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APN Content Level	BASIC	✓	INTERMEDIATE	ADVANCED	Confidentiality	Public	✓	Private
Hardware Compatibility	Product Line	AirPrime	Variant	HL8548-G	HL8549-G			
Software Compatibility	ALL							



1 Introduction

This technical note describes the GNSS issue that could be observed in very rare cases on the HL8548-G and HL8549-G modules, and describes a workaround to overcome this issue.

2 Problem Description

2.1 Overview

At cold start, a constant position error of up to 300 to 400 meters may occur. This positioning error disappears after a maximum of 5 minutes. This issue only happens if all of the following conditions are met:

- When SUPL¹ is not used (either the cellular network's SUPL service is not available, or the SUPL service is not enabled using AT command **AT+GPSUPLCFG**),
- During cold starts,
- When two constellations are used to make the fix (GPS and GLONASS), and
- When CN0² is unstable during the fix acquisition phase.

Note that the reproducibility of the issue can be increased if the RX chain is not designed correctly (the GNSS receiver should not be saturated. Refer to section 3.22.3 GNSS Antenna Recommendation of documents [1] AirPrime HL8548 and HL8548-G Product Technical Specification and [2] AirPrime HL8549 and HL8549-G Product Technical Specification for details).

2.2 Cause

In order to properly estimate the position based on both GPS and GLONASS systems, the ephemerides received from the satellites have to be properly decoded. While all the information is not correctly decoded, the GPS/GLONASS engine will perform some estimations based on the values already stored in ROM (these values will be default factory values during each cold start).

When the CN0 of some of the received satellites is unstable, the GPS/GLONASS engine won't be able to decode the ephemerides fast enough and will use the values stored in ROM instead, leading to the positioning error described in this document. When the process of ephemeris decoding ends, the positioning error will disappear.

Note that LEAP SECOND³ and TauGPS⁴ parameters, included in the ephemerides and stored in ROM, are key parameters in order to correctly combine the information received from both GPS and GLONASS satellites. They are also key factors in the origin of the error observed in the described case.

When SUPL service is used, the ephemerides are retrieved from the cellular network and therefore do not rely on the values stored in ROM. This explains why the issue will not happen when SUPL service is used.

1 SUPL stands for Secure User Plane Location. SUPL protocol defines the standards for using secure user plane location to receive GPS information quickly to mobile devices.

2 CN0 is the signal to noise ratio.

3 A leap second is a one-second adjustment that is occasionally applied to Coordinated Universal Time (UTC) in order to keep its time of day close to the mean solar time, or UT1. Without such a correction, time reckoned by Earth's rotation drifts away from atomic time because of irregularities in the Earth's rate of rotation.

4 Tau GPS is the GPS/GLONASS system time (sub 1-second) offset between GPS and GLONASS.

3 Workaround

Since the problem is linked to the simultaneous use of GPS and GLONASS constellations, the user could deactivate GLONASS constellation acquisition using AT command `AT+GPSCONF=10,0`. Refer to document [3] AirPrime HL6 and HL8 Series AT Commands Interface Guide for more information about this AT command.

It is also important to check the fix quality (refer to Table 4 Indicative Fix Reliability of document [3] AirPrime HL6 and HL8 Series AT Commands Interface Guide for more information).

4 Reference Documents

- [1] AirPrime HL8548 and HL8548-G Product Technical Specification
Reference number: 4114663
- [2] AirPrime HL8549 and HL8549-G Product Technical Specification
Reference number: 4115653
- [3] AirPrime HL6 and HL8 Series AT Commands Interface Guide
Reference number: 4114680

5 Support

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6 Document History

Level	Date	History
1.0	June 29, 2016	Creation
1.1	July 06, 2016	Fixed document typo

7 Legal Notice

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Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

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Note: Some airlines may permit the use of cellular phones while the aircraft is on the ground and the door is open. Sierra Wireless modems may be used at this time.

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