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STM32WB series MCU with built-in bluetooth 5.0 and IEEE 802.15.4

STM32

Make the choice of STM32WB series the 7 keys points to make the difference

Bluetooth 5

OPENTHREAD released by Google

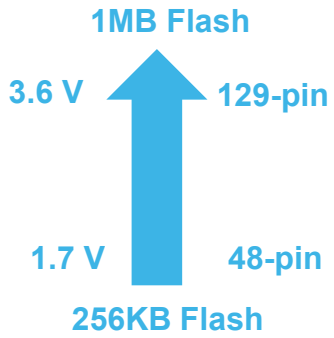
Zigbee 3.0

Open 2.4 GHz radio
Multi-protocol

Dual-core / Full control
Ultra-low-power

IoT Protection ready

Massive integration
Cost saving



A large offer

STM32 Cube

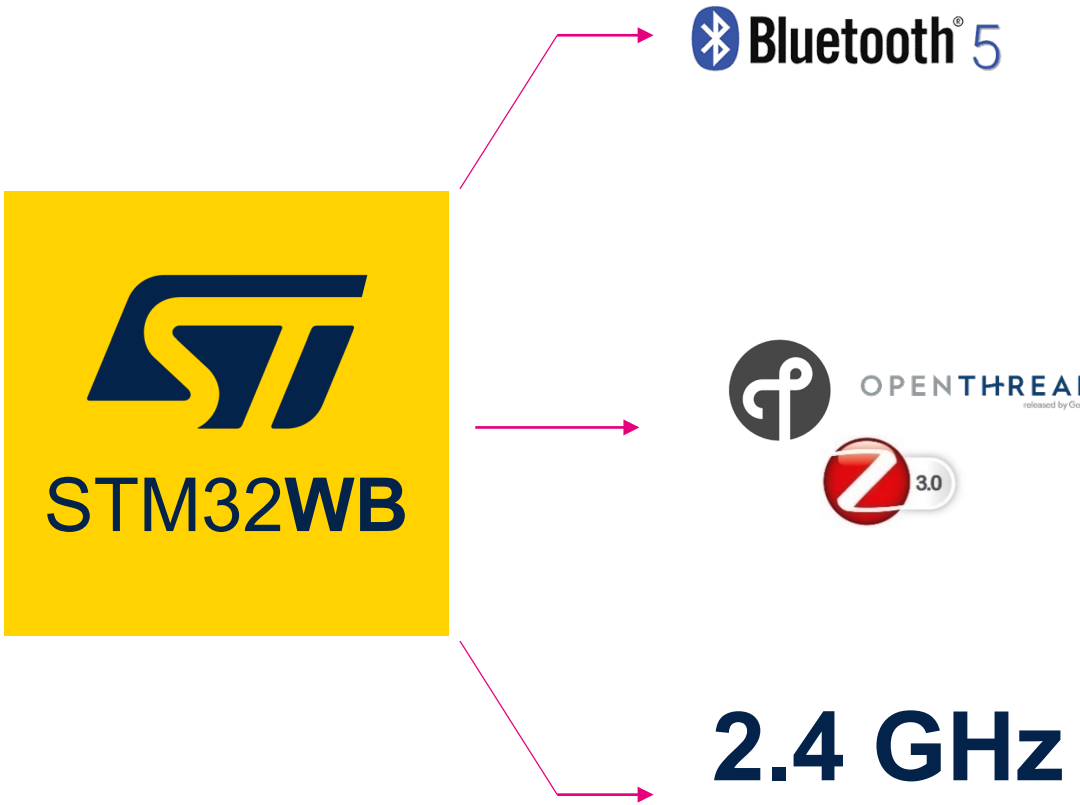
STM32 CubeMonitor-RF

Advanced RF tool, Energy control with C code generation

LONGEVITY 10 YEARS COMMITMENT

No matter what!

Multiprotocol and open radio

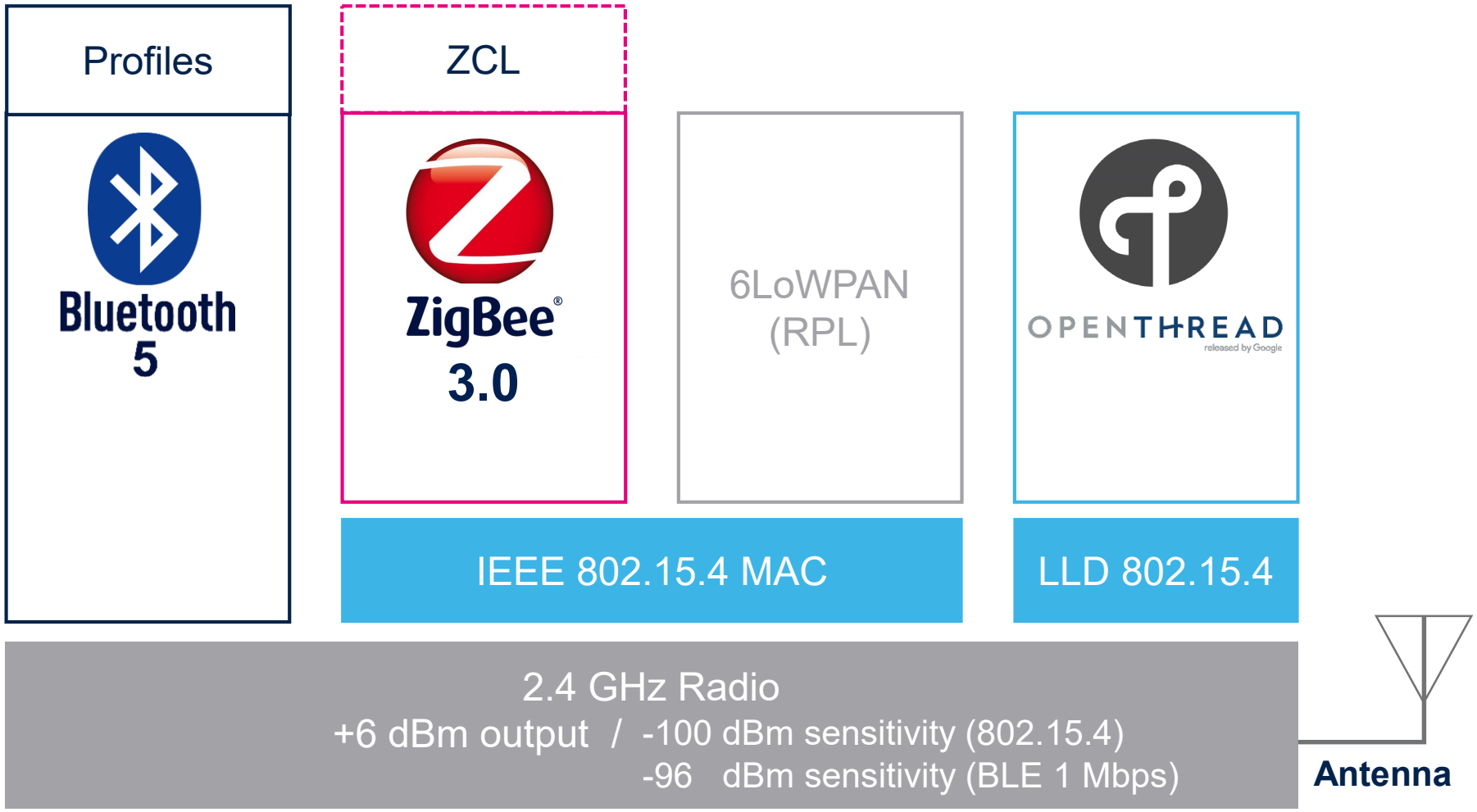


- Fully certified Bluetooth® 5.0 radio
- 2x faster speed with 2Mbps capable mode
- Extend network coverage with BLE Mesh

