MINEWSEMi

Bluetooth LE Module
MS88SF2
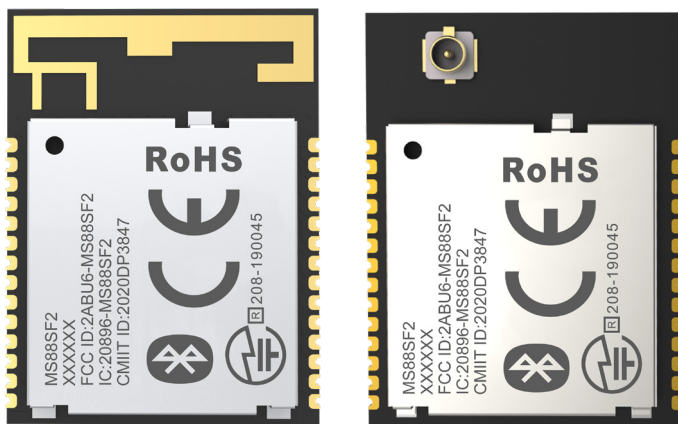
Datasheet

V 1.0.0

Version Note

Version	Details	Contributor(s)	Date	Notes
1.0.0	First edit	Michelle, Leo	2024.05.09	

Part Numbers

Model	Hardware Code
MS88SF21	1Y40AI
MS88SF23	3Y40AI

MS88SF2-nRF52840

Support BLE master-slave mode switching, serial port command configuration, Bluetooth transmitting master-slave module

The MS88SF2 is a master-slave module that can be switched into master/slave mode by command, master and slave cannot work at the same time and only one-to-one connection is possible. The device defaults to master mode. In master mode, the device can be scanned and connected through commands. The device communicates with the MCU through the UART interface. In command mode, commands can be sent through the UART to modify the scanning interval, scanning timeout, connection interval, broadcasting interval, broadcasting customized data, and baud rate.

FEATURES

| Supports master-slave switching | One-to-one connection | Transmission rates as fast as 11kB/S | Support serial command configuration | Transmission distance up to 600 meters in open space | Support iBeacon broadcast mode |

KEY PARAMETER

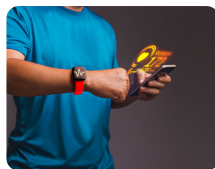| MS88SF2-nRF52840			
Chip Model	Nordic nRF52840	Antenna	PCB/IPEX
Module Size	23.2×17.4×2mm	GPIO	20
Flash	1M	RAM	256KB
Receiving Sensitivity	-95dBm(1Mbps)	Transmission Power	-40~ +8dBm
Current(TX)	0dBm-4.8mA	Current(RX)	4.6mA
Firmware	Master-Slave UART firmware		

APPLICATION
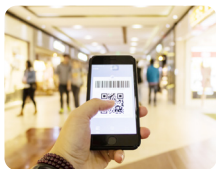
| Smart Home | Consumer Electronics | Intelligent Medical care | Smart Wearable Devices | Security Equipment | Automotive Equipment |

CERTIFICATION

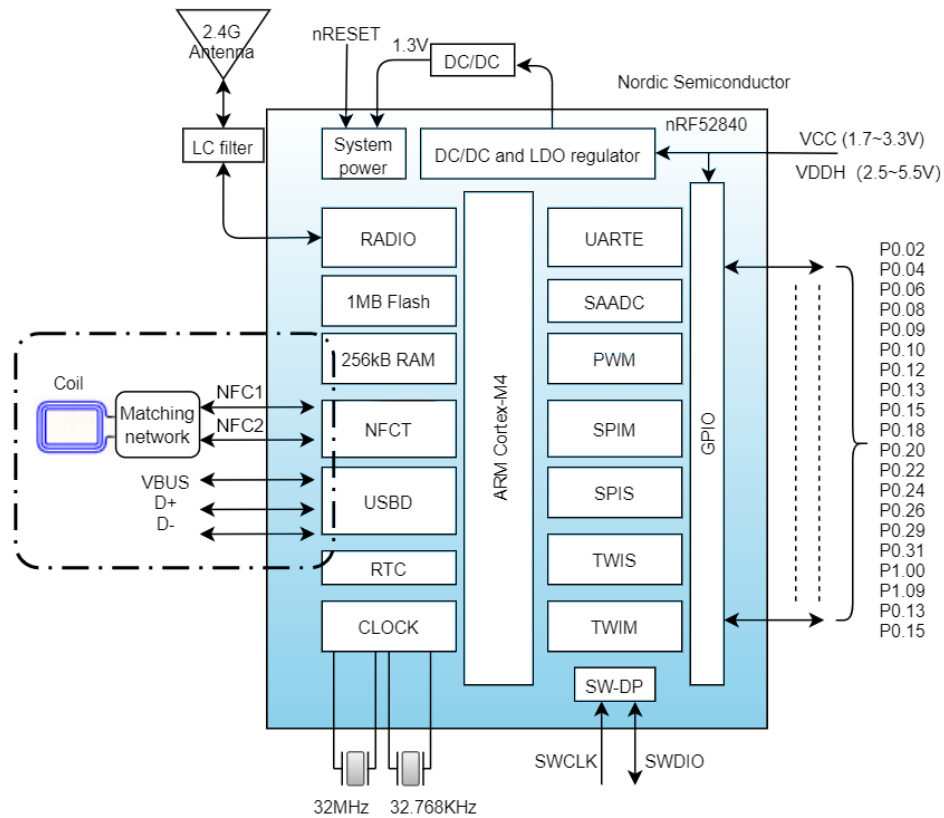Bluetooth®   CE   FC   REACH   RoHS   IC

SRRC   TELEC   WPC   RCM   EN50498

INDEX

1 BLOCK DIAGRAM

2 ELECTRICAL SPECIFICATION

Parameters	Value	Notes
Working Voltage	1.7V-5.5V	To ensure RF work, supply voltage suggest not lower than 2.3V
Working Temperature	-40℃~+85℃	Storage temperature is -40℃~+125℃
Transmission Power	-40 ~ +8dBm	Configurable
Current(RX)	4.6mA	RF reception current in 1Mbps mode
Current(TX)	4.8mA	RF emission current in 0dB mode
Module Dimension	23.2*17.4*2mm	
Quantity of IO Port	20	

3 CURRENT CONSUMPTION CHARACTERISTICS

The following power consumption tests were conducted with a supply voltage of 3.3V and at room temperature. The power consumption is not the same in master mode and slave mode.
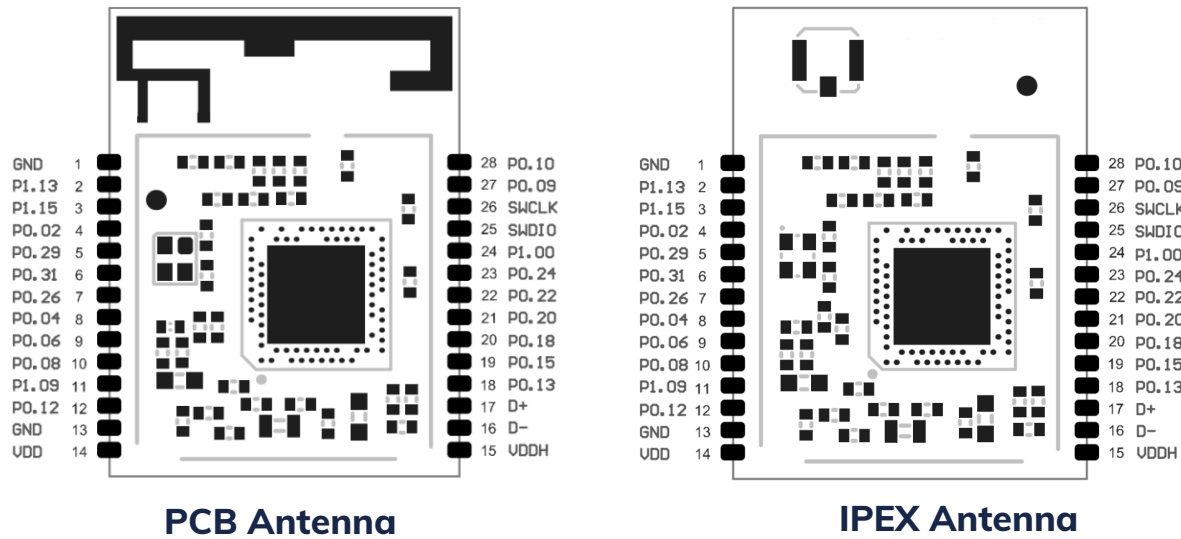
In slave mode, the power consumption is as follows: (broadcast interval is 1s, maximum and minimum connection interval is 20-40ms, and transmit power is 0dBm).

