

Quectel L80 GPS Module Presentation

2013.08.26

□ General Description

- Highlights
- Mechanical Dimensions
- Hardware Architecture
- Firmware
- Target Applications

□ Features

- Receiver Performance
- Specifications
- Self-AGPS EASY™ Technology
- Advantages of Soldering
- Automatic Antenna Switching Function
- Periodic Standby Mode
- AlwaysLocate™ Technology
- L80 vs. Ucompany MAX-6X

□ Support Package

HIGHLIGHTS

MT3339 Single Chip Solution

66 acquisition channels
22 tracking channels

Ultra Low Power Consumption

20mA@Tracking mode
25mA@Acquisition mode

AlwaysLocate™

An intelligent controller of power consumption

LOCUS

Innate logger solution with no need of host and external flash

Embedded Patch Antenna

15.0 x 15.0 x 4.0 mm
Automatic antenna switching function

EASY™

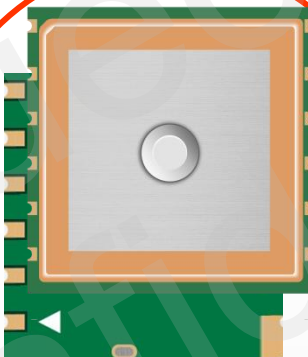
Advanced AGPS technology without external memory

