BlueNRG-LP ARtM

The 3rd series of BlueNRG family

EMEA Marketing and Application

Sep 2020

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BlueNRG-LP ARtM agenda

#1 BlueNRG family update

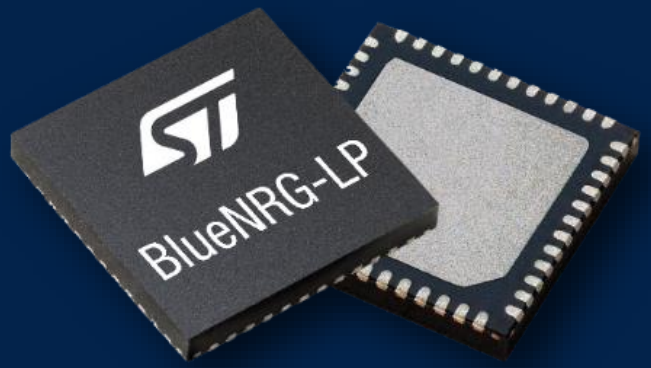
#2 BlueNRG-LP introduction

#3 Benefits and enhancements

#4 Development resources

#5 Summary and key benefits

BlueNRG family update



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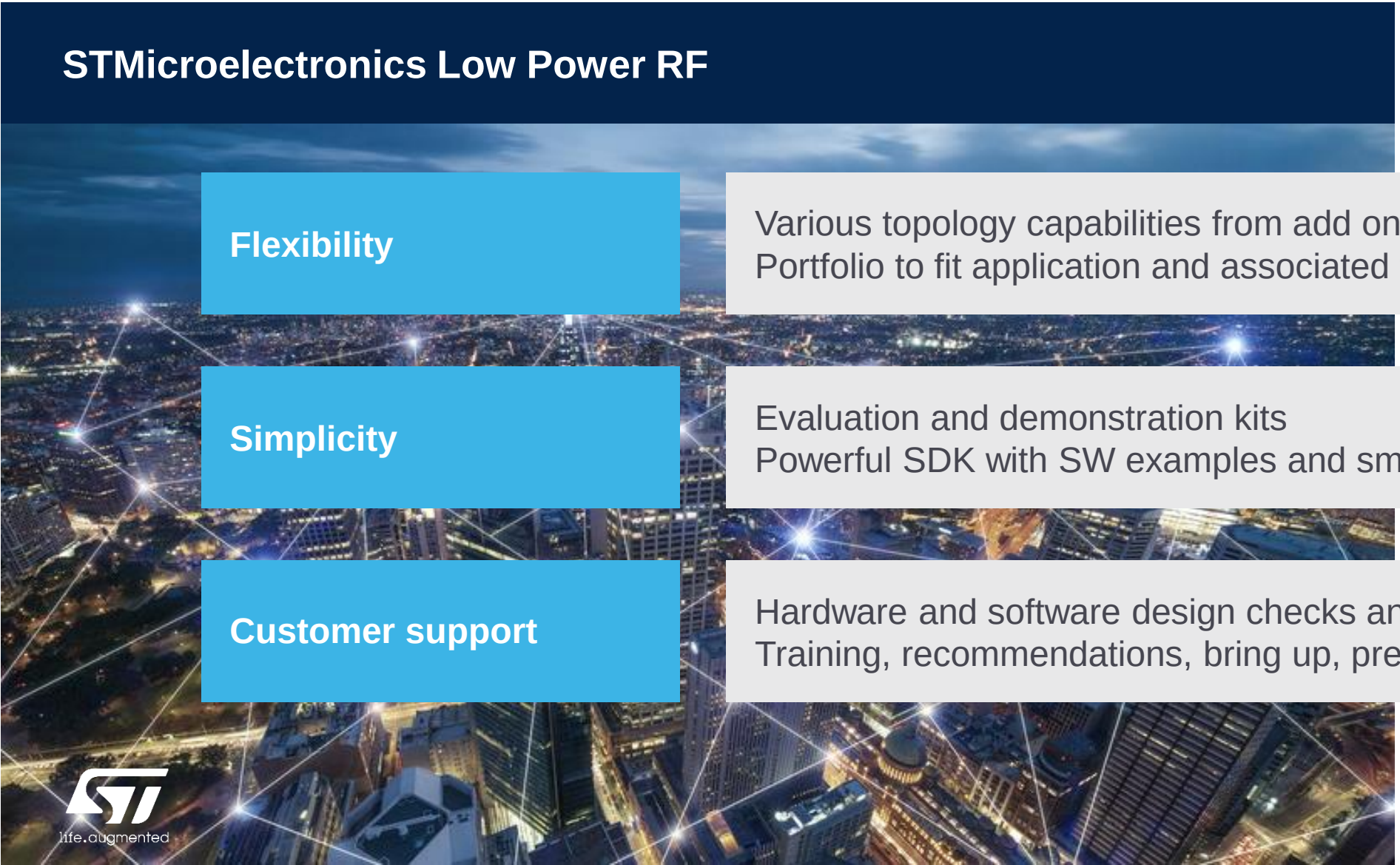
BlueNRG family value

STMicroelectronics Low Power RF



Flexibility	Various topology capabilities from add on BLE (NP,DP) to SoC (AP) Portfolio to fit application and associated technical requirements
Simplicity	Evaluation and demonstration kits Powerful SDK with SW examples and smart phone app
Customer support	Hardware and software design checks and guidance Training, recommendations, bring up, pre-cert, on-line/site support

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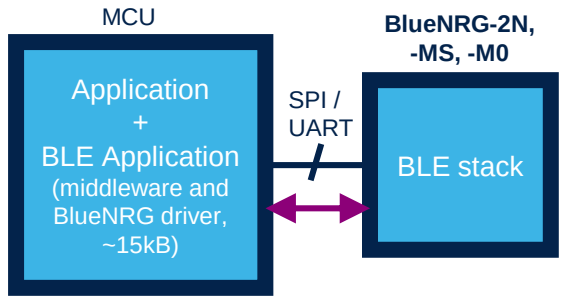
BlueNRG topologies

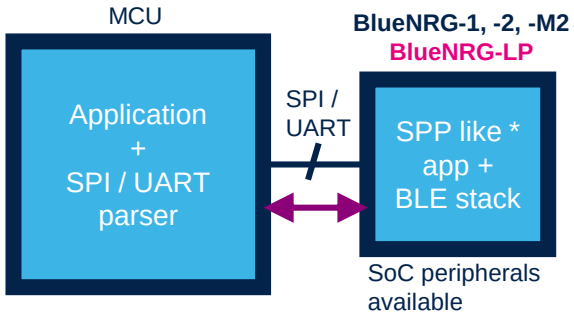
NP Network Processor



"I need to add BLE to my design "

+ stack image pre- programmed

DP Data Pump



"I need to add BLE to my design " with simplicity & flexibility "

+ UART/SPI to BLE bridge

AP Application Processor

"I need a Soc hosting Application & BLE"

+ Easy and simple implementation with to DK tool & examples

SPP like * = Built-in application enabling UART/SPI to BLE bridge. Available in ST DK.

