Teseo VI and Teseo APP2–Firmware configuration

Introduction

The STA86x0/STA9200 binary image supports the firmware configuration facility. It allows changing some application parameters in order to address most of the specific hardware constraints and/or the final product functionality requirements.

The firmware configuration management supports the ”factory setting”, embedded in the binary code, and the ”customized setting”, stored in the GNSS backup memory. The ”factory setting” can be changed directly on the binary image file using the FWConfigCmd.exe tool before flashing (or upgrading) the device’s flash memory. The ”customized setting” can be made and saved at run–time using specific NMEA or RTCM commands (see reference documents UM3407 and UM3401).

The purpose of this document is to provide details about specific parameters including procedures for changing and saving the firmware configuration.

The STA86x0/STA9200 binary image software is released with the ST defined default setting (factory setting). It is recommended to check if the default setting of all parameters is in line with the final product requirement. ST default setting may be changed on different releases.

The following descriptions are related to software configuration version ”5”. The software configuration version is returned in CDB [P00, L04].

Note:

- *The DR parameters sections in CDB [P44], [P48], [P49] and [P50] are applicable only to the STA86x0 DR dual freq L1–L5 PVT binary image.*
- *The CDB [P62] is reserved for customer usage. This is up to customer to define his own data structure over the 15 lines of 32 bits. Customer can only read and write the content of a whole line within [P62].*

1 Preface

Teseo VI and Teseo APP2 devices embed the Arm® Cortex®-M7.

For information on the Arm® Cortex®-M7, refer to the technical reference manuals, available from the www.arm.com website.

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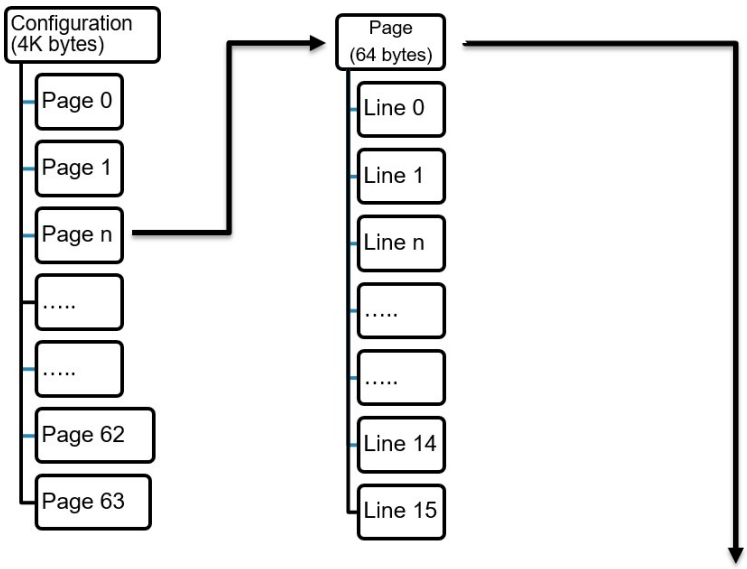
2 Firmware configuration

2.1 Structure

The firmware configuration area is composed of 64 pages. A page is divided into 16 lines of 32 bits each. A line is made of field(s), whose group bits have the same purpose. The field value range is from 0 to a maximum of 14. The field level is accessible only with NMEA/RTCM command or embedded API.

Figure 1. Firmware configuration structure



Page	Line (32 bits)																													
	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Line 0	Field 0																															
Line 1	Field 2											Field 1																		Field 0		
Line 2	Field 7				Field 6				Field 5				Field 4				Field 3				Field 2				Field 1				Field 0		
Line ….	…….																															
Line 14	Field 3								Field 2													Field 1								Field 0		
Line 15	Field 1																Field 0															

To ease the reading of the settings description the pattern [Pxx,Lxx,Fxx] will follow the chapter name. Pxx,Lxx,Fxx are respectively associated to page, line and field index.

2.2 Management

Firmware configuration is a memory space of 4 KB defined in binary (default configuration), in RAM (current configuration) and in flash (saved configuration). At startup, Teseo loads the configuration in RAM. This configuration comes either from the saved configuration data block (SCDB) or from the default configuration data block (DCDB). The SCDB is present in flash if the user has previously modified the default configuration and saved it.

Current configuration:

- It is placed in RAM memory and it includes the current configuration of each parameter. This configuration block can be modified with specific NMEA/RTCM commands. A dedicated NMEA ”save” command stores the current configuration data block into flash memory (saved configuration data block). On the other hand, a RTCM command offers to save parameters individually at set time. At startup, ”saved configuration” is loaded into current configuration in RAM. Else ”default configuration” is copied.
- Warning: most of the settings are read at program launching. So, a ”save” command and a restart are mandatory to take changes into account. Please refer to each parameter description in this document to know where this is applicable.
- It is available in the GNSS backup memory as soon as a store command is executed. It includes all parameters modified and stored by the user. At system startup the software configuration management checks if a valid ”saved configuration” is available in the GNSS backup memory. If not available the ”default configuration” setting is used.

Default configuration:

- It is placed in the flash/rom memory. It includes the factory setting for each parameter. This configuration is used at system startup if there is no ”saved configuration”.

Saved configuration:

- It is available in the GNSS backup memory as soon as a store command is executed. It includes all parameters modified and stored by the user. At system startup the software configuration management checks if a valid ”saved configuration” is available in the GNSS backup memory. If not available the ”default configuration” setting will be used.

Figure 2. Firmware configuration blocks mapping

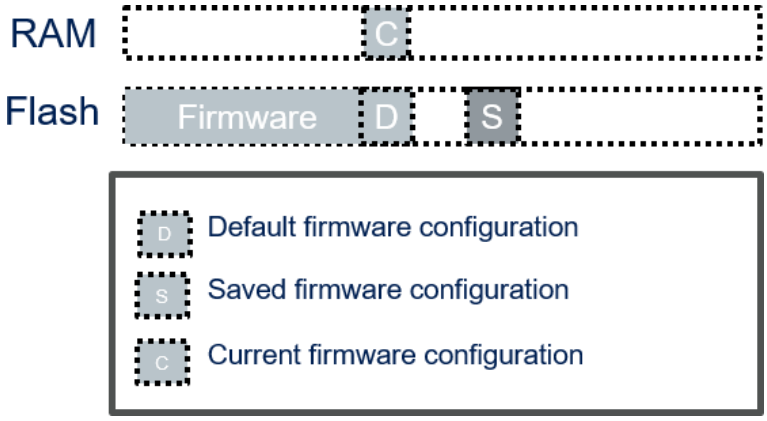
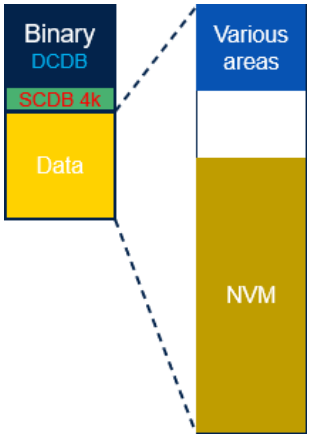


Figure 3. Generic view of flash organization and firmware configuration blocks location



3 Firmware setting configuration control

Firmware setting configuration control page is accessible in read only mode. This page guarantees the integrity of firmware setting area.

3.1 Firmware setting configuration control mapping

Table 1. Page 00 layout

Page 0																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
4	Version																															

3.2 Line 4: firmware setting version

This line defines the version of firmware settings.

Table 2. [P00,L04] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b23]	0xFFFFFF	Software configuration version value
F00	[b24-b31]	See table below	Product ID (see table below)

Table 3. Product ID values

Values	Definition
0x90	Teseo VI
0x91	Teseo APP2

4 Stream configuration (page 01)

Stream configuration tuning is accessible through the CDB [P01] of settings area. Debug, NMEA and RTCM flows are configured in this section.

NMEA and RTCM3 streams must be configured on a different UART port to allow the receiver to receive the commands properly (for example NMEA on port 2 and RTCM on port 0 assuming debug is on port 1). Please note that the NMEA and RTCM protocols are exclusive.

[P01, L12] defines how NMEA, RTCM and DEBUG streams are activated. The UART port configurations are set–up in [P01, L13-L15]. One UART port can support one of these 3 protocols:

- NMEA
- DEBUG
- RTCM, if RTCM protocol is activated (RTCM3 on off switch = 1 and RTCM data proc. on off switch = 1), the stream is routed either on UART or SSP port depending on the configuration below.

To activate NMEA:

- Set NMEA OVER UART ON OFF or NMEA OVER SSP ON OFF to 1.
- Assign an UART or SSP port to NMEA into NMEA UART port number [P01,L14].

To activate DEBUG:

- Set DEBUG OVER UART ON OFF or DEBUG OVER SSP ON OFF to 1.
- Set DEBUG MSG ON OFF to 0.
- Assign an UART or SSP port to DEBUG into DEBUG UART port number [P01,L13].

To activate RTCM:

- Set RTCM3 ON OFF SWITCH to 1 and RTCM DATA PROC ON OFF SWITCH to 1 into [P21].
- Set RTCM OVER UART ON OFF or RTCM OVER SSP ON OFF to 1.
- Assign an UART or SSP port to RTCM into RTCM UART port number [P01,L15].

To configure baud rate of each UART port:

- Select baud rate from 300 to 3000000 bauds for UART0 baud rate [P01,L13], UART1 baud rate [P01,L14] and UART2 baud rate [P01,L15].

4.1 Stream configuration mapping

Table 4. Page 01 layout

Page 1																													
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Reserved																STREAM0 OPTIONS								STREAM0 PERIPH				STREAM0 PURPOSE			
1	STREAM0 SPEED																															
2	Reserved																STREAM1 OPTIONS								STREAM1 PERIPH				STREAM1 PURPOSE			
3	STREAM1 SPEED																															
4	Reserved																STREAM2 OPTIONS								STREAM2 PERIPH				STREAM2 PURPOSE			
5	STREAM2 SPEED																															
6	Reserved																STREAM3 OPTIONS								STREAM3 PERIPH				STREAM3 PURPOSE			
7	STREAM3 SPEED																															
8	SSP1 CS PIN								SSP1 DALINE PIN								Reserved						SSP1 DALINE ENABLED		Reserved				Reserved		Reserved		Reserved	
10	Debug group enable mask																															
11	Reserved																								DEBUG CORE1 port NUMBER							
12	Reserved																Output configuration								Stream layout							
13	DEBUG port NUMBER								Reserved				Reserved				Reserved							UART0 HWFC	UART0 BAUDRATE							
14	HOST1 port NUMBER								HOST1 PERIPH				HOST1 Purpose				Reserved							UART1 HWFC	UART1 BAUDRATE							
15	HOST2 port NUMBER								HOST2 PERIPH				HOST2 Purpose				Reserved							UART2 HWFC	UART2 BAUDRATE							

4.2 Line 0: stream 0 configuration (not used in STA86x0/STA9200)

Table 5. [P01,L00] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b3]	0xF	Stream 0 purpose
F01	[b4-b7]	0xF0	Stream 0 peripheral
F02	[b8-b15]	0xFF00	Stream 0 options

4.3 Line 1: stream 0 speed (not used in STA86x0/STA9200)

Table 6. [P01,L01,F00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	Stream 0 speed

4.4 Line 2: stream 1 configuration (not used in STA86x0/STA9200)

Table 7. [P01,L02] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b3]	0xF	Stream 1 purpose
F01	[b4-b7]	0xF0	Stream 1 peripheral
F02	[b8-b15]	0xFF00	Stream 1 options

4.5 Line 3: stream 1 speed (not used in STA86x0/STA9200)

Table 8. [P01,L03,F00] fields description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Stream 1 speed

4.6 Line 4: stream 2 configuration (not used in STA86x0/STA9200)

Table 9. [P01,L04] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b3]	0xF	Stream 2 purpose
F01	[b4-b7]	0xF0	Stream 2 peripheral
F02	[b8-b15]	0xFF00	Stream 2 options

4.7 Line 5: stream 2 speed (not used in STA86x0/STA9200)

Table 10. [P01,L05] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	Stream 2 speed

4.8 Line 6: stream 3 configuration (not used in STA86x0/STA9200)

Table 11. [P01,L06] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b3]	0xF	Stream 3 purpose
F01	[b4-b7]	0xF0	Stream 3 peripheral
F02	[b8-b15]	0xFF00	Stream 3 options

4.9 Line 7: stream 3 speed (not used in STA86x0/STA9200)

Table 12. [P01,L07,F00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	Stream 3 speed

4.10 Line 8: SSP1 configuration

This line defines how SSP1 port is configured.

