



life.augmented

**STM32WB series MCU
built-in Bluetooth® LE 5.2
and IEEE 802.15.4**



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



OPENTHREAD
released by Google



zigbee

Open 2.4 GHz radio
Multi-protocol



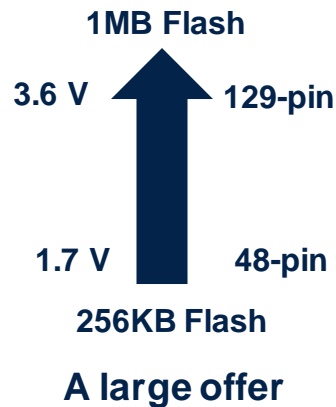
Dual-core / Full control
Ultra-low-power



IoT Protection ready



Massive integration
Cost saving

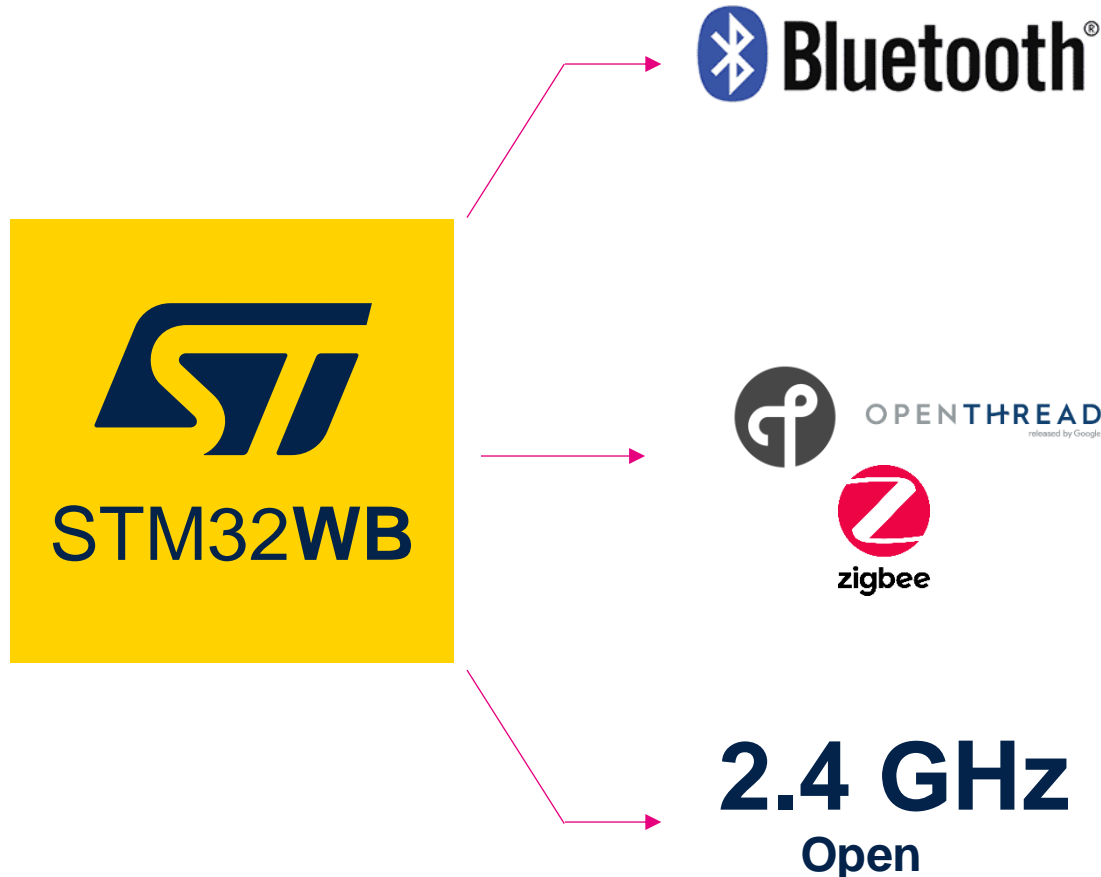


Advanced RF tool, Energy control
with C code generation



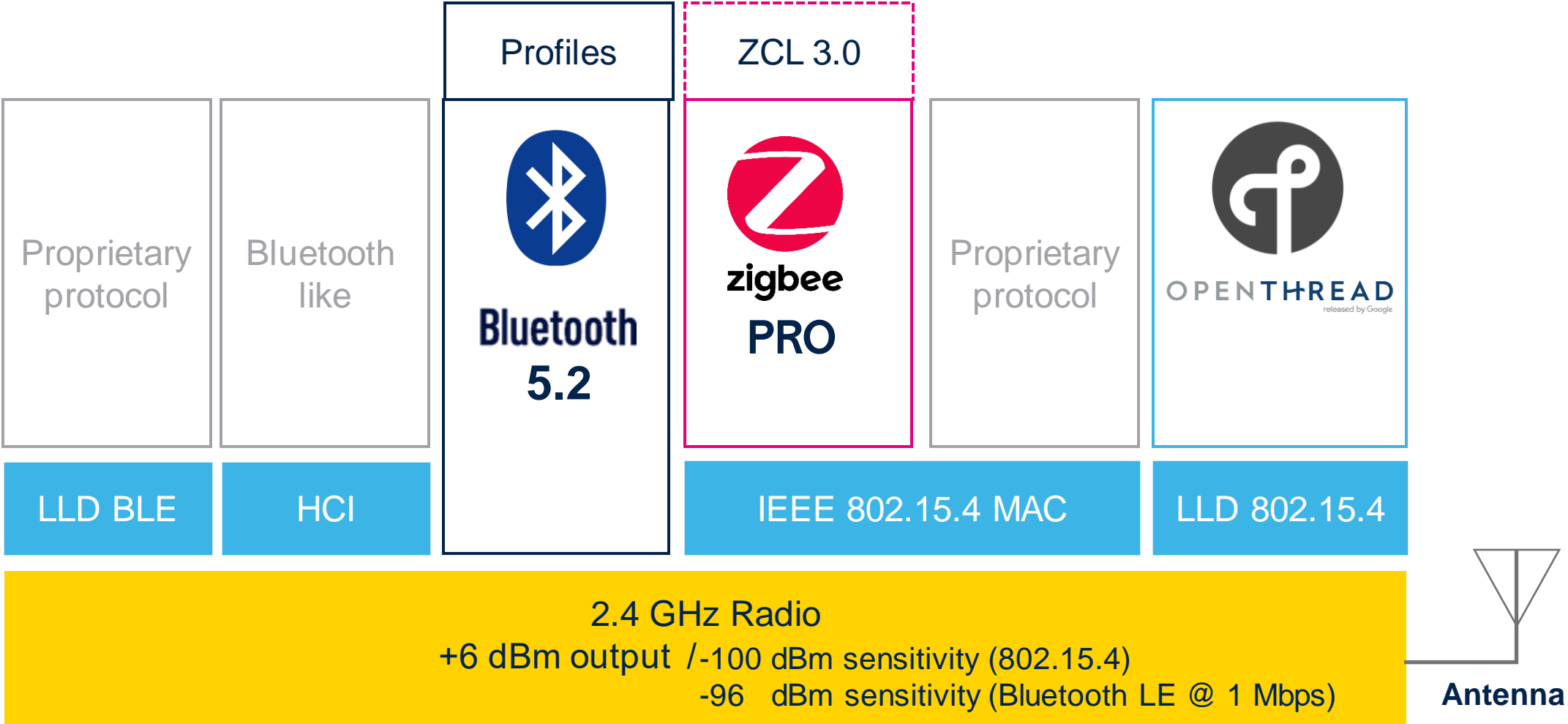
No matter what!