BlueNRG key performance indicators

Chipset Module	Network co-processor		Wireless Programmable SoC		
	BlueNRG-MS BlueNRG-M0	**BlueNRG-2N**	**BlueNRG-1**	**BlueNRG-2 BlueNRG-M2**	**BlueNRG-LP**
RF range *	96 dB	96 dB	96 dB	96 dB	105 / 112 dB DR LE1M / LR
Data rate	200 kbs	700 kbps	250 kbps	700 kbps	1200 kbps
Power ** consumption	9.7 uA	8.5 uA	8.5 uA	8.5 uA	<6 uA
BLE cert / BLE feat	4.2 / 4.1	5.0 / 4.2	5.0 / 4.2 LE Data Len excluded	5.0 / 4.2	5.2 / 5.0+

*) Bluetooth SiG range estimator tool : https://bluetooth.com/learn-about-bluetooth/bluetooth-technology/range#estimator
**) With beacon average power cons : adv conn 31 bytes, 3secs, +5dbm

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2.4GHz Wireless portfolio

FEATURES

ST: the most complete Bluetooth ® LE + 802.15.4 portfolio in the market!

STM32**WB**

Dual-Core

BlueNRG

Single-Core

BlueNRG-2
Bluetooth LE 5.0
Application processor
Cortex-M0 32MHz,
256KB QFN32,
QFN48, WLCSP34

BlueNRG-2N
Bluetooth LE 5.0
Network processor
QFN32, WLCSP34

BlueNRG-MS
Bluetooth LE 4.2
Network processor
QFN32, WLCSP34

BlueNRG-1
Bluetooth LE 5.0
Application processor
Cortex-M0 32MHz,
160KB QFN32,
WLCSP34

BlueNRG-LP
Bluetooth LE 5.2
Application processor
Cortex-M0+ 64MHz,
Industry leading radio performance, security features
Flash: 256KB Flash
RAM: up to 64KB
up to 32 GPIOs
QFN, WLCSP49

Bluetooth®

STM32WBx0
Bluetooth LE 5.0
Zigbee, Thread
Application processor
Dual core Cortex-M4, 64MHz / M0+, 32MHz
Advanced Security
Flash: 320K up to 1MB
RAM: 48K up to 128K
UQFN48 (30 GPIOs)

Bluetooth® THREAD

STM32WBx5
Bluetooth LE 5.0
802.15.4, Zigbee 3.0 Thread
Application processor
Dual core Cortex-M4, 64MHz / M0+, 32MHz
Advanced Security
Rich Analog
Rich peripherals (USB, LCD, Q-SPI, SAI)
Flash: 256K up to 1MB
RAM: 48K up to 256K
Up to 72 GPIOs,
UQFN48, VQFN68,
WLCSP49, WLCSP100,
BGA129

ULTRA-LOW POWER

Bluetooth LE CONNECTIVITY → ADVANCED CONNECTIVTY - MULTI-PROTOCOL

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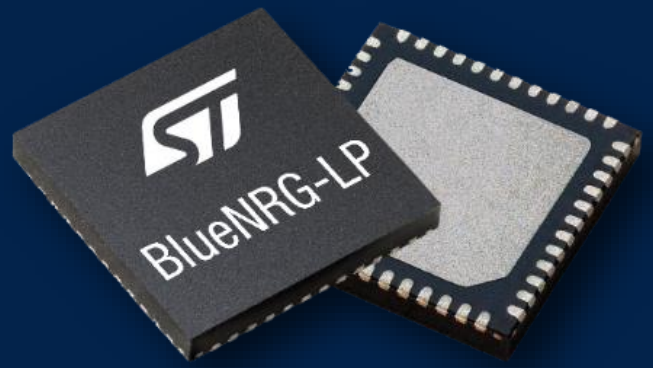
BlueNRG-LP introduction



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BlueNRG-LP
Bluetooth Low Energy 5.2 Certified SoC

- **High speed 2 Mbps** for faster data transfer
- **Long Range** (125/500kbps) connectivity
- **Advertisement Extension** and Dataset
- **Improved channel selection** and mapping
- **GATT Caching for** energy-efficiency improvements
- **Up to 128 concurrent connections**

LONGEVITY 10 YEARS COMMITMENT

Go faster, go further!

BlueNRG-LP parts numbers scalability

	32KB RAM	64KB RAM
QFN48	BlueNRG-345M	BlueNRG-355M
QFN32	BlueNRG-345A	BlueNRG-355A
WLCSP49	BlueNRG-345V	BlueNRG-355V

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BlueNRG-LP
Bluetooth Low Energy 5.2 Certified SoC