- Last IEEE 802.15.4 standard ready
- OpenThread, ZigBee 3.0
- Bluetooth 5.0 and 802.15.4 protocols in Static and Dynamic concurrent mode

- Proprietary protocol capable (Bluetooth Low Energy like or 802.15.4)
- Best-in-class RF with up to +6dBm output power and 102 dB link budget
- Energy sensitive application with only 4.5mA in RX and 5.2mA in TX (@ 0dBm)
- BOM cost reduction thanks to Integrated balun

Make it yours



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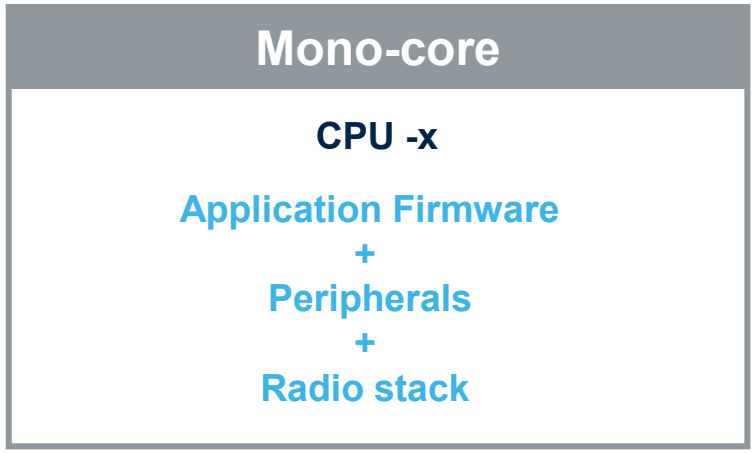
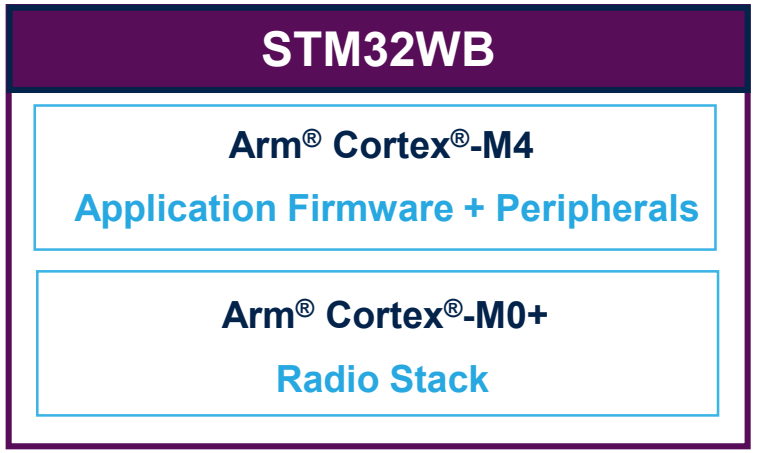
Simplicity of development

2 independent cores for real-time execution





- **Drawbacks**
  - Time sharing
  - Longer processing time – Greedy current consumption
  - Need companion MCU (increased cost)

- **Benefits**
  - SOC solution (1 single die)
  - Full flexibility - Easy development – User experience
  - Increase battery life
  - All-in-1 solution - cost saving
  - Speed up time to market
  - Easy certification process

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Rich feature set

KEY FEATURES

2 independent cores for real time execution

Ultra-low-power consumption

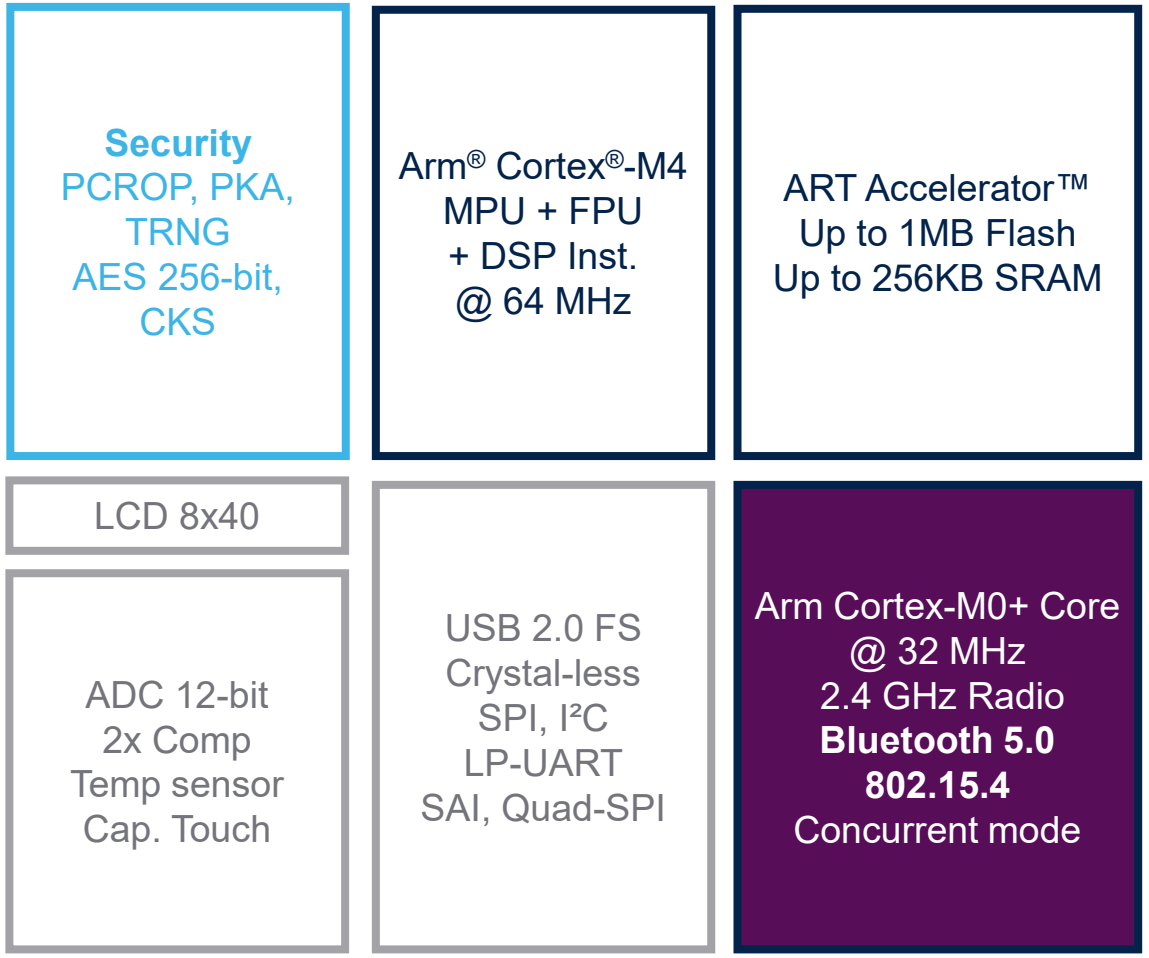
- 50 µA/MHz Active mode (at 3.0V)
- 2.1 µA Stop mode (Radio in standby + 256KB RAM)
- < 50 nA Shutdown mode

