Pilot LoRa Outdoor Gateway

Product Specification V 0.8

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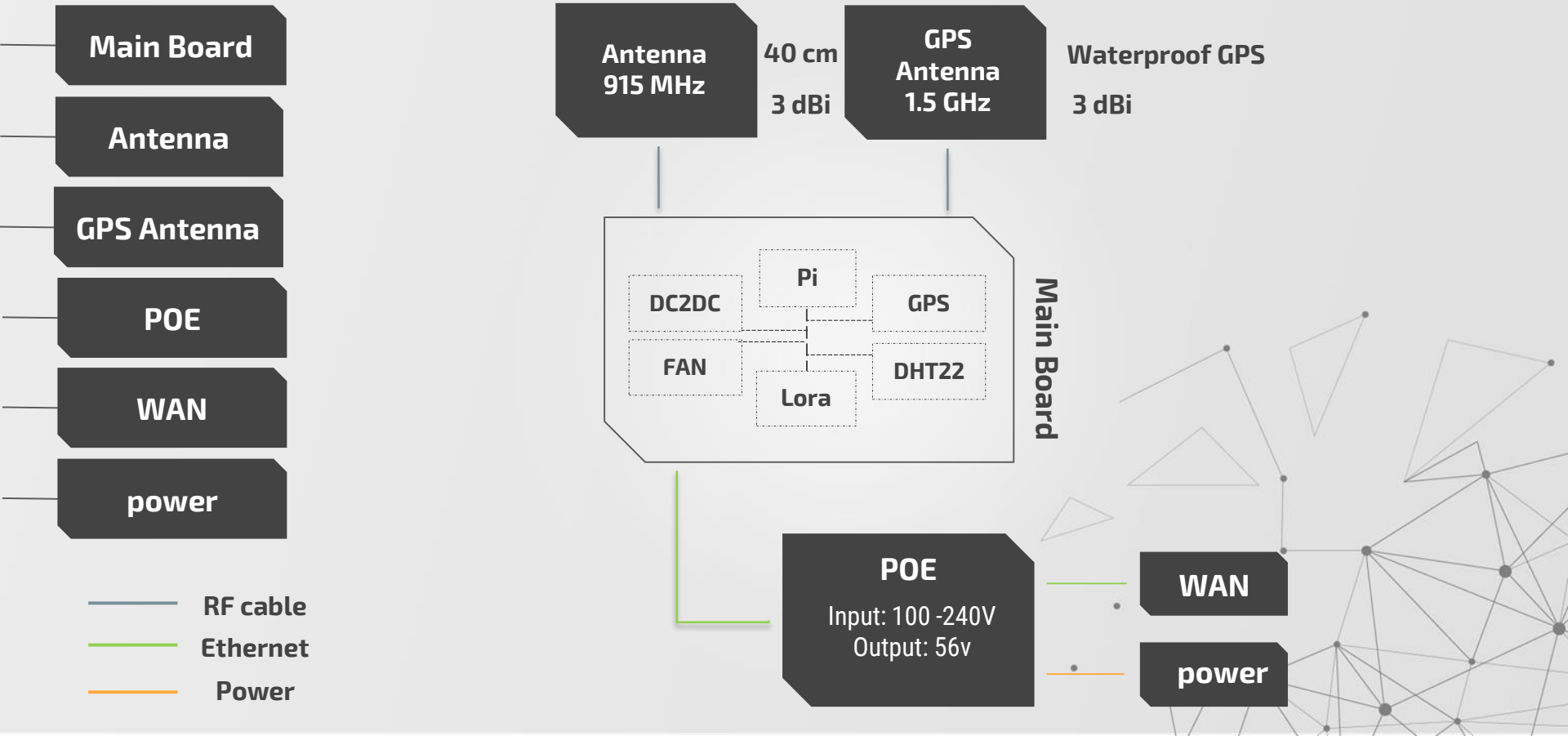
01

