SE873
EVK User Guide

1VV0301214 Rev1

2016-10-24

TELIT
TECHNICAL
DOCUMENTATION

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

NOTICE

While reasonable efforts have been made to ensure the accuracy of this document, Telit assumes no liability resulting from any inaccuracies or omissions in this document, or from use of the information obtained herein. The information in this document has been carefully checked and is believed to be reliable, however no responsibility is assumed for inaccuracies or omissions. Telit reserves the right to make changes to any products described herein and reserves the right to revise this document and to make changes from time to time in content hereof with no obligation to notify any person of revisions or changes. Telit does not assume any liability arising out of the application or use of any product, software, or circuit described herein; neither does it convey license under its patent rights or the rights of others.

It is possible that this publication may contain references to, or information about Telit products (machines and programs), programming, or services that are not announced in your country. Such references or information must not be construed to mean that Telit intends to announce such Telit products, programming, or services in your country.

COPYRIGHTS

This manual and the Telit products described herein may be, include or describe copyrighted Telit material, such as computer programs stored in semiconductor memories or other media. Laws in the Italy and other countries preserve for Telit and its licensors certain exclusive rights for copyrighted material, including the exclusive right to copy, reproduce in any form, distribute and make derivative works of the copyrighted material. Accordingly, any copyrighted material of Telit and its licensors contained herein or in the Telit products described in this manual may not be copied, reproduced, distributed, merged or modified in any manner without the express written permission of Telit. Furthermore, the purchase of Telit products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Telit, as arises by operation of law in the sale of a product.

COMPUTER SOFTWARE COPYRIGHTS

The Telit and Third Party supplied Software (SW) products described in this instruction manual may include copyrighted Telit and other Third Party supplied computer programs stored in semiconductor memories or other media. Laws in the Italy and other countries preserve for Telit and other Third Party supplied SW certain exclusive rights for copyrighted computer programs, including the exclusive right to copy or reproduce in any form the copyrighted computer program. Accordingly, any copyrighted Telit or other Third Party supplied SW computer programs contained in the Telit products described in this manual may not be copied (reverse engineered) or reproduced in any manner without the express written permission of Telit or the Third Party SW supplier. Furthermore, the purchase of Telit products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Telit or other Third Party supplied SW, except for the normal non-exclusive, royalty-free license to use that arises by operation of law in the sale of a product.

USAGE AND DISCLOSURE RESTRICTIONS

I. License Agreements

The software described in this document is the property of Telit and its licensors. It is furnished by express license agreement only and may be used only in accordance with the terms of such an agreement.

II. Copyrighted Materials

Software and documentation are copyrighted materials. Making unauthorized copies is prohibited by law. No part of the software or documentation may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, without prior written permission of Telit

III. High Risk Materials

Components, units, or third-party products used in the product described herein are NOT fault-tolerant and are NOT designed, manufactured, or intended for use as on-line control equipment in the following hazardous environments requiring fail-safe controls: the operation of Nuclear Facilities, Aircraft Navigation or Aircraft Communication Systems, Air Traffic Control, Life Support, or Weapons Systems (High Risk Activities"). Telit and its supplier(s) specifically disclaim any expressed or implied warranty of fitness for such High Risk Activities.

IV. Trademarks

TELIT and the Stylized T Logo are registered in the Trademark Office. All other product or service names are the property of their respective owners.

V. Third Party Rights

The software may include Third Party Right software. In this case you agree to comply with all terms and conditions imposed on you in respect of such separate software. In addition to Third Party Terms, the disclaimer of warranty and limitation of liability provisions in this License shall apply to the Third Party Right software.

TELIT HEREBY DISCLAIMS ANY AND ALL WARRANTIES EXPRESS OR IMPLIED FROM ANY THIRD PARTIES REGARDING ANY SEPARATE FILES, ANY THIRD PARTY MATERIALS INCLUDED IN THE SOFTWARE, ANY THIRD PARTY MATERIALS FROM WHICH THE SOFTWARE IS DERIVED (COLLECTIVELY “OTHER CODE”), AND THE USE OF ANY OR ALL THE OTHER CODE IN CONNECTION WITH THE SOFTWARE, INCLUDING (WITHOUT LIMITATION) ANY WARRANTIES OF SATISFACTORY QUALITY OR FITNESS FOR A PARTICULAR PURPOSE.

NO THIRD PARTY LICENSORS OF OTHER CODE SHALL HAVE ANY LIABILITY FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING WITHOUT LIMITATION LOST PROFITS), HOWEVER CAUSED AND WHETHER MADE UNDER CONTRACT, TORT OR OTHER LEGAL THEORY, ARISING IN ANY WAY OUT OF THE USE OR DISTRIBUTION OF THE OTHER CODE OR THE EXERCISE OF ANY RIGHTS GRANTED UNDER EITHER OR BOTH THIS LICENSE AND THE LEGAL TERMS APPLICABLE TO ANY SEPARATE FILES, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

PRODUCT APPLICABILITY TABLE

PRODUCT
SE873
SE873Q5

Table 0-1 Product Applicability Table

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

1.1 Purpose

The scope of this manual is provide product information for the SE873 Evaluation Kit (EVK).

1.2 Contact and Support Information

For general contact, technical support services, technical questions, and to report documentation errors contact Telit Technical Support at:

- TS-EMEA@telit.com
- TS-AMERICAS@telit.com
- TS-APAC@telit.com

Alternatively, use:
http://www.telit.com/support

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:
http://www.telit.com

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.3 Text Conventions

Dates are in ISO 8601 format, i.e. YYYY-MM-DD.

Symbol	Description
	Danger – This information MUST be followed or catastrophic equipment failure and/or bodily injury may occur.
	Caution or Warning – This is an important point about integrating the product into a system. If this information is disregarded, the product or system may malfunction or fail.
	Tip – This is advice or suggestion that may be useful when integrating the product.

1.4 Related Documents

- SE873 Product User Guide

1.4.1 Related Documents Requiring a Non-Disclosure Agreement

- None

2 Evaluation Kit Requirements

To use the SE873 Evaluation Kit (EVK), you will need:

- USB Drivers (on the included flash drive)
- SiRFLive 2.07P4 or later (on the included flash drive)
- A PC with a USB port that fulfills the minimum software requirements:
- Windows XP or later
- NET Framework 2.0 (automatically installed by the SiRFLive package if necessary - internet connection is required).

3 Evaluation Kit (EVK) Description

3.1 EVK Contents

Figure 3-1 EVK contents

Note: The antenna is included but not visible under the ground plane.

EVK Contents
Plastic case
USB cable
Multi-constellation antenna
Ground Plane
USB drive with software and documentation
Evaluation Kit

Table 3-1 EVK Contents

3.2 Evaluation Unit

Figure 3-2 SE873 Evaluation Unit

3.3 SE873 Module

3.3.1 SE873 Module variants

The SE873 includes a linear power supply.

The SE873Q5 includes a Switching Mode power supply which reduces power consumption.

