HOPERF

HM-BT2401DA
User Manual

Version	Date	Modification
V1.0	2025.7.14	Initial Version

Table of Content

1. Product Overview

The HM-BT2401DA is a high-performance BLE 6.0 Channel Sounding (CS) module based on SoC chip design, supporting Initiator and Reflector roles. It integrates PCB dual antennas and supports external dual antennas for high-precision ranging performance. The module features a high-performance 32-bit ARM Cortex®-M33 with a working frequency of 78 MHz, DSP instructions, and a floating-point unit for efficient signal processing. It includes up to 1024 KB of FLASH program memory and 128 KB of RAM data memory, supporting up to 72 channels in standard and random frequency-hopping modes. AT commands can be used to quickly establish wireless connections and perform ranging between Initiator and Reflector devices, with minimal resource consumption on the external MCU and simplified development.

2. Product Appearance
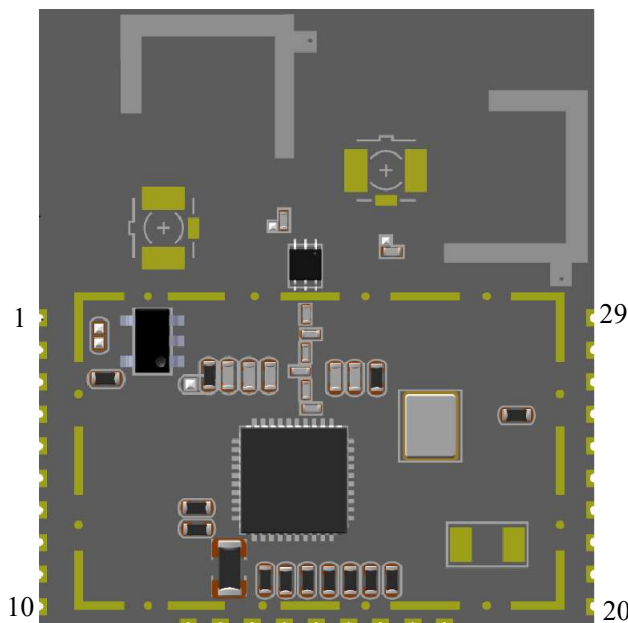
Figure 1: TopView
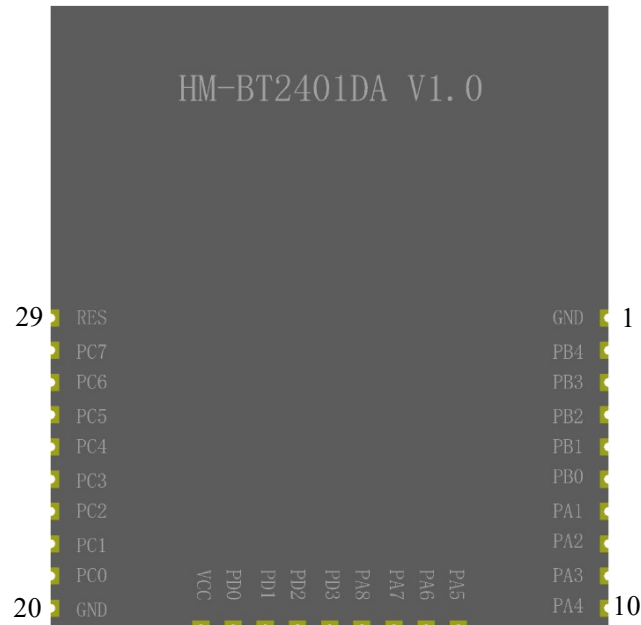
Figure 2:   BottomView

3. Pin Definitions

Pin No	Pin Name	Type	Description
1	GND	DG	Power Ground
2	PB4	I/O	Reserved
3	PB3	I/O	Reserved
4	PB2	I	Chip Select Pin (CS): Active Low
5	PB1	I	Mode Pin (MODE): High for AT Mode, Low for Transparent Mode
6	PB0	I/O	Connection Status: High for Connected, Low for Disconnected
7	PA1/SWCLK	I/O	SWCLK: Serial Clock for Debugging and Programming
8	PA2/SWDATA	I/O	SWDIO: Serial Data for Debugging and Programming
9	PA3	I/O	Reserved
10	PA4	O	Notification Pin (NTF)

11	PA5/TXD	DO	UART TX Pin
12	PA6/RXD	DI	UART RX Pin
13	PA7	O	Reserved
14	PA8	O	Reserved
15	PD3	I/O	Reserved
16	PD2	I/O	Reserved
17	PD1	I/O	Reserved
18	PD0	I/O	Reserved
19	VCC	DV	Power Supply (3.3V)
20	GND	DG	Power Ground
21	PC0	I/O	General GPIO
22	PC1	I/O	General GPIO
23	PC2	I/O	General GPIO
24	PC3	I/O	General GPIO
25	PC4	I/O	General GPIO
26	PC5	I/O	General GPIO
27	PC6	I/O	General GPIO
28	PC7	I/O	General GPIO
29	RES	I/O	Hardware Reset Pin: Active Low

4. Application Connection
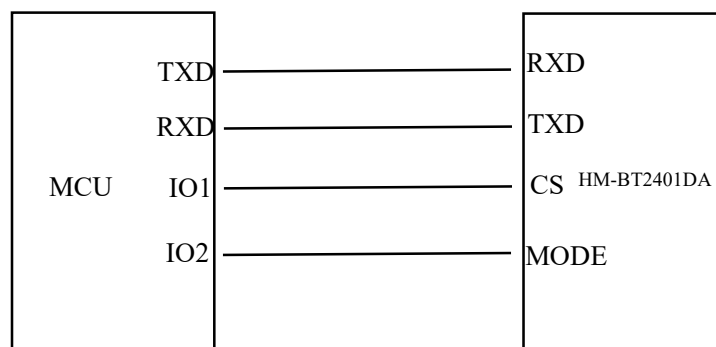
Figure 3:application connection diagram

5. Usage Instructions

The module requires at least four pins for basic operation: TXD, RXD, CS, and MODE. TXD and RXD are UART communication pins. CS is the data transmission enable pin (active low), and MODE is the operation mode selection pin.

