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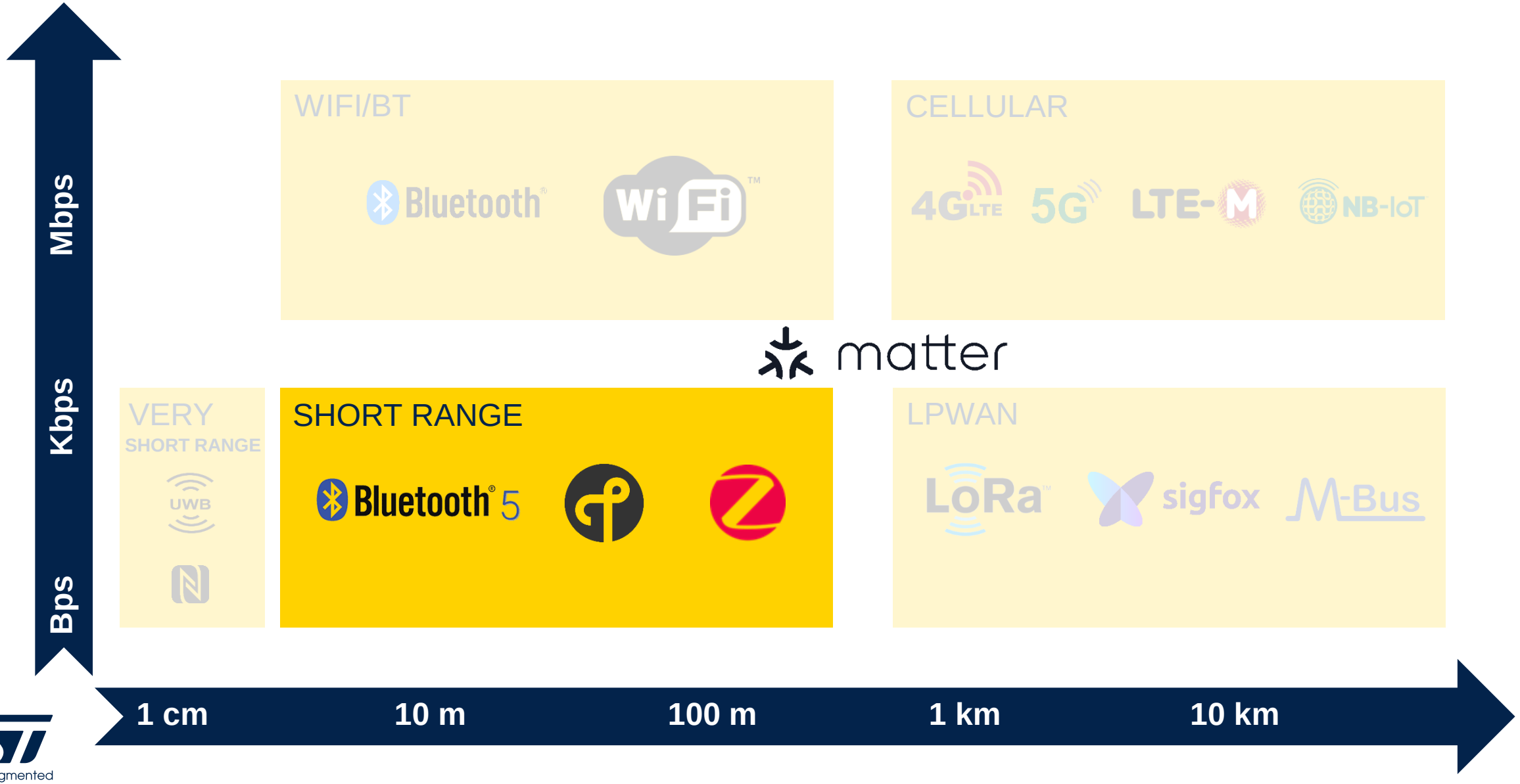
STM32WBA wireless MCU series

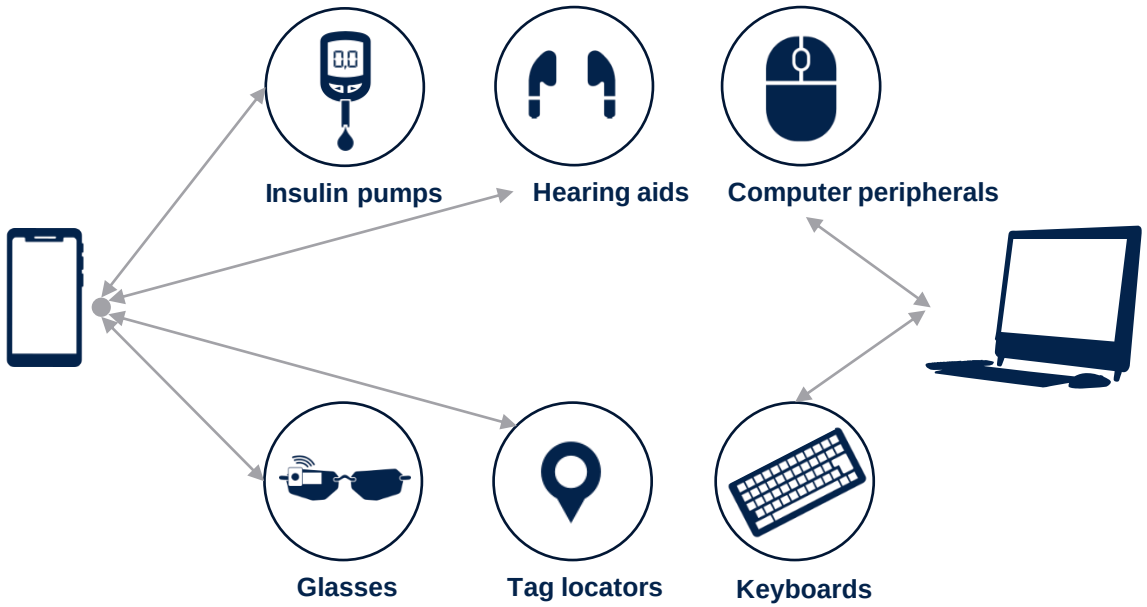
Faster time-to-market and higher performance for wireless short-range devices

