![DX-SMART logo]

DX-BT24&BT24-S

DX-BT27

SERIAL UART APPLICATION GUIDE

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Contents

Picture index

1. Introduction

DX-SMART Technology DX-BT24&BT24-S&BT27 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(Note: DX-BT27 does not support)
- 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 Data Throughput

Data throughput			
Android ->Module -> UART		**UART ->Module-> Android**	
Baud	115200	Baud	115200
connection	15	connection	15

interval(ms)		interval(ms)	
APP data package(bytes)	230	UART packet(bytes)	320
send interval(ms)	20	send interval(ms)	20
Throughput(bytes/s)	10120	Throughput(bytes/s)	10626
Characteristic	Write without Response	Characteristic	Notify
iPhone ->Module-> UART		**UART ->Module-> iPhone**	
Baud	115200	Baud	115200
connection interval(ms)	30	connection interval(ms)	30
APP data package(bytes)	140	UART packet(bytes)	300
send interval(ms)	20	send interval(ms)	20
Throughput(bytes/s)	5600	Throughput(bytes/s)	9536
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 253. The data throughput is related to the MTU value of the mobile phone's Bluetooth and the connection interval. The actual data shall prevail.

2. Mobile Phone Testing APP And PC-side Tools

2.1. Android Test APP

Install 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 'LIGHTBLUE' in the Apple Store, and use this APP to test the data transmission. The APP interface is as follows:
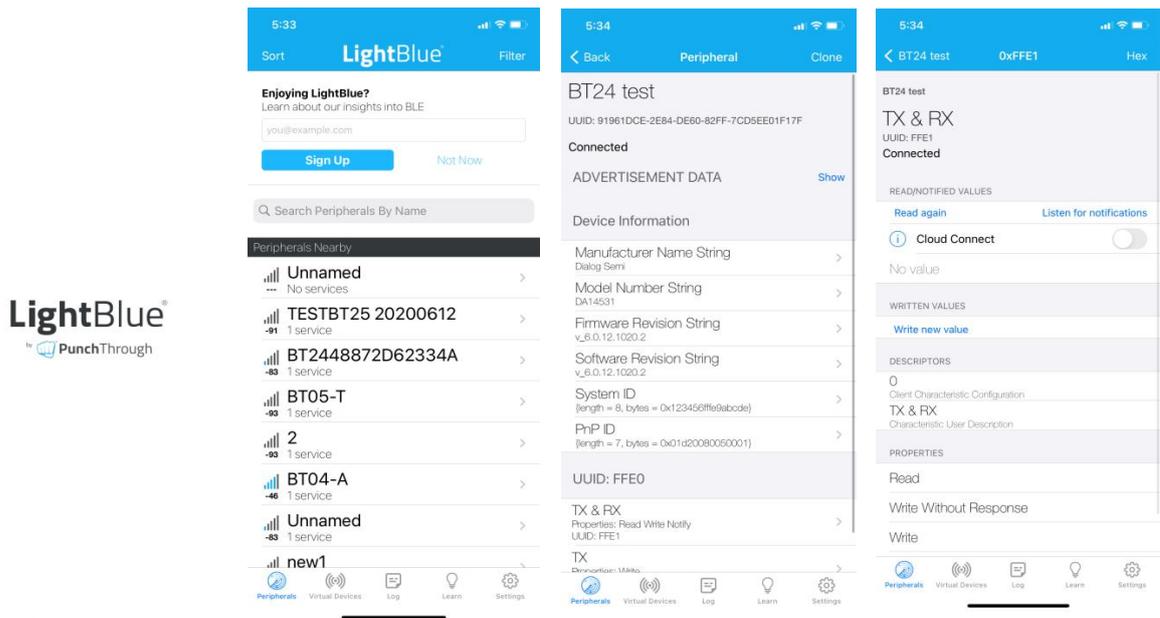
Figure 2：Apple mobile APP interface diagram

