

## 4 BLE Protocol Specification (APP Interface)

### UART Service UUID

6E400001B5A3F393E0A9E50E24DCCA9E

### BLE Data Receiving UUID (RX Characteristic)

Characteristics UUID	6E400002B5A3F393E0A9E50E24DCCA9E
Executable Operations	WRITE, WRITE NO RESPONSE
Remarks	The BLE input is transmitted to the serial port output: After APP writes to this channel through the BLE API interface, the data will be output from the serial port TX.

### BLE Data Transmitting UUID (TX Characteristic)

Characteristics UUID	6E400003B5A3F393E0A9E50E24DCCA9E
Executable Operations	NOTIFY
Remarks	The serial port input is transmitted to the BLE output, and the data input from the serial port RX will be notified in this channel and sent to the mobile device.

### AT Command Operation UUID

Characteristics UUID	6E400004B5A3F393E0A9E50E24DCCA9E
Executable Operations	NOTIFY, WRITE, WRITE NO RESPONSE
Remarks	Supports all commands in the command list, and any data will be processed as commands (No need to use +++ to enter the command mode). <b>The command must end with a carriage return and line feed (CRLF) (\r\n or 0x0D0A etc.).</b> The master needs to open notify to receive the data sent by the module.

## Device Information UUID: 0x180A

### Manufacturer Name

<b>Characteristics UUID</b>	0x2A29
<b>Executable Operations</b>	READ
<b>Remarks</b>	Shenzhen RF-star Technology Co., Ltd.

### Hardware Revision

<b>Characteristics UUID</b>	0x2A27
<b>Executable Operations</b>	READ
<b>Remarks</b>	Module hardware version reading channel. The module hardware version can be obtained by reading the channel. Such as RF-BM-BG22A3, which indicates that this firmware is suitable for the corresponding model of the module.

### Firmware Revision

<b>Characteristics UUID</b>	0x2A26
<b>Executable Operations</b>	READ
<b>Remarks</b>	Module firmware version reading channel. The module firmware version can be obtained by reading the channel. The format is v0.2.1_2021.01.12, it Indicates the firmware version is V0.2.1 generated on January 12 <sup>th</sup> , 2021.

### System ID

<b>Characteristics UUID</b>	0x2A23
<b>Executable Operations</b>	READ
<b>Remarks</b>	Module information acquisition channel. The module ID can be obtained by reading this channel. The format is as xxxxxxxFFFExxxxxx, and xx is the physical address of the module chip MAC, six bytes.

## Generic Access UUID: 0x1800

### Device Name

<b>Characteristics UUID</b>	0x2A00
<b>Executable operations</b>	READ
<b>Remarks</b>	The default is RFstar_XXXX, "XXXX" is the last two bytes of the module's MAC address, and it will be updated synchronously after modification with the command "AT+NAME=".

### Device Appearance

<b>Characteristics UUID</b>	0x2A01
<b>Executable operations</b>	READ
<b>Remarks</b>	The external appearance of the device. It is undefined.

### Peripheral Preferred Connection Parameters

<b>Characteristics UUID</b>	0x2A04
<b>Executable operations</b>	READ
<b>Remarks</b>	The 1 <sup>st</sup> , 2 <sup>nd</sup> bytes are the minimum coordinated connection interval. The 3 <sup>rd</sup> , 4 <sup>th</sup> bytes are the maximum coordinated connection interval. The 5 <sup>th</sup> , 6 <sup>th</sup> bytes are Slave Latency. The 7 <sup>th</sup> , 8 <sup>th</sup> bytes are Supervision Timeout Multiplier.

### Central Address Resolution

<b>Characteristics UUID</b>	0x2AA6
<b>Executable operations</b>	READ
<b>Remarks</b>	Whether this module supports address resolution can be obtained by reading this channel. If the module supports address resolution {Value: (0x01)}, the directional broadcast function can be used. <b>Note:</b> Directional broadcast function needs to be user-defined.

## 5 AT Command

### 5.1 AT Command Format

Table 3. AT Command Format Table

Type	Command Format	Description
<b>Test Command</b>	AT+[x]=?	This command is used to query the parameters and value range of the commands.
<b>Query Command</b>	AT+[x]?	This command returns the current value of the parameter.
<b>Configure Command</b>	AT+[x]=<...>	This command is used to set user-defined parameter values.
<b>Execute Command</b>	AT+[x]	This command is used to perform the function of immutable parameters.

Note:

1. This command can be sent through APP and the serial port.
2. The default baud rate of the serial port is 115200, 8-bit data bit, 1 stop bit, no parity.
3. Not every command has the above four types of commands.
4. The AT command must be **capitalized**. It must end with a carriage return and line feed (CRLF). **No need to add CRLF for “+++”**.
5. The <> returned in the query AT command indicates the optional parameters, and [] indicates the required parameters. If all parameters of the command are optional parameters, at least one parameter is needed to be filled, otherwise, it is also regarded as a command error.

**Example: AT+ADS=<0,1>,<0,1>,<10,10240>, you can fill in AT+ADS=,,500.**

6. The parameter positions that are not filled in the optional parameter command must **be reserved**. Refer to the previous example.
7. The parameters in any command cannot contain invisible characters such as spaces and tabs.
8. **The setting value can not be exceeding the settable range of the parameters.**

## 5.2 AT Command List

Table 3. AT Command List

AT Command	Function	Remark
<a href="#"><u>+++</u></a>	Enter AT command mode.	No need to add CRLF.
<a href="#"><u>AT+EXIT</u></a>	Exit AT command mode.	Take effect immediately.
<a href="#"><u>AT+NAME</u></a>	Query/set the device name.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+MAC</u></a>	Query/set the MAC address.	Take effect after <b>reboot</b> , can be saved after power off.
<a href="#"><u>AT+ROLE</u></a>	Query/set the device role.	Take effect after <b>reboot</b> , can be saved after power off.
<a href="#"><u>AT+POWER</u></a>	Query/set the device power.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+ADS</u></a>	Query/set the broadcast parameters under slave mode.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+ADV_DATA</u></a>	Query/set the user-defined broadcast data.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+RSP_DATA</u></a>	Query/set the user-defined broadcast response packet data.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+LE_CODED</u></a>	Query/set the Long Range broadcast	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+ADV_EXT</u></a>	Query/set the user-defined extended broadcast.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+BEACON</u></a>	Query/set the Beacon parameters.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+SCAN</u></a>	Scan the device.	Only effective in master mode and master-slave mode.
<a href="#"><u>AT+SCAN_PHY</u></a>	Query/set the PHY of the master.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+S_NAME</u></a>	Scan the slave device name and print it out.	Only effective in master mode and master-slave mode.
<a href="#"><u>AT+SEND</u></a>	Send data via AT command.	Take effect immediately.
<a href="#"><u>AT+CONNECT</u></a>	Connect the device.	Only effective in master mode and master-slave mode.

<a href="#"><u>AT+CNT_LIST</u></a>	Query the connected device list of the current device.	Take effect immediately.
<a href="#"><u>AT+DISCONNECT</u></a>	Disconnect the connected device.	Take effect immediately.
<a href="#"><u>AT+AUTO_CNT</u></a>	Automatically reconnect the slave devices.	Only effective in master mode and master-slave mode. Take effect immediately, can be saved after power off.
<a href="#"><u>AT+DEV_DEL</u></a>	Delete the saved automatic reconnection devices.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+CNT_INTERVAL</u></a>	Query/set the connection interval.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+TTM_HANDLE</u></a>	Designate the transparent transmission handle during multi-connection.	Only effective in master mode and master-slave mode. Take effect immediately, cannot be saved after power off.
<a href="#"><u>AT+SERVICE</u></a>	Query/set the slave UUID.	Take effect after <b>reboot</b> , can be saved after power off.
<a href="#"><u>AT+UUID_SCAN</u></a>	Enable/disable the master UUID configuration function.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+TRX_CHAN</u></a>	Configure the master UUID.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+OBSERVER</u></a>	Enable/disable the observer function.	Only effective in master mode and master-slave mode.
<a href="#"><u>AT+PHY</u></a>	Query/set the PHY rate.	Take effect immediately; can be saved after power off
<a href="#"><u>AT+UART</u></a>	Query/set the baud rate.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+PACK</u></a>	Query/set the serial port frame size and timeout time.	Take effect immediately, cannot be saved after power off.
<a href="#"><u>AT+ECHO</u></a>	Query/set whether the serial port is echoed.	Take effect immediately, cannot be saved after power off.
<a href="#"><u>AT+STATUS</u></a>	Query/set whether to display the device status.	Take effect immediately, cannot be saved after power off.
<a href="#"><u>AT+AUTH</u></a>	Query/set the user authentication.	Take effect after <b>the next connection</b> , can be