Peripherals

- 2xI²C, 1xUSART, 1xLP-UART, 2xSPI, 1x USB 2.0 FS device supporting Battery Charging Detection, 1xSAI, Quad-SPI (XIP), 6x 16-bit timer (including LPWM and low-power one)

1.7 to 3.6V voltage range (DC/DC, LDO)

-40°C to +105°C temperature range



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Benefit of dual cores processing

1 Independent Radio activity

- Uploading data to mesh network or smartphone
- OTA of Radio protocol stack or application FW
- Running on Arm Cortex-M0+

2 Energy saving mode

- RAM + RTC running @ 2. 1µA
- Fast wake up @ 5µs

3 Main application activity

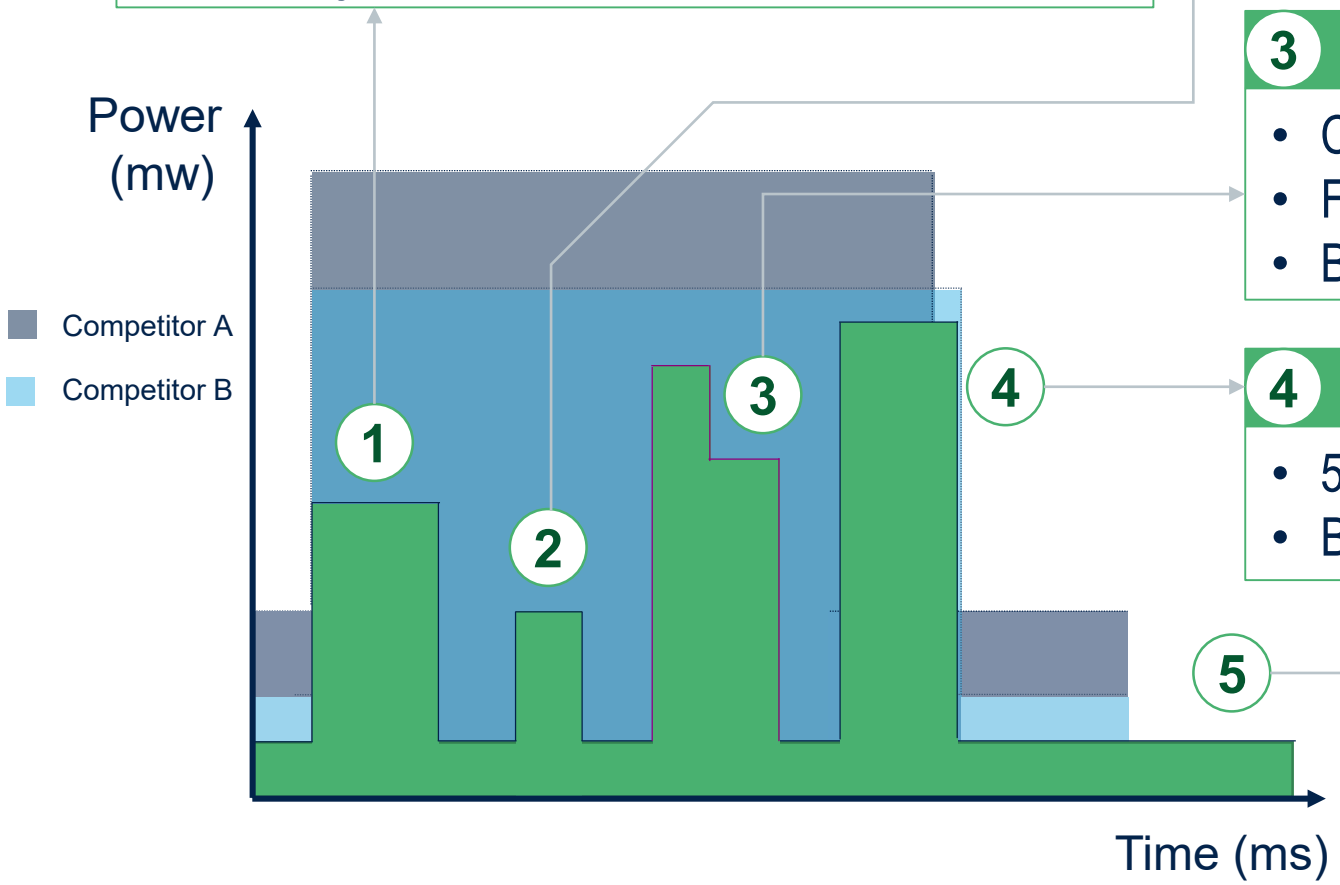
- Computing data (sensor fusion …)
- Flexible Arm Cortex-M4 CPU speed up to 64 MHz
- Batch Acquisition Mode (BAM) with CPU & Flash turned off

4 Dual CPU activity

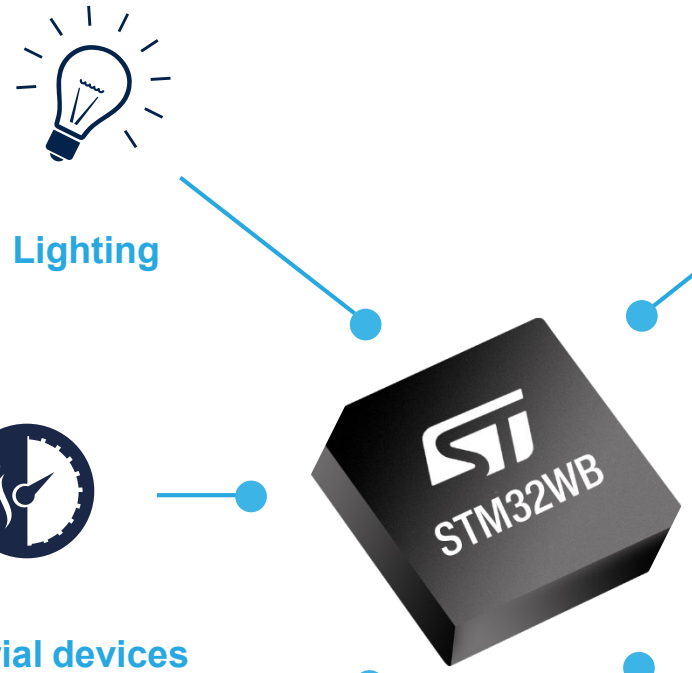
- 50µA/MHz only!
- Both Radio and Application running independently

