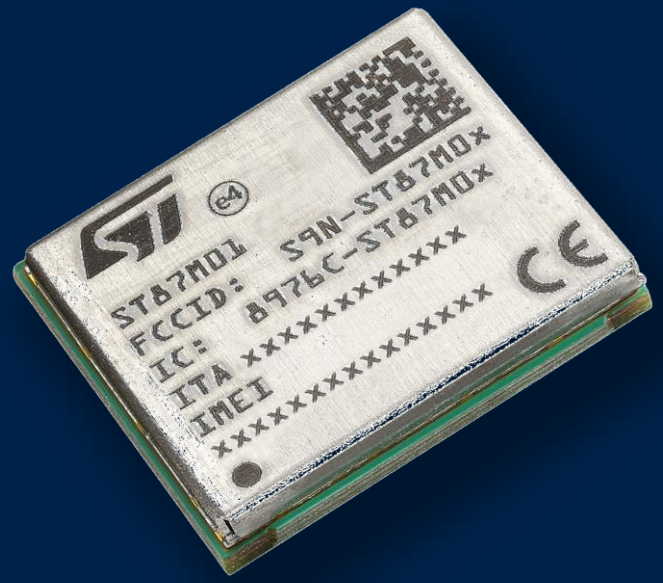
NB-IoT connectivity at the edge
Getting started with ST87M01



Ultra-compact, low-power NB-IoT industrial module

Meet ST87M01

Evaluation kit and board

Technical documentation and links

Partner Program

Ecosystem & reference designs

Software & tools

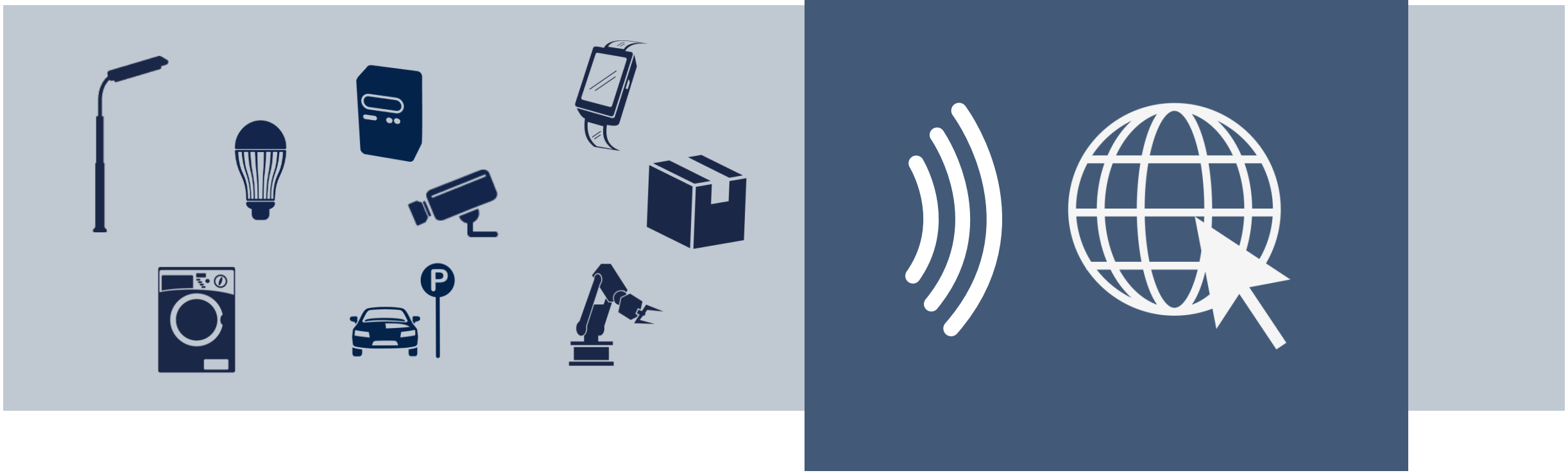
GUI

ST87M01 firmware

Easy connect library

What is an IoT device?

