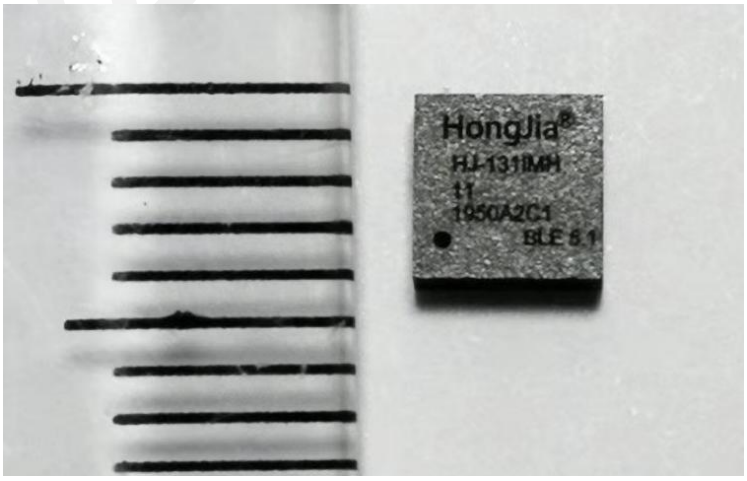
HJ-131IMH Ultra-small chip level (4mmx4mm, include ANT) ,ultra low power Bluetooth 5.1 Software Function Documentation

Software Manual : V1.0Beta

型号：HJ-131IMH



Quick Understanding

HJ-131IMH adopts chip-level package with a size of 4mm * 4mm (built-in antenna), which is the smallest Bluetooth module among the same solutions in the industry. The communication distance of the built-in antenna can reach 5 ~ 10 meters, and the communication distance of the external antenna can reach 40 ~ 80 meters.

HJ-131IMH can maintain communication connection with long connection gap for a long time, power consumption is within 3μA (2s connection gap). And there are many working modes to choose from.

Our company designed a feature-rich instruction set for this module, which can set many complicated parameters to meet different customer needs.

CATALOG

1、Version History

Table 1-1 Revision History

No.	Version Number	Release Time	Reviser	Checker	Description
1	V1.0	20200207	LMY	ZYP	First edition

2、Appointment

2.1 Byte sequence regulations of protocol stack

Among the instructions for all the functions listed in this document, all bytes are used Big-end. Characters of all instructions are coded in ASCII. All instructions start with '<' and end with '>'. There is No data returned line break at the end.

All instructions are divided into two parts according to the direction of transmission.

Some of them are sent from MCU to BLE module. They are mainly responsible for setting up and querying, and use uppercase ASCII characters.

The other part is sent to MCU from BLE module, mainly responsible for response and feedback, using lowercase ASCII characters.

For instructions sent from MCU to BLE module, instructions with setting function start with '<ST', instructions with reading function start with '<RD'.

For instructions sent to MCU from BLE module, the BLE module replies to the result of setting instructions execution with instructions which starting with '<st'. The BLE module replies the result of reading instructions execution with instructions which starting with '<rd'.

For example, we set the name of the BLE module to “HongJia”. We need to send instructions, such as “<ST_NAME=HongJia>”. When the module is set up successfully, instructions will be sent to the MCU, such as “<st_name=ok>”. We can send this command to read the module name, such as “<RD_NAME>”. If read successfully, the module will return an instruction, such as “<rd_name=HongJia>”.

2.2 Explanation of nouns

We can use the method of MCU send instructions to BLE module to control the BLE module. At the same time, the BLE module will process and send feedback information to the MCU after receiving the instruction sent from the MCU.

The instructions sent from the MCU to the BLE module constitute an instruction stream. Each instruction that reads or writes to the same attribute constitutes an instruction packet.

The feedback information sent from the BLE module to the MCU constitutes a response stream. Each feedback message which replied to the same instruction packet constitutes a response packet.

About the syntax, functions, and parameters of the instruction and response packets, we give detailed explanations in Chapters 5, 6 and 7 of the HJ-131IMH software documentation.

3、Module working mode description

3.1 Bluetooth working mode

HJ-131IMH has a built-in high-performance protocol stack. We have optimized the software. The instructions and data are automatically distinguished by our software. There is no need to switch modes. It is simple and easy to use.

At the same time, we multiplex the BLE wake-up pin with the RX pin of the UART. The simplest circuit only needs to connect the power supply and the TX, RX of the serial port, saving external MCU resources.

