SL869-ADR EVK User Guide

1VV0301304 r0 **2016-08-19**

Making machines talk.

APPLICABILITY TABLE

PRODUCT
SL869-ADR

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1. Introduction

1.1. Scope

The scope of this document is to give an overview of:

- Operation of the SL869-ADR and its MEMS sensor related features
- Connections to a test vehicle

1.2. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

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

Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

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

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

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

1.4. Related Documents

- SL869-ADR Product User Guide
- SL869-ADR Software User Guide

1.5. Product Usage Notes

- To prevent ESD and EOS damage, a properly grounded ESD wrist strap should be worn when the EVK case is opened
- Do not alter jumpers while power is applied
- Do not short the RF signal to ground if antenna supply voltage is connected. Damage to the EVK or module may occur.

Always follow ESD safety precautions when utilizing the evaluation kit. For additional information, contact your local sales representative.

This module shall be supplied by a limited power source complying with clause 2.5 of EN 60950-1 and mounted on a V1 flammability class material or better.

2. Dead Reckoning Overview

Dead Reckoning (DR) is the process of estimating one's current position based upon a previously determined position or "fix", and advancing that position based upon course and speed (which could be either estimated or measured).
The SL869-ADR receiver provides the user with accurate estimates of a vehicle's position and speed, even during interruptions in GNSS information, combining the best features of GNSS and Sensor navigation.

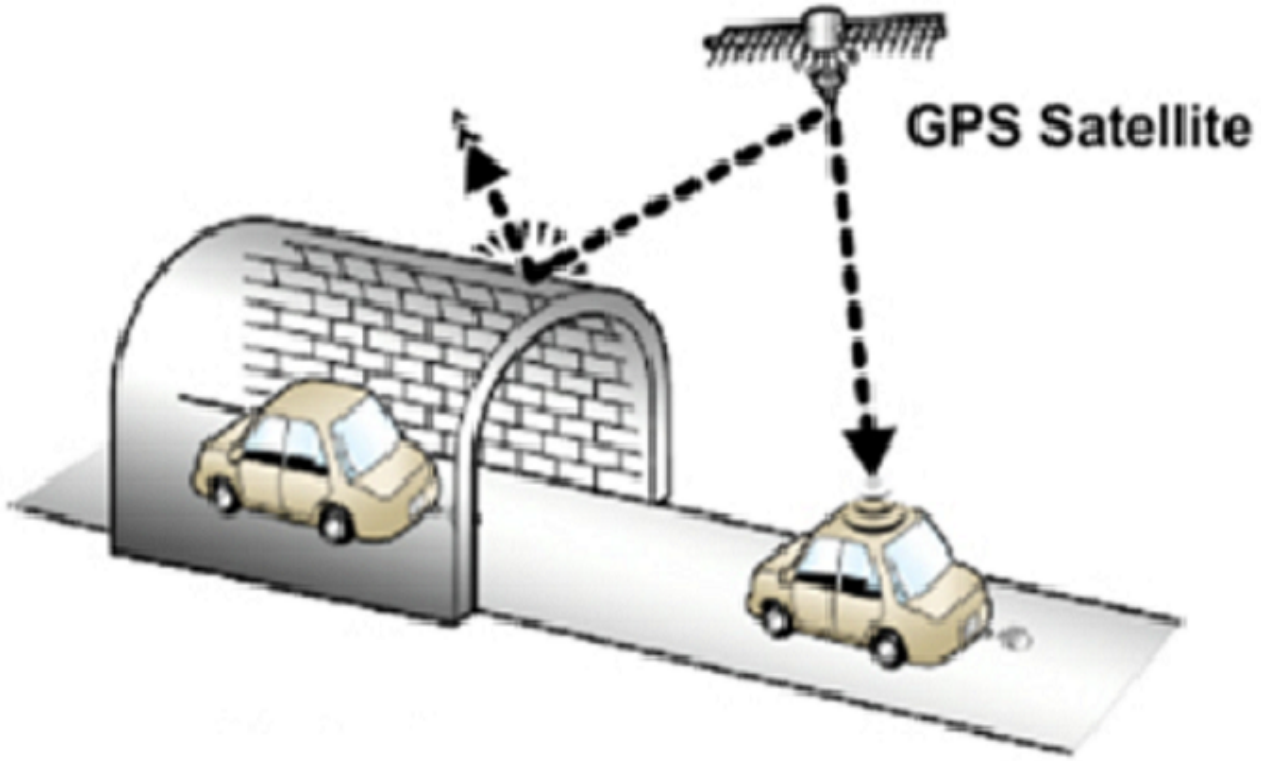


Figure 2-1 DR Operation in the absence of GNSS signals

When GNSS data is available, it provides navigation updates and corrections for sensor drift.
When the GNSS signal is interrupted, sensor data (speed and heading) are used to compute the navigation solution.
The result is improved navigation in harsh environments such as urban canyons, etc.

2.1. DR Description

In a DR configuration, a discrete odometer or wheel pulse signal provides the unit with vehicle speed data. This signal may be obtained from various locations in the vehicle such as the transmission, speed display or a port on some car radios. The SL869-ADR can accept odometer input pulses in the range of 12V.
An option for supplying the odometer or wheel tick pulse is through the on-board diagnostics (OBDII) connector, which provides access to the vehicle's controller area network (CAN) bus. This can be achieved with the addition of an "OBD VSS Signal Generator" - a device that generates a wheel pulse from the vehicle CAN bus data. Telit does not sell these devices.
Note: Telit currently does not support the direct connection of a CAN bus.

A forward-reverse signal, usually provided by the vehicle's transmission or a backup light circuit, supplies directional data to the SL869-ADR module. For proper operation, the reverse signal should be stable when on and not be pulsed.
The SL869-ADR Evaluation Kit (EVK) has a selection switch to invert the signal if necessary.

The SL869-ADR module also includes a set of MEMS gyros that are capable of measuring rates of angular motion around three axes, allowing the unit to maintain vehicle attitude data – heading, pitch, and roll angles.

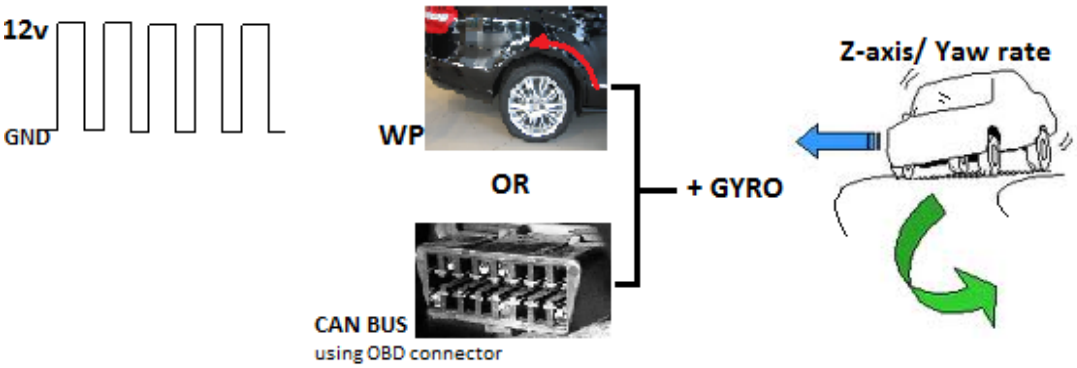


Figure 2-2 DR Operation Options

3. Evaluation Kit Requirements

To use the SL869-ADR Evaluation Kit (EVK), you will need the following items:

1. An SL869-ADR Evaluation Unit

   (ADR programmed receiver is included in the kit)
2. FTDI USB Drivers (included on the USB flash drive)
3. Current version of TelitView

   Note: There is a version of TelitView on the USB Drive supplied in the kit, however for full functionality, the latest version should be downloaded from the Telit Support Site.
4. A PC with a USB port and:

