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STM32WBA5x
The New and Better

Product Key Features

Workshop Team

Agenda

1. Bluetooth® Low Energy 5.3 full features
2. Power & Radio performances
3. Extensive security feature
4. Flash access improvement
5. BOM efficient
6. Extensive ecosystem

Bluetooth® Low Energy 5.3 full features, certified 5.4

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STM32WBA5x

STM32WBA52CxU6

ARCHITECTURE

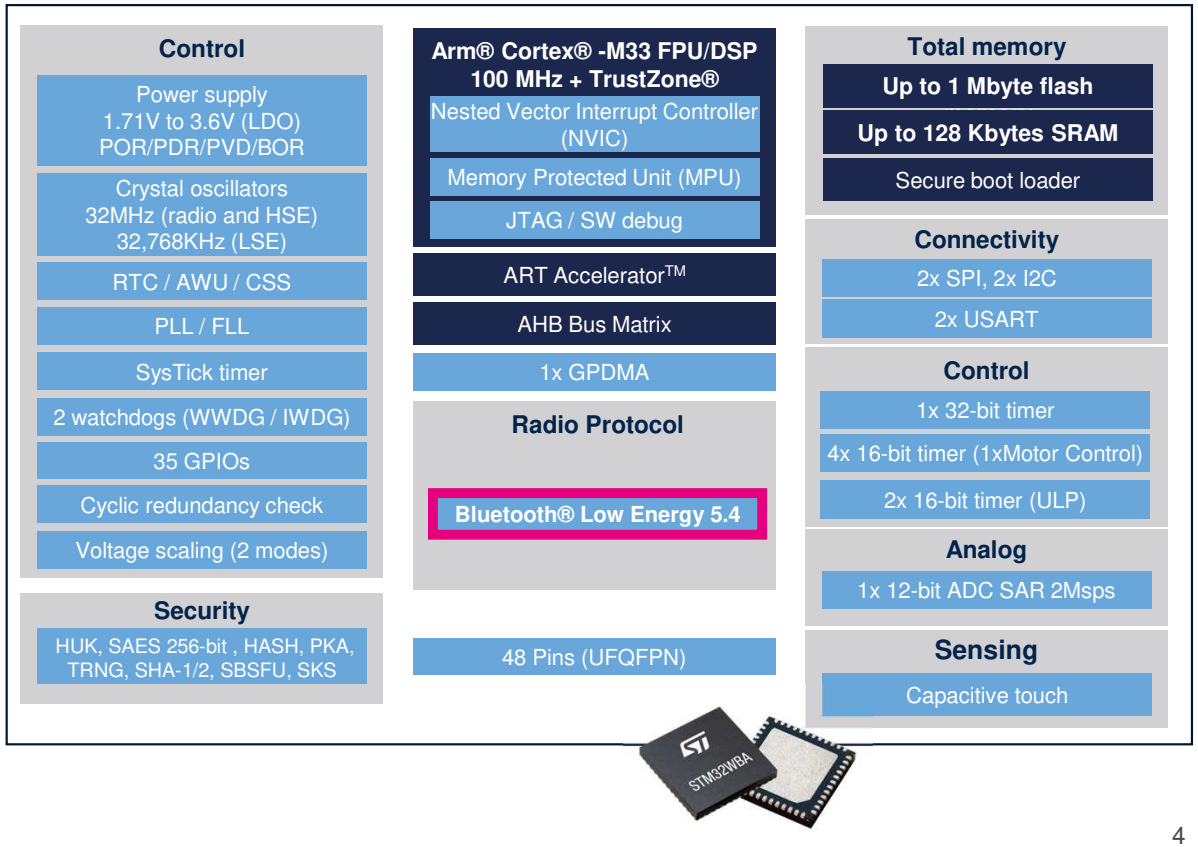
- 1 Mbyte of flash memory / 128Kbytes RAM
- Single Arm® Cortex® M33 @ 100MHz

Radio Key features

- +10dBm max output power, integrated balun
- **Bluetooth® Low Energy 5.4 certified** with advertising extension, 2Mbps, long range, Isochronous channel
- up to 20 connections
- TX : 10.6mA @ 0dBm, RX: 7.4mA
- - 40 to + 85°C

