

RN4677 Bluetooth® 4.0 Dual Mode Module User's Guide

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2355 W. Chandler Blvd.
Chandler, Arizona, 85224-6199
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Derek Carlson
VP Development Tools

12-Sep-14
Date

NOTES:

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Preface

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Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXXXXA", where "XXXXXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the RN4677 Bluetooth® 4.0 Dual Mode Module. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Revision History

DOCUMENT LAYOUT

This document describes how to use the RN4677 Bluetooth® 4.0 Dual Mode Module as a development tool to emulate and debug firmware on a target board. The document is organized as follows:

- **Chapter 1. "Introduction"** – This chapter describes the operating modes of the RN4677 Bluetooth 4.0 Dual Mode Module and presents how to establish Bluetooth connection.
- **Chapter 2. "Command Reference"** – This chapter describes the general command categories of the RN4677 Bluetooth 4.0 Dual Mode Module in detail.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File > Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
`Plain Courier New`	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
`Italic Courier New`	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`
Notes	A Note presents information that we want to re-emphasize, either to help you avoid a common pitfall or to make you aware of operating differences between some device family members. A Note can be in a box, or when used in a table or figure, it is located at the bottom of the table or figure.	**Note:** This is a standard note box. **CAUTION** **This is a caution note.** **Note 1:** This is a note used in a table.

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RECOMMENDED READING

This user's guide describes how to use RN4677. Other useful documents are listed below. The following Microchip document(s) are recommended as supplemental reference resources.

RN4677 Bluetooth® 4.0 Dual Mode Module Data Sheet (DS50002370A)
This document provides the technical specifications for the RN4677 module and is available for download from the Microchip website at www.microchip.com.

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- Field Application Engineer (FAE)
- Technical Support

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Technical support is available through the web site at:

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REVISION HISTORY

Revision A (May 2015)

This is the initial release of this document.

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Chapter 1. Introduction

1.1 OVERVIEW

Microchip RN4677 Certified Bluetooth Dual Mode module supports both Bluetooth Classic and Bluetooth Low Energy (BLE) communication. Under Bluetooth Classic, RN4677 implements standard Serial Port Profile (SPP) that supports serial data transfer between two Bluetooth Classic devices.

In addition to SPP for Bluetooth Classic connectivity, the RN4677 introduces a private Generic Attribute Profile (GATT) service for serial data transfer between two BLE devices. This BLE data streaming service provided in the RN4677 is named *"Transparent UART"*. Therefore, the RN4677 is a Dual mode Bluetooth module, which supports both Bluetooth Classic and BLE serial data connectivity.

RN4677 module is developed on top of Microchip's IS1677 Bluetooth IC. The primary difference between RN4677 firmware and the standard firmware in the IS1677 is that the RN4677 provides the control interface based on ASCII commands. The command interface on RN4677 is very similar to that of RN41/42/52/4020, providing an easy migration path for customers who are currently using RN modules.

Interactive ASCII commands enable the RN4677 to be configured without complex and customer configuration tools. Like the other RN modules, the RN4677 also supports master/central capability, actively scanning for other connectable devices instead of waiting for incoming connection requests.

1.2 COMMAND MODE VS. DATA MODE

RN4677 operates in two modes: Data mode (default) and Command mode. When RN4677 is connected to another device and in Data mode, RN4677 acts as a data pipe: anything received from UART is passed to the connected peer device through SPP if connected to a Bluetooth Classic device, or via a private GATT service if connected to a BLE device. When data is received from the peer device from SPP for Bluetooth Classic or UART Transparent for BLE, such data outputs directly to UART.

RN4677 is configured or controlled, or both by setting it into Command mode and executing ASCII commands over UART. All configuration changes made by Set commands remain in Non-Volatile Memory (NVM) and survive the power cycle. Any configuration changes must take effect after a reboot. All Action commands take effect immediately, but have no effect after power cycling.

1.3 ACCESSING THE RN4677 OVER UART

A terminal emulator, such as Tera Term (Windows) or CoolTerm (Mac OS-X®), can be used to control RN4677 from a computer.

