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CONFIDENTIAL INFORMATION

BnCOM Co.,Ltd.

Client Company	Date of Creation	Document Name	Document Version
BnCOM	Feb. 25, 2019	BnCOM Bluetooth Nordic Module UART Protocol	0.2.3

BLE Module Protocol

BnCOM (Blue and Communication)

AT communication protocol For Nordic module

■ **History**

Version	Distribution Date	Content
0.2.3	2019. 02. 25	- Changed from GPIO 7 to GPIO 9 in Uart On/Off function
0.2.2	2017. 9. 28	- Added GPIO 7 to Uart On/Off function
0.2.1	2017. 5. 10	- Added response completion time for each command - Added AT+FLOWCONTROL command
0.2.0	2017. 4. 27	- Added GPIO 2 (Use a Command mode when connected) - Added AT command description for inquiry in a connected status - Added AT+NEGOCONN? command
0.1.0	2017. 2. 27	- Created a draft protocol document for Nordic module (v0.1.0)

Contents

1. Overview

This document defines the communication protocol through UART (serial port) between the “BnCOM Nordic Module” (hereinafter “BT”) and the client’s MCU (hereinafter “HOST”) connected by UART interface.

1.1. Basic Protocol Rules

• Data transmission/reception between HOST and BT is made based on UART (serial port) interface.

• UART (serial port) default settings:

■ Baud rate : 9600bps
■ Data bit : 8
■ Parity bit : none
■ Stop bit : 1
■Flow Control : None

■ The above are default setting values. In case you want to change them, please make a request for modification when writing BT firmware or modify them using the corresponding AT command (AT+UART=BaudRate).

• Communication direction

■ REQUEST (HOST→BT): Generated from HOST and transmitted to BT.

■ RESPONSE (BT → HOST): A message is generated from BT and delivered to HOST, which is a response to a request.

■ NOTIFY(BT → HOST): A message that occurs in BT and is delivered to HOST. It informs the basic status of BT.

• Communication rule

All protocols are composed of a combination of ASCII values and the end of the command is announced through CR (Carriage Return: 0x0D).

e.g.) REQUEST – Inquire firmware version information: AT+VER?

Command	AT+VER?							
Command set	A	T	+	V	E	R	?	CR
ASCII set	0x41	0x54	0x2B	0x56	0x45	0x52	0x3F	0x0D

e.g.) RESPONSE – Operation failure responding to REQUEST: +ERROR

Command	+ERROR						
Command set	+	E	R	R	O	R	CR
ASCII set	0x2B	0x45	0x52	0x52	0x4F	0x52	0x0D

e.g.) NOTIFY - When the preparation is completed after power is applied: +READY

Command	+READY						
Command set	+	R	E	A	D	Y	CR
ASCII set	0x2B	0x52	0x45	0x41	0x44	0x59	0x0D

1.2. Basic protocol operation

• BT transmits the corresponding RESPONSE after receiving a request from HOST. HOST may basically
expect a RESPONSE of +OK or +ERROR, and may receive a specific RESPONSE corresponding to a
request (see to each command table for detailed RESPONSE).

1.3. Description of UART operation mode

• BT supports two modes: AT- COMMAND, which can make a request for HOST data delivered to UART, and BYPASS mode, which transmits data after connecting with the other device.

1.3.1 AT- COMMAND mode

In HOST, you can change the BT device setting or make a command to BT to perform a specific operation. This state is called AT- COMMAND mode.
BT always maintains AT- COMMAND mode when a connection with a remote device is not established.
Most of this document describes the commands available in AT- COMMAND mode.

1.3.2 BYPASS mode

BT is connected to a remote device and can transmit data generated from HOST to the remote device. This state is called a BYPASS mode.
In a BYPASS mode, it is not possible to change the BT device settings or perform specific operations using AT COMMAND. However, it is possible to switch to and return to an AT COMMAND mode through GPIO 18 while connected to the remote device.

1.4. Description of BT state

• BT state is divided into ADVERTISING and CONNECTED according to the connection status to a remote device and UART operation mode (see “**1.3. UART operation mode**”).

1.4.1 ADVERTISING

Advertising operates in a BLE Server mode. It is applicable in all cases except connected to a Remote Client device.
In an advertising state, the UART operation mode always operates in an AT- COMMAND mode.