Key Highlights

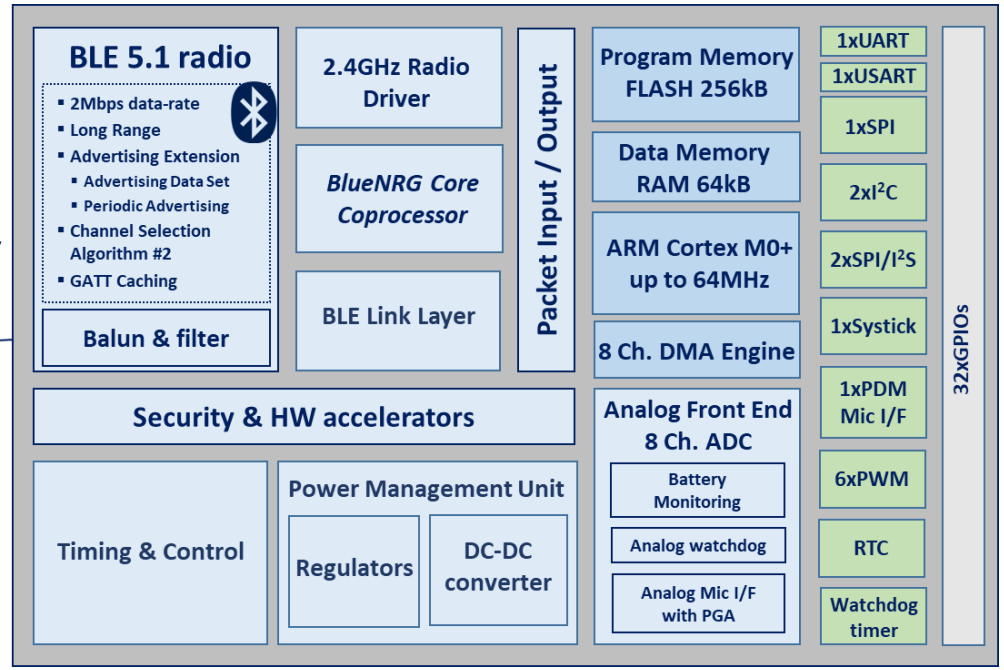
Bluetooth LE 5.2 certified

Radio performances
- RX Sensitivity level
  - -97dBm @ 1Mbps
  - -104 dBm @ 125bps
- Up to +8 dBm output power level.
- 4.3 mA TX current
- 3.4 mA RX current

Reduced BOM cost
- Integrated Balun
- Capacitor-less 32MHz crystal.

Advanced security set
- Flash read/write protection.
- Secure bootloader
- SWD access can be disabled

Block Diagram



Device information

- High Throughput: 2Mbps Data Rate
- Distance Robustness: Long-range 125kbps or 500kbps
- Advertisement Extension: 255 bytes Advertising data, Advertising Data Set and Periodic Advertising Sync Transfer
- Frequency Hopping Robustness: Channel Selection Algorithm #2
- GATT caching
- Up to 128 concurrent connections
- ARM Cortex-M0+, 64 MHz
- 256-Kbyte Flash, **64-Kbyte** (32-KByte) SRAM , MPU
- One-time-programmable (OTP) memory area of 1 kB
- Extensive peripheral set: 2 x SPI / I2S, 1x SPI, 2 x I²C, 1 x USART, 1 x UART, 6 x PWM, 1 x PDM, 1 x 12-bit ADC SAR
- Analog microphone i/f with PGA
- True Random Number Generator (RNG)
- Hardware encryption AES maximum 128-bit security co-processor
- HW public key accelerator (PKA)
- CRC calculation unit
- 48-bit unique ID
- Operating supply voltage: from 1.7 to 3.6 V
- Operating temperature: from -40 up to 85 ‘C or -40 up to 105 ‘C
- Package available: QFN32 (20 GPIOs), QFN48 (32 GPIOs), WLCSP49 (26 GPIOs)

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BlueNRG-LP applications

Asset tracking and beacons

- Ultra-low power consuption
- Market leading BLE range
- SigFox LPWAN with S2-LP
- Cost optimized (2-layer PCB, int. Balun & xtal caps, device variants)

Smart tools and appliances

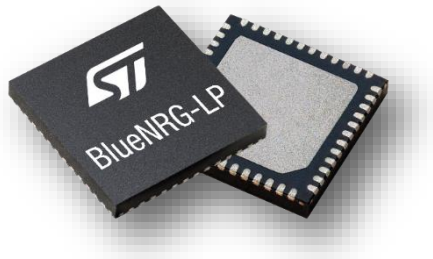
- Future proof with BTH5.2 certi.
- 10 years longevity
- Flexible arch. (SoC or add on)
- Device security

Industrial connectivity

- Remote UI, remote control units
- Enhanced processing & periph
- Audio IF (PDM, Analog, I2S)
- 10 years longevity
- Device security

Lighting and building automation

- Lighting, ventilation, heating, HVAC, smart locks
- BLE MESH, +105ºC compliancy (T version)
- Adv. ext. (AE), Long Range (LR), CSA #2
- Application security



Personal electronics

- Toothbrush, shaver, e-cigarette massage tools, gaming, etc.
- Enhanced processing & peripherals
- MEMS sensor libraries
- BLE stack flexibility, RF driver
- 2Mbps PHY and secure OTA
- Device package and mem. variants

Connected toys, robots

- Toys, robot vacuum, lawn mover, pool robot. etc.
- Flexible arch. (SoC or add on)
- Cost optimized (2-layer PCB, int. balun, xtal caps, device variants)

Healthcare, wearable

- Auto injectors, dispencers, inhalers, sports sensors
- 10 years longevity, security

People and animal tracking

- Social distancing and tracing, worker tracking, pet & livestock tracking, prisoner tags
- Ultra-low power, application security
- Cost effective in application

BlueNRG-LP
Key benefits and enhancements

1. Power & RF performances
2. HW flexibility
3. BLE 5.0 full feature set
4. Fast OTA capability
5. Core & Peripheral enhancement
6. Device security

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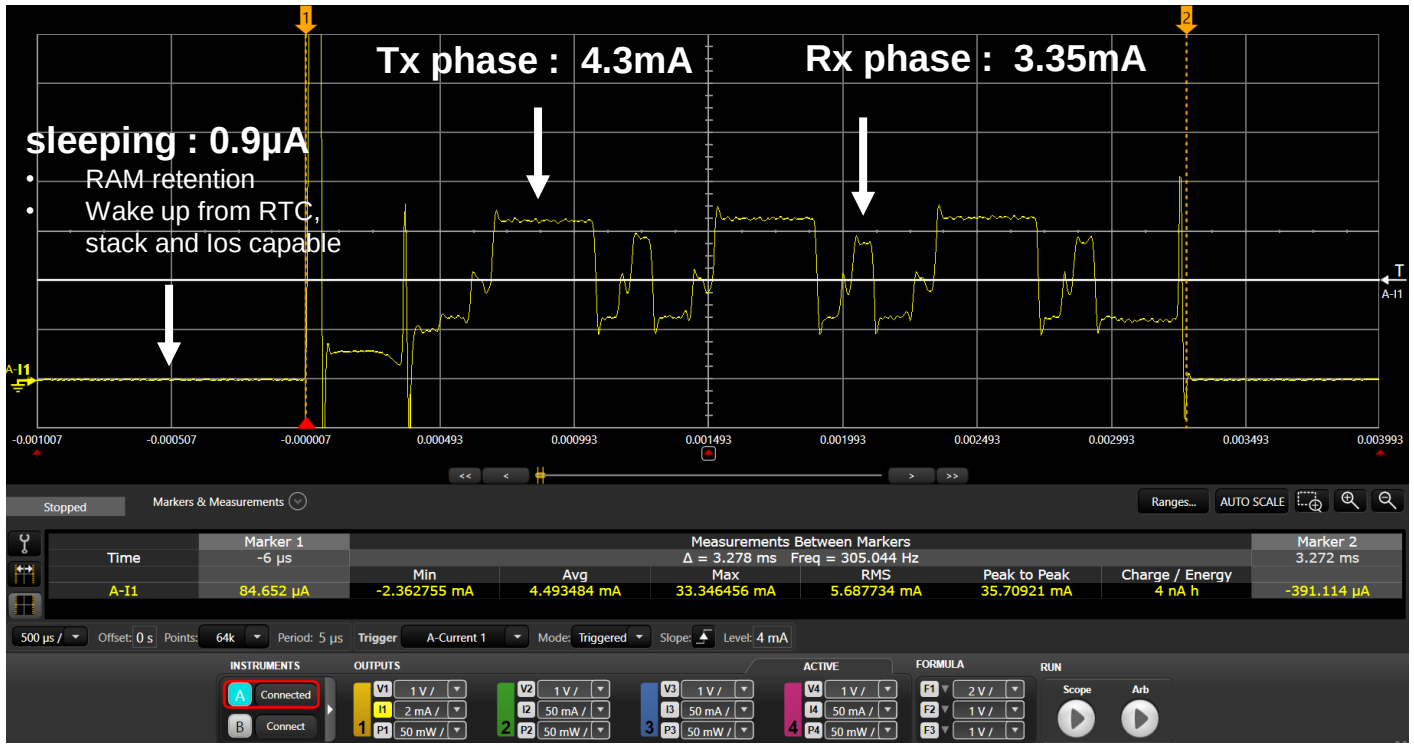
The lowest average power consumption