Table 13. [P01,L08] fields description

Field	Bit	Bit mask / value	Description
F04	[b9]	0x200	SSP1 DA LINE pin enabled
F06	[b16-b23]	0xFF0000	SSP1 DA LINE pin
F07	[b24-b31]	0xFF000000	SSP1 CS pin

4.11 Line 10: debug group enable mask

Table 14. [P01,L10] fields description

Field	Bit	Bit mask	Description
F0	[b0-b31]	See table below for the corresponding bit/group association	Select the group of messages to be enable in the Debug

Table 15. Message group enabling

Values	Definition
B0	Positioning group enable bit
B1	Tracker event group enable bit
B2	NavData group enable bit
B3	Channel group enable bit
B4	Application group enable bit
B5	Miscellaneous group enable bit
B6	Sensors group enable bit
B7	Common group enable bit
B8	Mandatory group enable bit
B9-B31	Reserved

4.12 Line 11: debug core1 port number

This line defines the UART port number assigned to debug stream of Core 1.

Table 16. [P01,L11] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	See table below	Debug core1 port number - Set UART port number used for debug stream on Core 1

Table 17. Debug core1 port number values

Values	Definition
0x0	UART0
0x1	UART1
0x2	UART2

4.13 Line 12: stream layout

This line defines how NMEA, RTCM and DEBUG streams are activated. Refer to Section Introduction for more details about configuration.

Table 18. [P01,L12] fields description

Field	Bit	Bit mask / value	Description
F00	[b0]	0x1	Debug messages ON/OFF (0 = ON 1 = OFF)
F01	[b8:b13]	0x3F00	b8: Enable/disable DEBUG over UART. (0 = disabled 1 = enabled) b9: Enable/disable DEBUG over SSP. (0 = disabled 1 = enabled) b10: Enable/disable NMEA over UART. (0 = disabled 1 = enabled) b11: Enable/disable NMEA over SSP. (0 = disabled 1 = enabled) b12: Enable/disable RTCM over UART. (0 = disabled 1 = enabled) b13: Enable/disable RTCM over UART. (0 = disabled 1 = enabled)

4.14 Line 13: debug settings and UART0 settings

This line defines the port number assigned to debug stream and the UART0 baud rate.

Table 19. [P01,L13] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	See Table 20. UART0 baud rate values	Set UART0 baud rate – allowed value in Table 20. UART0 baud rate values
F01	[b8]	0x100	HW flow control for UART0 (0: disable, 1: enable)
F03	[b24-b31]	See Table 21. DEBUG port number values	Set port number used for debug stream – allowed value in Table 21. DEBUG port number values

Table 20. **UART0 baud rate values**

Values	Definition
0x0	300 baud
0x1	600 baud
0x2	1200 baud
0x3	2400 baud
0x4	4800 baud
0x5	9600 baud
0x6	14400 baud
0x7	19200 baud
0x8	38400 baud
0x9	57600 baud
0xA	115200 baud
0xB	230400 baud
0xC	460800 baud
0xD	921600 baud
0xE	1843200 baud
0xF	2400000 baud
0x10	3000000 baud

Table 21. **DEBUG port number values**

Values	Definition
0x0	UART0
0x1	UART1
0x2	UART2

4.15 Line 14: HOST1 settings and UART1 settings

This line defines the usage of the HOST1 stream and the settings of the UART1.

Table 22. **[P01,L14]description**

Field	Bit	Bit mask / Value	Description
F00	[b0-b7]	0xFF	Set UART1 baud rate (see Table 23. UART1 baud rate values)
F01	[b8]	0x100	HW flow control for UART1 down: • 0: Disable • 1: Enable
F02	[b9-b15]	0xFE00	Reserved
F03	[b16-b19]	0xF0000	HOST1 purpose (see Table 24. HOST1 purpose values)
F04	[b20-b23]	0xF00000	HOST1 peripheral (see Table 25. HOST1 peripheral values)
F05	[b24-b31]	0xFF000000	Set UART port number used by HOST1 stream (see Table 26. HOST1 port number values)

Table 23. **UART1 baud rate values**

Values	Definition
0x0	300 baud
0x1	600 baud
0x2	1200 baud
0x3	2400 baud
0x4	4800 baud
0x5	9600 baud
0x6	14400 baud
0x7	19200 baud
0x8	38400 baud
0x9	57600 baud
0xA	115200 baud
0xB	230400 baud
0xC	460800 baud
0xD	921600 baud
0xE	1843200 baud
0xF	2400000 baud
0x10	3000000 baud

Table 24. **HOST1 purpose values**

Values	Definition
0x0	OFF (default value)
0x1	NMEA
0x2	RTCM3

Table 25. **HOST1 peripheral values**

Values	Definition
0x0	UART usage (default value)
0x1	SSP usage

Table 26. **HOST1 port number values**

Values	Definition
0x0	UART0
0x1	UART1
0x2	UART2

4.16 Line 15: HOST2 settings and UART2 settings

This line defines the usage of the HOST2 stream and the settings of the UART2.

Table 27. [P01,L15] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	Set UART2 baud rate (see Table 28. UART2 baud rate values)
F01	[b8]	0x100	HW flow control for UART2 down: • 0: Disable • 1: Enable
F02	[b9-b15]	0xFE00	Reserved
F03	[b16-b19]	0xF0000	HOST2 purpose (see Table 29. HOST2 purpose values)
F04	[b20-b23]	0xF00000	HOST2 peripheral (see Table 30. HOST2 peripheral values)
F05	[b24-b31]	0xFF000000	Set UART port number used by HOST2 stream (see Table 31. HOST2 port number values)

Table 28. UART2 baud rate values

Values	Definition
0x0	300 baud
0x1	600 baud
0x2	1200 baud
0x3	2400 baud
0x4	4800 baud
0x5	9600 baud
0x6	14400 baud
0x7	19200 baud
0x8	38400 baud
0x9	57600 baud
0xA	115200 baud
0xB	230400 baud
0xC	460800 baud
0xD	921600 baud
0xE	1843200 baud
0xF	2400000 baud
0x10	3000000 baud

Table 29. HOST2 purpose values

Values	Definition
0x0	OFF (default value)
0x1	NMEA
0x2	RTCM3

Table 30. HOST2 peripheral values

Values	Definition
0x0	UART usage (default value)
0x1	SSP usage

Table 31. HOST2 port number values

Values	Definition
0x0	UART0
0x1	UART1
0x2	UART2

5 General purpose I/Os (GPIO)

This section adresses some generalities about the general purpose I/Os.

STA86x0 and STA9200 feature 96 lines of GPIO (numbered from 0 to 95) thanks to three 32 bit wide GPIO banks. The 96 GPIOs lines are numbered so that GPIO0 corresponds to GPIO[0][0], GPIO31 to GPIO[0][31], GPIO32 to GPIO[1][0], GPIO63 to GPIO[1][31], GPIO64 to GPIO[2][0] and GPIO95 to GPIO[2][31] where:

- GIO[y][x] where 'y' addresses the banks (0, 1, 2) while 'x' addresses the pin (from 0 to 31).

5.1 Functionality

Each general purpose I/O block delivers 32 signals on GPIO[31:0] pins. By default, after reset, these signals are configured as GPIO inputs, with pull-up or pull-down enabled. These GPIOs can be configured in alternate functions to be used another peripheral inputs or outputs. Up to three peripheral alternate functions can be associated to each GPIO line. Refer to datasheet for GPIOs description, listing alternate functions.

The mode of each line is selected by the mode control registers, GPIO AFSLA and GPIO AFSLB, as defined in the table below.

Table 32. Alternate function selection

GPIO_AFSLbit y	GPIO_AFSLbit y	GPIO[y] line mode
0b	0b	General purpose IO line: the direction of the line is defined by bit y of GPIO_DIR register, the level is defined by bit y of GPIO_DAT register when configured as output, or can be read from bit y of GPIO_DAT register when configured as an input
0b	1b	Alternate function A: the GPIO line y is under control of an on-chip peripheral
1b	0b	Alternate function B: the GPIO line y is under control of an on-chip peripheral
1b	1b	Alternate function C: the GPIO line y is under control of an on-chip peripheral

In alternate function mode, the direction and level of the GPIO pin is controlled by the associated peripheral or internal logic. Thus GPIO_DIR and GPIO_DAT register values are ignored.

5.2 Data registers

The data register has associated set (GPIO_DATS) and clear (GPIO_DATC) registers, so that independent software drivers can set their GPIO bits without affecting any other pins in a single write operation.

During a write to GPIO_DATS, when writing a bit with 1b, the value of the GPIO_DAT register is set. Writing a 0b in GPIO_DATS left the bit unchanged in GPIO_DAT. During a write to GPIO_DATC, when writing a bit with 1b, the value of the GPIO_DAT register is cleared. Writing a 0b in GPIO_DATC left the bit unchanged in GPIO_DAT.

5.3 Direction registers

The direction registers operate in the following manner:

- 0b indicates the corresponding output pin is defined as an input
- 1b indicates the corresponding output pin is defined as an output

5.4 Pull-up and pull-down resistor control

When a GPIO is in alternate function mode, the pull-up/down resistor is not automatically switched off if the alternate function is using the GPIO as an output pin. In this configuration mode, the pull–up/down can only be disabled under software control, by setting the corresponding PDIS bit in the GPIO PDIS register.

The pull-up and pull-down control signal values nGPTU and nGPTD are described in the table below.

Table 33. Pull-up and pull-down control signals truth table

Sleep mode	Mode	PDIS bit	DIR bit	DAT bit	nGPTU signal	nGPTD signal	Comment
0	x	x	x	0	1	0	Pull-down enabled
0	x	x	x	1	0	1	Pull-up enabled
1	Software	0	0	0	1	0	Pin is GPIO input, pull-down enabled
1		0	0	1	0	1	Pin is GPIO input, pull-up enabled
1		1	0	x	1	1	Pin is GPIO input, pull-up/down disabled by PDIS
1		x	1	x	1	1	Pin is GPIO output, pull-up/down disabled
1	Alternate	0	x	0	1	0	Pin is peripheral line (input or output), pull-down enabled
1		0	x	1	0	1	Pin is peripheral line (input or output), pull-up enabled
1		1	x	x	1	1	Pin is peripheral line (input or output), pull-up/down disabled by PDIS

6 GPIO bank 0 and GPIO bank 1 configuration (page 02)

This section describes the GPIO banks 0 and 1 settings.

