Leadtek®
We Make Dreams a Reality

User's Technical Manual of Leadtek GPS EVK III

LR 9500

Leadtek®
We Make Dreams a Reality

Version 1.01

4 August 2003

Leadtek®
We Make Dreams a Reality

Contents

1 INTRODUCTION 3

2 PRODUCT FEATURES 3

3 TECHNICAL SPECIFICATIONS 3

4 MECHANICAL DIMENSIONS 4

5 OUTLINE AND DESCRIPTIONS 4

6 INNER PHOTOS OF EVK 6

7 OPERATION OF GMONITOR SOFTWARE WITH GPS EVK III 9

7.1 NORMAL OPERATION 9

7.2 COLD/WARM/HOT START TIME MEASUREMENTS 13

8 DOWNLOAD THE FIRMWARE TO GPS MODULE 18

9 MEASURE POWER CONSUMPTION OF GPS MODULE IN DIFFERENT OPERATION MODES 21

10 INSTALL THE USB DRIVER 25

11 UNINSTALL THE USB DRIVER 27

APPENDIX A GPS EVK SCHEMATIC 27

APPENDIX B SPECIFICATION OF GPS ACTIVE ANTENNA 29

APPENDIX C THE CONTENTS OF CD-ROM 31

1 Introduction

GPS 9500 EVK-III is an evaluation kit designed to demonstrate the performance of Leadtek GPS modules. It supports Leadtek 9540, 9543, and 9547 modules. GPS 9500 EVK-III not only helps customers to evaluate our GPS modules performance but also can be used to update new firmware for the GPS modules.

2 Product Features

* Easy Installation and operation of GPS modules
* Support Leadtek GPS 9540, 9543, 9547 modules.
* Testing and programming the GPS modules.

3 Technical Specifications

■EVK

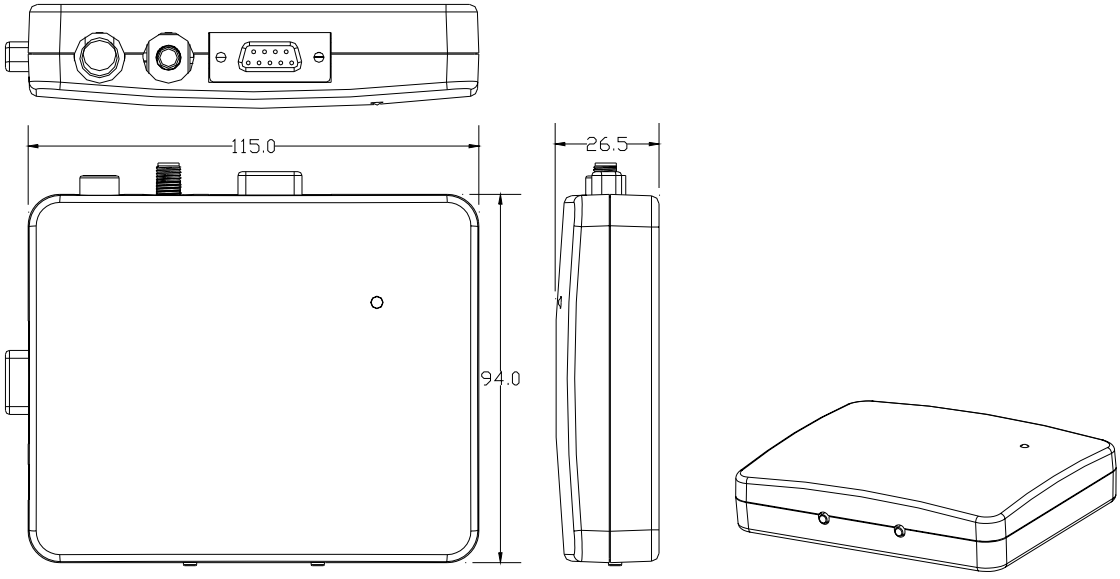
Power Input	**DC 5V**
PC Interface	**Two RS232 serial ports**
Size (H x W x D) in mm	**120.5 x 99.5 x 26mm**
Weight	**140 g (No GPS module)**
Accessories	**RS232 cable** **5V DC adapter** **USB cable** **GPS active antenna (Please refer to the Appendix B.)**

■General specification of GPS Module

General	
Frequency	L1, 1575.42 MHz
C/A code	1.023 MHz chip rate
Channels	12
Accuracy (Open Sky)	
Position	10 meters, 2D RMS 7 meters 2D RMS, WAAS corrected 1-5 meters, DGPS corrected
Altitude	< 35m Vertical (95%)
Velocity	0.1 meters/second
Time	1 microsecond synchronized to GPS time
Acquisition Rate (Open sky, stationary condition)	
Reacquisition	0.1 sec., average

Snap start	2 sec., average	
Hot start	8 sec., average	
Warm start	38 sec., average	
Cold start	45 sec., average	
Dynamic Conditions		
Altitude	18,000 meters (60,000 feet) max.	
Velocity	515 meters/second (1000 knots) max.	
Acceleration	4g, max.	
Jerk	20 meters/second^3, max.	
Power		
GPS Chipset	**SiRFstarIIe**	**SiRFstarIIe/LP**
Supply Current (without antenna)	≈160mA	≈65mA
Other		
Datum	WGS-84	
Interface	Two full duplex TTL level serial ports	
Protocol	SiRF binary and NMEA-0183	

4 Mechanical dimensions



5 Outline and Descriptions

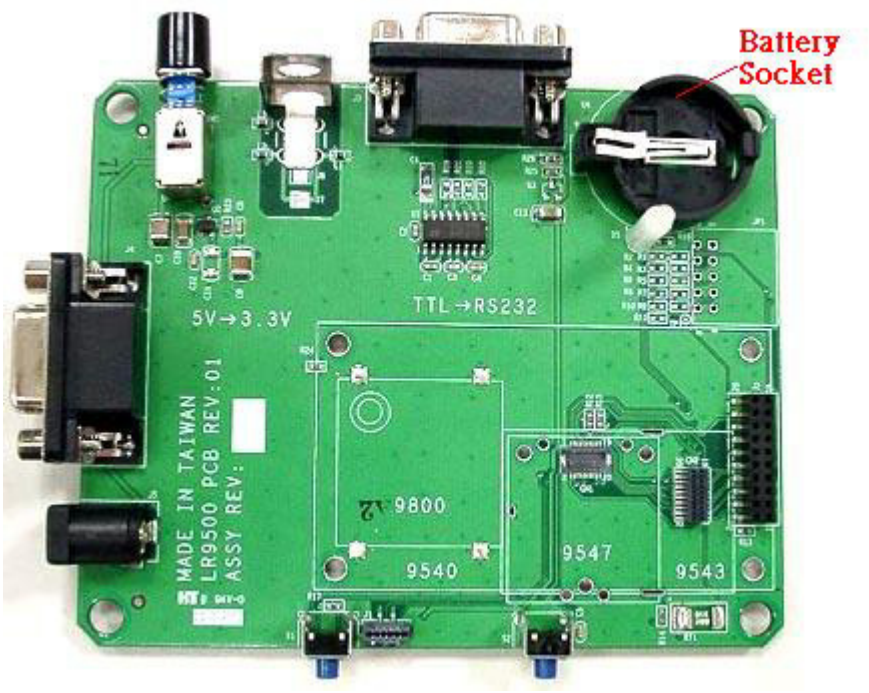
Functional kit	**Description**
Power ON/OFF	Power ON/OFF button for GPS 9500 EVK-III. Push down will turn on power.
GPS Antenna	Connect GPS active antenna with SMA connector
Power & Status LED	Two colors LED shows power and data transmitting status. The green is for power status and the red is for GPS data output status.
Port 1	This port outputs GPS messages. You have to use RS232 cable to connect EVK to PC or laptop.
Port 2	This port is used for RTCM message input for DGPS correction.
Power 5V DC Jack	Connection to AC adapter.

Reset Button	Reset GPS module and force a cold start.
Boot Select Button	Please refer to details on technical manual of CD-ROM for download instructions. To download firmware, push reset button once while hold down this button. The GPS module will enter into forced download mode. Perform reset to leave download mode.

6 Inner Photos of EVK

■EVK without GPS module

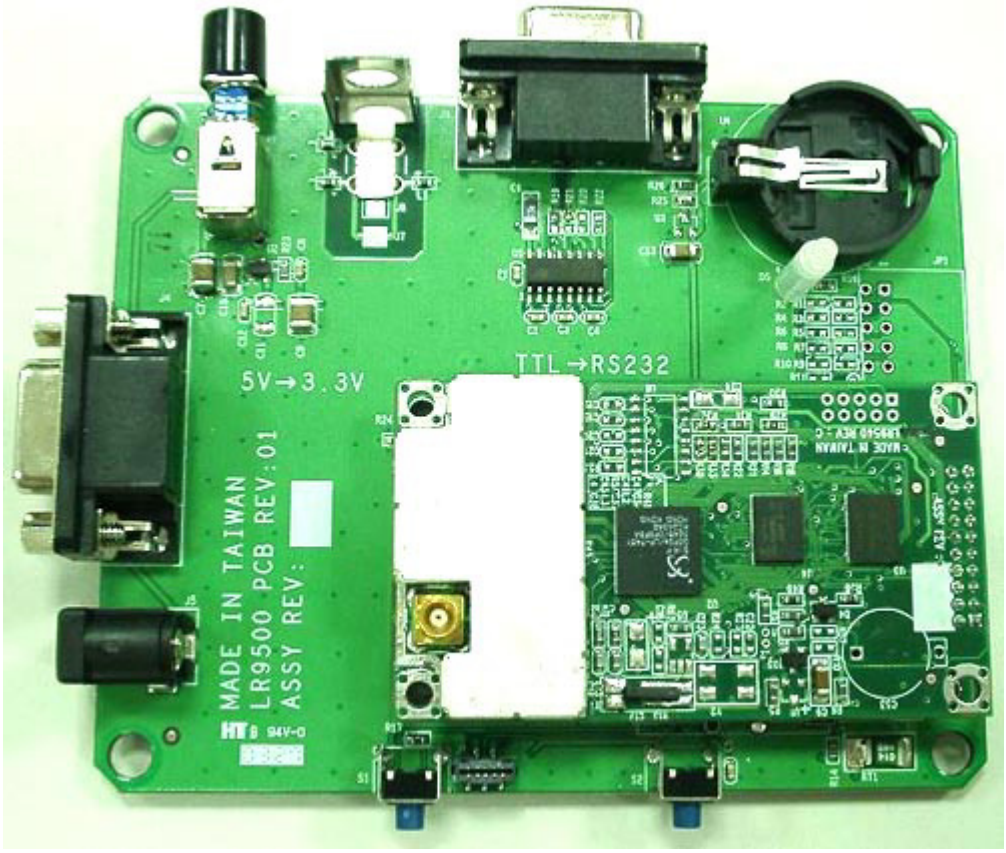
<Note> You can place a lithium battery in the battery socket to perform the battery backup function of GPS module. This lithium battery should be CR2305 type.