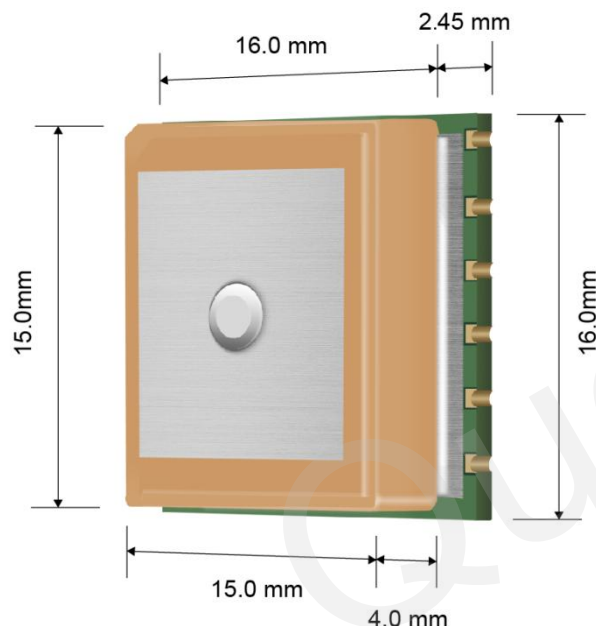
Anti-Jamming

Multi-tone Active Interference canceller

Highest Sensitivity

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





➤ L80 Module Dimensions

Length:	16.0 mm
Width:	16.0 mm
Height:	6.45 mm
Weight:	6.0 g

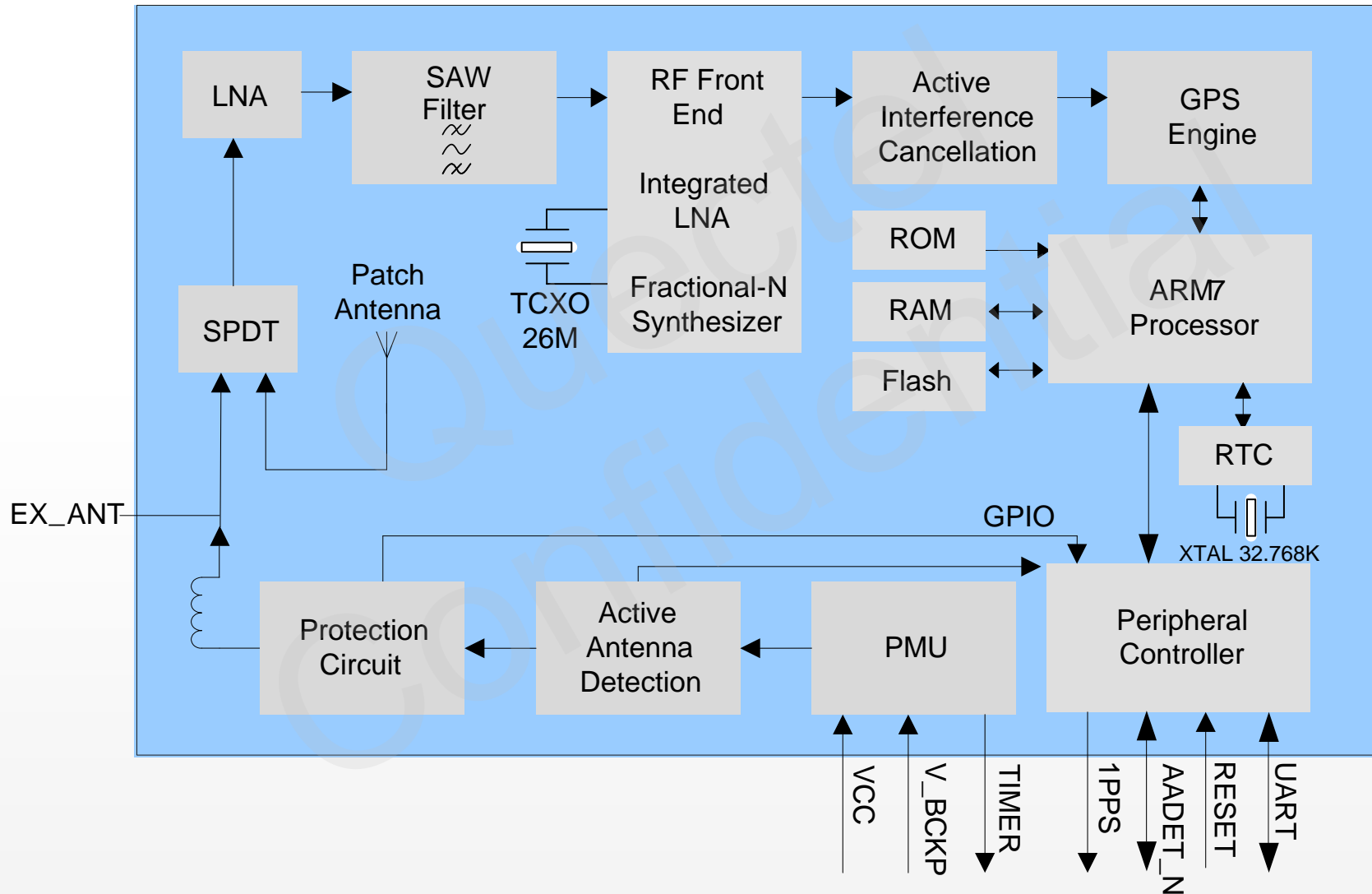
➤ Patch Antenna Dimensions

Length:	15.0 mm
Width:	15.0 mm
Thickness:	4.0 mm

Advantages of L80's mechanical dimensions:

1. The compact form factor of L80 is only 16.0mm x 16.0mm x 6.45mm and the patch antenna is on the top of L80. So it can save more space of customer's PCB.
2. With LCC package and integrated with 15 x 15 x 4mm patch antenna, L80 has the high level of performance both in acquisition and tracking. The thickness of the patch antenna is 4mm, which not only improves the accuracy of positioning, but also avoids interference from other components or external environments.

HARDWARE ARCHITECTURE



- Protocol
 - NMEA 0183 standard V3.01
 - MTK Private Protocol: PMTK
- Configurable Operating Modes
 - UART: Adjustable 4800~115200bps (default: 9600bps)
 - Update rate: 1Hz (default), up to 10Hz
 - Selectable output NMEA messages
 - Configurable Periodic Standby Mode

TARGET APPLICATIONS

- Portable Devices
- Vehicle Management
- Asset Tracking
- Security System
- Connected PND
- GIS Application
- Industrial PDA



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- L80 vs. Ucompany MAX-6X

□ Support Package

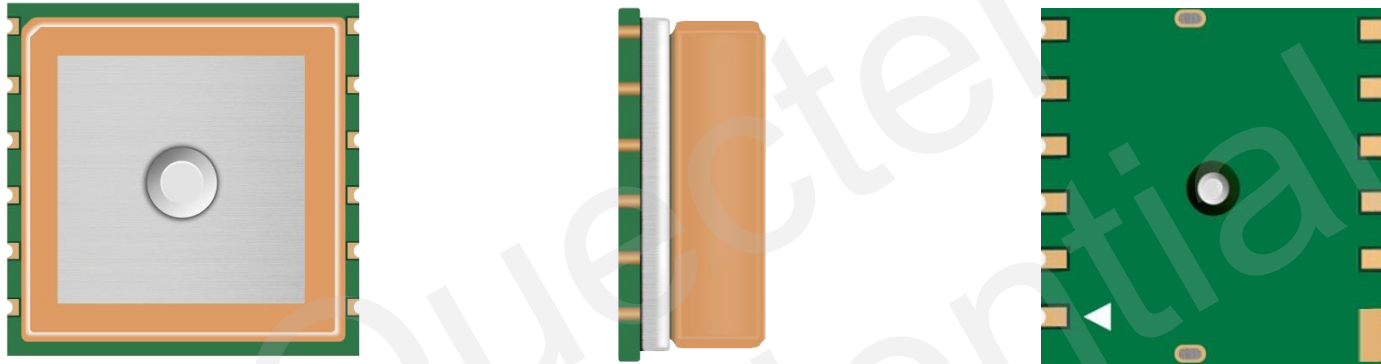
RECEIVER PERFORMANCE

- EASY™, advanced AGPS technology without the need of external memory
- Embedded patch antenna: 15.0 x 15.0 x 4.0mm
- Automatic antenna switching function
- Support short circuit protection and antenna detection
- Built-in LNA for better sensitivity
- Extremely low power consumption, 20mA@tracking mode
- AlwaysLocate™, an intelligent controller of periodic mode
- LOCUS, innate logger solution with no need of host and external flash
- High sensitivity, -165dBm@Tracking, -148dBm@Acquisition
- 66 acquisition channels, 22 tracking channels
- Support DGPS, QZSS, SBAS(WASS/EGNOS/MSAS/GAGAN)
- Anti-Jamming, Multi-tone Active Interference Canceller

