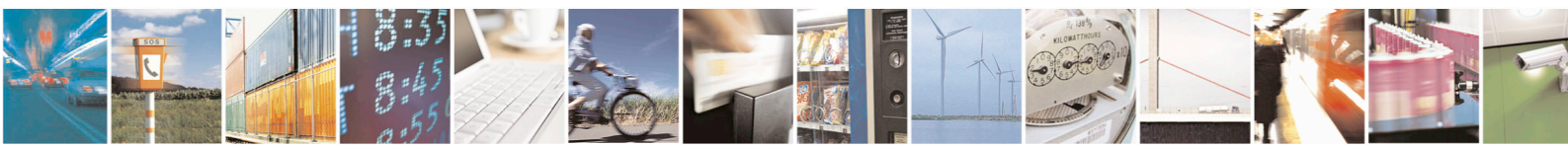
SiRFInstantFix™ Application Note

80000NT10064A Rev.3 – 2014-02-21

Making machines talk.

APPLICABILITY TABLE

PRODUCT
GC864-QUAD V2
GC864-DUAL V2
GE864-GPS
GE865-QUAD
GE866-QUAD
GL865-QUAD
GL865-DUAL
GL865-QUAD V3
GL865-DUAL V3
GL868-DUAL
GL868-DUAL V3
GE910-QUAD V3
GE910-QUAD
GE910-QUAD AUTO



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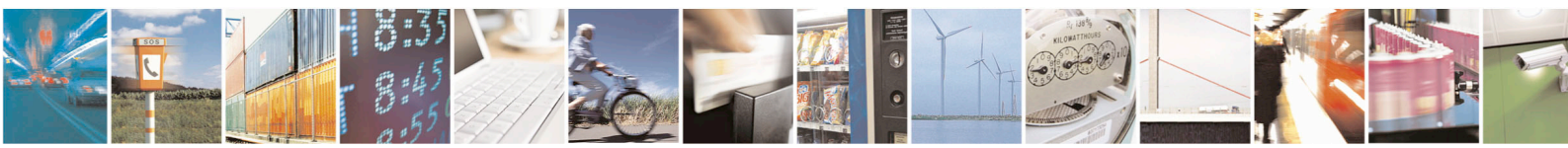

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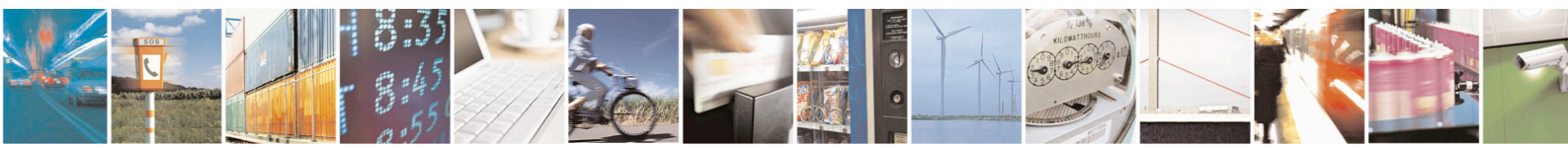
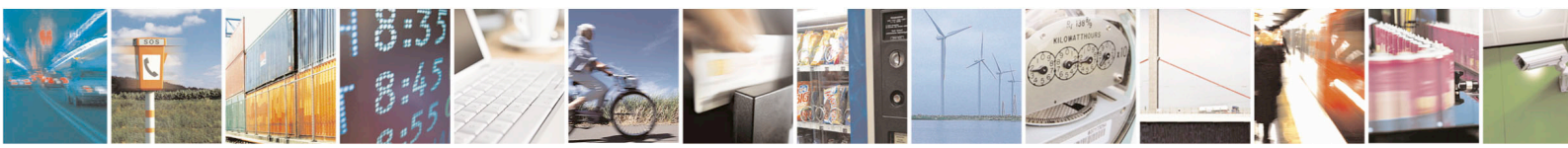


Contents



1. Introduction

1.1. Scope

Scope of this document is to provide customers with all the necessary information about the SiRFInstantFix™ technology and how it can be successfully used on the GE864-GPS (SiRF StarIV-based) module, and on the Telit GSM+GPS (SiRF StarIV-based) bundle solutions, to dramatically reduce Time to First Fix (TTFF) in most harsh environments.

1.2. Audience

This document is intended for customers developing location based applications.

1.3. 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-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

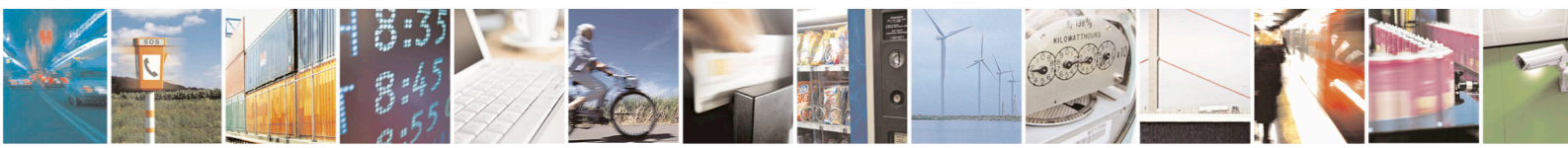
Alternatively, use:

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.



