DX-BT26& DX-BT28

SERIAL UART APPLICATION GUIDE

Version：1.2

Date：2022-10-11
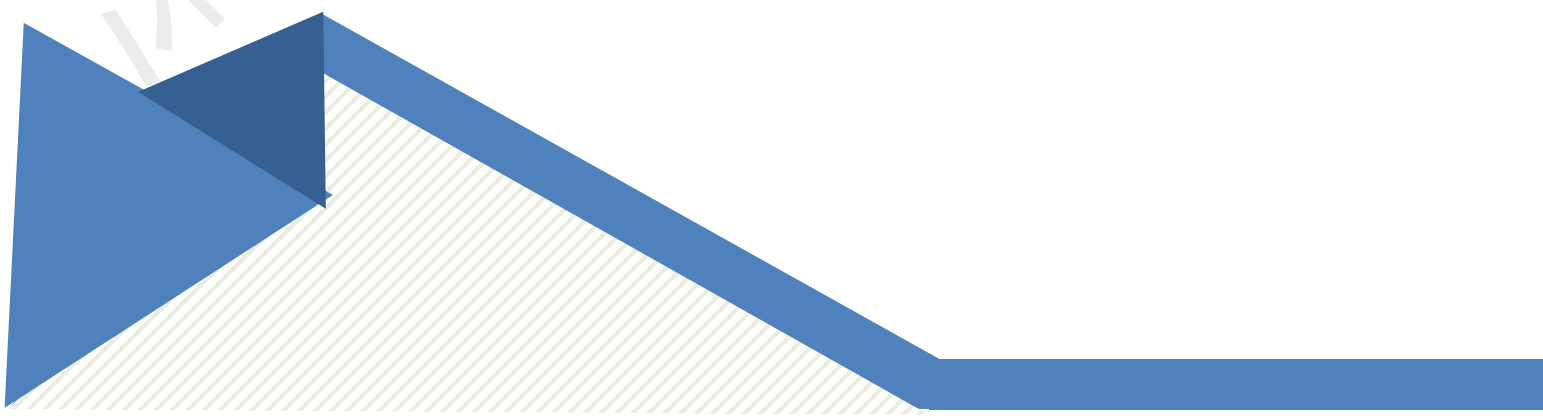
Update Record

Version	Date	Illustrate	Author
V1.1	2022/6/1	initial version	DL
V1.2	2022/10/11	Modify the AT command to set the low-power mode can not repeat the setting problem	DL

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1. Introduction

DX-SMART Technology DX-BT26&BT28 Bluetooth module has 5.1 Bluetooth protocol, and the module has built-in standard serial port protocol. Data can be exchanged with the mobile terminal, PC terminal, and main device terminal through the module serial port, and the module parameters can be configured and modified using AT commands. Thereby, the device can join the Internet of Things at a very low cost and at a very fast speed, making the device more convenient and intelligent.

1.1. Serial Port Basic Parameters

- Module serial port default parameters：9600bps/8/n/1（Baud/Data /No Parity/Stop Bits）
- Module supports software flow control
- Module BLE UUID：SERVICE UUID：FFE0
  NOTIFY/WRITE UUID：FFE1
  WRITE UUID：FFE2

1.2. AT Command And Transparent Transmission Mode

- AT command mode： When the module is not connected by other devices, it is in command mode and can respond to commands.
- Transparent Transmission Mode：After other devices are connected to the module, they are in transparent transmission mode, and data transmission can be started at this time.

1.3. Module composition network data transmission

BT26 & BT28 can be connected with up to 8 master devices at the same time and perform data transmission

For example, the modules form a network as follows, with data sent by master 1 with data '1234', and the network data is transmitted as follows:

Send '1234' → Master 1

Master 2

Master 3

Master 4

DX-BT26 &DX-BT28 → Receive '1234'
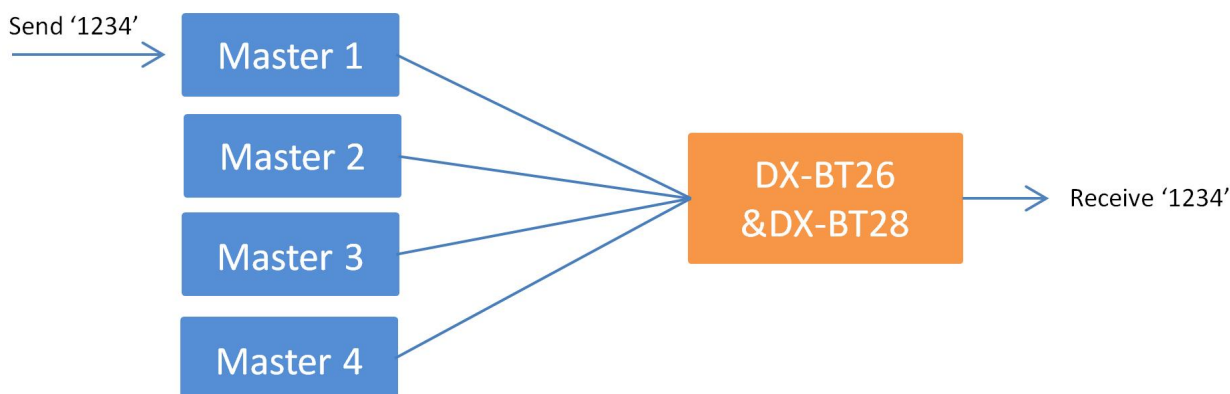
For example, the modules form a network as follows, with data sent by DX-BT26 & DX-BT28 with data '1234', and the network data is transmitted as follows:

Receive '1234' ← Master 1

Receive '1234' ← Master 2

Receive '1234' ← Master 3

Receive '1234' ← Master 4

DX-BT26 &DX-BT28 ← Send '1234'
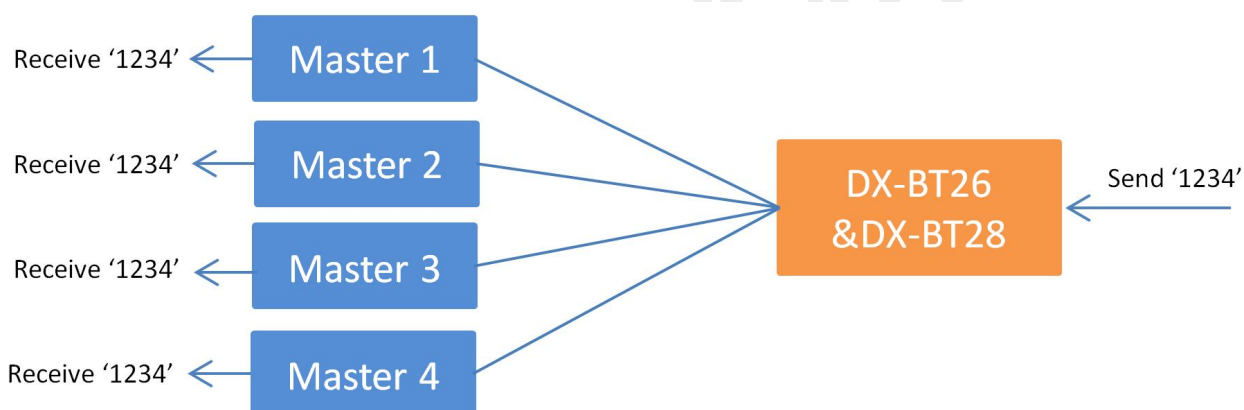
1.4. Module Data Throughput

