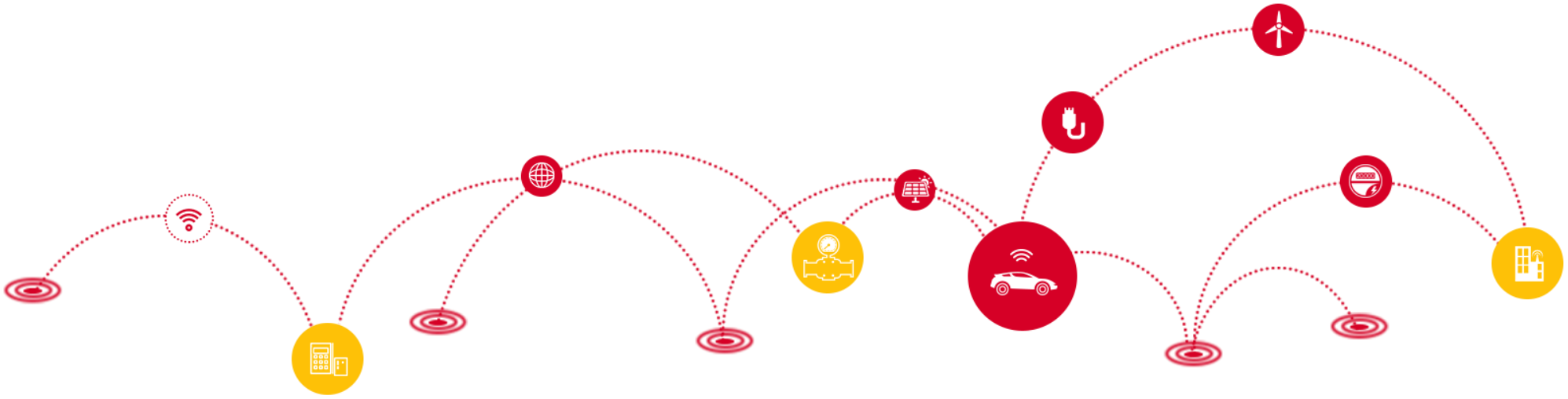
Quectel Automotive GNSS & Connectivity

Product Overview

February, 2020

Automotive GNSS Modules

Automotive Wi-Fi/BT Modules



Automotive GNSS Modules Roadmap

L26-T
ST Teseo III

> 2 m

- Single Frequency

GNSS+DR
L26-DR
ST Teseo III

2 m

- Single Frequency
- Dead Reckoning

1 m

RTK+DR
L26-P Note
ST Teseo III

dm

- Single Frequency
- Dead Reckoning
- RTK (PPE)

Dual-Frequency
LG69T
ST Teseo V

cm

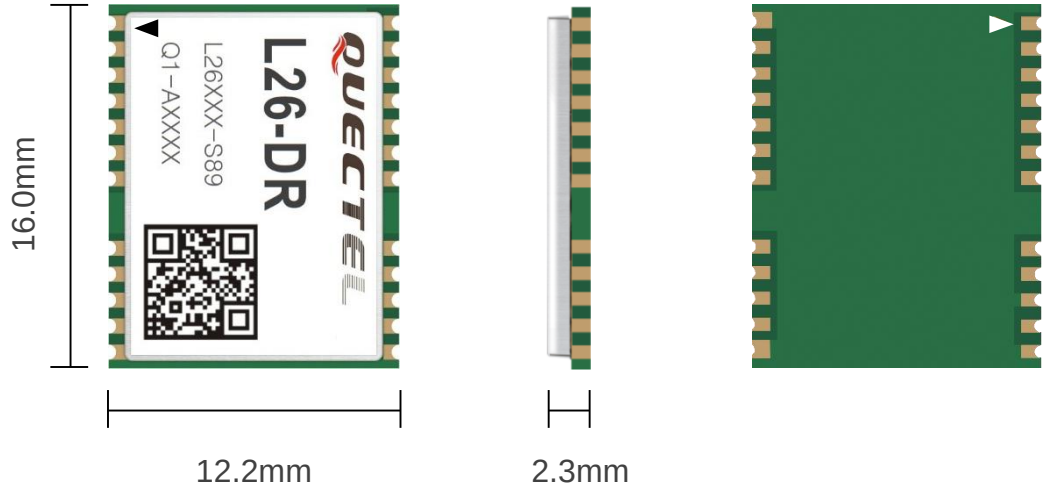
- Multi-Frequency
- Dead Reckoning
- RTK (PPE)
- AA/ AP/ AF/ AB Variants

Note: External AP needed

Q1	Q2	Q3	Q4	
2019				2020

L26-DR GNSS Module Overview

- 12.2mm × 16.0mm × 2.3mm in LCC package
- Dead reckoning algorithm integrated
- ADR and UDR supported based on different software versions
- Industrial and automotive grade versions to meet versatile demands
- NMEA+Sensor raw data output
- Short calibration time, easy to use
- Free installation angle
- AECQ-100 compliant
- Manufactured in ISO/TS 16949 certified factory

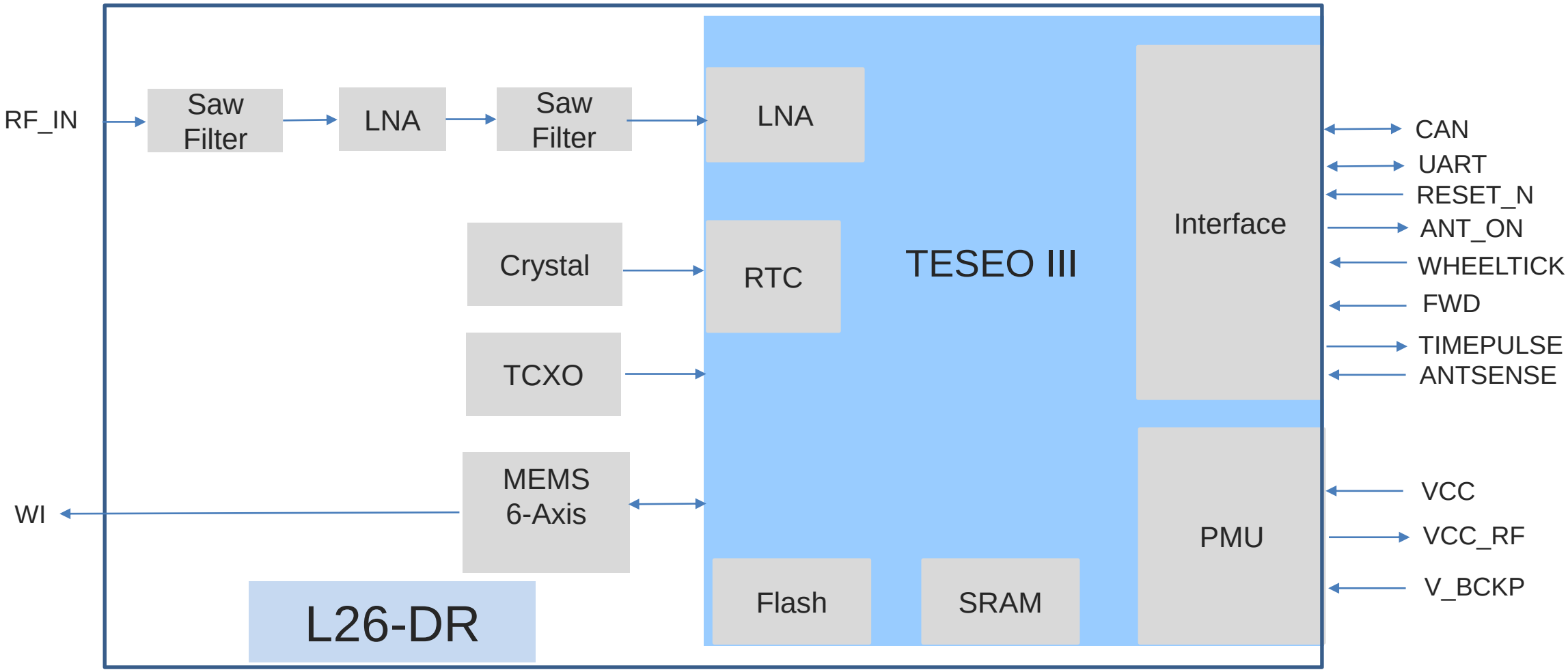


L26-DR Specifications

Multi-constellation GNSS	• GPS L1 C/A • GLONASS L1 • BeiDou (BDS) B1 • QZSS L1 • Galileo (GAL) E1	
SBAS	WAAS, EGNOS, MSAS, GAGAN	
Channels	48 (Tracking)/ 2 (Fast Acquisition)	
Horizontal Position Accuracy	Autonomous	1.5m CEP
Velocity Accuracy	Without Aid	<0.1m/s
Acceleration Accuracy	Without Aid	0.1m/s²
Timing Accuracy	1PPS	<100ns CEP
TTFF @-130dBm (with AGNSS)	Cold Start	<13s
TTFF @-130dBm (without AGNSS)	Cold Start	<32s
	Warm Start	<25s
	Hot Start	<2s

Sensitivity	Acquisition	-145dBm
	Tracking	-162dBm
	Reacquisition	-152dBm
Supply Voltage Range	3.0V~3.6V, typical 3.3V	
Operation Temperature	-40℃ ~ +85℃	
Dimensions	12.2mm × 16.0mm × 2.3mm	
Weight	Approx. 0.9g	
Low Power Consumption	Acquisition: 72mA @ 3.3V	
	Tracking: 58mA @ 3.3V	
Power Saving Modes	17μA @ Standby mode	
UART	• UART port: UART_TX and UART_RX • 115200~921600bps baud rate (115200bps by default) • Used for NMEA/PSTM transmission and firmware upgrade	
Remark	Two Versions: • Industrial Grade • Automotive Grade	

