



Telit GNSS Bundle Solutions Application Note

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TELIT
TECHNICAL
DOCUMENTATION

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APPLICABILITY TABLE

PRODUCTS

- ■ GE865-QUAD
- ■ GE866-QUAD
- ■ GL865-QUAD
- ■ GL865-QUAD V3
- ■ GL865-QUAD V3.1
- ■ GE910-QUAD V3
- ■ GE910-QUAD
- ■ GE910-QUAD AUTO
- ■ HE910-D
- ■ HE910-EUD
- ■ HE910-EUR
- ■ HE910-NAD
- ■ HE910-GL
- ■ HE910-NAR
- ■ UE910-EUD
- ■ UE910-EUR
- ■ UE910-NAD
- ■ UE910-N3G
- ■ UL865-EUD
- ■ UL865-EUR
- ■ UL865-NAR
- ■ UL865-NAD
- ■ UE866-N3G
- ■ UE866-EU
- ■ UE910-N3G
- ■ UE910-EU
- ■ UL865-EU
- ■ LE910-NA V2
- ■ LE910-SV V2
- ■ LE910-EU V2
- ■ LE910-AU V2

- ■ LE910-SV1
- ■ LE910-SVL
- ■ LE910-NA1
- ■ LE910-EU1
- ■ LE910B4-NA
- ■ LE910B1-NA
- ■ LE910B1-SA
- ■ LE910B1-EU
- ■ LE910-JN1
- ■ LE866-SV1
- ■ LE866A1-KK
- ■ LE866A1-KS
- ■ LE866A1-JS
- ■ LE866A1-NA
- ■ ME866A1-NV
- ■ ME866A1-NA

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1. INTRODUCTION

1.1. Scope

Scope of this document is to provide customers with the necessary information on how to configure the Telit cellular module in order to manage a Telit GNSS module through the Telit AT commands.

1.2. Audience

This document is intended for customers who are developing applications with Bundle Solutions.

1.3. Contact Information, Support

For general contact, technical support services, technical questions and 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.

1.4. Document Organization

This document contains the following chapters:

- “Chapter 1: “Introduction” provides a scope for this document, target audience, contact and support information, and text conventions.
- “Chapter 2: “Overview” gives an overview of the features of the product.
- “Chapter 3: “Software Bundle Configuration” details the suitable AT commands for configuring the Telit Bundle Solution.
- “Chapter 4: “Patching SiRFStar IV/V ROM based receivers” provides the steps required in order to patch a ROM receiver through the Telit cellular module.
- “Chapter 5: “A-GPS for SiRFStar IV/V based receivers” details how to download and inject SGEE files through a Telit cellular module.
- “Chapter 6: “A-GPS for SL869: How to download and inject SEED file” details how to download and inject SEED file through a Telit cellular module.
- “Chapter 7: “A-GPS for SC872-A, SE868-A, SL871 and SL869 V2” details how to manage SGEE-EPO files through a Telit cellular module.
- “Chapter 8: “Bundling with Telit 3G/4G cellular modules” shows the AT commands to be sent when using a Telit 3G/4G cellular module in bundling.
- “Chapter 9: “Document history” shows the history of this document.

1.5. 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.

1.6. Related Documents

- [1] Telit_AT_Commands_Reference_Guide_r22, 80000ST10025a
- [2] Telit_Jupiter_Host_NVM_Storage_Application_Note_r5
- [3] Telit_EVK2_User_Guide_r17
- [4] Telit_SiRF_InstantFix_Application_Note_r3
- [5] Telit_SL869_Server_AGPS_Application_Note_r0
- [6] Telit_SiRF_StarIV_ROM_Patching_Application_Note_r1
- [7] Telit_SGEE-EPO_Application_Note_r2

2. OVERVIEW

A bundle solution is made up of different layers, apps and modules that act and exchange data and/or resources in order to execute a defined task.

The Telit Bundle implementation provides customers with a straightforward solution to bundle Telit GNSS and Cellular technologies and manage both of them through a single module, with a single communication port and a single communication protocol.

2.1. Why Bundling?

There are two different ways to implement an application that uses Cellular and GNSS modules together:

- Stand-Alone solution
- Telit Bundle Solution

In the **Stand-Alone solution**, an application microprocessor handles both cellular and GNSS modules as separated entities. See the figure below:

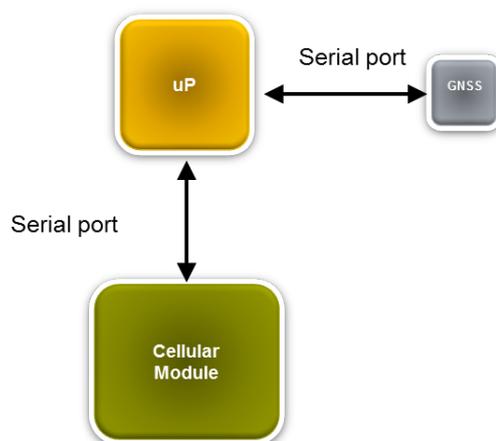


Fig. 1: Stand-Alone solution

This implementation has pros and cons.

Some pros are:

- Cellular and GNSS modules can be fully managed independently by the microprocessor;
- Battery life is generally well optimized since the cellular and/or GNSS can be switched ON/OFF independently by the application microprocessor.

On the other side, there are some cons due to the fact that the application processor:

- uses two different UARTs (one for GNSS and the other for cellular);
- manages two different protocols (AT commands for cellular, NMEA or Binary for GNSS);
- needs to embed the Assisted GPS downloader (if A-GPS is requested) into the application microprocessor (in order to download the A-GPS file from the Telit A-GPS server);
- manages the upload of the A-GPS file into the GNSS receiver when required;
- in addition, and only for ROM-based GNSS receivers, it could be also required to:
 - embed ROM SW Patcher into the application microprocessor (SW patch contains general improvements or customization parameters);
 - reserve a storage area in microprocessor's memory to store the SW patch for the GNSS ROM receiver (if existing);
 - reserve a storage area in microprocessor's memory to store the A-GPS files computed in the GNSS receiver (Telit GNSS receivers are able to create a prediction of ephemeris for the next 3-5 days, but this feature can be disabled if not required);
 - reserve a storage area in microprocessor's memory to store the server generated A-GPS files (since they must be injected into the ROM GNSS receiver at each startup of the GNSS).

The implementation of some of the features mentioned above, like A-GPS and ROM Patching, is not mandatory and the effort is related to the complexity of the application as well as the customers' skills.

The **Telit Bundle Solution** represents an alternative way to integrate such Cellular + GNSS applications.

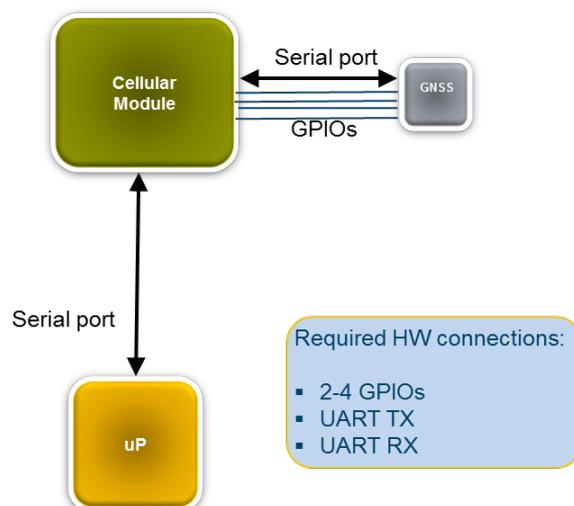


Fig. 2: Telit Bundle Solution

This solution requires that the main UART of the GNSS receiver has to be connected directly to the 2nd UART of the Cellular module (often it is the TRACE UART).

Some cellular GPIOs need to be connected to the GNSS receiver to manage some key pins (power control, boot, ..., etc.).

This implementation has pros and cons.

Some pros of the Telit Bundle Solution are:

- only one UART is used by the application processor;
- no effort is required to integrate and manage the GNSS protocol, since the GNSS receiver is managed by the Cellular module through AT commands;
- the A-GPS Downloader/Manager is already embedded into the Cellular module's SW;
- the Patcher SW engine (for GNSS ROM receivers only) is already embedded in the Cellular module's SW;
- the Application microprocessor could be removed and the whole application managed by the Python or AppZone engines running into the Telit cellular module.

