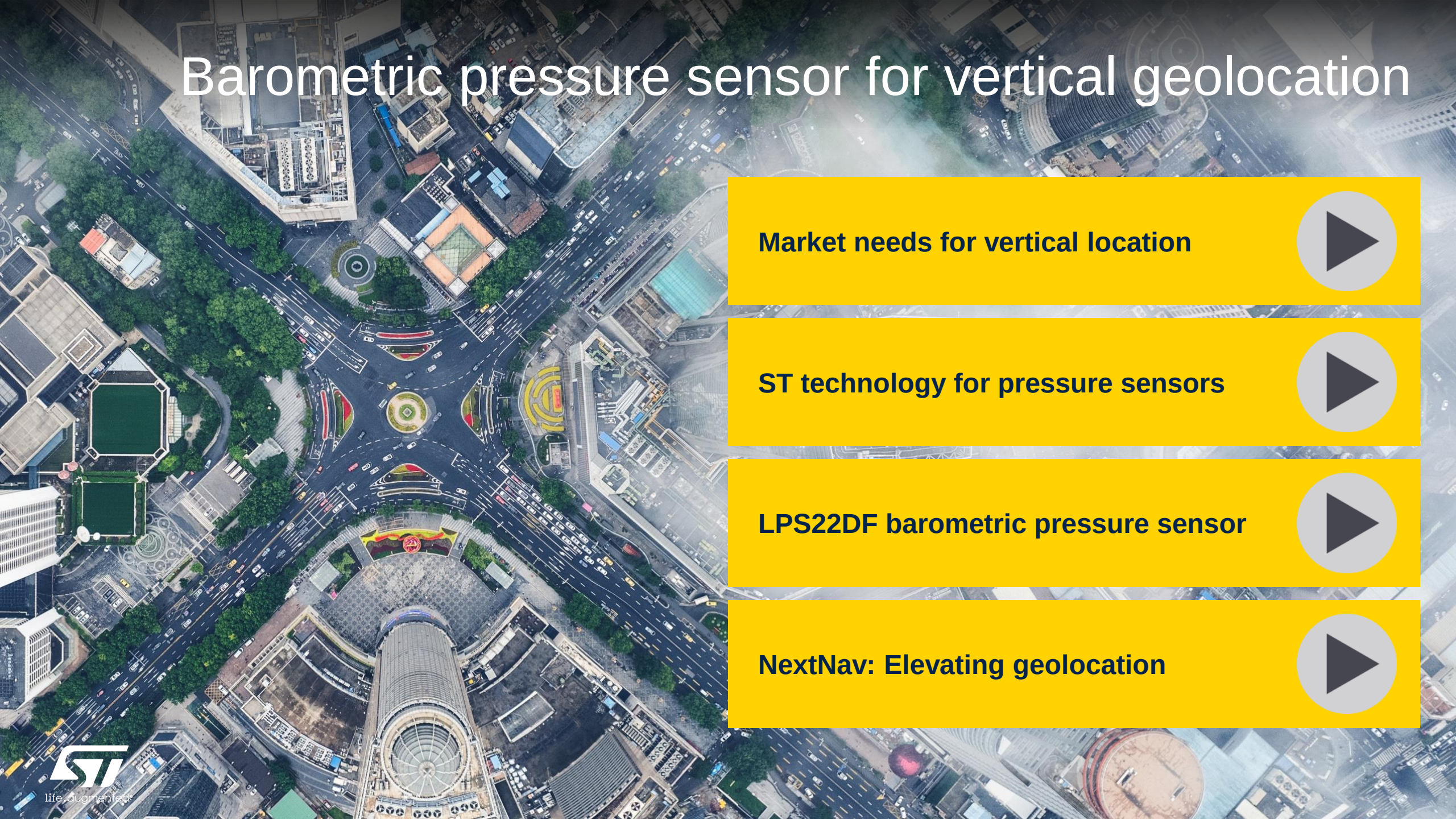
Barometric pressure sensor for vertical geolocation



- Market needs for vertical location
- ST technology for pressure sensors
- LPS22DF barometric pressure sensor
- NextNav: Elevating geolocation

