# L76-L GNSS Module Presentation

May, 2016

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# Highlights

**Support Multi-GNSS Systems**

L76-L: GPS+GLONASS

**Ultra Low Power Consumption**

22mA@Tracking mode (Note 1)
29mA@Acquisition mode (Note 1)
Only 40% power consumption@GLP mode

**EASY™**

Advanced AGPS technology
without the need of external memory

**EPO™**

Reduce TTFF (WTTFF < 5s)

**AlwaysLocate™**
An intelligent controller of power
consumption

**LOCUS™**

Embedded logger function without the
need of host and external flash

Note 1: Measured in GPS+GLONASS system.

**Compact Size**

10.1 x 9.7 x 2.5 mm

**SDK Command**
Integrated unique feature
Quectel command

**Anti-Jamming**

Multi-tone active interference
canceller

**Jamming Detection**

Increase interference and accuracy
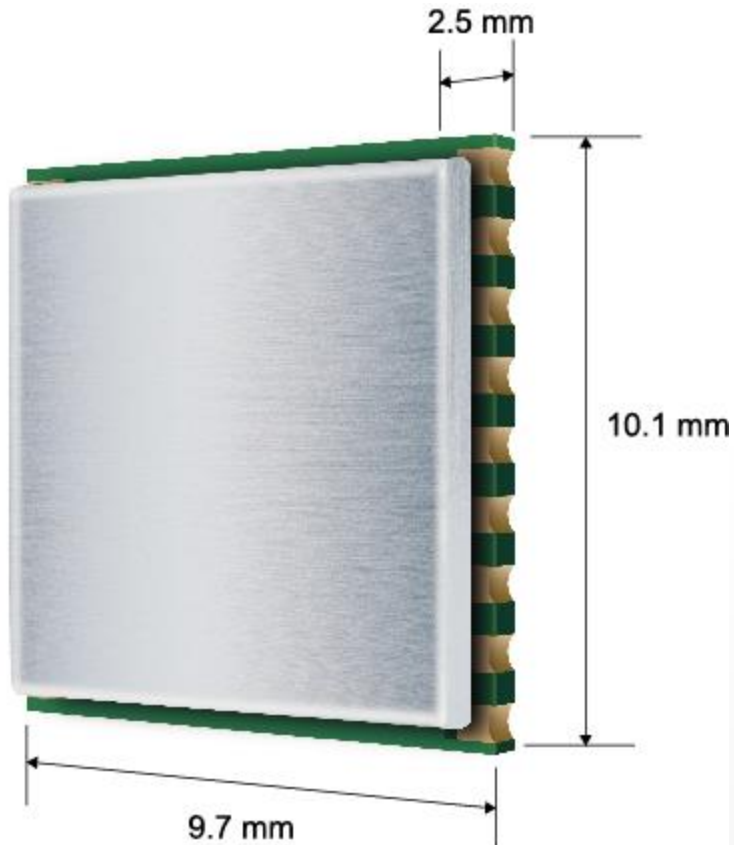
**Multi-Interface**