SPECIFICATIONS

L1 Band Receiver (1575.42MHz)	Channel	22 (tracking) / 66 (acquisition)	Environmental	Operating Temperature	-40°C to 85°C
	C/A code			Storage Temperature	-45°C to 125°C
	SBA	WAAS, EGNOS MSAS,GAGAN	Dynamic Performance	Maximum Altitude	Max.18000m
		Maximum Velocity		Max.515m/s	
Horizontal Position Accuracy	Autonomous	<2.5m CEP		Maximum Acceleration	4G
Velocity Accuracy	Without aid	<0.1m/s	Dimensions	16.0 x 16.0 x 6.45mm	
Acceleration Accuracy	Without aid	0.1m/s ²	Weight	Approx. 6.0g	
Timing Accuracy	1PPS	10ns	Serial Interface	UART: Adjustable 4800~115200 bps Default: 9600bps	
Reacquisition Time		<1s	Update Rate	1Hz by default, up to10Hz	
TTFF@-130dBm with EASY™	Cold Start	<15s	I/O Voltage	2.7V ~ 2.9V	
	Warm Start	<5s	Protocols	NMEA 0183 PMTK	
	Hot Start	<1s	Power Supply	3.0V ~ 4.3V	
TTFF@-130dBm without EASY™	Cold Start	<35s	Power Acquisition	25mA	
	Warm Start	<30s	Power Tracking	20mA	
	Hot Start	<1s	Power Saving	3mA@AlwaysLocate™	
		7uA@Backup Mode			
Sensitivity	Acquisition	-148dBm		1mA@Standby Mode	
	Tracking	-165dBm		Periodic Mode	
	Re-acquisition	-160dBm			

ADVANTAGES OF SOLDERING(1)



- L80 is a GPS POT (Patch on Top) module. Its patch antenna's feed point is embedded in the PCB. So the feed point is concave, rather than convex. There is no need to hollow out the feed point.
- L80 has 12 pins, which are very practical and easy for SMD soldering. Meanwhile, the pins are easily soldered by manual because of its large size (length=1.5mm; width=1.0mm).

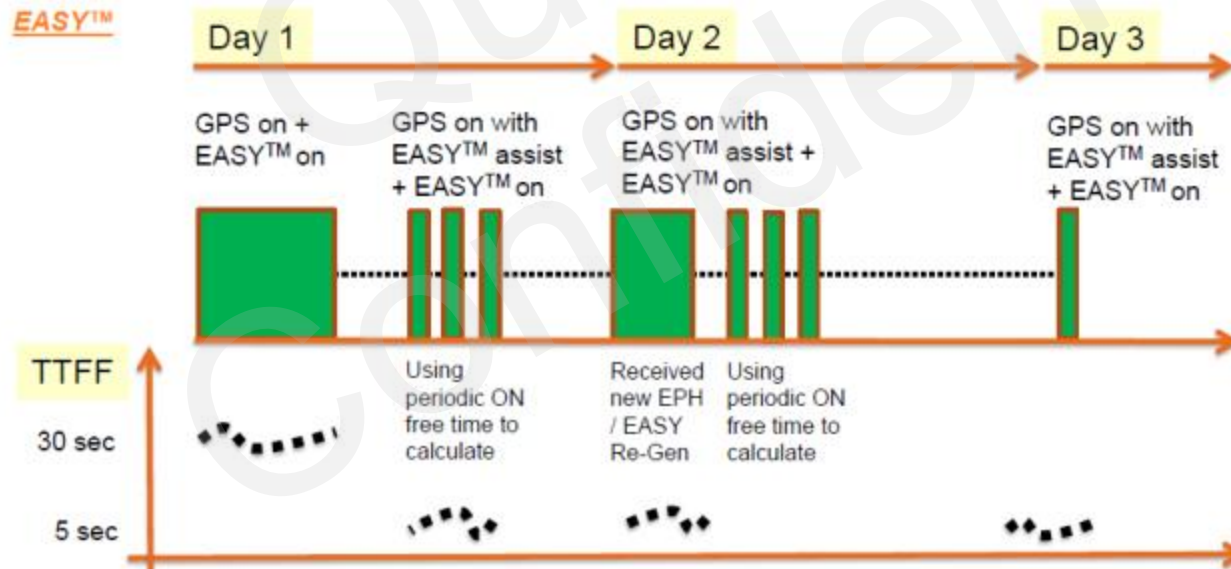
ADVANTAGES OF SOLDERING(2)



- L80 can be easily soldered into all kinds of evaluation boards through five cables (RXD,TXD,VCC,GND and V_BCKP), which is convenient for different customers to evaluate the module's performance on their own boards.
- Base on simple design and tiny size, L80 module is suitable for special applications, such as GPS mouse, OBD, and etc.

SELF-AGPS EASY TECHNOLOGY(1)

- EASY™ is the abbreviation for Embedded Assist System for quick positioning. With EASY™ technology, the GPS 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 GPS engine can use the information for positioning later if there are not enough information received from the satellites.
- This function will be 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 GPS signal Generator, conductive power level -130dBm	Cold Start	<35s	<15s
	Warm Start	<30s	<5 s

L80 patch antenna with EASY				L80 patch antenna without EASY				MAX-6X			
CNO 39dB				CNO 39dB				CNO 39dB			
	cold start	warm start	hot start		cold start	warm start	hot start		cold start	warm start	hot start
1	13.8	2.2	0.5	1	36.5	31.1	0.7	1	34.988	23.13	1.127
2	16.2	3.5	0.4	2	38.4	33	0.7	2	34.474	21.31	0.851
3	17.3	2.5	0.7	3	31.5	26.1	0.8	3	27.4	21.884	0.901
4	12	4.9	0.9	4	35.9	27	0.7	4	34.753	32.69	0.569
5	13.2	4.2	0.4	5	26.5	33.8	0.7	5	20.142	34.411	0.868
6	15.5	3.3	0.4	6	24.7	29.1	0.8	6	19.133	35.35	0.734
7	20.7	3.3	0.4	7	23	32	0.9	7	30.871	26.632	0.789
8	12.1	4	0.3	8	24.6	27	0.8	8	31.632	34.011	0.606
9	14.5	2.6	0.7	9	26.1	25.3	0.7	9	32.827	30.499	0.817
10	13.1	2.5	0.9	10	26.8	20.1	0.8	10	36.922	25.112	0.562
min	12	2.2	0.3	min	23	20.1	7	min	19.133	21.31	0.562
max	20.7	4.9	0.9	max	38.4	33.8	0.9	max	36.922	35.35	1.127
mean	14.84	3.3	0.56	mean	29.4	28.45	0.76	mean	30.3142	28.5029	0.7824

With EASY™ technology, L80 accelerates TTFF obviously.

