CIRCUIT DESCRIPTION (FRS-0128)

TRANSMITTER SECTION

RF Frequency Oscillator (VCO)

Q2 functions as a voltage control clapp oscillator (VCO). The frequency is determining by the Q2, C1, C3, C4, C5, DV1 and T1. The RF output of VCO is fed to both of the PLL IC2 prescaler input by the buffer Q3, Q7(on RF PCB) and RF driver of transmitting by the buffer Q3.

PLL Circuit

IC 2 on RF PBC is a phase lock loop (PLL) IC. The output of the oscillator TCXO (12.8Mhz) is input to the programmable reference divider. This 12.8Mhz frequency is divided to 12.5Khz as the reference frequency built in the PLL IC. RF frequency from VCO is still divided to about 12.5Khz by the prescaler built in the PLL IC. The phase difference between the reference frequency and the divided frequency by the prescaler will output to the tracking filter (R20, C31, R8, R21, C30, C33) for locking the frequency. The DC voltage by filtng from the tracking filter is fed the varactor diode to control the VCO oscillator frequency until the VCO frequency is locked. For the transmitter, the frequency is from 462.5625 to 467.7125Mhz through CH1 to CH14. For the receiver, the frequency is from 451.8625 to 457.0125Mhz. VC on TCXO is used to adjust RF frequency. The choice of TCXO and components is such that the required frequency tolerance is maintained over the required range of temperature and voltage.

RF Amplifier and Power Amplifier

In the transmitter mode, the switch diode D5 and D6 are ON and D3 is OFF. RF signal from the buffer Q7 (on RF PCB) is fed to the base of Q1 through the RF driver Q8 and Q9 (both on RF PCB) by the coupled capacitor. Q1(on RF PCB) is RF power amplifier.

Circuits for Suppression of Spurious Radiation

In addition to inter-stage filtering the out of final Q1 is coupled to the antenna through triple 'LC' and double 'PI' network (C5, C36 C37, L4, L5 and L14) which serves both to match and reduce harmonic to adequate level. The RF maximum power is 0.5Watt.

Circuits for Limiting Power

During alignment, R51 is selected to provide about 0.5-watt output power.

Modulation and Response

IC4A and IC4B (on main PCB) is MIC amplifier. The amplified audio signal from pin7 of IC4B is fed to DVC2 for makingF3E type modulation. VR2 is used to adjust the modulation deviation to ensure the deviation is not larger than 2.5Khz. Q11(on RF PCB) is the switch which is OFF at transmitter mode and ON in the receiver mode. R66, R67, R69, C37 and C39 are used to determine the transmit response which is 3.125Khz.

Circuit for limiting Modulation

Q15 and Q16 (both on main PCB) give the auto MIC control circuit. When the modulating voltage is excessive, the emitter of Q15 will obtain DC voltage which turns on Q16. This feedback system keeps the maximum modulation deviation is not exceed 2.5Khz.

MPU Controller

IC5 on main PCB is a MCU controller. It is used to control the unit in the transmitter (Q9, Q10on main PCB) / receiver mode (Q8 on main PCB), LCD display, back ground led of LCD ON/OFF (Q1 on main PCB, D3 D4), battery checking (IC2B on main PCB), auto squelch (Q7, Q14 on main PCB) and functional control (S1 to S4, PTT). By the time, MCU may create both of the beep sounds when the control button is pressed and code for communication. CY1, C58 and C59 functions as oscillator (32.768Khz) for LCD display. CY2, C3 and C8 function as oscillator (4Mhz) for MCU logic control.

Power Supply

Q5(on main PCB) is a regulator that the out DC voltage is 3.3V. This stable output is used to feed to VCO circuit, MCU, receiver part and PLL part. SW1 is used to control the power supply ON/OFF.

RECEIVER SECTION

The receiver is a conventional double conversion superheterodyne with the first local oscillator controlled by VCO operating at frequency 10.7Mhz below the received frequency to produce the first IF 10.7Mhz and the second local oscillator 10.245Mhz to produce the second IF 455Khz.

Local Oscillator

When the unit is in the receiver mode, MCU control PLL circuit to make the VCO frequency is locked in the range of 451.8625 to 457.0125Mhz. This VCO output is used as the first local oscillator that feed the first mixer (base of Q5 on RF PCB), CYI (on the RF PCB), C16, C24 and the circuit built in IC1(on main PCB) is given the seconds local oscillator.

RF amplifier

RF signal from antenna is fed to the base of Q8(on main PCB). Q8 and Q12 (on main PCB) is two stages RF amplifier. The output from the collector of Q9 is given to the base of Q5 for the first mixing.

Mixer Circuit

Q5 functions as the first mixer. The second mixer is built in the IC1 MC3361.

IF amplifier

Q4 functions as the first IF amplifier, which the first IF signal is fed from the first mixer Q5 through IF filter F2. The second IF amplifier is built in IC1 MC3361 through the second IF filter F1.

Demodulation

T1 and the built circuit of IC1 (on main PCB) function as the demodulation circuit.

Audio Power Amplifier

IC3 on the main PCB is an audio power amplifier. The gain of amplifier determines by R50 and R51. Q13(on main PCB) is a audio buffer before the audio is input IC3. Q6 is a buffer that the beep sound from MCU is fed to base of Q6. Q6 output the beeps to the input of IC3.

Auto Squelch

When there is (or not) RF signal, Pin 9 of IC1 (on main PCB) output the small (larger) noise. This noise is fed to pin 10 of IC1. After the noise is amplified by the built amplifier of IC1, the noise the voltage on Pin12 of IC1 will down (or rise) below (or over) 0.7V and pin 13 goes to low (or high) level, which is fed to MCU. MCU output the high (or low) level that making pin 7 of IC3 on the main PCB is goes low (or high level). The audio is into the un-muting (or muting) status.
VR1 on the main PCB is used to adjust the starting mute point.