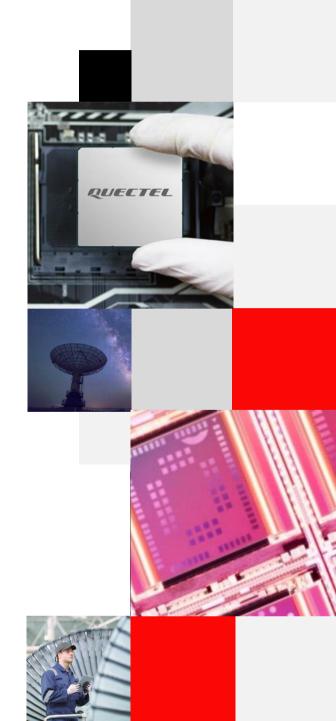




# **Duty of Confidentiality**

The Receiving Party shall keep confidential all documentation and information provided by Quectel, except when the specific permission has been granted by Quectel. The Receiving Party shall not access or use Quectel's documentation and information for any purpose except as expressly provided herein. Furthermore, the Receiving Party shall not disclose any of the Quectel's documentation and information to any third party without the prior written consent by Quectel. For any noncompliance to the above requirements, unauthorized use, or other illegal or malicious use of the documentation and information, Quectel will reserve the right to take legal action.







# **Product Overview**

**Technical Details** 

**Target Applications** 

QUECTEL

### Overview

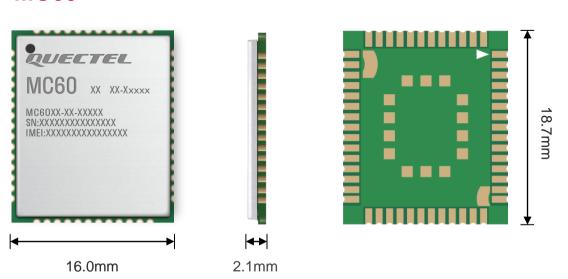


Quectel MCx0 is a series of GSM/GPRS+GNSS+Wi-Fi&Bluetooth combo module with high integration level and compact size.

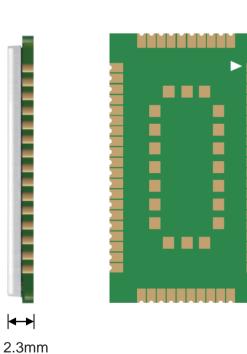
- MC60 supports GSM/GPRS+GNSS+Bluetooth
- MC90 supports GSM/GPRS+GNSS+Wi-Fi

With the mature hardware and software architectures, it is very easy to use these modules for most kinds of applications like tracker, sharing bike, black box, UBI, VTS device, etc.

### **MC60**



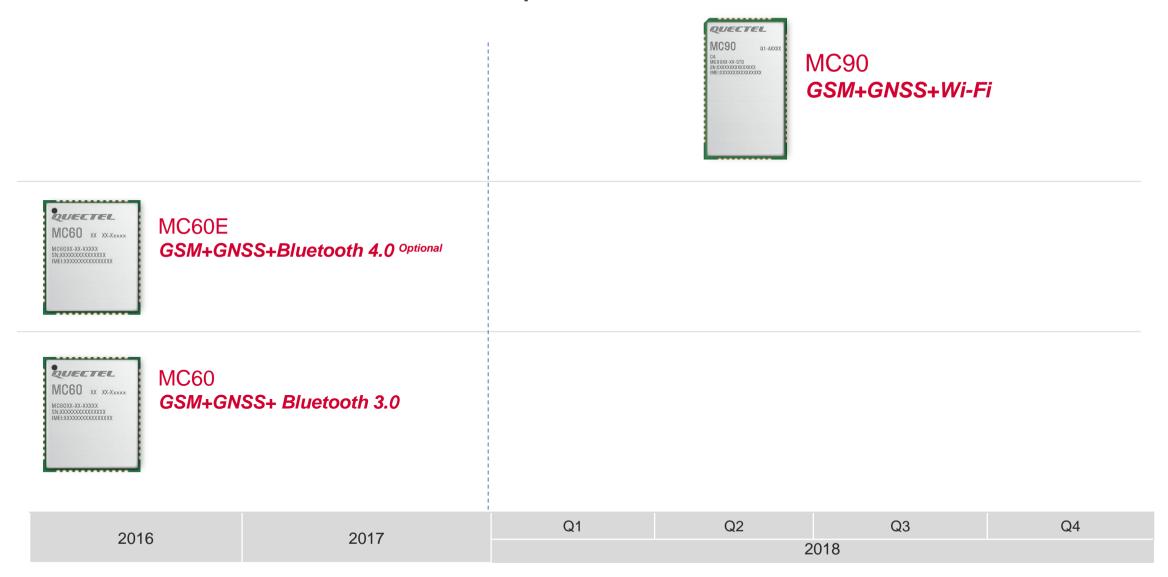




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# GSM Combo Modules Roadmap





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# MC60/MC90 Difference Table



Product		MC60	MC90	
Dimension		18.7 mm $ imes$ 16.0 mm $ imes$ 2.1 mm	25.6 mm × 15.0 mm × 2.3 mm	
GSM		850/ 900/ 1800/ 1900 MHz	850/ 900/ 1800/ 1900 MHz	
GNSS		GPS/ GLONASS/ Galileo/ QZSS	GPS/ GLONASS/ Galileo/ QZSS	
Bluetooth 3.0  Bluetooth 4.0		Υ	N	
		Optional	N	
Wi-Fi		N	Y	
QuecOpen®		Υ	Υ	
USB Interface		N	Υ	
GNSS SDK		Υ	Υ	
AGPS		Υ	Υ	

"Y" means supported.
"N" means not supported.