Multiprotocol and open radio



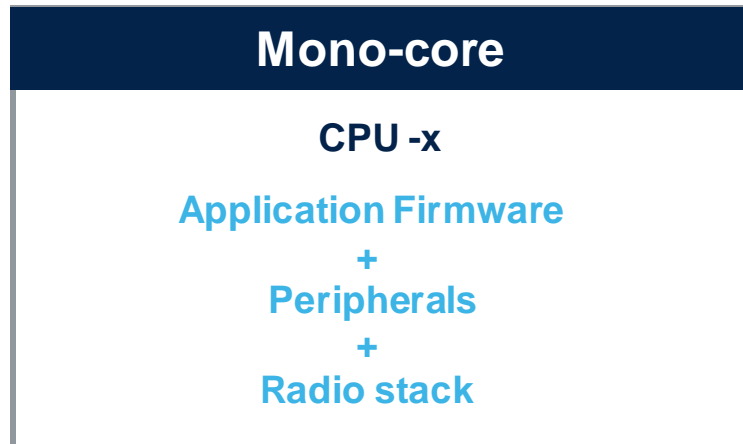
- Fully certified Bluetooth® LE 5.2 radio
- 2x faster speed with 2 Mbps capable mode
- Extend network coverage with Bluetooth Mesh
- Last IEEE 802.15.4 standard ready
- OpenThread, Zigbee 3.0
- Bluetooth 5.2 and 802.15.4 protocols in Static and Dynamic concurrent mode
- Proprietary protocol capable (Bluetooth 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



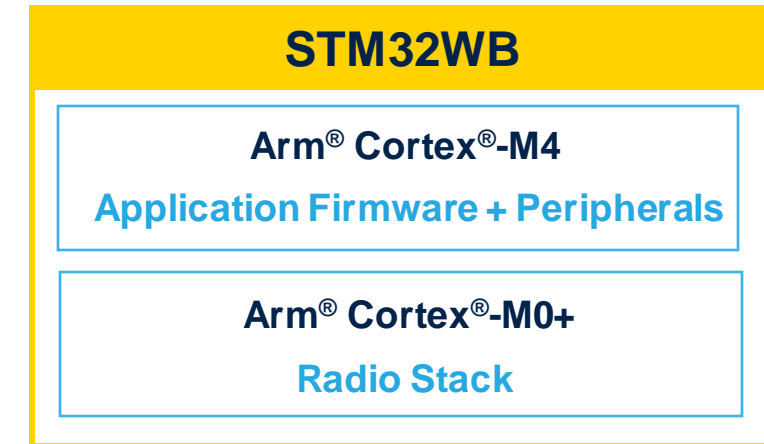
Simplicity of development

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

Rich feature set for STM32WB55

KEY FEATURES

2 independent cores for real time execution

Ultra-low-power consumption

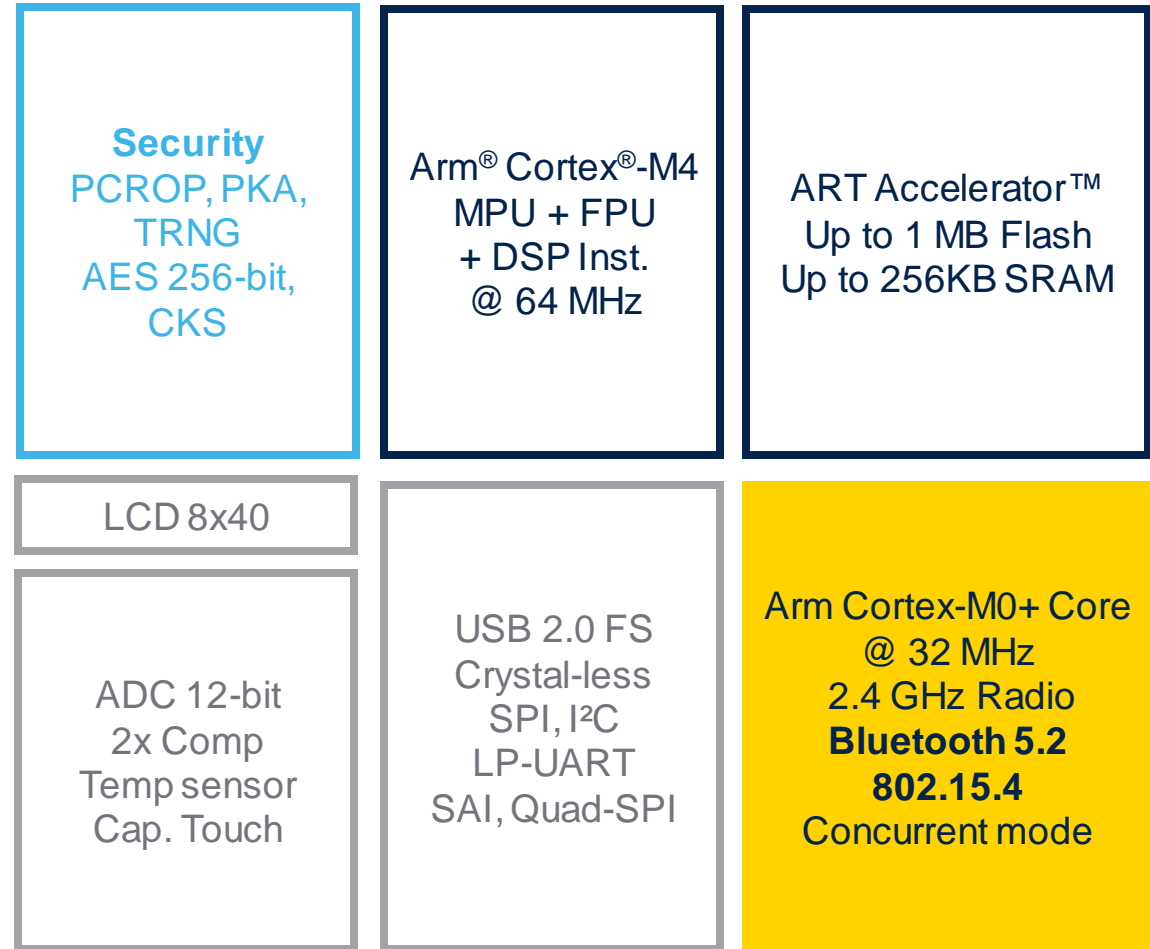
- 50 μ A/MHz Active mode (at 3.0 V)
- 2.1 μ A Stop mode (Radio in standby + 256 KB RAM)
- < 50 nA Shutdown mode

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 3.6 V voltage range (DC/DC, LDO)

-40°C to +105°C temperature range



STM32WB 2.4GHz offer

Featured product	Connectivity			Memory		Output power range (dBm)	Main peripherals	MCU Arm® Core	GPIOs	Packages	
	Bluetooth LE & Mesh	Zigbee / Thread	Other	Flash (kB)	RAM (kB)						
STM32WB Standard lines											
STM32WB55	2 Mbps	Zigbee 3.0 OpenThread	Concurrent / Open 2.4GHz	1024	256	-20 to +6	Touch sensing USB 2.0 FS LCD driver	ADC 16bits, Comparators Q-SPI	Cortex®- M4/M0+	72, 49, 30	UQFN48 VQFN68 UFBGA129 WLCSP100
STM32WB35	2 Mbps	Zigbee 3.0 OpenThread	Open 2.4GHz	512	96	-20 to +6	USB 2.0 FS	ADC 16bits, Comparators Q-SPI	Cortex®- M4/M0+	30	UQFN48
STM32WB15	2 Mbps		Open 2.4GHz	320	48	-20 to +6	Touch sensing	ADC 12bits Comparator	Cortex®- M4/M0+	37, 30	UQFN48 WLCSP49*
STM32WB Standard lines											
STM32WB50	1 Mbps	Zigbee 3.0 OpenThread		1024	128	-20 to +4	USB 2.0 FS	ADC 16bits	Cortex®- M4/M0+	30	UQFN48
STM32WB30	1 Mbps	Zigbee 3.0 OpenThread		512	96	-20 to +4			Cortex®- M4/M0+	30	UQFN48
STM32WB10	1 Mbps			320	48	-20 to +4			Cortex®- M4/M0+	30	UQFN48
STM32WB Standard lines											
STM32WB5M	2 Mbps	Zigbee 3.0 OpenThread	Concurrent / Open 2.4GHz	1024	256	-20 to +6	Touch sensing USB 2.0 FS LCD driver	ADC 16bits, Comparators Q-SPI	Cortex®- M4/M0+	68	LGA86