- Windows 7 or later
- .NET Framework 4.0

5. A test vehicle equipped with available wheel tick odometer pulse

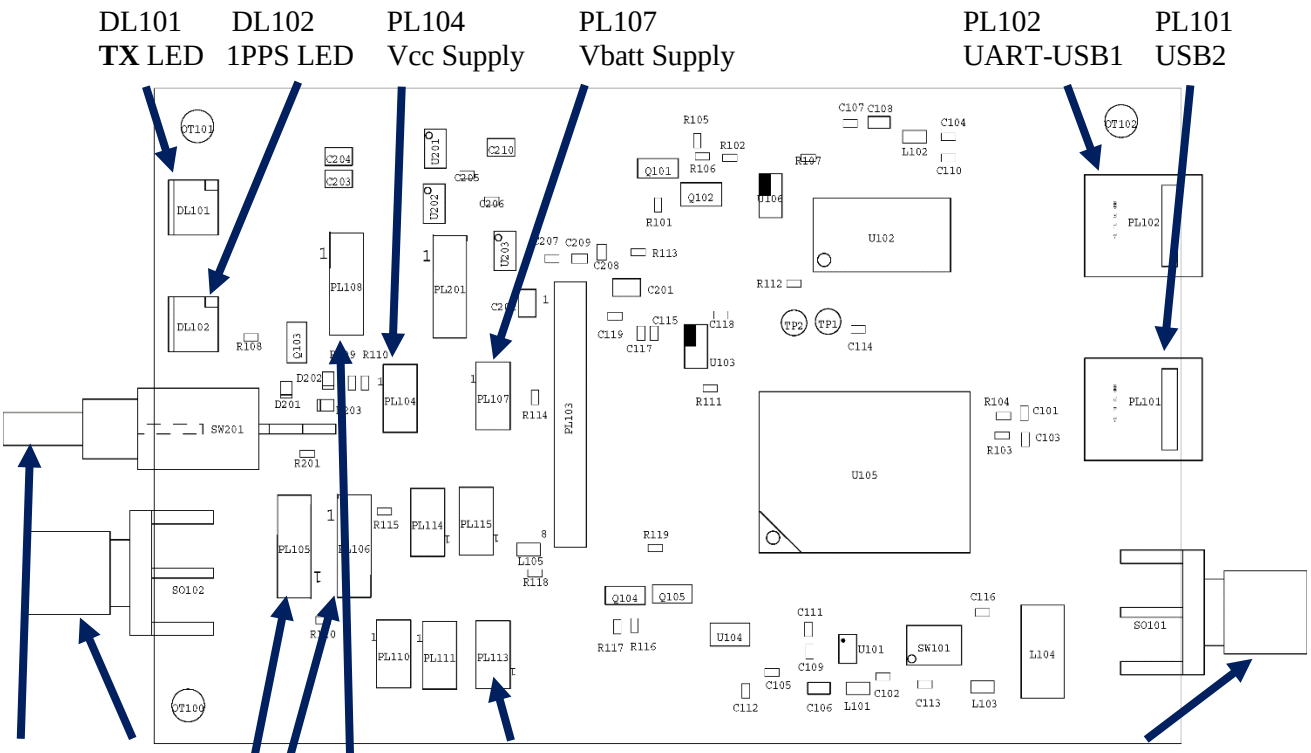
4. Evaluation Kit Description

4.1. SL869-ADR EVK Contents

Figure 4-1 SL869-ADR EVK Contents

4.2. SL869-ADR EVK Main Board Components

The SL869-ADR Unit contains a main board with an interface board mounted on top. The main board PL103 connects to interface board J1.



Note: PL105 and PL106 must be jumpered 1-2 to operate the on-board Teseo 3 Antenna Sense circuit.

Figure 4-2 SL869-ADR EVK Main Board components

Required External Connections

Connect the PC to UART-USB (PL102)

Connect the GNSS antenna to RF-IN (SO101)

Connect Forward/Reverse and Wheel Tick vehicle signals to the Interface Board connector

4.3. SL869-ADR EVK Main Board Component Identification

	SL869 Main Board Components	
ID	**Name**	**Description**
DL101	TX LED	TX data line display
DL102	1PPS LED	1PPS output line display
SW 201	ON/OFF Switch	Applies power to the EVK.
SO 102	1PPS Output SMA	1PPS buffer output connector
PL 108	SL869 BOOT Pin	To place the module into BOOT mode, place a shunt jumper on pins 2 & 3 before powering the unit up. Not connected for normal operation.
PL104	Vcc Supply	Place a shunt jumper to apply 3.3 V to the module Vcc. Required for normal operation.
PL 107	Vbatt Supply	Place a shunt jumper to apply 3.3 V to the module Vbatt. Required if standby power is desired when Vcc is removed.
PL 102	UART-USB1	USB: DC, Ground, TX, RX. Connect to laptop.
PL 101	USB2	Reserved
PL 113	Vant Supply	Place a shunt jumper to apply 3.3 V to the SMA connector for an external active antenna.
PL 201	+3.3 V LDO Antenna supply	Pins 1 & 2: Power LDO_Enable with On/Off switch Pins 2 & 3: Power LDO_Enable with module Pin 4 output
SO 101	Antenna SMA	Antenna: RF Input + Vant

