RAK4600 Module AT Command Manual

Introduction

The RAK4600 module is designed to simplify LoRa P2P peer-to-peer and LoRaWAN communication. This module saves customers in dealing with complicated SPI protocol with the LoRa transceivers. Instead, a well-known serial communication interface is provided to send commands and request the internal status of the module. This approach allows a straightforward way to integrate LoRa technology into your projects.

On top of this serial interface, a set of AT commands is defined wherein an external microcontroller will be able to control the RAK4600 module as a classic AT modem. Through the AT commands, customers can set parameters of the LoRaWAN communication, controlling GPIO pins, analog inputs, etc.

In the RAK4600 module, the serial communication is exposed on the UART1 port, through Pin 22 (USART1_RX) and Pin 23 (USART1_TX). The parameters of the UART1 communication are **115200 / 8-N-1**. The firmware upgrade is also possible through this port. To get familiar with the pin distribution of this module and find a schematic circuit of a reference application, refer to the RAK4600 Datasheet.

In addition, the RAK4600 also supports BLE. You can use your mobile phone to communicate with the module via BLE interface, or you can use the module to scan the surrounding Bluetooth beacon information.

Links to Quick Start Guide

For AT commands example usage, you can check these sections of quick start guide:

- TTN OTAA/ABP
- ChirpStack OTAA/ABP
- LoRa P2P

Software Tool

If you don't have a serial port tool yet, it is recommended to download and install the RAK Serial Port Tool. There are some ready-made AT commands in this tool that will be very useful for you.

- RAK Serial Port Tool

For more detailed information on how to use this tool, refer to the following guide:

- RAK Serial Port Tool Guide

Content

AT Command Syntax

The AT command is based on ASCII characters. A command begins with the prefix `at` and ends with `<CR><LF>` (i.e. \r\n). The maximum length is 255 characters, which includes the `<CR><LF>` characters at the end of the command. For the rest of the document, the `\r\n` part is omitted for the sake of clarity.

The AT commands can be classified into the following groups:

- **Read Command**: Reads the current configuration or status of the module. The command name and the list of parameters are separated by the `=` character. The `<m>` parameter is separated with its associated value `<n>` by the `:` character.

```
at+get_config=<m>:<n>
```

- **Write Command**: Writes/Modifies the current configuration of the module. The command name and the list of parameters are separated by the `=` character. The `<m>` parameter is separated with its associated value `<n>` by the `:` character.

```
at+set_config=<m>:<n>
```

- **Operational Commands**: Some commands are neither read nor write commands but are used to execute an action.

```
at+send=lora:<m>:<n> // Sends data through the LoRa transceiver.
```

- **Special Command**: The RAK4600 UART port has two operational modes: **Configuration Mode** (default mode) and **Data Transmission Mode**. Data transmission mode allows you to send ASCII payloads directly to the network server via UART without using any AT Command interface like `at+send=lora:X:YYY`. Data transmission mode is explained further on Interface Type AT Command section of this document.

> 📝 **NOTE:**
>
> To enable data transmission mode, you need to input `at+set_config=device:uart_mode:<index>:<mode>` command. To switch back from data transmission mode to configuration mode (AT command default mode), the command to be entered is `+++` and does not contain terminators such as `\r` and `\n`.

After the command is executed by the module, a reply is sent back to the external MCU. In the case the command is successful, the usual reply has the following format:

```
OK [information]\r\n
```

> 📝 **NOTE:**
>
> Only Read commands have information in the replied message, while Write commands do not have an informative description.

The firmware you developed, running in the external MCU, will expect at a minimum a string of `Ok\r\n` after sending a successful command to the board. On the other hand, when the command is not successfully executed by the board, a reply will be received in the following format:

```
ERROR: [Err Code]\r\n
```