Some cons of this solution are that:

- the cellular module has to be in power-on status every time the microprocessor needs to send, update or exchange data with the GNSS receiver. This results in a more complex power management in order to match a power consumption comparable with standard solution;
- not all the features of the GNSS receiver can be driven through the cellular module (see the Telit AT Commands User guide [1]).

Conclusion: both the **Stand-Alone solution** and the **Telit Bundle Solution** have pros and cons.

Customers have to weigh carefully pros, cons and requirements before choosing the implementation approach.

2.2. Telit Bundle Solution

The Telit Bundle solution's advantage is to combine multiple technologies and manage the whole set through a single dedicated communication port.

In the Telit Bundle solution, the cellular module is the master while the GNSS receiver is the slave.

The GNSS receiver is managed through the cellular module using dedicated AT commands; in this case, customers do not need to know or use any other protocol to manage the external GNSS receiver.

Moreover, this solution does not require to include any A-GPS Download Manager or Patching SW engine in the external Application Microprocessor to manage A-GPS aiding and ROM Patcher SW engine.

In fact, the Telit Bundle solution is composed by different SW blocks that allow customers to manage, keep up-to-date and assist the GNSS receiver.

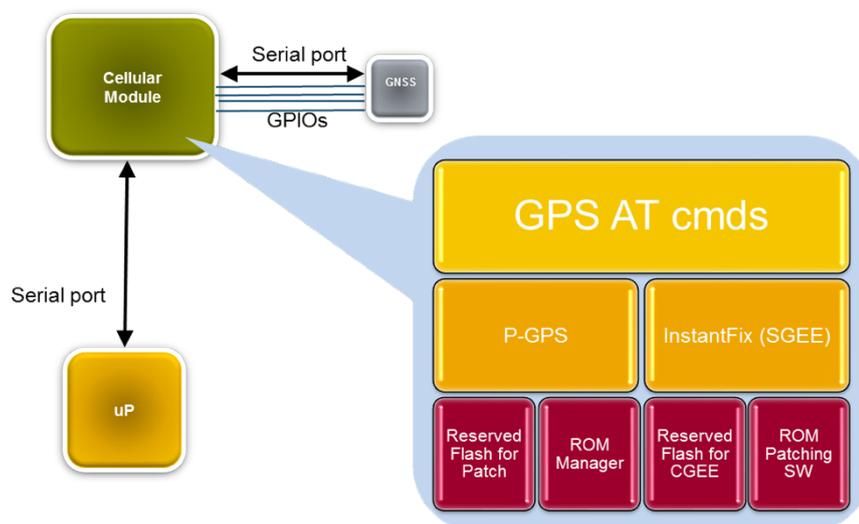


Fig. 3: Telit Bundle Solution SW blocks

2.3. Hardware Configuration

Telit cellular and GNSS modules communicate with each other through standard UART port. Both serial port and pins configuration setup are reported in the following paragraphs. Setup could change depending on the Cellular and GNSS model applied.



WARNING:

Please note that information reported below is the minimum required to set up the bundle solution between Telit cellular modules and GNSS receivers. Since Telit GNSS products are based on different platforms, please make sure to adjust the voltage levels by the means of the proper level translator. Refers to the Hardware User Guide of both products selected for further design explanation.

2.3.1. Serial port (UART) configuration

In order to set up the bundle communication, the cellular module's 2nd UART (normally used for Trace) has to be connected to the GNSS receiver's main UART port.

Cellular 2 nd UART	GNSS UART
TX_AUX	GPS_RX
RX_AUX	GPS_TX

2.3.2. Pin configuration

In order to control the external GNSS receiver, the cellular module has to manage the pins summarized in the table below:

		GNSS key pin/signal			
		ON_OFF/ LDO Enable	SYSTEM_ON	BOOT	RESET
GNSS Receiver	JF2 Flash	YES	YES	YES	YES
	SC872-A SE868-A SL871 SL869 V2	YES	NO	NO	YES
	JF2 ROM/Eeprom SE868-V2	YES	YES	NO	NO
	JN3 FLASH	YES	NO	YES	NO
	JN3 ROM/Eeprom	YES	NO	NO	NO
	SE880 ROM	YES	YES	NO	NO
	SL869	YES	NO	YES	NO
	<u>SE868-V3</u> <u>SE873</u>	<u>YES</u>	<u>YES</u>	<u>YES</u>	<u>YES</u>

Pin configuration



NOTE:

Customers can choose whatever set of the cellular module's GPIOs (among those available and not already assigned to other functionalities) to manage the GNSS receiver.

**WARNING:**

The first cellular module's selected GPIO must always be connected to the GNSS receiver's ON-OFF/LDO Enable pin.

This will be applied through the AT\$GPSGPIO command (see the following paragraphs).

3. SOFTWARE BUNDLE CONFIGURATION

In order to setup the cellular module in “bundle mode” a proper AT commands set is required.

Depending on the GNSS receiver connected to the cellular module, the AT commands set might be different.



WARNING:

It's strictly recommended to wait until the reception of the GNSS SW version string before issuing any AT command related with the specific GNSS behavior, otherwise the GNSS receiver could not be ready to work yet.

Verify the reception of the SW version string through the AT\$GPSSW command.



IMPORTANT:

SSIV/V ROM-based GNSS receivers (JF2-ROM, JN3-ROM, SE880 and SE868 V2) make an intensive use of the cellular module resources; therefore, we strongly recommend setting the CPU Clock @104 MHz (AT#CPUMODE=3) whenever one of the following cellular modules is bundled with a SSIV/V ROM-based GNSS receiver:

- GE865-QUAD
 - GE866-QUAD
 - GL865-QUAD
 - GL865-DUAL
 - GL865-QUAD V3
 - GL865-DUAL V3
 - GL868-DUAL
 - GL868-DUAL V3
 - GE910-QUAD V3
-

3.1. JF2 Flash

The Telit cellular module is configured to manage the JF2 Flash GPS module issuing the following AT commands (see [1]):

- **AT\$GPSD=2,0**, this command configures the Telit cellular module's serial port #1 (Trace) to manage the external GPS receiver JF2 flash. Moreover, it enables the whole set of "bundle" GPS AT commands.
- **AT\$GPSGPIO=x,y,w,z**, this command configures GPIOs # x, y, w and z to manage the JF2 GPS_ON/OFF, GPS_SYSTEM_ON, GPS_BOOTSEL and GPS_RESET signals respectively.
- **AT\$GPSSAV**, this command saves the bundle configuration in the cellular module's flash memory.
- **AT#REBOOT**, this command reboots the entire system.
- **AT\$GPSP=1**, this command turns the JF2 Flash ON.

From now on, the JF2 Flash GPS receiver will be managed through the Telit cellular module (so-called "controlled mode").



IMPORTANT:

The first GPIO in "**AT\$GPSGPIO=x,y,w,z**" must always be connected to the GNSS receiver's ON-OFF pin.



NOTE:

This configuration is valid for the JF2 Flash variant with default baud rate @ 4800bps. In case of JF2 baudrate equal to 9600 bps, the **AT\$GPSSERSPEED=9600** command must be sent before **AT\$GPSSAV**.

Issuing **AT\$GPSSAV** after **AT\$GPSP=1** the GPS receiver will be turned ON on every cellular module startup.

For further information please refer to the Telit AT Commands Reference Guide [1].

3.1.1. Example

Bundle solution with GE865-QUAD + JF2 Flash.

Cellular module's GPIOs chosen to control the JF2 Flash: #4, 5, 6, 7.

The list of the AT commands needed to configure the GE865 to control the JF2 Flash is:

- **AT\$GPSD=2,0**
- **AT\$GPSGPIO=4,5,6,7**
- **AT\$GPSSAV**
- **AT#REBOOT**
- **AT\$GPSP=1**

3.2. JF2 ROM

The Telit Cellular module is configured to manage the JF2 ROM GPS receiver by issuing the following AT commands (see AT Command User Guide [1]):

- **AT\$GPSSD=2,1**, this command configures the Telit cellular module's serial port #1 (Trace) to be used with a JF2 ROM receiver. Moreover, it enables the whole set of "bundle" GPS AT commands.
- **AT\$GPSGPIO=x,y,0,0** this command configures GPIOs # x, y to drive the JF2 GPS_ON/OFF and GPS_SYSTEM_ON respectively.
- **AT\$GPSSAV**, this command saves the configuration applied above.
- **AT#REBOOT**, this command reboots the entire system.
- **AT#CPUMODE=3**, this command sets the cellular module CPU Clock @104 MHz (to be issued if needed, see Chapter 3)
- **AT\$GPSP=1**, this command turns the JF2 ON.