Table 4-1 SL869-ADR EVK Main Board component identification

4.4. SL869-ADR EVK Main Board Schematic Diagrams

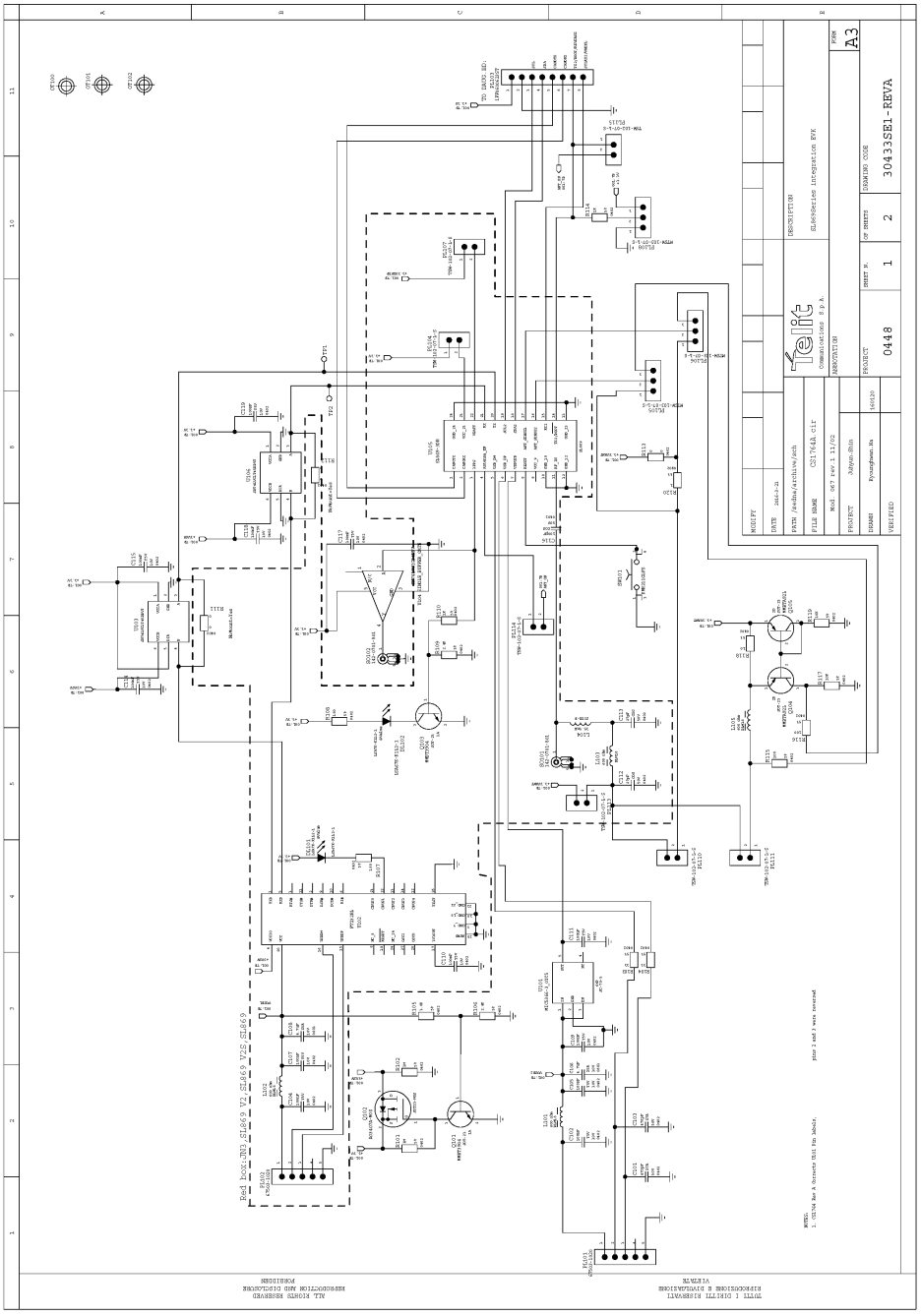


Figure 4-3 SL869-ADR EVK Main Board schematic – Page 1/2

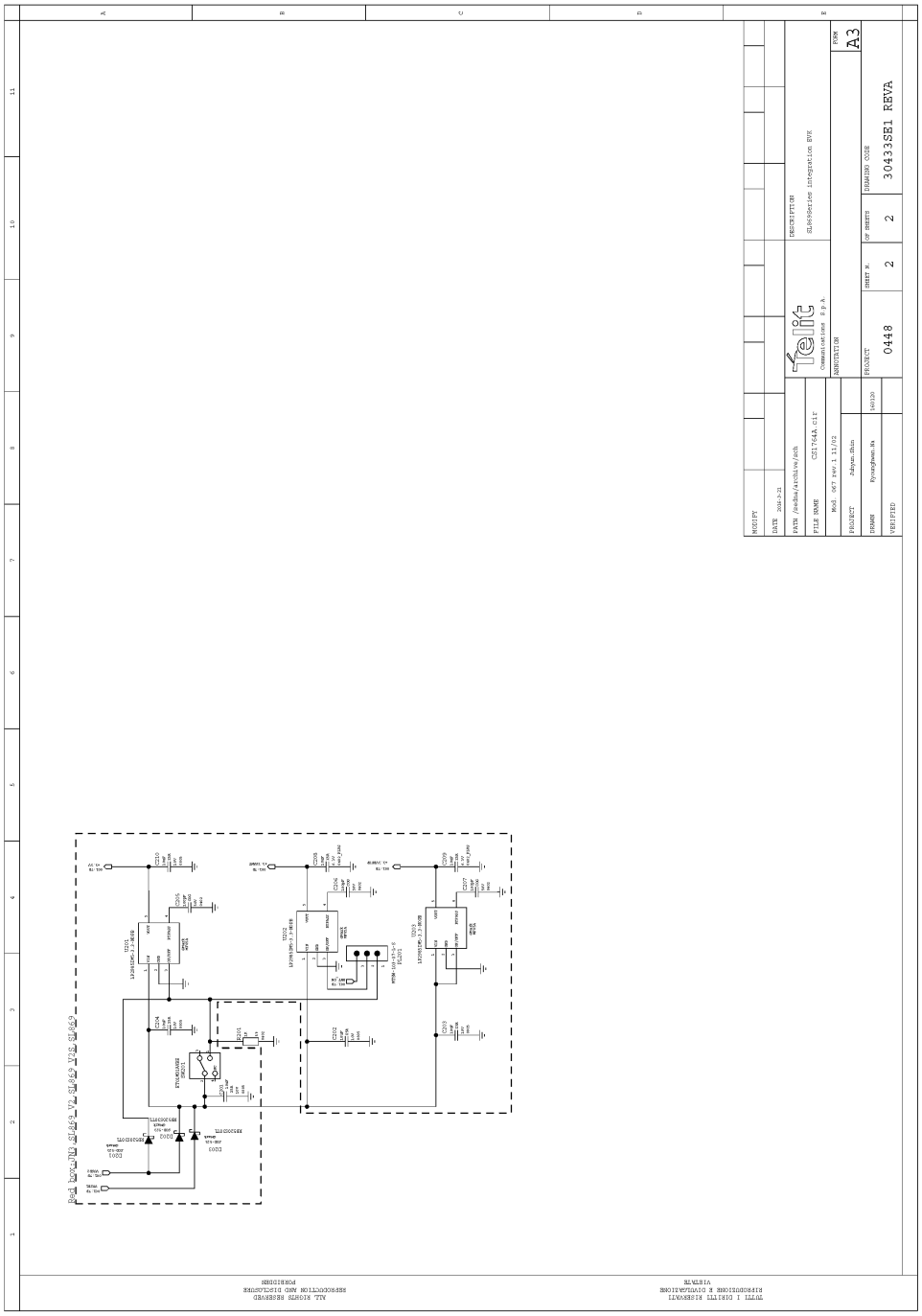
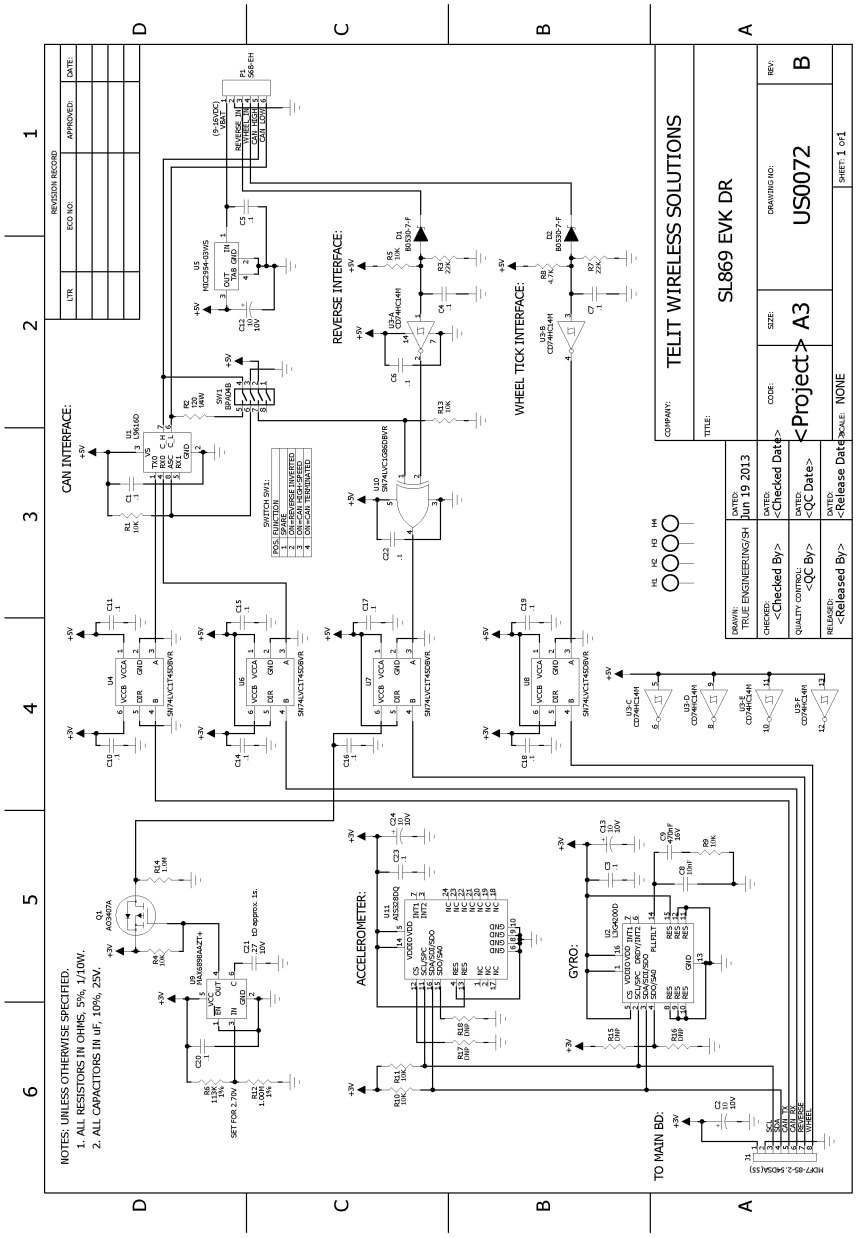