5 Super saving mode

- Shutdown < 50 nA
- Battery energy saving



All in one MCU full flexibility control



Lighting

- Robust RF link **-100dBm** sensitivity with IEEE 802.15.4 and **+6 dBm** output power
- Upgrade legacy 802.15.4 device to **Bluetooth 5.0**
- **Update** securely Radio and stack firmware with build-in FUS
- Bluetooth 5 and 802.15.4 protocols **Mesh capable** to extend network range

Fleet maintenance

- Retrofit legacy product to **Bluetooth 5.0** and concurrency mode
- Remotely upgrade device with **OTA capability**
- **Brand protection** with Authenticated **FW upgrade** system

Industrial devices

- **Up to 105°C** radio capable
- **External PA** support to get ultra wide communication distance
- Down to **600 nA mode with RTC** and 32KB of RAM
- Only **5µs wakeup** time over 16 wakeup lines
- PCROP, **ECC**, TRNG, **PKA**, for best design robustness
- Reduce BOM cost with **built-in LCD booster**

Fitness/ Healthcare

- **Multipoint** BLE 5 connections
- Small form factor design with CSP**100 pins**
- Battery life time care with **< 50 nA** Shutdown mode
- Dynamic Efficient **50 µA/MHz**
- Extend memory storage with **Quad-SPI**
- Handle advanced algorithm with **1 Mbyte** of Flash
- Cost optimized product with USB 2.0 **crystal-less** device

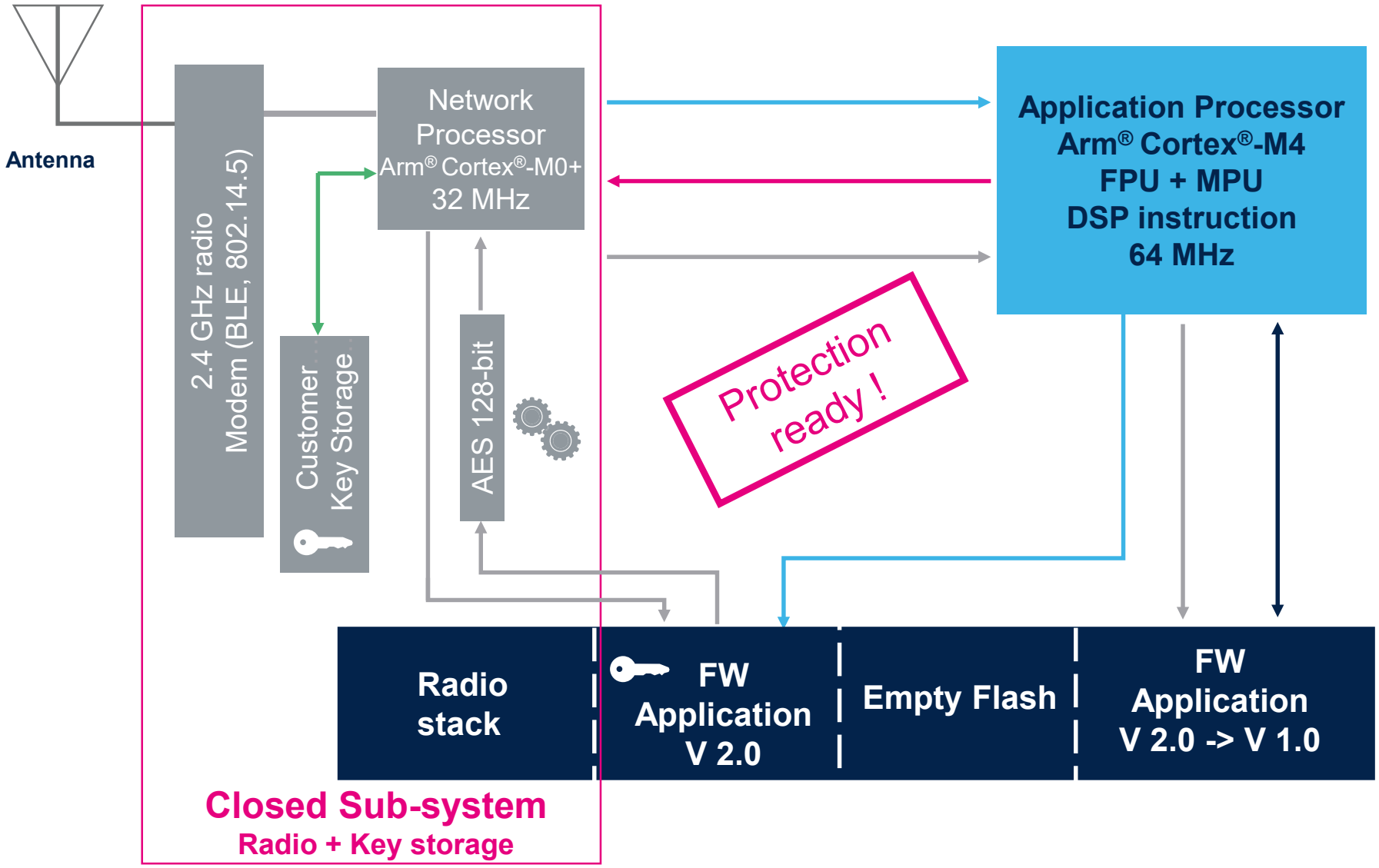
Beaconing

- **Beacon** profile available among a huge list
- **Embedded balun** to minimize design cost
- Only **5.2mA Radio TX** current to extend beacon life time
- **Up to +6 dBm** output power to get best beacon range
- < 2.1 µA Stop mode with full RAM for **battery life** optimization
- Down to 1.71 full feature capable

Home security and Audio

- **-100 dBm** sensitivity to increase area coverage
- **Customer Key Storage (CKS)** for trustable Application update
- Manage full duplex **audio** with embedded SAI
- USB FS 2.0 with Battery **Charging Detection** for remote device

IoT protection ready (1/2)
radio stack and/or application FW update



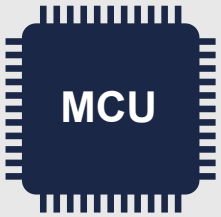
1. New FW package received
2. New FW detected
   Update is launched
3. App Processor send New FW package signature and encryption key for authentication
4. Authentication signature matches preprogrammed key
   Case not, the process is aborted and device resets
5. New FW package is decrypted with proprietary Key. Device upload on going.