1.4.2 CONNECTED

This is the case when a connection with a remote device is already established.
If it is in a BYPASS mode, all data generated from HOST is transmitted to a remote device.

1.5. Description of BT GPIO

• 4 GPIOs are separately allocated to facilitate a BT status or control from HOST

1.5.1. (CONNECTED state) Switching between COMMAND mode and BYPASS mode (GPIO2)

GPIO18 port is configured as input by default. When maintaining High (Rising Edge) in a CONNECTED state, it operates in an AT COMMAND mode. When maintaining Low (Falling Edge), it operates in a BYPASS mode (Default mode). However, only search commands can be executed with AT COMMAND in a CONNECTED state (e.g. - “AT+INFO?”, “AT+CONN?”).

1.5.2. Connection status indication (GPIO3)

The GPIO4 port is configured as output by default.
GPIO3 is High when connected with the other client device.
GPIO3 is Low when disconnected from the other client device.

1.5.3. Low power operation (GPIO4)

The GPIO4 port is configured as input by default. BT enters a low power mode whenever a low power mode is possible. When High Level (Rising Edge) is detected in GPIO4, it enters a low-power mode. In a low-power mode, when a low level.(Falling Edge) is detected in GPIO4, it wakes up and the module is restarted.

1.5.4. Factory reset and disconnection (GPIO12)

GPIO12 port is configured as input by default. In case the high value is maintained for 4 seconds or more, it returns to the factory default status after +OK response. In addition, it is possible to be disconnected when inputting High (Rising Edge) in a CONNECTED state.

1.5.5. Uart ON/OFF operation (GPIO9)

GPIO9 port is configured as input by default. When High Level (Rising Edge) is detected in GPIO7, it enters an Uart OFF state. Also, when Low Level (Falling Edge) is detected in GPIO7, it is switched to Uart ON again. In an Uart OFF state, only data transmitted from BT to Host can be received, and data transmission from Host to BT is not possible. In order to transmit data from host to BT, it must be Uart ON.

2. Summary of REQUEST (HOST→BT) Protocols

Protocol	Description	Remark
AT	+OK request	
ATZ	Module reset request	
AT&F	Reset after factory resetting the current module's changeable values	
AT+VER?	Request the version of the firmware currently applied to the module	
AT+INFO?	Request the current module's Bluetooth address, Device Name, Role information and State status e.g.) 74:F0:7D:B0:12:12,BnCOM,SERVER[PERIPHERAL],ADVERTISING	
AT+UART=xxxx	Used to change UART Baudrate 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 115200, 230400, 460800	
AT+FLOWCONTROL=xx	Used to change whether UART Flow Control is activated or not	
AT+FLOWCONTROL?	Request for use of UART Flow Control	
AT+SERVER=role	When the device operates in a Server mode, the operation mode is determined according to the role. : role=B – Broadcaster (no connectivity) : role=P – Peripheral (connectivity)	
AT+MANUF=xxxxxxxx	Use when changing the Manufacturer (Device Name). In case the manufacturer is changed using this command in a advertising state, it is immediately reflected in the advertising data. (MAX 8 byte)	
AT+MANUF?	Request for the Manufacturer (Device Name)	
AT+TXPWR=x	Used when adjusting the TX power level of BT, and the power level is automatically applied after using this command. Input range value: 0 to 7(- 18 to 8dBm)	
AT+TXPWR?	Request for the value of current BT TX power level	
AT+ADVDATA=xxxx	When the device is operated in a server mode, it is a configurable advertising user data area that can be displayed when the other device searches (max 13 bytes).	
AT+ADVDATA?	Request to know the data of the set Advertising User data	
AT+ADVINTERVAL=xxxxx	Used to change the Advertising Interval. Range: 20 to 2560 (ms)	
AT+ADVINTERVAL?	Request To know the Advertising Interval value	
AT+CONNINTERVAL=xxxx	Used to change the Connection Interval value Range: 10 to 1999ms	
AT+CONNINTERVAL?	Request to know the Connection Interval value	
AT+NEGOCONN?	Request to know the currently negotiated Connection Interval value	

3. Summary of NOTIFY (BT→HOST) Protocols

Protocol	Description	Remark

+READY	Power is applied and server operation is possible	Responds within 3ms after power on (Responds within 2.5ms of wakeup)
+ADVERTISING	Searchable and connectable status from the other device	
+BROADCASTING	Only search is possible from the other device	
+CONNECTED[xx:xx:xx:xx:xx:xx]	When connected to the other device	[xx:xx:xx:xx:xx:xx] : Remote BT Addr
+DISCONNECTED	When the connection with the other device is released	

4. Advertising (Discoverable) Data format

Advertising Data refers to data that can be checked during search even if the device is in a Server mode and is not connected.

