# AeroComm AC4424 Theory of Operation

The AC4424 is a FSK frequency hopping RF transceiver based on a discrete design. There is a digital section and a RF transceiver section. The digital section is an Intel 8051 microprocessor core that includes RAM memory for program variables and flash memory for program storage. The embedded program developed by Aerocomm (stored in flash) controls the RF transceiver section in every aspect.

## RF TRANSCEIVER

The RF Transceiver section is composed of a frequency synthesizer/modulator (VCO and PLL) which generates a LO (Local Oscillator), a transmitter section, and a receiver section. The synthesizer/modulator is powered by an on board Low Drop Out voltage regulator that ensures FCC compliance with any OEM power supply.

## TRANSMITTER HARDWARE

The transmitter section utilizes the modulated LO from the synthesizer section. The microprocessor commands the PLL/VCO to different hop channel frequencies. In transmit mode, the LO is modulated by data from the microprocessor in an FSK format at the center of a hop channel frequency. This FSK modulated LO signal is then amplified by the Power Amplifier, and is then routed through the R/T switch to the antenna.

## RECEIVER HARDWARE

The receiver section also utilizes the PLL/VCO hardware to generate a LO which is offset from the center of the defined hop channel frequency by the center frequency of the IF filter (a 38.9MHz SAW). In receive mode, the incoming signal is captured by the antenna and then filtered by a 2442MHz pre-selector filter. It is then routed through a Low Noise Amplifier, and fed into the down-converter where is beat against the LO from the synthesizer. The down-converter/mixer selects only the desired hop channel frequency to be translated down to the center of the IF filter. The IF filter has been selected to match the bandwidth of the transmitted signal and destroy all other RF frequency content. The result is then presented to a demodulator circuit which extracts the receive data from the baseband signal.

## HOPPING CHANNELS

The hopping channels are defined by Aerocomm in a pseudorandom fashion, and are separated by 1.5MHz. The channel separation is greater than the 20dB bandwidth of the transmitted signal (which is about 1.4MHz). Transmitted data will be equally distributed on the average over the 20 defined hopping channels.

## SYNCHRONIZATION

A non-volatile configuration byte indicates that the particular radio is a Server radio or a Client Radio. The Server radio tunes its LO to the next predefined pseudorandom hop channel frequency at the hopping rate. At each hop frequency, the Server radio transmits a beacon containing hop timing information and system flags. A Client radio must first find the Server by scanning the known list of hop channel frequencies until it receives a valid beacon. If this is a valid Server for the Client to be paired with, the Client radio will then begin hopping at the defined hopping rate around the known list of pseudorandom hopping channel frequencies. Once synchronized, the Client can communicate bidirectionally with the Server radio as defined by Aerocomm's embedded RF protocol.