

- **Version:** 0x0078=120=1.2.0
- **BAT:** 0x0cf0 = 3312 mV = 3.312 V
- **Singal:** 0x12 = 18
- **Model:** 0x03 = 3
- **ADC1:** 0x0cbc= 3260mV
- **Interrupt:** 0x00 = 0
- **ADC2:** 0x0cef =3311 mv
- **Temperature by SHT20/SHT31:** 0x010a = 266 = 26.6 °C
- **Humidity by SHT20/SHT31:** 0x024b =587 = 58.7 %rh
- **ADC3:** 0x0cef = 3311 mv
- **Timestamp:** 0x60dbc494 = 1,625,015,444= 2021-06-30 09:10:44

2.2.4 CFGMOD=4 (3 x DS18B20)

Hardware connection is as below, (**Note: R3 & R4 should change from 10k to 4.7k to support DS18B20, Software set to AT+CFGMOD=4**)



This mode has total 27 bytes. (**Note: Time stamp field are added since firmware version v1.2.0**) As shown below:

Size(bytes)	8	2	2	1	1	2	2	1	2	2	4
Value	Device ID	Ver	BAT	Signal Strength	MOD 0x04	Temperature1 (DS18B20) (PC13)	ADC	Digital in & Interrupt	Temperature2 (DS18B20) (PA9)	Temperature3 (DS18B20) (PA10)	Timestamp

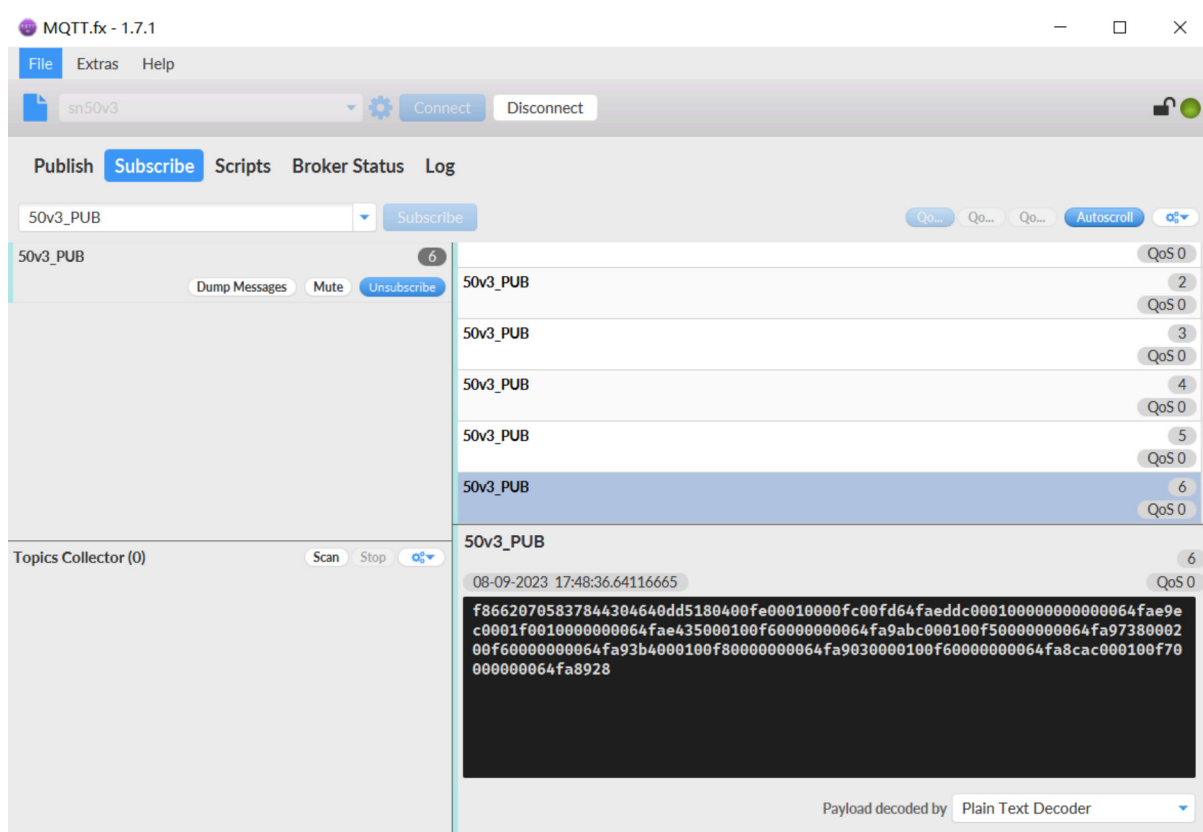
If the cache upload mechanism is turned on, you will receive the payload shown in the figure below.

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 is 215.

