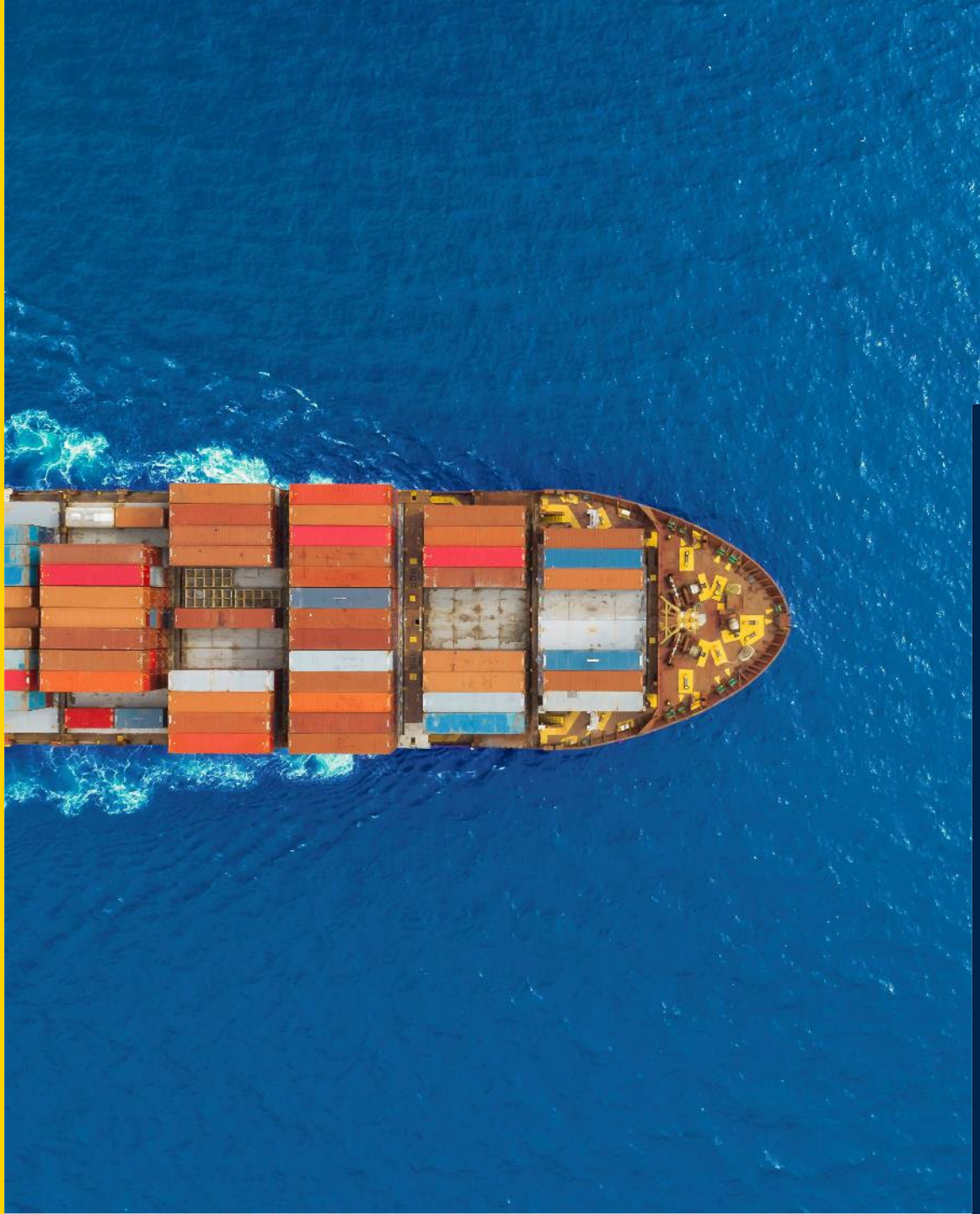

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STM32WL MCU series wireless System-on-Chip

Long-range communications

STM32

The STM32 MCU & MPU portfolio

General-purpose MCUs

- Wireless MCU
- Ultralow power MCU
- Mainstream MCU
- High Performance MCU
- Embedded MPU

5 product ranges

3,300+ part numbers

See full MCU portfolio

See full MPU portfolio

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A long-range System-on-Chip solution

One die, many IoT possibilities

Single Silicon Die

STM32L4

+

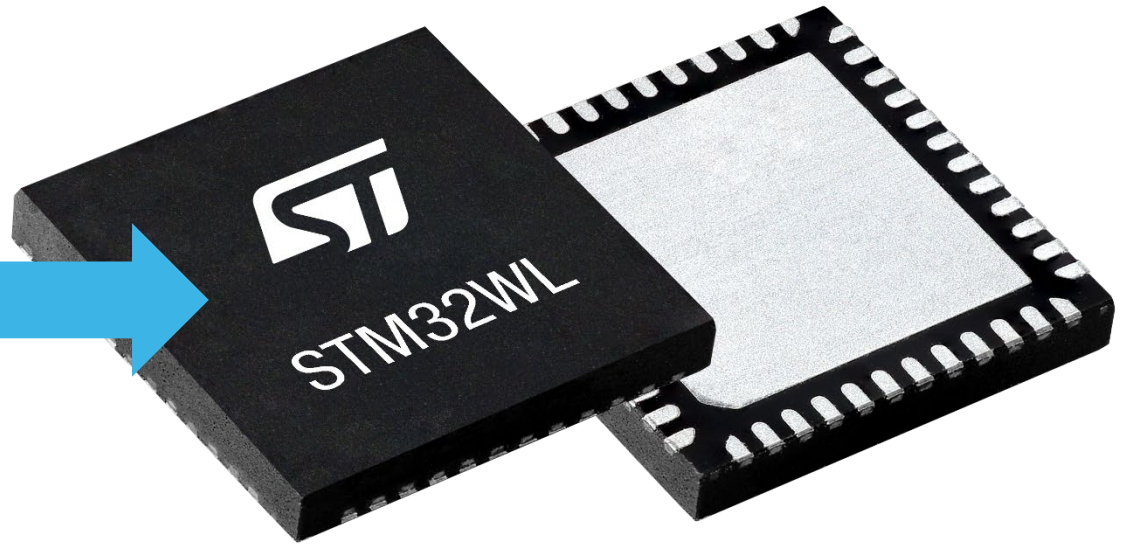
LoRa®

(G)FSK
(G)MSK
BPSK

+

Arm Cortex®-M0+

World first!



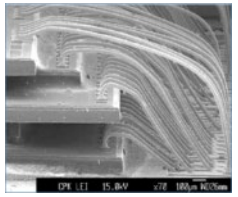
The integration pyramid

STM32WL
First LoRa-enabled SoC in the world

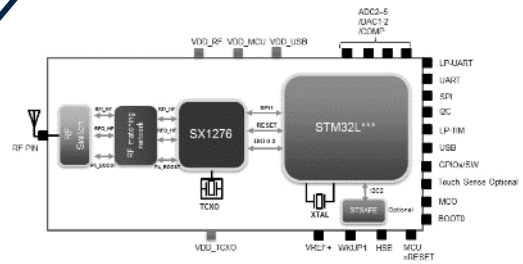
System-on-Chip (SoC)
Only one silicon die in one package

System-in-Package

*Different **silicon dice** inside the same package*



Source: PTI Blog

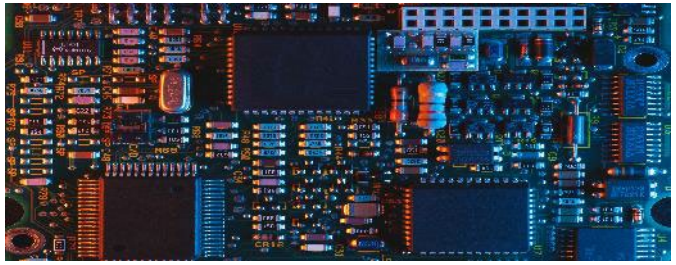


*Different **packages** on a very tiny piece of re-packaged PCB*

Module

PCB

*Different discrete **packages** on a BIG electronic board*



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Make the choice of the STM32WL series

The 8 key points that make the difference

(G)FSK
(G)MSK
BPSK

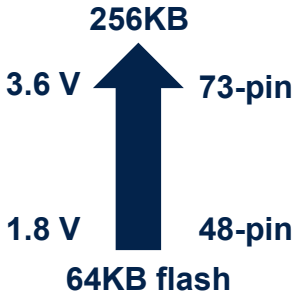
Multi-modulation

Massive integration
Cost saving

Open dual-core platform

Ultra-low-power

STM32 security



A large offer

End-to-end ecosystem
(advanced RF testing tool,
C code generation tool…)

No matter what!

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The STM32WL ecosystem is growing

LoRaWAN®

2019 — World-first LoRa-enabled SoC

2020 — STM32WL dual-core version; UFQFPN48 package

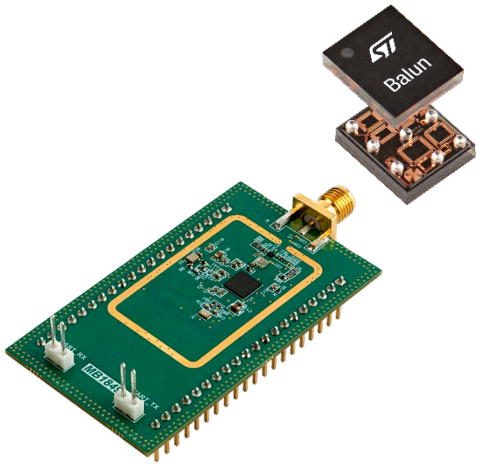
2021 — Long Packet support; LoRaWAN® 1.0.4 certification

2022 — LR-FHSS support; Reference designs & IPD

LoRa®

(G)FSK
(G)MSK
BPSK

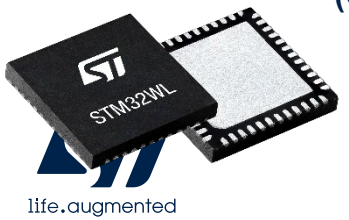
IoT World AWARDS 2020 Winner



Integration

Flexibility

Simplicity



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Deep integration for a wide range of applications

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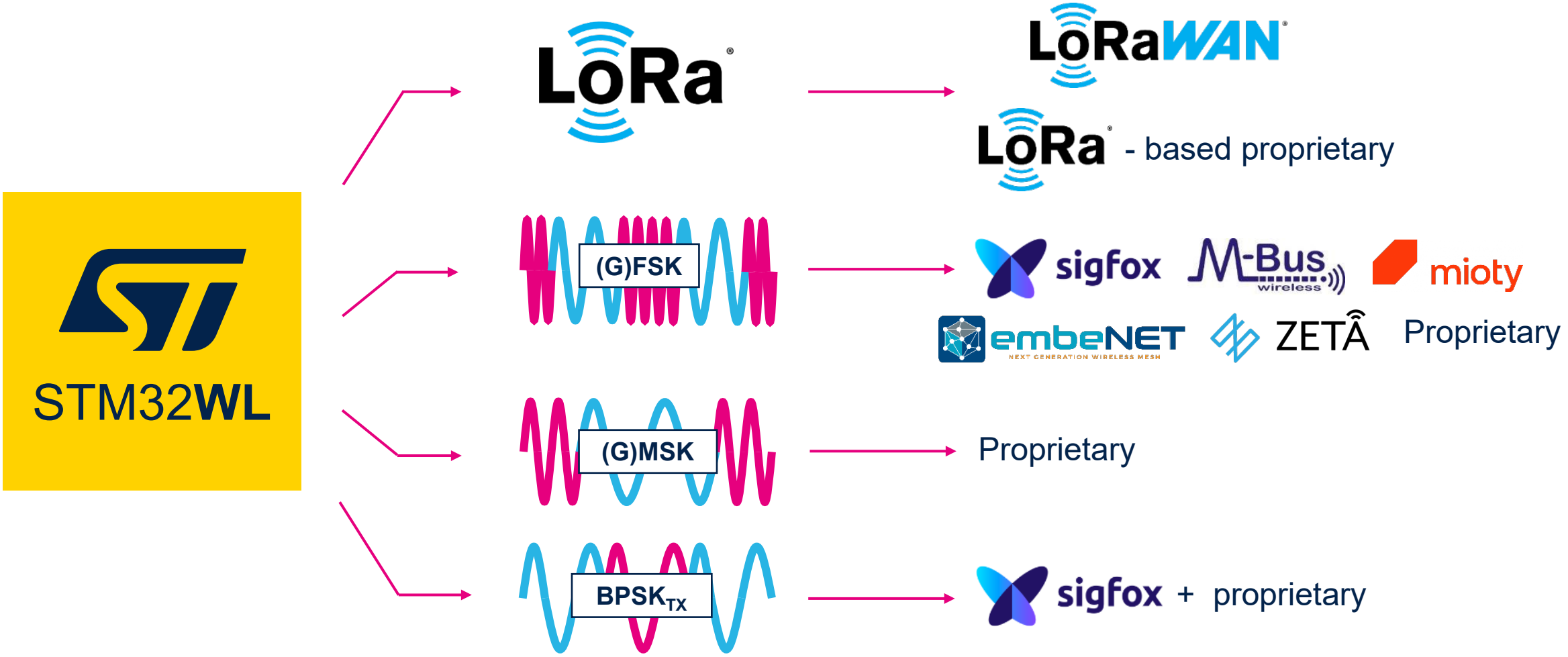
4 modulations - many protocols



STM32WL sub-GHz - portfolio

Flash / RAM Size (bytes)