Peripherals: touch sensor, LPBAM, ADC 12-bit, 3x UART, 2x SPI, 2x I²C

Package: UFQFN48 7 x 7 mm, 35 GPIOs



Bluetooth LE 5.3 keys stack features

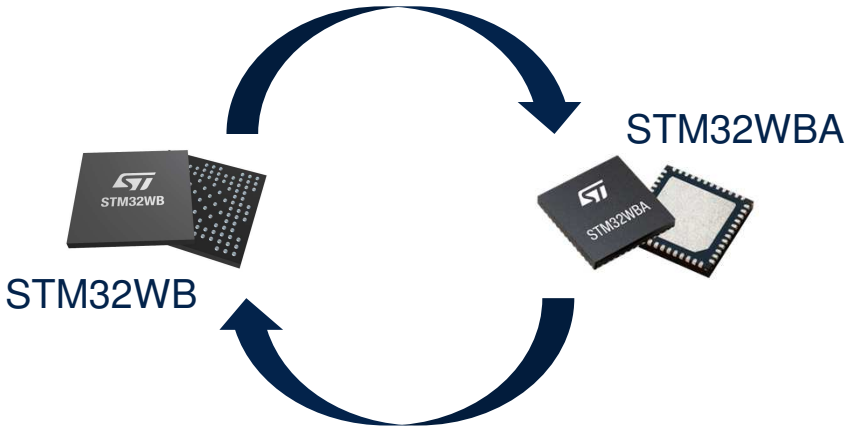
STM32WBA5x : certified 5.4 - full featured Bluetooth® Low Energy 5.3

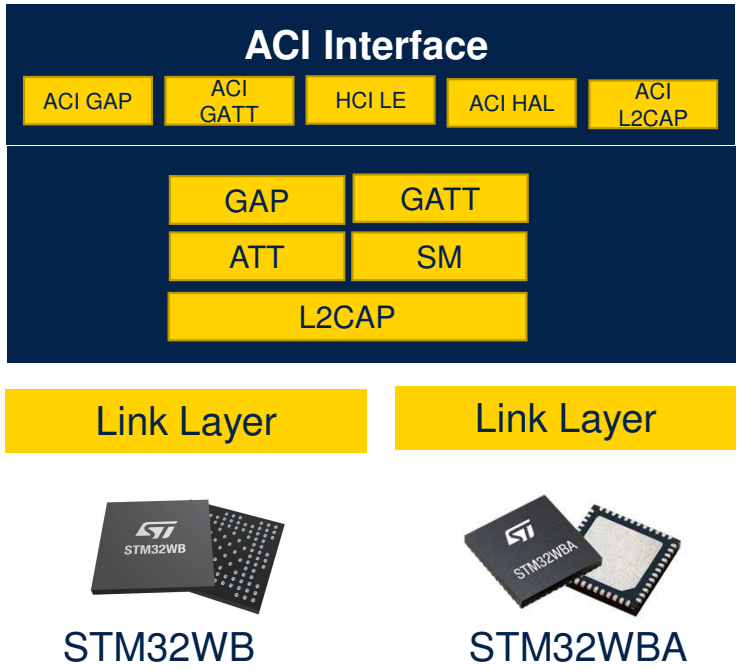
✓ Distance Robustness	Long Range CODED PHY 125kb/s or 500kb/s
✓ Frequency Hopping Robustness	Channel Selection Algorithm#2
✓ GAP Master/Slave topology GATT Server/Client	Up to 20 links simultaneously
✓ Power Control	Quality of link Power Consumption
✓ Advertisement Extension Periodic Advertising	1650 bytes advertising data set Up to 8 Adv set with limited data
✓ Isochronous Channel	Up to 2 channels Audio Broadcast & Unicast LC3 Codec support
✓ GATT Caching Enhanced Attribute Protocol	energy-efficiency improvements
✓ Angle-of-Arrival (AoA) Angle-of-Departure (AoD)	Direction finding

…more to come…

Bluetooth Low Energy application software APIs

STM32WB and STMB32WBA5x share the same BLE* application interfaces = very easy migration !





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* Bluetooth® Low Energy

STM32WBA5x
Radio & Power performances in a nutshell

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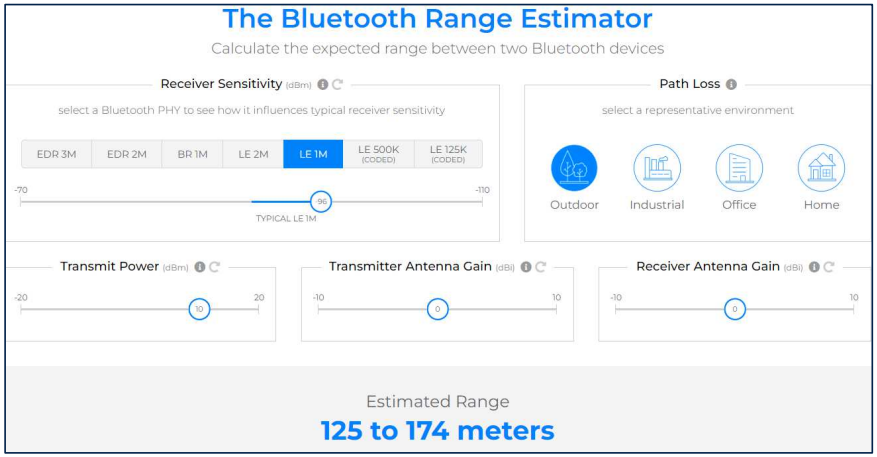
RF performances
Enhance user experience

