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High-precision positioning box (P-box)

June 2023

Version: 0.3

Empower autonomous driving with ASIL-B compliant high-precision positioning box

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Positioning evolution

Towards reliable precise positioning

Accuracy 1st

<1.5~2m	<1m	< 0.5m	**< 0.3m**
Traditional Navigation	Lane Level Navigation	High-Definition Navigation	**Autonomous Driving**

Single Band (SPP) → Multi-band + Multi-Constellation+ **Precise Positioning** (RTK, PPP, PPP-RTK)

Non-ASIL → ASIL Compliant

ST’s high-precision positioning solution

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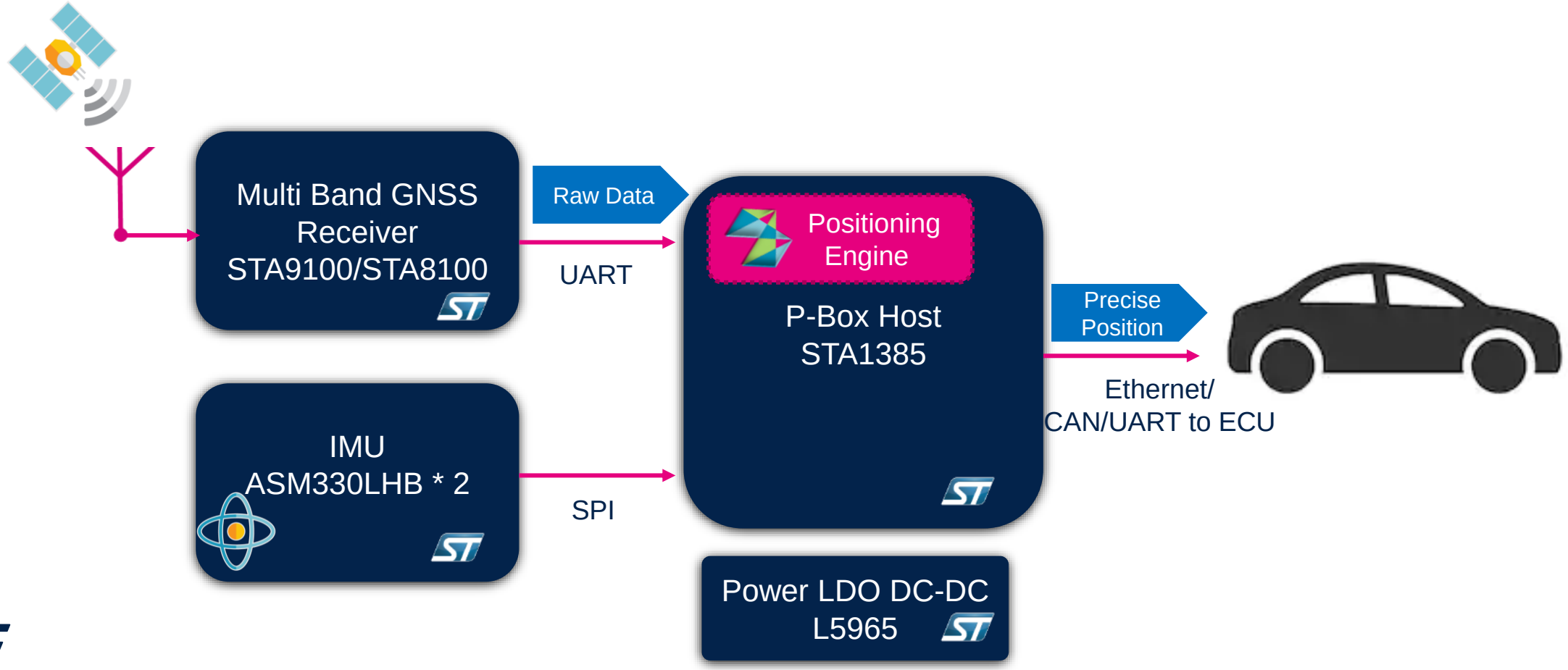
System architecture

Comprehensive solution with ST automotive-grade chipsets



ST high-precision positioning platform (P-Box)

