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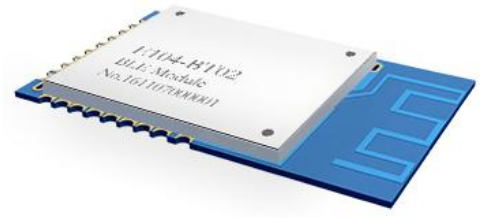
Chengdu Ebyte Electronic Technology Co.,Ltd.

E104-BT02 Datasheet v1.0

1. Introduction E104-BT02

1.1 Features E104-BT02



E104-BT02 is a SMD 1mW (0dBm) wireless UART to BLE module with high cost performance, small size and embedded PCB antenna and operates at 2.4 GHz frequency band. Serial port (UART) can be used to receive and transmit Bluetooth data, which lowers the threshold to apply Bluetooth.

Based on IC DA14580 imported from Dialog, E104-BT02 is researched and developed by Chengdu Ebyte Electronic Technology Co., Ltd., integrated with transparent transmission, master and slave integration and ready-to-use function. Parameters and functions are configurable according to instructions of serial port. The module is widely applied in wearable devices, home automation, family security and protection, individual healthcare, smart household appliances, accessory and remote control, automobile, illumination and Industrial Internet. The module has a stable sleep function with ultra low power consumption and a minimum operating current below 3uA in slave mode (with broadcasting function on). Power supply with button monocell is available. Data transmission is stable and highly efficient. In slave mode, it supports the data transmission with the baud rate of 192000bps in maximum as the veritable module for transparent data transmission.

E104-BT02 is compliant with Bluetooth V4.1 protocol. It can connect with any masters that are compliant with Bluetooth V4.1 protocol after a simple configuration to achieve transparent data transmission of serial port. The module supports configuration of master and slave to achieve quick transparent data transmission and point-to-point connection between the master and the slave, and to reduce user’ s time for operation and project development to a maximum limit.

Typical application:

√Wireless meter reading

√Wireless sensing

√Smart home

√Industrial telecontrol and telemetering

√Intelligent building

√Automatic data collection

√Health sensor

√RFID

√Smart wearable device

√Environmental engineering

√Intelligent robot

Features:

√Slave and master mode

√Three operating modes: transparent transmission mode, configuration mode and sleep mode

√Automatic broadcast when power-on, automatic connection

√Flexible parameters setting

√Seamless switches between IBeacon and general broadcast

√MAC bonded connection

√Transparent continuous transmission

√UART transparent transmission

√Various UART modes and baud rates

√Ultra low -power sleep and synchronized broadcast

√Utmost communication of 70m

1.2 Parameters E104-BT02

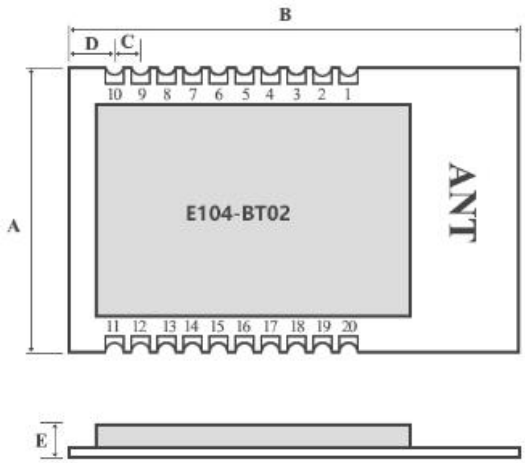
No.	Item	Parameter details	Description
1	RF IC	DA14580	Dialog
2	Size	14*22*3mm	With PCB antenna
3	Weight	1.15g	With PCB antenna
4	Frequency band	2.4GHz	2379 ~ 2496MHz
5	PCB	4-layer	Impedance debugging, lead-free , SMT
6	Connector	2 * 10 * 1.27mm	SMD
7	Supply voltage	2.35~3.3V DC	Note: the voltage higher than 3.6V is forbidden
8	Communication level	0-3V	Note: the voltage higher than 3.3V is forbidden
9	Operation range	Maximum 70m	In clear and open area, maximum power: 0dBm , height > 2m
10	Transmitting power	Maximum 0dBm	About 1mW
11	Standby current	3uA	Support broadcast transmission
12	Transmitting current	3.4mA@0dBm 3V	> 100mA (recommended)
13	Receiving current	3.7mA@3V	Average value
14	Communication interface	UART	4800~256000bps
15	Transmitting length	Maximum 20 bytes per package	BLE protocol requirement
16	Receiving length	Maximum 20 bytes per package	BLE protocol requirement
17	RSSI support	available	Find more details on <DA14580 Datasheet>
18	Antenna type	PCB	50Ω characteristic impedance
19	Operating temperature	-40 ~ +85℃	Industrial grade
20	Operating humidity	60%	Relative humidity, no condensation
21	Storage temperature	-50 ~ +150℃	Industrial grade
22	Receiving sensitivity	-93dBm	Find more details on <DA14580 Datasheet>

