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Satellite positioning to drive the smart mobility revolution

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Smart mobility cannot be achieved without localization

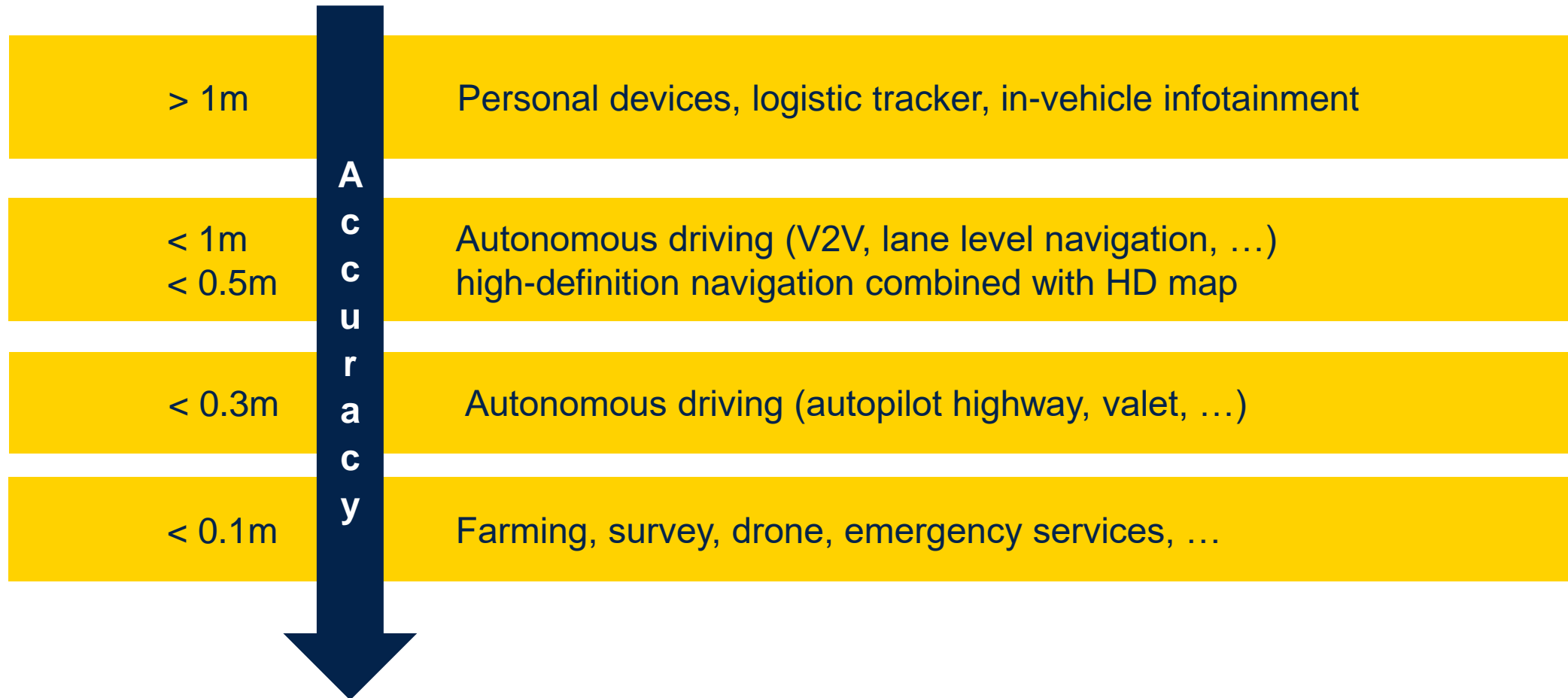
Traditional applications with satellite receiver