Automatic Antenna Switching Function(1)

➤ Patch Antenna Status



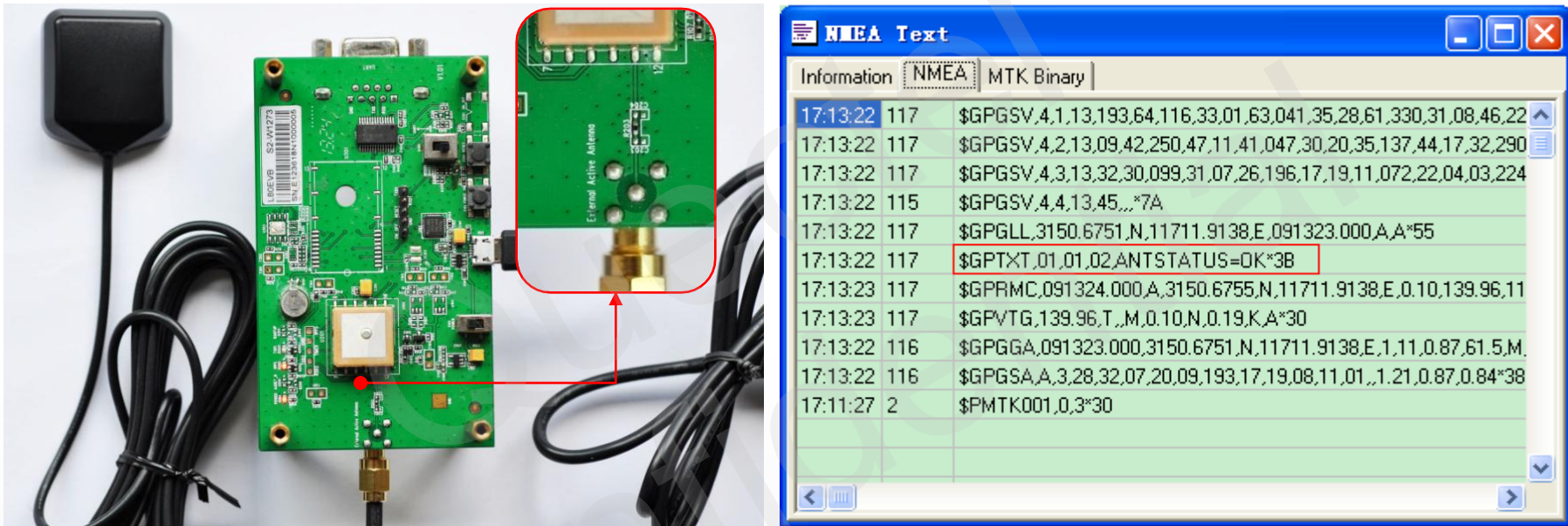
Time	Class	Message
17:12:16	51	\$GPGSV,4,1,13,193,64,117,40,01,63,041,27,28,60,330,41,08,46,22
17:12:16	51	\$GPGSV,4,2,13,09,42,251,41,11,41,046,33,20,35,137,47,17,32,289
17:12:16	51	\$GPGSV,4,3,13,32,30,099,36,07,26,196,14,44,23,247,,19,11,071,*7
17:12:15	50	\$GPGSV,4,4,13,04,03,224,*48
17:12:15	50	\$GPGLL,3150.6786,N,11711.9133,E,091216.000,A,A*53
17:12:15	50	\$GPTXT,01,01,02,ANTSTATUS=OPEN*2B
17:12:16	50	\$GPRMC,091217.000,A,3150.6776,N,11711.9130,E,0.04,294.70,11
17:12:16	50	\$GPVTG,294.70,T,,M,0.04,N,0.07,K,A*36
17:12:16	50	\$GPGGA,091217.000,3150.6776,N,11711.9130,E,1.9,0.99,61.4,M,0.0
17:12:16	50	\$GPGSA,A,3,28,32,07,20,09,193,17,08,11,,,,,2.60,0.99,2.40*32
17:11:27	2	\$PMTK001,0,3*30

Notes:

1. The patch antenna is used by default, and the "OPEN" is displayed in the GPTXT sentence of NMEA.
2. The L80 module with patch antenna could achieve 3D fix even inside the concrete buildings.