With RN4677 connected to a computer and a serial port enumerated for the UART port, run the terminal emulator to open the COM port with the following port settings:

- Baud rate 115,200 bps
- 8 bits
- No Parity
- 1 stop bit
- Hardware flow control disabled

To enter Command mode, type `$$$` into the terminal emulator. Once RN4677 enters Command mode, the string `CMD>` must be sent to UART to indicate the start of Command mode session. Once in Command mode, valid ASCII commands can be issued to control or configure RN4677. All commands end with `<cr>` key (carriage return `<cr>`), and are always responded by RN4677. The next command must not be issued prior receiving a response to the previous command. For Set or Action commands, the positive response is `AOK` and negative response is either `ERR` for error or `?` for unknown command. By default, when the RN4677 is ready to receive the next command, the command prompt `CMD>` is sent to UART. Users can turn off this feature by using command `S>` to ensure that the interface is backward compatible with RN41/42/52/4020.

To return to Data mode, type `---<cr>`. RN4677 automatically enters Data mode once it connects or disconnects with another device.

Note:	The module supports Fast Data mode. In this mode, the module does not enter Command mode even if it receives `$$$`. To enable Fast Data mode, use command `F,1`.

1.4 OPERATING MODES

RN4677 has several operating modes that the user can set using the command `SM`.

- **Slave mode** (`SM,0`) - Default mode, in which other Bluetooth devices can discover and connect to the module. Outbound connections can be initiated in this mode.
- **Master mode** (`SM,1`) - In this mode, the RN4677 module is not discoverable. The module makes a connection when a connection command `C` is received. Refer to command `C` for possible parameters for establishing connections.
- **Auto-Connect Master mode** (`SM,3`) - In this mode, the module automatically makes connections on power-up and reconnects when the connection is lost. In this mode, RN4677 automatically enters Fast mode, same as issuing command `F,1`, therefore `$$$` cannot enter Command mode. If an address is not stored, RN4677 automatically enters Master mode.
- **Paring mode** (`SM,6`) - In this mode, the module attempts to connect to the remote device that matches the stored remote address. To set the remote address, use command `SR`.

Note:	Any changes to the device configuration using the set `S` commands do not take effect until the device is rebooted using the reboot command `R,1` or power cycle.

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1.5 MAKING A BLUETOOTH CONNECTION

RN4677 can act as a master to initiate a connection to another Bluetooth device. The following steps can be used to start a Bluetooth Classic connection:

1. Type `$$$` to enter Command mode.
2. Type `+` to enable echo.
3. Type `I` to inquire the Bluetooth Classic devices in the neighborhood.
4. Wait until the inquiry is finished and find the MAC address of the device to be connected.
5. Type `C,<0,1>,<MAC address>` to attempt a connection with a remote device.
6. Once connected, characters entered in the terminal emulator is sent to the remote peer, and vice versa.
7. To terminate the connection, type `$$$` to get into Command mode, then type command `K,1.`

In a similar manner, the RN4677 can initiate BLE connection in Generic Access Profile (GAP) Central mode to another BLE device supporting the "Transparent UART" service. The command sequence is listed below:

1. Type `$$$` to enter Command mode.
2. Type `+` to enable echo.
3. Type `IL` to inquire BLE devices in the neighborhood.
4. Wait until the inquiry is finished and find the MAC address or address type of the device to be connected.
5. Type `C,<0,1>,<MAC address>` to attempt a connection with remote device, where the first parameter indicates the address type that can be found in the inquiry result: `0` for public address and `1` for private address.
6. Once connected, characters typed in the terminal emulator is sent to the remote peer, and vice versa.
7. To terminate the connection, type `$$$` to get into Command mode, then type command `K,1.`

1.6 SECURITY MODES

RN4677 supports encryption and authentication with security modes from 1 to 4. The definition of security mode are as follows:

- Security mode 1: Passkey Confirm
- Security mode 2: Just Works
- Security mode 3: Passkey Entry
- Security mode 4: Legacy Pin Code

For Bluetooth Classic, all security modes are supported. For BLE, *only* security modes 1 to 3 are supported.

For security modes 1 and 3, by default, a random 6-digit security pin is generated and displayed at one end of the connection and the other end must enter the security pin. Optionally, if both connection ends are RN4677, it is possible to fix the 6-digit security pin for BLE by supplying 6-digit pin to command `SP` instead of 4-digit pin for legacy Pin Code mode.