- **Personal devices:** Smartphones offering location feature coupled with services and map
- **Commercial transportation:** Planes, trains, boats and buses equipped with positioning box/tracker to provide location at any time.
- **Personal transportation:** Infotainment system in vehicle equipped with GNSS receiver to guide driver to reach their destination, Autonomous drive required precise positioning.
- **Logistics:** e-commerce company such as Amazon, JD developed their own logistic information system to lower cost and increase efficiency
- **Farming:** Agriculture machinery based on GNSS makes agricultural operations safer and more accurate (tractors, drones, ...)
- **Surveying:** purposes of mapping, establishing property boundaries, and topographic evaluation for construction, map deformation among others
- **Emergency and disaster relief:** platform deployed to dispatch 1st aid vehicle resources

Position accuracy vs. applications

Accuracy to centimeter level for most stringent applications



ST develops GNSS receivers since 90's

Pioneer for Automotive GNSS multi constellation / multi band receiver



- 7-th generation technology
- Pioneer for Automotive GNSS multi constellation / multi band receiver
- GNSS leadership in Automotive market
- Reliable and High-quality supplier market image

GNSS leadership in Automotive market

GNSS leadership in Automotive market



- Moving fast to leadership position
- Early Galileo qualified supplier
- Proprietary DR technology + MEMS
- Best in Class Automotive Precise Position
- eHorizon , V2X , ADAS
- Safety eCALL, ERA Glonass

ST GNSS chipset awarded but major worldwide Tier1s from:



ST GNSS chipset in production for on-board navigation system and Autonomous Drive

- Europe > 10 car brands including the TOP3 car OEMs
- China > 20 car brands
- Korea > 2 car brands
- Japan > 3 car brands
- USA > 10 car brands

Worldwide presence in all applications

GNSS solution by module approach



- Wide presence in all applications
- Worldwide Tech expertise
- Serving emerging markets
- GNSS module partners offer



ST GNSS chipset integrated in module to address various application such as

- ✓ Timing application for 3G/4G/5G base station
- ✓ Insurance box modules
- ✓ OBD modules
- ✓ Vehicle, marine and sport trackers
- ✓ High precision modules

GNSS chipsets

GNSS Receivers in production

Precise Positioning

Multiband (L1, L2, L5, E6)

ASIL-B Multi-Band & Multi-Constellation
Measurement Engine

Multi-Band & Multi-Constellation
Positioning Engine

Positioning

Single-Band & Multi-Constellation Receiver



GNSS modules

Modules in production

Multi-Band

Multiband (L1, L5)

Multi-Band
Multi-Constellation
Measurement Engine

Multi-Band
Multi-Constellation
Positioning Engine



Industrial.



TESEO-LIV4FM



TESEO-LIV4F

Single Band



Single Band
Multi-Constellation

Automotive



TESEO-VIC3DA

Industrial



TESEO-VIC3D



TESEO-LIV3F



TESEO-LIV3FL



TESEO-LIV3R

Positioning modules vs. applications

GNSS module offering



Asset Tracking

Teseo-LIV3FL

Teseo-LIV3R

Teseo-LIV4F



Fleet Management

Teseo-LIV3FL

Teseo-VIC3D

Teseo-LIV4F



Automotive

Teseo-VIC3DA



Smart lighting

Teseo-LIV3R

Teseo-LIV3F

Teseo-LIV3FL



Drone

Teseo-LIV3FL

Teseo-LIV3R

Teseo-LIV4F



Timing Infrastructure

Teseo-LIV3FL

Teseo-LIV3F

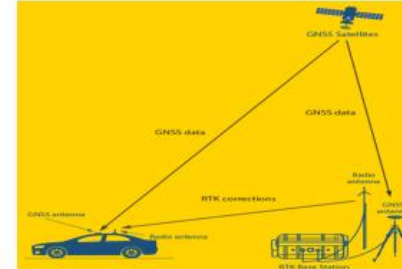


Marine

Teseo-LIV3FL

Teseo-LIV3F

Teseo-LIV4F



RTK/PPP

Teseo-LIV3FL

Teseo-LIV4FM

Automotive: TESEO-VIC3Dx Dead Reckoning for continuous positioning



- **Updates car position / velocity when GNSS satellites signal is not available** (e.g. tunnels, obscured areas)
- **Improves car position / velocity when GNSS satellites signals are marginal** (e.g. urban canyons, partially obscured areas)

