Wireless-Tag WT52840-S1

BLE Low Energy 5.0 Module
DATASHEET

Overview:

WT52840-S1 is a high-performance, ultra-low energy (BLE Low Energy) RF transceiver system module that uses Nordic's nRF52840 as the core processor. The overall size is 27.28*18.74*2.30, which is suitable for most application scenarios with volume requirements. The module supports BLE S140 SoftDevice, a BLE 5.0 pre-qualified protocol stack.

The module is used as a master or a slave, and the client's MCU is connected to the module through the UART port. When the module is used as a master, it can scan and search for the broadcast of our WT52810-S1, WT52832-S2, WT52840-S1 series modules to establish a connection. After successful connection, the two-way communication between the two modules can be realized through the serial port. The user can exchange data or control the communication parameters of the module through the UART port. The meaning of the data is defined by the upper application user. When the module is used as a slave, it can be connected by other mobile devices or master modules. App or master data will be received by the module and pushed to MCU through UART. After the module receives the data packet from the serial port of the client's MCU, it will automatically forward it to the mobile device or master.

Features:

- Operating temperature: -40℃~85℃, typical 25℃
- CPU: nRF52840-QIAA (32-bit ARM Cortex-M4F processor)
- Memory: 1MB flash + 256KB RAM memory
- Transparent transmission (Bridged method), easy and fast to use even for developers without BLE protocol stack development experience;
- Adopt standard UART (TTL) interface, bidirectional data reading and simple to operate;
- Support serial AT commands, users can modify the module's serial port baud rate (default 115200bps), name, MAC address and other basic parameters;
- Support master mode or slave mode;
- Serial data packet length: single data packet can support data length up to 244bytes;
- Operating distance: 0~45m, class II level;
- System: support Android and IOS;
- Supply voltage: 2.0~3.6V (3.3V typical);
- The module comes with a PCB antenna, and an external antenna can also be used (customization required);
- Module size：27.28*18.74*2.30mm
- Sleep current: 0.3uA

Applications:

- Electronic scales
- Electronic cigarettes
- Smart cups
- Smart bracelets
- Smart watches
- BLE toys
- Intelligent hardware
- Smart home

Revision History			3 / 27
Version	Author	Date	Description
0.0.1	Brussin	August 14, 2020	First release

Contents

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1. Working Mode Diagram

Master Mode

Slave Mode
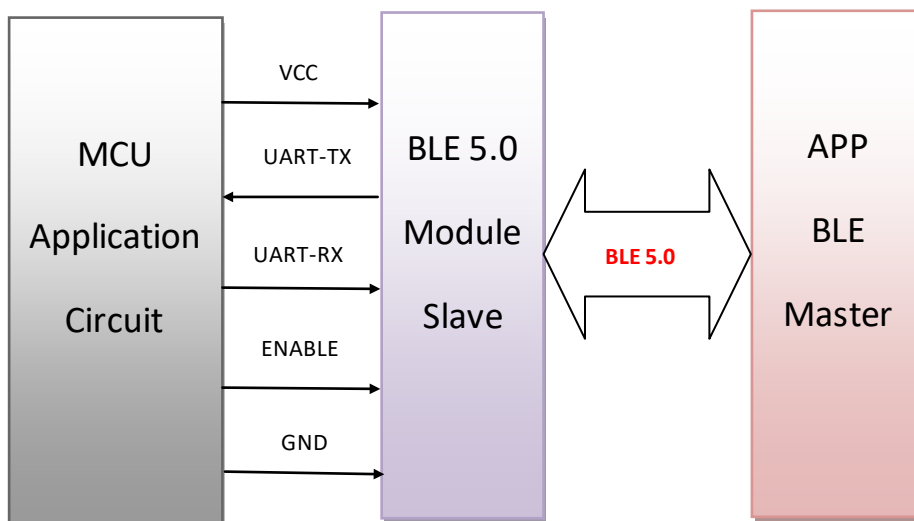
2. Module Pin Definitions and Module Size

GND   WT52840_S1   RF
P1.06   P0.09
P1.04   P0.10
P1.02   P1.11
SWCLK   GND
SWDIO   P1.10
P1.01   P1.13
P0.25   P1.15
P1.00   P0.02
P0.24   P0.29
P0.22   P0.31
P0.20   P0.00
P0.17   P0.01
P0.15   P0.26
P0.13   P0.04
GND   P0.06

P0.11 GND D+ D- VBUS DCCH VDDH VDD_NRF P0.12 P1.09 P0.08
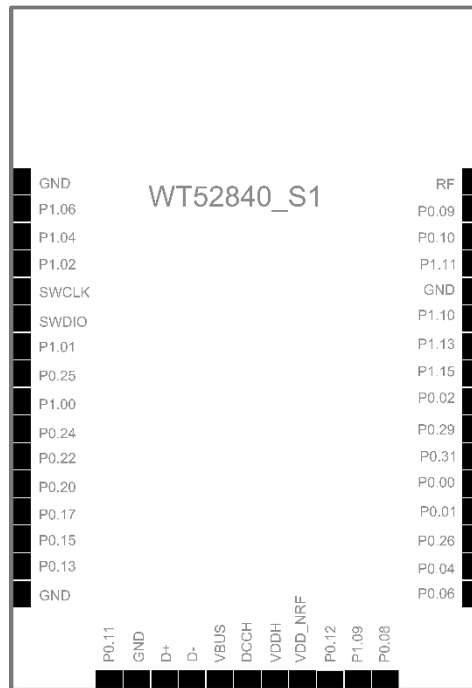
Bottom view