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



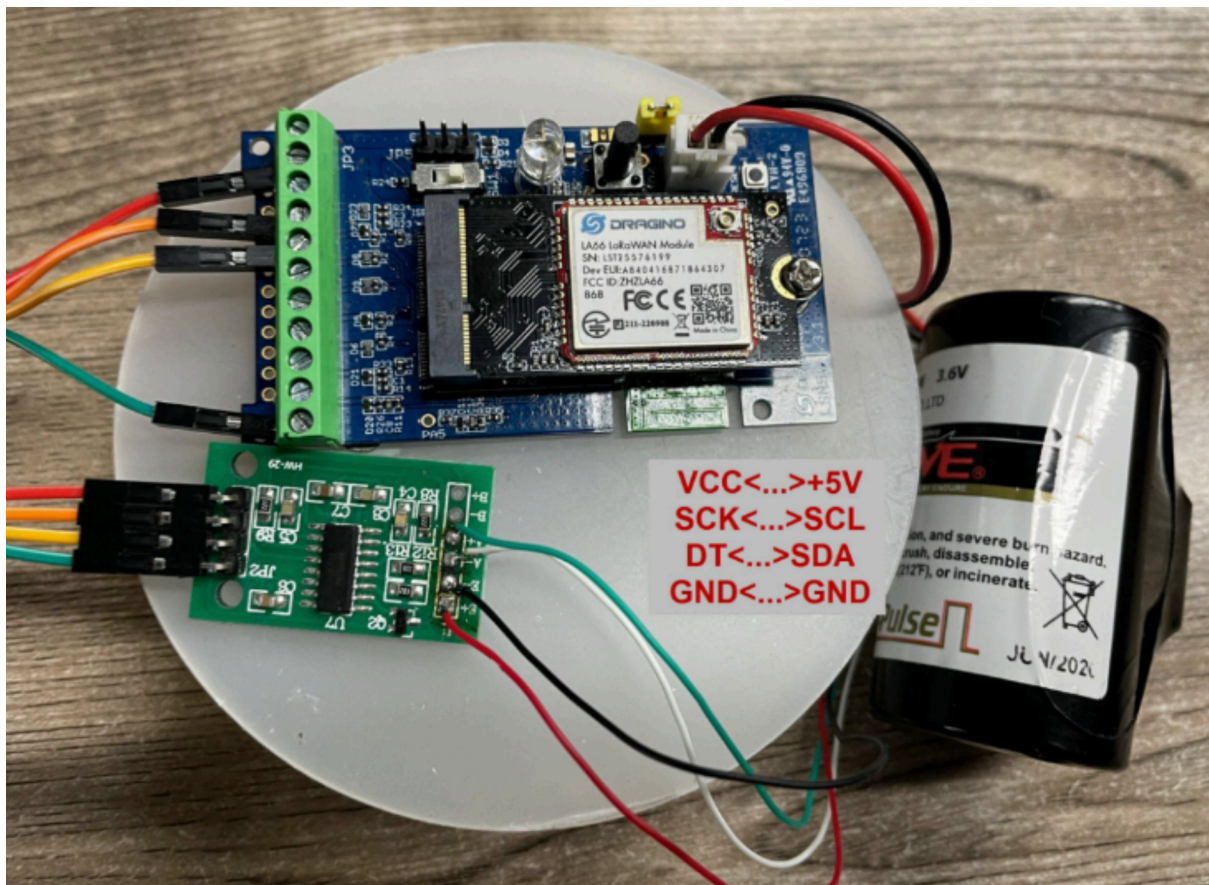
So the payload is **0x f868411056754138 0078 0cdf 15 04 010a 0cde 00 00fb 0100 60dbcb3f**

where:

- **Device ID:** 0xf868411056754138 = 868411056754138
- **Version:** 0x0078=120=1.2.0
- **BAT:** 0x0cdf = 3295 mV = 3.295 V
- **Singal:** 0x15 = 21
- **Model:** 0x04 = 4

- **Temperature1 by DS18B20:** 0x010a = 226 = 22.6 °C
- **ADC:** 0x0cde = 3294 mv
- **Interrupt:** 0x00 = 0
- **Temperature2 by DS18B20:** 0x00fb = 251 = 25.1 °C
- **Temperature3 by DS18B20:** 0x0100 = 256 = 25.6 °C
- **Timestamp:** 0x60dbcb3f = 1,625,017,151 = 2021-06-30 09:39:11

2.2.5 CFGMOD=5 (Weight Measurement by HX711)



Notes about hardware connection:

1. Don't connect the HX711 module VCC to SN50v3-NB 3.3v VCC, in this case, the SN50v3-NB will always power on HX711 and the battery will run out soon.
2. HX711 support 5v VCC, but while connect the SN50v3-NB's +5V to HX711 VCC, the value from HX711 is not stable.
3. Connect SN50v3-NB +5V to HX711 VCC via a LDO module is stable.

Each HX711 need to be calibrated before used. User need to do below two steps:

1. Zero calibration. Don't put anything on load cell and run **AT+WEIGRE** to calibrate to Zero gram.
2. Adjust calibration factor (default value 400): Put a known weight thing on load cell and run **AT+WEIGAP** to adjust the Calibration Factor.

For example:

AT+WEIGAP =403.0

Response: Weight is 401 g

Check the response of this command and adjust the value to match the real value for thing.

This mode has total 25 bytes. (**Note: Time stamp field are added since firmware version v1.2.0**). As shown below:

Size(bytes)	8	2	2	1	1	2	2	1	2	4
Value	Device ID	Ver	BAT	Signal Strength	MOD 0x05	Temperature (DS18B20)	ADC	Digital in & Interrupt	Weight	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.