Error Code Table

Error Code	Description
1	The last command received is an unsupported AT command.
2	Invalid parameter in the AT command.
3	There is an error when reading or writing the flash memory.
5	There is an error when sending data through the UART port.
41	The BLE felt into an invalid state, could not applied the command.
80	The LoRa transceiver is busy, could not process a new command.
81	LoRa service is unknown. Unknown MAC command received by node. Execute commands that are not supported in the current state, such as sending "`at+join`" command in P2P mode.
82	The LoRa parameters are invalid.
83	The LoRa frequency is invalid.
84	The LoRa data rate (DR) is invalid.
85	The LoRa frequency and data rate are invalid.
86	The device hasn’t joined into a LoRa network.
87	The length of the packet exceeded that maximum allowed by the LoRa protocol.
88	Service is closed by the server. Due to the limitation of the duty cycle, the server will send the "SRV_MAC_DUTY_CYCLE_REQ" MAC command to close the service.
89	This is an unsupported region code.
90	Duty cycle is restricted. Due to the duty cycle, data cannot be sent at this time until the time limit is removed.
91	No valid LoRa channel could be found.
92	No available LoRa channel could be found.
93	Internal state error. Generally, the internal state of the protocol stack is wrong
94	Time out reached while sending the packet through the LoRa transceiver.
95	Time out reached while waiting for a packet in the LoRa RX1 window.
96	Time out reached while waiting for a packet in the LoRa RX2 window.
97	There is an error while receiving a packet during the LoRa RX1 window.

Error Code	Description
98	There is an error while receiving a packet during the LoRa RX2 window.
99	Failed to join into a LoRa network.
100	Duplicate downlink message is detected. A message with an invalid downlink count is received.
101	Payload size is not valid for the current data rate (DR).
102	Many downlink packets are lost.
103	Address fail. The address of the received packet does not match the address of the current node.
104	Invalid MIC is detected in the LoRa message.

General AT Command

1. **at+version**

This command is used to get version the current firmware version number.

Operation	Command	Response
Read	`at+version`	`OK <version number>`

Parameter: None

Example:

```
at+version\r\n
OK V3.3.0.14
```

2. **at+help**

This command is used to obtain all the AT commands supported by the current firmware.

Operation	Command	Response
Read	`at+help`	`OK <all AT commands>`

Parameter: None

Example:

```
at+help\r\n
OK Device AT commands:
  at+version
  at+help
  at+set_config=device:restart
  at+set_config=device:sleep:X
  at+get_config=device:status
  at+set_config=device:uart:X:Y
  at+set_config=device:uart_mode:X:Y

LoRaWAM AT commands:
  at+set_config=lora:default_parameters
  at+join
  at+send=lora:X:YYY
  at+set_config=lora:region:XXX
  at+get_config=lora:channel
  at+set_config=lora:dev_eui:XXXX
  at+set_config=lora:app_eui:XXXX
  at+set_config=lora:app_key:XXXX
  at+set_config=lora:dev_addr:XXXX
  at+set_config=lora:apps_key:XXXX
  at+set_config=lora:nwks_key:XXXX
  at+set_config=lora:multicastenable:X
  at+set_config=lora:multicast_dev_addr:XXXX
  at+set_config=lora:multicast_apps_key:XXXX
  at+set_config=lora:multicast_nwks_key:XXXX
  at+set_config=lora:join_mode:X
  at+set_config=lora:work_mode:X
  at+set_config=lora:ch_mask:X:Y
  at+set_config=lora:class:X
  at+set_config=lora:confirm:X
  at+set_config=lora:dr:X
  at+set_config=lora:tx_power:X
  at+set_config=lora:adr:X
  at+get_config=lora:status
  at+set_config=lora:dutycycle_enable:X
  at+set_config=lora:send_repeat_cnt:X

LoRaP2P AT commands:
  at+set_config=lorap2p:XXX:Y:Z:A:B:C
at+set_config=lorap2p:transfer_mode:X
  at+send=lorap2p:XXX

BLE AT commands:
  at+set_config=ble:work_mode:X:Y
```

3. **at+set_config=device:restart**

This command is used for restarting the device.

Operation	Command	Response
Write	`at+set_config=device:restart`	

Parameter: None

Example:

```
at+set_config=device:restart\r\n
UART1 work mode: RUI_UART_NORMAL
Current work_mode:LoRaWAN, join_mode:ABP, Class: A
Initialization OK
```

4. **at+set_config=device:sleep:** `<status>`

This command is used to change the current state of the device between the sleep and the wake-up mode.