Figure 4-4 SL869-ADR EVK Main Board schematic – Page 2/2

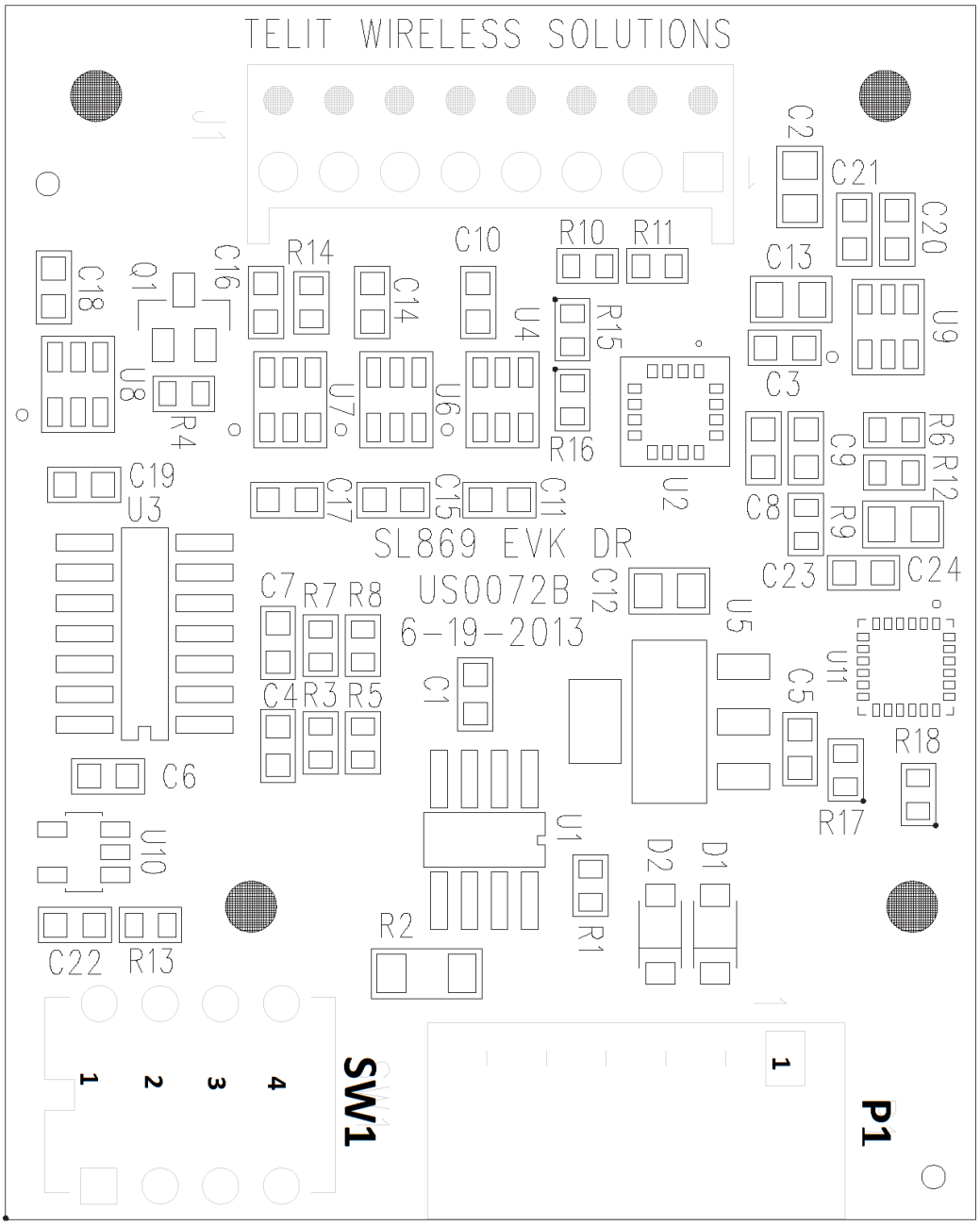
4.5. SL869-ADR EVK Interface Board schematic



Note: MEMS devices are not installed on the Interface Board since they are included in the SL869-ADR module.

Figure 4-5 SL869-ADR EVK Interface Board schematic

4.6. SL869-ADR EVK Interface Board components



Note: MEMS devices are not installed on the Interface Board since they are included in the SL869-ADR module.

Figure 4-6 Interface Board Components

Interface Board - Connector P1	
Pin	**Description**
1	VBAT (9-12VDC)
2	GND
3	REVERSE IN (see SW1-switch 2 for polarity)
4	WHEEL/ODO IN Pulse
5	Reserved
6	Reserved
Pin 1 is closest to the (top) board edge	

Table 4-2 Interface Board –Connector P1

Interface Board - SW1	
Switch	**Description**
1	No Connection
2	Invert the Reverse signal UP: +12V = Forward DOWN: +12V = Reverse
3	Reserved
4	Reserved
SW 1 is closest to the (bottom) board edge	
Down position (closest to the board) is OFF	

Table 4-3 Interface Board – Switch SW1

4.7. SL869-ADR EVK Unit connections

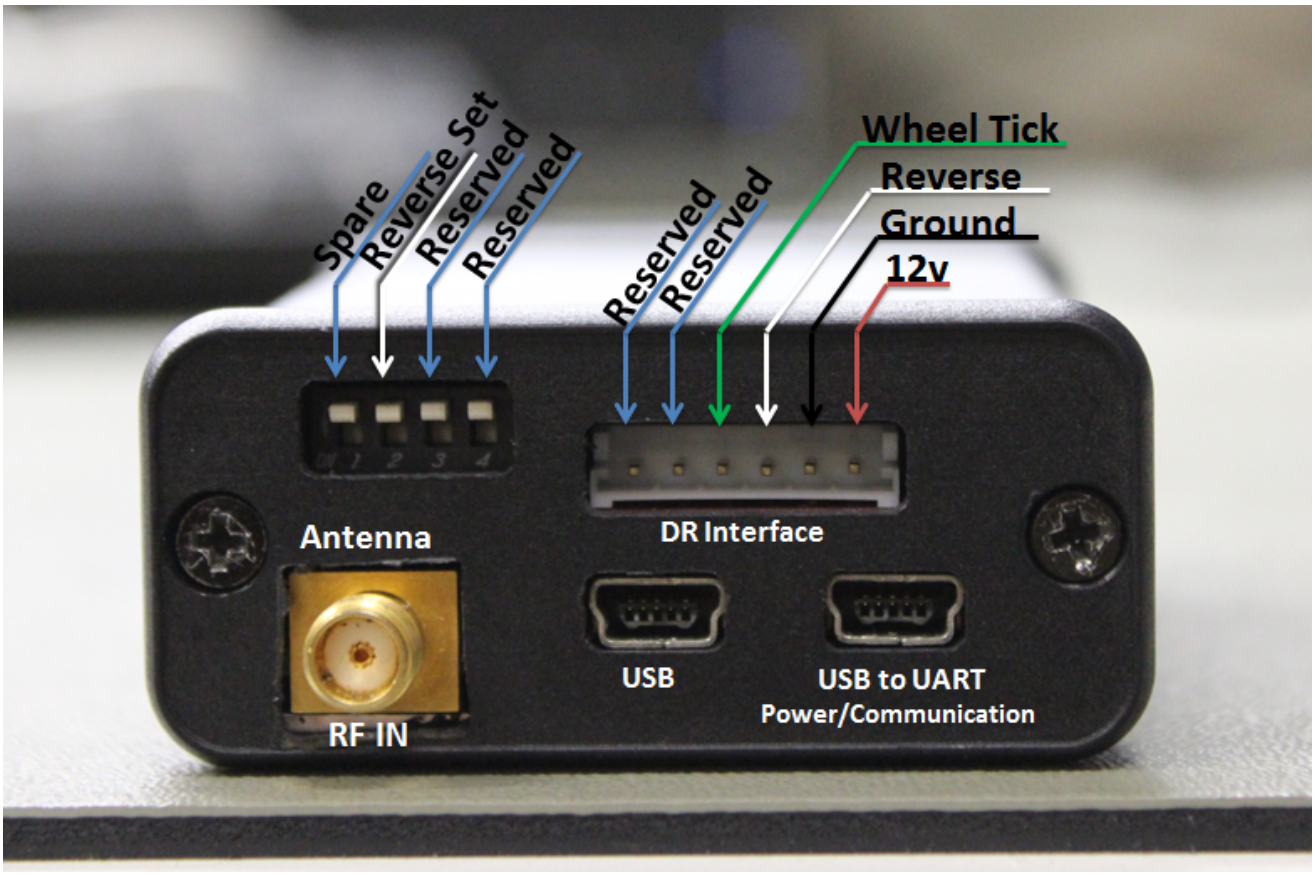


Figure 4-7 EVK Unit connections – rear panel

Rear Panel - Connector P1	
Pin	**Description**
	+12V (9 to 12 VDC)
	Ground
	Reverse Signal (see SW1-switch 2 for polarity)
	Wheel/Odo Signal (pulse)
	Reserved
	Reserved
The +12V pin (red) is closest to the right edge	