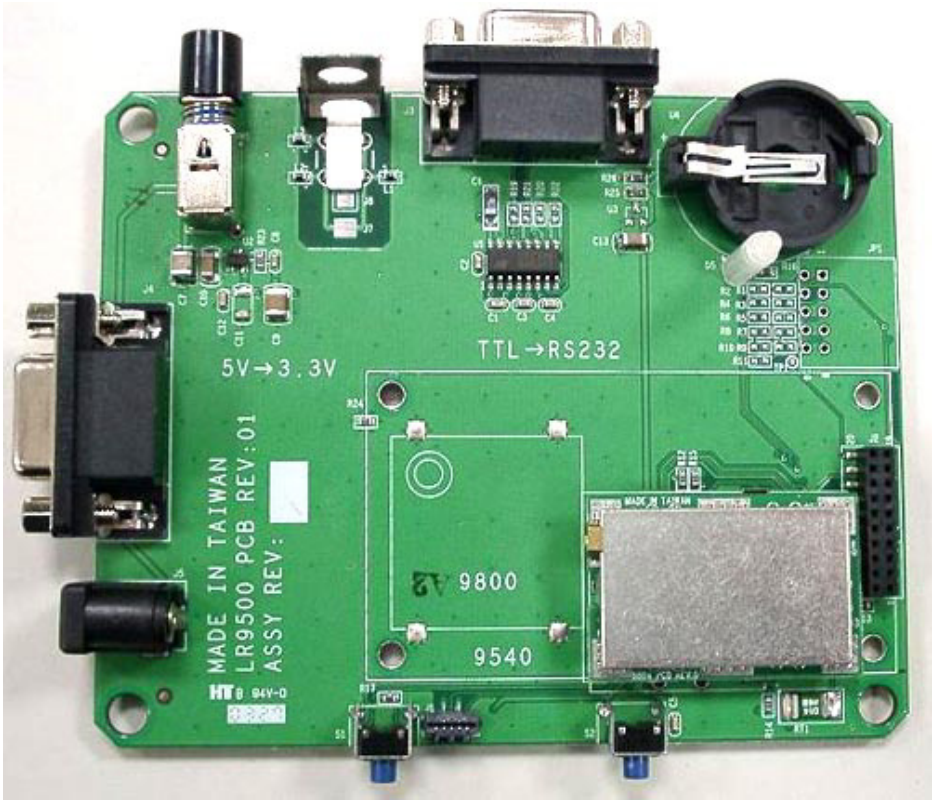
■ **GPS module**

Module	9540	9543
Photo		
Module	9547	
Photo		

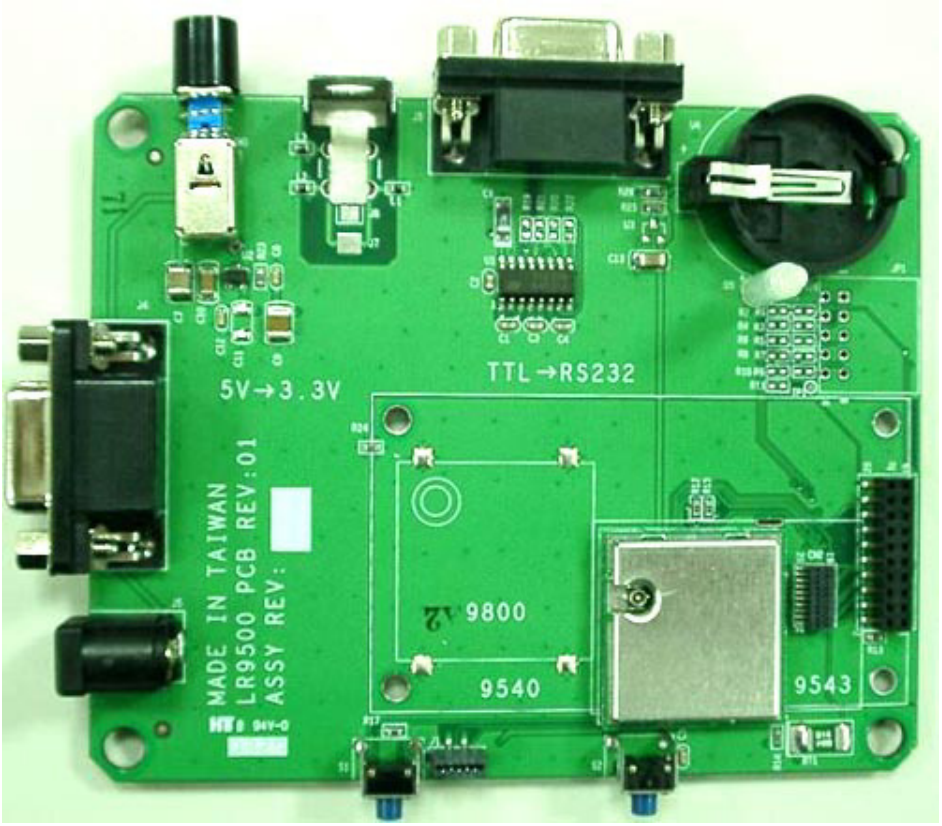
■**EVK with GPS 9540 module**



■EVK with GPS 9543 module



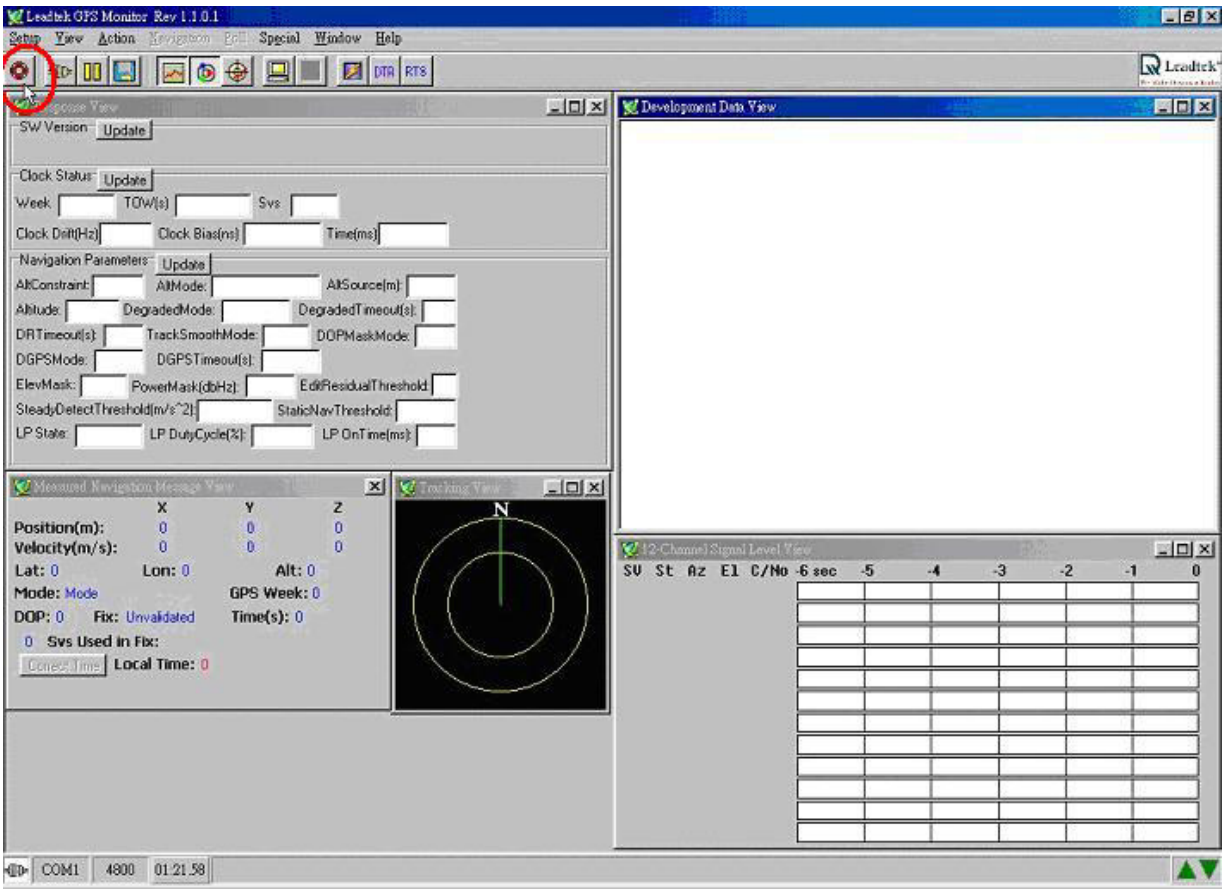
■EVK with GPS 9547 module



7 Operation of GMonitor software with GPS EVK III