- **ADC:** 0x0c93 = 3219 mv
- **Interrupt:** 0x00 = 0
- **Weight by HX711:** 0x003a = 58 g
- **Timestamp:** 0x60dbe59e = 1,625,023,902= 2021-06-30 11:31:42

2.2.6 CFGMOD=6 (Counting mode)

In this mode, uplink payload includes in total 22 bytes, (**Note: Time stamp field are added since firmware version v1.2.0**)

Size(bytes)	8	2	2	1	1	4	4
Value	Device ID	Ver	BAT	Signal Strength	MOD 0x06	Pulse count	Timestamp

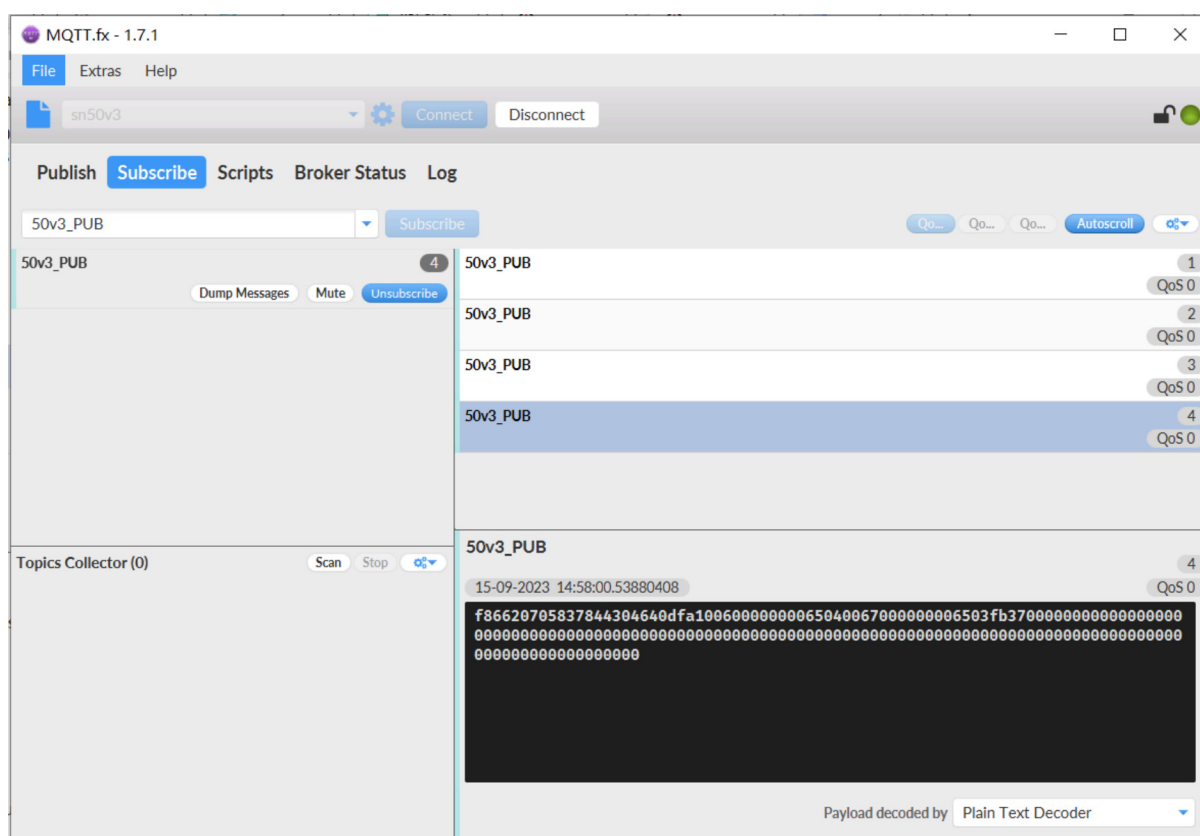
If the cache upload mechanism is turned on, you will receive the payload shown in the figure below.

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 160.

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



The payload is ASCII string, representative same HEX: **0x f868411056754138 0078 0cc7 14 06 00000002 60dc03e5**

where:

- **Device ID:** 0xf868411056754138 = 868411056754138
- **Version:** 0x0078=120=1.2.0
- **BAT:** 0x0cc7 =3271mV =3.271V
- **Singal:** 0x14 = 20
- **Model:** 0x06 = 6
- **Pulse count:** 0x00000002= 2

- **Timestamp:** 0x60dc03e5 = 1,625,031,653= 2021-06-30 13:40:53

2.3 Payload Types

To meet different server requirement, SN50v3-NB supports different payload type.

Includes:

- [General JSON format payload](#). (Type=5)
- [HEX format Payload](#). (Type=0)
- [ThingSpeak Format](#). (Type=1)
- [ThingsBoard Format](#). (Type=3)

User can specify the payload type when choose the connection protocol. Example:

AT+PRO=2,0 // Use UDP Connection & hex Payload

AT+PRO=2,5 // Use UDP Connection & Json Payload

AT+PRO=3,5 // Use MQTT Connection & Json Payload

2.3.1 General Json Format(Type=5)

This is the General Json Format. As below:

```
{
  "IMEI": "866207058378443",
  "Model": "SN50V3-NB",
  "mod": 1,
  "battery": 3.56,
  "signal": -25,
  "DS18B20_Temp": -409.5,
  "digital_in": 0,
  "adc1": 1,
  "temperature": 0.0,
  "humidity": 0.0,
  "1": {0.0,0.0,1,-409.5,2023/10/23 05:57:02},
  "2": {0.0,0.0,1,-409.5,2023/10/23 03:57:12},
  "3": {0.0,0.0,1,-409.5,2023/10/23 03:42:12},
  "4": {0.0,64.1,0,-409.5,2023/10/20 09:55:08},
  "5": {0.0,64.1,0,-409.5,2023/10/20 09:40:08},
  "6": {0.0,64.1,0,-409.5,2023/10/20 08:26:14},
  "7": {0.0,64.1,0,-409.5,2023/10/20 08:11:14},
  "8": {0.0,64.1,0,-409.5,2023/10/20 07:56:14}
}
```

