



BlueSoleil Ecosystem

BlueSoleil i410e Programming Manual

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Version 1.5

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VERSION HISTORY

REVISION	AMENDMENT	DATE	AUTHOR
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1.1	1. Add GLP, HTP, GP, HID, Battery Level commands; 2. Change commands' format.	2013-4-22	Yan Laijun Li Li
1.1	Update chapters 6.5.4&6.6.7.	2013-5-10	Li Li
1.2	1. Default baud rate changes to 115200 2. Add AT+B GLBD command 3. Remove AT+B SEND command. When i410e works as peripheral, it could transparently send data without using any AT commands. 4. When i410e works as central, it supports sending data either using AT commands, or without using AT commands. 5. Update chapter structures	2013-12-6	Li Li
1.3	Add AT+B Profile command	2014-4-8	Li Li
1.4	Add Chapter 8&11 PIO Assignment	2014-4-14	Li Li
1.5	Update advertising description	2014-4-15	Li Li

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1 Introduction

IVT BlueSoleil Module i410e is a *Bluetooth* 4.0 single-mode module targeted for low power sensors and accessories. i410e offers all *Bluetooth* low energy features: radio, stack, profiles and application space for customer applications. The module also provides flexible hardware interfaces to connect sensors and simple user interfaces.

i410e is embedded with BlueSoleil firmware that integrates *Bluetooth* low energy stack: L2CAP, SMP, ATT, GATT, GAP, and *Bluetooth* 4.0 profiles: GATT Data Profile (IVT proprietary profile based on GATT), HRP (Heart Rate Profile), CSCP (Cycling Speed and Cadence Profile), GLP (Glucose Profile), HID (Keyboard & Mouse), FMP (Findme Profile), HTP (Health Thermometer Profile), BP (Blood Pressure Profile), and Battery Service. The i410e module can work either as a central device or as a peripheral.

i410e can act as controller role, and MCU acts as host role. *Bluetooth* functions are embedded in the controller unit and the application is running in the host unit. To achieve high-level hardware integration, the host unit communicates with the controller unit via UART by sending well defined AT commands. Alternatively, when i410e works as a peripheral, it may not need to connect to any external MCU. For instance, when i410e is integrated into a fob, i410e can automatically advertise within a certain time interval and accept the connection establishment request that is initialized from the central device. iOS and Windows Middleware are provided for the third-party development.

This document addresses BlueSoleil firmware i410e's default setting, and how to develop *Bluetooth* 4.0 related functions.

2 State Machine

The i410e module can work either as a central device or as a peripheral. When i410e works as a central device, such as i410e is integrated into terminals or tablets, i410e can initialize a connection establishment request, and access peripherals' services. When i410e works as a central device, it can establish connections with more than one peripheral, but there is only one active connection at one time. When i410e works as a peripheral, such as i410e is integrated into healthcare or fitness sensor devices, it can accept the connection establishment request that is initialized from a central device. It can connect to only one central device at one time.

i410e's defined statuses are as follows:

Wake-up Idle: i410e's internal MCU is idle, and i410e does not meet the requirements of entering the Deep Sleep status.

Wake-up Idle: i410e's internal MCU is idle, and i410e does not meet the requirements of entering the Deep Sleep status.

Sleep (Deep Sleep): When i410e is the Wake-up Idle status, and it meets the requirements of entering the Deep Sleep status, i410e will gradually enter the Sleep status.

Hibernate: MCU can send an AT command to request i410e to enter the Hibernate status. Refer to the chapters 5.9. Pulling high the Wake PIN to wake up i410e from the Dormant status.

Dormant: MCU can send an AT command to request i410e to enter the Dormant status. Refer to the chapters 5.8. Pulling high the Wake PIN to wake up i410e from the Dormant status.

When i410e is in the Wake-up Idle status, all its components are power-on. When i410e is in the Sleep, Hibernate or Dormant status, only part of i410e's components are power-on. Entering the Sleep, Hibernate, or Dormant status, and waking up i410e from these statuses are relevant to i410e specific firmware versions.

3 Default Setting

This chapter introduces BlueSoleil firmware i410e's default settings.

3.1 UART Default Setting

The initial UART default setting is 115200/8/N/1. The baud rate and waking-up method can be customized according to specific requirements. There are two waking-up methods. When i410's UART setting is 115200/8/N/1, the waking-up method refers to Table 1 below.

Table 1 Waking up method when UART setting is 115200bps/8/N/1

i410e Status	Waking-up Method
Deep Sleep	When i410e's RF is idle, i410e will automatically enter the Deep Sleep status. It is able to waking up i410e either with pulling low the Wake pin or i410e's PIO level change. When the Wake pin pulls high, i410e cannot receive data from UART.
Hibernate	MCU can send an AT command to request i410e to enter the Hibernate status. Refer to the chapters 5.1.7. UART does not work. Pulling high the Wake pin to wake up i410e.
Dormant	MCU can send an AT command to request i410e to enter the Dormant status. Refer to the chapters 5.1.6. UART does not work. Pulling high the Wake pin to wake up i410e.

3.2 Default Device Name

When i410e works as a peripheral, GATT firmware version's default name is IVT Data; HRP firmware version's default name is IVT Heart Rate; CSCP firmware version's default name is IVT CSC; GLP firmware version's default name is IVT Glucose; HID keyboard firmware version's default name is IVT Keyboard; HID mouse firmware version's default name is IVT Mouse; FMP firmware version's default name is IVT FM; HTP firmware version's default name is IVT HIT; BP firmware version's default name is IVT BP.

3.3 Bonding

i410e's pairing strategy is Just Works, so it does not require inputting the PIN code when pairing with it. When i410e works as a peripheral and it has been successfully paired with a central device, i410e will save the bond information with this central device. This bond information is saved in i410e's local non-volatile memory. i410e will exclusively accept the connection establishment request only from this central device after paired with this central device. The i410e's bond information can be cleared by sending the AT command "AT+B RST\r". If the peripheral has been bonded with the central device before, the peripheral can choose if it would like to add the bonded address to the white list in order to enable white list functionality. When the white list functionality is enabled, the peripheral could only accept the connection initialization request from the central device added in the white list. i410e could provide link encryption functionality.

4 Convention

This chapter introduces the convention of i410e's AT commands and indications.

4.1 Format Convention

BlueSoleil firmware uses the standard AT command format to interact with remote devices. AT commands begin with AT+B and indications begin with AT-B. Both commands and indications end with the hexadecimal character 0d that is represented with \r in this document. MCU needs to follow the convention when sending AT commands to i410e to avoid any unpredictable error.

