

GLOSSARY

**RSSI** – Received signal strength indicator (RSSI) is a measure of the power present in a received radio signal.

**dBm** – A unit of measure of the absolute radio power level in decibels scale vs 1mW of power. It means 1 mW is 0 dBm, 10 mW is 10 dBm, 100 mW is 20 dBm, etc...

**DCDC converter** – An electronic circuit that provides an output regulated voltage that is different (higher / lower) than its input voltage. In a radio chipset and battery-operated system, its purpose is to convert the battery voltage to a lower regulated level (also called a “buck converter”).

**RF balun** – This RF circuit filters RF signals (ensuring compliance with local radio regulations such as ETSI, FCC, and ARIB) and performing 50-Ohm adaptation with an antenna connector to ensure optimal RF transmission and reception performance.

**PLL** – Phase Lock Loop is a circuit that generates the required phase or frequency in a radio system. This is basis of the analog part of a radio transceiver to perform radio modulation & demodulation.

**HS XTAL** – High-speed crystal oscillator required to provide the reference frequency to the PLL in order to generate the correct RF frequency.

**RO** – A ring oscillator is an internal circuit (low-cost vs external 32 kHz crystal oscillator) that is required for low-power management of transceivers. Internal transceiver timers run based on the RO frequency.

**PCB antenna** – PCB antenna is designed on a printed circuit board using copper lines. Its advantage in terms of cost is that its one-quarter wavelength ensures good RF performance.

**50-Ohm adaptation** – In RF applications, all measurements are based on 50-Ohm connectors to ensure a reference setup for radio & power consumption measurements. Moreover it eases radio designs with antennas which are close to 50-Ohms impedance.

**Extended data packet length** – Optional BLE 4.2 feature used to increase data transfer rates (up to 700 kbps).

**Secure connection** – Optional state-of-the-art BLE feature to improve connection security.

**FOTA** – Firmware (application & stack) Over-The-Air upgrade. The procedure allows to push new firmware on a device deployed in the field.

**BLE Profile** – A basic collection of attributes (services and characteristics) exposed by a device in order to share user data over a BLE link.

**GATT** – Generic Attribute Profile software layer (part of the BLE stack) that defines how attributes are organized and how the application can access them.

**Advertising** – Bluetooth devices send advertising packets (PDUs) to broadcast data, and to allow other devices (scanners) to find and connect to them. The advertising data consists of up to 31 bytes of user configurable data.

**Scan rsp** – An additional 31 bytes can be sent as a scan response to a scan request (scan request sent from client device such as smartphone).

**Beacon** – A beacon device uses advertising mode to share data with users. The payload can be specified such as Ibeacon (Apple) and Eddystone (Google) or can be configured by application.

For more information, visit us on [www.st.com/ble](http://www.st.com/ble)



# Bluetooth Low Energy (BLE) Quick reference guide

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Order code: BRBTBLE1220

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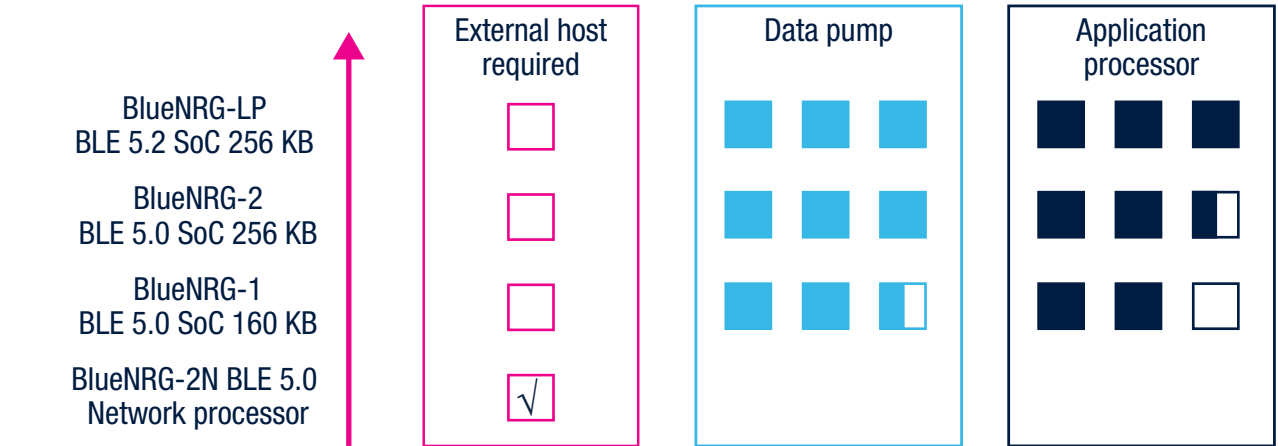
Operating in the unlicensed 2.4 GHz frequency band, what makes Bluetooth Low Energy (BLE) so special is that it can communicate with smartphones and similar devices. BLE enables communication for lots of applications from Industrial (remote device configuration), Smart Home (sensor control and monitoring), to Wearables, enhancing and improving the user experience.

