900 MHz Module Theory of Operation

The module contains a direct sequence spread spectrum transceiver operating in the 902 - 928 MHz ISM band. The system is based on the IEEE 802.15.4-2006 standard, with 10 channels spaced at 2 MHz intervals in the ISM band. The system can operate in several modes. 1) BPSK modulation with each bit mapped by a 15-chip PN sequence at a chip rate of 600 kcps, a symbol rate of 40 ksps, and a bit rate of 40 kbps. The chip sequences are modulated onto the carrier using BPSK modulation with raised cosine pulse shaping (roll-off factor = 1). 2) OQPSK modulation with each symbol mapped by a 16-chip PN sequence at a chip rate of 1000 kcps, a symbol rate of 62.5ksps, and a bit rate of 250 kbps. At the chip rate of 1000 kcps, half-sine pulse shaping is used. 3) OQPSK modulation with each symbol mapped by a 4-chip PN sequence at a chip rate of 1000 kcps, a symbol rate of 250 ksps, and a bit rate of 1Mbps. At the chip rate of 1000 kcps, half-sine pulse shaping is used. The radio is an Atmel AT86RF212B single-chip RF transceiver which provides a radio interface between the RF Front-End and the microcontroller. It is comprised of an analog part, digital modulation and demodulation, including time and frequency synchronization as well as data buffering. The Atmel AT86RF212B supports the IEEE 802.15.4 standard BPSK modulation.

On-chip regulators provide the chips regulated supply for its analog and digital components. The frequency accuracy is derived from a 16.0 MHz 10 ppm crystal.

The RF Front-End is a provided by a RFMD RF3858 which supplies a transmit power amplifier, receiver low noise amplifier, and antenna switching. Only receive antenna diversity is allowed, and it must be implemented by the user.

The microcontroller is an Atmel ATXMEGA256A3U which controls the radio and interfaces the digital circuits outside of the module. The XMEGA A3 is a family of low power, high performance and peripheral rich CMOS 8/16-bit microcontrollers based on the AVR® enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the XMEGA A3U achieves throughputs approaching 1 Million Instructions Per Second (MIPS), thus allowing the system designer to optimize power consumption versus processing speed. The microcontroller uses a 32.768 KHz crystal for a real time clock.