1.4. Document Organization

This document contains the following chapters (sample):

"Chapter 1: "Introduction" provides a scope for this document, target audience, contact and support information, and text conventions.

"Chapter 2: "SiRFInstantFix™" describes the SiRFInstantFix™ technology.

"Chapter 3: "Configuring SIRFInstantFix" describes how SiRFInstantFix™ can be enabled on GE864-GPS, and on the Telit GSM+GPS (SiRF StarIV-based) bundle solutions, and how customers can update and inject new Server Generated Extended Ephemeris (SGEE) files into SiRF Star IV using FTP or HTTP connection.

"Chapter 4: "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.

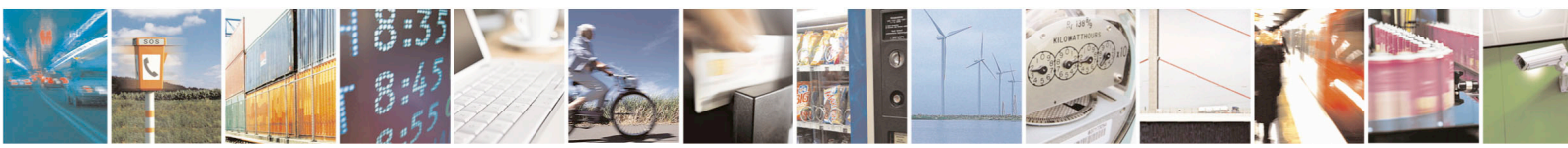
Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

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] CSR_InstantFix_Extended_Ephemeris_(EE)_and_A-GPS.pdf
- [2] A-GPS and SiRFInstantFixII™ SGEE_CGEE - CSR.pdf
- [3] Telit_AT_Commands_Reference_Guide_r17.pdf
- [4] Telit_Jupiter_Host_NVM_Storage_Application_Note_r3.pdf



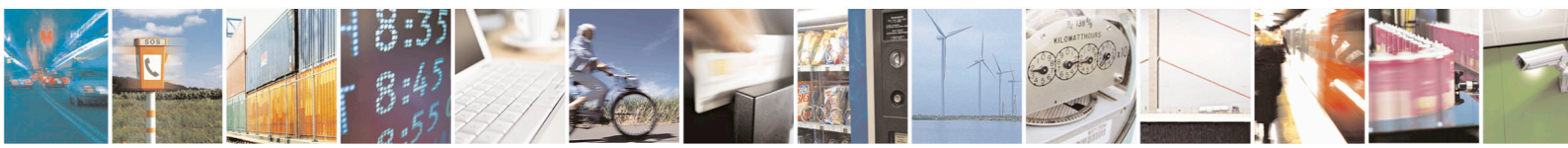
2. SiRFInstantFix™

Under Warm and Cold Start conditions, navigation data (broadcast ephemeris) download time is typically the major contributor to Time to First Fix (TTFF).
SiRFInstantFix™ satellite prediction technology greatly improves start-up times, for any location-centric device (with or without internet accessibility), in most harsh environments.
SiRFInstantFix™ is a system that provides pre-calculated synthetic Extended Ephemeris (EE) data to the GPS receiver to reduce TTFF.
This aiding method can work in either Client Generated Extended Ephemeris (CGEE) or Server Generated Extended Ephemeris (SGEE) modes, or both.

When in CGEE mode, the SiRF StarIV GPS receiver autonomously predicts ephemeris over 3 days without server assistance and by using broadcast ephemeris data downloaded from locally visible satellites.
When in SGEE mode, SiRFInstantFix™ the EE server generates predicted ephemeris (SGEE) files providing aiding over 1, 3, 7 and 14 days that can be consumed by the SiRF StarIV GPS receiver.
When both CGEE and SGEE are enabled at the same time, the SiRF StarIV GPS receiver autonomously decides which mode has to be used upon CGEE and SGEE data age.

The following table summarizes CGEE and SGEE aiding options and related performances [1]:

	CGEE	**SGEE**
Aiding Data	Predicted Ephemeris	Predicted Ephemeris
Time To First Fix (TTFF)	< 10 seconds	< 10 seconds
Aiding Duration	3 days	1, 3, 7, 14 days
Data Connection	NOT Required	Required
Assistance Data Download Size	0 KB: Predicted Ephemeris is generated on client device	1 day ≈ 11 KB 3 days ≈ 33 KB 7 days ≈ 77 KB 14 days ≈ 144 KB
Horizontal Accuracy (95%)	< 28m	1 day: 5.7 m 3 days: 13.7 m 7 days: 36.1 m