Teseo-VIC3DAx features

TESEO Dead Reckoning GNSS module (12.2 x 16.0 mm)

Best-in-class precision

Multi Constellation



Low-power modes

Autonomous, Predictive and
RT Assisted GNSS



Automotive or Industrial Grade

Dead-Reckoning

Freedom Installation
Self calibration

6-axis IMU included

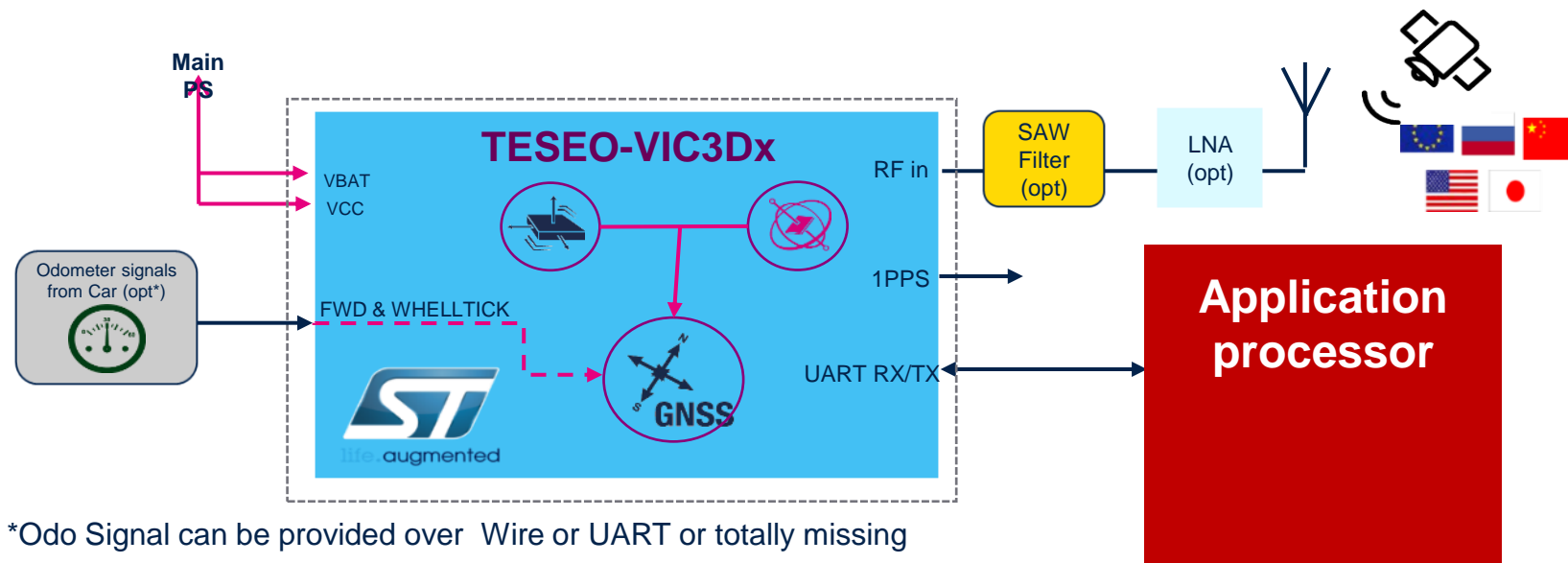
Free FW Configuration

Firmware upgrade



Teseo-VIC3Dx high-level design

TESEO-VIC3Dx module w/ Dead Reckoning



	TESEO-VIC3DA	TESEO-VIC3D
GNSS Receiver	STA8089FGA	STA8089FG
6-Axis IMU	ASM330LHH	ASM6DSR
Grade	Automotive	Industrial

Turn-Key solution from ST

- GNSS Receiver
- 6-Axis IMU
- Dead Reckoning FW

Centimeter accuracy for autonomous vehicles, agriculture, drones and robotics

Sub-meter accuracy enabling Autonomous smart mobility



Robo-taxi
Autonomous Drive

HD Map navigation
Valet parking
Auto-pilot



Drone
Monitoring, delivery ...