Table 4-4 Rear Panel - Interface Board connector P1

Rear Panel - SW1	
Switch	**Description**
1	No Connection
2	Invert the Reverse signal Up: +12V = Forward Down: +12V = Reverse
3	Reserved
4	Reserved
SW 1 is closest to the left edge	
Down position is OFF	

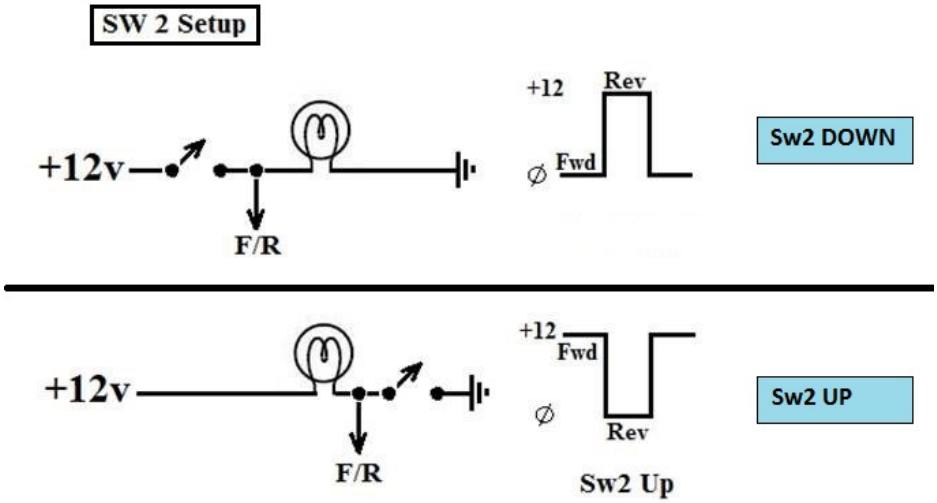
Table 4-5 Rear Panel - Interface Board switch SW1

5. SL869-ADR EVK Setup

5.1. Vehicle Connections

- The SL869-ADR EVK main board is powered by the USB cable connected to a PC.
- Vehicle signals can be connected to the SL869-ADR Interface Board connector P1 (on the EVK Unit rear panel) using the DR harness cable provided as follows:

1. An external 12 VDC supply is required.
   - RED (Pin 1): +12V
   - BLACK (Pin 2): Ground
2. A reverse signal from the vehicle is required.
   - WHITE (Pin 3): Reverse signal (input)
3. The polarity of the reverse signal is set by SW1-switch 2 on the rear panel of the EVK to suit the installation.
   - If +12V signals Forward, set SW1-switch 2 UP
   - If +12V signals Reverse, set SW1-switch 2 DOWN
   - If not connected (e.g. for test purposes), set SW1-switch 2 UP to indicate Forward gear.



4. A wheel tick signal is required.
   - GREEN (Pin 4) Wheel Tick / ODO

5.2. EVK Mounting

The EVK must be positioned near the center of the vehicle and mounted securely.

The EVK must be mounted flat and with the front panel facing the front of the vehicle.

5.3. Computer Setup and Connection

Before operation, ensure that the EVK power switch is in the OFF (down) position and the USB drivers are installed by performing the following steps:

1. Insert the USB flash drive and connect the EVK to the PC via the USB-1 connector on the rear of the EVK. Then, turn the Power switch vertically UP to turn On the EVK.
2. As soon as the evaluation board is connected to the PC, it will be detected and the USB driver installed.
3. Note: If a software Installation warning appears, select “Continue Anyway” option.

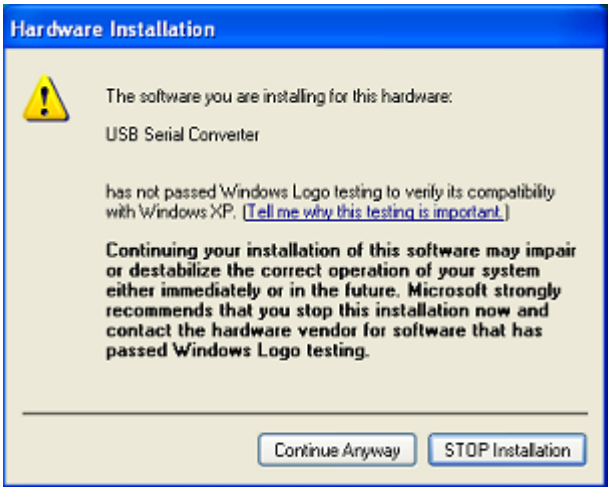


Figure 5-1 Hardware Installation Warning Screen

4. After the EVK is connected, check the “Device Manager” window for the evaluation board COM port number. This information is needed for use with the GPS tools.
5. Connect the provided Active Antenna to the SMA connector.

NOTE:

On some occasions, Windows will install a Microsoft Serial BallPoint mouse after connecting the USB. Uninstall the Microsoft Serial BallPoint mouse if Windows mistakenly installs it.

5.4. Install the TelitView application

To install the TelitView software on the host PC:

1. Insert the USB drive included in the Evaluation Kit.
2. Navigate to the Software -> TelitView folder.
3. Double-click the TelitView MSI file.
4. Follow the on-screen instructions.

6. Using TelitView

Please refer to the TelitView User Guide for detailed information.

Launch the TelitView application

Figure 6-1 TelitView Application Icon

6.1. Main Interface

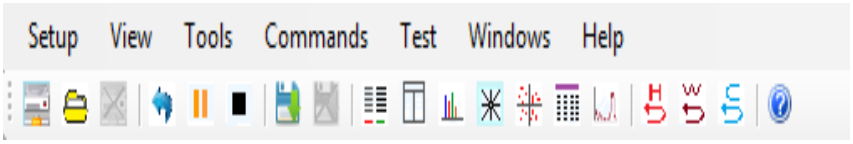


Figure 6-2 TelitView Main Tool Bar

6.2. Connecting to the EVK UART

- Main Menu Bar
  Under the Main Menu Bar, click “Setup” and select “Comm Port”. A “connect to Receiver” window will open.

- Main Tool Bar

  Select the “Connect to Receiver” icon under the Main Tool Bar and the ‘Connect to Receiver” window will open.

