Release note

Topic **ZED-F9R-03B with firmware FW1.00 HPS1.30**

UBX-22035201 C1-Public

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Contents

1 General information

The product with order code ZED-F9R-03B is delivered with the HPS1.30 firmware. This document is also applicable to other devices capable of running this firmware.

1.1 Scope

This release note covers the changes to the HPS 1.30 firmware compared to the HPS 1.21 firmware version. For a comprehensive list of changes with respect to earlier versions, this release note should be read in conjunction with the HPS 1.21 release notes [4].

1.2 Released firmware image

Released firmware image	
File	UBX_F9R_100_HPS130.3437fe3d1f7b8807403bed548d6142d0.bin
Firmware version	EXT CORE 1.00 (a59682) FWVER=HPS 1.30
ROM base support	ROM 1.02 - ROM BASE 0x118B2060

1.3 Related software

Version 22.07 (or later) of u-center GNSS evaluation software is recommended to be used with the released firmware. Please contact FAE if this version is not available on the official web site.

Version 19.03 (or later) of the firmware update tool supports this release.

1.4 Open-Source declaration

This u-blox positioning product described in this release note, comprising the company's proprietary software, does not contain open-source software to declare.

1.5 Related documentation

[1] u-blox HPS 1.30 Interface description, UBX-22010984
[2] u-blox ZED-F9R Integration Manual, UBX-20039643
[3] u-blox ZED-F9R-03B Data Sheet, UBX-22024085
[4] ZED-F9R-02B-HPS_Release Note, UBX-21035491

2 New features

When migrating from a previous version of the product, users of the product are advised to perform a thorough re-testing in their system. HPS130 should be thought of as a new firmware release rather than an update or upgrade from HPS121.

2.1 SPARTN 2.0.1

SPARTN, Secure Position Augmentation for Real Time Navigation, is an open standard format available at https://www.spartnformat.org/.

A service provider using SPARTN formatted corrections can enable high precision positioning applications with the ZED-F9R. Compared to RTCM, which is used primarily for OSR, SPARTN has a complete set of messages suitable for SSR models without the use of vendor specific messages. The use of SSR in the foundation allows services to be efficiently delivered over a broadcast medium such as L-band satellite signal or cellular networks. This allows a product to be deployed anywhere on a continent with a single service provider.

This release of SPARTN supports corrections for GPS, GLONASS and Galileo.

2.2 SPARTN over L-band

ZED-F9R supports SPARTN corrections as broadcasted by L-band satellites.

Receiving the SPARTN correction stream requires a NEO-D9S who then must pass the correction stream to ZED-F9R in the form of UBX-RXM-PMP messages either by directly connecting the UART interfaces between the devices or the host relaying the messages.

2.3 SPARTN source selection

ZED-F9R supports multiple SPARTN correction stream sources. It can support a SPARTN correction stream received over the internet (SPARTN IP stream) or over L-band satellites (SPARTN L-band stream). Only one source can be configured to be used at a time by ZED-F9R.

2.4 PointPerfect encrypted SPARTN support

ZED-F9R supports on-device decryption of encrypted PointPerfect SPARTN correction streams. PointPerfect is a correction service available from u-blox that can provide SPARTN correction streams over the internet or over L-band satellites.

2.5 CLAS CSSR

ZED-F9R supports CLAS (Centimeter Level Augmentation Service); an augmentation service broadcasted by the Japanese regional satellites system, QZSS. This free service is intended for mass market applications, such as surveying, heavy machinery used in precision construction, and precision agriculture.

The CLAS augmentation service is broadcasted by a QZSS L6 signal which is not part of the frequency range covered by ZED-F9R. As such, ZED-F9R does not support receiving, demodulating and decoding of the QZSS L6 signal. This is supported by NEO-D9C which then must pass the correction stream to ZED-F9R in the form of UBX-RXM-QZSSL6 messages. This enables the ZED-F9R to directly use these messages and extract the compact SSR (cSSR) formatted corrections in order to use them directly without further processing or reformatting by an intermediary.

At the time of this release note, a CLAS solution with ZED-F9R augments GPS L1C/A L2C, QZSS L1 C/A L2C, and Galileo E1B/C.

2.6 QZSS L1S signal support for SLAS

ZED-F9R supports SLAS (Sub-meter Level Augmentation Service); an augmentation service broadcasted by the Japanese regional satellites system, QZSS. This is a free service available in Japan.

The SLAS augmentation service is broadcasted by a QZSS L1S signal which is not part of the frequency range covered by ZED-F9R.