Max output power up to +10 dBm

Sensitivity -96 dBm @1Mbps
(down to -101 dBm @ LE S=8 coded PHY)

Outstanding dynamic range
106 dB (1Mbps)

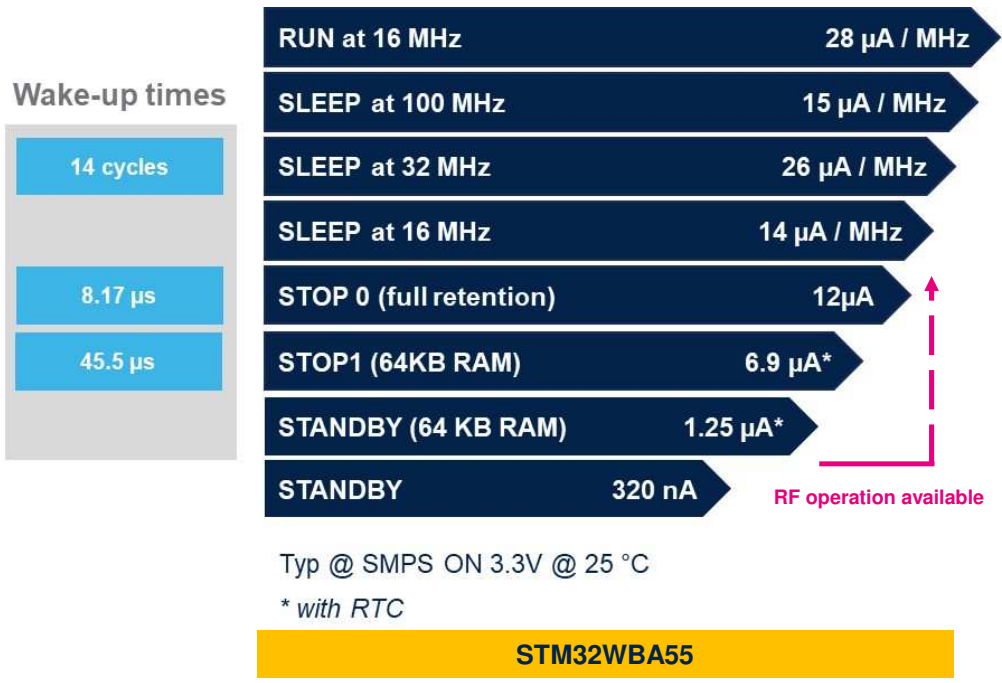
Link Budget = Pout – Rx sensitivity



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

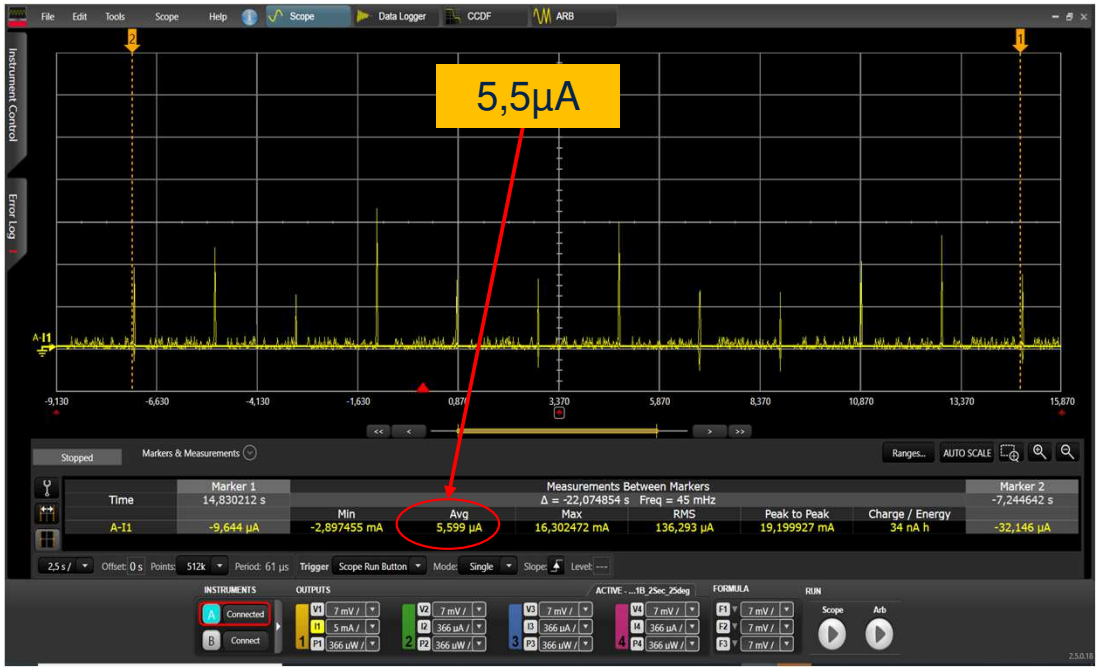
Thanks to strong budget link, increase connectivity range