- Connect to Receiver Window

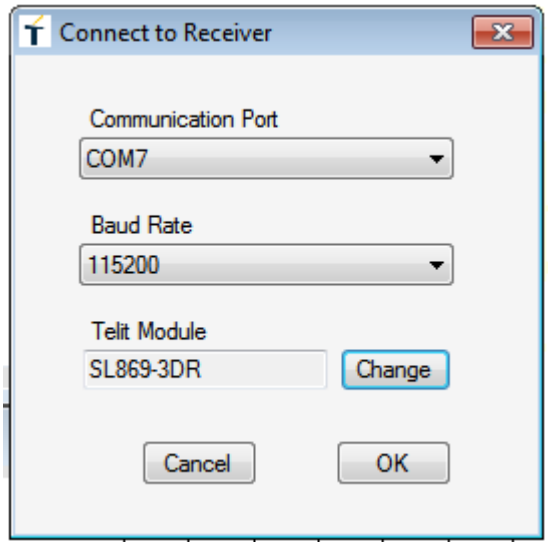
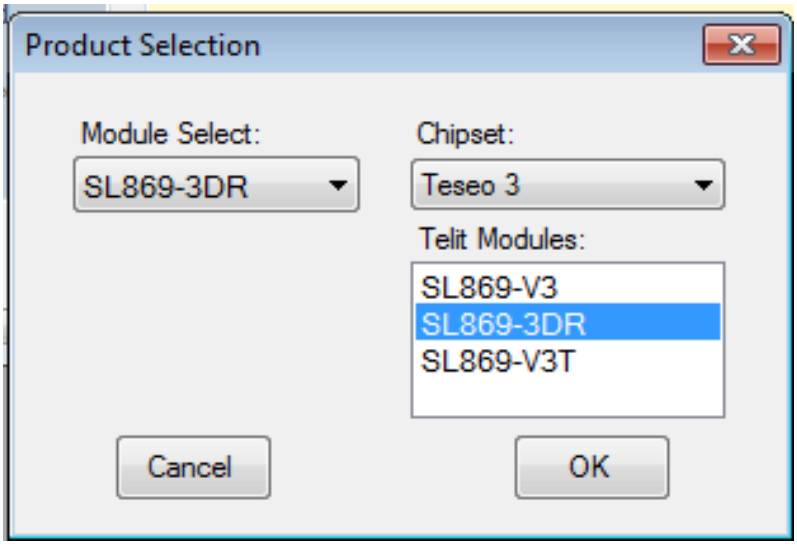


Figure 6-3 'Connect to Receiver" Window

1. Select the correct Communication Port.
2. Select the correct baud rate (SL869-ADR default = 115200).
3. Select "Change" and a "Product Selection" window will appear.
4. From the Products window, select "SL869-ADR" and click "OK".



Select “SL869-ADR”, not SL869-3DR as shown above.

Figure 6-4 Product Selection

6.3. TelitView Tabular View

TelitView implements a tabular view. Switching between tabs displays different information parsed from the receiver.

- Front Panel Status
  The Front Panel Status Tab displays satellite information as well as position information.

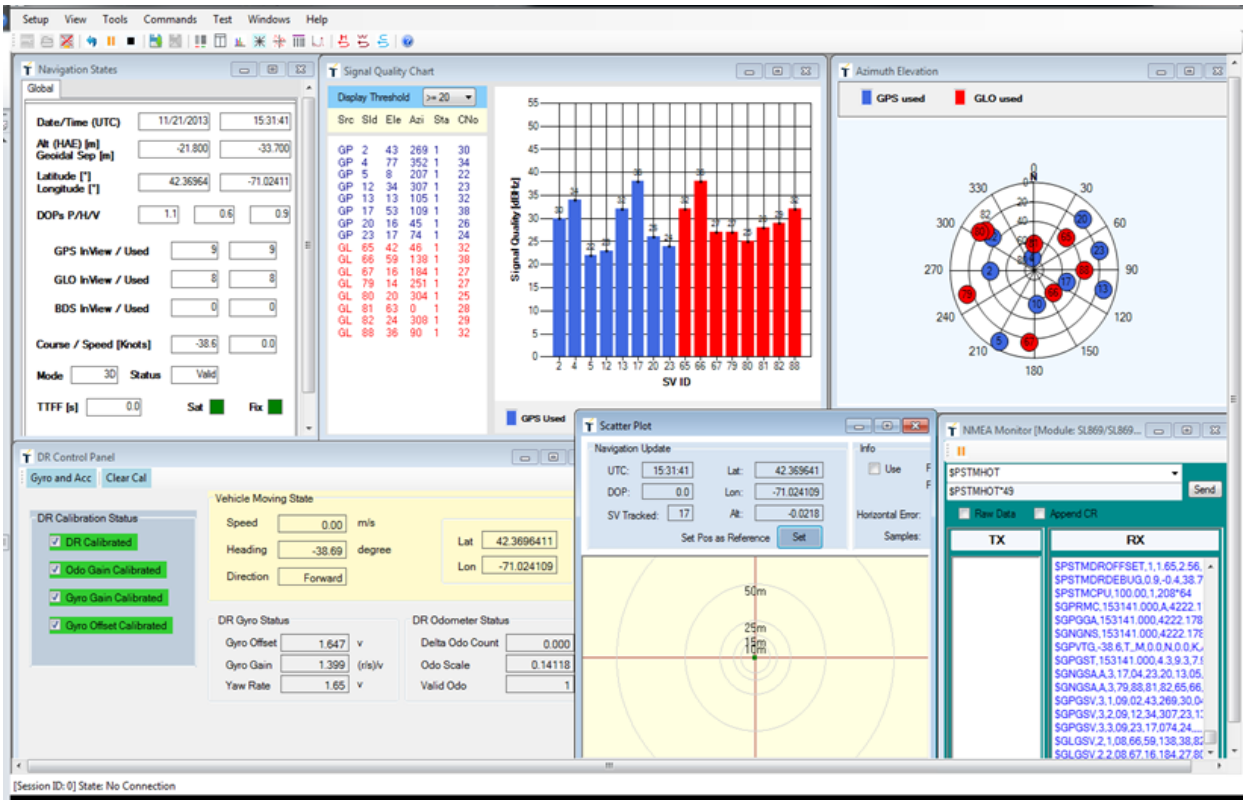


Figure 6-5 TelitView Front Panel Status Tab

- Scatter Plot
  The Scatter Plot displays position points that are updated every second. The position points are compared to each other in an axis in meters.

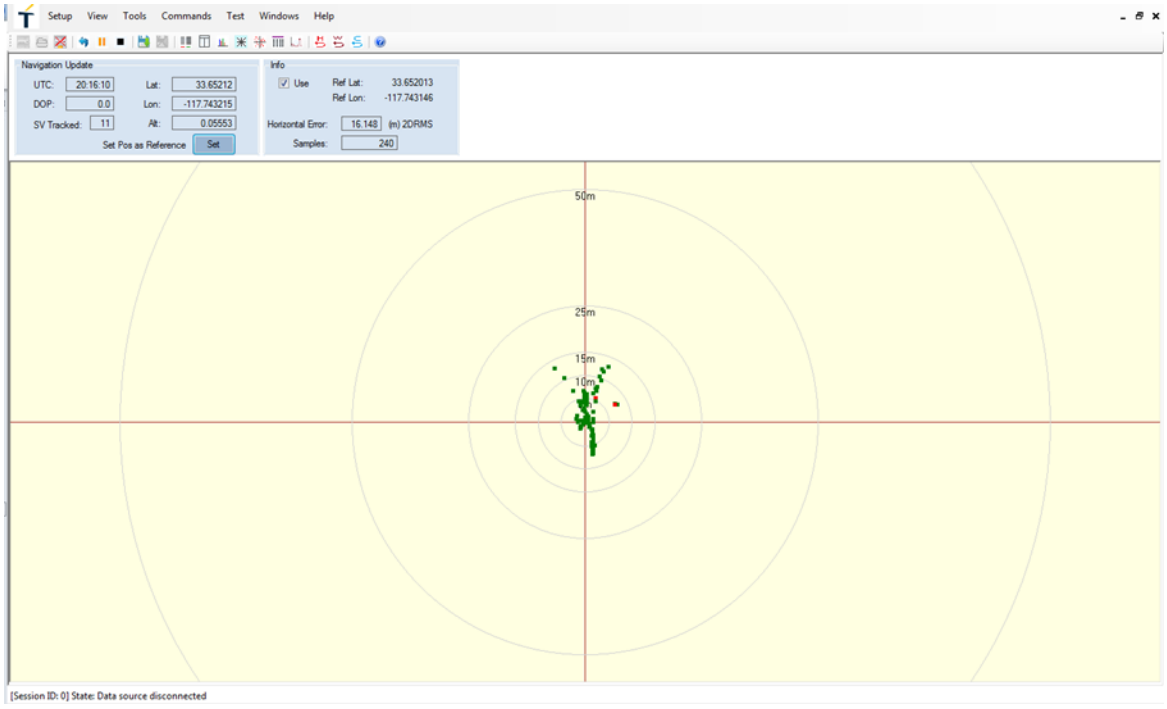


Figure 6-6 TelitView Scatter Plot Tab

- NMEA Monitor
  The NMEA Monitor displays the NMEA output of the receiver. The user can also type in commands in the Transmit toolbar. In order to pause the "Receive" screen, right-click on the window and select "Pause receive"