3.2 Data transparent transmission mode and instruction mode

For information sent to HJ-131IMH, firmware programs within the module can identify whether instructions or data are sent. For instructions sent to HJ-131IMH, module enter the instruction mode to process and respond. For the data sent to HJ-131IMH, module enter the data transparent transmission mode and forwards the data.

HJ-131IMH's instruction mode and data transparent transmission mode work at the same time, without affecting each other.

Other manufacturers usually use an IO port or AT instruction to switch, which makes the operation more troublesome. We simplify the process and make the module easier to use.

4、Pin Function Description

4.1 PIN8/P05 UART TX pin of Bluetooth module

In the transparent transmission mode, this pin is the TX pin of the UART, which is connected to the RX pin of the MCU.

4.2 PIN9/P02 Bluetooth module wake-up and UART RX multiplexing pin

In low power consumption mode (keep broadcasting or not broadcasting), this pin is a wake-up interrupt pin, which is active high more than 1ms can wakeup. Automatically switch to RX function of UART, can receive external commands or data normally. The user can wake up by continuously sending more than 3 bytes of 0XFF.

After waking up, the BLE module will wait for sleep through the T2 value. The default T2 time is 1s. After the serial port has no first data communication, the BLE module will automatically sleep after 3s. After sleep, the UART function of this pin is disabled. Automatically switch to wake-up function.

After waking up, this pin is used as the UART RX pin of the BLE module and connected to the TX of the MCU controller connected to it.

4.3 PIN11/P01 Connection status indication pin

When the BLE module is successfully connected by the mobile phone as a slave, this pin outputs high-level as 1.

When the BLE module is disconnected by the mobile phone as a slave, this pin outputs low-level as 0.

4.4 PIN10/h_RESET Hardware reset pin (active high)

It is recommended that the reset pin connected to the MCU's IO. This pin is ***active high***. When resetting, the high-level should maintain at least 1ms, and then reset HJ-131IMH.

For some industrial environments or complex electromagnetic environments, we recommend that the hardware reset pin be connected to your main control MCU. Be sure to perform a power-on reset operation when powering on.

4.5 PIN3/V_HJ Power supply pin of internal EEPROM

HJ-131IMH has a built-in 32Kb eeprom. This pin is the power supply pin of the internal eeprom. When using our standard version of the transparent transmission program, please connect this pin to PIN2 / VCC_HIGH.

If user need to develop user's own firmware, please handle this pin yourself.

4.6 PIN4/HJD SDA pin of internal EEPROM

When using our standard version of the transparent program, please connect this pin to PIN5 / P03.

If user need to develop user's own firmware, please handle this pin yourself.

4.7 PIN6/HJC SCL pin of internal EEPROM

When using our standard version of the transparent program, please connect this pin to PIN7 / P04.

If user need to develop user's own firmware, please handle this pin yourself.

4.8 PIN5/P03 General GPIO

When using our standard version of the transparent program, this pin acts as the SDA pin of the internal EEPROM.

If user need to develop user's own firmware, please handle this pin yourself.

4.9 PIN7/P04 General GPIO

When using our standard version of the transparent program, this pin acts as the SCL pin of the internal EEPROM.

If user need to develop user's own firmware, please handle this pin yourself.

5、UART command setting and description

5.1 Set / Read the English Name of Bluetooth

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-1.

Table 5-1 The format of instruction packet which is the function of "Set / Read the English Name of Bluetooth"

Instruction Type	Instruction Format
Write	<ST_NAME=xx..xx>
Read	<RD_NAME>

Note:

1. "xx..xx" is the name of what you need to set, its maximum length is 29 bytes.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-2.

Table 5-2 The format of the response packet which is the feedback of the instruction defined in Section 5.1

Response Type	Response Format
Successful Writing	<st_name=ok>
Successful reading	<rd_name=HJ-131IMH> （such as the name is "HJ-131IMH"）
Failure to read or write	No data returned

5.2 Turn on / off Broadcasting, Query the Status of Broadcasting

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-3.

Table 5-3 The format of instruction packet which is the function of "Turn on / off Broadcasting, Query the Status of Broadcasting"

Instruction Type	Instruction Format
Write	<ST_ADV_ONOFF=X>
Read	<RD_ADV_ONOFF>

Note:

1. When X is 1, BLE module turns on broadcasting. When X is 0, BLE module turn off broadcasting.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-4.