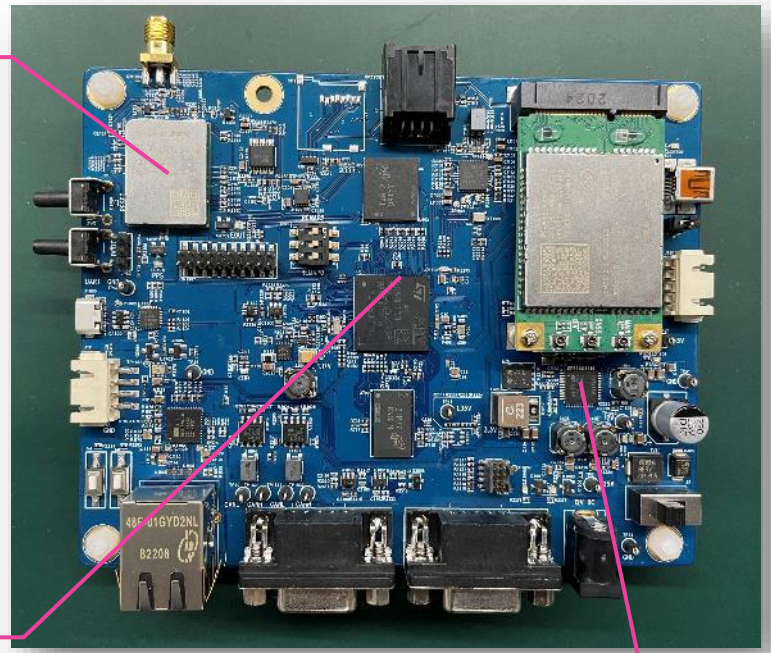
ST complete system with ASIL B compliant solutions

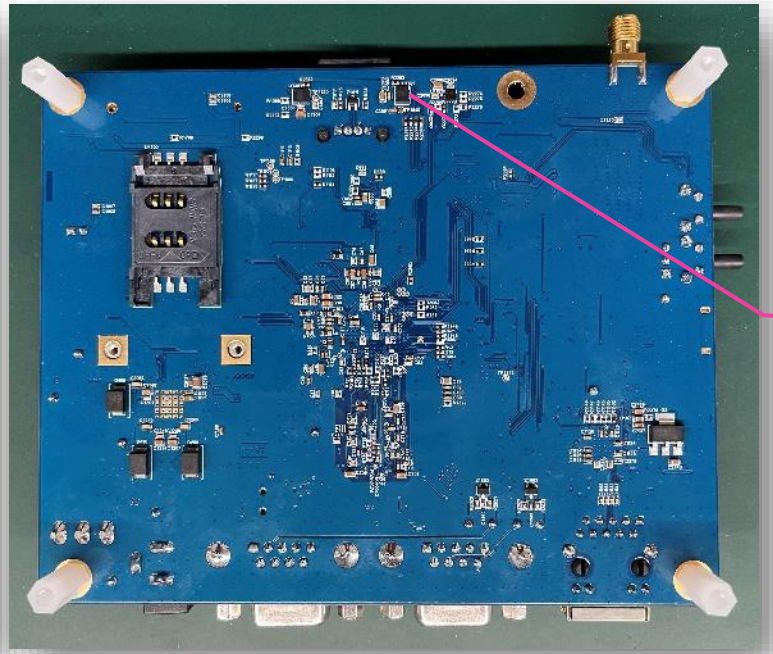
GNSS Module:

- **STA8100:** an AEC-Q100 qualified multi-band multi-constellation positioning receiver
- **STA9100:** an AEC-Q100 qualified multi-band multi-constellation positioning receiver, ASIL-B compliant.

Processor:

- **STA1385:** Cortex-M3 and dual Cortex-A7 ARCH, dispatching 2500 DMIPS, eHSM integrated, secure boot supported, ASIL-B compliant, AEC-Q100 Grade 2.





IMU

- **ASM330LHB:** High performance 6-axis IMU
- Adopted in redundancy (x2) and combined with dedicated safety engine Software to be compatible with ASIL-B systems.

PMIC

- **L5965:** An AEC-Q100 qualified multiple voltage regulator.
- Offers a set of features to support applications to fulfil ASIL A-B-C-D.