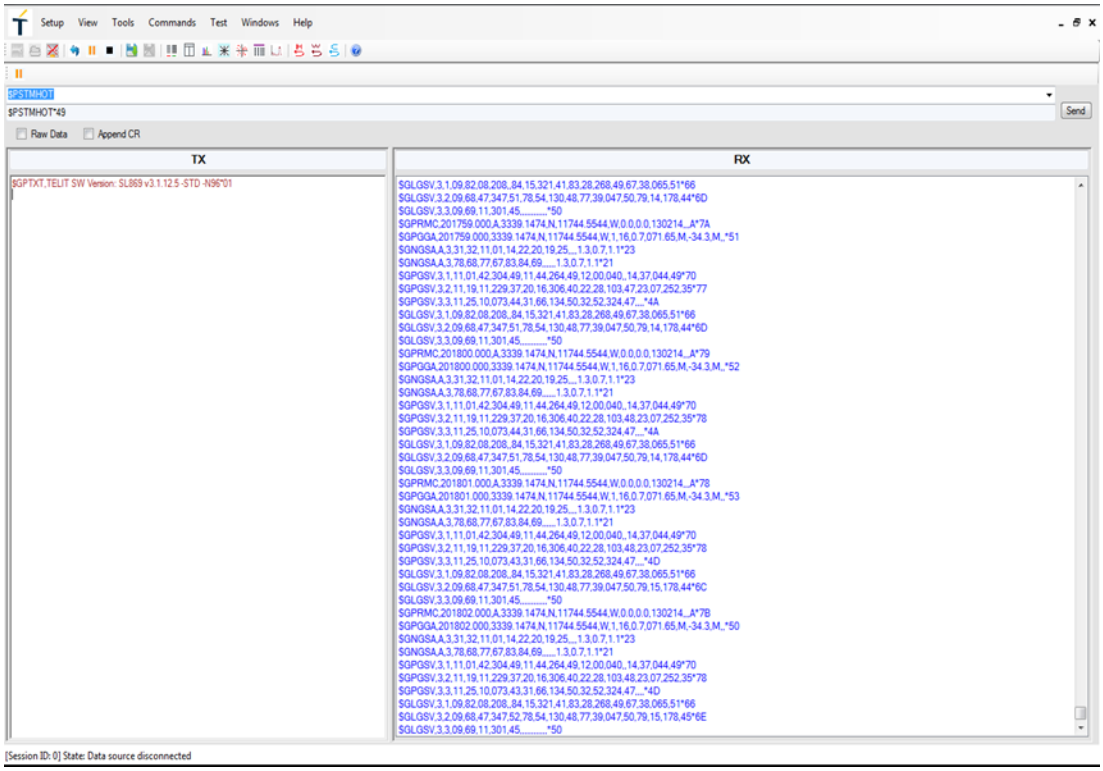


Figure 6-7 TelitView NMEA Monitor Tab

- User Menu Command Manager
  The user has the option to enter basic commands by clicking on the “Commands Tab”. There are 18 available basic commands.