2.1. CGEE Data

CGEE data is always generated for a prediction interval of three days:
- Consists of 18 blocks of 4-hour EE data blocks
- Updated when a newly visible satellite is acquired
- Updated when new broadcast ephemeris is received from a tracked satellite and the current EE data block is nearing expiration
- On average, it takes 1.2 seconds per satellite for the receiver to calculate CGEE

2.2. SGEE Data

SGEE files are generated for different prediction intervals. Prediction interval is the time period over which synthetic ephemeris data is applicable.
Currently the SiRF server calculates EE data for a prediction interval of 14 days; this EE data is then used to generate all the SGEE files below:

- packedDifference.f2p1enc.ee ➔ 1-day
- packedDifference.f2p3enc.ee ➔ 3-days
- packedDifference.f2p7enc.ee ➔ 7-days
- packedDifference.f2p7enc.ee ➔ 14-days

New SGEE files are published on the SiRF server at the start of each UTC day.
SGEE data consists of N segments of synthetic 4-hour ephemerides (e.g. 1-day file ➔6 segments); each segment contains ephemerides for all healthy satellites.

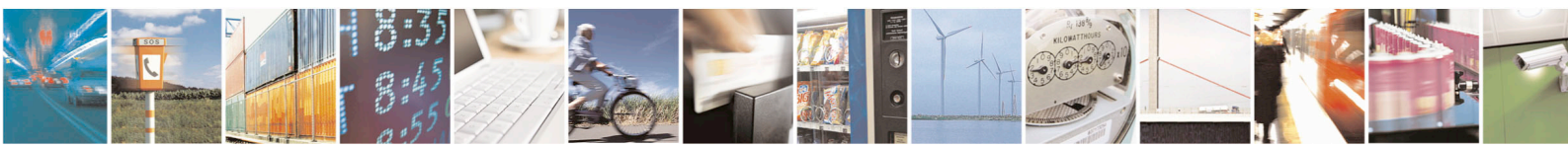
Each SGEE file is “repackaged” by SiRF throughout the day:

- Stale 4-hour segment dropped from the beginning of the EE file
- Next available 4-hour segment appended to the end of the file

Telit AGPS Server gets EE files from the SiRF Server every two hours in order to provide customers with the most up-to-date SGEE files.

WARNING:

GE864-GPS ONLY: 14-days SGEE files are supported starting from SiRF StarIV firmware version **GSD4e_4.1.2-P5_CCK F+ 01/08/2013 8TELIT100.**



3. Configuring SIRFInstantFix™

SiRFInstantFix™ can be enabled on GE864-GPS, and on the Telit GSM+GPS (SiRF StarIV-based) bundle solutions, by issuing the AT$GPSIFIX command (see [3]).

For details about SiRFInstantFix™ configuration on SiRF StarIV-ROM-based GPS receivers (JF2-ROM, JN3-ROM and SE880) please see the next paragraph 3.1.

Customer's applications can enable SiRFInstantFix™ as shown in the examples below:

- CGEE enabled only

AT$GPSIFIX=1,1,0

- SGEE enabled only

AT$GPSIFIX=1,0,1,0

The command above allows the GSM module to relay the "*$SIFIXEV: SGEE File Update Requested"* Unsolicited Result Code (URC) upon Aiding Data Requests coming from SIRF Star IV (e.g. previously stored SGEE data is expired).

The SGEE update requests can also be scheduled on a time basis as shown below:

AT$GPSIFIX=1,0,1,4

The command above allows the GSM module to relay the "*$SIFIXEV: SGEE File Update Requested"* URC every 4 hours.

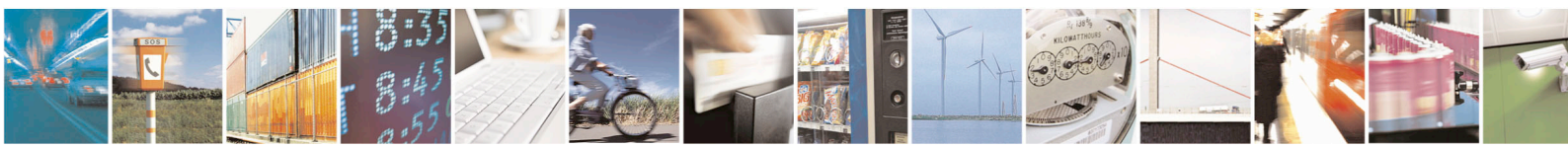
The URC shown above can be used by customer's application to trigger the SGEE file update procedure.

- CGEE + SGEE enabled (Mixed Mode)

AT$GPSIFIX=1,1,1,4

WARNING:

The maximum update rate value that can be set through the AT$GPSIFIX is currently limited to 168, i.e. hours in case of 7-days SGEE files usage.