Power consumption
STM32WBA5x Performances



High Performance
- CoreMark score: 407
- 45µA/MHz from M33

RF activities
Bluetooth® Low Energy Beacon example



use case : advertising every 2 secs (11 bytes, @ +0dBm)

STM32WBA55

RF in standby mode

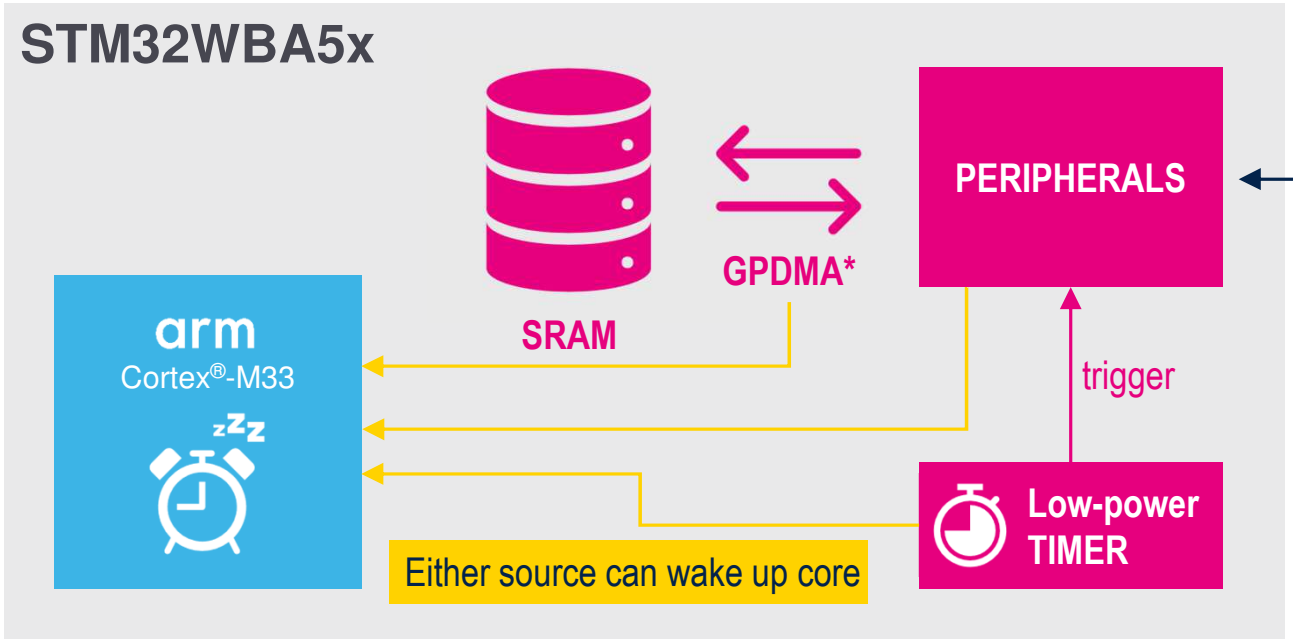
The lowest achievable low power mode with RF connectivity

RAM retention for saving:

- Link Layer configuration and context
- CPU execution context
- Optionally CPU peripheral registers

STM32WBA flex power capability

Background autonomous mode (BAM) enables power savings



Peripherals:

- I2C master or slave
- SPI / UART reception or transmission
- ADC
- LPTIM
- I/O

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** Operates in Run, Sleep, Stop0 & Stop1 modes*

STM32WBA5x - Security Features

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Tailored to build secured App