Notice, from above payload:

- Temperature , Humidity , Battery & Signal are the value at uplink time.
- Json entry 1 ~ 8 are the last 1 ~ 8 sampling data as specify by **AT+NOUD=8** Command. Each entry includes (from left to right): Temperature, Humidity, Sampling time.

2.3.2 HEX format Payload(Type=0)

This is the HEX Format. As below:

f86620705837844304640ddc1501Ffff0000010000000065360ee60001f0010000000065360b2e0001f001000000006535ef18000

Default Mode (CFGMOD=1)					HEX Format for 50v3-NB				
f866207053462762 f+IMEI 8 Bytes					0464 Version	0df2 BAT	14 Singal	01 Mod	0105 DS18b20
0001 f001 010e 024f 64f03e1b adc1 ds1820 sht31tem sht31hum timestamp (last 1st) 12 Bytes					00000000000000fa64f039c9 last 2nd data 12 Bytes				
					00000000000000fa64f03915 last 3rd data 12 Bytes				
					00000000000000fa64f03861 last 4th data 12 Bytes				
00000000000000fa64f037ad last 5th data 12 Bytes					00000000000000fa64f036f9 last 6th data 12 Bytes				
					000000000000014c64f03645 last 7th data 12 Bytes				
					000000000000014764f03591 last 8th data 12 Bytes				

Version:

These bytes include the hardware and software version.

Higher byte: Specify Sensor Model: 0x00 for SN50v3

Lower byte: Specify the software version: 0x64=100, means firmware version 1.0.0

BAT (Battery Info):

Ex1: 0x0CBA = 3258mV

Signal Strength:

NB-IoT Network signal Strength.

Ex1: 0x16 = 22

0 -113dBm or less

1 -111dBm

2...30 -109dBm... -53dBm

31 -51dBm or greater

99 Not known or not detectable

Temperature:

If payload is: 0105H: (0105 & 8000 == 0), temp = 0105H /10 = 26.1 degree

If payload is: FF3FH : (FF3F & 8000 == 1) , temp = (FF3FH - 65536)/10 = -19.3 degrees.

(FF3F & 8000: Judge whether the highest bit is 1, when the highest bit is 1, it is negative)

Humidity:

Read:0295(H)=661(D) Value: 661 / 10=66.1, So 66.1%

TimeStamp:

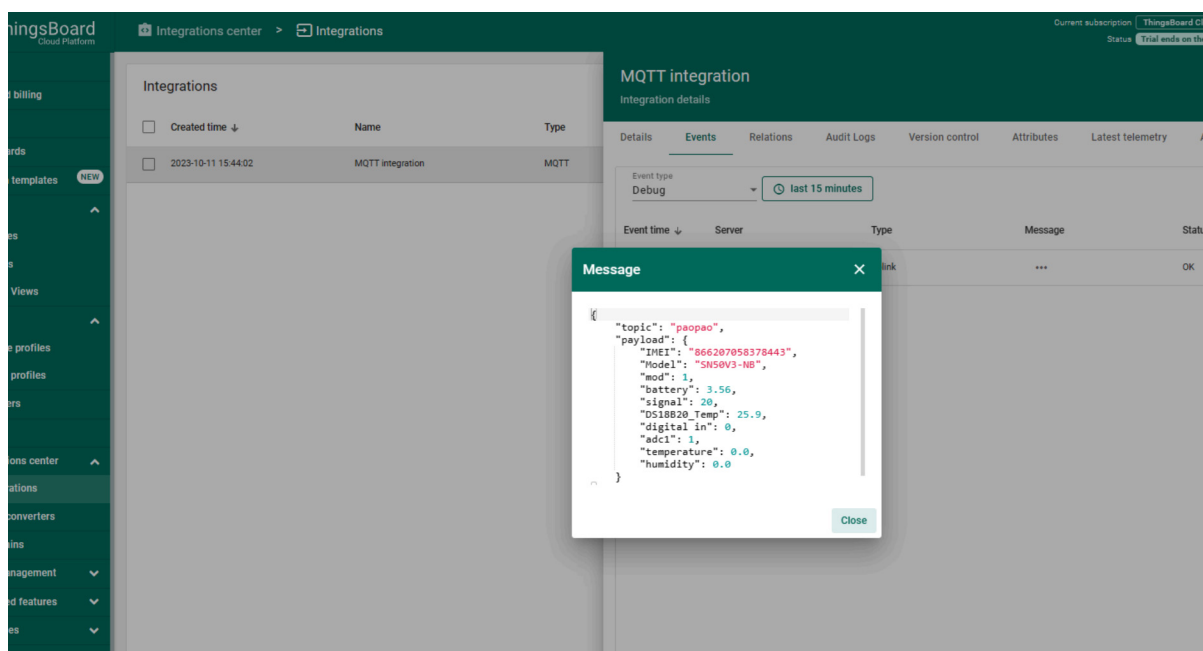
Unit TimeStamp Example: 64d49439(H) = 1691653177(D)

Put the decimal value into this link(<https://www.epochconverter.com/>) to get the time.