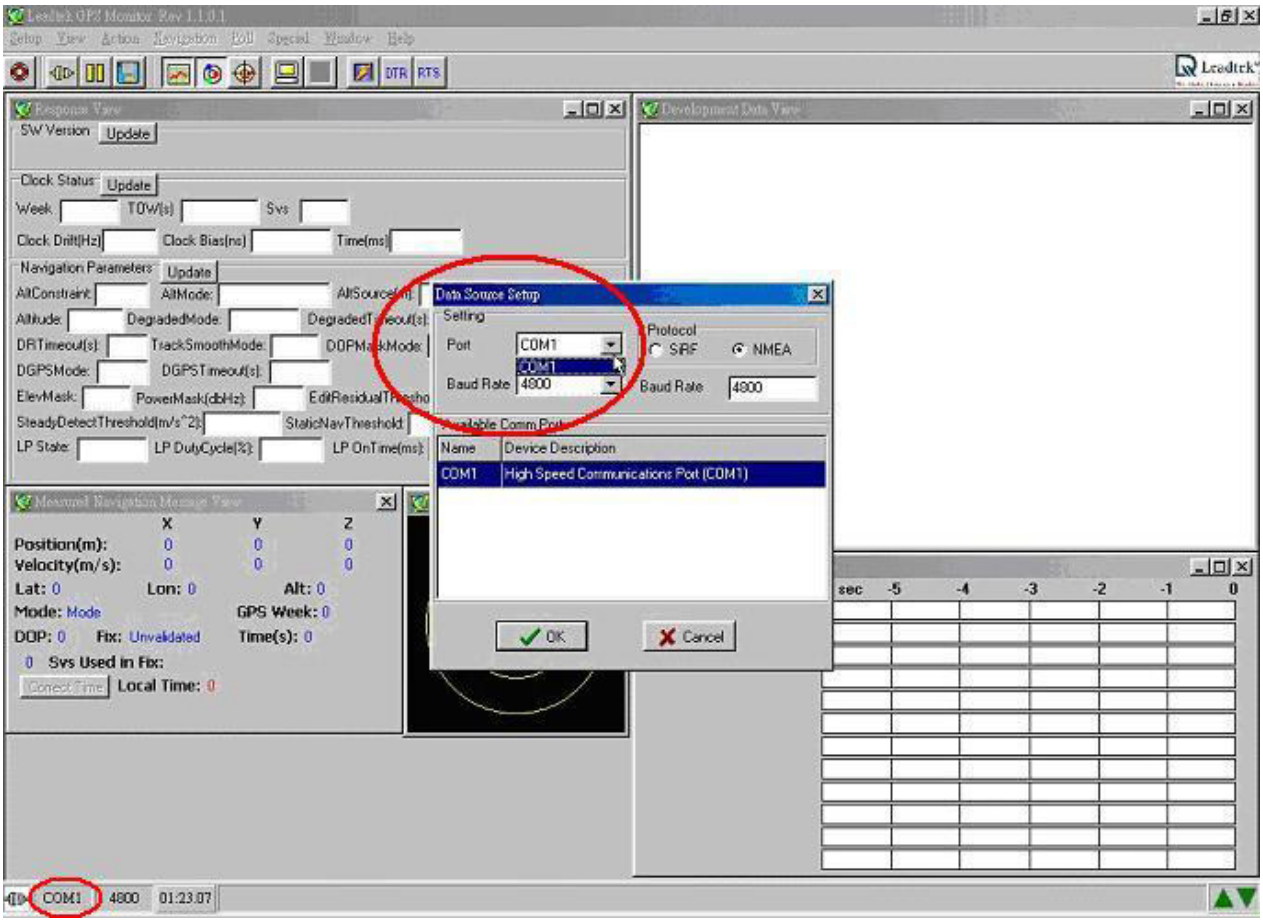
7.1 Normal operation

In GPS monitor main screen, click **data source setup** button indicated in the figure below.

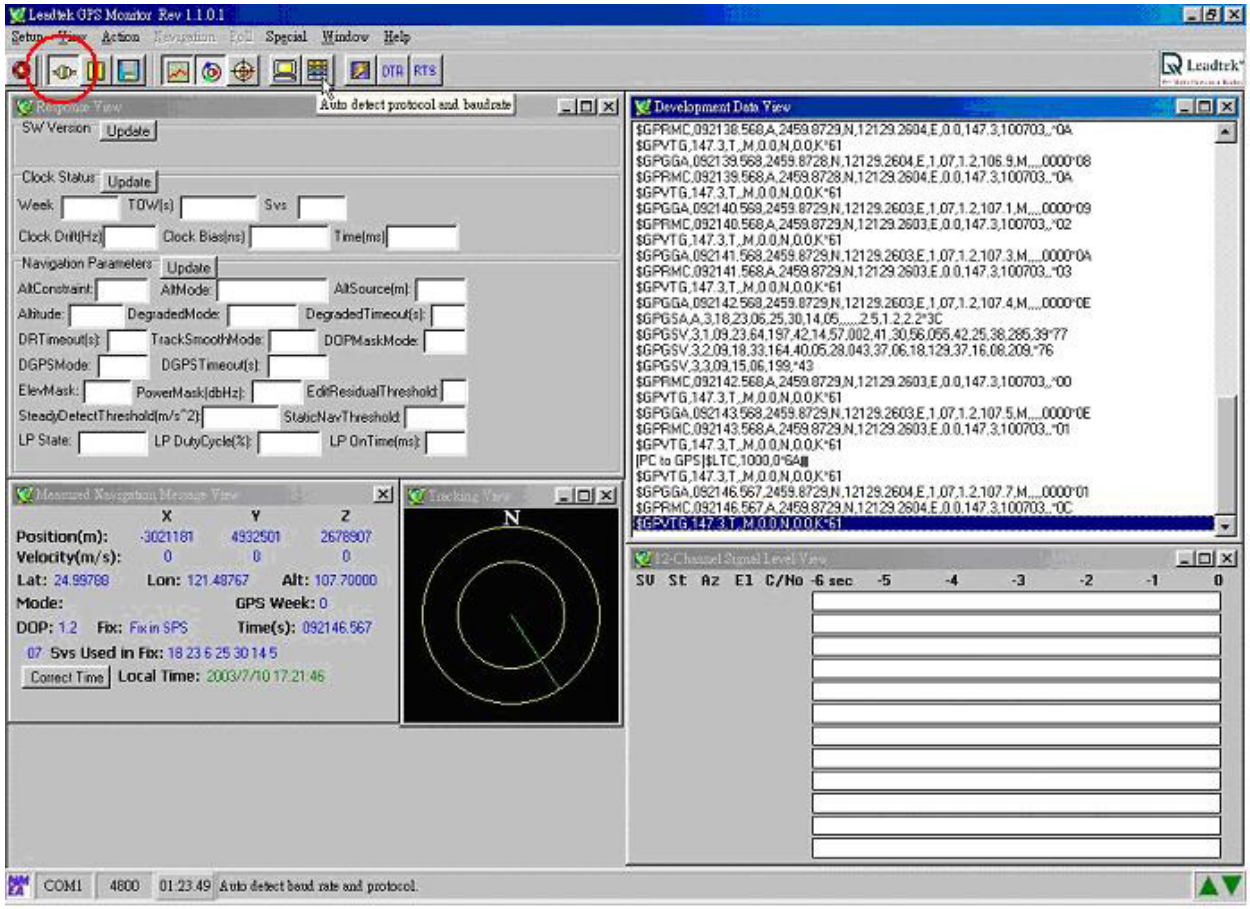


<Note>Go to view menu to choose desirable information windows you like to observe.

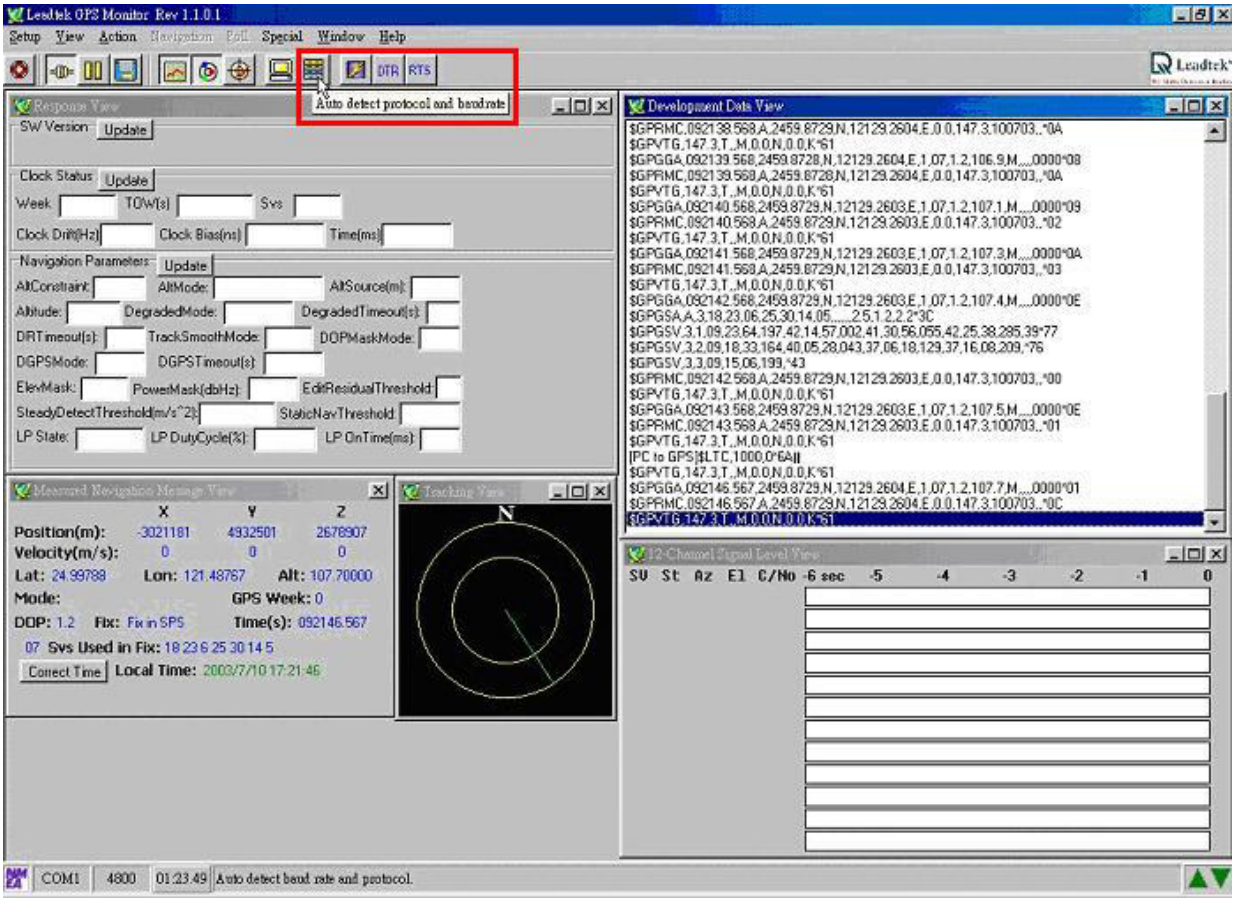
Next, please choose **Com Port**.