6.1 GPIO bank 0 and GPIO bank 1 configuration mapping

Table 34. Page 02 layout

Page 2																															
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	GPIO0 AFSLA																															
1	GPIO0 AFSLB																															
2	GPIO0 DIR																															
3	GPIO0 DATA																															
4	GPIO0 SLPM																															
5	GPIO0 PDIS																															
6	GPIO0 DAT SLPM																															
8	GPIO1 AFSLA																															
9	GPIO1 AFSLB																															
10	GPIO1 DIR																															
11	GPIO1 DATA																															
12	GPIO1 SLPM																															
13	GPIO1 PDIS																															
14	GPIO1 DAT SLPM																															

6.2 Line 0: GPIO bank 0 alternate function select A register

This line defines the GPIO AFSLA register which selects the alternate function for the GPIO lines of the GPIO bank 0.

Table 35. [P02,L00] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO0 AFSLA bits (0..31)

6.3 Line 1: GPIO bank 0 alternate function select B register

This line defines the GPIO AFSLB register which selects the alternate function for the GPIO lines of the GPIO bank 0

Table 36. [P02,L01] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO0 AFSLB bits (0..31)

6.4 Line 2: GPIO bank 0 direction register

This line defines the data direction register of the GPIO bank 0. Bits set to 1b in the GPIO DIR configure corresponding pin to be an output.

Table 37. [P02,L02] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO0 direction bits (0..31) –> 0: input / 1: output

6.5 Line 3: GPIO bank 0 data register

This line defines GPIO bank 0 data register (GPIO DAT).

Table 38. [P02,L03] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO0 data bits (0..31)

6.6 Line 4: GPIO bank 0 sleep mode register

This line defines GPIO bank 0 sleep mode register. The GPIO SLPM register defines the GPIO mode when SLEEP/DEEP–SLEEP mode is entered:

- 0: Corresponding GPIO is switched to input
- 1: Corresponding GPIO remains controlled by GPIO DAT/GPIO DIR/GPIO PDIS (when GPIO AFSLB/A = 00b) or on–chip peripherals (when GPIO AFSLB/A != 00b)

Table 39. [P02,L04] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO0 sleep mode bits (0..31)

6.7 Line 5: GPIO bank 0 pull disable register

This line defines GPIO bank 0 pull disable register. The GPIO PDIS register enables (default after reset) or disables the pull-up and pull-down associated with the GPIO pad:

- 0: GPIO pull-up or pull-down resistor is enabled, when pin is an input.
- 1: GPIO pull-up and pull-down resistor are disabled.

When an IO is in GPIO mode (AFSLA = AFSLB = 0) pull-up and pull-down are automatically disabled when the pin is set in output direction (by programming GPIO DIR register).

When an IO is in an alternate function mode, the pull-up/down resistor is not automatically switched off if the alternate function is using the IO as an output pin. In this mode, the pull-up/down can only be disabled under software control, by setting corresponding PDIS bit in GPIO PDIS register.

Table 40. [P02,L05] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO0 pull disable bits (0..31)

6.8 Line 6: GPIO bank 0 data register for standby mode

This line defines GPIO bank 0 data register for standby mode. The value is applied to the GPIO DAT before going in standby mode.

Table 41. [P02,L06] description

Field	Bit	Bit mask/value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO0 data for sleep mode bits (0..31)

6.9 Line 8: GPIO bank 1 alternate function select A register

This line defines the GPIO AFSLA register which selects the alternate function for the GPIO lines of the GPIO bank 1.

Table 42. [P02,L08] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO1 AFSLA bits (0..31)

6.10 Line 9: GPIO bank 1 alternate function select B register

This line defines the GPIO AFSLB register which selects the alternate function for the GPIO lines of the GPIO bank 1.

Table 43. [P02,L09] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO1 AFSLB bits (0...31)

6.11 Line 10: GPIO bank 1 direction register

This line defines the data direction register of the GPIO bank 1. Bits set to 1b in the GPIO DIR configure corresponding pin to be an output.

Table 44. [P02,L10] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO1 direction bits (0..31) –> 0: input / 1: output

6.12 Line 11: GPIO bank 1 data register

This line defines GPIO bank 1 data register (GPIO DAT).

Table 45. [P02,L11] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO1 data bits (0..31)

6.13 Line 12: GPIO bank 1 sleep mode register

This line defines GPIO bank 1 sleep mode register. The GPIO_SLPM register defines the GPIO mode when SLEEP/DEEP–SLEEP mode is entered:

- 0: Corresponding GPIO is switched to input
- 1: Corresponding GPIO remains controlled by GPIO DAT/GPIO DIR/GPIO PDIS (when GPIO AFSLB/A = 00b) or on–chip peripherals (when GPIO AFSLB/A != 00b)

Table 46. [P02,L12] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO1 sleep mode bits (0...31)

6.14 Line 13: GPIO bank 1 pull disable register

This line defines GPIO bank 1 pull disable register. The GPIO_PDIS register enables (default after reset) or disables the pull-up and pull down associated with the GPIO pad:

- 0: GPIO pull-up or pull-down resistor is enabled, when pin is an input.
- 1: GPIO pull-up and pull-down resistor are disabled.

Table 47. [P02,L13] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO1 pull disable bits (0..31)

6.15 Line 14: GPIO bank 1 data register for standby mode

This line defines GPIO bank 1 data register for standby mode. The value is applied to the GPIO DAT before going in standby mode.

Table 48. [P02,L14] description

Field	Bit	Bit mask/value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO1 data for sleep mode bits (0..31)

7 GPIO bank 2 configuration (page 03)

This section describes the GPIO bank 2 settings.

7.1 GPIO bank 2 configuration mapping

Table 49. Page 03 layout

Page 3																															
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	GPIO2 AFSLA																															
1	GPIO2 AFSLB																															
2	GPIO2 DIR																															
3	GPIO2 DATA																															
4	GPIO2 SLPM																															
5	GPIO2 PDIS																															
6	GPIO2 DAT SLPM																															
8	GPIO3 AFSLA																															
9	GPIO3 AFSLB																															
10	GPIO3 DIR																															
11	GPIO3 DATA																															
12	GPIO3 SLPM																															
13	GPIO3 PDIS																															
14	GPIO3 DAT SLPM																															

7.2 Line 0: GPIO bank 2 alternate function select A register

This line defines the GPIO AFSLA register which selects the alternate function for the GPIO lines of the GPIO bank 2.

Table 50. [P03,L00] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO2 AFSLA bits (0..31)

7.3 Line 1: GPIO bank 2 alternate function select B register

This line defines the GPIO AFSLB register which selects the alternate function for the GPIO lines of the GPIO bank 2.

Table 51. [P03,L01] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO2 AFSLB bits (0..31)

7.4 Line 2: GPIO bank 2 direction register

This line defines the data direction register of the GPIO bank 2. Bits set to 1b in the GPIO DIR configure corresponding pin to be an output.

Table 52. [P03,L02] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO2 direction bits (0..31) –> 0: input / 1: output

7.5 Line 3: GPIO bank 2 data register

This line defines GPIO bank 2 data register (GPIO_DAT).

Table 53. [P03,L03] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO2 data bits (0..31)

7.6 Line 4: GPIO bank 2 sleep mode register

This line defines GPIO bank 2 sleep mode register. The GPIO_SLPM register defines the GPIO mode when SLEEP/DEEP–SLEEP mode is entered:

- 0: Corresponding GPIO is switched to input
- 1: Corresponding GPIO remains controlled by GPIO_DAT/GPIO_DIR/GPIO_PDIS (when GPIO_AFSLB/A = 00b) or on–chip peripherals (when GPIO_AFSLB/A != 00b)

Table 54. [P03,L04] description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO2 sleep mode bits (0..31)

7.7 Line 5: GPIO bank 2 pull disable register

This line defines GPIO bank 2 pull disable register. The GPIO PDIS register enables (default after reset) or disables the pull-up and pull-down associated with the GPIO pad:

- 0: GPIO pull-up or pull-down resistor is enabled, when pin is an input.
- 1: GPIO pull-up and pull-down resistor are disabled.

Table 55. [P03,L05] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO2 pull disable bits (0..31)

7.8 Line 6: GPIO bank 2 data register for standby mode

This line defines GPI2 bank 0 data register for standby mode. The value is applied to the GPIO DAT before going in standby mode.

Table 56. [P03,L06] description

Field	Bit	Bit mask/value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO2 data for sleep mode bits (0..31)

7.9 Line 8: GPIO bank 3 alternate function select A register (not used in STA86x0/ STA9200)

This line defines the GPIO_AFSLA register which selects the alternate function for the GPIO lines of the GPIO bank 3.

Table 57. [P03,L08] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO3 AFSLA bits (0..31)

7.10 Line 9: GPIO bank 3 alternate function select B register (not used in STA86x0/ STA9200)

This line defines the GPIO_AFSLB register which selects the alternate function for the GPIO lines of the GPIO bank 3.

Table 58. [P03,L09] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO3 AFSLB bits (0..31)

7.11 Line 10: GPIO bank 3 direction register (not used in STA86x0/STA9200)

This line defines the data direction register of the GPIO bank 3. Bits set to 1b in the GPIO_DIR configure the corresponding pin to be an output.

Table 59. [P03,L10] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO3 direction bits (0..31) –> 0: input / 1: output

7.12 Line 11: GPIO bank 3 data register (not used in STA86x0/STA9200)

This line defines GPIO bank 3 Data register (GPIO DAT).

Table 60. [P03,L11] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO3 data bits (0..31)

7.13 Line 12: GPIO bank 3 sleep mode register (not used in STA86x0/STA92)

This line defines GPIO bank 3 sleep mode register. The GPIO_SLPM register defines the GPIO mode when SLEEP/DEEP–SLEEP mode is entered:

- 0: Corresponding GPIO is switched to input
- 1: Corresponding GPIO remains controlled by GPIO_DAT/GPIO_DIR/GPIO_PDIS (when GPIO_AFSLB/A = 00b) or on–chip peripherals (when GPIO_AFSLB/A != 00b)

Table 61. [P03,L12] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO3 sleep mode bits (0..31)

7.14 Line 13: GPIO bank 3 pull disable register (not used in STA86x0/STA9)

This line defines GPIO bank 3 pull disable register. The GPIO_PDIS register enables (default after reset) or disables the pull-up and pull-down associated with the GPIO pad:

- 0: GPIO pull-up or pull-down resistor is enabled, when pin is an input
- 1: GPIO pull-up and pull-down resistor are disabled

Table 62. [P03,L13] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO3 pull disable bits (0..31)

7.15 Line 14: GPIO bank 3 data register for standby mode

This line defines GPIO bank 3 data register for standby mode. The value is applied to the GPIO DAT before going in standby mode.

Table 63. [P03,L14] description

Field	Bit	Bit mask/value	Description
F00	[b0-b31]	0xFFFFFFFF	GPIO3 data for sleep mode bits (0..31)

8 Hardware configuration (page 4)

Various hardware configurations.

