Dragino ZHZ50V3NB NB-IoT Sensor Node User Manual

Contents

Dragino ZHZ50V3NB NB-IoT Sensor Node

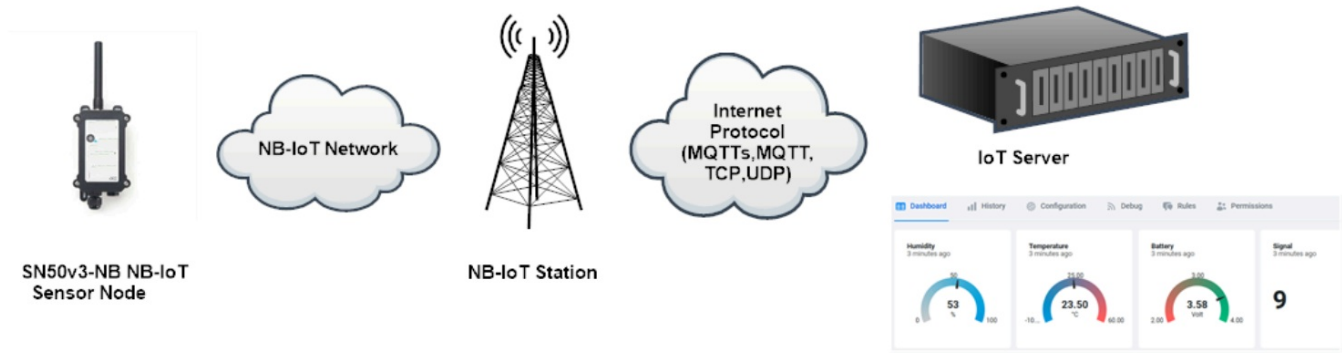
Introduction

What is SN50v3-NB NB-IoT Sensor Node

SN50v3-NB is a Long Range NB-IoT Sensor Node. It is designed to facilitate developers to quickly deploy industrial-level NB-IoT solutions. It helps users to turn the idea into a practical application and make the Internet of Things a reality. It is easy to program. create and connect your things everywhere.

- SN50v3-NB wireless part is based on NB model allows the user to send data and reach extremely long ranges at low data rates.It provides ultra-long range spread spectrum communication and high interference immunity whilst minimising current consumption.It targets professional wireless sensor network applications such as irrigation systems, smart metering, smart cities, building automation, and so on.
- SN50v3-NB uses STM32I0x chip from ST, STML0x is the ultra-low-power STM32L072xxxx microcontrollers incorporate the connectivity power of the universal serial bus (USB 2.0 crystal-less) with the high-performance ARM® Cortex®-M0+ 32-bit RISC core operating at a 32 MHz frequency, a memory protection unit (MPU), high-speed embedded memories (192 Kbytes of Flash program memory, 6 Kbytes of data EEPROM and 20 Kbytes of RAM) plus an extensive range of enhanced I/Os and peripherals.
- SN50v3-NB is an open source product, it is based on the STM32Cube HAL drivers and lots of libraries can be found in ST site for rapid development.
- SN50v3-NB supports different uplink methods including MQTT, MQTTs, UDP & TCP for different application requirement, and support uplinks to various IoT Servers.
- SN50v3-NB supports BLE configure and OTA update which make user easy to use.
- SN50v3-NB is powered by 8500mAh Li-SOCI2 battery, it is designed for long-term use up to several years.
- SN50v3-NB has optional built-in SIM card and default IoT server connection version. Which makes it works with simple configuration.

SN50v3-NB in a NB-IoT Network



Features

- NB-IoT Bands: B2/B4/B5/B12/B13/B17/B25/B66/B85 @H-FDD
- Ultra-low power consumption
- Open-source hardware I software
- Multiply Sampling and one uplink
- Support Bluetooth remote confi uge and u date firmware
- Uplink via MQTT, MQTTs, TCP, or UDP
- Uplink on periodically
- Downlink to change configure
- 8500mAh Battery for long-term use
- Nano SIM card slot for NB-IoT SIM

Specification

Common DC Characteristics:

- Supply Voltage: 2.5v ~ 3.6v
- Operating Temperature: -40 ~ 85° C

1/0 Interface:

- Battery output (2.6v ~ 3.6v depends on battery)
- +5v controllable output
- 3 x Interrupt or Digital IN/OUT pins
- 3 x one-wire interfaces
- 1 x UART Interface
- 1 x I2C Interface

NB-IoT Spec:
NB-IoT Module:

BC660K-GL Support Bands:

BLE — 24O2—248O(MHz) NB-LOT Band2—-185O–191O(MHz) NB-LOT Band4—-171O–1755(MHz) NB-LOT Band5—-824—-849(MHz) NB-LOT Band12—-699—716(MHz) NB-LOT Band13—-777—-787MHz) NB-LOT Band17—-7O4—7O6(MHz) NB-LOT Band25—-185O-1915(MHz) NB-LOT Band66—-171O-178O(MHz) NB-LOT

Band85—-698—716(MHz)

- Li/SOCl2 un-chargeable battery
- Capacity: 8500mAh
- Self Discharge: < 1 % / Year @ 25 ° C
- Max continuously current: 130mA
- Max boost current: 2A, 1 second