4.1 Format

- The format includes 22 bytes of changeable data area among 31 bytes of advertising data.
- The data included in the advertising data consists of a reserved data area (Length and Flag) that cannot be changed by the user and a data area that the user can change through UART.
- FIELD in yellow blocks in 4.1.1 Structure is an area that the user can change with AT command.

4.1.1 Structure

The packet format is as follows, and the index position of the packet may vary according to the data length.

TX level, Device Name, and User Data settings correspond to AT Commands “AT+TXPWR”, “AT+MANUF”, and “AT+ADVDATA”, respectively.

index	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Data	GAP Reserved			TX power Reserved		TX level User Data	Device name Reserved		Device Name User Data							

index	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Data	User data Reserved		Undefined User Data												

5. Summary of General RESPONSE (BT→HOST) Protocols

Protocol	Description	Remark
+OK	When REQUEST is normally executed, it is sent to HOST. However, when searching for a specific value as a response, the +OK response can be omitted.	
+ERROR	When REQUEST is not executed normally, it is sent to HOST.	

6. Details of REQUEST Protocols

6.1 Server AT Command

6.1.1 AT

Operation	Request +OK from HOST to BT
Response	+OK or +ERROR
Response completed	Within 5ms after receiving the command (based on 9600bps) Within 5ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, responds with "+OK".
Example of use	(HOST→BT) : **AT** (BT→HOST) : +OK

6.1.2 ATZ

Operation	Request BT reset from HOST
Response	+OK or +ERROR
Response completed	Within 5ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, reset after 2 seconds after responding "+OK". * Can be executed in an AT COMMAND mode in a CONNECTED state * For reference, this operation is possible from about 3ms after the initial power supply
Example of use	(HOST→BT) : **ATZ** (BT→HOST) : +OK …after 2sec.. (BT→HOST) : +READY ➔ When performing a reset, you can confirm that the reset was performed with a +READY response.

6.1.3 AT&F

Operation	When you want to perform a factory initialization (resetting) of changeable values of BT from HOST.
Response	+OK or +ERROR
Response completed	Within 8ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds with "+OK" and resets after 2 seconds after initializing the set values. * Can be executed in an AT COMMAND mode in a CONNECTED state (Initial value) 1. Baud Rate : 9600 2. Device Name : BnCOM 3. Advertising Interval : 1280ms

	4. Connection Interval : 20ms 5. Server Role : Peripheral 6. TX Power : 5(-4dBm)
Example of use	(HOST→BT) : **AT&F** (BT→HOST) : +OK …after 2sec.. (BT→HOST) : +READY ➔ After initializing the changeable values, you can confirm that the reset has been performed with a +READY response.

6.1.4 AT+VER?

Operation	To know the firmware version of BT from HOST
Response	Version information (v[major].[minor].[release])
Response completed	Within 8ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, the firmware version is displayed. * Can be executed in an AT COMMAND mode in a CONNECTED state
Example of use	(HOST→BT): **AT+VER?** (BT→HOST): v1.0.0 ➔ You can obtain information that the firmware version of BT is v1.0.0 from the HOST device.

6.1.5 AT+INFO?

Operation	To know BT address, Device Name, Mode[Role] and status from HOST
Response	BT Address, Device Name, Mode[Role],State
Response completed	Within 60ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it is displayed in the order of BT Addr, DeviceName, Mode[Role], and State. * Can be executed in an AT COMMAND mode in a CONNECTED state
Example of use	(HOST→BT) : **AT+INFO?** (BT→HOST) : 74:F0:7D:B0:10:00,BnCOM,SERVER[PERIPHERAL],ADVERTISING ➔ From the HOST device, you can obtain information about BT address, device name ‘BnCOM’, Server mode Peripheral Role, and Advertising status.