5.8uA average power consumption (advertising 31 bytes, every 3secs, 3V, +0dbm)

0.9µA sleep current : best on the market.

Outstanding active Rx and Tx current

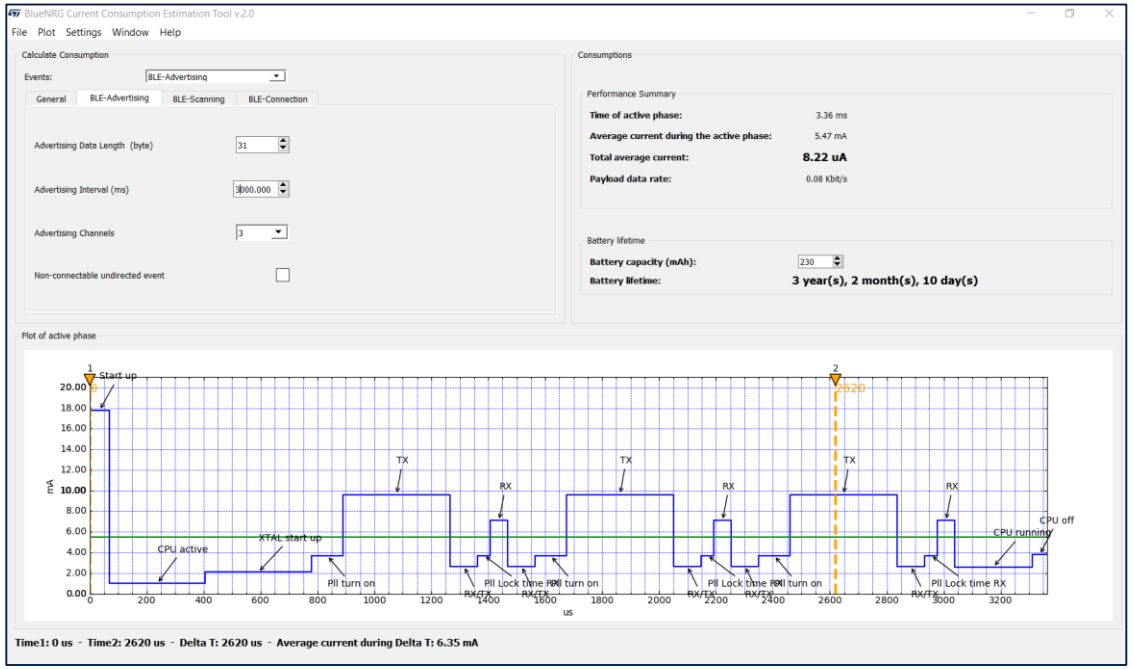
BlueNRG-LP designed for ultra low power applications

BlueNRG-LP is offering one of the best power efficient solution on the market

Easily estimate & measure power consumption

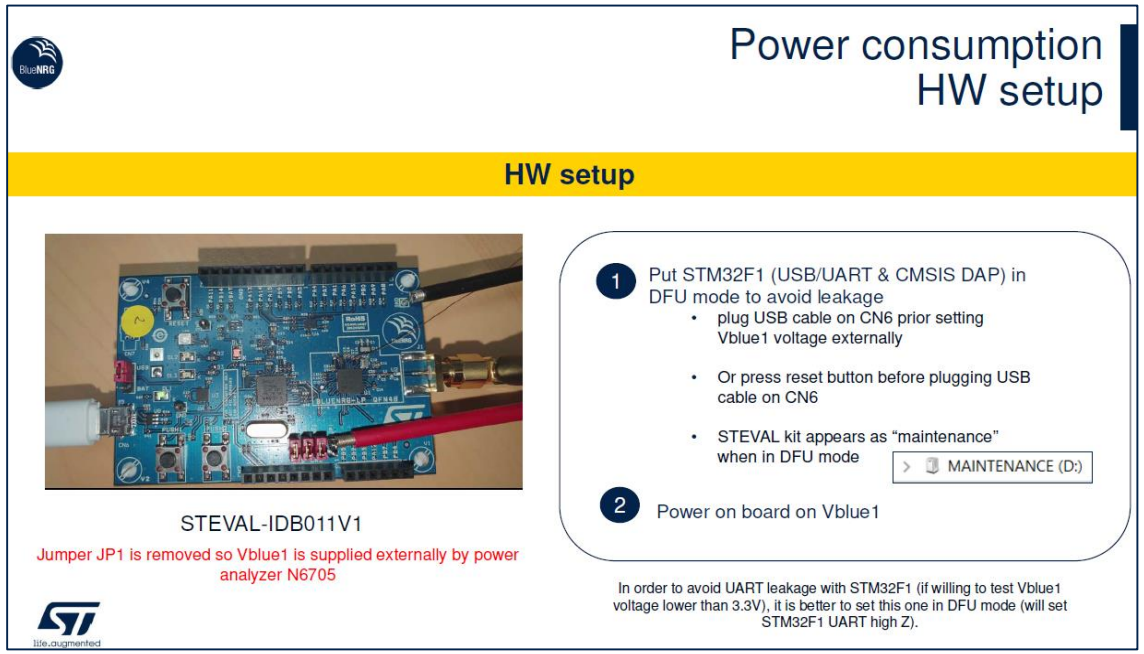
Estimate power consumption

estimate the average current consumption and the **battery lifetime** in the applicative cases using **PC tool**