1.3 Electrical features E104-BT02

Parameter		Min	Typ	Max	Unit
Storage temperature		-50	Normal temperature	+150	℃
Environment temperature		-40	Normal temperature	+85	℃
Operating voltage		2.35	3.3	3.6	V
Random I/O	VIL/VIH	GND/0.84	GND/VCC	0.36/VCC	V
	VOL/VOH	GND/1.88	GND/VCC	0.47/VCC	
Sleep: interrupting current		0.6	3.0	5.7	uA
Sleep: connecting current		110	130	250	
Wake-up: connecting current		660	670	730	
Wake-up: interrupting current		610	617	627	
No broadcasting	Sleep	0.4	3.0	5.4	uA
	Wake-up	610	617	627	
Modulation type		GFSK			

2. Functional description E104-BT02

2.1 Pin definition E104-BT02



Units: mm

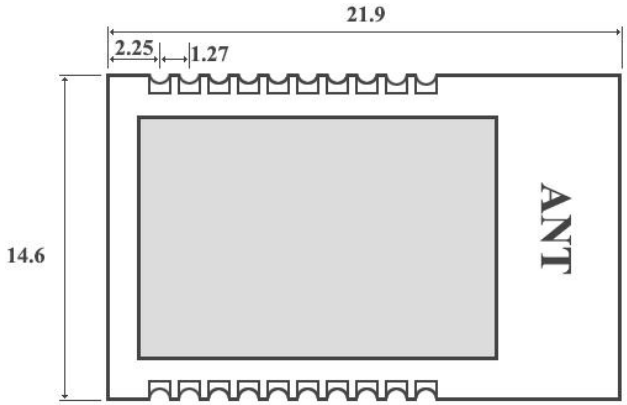
	MIN	MAX
A	14.60	14.70
B	21.90	22.00
C	1.27	1.27
D	2.25	2.27
E	2.60	2.70

1	GND	11	GND
2	NC	12	VCC
3	P0.0	13	REST-H
4	P0.1	14	P1.0
5	P0.2	15	P1.1
6	P0.3	16	P1.5
7	P0.4	17	P1.4
8	P0.5	18	P1.2
9	P0.6	19	P1.3
10	P0.7	20	GND

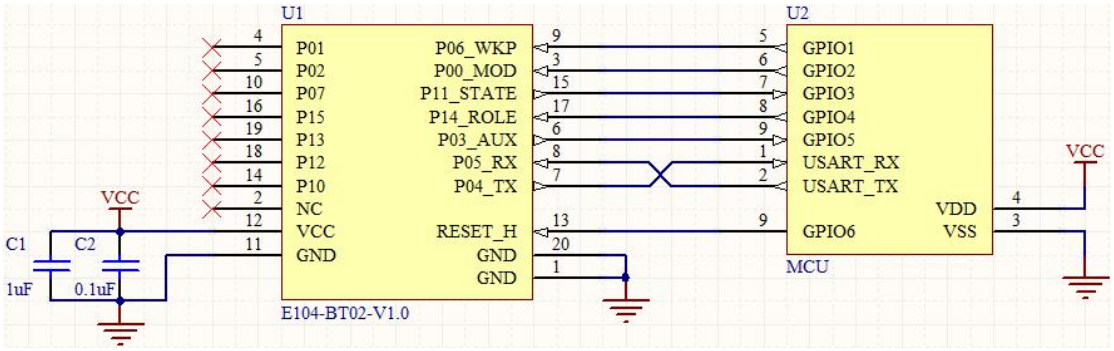
Pin item	I/O	Function	Description
GND	--	Ground	Referenced ground
NC	--	Reserved	-
P00	I	Mode configuration (MOD)	When low level is inputted, module enters configuration mode; when high level is inputted, module enters transparent transmission mode (it contains internal pull-up resistance and operates in transparent transmission mode by default)
P01	--	Reserved	-
P02	--	Reserved	-

