A510WIRE ##
P3011981271DEPOST-9210B-1-14Z147T
P3021981271DAPOST-9210B-1-10Z147T
P303198110792POST-IL-S-2PS5
P3042656284CONN-HSJ1468-01-010
Q301123300100TRANSISTOR,2SC3001
Q302123301700TRANSISTOR,2SC3017
Q303123335713TRANSISTOR,2SC3357T-E,F
Q304,Q305120001303TRANSISTOR,DTA124EKT
Q306,Q3071234116132SC4116T-G,L
Q3081220798132SB798T-K,L
Q309,Q310123335613TRANSISTOR,2SC3356T-24,25
Q3111233123032SC3123T
Q3121234116132SC4116T-G,L
R301165368106RESISTOR,CHIP,680OHM 1/16W
R302165718106RESISTOR,CHIP,180OHM 1/4W
R303165312406RESISTOR,CHIP,120KOHM 1/16W
R304,R321165322106RESISTOR,CHIP,220OHM 1/16W

RF CIRCUIT BOARD (35L9710/36C9810)

LOCATIONREFERENCEDESCRIPTION
No.No.
R305,R318165310306RESISTOR,CHIP,1OKOHM 1/16W
R306165333306RESISTOR,CHIP,33KOHM 1/16W
R307,R308165310106RESISTOR,CHIP,100OHM 1/16W
R30916534R706RESISTOR,CHIP,4.700OHM 1/16W
R310,R311165310106RESISTOR,CHIP,100OHM 1/16W
R312,R313165333106RESISTOR,CHIP,330OHM 1/16W
R314165368306RESISTOR,CHIP,68KOHM 1/16W
R315,R322165347006RESISTOR,CHIP,47OHM 1/16W
R316165310106RESISTOR,CHIP,100OHM 1/16W
R317,R331165333206RESISTOR,CHIP,3.3KOHM 1/16W
R319165310306RESISTOR,CHIP,10KOHM 1/16W

R320165356206RESISTOR,CHIP,5.6KOHM 1/16W
R323,R324165333106RESISTOR,CHIP,330OHM 1/16W
R325165318006RESISTOR,CHIP,18OHM 1/16W
R326165310206RESISTOR,CHIP,1KOHM 1/16W
R327,R330165315206RESISTOR,CHIP,1.5KOHM 1/16W
R328,R336165310406RESISTOR,CHIP,100KOHM 1/16W
R329,R342165322106RESISTOR,CHIP,220OHM 1/16W
R332165315406RESISTOR,CHIP,150KOHM 1/16W
R333165347306RESISTOR,CHIP,47KOHM 1/16W
R334,R351165315206RESISTOR,CHIP,1.5OHM 1/16W
R337165382106RESISTOR,CHIP,820OHM 1/16W
R338165322206RESISTOR,CHIP,2.2KOHM 1/16W
R339165310406RESISTOR,CHIP,100KOHM 1/16W
R340165322406RESISTOR,CHIP,220KOHM 1/16W
R341165368206RESISTOR,CHIP,6.8KOHM 1/16W
R35016A4103A6RVC-RVG4M01-103-CT

AF CIRCUIT BOARD (35L9720/36C9820)

LOCATIONREFERENCEDESCRIPTION
No.No.

