

Circuit Description

(A) Main board - MCU and audio

Audio Transmit Path

Audio signal picked up by condenser microphone M1 is amplified with pre-emphasis by U1A. U1B, U1C and D6 form an amplitude limiter. It then passes through a post-limiter low-pass-filter for bandwidth limiting. R50 sets the modulation depth of the FM modulation. The processed audio is then fed to the VCO for FM modulation.

Power supply of the transmit path is controlled by Q4.

Audio Receive path

Demodulated audio signal is fed to the low-pass-filter (U2A). It is then de-emphasized by U2B. U2C forms a high-pass filter to eliminate low-frequency noise. U3 is the audio power amplifier whose gain is controlled by the selection of resistors connected on U8. There are totally 8 receive audio levels. Power supplies of the receive path are controlled by Q10, Q7 and Q8.

MCU

U4 is a 8-bit micro-controller providing all necessary control signals for the audio circuits and the RF circuits. Clock frequency is 3.58MHz.

Power Management

U5 is low-drop-out voltage regulator providing a 2.8V for the audio and RF circuits. U7 is voltage detector of 3.3V. When battery voltage drops below 3.3V, U7 will provide a battery-low signal for the MCU. U10 is a reset circuit for the MCU. Minimum operating voltage is 3.0V.

(B) RF VCO and Synthesizer Board

Q1 is a voltage controllable oscillator. Its frequency is controlled by the reverse-bias on the diode D1. D4 switch the frequency band between the Tx and Rx band. Q7 is a buffer amplifier. U1 is a programmable synthesizer which accepts control data from the MCU. XT1 (20.95MHz) provides the reference frequency for calculating the transmit and receive channel frequencies. The buffered 20.95MHz from U1 is also used for the 2nd local oscillator for down-conversion.

(C) RF board

Buffered signal from VCO board is further amplified by Q1. D1 forms a 1P2T switch which diverts the RF signal to the transmit path or receive path.

Transmitter

When transmitting (i.e. PTT being pushed), the RF signal passes through D1 and is further amplified by Q5. It is then fed to the driver and power amplifier U2. C42, L7 and C43 form a low-pass matching circuit to reduce harmonic contents of the amplified RF signal. Then, it passes through D2 and is fed to the antenna.

Receiver

Receiving RF signal picked up by the antenna is amplified by the low-noise amplifier U4. It is then fed to the SAW filter F2 for out-of-band signal rejection. Q6 is a bipolar mixer. RF signal from the SAW filter and the LO signal from D1 are both fed to the base of Q6. The down-converted first IF signal at 21.4MHz is then fed to the crystal filter Y1 for un-wanted signal filtering. Filtered signal is then amplified by the IF amplifier Q8. Then, the amplified IF signal is fed to the IF-demodulator U3. The first IF signal is further down-converted to 450KHz by the 20.95MHz buffered reference from the VCO board. F1 is the 450KHz 2nd IF filter to provide out-of-band signal rejection. Pin 9 of U3 provides the demodulated audio signal to the receive audio circuit.