



# L96 GNSS Module Presentation

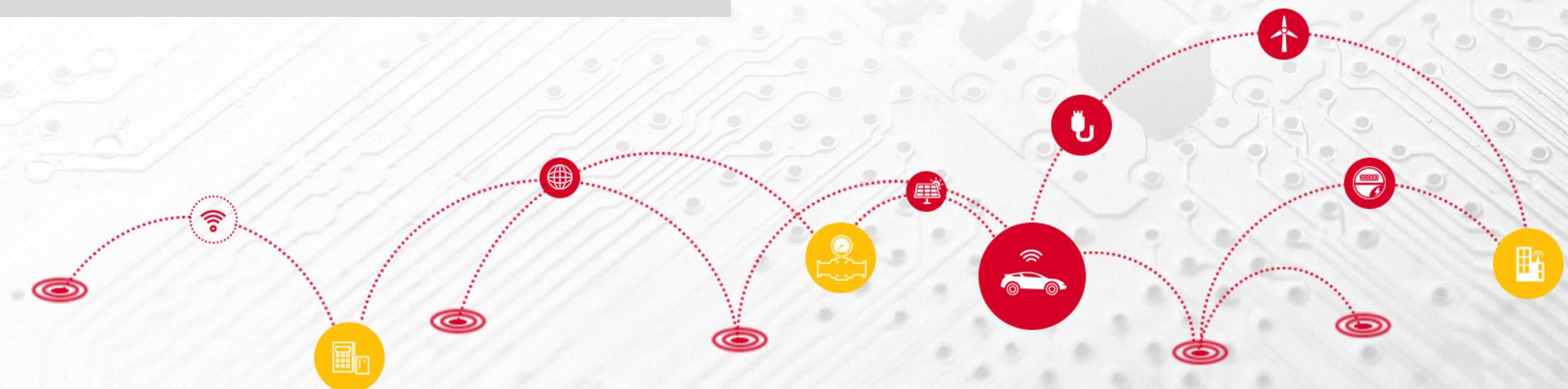
January, 2018

# Product Overview

## Technical Details

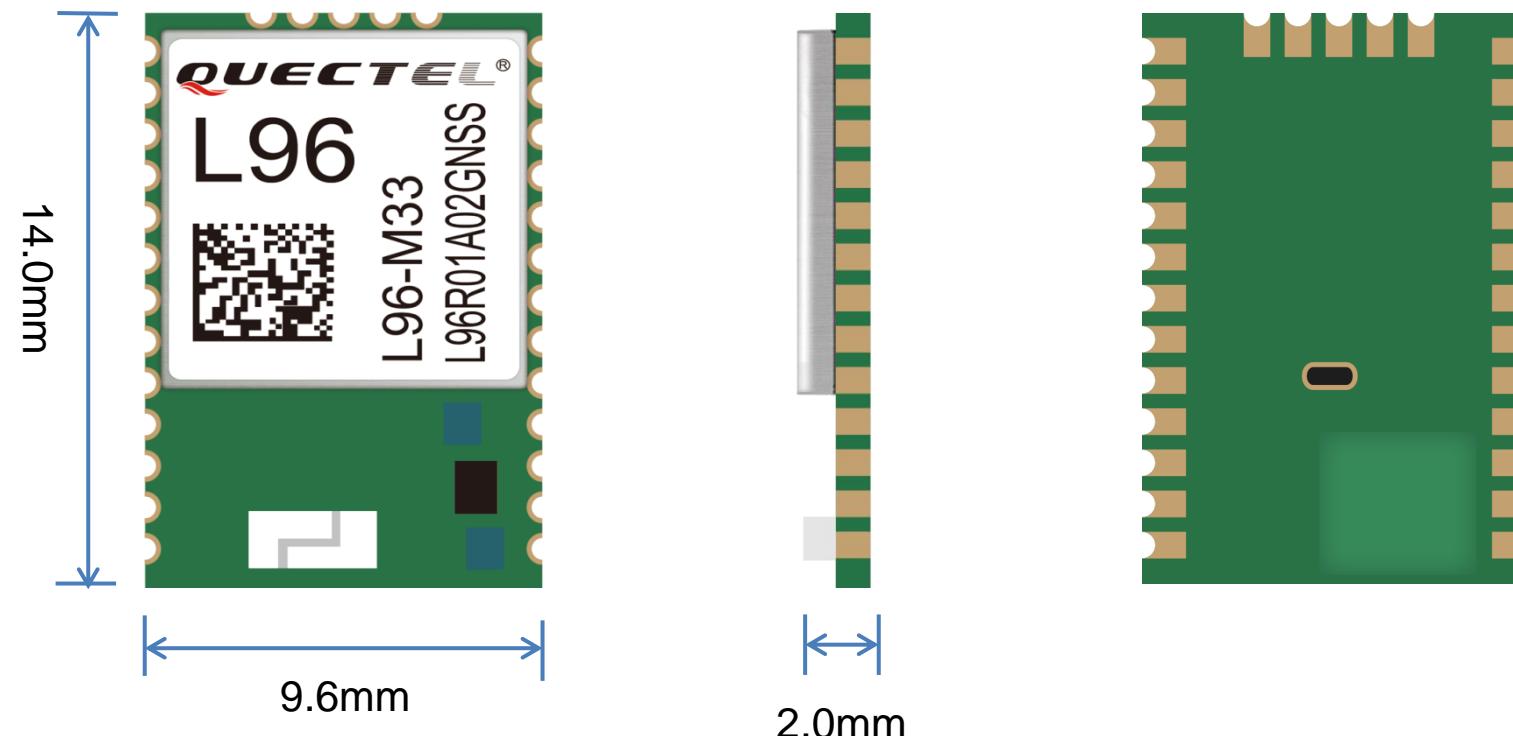
## L96 vs Competitors' Products

## Support Package



# Product Overview

L96 is a concurrent multi-GNSS receiver module with embedded chip antenna. It supports GPS, GLONASS, Galileo, BeiDou and QZSS navigation systems. Based on MT3333 platform, L96 supports multi AGPS functions, including EASY™, EPO mode, etc. Also L96 supports multi power saving modes to make the system work on the lowest power consumption. The embedded GNSS antenna enables customers to easily design smaller end devices without any performance lost.



