

## UART Communication Protocol

### Version

Version	Date	Author	Change Log
1.0	2018-08-27	Ding Ji Liang	1. First Time Release
1.1	2018-09-27	Ding Ji Liang	1. Modify PIN configuration. 2. Modify the default device information. 3. Add the response of Check Sum Error. 4. Add the event of UART type. 5. Add the event of Bluetooth Connection. 6. Add the event of data receive, and delete the response of data receive. 7. Update the Message Sequence Examples. 8. Update PIN Code format from ASCII Sequence to UINT32 9. Add Service BLE Definition 10. Add Test Speed Report
1.2	2018-12-10	Ding Ji Liang	1. PIN definition changed 2. The number of max bond device up to 5 3. Add OTA Service 4. External storage changed to SPI Flash 5. Remove hardware flow control
1.2.1	2019-1-11	Ding Ji Liang	1. LTK data is available by UART 2. ADD data event for LTK Data

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1.2.2	2019-8-30	Ding Ji Liang	<ol style="list-style-type: none"> <li>1. Data Length extension               <ol style="list-style-type: none"> <li>1.1 BLE PDU changed from 200 to 509</li> <li>1.2 UART Protocol Data length changed from UIN8 to UIN16, please refer to the Data Format part at page 6.UART max payload changed from 254 to 512</li> </ol> </li> <li>2. Connection Interval Min Changed from 15ms to 7.5ms(from 0X000C to 0X0006)</li> <li>3. UART set connection interval Protocol change (Command 0X03)</li> <li>4. UART Baud Rate List Updated(Command 0X01)</li> </ol>
1.2.3	2019-11-15	Ding Ji Liang	<ol style="list-style-type: none"> <li>1. Add GPIO Indication for connection status(Port 1 Pin 1,Active High)</li> </ol>
1.2.4	2020-05-28	Ding Ji Liang	<ol style="list-style-type: none"> <li>1. Add UART command for entering iBeacon Mode(0X61)</li> <li>2. Add UART command for entering normal mode(0X62)</li> <li>3. Change BT Connection Event(Event 0X03) to BLE Status Event(Add Parameter for the indication of iBeacon Mode )</li> </ol>

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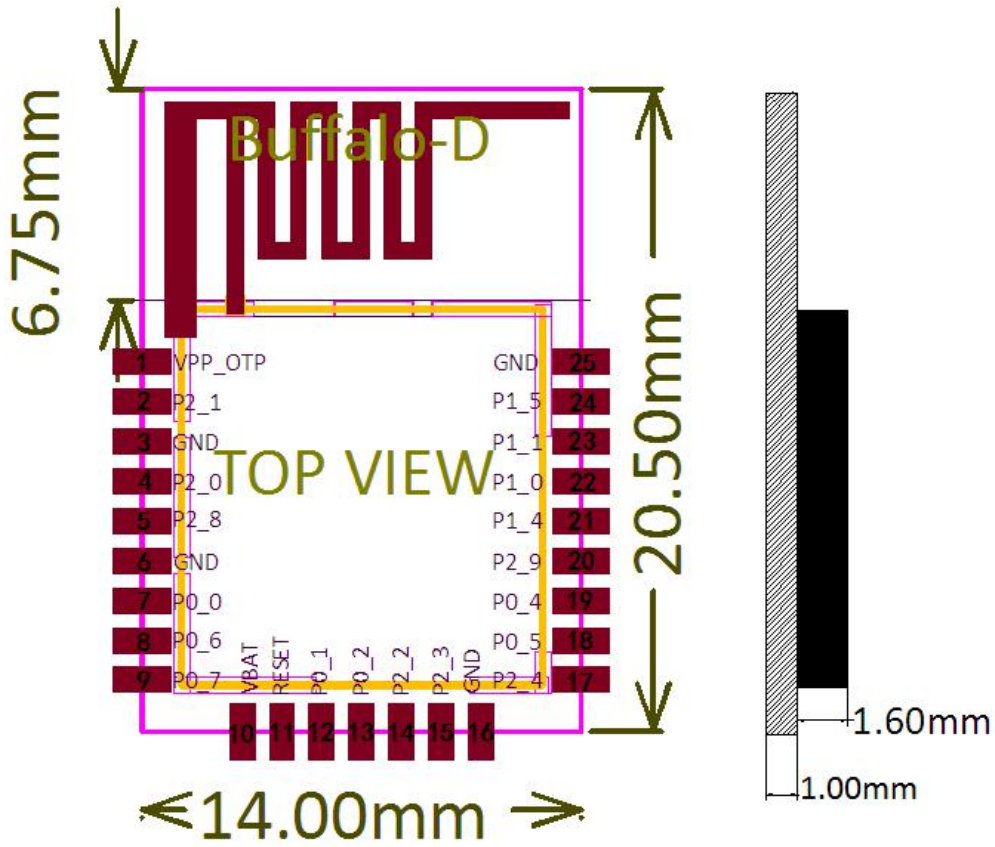
## General Description

The PLBD5EITO is a Bluetooth 5 SOC product, based on ARM Cortex-M0 processor. It's designed for pass-through application, which could be easily used between device and smart phone.

