TRANSCEIVER CIRCUIT DESCRIPTION

21-1864 is a single board design which consists both RF and Baseband part.

RF PART

The RF part contains all necessary RF circuit. It converts the RF signal picked up by the antenna to demodulated analogue signal for further processing. Besides, the base band analogue signal, including voice and CTCSS tone, will use to FM-modulate the RF carrier during transmission. The main building blocks of the RF part includes a LNA, a SAW filter, a Mixer, a VCO, a Ceramic filter, FM-IF detector circuit and power amplifier for transmission. Among those building blocks, the RF circuit can be divided into two sections.

A: RX section

This product employs traditional double conversion superheterodyne architecture with the following functional blocks:

1. The LNA with cascade configuration is composed by transistor Q1 and Q2. It has the merits of low noise figure and high insertion gain.
2. The LO signal is generated by VCO which is phase locked with the reference TCXO circuit (X801) at the 10.25MHz. The TCXO can stabilize the frequency of the oscillator within 2.5ppm from –20 to +50 degree C. The LO signal is amplified by transistor Q4 and coupled to the mixer (Q3) for RF to IF conversion. The LO frequency is controlled by the PLL (U2) after received command from MCU (U101).
3. The first image rejection filter, F1, is a SAW (surface acoustic wave) device, with the merits of having low insertion loss and high stop band attenuation.
4. The mixer is a common emitter configured transistor Q3. It converts RF signal to an IF of 10.7MHz. This IF will further be filtered by the crystal filter F2.
5. Inside the FM-IF chip, the IF signal is further down converted to 450KHz second IF demodulation. The second LO signal is generated by the reference oscillator of the PLL chip. The second IF signal is also further filtered by the ceramic filter for better adjacent channel rejection response. The second IF signal is then demodulated by the resonator X1. The demodulated audio signal will be transferred to the main board for further processing.
6. By trimming the VR1, the audio noise signal level to the internal comparator of the FM IF chip 3361 can be varied. Since the comparator output was used to determine the status of received signal quality, and hence the squelch level can be adjusted.

B: TX section

1. The TX carrier is also generated by the VCO with the control from PLL chip. The VCO signal is coupled to amplifier Q501 and Q502. The output signal will be boosted up by the Class-B power amplifier Q503, Q504 and Q505.

BASE BAND PART

The digital part controlled all the base band signal including voltage regulation, battery charging, keyboard input, call tone generator, CTCSS encode/decode, VOX, motor circuit and display.

1. Voltage regulation: The operating voltage of the circuit is stabilized by the 3.5V voltage regulator U103.
2. Power management: In order to extend the battery life of the unit, unnecessary circuit during different operation modes will be shut down for power saving. The on and off mechanism is controlled by the MCU with the help of some analogue switches which are realized by transistors: They can be classified as :
    a. Q101 VCO circuit
    b. Q102 RX RF circuit
    c. Q103 TX RF circuit
    d. Q112 MIC circuit
3. Display: The channel number, Quiet code, C-Tone icon, TX icon, Lock icon, battery icon will be prompted to the users by LCD. There is also a backlite LED for better visual effect under dim environment.
4. Keyboard input: The transceiver had several function keys such as MENU(QUIET), UP(SCAN), DOWN(CALL), PTT and Monitor switch. During the operation, all these function key input will be handled by the MCU.
5. Memory: The memory or setting of the transceiver is stored in the EEPROM U102.
6. Low battery dectection: It is realized by the internal A/D of the MCU during power saving mode.
7. High pass filter, Pre-emphasis, Limiter and Low pass filter: The acoustic input transducer by the microphone will go through a 300Hz high pass filter first. This HPF is used to reduced the interference between the user voice and CTCSS tone. This HPF is realized by U302. The pre-emphasis is realized by capacitor C141. The pre-emphasis responses follow the recommendation of EIA standard. After the pre-emphasis stage, limiter and low pass filter are inevitable which are realized by U106.
8. De-emphasis, High pass filter and volume control: The demodulated base band signal from RX section needs to be de-emphasised first. Then the signal will pass through the High pass filter for clear audio signal recovery. This section is realized by U302. This signal will feed to the audio amplifier U104 for power boosting. The volume level is control by the rotary resistor VR106.
9. CTCSS tone generator: Three different signals from MCU were connected to the external resistor network to generate the CTCSS tone. This pure CTCSS tone will add to the VCO for FM modulation.
10. CTCSS tone decode: The demodulated base band signal from RX section will pass through the low pass filter U301. The CTCSS tone received will be transformed to square wave by this filter. This signal will be used for decoding. The MCU will decode this signal by checking its frequency and duty cycle.

11. MCU internal clock and reset: The reset is realized by D104. Since the CTCSS tone is reference with the internal clock of the MCU, 4 MHz ceramic resonator is used as the main resonating element in order to have a better accuracy.
12. Battery charging: This transceiver can use with 6V DC regulated external CLA adaptor. The transceiver can function normally during charging the rechargeable battery in the compartment.
13. Automatic Squelch: The squelch detection signal from RX section will alert the MCU to mute the speaker. The squelch level is controlled by VR1 on the RF part.
14. VOX circuit: The MIC signal is amplified and rectified by amplifier Q107 and coupled to MCU for level detection.
15. Motor circuit: The motor is controlled by the switching circuit Q109 and Q110.