		saved after power off.
<a href="#"><u>AT+AUTH_KEY</u></a>	Enter the user authentication passkey.	Only effective in master mode and master-slave mode.
<a href="#"><u>AT+PAIR</u></a>	Query/set the slave role pairing function.	Only effective in slave mode. Take effect after <b>reboot</b> , can be saved after power off.
<a href="#"><u>AT+MASTER_PAIR</u></a>	Query/set the master role pairing function.	Only effective in master mode and master-slave mode. Take effect after <b>reboot</b> , can be saved after power off.
<a href="#"><u>AT+PASSKEY</u></a>	The master role enters the pairing passkey.	Only effective in master mode and master-slave mode. Take effect immediately.
<a href="#"><u>AT+PAIR_LIST</u></a>	Query the pairing list.	
<a href="#"><u>AT+PAIR_DEL</u></a>	Delete the paired device.	Take effect immediately, can be saved after power off.
<a href="#"><u>AT+SLEEP</u></a>	Query/set the device sleep mode (effective for once)	Take effect immediately, cannot be saved after power off.
<a href="#"><u>AT+WDOG</u></a>	Enable/disable the watchdog.	Take effect after <b>reboot</b> , can be saved after power off.
<a href="#"><u>AT+RESTART</u></a>	Restart the device.	Take effect immediately.
<a href="#"><u>AT+RESET</u></a>	Device parameters restore factory settings and reboot.	Take effect immediately.
<a href="#"><u>AT+VERSION</u></a>	Query the device firmware version.	

#### Return Value of AT Command

OK	Successful operation.
FAIL	Failed operation.
ERROR	Error operation.
BUSY	The operation is busy, please wait for the fulfillment of the previous operation.

### 5.3 Detailed AT Command

- **Enter AT Command Mode**

+++	
Function	Enter AT command mode.
Example	<b>+++ (No CRLF).</b>
Return Value	OK.
Remark	<p>No need to add CRLF. If OK is returned, the commands sent need to add CRLF.</p> <p>Need to exit AT command mode, the transparent transmission data can be received as well.</p> <p>The prefix "+RESEIVED:" refers to transparent transmission data. The data can be transmitted by "AT+SEND".</p>

- **Exit AT Command Mode**

AT+EXIT	
Function	Exit AT command mode and switch to transparent transmission mode.
Example	AT+EXIT
Return Value	OK
Remark	

- **Device Name**

AT+NAME?	
Function	Query the device name.
Example	AT+NAME?
Return Value	AT+NAME=0,RFstar_XXXX OK.
Remark	<p>Parameter 1: Broadcast name input format of the current device. (0: ASCII, 1: HEX)</p> <p>Parameter 2: Broadcast name of the current device. The factory default is RFstar_XXXX. XXXX is the last two bytes of the MAC address.</p>

AT+NAME=	
Function	Set the device name.
Example	AT+NAME=0,TEST-NAME
Example	AT+NAME=1,544553542D4E414D45

Return Value	OK.
Remark	<p>0 means that the name input format is in ASCII format,      1 means that the name input format is in HEX format.</p> <p>The maximum setting length is 16 bytes. The command "AT+NAME=0" or "AT+NAME=1" can be used to restore the device to its default factory name.</p> <p>Take effect immediately, can be saved after power off.</p>

#### • MAC Address

AT+MAC?	
Function	Query the device MAC address.
Example	AT+MAC?
Return Value	<p>AT+MAC=8A:E5:84:7A:E7:C9</p> <p>OK</p>
Remark	MAC address is in hexadecimal.

AT+MAC=	
Function	Set the device MAC address.
Example	AT+MAC=F1:F2:F3:F4:F5:F6
Return Value	OK
Remark	<p>The new MAC will take effect after reboot, and be saved after power off.</p> <p>Set to <b>00:00:00:00:00:00</b> or <b>FF:FF:FF:FF:FF:FF</b> to restore factory settings of the MAC address.</p>

#### • Device Role

AT+ROLE=?	
Function	Query the parameter range of this command.
Example	AT+ROLE=?
Return Value	<p>AT+ROLE=[0,1,2,3]</p> <p>OK</p>
Remark	<p>0: Slave (<b>by default</b>)</p> <p>1: Master</p> <p>2: Master-slave</p> <p>3: Beacon, connectable. <b>(The serial port is disabled by default and unavailable in this mode. The serial port can be enabled by pulling low the CTS pin.)</b></p>

**AT+ROLE?**

Function	Query the current device role.
Example	AT+ROLE?
Return Value	AT+ROLE=0 OK
Remark	The current role of the device is the slave role.

**AT+ROLE=**

Function	Set the device role.
Example	AT+ROLE=1
Return Value	OK
Remark	Set the current role of the device as the master role. <b>Take effect after reboot</b> , can be saved after power off. <b>Switching roles will cause the list of paired devices and auto-reconnect devices to be cleared.</b>

**• TX Power****AT+POWER=?**

Function	Query the parameter range of this command.
Example	AT+POWER=?
Return Value	AT+POWER=[-28,-20,-10,-5,-3,0,1,2,4,6] OK
Remark	The maximum TX power of RF-BM-BG22A1(I) is 0 dBm, and the return value of this command is [-28,-20,-10,-5,-3,0]

**AT+POWER?**

Function	Query the current TX power of the device.
Example	AT+POWER?
Return Value	AT+POWER=4 OK
Remark	The current TX power is 4 dBm.

**AT+POWER=**

Function	Set the device's TX power.
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Example	AT+POWER=-10
Return Value	OK
Remark	<p>Set the device TX power to -10 dBm.</p> <p>Take effect immediately after setting, can be saved after power off.</p>

- **Broadcast Parameter**

<b>AT+ADS=?</b>	
Function	Query the parameter range of this command.
Example	AT+ADS=?
Return Value	<p>AT+ADS=&lt;0,1&gt;,&lt;0,1&gt;,&lt;20~10240&gt;</p> <p>OK</p>
Remark	<p><b>Parameter 1:</b> Set broadcast status (0: Disable. 1: Enable).</p> <p><b>Parameter 2:</b> Set broadcast mode (0: Non-connectable. 1: Connectable).</p> <p><b>Parameter 3:</b> Set broadcast interval (in ms, Range 20 ms ~ 10240 ms, the default is 200 ms).</p>

<b>AT+ADS?</b>	
Function	Query the broadcast parameters.
Example	AT+ADS?
Return Value	<p>AT+ADS=1,1,200</p> <p>OK</p>
Remark	<p><b>Parameter 1:</b> Under broadcasting.</p> <p><b>Parameter 2:</b> Connectable broadcast.</p> <p><b>Parameter 3:</b> The broadcast interval is 200 ms.</p>

<b>AT+ADS=</b>	
Function	Set the broadcast parameters.
Example	AT+ADS=1,0,500
Return Value	OK
Remark	<p>Enable unconnectable broadcasting with 500 ms broadcast interval.</p> <p>Take effect immediately after setting, can be saved after power off.</p> <p>Invalid under master mode.</p> <p><b>Remark:</b> The minimum broadcast interval is 20 ms.</p>

## • User-defined Broadcast Data

AT+ADV_DATA?	
Function	Query the user-defined broadcast data.
Example	AT+ADV_DATA?
Return Value	AT+ADV_DATA=0,XXXXXXXXXXXXXXXXXXXX..... OK
Remark	Parameter 1: Broadcast data input format of the current device. (0: ASCII, 1: HEX) Parameter 2: Broadcast data of the current device. If this parameter is not set, NULL will be returned.