C201,C2381553106Z1CAPACITOR,ELECTROLYTIC,10UF 16V
C202,C211157A1010JCAPACITOR,CHIP,1000PF 50V
C203,C212157A6820JCAPACITOR,CHIP,6800PF 50V
C204,C21815851042ECAPACITOR,CHIP,TANTALUM,0.1UF,35V
C205,C21715824750DCAPACITOR,CHIP,TANTALUM,4.7UF 10V
C207,C20915831050DCAPACITOR,CHIP,TANTALUM,1UF 16V
C208,C220157A1030JCAPACITOR,CHIP,0.01UF 50V
C210157A2220JCAPACITOR,CHIP,2200OF 50V
C21315712210JCAPACITOR,CHIP,220PF 50V
C214,C223157A1020JCAPACITOR,CHIP,1000PF 50V
C215157A4740DCAPACITOR,CHIP,0.47UF 16V
C216,C21915822250DCAPACITOR,CHIP,TANTALUM,2.2UF 16V
C221,C229157A1030JCAPACITOR,CHIP,0.01UF 50V
C22215831050DCAPACITOR,CHIP,TANTALUM,1UF 16V
C224,C225157A1020JCAPACITOR,CHIP,1000OF 50V
C226,C227157A1020JCAPACITOR,CHIP,1000OF 50V
C22815834750HCAPACITOR,CHIP,TANTALUM,4.7UF 16V
C230,C23215824750DCAPACITOR,CHIP,TANTALUM,4.7UF 16V
C231157A1030JCAPACITOR,CHIP,0.01UF 50V
C22315822250DCAPACITOR,CHIP,TANTALUM,2.2UF 10V
C234,C23715821060HCAPACITOR,CHIP,TANTALUM,10UF 10V
C235,C240157A1020JCAPACITOR,CHIP,1000PF 50V
C236157M1040JCAPACITOR,CHIP,104X7S
C239157A1040ECAPACITOR,CHIP,1UF 25V
C241,C242157A1020JCAPACITOR,CHIP,1000PE 50V
C243,C244157A1020JCAPACITOR,CHIP,1000PF 50V
C245,C24615711010JCAPACITOR,CHIP,100PF 50V
C24715711010JCAPACITOR,CHIP,100PF 50V

C248,C21552227KOCAPACITOR,ELECTROLYTIC,220UF 10V
D201132003603DIODE,DAP202KT
D202132011403DIODE,DAN202KT
D204132003203DIODE,DAN202KT
IC20111642503IC,NJM3403AV-CT
IC202,IC20311668D03IC,TK11250M-CT
IC204111333603IC,BA1604F-CT
IC20511584503IC,NJM2070M-CT
N20119110550WIRE ##
P20119811265GOPOST-08-6212-024-CT
P2021981190DEPOST-IMSA-9110S-14
P2041981190DAPOST-IMSA-9110S-10
Q201120007403TRANSISTOR,DTA123JKT
Q2021234116132SC4116T-G,L
Q203120005903TRANSISTOR,DTC343TKT
Q204,Q2051211298132SA1298T-O,Y

AF CIRCUIT BOARD (35L9710/36C9810)

LOCATIONREFERENCEDESCRIPTION
No.No.
Q206120003503TRANSISTOR,DTA143EKT
Q207120001203TRANSISTOR,DTC124EKT
R201,R227165333206RESISTOR,CHIP,3.3KOHM 1/16W
R202165315406RESISTOR,CHIP,150KOHM 1/16W
R203,R216165368206RESISTOR,CHIP,6.8KOHM 1/16W
R204,R211165356306RESISTOR,CHIP,56KOHM 1/16W
R205,R223165347306RESISTOR,CHIP,47KOHM 1/16W
R206,R215165368306RESISTOR,CHIP,68KOHM 1/16W
R207165322206RESISTOR,CHIP,2.2KOHM 1/16W
R208,R219165310306RESISTOR,CHIP,10KOHM 1/16W
R209165356206RESISTOR,CHIP,5.6KOHM 1/16W
R210,R226165333306RESISTOR,CHIP,3.3KOHM 1/16W
R212165356306RESISTOR,CHIP,56KOHM 1/16W
R213,R214165339306RESISTOR,CHIP,39KOHM 1/16W
R217165382206RESISTOR,CHIP,8.2KOHM 1/16W
R218165322296RVC-RH03AXA-222-CT
R220165322406RESISTOR,CHIP,220KOHM 1/16W
R221,R222165347206RESISTOR,CHIP,4.7KOHM 1/16W
R224,R236165310306RESISTOR,CHIP,10KOHM 1/16W
R225165310006RESISTOR,CHIP,10OHM 1/16W
R228165333306RESISTOR,CHIP,33KOHM 1/16W
R229165347206RESISTOR,CHIP,4.7KOHM 1/16W
R230165322106RESISTOR,CHIP,220OHM 1/16W
R231165368206RESISTOR,CHIP,6.8KOHM 1/16W
R232165356006RESISTOR,CHIP,56OHM 1/16W
R235165347306RESISTOR,CHIP,47KOHM 1/16W
R237,R238165310306RESISTOR,CHIP,10KOHM 1/16W
R23916531R006RESISTOR,CHIP,1.00OHM 1/16W
R240165300006RESISTOR,CHIP,0OHM 1/16W