# L96 Specifications

Multi-constellation GNSS	GPS/GLONASS/BeiDou/Galileo/QZSS	
Channel Numbers	<ul style="list-style-type: none"> <li>• 33 tracking channels</li> <li>• 99 acquisition channels</li> <li>• 210 PRN channels</li> </ul>	
SBAS	WAAS, EGNOS, MSAS, GAGAN	
Horizontal Position Accuracy	Autonomous	<2.5m CEP
Velocity Accuracy	Without Aid	<0.1m/s
Acceleration Accuracy	Without Aid	0.1m/s <sup>2</sup>
Timing Accuracy	1PPS	10ns
TTFF @-130dBm with EASY™	Cold Start	<15s
	Warm Start	<5s
	Hot Start	<1s
TTFF @-130dBm without EASY™	Cold Start	<35s
	Warm Start	<30s
	Hot Start	<1s
Sensitivity	Acquisition	-148dBm
	Tracking	-165dBm
	Re-acquisition	-160dBm
		Supply Voltage Range
		2.8~4.3V, typical 3.3V
		Operation Temperature
		-40° C ~ +85° C
		Dimensions
		14.0mm × 9.6mm × 2.0mm
		Weight
		Approx. 0.6g
		Low Power Consumption
		@ Acquisition: <ul style="list-style-type: none"> <li>• 22mA @3.3V (GPS)</li> <li>• 25mA @3.3V (GPS+GLONASS)</li> </ul>
		@ Tracking <ul style="list-style-type: none"> <li>• 20mA @3.3V (GPS)</li> <li>• 20mA @3.3V (GPS+GLONASS)</li> </ul>
		Power Saving Modes <ul style="list-style-type: none"> <li>• 2.8mA @AlwaysLocate™</li> <li>• 7uA @Backup Mode</li> <li>• 500uA @Standby Mode</li> <li>• 3.7mA @Periodic Mode</li> </ul>
		I2C <ul style="list-style-type: none"> <li>• Max bit rate up to 400Kbps</li> <li>• Supports 7-bit address</li> <li>• Outputs NMEA data by default when reading; can also receive PMTK/PQ commands</li> </ul>
		UART <ul style="list-style-type: none"> <li>• UART port: TXD1 and RXD1</li> <li>• 4800~115200bps baud rate (9600bps by default)</li> <li>• Used for NMEA output, PMTK/PQ commands input and firmware upgrade</li> </ul>