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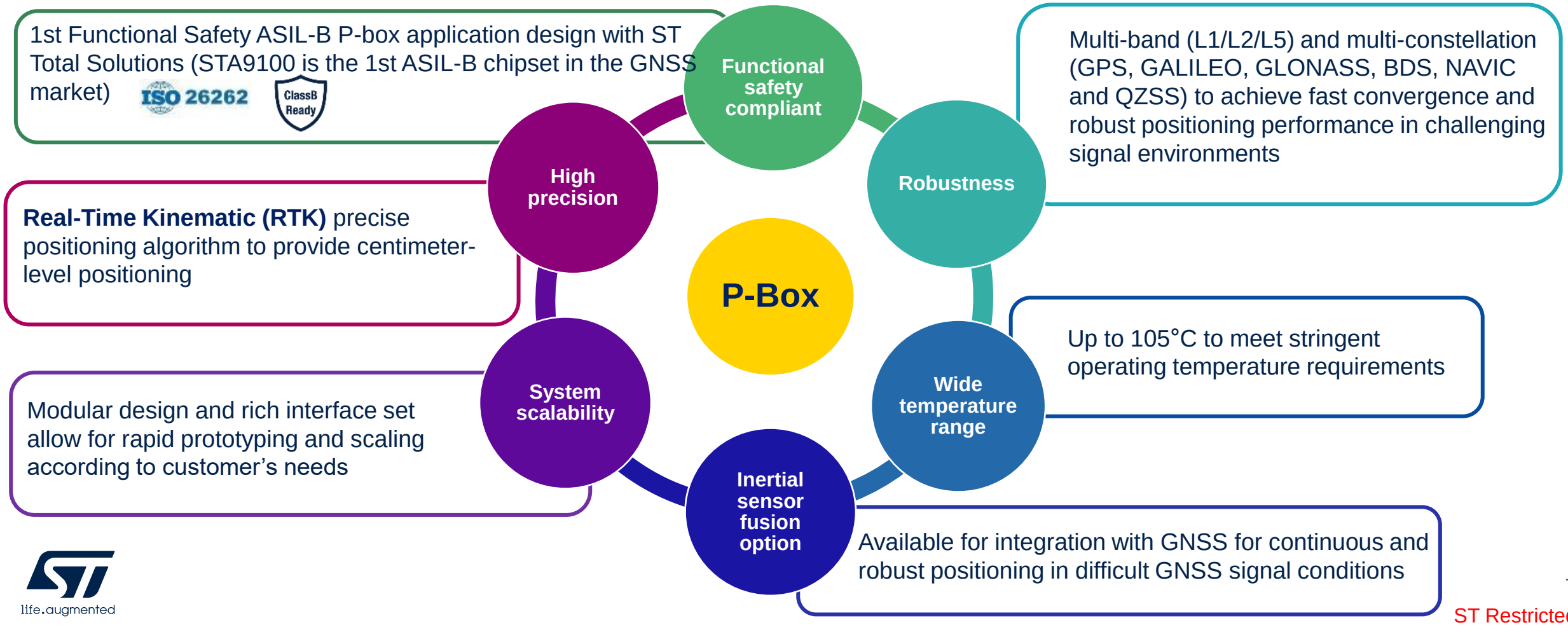
System highlights