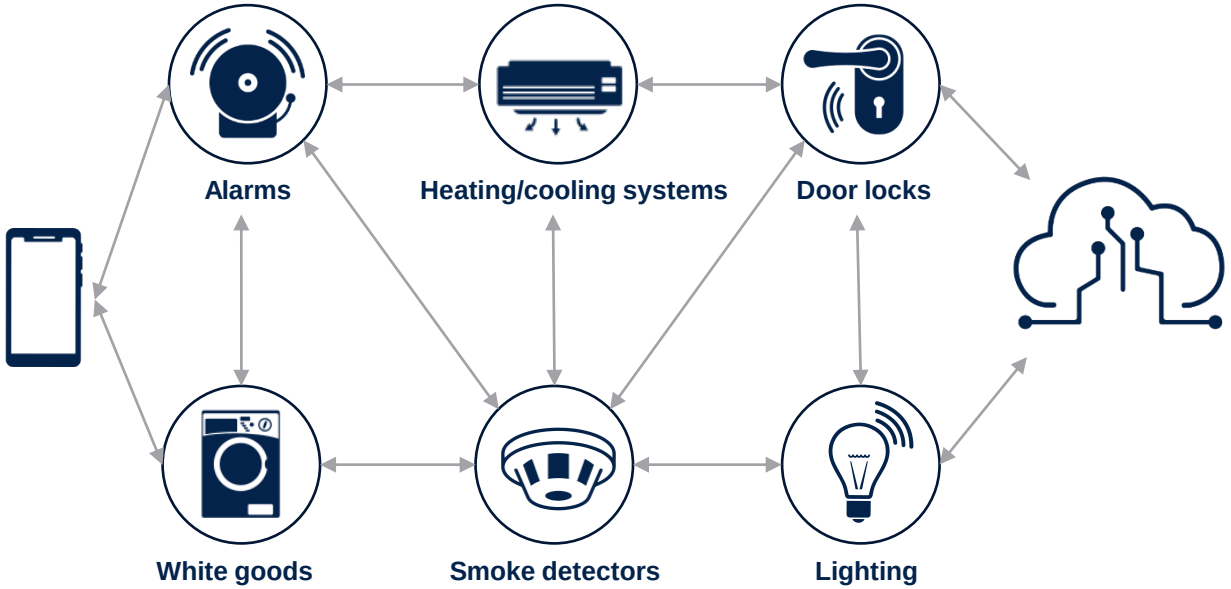
STM32

Communication technologies



Bluetooth® technology is all around us





P2Point or P2Multi-Comm. devices

Connected to smartphones, laptops…
Mostly battery powered

Bluetooth®

Proprietary protocols

Mesh communication devices

Home automation, Industry 4.0, consumer
power supply and/or battery powered

Bluetooth®

matter

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The STM32 portfolio

Five product categories

Wireless MCU

Short- and long-range connectivity

Ultra-low-power MCU

Mainstream MCU

High-performance MCU

Embedded MPU

32- and 64-bit microprocessors

Enabling edge AI solutions

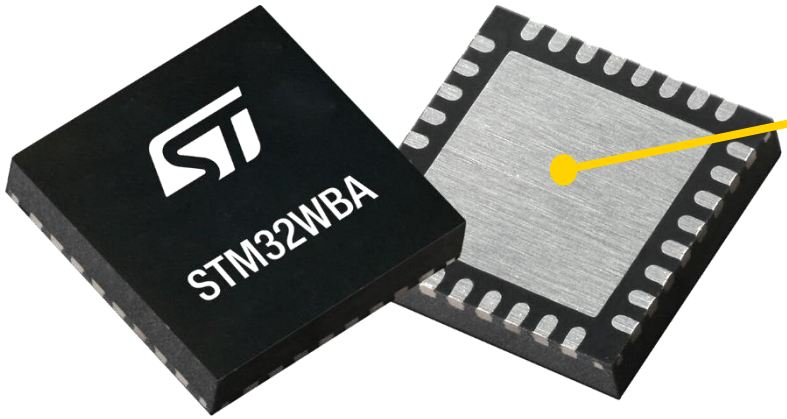
Scalable security

MPU portfolio

MCU portfolio

STM32WBA series enables faster time to market and higher wireless performance

matter



Built using **40 nm process technology**

SESIP™

Enhanced wireless performance for a greater user experience

- Arm® Cortex® -M33 at 100MHz. CoreMark score at 407.
- Multiprotocol support: Bluetooth® Low Energy 5.4, Zigbee, OpenThread, Matter
- +10 dBm output power with low power consumption
- Ultra-low-power radio performance (only 30 µA/MHz when running at 100MHz)
- Switched-mode power supplies (SMPS) for low power applications

Reliable and compliant with the latest regulations

- SESIP Level 3 target certification: compliance with the US Cyber Trust Mark and the EU Radio Equipment Directive (RED) regulations due to become mandatory in 2025
- 10-year rolling longevity commitment for continuous supply

Simpler and faster development thanks to proven STM32 ecosystem

- Rich ecosystem offering hardware, embedded software & tools, documentation

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STM32 MCU 2.4 GHz portfolio

STM32WB series

- **Dual core** & security (Arm® Cortex® -M4 / -M0+)
- Up to **1 Mbyte** of flash memory / **256 Kbytes** of RAM

MCUs: STM32WB55 | STM32WB35 | STM32WB15

Modules: STM32WB5M | STM32WB1M

5.4 & Mesh

matter

STM32WBA series

NEW

STM32WBA54/55

STM32WBA52

5.4

matter*

- Arm® Cortex® -M33/TrustZone® 100 MHz
- **1 Mbyte of** flash memory / **128 Kbytes** of RAM
- Up to **+10 dBm** output power

*Matter Thread RCP Mode only

BlueNRG series

- Arm® Cortex® -M0/M0+
- Up to **256 Kbytes** of flash memory / **64 Kbytes** of RAM

System on Chips: BlueNRG-1 | BlueNRG-2/2N | BlueNRG-LP | BlueNRG-LPS

Module: BlueNRG-M2SP/SA

5.2 to 5.4 & Mesh

EVOLUTION

STM32WB0 series

STM32WB09

5.3

- Arm® Cortex® -M0+ at 64 MHz
- **512 Kbytes** of flash memory / **64 Kbytes** of RAM
- Bluetooth® Low Energy 5.3 (long range, 2 Mbps, Advertising ext, **AoA/AoD, Isochronous channel**)
- Up to **+8 dBm** of output power

