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MClimate Flood Sensor LoRaWAN Device Communication protocol

DATE	VERSION	AUTHOR	COMMENT
25 November 2019	V1	Milan Stefanov	Initial draft
10 March 2020	V2	Milan Stefanov	1. Add a command to configure the keepalive intervals 2. Default Keepalive interval: 1 hour 3. Reducing the number of bytes in Payload. Reduced to 2 bytes 4. Add a command to read the temperature.
31 March 2020	V3	Milan Stefanov	Table 2 -> delete unused commands
23 April 2020	V4	Milan Stefanov	
26 May 2020	V5	Milan Stefanov	Update formula for battery voltage

1. Structure of the packets sent towards the radio devices.

With one packet of radio data one or more commands can be sent, as shown in table 1. The maximum available length of the packet is 50 bytes.

Index	Meaning
0	CMD-0 – Byte showing what command number 0 will execute
1	DATA-00 – Input data byte 0 for command 0
2	DATA-01 – Input data byte 1 for command 0
…	…
…	DATA-0n – Input data byte n for command 0
…	CMD-1 – Byte showing what command number 1 will execute
…	DATA-10 – Input data byte 0 for command 1
…	DATA-11 – Input data byte 0 for command 1
…	…
…	DATA-1j – Input data byte j for command 1
…	…
…	CMD-k – Byte showing what command number k will execute
…	DATA-k0 – Input data byte 0 for command k
…	DATA-k1 – Input data byte 1 for command k
…	…
49	DATA-km – Input data byte m for command k

Table 1

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In table 2 each command – byte CMD-x – is described with its input data.

CMD-x, [hex]	Meaning	Input data
01	Get temperature	none
02	LED activation	Data byte 0 – LED ID: 0x03: LED responsible for Flood; Data byte 1 – LED behavior: 0x01: ON; 0x02: Blink fast; 0x03: Blink slow; 0x04: OFF; Data byte 2 – duration for the specified LED behavior in seconds. If zero, do it until next LED related command is received or the verify button is pressed.
03	Buzzer control	Data byte 0: Buzzer volume and frequency. Bits 7:4: Buzzer volume: 0x0: Buzzer volume set to minimum available; 0x1: ... 0x2: ... 0x3: ... 0x4: ... 0x5: ... 0x6: ... 0x7: ... 0x8: ... 0x9: ... 0xA: ... 0xB: ... 0xC: ... 0xD: ... 0xE: Buzzer volume set to maximum available; 0xF: Buzzer is off. Bits 3:0 Buzzer frequency: 0x0: Buzzer frequency is 1kHz; 0x1: Buzzer frequency is 1.5kHz; 0x2: Buzzer frequency is 2kHz; 0x3: Buzzer frequency is 2.5kHz; 0x4: Buzzer frequency is 3kHz; 0x5: Buzzer frequency is 3.5kHz; 0x6: Buzzer frequency is 4kHz; 0x7: Buzzer frequency is 4.5kHz; 0x8: Buzzer frequency is 5kHz;

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		0x9: Buzzer frequency is 5.5kHz; 0xA: Buzzer frequency is 6kHz; 0xB: Reserved; 0xC: Reserved; 0xD: Reserved; 0xE: Reserved; 0xF: Reserved. Data byte 1: Time the buzzer to be active. Resolution – 1s. If zero, the buzzer will stay active until buzzer command with volume 0xF is received (buzzer turn-off) or the button is pressed. During this time the buzzer continuously alternate loud and silent states. Data byte 2: On time from the buzz loud-silent period. Resolution – 10ms. Data byte 3: Off time from the buzz loud-silent period. Resolution – 10ms.
04	Set flood alarm time	Data byte 0 – alarm time value. Resolution is 10s. A zero value is forbidden.
05	Set radio packet send period	Data byte 0 - MSB Data byte 1 – LSB Period for radio packet send. Resolution is 1 minute. Default value is 5.
55	Notification for received packet by the application server	None

Table 2

2. Structure of the packet sent from the radio device.

Byte index	Bit index	Meaning
0	7:5	Reason to send the packet: 0b000: Time period elapsed (5 minutes); 0b001: Device test switches combination is pressed; 0b010: Flood detected by device sensor; 0b100: Fraud detected – box tamper switch or magnetic sensor.
	4	reserved
	3	Box tamper status: 0: No box tamper detected; 1: Box tamper detected.
	2	reserved
	1	Flood detection status:

		0: No flood detected; 1: Flood detected.
	0	reserved
1	7:0	Battery voltage. It is calculated by the formula: Battery voltage, [mV] = (bits7:0)*16
2*	7:0	Temperature sensor 1 value in Celsius degrees.

