

## SECURE, POWERFUL WIRELESS ENGINE FOR YOUR IOT DESIGN



Building on Laird's expertise with Nordic from the BL600 and BL652 series comes the most powerful yet - the BL654 series! It provides OEMs with the maximum design flexibility and performance. A complete multi-protocol embedded wireless offering with exceptional processing capability, all at a micro power budget.

Powered by **Nordic's nRF52840** silicon, the small form factor BL654 modules, DVKs and USB Dongle provide for a secure, robust BLE and **Cortex -M4F** CPU for any OEM's product design. The BL654 provides you with maximum development flexibility with programming options for the **Nordic SDK**, a simple, intuitive **AT Command Set**, as well as Laird's own **smartBASIC** environment.

The BL654 series brings out all nRF52840 hardware features and capabilities including **USB access**, up to **5.5V** supply considerations, and **802.15.4 (Thread)** implementation. Complete regulatory certifications enable faster time to market and reduced development risk completes Laird's simplification of your next Bluetooth design!

- **Bluetooth v5** Bluetooth Low Energy (BLE) plus **NFC**
- **802.15.4** functionality (Thread & ZigBee via Nordic SDK)
- **Widest range of configurable interfaces:** UART, I2C, SPI, ADC, GPIO, PWM, IREQ, USB, and NFC
- Industrial Temp Rating (-40° to +85° C)
- **Ultra-Small footprint** (15mm x 10mm x 2.2mm)
- BLE Peripheral/Central roles with DTM embedded
- **2Mbps & LE Long Range:** Support for 2Mbps, 1Mbps, & 125kps coded
- **Hostless operation** – Internal MCU reduces BOM
- **Powerful Core** Cortex-M4F (1Mbit Flash, 256k RAM)
- Built on years of experience with Nordic (BL600 & BL652 Series)
- **Fully featured development kit** everything needed to start BLE development
- **Application Design Choice:** Leverage Laird's *smartBASIC*, simple AT Command Set or utilize Nordic SDK directly.
- **USB Dongle option:** Packaged USB Adapter – bring full Bluetooth v5 connectivity to ANY device with a virtual COM port capability

**Note:** Nordic SDK is not supported on the BL654 USB dongle, part #451-00003.

## FEATURES AT A GLANCE



### TRULY HOSTLESS OPERATION FOR AUTOMATED USE CASES

Combine on-module MCU, *smartBASIC* and simultaneous central/peripheral role support for a powerful hostless solution for sensor applications.



### SPEED TO MARKET

Easily write event-driven, automated applications, no toolchain required with *smartBASIC*. Or utilize the Nordic SDK directly – design your way



### EXTREMELY EFFICIENT POWER MANAGEMENT

Customize to balance throughput with power usage, enabled by ultra-low power sleep mode.



### GLOBAL APPROVALS – MAKE YOURSELF AT HOME

Carries several modular FCC, IC, CE, RCM, MIC and Bluetooth SIG approvals.



### PERSONAL SUPPORT FROM DESIGN TO MANUFACTURE

Laird's industry-renowned support is passionate about helping you speed your design to market.