It's faster, lower power consumption and lower cost.

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### Pin Layout



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## Pin Function Description

Port Pin	Function	Input / Output	Explanation
/	VCC	/	Typically 3.3V
/	GND	/	Ground
/	REST_P	/	Reset Pin High: Reset
P2_9	UART TXD	Output	UART Data tx Pin
P2_4	UART RXD	Input	UART Data rx Pin
P0_4	SLEEP_EN	Input	Sleep Control input Pin: Input High: Force active Input Low: Sleep allowed
P0_3	CS PIN	Output	PIN distributed to external spi flash.
P0_5	SPI DO	Output	
P0_6	SPI DI	Input	
P0_0	SPI Clock	Output	
P0_2	Factory Test		PIN distributed to enter factory test mode
P0_7	Factory Test		
P1_1	Connection Status Indication	Output	Connection Up set Pin Connection Down reset Pin

- **Notice: If customer do not need the low power mode, keep the SLEEP\_EN Pin high.**

## Serial Interface

### UART Configuration

Default baud rate	9600bps
Default flow control	Disable
Data bits	8 bits
Stop bits	1 bit
Parity	No Parity

### Data Format

<b>Header</b>	0x77
<b>Type</b>	Type of Packet Command      0x01 Response      0x03 Event          0x04
<b>Length</b>	Length of OpCode + Payload <b>UINT16 Little-Endian MAX:513(0X0201)</b>
<b>Opcode</b>	Detail operation function of the Packet
<b>Payload</b>	Detail data of each OpCode
<b>Checksum</b>	Check the validity Packet header Checksum = Header ^ Type ^ Length ^ OpCode ^ Payload

**Notice:**

- **Command is sent from MCU to PLBD5EITO. Detail refer to the every command Opcode.**
- **Response is sent from PLBD5EITO to MCU, when it receive one command from MCU.**
- **Event is sent from PLBD5EITO to MCU, to report MCU what happened in bluetooth.**



## Command Opcode Description

### Command 0x01: Set Baud Rate [Opcode=0X01]

Command					
H	T	L	O	P(1 Byte)	C
77	01	02 00 (0X0002)	01	Baud rate Index(UINT8)	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	01	Error Code	XX

0X00	2400 bps
0X01	4800bps
0X02	9600 bps
0X03	19200 bps
0X04	38400 bps
0X05	57600 bps
0X06	115200 bps
0X07	460800bps
0X08	500000 bps
0X09	921600bps
0X0A	1000000 bps

Baud Rate Index Table

#### Notice:

- After system Power one or system Reset, the default baud rate is 9600 bps.
- When UART Command set new baud rate successfully, the module will generate a response with old baud rate. Then change the new baud rate automatically.

E.g. MCU send 77 01 02 00 01 09 7D to PLBD5EITO in 9600bps, to set the new baud rate to 921600bps.

PLBD5EITO respond 77 03 02 01 00 77 to MCU in 9600bps, and then modify the UART baud rate to 1Mbps.

### Command 0x03: Set Connection Interval and Timeout [Opcode = 0X03]

Command					
H	T	L	O	P(4 Bytes)	C
77	01	05 00(0X0005)	03	Connection Interval(UINT16) + Connection Timeout(UINT16)	XX
Response					

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H	T	L	O	P(1 Byte)	C
77	03	02 00(0X0002)	03	Error Code	XX

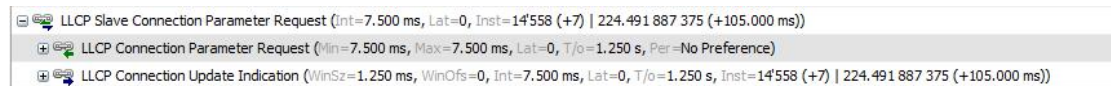
The **P**. should be between 0X0006 to 0X0640.

The connection interval = **P**. \* 1.25ms, could be set between 7.5ms to 2000ms.

E.g. MCU send "77 01 05 00 03 06 00 7D 00 XX"

Set connection interval as 0X0006 \* 1.25ms = 7.5ms

Set connection timeout as 0X007D \* 10ms = 1250ms



Module respond: 77 03 02 00 03 00 75

**Notice 1:** Once, the new Connection Interval is set by command, it would be saved in EEPROM, and would not be changed even the PLBD5EITO power off or software reset.

**Notice 2:** After set the connection interval, the PLBD5EITO would request the new interval to Master when bluetooth connection up, but if the master do not support the new connection interval, the final connection interval would be decided by the master.