AT+ADV_DATA=	
Function	Set the user-defined broadcast data.
Example	AT+ADV_DATA=0,112233445566778899AA#S=+
Example	AT+ADV_DATA=1,31313232333343435353636373738383939414123533D2B
Return Value	OK
Remark	<ol style="list-style-type: none"> <li><b>Parameter 1:</b> 0 means that the input broadcast data is in ASCII format, 1 means that the input broadcast data is in HEX format.</li> <li>The data is placed in the user-defined zone, and the user can user-definedize the broadcast data up to <b>26</b> bytes.</li> <li>Use "AT+ADV_DATA=0" or "AT+ADV_DATA=1" command to restore the broadcast data to the default data.</li> <li>Take effect immediately after setting, can be saved after power off.</li> </ol>

## • User-defined Broadcast Response Packet Data

AT+RSP_DATA?	
Function	Query the user-defined broadcast response packet data.
Example	AT+RSP_DATA?
Return Value	AT+RSP_DATA=0,XXXXXXXXXXXXXXXXXXXX..... OK
Remark	Parameter 1: The current device input format of broadcast response packet data. (0: ASCII, 1: HEX) Parameter 2: The current device broadcasts response packet data. If the user does not set this parameter, it returns NULL.

**AT+RSP\_DATA=**

Function	Set the user-defined broadcast response packet data.
Example	AT+RSP_DATA=1,070952467374617206FF5246010203
Return Value	OK
Remark	<p>1. 0 means that the input broadcast response packet data is in ASCII format, 1 means that the input broadcast response packet data is in HEX format.</p> <p>2. The user can user-definedize the broadcast response packet data up to <b>31</b> bytes.</p> <p>3. The "AT+RSP_DATA=0" or "AT+RSP_DATA=1" command can be used to restore the broadcast response packet data to its default data.</p> <p>4. Take effect immediately after setting, can be saved after power off.</p> <p><b>Note:</b> Since the setting of the response packet data occupies the position of the broadcast name, the broadcast name command will become invalid after setting the response packet data. If the broadcast name is required, the user needs to add it to the user-defined data.</p>

- **Long Range Broadcast**

**AT+LE\_CODED?**

Function	Query the user-defined Long Range broadcast status.
Example	AT+LE_CODED?
Return Value	AT+LE_CODED=1 OK
Remark	0: Disable Long Range broadcast (Default). 1: Enable Long Range broadcast.

**AT+LE\_CODED=**

Function	Set the Long Range broadcast (enable/disable).
Example	AT+LE_CODED=1
Return Value	OK
Remark	<p>Enable Long Range broadcast.</p> <p>After enabled, the broadcast itself does not carry data, and the command "AT+ADV_EXT" needs to be used to set the user's data.</p> <p>At the same time, the master must be in the LE CODED PHY to be able to scan this broadcast and connect.</p> <p>Take effect immediately after setting, can be saved after power off.</p> <p><b>Remark:</b> RF-BM-BG22A1 and RF-BM-BG22A1I do not support this command. Beacon mode does</p>

not support Long Range broadcast.

- Extended Broadcast (Big Broadcast Packet)

AT+ADV_EXT?	
Function	Query the user-defined <b>extended</b> broadcast packet.
Example	AT+ADV_EXT?
	AT+ADV_EXT=120\r\n
Return Value	XXXXXXXXXXXXXXXXXXXX..... OK
Remark	<b>Parameter 1:</b> Current extended broadcast data length. <b>Parameter 2:</b> XXX is the returned user-defined extended broadcast data. There is a carriage return and line feed (CRLF) followed by parameter 1 and parameter 2 in the returned data. If the user does not set this parameter, it will return "AT+ ADV_EXT=NULL".

	<p>Receive←◆OK</p> <p>The user can customize the extended broadcast data up to 251 bytes. When this function is enabled, the extended broadcast packet will be without the device name. At the same time, the module will automatically add the broadcast length (Len) and broadcast type (0xFF) to the data front end of the data set by the user.</p> <p><b>When the length of the extended broadcast data is no less than 189 bytes, the device is connectable. If it exceeds 189 bytes, the device is unconnectable.</b></p> <p>Take effect immediately after setting, can be saved after power off.</p>
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## • Beacon

AT+BEACON=?	
Function	Query the parameter range of this command.
Example	AT+BEACON=?
Return Value	AT+BEACON=<0~FFFF>,<0~FFFF>,<0~FFFF>,<-90~4>,<0~FF...>,<0,1> OK
Remark	<p><b>Parameter 1:</b> Company ID, 0x4C00 is by default.</p> <p><b>Parameter 2:</b> Major UUID, 0x0708 is by default.</p> <p><b>Parameter 3:</b> Minor UUID, 0x0506 is by default.</p> <p><b>Parameter 4:</b> Reference RSSI at 1 m, -48 is by default.</p> <p><b>Parameter 5:</b> User-defined UUID data, 0x0112233445566778899AABBCCDDEEFF0 is by default.</p> <p><b>Parameter 6:</b> Enhanced broadcast (0: Disable, 1: Enable). When enabled, it will broadcast three times for every broadcast event, to improve the crawl rate of the master.</p> <p><b>Remark:</b> In this mode, the serial port is disabled and unavailable. The serial port can be enabled by pulling down the CTS pin.</p>

AT+BEACON?	
Function	Query the Beacon parameters.
Example	AT+BEACON?
Return Value	AT+BEACON=4C00,0708,0506,-48,0112233445566778899AABBCCDDEEFF0 OK

AT+BEACON=	
Function	Set the Beacon parameters.
Example	AT+BEACON=4546,0102,0304,-50,0102030405060708090A0B0C0D0EF010

Return Value	OK
Remark	<p>Set the Company ID to 4546.</p> <p>Set Major to 0102.</p> <p>Set Minor to 0304.</p> <p>Set the reference RSSI at 1 m to -50 dBm.</p> <p>Set user-defined UUID data as 0102030405060708090A0B0C0D0EF010.</p>

### • Scan as a Master

AT+SCAN=?	
Function	Query the parameter range of this command.
Example	AT+SCAN=?
Return Value	<p>AT+SCAN=[0,1],&lt;1-65535&gt;,&lt;0,1&gt;,&lt;1-255&gt;</p> <p>OK</p>
Remark	<p><b>Parameter 1:</b> The current scan status, 0 means to stop scanning, 1 means scanning.</p> <p><b>Parameter 2:</b> Scan timeout time in s.</p> <p><b>Parameter 3:</b> Whether to enable the display name function, 1: enable, 0: disable (1 is by default)</p> <p>Only effective in master mode and master-slave mode.</p> <p><b>Parameter 4:</b> It means the time interval of scanning the reconnection device list after enabling the reconnection function. Modifying this parameter can increase the speed of automatic reconnection.</p> <p>In s, 3 seconds is by default.</p>

AT+SCAN?	
Function	Query the scan status and timeout time settings.
Example	AT+SCAN?
Return Value	<p>AT+SCAN=0,10,1,3</p> <p>OK</p>
Remark	<p><b>Parameter 1:</b> 0 means the current device stops scanning.</p> <p><b>Parameter 2:</b> The current scan timeout time is 10 s.</p> <p><b>Parameter 3:</b> 1 means display device name.</p> <p><b>Parameter 4:</b> The time interval of scanning the reconnection device list is 3 seconds. (This parameter is only effective when the automatic reconnection function is enabled.)</p>

AT+SCAN=	
Function	Regularly scan the surrounding slave devices.

Example	AT+SCAN=1,10,1
Return Value	OK 0 53:60:52:A4:3E:66 -67 RF-STAR-SMMT 1 5D:61:9B:78:2E:5E -83 RFstar_2E5E .....
Remark	<b>Parameter 1:</b> 1 means to start scanning <b>Parameter 2:</b> 10 means the scan timeout is 10 s. Remark: Automatically stop scanning after the number of devices reaches 20 or the scan time reaches 10 seconds.