* Available in Q3 2021

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 @ 2.1 μ A
- Fast wake up @ 5 μ s

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

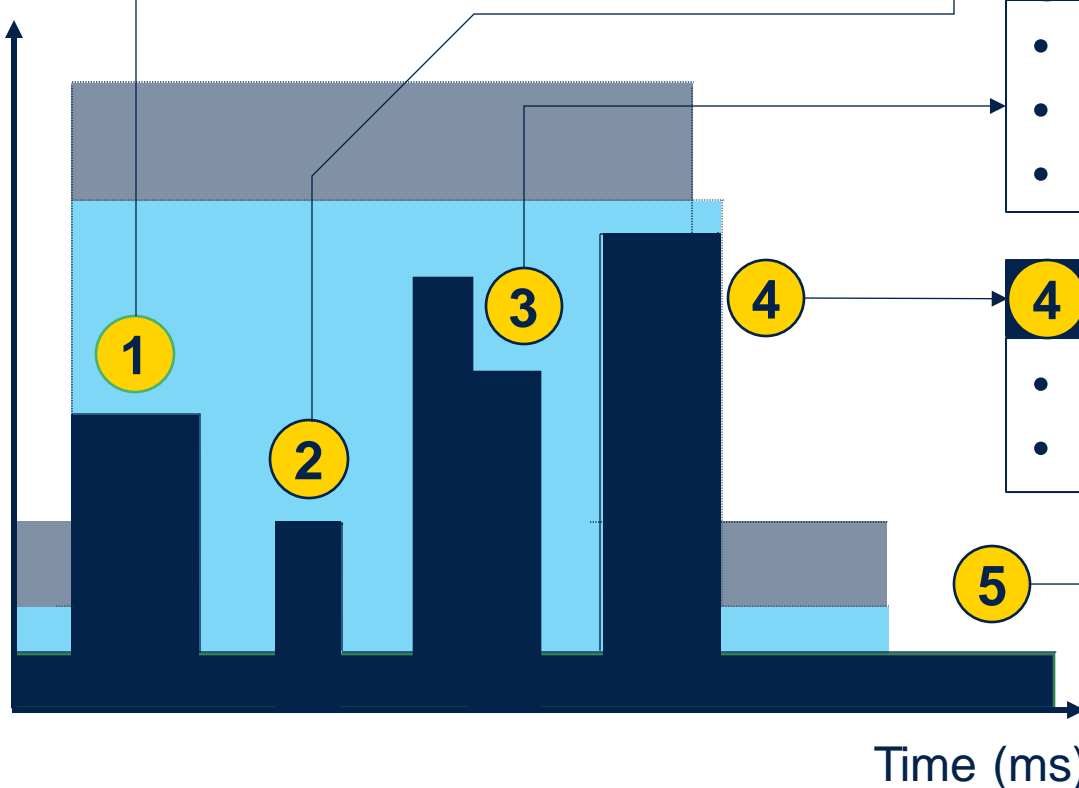
- 50 μ A/MHz only!
- Both Radio and Application running independently

5 Super saving mode

- Shutdown < 50 nA
- Battery energy saving

Power (mw)

Competitor A
Competitor B



All in one MCU full flexibility control

- Robust RF link **-100dBm** sensitivity with IEEE 802.15.4 and **+6 dBm** output power
- Upgrade legacy 802.15.4 device to **Bluetooth LE 5.2**
- **Update** securely Radio and stack firmware with build-in FUS
- Bluetooth 5 and 802.15.4 protocols **Mesh capable** to extend network range



Lighting

- **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**



Industrial devices

- **Beacon** profile available among a huge list
- **Embedded balun** to minimize design cost
- Only **5.2mA** **Radio TX** current to extend beacon lifetime
- **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



Beaconing



Fleet maintenance

- Retrofit legacy product to **Bluetooth LE 5.2** and concurrency mode
- Remotely upgrade device with **OTA capability**
- **Brand protection** with Authenticated **FW upgrade** system



Fitness/Healthcare

- **Multipoint** Bluetooth LE 5.2 connections
- Small form factor design with **CSP100 pins**
- Battery lifetime 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

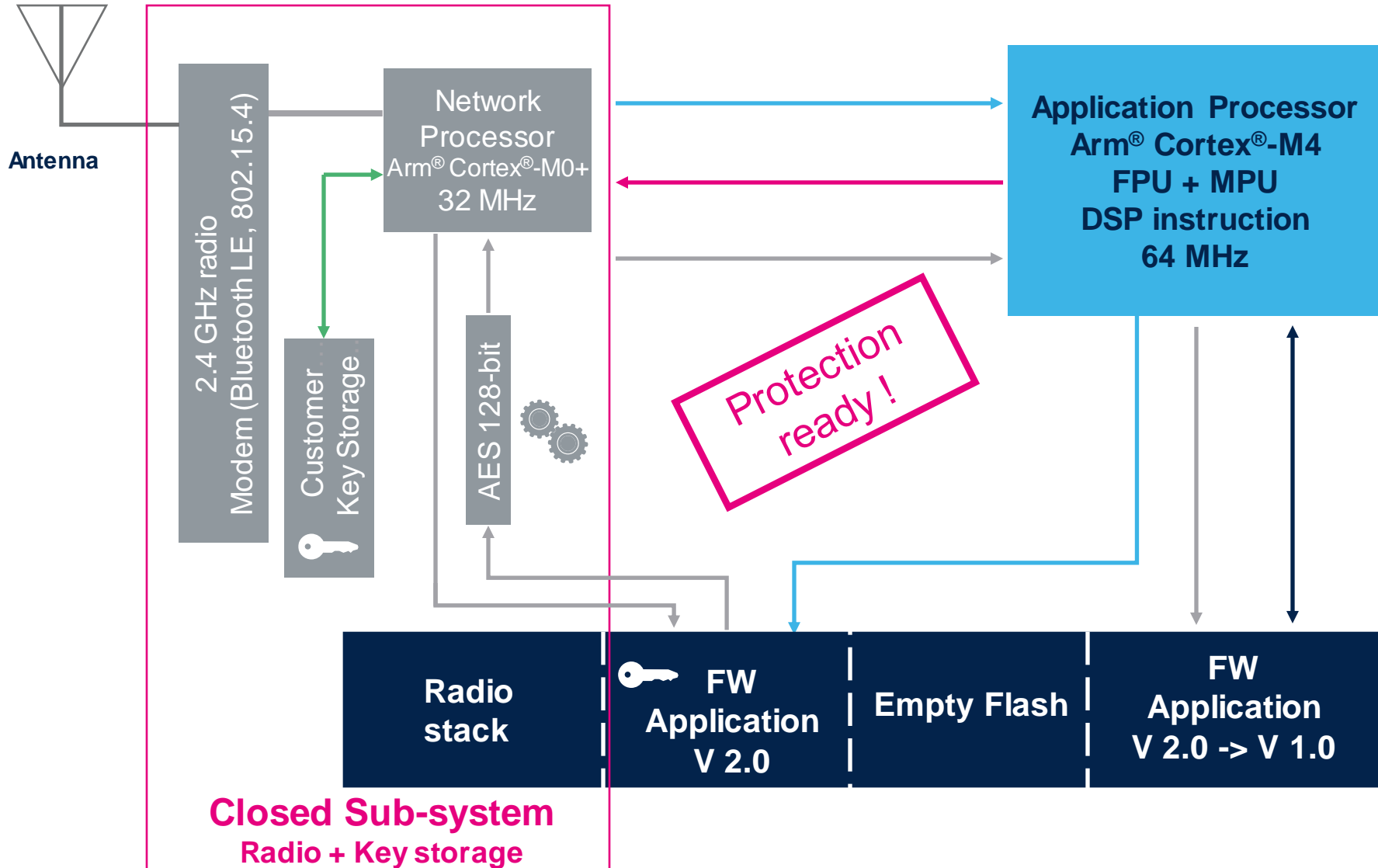


Home security and Audio

- **-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)