256K / 64K

256K / 64K

128K / 48K

64K / 20K

Up to 29 GPIOs
+
Optimized BOM cost
+
2-Layer PCB enablement

STM32WL5xCC	STM32WL5xJC
STM32WLExCC	STM32WLExJC
STM32WLExCB	STM32WLExJB
STM32WLExC8	STM32WLExJ8

Up to 43 GPIOs for full flexibility
+
Tiny package footprint

48 pins
7x7mm
UQFN (p=0.5)

73 pins
5x5 mm
BGA (p=0.5)

Pin count

Dual core

Single core

Note:
x = 5 all modulations available
x = 4 all modulations available except LoRa

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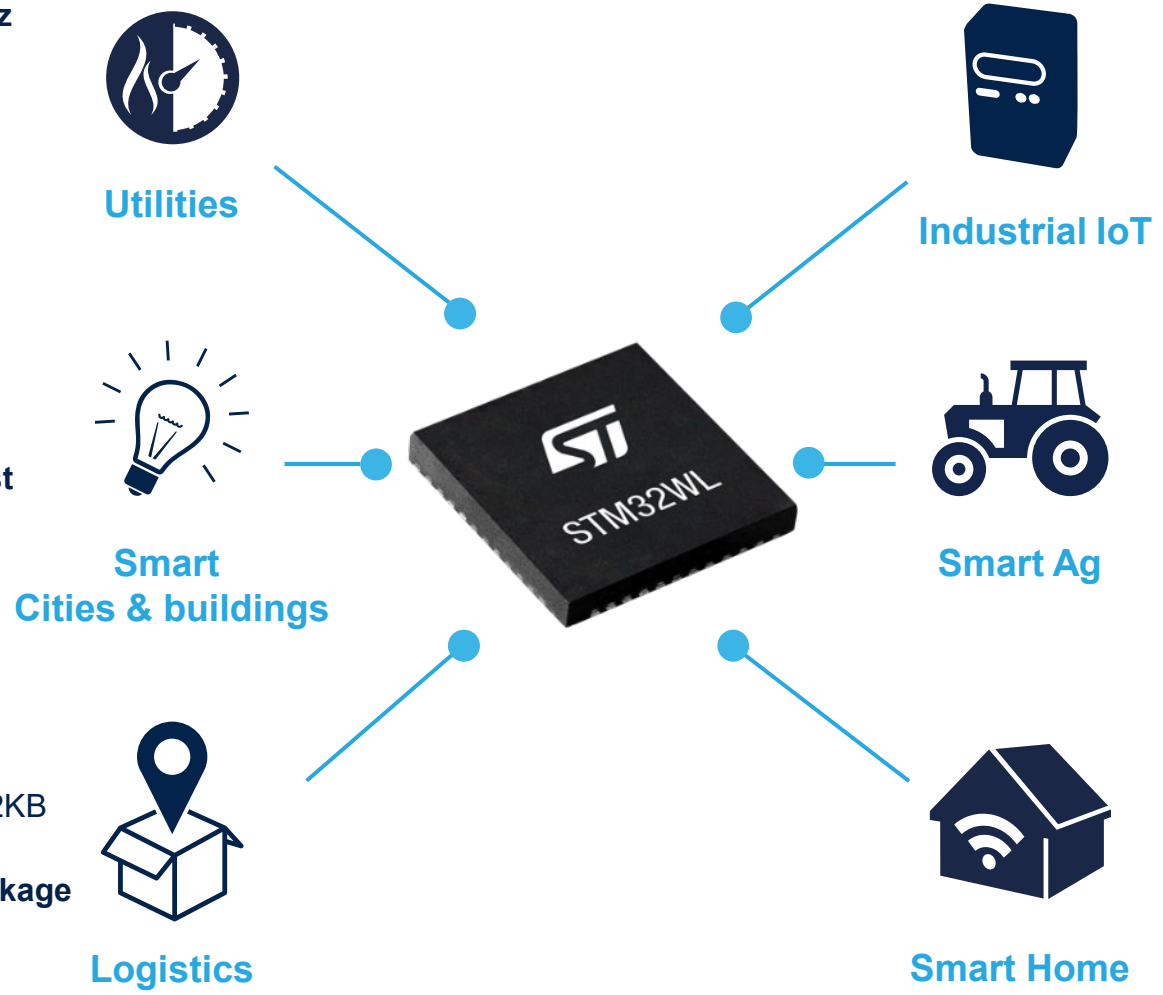
Ideal for multiple applications in the LPWAN market

- Worldwide compatibility **150 to 960 MHz** Linear Range
- Multiprotocol capable
- ST Longevity commitment program: continuous supply for **10 years**

- Up to +22 dBm output power for wide coverage
- **-148 dBm** sensitivity with LoRa: **Robust RF Link**
- **Reduced BOM cost**

- **Unique-IDs** for enhanced traceability
- Down to 390 nA mode with RTC and 32KB of RAM for extended Battery lifetime
- Small form factor with **UFBGA 5x5 package**



- Up to **105 °C** MCU capable
- **Only 5 µs wake up time** for best latencies
- Only 4.82 mA as LoRa Rx consumption for battery optimization

- Link budget > **160 dB** = Very long ranges
- Excellent battery lifetime: Only 15 mA for LoRa Tx consumption @ 10 dBm
- **PCROP**, **ECC**, TRNG, **PKA**, for best design robustness

- Down to 71 µA/MHz in run mode for efficient action
- < 1 µA stop mode with full RAM for **battery life** optimization
- 12-bit ADC & DAC for mixed applicative use cases

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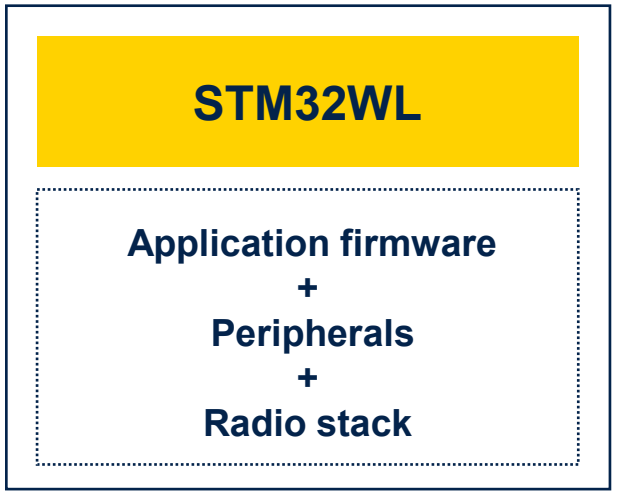
A higher level of integration

MCU + radio, a 2-in-1 solution



VS

- SoC solution **(1 single die)**
- **All-in-1** solution - cost saving
- Simplified development helps speeding up time to market
- Mono-core or dual-core version for excellent security

- **2 standalone chips, or dice (SiP)**
- Bigger final PCB (increased cost)
- Wired communication more exposed

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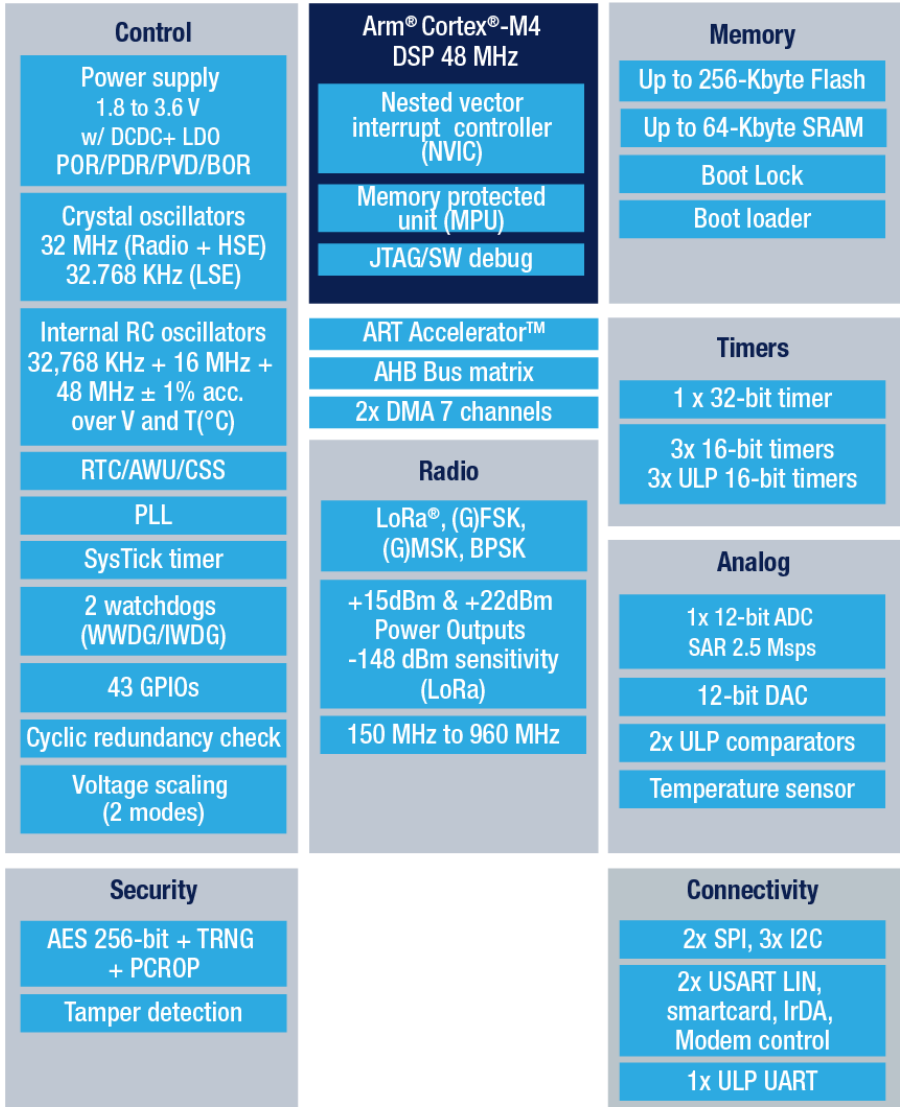
STM32WLEx line - a rich feature set



KEY FEATURES

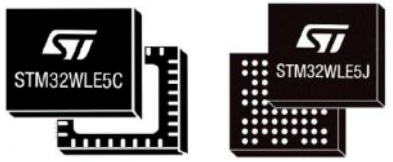
- Arm® Cortex®-M4 & DSP up to 48 MHz
- Up to 256 Kbytes of flash memory and 64 Kbytes of SRAM

- **sub-GHz radio**
  - Multimodulation: LoRa, (G)FSK, (G)MSK, BPSK
  - 2 embedded power amplifiers:
    - 1 output up to +15 dBm
    - 1 output up to +22 dBm
  - LoRa RX sensitivity: -148 dBm (SF12, BW=10.4kHz)
  - RX: 4.82mA and TX: 15mA (at 10dBm) / 87mA (at 20dBm) [3.3V]

- **Ultra-Low Power consumption**
  - < 71µA/MHz Active mode (3V - RF OFF)
  - 1 µA Stop2 mode with RAM retention
  - 390 nA Standby mode with RTC
  - 31 nA Shutdown mode

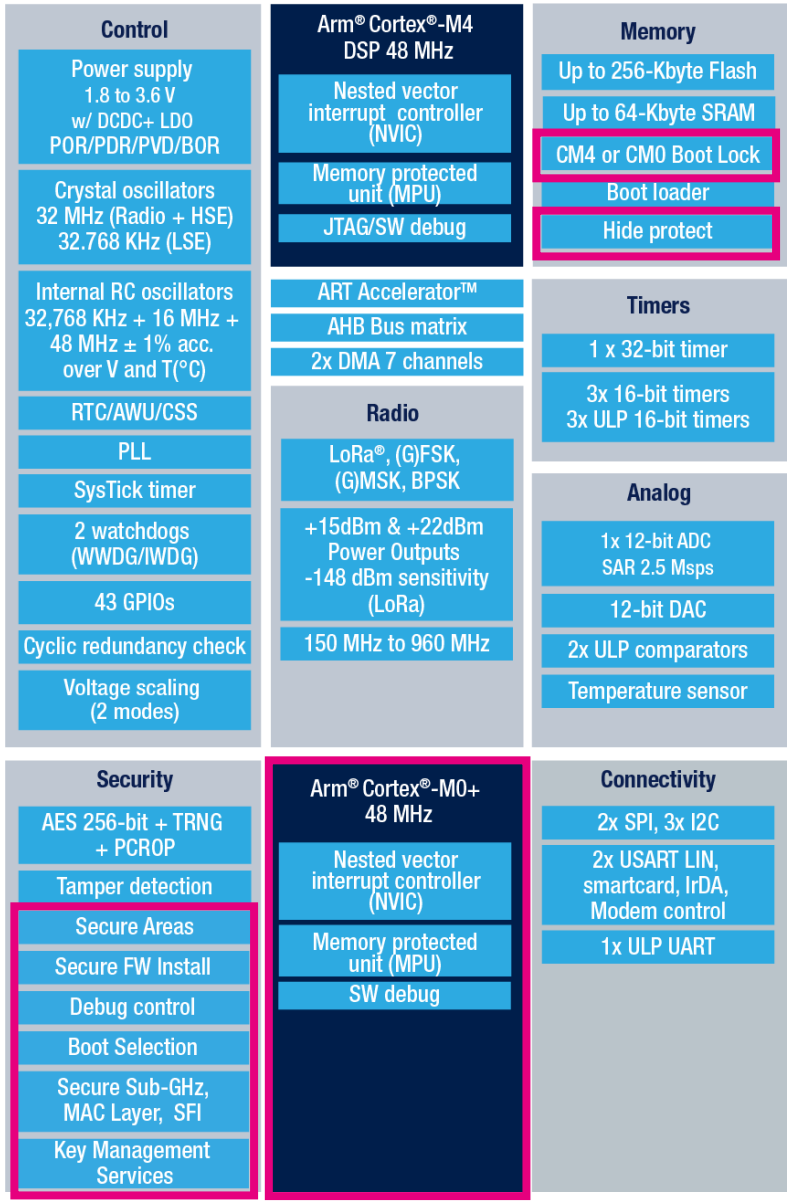
- **Peripherals**
  - 3xI²C, 2xUSART, 1xLP-UART, 2xSPI
  - 7x timers + 2x ULP Comparators