Basic Equipment

Gateway assembly framework illustration



Gateway Partlist

Box

Mount kit

Antenna

RF cable

GPS

Ethernet

Power

PoE

DC to DC

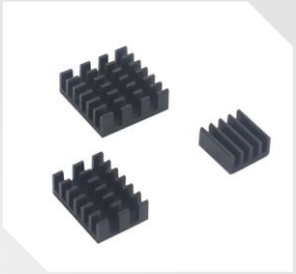
Fan

Gateway Partlist

USB

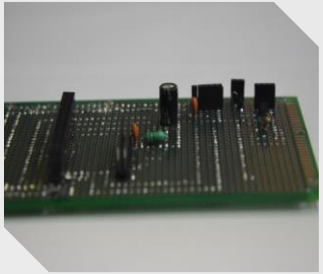
Eth cable

Spacer



Heatsink

RAM

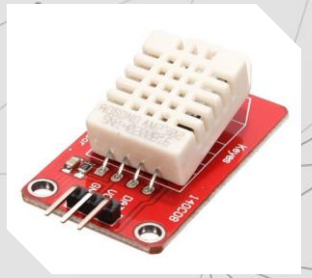


Main board

Raspberry

LoRa

GPS



DHT22

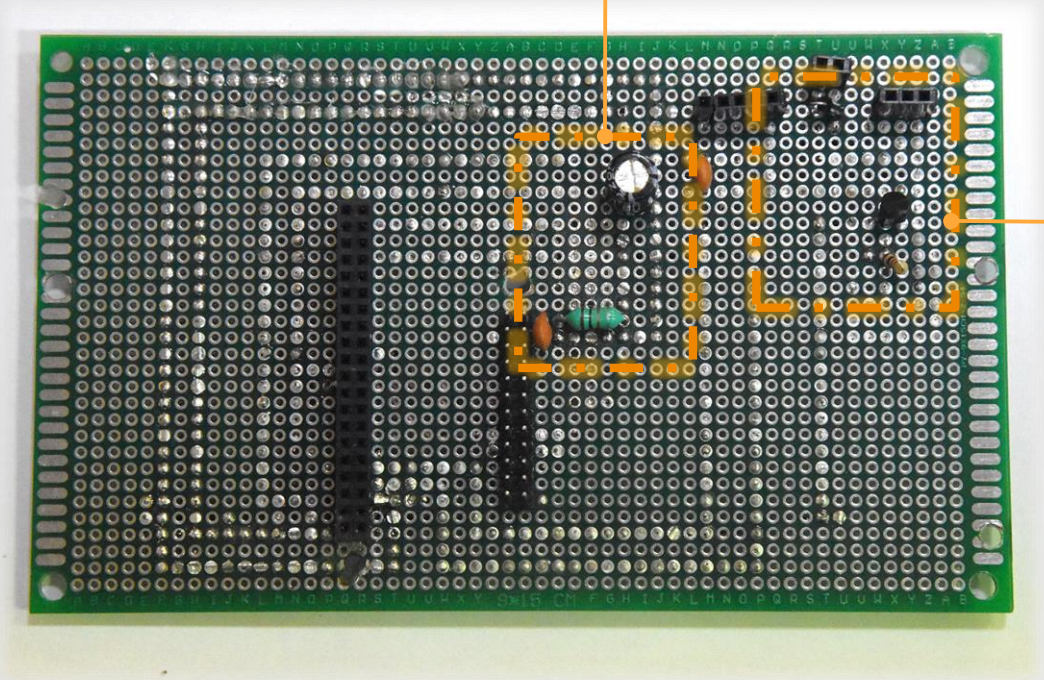
Main board

Noise Reduction Circuit

1- Capsitor(470 microF)

2- Inductor (1 m henry)

3- Capasitor(100nF)



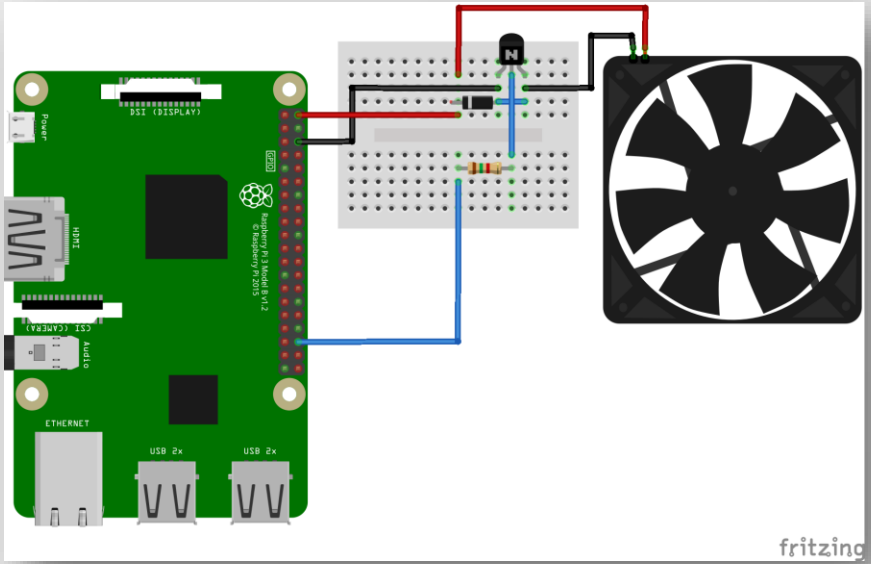
Fan Controller Circuit

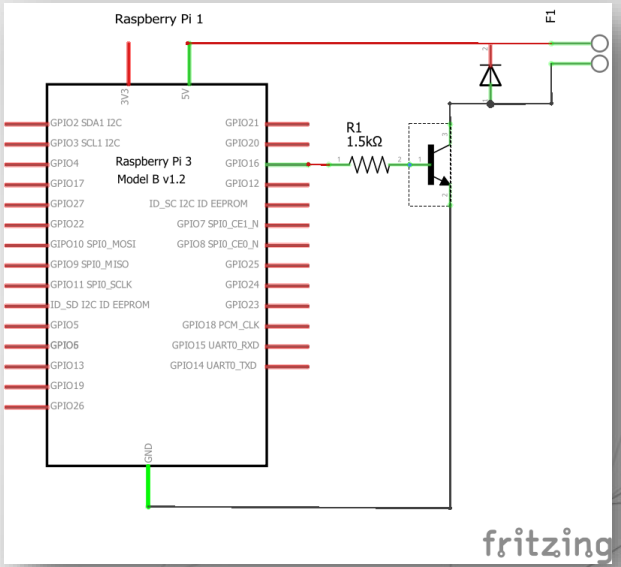
1- NPN transistor (2N2222)

2- 1.5k ohm resistor

3- diode (1N4001)