8.1 Hardware configuration mapping

Table 64. Page 04 layout

Page 4																													
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2	Reserved																Ext MEM FSPM								Reserved			Ext MEM OTFDEC	Ext MEM RAM En	Ext MEM FLASH En	Ext MEM FP Auto	Ext MEM FP En
3	Reserved								Reserved								Ext RF SI			Ext RF SO			Ext RF CLK		Ext RF CS							Ext RF Sel
4	Ext RF GPIO SI								Ext RF GPIO SO								Ext RF GPIO CLK								Ext RF GPIO CS							
5	Reserved								GNSS BSP RF1 MAX GAIN								GNSS BSP RF0 MAX GAIN								GNSS BSP TOTAL LNA GAIN							
6	VTSENSE COMP1																VTSENSE COMP0															
7	Reserved																VTSENSE COMP2															
8	Reserved																													STANDBY IN PUN	STANDBY IN PDN	STANDBY EN

8.2 Line 2: external memory configuration

This line details the configuration for external memory.

Table 65. [P04,L02] field description

Field	Bit	Bit mask / value	Description
F00	[b0]	0x1	Enable flash protection
F01	[b1]	0x2	Enable AUTO mode. • 0: Disabled – Use SPM from CDB, • 1: Enabled (default) – Use predefined SPM for each flash
F02	[b2]	0x4	Enable flash usage
F03	[b3]	0x8	Enable RAM usage
F04	[b4]	0x10	Enable OTFDEC usage
F05	[b5-b7]	0xE0	RESERVED
F06	[b8-b15]	0xFF00	Software protected mode value (read used flash datasheet to get the proper values)

8.3 Line 3: external RF configuration part 1

This line details the first part of STA86x0/STA9200 HW pins configuration for STA5635 external RF.

Table 66. [P04,L03] description

Field	Bit	Bit mask / value	Description
F00	[b0]	0x1	External FE enable: • 0: FE disabled • 1: FE enabled
F02	[b8-b9]	0x300	GPIO mode for CS line: • 0: None • 1: AltModeA • 2: AltModeB • 3: AltModeC
F03	[b10-b11]	0xC00	GPIO mode for CLK line: • 0: None • 1: AltModeA • 2: AltModeB • 3: AltModeC
F04	[b12-b13]	0x3000	GPIO mode for SO line: • 0: None • 1: AltModeA • 2: AltModeB • 3: AltModeC
F05	[b14-b15]	0xC000	GPIO mode for SI line: • 0: None • 1: AltModeA • 2: AltModeB • 3: AltMode

8.4 Line 4: external RF configuration part 2

This line details the second part of STA86x0/STA9200 HW pins configuration for STA5635 external RF.

Table 67. [P04,L04] description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	GPIO number for CS pin (0...95)
F01	[b8-b15]	0xFF00	GPIO number for CLK pin (0...95)
F02	[b16-b23]	0xFF0000	GPIO number for SO pin (0...95)
F03	[b24-b31]	0xFF000000	GPIO number for SI pin (0...95)

8.5 Line 5: GNSS BSP configuration

This line details the GNSS BSP configuration with RFA gain settings.

Table 68. [P04,L05] description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	Total LNA gain
F01	[b8-b15]	0xFF00	Internal RF (RF0) maximum gain
F02	[b16-b23]	0xFF0000	External RF (RF1) maximum gain

8.6 Line 6: temperature threshold for VTSENSE comparators

This line details the temperature threshold values to set the VTSENSE comparators.

Table 69. [P04,L06] description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	VTSENSE temperature threshold for comparator 0 (low) (1)(2)(3)(4)
F01	[b16-b31]	0xFFFF0000	VTSENSE temperature threshold for comparator 0 (high) (1)(2)(3)(4)

1. *Temperature threshold is: (sign)VALUE + (N*0.125).*
2. *THRESHOLD(11) sign: 1 for –, 0 for +.*
3. *THRESHOLD(10:3) VALUE temperature in Hexa .*
4. *THRESHOLD(2:0) N number of steps of 0.125.*

8.7 Line 7: temperature threshold for VTSENSE comparators

This line details the temperature threshold values to set the VTSENSE comparators.

Table 70. [P04,L07] description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	VTSENSE temperature threshold for comparator 2 (very high) (1)(2)(3)(4)

1. *Temperature threshold is: (sign)VALUE + (N*0.125)*
2. *THRESHOLD(11) sign: 1 for –, 0 for +.*
3. *THRESHOLD(10:3) VALUE temperature in Hexa.*
4. *THRESHOLD(2:0) N number of steps of 0.125.*

8.8 Line 8: hardware standby configuration

This line details the hardware standby configuration.

Table 71. [P04,L08] field description

Field	Bit	Bit mask / value	Description
F00	[b0]	0, 1	HW standby enable: • 0: STANDBY_IN pad does not trigger a standby entry • 1: STANDBY_IN pad can trigger a standby entry
F01	[b1]	0, 1	HW standby PAD pull-down: • 0: Enabled • 1: Disabled
F02	[b2]	0, 1	HW standby PAD pull-up: • 0: Enabled • 1: Disabled

9 Antenna sensing configuration (page 5)

Describes all configurable parameters for antenna sensing.

9.1 Antenna sensing configuration mapping

Table 72. Page 05 layout

Page 5																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Antenna sensing Cfg																															
1	Antenna sensing power configuration																															
2	Antenna sensing RF switch GPIO																															
3	Antenna sensing main ADC configuration																															
4	Antenna sensing ADC algorithm parameters																															
5	Antenna sensing single ADC channel algorithm parameters 0																															
6	Antenna sensing single ADC channel algorithm parameters 1																															
7	Antenna sensing single ADC channel algorithm parameters 2																															
8	Antenna sensing external component settings																															

9.2 Line 0: antenna sensing main configuration

This line defines main configuration for antenna sensing. Please refer to [4] or [5] for more details.

Table 73. [P05,L00,F00] bits description

Bit	Bit mask / value	Description
[b0-b3]	0xF	Antenna sensing type: • 0: Dis • 1: RF • 2: ADC • 3: GPIO • 4: Single ADC channel
[b9]	0x200	Antenna power switching capability: • 0: Disabled • 1: Enabled
[b11]	0x800	RF path: • 0: External • 1: Internal
[b12]	0x1000	Operating mode: • 0: Automatic • 1: Manual
[b16-b19]	0xF0000	Indicate which external LDO component is used for antenna sensing: • 0: None • 1: TPS7B7701 • 2: MAX4995CAUT
[b20]	0x00100000	Indicate if the current limiter is used or not: • 0: With current limiter • 1: Without current limite

9.3 Line 1: antenna sensing power configuration

This line defines antenna sensing power configuration.

Table 74. [P05,L01,F00] bits description

Bit	Bit mask / value	Description
[b0-b7]	0xFF	GPIO number for power on/off (0...49)
[b8]	0x100	Active level for antenna power ON: • 0: Low • 1: High
[b9]	0x200	Power switch: • 0: Power ON • 1: Power OFF

9.4 Line 2: antenna sensing RF switch and GPIO configurations

This line defines antenna sensing RF switch and GPIO configurations.

Table 75. [P05,L02,F00] bits description

Bit	Bit mask / value	Description
[b8-b15]	0xFF00	GPIO number for antenna short detection (0..95)
[b16-b23]	0xFF0000	GPIO number for antenna open detection (0..95)
[b25]	0x2000000	GPIO short level: • 0: Low • 1: High
[b26]	0x4000000	GPIO open level: • 0: Low • 1: High

9.5 Line 3: antenna sensing main ADC configuration

This line defines antenna sensing main ADC configuration.

Table 76. [P05,L03,F00] bits description

Bit	Bit mask / value	Description
[b0-b7]	0xFF	Clock division factor for ADC sampling rate
[b8-b15]	0xFF00	ADC clock divider (0..255)
[b16]	0x10000	ADC channel data read (0:Disabled, 1:Enabled)
[b24-b31]	0xFF000000	ADC input channel mask (AIN7..AIN0)

9.6 Line 4: antenna sensing ADC algorithm parameters

This line defines antenna sensing ADC algorithm parameters.

Table 77. [P05,L04,F00] bits description

Bit	Bit mask / value	Description
[b0-b9]	0x3FF	Minimum ADC threshold value (ADC value coded on 10 bits)
[b16-b25]	0x3FF0000	Maximum ADC threshold value (ADC value coded on 10 bits)

9.7 Line 5: antenna sensing single ADC channel algorithm parameters 0

This line defines antenna sensing single ADC channel algorithm parameters 0.

Table 78. [P05,L05,F00] bits description

Bit	Bit mask / value	Description
[b0-b9]	0x3FF	Open load threshold value for ADC mode (ADC value coded on 10 bits)
[b16-b25]	0x3FF0000	Short–circuit threshold value for ADC mode (ADC value coded on 10 bits)

9.8 Line 6: antenna sensing single ADC channel algorithm parameters 1

This line defines antenna sensing single ADC channel algorithm parameters 1.

Table 79. [P05,L06,F00] bits description

Bit	Bit mask / value	Description
[b0-b9]	0x3FF	Thermal shutdown threshold value for ADC mode (ADC value coded on 10 bits)
[b16-b25]	0x3FF0000	Reverse current threshold value for ADC mode (ADC value coded on 10 bits)

9.9 Line 7: antenna sensing single ADC channel algorithm parameters 2

This line defines antenna sensing single ADC channel algorithm parameters 2.

Table 80. [P05,L07,F00] bits description

Bit	Bit mask / value	Description
[b0-b9]	0x3FF	Normal threshold value for ADC mode (ADC value coded on 10 bits)
[b16-b25]	0x3FF0000	Overcurrent threshold value for ADC mode (ADC value coded on 10 bits)

9.10 Line 8: antenna sensing external component settings

This line defines antenna sensing external component settings.

Table 81. [P05,L08,F00] bits description

Bit	Bit mask / value	Description
[b0-b7]	0xFF	GPIO pin number for ERR signal (0..49). Set 0xFF if ERR signal not used

10 Internal RF registers bank0 (page 8)

Setting of RF registers [0–15].

10.1 Internal RF registers bank0 mapping

Table 82. Page 08 layout

Page 8																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Register 1																Register 0															
1	Register 3																Register 2															
2	Register 5																Register 4															
3	Register 7																Register 6															
4	Register 9																Register 8															
5	Register 11																Register 10															
6	Register 13																Register 12															
7	Register 15																Register 14															
8	Register 17																Register 16															
9	Register 19																Register 18															
10	Register 21																Register 20															
11	Register 23																Register 22															
12	Register 25																Register 24															
13	Register 27																Register 26															
14	Register 29																Register 28															
15	Register 31																Register 30															

11 Internal RF registers bank1 (page 9)

Setting of RF registers [16–31].

11.1 Internal RF registers bank1 mapping

Table 83. Page 09 layout

Page 9																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Register 33																Register 32															
1	Register 35																Register 34															
2	Register 37																Register 36															
3	Register 39																Register 38															
4	Register 41																Register 40															
5	Register 43																Register 42															
6	Register 45																Register 44															
7	Register 47																Register 46															
8	Register 49																Register 48															
9	Register 51																Register 50															
10	Register 53																Register 52															
11	Register 55																Register 54															
12	Register 57																Register 56															
13	Register 59																Register 58															
14	Register 61																Register 60															
15	Register 63																Register 62															

12 Internal RF registers bank2 (page 10)

Setting of RF registers [32–63].