Extensive functionality to protect your assets

Isolation

TrustZone®
Secure Peripherals
Secure DMA

Cryptography

Side channel AES, PKA
Additional AES, PKA, SHA, TRNG
CAVP certified CryptoLib

Security assurance level

psacertified™ L3

SESIP L3

1st 2.4GHz MCU to reach SESIP L3

Lifecycle

RDP: **4 protection level states**
Password based regression

Memory protections

OTP, HDP, WRP, RDP, MPU
Ext. Flash encryption OTFDec
Secure Debug

Active tamper

6x active pair of tamper pins.
RTC Active tamper
Total tamper I/Os: **8**

Trust anchor

TF-M, Secure Boot,
Secure Firmware Install
Hardware Unique Keys

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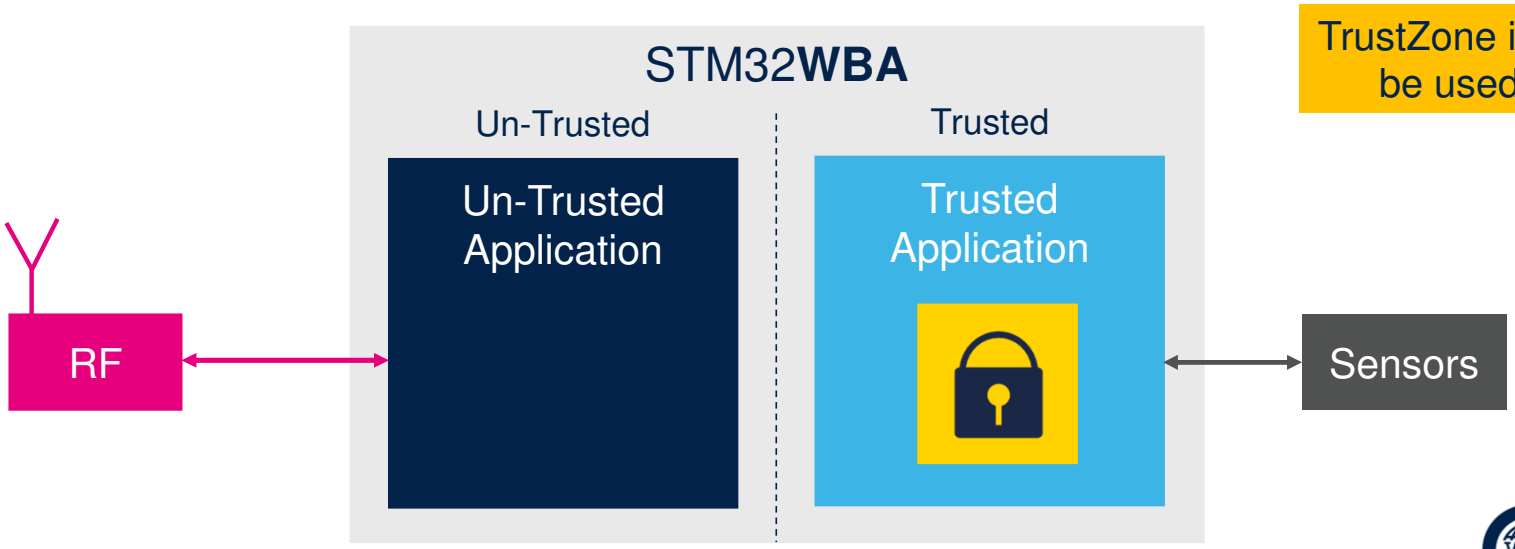
Security: TrustZone for isolation

TrustZone provides full isolation

Example of IoT application implementation



TrustZone is optional and can be used by Application

How to enable it ?
Dedicated Wiki page and associated code example coming end Nov.

by

Flash access improvement

STM32WBA flash handling

Flash operations with RF enable

Let’s consider Flash access constraints

STM32WBA5x

The Maximum time to erase an 8 kB sector is 3,4ms.
The Maximum time to write one raw is ~100us (128bits)

STM32WB past series

The Maximum time to erase an 8 kB sector is 22 ms.
The Maximum time to write one raw is ~100us (64bits)

The application can store data (EEPROM emulation) & stack use Flash for bonding data

The Flash Manager ensure synchronization between Flash access request & RF activity,

secure the guard time required to perform flash access (erase & write)

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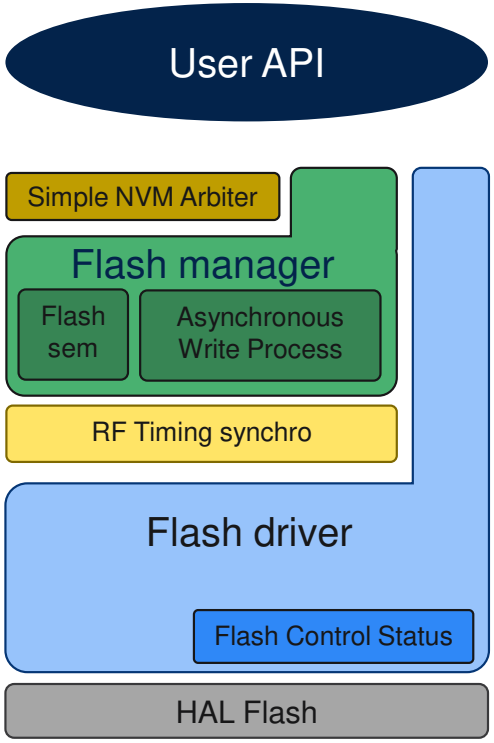
Flash Manager

Modules for RF flash operation synchronization



Asynchronous operations (Request / callback)

Flash access protection

Additional features (NVM creations, Abstraction of flash write/erase process, etc)