IoT protection ready (2/2)
STM32WB counter measure against attacks

Advanced

Basic

Attacks	Attacks description	STM32WB Countermeasures

Non Invasive Attacks 	• Environment modification
	  • Temperature
	  • Voltage
	  • Clock ….
	• Fault injection (glitches….)
	• Exploit debug features
	• Side channel, power Analysis, …
		• Temperature sensor
		• Power supply integrity monitor
		• Clock security system
		• Tamper pads
		• Memory ECC, Parity check
		• RTC alarm, registers, SRAM mass erase
		• JTAG Read out protection
		• BOOT from Flash only

Software Attacks 	• Low Authentication / Encryption • Extract keys • Exploitation of applicative test features • Malware / Virus • Replay, privilege escalation	• Customer Key Storage (CKS) • RNG, Crypto accelerator, CRC • Write memory protection • Read Out memory protection • Memory Protection Unit (MPU) • Firmware Upgrade Service (FUS) • Secure Firmware Update (SFU) • Proprietary Code Read-Out Protection (PCROP) • 96-bit ID

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Massive cost saving

The more feature integration, the more the BOM drops down !

Silicon cost

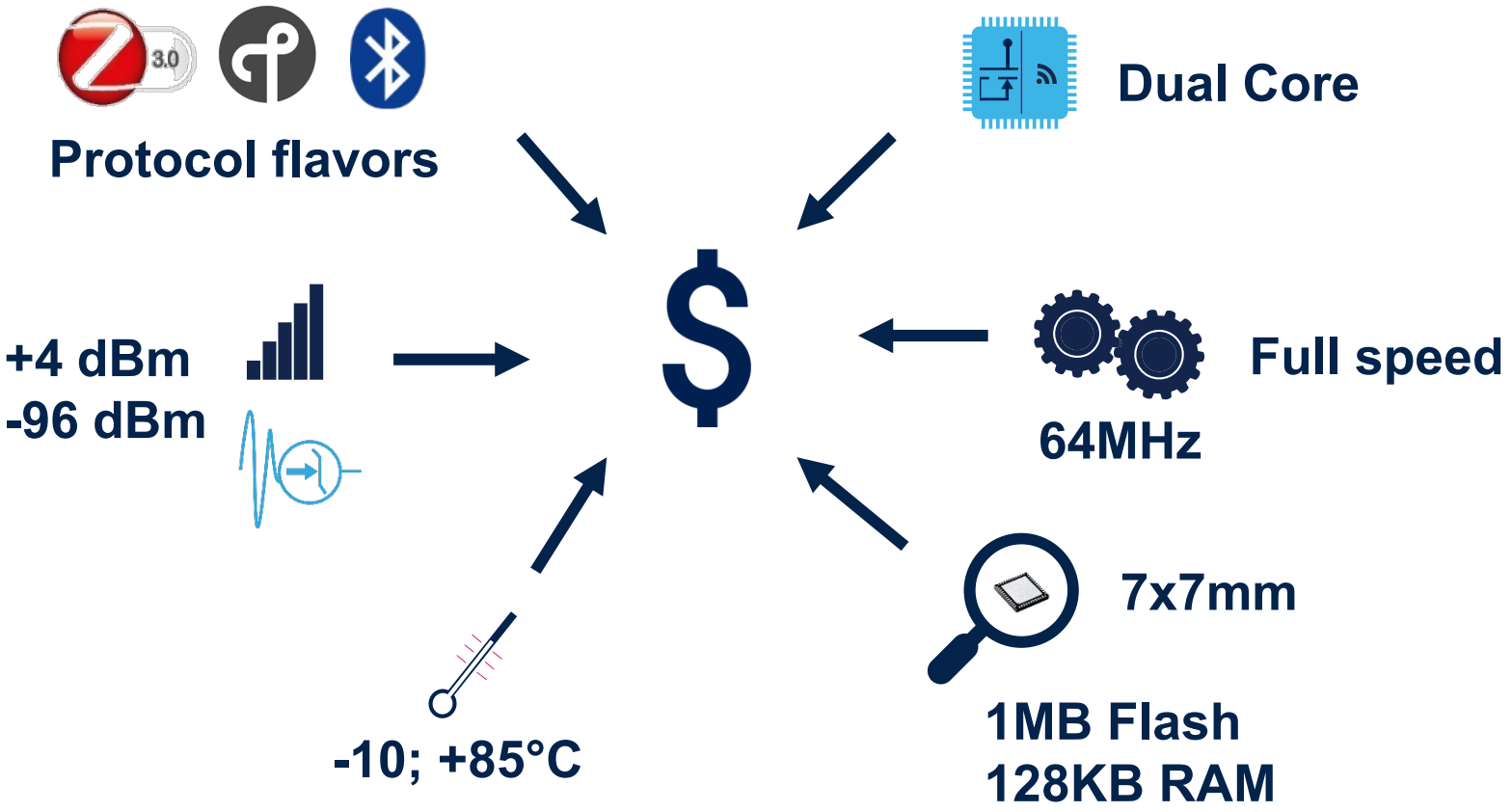
- RF balun cost: Embedded
- External components: 7
- 32 kHz Master clock output available
- Crystal for USB 2.0 FS operation: embedded
- LCD display booster: embedded (only single glass)
- Capacitive touch controller: embedded
- PCB cost: 2 layers PCB only

