HX300 Circuit Description

1. Receive Signal Path

Incoming RF from the antenna jack is delivered to the RF Unit and passes through a low-pass filter consisting of coils L1001, L1003 and L1006,capacitors C1014, C1016, C1020,C1023,C1029,C1033 and C1042, and antenna switching diode D1005.

Signals within the frequency range of the transceiver enter a band-pass filter consisting of coils L1018 and L1020, capacitors C1096, C1098 and C1102, then amplified by Q1023. The amplified RF is then passed through a SAW filter XF1001, the pure in-band input signal is delivered to 1st mixer Q1034.

Buffered output from the VCO is amplified by Q1006 to provide a pure first local signal between 134.35 and 141.575 MHz for injection to the first mixer Q1034.

The 21.7 MHz first mixer product then passes through monolithic crystal filter XF1002/XF1003 to strip away all but the desired signal, which is then amplified by Q1039.

The amplified first IF signal is applied to FM IF subsystem IC Q1041, which contains the second mixer, second local oscillator, limited amplifier, noise amplifier, and RSSI amplifier.

A second local signal is produced from the PLL reference/second local oscillator of X1001 (21.25 MHz). The 21.25 MHz reference signal is delivered to mixer section of Q1041 which produce the 450 kHz second IF mixed with the first IF signal.

The second IF then passes through the ceramic filter CF1001 to strip away unwanted mixer products, and is then applied to the limited amplifier in Q1041, which removes amplitude variations in the 450kHz IF, before detection of the speech by the ceramic discriminator CD1001.

2. Audio Amplifier

The demodulated audio signal from the Q1041 passes through a band-pass filter and High-pass filter, then applied to the de-emphasis of Q1005. Then passes through the audio mute switch Q1036, the Electric Volume audio volume Q1035 and the audio power amplifier Q1043, providing up to 700 mW of audio power to the 8 Ω loudspeaker.

3. Squelch Control

The squelch circuitry consists of a noise amplifier and band-pass filter and noise detector within Q1041.

When no carrier received, noise at the output of the detector stage in Q1041 is amplified and band-pass filtered by the noise amplifier section of Q1041 and the network between pins 7 and 8, and then rectified by detection circuit in Q1041.

The resulting DC squelch control voltage is passed to pin 100 of the microprocessor Q1033. If no carrier is received, this signal causes pin 82 of Q1033 to go low and the Electric Volume audio volume Q1035 is mute. The Electric Volume audio volume Q1035 is disable the supply voltage to the audio amplifier Q1043. Thus, the microprocessor blocks output from the audio amplifier, and silences the receiver, while no signal is being received (and during transmission, as well).

4. Transmit Signal Path

The speech input from the microphone MC1001 passes through the audio amplifier Q1003, which is adjusted the microphone gain. The speech signal passes through pre-emphasis circuit to Q1003, which contains the IDC, and low-pass filter.

The filtered audio signal is applied to varactor diode D1016, which frequency modulates the VCO Q1013.

The modulated signal from the VCO Q1013 is buffered by Q1006. The low-level transmit signal is then passes through the TX switching diode D1028 to the buffer amplifier Q1032, driver amplifier Q1028, then amplified transmit signal is applied to the final amplifier Q1018,1019 up to 5.0 watts output power.

The transmit signal then passes through the antenna switch D1005 and is low-pass

filtered to suppress harmonic spurious radiation before delivery to the antenna.

4-1 Automatic Transmit Power Control

Current from the final amplifier is sampled by C1007 and C1012, and R1005 and R1009, and is rectified by D1002. The resulting DC is fed back through Q1031 to the final amplifier Q1019, for control of the power output. When the microprocessor selects ”High” or “Low” power levels, pin 76 of Q1030 to go low at “High” power selected or pin 76 of Q1030 to go high at “Low” power selected.

5. PLL Frequency Synthesizer

The PLL circuitry on the Main Unit consists of VCO Q1012(RX),1013(TX), VCO buffer Q1006, PLL subsystem IC Q1029, which contains a reference divider, serial-to-parallel data latch, programmable divider, phase comparator and charge pump, and crystal X1001 which frequency stability is ±5 ppm @ -20 to +60 °C.

While receiving, VCO Q1012 oscillates between 134.35 and 141.575 MHz according to the transceiver version and the programmed receiving frequency. The VCO output is buffered by Q1006 then applied to the prescaler section of Q1029. There the VCO signal is divided, according to a control signal from the data latch section of Q1029, before being sent to the programmable divider section of Q1029.

The data latch section of Q1029 also receives serial dividing data from the microprocessor Q1033, which causes the pre-divided VCO signal to be further divided in the programmable divider section, depending upon the desired receive frequency, so as to produce a 25.0 kHz derivative of the current VCO frequency.

Meanwhile, the reference divider sections of Q1029 divides the 21.25 MHz crystal reference from the reference oscillator section of Q1029, by 850 to produce the 25.0 kHz loops reference.

The 25.0 kHz signal from the programmable divider (derived from the VCO) and that derived from the reference oscillator are applied to the phase detector section of Q1029, which produces a pulsed output with pulse duration depending on the phase difference between the input signals.

This pulse train is filtered to DC and returned to the Varactor D1017 and D1018.

Changes in the level of the DC voltage applied to the Varactor, affecting the reference in the tank circuit of the VCO according to the phase difference between the signals derived from the VCO and the crystal reference oscillator.

The VCO is thus phase-locked to the crystal reference oscillator. The output of the VCO Q1012 after buffering by Q1006 is applied to the first mixer as described previously.

For transmission, the VCO Q1013 oscillates between 156.025 and 157.425 MHz according to the model version and programmed transmit frequency. The remainder of the PLL circuitry is shared with the receiver. However, the dividing data from the microprocessor is such that the VCO frequency is at the actual transmit frequency (rather than offset for IF s, as in the receiving case). Also, the VCO is modulated by the speech audio applied to D1016, as described previously.

6. Miscellaneous Circuits

Push-To-Talk Transmit Activation

When the PTT switch on the main PCB is closed, pin 60 of Q1033 goes low. This signal disables the receiver by disabling the 3 V supply bus at Q1020 to the front-end, FM IF subsystem IC Q1041.

At the same time, Q1016 activate the transmit 3 V supply line to enable the transmitter.