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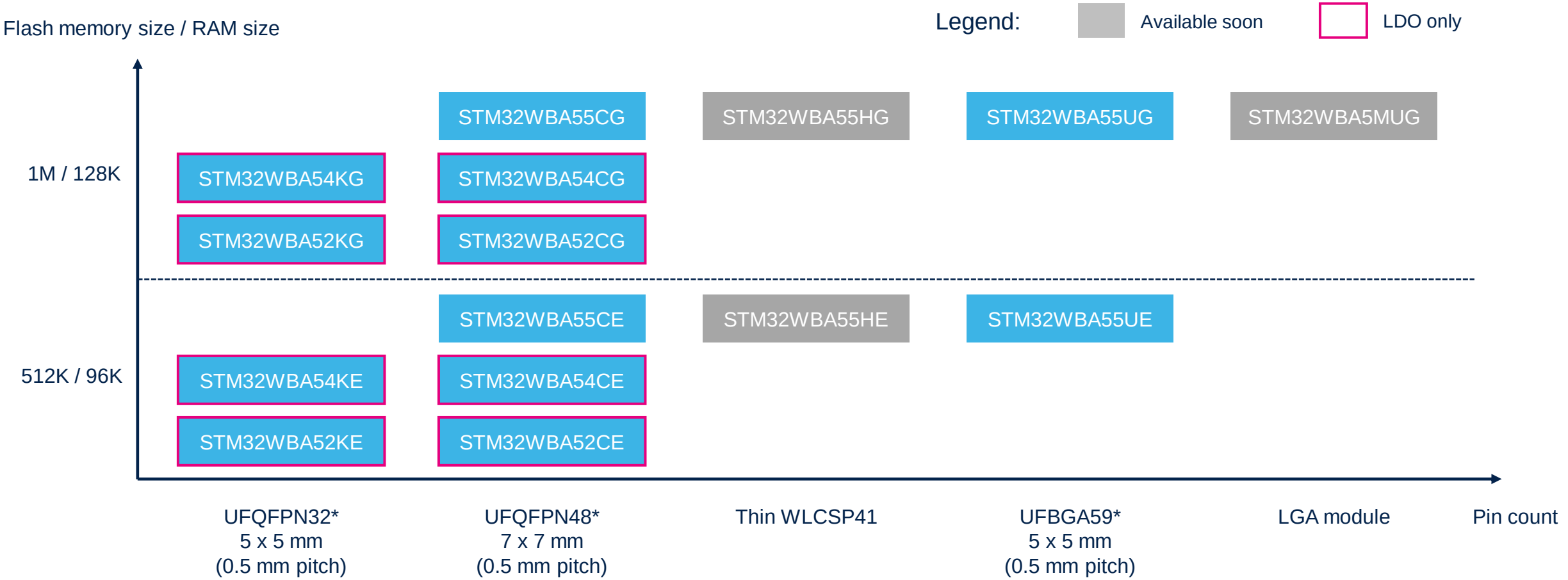
STM32WBA MCU series portfolio



* MLPF-WB-04D3: integrated matching RF components tailored for UFQFPN32 and UFQFPN48 packages.

STM32WBA product lines

ARM Cortex-M33 (DSP + MPU + TZ) - 100 MHz

- Arm Cortex – M33
- CPU max 100MHz
- ART Accelerator
- Integrated Balun + Antenna Matching
- +10dBm max output power
- -96 dBm Sensitivity @ 1Mbps
- 16-bit Motor Control timer
- 32-bit timer
- 1x ADC 12-bit, oversampling 16b
- Capacitive touch
- 2x Comparators 4-in-1
- Temperature sensor
- Low voltage 1.7 to 3.6V
- LDO or DC/DC
- Internal RC +/- 1%
- [-40; 105]°C full spec

Feature support depending on Lines

Product line	Flash (MB)	RAM (KB)	Connectivity					Security
			BLE	Zigbee	Thread	2.4GHz Proprietary	Other	
STM32WBA55	Up to 1	Up to 128	BLE 5.4	■	■	■	2x USART 2x SPI 2x I²C 1x SAI DCDC / LDO -40 to 105°C	TrustZone® AES 256-bit SHA2-256 PKA, SKS, PCK HUK, TRNG, SFI, SBSFU Unique ID
STM32WBA54	Up to 1	Up to 128	Bluetooth ® Low Energy 5.4	■	■	■	2x USART 2x SPI 2x I²C 1x SAI LDO -40 to 105°C	TrustZone® AES 256-bit SHA2-256 PKA, SKS, PCK HUK, TRNG, SFI, SBSFU Unique ID
STM32WBA52	Up to 1	Up to 128	BLE 5.4				2x USART 2x SPI 2x I²C LDO -40 to 85°C	TrustZone® AES 256-bit SHA2-256 PKA, SKS, PCK HUK, TRNG, SFI, SBSFU Unique ID

The building blocks to reach final application

Application requirements

Fitness

Medical

Lighting

Home automation

Wireless connectivity

Bluetooth 5.4 Point2Point

Bluetooth 5.4 Multipoint (up to 20 connections)

5.4 matter

Security

Anti cloning

App Radio

Isolation
Trusted environment

Anti roll back software
Secure bootloader
Data corruption check

Hardware, software & tools

STM32 CubeMX

STM32 CubeProgrammer

STM32 CubeIDE

STM32 CubeMonitor-RF

Mobile applications

ST BLE Toolbox ST BLE StarNet

32- to 59-pin packages

NUCLEO-WBA55CG

STM32WBA55G-DK1

High performance and scalable integration

Industrial

- Extended range capability
- Data privacy
- Cost optimized

Medical & consumer

- Anticloning
- Brand protection
- High interoperability

Smart home control

- Fingerprint accessible with high processing capability
- Market-proven security grade

