BT-10 (RN42) Bluetooth Module

Features:

- Fully qualified Bluetooth® version 2.1 Class 2 (RN42) data module, supports version 2.1 + Enhanced Data Rate (EDR)
- Backwards-compatible with Bluetooth version 2.0, 1.2, and 1.1
- Pin compatible with widely used 2 x 10 2-mm socket typically used by 802.15.4 applications
- RN42: 26 µA sleep, 3 mA connected, 30 mA transmit
- UART data connection interface
- Supports secure simple pairing (SPP)
- Sustained data rates: 240 Kbps (slave), 300 Kbps (master)
- Embedded Bluetooth stack profiles: SPP and HID profile support as well as GAP, SDP, RFCOMM, and L2CAP protocols
- Bluetooth SIG certified
- Certifications: FCC, IC, CE

Applications:

- Bluetooth replacement for 802.15.4 modules
- Cable replacement
- Barcode scanners/readers
- Measurement and monitoring systems
- Industrial sensors and controls
- Medical devices
- Computer accessories
- Asset tracking

1.0 DESCRIPTION

Based on the popular 2 x 10 (2-mm) socket footprint often found in embedded applications, the Spark Concepts BT-10 module provide Bluetooth connectivity in legacy and existing designs that may have been based upon the 802.15.4 standard.

The RN42 Class 2 Bluetooth module is based on the RN42. These modules are simple to design in and are fully certified, making them a complete embedded Bluetooth solution. The Class 2 RN42 module has a range up to 20 meters.

2.0 OVERVIEW

- Pin compatible with 2 x 10 (2-mm) socket
- Baud rate speeds: 1,200 bps up to 921 Kbps, non-standard baud rates can be programmed
- RN42XV: Class 2 radio, 60 feet (20 m) distance, +4 dBm output transmitter, -80 dBm typical receive sensitivity
- Frequency 2,402 ~ 2,480 MHz
- FHSS/GFSK modulation, 79 channels at 1-MHz intervals
- Secure communications, 128-bit encryption
- Error correction for guaranteed packet delivery
- Configuration via the local UART and over-the-air RF
- Auto-connect master, I/O pin (DTR), and character-based trigger modes

TABLE 1: ENVIRONMENTAL CONDITIONS

Parameter	Value
Temperature Range (Operating)	-40o C ~ 85o C
Temperature Range (Storage)	-40o C ~ 85o C
Relative Humidity (Operating)	≤ 90%
Relative Humidity (Storage)	≤ 90%

3.0   DESIGN CONCERNS

The following sections provide information on designing with the BT-10 (RN42) module, including radio interference, factory reset, connection status, etc.

3.1   Powering the Module

ONLY apply 3.3 V ±10% regulated power to pin 1 (VDD) and pin 10 (ground). The module does not have an on-board voltage regulator and MUST be powered from a regulated 3.3 V power supply.

Mode	Blue LED	Yellow LED
Fast blink, 10 times per second	-	Command mode
Blinks twice per second	-	Boot up, remotely configurable
Blinks once per second	-	Discoverable/idle
Solid ON	Connected	-

3.2   Reset Circuit

The BT-10 (RN42) modules contain a 10kΩ pullup to VCC, and the reset polarity is active low. The module's reset pin has an optional power-on-reset circuit with a delay, which should only be required if the input power supply has a very slow ramp or tends to bounce or have instability on power up.

3.3   Baud Rate Override

Solder jumper "9600 Baud" (GPIO7) - This jumper is used to configure 9,600 or a software selected (default = 115 K) baud rate. If the solder jumper is OPEN, the module uses the stored baud rate setting. When the solder jumper is closed, the baud rate is set to 9,600 regardless of the software setting.

> OFF – Stored setting (115 K)
> ON – 9,600

3.4   Factory Reset Using GPIO4

It is recommended that designers connect GPIO4 (pin 8) to a switch, jumper, or resistor so it can be accessed. This pin can be used to reset the module to its factory default settings, which is critical in situations where the module has been misconfigured.

TO RESET MODULE TO FACTORY DEFAULTS:
1.   GPIO4 should be HIGH on power-up
2.   Toggle LOW – HIGH – LOW – HIGH *(wait 1 second between transitions)*

3.5   Connection Status

The BT-10 modules have an on-board Blue LED to indicate the connection status. The connection status LED is located in the upper left corner of the module.