Status / Consumption	Airspeed(bps)	Peak(mA)	Avg(mA)
Average current in sleep state (SLP pulled high、BTDATA pulled low)	/	2.11	0.00027
Average current in broadcast state (SLP pin is connected to GND, BTDATA is pulled high)	1M	6.69	0.0148
	125k	6.64	0.0561
	1M and 125k switching	6.31	0.0587
Transparent transmission average current (SLP, BTDATA pins are connected to GND, connected to mobile phones)	1M	6.82	0.738
	125k	7.18	1.08

In host mode, the power consumption is as follows: (Maximum minimum connection interval of 20-40ms, transmit power 0dBm)

Status / Consumption	Airspeed(bps)	Peak(mA)	Avg(mA)
Average current in sleep state (SLP pulled high、BTDATA pulled low)	/	0.6085	0.0013
Transparent transmission average current (SLP, BTDATA pins are connected to GND, connected to mobile phones)	1M	7.18	1.18
	125k	7.16	1.06

4 PIN DESCRIPTION

GND	1		28	P0.10
P1.13	2		27	P0.09
P1.15	3		26	SWCLK
P0.02	4		25	SWDIO
P0.29	5		24	P1.00
P0.31	6		23	P0.24
P0.26	7		22	P0.22
P0.04	8		21	P0.20
P0.06	9		20	P0.18
P0.08	10		19	P0.15
P1.09	11		18	P0.13
P0.12	12		17	D+
GND	13		16	D-
VDD	14		15	VDDH

PCB Antenna   **IPEX Antenna**

5 PIN DEFINITION

| Pin Number	Symbol	Type	Definition	Note
1	GND	GND	Ground	
2~7	P1.13 to P0.26		GPIO	Not used in UART, floating
8	P0.04	BTX	UART TX	TX of Bluetooth Module
9	P0.06	BRX	UART RX	RX of Bluetooth Module
10-12	P0.08 to P0.12		GPIO	Not used in UART, floating
13	GND	GND	Ground	
14	VDD	Power	Power Supply	3.3V power supply interface, need to be connected with VDDH
15	VDDH	Power	Voltage Positive	For 5V power supply, connect this pin only. For 3.3V supply, connect with VDD.
16	D-		USB interface	The firmware does not enable USB function
17	D+		USB interface	The firmware does not enable USB function
18	P0.13	SLP	Sleep/Awake	Low level to wake-up,high level to sleep, no floating
19	P0.15	BTDATA	Serial port control	Serial port on / off to control pin, no floating 0: serial port open, can send and receive serial port data 1: Serial port off
20	P0.18	CON_IND	Connection indication	Sleep state: low level Broadcast status: Low level Connection status: High level
21	P0.20	FIFO_FULL	Transmission space full	Determine if the transmission space is available when it is full 0: Bluetooth module has available space for transmission 1: Host stops transmitting and waits for free space to be released
22-24	P0.22 to p1.00		GPIO	Not used in UART, floating
25	SWCLK		Burn-in Clock Pins	For burning firmware
26	SWDIO		Burn data pins	For burning firmware
27-28	P0.09 to P0.10		GPIO	Not used in UART, floating

6 MODULE OPERATION INSTRUCTION

6.1 Tool

PC serial port assistant: Baidu "Friendly Serial Port Assistant" can be downloaded. The PC serial port assistant is used to debug the UART interface of the module.Demonstration of module application

6.2 Demonstration of module application
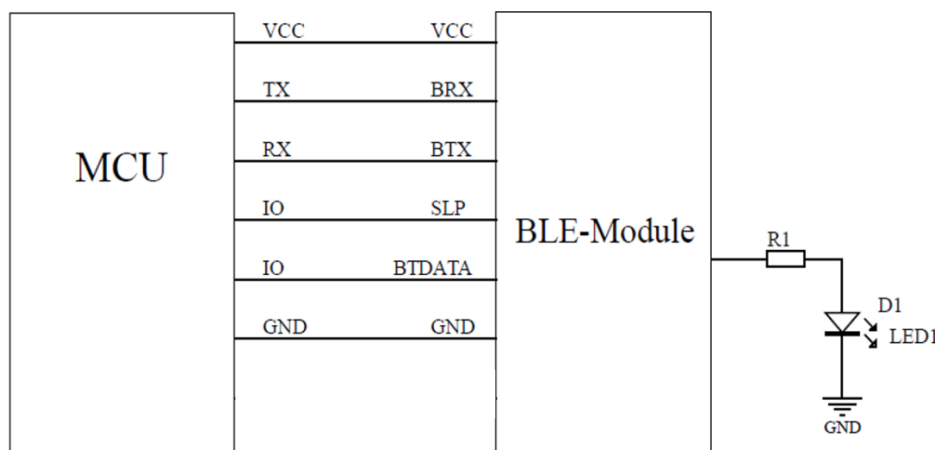
6.2.1 Power supply

The SoC working voltage is 1.7V-3.6V, to ensure a stablefunction, supply voltage should be 3.0V-3.6V.

6.2.2 SLP(Sleep/Awake)

When pull SLP low, the module in broadcast mode. BLE device can be found by smartphone APP, Device name: Minew_Vxxxxx(default) name, module can be connected with smartphone and enters connection mode. When pull SLP high, device will enter sleep mode.

> ⚠ Note：This pin cannot be left floating to avoid unpredictable errors.

6.2.3 BTDATA(UART control)

Only when BTDATA in low level,UART will be available. Both SLP and BTDATA in low level,when module in broadcast mode,all UART commands will be effective.When module in connection mode,all command or data will be transparently transfered.

> ⚠ Note：This pin cannot be left floating to avoid unpredictable errors.

6.2.4 UART interface:TX and RX

When both SLP and BTDATA in low level,UART port will be activated,the module TX and RX should be connected to MCU RX and TX,then start to communicate through UART.

In the test,module TX and RX can be connected with an UART to USB module's RX and TX pin，then send command through Serial Port Utility App from PC.

> ⚠ Note：The TX and RX of 2 modules can be connected reversed, each module connect with a smart phone, then transfer date over BLE between each smart phone.

6.2.5 CON_IND

CON_IND is uded to indicate module status,high level in connection mode, low level in sleep or broadcast mode to wake up MCU and safe power.

6.2.6 FIFO_FULL

FIFO_FULL is used to indicate whether the cache is full or not. When sending large amount of data from MCU to module, this pin can be added to judge. If it is high, then the FIFO is full, and you can not continue to send UART data at this time to avoid packet loss.

6.2.7 Command instruction

Connect VCC、GND to power and GND,SLP、 BTDATA to GND,module in broadcast mode(not connect with other device),UART interface activated,send command to configure or check parameter.

For all device instructions, the returning result is the same:

54544D3A4F4B0D0A00(TTM:OK\r\n\0) is returned after command sent successfully

54544D3A4552500D0A00 (TTM:ERP\r\n\0) is returned after command failed

After sending the correct setting command, the new parameters will take effect immediately(Expect that baud rate change command will only be effective after reset command sent successfully). While only after sending reset command then the command will be kept in flash and automatically effective after power off.

Below is the list of setup instructions：

> ⚠ Note：The first line in the command list should be sent by Hex format, the second line should be sent by ASCII format. When checking the parameter, the returned result are all hexadecimal numbers, so you need to use hexadecimal numbers to parse the command.phone.

The BLE device has scanning and connected states in master mode and broadcast and connected states in slave mode. This module has normal transmission mode as well as long distance transmission mode, for long distance transmission, the air rate is 125kbps, i.e. PHY selection is coded, and the distance is up to 600 meters. In normal transmission mode, the air rate is 125kbps, i.e. PHY is coded, and the distance is up to 600 meters. PHY selection is available in all three states: Broadcast, Scan, and Connected. After SLP and BTDATA are grounded, the PHY can be selected by the following command.