Operation	Command	Response
Write	`at+set_config=device:sleep:<status>`	`OK <STATUS>`

Parameter:

status	0: wake up 1: sleep

Example:

```
at+set_config=device:sleep:1\r\n
OK Sleep

at+set_config=device:sleep:0\r\n
OK Wake Up
```

> 📝 **NOTE:**
>
> During sleep, Pin 22 (USART1_RX) is automatically configured as a wake up pin and in external interrupt mode with an internal pull-down resistor. Wake-up will be triggered by a rising edge on this RX pin.

5. **at+get_config=device:status**

This command is used to obtain the current status of the device.

Operation	Command	Response
Read	`at+get_config=device:status`	`OK <information>`

Parameter: None

Example:

```
at+get_config=device:status\r\n
OK Board Core:RAK4600
MCU:nRF52832
LoRa chip:SX1276
```

Interface Type AT Command

1. **at+set_config=device:uart:** `<index>:<baud_rate>`

This command is used to configure the baud rate for a UART port.

Operation	Command	Response
Write	`at+set_config=device:uart:<index>:<baud_rate>`	`OK`

Parameter：

index	UART Number
baud_rate	UART Baud rate: 1200,2400,4800,9600,19200,38400,57600,115200

2. **at+set_config=device:uart_mode:** `<index>:<mode>`

This command is used to set the UART operation from AT **configuration mode** to **data transmission mode**.

During **data transmission mode**, all standard AT Commands will not work, and the data you sent to UART will go directly to the network server as ASCII payload with `\r\n`. If you input `AZ`, the network server will receive an uplink hex value of `415A0D0A`. This means **A**= `0x41`, **Z**= `0x5A`, **\r**= `0x0D` and **\n**= `0x0A`.

> 📝 **NOTE:**
>
> To switch back from data transmission mode to configuration mode, use `+++` (`+++` without `\ r\ n`).

Operation	Command	Response
Write	`at+set_config=device:uart_mode:<index>:<mode>`	`OK`

Parameter:

index	UART Port Number. Currently, the RAK4600 only supports UART1.
mode	UART Mode： Only 1 can be selected, which means the UART is set to data transmission mode.

Example:

```
at+set_config=device:uart_mode:1:1\r\n
OK

+++
OK
```

LoRaWAN Type AT Command

1. **at+join**

This command is used to join a LoRaWAN network.

Operation	Command	Response
	`at+join`	OK Join Success

Parameter: None

Example：

```
at+join\r\n
OK Join Success
```

2. **at+send=lora:**`<port>:<data>`

This command is used to send data via LoRaWAN.

Operation	Command	Response
	`at+send=lora:<port>:<data>`	OK

Parameter：

port	Sending port of LoRa. The value range is 1-223.
data	The sending data format is in hexadecimal format. The possible values are between **00-FF**. The module internally will cast every two characters into a byte before sending it to the LoRa transceiver. The maximum length varies depending on the band frequency and DR (LoRaWAN standard). Refer to Appendix III.

Example：

When sending data as unconfirmed uplink:

```
at+send=lora:1:5A00\r\n
OK
```

When sending data as confirmed uplink:

```
OK
at+recv=0,-105,-12,0
```

> 📝 **NOTE**
>
> - When sending a confirmed message, you will receive an ACK response, i.e. `at+recv=...`. The `0, -105, -12,0` stands for:
>   - `0` : For the LoRa port;
>   - `-105` : For the RSSI;
>   - `-12` : For the SNR;
>   - `0` : For the length of the data (no valid data in ACK).
> - When sending an unconfirmed message, sometimes the gateway will send MAC commands to nodes, and the node will also receive `at+recv=...`.

3. **at+set_config=lora:region:** `<region>`

This command is used to set the appropriate working frequency band.

Operation	Command	Response
Write	`at+set_config=lora:region:<region>`	OK

Parameter :

region	EU433, CN470, IN865, EU868, US915, AU915, KR920, AS923. The default is EU868.

Example :

```
at+set_config=lora:region:EU868\r\n
OK
```

> 📝 **NOTE:**
>
> In the AS923 frequency band, the supported frequency plan is "as2" and dwell time is set to 1.

4. **at+get_config=lora:channel**

This command is used for reading all the LoRa channel information for the device's current region.