Next, click **connect** button.



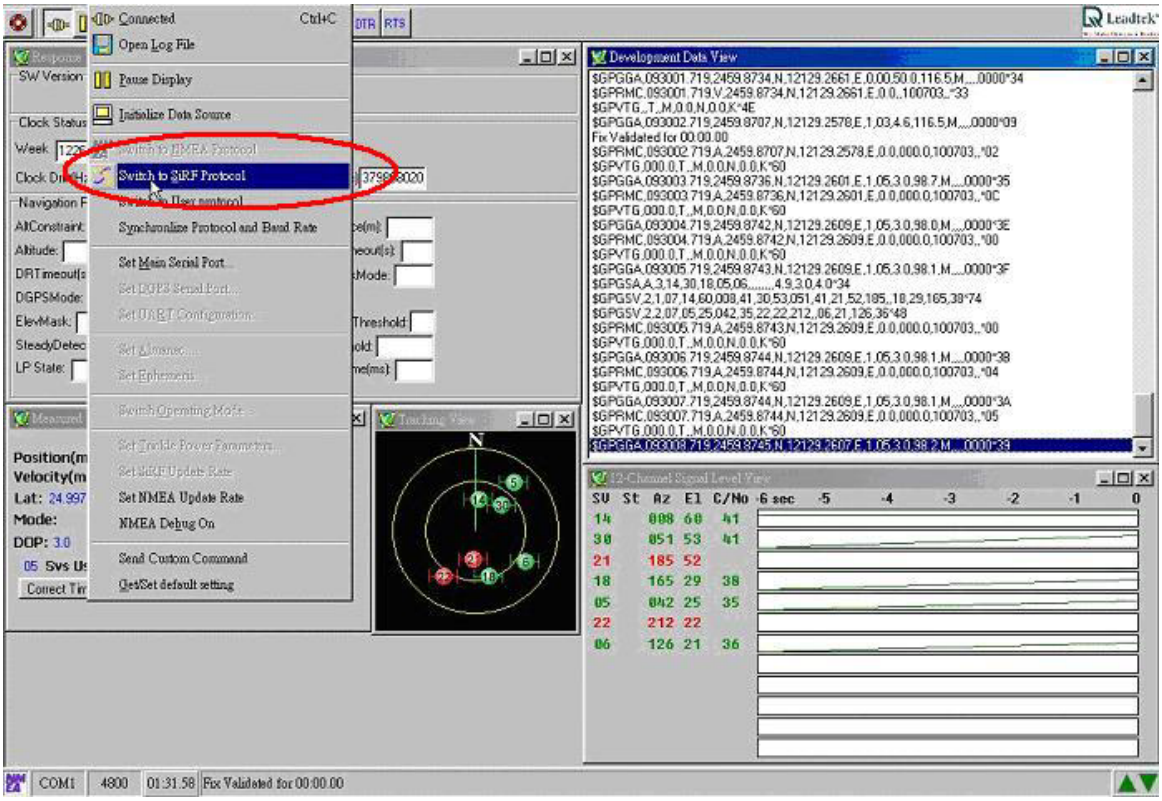
Next, please click on **Auto detect protocol and baud rate** button. The GPS software will go on detecting protocol for GPS module.



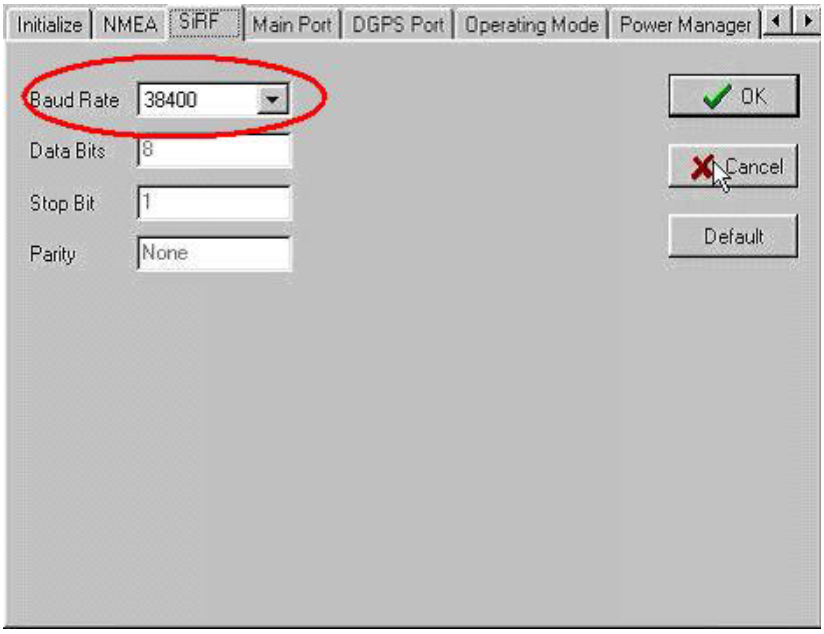
7.2 Cold/Warm/Hot start time measurements

You can use the GPS EVK device and GPS Monitor software to measure hot, warm and cold start time of the GPS module. To perform this operation, you need to switch GPS protocol to SiRF Binary mode.

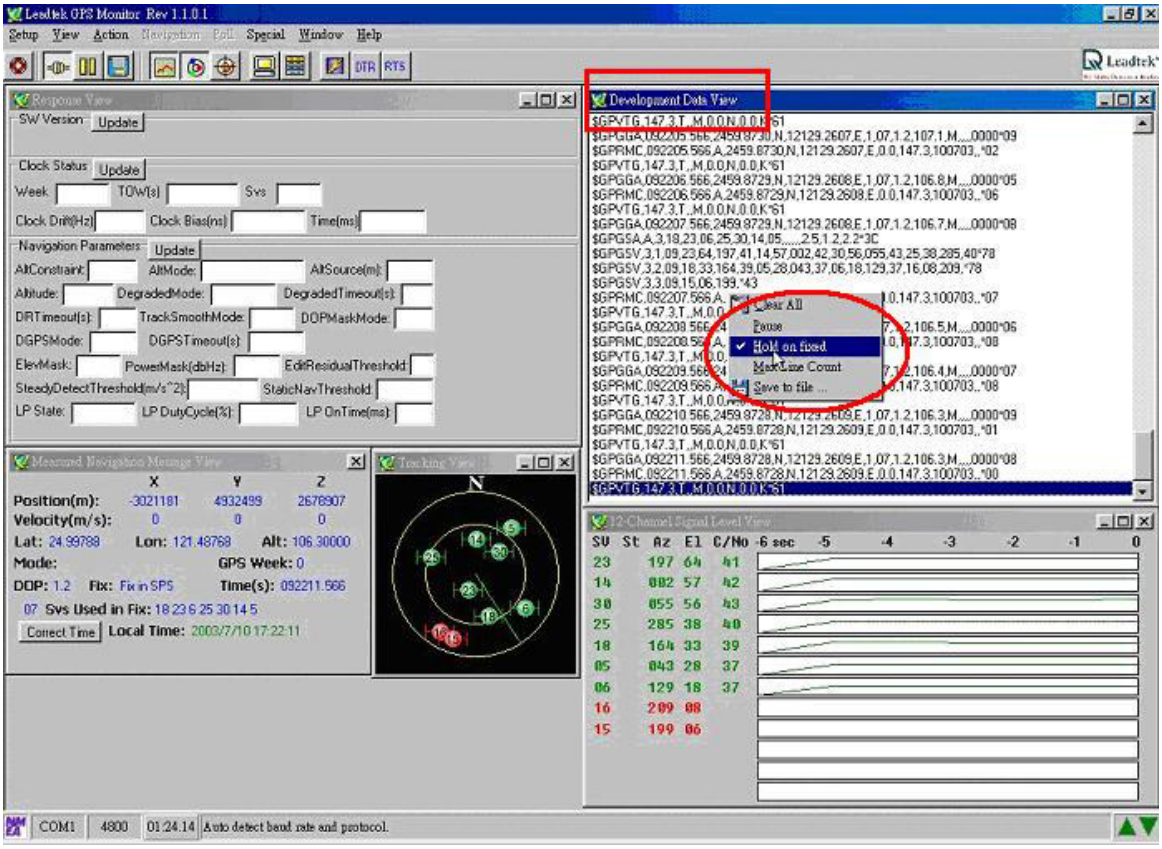
Click on **Action** function of main menu and **choose Switch to SiRF Protocol** item.