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Market trends driving needs for reliable vertical location services

E911: vertical location accuracy metric (±3 meters for 80% of all wireless E911 calls) has been adopted by FCC

Wi-Fi 6E/7: Vertical location of access point (AP) required by FCC to manage interference between AP and other systems operated at 6 GHz

Vertical warehouses have become the most common type of commercial building in the US – overtaking office space – to keep up with e-commerce demand

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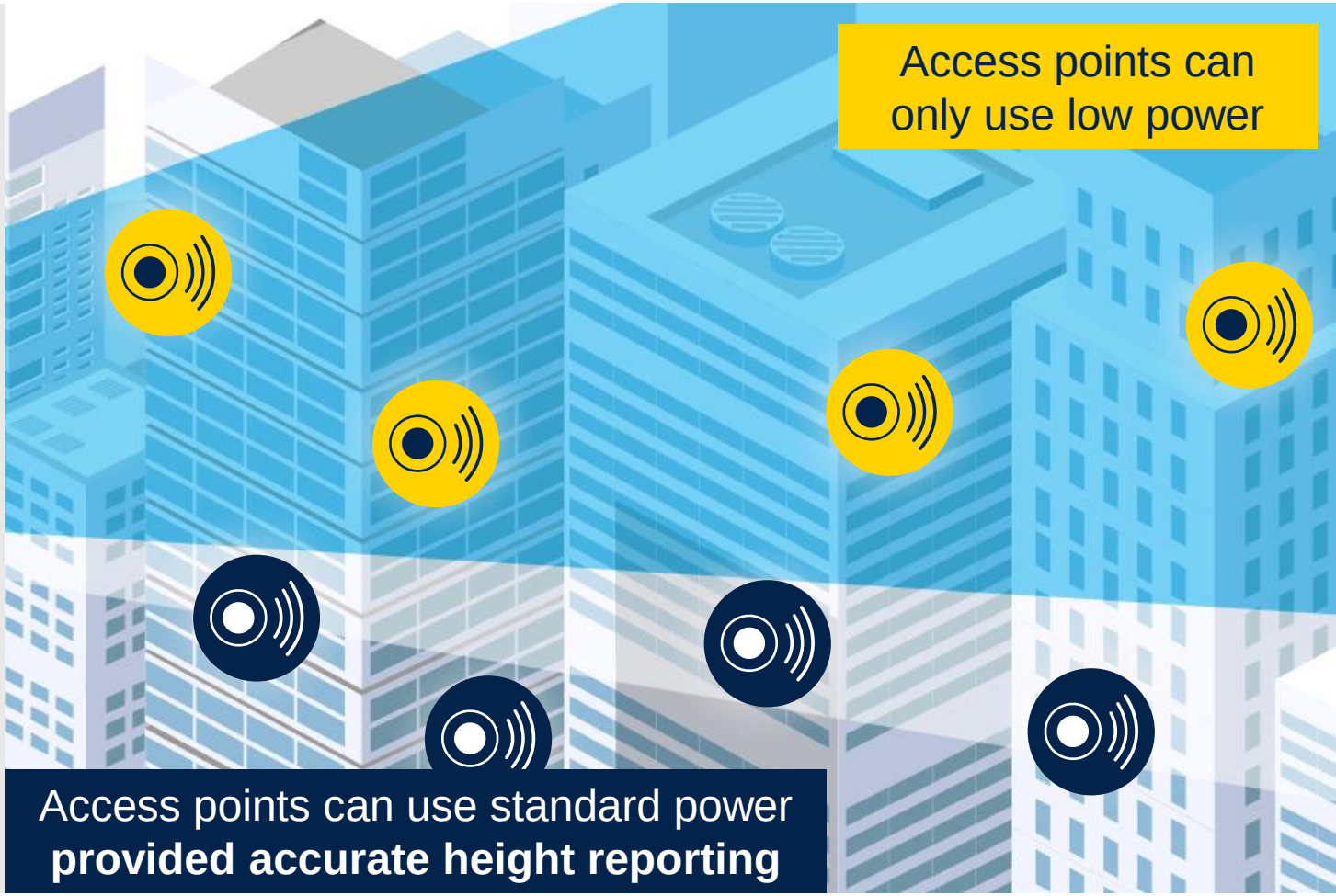
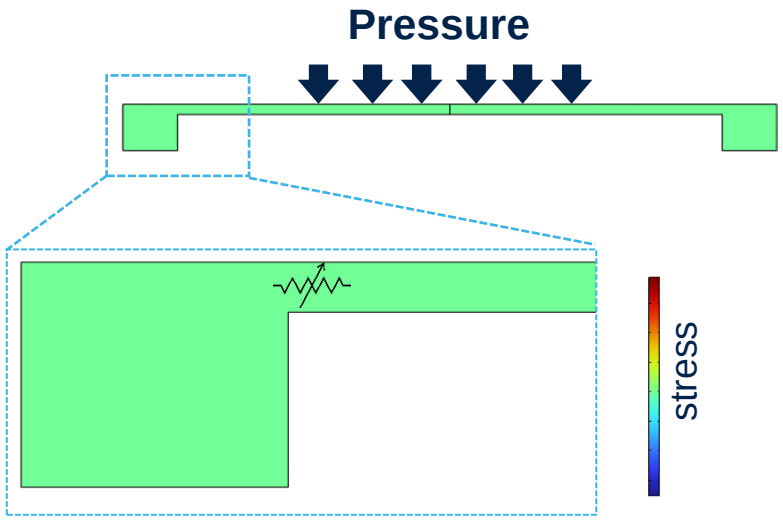
The need for vertical location in Wi-Fi 6E/7

