

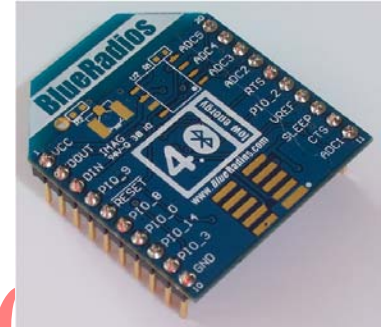
**Bluetooth® 4.0 Single Mode Low Energy SoC nano ampere network module**



**BR-XB-LE4.0-S2# XBee® Foot Print**

**OUTLINE**

- **AT HOME. AT WORK. ON THE ROAD. USING BLUETOOTH LOW ENERGY WIRELESS TECHNOLOGY MEANS TOTAL FREEDOM FROM THE CONSTRAINTS AND CLUTTER OF WIRES IN YOUR LIFE.**
- Three types of models: RF chip antenna, whip Antenna, or U.FL connector.
- FCC, IC, CE, RoHS, and Bluetooth® Ver 4.0 compliant ISM 2.4GHz band module.
- Code space for client applications (130kB Flash / 50kB w/parser, 2.5kB RAM)
- UART, SPI, USB data interface (2-wire or 4-wire with CTS/RTS).
- ADC, RTC, battery monitor, temperature sensor, watchdog timer.
- Includes integrated software stack, profiles, and AT modem like commands.
- Embedded Bluetooth Stack Protocols and Profiles Include: GAP, GATT, SMP, ATT, L2CAP, BATT, and future HDP.



nBlue Radio on bottom

**FEATURES**

- The BlueRadios serial radio modems can be configured, commanded, and controlled through simple ASCII strings over the Bluetooth RF link or directly through the hardware serial SPI (Master/Slave), UART or Full-Speed USB 2.0.
- UART baud rate speeds: 9600bps up to 460.8Kbps, and customized
- 120 meters (400 feet) est. distance (LOS) with chip antenna further with external.
- Software adjustable transmitter power from short to long range applications
- Low power consumption (22mA TX, 18mA RX, 0.22mA idle mode, and 0.5uA deep sleep timer)
- Optional 1Mb serial data Flash for Firmware-Over-The-Air (FOTA) or additional data storage
- Operating temperature range: -40~+85°C.
- Secure and robust communication link
  - ✓ FHSS (Frequency Hopping Spread Spectrum)
  - ✓ 24 bit CRC Error correction for guaranteed packet delivery
  - ✓ AES-128 bit encryption using CCM for encryption and authentication of packets.