12.1 Internal RF registers bank2 mapping

Table 84. Page 10 layout

Page 10																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Register 65																Register 64															
1	Register 67																Register 66															
2	Register 69																Register 68															
3	Register 71																Register 70															
4	Register 73																Register 72															
5	Register 75																Register 74															
6	Register 77																Register 76															
7	Register 79																Register 78															
8	Register 81																Register 80															
9	Register 83																Register 82															
10	Register 85																Register 84															
11	Register 87																Register 86															
12	Register 89																Register 88															
13	Register 91																Register 90															
14	Register 93																Register 92															
15	Register 95																Register 94															

13 Internal RF registers bank3 (page 11)

Setting of RF registers [48–63].

13.1 Internal RF registers bank3 mapping

Table 85. Page 11 layout

Page 11																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Register 97																Register 96															
1	Register 99																Register 98															
2	Register 101																Register 100															
3	Register 103																Register 102															
4	Register 105																Register 104															
5	Register 107																Register 106															
6	Register 109																Register 108															
7	Register 111																Register 110															
8	Register 113																Register 112															
9	Register 115																Register 114															
10	Register 117																Register 116															
11	Register 119																Register 118															
12	Register 121																Register 120															
13	Register 123																Register 122															
14	Register 125																Register 124															
15	Register 127																Register 126															

14 External RF registers bank0 (page 12)

14.1 External RF registers bank0 mapping

Table 86. Page 12 layout

Page 12																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Register 1																Register 0															
1	Register 3																Register 2															
2	Register 5																Register 4															
3	Register 7																Register 6															
4	Register 9																Register 8															
5	Register 11																Register 10															
6	Register 13																Register 12															
7	Register 15																Register 14															
8	Register 17																Register 16															
9	Register 19																Register 18															
10	Register 21																Register 20															
11	Register 23																Register 22															
12	Register 25																Register 24															
13	Register 27																Register 26															
14	Register 29																Register 28															
15	Register 31																Register 30															

15 External RF registers bank1 (page 13)

15.1 External RF registers bank1 mapping

Table 87. Page 13 layout

Page 13																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Register 33																Register 32															
1	Register 35																Register 34															
2	Register 37																Register 36															
3	Register 39																Register 38															
4	Register 41																Register 40															
5	Register 43																Register 42															
6	Register 45																Register 44															
7	Register 47																Register 46															
8	Register 49																Register 48															
9	Register 51																Register 50															
10	Register 53																Register 52															
11	Register 55																Register 54															
12	Register 57																Register 56															
13	Register 59																Register 58															
14	Register 61																Register 60															
15	Register 63																Register 62															

16 GNSS configuration 1 (page 16)

16.1 GNSS configuration 1 mapping

Table 88. Page 16 layout

Page 16																															
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Cold start type								GLONASS satellite ID type								Local geodetic datum selection								Differential source type							
1	GNSS positioning CN0 threshold								GNSS tracking CN0 threshold								GNSS positioning elevation mask angle								GNSS tracking elevation mask angle							
2	Reserved															Tree scenario	Gating bw		Chan mon			Gating			Drop				Reserved		TCXO jump	Mitigation
3	Dynamic HD acc threshold								Dynamic LD acc threshold								Dynamic HD hysteresis								Dynamic LD stabilization				Dynamic mode			
4	GNSS fix ratio																															
5	Reserved								GNSS integrity check time error threshold unit	GNSS integrity check time error threshold															GNSS integrity check configuration							
6	GPS MIN–MAX week number																															
7	GPS UTC default setting																															
8	WLS configuration parameters																															
9	NMEA delay to next fix																															
10	NCO range maximum value																															
11	NCO range minimum value																															
12	NCO center value																															
13	Reserved																								Reserved				GNSS reported fix ratio			
14 15	GNSS measurement rate																															

16.2 Line 0: GNSS settings 0

Table 89. [P16,L00] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	See Table 90. Differential source type values	Differential source type: Allow selecting the differential mode source type
F01	[b8-b15]	0xFF00	Local geodetic datum selection: Set the local geodetic datum to be used when position data is reported over the NMEA messages. Valid numbers from 0 to 254. Not valid numbers means default datum which is WSG84
F02	[b16-b23]	See Table 91. GLONASS satellite ID type values	GLONASS satellite ID type: Allow selecting between two different ways to report the GLONASS satellites ID in the NMEA GSV and GSA messages
F03	[b24-b31]	See Table 92. COLD START TYPE values	Cold start type: Set the cold start type with selective data erase

Table 90. Differential source type values

Values	Definition
0x0	NONE
0x1	SBAS
0x2	RTCM
0x3	AUTO (default)
0x4	SLAS

Table 91. GLONASS satellite ID type values

Values	Definition
0x0	GLONASS satellite ID based on the satellite frequency
0x1	GLONASS satellite ID based on the satellite slot

Table 92. COLD START TYPE values

Values	Definition
0xF	Clear almanach, clear ephemeris, clear user position and invalidate RTC.
0xE	Clear ephemeris, clear user position and invalidate RTC

16.3 Line 1: GNSS settings 1

Table 93. [P16,L01] fields description

Field	Bit	Bit mask / Value	Description
F00	[b0-b7]	0xFF	**GNSS tracking elevation mask angle** Set the GNSS mask angle for tracking algorithm. Satellites with elevation below the mask angle are not included in the tracking. The default value is 5 degrees.
F01	[b8-b15]	0xFF00	**GNSS positioning elevation mask angle**

Field	Bit	Bit mask / Value	Description
			Set the GNSS mask angle for positioning algorithm. Satellites with elevation below the mask angle are not used in the position solution.
F02	[b16-b23]	0xFF0000	**GNSS tracking CN0 threshold** Allow setting the minimum CN0 [dB] at which a satellite can be tracked. Satellites with CN0 below the configured threshold are not tracked.
F03	[b24-b31]	0xFF000000	**GNSS positioning CN0 threshold** Allow setting the minimum CN0 [dB] at which a satellite can be used in the position solution. Satellites with CN0 below the configured threshold are used in the position evaluation.

16.4 Line 2: GNSS settings 2

Table 94. [P16,L02] field description

Fields	Bit	Bit mask / value	Description
F00	[b0-b1]	0x3	**Multipath mitigation mode option** Configure a code loop to work with selected discriminator and logic. 0= Standard, 1= multipath mitigation mode 1 ON.
F01	[b2]	0x4	**TCXO jump detection mode option** Configure dsp to manage TCXO jumps. • 0 = Disable • 1 = TCXO jump detection active
F03	[b4-b7]	0xF0	**CN0 drop detection count option** Configure CN0 drop detection counter to gate measurements
F04	[b8-b10]	See Table 95. MEASUREMENT GATING values	**Bad measurements gating** Enable/disable the gating at forbidden frequencies –1 kHz and 3K4 GPS. Bad measurements gating is disabled by default.
F05	[b11-b13]	See Table 96. CHANNEL MONITORING CONFIG values	**Channel monitoring configuration** Enable the antispoofing feature and configure the number of pools dedicated to the feature.
F06	[b14-b15]	See Table 97. GATING BWTH CONFIG values	**Gating bandwidth configuration** Configure the gating bandwidth at forbidden frequencies.
F07	[b16]	0x0	• 0 = Tree scenario disabled • 1 = Tree scenario enable

Table 95. MEASUREMENT GATING values

Values	Definition
0x0	Set gating off
0x1	Activate dsp gating on noisy measurements on L1 [GPS–GAL–QZSS] (bit8)
0x2	Activate dsp gating on noisy measurements on B1 [B1I] (bit9)
0x4	Activate dsp gating on noisy measurements on supported secondary frequencies (bit10)
0x7	Set gating as operative on GPS, Galileo, BeiDou and secondary frequencies

Table 96. CHANNEL MONITORING CONFIG values

Values	Definition
0x0	Set antispoofing off
0x1	Activate the antispoofing feature with 1 pool that correspond to 2 tracking channels being used for antispoofing
0x2	Activate the antispoofing feature with 2 pools that correspond to 4 tracking channels being used for antispoofing
0x3	Activate the antispoofing feature with 3 pools that correspond to 6 tracking channels being used for antispoofing
0x4	Activate the antispoofing feature with 4 pools that correspond to 8 tracking channels being used for antispoofing

Table 97. GATING BWTH CONFIG values

Values	Definition
0x0	±20 Hz bandwidth
0x1	±30 Hz bandwidth
0x2	±40 Hz bandwidth
0x3	±50 Hz bandwidth

16.5 Line 3: GNSS settings 3

Table 98. [P16,L03] fields descriptions

Fields	Bit	Bit mask / value	Descriptions
F00	[b0-b3]	See Table 99. DYNAMIC MODE values	**Dynamic mode** Allow to configure supported dynamic modes for the satellites tracking engine
F01	[b4-b7]	0xF0	**Dynamic LD stabilization** Low dynamic stabilization counter value in sec
F02	[b8-b15]	0xFF00	**Dynamic HD hysteresis** High dynamic hysteresis timeout value in sec
F03	[b16-b23]	0xFF0000	**Dynamic LD acc threshold** Low dynamic acceleration threshold in m/sec * 10
F04	[b24-b31]	0xFF000000	**Dynamic HD acc threshold** High dynamic acceleration threshold in m/sec * 100

Table 99. DYNAMIC MODE values

Values	Definition
0	Low dynamic
1	High dynamic
2	Mild mode
3	Auto dynamic

16.6 Line 4: GNSS settings 4

Table 100. [P16,L04] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	**GNSS fix ratio** Allow setting the GNSS library fix ratio. GNSS fix rate is calculated every fix ratio measurements.

16.7 Line 5: GNSS settings 5

Table 101. [P16,L05] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**GNSS integrity check configuration** Allow enabling/disabling integrity checks for: • Bit0= position • Bit1= time; • Bit2= HPVT • Bit3= clk estimation • Bit4= PVT protection level monitor • Bit5= time integrity action • Bit6-7=RFU
F01	[b8-b21]	0x3FFF00	**GNSS integrity check time error threshold** Allow selecting the integrity check time error threshold
F02	[b22-b23]	0xC00000	**GNSS integrity check time error threshold unit** Allow selecting the integrity check time error threshold unit • 0: Seconds • 1: Milliseconds • 2: Microseconds • 3: Nanoseconds

16.8 Line 6: GNSS setting 6

Table 102. [P16,L06] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	**GPS MIN-MAX week number** Allow setting of minimum and maximum GPS week number. [b0–b15] = GPS min week number (0..65535); [b16–b31] = GPS max week number (0..65535).

16.9 Line 7: GNSS setting 7

Table 103. [P16,L07] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	**GPS UTC default setting** Define the default UTC delta time

16.10 Line 8: GNSS setting 8

This line defines the WLS activation parameters:

Bit0 is enable/disable.

Byte 0 is the tDouble weight least square algo measurement threshold 1 divided by 10.

Byte 1 is the tDouble weight least square algo measurement threshold 2 divided by 10.