A physical object that uses the internet to receive or transmit data



Evolution of cellular connectivity

1G

Phone call

Analog Voice

1991

2G

Phone call
Text

Digital foundation

1998

3G

Phone call
Text
Data

Global roaming

2009

4G

Phone call
Text
Data
Internet

IP-based network

2018

5G

Phone call
Text
Data
Internet
Massive IoT

Ultralow latency & density

LTE-M
NB-IoT

~2030

6G

Phone call
Text
Data
Internet
Massive IoT
Holographic Comm
AI-Native Sensing

Ubiquitous intelligence & sensing

LTE-M vs. NB-IoT

LTE-M

+

1. Higher data rate
2. Mobility support in connection mode with handover
3. Lower latency
4. Voice capability (VoLTE)

-

1. Higher power consumption
2. Weak indoor penetration
3. Higher module and connectivity costs

NB-IoT

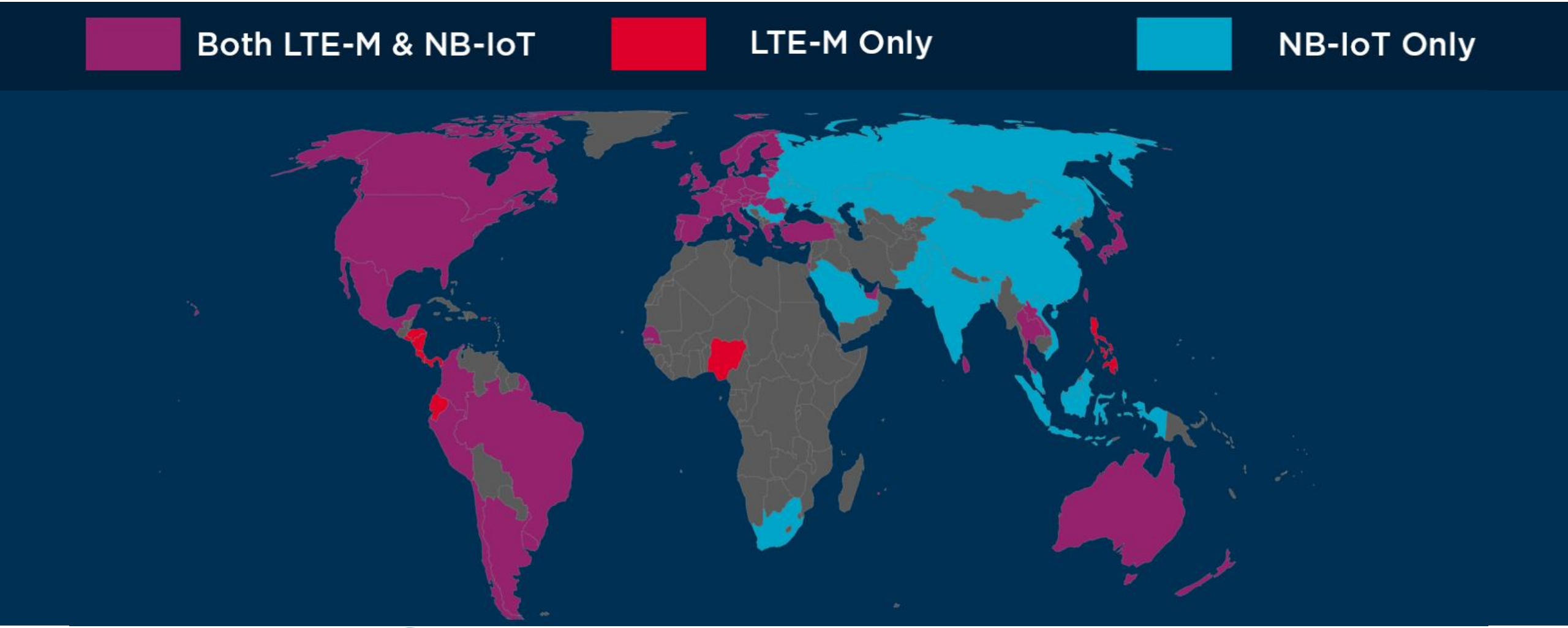
+

1. Deep indoor penetration
2. Very low power consumption
3. Low cost & complexity
4. High connection density

-

1. Lower data rate
2. Higher latency
3. No voice support

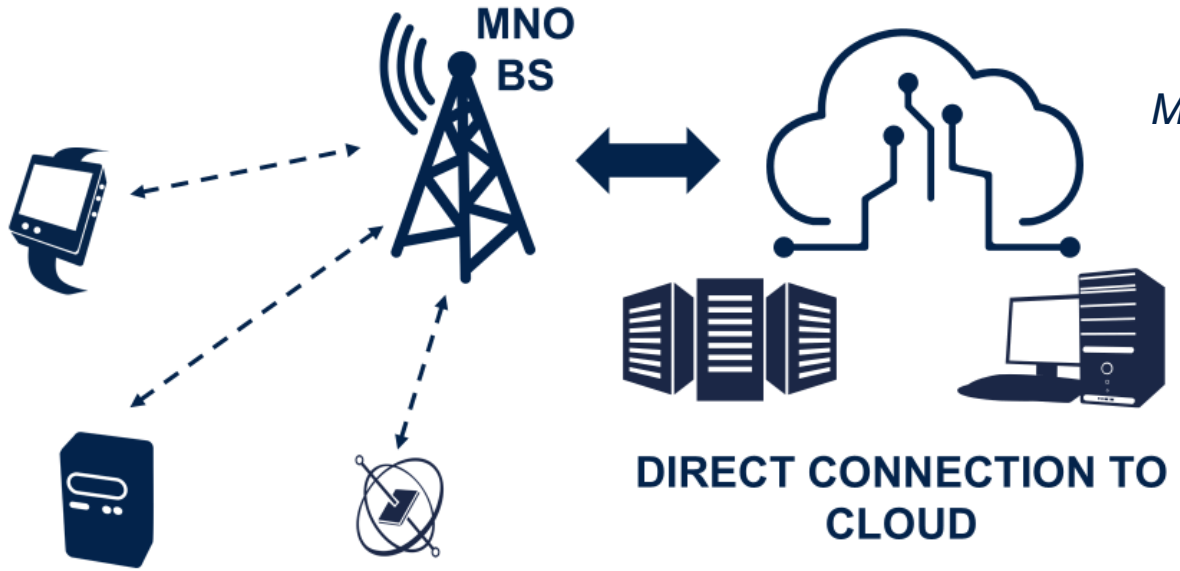
LTE-M and NB-IoT coverage



https://www.gsma.com/solutions-and-impact/technologies/internet-of-things/deployment-map/

What is NB-IoT?

Narrowband Internet of Things (NB-IoT) is a Low Power Wide Area Network (LPWAN) technology designed to provide **secure**, wide **coverage** and **low power** consumption connectivity for IoT applications.



MNO = Mobile Network Operator

No gateways required	Direct connection	Plug & play
Lower infrastructure and deployment costs	Deep indoor penetration based on cellular network infrastructure	Simplified setup for faster time-to-market

What is NB-IoT?

Narrowband Internet of Things (NB-IoT) is a Low Power Wide Area Network (LPWAN) technology designed to provide **secure**, wide **coverage** and **low power** consumption connectivity for IoT applications.

Global reliability (3GPP standard)

Uses existing LTE/5G networks. No private gateways needed.

Deep indoor penetration

Connects devices in basements or underground where 4G fails.

Ultra-low power & low cost

10–15 years of battery life.
Zero maintenance.

3GPP = 3rd Generation Partnership Project. The global organization that develops the technical standards for mobile networks (4G, 5G, 6G), ensuring worldwide compatibility and security.

ST87M01
Answering today's key IoT challenges

Millions of IoT devices need **reliable long-range connectivity** and **positioning** with minimal design complexity

Battery-powered, space-constrained devices need **multi-year lifetime** in a **very small footprint**

Long-lifecycle IoT deployments need **supply-chain control**, reliability and strong **security over time**, while mitigating geopolitical risk.

Developers need to **reduce risk** and **accelerate time-to-market** for new IoT products

All-in-one solution

LTE CatNB2, Release 15

NB-IoT + Wi-Fi Positioning + GNSS

Ultra-compact and ultralow-power

The smallest NB-IoT & GNSS Rel15 module on the market

LONGEVITY 15 YEARS COMMITMENT

End-to-End ownership & security

100% of ST ownership of the NB-IoT SoC, RF-FE and Module Design

Complete NB-IoT ecosystem ready to use

ST87M01 fully certified module

Power consumption

PSM floor current (@ 2.5 V):

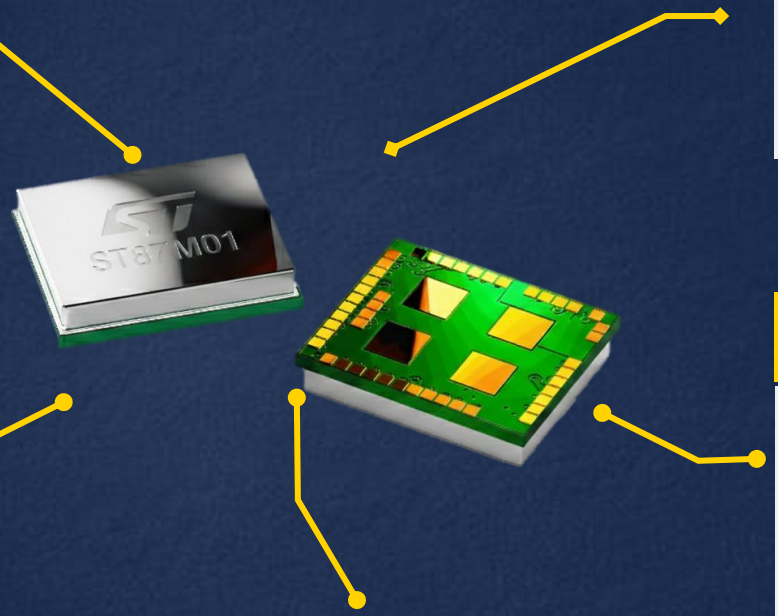
- < 1.8 µA (PSM < 6 h)
- **< 1.2 µA (PSM > 6 h)**

I_{OFF} < 0.5 µA

Module hardware

12.8 x 10.6 x 2.4 mm

Industrial grade GCF and PTCRB certification - 40 to + 85°C



Overview

Fully certified module

Qualified radio by major EMEA MNOs

Extensive field tests executed across different regions

NB-IoT modem

LTE Category NB2, Release 15

- B1/B3/B5/B8/B20/B28 **certified for EMEA**
- B2/B4/B5/B12/B13/B66/B85 **certified for N. AME**
- B3/B5/B8/B28 **certified for Brazil**

Large set of AT commands over UART I/F (3GPP compatible & ST custom)

Embedded protocol stacks

CoAP/LWM2M

MQTT

HTTP/HTTPS

TCP/UDP DTLS

IPv4/IPv6

Different options to fit your needs

	NB-IoT	Extra ADC	GNSS	Wi-Fi Positioning	WMBUS	Embedded SIM***
ST87M01-1001	✓	✓				
ST87M01-1301	✓	✓	✓	✓		
ST87M01-1400	✓				✓	
ST87M01-1000*	✓					
ST87M01-1100*	✓		✓	✓**		
ST87M01-1101*	✓	✓	✓	✓**		
ST87M01-11nX	✓	✓	✓	✓		✓
ST87M01-2001	✓	✓				
ST87M01-2301	✓	✓	✓	✓		
ST87M01-23nX	✓	✓	✓	✓		✓