- 1.8 to 3.6V voltage range (DC/DC, LDO)
- -40 to up to +105°C temperature range



-> Packages: QFN48, BGA73

STM32WL5x line - a rich feature set
Dual-core and enhanced security



KEY FEATURES

- Arm® Cortex®-M4 & DSP up to 48 MHz
- Up to 256 Kbytes of Flash and 64 Kbytes of SRAM
- Arm® Cortex®-M0+ up to 48 MHz

- **sub-GHz Radio**
  - Multi-modulation: LoRa, (G)FSK, (G)MSK, BPSK
  - 2 embedded power amplifiers:
    - 1 output up to +15 dBm
    - 1 output up to +22 dBm
  - LoRa RX sensitivity: -148 dBm (SF12, BW=10.4kHz)
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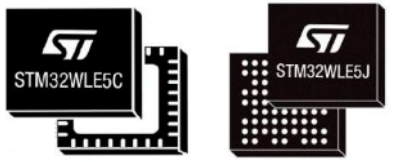
- **Ultra-Low Power consumption**
  - < 71µA/MHz Active mode (3V - RF OFF)
  - 1 µA Stop2 mode with RAM retention
  - 390 nA Standby mode with RTC
  - 31 nA Shutdown mode

- **Peripherals**
  - 3xI²C, 2xUSART, 1xLP-UART, 2xSPI
  - 7x timers + 2x ULP Comparators

- **Advanced security features**

- 1.8 to 3.6V voltage range (DC/DC, LDO)
- -40 to up to +105°C temperature range



-> Packages: QFN48, BGA73

A flexible power scheme

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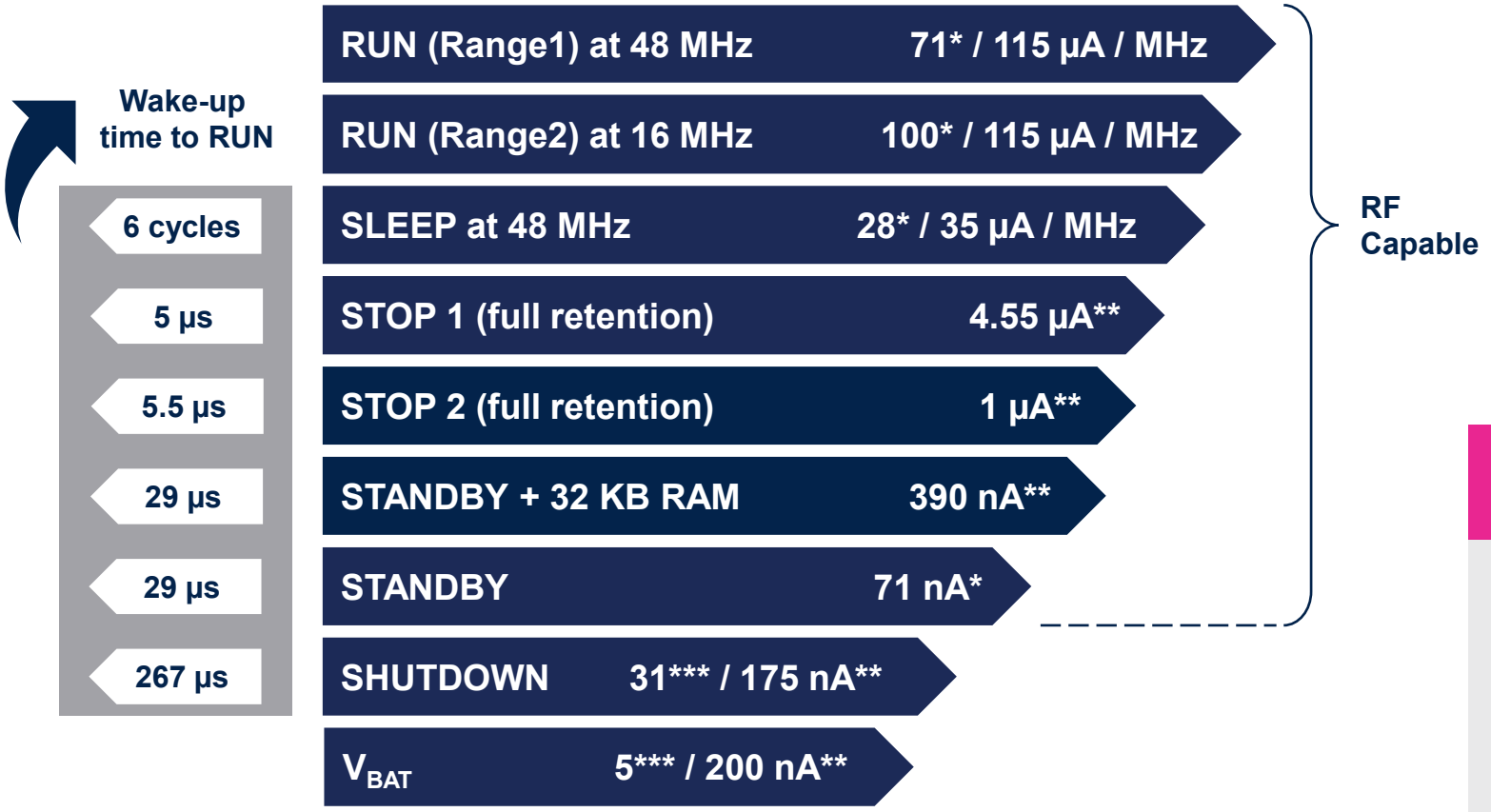
Flexible power scheme FlexPowerControl

Typ with LDO @ V_{DD} = 3 V @ 25 °C



* Typical values with SMPS, **RF OFF**
** with RTC on LSE Bypass
*** All OFF

Benchmark scores

- High efficiency
  - ➔ CoreMark score = 162
- Ultralow power platform
  - ➔ ULPBbench score ≈ 204

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Flexible power scheme matching your application needs

LPWAN made easy through ultra-low-power trade-offs

Power mode	Arm® Cortex®-M4 and/or Cortex-M0+	Peripherals	RAM Retention	RF
Run	✓	✓	✓	✓
Sleep	✗	✓	✓	✓
Stop 0	✗	✓	✓	✓
Stop 1	✗	✓	✓	✓
Stop 2	✗	Subset	✓	✓
Standby	✗	✗	✓	✓
Shutdown	✗	✗	✗	✗

Seamless toolbox
(I²C, SPI, USART, ADC/DAC, Timers, comparators etc.)

RF available
In all power modes

Back-up registers are **always** available

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Efficient power management stop mode comparison

Flexible peripherals: power mapping

		STOP0	STOP1	STOP2
Consumption (without real-time clock)		Typ, 25 °C, 3 V, LDO		
		400 µA	4.55 µA	1 µA
Wake up time to 48 MHz	**Flash**	2.2 µs	5 µs	5.5 µs
	RAM	2.2 µs	5.1 µs	5.5 µs
Wake up clock		≤ 48 MHz		
Regulator		Main or Low-Power regulator		Low-power regulator
Peripherals		All	All	CSS, RTC, 3 tamper pins, 1x LPUART, 1x I²C, VREFBUF, 2x COMP, 1x LPTIM, Dual-WDG, CRC, EXTI

No impact on wake up time from embedded DCDC

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Ultralow power & IoT-ready for worldwide applications

Best LoRa-enabled IP on the market

Transmission		
Parameter	Settings	Value
TX	+10 dBm 868/915 MHz	15 mA DCDC
TX	+20 dBm 868/915 MHz	87 mA DCDC

Worldwide compatibility

Reception		
Parameter	Settings	Value
LoRa sensitivity	BW_L = 10.4 kHz SF = 12	-148 dBm
2-FSK Sensitivity	BR_F = 0.6 kb/s FDA = 0.8 kHz BW_F = 4 kHz	-125 dBm
RX	FSK 4.8kb/s buck 100mA max	4.47 mA DCDC 8.18 mA LDO
RX	LoRa® 125 kHz	4.82 mA DCDC 8.9 mA LDO

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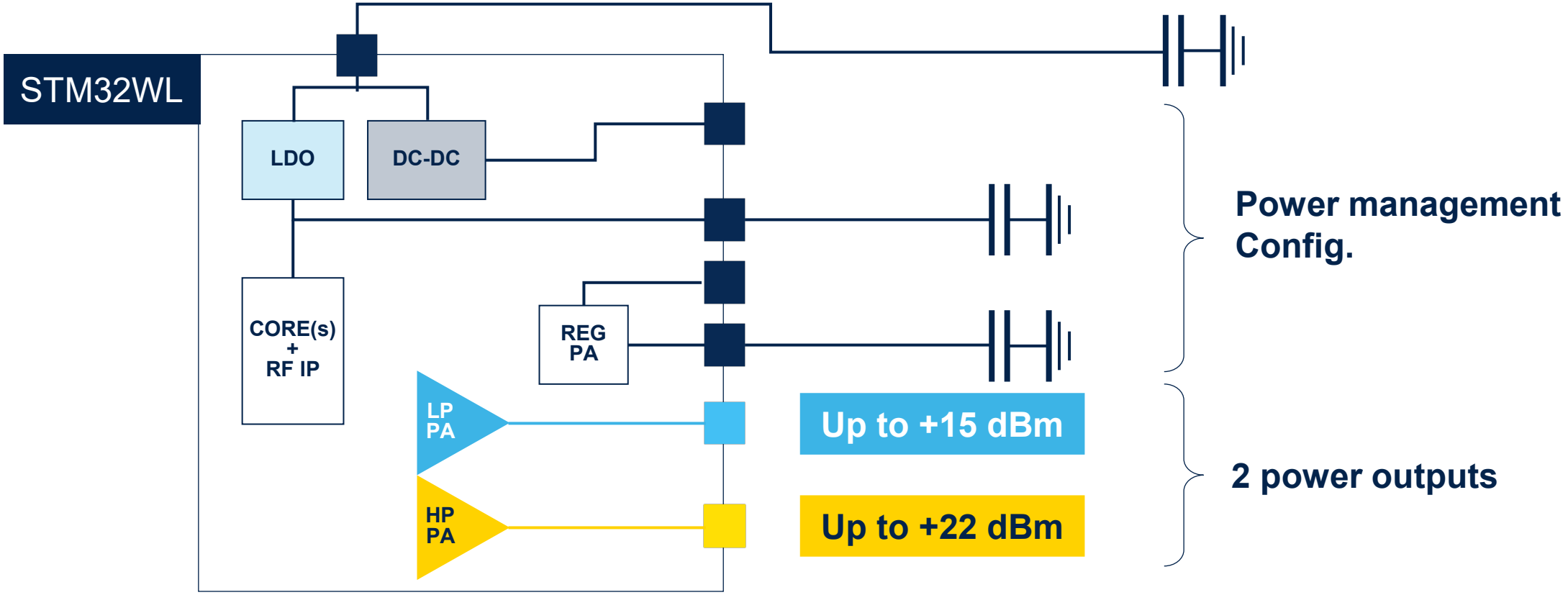
Flexible power implementation

Tailor STM32WL to the requirements of IoT applications



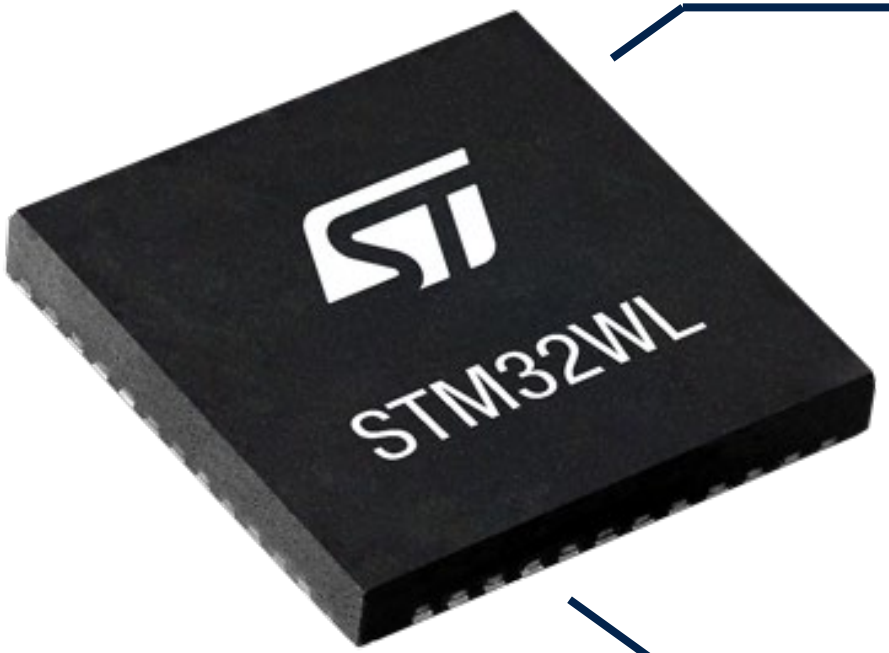
STM32WL: no more TCXO!

