

# PLRBNEITO Peripheral Application Protocol

**Project: PLRBNEITO/Bluetooth 5 BLE module**

**Module name:RabbitN/RabbitI/Rabbit-CN/Rabbit-CI**

**Designed:Suzhou Pairlink Network Technology Ltd.**

Version	Note	Date
V1.0	Create	2021/11/15

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# 1.Serial Interface

Send data packet via serial interface to manage the BLE connections.

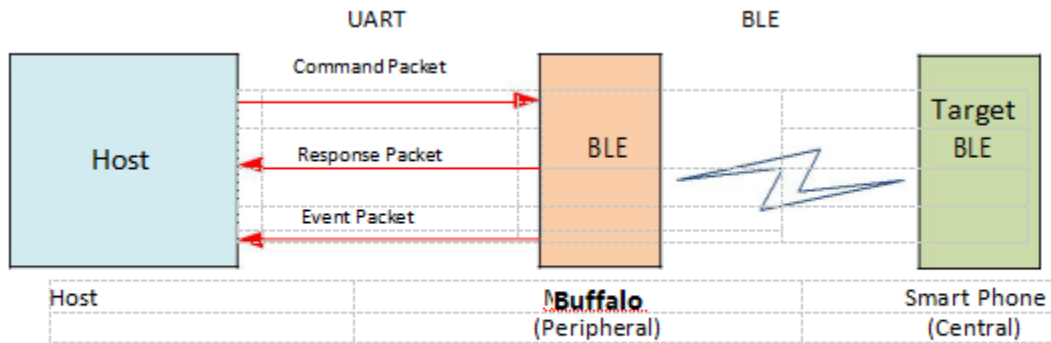
## 1.1.UART Setting

NO	NAME	CONFIG
1	Baud Rate	9600
2	Data Bit	8Bit
3	Stop	1Bit
4	Parity Bit	None

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## 1.2.Packet Format

Command	Host send to Rabbit, to manage the BLE connections
Reserved	N/A
Response	Rabbit send to Host, to response the command packet from Host
Event	Rabbit send to Host, to report BLE connection event to Host



<Pic. 1> Packet flow between Host and Target BLE

Packet format

LSB

MSB

Header	Type	Length	OpCode	Payload	Checksum
--------	------	--------	--------	---------	----------

Payload contents are variable, it depends on the OpCode.

Table 1 <Packet Format>

<b>Header</b>	0x77	
<b>Type</b>	Type of Packet	
	Command	0x01
	Reserved	0x02
	Response	0x03
	Event	0x04
<b>Length</b>	Length of OpCode + Payload	
<b>OpCode</b>	Selected Rabbit Function	
<b>Payload</b>	Detail data of each OpCode	
<b>Checksum</b>	Check the validity Packet header Checksum = Header ^ Type ^ Length ^ OpCode ^ Payload	

## 2.Protocol

### 2.1.Command [Type = 0x01]

Command control BLE Command : 0x01

\* Packet Format : Command

Header		Type	Length	OpCode	Payload	Checksum
0x77 (Fix)	0x01 (Fix)	Variable	Variable	Variable	Variable	Variable

\* Indication: Header, Type, Length, OpCode, Payload, Checksum in Sequence

mark as H, T, L, O, P, C

#### 2.1.1.OpCode

##### 1) Set Pairing Mode [0x01]

Set Rabbit start advertising.

Command					
H	T	L	O	P	C
77	01	N	01	User Data	76
Response					
H	T	L	O	P	C
77	03	02	01	Err(1 byte)	Checksum

Custom broadcast data supports up to 17 bytes.

E.g.

No custom data broadcast: 77 01 01 01 76

Custom data broadcast: 77 01 09 01 11 22 33 44 11 22 33 44 7E

##### 2) Set Pairing Mode Cancel [0x02]

Set Rabbit stop advertising.

Command					
H	T	L	O	P	C
77	01	01	02	NA	75
Response					
H	T	L	O	P	C
77	03	02	02	Err(1 byte)	Checksum

### 3) Set Disconnected [0x03]

Set Rabbit to disconnect BLE connection of Handle.

Command					
H	T	L	O	P	C
77	01	03	03	Handle	Checksum
Response					
H	T	L	O	P	C
77	03	02	03	Err(1 byte)	Checksum

Handle: the connection handle: 2 Bytes.

Rabbit could connect to 2 masters at the same time, the connection handle is dedicated to each master. This connection handle would be report to MCU once one master successfully connect to Rabbit, by the Pairing Status event[0x02].