Power Consumption

- STOP Mode: 1 0uA @ 3.3v
- Max transmit power: 350mA@3.3v

Applications

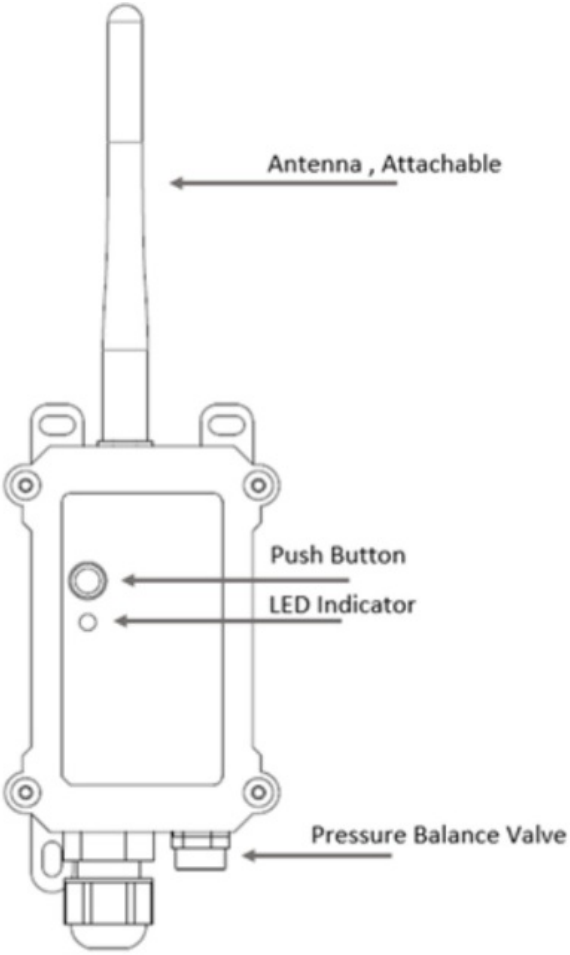
- Smart Buildings & Home Automation
- Logistics and Supply Chain Management
- Smart Metering
- Smart Agriculture
- Smart Cities
- Smart Factory

Sleep mode and working mode

Deep Sleep Mode: Sensor doesn’t have any NB-IoT activate. This mode is used for storage and shipping to save battery life.

Working Mode: In this mode, Sensor will work as NB-IoT Sensor to Join NB-IoT network and send out sensor data to server. Between each sampling/tx/rx periodically, sensor will be in IDLE mode), in IDLE mode, sensor has the same power consumption as Deep Sleep mode.

Button & LEDs



Behavior on ACT	Function	Action
Pressing ACT between 1s < time < 3s	Send an uplink	If sensor has already attached to NB-IoT network, sensor will send an uplink packet, **blue led** will blink once. Meanwhile, BLE module will be active and user can connect via BLE to configure device.
Pressing ACT for more than 3s	Active Device	**Green led** will fast blink 5 times, device will enter **OTA mode** for 3 seconds. And then start to attach NB-IoT network. **Green led** will solidly turn on for 5 seconds after joined in network. Once sensor is active, BLE module will be active and user can connect via BLE to configure device, no matter if device attach NB-IoT network or not.
Fast press ACT 5 times.	Deactivate Device	**Red led** will solid on for 5 seconds. Means device is in Deep Sleep Mode.

Note: When the device is executing a program, the buttons may become invalid. It is best to press the buttons after the device has completed the program execution.

BLE connection

SN50v3-NB support BLE remote configure and firmware update.

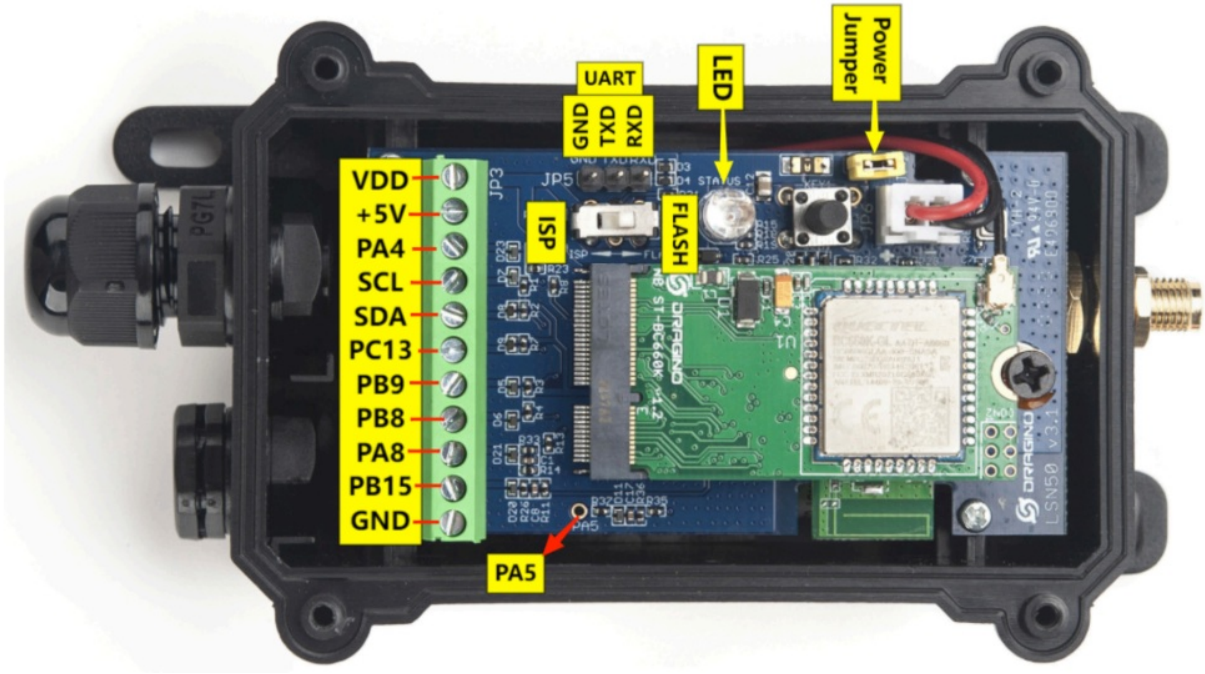
BLE can be used to configure the parameter of sensor or see the console output from sensor. BLE will be only activate on below case:

- Press button to send an uplink
- Press button to active device.
- Device Power on or reset.

