USB-TO-LoRa-xF

From Waveshare Wiki
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Overview

USB-TO-LoRa-xF



(https://www.waveshare.com/usb-to-lora.htm)

SMA, USB

This product does not support LoRaWAN.
This product only supports SX1262-LoRa-DTU-xF (https://www.waveshare.com/sx1262-lora-dtu-lf.htm) corresponding model communication.
At least two USB-TO-LoRa-HFs are required to form a LoRa communication network (same for USB-TO-LoRa-LF).

Introduction

The USB-TO-LoRa-xF is a wireless data transfer unit with USB interfaces based on the SX1262 module. Adopts LoRa Modulate and Demodulate technology, with the advantages of anti-interference and long-distance communication (up to 5KM). Supports point-to-point, point-to-multipoint, relay network, AES, etc. Compact size and easy to install.

Feature

- Adopts LoRa Modulate and Demodulate technology, anti-interference, and long-distance communication.
- Adopts the original SX1262 chip, with -148dBm reception sensitivity and 22dBm emit power.
- Supports preamble detection, with CRC, automatic packetization, 960 bytes cache functions.
- Supports LBT sending, RSSI output, and AT command configuration.
- AES communication to ensure data transmission security.
- Supports multi-level relay networking to increase the wireless communication distance.
- Supports host configuration and firmware upgrade (support firmware customization for batch order).
- High-quality components such as TCXO are used for stable operation in harsh conditions.
- Comes with online development resources and manuals.

Parameters

Shape

Interface	USB Type A Interface SMA-KE female header: 6dBi Omni-directional Antenna × 1
Case	ABS case
Dimensions	56.40 × 18.40 × 12.52mm
Wireless Parameters	
Frequency	Sub-GHz (410~490MHz, 850~930MHz)
Signal Modulation	LoRa
Encryption Type	AES
Emit Power	+22dBm Max
Receiving Sensitivity	-148dBm
UART Parameters	
Baud Rate	1200 ~ 115200bps
Checksum	None, even, odd
Data Bit	8 ~ 9 bit
Flow Control	No flow control
Environment Requirements	
Operating Temperature	TCXO version:0 ~ 85℃ Normal version:0 ~ 50℃
Humidity Range	5% ~ 95% Relative Humidity

Hardware Description

This product does not support LoRaWAN.

This product only supports SX1262-LoRa-DTU-xF (https://www.waveshare.com/sx1262-lora-dtu-lf.htm) corresponding model communication.

At least two USB-TO-LoRa-HFs are required to form a LoRa communication network (same for USB-TO-LoRa-LF).

USB

Power up and run after connecting to the USB Type A Female port.

SMA Connector (Antenna)

Connect the SMA connector to the matching 6dBi omnidirectional antenna.

Indicator

- PWR: when connecting to the USB interface, the PWR indicator is on.
- TXD: when sending the data, the TXD indicator is on and off after sending.
- RXD: when receiving the data, the RXD indicator is on and off after receiving.

Button

- KEY: Note: Do not press the button within 3 seconds after powering on. Press and hold the button for 2 seconds to enter firmware update mode within 3 seconds of powering on.

After 3 seconds of powering on, press and hold the KEY button for two seconds to restore factory settings.

Dimensions



(/wiki/File:USB-TO-LoRa-xF02.jpg)

LoRa & LoRaWAN

What is LoRa ?

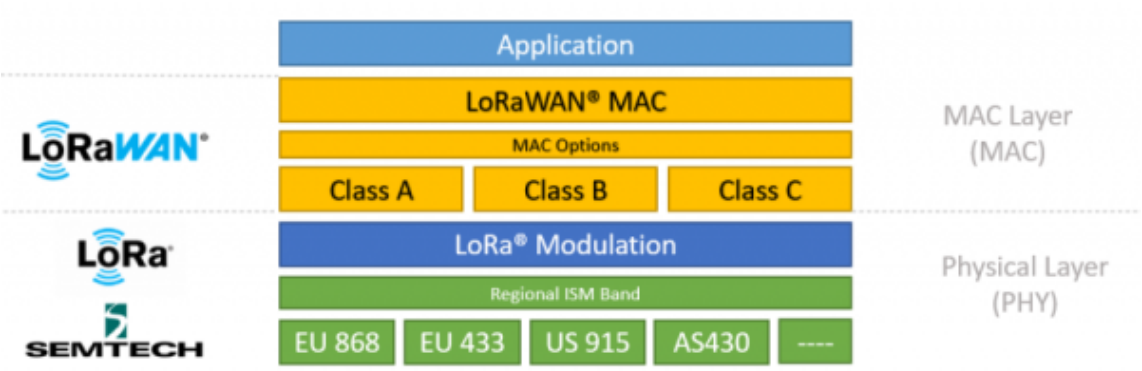
[Semtech (https://www.semtech.com/)]'s LoRa is a long-distance, low-power wireless platform for the Internet of Things (IoT), which generally refers to radio frequency chips using LoRa technology. The main features are as follows:

- The spread spectrum modulation technology adopted by LoRa (abbreviation of long-range) is derived from Chirp Spread Spectrum (CSS) technology, which is one of the long-distance wireless transmission technology and LPWAN communication technology. Spread spectrum technology uses bandwidth for sensitivity technology, Wi-Fi, ZigBee, etc. all use spread spectrum technology, but the characteristic of LoRa modulation is that it is close to the limit of Shannon's theorem, and the sensitivity can be improved with maximum efficiency. Compared with traditional FSK technology, at the same communication rate, LoRa is more sensitive than FSK by 8 ~12dBm. At present, LoRa mainly operates in the ISM frequency band of Sub-GHz.
- LoRa technology integrates technologies such as digital spread spectrum, digital signal processing, and forward error correction coding, which greatly improves the performance of long-distance communication. Lora's link budget is better than any other standardized

communication technology. The link budget refers to the main factors that determine the distance in a given environment.
- LoRa RF chips mainly include SX127X series, SX126X series and SX130X series, of which SX127X and SX126X series are used for LoRa nodes, and SX130X is used for LoRa gateways. For details, please refer to [Semtech (https://www.semtech.com/)]'s product list.

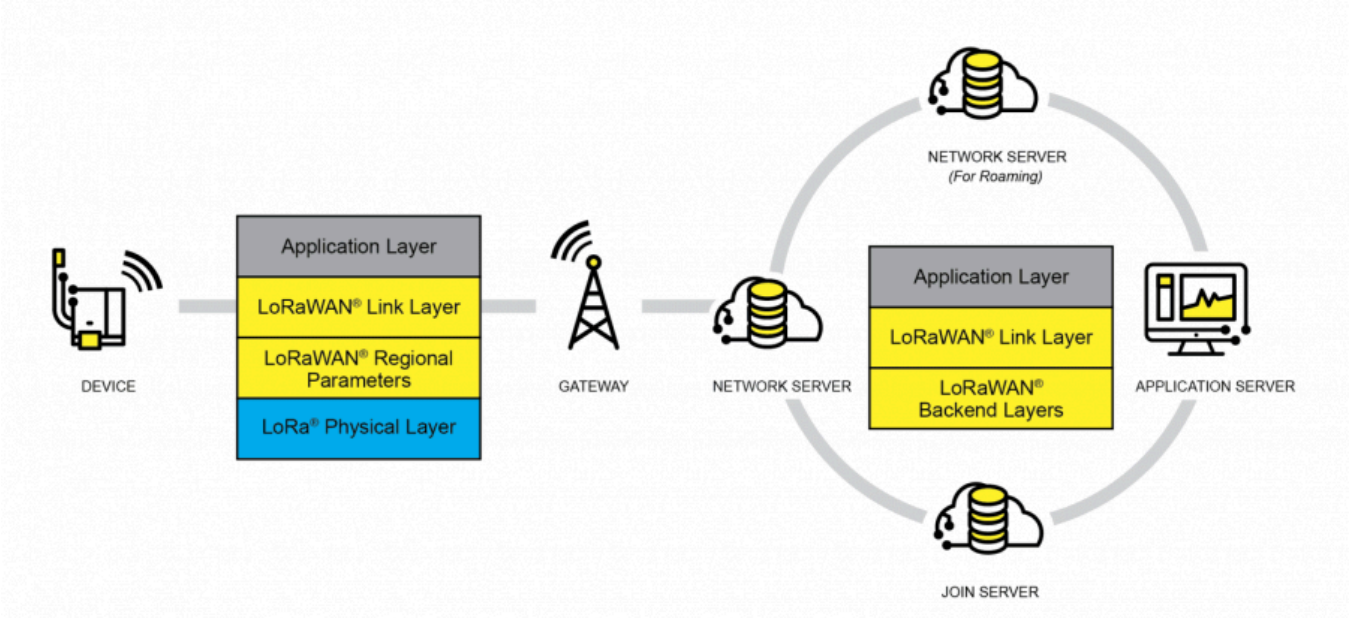
What is LoRaWAN ?

- LoWAN (https://lora-alliance.org/about-lorawan/LoRaWAN) is an open protocol for low-power wide-area networks based on LoRa radio modulation technology. Designed to wirelessly connect battery-powered "things" to the Internet in regional, national or global networks, and target critical Internet of Things (IoT) requirements such as two-way directional communication, end-to-end security, mobility, and localized services. The node wirelessly connects to the Internet with network access authentication, which is equivalent to establishing an encrypted communication channel between the node and the server. The LoRaWAN protocol level is shown in the figure below.
  - The Class A/B/C node devices in the MAC layer basically cover all the application scenarios of the Internet of Things. The differences among the three nodes lie in the different time slots of sending and receiving for nodes.
  - EU868 and AS430 in the Modulation layer show that frequency band parameters are different in different countries. Please click the reference [link (https://lora-alliance.org/wp-content/uploads/2019/11/rp_2-1.0.0_final_release.pdf)] for regional parameters.



(/wiki/File:SX1262-LoRa-HAT-0201.png)

- To achieve LoRaWAN network coverage in cities or other areas, it needs to be composed of four parts: nodes (LoRa node RF chips), gateways (or base stations, LoRa gateway RF chips), Servers and clouds, as shown in the figure below:
  - DEVICE (node device) needs to initiate a network access request packet to GATEWAY (gateway) and then to the server. After passing the authentication, it can normally send and receive application data from the server.
  - GATEWAY (gateway) can communicate with the server via a wired network or 3/4/5G wireless network.
  - The main operators on the server side include TTN (https://eu1.cloud.thethings.network/console/), etc. For building cloud services by yourself, please refer to lorawan-stack (https://github.com/TheThingsNetwork/lorawan-stack), chirpstack (https://www.chirpstack.io/).



(/wiki/File:SX1262-LoRa-DTU-xF_LORA.png)