Command 0x04: Get Connection Interval [Opcode = 0X04]

Command					
H	T	L	O	P(0 Byte)	C
77	01	01 00 (0X0001)	04	NA	XX
Response					
H	T	L	O	P(2 Byte)	C
77	03	03 00 (0X0003)	04	Connection Interval	XX

E.g. MCU send: 77 01 01 00 04 73

Module respond: 77 03 03 00 04 0C 00 7F

Command 0x05: Set Pair PIN Code [Opcode = 0X05]

Command					
H	T	L	O	P(4 Bytes)	C
77	01	05 00 (0X0005)	05	PIN Code	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	05	Error Code	XX

PIN Code is an UINT32 number (Little-endian) which is used for achieve authentication from the binding target.

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E.g. MCU send 77 01 05 00 05 40 E2 01 00 D5: While a new device connected to module, remote BLE device should enter “123456” to complete the authentication process.

Module respond: 77 03 02 00 05 00 73

**Notice: Once, the new PIN Code is set by command, it would be saved in EEPROM, and would not be changed even the PLBD5EITO power off or software reset.**

Command 0x06: Get Pair PIN Code [Opcode = 0X06]

Command					
H	T	L	O	P(0 Byte)	C
77	01	01 00 (0X0001)	06	NA	XX
Response					
H	T	L	O	P(4 Bytes)	C
77	03	05 00 (0X0005)	06	PIN Code	XX

E.g. MCU send 77 01 01 00 06 71

Module respond: 77 03 05 00 06 40 E2 01 00 D4 (Little-endian)

Command 0x07: Get BT Address [Opcode = 0X07]

Command					
H	T	L	O	P(0 Byte)	C
77	01	01 00 (0X0001)	07	NA	XX
Response					
H	T	L	O	P(6 Bytes)	C
77	03	07 00 (0X0007)	07	Bluetooth Public Address	XX

E.g.

MCU send: 77 01 01 00 07 70

Module respond: 77 03 07 00 07 33 22 11 D7 AC F0 FF

Command 0x08: Set BT Name [Opcode = 0X08]

Command					
H	T	L	O	P(20 bytes in max)	C
77	01	N	08	BT Name	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	08	Error Code	XX

BT Name should be in ASCII code. And the maximum length is 20 Characters.

In factory setting, the name is “BLE-Device-XXXXXX”. “XXXXXX” is the PLBD5EITO’s 3 low bytes BT Address. For example, MCU get BD Address “33 22 11 D7 AC F0” by

command and the default BT Name is “BLE-Device-112233”

E.g. MCU send: 77 01 05 00 08 41 42 43 44 7F Name of the module is set to “ABCD”.

Module respond 77 03 02 00 08 00 7E

**Notice: Once, the new BT name is set by command, it would be saved in EEPROM, and would not be changed even the PLBD5EITO power off or software reset.**

Command 0x09: Get BT Name [Opcode = 0X09]

Command					
H	T	L	O	P(0 Byte)	C
77	01	01 00 (0X0001)	09	NA	XX
Response					
H	T	L	O	P(20 bytes in max)	C
77	03	N	09	BT Name	XX

E.g. MCU send 77 01 01 00 09 7E

Module respond: 77 03 05 00 09 41 42 43 44 7C

Command 0x0A: Set Pair Mode [Opcode = 0X0A]

Command					
H	T	L	O	P(1 Byte)	C
77	01	02 00 (0X0002)	0A	Pair Mode	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	0A	Error Code	XX

P. 0X00 Disable the pair function after connection up.

P. 0X01 enable pair function: If there is one new device connected to the PLBD5EITO in pair mode, PLBD5EITO will launch binding. Pair PIN Code is needed in the process of authentication.

E.g. MCU send 77 01 02 00 0A 01 7F to enable the Pair Mode.

Module respond 77 03 02 00 0A 00 7C

**Notice 1: The PLBD5EITO is default in no pair mode.**

**Notice 2: After the command is handled correctly, the module will reset itself. And the pair mode will be Effective.**

**Notice 3: Once, the Pair Mode is set by command, it would be saved in EEPROM, and would not be changed even the PLBD5EITO power off or software reset.**

**Command 0x0B: Get Pair Mode [Opcode = 0X0B]**

Command					
H	T	L	O	P(0 Byte)	C
77	01	01 00 (0X0001)	0B	NA	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0020)	0B	Pair Mode	XX

E.g. MCU send: 77 01 01 00 0B 7C

Module respond: 77 03 02 00 0B 00 7D

**Command 0x0C: Set Advertisement Interval [Opcode = 0X0C]**

Command					
H	T	L	O	P(2 Bytes)	C
77	01	03 00 (0X0003)	0C	Advertisement Interval	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	0C	Error Code	XX

The **P**. should be between 0x0020 to 0x1F40 (20ms ~ 5000ms).