AT+SCAN	
Function	Scan the surrounding devices.
Example	AT+SCAN
Return Value	OK 0 53:60:52:A4:3E:66 -67 RF-STAR-SMMT 1 43:D5:CF:24:60:94 -58 RF-STAR-ABCD 2 21:DD:7C:E3:99:B5 -71 RFstar_99B5 3 5D:61:9B:78:2E:5E -83 RFstar_2E5E .....
Remark	Scan immediately (stop scanning after the number of devices reaches 20 or the scan time reaches 20 seconds), and print the MAC address, RSSI value, and device name of the slave devices, where "0, 1, 2, 3..." is the serial number of the scanned devices (Scan for devices with name by default).

### • PHY of Master Role

AT+SCAN_PHY=?	
Function	Query the parameter range of this command.
Example	AT+SCAN_PHY=?
Return Value	AT+SCAN_PHY=[0,1] OK
Remark	0: 1 M PHY 1: CODED PHY Only effective in master mode and master-slave mode.

**AT+SCAN\_PHY?**

Function	Query the PHY layer of the device during scanning and connection.
Example	AT+SCAN_PHY?
Return Value	AT+SCAN_PHY=0 OK
Remark	The current PHY layer of the device during scanning and connection is 1 M PHY (by default).

**AT+SCAN\_PHY=**

Function	Set the PHY layer of the device during scanning and connection.
Example	AT+SCAN_PHY=1
Return Value	OK
Remark	<p>Set the scan PHY of the current master role to LE CODED PHY. After setting LE CODED PHY, it can only scan the slave devices under the same LE CODED PHY, and can only connect to the device under LE CODED PHY.</p> <p>Take effect immediately after setting, can be saved after power off.</p> <p><b>Note:</b> RF-BM-BG22A1 and RF-BM-BG22A1I do not support this command.</p>

**• Scan and Print Out Slave Device Name****AT+S\_NAME=?**

Function	Query the parameter range of this command.
Example	AT+S_NAME=?
Return Value	AT+S_NAME=[0,1] OK
Remark	0: Stop scanning the slave device name. 1: Start scanning the slave device name. Only effective in master mode and master-slave mode.

**AT+S\_NAME?**

Function	Query the status of this function.
Example	AT+S_NAME?
Return Value	AT+S_NAME=1 OK
Remark	0 means the current scan status is stopped. 1 means the current scan status is scanning.

**AT+S\_NAME=**

Function	Set the status of scanning slave device name.
Example	AT+S_NAME=1
Return Value	OK MAC:5C:02:72:26:55:88,RSSI:-68,NAME:RFstar_XIANG7 MAC:AC:23:3F:5A:B7:DD,RSSI:-80,NAME:MBeacon .....
Remark	Enable the scan, and if need to stop scanning, please use the command "AT+S_NAME=0". Only effective in master mode and master-slave mode.

**• Connection as a Master****AT+CONNECT=**

Function	Connect to the specified device according to the serial number or MAC address returned by "AT+SCAN" command.
Example 1	AT+CONNECT=1
Return Value	OK 43:D5:CF:24:60:94 CONNECTED
Remark	Connect to the device in the first place of the serial number list returned by "AT+SCAN" command.
Example 2	AT+CONNECT=,F1:F2:F3:F4:F5:F6
Return Value	OK F1:F2:F3:F4:F5:F6 CONNECTED 1
Remark	<p>Connect to the device with the specified MAC address. Parameter 1 is omitted, only need to fill in the MAC address to be connected. The connected device may have timed out and failed to connect.</p> <p>The connection timeout period is 10 s, and the timeout time is settable. The timeout prompt: "F1:F2:F3:F4:F5:F6 CONNECT TIMEOUT". After the connection is successful, the last number of the connection prompt string is the handle of the newly established connection, and the current transparent transmission points to the same handle.</p> <p><b>Remark:</b></p> <ol style="list-style-type: none"> <li>1. The number of connected devices has reached 8, and it will return FAIL when using the command to connect to a new device. And one of the connected devices needs to be disconnected before connecting the new device.</li> <li>2. If the current mode is the master-slave mode, the master device can only connect up to 7 slave devices.</li> <li>3. <b>Please do not try to connect to an unconnectable broadcasting device.</b></li> </ol>

- |  |   |
|--|---|
|  | 4. Only effective in master mode and master-slave mode. |
|--|---|

- **Display the Connected Devices**

AT+CNT_LIST	
Function	Display the list of currently connected devices.
Example	AT+CNT_LIST
Return Value	AT+CNT_LIST= <b>1*</b> (FF:1C:2B:D1:4C:BD) <b>2</b> (EB:71:5B:DE:08:87) OK
Remark	<p>The string in red is the connect handle, and the “ * ” symbol behind the handle indicates that the connection is the master device (mobile phone or the module in master mode) connected to the slave role. And the string in the bracket is the device MAC address corresponding to the handle.</p> <p>This command is used with AT+TTM_HANDLE together.</p> <p>For example, AT+TTM_HANDLE=1 means that the master role transparently transmits the data value to the device whose handle value is 1 and MAC address is FF:1C:2B:D1:4C:BD.</p>

- **Disconnection**

AT+DISCONNECT=?	
Function	Query the parameter range of this command.
Example	AT+DISCONNECT=?
Return Value	AT+DISCONNECT=<0,1,2>,<1~x> OK
Remark	<p><b>Parameter 1:</b></p> <ul style="list-style-type: none"> <li>0: Disconnect the slave devices.</li> <li>1: Disconnect the master devices.</li> <li>2: Disconnect the master-slave devices.</li> </ul> <p><b>Parameter 2:</b> The device with the handle that needs to be disconnected. The handle value can be queried by the command "AT+CNT_LIST".</p> <p><b>Remark: Parameter 2 must be used in the correct role (that is, parameter 1 must be used in the role of the current device).</b></p> <p>For example: If device A is in the master role with two slave devices connected, and "AT+DISCONNECT=1,1" means disconnecting the slave device with handle 1 connected to device A.</p>

**AT+DISCONNECT=**

Function	Disconnect the specified connection.
Example	AT+DISCONNECT=1,1
Return Value	OK F1:F2:F3:F4:F5:F6 DISCONNECTED
Remark	In the master role, disconnect the slave device with the handle value of 1.

**AT+DISCONNECT**

Function	Disconnect all the currently connected devices.
Example	AT+DISCONNECT
Return Value	OK F1:F2:F3:F4:F5:F6 DISCONNECTED 5D:61:9B:78:2E:5E DISCONNECTED

**• Automatic Reconnection**
**AT+AUTO\_CNT=?**

Function	Query the parameter range of this command.
Example	AT+AUTO_CNT=?
Return Value	AT+AUTO_CNT=[0,1],<FF:FF:FF:FF:FF:FF>,<0,1> OK
Remark	<p><b>Parameter 1:</b>  0: Disable the automatic reconnection function.  1: Enable automatic reconnection function.</p> <p><b>Parameter 2:</b> Optional parameter. Add the device MAC address to the automatic reconnection list. If this parameter is set, the automatic reconnection function of the specified MAC address is enabled or disabled according to parameter 1, at the same time, the automatic reconnection function of other devices is not influenced by this command.</p> <p>Parameter 1 and parameter 2 affect each other. When only parameter 1 is set, the automatic reconnection function takes effect on the devices in the automatic reconnection list. When there are parameters 1 and 2, the automatic reconnection function takes effect on the parameter 2 specified MAC address device, and other devices maintain the original status.</p> <p><b>Parameter 3:</b> Optional parameter.  1: Automatic reconnection function will be enabled immediately, although the device is not</p>

	<p>connected before. The default setting is 0. If the parameter is set as 1, after the command is sent, pls operate according to the following steps to automatically reconnect the slave devices.</p> <p><b>Note: The device with the automatic reconnection function will not automatically connect to the slave devices in the following cases:</b></p> <ol style="list-style-type: none"> <li>1. Use "AT+DISCONNECT" to connect the disconnected slave device, the automatic reconnection function will not work at this time. The following conditions can restore the automatic reconnection function.             <ol style="list-style-type: none"> <li>a) Use the command again to connect the slave device.</li> <li>b) Restart the device</li> <li>c) Disable the BLE function of this device and then enable the BLE function (Use the command "AT+SLEEP=,0" to disable the BLE function, and then use the command "AT+SLEEP=,1" to enable the BLE function).</li> </ol> </li> <li>2. After using the command "AT+SLEEP=,0" to disable the BLE function, the device will not automatically reconnect. When BLE is enabled again, the device will automatically reconnect.</li> </ol>
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AT+AUTO_CNT?	
Function	Query the current automatic reconnection status of the device and the stored device list of the automatic reconnection devices.
Example	AT+AUTO_CNT?
Return Value	AT+AUTO_CNT= 1,FF:1C:2B:D1:4C:BD 0,EB:71:5B:DE:08:87 OK
Remark	Device FF:1C:2B:D1:4C:BD enable the automatic reconnection function (can be saved after power off). Device EB:71:5B:DE:08:87 disabled automatic reconnection function.