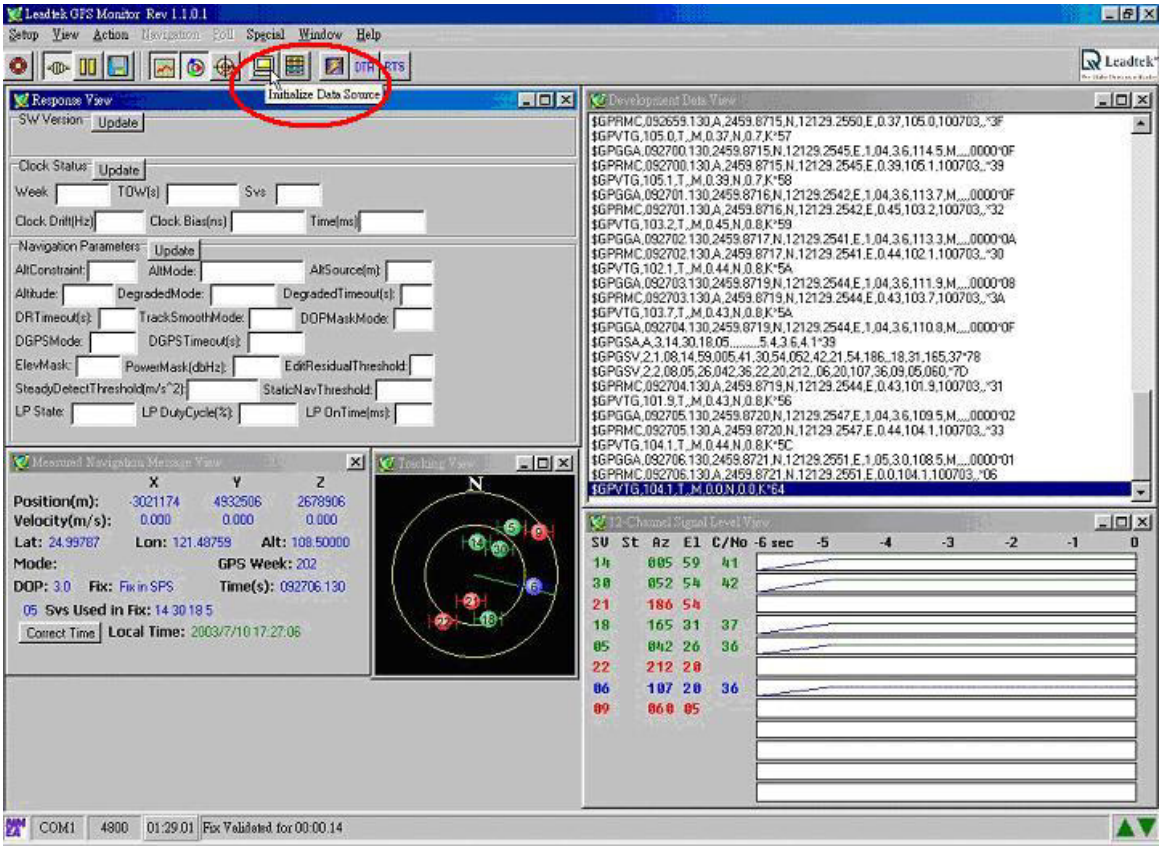
Next, please switch baud rate to 38400.



Next, please press the right button of mouse on window of **development data view**. It will pop up the menu and you have to choose **Hold on fixed** item.

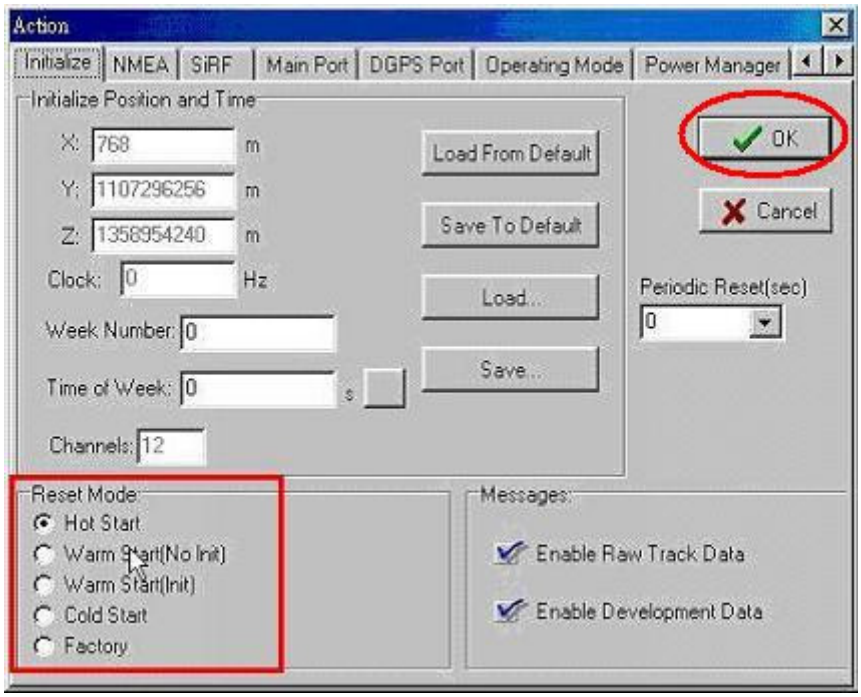


Next, please click on **Initialize Data Source** button.



This example shows how to measure hot start time.

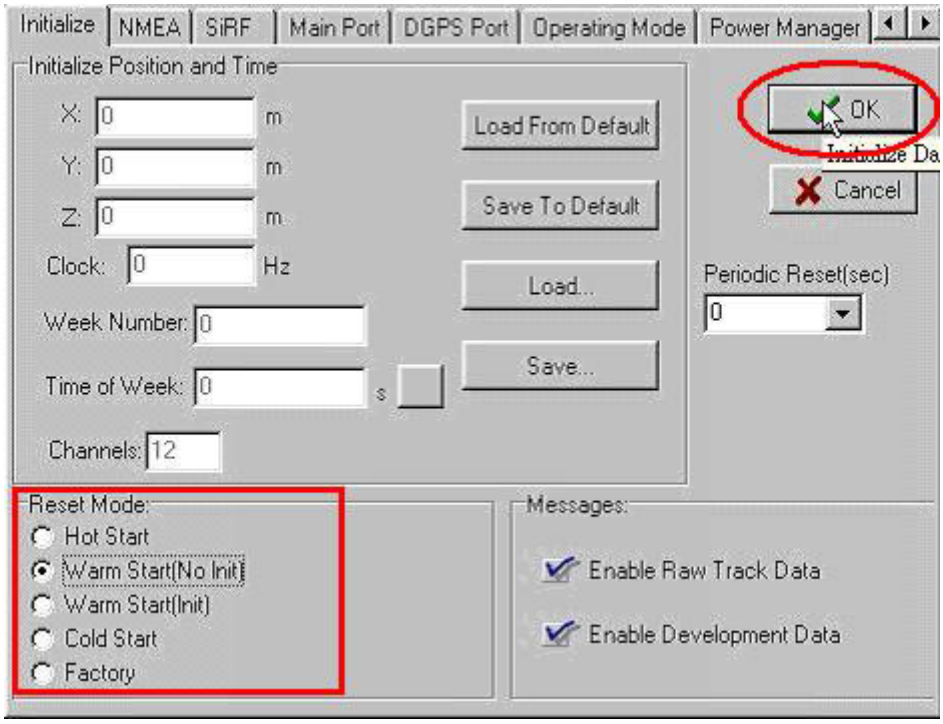
Please choose **Hot Start** item and click on **OK** button.

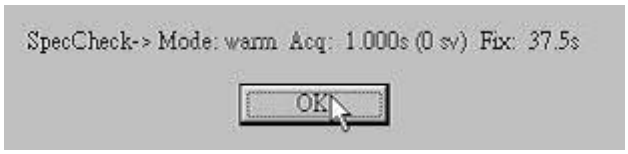


Finally, please wait a moment and you will get time of hot start.

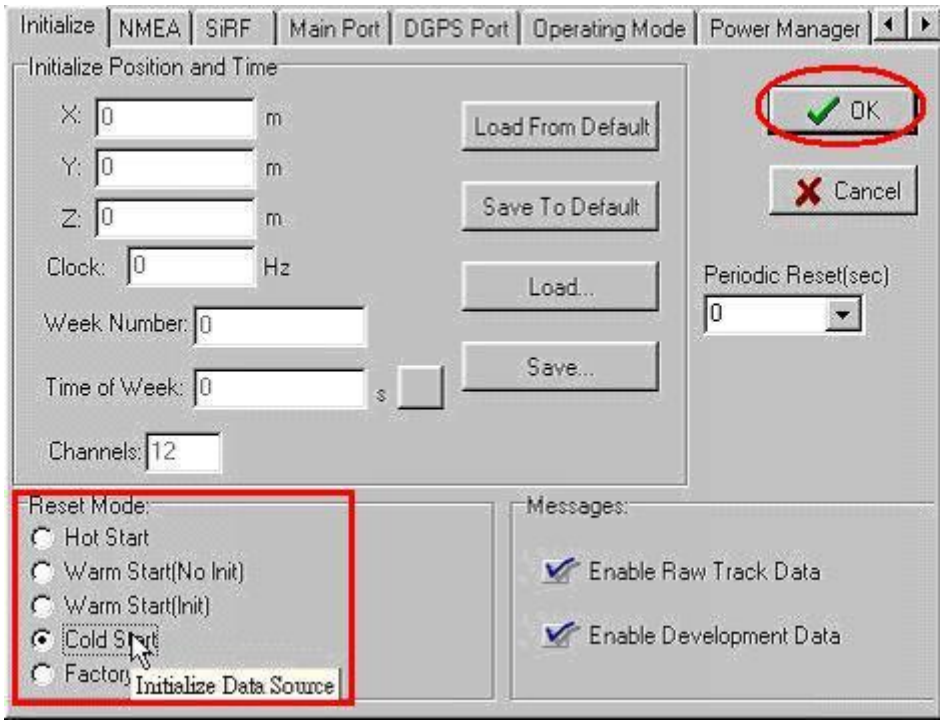
Please repeat above the steps and you will get time of warm and cold start.