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Chapter 2. Command Reference

2.1 INTRODUCTION

RN4677 supports a variety of commands for controlling and configuration. This section describes these commands in detail and provides examples.

2.2 COMMAND SYNTAX

The ASCII command syntax is a keyword followed by optional parameters.

- ASCII commands are divided into multiple groups:
  - Set Commands
  - Get Commands
  - Action Commands
- All commands are one, two or three case-insensitive characters
- Delimit command and any argument with a comma
- Text data is case sensitive such as Bluetooth name
- All commands end with carriage return ('\r', \x0d)
- Get commands return the value to retrieve. Most of the other commands return either `AOK` as a positive response or `ERR` as a negative response.

2.3 SET COMMANDS

Set commands change RN4677 configurations and take effect after rebooting via `R,1` command, hard Reset or power cycle.

2.3.1 SA,<1-4>

The Set Authentication command sets the authentication method when a remote device attempts to connect, where <value> is one of the values shown in Table 2-1.

Once a remote device exchanges pin codes with the RN4677 device, a link key is stored for future use. The device automatically and permanently stores up to four peer devices in flash memory using the First-In, First-Out (FIFO) method.

TABLE 2-1: SET AUTHENTICATION VALUES

Value	Description
1	Secure Simple Pairing (SSP) Pin Code Confirm mode If this option is set when authenticating the link, a 6-digit pin is sent to UART. On the remote side, the same 6-digit pin is shown and asked to be confirmed. For BLE, if the command `SP` sets the 6-digit pin code, the pin code is fixed to be displayed and confirmed on the remote side; otherwise, a random 6-digit pin code is generated for confirmation.
2	(*Default*) SSP "Just Works" mode This mode works without any request to display or input any security pin.

TABLE 2-1: SET AUTHENTICATION VALUES (CONTINUED)

Value	Description
3	SSP Pin Code Input mode If this mode is set when authenticating the link, a 6-digit pin is displayed at the remote device and the local RN4677 device is required to input the pin. For BLE, if the command SP sets the 6-digit pin code, the pin code is automatically provided. Ensure that the remote device supports fixed pin codes; otherwise, the authentication fails.
4	Legacy Pin Code mode This Security mode is defined in *Bluetooth specification 2.0*. *Only* Bluetooth Classic supports this Security mode. This mode requires a fixed 4-digit pin code that is configurable using command SP.

Default:

2

Example:

```
SA,2                    // Enable "Just Works" security mode
```

2.3.2 SC,<H16>

This command *only* applies to Bluetooth Classic.

This command sets the service class field in the Class of Device (COD). The service class consists of the 11 Most Significant bits in the COD. This command sets the most significant word (msw) to create the 24-bit device class number. The inquiring device interprets the service class to determine the service. A complete listing of available Bluetooth service classes is referenced on the Bluetooth SIG web site at www.bluetooth.org.

Default:

0000

Example:

```
SC,0002                 // Set service class to 0002
```

2.3.3 SD,<H16>

This command *only* applies to Bluetooth Classic.

This command sets the class of device (COD) least significant word (lsw). The COD is a 24-bit number that is made up of the device class with major 8-bit and minor in a 16-bit word. This command is used with the Service Class command.

Default:

1F00

Example:

```
SD,8040
```

To set the COD to 0x1F0123, use the following commands:

```
SC,001F
SD,0123
```


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2.3.4 SE,<H16>

This command *only* applies to Bluetooth Classic.

This command sets the universally unique identifier (UUID) for service discovery process. It *only* supports standard 16-bit UUID.

Default:

1101

Example:

```
SE,1101              // Set UUID for serial port
```

2.3.5 SF,1

This command restores the device to the factory defaults.

Example:

```
SF,1                 // Restore factory defaults
```

2.3.6 SG,<0-2>

This command changes Bluetooth modes between Classic 2.1 + EDR (SPP) and Low Energy 4.0. It accepts one parameter with the following values:

Parameter Value	Bluetooth Mode
0	Dual mode
1	*Only* Bluetooth Low Energy
2	*Only* Bluetooth Classic

2.3.7 SI,<H16>

This command *only* applies to Bluetooth Classic.