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:
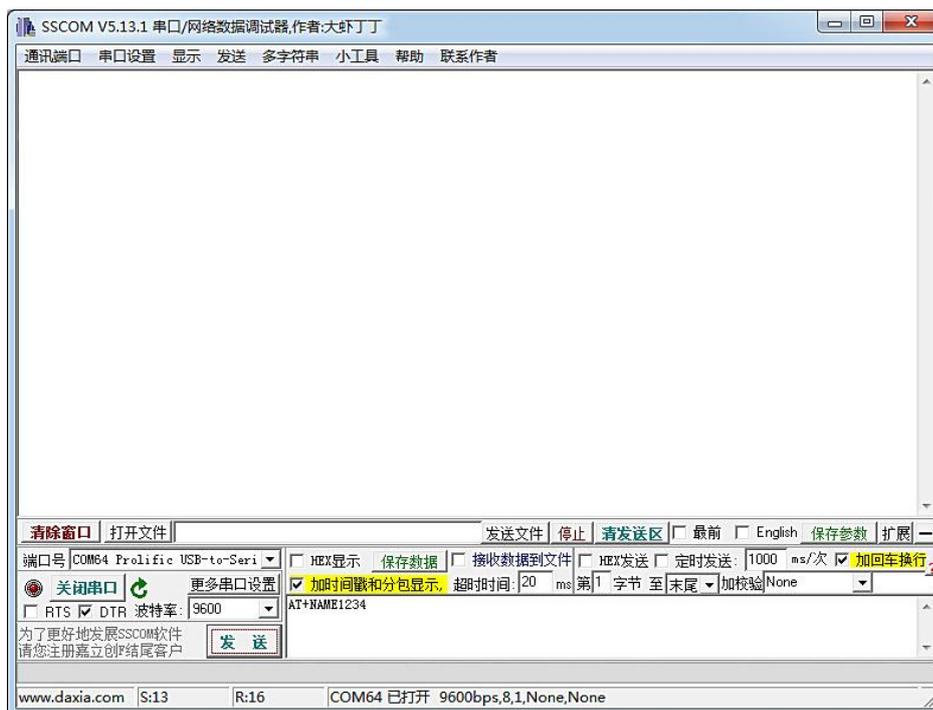
Figure 3：Computer serial port software diagram