- Supported LTE FDD frequency bands: B1, B3, B5, B8, B20, B28
- Supported LTE FDD frequency bands: B2, B4, B5, B12, B13, B66, B85

n: network operator identifier

X: customer identifier

*A firmware upgrade to version 2.7.0 or later is required

**Wi-Fi localization requires a firmware upgrade to the version 2.7.0 minimum

***on-demand

Discover ST87M01

Get samples

ST87M01
Small footprint, deep integration

The smallest NB-IoT & GNSS Rel15 module on the market

All-in-one solution with the highest level of integration

NB-IoT

ADS-B

GNSS

Wi-Fi positioning

Energy monitoring

M-Bus wireless

Made in Europe
A fully ST controlled solution

Manufactured in Europe

ST control of hardware and software

ST control of the supply chain

Uncompromised security

Globally certified and ready to deploy

Regional certifications

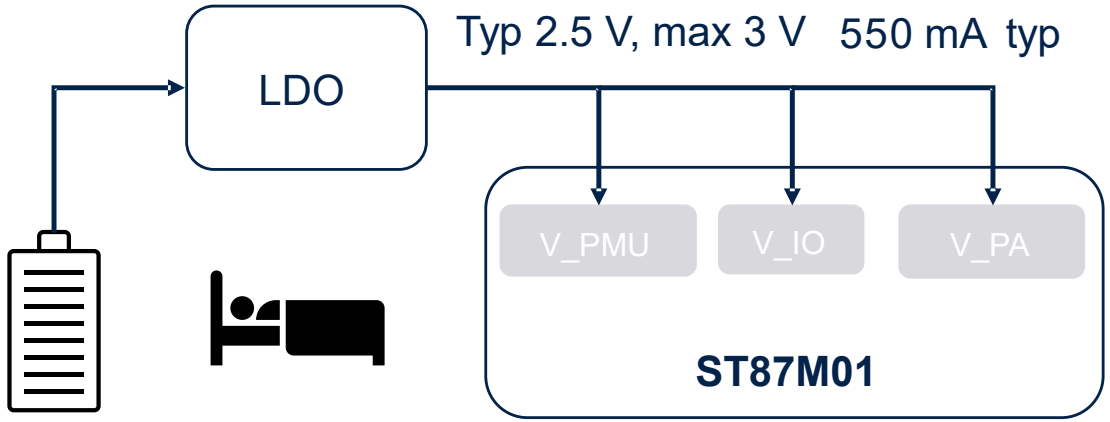
Telecom certifications

Leading operators certifications

- ✓ NB-IoT modem certified and ready to deploy
- ✓ No customer certification process needed on module
- ✓ 15 Year ST longevity commitment program

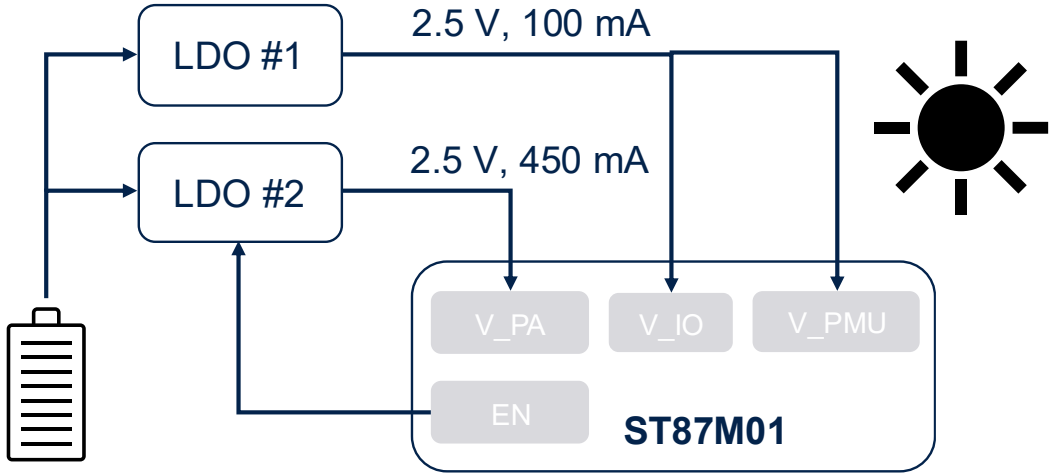
ST87M01 typical power management

Simplicity



- Always OFF applications (MCU to wake-up ST87M01)
- Recommended 2.5 V voltage supply for all rails
- The best solution if no constraints on power consumption
- Lowest BOM cost (compared to DC-DC)

Highest efficiency

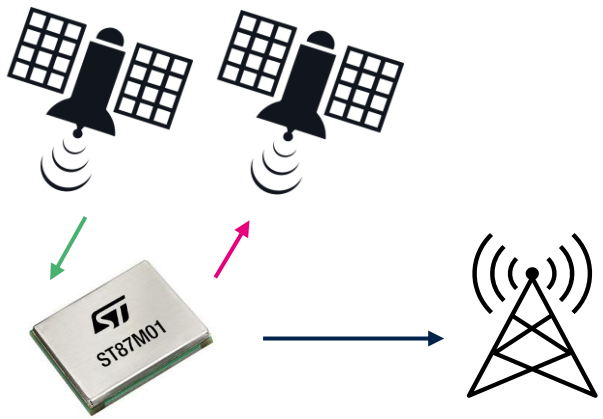


- Always ON applications with LDO #2 enabled in Tx only
- Require the same voltage for V_PMU, V_IO and V_PA
- Use Enable PIN to shut down LDO #2 during Tx sleep

GNSS & Wi-Fi positioning for full geolocation coverage

Outdoor geolocation

GNSS tracking

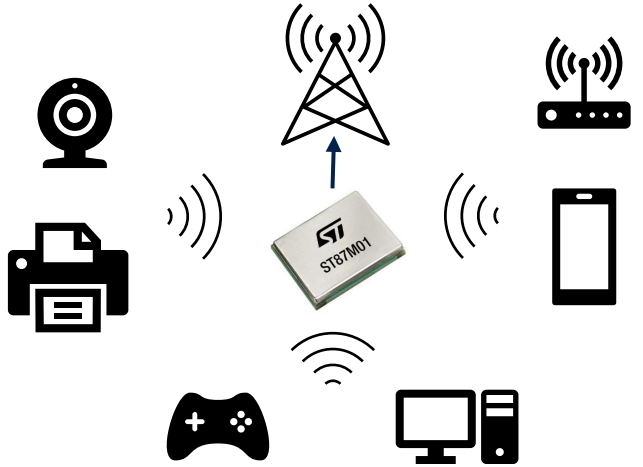


GNSS technology provides precise and reliable outdoor geolocation by leveraging satellite signals. The ST87M01 module receives and decodes signals from multiple satellite constellations, like GPS and Galileo, to determine accurate real-time positioning.