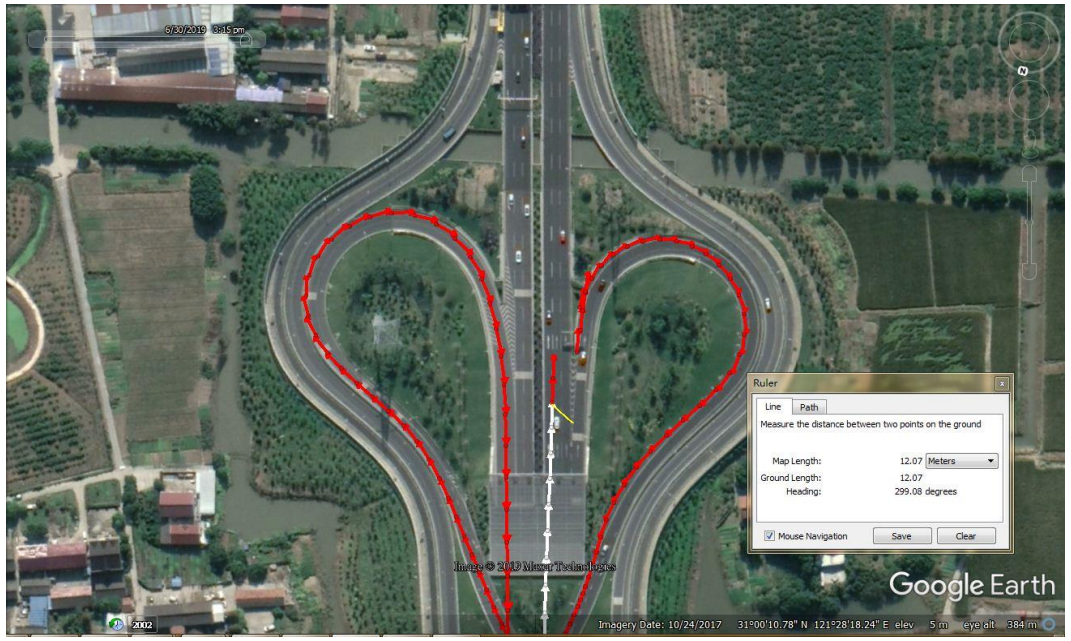
L26-DR Hardware Block Diagram



Comparative Test in Long Open-Area Tunnel

In the long open-area tunnel, L26-DR's performance is better than its counterpart.

L26-DR (ADR)



- GNSS+DR
- U company standalone module
- GNSS only

U-XXX

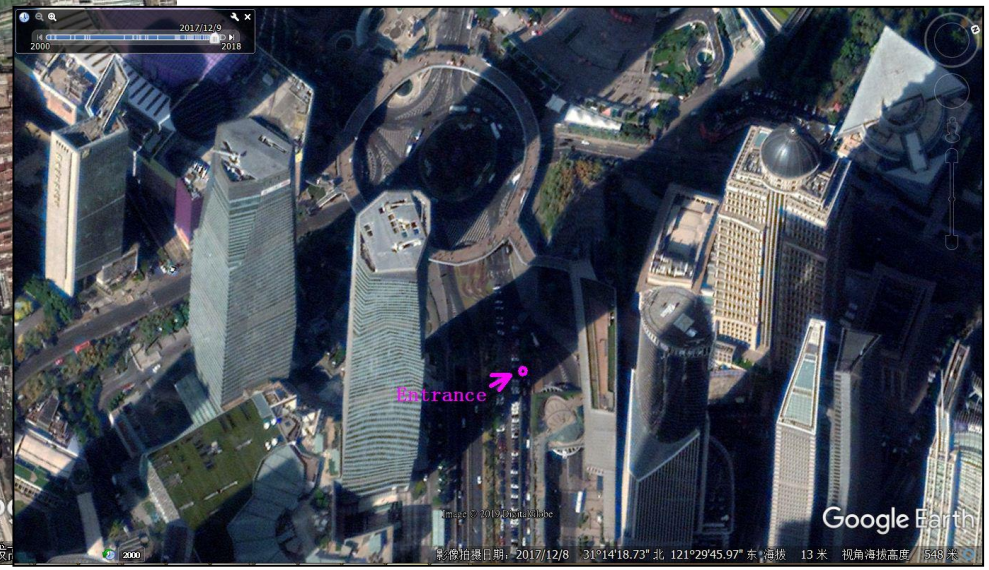
Long Tunnel (5260 meters)		
Example	Error distance	Error percent
L26-DR (ADR)	12m	0.23%
U-XXX	52m	0.99%

Comparative Test in Urban-Area Tunnel

East of Yan'an Road，2261 meters		
Example	Error distance	Error percent
L26-DR(ADR)-1#	18m	0.80%
L26-DR(ADR)-2#	15m	0.66%
U-XXX	70m	3.10%

In the urban-area tunnel, L26-DR's performance is better than its counterpart

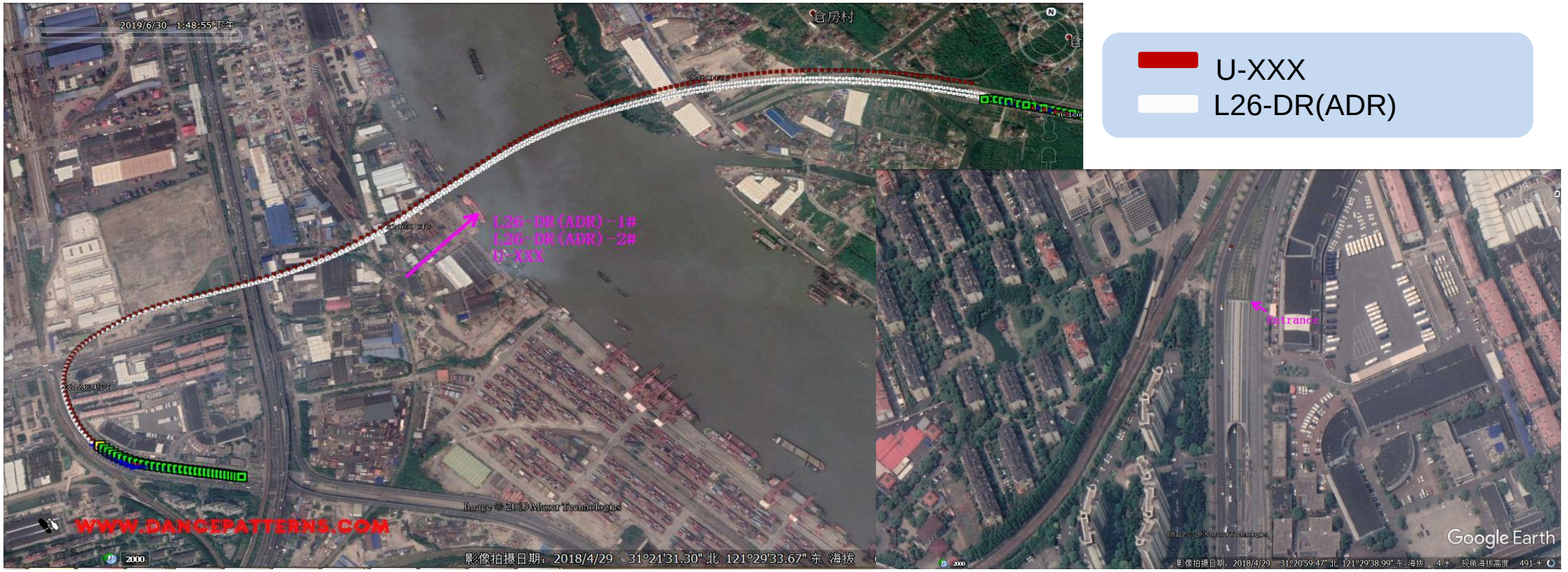
U-XXX
L26-DR(ADR)



Comparative Test in Curved Tunnel

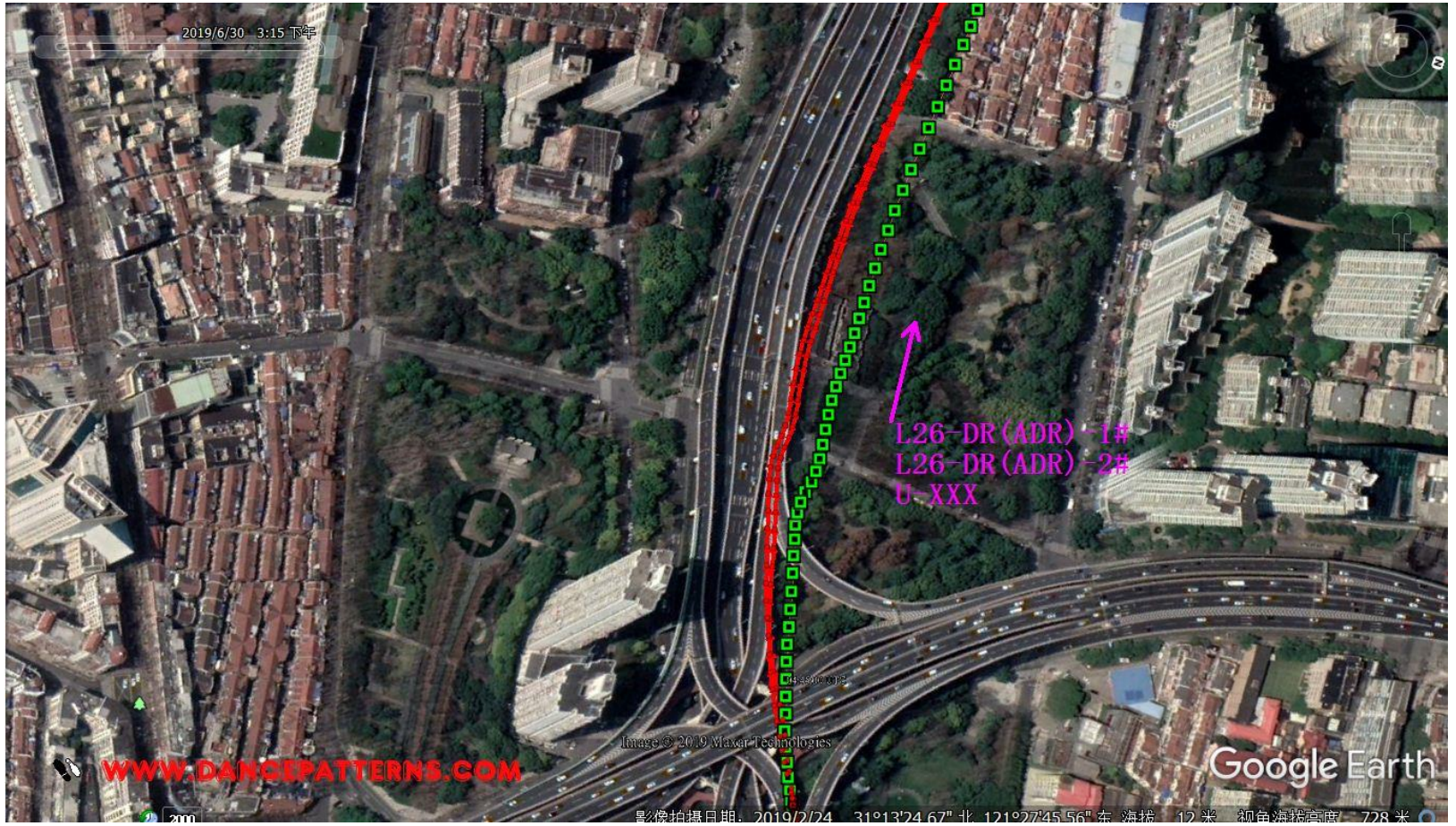
Curved Tunnel，2860 meters		
Example	Error distance	Error percent
L26-DR(ADR)-1#	3m	0.10%
L26-DR(ADR)-2#	15m	0.52%
U-XXX	45m	1.57%