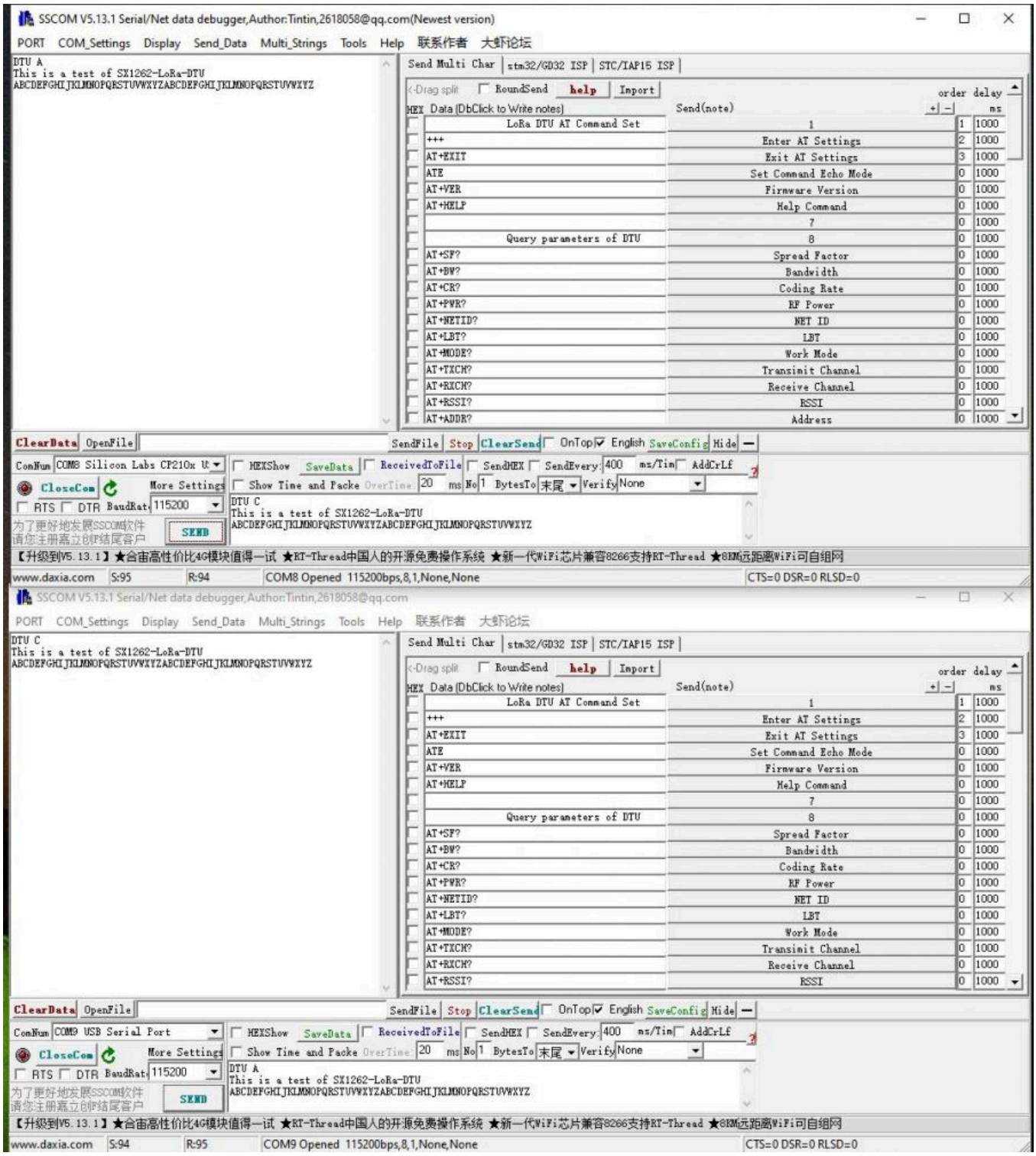
Application

LoRa devices and networks such as LoRaWAN enable smart IoT applications to help solve the planet's formidable challenges in energy management, natural resource reduction, pollution control, infrastructure efficiency, disaster prevention, and more. Semtech's LoRa devices have achieved hundreds of successful use cases in smart cities, homes and buildings, communities, metrology, supply chain, logistics, agriculture, and more. LoRa networks have covered hundreds of millions of devices in more than 100 countries and are committed to a smarter planet.

How To Use

Boot Test

- This test uses two sets of USB to RS232 cables and a DTU (https://www.waveshare.com/sx1262-lora-dtu-lf.htm) connection to test on PC Windows 10, DTU uses an RS232 interface for streaming mode transmission by default when powered on.
- Download and open the AT setting tool (https://files.waveshare.com/upload/0/0b/SX1262-LoRa-DTU-sscom5.13.1.zip) or other serial port assistant tools, connect the USB to the RS232 serial port number, set the baud rate to 115200, and finally click to open the serial port.
- After entering the data in the SSCOM sending area and clicking the send button, the received data will be printed on the other set of LoRa devices as shown in the figure below.



(/wiki/File:SX1262-LoRa-DTU-xF_User_Guide_01.jpg)

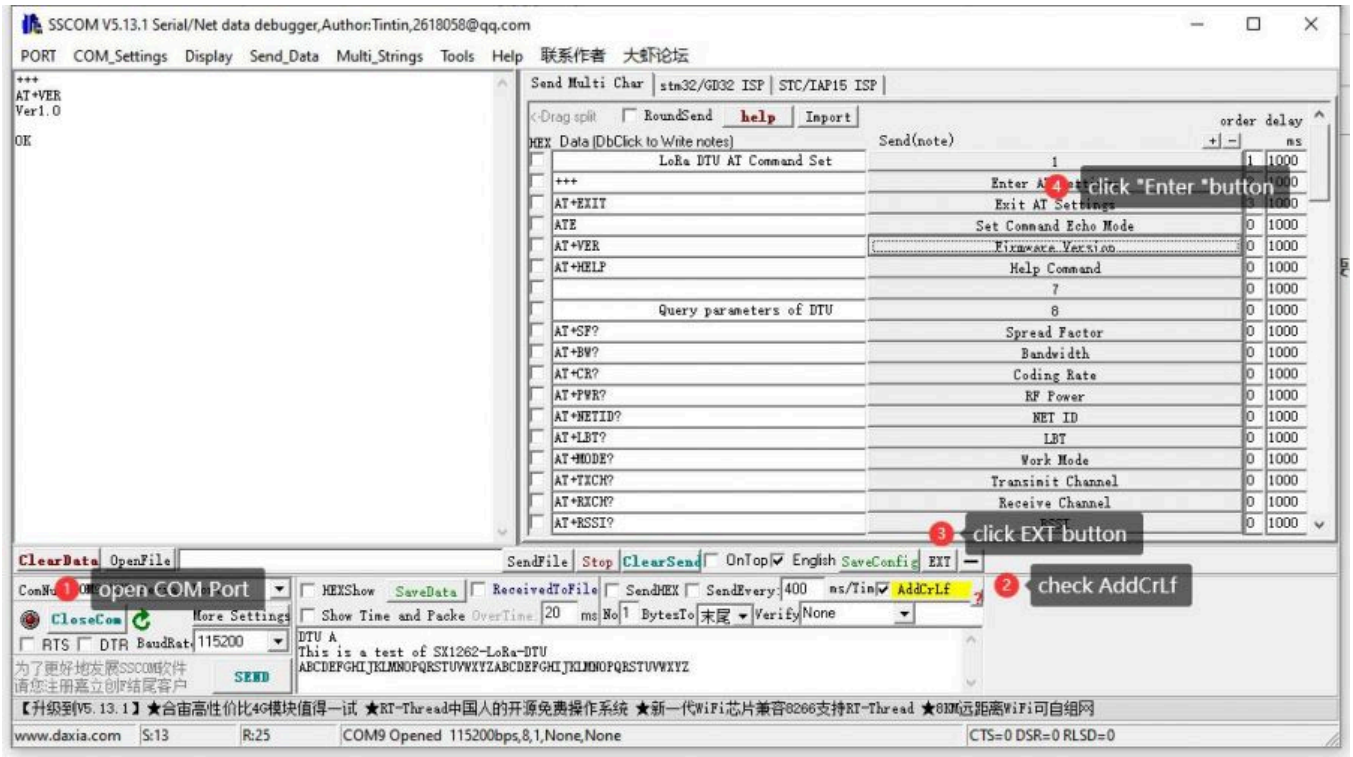
AT Commands

- The DTU works in the stream transmission mode of the RS232 interface by default, and the default parameters can be used for pairing and sending. The default parameters are as follows:

Item	Parameter Default Value
Spreading Factor	Default 7, (7~12 optional)
Bandwidth	Default 0: 125KHz (1:250, 2:500 (KHz) optional)
Code Rate	Default 4/5 (4/5, 4/6, 4/7, 4/8 optional)
Emit Power	Default 22dBm (10~22dBm optional)

Network ID	Default 0 (0~255 optional)
LBT (Listen Before Talk)	Default 0: disabled, 1: enabled
Operating Mode	Default 1: stream mode (2: packet mode, 3: relay mode)
Transmission Channel	HF version defaults to 18 (corresponding to 868MHz) (0~80 is optional, corresponding to 850~930Mhz or 410~490MHz) LF version defaults to 23 (corresponding to 433MHz)
Receiving Channel	HF version defaults to 18 (corresponding to 868MHz) (0~80 is optional, corresponding to 850~930Mhz or 410~490MHz) LF version defaults to 23 (corresponding to 433MHz)
Address	Default 0 (0~65535 optional, 65535 is broadcast listening address)
Interface Baud Rate	Default 115200bps (1200~115200bps optional)
Interface Parity	No parity by default (no parity, odd parity, even parity optional)
Key	Default 0 no encryption (0~65535 optional)

- For DTU settings, please check the add CRLF or add the carriage return line feed option. If the extension bar does not appear, click the extension button on the right to pop up. Click the +++ command button to enter the AT command mode, as shown in the figure below:



(/wiki/File:DTU-xF_User_Guide.jpg)

- When configuring DTU for other devices such as PLC, pay attention to the carriage return and line feed character CR LF(\r\n) at the end of the AT command.

```
+++\r\n                                                  Enter AT command mode
AT+EXIT\r\n                                              Exit AT command mode
ATE\r\n                                                  Enable/disable AT command echo
AT+VER\r\n                                               Check the software version number
AT+HELP\r\n                                              View AT help

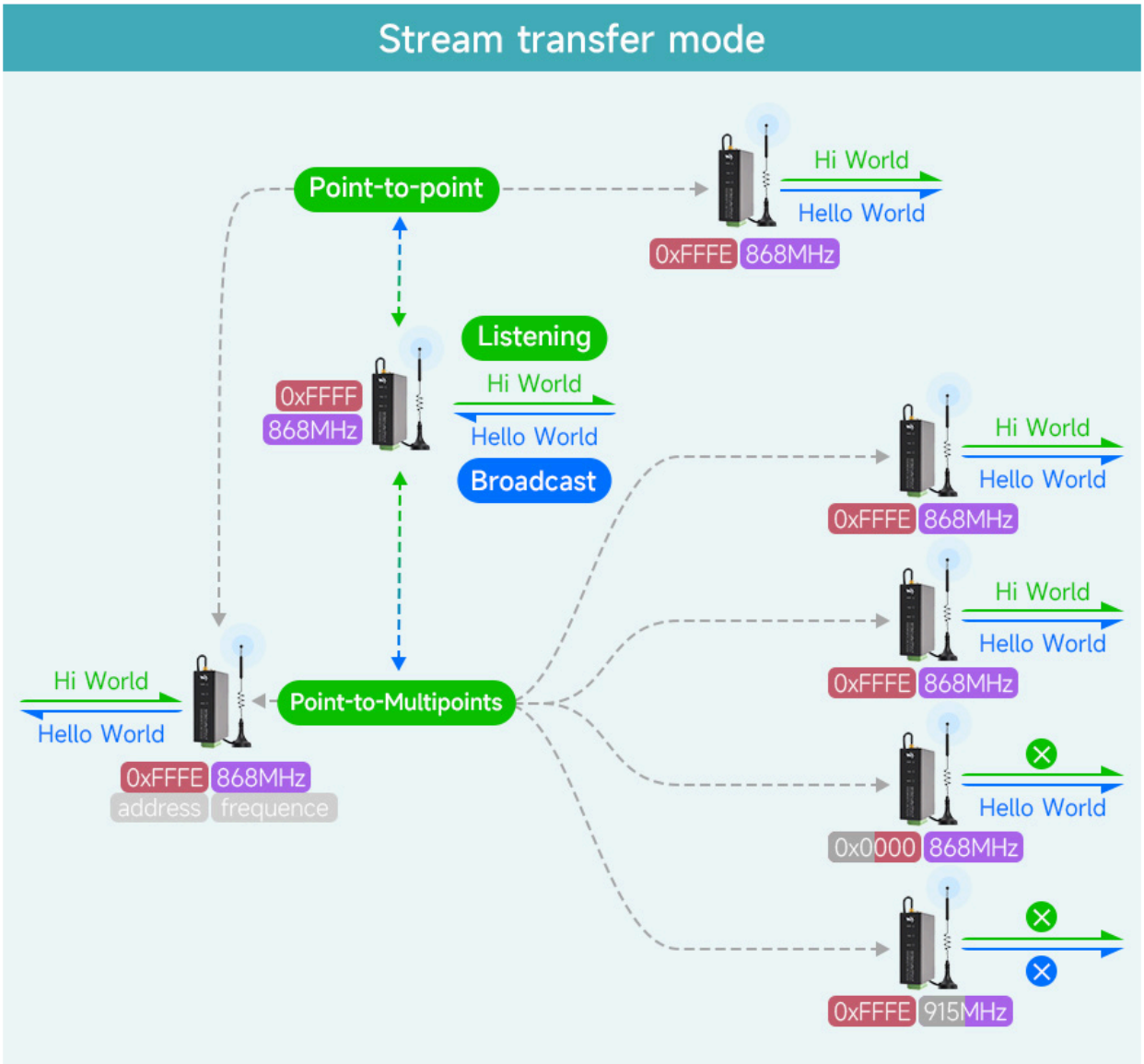
AT+SF=7\r\n                                              Set the spreading factor to 7, the
value range is 7~12
AT+BW=0\r\n                                              Set bandwidth, 0 means 125KHz, 1 me
ans 250KHz, 2 means 500KHz
AT+CR=1\r\n                                              Set the encoding rate to 1, 1 repre
sents 4/5, 2 represents 4/6, 3 represents 4/7, 4 represents 4/8
AT+PWR=22\r\n                                            Set the RF power, the value range i
s 10~22dBm
AT+NETID=0\r\n                                           Network ID assignment, the value ra
nge is 0~65535
AT+LBT=0\r\n                                             Enable/disable LBT function, 0: dis
able, 1: enable
AT+MODE=1                                                DTU working mode, 1: stream mode,
2: packet mode, 3: relay mode
AT+TXCH=18\r\n                                           Transmit channel, value range 0~80,
corresponding frequency point is 850~930MHz or 410~490MHz
AT+RXCH=18\r\n                                           Receive channel, value range 0~80,
corresponding frequency point is 850~930MHz or 410~490MHz
AT+RSSI=0\r\n                                            Enable/disable RSSI signal value ou
tput, 0: disable, 1: enable
AT+ADDR=0\r\n                                            Set DTU address, value range 0~6553
5
AT+BAUD=115200\r\n                                       Set COMx port baud rate, value rang
e 1200~115200, 1200, 2400, ....., 57600, 115200ss
AT+COMM="8N1"\r\n                                        Set COM port parameters, data bits:
8 or 9, parity: N, O, E, stop bits: 0, 1, 2
AT+AllP=7,125,1,22,0,0,1,18,18,0,0,3,115200, "8N1",0   Set the spreading factor to key mu
lti-parameter
AT+RESTORE=0\r\n                                         Restore factory settings, 0: disabl
ed, 1: enabled
```

Stream Transfer Mode

- Stream transfer mode refers to a transmission mode in which the DTU transmits the data stream sent by the interface to other Device for demodulation by LoRa and outputs the data stream from the specified interface, that is, send and receive as shown below:
  - Suppose there are Device A, B, C, D, E, F, and G devices to form a stream mode communication network. To change the address, channel, and working mode of the devices in the LoRa network, please refer to the following communication diagram and parameter table, and pay attention to using the AT command (AT+MODE=1\r\n) to switch to the stream transfer mode.
    - Device A and Device C form point-to-point communication.
      - Device A sends Hello World to Device C, and Device C with a matching address channel can receive it normally.

