DRAGINO NDDS75 NB-IoT Distance Detect Sensor User Manual

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Contents

Introduction

What is NDDS75 Distance Detection Sensor

The Dragino NDDS75 is a NB-IOT Distance Detection Sensor for Internet of Things solution. It is used to measure the distance between the sensor and a flat object. The distance detection sensor is a module that uses ultrasonic sensing technology for distance measurement, and temperature compensation is performed internally to improve the reliability of data.

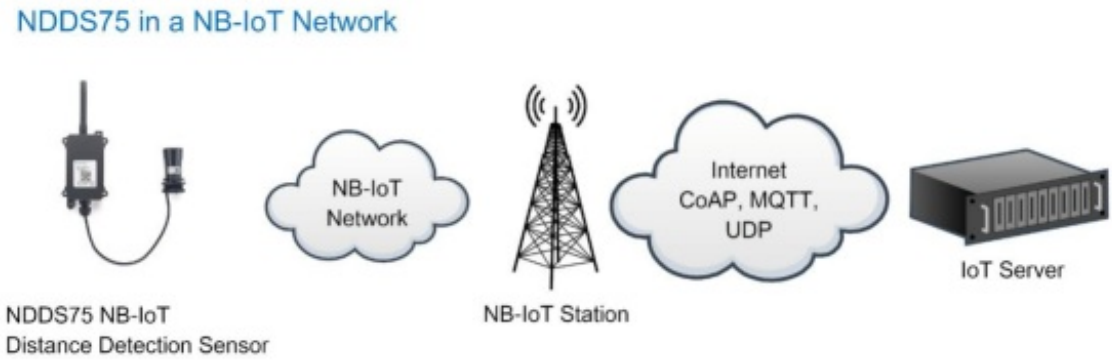
The NDDS75 can be applied to scenarios such as horizontal distance measurement, liquid level measurement, parking management system, object proximity and presence detection, intelligent trash can management system, robot obstacle avoidance, automatic control, sewer, bottom water level monitoring, etc.

It detects the distance between the measured object and the sensor, and uploads the value via wireless to IoT Server.

NarrowBand-Internet of Things (NB-IoT) is a standards-based low power wide area (LPWA) technology developed to enable a wide range of new IoT devices and services. NB IoT significantly improves the power consumption of user devices, system capacity and spectrum efficiency, especially in deep coverage.

NDDS75 is powered by 8500mA Li-SOCI2 battery; It is designed for long term use up to 5 years*.

Actually lifetime depends on network coverage and uplink interval and other factors



Specifications

Common DC Characteristics:

- Supply Voltage: 2.1v ~ 3.6v
- Operating Temperature: -40 ~ 85°C

NB-IoT Spec:

- – B1 @H-FDD: 2100MHz
- – B3 @H-FDD: 1800MHz
- – B8 @H-FDD: 900MHz
- – B5 @H-FDD: 850MHz
- – B20 @H-FDD: 800MHz
- – B28 @H-FDD: 700MHz

Battery:

- Li/SOCI2 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: 10uA @ 3.3v
- Max transmit power: 350mA@3.3v

Features

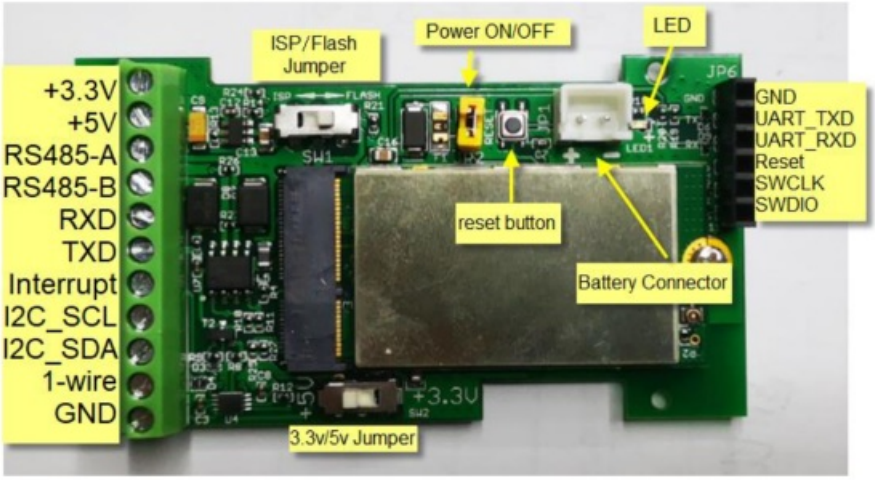
- NB-IoT Bands: B1/B3/B8/B5/B20/B28 @H-FDD
- Ultra low power consumption
- Distance Detection by Ultrasonic technology
- Flat object range 280mm – 7500mm
- Accuracy: ±(1cm+S*0.3%) (S: Distance)

- Cable Length: 25cm
- AT Commands to change parameters
- Uplink on periodically
- Downlink to change configure
- IP66 Waterproof Enclosure
- Micro SIM card slot for NB-IoT SIM
- 8500mAh Battery for long term use