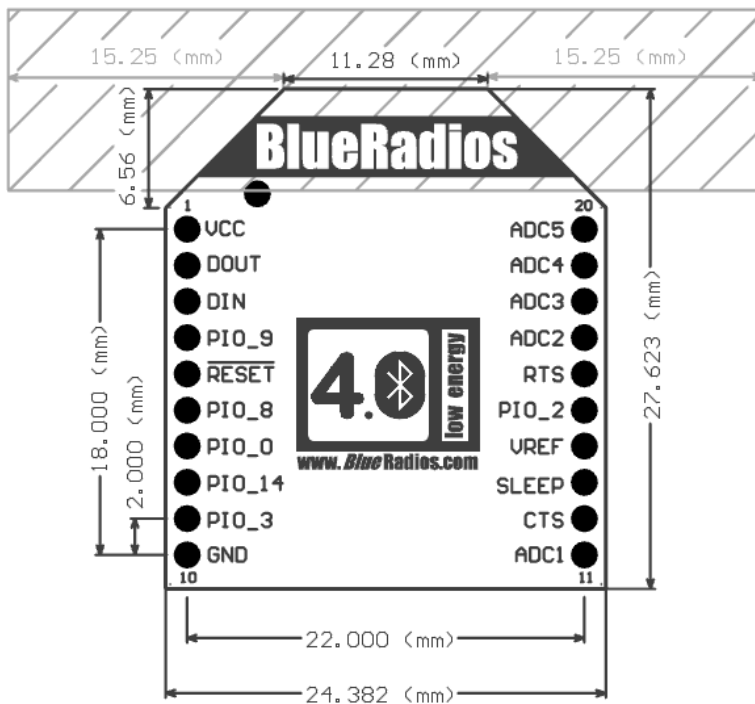
**SPECIFICATIONS**

Item	Specifications
Frequency	2394 ~ 2507MHz
Modulation	GFSK Modulation Index = 0.5
Channel intervals	Programmable 1MHz steps
Number of channels	40CH: 37 AFH data channels. 3 discoverable, connectable and broadcasting channel
Power supply voltage (w/o serial Flash)	2.0 to 3.6Vdc and < 10mVp-p noise
Current consumption	22mA worst case peak @4dBm
Transmission rate (over the air)	Programmable 2Mbps, 1Mbps, 500kbps, 250kbps
Receive sensitivity	-93dBm typ.
Output Power (Class2)	4dBm max.
RX/TX turnaround	150 usec. with 97dBm link budget
Dimensions	Without ext. antenna 24.38(W) X 27.62.(L) X 3.89(H)mm

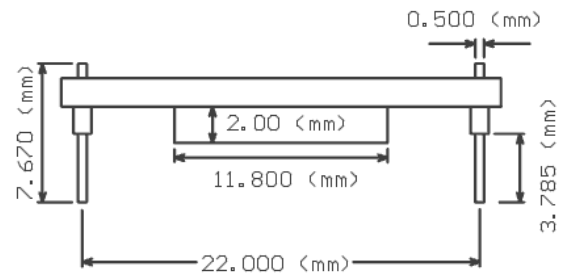
**DIMENSIONS**

- BR-XB-LE4.0-S2A (with Ceramic Antenna) 2 dBi TDK ANT8030-2R4-01
- BR-XB-LE4.0-S2U (U.FL)
- BR-XB-LE4.0-S2W (Whip Antenna)

Keep Out Area. DO NOT locate any parts or copper in Keep Out Area on any layer. (Chip Antenna Configuration Only)



0.062" Board Thickness



Mating Through Hole Connector:  
Digikey P/N: S5751-10-ND  
Manufacturer: Sullins Connector Solutions  
Man. P/N: NPPN101BFCN-RC

Mating Surface Mount Connector:  
Digikey P/N: S5901-10-ND  
Manufacturer: Sullins Connector Solutions  
Man. P/N: NPPN101BFLC-RC

TERMINALS	
1. VCC (2.0-3.6Vdc)	20. ADC5
2. DOUT	19. ADC4
3. DIN	18. ADC3
4. PIO_9	17. ADC2
5. RESET	16. RTS
6. PIO_8	15. PIO_2
7. PIO_0	14. VREF
8. PIO_14	13. SLEEP
9. PIO_3	12. CTS
10. GND	11. ADC1

Part is not 5Vdc tolerant.  
Reset is active **low**; pulse 1usec. (min)  
PIO Sink Current is 4mA max except for PIO(2&5)  
12-Bit ADC with Eight Channels and configurable resolution

## Power-up Sequence

Allow 100msec for module to fully reboot from initial power up (cold start).

Power management sleep modes:

PM1 – 220uA, 4uS wakeup (

PM2 – 1uA, 120uS wakeup (RX side still active)

PM3 – 0.5uA, 120uS wakeup (Turned off interrupt driven by PIO(3), power down state)

Please refer to BlueRadios Specification BR-LE4.0\_AT\_COMMANDS-200 hardware and software interface definition.

