TK-7102H(K2)
Circuit Descriptions

The Kenwood model TK-7102H is an all solid-state frequency synthesized VHF/FM transceiver designed for operation in the frequency range of 136 MHz to 162 MHz. This model has 4 channels.
The unit consists of a TX-RX unit and display unit and its transmitter is rated for 50 W output power.

1. TX-RX Unit

The TX-RX unit consists of a Voltage Control Oscillator (VCO), a receiver section, a transmitter section, a control section and a power supply section.

1.1 PLL Frequency Synthesizer

The transmit signal and the receiver first L. O. signal are generated by the PLL digital frequency synthesizer. The frequency synthesizer consists of a transmitter voltage controlled oscillator (TX VCO, Q11), a receiver voltage controlled oscillator (RX VCO, Q10), a buffer amplifier (Q15), an RF amplifier (Q3), a low-pass filter, a PLL IC (IC1) and TX VCO/RX VCO switches (Q7 and Q12).

In the transmit signal mode, an operating frequency programming data is sent to IC1, from the CPU(IC6), to set the programmable counter within IC1. Q7 is turned on to activate the TX VCO and the output signal of the TX VCO is amplified by Q15 and Q3 before it is routed to IC1.

The signal is then divided down in frequency, at the programmable counter in IC1, to 5.0kHz or 6.25kHz which is compared in phase with a 5.0kHz or 6.25kHz reference signal, derived from 16.8MHz crystal oscillator and a 1/3360 or a 1/2688 fixed counter in IC1, at the phase comparator in IC1. The crystal oscillator operates at 16.8MHz and its frequency stability is maintained within 2.5ppm (temperature range of –30 to +60°C).

The phase comparator output signal is fed into a low-pass filter before being applied to the TX VCO as a frequency control voltage. If an unlock condition occurs in the phase locked loop, this condition is detected by D6. This cause the transmitter 8V supply cut off, resulting in the prevention of an unauthorized transmission.

The transmitter modulation signals (processed Mic. audio and sub-audible signaling) are applied to the TX VCO for frequency modulation.

In the receive mode, the VCO is substituted with Q10 (RX VCO) and it generates the receiver first local oscillator signal according to the data sent from the CPU(IC6).
The basic operation of the synthesizer remains the same.

1.2 Receiver Circuit

The receiver is a double conversion super-heterodyne, designed to operate in the frequency range of 136 MHz to 162 MHz.

The receiver RF and IF sections consist of an RF amplifier (Q26), a first mixer (Q21), and an FM IF IC (IC5).

An incoming RF signal from the antenna is fed into a band-pass filter which consists of L36, L38, varactor diodes (D25 and D26) and variable capacitors (TC3 and TC5) after going through an antenna switch in the transmitter power amplifier section. TC3 and TC5 will be tuned manually with D25 and D26 tuned electrically by TV voltage for the best BPF response. This RF signal is then amplified by a RF amplifier (Q26) and filtered again by band-pass filters (L30, L32 and D21, D22). After amplification and filtering, the signal is applied to the first mixer (Q21) for mixing with the first local oscillator signal generated by the frequency synthesizer.

The heterodyning action of the first mixer produces a 49.950MHz intermediate frequency (first IF), which is applied into two monolithic crystal filters. The signal out of the crystal filters is amplified by a first IF amplifier (Q19) and is sent to the FM IF IC (IC5).

The FM IF IC (IC5) contains a second mixer, a second local oscillator, second IF amplifiers, a second IF filter, a FM detector and a RSSI output. The signal applied to IC5 is mixed with 50.400MHz, which produces a 450kHz second IF signal. The signal obtained at the second mixer is filtered by a 450kHz ceramic filter (CF1 for wide or CF2 for narrow) and it is amplified by limiting amplifiers. The recovered audio signal from the incoming signal is obtained from quadrature type FM demodulator. This recovered audio signal is then sent to the audio amplifier circuit and to the noise actuated squelch circuit.

The recovered audio signal obtained at IC5 is de-emphasized and further amplified for driving a loud speaker.

1.3 Transmitter Circuit

The transmitter circuit consists of a microphone amplifier, a RF power amplifier driver (Q23, Q25 and Q800), and RF power amplifier (Q801), an antenna switching network, a spurious and harmonics low-pass filter, and an automatic power control (APC).

The audio signal, originating at the microphone, is applied to the microphone amplifier (IC21, IC22). The audio signal is amplified, pre-emphasized (IC21, IC22), voltage limited and low-pass filtered. The signal is then switched by transistors to the TX VCO for modulating the transmit carrier signal.

The transmit signal, generated at the frequency synthesizer, is applied to the RF power amplifier driver to gain a sufficient signal level to drive the RF power amplifier.

The output signal from the RF power amplifier driver is further amplified, in the RF power amplifier, up to the level of the transmitter rated output power. This signal is routed to the antenna connector after going through the antenna switching network and the low-pass filter. This filter has a minimum attenuation of 65dB at the second harmonic frequency.

This output power level once it was set it will be maintained at a constant output level by automatic power control unit (D805, D806 and IC800).

1.4 Control Section

The control section consists of a CPU (IC6), display unit and associated interface circuits.

The CPU (IC6) is connected to an external EEPROM (IC7), which stores the operating frequency information.

The CPU (IC6) performs the following functions:

(1) Switches transmit and receive mode based on the push-to-talk line information at the Mic. connector (J1).
(2) Detects control signals from keypad and converts the information to a serial format.
(3) Retrieves the transmit and receive frequency programming data from the EEPROM (IC7), and sends it to the frequency synthesizer.
(4) Detects control signals from each function switch, and sends the information to the associated peripheral circuits in a serial format.
(5) Controls squelch and audio-mute
(6) Generate the sub-audible signaling encode data (QT, DQT) and DTMF signals.
(7) Decodes the sub-audible signaling data (QT, DQT) and DTMF signals.
(8) Detects the noise level from Q18, and controls the noise squelch operation.

2. Display Unit

The display unit consists of LEDs (D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12) and a Mic connector (J1), it receives the data from the CPU (IC6) in a control circuit and the data is displayed as a visual indication to the operator.