Applications

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

Pin Definitions

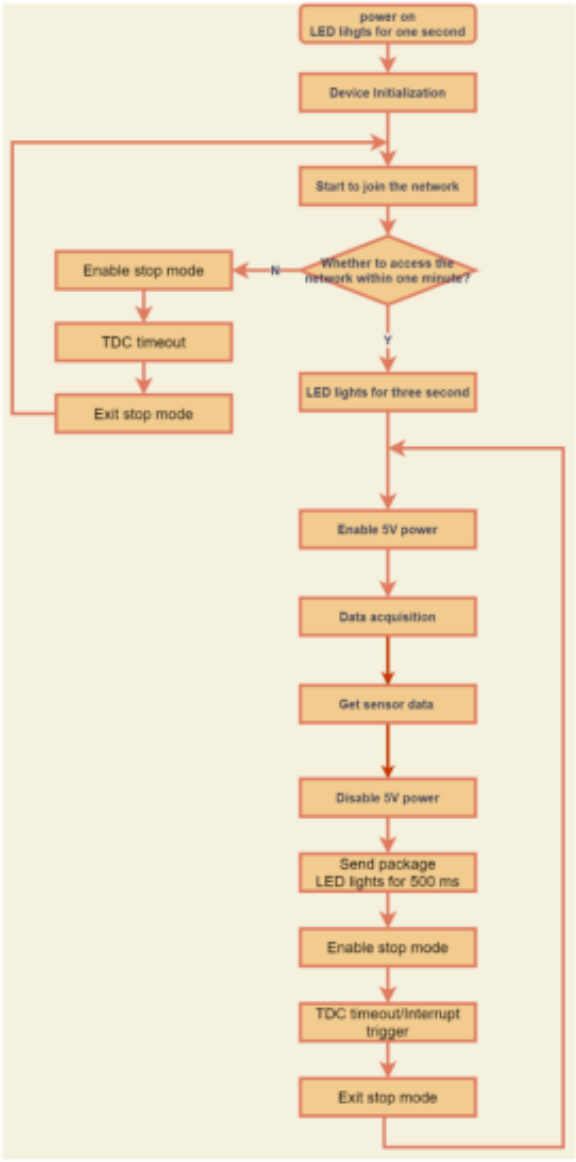


Use NDDS75 to communicate with IoT Server

How it works

The NDDS75 is equipped with a NB-IoT module, the pre-loaded firmware in NDDS75 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 NDDS75.

The diagram below shows the working flow in default firmware of NDDS75:



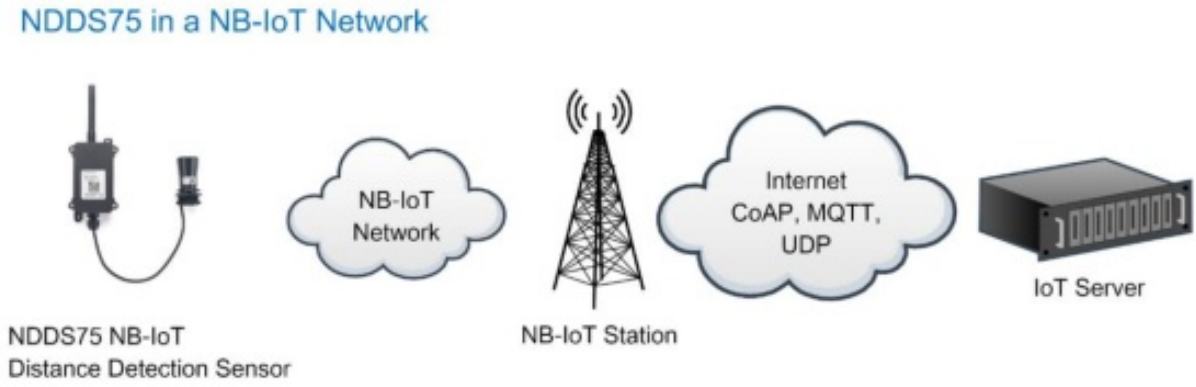
Configure the NDDS75

Test Requirement

To use NDDS75 in your city, make sure meet below requirements:

- Your local operator has already distributed a NB-IoT Network there.
- The local NB-IoT network used the band that NDDS75 supports.
- Your operator is able to distribute the data received in their NB-IoT network to your IoT server.

Below figure shows our testing structure. Here we have NB-IoT network coverage by China Mobile, the band they use is B8. The NDDS75 will use CoAP(120.24.4.116:5683) or raw UDP(120.24.4.116:5601) or MQTT(120.24.4.116:1883)or TCP(120.24.4.116:5600)protocol to send data to the test server



Insert SIM card

Insert the NB-IoT Card get from your provider.

User need to take out the NB-IoT module and insert the SIM card like below:

Connect USB – TTL to NDDS75 to configure it

User need to configure NDDS75 via serial port to set the Server Address / Uplink Topic to define where and how-to uplink packets. NDDS75 support AT Commands, user can use a USB to TTL adapter to connect to NDDS75 and use AT Commands to configure it, as below.

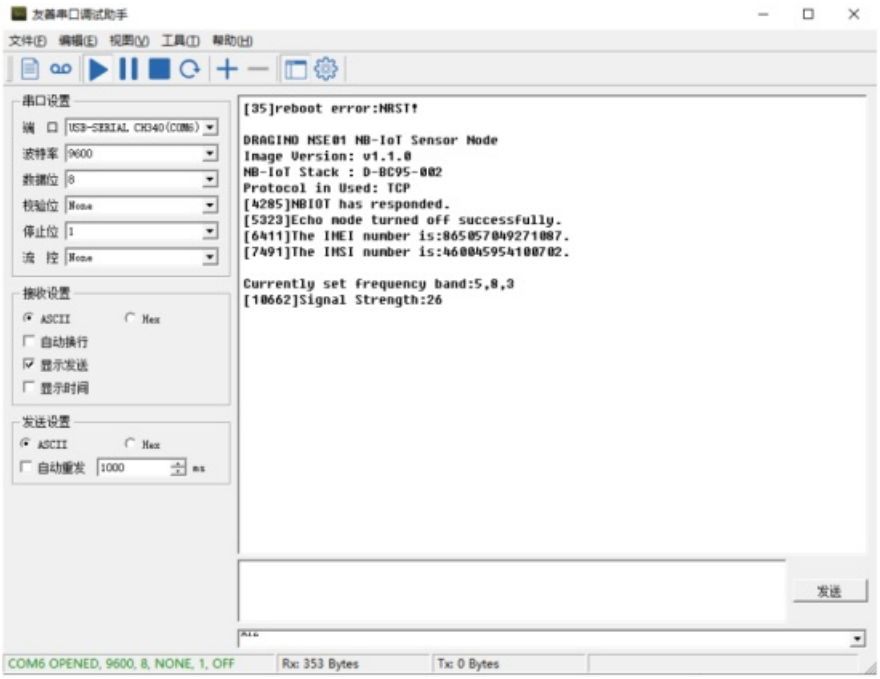
Connection:

USB TTL GND <—-> GND
USB TTL TXD <—-> UART_RXD
USB TTL RXD <—-> UART_TXD

In the PC, use below serial tool settings:

- Baud: 9600
- Data bits: 8
- Stop bits: 1
- Parity: None
- Flow Control: None

Make sure the switch is in FLASH position, then power on device by connecting the jumper on NDDS75. NDDS75 will output system info once power on as below, we can enter the password: 12345678 to access AT Command input.