The Inquiry Scan Window command sets the length of time the device spends enabling an inquiry scan (discoverability). The minimum value is `0x0012`, corresponding to about a 1% duty cycle. The page scan interval is fixed at `0x1000`. The default window is `0x0100`. The maximum value is `0x0800`. Set this parameter to `0x0000` to disable inquiry scanning and render the device undiscoverable. If the host already made the pairing, the inquiry scan is not used.

Default:

0100

Example:

```
SI,0200              // Set inquiry scan window to 0x0200
```

2.3.8 SJ,<H16>

This command *only* applies to Bluetooth Classic.

The Page Scan Window command sets the amount of time the device spends enabling page scanning (connectable). The minimum value is `0x0012`, which corresponds to about a 1% duty cycle. The page scan interval is fixed at `0x1000`. The default window is `0x0100`. The maximum value is `0x800`. Set this option to `0x0000` to disable page scanning and render the device nonconnectable.

Default:

0100

Example:

```
SJ,0200              // Set the page scan window to 0x0200
```

2.3.9 SM,<value>

This command sets the mode, where <value> is a number as shown in Table 2-2.

TABLE 2-2: MODE VALUES

Value	Description
0	Slave mode
1	Master mode
3	Auto-Connect Master mode
6	Pairing mode

Default:

0

Example:

```
SM,1                    // Set the mode to Master
```

2.3.10 SN,<string>

This command sets the device name, where <string> is up to 16 alphanumeric characters.

Default:

N/A

Example:

```
SN,MyDevice             // Set the device name to "MyDevice"
```

2.3.11 SO,<string1>[,<string2>]

This command sets the extended status string, where <string1> and <string2> are up to four alphanumeric characters each. Setting these strings to from one to four characters permits status messages to be sent to the RN4677 UART port. The first string is the prefix to the message, and the optional second string is the postfix to the message. For instance, when a Bluetooth Classic connection is established, the device sends the string <string1>CONNECT<string2>.

If the first parameter is a space, then both prefix and postfix are cleared, and no extended status string becomes an output.

Default:

%,%

Example:

```
SO,<,>          // Set the prefix and postfix of the message to <and>
                //respectively
```

2.3.12 SP,<string>

This command sets the security pin code, where <string> is either a 4-digit or a 6-digit pin. The 4-digit pin is used for legacy pin code pairing, while the 6-digit pin is used for SSP authentication in BLE if a fixed pin is desirable. The fixed 6-digit pin code in BLE is not supported by many of the Bluetooth Low Energy implementations.

Default:

1234

Example:

```
SP,0123                 // Set pin code to "0123"
```


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2.3.13 SQ,<0,1>

This command *only* applies to BLE.

This command sets the data streaming reliability between two RN4677 devices. If it communicates with a smart phone or tablet, the remote peer determines RN4677 data streaming reliability by either start notification (no acknowledgment) or indication (with acknowledgment). If the parameter of command SQ is 1, the data streams with acknowledgment; otherwise, the parameter 0 implies unacknowledged data streaming.

Default:

0

Example:

```
SQ,1                  // Enable acknowledgment for data streaming
```

2.3.14 SR[,<0,1>]<MAC Address>

This command stores the remote address. When the MAC address is for a Bluetooth Classic device, then the *only* parameter is the Bluetooth MAC address, 12 hexadecimal digits (6 bytes) without space or characters between digits. For a BLE device, the first parameter is either 0 (public) or 1 (random) to indicate address type, followed by the MAC address. Additionally, this command takes special character Z to erase any stored address.

Default:

N/A

Example:

```
SR,00A053112233       // Set the remote Bluetooth Classic
                      // address to 00A053112233
SR,0,00A053112233     // Set the remote BLE address to
                      // 00A053112233
SR,Z                  // Clear stored address
```

2.3.15 SS,<string>

This command sets the service name, where <string> is from 1 to 16 alphanumeric characters.

Default:

SerialPort

Example:

```
SS,SPP                // Service name set to SPP
```

2.3.16 ST,<H16>,<H16>,<H16>

This command *only* applies to BLE Transparent UART connections.