The CLAS solution augments systems using the GPS and QZSS constellations.

2.7 UBX protocol on UART2

ZED-F9R adds support for the UBX protocol as an input/output protocol on the UART2 interface.

Not all UBX functionality is available on UART2. UART2 should not be used as the sole interface.

2.8 Re-optimized sensor fusion

The sensor fusion system has been re-worked and optimized. As a result a higher GNSS update rate, when priority navigation mode is not enabled, can be achieved.

2.9 Improved jamming and spoofing detection

The ZED-F9R has improved mechanisms to detect jamming and spoofing related events that are reported to the user in a UBX message. Jamming is considered any kind of signal that is captured in RF band of the receiver and may affect the Carrier-to-noise ratio and signal tracking algorithms. Spoofing is broadly some kind of counterfeit signal generated intentionally by malicious parties in various possible ways.

The responses of different type of detectors are combined in a decision logic that is summarized in the log messages along with the duration of the detected events.

2.10 Wheel Tick-based spoofing detection

The ZED-F9R includes a specific spoofing detector for Dead Reckoning products that is using the wheel tick signal along with pure GNSS information for detecting spoofing events. The decision as to whether the indicator is a real threat to the system is use case dependent.

2.11 Advanced Calibration Handling

The ZED-F9R supports the restoration of sensor calibration values by the host after the system is powered off. Some hardware designs do not implement a battery backup due to costs. This feature allows the system to operate in sensor fusion mode after stopping the vehicle and backing up the values to the host.

2.12 Secondary output

A complete set of Navigation messages is available based on a solution computed by a secondary GNSS standalone filter at the same update rate as the primary output (GNS + sensor + RTK). These messages are available both in NMEA and UBX protocols.

These messages can be configured to restrict the use to only GPS satellites which have integrity monitoring messages. The resulting secondary output messages can be used as a check against potential software faults in the correction service or RTK software in the system. The secondary output is also a useful tool during development.

By default, the secondary output is disabled.

2.13 Processor loading monitoring

The UBX-MON-SYS message provides the instantaneous system performance in terms of CPU loading, memory usage and I/O usage. This may be used for user to evaluate the product in nondefault configurations to assess the impact on update rates on advanced functions like protection level or secondary outputs.

2.14 High-precision GNSS position protection level

ZED-F9R reports a high-precision GNSS position protection level (HPG PL) with a Target Misleading Information Risk (TMIR) of 5 [%MI/epoch], in other words a 5% probability of having misleading information per epoch.

ZED-F9R currently supports only position protection level output. It does not support velocity and time protection level output.

The confidence level of the protection level is validated against specific operating conditions. In the case of ZED-F9R it has been validated for RTK operation with RTCM input correction streams for VRS and local base as well as PPP-RTK with only the automotive dynamic model. The protection level output generated by the use of other dynamic models are marked as invalid.

2.15 Directionless Wheel Tick support

For systems where the direction input is not available in conjunction with the wheel tick, the ZED-F9R offers a configuration item to support this operating mode. The accuracy may be degraded compared to a system where both wheel tick and direction input is available.

2.16 Wake on motion

This feature is only available in ZED-F9R-03B hardware. The module IMU can monitor an accelerometer threshold and wake-up the host using an interrupt output pin.

With previous generations of hardware this pin is reserved and this feature is not available.

3 Message interface

3.1 UBX protocol

This firmware supports UBX protocol version 33.30.

3.2 NMEA protocol

NMEA version 4.11 is the default and is unchanged.

3.3 New messages

Message / Configuration item	Description / Comment
SPARTN-1X-OCB_GAL SPARTN-1X-HPAC_GAL SPARTN-1X-OCB_BDS SPARTN-1X-OCB_QZSS SPARTN-1X-HPAC_BDS SPARTN-1X-HPAC_QZSS	SPARTN 2.0 input messages supported beyond SPARTN 1.8.
CFG-SPARTN-USE_SOURCE	Select SPARTN input source to be used; can be IP stream containing SPARTN format messages or L-band stream containing UBX-RXM-PMP format messages (default: IP)
UBX-RXM-COR	Differential correction input status. Reported for all parsed correction input and can be used instead of UBX-RXM-RTCM and UBX-RXM-SPARTN.

