

## Bluetooth® 4.0 Low Energy Single and Dual Mode Intelligent Modules **nBlue™ & BlueBridge®**

BlueRadios intelligent modules offer a complete and easy to integrate solution for a much faster time to market. The modules are FCC, IC, ETSI and CE certified and just need to be dropped into your design. You won't need to worry about RF design/component selection, as the module has a built in antenna that can achieve a range of over 100m. If the customer would like to use their own antenna the module is also offered without an antenna or with a U.FL connector.

The modules can be controlled through the UART using a serial AT command stack that is extremely easy to use out of the box. The single mode stack includes a custom serial port profile, BlueRadios Serial Port (BRSP), for serial data streaming similar to the Bluetooth SPP profile. The modules come preprogrammed with the latest AT command stack and a boot loader that allows firmware updates to easily be programmed through the UART. BlueRadios also provides libraries for customers to write their own apps to run on the module. The libraries will sit on top of the TI stack, providing a simpler interface similar to what the AT command interface provides. Of course the TI stack can still be used to write apps for BlueRadios modules.

BlueRadios development boards are much more developer friendly with all I/O being pulled out to headers. They have a USB to Serial IC on board, allowing the AT Command stack to easily be tested from a PC. They can also be powered via battery, USB, CC Debugger or external supply. BlueRadios also offers multiple referenced design boards with various sensors on board including:

- **Apple iPhone 4s and Android supported smart phone applications**
- **Over-the-Air (OTA) firmware programming or over two wire UART interface**

Below is a comparison matrix comparison for a module solution vs. "chip-on-board" designs by clients.

X	<b>Board Solution</b>	<b>Module Solution</b>	<b>Board Solution</b>
X	<b>TI CC2540 Single Mode Baseband I.C.</b>	<b>nBlue™</b> P/N: BR-LE4.0-S2A or S3A <b>BlueBridge®</b> P/N: BR-LE4.0-D2A	<b>TI CC2564 Dual Mode baseband I.C. requires external processor for stack</b>
<b>Baseband Processor Unit Cost</b>	~\$3/unit for baseband in volume	Complete turnkey module solutions. See website for pricing	~\$5/unit for baseband in volume
<b>Host processor</b>	Not required	Not required	\$\$ Required
<b>BT Stack, API, Application</b>	LE stack only, limited profiles	API plus application No royalties	\$30,000 - \$40,000 fee Plus unit royalties of ~\$1/unit
<b>Additional Component &amp; Hardware Costs</b>	\$5/unit 32KHz crystal 32MHz crystal Balun, Antenna RF caps, resistors, inductors Custom Metal RF shield, multilayer impedance controlled PCB	No hidden cost.	\$10/unit additional parts, level shifter required and expensive host processor. 32KHz crystal 32MHz crystal Balun, Antenna RF caps, resistors, inductors, Custom Metal RF shield, multilayer

	Bed of nails testing Specialized RF test and equipment. \$10K Tooling for RF shield		impedance controlled PCB Bed of nails testing Specialized RF test and \$10K Tooling for RF shield
<b>Assembly</b>	\$1/assembly for all BOM parts	No additional cost – one part.	\$2/assembly for all BOM parts & micro BGA
<b>RF Circuit Yield (1<sup>st</sup> elect.)</b>	2% approx. failure rate	0%	3% approx. failure rate
<b>Board level RF, full I/O testing, QA testing</b>	\$1/unit +0/-0.5dB of the power listed in the Grant for certification	Not required by client – done prior to shipping each module	\$1/unit +0/-0.5dB of the power listed in the Grant for certification
<b>Certification Testing</b>	FCC IC ETSI CE BT \$40,000 total	Included	FCC IC ETSI CE BT \$40,000
<b>Loading firmware stack</b>	\$.50/unit at component level or 1\$/unit at finished board level.	Stack preloaded in module no additional cost. Built in test code as well	\$.50/unit at component level or 1\$/unit at finished board level.
<b>Level shifting to support 3.3Vdc logic</b>	Standard	Standard	No – additional parts required
<b>Apple AMF firmware support?</b>	No	Yes	No
<b>AMF encoder</b>	Not included \$1/unit	Not included \$1/unit	Not included \$1/unit
<b>AMF Royalty</b>	Not included \$0.50/unit	Not included \$0.50/unit	Not included \$0.50/unit
<b>Architecture</b>	System on Chip (SOC)	System on Module	External high end CPU and BT stack required
<b>Power Consumption</b>	Same	Same	Same
<b>Tools</b>	IDE – IAR Systems \$2950	Free	Code Composer Studio IDE \$450
<b>Profiles</b>	Battery, proximity, etc.	Supplied profile libraries, Customer can define profiles	Supplied profile libraries, Customer can define profiles
<b>Labor support for entire project</b>	Requires a team of at least two full time engineers for one year	Only 40 hours of total engineering	Requires a team of at least two full time engineers for one year
<b>Target Market</b>	Annual volumes over 100K for large OEM with full time project engineers	Annual volumes less than 100K and fast time to market	Annual volumes over 100K for large OEM with full time project engineers

<b>Memory</b>	Application code space	Application code space	Application code space
<b>RAM</b>	Yes	Yes	None - HCI only solution
<b>FLASH</b>	Yes	Yes	
<b>Availability</b>	Full Production	Full Production	Full Production

There are three options available to write applications for the BlueRadios Single mode modules. ATLE.s (Serial) - The module is controlled through the UART using an AT command set or GATT Commands. This requires an external processor or source of data, which most customers may already be familiar with and may not require an expensive compiler. For some applications like proximity, tracking, and I/O control no external processor would be required.

ATLE.e (Embedded) - BlueRadios provides a library that is built on top of the TI stack, allowing customers to build custom applications. This requires the IAR compiler but will provide a simplified programming experience compared to the TI Stack.

TI BLE-STACK - Customers can use the TI stack with IAR.

*Bluetooth* Low Energy, part of *Bluetooth* Ver. 4.0, specifies two types of implementation: **single** mode (Smart) and **dual** mode (Smart Ready). 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.