## TABLE 3-1:   BT-10 (RN42) ELECTRICAL CHARACTERISTICS

Parameter	Min.	Typ.	Max.	Units
Supply Voltage (DC)	3.0	3.3	3.6	V
Average Power Consumption				
Radio On (Discovery or Inquiry Window Time)		40		mA
Connected Idle (No Sniff)		25		mA
Connected Idle (Sniff 100 ms)		12		mA
Connected with Data Transfer	40	45	50	mA
Deep Sleep Idle Mode		26		µA

TABLE 3-2:   BT-10 (RN42) DIGITAL I/O CHARACTERISTICS

3.0 V ≤ VDD ≤ 3.3 V	Min.	Typ.	Max.	Units
Input Logic Level Low	-0.4	-	3.6	V
Input Logic Level High	0.7 VDD	-	VDD + 0.4	V
Output Logic Level Low	-	-	0.2	V
Output Logic Level High	VDD - 0.2	-	-	V
All I/O pins (Except Reset) Default to Weak Pull Down	+0.2	+1.0	+5.0	µA

FIGURE 4-1:   BT-10 (RN42) DIMENSIONS
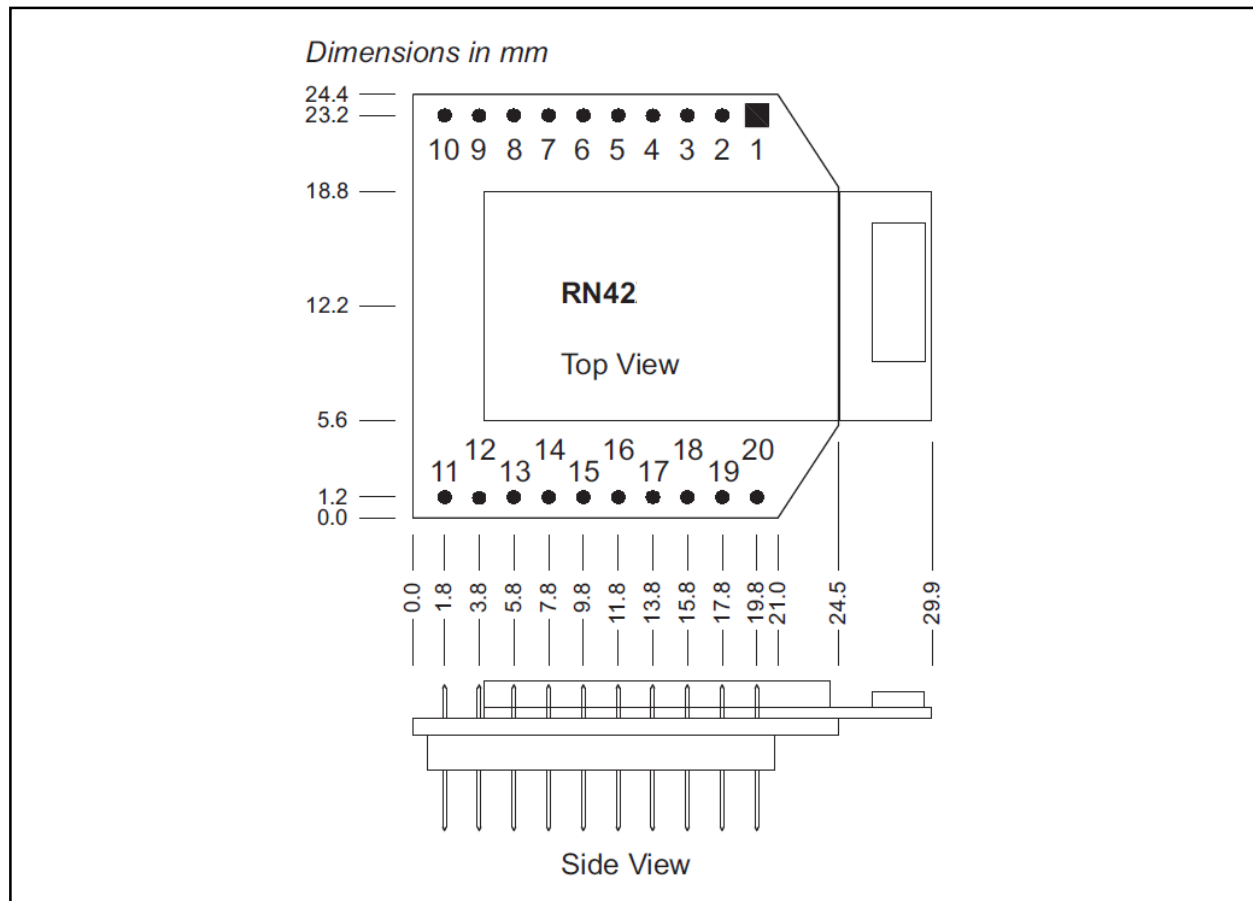
Pin Assignments:

Pin Number	Signal Name	Description	Operational Function	Direction
1	VDD_3V3	3.3 V regulated power input to the module.		Power
2	TXD	UART TX, 8 mA drive, 3.3-V tolerant.		From module
3	RXD	UART RX, 3.3 V tolerant.		To module
4	GPIO10	GPIO, 24 mA drive, 3.3 V tolerant/ADC input.		I/O
5	RESET	Optional module reset signal (active low), 10 k pull up, apply pulse of at least µ160 s, 3.3 V tolerant.		Input
6	GPIO6	GPIO, 24 mA drive, 3.3-V tolerant/ADC input.	Data TX/RX	From module
7	GPIO9	GPIO, 24 mA drive, 3.3-V tolerant/ADC input.		I/O
8	GPIO4	GPIO, 24 mA drive, 3.3 V tolerant/ADC input.		I/O
9	GPIO11	GPIO, 8 mA drive, 3.3 V tolerant.		I/O
10	GND	Ground.		Ground

11	GPIO8	GPIO, 8 mA drive, 3.3-V tolerant. The RN42 drives GPIO8 high on powerup, which overrides software configured powerup values, on GPIO8.		I/O
12	RTS	UART RTS flow control, 8 mA drive, 3.3 V tolerant. (default: RTS – CTS bridged to RN42)		From module
13	GPIO2	GPIO, 24 mA drive, 3.3 V tolerant/ADC input.		I/O
14	Not Used	No connect.		No Connect
15	GPIO5	GPIO, 24 mA drive, 3.3 V tolerant/ADC input.		I/O
16	CTS	UART CTS flow control, 3.3 V tolerant. (default: RTS – CTS bridged to RN42)		To module
17	GPIO3	GPIO, 24 mA drive, 3.3 V tolerant/ADC input.		I/O
18	GPIO7	GPIO, 24 mA drive, 3.3 V tolerant/ADC input.		I/O
19	AIO0			
20	AIO1			

BT-10 (RN-42) Schematic:

REVISION 2
BT10_Rev2
11/8/2015 5:37:25 PM
Sheet: 1/1
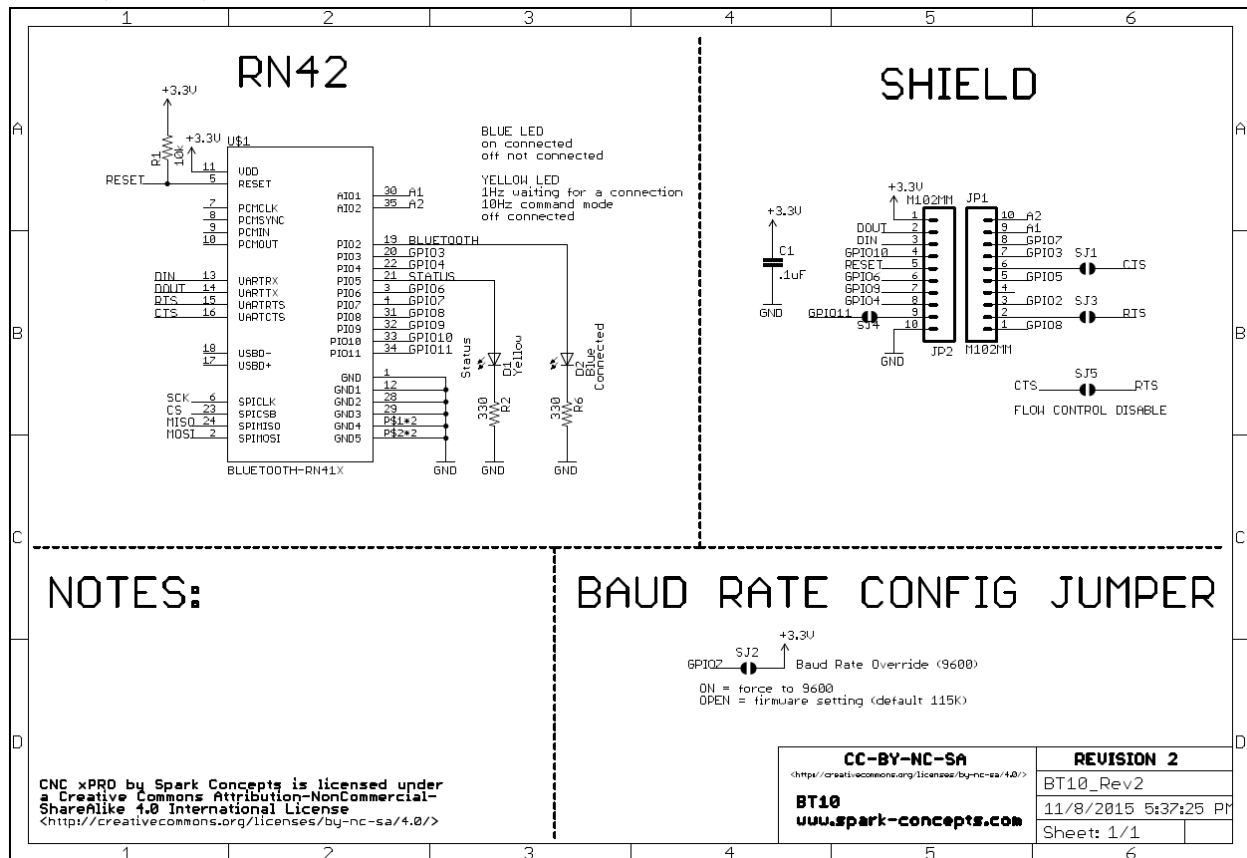
Advanced Configuration:

A-1 Custom configuring the Module

Connect the module to your computer: You can connect the BT-10 (RN-42) using a USB-to-Serial converter such as an XBee Explorer USB. For example, if you are using the XBee USB Explorer board, connect it to your computer using a USB cable. With the Bluetooth module connected and powered on, run a terminal emulator and open the COM port to which the cable is connected. The terminal emulator's communication settings should be the default serial port settings.
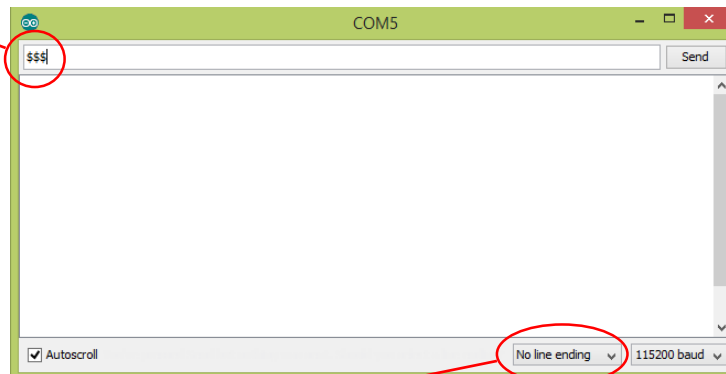
Default Serial Port Settings
1. Baud rate 115200 kbps
2. 8 bits
3. No parity
4. 1 stop bit
5. Flow control, None

A-2 Enter Command Mode

To enter command mode, launch a terminal emulator and specify the module's default settings. The table above shows the serial port settings. (note: <cr> indicates Carriage return)
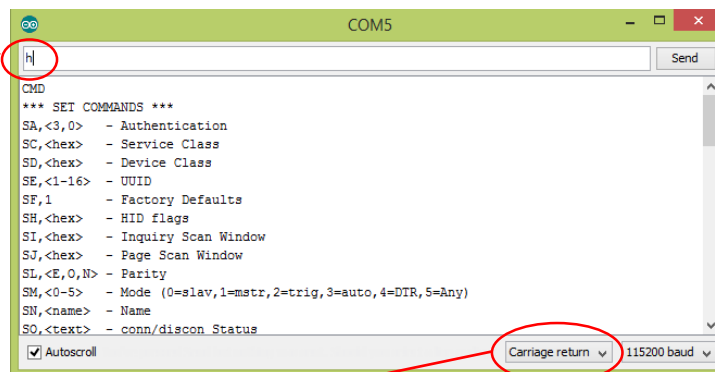
Type/send $$$ using terminal emulator to enter command mode

* prior to entering command mode, select 'no line ending'