The Advertisement interval = P. \* 625uS.

E.g. MCU send 77 01 03 00 0C 20 00 59 to set the advertisement interval as 20ms.

Module respond 77 03 02 00 0C 00 7A

**Notice 1: The default advertising interval is 100ms.**

**This advertising interval is affect to the power consumption. The power consumption would be lower while the interval is longer. But when advertising interval longer than 1s, the bluetooth connection would be difficult.**

**Notice 2: Once, the new Advertising Interval is set by command, it would be saved in EEPROM, and would not be changed even the PLBD5EITO power off or software reset.**

**Command 0x0D: Get Advertisement Interval [Opcode = 0X0D]**

Command					
H	T	L	O	P(0 Byte)	C
77	01	01 00 (0X0001)	0D	NA	XX
Response					
H	T	L	O	P(2 Bytes)	C
77	03	03 00 (0X0003)	0D	Advertisement Interval	XX

E.g. MCU send: 77 01 01 00 0D 7A

Module respond: 77 03 03 00 0D 20 00 5A

**Command 0x0E: Set Advertising RF Power [Opcode = 0X0E]**

Command					
H	T	L	O	P(1 Byte)	C
77	01	02 00 (0X0002)	0E	Advertising RF Power	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	0E	Error Code	XX

**P. 0X00:** -20dBm (Near Field Mode)

**P. 0X01:** 0dBm (Default advertising RF Power)

E.g. MCU Send 77 01 02 00 0E 00 7A to set TX Power as -20dBm

Module respond 77 03 02 00 0E 00 78

**Command 0x0F: Get Advertising RX Power [Opcode = 0X0F]**

Command					
H	T	L	O	P(0 Byte)	C
77	01	01 00 (0X0001)	0F	NA	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	0F	Advertising RF Power	XX

E.g. MCU send: 77 01 01 00 0F 78

Module respond: 77 03 02 00 0F 01 78

**Command 0x10: Set BT Action [Opcode = 0X10]**

Command					
H	T	L	O	P(1 Byte)	C
77	01	02 00 (0X0002)	10	BT Status	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	10	Error Code	XX

**P. 0X00:** If PLBD5EITO in advertising mode, stop advertising.

If PLBD5EITO is in bluetooth connection mode, disconnect it and no advertising.

**P. 0X01:** Start to advertising if there is no bluetooth connection. The PLBD5EITO would no advertising after the next connection down.(Manual-Advertising).

**P. 0x02:** Start to advertising if there is no bluetooth connection. The PLBD5EITO would enter into advertising automatically after the next connection down (Auto-Advertising).

E.g. MCU send: 77 01 02 00 10 02 66 // Start ADV and Auto re-ADV if

disconnected from remote device

Module respond: 77 03 02 00 10 00 66

**Notice: Auto-Advertising(P. 0x02) is default enabled after system reset.**

Command 0x11: Get BT Status [Opcode = 0X11]

Command					
H	T	L	O	P(0 Byte)	C
77	01	01 00 (0X0001)	11	NA	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	11	BT Status	XX

MCU get BT Status from PLBD5EITO with the response:

0X00: No Connection, No Advertising

0X01: Advertising

0X02: Connected

E.g. MCU send: 77 01 01 00 11 66

Module respond: 77 03 02 00 11 02 65 (Remote Device Connected)

Command 0x1A: Set Device Info [Opcode = 0X1A]

Command					
H	T	L	O	P(N-1 Byte)	C
77	01	N	1A	Device Info data structure	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	1A	Error Code	XX

Device Info data structure include an index and a string, as the table below.

	Index	Type	Max Length	Default Data
System ID	0	8 Bytes	8	The first half part of BT Address + "0X00,0X00" + the second half part of BT Address E.g. 33 22 11 00 00 D7 AC F0
Model Number	1	String	20	"PLBD5EITO"
Serial Number	2	String	20	"SN:"
Firmware Revision	3	String	20	Refer to BLE SDK Version
Hardware Revision	4	String	20	"1.0.0"

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Software Revision	5	String	20	"1.0.0"
Manufacture Name	6	String	20	"Pairlink Network"

E.g. MCU send 77 01 0A 00 1A 00 33 22 11 00 00 D7 AC F0 ED.  
 Module respond 77 03 02 00 1A 00 6C

Command 0x1B: Get Device Info [Opcode = 0X1B]

Command					
H	T	L	O	P(1 Byte)	C
77	01	02 00 (0X0002)	1B	Index of device info	XX
Response					
H	T	L	O	P(N-1 Byte)	C
77	03	N	1B	Device Info	XX

E.g. MCU send 77 01 02 00 1B 00 6F  
 Module respond 77 03 0A 00 1B 00 33 22 11 00 00 D7 AC F0 EE

Command 0x41: Send Data [Opcode = 0X41]

Command					
H	T	L	O	P(N-1 Byte)	C
77	01	N	41	Data[]	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	41	Error Code	XX

MCU send data to bluetooth master when the PLBD5EITO has connected to one bluetooth master.