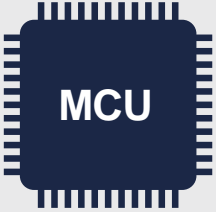

radio stack and/or application FW update



- 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

	Attacks	Attack's description	STM32WB Countermeasures
<p>Advanced</p> 	<p>Non-Invasive Attacks</p> <ul style="list-style-type: none"> • Environment modification <ul style="list-style-type: none"> • Temperature • Voltage • Clock • Fault injection (glitches....) • Exploit debug features • Side channel, power Analysis, ... 	<ul style="list-style-type: none"> • 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 	
<p>Basic</p> 	<p>Software Attacks</p> <ul style="list-style-type: none"> • Low Authentication / Encryption • Extract keys • Exploitation of applicative test features • Malware / Virus • Replay, privilege escalation 	<ul style="list-style-type: none"> • 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 	

Massive cost saving

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

Silicon cost

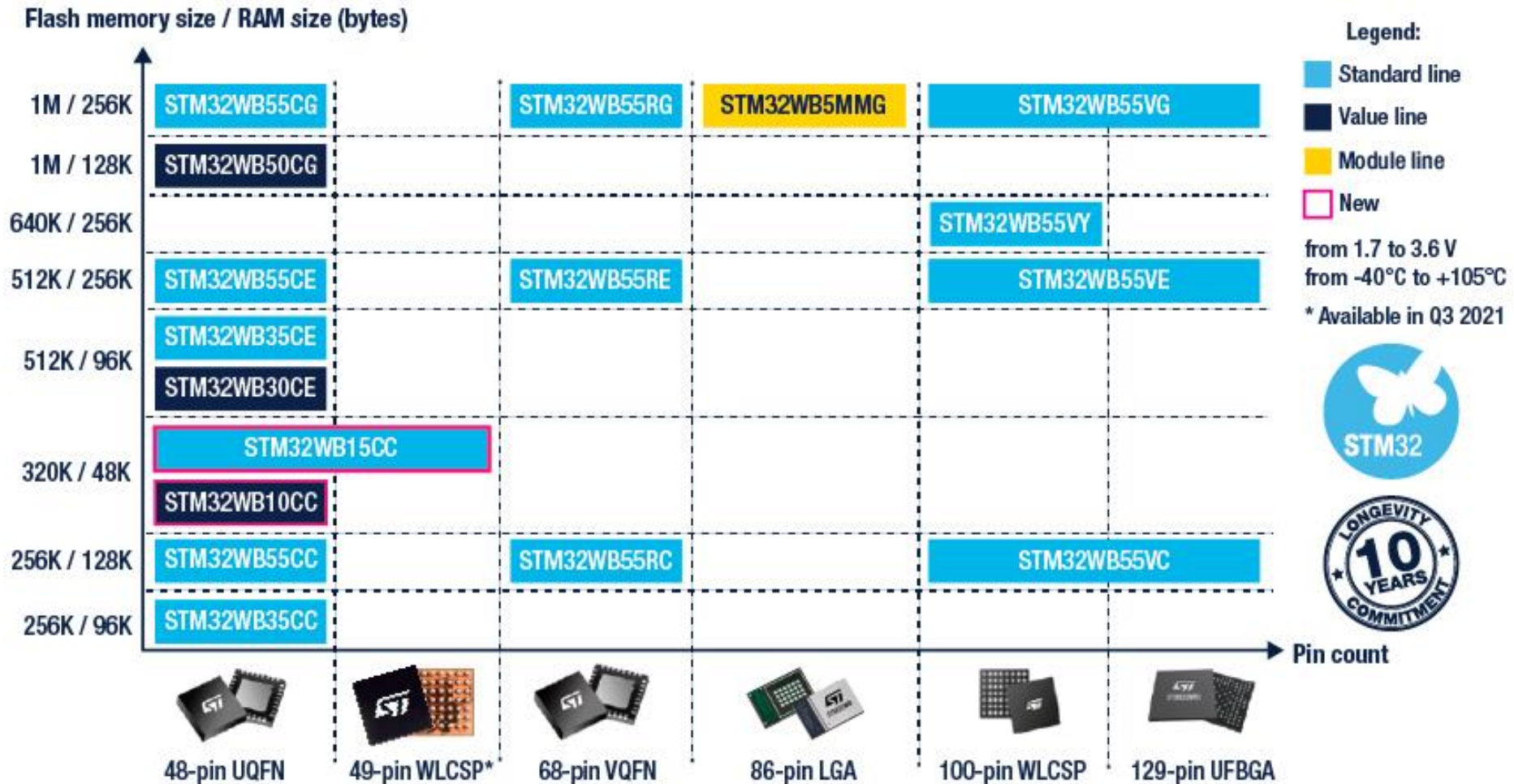
- RF balun cost: Embedded
- External components: 7
- 32 kHz Master clock output available
- Crystal for USB 2.0 FS operation: embedded
- LCD display booster: embedded (only single glass)
- Capacitive touch controller: embedded
- PCB cost: 2 layers PCB only

Free of charge Ecosystem

- Bluetooth LE™ 5.2 stack
- Zigbee 3.0 stack
- OpenThread stack
- Generic 802.15.4 MAC
- Generic HCI drivers
- STM32CubeMX
- STM32CubeMonRF
- IDEs (AC6: SW4STM32; ST: STM32CubeIDE)
- Bluetooth LE and 802.15.4 concurrency avoids to use a second radio MCU