When the host MCU needs to send data to the module, the CS pin must be pulled low first. When CS is high, the module operates in low-power mode (sleep mode), and the UART is inactive. Pulling CS low keeps the module in active mode, allowing UART data transmission. Data reception is unaffected by the CS pin state. After pulling CS low, wait at least 50 μs before sending data.

The MODE pin determines the operation mode:

High: AT command mode (send AT commands to communicate with the module).

Low: Transparent mode (after establishing a connection, pull this pin low to enable transparent data transmission).

The NTF pin is a notification pin used to alert the host of incoming data or wake up the host device. When the module has data to send, the NTF pin is pulled high for 1 ms before data transmission begins and is pulled low afterward. This pin is only effective in low-power mode.

The LINK pin indicates the connection status:

High: Connected.

Low: Disconnected.

Different roles support different maximum connection counts:

A Reflector can connect to up to 4 Initiators.

An Initiator can connect to only 1 Reflector.

Ranging results are reported by the Initiator.

Channel Sounding System Block Diagram Example:
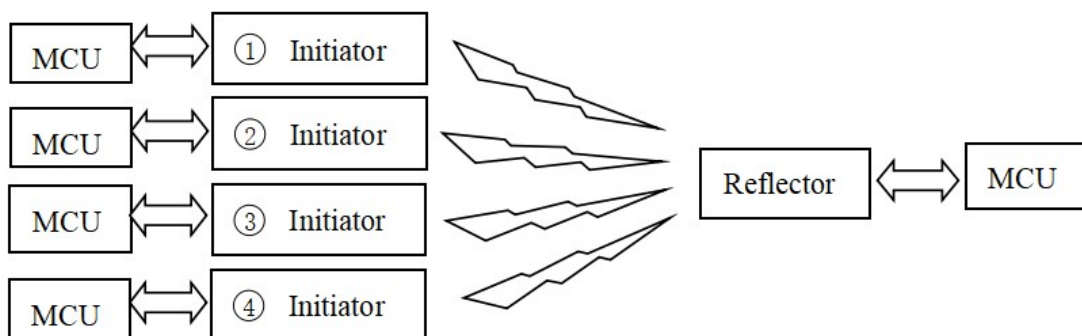
Operation Timing Example
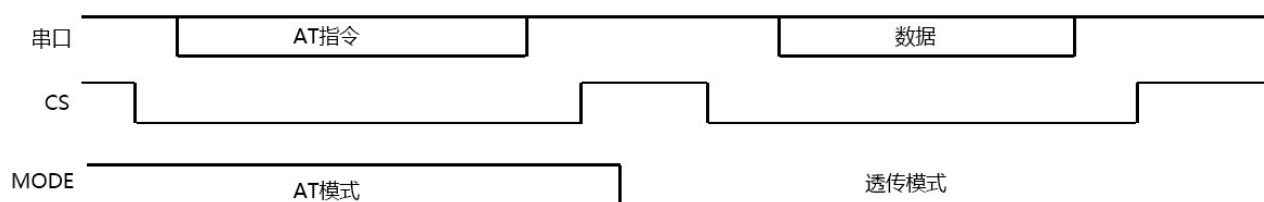
GATT Transparent Transmission Server Interface:

The HM-BT2401DA provides a service for transparent data transmission. It includes three characteristics: TXD, RXD, and SW Version. The module uses the TXD characteristic's Notify to send data to the host. The host can use the RXD characteristic's Write or Write Without Response to send data to the module. The SW Version characteristic contains the firmware version information, which can be read via a Read operation.

Channel Sounding Ranging Process:

1. The Reflector device starts advertising.

2. The Initiator device scans and initiates a connection to the Reflector.

3. After establishing the connection, secure communication is enabled, and both devices exchange supported ranging features.

4. The Initiator sends the first ranging packet.

5. The Reflector returns the ranging packet (using the same phase for PBR).

6. The Initiator calculates the distance based on the returned data and reports the result to the MCU via UART.

6. AT Command Usage Instructions

6.1 Command Syntax

AT commands are based on ASCII command lines. The format is as follows:

Request Message Format: AT+<CMD>[OP][para-1,para-2,……para-n]<\r>

Request format description:

Domain	Illustrate
AT+	Command message prefix
CMD	Command string
Op	Instruction operator. It can be the following: "=": indicates parameter setting "?": indicates querying the current value of the parameter "": indicates executing the instruction "=?": indicates querying the parameter of the setting instruction
para-1,para-2,……para-n	Indicates the parameter value to be set, or specifies the parameter to be queried
\r	Carriage return terminator, ASCII code is 0x0D

Response Message Format:[+CMD:][para-1,para-2,……para-n]<\r\n>

Or:[+CMD:OK]<\r\n>

Or:[+ERR:][ErrorCode]<\r\n>

Response format description:

Domain	Illustrate
\n	Newline character, ASCII code is 0x0A
+CMD	The corresponding command string
para-1,para-2,……para-n	The corresponding parameter string
+ERR	Error response prefix
ErrorCode	Error code, please check the error code table for details