ST’s BlueNRG portfolio offers various low-cost BLE solutions from the basic network processor to single-core Wireless SoC application processors as well as chipsets and modules. This reference guide aims to help developers understand which BlueNRG solution best addresses their needs and constraints.

- System architecture: BLE add-on to an existing product? New BLE design?
- Application features: Power consumption? Firmware Over-The-Air (FOTA) capability? Data rate?
- Application integration: Chipset scalability and module approach?
- Application topology: Point-to-point BLE? BLE Mesh? Simple radio communication at 2.4 GHz?

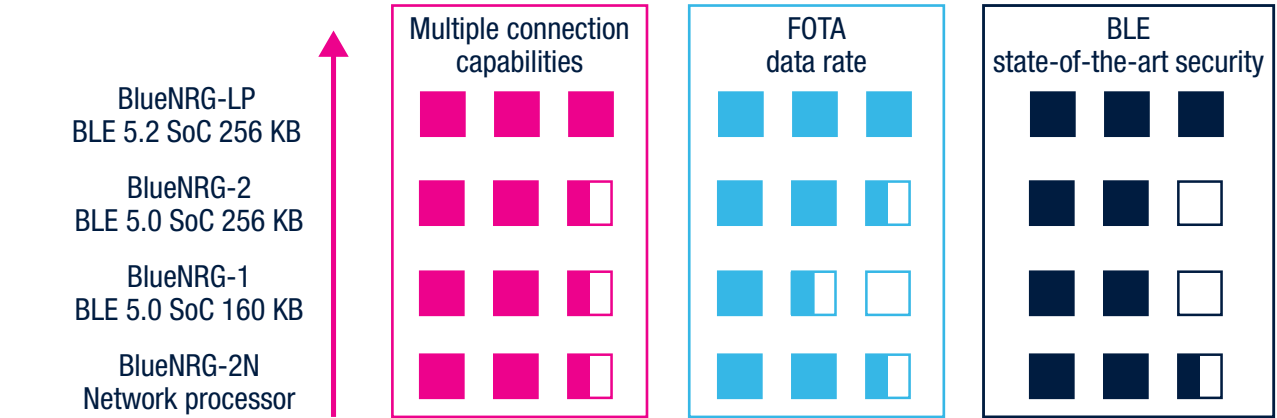
SYSTEM ARCHITECTURE FLEXIBILITY

ST’s BlueNRG portfolio gives developers flexibility to select the right product according to their existing hardware architecture. In industrial applications, there is today a strong need to connect sensors and be able to monitor and control machines. The network processor (external host required) approach leverages software efforts and minimizes deployment risks, by just adding BLE functionality on top of an existing product. In data pump mode, our BlueNRG SoC lets developers easily add BLE functions to an existing product via a basic UART-to-BLE bridge (hosted over BlueNRG). This approach also minimizes integration and deployment risks as well as reduce main CPU processing. Thanks to our BlueNRG SoC family, a full application and stack can be hosted over the same core and Flash memory. Here, the application processor approach enables the design new products at lower cost by reducing the BOM.