From now on, the JF2 ROM GPS receiver will be managed through the Telit cellular module.



IMPORTANT:

The first GPIO in "**AT\$GPSGPIO=x,y,w,z**" must always be connected to the external GNSS receiver's ON-OFF pin.



NOTE:

This configuration is valid for the JF2 ROM variant with default baud rate @ 4800bps. In case of JF2 baudrate equal to 9600 bps, the **AT\$GPSSERSPEED=9600** command must be sent before **AT\$GPSSAV**.

Issuing **AT\$GPSSAV** after **AT\$GPSP=1** the GPS receiver will be turned ON on every cellular module startup.

For further information please refer to the Telit AT Commands Reference Guide [1].

3.2.1. Example

Platform: GE865-QUAD + JF2 ROM.

GPIOs chosen to control the JF2 ROM: #4, 5. These GPIOs will be used to drive the JF2 ROM's ON_OFF and SYSTEM_ON pins.

The proper AT commands sequence is:

- AT\$GPSD=2,1
- AT\$GPSGPIO=4,5,0,0
- AT\$GPSSAV
- AT#REBOOT
- Wait the URC “\$SIFIXEV: Host EE Files Successfully Created”
- AT#CPUMODE=3
- AT\$GPSP=1

For further information about the EE Host Storage Mode please refer to [2] and [1].

3.3. JF2 EEPROM

The Telit Cellular module is configured to manage the JF2 EEPROM GPS receiver by issuing the following AT commands (see the Telit AT Command User Guide [1]):

- **AT\$GPSD=2,2**, this command configures the Telit cellular module's serial port #1 (Trace) to be used with a JF2 EEPROM. Moreover, it enables the whole set of “bundle” GPS AT commands.
- **AT\$GPSGPIO= x,y,0,0** this command configures GPIOs # x, y to drive the JF2 GPS_ON/OFF and GPS_SYSTEM_ON respectively.
- **AT\$GPSSAV**, this command saves the configuration applied above.
- **AT#REBOOT**, this command reboots the entire system.
- **AT#CPUMODE=3**, this command sets the cellular module CPU Clock @104 MHz (to be issued if needed, see Chapter 3)
- **AT\$GPSP=1**, this command turns the JF2 ON.

From now on, the JF2 EEPROM GPS receiver will be managed through the Telit cellular module.



IMPORTANT:

The first GPIO in “**AT\$GPSGPIO=x,y,w,z**” must always be connected to the external Telit GNSS receiver's ON-OFF pin.

**NOTE:**

This configuration is valid for the JF2 EEPROM variant with default baud rate @ 4800bps. In case of JF2 baudrate equal to 9600 bps, the AT\$GPSSERSPEED=9600 command must be sent before AT\$GPSSAV.

Issuing AT\$GPSSAV after AT\$GPSP=1 the GPS receiver will be turned ON on every cellular module startup.

For further information please refer to the Telit AT Commands Reference Guide [1].

3.3.1. Example

Platform: GE865-QUAD + JF2 EEPROM.

Cellular GPIOs chosen to control the JF2 EEPROM: #4,5.

The proper AT commands sequence is:

- AT\$GPSD=2,2
- AT\$GPSGPIO=4,5,0,0
- AT\$GPSSAV
- AT#REBOOT
- Wait the URC “*\$SIFIXEV: Host EE Files Successfully Created*”
- AT#CPUMODE=3
- AT\$GPSP=1

For further information about the EE Host Storage Mode please refer to [2] and [1].

3.4. JN3 Flash

The Telit Cellular module is configured to manage the JN3 Flash GPS receiver by issuing the following AT commands (see the Telit AT Command User Guide [1]):

- **AT\$GPSD=3,0**, this command configures the Telit cellular module's serial port #1 (Trace) to be used with JN3 receiver. Moreover, it enables the whole set of "bundle" GPS AT commands.
- **AT\$GPSGPIO=x,0,w,0**, this command configures GPIOs # x and w to drive the JN3 LDO Enable and BOOT respectively.
- **AT\$GPSSAV**, this command saves the configuration applied above.
- **AT#REBOOT**, this command reboots the entire system.
- **AT\$GPSP=1**, this command turns the JN3 Flash ON.

From now on, the JN3 Flash receiver will be managed through the Telit Cellular module.



IMPORTANT:

The first GPIO in "**AT\$GPSGPIO=x,y,w,z**" must always be connected to the LDO Enable signal, which supplies the external Telit GNSS receiver.



NOTE:

This configuration is valid for the JN3 Flash variant with default baud rate @ 4800bps. In case of JN3 baudrate equal to 9600 bps, the **AT\$GPSSERSPEED=9600** command must be sent before **AT\$GPSSAV**.

Issuing **AT\$GPSSAV** after **AT\$GPSP=1** the GPS receiver will be turned ON on every cellular module startup.

For further information please refer to the Telit AT Commands Reference Guide [1].

3.4.1. Example

Platform: GE865-QUAD + JN3 Flash

Cellular GPIOs chosen to control the JN3 Flash: #4, 6

The proper AT commands sequence is:

- **AT\$GPSD=3,0**
- **AT\$GPSGPIO=4,0,6,0**
- **AT\$GPSSAV**
- **AT#REBOOT**
- **AT\$GPSP=1**

3.5. JN3 ROM

The Telit Cellular module is configured to manage the JN3 ROM GPS receiver by issuing the following AT commands (see Telit AT command user guide [1]):

- **AT\$GPSSD=3,1**, this command configures Telit cellular module's serial port #1 (Trace) to be used with a JN3 ROM receiver (Controlled Mode). Moreover, it enables the whole set of "bundle" GPS AT commands.
- **AT\$GPSGPIO=x,0,0,0** this command configures GPIOs # x to manage the JN3 LDO Enable.
- **AT\$GPSSAV**, this command saves the configuration applied above.
- **AT#REBOOT**, this command reboots the entire system.
- **AT#CPUMODE=3**, this command sets the cellular module CPU Clock @104 MHz (to be issued if needed, see Chapter 3)
- **AT\$GPSP=1**, this command turns the JN3 ON.

From now on, the JN3 ROM receiver will be fully managed through the Telit cellular module.



IMPORTANT:

The first GPIO in "**AT\$GPSGPIO=x,y,w,z**" must always be connected to the LDO Enable signal, which supplies the external Telit GNSS receiver.



NOTE:

This configuration is valid for JN3 ROM variant with default baud rate @ 4800bps. In case of JN3 baudrate equal to 9600 bps, the **AT\$GPSSERSPEED=9600** command must be sent before **AT\$GPSSAV**.

Issuing **AT\$GPSSAV** after **AT\$GPSP=1** the GPS receiver will be turned ON on every cellular module startup.

For further information please refer to the Telit AT Commands Reference Guide [1]

3.5.1. Example

Platform: GE865-QUAD + JN3 ROM

Cellular GPIOs chosen to control the JN3 ROM: #4

The proper AT commands sequence is:

- AT\$GPSD=3,1
- AT\$GPSGPIO=4,0,0,0
- AT\$GPSSAV
- AT#REBOOT
- Wait the URC “\$SIFIXEV: Host EE Files Successfully Created”
- AT#CPUMODE=3
- AT\$GPSP=1

For further information about the EE Host Storage Mode please refer to [2] and [1].

3.6. JN3 EEPROM

The Telit Cellular module is configured to manage the JN3 EEPROM GPS receiver by issuing the following AT commands (refer to Telit AT command user guide [1]):

- **AT\$GPSD=3,2**, this command configures the Telit cellular module’s serial port #1 (Trace) to be used with a JN3 EEPROM. Moreover, it enables the whole set of “bundle” GPS AT commands.
- **AT\$GPSGPIO=x,0,0,0** this command configures GPIOs # x to drive the JN3 LDO Enable.
- **AT\$GPSSAV**, this command saves the configuration applied above.
- **AT#REBOOT**, this command reboots the entire system.
- **AT#CPUMODE=3**, this command sets the cellular module CPU Clock @104 MHz (to be issued if needed, see Chapter 3)
- **AT\$GPSP=1**, this command turns the JN3 ON.