R25016A4103A6RVC-RVG4M01-103-CT
SW20123A1141SWITCH SKHHLN

VOL CIRCUIT BOARD (35L9730/36C9830)
LOCATIONREFERENCEDESCRIPTION
No.No.
N501196303520QS-CONN-ZHR-09
VE5012311678VOLUME(SW)
VE5022311679VOLUME

SW CIRCUIT BOARD (35L9740/36C9840)
LOCATIONREFERENCEDESCRIPTION
No.No.
SW70123A1140SWITCH SKQDPA-CT

CPU CIRCUIT BOARD (35L9810/36C9910)
LOCATIONREFERENCEDESCRIPTION
No.No.
C400,C401157M1040JCAPACITOR,CHIP,104X7S
C40215831050DCAPACITOR,CHIP,TANTALUM,1UF 16V
C403,C40415711010JCAPACITOR,CHIP,100PF 50V
C405157M1040JCAPACITOR,CHIP,104 X7S
C40615831060HCAPACITOR,CHIP,TANTALUM,10UF
C407,C40815712200JCAPACITOR,CHIP,22PF 50V
C409157A1020JCAPACITOR,CHIP,1000PF 50V
F400175307160CERAMIC FILTER,CSB1200JT
F401176401730X'TAL,32,768KHZ
H400144021000LCD,210
IC400119256305IC-M34520M6-111FP-YT
IC401111555B03IC,RH5VA45AA-CT
IC402113068C03IC,93LC46X-CT
N401195105110STRIP WIRE
P4011981265GOPOST-08-6212-024-CT
PL400,PL401146010000POLOTLAMP,100-3/4
Q400120005703DTB123YKT
Q401120001203TRANSISTOR,DTC124EKT
R400,R401165347206RESISTOR,CHIP,4.7KOHM 1/16W
R402,R403165347206RESISTOR,CHIP,4.7KOHM 1/16W
R404,R406165347206RESISTOR,CHIP,4.7KOHM 1/16W
R405165310206RESISTOR,CHIP,1KOHM 1/16W
R407,R427165310306RESISTOR,CHIP,10KOHM 1/16W

CPU CIRCUIT BOARD (35L9810/36C9910)

LOCATIONREFERENCEDESCRIPTION
No.No.
R408,R409165347206RESISTOR,CHIP,4.7KOHM 1/16W
R410,R411165347206RESISTOR,CHIP,4.7KOHM 1/16W
R412,R413165347206RESISTOR,CHIP,4.7KOHM 1/16W

R414,R418165312206RESISTOR,CHIP,1.2KOHM 1/16W
R415,R419165318206RESISTOR,CHIP,1.8KOHM 1/16W
R416165339206RESISTOR,CHIP,3.9KOHM 1/16W
R417165312306RESISTOR,CHIP,12KOHM 1/16W
R420165312206RESISTOR,CHIP,1.2KOHM 1/16W
R421165318206RESISTOR,CHIP,1.8KOHM 1/16W
R424,R425165347306RESISTOR,CHIP,47KOHM 1/16W
R426165368306RESISTOR,CHIP,68KOHM 1/16W
R428165310006RESISTOR,CHIP,10OHM 1/16W
R429165310306RESISTOR,CHIP,10KOHM 1/16W
SW401,SW40223A1142SW SKHMPW-CT
SW403,SW40423A1142SW SKHMPW-CT
SW405,SW40623A1142SW SKHMPW-CT
SW40723A1142SW SKHMPW-CT
SW408,SW40923F1001SW SOP-112HST-CT
2111055HOLDER BKT (LCD)
2215162SPACER (LCD)
2538049INTER CONECTOR
2802102REEL SHEET