If there is no activity connection on BLE in 60 seconds, sensor will shut down BLE module to enter low power mode.

Pin Definitions , Switch & SIM Direction

SN50v3-NB use the mother board which as below.



Jumper JP2

Power on Device when put this jumper.

BOOT MODE / SW1

1. **ISP:** upgrade mode, device won't have any signal in this mode. but ready for upgrade firmware. LED won't work. Firmware won't run.
2. **Flash:** work mode, device starts to work and send out console output for further debug

Reset Button
Press to reboot the device.

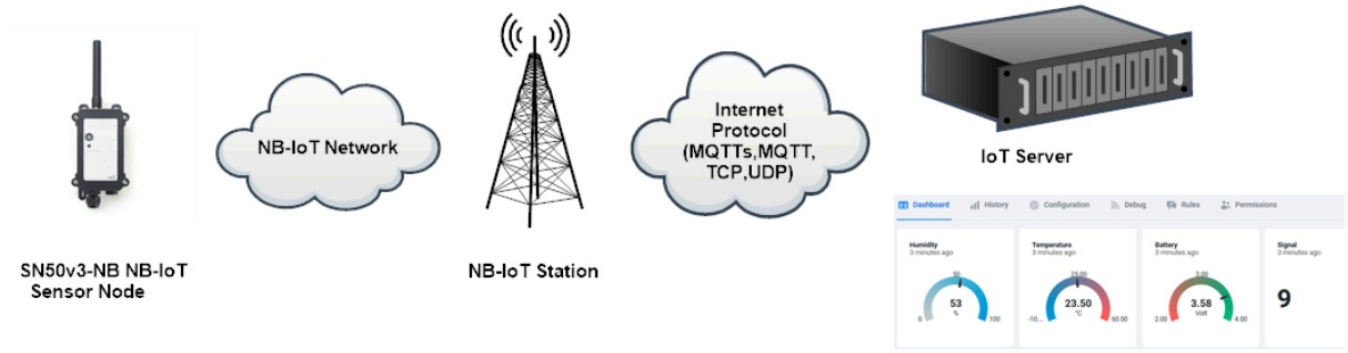
SIM Card Direction
See this link. How to insert SIM Card.

Use SN50v3-NB to communicate with IoT Server

Send data to IoT server via NB-IoT network
The SN50v3-NB is equipped with a NB-IoT module, the pre-loaded firmware in SN50v3-NB will get environment data from sensors and send the value to local NB-IoT network via the NB-IoT module. The NB-IoT network will forward this value to IoT server via the protocol defined by SN50v3-NB.

Below shows the network structure:

SN50v3-NB in a NB-IoT Network



There are two version: -GE and -1 D version of SN50v3-NB.

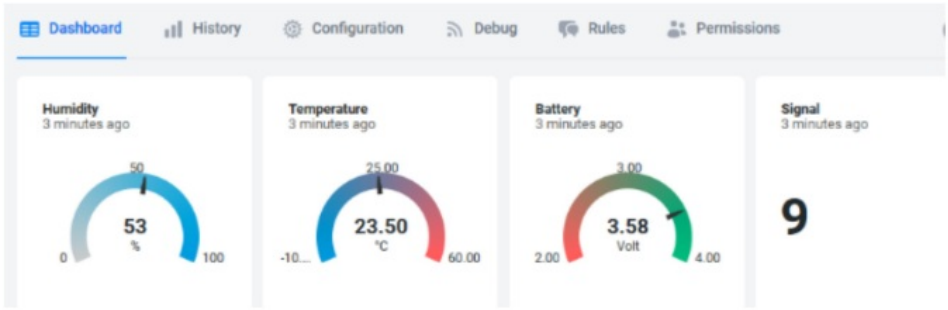
GE Version: This version doesn't include SIM card or point to any IoT server. User needs to use AT Commands to configure below two steps to set SN50v3-NB send data to IoT server.

- Install NB-IoT SIM card and configure APN. See instruction of Attach Network.
- Set up sensor to point to IoT Server. See instruction of Configure to Connect Different Servers.

Below shows result of different server as a glance.

Servers	Dash Board	Comments

DataCake



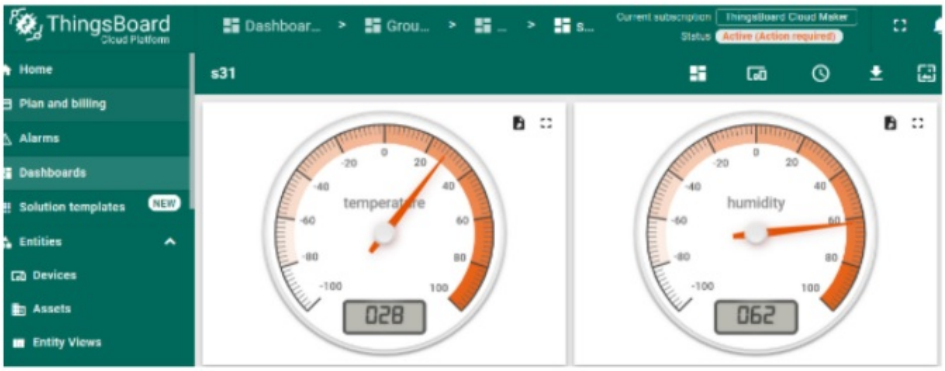
Tago.IO

General UDP Raw Payload. Need Developer to design Dash Board

General MQTT Raw Payload. Need Developer to design Dash Board

ThingSpeak

ThingsBoard



1 D Version: This version has 1 NCE SIM card pre-installed and configure to send value to DataCake. User Just need to select the sensor type in DataCake and Activate SN50v3-NB and user will be able to see data in DataCake. See here for DataCake Config Instruction.

Working Mode & Uplink Payload

SN50v3-NB has different working mode for the connections of different type of sensors. This section describes these modes. User can use the AT Command AT +CFGMOD to set SN50v3-NB to different working modes.

