

Distributed by
Raymarine

Any reference to Raytheon or RTN in this manual should be interpreted as Raymarine. The names Raytheon and RTN are owned by the Raytheon Company.

Apelco

Amplifiers

V

501
PLUS

Instruction Manual

CONTENTS

SECTION 1	INTRODUCTION	Page
1.1	GENERAL	1-1
1.2	EQUIPMENT FEATURES	1-1
1.3	SPECIFICATIONS	1-2
SECTION 2	INSTALLATION	
2.1	UNPACKING AND INSPECTION	2-1
2.2	EQUIPMENT SUPPLIED	2-1
2.2.1	OPTIONAL ACCESSORIES	2-1
2.3	ELECTRICAL CONNECTIONS	2-1
2.3.1	ASSEMBLY	2-2
SECTION 3	OPERATION	
3.1	AVAILABLE CHANNELS	3-1
3.2	CONTROLS AND MODE DISPLAY	3-1
3.2.1	CONTROLS	3-1
3.2.1.1	TURNING THE POWER ON	3-3
3.2.1.2	SETTING THE VOLUME	3-3
3.2.1.3	SETTING THE SQUELCH	3-5
3.2.1.4	SETTING THE POWER OUTPUT	3-5
3.2.1.5	SELECTING A CHANNEL	3-5
3.2.1.6	TO TRANSMIT	3-5
3.2.1.7	TO SELECT A WEATHER CHANNEL	3-5
3.2.1.8	THE 16 PLUS (PRIORITY) CHANNEL	3-5
3.2.1.9	SCAN MODE	3-6
3.2.1.10	DUAL WATCH MODE	3-6
3.2.1.11	MEMORY SCAN MODE	3-6
3.2.1.12	MASTER RESET	3-6
3.2.1.13	MARINE CHANNELS AND THEIR USAGE	3-7
SECTION 4	TECHNICAL DESCRIPTION	
4.1	GENERAL	4-1
4.2	THE CONTROL SECTION	4-1
4.3	THE TRANSMITTER/RECEIVER/PLL CIRCUIT	4-1
4.3.1	PLL CIRCUIT	4-1
4.3.2	TRANSMITTER CIRCUIT	4-2
4.3.3	RECEIVER CIRCUIT	4-3
SECTION 5	MAINTENANCE AND ALIGNMENT	
5.1	GENERAL	5-1
5.2	PERIODIC MAINTENANCE	5-1
5.3	ADJUSTMENT PROCEDURE	5-1
5.3.1	SYNTHESIZER ADJUSTMENT	5-2
5.3.2	FREQUENCY ADJUSTMENT	5-3
5.3.3	MODULATION ADJUSTMENT	5-3
5.3.4	POWER OUTPUT ADJUSTMENT	5-3

WARRANTY CERTIFICATE

GLOSSARY OF TERMS

VHF	Very High Frequency (30MHz to 300MHz)
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.
ALL SCAN	Scan mode scans all channels in selected channel group.
SELECT SCAN	Scan mode scans all selected channels.
MEMORY SCAN	Scan mode scans up to 10 memorized channels.
USA CHANNELS	Channel designations as defined by the FCC.
INTERNATIONAL CHANNELS	Channel designations as defined by the International Telecommunication Union.
CANADA CHANNELS	Channel designations as defined by the DOC.
WEATHER CHANNELS	Channels for routine and emergency weather information broadcasted by NOAA.
SIMPLEX	Transmit and receive on the same frequency.
SEMIDUPLEX	Transmit and receive on different frequencies.
SQUELCH	To suppress totally.
LCD DISPLAY	Liquid crystal display.
TX	Transmit.
RX	Receive.
RF	Radio Frequency.

SECTION 1
INTRODUCTION

1.1 GENERAL

The VHF 501 PLUS is a CPU-controlled, digitally synthesized, compact hand held transceiver, which provides reliable simplex and duplex (two-frequency) communications between ships and from ships at sea to public or private shore stations. The VHF 501 PLUS provides two-way communications on the International and US channels, reception on 10 separate weather channels, and two-way communications on the international calling and safety channel (16).

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

1.2 EQUIPMENT FEATURES

The VHF 501 PLUS is designed and manufactured to provide ease of operation with excellent reliability. The important built-in features of the equipment are listed below:

- All solid-state circuitry for low current drain and maximum reliability.
- High-performance receiver section with optimum selectivity.
- 53 channel transmit and 93 channel receive capability within the assigned VHF-FM maritime band. All US and International channels are included.
- Exclusive circuit that automatically selects channel 16 PLUS (priority channel) when the radio is turned on.
- Microcomputer-controlled channel frequencies and characteristics.
- Selected channel number indicated on the LCD digital display.
- Keyboard entries for "Quick" channel 16 PLUS, and 10 weather channels WX-0 thru WX-9.
- LOW Battery Display. If low battery is detected during transmission, selected channel number and "LO (low battery)" are alternately displayed on the LCD.

1.3 SPECIFICATIONS

Transmitter

Channels

53 US/International

Frequency Stability

5PPM (+ 0.0005%)
(20 °C to +50 °C)

Frequency Range

156.025 to 157.425 MHz

Channel spacing

25 KHz increments

Power output

5 watts switchable to 1 watt into
50 ohms at 10.8Vdc

Modulation

Frequency modulated 16F3
(± 4.5 KHz at 1000Hz)

Modulation Audio Response

Shall not vary $\pm 1/-3$ db from true
6db pre-emphasis from 300 to 2500
Hz, reference 1000Hz. Audio
frequencies 3-20KHz shall be
attenuated (at 1KHz by 60 log $f/3$
db. Above 20KHz by 50db.)

FM Hum & Noise Level

Greater than -40db below audio

Audio Distortion

Less than 10% at 1KHz for ± 3 KHz
deviation

Spurious & Harmonic Emissions

Attenuated at least 43 + 10 log
Po (below rated radiated carrier
power) per FCC Rules Parts 2 & 80

Antenna Impedance

50 ohms

Receiver

Channels

93 (includes 10 weather channels)

Frequency Range

156.025 to 163.275MHz in 25KHz
increments

Frequency Stability

+ 5PPM (0.0005%) from -20 °C to
+50 °C

Usable Sensitivity	0.3 uv for 12 db (SINAD) 0.5 uv for -20db quieting
Squelch Sensitivity Threshold	0.3uv or better 0.8uv full squelch
Modulation acceptance	Not less than ± 7.0 KHz
Adjacent Chl Rejection	Greater than 70db
Spurious Image Rejection	Greater than 70db
Intermodulation Rejection	Greater than 60db
Audio output	350mW or more at 10% less distortion into 8 ohm load
Hum & Noise in Audio	Less than -40db
<u>Operating Requirements</u>	
Input voltage	10.8 Vdc Nicad rechargeable battery
Battery Capacity	600 mA/H
Current Required Transmit	Less than 1.5 amps at 5 watts Less than 0.8 amps at 1 watt
Receiving (squelched)	Less than 60 ma; 200 ma at 0.3 watts audio output (1KHz)
Operating Temperature	(-20 °C to +50 °C)
Duty Cycle	Continuous, 80% receive, 20% transmit (max. 10 min. @ 25°C)
Humidity	100% at 50 °C for 8 hours
<u>Radio Dimensions</u>	
Height	173mm (6.8 inches)
Width	66mm (2.6 inches)
Depth	35mm (1.4 inches)
Weight	Approx. 0.5Kg. (1 lb)

NOTE

The VHF 501 PLUS VHF-FM radiotelephone meets all applicable sections of FCC rules Parts 2, 15 and 80.