Figure 3-3 SE873 Module

3.4 Evaluation Board Picture

Figure 3-4 SE873 Evaluation Board

3.5 Evaluation Board Layout

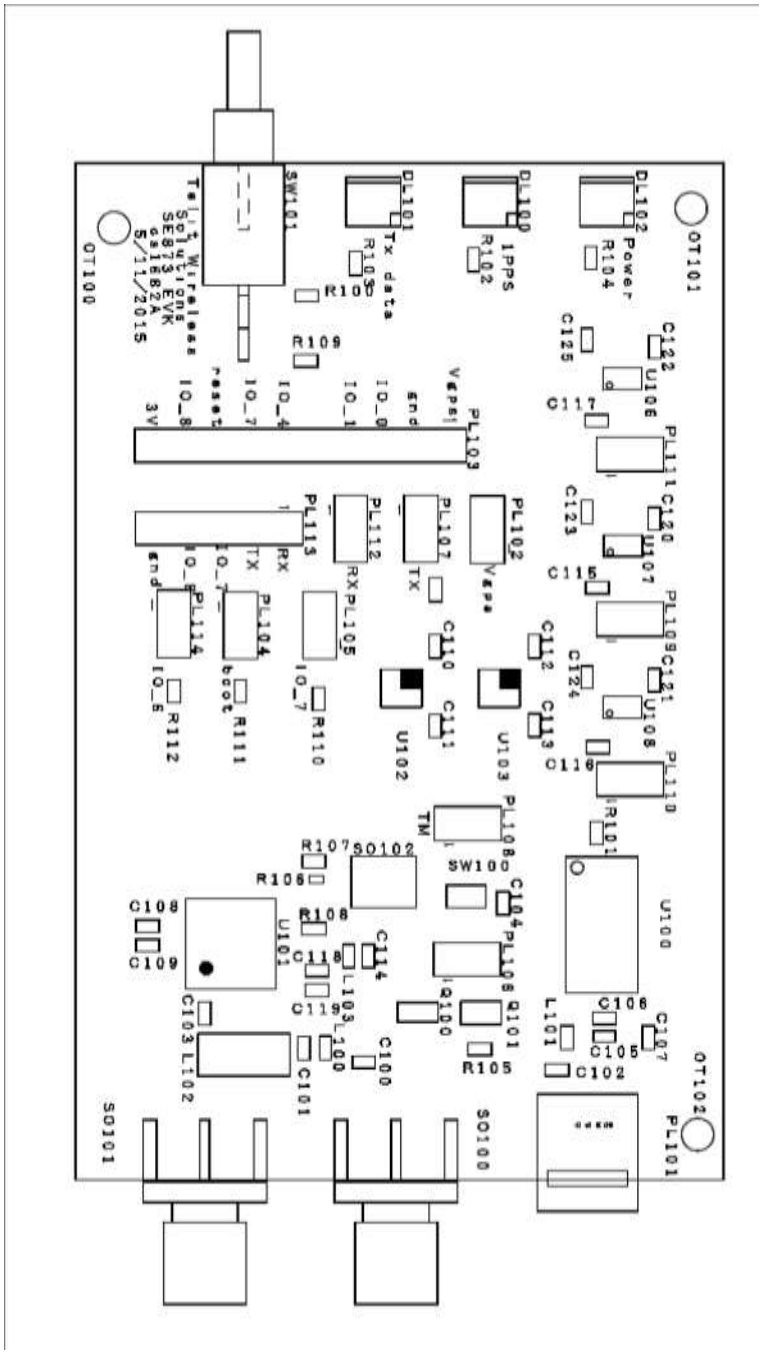

Figure 3-5 SE873 Evaluation Board Layout

ID	Description
DL102	LED - System ON
DL100	LED - 1PPS
DL101	LED - TX data
SW101	On/off switch – 1.8 V to module On/Off pin
PL101	USB connector – Power, ground, Tx, and Rx
S0100	SMA connector – 1PPS
S0101	SMA connector - RF input
PL102	1.8 V module power (current measurement)
PL104	Boot pin to 1.8 V
PL105	GPIO7 to ground
PL106	3.3 V active antenna power (remove for passive antenna)
PL107	TX output
PL108	1PPS output
PL109	1.8 V regulator enable
PL110	3.3 V regulator enable
PL111	1.8 V module regulator enable
PL112	RX input
PL114	GPIO6 pin to 1.8 V

Table 3-2 SE873 Evaluation Board Components

3.6 Evaluation Board Schematic Diagram

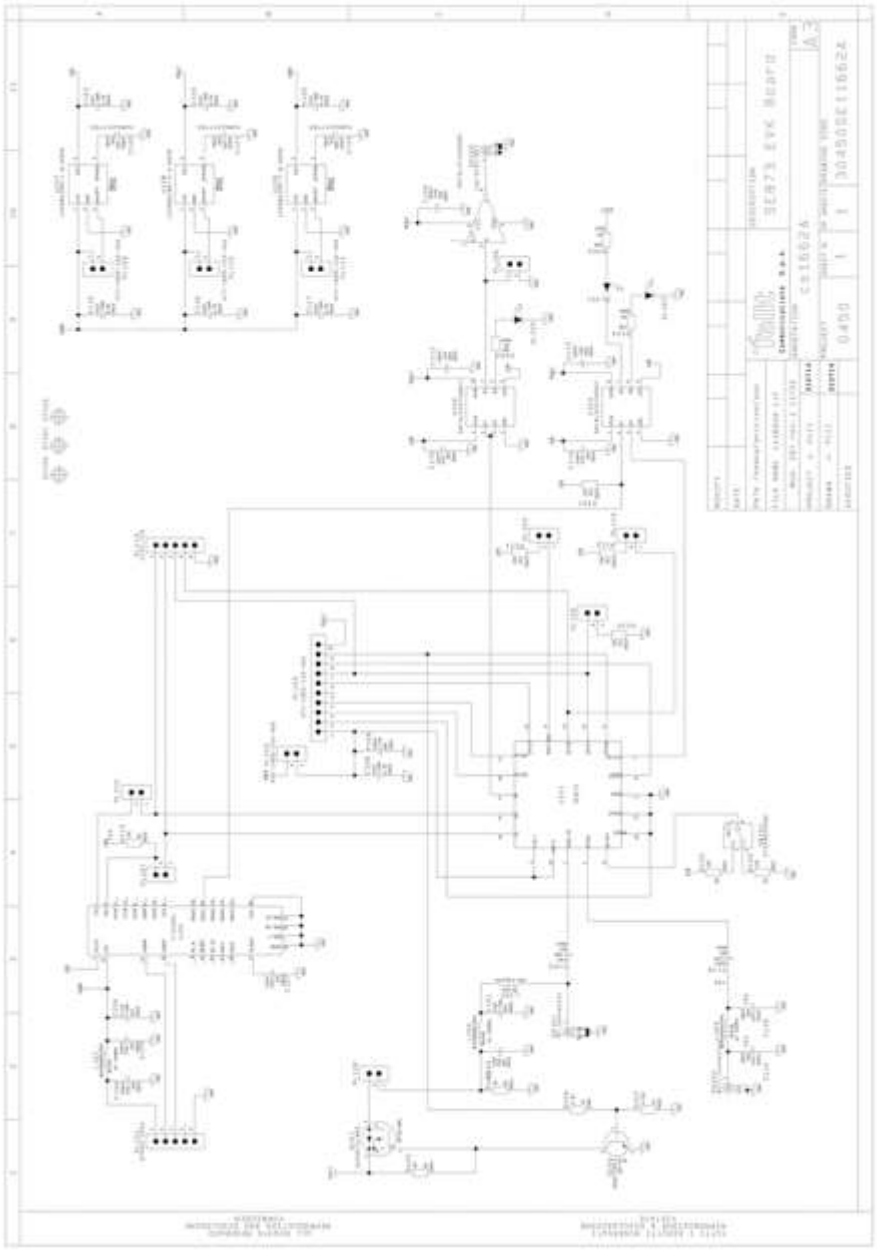

Figure 3-6 SE873 Evaluation Board Schematic Diagram

4 Evaluation Kit Setup

4.1 Installing the USB Drivers

Before connecting the SE873 Evaluation Kit, install the necessary USB drivers.

- Double-click the USB driver executable CDM v2.12.00 WHQL Certified.exe, and follow the directions to install the USB drivers.

Figure 4-1 Hardware Installation

- Click “Continue Anyway” to install the USB COM port driver
- When the EVK board is connected to a personal computer USB port, the driver will create a COM port.
- Use the Windows “Device Manager” to check the identification of the new COM port.

  This port identification is necessary for EVK tools to connect to the evaluation kit.

Figure 4-2 Identify new COM port

- In this example, the COM port is assigned as COM5

4.2 Installing SiRFLive

Minimum PC requirements:

- Pentium CPU 2 GHz
- 1 GB of RAM
- 100 MB hard drive

Recommended:

- 2 GB of RAM
- 1280 x 1024 screen resolution

Double-click the SiRFLiveInstaller_MKTG_Lite.msi file to install the SiRFLive program, then follow the installer directions until finished.

It is recommended that SiRFLive be installed to the default location – C:\CSR\SiRFLive.

5 SE873 Evaluation Board Operation

1. Power will be applied to the SE873 module when the USB interface is connected to a USB port on a personal computer. When the EVK On-Off switch is turned ON, the module ON_OFF pin will be powered up and the module will begin operation.