From now on, the JN3 EEPROM receiver can be managed through the Telit cellular module.



IMPORTANT:

The first GPIO in “**AT\$GPSGPIO=x,y,w,z**” must always be connected to the LDO Enable signal, which supplies the external Telit GNSS receiver.

**NOTE:**

This configuration is valid for the JN3 EEPROM variant with default baud rate @ 4800bps. In case of JN3 baudrate equal to 9600 bps, the AT\$GPSSERSPEED=9600 command must be sent before AT\$GPSSAV.

Issuing AT\$GPSSAV after AT\$GPSP=1 the GPS receiver will be turned ON on every cellular module startup.

For further information please refer to the Telit AT Commands Reference Guide [1].

3.6.1. Example

Platform: GE865-QUAD + JN3 EEPROM.

Cellular GPIOs chosen to control the JN3 EEPROM: #4.

The proper AT commands sequence is:

- AT\$GPSD=3,2
- AT\$GPSGPIO=4,0,0,0
- AT\$GPSSAV
- AT#REBOOT
- Wait the URC “*\$SIFIXEV: Host EE Files Successfully Created*”
- AT#CPUMODE=3
- AT\$GPSP=1

For further information about the EE Host Storage Mode please refer to [2] and [1].

3.7. SE880

The Telit Cellular module is configured to manage the SE880 GPS receiver by issuing the following AT commands (see Telit AT Command User Guide [1]):

- **AT\$GPSD=2,1**, this command configures the Telit cellular module's serial port #1 (Trace) to be used with a SE880 receiver. Moreover, it enables the whole set of "bundle" GPS AT commands.
- **AT\$GPSGPIO=x,y,0,0** this command configures GPIOs # x, y to drive the SE880 GPS_ON/OFF and GPS_SYSTEM_ON respectively.
- **AT\$GPSSAV**, this command saves the configuration applied above.
- **AT#REBOOT**, this command reboots the entire system.
- **AT#CPUMODE=3**, this command sets the cellular module CPU Clock @104 MHz (to be issued if needed, see Chapter 3)
- **AT\$GPSP=1**, this command turns the SE880 ON.

From now on, the SE880 GPS receiver can be managed through the Telit cellular module.



IMPORTANT:

The first GPIO in "**AT\$GPSGPIO=x,y,w,z**" must always be connected to the external GNSS receiver's ON-OFF pin.



NOTE:

In case of baud rate of SE880 is different to 4800, **AT\$GPSSERSPEED=9600** must be sent before **AT\$GPSSAV**.

Issuing **AT\$GPSSAV** after **AT\$GPSP=1** the GPS receiver will be turned ON on every cellular module startup.

For further information please refer to the Telit AT Commands Reference Guide [1].

3.7.1. Example

Platform: GE865-QUAD + SE880.

Cellular GPIOs chosen to control the SE880: #4, 5.

The proper AT commands sequence is:

- **AT\$GPSD=2,1**
- **AT\$GPSGPIO=4,5,0,0**
- **AT\$GPSSAV**
- **AT#REBOOT**
- Wait the URC "**\$SIFIXEV: Host EE Files Successfully Created**"
- **AT#CPUMODE=3**
- **AT\$GPSP=1**

For further information about the EE Host Storage Mode please refer to [2] and [1].

3.8. SL869

The Telit Cellular module is configured to manage the SL869 GNSS receiver by issuing the following AT commands (refer to Telit AT command user Guide [1]):

- **AT\$GPSSD=4**, this command configures the Telit cellular module's serial port #1 (Trace) to be used with a SL869 receiver. Moreover, it enables the whole set of "bundle" GPS AT commands.
- **AT\$GPSGPIO=x,0,w,0**, this command configures GPIOs # x and w to manage the SL869 LDO Enable and BOOT respectively.
- **AT\$GPSSAV**, this command saves the configuration applied above.
- **AT#REBOOT**, this command reboots the entire system.
- **AT\$GPSP=1**, this command turns the SL869 ON

From now on, the SL869 GNSS receiver will be fully managed through the Telit cellular module.



IMPORTANT:

The first GPIO in "**AT\$GPSGPIO=x,y,w,z**" must always be connected to the LDO Enable signal, which supplies the external Telit GNSS receiver.

Since the latest SL869 firmware versions (next to v. 3.1.5.1) are configured to work using the lowest TESEOII CPU clock speed, we strongly suggest to issue the AT\$GPSSTCPUCLK command (once the GNSS receiver is up and running) to improve the SL869 general responsiveness to AT commands and performances when using ST-AGPS.



NOTE:

Issuing AT\$GPSSAV after AT\$GPSP=1 the GNSS receiver will be turned ON on every cellular module startup.

For further information please refer to the Telit AT Commands Reference Guide [1].

3.9.1. Example

Platform: GE865-QUAD + SE868 V2.

Cellular GPIOs chosen to control the SE868-V2: #4, 5.

The proper AT commands sequence is:

- AT\$GPSD=5,2
- AT\$GPSGPIO=4,5,0,0
- AT\$GPSSERSPEED=9600
- AT\$GPSSAV
- AT#REBOOT
- AT#CPUMODE=3
- AT\$GPSP=1

3.10. SC872-A, SE868-A, SL871 and SL869 V2

The Telit Cellular module is configured to manage the SC872-A, SE868-A, SL871 or SL869 V2 GNSS receiver by issuing the following AT commands (refer to AT Command User Guide [1]):

- **AT\$GPSD=6**, this command configures the Telit cellular module's serial port #1 (Trace) to be used with a SC872-A, SE868-A, SL871 or SL869 V2 receiver. Moreover, it enables the whole set of "bundle" GPS AT commands.
- **AT\$GPSGPIO=x,0,0,z**, this command configures GPIOs # x, z to drive the SC872-A, SE868-A, SL871 or SL869 V2 LDO Enable and RESET respectively.
- **AT\$GPSSERSPEED=9600**, this command configures Trace serial port baudrate.
- **AT\$GPSSAV**, this command saves the configuration applied above.
- **AT#REBOOT**, this command reboots the entire system.
- **AT\$GPSP=1**, this command turns the SC872-A, SE868-A, SL871 or SL869 V2 ON.

From now on, the SC872-A, SE868-A, SL871 or SL869 V2 GNSS receiver will be managed through the Telit cellular module.



IMPORTANT:

The first GPIO in "**AT\$GPSGPIO=x,y,w,z**" must always be connected to the LDO Enable signal, which supplies the external Telit GNSS receiver.



NOTE:

AT\$GPSSERSPEED=9600 must be sent before AT\$GPSSAV.

Issuing AT\$GPSSAV after AT\$GPSP=1 the GNSS receiver will be turned ON on every cellular module startup.

For further information please refer to the Telit AT Commands Reference Guide [1].

3.10.1. Example

Platform: GL865-QUAD + SL871

Cellular GPIOs chosen to control the SL871: #5, 7

The proper AT commands sequence is:

- AT\$GPSD=6
- AT\$GPSGPIO=5,0,0,7
- AT\$GPSSERSPEED=9600
- AT\$GPSSAV
- AT#REBOOT
- AT\$GPSP=1

3.11. SE868-V3 and SE873

The Telit Cellular module is configured to manage the SE868-V3 or SE873 receiver by issuing the following AT commands (refer to AT Command User Guide [1]):

- **AT\$GPSD=5**, this command configures the Telit cellular module's serial port #1 (Trace) to manage the external GNSS receiver. Moreover, it enables the whole set of "bundle" GNSS AT commands.
- **AT\$GPSGPIO=x,y,w,z**, this command configures GPIOs # x, y, w and z to manage the GNSS receiver GPS_ON/OFF, GPS_SYSTEM_ON, GPS_BOOTSEL and GPS_RESET signals respectively.
- **AT\$GPSSERSPEED=9600**, this command configures Trace serial port baudrate.
- **AT\$GPSSAV**, this command saves the bundle configuration in the cellular module's flash memory.
- **AT#REBOOT**, this command reboots the entire system.
- **AT\$GPSP=1**, this command turns the receiver ON.

From now on, the SE868-V3 or SE873 GNSS receiver will be managed through the Telit cellular module (so-called "controlled mode").



IMPORTANT:

The first GPIO in "**AT\$GPSGPIO=x,y,w,z**" must always be connected to the GNSS receiver's ON-OFF pin.