P03	O	Valid data output(APP)	To indicate data outputted via serial port is valid, and the low level indicates that data is in transmission and the high level indicates that data transmission has completed.(see more details on <2.5 Data validity >)
P04	O	UART transmit data	Module outputs serial port data
P05	I	UART receive data	Module receives external serial port data
P06	I	Wake-up (WKP)	In any case, module enters wake-up mode when a low level is inputted and module enters sleep mode when a high level is inputted.(it contains internal pull-up resistance and operates in sleep mode by default)
P07	--	Reserved	-
GND	--	Ground	Referenced ground
VCC	--	3.3V	Input power
RESET_H	I	Reset (RST)	Module inputted a high level enters hardware reset state and module inputted a low level come back to normal operating state, which is used for restoration in emergency.
P10	--	Reserved	-
P11	O	Connection state (STA)	To indicate connection state of Bluetooth, when connected the pin output a low level; when interrupted the pin output a high level
P15	--	Reserved	-
P14	I	Role selection (ROL)	To configure the role of the module and it is a slave when a high level is inputted and it is a master when a low level is inputted. (It contains internal pull-up resistance and operates as a slave by default. See more on 2.6 Role selection)
P12	--	Reserved	-
P13	--	Reserved	-
GND	--	Ground	Referenced ground

2.2 Package E104-BT02



2.3 Circuit diagram E104-BT02



2.4 Operating mode E104-BT02

1. Low power mode: in any case, Pin P06 input high enters sleep mode and reduces the whole power consumption. Now the serial port stops receiving any data while the transparent transmission of the Bluetooth remains unaffected, i.e., in this mode the output function of the serial port is still valid and data received in Bluetooth port can output via serial port. What is more, if the module has connected with Bluetooth before entering this mode, when entering the mode the connection will shut down automatically. This function is applied for quickly interrupting Bluetooth connection and entering low power mode when the receiving and transmitting of the external MCU is completed. When masters and slaves enter this mode, its scanning and broadcasting function remain unaffected.

2. Wake-up mode: in any case, P06 input low will wake up the module. If instruction <WSMON> is operated, feedback is activated, and the module will output "WAKEUP" automatically to inform a successful MCU operation. The latency is about 25 ms during P06 input low till waking up the module when transparent data transmission disables and only restores once it is waken up.

3. Configuration mode: In wake-up mode, the module enters configuration mode via pulling down Pin P00 and now any data received by the module is regarded as configuration instructions rather than for transparent data transmission. Any data transmitted by the master via Bluetooth channel "CENTER DATA BUFF" is not for transparent transmission if Bluetooth is connected now, and channel "BLE DATA BUFF" will receive feedback information "<CONFIG MODE BUSY>" to indicate that the slave is in configuration mode and doesn't receive data via transparent transmission. In configuration mode, all configured information for the module will be saved after powering down and it will operate according to the new configuration when powering up next time.

2.5 Data validity E104-BT02

Bluetooth outputs transparent transmission via serial port when receiving data. To ensure correct receiving of external MCU, at 10 ms before UART outputs the first start bit, P03 (APP) pulls down and wakes up external MCU till data transmission is completed and P03 recovers a high level. As shown in the figure:

2.6 Role selection E104-BT02

The module can be configured as a master or a slave. In 160ms after powering up it starts to read the level signal of Pin P14. If a low level signal is detected the module will be configured as the master; if a high level signal is detected it will be the slave; if the pin floats, module with internal pull-up resistance will act as a

slave. Role configuration is only valid when the module is powered up and initialized and the role is fixed after powering up is completed till next restart to redetect role configuration.

When operating as a master and with scanning started, the module will automatically scan surrounding slaves until valid slaves are detected (If MAC address bonding is set, it is likely to connect to slaves with assigned MAC address) and the Bluetooth connection is completed automatically.

When operating as a slave and with broadcasting started, the module will transmit broadcasting data packet to surrounding areas via configured broadcasting gap and wait the Bluetooth master to initialize connection.