2.1 Pin Description

Chip Pin	Module Pin	Function Description
VDD_NRF	VDD	DC 2.0~3.6V
GND	GND	Ground
P0.04	ENABLE	Serial port enabling pin, pull it up to activate the module serial port functions, pull it down to close the serial port, the module power consumption is reduced
P0.06	TXD	UART--TX
P0.08	RXD	UART--RX
P0.13	Led status	BLE status indication, broadcast/scan status flashes, connection status is always on
P0.11	Wake up	Module wake-up pin, wake up on rising edge after module sleep
SWDCLK	SWDCLK	Debug clock signal input
SWDIO	SWDIO	Debug Interface

2.2 Module Package Size

Tolerance ±0.1mm

2.3 Reflow Soldering Reference Diagram
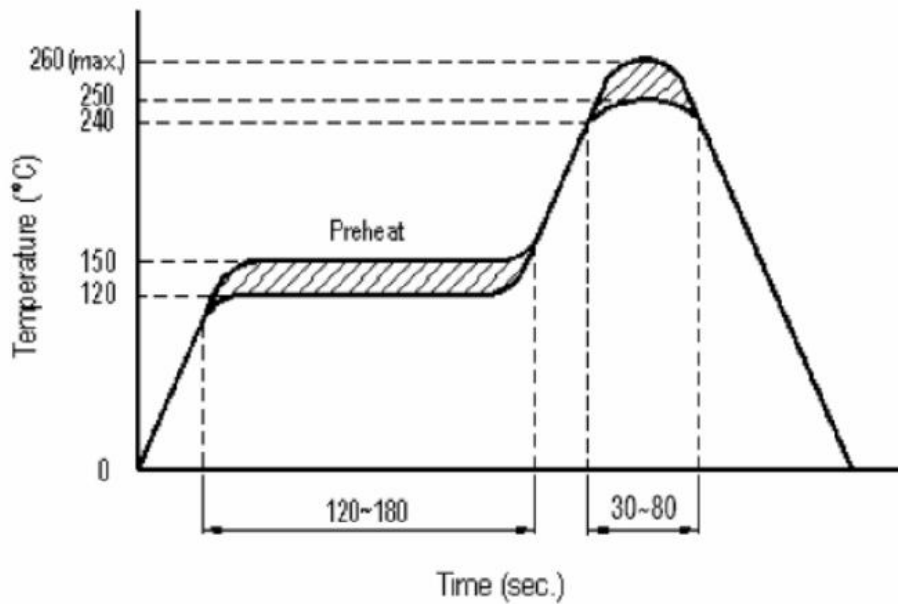
3.   Module Power Consumption Description

To control the power consumption of the module, when the serial port enable pin (enable) is at a low level, the UART of the module is closed; At this time, the serial port data and AT commands cannot be sent normally, but the serial port can receive the BLE transparent data normally. After the data transparent transmission is completed, the UART will continue to remain active for 5s to provide the user MCU with a response time (if necessary), and then the serial port will automatically close . When the serial port enable pin (enable) is at a high level, the module UART is in an active state, and the serial port function can be used normally. When the BLE function is not required, the module can be put into sleep mode by using the sleep command, at which time the power consumption is 0.3uA; After sleeping, you can wake up the module by pulling up the wake up pin.

4.   Serial Transparent Transmission Protocol Instructions

Serial transparent transmission means that the module connects with the user MCU through a general-purpose serial port to establish two-way communication between the user MCU and the mobile device. The module can obtain up to 244 bytes of transmission data from the serial port at a time.   The mobile device can send a data packet with a maximum of 244 bytes to the module each time. After the module receives the data packet, it will be forwarded and transmitted to the MCU serial port receiver in turn. Users can modify the basic BLE parameters of the module through serial AT commands. For details, see *Serial AT Commands Description*.

    4-1. Serial hardware protocol: default 115200bps, 8, no parity bit, 1 stop bit;
    4-2. In order to save volume, the module adopts TXD/RXD dual-wire serial port mode, without

increasing data flow control, it is recommended that the serial port rate should not be set too high to avoid packet loss problems. It is recommended to use 115200bps, and the highest can be set to 250000bps;

4-3. The default BLE connection interval time of the module is 45ms. If you need to save power consumption and adopt low-speed forwarding mode, you can adjust the BLE connection interval through AT commands. The longest BLE connection interval is 2000ms.

5. Serial AT Commands Description

The module will automatically identify and distinguish serial port data. The data packet with the beginning of AT+ will be defaulted as AT command and parsed, and the processing result will be returned. Therefore, the data in transparent transmission mode cannot start with AT+ characters.

No.	Command	Description	Permission
1	AT+TEST	AT firmware test	Allowed
2	AT+VERSION?	Query firmware version	Allowed
3	AT+RESET	Reset	Allowed
4	AT+BAUD=	Set serial baud rate	Allowed
5	AT+ADDR?	Query MAC address	Allowed
7	AT+ADDR=	Set MAC address	Allowed in disconnected state
8	AT+ROLE?	Query role	Allowed
9	AT+ROLE=	Set role	Allowed in disconnected state
10	AT+NAME?	Query BLE name	Allowed
11	AT+NAME=	Set BLE name	Allowed in disconnected state
12	AT+ADP=	Set BLE advertising interval	Allowed in disconnected state
13	AT+ADV_START	Start advertising	Allowed in slave mode and disconnected state
14	AT+ADV_STOP	Stop advertising	Allowed in slave mode and disconnected state
15	AT+SCAN_START	Start scanning	Allowed in master mode and disconnected state
16	AT+SCAN_STOP	Stop scanning	Allowed in master mode and disconnected state
17	AT+CIT=	Set BLE connect interval time	Allowed in disconnected state
18	AT+CONN=	Set the MAC address of the target device connected in master mode	Allowed
19	AT+CONN?	Query the MAC address of the target device in	Allowed