Function	Command（hex/ASCII）	Description
Set Broadcast PHY	54544D3A4144542D <Para> TTM:ADT-<Para>	Length: 1 Byte,Values: 1-3, 1: 1M phy broadcast 2: coded phy broadcast 3: 1M+coded phy toggle broadcast
Read Broadcast PHY	54544D3A4144543F TTM:ADT?	Return TTM:ADT-<Para>\r\n\0, Para: Hexadecimal
Set Scanning PHY	54544D3A5343562D <Para> TTM:SCV-<Para>	Length: 1 Byte, Values: 1-2, 1: only scanning 1M phy broadcasts 2: only scanning coded phy broadcasts
Read Scanning PHY	54544D3A5343563F TTM:SCV?	Return TTM:SCV-<Para>\r\n\0, Para: Hexadecimal
Set Transport PHY	54544D3A434E502D <Para> TTM:CNP-<Para>	Length: 1 Byte, values: 1-2, 1: in 1M phy 2: in coded phy
Read Transport PHY	54544D3A434E503F TTM:CNP?	Length: 1 Byte, values: 1-2, 1: in 1M phy 2: in coded phy

The host-related parameters are scan timeout, scan interval, and connection interval. The Set Connection Interval command is effective for both master and slave modes. Scan Timeout and Scan Interval are valid only under the host module:

Function	Command（hex/ASCII）	Description
Setting the scan timeout	54544D3A5343542D<Para> TTM:SCT-<Para>	Length: 1 Byte, Values: 0-29, Para*5S, 0 means scanning all the time and output scanning result in real time.
Query Scan Timeout	54544D3A5349572D<Para> TTM:SIW-<Para>	Return TTM:SCT-<Para>\r\n\0, Para: Hexadecimal
Setting the scanning interval	54544D3A5349572D<Para> TTM:SIW-<Para>	Length: 1 Byte,Value: 0-100,Para*10S
Query Scan Interval	54544D3A5349573F TTM:SIW?	Return TTM:SIW-<Para>\r\n\0, Para: Hexadecimal
Setting up RSSI filtering	54544D3A5253492D<Para> TTM:RSI-<Para>	Value: -120 ~ -30dBm, if less than -100dbm, then disable RSSI filtering.
Query RSSI Filtering	54544D3A5253493F TTM:RSI?	Return TTM:RSI-<Para>\r\n\0, Para: Hexadecimal

Function	Command（hex/ASCII）	Description
Setting up broadcast name filtering	54544D3A404E462D<Para> TTM:AVF-<Para>	Length: 16 Byte, Value: ASCII code
Query Broadcast Name Filtering	54544D3A404E463F TTM:ANF?	Return TTM:ANF-<Para>\r\n\0, Para: Hexadecimal
Cancel broadcast name filtering	54544D3A404E462D TTM:ANF-	Cancel broadcast name filtering
Setting up MAC address filtering	54544D3A4D41462D<Para> TTM:MAF-<Para>	Length: 6 Byte, value: hexadecimal number
Query MAC Address Filtering	54544D3A4D41463F TTM:MAF?	Return TTM:MAF-<Para>\r\n\0, Para: Hexadecimal
Cancel MAC address filtering	54544D3A4D41462D	Cancel MAC address filtering

⚠️ Note: RSSI, broadcast name and MAC address filtering are added to make it easier to locate the device; only one of MAC address filtering and broadcast name filtering can be effective at the same time; when MAC address filtering is turned on, broadcast name filtering will be turned off automatically; when broadcast name filtering is turned on, MAC address filtering will be turned off automatically.

As a host, you need to send relevant commands to let the device enter the Bluetooth state, such as scanning and initiating a connection to a certain device, and after connecting, when transmitting data, you will judge all the data whether it is a disconnect command.

Function	Command（hex/ASCII）	Description
Turn on scanning	54544d3a5343414e TTM:SCAN	Command correctly return: TTM:SCANNING\r\n\0, error return TTM:ERP\r\n\0, after scanning to the device serial port output 10 RSSI value of the strongest device, scanning timeout is 0 or MAC address filtering scanning output results format 0xAA + MAC + RSSI + adv_data + 0x0D0A, the rest of the output for MAC + broadcast name
stop scanning (computing)	54544d3a5343414e2d53544f50 TTM:SCAN-STOP	The instruction returns correctly: TTM:S-CAN-STOP\r\n\0, incorrectly returns TTM:ERP\r\n\0
Connect to the specified MAC	54544D3A434F4E4E2D <MAC> TTM:CONN-<MAC>	Command return: TTM:CONNING\r\n\0, indicating connection in progress TTM:CONN-TOUT\r\n\0, connection timeout TTM:NO-DEVICE\r\n\0, device not found TTM:CONN-MAC-XXXXXXXXXXXX\r\n\0, connected TTM:MAC-DCON-XXXXXXXXXXXX\r\n\0, Disconnect TTM:ERP\r\n\0, Command Error
Disconnect all connections	54544D3A444953432D414C4C TTM:DISC-ALL	Correctly return TTM:DISC-XXXXXXXXXXX XXX\r\n\0, incorrectly return TTM:ERP\r\n\0

⚠️ Note: The above commands are only valid in host mode, sending these commands when the device role is not host will return TTM:ERP\r\n\0.
Except for the above four commands, all other device commands, whether in master or slave mode, will return TTM:OK\r\n\0 as long as they fulfill their parameter range requirements, and the parameters will take effect when the corresponding roles are in effect.

A master device can initiate a connection to a slave device with a specified MAC and enter connection mode. When the MAC address of the desired connected device is known, the connection command can be sent directly without scanning.

When the device is switched from master mode to slave mode, it is necessary to first ensure that the device is in the unconnected state, call the set role command, and then call the reset command, which can successfully switch to the slave role, and vice versa.

Function	Command（hex/ASCII）	Description
Setting up the rol	54544D3A524F4C2D <Para> TTM:ROL-<Para>	Length: 1 Byte,Values: 0-1, 0 for slave mode, 1 for master mode
Query Role	54544d3a524f4c3f TTM:ROL?	Return to TTM:ROL-<Para>\r\n\0, Para: Hexadecimal

When in slave mode, you can set and query many parameters of the broadcast process and connection process as follows:

Function	Command（hex/ASCII）	Description
Setting the broadcast name	54544D3A52454E2D <Para> TTM:REN-<Para>	Length: 1-16 Byte,Value: ASCII
Query broadcast name	54544d3a52454e3f TTM:REN?	Return TTM:REN-<Para>\r\n\0, Para is ASCII
Setting the broadcast interval	54544D3A4144502D <Para> TTM:ADP-<Para>	Length: 1 Byte, value: 1-20, corresponding to broadcast interval 1*100ms.
Query broadcast interval	54544D3A4144503F TTM:ADP?	Return TTM:ADP-<Para>\r\n\0, Para: Hexadecimal
Setting the transmit power	54544D3A54504C2D <Para> TTM:TPL-<Para>	Length: 1 Byte, Values: 0-8, corresponding to -40, -20, -16, -12, -8, -4, 0, +4, +8 (unit: dB)
Query Transmit Power	54544D3A54504C3F TTM:TPL?	Return TTM:TPL-<Para>\r\n\0, Para: Hexadecimal

Function	Command（hex/ASCII）	Description
Setting the broadcast data	54544D3A4144442D <Para> TTM:ADD-<Para>	Length: 1-16 Byte, value: any hexadecimal number
Query Broadcast Data	54544D3A4144443F TTM:ADD?	Return TTM:ADD-<Para>\r\n\0, Para: Hexadecimal
Setting the factory ID	54544D3A5049442D <Para> TTM:PID-<Para>	Length: 2 Byte, value: any hexadecimal number
Query Factory ID	54544D3A5049443F TTM:PID?	Return TTM:PID-<Para>\r\n\0, Para: Hexadecimal
Setting the Service UUID	54544D3A5549442D <Para> TTM:UID-<Para>	Length: 6Byte, (2 Byte service uuid+2 Byte rx UUID+2 Byte tx UUID) Values: Any hexadecimal number, service, rx, tx UUID can't be the same.
Query Service UUID	54544D3A5549443F TTM:UID?	Return TTM:UID-<Para>\r\n\0, Para: Hexadecimal
Setting the broadcast mode	54544D3A4D4F442D <Para> TTM:MOD-<Para>	Set device broadcast packet format: 0: pass-through broadcast packet 1: iBeacon broadcast packet, you can see the specific broadcast packet format instructions
Query broadcast mode	54544d3a4d4f443f TTM:MOD?	Return TTM:MOD-<Para>\r\n\0, Para: Hexadecimal
Setting the UUID	54544D3A4149442D <Para> TTM:AID-<Para>	Length: 16 bytes, value: any hexadecimal number
Query UUID	54544D3A4149443F TTM:AID?	Return TTM:AID-<Para>\r\n\0, Para: Hexadecimal
Set Major	54544D3A4D414A2D<Para> TTM:MAJ-<Para>	Length: 2 bytes, value: any hexadecimal number
Query Major	54544D3A4D414A3F TTM:MAJ?	Return to TTM:MAJ-<Para>\r\n\0, Para: Hexadecimal
Set Minor	54544D3A4D494E2D <Para> TTM:MIN-<Para>	Length: 2 bytes, value: any hexadecimal number
Query Minor	54544d3a4d494e3f TTM:MIN?	Return TTM:MIN-<Para>\r\n\0, Para: Hexadecimal