3. Serial Port Usage

3.1. Use Serial Port To Read And Write AT Commands

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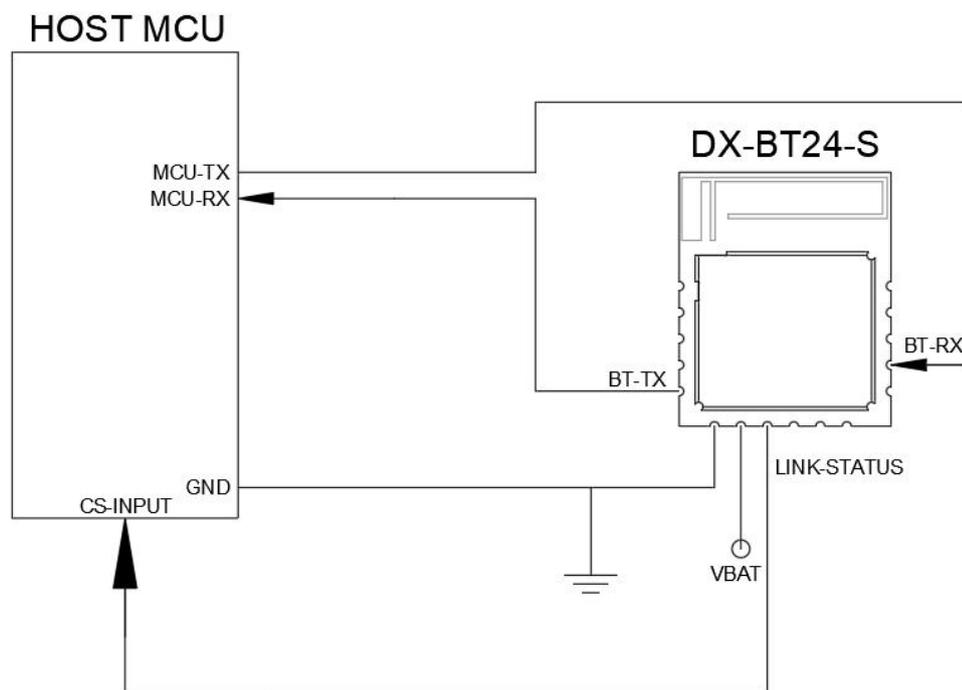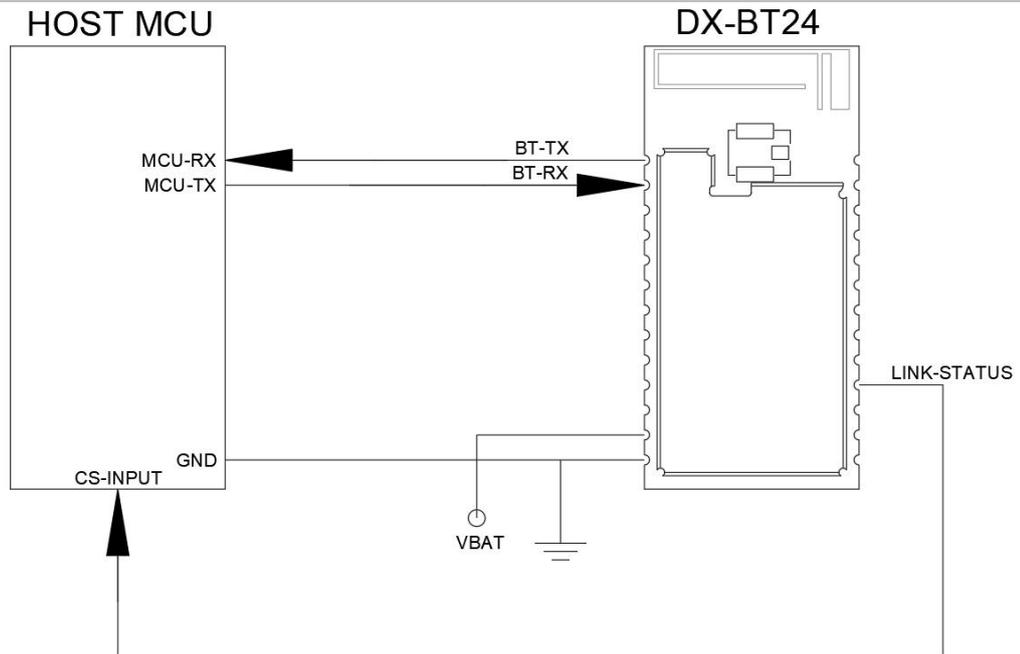
Figure 4：Module minimum system diagram