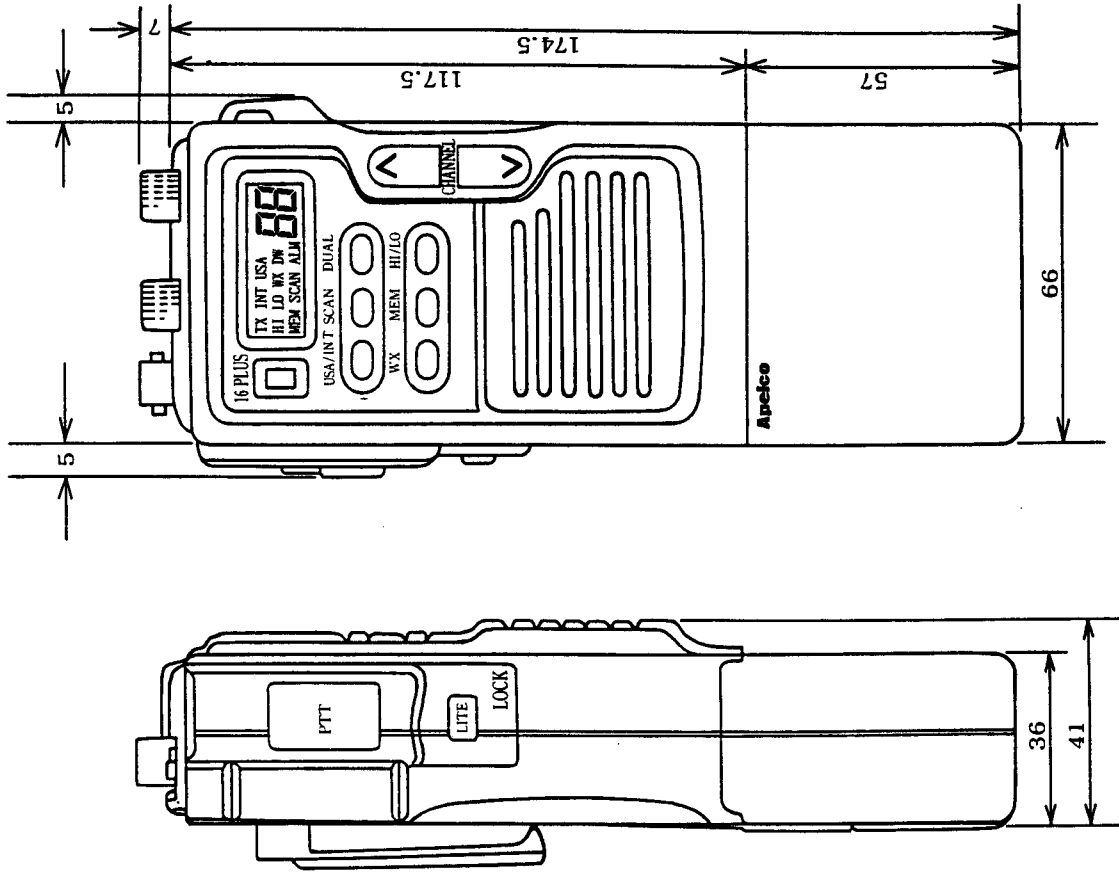


FIG. 1-1 OUTLINE DIMENSIONS

SECTION 2

INSTALLATION

1 UNPACKING AND INSPECTION

Use care when unpacking the unit 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 is necessary to return the unit to the factory.

2 EQUIPMENT SUPPLIED

The following is a list of materials supplied with the VHF 501 US.

Radiotelephone w/acc. M56795
Instruction Manual G623253-1
Nicaid Battery Pack G623253-2
Rubber Helical Antenna G6233532-3
Wall Charger 115V AC G263531-6
Vinyl Carrying Case G263531-7
Belt Clip w/screws G263532-8
Wrist Strap G263531-8
Important Safety Message G263695-1
FCC Instructions FCC Form 506

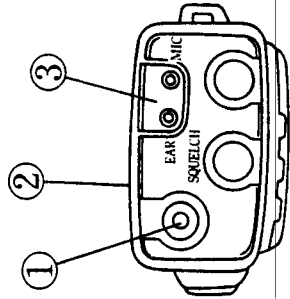
OPTIONAL ACCESSORIES

Leather Carrying Case M56366
High Gain Antenna M56367
Lapel Speaker Microphone M56368
Universal Charger Kit M56791A
Charger Sleeve M56793
Soft Storage Carrying Case M99-117
Cigarette Lighter Charger M99-125

These optional accessories may be ordered by calling our former service department directly at (603) 647-7530, Monday through Friday 8:30 am - 5:00 pm E.S.T.

ELECTRICAL CONNECTIONS

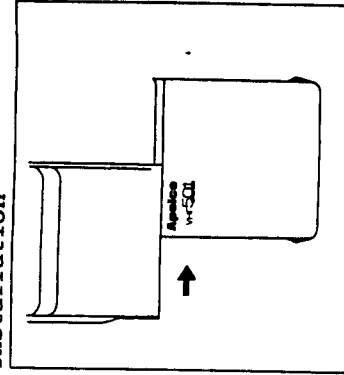
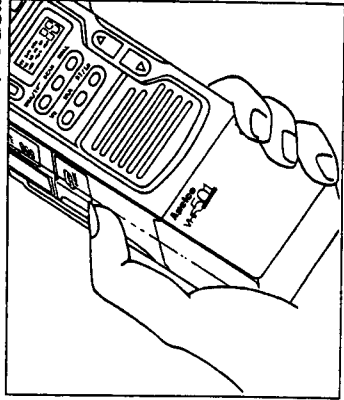
- 1 Antenna Connector
- 2 Wall Charger Connector
- 3 Speaker/Microphone Connector



2.3.1 ASSEMBLY

Remove the radio from the carton, attach the whip antenna to the BNC antenna connector. Remove the Belt Clip and attach it to the back of the radio with the two screws provided. Remove the battery pack and slide it onto the radio.

Battery Pack Installation

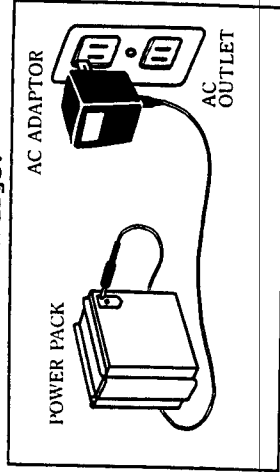


Although the battery pack is fully charged when it leaves the factory, it may be necessary to charge it prior to use. Remove the Wall Charger from the carton, and insert the connector into the rear of the battery pack, then plug it into the wall outlet. A typical time to recharge the battery pack can be up to 15 hours.