Serial port parameter configuration values: baud rate 115200 (factory value), data bit 8, stop bit 1, check bit none

6.2 AT Command Table

System Commands	
AT	Test Command
AT+BAUD	UART Baud Rate
AT+INFO	Firmware Information
AT+DEF	Restore Factory Settings
AT+RESET	Reset and Restart
AT+ECHO	Input Echo
AT+MAC	Device MAC Address
AT+SLP	Deep Sleep
AT+PWR	Transmission Power
AT+IOC	IO Port Control
AT+ADC	ADC Read
AT+PWM	PWM Output
BLE Commands	
AT+ADVSA	Start Advertising
AT+ADVSO	Stop Advertising

AT+ADVINT	Advertising Interval
AT+ADVDAT	Advertising Data
AT+ADVPHY	Advertising Physical Rate
AT+SCANSA	Start Scanning
AT+SCANSO	Stop Scanning
AT+SCANPM	Scanning Parameters
AT+CONN	Connect Slave Device
AT+DISCON	Disconnect
AT+MTU	GATT MTU
AT+CONPM	Connection Parameters
AT+CONDEF	Set Default Connection Parameters
AT+SCM	Set Connection Password
AT+LINKS	Query Connection Status
AT+RSSI	Get Connection RSSI
AT+SEND	Send Data
AT+TXPORT	Set Write Characteristic Handle
AT+AOADV	Auto Advertising
AT+DEVNA	Modify Device Name
AT+GADIS	Discover Service Attributes
AT+READ	GATT Read Operation
AT+WRITE	GATT Write Operation
AT+PHY	Set Physical Rate
AT+CSINT	Set Ranging Result Reporting Interval
AT+CSMAP	Set Channel Map
AT +AOREC	Enable Auto Reconnection
AT +CSROLE	Set CS Role
AT+CSEN	Enable Ranging Result Reporting
Test Commands	
AT+TXTEST	Transmission Test

AT+RXTEST	Reception Test
AT+STOPTEST	Stop Test

6.3 AT Test Command

Command Type	Command Format	Response
Test Command	AT	AT

6.4 AT+BAUD UART Baud Rate

Command Type	Command Format	Response
Query	AT+BAUD?	+BAUD:<baud>
Set	AT+BAUD=<save>,<baud>	+BAUD:OK +ERR:<ErrorCode>
Parameter	<save>: Save to FLASH (1: Yes, 0: No)	
Response value description	<baud>: Baud rate (2400, 4800, 9600, 19200, 38400, 115200, 230400)	
Example	AT+BAUD=1,115200 +BAUD:OK	

6.5 AT+INFO Query Firmware Information

Command Type	Command Format	Response
Query	AT+INFO?	+ INFO:<version>,<max link>,<series>,< manufacturer >
Parameter	< version >	
Response value description	< max link > < series > < manufacturer >	

Example	AT+INFO?
	+INFO:V1.0,4,HM-BT2401DA,HopeRF

6.6 AT+DEF Restore Factory Settings

Command Type	Command Format	Response
Execute	AT+DEF	
Notice	This command has no response. After executing it, all configurations are restored to the factory state and the module is restarted. Factory default configuration Baud rate:115200 Minimum Advertising interval: 500ms Maximum Advertising interval: 600ms Minimum connection interval: 20ms Maximum connection interval: 20ms Number of skippable connection events: 0 Connection timeout: 1s Transmit power: 10dbm Device Name: HM-BT2401DA Advertising data: 02010607ff486f706552460a08484d2d425432313058 Advertising data:0 Automatic Advertising:1	

6.7 AT+RESET Reset and Restart

Command Type	Command Format	Response
Execute	AT+RESET	
Notice	No response. Reboots the module.	

6.8 AT+ECHO Input Echo

Command Type	Command Format	Response
Set	AT+ECHO=<open>	+ECHO:OK +ERR:<ErrorCode>
Parameter	<open>: 1: Enable, 0: Disable	
Response value description	After the echo is turned on, the characters sent by the serial port will be echoed back. It is turned off by default and it is not recommended to turn on this function in non-debugging situations.	
Example	AT+ECHO=1 +ECHO:OK	

6.9 AT+MAC Set Device MAC Address

Command Type	Command Format	Response
Query	AT+MAC?	+MAC:<mac>
Set	AT+MAC=<type>,<mac>	+MAC:OK +ERR:<ErrorCode>
Parameter	< type > 1:Static device address 0:Public device address	
Response value description	< mac >:MAC	
Example	AT+MAC? +MAC:11:22:33:44:55:66 AT+MAC=1,FF2233445566 +MAC:OK	
Notice	The device will take effect after restarting.	

6.10 AT+SLP Deep Sleep

Command Type	Command Format	Response
Execute	AT+SLP	
Notice	This command has no response and can only be executed in a disconnected state. After execution, the module will enter deep sleep to reduce power consumption and will be awakened by the MODE pin. After waking up, the device will restart. Wait 10ms before operating again	

6.11 AT+PWR Set Transmission Power

Command Type	Command Format	Response
Query	AT+PWR?	+PWR:\<power>
Set	AT+PWR =\<save>,\<power>	+PWR:OK +ERR:\<ErrorCode>
Parameter	< save >:Whether to save the setting value to FLASH 1:Save 0:No Save	
Response value description	< power >:Setting value -260~100 corresponds to -26.0~20dBm (some modules only support a maximum of 10dBm) 0.1dbm/step	
Example	AT+PWR =1,85 +PWR:OK	
Notice	It can only be set when all connections are idle. Different module models support different powers.	