# MC60/MC90 Features



### ■ GSM/GPRS+GNSS+Wi-Fi&Bluetooth Combo Module

Product	MC60	MC90
CPU	ARM7EJ-STM 32-bit RISC processor	ARM7EJ-STM 32-bit RISC processor
Memory	32Mb PSRAM + 32Mb ROM (Built-in)	32Mb PSRAM + 32Mb ROM (Built-in)
WLAN	-	2.4 GHz, IEEE 802.11 b/g/n
Bluetooth	Bluetooth 3.0 Bluetooth 4.0 (Optional)	-
GNSS	GPS+GLONASS+Galileo+QZSS	GPS+GLONASS+Galileo+QZSS
os	Nucleus	Nucleus
Modem	3GPP Release 99/4	3GPP Release 99/4
QuecOpen®	Supported	Supported
Certification	Regulatory: GCF/ CE/ UCRF/ FCC/ Anatel/ FAC/ ICASA Others: AITC	Regulatory: CE*

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# MC60 Specifications



Multi-constellation GNSS	GPS+GLONASS+Galileo <sup>⊕</sup>		
Channel Number	33 tracking channels 99 acquisition channels 210 PRN channels		
SBAS	WAAS, EGNOS,	WAAS, EGNOS, MSAS, GAGAN	
Horizontal Position Accuracy	Autonomous	<2.5 m CEP	
Velocity Accuracy	Without Aid	<0.1 m/s	
Acceleration Accuracy	Without Aid	0.1 m/s <sup>2</sup>	
Timing Accuracy	1PPS	10 ns	
TTFF @-130dBm with QuecFastFix Online	Cold Start	<4.5 s	
TTEE @ 400 ID	Cold Start	<15 s	
TTFF @-130dBm with EASY™	Warm Start	<5 s	
	Hot Start	<1 s	
TTEE @ 420 dD:	Cold Start	<35 s	
TTFF @-130dBm without EASY™	Warm Start	<30 s	
	Hot Start	<1 s	
	Acquisition	-149 dBm	
Sensitivity	Tracking	-167 dBm	
	Re-acquisition	-161 dBm	

Quad-band	850/ 900/ 1800/ 1900MHz	
GPRS Multi-slot Class	Class 12	
GPRS Mobile Station	Class B	
Compliant to GSM Phase 2/2+	Class 4 (2W @ 850/900 MHz) Class 1 (1W @ 1800/1900 MHz)	
Supply Voltage Range	3.3-4.6 V, 4.0 V Typ.	
Low Power Consumption	1.2 mA @ DRX=5	
Bluetooth 4.0 Current Consumption (Modem Off)	1.26 mA @ Advertising 1.35 mA @ Connection	
OperatingTemperature	-40 °C to +85 °C	
Dimensions	18.7 mm × 16.0 mm × 2.1 mm	
Weight	Approx. 1.3 g	
Control via AT Commands	GSM 07.07, 07.05 and other enhanced AT commands	
Speech Codec Modes	Half Rate (HR) Enhanced Full Rate (EFR) Full Rate (FR) Adaptive Multi-Rate (AMR)	
Echo Arithmetic	Echo Cancellation Echo Suppression Noise Reduction	
Bluetooth	Bluetooth 3.0 Bluetooth 4.0 Optional GATT/ PXP*/ FMP*/ SPP/ HFP-AG	
(U)SIM	3.0 V/1.8 V	
UART	×4	

① Galileo is disabled by default. It can be enabled by PMTK command.

<sup>&</sup>quot;\*" means under development. Version: 2.5 | Status: Released

# MC90 Specifications



Multi-constellation GNSS	GPS+GLONASS+Galileo <sup>①</sup>		
Channel Number	33 tracking channels 99 acquisition channels 210 PRN channels		
SBAS	WAAS, EGNOS,	WAAS, EGNOS, MSAS, GAGAN	
Horizontal Position Accuracy	Autonomous	<2.5 m CEP	
Velocity Accuracy	Without Aid	<0.1 m/s	
Acceleration Accuracy	Without Aid	0.1 m/s <sup>2</sup>	
Timing Accuracy	1PPS	10 ns	
TTFF @-130dBm with QuecFastFix Online	Cold Start	<4.5 s	
	Cold Start	<15 s	
TTFF @-130dBm with EASY™	Warm Start	<5 s	
	Hot Start	<1 s	
TTEE @ 400 ID	Cold Start	<35 s	
TTFF @-130dBm without EASY™	Warm Start	<30 s	
	Hot Start	<1 s	
	Acquisition	-149 dBm	
Sensitivity	Tracking	-167 dBm	
	Re-acquisition	-161 dBm	