For example:

AT +CFGMOD:2 // will set the SN50v3-NB to work in MOD=2 distance mode which target to measure distance via Ultrasonic Sensor.

The uplink payloads are composed in ASCII String. For example:
0a cd 00 ed 0a cc 00 00 ef 02 d2 1 d (total 24 ASCII Chars). Representative the actually payload:
Ox 0a cd 00 ed 0a cc 00 00 ef 02 d21d Total 12 bytes

NOTE:

1. All modes share the same Payload Explanation from HERE.
2. By default, the device will send an uplink message every 1 hour.

CFGM0D=1 (Default Mode}

In this mode, the uplink payload usually contains 27 bytes. (Note: Time stamp field are added since firmware version v1 .2.0)

Size(bytes)	**8**			**1**		**2**	**1**	**2**	**2**	**2**	**4**
Value	Device ID	Ver	BAT	Signal Strength	MOD 0x01	Temperature (DS18B20) (PC13)	Digital in (PB15) & Interrupt	ADC (PA4)	Temperature by SHT20/ SHT31	Humidity by SHT20/SHT31	Timestamp

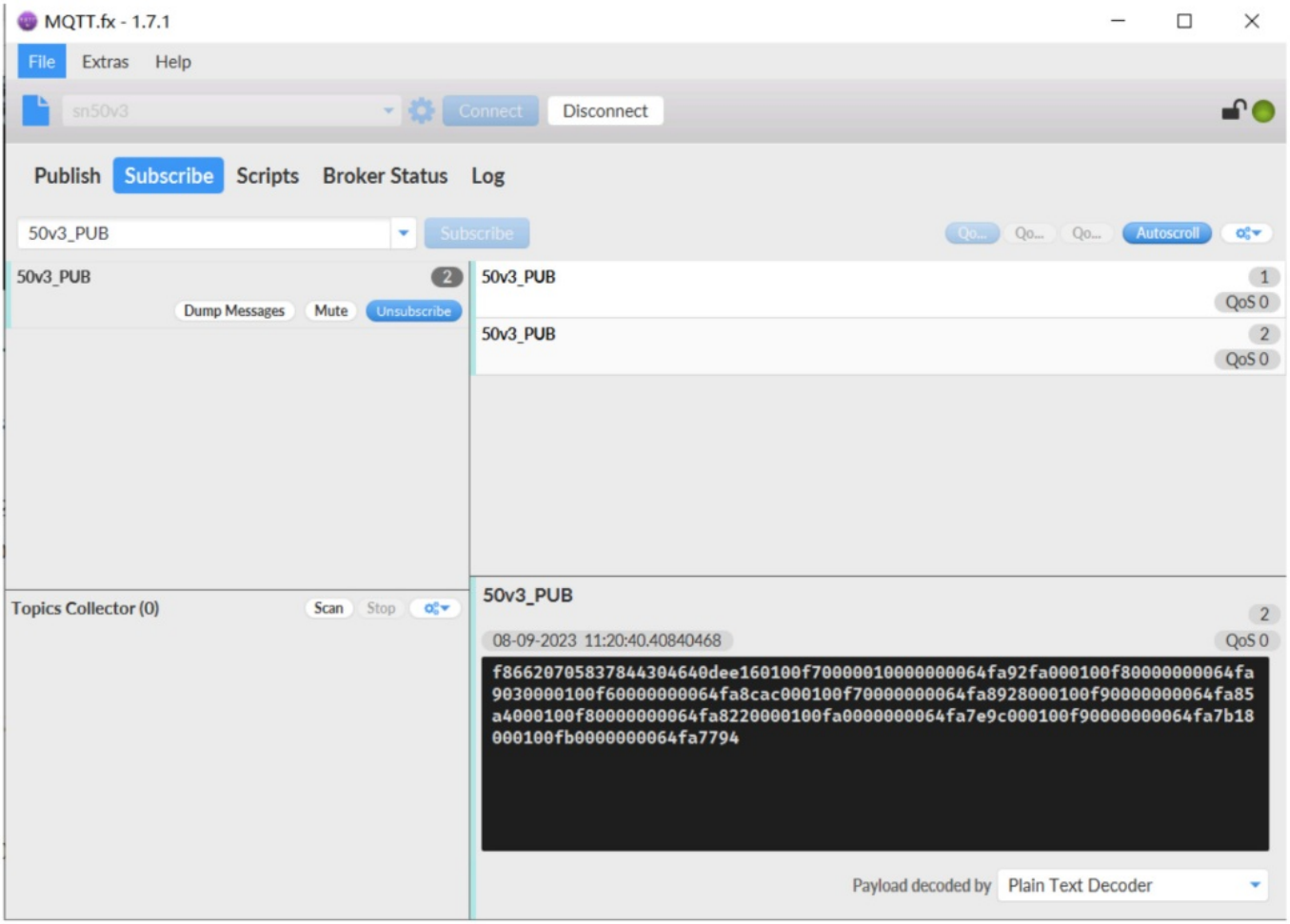
If the cache upload mechanism is turned on, you will receive the payload shown in the figure below.

Frame header	**Frame data(1)**	**Frame data(2)**	**F...**	**Frame data(X)**

NOTE:

1. Only up to 10 sets of latest data will be cached.
2. Theoretically, the maximum upload bytes are 215.

If we use the MOTT client to subscribe to this MOTT topic, we can see the following information when the NB sensor uplink data.