2.7 Dynamic switching of broadcasting data E104-BT02

When operating as a slave instruction "<ADVDATA>" and "<IBACON>" are carried out firstly configured with general and Ibeacon broadcasting data respectively. When broadcasting is started broadcasting gap is fixed gap and every three general broadcasting data packets are broadcasted, three Ibeacon broadcasting data packets are switched, cycling this way. This function achieves synchronous transmission of general broadcast and Ibeacon broadcast to realize a seamless connection.

2.8 MAC address bonding E104-BT02

The module supports bonding of MAC address connected via Bluetooth, which bond connected MAC address via instruction "<BONDMAC>". When master sets bonded address, before a connection is completed, the master will firstly search that if address of devices is compliant with bonded address, and only bonded devices can complete connection. Likewise, when slave sets bonded address, before receiving request for connection from master it will search if MAC address of the master is the bonded address, and when address is successfully matched the connection can be enabled or the salve will continue to broadcast. Carrying out instruction "<DISBOND>" will stop MAC bonding. The slave can receive any request for connection from master when being stopped and the master will connect to any slave devices in a valid area.

MAC address bonding can help to realize directional connection in complex conditions. For example, there are several slaves in a valid scanning area for a master device. The master can filter requests for connection from salve devices to realize directional connection.

2.9 Transparent continuous transmission E104-BT02

Slave supports transparent continuous transmission in which mode configured UART baud rate can be as high as 19200bps, i.e., no matter how large the data packet UART received is, or it is continuous data flow, transparent transmission remains unaffected. Abnormal packet loss will not happen. This function realizes transparent transmission in a real sense.

3. Operating instruction E104-BT02

Warning: Make sure the module is in wake-up mode and enters configuration mode before sending operating instruction or it is unable to receive any configuration instruction.

Description:

1. Instruction format: the format for all operation instruction uses prefix sign '<'and suffix sign '>', instruction format is <instruction>

For example, for transmitting and receiving baud rate of serial port the format is <COMBAUD>

2. Instruction returning

Returning value	Description
INVALID_ERR	Unrecognized instruction
HT_ERR	Unrecognized instruction or lack of prefix/suffix sign of instruction
LEN_ERR	Parameter length out of range
OK	Correct execution

3. Factory parameter setting

Parameter for serial port	Baud rate	19200bps
	Calibration	NONE
	Stop bit	1
Slave	Module name	E104-BT02
	Broadcasting gap	1s
	Min connecting gap	10ms
	Max connecting gap	10ms
	Connecting timeout	5s
	General broadcasting data	02 01 06 03 03 58 69 05 FF 01 02 03 05
	Ibeacon broadcasting data	02 01 06 1A FF 4C 00 02 15 52 41 44 49 55 00 4E 45 54 57 4F 52 4B 53 43 4F 00 01 00 02 D2
	Manufacturer name	CDEBYTE
	Serial number (SN)	160705000004
	Hardware version	VER1.0
	Software version	VER1.0
Master	Scanning gap	12.5ms
	Scanning time	10ms
	Min connecting gap	10ms

1. Module reset instruction

Instruction	Description
<RESET>	Restart BLE protocol stack (different from pin reset, it only resets protocol stack and buffered data will be remained)
No returning	

2. Configuration instruction for baud rate of serial port

Instruction	Description
<BAUDxxx>	To configure baud rate assigned by xxx (ASCII code) and optional baud rate includes 4800, 9600, 19200, 38400, 57600, 115200, 256000
When parameter is out of range return to<RANGE_ERR>; when succeed return to<OK> Special note: The configuration is stored at once but it only takes effect after exiting configuration mode. Uninterrupted continuous transmission below 19200bps from the slave to the master is available.	

3. Read instruction for baud rate of serial port

Instruction	Description
<COMBAUD>	Read present baud rate configuration
For example, when baud rate is 19200bps return to<19200>	

4. Configuration instruction for stop bit of serial port

Instruction	Description
<xSB>	To configure number of stop bit assigned by x (ASCII code) and one and two stop bits are optional.
When succeed return to<OK> Special note: The configuration is stored at once but it only takes effect after exiting configuration mode.	

5. Read instruction for stop bit of serial port

Instruction	Description
<STOPBIT>	Read present stop bit configuration
For example, for one stop bit return to <STOPBIT1>	

6. Configuration instruction for parity bit of serial port

Instruction	Description
<PEVEN>	Even parity check of serial port
<PODD>	Odd parity check of serial port
<PNO>	No parity

When succeed, return to<OK> Special note: The configuration is stored at once but it only takes effect after exiting configuration mode.