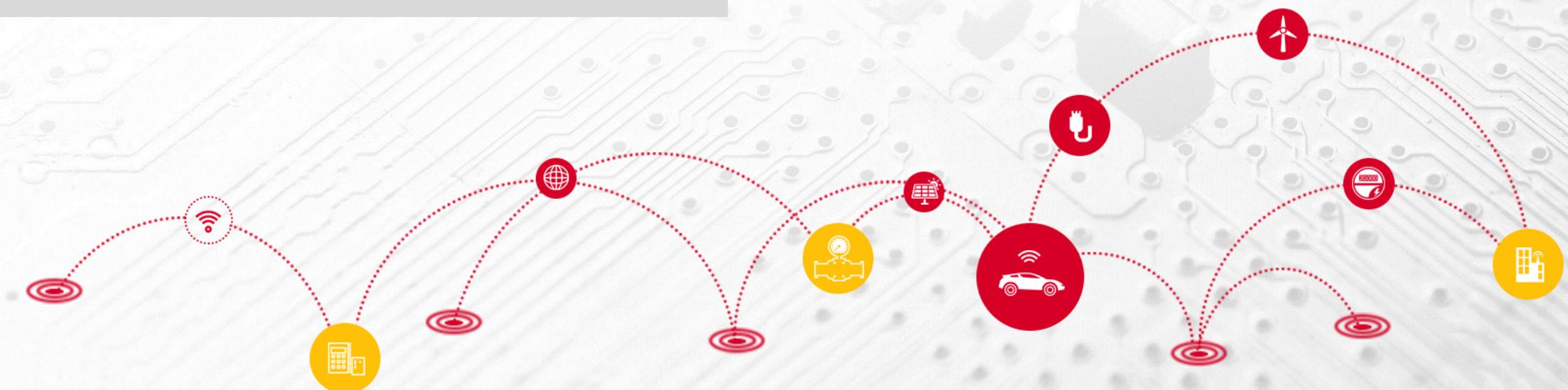
# Product Overview



## Technical Details

## L96 vs Competitors' Products

## Support Package



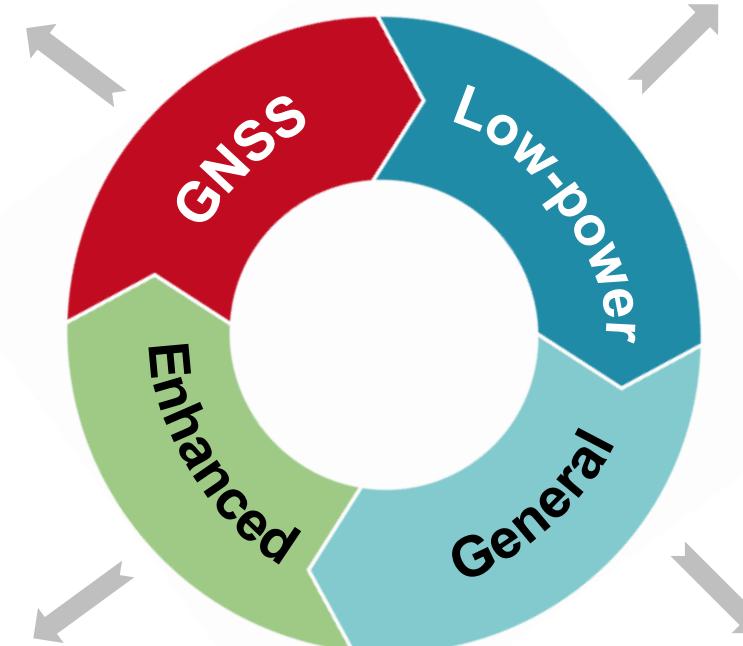
# Highlights

## GNSS Features

- GPS/GLONASS/Galileo/BeiDou
- SBAS/QZSS
- RLM (Return-Link-Message)
- EASY™
- EPO™
- Autonomous GPS
- LOCUS™
- GLP
- AlwaysLocate™
- 1PPS
- Quectel SDK

## Enhanced Features

- RTCM
- GPIO interfaces: 3D fix/jamming detection/Geo-fence indicators
- Odometer
- Embedded chip antenna
- External antenna supported
- Anti-jamming:  
multi-tone active interference cancellation
- Build-in LNA for better performance in weak signal areas



## Low Power & High Sensitivity

### Low Power Consumption

- 20mA @Tracking mode
- 25mA @Acquisition mode

### Multi Power Saving Modes

- 2.8mA @AlwaysLocate™
- 7uA @Backup Mode
- 500uA @Standby Mode
- 3.7mA @Periodic Mode

### High Sensitivity

- -165dBm @Tracking mode
- -148dBm @Acquisition mode

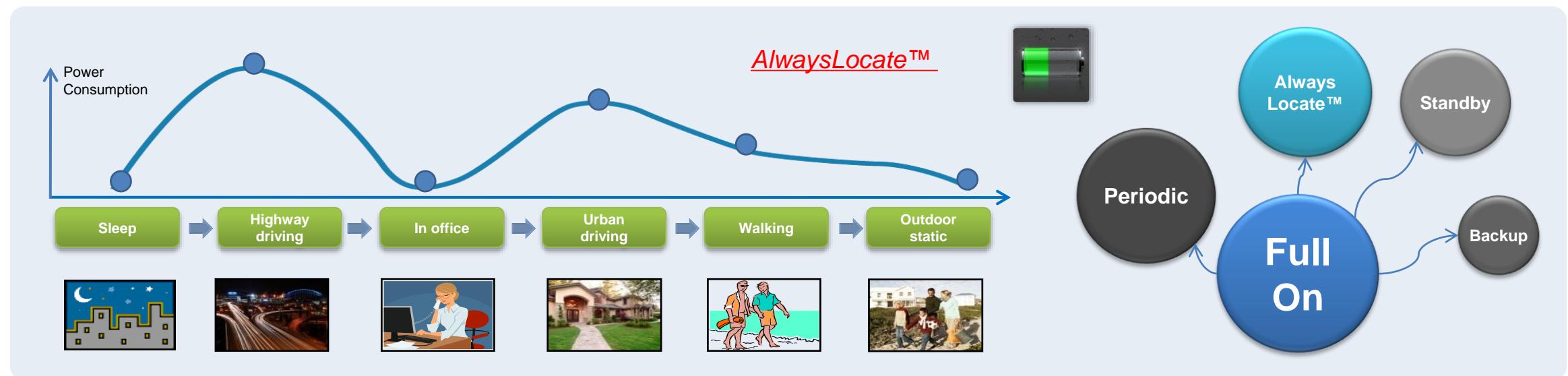
## General Features

- Ultra-compact size: 14.0mm × 9.6mm × 2.0mm
- Extended temperature range: -40 °C~ +85 °C
- I2C: maximum bit rate up to 400kbps
- UART: 4800~115200bps (9600bps by default)
- Protocols: NMEA 0183/PMTK

# Multi Power Management Modes - 1

Power Management Modes	L96	CAM-XX	SXMXXXXX
Full on @Acquisition	25mA@3.3V	28mA@3.0V	25mA@3.3V
Full on @Tracking	20mA @3.3V	30mA @3.0V	20mA@3.3V
Backup	7uA	15uA	15uA
Standby	500uA	N/A	N/A
Periodic	3.7mA	N/A	N/A
AlwaysLocate™	2.8mA	10.1mA	N/A

Quectel GNSS modules provide multiple power management modes to reduce current consumption, including Backup, Standby, Periodic, GLP and AlwaysLocate™ modes.