Note: the valid AT Commands can be found at:
http://www.dragino.com/downloads/index.php?dir=NB-IoT/NDDS75/

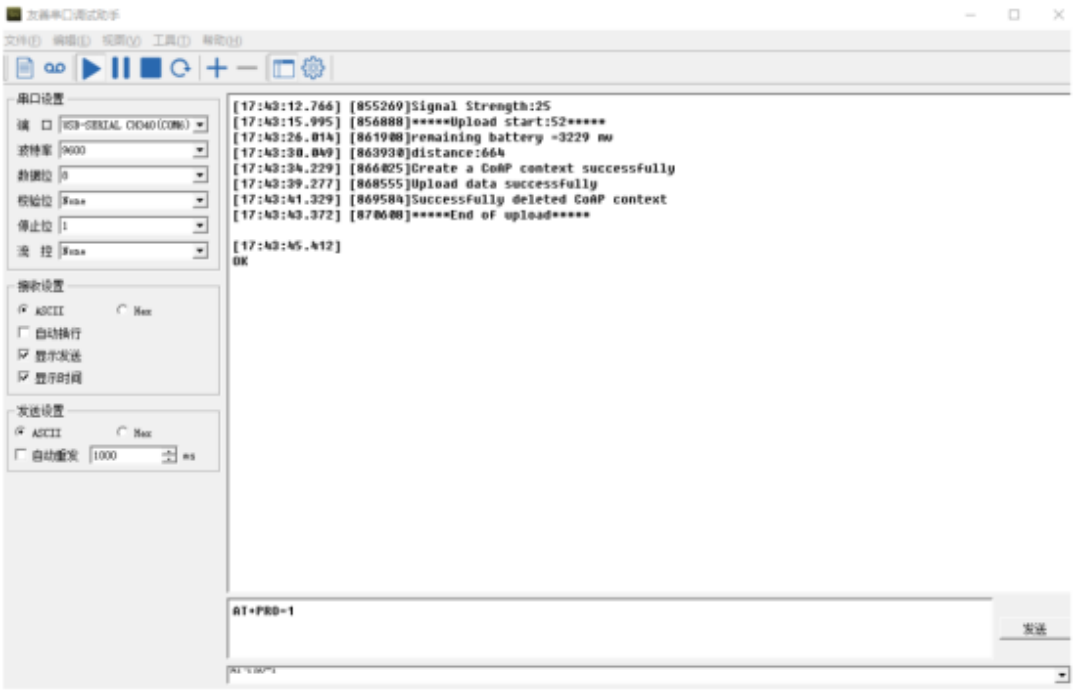
Use CoAP protocol to uplink data

Note: if you don’t have CoAP server, you can refer this link to set up one:
http://wiki.dragino.com/index.php?title=Set_up_CoAP_Server

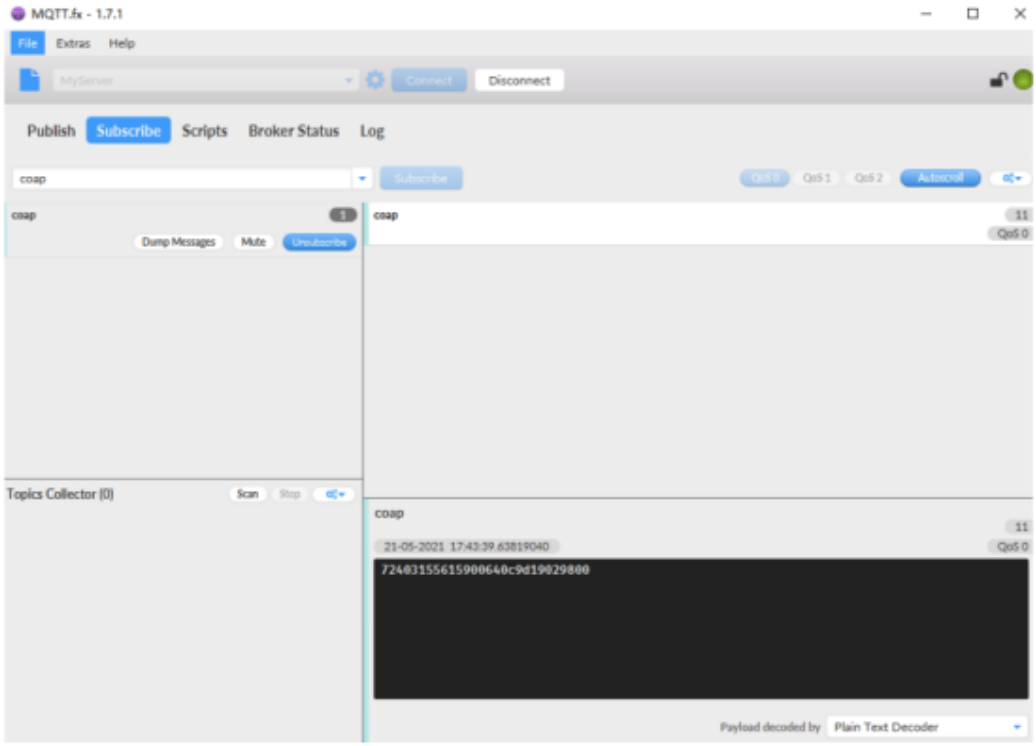
Use below commands:

- AT+PRO=1 // Set to use CoAP protocol to uplink
- AT+SERVADDR=120.24.4.116,5683 // to set CoAP server address and port
- AT+URI=5,11,”mqtt”,11,”coap”,12,”0″,15,”c=text1″,23,”0″ //Set COAP resource path