Can switch by leveraging the ST87M01 software-defined radio capabilities

Indoor geolocation

Wi-Fi positioning tracking

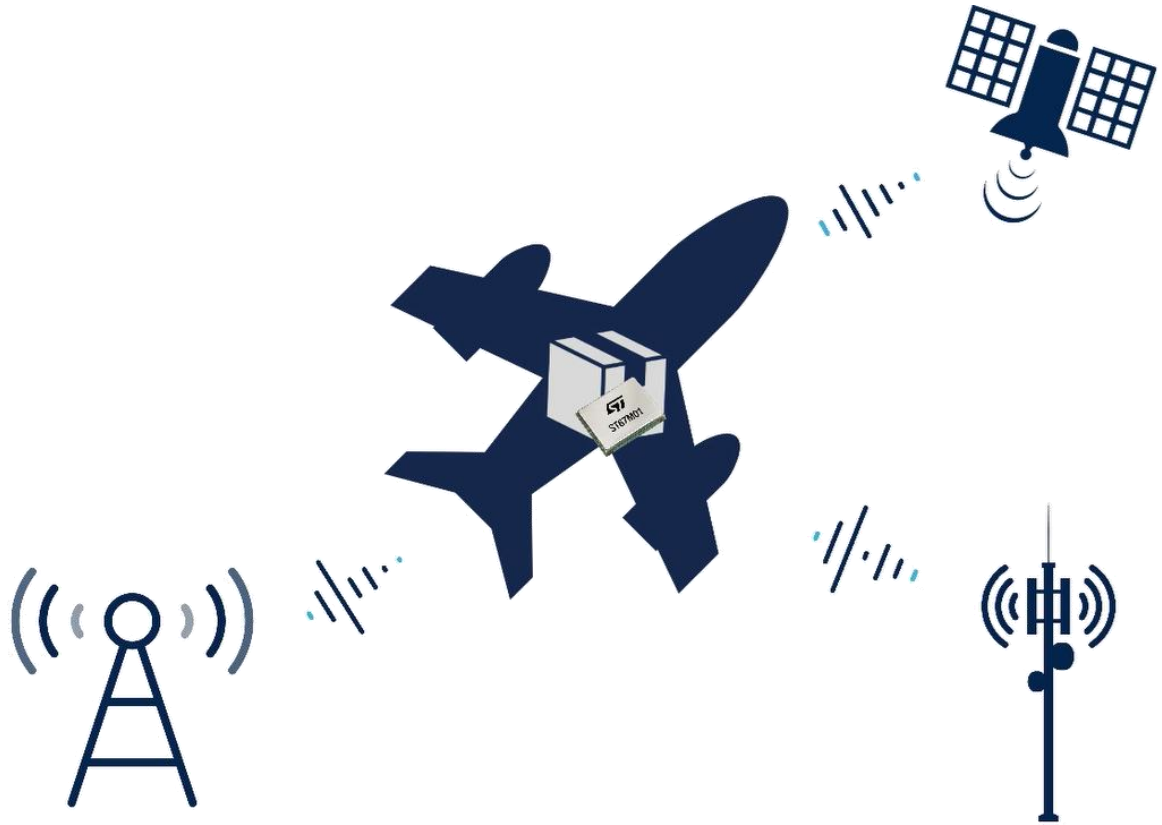


The **Wi-Fi positioning** feature enables precise indoor geolocation by detecting nearby Wi-Fi networks and taking SSID, MAC, and RSSI public information for accurate positioning. The collected data is then transmitted via the NB-IoT network to allow the customer to triangulate the asset location.

ADS-B support for enhanced positioning

ADS-B stands for **A**utomatic **D**ependent **S**urveillance–**B**roadcast.
It is a technology used by **aircraft** to continuously broadcast position and flight information.

ST87M01 captures ADS-B broadcasts and tracks the aircraft, the data is then transmitted via the NB-IoT network when available.



ST87 Energy Estimator (ST87-E^2)

How to get the energy consumed of the product in unpredictable conditions?

The problem

- Energy consumption of an NB-IoT modem depends on the network conditions
- Network performance varies with operator settings
- Battery-powered products do not have the budget for real-time energy measurement

The solution

- ST87-E^2 is an application running inside ST87M01
- Thanks to ST87 design, we can monitor the activity of the modem and deliver its relevant energy consumption
- Target accuracy above 90%
- Customers are now able to get the remaining capacity

Wireless M-Bus implementation on ST87M01

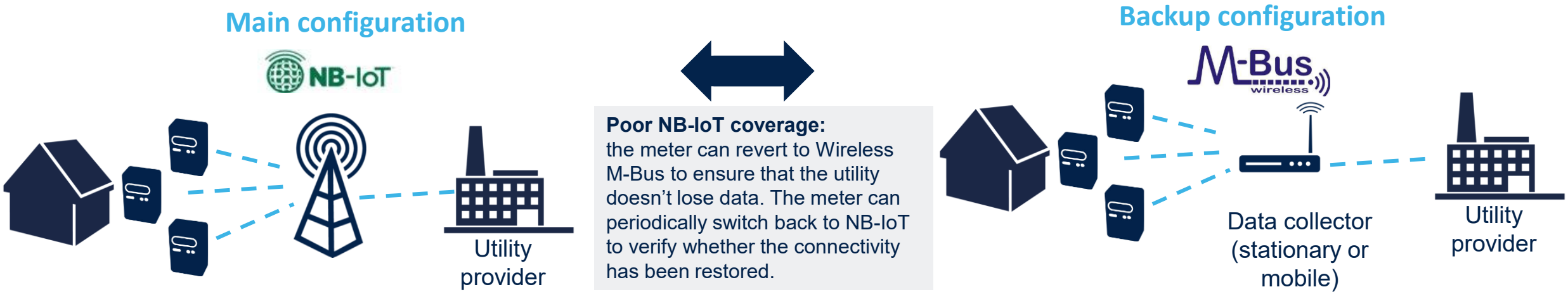
Provides protocol switch on the field in case of poor NB-IoT coverage

- T1 & C1 modes fully operational,
- T2 & C2 ready

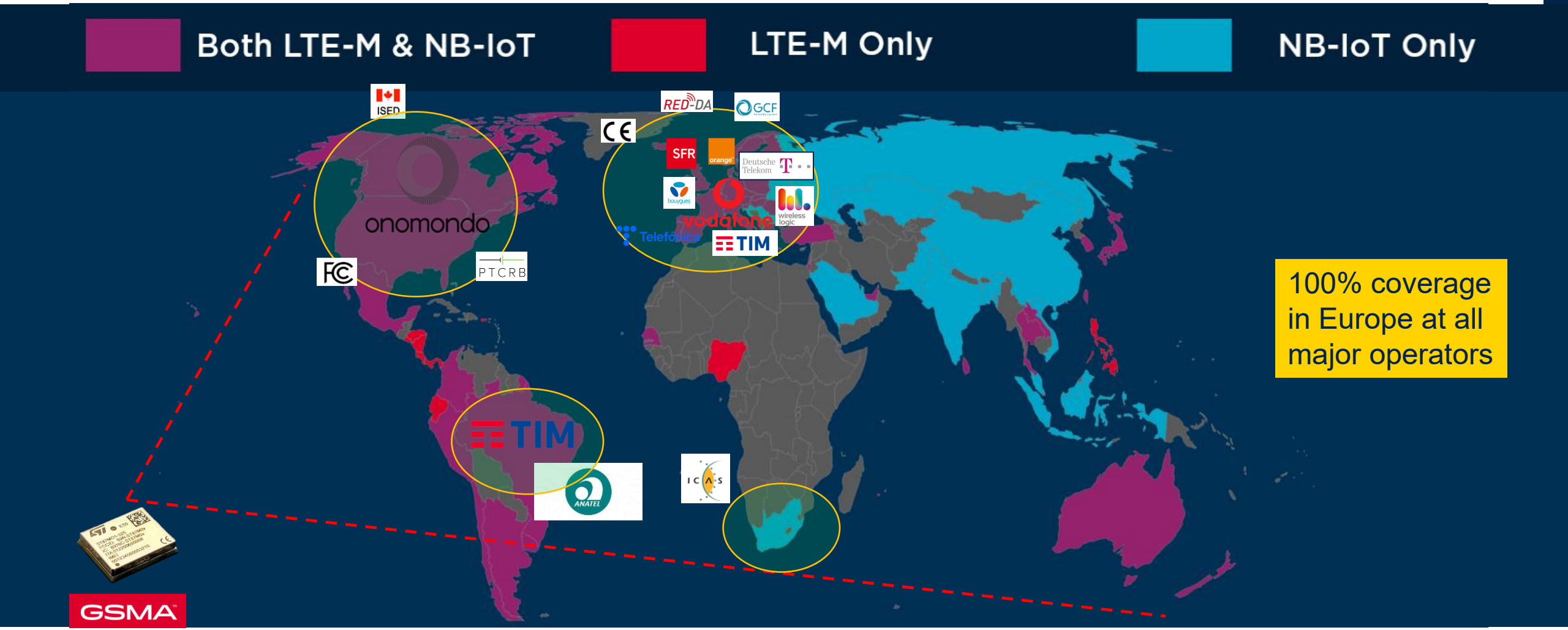
WM-Bus PHY layer hosted in ST87M01 as fallback DSP firmware vs NB-IoT

- PHY layer EN 13757-4 Release 2013
- Initial development on T1 and C1 modes (unidirectional) compatible with walk-by/drive-by receivers
  - Mode T1: FSK 100 kcps at 868.95 MHz – code 3 out of 6
  - Mode C1: FSK 100 kcps at 868.95 MHz – code NRZ