A versatile product

STM32**WBA**

Lighting

- Robust RF link **106dBm** with **IEEE 802.15.4**
- **+10 dBm** output power
- **ecure** radio update and stack firmware with SBSFU/SFI
- Bluetooth 5.4 / 802.15.4 multiprotocols **capable**
- **Concurrent mode**

Fleet maintenance

- Retrofit legacy product to **Bluetooth® Low Energy 5.4** and concurrency mode
- Remotely upgrade device with **OTA capability**
- **Brand protection** with authenticated **firmware upgrade** system
- **IoT protection ready**

Industrial devices

- **Up to 105°C** radio capable
- **Capacitive Touch**
- **External PA** support to get ultra wide communication distance
- Down to **1.35µA mode with RTC** and 64KB of RAM
- **Security:** AES, PKA side attack resistant
- **Security:** RTC active tampers enabled
- **Robustness:** 100KB cycle flash cycle capable

Fitness/ healthcare

- **Multipoint** Bluetooth® Low Energy 5.4 connections, up to 20 links
- Battery lifetime care with **< 140 nA** standby mode
- Dynamic efficient **23µA/MHz**
- Battery care thanks top LPBAM acquisition mode
- **Single crystal** operation capable
- Handle an advanced algorithm with **1 Mbyte** of flash memory

Beaconing and sensors

- **Beacon** profile available among a huge list
- **Bluetooth® Low Energy, long-range** capable
- **Embedded balun + matching** to minimize design cost
- Only **5.2 mA Radio Tx** current to extend beacon lifetime
- **Up to +10 dBm** output power to get best beacon range
- 0.9 µA ULP-mode with full RAM for **battery life** optimization
- Down to 1.71 V power supply full feature capable

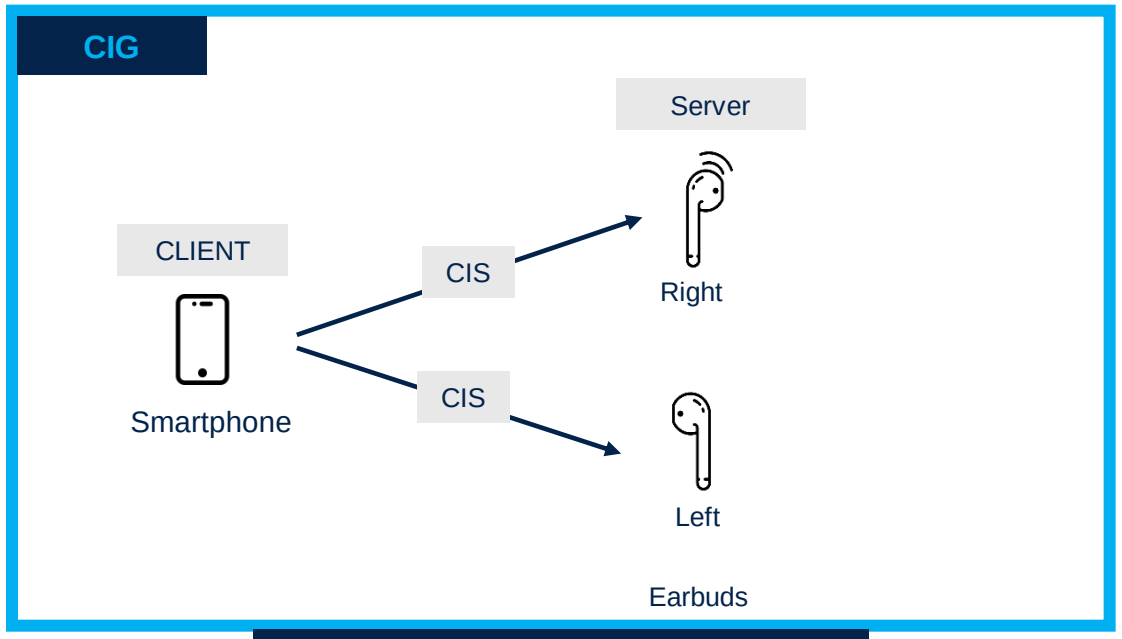
Home automation & Audio

- Built-in **Bluetooth® Low Energy 5.4 audio broadcast / unicast** enabled
- **-96 dBm** sensitivity to increase area coverage
- Embedded SAI 2ch
- **Best-in-class security**: SESIP L3 certification target

Bluetooth® Low Energy for audio devices

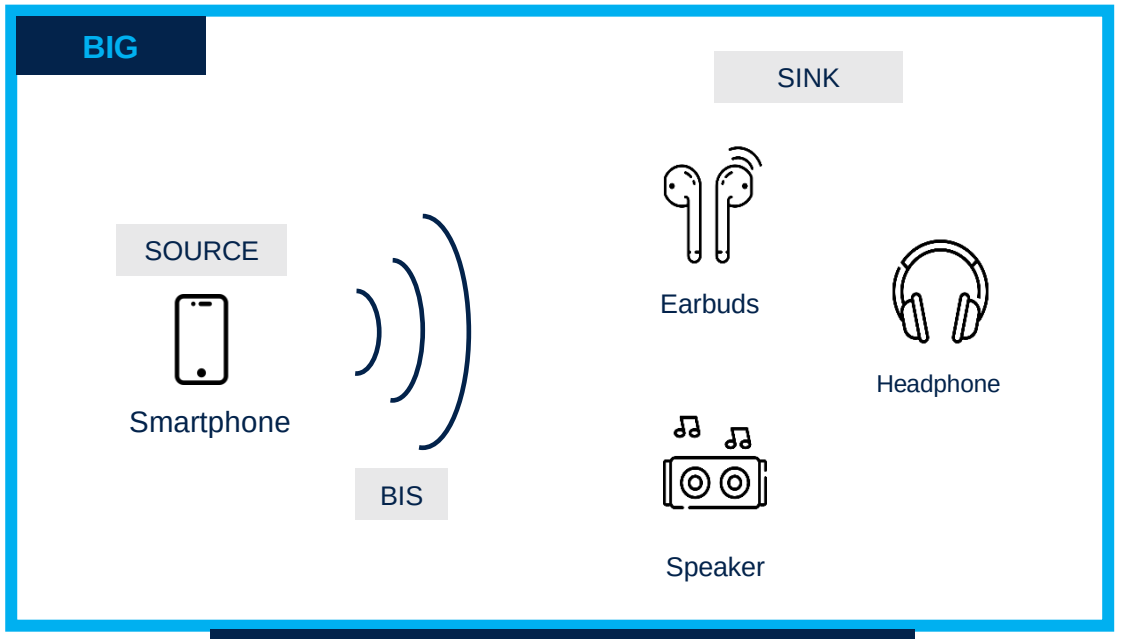
Enabling new applications for richer listening and hearing experiences