Navigation guidance
Collision avoidance
Landing



Autonomous tractors
To drive vehicles along
precise paths

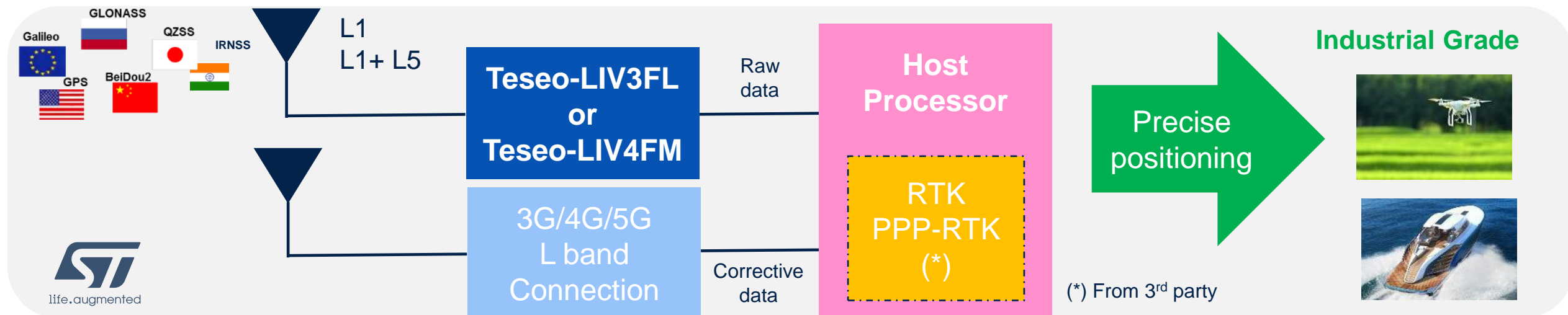
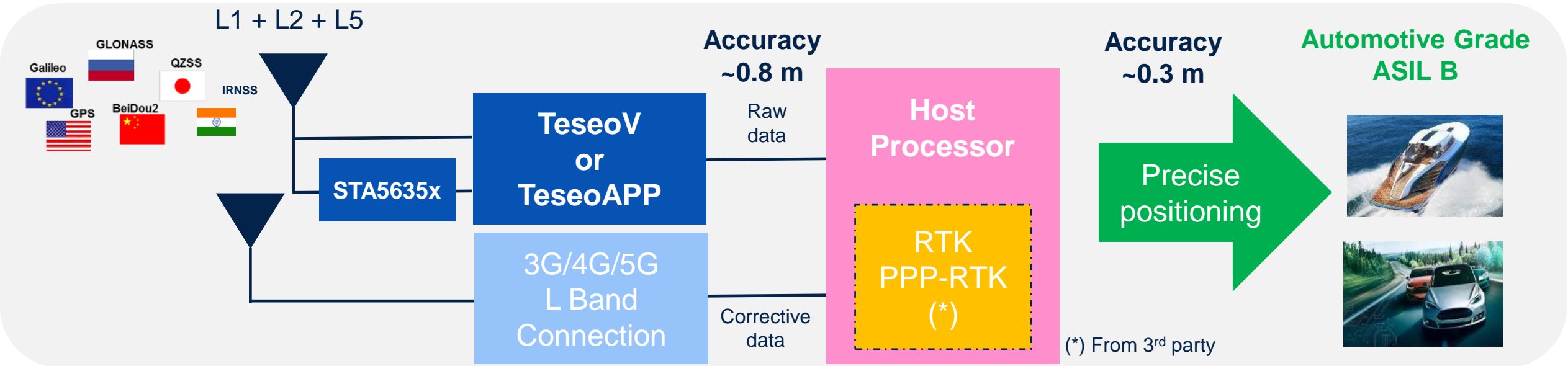
Increase yields
Increase productivity
Reduce inputs of
fertilizer, pesticides.