In the curved tunnel, L26-DR's performance is better than its counterpart



Comparative Test Under Elevated Highway

Under elevated highway, L26-ADR's performance is better than its counterpart



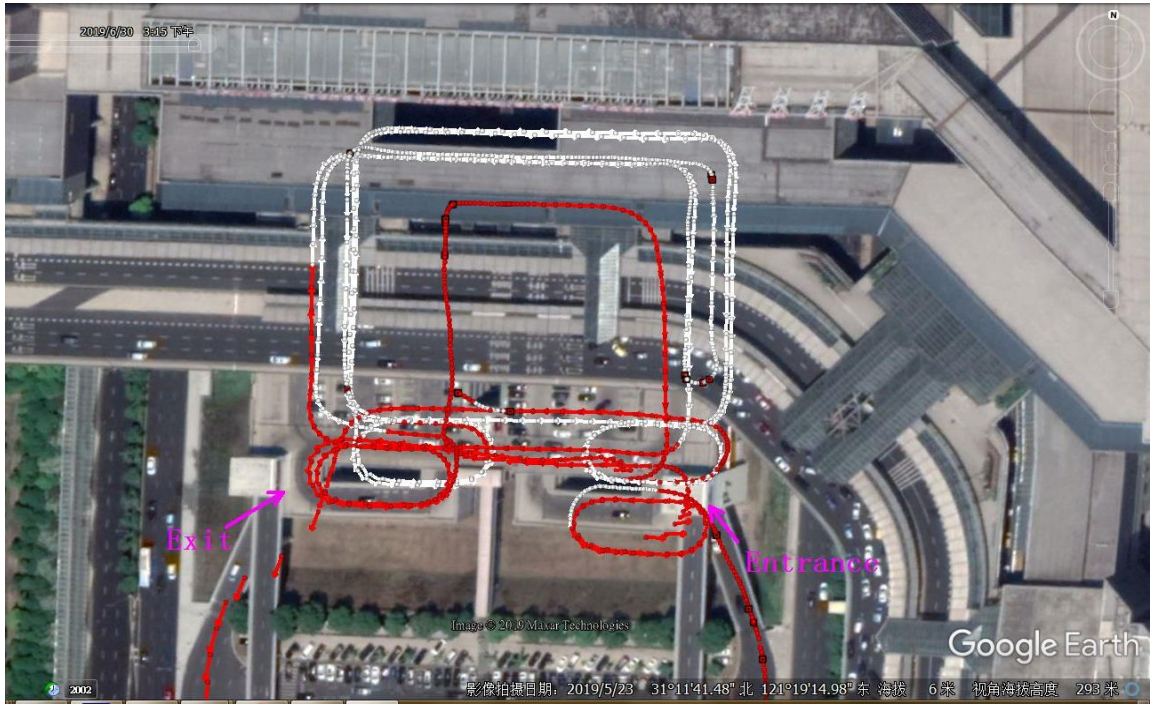
L26-DR(ADR)

U-XXX

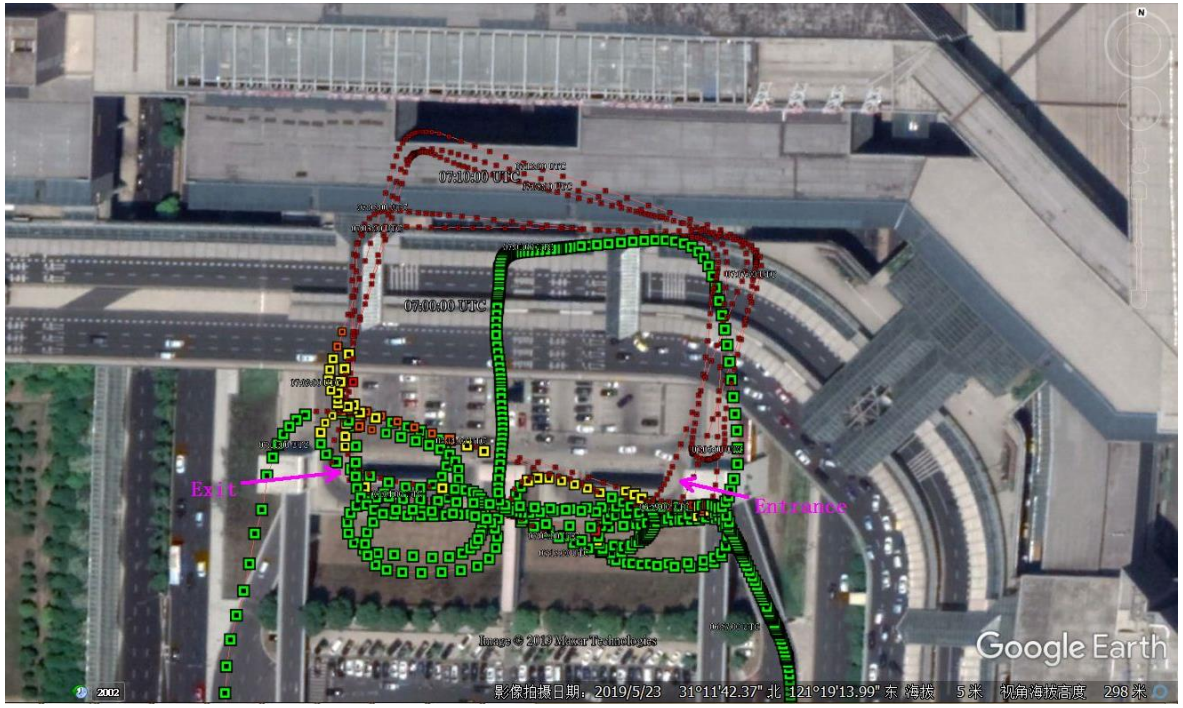
Comparative Test in Multi-layer Parking Garage
(Shanghai Hongqiao Airport)

Under multi-layer parking system, L26-DR's performance is better than its counterpart.

L26-DR(ADR)

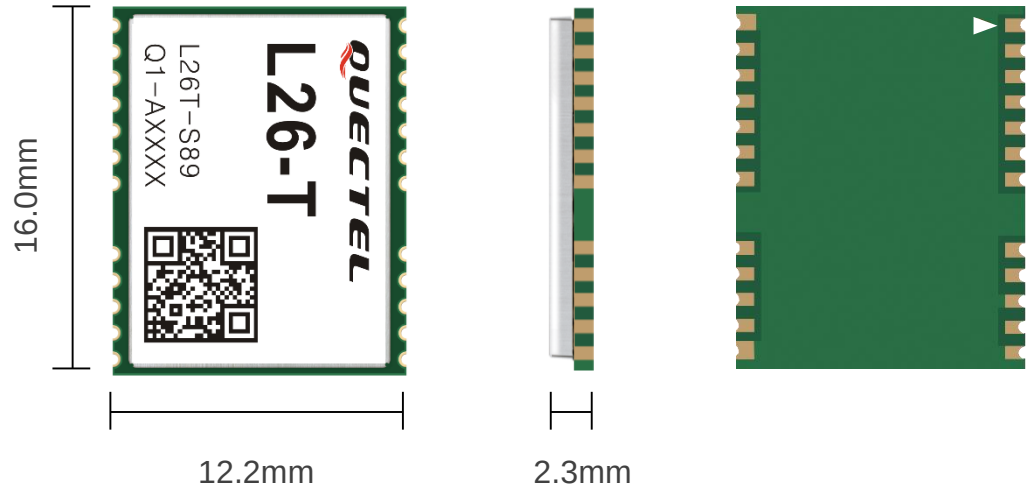


U-XXX



L26-T GNSS Module Overview

- 12.2mm × 16.0mm × 2.3mm in LCC package
- High positioning and timing accuracy
- Industrial and automotive grade versions to meet versatile demands
- AECQ-100 compliant
- Manufactured in ISO/TS 16949 certified factory