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:
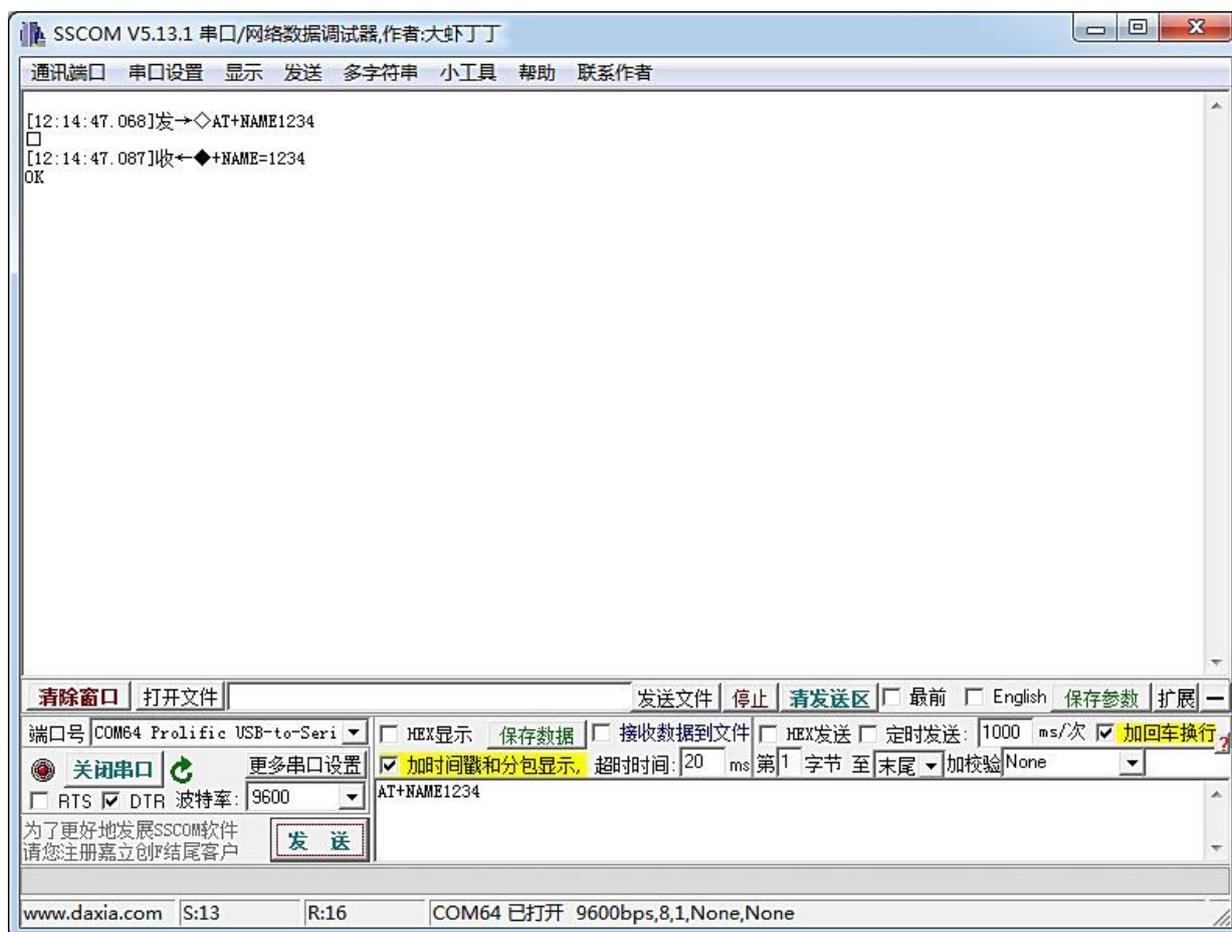
Figure 5：Demonstration diagram of computer serial port

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:
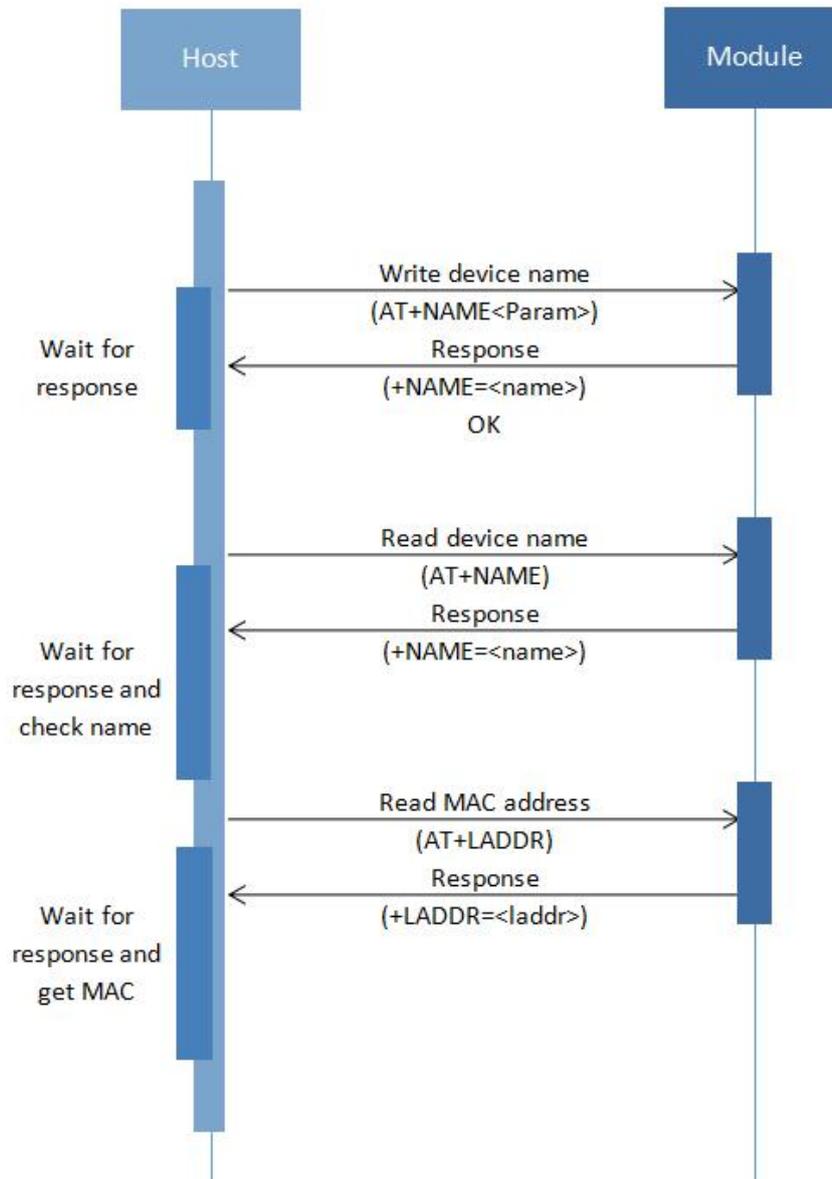
Figure 6：Read and write AT command logic reference diagram