AT+AUTO_CNT=	
Function	Set the automatic reconnection function. <b>Only effective in master mode and master-slave mode.</b>
Example 1	AT+AUTO_CNT=1
Return Value	OK
Remark	Enable the automatic reconnection function of all devices in the automatic reconnection list.
Example 2	AT+AUTO_CNT=0,EB:71:5B:DE:08:87

Return Value	OK
Remark	Disable the automatic reconnection function of the device with MAC address EB:71:5B:DE:08:87. Take effect immediately after setting, can be saved after power off.
Example 3	AT+AUTO_CNT=1,EB:71:5B:DE:08:87,1
Return Value	OK
Remark	Add the device with MAC address EB:71:5B:DE:08:87 to the automatic reconnection device list. The device will automatically reconnect immediately.

#### • Delete Automatic Reconnection Device

<b>AT+DEV_DEL=</b>	
Function	Delete the stored devices. Take effect immediately after setting, can be saved after power off. <b>Only effective in master mode and master-slave mode.</b>
Example 1	AT+DEV_DEL=FF:1C:2B:D1:4C:BD
Return Value	OK
Remark	Delete the device with the MAC address of FF:1C:2B:D1:4C:BD. Query the stored devices by “AT+AUTO_CNT?”.
Example 2	AT+DEV_DEL=ALL
Return Value	OK
Remark	Delete all devices in the list. This command will not actively disconnect the device. For example: When the device is connected to the FF:1C:2B:D1:4C:BD device, only the stored device list is cleared after this command is executed, and the connection with the FF:1C:2B:D1:4C:BD device will not be actively disconnected.

#### • Connection Interval

<b>AT+CNT_INTERVAL=?</b>	
Function	Query the parameter range of this command.
Example	AT+CNT_INTERVAL=?
Return Value	AT+CNT_INTERVAL=[6~3200] OK
Remark	The parameter range is 6 ~ 3200. The connection interval = parameter * 1.25 ms, which corresponds to 7.5 ms ~ 4000 ms.

	20 ms is by default.
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**AT+CNT\_INTERVAL?**

Function	Query the current connection interval of the device.
Example	AT+CNT_INTERVAL?
Return Value	AT+CNT_INTERVAL=16 OK
Remark	The current connection interval of the device is 20 ms (16 * 1.25 ms).

**AT+CNT\_INTERVAL=**

Function	Set the device connection interval.
Example	AT+CNT_INTERVAL=16
Return Value	OK
Remark	<ul style="list-style-type: none"> <li>1. The connection interval is set as 20 ms. Take effect immediately after setting, can be saved after power off.</li> <li>2. The connection interval can reach less than 20 ms (minimum 8 ms), when the Bluetooth module is working as a master.</li> <li>3. Due to system problems with mobile phones, the minimum connection interval can only be 20 ms.</li> <li>4. After the connection interval takes effect, the connection interval will be coordinated according to different mobile phones. Maximum coordination to 2 times the set interval.</li> </ul> <p>For example, if the connection interval is set to 10 ms by the command, the maximum coordinated connection interval is 20 ms.</p>

**• Designate Transmission Device****AT+TTM\_HANDLE=?**

Function	Query the available handle value.
Example	AT+TTM_HANDLE=?
Return Value	AT+TTM_HANDLE=[1~8] OK
Remark	<p>The handle value range is 1 ~ 8. And it is allocated by the system.</p> <p>Remark: There are at most 8 values. It is that the module is simultaneously connected to 8 slave devices, and each handle corresponds to a slave device.</p>

**AT+TTM\_HANDLE?**

Function	Query the current data transparent transmission handle of the device.
Example	AT+TTM_HANDLE?
Return Value	AT+TTM_HANDLE=1 OK

**AT+TTM\_HANDLE=**

Function	Designate the slave role for data transmission under multi-connection.
Example	AT+TTM_HANDLE=1
Return Value	OK
Remark	<p>Set the device with a handle value of 1 to transmit data.</p> <p><b>Use AT+CNT_LIST to get the current handle value of the device to be connected.</b></p> <p>Take effect immediately after setting, do not be saved after power off.</p> <p>Only effective in master mode and master-slave mode.</p>

**• Set the UUID of Slave Role****AT+SERVICE=?**

Function	Query the parameter range of this command.
Example	AT+SERVICE=?
Return Value	AT+SERVICE=<0,1>,<0~FFFF>,<0~FFFF>,<0~FFFF>,<0~FFFF>,<0~FF...> OK
Remark	<p><b>Parameter 1:</b> 128-bit UUID function (0: 16-bit; 1: 128-bit, take effect after reboot).</p> <p><b>Parameter 2:</b> Device service UUID (the 3<sup>rd</sup> and 4<sup>th</sup> byte).</p> <p><b>Parameter 3:</b> Device receiving channel UUID (the 3<sup>rd</sup> and 4<sup>th</sup> byte in 128-bit mode).</p> <p><b>Parameter 4:</b> Device transmitting channel UUID (the 3<sup>rd</sup> and 4<sup>th</sup> byte in 128-bit mode).</p> <p><b>Parameter 5:</b> Device AT command channel UUID (the 3<sup>rd</sup> and 4<sup>th</sup> byte in 128-bit mode).</p> <p><b>Parameter 6:</b> 128-bit basic UUID values (the 3<sup>rd</sup> and 4<sup>th</sup> bytes of the basic UUID are replaced with the UUID of the above parameters to constitute the actual 128-bit UUID of the device).</p> <p>Remark:</p> <ol style="list-style-type: none"> <li>1. The basic UUID of 0000xxxx-0000-1000-8000-00805F9B34FB cannot be used.</li> <li>2. This command is only effective in the slave role. (Slave mode, master-slave mode, and Beacon mode)</li> </ol>

**AT+SERVICE?**

Function	Query the current service configuration parameters of the device.
Example	AT+SERVICE?
Return Value	AT+SERVICE=1,0001,0002,0003,0004,9ECADC240EE5A9E093F3A3B50000406E OK

#### **AT+SERVICE=**

Function	Set the related service parameters of the device.
Example	AT+SERVICE=0,FFF0,FFFF1,FFF2,FFF3
Return Value	OK
Remark	The device is in 16-bit UUID mode. UUID is FFF0, FFFF1, FFF2, FFF3 respectively. Set the basic 128-bit UUID, if it exceeds 16 bytes, only the first 16 bytes will be taken, if it is less than 16 bytes, the end will be filled with 0. Take effect after reboot, can be saved after power off.

• **Enable/Disable UUID Configuration Function of Master Role**

#### **AT+ UUID\_SCAN=?**

Function	Query the parameter range of this command.
Example	AT+ UUID_SCAN=?
Return Value	AT+ UUID_SCAN?=[0,1] OK
Remark	0: Enable the user-defined UUID transmission channel function. 1: Disable the user-defined UUID transmission channel function.