Minimize your BOM costs, maximize your revenues

LoRaWAN®

AND / OR

sigfox



No need for TCXOs: a simple crystal (XO) is all you need

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Advanced features, security, and stacks

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Safety and security

Secure your application with embedded safety & security

Safety

- Back-up clock circuitry
- Supply monitoring
- Dual watchdog
- Flash memory with ECC (address status register)
- SRAM Parity check
- Cyclic Redundancy Check
- Brown-out reset in all modes
- Clock security system
- Backup byte registers

STM32**WL**

Security

- Tamper detection
- Read & Write protection
- Memory protection unit (MPU)
- Software IP Protection
- True random number generator
- AES and public key accelerator
- Unique IDs (64- and 96-bit)
- Boot-Lock in user flash memory

- **Secure hardware isolation between CM4 / CM0**
- **Boot selection**
- **Secure boot code protection**
- **Debug control**
- **Secure firmware install**
- **Secure Boot Secure Firmware Update***
- **Key Management Services***
- **Crypto Library***

Available on STM32WL5x dual-core versions

** Software downloadable on st.com*

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Extended security

Dual-core security features

Data encryption

Secure Key Management Services

- Store keys in a dedicated memory area
- Secure memory area size is programmable
- Any type of key or secure object can be stored

Secure download

Secure Firmware Install or Update

- Embedded Secure Firmware Install (SFI) to secure manufacturing from untrusted manufacturer
- Customizable In the-field update (SBSFU) to perform extremely secure upgrade of the platform

Firmware IP Protection

Secure Boot (Root of trust)

- Boot from the right secure memory location
- Each application firmware is authenticated before being executed

Authentication

Crypto

- Embedded HW crypto accelerators for high performances. Supports ECC signature generation and verification
- True Random Generator
- Software Crypto Library to support additionally DES/TDES, ARC4, HASH, Poly, CHACHA, MD5 etc.

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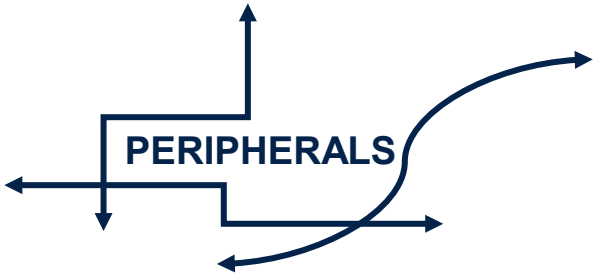
STM32WL the most secure sub-GHz SoC

Security in every corner with a dual-core architecture

- Secure System Flash Area (SFI/RSS)
- Memory Privilege watermarking, controlled by Secure Areas for the Flash and SRAM areas + Hide Protected Area (HDPA)
- Cortex-M0+ SRAM execution prevention



- Secure Area-aware configurable peripherals :
  - AES, PKA, TRNG, SPI3
  - DMA/DMAMUX channels
- Security by Option Bytes

- Independent configurable debug access to CM4 and CM0+
- Customer Secure Boot can be protected against debug
- Cortex-M0+ debug:
  - Can be disabled by User Option.
  - Disabled when executing system Flash SFI/RSS services

Configurable Flash Interface

Secure Areas & Interrupt Controllers

Power Controller

Secure boot and chain of trust

Firmware start and execution are always trusted

- A secure Boot, locked and protected against debug, is executed first at reset
- Next steps are authenticated and certified (RF stack & User Application)
- Next execution steps can then be started in a trusted way

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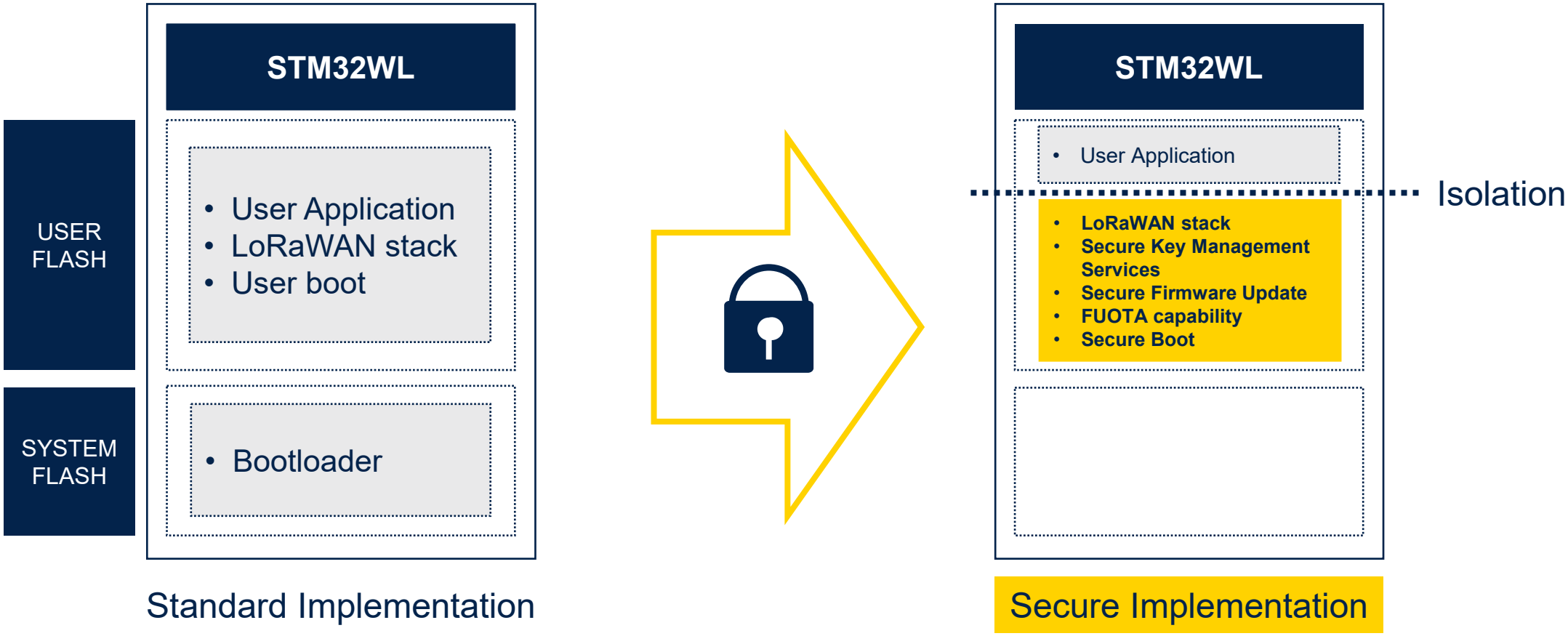
Bring more security to your LoRaWAN® apps

Your implementation, your choice



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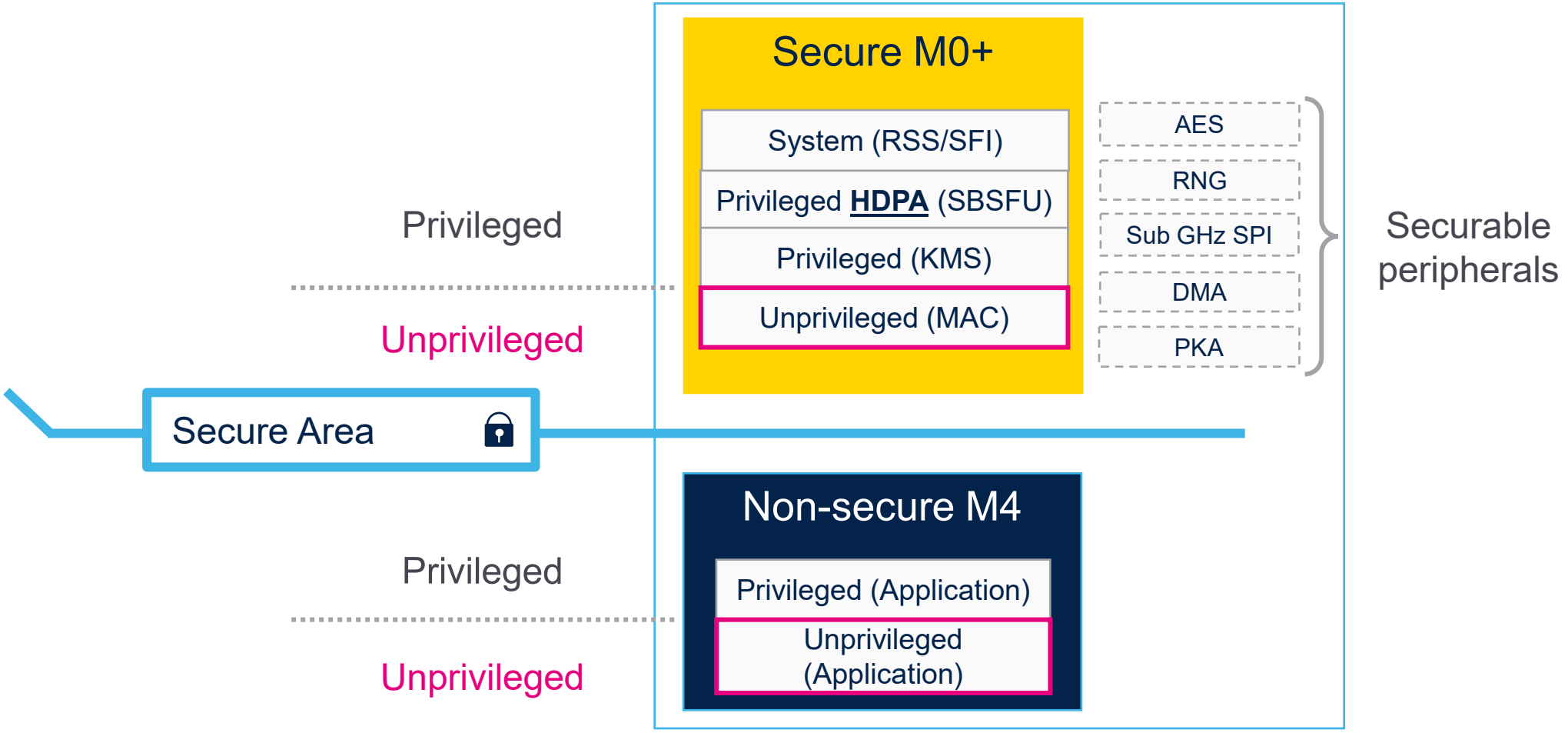
Security overview
dual-core secure implementation example

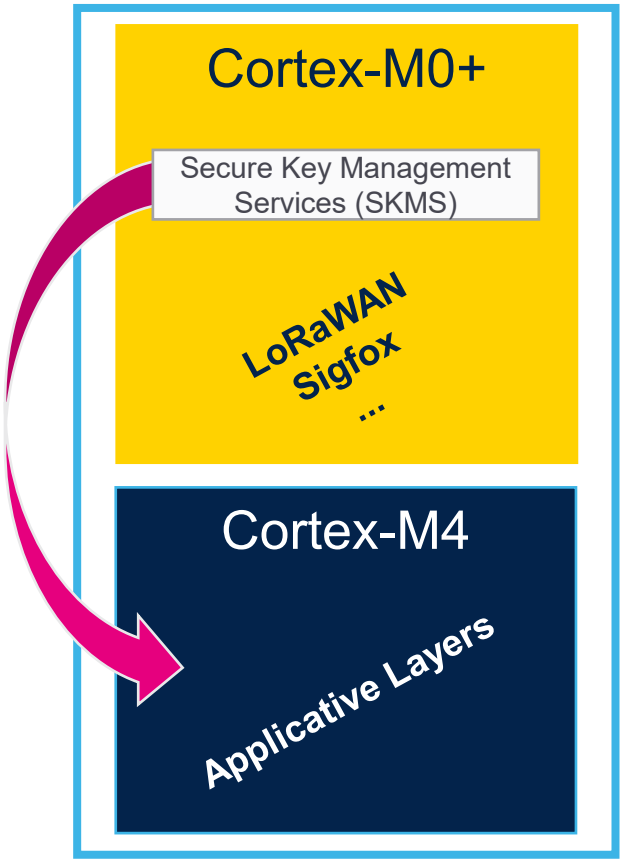
6 security domains for hardware + software isolation



Dual-core firmware isolation example

How to ensure devices are IoT-ready with radio certification in mind

- Cortex-M4 (non-secure)
  - Non-secure / Open debug
  - Intended for Application Code
- Cortex-M0+ (secure)
  - Secure code & data / Closed debug
  - Intended for radio stack isolated from Application
  - Secure FW Upgrade included (with ST keys)
  - Key Management Services for Application side (CM4) (Customers Key)



- Security is enabled.
- No need to pay for re-certification
- Update flow is never broken

Applicative development isolated from Radio stack.