Table 5-4 The format of the response packet which is the feedback of the instruction defined in Section 5.2

Response Type	Response Format
Successful Writing	<st_adv_onoff=ok>
Successful reading	<rd_adv_onoff=x>
Failure to read or write	No data returned

5.3 Set / Read the Data About Broadcasting

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-5.

Table 5-5 The format of instruction packet which is the function of "Set / Read the Data About Broadcasting"

Instruction Type	Instruction Format
Write	<ST_ADV_DATA=xx..xx>
Read	<RD_ADV_DATA>

Note:

1. xx..xx is the broadcasting data that needs to be set. Its maximum length is 16 bytes, and the number of bytes must be even, and the format must be limited to HEX type. For example, if the broadcast data is set to "0X12 0X13 0X14 0X15 0X16", the instruction "<ST_ADV_DATA=1213141516>" will be sent.
2. The broadcast data can be set to Chinese characters, which following UTF-8 encoding. A Chinese character occupies 3 bytes of HEX data, and up to 5 Chinese characters can be set.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-6.

Table 5-6 The format of the response packet which is the feedback of the instruction defined in Section 5.3

Response Type	Response Format
Successful Writing	<st_adv_data=ok>
Successful reading	<rd_adv_data=xx..xx>
Failure to read or write	No data returned

Note:

1. We can read the broadcast data by reading "xx..xx" in the feedback message, broadcast data are HEX format, two characters constitute a HEX data, pay attention to conversion.

5.4 Set / Read the Broadcast Gap

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-7.

Table 5-7 The format of instruction packet which is the function of "Set / Read the Broadcast Gap"

Instruction Type	Instruction Format
Write	<ST_ADV_GAP=xx..xx>
Read	<RD_ADV_GAP>

Note:

1. xx..xx is the broadcast gap that needs to be set. Its range is 20 to 10000, corresponding to 20ms~10000ms.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-8.

Table 5-8 The format of the response packet which is the feedback of the instruction defined in Section 5.4

Response Type	Response Format

Successful Writing	<st_adv_gap=ok>
Successful reading	<rd_adv_gap=xx..xx>
Failure to read or write	No data returned

5.5 Active disconnect instruction / read current connection status

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-9.

Table 5-9 The format of instruction packet which is the function of "Active disconnect instruction/read current connection status"

Instruction Type	Instruction Format
Write	<ST_DISCONNECT_LINK>
Read	<RD_LINK>

Note:

1. Set to 0 to disconnect from the slave state.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-10.

Table 5-10 The format of the response packet which is the feedback of the instruction defined in Section 5.5

Response Type	Response Format
Successful Writing	<st_disconnect_link=ok>
Successful reading	<rd_link=x>
Failure to read or write	No data returned

Note:

1. After execution, the slave will immediately disconnect from the master.
2. Read the current connection status. The value of x is 1 for the current normal connection; the value of x is 0 for the current Bluetooth disconnected state.

5.6 Set / read module transmit power

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-11.

Table 5-11 The format of instruction packet which is the function of "Set/read module transmit power"

Instruction Type	Instruction Format
Write	<ST_TX_POWER=xx..xx>
Read	<RD_TX_POWER>

Note:

1. There are 12 levels of power that can be set, which are -19.5dBm, -13.5dBm, -10dBm, -7dBm, -5dBm, -3.5dBm, -2dBm, -1dBm, 0dBm, + 1dBm, + 1.5dBm and + 2.5dBm.. For example, if you want to set the transmission power to + 4dbm, so sent "<ST_TX_POWER = + 4>" . And if you want to set the current transmission power to -19.5dBm, so sent "<ST_TX_POWER = -19.5>".

The direction of response stream is BLE module to MCU. The format of response packet is

shown in Table 5-12.

Table 5-12 The format of the response packet which is the feedback of the instruction defined in Section 5.6

Response Type	Response Format
Successful Writing	<st_tx_power=ok>
Successful reading	<rd_tx_power=xx..xx>
Failure to read or write	No data returned

5.7 Bluetooth reset command

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-13.

Table 5-13 The format of instruction packet which is the function of "Bluetooth reset command"

Instruction Type	Instruction Format
Write	<ST_RESET_BLE>

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-14.

Table 5-14 The format of the response packet which is the feedback of the instruction defined in Section 5.7

Response Type	Response Format
Successful Writing	<st_reset_ble=ok>
Failure to write	No data returned

Note:

1. After the module feedback is successful, the BLE module will be reset after about 500ms.

5.8 Set / read serial baud rate

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-15.