CABINET & CHASSIS
LOCATIONREFERENCEDESCRIPTION
No.No.
1100005800BATTERY-PAC-800VHF
2196306090QS-CONN-IL02 ##
3198302700JUMPER 0.5X30
4194001040FLEXIBLE WIRE ##
5105A03100SPEKER,S28G07K-2
6105201100MIC-EM-128
7265A025TNC-BR-001
82111056HOLDER BKT (TERM)
92279125P.BUTTON (PTT)
102279126P.BUTTON (16)
112279127P.BUTTON (CH)
122279128P.BUTTON (RUBBER)
132279129P.BUTTON (LIGHT)
142564077o-RING (VOL)
152534078BUSHING (MIC)
162534085RUBBER CAP (MIC)
172530017GASLET
182537079BUBBER SPACER (TOP)
192180002WASHER (VOL)
202143025BACKGROUND
212504035NUT (VOL)
222504036NUT (ANT)
232500012PC SPACER (AF)
242117537BRACKET (SPK)
252215167SPACER (COLLAR)
262537147RUBBER SPACER (ANT)

272180004WASHER (ANT)
282503171SPACER (VOL)
292246281COVER GLASS
302219114TERMMINAL PLATE
312210525MNOB (510)
322570202SPRING (BATT)
332232472FPASSY
342104553COVER (REAR)
3829B5225ACPPB1-2X2.5SSA
3629B5235ACPPB1-2X3.5SSA
3729B5206ACPPB1-2X6SSA
3829B5208CCPPB1-2X8SSC
3929B5210CCPPB1-2X10SSC
4029B5265CCPPB1-2.6X5SSC
4129B6144ACPPB3-1.4X4SSA
4229B1205CCPPM1-2X5SSC
432912304CCPPM-3X4SSC
4435L9710/36C9810RF CIRCUIT BOARD

CABINET & CHASSIS
LOCATIONREFERENCEDESCRIPTION
No.No.
4535L9720/36C9820AF CIRCUIT BOARD
4635L9730/36C9830VOL CIRCUIT BOARD
4735L9740/36C9840SW CIRCUIT BOARD
4835L9710/36C9910CPU CIRCUIT BOARD
49RUBBER WASHER (ANT)

SECTION 7

APPENDIX

7.1   VHF MARINE CHANNEL USAGE GUIDE AND LICENSING REQUIREMENTS

Most of the information found in this section is reprinted in whole or in part from FCC Information Bulletin No.2 REVISED EDITION February 1991 and FCC Fact Sheet PR5000 March 1990.

REMEMBER:
Maintain a radio watch on Channel 16. Channel 16 is used for distress and safety purposes only.
Use VHF Channel 70 only for Digital Selective Calling (DSC). It may be used for general-purpose calling using DSC. Your cooperation in not using Channel 70 for general intership communications is necessary to prevent interference.
Your VHF transceiver has a high-low power switch. Use low power whenever feasible. Unnecessary high-power operations can interfere with other important communications.
Always use your radio call sign at the beginning and end of each transmission.
Be sure only qualified persons operate your radio. You are responsible for control of your radio. Know the rules.
Limit calls to other vessels to 30 seconds. If you receive no reply, wait 2 minutes; then try again. Keep communications brief and avoid chit-chat.
Never transmit false distress messages, and never use profanity of the air.
OTHER REMINDERS:
Do not install or operate your radio until it is licensed. You can obtain a station license and call sign by completing FCC Form 506 and mailing it with the required fee to the FCC, Marine Ship Service, P.O. Box 358275, Pittsburgh, PA 15251-5275. Form 506-A provides you with immediate operating authority, valid for 90 days after you mail your license application.
you need a radio operator license to operate VHF Marine Radio only if you plan to dock in a foreign port or leave a foreign port to dock in a U.S. port.
Your radio license is not transferable. If you sell your boat, request the FCC to cancel your station license.
If you replace your radio, you do not need to change your license unless the new radio operates on another frequency band. If you install equipment to operate on another frequency band, apply for modification of your license.
If you carry more than six passengers for hire, your vessel must be certified as a passenger-carrying vessel by the FCC and the Coast Guard.
Licensing Requirements for Hand Held Portable VHF Marine Transceivers 10 Watts Power or Less
All transceivers, handhelds included, operated in the Maritime Radio Services are required to be operated under and appropriate maritime station license. Operation of hand held VHF Marine transceivers without proper station license can lead to fines and/or administrative sanctions issued against its user and/or owner.
VHF Marine hand held transceivers can be operated and licensed as follows:
a)Associated Ship Unit: A hand held VHF Marine transceiver can be operated under an existing valid ship station license under the following conditions only:
i)Except for safety purposes, the hand held transceivers must be used only to communicate