The module returns the string CMD, which indicates that your connection and terminal settings are correct. While in command mode, the module accepts ASCII bytes as commands. When you enter a valid command, the module returns AOK. It returns ERR for an invalid command and ? for unrecognized commands.
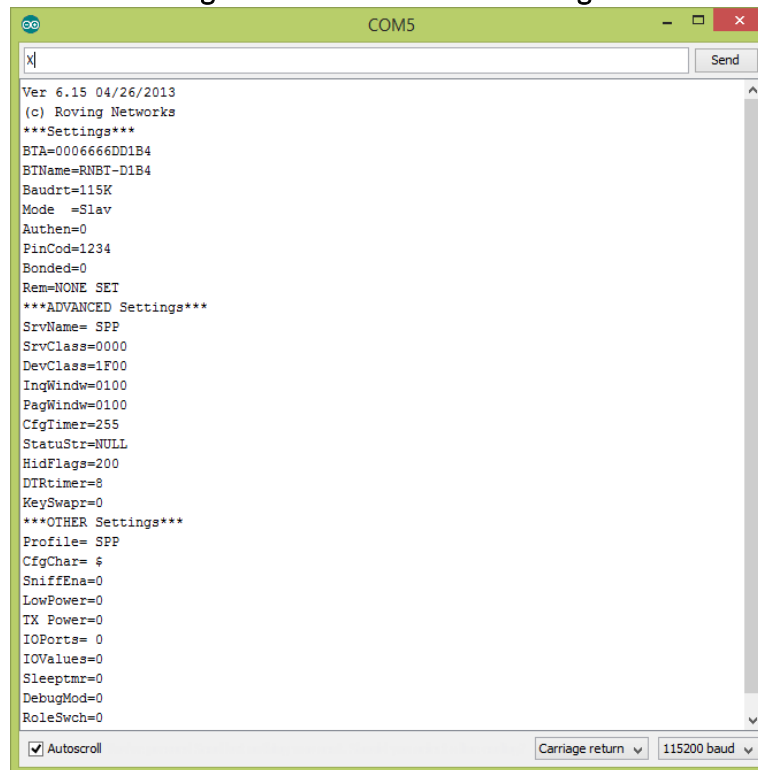
Type/send h <cr> to see a list of commands

* once in command mode, select 'Carriage return'

A quick check to confirm that you are in command mode is to type the X <cr> command after entering command mode. This command shows a summary of the module's current settings, such as the Bluetooth name, device class, and serial port settings. *See Figure A-1*

Figure A-1: View Current Settings

To return to data mode, type/send --- <cr> or reset the module and re-connect.

OPERATING MODES

The Bluetooth module has several operating modes, which you set using the SM command in command mode.

- *Slave Mode (SM,0)*—Default mode, in which other Bluetooth devices can discover and connect to the module. You can also make outbound connections in this mode.
- *Master Mode (SM,1)*—In this low-speed connection mode, the module makes connections when a connect command (C) is received. This command can also contain the Bluetooth address of the remote device. If a device is not specified, the module uses the stored remote address. The connection can be broken if the special break character or string is sent (use the SO command to set the break character). This mode is useful when you want the module to initiate connections (not receive them). In this mode, the module is NOT discoverable or connectable.
- *Trigger Mode (SM,2)*—In this low-speed connection mode, the module makes connections automatically when a character is received on the serial port (UART). The connection continues as long as characters are received on either end. The module has a configurable timeout (which you set using the ST command) that disconnects the module after the specified number of seconds of inactivity (1 to 255) or a configurable break character is received.
- *Auto-Connect Master Mode (SM,3)*—In this mode, the module makes connections automatically on power-up and re-connects when the connection is lost. This mode can be set by command, or by setting the external dipswitch 3 during power up (evaluation kits) or by driving GPIO6 high (Bluetooth modules). If an address is not stored, the module performs an inquiry process and the first device found that matches the COD is stored. In this mode, high-speed data is passed without being interpreted; therefore, the connection cannot be broken via commands or software break characters. If a disconnect occurs, the module attempts to re-connect until successful.
- *Auto-Connect DTR Mode (SM,4)*—This mode must be set by command. It operates like Auto-Connect Master Mode, except that you control connection and disconnection with dipswitch 3 (evaluation kits) and GPIO6 (Bluetooth modules). Turning the dipswitch on or driving GPIO6 high initiates the auto-connect process; turning the dipswitch off or driving GPIO6 low causes a disconnect.
- *Auto-Connect ANY Mode (SM,5)*—This mode must be set by command. This mode operates like Auto-Connect DTR Mode, except that each time the dipswitch or GPIO is set, an inquiry is performed and the first device found is connected. The stored address is NOT used, and the address found is never stored.
- *Pairing Mode (SM,6)*—In this mode, the module attempts to connect with the remote device matching the store remote address. You set the remote address using the SR command.

