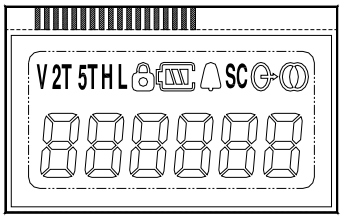
ⓗ PTT(Push To Talk) Button
Hold down to transmit, release to receive.
ⓘ Monitor Button
Press to monitor. Holding down over 2 seconds keeps monitoring function on, and press shortly again or PTT Button to stop.
ⓙ LCD



DISPLAY	FUNCTION
V	VOX
2T	2 tone setting
5T	5 tone setting
H L	Transmit output power
	Button lock
	Battery icon
	Beep
SC	Scanning
	Sub-tone
CH-001	Channel

ⓚ Volume/Function Setting Knob Switch

3. THEORY OF OPERATION

INTRODUCTION

AQ-10 is a micro size 128 channel portable FM transceiver constructed with a microprocessor controlled, temperature compensated Phase Locked Loop (PLL) frequency synthesizer. The radio features a double conversion receiver and a direct FM transmitter modulator. A special integrated circuit provides support to sub-audible signaling (CTCSS & DCS) and most of the receiving parts are switched off periodically in the power save mode to reduce battery current drain during standby.

The Block Diagram RF and Control Circuit Diagrams for AQ-10 shall be used in associate with the following circuit description.

CIRCUIT DESCRIPTIONS

1) PHASE-LOCK LOOP (PLL) CIRCUIT

*** REFERENCE OSCILLATOR**
The reference oscillator consists of TCX500 in U500 with a frequency of 14.4MHz. The reference oscillator frequency is stabilized and drives a divider to produce a comparison frequency.
This comparison frequency is selected by decoding the first three bits of the data input from microcomputer.

*** PROGRAMMABLE DIVIDER**
The programmable divider in U500 consists of a two-modulus prescaler with a 7bit control register followed by a 11-bit internal programmable divider. The overall division ratio is selected by a single 19-bit world located on the serial data bus.

*** PHASE COMPARATOR**

After comparing the frequency which user want to use with VCO frequency, the difference from selected frequency is outputted as PIN5 pulse form.

Signal that is outputted to Do(pin5) is applied to VCO through the connection with LPF(R505, C514, C515, R507, R508, R506, C516, R626, C632).

*** VCO CIRCUIT**

The transmit/receive frequency is directly generated by the Colpitts oscillation circuit contains Q701,Q702,Q700.

The oscillation frequency is variable by applying the VCO control voltage to variable to variable capacitors D700-D707 and by L702,L705.

To change the frequency of Tx and Rx, they are changed in accordance with TX5V and RX5V

2) TRANSMITTER

*** MIC AMP CIRCUIT**

Voice signal from the microphone are applied to microphone amplifier U601 through CON 1 .

U601 contains a low-pass filter that has a 6dB/oct response between 300Hz and 3 kHz, and eliminates harmonics above 3 kHz. The pre-emphasized audio signal is applied to VR502 from U400 pin 23 to adjust maximum frequency deviation.

*** VCO AND AMPLIFIER**

The VCO signal output is amplified by Q103,Q102,Q101 and then fed to power module Q100.

*** POWER AMPLIFIER CIRCUIT**

Tx is done when 7.5V is applied to Q100 directly from Battery(7.5V) and the power is supplied to Q101, U201 through Q400. The value that is out of set is controlled by Auto Power Control.

Also, Tx signal output is selected depending on standard voltage which supplies to D400. The control of this output is also controlled by U503 on the logic board. In the above case, the Tx signal through Q101 is transmitted through D100, C106 and LPF to Antenna.

3) RECEIVER

*** ANT SWITCHING CIRCUIT**

Signals from antenna connector fed to the antenna switching circuit through the low pass filter

consisting of L100,L101,L102 and C100,C101,C103,C105. In receive mode, D100 is turned off, isolates the antenna from the transmitter circuit and matching circuitry, so that the incoming signals are fed to the RF amplifier through L103.

*** RF AMPIFIER CIRCUIT**

The signals from the switching circuit are fed to the RF amplifier Q200 through a band pass filter made up of mold coil , VVC_diode and capacitor.

*** FIRST MIXER CIRCUIT**

The amplified signals are fed to Gate 1 of the first mixer Q202 through C214.

First local oscillator signal is supplied to Gate 2 of Q202 form the PLL circuit through C242 to convert the RF signals into 21.4MHz first IF signal.

*** IF CIRCUIT**

The first IF signals from Q202 are fed to the matched pair crystal filter FL200,BFL200 then IF signals are amplified in Q203. And those signals are fed to U300 which is composed of the second local oscillator, second mixer, limiter amplifier, quadrature detector and active filter circuit. The second local oscillator at 20.945MHz with X301, and is fed to the second mixer with the first IF signals to convert into 455kHz second IF signals.

The second IF signals leave through pin 3, and are fed to external ceramic filters FL300, FL301 which has excellent selectivity, then fed to U300 (pin 5) again to be amplified and detected. Narrow /Wide band are switched by diode D300, D301, Q303, Q304.

The detected AF signals are output from pin 9.

*** AUDIO AND SQUELCH CIRCUIT**

The detected audio signals are put through a 6dB/oct de-emphasis circuit made up of C305 and R305. The signal is then applied to audio power amplifier U607 through the volume control E501(ENCODER) to obtain enough power to driver the speaker.
Part of the recovered noise signal is fed to the integrated operational amplifier inside U300, which, with VR300,C318,C309,R309,R321 ,R121 makes up an Band pass filter . The DC signal detected by U300 (pin13) reaches the integrated DC amplifier in U300 which has hysteresis to prevent jitter.
The sensitivity of squelch is adjusted by VR300.

4. ALIGNMENT PROCEDURE

1) Measurement Condition

The following sections describe the alignment procedure for AQ-10 LMR transceiver under the following reference environment conditions:

Temperature	:	25℃ (77°F)
Relative Humidity	:	65%
Power Supply Voltage	:	7.5VDC

2) Test Equipment / Tools required

The following list of equipment is recommended for use in setting up the radio properly. Please ensure the test equipment are calibrated according to the manufacturer's instructions:

- Frequency counter more than 500MHz +/-100Hz tolerance, high input impedance and high sensitivity
- VHF FM Signal generator, 500MHz with adjustable frequency, FM deviation, and RF output attenuators. 50Ω out-put impedance.
- Oscilloscope, high input impedance.
- 16Ω 1 Watt resistor as loudspeaker load
- Audio Signal Generator, 10Hz to 20kHz, 600Ω impedance with attenuators.
- RF Watt meter, with 50Ω 10 Watt termination resistor (Or RF Voltmeter with 50Ω termination and external 50Ω attenuators)
- Regulated Power Supply 7.5VDC 3A output
- Digital A-V-O Multi-meter
- SINAD Meter
- External Speaker MIC plug (or special audio test jig)
- Interconnection test cable for RF and Control PCB
- Circuit Diagram for AQ-10
- PCB layout diagram for AQ-10
- Tuning tools for RF/IF transformer and the VR potentiometers

3) Disassembling the unit

The antenna
- Disconnect the antenna

The Cover
- Remove the battery.
- Remove the 2 screws.
- The case could then be opened for servicing.
- Be careful NOT to disconnect the pin connector between RF board and Control board.

The PCBs
- The radio consists of two PCBs, the RF (rear side) and control board (front side)..