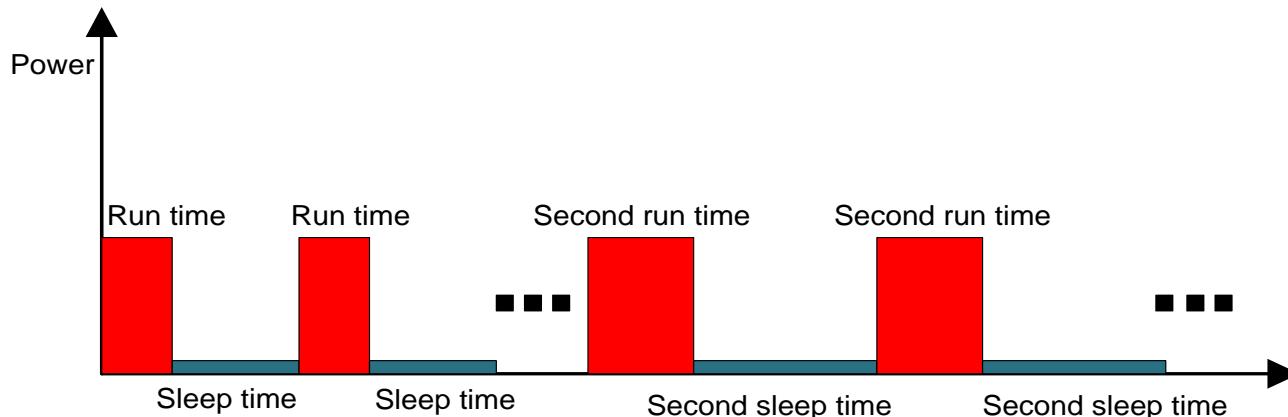


# Multi Power Management Modes - 2

## Periodic Standby/Backup Mode

Periodic Standby/Backup mode can control power ON/OFF time of GNSS periodically to reduce average power consumption, and ON/OFF time can be configured by using PMTK commands. For details, see the figure below. Periodic Standby/Backup mode can be entered by sending the following PMTK command.

**\$PMTK255, Type, Run time, Sleep time, Second run time, Second sleep time**



**Run time:** Tracking mode period (ms)  
**Sleep time:** Standby/backup mode period (ms)  
**Second run time:** Extended acquisition period (ms) when GNSS acquisition fails during the Run time  
**Second sleep time:** Extended standby/backup mode period (ms) when GNSS acquisition fails during the Run time

### Note:

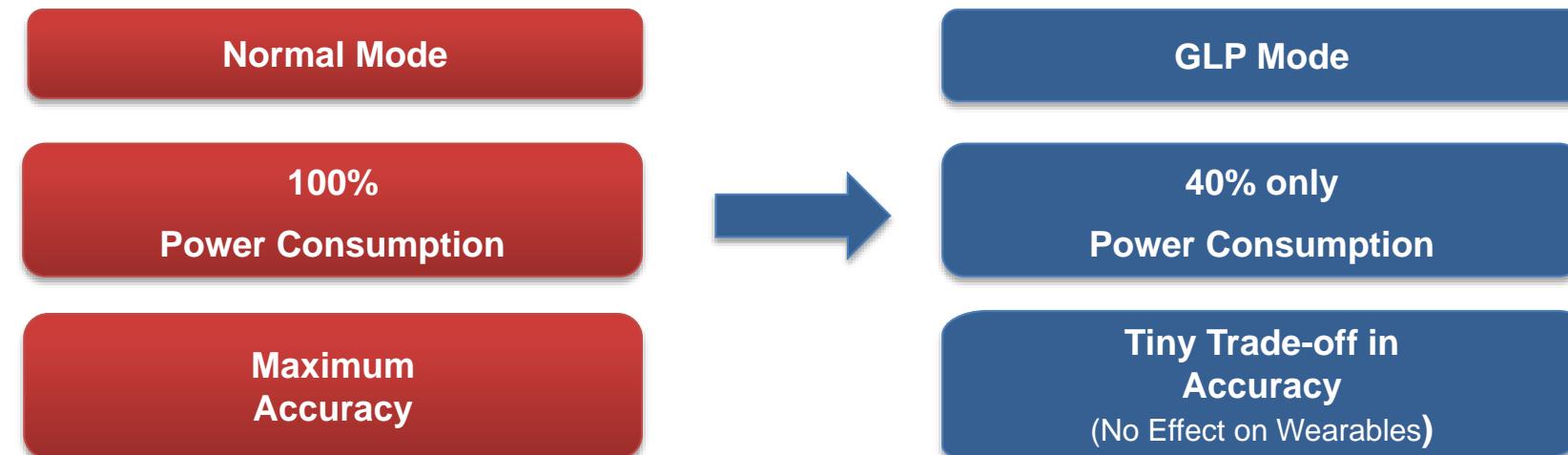
Normally, the GNSS module will enter the periodic mode after successfully fixing position. But if acquisition fails, the GNSS module still can enter this mode. If GNSS acquisition fails during the **Run time**, in order to ensure the success of reacquisition, it is better to set a longer **Second run time**.

Example: PMTK225,1,3000,12000,18000,72000\*16 for periodic mode means 3s in tracking mode and 12s sleep in standby mode. The average current consumption is about 3.7mA.

# Multi Power Management Modes - 3

Low power mode is an optimized solution for wearables, fitness devices and tracking device. It provides a GNSS Low Power (GLP) mode for Quectel GNSS modules to reduce power consumption with tiny accuracy trading-off. The low power mode can be easily set by using a specific message.

In GLP mode, the module has good route consistence in walking and running scenarios, and can switch dynamic duty operation automatically. It will come back to normal mode in difficult environment to keep good accuracy as well, thus realizing maximum performance with the lowest power consumption.



# AGPS Technology - EASY™



EASY™ is the abbreviation for Embedded Assist System for quick positioning. With EASY™ technology, the GNSS engine can calculate and predict automatically single ephemeris (up to 3 days) when the power is on, and then save the predict information into the memory. So the GNSS engine can use the information for positioning later if there are not enough information received from the satellites.

**With EASY™ technology, Quectel modules can decrease the TTFF (Time To First Fix) considerably.**

L96 Chip Antenna Module with EASY™				L96 Chip Antenna Module without EASY™			
CN0 39dB	TTFF (result of 10 times of testing) (s)			CN0 39dB	TTFF (result of 10 times of testing) (s)		
	Cold start	Warm start	Hot start		Cold start	Warm start	Hot start
Min.	12	2.2	0.3	Min.	23	20.1	0.7
Max.	20.7	4.9	0.9	Max.	38.4	33.8	0.9
Mean	<b>14.84</b>	<b>3.3</b>	<b>0.56</b>	Mean	<b>29.4</b>	<b>28.45</b>	<b>0.76</b>

EASY™ function is enabled by default in Quectel modules. The command “\$PMTK869,1,0\*34” can be used to disable EASY™.