Autonomous lawn
mowers

Mowing task easier, safer
and more convenient

High-precision positioning for sub-meter accuracy



Teseo-LIV3FM

Tiny GNSS low power module

Best-in-class precision

Multi Constellation
Single Band L1



Low-power modes
(Continuous, Periodic, On-demand)
1.71V to 4.2V V power supply



Autonomous, Predictive and
RT Assisted GNSS

DGPS (SBAS & RTCM)



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Odometer

Data logging
Geofencing (8 configurations)

Raw Measurement data
enabling RTK-PPP host-solution
with accuracy ~5cm

Free Firmware Configuration

Firmware upgrade

Teseo-LIV4FM

Tiny dual-band GNSS measurement engine module

Best-in-class precision

Multi Constellation
Multi Band L1+ L5



Voltage power supply: 3.3V

Raw Measurement data on RTCMv3

DGPS (SBAS & RTCM)



Antenna monitor

 IRNSS/Navic supported*

LNA & SAW integrated

Free FW Configuration

Firmware upgrade

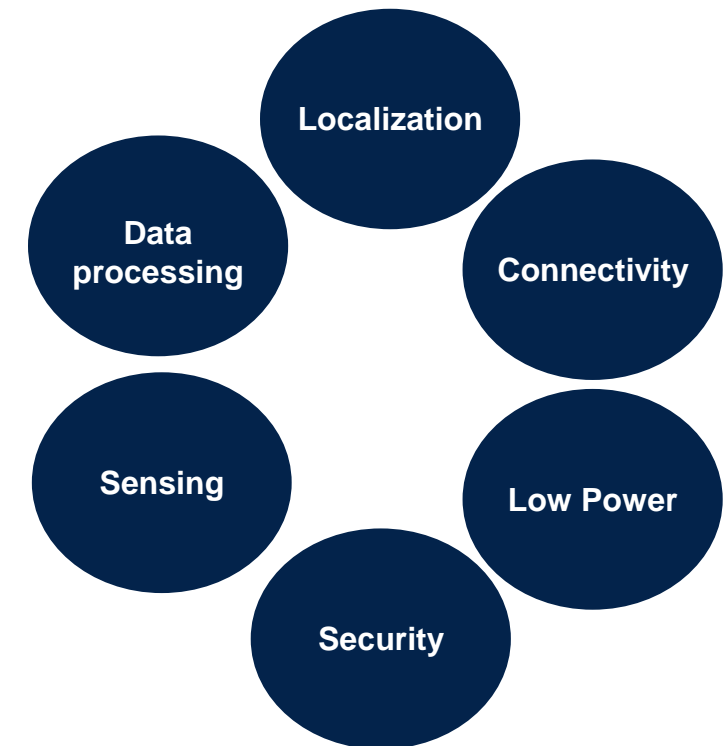
Asset tracker for smart mobility

- Remote visibility of the location of the asset in complex environment (indoor and outdoor).
- Smoothly tracking across countries and continents without roaming problems.
- Send location and key information to the management center to the data server for post-processing
- The evolution toward IoT and the increasing availability of new technologies such as LPWANs, asset-tracking applications are becoming more sophisticated software.