2. Connect the provided GNSS Active Antenna.

NOTE: The evaluation kit supplies 3.3V to the antenna. For a passive antenna, jumper PL106 must be removed.

3. Place the antenna face up in a location with a clear view of open sky.

4. Use SiRFLive or TelitView to send commands to and display output from the module.

6 Using SiRFLive

6.1 Starting SiRFLive

1. Connect Power and Antenna to the EVK.
   See Section **Error! Reference source not found. Error! Reference source not und.**.

2. Turn on the EVK Power switch (up).

3. Launch the SiRFLive application.

4. Connection Settings window: Select the Receiver. This is where you select the COM port that was previously created by the USB driver. See Section **Error! Reference ource not found. Error! Reference source not found.**.
   Use the **Receiver** drop-down box**.**

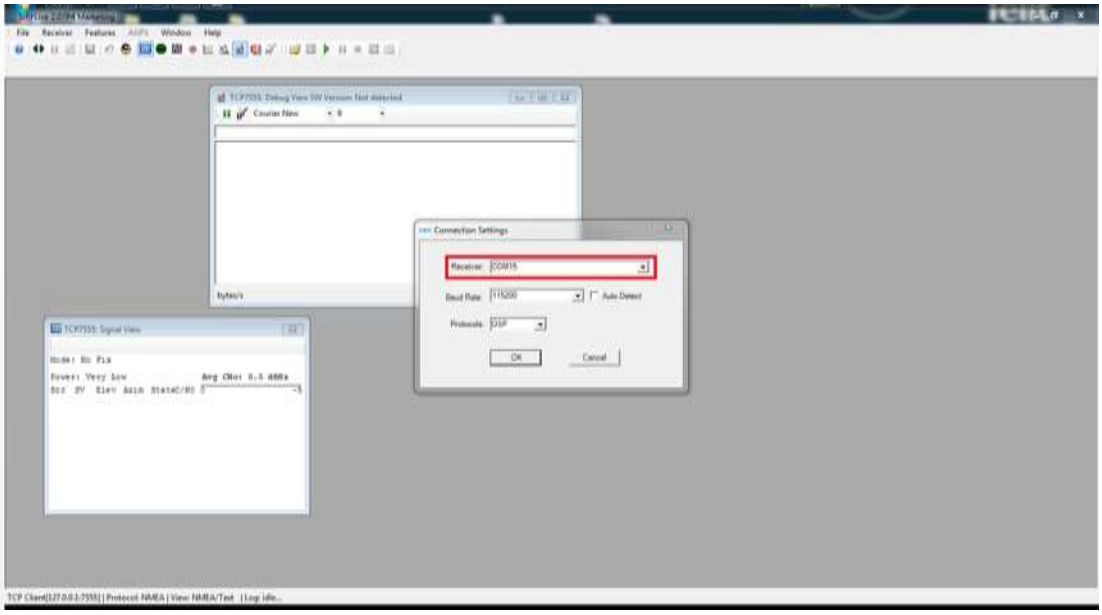

Figure 6-1 Connection settings window

5. If the default **Baud Rate** is 115200 and **Protocol** is OSP on your EVK, leave those boxes with their values as presented.
   If the default **Baud Rate** is 9600 and **Protocol** is NMEA on your EVK, change those boxes to match.
   If you have changed the receiver's defaults, select them using the **Baud Rate** and **Protocol** drop-down boxes.
6. Click **OK**. The remainder of these screen captures will show NMEA protocol. OSP will present somewhat different data.

7. If necessary, click Receiver, then Connect on the menu bar.

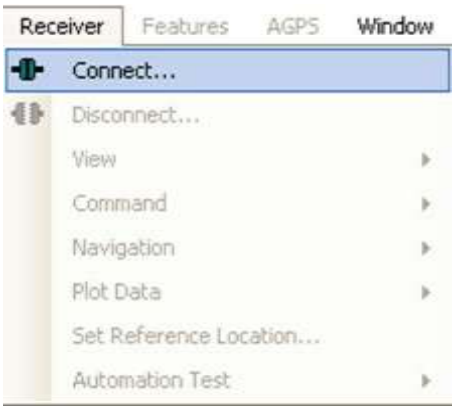

Figure 6-2 Click Receiver, then Connect on the menu bar

8. The SE873 defaults to a power-saving mode called SmartGNSS2, so you may see the GLONASS satellites disappear from the Radar View. This is normal. If you wish to command the full-time use of GLONASS as well as GPS, use the following procedure:

    a. Click Receiver, Command, then Switch Comm Settings.

Figure 6-3 Switch Comm Settings window

    b. Verify that **Switch Protocol (to OSP)** and **Baud Rate** of **115200** are selected as shown above.

    c. Click **Set**. The receiver and display will both switch to OSP protocol at 115,200 bps.

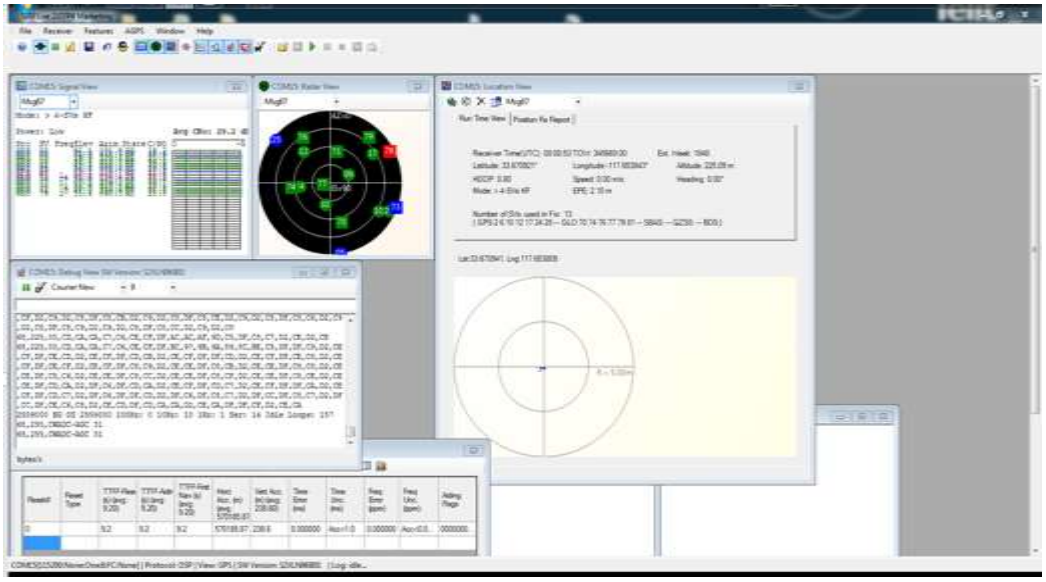

Figure 6-4 The OSP protocol window

d. Click Features, Power Mode, **then** Advanced.

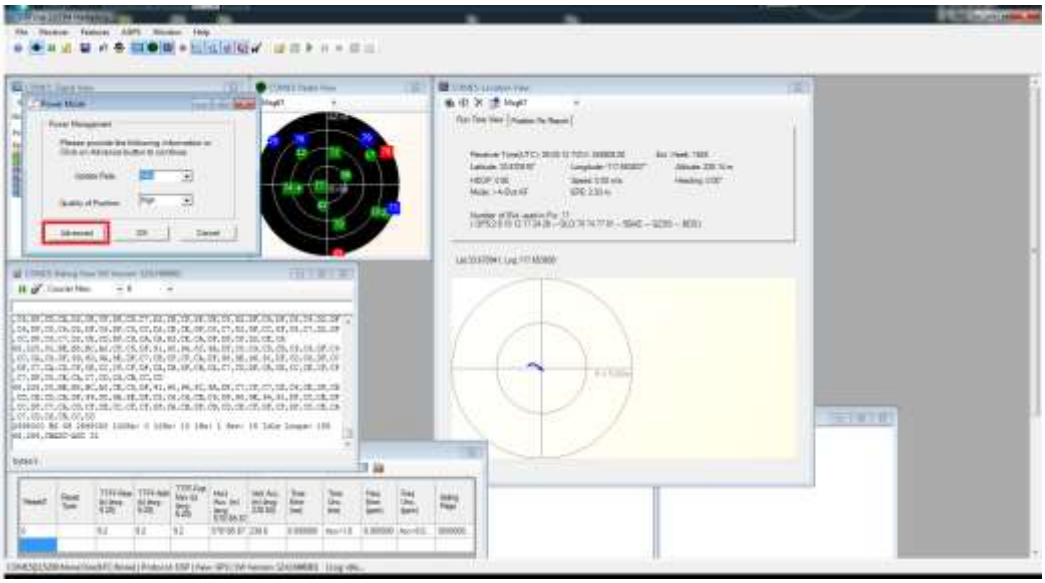

Figure 6-5 Features, Power Mode window

e. Verify that **Full Power** is selected, and click OK.