Quad-band	850/ 900/ 1800/ 1900MHz	
GPRS Multi-slot Class	Class 12	
GPRS Mobile Station	Class B	
Compliant to GSM Phase 2/2+	Class 4 (2W @ 850/900 MHz) Class 1 (1W @ 1800/1900 MHz)	
Supply Voltage Range	3.3–4.3 V, 4.0 V Typ.	
Low Power Consumption	1.2 mA @ DRX=5	
Wi-Fi Current Consumption (Wi-Fi part only)	0.4 mA	
Operation Temperature	-40 °C to +85 °C	
Dimensions	25.6 mm $ imes$ 15.0 mm $ imes$ 2.3 mm	
Weight	Approx. 1.4 g	
Control via AT Commands	GSM 07.07, 07.05 and other enhanced AT commands	
Speech Codec Modes	Half Rate (HR) Enhanced Full Rate (EFR) Full Rate (FR) Adaptive Multi-Rate (AMR)	
Echo Arithmetic	Echo Cancellation Echo Suppression Noise Reduction	
WLAN Protocol	2.4 GHz, IEEE 802.11 b/g/n	
(U)SIM	3.0 V/1.8 V	
UART	×4	

Galileo is disabled by default. It can be enabled by PMTK command. Version: 2.5 | Status: Released



**Product Overview** 

# **Technical Details**

**Target Applications** 

QUECTEL

### **Advanced Features**



### **Positioning Features**

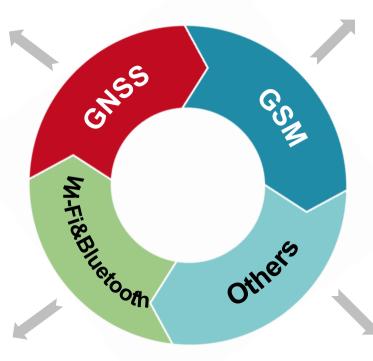
- GPS+GLONASS+Galileo <sup>①</sup>
- QuecFastFix Online
- Wi-Fi/Cell ID Positioning<sup>②</sup>
- EASY<sup>TM</sup>
- LOCUS<sup>TM</sup>
- GLP
- DGPS
- AlwaysLocate<sup>TM</sup>
- Built-in LNA
- EPO<sup>TM</sup>
- SDK
- 1PPS

### **Bluetooth**

- Bluetooth 4.0 Optional: GATT/ PXP\*/ FMP\* profiles
- Bluetooth 3.0: SPP/ HFP-AG profiles

#### Wi-Fi

- IEEE802.11 b/g/n
- Support hotspot scanning only



#### **GSM/GPRS** Features

- Quad-band: 850/900/1800/1900MHz
- GPRS Multi-slot Class: Class 12
- AT Commands: GSM 07.07, 07.05 and enhanced AT commands
- TCP/ UDP/ HTTP/ PPP/ SSL/ MQTT/ FTP
- Jamming Detection
- Audio
- QuecFOTA
- Dual (U)SIM Single Standby
- QuecOpen®
- eCall

#### **Others**

- Extended temperature range: -40 °C to +85 °C
- Support 3.0 V/1.8 V (U)SIM cards
- Highly compact size

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① Galileo is disabled by default. It can be enabled by PMTK command. ② Wi-Fi/Cell ID positioning is supported on MC90 only.

<sup>&</sup>quot;\*" means under development.

# **Enhanced AT Commands**



- Standard V.25ter AT commands
- GSM 07.07
- GSM 07.05 (SMS)
- GPRS AT commands in accordance with GSM 07.07
- TCP/ IP stack AT commands
- STK (SIM Application Toolkit)
- Quectel defined AT commands (Enhanced Functions)



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### PQ Commands Based on SDK



MC60&MC90's GNSS part supports PQ commands which are developed based on SDK. The commands and corresponding functions are:

PQ Command	Description	
PQEPE	Get estimated position error in horizontal and vertical directions	
PQGLP	Set the module into GLP (GNSS Low Power) mode	
PQJAM	Jamming detection	
PQODO	Start/stop odometer reading	
PQPZ90	Enable/disable switching from WGS84 to PZ-90.11	
PQVEL	Get velocity component values of 3 directions	
PQ1PPS	Set the type and pulse width of 1PPS's output	
PQECEF	Enable/disable ECEFPOSVEL sentence output	
PQGEO	Set Geo-fence type and parameters	
PQRLM	Get return link message information	
PQGBS	Get RAIM information	