Data throughput			
Android ->Module -> UART		**UART ->Module-> Android**	
Baud	115200	Baud	115200
connection interval(ms)	40ms-80ms	connection interval(ms)	40ms-80ms
APP data package(bytes)	244	UART packet(bytes)	244
send interval(ms)	15	send interval(ms)	15
Throughput(bytes/s)	6344	Throughput(bytes/s)	10736
Characteristic	Write without Response	Characteristic	Notify

iPhone ->Module-> UART		UART ->Module-> iPhone	
Baud	115200	Baud	115200
connection interval(ms)	40ms-80ms	connection interval(ms)	40ms-80ms
APP data package(bytes)	153	UART packet(bytes)	153
send interval(ms)	70	send interval(ms)	70
Throughput(bytes/s)	2040	Throughput(bytes/s)	1960
Characteristic	Write without Response	Characteristic	Notify

Remark

The data in the above table is for reference only. The maximum MTU value supported by this module is 244. The data throughput is related to the MTU value of the mobile phone's Bluetooth and the connection interval. The actual data shall prevail.

Data throughput of BT26 connected by multiple hosts at the same time

Number of connections	phone→Modules (bytes)	Data Packages(byte)/Send interval(ms)	Modules→phone (bytes)	Data Packages(byte)/Send interval(ms)	Test phone model
1	5856	244/1	10736	244/1	①
2	1800	180/100	1952	244/150	①②
	4880	244/50	3904	244/150	①③
3	1440	180/150	1464	244/150	①②③
4	960	160/200	1256	244/180	①②③④
5	640	160/300	800	190/300	①②③④⑤
6	560	120/300	720	180/300	①②③④⑤⑥
7	440	110/300	680	170/300	①②③④⑤⑥⑦
8	180	50/300	600	150/300	①②③④⑤⑥⑦⑧

Data throughput of BT28 connected by multiple hosts at the same time

Number of connections	phone→Modules (bytes)	Data Packages(byte)/Send interval(ms)	Modules→phone (bytes)	Data Packages(byte)/Send interval(ms)	Test phone model

1	6344	244/20	9760	244/1	①
2	1900	190/100	1840	230/100	①②
	2100	210/100	2440	244/100	①③
3	1440	180/150	1464	244/150	①②③
4	960	160/220	1464	244/150	①②③④
5	640	160/300	976	244/250	①②③④⑤
6	640	160/300	852	244/300	①②③④⑤⑥
7	400	100/300	640	160/250	①②③④⑤⑥⑦
8	160	40/300	560	130/300	①②③④⑤⑥⑦⑧

Remark

The data in the above table is for reference only, and the data is subject to actual.

Test conditions: one-way data transmission between the module and cell phone connection, no packet loss within 10min of data transmission, transmission interval not more than 300ms, baud rate 115200, connection interval 40ms-80ms

Test phone model：①Huawei nova 4e ②iphone6 (V 12.5.4) ③OPPO Reno4 SE ④MI MAX2 ⑤iphone6(V 12.5.5) ⑥Galaxy S10 ⑦Redmi Mate 11 Pro ⑧HONOR PAD 6

2. Mobile Phone Testing APP And PC-side Tools

2.1. Android Test APP

nstall the Android test APP in the data package to the Android phone, open the transparent transmission interface to search and connect, and connect the module to perform data transmission. The APP interface is as follows:

Figure 1：Android APP interface

2.2. Apple Test App

Apple Test APP Download 'DX-SMART' in the Apple Store, and use this APP to test the data transmission. The APP interface is as follows:
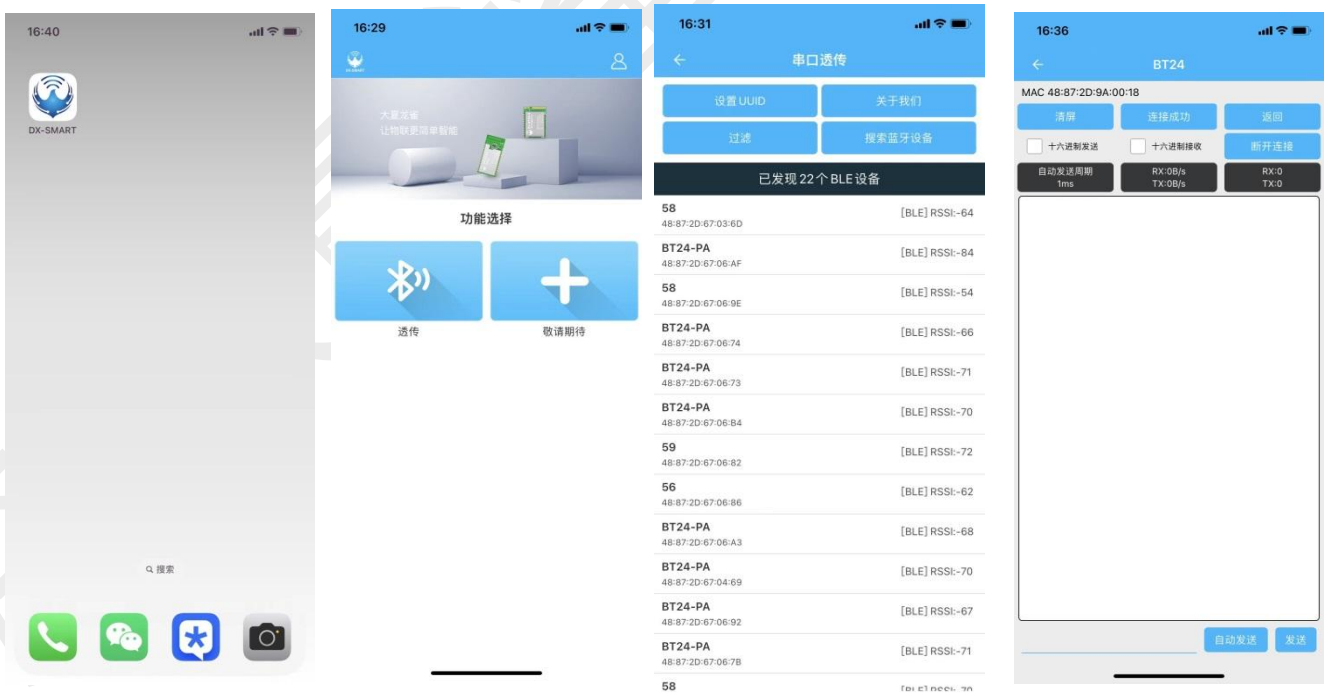
Figure 2：Apple mobile APP interface diagram