Support UART and I2C

**Highest Sensitivity**

Build-in LNA for better sensitivity
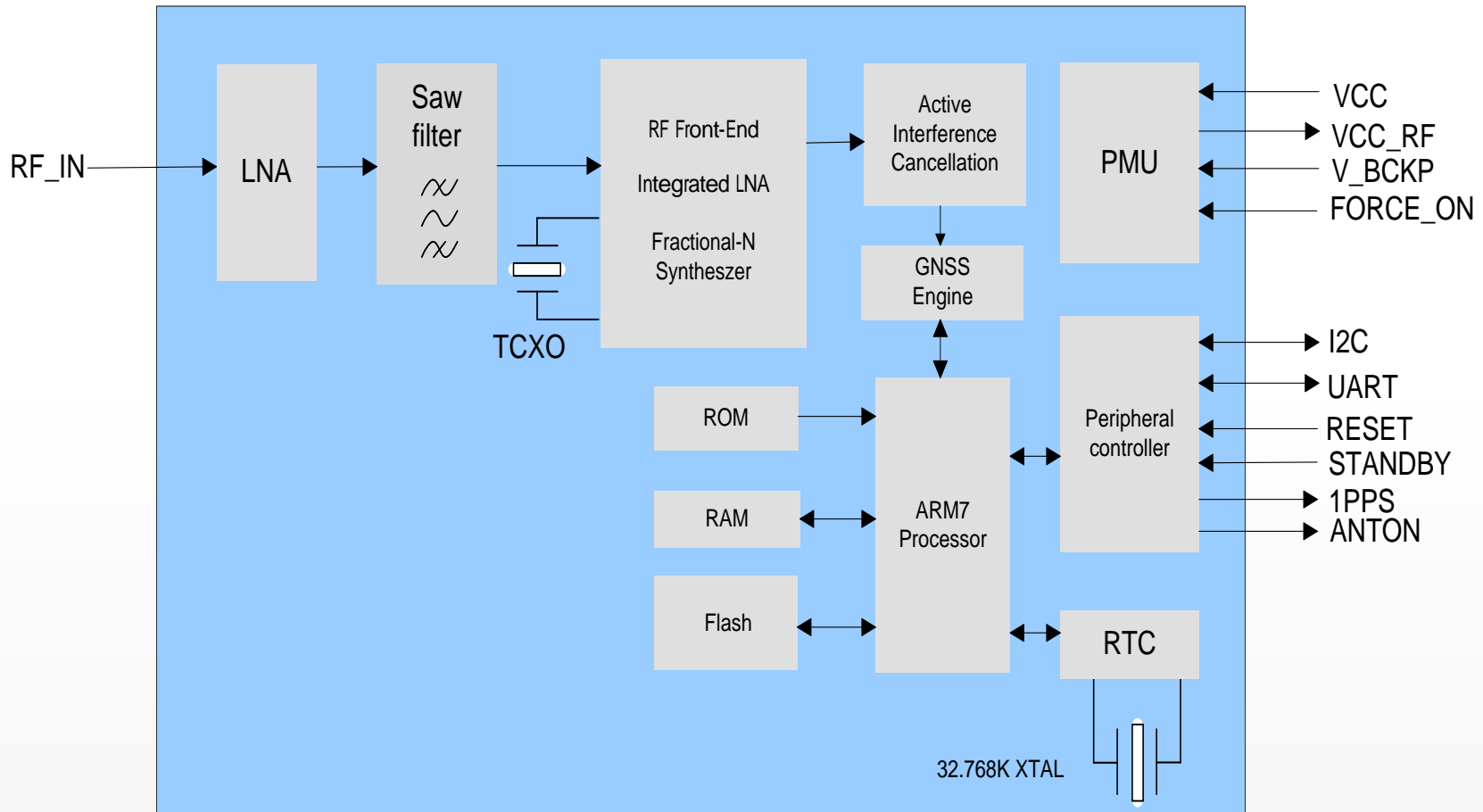-167dBm@Tracking mode
-149dBm@Acquisition mode

# Mechanical Dimensions



**Length:** 10.1 mm
**Width:** 9.7 mm
**Height:** 2.5 mm
**Weight:** 0.6 g

# Hardware  Architecture

# Firmware

➢ Protocol

- NMEA 0183 standard V3.01

- MTK  Private  Protocol: PMTK

- Quectel Private Protocol: PQ

➢ Configurable Operating Modes

- I2C: Up to 400k bps

- UART: Adjustable 4800~115200bps (default: 9600bps)