Table 5-15 The format of instruction packet which is the function of "Set/read serial baud rate"

Instruction Type	Instruction Format
Write	<ST_BAUD=xx..xx>
Read	<RD_BAUD>

Note:

1. The baud rate that can be set is up to 1Mbps. For example, if you want to set the baud rate to 19200bps, so sent "<ST_BAUD = 19200>".

2. The baud rates that can be set are: 1200bps, 2400bps, 4800bps, 9600bps, 14400bps, 19200bps, 28800bps, 38400bps, 57600bps, 115200bps, 230400bps, 460800bps, 500,000bps, 921600bps, and 1000000bps.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-16.

Table 5-16 The format of the response packet which is the feedback of the instruction defined in Section 5.8

Response Type	Response Format
Successful Writing	<st_baud=ok>
Successful reading	<rd_baud=xx..xx>
Failure to read or write	No data returned

5.9 Set / read the minimum connection gap of the slave

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-17.

Table 5-17 The format of instruction packet which is the function of "Set / read the minimum connection gap of the slave"

Instruction Type	Instruction Format
Write	<ST_CON_MIN_GAP=xx..xx>
Read	<RD_CON_MIN_GAP>

Note:

2. xx..xx is the smallest connection gap, set in the range of 75~40000, corresponding to 7.5ms~4000ms. We expand the time value (in milliseconds) by 10 times and write it into the instruction as a parameter.

3. The maximum connection gap must be greater than or equal to the minimum connection gap, otherwise an error will be reported.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-18.

Table 5-18 The format of the response packet which is the feedback of the instruction defined in Section 5.9

Response Type	Response Format
Successful Writing	<st_con_min_gap=ok>
Successful reading	<rd_con_min_gap=xx..xx,yy..yy>
Failure to read or write	No data returned

5.10 Set / Read the maximum connection gap of slave

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-19.

Table 5-19 The format of instruction packet which is the function of "Set / read the maximum connection gap of slave"

Instruction Type	Instruction Format
Write	<ST_CON_MAX_GAP=yy..yy>
Read	<RD_CON_MAX_GAP>

Note:

1. yy..yy is the maximum connection gap, set in the range of 75~40000, corresponding to 7.5ms~4000ms. We expand the time value (in milliseconds) by 10 times and write it into the instruction as a parameter.

2. The maximum connection gap must be greater than or equal to the minimum connection gap, otherwise an error will be reported.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-20.

Table 5-20 The format of the response packet which is the feedback of the instruction defined in Section 5.10

Response Type	Response Format
Successful Writing	<st_con_max_gap=ok>
Successful reading	<rd_con_max_gap=xx..xx,yy..yy>
Failure to read or write	No data returned

5.11 Set / read the timeout of the slave connection timeout

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-21.

Table 5-21 The format of instruction packet which is the function of "Set / read the timeout of the slave connection timeout"

Instruction Type	Instruction Format
Write	<ST_CON_TIMEOUT=xx..xx>
Read	<RD_CON_TIMEOUT>

Note:

3. xx..xx is the maximum length of timeout, set in the range of 500~8000, corresponding to 500ms~8000ms.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-22.

Table 5-22 The format of the response packet which is the feedback of the instruction defined in Section 5.11

Response Type	Response Format
Successful Writing	<st_con_timeout=ok>
Successful reading	<rd_con_timeout=xx..xx>
Failure to read or write	No data returned

5.12 Query the MAC Address of the BLE Module of this unit

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-23.

Table 5-23 The format of instruction packet which is the function of "Query the MAC Address of the BLE Module of this unit"

Instruction Type	Instruction Format
Read	<RD_BLE_MAC>

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-24.

Table 5-24 The format of the response packet which is the feedback of the instruction defined in Section 5.12

Response Type	Response Format
Successful reading	<rd_ble_mac=xxxxxxxxxxxx>
Failure to read	No data returned

Note:

1. "xxxxxxxxxxxx" fixed to 12 bytes of MAC address, returned in large-end mode.

5.13 Set the user-defined MAC address

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-25.