7. Read instruction for parity bit of serial port

Instruction	Description
<PARITY>	Read parity bit configuration
For example，for no parity return to<NOP>, for even parity check return to <EVENP>, for odd parity check return to <ODDP>	

8. Instruction for starting broadcast

Instruction	Description
<STARTADV>	Start broadcasting
When succeed return to <OK>	

9. Instruction for stopping broadcast

Instruction	Description
<STOPADV>	Stop broadcasting
When succeed return to <OK>	

10. Broadcast state inquiry

Instruction	Description
<ADVSTATE>	Read present broadcast state
For example, when broadcast is started, return to <ADVON>, when closed, return to <ADVOFF> Special note: When broadcast is started in any case (including sleep mode), module will carry out periodic broadcasting according to configured gap. This instruction only supports master. Slave sends instruction and returns to <INVALID_ERR>.	

11. Set general broadcasting data

Instruction	Description
<ADVDATAxxx>	Set broadcasting data of max 22 bytes (hex) assigned by xxx, update data in the next broadcasting period, and clear data if it is not assigned by xxx.
Length of broadcasting data is out of range, return to<RANGE_ERR>, when succeed, return to<OK>. Special note: General broadcasting and IBeacon broadcasting can be started at the same time, i.e., every two general broadcasting data is broadcasted, two IBeacon broadcasting data is switched.	

12. Set IBeacon broadcasting data

Instruction	Description
<IBACONxxx>	Set broadcasting data of max 25 bytes (hex) assigned by xxx, update data in the next broadcasting period, and clear data if it is not assigned by xxx.
Length of broadcasting data is out of range, return to<RANGE_ERR>, when succeed, return to<OK>. Special note: General broadcasting and IBeacon broadcasting can be started at the same time, i.e., when every two general broadcasting data is broadcasted, two IBeacon broadcasting data is switched.	

13. Set device name

Instruction	Description
<NAMExxx>	Set device name of max 18 bytes (ASCII code) assigned by xxx, update broadcasting data in the next broadcasting period when disconnected, and update after interruption when connected.
Length of device name is out of range, return to<RANGE_ERR>, when succeed, return to<OK>.	

14. Read device name

Instruction	Description
<MNAME>	Read device name
For example, device name is E104-BT02, return to <E104-BT02>	

15. Set manufacturer name

Instruction	Description
<FACxxx>	Set manufacturer name of max 18 bytes (ASCII code) assigned by xxx, and update at once.
Length of manufacturer name is out of range, return to<RANGE_ERR>, when succeed, return to<OK>	

16. Read manufacturer name

Instruction	Description
<FNAME>	Read manufacturer name
For example, manufacturer name is CDEBYTE, return to <CDEBYTE>	

17. Set software version number

Instruction	Description
<SOFTxxx>	Set software version number of max 18 bytes (ASCII code) assigned by xxx, and update at once
Length of software version number is out of range, return to<RANGE_ERR>, when succeed, return to<OK>.	

18. Read software version number

Instruction	Description
<SVER>	Read software version number
For example, if software version number is VER1.0, return to<SVER1.0>	

19. Set hardware version number

Instruction	Description
<HARDxxx>	Set hardware version number of max 18 bytes (ASCII code) assigned by xxx, and update at once
Length of hardware version number is out of range, return to<RANGE_ERR>, when succeed, return to<OK>.	

20. Read hardware version number

Instruction	Description
<HVER>	Read hardware version number
For example, if the hardware version number is VER1.0 return to <HVER1.0>.	

21. Set module SN

Instruction	Description
<SNxxx>	Set module SN of max 18 bytes (ASCII code) assigned by xxx, and update at once
SN length is out of range, return to<RANGE_ERR>, when succeed, return to<OK>.	

22. Read module SN

Instruction	Description
<MSN>	Read module SN
For example, if SN is 160705000004, return to<N160705000004>	

23. Set broadcasting gap

Instruction	Description
<ADVGAPxxx>	Set broadcasting gap assigned by xxx (ASCII code) ranging from 32 to 16000, i.e., from 20ms to 10s correspondingly.
If parameter is out of range return to <RANGE_ERR>, when succeed return to <OK>.	

24. Read broadcasting gap

Instruction	Description
<AGAP>	Read broadcasting gap configuration
For example, if the gap is 1s, return to<A1600>.	