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 "Use the main Bluetooth to communicate with the module" and "DX-BT24 series Bluetooth module_Main mode_ Application Guidelines".

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:
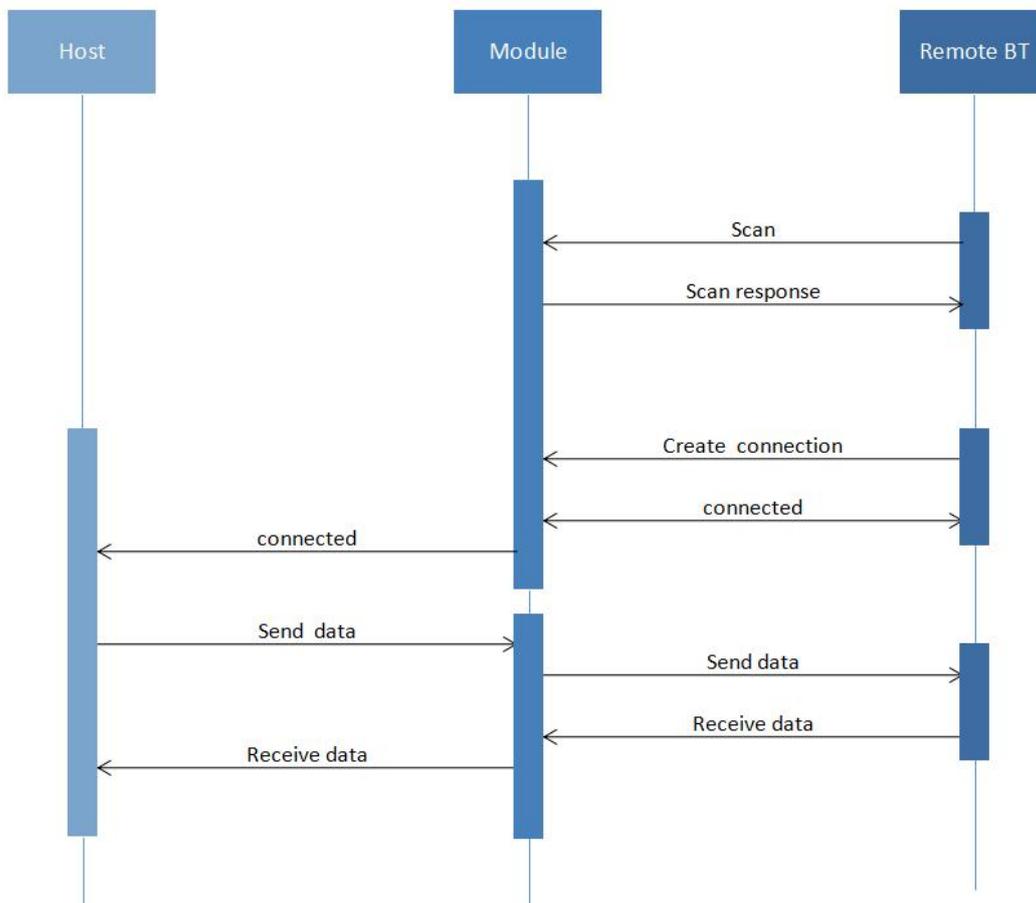
Figure 7：Module communication flow chart