Ecosystem cost

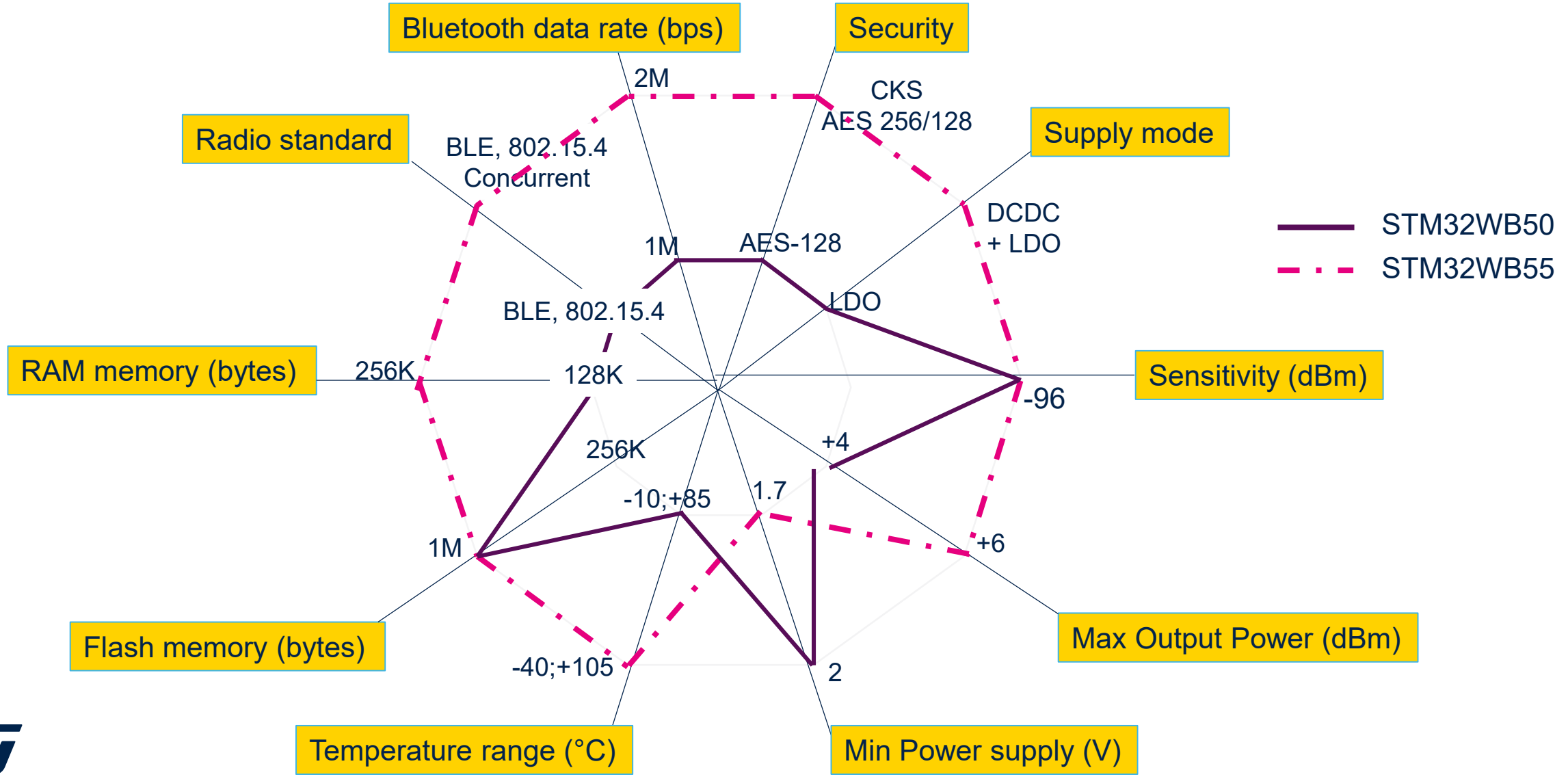
- Bluetooth 5.0 stack: Free of charge
- ZigBee 3.0 stack: Free of charge
- OpenThread stack: Free of charge
- Generic 802.15.4 MAC: Free of charge
- Generic HCI drivers: Free of charge
- STM32CubeMX: Free of charge
- STM32CubeMonitor-RF: Free of charge
- IDEs (AC6: SW4STM32; ST: STM32CubeIDE): Free of charge
- BLE and 802.15.4 concurrency avoids to use a second radio MCU

STM32WB50 value line

Essentials features product targeting entry-level Bluetooth 5.0 and Mesh application



STM32WB50 positioning



STM32WB - a large offer

Bluetooth 5.0, OpenThread, ZigBee 3.0 and proprietary protocol capable

from 1.7 V to 3.6 V
from -40°C to +105°C

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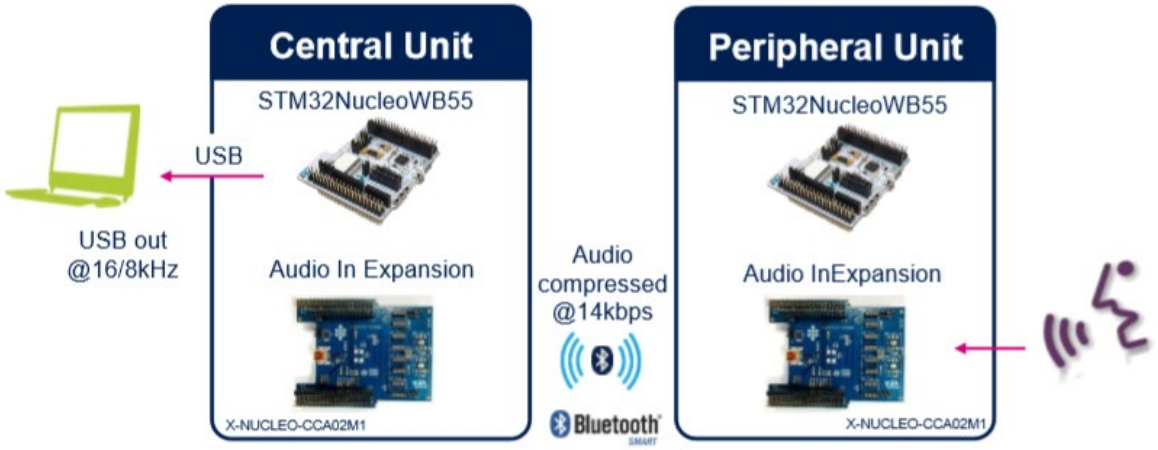
Advanced functionalities

Audio - Voice & streaming

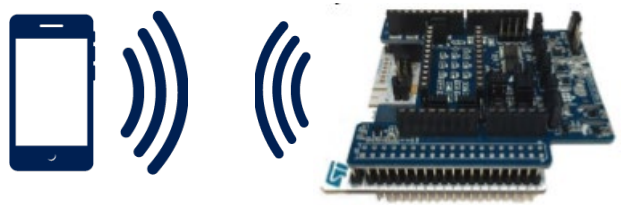
Full-duplex audio streaming over Bluetooth 5.0 using Opus codec
STM32Cube function pack for STM32WB MCU: FP-AUD-BVLINKWB1



STM32WB Nucleo development board
+
Digital MEMS microphones Expansion board

Sensor fusion & activity recognition

BLE connectivity with environmental and motion sensors
STM32Cube function pack for STM32WB MCU: FP-SNS-MOTENVWB1



STM32WB Nucleo-64
development board
+
Motion MEMS and
Environmental Sensor
Expansion board

Both packages are compatible with STBLESensor app for iOS and Android

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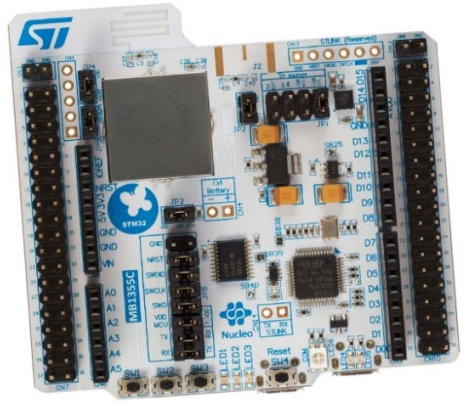
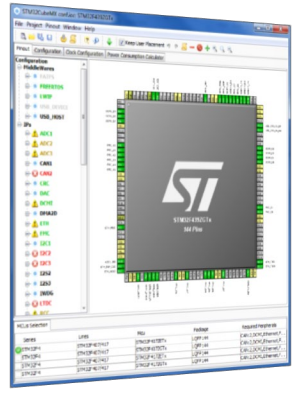
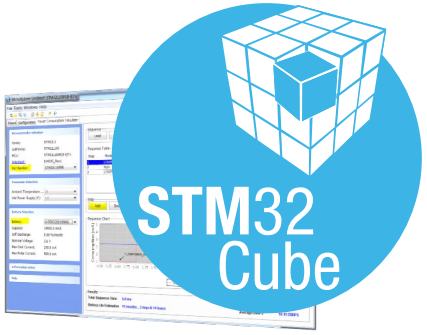
Prototyping made as easy as 1,2,3