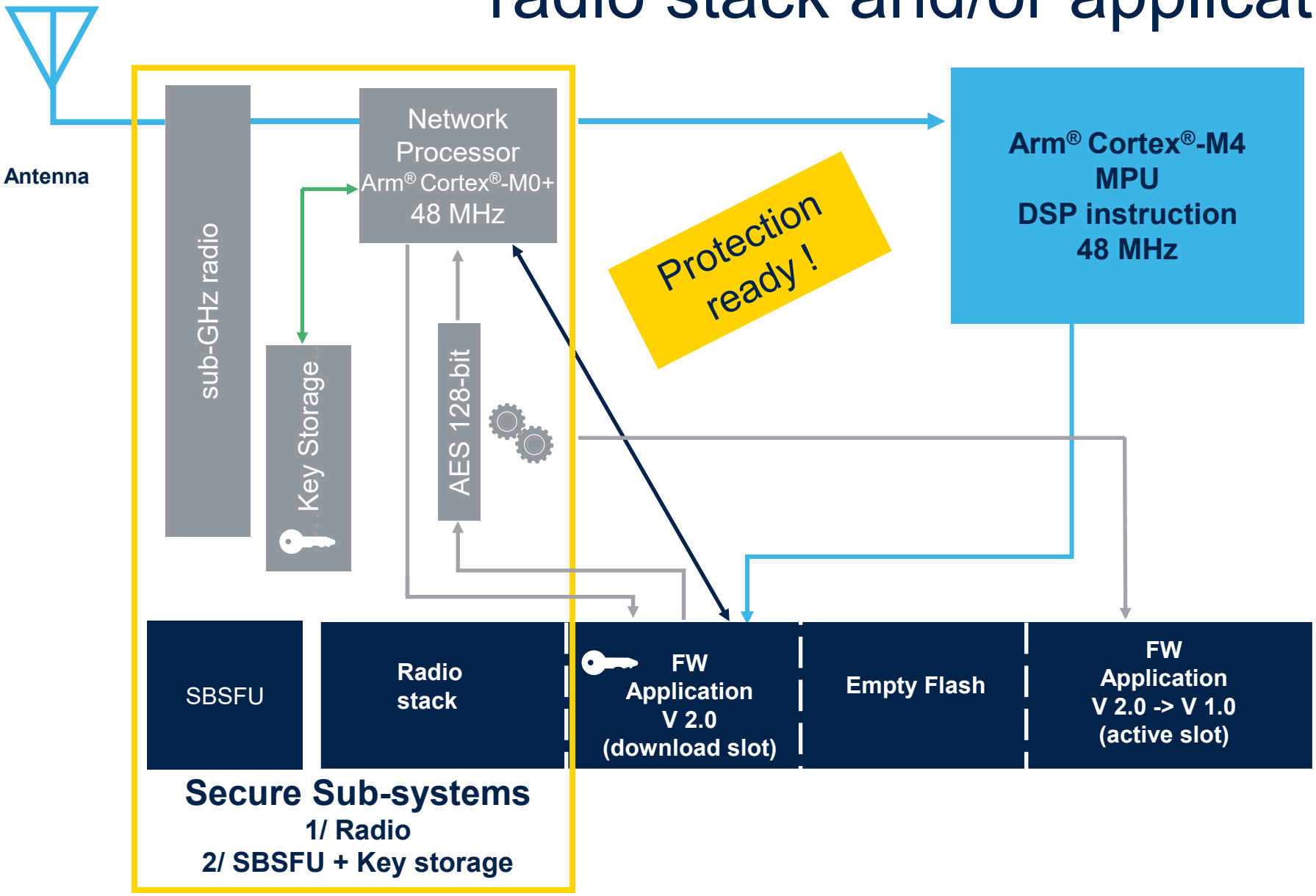
Memory security & privilege access

Secure firmware development

Memory Area \ Core / DMA			M0+ Hide Protection Secure	M0+ Secure	M0+ UNPRIVILEGED	M4 Non-Secure	M4 Non-Secure UNPRIVILEGED	DMA Secure	DMA Secure UNPRIVILEGED	DMA Non-Secure	DMA Non-Secure UNPRIVILEGED
Flash	X	Hide Protection Secure	✓	✗	✗	✗	✗	RW	✗	✗	✗
	SRAM	Secure	✓	✓	✗	✗	✗	RW	✗	✗	✗
	X	Secure UNPRIVILEGED	✓	✓	✓	✗	✗	RW	R	✗	✗
	SRAM	Secure UNPRIVILEGED	✓	✓	✓	✗	✗	RW	RW	✗	✗
		Non-Secure	RW	RW	✗	✓	✗	RW	✗	RW	✗
		Non-Secure UNPRIVILEGED	RW	RW	RW	✓	✓	RW	RW	RW	RW

Legend: Secure | Non-Secure | UNPRIVILEGED Unprivileged execution (privileged otherwise)

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



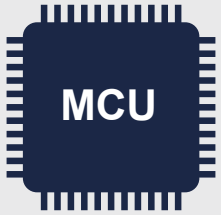
1. New FW package downloaded
2. New FW detected
   Update is launched
3. Authentication signature matches target signature.
   In case not, the process is aborted and device resets
4. New FW package is decrypted with proprietary Key. FW updates on going.

IoT protection ready (2/2)
STM32WL countermeasures against attacks

Advanced

Basic

Attacks	Forms of attacks	STM32WL 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
		• Watchdog
		• Memory ECC, Parity check
		• RTC alarm, Backup 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	• Key Storage (KS) • RNG, Crypto accelerator, CRC • Write memory protection (WRP) • Read Out memory protection (RDP) • Memory Protection Unit (MPU) • Secure Areas • Secure Boot (SB) • Secure Firmware Update (SFU) • Proprietary Code Read-Out Protection (PCROP) • 96-bit ID

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Security takeaways

2 independent cores for maximum flexibility

Application benefits

- ST Secure Firmware Install (SFI/RSS)
- Secure Boot (SB)
- Secure Firmware Update (SFU)
- Secure Key Management Services (KMS)
- Secure radio MAC layer communication
- Up to 6 Security domains
- Chain of trust

Customer benefits

➔ Flexible Security implementation
➔ IP protection
➔ Non cloneable device
➔ Trustability of the device, anti-hacking
➔ Trustable fleet maintenance

LoRaWAN - Chips & stacks delivery model

Open chips, takeaway stacks

STM32WLE5

Arm Cortex-M4

Application Firmware
+
Radio stack

STM32WL55

Arm Cortex-M4

Application Firmware

Arm Cortex-M0+

Radio stack
+
Advanced security services

LoRaWAN®

Certified LoRaWAN stack

- *Open stack*
- *Available from st.com/STM32CubeWL*

Open platform

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Enjoy Sigfox wherever you are

An open SoC for a global network

STM32WLE5

Arm Cortex-M4

Application Firmware
+
Radio stack

STM32WL55

Arm Cortex-M4

Application Firmware

Arm Cortex-M0+

Radio stack
+
Advanced security services

Certified stack from RC1 to RC7
+ Monarch certified!

- *Open stack*
- *Available from st.com/STM32CubeWL*

Open platform

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STM32WL and W-MBUS

STM32WL is ideal for smart metering applications

STACKFORCE
embedded.connectivity.solutions

STM32 Partner

Partner Program
life.augmented

STM32WL

M-Bus wireless

LoRaWAN

Please contact Stackforce Sales Office to get W-MBUS stack for STM32WL

STM32WL – W-MBUS Modes

STM32WL is ideal for smart metering applications

- **Mode S**: Stationary — 868 MHz
  - *Meters send data few times a day*
- **Mode T**: Frequent Transmit — 868 MHz
  - *Meters send data several times a day*
- **Mode C**: Compact — 868 MHz
  - *Higher data rate version of mode T*
- **Mode N**: Narrowband — 169 MHz
  - *Long range, narrow band system*

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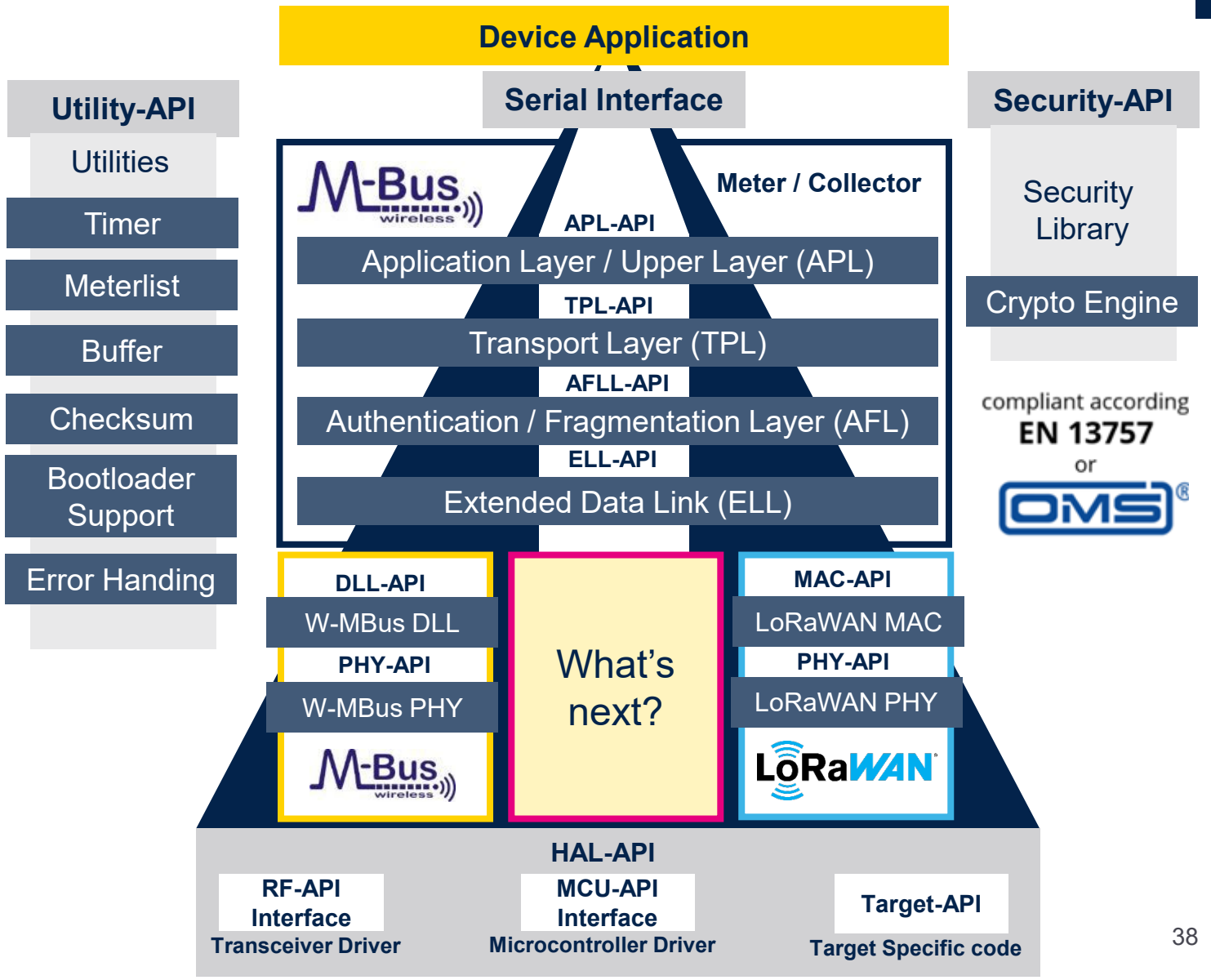
Note: 915MHz modes available on demand

From W-MBUS to W-MBUS-over-LoRaWAN

STM32WL for smart metering

STACKFORCE
embedded.connectivity.solutions

- W-MBUS MAC and PHY can be replaced by LoRaWAN Mac and PHY
- W-MBUS benefits from LoRaWAN long-range capabilities and flexibility
- Mioty stack offer also available



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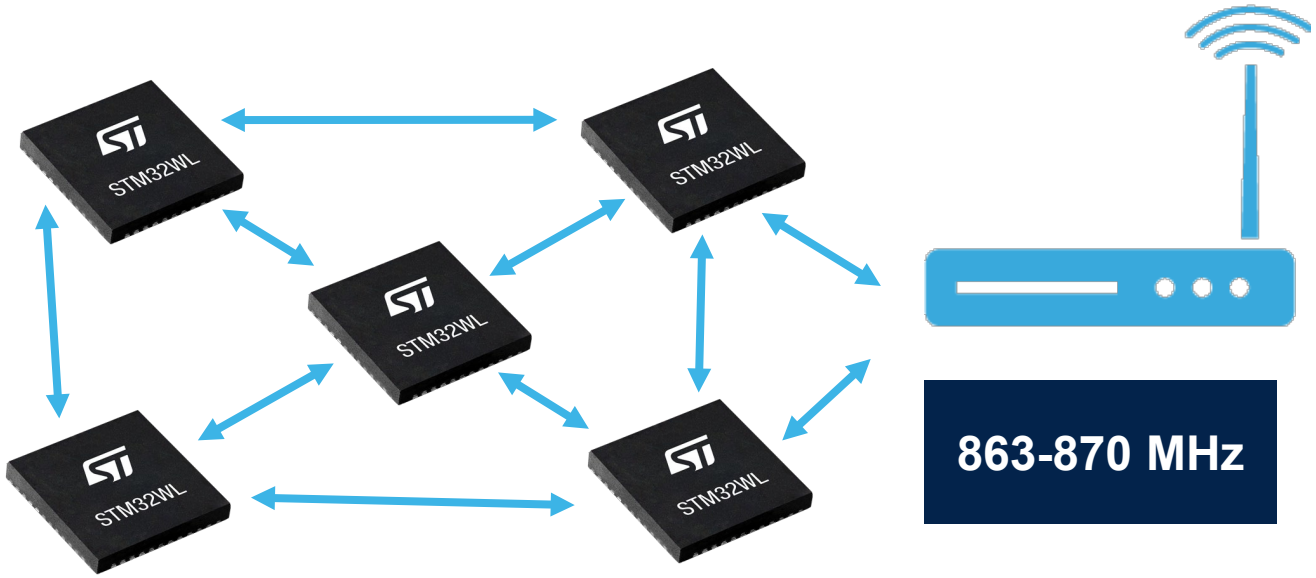
STM32WL and Mesh

Large-scale mesh networking with EmbeTECH

Authorized Partner

embeNET
NEXT GENERATION WIRELESS MESH

Demo version available
for Nucleo boards!



