Pacific
Technical Description

A. GENERAL DESCRIPTION

The PACIFIC Marine Radio is a self-contained transceiver unit with removable antenna intended for use as a general communication tool. It is designed to operate on all 56 International Marine channel plus USA and Canada frequency as well. This model also features 20 channels User Programmable function, wherein user can program frequencies from 155~162MHz.
The useable range, while dependent upon terrain and other propagation principles, is typically three miles. The Pacific uses the maximum transmit power allowed to help ensure the maximum communication range.

Features include:
- Up to 20 User-Programmable Channels
- Emergency Channel 16
- Quick recall and Scanning of Stored Channels
- Battery Level Meter Function
- Scan function
- Keypad Lock
- High/Low TX Power Selection
- Dual Watch Function
- VOX Function
- Jack for External Microphone, NiMH Battery Recharge, and Channel Programming
- Jack for External Speaker
- Roger Beep On/Off

Four AA Alkaline batteries that are readily available in retail outlets supply the operating power. An automatic power saving feature allows the typical standby battery life to more than 10 days.

B. FREQUENCY DETERMINING CIRCUITS

The fundamental frequency for both the transmitter and the receiver local oscillators are controlled by a Phase Lock Loop (PLL) circuits inside the IC501 AN29160 Single Chip IC. The frequency of operation of the Voltage Controlled Oscillator (VCO) composed of Q401 and Q402 operating in cascade is phase locked to a voltage controlled crystal reference (VCXO) operating at 20.95MHz (X501).

The VCO is locked to the fundamental of the transmit signal in the transmit mode and is locked to the receive 1st LO (Fundamental channel frequency minus

21.4MHz) in the receive mode. The crystal reference frequency is shared with the 2nd LO of 20.95MHz.

C. TRANSMITTER CIRCUITS

The transmitter amplifies the 0dBm signal from the VCO to approximately 27dBm that is fed to the antenna. The transmitter is a three stage amplifier composed of Q207, Q204, Q205, and Q1. The first two stages are operated class A and the final is operated class B in full saturation to help prevent unwanted amplitude modulation. The fundamental transmit signal is fed through a low pass filter (5pole, 2 zero) in order to suppress the harmonics to below -50dBc. The desired frequency modulation of the carrier is accomplished by modulating the current I the VCO directly with the microphone audio signal. The microphone audio is conditioned with a three-pole high pass, a hard clipper to limit the maximum deviation to +/-3.5kHz and a three-pole low pass or splatter filter at 5.0kHz, all is inside the IC501 AN29160. The low pass filter insures that the occupied bandwidth of the FM modulated signal meets the ETSI requirement under all input conditions.

D. RECEIVER CIRCUITS

The received signal from the antenna is band limited to 600MHz by the transmitter harmonic filter. The desired signal is fed to a low noise amplifier (LNA - Q208) centered 160MHz that provides approximately 10dB of gain. The output of the LNA is filtered with a Band Pass Filter (SF201) with a pass-band of 160MHz and a stopband attenuation of 50dB. The filtered received signal is one input to the 1st mixer (Q209), the other mixer input (1st LO) is the output of the VCO at the desired channel frequency minus 21.4MHz. The output of the mixer is tuned to the 1st IF of 21.4MHz.

The 1st IF is transformer coupled for impedance matching to a X-Tal filter centered at 21.4MHz with a bandwidth of +/-3.75Hz. The filtered 1st IF is then amplified by Q210 and fed to the 2nd mixer input of the IC501 AN29160. The 2nd LO (20.95MHz) is generated by VCXO that is the reference frequency for the PLL. The 2nd mixer output of 450kHz is filtered through a 4 section ceramic filter that in combination with 21.4MHz X-tal filter provides approximately 50dB of adjacent channel attenuation. The 450kHz 2nd IF is then amplified, limited and fed to a quadrature detector for FM demodulation. The resulting audio output signal is bandpass filtered from 300Hz to 3kHz and amplified to provide 150mW of audio power, all inside IC501 AN29160. The squelch circuit is provided to mute the receiver noise under low signal conditions. The squelch circuit amplifies and detects noise in a narrow bandwidth at approximately 9dB SINAD receive signal strength, the audio output is muted.

E. TRANSMIT/RECEIVE SWITCH

When the radio is in the transmit mode, pin diode D201 is turned on (representing less than 0.7 ohms). D201 allows the transmit signal to pass to the antenna. This result in a parallel tuned circuit high impedance being presented to the transmit signal so that the receive path does not load the transmit signal. In receive mode D201 is turned off resulting in the antenna signal being coupled into the receive LNA through the 50ohm T matching network and the unwanted load of the transmit final amplifier is reduce to less than 1pF by D202.

F. RADIO CONTROL CIRCUIT

A microprocessor IC101 is used to control the transceiver. User stimuli is prvided through a tact switch for PTT (push to talk), along with the keypad for channel selection, the monitor/scan and ch16 emergency channel access. Pressing the PTT switch instruct the IC101 to switch to transmit mode. This is accomplished by loading the proper channel counter information through a 3-wire serial link to the PLL IC (IC501 AN29160), turning on power to the PLL and VCO, microphone and transmit audio circuits and the transmit RF amplifiers. Pressing the channel up/down button (active in receive mode) instruct IC101 to increment or decrement respectively the channel frequency by one channel from the channel previously selected.

In receive mode the microcontroller periodically switches on the VCO and the receive power and checks for a valid receive signal by monitoring the squelch circuit output. If a valid signal is present, the audio output is turned on and receive power is maintained for the duration of the valid signal. If the valid signal is removed or no valid signal was present, the microcontroller removes power from the VCO and receiver, waits for approximately 100ms and the checks again. This periodic cycling of the power to the receiver circuits results in a much longer battery life vs. leaving power on continuously. The total period of the cycling is selected such that the worst case delay in "seeing" a valid receive signal is not disruptive to normal two-way voice communication.