BOM Cutter

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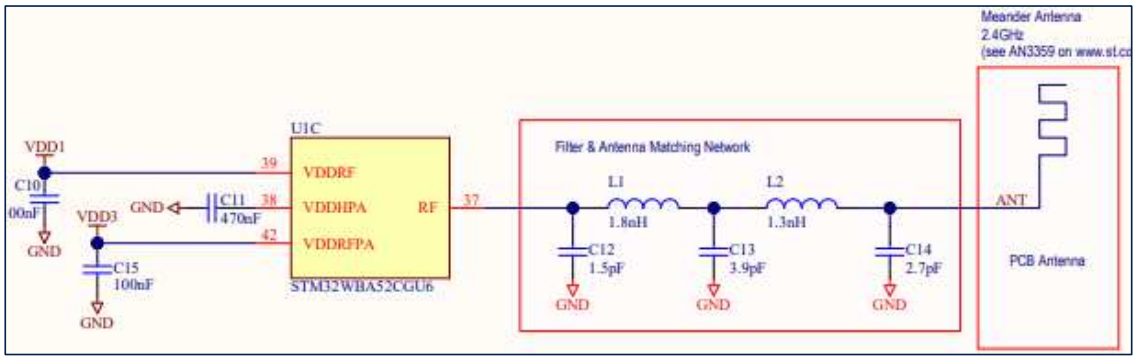
STM32WBA5x: flexible & BOM efficient

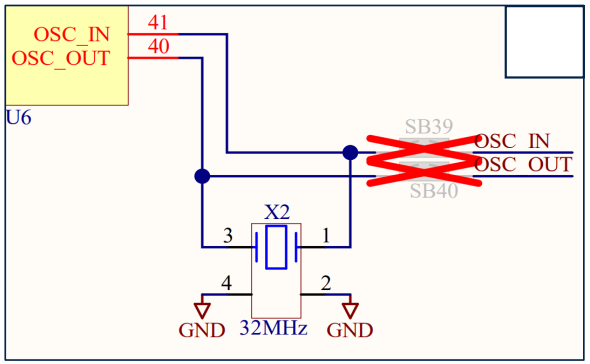
BOM cutter : size and cost efficient

Integrated balun - 50Ω single ended output



small amount of discretes (matching/filtering) from STM32WBA to antenna

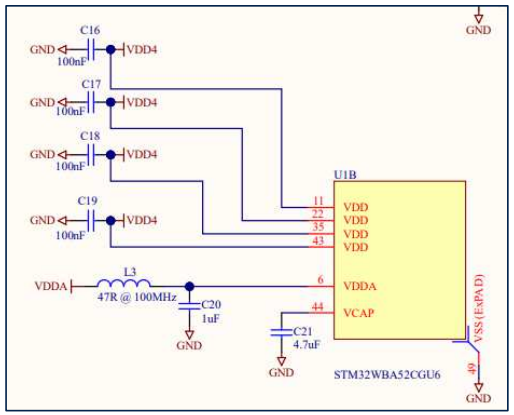
Integrated High Speed Oscillator capacitors



STM32WBA5x: flexible & BOM efficient

BOM cutter : size and cost efficient

Limited decoupling caps required



Flexible : Adapt HW size and cost versus application need

Large set of peripherals

SMPS or LDO

External 32 KHz LSE or internal LSI

Package scalability QFN32, QFN48, BGA59 and WLCSP

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Ecosystem : addons to ease your RF design