* this byte is only sent if command from the server is received

3.Behavior

The device starts to establish connection to LoRaWAN network immediately after power up. User can check the communication status with pressing the button B1. If the device Is Joined to the network, the LED1 flashes for 1 second, one time. If connection does not established yet, the LED1 blinks few times with 500mS duration. The default keepalive period is 60min (at now 3 min for developing). In every 60 minutes T-Flood sending two bytes of payload (status and battery voltage). Users can check the device temperature with sending command 0x01. Next keepalive will be three bytes. The third byte represents measured temperature. Next keepalive messages will be again two bytes.

If flood is measured, the device will wake up immediately. There is no flood checking intervals. The flood generate interrupt and wake up the device. The buzzer is beeping all the time if flood is present. If flood is stop, then the beeping stops.

3.1 Current consumption

There is different current consumption intervals described in table below. All of them are measured with an oscilloscope and 10 Ohm shunt resistor and added to table below. The form of pulse 1, 2 and 3 and measured timing and values are saved as pictures. Measured consumption were calculate in worst case scenario in Speeding Factor 12

	sleeping	self discharge	0	1	2	3
current consumption [mA]	0,0000012		8	24	9	9
pulse duration [s]			0,0006	1,15	0,19	1,2
pulse interval [s]			15	3600	3600	3600
daily counter [number]			5760	24	24	24
daily wakups duration [s]			3,456	27,6	4,56	28,8
daily consumption [mAh]	0,0000288		0,00768	0,184	0,0114	0,072

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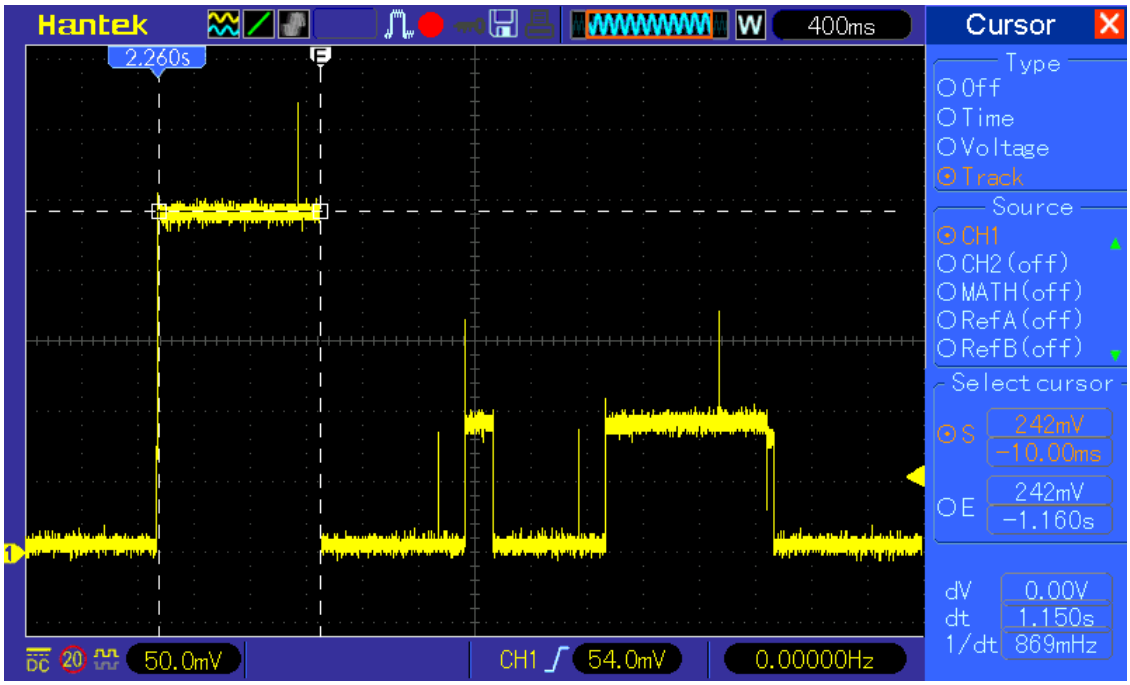
year consumption [mAh]	0,010512	10,5	2,8032	67,16	4,161	26,28	TOTAL
10 year [mAh]	0,10512	105	28,032	671,6	41,61	262,8	1109,15