Measure Power Consumption

Perform **real measurements** using our evaluation kit, dedicated SW and documentation



Dedicated example in
App note available (rf-support-emea@st.com)

The best range

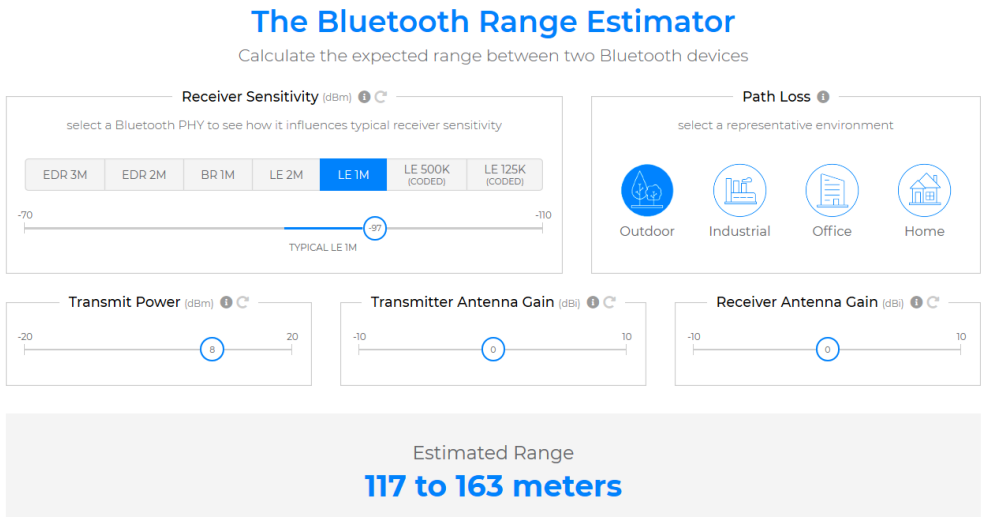
Sensitivity -97dbm @1Mbps
Sensitivity - 104 dBm @ LE S=8 (Long range)

Max output power up to +8dbm (PA extension possible)

The best dynamic range : 105dB (1Mbps)

Long Range provides sensitivity improvement

Range improvement depending antenna & environment



https://www.bluetooth.com/learn-about-bluetooth/bluetooth-technology/range/#estimator

BlueNRG-LP offers one of the best budget link on the market, extending range and user experience.
On top of it, Long Range feature allows extra range enhancement.

The best range
Mont Saint Michel Bay

1 Mbps - 960m
LE1M PHY

Long Range - 1.3km
Coded PHY LE S=8

Range measurement report available

BlueNRG-LP
Flexible & integrated

Flexible

- ✓ Internal SMPS or internal LDO
- ✓ External 32kHz or internal RO
- ✓ QFN32, QFN48 and WCSP49 package available

⇨ **Adapt HW size and cost versus application need**

- ✓ Flexible Cortex-M0+ Core speed

⇨ **Processing power on demand**

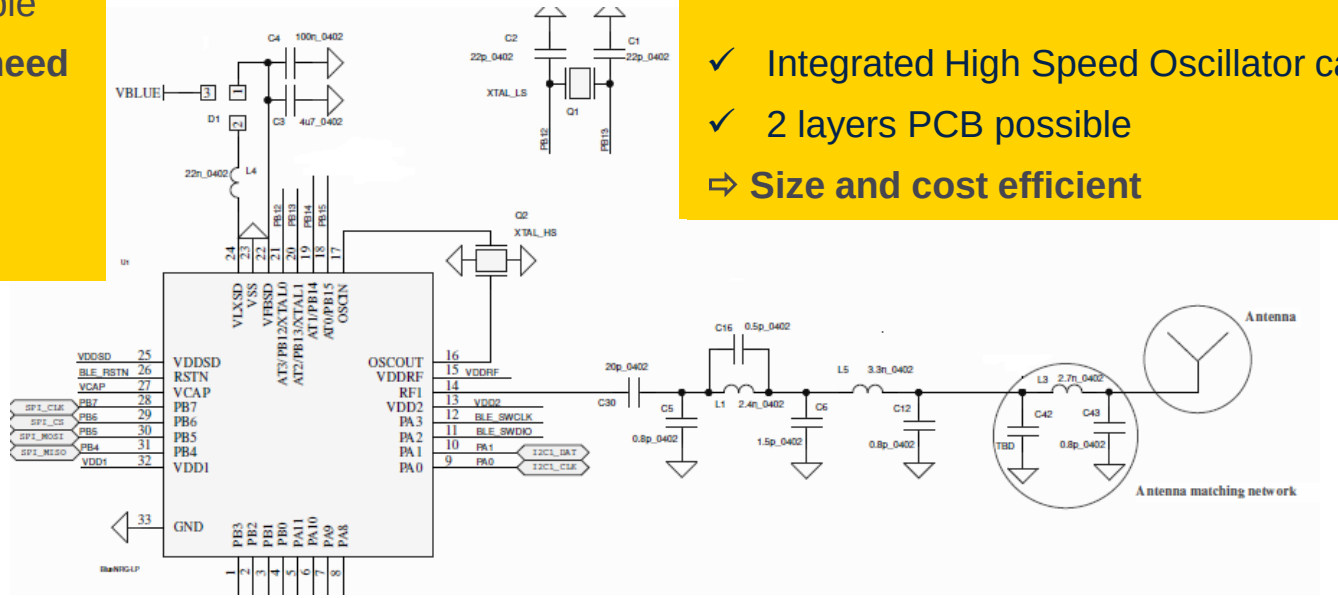
Integrated

- ✓ Integrated balun - 50Ω single ended output

⇨ **Only few discretes matching/filtering needed**

- ✓ Integrated High Speed Oscillator capacitor
- ✓ 2 layers PCB possible

⇨ **Size and cost efficient**



BlueNRG-LP offers flexibility with cost and size integrated solution

BlueNRG-LP fast OTA capability

Firmware upgrade - ST BLE Sensor App protocol

ST BLE Sensor App

upgrade of a Sensor BLE typical application
~80KB (stack included)