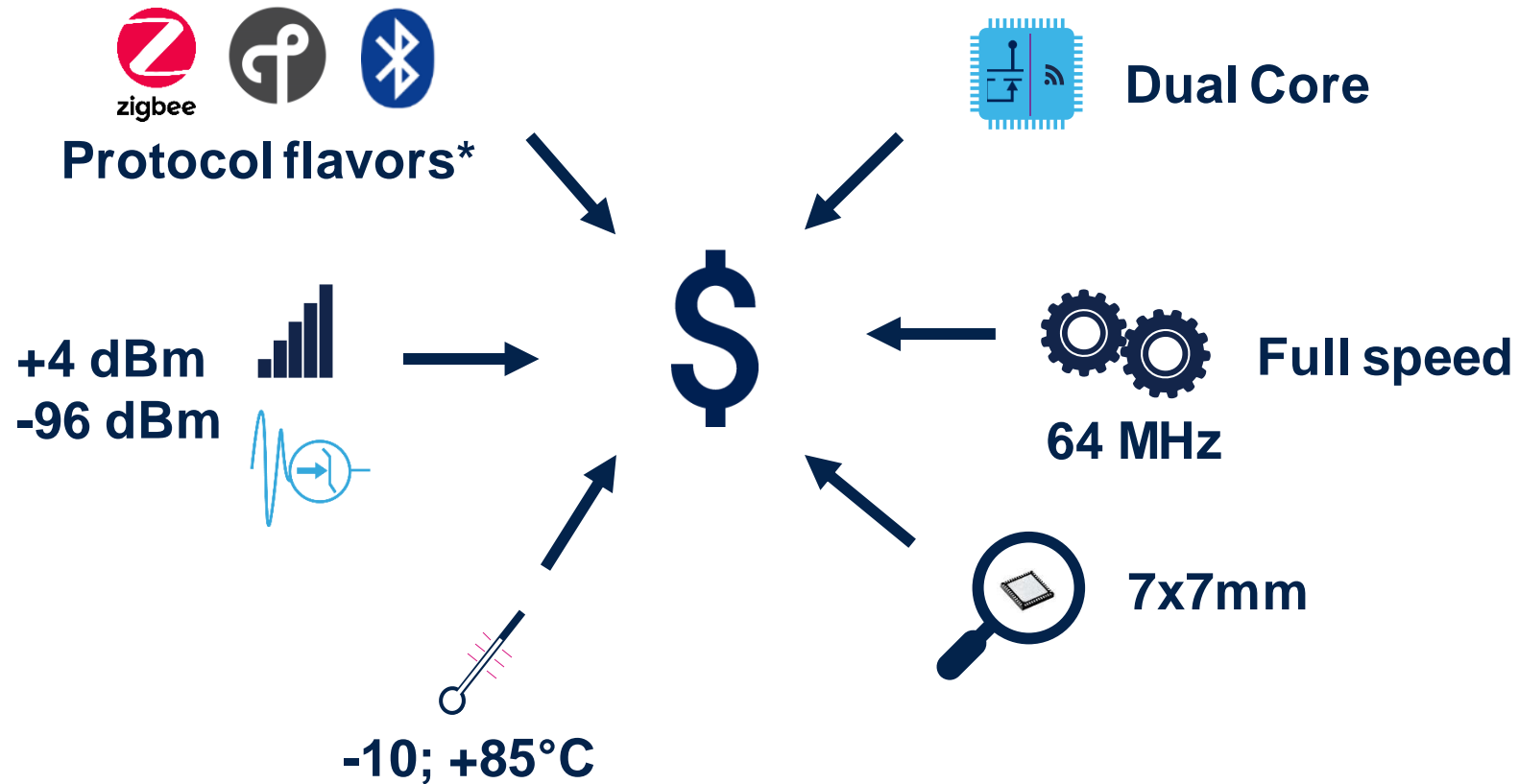
STM32WB - a large offer

Bluetooth LE 5.2, OpenThread, Zigbee 3.0
and proprietary protocol capable



STM32WB value lines

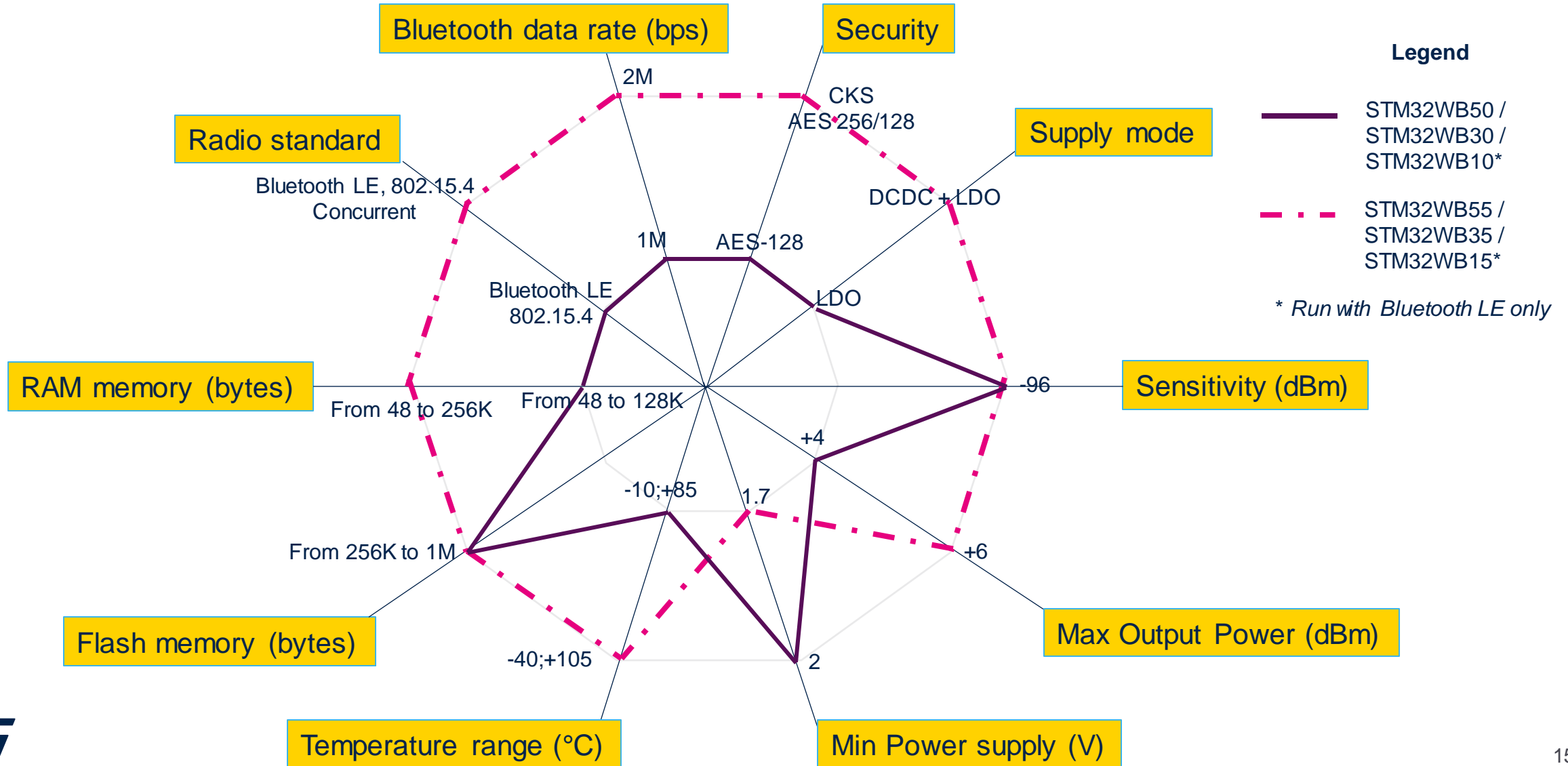
Essentials features product targeting
entry-level Bluetooth® LE 5.2 and Mesh applications



WB50	1MB Flash 128KB RAM
WB30	512KB Flash 96KB RAM
WB10	320KB Flash 48KB RAM

* Zigbee and Thread
not available on STM32WB10

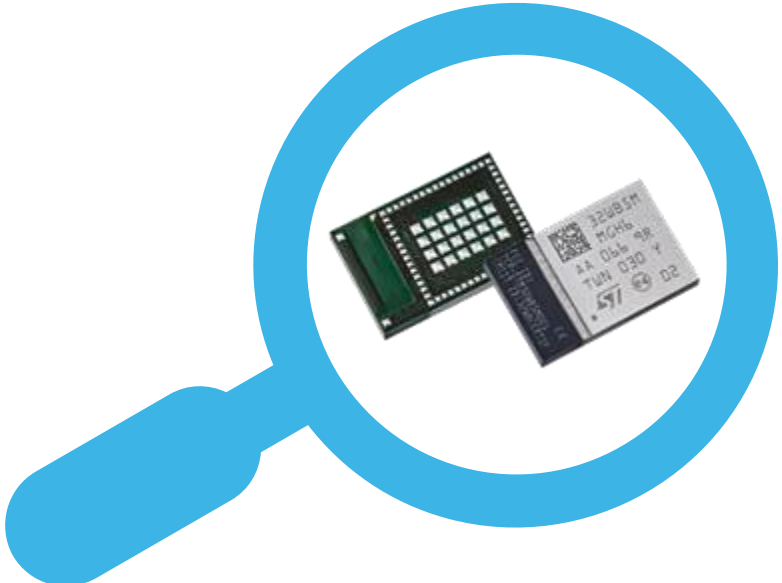
STM32WB50 / STM32WB30 / STM32WB10 positioning