Automatic Antenna Switching Function(2)

➤ External Active Antenna Status(1)

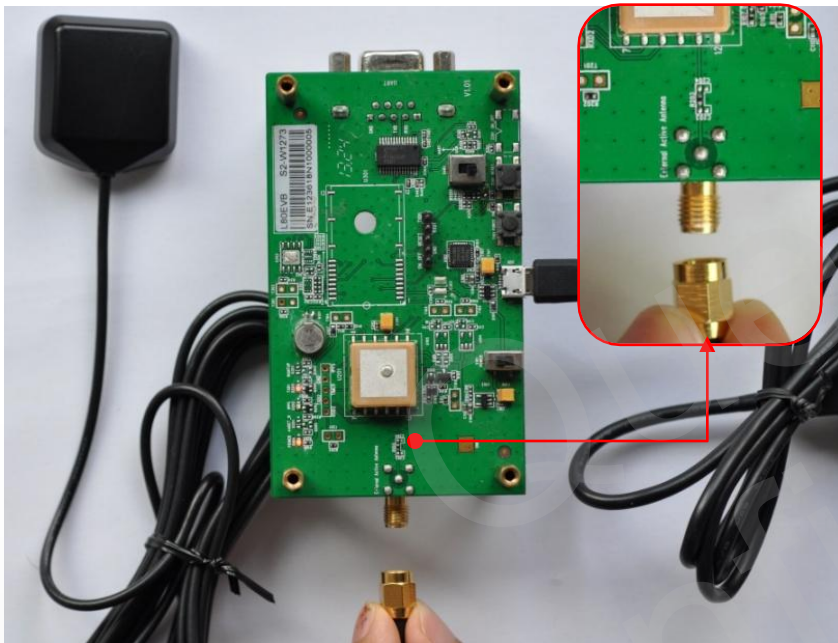


Notes:

1. When the external active antenna is connected well, L80 module will switch to use external active antenna automatically. L80 module keeps positioning during the switching process.
2. The "OK" will be displayed in the GPTXT sentence of NMEA, which means the external active antenna works well.

Automatic Antenna Switching Function(3)

➤ External Active Antenna Status(2)



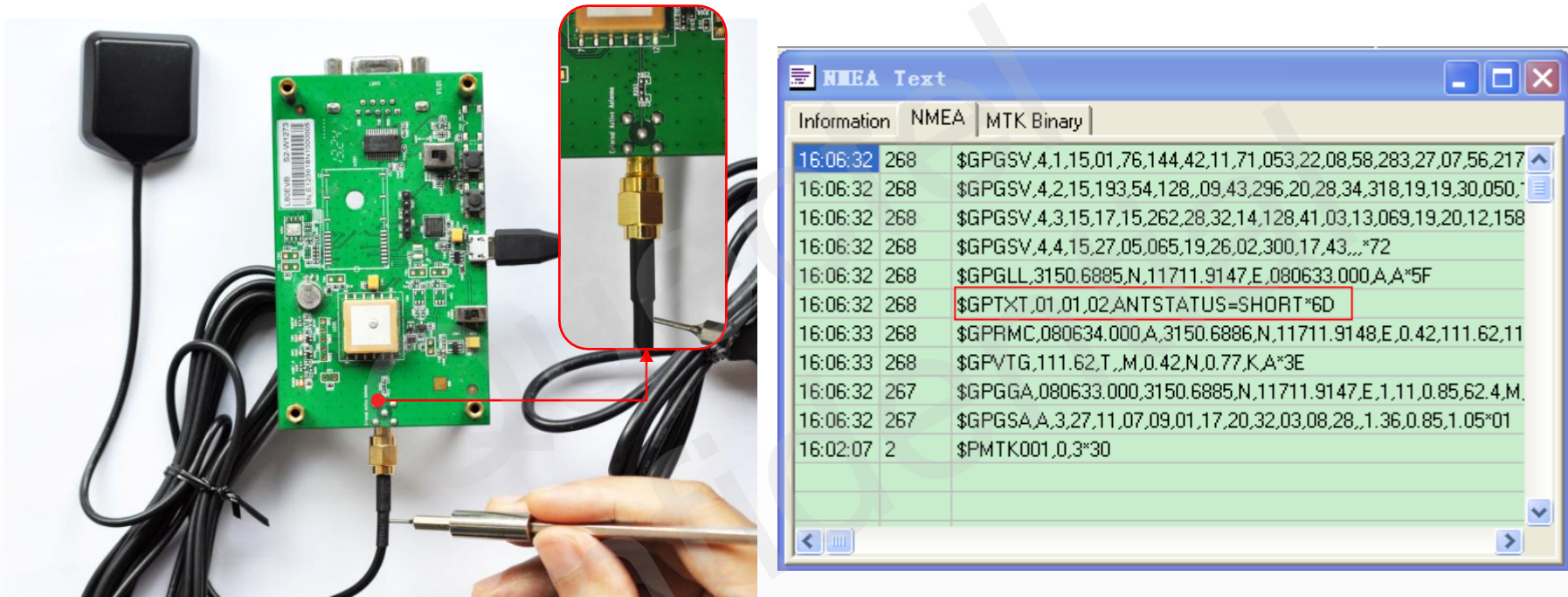
```
NMEA Text
Information NMEA MTK Binary
17:14:35 190 $GPGSV,4,1,13,193,65,116,37,01,62,041,32,28,61,330,25,08,46,22
17:14:35 190 $GPGSV,4,2,13,50,42,134,40,09,41,249,41,11,40,047,30,20,36,136
17:14:35 190 $GPGSV,4,3,13,17,32,290,22,32,31,098,37,07,25,195,13,19,10,072
17:14:35 188 $GPGSV,4,4,13,04,04,224,17*49
17:14:36 190 $GPGLL,3150.6668,N,11711.9120,E,091436.000,A,A*54
17:14:36 190 $GPTXT,01,01,02,ANTSTATUS=OPEN*2B
17:14:35 189 $GPRMC,091436.000,A,3150.6668,N,11711.9120,E,0.10,139.96,11
17:14:35 189 $GPVTG,139.96,T,,M,0.10,N,0.19,K,A*30
17:14:35 189 $GPGGA,091436.000,3150.6668,N,11711.9120,E,1,11,0.89,67.1,M,
17:14:35 189 $GPGSA,A,3,01,28,32,20,09,193,17,19,08,11,07,,1.78,0.89,1.54*36
17:11:27 2 $PMTK001,0,3*30
```

Notes:

1. When external active antenna is removed, the internal patch antenna of L80 module will take effect automatically because of antenna switching function. During the switching process, L80 module keeps positioning.
2. The "OPEN" will be displayed in the GPTXT sentence of NMEA at this time.