with the ship station with which it is associated. Such associated ship units MAY NOT be operated from shore.

ii)The transmitting power is limited to ONE WATT only.

iii)The hand held transceiver must be identified by the call sign of the ship station along with its associated unit designator.

b)Portable Ship Station: The Commission may grant a station license permitting operation of a portable ship station aboard different vessels of the United States. Each application (FCC Form 506-Application for a Ship Radio Station License) for a portable ship station license must include a showing that:

i)The station will be operated aboard a vessel.

ii)A station license for portable equipment is necessary to eliminate separate applications to operate a ship station aboard different vessels.

c)Marine Utility Station: A utility station in the maritime mobile service consists of one or more hand held transceiver units licensed under a single authorization. Each unit is capable of operating while being hand carried by an individual. There are two types of stations authorized:

i)Marine Utility Coast-when transmitters are located on land; may communicate directly to vessels only.

ii)Marine Utility Coast/Ship-transmitters from land may communicate with vessels or when aboard a vessel, may communicate with other vessels or coast stations.

NOTE: A Marine Utility Ship license will not be authorized.

The station operates under the rules applicable to a private coast station when the unit (s) are on land and under the rules applicable to a ship station when the unit (s) are aboard a vessel. FCC Form 503, application for Land Radio Station License is used when applying for a marine utility License.

USAGE GUIDE

Emergency Calling Monitoring Intership Safety U.S. Coast Guard Navigation Port Operations Noncommercial Commercial Marine Operator State Control Environmental Weather

Emergency

Channel 16

If:

Your ship is sinking, or on fire

Someone has been lost overboard

There exists grave and imminent danger

Use this distress procedure:

Select Channel 16

Say "Mayday, Mayday, Mayday."

Give call sign and boat name

Give location of boat

Describe emergency

If no answer, repeat; then try and other channel

Caution:

Ever ship at sea is obliged to give absolute priority to radio communications relating to ships distress-it is vital that false distress calls or messages not be broadcast.