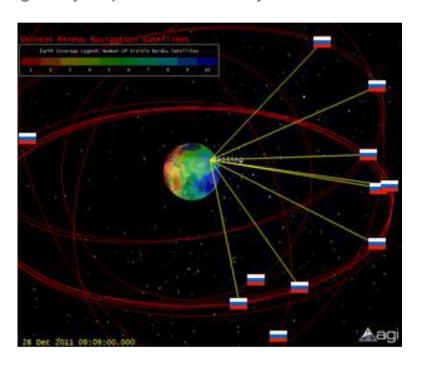
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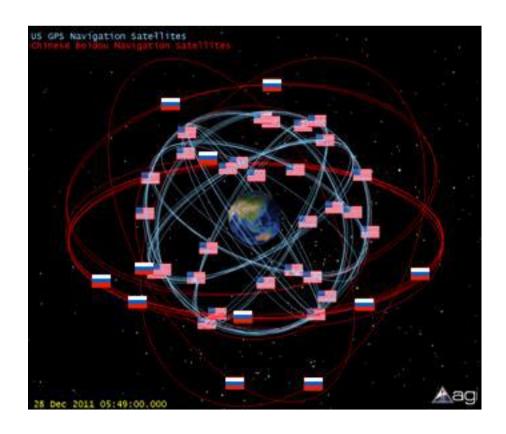
# Positioning - Multi-Constellation GNSS



### MC60&MC90 support GPS+GLONASS+Galileo

- GPS: approx. 12 SV
- GPS+GLONASS+Galileo: approx. 22 SV
   More satellites are available for position calculation, which greatly improves accuracy.





The three-constellation system is especially suitable for urban areas with high-rise buildings and complex environments.

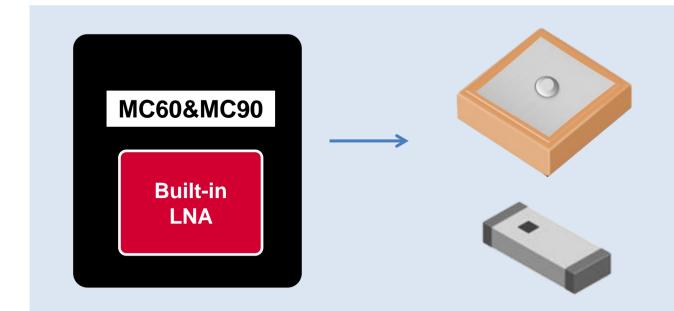
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# Positioning - Built-in LNA





- Expensive active antenna
- Increased external circuits



- Low-cost ceramic/ chip antenna
- No need of external circuits

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# Positioning - EPO (1)



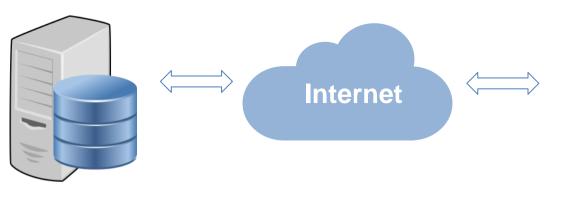
### **EPO Function**

It is a kind of offline AGPS technology which provides predicted Extended Prediction Orbit to speed up TTFF (Time to First Fix).

### **Key Benefits**

- No need of extra server.
- EPO data downloading through GPRS network and uploading to GNSS engine automatically.
- Small data size ensures short download time.

#### **MTK EPO Server**





GSM/GPRS

MC60&MC90
Terminal



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# Positioning - EPO (2)





### **TTFF Comparison**

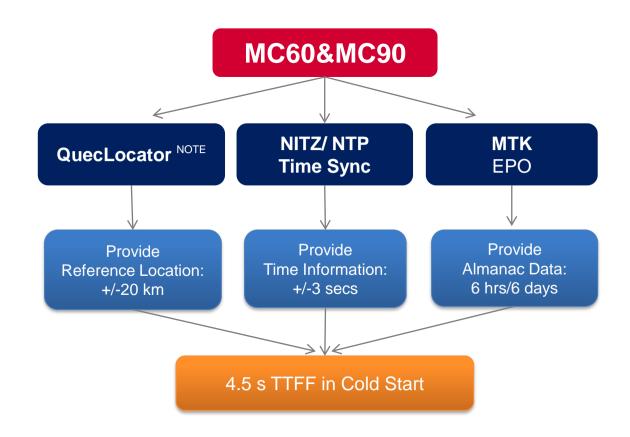
Test Condition		TTFF without EPO™	TTFF with EPO™
Under actual network conditions	Cold Start	< 35 s	< 15 s
(open sky)	Warm Start	< 30 s	< 5 s

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# Positioning - QuecFastFix Online



QuecFastFix Online is an online AGPS technology which integrates EPO data, NITZ/NTP time sync, and QuecLocator to achieve 4.5 seconds cold start TTFF in open sky.



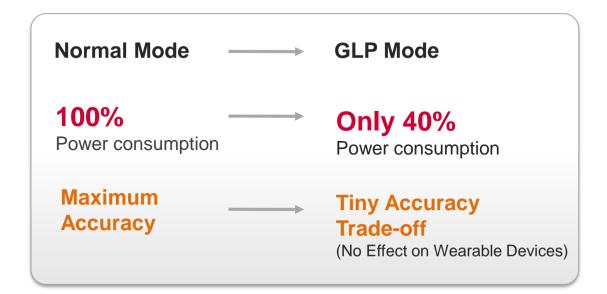
NOTE: For details about QuecLocator service, please contact Quectel Sales Representatives or Technical Supports.