This command sets the connection parameters for BLE connection. These connection parameters are used for establishing connection when RN4677 acts as a master. Connection parameters can be modified after connection is established by Action command T.

This command expects three 16-bit hexadecimal parameters: minimum connection interval, slave latency and supervision timeout, respectively. The unit for the first parameter is 1.25 ms. The unit for the last parameter is 10 ms.

Default:

0008,0000,0200

Example:

```
ST,0010,0000,0100    // Set minimum connection to be 20 ms, slave
                     // latency to be 0 and supervision timeout to be
                     // 2.56 seconds
```

2.3.17 SU,<value>

The Set UART Baud Rate command sets the baud rate where <value> is 1200, 2400, 4800, 9600, 19.2, 28.8, 38.4, 57.6, 115K, 230K, 460K, or 921K. *Only* the first two characters for the desired baud rate must be specified.

Default:

115,200

Example:

```
SU,57                // Set the UART baud rate to 57,600
```

2.3.18 SW,<value>

This command *only* applies to Bluetooth Classic.

This command enables low-power Sniff mode, which enables extremely low-power operation. In this mode, the device goes into a deep sleep and wakes up every 625 µs x <value> to send/receive data. For example, the SW,0050 setting (0x50 = 80, 80 x 625 µs = 50 ms) causes the module to enter low-power sleep and wake once every 50 ms to check for RF activity.

This setting is useful for applications in which the device is connected and sending data. Data is not lost, however, some delay may occur.

Default:

```
0000                 // Disable Sniff mode
```

Example:

```
SW,0050              // Enable Sniff mode with interval time of 50 ms
```

2.3.19 SY,<0-4>

This command sets the transmit power of the module .

Default:

3

Example:

```
SY,1                 // Change max RF power output to be 1
```


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2.3.20 S-,<string>

This command sets the serialized friendly name of the device, where <string> is up to 11 alphanumeric characters. This command automatically appends the last two bytes of the Bluetooth MAC address to the name, which is useful for generating a custom name with unique numbering.

Default:
N/A

Example:

```
S-,MyDevice           // Set name to "MyDevice-ABCD"
```

2.3.21 S?,<0,1>

This command *only* applies to Bluetooth Classic.

The Role Switch command enables and disables the role switch, where `0` means disable role switch and `1` means enable role switch. If the switch is set when a slave mode device receives an incoming connection, the device tries to force a role switch, which enables the slave to become the master.

This option is useful in situations where the local device sends high-speed data up to the remote host, and can improve performance. While connected to this device, the connecting host may not be able to make additional outbound (multi-point) connections.

Default:

0

Example:

```
S?,1                  // Enable role switch
```

2.3.22 S$,<char>

This command sets the configuration detect character string, where <char> is a single character. This setting configures the escape character to enter Command mode (`$$$`) to a new character. Restoring the factory defaults returns the device to using `$$$`.

Default:

$

Example:

```
S$,#                  // Set ### as string to go into Command mode
```

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2.3.23 S:,<H16>,<data>

This command is used to change any settings in configuration EEPROM.

This command expects two parameters. The first parameter is a 16-bit hex value that represents memory address of EEPROM of the first byte of data. If there is more than one byte of data to be written, the memory address automatically increases. Set the second parameter value with the following format:

- Hex values up to 32 bytes.
- ASCII values up to 32 characters; enclosed by a quote

User must understand the mapping between EEPROM memory address and configuration parameters for the RN4677.

Default:

N/A

Example:

```
S:,0010,414243        // Set device name to be "ABC", where device
                      // name is stored in EEPROM starting from
                      // memory address 0x0010
S:,0010,"ABC"         // Set device name to be "ABC", where device
                      // name is stored in EEPROM starting from
                      // memory address 0x0010
```

CAUTION

Use caution when writing values to the EEPROM memory. Incorrect values can give unexpected results. It is strongly recommended to contact Microchip Technical Support before using this command.

2.3.24 S>,<0,1>

Command S> enable or disable command prompt. If command prompt is on whenever RN4677 is ready to receive a command, prompt CMD> is sent to UART to notify user that RN4677 is ready for next command. This feature releases the host MCU load to keep track of command response and timing requirements.