		master mode	
20	AT+DISCONN	Disconnect BLE	Allowed in connected state
21	AT+RFPW?	Query transmit power	Allowed
22	AT+RFPW=	Set transmit power	Allowed in disconnected state
23	AT+PID=	Set serial number	Allowed in disconnected state
24	AT+ADD=	Set custom data	Allowed in disconnected state
25	AT+STATUS?	Query device status	Allowed
26	AT+DEFAULT	Restore default settings, take effect after restart	Allowed
27	AT+SLEEP	Sleep	Allowed
28	AT+DFU	Firmware update	Allowed

5.1 Test Command

Command format: AT+TEST\r\n

Return value：   OK\r\n

Content: Send AT test command. The return value OK indicates that the module AT command function is normal.

5.2 Query Module Version Command

Command format: AT+VERSION?\r\n

Return value：   0.0.1\r\n

Content: Query the current version of the module and return the current version number 0.0.1.

5.3 Module Reset Command

Command format: AT+RESET\r\n

Return value：   OK\r\n

Content: Module reset command. After returning OK, the module resets and restarts.

5.4 Serial Baud Rate Operation Command

Command format: AT+BAUD=115200\r\n

Return value：   OK\r\n

ERR:CODE\r\n

Content: Modify the serial baud rate of the module communication to 115200bps. Returning value OK indicates that the modification has been successful, and returning value ERR indicates that the new serial baud rate has failed to be modified because the set value is not commonly used serial baud rate value. Currently, the serial baud rates supported by the module are：1200/2400/4800/9600/14400/19200/28800/38400/57600/76800/115200/230400/250000

5.5 MAC Address Operation Command

Command format： AT+ADDR?\r\n
Return value： xxxxxxxxxxxx\r\n
Content: Return the current MAC address of the module： xxxxxxxxxxxx
Command format： AT+ADDR=123456789ABC\r\n
Return value： OK\r\n
            ERR:CODE\r\n
Content: Modify the MAC address of the module as： 123456789ABC. Returning value OK means that the MAC address has been reset successfully.

Note: The MAC address of the module cannot be modified when the BLE module is in the connected state. It needs to be modified after disconnecting the module. After the modification is successful, if the module is in the slave mode, it will restart broadcasting with the new MAC address.

5.6 Device Role Operation Command

Command format： AT+ROLE?\r\n
Return value： C\r\n （master mode）
            P\r\n （slave mode）
            ERR:CODE\r\n
Content: Query current device role
Command format： AT+ROLE=C \r\n
Return value： OK\r\n
            ERR:CODE\r\n
Content: Set the current device role to the master mode.
Note: The BLE module cannot be set when it is connected. It needs to be modified after disconnecting the module.

5.7 BLE Name Operation Command

Command format: AT+NAME=WT52840-S1\r\n
Return value: OK\r\n
ERR:CODE\r\n
Content: Rename the module as: WT52840-S1, the length of the name does not exceed 22 bytes; Return value ERR indicates renaming failed. The reason is that the length has exceeded the length limit or BLE has been connected. It needs to be modified after disconnecting; In slave mode, after the setting is successful, BLE will restart broadcasting with the new name.

Command format: AT+NAME?\r\n
Return value: WT52840-S1\r\n
Content: Query the current device name of the module, and the serial port returns the current device name: WT52840-S1.

5.8 Set BLE Advertising Interval Command

Command format: AT+ADP=500\r\n
Return value: OK\r\n
ERR:CODE\r\n
Content: The effective time interval of BLE advertising is set to 45ms—4000ms, and the factory default is 100ms. Reset the BLE advertising interval to500ms. Returning value OK indicates that the reset is successful, and returning value ERR indicates reset failure. In the BLE connection state, you cannot modify it. You need to disconnect the BLE connection to modify it.

5.9 BLE Advertising Operation Command

Command format: AT+ADV_START\r\n
Return value: OK\r\n
ERR:CODE\r\n
Content: Start BLE advertising. It can be operated in slave mode and BLE is not connected.

Command format: AT+ADV_STOP\r\n
Return value: OK\r\n
ERR:CODE\r\n
Content: Stop BLE advertising. It can be operated in slave mode and BLE is not connected.

5.10 Master Scanning Operation Command

Command format: AT+SCAN_START\r\n
Return value: OK\r\n
                     ERR:CODE\r\n
Content: Start BLE scanning. It can be operated in master mode and BLE is not connected.

Command format: AT+SCAN_STOP\r\n
Return value: OK\r\n
                     ERR:CODE\r\n
Content: Stop BLE scanning. It can be operated in master mode and BLE is not connected.

5.11 Set BLE Connection Interval Time Command

Command format: AT+CIT=100\r\n
Return value: OK\r\n
                     ERR:CODE\r\n
Content: The effective BLE connection interval time is 10ms—2000ms, and the factory default is 45ms. Reset the BLE connection interval time to 100ms. Returning value OK indicates successful reset and ERR indicates reset failure.

Note: The module does not support modifying connection interval time during the dynamic process. The modification will take effect after restarting the module. In the BLE connecting state, it cannot be modified and the BLE connection needs to be disconnected. The shorter the BLE connection interval time, the faster the BLE communication rate and the higher the power consumption.