Hardware
Evaluation Pack

STM32**WB**

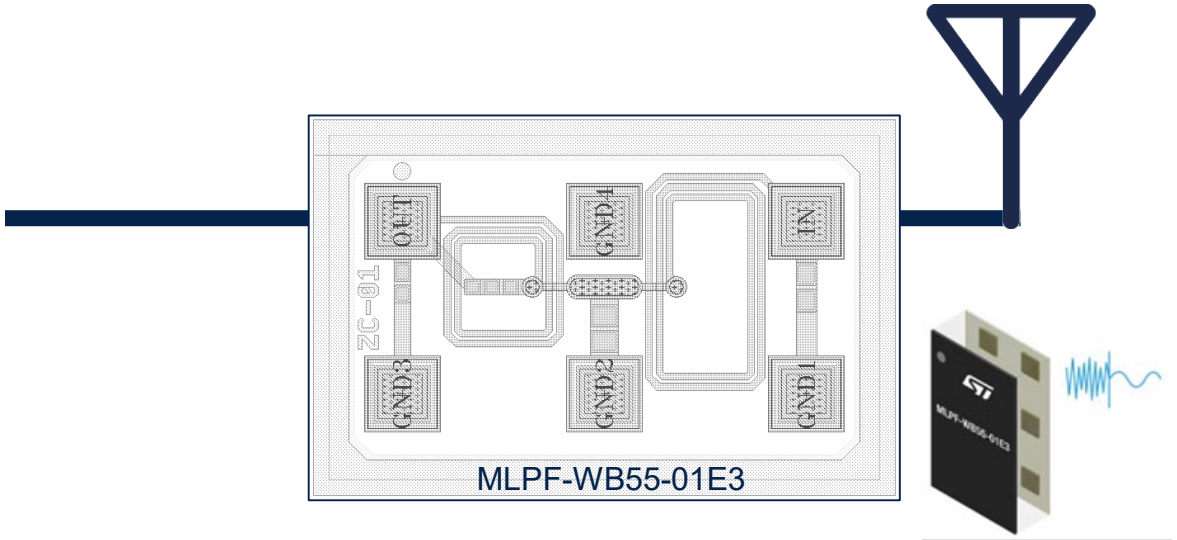




STM32CubeMX
STM32CubeWB
Code generation
Power calculation
STM32CubeMonRF

IPD - MLPF-WB55-01E3 harmonic filter with integrated impedance matching

Integrated Balun



STM32WB

Arm Cortex-M4
Application Firmware + Peripherals

Arm Cortex-M0+
Radio Stack

MLPF-WB55-01E3

Integrated STM32WB **impedance matching**

Deep rejection **harmonic filter**

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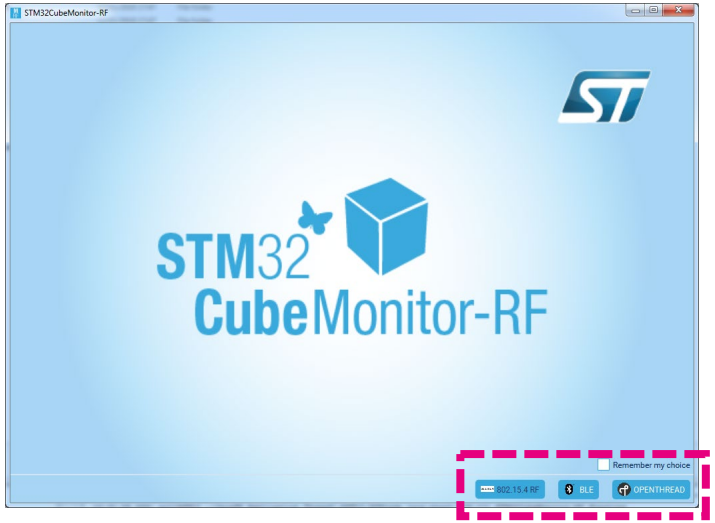
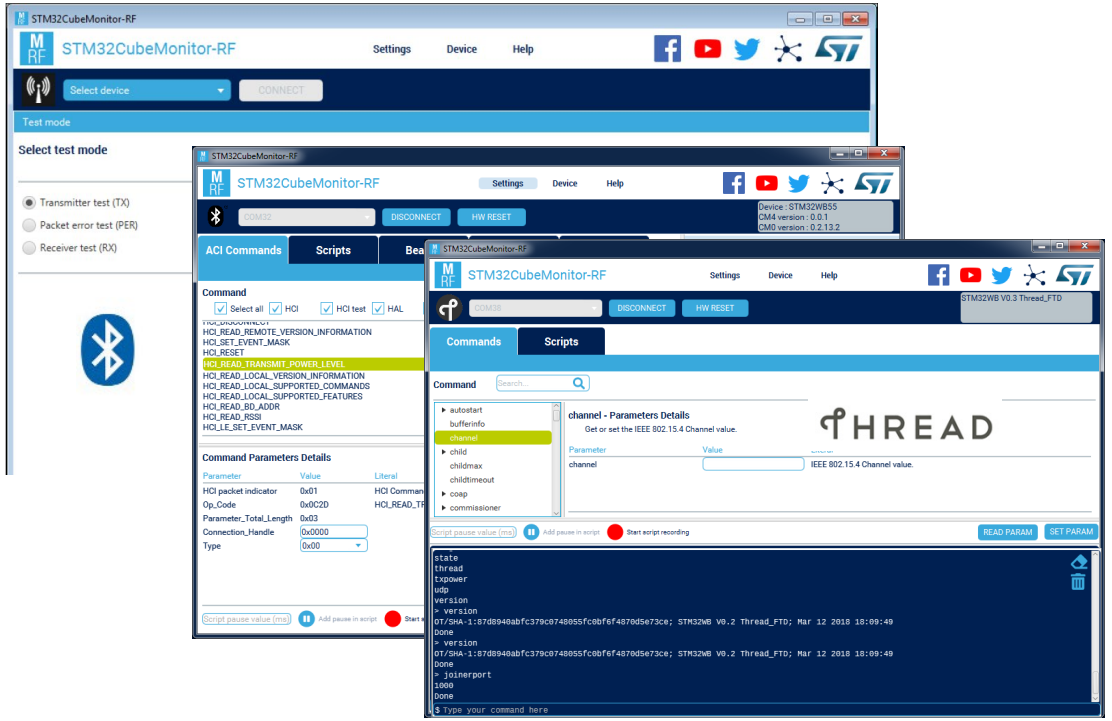
STM32CubeMonitor-RF