6.12 AT+IOC IO Port Control

Command Type	Command Format	Response
Set	AT+IOC=\<pinidx>,\<mode>[,\<val>]	+IOC:OK +IOC:\<val>

		+ERR:<ErrorCode>
Parameter	< pinidx >:IO index 0~7 corresponds to pins PC0 ~ PC7	
Response value description	< mode >:Input or Output 0:Output 1:Input <val>:Output high and low level 1: high level 0: low level	
Example	AT+IOC=0,1 +IOC:1 AT+IOC=0,0,1 +IOC:OK	

6.13 AT+ADC ADC Read

Command Type	Command Format	Response
Set	AT+ADC=<pinidx>	OK +ADC:<val> +ERR:<ErrorCode>
Parameter	< pinidx >:IO index 0~5 corresponds to pins PC0 ~ PC5	
Response value description	<val>:Reading Values:0~4095 Conversion formula: voltage value = read value * VDD/4095	
Example	AT+ADC=0 OK +ADC:1234	
Notice	Cannot read pins already used by PWM	

6.14 AT+PWM PWM Output

Command Type	Command Format	Response

Set	AT+PWM	+PWM:<pinidx>,<pinidx>,<pinidx>
Parameter	AT+PWM=<pwmidx>,<en>,<pinidx>,<period>,<percent>	+PWM:OK +ERR:<ErrorCode>
Response value description Example	<pwmidx>:0~2 PWM index, supports up to three PWM outputs at the same time <en>:Enable/disable 1: Enable 0: Disable <pinidx>:IO index 0~5 Corresponding to pins PC0 ~ PC5, the three PWM corresponding output IOs will be replied in the response. Therefore, displaying 255 means that the PWM is in the off state <period>:PWM output cycle Unit: Hz <percent>:Duty cycle input range: 0~100	
Notice	AT+PWM=0,1,0,1000,50 +PWM:OK	
Set	PWM cannot work in sleep mode, so CS needs to be kept low during PWM operation.	

6.15 AT+ADVSA Start Advertising

Command Type	Command Format	Response
Query	AT+ADVSA?	+ADVSA: <state>
Set	AT+ADVSA	+ADVSA:OK +ERR:<ErrorCode>
Parameter	<state>:Advertising status 1. Advertising 0. Advertising stopped	
Response value description	AT+ADVSA +ADVSA:OK	
Example		

6.16 AT+ADVSO Stop Advertising

Command Type	Command Format	Response
Execute	AT+ADVSO	+ADVSO:OK +ERR:<ErrorCode>
Example	AT+ADVSO +ADVSO:OK	

6.17 AT+ADVINT Set Advertising Interval

Command Type	Command Format	Response
Query	AT+ADVINT?	+ADVINT: <minInt>,< maxInt >
Set	AT+ADVINT=<save>,<minInt>,< maxInt >	+ADVINT:OK +ERR:<ErrorCode>
Parameter	<save>:Save the setting value to FLASH 1: Save 0: Do not save	
Response value description	<minInt>:Minimum connection interval setting value 32~65535 <maxInt>:Maximum connection interval setting value 32~65535 minInt must be less than or equal to maxInt, the actual interval time ms = interval * 0.625ms	
Example	AT+ADVINT =1,100,150 +ADVINT:OK	

6.18 AT+ADVDAT Set Advertising Data

Command Type	Command Format	Response
Query	AT+ADVDAT	+ ADVDAT:<data>
Set	AT+ADVDAT =<save>,<data>	+ ADVDAT:OK +ERR:<ErrorCode>
Parameter	<save>:Save the setting value to FLASH 1: Save 0: Do not save	

Response value description	<data>:Advertising data Hexadecimal input A maximum of 31 bytes of Advertising data can be input
Example	AT+ ADVDAT =1,02010a + ADVDAT:OK

6.19 AT+ADVPHY Set Advertising Physical Rate

Command Type	Command Format	Response
Set	AT+ADVPHY =<primary>	+ ADVPHY:OK +ERR:<ErrorCode>
Parameter	<primary>: Primary Advertising channel physical rate	
Response value description	Setting value: 1:1M 2: 2M	
Example	AT+ADVPHY =1 +ADVPHY:OK	

6.20 AT+SCANSA Start Scanning

Command Type	Command Format	Response
Execute	AT+ SCANSA	+ SCANSA:OK +ERR:<ErrorCode>
Set	AT+ SCANSA =<mode>[,<limitcount>][,<rawdata>][,<filtmode>][,<filtphy>][,<filtrssi>][,<filtname>][,<filtdata>]	+ SCANSA:OK +ERR:<ErrorCode>

Parameter	< mode >Scan Mode 0:Passive scanning 1:Active scanning
Response value description	Passive scanning is used by default when executing instructions
	<limitcount>:Limitation of the number of scan echo packets
	0: There is no limit on the number of echo packets, and the scanning results are real-time and repeatable，<num>range 0~255(Article 1<num>=1)；
	1: The maximum number of echo packets is 32.，<num>range 1~32
	<rawdata>:Scanning Advertising packetsraw data c 0: no print raw data
	1:print raw data
	<filtmode>:Filter type, must be included when non-zerofiltphy,filtrssi,filtname,filtdata
	filtmode = 0、1、2、4、8 any bit or combination
	1:Filter phy, <filtphy>control
	2:Filter RSSI,<filtrssi>control
	4:Filter Advertising name, <filtname>control
	8:Filter Advertising data, <filtdata>control
	<filtphy>: Filter PHY ，<filtmode> when this filtering function is not enabled <filtphy>Use 0
	0: Do not filter phy, both 1M phy and coded phy can be scanned and displayed
	1:Filter to show only 1M phy
	2:Filter to show only coded phy
	Note: Some modules only support 1M phy
	<filtrssi>: :Filter RSSI ，<filtmode>When this filtering function is not enabled<filtrssi>use 0
	range:-100~0
	<filtname>: Filter Advertising name, <filtmode>When this filtering function is not enabled <filtname>use 0
	Parameters: string format
	<filtdata>: Filtering Data, <filtmode> is set to 0 when this filtering function is not enabled