Fan Controller Circuit





Fan= 200mA, 5V
B=2mA,0.7V

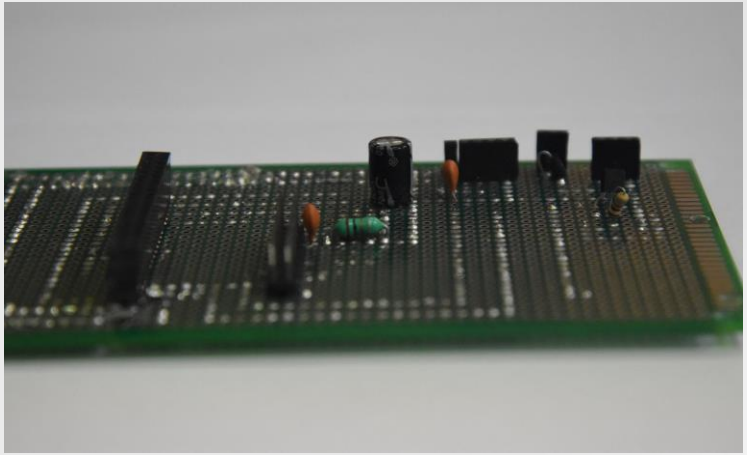
5 - 0.7 = 4.3V
4.3 / 0.002=2000 ohm

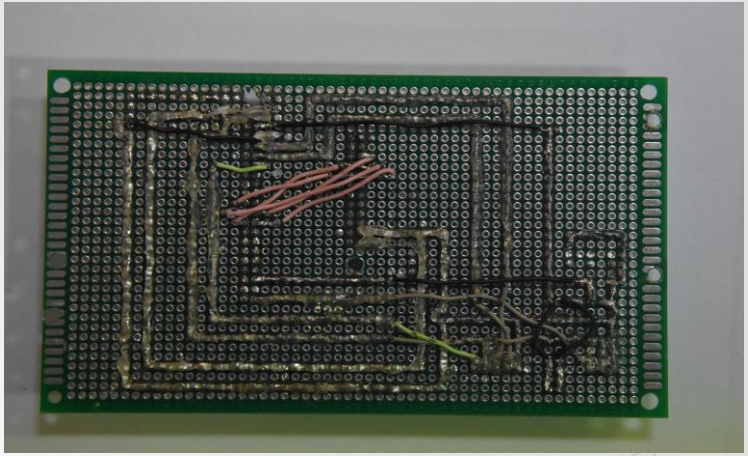
Fan Controller Circuit

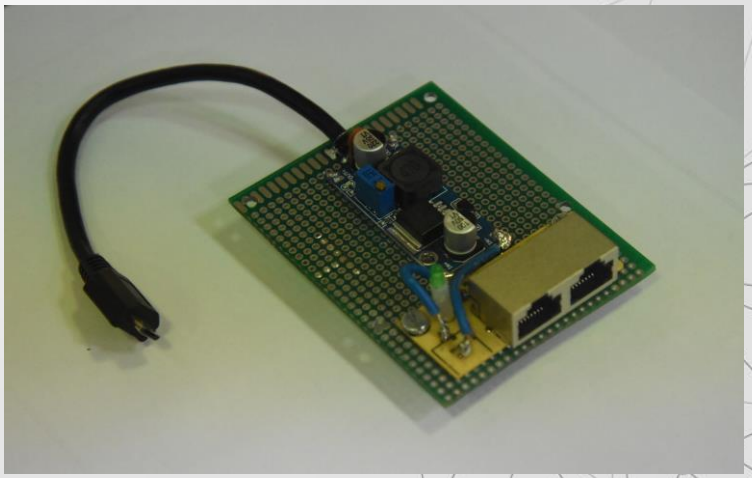
```python
import subprocess
import os
import time
import Adafruit_DHT as dht

from gpiozero import OutputDevice


HIGH_THRESHOLD_CORE = 48
LOW_THRESHOLD_CORE = 39
GPIO_PIN_CORE = 16
fanCore=0

SLEEP_INTERVAL= 5

HIGH_THRESHOLD_DHT = 24
LOW_THRESHOLD_DHT = 22
GPIO_PIN_DHT = 21
fanDHT=0
```

```python
def getTemp():
    output=os.popen("vcgencmd measure_temp").readline()
    h,tempDHT = dht.read_retry(dht.DHT22, GPIO_PIN_DHT)
    tempCore=float(output.split('=')[1].split('\'')[0])
    return tempCore,tempDHT

if (LOW_THRESHOLD_CORE >= HIGH_THRESHOLD_CORE) or (LOW_THRESHOLD_DHT >= HIGH_THRESHOLD_DHT):
    raise RuntimeError('OFF_THRESHOLD must be less than ON_THRESHOLD')

fan = OutputDevice(GPIO_PIN_CORE)
fan.on()
while True:
    tempCore,tempDHT = getTemp()
    print(tempCore)
    print(tempDHT)
    if (tempCore >= HIGH_THRESHOLD_CORE and fanCore==0):
        fan.off()
        fanCore=1
    elif (tempCore <= LOW_THRESHOLD_CORE and fanCore==1):
        fan.on()
        fanCore=0
    elif (tempDHT >= HIGH_THRESHOLD_DHT and fanDHT==0):
        fan.off()
        fanDHT=1
    elif (tempDHT <= LOW_THRESHOLD_DHT and fanDHT==1):
        fan.on()
        fanDHT=0
    time.sleep(SLEEP_INTERVAL)
```