3.1. SiRFInstantFix™ On SiRF StarIV ROM-based GPS Receivers

The Telit Jupiter receiver modules, J-F2, J-N3 and SE880, store broadcast ephemeris as well as synthetic ephemeris data in non-volatile memory.
If non-volatile storage is not available, broadcast ephemeris data is retained by the module in battery-backed RAM and is therefore available after the module is awakened from the Hibernate state. However, non-volatile storage is required to store synthetic ephemeris data (EE), whether it is calculated locally (CGEE) or provided externally (SGEE).

In cases where the GPS module has no non-volatile storage resources (ROM-only module) or limited resources (ROM+EEPROM module), the module needs to be put into Host EE Storage mode to use non-volatile storage resources provided by the Host device (Telit GSM module). Once in this operating mode, the receiver uses the host serial port to access the Host resources and to read and write ephemeris data as needed.

The EE Host Storage Mode is transparently enabled on a SiRF StarIV-ROM-based GPS receiver as soon as it is configured to work with a Telit GSM module, through the AT$GPSD command.

The example below shows how SiRFInstantFix™ can be enabled on a SiRF StarIV-ROM-based GPS receiver (e.g. JF2-ROM). For further details on the AT commands used below, see [3].

1. Configure the GPS receiver in Controlled Mode (this enables the EE Host Storage Mode too):

   AT$GPSD=2,1

2. Configure the GPIOs of the GSM module to drive the GPS receiver:

   AT$GPSGPIO=4,5,0,0

3. Save the current AT configuration for the GPS receiver:

   AT$GPSSAV

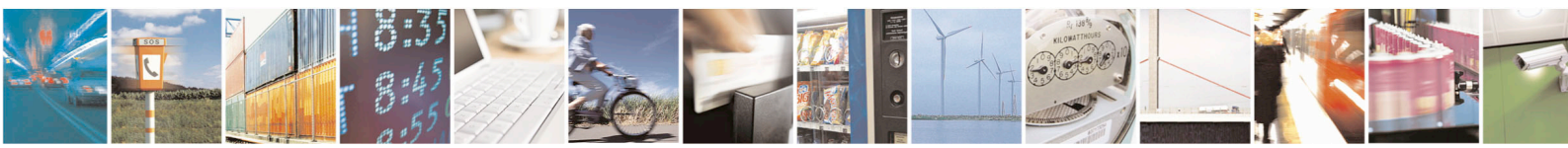
4. Reboot the GSM module to let the system create empty EE Files and wait for the reception of the following Unsolicited Result Code (URC) before going ahead (see the WARNING note in the next page):

   $SIFIXEV: Host EE Files Successfully Created

5. Turn the GPS receiver ON:

   AT$GPSP=1

6. Check if the GPS receiver is ON by polling its SW version:



AT$GPSSW

7. Configure the SiRFInstantFix™:

   AT$GPSIFIX=1,1,1,0

8. Save the current AT configuration for the GPS receiver:

   AT$GPSSAV

For further information on the EE Host Storage Mode please refer to [4].

WARNING:

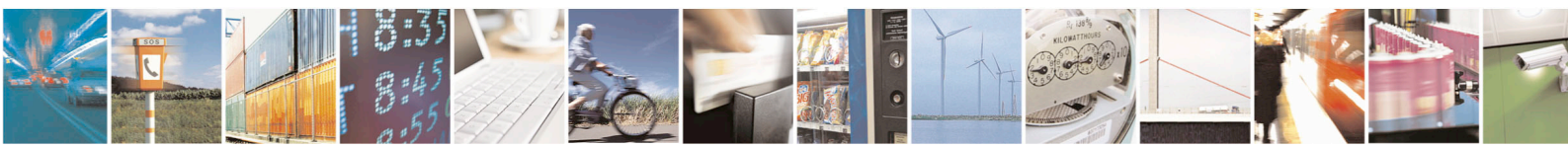
The EE Host Storage Mode currently supports 1, 3, 7 days SGEE files.

The URC "*$SIFIXEV: Host EE Files Successfully Created"* is relayed when:

- The EE files are created for the first time, i.e. after the very first GPS configuration: in this case the URC is relayed with a delay of about 20-25 seconds.

- The EE files pass the integrity checks performed during next startups

The URC "*$SIFIXEV: Host EE Files Creation Failed"* is relayed when the EE files creation or integrity check fails. In this case a system reboot should be forced to let the GSM module create the database for the EE Files again.