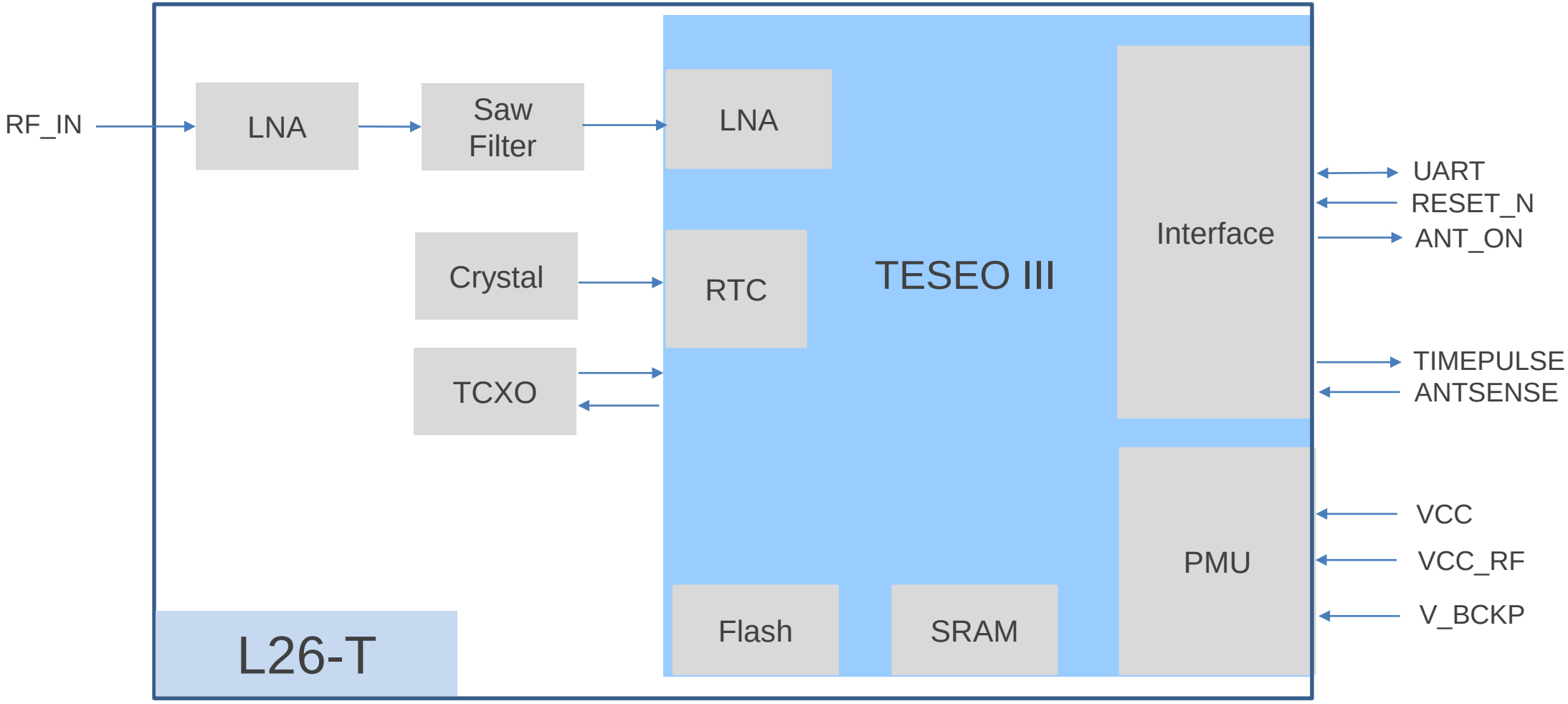


L26-T Specifications

Multi-constellation GNSS	• GPS L1/Galileo E1 C/A • GLONASS L1 C/A • BeiDou B1 C/A • QZSS	
SBAS	WAAS, EGNOS, MSAS, GAGAN	
Channels	48 (Tracking)/ 2 (Fast Acquisition)	
Horizontal Position Accuracy	Autonomous	1.5m CEP
Velocity Accuracy	Without Aid	<0.1m/s
Acceleration Accuracy	Without Aid	0.1m/s²
Timing Accuracy	1PPS	18ns (24h)
TTFF @-130dBm (with AGNSS)	Cold Start	<13s
TTFF @-130dBm (without AGNSS)	Cold Start	<32s
	Warm Start	<25s
	Hot Start	<2s

Sensitivity	Acquisition	-147dBm
	Tracking	-162dBm
	Reacquisition	-154dBm
Supply Voltage Range	3.0V~3.6V, typical 3.3V	
Operation Temperature	-40℃ ~ +85℃	
Dimensions	12.2mm × 16.0mm × 2.3mm	
Weight	Approx. 0.9g	
Low Power Consumption	Acquisition: 64mA @ 3.3V	
	Tracking: 51mA @ 3.3V	
Power Saving Modes	9μA @ Standby mode	
UART	• UART port: UART_TX and UART_RX • 9600~921600bps baud rate (9600bps by default) • Used for NMEA/PSTM transmission and firmware upgrade	
Remark	Two Versions: • Industrial Grade • Automotive Grade	

L26-T Hardware Block Diagram

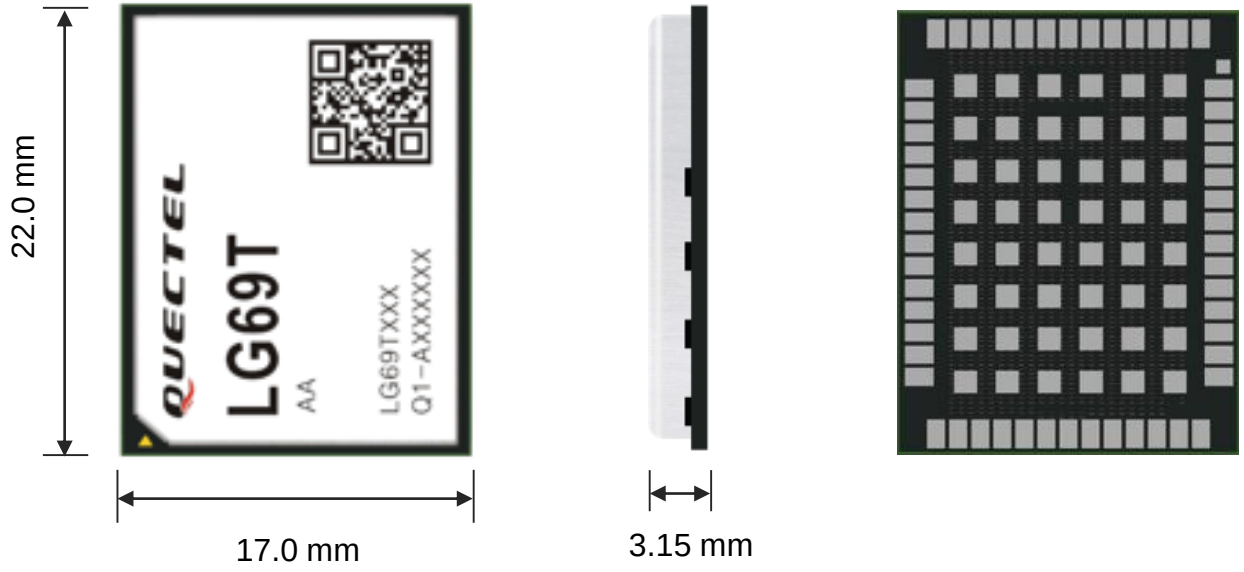


LG69T GNSS Module Overview

LG69T is a series automotive grade, dual-band, high precision GNSS modules based on the fifth generation platform of ST.

The module includes four variants:

- LG69T (AA) features raw data output and has to work with an external application processor.
- LG69T (AF) features dual-band standalone positioning and DR function.
- LG69T (AP) integrates RTK and DR, and therefore outputs high precision results.
- LG69T (AB) is ASILB compliant and supports raw data output.



LG69T series are distinguished from each other with different OCs (ordering codes).

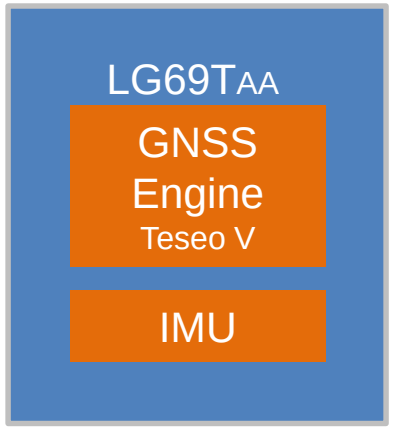
LG69T Series

Dual-Band Automotive Grade GNSS Modules

Automotive Grade

LG69T (AA)

Raw Data Output

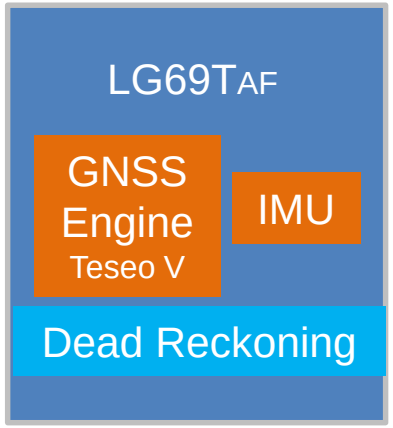


- ST Teseo V
- L1+L5 Dual-Band GNSS
- GNSS Raw Data Output
- Sensor Raw Data Output
- Base station(under plan, no IMU inside)
- Automotive Grade

Automotive Grade

LG69T (AF)

DR Integrated

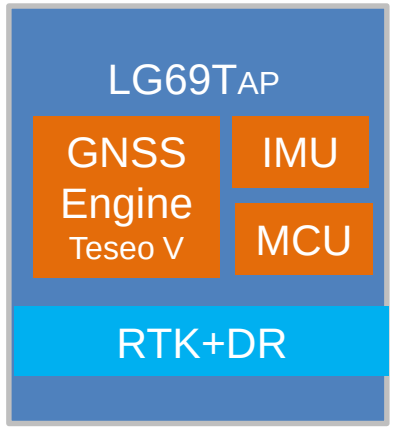


- ST Teseo V
- L1+L5 Dual-Band GNSS
- DR Integrated
- Automotive Grade

Automotive Grade

LG69T (AP)