2.3.　Computer Test Software

Please download and install the sscom5.13.1 computer serial port software in the data package for the computer test software for testing. The serial port software interface is as follows:
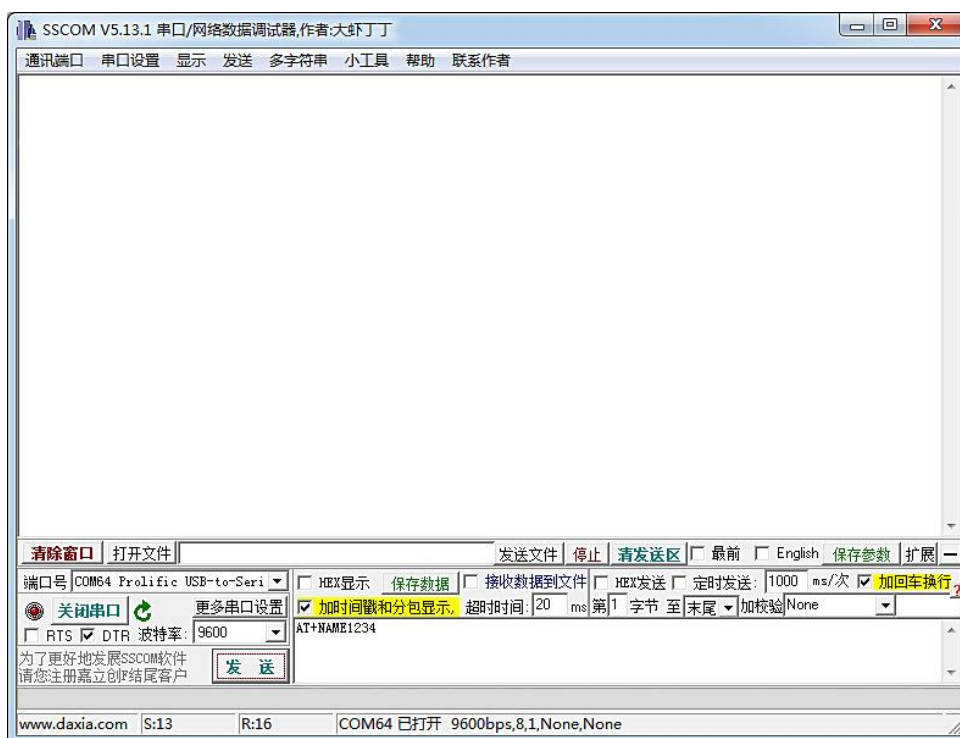
Figure 3：Computer serial port software diagram

3.　Serial Port Usage

3.1.　Use Serial Port To Read And Write AT Commands

3.1.1.　Module Test Minimal System
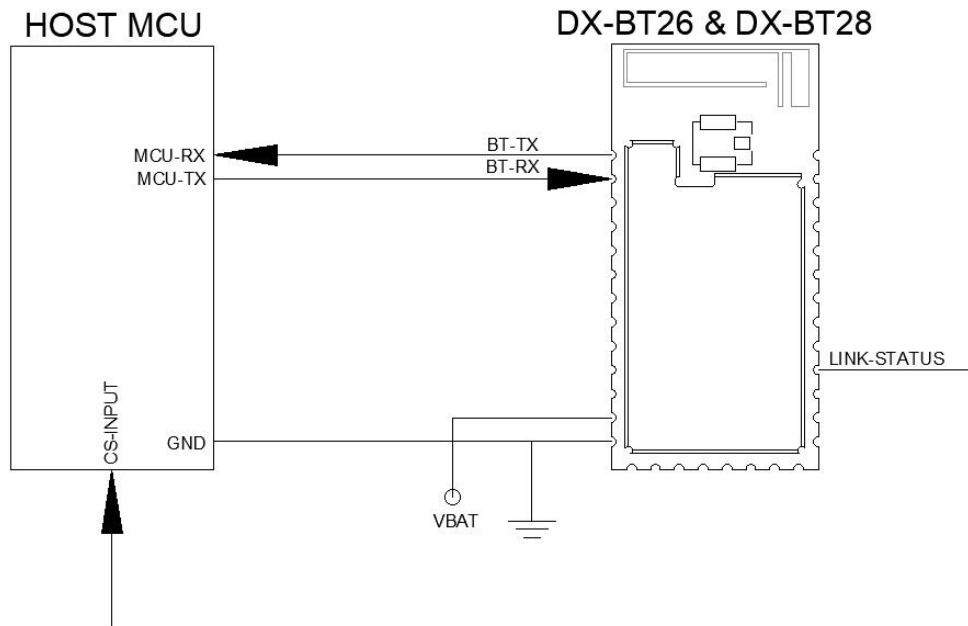
Figure 4：**Module minimum system diagram**

3.1.2. The Process Of Reading And Writing AT Commands On the Computer

Install the serial assistant software on the computer, use the USB to TTL serial cable to communicate with the module, refer to "Module Test Minimum System" for wiring, and then send AT commands to query and configure parameters. Note: The power supply of the module is 3.3V.

Example: Change the name of the Bluetooth module to: 1234.

Install the sscom5.13.1 computer serial port software, open the serial port software and select the corresponding COM port, and configure the default parameter configuration of the serial port software installation: 9600bps/8/n/1 (baud rate/data bit/No parity/stop bit), Fill in the corresponding AT+NAME1234 command, and be sure to add a carriage return and line feed (you can directly press the Enter key) or check "Add carriage return and line feed", and then send the command, as shown below:
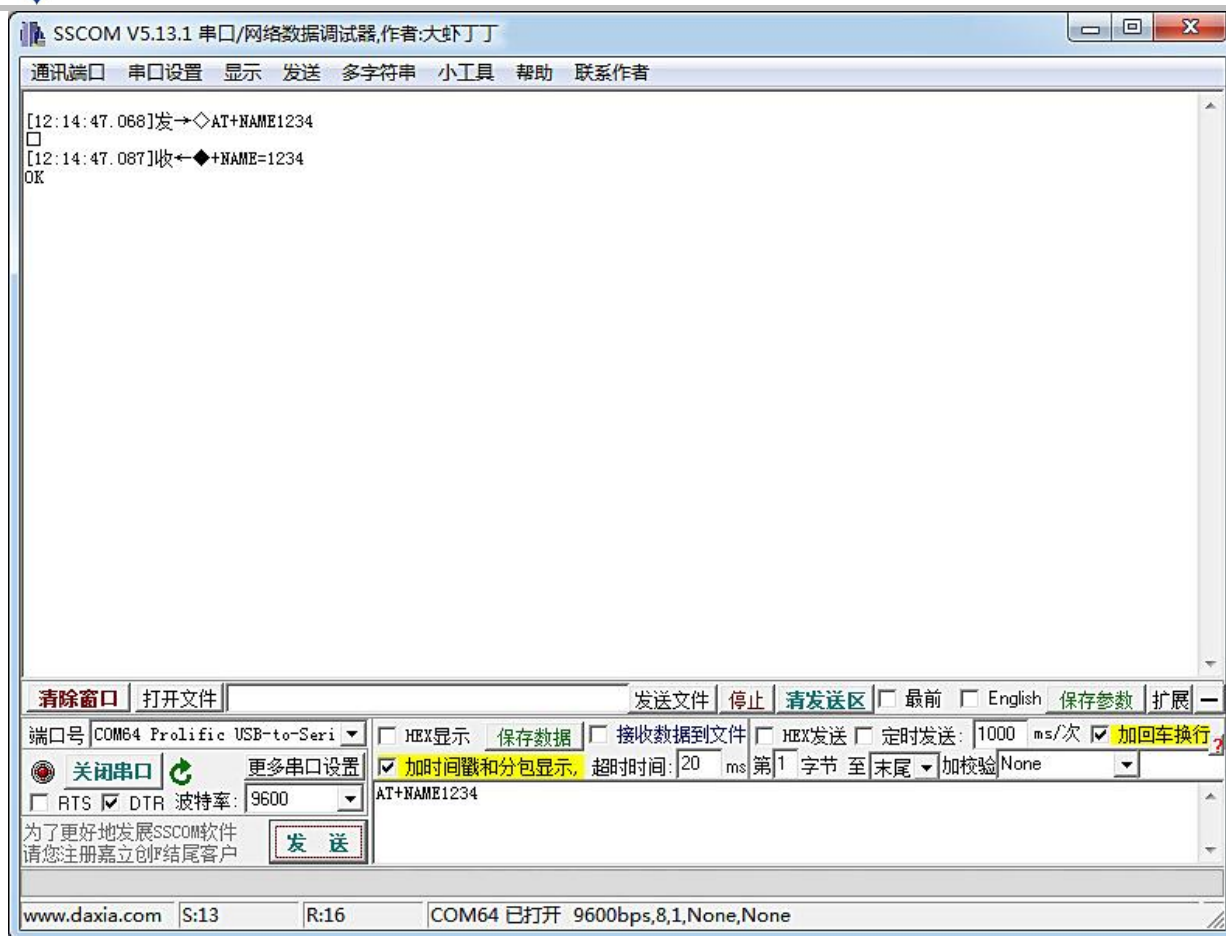
Figure 5：Demonstration diagram of computer serial port