STM32WB5M Module

Control	<ul style="list-style-type: none"> Power supply 1.8 to 3.6 V w/ DC/DC + POR/PDR/PVD/BOR Xtal oscillators 32 MHz (RF) 32.769 kHz (LSE) Internal RC oscillators 32 kHz+ 4 ~ 48 MHz + 16 MHz (HSI) + 48 MHz ± 1% acc. over V and T(°C) RTC/AWU/CSS PLL/FLL SysTick timer 2 watchdogs (WWDG/IWDG) Up to 68 GPIOs Cyclic redundancy check Voltage scaling (2 modes) 	Memory	<ul style="list-style-type: none"> 1-Mbyte Flash memory 256-Kbyte SRAM Boot ROM Secure boot loader
	<ul style="list-style-type: none"> Arm® Cortex®-M4 FPU/DSP 64 MHz Nested vector interrupt controller (NVIC) Memory protected unit (MPU) JTAG/SW debug 	Connectivity	<ul style="list-style-type: none"> 2 x SPI, 2 x I²C 1 x USART, LIN, Smartcard, IrDA Modem control 1 x ULP UART USB 2.0 FS - Xtal less Quad-SPI (XIP) SAI (full duplex)
	<ul style="list-style-type: none"> ART Accelerator™ AHB Bus matrix 2 x DMA 7 channels 	Timers	<ul style="list-style-type: none"> 4 x 16-bit 32-bit timers 2 x ULP 16-bit timers
	<ul style="list-style-type: none"> Multi-protocol RF stack Bluetooth™ 5 IEEE 802 15.4 AES 	Sensing	<ul style="list-style-type: none"> 16-key capacitive touch
	<ul style="list-style-type: none"> Arm® Cortex®-M0+ 32 MHz Nested vector interrupt controller (NVIC) 	Encryption/security	<ul style="list-style-type: none"> 256-bit AES/PKA TRNG/PCROP FUS/CKS
Analog	<ul style="list-style-type: none"> 2 x ULP comparators 1 x 12-bit ADC SAR 4.25 Msp Temperature sensor 	Display	<ul style="list-style-type: none"> 8 x 40 LCD driver

Flash memory / RAM size (bytes)



STM32WB5M multi-protocol module

Small form factor

7.3x11 mm

Full ref design up to antenna, crystals



Reduce the cost

Down to 2 PCB layers

Everything inside (single cap outside)

Free of charge radio stack

Certified FCC, CE, NCC, JRF, KC, SRRC, ISED, GOST

Multi-protocols



Strong feature set

Dual-core based

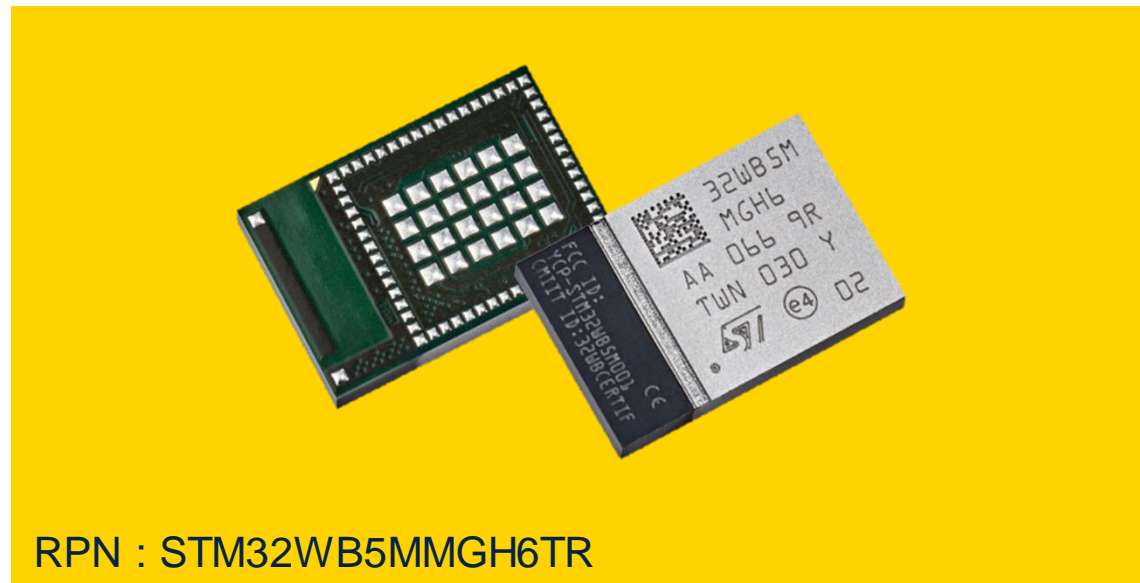
1MB Flash/256KB RAM

LCD, USB FS, ADC, COMP

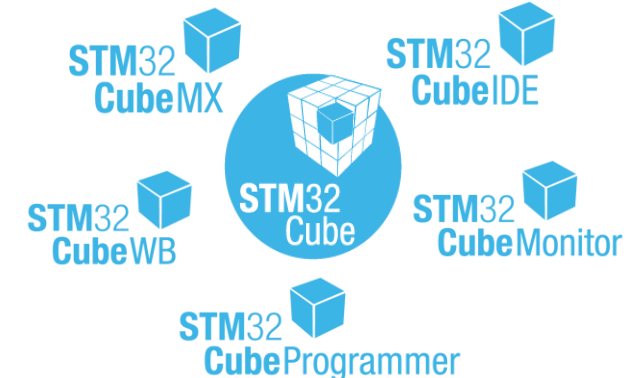
Security

OTA (application, radio)