4.2 Parameter Format

If the parameter defined in either commands or events are embraced by parentheses, it represents this parameter's contents are raw data string, which can include the character \r. If the parameter defined in either commands or events are embraced by brackets, it represents these parameters will be transformed to integers. For instance, "AT+B GLP ND 0f,\x0e\x00\x00\xdd\x07\x02\x01\x01\x01\x00\x00\x11\x00\x00\r" is an instance of AT command "AT+B GLP ND [len],[raw_data]\r". It represents to send a measurement data string which length is 15 bytes.

5 Generic Commands when i410e Works as Peripherals

This chapter introduces generic AT commands and indications when i410e works as peripherals

5.1 Query Firmware Version

Command	AT+B GVER\r	
Indication	AT-B GVER [version_info]\r	
Parameter	version_info	For instance, I410E.HRP.0.20121112.1 represents the i410e firmware's release date is 2012-11-12 and it supports HRP. I410E.CSCP.0.20121112.1 represents the i410e firmware's release date is 2012-11-12 and it supports CSCP.
Note	N/A	

5.2 Set Local Device Name

Command	AT+B SLDN [new_name_string]\r	
Indication	AT-B SLDN 0\r	
Parameter	new_name_string	Local device name. Less than 20 bytes. Cannot include \r.

Note	N/A
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5.3 Query Local Bluetooth Address

Command	AT+B GLBD \r	
Indication	Succeeded: AT-B GLBD 0,[bd]\r Failed: AT-B GLBD 1,0\r	
Parameter	bd	Local Bluetooth address
Note	This command is used to get local Bluetooth address	

5.4 Advertising

Command	AT+B ADV [op]\r	
Indication	Succeeded: AT-B ADV 0\r Failed: AT-B ADV 1\r	
Parameter	op	1: start advertising; 0: stop advertising.
Note	<p>After i410e successfully starts to advertise, it will return the status indication "AT-B STATE 1". i410e starts 30s fast advertising which advertising interval is 20ms. After the fast advertising is completed, i410e starts 30s slow advertising which advertising interval is 1.28s. i410e can be searched and connected by a central device when i410e is in the advertising status. After the slow advertising is completed, i410e will enter idle status. i410e cannot be searched and connected by a central device when i410e in the idle status. The indication "AT-B STATE [state_num]\r" refers to the chapter 6.1.</p>	

5.5 Pair

Command	AT+B PAIR\r
Indication	Start to execute: AT-B PAIR 0\r Haven't executed: AT-B PAIR 1\r

	Pair result: AT-B PAIR [sys_status],[security_level]\r	
Parameter	sys_status	0: pair succeeded; Other values: pair failed.
	security_level	BLE Security Mode 1 security level. 00: security none; 01: unauthenticated; 02: authenticated.
Note	i410e can save the bond information with one device. After i410e successfully pairs with a new device, the new device's bond information will overwrite the old bond information.	

5.6 Release Connection

Command	AT+B DISCON\r
Indication	Succeeded: AT-B DSICON 0\r Failed: AT-B DISCON 1\r
Parameter	N/A
Note	When there is a connection, this command will release the connection. After the connection is successfully released, it will return the status indication AT-B STATE 5. The indication "AT-B STATE [state_num]\r" refers to the chapter 6.1.

5.7 Reset

Command	AT+B RST\r
Indication	Succeeded: AT-B RST 0\r Failed: AT-B RST 1\r
Parameter	N/A
Note	This command will clear the bond information saved in i410e. When i410e is in the connected status, i410e will enter the idle status. When i410e is in the advertising status, i410e will stop advertising. After this command is successfully executed, it will return the indication "AT-B STATE [state_num]" to report i410e status change. Refer to the chapter 6.1.

5.8 Enter Dormant

Command	AT+B DORMANT\r
Indication	N/A
Parameter	N/A
Note	The Dormant Status has the lowest power consumption. Pulling high the Wake PIN (PIN No.15) to wake up i410e from the Dormant Status.

5.9 Enter Hibernate

Command	AT+B HIBERNATE [hibernate_duration]\r	
Indication	N/A	
Parameter	hibernate_duration	Hibernate time. The unit is us. Hexadecimal character. The minimum hibernate time is 2^{20} , 1.048576s. When hibernate_duration is less than the minimum hibernate time, hibernate_duration will be set with the minimum hibernate time, 1.048576s.
Note	For instance, AT+B HIBERNATE 100000 represents hibernate_duration is 2^{20} us, 1.048576s.	

5.10 Query Status

Parameter	AT+B STATE\r	
Indication	AT-B STATE [state_num]\r	
Parameter	state_num	Module status. Refer to the chapter 6.1.
Note	N/A	

5.11 Enable White List

Command	AT+B SWLF [enable]\r
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Indication	Succeeded: AT-B SWLF 0\r Failed: AT-B SWLF 1\r	
Parameter	enable	0: disable White list; 1: enable White list.
Note	If i410e has been bonded with a device before, i410e can choose if it would like to add the bonded address to the white list and enable the white list function when advertising. When the white list function is enabled, i410e can only accept the connection establishment request from the device in the white list.	

5.12 Query White List

Command	AT+B GWLF\r	
Indication	AT-B GWLF [enable]\r	
Parameter	enable	0: i410e doesn't enable white list; 1: i410e enables white list.
Note	This command queries if i410e enables the white list function.	

5.13 Enable Profiles

Command	AT+B PROFILE [num]\r	
Indication	Succeeded: AT-B PROFILE 0\r Failed: AT-B PROFILE 1\r	
Parameter	num	0: BLP; 1: CSCP; 2: FMP; 3: GATT; 4: GLP; 5: HTP; 6: HRP; 7: HID Keyboard;

		8: HID Mouse; 9: Central.
Note	N/A	

6 Generic Indications when i410e Works as Peripherals

6.1 Status

Indication	AT-B STATE [current_state_num]\r	
Parameter	current_state_num	i410e's status. When i410e's status changes, it will return its new status and report it to MCU, where 0: Initial status; 1: Advertising status; 3: Connected status; 4: Disconnecting status; 5: Idle status.
Note	When a connection is established, the indication "AT-B STATE 3\r" will return.	

6.2 Error

Indication	AT-B ERROR\r	
Parameter	N/A	
Note	If i410e returns this indication, it represents i410e fails to parse the received AT command, such as the AT command is wrong or i410e does not support the received AT command.	

6.3 Encryption Check Failure

Indication	AT-B VERIFY 1\r
Parameter	N/A
Note	After 15s when i410e starts to initialize, it will execute the hardware encryption check procedure. If this procedure fails, i410e will return this indication. Under this circumstance, i410e cannot work properly, and it will not proceed AT commands sent from MCU.