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# Positioning - GLP



- In acquisition or tracking condition, GLP (GNSS Low Power) is the best power-saving mode.
- In GLP mode, MC60&MC90 modules still output NMEA data at 1 Hz data update rate.
- The module will automatically exit GLP mode when positioning conditions are not satisfied.



### **Average Current Consumption in GLP and Normal Modes**

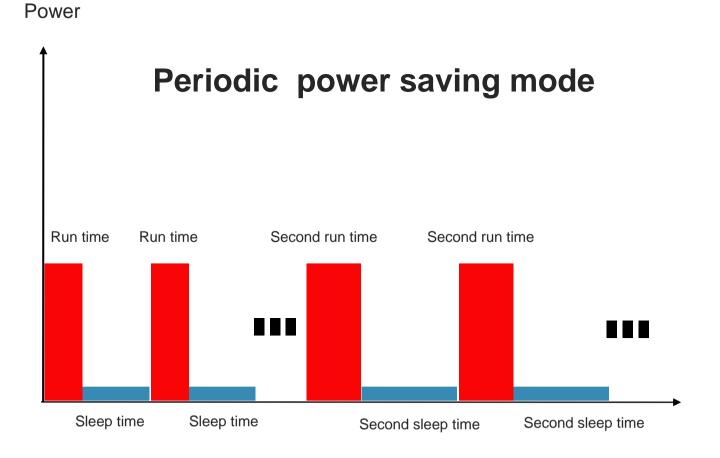
Scenario	In GLP Mode (mA)	In Normal Mode (mA)	
Static 8.9		22	
Walking 11.2		22	
Running 11.5		22	
Driving 21.5		22	

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# Positioning - Periodic Mode



- Periodic mode can control the Full-on Mode period and Standby/Backup Mode period of MC60&MC90's GNSS part periodically to reduce average power consumption.
- The time period can be configured by using PMTK command. For details, please see the figure on the right.



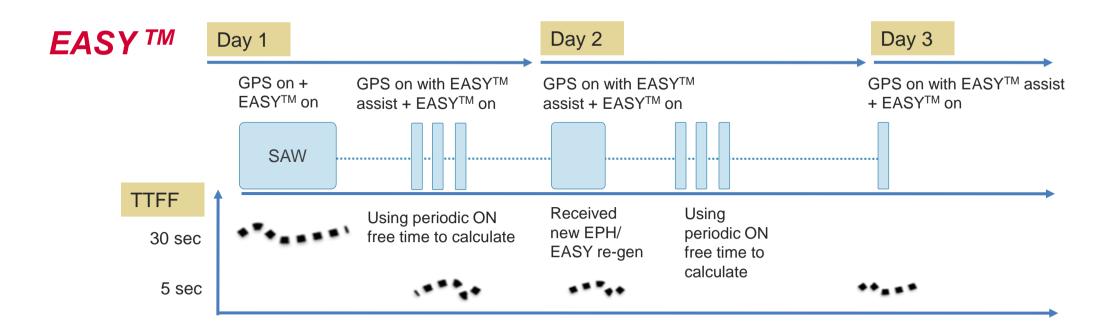
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# Positioning - EASY™ Technology (1)



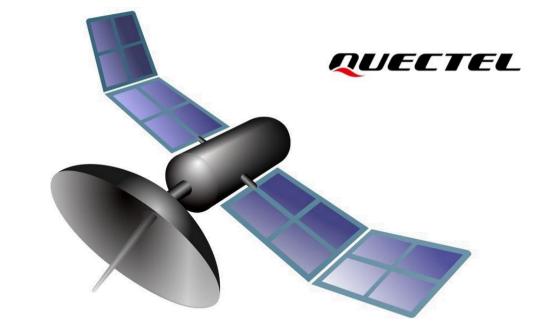
EASY™ is the abbreviation of Embedded Assist System for quick positioning. With EASY™ technology, MC60&MC90's GNSS engine can automatically calculate and predict orbits automatically using the ephemeris data (up to 3 days) when the power is on, and then save the predict information into the memory.

Therefore, the GNSS engine can use the information for positioning later if there is no enough information received from the satellites.



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# Positioning - EASY™ Technology (2)



### **TTFF Comparison**

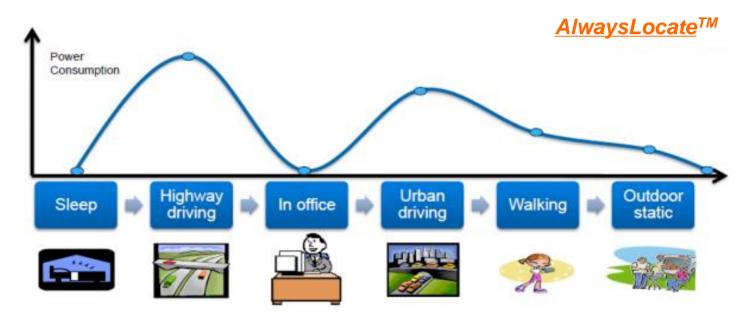
Test Condition		TTFF without EASY™	TTFF with EASY™
Under actual network conditions (open sky)	Cold Start	< 35 s	< 15 s
	Warm Start	< 30 s	< 5 s

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# Positioning - AlwaysLocate™ Technology



AlwaysLocate<sup>™</sup> is an intelligent controller of periodic mode.