Function	Command（hex/ASCII）	Description
Setting the connection mode	54544D3A5057452D <Para> TTM:PWE-<Para>	Whether the device requires a password to connect, 0: no password required to connect 1: Connection password required
Query Connection Mode	54544D3A5057453F TTM:PWE?	Return TTM:PWE-<Para>\r\n\0, Para: Hexadecimal
Setting the connection password	54544D3A5057442D <Para> TTM:PWD-<Para>	Length: 1-8 bytes, value: ASCII, the correct password must be entered within 5s on the connection, otherwise the connection will be disconnected
Query connection password	54544D3A5057443F TTM:PWD?	Return to TTM:PWD-<Para>\r\n\0, Para:ASCII

Whether it is the host mode or the slave mode, all the setting commands need the reset command to take effect. while the query command will return the relevant parameters, and the command error will return TTM:ERP\r\n\0. For the whole device, the baud rate, the connection interval commands take effect regardless of whether it is the host mode or the slave mode.

Function	Command（hex/ASCII）	Description
Setting the baud rate	54544D3A4250532D <Para> TTM:BPS-<Para>	Length: 1 Byte, Values: 0-4, corresponding to 9600/ 19200/38400/57600/115200 (unit: bps) respectively.
Query Baud Rate	54544D3A4250533F TTM:BPS?	Return TTM:BPS-<Para>\r\n\0, Para: Hexadecimal
Setting the connection interval	54544D3A4349542D <Para> TTM:CIT-<Para>	Length: 1 Byte, <Para> can only be represented in hexadecimal as 0x01~0x64; The actual connection interval is (<Para>*10~<Para>*10+20)ms
Query Connection Interval	54544D3A4349543F TTM:CIT?	Return to TTM:CIT-<Para>\r\n\0, Para: Hexadecimal
Retrieve MAC address	54544d3a4d4143(2d)3f TTM:MAC-? or TTM:MAC?	Return TTM:MAC-<Para>\r\n\0, Para: Hexadecimal
Read version information	54544d3a564552(2d)3f TTM:VER-? or TTM:VER?	Return to TTM:VER-<Para>\r\n\0, Para:ASCII

Function	Command（hex/ASCII）	Description
Restore factory equipment	54544d3a5253542d464143 TTM:RST-FAC	Consistent with the return of the setup command
reset (a dislocated joint, an electronic device etc)	54544d3a5253542d535953 TTM:RST-SYS	Success will return TTM:OK\r\n\0

6.3 Example of operation

6.3.1 Factory Default Parameters

Factory Default Parameters:
Serial port baud rate: 9600bps,8N1
Transmit power: 0dBm
Minimum and maximum connection interval: 20ms - 40ms
Device Role: Host
Broadcast, Scan, Connect PHY: 1M
DC_RC: DCDC on, external 32K
Default parameters related to host mode:
Scanning timeout: 10s
Scanning interval: 100ms
Default parameters related to slave mode:
Broadcast Name: Minew_Vxxxxx
Broadcast interval: 1s
Broadcast mode: pass-through broadcast package
Customized data: MinewTech
Connection password enable: not enabled
Connection password: minew123
Major: 0x1234
minor: 0x1235
UUID:
74278BDA-B644-4520-8F0C-720EAF059935

6.3.2 Example of Modifying Parameters

Connect all the pins according to the wiring, ground SLP and BTDATA, the device enters the unconnected state, at this time you can set the parameters, whether it is the host mode or the slave mode, all the parameters can be set, the parameters take effect immediately. Parameters after taking effect can only be reflected under the corresponding role. For example, if the broadcast name of the device is changed in the host mode, the parameters will take effect, but only when the device is switched to the slave mode will you see that the broadcast name has been changed. After sending the reset command, all the parameters are powered down and saved.

> ⚠ Note: When you need to modify multiple parameters, you can send all the setting commands first and then send the reset command.
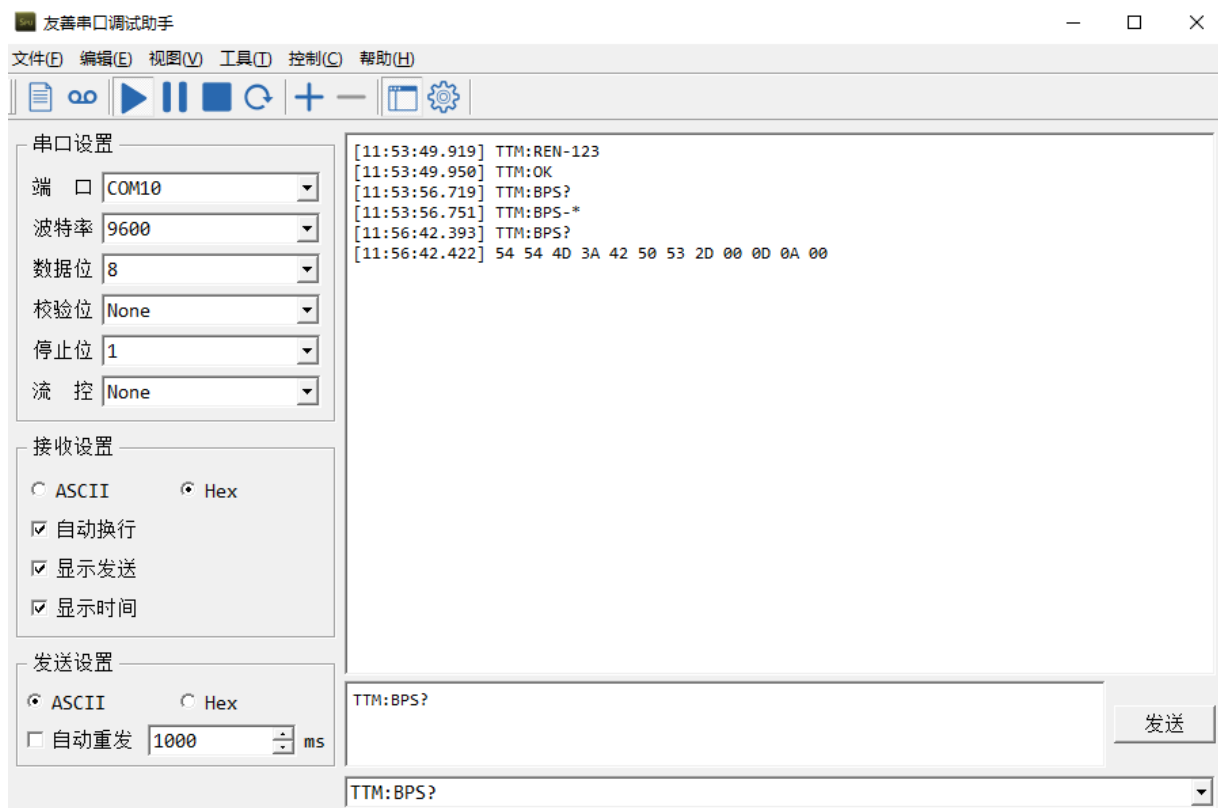
When querying the device parameters, because the parameters are hexadecimal numbers, when selecting the ASCII display, the parameter position may be garbled, at this time, you need to set to HEX display, the parameters correspond to the position after 2D, see the above figure, query the baud rate, you need to use the HEX display to view the specific parameters.