Complete range of high-precision positioning solutions



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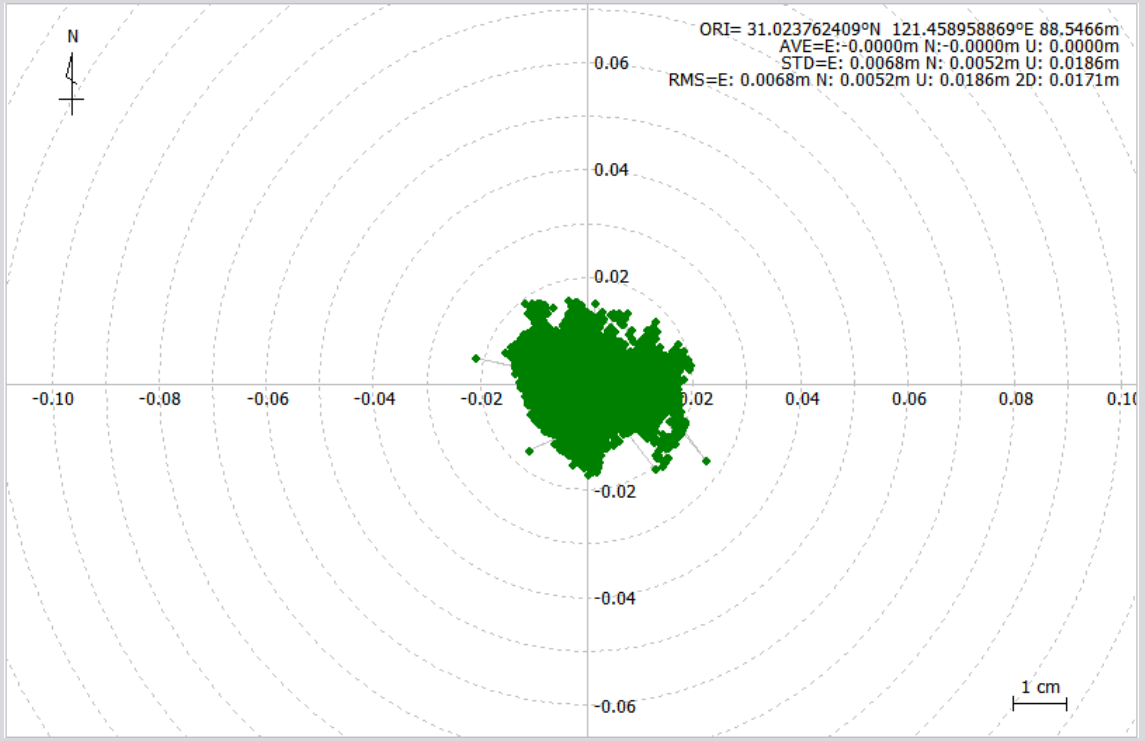
P-Box bench performance test

Test Items			Reference Requirement	ST P-BOX Test Results
Timing	PVT output rate		10 Hz	1 Hz or 10Hz update rate
	Timing, Pulse Per Second (PPS) signals		Yes	Yes
	Timing accuracy		not required yet in most of case	PPS jitter: +/-22 ns RMS: 3.6ns (1-Sigma), 7.3ns (2-Sigma), 10.9ns (3 - Sigma)
	Time to First Fix (TTFF)	Cold start (s)	<35	28.2s in 50 cycles
		Warm start (s)	<30	28.6s in 50 cycles
		Hot start (s)	<3	2.4s in 50 cycles
Accuracy	*Horizontal position accuracy (RMS)	Single Point Positioning (SPP)	1.5 m	0.78m for 2hours static test
		Real-Time Kinematic (RTK)	0.03 m	0.01m for 24hours static test
	*Vertical position accuracy (RMS)	Single Point Positioning (SPP)	1.8 m	1.28m for 2hours static test
		Real-Time Kinematic (RTK)	0.05 m	0.02m for 24hours static test
	*Velocity accuracy (RMS)		0.05 m/s	0.02 m/s
Sensitivity	Tracking Sensitivity		-160 dBm	-160 dBm
	Reacquisition Sensitivity		-150 dBm	-152 dBm
	Cold start Sensitivity		-140 dBm	-146 dBm
	Warm start Sensitivity		-	-147 dBm
	Hot start Sensitivity		-	-148 dBm