7 Profile Related AT Commands & Indications when i410 works as peripherals

When i410e works as a peripheral, such as i410e is integrated into low power sensor devices, it supports the following profiles: GATT Data Profile, HRP, CSCP, GLP, HID, FMP, HTP, BP and Battery Service. Each profile has a separate firmware version. This chapter introduces profile related AT commands and indications when i410e works as peripherals.

7.1 GATT Data Profile

The data could be transparently sent to the central without using any AT commands after the GATT connection is established.

7.2 Heart Rate Profile

7.2.1 Query HR Measurement Notify Status

Command	AT+B HR NS\r
Indication	AT-B HR NS [state_num]\r

Parameter	state_num	0: HR Measurement Notify does not be configured; 1: HR Measurement Notify is configured.
Note	i410e will support this command only when i410e works as peripherals and its firmware supports HRP.	

7.2.2 HR Measurement Notification

Before sending the measurement data, if 410e returns the indication “AT-B HRP N 1\r” to MCU, it represents i410e can send the heart rate measurement data; if i410e returns the indication “AT-B HRP N 0\r” to MCU, it represents i410e cannot send the heart rate measurement data to the central device.

Command	AT+B HR ND [heart_rate],[energy],[RR_Interval]\r	
Indication	Succeeded: AT-B HR ND 0\r Failed: AT-B HR ND 1\r	
Parameter	heart_rate	Heart rate. Hexadecimal character. The unit is beats per minute. 8 bit.
	energy	Calorie consumption. Hexadecimal character. The unit is kilojoule. 16 bit.
	RR_Interval	ECG R-R wave interval. Hexadecimal character. The unit is second. 16 bit.
Note	For instance, “AT+B HRP ND 12, 34, 56\r”, it represents the measured heart rate is 0x12, energy is 0x34, and RR-interval is 0x56.	

7.2.3 HR Control Event

Event	AT-B HRCP [opcode]\r	
Parameter	opcode	01: Reset energy value to 0. MCU needs to re-calculate the energy value.
Note	N/A	

7.3 Cycling Speed and Cadence Profile

7.3.1 Query CSC Measurement Notify Status

Command	AT+B SC NS\r	
Indication	AT-B SC NS [state_num]\r	
Parameter	state_num	0: CSC Measurement Notify does not be configured; 1: CSC Measurement Notify is configured.
Note	i410e will support this command only when i410e works as peripherals and its firmware supports CSCP.	

7.3.2 CSC Measurement Notification

Before sending the measurement data, if i410e returns the indication “AT-B SC NS 1\r” to MCU, it represents i410e can send the cycling speed and cadence measurement data; if i410e returns the indication “AT-B SC NS 0\r” to MCU, it represents i410e cannot send the cycling speed and cadence measurement data to the central device.

Command	AT+B SC ND [cumulative_wheel],[last_wheel],[cumulative_crank],[last_crank]\r	
Indication	Succeeded: AT-B CSCP NOTIFY 0\r Failed: AT-B CSCP NOTIFY 1\r	
Parameter	cumulative_wheel	Cumulative wheel. Hexadecimal character. 32 bit.
	last_wheel	Last wheel event time. Hexadecimal character. The unit is 1/1024s. 16 bit.
	cumulative_crank	Cumulative crank. Hexadecimal character. 16 bit.
	last_crank	Last crank event time. Hexadecimal character. The unit is 1/1024s. 16 bit.
Note	For instance, “AT+B CSCP NOTIFY 12,34,56,78\r” represents cumulative_wheel is 0x12, last_wheel is 0x34, cumulative_crank is 0x56, last_crank is 0x78.	

7.3.3 SC Control Event

Event	AT-B SCCP [opcode], [param]\r	
Parameter	opcode	01: Reset cumulative wheel value. MCU needs to re-calculate the cumulative wheel value.
	param	Cumulative wheel value.
Note	i410e only supports the control event when opcode equals to 1.	

7.4 Glucose Profile

7.4.1 RACP Command Event

When the central device sends RACP (RACP: Record Access Control Point) command to the glucose sensor, the glucose sensor will report an event to MCU. The glucose sensor needs to response the RACP command within 25s when it receives it. Otherwise, it will refuse the RACP command.

According to different parameters opcode and operator's types, the RACP command may carry no or up to two extra parameters. Parameters param1 and param2's type is Sequence Number. i410e glucose service does not the RACP command when parameters param1 and param2's type are User Facing Time.

Indication	AT-B RACPIND [opcode], [operator], {[param1],[param2]}\r	
Parameter	opcode	01: Report Stored Records. The central device sends a request to the glucose sensor to require glucose measurement records. It uses RACP command when opcode equals to 1; 02: Delete Stored Records; 03: Abort Operation, don't include param parameters, and the operator value equals to 0x00; 04: Report Number of Stored Records.
	operator	0: when opcode equals to 0x03, operator equals to 0x00; 1: All Records, don't have param parameters; 2: <=, param1 is max filter value; 3: >=, param1 is min filter value; 4: param1 <= filter value <= param2;

		5: first record, don't have param parameters; 6: last record, don't have param parameters.
Note	For instance, "AT-B RACPIND 01,01\r" represents the glucose collector requires the glucose sensor to send all glucose measurement records.	

7.4.2 Execute RACP command

When the glucose sensor receives the RACP command, it needs to response it with the RACPRES command within 25s when it receives it. If it agrees to execute the RACP command, the glucose sensor's MCU will use "AT+B GLP ND\r" and "AT+B RACP ID\r" to return RACP command's results.

Command	AT+B RACPRES [0/1]\r	
Indication	AT-B RACPRES [status]\r	
Parameter	status	0: agree to execute RACP command; 1: refuse to execute RACP command.
Note	N/A	

7.4.3 Glucose Measurement Notification

When the glucose sensor executes the received RACP command to report stored records, the glucose sensor can use this command to send glucose data to the glucose collector.