6.3.3 Scanning devices and connections

Send the 54544D3A5343414E (TTM:SCAN) command to scan for a device and obtain its MAC address. The scanned device returns MAC + broadcast name information. Send the 54544D3A434F4E4E2D201907230857 command and the module will connect the device with MAC address 20:19:07:23:08:57. The device connected will return TTM:CONN-MAC-XXXXXXXXXXXXX\r\n\0. Since MAC is a hexadecimal number, the entire command is sent as a hexadecimal number. Once connected you can perform data passthrough.
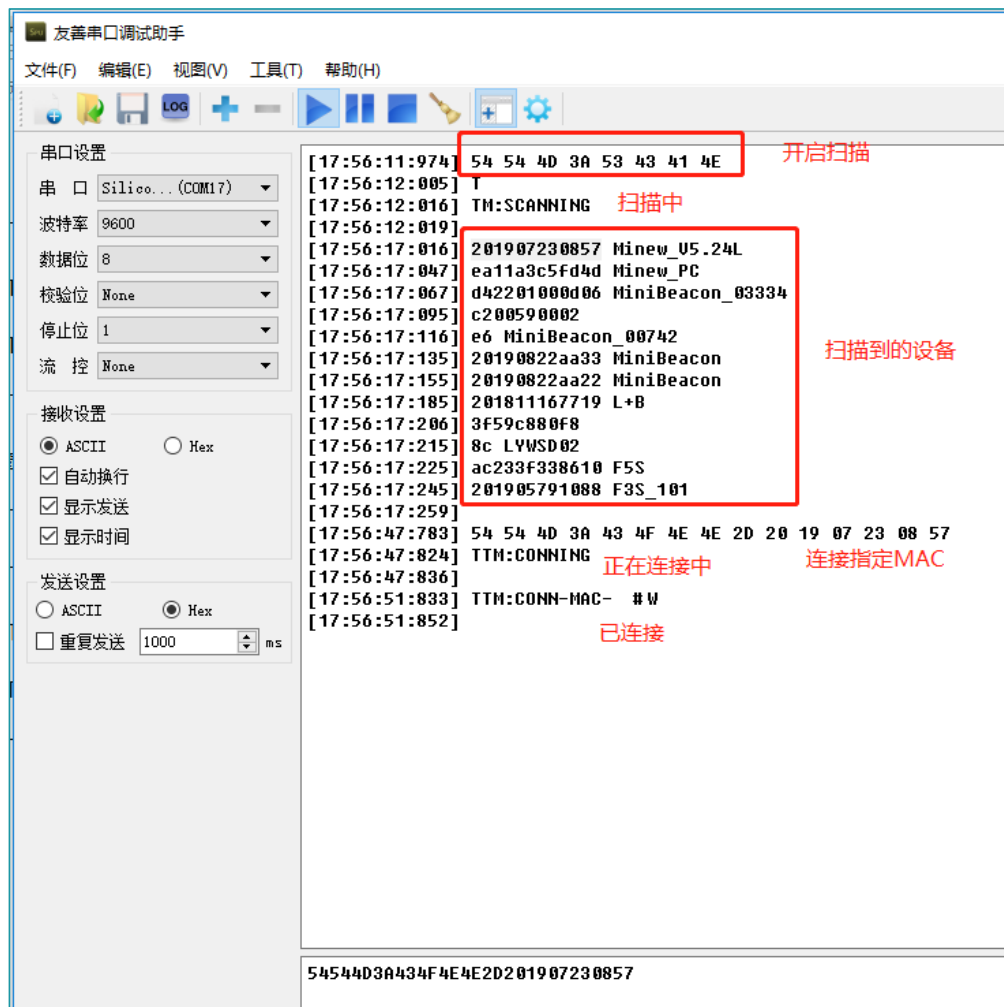
6.3.4 mainframe transmission

Data passthrough is possible after the connected command is returned in step 7.3 The prerequisite for correct communication between the module and the slave device is that the slave device must have the same services, features, and their UUIDs and attributes as the module.

Relevant information is provided below:

Eigenvalue UUID	Executable operation	Packet length	Note
FFF1	notify	244	Module data reception, the data sent from the device to the module shall not exceed 244 Byte per packet.
FFF2	write	244	Module data sending, the module has to do automatic packetization, data more than 244 Byte will be automatically divided into 244 packets sent to the slave device.

As an example, the master module connects to the passthrough slave module, and then sends the data after connecting.
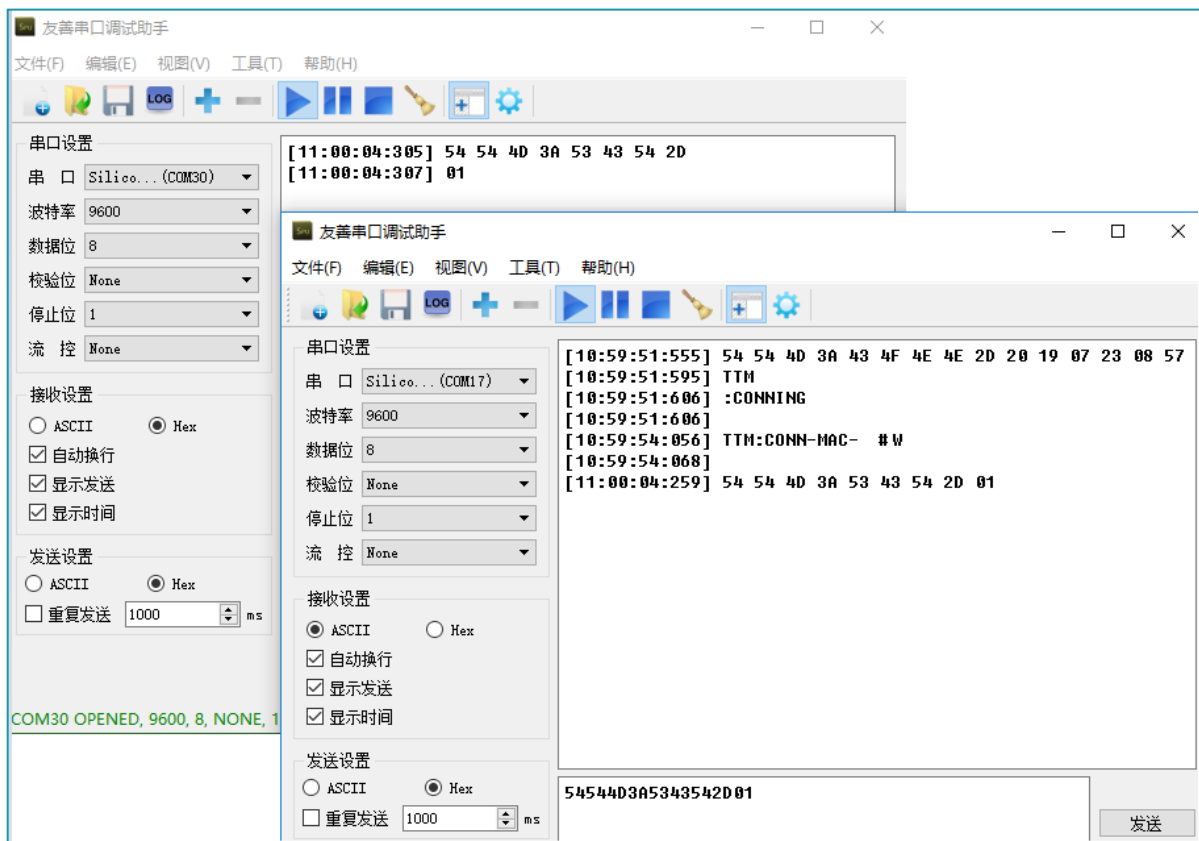

6.3.5 slave radio

After setting the device role to slave mode with the command TTM:ROL-0, data can be transmitted to and from the cell phone. With the SLP pin low, the device is in broadcast state. Use nrf connect to scan the device, click Raw after scanning to the device, Raw data is the unparsed data of the scanned device. After parsing the data according to BLE data type, see Detail section, BLE broadcast data has a certain format: length + type + content.

The content is changeable, the type is fixed and the length is determined by the content. There are two broadcast formats for the device, the pass-through broadcast packet and the iBeacon broadcast packet. Both formats contain four types: flag(0x01), broadcast name(0x09), service data(0x16), and manufacturer data(0xFF).