Table 5-25 The format of instruction packet which is the function of "Set the user-defined MAC address"

Instruction Type	Instruction Format
Write	<ST_OWN_MAC=xxxxxxxxxxxx>

Note:

1. Where "xxxxxxxxxxxx" is the MAC address to be set.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-26.

Table 5-26 The format of the response packet which is the feedback of the instruction defined in Section 5.13

Response Type	Response Format
Successful Writing	<st_own_mac=ok>
Failure to write	No data returned

Note:

1. After setting up, the module will restart automatically, and then broadcast with the new user-defined MAC address.

5.14 Cancel the User-defined MAC Address of this unit

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-27.

Table 5-27 The format of instruction packet which is the function of "Cancel the User-defined MAC Address of this unit"

Instruction Type	Instruction Format
Write	<ST_OWN_MAC=0>

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-28.

Table 5-28 The format of the response packet which is the feedback of the instruction defined in Section 5.14

Response Type	Response Format
Successful Writing	<st_own_mac=ok>
Failure to write	No data returned

Note:

1. When the user-defined MAC address is cancelled, the module will return to the default MAC address.

5.15 Enable / disable serial port verification /Query serial port verification status

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-29.

Table 5-29 The format of instruction packet which is the function of "Enable or disable serial port verification /Query serial port verification status"

Instruction Type	Instruction Format
Write	<ST_UART_PARITY=x..x>
Read	<RD_UART_PARITY>

Note:

1. When the value of x..x is 'EVEN' for even parity, 'ODD' for odd parity, and 'NONE' for no parity.
2. Effective immediately after setting up.
3. The data format of the serial port with parity are: 7 bits of data, and 1bit of check bit.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-30.

Table 5-30 The format of the response packet which is the feedback of the instruction defined in Section 5.15

Response Type	Response Format
Successful Writing	<st_uart_parity=ok>
Successful reading	<rd_uart_parity=x..x>
Failure to write	No data returned

5.16 Set / read delay time to enter low power mode after wake up

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-31.

Table 5-31 The format of instruction packet which is the function of "Set / read delay time to enter low power mode after wake up"

Instruction Type	Instruction Format
Write	<ST_SLEEP_DELAY=x>
Read	<RD_SLEEP_DELAY>

Note:

1. x is the value to be set. The setting range is 1 ~ 255, corresponding to 100ms ~ 25.5s. The default parameter is 10, and the time is 1s.
2. When the RX pin is pulled high to wake up, the system will delay the set time and then enter the low power mode.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-32.

Table 5-32 The format of the response packet which is the feedback of the instruction defined in Section 5.16

Response Type	Response Format
Successful Writing	<st_sleep_delay=ok>
Successful reading	<rd_sleep_delay=x>
Failure to write	No data returned

5.17 Restore the module to factory settings

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-33.

Table 5-33 The format of instruction packet which is the function of “Restore the module to factory settings”

Instruction Type	Instruction Format
Write	<ST_FACTORY>

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-34.

Table 5-34 The format of the response packet which is the feedback of the instruction defined in Section 5.17

Response Type	Response Format
Successful Writing	<st_factory=ok>
Failure to write	No data returned

5.18 Set / Read the Chinese Name of Bluetooth

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-35.

Table 5-35 The format of instruction packet which is the function of “Set or Read the Chinese Name of Bluetooth”

Instruction Type	Instruction Format
Write	<ST_CH_NAME=xx..xx>
Read	<RD_CH_NAME>

Note:

1. xx..xx is the HEX data of the Chinese name to be set. Because Chinese characters follow UTF-8 encoding, one Chinese character occupies 3 bytes of HEX data. So to set the Chinese name, the number of bytes must be a multiple of 3. You can set up to 8 Chinese characters.

2. For example, the HEX data corresponding to the Chinese name "宏佳电子" is "e5ae8fe4bdb3e794b5e5ad90". So you can directly send "<ST_CH_NAME = e5ae8fe4bdb3e794b5e5ad90>". Please refer to the website "https://tool.lu/hexstr/" for conversion testing.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-36.

Table 5-36 The format of the response packet which is the feedback of the instruction defined in Section 5.18

Response Type	Response Format
Successful Writing	<st_ch_name=ok>
Successful reading	<rd_ch_name=xx..xx>
Failure to read or write	No data returned

Note:

1. “xx..xx” is the data in HEX.

5.19 Set / Clear / Read the Connection Password of Bluetooth Slave

The function of the connection password of the slave is to protect the security of the Bluetooth connection. When any mobile APP or host is connected to the BLE module, they must send our set password to the APP-> BLE (0xFFF2) channel within the set timeout period (Default 15s).