- Large scale deployments (1000+ nodes)
- Deterministic behavior (simulator available)
- Reliable IPv6 /UDP networking

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STM32WL and W-MBUS

STM32WL is ideal for smart metering applications

Authorized Partner

STACKFORCE
embedded.connectivity.solutions

STM32 Partner

life.augmented

STM32WL

M-Bus wireless

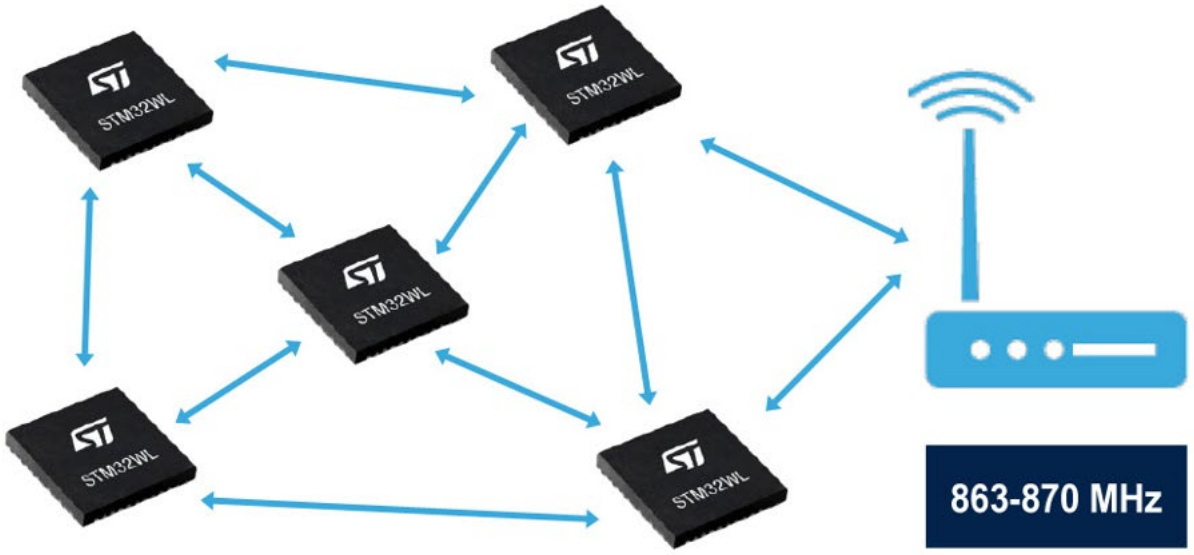
LoRaWAN

Please contact Stackforce Sales Office to get W-MBUS stack for STM32WL

STM32WL and Mesh by embetech

Large-scale mesh network with embeNET

Authorized Partner



Large scale Deployment (1000+ nodes)

Deterministic behavior (simulator available)

Reliable IPv6/UDP networking

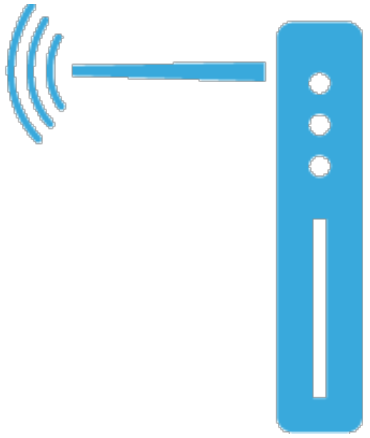
Demo version available for Nucleo Boards

Please contact embetech Sales Office to get EmbeNET stack for STM32WL
contact@embe.tech

STM32WL and FUOTA

Firmware Update Over The Air

LoRaWAN®



FUOTA libraries available in STM32CubeWL

Suitable for massive STM32WL fleets updates

LoRaWAN Network Server agnostic*

Secure Firmware Update

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** If Network Server is fully interoperable with LoRaWAN*

STM32WL ecosystem

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STM32WL reference designs best performance for your country regulation

Security services
Radio Stacks
RTOS

LoRaWAN 1.0.4

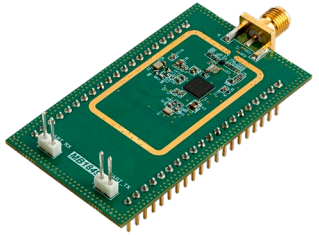
sigfox

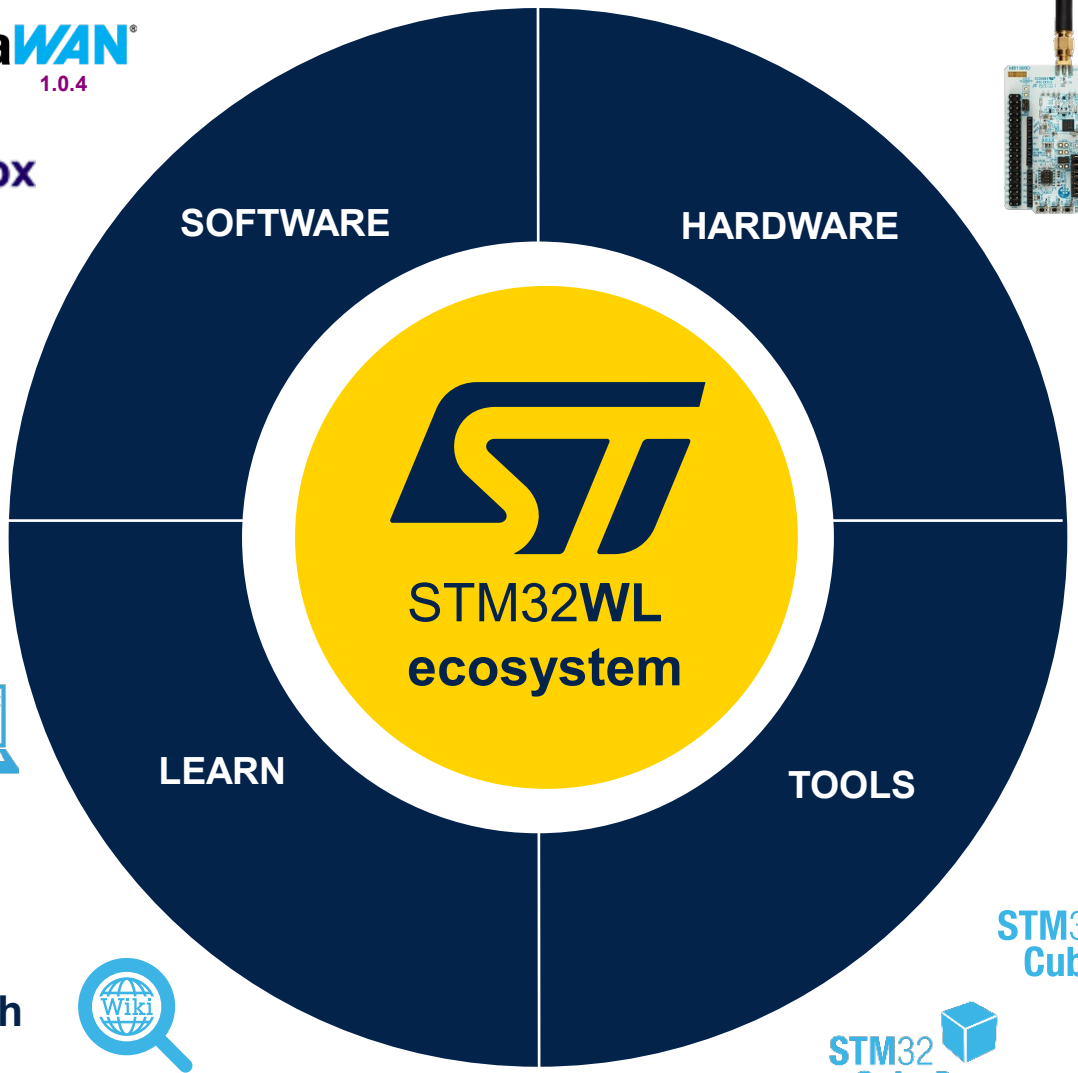
STM32 CubeWL

LoRaWAN CERTIFIED

embeNET NEXT GENERATION WIRELESS MESH

Demo board
Nucleo boards
Reference designs





Online trainings
35 application notes

Wiki.st.com
Getting started with LoRaWAN®

STM32 CubeIDE

STM32 CubeMX

STM32 CubeMonitor

STM32 CubeProgrammer

Complete suite of development tools

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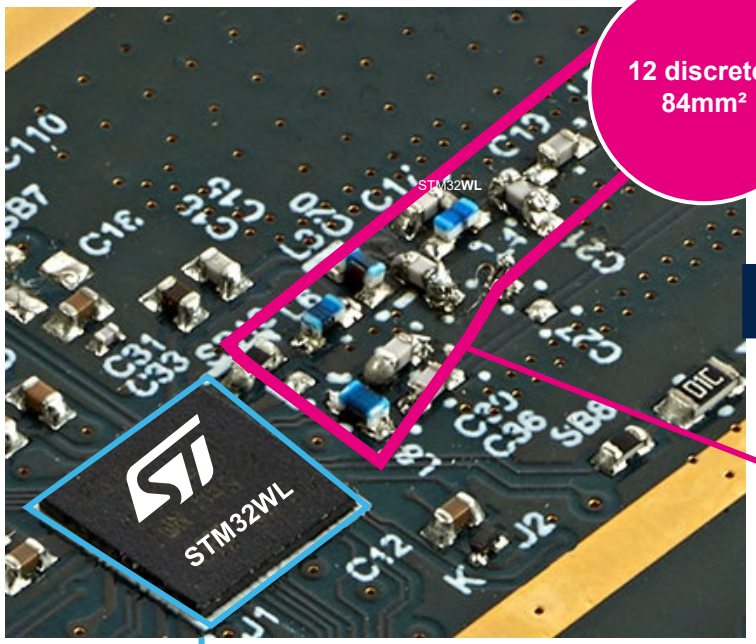
RF integrated passive device (IPD) for STM32WL

Housed between STM32WL and the antenna,
From discrete to RF IPD

BEFORE



AFTER

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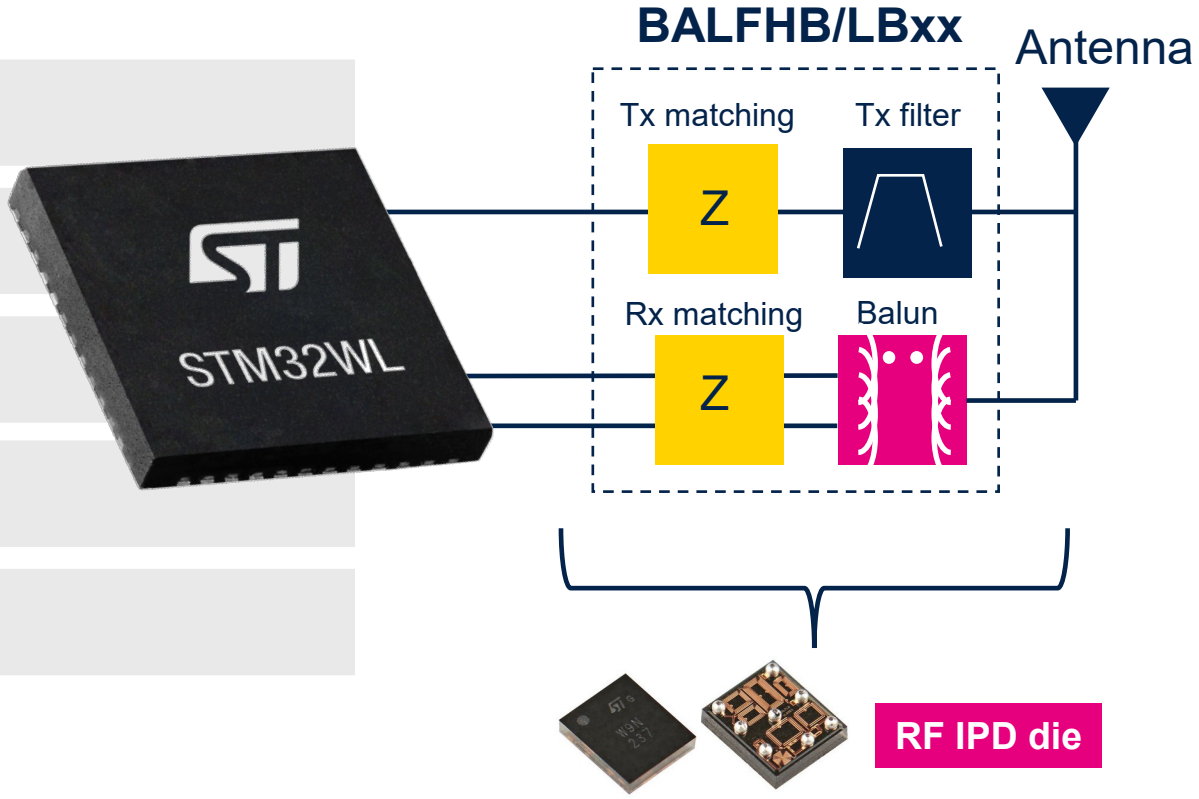
RF IPD for STM32WL

Ready-to-use, between the STM32WL and the antenna

- Design simplification
- Performance optimization
- System integration
- Reliability improvement
- BOM reduction



Tx and Rx matching,
Rx Balun,
Tx Filtering
All in 1.8 x 2.13 mm

STM32WL IPD tailored for your needs

Pick-up your own IPD and start your wireless design

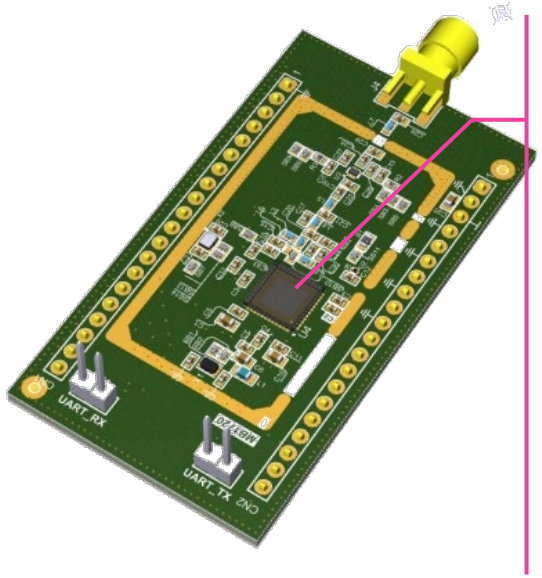
Select your IPD fine-tuned for your application