RTK+DR Integrated



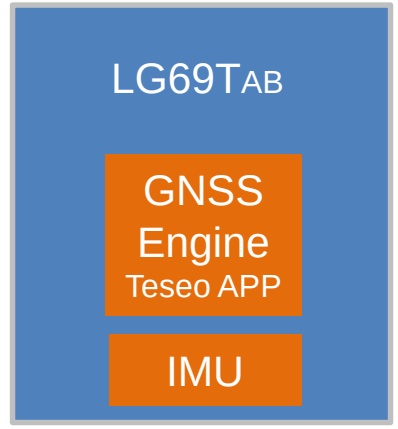
- ST Teseo V
- L1+L5 Dual-Band GNSS
- High Performance MCU Embedded
- RTK+DR Integrated for High Precision Positioning (cm level)
- GNSS Raw Data Output
- Sensor Raw Data Output
- Automotive Grade

Standard Automotive Grade

Automotive Grade

LG69T (AB)

ASIL B Compliant



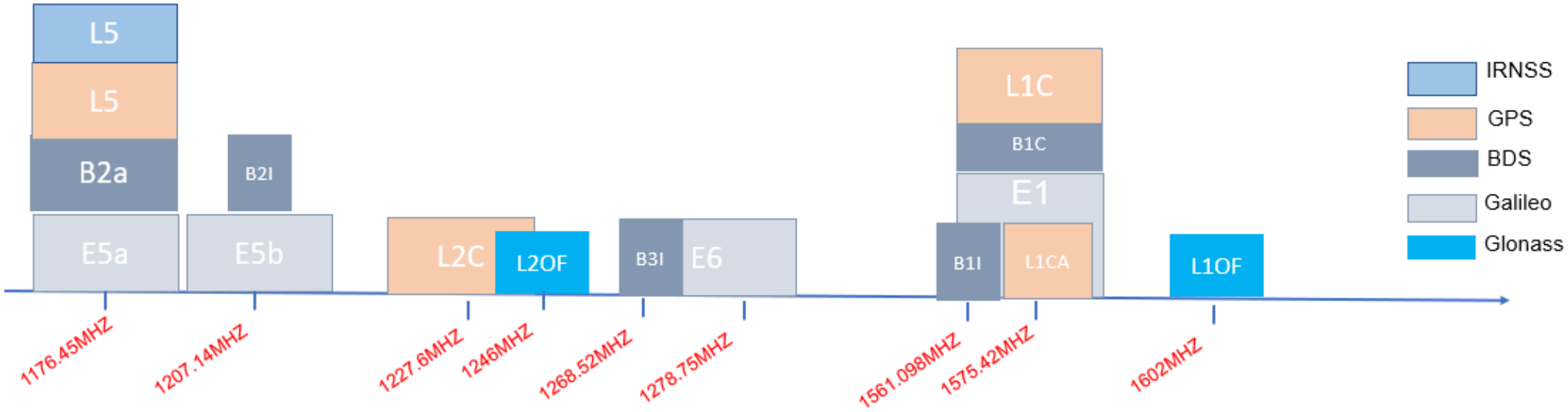
- ST Teseo App
- L1+L5 Dual-Band GNSS
- GNSS Raw Data Output
- Automotive Grade
- ASIL B Compliant

ASILB Grade

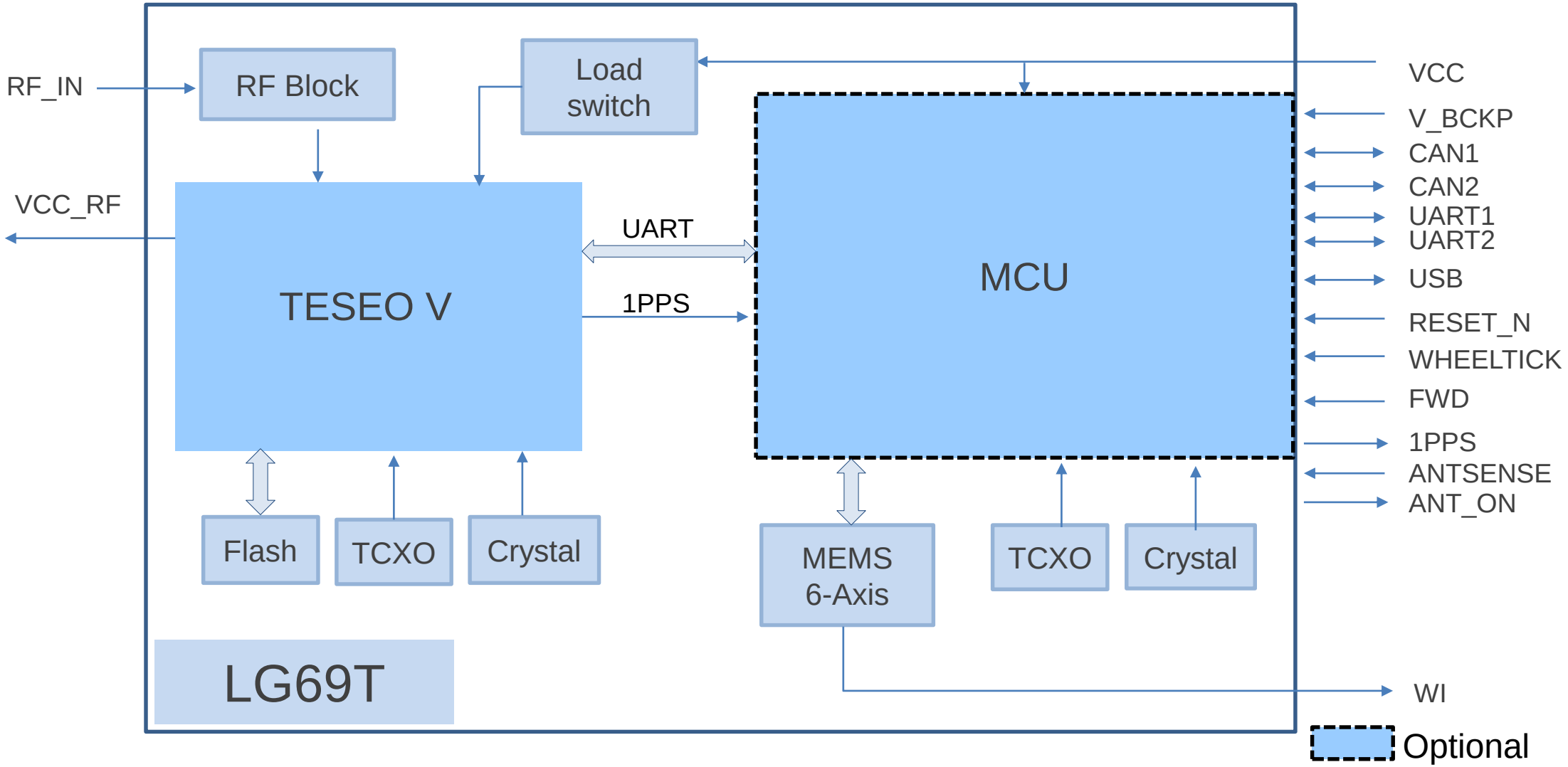
LG69T series are distinguished from each other with different OCs (ordering codes).

LG69T Supported Bands

	GPS/QZSS					Beidou				Glonass		Galileo				SBAS
	L1C/A	L1C	L2C	L5	L6	B1I	B2I	B2a	B3I	L1OF	L2OF	E1	E5a	E5b	E6	L1
Centrel frequency(MHZ)	1575.42	1575.42	1227.60	1176.45	1278.75	1561.10	1207.14	1176.42	1268.52	1602.00	1246.00	1575.42	1176.42	1207.14	1278.75	1575.42
LG69TAA	●	●		●		●		●				●	●			●
LG69TAA-Version2	●	●	●			●	●			●		●		●		●
LG69TAP	●	●		●		●		●				●	●			●
LG69TAF	●	●		●		●		●				●	●			●
LG69TAB	●	●		●		●		●		●		●	●			●