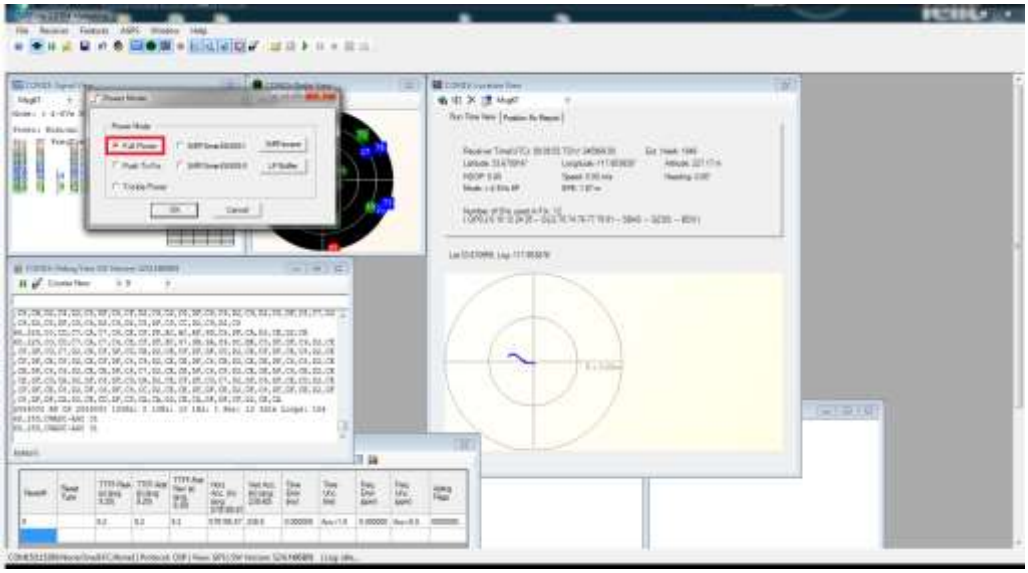

Figure 6-6 Full Power Mode window

f. To return to the NMEA display, click **Receiver**, **Command**, **Switch Comm** Settings

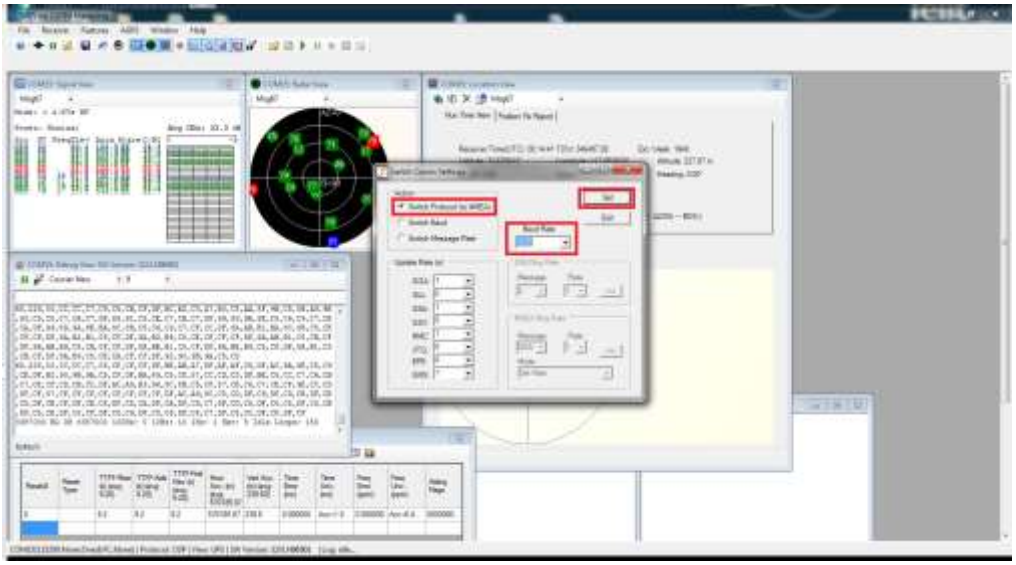

Figure 6-7 Verify NMEA window

g. Verify **NMEA** at **9600** bps (or your desired rate), and click **Set**.

9. There are many additional functions available in SiRFLive. Please refer to the built-in User Manual for further details. Click **Help** in the Menu Bar, **then User Manual.**

6.2 SiRFLive Windows

After a successful connection with the receiver is established, the default SiRFLive windows should be arranged and become filled with data.

If not all the default windows are arranged or opened, under the Main Menu Bar,

Click **Window**, **Restore Layout**, and **Default**.

6.2.1 Signal View

 (Tool Bar icon)

Type of Fix Satellite Data

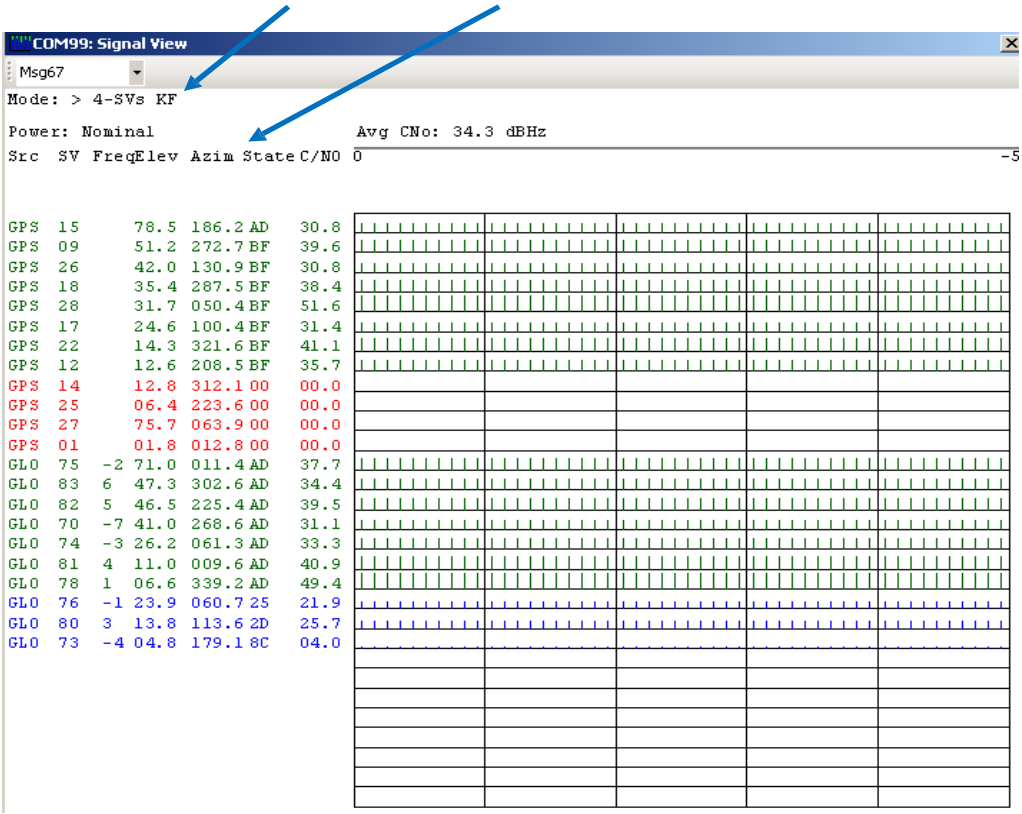

Figure 6-8 Satellite signal levels

6.2.2 Radar View

 (Tool Bar icon)