E.g. MCU send 77 01 09 00 41 01 02 03 04 05 06 07 08 36

E.g. MCU send 77 01 01 02 41 XXXXXXXXXXXX XX

Payload Len: 0X0200

Para Len: 0X0201

Module respond 77 03 02 00 41 00 37

Command 0X61: Enter iBeacon Mode [Opcode = 0X61]

Command					
H	T	L	O	P	C
77	01	16 00(0X0016)	61	Data[](0X15Bytes)	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	61	Error Code	XX

Parameter Description:



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Index	0~15	16~17	18~19	20
Type	Uint8 array	Uint16	Uint16	Int8
Parameter	UUID	Major	Minor	RSSI
Description				

If module is in connectable mode (do connectable advertising or be connected), module will stop connectable advertising (disconnect link if be connected) and start non-connectable beacon advertising with parameter.

If Module has been in iBeacon mode, module will update the data advertised.

Attention: Module is set to connectable mode after every reset boot.

E.g.

UART Command: 77 01 16 00 61 E2 C5 6D B5 DF FB 48 D2 B0 60 D0 F5 A7 10 96 E0 11 22 33 44 AB 9B

Module Response: 77 03 02 00 61 00 17 (Command Error None)

Module Status Update: 77 04 02 00 03 03 71 (iBeacon Advertising Start)

Command 0X62: Enter Connectable Mode [Opcode = 0X62]

Command					
H	T	L	O	P	C
77	01	01 00	62	N/A	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	62	Error Code	XX

If module is in iBeacon mode, it will stop advertising and start connectable advertising.

If module has been in connectable mode, module do nothing.

E.g.

UART Command: 77 01 01 00 62 15

Module Response: 77 03 02 00 62 00 14

Module Status Update: 77 04 02 00 03 01 73 (Connectable Advertising Start)

Command 0x80: Factory Reset [Opcode = 0X80]

Command					
H	T	L	O	P(0 Byte)	C
77	01	01 00 (0X0001)	80	NA	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00 (0X0002)	80	Error Code	XX

Once PLBD5EITO receive this command correctly, it would erase all the user settings, include BT Name, Pair Mode, Pair Pin Code, Advertisement Interval, Connection Interval, Device Information.

E.g. MCU send 77 01 01 00 80 F7

Module respond 77 03 02 00 80 00 F6

### Command 0x81: System Reset [Opcode = 0X81]

Command					
H	T	L	O	P(0 Byte)	C
77	01	01 00 (0X0001)	81	NA	XX
Response					
H	T	L	O	P(1 Byte)	C
77	03	N	81	Error Code	XX

Once PLBD5EITO receive this command correctly, it will soft reset itself.

E.g. MCU send 77 01 01 00 81 F6

Module respond 77 03 02 00 81 00 F7

### Response Error Code Description

Response					
H	T	L	O	P(1 Byte)	C
77	03	02 00(0X0002)	81	Error Code	XX

P. 0x00 Error None

P. 0x01 Opcode Invalid

P. 0x02 Parameter Invalid

P. 0x03 Check Sum Error

E.g. MCU send 77 01 02 00 01 02 76

PLBD5EITO would generate a check sum error response: 77 01 02 00 00 03 77

#### Notice: Check Sum Error [Opcode=0X00]

Once the PLBD5EITO received one data stream from MCU, but the checksum is error after verified. PLBD5EITO would generate a response with opcode 0X00, means check sum error.

### Event Description [Type = 0X04]

#### Event 0x01: System boot up Event [Opcode = 0X01]

Event					
H	T	L	O	P(0 Byte)	C
77	04	01 00 (0X0001)	01	N/A	XX

Once the PLBD5EITO is powered on or system reset, software reset, it would generate this event to MCU.

System boot up event: 77 04 02 00 01 00 70

**Event 0x02: Receive Data [Opcode = 0X02]**

Event					
H	T	L	O	P(N-1 Byte)	C
77	04	N	02	Data	XX

Once PLBD5EITO received a data stream from bluetooth master, it will generate a event package with data to MCU.