Automatic Antenna Switching Function(4)

➤ External Active Antenna Status(3)



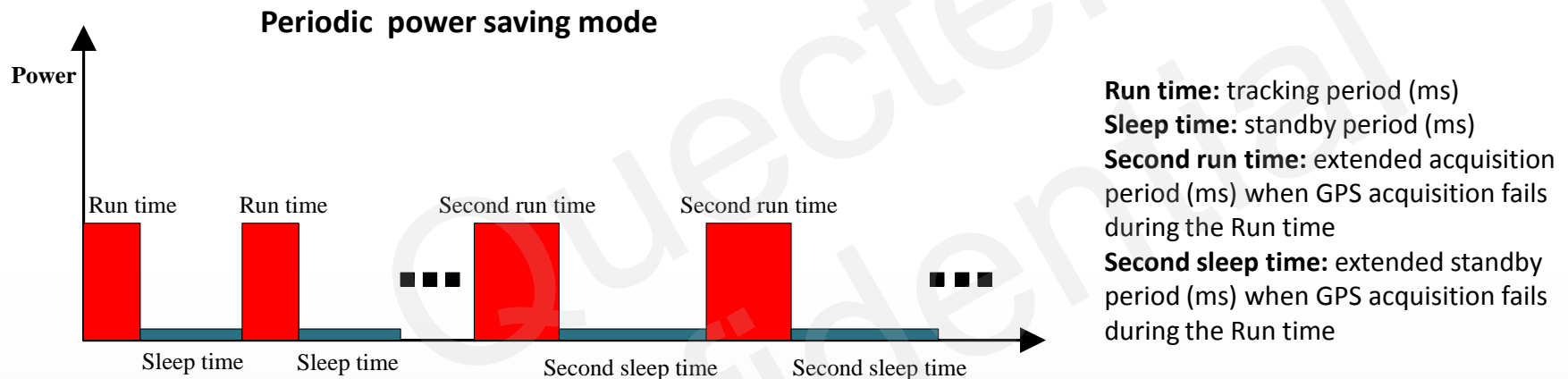
Notes:

1. If external active antenna short-circuited or damaged, L80 module will use internal patch antenna automatically. There is no need to worry about position fixing because L80 module is persistently positioning during the switching process. The most important is that you need to check the external active antenna and find out the reason, when the "SHORT" is appeared in the NMEA sentence.
2. The "SHORT" will be displayed in the GPTXT sentence of NMEA at this time.

PERIODIC STANDBY MODE

Periodic standby mode can control power on/off time of GPS periodically to reduce average power consumption, and 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



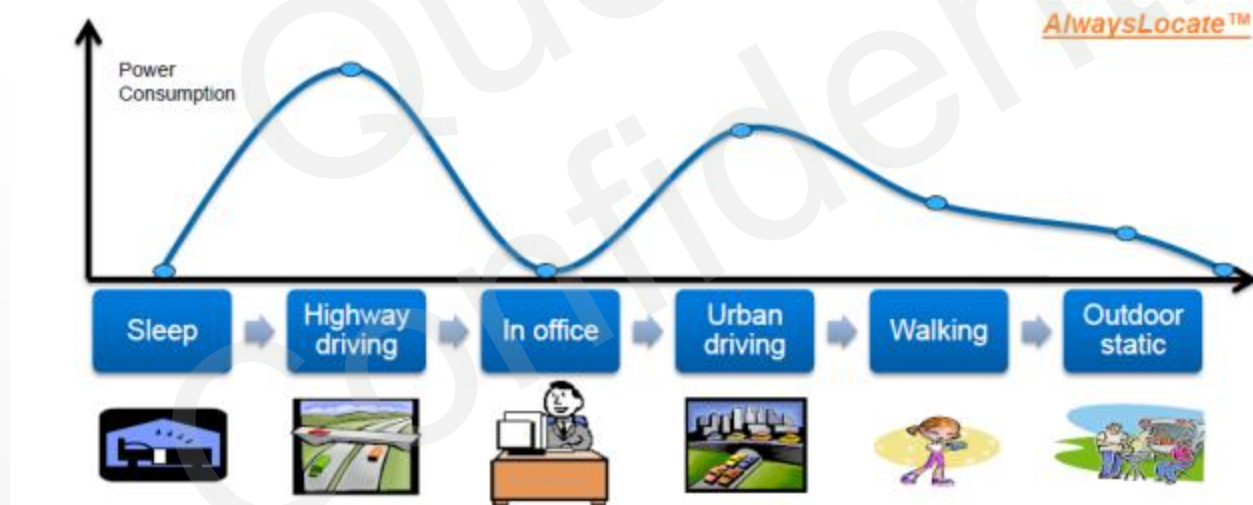
Notes:

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

Example: `PMTK225, 2, 3000, 12000, 18000, 72000*15` with 3s wakeup time and 12s sleep time in periodic standby mode. The average current is about 4.8mA.

ALWAYSLOCATE™ TECHNOLOGY

- AlwaysLocate™ is an intelligent controller of periodic mode.
- L80 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 is 3.0mA.