  For parameter description, please refer to AT command set

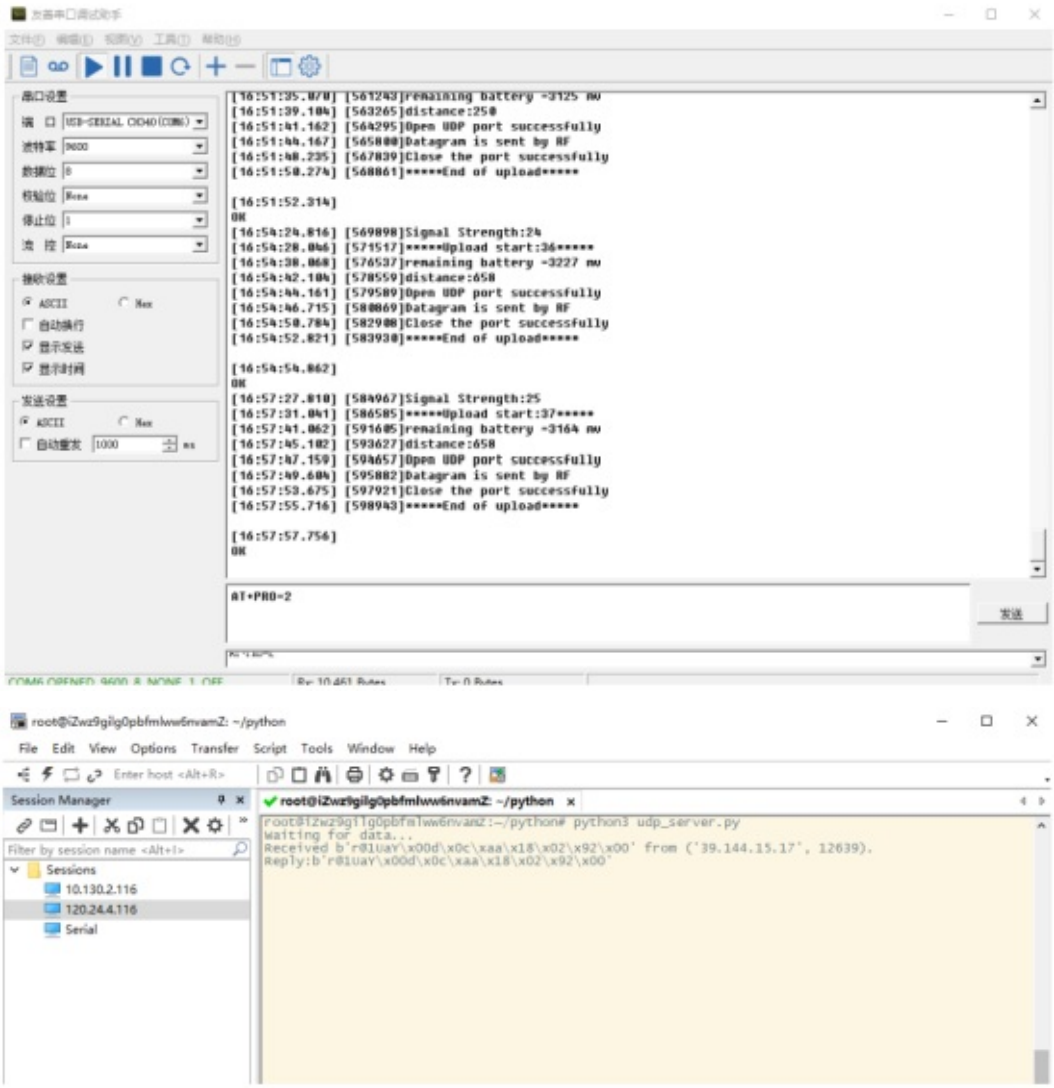


After configure the server address and reset the device (via AT+ATZ), NDDS75 will start to uplink sensor values to CoAP server.



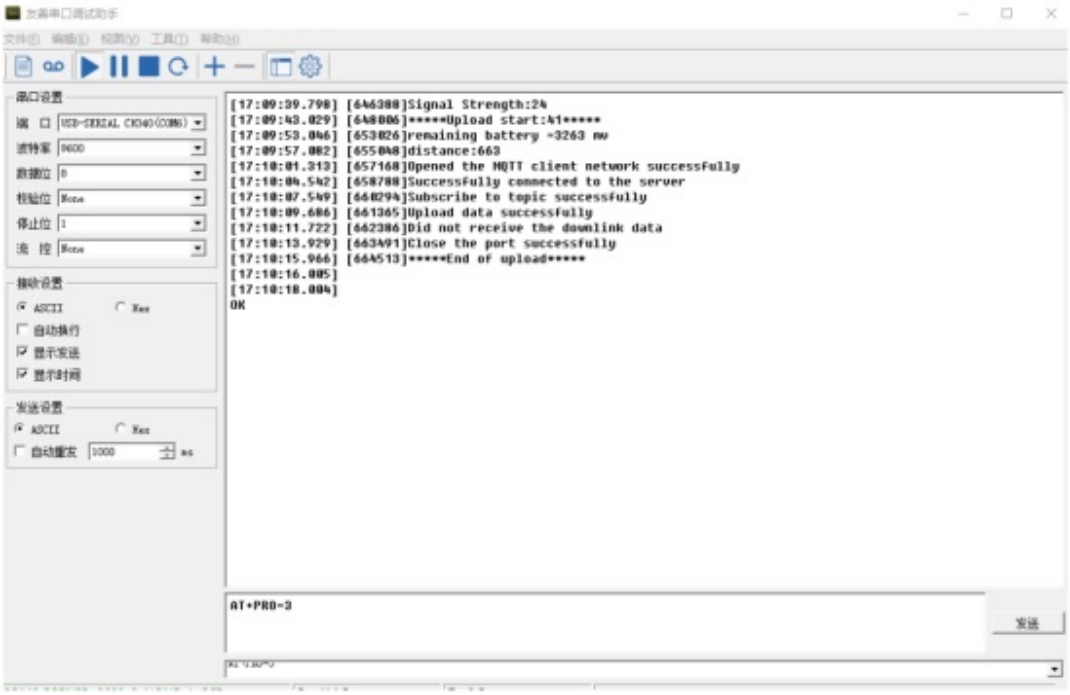
Use UDP protocol to uplink data (Default protocol)

