





- 3) IC5 problem
3. RX sensitivity is weak
  - 1) Antenna connector problem
  - 2) Front-End circuit problem
  - 3) Local oscillation Frequency Deviation
  - 4) L13,14,15,16 trimming problem
  - 5) VCO problem
4. SQUELCH does not work
  - 1) IC 6 problem

## 5. DESCRIPTION OF RADIO CIRCUIT

### 5-1 Frequency synthesizer

Frequency synthesizer consists of VCO, PLL IN(built in PRESCALER) and Loop filter

#### 5-1-1 VCO

VCO is composed of TX VCO and RX VCO. Oscillation circuit takes colpitts oscillation circuit using variable Diode.

##### a) TX VCO

TX VCO is composed of D302, D303, Q302, C305, 306, 308, 309 310 and L305. VCO control voltage through Loop filter adjusts frequency and Microphone signal through Modulation terminal makes modulation.

##### b) RX VCO

RX VCO consists of D301, Q301, C301, 302, 303, 304, L302. VCO control voltage through Loop filter adjusts frequency.

#### 5-1-2 PLL IC

PLL IC is adjustable IC to produce the wished frequency which VCO provides through Loop Filter.

It has internal counter using 12.8MHz reference frequency to make 6.25KHz as Reference Signal. VCO frequency from prescaled input is divided signal is compared with Reference signal phase in phase

**comparator. Built-in charger pump changes voltage (until two signals are in phase) and charged voltage supplies VCO through Loop Filter to produce the desired Frequency.**

**PIN8 is LD terminal. It will be high in Logic When Reference signal and divided VCO signal are in phase. It comes Logic Low by Q1 and informs CPU to be in Locking condition.**

**Frequency data associated with channel goes to PLL IC by CPU through CLOCK, DATA, LINE. PLL IC enables by enable line of CPU.**

### **5-1-3 Loop Filter**

**Loop Filter is composed of C5, R3, C4 and changes pulse from PIN6 to DC and eliminates harmonic component in pulse. It helps VCO oscillate clearly as DC voltage is supplied into Varicap.**

## **5-2 RECEIVER**

**This is composed of Dual Conversion Super Heterodyne.**

**First IF is 21.4MHz. Local oscillator Frequency is lower in 1<sup>st</sup> IF than RX Frequency. It is called low side Injection.**

**Second IF is 455KHz. 2<sup>nd</sup> Local Oscillator Frequency comes to 20.945MHz.**

### **5-2-1 RX/TX conversion circuit**

**RX signal goes to RX/TX conversion circuit through STUD TYPE ANTENNA CONNECTOR, Low Pass Filter(L9,10,C56, 57,58) and Receiver resonance circuit composed of L11, C60.**

**When Transmitting, Voltage at PIN Diode D4 through R34,35, L6,7,8 supplies, D5 of Receive Input is short and TX is on condition.**

**When PIN DIODE is off in condition of RX, L11 and C60 resonate serially and make impedance matching at Receiver Band Pass Filter.**

### **5-2-2 Front End**

**Front-End has BF998(Q14) to provide a high sensitivity and low noise feature. It employs C84, D11, L16, C83, L15, C82, D10, C74, D9,L14, C73, L13, C72,D8 as Band Pass Filter to eliminate Image Frequency and to Produce enough pass band by Q14 input and output.**

### **5-2-3 Mixer**

**Mix has Dual Gate FET 3SK240(Q13) to feature high low noise quality. It has RF signal (through Q14 and L15,16,D10,11,C84,83) and RF signal from Local oscillator mixed. It develops 1<sup>st</sup> IF 21.4MHz. 1<sup>st</sup> IF goes to 1<sup>st</sup> IF amplifier Q16(BFR92A) Base through T1 and X-tal filter XF1, XF2.**

### **5-2-4 X-tal Filter**

**Transformer connected with Mixer Drain tunes in 21.4MHz.**

**IF of Mixing signals is selected and taken into X-tal filter.**

**Output Impedance of Mixer is matched with Input Impedance of X-tal filter.**

**Input/Output matching of Filter satisfies pass bandwidth of Filter, ripple elimination with in pass band, and attenuation characteristic of Stop Band.**

**X-tal Filter is composed of two 2 Pole monolithic X-tal filter,15KHz of IF Bandwidth of 4 Pole resonance characteristic totally.**