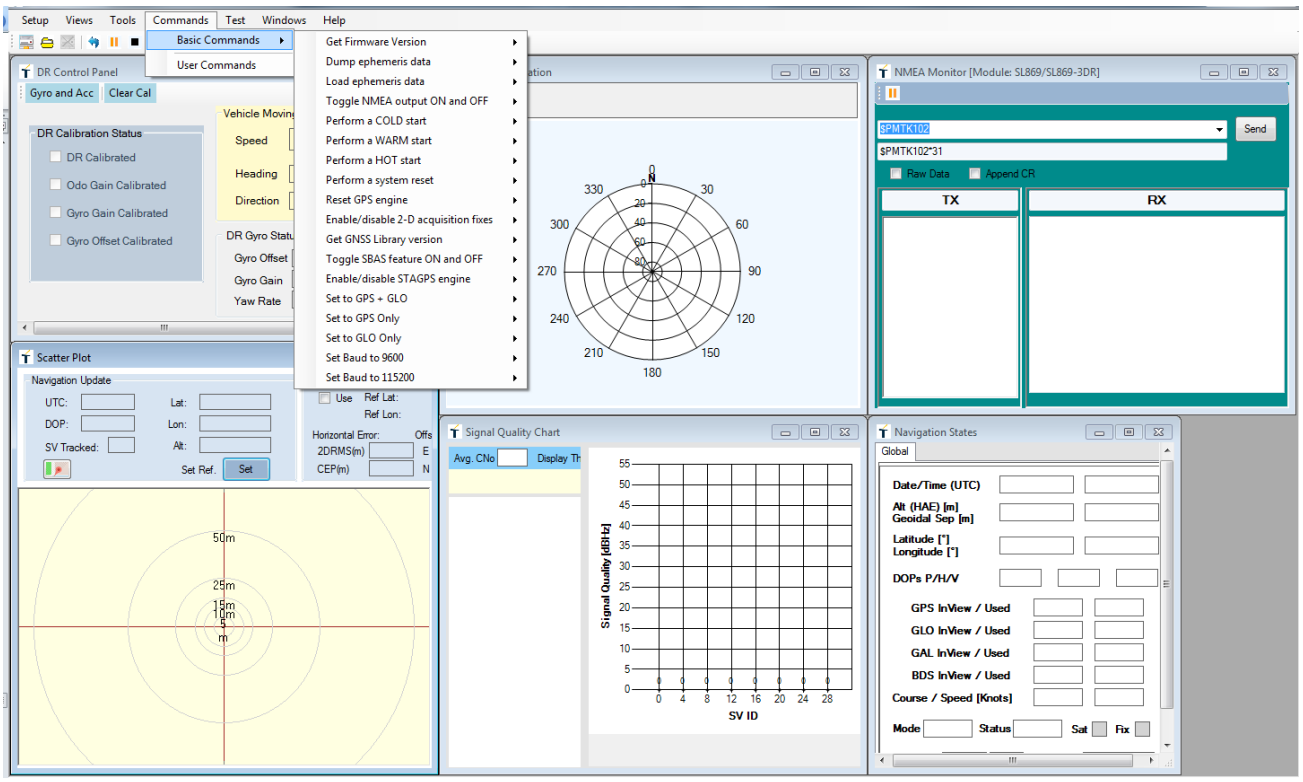


Figure 6-8 User Menu Command Manager

- DR Control Panel and Data View

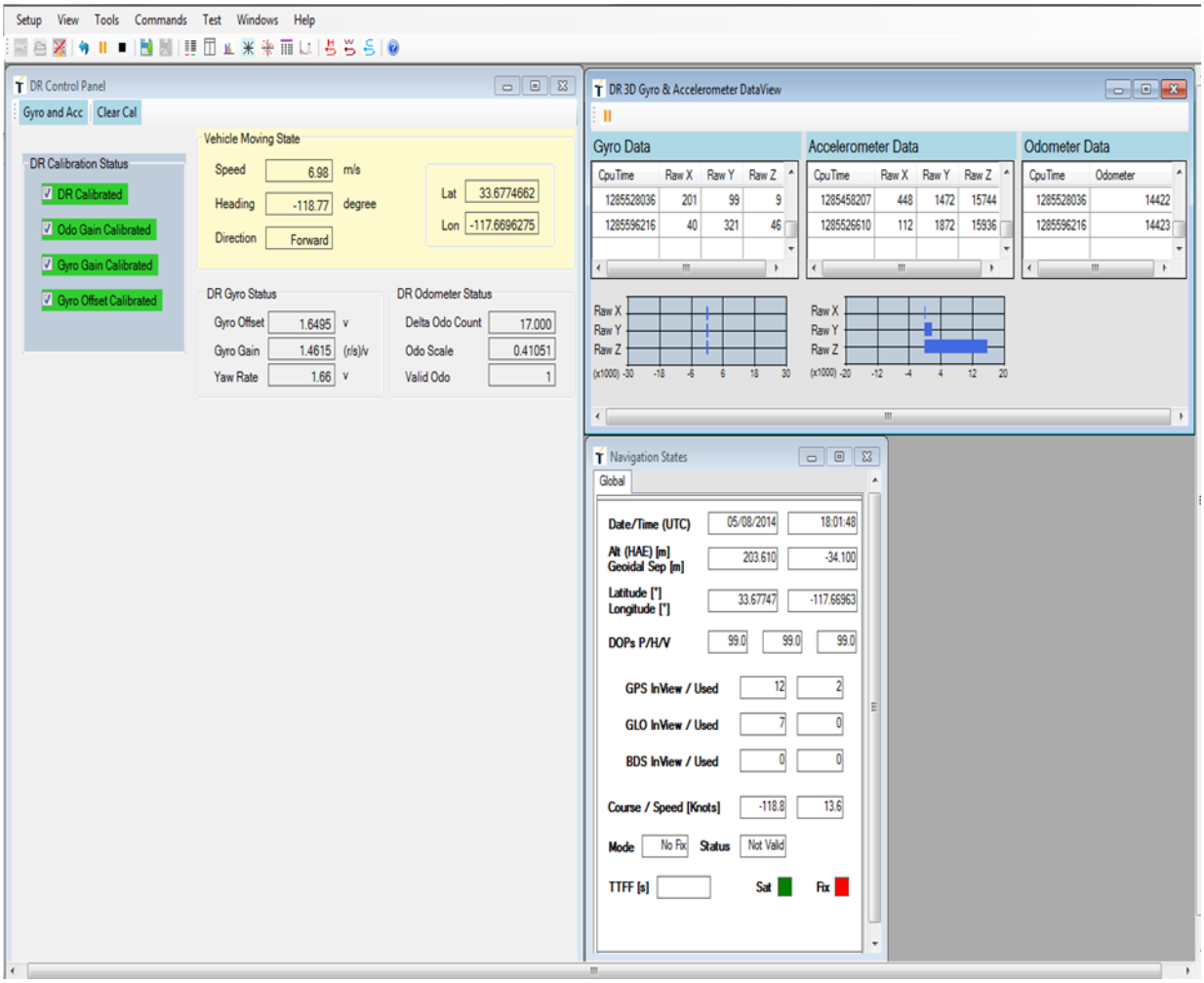


Figure 6-9 DR Control Panel View

7. Flashing Firmware with TeseoIII X-Loader

The EVK will be preloaded with firmware, however if updates are required, perform the following steps:

7.1. Flashing Requirements

- SL869-ADR software from TELIT
- TESEOIII X-Loader v1.11 (or newer) from TELIT

7.2. Flashing Instructions

1. Install a shunt jumper on Main Board SL869 BOOT (pins 2 & 3), tying both pins together.
2. Connect the USB connector and let the Host PC machine enumerate the USB connection.
3. Set SW201 (Main Power) ON (up) to power the SL869-ADR receiver.
4. Launch the TESEOIII X-Loader and set the selections as shown in the figure below.

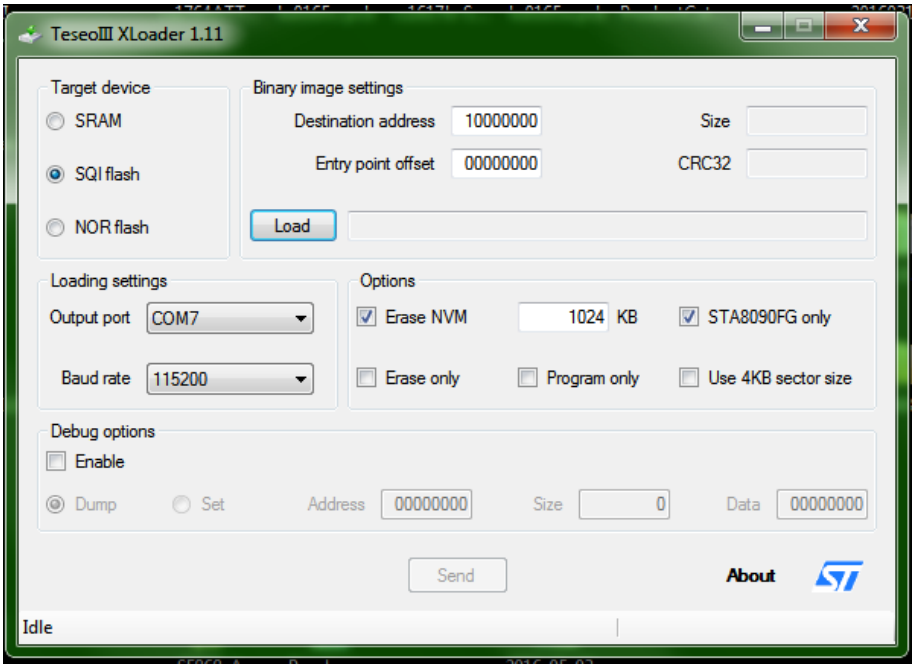


Figure 7-1 TESEOIII X-Loader

5. Click on the Load button then locate and select the provided software by Telit.

6. Verify selections as follows:
   - “Target device” is SQI flash
   - “Loading settings” is UART mode
   - “Options” is “Erase NVM”
   - “STA8090FG Only” is selected

7. After selecting the correct configuration and the selected COM port is properly identified (Look under Device Manager in Windows OS for COM port if cannot be identified/found), click on “Send” to program the device.
   When done, a pop up window will confirm, “Device successfully programmed”.

8. Remove the shunt jumper from Step 1.

9. Cycle power to EVK. Verify NMEA data is streaming out with TelitView under the NMEA Monitor window.

8. Calibration

Once the system has been installed with desired firmware and connected to vehicle wheel ticks, proper calibration is required for optimum performance.

Steps:

1. First, choose a location where there is open sky over the entire course for a good GNSS signal. Calibration will require the vehicle to be moving.

2. Place the EVK on a flat and secure surface with the power switch facing toward the front of vehicle and as close as possible to the center of vehicle. This will allow the gyro to stabilize and the DR FW to store starting point parameters. Once oriented in this position, it should remain in same direction and location to keep results consistent.
   Ensure a rigid mount.

3. Connect USB from the laptop PC to the EVK port USB1, located at opposite side from the SMA antenna connection.

4. Run TelitView on the laptop to verify NMEA output activity from the EVK when powered on. TelitView will also allow you to see and record data from the EVK output.

5. Turn on car and the power up the EVK.

6. Synchronize the EVK to Telit view.
   Note: Make sure to select correct COM port and set baud rate 115200.

7. Wait approximately 2 minutes in a stopped position with the EVK and vehicle on. This allows the unit to initialize the yaw rate offset with reliable values. Verify a valid GNSS position fix.

8. After 2 minutes, drive in a straight line direction for at least five minutes at a constant speed. The speed should be greater than 35 km/h (approx. 22mph).

9. Following the straight drive, make several left and right turns of at least 90 degrees allowing the system to calculate the gyro yaw rate gain.
   Note: Calibration will be improved with more turns completed. A minimum of 10 turns is recommended.

10. Calibration should be performed in an open sky environment. Avoid urban canyons, tunnels, parking garages, dense foliage, etc.

To complete calibration, the vehicle should stop and remain stationary for at least 10 seconds. For a full calibration to be successful, the above procedure must be followed.

11. Verify through the TelitView DR Control Panel that the DR Calibration Status fields are all checked and highlighted in green as shown in **Figure 6-9 DR Control Panel View**.
    Another way to verify that calibration is completed is by checking NMEA message **$PSTMDRCAL,A,B,C,D,xx**
    If the highlighted fields (A, B, C, D) have values of '1', a coarse calibration was achieved.

12. To clear calibration (for testing purposes), click the "Clear Cal" button on the TelitView DR Control Panel screen. Follow the instructions and issue a reset to complete the process.

9. Document History

Revision	Date	Changes
0	2016-08-19	First Issue