Command	AT+B GLP ND [len],[[raw_data]]\r	
Indication	Succeeded: AT-B GLP ND 0\r Failed: AT-B GLP ND 1\r	
Parameter	len	data length.
	raw_data	Little endian. Glucose data contain a Flags field, a Sequence Number field, and a Base Time field. According to Flags field's contents, it may include a Time Offset field, a Glucose Concentration field, a Type-Sample Location field and a Sensor Status Annunciation field. Refer to Table 2 below.
Note	If the glucose sensor agrees to execute the received RACP command "AT-B RACPIND 01,01", it sends glucose measurement data with the command "AT+B	

	<p>GLP ND [len], [(raw_data)]\r" to the glucose collector. If it needs to send multiple records, it needs send this command multiple times. For instance, the command "AT+B GLP ND</p> <p>Of,\x0e\x00\x00\xdd\x07\x02\x01\x01\x01\x00\x00\x11\x00\x00\r"</p> <p>represents sending a glucose measurement record to the glucose collector, which Sequence Number is 0, Base Time is 2013/02/01/01/01/01, Glucose Concentration is 0, Test Type is Capillary Whole Blood, Type-Sample Location is Finger, and Sensor Status is normal.</p>
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Table 2 Glucose Data Contents

Field	Type	Descriptions					
Flags (i410e Glucose Service does not support Context at the moment, so it needs to set the Context Information Follows field to 0)	uint8	Bit Field					
		Bit	Size	Name	Definition		
					Key	Value	Requires
		0	1	Time Offset Present	0	False	
					1	True	C1
		1	1	Glucose Concentration, Type and Sample Location Present	0	False	
					1	True	C2
		2	1	Glucose Concentration Units	0	kg/L	C3
					1	mol/L	C4
		3	1	Sensor Status Annunciation Present	0	False	
1	True				C5		
4	1	Context Information Follows	i410e does not support this field at the moment.				
5	3	Reserved for future use					

Sequence Number	uint16	Every glucose measurement data has a sequence number.	
Base Time	(7 Bytes)	7 bytes in total. year(2 Bytes), month(1 Byte), data(1 Byte), hour(1 Byte), minute(1 Byte), second(1 Byte).	
Time Offset	C1(sint16)	Optional. It adds the Base Time field to calculate the real measure time. Unit is minute.	
Glucose Concentration	C2/C3 或 C2/C4 (IEEE-11073 16-bit SFLOAT)	Glucose Concentration. 2 bytes IEEE-11073 float. Unit is decided by C3/C4.	
Type	C2(4-bit)	Enumerations	
		Key	Value
		0	Reserved for future use
		2	Capillary Plasma
		3	Venous Whole blood
		4	Venous Plasma
		5	Arterial Whole blood
		6	Arterial Plasma
		7	Undetermined Whole blood
		8	Undetermined Plasma
		9	Interstitial Fluid (ISF)
		10	Control Solution
		11 - 15	Reserved for future use
Sample Location	C2(4bit)	Enumerations	
		Key	Value
		0	Reserved for future use
		1	Finger

		2	Alternate Site Test (AST)			
		3	Earlobe			
		4	Control solution			
		15	Sample Location value not available			
		5 - 14	Reserved for future use			
Sensor Status Annunciation (Set bits in this field according to sensor's status)	C5(uint16)	Bit Field				
		Bit	Size	Name	Definition	
					Key	Value
		0	1	Device battery low at time of measurement	0	False
					1	True
		1	1	Sensor malfunction or faulting at time of measurement	0	False
					1	True
		2	1	Sample size for blood or control solution insufficient at time of measurement	0	False
					1	True
		3	1	Strip insertion error	0	False
1	True					
4	1	Strip type incorrect for device	0	False		
			1	True		
5	1	Sensor result higher than the device can process	0	False		
			1	True		

		6	1	Sensor result lower than the device can process	0	False
					1	True
		7	1	Sensor temperature too high for valid test/result at time of measurement	0	False
					1	True
		8	1	Sensor temperature too low for valid test/result at time of measurement	0	False
					1	True
		9	1	Sensor read interrupted because strip was pulled too soon at time of measurement	0	False
1	True					
10	1	General device fault has occurred in the sensor	0	False		
			1	True		
11	1	Time fault has occurred in the sensor and time may be inaccurate	0	False		
			1	True		
12	4	Reserved for future use				

7.4.4 Query Glucose Measurement Notification Status

Command	AT+B GLP NS\r
---------	---------------

Indication	AT-B GLP NS [status]\r	
Parameter	status	0: central isn't ready to receive glucose measurement data; 1: central is ready to receive glucose measurement data.
Note	This command queries if the central device is ready to receive glucose measurement results (NS: Notification Status).	

7.4.5 RACP Command Result

After the glucose sensor executes the RACP command, it uses this command to report results (ID: Indication Data) to the central device.

Command	AT+B RACP ID [len], [(raw_data)]\r	
Indication	AT-B RACP ID 0\r AT-B RACP ID 1\r	
Parameter	len	Data length.
	raw_data	When the opcode parameter of RACP command equals to 0x01, 0x02, and 0x03, the data parameter format refers to Table 3. When the opcode parameter in the RACP command equals to the opcode field of the data parameter, response code values refer to Table4. When the opcode parameter of the RACP command equals to 04(Report Number of Stored Records), the data parameter format refers to Table5.
Note	N/A	

Table 3 Data Parameter Format when opcode equals to 0x01,0x02,0x03

0x06(uint8)	NULL(uint8)	Opcode(uint8)	Response Code(uint8)
-------------	-------------	---------------	----------------------

Table4 Data Parameter's Response Code Values when RACP command's opcode field equals to 0x01, 0x02, 0x03

Value	Definition	Description
1	Success	Normal response for successful operation

2	Op Code not supported	Normal response if unsupported Op Code is received
3	Invalid Operator	Normal response if Operator received does not meet the requirements of the service (e.g. Null was expected)
4	Operator not supported	Normal response if unsupported Operator is received
5	Invalid Operand	Normal response if Operand received does not meet the requirements of the service
6	No records found	Normal response if request to report stored records or request to delete stored records resulted in no records meeting criteria.
7	Abort unsuccessful	Normal response if request for Abort cannot be completed
8	Procedure not completed	Normal response if unable to complete a procedure for any reason
9	Operand not supported	Normal response if unsupported Operand is received

Table5 Data Parameter's Format when the opcode parameter of the RACP command equals to 0x04

0x04(uint8)	NULL(uint8)	Number of Records(uint16)
-------------	-------------	---------------------------

7.4.6 Query RACP Indication Status

This command is used to query if the central device will send the RACP command to the glucose sensor (IS: Indication Status).

Command	AT+B RACP IS\r	
Indication	AT-B RACP IS [status]\r	
Parameter	status	0: the glucose collector will not send RACP command to the glucose sensor; 1: the glucose collector will send RACP command to the glucose sensor.

Note	N/A
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7.5 HID Keyboard

7.5.1 Protocol Mode Event

After the connection is established, i410e's protocol mode is always report mode (no matter if it has been bonded before). When the host changes i410e's protocol mode to boot mode, i410e will report the current protocol mode to MCU.

Event	AT-B PMODE [mode]\r	
Parameter	mode	0: boot mode; 1: report mode.
Note	i410e will report this event to MCU when its protocol mode is changed.	