Default:

1

Example:

```
S>,0                  // Turn off command prompt
```

2.4 GET COMMANDS

The Get commands retrieve and display the stored information of the device. Most of these commands do not have a keyword or character and do not take any parameters.

2.4.1 D

This command displays basic settings such as the address, name, UART settings, security, pin code, bonding, and remote address.

Example:

```
D                     // Display basic settings
```


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2.4.2 E

This command displays the extended settings of the device such as the service name, service class and device class.

Example:

```
E                       // Display extended settings
```

2.4.3 GB

This command returns the Bluetooth address of the device.

Example:

```
GB                      // Display the device's Bluetooth address
```

2.4.4 GK

This command returns the current connection status of the device. There are three single digit values returned, which are separated by a comma.

The first digit indicates the status of the Bluetooth connection: 0 means no connection, and 1 means connected.

The second digit indicates authentication status, which is shown in Table 2-3.

TABLE 2-3: AUTHENTICATION STATUS

Value	Description
0	No BLE authentication
3	APP closed; no data transfer possible
6	BLE link authenticated

The third digit indicates the type of connection, which is shown in Table 2-4.

TABLE 2-4: CONNECTION TYPES

Value	Description
0	SPP
2	BLE

Example:

```
GK                  // Display current connection status
```

2.4.5 G:,<H16>,<H8>

This command reads the settings from configuration EEPROM.

This command expects two parameters. The first parameter is the 16-bit hex value of the starting memory address for configuration to read. The second parameter is the 8-bit hex value for the length of configuration to be read. This value must be less than 32, or 0x20 in hex format.

Example:

```
G:,0010,10      // Read the device name up to 16 bytes, which is stored
                // starting from address 0x0010
```

2.4.6 G<char>

This command displays the stored settings for a Set command, where <char> is a Set command name.

Example:

```
GA                  // Return Authentication mode set by command SA
```

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2.5 ACTION COMMANDS

Action commands perform actions such as inquiries, connecting, and entering/exiting Command mode. Action commands do not return AOK.

2.5.1 $$$

This command causes the device to enter Command mode and display command prompt. The device passes characters as data until it sees this exact sequence.

The escape character to enter Command mode can be changed with the S$ command.

Example:

```
$$$                    // Enter Command mode
```

2.5.2 ---

This command causes the device to exit Command mode, displaying END.

Example:

```
---                    // Exit Command mode
```

2.5.3 +

This command toggles the local echo on and off. If the + command is sent in Command mode, all typed characters are echoed to the output. Typing + a second time turns local echo off.

Default:

Off

Example:

```
+                      // Turn local echo on
```

2.5.4 A[,<H16>,<H16>]

This command *only* applies to BLE.

This command starts the advertisement. Optionally, it can take up to two parameters.

The first parameter is the 16-bit hex value of the advertisement interval with the unit of 0.625 ms.

The second parameter is the 16-bit hex value of the advertisement lasting time with the unit of millisecond. After this time, the advertisement stops. If the second parameter is not set but the first parameter is set, advertisement starts with interval of the parameter 1 until a connection is established.

If no parameter is given, the advertisement starts with an interval of 20 ms for 10s and then increase the advertisement interval to 160 ms to save power.

Example:

```
A,0040,03E8            // Advertise with interval of 40 ms for 1 second
```

2.5.5 B

This command *only* applies to BLE.

Command B is used to secure the connection and bond two connected devices. Command B is *only* effective if the two devices are already connected. Bonding can be issued from either the central or the peripheral device.

Once bonded, security materials are saved in both end of the connection. Therefore, reconnection between bonded devices does not require authentication as reconnection can be done in a very short time.

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If the bonded connection is lost for any reason, reconnection does not automatically provide a secured link. To secure the connection, the user must issue another `B` command. However, this command is *only* for securing link other than saving connection information.

Example:

```
B                    // Secure the BLE link
```

2.5.6 C

This command causes the device to attempt connecting to the stored remote address.

Example:

```
C                    // Connect to stored remote address
```

2.5.7 C,<address>

This command *only* applies to Bluetooth Classic.

This command causes the device to connect to a remote address, where <address> is specified in hex format. The address is also stored as the remote address if connection is successful.