NOTE:

AT\$GPSSERSPEED=9600 command must be sent before AT\$GPSSAV.
Issuing AT\$GPSSAV after AT\$GPSP=1 the GNSS receiver will be turned ON on every Telit cellular module startup.
For further information please refer to the Telit AT Commands Reference Guide [1].

3.11.1. Example

Bundle solution with GE910-QUAD + SE868-V3.

Cellular module's GPIOs chosen to control the SE868-V3: #7, 8, 9, 10.

The list of the AT commands needed to configure the GE910-QUAD to control the SE868-V3 is:

- AT\$GPSD=5
- AT\$GPSGPIO=7,8,9,10
- AT\$GPSSERSPEED=9600
- AT\$GPSSAV
- AT#REBOOT
- AT\$GPSP=1

4. PATCHING SIRFSTAR IV/V ROM-BASED RECEIVERS

JF2 ROM, JN3 ROM and SE880 receivers are based on SiRF Star IV whereas SE868 V2 is based on SiRF Star V.

A ROM-based GNSS receiver cannot neither permanently store a custom configuration nor be updated with a new software version. This is inherent to the ROM (Read Only Memory) technology.

However, a ROM-based GNSS receiver allows the application of firmware patches.

Patches are sent into an operating SiRF Star ROM and applied into the GNSS receiver's internal patch RAM.

If backup battery power is lost or if BBRAM is corrupted, the patch contents must be re-sent to the operating receiver.

In order to patch a GNSS ROM-based receiver in a bundle solution, a proper set of AT commands is required.

This set of AT commands allows customers to use the Patch Manager embedded in the cellular module.

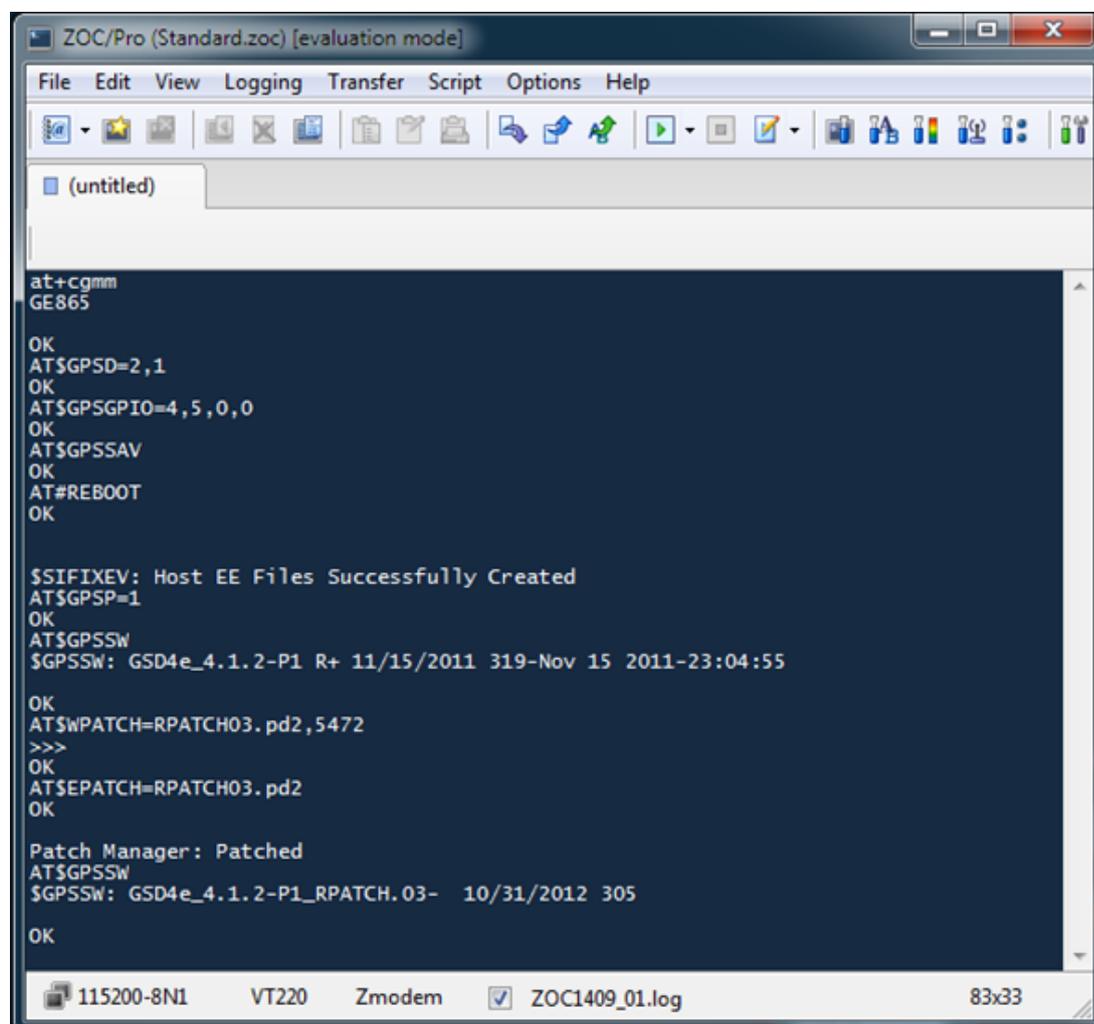
For further information about ROM Patching please refer to [6].

The following examples show how to patch a SiRFStar IV/V ROM-based GNSS receiver.

4.1. How to patch SiRFStar IV ROM 2.2-based receivers

This procedure can be applied to JF2 ROM, JN3 ROM and SE880.

An example on how to setup the bundle mode (controlled mode) and patch a SiRF Star IV ROM 2.2-based GNSS receiver (e.g. through a GE865 cellular module) is shown in the figure below:

The image shows a screenshot of the ZOC/Pro software interface. The window title is "ZOC/Pro (Standard.zoc) [evaluation mode]". The menu bar includes File, Edit, View, Logging, Transfer, Script, Options, and Help. The toolbar contains various icons for file operations and communication. The main text area displays the following AT commands and responses:

```
at+cgmm
GE865

OK
AT$GPSD=2,1
OK
AT$GPSGPIO=4,5,0,0
OK
AT$GPSSAV
OK
AT#REBOOT
OK

$SIFIXEV: Host EE Files Successfully Created
AT$GPSP=1
OK
AT$GPSSW
$GPSSW: GSD4e_4.1.2-P1 R+ 11/15/2011 319-Nov 15 2011-23:04:55

OK
AT$WPATCH=RPATCH03.pd2,5472
>>>
OK
AT$EPATCH=RPATCH03.pd2
OK

Patch Manager: Patched
AT$GPSSW
$GPSSW: GSD4e_4.1.2-P1_RPATCH.03- 10/31/2012 305

OK
```

The status bar at the bottom shows the device ID "115200-8N1", baud rate "VT220", modem type "Zmodem", a checked box for "ZOC1409_01.log", and the resolution "83x33".