Red	$C/N_0 = 0$
Blue	$C/N_0 \neq 0$ and not used in the navigation solution
Green	$C/N_0 \neq 0$ and used in the navigation solution
Skyblue	SBAS
Circle	GPS
Square	GLONASS
Orange	ABP is being used to acquire satellites
Purple	CGEE is being used
Pink	SGEE is being used

Figure 6-9 Satellites by azimuth and elevation

6.2.3 Debug View


(Tool Bar icon)

Displays the messages incoming from the receiver

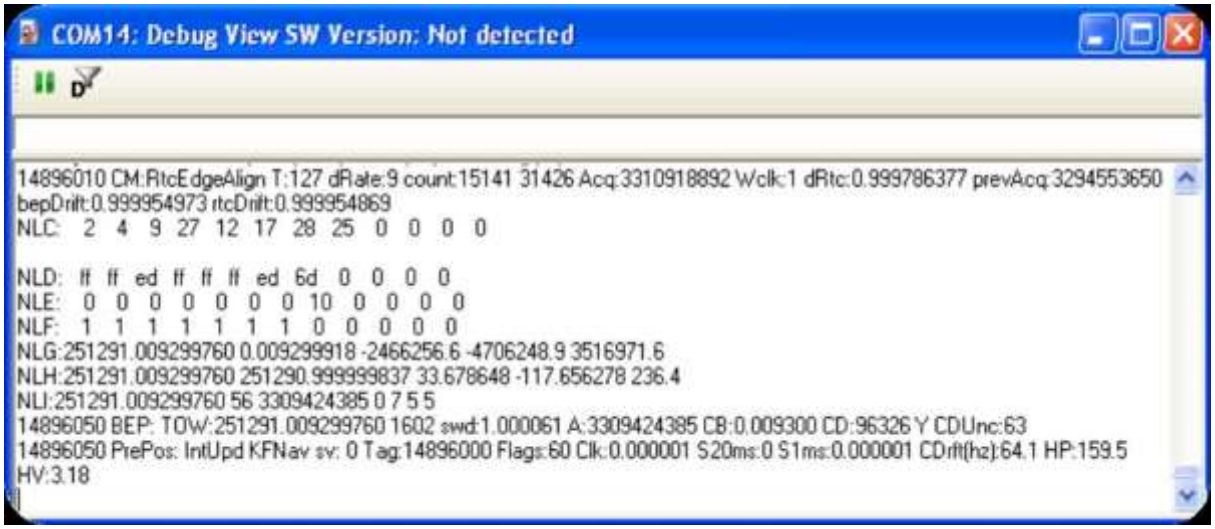

Figure 6-10 Receiver Messages (OSP)

6.2.4 Location View

 (Tool Bar icon)

 Map position button requires Internet access.

Map Position Configuration Clear Data Set Reference Location

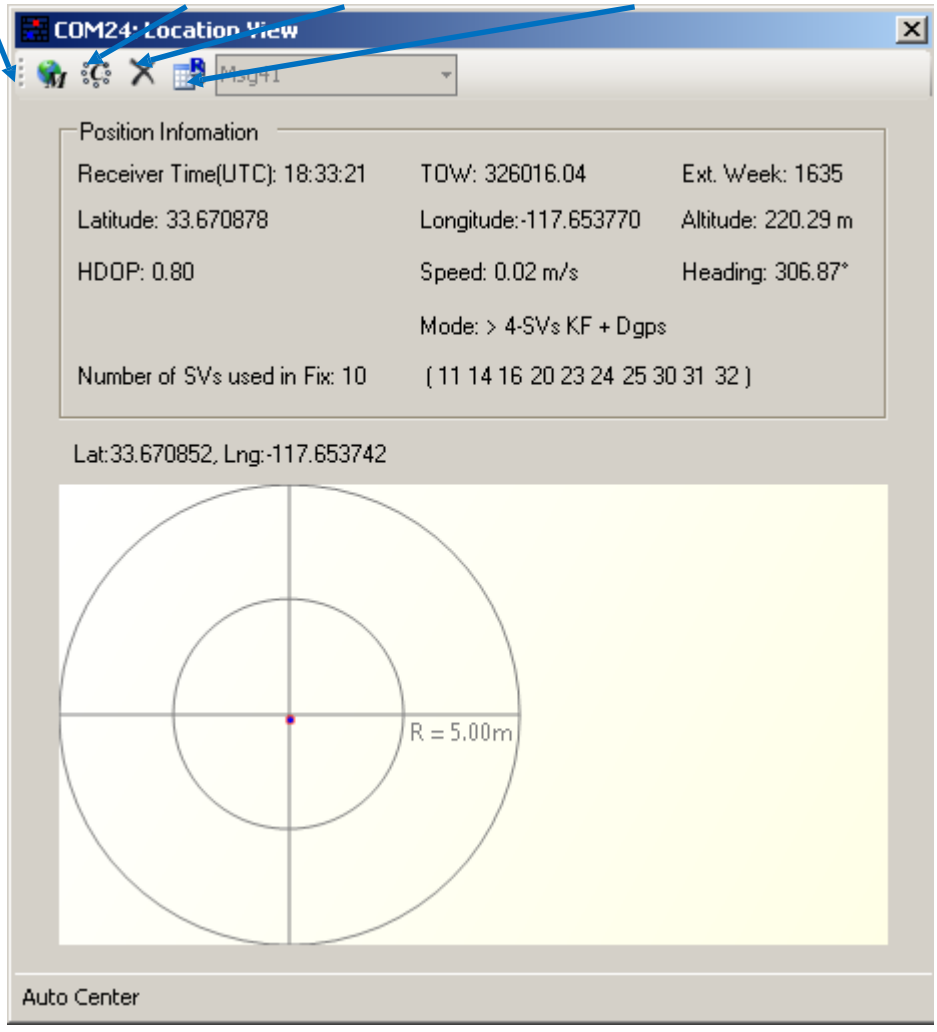

Figure 6-11 Details of the position fix

6.3 Logging Data

 (Main Tool Bar icon)

SiRFLive can record the current message stream (OSP or NMEA) into a log file.

From the Menu Bar, click **File, Log File, Start** or click the **Log File** icon on the Tool Bar.

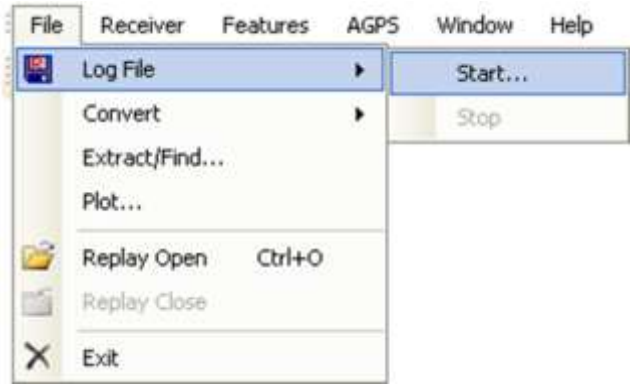

Figure 6-12 Log File command

Enter the desired log file path and filename in the **Log File Path** box, as shown below, then click **Start** to begin logging.