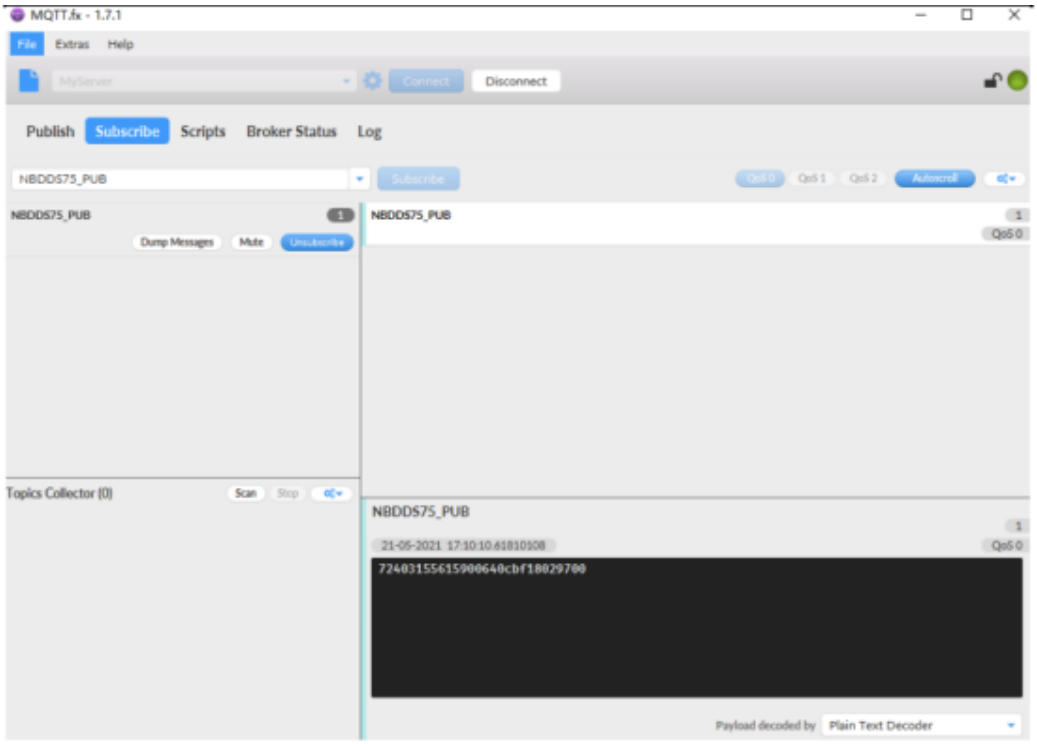
- AT+PRO=2 // Set to use UDP protocol to uplink
- AT+SERVADDR=120.24.4.116,5601 // to set UDP server address and port
- AT+CFM=1 //If the server does not respond, this command is unnecessary



Use MQTT protocol to uplink data

- AT+PRO=3 //Set to use MQTT protocol to uplink
- AT+SERVADDR=120.24.4.116,1883 //Set MQTT server address and port
- AT+CLIENT=CLIENT //Set up the CLIENT of MQTT
- AT+UNAME=UNAME //Set the username of MQTT
- AT+PWD=PWD //Set the password of MQTT
- AT+PUBTOPIC=NDDS75_PUB //Set the sending topic of MQTT
- AT+SUBTOPIC=NDDS75_SUB //Set the subscription topic of MQTT

