Carnegie Technology Push Buttons
1 Button (Model LV-PSH-171) and 3 Button (Model LV-PSH-173)

The Push Buttons are intended to be a remote wireless LoRa indicator of an event. After a switch is depressed, the Push Buttons will communicate via the LoRa radio through a LoRaWAN to Wi-Fi (802.11n) Access Point Gateway.

The Push Buttons defaults to Low Power Sleep mode when not in any other mode and will transition to modes other than Low Power Sleep at configurable intervals. It is also capable of obtaining time and position from the GPS chipset. The Push Buttons can also be configurable to awake at configurable intervals to broadcast some subset of:

- GPS acquired data (Position or Position data)
- On board and Remote temperature (assembly option)
- Battery Status

Operational Description

The Push Buttons consist of a carrier PCA that support one or three switches, an accelerometer, the battery connections and the connections to the LoRa Module all housed in a sealed plastic enclosure. One or three switches provide inputs to the LoRa module to indicate an event.

The device is powered by an internal battery or combination of batteries that produce a nominal voltage of 3Vdc. The Push Buttons uses two 1.5 Volt AAA lithium batteries are connected in series. The Push Buttons will spend most of their life in a very low power sleep mode to conserve battery life, with the LoRa Module, GPS radios and any non-essential components powered off.

The LoRa Module consist is a PCA that is soldered down to the carrier board. The LoRa RF front end consists of the on-board PIFA antenna (non-replaceable) in combination with the SX1276 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 SX1276 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 LoRa module also supports the UBlox EVA-M8M GPS chipset and PCB etched helical antenna to acquire time and position. Through an SI interface the LoRa Module communicate to the ST LIS2DW12TR 3 axis accelerom6eter for motion sensing.

These LoRa devices operate 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.

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.