E.g. Module send 77 04 **09 00** 02 01 02 03 04 05 06 07 08 70

**Event 0x03: BLE Status Event [Opcode = 0X03]**

Event					
H	T	L	O	P(1 Byte)	C
77	04	<b>02 00 (0X0002)</b>	03	Module Status	XX

Module Generate a status event, while advertising mode changed or connection status changed

**P. 0x00:** 77 04 **02 00** 03 **00** 72, connection down event and stay in no advertising mode.

**P. 0x01:** 77 04 **02 00** 03 **01** 73, connectable Advertising Start Event

**P. 0x02:** 77 04 **02 00** 03 **02** 70, connection up event.

**P. 0x02:** 77 04 **02 00** 03 **03** 71, iBeacon Advertising Start Event

**Event 0x04: LTK Data Event [Opcode = 0X04]**

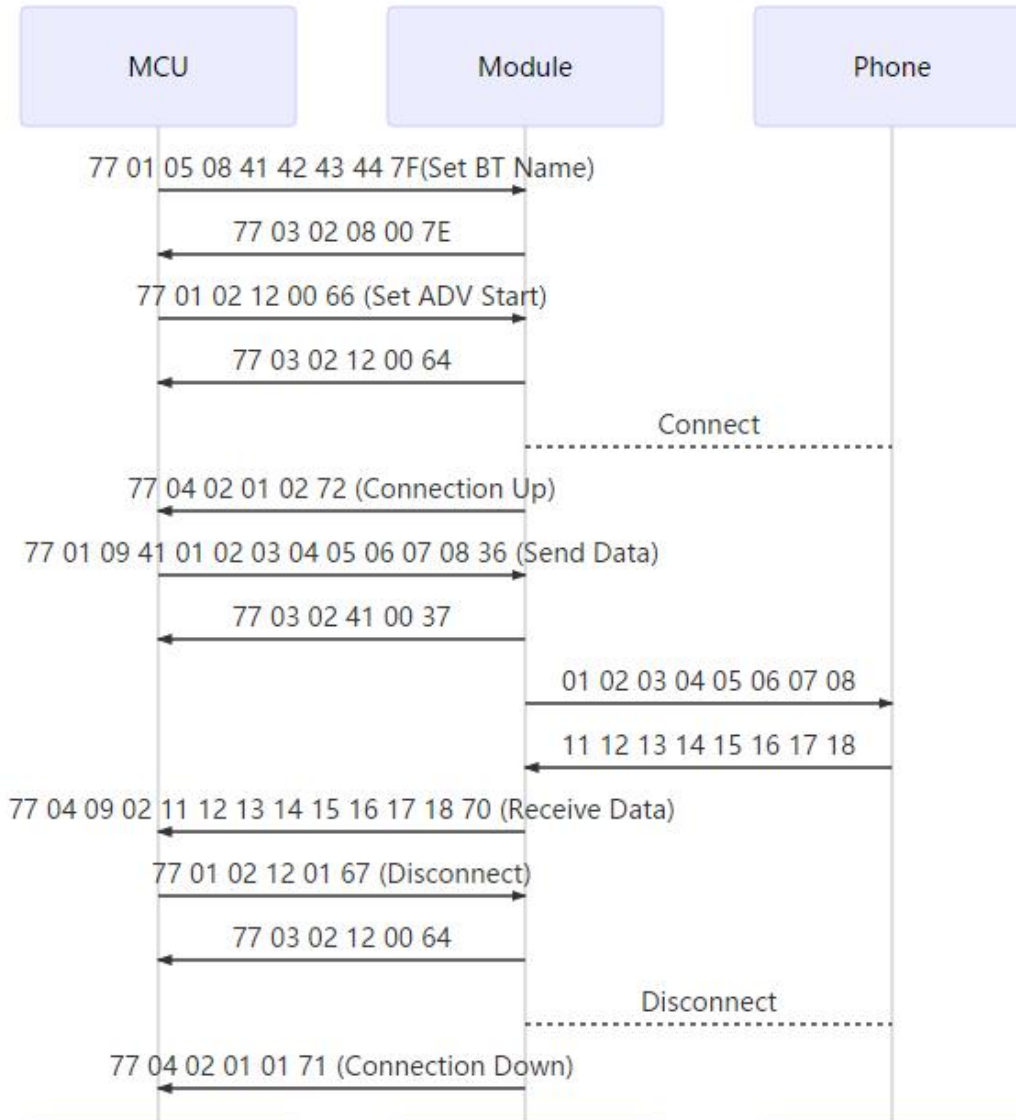
Event					
H	T	L	O	P(16 Byte)	C
77	04	<b>11 00 (0X0011)</b>	04	LTK Data	XX

LTK Data format: Little endian,16byte

Sample: After pair succeed, app generate a UART message.