- Update rate: 1Hz (default), up to 10Hz

- Selectable output NMEA messages

- Configurable periodic standby mode

- Selectable navigation mode

# Target Applications

- ➢ Portable Devices

- ➢ Vehicle Management

- ➢ Asset Tracking

- ➢ Security System

- ➢ Connected PND

- ➢ GIS Application

- ➢ Industrial PDA

# Contents

# Receiver Performance

- Support EASY™, advanced AGPS technology without the need of external memory

- Extremely low power consumption, 22mA@Tracking

- AlwaysLocate™, an intelligent algorithm for power saving

- LOCUS, embedded logger function with no need of host and external flash

- High sensitivity, -167dBm@Tracking, -149dBm@Acquisition

- Support DGPS, QZSS, SBAS (WASS/EGNOS/MSAS/GAGAN)

- Great anti-jamming performance due to multi-tone active interference canceller

- Balloon mode, for high altitude up to 80km

- PPS VS. NMEA can be used in time service

# Specifications

| | | |
|---|---|---|
| GPS<br>L1 Band Receiver<br>(1575.42MHz)<br><br>GLONASS<br>L1 Band Receiver<br>(1601.71MHz) | Channel | 33 tracking channels<br>99 acquisition channels<br>210 PRN channels |
| | C/A code | |
| | SBAS | WAAS, EGNOS<br>MSAS, GAGAN |
| Horizontal Position Accuracy | Autonomous | <2.5m CEP |
| Velocity Accuracy | Without Aid | <0.1m/s |
| Acceleration Accuracy | Without Aid | 0.1m/s² |
| Timing Accuracy | 1PPS | 10ns |
| Reacquisition Time | | <1s |
| TTFF@-130dBm<br>with EASY™ | Cold Start | <15s |
| | Warm Start | <5s |
| | Hot Start | <1s |
| TTFF@-130dBm<br>without EASY™ | Cold Start | <35s |
| | Warm Start | <30s |
| | Hot Start | <1s |
| Sensitivity | Acquisition | -149dBm |
| | Tracking | -167dBm |
| | Re-acquisition | -161dBm |

| | | |
|---|---|---|
| Environmental Conditions | Operating Temperature | -40℃ to 85℃ |
| | Storage Temperature | -45℃ to 125℃ |
| Dynamic Performance | Maximum Altitude | Max.18000m |
| | Maximum Velocity | Max.515m/s |
| | Maximum Acceleration | 4G |
| Dimensions | 10.1 x 9.7 x 2.5mm | |
| Weight | Approx. 0.6g | |
| Serial Interface | I2C: Up to 400k bps<br>UART: Adjustable 4800~115200 bps   Default: 9600bps | |
| Update Rate | 1Hz by default, up to 10Hz | |
| I/O Voltage | 2.7V ~ 2.9V | |
| Protocols | NMEA 0183<br>PMTK | |
| Power Supply | 2.8V ~ 4.3V | |
| Power Acquisition | 29mA (GPS+GLONASS) | |
| Power Tracking | 22mA (GPS+GLONASS) | |
| Power Saving | 2.8mA@AlwaysLocate™ | |
| | 7uA@Backup Mode | |
| | 500uA@Standby Mode | |
| | Periodic Mode | |
| Antenna Type | Active or Passive | |
| Antenna Power | External or Internal VCC_RF | |

# Self-AGPS EASY Technology (1)

➤ EASY™ is the abbreviation of Embedded Assist System for quick positioning. With EASY™ technology, the GNSS engine can automatically calculate and predict orbits automatically using the ephemeris data ( 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.