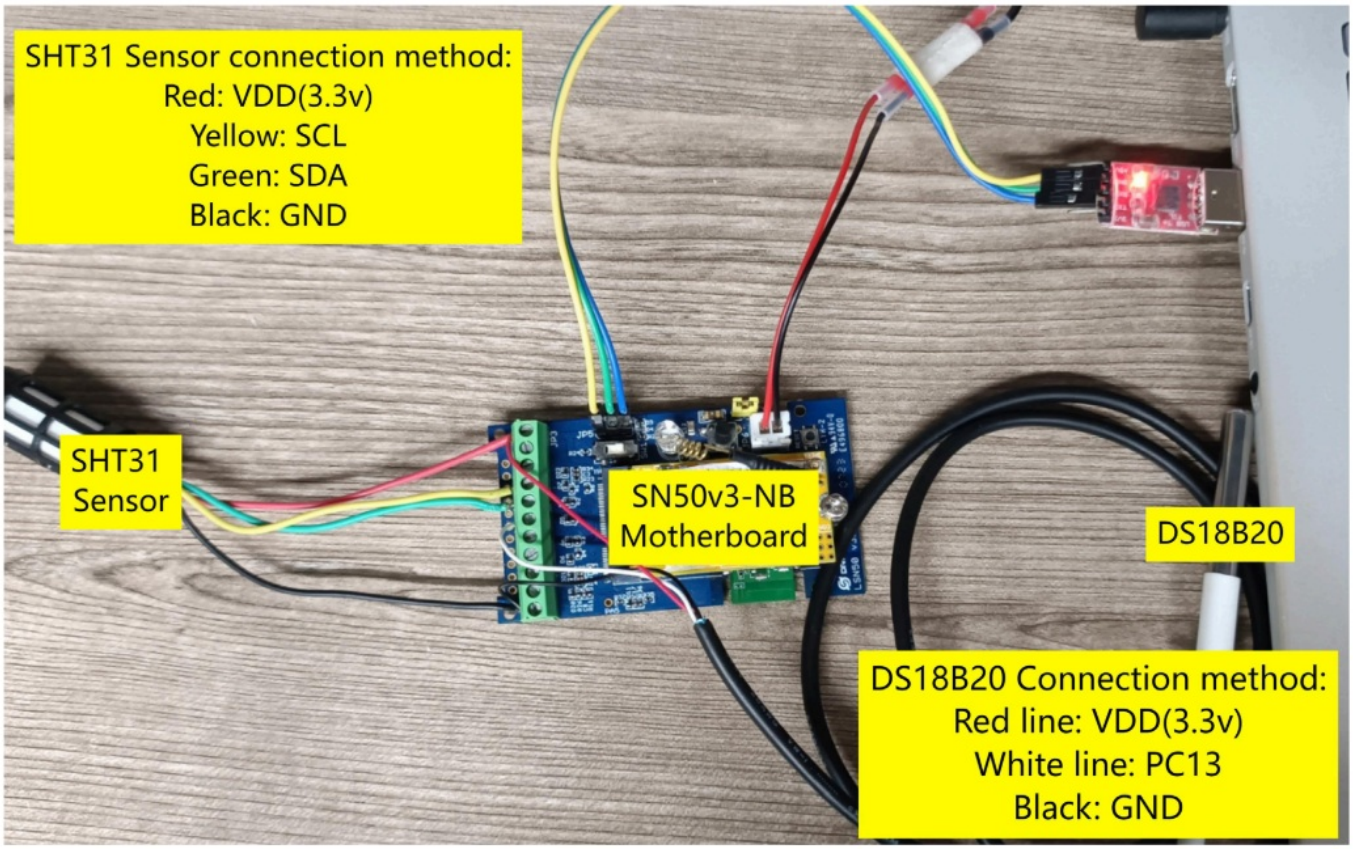


The payload is ASCII string, representative same HEX: Ox f866207058378443 0464 Odee 16 01 00f7 00 0001 OOfc 0232 64fa7491

where:

- Device ID: f866207058378443 = 866207058378443
- Version: 0x04:dSN50v3-NB,0x64=100=1.0.0
- BAT: 0x0dee = 3566 mV = 3.566V
- Singal: 0x16 = 22
- Model: 0x01 = 1
- Temperature by DS18b20: 0x00f7 = 247/10=24.7
- Interrupt: 0x00 = 0
- ADC: 0x0001 = 1 = 1.00mv
- Temperature by SHT20/SHT31: 0x00fc = 252 = 25.2 °C
- Humidity by SHT20/SHT31: 0x0232 = 562 = 56.2 %rh
- Timestamp: 64fa7491 =1694135441=2023-09-0809:10:41

Connection mode of I2C sensor and DS18820 temperature sensor:



CFGMOD:2 (Distance Mode)
This mode is target to measure the distance. Total 25 bytes, (Note: Time stamp field are added since firmware version v1 .2.0)

Size(bytes)	**8**			**1**		**2**	**1**		**2**	**4**
Value	Device ID	Ver	BAT	Signal Strength	MOD 0x02	Temperature (DS18B20) (PC13)	Digital in (PB15) & Interrupt	ADC (PA4)	Distance measure by: 1) LIDAR-Lite V3HP Or	Timestamp