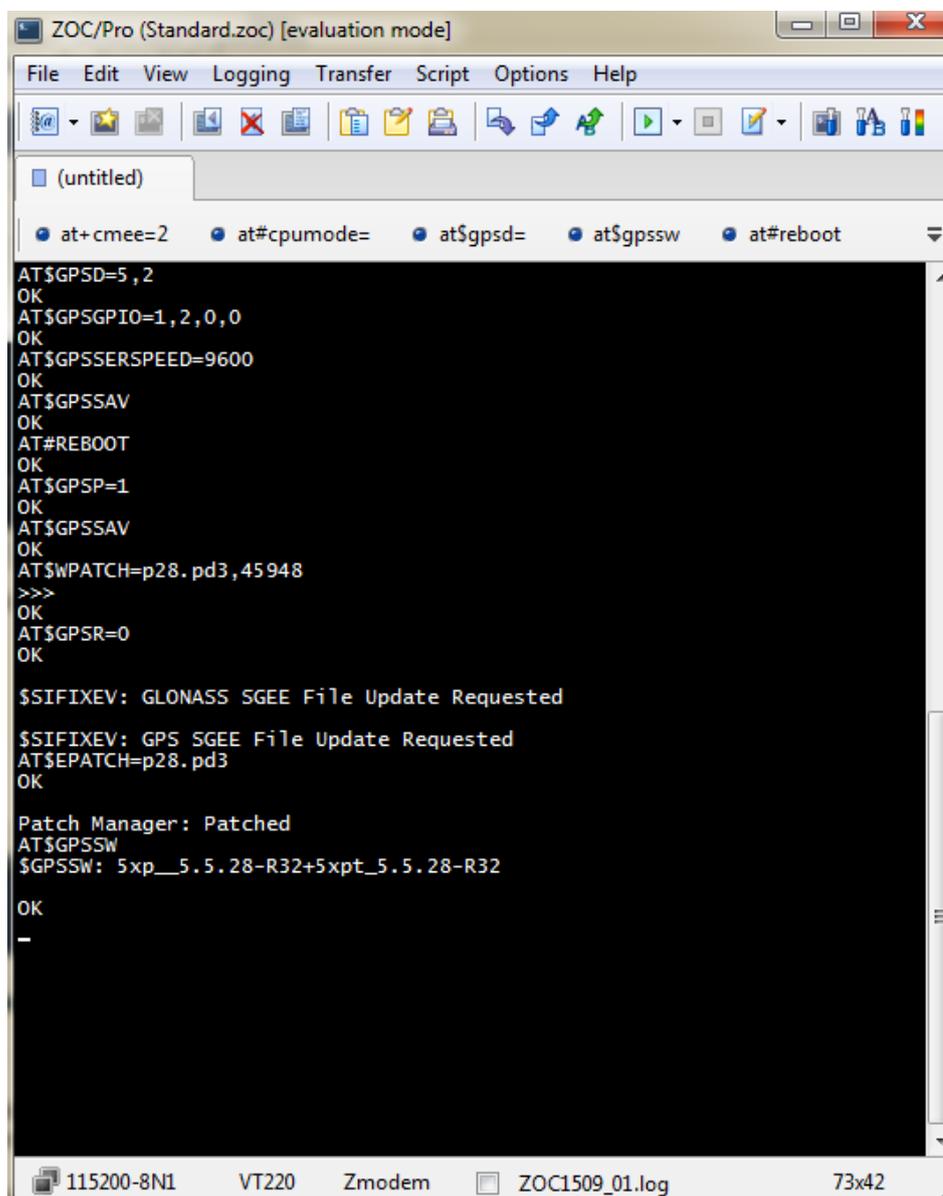
Fig. 4: AT commands for ROM patching

Issue the AT\$GPSSAV command if the patch has to be automatically applied on every startup of the cellular module and whenever the backup battery power is lost.

4.2. How to patch SiRFStar V ROM based receivers

This procedure can be applied to SE868 V2.

An example on how to setup the bundle mode (controlled mode) and patch a Sirf Star V ROM-based GNSS receiver (e.g. through a GE910-QUAD cellular module) is shown in the figure below:



```

ZOC/Pro (Standard.zoc) [evaluation mode]
File Edit View Logging Transfer Script Options Help
(untitled)
at+cme=2 at#cpumode= at$gpsd= at$gpssw at#reboot
AT$GPSD=5,2
OK
AT$GPSGPIO=1,2,0,0
OK
AT$GPSSERSPEED=9600
OK
AT$GPSSAV
OK
AT#REBOOT
OK
AT$GPSP=1
OK
AT$GPSSAV
OK
AT$WPATCH=p28.pd3,45948
>>>
OK
AT$GPSR=0
OK
$SIFIXEV: GLONASS SGEE File Update Requested
$SIFIXEV: GPS SGEE File Update Requested
AT$EPATCH=p28.pd3
OK
Patch Manager: Patched
AT$GPSSW
$GPSSW: 5xp__5.5.28-R32+5xpt_5.5.28-R32
OK
-
115200-8N1 VT220 Zmodem ZOC1509_01.log 73x42

```

Fig. 5: AT commands for ROM patching

Issue the AT\$GPSSAV command if the patch has to be automatically applied on every startup of the cellular module and whenever the backup battery power is lost.

5. A-GPS FOR SIRF STAR IV/V BASED RECEIVERS

5.1. JF2, JN3 and SE880: how to download and inject SGEE files

This procedure can be applied to all JF2/JN3 variants and SE880.

In order to evaluate the SiRF InstantFix feature through the usage of SGEE (Server Generated Extended Ephemeris) files, the following set of AT Commands is required:

```

ZOC/Pro (C:\Users\matteoma\Desktop\ZOC Terminal .zoc) [evaluation mode]
File Edit View Logging Transfer Script Options Help
(untitled)
AT#HTTPCFG AT#HTTPQRY AT$HTTGETIFIX RMC AT#SGACT
AT&F
OK
AT+CGMM
GE865
OK
AT$GPSSW
$GPSSW: GSD4e_4.1.2-P1_RPATCH.03- 10/31/2012 305
OK
AT$GPSIFIX=1,1,1,0
OK
SSIFIXEV: SGEE File Update Requested
AT+CGDCONT=1,IP,internetm2m.air.com
OK
AT#SGACT=1,1
#SGACT: 10.42.4.88
OK
AT#HTTPCFG=0,"Telit AGPS Server",,1,"user",password"
OK
AT#HTTPQRY=0,0,"/diff/packedDifference.f2p1enc.ee"
OK
#HTTTPRING: 0,200,"ephemeris/plain",10388
AT$HTTGETIFIX=0,10388
OK
115200-8N1 VT220 Zmodem [x] ZOC1409_01.log 83x33

```

Fig. 6: AT commands for SiRF InstantFix



IMPORTANT:

In a bundle solution with a ROM2.2-based GNSS receiver, SGEE (Server Generated Extended Ephemeris) and CGEE (Client Generated Extended Ephemeris) data are saved in the Telit cellular module's NVM, since the GNSS receiver is not able to permanently store any data.

Therefore, if the cellular module is turned off while the GNSS receiver is operating, it won't be possible to use SGEE/CGEE GNSS aiding for a faster TTFF.

In order to obtain the credentials to access and download SGEE files from the Telit A-GPS Server, the execution of a Non-Disclosure Agreement (NDA) is required.

Please contact your Regional Sales representative or Telit Technical Support to request and receive the appropriate NDA form for your region/country.

For further information about SiRF InstantFix technology please refer to [4].



WARNING:

The GSD4E_4.1.2-P1_RPATCH_03 is the minimum software patch version required to use the SGEE feature on ROM2.2-based GNSS receivers.

In a bundle solution with ROM2.2-based GNSS receiver, VBatt (battery backup) removal causes a loss of data in GNSS receiver's SRAM, so it is necessary to download the SGEE file again.

Please contact our Telit Technical Support in order to verify if your Telit cellular firmware supports all the commands for the SGEE feature.

5.2. [SE868 V2, SE868-V3, SE873: how to download and inject SGEE files](#)

SE868 V2, SE868-V3 and SE873 support both GPS and GLONASS SGEE files.

The following paragraphs show how to download and inject GPS and GLONASS SGEE files into the receiver.



WARNING:

The GSD5xp_5.5.28. is the minimum software patch version required to use the SGEE feature on a SE868 V2.

Please contact our Telit Technical Support in order to verify if your Telit cellular firmware supports all the commands for the SGEE feature.

In order to obtain the credentials to access and download SGEE files from the Telit A-GPS Server, the execution of a Non-Disclosure Agreement (NDA) is required.

Please contact your Regional Sales representative or Telit Technical Support to request and receive the appropriate NDA form for your region/country.

For further information about specific Telit AT commands please refer to [1].