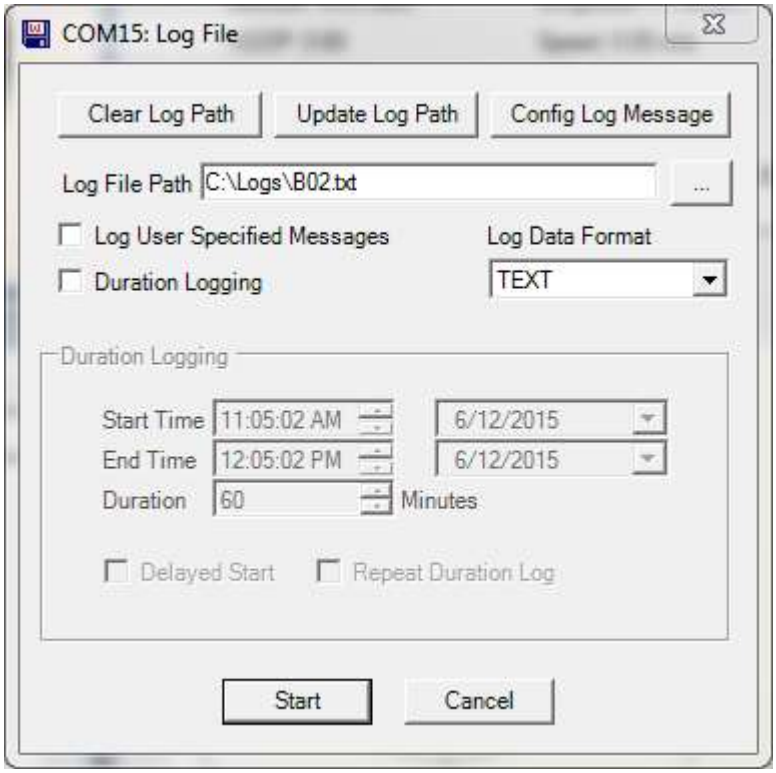

Figure 6-13 Enter the filename to specify the log file

6.4 Receiver Commands

Many of the receiver commands can be accessed through the Menu Bar under **Receiver**, **Command**. There are also equivalent shortcuts on the Tool Bar for frequently used commands

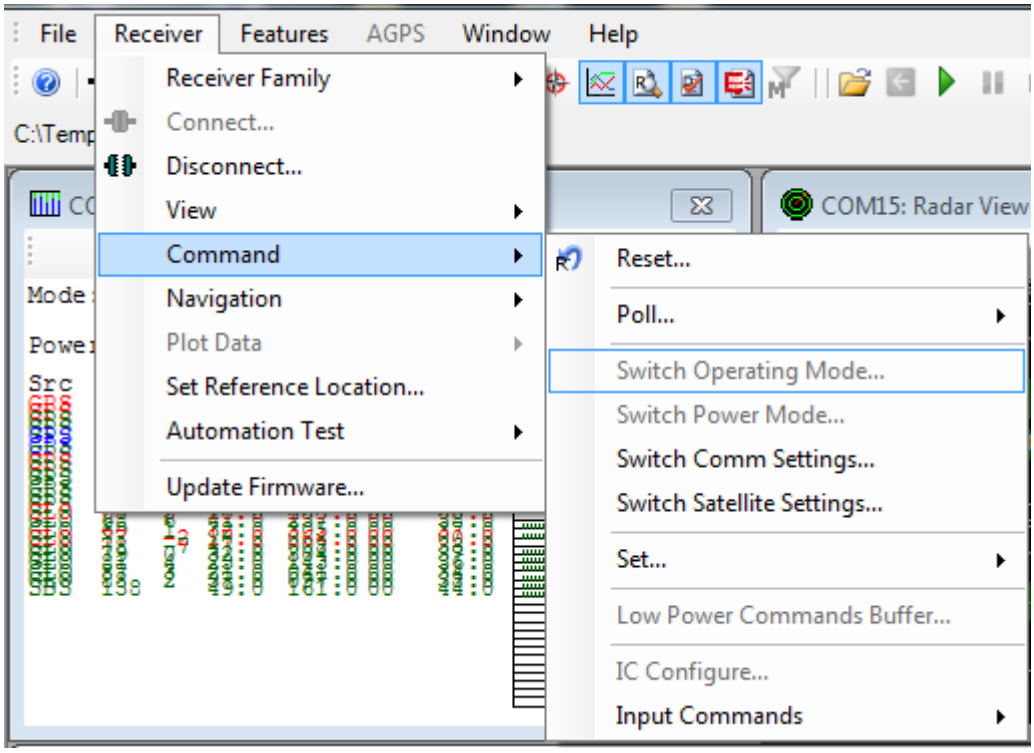

Figure 6-14 Receiver commands

Some receiver commands are available in One Socket Protocol (OSP) only.

6.4.1 Reset commands

 (Tool Bar icon)

Select from the Menu Bar **Receiver**, **Command**, **Reset**

or click the **Reset** icon on the Tool Bar.

Resets are used to measure the TTFF of the receiver. The TTFF/Nav Accuracy window conveniently displays the TTFF in seconds and Navigation accuracy based on the Reference Location.

Reference Location allows the user to change the position used as the reference. This helps determine position accuracy in conjunction with Time-To-First-Fix values.

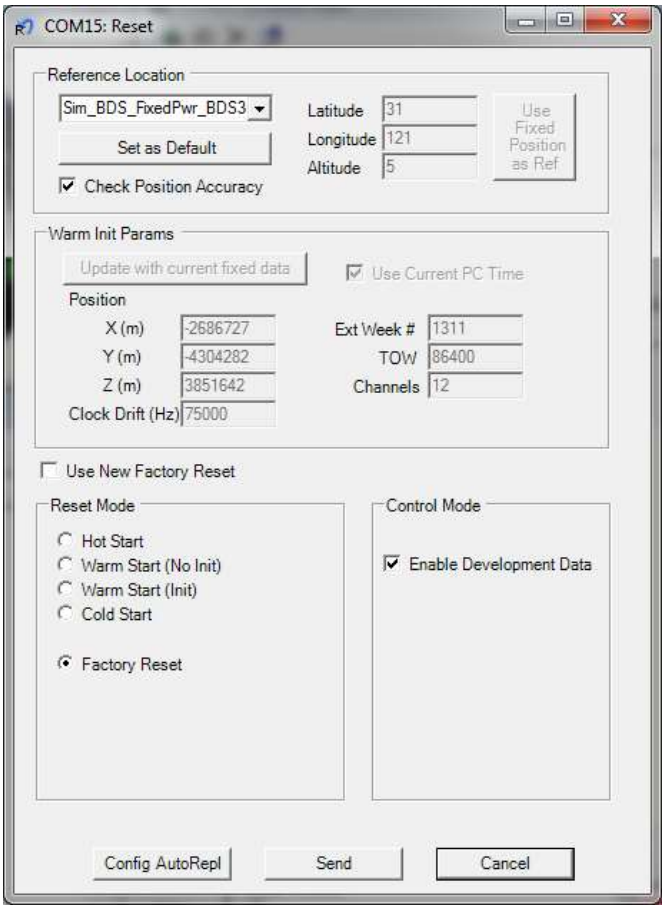

Figure 6-15 Reset Window

.

6.4.2 Switching Protocols

On the Menu Bar, select **Receiver, Command, Switch COMM Settings**.

Click **Set** to apply settings.

OSP has many commands that are not available in NMEA. Therefore, switching to OSP is recommended for testing purposes.

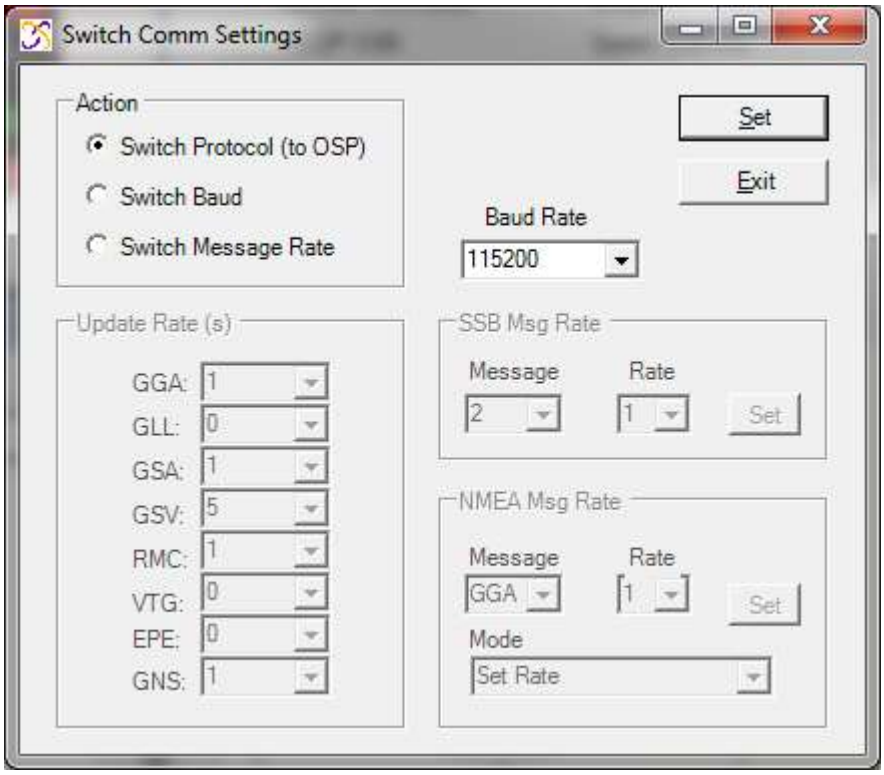

Figure 6-16 Switching to OSP protocol with its default 115200 baud rate

6.4.3 Setting the Receiver Type

SiRFLive will normally auto-detect the connected chipset, but if not, click **Receiver**, **Receiver Family**, then the desired family.