- Device C sends Hello World to Device A, and Device A with a matching address channel can receive it normally.

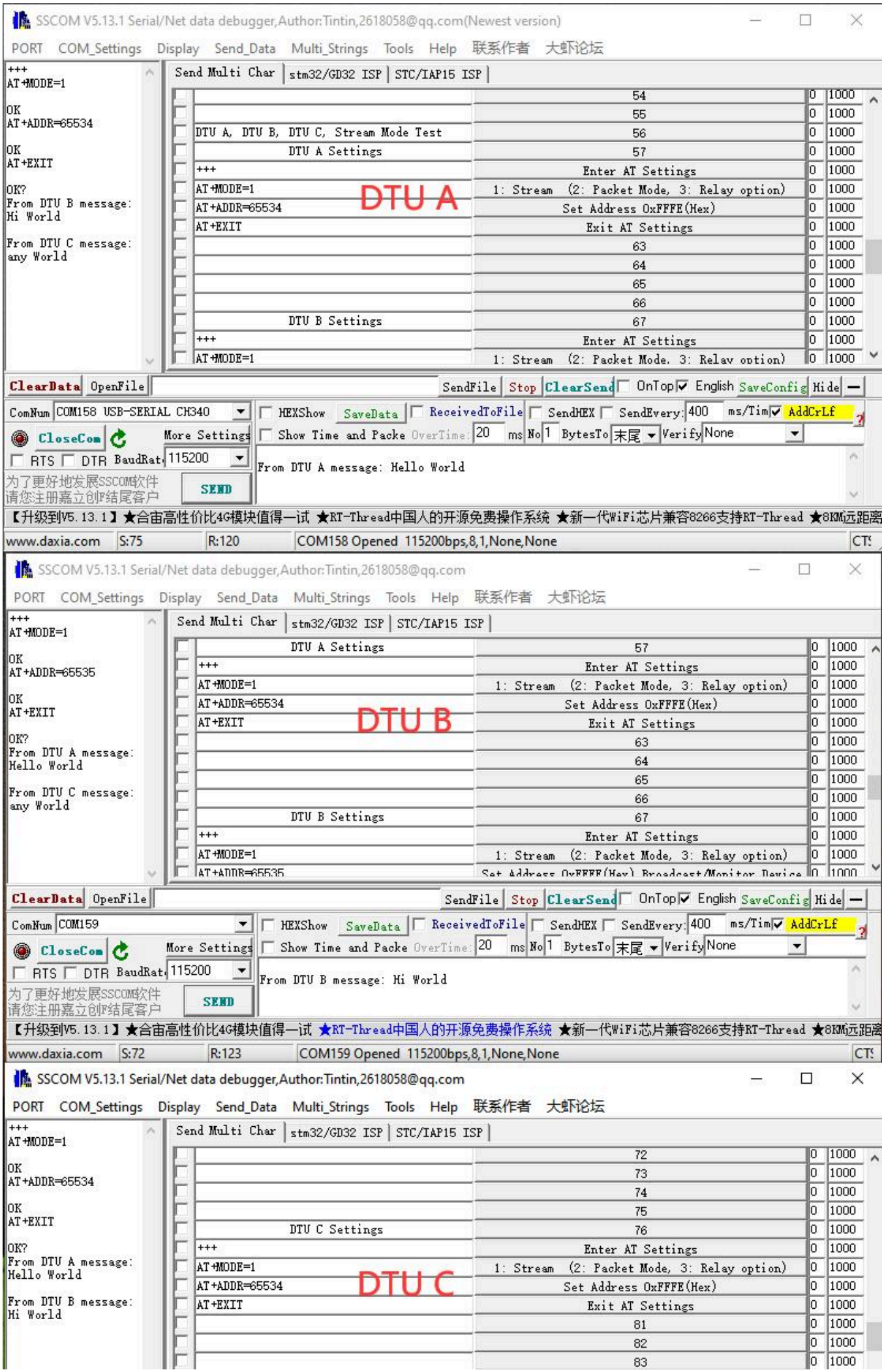
- Device A, B, C, D, E, and F constitute stream mode point-to-multiple communication, Device B's address is set to 65535 (Hex: 0xFFFF), at this time it will be used as a device with broadcast monitoring function in the LoRa network, Device B broadcast when sending data streams, devices with addresses 0~65535 in the same channel can receive data streams, and when other devices send data streams, Device B can monitor the data streams of devices with addresses 0~65535 in the same channel.
  - Device B broadcasts and sends HI World data streams, Device A, C, D, and E with matching channels receive normally, and Device F with mismatched channels fails to receive.
  - When Device A, C, D, and E send data stream, such as Device A sends Hello World, Device B can monitor the received data stream.
  - When Device F with a mismatched channel sends a data stream, Device B fails to monitor and receive.

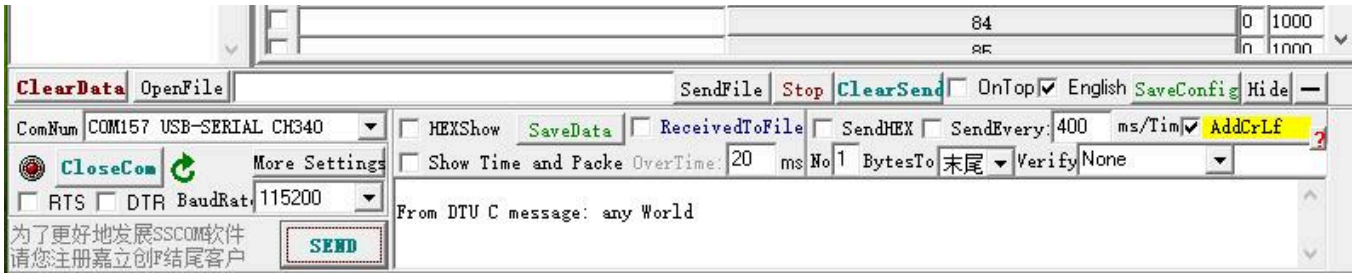


(/wiki/File:DTU-xF_User_Guide02.jpg)

Parameters	Device A	Device B	Device C	Device D	Device E	Device F

Spreading Factor	7	7	7	7	7	7
Bandwidth	0: 125KHz	0: 125KHz	0: 125KHz	0: 125KHz	0: 125KHz	0: 125KHz
Code rate	1: 4/5	1: 4/5	1: 4/5	1: 4/5	1: 4/5	1: 4/5
Operating Mode	1: Stream mode	1: Stream mode	1: Stream mode	1: Stream mode	1: Stream mode	1: Stream mode
Address	65534 (Hex:0xFFFE)	65535 (Hex:0xFFFF)	65534 (Hex:0xFFFE)	65534 (Hex:0xFFFE)	0 (Hex:0x0000)	65534 (Hex:0xFFFE)
Channel	18 (Hex:0x12)	18 (Hex:0x12)	18 (Hex:0x12)	18 (Hex:0x12)	18 (Hex:0x12)	65 (Hex:0x41)
Example 1	Send Hello World	√	√	√	×	×
Example 2	√	Send Hi World	√	√	√	×
Example 3	√	√	Send Any World	√	×	×


SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com(Newest version)
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
Send Multi Char stm32/GD32 ISP STC/IAP15 ISP
DTU A, DTU B, DTU C, Stream Mode Test
DTU A Settings
+++
AT+MODE=1
AT+ADDR=65534
AT+EXIT
DTU B Settings
DTU A
Enter AT Settings
1: Stream (2: Packet Mode, 3: Relay option)
Set Address 0xFFFE(Hex)
Exit AT Settings
ClearData OpenFile SendFile Stop ClearSend OnTop English SaveConfig Hide
ComNum COM158 USB-SERIAL CH340
CloseCom More Settings
RTS DTR BaudRat 115200
HEXShow SaveData ReceivedToFile SendHEX SendEvery 400 ms/Tim AddCrLf
Show Time and Packe OverTime 20 ms No 1 BytesTo 末尾 Verify None
From DTU A message: Hello World
为了更好地发展SSCOM软件
请您注册嘉立创P结尾客户
SEND
【升级到V5.13.1】★合宙高性价比4G模块值得一试 ★RT-Thread中国人的开源免费操作系统 ★新一代WiFi芯片兼容8266支持RT-Thread ★8KM远距离
www.daxia.com S:75 R:120 COM158 Opened 115200bps,8,1,None,None
From DTU B message: Hello World
From DTU C message: any World
OK
OK?
SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com
DTU B
AT+ADDR=65535
From DTU A message: Hello World
ComNum COM159
COM159 Opened 115200bps,8,1,None,None
Hi World
SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com
DTU C
From DTU A message: Hello World
From DTU B message: Hi World
DTU C Settings

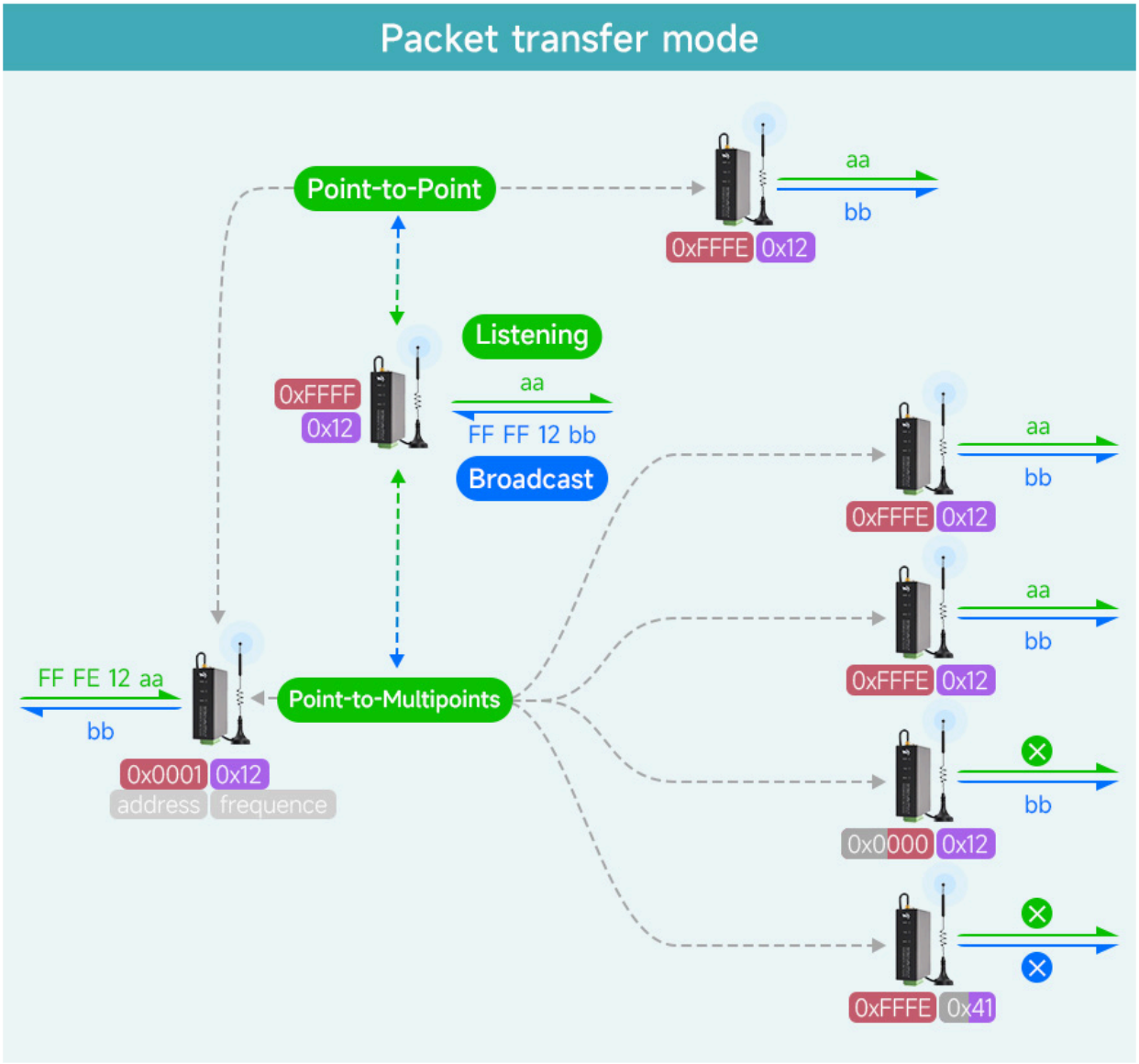


(/wiki/File:SX1262-LoRa-DTU-xF_User_Guide090.jpg)