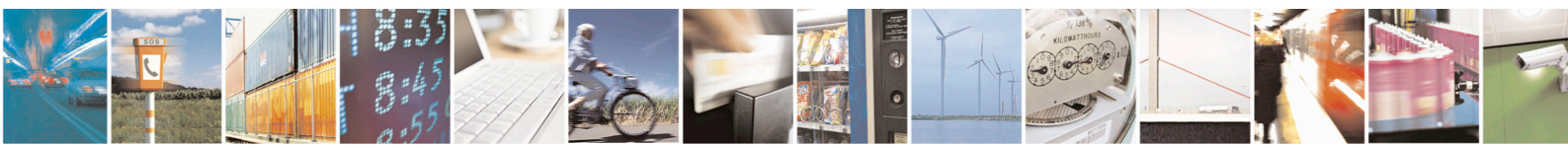
3.2. SGEE File Update using FTP

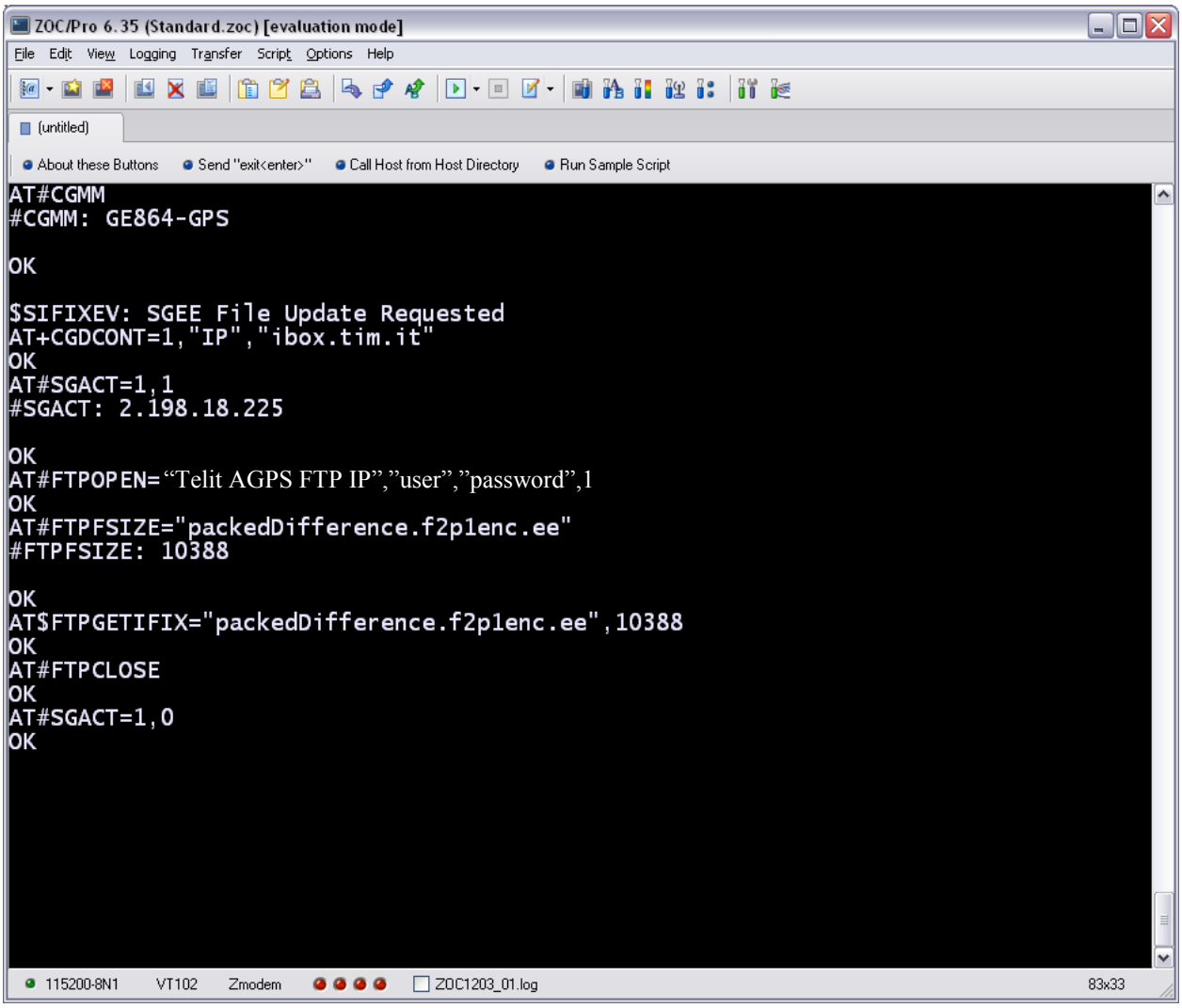
Whenever SiRF Star IV needs a fresh SGEE file, or when an update has been scheduled on a time basis, the *"$SIFIXEV: SGEE File Update Requested"* URC is relayed by the GSM module as described in 3.
The URC above can therefore be used to trigger the SGEE file update procedure.

The SGEE file update is a very simple procedure and can be accomplished in just a few easy steps:

1) Once the "*$SIFIXEV: SGEE File Update Requested*" URC is received, the customer's application must activate a PDP context and open an FTP connection to Telit AGPS Server (please contact Telit Technical Support Center [1.3] for Telit AGPS Server Access Credentials).
2) Afterwards the new SGEE file size must be taken through the AT#FTPFSIZE command.
3) The AT$FTPGETIFIX command [3] must then be issued, specifying the SGEE file size got before, to open a data connection, download a new SGEE file from the FTP server and inject it into the SiRF StarIV.
4) Once the SGEE update procedure has successfully finished, the customer's application must close the FTP connection and deactivate the previously activated PDP context.