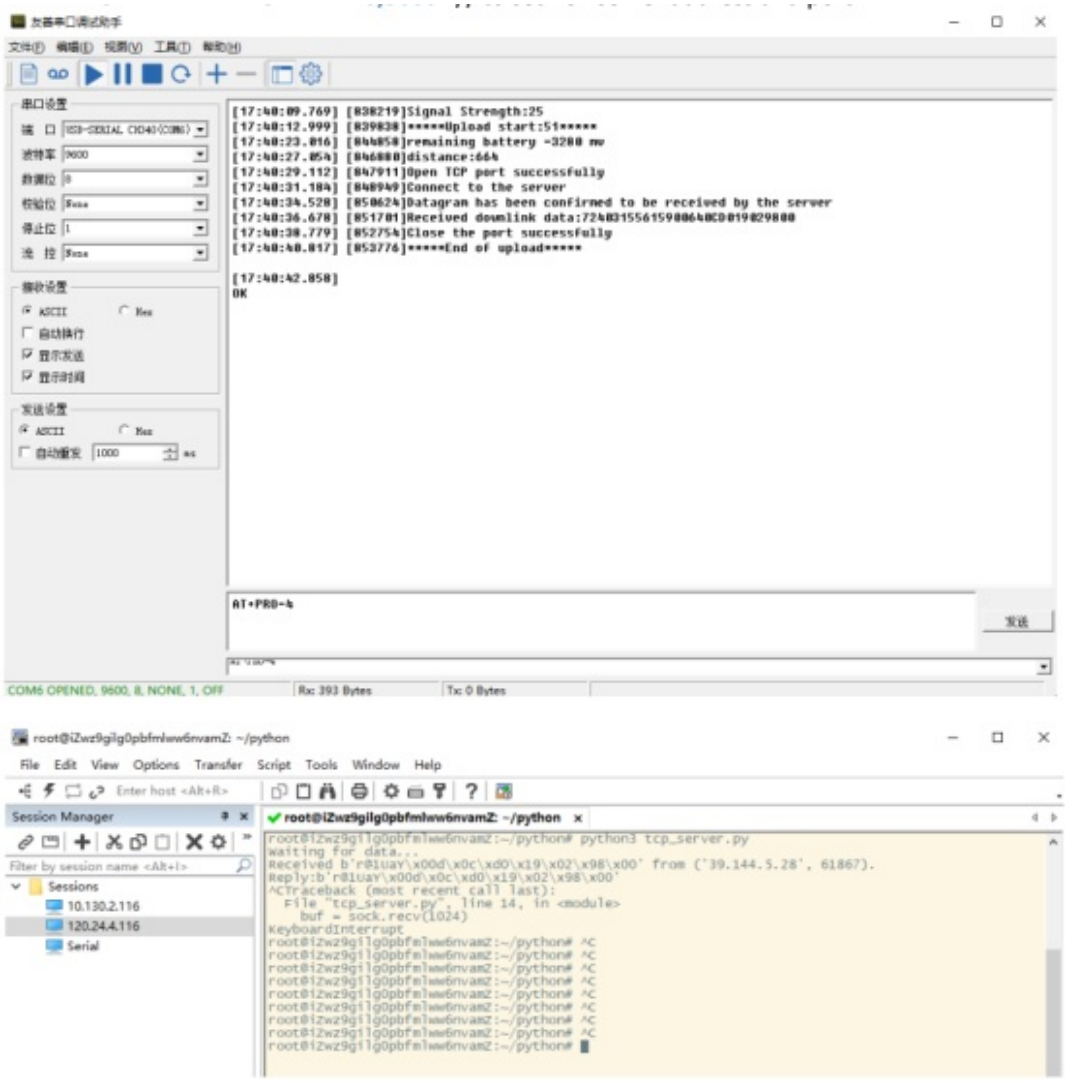




MQTT protocol has a much higher power consumption compare vs UDP / CoAP protocol. Please check the power analyze document and adjust the uplink period to a suitable interval.

Use TCP protocol to uplink data

- AT+PRO=4 // Set to use TCP protocol to uplink
- AT+SERVADDR=120.24.4.116,5600 // to set TCP server address and port



Change Update Interval

User can use below command to change the uplink interval.

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

NOTE:

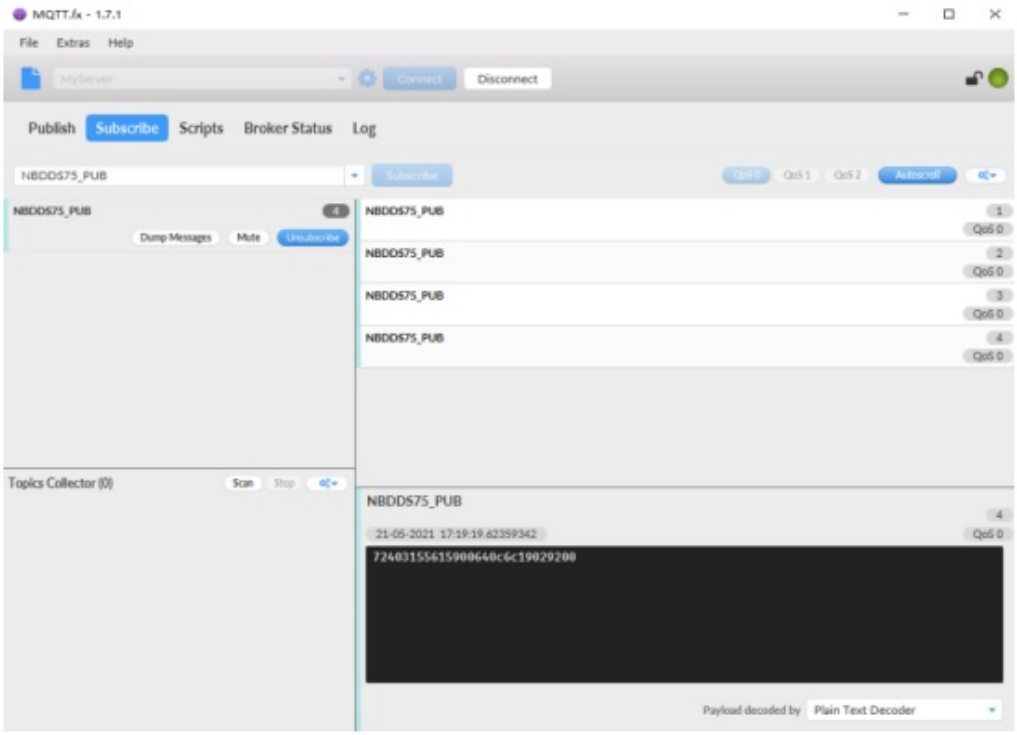
By default, the device will send an uplink message every 1 hour (3600s).

Uplink Payload

In this mode, uplink payload includes in total 14 bytes

Size (bytes)	**6**	**2**	**2**	**1**	**2**	**1**
Value	Device ID	Ver	BAT	Signal Strength	Distance (unit: mm)	Interrupt

If we use the MQTT client to subscribe to this MQTT topic, we can see the following information when the NDDS75 uplink data.



The payload is ASCII string, representative same HEX:

0x72403155615900640c6c19029200 where:

- Device ID: 0x724031556159 = 724031556159
- Version: 0x0064=100=1.0.0
- BAT: 0x0c6c = 3180 mV = 3.180V
- Signal: 0x19 = 25
- Distance: 0x0292= 658 mm
- Interrupt: 0x00 = 0

Payload Explanation and Sensor Interface

Device ID

By default, the Device ID equal to the last 6 bytes of IMEI.

User can use AT+DEUI to set Device ID

Example:
AT+DEUI=A84041F15612
The Device ID is stored in a none-erase area, Upgrade the firmware or run AT+FDR won't erase Device ID.

Version Info

Specify the software version: 0x64=100, means firmware version 1.00.

For example: 0x00 64 : this device is NDDS75 with firmware version 1.0.0.

Battery Info

Ex1: 0x0B45 = 2885mV

Ex2: 0x0B49 = 2889mV

Signal Strength

NB-IoT Network signal Strength.

Ex1: 0x1d = 29

0 -113dBm or less
1 -111dBm
2…30 -109dBm… -53dBm
31 -51dBm or greater
99 Not known or not detectable

Distance

Get the distance. Flat object range 280mm – 7500mm.

For example, if the data you get from the register is 0x0B 0x05, the distance between the sensor and the measured object is

0B05(H) = 2821 (D) = 2821 mm.

If the sensor value is 0x0000, it means system doesn't detect ultrasonic sensor.

If the sensor value lower than 0x0118 (280mm), the sensor value will be invalid.

Digital Interrupt

Digital Interrupt refers to pin GPIO_EXTI, and there are different trigger methods.

When there is a trigger, the NDDS75 will send a packet to the server.