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:
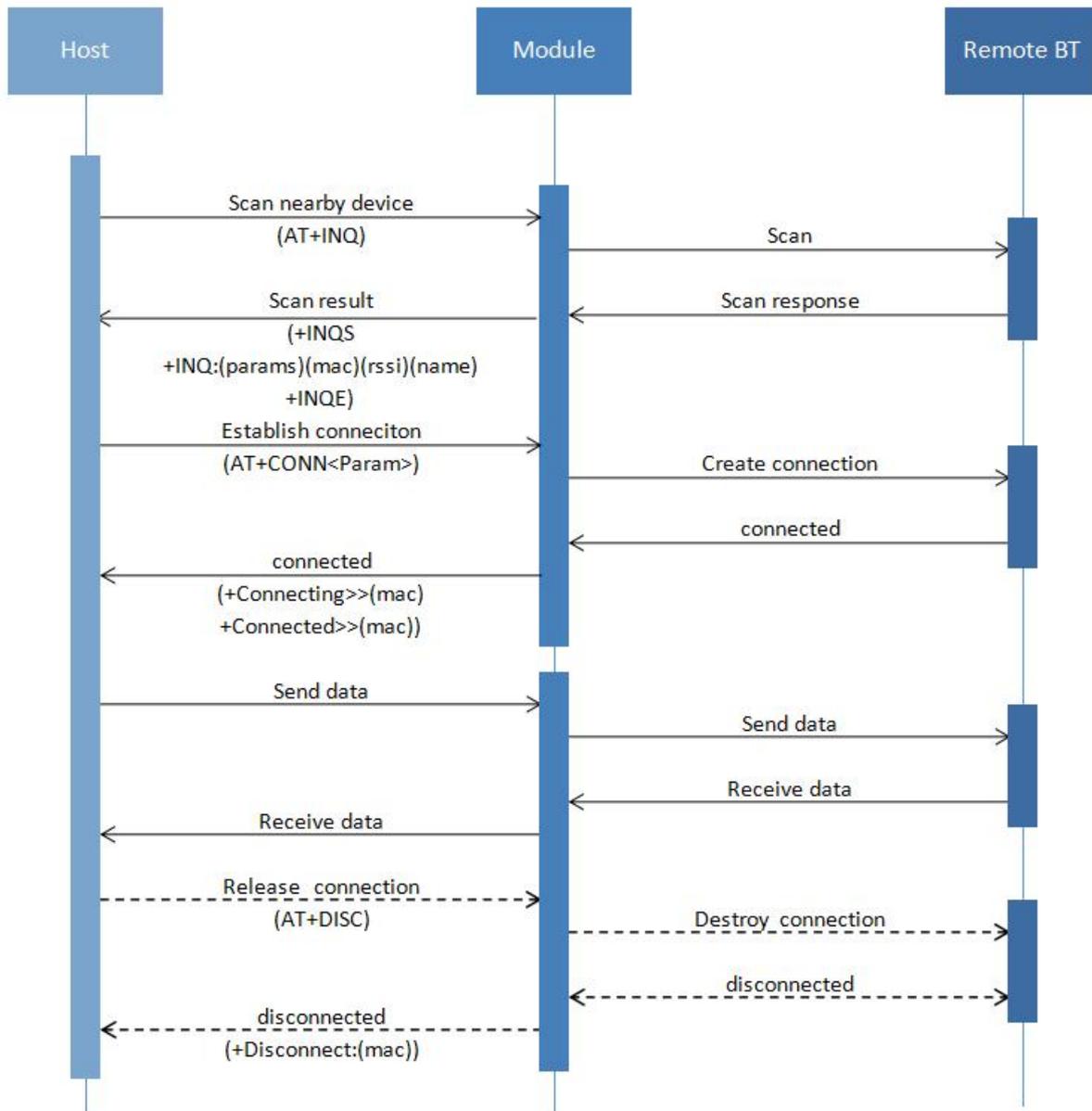
Figure 8：Master-slave module communication flow chart