## APPLICATION AREAS



IoT Devices and Sensors



Beacons and Proximity Applications



Secure Medical Peripherals



Industrial Monitoring

### KEY SPECIFICATIONS

CATEGORY	FEATURE	SPECIFICATION
Wireless Specification	Bluetooth®	v5 – Single-Mode (Peripheral and Central Roles)
	Thread®	802.15.4 stack provided via Nordic SDK
	Frequency	2.402 - 2.480 GHz
	Transmit Power	+ 8 dBm (maximum). Configurable down to -40 dBm
	Receive Sensitivity	-95 dBm (typical @ BLE 1 Mbps) -92 dBm (typical @ BLE 2 Mbps) -103 dBm (typical @ BLE 125 kbps)
	Link Budget	103 dB (@ BLE 1 Mbps), 111 db (@ BLE 125kbps)
	Antenna Options	PCB Trace antenna or IPEX MHF4 RF Connector
	Raw Data Rates (Air)	1 Mbps, 2 Mbps, 125kbps
Host Interface and Peripherals	UART Interface	TX, RX, CTS, RTS, DTR, DSR, DCD, RI possible in <i>smartBASIC</i> (GPIO) Default: 115200, N, 8, 1. Configurable from 1200 bps to 1 Mbps
	USB Interface	2 pins - CDC/Audio/HID & Mass storage virtual interfaces
	Other	48 multifunction GPIO's that can provide: <ul style="list-style-type: none"> <li>▪ 2 UART (4 GPIO pins each)</li> <li>▪ 8 ADC channels (1 pin each)</li> <li>▪ 2 I2C (2 GPIO pins each)</li> <li>▪ 4 SPI Master (4 GPIO pins including CS each)</li> <li>▪ 1 QSPI (6 GPIO pins)</li> <li>▪ 2 PDM (2 GPIO pins each)</li> <li>▪ 2 I2S (5 GPIO pins)</li> <li>▪ 2 GPIO pins for 32.768kHz crystal</li> <li>▪ 2 GPIO pins for NFC</li> <li>▪ PWM output on 16 pins</li> <li>▪ FREQ output on 16 pins</li> </ul>
Key BLE Features	Bluetooth Low Energy	<ul style="list-style-type: none"> <li>▪ GATT Client &amp; GATT Server – Any Adopted / Custom Services</li> <li>▪ Central / Peripheral Roles.</li> <li>▪ Up to 20 BLE connections</li> <li>▪ BLE Mesh</li> <li>▪ CODED PHY</li> <li>▪ 2M PHY</li> <li>▪ LE Advertising Extensions</li> <li>▪ LE Secure Connections</li> <li>▪ Data Packet Length Extensions</li> <li>▪ LE Privacy v1.2</li> <li>▪ LE Ping</li> <li>▪ vSP – Virtual Serial Port</li> </ul>
Programmability Options	<i>smartBASIC</i>	On-board BASIC programming language
	AT Command Set	Simple AT 'Hayes style' command protocol
	Nordic SDK	Software / Support available from Nordic directly <b>Note:</b> Nordic SDK is not supported on the BL654 USB dongle, part #451-00003.
FW upgrade		Via UART or JTAG
Supply Voltage		1.7V – 5.5V
Power Consumption	Current	Max Peak Radio Current (@ +8dBm TX) – 14.1mA (DCDC at 3V) Max Peak Radio Current (@ 0dBm TX) – 4.9mA (DCDC at 3V) Standby Doze – 3.1µA Deep Sleep –0.4µA (external signal wake up)
Physical	Dimensions	15mm x 10mm x 2.2mm (Modules) 18.39 mm x 50.74 mm x 11mm (USB Adapter)
Environmental	Temp Range	-40°C to +85°C
Miscellaneous	Lead Free	Lead-free and RoHS compliant
	Development Kit	Development board and free software tools
Development Tools	Utilities	UwTerminalX (Multi-platform) Android and iOS applications UART firmware upgrade
Qualifications	Bluetooth®	Complete Declaration ID
Regulator	Approvals	FCC / IC / CE / MIC / RCM - All BL654 Series

**For full specifications on BL654 modules, please see the appropriate datasheet.**

PART #	DESCRIPTION
451-00001	Bluetooth v5 + 802.15.4 + NFC Module – Integrated Antenna (Tape / Reel)
451-00002	Bluetooth v5 + 802.15.4 + NFC Module – IPEX MHF4 Antenna Connector (Tape / Reel)
451-00001C	Bluetooth v5 + 802.15.4 + NFC Module – Integrated Antenna (Cut Tape)
451-00002C	Bluetooth v5 + 802.15.4 + NFC Module – IPEX MHF4 Antenna Connector (Cut Tape)
451-00003	Intelligent USB Bluetooth v5 Adapter
455-00001	Development Board for Bluetooth v5 + 802.15.4 + NFC Module – Integrated Antenna
455-00002	Development Board for Bluetooth v5 + 802.15.4 + NFC Module – IPEX MHF4 Antenna Connector