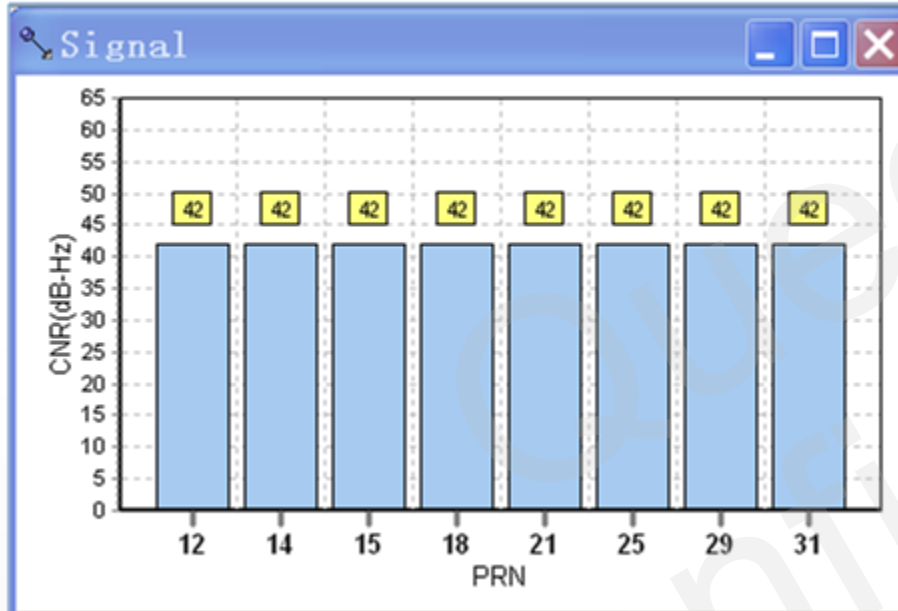
L80 vs. UCOMPANY MAX-6X(1)

➤ Specification Comparison

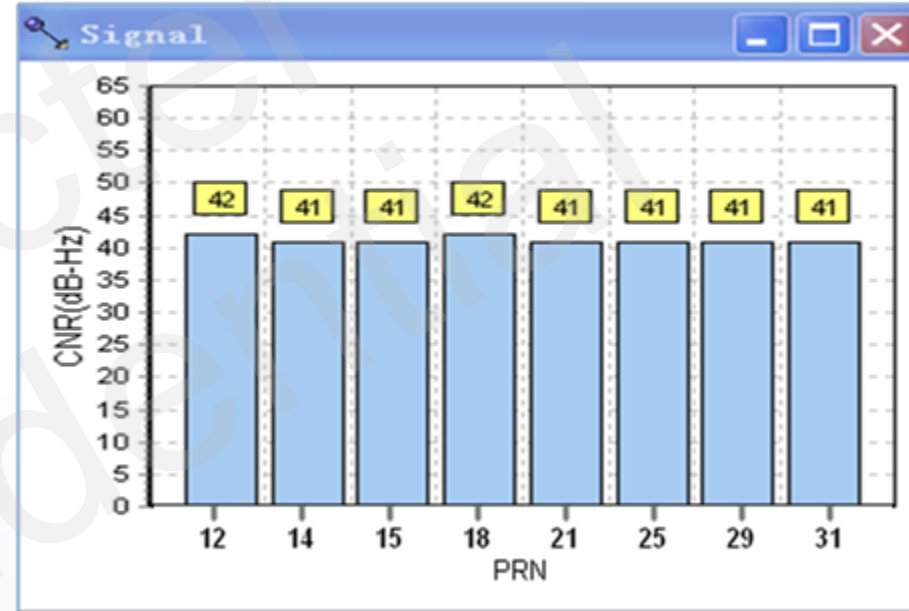
Product Features		L80 (Patch Antenna)	MAX-6X(EXT_Antenna)
Power supply		3.0V~4.3V	2.7V~3.6V
Power Consumption	Acquisition Mode	25mA@3.3V	47mA
	Tracking Mode	20mA@3.3V	41mA
Sensitivity	Acquisition	-148dBm	-148dBm
	Tracking	-165dBm	-162dBm
	Re-acquisition	-160dBm	-160dBm
TTF @ -130dBm	Hot Start	<1s	1s
	Warm Start	<5s (EASY™)	26s
	Cold Start	<15s (EASY™)	26s
Position Accuracy		2.5m CEP	2.5m CEP
Timing Accuracy	1PPS	10ns	30ns
Data Update Rate		Up to 10Hz	Up to 5Hz

L80 vs. UCOMPANY MAX-6X(2)

➤ CN Value (-110dBm@SV=8) with coupling testing



L80



MAX-6X

Note:

CN value is measured by a 8-channel GPS signal simulator under coupling testing mode with a -110dBm signal level.