External host MCU running stack & application layer (OMS)



ST87M01 coverage



100% coverage in Europe at all major operators

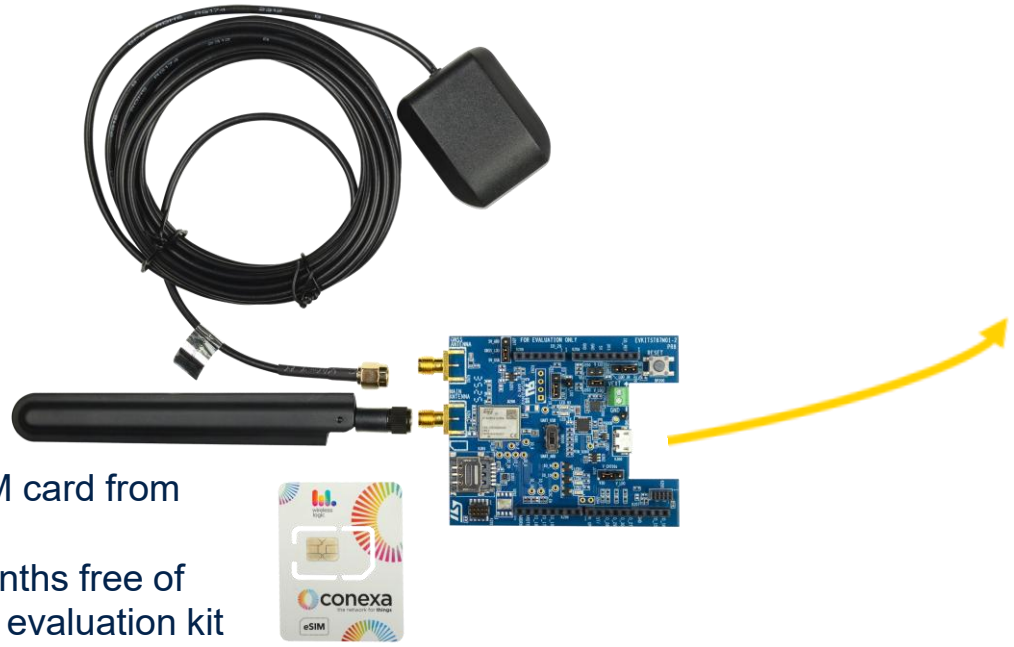
https://www.gsma.com/solutions-and-impact/technologies/internet-of-things/deployment-map/

ST87M01 easy evaluation with EVKITST87M01-2

[Discover EVKITST87M01-2]

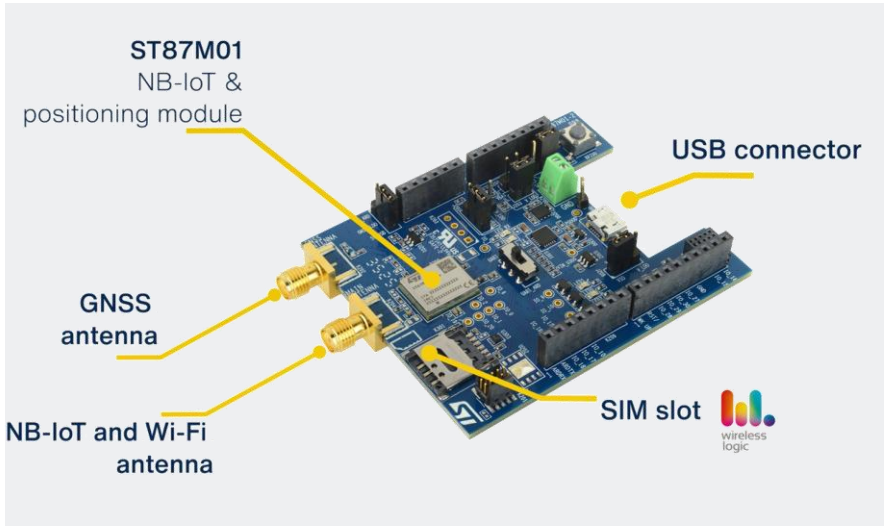
[Get your kit]

[Read the user manual]



Conexa IoT SIM card from Wireless Logic:
50 MB for 6 months free of charge with the evaluation kit

	NB-IoT	Extra ADC	GNSS	Wi-Fi Positioning	WMBUS
ST87M01-1301	✓	✓	✓	✓	

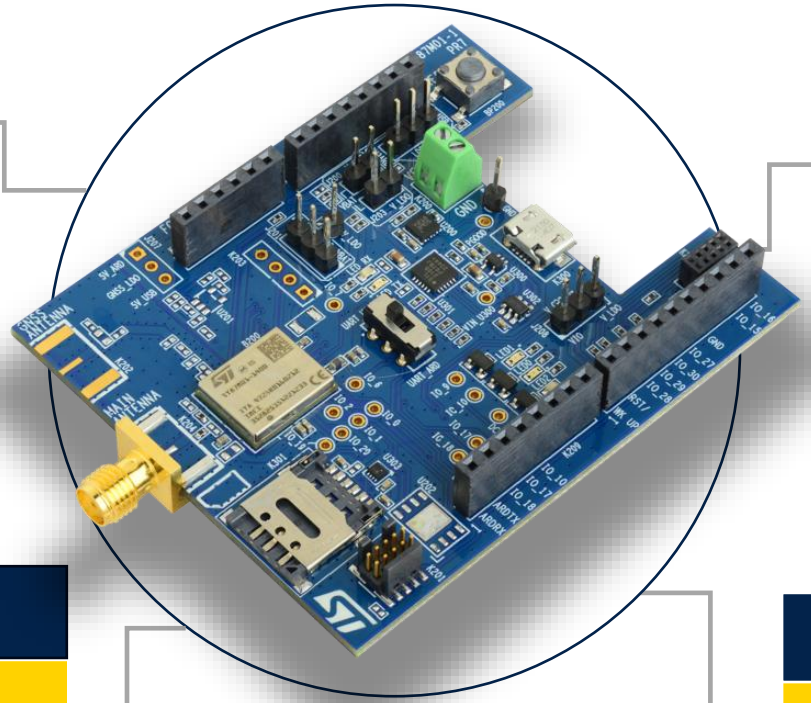


NB-IoT and W-MBus evaluation kit overview
EVST87M01W-1

Discover EVST87M01W-1

Evaluation hardware

- EVST87M01W-1 evaluation kit specific for NB-IoT with Wireless M-Bus fallback
- User manual



CAD resources

- EVST87M01W-1 BOM
- EVST87M01W-1 schematic
- EVST87M01W-1 PCB layout
- Hardware user manual

Documentation

- AT commands user manual
- Application notes (GNSS, MQTT, startup, TCP IP/UDP)
- Datasheet / data brief

Tools & software

- ST87M01 GUI
- User manual

	NB-IoT	Extra ADC	GNSS	Wi-Fi Positioning	WMBUS
ST87M01-1400	✓				✓

STSW-ST87MGUI
ST87Mxx startup package

Easy installation and intuitive GUI

Windows tool that installs without admin rights and offers an easy-to-use graphical interface to control ST87Mxx modules.

Complete ST87Mxx feature control

Single environment to manage firmware download, AT command console, GNSS/Wi-Fi positioning, spectrum, ST Engineering trace, and diagnostic tools.