5.12 BLE Connection Operation Command

Command format: AT+CONN=F0F1F2F3F4F5r\n
Return value: OK\r\n
                     ERR:CODE\r\n
Content: Set the MAC address of the target device connected by BLE in master mode, little-endian; After the setting is successful and scanning is turned on, the master will automatically connect to the device; If the target device is not set, the master will connect to the first slave module found by default(Only for WT52810-S1, WT52832-S2, WT52840-S1 series modules).
Command format: AT+CONN?\r\n
Return value: F0F1F2F3F4F5F6\r\n
                    ERR:7\r\n (Parameter not set)

Content: Query the MAC address of the target device in master mode, little-endian.

Command format: AT+DISCONN\r\n

Return value: OK\r\n

  ERR:CODE\r\n

Content: Disconnect the current BLE connection. It is valid in the connection state.

5.13 Transmit Power Operation Command

Command format: AT+RFPM=4\r\n

Return value: OK\r\n

  ERR:CODE\r\n

Content: Modify the transmit power of the module to 4dBm. This command can be operated in a disconnected state. Returning OK indicates that the power reset is successful, and returning ERR indicates that the power reset fails. The reason may be that the set power is not in the power level list.

Command format: AT+RFPM?\r\n

Return value: 4dBm\r\n

Content: Query the current transmit power configuration of the BLE module. The factory default is 4dBm.

Note: The transmit power levels currently supported by the module are as follows:

Power level	Power value
0	8dBm
1	4dBm
2	0dBm
3	-4dBm
4	-8dBm
5	-12dBm
6	-16dBm
7	-20dBm

5.14 Restore Default Configuration Command

Command format: AT+DEFAULT\r\n

Return value: OK\r\n

Content: Restore the configuration parameters of the module to the default parameters, and the MAC address is also restored to the factory default address. Returning OK means that the module starts to restore the factory mode; it will be effective after restarting.

5.15 Custom Advertising Data Command

Command format: AT+ADD=0123456A\r\n
Return value: OK\r\n
ERR:CODE\r\n
Content: Users can add the custom advertising data to the BLE advertising data. For example, add the data of 0123456A to the BLE advertising data, and return OK to indicate that it has been added successfully. After the setting is successful in slave mode, BLE will start broadcasting with the new configuration. Returning ERR indicates adding failed, for the reason that data length may exceed the maximum limit 22bytes. You cannot modify it in the BLE connecting state.

5.16 Custom Product Serial Number Command

Command format: AT+PID=ABCD\r\n
Return value: OK\r\n
ERR:CODE\r\n
Content: Customize product serial number in the advertising data. Returning OK indicates the custom adding is successful and returning ERR indicates the adding fails, the possible reason of which may be that the custom data exceeds the range of serial number requirements. The module serial number supports the content in 0000—FFFF, and the factory default is 0x0000. In the BLE connection state, it cannot be modified and the BLE connection needs to be disconnected. After setting successfully in slave mode, BLE will start advertising with the new configuration.

5.17 Query BLE Status Command

Command format: AT+STATUS?\r\n
Return value: 0\r\n (BLE is idle)
1\r\n (BLE is advertising)
2\r\n (BLE is scanning)
3\r\n (BLE is connected)
Content: Query the current BLE status.

5.18 Set Low Power Sleep Mode Command

Command format: AT+SLEEP\r\n

Return value： OK\r\n

Content： When the module is in the idle state, in order to reduce the power consumption, the module can be set to enter the sleep mode by the sleep command. At this time, the BLE and serial port functions are turned off, and the power consumption is reduced. The module can be awakened by external enabling. The power consumption in sleep mode is 0.3uA.

5.19 Firmware Upgrade Command

Command format： AT+DFU\r\n

Return value： OK\r\n

Content： After returning OK, the module enters the firmware upgrade mode. In this mode, users can download the latest firmware patch released by our company to upgrade the module firmware. After the update is completed, the new firmware will automatically run. For details, please refer to the relevant firmware upgrade documents.

6. BLE Protocol Description (APP Interface)

[Service UUID: 0x2214]

Eigenvalue	Attribute	
0x2215	Write Without Response	

[Service UUID: 0x2214]

Eigenvalue	Attribute	
0x2216	Notify	

7. Error CODE Description

Err CODE	Description	Reason
1	Invalid input	
2	Unsupported command	
3	Parsing commands is not allowed in the current state	
4	The command is not allowed in the current state	Some commands are not allowed in the BLE connection status. You need to disconnect the BLE before operating.
5	No action can be performed for this command	
6	Invalid command parameter	
7	Parameters are not configured	
8	Hardware error	
9	Command process timed out	
10	Other errors	

8. BLE Module Application Examples

1. Auxiliary tool BLE-DK

   WT-Demo-Kit is an auxiliary tool designed by our company for the simple application of nRF51822, nRF52810, nRF52832, nRF52840 series BLE BLE transparent transmission modules. The BLE module can be easily connected to PC through the DEMO-Kit. The module can be configured with AT commands and some basic parameters of the BLE module can be reset through the serial port debugging tool on the PC side. As a slave device, the BLE module can be found and connected by the BLE master. When the connection is successful, data can be input to the BLE module through the serial debugging tool, and the BLE module transmits this data to the BLE master. At the same time, the data returned by the BLE master received by the BLE module can be transferred to the serial port debugging tool. Developers can conveniently and simply view the contents of data transmission between the BLE module and the BLE master terminal.

2. Connection method of DEMO-Kit and BLE module

   The interface of DEMO-Kit is the currently popular XBee module interface. The BLE module and Kit tool are connected through the XBee adapter board, and the module is welded on the corresponding XBee adapter board, and then the adapter board is inserted into the Kit tool.