#### **AT+ UUID\_SCAN?**

Function	Query the enable status of the user-defined UUID transmission channel.
Example	AT+ UUID_SCAN?
Return Value	AT+ UUID_SCAN=0 OK
Remark	0: Disable the user-defined UUID transmission channel function. 1: Enabled the user-defined UUID transmission channel function. <b>Remark: After enabled, the master will print the characteristic UUID of each slave in turn when connecting. It is shown as follows:</b> -CHAR:0 UUID:002A,Read;

	<p>-CHAR:1 UUID:052A,Indicate;</p> <p>-CHAR:2 UUID:E4FF,Notify;</p> <p>-CHAR:3 UUID:E9FF,Write Without Response,Write;</p> <p>-CHAR:4 UUID:F3FF,Read,Notify;</p> <p>-CHAR:5 UUID:91FF,Read,Write Without Response,Write;</p> <p>.....</p> <p>Up to 16 services and 32 UUID channels can be found. Then the "AT+TRX_CHAN" can be used to select the data sending and receiving channel according to the serial number.</p> <p>Take effect immediately after setting, can be saved after power off.</p>
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**AT+UUID\_SCAN=**

Function	Disable/enable the user-defined UUID transmission channel function.  <b>Only effective in master mode and master-slave mode.</b>
Example	AT+UUID_SCAN=1
Return Value	OK
Remark	Enable user-defined UUID transmission channel function

**• Configure UUID of Master Role****AT+TRX\_CHAN=**

Function	Set the user-defined UUID channel for sending and receiving.  <b>Only effective in master mode and master-slave mode.</b>
Example	AT+TRX_CHAN=1,8,7,0
Return Value	OK
Remark	<p><b>Parameter 1:</b> The connection handle value, can be obtained by "AT+CNT_LIST".</p> <p><b>Parameter 2:</b> The serial number is scanned and printed by the serial port by "AT+UUID_SCAN".</p> <p>This parameter sets the channel to be selected when the master sends data (channels with Write attribute).</p> <p><b>Parameter 3:</b> The serial number is scanned and printed by the serial port by "AT+UUID_SCAN".</p> <p>This parameter sets the channel to be selected when the master receives data (channels with Notify and Indicate attributes).</p> <p><b>Parameter 4:</b> The specific attribute to be selected of Parameter 2 Write operation. For example, if the Write channel to be selected is Without Response attribute, the parameter should be 0; if the Write channel to be selected is Write attribute, the parameter should be 1.</p>

	Take effect after setting, can be saved after power off ( <b>Supports the use under multi-connections, but the function of saving after power off is only valid for the first connected device.</b> )
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#### • Master Role Reads the Specified UUID Data

AT+READ_UUID=	
Function	Read the specified channel data.  <b>Only effective in master mode and master-slave mode.</b>
Example	AT+READ_UUID=1,8
Return Value	OK
Remark	<b>Parameter 1:</b> The connection handle value, can be obtained by "AT+CNT_LIST".  <b>Parameter 2:</b> The serial number is scanned and printed by the serial port by "AT+UUID_SCAN".  This parameter sets the channel to be selected when the master reads data (channels with Read attribute).

#### • Send Data by AT Command

AT+SEND=?	
Function	Query the parameter range of this command.
Example	AT+SEND=?
Return Value	AT+SEND=[1~8],[1~3328],<1~5000> OK
Remark	<b>Parameter 1:</b> Connection handle value (range: 1~8), can be obtained by "AT+CNT_LIST".  <b>Parameter 2:</b> Length of data sent (range: 1 byte ~ 3328 bytes).  <b>Parameter 3:</b> The input timeout time during sending data (range: 1 ms ~ 5000 ms, 500 ms is by default).

AT+SEND=	
Function	The master role sends data in AT command mode.
Example	AT+SEND=1,10,1000
Return Value	OK INPUT_BLE_DATA:10
Remark	The example above shows that the connection handle value is 1, the data length is 10 bytes, and the input timeout time is 1000 ms.  If the sending data with the specified length is entered within the set valid time, it will return OK when the specified length is reached. If the set timeout time is up but the specified input length is

	not reached, it will return to RECEIVE_TIMEOUT ( <b>If there is “\r\n”, two bits will be occupied</b> ).
Receiving Specification	<p>In AT command mode, if BLE data is received from the other end, the prefix "+RECEIVED:" will be printed. The first parameter after the prefix is the connection handle value, and the second parameter is the length of the received data, "123456789A\r\n" is the received data. When receiving BLE data, it will return:</p> <pre>+RECEIVED:1,10 OUTPUT_BLE_DATA 123456789A OK</pre> <p>If it is the data received in transparent transmission mode, there will be no prefix of "+RECEIVED" and the data will be printed directly.</p>

### • Observer

AT+OBSERVER?	
Function	Query the current configuration of the observer function.
Example	AT+OBSERVER?
Return Value	AT+OBSERVER=1,1,F1:F2:F3:F4:F5,RF,-60,4C00
Remark	<p><b>Parameter 1:</b> Observer function status: (0: Disable, 1: Enable the normal observer function, 2: Enable scanning extended broadcast packets.)</p> <p><b>Parameter 2:</b> Filter, parameter range 0 ~ 15. It can enable the observer filter function (0: Disable is by default.). Each bit determines the enable and disable of the corresponding filtering function (0: Disable, 1: Enable). The specific meaning is as follows:</p> <ul style="list-style-type: none"> <li>bit 0: MAC address</li> <li>bit 1: Broadcast name</li> <li>bit 2: RSSI value</li> <li>bit 3: Vendor ID</li> <li>bit 4: The specified data field of the broadcast packet or broadcast response packet</li> <li>bit 5 ~ 7: Reserved</li> </ul> <p><b>Parameter 3:</b> The MAC address that needs to be filtered. The 6-byte complete MAC address needs to be filled in.</p> <p><b>Parameter 4:</b> The broadcast name that needs to be filtered, at least one character needs to be filled in. The device in which the broadcast name starts with the selected character will be filtered out.</p> <p><b>Parameter 5:</b> The RSSI that needs to be filtered. The value less than the RSSI value will be filtered.</p> <p><b>Parameter 6:</b> The vendor ID that needs to be filtered. 2-byte complete ID needs to be filled in.</p>

	<p><b>Parameter 7:</b> The data field that needs to be filtered. The bit 4 of parameter 4 should be set as 1. The length is 1 ~ 16 bytes. The specified data contained in the broadcast packet or broadcast response packet can be filtered.</p> <p>In the observer mode, the broadcasts from the surrounding slave devices will be monitored, but not every broadcast from the slave device can be monitored. For example, if a device broadcasts in a period of 1 s, it may take 2 to 3 times broadcasts to scan the broadcast device for once. This monitor loss event is varying to some degree from the number of surrounding devices and signal strength (RSSI). At the same time, the device will not receive broadcast packets, when the observer itself switches channels at the end of each scanning interval.</p> <p>If the device that satisfies the filtering conditions is in the broadcast response packet, the time to scan the broadcast response packet of the device will be longer, because the efficiency of the observer itself in obtaining the response packet is not high, and the response packets cannot be obtained every time.</p>
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#### AT+OBSERVER=

Function	Disable/enable the observer function to scan and print out the slave devices.  <b>Only effective in master mode and master-slave mode.</b>
Example 1	AT+OBSERVER=1,20,,,,-60,,020106  OK  MAC:FA:8D:0D:27:50:C6, RSSI:-50  ADV/RSP:0201060C095246737461725F3838383838
Return Value	
Remark	The normal observer function is enabled, and the slave device information is always scanned and printed out after it is enabled. And the scan filter function is enabled too. That is, only devices whose RSSI value is greater than -60 dBm and broadcast name with "020106" can be scanned.  If you only would like to filter the devices with "RF" character in the broadcast name, only need to change the "020106" to "5246". Wherein "5246" is the hexadecimal format for ASCII character "RF". Or, you can change the parameter 4 to do the filter.  The command "AT+OBSERVER=0" can be sent to stop scanning. Wherein, "ADV" is the broadcast packet data, and "RSP" is the broadcast response packet.
Example 2	AT+OBSERVER=2  OK  Primary PHY:FA:8D:0D:27:50:C6,
Return Value	

	<p>Secondary PHY:-75, SID:0, RSSI:-47, ADV:8FFF313233343536373839613132333435363738396131323334353637383961313233343 53637383961313233343536373839613132333435363738396131323334353637383961313233343 435363738396131323334353637383961313233343536373839613132333435363738396131323 3435363738396131323334353637383961313233343536373839610D0A</p>
Remark	<p>Enable scanning extended broadcast packet function, "Primary PHY" is the primary physical layer, "Secondary PHY" is the second physical layer, and "SID" is the authentication ID.</p> <p>Extended broadcast has no filtering function, and parameters of 2 ~ 6 are considered invalid.</p>

- PHY Rate

AT+PHY=?	
Function	Query the parameter range of this command.
Example	AT+PHY=?
Return Value	AT+PHY=[1~15] OK
Remark	<p>1: 1M PHY 2: 2M PHY 4: 125k Coded PHY 8: 500k Coded PHY</p> <p>This parameter is a bitfield, multiple PHYs can be set. For example: Setting AT+PHY=3 means 1M PHY and 2M PHY are preferred. A setting of 15 means that all 4 PHY rates are preferred. The default PHY is 1M PHY.</p> <p>This command only takes effect in slave mode. If the slave device is connected, the parameters will be updated immediately, otherwise, it will take effect at the next connection, and the settings will be saved after power-off.</p> <p><b>Remark:</b> RF-BM-BG22A1 and RF-BM-BG22A1I only support 1M PHY and 2M PHY.</p>

AT+PHY?	
Function	Query the preferred PHY when connecting.
Example	AT+PHY?
Return Value	AT+PHY=1

	OK
Remark	The preferred PHY when connecting is 1M PHY.