Unicast



CIG: connected isochronous stream

Auracast™



BIG: broadcasted isochronous stream

STM32WBA54/55x
Product ID card & block diagram

Control

- Power supply 1.71 V to 3.6 V (LDO/DCDC) POR/PDR/PVD/BOR
- Crystal oscillators 32MHz (radio and HSE) 32,768 kHz (LSE)
- Internal RC oscillators 32,768 kHz (500 ppm)
- RTC / AWU / CSS
- PLL / FLL
- SysTick timer
- 2 watchdogs (WWDG / IWDG)
- Up to 35 GPIOs
- Cyclic redundancy check
- Voltage scaling (2 modes)

Security

- **TZ, HUK, AES 256-bit, HASH, PKA, TRNG, SHA-1/2**

Arm® Cortex®-M33 FPU/DSP 100 MHz + TrustZone®

- Nested vector interrupt controller (NVIC)
- Memory protected unit (MPU)
- JTAG / software debug

- ART Accelerator™
- AHB bus matrix
- 1x LPDMA
- 32 to 59 pins (QFN/BGA/CSP)

Multiprotocol radio

- **Bluetooth® Low Energy 5.4**
- **Zigbee / Thread / Matter**
- **Long Range / Ext adv / 2 Mbps**
- **Isochronous channel**
- **LE power control**

Total memory

- Up to 1 Mbyte flash memory
- Up to 128 Kbytes SRAM
- Secure bootloader

Connectivity

- 2x SPI, 2x I²C, SAI (1ch)
- 2x USART, LPUART

Control

- 1x 32-bit timer
- 4x 16-bit timer (1xMotor control)
- 2x 16-bit timer (ULP)

Analog

- 1x 12-bit ADC SAR 2 Msps
- 2x ULP Comparator

Sensing

- Capacitive touch

Side attack resistant
Active antitamper

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STM32WBA52x
Product ID card & block diagram

Control

- Power supply 1.71 V to 3.6 V (LDO) POR/PDR/PVD/BOR
- Crystal oscillators 32MHz (radio and HSE) 32,768 kHz (LSE)
- RTC / AWU / CSS
- PLL / FLL
- SysTick timer
- 2 watchdogs (WWDG / IWDG)
- 35 GPIOs
- Cyclic redundancy check
- Voltage scaling (2 modes)

Security

- HUK, AES 256-bit, HASH, PKA, TRNG, SHA-1/2, SBSFU, SKS

Arm® Cortex®-M33 FPU/DSP 100 MHz + TrustZone®

- Nested vector interrupt controller (NVIC)
- Memory protected unit (MPU)
- JTAG / software debug

- ART Accelerator™
- AHB bus matrix
- 1x LPDMA

Radio protocol

- **Bluetooth® Low Energy 5.4**
- Long Range / Ext Adv / 2Mbps
- Flexible controller/target setting

- 32 to 48 pins (UFQFPN)

Total memory

- Up to 1 Mbyte flash memory
- Up to 128 Kbytes SRAM
- Secure bootloader

Connectivity

- 2x SPI, 2x I²C
- 2x USART

Control

- 1x 32-bit timer
- 4x 16-bit timer (1xMotor control)
- 2x 16-bit timer (ULP)

Analog

- 1x 12-bit ADC SAR 2 Msps

Sensing

- Capacitive touch

Side attack resistant
Active antitamper

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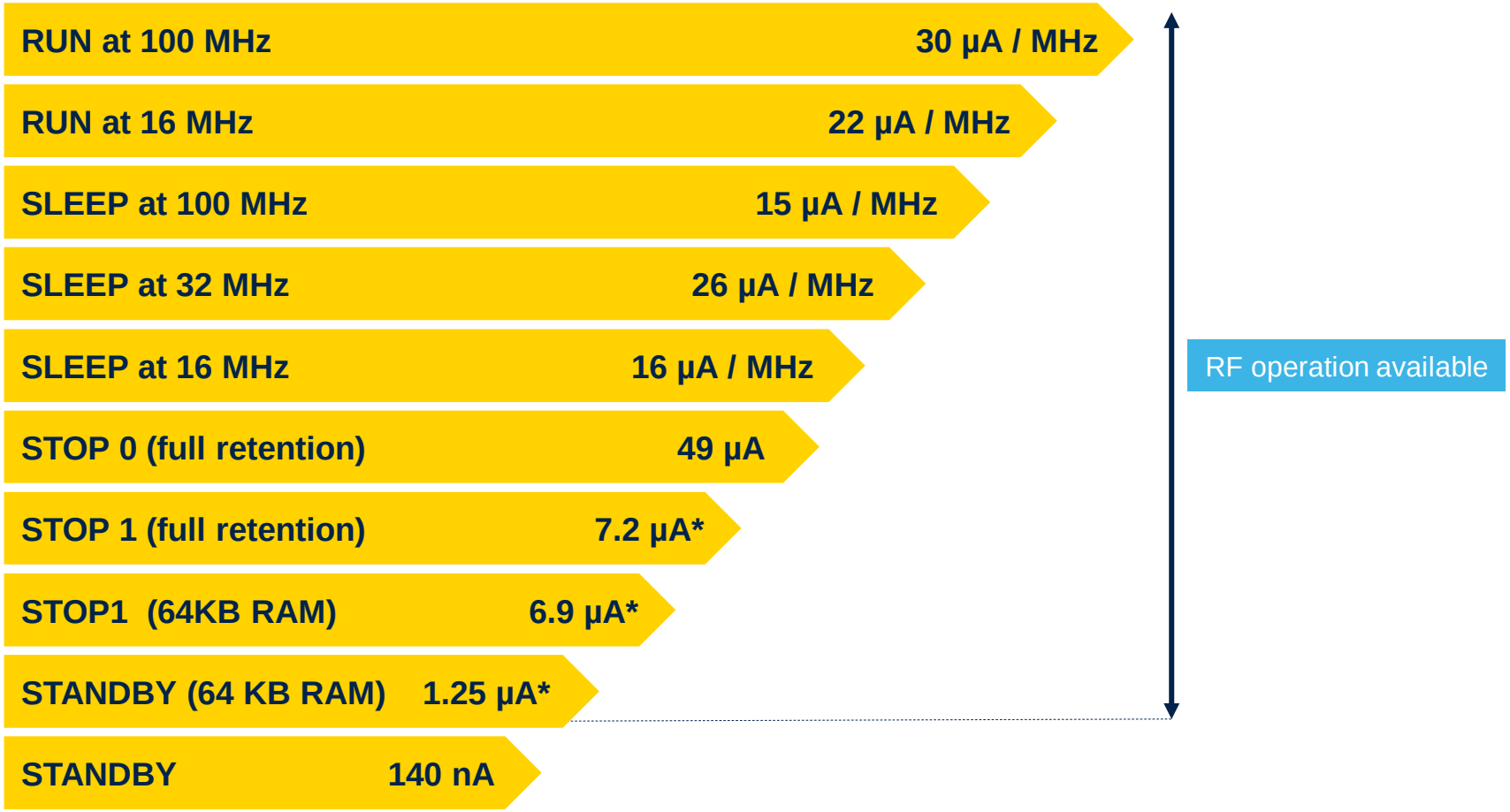
STM32WBA55 power consumption