77 04 **11 00** 04 3F 2A 98 47 F9 DD AB 50 B2 AC A7 40 42 7E 44 3E CC

## Appendix I Message Sequence Example



## Appendix II Factory Configuration in EEPROM

Default BT Name: BLE-Device-XXXXXX (XXXXXX is depend on BD Address)

Default Connection Interval: 0X000C (12\*1.25ms = 15ms)

Default Advertising Interval: 0X00A0 (160 \* 0.625 = 100ms)

Default Pair Mode: Disabled

Default PIN Code: 0X0001E240 (123456)

Default device info service:

	Index	Type	Max Length	Default Data
System ID	0	8 Bytes	8	The first half part of BT Address

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				+ "0X00,0X00" + the second half part of BT Address E.g. 33 22 11 00 00 D7 AC F0
Model Number	1	String	20	"PLBD5EITO"
Serial Number	2	String	20	"SN:"
Firmware Revision	3	String	20	Refer to BLE SDK Version
Hardware Revision	4	String	20	"1.0.0"
Software Revision	5	String	20	"1.0.0"
Manufacture Name	6	String	20	"Pairlink Network"

Bluetooth Interface Definition:

### Device Information

Device Information Service:

Service UUID: 0X180A

System ID Char:

Char UUID: 0X2A23

Char Permission: Read Only

Model Number String Char:

Char UUID: 0X2A24

Char Permission: Read Only

Serial Number String:

Char UUID: 0X2A25

Char Permission: Read Only

Firmware Revision String:

Char UUID: 0X2A26

Char Permission: Read Only

Hardware Revision String:

Char UUID: 0X2A27

Char Permission: Read Only

**Software Revision String:**

Char UUID: 0X2A28

Char Permission: Read Only

**Manufacture Name String Char:**

Char UUID: 0X2A29

Char Permission: Read Only

**PLBD5EITO Transmission****PLBD5EITO Transmission Service**

Service UUID: {0x9E, 0xE7, 0xBA, 0x08, 0xB9, 0xA9, 0x48, 0xAB, 0xA1, 0xAC, 0x03, 0x1C, 0x2E, 0x0D, 0x29, 0x6C}

**Data in Char:**

Char UUID: {0x20, 0xEE, 0x8D, 0x0C, 0xE1, 0xF0, 0x4A, 0x0C, 0xB3, 0x25, 0xDC, 0x53, 0x6A, 0x68, 0x86, 0x2D}

Char Permission: Write with Response | Write without Response

**Data out Char:**

Char UUID: {0x4F, 0x43, 0x31, 0x3C, 0x93, 0x92, 0x42, 0xE6, 0xA8, 0x76, 0xFA, 0x3B, 0xEF, 0xB4, 0x87, 0x5A}

Char Permission: Notification

**Baud Rate Set Char:**

Char UUID: {0x17, 0xB9, 0x67, 0x98, 0x4C, 0x66, 0x4C, 0x01, 0x96, 0x33, 0x31, 0xB1, 0x91, 0x59, 0x00, 0x15}

Char Permission: Write with Response | Write without Response | Read

**Connection ITV Char:**

Char UUID: {0x23, 0x68, 0xEC, 0x52, 0x1E, 0x62, 0x44, 0x74, 0x9A, 0x1B, 0xD1, 0x8B, 0xAB, 0x75, 0xB6, 0x6E}

Char Permission: Write with Response | Write without Response | Read

**Advertisement ITV Char:**

Char UUID: {0x2F, 0x2A, 0x93, 0xA6, 0xBD, 0xD8, 0x41, 0x52, 0xAC, 0x0B, 0x10, 0x99, 0x2E, 0xC6, 0xFE, 0xED}

Char Permission: Write with Response | Write without Response | Read

**Tx Power Char:**

Char UUID: {0x28, 0xD5, 0xE1, 0xC1, 0xE1, 0xC5, 0x47, 0x29, 0xB5, 0x57, 0x65, 0xC3, 0xBA, 0x47, 0x15, 0x9E}

Char Permission: Write with Response | Write without Response | Read

**Factory Set Char:**

Char UUID: {0x8C, 0xAC, 0xE0, 0xD1, 0x81, 0x54, 0x42, 0x40, 0x8E, 0x4F, 0xD2, 0xB3, 0x77, 0xE3, 0x2A, 0x77}

Char Permission: Write with Response | Write without Response | Read

**System Reset Char:**

Char UUID: {0x2F, 0x2A, 0x93, 0xA6, 0xBD, 0xD8, 0x41, 0x52, 0xAC, 0x0B, 0x10, 0x99, 0x2E, 0xC6, 0xFE, 0xEC}

Char Permission: Write with Response | Write without Response | Read

## Appendix III Transmission Speed

Test Unit: **iPhone7**

Test Package Size: **182 bytes**

Test Package Number: **100, 200, 500**

	100	100	100	100	100	100	100	100	100	100
Time S (Write without Response)	0.496	0.451	0.458	0.433	0.427	0.482	0.440	0.511	0.497	0.497
Speed KB/S(Write without Response)	36.7	40.3	39.7	42	42.7	37.8	41.4	35.6	36.6	36.6
Time S (Write with Response)	3.089	3.336	3.217	3.290	3.182	3.221	3.124	3.216	3.094	3.134
Speed KB/S(Write with Response)	5.9	5.5	5.7	5.5	5.7	5.7	5.8	5.7	5.9	5.8