- RTK accuracy in static tests with roof antenna for 24 hours

  CEP95 accuracy: <2cm



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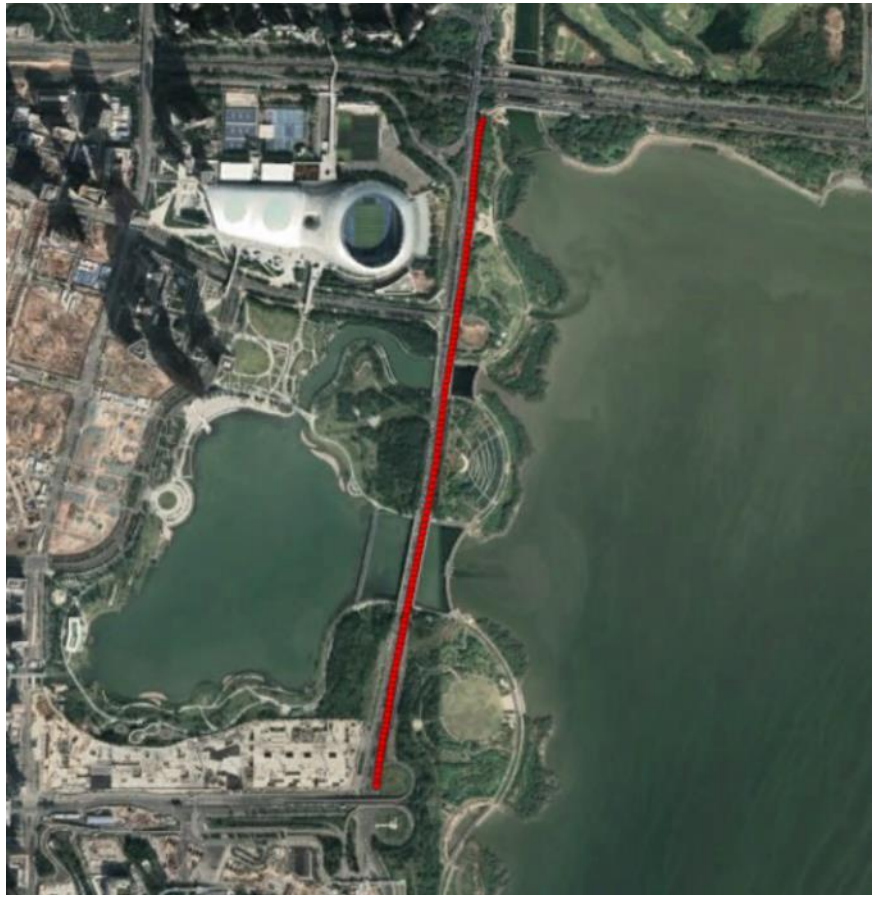
P-Box field test performance



Open sky scenario in Shenzhen

- Sample results for open-sky scenario in Shenzhen using RTK with QX correction services in real-time

Test Items	ST P-BOX Test Results
Horizontal Position Error (50%) (m)	0.009
Horizontal Position Error (68%) (m)	0.016
Horizontal Position Error (95%) (m)	0.168
Vertical Position Error (50%) (m)	0.024
Vertical Position Error (68%) (m)	0.030
Vertical Position Error (95%) (m)	0.128