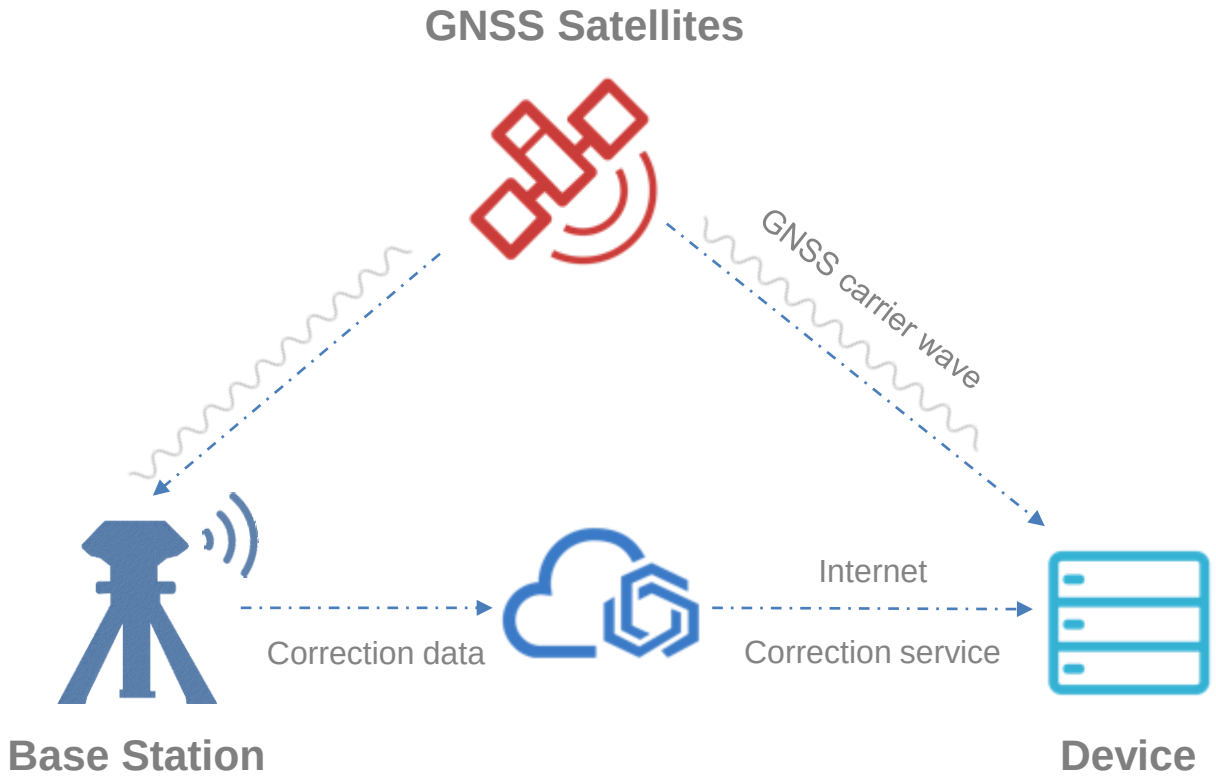
LG69T Hardware Block Diagram



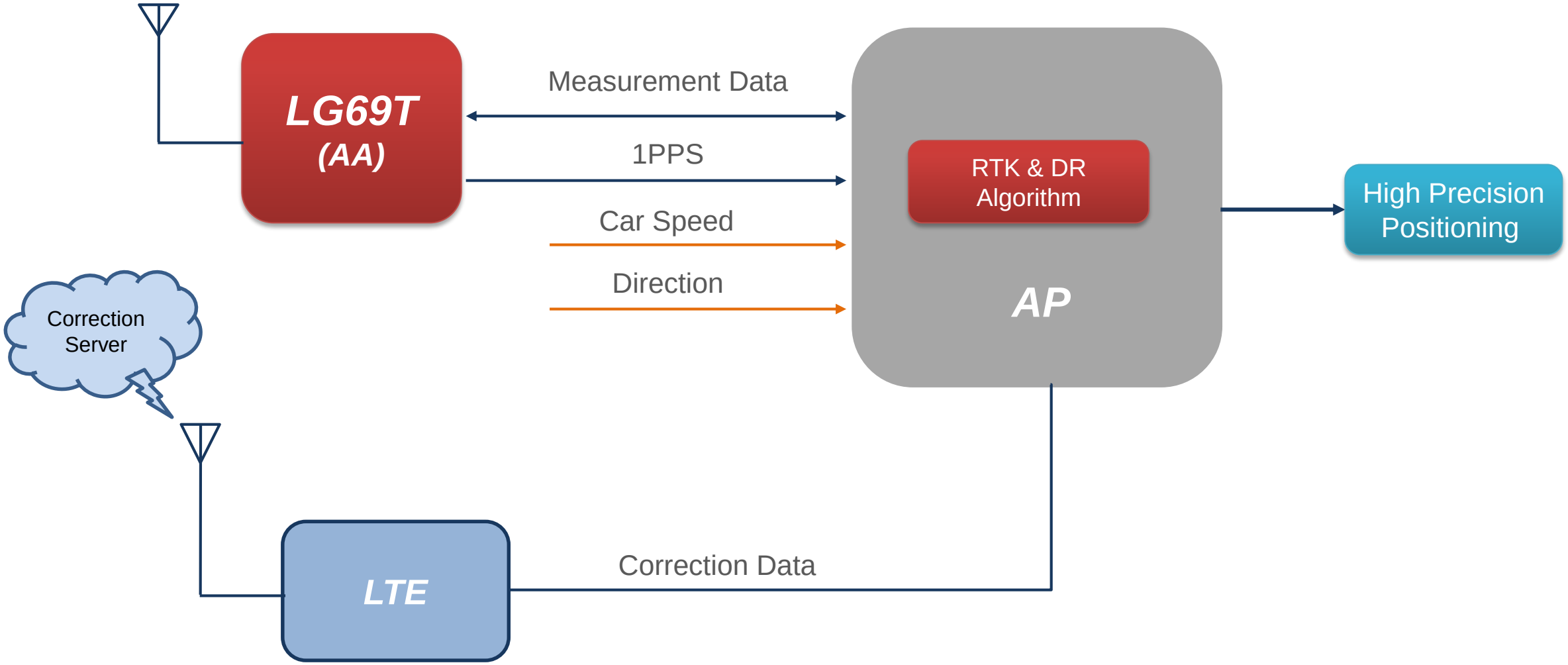
High Precision Positioning - RTK

Real-Time Kinematic (RTK) Positioning Process:

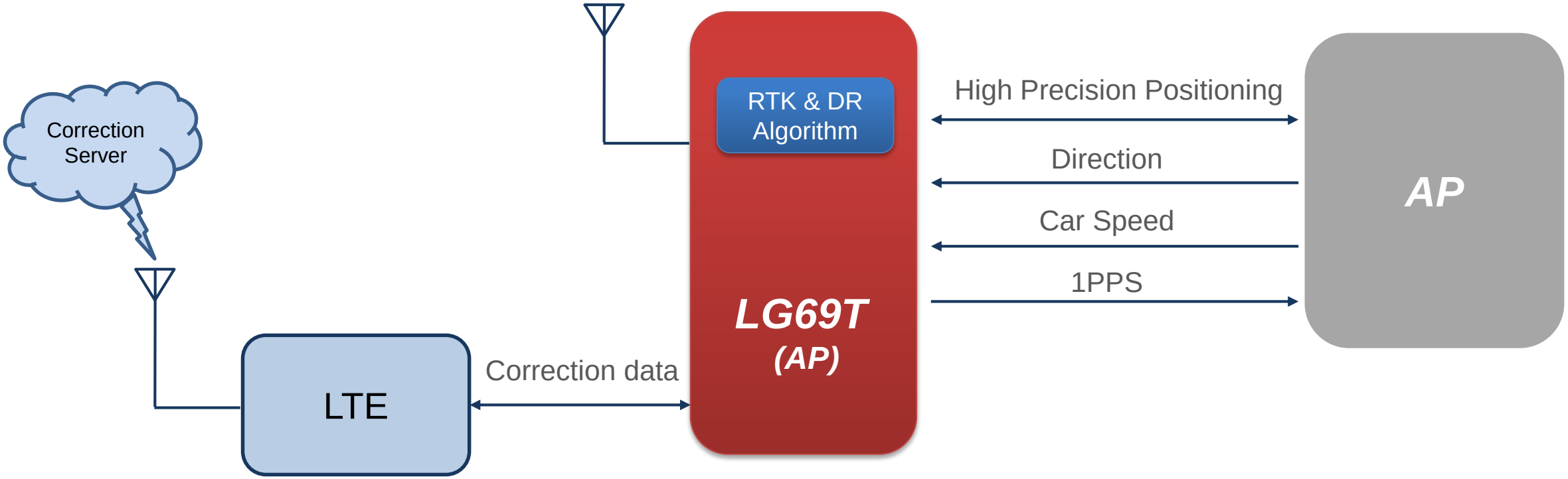
- Satellites broadcast the signal
- The base station calculates the common errors based on carrier phase, and then transfer them to the cloud server
- The device or receiver calculates a precise position with the carrier phase it received and the correction data from correction server



LG69T (AA) Application Architecture



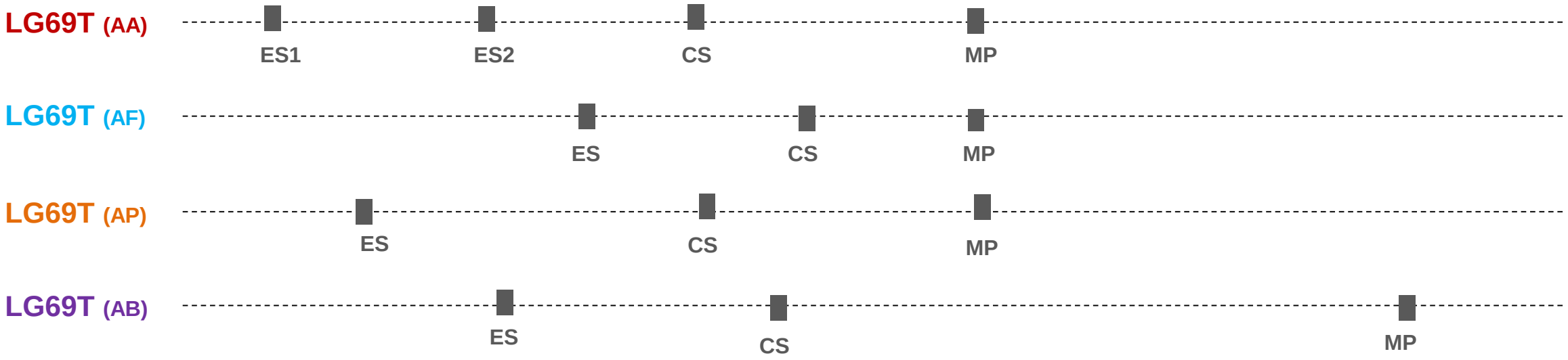
LG69T (AP) Application Architecture



LG69T Timeline

2019			2020											2021			
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.