	200	200	200	200	200	200	200	200	200	200
Time S (Write without Response)	1.035	1.139	1.081	0.999	1.138	1.058	1.075	1.084	1.033	1.014
Speed KB/S(Write without Response)	35.2	32	33.7	36.4	32	34.4	33.9	33.6	35.2	35.9
Time S (Write with Response)	6.568	6.438	6.404	6.516	6.487	6.350	6.576	6.508	6.360	6.457
Speed KB/S(Write with Response)	5.5	5.7	5.7	5.6	5.6	5.7	5.5	5.6	5.7	5.6

	500	500	500	500	500	500	500	500	500	500
Time S (Write without Response)	3.469	3.455	3.141	3.980	3.222	2.819	3.268	2.932	3.361	3.901
Speed KB/S(Write without Response)	26.2	26.3	29.0	22.8	28.2	32.3	27.8	31.0	27.1	23.3
Time S (Write with Response)	16.448	16.606	16.509	16.498	16.638	16.683	15.790	15.969	15.930	16.187
Speed KB/S(Write with Response)	5.5	5.5	5.5	5.5	5.5	5.5	5.8	5.7	5.7	5.6

Test Unit: **iPhone6S**

Test Package Size: **182 bytes**

Test Package Number: **100, 200, 500**

PLBD5EITO UART Protocol

	100	100	100	100	100	100	100	100	100	100
Time S (Write without Response)	1.268	1.338	1.307	1.284	1.314	1.277	1.279	1.319	1.327	1.275
Speed KB/S(Write without Response)	14.4	13.6	13.9	14.2	13.8	14.3	14.2	13.8	13.7	14.3
Time S (Write with Response)	3.561	3.912	3.354	3.300	3.451	3.344	3.383	3.405	3.419	3.338
Speed KB/S(Write with Response)	5.1	4.7	5.4	5.5	5.3	5.4	5.4	5.3	5.3	5.5

	200	200	200	200	200	200	200	200	200	200
Time S (Write without Response)	2.929	2.970	2.950	2.848	2.791	2.824	2.838	2.817	2.856	2.885
Speed KB/S(Write without Response)	12.4	12.3	12.3	12.8	13	12.9	12.8	12.9	12.7	12.6
Time S (Write with Response)	7.033	6.946	6.682	6.962	6.893	6.904	6.848	6.986	7.092	7.318
Speed KB/S(Write with Response)	5.2	5.2	5.4	5.2	5.3	5.3	5.6	5.2	5.1	5

	500	500	500	500	500	500	500	500	500	500
Time S (Write without Response)	8.520	7.776	7.825	7.891	7.610	7.724	7.718	7.993	7.849	7.768
Speed KB/S(Write without Response)	10.7	11.7	11.6	11.5	12.0	11.8	11.8	11.4	11.6	11.7
Time S (Write with Response)	17.690	17.641	17.603	17.279	17.325	17.157	17.477	17.673	17.773	17.418
Speed KB/S(Write with Response)	5.1	5.2	5.2	5.3	5.3	5.3	5.2	5.1	5.1	5.2

Test Unit: iPhone5S

Test Package Size: 182 bytes

Test Package Number:100, 200, 500

	100	100	100	100	100	100	100	100	100	100
Time S (Write without Response)	1.554	1.464	1.406	1.874	1.470	1.557	1.508	1.505	1.610	1.608
Speed KB/S(Write without Response)	11.7	12.4	12.9	9.7	12.4	11.7	12.1	12.1	11.3	11.3
Time S (Write with Response)	3.964	4.206	4.160	4.323	4.184	4.270	4.180	4.417	4.527	4.417
Speed KB/S(Write with Response)	4.6	4.3	4.4	4.2	4.3	4.3	4.4	4.1	4	4.1

	200	200	200	200	200	200	200	200	200	200
Time S (Write without Response)	3.261	3.392	3.382	3.318	3.468	3.420	3.439	3.433	3.514	3.512
Speed KB/S(Write without Response)	11.2	11.1	10.8	11	10.5	10.6	10.6	10.6	10.4	10.4
Time S (Write with Response)	8.779	8.627	8.267	8.271	8.716	8.131	8.525	8.268	8.166	8.058
Speed KB/S(Write with Response)	4.1	4.2	4.4	4.4	4.2	4.5	4.3	4.4	4.5	4.5

	500	500	500	500	500	500	500	500	500	500
Time S (Write without Response)	8.223	8.637	8.868	8.518	8.560	8.717	8.549	8.484	8.688	8.404
Speed KB/S(Write without Response)	11.1	10.5	10.3	10.7	10.6	10.4	10.6	10.7	10.5	10.8
Time S (Write with Response)	21.836	21.116	21.274	20.466	19.321	19.456	19.419	20.082	18.949	19.396
Speed KB/S(Write with Response)	4.2	4.3	4.3	4.4	4.7	4.7	4.7	4.5	4.8	4.7