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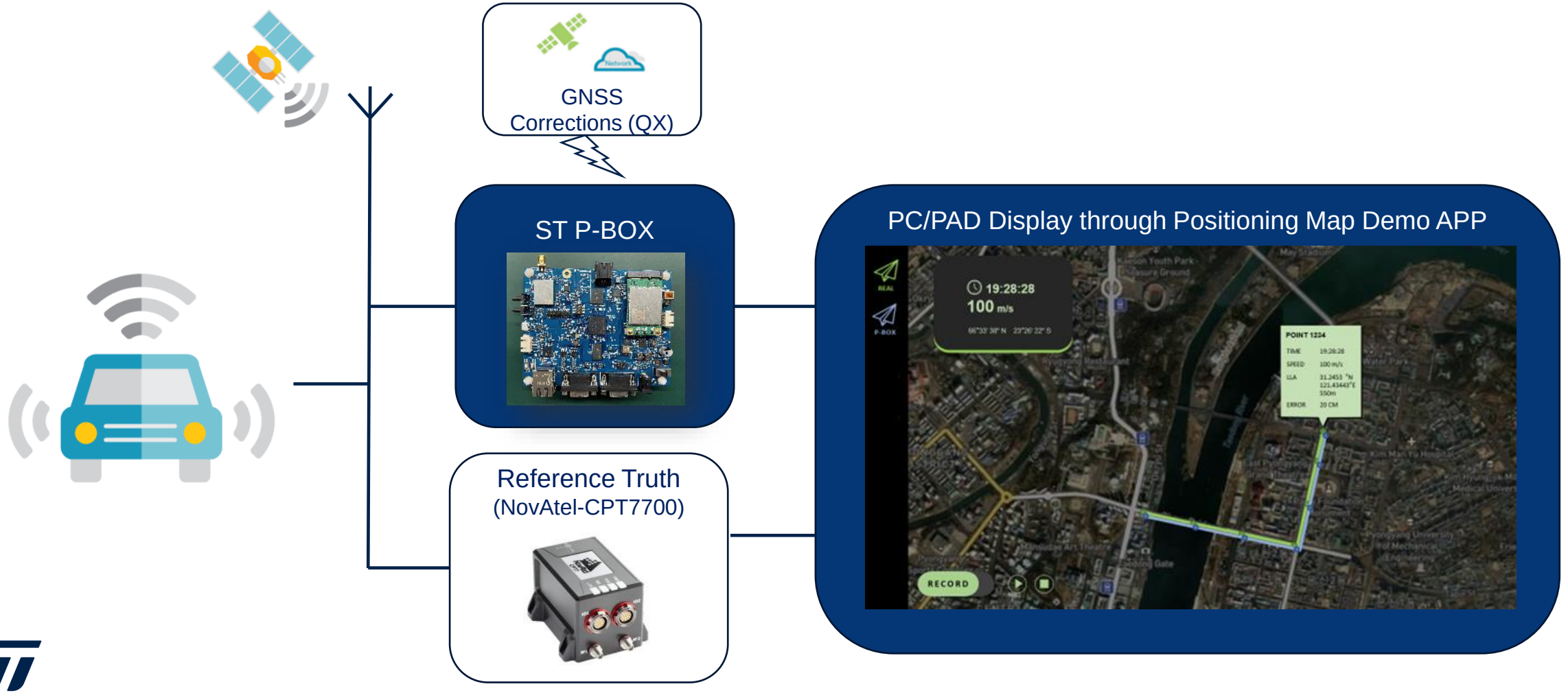
Positioning engine demonstration platform architecture



ST high-precision positioning box key components

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GNSS: STA8100

1st L1+L5 automotive-grade single-chip solution

- ST 5th generation positioning receiver with 80 tracking channels and 4 fast acquisition channels
- Support for multi-constellations: GPS, Galileo, GLONASS, BeiDou, QZSS, NAVIC (former IRNSS)
- Dual-band L1 and L5 single chip solution
- Triple-band capability with external RF STA5635A
- SBAS systems: WAAS, EGNOS, MSAS, GAGAN, BeiDou
- Code phase, carrier phase, Doppler frequency measurement
- Antenna sensing
- PPS output
- Notch filter for anti-jamming
- AEC-Q100 qualified
- Automotive grade 105°C option

