

Collector Indoor.

FCC ID : 2BSNU-EFSV01SEN01

THE SENSOR

Functional description :

When a birth is detected (foal or calf), the sensor positioned on the animal sends an alert to the outdoor collector via the LoRa modem.

The collector receives birth alerts from the sensor placed on the animal and sends a text message or voice message to the farmer's phone, via 4G cellular network.



This sensor is used for two applications:

- foaling detection with the system name EASYFOAL
- and calving detection with the system name SMARTVEL

Difference between the 2 products :

The only difference between SMARTVEL and EASYFOAL sensor products is the detection algorithm. This algorithm is based on analyzing the animal's movements as it approaches the birth.

The movements are captured by the internal accelerometer.

In both cases, the algorithm analyzes activity, tail lifting, standing up/lying down, colic, and contractions, with weighting coefficients adapted to each animal.

While cows begin to show signs of calving about 1.5 hours before calving, mares begin to show the first signs about 20 minutes before foaling.

In both cases, the hardware is exactly the same (same electronic board and casing), and the LoRa communication protocol is exactly the same (see below).

Only the color of the casings changes, which allows to distinguish between EASYFOAL Sensors (pink) and SMARTVEL sensors (blue).

Internal functions :

The Sensor (EASYFOAL system (for mares) or SMARTVEL system (for cows)) contains

- a LoRa modem with an internal LoRa antenna
- An accelerometer 3D
- a microcontroller that manages all electronic functions
- A primary battery Li-SOCL2 3.6V, 2.4Ah, non replaceable.

The internal battery makes the Sensor autonomous for at least 5 years

LoRa modulation description :

- Modulation : LoRa
- Frequency : 915MHz
- Spreading factor : SF10
- Bandwidth : 500KHz
- Error coding : 4/5

The LoRa Antenna is a GC-409-150, from Gigaconcept. It can't be removed.

LoRa Protocol description :

The transmissions are foaling, calving, or battery alert alarms, which are rare events.

The gateway listens every 250 ms (RX in green) at a frequency of 915 MHz.

When the sensor detects a birth process in progress (foaling or calving), it sends an alert to the collector via the LoRa protocol described below.

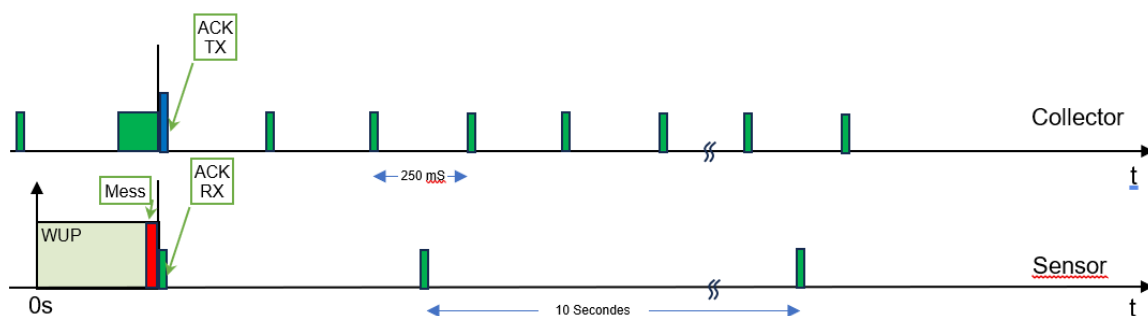
The alert contains a wakeup part (250ms), and a message part (100ms).

The Lora transmission is at a frequency of 915 MHz.

The collector then waits for the message (red) and then immediately responds with an acknowledgment (in blue), which completes the procedure.

If the acknowledgment is not received by the sensor, it immediately resends the message and waits for acknowledgment.

If, after 3 acknowledgment requests, the sensor has not received anything, it repeats the procedure after 6 minutes, then 12 minutes, then 24 minutes if it still does not receive an acknowledgment. If it still has not received the acknowledgment at the end of these 24 minutes, it stops the procedure.



The total alert transmission duration is 350ms including the 250ms duration of the wake up and the message.

The acknowledgement duration is 80ms.

The communications uses CAD (Chanel Activity Detection) before transmission, wich means that it listens if the chanel is occupied before any transmission.

The sensor can also receive an RSSI order measurement from the searching tool.

The protocol is the same as alerts to the collector.

The range of the LoRa link is about 500m between the sensor and the collector. This area can be reduced if there are major obstacles (storage building, metal cladding, wood...).

The collector can communicate with an unlimited number of sensors.

Mechanical description :

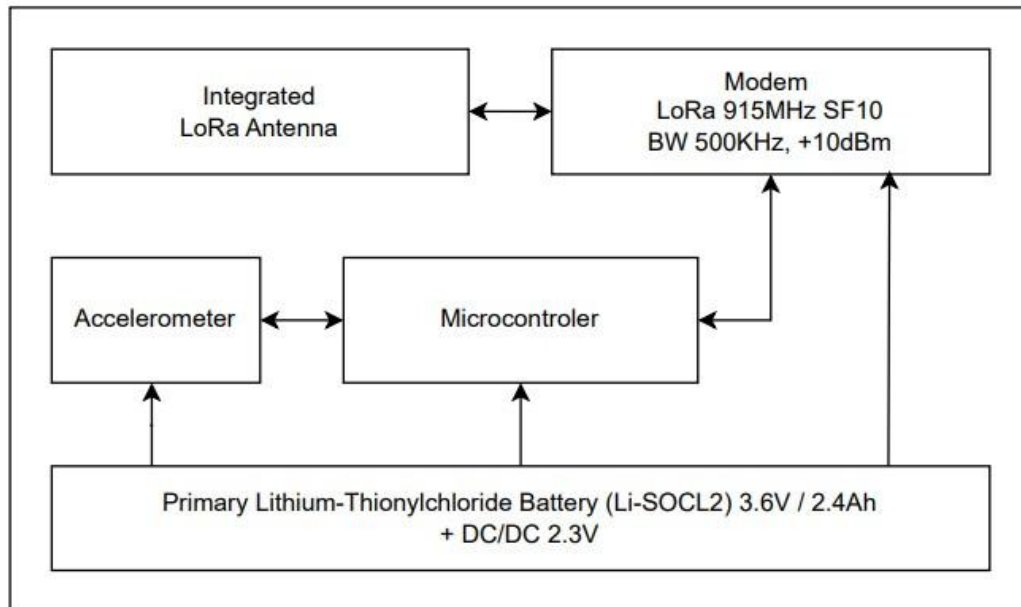
The enclosure is permanently sealed

The polycarbonate enclosure is rugged, and the IP class is 68

Bloc diagram :

Sensor

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Note :

The based SX1272 LoRa tranceiver is a zero IF transceiver.
So, the unique unwanted frequency is the 32MHz crystal.
The microcontroler has a 32.768KHz clock