MC60&MC90's GNSS part 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. The average power consumption is 2.8mA.

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# Positioning - LOCUS™ Technology

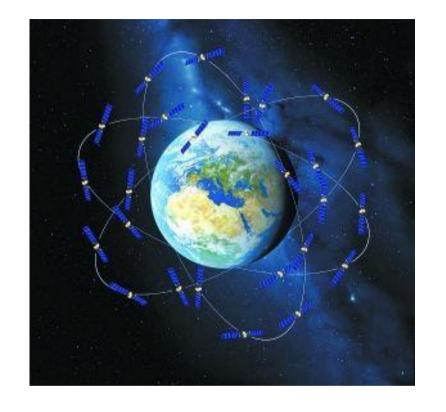


**LOCUS™** is an embedded logger function of MC60&MC90's GNSS part. Once enabled by PMTK command, it allows the module to log GNSS data (data format: UTC, Latitude, Longitude, Height) to internal flash memory automatically without the need of host CPU (MCU) or external flash.

#### **Benefits:**

- Automatically log data to chipset internal flash, without the need to wake up the HOST
- Smart overlapping mechanism to keep the latest logger data (4 KB base)
- Logger capability in chipset internal flash:

With 1 sector flash (64 KB), users can log >16 hours. With AlwaysLocate<sup>™</sup>, users can log up to 48 hrs (2 days) under standard scenario.

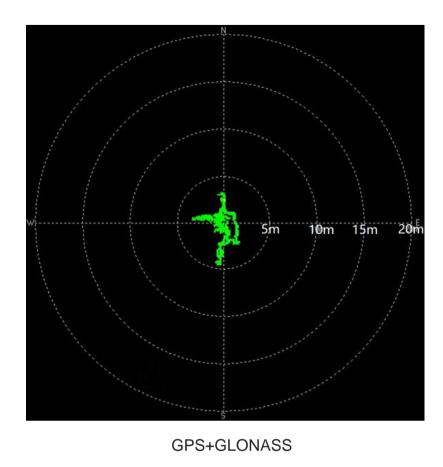


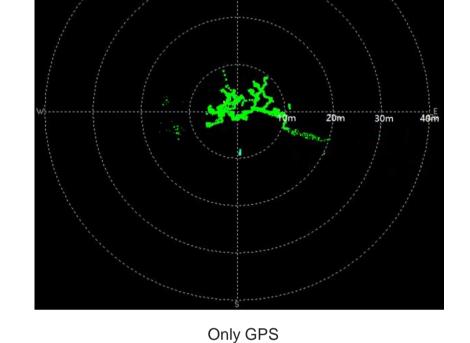
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# Positioning - Static Filed Test



The following is a 12-hour testing result in static field.





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# Positioning - Estimated Position Error



### Estimated Position Error:

Large error values can be filtered via **PQEPE** function.

### Static Speed Threshold:

Threshold setting can effectively suppress static drift.



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# **GNSS** Positioning - Dynamic Field Testing

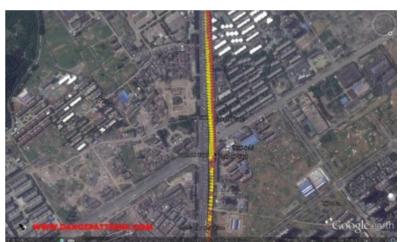














**U-shaped Turning** 

**Under Viaduct** 

**Common Turning** 



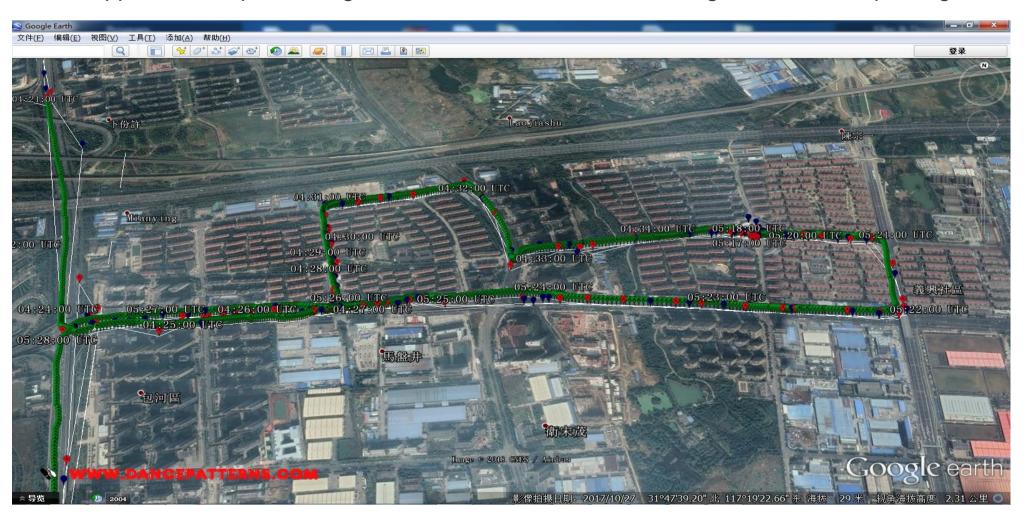


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# Wi-Fi Positioning - Dynamic Field Testing



MC90 supports Wi-Fi positioning in urban areas where the coverage of Wi-Fi hotspot is good.