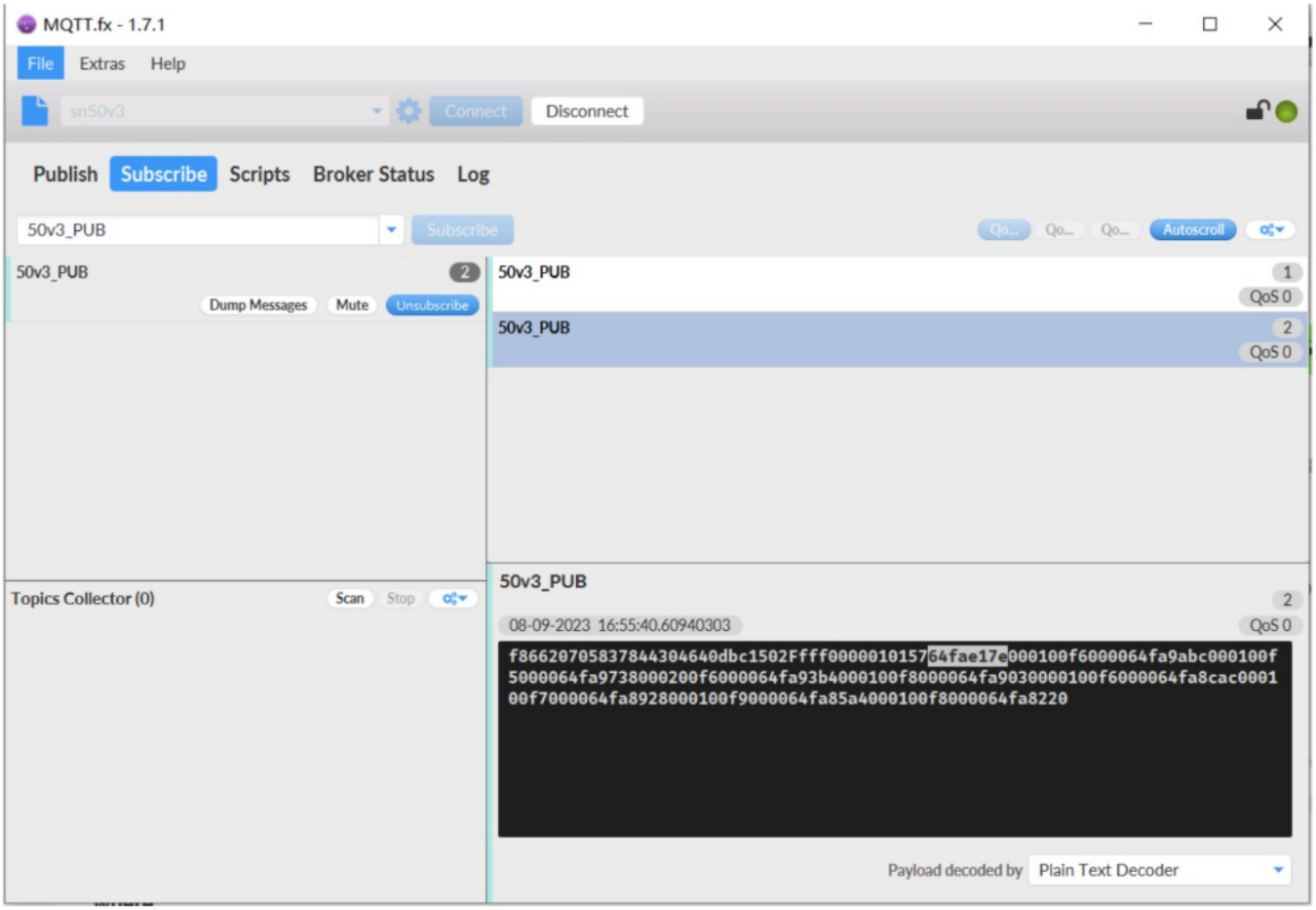
If the cache upload mechanism is turned on, you will receive the payload shown in the figure below.

Frame header	**Frame data(1)**	**Frame data(2)**	**F...**	**Frame data(X)**

NOTE:

1. Only up to 10 sets of latest data will be cached.
2. Theoretically, the maximum upload bytes are 193.

If we use the MQTT client to subscribe to this MQTT topic, we can see the following information when the NB sensor uplink data.