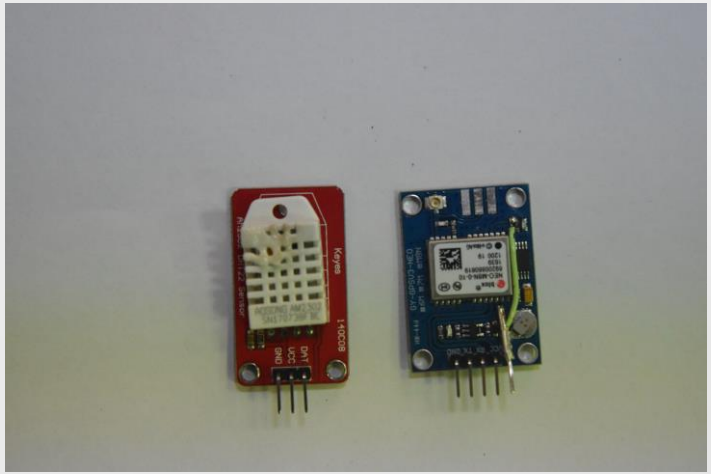
Installation





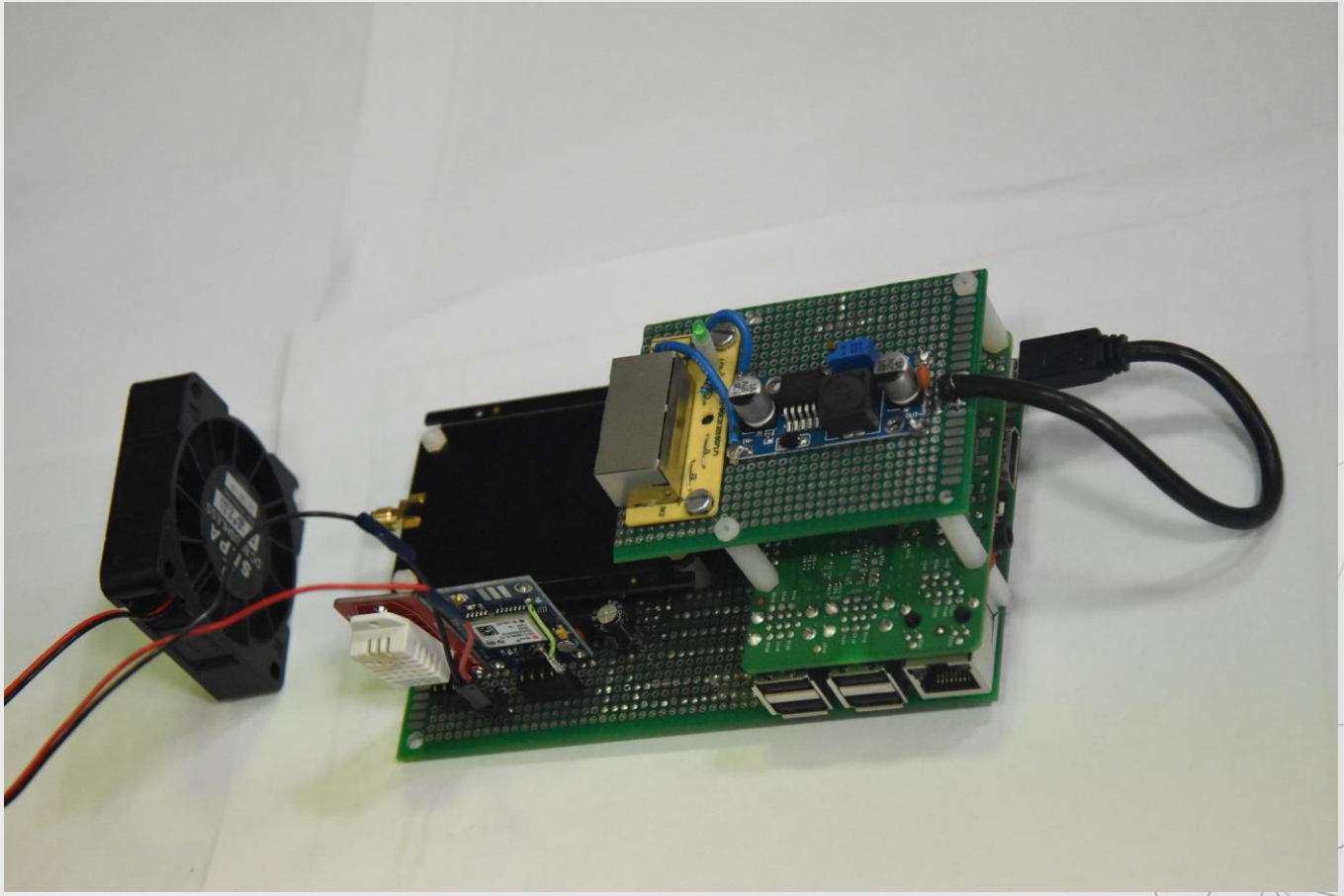


Installation



Installation

Installation



Installation

01
Software

Services

Fan Controller

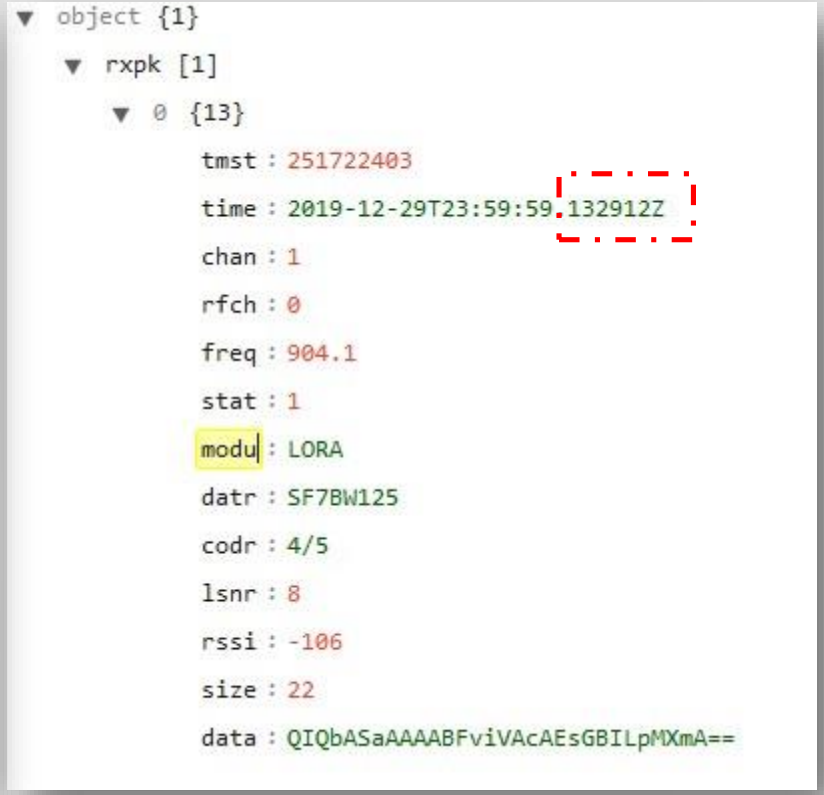
1- Start
2- Read CPU Temp and DHT22
3- Comparison with threshold
4- Start/Stop

Packet Forwarder

1- packet forwarder is program running on the host
2- Semtech UDP Packet Forwarder
3- receive and transmits LoRa packets
4- calculation(RSSI,SNR,Time,...)
5- send/receive JSON Object

JSON Object


```
{"rxpk":[{"tmst":251722403,"time":"2019-12-29T23:59:59.132912Z"
,"chan":1,"rfch":0,"freq":904.100000,"stat":1,"modu":"LORA","datr"
:"SF7BW125","codr":"4/5","lsnr":8.0,"rssi":-106,"size":22,"data"
:"QIQbASaAAAABFviVAcAEsGBILpMXmA=="}]}
```