Table 104. [P16,L08] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	**WLS configuration parameters** Define WLS activation parameters

16.11 Line 9: GNSS setting 9

Table 105. [P16,L09] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	NMEA delay to next fix

16.12 Line 10: NCO MAX range configuration

Table 106. [P16,L10] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	**NCO range maximum value** Allow setting the upper limit for the NCO search range. A system reboot is needed to have new setting in use (1)

1. *There is the possibility to let the GNSS software to evaluate automatically the best range and center values for the selected TCXO. In such case all NCO configuration parameters (P16, L10,L11 and L12) must be set to 0.*

16.13 Line 11: NCO MIN range configuration

Table 107. [P16,L11] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	**NCO range minimum value** Allow setting the lower limit for the NCO search range. A system reboot is needed to have new setting in use. (1)

1. *There is the possibility to let the GNSS software to evaluate automatically the best range and center values for the selected TCXO. In such case all NCO configuration parameters (P16, L10,L11 and L12) must be set to 0.*

16.14 Line 12: NCO center value configuration

Table 108. [P16,L12] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	0xFFFFFFFF	**NCO center value** Allow setting the NCO center frequency. A system reboot is needed to have new setting in use (1)

1. *There is the possibility to let the GNSS software to evaluate automatically the best range and center values for the selected TCXO. In such case all NCO configuration parameters (P16, L10,L11 and L12) must be set to 0.*

16.15 Line 13: GNSS setting 13

Table 109. [P16,L13] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b3]	0xF	**GNSS reported fix ratio** Configuration which allows to set the reported GNSS fix ratio. This value will impact the number of fix by second which will be extrapolated by GNSSLib. For example, if GNSS fix ratio (P16L4) and GNSS reported fix ratio are equal, no fix extrapolated. Other example, if GNSS fix ratio (P16L4) is equal to 10 and GNSS reported fix ratio is equal to 1, 1 GNSS fix will be computed by second and 9 will be extrapolated to provide 10 fix by second. *Note: It is not used if high fix rate feature is enabled (NMEA HIGH FIX RATE ON OFF SWITCH).*

16.16 Line 14: GNSS setting 14

Table 110. [P16,L14] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b63]	0x0	**GNSS Measurement rate** Allow setting the GNSS library measurement rate. It is the time period between two consecutive position measurements. A system reboot is needed to have new setting in use. Expressed in second, 10 hz will give 0.1 sec **Warning:** *This is a 64–bit value, using next line too.*

17 GNSS configuration 2 (page 17)

17.1 GNSS configuration 2 mapping

Table 111. Page 17 layout

Page 17																															
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Geometric dilution of precision								Horizontal dilution of precision								Vertical dilution of precision								Position dilution of precision							
1	Geometric dilution of precision								Horizontal dilution of precision								Vertical dilution of precision								Position dilution of precision							
2	Geometric dilution of precision								Horizontal dilution of precision								Vertical dilution of precision								Position dilution of precision							
3	Geometric dilution of precision								Horizontal dilution of precision								Vertical dilution of precision								Position dilution of precision							
4	Least square navigation algorithm config params 1																															
5	Least square navigation algorithm config params 2																															
6	Reserved												SSR mode	Smoothed PR mode	Slow PVT mode	Position antispoofing mode	Reserved																IONO mode
7	SBAS ratio								Reserved		Lock Vel R	LS AllPASS	IFLC De–activation threshold				Reserved				IFLC activation threshold				Reserved				IFLC auto latitude threshold			
8	Constellation smooth pseudorange mask																															
9	Reserved										HDOP OSNMA										VDOP OSNMA								PDOP OSNMA			
10	Position hold altitude																															
11																																
12	Position hold latitude																															
13																																
14	Position hold longitude																															
15																																

17.2 Line 0: default_2D DOPS setting

Table 112. **[P17,L00] fields description**

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**Position dilution of precision** This value is a threshold used to declare the validity of the calculated position DOP of 2D fix during normal system operation (for example, after startup)
F01	[b8-b15]	0xFF00	**Vertical dilution of precision** This value is a threshold used to declare the validity of the calculated vertical DOP of 2D fix during normal system operation (for example, after startup)
F02	[b16-b23]	0xFF0000	**Horizontal dilution of precision** This value is a threshold used to declare the validity of the calculated horizontal DOP of 2D fix during normal system operation (for example, after startup)
F03	[b24-b31]	0xFF000000	**Geometric dilution Of precision** This value is a threshold used to declare the validity of the calculated geometric DOP of 2D fix during normal system operation (for example, after startup)

17.3 Line 1: default_3D DOPS setting

Table 113. **[P17,L01,F00] fields description**

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**Position dilution of precision** This value is a threshold used to declare the validity of the calculated position DOP of 3D fix during normal system operation (for example, after startup)
F01	[b8-b15]	0xFF00	**Vertical dilution of precision** This value is a threshold used to declare the validity of the calculated vertical DOP of 3D fix during normal system operation (for example, after startup)
F02	[b16-b23]	0xFF0000	**Horizontal dilution of precision** This value is a threshold used to declare the validity of the calculated horizontal DOP of 3D fix during normal system operation (for example, after startup)
F03	[b24-b31]	0xFF000000	**Geometric dilution of precision** This value is a threshold used to declare the validity of the calculated Geometric DOP of 3D fix during normal system operation (for example, after startup)

17.4 Line 2: start up 2D DOPS setting

Table 114. **[P17,L02,F00] fields description**

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**Position dilution of precision** This value is a threshold used to declare the validity of the calculated position DOP of 2D fix during system start up operation (for example, first fix)
F01	[b8-b15]	0xFF00	**Vertical dilution of precision** This value is a threshold used to declare the validity of the calculated vertical DOP of 2D fix during system startup operation (for example, first fix)
F02	[b16-b23]	0xFF0000	**Horizontal dilution of precision**

Field	Bit	Bit mask / value	Description
			This value is a threshold used to declare the validity of the calculated horizontal DOP of 2D fix during system startup operation (for example, first fix)
F03	[b24-b31]	0xFF000000	**Geometric dilution of precision** This value is a threshold used to declare the validity of the calculated Geometric DOP of 2D fix during system start up operation (for example, first fix)

17.5 Line 3: start up 3D DOPS setting

Table 115. [P17,L03] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**Position dilution of precision** This value is a threshold used to declare the validity of the calculated position DOP of 3D fix during system start up operation (for example, first fix)
F01	[b8-b15]	0xFF00	**Vertical dilution of precision** This value is a threshold used to declare the validity of the calculated vertical DOP of 3D fix during system start up operation (for example, first fix)
F02	[b16-b23]	0xFF0000	**Horizontal dilution of precision** This value is a threshold used to declare the validity of the calculated horizontal DOP of 3D fix during system start up operation (for example, first fix)
F03	[b24-b31]	0xFF000000	**Geometric dilution of precision** This value is a threshold used to declare the validity of the calculated geometric DOP of 3D fix during system start up operation (for example, first fix)

17.6 Line 4: least square navigation algorithm config. params 1

Table 116. [P17,L04,F00] bits description

Bit	Bit mask / value	Bits description
[b0]	0x1	2D Fix enable/disable
[b1]	0x2	HDOP product in range error metric enable/disable
[b2]	0x4	GLONASS path delay lock enable/disable
[b8-b15]	0xFF00	Position residual threshold [m]
[b16-b23]	0xFF0000	Position residual threshold after RAIM [m]

17.7 Line 5: least square navigation algorithm config. params 2

Table 117. [P17,L05,F00] bits description

Bit	Bit mask / value	Bits description
[b0-b7]	0xFF	Minimum number of satellites in GNSS mode
[b8-b15]	0xFF00	Minimum number of satellites in single constellation mode
[b16-b31]	0xFFFF0000	Initial GLONASS path delay [dm]. (It is expressed in 2–complements on 16 bits)

17.8 Line 6: position algorithms options

Table 118. [P17,L06] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b2]	See Table 119. Iono compensation mode values	IONO Compensation mode: allow to configure Iono free linear combination mode
F01	[b3-b15]	0xFFF8	Reserved
F02	[b16]	See Table 120. ASPF MODE values	Position antispoofing mode: apply antispoofing algorithm at position level
F03	[b17]	See Table 121. SPVTM MODE values	Slow PVT mode activation
F04	[b18]	See Table 122. SPRM MODE values	Smoothed pseudorange mode activation
F05	[b19]	See Table 123. SSR MODE values	SSR correction Usage
F06	[b20-b31]	0xFFF00000	Reserved

Table 119. Iono compensation mode values

Values	Definition
0	Standard. Corrections predicted from models broadcasted by navigation data (for example, Klobuchar) or SBAS (if enabled) are applied to pseudoranges
1	Iono–Free pseudoranges. Pseudoranges free from ionospheric error are derived from combination of two raw pseudoranges measurements from different frequencies
2	Automatic Iono free pseudoranges. Runtime estimation of solar activity is performed. Depending on that, FW switches seamlessly from mode 0 to 1 or vice versa
3	Calculated correction applied on dual band. Corrections to ionospheric error are derived combining two raw pseudoranges measurements from different frequencies and then applied to pseudoranges of both L1 and L5 (or L2) bands
4	Calculated correction applied on single band. Corrections to ionospheric error are derived combining two raw pseudoranges measurements from different frequencies and then applied to pseudoranges of L1 band
5	Automatic calculated correction. Runtime estimation of solar activity is performed. Depending on that, FW switches seamlessly from mode 0 to 3 or vice versa

Table 120. ASPF MODE values

Values	Definition
0	Antispoofing at position OFF
1	Antispoofing at position ON

Table 121. SPVTM MODE values

Values	Definition
0	Slow PVT mode OFF
1	Slow PVT mode ON

Table 122. **SPRM MODE values**

Values	Definition
0	Smoothed pseudorange mode OFF
1	Smoothed pseudorange mode ON

Table 123. **SSR MODE values**

Values	Definition
0	SSR correction usage OFF
1	SSR correction usage ON

17.9 Line 7: position algorithms options

Table 124. **[P17,L07] field description**

Field	Bit	Bit mask / value	Description
F00	[b0-b6]	0x7F	**IFLC auto latitude threshold** Allow to configure IFLC auto latitude threshold
F02	[b8-b12]	0x1F00	**IFLC activation threshold** Allow to configure IFLC activation threshold
F04	[b16-b20]	0x1F0000	**IFLC De-activation threshold** Allow to configure IFLC de–activation threshold
F05	[b21]	0x200000	**LS ALLPASS mode** Allow to configure lms all pass mode • 0: means disabled • 1: means enabled
F06	[b22]	0x400000	**LOCK VEL R** Allow to lock vel r • 0: means disabled • 1: means enabled
F07	[b23]	0x800000	Reserved
F08	[b24-b31]	0xFF000000	SBAS ratio threshold of L1 sats with SBAS correction ratio (%)

17.10 Line 8 : constellation mask used for smooth pseudorange

Smooth pseudorange will be used for any constellation set in this mask.

