TK-980
Circuit Descriptions

The Kenwood model TK-980 is an all solid-state frequency synthesized UHF/FM transceiver designed for operation in the frequency range of 806 MHz to 825MHz /851MHz to 870MHz(TX), 851MHz to 870MHz(RX)(ALH24563110).
The unit consists of a TX-RX unit and LCD assembly and its transmitter is rated for 15W output power.

1. TX-RX Unit

The TX-RX unit consists of a Voltage Control Oscillator (VCO) sub-unit, 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 & receiver voltage controlled oscillator (TX & RX VCO, Q101), a doubler (Q102), a buffer amplifier (Q100), an RF amplifier (Q300), a low-pass filter, a PLL IC (IC300).

The signal from Q300 passes through the low-pass filter and is applied to IC300 which is PLL frequency synthesizer with VCXO ; X1. The VCXO of which the frequency stability is within 1.5ppm (temperature range of –30 to +60℃) generates 16.8MHz.

The PLL-IC consists of three modulus prescaler, fractional divider, reference divider, digital phase comparator with pump output.

This PLL-IC is Fractional-N type synthesize and performs is 50kHz reference signal which is eighth of the channel step (6.25kHz). The input signal from the pins 5 and 8 of the PLL-IC is divided down to the or 50 kHz and compared at digital phase comparator. The pulsed output signal of the digital phase comparator is applied to the charge pump and transformed into DC signal. The DC signal from the pin 14 of the PLL-IC passes through the active low-pass filter (loop filter), is applied to the VCO and controls to keep the frequency of the VCO.

The serial data (DT,CP,EP) from the CPU (IC511) is input to the PLL-IC. And PLL lock condition is always monitored the pin 31 (LD) of IC511.

The transmitter modulation signals (processed Mic. audio and sub-audible signaling) are applied to the VCO(Q101) for frequency modulation.

In the receive mode, it generates the receiver first local oscillator signal according to the data sent from the control unit. 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 851MHz to 870MHz .

The receiver RF and IF sections consist of an RF amplifier (Q201), a first mixer (Q203), a first IF amplifier (Q15) and an FM IF IC (IC11).

An incoming RF signal from the antenna is fed into a band-pass filter which consists of L203 after going through an antenna switch in the transmitter power amplifier section. This RF signal is then amplified by an RF amplifier (Q201) and filtered again by band-pass filters (L207). After amplification and filtering, the signal is applied to the first mixer (Q203) for mixing with the first local oscillator signal generated by the frequency synthesizer.

The heterodyning action of the first mixer produces a 44.850MHz 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 (Q15) and is sent to the FM IF IC (IC11).

The FM IF IC (IC11) contains a second mixer, a second local oscillator, second IF amplifiers, a second IF filter, an FM detector and a RSSI output. The signal applied to IC11 is mixed with 44.395MHz, which produces a 455kHz second IF signal. The signal obtained at the second mixer is filtered by a 455kHz 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 IC11 is de-emphasized and further amplified for driving a loud speaker.

1.3 Transmitter Circuit

The transmitter circuit consists of a microphone amplifier, an RF power amplifier driver (Q202 and Q204), an RF power amplifier module (IC400), 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 (IC711, IC504). The audio signal is amplified, pre-emphasized (IC504), voltage limited and low-pass filtered. The signal is then switched by transistors to the VCO for modulating the transmit carrier signal or to public address operation.

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 module, 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 35dB 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 (IC13, Q17).

1.4 Control Section

The control section consists of a CPU (IC511), LCD assembly and associated interface circuits.

The CPU (IC511) is connected to an external EEPROM (IC512), which stores the operating frequency information.

The CPU (IC511) performs the following functions:

(1) Switches transmit and receive mode based on the push-to-talk line information at the Mic. connector (J501).
(2) Detects control signals from key pad and converts the information to a serial format.
(3) Retrieves the transmit and receive frequency programming data from the EEPROM (IC512), 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 LTR DATA) and DTMF signals.

(7) Decodes the sub-audible signaling data (QT, DQT 2TONE) and LTR DATA signals.

(8) Detects the noise level from Q503, and controls the noise squelch operation.

2. LCD (Liquid Crystal Display) Assembly

The display receives the data from the CPU (IC511) in a control circuit and the data is displayed as a visual indication to the operator.