3. DEMO-Kit adopts FTDI's USB to UART IC, so before it can be used on PC, you need to install the driver of the FTDI chip first. After the driver is installed successfully, connect DEMO-Kit to PC by a USB cable. At this time, the serial port label of Demo Kit tool can be recognized by PC terminal;

4. Start the serial port debugging tool on PC, select the virtual COM port number mapped by the FTDI chip. Set the serial port parameters as: baud rate 115200, the data format is 8 data bits, no parity bit and 1 stop bit. Then turn on the serial port, and read and modify the current BLE module settings through AT command, as shown in the figure.
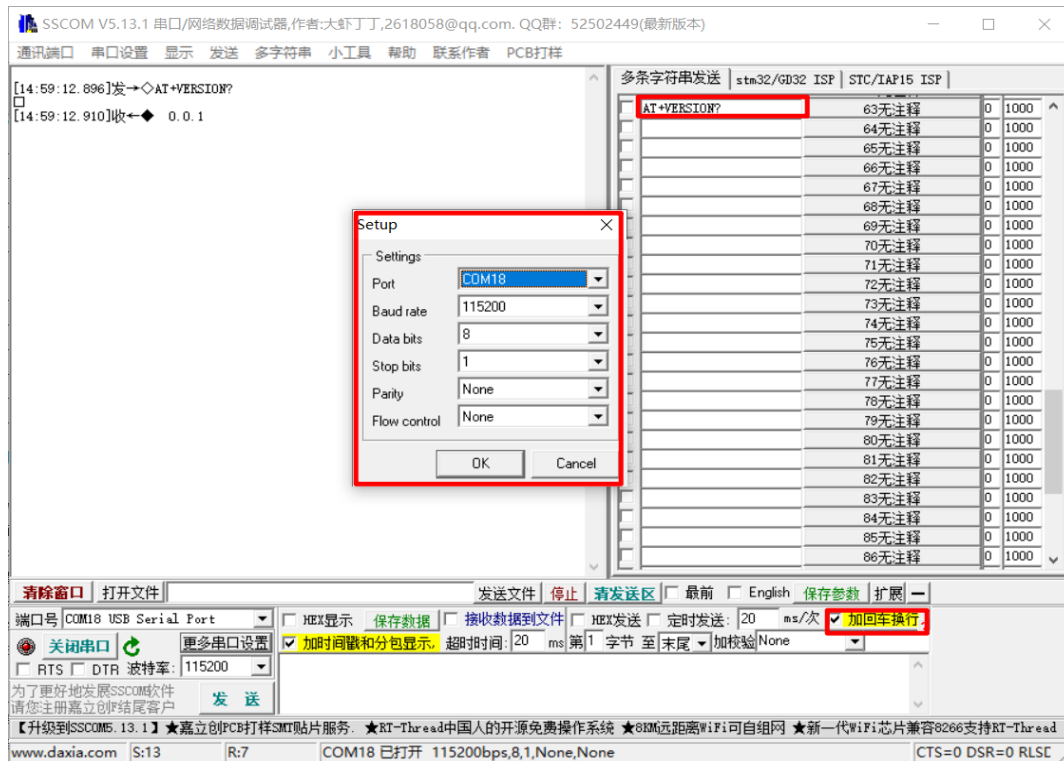

5. Use the mobile device APP BLE master to query the slave device of the BLE module. The recognized BLE test software LightBlue can be used in the IOS system, and the BLE serial test APP software provided by nrfconnect can be used in the Android system. Search for the device name of the BLE module, and then click to establish BLE connection with it and the pairing is successful. Send data to the BLE module through the APP tool to establish a data communication connection between the mobile terminal and the BLE module.