### 4) Get Local Device Name [0x04]

Get the Rabbit Local device name.

Command					
H	T	L	O	P	C
77	01	01	04	NA	73
Response					
H	T	L	O	P	C
77	03	02	04	Err(1 byte)	Checksum
Event					
H	T	L	O	P	C
77	04	Length	03	Payload	Checksum

### 5) Get Local BD Address [0x05]

Get the Rabbit BD address, the BD\_ADDR would be report with ASCII code.

Command					
H	T	L	O	P	C
77	01	01	05	NA	72
Response					
H	T	L	O	P	C
77	03	02	05	Err(1 byte)	Checksum
Event					
H	T	L	O	P	C
77	04	Length	04	Payload	Checksum

E.g. BD\_ADDR is 00 18 31 84 A1 32

Command: 77 01 01 05 72

Response: 77 03 02 05 01 72

Event: 77 04 0D 04 30 30 31 38 33 31 38 34 41 31 33 32 Checksum

## 6) Get Firmware Version [0x06]

Get the Rabbit Firmware Version.

Command					
H	T	L	O	P	C
77	01	01	06	NA	71
Response					
H	T	L	O	P	C
77	03	02	06	Err(1 byte)	Checksum
Event					
H	T	L	O	P	C
77	04	Length	05	Payload	Checksum

E.g. Version: S20150506(ASCII 53 32 30 31 35 30 35 30 36)

Command: 77 01 01 06 71

Response: 77 03 02 06 01 71

Event: 77 04 0A 05 53 32 30 31 35 30 35 30 36 Checksum

## 7) Send Data [0x0B]

Send data to master(APP/APK).

Command					
H	T	L	O	P	C
77	01	Length	0B	Payload	Checksum
Response					
H	T	L	O	P	C
77	03	02	0B	Err(1 byte)	Checksum

Payload: handle of connection(2 bytes) + user data(ex: 0A CE 09 )

Max length of the Payload is 22 bytes.

Rabbit can connected 2 masters at the same time, each master with a different Handle, and one of the Handle must be selected when sending data.

## 8) Set Local Name [0x0C]

After local name set, Rabbit would advertising with this name, and APP/APK could scan and show the BLE device with this name.

This command should be set after Rabbit Reset or Power on. Must before the command of "Set Pairing Mode"

Command					
H	T	L	O	P	C
77	01	Length	0C	Payload	Checksum
Response					
H	T	L	O	P	C
77	03	02	0C	Err(1 byte)	Checksum

Payload: Local name in ASCII code.

Max length of the Payload is 16 bytes.

## 9) Get System State [0x0D]

After send this command to Rabbit, MCU could get the system state by the command response.

Command					
H	T	L	O	P	C
77	01	01	0D	NA	7A
Response					
H	T	L	O	P	C
77	03	06	0D	Payload	Checksum

Payload: Advertising status(0 disable; 1 advertising) + handle1(00 no handle1) + handle2(00 no handle2).



## 10) Set GPIO [0x0E]

After send this command to Rabbit, Rabbit can set the GPIOs output High or Low.

Command					
H	T	L	O	P	C
77	01	Length	0E	Payload <sup>(4)</sup>	Checksum
Response					
H	T	L	O	P	C
77	03	02	0E	Err(1 byte)	Checksum

Payload: Level(bit7) | GPIO\_Number(bit0~6),

Bit7 means High or low levels , 1 means high level and 0 means low level.

Bit4~Bit6 means GPIO Port, Bit0~Bit3 means GPIO Pin.

Max length of the Payload is 8 bytes. User can control 8 GPIOs one time.

The pins can be set are as follows:

P0_0	P0_1	P0_2		P0_4	P0_5	P0_6	P0_7
		P1_2	P1_3	P1_4	P1_5	P1_6	P1_7
P2_0	P2_1	P2_2	P2_3	P2_4	P2_5	P2_6	P2_7
		P3_2	P3_3	P3_4	P3_5	P3_6	
P4_0	P4_1	P4_2	P4_3				

E.g.

CMD :0x 77 01 04 0E A3 A4 A5 DE

0xA3        P2\_3    output High

0xA4        P2\_4    output High

0xA5        P2\_5    output High

CMD :0x 77 01 04 0E 23 24 25 5E

0x23        P2\_3    output Low

0x24        P2\_4    output Low

0x25        P2\_5    output Low

## 11) Set Baudrate [0x0F]

After send this command to Rabbit, Rabbit can set UART output baudrate.