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：BT24/BT24-S/BT27
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
设置参数	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

| Set stop bit | AT+STOP<param> | +STOP=<param>

OK | 0：1 stop bit
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 2:4800 3:9600 4: 19200	5: 38400 6: 57600 7:115200 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

Remark：

DX-BT27 does not support this command

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
Set transparent transmission mode	AT+TRANSPORT \<param>	+TRANSPORT=\<param> OK	1：Turn on transparent transmission Defaults：1

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		

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.

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	

5.2. 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 FFF0

        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>Write UUID Defaults：0xffe2
Set module write	AT+WRITE<param>	+ WRITE=<param>	

UUID	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：1BFF0102030405060708090102030405060708090102030405060708

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 clear the broadcast parameters or modify the format to the correct broadcast packet format).

Example：

Write the content of the module broadcast package as：

1BFF01020304050607 08090A0B0C0D0E0F10 1112131415161718191A

    Send：AT+TEADV1BFF01020304050607 08090A0B0C0D0E0F10 1112131415161718191A

    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-byte data in the broadcast packet at will. If the number of bytes is not enough, it will automatically fill with zeros after adding data. The red part in the broadcast packet is 7 bytes of data

  (0302ffe031900008161122334455667709ff584448872d62334a)

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：

0302ffe0319000816aabbccddeeff0009ff584448872d62334a

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 password	AT+APASS	+APASS=<param>	<param> Password can only be four decimal digits
Set private password	AT+APASS<param>	OK	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 Turn on：1
Set module status	AT+DIRADV<param>,<type>,<mac>	OK	<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 <type>：address type <mac>：mac address Defaults：0,0,NULL
Set whitelist	AT+ WHITELIST<num>,<type >,<mac>	OK	

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.

DX-BT27 does not support this command

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	AT+AUTOLIST<switch>,< num>	OK	<type>：address type <mac>：mac address <switch>：switch Turn off：0 Turn on：1

<div align="right">

<num>：Number
Defaults：0,0,NULL

</div>

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.

DX-BT27 does not support this command

Example：

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.

DX-BT27 does not support this command

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
		+NOTI=<param>	1：notify
Set parameter	AT+NOTI<param>	OK	Defaults：0

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>	1：Normal working mode
		OK	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 0—100ms	8—1022.5ms 9—1285ms
Set Broadcast interval	AT+ADVI\<param\>	+ ADVI =\<param\> OK	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—7000ms 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. (DX-BT27 does not support)

Broadcast interval	Low power mode power consumption	Normal working mode power consumption
100	71	329.67
152.5	50.09	313.65

211.25	37.48	300.58
318.75	27.62	290.38
417.5	21.24	285.78
546.25	16	282.53
760	13.11	281.66
852.5	12.14	28046
1022.5	9.14	279.05
1285	8.85	278.24
2000	8.40	277.57
3000	7.48	275.54
4000	6.56	275.16
5000	5.18	274.55
6000	4.60	273.9
7000	4.29	273.7

5.5.4. Set/Query—Module Transmit Power

Function	Command	Response	Description	
Query Transmit power	AT+POWE	+POWE=\<powe\>	\<powe\>Serial number: 1：-19.5 dB 2：-13.5 dB 3：-10dB 4：-7dB 5：-5dB 6：-3.5dB	7：-2dB 8：-1dB 9：0dB A：+1dB B：+1.5dB C：+2.5dB Defaults：C
Set Transmit power	AT+POWE\<powe\>	+POWE=\<powe\> OK		

Remark：

This instruction can be used to reduce power consumption and adjust module broadcast distance

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: 0302e0ff0319000009ff5844202105211ad8
Set pairing mode	AT+SEADV534d4152542d00	OK Power On	Enter pairing mode to broadcast packets: 0302ffe0319000816534d415254 2d0009ff5844202105211ad8 Defaults: 0302e0ff0319000009ff5844202 105211ad8

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.