Packet Forwarder

```
pi@LoRa-Gateway:/opt/ttn-gateway/packet_forwarder $ ls -l
total 72
drwxr-xr-x 5 root root  4096 Nov 13 17:12 basic_pkt_fwd
drwxr-xr-x 5 root root  4096 Nov 13 17:12 beacon_pkt_fwd
drwxr-xr-x 5 root root  4096 Nov 13 17:12 gps_pkt_fwd
-rw-r--r-- 1 root root  2612 Nov 13 17:12 LICENSE
-rw-r--r-- 1 root root   603 Nov 13 17:12 Makefile
drwxrwxrwx 5 root root  4096 Nov 14 06:44 poly_pkt_fwd
-rw-r--r-- 1 root root 14059 Nov 13 17:12 PROTOCOL.TXT
-rw-r--r-- 1 root root  8400 Nov 13 17:12 readme.md
-rwxr-xr-x 1 root root  2288 Nov 13 17:12 reset_pkt_fwd.sh
drwxr-xr-x 4 root root  4096 Nov 13 17:13 util_ack
drwxr-xr-x 4 root root  4096 Nov 13 17:13 util_sink
drwxr-xr-x 5 root root  4096 Nov 13 17:13 util_tx_test
-rw-r--r-- 1 root root     6 Nov 13 17:12 VERSION
```

```
pi@LoRa-Gateway:/opt/ttn-gateway/packet_forwarder/poly_pkt_fwd $ ls -l
total 156
-rw-r--r-- 1 root root   7440 Nov 13 17:12 global_conf.json
drwxr-xr-x 2 root root   4096 Nov 13 17:12 inc
-rw-r--r-- 1 root root    430 Nov 13 17:12 local_conf.json
-rwxrwxrwx 1 root root   2250 Nov 13 17:12 Makefile
drwxr-xr-x 2 root root   4096 Nov 14 06:44 obj
-rwxr-xr-x 1 root root 117780 Nov 14 06:44 poly_pkt_fwd
-rw-r--r-- 1 root root   8802 Nov 13 17:12 readme.md
drwxrwxrwx 2 root root   4096 Nov 14 06:41 src
```

```
pi@LoRa-Gateway:/opt/ttn-gateway/packet_forwarder/poly_pkt_fwd/src $ ls -l
total 172
-rwxrwxrwx 1 root root   9551 Nov 13 17:12 base64.c
-rwxrwxrwx 1 root root  12180 Nov 13 17:12 ghost.c
-rwxrwxrwx 1 root root  14977 Nov 13 17:12 monitor.c
-rwxrwxrwx 1 root root  26280 Nov 13 17:12 parson.c
-rw-r--r-- 1 pi   pi   105535 Apr 18  2019 poly_pkt_fwd.c
```

Packet Forwarder

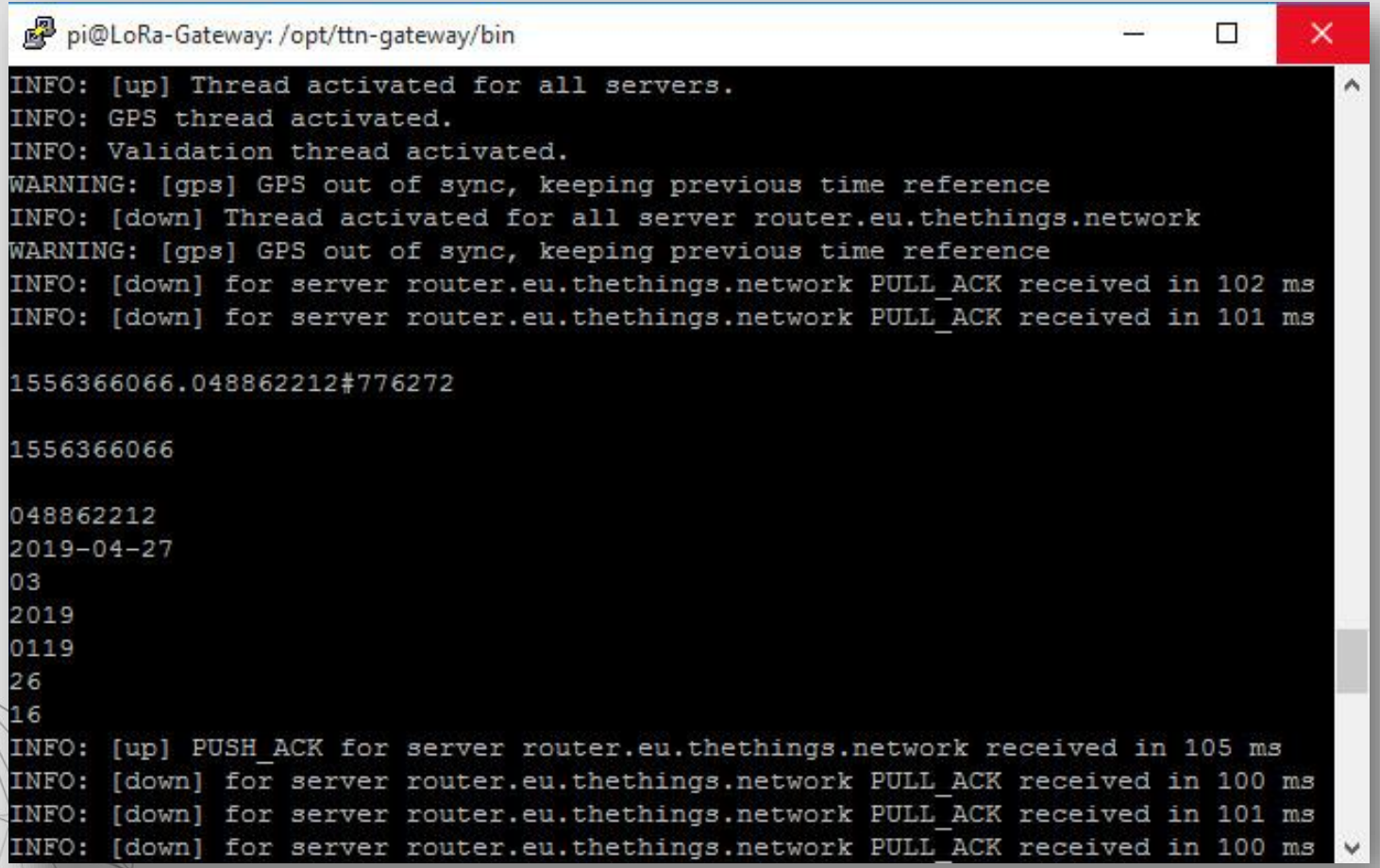
```
/* ---------------------------------------------------------------------------- */
/* --- PRIVATE FUNCTIONS DEFINITION ----------------------------------------- */

void substring1(const char *source, char *dest, size_t start, size_t length) {
  size_t source_len = strlen(source);
  if (start > source_len) start = source_len;
  if (start + length > source_len) length = source_len - start;
  memmove(dest, &source[start], length);
  dest[length] = 0;
}

unsigned long ToUInt(char* str)
{
    unsigned long mult = 1;
    unsigned long re = 0;
    int len = strlen(str);
    for(int i = len -1 ; i >= 0 ; i--)
    {
        re = re + ((int)str[i] -48)*mult;
        mult = mult*10;
    }
    return re;
}
```

```
(now->tm_year)+1900, (now->tm_mon)+1, now->tm_mday, now->tm_hour, now->tm_min, now->tm_sec, (ToUInt(timeN)));
```