GNSS Positioning



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## Bluetooth Function - Bluetooth 4.0 NOTE



Bluetooth low energy (BLE) wireless technology is a hallmark feature of the Bluetooth Core Specification Version 4.0 (Bluetooth v4.0).

BLE enables the Bluetooth wireless connection in low-cost, low-power devices, and thus extends the applicability of the technology to a wide range of extended applications, such as watch, anti-theft key ring, sports and fitness sensor, health care sensor and remote control.

### **Key Features of BLE**

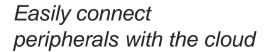
- Ultra-low peak, average and idle mode power consumption
- Easy to develop and use
- Low cost
- Multi-vendor interoperability



NOTE: Bluetooth function is supported on MC60 only and Bluetooth 4.0 is optional for MC60.

### Bluetooth Function - Bluetooth 4.0 Profiles







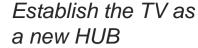
Beyond hands free







Enable a new set of peripherals





Enable connected health and fitness solutions

NOTE: Bluetooth function is supported on MC60 only and Bluetooth 4.0 is optional for MC60.

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### Bluetooth Function - Bluetooth 3.0 Profiles



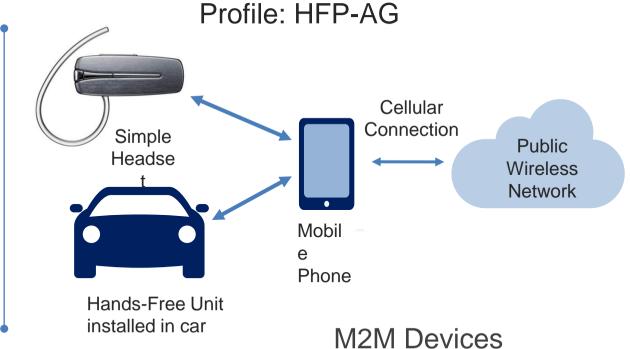






Laptop or PC

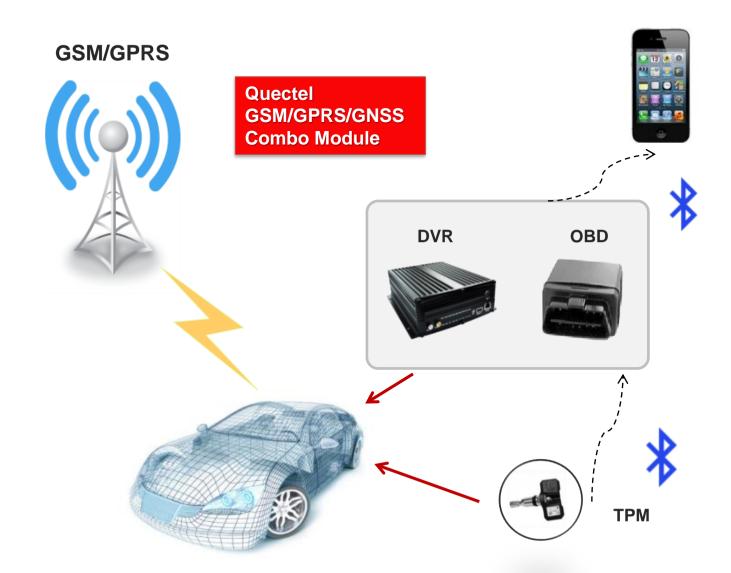
Laptop or PC



NOTE: Bluetooth function is supported on MC60 only.