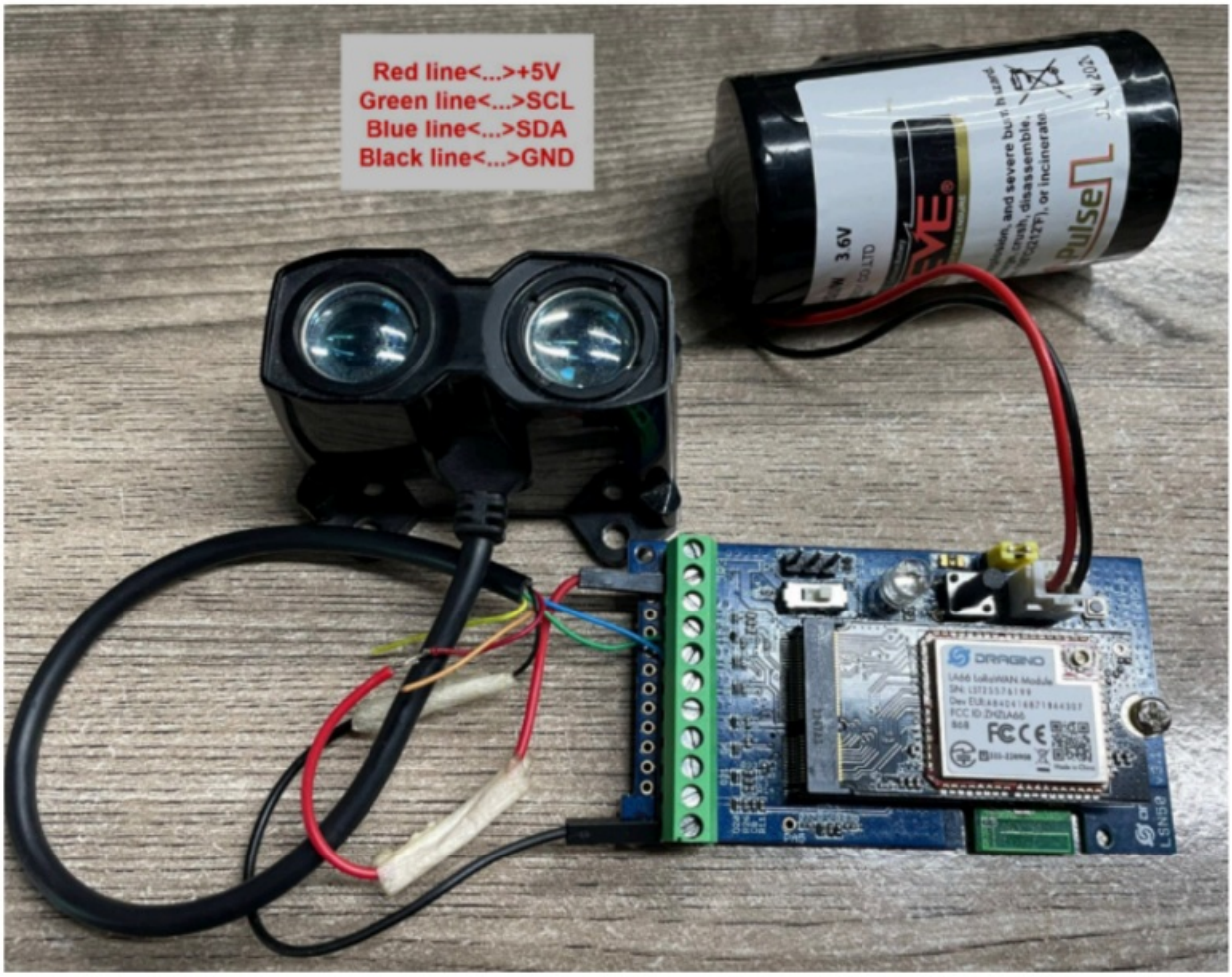


So the payload is 0xf868411056754138 0078 0ca9 11 02 01 Ob 00 0ca8 0158 60dacc87

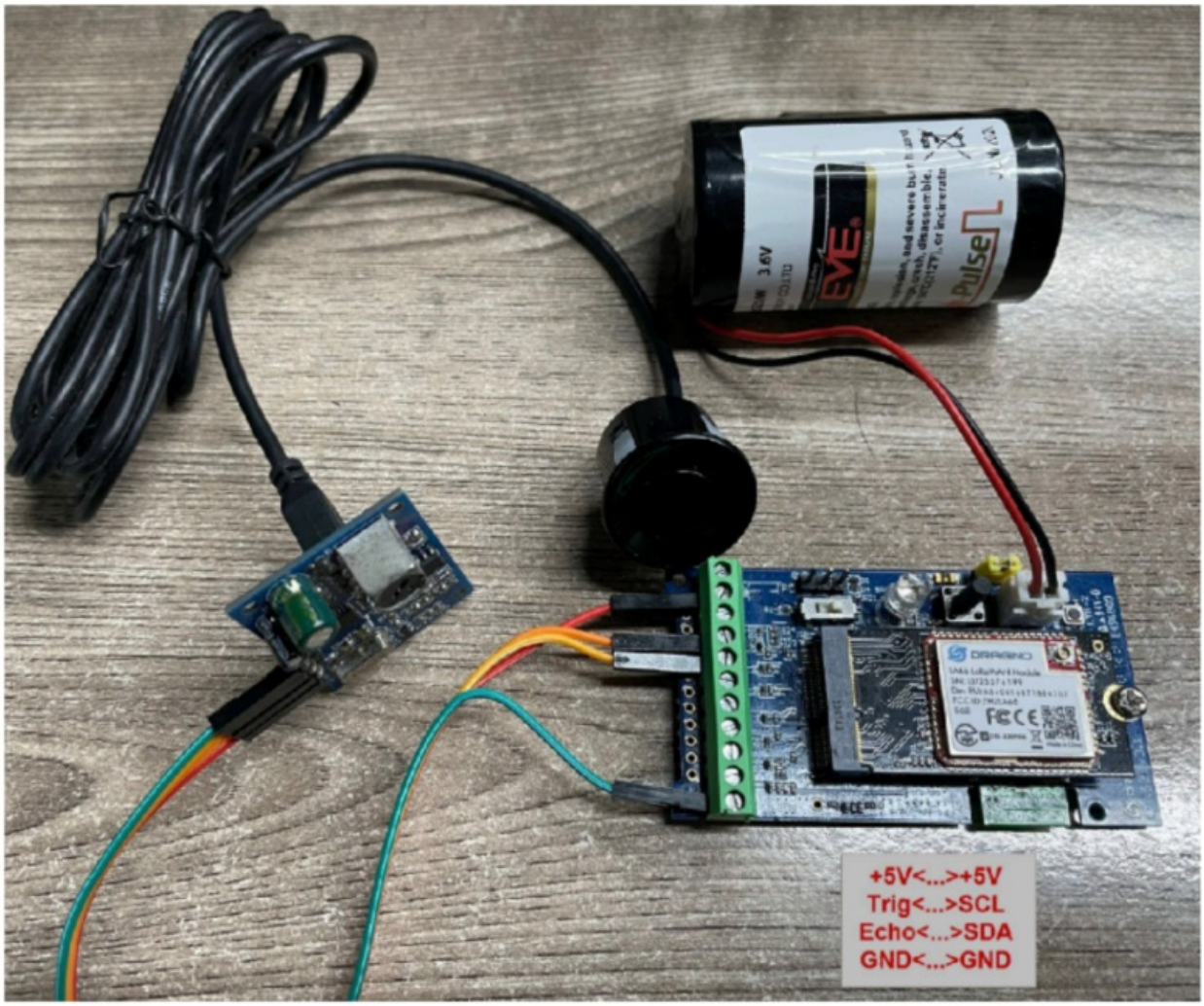
where:

- **Device ID:** 0xf868411056754138 = 868411056754138
- **Version:** 0x0078= 120= 1.2.0′
- **BAT:** 0x0ca9 = 3241 mV = 3.241 V
- **Singal:** 0x11 = 17
- **Model:** 0x02 = 2
- **Temperature by DS18b20:** 0x010b= 267 = 26.7 °C
- **Interrupt:** 0x00 = 0
- **ADC:** 0x0ca8 = 3240 mv
- **Distance by LIDAR-Lite V3HP/Ultrasonic Sensor:** 0x0158 = 344 cm
- **Timestamp:** 0x60dacc87 = 1,624,951,943 = 2021-06-29 15:32:23

Connection of LIDAR-Lite V3HP:



Connection to Ultrasonic Sensor:
Need to remove R1 and R2 resistors to get low power,otherwise there will be 240uA standby current.