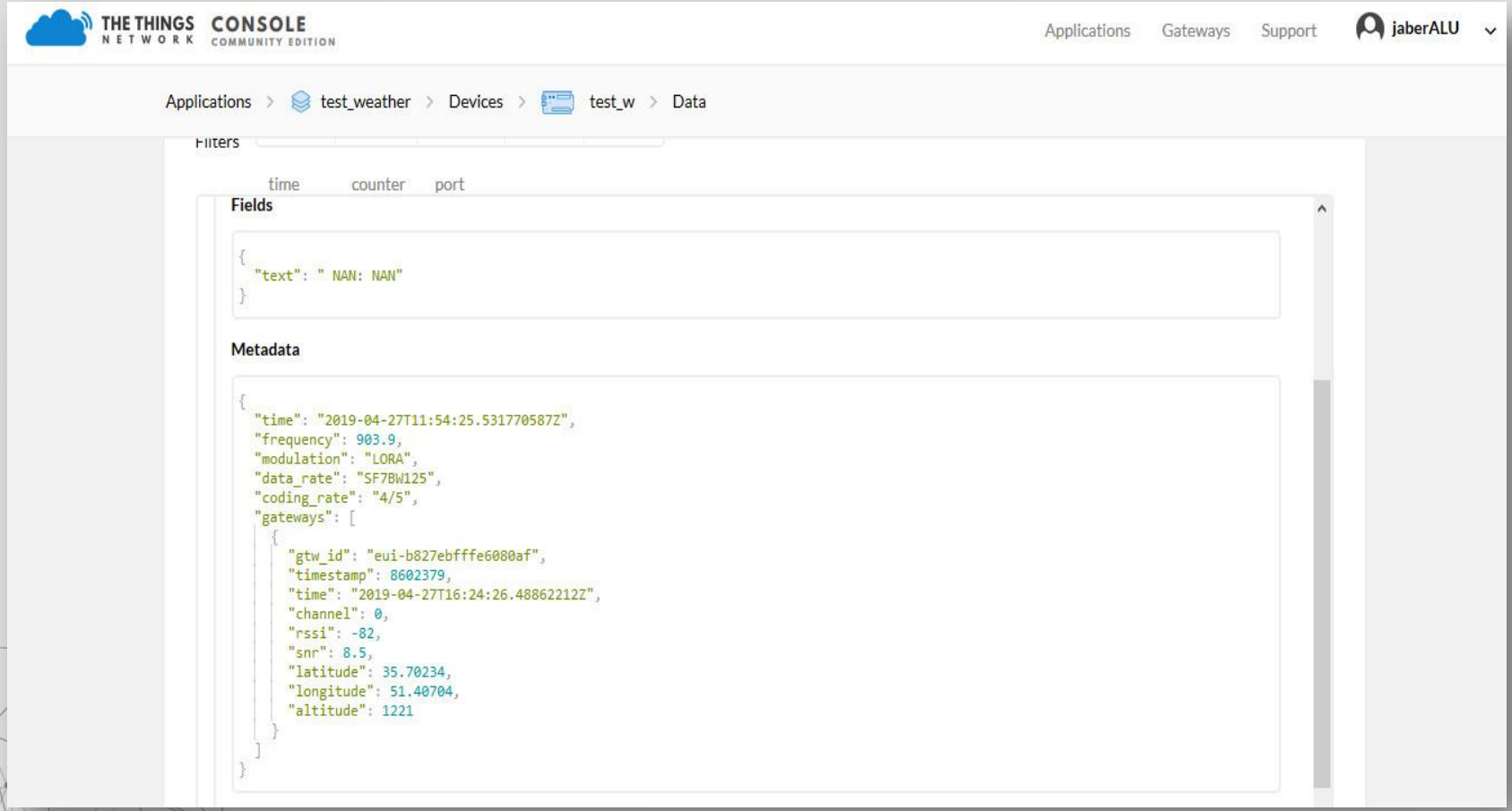
01

Test/Result

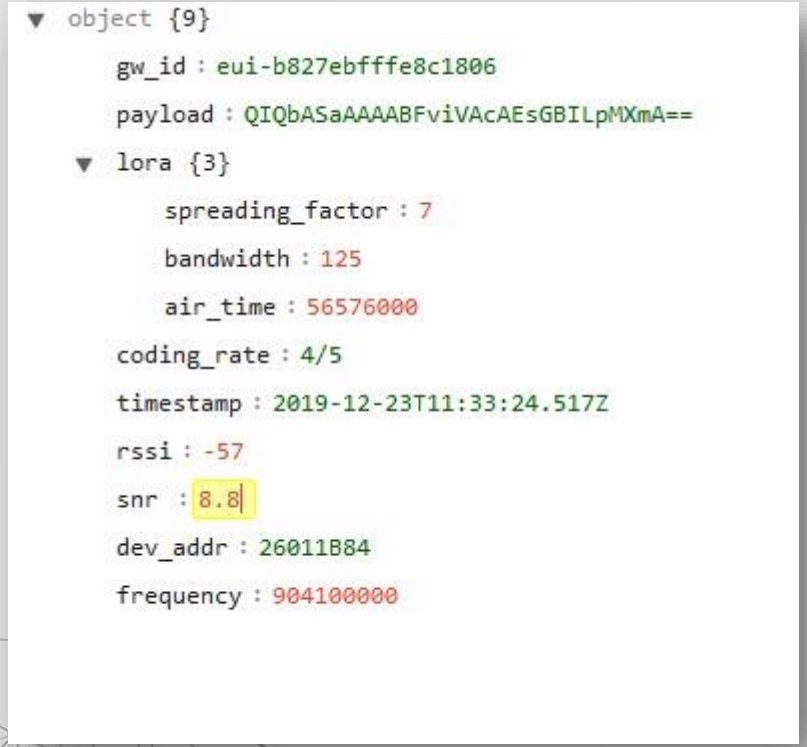
Nano Second


pi@LoRa-Gateway: /opt/ttn-gateway/bin
INFO: [up] Thread activated for all servers.
INFO: GPS thread activated.
INFO: Validation thread activated.
WARNING: [gps] GPS out of sync, keeping previous time reference
INFO: [down] Thread activated for all server router.eu.thethings.network
WARNING: [gps] GPS out of sync, keeping previous time reference
INFO: [down] for server router.eu.thethings.network PULL_ACK received in 102 ms
INFO: [down] for server router.eu.thethings.network PULL_ACK received in 101 ms
1556366066.048862212#776272
1556366066
048862212
2019-04-27
03
2019
0119
26
16
INFO: [up] PUSH_ACK for server router.eu.thethings.network received in 105 ms
INFO: [down] for server router.eu.thethings.network PULL_ACK received in 100 ms
INFO: [down] for server router.eu.thethings.network PULL_ACK received in 101 ms
INFO: [down] for server router.eu.thethings.network PULL_ACK received in 100 ms

Nano Second

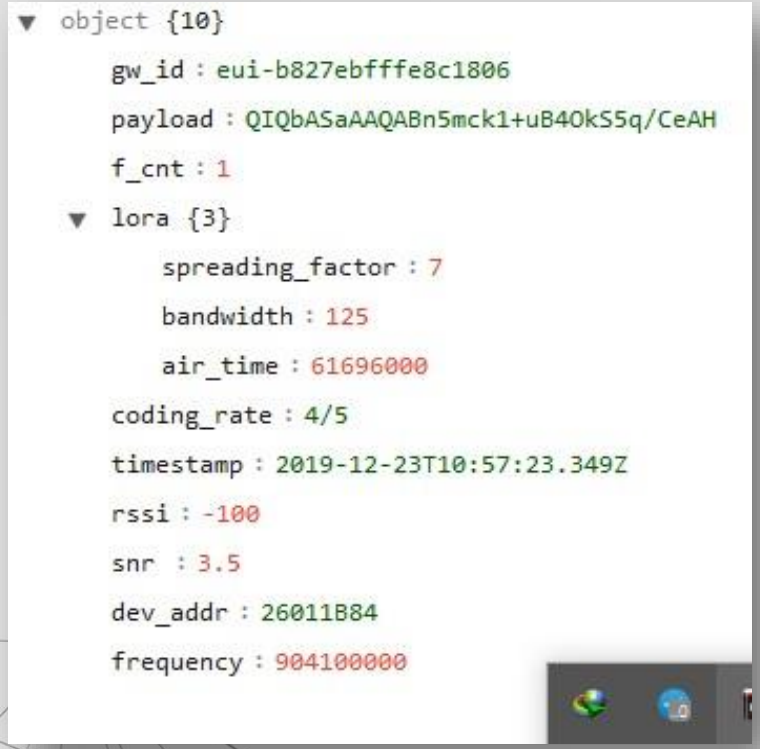