	Parameter: Advertising hexadecimal data in ASC format, such as filtering 0xaabb, fill in aabb in the filtdata parameter
	After scanning the device, the response format is as follows:
	[SCAN]:<num>,<type>,<addrtype>,<mac> ,<rssi>[,<devname>]
	[Scanning Data Packets]（when <packetoutput>=1 show）
	<num>:Scan number: 1~32 or 0~255 cycles
	<type>:
	0 :Connectable scannable undirected advertising
	1 :Connectable undirected advertising
	2 :Scannable undirected advertising
	3 :Non-connectable non-scannable undirected advertising
	4 :Scan Response.
	<addrtype>:
	0:Public address
	1:Random address
	<mac>:MAC address
	<rssi>:RSSI value of the received signal
	<devname>:Device Name
Example	AT+ SCANSA =1
	+ SCANSA:OK
	Filter RSSI:-80 and PHY=coded phy
	AT+SCANSA=1,0,0,1,2,-80,0,0
	+SCANSA:OK
	[SCAN]:1,129,0,74:6D:69:00:00:3D,-36,980B
	[SCAN]:2,129,0,74:6D:69:00:00:3D,-36,980D
	Filter RSSI: -50 and Advertising name contains: HM

AT+SCANSA=1,1,0,6,0,-50,HM,0

+SCANSA:OK

[SCAN]:1,0,0,84:71:27:1C:DB:5D,-30,HM-BT210X

Filter RSSI: -50 and the Advertising name contains: HM Print Advertising raw data, filter RSSI: -40 and the Advertising data contains: 0xFF486F70655246

AT+SCANSA=1,1,1,10,0,-40,0,FF486F70655246

+SCANSA:OK

[SCAN]:1,0,0,84:71:27:1C:DB:5D,-28,HM-BT210X

[hex_len]=22:02 01 06 07 FF 48 6F 70 65 52 46 0A 08 48 4D 2D 42 54 32 31 30 58

6.21 AT+SCANSO Stop Scanning

Command Type	Command Format	Response
Execute	AT+SCANSO	+SCANSO:OK +ERR:<ErrorCode>
Parameter	Stop Scanning	
Response value description		
Example	AT+SCANSO +SCANSO:OK	

6.22 AT+SCANPM Set Scanning Parameters

Command Type	Command Format	Response
Set	AT+SCANPM=<interval>,<window>[,<phy>]	+SCANPM:OK +ERR:<ErrorCode>
Parameter	< interval >:Scan Interval setting Value:4~65535	

Response value description	< window >:Scan Window setting Value: 4~65535
	<phy>:Physical Layer:
	1:1M
	4:Coded PHY
	5:1M and Coded PHY
	Actual time ms= Setting Value* 0.625ms Device startup defaults: interval:10ms window:10ms
Example	AT+SCANPM=100,100
	+SCANPM:OK
Notice	The configuration will take effect after the next scan is started

6.23 AT+CONN Connect Device

Command Type	Command Format	Response
Set	AT+CONN=<linkidx>,<addrtype>,<mac>[,<passkey>]	+CONN:OK
		+ERR:<ErrorCode>
Parameter	< linkidx >:Connection index, if it is 0, an idle connection is allocated	
Response value description	<addrtype>:Address type, setting value 1 ~ 4	
	1:public_address	
	2:static_address	
	3:random_resolvable_address	
	4:random_nonresolvable_address	
	< mac >:From the device mac address	
	<passkey>:Connection password 0~999999(optional parameter)	
	After the connection is successful, it will reply	
	[BLE]:Connected,<linkidx>	
	If there is no slave device, it will keep trying to connect. You need to use AT+DISCON to stop the operation.	

Example	AT+CONN =1,1,112233445566
	+ CONN:OK
Notice	Available only when the connection is idle

6.24 AT+DISCON Disconnect

Command Type	Command Format	Response
Set	AT+DISCON=<linkidx>	+DISCON:OK
		+ERR:<ErrorCode>
Parameter	< linkidx >:Join Index	
Response value description	After successful disconnection, it will reply [BLE]: Disconnect,<linkidx>	
Example	AT+DISCON =1	
	+DISCON:OK	
Notice	Only available when connected	

6.25 AT+MTU Set ATT Maximum Transmission Unit

Command Type	Command Format	Response
Set	AT+MTU=<server>,<mtu>	+MTU:OK
		+ERR:<ErrorCode>
Parameter	< server >: Set Module GATT Serve or GATT Client	
Response value description	0:Server 1:Client	
	<mtu>: Set Value 23 ~ 250 Device Defaults :247	
Example	AT+MTU=1,247	
	+MTU:OK	