5.2.1. GPS SGEE files

In order to download and inject a GPS SGEE file, the following set of AT Commands is required:

```
AT&F
OK
AT+CGMM
UL865-EUR

OK
AT$GPSSW
$GPSSW: 5xp__5.5.28-R32+5xpt_5.5.28-R32

OK
AT$GNSSIFIX?
$GNSSIFIX: 0,1,1
$GNSSIFIX: 1,1,1

OK
AT+CGDCONT=1,IP,internetM2M.air.com
OK
AT#SGACT=1,1
#SGACT: 10.49.16.114

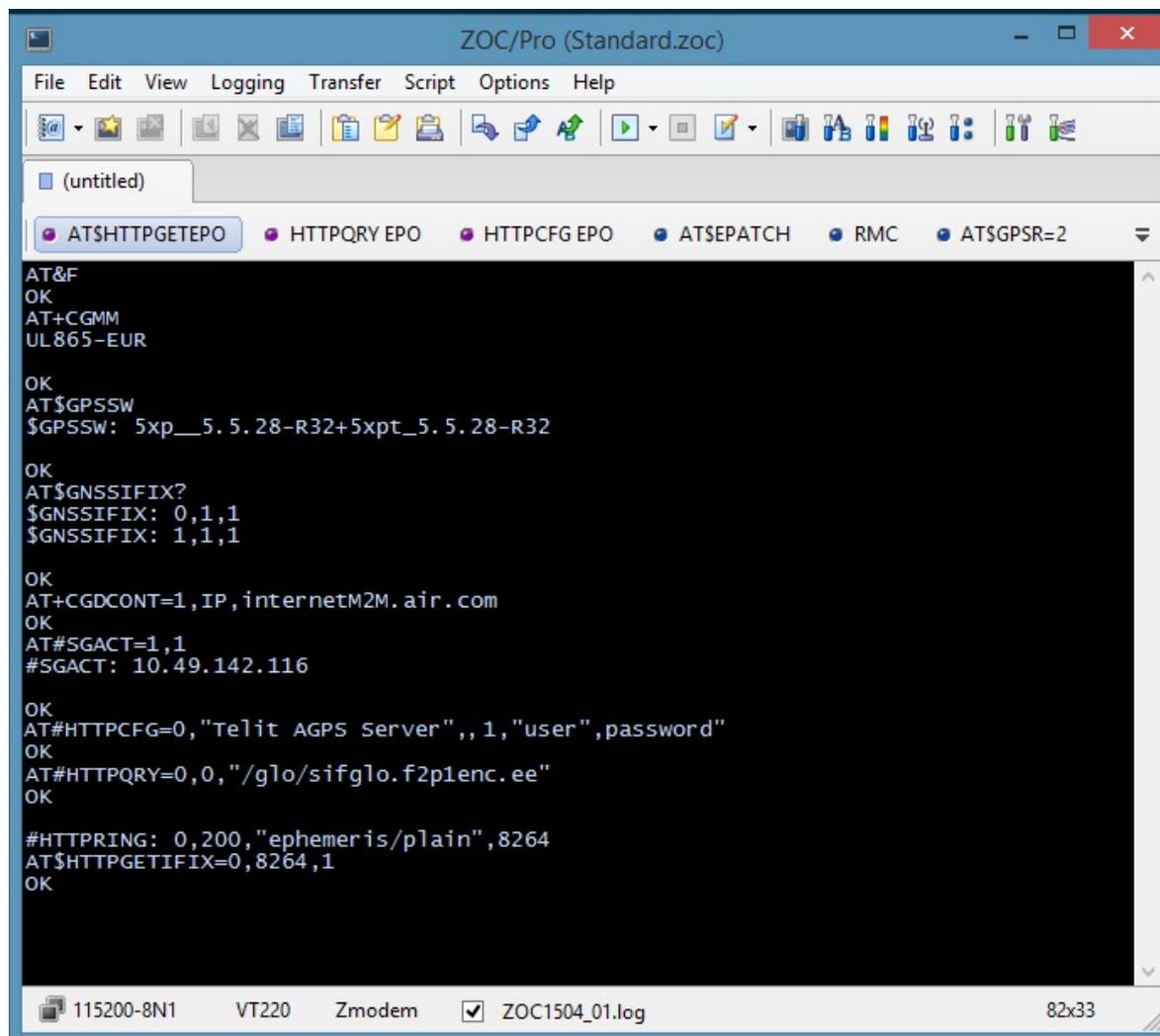
OK
AT#HTTPCFG=0,"Telit AGPS Server",,1,"user",password"
OK
AT#HTTPQRY=0,0,"/gps/sifgps.f2p1enc.ee"
OK

#HTTPRING: 0,200,"ephemeris/plain",10742
AT$HTTPGETIFIX=0,10742
OK
```

Fig. 7: AT commands for SiRF InstantFix

5.2.2. GLONASS SGEE files

In order to download and inject a GLONASS SGEE file, the following set of AT Commands is required:

The image shows a screenshot of the ZOC/Pro terminal window. The window title is "ZOC/Pro (Standard.zoc)". The menu bar includes "File", "Edit", "View", "Logging", "Transfer", "Script", "Options", and "Help". The toolbar contains various icons for file operations and terminal control. The main text area displays the following AT commands and responses:

```
AT&F
OK
AT+CGMM
UL865-EUR

OK
AT$GPSSW
$GPSSW: 5xp__5.5.28-R32+5xpt_5.5.28-R32

OK
AT$GNSSIFIX?
$GNSSIFIX: 0,1,1
$GNSSIFIX: 1,1,1

OK
AT+CGDCONT=1,IP,internetM2M.air.com
OK
AT#SGACT=1,1
#SGACT: 10.49.142.116

OK
AT#HTTPCFG=0,"telit AGPS Server",,1,"user",password"
OK
AT#HTTPQRY=0,0,"/glo/sifglo.f2p1enc.ee"
OK

#HTTTPRING: 0,200,"ephemeris/plain",8264
AT$HTTPGETIFIX=0,8264,1
OK
```

The status bar at the bottom shows "115200-8N1", "VT220", "Zmodem", a checked box for "ZOC1504_01.log", and "82x33".

Fig. 8: AT commands for SiRF InstantFix

5.3. How to test the SGEE functionality

This procedure can be applied to all JF2/JN3 variants, SE880, SE868 V2, SE868-V3 and SE873.

Under Warm start conditions the usage of SGEE files reduces the TTFF required by the GNSS receiver.

```

ZOC/Pro (C:\Users\matteoma\Desktop\ZOC Terminal .zoc) [evaluation mode]
File Edit View Logging Transfer Script Options Help
[untitled]
AT#HTTPCFG AT#HTTPQRY AT#HTTPGETIFIX RMC AT#SGACT
AT+CGMM
GE865
OK
AT$GPSSW
$GPSSW: GSD4e_4.1.2-P1_RPATCH.03- 10/31/2012 305
OK
AT$GPSNMUN=3,0,0,0,0,1,0
CONNECT
$GPRMC,143214.000,A,3913.6596,N,00904.1271,E,0.0,167.15,030914,,A=58
$GPRMC,143215.000,A,3913.6596,N,00904.1271,E,0.0,167.15,030914,,A=59
$GPRMC,143216.000,A,3913.6596,N,00904.1271,E,0.0,167.15,030914,,A=5A
NO CARRIER
AT$GPSR=2
OK
AT$GPSNMUN=3,0,0,0,0,1,0
CONNECT
$GPRMC,143225.005,V,,,,,030914,,N=44
$GPRMC,143226.005,V,,,,,030914,,N=47
$GPRMC,143227.005,V,,,,,030914,,N=46
$GPRMC,143228.004,V,,,,,030914,,N=48
$GPRMC,143229.004,A,3913.6658,N,00904.1179,E,0.05,94.70,030914,,A=53
$GPRMC,143230.005,A,3913.6627,N,00904.1264,E,0.13,94.70,030914,,A=5A
$GPRMC,143231.000,A,3913.6625,N,00904.1266,E,0.03,94.70,030914,,A=5F
NO CARRIER
115200-8N1 VT220 Zmodem [x] ZOC1409_01.log 84x33
  