CAUTIONS

- * To recharge the radio's battery pack safely, do not use any charger other than the one provided.
- * The battery pack may be charged on or off of the radio, when charged on the radio, the radio should be off.
- * Avoid high temperature areas (over 110°F) while recharging the battery pack.
- * If the radio is to be stored for an extended period of time, remove the battery pack to avoid possible discharge and/or resultant battery failure.
- * When it is determined that the battery is no longer useful, it should be disposed of properly.

To Charge:



SECTION 3

OPERATION

1.1 AVAILABLE CHANNELS

Your VHF 501 PLUS has the capability to transmit on 53 and receive on 93 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). Table 3-1 lists all of the marine HF channels available in your VHF 501 PLUS for international and . S. radiotelephone use. Full familiarization with this table is essential. The international frequencies were agreed upon by the attending countries at the 1968 International Telecommunication union meeting in Geneva. These frequencies are in active use around the world. The U. S. channels are those channels authorized or use in the U. S. by the FCC.

1.2 CONTROLS AND MODE DISPLAY

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

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
Provides an adjustable input signal threshold to eliminate random RF background noise during "no signal" conditions. This control sets the signal-to-noise ratio at which a signal will become audible.
- ③ [16 PLUS] Key
Used to select channel 16 immediately.
Channel 16 has been preset as the default channel at the factory prior to shipment. However, the default channel can easily be changed to any desired working channel by using the "16 plus" feature. (Refer to section 3.3.8 for an explanation of this operation).
- ④ [USA/INT] Key
When pressed causes the synthesizer to program International channel frequencies and INT is displayed on the LCD; when pressed again the synthesizer programs US frequencies and the LCD displays USA.
- ⑤ [PTT] (Push-To-Talk) Switch
When pressed puts the radio into the transmit mode, and a reverse character TX will be displayed on the LCD.

⑥ [WX] Key

When pressed puts the radio into the Weather receiving mode. A WX will be displayed on the LCD along with the weather channel number (0-9). When in this mode, the transmitter is disabled.

⑦ [LITE] Key

When pressed, this key turns On/Off the backlighting of the LCD display. If pressed and held, (approx 2 seconds) activates "KEYBOARD LOCK" feature. Repeat to "unlock" the keyboard.

⑧ [MEM] Key

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

⑨ [HI/LO] Key

When pressed, alternately changes the transmitter output power from 1 watt to 5 watts.

⑩ [▲] [▼] Keys

The Up and Down keys are used to move the channel number up or down. The channel number can be increased or decreased one with each press, or if held will continue increase or decrease the number as long as the key is held.

⑪ [DUAL] Key

When pressed, puts the radio into the Dual Watch mode. In this mode, the radio will scan (monitor) priority channel 16 (or reprogrammed 16 PLUS channel), a user selected channel, and all weather channels.

⑫ [SCAN] Key

When pressed, puts the radio into the All Scan mode.

All of the above keys will produce an audible beep when pressed.

- ⑬ LCD Display: A number of characters and digits will appear on the display. The following lists the characters and when they will appear on the display.

- 1) TX (Transmit): will be displayed on the LCD when the Push-To-Talk switch on the radio has been pressed and the transmitter circuits are providing a signal to the antenna.

- 2) INT (International): will be displayed when International channels are programmed for use.
- 3) USA (United States): will be displayed when US channels are programmed for use.
- 4) HI (High Power): will be displayed when the transmitter circuits are set to provide 5 watts of power to the antenna.
- 5) LO (Low Power): will be displayed when the transmitter circuits are set to provide 1 watt of power to the antenna.
- 6) WX (Weather): will be displayed when the channel selected to be monitored is a weather channel.
- 7) DW (Dual Watch): will be displayed when the DUAL key is pressed and the radio is in the Dual Watch mode.
- 8) MEM (Memory): will be displayed when channels are written into the memory.
- 9) SCAN (All Scan): will be displayed when the SCAN key is pressed and the radio is in the All Scan mode.
- 10) MEMSCAN (Memory Scan): will be displayed when the memory channels are being scanned.
- 11) ALM (Alarm): will be displayed when a Weather Alert tone has been received.

- ⑭ Wall Charger Input
- ⑮ Antenna Connector
- ⑯ Earphone/Microphone Connectors

1.3 OPERATING PROCEDURES

Specific operating procedures for your VHF 501 PLUS are presented below.

.3.1 Turning the Power On

Rotate the Volume control clockwise and set it at approximately its midpoint.

NOTE

When the Power is turned on, the synthesizer automatically programs for US channel frequencies and selects the 16 PLUS channel.