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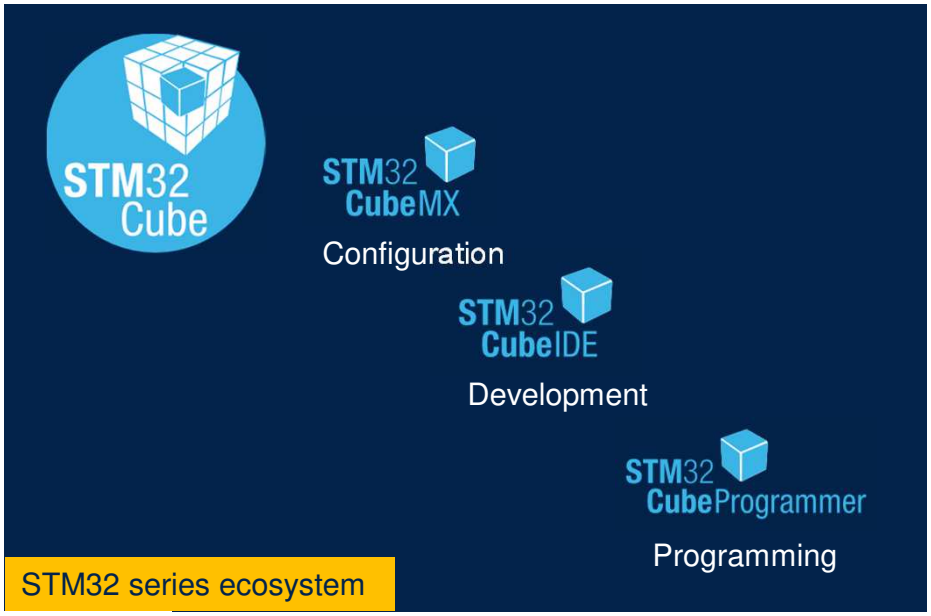
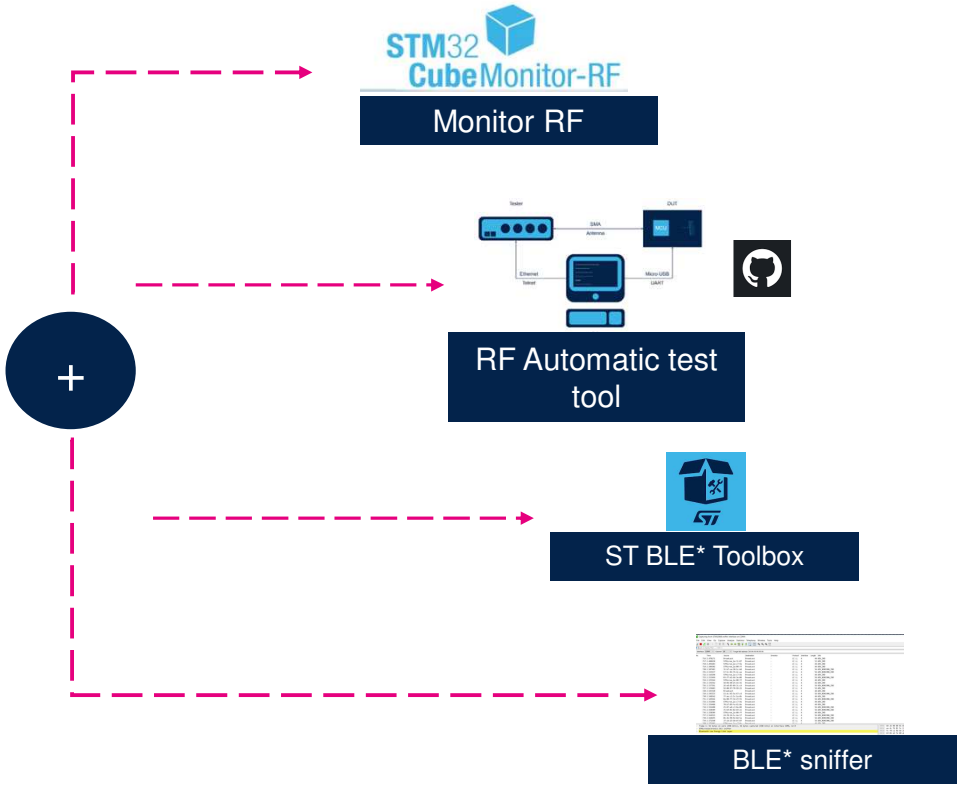
Complete ecosystem
SW and tool resources to ease your design

Additional resources to ease your Bluetooth® Low Energy design





* Bluetooth® Low Energy

STM32CubeMonitor-RF

Making the lives of developers easier

- Emulate Bluetooth Low Energy application from your laptop
- Advanced scripting capabilities
- Data logging and report generation

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ST Bluetooth® Low Energy smartphone Apps

Test debug your embedded SW

ST BLE Toolbox

Test

- Display advertising, showing **all peripherals**
- perform Read & Write to **raw characteristic**
- Bond devices, Test throughput, FOTA

ST BLE Sensor

Custom App (source available)

- Connect and play **with only ST examples** (eg: Heart Rate)
- Source code for Android & iOS **available**

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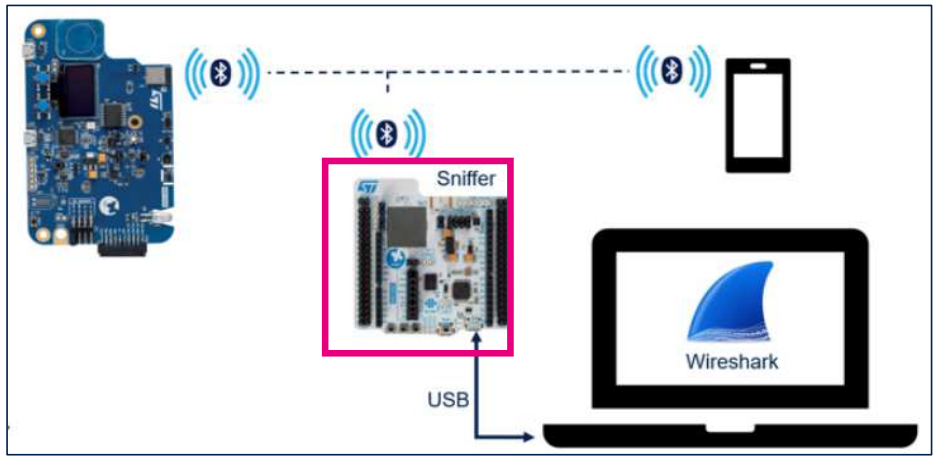
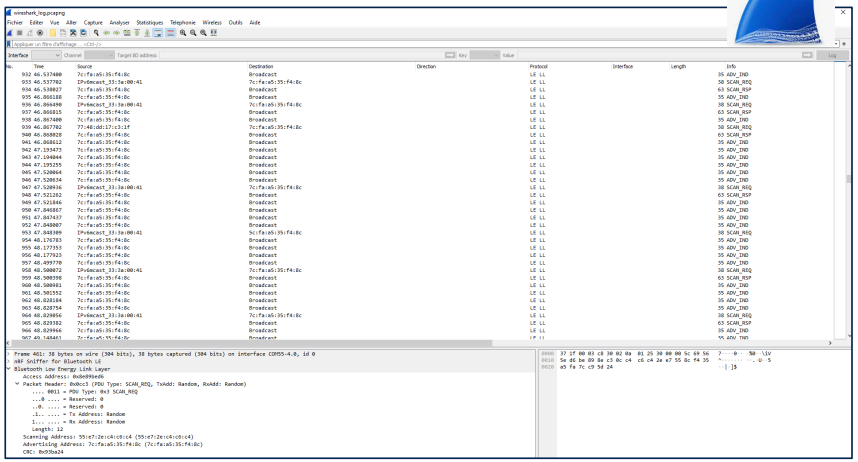
STM32WB sniffer for Bluetooth® Low Energy