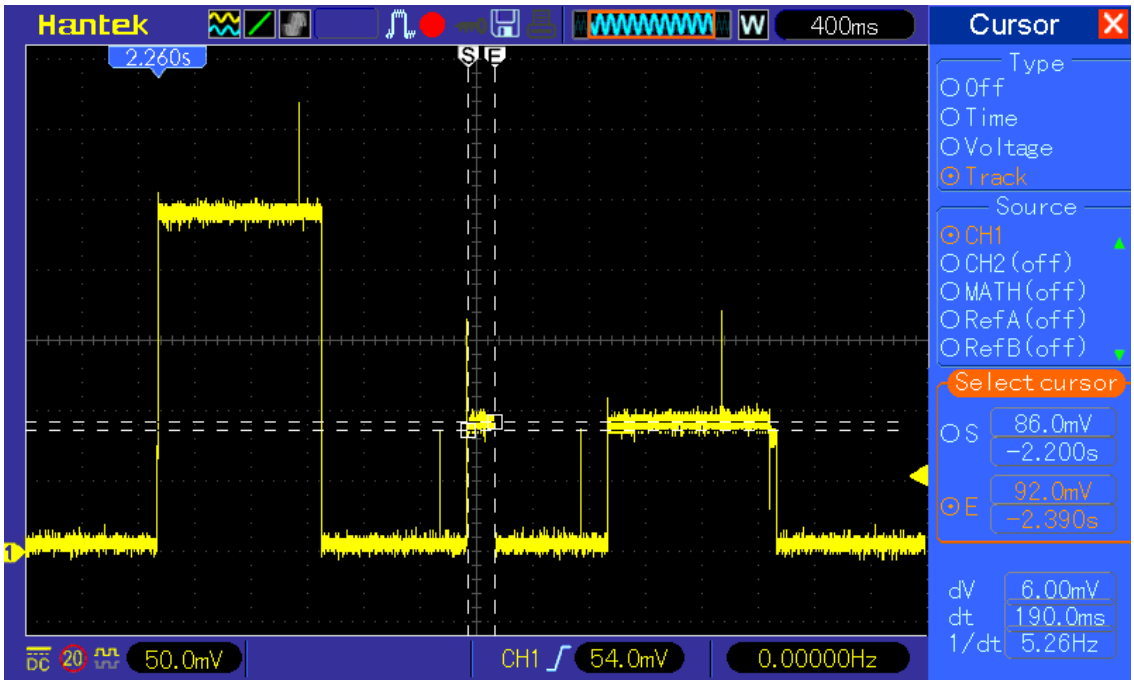
Pulse 1: Transmitting

The device is consuming 24mA for 1,15s



Pulse 2: Receive interval 1

The device is consuming 9mA for 190mS



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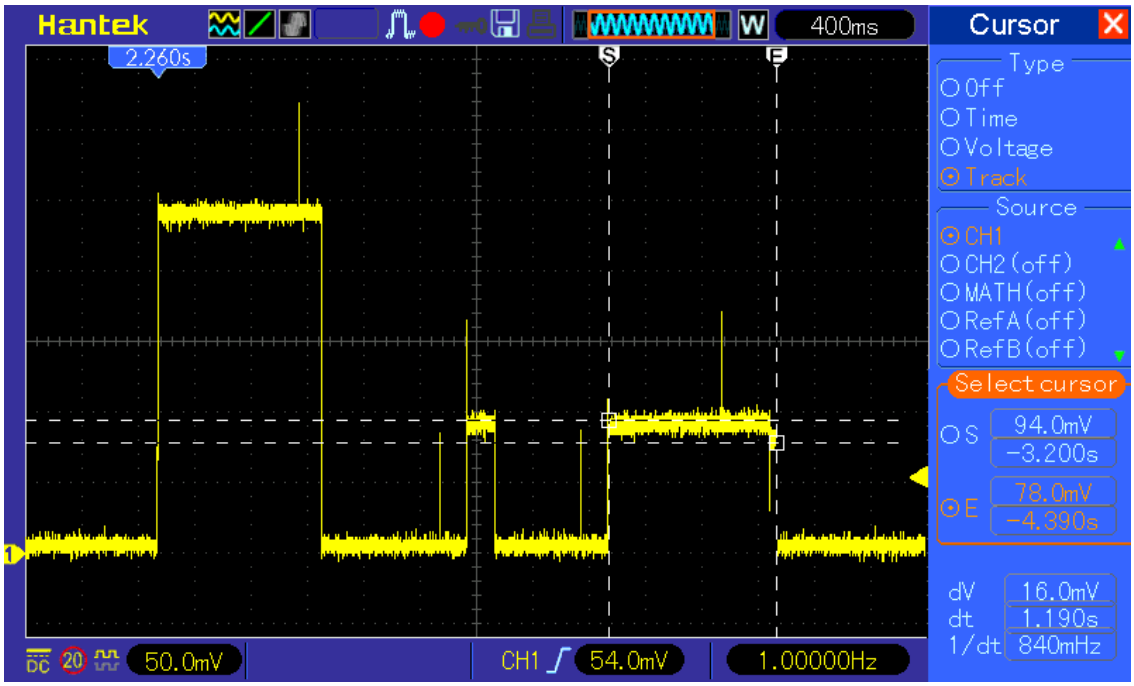