3.1.3. MCU Read And Write AT Command Process

For the wiring of MCU reading and writing AT commands, please refer to "Module Test Minimum System". For example, modify the Bluetooth name and query the Bluetooth address code. The specific instruction program logic flow refers to the following figure:
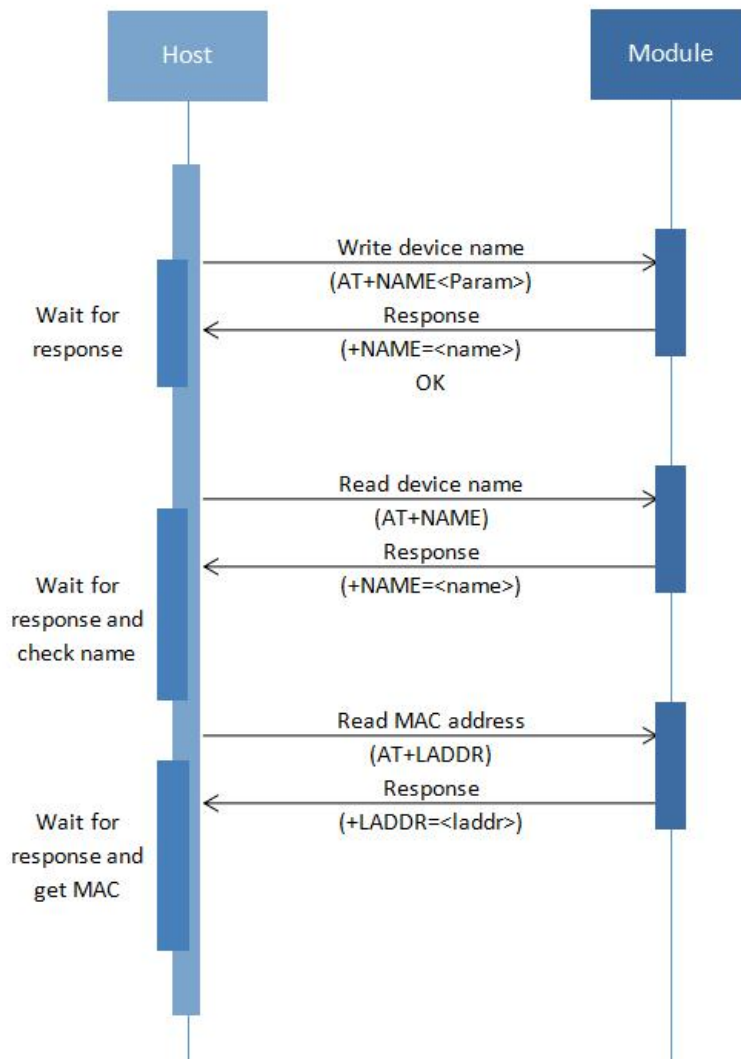
Figure 6: Read and write AT command logic reference diagram

3.2. Use Serial Communication

3.2.1. Use The PC To Communicate With The Module

Because this module is a BLE serial port protocol, the PC side cannot use the built-in Bluetooth or Bluetooth adapter for connection and communication temporarily. If you need to connect the Bluetooth module, you need to use our main module on the PC side, and use the main module for connection and communication. For the specific process, please refer to 3.2.3 "Use the main Bluetooth to communicate with the module"

3.2.2. Communicate With The Module Using The Mobile Terminal

The MCU communicates with the mobile terminal through the Bluetooth module. The process is as follows:
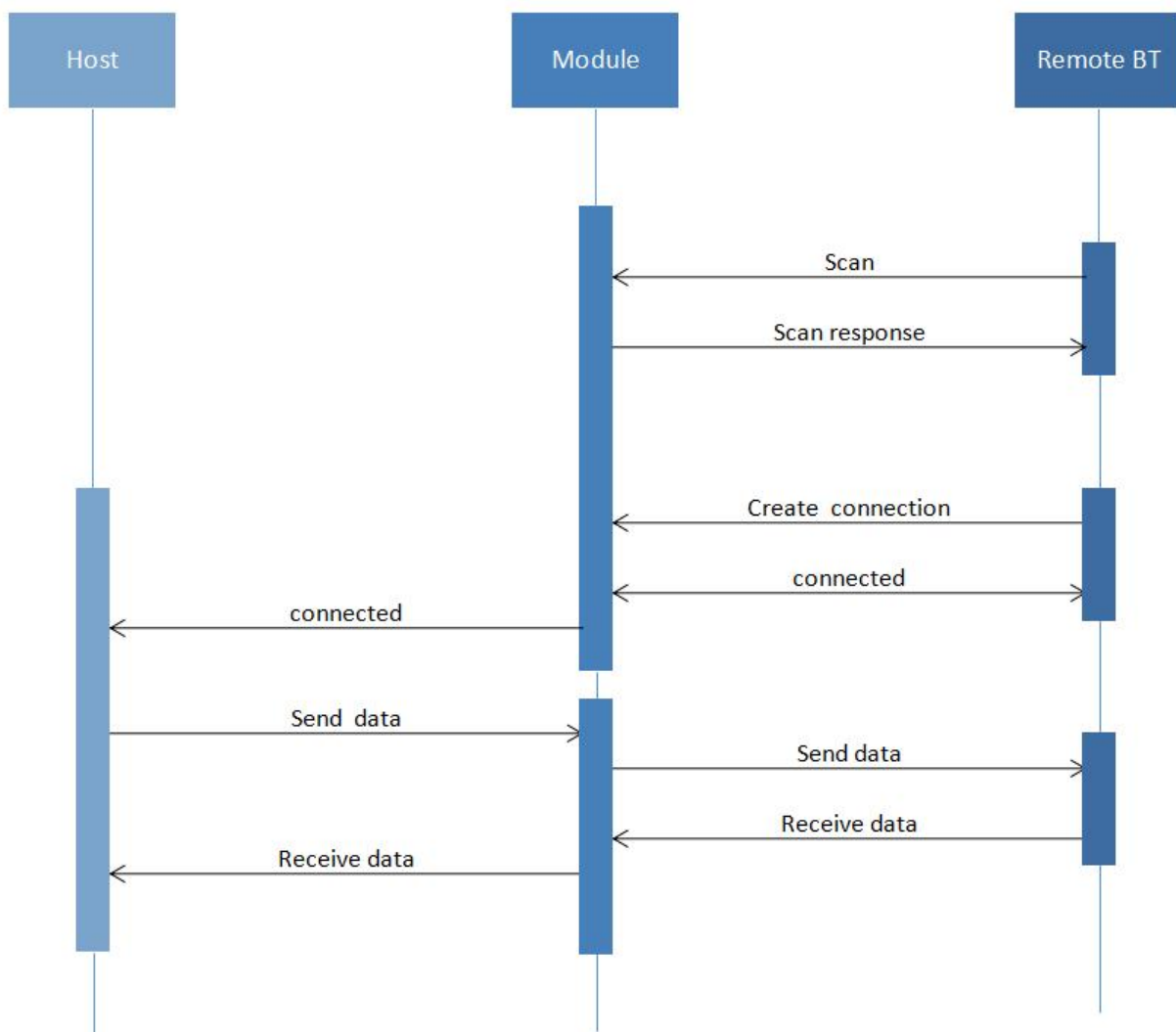
Figure 7：Module communication flow chart