Operation	Command	Response
Read	`at+get_config=lora:channel`	`OK <channel information>`

Parameter：None

Example：

```
at+get_config=lora:channel\r\n
OK *0,on,868100000,0,5; *1,on,868300000,0,5; *2,on,868500000,0,5; 3,off,0,0,0; 4,off,0,0,0; 5,off
```

> 📝 **NOTE**
>
> With ***0,on,868100000,0,5** as an example，the following is the channel parameter analysis:
>
> - `*` at the beginning, if the channel is open;
> - `0` is the channel ID;
> - `on` indicates the current status of the channel;
> - `868100000` is the actual frequency of the channel，unit is Hz;
> - `0,5` indicates the DR of the channel, DR0~DR5.

5. **at+set_config=lora:ch_mask:** `<channel_number>:<status>`

This command is used to enable (on) or disable (off) a channel in the current region.

Operation	Command	Response
Write	`at+set_config=lora:ch_mask:<channel_number>:<status>`	OK

Parameter：

channel_number	Channel number
status	0: off 1: on

Example:

```
at+set_config=lora:ch_mask:0:0\r\n
OK
```

6. **at+set_config=lora:dev_eui:** `<dev_eui>`

This command is used to set the Device EUI parameter for LoRaWAN OTAA mode.

Operation	Command	Response
Write	`at+set_config=lora:dev_eui:<dev_eui>`	OK

Parameter：

dev_eui	Device EUI

Example：

```
at+set_config=lora:dev_eui:3530353064377716\r\n
OK
```

7. **at+set_config=lora:app_eui:** `<app_eui>`

This command is used to set the Application EUI parameter for the LoRaWAN OTAA mode.

Operation	Command	Response
Write	`at+set_config=lora:app_eui:<app_eui>`	OK

Parameter：

app_eui	Application EUI

> 📝 **NOTE:**
>
> All zero value Application EUI `at+set_config=lora:app_eui:0000000000000000` is **not supported** and will return error.

Example：

```
at+set_config=lora:app_eui:0000000000000001\r\n
OK
```

8. **at+set_config=lora:app_key:** `<app_key>`

This command is used to set the Application Key parameter for the LoRaWAN OTAA mode.

Operation	Command	Response
Write	`at+set_config=lora:app_key:<app_key>`	OK

Parameter：

app_key	Application Key

Example :

```
at+set_config=lora:app_key:841986913ACD00BBC2BE2479D70F3228\r\n
OK
```

9. **at+set_config=lora:dev_addr:** `<dev_addr>`

This command is used to set the Device Address parameter for the LoRaWAN ABP mode.

Operation	Command	Response
Write	`at+set_config=lora:dev_addr:<dev_addr>`	OK

Parameter :

dev_addr	Device Address

Example :

```
at+set_config=lora:dev_addr:260125D7\r\n
OK
```

10. **at+set_config=lora:apps_key:** `<apps_key>`

This command is used to set the Application Session Key parameter for the LoRaWAN ABP mode.

Operation	Command	Response
Write	`at+set_config=lora:apps_key:<apps_key>`	OK

Parameter :

apps_key	Application Session Key

Example :

```
at+set_config=lora:apps_key:841986913ACD00BBC2BE2479D70F3228\r\n
OK
```

11. **at+set_config=lora:nwks_key:** `<nwks_key>`

This command is used to set the Network Session Key parameter for the LoRaWAN ABP mode

Operation	Command	Response
Read	`at+set_config=lora:nwks_key:<nwks_key>`	OK

Parameter :

nwks_key	Network Session Key

Example :

```
at+set_config=lora:nwks_key:69AF20AEA26C01B243945A28C9172B42\r\n
OK
```

12. **at+set_config=lora:multicastenable:** `<IsEnable>`

This command is used to enable or disable the multicast feature.

Operation	Command	Response
Write	`at+set_config=lora:multicastenable:<IsEnable>`	OK

Parameter :

IsEnable	0: disable 1: enable The default is disable.

Example :

```
at+set_config=lora:multicastenable:1\r\n
OK
```

13. **at+set_config=lora:multicast_dev_addr:** `<multicast_dev_addr>`

This command is used to set the Device Address for the multicast feature.

Operation	Command	Response
Write	`at+set_config=lora:multicast_dev_addr:<multicast_dev_addr>`	OK

Parameter :

multicast_dev_addr	Multicast Device Address

Example :

```
at+set_config=lora:multicast_dev_addr:260111fd\r\n
OK
```

14. **at+set_config=lora:multicast_apps_key:** `<multicast_apps_key>`

This command is used to set the Application Session Key for the multicast feature.