	Message output rate configurable with new CFG-MSGOUT-UBX_RXM_COR_* configuration items.
UBX-RXM-SPARTNKEY	Poll or transfer dynamic SPARTN keys to be used for decrypting input SPARTN format messages
UBX-RXM-QZSSL6	QZSS L6 message. Input support for QZSS L6 messages containing a CLAS CSSR correction stream. UBX-RXM-QZSSL6 output requires a NEO-D9C.
UBX-RXM-PMP	Point to Multipoint (LBAND) message. Input support for SPARTN corrections as broadcasted by L-band satellites. UBX-RXM-PMP output requires a NEO-D9S.
CFG-QZSS-SLAS_MAX_BASELINE	Maximum baseline distance to closest GMS for applying SLAS corrections (default: 350 km)
CFG-QZSS-USE_SLAS_DGNSS CFG-QZSS-USE_SLAS_RAIM_UNCORR CFG-QZSS-USE_SLAS_TESTMODE	Configurations for SLAS corrections: 1. Set maximum baseline distance to the closest ground monitoring station 2. Use SLAS differential corrections 3. RAIM measurements that are not corrected by SLAS corrections 4. Enable Use of SLAS messages which are in test mode
CFG-NAV2-* CFG-NAV2-OUT_ENABLED CFG-NAV2-SBAS_USE_INTEGRITY	Configuration group CFG-NAV2 with configuration items for secondary output setup (default: secondary output disabled)
UBX-NAV2-CLOCK UBX-NAV2-COV UBX-NAV2-DOP UBX-NAV2-EELL UBX-NAV2-EOE UBX-NAV2-ODO UBX-NAV2-POSECEF UBX-NAV2-POSLLH UBX-NAV2-PVAT UBX-NAV2-PVT UBX-NAV2-SAT UBX-NAV2-SBAS UBX-NAV2-SIG UBX-NAV2-SLAS UBX-NAV2-STATUS UBX-NAV2-TIMEBDS UBX-NAV2-TIMEGAL UBX-NAV2-TIMEGLO UBX-NAV2-TIMEGPS UBX-NAV2-TIMELS UBX-NAV2-TIMEQZSS UBX-NAV2-TIMEUTC UBX-NAV2-VELECEF UBX-NAV2-VELNED	Secondary output (NAV2) messages in UBX format. Message output rate configurable with new CFG-MSGOUT-UBX_NAV2-* configuration items.
NMEA-NAV2-ID-GGA NMEA-NAV2-ID-GLL NMEA-NAV2-ID-GNS NMEA-NAV2-ID-GSA NMEA-NAV2-ID-RMC NMEA-NAV2-ID-VTG NMEA-NAV2-ID-ZDA	Secondary output (NAV2) messages in NMEA format. Available if configured NMEA version is NMEA 4.0 or later. Message output rate configurable with CFG-MSGOUT-NMEA_NAV2_ID_* configuration items.
UBX-NAV-PL	Protection level information. Message output rate configurable with new CFG-MSGOUT-UBX_NAV_PL_* configuration items.

CFG-NAVSPG-PL_ENA	Enable/disable protection level computing (default: protection level computing enabled)
UBX-SEC-SIGLOG	A new message to output signal security log, message output rate is configurable with CFG-MSGOUT-UBX_SEC_SIGLOG_ * configuration items
UBX-MON-SYS	Current system performance information. Message output rate configurable with new CFG-MSGOUT-UBX_MON_SYS_* configuration items.
UBX-MGA-SF	Aiding message for sensor fusion calibration
CFG-HW-SENS_WOM_MODE CFG-HW-SENS_WOM_THLD	Configuration to set the Wake-on-motion mode of operation Configuration to set the acceleration threshold which when reached would wake up the IMU sensor
CFG-SBAS-USE_IONOONLY	Configuration to enable use of SBAS ionosphere correction only
CFG-SEC-JAMDET_SENSITIVITY_HI	Enable to increase the sensitivity of jamming detection at the expense of increased false alarm rate
CFG-SFODO-DIS_DIR_INFO	Configuration to disable the use of WT directional information
CFG-SIGNAL-QZSS_L1S_ENA	Configuration to enable QZSS L1S signal
CFG-MSGOUT-UBX_RXM_COR_*	Configuration to enable output of differential correction input status
CFG-MSGOUT-UBX_NAV2-*	Configuration to enable output of secondary output messages in UBX format
CFG-MSGOUT-NMEA_NAV2_ID_*	Configuration to enable output of secondary output messages in NMEA format
CFG-MSGOUT-UBX_NAV_PL_*	Configuration to enable output of Protection level messages
CFG-MSGOUT-UBX_SEC_SIGLOG_ *	Configuration to enable output of security log messages