25. Set max connecting gap

Instruction	Description
<CONMAXxxx>	Set max connecting gap assigned by xxx (ASCII code) ranging from 6 to 3200, i.e., from 7.5ms to 4s correspondingly.
If parameter is out of range return to <RANGE_ERR>, when succeed return to <OK>. Special note: The max connecting gap must be larger than or equal to the min connecting gap.	

26. Read max connecting gap

Instruction	Description
<MAXCGAP>	Read the max connecting gap.
For example, if the gap is 10ms return to <CX8>.	

27. Set min connecting gap

Instruction	Description
<CONMINxxx>	Set min connecting gap assigned by xxx (ASCII code) ranging from 6 to 3200, i.e., from 7.5ms to 4s correspondingly.
If parameter is out of range return to <RANGE_ERR>, when succeed return to <OK>. Special note: The min connecting gap must be less than or equal to the max connecting gap.	

28. Read min connecting gap

Instruction	Description
<MINCGAP>	Read min connecting gap
For example if connecting gap is 10ms return to <CN8>.	

29. Set connecting timeout

Instruction	Description
<TIMEOUTxxx>	Set connecting timeout assigned by xxx (ASCII code) ranging from 10 to 3200, i.e., from 100ms to 32s correspondingly.
If parameter is out of range return to <RANGE_ERR>, when succeed return to <OK>.	

30. Read connecting timeout

Instruction	Description
<CTIMEOUT>	Set connecting timeout configuration
For example, if the connecting timeout is 5s return to < T500 >	

31. Disconnect present connection

Instruction	Description
<DISCONNECT>	Disconnect presently connected devices
If it is connected return to <OK>, if not return to <DISCONNECTED>	

32. Inquire Bluetooth connecting state

Instruction	Description
<STATE>	Inquire present Bluetooth connecting state
In connected state return to<CONNECTED>, in disconnected state return to<DISCONNECTED>.	

33 Inquire local MAC address

Instruction	Description
< MAC >	Read local MAC address (6 s in total with hex system).
For example, MAC address of module is 010203040506 return to 0x3C 0x01 0x02 0x03 0x04 0x05 0x06 0x3E. (in which 0x3C corresponds to ‘<’, 0x3E corresponds to ‘>’, 0x01 0x02 0x03 0x04 0x05 0x06 corresponds to MAC address).	

34. Inquire MAC address of connected devices

Instruction	Description
< PEERMAC>	Read the MAC address (hex) of devices connected to the locality
In connected state return to <xxx>, xxx (hex) is the MAC address of connected devices; in disconnected state return to < DISCONNECTED >.	

35. Set bonded MAC address

Instruction	Description
< BONDMACxxx>	Set MAC filtered address with 6 bytes assigned by xxx (hex), i.e., only receive requests for connection from devices with MAC address.
If parameter is out of range return to <RANGE_ERR>, when succeed return to <OK>. Special note: This function can be applied in conditions where several requests for connection happen and to choose MAC- matching connection.	

36 Read set bonded MAC address

Instruction	Description
< RBMAC>	Read set MAC filtered address (hex).
For example, the filtered address is 010203040506 return to < B010203040506 > (hex).	

37. Turn off MAC address filtering

Instruction	Description
< DISBOND>	Stop Turn off MAC address filtering，i.e., receive random connecting request from MAC master.
When succeed return to <OK>.	

38. Start mode feedback

Instruction	Description
< WSMON>	Start mode feedback. To switch to ports in sleep mode, output “SLEEP”; to switch to wake-up mode, output “WAKEUP”
When succeed return to <OK>.	

39. Turn off mode feedback

Instruction	Description
< WSMOFF>	Turn off mode feedback.
When succeed return to <OK>.	

40. Start scanning

Instruction	Description
<STARTSCAN>	Start master’s scanning
When succeed return to<OK>. NOTE: 1. This instruction is only valid for master. It is not available for slave and return to <INVALID_ERR>. 2. If the master is connected return to <CONNECTED>, which means scanning is stopped when connected and one can carry out scanning after disconnected. 3. Power consumption of master will rise when scanning is on.	

41. Stop scanning

Instruction	Description
<STOPSCAN>	Stop master’s scanning
When succeed return to<OK>. NOTE: 1. This instruction is only valid for master. It is not available for slave and return to <INVALID_ERR>. 2. If the master is connected return to <CONNECTED>, which means scanning is stopped when connected and one can carry out scanning after disconnected. 3. Power consumption of master will rise when scanning is on.	

