

Theory of Operation on WM200

The WM200 Handheld Radio Transceivers are comprised of one main PCB.

The main PCB contains the transmitter, receiver, and control circuits.

Receiver

The receiver circuit adopts dual conversion superheterodyne with 1st IF 21.7MHz and 2nd IF 450kHz

Front-end

Front-end consists of pre-selector filter, RF Amplifier, Post-selector filter. The receive signal is routed through C5 and selected by C158, C202, C204, C197, C208, L31, L34, L35, L36 to amplified around 13dB at RF amp. Q8.

This circuit removes unnecessarily spurious 1st Image.

A. First Mixer

The signal from Front-end is input to Q7 base of 1st mixer. 1st local signal generated from VCO is input to Q7 emitter. These two signals are mixed at Mixer into 1st IF signal 21.7Mhz, which is resonated in parallel at C151, L27 and inputted to XF2, XF1, DUAL crystal filter.

B. IF Amplifier

1st IF signal from XF2 is amplified about 15dB at IF amp Q6 and inputted to IC4, IF IC.

IC4 includes 2nd Mixer, 2nd Local Oscillator. The signal from 2nd Mixer is refined removing unnecessary spurious signal and detected through high gain linear amp. This detected signal out to IC4 pin9.

C. AF Amplifier

De-emphasis functions to get 6dB/oct by R17, C145 and this signal controls volume of sound by RV6.

IC10 can operate a speaker as audio current amplifier amplifying the signal. The operating current can be reduced by mute signal.

D. Squelch

The demodulated signal from IC4 is coupled of noise to C22. The noise is filtered and amplified by C199,24, R165, 32 and rectified by double voltage at D6, C23 and transformed to DC level. And this DC signal is

controlled by Q17, 25, 27 and used as the signal to mute audio.

E. Audio AMP

De-emphasized to -6 dB/Oct at R4, C181, the volume of sound is controlled by RV6.

IC10 is doing low frequency current amplify as audio amplifier to operate a speaker.

IC10 has mute function and if Pin 2, mute port is high, it's on mute. If it is low, it's unmute.

Transmitter

The transmitter consists of Buffer, Power Amplifier, Low-Pass Filter, Antenna Switch, Auto-Power Control.

Buffer

-6 dBm TX RF signal from VCO is amplified to around $+25$ dBm by buffer Q4 to have desired output power at final Amp.

Pie style resister attenuator is used between VCO and Buffer Amp. To minimize the effect of load caused by transmit amplifier in TX.

Power Amplifier

TX RF Signal form buffer Amp. Gains 6Watt output by final Amp Q11.

Drain of Q11 inputted to 5th Low Pass Filter through strip line.

Low Pass Filter

5th Low Pass Filter reduces the unwanted spurious for TX output power from final Amp.

L24, 25, C129, 43, 4 are Chebisheve Filter.

Antenna Switch

Ant. Switch is to share the antenna in TX and RX. It prevents TX sensitivity from degradation by LPF. Also, it protects receive circuit by blocking TX signal to receive end, turning on D2, 3.

Flow of the signal in RX is designed to minimize the loss of the signal using the character of series resonance of L23, C158.

Auto-Power Control

This circuit controls TX Power by detection on the current through R35. The voltage difference from the resistor is amplified by U1-A and gets the voltage comparing the this signal with the reference voltage from R157, 162 at U1-B.

This voltage difference is kept to be stable value by RV2, changing Gate voltage of Final Amp.

Power H/M/L controls output voltage of U1-A. This function is saving the battery.

PLL Synthesizer

Reference frequency is 21.25Mhz and this oscillated frequency is compensated in temperature by the variation of D23 capacitor according to the voltage changes from thermistor.

The frequency from VCO is inputted to PLL IC and this inputted signal is divided by the ratio set by data and compared with reference step frequency.

Then, the difference comes to IC3 PD Port.

PD output turns into DC by PLL LPF R23, 24, C6, 9, 153 so that it can vary VCO control voltage to have set frequency.

Parallel resonance of D4, TC4 and L21 generates TX/RX frequency.

For TX and RX switch, Q2 and D5 switch C18 to control TX/RX frequency oscillation range.

Audio and Control circuit

IC1 controls all factions of the radio as Microprocessor.

It detects outer condition such as function data on frequency, Power supply switching and make it operate correctly.

IC U2-C consists of LPF to function WX ALERT decoding correctly. Then, it goes to Q23 to be changed to logic signal so that WX Alert Decoding is enabled.

U2-A, B is TX Audio Amp and limiter. It amplifies the voice signal from C-Mic and have the character of 6dB/Oct Pre-Emphasis.

This voice signal is controlled by RV3 for the volume.

U2-D is 3kHz LPF and has the character that reduces to 18dB/Oct.

This character minimizes the interference of adjacent channel by voice signal