➤ This function is helpful for positioning and TTFF improvement under indoor or urban conditions.
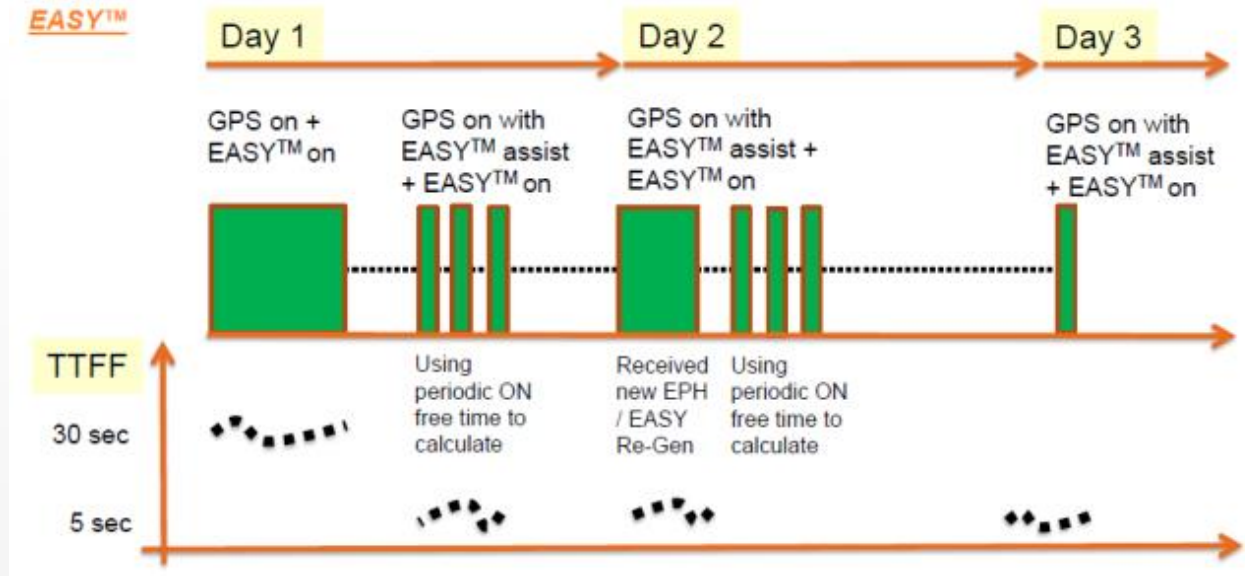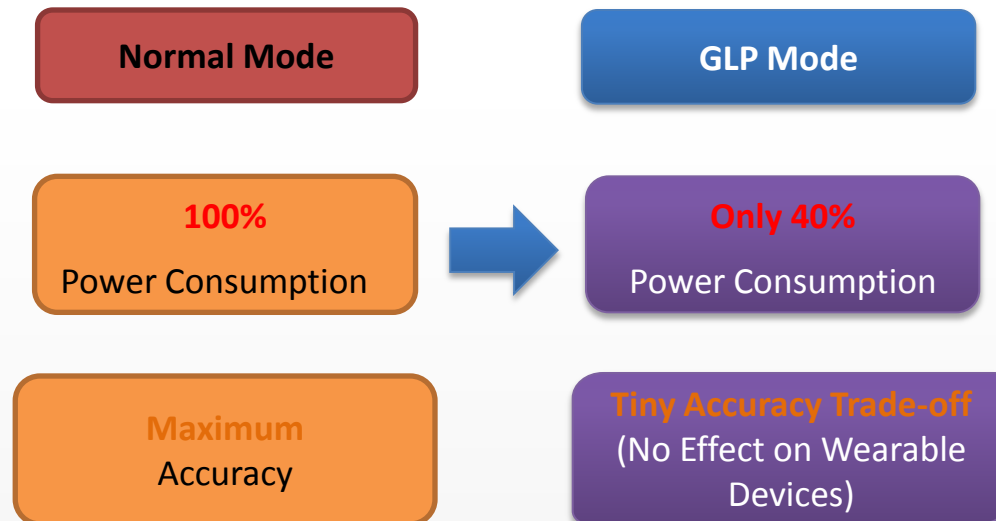
# Self-AGPS EASY Technology (2)

## ➤ TTFF Comparison

| Test Condition | | TTFF without EASY™ | TTFF with EASY™ |
|---|---|---|---|
| Under GNSS signal generator, and conductive power level of -130dBm | Cold Start | <35s | <15s |
| | Warm Start | <30s | <5 s |

With EASY™ technology, L76-L accelerates TTFF obviously.