2.3.3 ThingsBoard Payload(Type=3)

Type3 payload special design for ThingsBoard, it will also configure other default server to ThingsBoard.

{"IMEI": "866207058378443", "Model": "SN50V3-NB", "mod": 1, "battery": 3.56, "signal": 20, "DS18B20_Temp": 25.9, "digital in": 0, "adc1": 1, "temperature": 0.0,}



2.3.4 ThingSpeak Payload(Type=1)

This payload meets ThingSpeak platform requirement. It includes only four fields. Form 1~6 are:

adc1,Battery,Signal,DS18B20_Temp,Temperature&Humidity. This payload type only valid for ThingSpeak Platform.

As below:

field1=adc_mV value&field2=BAT value&field3=Signal value3&field4=DS18B20_Temp value&field5=Temperature value&field6=Humidity value



2.4 Test Uplink and Change Update Interval

By default, Sensor will send uplinks **every 2 hours** & AT+NOUD=8

User can use below commands to change the **uplink interval**.

AT+TDC=600 // Set Update Interval to 600s

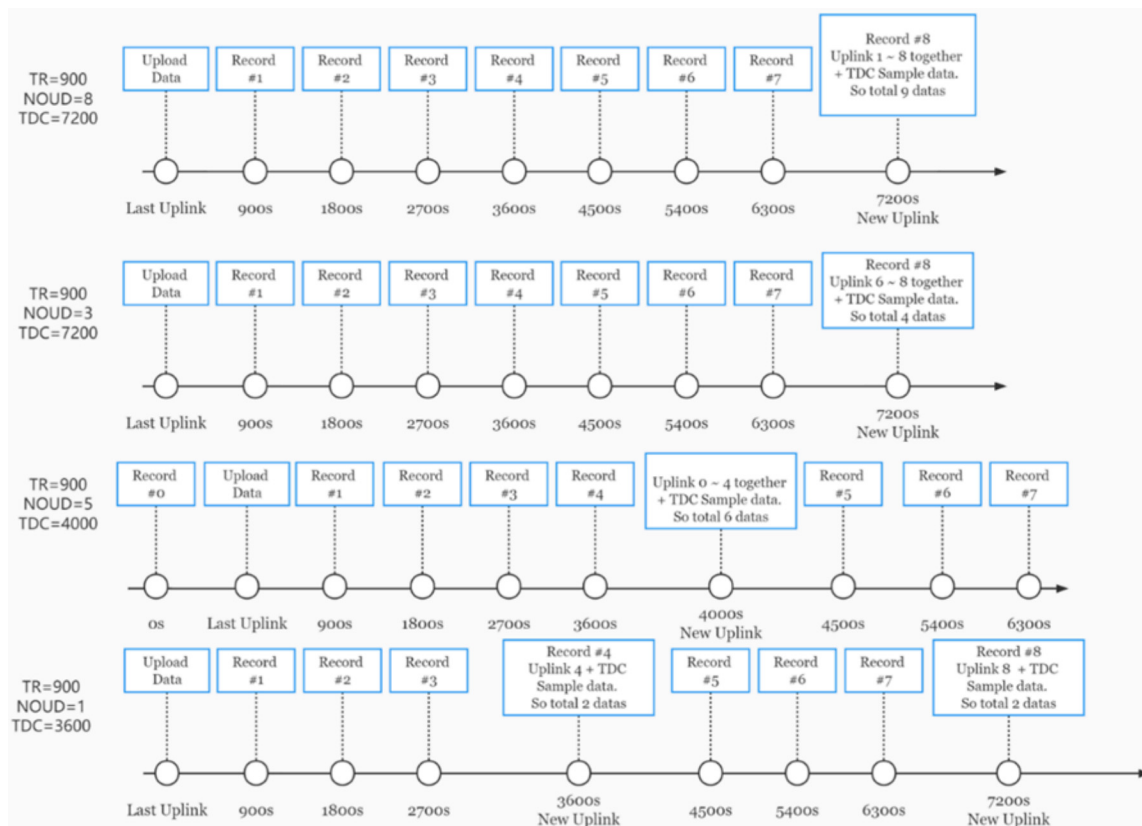
User can also push the button for more than 1 seconds to activate an uplink.

2.5 Multi-Samplings and One uplink

To save battery life, SN50v3-NB will sample temperature & humidity data every 15 minutes and send one uplink every 2 hours. So each uplink it will include 8 stored data + 1 real-time data. They are defined by:

- **AT+TR=900** // The unit is seconds, and the default is to record data once every 900 seconds (15 minutes, the minimum can be set to 180 seconds)
- **AT+NOUD=8** // The device uploads 8 sets of recorded data by default. Up to 32 sets of record data can be uploaded.

The diagram below explains the relationship between TR, NOUD, and TDC more clearly:



2.6 Triggier an uplink by external interrupt

SN50v3-NB has an external trigger interrupt function. Users can use the PB15 pin to trigger the upload of data packets.