The command is:

AT+INTMOD=3 //(more info about INMOD please refer **AT Command Manual**).

The lower four bits of this data field shows if this packet is generated by interrupt or not. Click here for the hardware and software set up.

Example:

0x(00): Normal uplink packet.
0x(01): Interrupt Uplink Packet.

+5V Output

NDDS75 will enable +5V output before all sampling and disable the +5v after all sampling.

The 5V output time can be controlled by AT Command.

AT+5VT=1000

Means set 5V valid time to have 1000ms. So the real 5V output will actually have 1000ms + sampling time for other sensors.

Downlink Payload

By default, NDDS75 prints the downlink payload to console port.

Downlink Control Type	FPort	Type Code	Downlink payload size(bytes)
TDC (Transmit Time Interval)	Any	01	4
RESET	Any	04	2
INTMOD	Any	06	4

Examples

Set TDC

If the payload=0100003C, it means set the END Node's TDC to 0x00003C=60(S), while type code is 01.

Payload: 01 00 00 1E TDC=30S
Payload: 01 00 00 3C TDC=60S

Reset

If payload = 0x04FF, it will reset the NDDS75

INTMOD

Downlink Payload: 06000003, Set AT+INTMOD=3

LED Indicator

The NDDS75 has an internal LED which is to show the status of different state.

- When power on, NDDS75 will detect if sensor probe is connected, if probe detected, LED will blink four times. (no blinks in this step is no probe)

- Then the LED will be on for 1 second means device is boot normally.
- After NDDS75 join NB-IoT network. The LED will be ON for 3 seconds.
- For each uplink probe, LED will be on for 500ms.

Firmware Change Log

Download URL & Firmware Change log
www.dragino.com/downloads/index.php?dir=NB-IoT/NDDS75/Firmware/

Upgrade Instruction: Upgrade Firmware

Battery Analysis

Battery Type

The NDDS75 battery is a combination of an 8500mAh Li/SOCI2 Battery and a Super Capacitor.

The battery is none-rechargeable battery type with a low discharge rate (<2% per year). This type of battery is commonly used in IoT devices such as water meter.

The battery is designed to last for several years depends on the actually use environment and update interval.

The battery related documents as below:

- Battery Dimension,
- Lithium-Thionyl Chloride Battery datasheet
- Lithium-ion Battery-Capacitor datasheet,

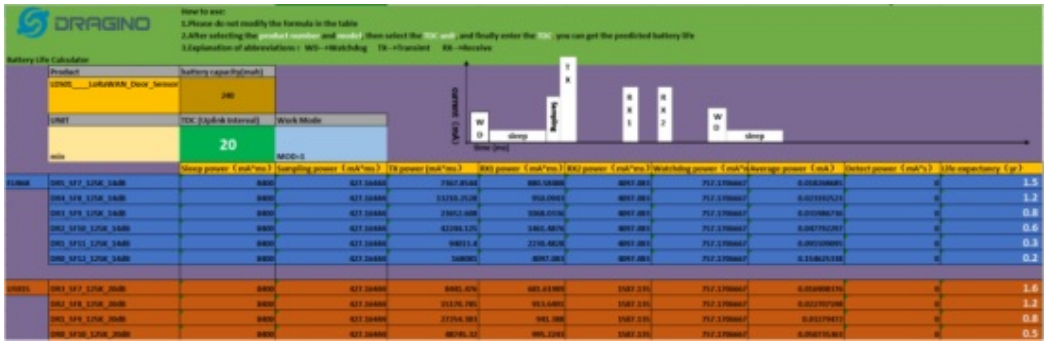
Power consumption Analyze

Dragino battery powered product are all runs in Low Power mode. We have an update battery calculator which base on the measurement of the real device. User can use this calculator to check the battery life and calculate the battery life if want to use different transmit interval.

Instruction to use as below:

- **Step 1:** Downlink the up-to-date DRAGINO_Battery_Life_Prediction_Table.xlsx from: https://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/Battery_Analyze/
- **Step 2:** Open it and choose
  - Product Model
  - Uplink Interval
  - Working Mode

  And the Life expectation in difference case will be shown on the right.



Battery Note

The Li-SICO battery is designed for small current / long period application. It is not good to use a high current, short period transmit method. The recommended minimum period for use of this battery is 5 minutes. If you use a shorter period time to uplink data, then the battery life may be decreased.

