Advanced Control Technologies, Inc.
Theory of Operation: 200 Series Z-Wave RF Circuitry
Project: ZRW103, ZRW113, ZRF113, & ZTW113
Project No. 0763-01, 0766-01, 0767-01, & 0768-01 (respectively)
Project Engineer: Mark Scott

 Technical Description:

The ZM2102 is the Zensys designed RF transceiver module that is used on the ZRW103, ZRW113, ZRF113, and ZTW103 products. Inside these products the control PCB that uses this ZM2102 module was designed during the development of the ZDW103 and ZDW120 Solid state dimmer products. This control PCB using the ZM2102 module is versatile enough that it can be used in a variety of different applications.

The transceiver operates in half-duplex fashion to provide two-way communications with other devices. The communications, while varied, most often consist of a command from the remote control followed by an acknowledgement by the addressed module(s) that a valid command was received.

The transceiver operates in the 900MHz ISM band at 908.42 MHz. The data, which is digital in nature, is Manchester encoded and sent using FSK modulation at a 9.6Kbit/sec or 40Kbit/sec rate. The deviation of the modulation is plus and minus 15 KHz

A 32 MHz crystal oscillator is used both as a clock for the micro-controller and a reference oscillator for the fractional PLL frequency synthesizer portions of the ASIC. This PLL is used to generate both the local oscillator for the receiver and the fundamental frequency of the transmitter. The output power of the transmitter portion of the transceiver is controlled by the microcontroller which causes the transmit power to be very low for some setup functions.

Modulation of the transmitter is accomplished in the PLL by having the microcontroller cause it to use one divisor when the binary modulating data is zero (low) and a slightly different one, when it is one (high).

The receiver is a single conversion type. The local oscillator runs at 908.275 MHz (145 KHz below the receive frequency).

A wireless transmission occurs briefly in response to one of two events: 1) A manually issued command initiated by the User via a remote control, or 2) An automated command that is initiated when the internal time of day clock matches a previously User-programmed time.

The communications are done using a protocol called the Z-Wave protocol, a wireless network protocol that was designed especially for home automation applications. It defines how various types of information are to be formatted into frames. These frames not only include commands and data, but also source and destination information, as well as checksums that are used for error detection. The ZM2102 Transceiver/Control PCB and accompanying application board, the remote control, and other modules make up a wireless local network, where each of the modules can function as wireless repeaters (also half duplex). There is provision within the protocol for intelligent and adaptive routing and for the handling of collisions.

Except for a handful of discrete passive components the entire transceiver is contained in the ZM2102 made by Zensys. The transmitter and receiver share a common antenna which is eternal to the ZM2102. A SAW filter is used to help minimize receiver overload from strong signals on nearby frequencies and to attenuate any undesired harmonics from the transmitter. The antenna used in these applications is a wire antenna.