The following example shows all the required steps to perform the update of a 1-day SGEE file (packedDifference.f2p1enc.ee).





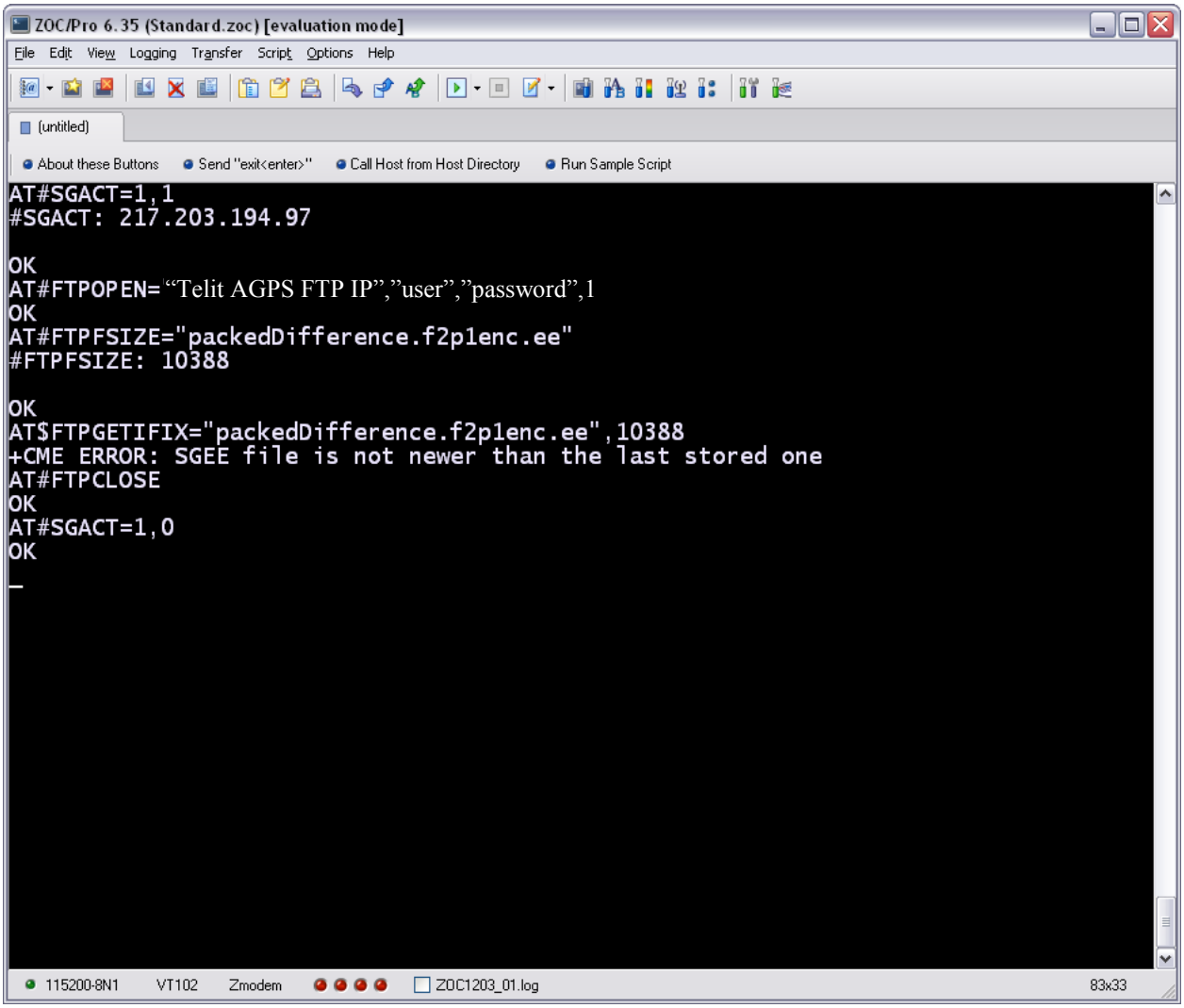
WARNING:

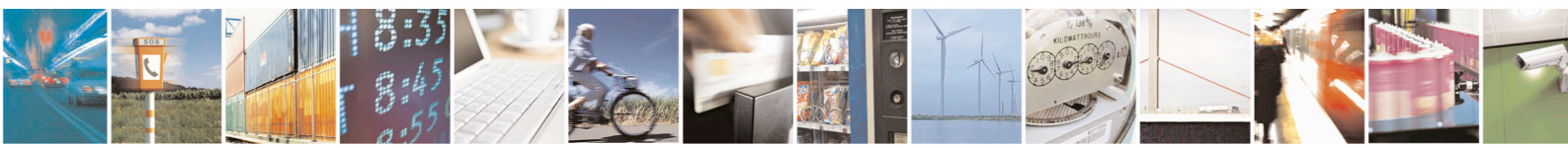
An ERROR result code is returned whenever an error occurs during the SGEE file injection stage. If the AT+CMEE command has been issued to enable the Report Mobile Equipment Error, all the AT$FTPGETIFIX specific errors will be reported in the form: **+CME ERROR: <err>.**

If an error occurs, the customer's application must close the FTP connection, deactivate the previously activated PDP context and reschedule the SGEE update.