Wake-up times

14 cycles	
STM32WBA55: 13.5 µs	
19.1 µs	
45.5 µs	



Typ @ SMPS ON 3 V @ 25°C

** with RTC*

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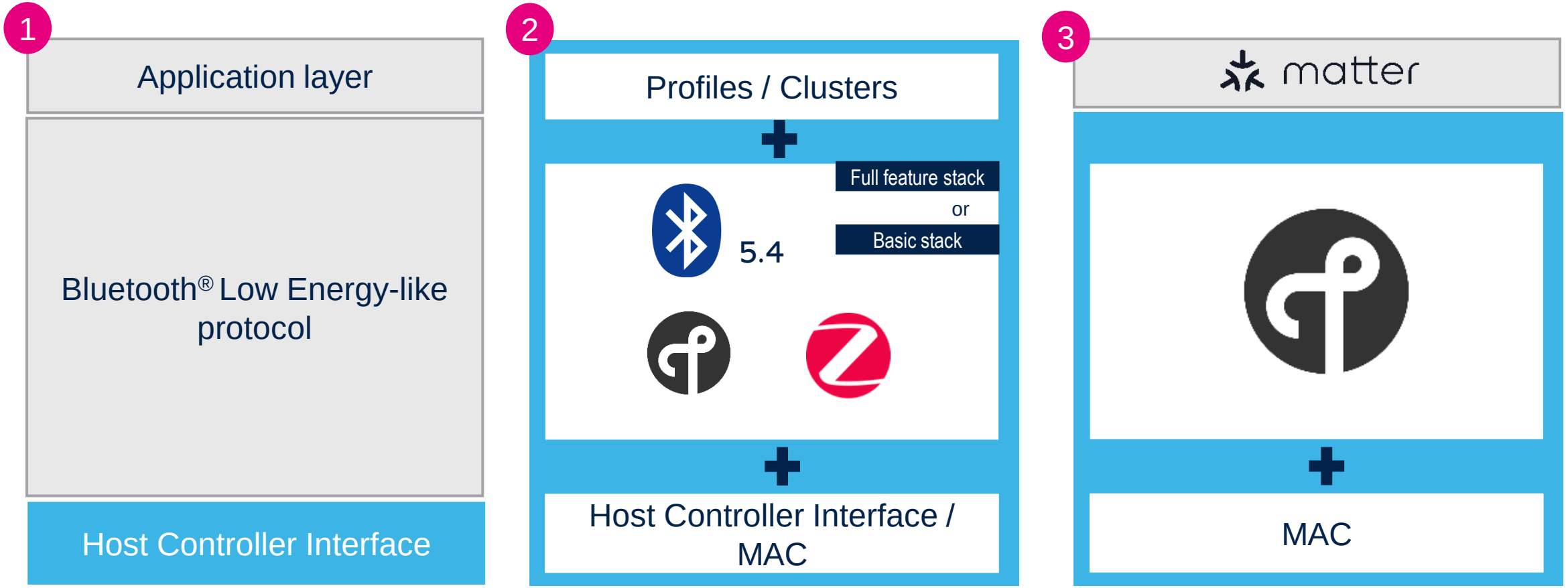
Choose from different levels of integration to customize your solutions



STM32WBA

Host device

STM32WBA increases security

Extensive functionalities to protect your assets

Memory protections
against illegal access control

OTP, **HDP**, WRP, MPU
Secure Debug
Active Tamper, 4 pairs & V/T

Cryptography
for hardware robustness

Side channel AES, PKA
Additional AES, SHA, TRNG,
HUK (Hardware Unique key)

Platform protection
during product lifecycle

RDP: 4 protection level states
Password based regression

Code isolation
for runtime protection

4 isolation stages
Arm® TrustZone® technology

Security services

- STM32Trust **TEE TF-M**
- Secure boot & secure updates
- Secure firmware install
- **NIST - CAVP certified CryptoLib**

State-of-the-art security assurance level*

SESIP™3

psacertified™ level three

target certifications

*Ready to address the US Cyber Trust Mark and EU Radio Equipment Directive (RED) regulations due to become mandatory in 2025.