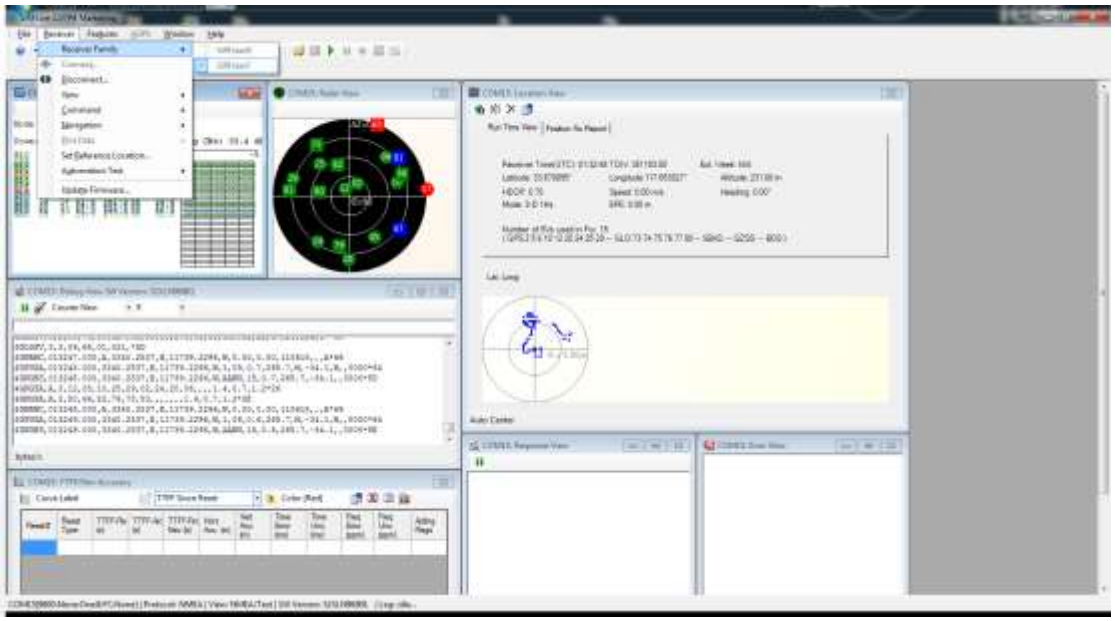

Figure 6-17 Click Receiver, Receiver Family, then the desired family

6.4.4 Enabling 5Hz Update

First, set the baud rate high enough so that characters are not dropped. The default rates (9600 for NMEA and 115.200 for OSP) may be too low depending on the configured message set.

Through the SiRFLive Menu Bar, click **Receiver, Navigation, Set 5Hz Nav** and select **Enable 5Hz Nav**.

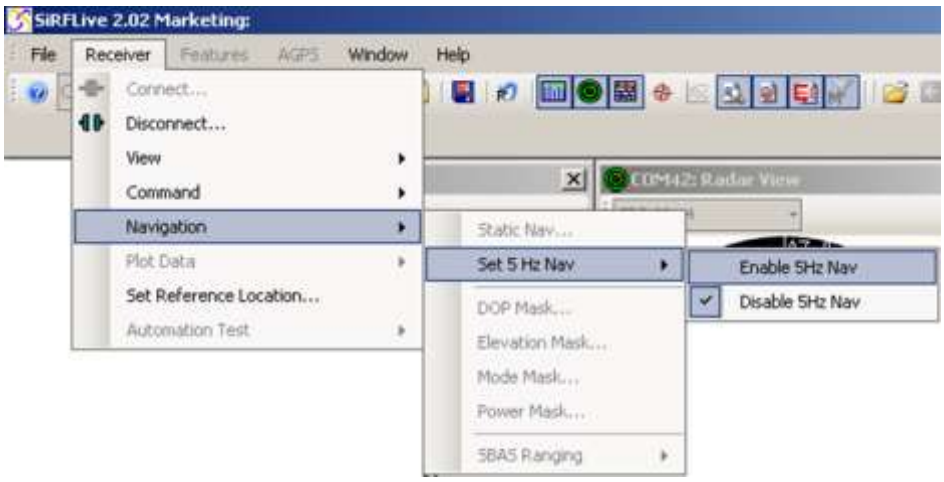

Figure 6-18 Enable 5Hz Nav command

The **Enable 5Hz Nav** command in SiRFLive sends the following OSP:

A0 A2 00 0E 88 00 00 04 04 00 00 00 00 00 00 00 0F 02 00 A1 B0 B3

The **Disable 5Hz Nav** command in SiRFLive sends the following OSP:

A0 A2 00 0E 88 00 00 04 00 00 00 00 00 00 00 00 0F 02 00 9D B0 B3

6.4.5 OSP MID 136 - Mode Control Command

Name	Bytes	Binary (Hex)		Unit	Description
		Scale	Example		
Message ID	1 U		88		Decimal 136
Reserved	2 U		0000		Reserved
Degraded Mode	1 U		01		Controls use of 2-SV and 1-SV solutions
PositionCalc Mode	1 U		01		xxxx xxx0 = ABP, OFF xxxx xxx1 = ABP, ON xxxx xx0x = Reverse EE OFF xxxx xx1x = Reverse EE ON xxxx x0xx = 5Hz nav update OFF xxxx x1xx = 5Hz nav update ON xxxx 0xxx = SBAS Ranging use OFF xxxx 1xxx = SBAS Ranging use ON
Reserved	1 U		00		Reserved
Altitude	2 S		0000	meters	User specified altitude, range - 1,000 to 10,000
Alt Hold Mode	1 U		00		Controls use of 3-SV solution
Alt Hold Source	1 U		00		0 = Use last computed altitude 1 = User user-input altitude
Reserved	1 U		00		Reserved
DegradedTime Out	1 U		05	sec	0 = disable degraded mode, 1 to 120 seconds degraded mode time limit
DR Time Out	1 U		02	sec	0 = disable dead reckoning, 1 to 120 seconds dead reckoning mode time limit
Measurement and Track Smoothing	1 U		00000011		xxxxxxx0 = disable track smoothing xxxxxxx1 = enable track smoothing xxxxxx0x = use raw measurements xxxxxx1x = use smooth measurements

Table 6-1 MID 136 - Mode Control command

7 Updating Firmware with SiRFLive

7.1 Flashing Requirements

- Personal Computer with a USB/COM port running SiRFLive

Firmware file

7.2 Flashing Instructions

Click on **Receiver**, **Update Firmware** from the Menu Bar.