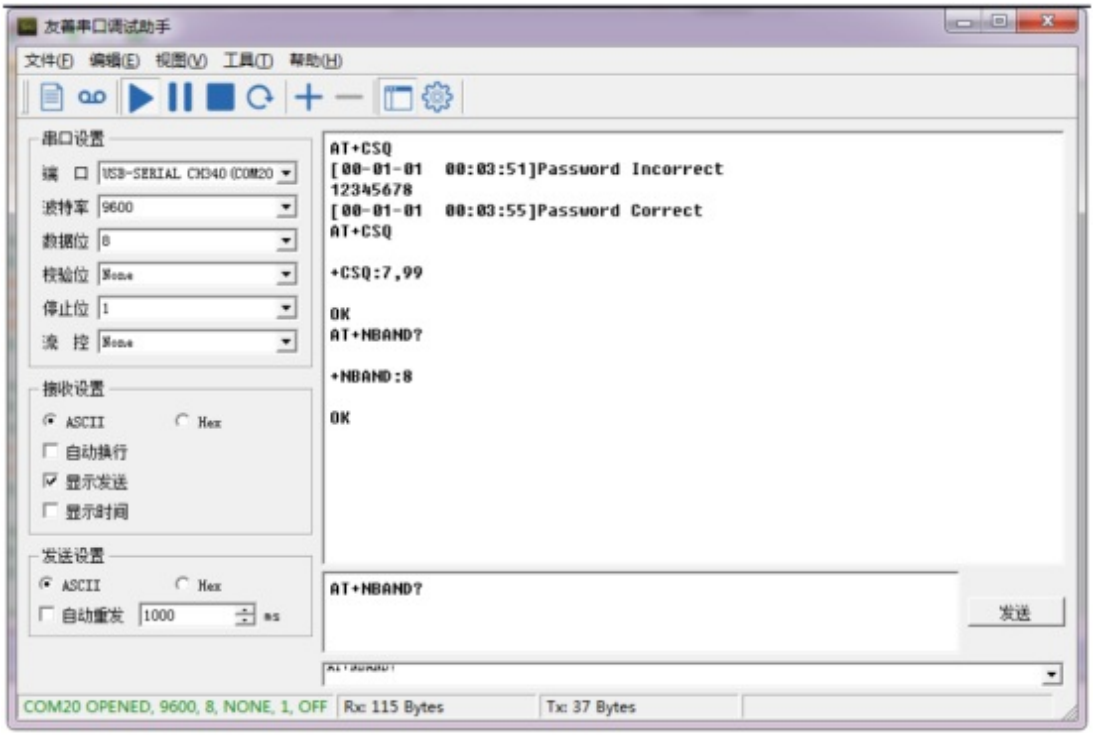
Replace the battery

The default battery pack of NDDS75 includes a ER26500 plus super capacitor. If user can't find this pack locally, they can find ER26500 or equivalence without the SPC1520 capacitor, which will also work in most case. The SPC can enlarge the battery life for high frequency use (update period below 5 minutes)

Access NB-IoT Module

Users can directly access the AT command set of the NB-IoT module.

The AT Command set can refer the BC35-G NB-IoT Module AT Command: https://www.dragino.com/downloads/index.php?dir=datasheet/other_vendors/BC35-G/



Using the AT Commands

Access AT Commands

See this link for detail:
http://www.dragino.com/downloads/index.php?dir=NB-IoT/NDDS75/

AT+? : Help on
AT+ : Run
AT+= : Set the value
AT+=? : 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+CFGMOD : Working mode selection
AT+INTMOD : Set the trigger interrupt mode
AT+5VT : Set extend the time of 5V power
AT+PRO : Choose agreement
AT+WEIGRE : Get weight or set weight to 0
AT+WEIGAP : Get or Set the GapValue of weight
AT+RXDL : Extend the sending and receiving time
AT+CNTFAC : Get or set counting parameters
AT+SERVADDR : Server Address

COAP Management

AT+URI : Resource parameters

UDP Management

AT+CFM : Upload confirmation mode (only valid for UDP)

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+PWORD : Serial Access Password

FAQ

How to Upgrade Firmware

User can upgrade the firmware for 1) bug fix, 2) new feature release.

Please see this link for how to upgrade:
http://wiki.dragino.com/index.php?title=Firmware_Upgrade_Instruction_for_STM32_base_prod
ucts#Hardware_Upgrade_Method_Support_List

Notice, LDDS75 and NDDS75 share the same mother board. They use the same connection and method to update.

Trouble Shooting

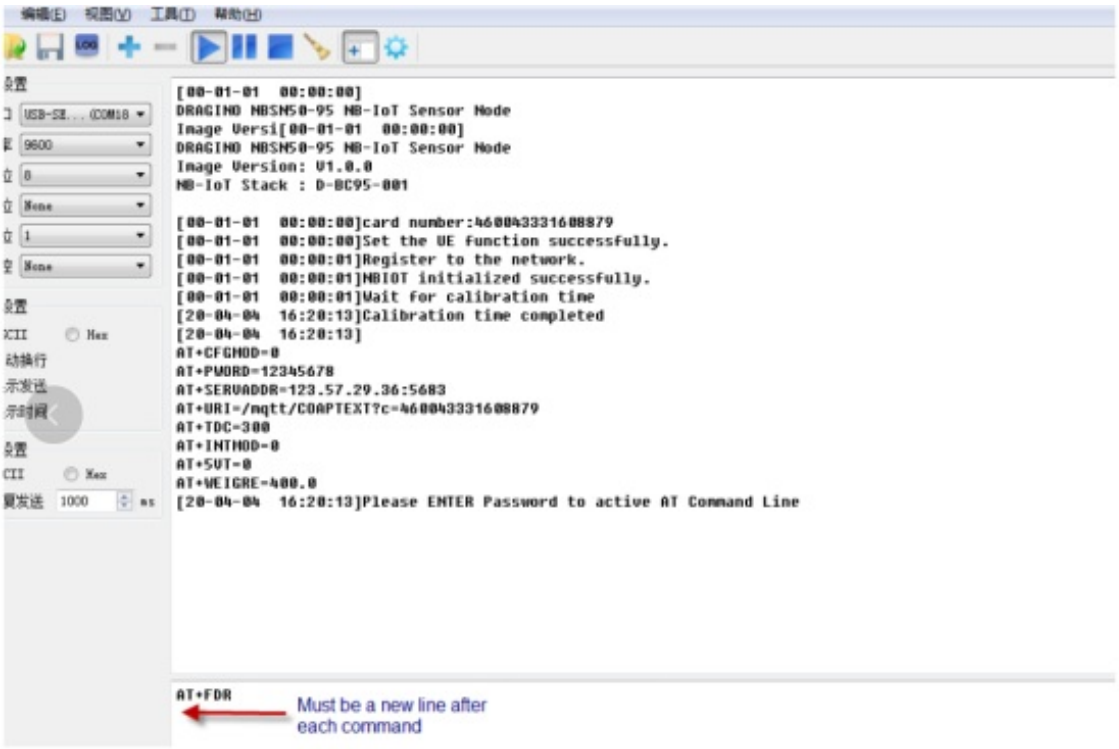
Connection problem when uploading firmware.

Please see:
http://wiki.dragino.com/index.php?title=Firmware_Upgrade_Trouble_Shooting#UART_upgr
ade_trouble_shooting

AT Command input doesn't work

In the case if user can see the console output but can't type input to the device.

Please check if you already include the ENTER while sending out the command. Some serial tool doesn't send ENTER while press the send key. In this case, user need to add ENTER in the string to send, as below:



Order Info

Part Number: NDDS75

Packing Info

Package Includes:

- NDDS75 NB-IoT Distance Detect 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

Support

- Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different time zones 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.com**

Documents / Resources

	DRAGINO NDDS75 NB-IoT Distance Detect Sensor [pdf] User Manual NDDS75, NB-IoT Distance Detect Sensor