Table 125. **[P17,L08,F00] bits description**

Bits	Bit mask / value	Description
[b0]	0x1	**CONSTELLATION USE FOR SPR GPS ON OFF** Enable/disable GPS constellation usage for smooth PR
[b1]	0x2	**CONSTELLATION USE FOR SPR GLONASS ON OFF** Enable/disable GLONASS constellation usage for smooth PR
[b2]	0x4	**CONSTELLATION USE FOR SPR QZSS L1 CA ON OFF** Enable/disable QZSS constellation usage for smooth PR
[b3]	0x8	**USE FOR SPR GALILEO ON OFF** Enable/disable GALILEO constellation usage for smooth PR

Bits	Bit mask / value	Description
[b4]	0x10	Reserved
[b5]	0x20	**CONSTELLATION USE FOR SPR QZSS L1 SAIF ON OFF** Enable/disable QZSS L1 SAIF constellation usage for smooth PR
[b6]	0x40	Reserved
[b7]	0x80	**CONSTELLATION USE FOR SPR BEIDOU ON OFF** Enable/disable BEIDOU constellation usage for smooth PR
[b8]	0x100	Reserved
[b9]	0x200	**CONSTELLATION USE FOR SPR L2C ON OFF** Enable/disable GPS L2C frequency usage for smooth PR
[b10]	0x400	**CONSTELLATION USE FOR SPR IRNSS ON OFF** Enable/disable IRNSS constellation usage for smooth PR
[b11]	0x800	**CONSTELLATION USE FOR SPR GPS L5 ON OFF** Enable/disable GPS L5 frequency usage for smooth PR
[b12]	0x1000	**CONSTELLATION USE FOR SPR GAL E5 ON OFF** Enable/disable GAL E5 frequency usage for smooth PR
[b14]	0x4000	**CONSTELLATION USE FOR SPR BEIDOU B2A ON OFF** Enable/disable BEIDOU B2A frequency usage for smooth PR
[b15]	0x8000	**CONSTELLATION USE FOR SPR QZSS L2C ON OFF** Enable/disable QZSS L2C frequency usage for smooth PR
[b16]	0x10000	**CONSTELLATION USE FOR SPR QZSS L5 ON OFF** Enable/disable QZSS L5 frequency usage for smooth PR
[b17]	0x20000	**CONSTELLATION USE FOR SPR GPS L1C ON/OFF**
[b18]	0x40000	**CONSTELLATION USE FOR SPR BEIDOU B3I ON/OFF**
[b19]	0x80000	**CONSTELLATION USE FOR SPR BEIDOU B2B ON/OFF**
[b21]	0x200000	**CONSTELLATION USE FOR SPR GLONASS L2 ON/OFF**
[b22]	0x400000	**CONSTELLATION USE FOR SPR BEIDOU B2I ON/OFF**
[b23]	0x800000	**CONSTELLATION USE FOR SPR GALILEO E5B ON/OFF**

17.11 Line 9: Position algorithms options

Table 126. [P17,L09]description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**PDOP OSNMA** Make configurable the position dops thresholds
F01	[b8-b15]	0xFF00	**VDOP OSNMA** Make configurable the vertical dops thresholds
F02	[b15-b21]	0xFF0000	**HDOP OSNMA** Make configurable the horizontal dops thresholds
F03	[b22-b31]	0xFF000000	Reserved

17.12 Line 10: position hold altitude setting

Table 127. [P17,L10] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b63]	0x0	**Position hold altitude** Allow setting the altitude [m] for the position hold mode *Note: To be used the position hold functionality must be enabled, see P21,L0 for details.* *Note: A system reboot is needed to have new setting in use.* **Warning:** *This is a 64–bit value, using next line too.*

17.13 Line 12: position hold latitude setting

Table 128. [P17,L12] field descriptions

Field	Bit	Bit mask / value	Descriptions
F00	[b0-b63]	0x0	**Position hold latitude** Allow setting the latitude [degrees] for the position hold mode. *Note: To be used the position hold functionality must be enabled, see P21,L0 for details.* *Note: A system reboot is needed to have new setting in use.* **Warning:** *This is a 64–bit value, using next line too.*

17.14 Line 14: position hold longitude setting

Table 129. [P17,L14] field descriptions

Field	Bit	Bit mask / value	Description
F00	[b0-b63]	0x0	**Position hold longitude** Allow setting the longitude [degrees] for the position hold mode. *Note: To be used the position hold functionality must be enabled, see P21,L0 for details.* *Note: A system reboot is needed to have new setting in use.* **Warning:** *This is a 64–bit value, using next line too.*

18 Tracker configuration (page 18)

The tracker limit feature allows balancing the usage of the channels among the constellations (on main frequency only for example, L1). This feature is intended to avoid any unfair allocation. It defines some limits for the maximum number of tracking channels that can be allocated for each subset of constellations. For example, max. 10 channels for GPS.

However the limit is the average allocation (+1 allowed). It means that the value set for a given constellation (group) can temporarily exceed by one unit the limit because the group logic does not kill the extra one.

It is possible to configure up to eight tracker constellation mask groups. Several constellations can be set per group. A constellation can only be assigned to one group, and not to multiple groups. A constellation that is not inside any group, but is configured in the user selected frequency scenario, will not have any limits on the number of satellites that can be put into the channels.

A constellation that is not part of the user selected scenario will never be taken, even if inside a group.

The constellation masks can be configured in lines 0, 1, 2, 3, 4, 5, 6, 7 and the tracking channel limits can be configured in line 8 and 9. A value of 32 in a tracker channel limit field means that the number of channels is not limited for the corresponding constellation.

18.1 Tracker configuration mapping

Table 130. Page 18 layout

Page 18																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	TrkGroup 0 constellation mask																															
1	TrkGroup 1 constellation mask																															
2	TrkGroup 2 constellation mask																															
3	TrkGroup 3 constellation mask																															
4	TrkGroup 4 constellation mask																															
5	TrkGroup 5 constellation mask																															
6	TrkGroup 6 constellation mask																															
7	TrkGroup 7 constellation mask																															
8	Trk channel limits group 0–3																															
9	Trk channel limits group 4–7																															
10	Reserved																								TRK ELEV MASK							
11	TRK ATRK CFG																															
12	TRK DUAL ANT MASK																															
13	Trk dual antenna parameters																															
14	Tracking CNO min threshold																															

18.2 Line 0: tracker constellation mask group 0

Table 131. [P18,L00,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**CONSTELLATION GPS ON/OFF** Enable/disable GPS constellation in tracker group 0
[b1]	0x2	**CONSTELLATION GLONASS ON/OFF** Enable/disable GLONASS constellation in tracker group 0

Bit	Bit mask / value	Description
[b2]	0x4	**CONSTELLATION QZSS L1 CA ON/OFF** Enable/disable QZSS constellation in tracker group 0
[b3]	0x8	**CONSTELLATION GALILEO ON/OFF** Enable/disable GALILEO constellation in tracker group 0
[b7]	0x80	**CONSTELLATION BEIDOU ON/OFF** Enable/disable BEIDOU constellation in tracker group 0
[b10]	0x400	**CONSTELLATION IRNSS ON/OFF** Enable/disable IRNSS constellation in tracker group 0

18.3 Line 1: tracker constellation mask group 1

Table 132. [P18,L01,F0] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**CONSTELLATION GPS ON/OFF** Enable/disable GPS constellation in tracker group 1
[b1]	0x2	**CONSTELLATION GLONASS ON/OFF** Enable/disable GLONASS constellation in tracker group 1
[b2]	0x4	**CONSTELLATION QZSS L1 CA ON/OFF** Enable/disable QZSS constellation in tracker group 1
[b3]	0x8	**CONSTELLATION GALILEO ON/OFF** Enable/disable GALILEO constellation in tracker group 1
[b7]	0x80	**CONSTELLATION BEIDOU ON/OFF** Enable/disable BEIDOU constellation in tracker group 1
[b10]	0x400	**CONSTELLATION IRNSS ON/OFF** Enable/disable IRNSS constellation in tracker group 1

18.4 Line 2: tracker constellation mask group 2

Table 133. [P18,L02,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**CONSTELLATION GPS ON/OFF** Enable/disable GPS constellation in tracker group 2
[b1]	0x2	**CONSTELLATION GLONASS ON/OFF** Enable/disable GLONASS constellation in tracker group 2
[b2]	0x4	**CONSTELLATION QZSS L1 CA ON/OFF** Enable/disable QZSS constellation in tracker group 2
[b3]	0x8	**CONSTELLATION GALILEO ON/OFF** Enable/disable GALILEO constellation in tracker group 2
[b7]	0x80	**CONSTELLATION BEIDOU ON/OFF** Enable/disable BEIDOU constellation in tracker group 2
[b10]	0x400	**CONSTELLATION IRNSS ON/OFF** Enable/disable IRNSS constellation in tracker group 2

18.5 Line 3: tracker constellation mask group 3

Table 134. **[P18,L03,F00] bits description**

Bit	Bit mask / value	Description
[b0]	0x1	**CONSTELLATION GPS ON/OFF** Enable/disable GPS constellation in tracker group 3
[b1]	0x2	**CONSTELLATION GLONASS ON/OFF** Enable/disable GLONASS constellation in tracker group 3
[b2]	0x4	**CONSTELLATION QZSS L1 CA ON/OFF** Enable/disable QZSS constellation in tracker group 3
[b3]	0x8	**CONSTELLATION GALILEO ON/OFF** Enable/disable GALILEO constellation in tracker group 3
[b7]	0x80	**CONSTELLATION BEIDOU ON/OFF** Enable/disable BEIDOU constellation in tracker group 3
[b10]	0x400	**CONSTELLATION IRNSS ON/OFF** Enable/disable IRNSS constellation in tracker group 3

18.6 Line 4: tracker constellation mask group 4

Table 135. **[P18,L04,F00] bits description**

Bit	Bit mask / value	Description
[b0]	0x1	**CONSTELLATION GPS ON/OFF** Enable/disable GPS constellation in tracker group 4
[b1]	0x2	**CONSTELLATION GLONASS ON/OFF** Enable/disable GLONASS constellation in tracker group 4
[b2]	0x4	**CONSTELLATION QZSS L1 CA ON/OFF** Enable/disable QZSS constellation in tracker group 4
[b3]	0x8	**CONSTELLATION GALILEO ON/OFF** Enable/disable GALILEO constellation in tracker group 4
[b7]	0x80	**CONSTELLATION BEIDOU ON/OFF** Enable/disable BEIDOU constellation in tracker group 4
[b10]	0x400	**CONSTELLATION IRNSS ON/OFF** Enable/disable IRNSS constellation in tracker group 4

18.7 Line 5: tracker constellation mask group 5

Table 136. **[P18,L05,F00] bits description**

Bit	Bit mask / value	Description
[b0]	0x1	**CONSTELLATION GPS ON/OFF** Enable/disable GPS constellation in tracker group 5
[b1]	0x2	**CONSTELLATION GLONASS ON/OFF** Enable/disable GLONASS constellation in tracker group 5
[b2]	0x4	**CONSTELLATION QZSS L1 CA ON/OFF**

Bit	Bit mask / value	Description
		Enable/disable QZSS constellation in tracker group 5
[b3]	0x8	**CONSTELLATION GALILEO ON/OFF** Enable/disable GALILEO constellation in tracker group 5
[b7]	0x80	**CONSTELLATION BEIDOU ON/OFF** Enable/disable BEIDOU constellation in tracker group 5
[b10]	0x400	**CONSTELLATION IRNSS ON/OFF** Enable/disable IRNSS constellation in tracker group 5

18.8 Line 6: tracker constellation mask group 6

Table 137. [P18,L06,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**CONSTELLATION GPS ON/OFF** Enable/disable GPS constellation in tracker group 6
[b1]	0x2	**CONSTELLATION GLONASS ON/OFF** Enable/disable GLONASS constellation in tracker group 6
[b2]	0x4	**CONSTELLATION QZSS L1 CA ON/OFF** Enable/disable QZSS constellation in tracker group 6
[b3]	0x8	**CONSTELLATION GALILEO ON/OFF** Enable/disable GALILEO constellation in tracker group 6
[b7]	0x80	**CONSTELLATION BEIDOU ON/OFF** Enable/disable BEIDOU constellation in tracker group 6
[b10]	0x400	**CONSTELLATION IRNSS ON/OFF** Enable/disable IRNSS constellation in tracker group 6