AT command:

- **AT+INTMOD** // Set the trigger interrupt mode
- **AT+INTMOD=0** // Disable Interrupt
- **AT+INTMOD=1** // Trigger by rising and falling edge
- **AT+INTMOD=2** // Trigger by falling edge
- **AT+INTMOD=3** // Trigger by rising edge

2.7 +5V Output

Control the output duration 5V . Before each sampling, device will

1. first enable the power output to external sensor,
2. keep it on as per duration, read sensor value and construct uplink payload
3. final, close the power output.

AT command: AT+5VT

Command Example	Function	Response
AT+5VT=?	Show 5V open time.	0(default)

AT+5VT=1000	Close after a delay of 1000 milliseconds.	OK
		OK

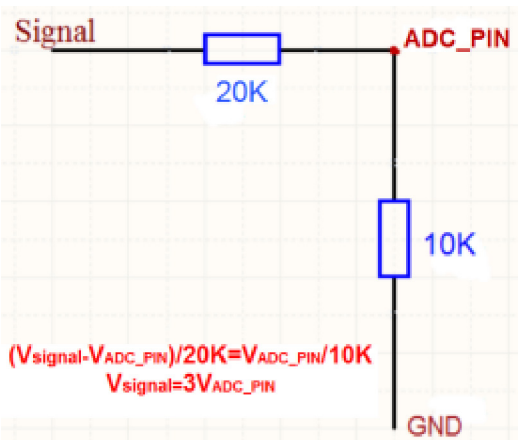
2.8 Analogue Digital Converter (ADC)

The ADC pins in SN50V3-NB can measure range from 0~Vbat, it use reference voltage from STM32. If user need to measure a voltage > VBat, please use resistors to divide this voltage to lower than VBat, otherwise, it may destroy the ADC pin.

Note: minimum VBat is 2.5v, when batrrey lower than this value. Device won't be able to send LoRa Uplink.

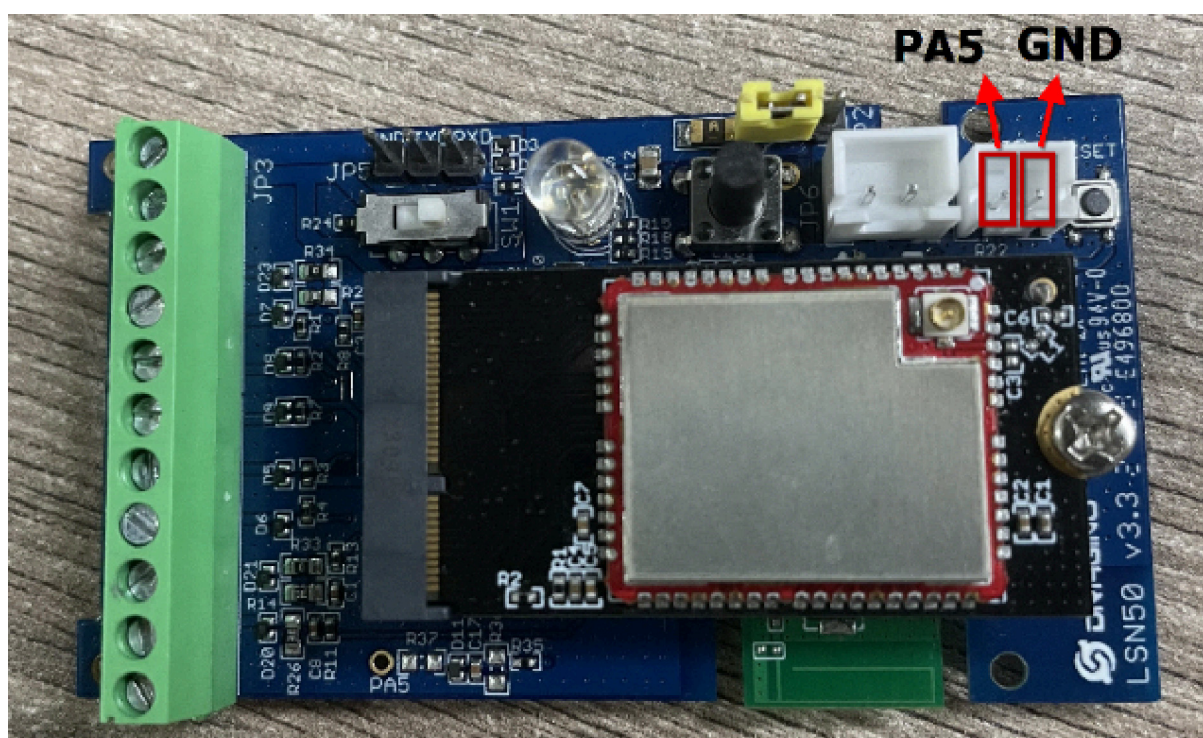
The ADC monitors the voltage on the PA0 line, in mV.

Ex: 0x021F = 543mv,



Note: If the ADC type sensor needs to be powered by SN50_v3, it is recommended to use +5V to control its switch. Only sensors with low power consumption can be powered with VDD.

The position of PA5 on the hardware after **SN50 v3.3** is changed to the position shown in the figure below, and the collected voltage becomes one-sixth of the original.



2.9 Clock logging (Since firmware version v1.2.1)

Sometimes when we deploy lots of end nodes in field. We want all sensors sample data at the same time, and upload these data together for analyze. In such case, we can use clock logging feature.