Project Schedule

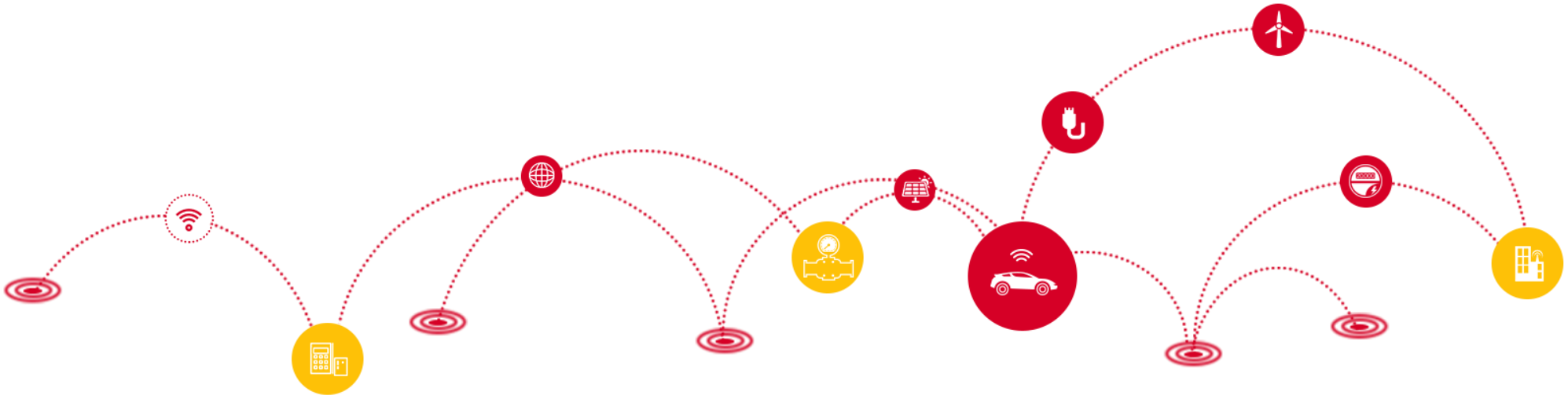


ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Regulatory Certification Schedule

Automotive GNSS Modules

Automotive Wi-Fi/BT Modules



Automotive Wi-Fi/BT Modules Roadmap

Wi-Fi 5
AF30x
QCA6595

Planning

- 802.11 a/b/g/n/ac
- 2×2+1×1, dual-MAC
- 2.4 GHz/ 5 GHz
- BT 5.1
- PCIe/ UART
- -40℃ ~ +85℃

Wi-Fi 6
AF50T
QCA6696

- 802.11 a/b/g/n/ac/ax
- 2×2+2×2, dual-MAC
- 2.4 GHz/ 5 GHz
- BT 5.1
- PCIe/ UART
- -40℃ ~ +85℃

AF20
QCA6564

- 802.11 a/b/g/n/ac
- 1×1, 2.4 GHz/ 5 GHz
- BT 4.2
- SDIO/ UART
- -40℃ ~ +85℃

2018	2019	2020

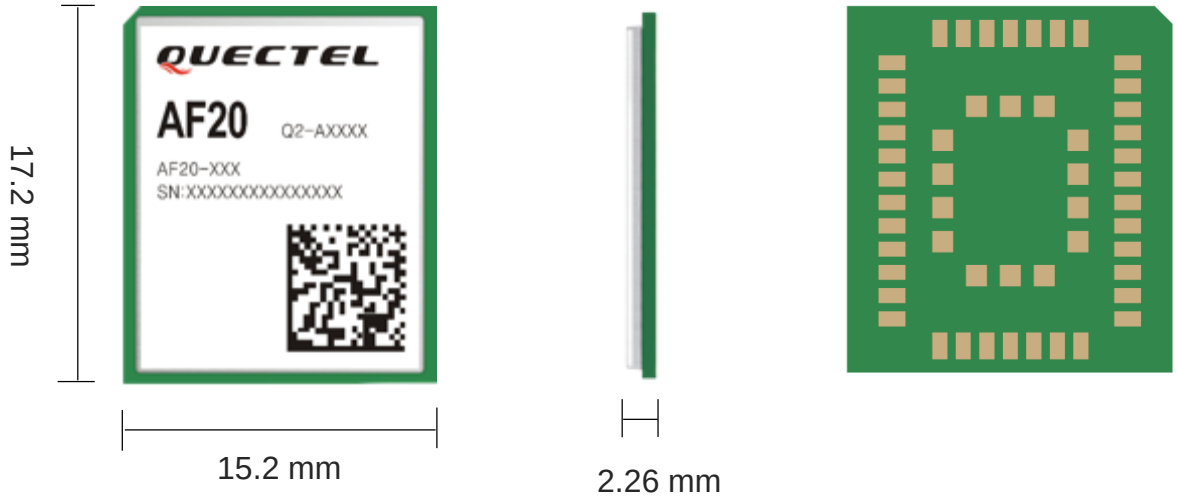
Automotive Grade Wi-Fi/BT Modules Specifications

Feature	AF20	AF50T	AF30x*
Chipset	Qualcomm QCA6564A	Qualcomm QCA6696	TBD
WLAN Protocol	802.11 a/b/g/n/ac	802.11 a/b/g/n/ac/ax	802.11 a/b/g/n/ac
Wi-Fi Bands	2.4GHz/5GHz	2.4GHz/ 5GHz	TBD
BT Protocol	BT 4.2	BT 5.1	BT 5.1
Dimension	17.2mm × 15.2mm × 2.26mm	19.5mm × 21.5mm × 2.3mm	TBD
Working Mode	AP/STA	AP/STA	TBD
Power Supply Voltage (V)	3.14V~3.46V, 3.3V Typ.	**VDD_CORE_VL:** 0.9~1.0, 0.95 Typ. **VDD_CORE_VM:** 1.28~1.42, 1.35 Typ. **VDD_CORE_VH:** 1.85~2.05, 1.95 Typ. **VDD_RF:** 3.3~4.25, 3.85 Typ.	TBD
I/O Pins Supply Voltage Range (V)	1.71V~1.89V, 1.8V Typ.	1.7~1.9, 1.8 Typ.	TBD
Matched Cellular Module(s)	AG35	AG550Q/AG520R	TBD

"" means under development.*

AF20 Highlights

Automotive Wi-Fi/BT Module (QCA6564A)



Length: 17.2 mm (±0.15 mm)
Width: 15.2 mm (±0.15 mm)
Height: 2.26 mm (±0.20 mm)
Weight: 1.26 g

- Qualcomm QCA6564A chipset solution dedicated for automotive applications with IATF 16949 requirement
- Designed to work with Quectel AG35 module
- 1×1 device supporting 802.11 a/b/g/n/ac and 2.4 GHz/5 GHz dual-band
- Operate in soft-AP or station mode and support BT 4.2
- Automotive quality processes (PPAP, 8D, DFMEA, PFMEA…)
- Wide operation temperature range (-40 ℃ to +85 ℃)
- Excellent EMC/ESD protection ensures great robustness even in harsh environments
- Compact SMT form factor ideal for integration in slim and size-constrained automotive solutions

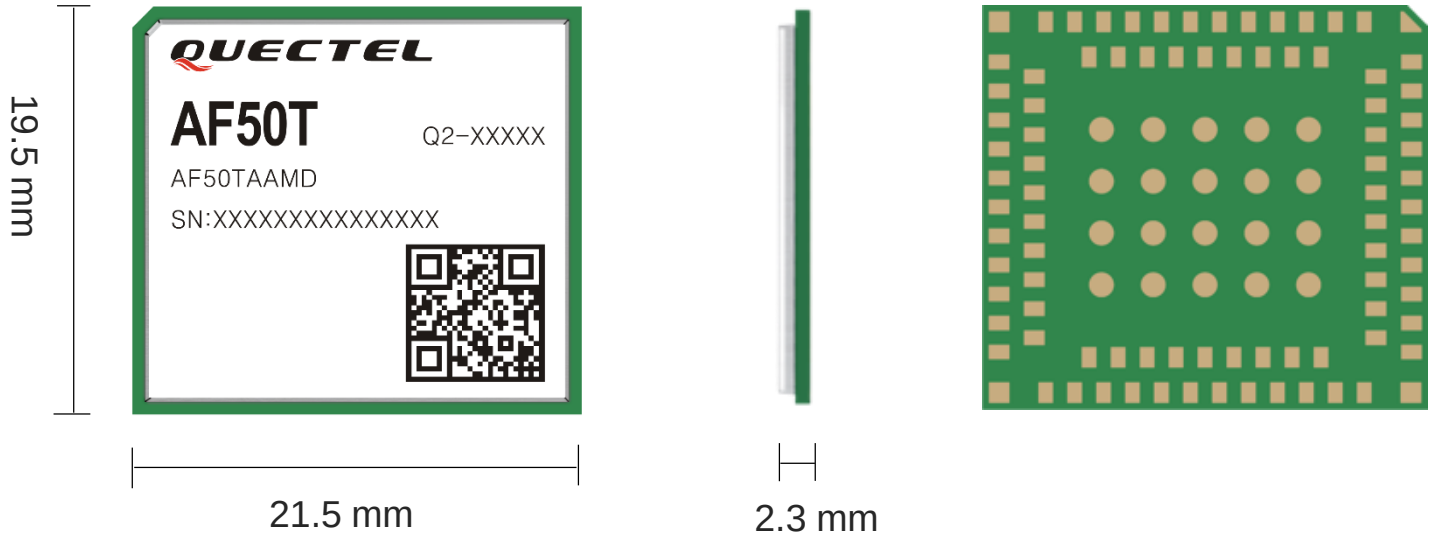
AF20 Specifications

Item	AF20①
Chip	QCA6564A
WLAN Protocol	802.11 a/b/g/n/ac, 1×1
Wi-Fi Bands	2.4 GHz/ 5 GHz
Wi-Fi Modulation	BPSK, QPSK, CCK, 16QAM, 64QAM, 256QAM
BT Protocol	BT 4.2
Work Mode	AP/ STA
Power Supply	3.14–3.46 V, 3.3 V Typ.
Interface	SDIO 3.0 × 1, LTE_UART × 1, 32KHz_IN × 1, Wi-Fi/BT × 1
I/O Port Power Domain	1.71–1.89 V, 1.8 V Typ.
Security	WEP/ TKIP/ AES/ WPA-PSK/ WPA2-PSK
Extended Temperature Range	-40 ℃ to +85 ℃
Region	Global
Certification	**Regulatory：** FCC*/ IC*/ CE*/ TELEC*/ JATE*/ Anatel*

"" means under planning*

AF50T Highlights

Automotive Wi-Fi/BT Module (QCA6696)



Length: 19.5 mm (±0.20 mm)
Width: 21.5 mm (±0.20 mm)
Height: 2.3 mm (±0.20 mm)

- Qualcomm QCA6696 chipset solution dedicated for automotive applications with IATF 16949 requirement
- Designed to work with Quectel AG550Q/AG520R module
- Support 802.11 a/b/g/n/ac/ax Wi-Fi and Dual-Band Simultaneous (DBS) with dual-MAC
- Operate in soft-AP and station mode and support BT 5.1
- Automotive quality processes (PPAP, 8D, DFMEA, PFMEA…)
- Wide operation temperature range (-40℃ to +85℃)
- Excellent co-existence with Quectel LTE/5G modules
- Excellent EMC/ESD protection ensures great robustness even in harsh environments
- Compact SMT form factor ideal for integration in slim and size-constrained automotive solutions