Set Commands: (store information to flash, changes take effect after power cycle or reboot)

Command	Description	Factory Setting
S7,<1,0>	7-Bit Data Mode Enable/Disable.	0, Disabled
SA,<0,1,2,4>	Authentication Enable/Disable.	0, Disabled
SB,<value>	Send Break.	Not Applicable
SC,<value>	Service Class. 0x0000,	Unknown
SD,<value>	Device Class. 0x1F00,	Undefined
SE,<string>	Sets the UUID for SPP Data Connections.	0x1101
SF,1	Factory Defaults.	N/A
SH,<value>	Sets the HID flag register (HID firmware only).	200
SI,<hex value>	Inquiry Scan Window.	0x0100
SJ,<hex value>	Page Scan Window.	0x0100
SL,<E,O,N>	Parity. N,	None
SM,<0,1,2,3,4,5>	Mode (0 = Slave, 1 = Master, 2 = Trigger, 3 = Auto, 4 = DTR, 5 = Any).	SM,0
SN,<string>	Name.	xxxx-xxxx
SO,<string>	Connect/Disconnect Status String.	NULL, No Status String
SP,<string>	Pin Code.	1234
SQ,<mask>	Special Configuration Settings.	0
SR,<hex value>	Remote Address (Use SR,Z to Remove).	None Set
SS,<string>	Service Name.	SPP
ST,<value>	Configuration Timer.	60 Seconds
SU,<value>	Baud Rate. {1200, 2400, 4800, 9600, 19.2, 28.8, 38.4, 57.6, 115K, 230K, 460K, 921K }, only the first 2 characters are needed	115 K
SW,<value>	Sniff Rate. 0x0000,	Disabled
SX,<1,0>	Bonding. 0,	Disabled
SY,<hex value>	Power Setting.	10
SZ,<value>	Raw Baud Rate.	N/A
S|,<value>	Low-Power Connection Mode.	0
S~,<0, 1, 2, 3, 4, 5, 6>	Profile Setting (0 = SPP, 1 = DUN-DCE, 2 = DUN-DTE, 3 = MDM SPP, 4 = DUN-DCE & SPP, 5 = APL, and 6 = HID).	0, SPP
S-,<string>	Sets the Serialized Friendly Name of the Device.	N/A
S?,<0,1>	Enable/Disable Role Switch.	0, Disabled
S$,<string>	Configuration Detection Character.	$$$

Action Commands: (perform action such as inquiry, connect, etc.)

Command	Description
$$$	Enter Command Mode.
---	Exit Command Mode.
+	Toggle the Local Echo of RX Characters in Command Mode.
&	Return the Dipswitch Values.
C	Connect Immediately to the Stored Remote Address.
C,<address>	Connect to Address.
CF<address>	Connect to Address in Fast Mode.
CFI	Connect and Immediately Go into Fast Data Mode Using Last Address Found.
CFR	Connect to Stored Remote Address in Fast Mode.
CT<address>,<value>	Connect, Address Required, Optional Disconnect Timer in ¼ Seconds.
F,1	Enter Fast Data Mode, End Configuration Immediately.
I,<value>,<COD>	Device Scan Inquiry, Time in Seconds, Optional COD Filter (0 = All).
IN<value>,<COD>	Device Scan Inquiry, Returns NAMEs. IQ Scans for Devices and Returns their RSSI.
IS<value>	Device Scan Inquiry, Fixed COD (0x001F00) to Find Roving Networks Devices.
IR<value>	Device Scan Inquiry, Fixed COD (0x0055AA) to Find Instant Cable Pairs.
J	Hides the Device's Pin Code.
K,	Kill (Disconnect) from Current Connection.
L	Toggle Link Quality Readings.
P,<char>	Pass through Any Character up to a Carriage Return or Line Feed.
Q	Quiet, Turn off Discovery and Connectability.
R,1	Reboot.
T,<0,1>	Pass Received Data (from UART or Bluetooth) while in Command Mode.
U,<value>,<E,O,N>	Temporary UART Change.
W	Re-Enable Discovery and Connectability.
Z	Enter Low-Power Sleep Mode.

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