# AGPS Technology - EPO™

EPO™ (Extended Prediction Orbit) supplies the predicated Extended Prediction Orbit data to speed up TTFF, customers can download the EPO data to GNSS engine from their own FTP server by internet or wireless network, the GNSS engine will use the EPO data to assist position calculation when there are not enough navigation information or in weak signal areas.

EPO data service supports 3/6/9/12/18/21/24/27/30 days' orbit predictions. There is no need to download EPO data from EPO server every day. Aiding information like ephemeris, almanac, satellites status and an optional time synchronization signal will reduce the time to first fix significantly.

*Note: Any authorized customer can download EPO data from MTK EPO server, without the need of any external server.*



# Enhanced Technologies - LOCUS



LOCUS is the name of MTK innate logger solution. The embedded logger function can be realized without any need for host CPU (MCU) or external flash. GPS engine will use internal flash (embedded in GNSS chipset) to log the GNSS data (Data format: UTC, Latitude, Longitude, Height).

## Benefits

- Auto logging data to chipset internal flash, no need to wake up HOST
- Smart overlapping mechanism to keep the latest logger data always (4KB base)
- Logger capability in chipset internal flash:
  - A. With 1 sector flash (64KB), users can log >16 hours
  - B. With AlwaysLocate™, users can log up to 48hrs (2days) under standard scenario.

## Logging Mode

- AlwaysLocate™ Mode:  
It can be used to save internal flash space and only log once before entering sleep when GNSS module is in the AlwaysLocate mode.
- Fix only mode: Logging GNSS data when 3D-fix only.
- Interval mode: Logging one time per 15s interval.

# Enhanced Technologies - SDK



## Quectel GNSS module functions developed based on SDK command

Quectel offers unique features which are developed based on SDK, and those features are:

- Set NEMA port baud rate (PQBAUD command)
- Get estimated position error in horizontal and vertical direction (PQEPE command)
- Set the type and pulse width of 1PPS's output (PQ1PPS command)
- Set the module into FLP/GLP mode (PQFLP/PQGLP command)
- Enable/disable GPTXT sentence output (PQTXT command)
- Detect antenna status (GPTXT command)
- Enable/disable ECEFPOSVEL sentence output (PQECEF command)
- Odometer reading (PQODO command)
- Jamming detection (PQJAM command)
- Enable/disable switching from WGS84 to PZ-90.11 (PQPZ90 command)

*NOTE: Please refer to Quectel\_GNSS\_SDK\_Commands\_Manual  
for the detailed information about these commands.*