```

Fig. 9: Verify SiRF InstantFix SGEE feature

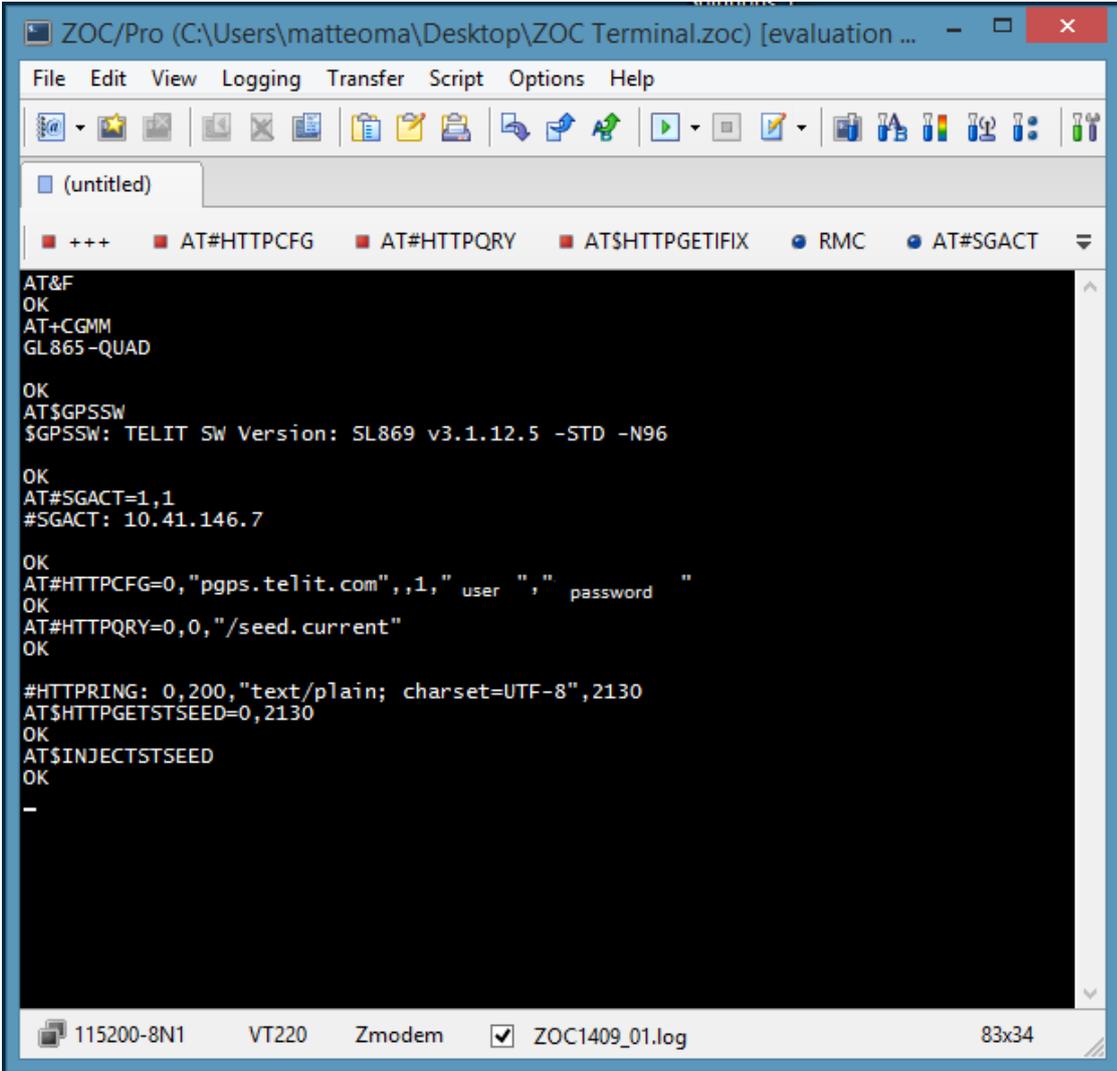


WARNING:

The external GNSS receiver must be in a Warm start condition, i.e. a valid UTC Time is required before using the SGEE feature.

6. A-GPS FOR SL869: HOW TO DOWNLOAD AND INJECT A SEED FILE

To download and inject a ST-AGPS Seed file and then evaluate the server-based assistance provided by the ST-AGPS technology, the following set of AT Commands is required:



```

ZOC/Pro (C:\Users\matteoma\Desktop\ZOC Terminal.zoc) [evaluation ...
File Edit View Logging Transfer Script Options Help
(untitled)
+++ AT#HTTPCFG AT#HTTPQRY AT$HTTPGETIFIX RMC AT#SGACT
AT&F
OK
AT+CGMM
GL865-QUAD
OK
AT$GPSSW
$GPSSW: TELIT SW Version: SL869 v3.1.12.5 -STD -N96
OK
AT#SGACT=1,1
#SGACT: 10.41.146.7
OK
AT#HTTPCFG=0,"pgps.telit.com",,1," user "," password "
OK
AT#HTTPQRY=0,0,"/seed.current"
OK
#HTTPRING: 0,200,"text/plain; charset=UTF-8",2130
AT$HTTPGETSTSEED=0,2130
OK
AT$INJECTSTSEED
OK
-
115200-8N1 VT220 Zmodem [x] ZOC1409_01.log 83x34

```

Fig. 10: AT commands for ST-AGPS

In order to obtain the credentials to access and download Seed files from the Telit PGPS Server, the execution of a Non-Disclosure Agreement (NDA) is required.

Please contact your Regional Sales representative or Telit Technical Support to request and receive the appropriate NDA form for your region/country.

For further information about the ST-AGPS technology please refer to [5].

**WARNING:**

ST-AGPS is available starting with firmware version 3.1.5.1.

Before injecting a Seed file, a valid UTC time is required. For Seed computation time please refer to the Telit AGPS Server Based Application Note for SL869 [5].

Please contact our Telit Technical Support in order to verify if your Telit cellular firmware supports all the commands for the ST-AGPS feature.

7. A-GPS FOR SC872-A, SE868-A, SL871 AND SL869 V2

To download and inject the server-based assistance SGEE-EPO files, the following set of AT Commands is required:

The screenshot shows the ZOC/Pro (Standard.zoc) [evaluation mode] window. The main text area contains the following AT commands and responses:

```

AT+CGDCONT=1,"IP","internet.wind.biz"
OK
AT#SGACT=1,1
#SGACT: 10.60.231.120

OK
AT#HTTPCFG=0,"epo.telit.com",,1," user "," password "
OK
AT#HTTPORY=0,0,"/MTK30.EPO"
OK

#HTTTPRING: 0,200,"application/octet-stream",276480
AT$HTTPEGETEPO=0,276480
OK
AT#SGACT=1,0
OK
AT$INJECTEPO
OK
  
```

The status bar at the bottom shows: 115200-8N1 VT220 Zmodem ZOC1509_01.log 73x36

Fig. 11: AT commands for SGEE-EPO

Other AT commands:

- **AT\$QUERYEPO**: queries the EPO data status;
- **AT\$CLEAREPO**: deletes all the EPO data.

6 hours / 1 day / 3 days / 5 days / 7 days / 14 days / 30 days SGEE EPO files, for GPS and GPS + GLONASS (GR), are available on epo.telit.com Telit EPO Server (e.g.: EPO_GR_14.DAT).

In order to obtain the credentials to access and download EPO files from the Telit EPO Server, the execution of a Non-Disclosure Agreement (NDA) is required.

Please contact your Regional Sales representative or Telit Technical Support to request and receive the appropriate NDA form for your region/country.

8. BUNDLING WITH TELIT 3G/4G CELLULAR MODULES

Hardware and software configurations reported in the paragraphs above are still valid when bundling a GNSS receiver with a Telit 3G/4G cellular module.

Bundle solutions with 3G/4G cellular modules require one mandatory AT command in addition to the ones seen so far: AT#PORTCFG=11.

This AT command enables communication between the external GNSS receiver and the Trace port.



IMPORTANT:

The AT#PORTCFG=11 command must be issued on Telit 3G/4G cellular modules (e.g.: HE910 family) only.

8.1. Example

Platform: UL865-EUR + SE868 V2

Cellular GPIOs chosen to control the SE868 V2: #4, 5

AT commands sequence:

- AT#PORTCFG=11
- AT\$GPSD=5,2
- AT\$GPSGPIO=4,5,0,0
- AT\$GPSSERSPEED=9600
- AT\$GPSSAV
- AT#REBOOT
- AT\$GPSP=1

9. DOCUMENT HISTORY

Revision	Date	Changes
0	2014-09-01	First issue
1	2015-04-14	Updated Applicability Table. Add SE868-V2 configuration procedure for 2G and HSPA Modules
2	2015-06-26	Added a note in Software Bundle Configuration chapter to suggest AT#CPUMODE usage with some bundling HW configurations.
3	2015-07-06	Added a note in Software Bundle Configuration chapter to suggest AT#CPUMODE usage with some bundling HW configurations.
4	2015-12-18	Added SC872-A, SE868-A, SL871 and SL869-V2 support, SE868-V2 support for patching and other minor changes.
5	2016-11-07	Added SE868-V3, SE873 and 4G technology support.
6	2017-06-07	2017 Template Applied
7	2018-04-13	Updated applicability table
8	2018-09-06	Corrected wrong doc revision number. Updated fig.6, 7 and 8.



SUPPORT INQUIRIES

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

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