THE THINGS NETWORK CONSOLE COMMUNITY EDITION
Applications
Gateways
Support
jaberALU
Applications > test_weather > Devices > test_w > Data
Filters
time
counter
port
Fields
{
"text": " NAN: NAN"
}
Metadata
{
"time": "2019-04-27T11:54:25.5317705872",
"frequency": 903.9,
"modulation": "LORA",
"data_rate": "SF7BW125",
"coding_rate": "4/5",
"gateways": [
{
"gtw_id": "eui-b827ebfffe6080af",
"timestamp": 8602379,
"time": "2019-04-27T16:24:26.488622122",
"channel": 0,
"rssi": -82,
"snr": 8.5,
"latitude": 35.70234,
"longitude": 51.40704,
"altitude": 1221
}
]
}

SNR/RSSI


object {9}
gw_id : eui-b827ebfffe8c1806
payload : QIQbASaAAAABFviVAcAEsGBILpMXmA==
lora {3}
spreading_factor : 7
bandwidth : 125
air_time : 56576000
coding_rate : 4/5
timestamp : 2019-12-23T11:33:24.517Z
rssi : -57
snr : 8.8
dev_addr : 26011B84
frequency : 904100000


object {9}
gw_id : eui-b827ebfffe8c1806
payload : QIQbASaAAAABFviVAcAEsGBILpMXmA==
lora {3}
spreading_factor : 7
bandwidth : 125
air_time : 56576000
coding_rate : 4/5
timestamp : 2019-12-23T10:57:00.785Z
rssi : -103
snr : 1.8
dev_addr : 26011B84
frequency : 904100000