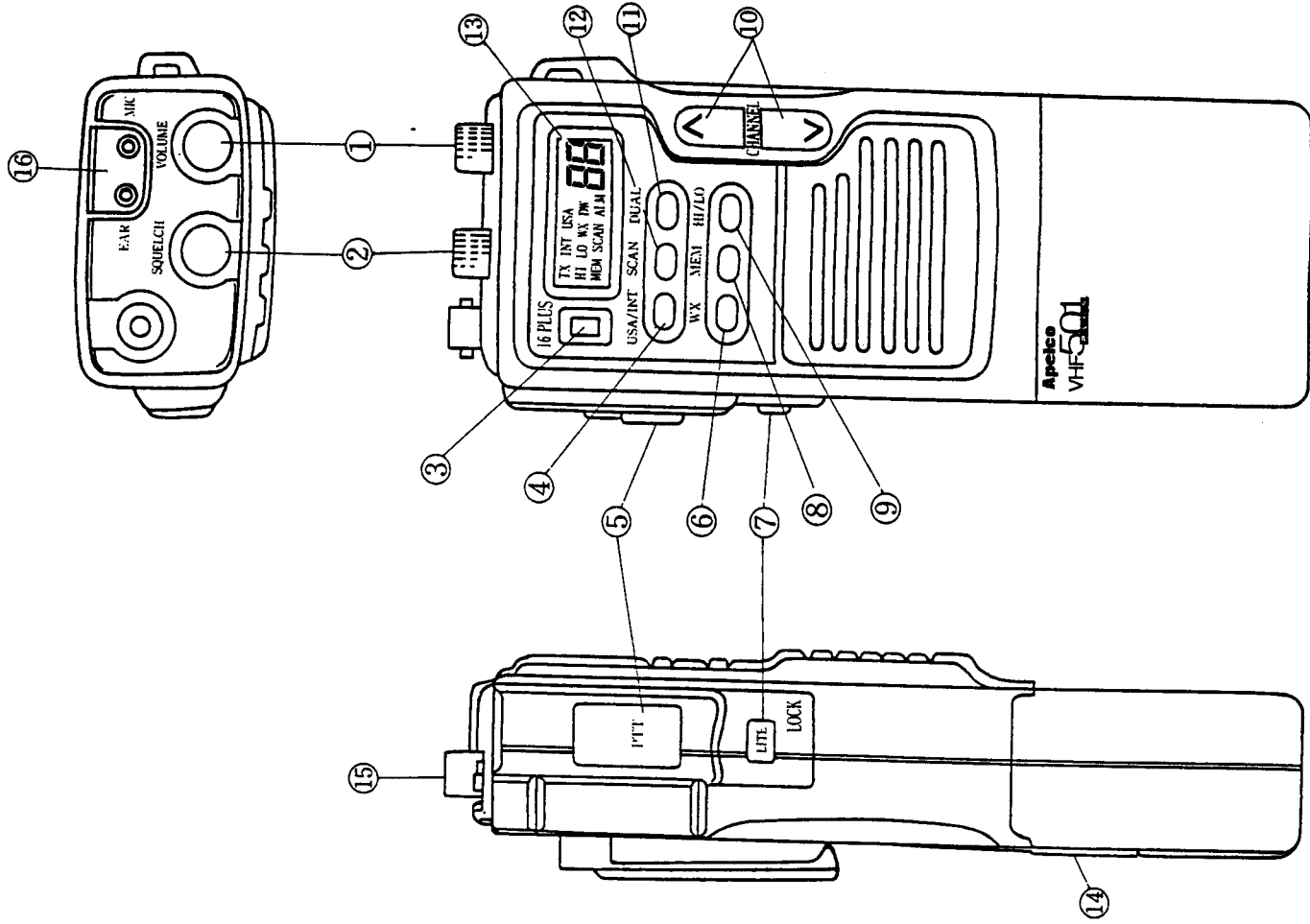


FIG. 3-1 LAYOUT OF CONTROLS AND CONNECTORS

3.2 Setting the Volume

- 1) Rotate the Squelch control fully counterclockwise.
- 2) Rotate the Volume control for the desired listening level.

3.3 Setting the Squelch

- 1) Rotate the Squelch control slowly clockwise until the noise in the speaker ceases.

3.4 Setting the Power Output

- 1) Press the HI/LO key to select 1 watt (LO) or 5 watt (HI) power output. This will be dependent on the distance the message is to be transmitted, and transmitting conditions. 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 operation when the channel is selected.

3.5 Selecting a Channel

- 1) To select the appropriate channel, press the [▲] or [▼] channel select keys. Refer to Table 3-1 to select your "working" channel.

3.6 To Transmit (INT/USA)

- 1) Select the desired mode (INT or USA) by pressing the INT/USA key. Then press the Push-To-Talk switch and speak into the microphone using a clear normal voice.

NOTE: Initial communication contacts are usually made over channel 16 as all ships and shore stations monitor this channel, then a shift to a working frequency will be necessary.

3.7 To Select a Weather Channel

- 1) Press the WX key, then the up or down key to select the desired weather channel from 0 to 9. When this mode is selected, the transmitter is locked out.
- 2) If a weather alert signal (1050Hz) is received there is an audible alarm generated. To cancel the audible alarm, press any key except the HI/LO or USA/INT keys.

3.8 The 16 PLUS (Priority) Channel

Channel 16 has been preset as the default "16 PLUS" channel at the factory prior to shipment. However, the default channel can be changed to any desired working channel by using the "16 PLUS" feature. (Note: weather channels can not be programmed as the 16 PLUS channel.)

- 1) Press the UP [▲] or Down [▼] Key to select the desired channel. Then press and hold the 16 PLUS Key for three seconds. An audible beep tone will confirm that the selected channels is stored in memory as the 16 PLUS channel.
- 2) To set CH 16 as the 16 PLUS channel again, repeat step 1 for CH 16.

3.3.9 Scan (All Channel Scan) Mode

When the SCAN key is pressed, the radio will start scanning channels from the one displayed in an upward direction. If a signal is received, scanning will stop for 5 seconds, then continue scanning. To cancel the scanning, press any key except the HI/LO or INT/USA keys.

3.3.10 Dual Watch Mode

In the Dual Watch mode you must first select the WX mode and select the weather channel you wish to monitor (for example WX 0 press WX, [▲], [▼], WX). Then use the Up/Down [▲] or [▼] to select the channel you wish to monitor (for example CH 83, press the [▲] key until 83 is displayed). Then press the DUAL key, the radio will scan channel 16 PLUS, 83, WX02, 16, etc.,

If while scanning a signal is received on CH 16, the scanning will stop on CH 16 for as long as the signal is being received. If the signal ceases in less than 3 seconds, the scanning will continue.

If a signal is received on CH 83, the scan will stop on CH 83 but will continue to monitor CH 16 PLUS every 3 seconds.

If a signal is received on WX 02, the scan will stop on WX briefly, but will not give any audio output. If a weather alert tone (1050) is generated, the scan will stop and an audible alarm will sound. To silence the alarm, push any key except HI/LO or INT/USA.

To cancel the Dual Watch mode, press any key except HI/LO or INT/USA.

3.3.11 Memory Scan Mode

The VHF 501 PLUS has the capability of memorizing and scanning up to a maximum of 10 channels in this mode. To put a channel into memory, use the [▲] or [▼] key to put the channel number to be memorized on the display. Press and hold the MEM (memory) Key until 2 beep tones are heard. The second beep tone confirms that the channel number has been entered into memory. The above procedure can be continued until all 10 channel memories have been filled.

When an 11th channel is selected to be put into memory, the channel display will show FL (Full). To put this channel into memory, another channel will have to be canceled from memory. To cancel a memorized channel, use the [▲] or [▼] key to put the channel number on the display, then press and hold the MEM key until "FL" is displayed, and continue holding the key until "CL" (clear) is shown (approximately 5 seconds total) to verify cancellation. The above procedure can be used to cancel all memorized channels.

To scan the memorized channels, press the MEM key followed by the SCAN key. The SCAN key should be pressed within 4 seconds, while the MEM is displayed on the LCD.

3.3.12 Master Reset

If you hold down the MEM key (for approximately 3 seconds) when turning the power on, all channels will be erased from memory, and the 16 PLUS channel will be automatically programmed back to channel 16. "CL" will appear on the display to confirm that the memory has been erased.

3.3.13 VHF 501 PLUS Marine Channels and Their Usage

CAUTION

* The transmitter of the VHF 501 PLUS is disabled when channel 15 or WX0-WX9 is displayed.