We can use this command to set the start time of data recording and the time interval to meet the requirements of the specific collection time of data.

- **AT command:** `AT+CLOCKLOG=a,b,c,d`

a: 0: Disable Clock logging. 1: Enable Clock Logging

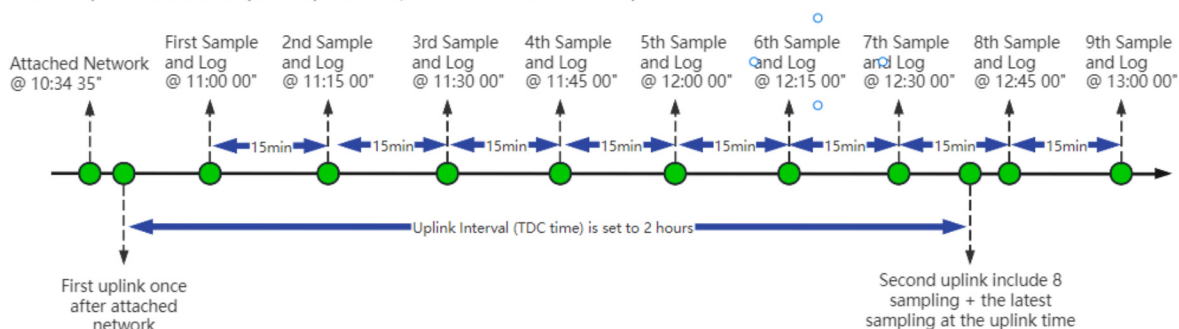
b: Specify First sampling start second: range (0 ~ 3599, 65535) // **Note:** If parameter b is set to 65535, the log period starts after the node accesses the network and sends packets.

c: Specify the sampling interval: range (0 ~ 255 minutes)

d: How many entries should be uplink on every TDC (max 32)

Example: AT+CLOCKLOG=1,0,15,8

Device will log data to memory start from the 0th second (11:00 00" of first hour and then sampling and log every 15 minutes. Every TDC uplink, the uplink payload will consist: Battery info + last 8 memory record with timestamp + the latest sample at uplink time) . See below for the example.



Example:

AT+CLOCKLOG=1,65535,1,5

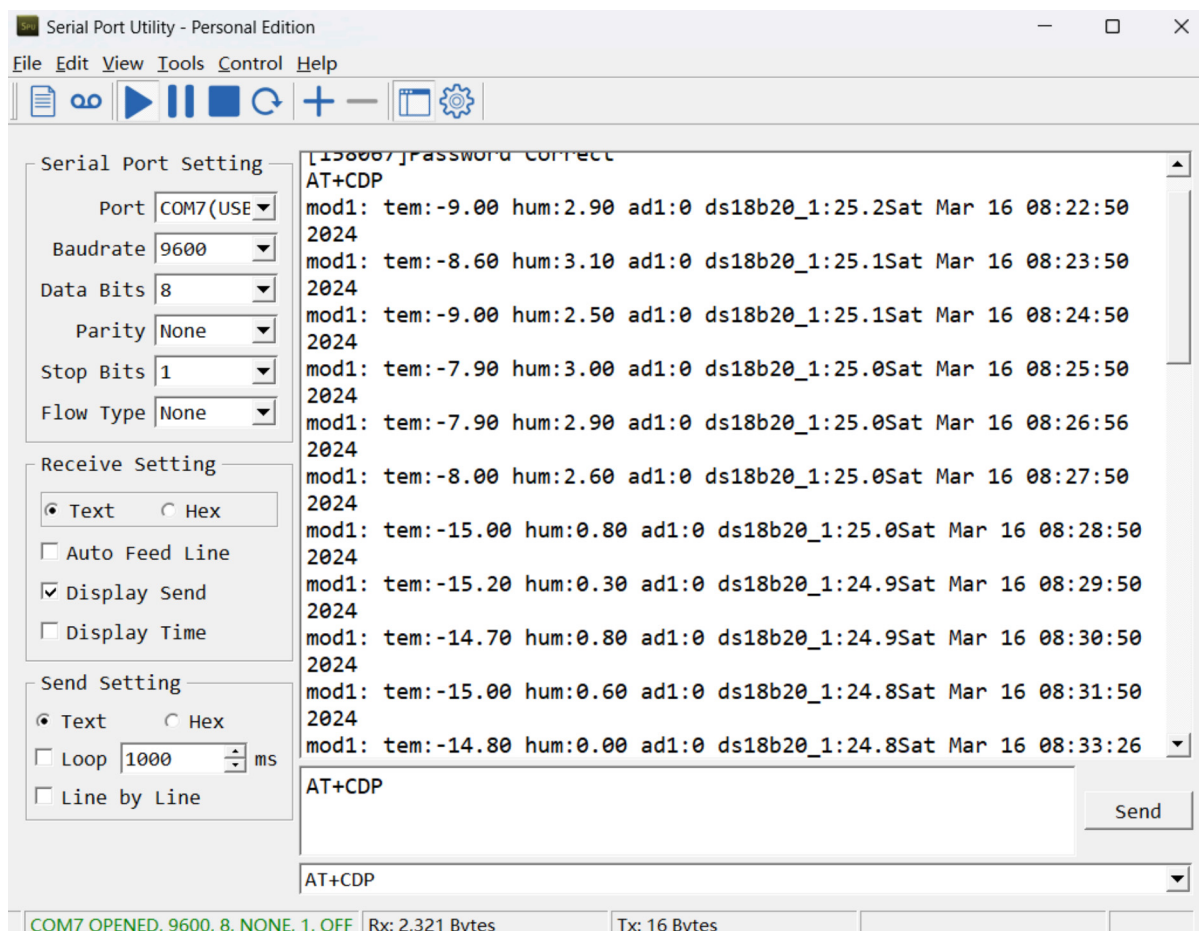
After the node sends the first packet, data is recorded to the memory at intervals of 1 minute. For each TDC uplink, the uplink load will include: battery information + the last 5 memory records (payload + timestamp).