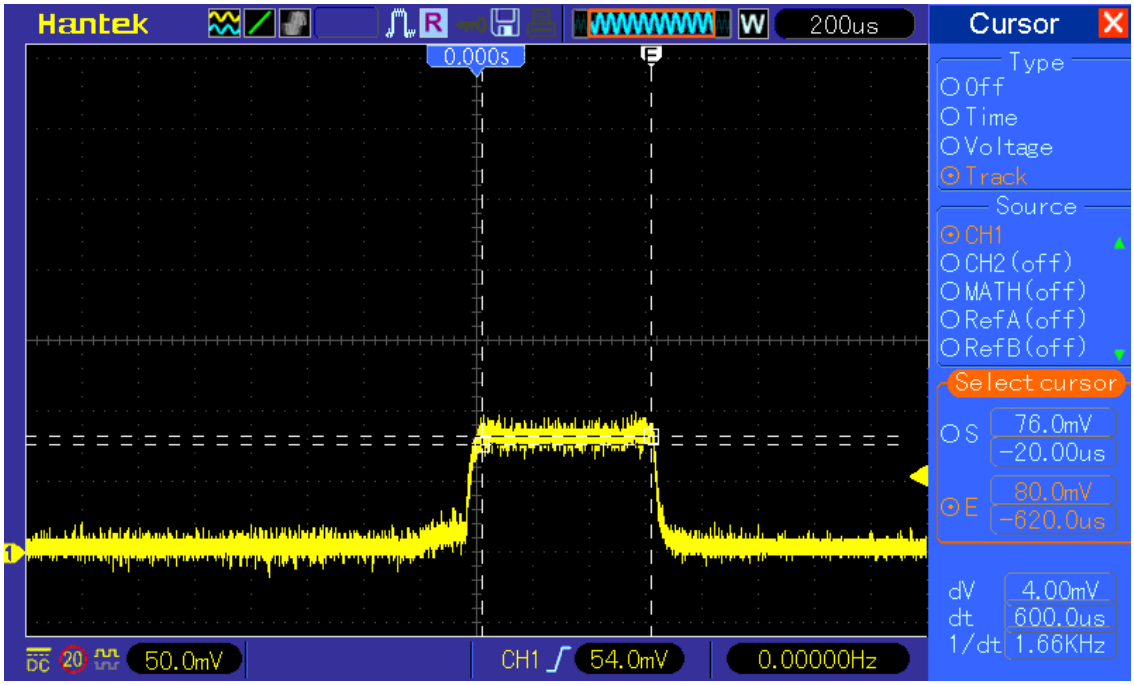
Pulse 3: Receive interval 2

The device is consuming 9mA for 1,19s



Pulse 0: This interval represents wakeup of every 15 sec with duration of 400uS, to check some system timings.



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