42. Read scanning state

Instruction	Description
<SCANSTATE>	The master returns to present scanning enabled state.
For example, when scanning is on, return to <SCANON>, when it is off return to <SCANOFF>	

43. Read present RSSI value

Instruction	Description
<RSSI>	Read the RSSI value (1byte with hex system, unit: dBm) in connected state.
Return to<Rx> and x represents RSSI value. NOTE: this RSSI is only valid in connected state, otherwise when it is disconnected return to <DISCONNECTED>.	

4. UUID description E104-BT02

Channel Name	UUID	Property	Description
BLE DATA BUFF	0xFFF1	Read only, inform	This channel is for receiving UART data and it returns to Bluetooth master by informing. The biggest data length for a single packet is 20 bytes and data more than 20 bytes are to be sent separately. NOTE: If IPHONE or Android mobile phone is set as the master, the Notification function should be activated for receiving module data .
CENTER DATA BUFF	0xFFF2	Read, write	This channel is for master to transmit data. The biggest data length for a single packet is 20 bytes and data more than 20 bytes are to be sent separately. The transmitted data will be outputted via serial port.
BLE DATA CONFIG	0xFFF3	Read, write	Not used

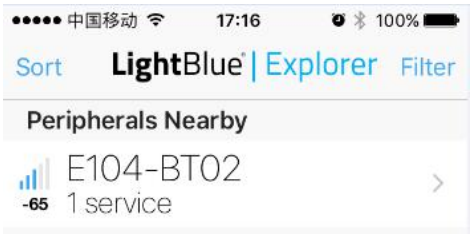
5. Quick usage E104-BT02

Use Android mobile phone (version 4.3 and above), IPHONE 4s and above version or Ipad with BLE function to achieve connection and communication with the module.

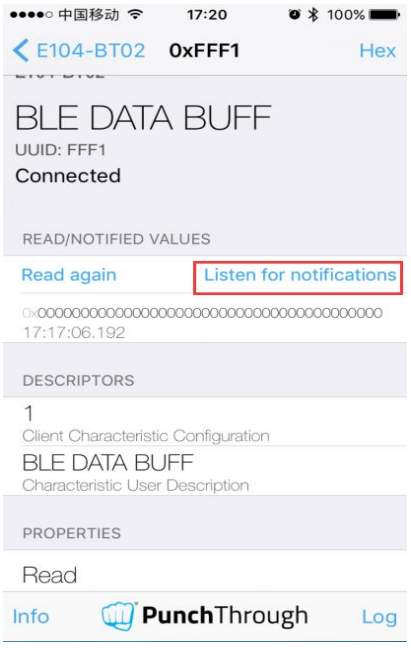
Take iphone as an example:

1. Download and install “LightBlue”.

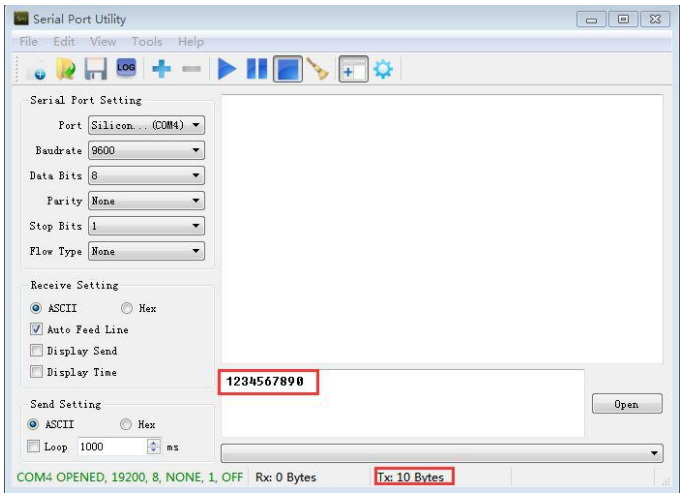
2. Open “LightBlue”, scan surrounding broadcasting devices. Click and connect Bluetooth devices. UUID: FFF0 is transparent data transmission service. Click and enter this service. UUID: FFF0 is transparent data transmission service. Click and enter this service.