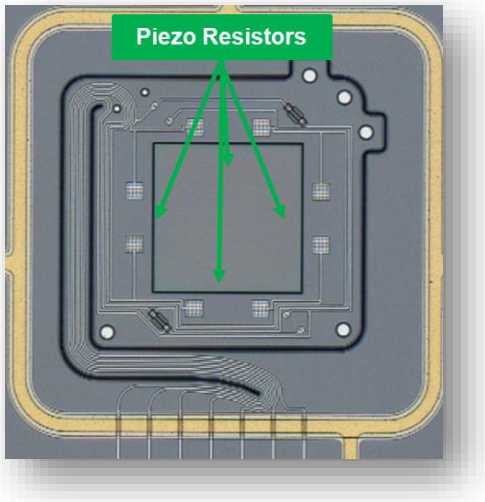
To enable higher power transmission, WiFi-6E/7 providers are required by the FCC to provide the height above ground of WiFi 6E/7 access points to automated frequency coordination (AFC) system.



ST technology for pressure sensors



+ Suspended membrane with spring structure ➡



Robustness to thermal deformation
Robustness to mechanical stress

MEMS absolute pressure sensors

MEMS sensing element

ASIC

Package

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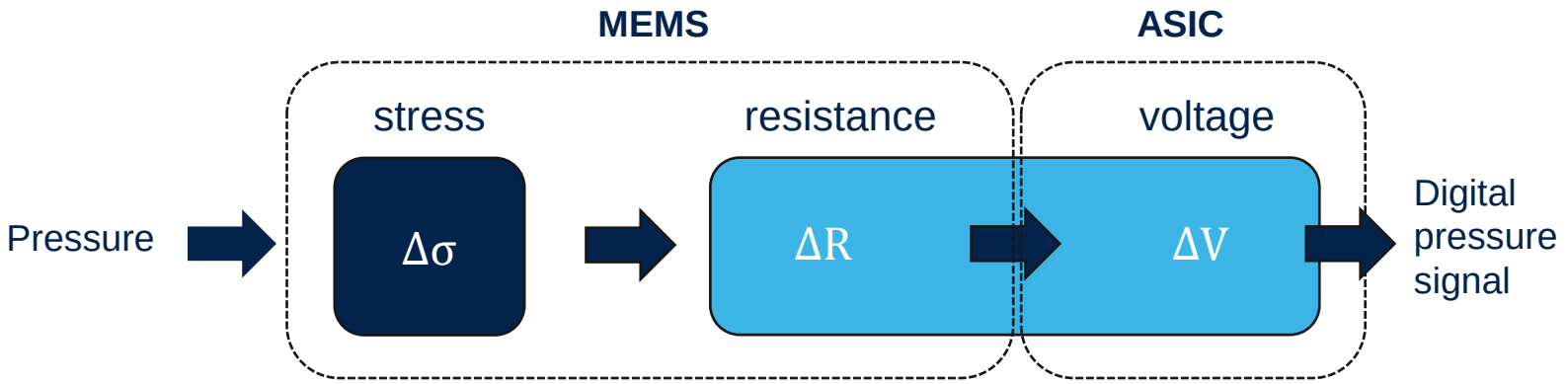
ST technology for pressure sensors