3.2.3. Communicate With The Module Using Master Bluetooth

The connection between the master module and the slave module needs to use AT commands to connect and communicate. The process is as follows:
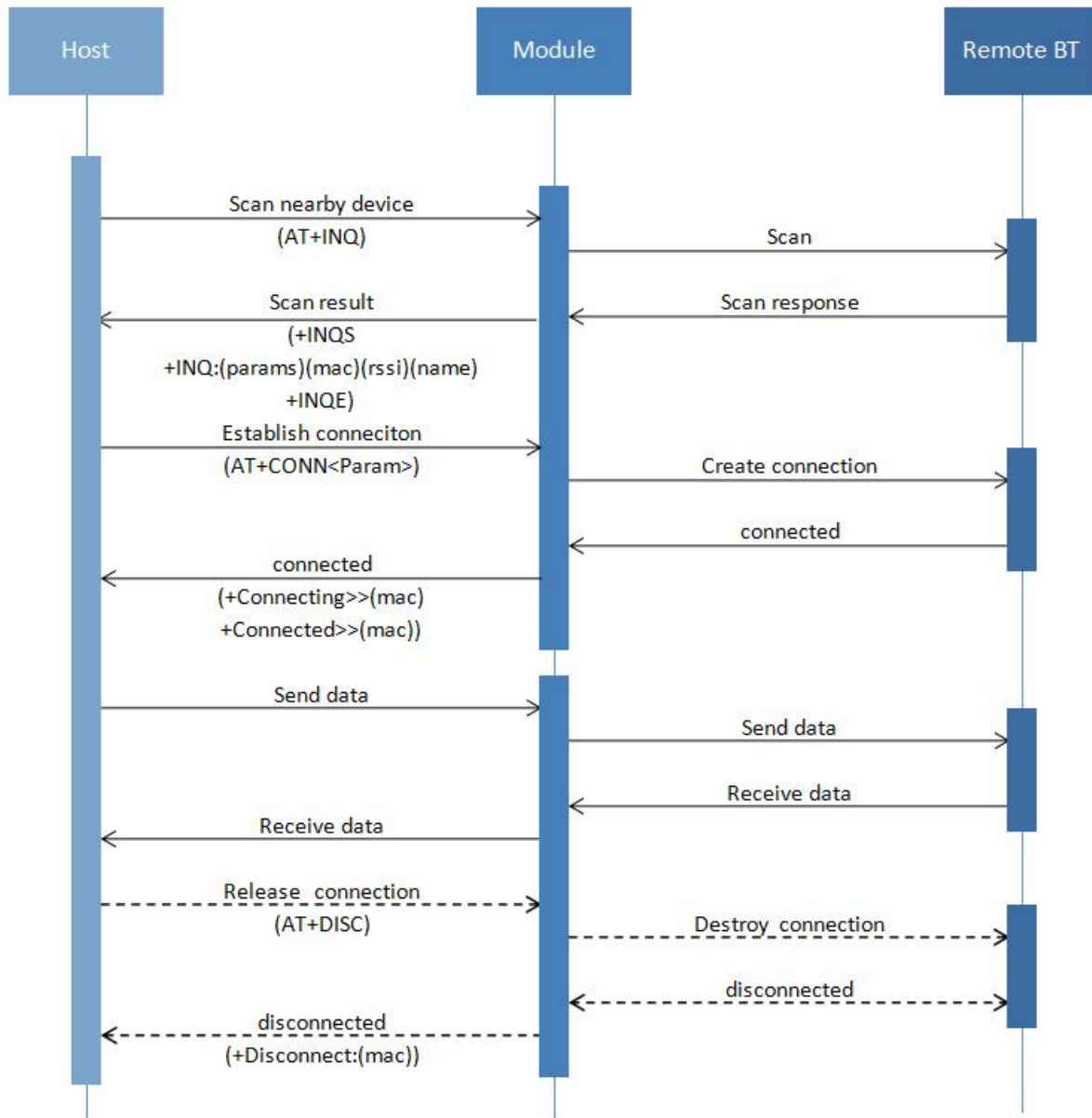
Figure 8: Master-slave module communication flow chart

4. Detailed Explanation Of Related AT Commands

4.1. Command Format Description

AT+Command<param1，param2，param3> <CR><CF>

- All commands start with AT , end with <CR><LF>， In the table showing commands and responses in this document, <CR><LF> is omitted, and only commands and responses are displayed.
- All AT command characters are uppercase.
- <>The content inside is optional， If there are multiple parameters in the command， Separate by comma ","， The angle brackets are not included in the actual command.
- <CR>stands for "carriage return" \r， corresponding hex is 0X0D.
- <LF>stands for "line feed" \n， corresponding hex is 0X0A.
- The command is executed successfully, the corresponding command is returned and ends with OK, and EEROR=<> if it fails， The content of "<>" is the corresponding error code（Please refer to 5.7.）

4.2. Indicacion Format

+Indication<=param1，param2，param3><CR><CF>

- All Indicacion starts with plus sign "+"， ends with <CR><CF>
- "=" is followed by the indication parameter
- If indication has multiple parameters, parameters must be separated by "，"

4.3. Examples Of AT Commands

Example：Modify the name of the Bluetooth device to 1234
Send：AT+NAME1234
Return：+NAME=1234
OK

5. AT Command

5.1. Basic Commands

5.1.1. Test Command

Function	Command	Response	Description
Test command	AT	OK	Test uart communication

5.1.2. Read Firmware Version

Function	Command	Response	Description
Read version	AT+VERSION	+VERSION=\<version>	\<version >firmware version According to different modules and customized requirements version will be different

5.1.3. Read MAC Address

Function	Command	Response	Description
Read MAC address	AT+LADDR	+LADDR=\<laddr>	\<laddr>MAC address

5.1.4. Read/Write Local Name

Function	Command	Response	Description
Read Bluetooth name	AT+NAME	+NAME=<name>	<name>Bluetooth name The maximum length is 28 bytes Default name：BT26/BT28
Write Bluetooth name	AT+NAME<name>	+NAME=<name> OK	

Remark：

After setting this command, it needs to restart to take effect.