3.4 Modified messages

Message / Configuration item	**Description / Comment**
CFG-SBAS-PRNSCANMASK	Default value changed from 0x0000000000072bc8 to 0x0000000000072b88 and does not include PRN126
CFG-SFIMU-ACCEL_ACCURACY CFG-SFIMU-GYRO_ACCURACY	Default value was changed from FW default (0) to 1000 (10^-4 * m/s^2) and 100 (10^-3 * deg/s) respectively
CFG-SFODO-DIS_AUTOSW	Default value was changed from false to true
CFG-UART2INPROT-UBX	UBX input on UART2 is now enabled by default
UBX-NAV-SIG UBX-NAV-SAT	New correction sources CLAS reported

3.5 Removed messages

Message / Configuration item	**Description / Comment**
UBX-CFG-ANT UBX-CFG-DAT UBX-CFG-DGNSS UBX-CFG-ESFA UBX-CFG-ESALG UBX-CFG-ESFWT UBX-CFG-GEOFENCE UBX-CFG-GNSS UBX-CFG-INF UBX-CFG-ITFM	Legacy configuration messages that were dropped, please refer to the interface description document for the recommended configuration items to use in the new configuration concept.

UBX-CFG-NAV5 UBX-CFG-NAVX5 UBX-CFG-NMEA UBX-CFG-PWR UBX-CFG-RATE UBX-CFG-RINV UBX-CFG-SBAS UBX-CFG-SENIF UBX-CFG-TP5 UBX-CFG-USB	
CFG-ITFM-ANTSETTING CFG-ITFM-BBTHRESHOLD CFG-ITFM-CWTHRESHOLD CFG-ITFM-ENABLE CFG-ITFM-ENABLE_AUX	Configuration for legacy interference monitor, this has been replaced with simpler configuration interface

3.6 Firmware changes

3.6.1 Improvements

- Improved SBAS Message Type 1 content handling when containing invalid data
- Improved L2 tracking performance when receiver configured with GPS and GLONASS only
- Configuring the CFG-RATE-NAV configuration item with the unsupported value 128 no longer causes a system restart
- Improvements with handling of SPARTN ionospheric data and operations in Southern Hemisphere
- Improvements when working with datum other than WGS84 in corrections
- Improvements to bring the upper speed limits of the RLM dynamic model in line with specification. It has further been increased to 3 m/s.
- Improvements with many configurations written to flash quickly.

3.6.2 Firmware known limitations

- After exiting a tunnel, solution stays in dead reckoning mode longer than expected.
- System signal configuration performed by CFG-SIGNAL-* immediately after startup may be ignored until the next GNSS restart. Configuring to flash is a workaround.
- NMEA GxVLW and GxTHS messages in version 2.3 where information in version 4.0 is present.
- NMEA GxGRS and GxGNS messages may exceed the 82-character limit to 85 characters.
- Inconsistent WT (wheel tick or speed) input can lead to an unexpected receiver reset and a potential configuration reset to factory default values in RAM, BBR and flash. An exception string output ($GNTXT,01,01,01,exception 0x00020002 has occurred*2E) might be observed. This happens during the WT scale factor estimation process and is typically seen when starting to drive. There are two scenarios that could trigger the issue:
    - The WT input signal reflecting vehicle movement is not provided to the WT pin while the configuration item CFG-SFODO-USE_WT_PIN is set to 1 (true).
    - The WT is provided as data via UBX-ESF-MEAS messages, but the data values do not indicate true speed or distance travelled.

  Workaround 1: Configure CFG-SFODO-USE_WT_PIN to 0 (false) if the WT pin is not intended to be used by the application.

Workaround 2: Refrain from sending inconsistent odometer data in UBX-ESF-MEAS which does not reflect the travelled distance.

- UBX-MON-RF message is incorrectly implemented. Flags fields and trailing reserved bytes are missing and the cwSuppresion field is in a different order within the repeat block. This is inconsistent with the same message implemented for other for products and the format supported by u-center. Logs could be made compatible with u-center by the user modifying the log. U-blox does not provide an application to do this. There may be other work arounds.

3.6.3 Hardware known limitations

- USB interface may not be possible to certify according to the USB standard.
- I2C has setup time issue when used with clock stretching and using fast mode is recommended.

4 Revision history

Revision	Date	Name	Comments
R01	20-SEP-2022	ANGI	First release of release note
R02	10-MAR-2023	ANGI	Update of known limitation regarding WT
R03	15-JAN-2025	ANGI	Update of known limitation regarding UBX-MON-RF