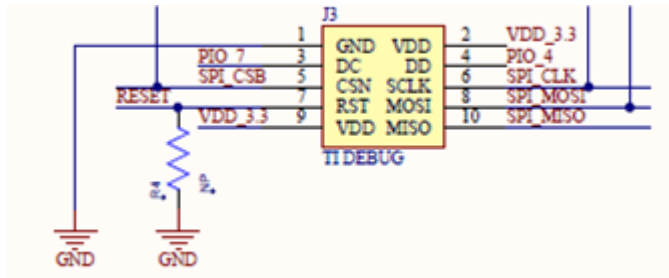
## SMD Module Cross Reference Table

XBee Pinout	Pin Name	BR-C40 BT2.0	BR-XX-S1 BLE	BR-C46 BT2.0	BR-XX-S2 BLE
1.	VCC (3.3V)	3.3V	3.3V	3.3V	3.3V
2.	DOUT	UART_TX	UART_TX	UART_TX	UART_TX
3.	DIN	UART_RX	UART_RX	UART_RX	UART_RX
4.	PIO_9	NC	PIO_9	PIO_9	PIO_9
5.	RESET	RESET	RESET	RESET	RESET
6.	PIO_8	NC	PIO_8	PIO_8	PIO_8
7.	PIO_0	PIO_0	PIO_0/ADC0	PIO_0/ADC0	PIO_0/ADC0
8.	PIO_14	NC	NC	NC	PIO_14
9.	PIO_3	PIO_3	PIO_3	PIO_3	PIO_3
10.	GND	GND	GND	GND	GND
11.	ADC1	NC	PIO_1/ADC1	PIO_1/ADC1	PIO_1/ADC1
12.	CTS	UART_CTS	UART_CTS	UART_CTS	UART_CTS
13.	SLEEP	PIO_5	PIO_5	PIO_5	PIO_5
14.	VREF	PIO_6	PIO_6	PIO_6	PIO_6
15.	PIO_2	PIO_2	PIO_2	PIO_2	PIO_2
16.	RTS	UART_RTS	UART_RTS	UART_RTS	UART_RTS
17.	ADC2	SPI_MISO	SPI_MISO / ADC2	SPI_MISO	SPI_MISO / ADC2
18.	ADC3	SPI_MOSI	SPI_MOSI / ADC3	SPI_MOSI	SPI_MOSI / ADC3
19.	ADC4	SPI_CSB	SPI_CSB / ADC4	SPI_CSB	SPI_CSB / ADC4
20.	ADC5	SPI_CLK	SPI_CLK / ADC5	SPI_CLK	SPI_CLK / ADC5

## BLE Firmware Options

- AT Command
- HCI only
- Custom

Programming interface tool TI CC-DEBUGGER and programmer (HPL15195U), pictured below. Tool is not needed if you are just upgrading **nBlue** firmware over module UART interface.



PIO\_4 and PIO\_7 have dual modes and when not used for programming inputs.

**Note:** Keep metallic components, connectors, copper traces, internal layers, and ground planes away from the antenna area in 3D space!

**nBlue** module communicating once a second consumes 30µA on average. To put this in perspective, 30µA corresponds to 330 days of battery life using a CR2032 coin cell. BLE is not recommended for data streaming applications over the standard defined profiles like GAP & GATT. BLE is ideal for efficient short (22 byte or less) packet burst technology.

## AT-Style Commands Reference (BlueRadios\_ATBLE\_Commands\_Rev)

### Benefits of BLE over traditional Bluetooth

IP aware, automatically interacts directly with the web application, phone PC, STB, or gateway is a pass through no special applications required on the Gateway which is a transparent pipe from device to an IP address.

- Broadcast support
- Connectionless always off technology
- Proximity and out of range detection
- 3 msec. connect time and low data latency
- First low power wireless technology standard

In LE, GAP defines four specific roles: Broadcaster, Observer, Peripheral, and Central. A device may support multiple LE GAP roles provided that the underlying Controller supports those roles or role combinations. However, only one LE GAP role may be supported at a given time. Each role specifies the requirements for the underlying Controller. This allows for Controllers to be optimized for specific use cases.