Command					
H	T	L	O	P	C
77	01	05	0F	Payload <sup>(1)</sup>	Checksum
Response					
H	T	L	O	P	C
77	03	02	0F	Err(1 byte)	Checksum
Event					
H	T	L	O	P	C
77	04	05	07	Payload	Checksum

Payload: UINT 32 Baudrate 9600~1500000

E.g. Set Rabbit Baudrate to 115200. (0x 00 01 C2 00)

CMD:0x 77 01 05 0F 00 C2 01 00 BF

After send this command to Rabbit, Rabbit will response a value (0x 77 03 02 0F 01 78) to MCU by 9600bps, then change the baudrate to 115200 100ms later and use new baudrate send a Event(0x 77 04 05 07 00 C2 01 00 B2) to MCU.

Note:

(1): Note: Default baudrate of Rabbit is 9600bps.

The supported Baudrates are as follows:

9600	14400	19200
28800	38400	57600
76800	115200	12800
153600	230400	460800
500000	921600	1000000
1382400	1444400	1500000

## 12) Set\_Deep\_Sleep[0x11]

After send this command to Rabbit, Rabbit into DeepSleep mode after 100ms.

Command					
H	T	L	O	P	C
77	01	03	11	Payload	Checksum
Response					
H	T	L	O	P	C
77	03	02	11	Err(1 byte)	Checksum

Payload(2 Bytes):

Byte 0: Bit7~Bit4 GPIO Port, Bit3~Bit0 GPIO Pin

Byte 1: Wakeup Level(0:Low, 1:High)

E.g. CMD:77 01 03 11 04 01 61

Set GPIO P0\_4 high level to wake up Rabbit. Rabbit into Deepsleep mode after 100ms when receive this command, and Rabbit can wake up by P0\_4 high level status.

### 13) Set\_LPM\_WAKEUP\_IO[0x12]

Set the pin to wake up the MCU and model.

Command					
H	T	L	O	P	C
77	01	03	12	Payload	Checksum
Response					
H	T	L	O	P	C
77	03	02	12	Err(1 byte)	Checksum

Payload(2 Bytes):

Byte 0: Bit7~Bit4 GPIO Port, Bit3~Bit0 GPIO Pin,

Byte 1: The duration of the high-level pulse, unit is 10ms.

E.g. CMD: 77 01 03 12 06 04 65

Set the P0\_6 pin of the Bluetooth module, the high-level pulse lasts for 40ms to wake up the MCU.

### 14) Set\_LPM\_ADV[0x13]

Set the Bluetooth heartbeat mode sleep interval.

Command					
H	T	L	O	P	C
77	01	05	13	Payload	Checksum
Response					
H	T	L	O	P	C
77	03	02	13	Err(1 byte)	Checksum
Event					
H	T	L	O	P	C
77	04	01	09	N	7B

Payload(4 Bytes):

UINT16 Interval , Bluetooth heartbeat mode sleep interval:  $0.625 \times \text{Interval}$  ms.

UINT16 Timeout, The broadcast duration of the heartbeat mode, in seconds, the timeout will wake up the MCU through the CMD[0x12] setting, and send the event EVENT\_LPM\_ADV\_TIMEOUT[0x09].

## 15.Set\_LPM\_CON[0x14]

Set the Bluetooth heartbeat mode connection interval.

Command					
H	T	L	O	P	C
77	01	05	14	Payload	Checksum
Response					
H	T	L	O	P	C
77	03	02	14	Err(1 byte)	Checksum
Event					
H	T	L	O	P	C
77	04	01	0A	N	78

Payload(4 Bytes):

UINT16 Interval , Bluetooth heartbeat mode connection interval :1.25\*Interval ms.

UINT16 Timeout,The duration of the heartbeat mode connection broadcast, in seconds, the timeout will wake up the MCU through the CMD[0x12] setting, and send the event EVENT\_LPM\_CON\_TIMEOUT[0x0A],

Interval : 0x0020~0x4000, interval \*0.625ms. The power consumption becomes lower as the interval set becomes larger.

### 2.2.Reserved [Type = 0x02]

Not in use

### 2.3.Response [Type = 0x03]

Response is the packet to notify result to host when it successfully receive the command from host.Host can check the response packet after command send.