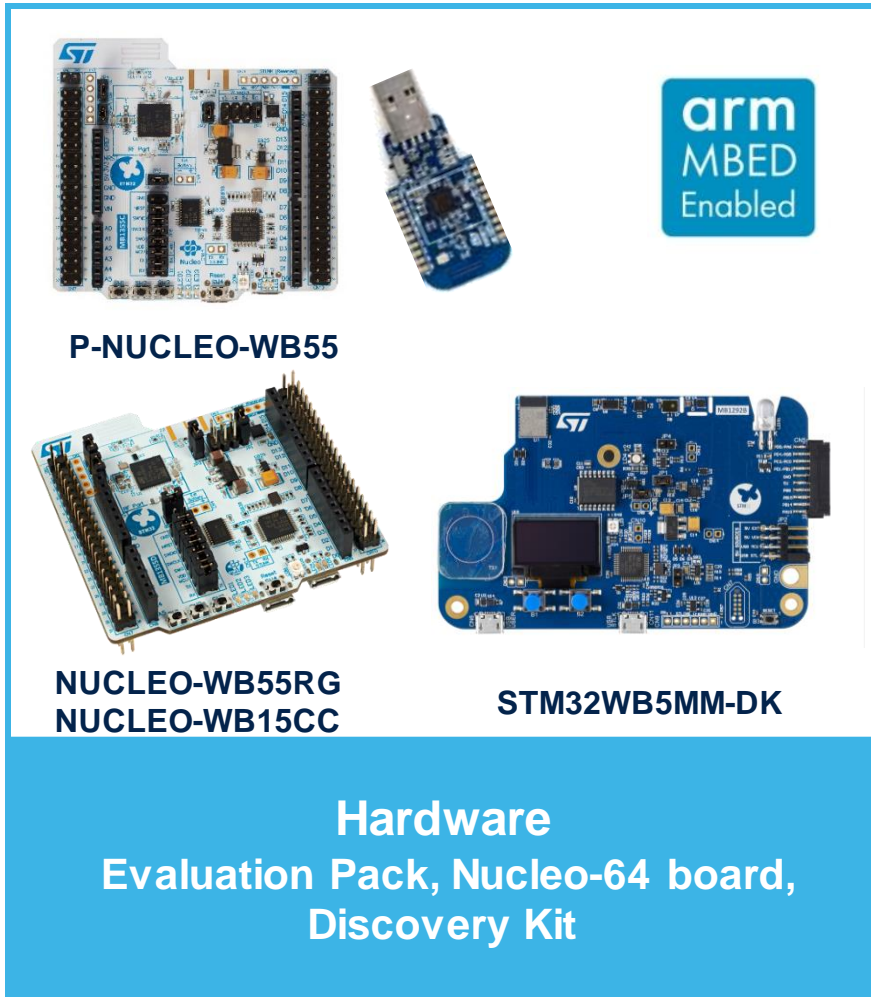
Discovery kit



STM32 ecosystem



Prototyping made as easy as 1,2,3



arm MBED Enabled

P-NUCLEO-WB55

NUCLEO-WB55RG
NUCLEO-WB15CC

STM32WB5MM-DK

Hardware Evaluation Pack, Nucleo-64 board, Discovery Kit



STM32CubeMonitor

STM32CubeProgrammer

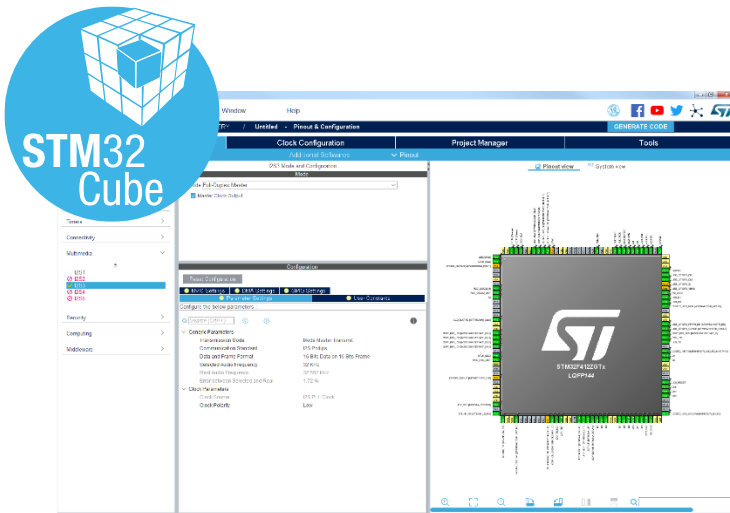
STM32CubeMX

STM32CubeMX/STM32CubeWB/STM32CubeProg & STM32CubeMonitor

Code generation
Power calculation

Software development tools

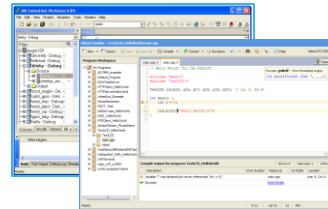
A complete flow, from configuration up to monitoring



STM32
CubeMX

STM32CubeMX, GUI Builders
Configure & Generate Code

FREE
IDE's



IAR
SYSTEMS

arm
KEIL

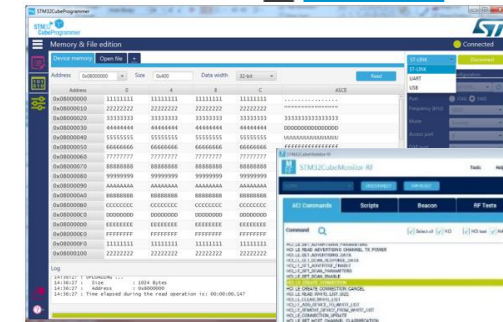
arm
MBED

STM32
CubeIDE

More to come after mass market launch

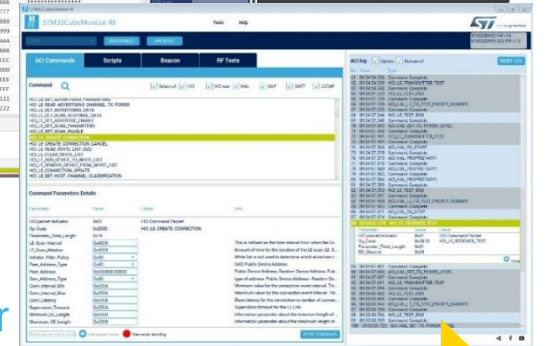
ST and Partner IDEs
Compile and Debug

STM32
CubeMonitor



Address	Subsector	Size	Quad	Data width	Sub-sec	Flash	Bank
0x00000000	11111111	11111111	11111111	11111111	11111111		
0x00000000	22222222	22222222	22222222	22222222	22222222		
0x00000000	33333333	33333333	33333333	33333333	33333333		
0x00000000	44444444	44444444	44444444	44444444	44444444		
0x00000000	55555555	55555555	55555555	55555555	55555555		
0x00000000	66666666	66666666	66666666	66666666	66666666		
0x00000000	77777777	77777777	77777777	77777777	77777777		
0x00000000	88888888	88888888	88888888	88888888	88888888		
0x00000000	99999999	99999999	99999999	99999999	99999999		
0x00000000	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA	AAAAAAAA		
0x00000000	BBBBBBBB	BBBBBBBB	BBBBBBBB	BBBBBBBB	BBBBBBBB		
0x00000000	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC	CCCCCCCC		
0x00000000	DDDDDDDD	DDDDDDDD	DDDDDDDD	DDDDDDDD	DDDDDDDD		
0x00000000	EEEEEEEE	EEEEEEEE	EEEEEEEE	EEEEEEEE	EEEEEEEE		
0x00000000	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF		
0x00000000	11111111	11111111	11111111	11111111	11111111		
0x00000000	22222222	22222222	22222222	22222222	22222222		