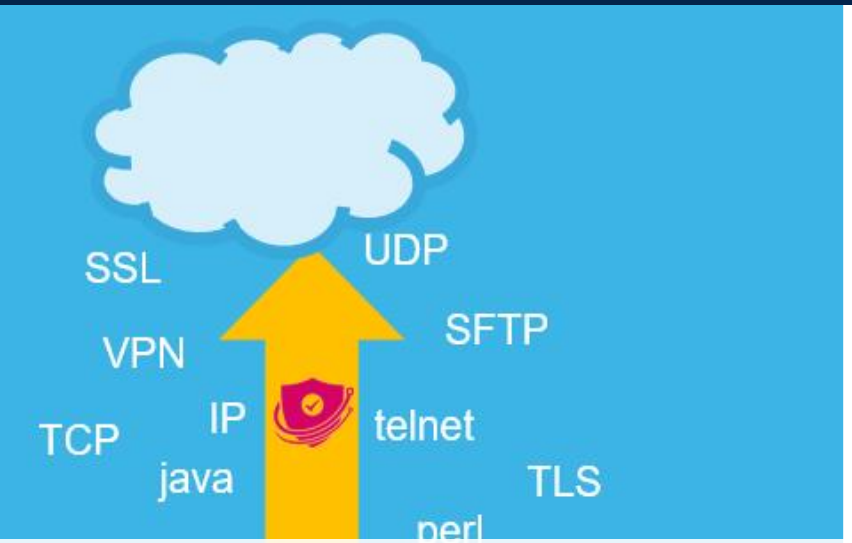
GNSS: STA9100

1st ASIL-B chipset in GNSS market

- ST 5th generation positioning receiver with 80 tracking channels and 4 fast acquisition channels
- Support for multi-constellations: GPS, Galileo, GLONASS, BeiDou, QZSS, NAVIC (former IRNSS)
- Multiband L2, L5, E6 capability with external RF Front-end STA5635S for simultaneous reception with L1 band signals
- SBAS systems: WAAS, EGNOS, MSAS, GAGAN, BeiDou
- Code phase, carrier phase, Doppler frequency measurement
- Embedded Hardware Security Micro
- Automotive grade 105°C
- Comprehensive ISO26262 safety concept
- Antenna sensing
- PPS output
- Notch filter for anti-jamming

Processor: STA1385

Secure functional safety compliant high-performance processor



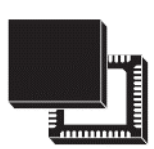
Key applications

- Precise Positioning Box
- Smart Gateway
- Advanced T-Box (scalability to V2X)

- Robust single or dual Arm Cortex A7 processing core, up to 2400 DMIPS
- Isolated ARM Cortex M3 core architecture with embedded eSRAM
  - CAN bus subsystem control and handling of time-critical operations
- Optimized power management
  - No PMIC
  - Typical standby power < 24 mA
- Embedded Hardware Security Module (eHSM) integrated
- Security Booting supported to protect customer's property
- Wide range of connectivity peripherals (e.g. 2x 1Gbps Automotive Ethernet)
- Eligible for ISO26262 ASIL-B certification
- AEC Q100 Grade 2 qualified (-40℃, + 105℃)
- Availability of reach development environment : MTP, SGP, Pbox development kit ready for delivery.

PMIC: L5965

PMIC for automotive ECUs, vision and radar systems



ISO26262 compliancy

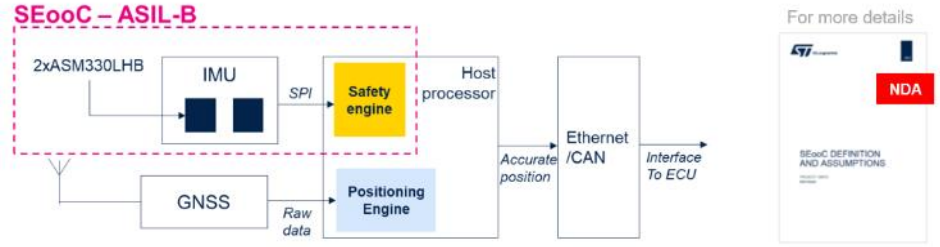
- ✓ **Fulfilling functional safety requirements:**
  - Vin/Vout voltage monitor. Over/Undervoltage threshold setting via SPI.
  - 2x independent band-gaps: reference and monitor.
  - Ground loss monitors.
  - Internal compensation network and resistor divider.
  - Analog BIST & Digital BIST on internal logic.
  - Fault pin to Microcontroller.

- ✓ **OTP programmable parameters contribute to safety and precision:**
  - BUCK1/BUCK2/BUCK3/BUCK4/LDO/BOOST/VREF output voltages.
  - BUCK2 switching frequency.
  - BUCK2/LDO current limitations.
  - Power-on & Reset sequence.

- ✓ **BOM optimization and external components reduction:**
  - 1x BUCK pre-regulator with external MOS compatible to battery 12V to 5V
  - 6x BUCK post-regulators with integrated MOS compatible to the main regulator output

IMU: ASM330LHB

High-performance ASIL-B IMU solution



- Very high stability & low noise 6-axis IMU (A+G), for Automotive applications with 4 Kbytes of FIFO:
- A: from ±2 to ±16g FS, G: from ±125 to ±4000dps FS
- High accuracy and stability over temperature and time, high-stability, improved temperature behavior
- 2x Interrupt lines for basic movement recognition
- ARW: 0.21 °/√h ; Bias Instability (BI): 3°/hr
- Temperature range: -40 to +105°C
- ASIL-B compliant for high positioning, active suspension…
- Low power accelerometer supporting Sentry mode demand

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About ST Automotive

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网址 | https://www.st.com/en/automotive-analog-and-power/led-drivers.html

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Our technology starts with You

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