THEORY OF OPERATION (SR2001A)

Phase Locked Loop (P.L.L.) and Voltage Controlled Oscillator (V.C.O.)

The oscillating frequency of V.C.O. (Q10) is set as (channel frequency + 21.6) MHz. in receiving and (channel frequency) MHz. in transmitting, and the channel spacing is 25 KHz.
Press Channel Selector Switch and select the channel number you want, which will be indicated on LCD display. Enter the selected channel to the microcomputer (U1).
The counter number to be conveyed to the programmable counter will be transmitted with the synchronized serial system. The counter number entered to the programmable counter will be latched until the next number is entered.

The counter number will be calculated in the following formula;

WHEN RECEIVING	N = Channel Frequency + 21.6 (MHz.)
WHEN TRANSMITTING	N = Channel Frequency (MHz.)

The oscillating frequency of V.C.O. is amplified at AMP (Q102) and entered to the programmable counter. The programmable counter divides the V.C.O. oscillating frequency with the "N" value which is the counter number.
The oscillating circuit inside of U1 will be a crystal oscillation of 4.5 MHz. The crystal oscillating frequency of 4.5 MHz. will be divided and becomes to the reference frequency of P.L.L.

The P.L.L. compares the oscillating frequency of V.C.O. divided at the programmable counter and the reference frequency, and controls the oscillating frequency in stability through a low pass filter (IC3) and a voltage controlled capacitor diode (DV1).

The oscillating frequency of V.C.O. is amplified at AMP (Q9) and to be applied to the receiving section (block) or the transmitting section (block).

1. TRANSMITTER (TX)

The channel frequency signal is amplified at Amplifier Q5, Q6 & Q8, and drives RF-POWER Module IC4. In RF-POWER Module, the channel signal is subject to the automatic power control, and amplified to 25 W in the high power mode and 1 W in the lower power mode.
Thus the amplified power output is finally fed to Antenna Connector in passing through Antenna Filter.
Antenna Filter is provided to reject spurious frequencies, adjacent to the chann el frequency and harmonic frequencies, respectively.

2. AUTOMATIC POWER CONTROL (A.P.C.)

A signal, which is proportional to the RF-output power of RF-POWER Module, is detected and rectified by Detector D2,D3.
The DC output proportional to the RF-output power is amplified by amplifiers Q20, Q21 & Q13,Q14, and applied to Control Circuit Q12.
The control circuit controls the power supply voltage to RF-POWER Module and the voltage to Driver Circuit Q5 thus controlling the antenna output power.

Q15 nctions as a power output switch which selects either 25 W or 1 W.

3. MODULATOR

An audio signal developed in a microphone is fed to the Audio Amplifier IC3 and amplified.
The amplitude of the audio signal is limited to the value which gives the Maximum deviation by I.D.C. Circuit IC3. The amplified audio signal enters Modulator DV1 rough a roll-off filter which limits the occupied bandwidth. The modulator uses voltage control capacitor and modulates the V.C.O. frequency with the audio signal.

4. RECEIVER (RX)

The signals induced on an antenna are amplified by RF Amplifier Q1and all undesirable frequency components outside the band are eliminated in passing through the five stage resonator.

The amplified RF signal is mixed with the local frequency signal sent from the V.C.O. in the first Mixer Circuit Q2, thus developing a first signal of 21.6 MHz. The IF signal is then amplified in the first IF Amplified Circuit Q3.

Undesirable frequency signals including adjacent channel frequencies, etc., caused in conversion process are removed by one stages of crystal filter F1.

The 21.6 MHz. Signal amplified in this way is applied to the 2nd mixer circuit and mixed with the second local oscillator frequency of 21.145 MHz., generated in the crystal oscillator circuit IC2 to create a 2nd IF signal of 455 KHz.
The 455 KHz. IF signal is amplified in the 2nd IF amplifier circuits IC2.

Adjacent interference signals included in the IF signal are also removed with the ceramic filter CF1.

Thus processed IF signal is detected with the discriminator IFT T8 and demodulated into the audio signal.

5. SQUELCH (SG)

(In a FM receiver, excessive noise will be heard at no signal condition)

A noise amplifier IC2 amplifies noise components in the outputs developed in the discriminator circuit T8 and rectifier diodes D1 rectify the amplified output to create a DC control signal.

The DC control signal turns the electronic switch Q7 on, so that the noises cannot be amplified. Thus noises will be suppressed at no signal condition.

On the other hand, the noises will be reduced when a signal enters through the antenna. Then the DC control signal created from the noise signal also reduces and the electronic switch Q7 turns off, allowing the audio signal to enter the audio amplifier.

6. AUDIO POWER AMPLIFIER

A volume control resistor VR5 adjusts audio signal level and the audio power amplifier IC5 amplifies the adjusted audio signal to a sufficient power level capable of driving the speaker.

7. RX and TX SWITCHING

Normally, the transceiver is in RX standby mode. to switch the transceiver to TX mode, a P.T.T. switch provided on the microphone is pushed. When a transmit operation is available, the microcomputer develops a TX enable signal and this signal is added with the P.t.t. on signal in the Logic Circuit U1 and the resultant output turns on TX-RX Switch Q17 and Q16.

8. VOLTAGE REGULATOR CIRCUIT

To assure stable operation of the transceiver if the battery voltage varies (10.8 –15.6 V), voltage regulators are provided.

IC100 is used to stabilize the line voltage for the P.L.L. circuit, receiver circuit, and transmit circuit, and IC1 for the V.C.O Oscillator circuit.