

TRANSCEIVER CIRCUIT DESCRIPTION

The functional blocks of 19-1207 can mainly be divided into 2 categories: RF circuits and base band circuits. Components in the RF circuits include the VCO, LNA, SAW filter, mixer, IF filter, IF amplifier, FM demodulator; Tx driver and power amplifier. In the base band counterpart, the MCU controls the overall operation of the transceiver. Other main components include the switch detection, voltage regulation, battery voltage detection, CTCSS tone encoding/decoding, audio amplifier and the pre-emphasis circuit for the input signal from mic.

RF Section - Rx

The transceiver employs traditional double conversion superheterodyne architecture with the following blocks:

1. The LNA is configured with Q201 which has the merits of low noise figure and high insertion gain.
2. The LO signal is generated by the VCO which is phase locked with the reference TCXO (X201) at 21.25 MHz. The TCXO can provide frequency stability over the transceiver operation temperature range. The spurious generated by the VCO is filtered by the tank circuit L209 and C239 and is coupled to the mixer for down converting the RF signal to IF band.
3. The first image rejection filter, F202, is a SAW device, with the merits of having low insertion loss and high stop band attenuation.
4. The mixer is configured by a dual gate field effect transistor Q202, which converts RF signal to the IF at 21.7 MHz. The IF signal is filtered by a pair of crystal filters F201 and F204, and then amplified by the IF amplifier Q203.
5. The IF signal is then input to the FM demodulator U201. Inside the FM demodulator IC, the IF signal is down converted to 450 kHz for demodulation. The second LO signal is actually the reference oscillator of the PLL IC. The 2nd IF is further filtered by a ceramic filter to enhance the transceiver selectivity. Dielectric discriminator is used for demodulation.

RF Section Tx

1. The Tx carrier is generated by the same VCO that produces the LO signal. The VCO output is modulated by the baseband signal through varactor VD203, and is coupled to the Tx amplifying circuits by C262. After the driver stage, the Tx signal is boosted up by the MOSFET power amplifier Q210. The harmonics of the carrier are suppressed by the low-pass filter which is composed by L217, L202 and L201.

Base Band Section

1. The operating voltage of the circuit is 5V and is achieved by the voltage regulators U6 and U7. Output of regulator U7 is for the 5V supply of the RF, including the Tx, Rx, PLL, circuits and the CTCSS encoder IC; output of U6 is for the circuits remained from the above.
2. In order to lengthen the battery life of the transceiver, unnecessary circuit during different operation modes will be shut down for power saving. It is achieved by employing transistor switches for different circuit blocks as follows:
 - Q3: CTCSS Encoder IC
 - Q4: Opamp Circuit
 - Q5: Tx Circuit
 - Q6: Rx Circuit
 - Q7: PLL Circuit
3. The settings of the transceiver is stored in the EEPROM U3.
4. Voltage detector U5 is employed to observe battery charge status. The detector output will alert the MCU and at the same time controls the on/off of the red Low Battery LED.
5. The acoustic input transduced by the microphone goes through a 300 Hz HPF and a 3 kHz LPF in the CTCSS encoder C U1. The audio signal is then passed through the pre-emphasis and limiter circuits

implemented by opamp U8. The processed audio input, together with the CTCSS tone (if there is any) generated by the encoder IC, will FM modulate the VCO.

6. For the demodulated signal, it is band pass filtered and de-emphasized in the CTCSS encoder U1. CTCSS tone is also detected in the IC. The signal is then fed to the audio amplifier (U9) for power boosting. The volume level is controlled by adjusting the VR SW1, which changes the signal level being input into the audio amplifier. On the other hand, the noise in the demodulated signal is amplified by Q212. The signal is then rectified for squelch detection by the MCU. The squelch threshold is adjusted by VR201.
7. The MCU clock is supplied by the 4 MHz crystal X1 and the reset circuit is implemented by means of a voltage detector U4.
8. When the charging adapter is plugged into the transceiver DC jack, trickling charge occurs. A 7.5V zener diode (Z1) is used to protect the battery from over-charge.