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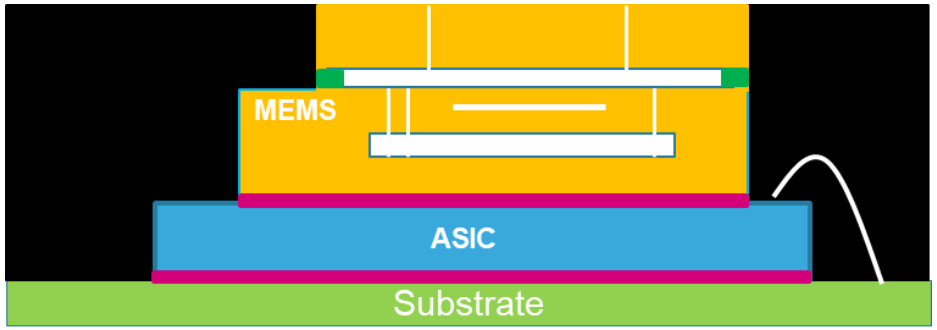
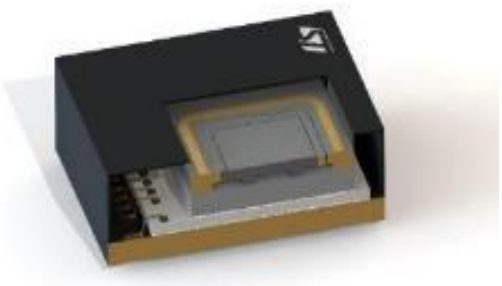
ST technology for pressure sensors





2 x 2 x 0.73 mm

+ Unique fully-molded package ➡ **Superior reliability & moisture resistance**

MEMS absolute pressure sensors

MEMS sensing element

ASIC

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ST technology for pressure sensors

MEMS absolute pressure sensors

MEMS sensing element

Suspended membrane manufactured using a proprietary process developed by ST

When pressure is applied, the membrane deflection induces an imbalance in the Wheatstone bridge piezo-resistances

+

ASIC

Output signal is converted by the IC interface

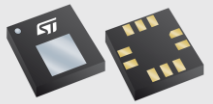
Digital output for connection to host microcontroller/processor

Factory calibration (trimming parameters stored on the device)

+

Package

Unique fully-molded package



- Ultra-thin package
- Shock and vibration suppression
- Improved dust/moisture resistance

Water-resistant package option

- Cylindrical design & O-ring compatibility
- Potting gel & grounded metal cap
- Low-stress encapsulation

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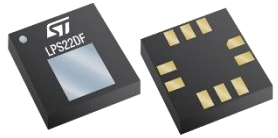
Barometric pressure sensor: LPS22DF

Delivering high performance with low power consumption



Key application requirements

Current consumption ⟷ **Noise Long term stability**

Supply current @ 1Hz output data rate **1.7 µA**	RMS pressure noise (with embedded filter) **0.34 Pa RMS (<3cm)**
Supply current in power-down mode **0.9 µA**	Long term stability **0.1 hPa (~80cm)**