# GNSS Low Power Mode

Low power mode is an optimized solution for wearable fitness and tracking devices. It provides GNSS low power (GLP) mode for Quectel multi-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 GNSS low power 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.

| Normal Mode | GLP Mode |
|---|---|
| **100%** Power Consumption | **Only 40%** Power Consumption |
| **Maximum** Accuracy | **Tiny Accuracy Trade-off** (No Effect on Wearable Devices) |

# EPO<sup>TM</sup> Technology

EPO™ (Extended Prediction Orbit) supplies 30-day orbit predications to speed up TTFF. Customers can download the EPO data to GNSS engine from the their own FTP server by internet or wireless network. The GNSS engine will use the EPO data to assist in position calculation when the navigation information of satellites is not enough or when the satellites are in weak signal areas.

EPO data service supports 1/3/5/7/14/30 days orbit predictions. There is no need to download EPO data from EPO server every day. Aided information like ephemeris, almanac, satellites status and an optional time synchronization signal will reduce the time to first fix significantly.

# SDK Command Function

Quectel GNSS modules offers some unique features which are developed based on SDK. That is, through SDK commands, users are enabled to realize the following functions easily:

1.  Set NEMA port baudrate  (PQBAUD command)
2.  Get estimated position errors in horizontal and vertical directions (PQEPE command)
3.  Set the type and pulse width of 1PPS's output (PQ1PPS command)
4.  Set the module into GLP Mode (PQGLP command)
5.  Enable/disable ECEFPOSVEL sentence output (PQECEF command)
6.  Start/stop odometer reading (PQODO command)
7.  Enable/disable switching from WGS84 to PZ-90.11 (PQPZ90 command)
8.  Enable/disable 3 ways velocity sentence output (PQVEL command)

# LOCUS ™ Technology

LOCUS is an embedded logger function of L76-L. When enabled by PMTK command "$PMTK185, 0*22", it allows the module to log GNSS data (Data format: UTC, Latitude, Longitude, Height) to internal flash memory (embedded in GNSS chipset) automatically without the need of host CPU (MCU) or external flash.

➢ Benefits:
1. Automatically log data to chipset internal flash, with no need to wake up HOST
2. Smart overlapping mechanism to keep the latest logger data (4KB base)
3. Logger capability in chipset internal flash:
   A. With 1 sector flash (64KB), user can log >16 hours
   B. With AlwaysLocate™, user can log up to 48hrs (2days) under standard scenario.
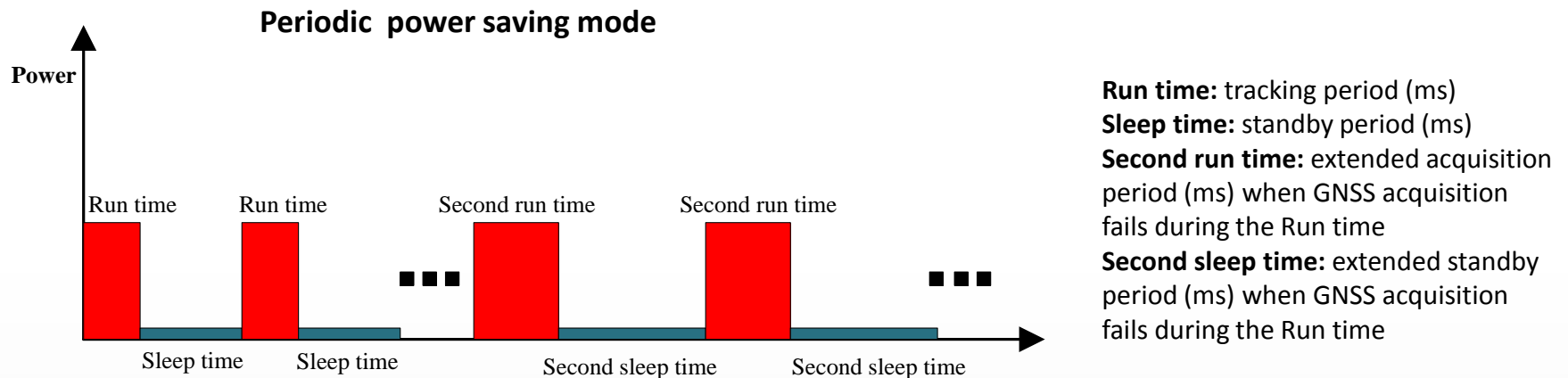
➢ Logging Mode:
1. AlwaysLocate™ Mode:
   It can be used to save internal flash space and only log once before entering sleep mode when GNSS module is in the AlwaysLocate™ mode.
2. Fix only mode: Logging GNSS data when 3D-fix only.
3. Interval mode: Logging once every 15s.