The **Broadcaster** role is optimized for transmitter only applications. Devices supporting the broadcaster role use advertising to broadcast data. The broadcaster role does not support connections. The **Observer** role is optimized for receiver only applications. Devices supporting the observer role are the complementary device for a broadcaster and receives broadcast data contained in advertisements. The observer role does not support connections. The **Peripheral** role is optimized for devices that support a single connection and are less complex than central devices. Devices supporting the peripheral role only require Controllers that support the Controller's slave role. The **Central** role supports multiple connections and is the initiator for all connections with devices in the peripheral role. Devices supporting the central role require a Controller that supports the Controller's master role and generally supports more complex functions compared to the other LE GAP roles.

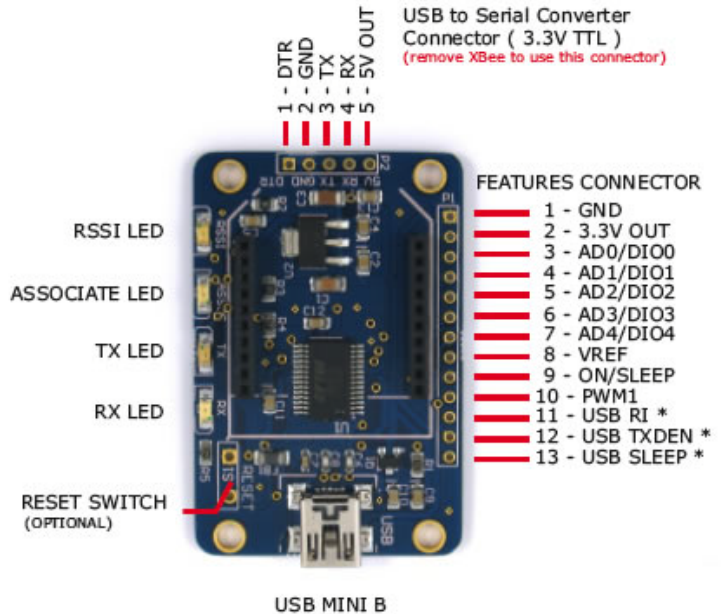
**PART NUMBER ORDERING: BR-XB-LE4.0-S2#**

- BR = BlueRadios
- XB = XBee® foot print
- LE = Low Energy
- 4.0 = *Bluetooth* LE version
- S = Single Mode
- 2 = Class2 +100 meter
- # = A (Antenna)
- # = U (U.FL RF Connector)
- # = W (Whip Antenna)

Part Number	Description
1) BR-XB-LE4.0-S2A	<i>Bluetooth</i> Low Energy v4.0 Single Mode with Ceramic Antenna
2) BR-XB-LE4.0-S2U	<i>Bluetooth</i> Low Energy v4.0 Single Mode with U.FL RF Connector
3) BR-XB-LE4.0-S2W	<i>Bluetooth</i> Low Energy v4.0 Single Mode Whip Antenna

**Optional Evaluation Test Board**

Part number: **BR-XB-TSB**



**Price and Order information**

[http://www.blueradios.com/orderinfo\\_new.htm](http://www.blueradios.com/orderinfo_new.htm)

*Bluetooth* Low Energy, part of *Bluetooth* Ver. 4.0, specifies two types of implementation: **single** mode and **dual** mode. Single mode chips implement the low energy specification and consume just a fraction of the power of classic *Bluetooth*, allowing the short-range wireless standard to extend to coin cell battery applications for the first time. Dual mode chips combine low energy with the power of classic *Bluetooth* and are likely to become a de facto feature in almost all new *Bluetooth* enabled cellular phones and computers.

**Note:** Single mode *Bluetooth* 4.0 Low Energy is **not** backwards compatible with previous *Bluetooth* standards. Dual mode *Bluetooth* 4.0 Low Energy is backwards compatible but is not practical for low power devices but targeted to gateway products.