\*Packet Format :Response

LSB		MSB			
Header	Type	Length	OpCode	Payload	Checksum
0x77 (Fix)	0x03 (Fix)	Variable	Variable	Variable	Variable

#### 2.3.1. Response Error Code

Error	Remark
0x01	ERR_NONE //Command received and processing
0x02	ERR_LENGTH_FAIL // Length of command is error
0x03	ERR_INVALID_FAIL // Command invalid error

## 2.4.Event [Type = 0x04]

Event is the packet to transmit data from Rabbit to Host, to report the event happened on BLE connections. Opcode of event package is complied with each event.

\* Packet Format : Event

Header		Type	Length	OpCode	Payload	Checksum
0x77 (Fix)	0x04 (Fix)	Variable	Variable	Variable	Variable	Variable

### 2.4.1. OpCode

#### 1) BLE Startup [0x01]

BLE is ready.

Event					
H	T	L	O	P	C
77	04	02	01	Payload	Checksum

Payload: 0x01ready; 0x02 fail.

#### 2) Pairing Status [0x02]

One master connected or disconnected with Rabbit.

To report this event to host.

Event					
H	T	L	O	P	C
77	04	Length	02	Payload	Checksum

Payload: Connected: 0x01 + connection Handle + master BD\_ADDR

Disconnected: 0x02 + connection handle

#### 3) Local Device Name [0x03]

Report Rabbit device name to Host.

Event					
H	T	L	O	P	C
77	04	Length	03	Payload	Checksum

Payload: Rabbit device name in ASCII code.

#### 4) Local BD Address [0x04]

Report Rabbit BD address to Host in ASCII.

Event					
H	T	L	O	P	C
77	04	Length	04	Payload	Checksum

Payload: Rabbit BD\_ADDR in ASCII.

#### 5) Local Firmware Version [0x05]

Report Rabbit Firmware version to Host.

Event					
H	T	L	O	P	C
77	04	Length	05	Payload	Checksum

Payload: Rabbit firmware version in ASCII.

#### 6) Master send data package [0x06]

Report to Host, the data sent by BLE master.

Event					
H	T	L	O	P	C
77	04	Length	06	Payload	Checksum

Payload: connection handle(2 bytes) + data from BLE master.

#### 7) Baudrate Return [0x07]

Report to Host, the data sent by BLE master.

Event					
H	T	L	O	P	C
77	04	05	07	Payload	Checksum

Payload: UINT 32 Baudrate 9600~1500000. The Baudrate which set by MCU.

E.g. SET Rabbit Baudrate to 115200. (0x 00 01 C2 00)

#### 8) EVENT\_LPM\_ADV\_TIMEOUT [0x09]

Rabbit reports heartbeat mode broadcast interval timeout information.

Event					
H	T	L	O	P	C
77	04	01	09	N	7B

Payload: NO

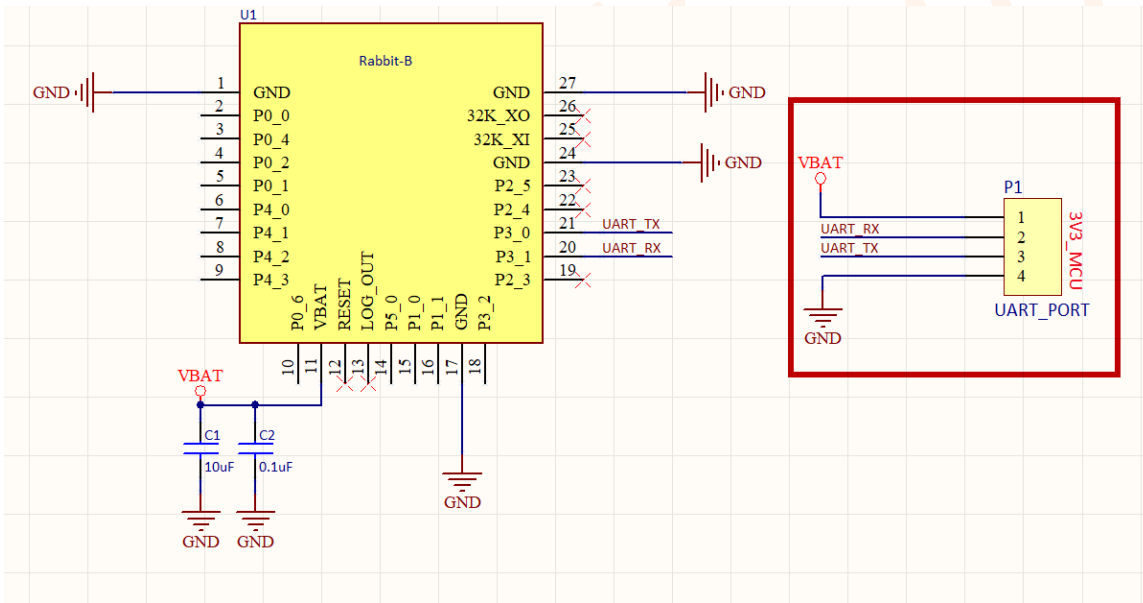
### 9) EVENT\_LPM\_CON\_TIMEOUT [0x0A]