L80 vs. UCOMPANY MAX-6X(3)

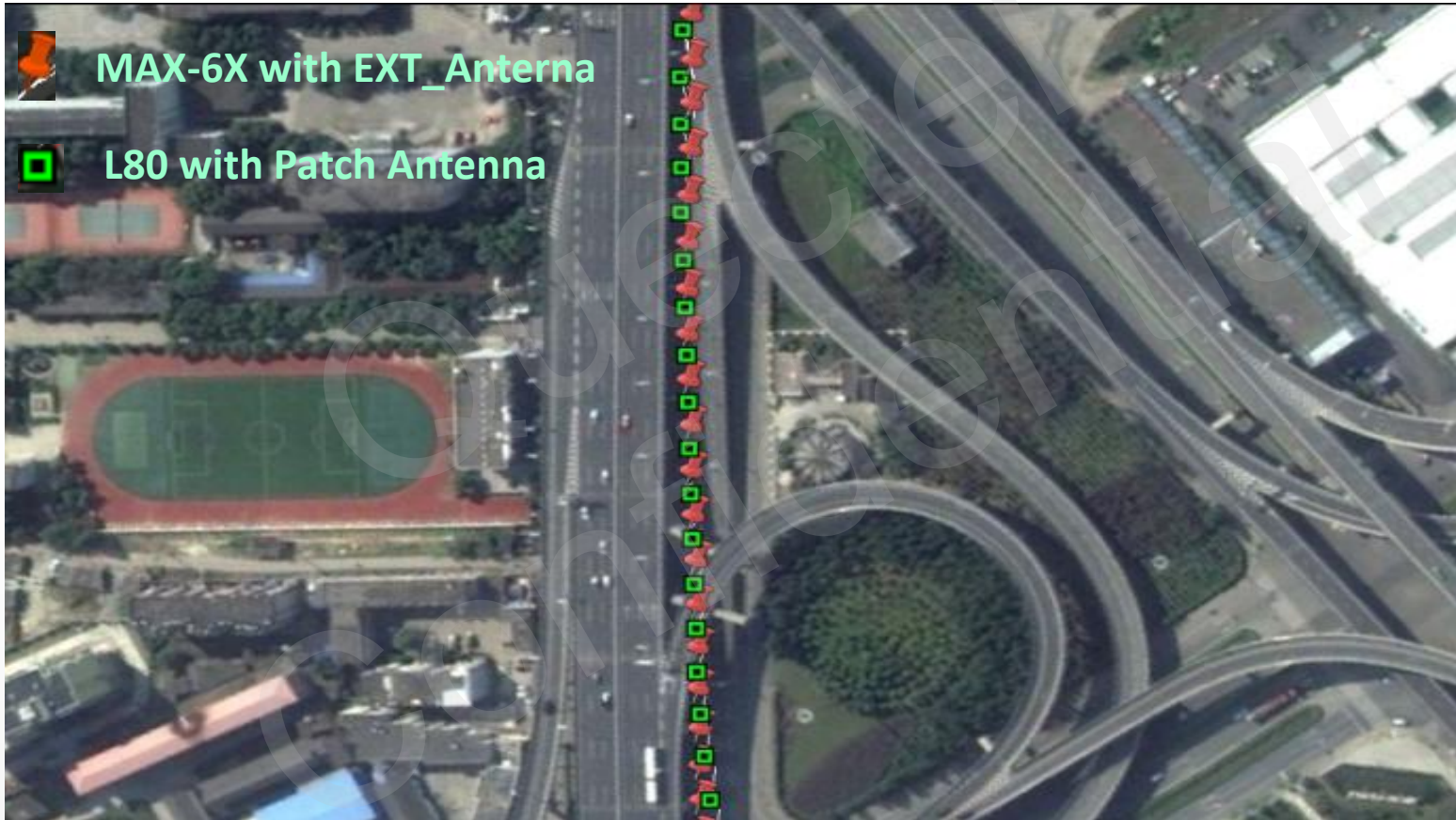
➤ Tracking Comparison



When driving across overpass and making a turn, L80 module with Patch Antenna and U company module with EXT Antenna can capture almost same accurate tracking data.

L80 vs. UCOMPANY MAX-6X(4)

➤ Tracking Comparison



When driving under the overpass, L80 module shows its excellent performance.

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□ Support Package

SUPPORT PACKAGE(1)

Evaluation Board

➤ Interfaces

- GPS serial port
- Active Antenna interface
- Micro-USB interface

➤ Accessories

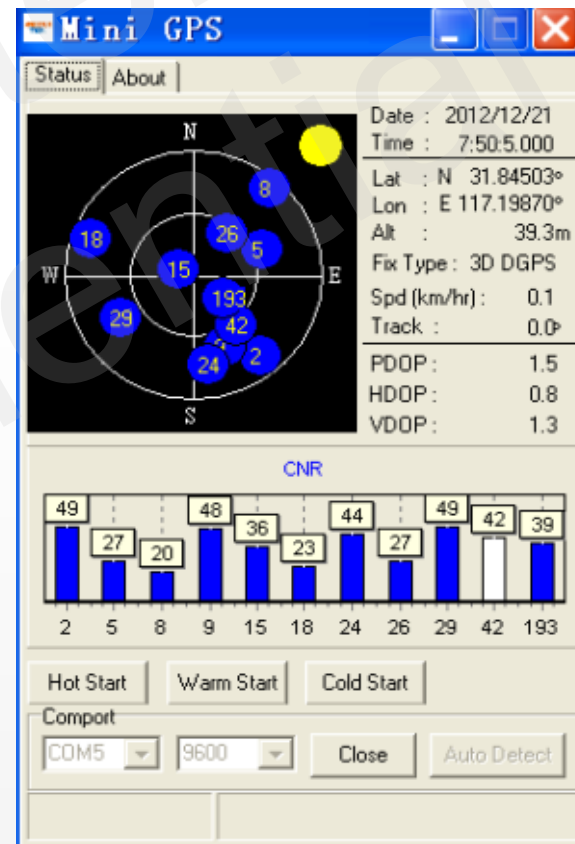
- Micro-USB cable



SUPPORT PACKAGE(2)

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

- PC tool
 - MiniGPS-GPS testing tool



Thank you