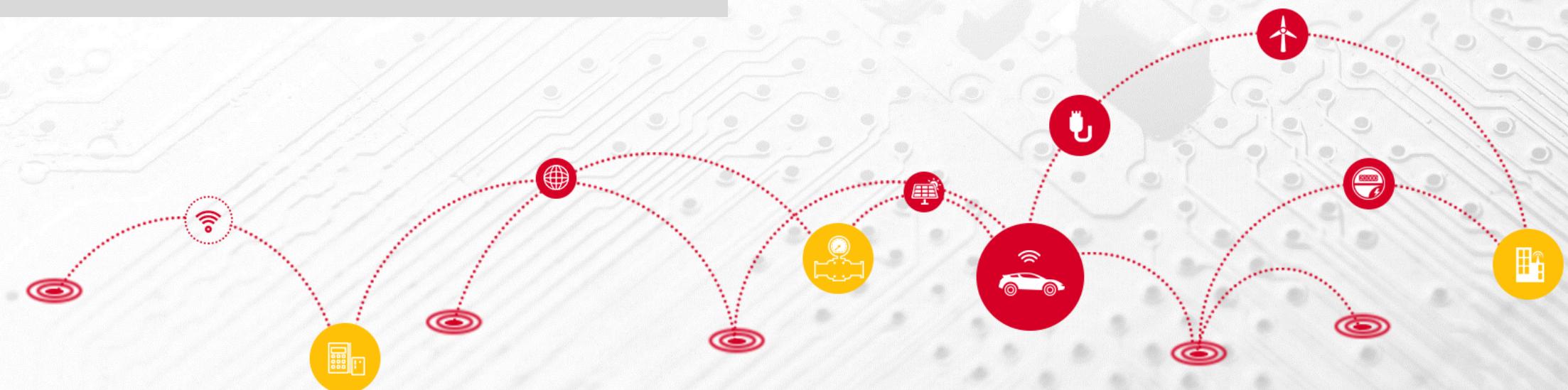


## Product Overview

## Technical Details

## L96 vs Competitors' Products

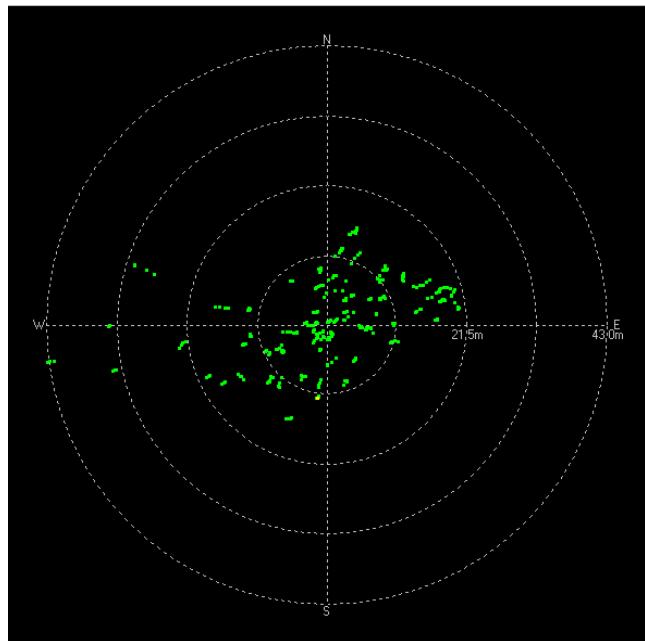
## Support Package



# Performance Comparison - Static

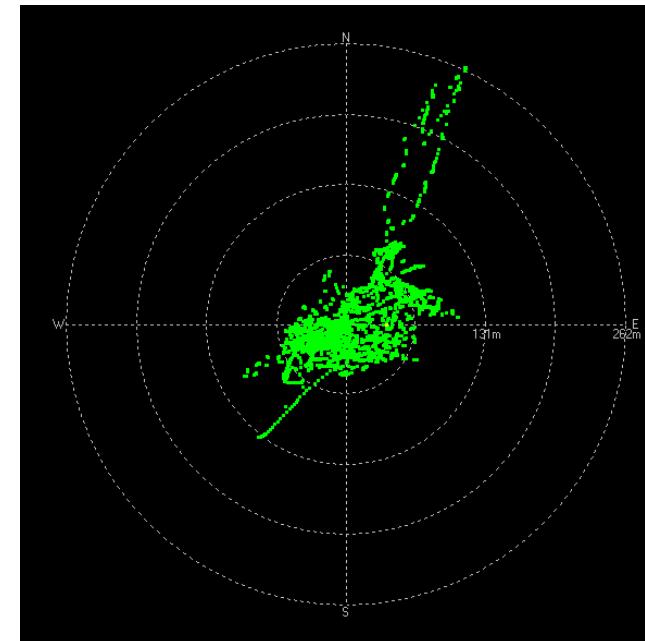
**L96**

CEP: 8.055  
Drift: 43m



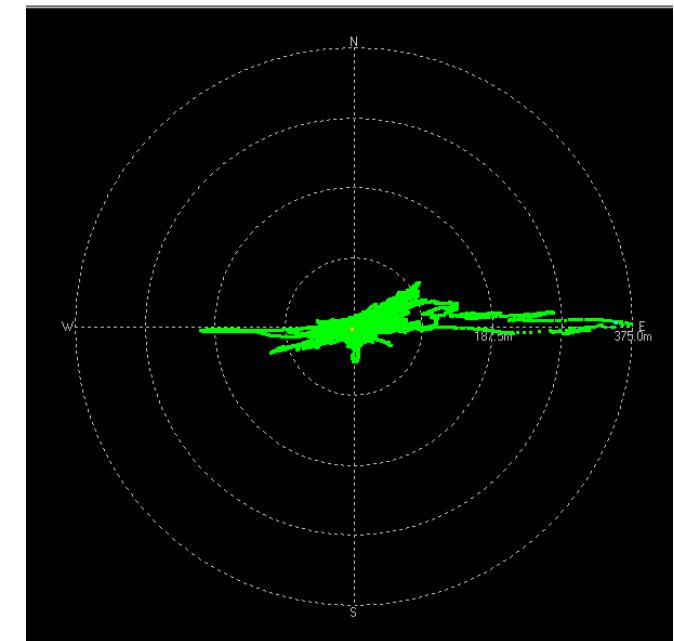
**S company product**

CEP: 16  
Drift: 262m



**U company product**

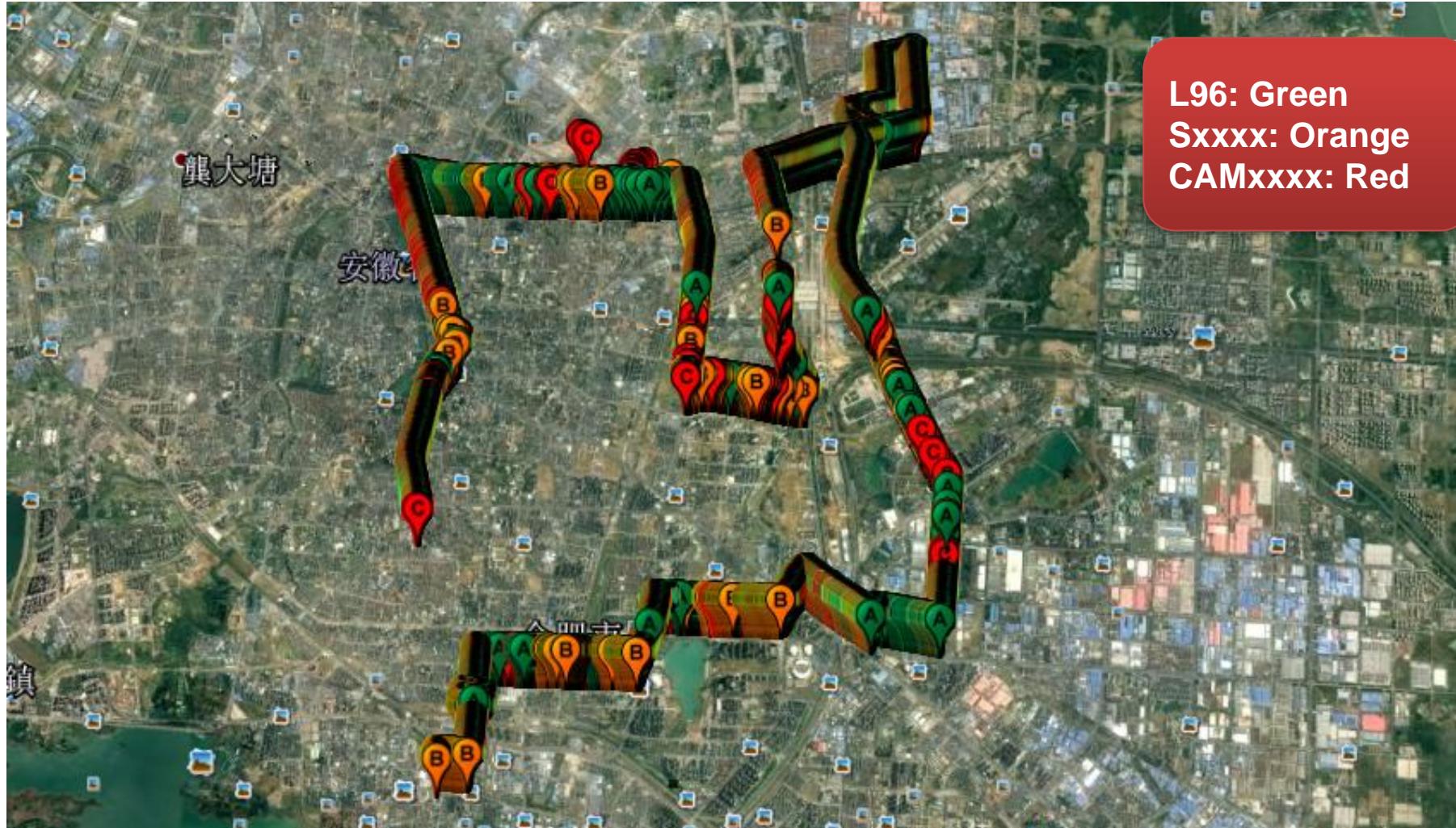
CEP: 11.393  
Drift: 375m



*Notes: The modules are tested under half open sky environment.*

# Performance Comparison – Dynamic (Overall)

The following illustrates the overall tracking path of the GNSS modules. U company product (CAMxxxx) has a large position drift in one place.



# Performance Comparison – Dynamic (Startup)

The following illustrates the tracking path of the GNSS modules during startup period. L96 and Sxxxx have similar performance, but CAMxxxx has large position drifts.



# Performance Comparison – Dynamic (At a Turning)

The following illustrates the tracking path of the GNSS modules at a turning under an elevated highway. Under such scenario, L96 performs a little better than CAMxxxx, and S company product (Sxxxx) offers the biggest position drift.



# Performance Comparison – Dynamic (Under Trees)

The following illustrates the tracking path of the GNSS modules under roadside trees. Under such scenario, CAMxxxx and Sxxxx both have a little position drift, and L96 performs the best.



# Performance Comparison – Dynamic (Elevated Highway)

The following illustrates the tracking path of the GNSS modules under an elevated highway. Under such scenario, CAMxxxx has failed to get fixed in the following two road sections, and L96 performs the best.



# Performance Comparison – Dynamic (In a Tunnel)

The following illustrates the tracking path of the GNSS modules in a tunnel. Under such scenario, L96 loses lock first, and gets re-fixed at the same time with the other two modules.



# Performance Comparison – Dynamic (At a Roundabout)

The following illustrates the tracking path of the GNSS modules at a roundabout. Under such scenario, L96 and Sxxxx have similar performances, and CAMxxxx has the biggest position drift.