**AT+PHY=**

Function	Set the preferred PHY when connecting.
Example	AT+PHY=2
Return Value	OK
Remark	Set the preferred PHY currently connected to 2 M.

**• Baud Rate****AT+UART=?**

Function	Query the parameter range of this command.
Example	AT+UART=?
Return Value	AT+UART=[1200,2400,4800,9600,14400,19200,38400,56000,57600,115200,128000,230400,256 000,460800,500000,512000,921600] OK
Remark	The default Baud rate is 115200 bps. After actual verification, under the conditions of the maximum MTU of the 2M physical layer and the minimum connection interval, the baud rate above 512000 bps can reach a stable transmission rate of up to 50 KB/s.

**AT+UART?**

Function	Query the current serial port baud rate.
Example	AT+UART?
Return Value	AT+UART=115200 OK
Remark	The current UART baud rate is 115200 bps.

**AT+UART=**

Function	Set the serial port baud rate.
Example	AT+UART=9600
Return Value	OK
Remark	Set the baud rate as 9600 bps. The changed setting will take effect after 2 s and print the string "BPS SET AFTER 2S..."

	Can be saved after power off.
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## • Serial Port Frame Size and Timeout Time

AT+PACK=?	
Function	Query the parameter range of this command.
Example	AT+PACK=?
Return Value	AT+PACK=<0~2048>,<1~1000> OK
Remark	<p><b>Parameter 1:</b> Serial port frame receiving size, in byte (Range: 0 byte ~ 1024 bytes), 0 byte is by default. When set to 0, the module will automatically adjust the frame size according to the current baud rate to meet high-speed transparent transmission.</p> <p><b>Parameter 2:</b> Serial port frame receiving timeout time, in ms. Range: 1 ms ~ 1000 ms. <b>50 ms is by default.</b> The parameter is used to judge the end of the frame of the serial port input data stream. When the serial port data cut-off time exceeds the setting, the module will judge that the current serial port input data frame has been completed, and will forward the frame data after the timeout ends. When parameter 1 is set to a value non-zero, after the serial port input data length reaches the set value of parameter 1, the module will not make a frame end timeout judgment and will immediately forward the received frame data.</p>

AT+PACK?	
Function	Query the receiving frame size and the timeout time.
Example	AT+PACK?
Return Value	AT+PACK=0,50 OK
Remark	The current timeout time is 50 ms. If the returned frame receiving size is 0, it means that the module will automatically adjust the frame receiving size according to the current baud rate.

AT+PACK=	
Function	Set the receiving frame size and the timeout time.
Example	AT+PACK=250,100
Return Value	OK
Remark	Set the receiving frame size to 250 bytes, and the receiving timeout time to 100 ms. Take effect immediately after setting, can be saved after power off.

**• Serial Port Echo**

AT+ECHO=?	
Function	Query the parameter range of this command.
Example	AT+ECHO=?
Return Value	AT+ECHO=[0,1] OK
Remark	0: Disable echo. 1: Enable echo.

AT+ECHO?	
Function	Query the current serial port echo status.
Example	AT+ECHO?
Return Value	AT+ECHO=0 OK
Remark	0: Disable echo. (Disable by default). 1: Enable echo.

AT+ECHO=	
Function	Set the serial port echo.
Example	AT+ECHO=1
Return Value	OK
Remark	Enable echo. Take effect immediately after setting, cannot be saved after power off.

**• Device Status Display**

AT+STATUS=?	
Function	Query the parameter range of this command.
Example	AT+STATUS=?
Return Value	AT+STATUS=[0,1] OK
Remark	0: Disable device status display function. 1: Enable device status display function (enable by default).

**AT+STATUS?**

Function	Query the current display status of the device.
Example	AT+STATUS?
Return Value	AT+STATUS=0 OK

**AT+STATUS=**

Function	Set the display status of the device.
Example	AT+STATUS=0
Return Value	OK
Remark	Disable device status display. Take effect immediately after setting, cannot be saved after power off.

**• User Authentication****AT+AUTH?**

Function	Query the parameter range of this command.
Example	AT+AUTH=?
Return Value	AT+AUTH=<0,1>,<*****>,<1~65535> OK
Remark	Query parameter list and value range <b>Parameter 1:</b> Enable/disable user authentication function. <b>Parameter 2:</b> Key, up to 16 bytes of any visible character. <b>This parameter cannot be empty when authentication is enabled.</b> <b>Parameter 3:</b> Authentication valid time (in s), 15 s is by default. Remark: Take effect after reboot. The slave has disconnected automatically after the master authentication key is not sent within the valid time. (Data transmission characteristic value sends the authentication key.)

**AT+AUTH?**

Function	Query the current status of the user authentication function.
Example	AT+AUTH?
Return Value	AT+AUTH=1,12GH**_),15 OK
Remark	<b>Parameter 1:</b> 1, enable user authentication function.

	<b>Parameter 2:</b> Key is 12GH**_)). <b>Parameter 3:</b> The valid time of user authentication is 15 s.
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AT+AUTH=	
Function	Set the user authentication.
Example	AT+AUTH=1,12GH**_)),10
Return Value	OK
Remark	<p>Enable user authentication function.</p> <p>Set key to 12GH**_)), and the valid time of user authentication is 10 s.</p> <p>Take effect immediately after setting, can be saved after power off.</p>

#### • Enter User Authentication Key

AT+AUTH_KEY=	
Function	Enter the user authentication key on the master end.
Example	AT+AUTH_KEY=1,123456
Return Value	OK
Remark	<p><b>Parameter 1:</b> The connection handle value of the slave role.</p> <p><b>Parameter 2:</b> When the authentication function is enabled on the slave device to be connected, the master needs to enter the key in the form of a command for authentication.</p> <p><b>Only effective in master mode and master-slave mode.</b></p>

#### • Pairing Function of Slave Role

AT+PAIR=?	
Function	Query the parameter range of this command.
Example	AT+PAIR=?
Return Value	AT+PAIR=<0,1>,<*****> OK
Remark	<p><b>Parameter 1:</b></p> <p>0: Disable the pairing function of the slave role.</p> <p>1: Enable the pairing function of the slave role.</p> <p><b>Parameter 2:</b> Pairing passkey, 123456 is by default.</p> <p><b>Only effective in slave mode.</b></p>

AT+PAIR?

Function	Query the pairing setting of the slave role.
Example	AT+PAIR?
Return Value	AT+PAIR=0,123456 OK
Remark	Disable the pairing function of the slave role, and the pairing passkey is 123456.

**AT+PAIR=**

Function	Set the pairing function of the slave role.
Example	AT+PAIR=1,135648
Return Value	OK
Remark	Enable the pairing function of the slave role and set the pairing passkey to 135648. The length of the passkey cannot exceed 6 characters. Take effect after reboot, can be saved after power off.