NEXTNAV CERTIFIED

LPS22DF, ST's first pressure sensor to receive the NextNav Certification thanks to unique capabilities

https://blog.st.com/lps22df-nextnav

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Pressure sensor use cases

High accuracy pressure sensing is key for multiple applications

Barometer
LPS22DF

Water-resistant pressure sensor
LPS28DFW

Vertical location	Activity recognition	Airplane mode detection	Flow detection	Water depth monitoring
				
Altitude monitoring Indoor vertical location Ambient pressure monitor	Vertical context detection Stair count / Man Fall down Pose & Fitness monitoring	Recognize take-off and landing to set the radio/GPS signal	Inhale detection Air Flow metering	Water Depth monitoring
Wi-Fi AP Drones Weather station	**Smartphone Wearable**	**Asset tracking**	**Gas metering Vacuum cleaner Smart filter**	**Wearable**

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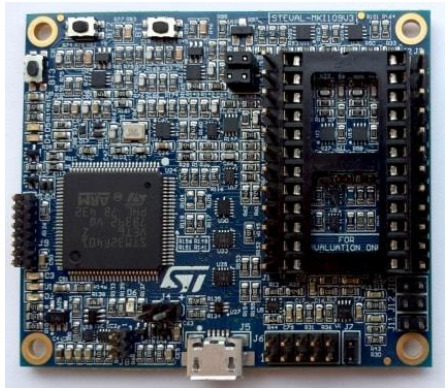
Barometric pressure sensor: LPS22DF Evaluation tools ecosystem

Hardware:

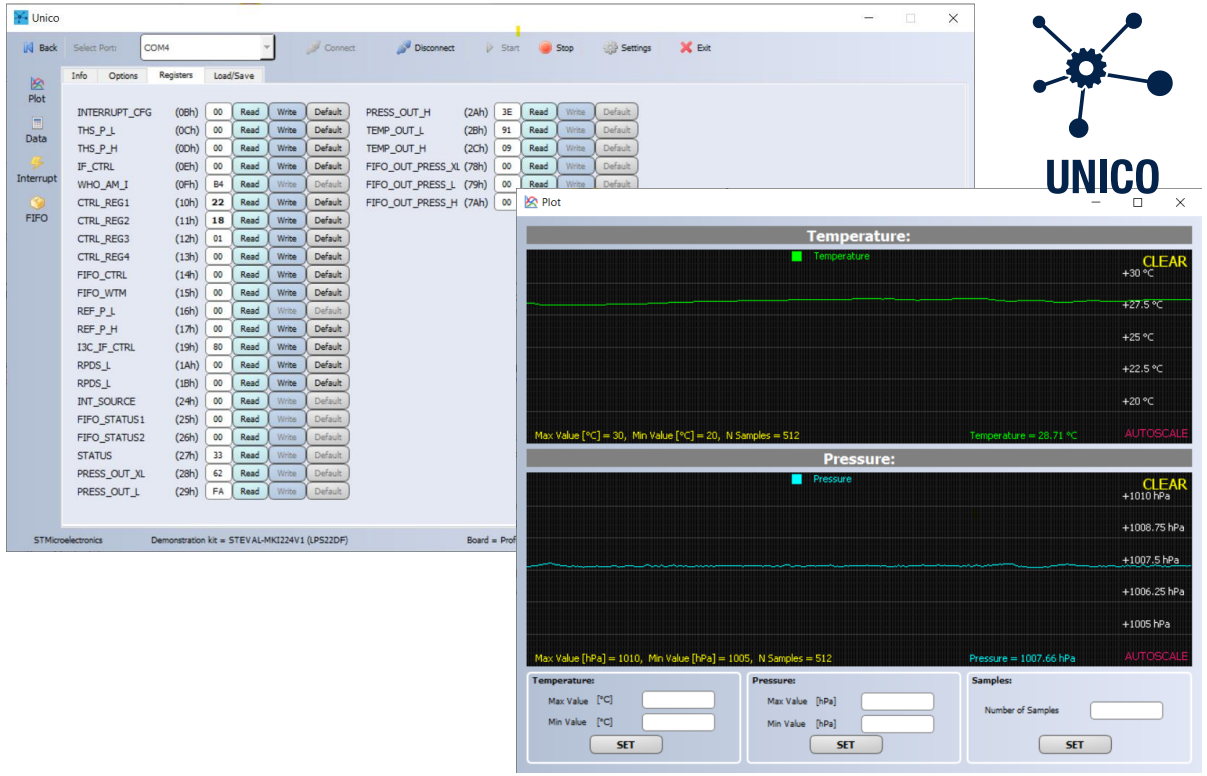
- ST MEMS adapters **motherboard** - STEVAL-MKI109V3
- LPS22DF **sensor** adapter board - STEVAL-MKI224V1