Packet Transfer Mode

- Packet mode refers to a transmission mode in LoRa devices where the first 3 bytes of the sent data stream specify the destination device address and channel. The data stream uses the hexadecimal (Hex) data format.
  - Assuming there are Device A, B, C, D, E, and F, a total of 6 LoRa devices forming a packet mode LoRa communication network. To modify the address, channel, and working mode of the LoRa devices in the network, please refer to the communication diagram and parameter table provided below. Please note to use the AT command (AT+MODE=2\r\n) to switch to packet mode.
    - Device A and Device C devices form a packet-mode point-to-point communication
      - Device A sends hexadecimal data stream FF FE 12 AA, where FF FE is the address of the receiving data stream device (i.e., Device C), 12 is the channel of the receiving data stream device (i.e., Device C), and AA is the data (note that the hexadecimal data format is A...F, such as AA, AF, FA, etc.). F, such as AA, AF, FA, etc.), the Device C device with a matching address channel receives the data normally.
      - Device C sends hexadecimal data stream 00 01 12 CC, where 00 01 is the address of the receiving data stream device (i.e., Device A), 12 is the channel of the receiving data stream device (i.e., Device A), and CC is the data (note that the hexadecimal data format is A...F, such as AA, AF, FA, etc.). F, such as AA, AF, FA, etc.), the Device A device with a matching address channel receives the data normally.
    - Device A, B, C, D, E, and F form a packet mode point-to-multiple communication, Device B's address is set to 65535(Hex:0xFFFF), this time it will be used as a broadcast listening device in the LoRa network, Device B broadcasts and sends out a data stream, the devices with the address 0~65535 under the same channel will be able to receive the stream, and when the other devices send out a stream, Device B will be able to listen to the stream of the devices with the address 0~65535 under the same channel. When other devices send data streams, Device B can listen to the data streams of devices with addresses 0~65535 under the same channel.
      - Device B broadcasts and sends a hexadecimal data stream FF FF 12 BB, where FF FF is the broadcast address, 12 is the channel, BB is the data, Device A, C, D, E (channel 18(Hex:0x12)) with matching channel receives it normally, and Device F (channel 65(Hex:0x41)) with mismatching channel fails to receive it.
      - When Device A, C, D, or E sends a data stream, such as Device A sends FF FE 12 AA, Device B can listen to the received data stream BB.

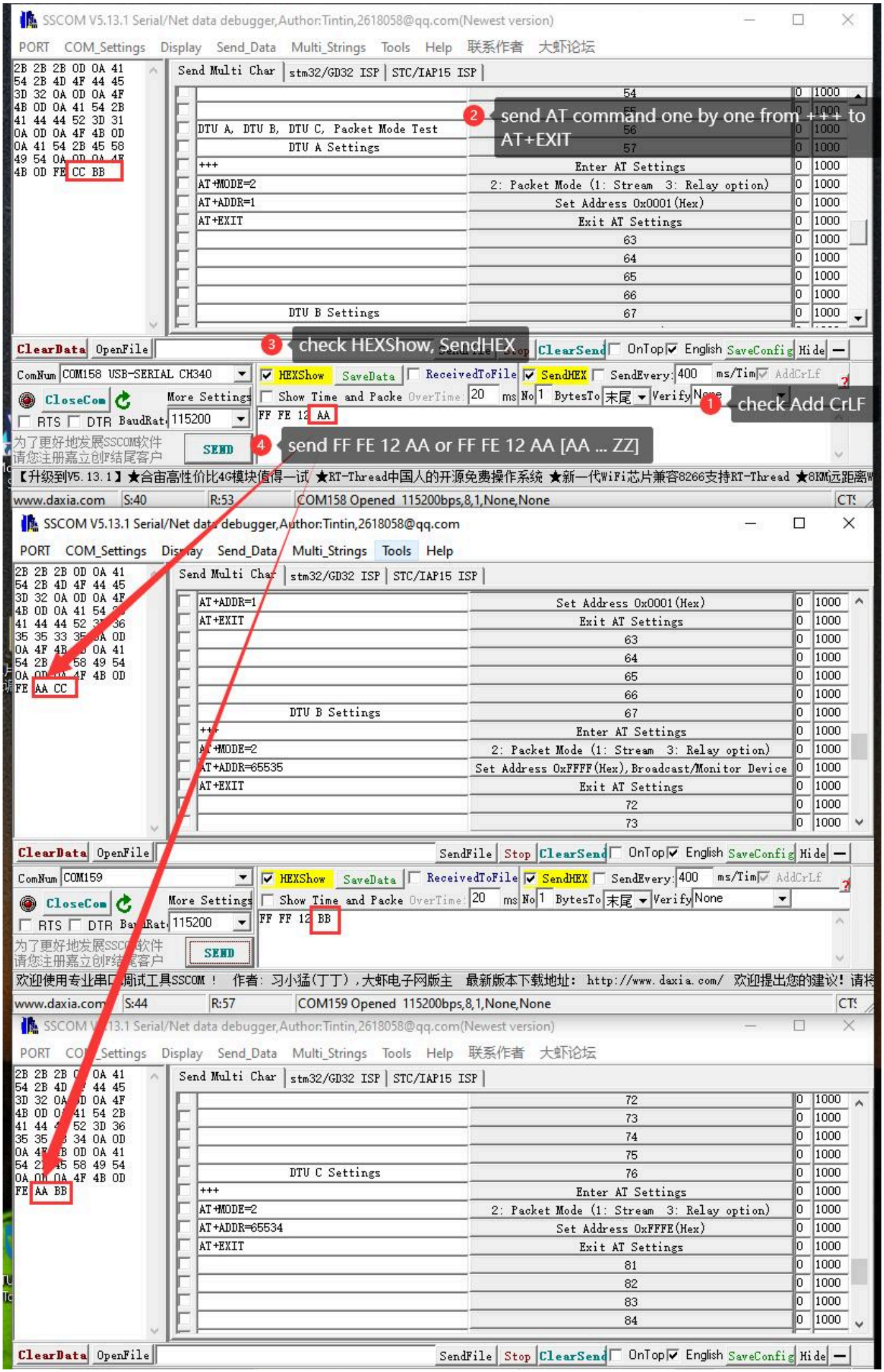
- When Device F device (channel 65 (Hex: 0x41)) with a mismatched channel sends a data stream, Device B fails to monitor and receive.



(/wiki/File:DTU-xF_User_Guide03.jpg)

Parameters	Device A	Device B	Device C	Device D	Device E	Device F
Spreading Factor	7	7	7	7	7	7
Bandwidth	0: 125KHz	0: 125KHz	0: 125KHz	0: 125KHz	0: 125KHz	0: 125KHz
Code Rate	1: 4/5	1: 4/5	1: 4/5	1: 4/5	1: 4/5	1: 4/5
Operating Mode	2: Packet transfer mode	2: Packet transfer mode	2: Packet transfer mode	2: Packet transfer mode	2: Packet transfer mode	2: Packet transfer mode
Address	65534 (Hex:0xFFFE)	65535 (Hex:0xFFFF)	65534 (Hex:0xFFFE)	65534 (Hex:0xFFFE)	0 (Hex:0x0000)	65534 (Hex:0xFFFE)
Channel	18 (Hex:0x12)	18 (Hex:0x12)	18 (Hex:0x12)	18 (Hex:0x12)	18 (Hex:0x12)	65 (Hex:0x41)

Example 1	Send AA (Hex)	√	√	√	×	×
Example 2	√	Send BB (Hex)	√	√	√	×
Example 3	√	√	Send CC (Hex)	√	×	×