CHANNEL DESIGN.	FREQUENCY (MHz)			TYPE OF TRAFFIC	FUNCTION	
	TX	RX (USA)	RX (INT'L)		SHIP TO SHIP	SHIP TO SHORE
01#	156.050	156.050	160.650	-	-	-
02#	156.100	156.100	160.700	-	-	-
03#	156.150	156.150	160.750	-	-	-
04#	156.200	156.200	160.800	-	-	-
05	156.250	156.250	160.850	Port Operations	Yes	Yes
06	156.300	156.300	156.300	Inter-ship Safety	Yes	No
07	156.350	156.350	160.950	Com'l	Yes	Yes
08	156.400	156.400	156.400	Com'l	Yes	No
09	156.450	156.450	156.450	Call & Ship/Ship	Yes	Yes
10	156.500	156.500	156.500	Com'l & Ship/Ship	Yes	Yes
11	156.550	156.550	156.550	Com'l & Ship/Ship	Yes	Yes
12	156.600	156.600	156.600	Port Operations	Yes	Yes
13**	156.650	156.650	156.650	Nav. Ship/Bridge	Yes	Yes
14	156.700	156.700	156.700	Port Operations	Yes	Yes
15#	-	156.750	156.750	Environmental	-	-
16	156.800	156.800	156.800	Emerg/Calling	Yes	Yes
17*	156.850	156.850	156.850	State Controlled	Yes	Yes
18	156.900	156.900	161.500	Com'l	Yes	Yes
19	156.950	156.950	161.500	Com'l	Yes	Yes
20	157.000	157.000	161.600	Port Operations	Yes	Yes
21 (CG)	157.050	157.050	161.650	Coast Guard	Yes	Yes
22 (CG)	157.100	157.100	161.700	Coast Guard	Yes	Yes
23 (CG)	157.150	157.150	161.750	Coast Guard	Yes	Yes
24	157.200	161.800	161.800	Public Corresp	No	Yes
25	157.250	161.850	161.850	Public Corresp	No	Yes
26	157.300	161.900	161.900	Public Corresp	No	Yes
27	157.350	161.950	161.950	Public Corresp	No	Yes
28	157.400	162.000	162.000	Public Corresp	No	Yes
60+	156.025	156.025	160.625	Public Corresp	No	Yes
61+	156.075	156.075	160.675	-	-	-
62+	156.125	156.125	160.725	-	-	-
63	156.175	156.175	160.775	Com'l	Yes	Yes
64+	156.225	156.225	160.825	-	-	-

Table 3-1

- * 1 watt only
- ** 1 watt initially. User can override to high power (5 watts) via front panel controls.
- # The transmitter is automatically disabled when channels 1, 2, 3, and 4, for USA; and 15 for USA and International are selected.
- + Assigned by Canadian Government, proper authorization must be ensured prior to use.

Caution

* Operation on channels not designated for use by your classification or craft (C) on International Channels within the US territorial waters is a violation of FCC Rules and Regulations and may result in severe penalties.

CHANNEL DESIGN.	FREQUENCY (MHz)			TYPE TRAFFIC	FUNCTION	
	TX	RX (USA)	RX (INT'L)		SHIP TO SHIP	SHIP TO SHORE
65	156.275	156.275	160.875	Port Operations	Yes	Yes
66	156.325	156.325	160.925	Port Operations	Yes	Yes
67**	156.375	156.375	156.375	Com'l	Yes	No
68	156.425	156.425	156.425	Non Com'l	Yes	Yes
69	156.475	156.475	156.475	Non Com'l	Yes	Yes
70#	-	156.525	156.525	DSC	Yes	Yes
71	156.575	156.575	156.575	Non Com'l	Yes	Yes
72	156.625	156.625	156.625	Non Com'l	Yes	No
73	156.675	156.675	156.675	Port Operations	Yes	Yes
74	156.725	156.725	156.725	Port Operations	Yes	Yes
75#	-	156.775	156.775	-	-	-
76#	-	156.825	156.825	-	-	-
77*	156.875	156.875	156.875	Port Operations	Yes	No
78	156.925	156.925	161.525	Non Com'l	Yes	Yes
79	156.975	156.975	161.575	Com'l	Yes	Yes
80	157.025	157.025	161.625	Com'l	Yes	Yes
81	157.075	157.075	161.675	Coast Guard	Yes	Yes
82	157.125	157.125	161.725	Coast Guard	Yes	Yes
83	157.175	157.175	161.775	Coast Guard	Yes	Yes
84	157.225	161.825	161.825	Public Corresp.	No	Yes
85	157.275	161.875	161.875	Public Corresp.	No	Yes
86	157.325	161.925	161.925	Public Corresp.	No	Yes
87	157.375	161.975	161.975	Public Corresp.	No	Yes
88	157.425	157.425	162.025	Com'l	Yes	No

Table 3-1 (Continued)

- * 1 watt only
- ** 1 watt initially. User can override to high power (5 watts) via front panel controls.
- # The transmitter is disabled when channels 75 and 76 are selected. Channel 70 is now used for DSC calling only, therefore transmission is disabled on channel 70 in this radio.

CHANNEL	FREQUENCY (MHz)	TYPE TRAFFIC	FUNCTION-SHIP TO SHORE
WX0	163.275	NOAA Weather	Receive Only
WX1	162.550	NOAA Weather	Receive Only
WX2	162.400	NOAA Weather	Receive Only
WX3	162.475	NOAA Weather	Receive Only
WX4	162.425	NOAA Weather	Receive Only
WX5	162.450	NOAA Weather	Receive Only
WX6	162.500	NOAA Weather	Receive Only
WX7	162.525	NOAA Weather	Receive Only
WX8	161.650	Canadian Weath.	Receive Only
WX9	161.775	Canadian Weath.	Receive Only

Table 3-2

Caution

- Operation on channels not designated for use by your classification of craft or on International Channels within US territorial waters is a violation of FCC Rules and Regulations and may result in severe penalties.

SECTION 4

TECHNICAL DESCRIPTION

4.1 GENERAL

The VHF 501 PLUS can be considered as consisting of two major sections. They are:

- A. The Control Circuitry (consisting of the front panel controls, the LCD display, control CPU).
- B. The Transmitter/Receiver/PLL circuits.

4.2 THE CONTROL SECTION

The heart of the control section is the CPU, IC1 on the digital pcb. The CPU controls all of the following items:

- 1) controls the Squelch circuit by detecting a busy signal from the 2nd IF circuit IC4.
- 2) generates a beep tone when a key is activated on the keyboard.
- 3) mutes the transmitter modulation circuit when receiving.
- 4) controls the output power of the transmitter High/Low.
- 5) controls the dividing ratio N of the PLL circuit.
- 6) switches On/Off the transmitter power.
- 7) mutes AF audio.
- 8) controls the LCD display.

4.3 The Transmitter/Receiver/PLL Circuit

4.3.1 PLL (Phase Lock Loop) Circuit

The PLL circuit is the frequency synthesizer in the VHF 501 PLUS.

The reference frequency of 12.8 MHz is provided by crystal X1 and IC1. IC1 contains the reference oscillator (12.8MHz) circuit, the phase comparator, the program counter and the phase detector.

The 12.8MHz reference signal is divided by 512 in the program counter in IC1 to obtain a 25KHz reference signal. The dividing ratio is determined by CPU DIC1. The VCO output from oscillator Q4 is amplified by buffer amplifiers Q5 and Q11, and returned to IC1 and is divided by the dividing ratio N to obtain a 25KHz signal. N for 1/N in IC1 is determined by CPU DIC1. Both of these 25KHz signals are fed into the phase comparator circuit of IC1.