7.5.2 Suspend Signal Event

Event	AT-B SUSPEND [signal]\r	
Parameter	signal	0: Suspend; 1: Exit suspend.
Note	The host (PC) sends the suspend signal to i410e, i410e will report this event to MCU.	

7.5.3 HID Connection Event

This event is used to inform MCU if i410e establishes the HID connection with the host (if i410e can send HID reports to the host).

Event	Boot mode: AT-B BIRPT NS [result]\r Report mode: AT-B IRPT NS [result]\r	
Parameter	result	0: the host isn't connected with i410e or the connection is released;

	1: the host is connected with i410e.
Note	When i410e is in boot mode, it uses "AT-B BIRPT NS 1\r" to inform MCU that the HID connection is established, and use HID boot protocol to communicate with the host; When i410e is in report mode, it uses "AT-B IRPT NS 1\r" to inform MCU that the HID connection is established, and use HID report protocol to communicate with the host;

7.5.4 Keyboard Input & Output

Command	AT+B IRPT [len], [(raw_data)]\r																								
Indication	Succeeded: AT-B IRPT 0\r Failed: AT-B IRPT 1\r																								
Parameter	len	Data length																							
	raw_data	Format definition as follows: <table border="1" data-bbox="635 1019 1353 1256"> <tr> <td>8-bit</td> <td>8-bit</td> <td>Key1</td> <td>Key</td> <td>Key</td> <td>Key</td> <td>Key</td> <td>Key</td> </tr> <tr> <td>(Keycode-224-231)</td> <td>(Reserved)</td> <td>(8-bit)</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td></td> <td></td> <td>)</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	8-bit	8-bit	Key1	Key	Key	Key	Key	Key	(Keycode-224-231)	(Reserved)	(8-bit)	2	3	4	5	6)				
8-bit	8-bit	Key1	Key	Key	Key	Key	Key																		
(Keycode-224-231)	(Reserved)	(8-bit)	2	3	4	5	6																		
)																							
Note	When i410e is in report mode, this command is used to send an input report to the host. The first field's length is 8 bit, every bit refers to Usage ID 224-231 statuses in HID Keyboard Usage Page. Key1~Key6 respectively represents the pressed key's Usage ID. The range of Usage ID is 0~101.																								

Event	AT-B ORPT [len], [(raw_data)]\r				
Parameter	len	Data length			
	raw_data	Format definition as follows: <table border="1" data-bbox="635 1753 1353 1928"> <tr> <td>5-bit</td> <td>3-bit</td> </tr> <tr> <td>(Num Lock --- Kana)</td> <td>(Reserved)</td> </tr> </table>	5-bit	3-bit	(Num Lock --- Kana)
5-bit	3-bit				
(Num Lock --- Kana)	(Reserved)				
Note	When i410e is in report mode, this event represents the host sends an output report to i410e. The output report's length is 1 byte. The first 5 bits refer to				

	Usage ID 1-5 statuses in HID LED Usage Page.
--	--

Command	AT+B BIRPT [len],[(raw_data)]\r																
Indication	Succeeded: AT-B BIRPT 0\r Failed: AT-B BIRPT 1\r																
Parameter	len	Data length															
	raw_data	Format definition as follows: <table border="1" data-bbox="635 701 1353 936"> <tr> <td>8-bit</td> <td>8-bit</td> <td>Key1</td> <td>Key</td> <td>Key</td> <td>Key</td> <td>Key</td> <td>Key</td> </tr> <tr> <td>(Keycode-22 4-231)</td> <td>(Reserv ed)</td> <td>(8-bit)</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> </table>	8-bit	8-bit	Key1	Key	Key	Key	Key	Key	(Keycode-22 4-231)	(Reserv ed)	(8-bit)	2	3	4	5
8-bit	8-bit	Key1	Key	Key	Key	Key	Key										
(Keycode-22 4-231)	(Reserv ed)	(8-bit)	2	3	4	5	6										
Note	When i410e is in boot mode, this command is used to send an input report to the host. The first field' length is 8 bit, every bit refers to Usage ID 224-331 statuses in HID Keyboard Usage Page. Key1~Key6 respectively represents the pressed key's Usage ID. The range of Usage ID is 0~255.																

Event	AT-B BOPRT [len],[(raw_data)]\r				
Parameter	len	Data length			
	raw_data	Format definition as follows: <table border="1" data-bbox="635 1435 1353 1608"> <tr> <td>5-bit</td> <td>3-bit</td> </tr> <tr> <td>(NumLock--Kana)</td> <td>(Reserved)</td> </tr> </table>	5-bit	3-bit	(NumLock--Kana)
5-bit	3-bit				
(NumLock--Kana)	(Reserved)				
Note	When i410e is boot mode, this event represents the host sends an output report to i410e. The output report's length is 1 byte. The first 5 bits refer to Usage ID 1-5 statuses in HID LED Usage Page.				

7.6 HID Mouse

7.6.1 Protocol Mode Event

Refer to the chapter 7.5.1.

7.6.2 Suspend Signal Event

Refer to the chapter 7.5.2.

7.6.3 HID Connection Event

Refer to the chapter 7.5.3.

7.6.4 Query HID Connection Status

Command	AT+B RPT NS [protocol_mode]\r	
Indication	AT-B RPT NS [protocol_mode],[notify_state]\r	
Parameter	protocol_mode	0: boot mode; 1: report mode.
	notify_state	0: HID connection is not established. Cannot send HID report; 1: HID connection is established. Can send HID report.
Note	N/A	

7.6.5 Query Resolution

Event	AT-B RFRPTIND\r
Note	When the central device tries to read resolution, MCU will return this event. i410e needs to use "AT+B RFRPTRES [len],[resolution]\r" to respond the resolution query within 25s when MCU receives this event.

Command	AT+B RFRPTRES [len], [(resolution)]\r	
Indication	Succeeded: AT-B RFRPTRES 0\r Failed: AT-B RFRPTRES 1\r	
Parameter	len	Set to 1
	resolution	0x00: resolution(cpi)400; 0x01: resolution(cpi)800; 0x02: resolution(cpi)1200; 0x03: resolution(cpi)1600.
Note	This command is used to respond the resolution query.	

7.6.6 Change Resolution

Event	AT-B WFRTPIND [len], [(raw_data)] \r	
Parameter	len	Set to 1
	resolution	0x00: resolution(cpi)400; 0x01: resolution(cpi)800; 0x02: resolution(cpi)1200; 0x03: resolution(cpi)1600.
Note	After the host changes i410e's resolution, i410e will return this event to MCU. Afterwards, MCU needs to use new resolution.	