6.26 AT+CONPM Set Connection Parameters

Command Type	Command Format	Response
Query	AT+CONPM? (recommended to use the AT+CONDEF command to query)	+CONPM: <minint>,<maxint>,<latency>
Set	AT+CONPM=<linkidx>,<save>,<minint>,<maxint>,<latency>[,<timeout>]	+CONPM:OK +ERR:<ErrorCode>
Parameter	< linkidx >:link index	
Response value description	<save>:Save the setting value to FLASH 1:Save 0:No Save (Not recommended to use this command to save. Please use AT+CONDEF command to save) <minint>:Minimum connection interval Setting Value: 6~3200 <maxint>: Maximum connection interval Setting Value: 6~3200 minint must be less than or equal to maxint Actual time = setting value x 1.25 ms <latency>:Skippable connection events Setting Value 0~500 <timeout>:Optional parameter, connection timeout, Setting Value:10~3200, Actual time ms=Setting Value*10ms	
Example	AT+CONPM =1,1,15,15,0 +CONPM:OK	
Notice	It is only available in the connected state. If you save the settings, the default configuration will be set at the same time. The parameters of the subsequent connected slave devices will be based on this configuration. (It is recommended to use the AT+CONDEF command to set and save the default configuration)	

6.27 AT+CONDEF Set Default Connection Parameters

Command Type	Command Format	Response

Query	AT+CONDEF?	+CONDEF: <minint>,<maxint>,<latency>
Set	AT+CONDEF=<save>,<minint>,<maxint>,<latency>[,<timeout>]	+CONDEF:OK +ERR:<ErrorCode>
Parameter Response value description	<save>:Save the setting value to FLASH 1:Save 0:No Save <minint>:Minimum connection interval Setting Value: 6~3200 <maxint>: Maximum connection interval Setting Value: 6~3200 Minint must be less than or equal tomaxint Actual time= Setting Value x 1.25 ms <latency>:Skippable connection events Setting Value: 0~500 <timeout>:Optional parameter, connection timeout, Setting Value:10~3200, Actual time ms=Setting Value*10ms	
Example	AT+CONDEF =1,15,15,0 +CONDEF:OK	
Notice	After setting the default connection parameters, all newly established connections will use this configuration. If the parameters are saved, the configuration will continue to be used at the next power-on.	

6.28 AT+SCM Set Connection Password

Command Type	Command Format	Response
Query	AT+SCM?	+SCM: <level>,<passkey>
Set	AT+SCM =<save>,<level>[,<passkey>]	+SCM:OK +ERR:<ErrorCode>
Parameter Response value description	<save>:Save the setting value to FLASH 1: Save 0: Do not save <level>: Setting Value 0~1 0: No encryption 1: Encrypted connection <passkey>:Connection password:0~999999 Optional setting, default is 0 if not set	
Example	AT+SCM =1,1,123456	

	+SCM:OK
Notice	After setting, the security level of existing connections will not be increased, only new connections will be effective

6.29 AT+LINKS Query Connection Status

Command Type	Command Format	Response
Query	AT+LINKS?	+LINKS: <linkidx>:<status>,[,<role>][,<mac>,<conInt>,<latency>,<phy>]
Parameter	<linkidx>: link index	
Response value description	<status>: connection status, there are 4 states, namely: idle: connection idle connected: connected status initConnection:connecting dev in DTM:test status <role>: master or slave, this item will be displayed only when connected <mac>: the MAC address of the other device after connection. This item will be displayed only when connected <conInt>: connection interval, this item will be displayed only when connected <latency>: connection events that can be skipped will be displayed only when the connection status is reached <phy>: physical rate used	
Example	AT+ LINKS + LINKS: 1:idle 2:idle	

	3:connected,master,11:22:33:44:55:66,150,0	

6.30 AT+RSSI Get Connection RSSI Value

Command Type	Command Format	Response
Set	AT+RSSI =<linkidx>	+RSSI:OK +ERR:<ErrorCode>
Parameter	<linkidx>: link index	
Response value description	After successful acquisition, it will reply: [RSSI]:<rssi> <rssi>: the RSSI value of the connection, in dBm	
Example	AT+RSSI =1 +RSSI:OK [RSSI]:-50	
Notice	This command can only be used in connected state	

6.31 AT+SEND Send Data

Command Type	Command Format	Response
Set	AT+SEND =<linkidx>,<format>,<data>	+SEND:OK +ERR:<ErrorCode>
Parameter	<linkidx>:link index, special indexes: 255 all connected devices, 254 all peer master devices, 253 all peer slave devices	
Response value description	<format>:data format 0:ascii data 1: hexadecimal data <data>: the data to be sent is formatted according to the format. The length of the entire instruction cannot exceed 256 bytes, so the data length is limited. this command provides a data interaction method in AT mode. It can also receive and display data when it is sent. The format is as follows:	

	[RCV]: < linkidx >,<datalen>,<rawdata>
	<datalen>:length of received data bytes
	<rawdata>: raw byte data
Example	AT+SEND =1,0,1234567890
	+SEND:OK
	AT+SEND =1,1,0a0b03040506070f
	+SEND:OK
Notice	This command can only be used in connected state

6.32 AT+TXPORT Set Transmission Handle

Command Type	Command Format	Response
Set	AT+TXPORT=<linkidx>[,<handle>]	+TXPORT:OK
		+ERR:<ErrorCode>
Parameter	< linkidx >:Connection index, special index: 255 all connected devices, 254 all	
Response value description	peer master devices, 253 all peer slave devices	
	<handle>:The handle of the received data connected to the peer device	
	This command is used to set the sending port in transparent transmission mode. If the firmware is a multi-connection firmware and has established connections with multiple devices, you need to select which device to send data to in transparent transmission mode. The default device startup is connection 1; the second parameter is an optional setting, which can set the handle of the peer device receiving data. This parameter is used for compatibility with non-series modules or modules from other manufacturers. If the two connected parties are modules of the same series, this parameter is ignored.	
Example	AT+TXPORT =2	
	+TXPORT:OK	
Notice	This command can only be used in connected state	