The phase detected signal, obtained by comparing the phase difference between these two signals, is applied to IC5 (LPF) to get a DC voltage correlated with the phase difference.

This DC voltage acts on the VCO to make the two 25KHz signals the same phase. When this condition is met, the PLL circuit is locked. If the two signals have a large phase difference, the PLL is unlocked. In this condition, the signal is fed to CPU DIC1 and the transmitter is compelled to stop.

The VCO output from Q4 is fed to the TX amplifier Q6 and the first RX mixer Q13 through buffer amplifiers Q5 and Q11.

4.3.2 Transmitter Circuit

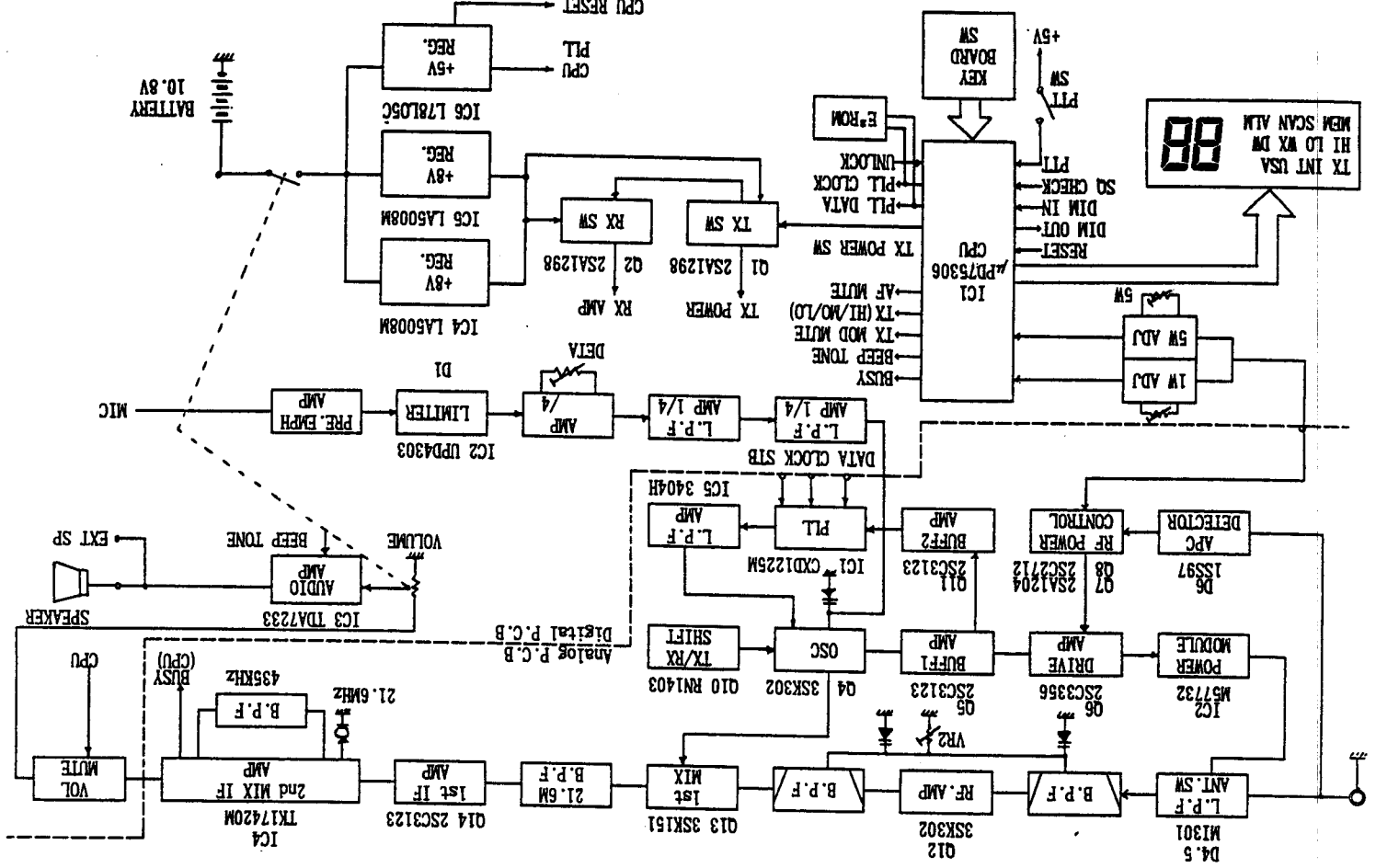
A signal from the microphone is fed to a preamplifier operational amplifier DIC2 (C,D), deviation limiter circuit DD1, and modulates VCO (Q4) through active LPF DIC2 (A,B). The VCO output signal from Q4 is sent to the RF power amp. IC2 through buffer amps. Q5 and Q6. The RF signal from IC2 is fed to the antenna through a low pass filter. The DC voltage correlative to the RF output is detected by D6, amplified by Q7 and Q8 and fed to Q6. The output voltage from Q6 controls the RF power and IC2 to keep the RF output at a constant level.

4.3.3 Receiver Circuit

1) RF Circuit
The signal from the antenna passes through the dual tuned band pass filter, and is amplified by RF amplifier Q12, and is fed into a double tuned band pass filter. The signal is then mixed Q4 (lock freq.) by Q13 (first mixer) and produces the first IF signal of 21.6MHz. This signal is sent to a crystal filter (21.6MHz) and 1st IF amplifier Q14, mixed by IC4, the 2nd mixer, and becomes an audio signal after detection.

2) AF Circuit
The AF signal from IC4 is amplified by IC3 to drive the speaker while the receiver is in the squelched condition. Muting control of IC3 is carried out by the CPU DIC1.

3) IF Circuit
The output of the 1st IF amplifier Q13 is fed into IC4. IC4 contains the second mixer, second local oscillator, 455KHz amplifier, quadrature detector and DC switching amplifier.
A 455KHz ceramic filter is installed between pins 4 and 5 of IC4 to examine the selectivity of this unit. The detector output is separated into audio and noise components by an RC filter. The noise component is fed back to the noise amplifier section of IC4. Its output is rectified by diode D12, and then fed to the switching amplifier in IC4.



SECTION 5

MAINTENANCE AND ALIGNMENT

5.1 GENERAL

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

5.2 PERIODIC MAINTENANCE

The VHF 501 PLUS has been constructed to be virtually maintenance free. Your attention to a few basic points should assure years of service.

- 1) Keep the unit as dry as possible.
- 2) Clean the exterior of the unit with a tissue or soft non-abrasive cloth. Do not use solvents or other chemicals for cleaning this equipment.
- 3) Inspect the radio case, battery pack, and antenna for any physical damage.
- 4) Check the antenna connector, external microphone/speaker jack, and battery terminals for any dirt or corrosion.

NOTE: The following alignment procedures are in this manual to aid FCC licensed technicians and service personnel only!