5.1.5. Set\Query—Bluetooth Device Name + MAC

Function	Command	Response	Description
Query parameter	AT+NAMAC	+NAMAC=<param>	<param>parameters Closure：0
SET parameter	AT+NAMAC<param>	+NAMAC=<param> OK	Open 6-digit MAC suffix：1 Open 3-digit MAC suffix：2

Remark：

Set to open the 6-digit MAC suffix, the longest Bluetooth effective name is 16 bytes, set to open the 3-digit MAC suffix, the longest Bluetooth effective name is 22 bytes.

Suppose the address code is: 112233aabbcc, and the Bluetooth name of the device is BT24.Turn on the 3-digit MAC suffix, that is, the Bluetooth name of the device is: BT24aabbcc, turn on the 6-digit MAC suffix, that is, the Bluetooth name of the device is: BT24112233aabbcc.

After the setting is completed, it needs to be restarted to take effect

5.1.6. Set/Query—Serial-port Stop Bit

Function	Command	Response	Description
Query stop bit	AT+STOP	+STOP=<param>	< param>Serial number 0：1 stop bit
Set stop bit	AT+STOP<param>	+STOP=<param> OK	1：2 stop bit Defaults：0

Remark：

After setting this command, it needs to restart to take effect.

5.1.7. Set/Query—Serial-port Parity Bit

Function	Command	Response	Description
Query parity bit	AT+PARI	+PARI=<param>	< param>Serial number
Set parity bit	AT+PARI<param>	+PARI=<param> OK	0：No Parity 1：Odd parity 2：Even parity Defaults：0

Remark：

After setting this command, it needs to restart to take effect.

5.1.8. Set/Query—UART Baudrate

Function	Command	Response	Description
Read Baudtate	AT+BAUD	+BAUD=<baud>	<baud>serial number of Baudrate
Write Baudtate	AT+BAUD<baud>	+BAUD=<baud> OK	1:2400　　5: 38400 2:4800　　6: 57600 3:9600　　7:115200 4: 19200　Defaults：3(9600)

Remark：

After setting this command, it needs to restart to take effect.

5.1.9. Set/Query—Software Flow Control

Function	Command	Response	Description
Query flow control status	AT+FLOW	+ FLOW =<param>	< param>Serial number

| Set flow control status | AT+FLOW<param> | OK | 0：Turn off flow control
1：Turn on flow control
Defaults：0 |

5.1.10. Set/Query—Transparent Transmission Mode

Function	Command	Response	Description
Query transparent transmission mode	AT+TRANSPORT	+TRANSPORT=<param>	< param>Serial number 0：Turn off transparent transmission 1：Turn on transparent transmission Defaults：1
Set transparent transmission mode	AT+TRANSPORT<param>	+TRANSPORT=<param> OK	

Remark：

If the transparent transmission is turned off, the module can continue to respond to AT commands after connecting. If the connection is successful and then send the open transparent transmission command, it will enter the transparent transmission mode and no longer respond to the command. The command will be saved after power off.

5.1.11. Disconnect Bluetooth

Function	Command	Response	Description
Disconnect	AT+DISC		Disconnect all connections
	AT+DISC,<mac1>,<mac2>,<mac3>….		<num>：Number of disconnected Bluetooth <mac>：mac address

Remark：

This command can only be used in transparent transmission mode, and can only be sent by the serial port, and is invalid when sent by the mobile phone. It is also possible to disconnect via the KEY pin

Examples：

The module is connected by 8 master devices and requests to disconnect the specified 3 master devices whose addresses are: 112233aabbc1. 112233aabbc2, 112233aabbc3.The command is sent as follows:

　　Send：AT+DISC3, 112233aabbc1,112233aabbc2, 112233aabbc3

5.1.12. Set/Query—Bluetooth Device Type

Function	Command	Response	Description
Query Bluetooth device type	AT+TYPE	+TYPE=<param>	< param>parameter 0x0000:No type specified 0x0040:Phone book type 0x0080:Laptop type ...
Set Bluetooth device type	AT+TYPE<param>	+TYPE=<param> OK	For more types, please find the Bluetooth type table Defaults：0x0000

Remark：

After setting this command, it needs to restart to take effect.

5.1.13. Software Reset

Function	Command	Response	Description
Software Reset	AT+RESET	+RESET OK Power On	

5.1.14. Restore Factory Settings

Function	Command	Response	Description
Restore factory settings	AT+DEFAULT	+DEFAULT OK	

5.1.15. Read Basic Module Information

Function	Command	Response	Description
Read basic information	AT+HELP		

5.2. Broadcast Packet Instruction

5.2.1. Set/Query—SERVICE UUID

Function	Command	Response	Description
Query SERVICE UUID	AT+UUID	+UUID =<param>	<param>SERVICE UUID Default service UUID: 0xffe0
Set SERVICE UUID	AT+UUID<param>	+UUID =<param> OK	

Remark：

After setting this command, it needs to restart to take effect.If you need to change the UUID to 128 bits, please contact our customer service staff to customize the program.

Example：

Set module service UUID is 0xFFF0

      Send：AT+UUID0xfff0

      Return：+UUID=0xfff0

         OK

5.2.2. Set/Query—NOTIFY UUID\WRITE UUID

Function	Command	Response	Description
Query module notify\write UUID	AT+CHAR	+CHAR=<param>	<param>Notify\Write Parameters Defaults：0xffe1 This channel is a readable and writable channel
Set module notify\write UUID	AT+CHAR<param>	+CHAR=<param> OK	

Remark：

After setting this command, it needs to restart to take effect.

5.2.3. Set/Query—WRITE UUID

Function	Command	Response	Description
Query module writes UUID	AT+WRITE	+WRITE=<param>	<param>写入 UUID Defaults：0xffe2
Set module write UUID	AT+WRITE<param>	+ WRITE=<param> OK	

Remark：

After setting this command, it needs to restart to take effect.

5.2.4. Modify The 28-byte Content In The Broadcast Packet

Function	Command	Response	Description
Query broadcast packet parameters	AT+TEADV	+TEADV=<param>	This instruction is the 28-byte broadcast packet data after modifying 020106
Set broadcast packet parameters	AT+TEADV<param>	OK	

The specific format of the broadcast is as follows:

1、Common broadcast packet format：Effective data length + data type + data

Example：1BFF010203040506070809010203040506070809010203040506070708

2、IBeacon broadcast packet format：

1A(length，Fixed value)+FF(type of data) +4C00(Company ID)+02(iBeacon)+15（iBeacon length, It is a fixed value）+UUID(16 bytes)+major(2 bytes)+mainor(2 bytes)+ measured power(When 1 meter, the scanned rssi value);

Example：1AFF4C000215FDA50693A4E24FB1AFCFC6EB076478251527C04CC5

Remark：

The content of the broadcast packet is a hexadecimal number, and the 020106 broadcast packet header is the default setting. This command can only modify the last 28 bytes of the entire broadcast packet.(If you use this command to set the broadcast packet format incorrectly, Bluetooth will not be able to broadcast, and you need to send AT+CLEARADV clear the broadcast parameters or modify the format to the correct broadcast packet format).