Logistic Market classification

Logistics Player Type	Logistics Player Business Model	Typical Customers	Segment
Logistics Service Providers (LSPs)	Mainly freight forwarders, third and fourth parties	Manufacturers, wholesalers, retailers	B2B
Carriers	Trucking, rail freight, sea freight, air freight	LSPs	B2B
Courier Express Parcel (CEP)	Last-mile delivery	Retailers and manufacturers, other companies with the need to deliver items	B2B and B2C

Source: Elaboration on classification by PWC "Shifting Patterns: The Future of the Logistics Industry"



STEVAL-ASTRA1B

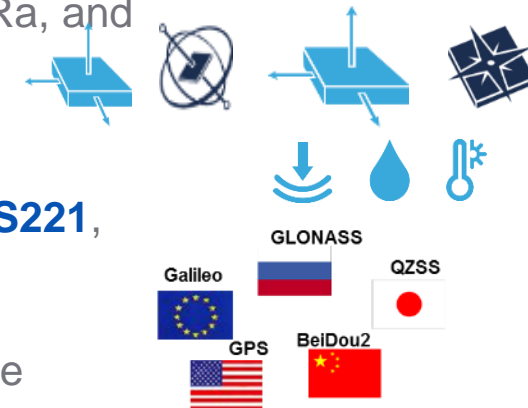
Asset tracker evaluation kit

ASTRA platform (STEVAL-ASTRA1B) for fast prototyping

Simplifies prototyping, testing and evaluating advanced asset tracking applications such as livestock monitoring, fleet management, and logistics.



- The STEVAL-ASTRA1B is built around the
 - ✓ **STM32WB5MMG** module 2.4 GHz wireless dual core module running the main application with support of Bluetooth Low energy 5.3
 - ✓ **STM32WL55JC** SoC for short- and long-range connectivity (BLE, LoRa, and 2.4 GHz and sub 1-GHz proprietary protocols)
 - ✓ **ST25DV64K** for NFC connectivity
 - ✓ **STSAFE-A110** secure element for security features
 - ✓ Environmental and motion sensors: **LIS2DTW12**, **LSM6DSO32X**, **HTS221**, **STTS22H**, **LPS22HH**.
 - ✓ **TESEO-LIV3F** GNSS Single Band module for outdoor positioning
 - ✓ **ST1PS02**, **STBC03** and **TCPP01-M12**, is optimized for long battery life



- End to End proof of concept ecosystem mobile app and cloud dashboard
 - ✓ **DSH-ASSETTRACKING** web cloud dashboard
 - ✓ **STAssetTracking** module app available on Google Play and App store.
 - ✓ **Android HAL** support



STDEMO-ASTRCO22A

Asset tracker demo kit

The demo emulates the tracking of an asset managed by a shipping company that can constantly monitor the asset both upon arrival (outdoor) and when it moves between the various sectors (indoor). Through a Touch-GFX Display, driven with an STM32H7 discovery board, each time the buttons are pressed, data will be sent to STEVAL-ASTRA1B which will communicate with our dashboard showing the movements of the asset to the pc / app. The demo can operate either automatically or manually.

- **Key products:** STM32WB5MMG, STM32WL55JC, STM32H7, STSAFE-A110, TESEO-LIV3F, STTS22H, LPS22HH, HTS221, LIS2DTW12, LSM6DSO32X, ST25DV64K, ST1PS02.
- **Demo based on:** STEVAL-ASTRA1B, STM32H747I-DISCO
- **Dimensions and weight:** 30 cm x 15 cm / 2 Kg
- **Installations:** Power supply, App, Ethernet/Wi-Fi



Developer resources

Active web



Selector on st.com

PC Software



Teseo-Suite

Evaluation HW



EVB-LIV3F/FL/R/4F



EVB-VIC3DA

Prototyping HW



X-NUCLEO-GNSS1A1



X-NUCLEO-GNSS2A1

Embedded Software

FREE RTOS

X-CUBE-GNSS



X-LINUX-GNSS



AndroidHAL-Teseo



Teseo chips and modules DOCUMENTATION



■ Datasheet/Databrief for all the products

■ HW / SW User manual

■ Application note

■ Training/QSG presentation

■ Schematic/BOM/Gerber of EVBs

Our technology starts with You



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