Integrated documentation and user guides

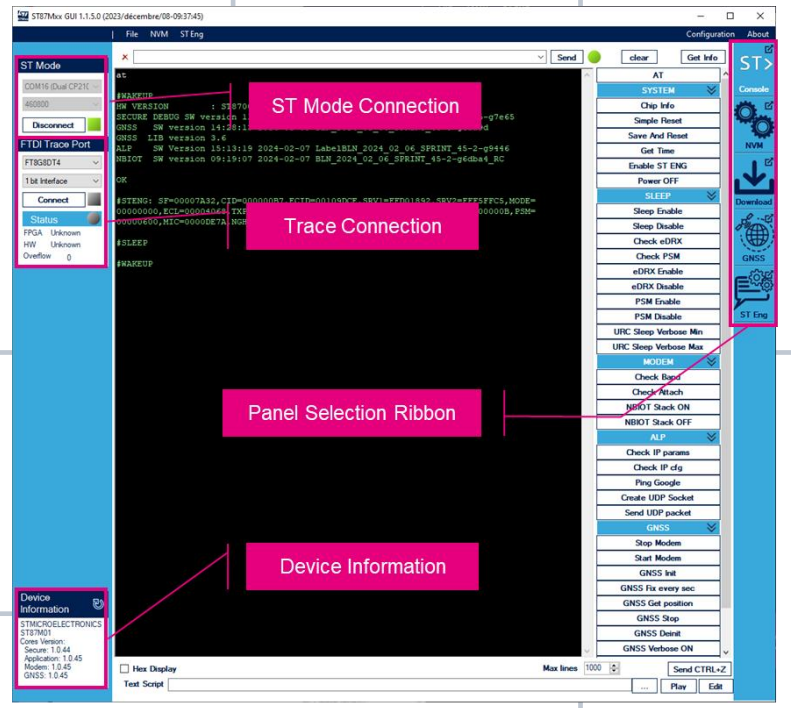
Startup package includes built-in user guides and reference material to simplify setup and accelerate ST87M01 evaluation.

ST87MGUI GUI for a seamless navigation experience

Console
- Send single/group of AT commands by specifying a “Text Script” file

Configuration panel
- Define commands shortcuts buttons

Download panel
- Program firmware images into the module



[Download ST87Mxx startup package]

[Read the databrief]

Trace panel
- Manage module debug trace capabilities

GNSS panel
- Manage positioning services

ST Eng panel
- Manage NB-IoT network / radio link information

ST87M01 firmware

Firmware bundle for the STSW-ST87M01 module family

The module supports the following three types of bundles:

Type 1 = NB-IoT

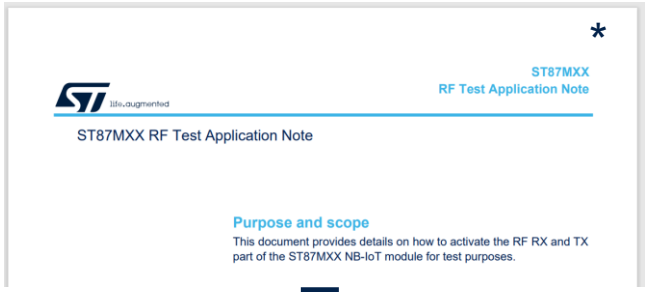
Type 2 = NB-IoT & GNSS & Wi-Fi & ADS-B positioning

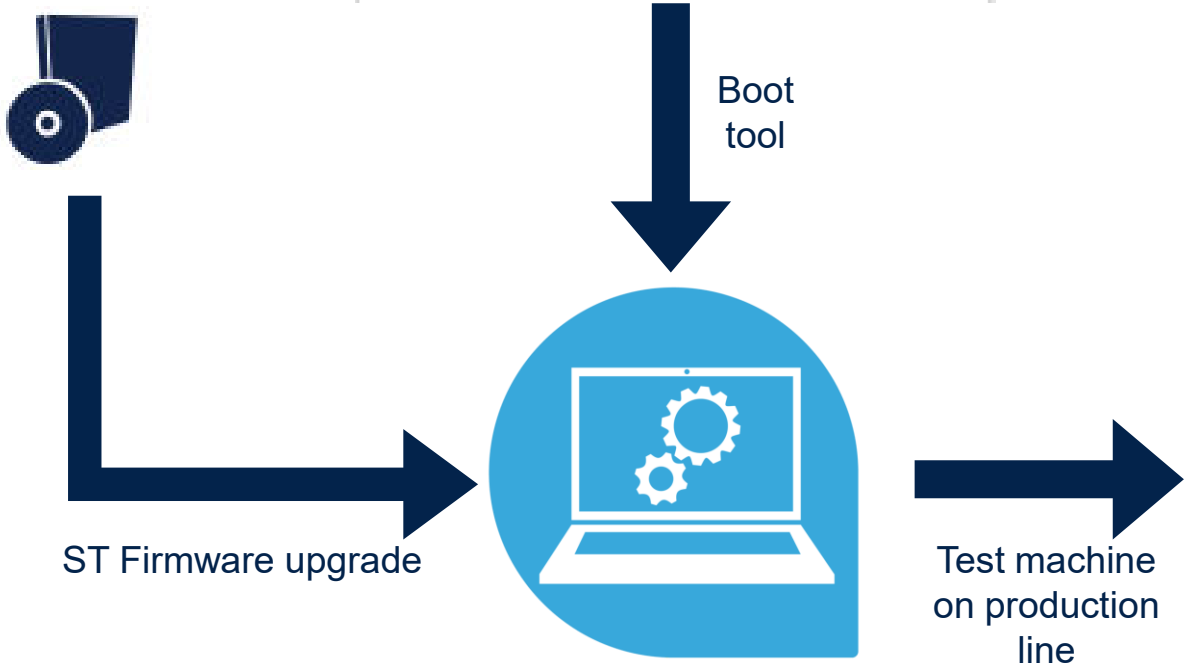
Type 3 = NB-IoT & WMBUS

Download ST87M01 firmware

Read the databrief

ST87M01 firmware upgrade at production line





Boot Tool is a procedure and software that – installed on customer's test machine in the production line – allows ST87M01 firmware upgrade on the field. It takes our executable file as input to perform firmware upgrades efficiently and reliably.

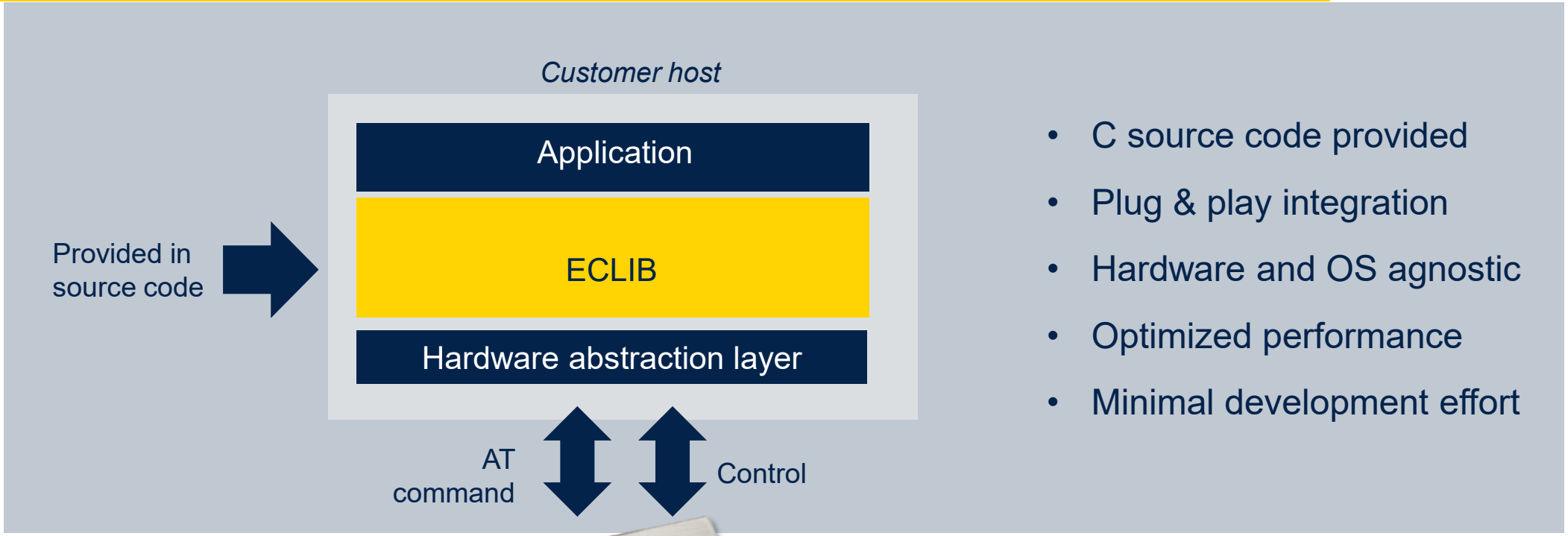
Windows

Linux

* Downloaded by ST87M01 start up package (GUI) installation ST87Mxx startup package
The documents are available from the "Help" drop-down menu.