Example:

```
C,00A053112233       // Connect to the Bluetooth address
                     // 00A053112233
```

2.5.8 C,<0,1>,<address>

This command *only* applies to BLE.

This command causes the device to connect to a remote BLE address, where <address> is specified in hex format. The address is also stored as the remote address if connection is successful. The first parameter indicates the address type: `0` for public address and `1` for private random address.

Example:

```
C,0,00A053112233     // Connect to the BLE address
                     // 00A053112233
```

2.5.9 C<1-4>

RN4677 can store up to four paired devices. This command provides an easy way to reconnect to any paired device without typing the MAC address. To display the list of paired devices, use command `Y,1`.

Example:

```
C2                   // Reconnect to the 2nd stored device
```

2.5.10 CF,<address>

This command *only* applies to Bluetooth Classic.

This command causes the device to connect to <address> and immediately go into Fast Data mode.

Example:

```
CF,00A053112233      // Connect to 00A053112233 in Fast Data
                     // mode
```

2.5.11 CFR

This command causes the device to connect and immediately go into Fast Data mode using the stored remote address.

Example:

```
CFR
```

2.5.12 F,<0, 1>

This command puts the RN4677 into Fast Data mode.

If the parameter is 1, Fast Data mode is enabled; otherwise, Fast Data mode is disabled. Fast Data mode improves data transfer throughput by disabling check for escape characters to enter Command mode.

When RN4677 is connected to another device, enabling Fast Data mode exits Command mode immediately and puts the device into Fast Data mode; when RN4677 is not connected to another device, enabling Fast Data mode puts RN4677 into Fast Data mode once it connects to another device.

Note:	Once in Fast Data mode, it is impossible to enter Command mode unless the remote side drops the connection or hardware Reset is invoked to reboot the module.

Example:

```
F,1                    // Leave Command mode and enter Fast Data mode
```

2.5.13 H

The Help command displays a list of commands and their basic syntax.

Example:

```
H                      // Display help
```

2.5.14 I,<value 1>,<value 2>

This command *only* applies to Bluetooth Classic.

This command performs an inquiry scan, where <value 1> is the scan time in seconds and <value 2> is the optional COD of the device class being scanned. The default time is 10 seconds, and the maximum is 48 seconds. If <value 2> is unused or set to 0, the device looks for all device classes. When entering a COD, all six hex characters must be provided. For example, enter 0040F0 for COD 0x40F0 value. The scan returns a maximum of nine devices. As devices are found, they are displayed in the following format:

<Bluetooth address>,<Bluetooth name>,<COD>

00A053000123,MySerial-Port,72010C

Default:

10 seconds, no COD

Example:

```
I,20,0040F0            // Scan for 20 seconds using the COD 0x40F0
```

2.5.15 IL[,<H8>,<H16>,<H16>]

This command *only* applies to BLE.

This command scans the neighborhood for BLE devices. This command can take up to three parameters.

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The first parameter is an 8-bit hex value for scan time in of seconds.

The second parameter is a 16-bit hex value for scan interval in the unit of 0.625 ms.

The third parameter is a 16-bit hex value for scan window in the unit of 0.625 ms. This parameter must be less than or equal to the second parameter.

If parameters are not provided, the default scan time is 8 seconds, scan interval is 230 ms and scan window is 125 ms.

Example:

```
IL,10,0320,0190       // Scan BLE peripherals for 16 seconds with
                      // scan interval 500 ms and scan window 250 ms
```

2.5.16 IN<value 1>,<value 2>

This command *only* applies to Bluetooth Classic.

This command is similar to the `I` command, but it does not return the Bluetooth name, where <value 1> is the scan time in seconds and <value 2> is the optional COD of the device class being scanned.

Example:

```
IN10,001F00           // Scan for 10 seconds using the COD 0x1F00
```

2.5.17 IQ

This command *only* applies to Bluetooth Classic.

This command scans for Bluetooth devices in Pairing mode and returns the Received Signal Strength Indicator (RSSI), which is an indicator of the signal quality for remote devices. Inquiry scanning with RSSI is part of the Bluetooth specification where the TX power is held at a constant level (no power control) while sampling the RSSI. A useful application for RSSI scanning is proximity-based pairing.

Example:

```
IQ
```

2.5.18 IS<value>

This command *only* applies to Bluetooth Classic.