Operation	Command	Response
Write	`at+set_config=lora:multicast_apps_key:<multicast_apps_key>`	OK

Parameter :

multicast_apps_key	Multicast Application Session Key

Example :

```
at+set_config=lora:multicast_apps_key:F13DDFA2619B10411F02F042E1C0F356\r\n
OK
```

15. **at+set_config=lora:multicast_nwks_key:** `<multicast_nwks_key>`

This command is used to set the Network Session Key for the multicast feature.

Operation	Command	Response
Write	`at+set_config=lora:multicast_nwks_key:<multicast_nwks_key>`	OK

Parameter :

multicast_nwks_key	Multicast Network Session Key

Example :

```
at+set_config=lora:multicast_nwks_key:1D1991F5377C675879C39B6908D437A6\r\n
OK
```

16. **at+set_config=lora:join_mode:** `<mode>`

This command is used to switch the LoRaWAN access mode between the OTAA and the ABP mode.

Operation	Command	Response
Write	`at+set_config=lora:join_mode:<mode>`	OK

Parameter :

mode	Activation mode 0: OTAA 1: ABP The default is OTAA.

Example :

```
at+set_config=lora:join_mode:1\r\n
OK
```

17. **at+set_config=lora:class:** `<class>`

This command is used to set LoRaWAN class to Class A, Class B, or Class C.

Operation	Command	Response
Write	`at+set_config=lora:class:<class>`	OK

Parameter :

class	0: Class A 1: Class B (Not supported at this time) 2: Class C The default is Class A.

Example :

```
at+set_config=lora:class:0\r\n
OK
```

18. **at+set_config=lora:confirm:** `<type>`

This command is used to set the type of data to be sent: Confirmed/Unconfirmed.

Operation	Command	Response
Write	`at+set_config=lora:confirm:<type>`	OK

Parameter：

type	0: unconfirm type 1: confirm type The default is unconfirm type.

Example：

```
at+set_config=lora:confirm:0\r\n
OK
```

19. **at+set_config=lora:dr:** `<dr>`

This command is used to set the data rate (DR) of LoRa.

Operation	Command	Response
Write	`at+set_config=lora:dr:<dr>`	OK

Parameter：

dr	The data rate of LoRa is related to the current region. In most LoRa areas, it is common to use 0 to 5. Detailed reference can be made to LoRaWan 1.0.2 specification.

20. **at+set_config=lora:tx_power:** `<tx_power>`

This command is used to set the RF transmission power level of the LoRa transceiver.

Operation	Command	Response
Write	`at+set_config=lora:tx_power:<tx_power>`	OK

Parameter:

tx_power	Refer to Appendix II for possible values of tx_power. The table of Appendix II is based on LoRaWAN 1.0.2 specification. LoRa transmit power level varies depending on frequency band. If the resulting TX power is higher than the capability of LoRa Radio, the output power will be based on the max TX power of the LoRa Radio in the module. For RAK4600 module, the max TX power is 20dBm. Take note of this when using regional bands with MaxEIRP higher than 20dBm like US915, AU915 and IN865 whose MaxEIRP is 30dBm. The default setting is 0.

Example：

```
at+set_config=lora:tx_power:0\r\n
OK
```

21. **at+set_config=lora:adr:** `<status>`

This command is used to turn on/off the ADR feature of the LoRa communication.

Operation	Command	Response
Write	`at+set_config=lora:adr:<status>`	OK

Parameter：

status	0: Turn off 1: Turn on The default is on.

Example：

```
at+set_config=lora:adr:0\r\n
OK
```

22. **at+get_config=lora:status**

This command is used to get all the information related to the current LoRa status, except channel information.