For example, if you want to set the password to "123456", so sent "123456" . If the verification is successful, the module will return "<SECRET_CONFIRM>" in the BLE-> APP (0xFFF1) notification. If it fails, it will disconnect immediately, and it will also disconnect when it times out.

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-37.

Table 5-37 The format of instruction packet which is the function of “Set / Clear / Read the Connection Password of Bluetooth Slave”

Instruction Type	Instruction Format
Write	<ST_SECRET=xx..xx>
Clear	<ST_CLEAR_SECRET=1>
Read	<RD_SECRET>

Note:

1. “xx..xx” is the password that needs to be set, and its maximum length is 8 bytes.

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-38.

Table 5-38 The format of the response packet which is the feedback of the instruction defined in Section 5.19

Response Type	Response Format
Set password successfully	<st_secret=ok>
Clear password successfully	<st_clear_secret=ok>
Successful reading	<rd_secret=xx..xx>
No password set	<rd_secret=null>

Note:

1. When the password is empty, there is no password authentication process when connecting.

5.20 Allow APP configuration enable

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-39.

Table 5-39 The format of instruction packet which is the function of "Allow APP configuration enable"

Instruction Type	Instruction Format
Write	<ST_APP_CONFIG>

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-40.

Table 5-40 The format of the response packet which is the feedback of the instruction defined in Section 5.20

Response Type	Response Format
Successful Writing	<st_app_config=ok>
Failure to write	No data returned

Note:

1. After the sent the command, the APP configuration function is enabled within this connection.The user can send commands and feedback to the BLE module through the app config (0XFFF3) channel. When the BLE module is disconnected, the APP configuration is disabled.In the next time of connection, if you need to enable the APP configuration again, the MCU must send the instruction to the BLE module to enable it again.

2.If the BLE module sets a connection password. After the connection password authentication is successful, the APP configuration function is always enabled during the BLE connection.

5.21 Enable the BLE module at full speed during this connection

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-41.

Table 5-41 The format of instruction packet which is the function of "Enable the BLE module at full speed during this connection"

Instruction Type	Instruction Format
Write	<ST_WAKE=ONCE>

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-42.

Table 5-42 The format of the response packet which is the feedback of the instruction defined in Section 5.21

Response Type	Response Format
Successful Writing	<st_wake=ok>
Disconnected	<st_wake=disconnect>
Failure to write	No data returned

Note:

1. After sending instructions while in the connected state, during this connection, the BLE module will not enter low-power mode. The BLE module will run at full speed and the power consume about 250uA. At this time, if you want the serial port RX to receive data, you do not need to pull RX high before sending data.This function is suitable for large data volume and long-term data interaction use in this connection.

2. When the connection is disconnected, this function will be automatically cancelled. And the BLE module will enter the low power state according to the ST_SLEEP_DELAY set in 5.16.

3. When in a non-connected state, send command will return <st_wake = disconnect> to indicate that it is in a disconnected state at this time and cannot perform this function.

5.22 Enable the BLE module always at full speed

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-43.

Table 5-43 The format of instruction packet which is the function of "Enable the BLE module always at full speed"

Instruction Type	Instruction Format
Write	<ST_WAKE=FOREVER>

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-44.

Table 5-44 The format of the response packet which is the feedback of the instruction defined in Section 5.22

Response Type	Response Format
Successful Writing	<st_wake=ok>
Failure to write	No data returned

Note:

1. After send this command , the BLE module will always be at full speed (will save after power off, that is still valid after restart), and will not enter a low power state. After the send this command , the BLE module will always be at full speed and will not enter a low power state. In order to speed up the connection speed in this mode, the broadcast gap will automatically change to 20ms. The power consumption is about 400uA. At this time, if you want the serial port RX to receive data, you do not need to pull RX high before sending data.This function is suitable for occasions without considering power consumption.

5.23 Set the BLE module to normal wake-up mode

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-45.

Table 5-45 The format of instruction packet which is the function of "Set the BLE module to normal wake-up mode"

Instruction Type	Instruction Format
Write	<ST_WAKE=NORMAL>

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-46.

Table 5-46 The format of the response packet which is the feedback of the instruction defined in Section 5.23

Response Type	Response Format

Successful Writing	<st_wake=ok>
Failure to write	No data returned

Note:

1. After send this command, the BLE module will switch to the normal wake-up mode. In this mode, waking the BLE module needs to pull up the RX pin for at least 1ms. After the wake-up, normal data and instructions can be transmitted. If no data is sent or received through the serial port within the time which set in the 5.16： ST_SLEEP_DELAY instruction, it will automatically enter the low power consumption mode.

