HX460S Circuit Description

Reception and transmission are switched by "RX" and "TX" lines from the microprocessor unit(MPU). The receiver uses double-conversion superheterodyne circuitry, with a 21.7 MHz 1st IF and 450 kHz 2nd IF. The 1st LO,produced by a PLL synthesizer,yields the 21.7Mhz 1st IF.

The 2nd LO uses a 21.250 MHz (21.7 MHz-450 kHz) signal ogenerated by a crystal oscillator. The 2nd mixer and other circuits use a custom IC to convert and amplify the 2nd IF, and detect FM to obtain demodulated signals.During transmit, the PLL synthesizer oscillates at the desired frequency directly, for amplification to obtain RF power output. During transmit, voice modulation is applied to this synthesizer.Transceiver functions, such as tx/rx control, PLL synthesizer settings, and channel programming, are controlled using the MPU.

Receiver

Incoming RF signals from the antenna conector are delivered to the RF Unit, and pass through a low-pass filter (LPF) consisting of coils L2030, L2031, L2032 and L2033, capacitors C2127, C2131, C2133, C2137, C2142, C2134, and C2138, and antenna switching diodes D2020 and D2021 for delivery to the receiver front end.

Signals within the frequency range of the transceiver are then passed through a varactor-tuned bandpass filter consisting of L2001, L2002 / L2003 before RF amplification by Q2006 (2SC5374).

The amplified RF is then bandpass filtered again by varactor-tuned resonators L2006, L2007 / L2010, to ensure pure in-band input to 1st mixer Q2012 (3SK320).

Buffered output from the VCO Unit is amplified by Q2016 (2SC5374) and bandpass filtered by L2014, L2015 and C2056, to provide a pure 1st local signal between 134.35 and 140.325 MHz to the 1st mixer.

The 21.7MHz 1st mixer product then passes through dual monolithic crystal filters XF2001 and XF2002 (±6.0 kHz BW), and is amplified by Q2015 (2SC4400-4) and delivered to the input of the FM IF subsystem IC Q2018 (TA31136FN).

This IC contains the 2nd mixer, 2nd local oscillator, limiter amplifier, FM detector, noise amplifier, squelch gates.

The 2nd LO in the IF-IC is produced from crystal X2001 (21.250MHz), and the 1st IF is converted to 450kHz by the 2nd mixer and stripped of unwanted components by ceramic filter CF2001. After passing through a limiter amplifier, the signal is demodulated by the FM detector.

Demodulated receive audio from the IF-IC is amplified by Q1001 (2SC4154E) and Q1008 (2SC4154E) on the CNTL Unit.
After volume adjustment by the AF power amplifier Q1007 (TDA7233D),the audio signal is passed to the external SP/microphone jack or 8-ohm loudspeaker.

PLL synthesizer

The 1st LO maintains stability from the PLL synthesizer by using a 21.250 MHz reference signal from crystal X2001. PLL synthesizer IC Q2008 (LV2105V) consists of a prescaler, reference counter, swallow counter, programmable counter, a serial data input port to set these counters based on the external data , a phase comparator, and charge pump.

The PLL-IC divides the 21.250 MHz reference signal by 4,250 using the reference counter (5.0 kHz comparison frequency). The VCO output is divided by the prescaler,

swallow counter and programmable counter. These two signals are compared by the phase comparator and input to the charge pump. A voltage proportional to their phase difference is delivered to the low-pass filter circuit, then fed back to the VCO as a voltage with phase error, controlling and stabilizing the oscillating frequency. This synthesizer also operates as a modulator during transmit.

The VCO is comprised of Q2013 (2SC5374) and D2013,14, (HVC362 × 2), and oscillates at 21.7 MHz during receive, and at the fundamental frequency during transmit, with direct frequency-modulation using varactor diode D2015 (HSC277). The VCO output passes through buffer amplifier Q2014 (2SC5374), and amplified by Q2016 (2SC5374) to obtain stable output. The VCO DC supply is regulated by Q2017 (2SC4154E). Synthesizer output is fed to the 1st mixer by diode switch D2019 (MC2848) during receive, and to drive amplifier Q2019, Q2023 (2SC5374, 2SK3074) for transmit. The reference oscillator feeds the PLL synthesizer, and is composed of crystal X2001 (21.250 MHz), the temperature compensation circuit which includes thermostats TH2001.

Transmitter

Voice audio from the microphone is delivered via the Mic (Jack) Unit to the CNTL Unit, after passing through amplifier Q1006 (NJM3403V), pre-emphasis, limiter (IDC instantaneous deviation control) ,and LPF Q1006 (NJM3403V), is adjusted for optimum deviation level and delivered to the next stage.
Voice input from the microphone is FM-modulated to the VCO of the synthesizer.

Synthesizer output, after passing through diode switch D2019(MC2848), is amplified by driver Q2019, Q2023 (2SC5374, 2SK3074) and power amplifier Q2026 (3SK3075) to obtain full RF output. The RF energy then passes through antenna switch D2020 and a low-pass filter circuit and finally to the antenna connector.

RF output power from the final amplifier is sampled dy C2129 and C2131 and is rectified by D2022(1SS321). The resulting DC is fed through Automatic Power Controller Q2032 (NJM2904V) to transmitter RF amplifier Q2026 and thus the power output.

Generation of spurious products by the transmitter is minimized by the fundamental carrier frequency being equal to the final transmitting frequency, modulated directly in the transmit VCO. Additoinal harmonic suppression is provided by a low-pass filter consisting of L2030, L2031, L2032 and L2033, capacitors C2127, C2131, C2133, C2137, C2142, C2134, and C2138 resulting in more than 65dB of harmonic suppression prior to delivery to the RF energy to the antenna.

1050 Hz Weather Alert decoder

1050Hz Weather Alert signals are demodulated on the CNTL-UNIT, and are applied to band-pass filter Q1030 (NJM2904V), as well as the limiter comparator Q1030 (NJM2904V).

MPU

Operation is controlled by 8-bit MPU IC Q1028 (HD6473802H). The system clock uses a 3.57954 MHz crystal for a time base. IC Q1035 (S-80730SN) resets the MPU when the power is on, and monitors the voltage of the regulated 3V power supply line.

EEPROM

The EEPROM retains Tx and Rx data for all memory channels , prescaler dividing, IF frequency, local oscillator injection side, and REF oscillator data.