6.1.6 AT+UART=xxxx

Operation	When changing the communication speed with BT from HOST
Response	+OK or +ERROR
Response completed	Within 8ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds with "+OK" and resets after 2 seconds after changing the communication speed. Otherwise, it responds with "+ERROR". Supportable communication speeds are 2400, 4800, 9600, 14400, 28800, 19200, 38400, 57600, 115200, 230400, 460800, etc.

Example of use	(HOST→BT) : **AT**+**UART=9600** (BT→HOST) : +OK … after 2sec.. (BT→HOST) : +READY

6.1.7 AT+FLOWCONTROL=xx

Operation	When changing whether to use flow control in UART communication with BT from HOST
Response	+OK or +ERROR
Response completed	Within 5ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds "+OK" and resets after 2 seconds after changing the flow control status, otherwise it responds "+ERROR". ** xx can be set to “ON” or “OFF” (Initial value) “OFF”: Flow control not used
Example of use	(HOST→BT) : **AT**+**FLOWCONTROL=ON** (BT→HOST) : +OK … after 2sec.. (BT→HOST) : +READY

6.1.8 AT+FLOWCONTROL?

Operation	To know whether to use flow control in communication with BT from HOST
Response	Whether to use flow control (ON or OFF)
Response completed	Within 5ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds in ON/OFF format to display whether to use flow control. * Can be executed in an AT COMMAND mode in a CONNECTED state
Example of use	(HOST→BT) : **AT**+**FLOWCONTROL?** (BT→HOST) : ON

6.1.9 AT+SERVER=ROLE

Operation	When BT is in a SERVER mode, it is used to change the BT ROLE from HOST.
Response	+OK or +ERROR
Response completed	Within 8ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds with “+OK”. If not, reply “+ERROR”.
Example of use	(HOST→BT) : **AT**+**SERVER=P** (BT→HOST) : +OK (BT→HOST) : +ADVERTISING ➔ BT starts operating as a peripheral device (HOST→BT) : **AT**+**SERVER=B**

	(BT→HOST) : +OK (BT→HOST) : +BROADCASTING ➔ BT starts operating as a Broadcaster device

6.1.10 AT+MANUF=xxxx

Operation	Used when changing the BT Manufacture (Device Name) name from HOST
Response	+OK or +ERROR
Response completed	Within 8ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds with "+OK". If not, reply "+ERROR". A maximum 8 digits.
Example of use	(HOST→BT) : **AT**+**MANUF=BnCOM** (BT→HOST) : +OK (BT→HOST) : +ADVERTISING ➔ Used to set the BT MANUFACTURE to BnCOM from the HOST device. Information '**BnCOM'** can be obtained from Advertising Data when searching on the client. If the command is executed during advertising (or broadcasting), the name is applied and advertising (or broadcasting) is restarted.

6.1.11 AT+TXPWR=xx

Operation	When changing the TX power of BT from HOST
Response	+OK or +ERROR
Response completed	Within 8ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds with "+OK". If not, reply "+ERROR".
Example of use	(HOST→BT) : **AT**+**TXPWR=xx** (BT→HOST) : +OK (BT→HOST) : +ADVERTISING ** The range of xx can be changed from 0 to 7 **0** : -40dBm, **1** : -20dBm, **2** : -16dBm, **3** : -12Bm, **4** : -8dBm, **5** : -4dBm, **6** : 0dBm, **7** : 4dBm ➔ When the command is executed during advertising (or broadcasting), advertising (or broadcasting) is restarted after applying the new TX power.

6.1.12 AT+TXPWR?

Operation	To know the TX power of BT from HOST
Response	TX Power(0~7)
Response completed	Within 5ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, the TX Power value is displayed. (0: -40dBm, 1: -20dBm, 2: -16dBm, 3: -12dBm, 4: -8dBm, 5: -4dBm, 6: 0dBm, 7: 4 dBm) * Can be executed in an AT COMMAND mode in a CONNECTED state
Example of use	(HOST→BT) : **AT**+**TXPWR?** (BT→HOST) : 5

	➔ You can obtain information that TX Power of BT is 5 (-4dBm) from the HOST device.