A. In the IOS system (only iPhone 4S and above mobile phones support BLE 4.0), use LightBlue to test the module connection performance. First turn on the iPhone BLE and run the LightBlue program. When LightBlue is running, it will automatically search for the slave device. After the slave device is found, the slave list will be displayed, and it will contain the main information, UUID of Services, transmit power, device name, etc.
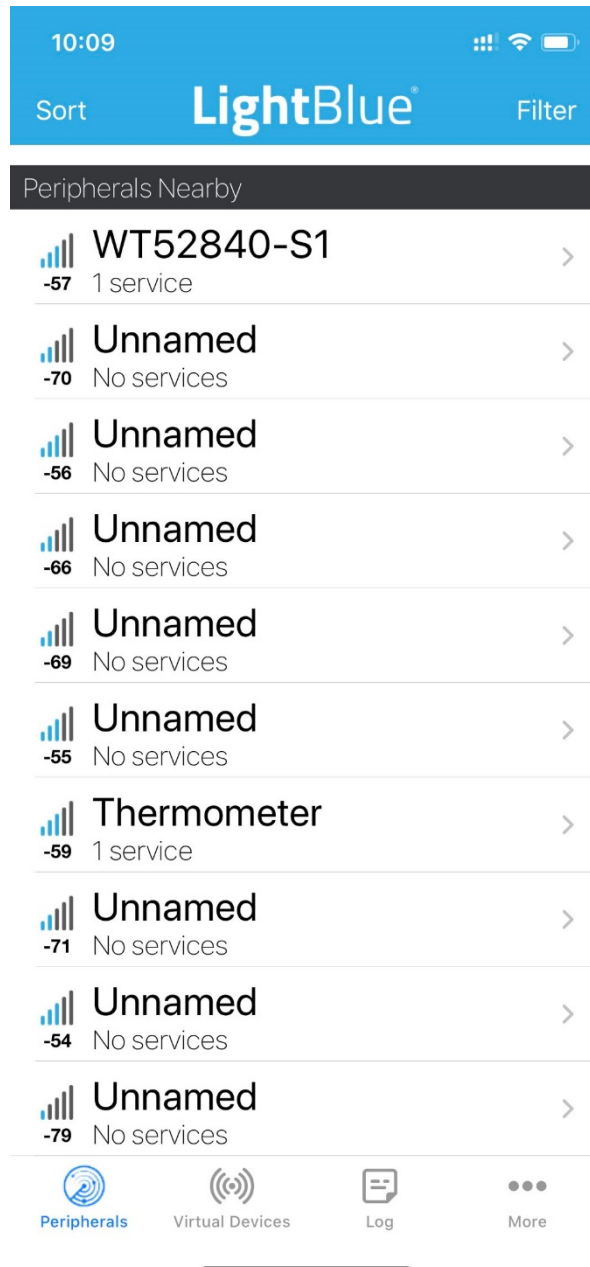
Click on the slave that needs to be connected, the iPhone will connect to the slave, and then the program will automatically search for all services of the slave, as shown below.
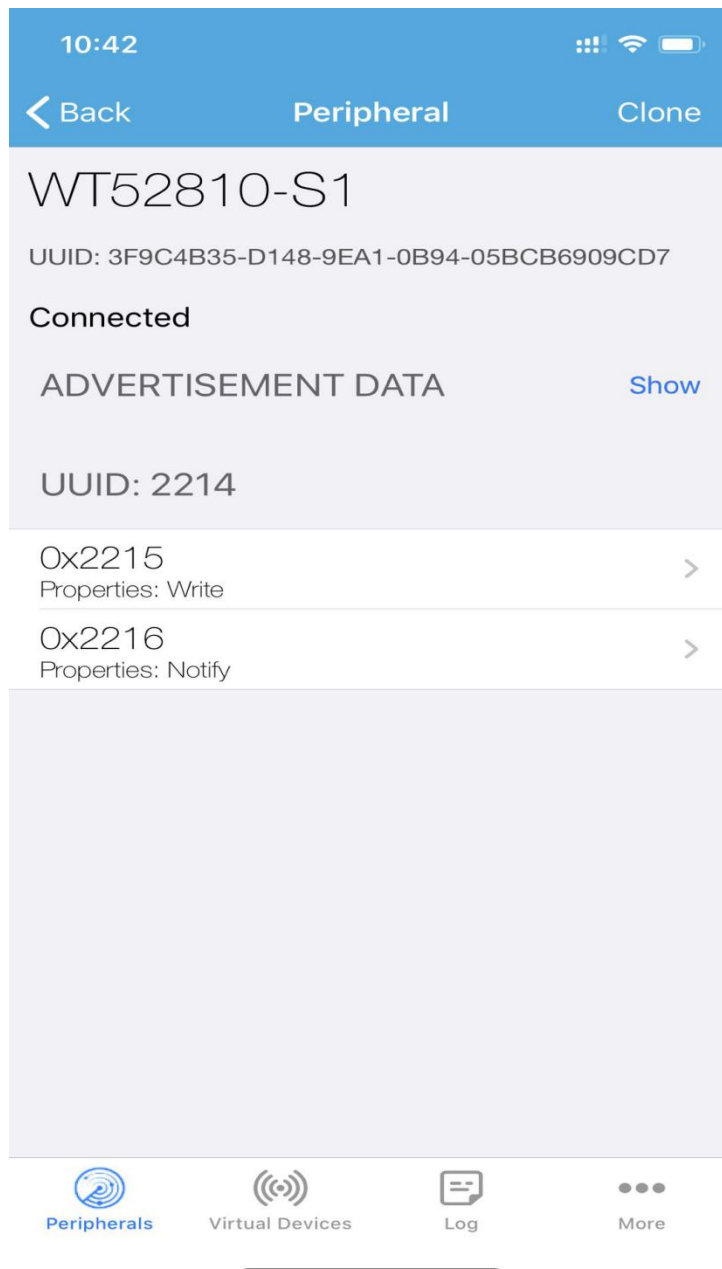