5.24 Read the wake-up mode of the BLE module

The direction of instruction stream is MCU to BLE module. The format of instruction packet is shown in Table 5-47.

Table 5-47 The format of instruction packet which is the function of "Read the wake-up mode of the BLE module"

Instruction Type	Instruction Format
Write	<RD_WAKE>

The direction of response stream is BLE module to MCU. The format of response packet is shown in Table 5-48.

Table 5-48 The format of the response packet which is the feedback of the instruction defined in Section 5.24

Response Type	Response Format
Successful Writing	<st_wake=forever>或<st_wake=normal>或<st_wake=once>
Failure to write	No data returned

6、Instructions for serial port operation in transparent mode and command mode

NOTE

If the BLE module works in FOREVER mode, it can ignore the following operations and directly perform data reception and command control.

1. First send 3-5 bytes of 0XAA data continuously to the RX pin of the BLE module, and the BLE module can be woken up immediately.
2. 500us-1ms delay after sending
3. If in the connected state, you can continuously send data to the APP through the RX pin; or directly send instructions to read and write configuration parameters.
4. Special Note: In the connected state, the APP sends data to BLE, BLE will automatically wake up and send the data through UART. After the transmission, it will automatically enter the low power consumption state.

7、Explanation of mobile APP configuration module parameters

In order to facilitate the user to configure the parameters of the module, we allow the APP to read or write all the parameters of the module.

However, for security reasons, only when the external MCU send APP configuration enable command:‘<ST_APP_CONFIG>’ or set connection password to the BLE module, the APP is allowed to configured.

Reference steps:

1. First, please keep the BLE module connected and the "notification" notification function of the app config (0XFFF3) channel is turned on.

2. Send the command <ST_APP_CONFIG> through the serial port to enable APP configuration. (If the BLE module has set the connection password, this step is skipped.)

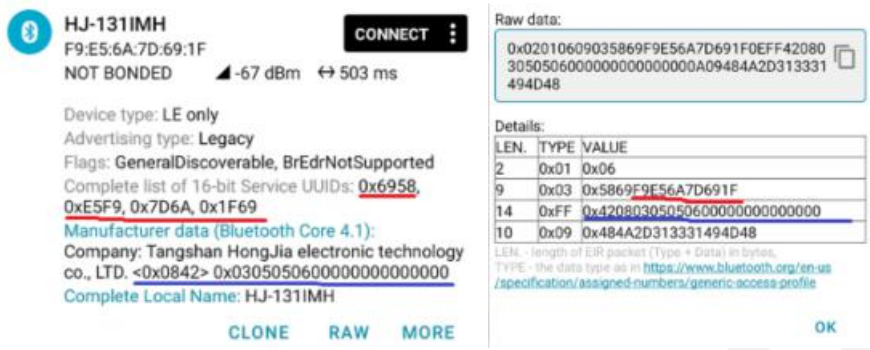
3. Then you can send instructions and read parameters through the app config (0XFFF3) channel.

Note: 1.When the APP configuration is enabled, if the instruction does not exist, it will return “<st_cmd_error>” in the app config (0XFFF3) channel. If the instruction exists and the rules are met, it will return according to the instruction table.

2. When the APP configuration is disabled, no matter what instruction data is sent, it will return "<st_dis_config>" in the app config (0XFFF3) channel.

8、BLE module broadcast data format description

We scanned through Android and the results were as follows (the parsed data on the left and the original data on the right):



1. As the red part, this section is mainly used for IOS device identification to read the MAC address; the first two bytes 0X58 0X69 as our device identification header Header data, they always remain unchanged.
2. The user-defined data is the blue part. The broadcast data of the BLE module is set by instructions. This section will become the set data.

9、BLE Bluetooth module default parameters

●Serial port parameters
- Default serial port parameters:19200bps, N 8 1
- Default transmit power: +2.5dBm

●Module normal broadcasting enabling
- Default broadcasting gap of slave: 500ms
- Default minimum connection gap for slave:15ms
- Default maximum connection gap for slave: 15ms
- Default connection timeout time of slave: 3s

●Wait for 3s to enter low power state after waking up

●User-defined MAC address is disabled, and the module comes with a random address by default

●The connection password function is disabled, no password authentication is required for the connection

● Wake working mode is normal