<Warm Start>





<Cold Start>

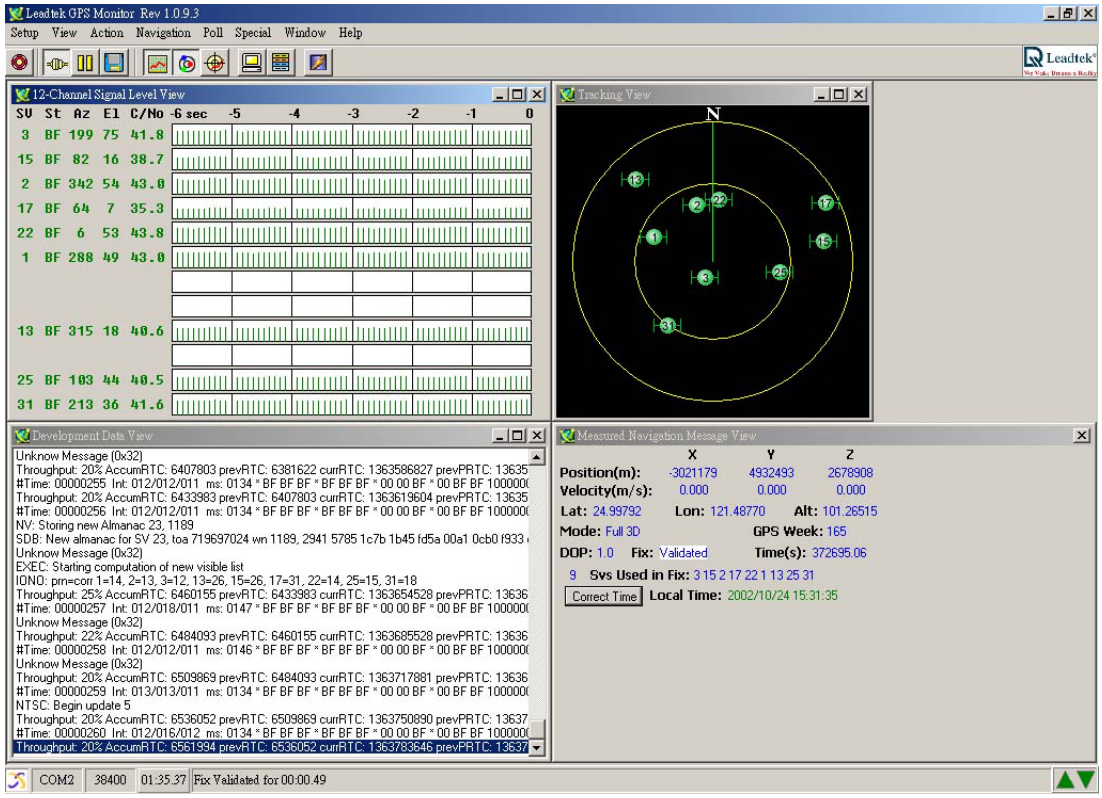

Initialize
NMEA
SiRF
Main Port
DGPS Port
Operating Mode
Power Manager
Initialize Position and Time
X: 0 m
Y: 0 m
Z: 0 m
Clock: 0 Hz
Week Number: 0
Time of Week: 0 s
Channels: 12
Load From Default
Save To Default
Load...
Save...
OK
Cancel
Periodic Reset(sec)
0
Reset Mode:
Hot Start
Warm Start(No Init)
Warm Start(Init)
Cold Start
Factory
Initialize Data Source
Messages:
Enable Raw Track Data
Enable Development Data


SpecCheck-> Mode: cold Acq: 1.000s (0 sv) Fix: 48.3s
OK

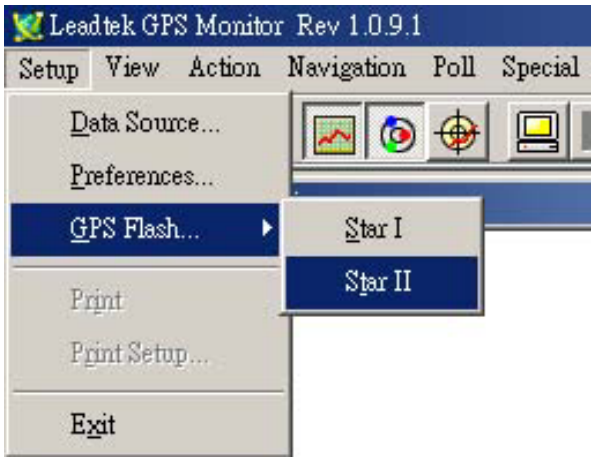
8 Download the firmware to GPS module

<Step 1>Double click the GMonitor desktop icon to run software in order to download firmware. 

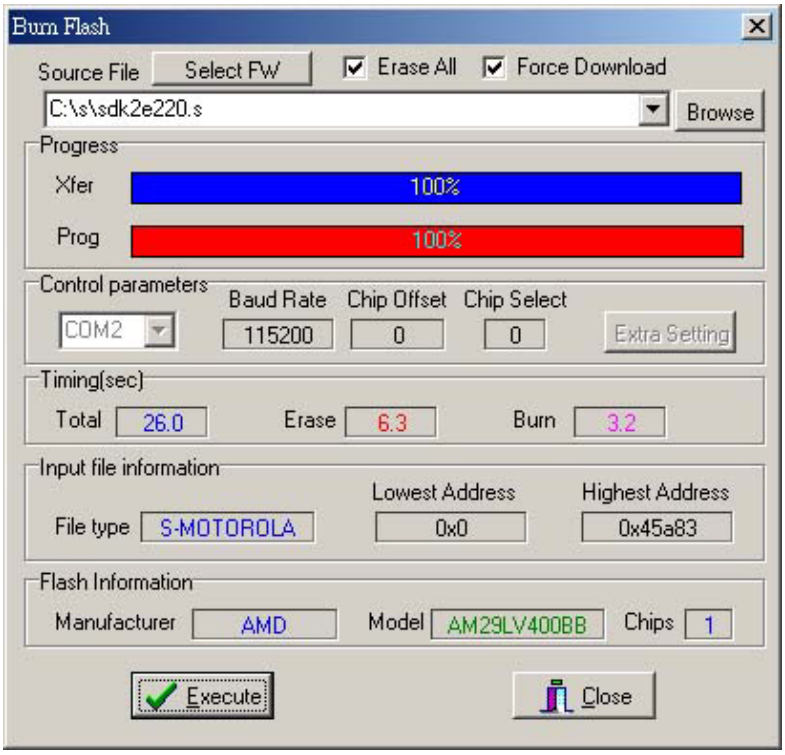
The Main screen is shown as follows.



<Step 2> Choose the **Setup→GPS Flash→Star II** option from of main menu.



The following screen shows the download options.



<Download Options>

Erase All	**Uncheck this box and program will only clear the portion of the flash memory that the new firmware will occupy.**
	Check this box will clear the entire flash memory space before firmware burn-in.
Force download	**Uncheck this box and GMonitor will use only software command in GPS module to download the update firmware. This is called software download method.**
	Check this box and holding the boot select button in EVK while press and release reset button will force GPS module into Force Download mode, which can only break by press reset button again. This is the preferred download method and should be use whenever possible.

To use EVK to download new firmware, perform the following steps.

1. Check “Erase All” and “Force Download” options
2. Click “Browse” button to locate the new firmware you want to upgrade.
3. Click “Execute button to start download.
4. After download finish, click “Close” to close the download screen.

<Note>

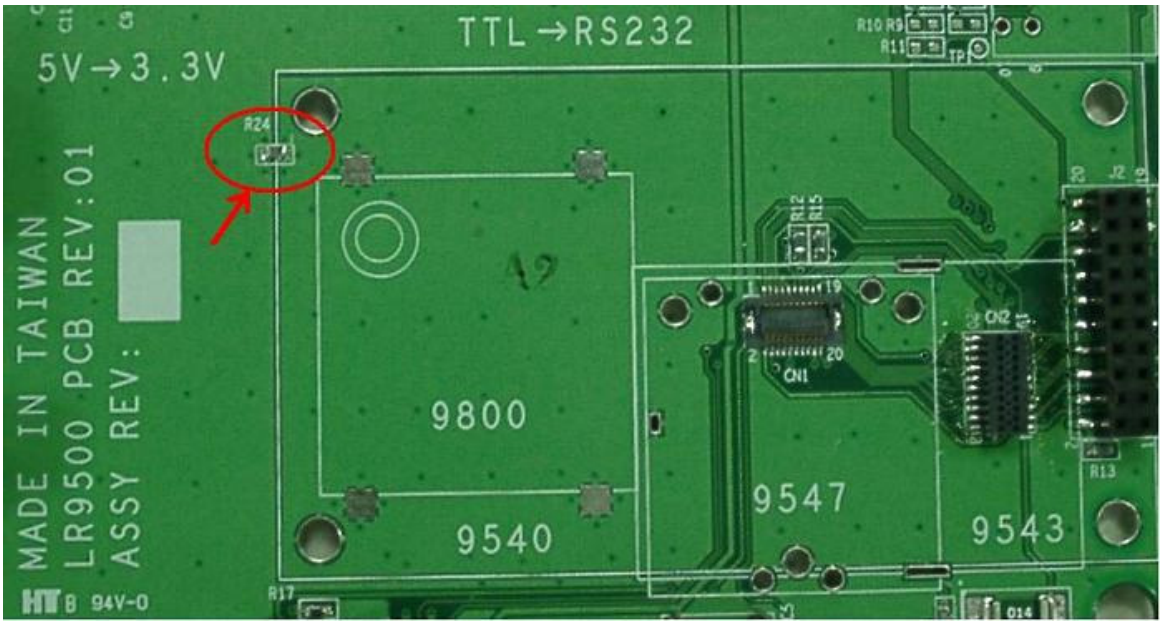
1. To use Software Download method, uncheck "**Force Download**" box and follow the reset of the download operations. For some Leadtek products that do not have boot select and reset switches, software download is the only way to upgrade firmware.
2. When you cannot finish updating firmware by software download, we suggest that you use the force download. This method can only be performed when GPS hardware support the boot select and reset switch. Before executing software to update firmware you have to push reset button once while hold down boot select button and make GPS module enter into download mode.

9 Measure Power consumption of GPS module in different operation modes

You can use the GPS EVK device and oscilloscope to measure power consumption or current of the GPS module. We will use 9547 module for demonstration here.

■Step 1.

