Carnegie Technology
World IoT LoRa Module (LV-WLM-271)

The World IoT LoRa Module (WLoRa) is a Carnegie Technologies second generation LoRa Transceiver capable of being utilized in different regions around the world requiring various spectrum frequencies and power limits. It qualifies as an independent module but has a uniquely proprietary interface that can be only used on Carnegie designed sensor products.

Operational Description

For the purpose of testing the WLoRa on a representative device, a specific FCC carrier board was developed. The carrier board provides a connector for power - in this case battery terminals were attached to the connector. Reverse polarization protection for the 3 Vdc input to the module is provide by a FET. A second connector provides access to serial debug signals, an MCU reset signal and serial programming signals. There are no active components on the carrier board.

The WLoRa Module consists of a Low Drop Out (LDO) Voltage Regulator, the LoRa RF Front End, a Microprocessor and GPS receiver all contained within a shielded can. An etched PIFA Antenna extend out onto an exposed portion of the PCB and is not replaceable. A second receive only etched Helical Antenna is provided for for access to the GPS signals.

The WLoRa RF front end consists of the on-board PIFA antenna (non-replaceable) in combination with the SX1262 transceiver providing a LoRa long range modem with a proprietary spread spectrum data modulation scheme that is a derivative of Chirp Spread Spectrum (CSS).

The SX1262 operates using a 32 MHz crystal oscillator. RX and TX switching, timing and control are provided by a STM32L072 microprocessor driven by a 32.768 kHz crystal oscillator. The WLoRa module also supports the UBlox EVA-M8M GPS chipset and PCB etched helical antenna to acquire time and position.

The WLoRa is a Hybrid Device, capable of Frequency Hopping Spread Spectrum (FHSS) or single channel digital transmission (DTS). For the US and Canadian markets, the WLoRa Module operates within the 902 to 928 MHZ license-exempt ISM band and use 64 channels (0 to 63) at 125 kHz BW. Starting at 903 MHz channels increment linearly every 200 kHz to 915 MHz. Like FSK the amplitude of the carrier is constant thus these devices have a modulation index of zero. Frequency Hopping is employed to ensure spectral density requirements are not exceeded.

Description of Chirp Spread Spectrum (CSS)

For an unmodulated signal, the Chirp increases linearly from the low channel frequency to the high channel frequency without interruption. One complete channel sweep is called a Symbol. The Symbol represents a number of bits. The Spreading Factor (SF) changes the number of bits that can be encoded in each Symbol (101010 = SF6 and 101010101010 is SF12). Digital modulation of the Chirp causes the frequency to jump to different frequencies with in each Symbol. Different bit combinations are represented by where in the frequency the stop and start back.