BlueNRG-1
65secs

BlueNRG-2
12 secs

BlueNRG-LP
5 secs

BlueNRG-LP Peripherals enhancement

Enhanced set of Standard peripherals

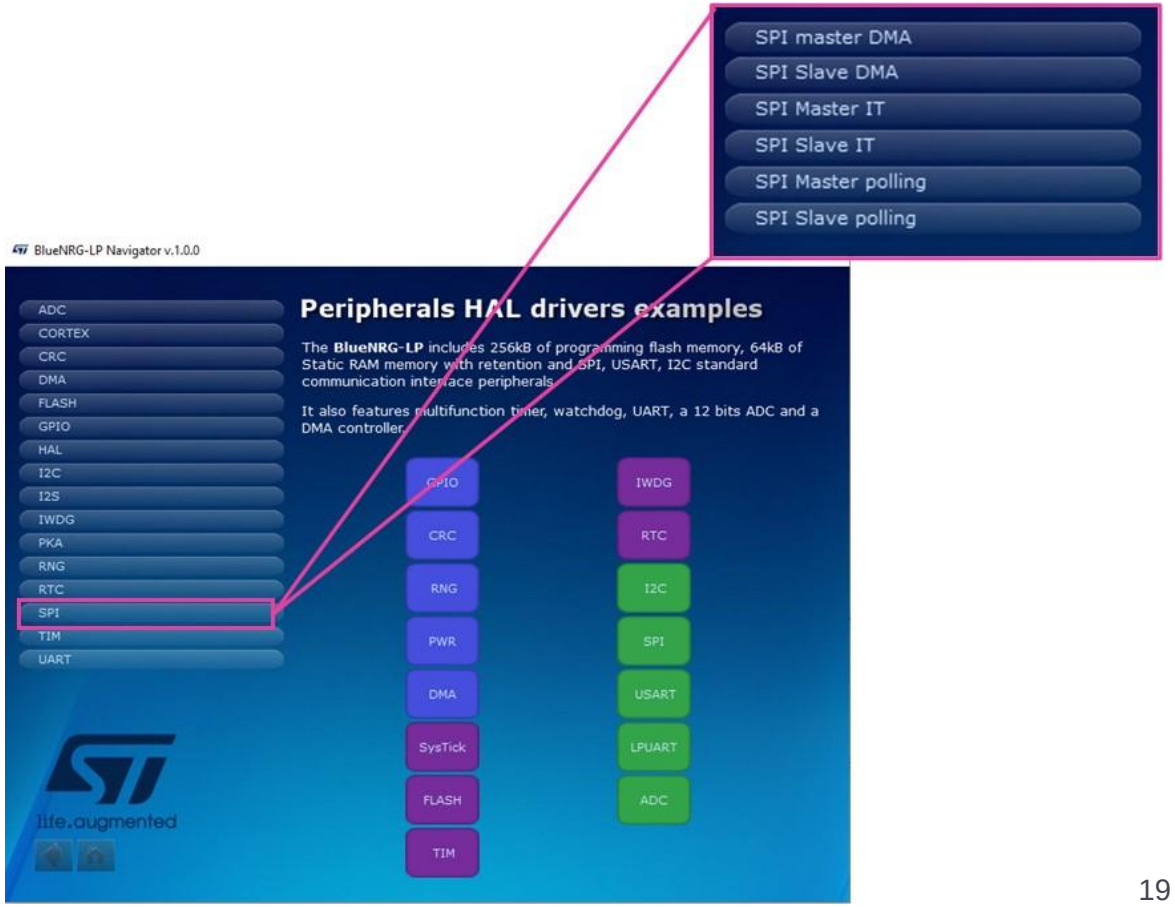
- USART, LPUART, I2S/SPI **(x3)** , I²C **(x2)**
- PDM, 16-bit 6 channel **advanced timer**
- Independent RTC with capabilities to wake-up system.
- Independent WDG, Independent SysTick, …
- 12bits ADC – 8 channels, **analog µPhone input**, PGA,…
- Battery monitoring
- …

Comprehensive and easy to use APIs

Based on ST HAL or LL APIs

Multiple code Examples for each peripherals

Covering multiple customer use case



BlueNRG-LP
Core & MIPS enhancement

Opening to more demanding application

Improving MIPS X 2

M0+ Cortex up to **64Mhz**

Extended RAM

Up to 64KB RAM

Thanks to enhancement BlueNRG-LP customers taking benefits from wide in-house product portfolio

Easy integration of any ST MEMS sensors portfolio, thanks to drivers available @GitHub and fully compatible with BlueNRG-LP DK

Capability to run advanced SW algorithm

Voice over BLE
MIPS improvement allowing more performant algorithm integration *(OPUS)*

Motion Algorithms
Gesture and Activity recognition

Enhanced security features

Flash protection : disabling SWD & UART access (refer RM0479)

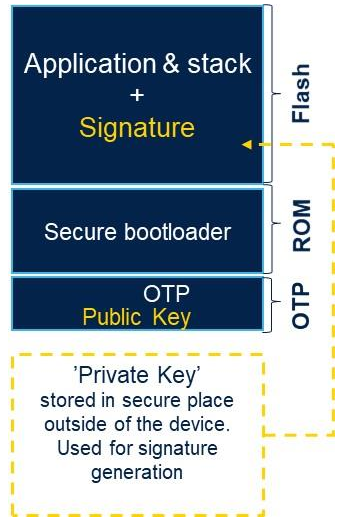
3 level of **Protection** preventing application cloning & modification

- 3 level of **Protection** preventing application cloning & modification.
- Protection against external memory access (Reversible or Irreversible)

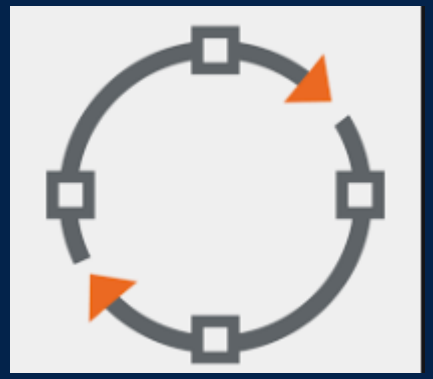
Secure boot : FW image authentication (refer AN5471)

Ensure that only a firmware image **signed** with a correct Private Key is executable

- Secure bootloader in ROM
- FW image authentication before execution - Only Signed image can be executed.