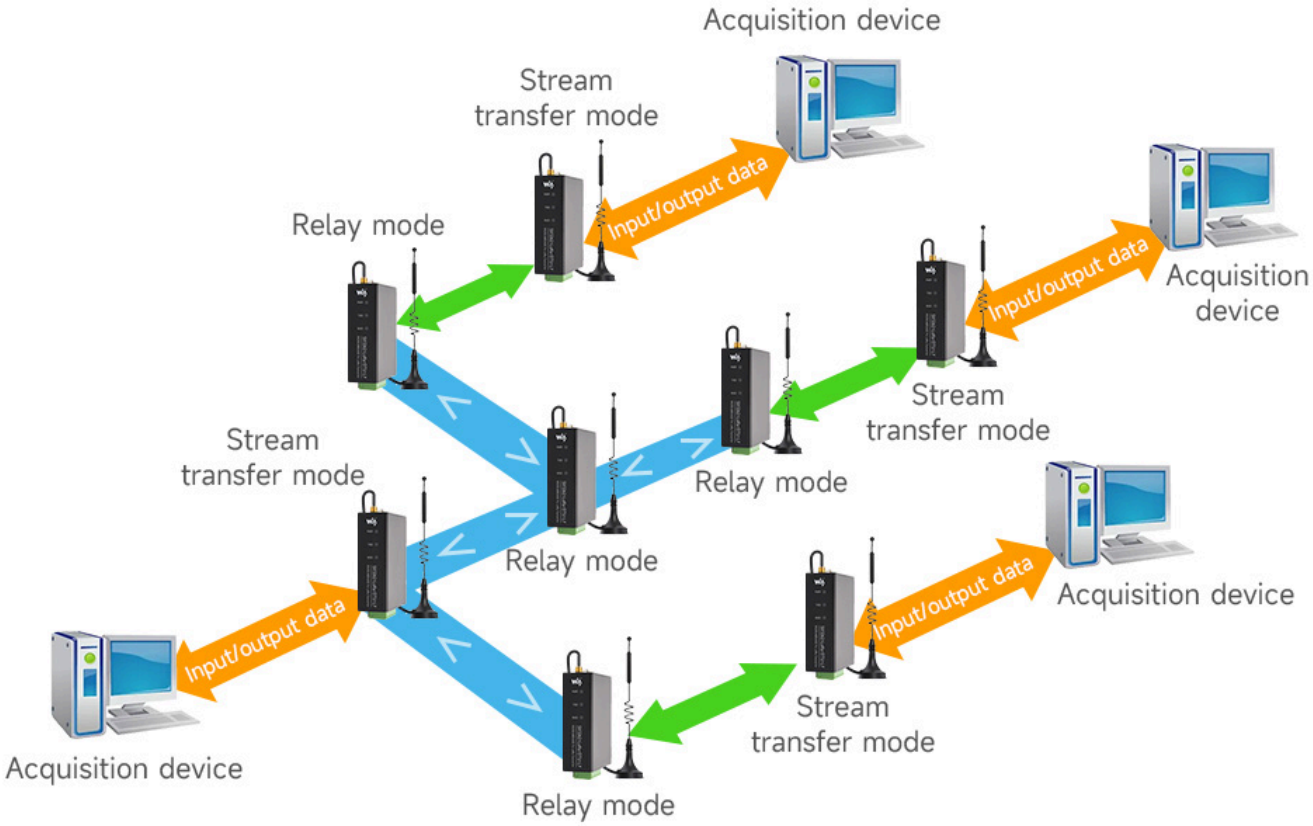

SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com(Newest version)
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
Send Multi Char stm32/GD32 ISP STC/IAP15 ISP
2B 2B 2B 0D 0A 41
54 2B 4D 4F 44 45
3D 32 0A 0D 0A 4F
4B 0D 0A 41 54 2B
41 44 44 52 3D 31
0A 0D 0A 4F 4B 0D
0A 41 54 2B 45 58
49 54 0A 0D 0A 4F
4B 0D FE CC BB
DTU A, DTU B, DTU C, Packet Mode Test
DTU A Settings
+++ Enter AT Settings
AT+MODE=2 2: Packet Mode (1: Stream 3: Relay option)
AT+ADDR=1 Set Address 0x0001(Hex)
AT+EXIT Exit AT Settings
DTU B Settings
2 send AT command one by one from +++ to AT+EXIT
ClearData OpenFile SendFile Stop ClearSend OnTop English SaveConfig Hide
3 check HEXShow, SendHEX
ComNum COM158 USB-SERIAL CH340
CloseCom More Settings
RTS DTR BaudRat 115200
HEXShow SaveData ReceivedToFile SendHEX SendEvery: 400 ms/Tim AddCrLf
Show Time and Packe OverTime: 20 ms No 1 BytesTo 末尾 Verify None
1 check Add CrLF
FF FE 12 AA
为了更好地发展SSCOM软件
请您注册嘉立创P结尾客户
SEND
4 send FF FE 12 AA or FF FE 12 AA [AA ... ZZ]
【升级到V5.13.1】★合宙高性价比4G模块值得一试 ★RT-Thread中国人的开源免费操作系统 ★新一代WiFi芯片兼容8266支持RT-Thread ★8KM远距离W
www.daxia.com S:40 R:53 COM158 Opened 115200bps,8,1,None,None
SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com
PORT COM_Settings Display Send_Data Multi_Strings Tools Help
Send Multi Char stm32/GD32 ISP STC/IAP15 ISP
2B 2B 2B 0D 0A 41
54 2B 4D 4F 44 45
3D 32 0A 0D 0A 4F
4B 0D 0A 41 54 2B
41 44 44 52 3D 36
35 35 33 35 0A 0D
0A 4F 4B 0D 0A 41
54 2B 45 58 49 54
0A 0D 0A 4F 4B 0D
FE AA CC
AT+ADDR=1 Set Address 0x0001(Hex)
AT+EXIT Exit AT Settings
DTU B Settings
+++ Enter AT Settings
AT+MODE=2 2: Packet Mode (1: Stream 3: Relay option)
AT+ADDR=65535 Set Address 0xFFFF(Hex),Broadcast/Monitor Device
AT+EXIT Exit AT Settings
ClearData OpenFile SendFile Stop ClearSend OnTop English SaveConfig Hide
ComNum COM159
CloseCom More Settings
RTS DTR BaudRat 115200
HEXShow SaveData ReceivedToFile SendHEX SendEvery: 400 ms/Tim AddCrLf
Show Time and Packe OverTime: 20 ms No 1 BytesTo 末尾 Verify None
FF FF 12 BB
为了更好地发展SSCOM软件
请您注册嘉立创P结尾客户
SEND
欢迎使用专业串口调试工具SSCOM ！ 作者：习小猛（丁丁），大虾电子网版主 最新版本下载地址：http://www.daxia.com/ 欢迎提出您的建议！请将
www.daxia.com S:44 R:57 COM159 Opened 115200bps,8,1,None,None
SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com(Newest version)
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
Send Multi Char stm32/GD32 ISP STC/IAP15 ISP
2B 2B 2B 0D 0A 41
54 2B 4D 4F 44 45
3D 32 0A 0D 0A 4F
4B 0D 0A 41 54 2B
41 44 44 52 3D 36
35 35 33 34 0A 0D
0A 4F 4B 0D 0A 41
54 2B 45 58 49 54
0A 0D 0A 4F 4B 0D
FE AA BB
DTU C Settings
+++ Enter AT Settings
AT+MODE=2 2: Packet Mode (1: Stream 3: Relay option)
AT+ADDR=65534 Set Address 0xFFFE(Hex)
AT+EXIT Exit AT Settings
ClearData OpenFile SendFile Stop ClearSend OnTop English SaveConfig Hide



(/wiki/File:SX1262-LoRa-DTU-xF_User_Guide15.jpg)

Relay Mode

- Relay mode refers to a transmission mode in the LoRa network where some LoRa devices act as relay nodes to forward data streams from either stream mode or packet mode. Relay mode devices do not output any data from their interfaces; their main function is to increase the wireless communication distance.



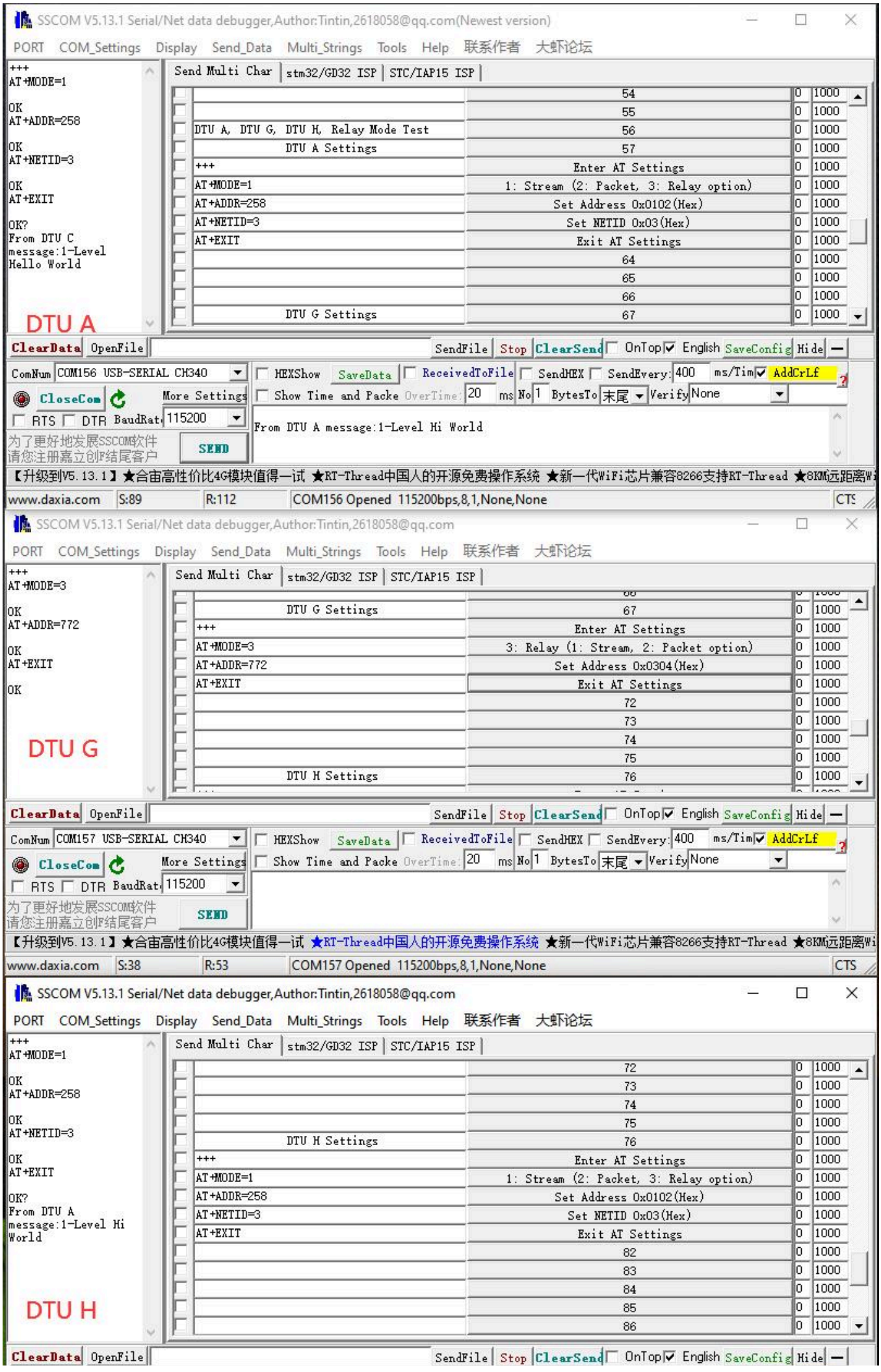
(/wiki/File:DTU-xF_User_Guide10.jpg)

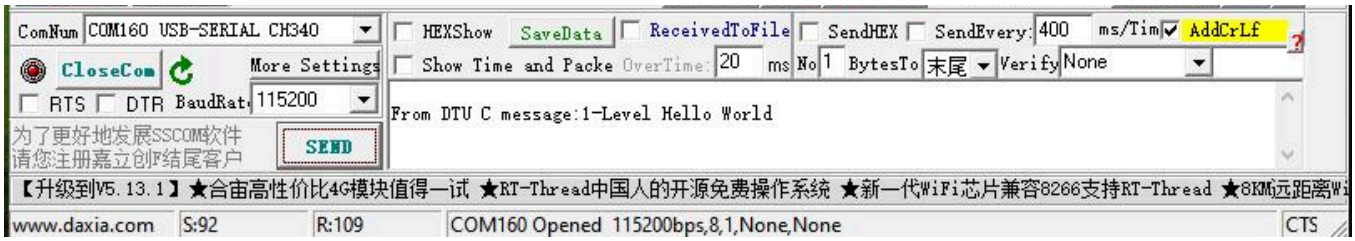
First-level Relay

- The first-level relay refers to a transmission mode in a LoRa network where multiple LoRa devices are configured, and only one LoRa device acts as a relay node to forward data streams from other LoRa devices.
  - In a separate first-level relay LoRa network comprising devices A, G, and H, when Device G is set as the relay mode using the AT+MODE=3\r\n command, it only relays data streams from Device A and Device H while not outputting any data streams from its interface.

- In the relay mode LoRa communication network, the communication devices in stream mode or packet mode have the same parameters except for the NETID parameter. For Device A and H, their NETID parameters will be used as addressing addresses for the relay node. For example, the NETID values of Device A and H form the address for Device G in hexadecimal: 0x0304 (Decimal: 772).

Parameters	Device A	Device G	Device H
Spreading Factor	7	7	7
Bandwidth	0: 125KHz	0: 125KHz	0: 125KHz
Code Rate	1: 4/5	1: 4/5	1: 4/5
NETID	Hex: 0x03 (Decimal: 3)	Ignore	Hex: 0x03 (Decimal: 3)
Operating Mode	1: Stream Transfer Mode	3: Relay Mode	1: Stream Transfer Mode
Address	Hex: 0x0102 (Decimal: 258)	Hex: 0x0304 (Decimal: 772)	Hex: 0x0102 (Decimal: 258)
Channel	18 (Hex:0x12)	18 (Hex:0x12)	18 (Hex:0x12)


SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com(Newest version)
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
+++
AT+MODE=1
OK
AT+ADDR=258
OK
AT+NETID=3
OK
AT+EXIT
OK?
From DTU C
message:1-Level
Hello World
DTU A
Send Multi Char
stm32/GD32 ISP
STC/IAP15 ISP
54
55
DTU A, DTU G, DTU H, Relay Mode Test
56
DTU A Settings
57
+++
Enter AT Settings
AT+MODE=1
1: Stream (2: Packet, 3: Relay option)
AT+ADDR=258
Set Address 0x0102(Hex)
AT+NETID=3
Set NETID 0x03(Hex)
AT+EXIT
Exit AT Settings
64
65
66
DTU G Settings
67
ClearData
OpenFile
SendFile
Stop
ClearSend
OnTop
English
SaveConfig
Hide
ComNum
COM156 USB-SERIAL CH340
HEXShow
SaveData
ReceivedToFile
SendHEX
SendEvery:
400
ms/Tim
AddCrLf
CloseCom
More Settings
Show Time and Packe
OverTime:
20
ms
No
1
BytesTo
末尾
Verify
None
RTS
DTR
BaudRat
115200
为了更好地发展SSCOM软件
请您注册嘉立创P结尾客户
SEND
From DTU A message:1-Level Hi World
【升级到V5.13.1】★合宙高性价比4G模块值得一试 ★RT-Thread中国人的开源免费操作系统 ★新一代WiFi芯片兼容8266支持RT-Thread ★8KM远距离Wi
www.daxia.com
S:89
R:112
COM156 Opened 115200bps,8,1,None,None
CTS
SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
+++
AT+MODE=3
OK
AT+ADDR=772
OK
AT+EXIT
OK
DTU G
Send Multi Char
stm32/GD32 ISP
STC/IAP15 ISP
DTU G Settings
67
+++
Enter AT Settings
AT+MODE=3
3: Relay (1: Stream, 2: Packet option)
AT+ADDR=772
Set Address 0x0304(Hex)
AT+EXIT
Exit AT Settings
72
73
74
75
DTU H Settings
76
ClearData
OpenFile
SendFile
Stop
ClearSend
OnTop
English
SaveConfig
Hide
ComNum
COM157 USB-SERIAL CH340
HEXShow
SaveData
ReceivedToFile
SendHEX
SendEvery:
400
ms/Tim
AddCrLf
CloseCom
More Settings
Show Time and Packe
OverTime:
20
ms
No
1
BytesTo
末尾
Verify
None
RTS
DTR
BaudRat
115200
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SEND
【升级到V5.13.1】★合宙高性价比4G模块值得一试 ★RT-Thread中国人的开源免费操作系统 ★新一代WiFi芯片兼容8266支持RT-Thread ★8KM远距离Wi
www.daxia.com
S:38
R:53
COM157 Opened 115200bps,8,1,None,None
CTS
SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
+++
AT+MODE=1
OK
AT+ADDR=258
OK
AT+NETID=3
OK
AT+EXIT
OK?
From DTU A
message:1-Level Hi
World
DTU H
Send Multi Char
stm32/GD32 ISP
STC/IAP15 ISP
72
73
74
75
DTU H Settings
76
+++
Enter AT Settings
AT+MODE=1
1: Stream (2: Packet, 3: Relay option)
AT+ADDR=258
Set Address 0x0102(Hex)
AT+NETID=3
Set NETID 0x03(Hex)
AT+EXIT
Exit AT Settings
82
83
84
85
86
ClearData
OpenFile
SendFile
Stop
ClearSend
OnTop
English
SaveConfig
Hide