Operation	Command	Response
Read	`at+get_config=lora:status`	`OK <lora status detail>`

Parameter： None

Example：

```
at+get_config=lora:status\r\n
OK Work Mode: LoRaWAN
Region: EU868
Send_interval: 600s
Auto send status: false.
MulticastEnable: true.
Multi_Dev_Addr: 260111FD
Multi_Apps_Key: F13DDFA2619B10411F02F042E1C0F356
Multi_Nwks_Key: 1D1991F5377C675879C39B6908D437A6
Join_mode: OTAA
DevEui: 0000000000000888
AppEui: 0000000000000888
AppKey: 00000000000008880000000000000888
Class: C
Joined Network:false
IsConfirm: unconfirm
AdrEnable: true
EnableRepeaterSupport: false
RX2_CHANNEL_FREQUENCY: 869525000, RX2_CHANNEL_DR:0
RX_WINDOW_DURATION: 3000ms
RECEIVE_DELAY_1: 1000ms
RECEIVE_DELAY_2: 2000ms
JOIN_ACCEPT_DELAY_1: 5000ms
JOIN_ACCEPT_DELAY_2: 6000ms
Current Datarate: 4
Primeval Datarate: 4
ChannelsTxPower: 0
UpLinkCounter: 0
DownLinkCounter: 0
```

23. **at+set_config=lora:dutycycle_enable:** `<status>`

This command is used for enabling or disabling the Duty Cycle feature.

Operation	Command	Response
Write	`at+set_config=lora:dutycycle_enable:<status>`	OK

Parameter：

status	0: disable 1: enable The default is disable.

Example：

```
at+set_config=lora:dutycycle_enable:1\r\n
OK
```

24. **at+set_config=lora: send_repeat_cnt:** `<num>`

This command is used to set the number of retransmitting attempts on an uplink message. When activated, the board will resend a message if its corresponding ACK (downlink) is not received after sending a confirmed uplink message. The default value is 0, which means that the board will not resend any message by default.

Operation	Command	Response
Write	`at+set_config=lora: send_repeat_cnt:<status>`	OK

Parameter：

num	Number of retries, up to 7. The default is 0.

Example：

```
at+set_config=lora:send_repeat_cnt:1\r\n
OK
```

25. **at+set_config=lora:default_parameters**

This command is used to restore OTAA, ABP, multicast related network access parameters set at the factory, including dev_eui，app_eui, etc.

Operation	Command	Response
Write	`at+set_config=lora:default_parameters`	OK

Parameter： None

Example：

```
at+set_config=lora:default_parameters\r\n
OK
```

LoRa P2P Type AT Command

1. **at+set_config=lora:work_mode:** `<mode>`

This command is used to switch the LoRa's transmission mode between the LoRaWAN and LoRA P2P mode. This command will cause the module to restart once applied.

Operation	Command	Response
Write	`at+set_config=lora:work_mode:<mode>`	

Parameter：

mode	Work mode of LoRa 0: LoRaWAN 1: LoRaP2P The default is LoRaWAN mode

Example :

```
at+set_config=lora:work_mode:1\r\n
UART1 work mode: RUI_UART_NORMAL
Current work_mode:P2P
Initialization OK
```

2. **at+set_config=lorap2p:** `<frequency>:<spreadfact>:<bandwidth>:<codingrate>:<preamlen>:<power>`

This command is used to set the relevant parameters of LoRA P2P mode and is only valid when the LoRa work mode is changed to LoRa P2P before.

Operation	Command	Response
Write	`at+set_config=lorap2p:<frequency>:<spreadfact>:<bandwidth>:<codingrate>:<preamlen>:<power>`	OK

Parameter :

frequency	Frequency, the unit is Hz The default is 869525000 Hz.
spreadfact	Spreading factor The default is 12.
bandwidth	0: 125 kHz 1: 250 kHz 2: 500 kHz The default is 0.
codingrate	1: 4/5 2: 4/6 3: 4/7 4: 4/8 The default is 1.
preamble	Preamble Length. 5~65535 The default is 8.
power	TX power. The unit is in dBm. 5~20 The default is 20.

Example :

```
at+set_config=lorap2p:869525000:12:0:1:8:20\r\n
OK
```

3. **at+set_config=lorap2p:transfer_mode:** `<mode>`

This command is used to change the state of the LoRa transceiver between sending and receiving state, and it is only valid when the LoRa mode is set to LoRa P2P before.

Operation	Command	Response
Write	`at+set_config=lorap2p: transfer_mode:<mode>`	OK

Parameter：

mode	1: receiver mode 2: sender mode The default is sender mode.

Example：

```
at+set_config=lorap2p:transfer_mode:1\r\n
OK
```

4. **at+send=lorap2p:** `<data>`

This command is used to send data through LoRa P2P and is only valid when the LoRa work mode was set to LoRa P2P before.