+

Software:

- MEMS evaluation kit **software package** for Linux, Mac OSX and Windows - Unico-GUI



Documentation:

- **User manual**: Professional MEMS Tool motherboard for MEMS adapter boards - UM2116 - STEVAL-MKI109V3
- **Application note**: LPS22DF low-power and high-precision MEMS nano pressure sensor - AN5699

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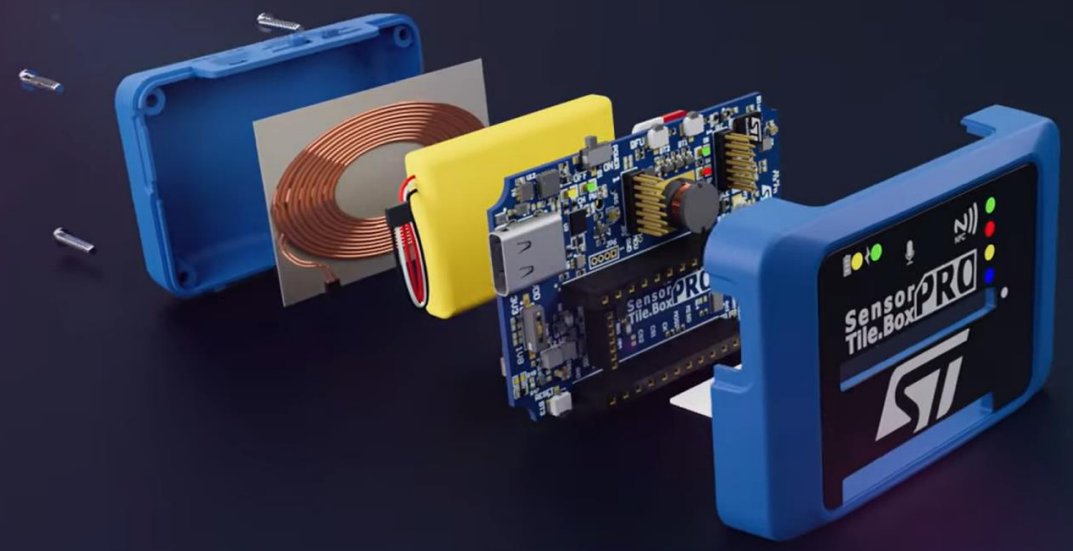
SensorTile.box PRO
Ready-to-use programmable wireless IoT node

ST makes IoT sensing accessible with a ready-to-use device connectable via Bluetooth® to your smartphone



Can be configured **for users of any skill level (ENTRY, PRO, EXPERT)** to support learning and prototyping

Built into a **compact box**

Bundled with **app for smartphone**

Order code: STEVAL-MKBOXPRO

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Sense, process and connect

Inertial sensors

6-axis inertial measurement unit
LSM6DSV16X

3-axis low-power accelerometer
LIS2DU12

3-axis magnetometer
LIS2MDL

Processing & memory

Ultra-low-power with FPU Arm Cortex-M33 with Trust Zone
STM32U585AI

Micro SD card slot

Environmental sensors

Low-voltage local digital temperature sensor
STTS22H

Barometer / pressure sensor
LPS22DF

Digital microphone / audio sensor
MP23DB01HP

Connectivity

Bluetooth Low Energy 5.2 SoC
BlueNRG355AC

NFC tag on board
ST25DV04K

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Power options and user interface

