THEORY OF OPERATION

The device is a FM transceiver operating in the 400MHz range which has an output power of 500MW and multi-channels selected by programming the PLL through the use of microprocessor.

The RF part of the circuit is of the traditional analogue type. All display and control functions are performed by microprocessor.

The main functional blocks are the microprocessor plus control interfacings, the receiver block with 2 IF conversions, the transmitter block with transistors amplifiers, PLL synthesizer and the power supply to these blocks. The mechanical construction separates the RF circuitry which contain the reception, transmission and PLL oscillation circuitries , from the control and audio circuitries which contain the microprocessor and audio amplifiers, into two circuit boards and interlinked by a flexible PCB. Following are detailed description of these functional blocks and finally the tunning procedure for all functions.

1.0 Microprocessor plus control interfacings

The microprocessor has interface to the inputs, namely, keyboard, channel switch and temperature limit detector. Different functions will be performed according to the inputs and details can be found in the operating manual. Outputs include LCD display (optional), audible alarm tones, LED display and power supplies to receiver, transmitter and PLL oscillator circuitry.

2.0 Receiver

Refer to schematic page 2. RF signal comes through the antenna, low-pass filter and band-pass filter and enters gate 1 of the dual-gate mosfet Q9 which amplifies it. It then goes into the mixer which is composed of dual-gate mosfet Q8. The local oscillator, which is 21.4MHz displaced from the RF input, is buffered by Q5 and injected into gate 2 of Q8 which is slightly biased to 0.6ma. The 21.4MHz IF is band-limited by B2 and filtered by the crystal filter F2. The IF enters IC1 which further down-converts the IF to 450KHz. This second IF is amplified and filtered by ceramic filter F1 and then demodulated to recover the audio signal. IC1 has an RSSI output which is a voltage proportional to the signal strength. This RSSI is compared

with a fixed voltage and the resultant high or low is input to the microprocessor to determine whether a reasonably well received signal is present. If positive, the microprocessor will turn on the supply to the audio amplifier IC3, otherwise it will shut it down, a squelched condition. If CTCSS is used, then the valid sub-tone is needed to turn on the amplifier, as determined by the microprocessor. The power supply to all the relevent circuitry are controlled by the microprocessor. It turns on the power intermittently in synchronization with the LED display which blinks on and off. When the above receive condition is met, the power stays put and reception continues.

3.0 Transmitter

Refer to schematic page 2. When the PTT switch is pressed, the microprocessor turns on the power to the microphone amplifier, PLL oscillator, pre-driver Q3 and bias to driver Q2 and Q1. Audio signal enters the microphone which is amplified by op-amp and is amplitude-limited by the diode clipper D7 and D8. It then passes through three stages of RC low-pass (composed of R30,31,34 and C5,12,16,44) and fed into the VCO for FM modulation. This serves the purpose of modulation limiting. The modulated VCO is fed to pre-driver Q3 whose supply is controlled by the microprocessor and is a regulated 3-volt supply. This stabilizes the driving power into pre-driver Q2 and hence the power amplifier Q1. Q1 and Q2 have their supply directly from the batteries and are current-limited and protected by resettable fuses FUS1 and FUS2. The final amplified signal passes through the RF switch formed by PIN diode D1 and passes through a band-pass filter realized by L15 and stripline. Finally it goes through three stages of LC low-pass and to the antenna. The antenna is of helical type which has a very narrow bandwidth and provide further filtering of the signal. The DC voltages and currents of the power amplification elements are as follows:

Element	Function	Voltage	Current
Q3	pre-driver	3V	10ma
Q2	driver	4.5V	100ma
Q1	power amp	4.5V	200ma