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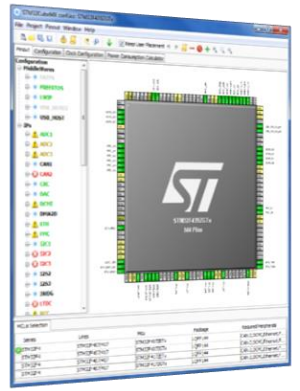
STM32WBA ecosystem simplifies your design journey

STM32**WBA**



STM32 Cube

Hardware

Nucleo board & discovery kit

Software

STM32CubeWBA
(connectivity + examples + peripherals)
STM32CubeMX
(code generation + power calculation)
STM32CubeMonRF
STM32CubeProg

STM32WBA55 development boards

Discover many use cases with the STM32WBA using Arduino connectivity and I/Os

STM32WBA55G-DK1
Discovery kit

- UFQFPN48 package
  7 x 7 mm 0.5 mm pitch
- Small serial LCD for simple GUI use cases
- Arduino and STMod+ connectors
- RF certified for protocols & regulations

NUCLEO-WBA55CG
Nucleo-64 board

- UFQFPN48 package
  7 x 7 mm 0.5 mm pitch
- 35 GPIOs
- Arduino and Morpho connectors
- RF certified for protocols & regulations

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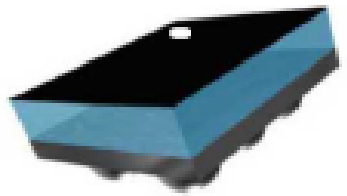
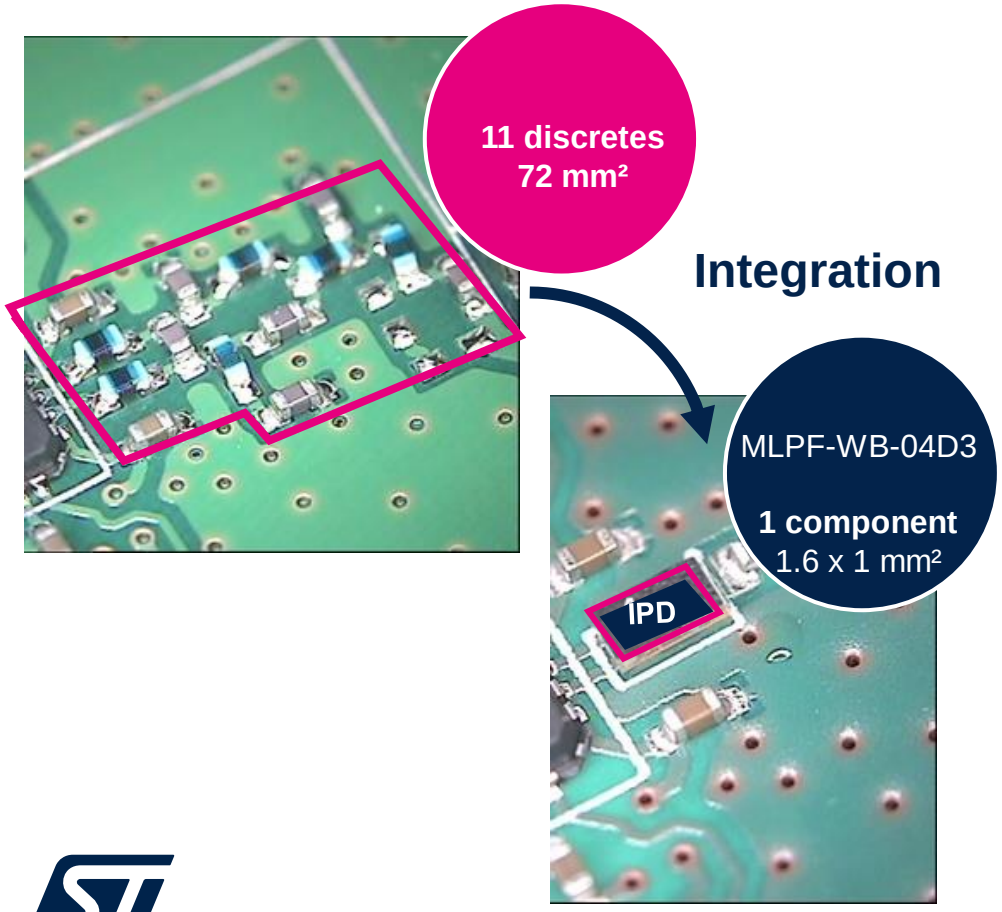
RF integrated passive devices (IPD) companion chip

**Designed for the STM32WBA5 MCUs in a QFN package,
the IPD replaces the components between the MCU and the antenna**



Chip scale package on glass 6 bumps



Simpler integration

- Impedance matching, harmonics filtering and antenna protection
- Designed to simplify the RF path between STM32WBA and antenna

Efficiency

- Optimizes wireless performance

Cost effective

- BOM reduction
- Reliability improvement

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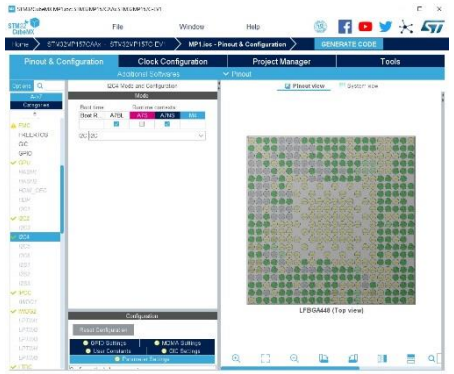
Software tools for STM32WBA

Complete support of Arm® Cortex®-M33 architecture

STM32 CubeMX

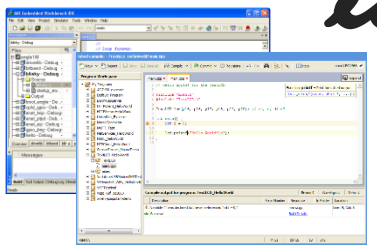


STM32 CubeIDE

arm KEIL

iar

eclipse



STM32 CubeProgrammer

STM32 CubeMonitor

STM32CubeMX

Graphical tool for easy configuration

- Configure and generate code
- Peripherals and middleware configuration

IDEs
Compile and debug

Simple, powerful solutions

- Partners IDE (Arm® Keil®) FREE
- IDE based on Eclipse FREE
- RTOS aware debug

STM32 programming & monitoring tools

STM32CubeProg
STM32CubeMonitor

- Device and memory configuration
- Program the application
- Monitor variables at runtime