- Exercise wireless features of STM32WB55
  - Bluetooth Low Energy (BLE) commands
  - BLE RF tests
  - send OpenThread commands
  - perform 802.15.4 RF tests



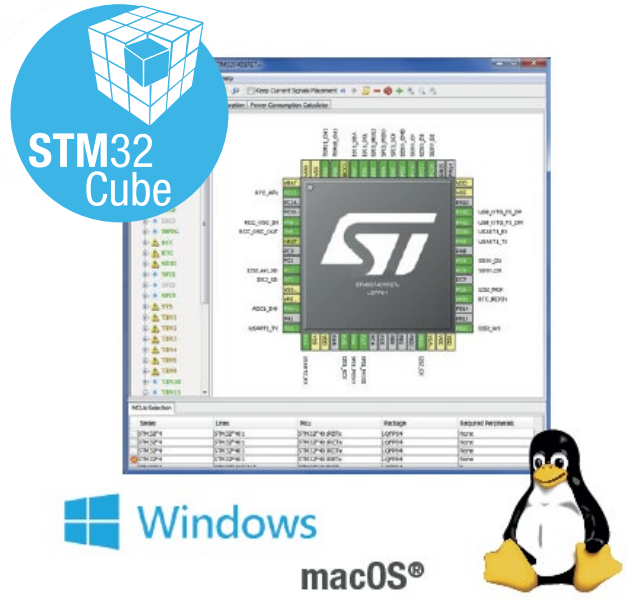
Mode selection

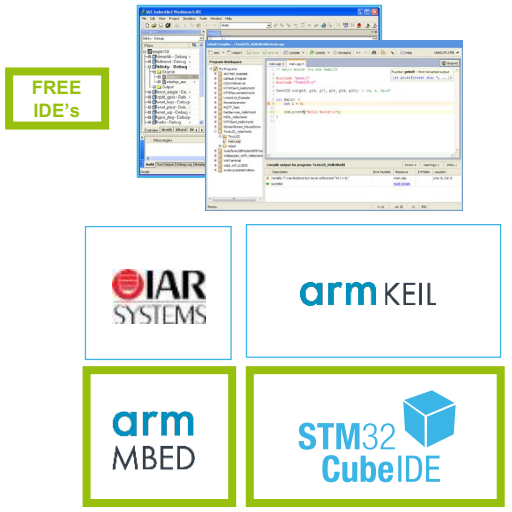
- DUT - Nucleo, USB dongle or customer boards.
- USB or UART to Virtual Com Port



Software development tools

A complete flow, from configuration up to monitoring

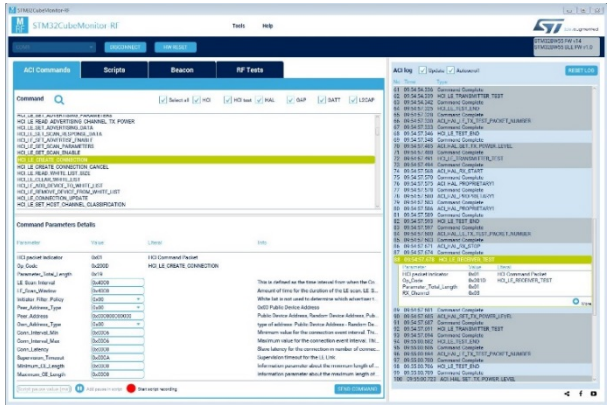




More to come after mass market launch

STM32 CubeMonitor-RF

STM32 CubeProgrammer



STM32CubeMX
Configure & Generate Code

Partners IDEs
Compile and Debug

STM32CubeMonRF
STM32CubeProg

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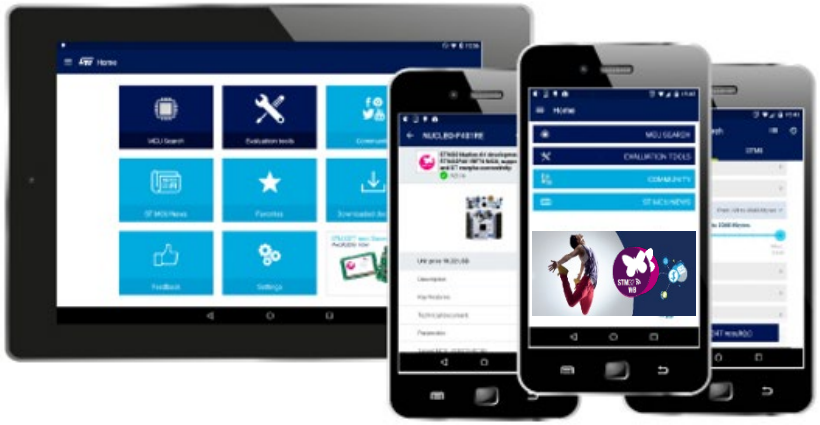
Find easily the MCU that suits YOU tablets/phones/computers ST MCU finder



- Browse STM32 & STM8 families wide portfolio and select the product that best fit their needs
- Access to technical information
- Also works offline !

ANDROID APP ON Google play

Available on the App Store

Windows

macOS™

www.st.com/STMCUFinder

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STM32 MCU “Wireless” series

High Perf MCUs			STM32**F2** 398 CoreMark 120 MHz		STM32**F4** 608 CoreMark 180 MHz	**STM32H7** 3224 CoreMark 240 MHz Cortex -M4 480 MHz Cortex -M7	STM32**F7** 1082 CoreMark 216 MHz
Mainstream MCUs	STM32**F0** 106 CoreMark 48 MHz	STM32**G0** 142 CoreMark 64 MHz	STM32**F1** 177 CoreMark 72 MHz		STM32**F3** ● 245 CoreMark 72 MHz	STM32**G4** ● 550 CoreMark 170 MHz	
Ultra-low Power MCUs		STM32**L0** 75 CoreMark 32 MHz	STM32**L1** 93 CoreMark 32 MHz	STM32**L5** 424 CoreMark 110 MHz	STM32**L4** 273 CoreMark 80 MHz	STM32**L4+** 409 CoreMark 120 MHz	
Wireless MCUs					STM32**WL** **161 CoreMark** **48 MHz**	STM32**WB** ● **219 CoreMark** **64 MHz**	

LONGEVITY 10 YEARS COMMITMENT

Arm® Cortex® core	-M0	-M0+	-M3	-M33	-M4	-M7

● Optimized for mixed-signal applications

● Cortex-M0+ Radio co-processor

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Releasing your creativity

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