*n*Blue Dev Board Summary Datasheet

Bluetooth® 5.0 Low Energy Single Mode Class 1 SoC Development Board

*n*Blue™ BR-DEV-LE5.0-S1A (nRF52840)

- ***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.***
- **FCC, IC, CE, RoHS, *and Bluetooth*® 5.0 Certified ISM 2.4GHz module supporting *Bluetooth*® 5.0 high speed mode, long range mode and advertising extensions. Can also support *Bluetooth* Mesh, 802.15.4 for Thread and Zigbee, ANT or proprietary 2.4Ghz.**
- **Utilizes the Nordic nRF52840 SoC. 64Mhz ARM® Cortex™ M4F 32-bit processor with FPU, 1MB Flash, 256K RAM, built in DC-DC converter and ARM CryptoCell cryptographic accelerator.**
- **Programmable output power from -40dBm to +8dBm for short to long range applications.**
- **Over 1000 meter line of site distance with integrated antenna. External antenna can be connected to RF_OUT pad or through optional u.FL connector (requires moving RF path resistor).**
- **Can be externally controlled via simple ASCII AT commands over UART, USB and Bluetooth, or programmed with custom applications embedded in the module.**
- **USB, CR2032 coin battery, or external power options. A USB Male-to-Mini B Male 1meter cable included**
- **USB 2.0 CDC ACM virtual serial port, no custom software driver installation required.**

***n*Blue™ BR-DEV-LE5.0-S1A module**

FEATURES

- Peripherals: Full-speed USB 2.0 controller, UART (2 or 4 wire with CTS/RTS, 9600 to 921.6K baud), I2C, I2S, SPI (32MHz), QSPI (32MHz), PWM, PDM, AES, 8 channel 12-Bit ADC, comparator, quadrature decoder, temperature sensor, real time counter, watchdog timer, 46 PIOs. Integrated 32kHz crystal.
- Type 2 Near Field Communication (NFC-A) Tag support. (External antenna required.)
- Very low power consumption: *14.8mA at +8dBm TX, 4.6mA RX, 3.4uA sleep, and 0.4uA shutdown.*
- 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.
  - ✓ LE Secure Connections Pairing using the Elliptic-Curve Diffie-Hellman (ECDH) algorithm.
- LED status indicators: Module Power (**red**), PIO2 Bluetooth Connection (**blue**), PIO5 Slave status (**green**), PIO7 Sleep status (**orange**) PIO8 AT command received (**red**).
- Module easily configured to advertise as iBeacons to support immediate, near, and far proximity ranges.
- Free iOS & Android libraries and applications. Supports iBeacon.

SOFTWARE

- Integrated AT.s command stack for external control via UART or RF, with *Bluetooth* 5.0 support, BRSP serial profile, battery (BAS) profile and device information (DIS) profile. BRSP allows the user to stream data over LE similar to the way SPP works on Classic *Bluetooth* devices – now with throughput up to 50kBps.

- Bootloader allows updates to be done Over-the-Air (with no external flash required), over the UART or over USB. Clients should make hardware accommodations for upgrading firmware on custom designs since modules shipped from the factory in tape and reel cannot be guaranteed to contain the latest AT.s firmware. **Be sure to update the AT.s firmware regularly to ensure compliance.** Firmware updates can be found by going to http://www.blueradios.com/forum/ in the *Bluetooth 5.0 Low Energy Modules » AT.s Firmware » BR-LE5.0-S1 AT.s Firmware* section.
- Nordic Semiconductor nRF5 SDK available for custom embedded applications. Available embedded *Bluetooth* Profiles include: ANS, Apple ANCS, BAS, BPS, CSCS, CTS, Nordic DFU, DIS, Eddystone ESCS, GLS, HIDS, HRS, HTS, IAS, IPSP, LBS, LLS, Nordic NUS, RSCS, TPS.
- Also available from Nordic Semiconductor: nRF5 SDK for Mesh for *Bluetooth* Mesh development and nRF5 SDK for Thread and Zigbee 802.15.4 development.
- BRSP Service Library for nRF5 SDK (Coming Soon) to add BRSP service support to custom embedded applications.
- Apple iOS and Android libraries, as well as a data terminal example application (nBlueTerm - with source code) provided free of charge. nBlueTerm supports connect, disconnect, pairing and sending data over BRSP.

SPECIFICATIONS SUMMARY (Module only)

Operating Conditions Summary

Item	Specifications
Supply voltage (VDD)	1.7-3.6 V
VDD Supply rise time (0V to 1.7V)	60ms
Supply voltage (VDDH – Optional)	2.5-5.5 V
VDDH Supply rise time (0V to 3V)	1ms
Supply voltage (VBUS - Optional)	4.35-5.5 V
Supply ripple	100 mV Max
Max I/O pin voltage	VDD + .3V, 3.9V Max **(Not 5V Tolerant)**
Ambient Temperature Range	-40 – 85 °C

Sleep Mode Consumption Summary

TA = 25°C, VDD = 3 V, LDO regulator (Data from nRF52840 Product Specification v1.0)

Item	Specifications
Shutdown Mode (No RAM retention, Wake on Reset)	0.4 µA
Sleep Mode (No RAM retention, Wake on any event)	0.97 µA
Sleep Mode (Full RAM retention, Wake on any event)	2.35 µA
Sleep Mode (No RAM retention, Wake on RTC)	1.5 µA
Sleep Mode (No RAM retention, Wake on RTC)	3.16 µA