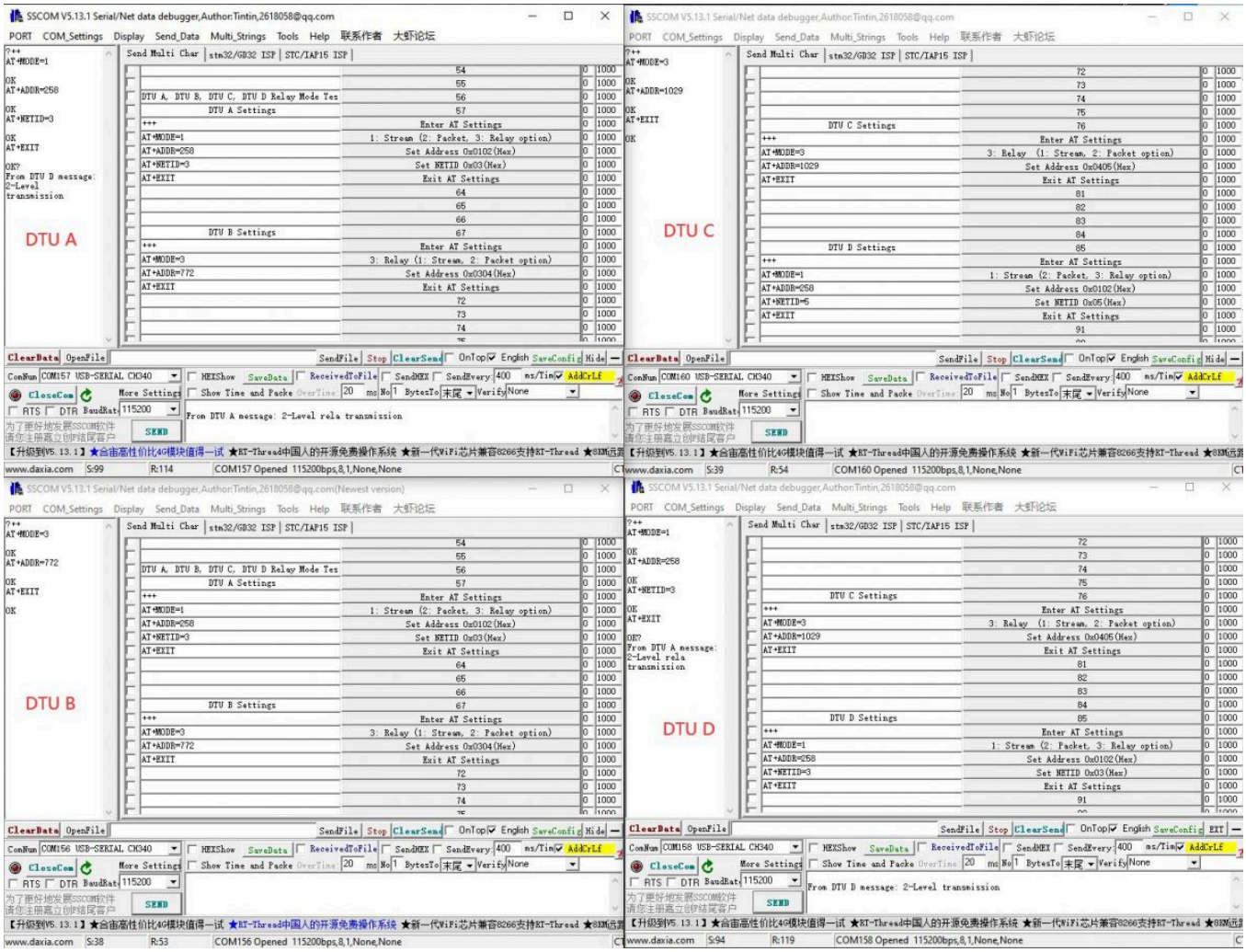


(/wiki/File:SX1262-LoRa-DTU-xF_User_Guide17.jpg)

Second-level Relay

- Second-level relay refers to a transmission mode in a LoRa network where multiple LoRa devices are configured, and only two LoRa devices act as relay nodes to forward data streams from other LoRa devices.
- In the network depicted above, devices A, B, C, and D form a second-level relay LoRa network. After configuring Device B and C as relay mode using the AT+MODE=3\r\n command, they will only relay data streams from Device A and Device D while not outputting any data streams from their interfaces.

Parameters	Device A	Device B	Device C	Device D
Spreading Factor	7	7	7	7
Bandwidth	0: 125KHz	0: 125KHz	0: 125KHz	0: 125KHz
Code Rate	1: 4/5	1: 4/5	1: 4/5	1: 4/5
NETID	Hex: 0x03 (Decimal: 3)	Ignore	Ignore	Hex: 0x05 (Decimal: 3)
Operating Mode	1: Stream Transfer Mode	3: Relay Mode	3: Relay Mode	1: Stream Transfer Mode
Address	Hex: 0x0102 (Decimal: 258)	Hex: 0x0304 (Decimal: 772)	Hex: 0x0405 (Decimal: 1029)	Hex: 0x0102 (Decimal: 258)
Channel	18 (Hex: 0x12)	18 (Hex: 0x12)	18 (Hex: 0x12)	18 (Hex: 0x12)

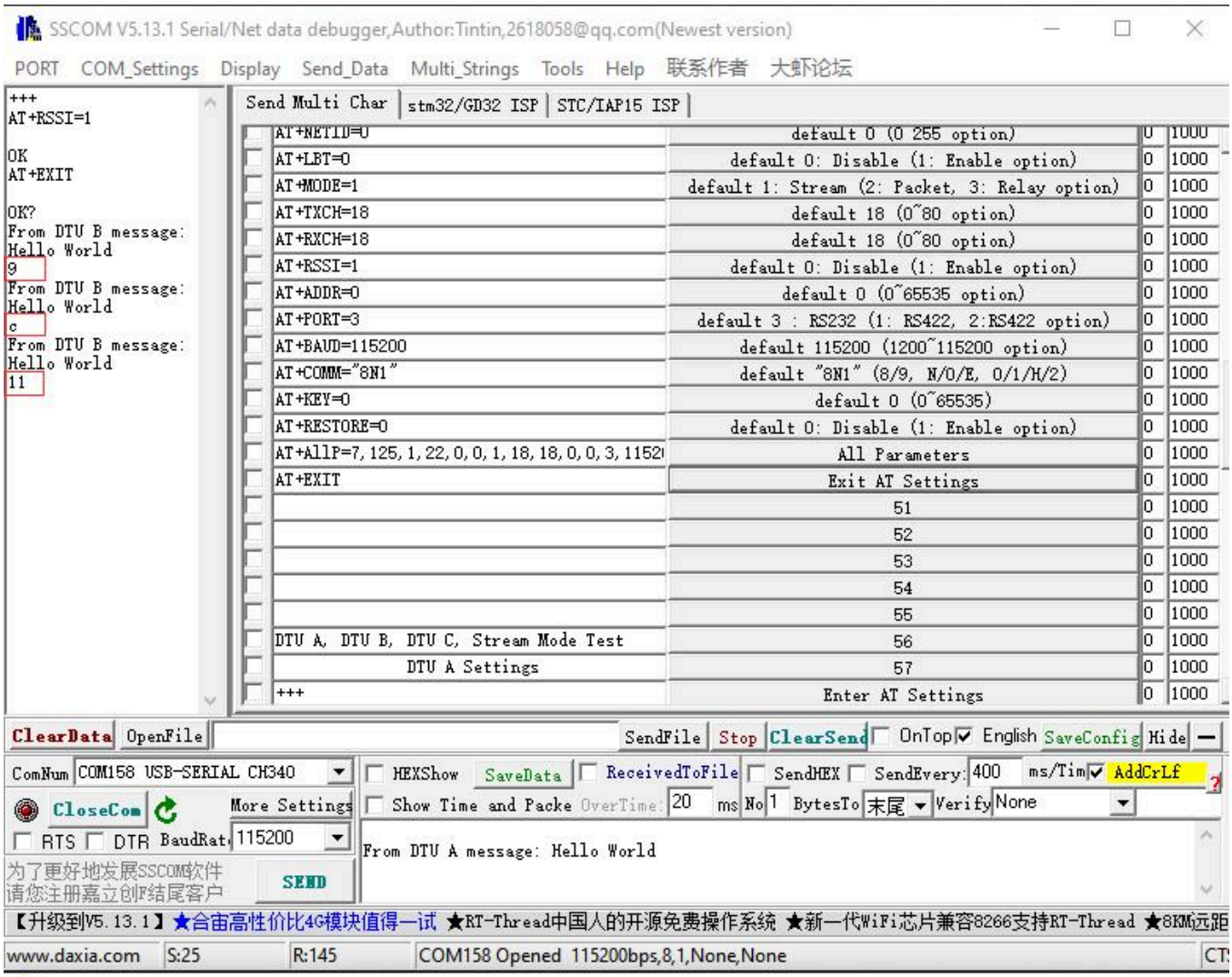


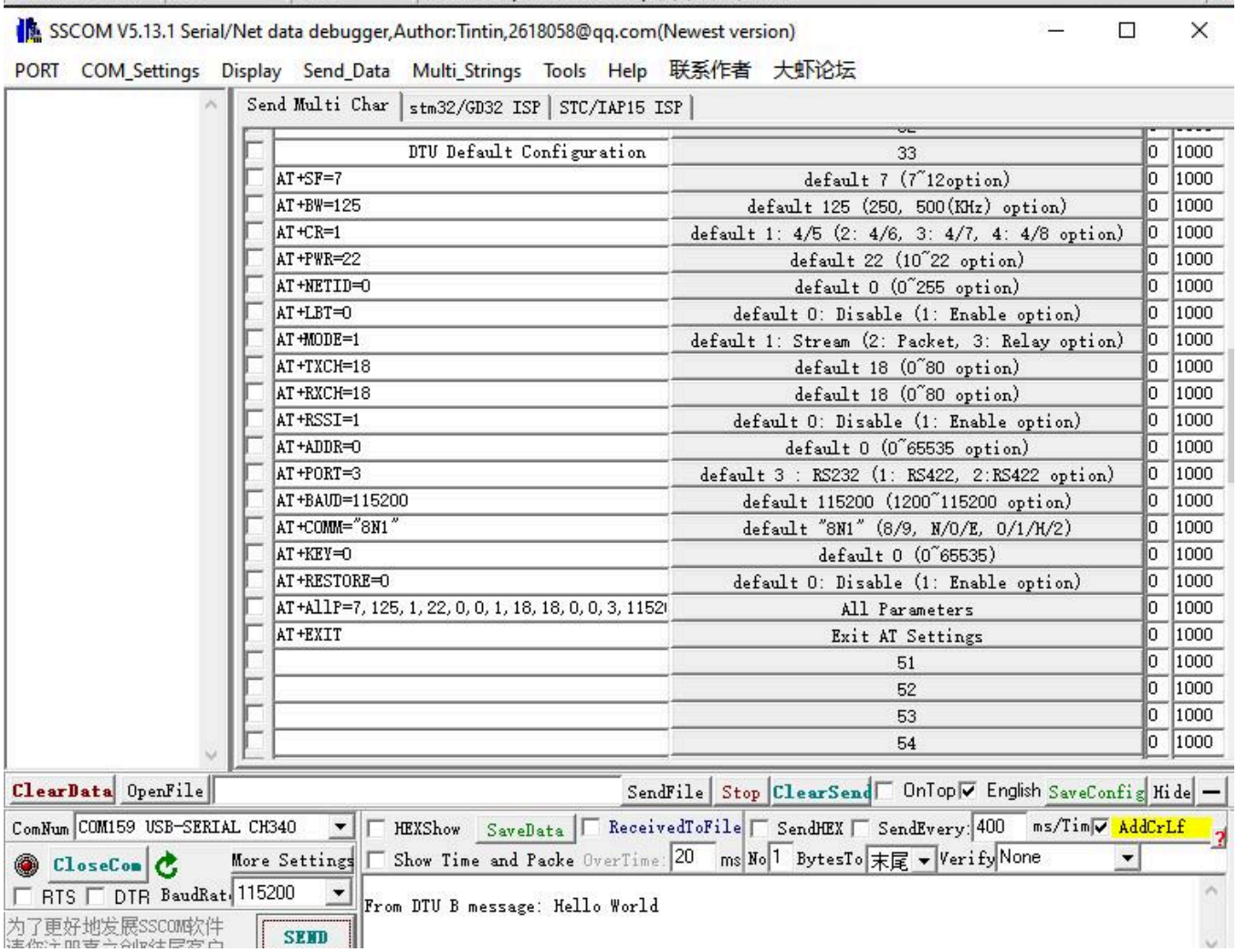
(/wiki/File:SX1262-LoRa-DTU-xF_User_Guide_18.jpg)

Other Functions

RSSI Output

- RSSI, Received signal strength indication, used to evaluate signal quality, improve communication network, distance measurement, etc.
- After using AT+RSSI=1 (default 0: disabled) to enable the RSSI function, as shown in the figure below, each output data packet will follow a hexadecimal RSSI value.


SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com(Newest version)
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
+++
AT+RSSI=1
OK
AT+EXIT
OK?
From DTU B message:
Hello World
9
From DTU B message:
Hello World
c
From DTU B message:
Hello World
11
Send Multi Char
stm32/GD32 ISP
STC/IAP15 ISP
AT+NETID=0 default 0 (0 255 option)
AT+LBT=0 default 0: Disable (1: Enable option)
AT+MODE=1 default 1: Stream (2: Packet, 3: Relay option)
AT+TXCH=18 default 18 (0~80 option)
AT+RXCH=18 default 18 (0~80 option)
AT+RSSI=1 default 0: Disable (1: Enable option)
AT+ADDR=0 default 0 (0~65535 option)
AT+PORT=3 default 3 : RS232 (1: RS422, 2:RS422 option)
AT+BAUD=115200 default 115200 (1200~115200 option)
AT+COMM="8N1" default "8N1" (8/9, N/O/E, O/1/H/2)
AT+KEY=0 default 0 (0~65535)
AT+RESTORE=0 default 0: Disable (1: Enable option)
AT+AllP=7,125,1,22,0,0,1,18,18,0,0,3,1152
All Parameters
AT+EXIT Exit AT Settings
51
52
53
54
55
DTU A, DTU B, DTU C, Stream Mode Test 56
DTU A Settings 57
+++ Enter AT Settings
ClearData OpenFile SendFile Stop ClearSend OnTop English SaveConfig Hide
ComNum COM158 USB-SERIAL CH340
CloseCom More Settings
RTS DTR BaudRat 115200
为了更好地发展SSCOM软件
请您注册嘉立创F结尾客户
SEND
HEXShow SaveData ReceivedToFile SendHEX SendEvery: 400 ms/Tim AddCrLf
Show Time and Packe OverTime: 20 ms No 1 BytesTo 末尾 Verify None
From DTU A message: Hello World
【升级到V5.13.1】★合宙高性价比4G模块值得一试 ★RT-Thread中国人的开源免费操作系统 ★新一代WiFi芯片兼容8266支持RT-Thread ★8KM远距
www.daxia.com S:25 R:145 COM158 Opened 115200bps,8,1,None,None

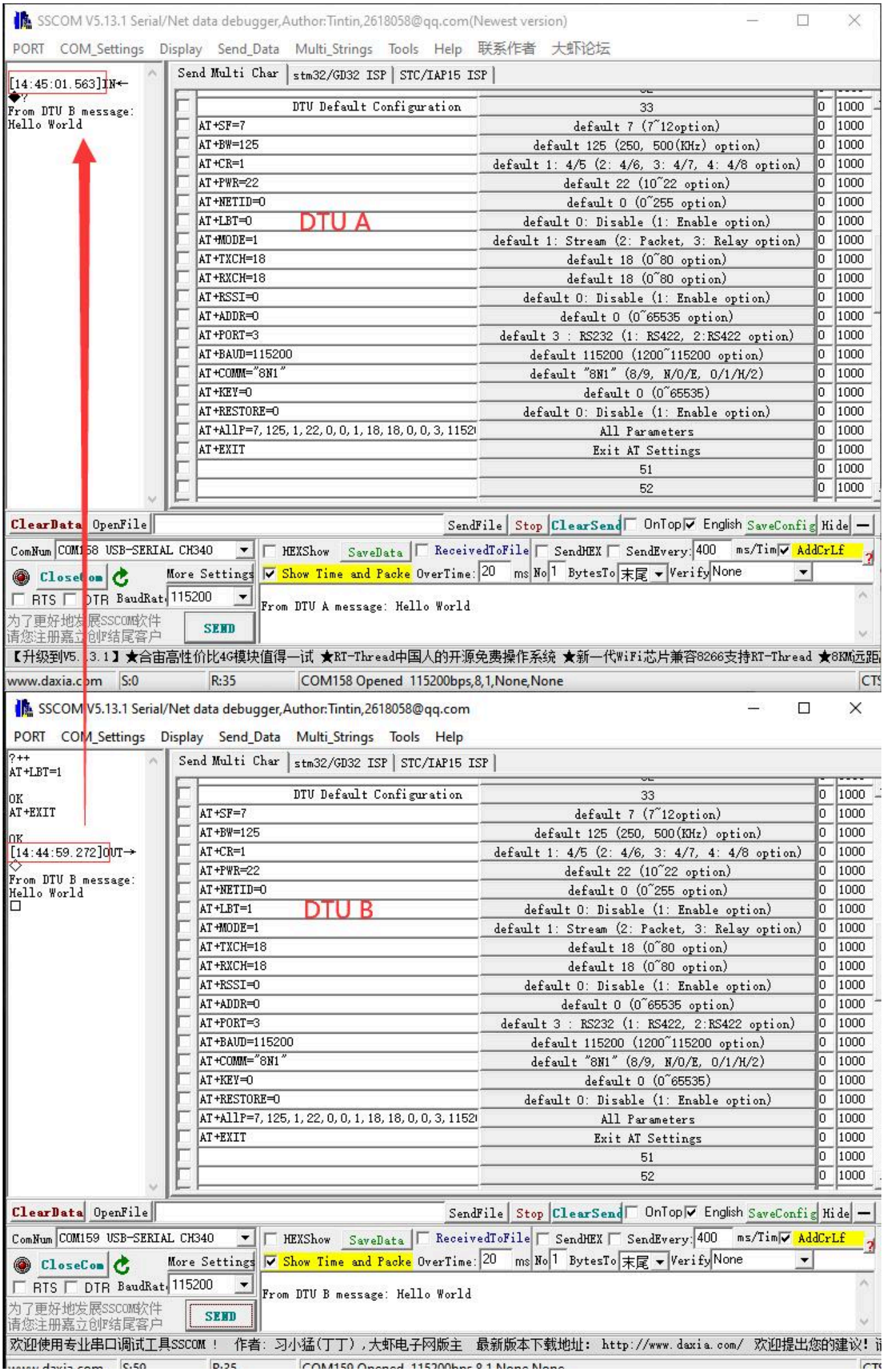

SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com(Newest version)
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
Send Multi Char
stm32/GD32 ISP
STC/IAP15 ISP
DTU Default Configuration 33
AT+SF=7 default 7 (7~12option)
AT+BW=125 default 125 (250, 500(KHz) option)
AT+CR=1 default 1: 4/5 (2: 4/6, 3: 4/7, 4: 4/8 option)
AT+PWR=22 default 22 (10~22 option)
AT+NETID=0 default 0 (0~255 option)
AT+LBT=0 default 0: Disable (1: Enable option)
AT+MODE=1 default 1: Stream (2: Packet, 3: Relay option)
AT+TXCH=18 default 18 (0~80 option)
AT+RXCH=18 default 18 (0~80 option)
AT+RSSI=1 default 0: Disable (1: Enable option)
AT+ADDR=0 default 0 (0~65535 option)
AT+PORT=3 default 3 : RS232 (1: RS422, 2:RS422 option)
AT+BAUD=115200 default 115200 (1200~115200 option)
AT+COMM="8N1" default "8N1" (8/9, N/O/E, O/1/H/2)
AT+KEY=0 default 0 (0~65535)
AT+RESTORE=0 default 0: Disable (1: Enable option)
AT+AllP=7,125,1,22,0,0,1,18,18,0,0,3,1152
All Parameters
AT+EXIT Exit AT Settings
51
52
53
54
ClearData OpenFile SendFile Stop ClearSend OnTop English SaveConfig Hide
ComNum COM159 USB-SERIAL CH340
CloseCom More Settings
RTS DTR BaudRat 115200
为了更好地发展SSCOM软件
SEND
HEXShow SaveData ReceivedToFile SendHEX SendEvery: 400 ms/Tim AddCrLf
Show Time and Packe OverTime: 20 ms No 1 BytesTo 末尾 Verify None
From DTU B message: Hello World



(/wiki/File:SX1262-LoRa-DTU-xF_User_Guide22.jpg)

LBT (Listen Before Talk)

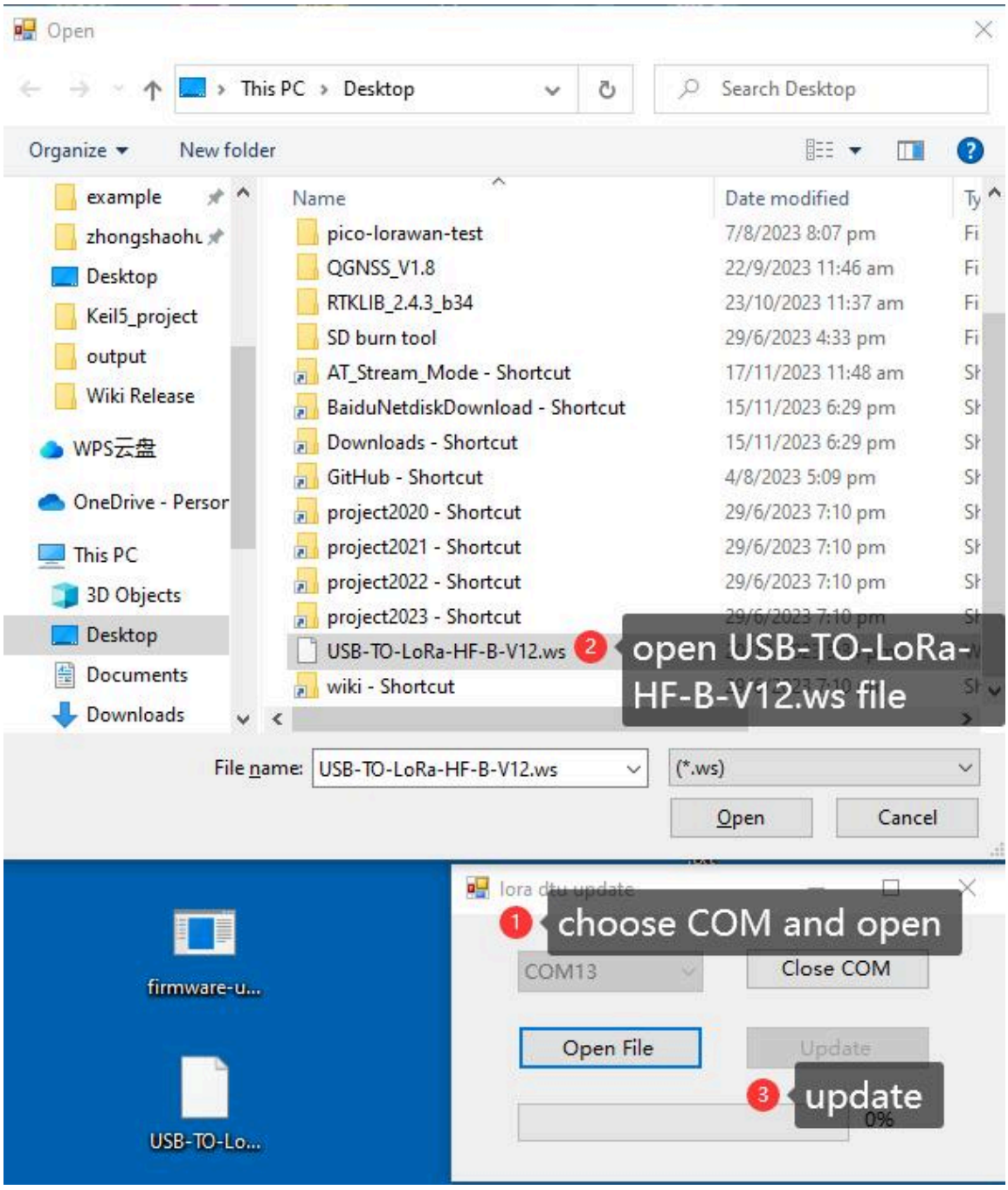
- LBT (Listen Before Talk) means that the module actively monitors the channel environment noise before sending. This function can improve the communication success rate and anti-collision processing of DTU in harsh environments.
- Use AT+LBT=1 (default 0: disabled) to enable the LBT function, and actively monitor the channel noise before sending the data packet, if it exceeds the threshold, the sending will be delayed, the maximum delay is two seconds, and the sending will be forced after more than two seconds.


SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com(Newest version)
PORT COM_Settings Display Send_Data Multi_Strings Tools Help 联系作者 大虾论坛
[14:45:01.563]IN←
From DTU B message:
Hello World
Send Multi Char
stm32/GD32 ISP
STC/IAP15 ISP
DTU Default Configuration 33
AT+SF=7 default 7 (7~12option)
AT+BW=125 default 125 (250, 500(KHz) option)
AT+CR=1 default 1: 4/5 (2: 4/6, 3: 4/7, 4: 4/8 option)
AT+PWR=22 default 22 (10~22 option)
AT+NETID=0 default 0 (0~255 option)
AT+LBT=0 default 0: Disable (1: Enable option)
DTU A
AT+MODE=1 default 1: Stream (2: Packet, 3: Relay option)
AT+TXCH=18 default 18 (0~80 option)
AT+RXCH=18 default 18 (0~80 option)
AT+RSSI=0 default 0: Disable (1: Enable option)
AT+ADDR=0 default 0 (0~65535 option)
AT+PORT=3 default 3 : RS232 (1: RS422, 2:RS422 option)
AT+BAUD=115200 default 115200 (1200~115200 option)
AT+COMM="8N1" default "8N1" (8/9, N/O/E, O/1/H/2)
AT+KEY=0 default 0 (0~65535)
AT+RESTORE=0 default 0: Disable (1: Enable option)
AT+AllP=7, 125, 1, 22, 0, 0, 1, 18, 18, 0, 0, 3, 1152 All Parameters
AT+EXIT Exit AT Settings
51
52
ClearData OpenFile SendFile Stop ClearSend OnTop English SaveConfig Hide
ComNum COM158 USB-SERIAL CH340 HEXShow SaveData ReceivedToFile SendHEX SendEvery: 400 ms/Tim AddCrLf
CloseCom More Settings Show Time and Packe OverTime: 20 ms No 1 BytesTo 末尾 Verify None
RTS DTR BaudRat 115200
为了更好地发展SSCOM软件
请您注册嘉立创P结尾客户
SEND
From DTU A message: Hello World
【升级到V5.13.1】★合宙高性价比4G模块值得一试 ★RT-Thread中国人的开源免费操作系统 ★新一代WiFi芯片兼容8266支持RT-Thread ★8KM远距
www.daxia.com S:0 R:35 COM158 Opened 115200bps,8,1,None,None
SSCOM V5.13.1 Serial/Net data debugger,Author:Tintin,2618058@qq.com
PORT COM_Settings Display Send_Data Multi_Strings Tools Help
?++
AT+LBT=1
OK
AT+EXIT
OK
[14:44:59.272]OUT→
From DTU B message:
Hello World
Send Multi Char
stm32/GD32 ISP
STC/IAP15 ISP
DTU Default Configuration 33
AT+SF=7 default 7 (7~12option)
AT+BW=125 default 125 (250, 500(KHz) option)
AT+CR=1 default 1: 4/5 (2: 4/6, 3: 4/7, 4: 4/8 option)
AT+PWR=22 default 22 (10~22 option)
AT+NETID=0 default 0 (0~255 option)
AT+LBT=1 default 0: Disable (1: Enable option)
DTU B
AT+MODE=1 default 1: Stream (2: Packet, 3: Relay option)
AT+TXCH=18 default 18 (0~80 option)
AT+RXCH=18 default 18 (0~80 option)
AT+RSSI=0 default 0: Disable (1: Enable option)
AT+ADDR=0 default 0 (0~65535 option)
AT+PORT=3 default 3 : RS232 (1: RS422, 2:RS422 option)
AT+BAUD=115200 default 115200 (1200~115200 option)
AT+COMM="8N1" default "8N1" (8/9, N/O/E, O/1/H/2)
AT+KEY=0 default 0 (0~65535)
AT+RESTORE=0 default 0: Disable (1: Enable option)
AT+AllP=7, 125, 1, 22, 0, 0, 1, 18, 18, 0, 0, 3, 1152 All Parameters
AT+EXIT Exit AT Settings
51
52
ClearData OpenFile SendFile Stop ClearSend OnTop English SaveConfig Hide
ComNum COM159 USB-SERIAL CH340 HEXShow SaveData ReceivedToFile SendHEX SendEvery: 400 ms/Tim AddCrLf
CloseCom More Settings Show Time and Packe OverTime: 20 ms No 1 BytesTo 末尾 Verify None
RTS DTR BaudRat 115200
为了更好地发展SSCOM软件
请您注册嘉立创P结尾客户
SEND
From DTU B message: Hello World
欢迎使用专业串口调试工具SSCOM ！ 作者：习小猛(丁丁)，大虾电子网版主 最新版本下载地址： http://www.daxia.com/ 欢迎提出您的建议！

(/wiki/File:SX1262-LoRa-DTU-xF_User_Guide23.jpg)

Update Firmware

- Press and hold the button for 2 seconds to enter firmware update mode after 3 seconds of powering on. Release the KEY button when the TXD and RXD lights are on simultaneously. Enter firmware update mode after the TXD and RXD lights turn off.
- Download and open the firmware update software (https://files.waveshare.com/upload/0/0b/USB-TO-LoRa-Update.zip) and select the corresponding COM port. Choose the latest firmware for the corresponding model, such as USB-TO-LoRa-HF-B-V12.ws, and click the 'Update' button to update.



(/wiki/File:USB-TO-LoRa-xF-Update01.jpg)

Resource

Datasheet

- SX1261-2 Datasheet (https://files.waveshare.com/upload/e/e1/DS_SX1261-2_V1.2.pdf)

Software

- Update Firmware (https://files.waveshare.com/upload/0/0b/USB-TO-LoRa-Update.zip)
- sscom5.13.1 AT commands (https://files.waveshare.com/upload/0/0b/SX1262-LoRa-DTU-sscom5.13.1.zip)

Others

- LoRa Range Calculator and formula (https://www.rfwireless-world.com/calculators/LoRaWAN-Range-calculator.html)

FAQ

Question: Why there is no response to send the AT command?

Answer:

- The default mode is transparent transmission. Enable carriage return and line feed by checking the corresponding option. Use a baud rate of 115200 to send '+++' to enter command mode.
- To exit the AT command mode, send the following command with carriage return and line feed.

```
+++
AT+EXIT
```

Question: Does it support preamble detection? Does it support CRC, auto packetization, or 960 bytes caching?

Answer:

By default, LoRa packet CRC detection cannot be canceled, auto packetization and 960 bytes caching are fixed and cannot be changed, and the maximum data size of a single packet is 240 bytes, if it exceeds 240 bytes, it will be automatically packetized. Support preamble detection with CRC, auto packetization, and 960 bytes caching:

Question: Why didn't the setup parameters take effect?

Answer:

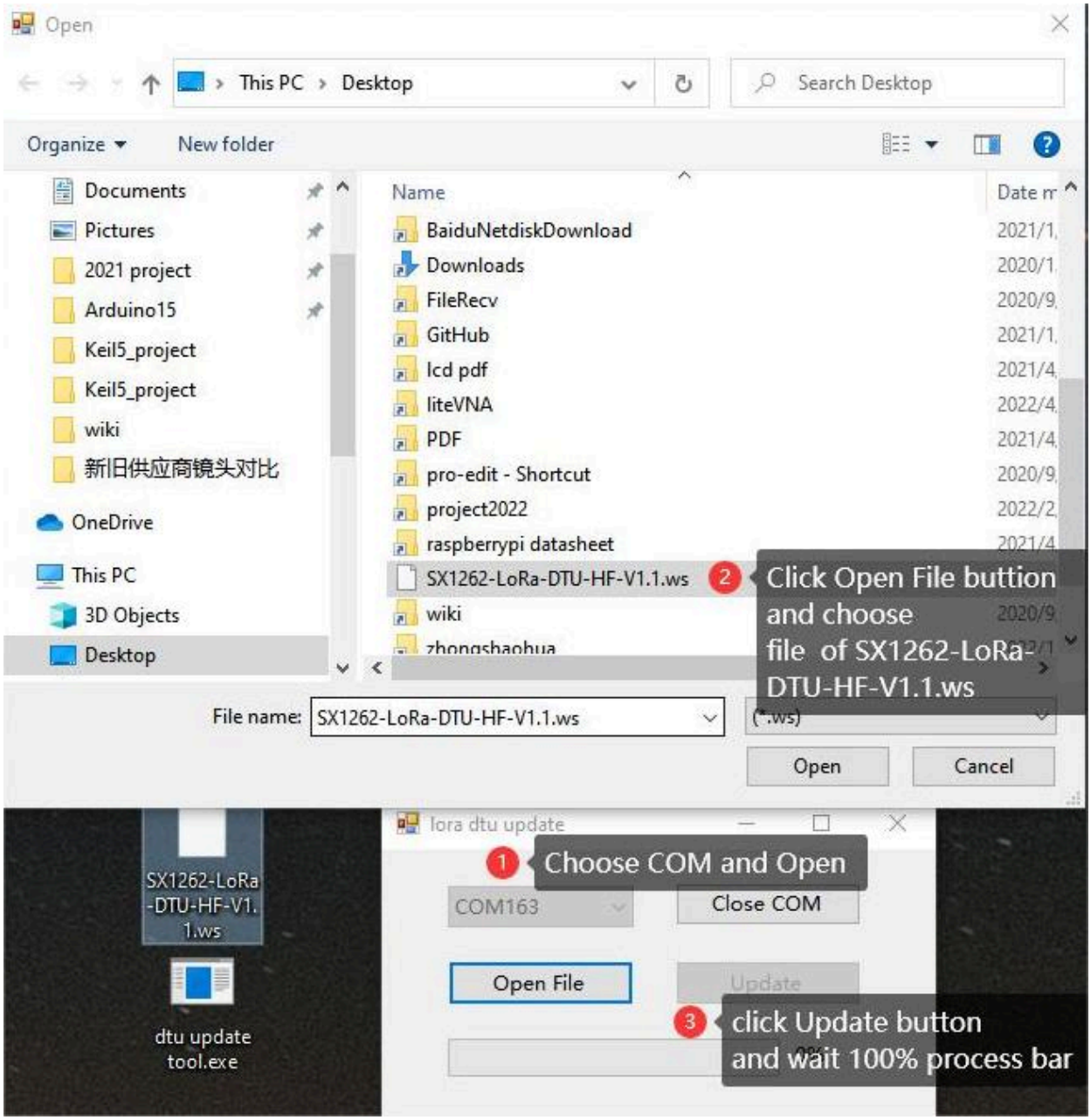
Exit AT command mode after setting.

Question: I have bough 3 LoRa. It has only 1 cannot communicate with others, but 2 can communicate normally. It cannot config?

Answer:

For abnormal modules, please refer to the steps to upgrade the firmware and repair it.
Press the KEY button within three seconds after powering on, the TXD RXD light flashes once, and the firmware update mode is entered.
Download and open the firmware update software, open the corresponding COM, select the latest firmware such as SX1262-LoRa-DTU-HF-V1.1.ws, and click the Update button to

update:



(/wiki/File:USB-TO-Lora-faq.jpg)

- Firmware:

https://files.waveshare.com/upload/0/0b/USB-TO-LoRa-Update.zip (https://files.waveshare.com/upload/0/0b/USB-TO-LoRa-Update.zip)

- Update tool:

https://files.waveshare.com/wiki/USB-TO-LoRa-XF/firmware/DTU%20Update%20Tool.exe (https://files.waveshare.com/wiki/USB-TO-LoRa-XF/firmware/DTU%20Update%20Tool.exe)

- Refer Video:

https://files.waveshare.com/wiki/USB-TO-LoRa-XF/video/lora-dtu-firmware-video.zip (https://files.waveshare.com/wiki/USB-TO-LoRa-XF/video/lora-dtu-firmware-video.zip)

Support

Technical Support

If you need technical support or have any feedback/review, please click the **Submit Now** button to submit a ticket, Our support team will check and reply to you within 1 to 2 working days. Please be patient as we make every effort to help you to resolve the issue.
Working Time: 9 AM - 6 PM GMT+8 (Monday to Friday)

Submit Now (https://service.waveshare.com/)

Retrieved from "https://www.waveshare.com/w/index.php?title=USB-TO-LoRa-xF&oldid=108187 (https://www.waveshare.com/w/index.php?title=USB-TO-LoRa-xF&oldid=108187)"