ST87M01 Easy Connect library

The Easy Connect Library (ECLIB) simplifies communication between your host processor and the ST87M01 module



- C source code provided
- Plug & play integration
- Hardware and OS agnostic
- Optimized performance
- Minimal development effort

ST87Mxx easy connect library release note

MCU easy connect library for ST87Mxx data brief

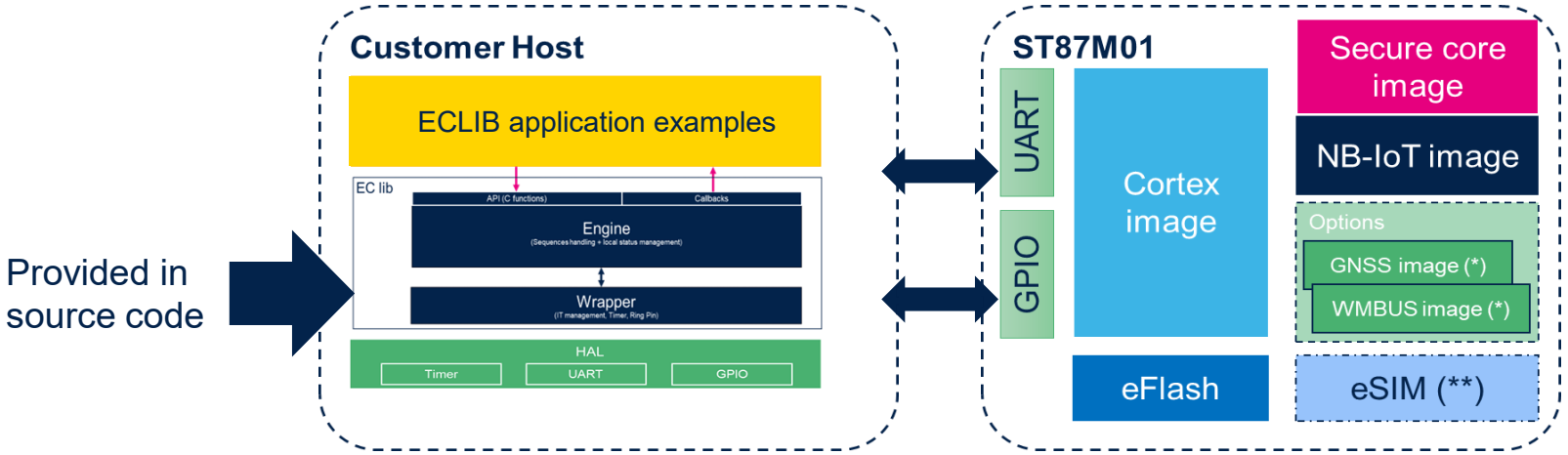
Download STSW-ST87ECLIB

ST87M01 Easy-Connect software library

ST87M01 **Easy-Connect software library** as **source code** to manage AT commands

- **Simplify** access to ST87M01 NB-IoT, GNSS, Wi-Fi, and WMBUS resources
- Give guidance to customer via **precoded** sequences
- Set default **settings to preferred ones** (best performance oriented)
- Make configuration as simple as possible for users

- **No OS dependency** (OS agnostic)
- C-coded agnostic interface (no hardware dependency)
- Static configuration (config.h, …)
- Minimal API number to perform actions



ECLIB application examples

STSW-ST87M01APP
ECLIB application examples

What is STSW-ST87M01APP?

Demonstrates the Easy Connect Library (ECLIB) on STM32 platforms, targeting the **ST87M01** module and boards like NUCLEO-U545RE-Q + EVKITST87M01-2 and STEVAL-NBIOTV1.

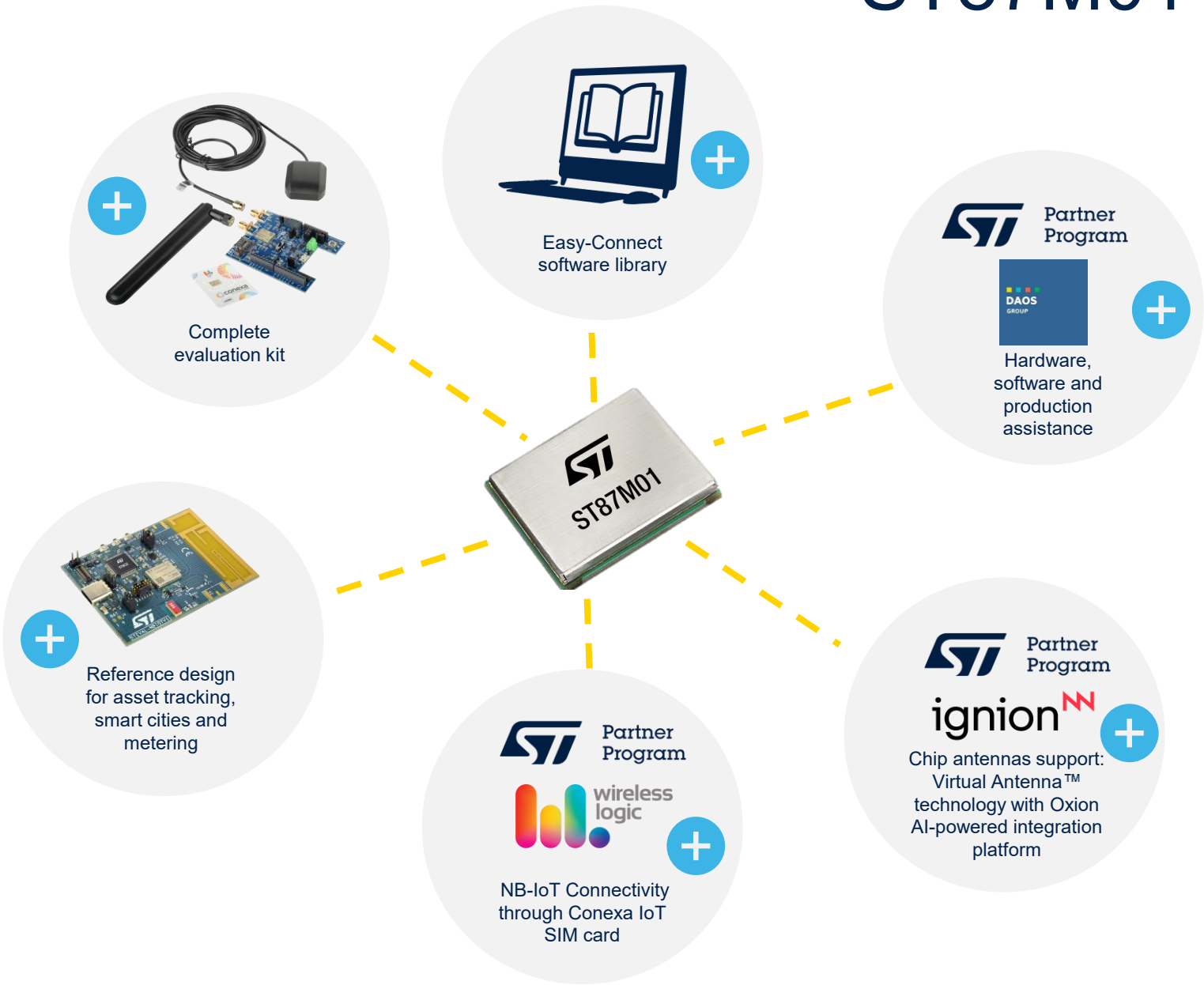
Why STSW-ST87M01APP?

ECLIB provides a **high-level API** for rapid IoT development, abstracting complex connectivity and protocol management.