BlueNRG-LP
Development resources



1. DK package & associated protocol
2. BLE key SW examples
3. DK tools : BLE out of the box
4. Development flow

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BlueNRG-LP evaluation boards

BlueNRG-LP evaluation kit - Available & orderable !

QFN48 > **STEVAL-IDB011V1** (orderable)
WCSP49 > **STEVAL-IDB010V1** (available end Q2 21)
QFN32 > No dedicated kit – reference HW available (rf-support-emea@st.com)

Evaluate and prototype

- **Integrating various MEMS sensors**

  Pressure LPS22HH, Audio MP34DT05A & IMU LSM6DSOX
- **Power, Flash & debug through USB**

  CMSIS DAP debugger/programmer – drag & drop FW
- **Button and LEDs for prototyping and debug**

Full documentation

- Reference schematics and layout
- PCB design guideline : AN5526
- Bring up the BlueNRG-LP : AN5503

BlueNRG-LP – Certified solution

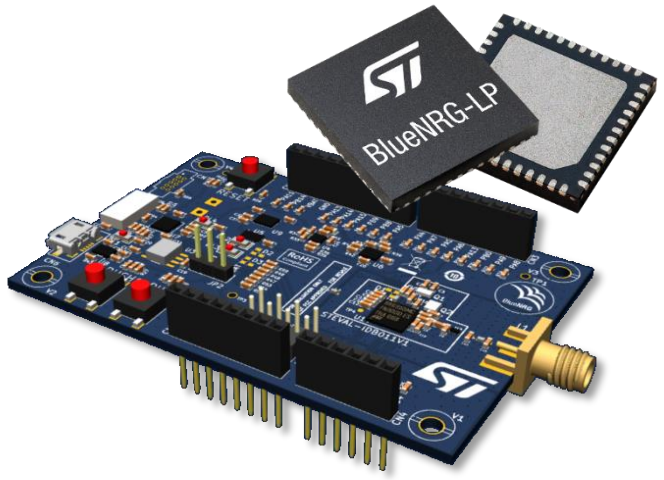
BlueNRG-LP is fully certified.	
BLE certification PHY and stack certified as per below table	**Regional certification** Compliant with regional regulation (RED, FCC, ARIB, etc.)

	BlueNRG-LP (QFN & WLCSP) BT5.2
QDID (PHY)	**150274** (Component - BT5.2)
QDID (Stack)	**151645** Stack 3.0 - DK1.0 - BT5.2

Full documentation
DTM FW available in STSW-BNRGLP-DK
Regional certification AN – On st.com End October

BlueNRG-LP SW Development Kit

HW Evaluation Kit → **SW Development Kit** → **Tackle your market!**



STEVAL-IDB010V1 (WLCSP)
STEVAL-IDB011V1 (QFN48)

BLE

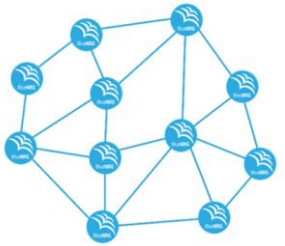
Bluetooth™

STSW-BNRGLP-DK

2.4Ghz proprietary protocol

1 Byte	4 Bytes	1 Byte	1 Byte	0 to 31 Bytes	3 Byte
Preamble	NetworkID	Header	Length	Data	CRC

STSW-BNRG-MESH



BLE Mesh

Free of charge **Certified Stack:** BLE and Mesh

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BLE Software Development Kit

STSW-BNRGLP-DK : rich set of code examples

How to benefit and use **BLE 5.0 features**

2 X Speed

BLE_Thoughput

How to increase application data rate

8 X Increase broadcast

BLE_Beacon

Advertsing Extension

1.5 X Range

BLE_RC_LongRange

Enhance application range

Turnkey Full examples

BLE_SensorDemo_BlueMSapp

BLE Sensor device, OTA capable
Full OTA source (App & FW) reuse

BLE_SerialPort - SPP

Cable replacement Application

BlueNRG-LP
SW Application – simplicity

Simple Architecture

- Free RTOS not required (code example available)
- **BLE stack schedule thanks to a dedicated hw state machine**
- Application do not require any resource manager (stack and application running on same core)
- Automatic efficient power (sleep mode) management

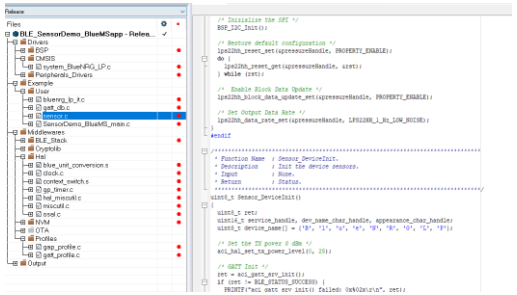
Application simplicity

- RF HW block is not preempting any system resources to process RF activities (advertising, connected events)
- BLE events (connect, disconnect) handle over basic SW interrupts

BLE Software Development Kit

BlueNRG-LP ecosystem

IDEs



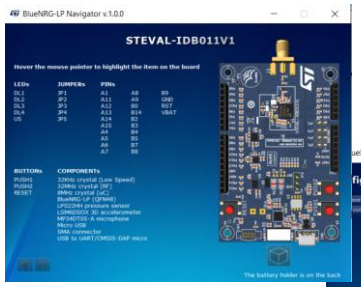
IAR SYSTEMS

KEIL™ Tools by ARM

eclipse

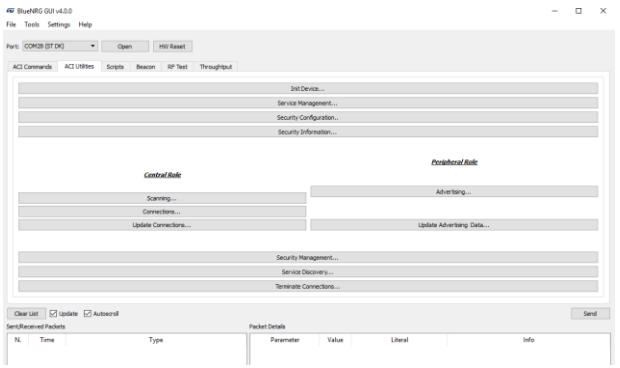
GCC Eclipse tool schedule in Q4 2020

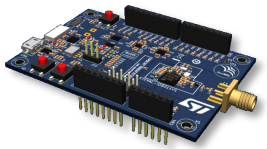
Navigator Tool



BlueNRG-LP out of the box

BlueNRG GUI





Click & understand BLE APIs

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BlueNRG-LP from evaluation to mass production

Hardware related

Software related

Eval boards
STEVAL-IDB011V1 (QFN48)
STEVAL-IDB010V1 (WLCSP)

Peripherals and pinout
RM0479

Schematic & layout
AN5526 : PCB design guidelines for the BlueNRG-LP device Application Note

Production test
Specific internal AN ready to be discussed

BTH & regional certification
BlueNRG certification process & tests AN

Orders for production prior lead time window

Enjoy product sales!