Operation	Command	Response
Send	`at+send=lorap2p:<data>`	OK

Parameter：

data	The data to be sent, and the format is hexadecimal

Example：

```
at+send=lorap2p:1234\r\n
OK
```

In LoRa P2P mode, the receiving node receives the data and outputs the data in the following format:

```
at+recv=<RSSI>,<SNR>,< Data Length >:< Data >
```

BLE Type AT Command

1. **at+set_config=ble:work_mode:** `<mode>:<long_range>`

This command is used to configure the BLE mode.

Operation	Command	Response
Write	`at+set_config=ble:work_mode:<mode>:<long_range>`	OK

Parameter：

mode	BLE work mode. 0: Peripheral mode (Default) 1: Central mode 2: Beacon scan mode
long_range	Long range enable, only ‘0’ can be selected because RAK4600 does not support this feature.

Example：

```
at+set_config=ble:work_mode:0:0\r\n
OK
```

Appendix I： Data Rate by Region

EU433/EU868/AS923

Data Rate	Configuration	Indicative Physical Bit Rate [bit/s]
0	LoRa: SF12 / 125 kHz	250
1	LoRa: SF11 / 125 kHz	440
2	LoRa: SF10 / 125 kHz	980
3	LoRa: SF9 / 125 kHz	1760
4	LoRa: SF8 / 125 kHz	3125
5	LoRa: SF7 / 125 kHz	5470
6	LoRa: SF7 / 250 kHz	11000
7	FSK: 50 kbps	50000
8 ~ 15	RFU	

CN470/KR920

Data Rate	Configuration	Indicative Physical Bit Rate [bit/s]
0	LoRa: SF12 / 125 kHz	250
1	LoRa: SF11 / 125 kHz	440
2	LoRa: SF10 / 125 kHz	980
3	LoRa: SF9 / 125 kHz	1760
4	LoRa: SF8 / 125 kHz	3125
5	LoRa: SF7 / 125 kHz	5470
6 ~ 15	RFU	

US915

Data Rate	Configuration	Indicative Physical Bit Rate [bit/s]
0	LoRa: SF10 / 125 kHz	980
1	LoRa: SF9 / 125 kHz	1760
2	LoRa: SF8 / 125 kHz	3125
3	LoRa: SF7 / 125 kHz	5470
4	LoRa: SF8 / 500 kHz	12500
5 ~ 7	RFU	
8	LoRa: SF12 / 500 kHz	980
9	LoRa: SF11 / 500 kHz	1760
10	LoRa: SF10 / 500 kHz	3900
11	LoRa: SF9 / 500 kHz	7000
12	LoRa: SF8 / 500 kHz	12500
13	LoRa: SF7 / 500 kHz	21900
14 ~ 15	RFU	

AU915

Data Rate	Configuration	Indicative Physical Bit Rate [bit/s]
0	LoRa: SF12 / 125 kHz	250
1	LoRa: SF11 / 125 kHz	440
2	LoRa: SF10 / 125 kHz	980
3	LoRa: SF9 / 125 kHz	1760
4	LoRa: SF8 / 125 kHz	3125
5	LoRa: SF7 / 125 kHz	5470
6	LoRa: SF8 / 500 kHz	12500
7	RFU	RFU
8	LoRa: SF12 / 500 kHz	980
9	LoRa: SF11 / 500 kHz	1760
10	LoRa: SF10 / 500 kHz	3900
11	LoRa: SF9 / 500 kHz	7000
12	LoRa: SF8 / 500 kHz	12500

IN865

Data Rate	Configuration	Indicative Physical Bit Rate [bit/s]
0	LoRa: SF12 / 125 kHz	250
1	LoRa: SF11 / 125 kHz	440
2	LoRa: SF10 / 125 kHz	980
3	LoRa: SF9 / 125 kHz	1760
4	LoRa: SF8 / 125 kHz	3125
5	LoRa: SF7 / 125 kHz	5470
6	RFU	RFU
7	FSK: 50 kbps	50000
8 ~ 15	RFU	RFU

Appendix II： TX Power by Region

EU868

By default, MaxEIRP is considered to be +16 dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB
8 ~ 15	RFU

US915

By default, MaxEIRP is considered to be +30 dBm based on LoRa Alliance specification. However, the module's max TX power is only up to 20 dBm.