7.6.7 Mouse Input

Command	AT+B IRPT [len], [(raw_data)]\r	
Indication	Succeeded: AT-B IRPT 0\r Failed: AT-B IRPT 1\r	
Parameter	len	Data length, equals to 6.

	raw_data	Input X/Y coordinates, mouse wheel, press. Little endian. Format definition as follows: <table border="1" data-bbox="598 324 1372 443"> <tr> <td>Button1-3(bit0-2),(bit3-bit7 is 0)</td> <td>X - 16bit</td> <td>Y - 16bit</td> <td>Wheel - 8bit</td> </tr> </table>	Button1-3(bit0-2),(bit3-bit7 is 0)	X - 16bit	Y - 16bit	Wheel - 8bit
Button1-3(bit0-2),(bit3-bit7 is 0)	X - 16bit	Y - 16bit	Wheel - 8bit			
Note	When i410e is in report mode, it uses this command to send mouse input information. The first field's length is 1byte. Bit 0-2 represents mouse press status; bit 3-7 are 0. The second and third fields are 2 bytes, representing X/Y coordinate drift values. The fourth field's length is 1 byte, representing mouse wheel value. The X/Y values are between -2048 to 2047. For instance, "AT+B IRPT \x00\x50\x00\x50\x00\NUL\r" represents the mouse position drift is 0x0050(X)/0x0050(Y).					

Command	AT+B BIRPT [len], [(raw_data)]\r					
Indication	Succeeded: AT-B BIRPT 0\r Failed: AT-B BIRPT 1\r					
Parameter	len	Data length, equals to 6.				
	raw_data	Input X/Y coordinates, mouse wheel, press. Little endian. Format definition as follows: <table border="1" data-bbox="635 1254 1353 1373"> <tr> <td>Button1-3(bit0-2),(bit3-bit7 为 0)</td> <td>X - 8bit</td> <td>Y - 8bit</td> </tr> </table>		Button1-3(bit0-2),(bit3-bit7 为 0)	X - 8bit	Y - 8bit
Button1-3(bit0-2),(bit3-bit7 为 0)	X - 8bit	Y - 8bit				
Note	When i410e is in boot mode, MCU uses this command to send mouse input information.					

7.7 Findme Profile

Event	AT-B IALEVEL [immediate_alert_level]\r	
Parameter	immediate_alert_level	Alert statuses, where, 0: stop alerting; 1: mild alert; 2: serious alert.
Note	After the Find Me Locator sets i410(Find me Target)'s alert level, i410e will report	

	this even to MCU.
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7.8 Health Thermometer Profile

7.8.1 Query Temperature Measurement Notify Status

Command	AT+B TEMP IS\r	
Indication	AT-B TEMP IS [state_num]\r	
Parameter	state_num	0: Temperature Measurement Indication is not configured. i410e cannot send temperature measurement results to the central device; 1: Temperature Measurement Indication is configured. i410e can send temperature measurement results to the central device.
Note	i410e will support this command only when i410e works as peripherals and its firmware supports HTS.	

7.8.2 Send Temperature Measurement Result

Command	AT+B TEMP ID [thermo_meas]\r	
Indication	Succeeded: AT-B TEMP ID 0\r Failed: AT-B TEMP ID 1\r	
Parameter	thermo_meas	Temperature measurement result, 32bit. The format is IEEE-11073 32bit Float, low 24 bits are unsigned integer mantissa, and high 8 bits are exponential complement.
Note	After Temperature Measurement Indication is configured, i410e uses this command to send temperature measurement results.	

7.9 Blood Pressure Profile

7.9.1 Query Blood Pressure Measurement Notify Status

Command	AT+B BLP IS\r	
Indication	AT-B BLP IS [state_num]\r	
Parameter	state_num	<p>0: Blood Pressure Measurement Indication isn't configured, i410e cannot send temperature measurement results to the central device;</p> <p>1: Blood Pressure Measurement 的 Indication is configured, i410e can send temperature measurement results to the central device.</p>
Note	When i410e burns with firmware that supports Blood Pressure Sensor, i410e will support this command.	

7.9.2 Send Blood Pressure Measurement Result

Command	AT+B BLP ID [systolic], [diastolic], [mean_arterial]\r	
Indication	<p>Succeeded: AT-B BLP ID 0\r</p> <p>Failed: AT-B BLP ID 1\r</p>	
Parameter	systolic	SBP. The format is IEEE-11073 16bit SFLOAT, low 12 bits are unsigned integer mantissa, and high 4 bits are exponential complement.
	diastolic	DBP. The format is as same as systolic's.
	mean_arterial	Aortic pressure. The format is as same as systolic's.
Note	After Blood Pressure Measurement Indication is configured, i410e uses this command to send Blood Pressure measurement results.	

7.10 Battery Level

7.10.1 Battery Level Event

Event	AT-B BLIND\r
Note	i410e only supports querying battery level, and does not support battery level notify. When the central device sends a battery level query to i410e, i410e will return this event. MCU needs to use “AT+B BLRES [battery_level]\r” to return the battery level to the central device.

7.10.2 Send Battery Level

When MCU receives the battery level event, MCU can send battery level to the central device. The battery level request will fail if MCU does not response to the battery level event within 25s.

Command	AT+B BLRES [battery_level]\r	
Indication	Succeeded: AT-B BLRES 0\r Failed: AT-B BLRES 1\r	
Parameter	battery_level	Battery level. Hexadecimal character, ranging from 0 to 100. The percentage of the resting battery level.
Note	<p>After the peripheral’s MCU receives the battery level inquiry indication, it should send this command to report the local device’s battery level to the central device. If the peripheral’s MCU sends this command to report the battery level without receiving the battery level inquiry indication, the central’s MCU will not receive the battery level indicated in this command.</p> <p>When the peripheral is in the Connected status, this command will always succeed.</p> <p>i410e’s MCU uses this command to report the local device’s battery level to the central device. This command always succeeds when there is i410e is in the Connected status. If i410e sends the battery level without receiving the battery level request from the central device, the central device will not receive the battery level.</p>	

8 PIO Assignment

This chapter introduces PIO assignment when i410e works as peripheral. PIO 5 and PIO 6 are outputs, and PIO 8 is an input.

8.1 PIO5, 6

PIO5 and PIO6 are outputs. They are used to notify module status. The corresponding outputs of PIO[6:5] are as follows: [00] Idle; [01] advertising; [10] Data buffer isn't full; [11] Data buffer is full.

It is used to release the current active connection. When PIO8 changes from high level to low level, the falling edge will release the existing connection.