Note: Users need to synchronize the server time before configuring this command. If the server time is not synchronized before this command is configured, the command takes effect only after the node is reset.

2.10 Example Query saved historical records

- **AT command: AT+CDP**

This command can be used to search the saved history, recording up to 32 groups of data, each group of historical data contains a maximum of 100 bytes.



3. Configure SN50v3-NB

3.1 Configure Methods

SN50v3-NB supports below configure method:

- AT Command via Bluetooth Connection (**Recommended**): [BLE Configure Instruction](#).
- AT Command via UART Connection : See [UART Connection](#).

3.2 AT Commands Set

AT+<CMD>? : Help on <CMD>

AT+<CMD> : Run <CMD>

AT+<CMD>=<value> : Set the value

AT+<CMD>=? : Get the value

General Commands

AT : Attention

AT? : Short Help

ATZ : MCU Reset

AT+TDC : Application Data Transmission Interval

AT+CFG : Print all configurations

AT+5VT : Set extend the time of 5V power

AT+PRO : Choose agreement

AT+APN : Get or set the APN

AT+EXT : Get or Set Count value

AT+EXT : Get or Set Count value

AT+RXDL : Extend the sending and receiving time

AT+SERVADDR : Server Address

AT+WEIGRE : Get weight or set weight to 0

AT+WEIGAP : Get or Set the GapValue of weight

AT+DNSCFG : Get or Set DNS Server

AT+CFGMOD : Working mode selection

AT+INTMOD : Set the trigger interrupt mode

AT+GETSENSORVALUE : Returns the current sensor measurement

AT+CSQTIME : Get or Set the time to join the network

AT+DNSTIMER : Get or Set the NDS timer

AT+TLSMOD : Get or Set the TLS mode

AT+NOUD : Get or Set the number of data to be uploaded

AT+CDP : Read or Clear cached data

AT+CUM : Get or Set cache upload mechanism (0: Off 1: On)

AT+SERVADDR : Server Address

MQTT Management

AT+CLIENT : Get or Set MQTT client

AT+UNAME : Get or Set MQTT Username

AT+PWD : Get or Set MQTT password

AT+PUBTOPIC : Get or Set MQTT publish topic

AT+SUBTOPIC : Get or Set MQTT subscription topic

Information

AT+FDR : Factory Data Reset

AT+PWD : Serial Access Password

AT+LDATA : Get the last upload data

AT+CDP : Read or Clear cached data

4. Battery & Power Consumption

SN50v3-NB use ER26500 + SPC1520 battery pack. See below link for detail information about the battery info and how to replace.

[Battery Info & Power Consumption Analyze](#) .

5. Firmware update

User can change device firmware to::

- Update with new features.
- Fix bugs.

Firmware and changelog can be downloaded from : [Firmware download link](#)

Methods to Update Firmware:

- (Recommended way) OTA firmware update via BLE: [Instruction](#).
- Update through UART TTL interface : [Instruction](#).

6. Get and compile Software

NBSN95 is an open-source project, developer can compile their firmware for customized applications. User can get the source code from:

- Software Source Code: <https://github.com/dragino/SN50V3-NB>
- Compile instruction: <http://wiki.dragino.com/xwiki/bin/view/Main/Firmware%20Compile%20Instruction%20--%20STM32/>
- Upgrade firmware instruction

See FAQ of this file.

The project file is in: [SN50V3-NB\MDK-ARM\uvprojx](#)

7. FAQ

7.1 How can I access the BC660K-GL AT Commands?

User can access to BC660K-GL directly and send AT Commands.

[See BC660K-GL AT Command set](#)

8. Order Info

Part Number: [SN50v3-NB-XX](#)

XX:

- **GE:** General version (Exclude SIM card)
- **1D:** with 1NCE* 10 years 500MB SIM card and Pre-configure to DataCake server

YY: The grand connector hole size

- **M12:** M12 hole
- **M16:** M16 hole
- **M20:** M20 hole

9. Packing Info

Package Includes:

- SN50v3-NB NB-IoT Sensor Node x 1
- External antenna x 1

Dimension and weight:

- Device Size: 13.0 x 5 x 4.5 cm
- Device Weight: 150g
- Package Size / pcs : 14.0 x 8x 5 cm
- Weight / pcs : 180g

10. Support

- Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different timezones we cannot offer live support. However, your questions will be answered as soon as possible in the before-mentioned schedule.
- Provide as much information as possible regarding your enquiry (product models, accurately describe your problem and steps to replicate it etc) and send a mail to Support@dragino.cc.

11. FCC Warning

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.