Rabbit reports connection interval timeout information in heartbeat mode.

Event					
H	T	L	O	P	C
77	04	01	0A	N	78

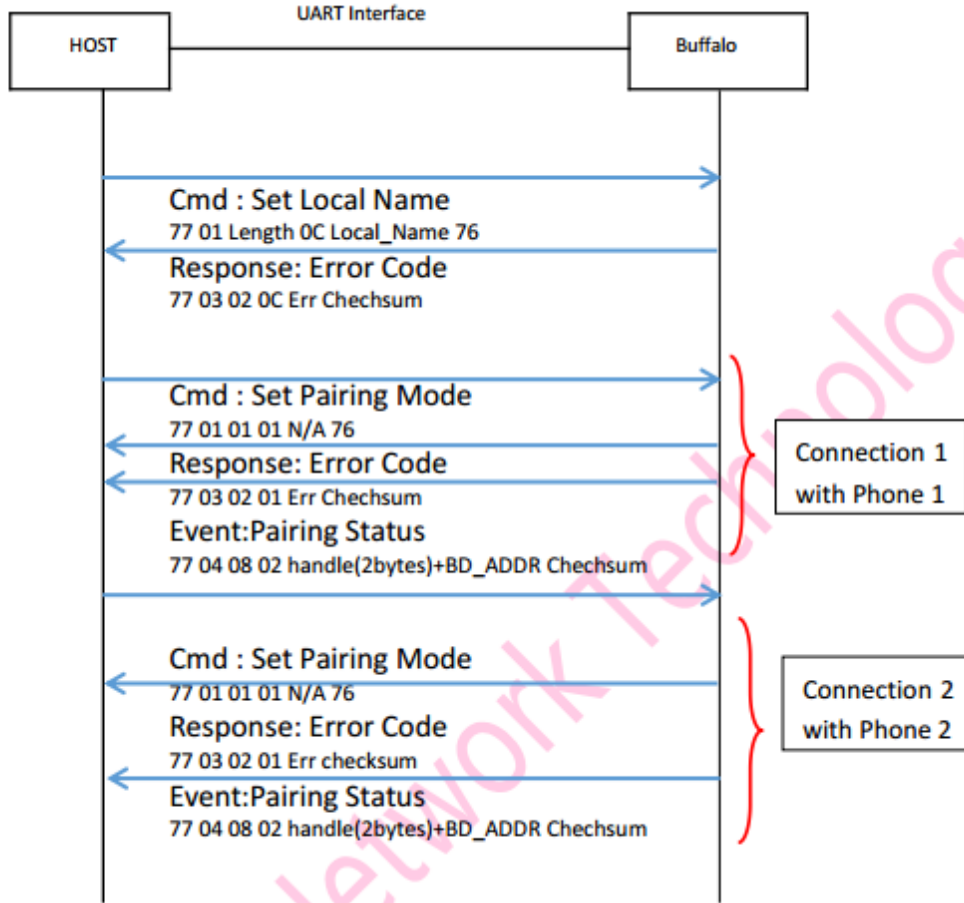
Payload: NO

### 3.Uart Port Diagram



## 4.Message Sequence Example

Set Pairing Mode : 0x01 to connect with Phone 1 & Phone 2.



Notice: Rabbit works as peripheral, could supports 2 BLE connections with two central phones at the same time.

For connection 1: Host set Rabbit into pairing mode, and when the Phone1 connect with Rabbit, it would report the 2-bytes connection handle1 to Host with the Phone1's BD\_ADDR.

For connection 2: Host set Rabbit to pairing mode again, and when the Phone2 connect with Rabbit, it would report this 2-bytes connection handle2 to HOST with the Phone2's BD\_ADDR.

Handle1 and Handle2 is a different value.