TXPower	Configuration (Conducted Power)
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3 ~ 9	
10	10 dBm
11 ~ 15	RFU

AU915

By default, MaxEIRP is considered to be +30 dBm based on LoRa Alliance specification. However, the module's max TX power is only up to 20 dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1 ~ 10	MaxEIRP - 2*TX Power
11 ~ 10	RFU

KR920

By default, MaxEIRP is considered to be +14 dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB
8 ~ 15	RFU

AS923

By default, MaxEIRP shall be 16 dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB
8 ~ 15	RFU

IN865

By default, MaxEIRP is considered to be +30 dBm based on LoRa Alliance specification. However, the module's max TX power is only up to 20 dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB
8	MaxEIRP - 16 dB
9	MaxEIRP - 18 dB
10	MaxEIRP - 20 dB
11 ~ 15	RFU

CN470

By default, MaxEIRP is considered to be +19.15 dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB
8 ~ 15	RFU

EU433

By default, MAxEIRP is considered to be +12.15 dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6 ~ 15	RFU

Appendix III： Maximum Transmission Load by Region

> 📝 **NOTE:**
>
> The LoRaWAN stack adds 8 bytes to the user payload. In the following list, M is the maximum payload size and N is the maximum usable payload size for the user data without the MAC header.

EU868

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	250	242
8 ~ 15	Not Defined	Not Defined

US915

DataRate	M	N
0	19	11
1	61	53
2	133	125
3	250	242
4	250	242
5 ~ 7	Not Defined	Not Defined
8	61	53
9	137	129
10	250	242
11	250	242
12	250	242
13	250	242
14 ~ 15	Not Defined	Not Defined

AU915

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	Not Defined	Not Defined
8	61	53
9	137	129
10	250	242
11	250	242
12	250	242
13	250	242
14 ~ 15	Not Defined	Not Defined

KR920

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6 ~ 15	Not Defined	Not Defined

AS923

DataRate	Uplink MAC Payload Size (M)		Downlink MAC Payload Size (M)	
	UplinkDwellTime = 0	UplinkDwellTime = 1	DownlinkDwellTime = 0	DownlinkDwellTime = 1
0	59	N/A	59	N/A
1	59	N/A	59	N/A
2	59	19	59	19
3	123	61	123	61
4	250	133	250	133
5	250	250	250	250
6	250	250	250	250
7	250	250	250	250
8	RFU		RFU	

IN865

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	250	242
8 ~ 15	Not Defined	Not Defined

CN470

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6 ~ 15	Not Defined	Not Defined

EU433

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	250	242
8 ~ 15	Not Defined	Not Defined

Appendix IV: Pin Description of RAK4600

The pin definition of the RAK4600 module can be reviewed in the Pin Definition section on the Datasheet.

A summary of the pins of the RAK4600 module:

1. **About the UART Pin**:
   - Pin 22 (USART1_RX) and Pin 23 (USART1_TX).
   - During sleep, Pin 22 (USART1_RX) is automatically configured as a wake up pin and in external interrupt mode with an internal pull-down resistor. Wake-up will be triggered by a rising edge on this RX pin.
2. **About the SWD debug Pin**: Pin 37 (SYS_SWDIO) and Pin 38 (SYS_SWDCLK) are used for SWD debug programming.
3. **About the Power Pin**: The power pins on the RAK4600 module includes the VCC Pins on Pin 40 (3V3_IN) and Pin 41 (3V3_IN), and the ground pins (GND) are on the Pin 1, Pin 8, Pin 12, Pin 13, Pin 14, Pin 16, Pin 18, Pin 19, Pin 20, Pin 31, Pin 39, and Pin 42.
4. **About the Reset Pin**: The reset pin on the RAK4600 module is the Pin 36 (MCU_NRST);
5. **About the RF Antenna Pin**: The RF Antenna pins on the RAK4600 module are the pin15 (RF_BT) BLE antenna and Pin 17 (RF_L) LoRa antenna.
6. **About the GPIO Pin**: The GPIO pins available on the RAK4600 module are Pin 4, Pin 5, Pin 6, Pin 7, Pin 9, Pin 10, Pin 21, and Pin 24.

> 📝 **NOTE:**
>
> The subsequent firmware upgrade of the product is carried out through the OTA interface.