This command performs an inquiry scan with a COD of 0x001F00, which is the default COD for Microchip Bluetooth Classic RN modules, where <value> is the scan time in seconds.

Example:

```
IS10   // Scan for Microchip Bluetooth Classic RN devices for 10 s
```

2.5.19 IR<value>

This command *only* applies to Bluetooth Classic.

This command performs an inquiry scan with a COD of 0x0055AA, where <value> is the scan time in seconds. Microchip Bluetooth Classic RN modules use this COD for instant cable replacement.

Example:

```
IR10   // Scan for instant cable replacement devices for 10s
```

2.5.20 K,1

The Kill command disconnects the current connection. The characters KILL <cr><lf> are echoed to the local UART once the connection is broken.

Example:

```
K,1                  // Disconnect the current connection
```

2.5.21 N,<address>

This command removes a device from the paired device list. The RN4677 is able to store up to four devices. The paired device list can be displayed by issuing command Y.

This command expects one parameter. The parameter can be letter Z, indicating to remove all devices from the paired device list, or the parameter can be hex value of a MAC address. This command removes the device with the input MAC address from the paired device list. If input MAC address is not associated with one of the devices in the paired device list, an error information is displayed.

Example:

```
N, 00A053112233      // Remove device with MAC address
                     // 00A053112233 from paired device list
N,Z                  // Clear paired device list
```

2.5.22 O

This command displays other settings such as the configuration character.

Example:

```
O                    // Show the other settings
```

2.5.23 Q

This command puts the device into Quiet mode, which means it is temporarily not discoverable or connectable. When this command is issued, the device responds Quiet. This command does not survive a power cycle or Reset.

The Q command settings with different responses include:

- Q - The module is undiscoverable for both Bluetooth Classic and BLE
- Q,0 - The module is discoverable and able to connect for both Bluetooth Classic and BLE. Response is AOK.
- Q,1 - The module is not discoverable and not able to connect for both Bluetooth Classic and BLE
- Q,2 - The module is able to connect but is not discoverable in Bluetooth Classic
- Q,3 - The module is not discoverable in BLE
- Q,? - Displays the current quiet mode

Example:

```
Q                    // Make module undiscoverable
```

2.5.24 R,1

This command forces a complete device reboot (similar to power cycle).

> **Note:** Any changes to the device configuration using the Set commands do not take effect until the device is rebooted.

Example:

```
R,1                  // Reboot device
```


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2.5.25 T,<H16>,<H16>,<H16>,<H16>

This command *only* applies to BLE.

This command adjusts the connection parameters after establishing the BLE connection.

The first parameter is a 16-bit hex value for minimum connection interval with unit of 0.625 ms.

The second parameter is a 16-bit hex value for maximum connection interval with unit of 0.625 ms.

The third parameter is slave latency.

The fourth parameter is supervision timeout with unit of 10 ms.

Example:

```
T,0010,0020,0000,0100   // Adjust the connection parameter to be
                        // min_conn_interval: 10 ms
                        // max_conn_interval: 20 ms
                        // slave_latency: 0
                        // supervision timeout: 2.56 seconds
```

2.5.26 V

This command displays the firmware version.

Example:

```
V                       // Display the firmware version
```

2.5.27 W

This command is the same as command Q,0. It is implemented for backward compatibility.

This command enables discovery and connection after it has been disabled with the Q command. It reloads the stored value of the inquiry and page window to re-enable.

Example:

```
W                       // Turn on discovery and connections
```

2.5.28 X

This command is a combination of commands D, E and O to display configurations.

Example:

```
X                       // Display configurations
```

2.5.29 Y[,1]

Command Y displays the MAC addresses of devices in the paired device list. Optionally, if parameter 1 is provided, the indexes of the MAC address of devices in the paired device list are also displayed. The index is useful if the user plans to use command C<1-4> to reconnect device in the stored device list.

Example:

```
Y                       // Display MAC addresses of devices in
                        // the stored device list
```

2.5.30 Z

This command *only* applies to BLE.

Command Z cancels attempt to establish a BLE connection by C command before a connection is established.

Example:

```
Z                    // Cancel attempt to establish a BLE
                     // connection.
```


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