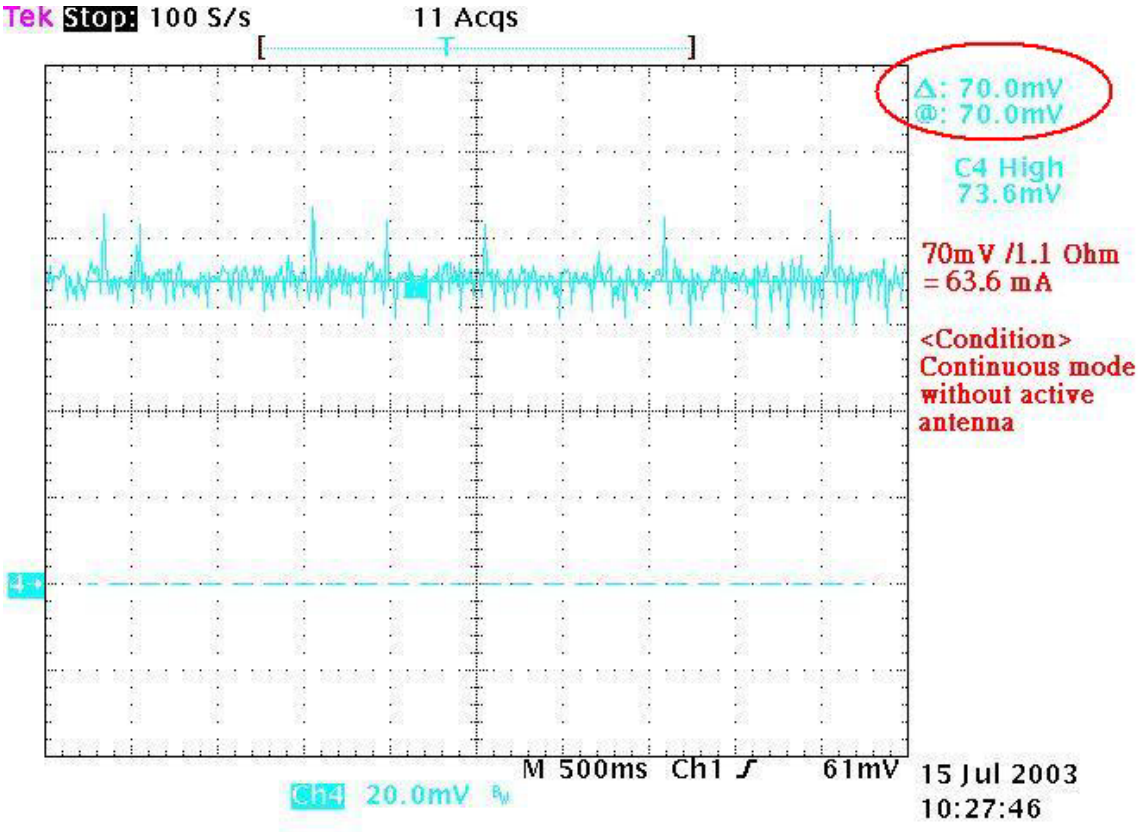
Replace the resistor value of R24 to1.1 Ohm. Measure the voltage for both side of this resister. Base on the difference in voltages between the right and left side of this resister, you can figure out the current of GPS module.



■**Step 2.**

The following figure shows the current of GPS 9547 module. We can calculate the current value. **The value is about 64 mA and this operation is based on continuous mode without active antenna.**

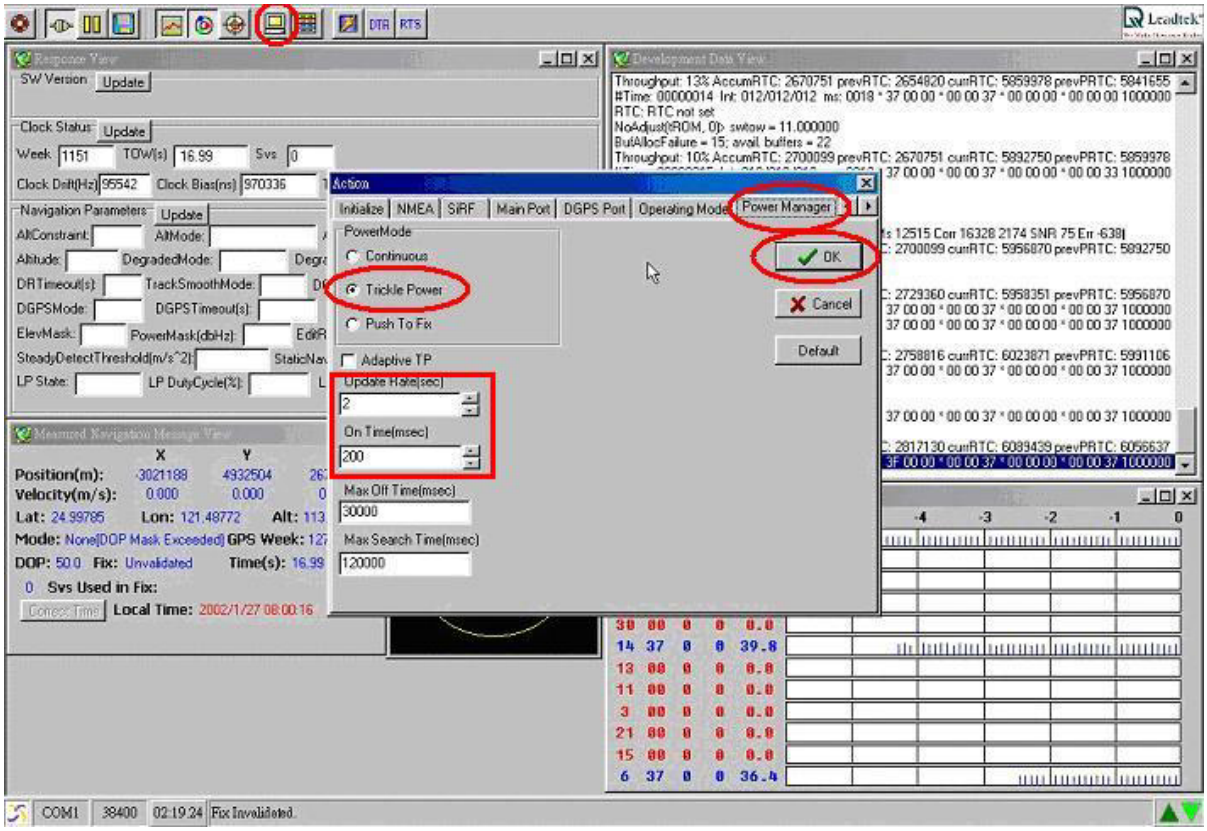
I = V / R = 70 mV / 1.1 Ohm = 63.6 mA



■**Step 3.**

You can switch continuous mode to Trickle Power mode and observe the current consumption changes. Use GMonitor to enable trickle power mode and set the parameters to 2 seconds of update rate and 200 milliseconds of on time.

(Update rate = 2 sec, On time = 200 msec)

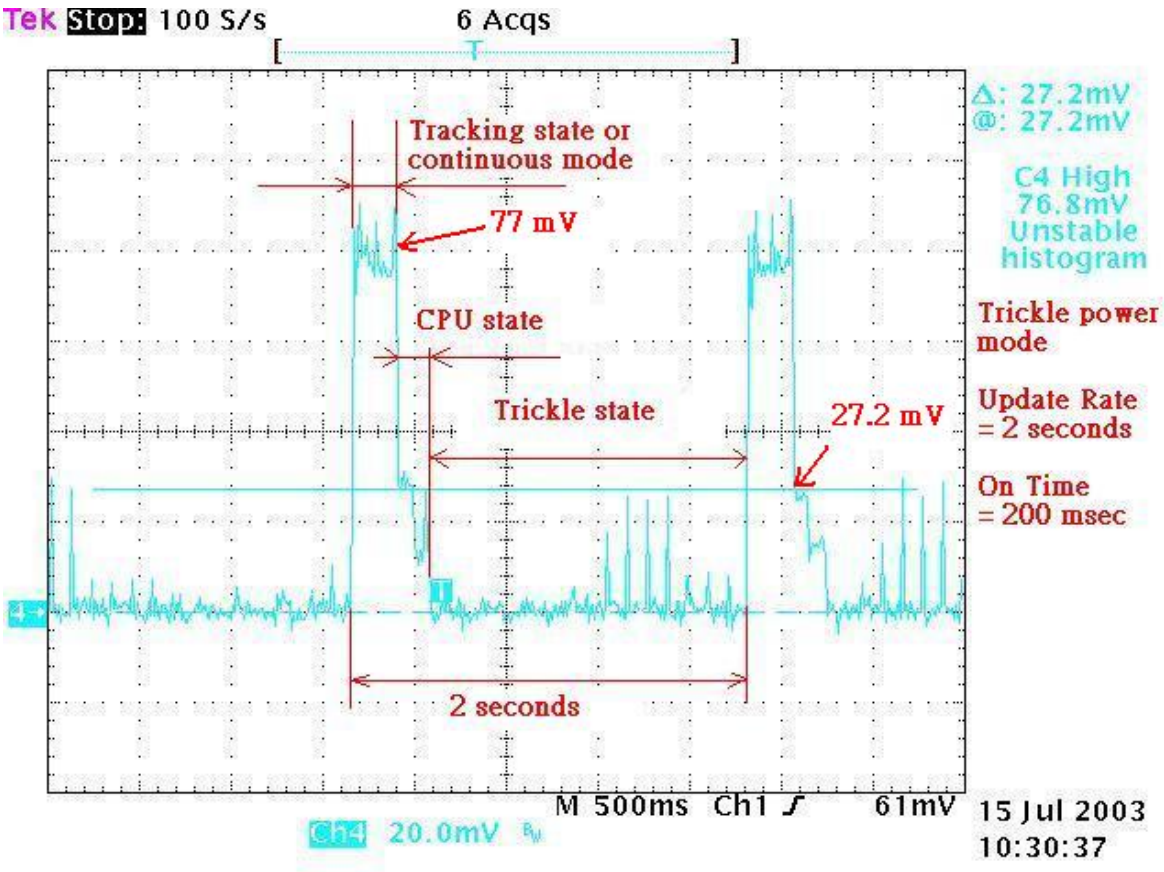


■**Step 4.**

The following figures show the current of EVK with GPS 9547 module and active antenna operated at trickle power mode. The active antenna has a current consumption of 6.4 mA in this example.