The following figure shows the transmitting broadcast packet: flag, broadcast name, service data is put in the broadcast packet, manufacturer data is put in the reply packet. The service data content is: service data UUID(E1FF) + MAC address. manufacturer data content consists of company id(3906) + battery level information(1 byte) + custom data.
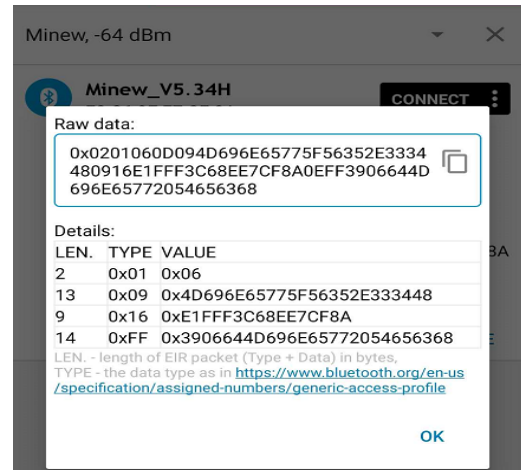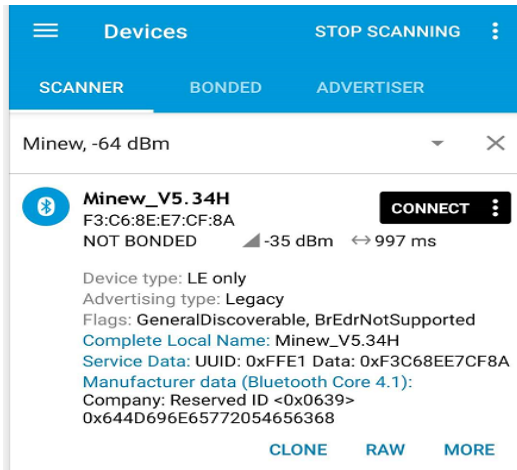
⚠ Note: The IOS side can not get the content of the MAC address field, so the MAC address is put back into the broadcast packet to ensure that the IOS side can get the device MAC address. In addition, the WeChat applet can't get the reply packet, so the MAC is put into the service data of the broadcast packet to ensure that the IOS side can also get the device MAC address using the WeChat applet connection.

The following figure shows the iBeacon broadcast packet: flag, manufacturer data is put in the broadcast packet, service data and broadcast name are put in the reply packet. The broadcast packet must follow this fixed format to fulfill the iBeacon protocol definition. In manufacturer data data, 4C 00 is Apple's company id, 02 15 is iBeacon's fixed format, Proximity uuid(16 bytes)+Major(2 bytes)+Minor(2 bytes)+Measured power(1 byte). In iBeacon broadcast mode, manufacturer data can only change the value of Proximity uuid, Major, Minor.
service data= service data UUID(FFE1) + battery level information + MAC address.
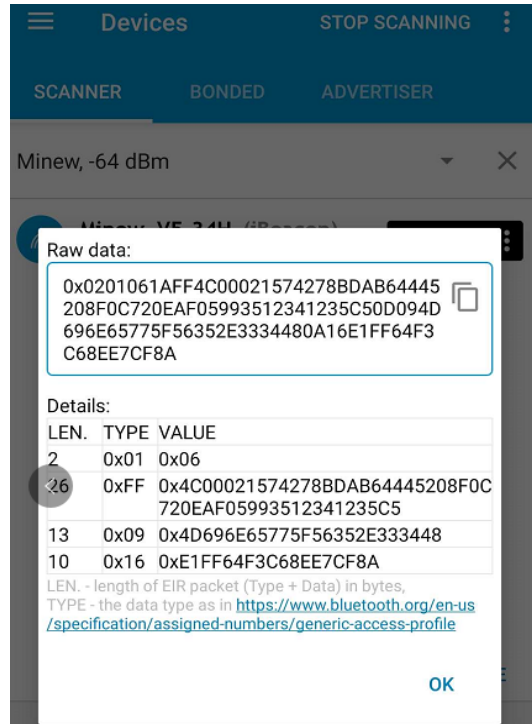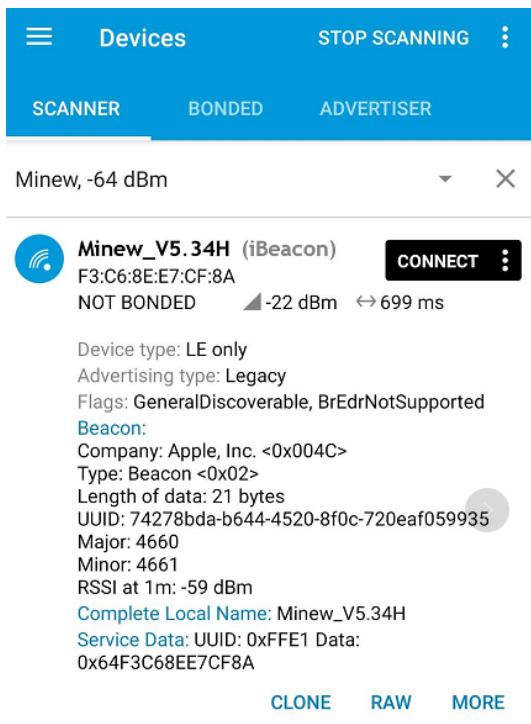
6.3.6 Slave transponder

Based on 7.2, connect to the device using the mobile app and keep the BTDATA pin low to perform data passthrough. when BTDATA is not low, it does not affect the broadcasting and connecting of the device, just that passthrough is not possible. Using nRF connect, you can see the specific service, characteristic and corresponding properties.

The UUID consists of the alias UUID (2 byte, 3.4 byte on the left in the figure) + the base UUID (the remaining 14 byte).

The base UUID used for services, features in the passthrough program is standard and is illustrated below with the alias UUID.
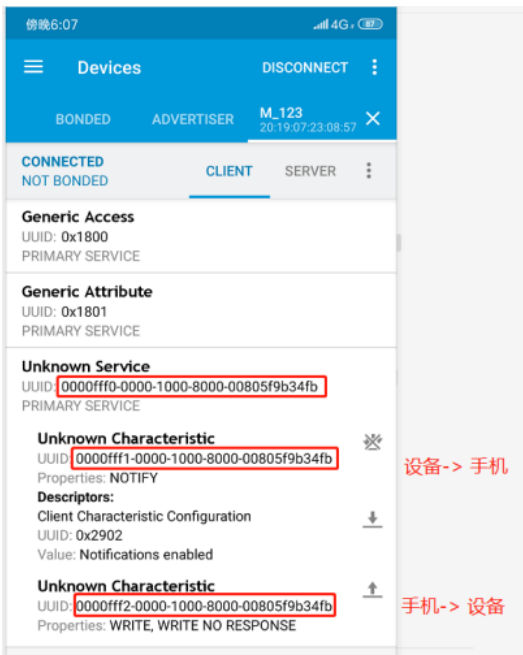

FFF0 is the service UUID, FFF1 is the cell phone receives data and the module sends data; FFF2 is the cell phone sends data and the module receives data.