# **Bluetooth Applications**





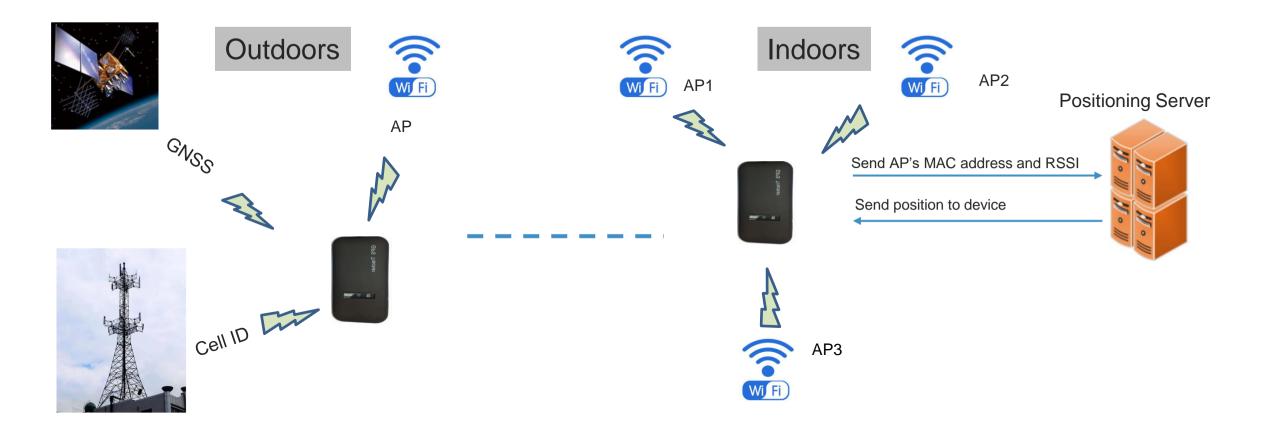


**Application on Vehicles** 

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# MC90 Hybrid Positioning





Outdoors: GNSS+Wi-Fi+Cell ID hybrid positioning, with positioning modes configurable by AT commands.

Indoors: Wi-Fi positioning

NOTE: Position Server service is provided by a third party. Please contact Quectel Technical Supports for cooperation.

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# Support Package (1)







### **GSM-EVB Kit**

- GSM FVB
- 5V DC Power Supply
- GSM Antenna
- USB Data Cable
- USB-UART Converter Cable
- RF Cable for GSM Antenna Connection
- USB Flash Drive

### MC60&MC90-TE-A Kit

- MC60-TE-A/ MC90-TE-A
- GNSS Antenna
- RF Cable for GNSS Antenna Connection
- USB Flash Drive

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# Support Package (2)

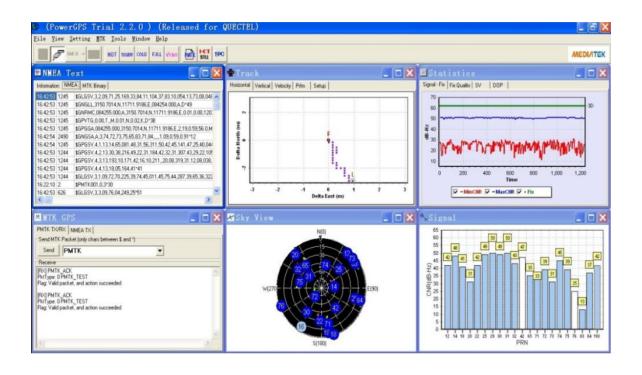


### **Documents**

- Specification
- Hardware Design
- AT Commands Manual
- Footprint&Part in PADS and Protel Formats
- GSM EVB/ TE-A User Guide
- GNSS AGPS Application Note
- GNSS Protocol Specification
- Reference Design
- BLE AT Commands
- Bluetooth AT Commands
- Wi-Fi Application Note

### PC tool

PowerGPS - GPS/GLONASS testing tool

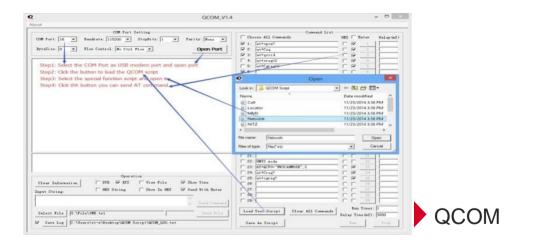


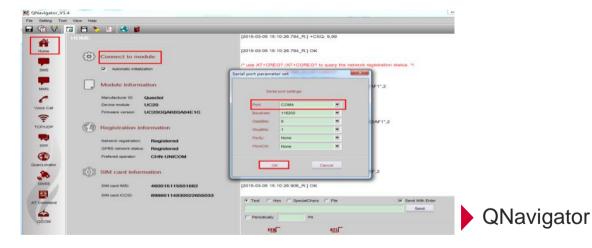
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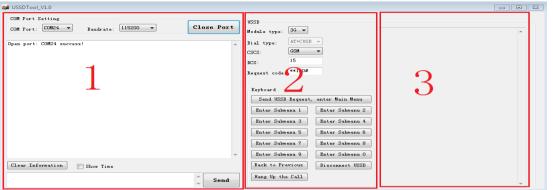
# Support Package (3)



### PC tool: QCOM/QNavigator/USSDTool - GSM Test Tool







USSDTool

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**Product Overview** 

**Technical Details** 

# **Target Applications**



**Build a Smarter World** 

# **Target Applications**



Personal Tracker



Bicycle-sharing System



Pet Tracker



Vehicle Tracker



Wearable Devices (e.g. smartwatch)



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# The number one cellular module vendor in the world and a leading GNSS module supplier

- Unbeatable choice from the broadest module portfolio in the world
- The highest quality products for the best possible prices
- Superb support with the largest R&D team in the industry
- Continuous innovation first to market with 5G, LPWA, CV2X, snapdragon
- A passionate, dedicated team of "Quectelers" ensure our customers always come first

Thankyou

Build a Smarter World