Turn NUCLEO-STM32WB55
into a low-end low-cost Bluetooth® Low Energy sniffer*

* sniffing 1 Advertising

Useful to learn, analyze, and debug Bluetooth® Low Energy communications

by STM32 MCU

Instructions on Wiki page

Connectivity:STM32 Sniffer for BLE Setup guide - stm32mcu

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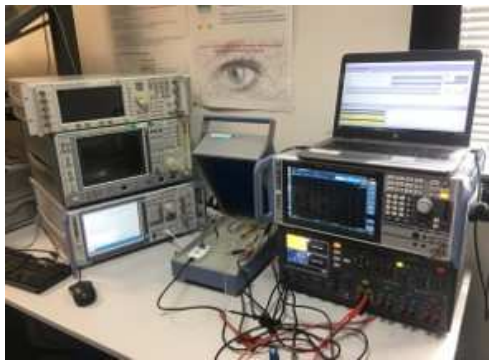
Application support part of ecosystem

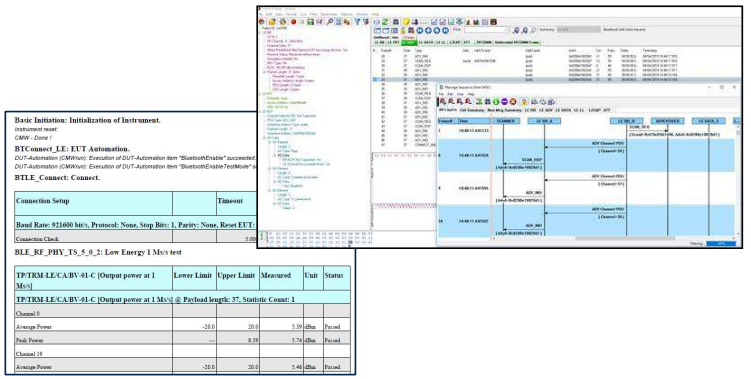
HW Support activities

HW debugging
Schematics and layout review
BOM and performances optimization
BLE & regional certification
RF sanity check



SW Support activities

SW debugging
Implementation example
Optimization (data rate, OTA)
Tips & guideline
Air trace analysis



Basic Initiation: Initialization of Instrument.
Instrument reset
CMW - Done !
BTConnect_LE: EUT Automation.
DUT-Automation (CMWrun): Execution of DUT-Automation item "BluetoothEnable" succeeded
DUT-Automation (CMWrun): Execution of DUT-Automation item "BluetoothEnableTestMode" s
BTLE_Connect: Connect.

Connection Setup		Timeout
Band Rate: 921600 bit/s, Protocol: None, Stop Bits: 1, Parity: None, Reset EUT:		
Connection Check		5.000

BLE_RF_PHY_TS_5_0_2: Low Energy 1 Ms/s test

TP/TRM-LE/CA/BV-01-C [Output power at 1 Ms/s]	Lower Limit	Upper Limit	Measured	Unit	Status
TP/TRM-LE/CA/BV-01-C [Output power at 1 Ms/s] @ Payload length: 37, Statistic Count: 1					
Channel 0					
Average Power	-20.0	20.0	5.39	dBm	Passed
Peak Power	---		8.39		Passed
Channel 19					
Average Power	-20.0	20.0	5.46	dBm	Passed

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Takeaways
What's next

BLE 5.3 Full Features

Power efficiency in running &
Bluetooth® Low Energy

Security add-ons

BLE Appli ecosystem to secure design

Understand how to evaluate and play with STM32CubeMX

Thank you

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