AF50T Specifications

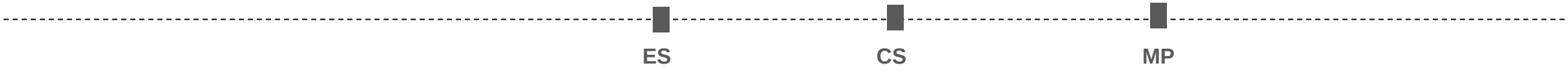
Item	AF50T ①
Chip	QCA6696
WLAN protocol	802.11 a/b/g/n/ac/ax, 2×2+2×2, dual-MAC
Wi-Fi bands	2.4 GHz/ 5 GHz
Wi-Fi modulation	DBPSK, DQPSK, CCK, BPSK, QPSK, QAM, MU-MIMO-OFDMA
BT protocol	BT 5.1
Work mode	AP/ STA
Power supply	VDD_RF, VDD_CORE_VL, VDD_CORE_VM, VDD_CORE_VH, VDD_IO
Interfaces	PCIe, WLAN_EN, UART, PCM, BT_EN, GPIOs
Security	WPA3
Extended temp. range	-40 ℃ to +85 ℃
Area	Global
Certification	FCC*/ IC*/ CE*/ TELEC*/ JATE*/ Anatel*

"" means under planning*

AF50T Timeline

2019			2020									
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.

Project Schedule



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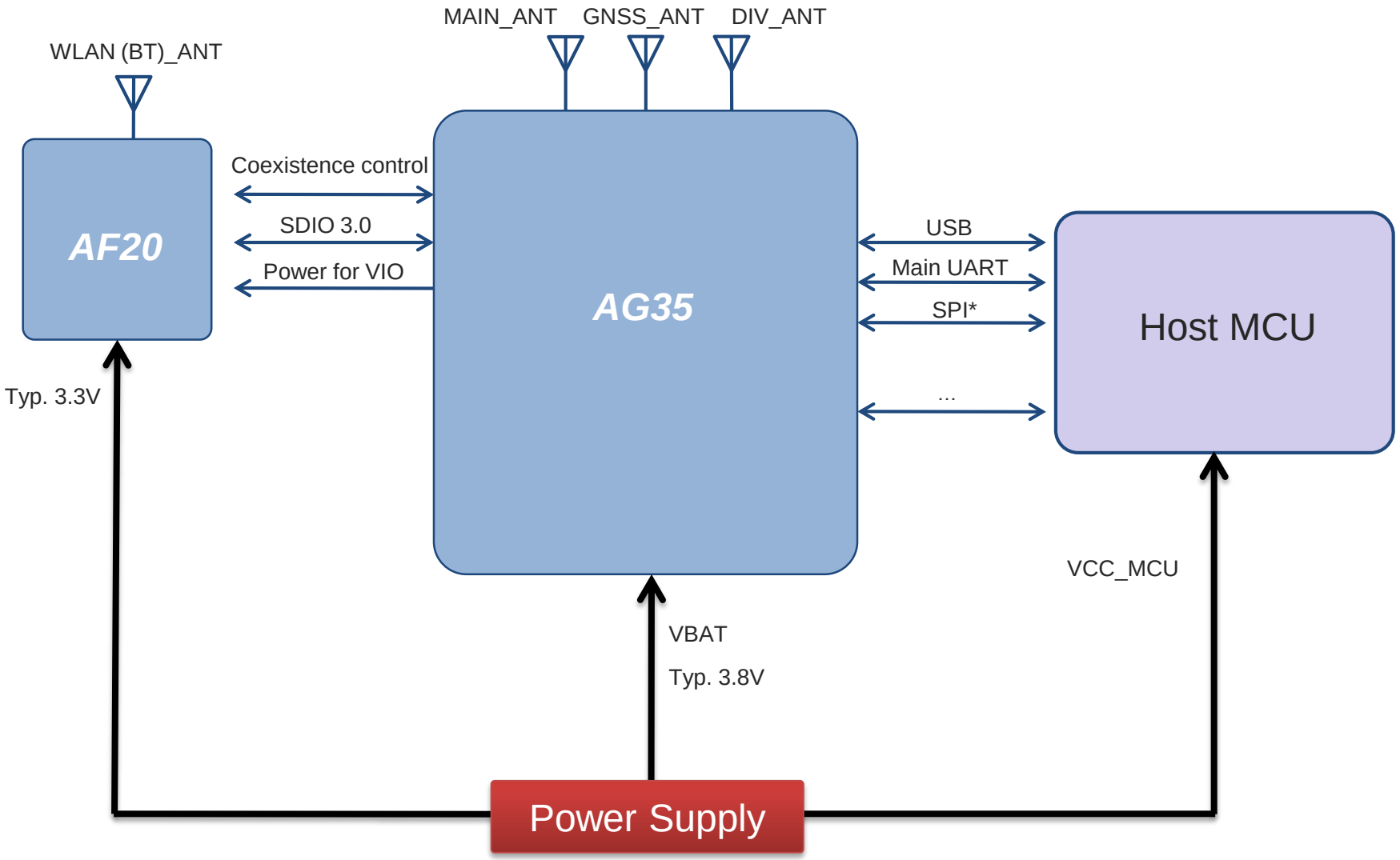
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

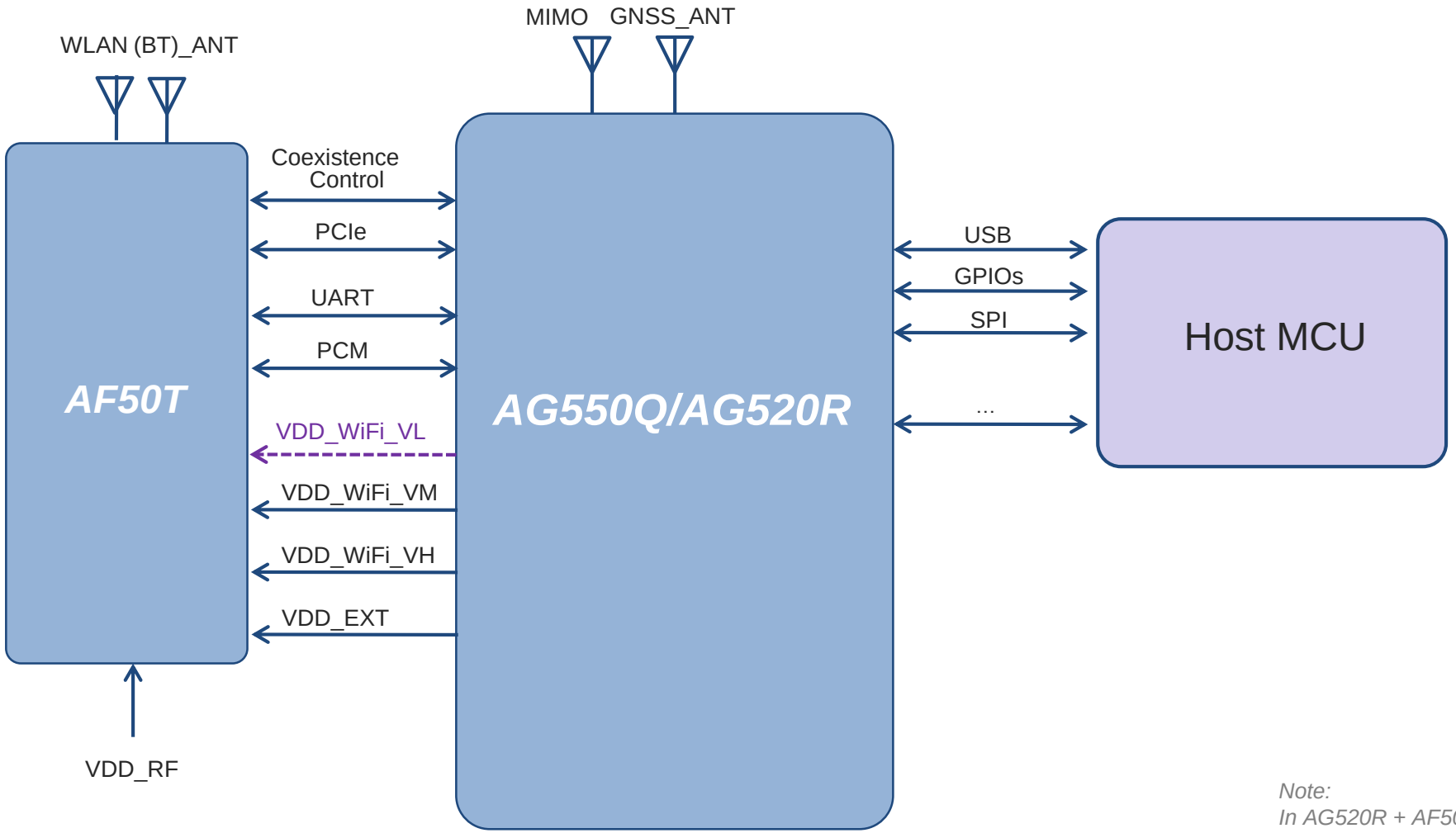
Regulatory Certification Schedule

AG35 + AF20 Solution



"" means under development.*

AG550Q/AG520R + AF50T Solution



Note:
In AG520R + AF50T solution, VDD_WiFi_VL is inputted by an external DC-DC converter.

Automotive Wi-Fi/BT Module Advantages

Best Co-existence

- The best co-existence of Wi-Fi and LTE/5G
- The best co-existence of Wi-Fi and BT

Quality

- Stable and robust network connectivity
- Wide working temperature
- Low power consumption

One-stop Solution

- Used with Quectel cellular modules
- One stop LTE/5G + Wi-Fi/BT solution
- Provide the best performance

Easy Design

- Compact module package
- Convenient for test
- Convenient for automatic mass production
- Reduced manufacturing cost

Thank you!

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