8.2 PIO8

PIO8 is an input. It is used to release the current active connection. When PIO8 changes from high level to low level, the falling edge will release the existing connection.

9 Generic AT Commands & Indications when i410e Works as Centrals

When i410e works as a central device, such as i410e is integrated into tablets or terminals, it can initialize a connection establishment request, and access peripherals' services. When i410e works as a central device, it can establish connections with several peripherals, but only one active connection at one time. This chapter introduces generic AT commands and indications when i410e works as centrals.

9.1 Initialization

Indication	AT-B INIT 0\r
Parameter	N/A
Note	When i410e returns this indication, it represents the <i>Bluetooth</i> initialization procedure completes.

9.2 Query Firmware Version

Command	AT+B GVER\r	
Indication	AT-B GVER [version_info]\r	
Parameter	version_info	For instance, I410E.HRP.0.20121112.1 represents the i410e firmware's release date is 2012-11-12 and it supports HRP. I410E.CSCP.0.20121112.1 represents the i410e firmware's release date is 2012-11-12 and it supports CSCP.
Note	N/A	

9.3 Set Scan mode

Command	AT+B SCAN [scan_mode]\r	
Indication	<p>Start scanning: AT-B SCAN 0\r</p> <p>Failed: AT-B SCAN 1\r</p> <p>If any remote device is found, it will return the remote device's <i>Bluetooth</i> address at the first:</p> <p>AT-B SCAN IS [addr_type],[bd_addr]\r</p> <p>Afterwards, it will return the advertisement data of the discovered remote device:</p> <p>AT-B SCAN ADVD [adv_type],[len],[adv_type_data]\r</p> <p>Finally, when the scan procedure completes, it returns: AT-B SCAN IE\r</p>	
Parameter	scan_mode	Scan mode, where 1: fast scan, scan interval is 60ms, scan window is 30ms; 2: slow scan, scan interval is 1.28s, scan window is 11.25ms. 0: stop scanning.
	addr_type	<i>Bluetooth</i> address type, 8bit, where 00: public address; 01: random address.
	bd_addr	Remote device <i>Bluetooth</i> address. Hexadecimal character.

		12 bytes.
	adv_type	Advertising type, where, 0x02: 16 bit Service UUID of a service supported by the peripheral; 0x03: 16 bit Service UUID of one or more service(s) supported by the peripheral; 0x04: 32 bit Service UUID of a service supported by the peripheral; 0x05: 32 bit Service UUID of one or more service(s) supported by the peripheral; 0x08: Peripheral's short device name; 0x09: Peripheral's complete device name; 0x0a: Peripheral's TX power; 0x19: Peripheral's Appearance.
	len	The length of the parameter adv_type_data.
	adv_type_data	Little-endian, store the least significant byte in the smallest address. For instance, if adv_type_data is 0xff00, 0x00 is stored in the first byte, and 0xff is stored in the second byte.
Note	If i410e is in the Connected status, it cannot start searching devices. Therefore, this command will always fail if i410e sends it when i410e is in the Connected status.	

9.4 Search Services

Command	AT+B BSVC [cid]\r	
Indication	Succeeded: AT-B BSVC 0\r Failed: AT-B BSVC 1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
Note	After executing this command, the following result will be returned:	

	AT-B BSVC [cid], [srv_uuid1(16-bit or 128-bit)], [start_hdl], [end_hdl] AT-B BSVC [cid], [srv_uuid2], [start_hdl], [end_hdl] AT-B BSVC [cid], [srv_uuid3], [start_hdl], [end_hdl] AT-B BSVC [cid], [srv_uuid4], [start_hdl], [end_hdl] ... AT-B BSVC [cid], 0,0,0, [sys_status]
--	--

9.5 Find Included Service

Command	AT+B BISVC [cid],[srv_start_hdl],[srv_end_hdl]\r	
Indication	Succeeded: AT-B BISVC 0\r Failed: AT-B BISVC 1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
Note	After executing this command, the following result will be returned: AT-B BISVC [cid], [srv_uuid1(16-bit or 128-bit)], [start_hdl], [end_hdl] AT-B BISVC [cid], [srv_uuid2], [start_hdl], [end_hdl] AT-B BISVC [cid], [srv_uuid3], [start_hdl], [end_hdl] AT-B BISVC [cid], [srv_uuid4], [start_hdl], [end_hdl] ... AT-B BISVC [cid], 0,0,0, [sys_status]	

9.6 Search Descriptor

Command	AT+B BDESC [cid],[start_hdl],[end_hdl]\r	
Indication	Succeeded: AT-B BDESC 0\r Failed: AT-B BDESC 1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
Note	After executing this command, the following result will be returned:	

	AT-B BDESC [cid], [desc_hdl1] , [uuid-16bit or 128-bit] AT-B BDESC [cid], [desc_hdl2] , [uuid-16bit or 128-bit] AT-B BDESC [cid], [desc_hdl3] , [uuid-16bit or 128-bit] ... AT-B BDESC [cid],0,0,sys_status
--	---

9.7 Read Attribute

Command	AT+B READ [cid], [handle]\r	
Indication	Succeeded: AT-B READ [cid],[size_val],[value_data]\r Failed: AT-B READ 1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
	size_val	The length of the parameter value_data
	value_data	Handle value.
Note	Failed to execute this command may due to either this command is not executed or fail to read.	

9.8 Read Long Attribute

Command	AT+B READL [cid], [handle],[offset]\r	
Indication	Results: AT-B READL [cid],[offset],[size_val],[value_data]]\r ... When the procedure completes, it returns: AT-B READL 0,0,0\r Failed: AT-B READ 1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
	size_val	The length of the parameter value_data.

	value_data	Handle value.
Note	N/A	

9.9 Search Service Characteristic

Command	AT+B BCHAR [cid],[srv_uuid]\r	
Indication	Command starts to execute: AT-B BCHAR 0\r Command is not executed: AT-B BCHAR 1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
	srv_uuid	Service UUID.
	prop	Characteristic Properties. Hexadecimal character, 8 bit Mask, where, 0x01: Broadcast; 0x02: Read; 0x04: Write without Responses; 0x08: Write; 0x10: Notify; 0x20: Indicate; 0x40: Authenticated Signed Writes; 0x80: Extended Properties.
Note	After executing this command, the following result will be returned: AT-B BCHAR [cid], [char_uuid1(16-bit or 128-bit)], [val_handle], [prop] AT-B BCHAR [cid], [char_uuid2], [val_handle], [prop] AT-B BCHAR [cid], [char_uuid3], [val_handle],[prop] AT-B BCHAR [cid], [char_uuid4], [val_handle],[prop] ... AT-B BCHAR [cid], 0, 0, 0,[sys_status]	

9.10 Write Service Characteristic

Command	AT+B WCMD [cid],[handle],[length],[data_string]\r	
Indication	AT-B WCMD [cid], 0/1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
	handle	Service handle.
	length	The length of the parameter data_string. Hexadecimal character.
	data_string	Data string to be sent. Its length is between 1 and 20 bytes. If its length is longer than 20 bytes, only the first 20 bytes can be sent.
Note	If the peripheral's characteristic property is 0x04, it needs to use this command to write this peripheral's service feature.	