I = V / R = 77 mV / 1.1 Ohm ≈ 70 mA

$I_{Active\ antenna}$ ≈ 70 - 63.6 = 6.4 mA



10 Install the USB Driver

<Note>Please do not plug in USB serial cable before installation of USB Driver!

■Step 1.

Insert the software CD in your CD-ROM drive. The Autorun program will display a setup screen as the figure to the right.

Note: You can also start the setup program by running install.exe in the main directory of the CD.

■Step 2.

Please click on the **USB Driver** button for installation. You will see the following picture on your screen.

■Step 3.

You can begin installing the USB driver by click on the **Install** button. Then you can also see the following picture on your screen.

■**Step 4.**

Finally you will click on **OK** and **Exit** buttons to finish installation.

■**Step 5.**

Perform a reboot of PC and then insert the USB serial cable. GMonitor should now be able to detect a new serial port for the USB serial cable.

11 Uninstall the USB Driver

■Step 1.

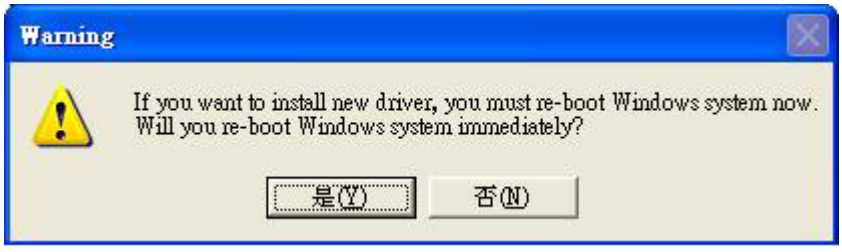
Insert software CD in your CD-ROM drive. Run **Remover.exe** at **E:\USB Driver** (assuming E: is the CD-ROM drive). A dialog box as the figure to the right appears

■Step 2.

A message telling you the driver has been removed appears. Close the message box.

■Step 3.

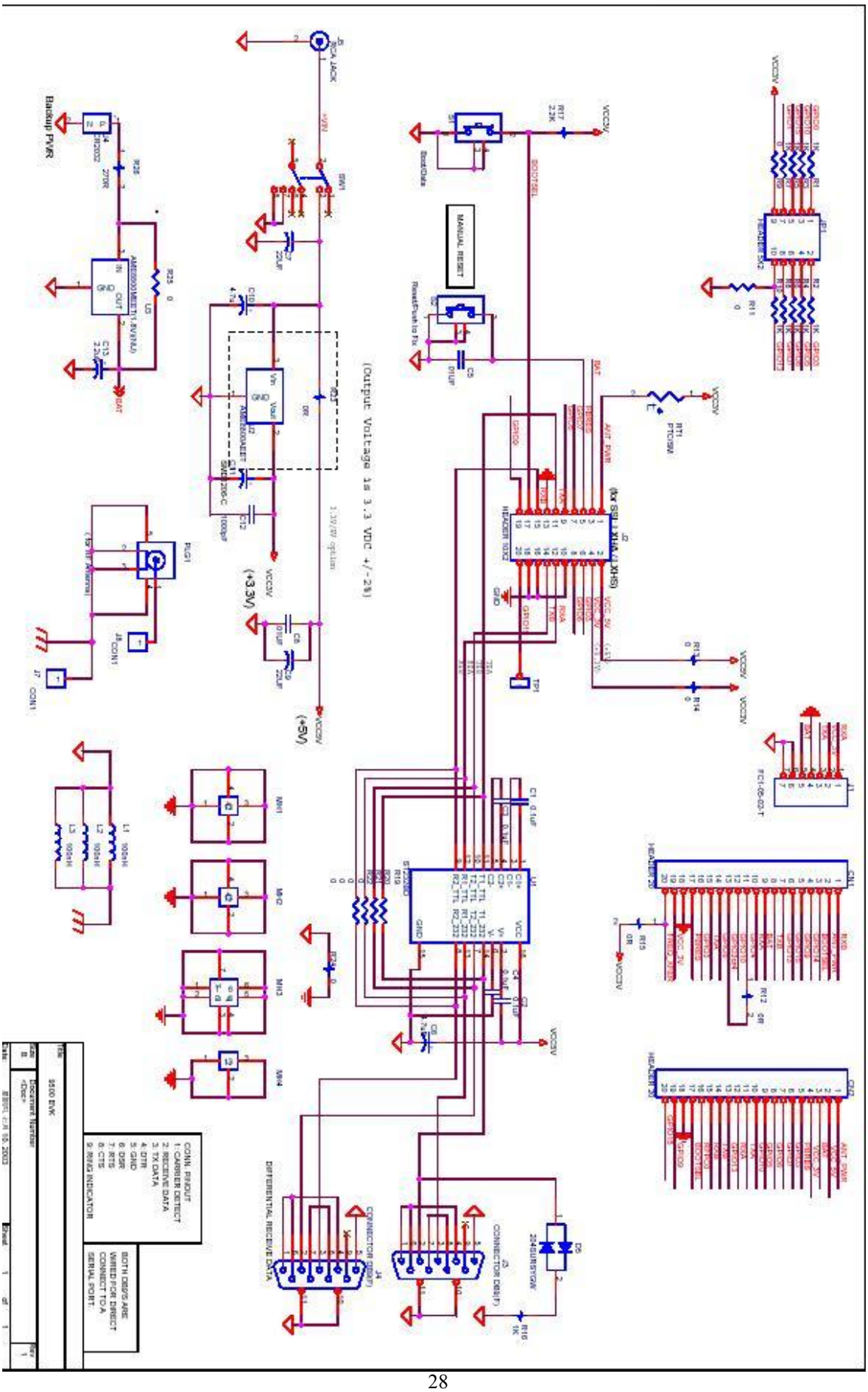
A dialog box appears prompting you to restart your computer. Click "**Yes**" to finish removing the driver and reboot.



Appendix A GPS EVK schematic

You can find this file from CD-ROM.

(Path: \\User Manual\GPS EVK-III\9500EVK_schematic.pdf)


Backup PWR
MANUAL RESET
(Output Voltage is 3.3 VDC +/- 2%)
(+3.3V)
(+5V)
CONN PINOUT
1: CARRIER DETECT
2: RECEIVE DATA
3: TX DATA
4: DTR
5: GND
6: DSR
7: RTS
8: CTS
9: RING INDICATOR
BOTH DB9'S ARE WIRED FOR DIRECT CONNECT TO A SERIAL PORT.

Appendix B Specification of GPS active antenna

Active GPS Antenna

Model: LR9400

Specifications

Performance	
Center Frequency	L1 (1575.42 MHz, +/- 1.023 MHz)
Impedance	50 Ohm
Bandwidth	10 MHz (min)
VSWR	2.0 (max)
Polarization	RHCP (Right Hand Circular Polarization)
Gain Characteristics of Antenna Element	+3 dBic (typical, at zenith) -1 dBic (typical, at 10° elevation)
Axial Ratio	3 dB (max)
LNA Gain	**27 dB (typical, without cable loss)**
Filtering	-30 dB@ 1675MHz (typical) -30 dB@ 1475MHz (typical)
Noise Figure	**< 1.7dB (typical), 2.0 (max)**
Electrical	
Power Requirements	**3V +/- 0.3Vdc for 3V Version** 5V +/- 0.5Vdc for 5V Version
Power Consumption	10 mA (typical), 15 mA (max)
Physical	
Dimensions	42 x 40 x 11 mm
Weight	< 90 grams (including 5 meter cable and connector)

Plastic Color	Black
Mount	Magnetic
Cable	RG-174 type coaxial cable 5 meters long
Connector	BNC, SMA, SMB, MMCX, etc
Environmental	
Operating Temperature	-40°C to +85°C
Storage Temperature	-50°C to +100°C
Humidity	95% non-condensing
Waterproof	100% Waterproof

<Note 1> Accessory of GPS EVK, active antenna operates in 3V. It has a SMA connector for GPS EVK and 3 meters cable length.

<Note 2>Part number of LR9400 is 39000052.

Appendix C The Contents of CD-ROM

Folder	Path or files	Description
Winfast Navigator	WinFast-Nav.EXE	The software supplied by Leadtek applies to demonstration of GPS receiver
GPSMonitor	GMSetup1093.EXE	The software applies to Leadtek's GPS module testing.
Acrobat Reader	Path:\\Acrobat Reader 6.0\Installer\ setup.exe	This is a free software which Adobe company supplied.
USB driver	InstallDriver.exe	This program is for USB installation.
	Remover.exe	This program is for USB uninstallation.
User Manual	GPSMonitor	The folder includes the manual of GPS Monitor software.
	GPS EVK-III	The folder includes the quick start manual, user's technical manual and schematic of GPS EVK.
	GPS module	The folder includes three kinds of manuals about Leadtek 9540, 9543, 9547 GPS module.
Leadtek Products	*.pdf	The folder includes the product guides of Leadtek GPS product.

Leadtek®
We Make Dreams a Reality

Leadtek Research Inc.: 18F, 166, Chien-Yi Rd., Chung Ho, Taipei Hsien, Taiwan (235)
Phone: +886-(0)2 8226 5800 Fax: +886-(0)2 8226 5801
Leadtek U.S.A.: 46721 Fremont Blvd., Fremont, CA94538, U.S.A.
Phone: +510 490 8076 Fax: +510 490 7759
Leadtek Research Europe B.V.： Antennestraat 16 1322 AB, Almere – The Netherlands
Tel:+31(0)36 536 55 78 Fax:+31(0)36 536 22 15
E-mail: service@leadtek.com.tw Home Page: www.leadtek.com.tw