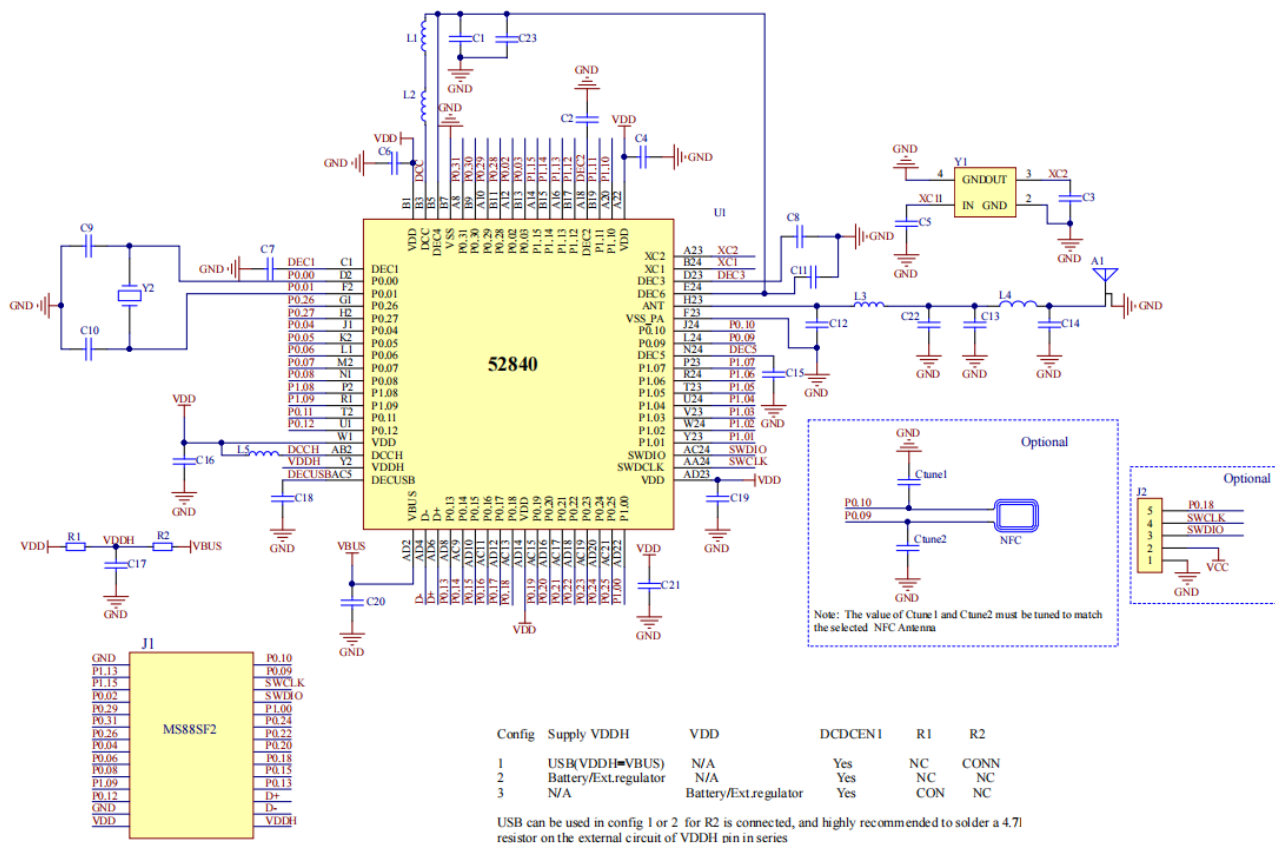| Eigenvalue UUID	Executable operation	Maximum Packet Length	Note
FFF1	notify	244	The serial port sends data to the module, which is forwarded to the phone. The cell phone enables notify before it can get the data. The maximum number of bytes the module can send in a packet is 244 byte. Note: This process firmware does automatic sub-package processing, you can do not have to follow the length of a package for sub-package.
FFF2	write	244	The phone sends data to the module and forwards it to the serial port. When using the API interface function to write data, the maximum length of data written at one time is 244 bytes

7 MECHANICAL DRAWING

PCB antenna   IPEX antenna
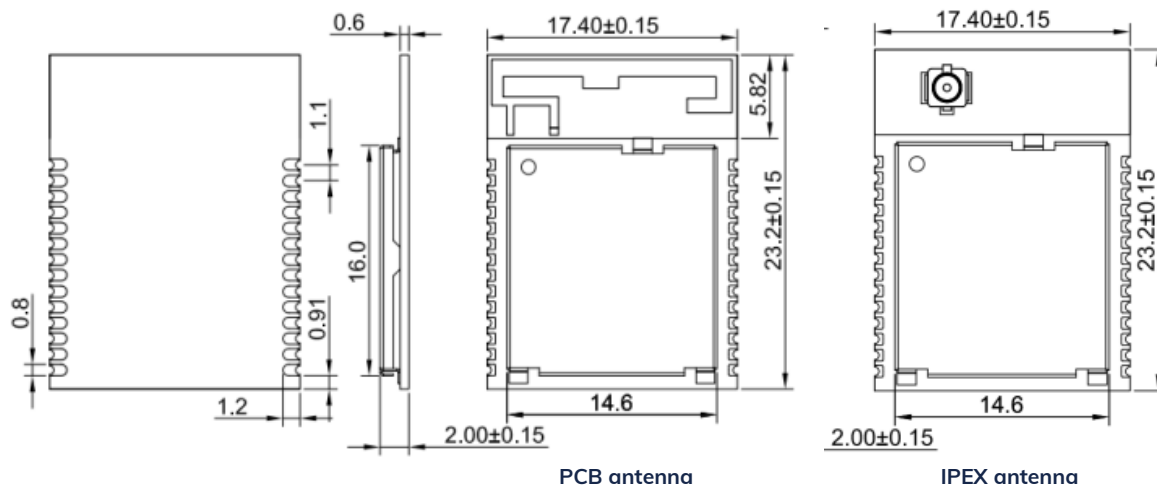
⚠	Default unit：mm Default tolerance：±0.15

⚠	Note: Recommended pad size 1.8*0.8mm, pad extends outward 0.5mm

8 ELECTRICAL SCHEMATIC

Config	Supply VDDH	VDD	DCDCEN1	R1	R2
1	USB(VDDH=VBUS)	N/A	Yes	NC	CONN
2	Battery/Ext.regulator	N/A	Yes	NC	NC
3	N/A	Battery/Ext.regulator	Yes	CON	NC

USB can be used in config 1 or 2 for R2 is connected, and highly recommended to solder a 4.7l resistor on the external circuit of VDDH pin in series

| ⚠	Notice：Before placing an order, please confirm the specific configuration required with the salesperson.

9 PCB LAYOUT

There should be no GND plane or metal cross wiring in the module antenna area, and components should not be placed nearby. It is best to make a hollow or clear area, or place it on the edge of the PCB board.

⚠ Notice: Refer to examples as below, and highly suggest to use the first design and the adjustment of modules antenna design according to the first wiring.
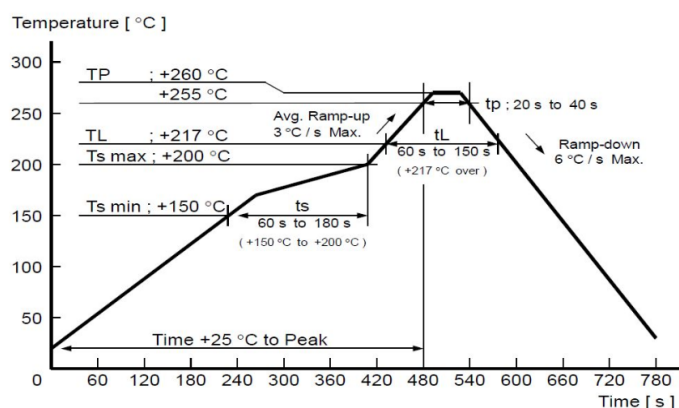
Layout Notes：

1) Preferred Module antenna area completely clearance and not be prevented by metals, otherwise it will influence antenna's effect (as above DWG. indication).

2) Cover the external part of module antenna area with copper as far as possible to reduce the main board's signal cable and other disturbing.

3) It is preferred to have a clearance area of 4 square meter or more area around the module antenna (including the shell) to reduce the influence to antenna.

4) Device should be grounded well to reduce the parasitic inductance.

5) Do not cover copper under module's antenna in order to avoid affect signal radiation or lead to transmission distance affected.

6) Antenna should keep far from other circuits to prevent radiation efficiency reduction or affects the normal operation of other lines.

7) Module should be placed on edge of circuit board and keep a distance away from other circuits.