Power options

- USB-C charging port
- Wireless charging
- 480 mAh long life battery

User interface

- 4 Programmable LEDs
- 2 Programmable buttons + Reset button
- Programmable Audio Buzzer
- Qvar sensor electrodes

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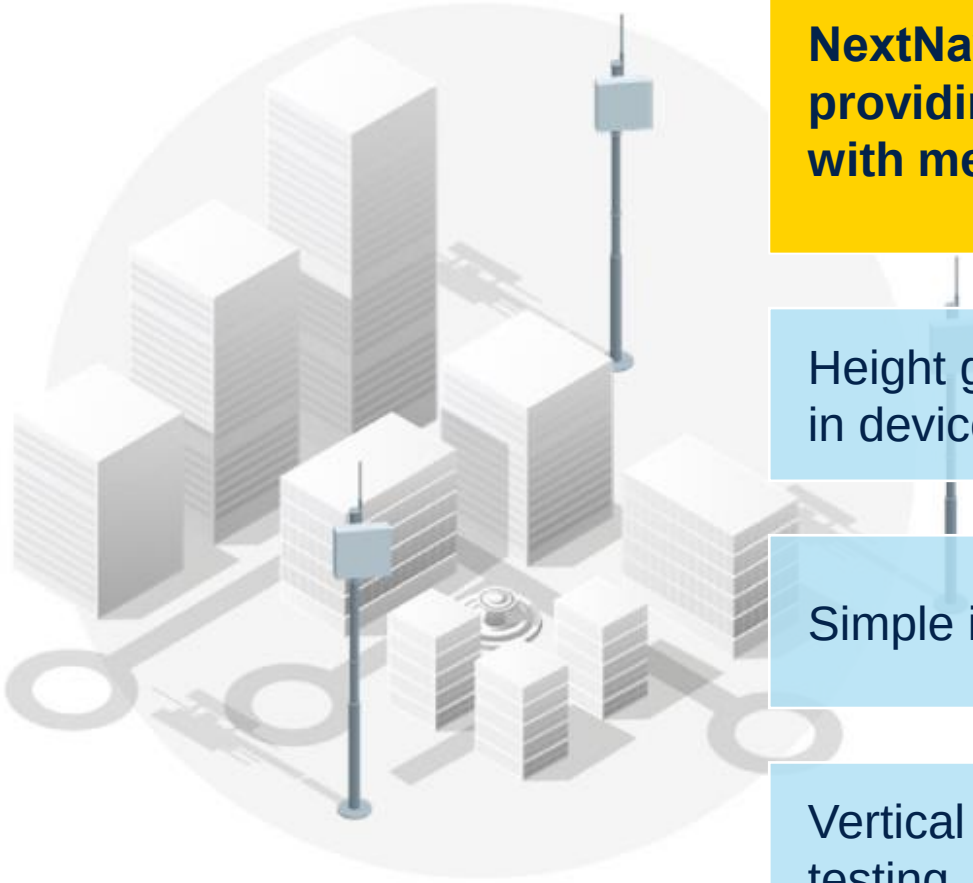
NextNav Pinnacle: a proven solution



NextNav's Pinnacle vertical location service is the industry leader in providing accurate height information for a variety of applications with metro-wide coverage through a dedicated network

Height generation using real-time pressure data from barometric sensors in devices

Simple integration of Pinnacle API to get height above ground information

Vertical location accuracy already proven in FCC and CTIA independent testing

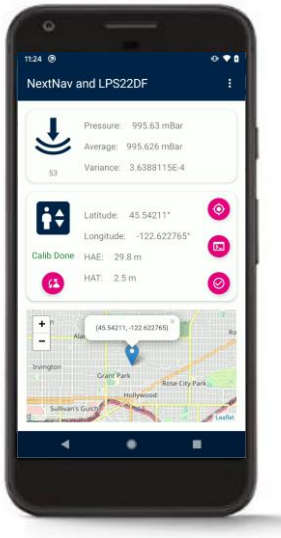
Ecosystem and demo flow

STEVAL-MKBOXPRO

ST BLE SENSOR app

NextNav cloud

NextNav altitude stations



Pressure data

PS and GPS

Station data

Altitude