

## WT202 Circuit Description

### DC Power distribution

The DC output is regulated to 3V by 3V-REG. It should provide 20dB or more isolation from power supply noise, making the 3V power line is used for all digital circuits and analog lines. The power control loop T3V and R3V is control the by the MCU asserting the transmitter or receiver.

### PLL Synthesizer

Heart of the synthesizer is the VCO which supplies RX and TX as well. A helix coil guarantees low oscillator phase noise, the VCO works on half the receiving injection frequency and the transmission frequency, to decouple it from interference by the power amplifier and avoids feedback loop signals. A doubler follows the VCO, which again is followed by a match-network between the stages gives some additional isolation. In the collector circuit of the buffer a notch filter is used to suppress the VCO frequency.

The VCO are switched between the TX and the RX modes with switching transistor and pin diode, in the RX mode L.OSC runs 21.4MHz below the receive frequency.

The reference oscillator is 20.95MHz it also used to drive the second receiver mixer.

The synthesizer chip TB31202 control the VCO, the current source of the internal phase detector is drives the low-impedance loop filter.

### Two-Point Modulation

The single-point modulation scheme is low-frequency content limited by the PLL loop-filter. To achieve better CDS low bit ratio data and CTCSS sub-audio frequency response, the device, provides signal to both the VCO and PLL reference oscillator together, this results in the low frequency content that is within the loop bandwidth.

### Receiver

The antenna is connected to the receiver's front-end via the low-pass filter and T/R PIN switch. 2 pole L.C. band-pass filter reduces some of the broad-band noise and interference. LNA amplifies the signal about 18dB, and then a SAW filter follows. Image responses should be down 56 or more dB with this line up. A 2SC4226 transistor acts as mixer to obtain a good intermodulation response, the base are driven with the receive signal and the RX VCO local oscillator signal (low-side injected). The output of the mixer is applied to a 21.4 MHz crystal filter that provides the first IF channel filtering.

An IF/Demod chip the MC3361. This chip converts the signal to 450KHz, external ceramic filters further reduce adjacent channel interference, and then the FM is demodulated with a quadrature detector.

The MC3361 also amplified, filtered, and rectified by a noise amp. The DC level proportional to the noise is compared to a digitally set squelch threshold by MCU-EM78566 port-P70.

The RX voice signals are via a High Pass Filter amplifier to the final Audio PA, both amplifier reject the sub-audio signals (0~250.3Hz) about 36dB.

The RX CTCSS / CDS sub-audio signals pass-through the post amplifier to the MCU A/D-Port P93, the micro controller provides software filtering to avoids higher than 250.3Hz unwanted signals.

### **Transmitter**

The TX voice signals are also processing by two operation amplifier it is consist of limiter, pre-emphasizer and harmonic filter, the voice output signals mixing the sub-audio signals to the VCO and PLL reference oscillator.

The driver 2SC4226 boosts the VCO signal up by 20dB gain. This is sufficient to drive the RF PA 2SK3078A which at 3.7V power supply voltage delivers an output power of 0.5 Watt. 30mS after switching the VCO to the TX mode, the RF power control loop T3V is enable by the MCU asserting the transmitter on, the slow ramping of the transmitter avoids spurious signals in the adjacent channels.

### **Micro Controller Unit**

A MCU EM78566 is used to control the whole radio. It polls the PTT and VOX line, sub-audio signals filtering, CTCSS / CDs codes generation and detection, and CTCSS Reverse Burst, programs the PLL synthesizer chip, switches receiver and transmitter path in a well defined time scheme and select or checks the channels, checks battery levels etc.