# Periodic Standby Mode

Periodic standby mode can control the power on/off time of GNSS module periodically to reduce average power consumption, and the on/off time can be configured by using PMTK command. For details, see the figure below. Periodic standby 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 period (ms)
**Sleep time:** standby period (ms)
**Second run time:** extended acquisition period (ms) when GNSS acquisition fails during the Run time
**Second sleep time:** extended standby period (ms) when GNSS acquisition fails during the Run time

**Notes:**

1. 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.
2. 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 with 3s in tracking mode and 12s sleep in standby mode. The average current is about 3.7mA.

# AlwaysLocate<sup>TM</sup> Technology

➤ AlwaysLocate™ is an intelligent controller of periodic mode.

➤ L76-L can adaptively adjust the on/off time to achieve balance between positioning accuracy and power consumption according to the environmental and motion conditions. So the average power consumption is lower in AlwaysLocate™ power saving mode than that in periodic power saving mode. Typical average power consumption is 2.8mA.
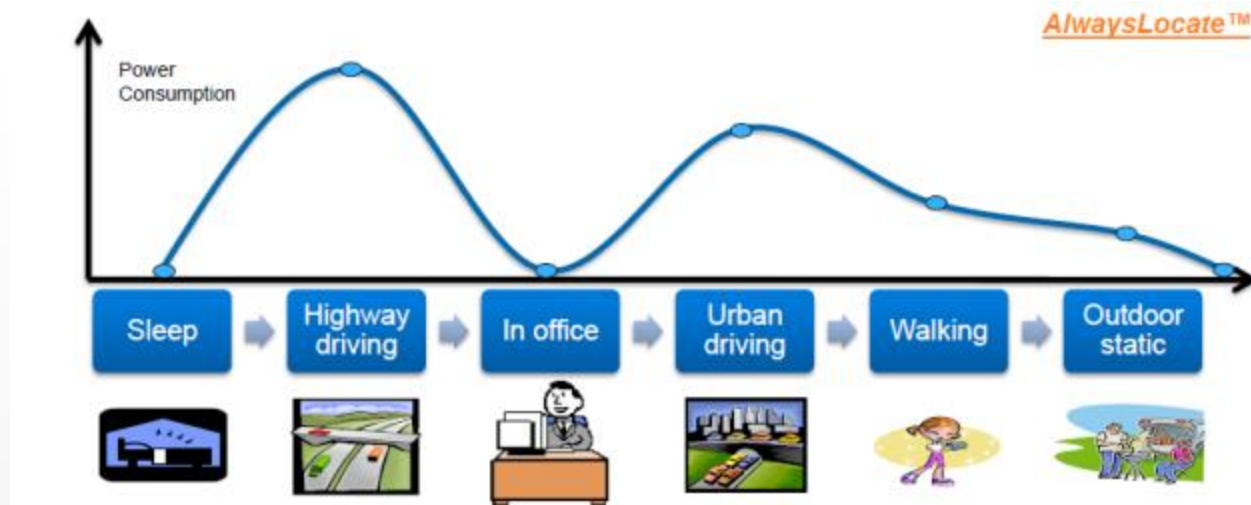
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**Highlights**