**• Pairing Function of Master Role****AT+MASTER\_PAIR=?**

Function	Query the parameter range of this command.
Example	AT+MASTER_PAIR=?
Return Value	AT+MASTER_PAIR=<0,1,2,3,4> OK
Remark	According to different pairing interaction processes, the master role has the following pairing functions for setting: 0: Display Only 1: Display with Yes/No-buttons 2: Keyboard Only (by default) 3: No Input and No Output 4: Display with Keyboard  Remark: According to the above setting function, there will be 5 different pairing methods and processes, as shown below (Please refer to the table below for the correspondence between the pairing function and the pairing method)  Pairing methods description: <b>A. Just works</b> In this case, it is impossible to confirm the identity of the connected device. This method does

	<p>not require interaction. The device will be paired and encrypted but not authenticated.</p> <p><b>B. Numeric Comparison</b></p> <p>In this mode, both devices will display a 6-digit key. The user must confirm that the two devices display the same key by pressing a button.</p> <p><b>C. Passkey Entry (Initiator displays, Responder inputs)</b></p> <p>The passkey is displayed on the Responder device and must be entered on the Initiator device.</p> <p><b>D. Passkey Entry (Responder displays, Initiator inputs)</b></p> <p>The passkey is displayed on the Initiator device and must be entered on the Responder device to confirm the authentication.</p> <p><b>E. Passkey Entry (Responder and Initiator inputs)</b></p> <p>In this case, both devices must enter the passkey.</p> <p>The master device can generally be regarded as Responder, and the module adopts Keyboard Only in the master role by default (Corresponding pairing method C: Initiator displays, Responder inputs). In this mode, the master device will receive the pairing key request from the slave device (Initiator), at this time, the pairing passkey needs to be entered through the AT command "AT+PASSKEY=" to complete the pairing and bonding.</p> <p>The configuration of this device should be set according to the configuration of the slave device to be paired, otherwise, the bonding may be failed.</p>
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Corresponding Reference of Pairing Function		Initiator				
		Display Only	Display with Yes/No-buttons	Keyboard Only	No Input and No Output	Display with Keyboard
Responder	Display Only	Just Works	Just Works	R displays I inputs	Just Works	R displays I inputs
	Display with Yes/No-buttons	Just Works	Numeric Comparison	R displays I inputs	Just Works	Numeric Comparison
	Keyboard Only	I displays R inputs	I displays R inputs	R displays I inputs	Just Works	I displays R inputs
	No Input and No Output	Just Works	Just Works	Just Works	Just Works	Just Works
	Display with	I displays	Numeric	R displays	Just Works	Numeric

	Keyboard	R inputs	Comparison	I inputs		Comparison
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**AT+MASTER\_PAIR?**

Function	Query the pairing setting of the master role.
Example	AT+MASTER_PAIR?
Return Value	AT+MASTER_PAIR=2 OK
Remark	The current pairing method is Keyboard Only.

**AT+MASTER\_PAIR=**

Function	Set the pairing function of the master role.
Example	AT+MASTER_PAIR=0
Return Value	OK
Remark	Set the pairing setting of the master role to Display Only. Take effect after reboot, can be saved after power off.

**• Enter Pairing Passkey of Master Role****AT+PASSKEY=**

Function	Enter the passkey when the master role is paired with the slave device.
Example	AT+PASSKEY=1,123456
Return Value	OK
Remark	<b>Parameter 1:</b> The connection handle value of the slave role. <b>Parameter 2:</b> When the pairing function is enabled on the slave device to be connected, enter the pairing passkey in the form of a command. Only effective in <b>master mode and master-slave mode</b> .

**• Pairing List****AT+PAIR\_LIST**

Function	Query the pairing list.
Example	AT+PAIR_LIST
Return Value	AT+PAIR_LIST= 0 (FF:1C:2B:D1:4C:BD) 1 (EB:71:5B:DE:08:87)

	..... OK
Remark	<p>0, 1 is the pairing list serial number. There can be up to 6 paired devices under the master role or slave role respectively.</p> <p>When using this command in the master role (master and master-slave mode), the paired slave devices with the master will be obtained.</p> <p>When using this command in the slave role, the paired master devices with the slave will be obtained.</p> <p>If switch the working role, the current saved list of paired devices will be cleared.</p>

#### • Delete Paired Device

AT+PAIR_DEL=	
Function	Delete the paired device.
Example 1	AT+PAIR_DEL=0
Return Value	OK
Remark	<p>Delete the device with the serial number 0 in the pairing list. The device under connection will be disconnected after deletion.</p> <p>The pairing list serial number can be obtained through "AT+PAIR_LIST"</p>
Example 2	AT+PAIR_DEL=ALL
Return Value	OK
Remark	<p>Delete all devices in the pairing list. The devices under connection will be disconnected after deletion.</p> <p>When using this command in the master role (master and master-slave mode), the paired slave devices with the master will be deleted.</p> <p>When using this command in the slave role, the paired master devices with the slave will be deleted.</p>

#### • Sleep Mode

AT+SLEEP=?	
Function	Query the parameter range of this command.
Example	AT+SLEEP=?
Return Value	AT+SLEEP=<0,1>,<0,1>,<0,1> OK
Remark	<b>Parameter 1:</b> Device serial port function switch (0: disable, 1: enable)

	<p><b>Parameter 2:</b> Device BLE function switch (0: disable. 1: enable)</p> <p><b>Parameter 3:</b> Device serial port wake-up function switch (0: disable. 1: enable)</p> <p>Remark: After the serial port function is disabled, set the <b>CTS</b> pin at a high level first and then set it low to <b>wake up the serial port</b>. Also, it can be enabled by sending a command "AT+SLEEP=1 (BLE function needs to be enabled).</p> <p>If the serial port wake-up function is enabled, you can wake up the module by sending a <b>wake-up character</b> through the serial port during sleep. To wake up the module, the wake-up character must be <b>less than or equal to 3 bytes</b>, and at least 1 byte.</p> <p>Use parameter 2 to disable the BLE function. If the device is under connection, all connections with the device will be disconnected and the broadcast will be disabled. If the device is under broadcasting, the broadcast will be disabled.</p> <p>When the device is in the master role (in the master and master-slave mode), and the currently connected device is enabled the automatic reconnection function, the device will not automatically reconnect after disabling the BLE function. When the BLE function is turned on again, the device will resume automatic reconnection.</p> <p>Disable the BLE function will not prohibit the use of the AT command of the corresponding role, but just let the module's Bluetooth enter the idle status and keep it, and any BLE-related operations are valid.</p>
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AT+SLEEP?	
Function	Query the current sleep mode of the device.
Example	AT+SLEEP?
Return Value	AT+SLEEP=1,1,0 OK
Remark	<p><b>Parameter 1:</b> Enable the device serial port function.</p> <p><b>Parameter 2:</b> Enable the device BLE function.</p> <p><b>Parameter 3:</b> Disable the device serial port wake-up function (by default).</p>

AT+SLEEP=	
Function	Set the device sleep mode.
Example	AT+SLEEP=
Return Value	AT+SLEEP=0, 0, 0 OK

Remark	Disable the device's BLE function, serial port, and serial port wakeup functions. If the device is connected, it will immediately disconnect the current connection.  Take effect immediately after setting, cannot be saved after power off.
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### • Enable/Disable Watchdog

AT+WDOG?	
Function	Query the watchdog function status.
Example	AT+WDOG?
Return Value	AT+WDOG=0 OK
Remark	0: Disable Watchdog 1: Enable Watchdog. Enabled by default.

AT+WDOG=	
Function	Set the watchdog function.
Example	AT+WDOG=0
Return Value	OK
Remark	Disable the watchdog function, <b>the overall power consumption will be reduced by 2 μA ~ 3 μA</b> . Take effect after reboot, can be saved after power off.

### • Restart Device

AT+RESTART	
Function	Restart the device.
Example	AT+RESTART
Return Value	OK
Remark	The device will be rebooted after setting. Take effect immediately.

### • Reset Device

AT+RESET	
Function	Reset the device.
Example	AT+RESET
Return Value	OK
Remark	The device will be rebooted after setting. Take effect immediately.

**• Query Firmware Version**

AT+VERSION	
Function	Query the device firmware version.
Example	AT+VERSION
Return Value	AT+VERSION= RF_BM_BG22A3_V0.2.1_2021.01.21 OK
Remark	Query the firmware version information and the updated date.