Click the corresponding service to display the characteristics contained in the service, as shown in the figure below.
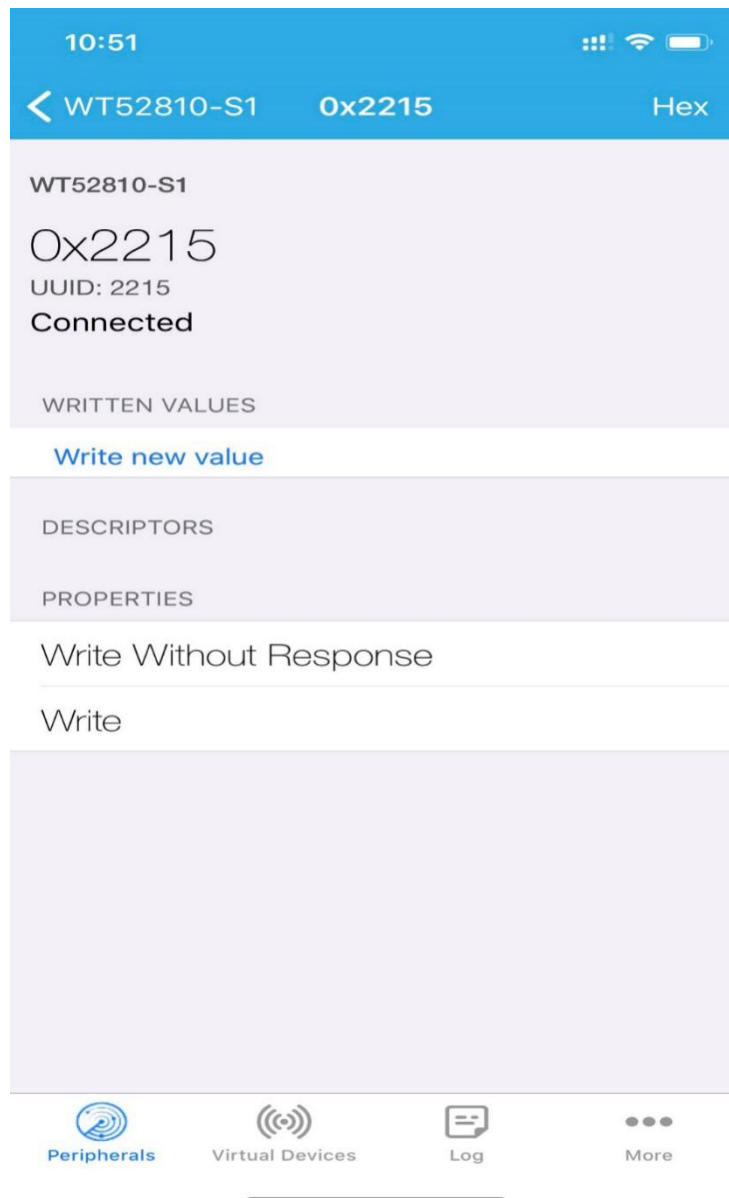
Click "Writer new value" to enter the Characteristic communication interface and input a value, as shown in the figure below:
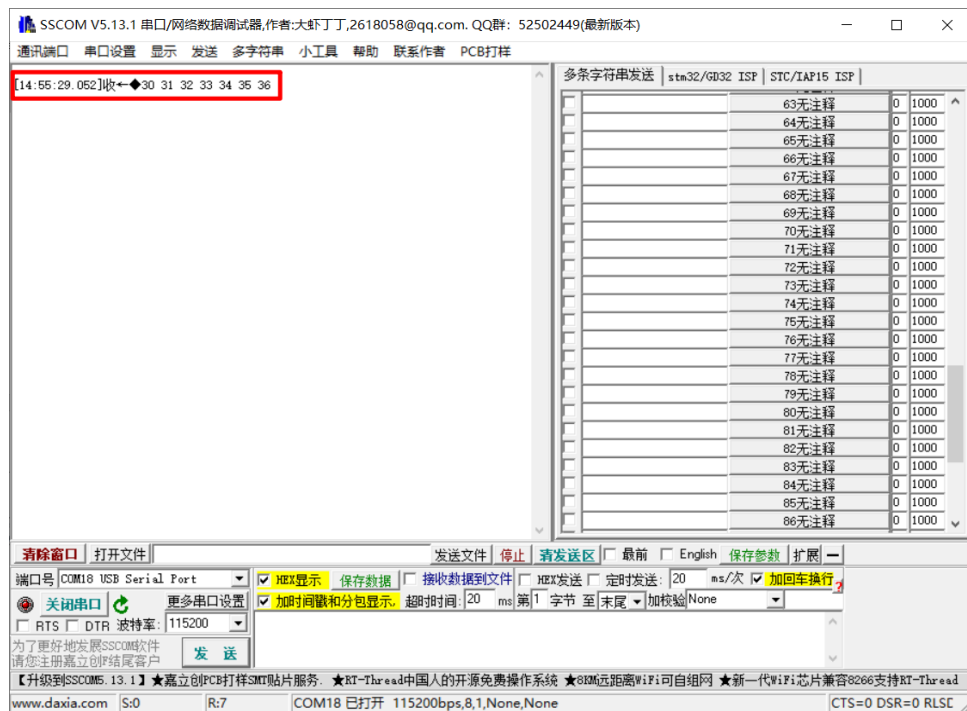
After the module receives the data sent by LightBlue, it pushes the received data to the serial port through DEMO-KIT, and displays it in the serial debugging tool on PC:
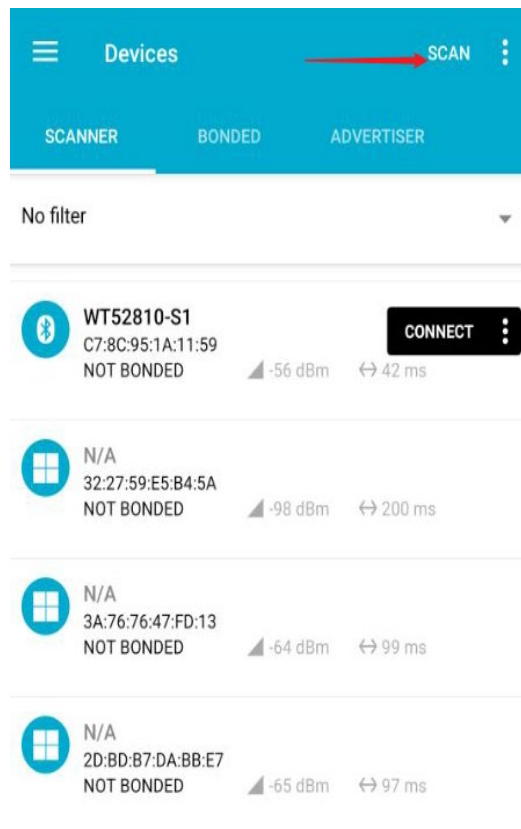
B. In the Android system (Android 4.3 and above, only supports BLE 4.0; Android 6.0 and above, you need to turn on the GPS service to search for BLE) nrfconnect can be used as an APP debugging tool. The way to obtain APK and source code is:
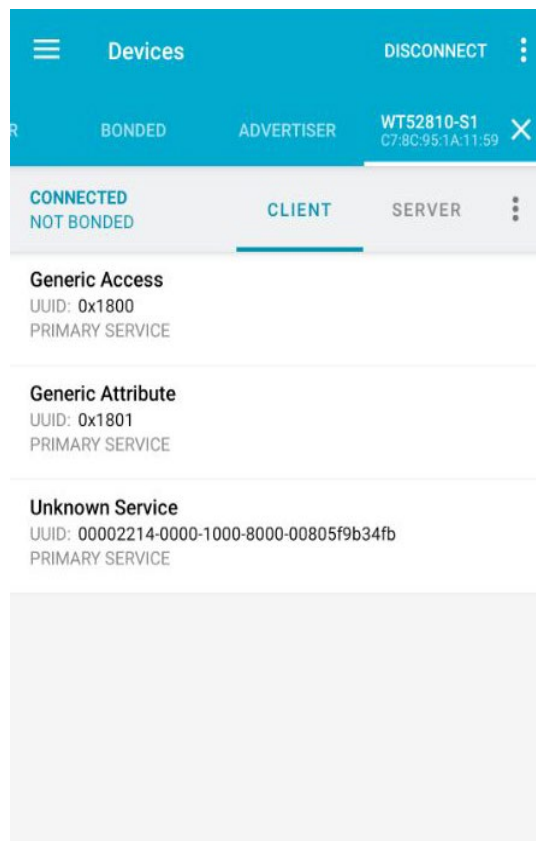
https://github.com/NordicSemiconductor/Android-nRF-Connect/releases?tdsourcetag=s_pctim_ai omsg
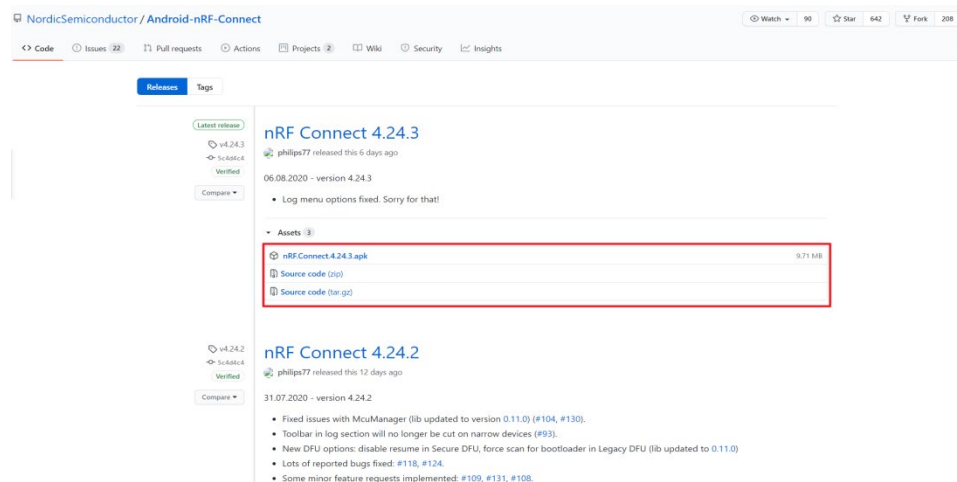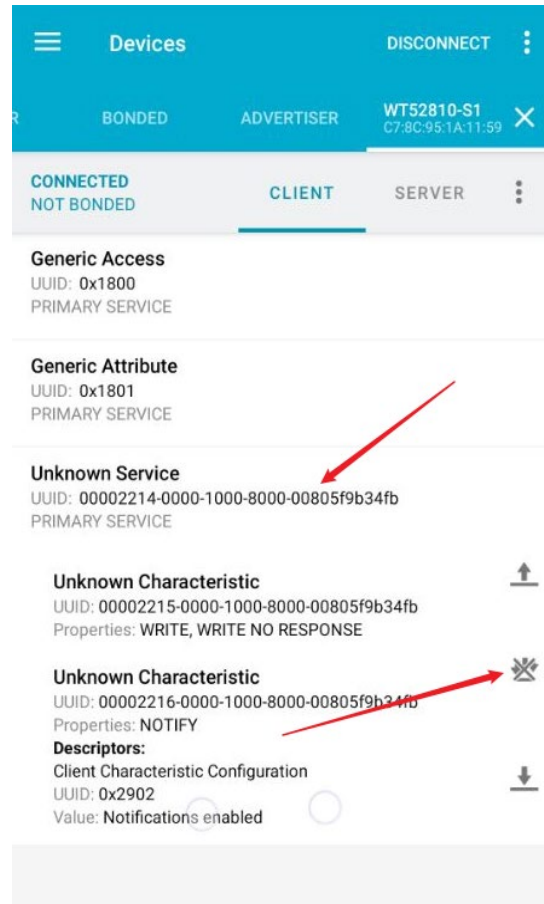
Click SCAN to search for the BLE device:

Click CONNECT to establish a connection with the BLE device:

After the connection is successful, expand the 0x2214 service and turn on the NOTIFY channel:

At this time, the NOTIFY channel can receive the serial port data, or send data to the serial port through the WRITE, WRITE NO RESPONSE channel.

9. Appendix

For more technical support, please email to: technical@wireless-tag.com