An "SGEE update generic error" ERROR is returned whenever a wrong SGEE file size is used to perform the update. Note that when a wrong SGEE file size is used, the SGEE file update may be successful even if an ERROR is returned.
A wrong SGEE file size may also cause an "SGEE update initialization stage failed" ERROR.

An "SGEE file is not newer than the last stored one" ERROR is returned whenever an SGEE update is performed before the currently stored SGEE file has expired (see the image below).





3.3. SGEE File Update using HTTP

An SGEE file can be alternatively updated by using the HTTP protocol.

The SGEE file update via HTTP is a very simple procedure and can be accomplished in just a few easy steps:

1) Once the "*$SIFIXEV: SGEE File Update Requested*" URC is received, the customer's application must configure all the HTTP parameters, needed to access the Telit AGPS Server, through the AT#HTTPCFG command [3] and then activate a PDP context.

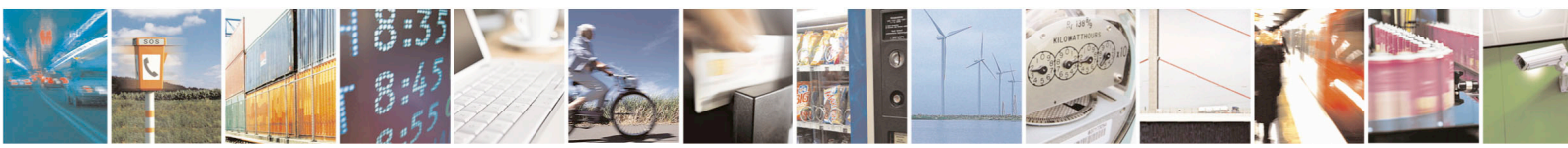
   Please contact the Telit Technical Support Center [1.3] for Telit AGPS Server Access Credentials).

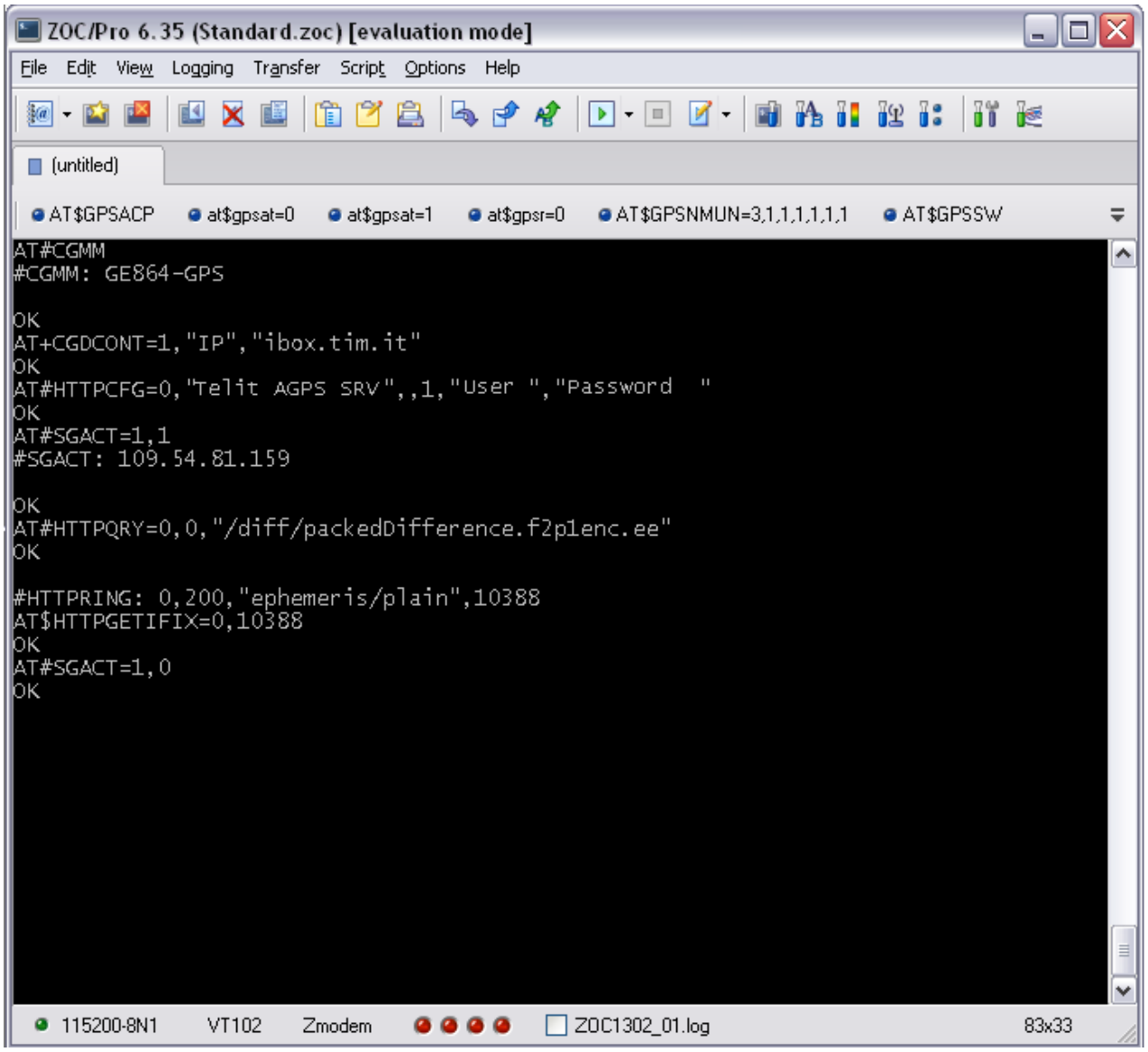
2) Once the PDP context has been activated, the new SGEE file size must be retrieved through the AT#HTTPQRY command [3] by specifying the SGEE file name. The SGEE file size is returned through the #HTTPRING URC.