Calling

Channel 16 & Working Channel

If-you wish to establish communications with another station

And-you know which working channel the station is monitoring

Then-initiate the call directly on that working channel

If-you wish to establish communications with another station

And-you do not know what working channel the station may be monitoring

Then-initiate the call on channel 16. After contact is made switch to a working channel.
NOTE: Due to congestion on channel 16 caused by frequent hailing of other vessels, the FCC has approved channel 9 as a second hailing channel.
Avoid excessive calling and radio checks
Always monitor before transmitting
Never interrupt emergency communications
Monitoring
Channel 16 & working Channel
When-your VHF station is turned on and it is not being used to exchange communications
You Must-monitor channel 16
As an operating convenience, many stations employ a second receiver so that they can monitor a working channel and channel 16 simultaneously.
Intership Safety
Channel: 6
Vessels: Any
Use: Communicating navigational and weather warnings to other ships
Communicating with U.S. Coast Guard stations or other vessels during search and rescue operations
Between: Ship-to-ship only
Comments: Do not use for routine communications. This is a safety channel.
U.S. Coast Guard
Channel: 22
Vessels: Any
Use: Working channel for exchange of communications with stations of the U.S. Coast Guard
Between: Ship to U.S. Coast Guard ship, coast to aircraft stations
Comments: U.S. Coast Guard does not regularly monitor this channel. Establish contact on channel 16 and shift to channel 22 as directed.
Navigation
Channel: 13
Vessels: Any
Use: Safety communications pertaining to the maneuvering of vessels or the directing of vessel movements
Primarily ship-to-ship and secondarily ship-to-coast
This is commonly called the Bridge-to-Bridge channel. Large vessels and towboats depend on this channel for their safe navigation. Railway or highway bridges which open for ship navigation often operate on this channel.
Bridge-to-Bridge stations must reduce power to one watt for routine operations.
Port Operations
Channels: 5, 12, 14, 20, 65, 66, 73, 74, [77]
Vessels: Any
Use: Messages relating to the operational handling, movement and safety of vessels in or near ports, locks and waterways
Between: Ship-to-ship or ship-to-coast
Comments: Channel 77 is limited to communication to and from commercial pilots concerning the movement and docking of vessels.
Note: Channels 11, 12, 13 and 14 are used for vessel traffic service on the Great Lakes, St. Lawrence Seaway and designated major ports.
Non Commercial (Boat Operations)
Channels: 9, 68, 69, 71, 72, 78
Vessels: Recreational boats and any others not used primarily for commercial transport.

Use: Communications pertaining to the needs of the vessel (i.e.,. fishing, rendezvous, maneuvers, berthing, scheduling of repairs, provisioning, etc.)
Between: Ship-to-ship or ship to limited coast stations
Comments: Channel 72 may not be used for ship to coast communications. Channel 9 is shared with commercial users.
If you regularly monitor one of these channels with a second receiver, please notify frequently-called stations of this practice. Help reduce congestion on channel 16.
Commercial
Channels: 7, 8, 9, 10, 11, 18, 19, 67, 79, 80, [88]
Vessels: Those used primarily for commercial transport of persons or goods, or engaged in servicing other vessels
Use: Communications pertaining to the purpose for which the vessel is used
Between: Commercial transport vessels (ship-to-ship) or between commercial transport vessels and limited coast stations
Channels 8, 67 and 88 may not be used for ship-to-coast communications
Recreational boats are not permitted to use these channels
Channel 88 not available on Great Lakes and St. Lawrence Seaway.
Marine Operator
Channels: 24, 25, 26, 27, 28, 84, 85, 86, 87, 88
Vessels: Any
Use: To place a telephone call to any location in the world or to a vessel outside of your transmitting range
Between: Vessels and public coast stations
Comments: Contact the marine operator on the channel assigned to your navigating area. If unable to determine this channel, use channel 16.
Be patient. Do not interrupt calls in progress. Avoid excessive calling if the operator does not answer-give the operator a chance to reply.
State Control
Channel: 17
Vessels: State and local government
Use: Coordination, regulation and control of boating activities and the rendering of assistance to vessels.
Between: Ship and coast stations associates with state and loca governments.
Environmental
Channel: 15
Vessels: Any (receive only)
Use: Broadcast of information concerning the environmental conditions in which vessels operate-weather, sea conditions, time signals, notices to mariner, hazards to navigation
Between: One-way broadcast form coast to ship stations
Note: Currently used for Class C EPIRB emergency signals.
Weather
Channels: WX1, WX2, WX3
Vessels: Any
Use: Continuous weather information form NOAA (National Oceanic and Atmospheric Administration)
Between: One-way broadcast form NOAA to any interested parties
Comments: Receive only. You are not allowed to transmit on these frequencies.
PHONETIC ALPHABET:
To help make call letters more clearly understood, and to assist in spelling out similar sounding or unfamiliar words, radiotelephone users usually employ the international phonetic alphabet.

Phonetic alphabet:
A-ALPHAJ-JULIETS-SIERRA
B-BRAVOK-KILOT-TANGO
C-CHARLIEL-LIMAU-UNIFORM
D-DELTAM-MIKEV-VICTOR
E-ECHON-NOVEMBERW-WHISKEY
F-FOX-TROTO-OSCARX-X-RAY
G-GOLFP-PAPAY-YANKEE
H-HOTELQ-QUEBECZ-ZULU
I-INDIAR-ROMEO

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