CFGM0D=3 (3 ADC + 12C)
This mode has total 29 bytes. Include 3 x ADC + 1 x I2C, (Note: Time stamp field are added since firmware version v1 .2.0)

Size(bytes)	8	2	2	1	1	2	1	2	2	2	2	4
Value	Device ID	Ver	BAT	Signal Strength	MOD 0x03	ADC1 (PA4)	Digital in(PB15) & Interrupt	ADC2 (PA5)	Temperature by SHT20/SHT31	Humidity by SHT20/SHT31	ADC3 (PA8)	Timestamp

- ADC1 uses pin PA4 to measure
- ADC2 uses pin PA5 to measure
- ADC3 uses pin PAS to measure

(Suitable for motherboard version: LSN50 v3.1)

If the cache upload mechanism is turned on, you will receive the payload shown in the figure below.

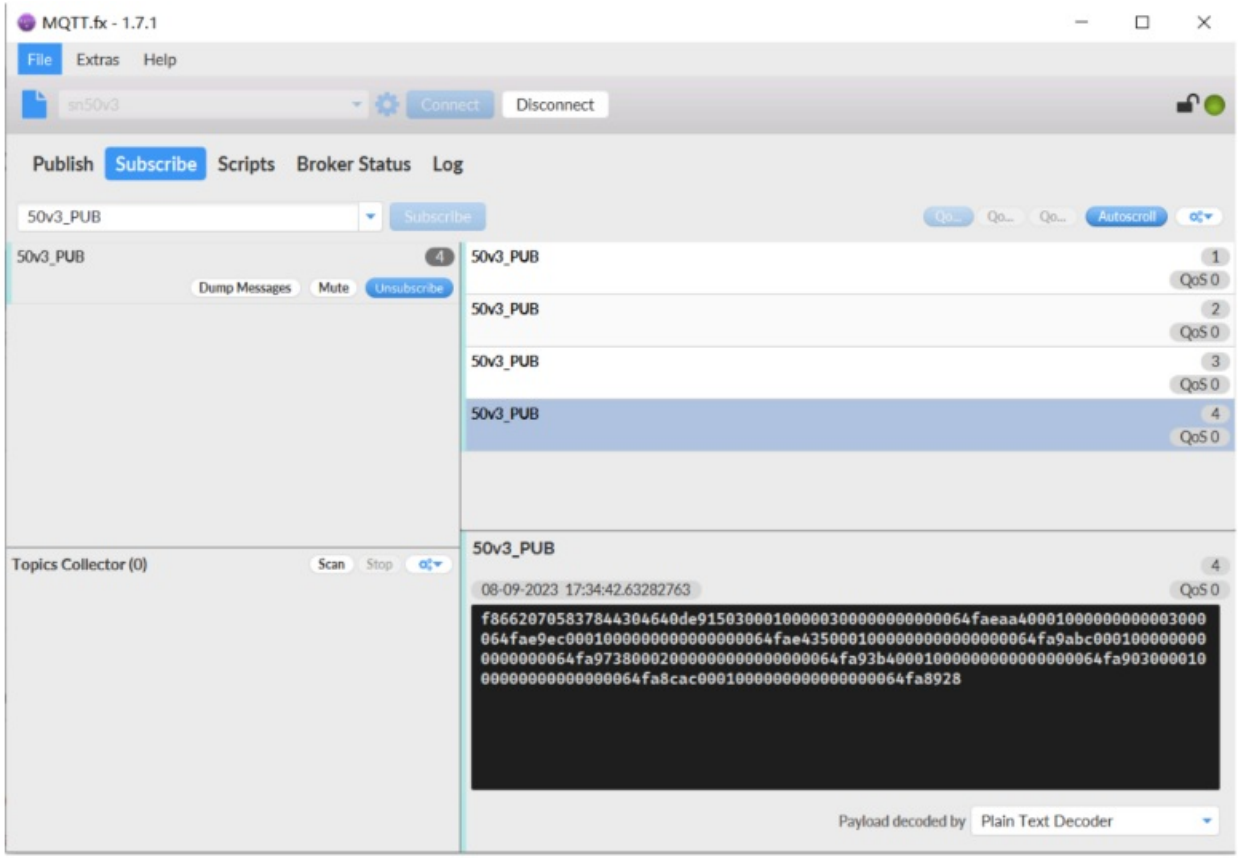
Frame header	Frame data(1)	Frame data(2)	F...	Frame data(X)

NOTE:

1. Only up to 10 sets of latest data will be cached.

2. Theoretically, the maximum upload bytes are 226.

If we use the MQTT client to subscribe to this MQTT topic, we can see the following information when the NB sensor uplink data.



So the payload is Ox 1868411056754138 0078 0cf0 12 03 0cbc 00 0cef 010a 024b 0cef 60dbc494

where:

- Device ID: 0xf868411056754138 = 868411056754138

Documents / Resources

	Dragino ZHZ50V3NB NB-IoT Sensor Node [pdf] User Manual ZHZ50V3NB NB-IoT Sensor Node, ZHZ50V3NB, NB-IoT Sensor Node, IoT Sensor Node, Sensor Node, Node

References

- User Manual

Manuals+, Privacy Policy

This website is an independent publication and is neither affiliated with nor endorsed by any of the trademark owners. The "Bluetooth®" word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. The "Wi-Fi®" word mark and logos are registered trademarks owned by the Wi-Fi Alliance. Any use of these marks on this website does not imply any affiliation with or endorsement.