9.11 Write Service Feature

Command	AT+B WRITE [cid],[handle],[length],[data_string]\r	
Indication	AT-B WRITE [cid], 0/1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
	handle	Service handle.
	length	The length of the parameter data_string. Hexadecimal character.
	data_string	Data string to be sent. Its length is between 1 and 20 bytes. If its length is longer than 20 bytes, only the first 20 bytes can be sent.
Note	If the peripheral's characteristic property is 0x08, it needs to use this command to write this peripheral's service feature.	

9.12 Establish Connection

Command	AT+B CONN [addr_type],[bd_addr]\r	
Indication	Command starts to execute: AT-B CONN 0\r Failed: AT-B CONN 1\r Connection is established: AT-B CONN 0, [cid],[bd_addr]\r	
Parameter	addr_type	<i>Bluetooth</i> address type, 8bit, where 00: public address; 01: random address.
	bd_addr	Remote device <i>Bluetooth</i> address. Hexadecimal character. 12 bytes.
	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
Note	After send this command, i410e will wait until the connection establishment succeeds, or fails, or being cancelled. If this command has not cancelled or no indication is returned, and MCU sends this command again, it will return the failure indication. Before i410e establishes a connection with a peripheral, it needs to disable scanning. Otherwise, it may affect the connection's performance and stability. When a connection is established and i410e sends this command, it will always return fail. This command will also stop searching devices.	

9.13 Terminate Connection Establishment

Command	AT+B CANCEL\r
Indication	Succeeded: AT-B CANCEL 0\r Failed: AT-B CANCEL 1\r
Parameter	N/A
Note	N/A

9.14 Release Connection

Command	AT+B DISCON [cid]\r	
Indication	Command starts to execute: AT-B DISCON 0\r Failed: AT-B DISCON 1\r Connection is released: AT-B DISCON 0,[cid-16bit]\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
Note	N/A	

9.15 Pair or Link Encryption

Command	AT+B PAIR [cid]\r	
Indication	AT-B PAIR [cid],[sys_status],[security_level]\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
	sys_status	00: pair or link encryption succeeds; 06: pair or link encryption fails, and the link key lost; Other values represent pair or link encryption fails.
	security level	The security level of LE security mode 1, where 00: security none; 01: unauthenticated; 02: authenticated.
Note	If the peripheral initiates pairing or security procedures, i410e will return the indication "AT-B PAIR [cid],[sys_status],[security_level]\r" to report the pair or link encryption result to MCU.	

9.16 Delete BOND Information

Command	AT+B RBOND [addr_type],[bd_addr]\r
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Indication	Succeeded: AT-B RBOND 0\r Failed: AT-B RBOND 1\r	
Parameter	addr_type	<i>Bluetooth</i> address type, 8bit, where 00: public address; 01: random address.
	bd_addr	Paired device <i>Bluetooth</i> address. Hexadecimal character. 12 bytes.
Note	N/A	

10 Profile Related AT Commands and Indications when i410e Works as Centrals

This chapter introduces generic AT commands and indications when i410e works as centrals.

10.1 GATT Data Profile

There are two strategies: sending data by using AT commands; or without using AT commands. This could be configured by IVT.

10.1.1 Send Data

Command	AT+B SNED [cid],[length],[data_string]\r	
Indication	Succeeded: AT-B SEND 0\r Failed: AT-B SEND 1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
	length	The length of the parameter data_string. Hexadecimal character.
	data_string	Data string to be sent. Its length is between 1 and 20 bytes. If its length is longer than 20 bytes, only the first 20 bytes can be

	sent.
Note	For instance, the command “\rAT+B SEND 00,09,123456789\r” represents i410e sends a 9 bytes data string 123456789 to the peripheral.

10.1.2 Receive Data

Indication	AT-B RECV [cid],[char_val_handle],[length],[data_string]\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e’s connection.
	char_val_handle	Property handle. Hexadecimal character.
	length	The length of the parameter data_string. Hexadecimal character.
	data_string	Received data string. It can include 0d.
Note	This command is used to receive data sent from peripherals.	

10.2 Heart Rate Profile

10.2.1 Request Peripheral to Start HR Measurement

Command	AT+B HRPC [cid]\r	
Indication	Succeeded: AT-B HRPC 0\r Failed: AT-B HRPC 1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e’s connection.
Note	This command is used to configure i410e HR service’s HRP measurement as Notify, which allows peripherals to send HR measurement data to i410e.	

Command	AT+B HRPC [cid],1\r	
Indication	Succeeded: AT-B HRPC 0\r	

	Failed: AT-B HRPC 1 \r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
Note	Request peripherals to start measuring HR data.	

10.2.2 Request Peripheral to Stop HR Measurement

Command	AT+B HRPC [cid],0 \r	
Indication	Succeeded: AT-B HRPC 0 \r Failed: AT-B HRPC 1 \r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
Note	Request peripherals to stop measuring HR data.	

10.3 Cycling Speed and Cadence Profile

10.3.1 Request Peripheral to Start CSC Measurement

Command	AT+B CSCPC [cid] \r	
Indication	Succeeded: AT-B CSCPC 0 \r Failed: AT-B CSCPC 1 \r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
Note	This command is used to configure i410e CSC service's CSCP measurement as Notify, which allows peripherals to send cycling speed and cadence measurement data to i410e.	

Command	AT+B CSCPC [cid],1 \r	
Indication	Succeeded: AT-B CSCPC 0 \r	

	Failed: AT-B CSCPC 1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
Note	Request peripherals to start measuring CSC data.	

10.3.2 Request Peripheral to Stop CSC Measurement

Command	AT+B CSCPC [cid],0\r	
Indication	Succeeded: AT-B CSCPC 0\r Failed: AT-B CSCPC 1\r	
Parameter	cid	Connection ID. Hexadecimal character. It is used to identify i410e's connection.
Note	Request peripherals to stop measuring CSC data.	

11 PIO Assignment

This chapter introduces PIO assignment when i410e works as central.

11.1 PIO8

PIO8 is an input. It is used to release the current active connection. When PIO8 changes from high level to low level, the falling edge will release the existing connection.

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