Example：

Write the content of the module broadcast package as：

1BFF0102030405060708090A0B0C0D0E0F10111213141516171819 1A

　　　Send：AT+TEADV1BFF0102030405060708090A0B0C0D0E0F10111213141516171819 1A

　　　Return：OK

5.2.5. Modify The 7-byte Content In The Broadcast Packet

Function	Command	Response	Description
Query broadcast package content	AT+SEADV	+ SEADV=<param>	
Set broadcast package content	AT+SEADV<param>	OK	

Remark：

Using this command, you can modify the 7-bit hexadecimal byte data in the broadcast packet at will. If there are not enough bytes, zeroes will be automatically filled in after the data is added. The red part of the broadcast packet is 7 bytes of data

 (0302e0ff031900000303f5fe081611223344556677)

Application：You can use this command to write data in the broadcast, and use the master device to parse the data, then data transmission can be carried out.

Example：

Modify the content of 7 bytes in the broadcast packet as：aabbccddeeff

　　　Send：AT+SEADVaabbccddeeff

　　　Return：OK

That is, the content of the broadcast packet is：0302e0ff031900000303f5fe0816aabbccddeeff00

5.2.6. Clear The Written Broadcast Parameters And Broadcast Content

Function	Command	Response	Description
Clear broadcast parameters and content	AT+CLEARADV	OK	

Remark：

This command can be used to clear the configured broadcast parameters and broadcast content (Including broadcast content, whitelist, targeted broadcast, unconnectable broadcast)，Return OK after success and restart.

5.3. Safety Control Instructions

5.3.1. Set/Query—Open Private Cryptographic Protocol

Function	Command	Response	Description
Query password switch	AT+OPASS	+OPASS=<param>	<param>Serial number Turn off：0
Set password switch	AT+OPASS<param>	OK	Turn on：1 Defaults：0

Remark：

When this command is set to open, after the module is connected, the main device needs to enter the corresponding private password within 7 seconds, otherwise the module will automatically disconnect after 7 seconds. If the correct private password is entered within 7 seconds after connection, the module will Return succeed, if the password is incorrectly entered, Return error=103（Note: APP can receive the module response value, provided that NOTIFY is turned on)

5.3.2. Set/Query—Private Password

Function	Command	Response	Description
Query private	AT+APASS	+APASS=<param>	<param>

			password	Password can only be four
Set private password	AT+APASS<param>	OK		decimal digits Defaults：0000

Remark：

This command can modify parameters in the connected state, and it only takes effect when +OPASS=1. In the connected state, the master-end device Sends this command. After the modification is successful, it will return OK to the master-end device. If it is not successful, it will be processed as data transmission.

Tip: This command can be modified on the APP side, that is, the product can also be modified on the main terminal device (such as a mobile APP) when the product is in the hands of the user. If you forget the password and need to restore the Defaults password, you can re-Send AT+APASS0000.

5.3.3. Set/Query—Directed Broadcast

Function	Command	Response	Description
Query module status	AT+DIRADV	+DIRADV=<param>,<type>,<mac>	<param>Serial number Turn off：0
Set module status	AT+DIRADV<param>,<type>,<mac>	OK	Turn on：1 <type>：Address type mac>：mac address Defaults：0,0,000000

Remark：

<type>Address type: 0=public, 1=random (Note: different main device address types are different, you need to switch 0 or 1 to verify, the mobile phone address type is generally random, that is, 1), <mac> main device address code. After setting this command, it can only be found by the master device with the specified address code. If you want to clear the setting content, you need to use the AT+CLEARADV command. To close the command, send AT+DIRADV0. This command cannot be used with AT+WHITELIST, AT+AUTOLIST, AT+ADVMODE at the same time

Example：

The setting module can only be searched by the device whose address code is 001122334455.

Send：AT+DIRADV1,0,001122334455

Return：OK

5.3.4. Set/Query—Add Whitelist

Function	Command	Response	Description
Query whitelist	AT+WHITELIST	+WHITELIST=<num>,<type>, <mac>	<num>：The number of address digits to be added, up to 5
Set whitelist	AT+ WHITELIST<num>,<type >,<mac>	OK	<type>：address type <mac>：mac address Defaults：0,0,NULL

Remark：

Address type: 0: public, 1: random (Note: different main device address types are different, you need to switch 0 or 1 to verify, the phone address type is generally random, that is, 1).

After this command is set, it can only be connected by the master device with the address code in the whitelist. If you want to clear the setting content, you need to use the AT+CLEARLIST command.

This command cannot be used with AT+DIRADV, AT+AUTOLIST, AT+ADVMODE at the same time.

Example：

Set the whitelist address code as: master device a address: 001122334400, master device b address: 001122334411, master device c address: 001122334422, master device d address: 001122334433, master device e address: 001122334444.

Send：
AT+WHITELIST5,0,001122334400,001122334411,001122334422,001122334433,001122334444

Return：OK

5.3.5. Set/Query—Automatically Add Whitelist

Function	Command	Response	Description
Query whitelist	AT+AUTOLIST	+AUTOLIST=<param>,<type> ,<mac>	<param>:Serial number
Set whitelist		OK	<type>：address type

AT+AUTOLIST\<switch\>,\<num\>	\<mac\>：mac address \<switch\>：switch Turn off：0 Turn on：1 \<num\>：Number Defaults：0,0,NULL

Remark：

Address type: 0: public, 1: random (Note: different main device address types are different, you need to switch 0 or 1 to verify, the phone address type is generally random, that is, 1). \<num\> is the number of whitelists that can be remembered, and the maximum value is 5.

After this setting is turned on, it can automatically remember the MAC address code of the main device that initially started to connect and set it as a whitelist。The module only allows the main device that is set to the whitelist to connect, and other main devices cannot connect to the module. If you need to add a new whitelist, you need to use the AT+CLEARLIST command to clear the memory. To close this command, please send AT+AUTOLIST0.

This command cannot be used simultaneously with AT+DIRADV, AT+WHITELIST, AT+ADVMODE.

举例：

Set to open the automatic white list, and the single number of memorable white names is 3.
Send：AT+AUTOLIST1,3
Return：OK

5.3.6. Set/Query—Clear Whitelist

Function	Command	Response	Description
Clear whitelist	AT+CLEARLIST		

Remark：

You need to clear the whitelist every time you add the whitelist.

5.4. Connect Instruction

5.4.1. Set/Query—Notify The Upper Computer Connection Status

Function	Command	Response	Description
Query parameter	AT+NOTI	+NOTI=<param>	< param>Serial number 0：No notice
Set parameter	AT+NOTI<param>	+NOTI=<param> OK	1：notify Defaults：1

Remark：

After turning on the notification of the host computer connection status，After the module is connected, return OK+CONN0x79AF13557E35(The red part is the main device address)

5.4.2. Set/Query—Whether The Module Can Be Connected

Function	Command	Response	Description
Query parameter	AT+ADVMODE	+ADVMODE=<param>	<param>：Parameter value
Set parameter	AT+ADVMODE<param>	OK	0：Module cannot be connected 1：Module can be connected

Remark：

After the status configuration is successful, return OK and restart. If the status is set repeatedly, it will not restart after returning to OK.