Power Frequency	22 dBm 864-928 MHz			15 dBm 864-928 MHz		
#PCB Layers	4	4	2	4	4	2
STM32WL BGA	BALFHB-WL-01D3			BALFHB-WL-04D3		
STM32WL QFN		BALFHB-WL-02D3	BALFHB-WL-03D3		BALFHB-WL-05D3	BALFHB-WL-06D3

Power Frequency	17 dBm 470-530 MHz		
#PCB Layers	4	4	2
STM32WL BGA	BALFLB-WL-07D3		
STM32WL QFN		BALFLB-WL-08D3	BALFLB-WL-09D3

STM32WL BGA	STM32WL5xJx|x STM32WLExJx|x
STM32WL QFN	STM32WL5xCxUx STM32WLExCxUx

Download schematics and layout



STM32WL REFERENCE DESIGN

- **Fast time to market**
  FCC/CE certified open hardware
- **Worldwide support:**
  Optimized for frequency regulation
- **Material available:**
  Schematics & Layout

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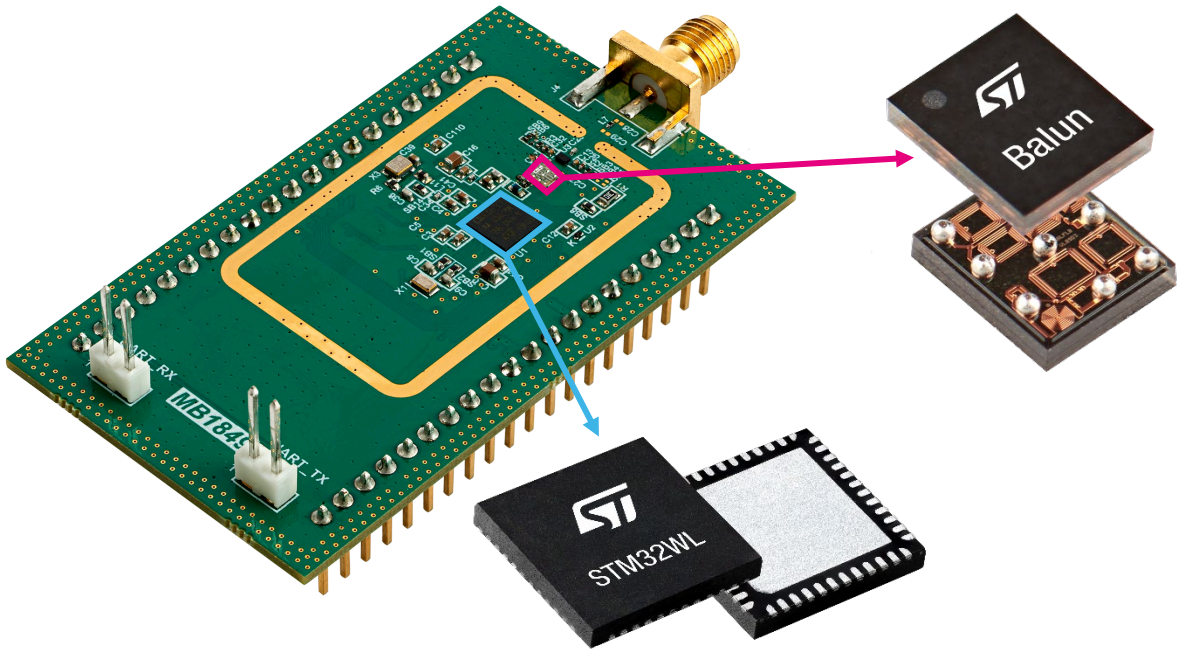
STM32WL reference designs

Get ready to start your LoRaWAN® application



Fast time to market
FCC/CE certified open hardware

Worldwide support
- Optimized for frequency regulation

Material available
- Supply and SMPS circuit
- RF matching circuit
- RF filtering circuit
- Discrete and IPD solution

STM32**WL**
RF IPD
inside

Download free schematics, layout, bill of materials & firmware

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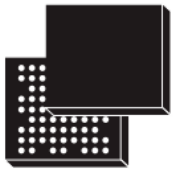
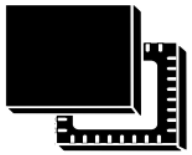
STM32WL reference designs best performance for your country regulation



UFBGA73
(5 x 5 mm)



UFQFPN48
(7 x 7 mm)

Frequency & Output Power	[470:530 MHz] 17 dBm	[864:928 MHz] 15 dBm	[864:928 MHz] 22dBm
UFBGA73	STDES-WL5I4SBB		
UFQFPN48	STDES-WL5U4SBB		

+169Mhz reference design : **STDES-WL5U4SHW**

STM32WL reference designs optimized to reduce your BOM cost

Save RX-TX Switch Cost Direct Tie Design	
[433 MHz]/15 dBm	STDES-WL5U4DLB
[864:928 MHz]/15 dBm	
[470:530 MHz]/17 dBm	STDES-WL5U4DHB
[864:928 MHz]/22 dBm	

Save PCB cost: 2-LAYER PCB Design	
[470:530 MHz]/17 dBm	STDES-WL5U2SBB
[864:928 MHz]/15 dBm	
[864:928 MHz]/22 dBm	

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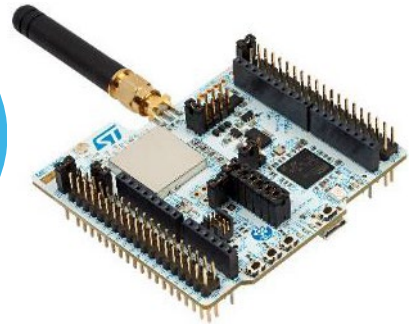
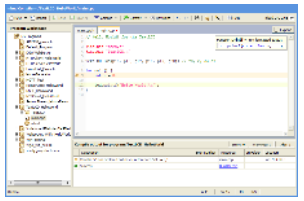
STM32WL – ecosystem overview

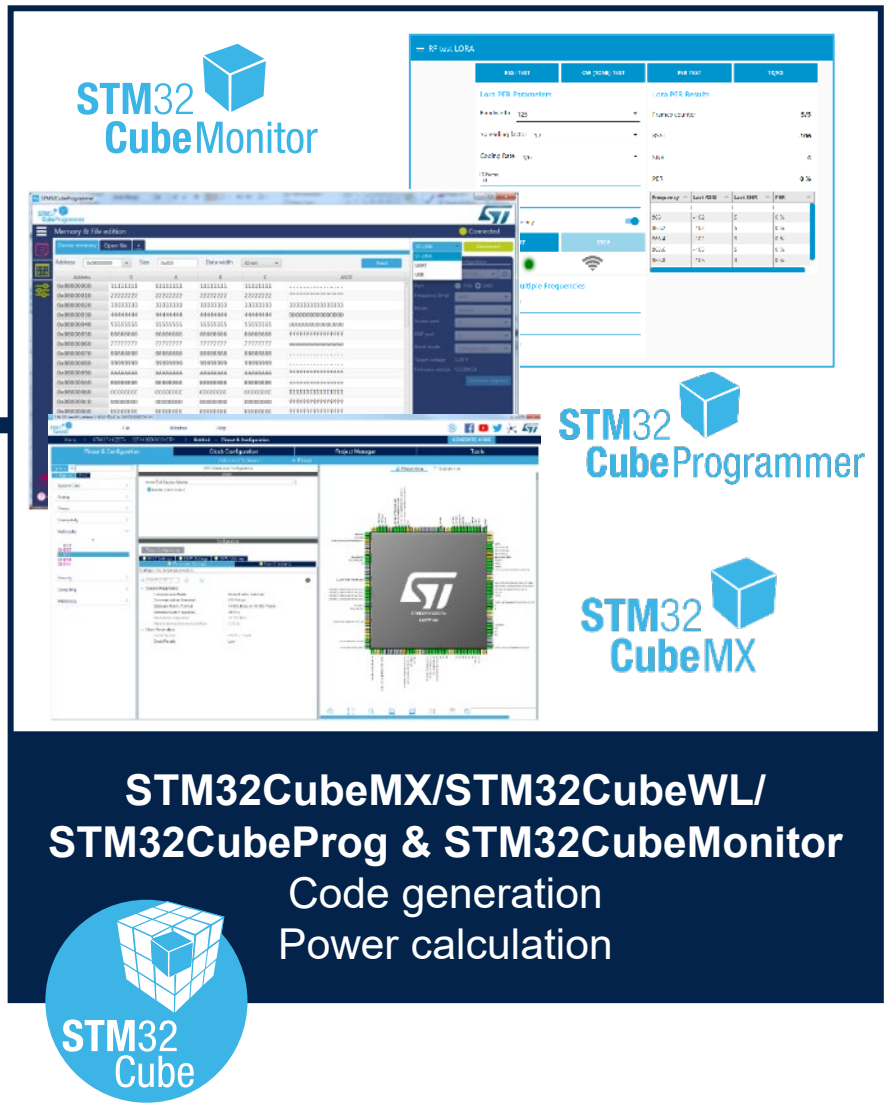
Fully integrated into the rich and market-proven STM32 ecosystem





STM32 Nucleo-64	Dev tools	Stacks
Flexible prototyping	STM32CubeMX STM32CubeWL STM32CubeMonitor STM32CubeProg STM32CubeIDE + Partners IDEs	LoRaWAN (ST) Sigfox (ST) Wireless-MBUS / Mioty (Stackforce) ZETA (Zifisense) EmbeNET (embetech)

Prototyping made as easy as 1,2,3



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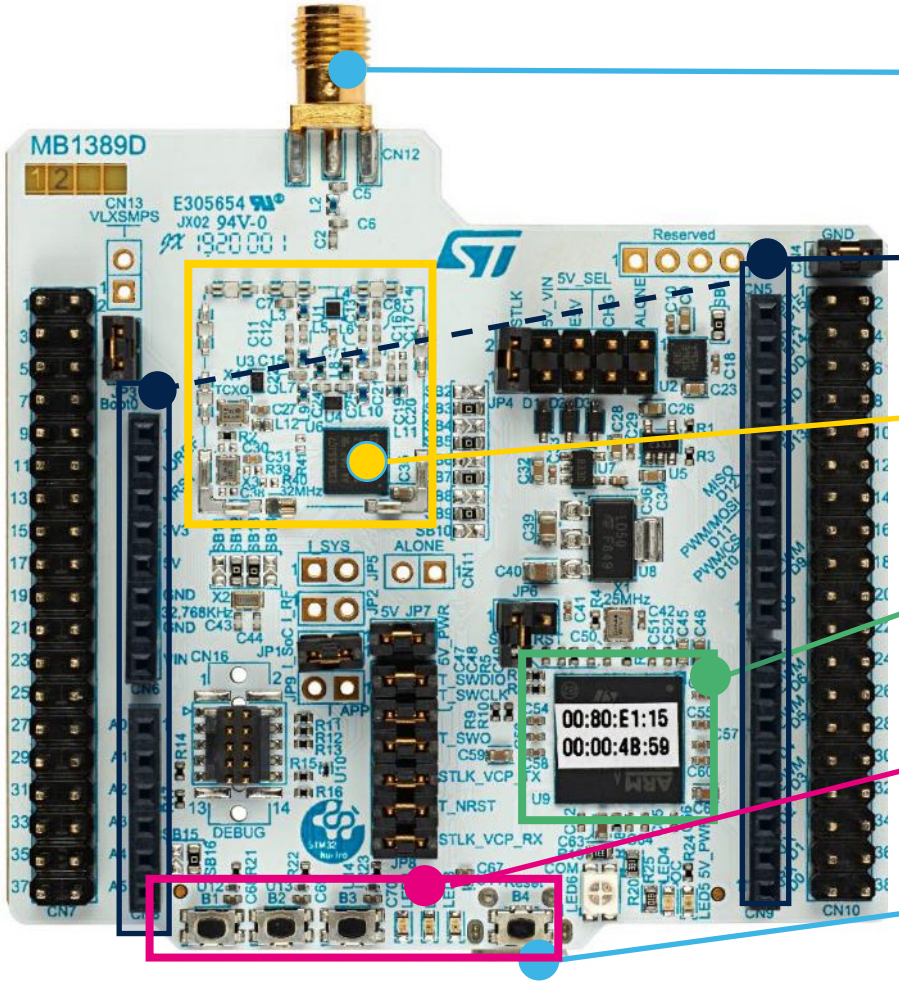
The STM32WL Nucleo-64 at a glance

NUCLEO-WL55JC1

868/915/923 MHz

NUCLEO-WL55JC2

433/470 MHz



SMA Antenna connector

Arduino™ extension connectors :
easy access to add-ons

STM32WL
(under a metallic shield)