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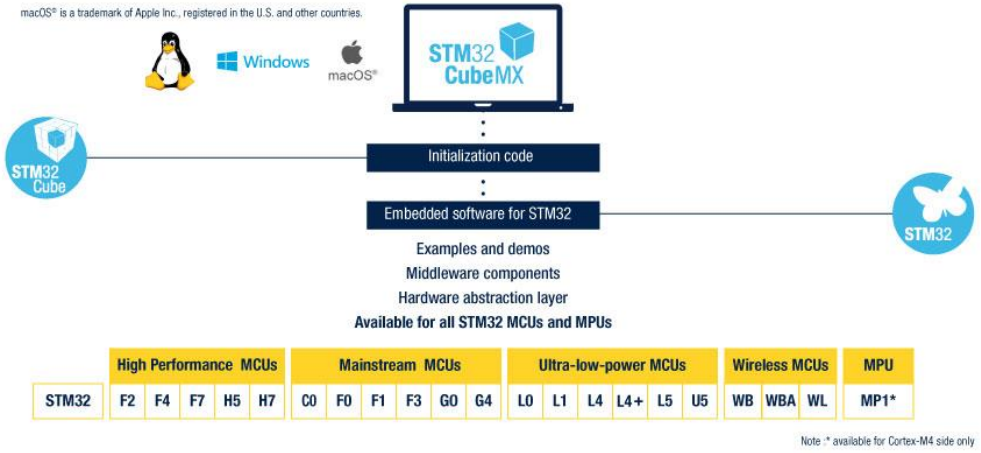
STM32CubeMX

Extensive radio stack support



- Enabling the STM32_WPAN
- Integration of RTOS and radio use cases
- Configuration GUI for Bluetooth® Low Energy, Zigbee, Thread
- Examples generated with STM32CubeMX
- Bluetooth® Low Energy, Zigbee, and Thread standardized and custom profiles

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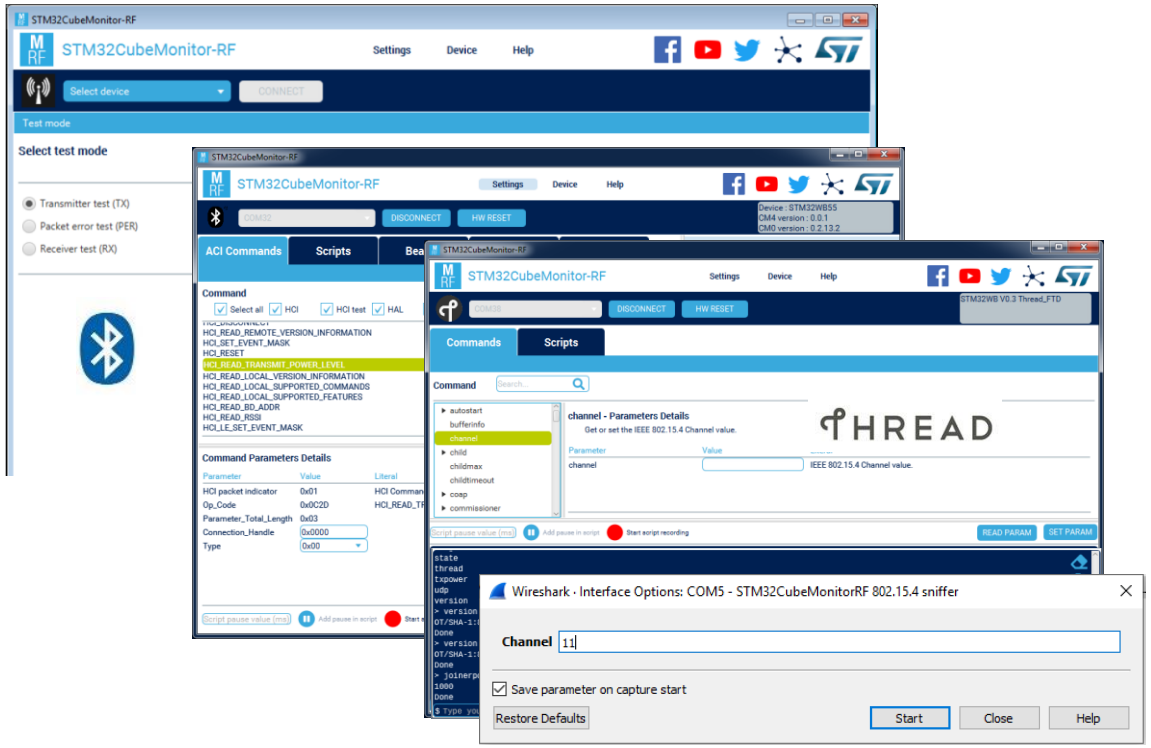
STM32CubeMonitor-RF



- Performance monitoring
- Radio testing
- Advanced scripting capabilities
- Data logging and report generation

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ST Bluetooth® Low Energy smartphone apps

ST BLE Sensor

ST BLE StarNet

new

ST BLE Toolbox

ST BLE Sensor – Used with our OOB demo

Read the data exported by a Bluetooth® Low Energy device using the BlueST protocol.

ST BLE StarNet (Star topology)

View the data exported by a Bluetooth® Low Energy gateway connected to a network of devices.

ST BLE ToolBox

Discover peripherals, services, and characteristics, and perform R&W. Users can collect cloud-based analytics on the Azure App Center, bond devices, test throughput, log messages.

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STM32WBA ecosystem takeaways

- Dedicated Nucleo boards and discovery kit for prototyping
- Full support & integration of Bluetooth® Low Energy 5.4, Zigbee, Thread stacks
- Advanced RF stacks integration with STM32CubeMX
- Advanced QoL features for STM32CubeMonRF
- Mobile applications to address applicative use cases
- Resources on GitHub, including STM32 hotspot

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STM32WBA takeaways

Wireless	Multiple protocols supported +10 dBm output power
Performance	Arm® Cortex®-M33 at 100MHz Efficiency
Power efficiency	Extended battery lifetime Autonomous low-power mode
Security	TrustZone® DPA resistant
Integration	1 Mbyte of flash memory, 128 Kbytes RAM Reduced BOM
Free ecosystem	Faster time to market Enhanced design journey

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Releasing your creativity

@STM32

@ST_World

community.st.com

www.st.com/stm32wba

wiki.st.com/stm32mcu

github.com/stm32-hotspot

STM32 MCU Developer Zone

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Our technology starts with You

Find out more at www.st.com/STM32WBA

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