Key Features

- **Modular structure** with easy customization.
- Supports CoAP, HTTP/HTTPS, MQTT, LWM2M, TCP, UDP, GNSS positioning, and Wi-Fi scanning.
- **Example applications** for each protocol/feature, ready to run on supported boards.
- **Specific examples** with ultralow power implementation for STM32U5
- **Example** with FreeRTOS as a reference for multitasking applications.

ST87M01 ecosystem

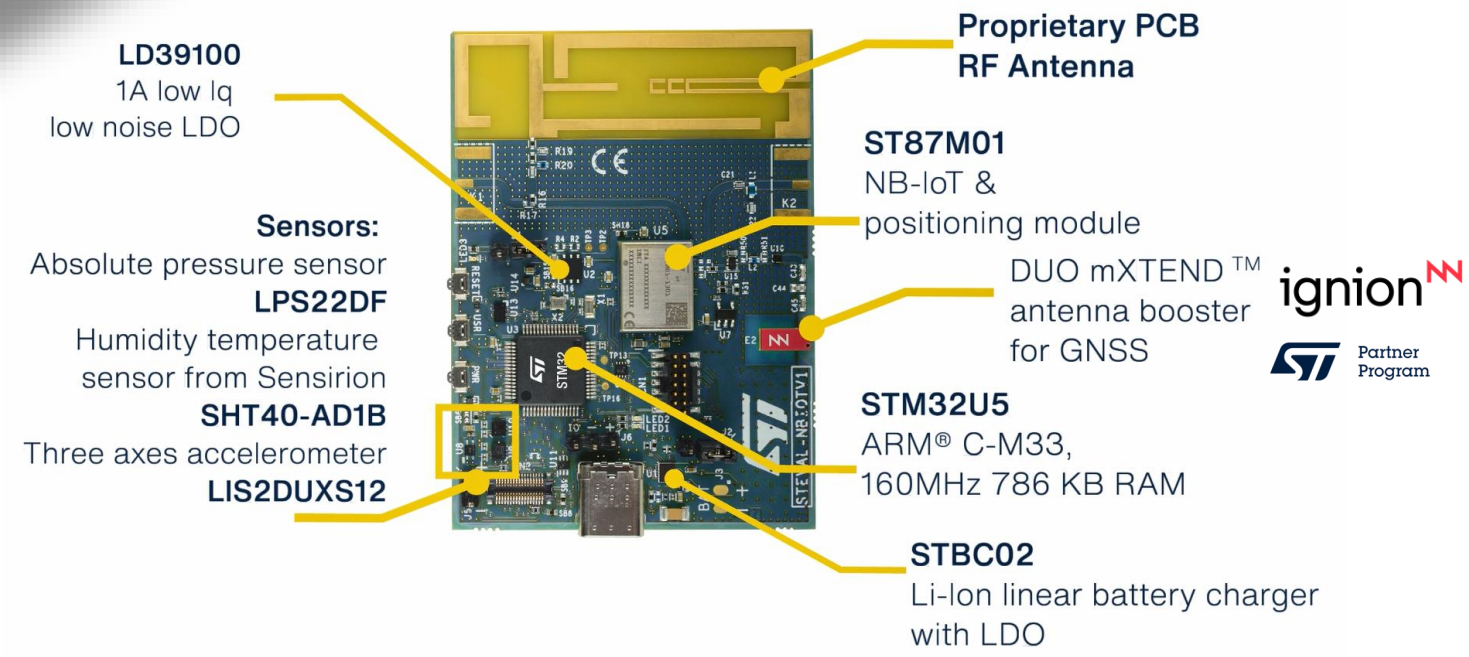


STEVAL-NBIOTV1: ST87M01 reference design

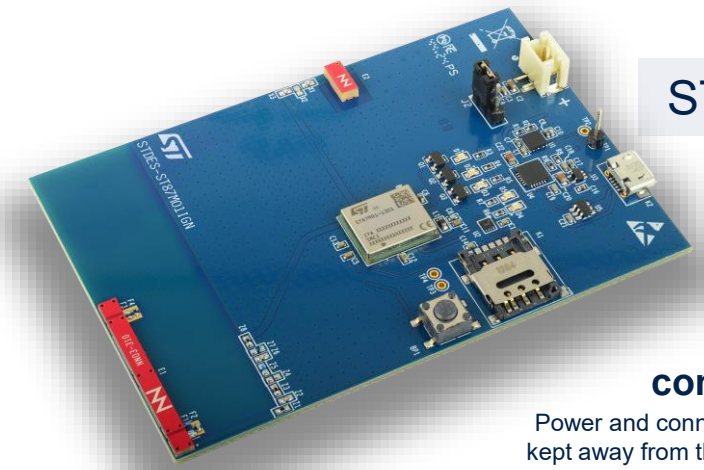
NB-IoT evaluation platform and reference design for asset tracking and smart cities with ST87M01

Discover STEVAL-NBIOTV1

STEVAL-NBIOTV1 application examples



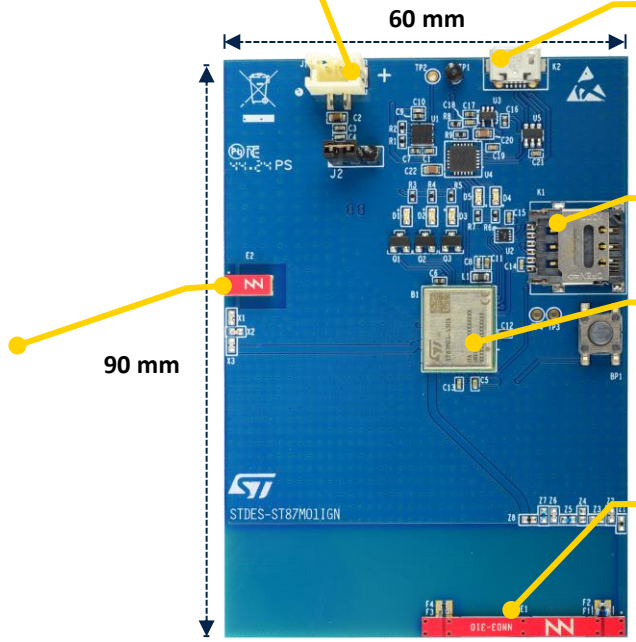
STDES-ST87M01IGN: ST87M01 reference design



ST87M01 reference design with Virtual Antenna® technology

Power connector
Power and connectivity are kept away from the antenna regions and outside clearances/keep-out zones

NN03-320 GNSS antenna
Located on the left edge, with its matching network close to the feed



USB connector

SIM holder

ST87M01-1301
ST87M01 module placed near the center of the PCB

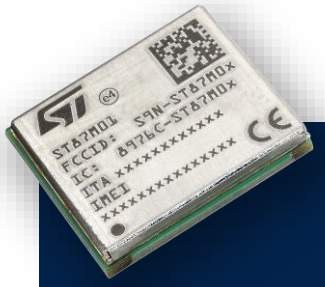
NN03-310 NB-IoT antenna
Located on the bottom-right edge, with its matching network close to the feed

Discover STDES-ST87M01IGN

STDES-ST87M01IGN technical note

ignion Partner Program

Technical documentation and links



ST87M01

Discover ST87M01

Get samples

GUI

Download ST87Mxx startup package

Read the databrief

Easy connect library

ST87Mxx easy connect library release note

Download STSW-ST87ECLIB

MCU easy connect library for ST87Mxx data brief

ECLIB application examples

Design guide and application notes

These documents are installed with the ST87M01 startup package (GUI) – ST87Mxx startup package– and are available from the “Help” drop-down menu.

ST87M01 firmware

Download ST87M01 firmware

Read the databrief

EVKITST87M01-2

Discover EVKITST87M01-2

Get your kit

Read the user manual

STEVAL-NBIOTV1

Discover STEVAL-NBIOTV1

EVST87M01W-1

Discover EVST87M01W-1

STDES-ST87M01IGN

Discover STDES-ST87M01IGN

STDES-ST87M01IGN technical note

Our technology starts with You

Find out more at www.st.com