CPU Current Consumption Summary

TA = 25°C, VDD = 3 V, DCDC regulator enabled (Data from nRF52840 Product Specification v1.0)

Item	Specifications
CPU executing CoreMark (Running from RAM)	2.8 mA
CPU executing CoreMark (Running from Flash)	3.3 mA

Radio Current Consumption Summary

TA = 25°C, VDD = 3.3 V, DCDC regulator enabled (Data from nRF52840 Product Specification v1.0)

Item	Specifications
Radio RX Current (1Mbps BLE Mode)	4.6 mA
Radio RX Current (2Mbps BLE Mode)	5.2 mA
Radio TX Current	
8 dBm	14.8 mA
4 dBm	9.6 mA
0 dBm	4.8 mA
-4 dBm	3.3 mA
-8 dBm	3.1 mA
-12 dBm	3.0 mA
-16 dBm	2.8 mA
-20 dBm	2.7 mA
-40 dBm	2.3 mA

AT.s Current Consumption Summary

TA = 25°C, VDD = 3.3 V, DCDC regulator enabled (Data measured on BR-LE5.0-S1A module running AT.s 5.0.2.0-S1)

Item	Specifications
Shutdown Mode	~0.4 µA
Sleep Mode	~3.4 µA
Sleep Mode, Default Advertising at 100ms Interval, 0dB	~140 µA
Sleep Mode, Default Advertising at 100ms Interval, 8dB	~240 µA
Idle	~625 µA
Default Advertising at 100ms Interval, 0dB	~750 µA
Default Advertising at 100ms Interval, 8dB	~850 µA

RF Specifications Summary

Item	Specifications
Frequency	2402 – 2480 MHz in 2 MHz steps
Data Rate	2Mbps, 1Mbps, 500kbps, 125kbps
Number of Channels	40: 37 data / 3 advertising (0,12,39)
Receive Sensitivity	-103 (125kbps BLE Mode), -95dBm (1Mbps BLE Mode), -92 (2Mbps BLE Mode)
Output Power	-40 to +8 dBm
Link Budget	Up to 111dB

For complete specifications of the nRF52840 see the nRF52840 Product Specification:
https://www.nordicsemi.com/DocLib/Content/Product_Spec/nRF52840/latest/keyfeatures_html5

PINOUT

Pin	PIO#	Pin Name	Pin	PIO#	Pin Name
J1-1	-	GND	J2-1	33	PIO_33
J1-2	-	VDD	J2-2	34	PIO_34
J1-3	0	PIO_0 (ADC_0)	J2-3	35	PIO_35
J1-4	1	PIO _1 (ADC_1)	J2-4	36	PIO_36
J1-5	10	PIO _10 (ADC_2)	J2-5	37	PIO_37
J1-6	13	PIO _13 (ADC_3)	J2-6	38	PIO_38
J1-7	11	PIO _11 (ADC_4)	J2-7	39	PIO_39
J1-8	12	PIO _12 (ADC_5)	J2-8	40	PIO_40
J1-9	9	PIO_9 (ADC_6)	J2-9	41	PIO_41
J1-10	2	PIO_2	J2-10	42	PIO_42
J1-11	3	PIO_3	J2-11	43	PIO_43
J1-12	4	PIO_4	J2-12	44	PIO_44
J1-13	5	PIO_5	J2-13	-	GND
J1-14	6	PIO_6	J2-14	16	UART_RTS
J1-15	7	PIO_7	J2-15	-	-
J1-16	8	PIO_8	J2-16	18	UART_RX
J1-17	14	PIO_14	J2-17	17	UART_TX
J1-18	19	PIO_19	J2-18	15	UART_CTS
J1-19	20	PIO_20			
J1-20	21	PIO_21	P1-1		NFC1
J1-21	22	PIO _22	P1-2		NFC2
J1-22	25	PIO_25			
J1-23	26	PIO_26			
J1-24	27	PIO_27			
J1-25	28	PIO_28			
J1-26	29	PIO_29			
J1-27	30	PIO_30			
J1-28	31	PIO_31			
J1-29	32	PIO_32			
J1-30	-	~RESET			
J1-31	-	VDD			
J1-32	-	GND			

DEBUGGING

Debugging is done through a two-pin serial wire debug (SWD) interface. A debugger is only needed for programming/debugging a custom application and is not necessary for using the AT.s command set. If a debugger is needed a Segger J-Link can be used, or for a more cost effective option a Nordic PCA10056 nRF52840 development board can be used. The PCA10056 has a J-Link built in and can connect to an external board using its P19 Debug out header.

J-Link: https://shop-us.segger.com/DebugProbe_s/40.htm
PCA10056: https://www.nordicsemi.com/Software-and-Tools/Development-Kits/nRF52840-DK

A debugger is only needed for writing a custom application for a module and not using the AT.s command set, AT.s firmware can be updated without a debugger.

ORDERING INFORMATION

Pricing and ordering information can be found at:
http://www.blueradios.com/orderinfo_new.htm

PART NUMBER

BR-DEV-LE5.0-S1A

Bluetooth Low Energy Single Mode with Antenna Development Board

DEVELOPMENT KIT (BR-EVAL-LE5.0-S1A)

Development kit available containing everything required to set up a connection quickly and evaluate range and performance of the BR-LE5.0-S1A: http://www.blueradios.com/hardware_EVAL-LE5.0-S1A.htm

CUSTOM FIRMWARE

The AT.s command interface can be modified for high volume customers and custom embedded software development is available upon request

ADDITIONAL DOCUMENTATION

Complete Documentation can be found at: http://www.blueradios.com/forum.