5.3 ADJUSTMENT PROCEDURE

This transceiver is completely aligned at the factory and does not require any adjustments at installation. The test equipment listed below 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 (10.8VDC) 0-20V variable, 3A max.
2. RF Power Meter 10W, 50 ohm, 100-200 MHz
3. RF Signal Generator 100-200 MHz, 50 ohm term.
4. FM Linear Detector (FMLD) 100-200 MHz
5. Frequency Counter 1-500 MHz
6. Oscilloscope
7. Distortion Meter
8. SINNADDER (Trademark of Helper Instruments Co.)
9. Audio Oscillator
10. Toggle Switch (for use as PTT switch)

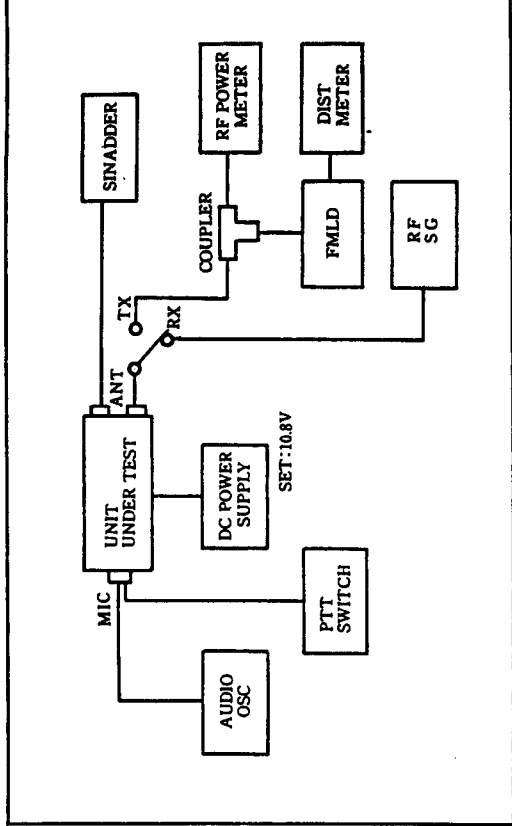


FIG. 5-1 TEST SETUP

5.3.1 SYNTHESIZER ADJUSTMENT

- 1) Connect the power supply (10.8V, 3A) to the power line RF power meter with coupler to the antenna connector the PTT switch to the microphone terminal.
- 2) Connect a digital voltmeter or high impedance tester (positive lead to TP1, negative to ground) and adjust L1 and L2 as shown in Table 1. (See Fig. 5-2)

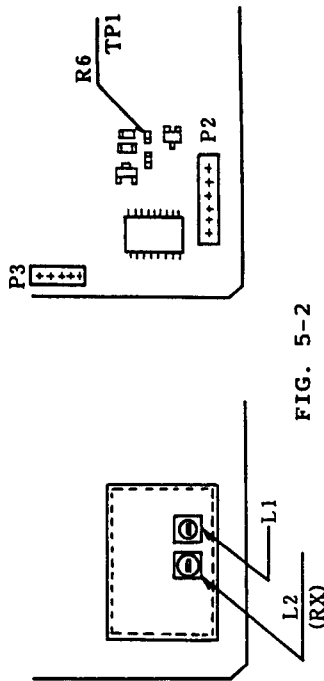


FIG. 5-2

TABLE 1

Sequence	Item	Condition	Adj. point	Adj. volt.
1	TX	transmit CH. 16 USA/INT	L1	2.1 V
2	RX	receive CH. WKO	L2	3.8 V
3	RX	receive CH. 16	-----	check 2.0 V

5.3.2 FREQUENCY ADJUSTMENT

- 1) Connect the coupler output to the frequency counter, set the radio on CH 16 (156.800MHz), key to transmit, and read the indication on the counter.
- 2) Adjust trimmer capacitor CV1 in PLL section (See Fig. 3) for the desired frequency (156.800MHz) \pm 20Hz on the frequency counter.

5.3.3 MODULATION ADJUSTMENT

- 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 -20dBm, 300Hz and adjust VR1 on the CPU PCB for a deviation of \pm 4.5KHz.
- 3) Set the audio oscillator output to -45dBm, 1KHz and read the deviation meter (\pm 2.5KHz - \pm 3KHz).

5.3.4 POWER OUTPUT ADJUSTMENT

- 1) Connect the RF power meter to the antenna connector through the coupler. Key to transmit and adjust RV1 on the RF PCB as shown in Table 2.

Sequence	Condition	Adjust point	Target power
1	DC 10.8v H/L L	RV1 low power	0.8w (limit 1.0w)
2	DC 10.8v H/L H	ckeck	5w (over 4.5w)