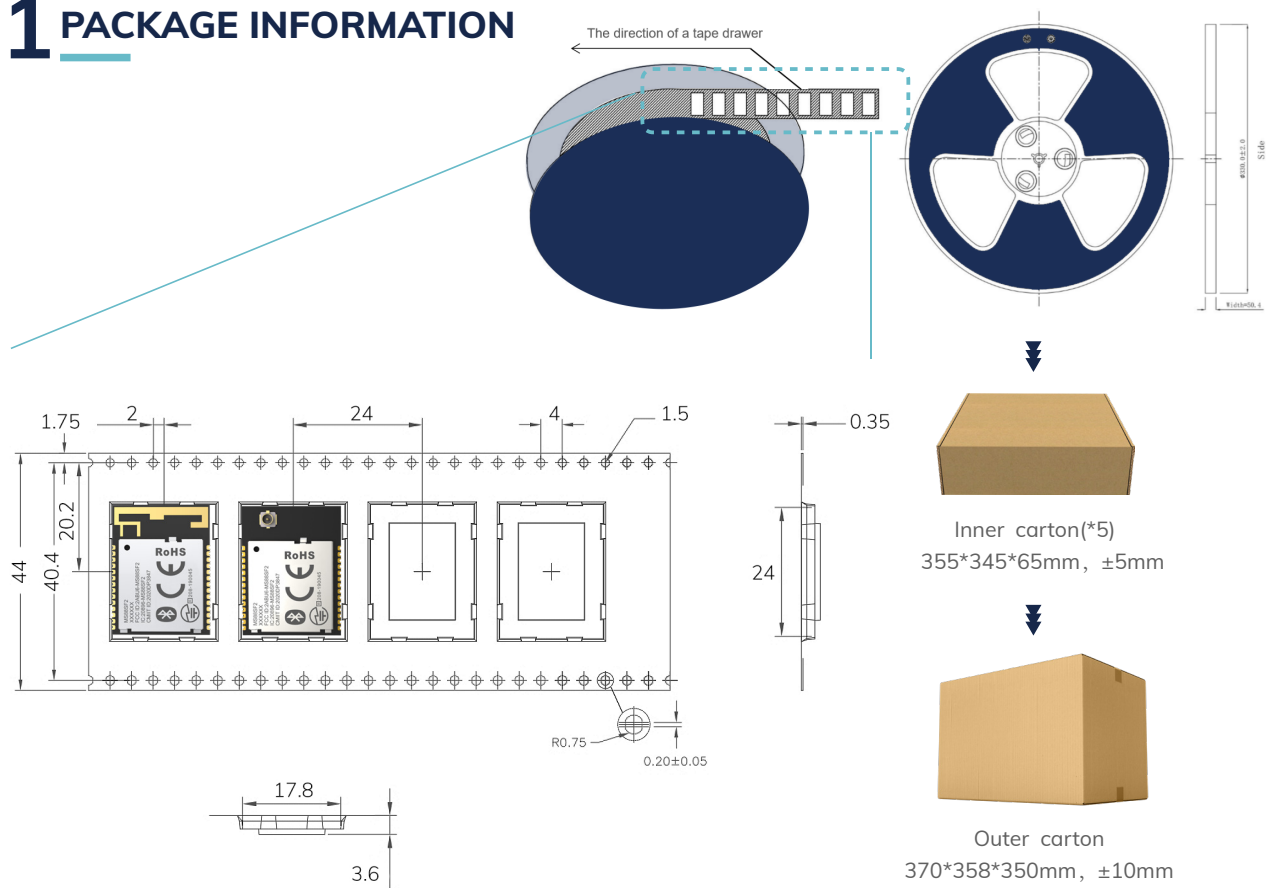8) Suggesting to use magnetic beads to insulate module's access power supply.
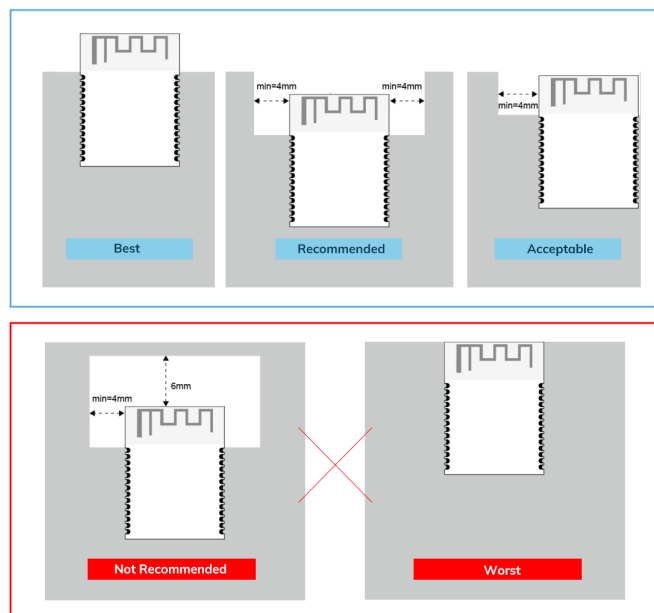
10 REFLOW AND SOLDERING

1) Do SMT according to above reflow oven temperature deal curve. Max. Temperature is 260℃；

2) Refer to IPC/JEDEC standard；Peak TEMP<260℃；Times：≤2 times，suggest only do once reflow soldering on module surface in case of SMT double pad involved. Contact us if special crafts involved.

3) Suggesting to make 0.2mm thickness of module SMT for partial ladder steel mesh, then make the opening extend 0.8mm

4) After unsealing, it cannot be used up at one time, should be vacuumed for storage, couldn't be exposed in the air for long time. Please avoid getting damp and soldering-pan oxidizing. If there are 7 to 30 days interval before using online SMT, suggest to bake at 65-70 ℃ for 24 hours without disassembling the tape.
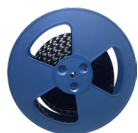
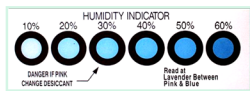5) Before using SMT, please adopt ESD protection measure.

11 PACKAGE INFORMATION

The direction of a tape drawer

Inner carton(*5)
355*345*65mm，±5mm

Outer carton
370*358*350mm，±10mm

Dimensions shown: 1.75, 2, 24, 4, 1.5, 44, 40.4, 20.2, 17.8, 3.6, R0.75, 0.20±0.05, 0.35, 24

Remarks

General material list for FCL packaging:

Carrier tape packaging tray

Humidity Indicator
(1 pcs/bag)

Desiccant
(placed in a vacuum bag)

Vacuum bag

Inner carton(*5)
355*345*65mm，±5mm

Outer carton
370*358*350mm，±10mm

Other:

Moisture-proof label (attached to the vacuum bag)

Certification label (attached to the vacuum bag)

Outer box label

⚠ Default unit：mm   Default tolerance：±0.1

Packing detail	Specification	Net weight	Gross weight	Dimension
MS88SF2	650PCS	460g	1200g	W=44mm，T=0.35mm

⚠ Note: Default weight tolerance all are within 10g（except the special notes）

12 STORAGE CONDITIONS

- **Please use this product within 6 months after signing the receipt.**
  - This product should be stored without opening the package at an ambient temperature of 5~35°C and a humidity of 20~70%RH.
  - This product should be left for more than 6 months after receipt and should be confirmed before use.
  - The product must be stored in a non-corrosive gas (Cl2, NH3, SO2, NOx, etc.).
  - To avoid damaging the packaging material, do not apply any excessive mechanical shocks, including but not limited to sharp objects adhering to the packaging material and product dropping.

- **This product is suitable for MSL2 (based on JEDEC standard J-STD-020).**
  - After opening the package, the product must be stored at ≤30°C/<60%RH. It is recommended to use the product within 3-6 months after opening the package.
  - When the color of the indicator in the package changes, the product should be baked before welding.

- **Baking is not required for one year if exposure is limited to <30°C and 60%RH. Refer to MSL2 for exposure criteria for moisture sensitivity level. If exposed to (≥168h@85°C/60%RH) conditions or stored for more than one year, recommended baking conditions.**
  1. 120 +5/-5°C, 8 hours, 1 time
  Products must be baked individually on heat-resistant trays because the materials (base tape, reel tape, and cover tape) are not heat-resistant, and the packaging material may be deformed at temperatures of 120℃;
  2、90℃ +8/-0℃，24hours，1times
  The base tape can be baked together with the product at this temperature. Please pay attention to the uniformity of heat.

13 HANDLING CONDITIONS

- Be careful in handling or transporting products because excessive stress or mechanical shock may break products.
- Handle with care if products may have cracks or damages on their terminals. If there is any such damage, the characteristics of products may change. Do not touch products with bare hands that may result in poor solder ability and destroy by static electrical charge.

14 QUALITY

Cognizant of our commitment to quality, we operate our own factory equipped with state-of-the-art production facilities and a meticulous quality management system. We hold certifications for ISO9001, ISO14001, ISO27001, OHSA18001, BSCI.

Every product undergoes stringent testing, including transmit power, sensitivity, power consumption, stability, and aging tests. Our fully automated module production line is now in full operation, boasting a production capacity in the millions, capable of meeting high-volume production demands.

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16 RELATED DOCUMENTS

- nRF52840_Chip_Datasheet
  https://en.minewsemi.com/file/nRF52840_Chip_Datasheet_EN.pdf

- MinewSemi_Product_Naming_Reference_Manual_V1.0
  https://en.minewsemi.com/file/MinewSemi_Product_Naming_Reference_Manual_EN.pdf

- MinewSemi_Connectivity_Module_Catalogue_V2.0
  https://en.minewsemi.com/file/MinewSemi_Connectivity_Module_Catalogue_EN.pdf

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