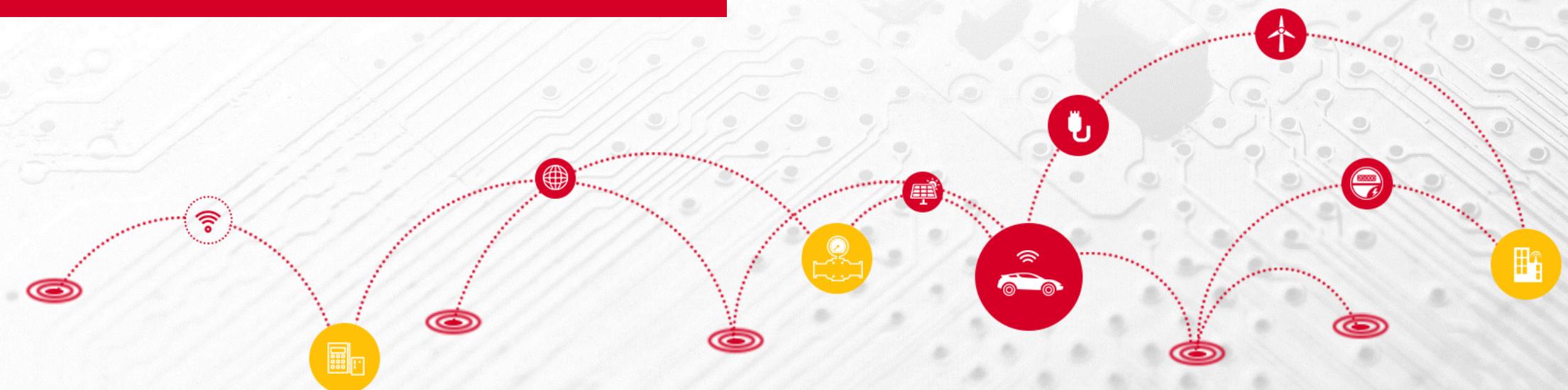


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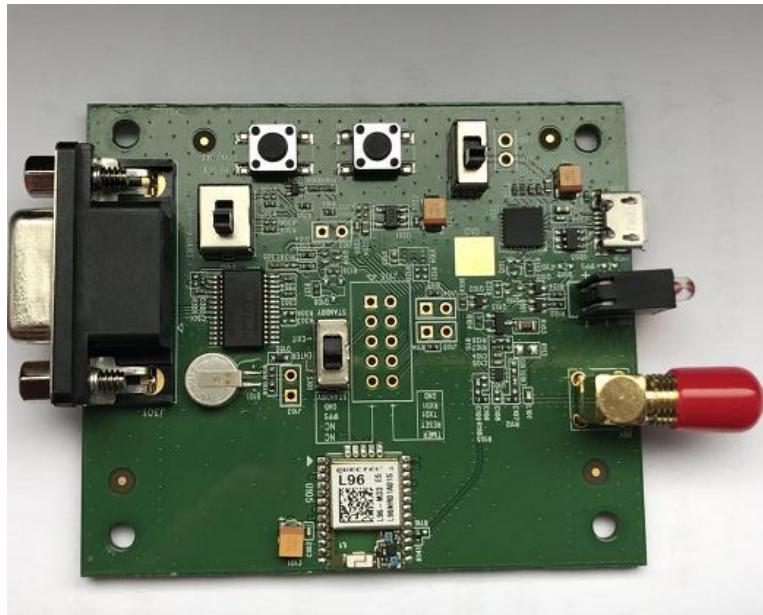
## L96 vs Competitors' Products

## Support Package



# Support Package – EVB & Technical Materials

**QUECTEL**®  
Build a Smarter World



## L96 EVB Kit

- L96 EVB Board
- USB Cable
- GNSS Active Antenna

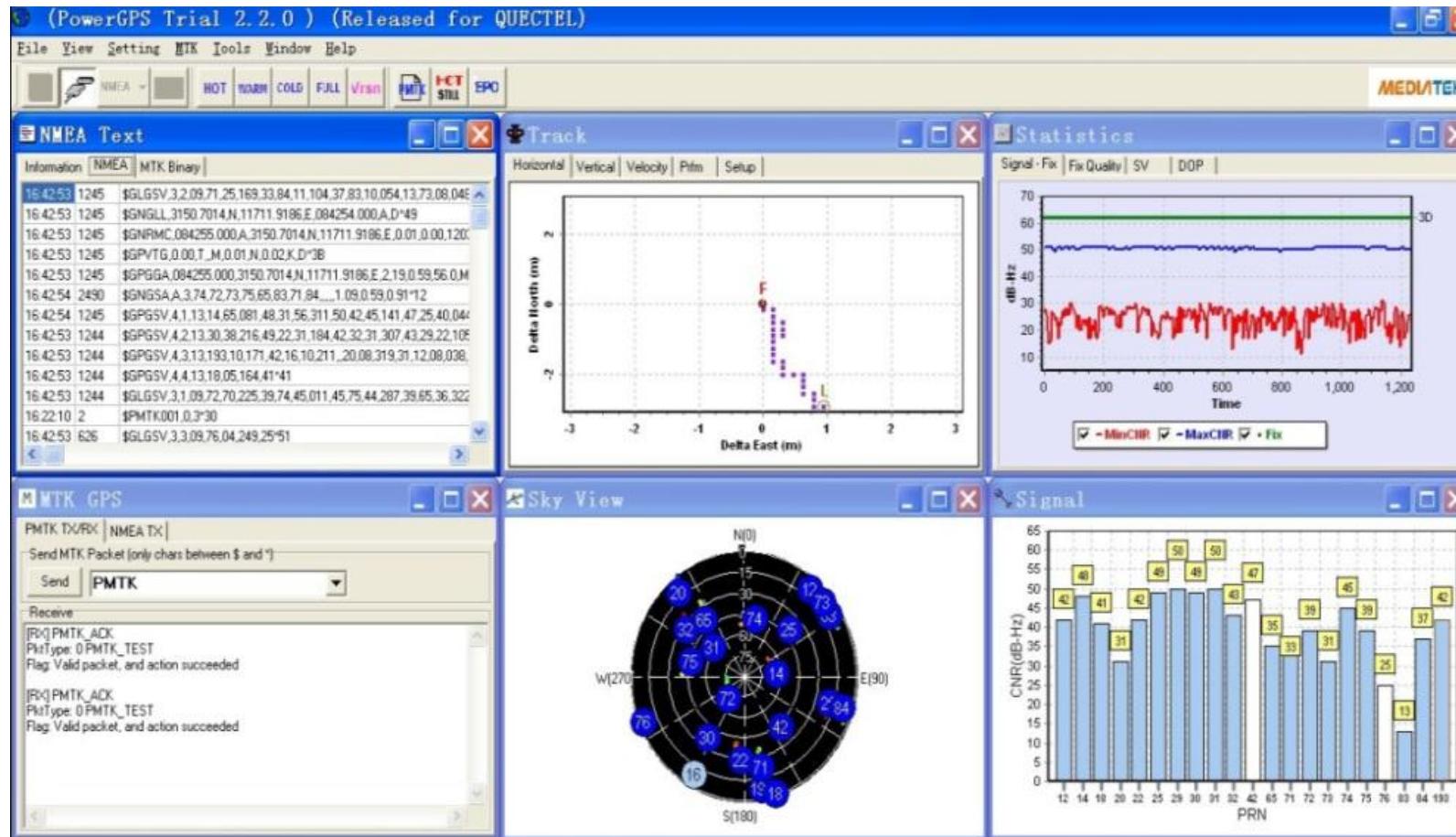
## Technical Materials Package

- Specification
- Hardware Design
- Reference Design
- GNSS Protocol Specification
- EVB User Guide
- Application Notes

# Support Package - Test Tool

## PC Tool

- PowerGPS - GPS/GLONASS testing tool





# Thank you!

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