TABLE 2

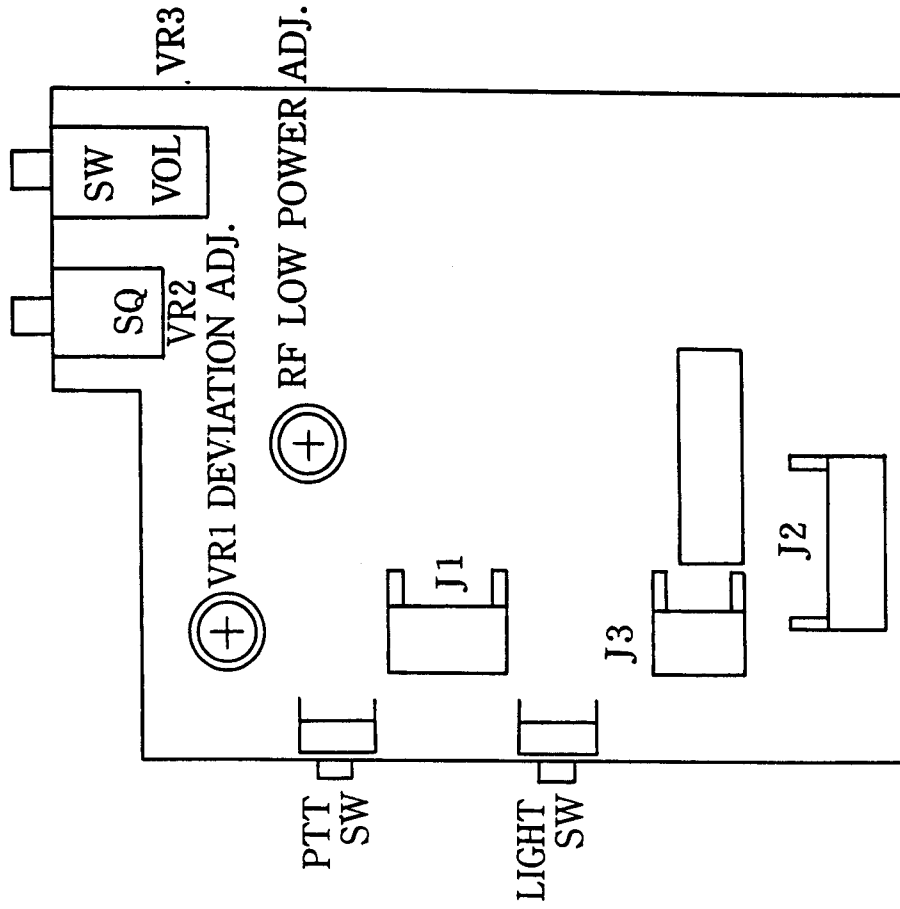


FIG. 5-3 CPU PCB PARTS LOCATION

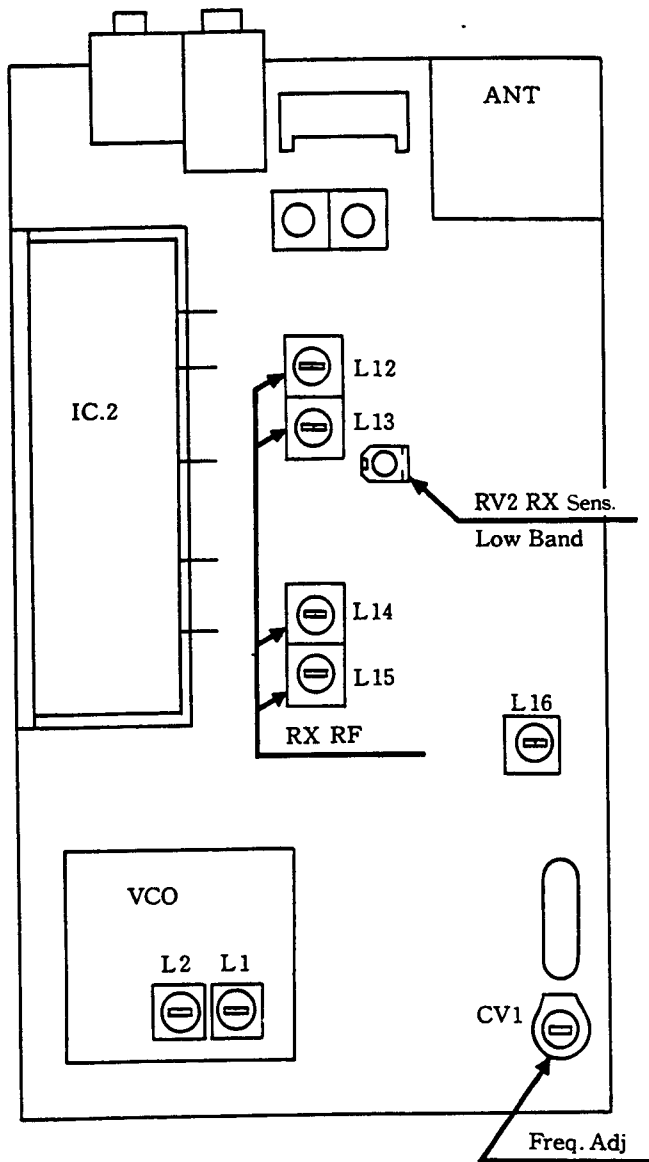


FIG. 5-4 RF PCB PARTS LOCATION

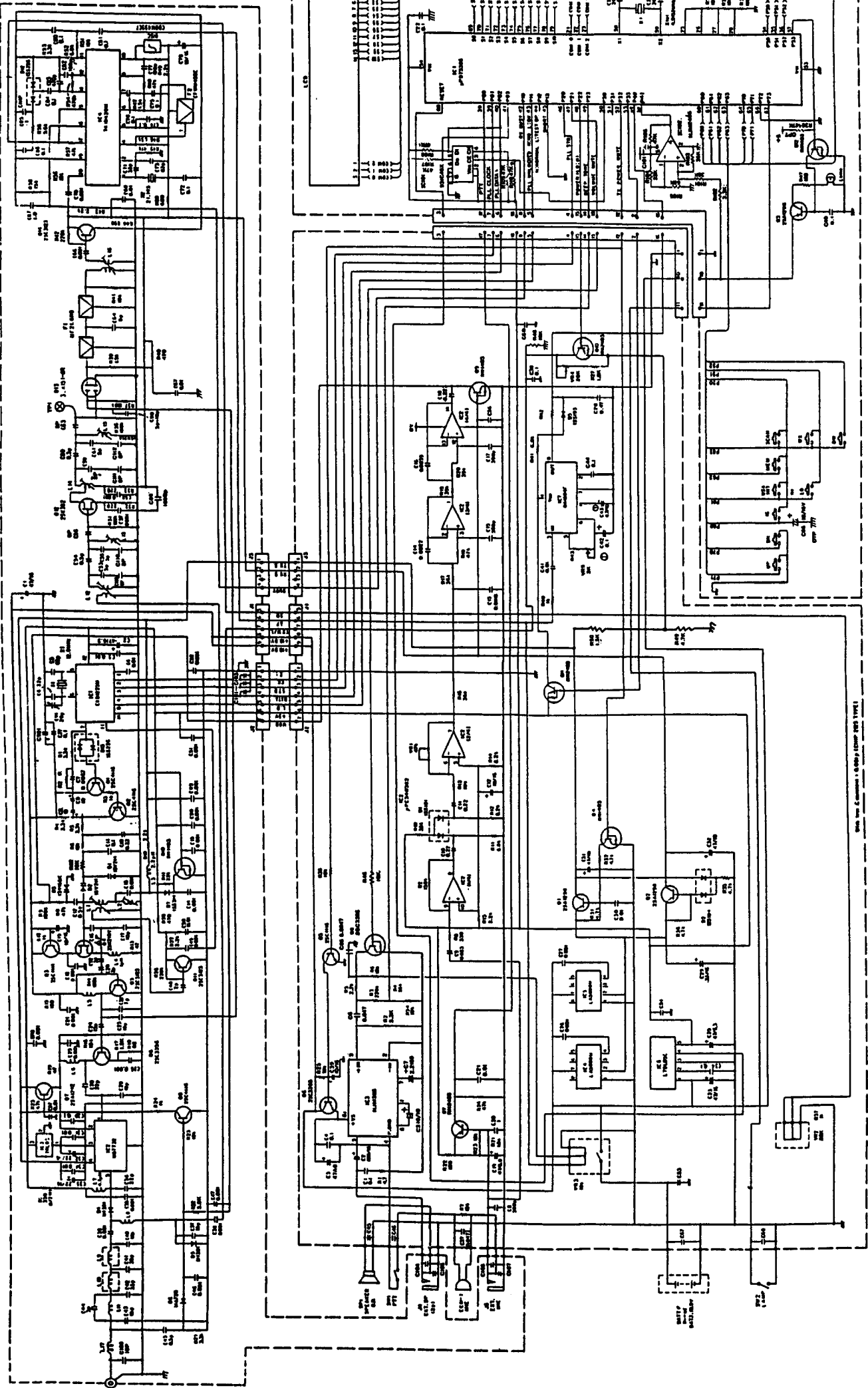


FIG. 5-5 VHF 501 PLUS SCHEMATIC DIAGRAM

© 1955 RCA Corporation