**C101 functions Ripple in pass band to be optimized.**

**R52 is used as impedance matching with 1<sup>st</sup> IF Amp Q16 Base.**

### **5-2-5 IF AMP and Detection**

**1<sup>st</sup> IF AMP Q16 supplies IF (IC5) Mixer Input pin 16 through output Resistor R59 and C102 to need gain in insertion loss of X-tal Filter and Last stage circuit. Multi-use IF IC makes up of Mixer IF AMP,OSC, PIN1,2 has oscillator to oscillate 2<sup>nd</sup> Local Frequency to produce 2<sup>nd</sup> IF. 20.945MHz through X2, C95 and C26 is oscillated as Local Oscillation. It supplies Mixer of internal IC. Mixer output of IC through PIN 3 passes 455KHz ceramic Filter, supplies 2<sup>nd</sup> IF AMP, amplifies, and limits. After 2<sup>nd</sup> IF AMP has a process of enough gain and AM rejection, it comes to Quadrature Detection.**

**Demodulated Audio signal by T2(QUAD, COIL) is amplified and comes out to PIN9.**

**Detected Audio Signal with elimination of 2<sup>nd</sup> IF component by C108 input in IC404PIN3 of Digital Board through 300Hz HPF.**

### **5-2-6 SQUELCH Circuit**

**Noise component of detected outputs has amplification and temperature compensation in IC6A through 8.9KHz Active Band Pass Filter composed of Amp in IF IC , C106,R58,R57,R55, C104 and C105.**  
**It amplifies two times in IC6B after minimizing Ripple of detected voltage in D7 by c113, and supplies to A/D converter terminal of CPU.**  
**Voltage of A/D converter is compared with designated data value in CPU and controls Audio Mute Terminal.**  
**Squelch Threshold is controlled by the designated data in CPU.**  
**Hysteresis is controlled by programmed data in CPU.**

### **5-2-7 Audio high pass filter and Audio amplifier**

**Demodulated Audio signal passes De-emphasis circuit composed of R461 C462 through IC 405 A , 300Hz. It has flat Frequency Response Characteristic to attenuate emphasized high signal in TX by 6dB/OCT.**  
**Signal out of IC404 PIN6 input form PIN3 amplifies in IC408 PIN3 and It comes out to PIN5 through C428. Then, It reaches at speaker.**  
**Q407 connected with PIN7 of IC408 is to make voltage of IC408 PIN7 be equal to VCC. Would voltage of PIN7 be equal to one of PIN6, Audio would be mute by IC408 internal circuit.**

## **5-3 Transmitter**

**When TX develops with pressing PTT switch, VCO output amplifies through Q4 and IC3, and transmits by antenna through Low pass filter.**  
**Transmitter keeps stable. TX power in spite of variable voltage of battery by APC(AUTOMATIC CIRCUIT POWER CONTROL).**

### **5-3-1 TX power switching circuit**

**TX EN1 signal turns on Q303,Q10,Q12,D2,Q6 AND IC7, which supplies power to TX VCO and VBB of IC3.**

**TX EN2 turns on Q3, D4, and D5 which supplies power to Q4.**

**TX signal from VCO is amplified through Q3, Q4 and IC3 and transmits into antenna after passing low pass filter.**

### **5-3-2 Power amplification and low pass filter**

**TX RF signal problem from TX VCO enter to driver Q4 through D2 & C32.**

**Entered RF signal is amplified and IC3 POWER MODULE, INPUT terminal with final amplification through C33.**

**After this stage, the signal is emitted at antenna through  $50\Omega$  STRIP LINE low pass Filter(L7,8,9,10,C53,54,55,56,57,58) to eliminate Harmonic.**

### **5-3-3 Automatic power control circuit**

**APC circuit functions to detect progressive wave output power by directional coupler(R31,C46 Stripline) and to rectify output power by RV1. After output power is adjusted by RV1 and compared by IC4A, it controls VCC, PIN2 of IC3, last stage amplifier by Q8, Q7. A stable output can be Created as much as wished.**

### **5-3-4 Audio modulation and Audio amplification.**

**Audio signal produced by external or internal microphone, limits amplification by IC 406 OP AMP. It enters VCO through Low pass Filter. Max. Frequency modulation deviation is adjusted by RV401.**

**Q411 keeps noise and Audio from entering to VCO at time of TX.**

**Audio modulation and Audio amplification has characteristic of 6dB/OCT per-EMPHASIS by IC 406C and 406D.**