6.33 AT+AOADV Auto Advertising

Command Type	Command Format	Response
Query	AT+AOADV?	+AOADV:<state>
Set	AT+AOADV=<save>,<open>	+AOADV:OK +ERR:<ErrorCode>
Parameter	<save>: Save the setting value to FLASH 1: Save 0: Do not save	
Response value description	<open>: Setting value 0~1 0: Close 1: Open <state>: The returned switch value is 0: closed 1: open	
Example	AT+AOADV =1,1 +AOADV:OK	
Notice	After the automatic Advertising is started, the connection number will be automatically Advertisinged after the power is turned on again. The Advertising will also be automatically started after the connection is disconnected.	

6.34 AT+DEVNA Set Device Name

Command Type	Command Format	Response
Query	AT+DEVNA?	+DEVNA: <devicename>
Set	AT+DEVNA =<save>,<devicename>	+DEVNA:OK +ERR:<ErrorCode>
Parameter	< save>: Save the setting value to FLASH 1: Save 0: Do not save	
Response value description	<devicename>: Device name, ASCII characters within 13 bytes	
Example	AT+DEVNA =1,HM-BT2401DA +DEVNA:OK	
Notice	This command will modify the device name and Advertising name in the GATT	

	server, so it will overwrite the content set by AT+ADVDAT

6.35 AT+GADIS Discover Services, Attributes, Descriptors

Command Type	Command Format	Response
Set	AT+GADIS=<linkidx>,<distype>[,<starthandle>,<stophandle>][,<handle>]	+GADIS:OK +ERR:<ErrorCode>
Parameter	< linkidx >: link index	
Response value description	< distype >: Setting value: 0~2 There are three types of discovery: 0: Discovering the primary service 1: Discovery Properties 2: Discovery Description <starthandle>: The starting handle value, which is only set when the attribute type is discovered <stophandle>: End handle value, only set when the attribute type is found <handle>: The handle value of the attribute, which is only set when the description type is found After the command is successfully executed, the discovery task will be started and the corresponding reply will be received: [SRV]:<linkidx>,<starthandle>,<stophandle>,<uuidlen>,<uuid> [CHAR]: <linkidx>,<thandle>,<uuidlen>,<uuid> [DSC]: <linkidx>,<thandle>,<uuidlen>,<uuid>	
Example	AT+GADIS =1,0 +GADIS:OK	
Notice	This command can only be used in connected state	

6.36 AT+READ GATT Read Operation

Command Type	Command Format	Response
Set	AT+READ =<linkidx>,<type>,<handle>	+READ:OK +ERR:<ErrorCode>
Parameter	<linkidx>: link index	
Response value description	<type>: read type setting value: 0~1 0:read characteristic 1:read descriptor <handle>: the handle of the ATT to be read the read value reply format is as follows: [READ]:<linkidx>,<len>,<rawdata>	
Example	AT+READ =1,0,50 +READ:OK	
Notice	This command can only be used in connected state	

6.37 AT+WRITE GATT Write Operation

Command Type	Command Format	Response
Set	AT+WRITE=<linkidx>,<type>,<handle>,<format>,<data>	+WRITE:OK +ERR:<ErrorCode>
Parameter	<linkidx>: link index	
Response value description	<type>: Write Type Setting value:0~2 0:write characteristic 1:write descriptor 2:write characteristic without response <handle>: The handle of the ATT to be written <format>:Data Format 0:ascii data 1: hexadecimal data <data>: The data to be sent is entered in the format according to format. The length	

	of the entire instruction cannot exceed 256 bytes.
Example	AT+WRITE=1,0,50,0,1234567890 +WRITE:OK
Notice	This command can only be used in connected state

6.38 AT+PHY Set Physical Rate

Command Type	Command Format	Response
Set	AT+PHY=<linkidx>,<phy>	+PHY:OK +ERR:<ErrorCode>
Parameter	<linkidx>: link index	
Response value description	<phy>: Physical connection rate Setting value:1~4 1:1M PHY 2:2M PHY 3:125k Coded PHY 4:500k Coded PHY	
Example	AT+PHY=1,1 +PHY:OK	
Notice	This command can only be used in the connected state. Currently only some modules support 125k and 500k PHY	

6.39 AT+CSINT Set Ranging Result Reporting Interval

Command Type	Command Format	Response
Query	AT+CSINT?	+CSINT: <type>,<interval >
Set	AT+CSINT=<save>,<type>[,<interval >]	+CSINT:OK +ERR:<ErrorCode>
Parameter	<save>:Save the setting value to FLASH 1: Save 0: Do not save	

Response value description	< type >: Procedure execution number
	0:Free running
	1:Start new procedure after one finished
	< interval >: Minimum connection interval setting value 30~255
	Actual interval time ms= interval * Connection interval (default 20ms)
Example	AT+ CSINT=1,0,100
	+ CSINT:OK
Notice	The default type=1, the results are reported at the fastest interval (about 300ms), and there is no need to fill in the interval;
	If type=0, you need to fill in the interval. The interval for reporting ranging results should not be too short, otherwise it may cause the connection to be disconnected.