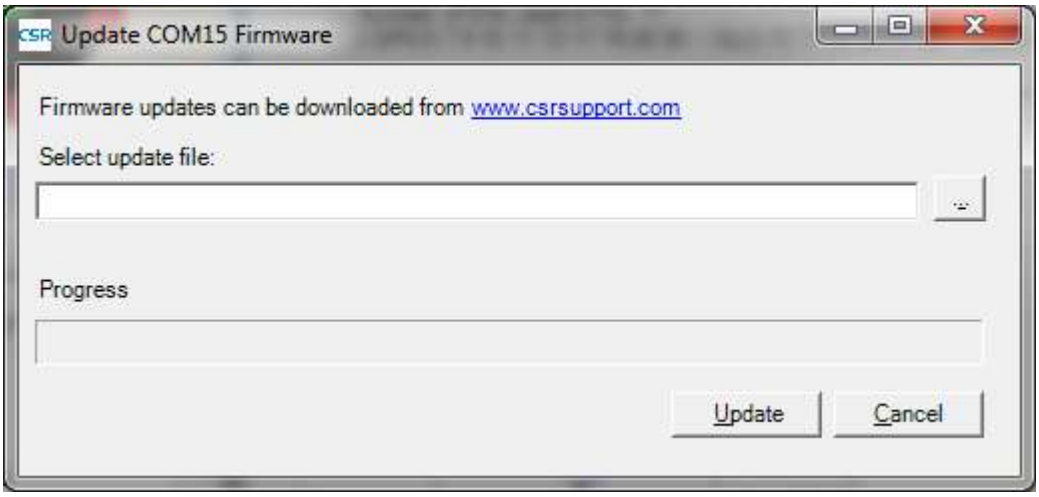

Figure 7-1 Firmware file selection

Enter the filename or browse to the firmware file.

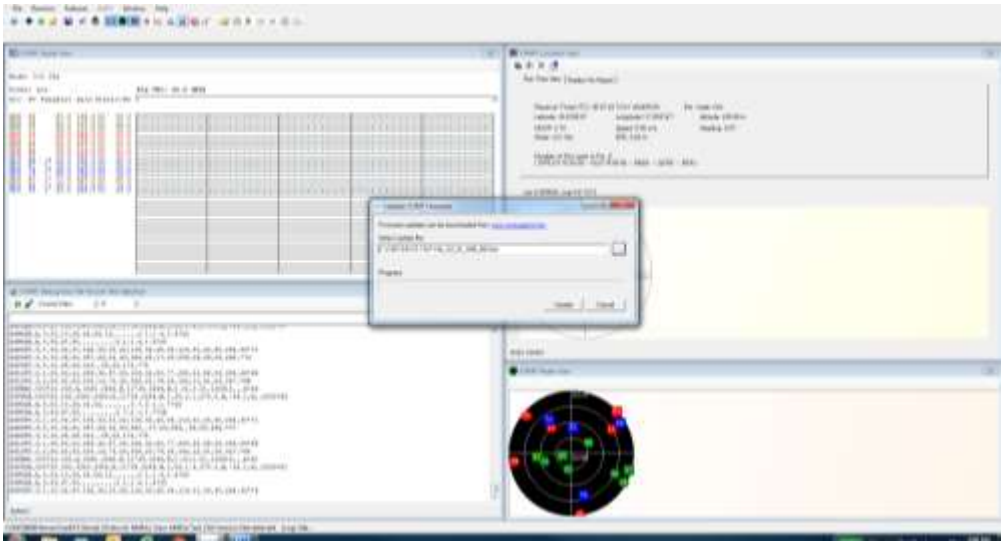

Figure 7-2 Select Firmware file

Click **Update**.

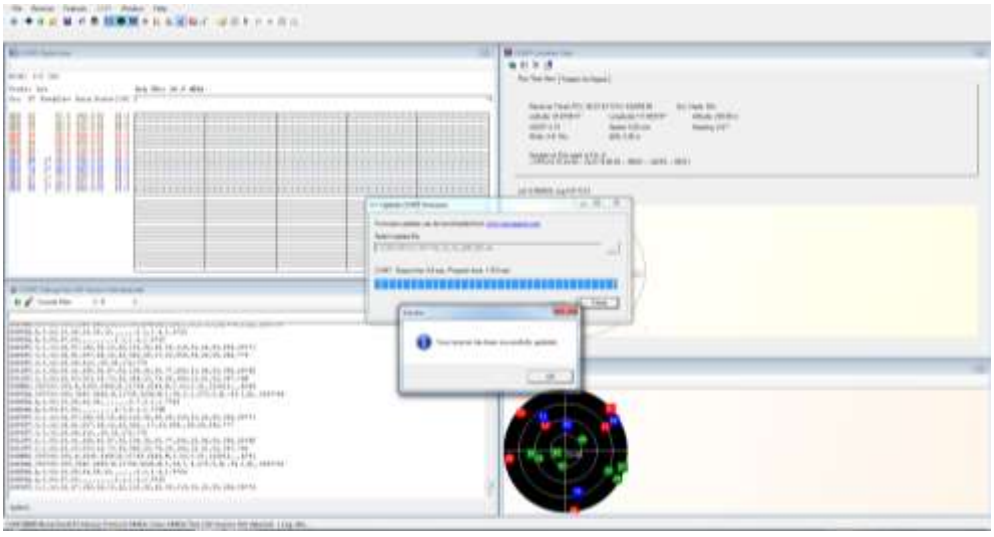

Figure 7-3 Successful firmware installation

The new firmware will be installed, and the receiver will begin operation.

8 Software Interface

The host serial I/O port (UART, I^2C, or SPI) supports full duplex communication between the receiver and the user.

The default UART configuration is: NMEA, 9600 bps, 8 data bits, no parity, and 1 stop bit.

Two protocols are available for data output and command input:

- NMEA-0183 V4.10
- SiRF One Socket Protocol (OSP)

More information regarding the software interface can be found in the Telit CSR Software User Guide. Access to this document requires a Non-Disclosure Agreement (NDA) with Telit.

8.1 NMEA Output Messages

Defaults:

- NMEA-0183
- 1 Hz fix rate. Maximum is 5 Hz.
- Message Set

Standard Messages

Message ID	Description	Frequency
RMC	GNSS Recommended minimum navigation data	1
GGA	GNSS position fix data	1
GSA	GNSS Dilution of Precision (DOP) and active satellites	1
GSV	GNSS satellites in view.	1 / 5
Note: Multiple GSA and GSV messages may be output per cycle.		

Table 8-1 Default NMEA Output Messages

The following messages can be enabled by command:

Message ID	Description
GLL	Geographic Position – Latitude & Longitude
GNS	GNSS Fix Data
VTG	Course Over Ground & Ground Speed

Table 8-2 Available Messages

Talker ID	Constellation
GA	Galileo
GB	BeiDou
GL	GLONASS
GP	GPS
GN	Solutions using multiple constellations

Table 8-3 NMEA Talker IDs

Proprietary Messages

The receiver can issue several proprietary NMEA output messages ($PSRF) which report additional receiver data and status information.

8.2 NMEA Input Commands

The receiver uses NMEA proprietary messages for commands and command responses. This interface provides configuration and control over selected firmware features and operational properties of the module.

The format of a command is:

$<command-ID>[,<parameters>]*<cr><lf>

Commands are NMEA proprietary format and begin with “$PSRF”.

Parameters, if present, are comma-delimited as specified in the NMEA

8.3 One Socket Protocol (OSP) Output Messages

SiRF One Socket Protocol (OSP) is supported. This is an extension of the existing SiRF Binary protocol. The following messages are output once per second:

- MID 2
- MID 3
- MID 4
- MID 7
- MID 9
- MID 41
- MID 64 SUB ID 2 (One message for each satellite being tracked).
- MID 138

9 DOCUMENT HISTORY

Revision	Date	Changes
0	2015-07-29	First Issue
1	2016-10-21	Added SE873Q5

SUPPORT INQUIRIES

Link to **www.telit.com** and contact our technical support team for any questions related to technical issues.

www.telit.com

Telit Communications S.p.A.
Via Stazione di Prosecco, 5/B
I-34010 Sgonico (Trieste), Italy

Telit IoT Platforms LLC
5300 Broken Sound Blvd, Suite 150
Boca Raton, FL 33487, USA

Telit Wireless Solutions Inc.
3131 RDU Center Drive, Suite 135
Morrisville, NC 27560, USA

Telit Wireless Solutions Co., Ltd.
8th Fl., Shinyoung Securities Bld.
6, Gukjegeumyung-ro8-gil, Yeongdeungpo-gu
Seoul, 150-884, Korea

Telit Wireless Solutions Ltd.
10 Habarzel St.
Tel Aviv 69710, Israel

Telit Wireless Solutions
Technologia e Servicos Ltda
Avenida Paulista, 1776, Room 10.C
01310-921 São Paulo, Brazil