This command cannot be used simultaneously with AT+DIRADV, AT+ WHITELIST, AT+AUTOLIST

5.5. Power Consumption Instruction

5.5.1. Set/Query—Energy Saving Mode

Function	Command	Response	Description
Query Energy saving mode	AT+PWRM	+PWRM=<param>	<param>(0、1、2) 0：Low power mode
Set Energy saving mode	AT+PWRM<param>	+PWRM=<param> OK	1：Normal working mode 2：Hibernation mode

Defaults：1

5.5.2. Set/Query—Whether To Turn Off The Broadcast

Function	Command	Response	Description
Query broadcast status	AT+CLOSEADV	+CLOSADV=<param>	<param>Serial number 0：Turn off broadcast
Set broadcast status	AT+CLOSEADV<param>	OK	1：Turn on broadcast Default Turn on：1

Remark：

This instruction can be used to reduce power consumption

5.5.3. Set/Query—Broadcast Interval

Function	Command	Response	Description	
Query Broadcast interval	AT+ADVI	+ADVI=<param>	param：0~F	8—1022.5ms 9—1285ms
Set Broadcast interval	AT+ADVI<param>	+ ADVI=<param> OK	0—100ms 1—152.5ms 2—211.25ms 3—318.75ms 4—417.5ms 5—546.25ms 6—760ms 7—852.5ms	A—2000ms B—3000ms C—4000ms D—5000ms E—6000ms F—20ms(20msBT28 support only) Defaults：5

Note:The following table is a comparison of power consumption under different broadcast intervals. The following parameters are for reference only, and the actual parameters are subject to actual measurement.

BT26 Broadcast interval(ms)	BT26 Low power mode power consumption(uA)	BT26 Normal working mode power consumption(uA)

100	112.42 uA	542.22 uA
152.5	78.79 uA	520.32 uA
211.25	57.51 uA	507.36 uA
318.75	65.11 uA	496.63 uA
417.5	31.06 uA	491.36 uA
546.25	25.53 uA	487.20 uA
760	21.21 uA	483.55 uA
852.5	18.04 uA	483.37 uA
1022.5	15.15 uA	481.90 uA
1285	13.13 uA	479.70 uA
2000	10.34 uA	478.10 uA
3000	8.48 uA	476.83 uA
4000	7.56 uA	476.27uA
5000	6.88 uA	476.26uA
6000	6.62 uA	476.16uA
BT28 Broadcast interval(ms)	BT28 Low power mode power consumption	BT28 Normal working mode power consumption
20	6.85 mA	12.61 mA
100	1.59 mA	9.13 mA
152.5	1.10 mA	8.75 mA
211.25	810.34 uA	8.55 mA
318.75	659.21 uA	8.39 mA
417.5	405.66 uA	8.29 mA
546.25	325.71 uA	8.26 mA
760	230.58 uA	8.18 mA
852.5	202.85 uA	8.15 mA
1022.5	166.55 uA	8.13 mA
1285	142.21 uA	8.12 mA
2000	90.69 uA	8.09 mA
3000	64.40 uA	8.08 mA
4000	45.93 uA	8.05 mA
5000	39.90 uA	8.05 mA
6000	33.58 uA	8.04 mA

5.5.4. Set/Query—Module Transmit Power

Function	Command	Response	Description
Query Transmit power	AT+POWE	+POWE=\<param\>	\<param\>Serial number(0、1)
Set Transmit power	AT+POWE\<param\>	+POWE=\<param\> OK	0: Normal working mode 1: Near Field Mode

Remark：

In near-field mode, the transmitting power of the module becomes lower, and the broadcasting distance of the module becomes shorter, depending on the actual environment.

5.6. Pairing Mode

5.6.1. Set/Query—Enter Pairing Mode

Function	Command	Response	Description
Query pairing mode	AT+SEADV	+SEADV=\<param\>	\<param\>broadcast packet Not entering pairing mode broadcast packet： 0302e0ff031900000303f5fe09ff584448872da002a7
Set pairing mode	AT+SEADV534d4152542d00	OK Power On	Enter pairing mode to broadcast packets： 0302e0ff031900000816534d4152542d0009ff584448872da002a7 Defaults： 0302e0ff031900000303f5fe09ff584448872da002a7

Remark：

1、 To exit the pairing mode, you can send AT+ CLEARADV to clear the contents of the broadcast packet.

2、 If there are multiple slave modules, it is recommended to press and hold the button to enter the pairing mode, because after multiple modules are set to enter the pairing mode at the

same time, the master module will not be able to find the corresponding module, and the meaning of the pairing mode will be lost.

5.7. List Of Error Codes

The detailed information of the error code in ERROR=<> is listed as follows：

Return Value	Error Message
101	Parameter length error
102	Parameter format error
103	Abnormal parameter data
104	Command error

6. Value-added Services

In order to meet the various functional requirements of customers, our company can provide the following technical value-added services:

- Module program customization, such as: IO function port customization, AT command customization, broadcast package customization, etc.
- Module PCB hardware customization,Can be customized to customer's hardware requirements.
- Various Bluetooth solutions can be customized, and a complete set of Bluetooth software and hardware solutions can be customized according to customer needs.
- A complete set of networking solutions can be customized, and a complete set of networkable and gateway solutions can be customized according to customer needs.

If you have the above customization requirements, please contact our sales staff directly.

FCC Statement

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

The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device.

FCC Radiation Exposure Statement
This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 2AKS8-DX-BT28 Or Contains FCC ID: 2AKS8-DX-BT28"

When the module is installed inside another device, the user manual of the host must contain below warning statements;

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

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with Single modular approval should perform the test of radiated emissionand spurious emission according to FCC part 15C : 15.247 and 15.209 requirement,Only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement, then the host can be sold legally.

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

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

OEM INTEGRATION INSTRUCTIONS:

This device is intended only for OEM integrators under the following conditions:

The module must be installed in the host equipment such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the internal on-board antenna that has been originally tested and certified with this module. External antennas are not supported. As long as these 3 conditions above are met, further transmitter test will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.). The end-product may need Verification testing, Declaration of Conformity testing, a Permissive Class II Change or new Certification. Please involve a FCC certification specialist in order to determine what will be exactly applicable for the end-product.

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. In such cases, please involve a FCC certification specialist in order to determine if a Permissive Class II Change or new Certification is required.

Upgrade Firmware:

The software provided for firmware upgrade will not be capable to affect any RF parameters as certified for the FCC for this module, in order to prevent compliance issues.

End product labeling:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: 2AKS8-DX-BT28".

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

2.2 List of applicable FCC rules
List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below

concerning the need to notify host manufacturers that further testing is required.3 Explanation: This module meets the requirements of FCC part 15C(15.247).

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands. Explanation: The EUT has a Integral Antenna , and the antenna use a permanently attached antenna which is not replaceable.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module. Explanation: The Module is not a limited module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

a)   Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width,shape(s),
dielectric constant, and impedance as applicable for each type of antenna);

b)   Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency,the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered); c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;

d) Appropriate parts by manufacturer and specifications;

e) Test procedures for design verification; and

f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.
Explanation: Yes, The module with Integral antenna designs, Please refer to the antenna specification book for antenna dimensions.

2.6 RF exposure considerations
It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).
Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2AKS8-DX-BT28.

2.7 Antennas
A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an "omni-directional antenna" is not considered to be a specific "antenna type")).
For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.
Explanation: The EUT has a Integral Antenna, and the antenna use a permanently attached antenna which is unique.

2.8 Label and compliance information
Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating "Contains FCC ID" with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.
Explanation:The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2AKS8-DX-BT28."

2.9 Information on test modes and additional testing requirements5
Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone

modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer's determination that a module as installed in a host complies with FCC requirements.

Explanation: Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuity, so the module does not require an evaluation by FCC Part 15 Subpart B. The host shoule be evaluated by the FCC Subpart B.