Integrated ST-LINK/V3:
mass storage device flash programming

4 push buttons, 3 color LEDs,
Jumper settings

Flexible board power supply :
through USB or external source

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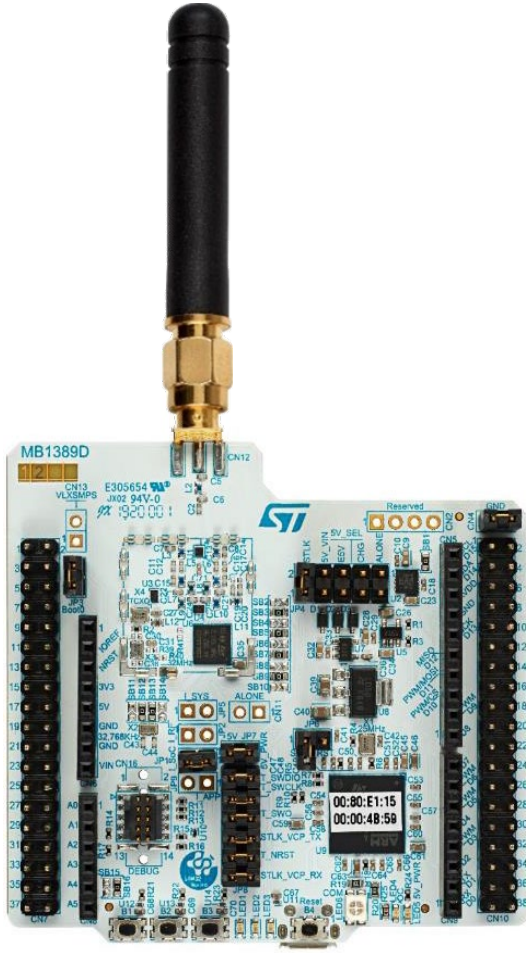
STM32WL - certifications overview

Protocol and commercial certifications



LoRaWAN

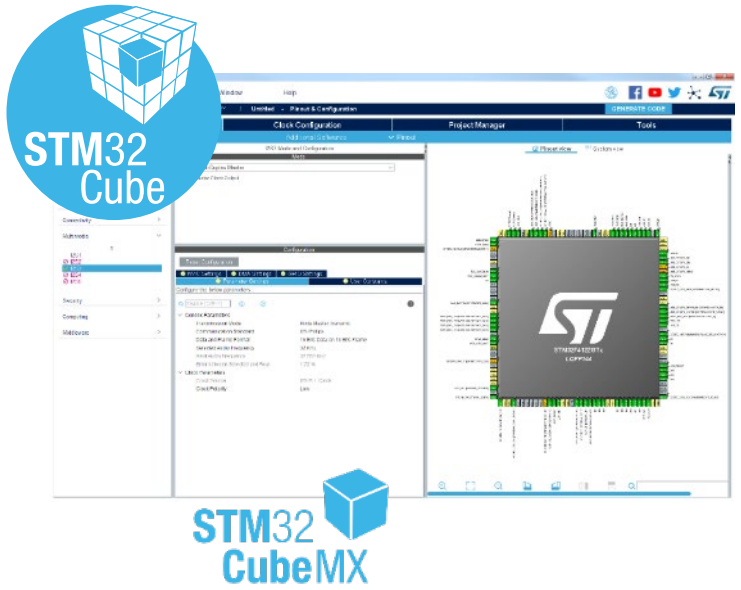
sigfox verified

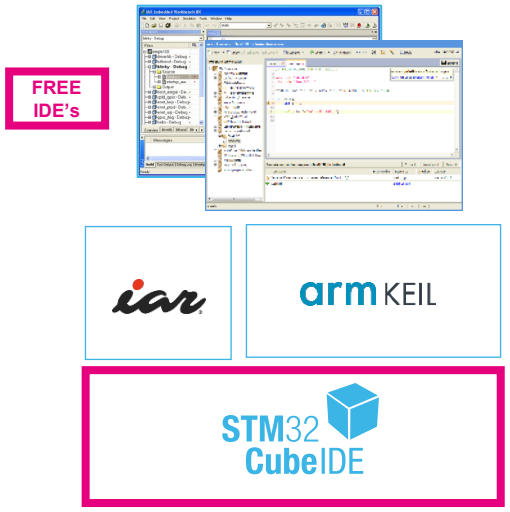
CE FC IC

RoHS COMPLIANT

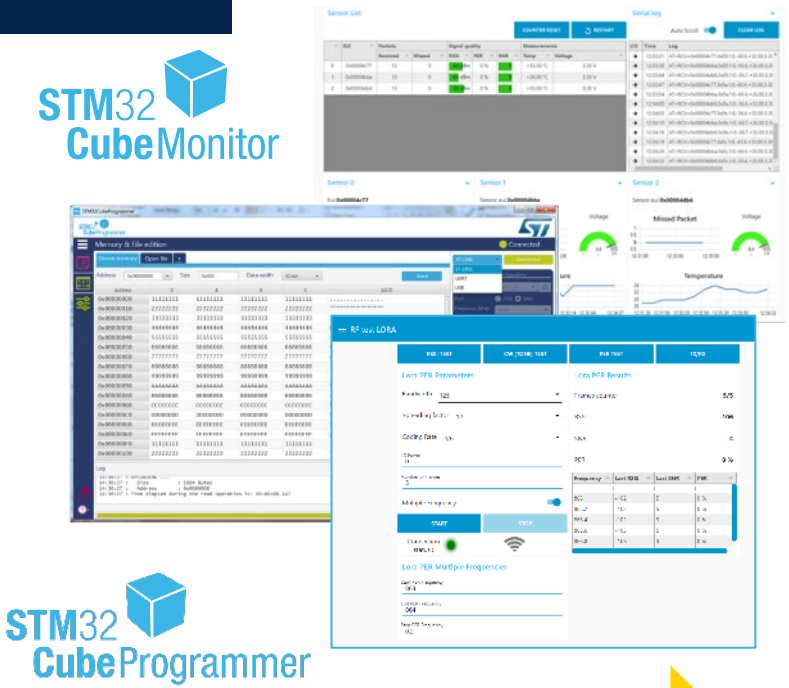
Software development tools

A complete flow, from configuration to monitoring





More to come after mass market launch



STM32CubeMX, GUI Builders
Configure & Generate Code

ST and Partner IDEs
Compile and Debug

STM32CubeProg/Monitor
Monitor, Program & Utilities

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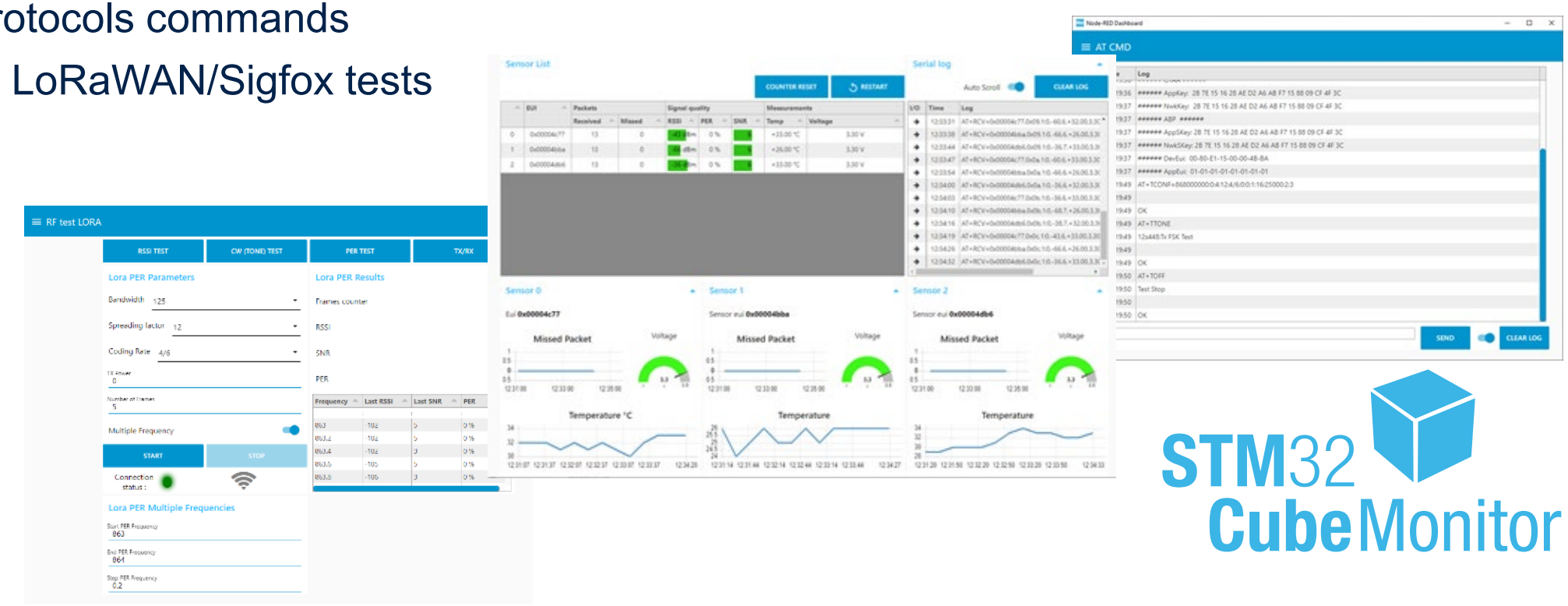
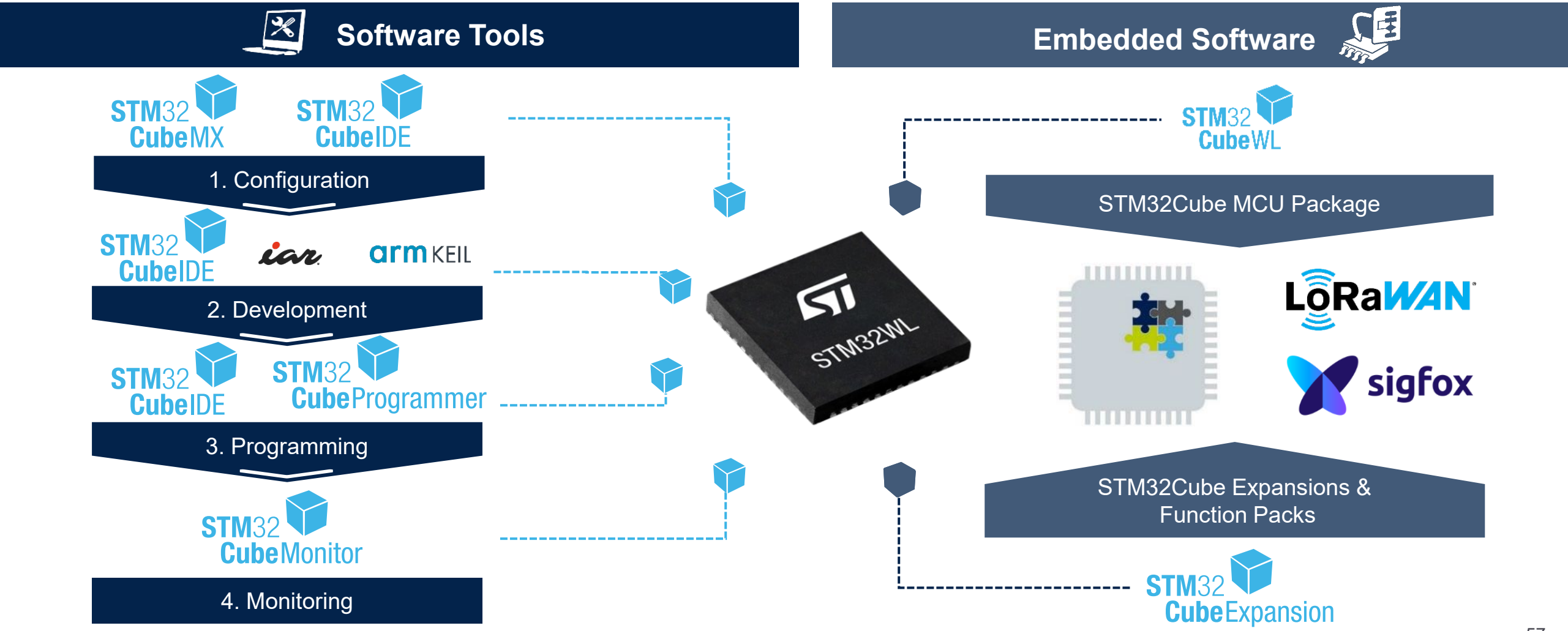
STM32CubeMonitor

- Wireless features of STM32WL55
  - Multi-Modulation commands
  - sub-GHz RF tests
  - Send Protocols commands
  - Perform LoRaWAN/Sigfox tests
- Suitable for STM32 Nucleo, or custom boards
- USB or UART to Virtual Com Port



STM32 CubeMonitor

Key takeaway: end-to-end ecosystem



Save on your application cost

Integrated functionalities helps you drop the BOM down

Optimization of the silicon cost

- Deep integration factor
- System-on-chip avoids to use a second radio
- Less external components
- Single 32 MHz crystal for CPU & embedded radio
- 32 kHz master clock output available
- Possibility to use a 32 MHz crystal (XO) instead of a temperature compensated crystal (TCXO)
- 2-layer PCB enablement with QFN package

Free ecosystem

- LoRaWAN® stack
- Sigfox stack
- STM32CubeMX
- STM32CubeMonitor
- STM32CubeProg

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STM32 rolling longevity commitment

Longevity commitment is renewed every year

Starting in 2021

- **STM32F1** (launched in **2007**) — **22 years** of commitment
- **STM32L1** (launched in **2009**) — **20 years** of commitment
- **STM32F2** (launched in **2010**) — **19 years** of commitment
- **…**
- **STM32WB** (launched in **2018**) — **11 years** of commitment
- **STM32G0** (launched in **2018**) — **11 years** of commitment
- **STM32G4** (launched in **2019**) — **10 years** of commitment
- **STM32WL** (launched in **2020**) — **10 years** of commitment

Releasing your creativity

- /STM32
- @ST_World
- community.st.com
- www.st.com/STM32WL
- wiki.st.com/stm32mcu
- github.com/STMicroelectronics
- STM32 Wireless – Video Playlist
- STM32WL blog article
- STM32WL Online Training

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Our technology starts with You

Find out more at www.st.com/STM32WL

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