3) The AT$HTTPGETIFIX command [3] must then be issued, specifying the SGEE file size got before, to download a new SGEE file from the HTTP server and inject it into the SiRF StarIV.

4) Once the SGEE update procedure has successfully finished, the customer's application must deactivate the previously activated PDP context.

The following example shows all the required steps to perform the update of a 1-day SGEE file (packedDifference.f2p1enc.ee).



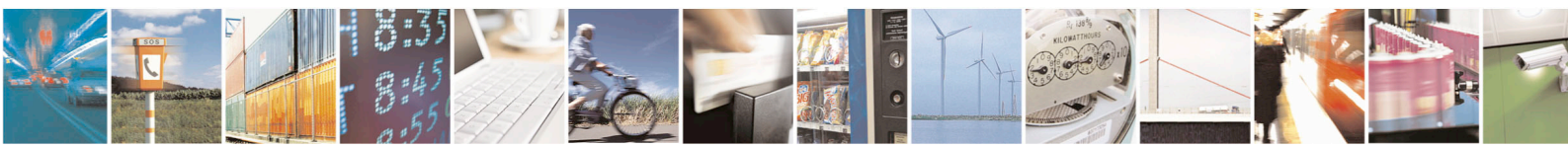


WARNING:

An ERROR result code is returned whenever an error occurs during the SGEE file injection stage. If the AT+CMEE command has been issued to enable the Report Mobile Equipment Error, all the AT$HTTPGETIFIX specific errors will be reported in the form: **+CME ERROR: <err>.**

If an error occurs, the customer's application must deactivate the previously activated PDP context and reschedule the SGEE update.

An "SGEE update generic error" ERROR is returned whenever a wrong SGEE file size is used to perform the update. Note that when a wrong SGEE file size is used, the SGEE file update may be successful even if an ERROR is returned.
A wrong SGEE file size may also cause an "SGEE update initialization stage failed" ERROR.



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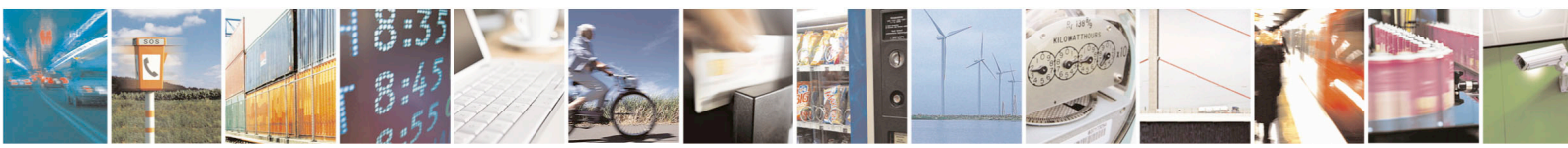

4. Document History

Revision	Date	Changes
0	2012-03-19	First issue
1	2012-05-04	Change Applicability Table: GE864-GPS Chapter 2 – Remove all SGEE 5-days file references Paragraph 3.1 – SGEE File Update: - Add minor changes to the WARNING Section.
2	2012-02-20	Change Applicability Table. Add 14-days SGEE file support Paragraph 3.1 - SiRFInstantFix On SiRF StarIV ROM-based GPS Receivers - New paragraph Paragraph 3.2 - SGEE File Update using FTP - Changed name Paragraph 3.3 - SGEE File Update using HTTP - New paragraph
3	2014-02-21	Updated Applicability Table. Paragraph 3.1 - SiRFInstantFix On SiRF StarIV ROM-based GPS Receivers - Modified the configuration procedure