Evaluation | **HW design** | **SW implementation** | **Certif** | MP

Power cons. estimation
STSW-BNRG001

BLE coms and profile setup
PM0269
Bluetooth LE stack v3.x programming guidelines

OTA FW upgrade
Reference : AN5463
Bluetooth LE Over The Air Firmware Upgrade

SDK : STSW-BNRGLP-DK
GUI : STSW-BNRGUI
Flasher: STSW-BNRGFLASHER

Optimze power
AN5466
BlueNRG-LP power save modes & Internal AN for setup measurments

Full reuse of ST Service Manager code and ST BLE Sensor App code

UM2735 : BlueNRG-LP Development Kit User Manual

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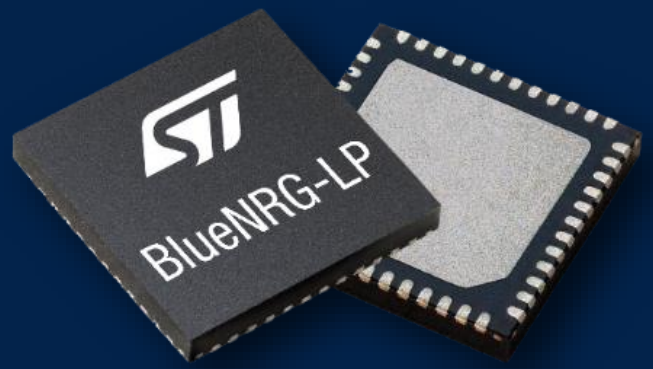
BlueNRG-LP
Summary



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BLUENRG-LP order Code and availability

ORDERING CODES

SoC 256/64KB:

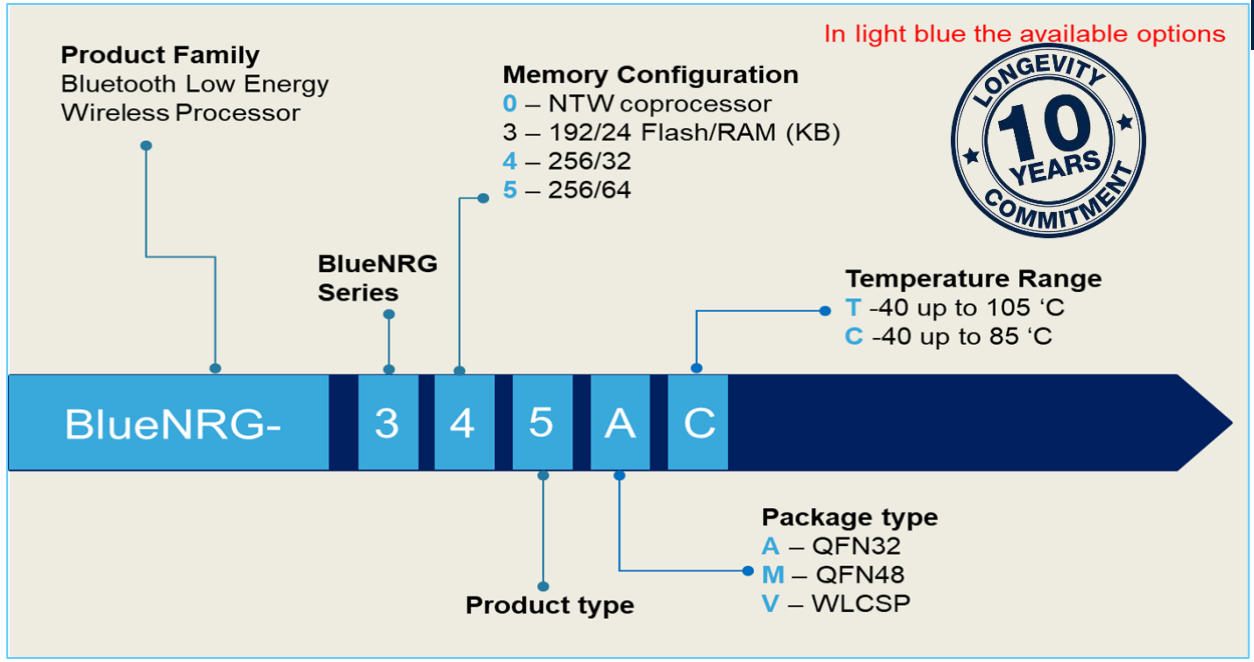
- BlueNRG-355AC (QFN32)
- BlueNRG-355MC (QFN48)
- BlueNRG-355VC (WLCSP)

SoC 256/32KB:

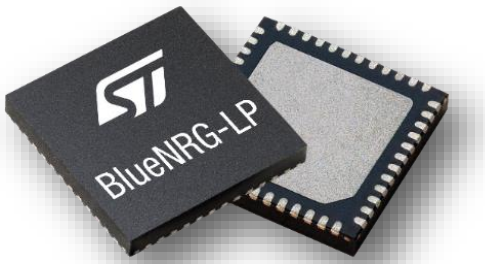
- BlueNRG-345AC (QFN32)
- BlueNRG-345MC (QFN48)
- BlueNRG-345VC (WLCSP)

EVALUATION BOARDS

- **QFN48, BlueNRG-355MC** (STEVAL-IDB011V1)
  - online Sep ‘20
- **WLCSP, BlueNRG-355VC** (STEVAL-IDB010V1)
  - online Q2‘21



The same package and RAM options exist for the T version (up to 105º C)



CP	ES availability	MP
BlueNRG-355A (QFN32)	**NOW!**	November ’20
BlueNRG-345A (QFN32)	October ‘20	December ’20
BlueNRG-355MC/T (QFN48)		**NOW!**
BlueNRG-345M (QFN48)	October ’20	November ’20
BlueNRG-355V (WLCSP49)	October ‘20	February ’21
BlueNRG-345V (WLCSP49)	Tba	Tba

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BlueNRG-LP key benefits

BlueNRG family step up

1. Market best dynamic range and current consumption
2. BLE 5.0+ full feature set : 2Mpbs, AE, Long Range
3. Extended application capability with enhanced peripherals , computational power and security

BlueNRG-LP available @st.com

Thank you

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