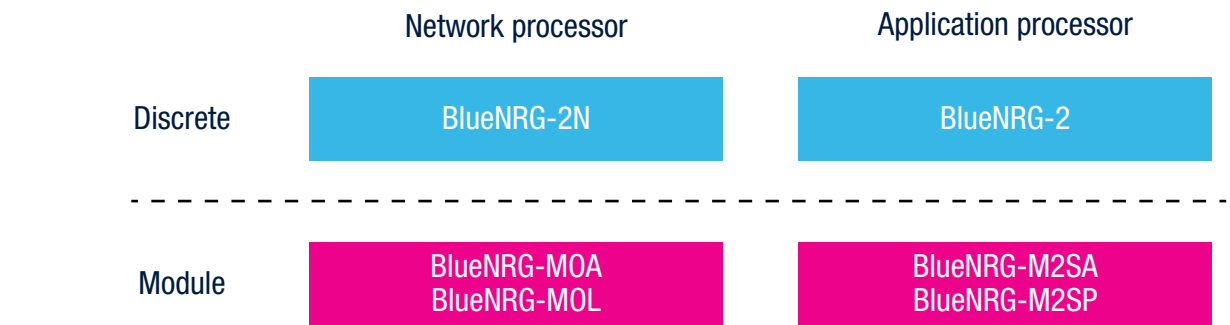
APPLICATION FEATURES

On top of basic beacons or point-to-point connections, BLE technology brings flexibility to enable multiple connection scenarios (i.e. a smart hub connected to several sensors). ST solutions enable maintaining multiple connections at the same time, impacting available RAM resources. While BlueNRG-2 and BlueNRG-2N support up to 8 connections, the BlueNRG-LP goes beyond and support up to 128 connections. To ensure secure product maintenance and upgrades, the Firmware Over-The-Air procedure is more and more deployed, leading to memory and data rate constraints. Thanks to 256 Kbytes of Flash memory and support for faster data transfer rates (thanks to data packet length extension) BlueNRG-2 SoC allows an efficient OTA deployment. Moreover, thanks to 2Mbps feature, the BlueNRG-LP allows the OTA upgrade in less than 5 seconds. With the number of connected devices increasing daily, ensuring the security of one’s devices is a very important concern. The Bluetooth Low Energy stack integrated over our latest BlueNRG SoC offers state-of-the-art communication, security and privacy mechanisms. Going further in this direction, the BlueNRG-LP and BlueNRG-2N offers secure bootloader feature, which always checks the stack before starting to allow only signed firmware images to run. The BlueNRG-LP adds other layers in security, like SWD interface disabling and flash read/write protection.



APPLICATION INTEGRATION: CHIPSET SCALABILITY AND MODULE OFFER

ST’s BlueNRG portfolio offers hardware flexibility, using a chipset or associated modules with common software resources. One of the major considerations when designing a BLE solution, aside from picking a chipset itself, is whether to use a Bluetooth Module or a discrete Bluetooth design. Bluetooth requires regional (FCC, CE, IC, etc.) and Bluetooth SIG certifications. Using a pre-certified module eliminates a costly certification process and is usually faster to market thanks to hardware integration: no layout, no schematics and no RF validation workload. ST products are available with different packages from QFN32, QFN48 (BlueNRG-2) to WLCSP34 (2.5 x 2.5 mm). This flexibility, in addition to a high-speed crystal oscillator selection (16 MHz vs. 32 MHz) and low-power crystal oscillator integration (external 32 kHz or internal RO), brings an overall hardware flexibility and scalability during product design.

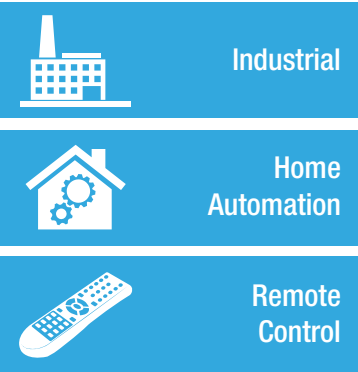


APPLICATION TOPOLOGIES: SOFTWARE ENABLERS

BlueNRG Software Development Kits offer flexibility to host different software enablers in order to address various application needs.

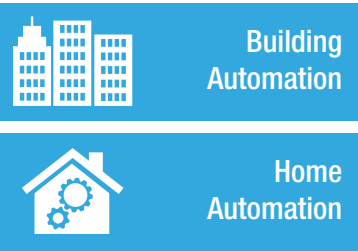
Bluetooth low energy

The Bluetooth Low Energy protocol stack (5.2 certified), part of our STSW-BLUENRG1-DK and STSW-BLUENRGLP-DK software packages, integrates the complete API needed to enable BLE communication with a BLE device such as a smartphone or tablet. Moreover, on top of the BLE stack, the SW Development Kits provide associated programming guidelines as well as various code examples from simple Beacon to Sensor node.



Bluetooth Low Energy Mesh

Bluetooth Mesh is a new topology available for Bluetooth Low Energy (LE) devices that enables many-to-many communications. It is optimized for creating large-scale device networks, and is ideally suited for building automation solutions including lighting and sensor networks. The STSW-BNRG-Mesh and STSW-BNRGLP-Mesh software packages include the ST BLE Mesh stack (BT SIG Mesh 1.0.1 Profile Certification and 1.0 Client and Server Model Certification), firmware and smartphone code library for easily deploying a Lighting application.



BlueNRG 2.4GHz Radio driver

Bluetooth Low Energy technology easily brings connectivity from an RF product to a user’s smartphone with a low-power impact. This is possible thanks to specification and associated timing constraints. Applications such as gaming or Industrial devices required high accuracy and fast transmissions. The 2.4 GHz proprietary radio examples (part of the SW Development Kits) built on top of the BlueNRG SoC Radio low-level driver can be used as reference for building such applications.