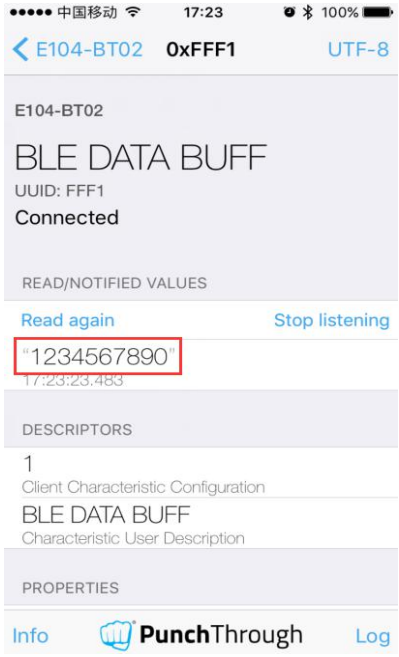


3. Display 3 channels and FFF1 is channel for data transmission from module to master. Enter this channel and click “Listen for notifications”.

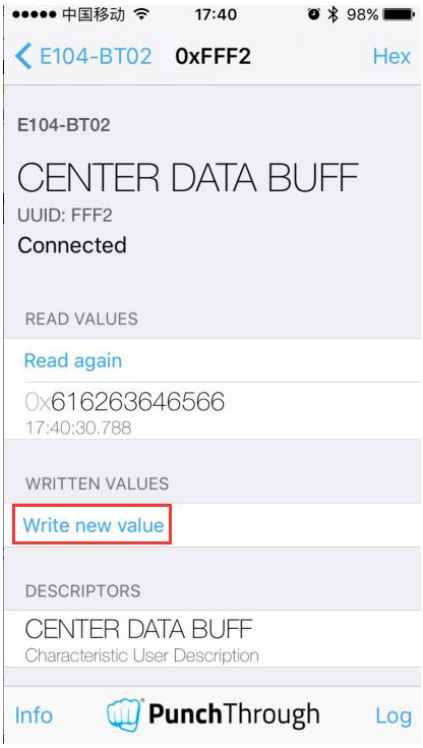


4. Use COM debugging assistant and transmit character string “1234567890” via module E104-BT02 (operating in wake-up transparent transmission mode). APP says character string is received.

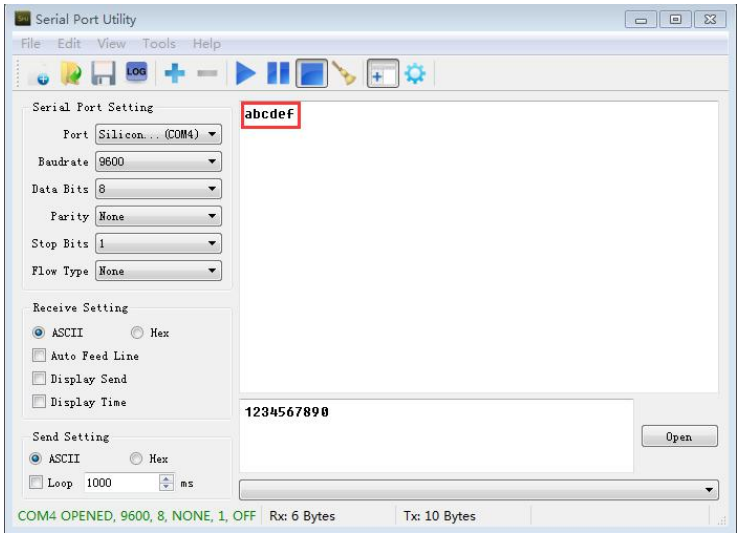




5. Return to upper level and enter channel FFF2 which is the channel for data transmission of master. Click “Write new value”.



6. Fill out and transmit “abcdef”, module E104-BT02 will output received data via UART transparent transmission.



6. About us E104-BT02

Chengdu Ebyte Electronic Technology Co., Ltd., a high-tech company focusing on application of Internet of Things, owns a number of independently researched and developed products and obtains unanimous approvals from customers. With a powerful R&D team, perfect after-sales system, our company provides perfect solutions and technical assistance, shortens R&D period, reduces R&D cost and provides a strong platform for brand new ideas about product R&D.

Our products have been widely applied in various fields, such as consumer electronics, industrial control, healthcare, security alarm, field acquisition, smart home, expressway, property management, water and electricity meter reading, power monitoring, etc.

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