STM32
CubeProgrammer



STM32CubeProg/Monitor
Monitor, Program & Utilities

IPD - MLPF-WB-0xE3

Harmonic filter with integrated impedance matching

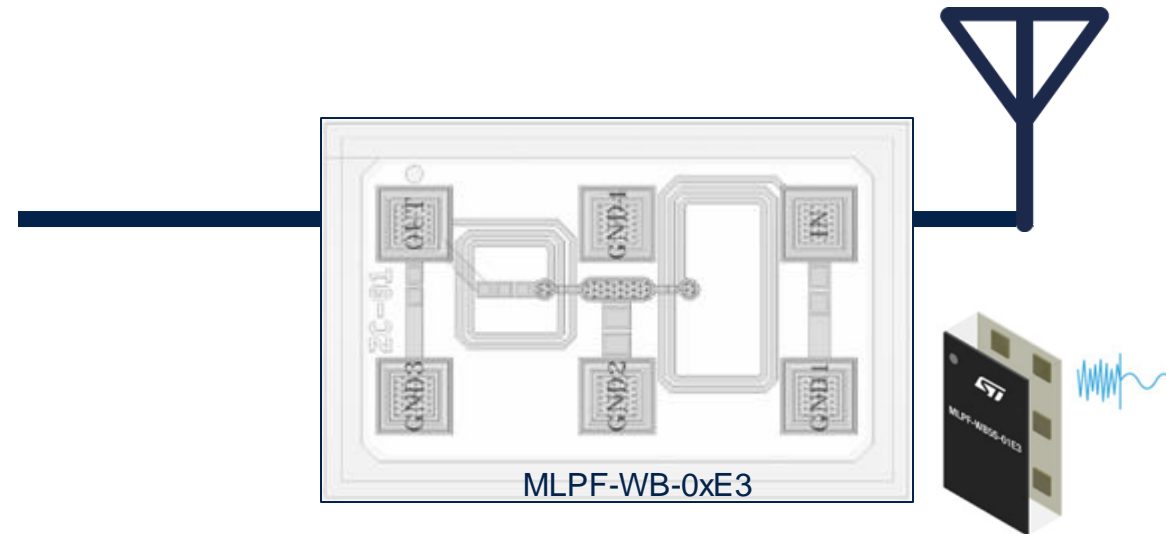


Integrated Balun

STM32WB

Arm Cortex-M4
Application firmware + Peripherals

Arm Cortex-M0+
Radio Stack



MLPF-WB-0xE3

MLPF-WB-0xE3

Integrated STM32WB **impedance matching**

Deep rejection **harmonic filter**

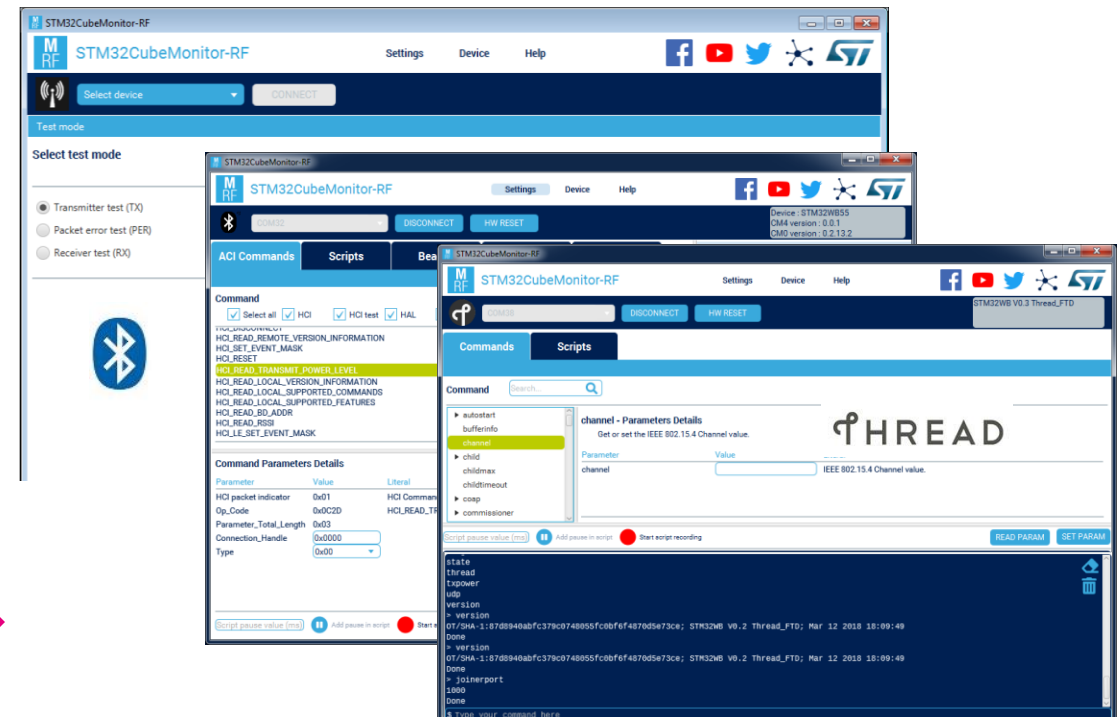
STM32CubeMonRF

- Exercise wireless features of STM32WB
 - Bluetooth Low Energy commands
 - Bluetooth LE RF tests
 - send OpenThread commands
 - perform 802.15.4 RF tests, sniff RF activity

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



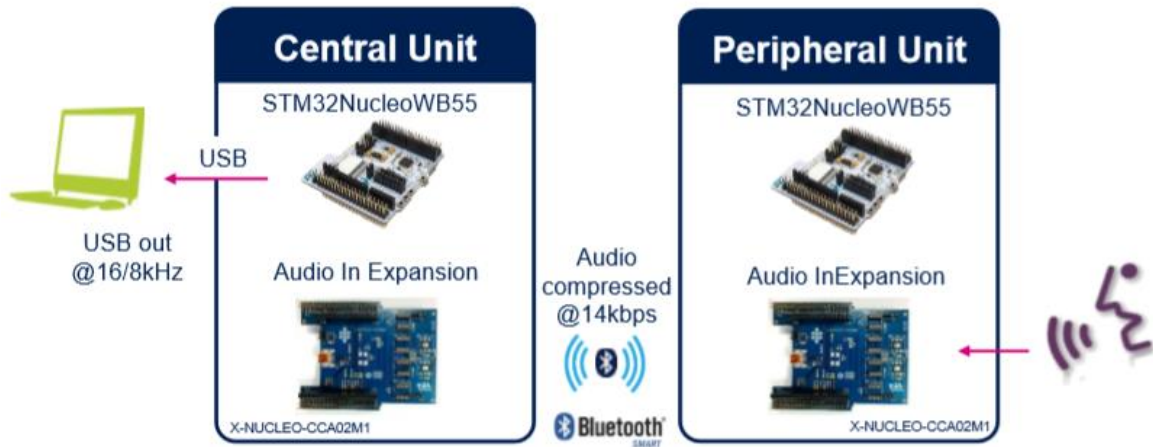
Mode selection



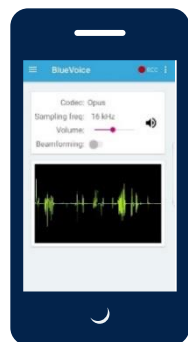
Advanced functionalities

Audio - Voice & streaming

Full-duplex audio streaming over Bluetooth LE 5.2 using Opus codec
 STM32Cube function pack for STM32WB MCU: [FP-AUD-BVLINKWB1](#)



STM32WB Nucleo development board
 +
 Digital MEMS microphones Expansion board



Both packages are compatible with **STBLESensor** app for iOS and Android

Sensor fusion & activity recognition

Bluetooth LE connectivity with environmental and motion sensors
 STM32Cube function pack for STM32WB MCU: [FP-SNS-MOTENVWB1](#)

This block shows the sensor fusion and activity recognition setup. A smartphone is connected via Bluetooth LE to an STM32WB Nucleo-64 development board with a Motion MEMS and Environmental Sensor Expansion board. Below this, a grid of 15 screenshots from the STBLESensor app is displayed, showcasing various sensor data and activity recognition features:

- Environmental page: Shows environmental data like humidity and temperature.
- Accelerometer plot: Displays a graph of accelerometer data.
- Led Status: Shows the status of a light sensor.
- DS3DSMDL Menu Events: Shows menu events from a DS3DSMDL sensor.
- RSS & Battery Page: Shows RSSI and battery level.
- Multiple events page: Shows multiple sensor events.
- Pedometer: Shows step counting data (e.g., 6 steps, 83 step/min).
- Wake Up: Shows wake-up events.
- Orientation: Shows orientation data.
- MotorFX sensor fusion page: Shows fused sensor data.
- MotorFX - compass: Shows a digital compass.
- MotorCP carry position recognition page: Shows carry position recognition.
- MotorGR gesture recognition page: Shows gesture recognition.
- MotorPM Pedometer page: Shows pedometer data.
- MotorAR activity recognition page: Shows activity recognition (e.g., walking, running, cycling).
- MotorID motion intensity page: Shows motion intensity data.

Releasing your creativity



[/STM32](#)



[@ST_World](#)



[community.st.com](#)



[www.st.com/STM32WB](#)



[wiki.st.com/stm32mcu](#)



[github.com/STMicroelectronics](#)



[STM32WB online training](#)



[STM32WB blog article](#)



[MOOC – STM32WB workshop](#)



Our technology starts with You



Find out more at www.st.com/stm32wb

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