6.40 AT+CSMAP Set Channel Map

Command Type	Command Format	Response
Query	AT+CSMAP?	+ CSMAP: <mode>,<preset>,<map >
Set	AT+CSMAP=<save>,<mode>,<preset>[,<map >]	+ CSMAP:OK
		+ERR:<ErrorCode>
Parameter	<save>: Save the setting value to FLASH 1: Save 0: Do not save	
Response value description	< mode >: Object tracking mode	
	0: Dynamic tracking ranging	
	1: Static tracking ranging	
	< preset >:CS channel map preset	
	0:{ 0x00, 0x00, 0x00, 0xC0, 0xFF, 0xFF, 0x03, 0x00, 0x00, 0x00 },20channels, channel spacing is 1 ;	
	1:{ 0x54, 0x55, 0x55, 0x54, 0x55, 0x55, 0x55, 0x55, 0x55, 0x15 },37channels, channel spacing is 2 ;	

	2:{ 0xFC, 0xFF, 0x7F, 0xFC, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0x1F },72channels,channel spacing is 1 ; 3: custom channel map; <map >：when preset=3, need to fill in the <map> parameter;
Example	AT+ CSMAP =1,0,3, FCFF7FFCFFFFFFFFFF1F + CSMAP:OK
Notice	1. 1. Default mode=0; preset=2; 2. 2. Set when the connection state is idle; 3. 3. When preset=3, the <map> parameter needs to be filled in; 4. 4. Each hexadecimal byte array represents a channel map, where each bit in the byte corresponds to a channel; 5. 5. Bytes are arranged in big-endian order, and the bits in each byte are arranged in little-endian order; 6. There are 79 channels in total, which are excluded due to overlap with the main Advertising channel (0 1 23 24 25 77 78), so a maximum of 72 channels are supported and a minimum of 20 channels.

6.41 AT+AOREC Enable Auto Reconnection

Command Type	Command Format	Response
Query	AT+AOREC?	+AOREC: < enable >
Set	AT+AOREC=<save>,<enable>	+AOREC:OK +ERR:<ErrorCode>
Parameter	<save>: Save the setting value to FLASH 1: Save 0: Do not save	
Response value description	< enable >:1After power-on or link disconnection, the host automatically reconnects to the last connected slave device until the connection is successful; < enable >:0 Disable automatic re-connection	
Example	AT+AOREC=1,1 +AOREC:OK	

Notice	enable=1 Disable automatic re-connection. It is recommended to use it on the channel sounding host function; enable=0 Terminate all ongoing connection attempts that have not yet succeeded and prevent all subsequent automatic reconnections.

6.42 AT+CSROLE Set CS Role

Command Type	Command Format	Response
Query	AT+CSROLE?	+CSROLE: < role >
Set	AT+CSROLE =<save>,< role >	+CSROLE:OK +ERR:<ErrorCode>
Parameter	< role >:0 : initiator; 1: reflector.	
Response value description		
Example	AT+ CSROLE=1,0 + CSROLE:OK	
Notice	After the role switch, the automatic restart takes effect	

6.43 AT+CSEN Enable Ranging Result Reporting

Command Type	Command Format	Response
Query	AT+CSEN?	+CSEN: < enable >
Set	AT+CSEN=<save>,<enable>	+CSEN:OK +ERR:<ErrorCode>
Parameter	<save>: Save the setting value to FLASH 1: Save 0: Do not save	
Response value description	< enable >:1Enable ranging result reporting; [CSRESULT]:<result> < result >: Channel Sounding distance measurement results, in millimeters (mm)	

	< enable >:0Disable ranging result reporting;
Example	AT+CSEN=1,1
	+CSEN:OK
	[CSRESULT]:655

6.44 AT+TXTEST Transmission Test

Command Type	Command Format	Response
Set	AT+TXTEST =<packet_type>,<length>,<channel>,<phy>[,<pwr>]	+TXTEST:OK +ERR:<ErrorCode>
Parameter Response value description	<packet_type>: 0: PRBS9 packet payload 1: 11110000 packet payload 2: 10101010 packet payload 3: 11111111 packet payload 4: 00000000 packet payload 5: 00001111 packet payload 6: 01010101 packet payload 7: PN9 continuously modulated output 8: Unmodulated carrier <length>: 0-255 <channel>: 0-39 <phy>: 1: 1M PHY 2: 2M PHY 3: 125k Coded PHY	

	4: 500k Coded PHY
	<pwr>:
	-127~20dBm(Some modules only support a maximum of 10dBm)
Example	AT+TXTEST =8,255,0,1 +TXTEST:OK
Notice	This command can only be used when all connections are idle.

6.45 AT+RXTEST Reception Test

Command Type	Command Format	Response
Set	AT+RXTEST=<channel>,<phy>	+RXTEST:OK +ERR:<ErrorCode>
Parameter	<channel>:	
Response value description	0-39 <phy>: 1: 1M PHY 2: 2M PHY 3: 125k Coded PHY 4: 500k Coded PHY	
Example	AT+RXTEST =0,1 +RXTEST:OK	
Notice	This command can only be used when all connections are idle.	

6.46 AT+STOPTEST Stop Test

Command Type	Command Format	Response
Execute	AT+STOPTEST	+STOPTEST:OK

		+ERR:<ErrorCode>
Parameter	Stop the transmission test or reception test	
Response value description	After stopping, the number of test packets will be returned [DTM]:<packnum>	
Example	AT+STOPTEST +STOPTEST:OK	

6.47 Error Codes

Error Code	Description
1	Invalid command format
2	Incorrect number of parameters
3	Invalid parameter
4	Protocol stack execution error
5	Failed to save to flash
6	Command invalid in current connection state
7	Invalid data length
8	Invalid transmission handle
9	Memory error
10	Peripheral operation error