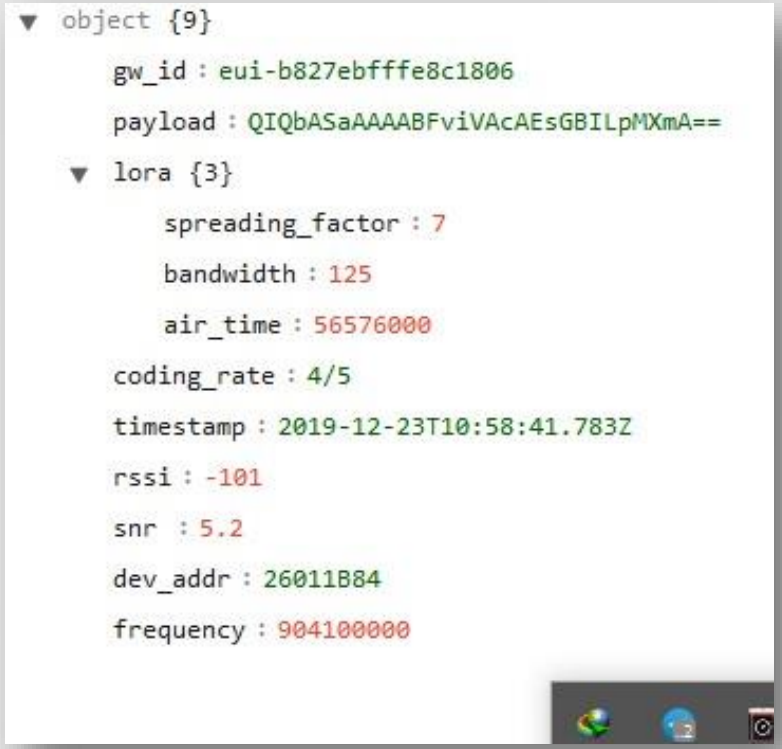
SNR/RSSI


object {10}
gw_id : eui-b827ebfffe8c1806
payload : QIQbASaAAQABn5mck1+uB4OkS5q/CeAH
f_cnt : 1
lora {3}
spreading_factor : 7
bandwidth : 125
air_time : 61696000
coding_rate : 4/5
timestamp : 2019-12-23T10:57:23.349Z
rssi : -100
snr : 3.5
dev_addr : 26011B84
frequency : 904100000


object {9}
gw_id : eui-b827ebfffe8c1806
payload : QIQbASaAAAABFviVAcAEsGBILpMXmA==
lora {3}
spreading_factor : 7
bandwidth : 125
air_time : 56576000
coding_rate : 4/5
timestamp : 2019-12-23T10:57:37.969Z
rssi : -103
snr : 2.5
dev_addr : 26011B84
frequency : 904100000

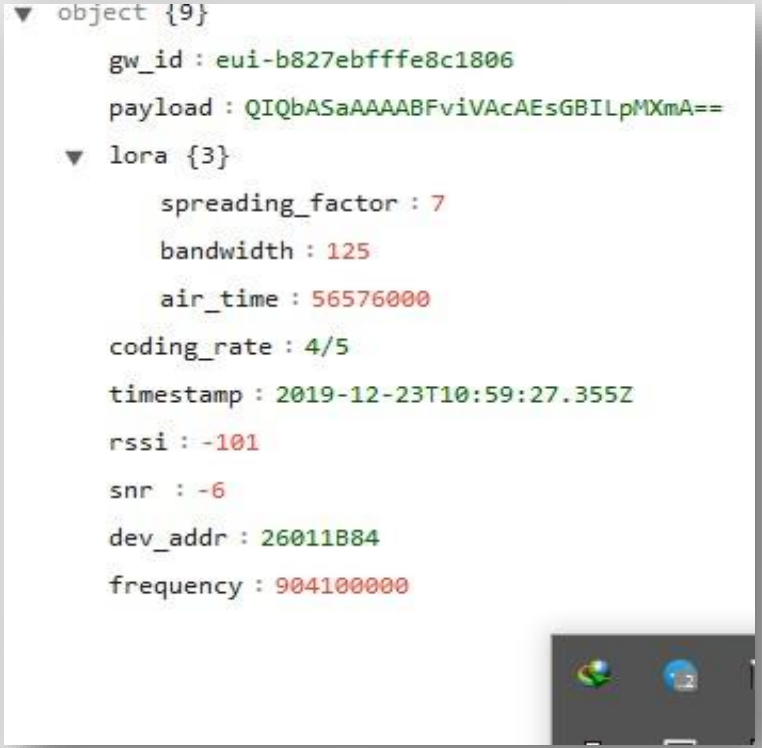
SNR/RSSI


▼ object {9}
gw_id : eui-b827ebfffe8c1806
payload : QIQbASaAAAABFviVAcAEsGBILpMXmA==
▼ lora {3}
spreading_factor : 7
bandwidth : 125
air_time : 56576000
coding_rate : 4/5
timestamp : 2019-12-23T10:58:00.145Z
rssi : -97
snr : 5.2
dev_addr : 26011B84
frequency : 904100000


▼ object {9}
gw_id : eui-b827ebfffe8c1806
payload : QIQbASaAAAABFviVAcAEsGBILpMXmA==
▼ lora {3}
spreading_factor : 7
bandwidth : 125
air_time : 56576000
coding_rate : 4/5
timestamp : 2019-12-23T10:58:41.783Z
rssi : -101
snr : 5.2
dev_addr : 26011B84
frequency : 904100000

SNR/RSSI


object {10}
gw_id : eui-b827ebfffe8c1806
payload : QIQbASaAAQABn5ecll+uB4OkTZrXmvrq
f_cnt : 1
lora {3}
spreading_factor : 7
bandwidth : 125
air_time : 61696000
coding_rate : 4/5
timestamp : 2019-12-23T10:59:10.399Z
rssi : -106
snr : -3.2
dev_addr : 26011B84
frequency : 904100000


object {9}
gw_id : eui-b827ebfffe8c1806
payload : QIQbASaAAAABFviVAcAEsGBILpMXmA==
lora {3}
spreading_factor : 7
bandwidth : 125
air_time : 56576000
coding_rate : 4/5
timestamp : 2019-12-23T10:59:27.355Z
rssi : -101
snr : -6
dev_addr : 26011B84
frequency : 904100000

SNR/RSSI


```
▼ object {9}
    gw_id : eui-b827ebfffe8c1806
    payload : QIQbASaAAAABFviVAcAEsGBILpMXmA==
  ▼ lora {3}
      spreading_factor : 7
      bandwidth : 125
      air_time : 56576000
    coding_rate : 4/5
    timestamp : 2019-12-23T10:59:51.947Z
    rssi : -107
    snr  : -1
    dev_addr : 26011B84
    frequency : 904100000
```

```
▼ object {9}
    gw_id : eui-b827ebfffe8c1806
    payload : QIQbASaAAAABFviVAcAEsGBILpMXmA==
  ▼ lora {3}
      spreading_factor : 7
      bandwidth : 125
      air_time : 56576000
    coding_rate : 4/5
    timestamp : 2019-12-23T11:00:20.677Z
    rssi : -106
    snr  : -4
    dev_addr : 26011B84
    frequency : 904100000
```

THANKS

Does anyone have any questions?