6.1.13 AT+ADVDATA=xxxx

Operation	When BT is in a Server mode, you can change the Advertising User Data of BT from HOST.
Response	+OK or +ERROR
Response completed	Within 5ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds with "+OK". If not, reply "+ERROR". User can specify up to 13 characters and there is no setting value as default (NULL). There is no memory storage function (value is initialized when reset).
Example of use	(HOST→BT) : **AT**+**ADVDATA=Beacon** (BT→HOST) : +OK (BT→HOST) : +ADVERTISING ➔ When searching for BT from a remote device, you can obtain information **Beacon** from the Advertising User Data item. If the command is executed during advertising (or broadcasting), advertising (or broadcasting) is restarted after applying new user data.

6.1.14 AT+ADVDATA?

Operation	To know the Advertising User Data of BT from HOST
Response	Advertising User Data
Response completed	Within 16ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, Advertising User Data is displayed. * Can be executed in an AT COMMAND mode in a CONNECTED state
Example of use	(HOST→BT) : **AT**+**ADVDATA?** (BT→HOST) : Beacon ➔ From the HOST device, you can obtain information that the Advertising User Data of BT is **Beacon.**

6.1.15 AT+ADVINTERVAL=xxxx

Operation	When you want to change the Advertising Interval of BT from HOST
Response	+OK or +ERROR
Response completed	Within 8ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds with "+OK". If not, reply "+ERROR". Advertising Interval Range : 20 to 2560 (ms) * Default Advertising Interval : 1280ms
Example of use	(HOST→BT) : **AT**+**ADVINTERVAL=800** (BT→HOST) : +OK (BT→HOST) : +ADVERTISING

	➔ Set the Advertising Interval of BT to 800ms from the remote device If the command is executed during Advertising (or Broadcasting), a new Advertising Interval is applied and then Advertising (or Broadcasting) is restarted.

6.1.16 AT+ADVINTERVAL?

Operation	To know the Advertising Interval of BT from HOST
Response	Advertising Interval 표시(20~2560) Advertising Interval display (20 to 2560)
Response completed	Within 5ms after receiving the command (based on 9600bps)
Description	Advertising Interval is displayed if the request is normally received and the command is executed. * Can be executed in an AT COMMAND mode in a CONNECTED state
Example of use	(HOST→BT): **AT**+**ADVINTERVAL?** (BT→HOST): 800 ➔ You can obtain information that the Advertising Interval of BT is 800ms from the HOST device.

6.1.17 AT+CONNINTERVAL=xxxx

Operation	When changing the (Maximum) Connection Interval of BT from HOST
Response	+OK or +ERROR
Response completed	Within 8ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds with "+OK". If not, reply "+ERROR". Up to four digits can be entered as input (10 to 1999). The actual Negotiated Connection Interval value may vary depending on the connected device, and connection parameter update request may fail due to rejection of the other device. * If it is executed in an advertising state, the existing advertising is canceled and the connection interval is applied and then restarted.
Example of use	(HOST→BT) : **AT**+**CONNINTERVAL=30** (BT→HOST) : +OK (BT→HOST) : +ADVERTISING ➔ Request the Connection Interval to be 30ms If the command is executed during Advertising (or Broadcasting), Advertising (or Broadcasting) is restarted after applying a new Connection Interval.

6.1.18 AT+CONNINTERVAL?

Operation	To know the Connection Interval setting value of BT from HOST
Response	Connection Interval 표시(Max Conn Interval)
Response completed	Within 5ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, the set Connection Interval is displayed.

	* Can be executed in an AT COMMAND mode in a CONNECTED state
Example of use	(HOST→BT) : **AT+CONNINTERVAL?** (BT→HOST) : 30 ➔ You can obtain information that the connection interval currently set by BT is 30ms from the HOST device.

6.1.19 AT+DISCONNECT

Operation	When disconnecting the connection through AT COMMAND while BT is connected to the external device from HOST
Response	+DISCONNECT or +ERROR after +OK
Response completed	Within 100ms after receiving the command (based on 9600bps)
Description	If the request is received and the command is executed normally, it responds with +OK; otherwise reply “+DISCONNECT” * Can be executed in an AT COMMAND mode in a CONNECTED state
Example of use	(HOST→BT) : **AT+DISCONNECT** (BT→HOST) : +OK (BT→HOST) : +DISCONNECT (BT→HOST) : +ADVERTISING ➔ The HOST device requests release of the current connection between BT and the external device, and the connection is released normally.