**Advanced Features**

**Quectel L76-L vs. Competitor's Product**

**Support Package**

# L76-L vs. Telit SL87X (1)

➢ **Specification Comparison**

| Product Features | | L76-L | Telit SL87X |
|---|---|---|---|
| Power supply | | 2.8V~4.3V | 2.8V~4.3V |
| Power Consumption | Acquisition mode | 29mA@3.3V | 24mA@3.3V |
| | Tracking mode | 22mA@3.3V | 22mA@3.3V |
| Sensitivity | Acquisition | -149dBm | -148dBm |
| | Tracking | -167dBm | -165dBm |
| | Re-acquisition | -161dBm | -163dBm |
| TTFF @ -130dBm | Hot start | <1s | 1s |
| | Warm start | <5s (EASY™ ) | 28s |
| | Cold start | <15s (EASY™ ) | 31s |
| Position Accuracy | | 2.5m CEP | 2.5m CEP |
| Weight | | Approx. 0.6g | Approx. 1g |

# L76-L vs. Telit SL87X (2)

➤ **Tracking Comparison**



When driving across overpass, L76-L module can still capture the accurate tracking data. But Telit's module has a small drift.

**QUECTEL** ®
Build a Smarter World

➢ **Tracking Comparison**



When driving under the overpass and making a turn, L76-L module shows its excellent performance. But Telit's module has a bigger drift.

# Contents

Evaluation Board
- ➢ Interfaces
  - • Serial port
  - • Antenna interface
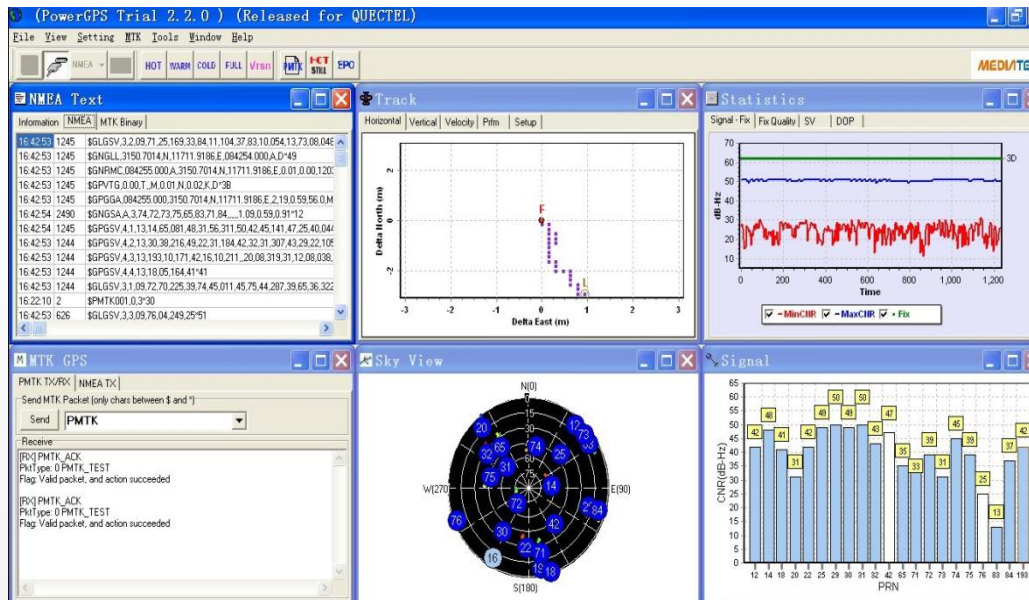  - • Micro-USB interface

- ➢ Accessories
  - • Micro-USB cable
  - • Antenna

# Support Package (2)

- ➢ Documents
  - Hardware Design
  - Protocol Specification
  - Part&Decal in PADS and Protel Format
  - Evaluation Board User Guide
  - Circuit Reference Design

- ➢ PC tool
  - PowerGPS - GPS/GLONASS testing tool

**Thank you**