

## Operational Description

The GBE Controller is a control device that is used in water softener systems. The controller can be operated from the front keypad or can be fitted with a radio board which provides remote control and programming of the controller.

The design of the rf board mounted in the controller is based on the Semtech XE1205 RF Transceiver Chip. The rf circuit is designed to produce a Frequency Shift Key modulated rf carrier fixed at 915 MHz. The rf power output is set to -3 dBm at the output of the transceiver chip. The rf output is fed through a matching network and band-pass filter and finally to an integral antenna.

### Transmitter

The transmit carrier generation is accomplished within the transceiver chip via an on-chip Phase Locked Loop circuit. A crystal oscillator fed to the transceiver chip to serve as a reference for the PLL. An external LC tank circuit is used for setting the VCO frequency. The 915 MHz frequency synthesizer signal is modulated directly. The chip input includes pulse shaping for the modulation data. The modulating information is sent directly to the frequency synthesizer.

### Receiver

The receiver is direct conversion (zero IF) circuit. The receiver converts the incoming 2-level FSK modulated, 915 MHz rf signal into a synchronous bit stream. The receiver includes a Low Noise Amplifier, down-conversion mixers, baseband filters, baseband amplifiers, and baseband limiters., demodulator, and bit stream synchronizer. These circuits are all on the transceiver chip. The bandwidth of the base-band filters, the frequency deviation of the expected incoming FSK signal as well as the bit rate of the received data signal are all user-programmable. The receiver also embeds an automatic frequency offset cancellation to compensate local oscillator drifts due to XTAL.

### Antenna

The antenna is a PCB trace with the dimensions:

Length: 87 mm

Width: 2 mm

The gain of the antenna has not been measured. The design is intended to be a  $1/4\lambda$  un-terminated loop.