6.1.20 AT+NEGOCONN?

Operation	To know the connection interval setting value that BT has negotiated with the other device from HOST
Response	Displays the current Negotiated value (ms) up to two decimal places.
Response completed	Within 8ms after receiving the command
Description	If request is received and command is executed normally, Negotiated Connection Interval is displayed. * Can be executed in an AT COMMAND mode in a CONNECTED state
Example of use	(HOST→BT) : **AT+NEGOCONN?** (BT→HOST) : 18.75 ➔ From the HOST device, you can obtain information that the connection interval between BT and the current other device is 18.75ms.

7. General Data transmission

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After the SERVER and the other CLIENT BLE device are connected, the data transmitted through UART or the BLE link from the other device are automatically transmitted without conversion.

Status	A status in which the SERVER and CLIENT are connected
Example of use	(HOST→BT) : **ABCD<CR>** (the other device): **ABCD<CR>**

8. Classification of Service UUIDs

Based on the current firmware, the SERVER provides Custom Data Service and the UUID is as shown in the table below. Smartphones or other devices can access the service through the following UUID.

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Class.	UUID	Property
Data Service (Primary)	**0xFFF0**	**N/A**
Read/Notification	**0xFFF1**	**Notification**
Write(No response)	**0xFFF2**	**Write without Response**

*16bit UUID 0xFFF0 to 128 bit UUID : 0000FFF0-0000-1000-8000-00805F9B34FB
*16bit UUID 0xFFF1 to 128 bit UUID : 0000FFF1-0000-1000-8000-00805F9B34FB
*16bit UUID 0xFFF2 to 128 bit UUID : 0000FFF2-0000-1000-8000-00805F9B34FB

9. Classification of PIOs

Class.	Function	Description
PIO 2 (Input)	**AT Command / BYPASS**	**(In a connected state) Used as a switch for AT Command and a Bypass mode (Low state is recommended at a booting time). AT Command Mode: High (Rising Edge) BYPASS mode: Low (Falling Edge)**
PIO 3 (Output)	**Connection Status**	**Displays the connection status of the Server HIGH : Connected LOW : Disconnected**
PIO 4 (Input)	**Enter Sleep / Wakeup**	**Used as a Sleep Mode and a Wake Up switch. Entering a Sleep mode: Rising Edge (HIGH) Wakeup execution: Falling Edge (LOW)**
PIO 12 (Input)	**Factory Reset & Disconnecting**	**Performs a Factory Reset when the corresponding port is kept high for 4 seconds or more, Disconnected when High (Rising Edge) is applied in a CONNECTED state**
PIO 9 (Input)	**Uart ON / Uart OFF**	**Used as Uart ON and Uart OFF switch. Entering Uart OFF state: Rising Edge (HIGH) Entering Uart ON state: Falling Edge (LOW)**

FCC MODULAR APPROVAL INFORMATION EXAMPLES for Manual

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

CAUTION: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

OEM INTEGRATION INSTRUCTIONS:

This device is intended only for OEM integrators under the following conditions:

The module must be installed in the host equipment such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the internal on-board antenna that has been originally tested and certified with this module. External antennas are not supported. As long as these 3 conditions above are met, further transmitter test will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.). The end-product may need Verification testing, Declaration of Conformity testing, a Permissive Class II Change or new Certification. Please involve a FCC certification specialist in order to determine what will be exactly applicable for the end-product.

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. In such cases, please involve a FCC certification specialist in order to determine if a Permissive Class II Change or new Certification is required.

Upgrade Firmware:

The software provided for firmware upgrade will not be capable to affect any RF parameters as certified for the FCC for this module, in order to prevent compliance issues.

End product labeling:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: 2APDI-BCM-LA100-AS".

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

RSS-GEN Section

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:(1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RSS-102 RF Exposure

L'antenne (ou les antennes) doit être installée de façon à maintenir à tout instant une distance minimum de au moins 20 cm entre la source de radiation (l'antenne) et toute personne physique. Cet appareil ne doit pas être installé ou utilisé en conjonction avec une autre antenne ou émetteur.