

## THEORY OF OPERATION

### RECEIVE PART

#### 1) The Front-End

---The N.F(Noise Figure) of a LNA(Q50, AT32032) that is matched by L101, L102 and L104 has been measured about 1.2dB. Also, the gain of one has 14dB.

And then, RF signals(462.5500~467.7125MHz) will go to F10(SAW Filter), which must be matched by L66 & L67. The RF signal that is coming through a SAW Filter, will be mixed with local frequency (440.85~446.0125 MHz) from VCO(Voltage Control Oscillator) by mixer device-Q51(AT32032).

The output signal from Q51(mixer) transits IF(F11, Intermediate Frequency) Filter, and then it is filtered with only 21.7MHz-signal by F11, this 21MHz-IF-signal that F11 filtered is amplified by IF-AMP(Q52, AT320232).

#### 2) IF(Intermediate Frequency) Part

---The Inner-circuits construction of IF IC(TA31136FN) include Buffer, Mixer, IF Amp, Quadrature detector and LPF(low pass filter), its circumference-devices are arranged with IF X`tal Oscillator, 450MHz-Filter and Discriminator.

To descript in detail, 21.7MHz-IF-signal that is amplified by IF-AMP(Q152, AT320232) is mixed with IF-X`tal Oscillator frequency(21.25MHz). Its output-signal mixed, to pass through two 450MHz-BPF(Band Pass Filter), if that is so, only 450MHz-IF-signal will be passed by them. 450MHz-IF-signal passed, is amplified by IF-AMP(inner IF IC). To pass through Discriminator(X10, JTBM450C24) that can draw out audio signal, we will obtain the Audio Signal that we need to analysis.

## **7-2. Transmit Part**

---The RF-signal modulated by Variable capacitor & Oscillation Transistor into VCO goes to Buffer AMP(Q58, AT32032). If we use not it, maybe the rest RF-signal power will go out to forming unstable propagation. Because, the Buffer AMP keeps a stability against trembling RF-signal . And then, this RF-signal amplified progresses toward the Middle-Power AMP(Q57, 2SC5754). The RF-signal through Power Amp has Gain 12dB, it progresses toward the PA(Power Amp) with 20dBm-output power. Afterwards, this RF-signal amplified progresses toward the Power AMP(Q56, NE5500479A). The RF-signal through Power Amp has Gain 10Db & Output Power 27~30dBm, it progresses toward the Passive Low Pass Filter . Afterwards, the LPF(Low Pass Filter) designed by passive element (capacitor, inductor) accepts output RF-signal of Power Amp. The LPF`s cutoff-frequency is 475MHz, this LPF is designed to reduce homonic spurious(about 900, 1800MHz,...). The last step is a half duplexing network that is able to control Tx or Rx-signal`s direction as RF-switching Diode.

### **7-3. Synthesizer part**

This Synthesizer parts are constructed with TCXO(X15, VX-23V, Temperature Compensation X`tal Oscillator), PLL(U13, TB31243FN, Phase Locked Loof)IC, VCO(U14, VC-3R0A20-0815 , Voltage Control Oscillator), LPF(C127,R123,C128,R122,C129, Low Pass filter).

TCXO`s output is 12.8MHz, which enters into the PLL IC. At the same time, the PLL IC accepts a PLL-DATA from the CPU. And then, a proper Direct Current(DC) from PLL IC-cp terminal passes LPF before the VCO-vt terminal.

The VCO outputs a proper frequency according to a Direct Current by Variable capacitor & Oscillation Transistor into VCO. The VCO`s output is divided into three parts. One of them feeds back PLL-to-VCO. If that is so, a proper frequency will be kept continually.

## **7- 4. CTCSS Processing**

### **RX CTCSS Tone Processing**

The received CTCSS tone is sent out through 9th pin of the U10, and through the U1 analog switch. The voice band signal which can affect the reception of the CTCSS tone is decreased enough at the U16. The cut off frequency at the U16 is adjusted by the U22 CPU to suit the characteristic of the CTCSS tone.

The CTCSS tone received at the U16 is supplied to the 5th pin of the U22 CPU, and receives the desired CTCSS tone.

### **TX CTCSS Tone Processing**

The TX CTCSS tone composed at the U16 is the components in the high frequency which can affect the voice communication. And then, the TX CTCSS tone is combined with the TX voice signal through the U16, and supplied to the VR1 TX deviation control volume.

## **7-5. MPU and Memory**

. Most of the control functions of the XA-1500 are controlled by the U22 CPU.

The U22 CPU has the internal ROM in the capacity of 32Kbyte, and the program for the operation of the U22.

When the power of turned on, the U22 reads the data necessary for the operation from the U23 EEPROM, and decide the operation channel, frequency, etc.

If the user alters any parameter of the radio, the U22 updates the altered parameter to the U23.