18.9 Line 7: tracker constellation mask group 7

Table 138. [P18,L07,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**CONSTELLATION GPS ON/OFF** Enable/disable GPS constellation in tracker group 7
[b1]	0x2	**CONSTELLATION GLONASS ON/OFF** Enable/disable GLONASS constellation in tracker group 7
[b2]	0x4	**CONSTELLATION QZSS L1 CA ON/OFF** Enable/disable QZSS constellation in tracker group 7
[b3]	0x8	**CONSTELLATION GALILEO ON/OFF** Enable/disable GALILEO constellation in tracker group 7
[b7]	0x80	**CONSTELLATION BEIDOU ON/OFF** Enable/disable BEIDOU constellation in tracker group 7
[b10]	0x400	**CONSTELLATION IRNSS ON/OFF** Enable/disable IRNSS constellation in tracker group 7

18.10 Line 8: tracking channel limits 0

Table 139. **[P18,L08,F00] bits description**

Bit	Bit mask / value	Description
[b0-b7]	0xFF	**TRK CHANNEL LIMITS GROUP 3** Allow to set the tracking limit threshold for tracking constellation mask group 3
[b8-b15]	0xFF00	**TRK CHANNEL LIMITS GROUP 2** Allow to set the tracking limit threshold for tracking constellation mask group 2
[b16-b23]	0xFF0000	**TRK CHANNEL LIMITS GROUP 1** Allow to set the tracking limit threshold for tracking constellation mask group 1
[b24-b31]	0xFF000000	**TRK CHANNEL LIMITS GROUP 0** Allow to set the tracking limit threshold for tracking constellation mask group 0

18.11 Line 9: tracking channel limits 1

Table 140. **[P18,L09,F00] bits description**

Bit	Bit mask / value	Description
[b0-b7]	0xFF	**TRK CHANNEL LIMITS GROUP 7** Allow to set the tracking limit threshold for tracking constellation mask group 7
[b8-b15]	0xFF00	**TRK CHANNEL LIMITS GROUP 6** Allow to set the tracking limit threshold for tracking constellation mask group 6
[b16-b23]	0xFF0000	**TRK CHANNEL LIMITS GROUP 5** Allow to set the tracking limit threshold for tracking constellation mask group 5
[b24-b31]	0xFF000000	**TRK CHANNEL LIMITS GROUP 4** Allow to set the tracking limit threshold for tracking constellation mask group 4

18.12 Line 10: tracking configuration 1

Table 141. **[P18,L10,F00] bits description**

Bit	Bit mask / value	Description
[b0-b7]	0xFF	**TRK ELEV MASK** Allow to set the tracking elevation mask

18.13 Line 11: ATRK configuration

Table 142. **[P18,L11,F00] bits description**

Bit	Bit mask / value	Description
[b0-b3]	0xF	ATRK frequency aiding coefficient
[b4-b7]	0xF0	ATRK code-phase aiding coefficient
[b8-b13]	0x3F00	ATRK CN0 carrier loop aiding threshold
[b14-b19]	0xFC000	ATRK CN0 code loop aiding threshold
[b20-b25]	0x3F00000	CN0 alarm threshold in dB
[b26-b29]	0x3C000000	CN0 monitor elevation threshold x 6 degrees granularity

Bit	Bit mask / value	Description
[b30]	0x40000000	ATRK used only for monitoring: • 1 = if ATRK is enabled, it is used only for monitoring • 0 = if ATRK is enabled, code/frequency corrections are applied
[b31]	0x80000000	Enable/disable ATRK: • 0 = disable ATRK • 1 = enable ATRK ATRK code enabled if ATRK code-phase aiding coefficient != 0 ATRK frequency enabled if ATRK frequency aiding coefficient != 0

Proposed ATRK configuration:

- ATRK enabled in monitoring only [0xC on bits 30..31]
- ATRK alarm threshold 25dB [0x19 on bits 20..25]
- ATRK monitor elevation mask 42deg [0x7 on bits 26..30]

Note: ATRK, even in monitoring only mode, needs global enable bit 31 set and frequency aiding active to enable the generation of predictions for monitoring itself.

18.14 Line 12: tracking dual antenna mask configuration

Table 143. [P18,L12,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**TRK DUAL ANT MASK** Allow to set the mask for dual antenna setup

18.15 Line 13: tracking dual antenna parameters

Table 144. [P18,L13,F00] bits description

Bit	Bit mask/value	Description
[b0-b11]	0xFFF	**TRK DUAL ANT 0 ID** Allow to set the station ID for antenna 0
[b12-b23]	0xFFF000	**TRK DUAL ANT 1 ID** Allow to set the station ID for antenna 1

18.16 Line 14: tracking CN0 min. threshold

Table 145. [P18,L14,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	CN0 min threshold for secondary frequencies in linear format. Default 100 = 20db

19 PPS configuration 1 (page 19)

19.1 PPS configuration 1 mapping

Table 146. Page 19 layout

Page 19																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0 1	RF time correction																															
2 3	GPS RF time correction																															
4 5	GLONASS RF time correction																															
6 7	COMPASS RF time correction																															
8 9	GALILEO RF time correction																															
10 11	PPS pulse duration																															
12 13	Timing TRAIM alarm																															

19.2 Line 0: time correction setting

Table 147. [P19,L00,F00] bits description

Bit	Bit mask / value	Description
[b0-b63]	0x0	**RF time correction** Allow setting a time correction (float value in seconds) to compensate any delay introduced on the pulse per second (PPS) signal by cables and/or RF chain. **Warning:** *This is a 64-bit value, using next line too.*

19.3 Line 2: GPS RF time correction setting

Table 148. [P19,L02,F00] bits description

Bit	Bit mask / value	Description
[b0-b63]	0x0	GPS RF time correction allow setting the RF time delay (float value in seconds) for the GPS signal path. The value calibrated for the ST reference design is 633E–9 s. **Warning:** *This is a 64-bit value, using next line too.*

19.4 Line 4: GLONASS RF time correction setting

Table 149. [P19,L04,F00] bits description

Bit	Bit mask / value	Description
[b0-b63]	0x0	GLONASS RF time correction allow setting the RF time delay (float value in seconds) for the GLONAS signal path. **Warning:** *This is a 64-bit value, using next line too.*

19.5 Line 6: COMPASS RF time correction setting

Table 150. [P19,L06,F00] bits description

Bit	Bit mask / Value	COMPASS RF time correction
[b0-b63]	0x0	Allow setting the RF time delay (float value in seconds) for COMPASS signal path. **Warning:** *This is a 64-bit value, using next line too.*

19.6 Line 8: GALILEO RF time correction setting

Table 151. [P19,L08,F00] bits description

Bit	Bit mask / value	Description
[b0-b63]	0x0	**GALILEO RF time correction** Allow setting the RF time delay (float value in seconds) for GALILEO signal path. **Warning:** *This is a 64-bit value, using next line too.*

19.7 Line 10: PPS pulse duration setting

Table 152. [P19,L10,F00] bits description

Bit	Bit mask / value	Description
[b0-b63]	0x0	**PPS pulse duration** Allow setting the pulse duration (float value in seconds) of the PPS signal. The pulse duration is intended to be the time distance between the PPS rising edge and the next falling edge if polarity inversion is disabled or the time distance between falling and rising edge if polarity inversion is enabled. **Warning:** *Enable/disable PPS and PPS polarity inversion can be configured in P21,L00,F00 b24 and b25 respectively.* **Warning:** *This is a 64-bit value, using next line too.*

19.8 Line 12: timing TRAIM alarm setting

Table 153. [P19,L12,F00] bits description

Bit	Bit mask / value	Description
[b0-b63]	0x0	**Timing TRAIM alarm** Allow setting the time error threshold (float value in seconds) for satellites removal in the TRAIM algorithm. Satellites which have a time error bigger than the TRAIM threshold are not used for time correction. The TRAIM threshold is also used to rise the TRAIM alarm if the time correction error is bigger than it. **Warning:** *This is a 64-bit value, using next line too.*

20 PPS configuration 2 (page 20)

20.1 PPS configuration 2 mapping

Table 154. Page 20 layout

Page 20																													
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Position hold auto survey samples																															
1	PPS MIN SAT ELEV FOR TIME CORRECTION								PPS MIN SAT NB FOR TIME CORRECTION								Reserved				PPS GNSS FIX CONDITION				PPS REF TIME SYNC				PPS GEN MODE		
2	Reserved																								TRAIM CN0 THR							
4	PPS MIX CONST FOR TIME CORRECTION ONOFF																															
8	G1 path delay																L5 path delay															
9	GAL E1 path delay																GAL E5a path delay															
10	BEI B1I path delay																BEI B2A path delay															
11	GAL E5B path delay																GPS L2C path delay															
12	Reserved																BEI B2I path delay															
10	E2E measurement LLI source data ID																															
11	E2E time sync header source data ID																															
12	E2E SCL header source data ID																															
13	Warm up time												Threshold synchro quality error												Threshold BRIDGE time conv error							
14	DDNCO Frequency out Enable	Reserved							DDNCO frequency out																							
15	Airborne enable	Reserved															Airborne mode threshold															

20.2 Line 0: PPS hold auto survey samples

Table 155. [P20,L00,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**Position hold auto survey samples** Sets the number of position samples to be captured before entering in the position hold mode. The auto survey procedure is disabled if the number of samples is set to 0

20.3 Line 1: PPS operating mode setting 1

Allow setting different operating modes for the PPS signal generation. Full operating mode setting is achieved using both P20,L1 and P20,L4 parameters. This parameter includes different fields as reported in the following table.

Table 156. [P20,L01] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b3]	See Table 157. PPS GEN MODE values	**PPS GEN MODE** PPS generation mode
F01	[b4-b7]	See Table 158. PPS REF TIME SYNC values	**PPS REF TIME SYNC** Reference time on which the PPS signal is synchronized *Note: For TeseoAPP2 and TeseoVI–ME, allowed reference time are UTC, GPS time and GST.*
F02	[b8-b11]	See Table 159. PPS GNSS FIX CONDITION values	**PPS GNSS FIX CONDITION** GNSS fix condition for PPS signal generation. NO FIX: PPS signal is present even in GNSS NO fix conditions. 2D FIX: the PPS is present if the GNSS is at least in 2D fix condition. 3D FIX: the PPS is present only if the GNSS is in 3D fix conditions
F04	[b16-b23]	0xFF0000	**PPS MIN SAT NB FOR TIME CORRECTION** Minimun number of satellites used for timing correction. PPS signal is generated if the number of satellites used for time correction is bigger than the minimun number. This parameter should be set to 0 if the threshold is not used
F05	[b24-b31]	0xFF000000	**PPS MIN SAT ELEV FOR TIME CORRECTION** Satellite elevation mask for time correction. It is the minimum satellite elevation angle to use the satellite for time correction. If this parameter is set to 0 there is no satellites filetring based on the elevation

Table 157. PPS GEN MODE values

Values	Definition
0x0	On every second
0x1	On even seconds
0x2	On odd seconds

Table 158. **PPS REF TIME SYNC values**

Values	Definition
0x0	UTC
0x1	GPS time
0x2	GLONASS time
0x3	UTC (SU)
0x4	GPS time (from GLONASS time ref)
0x5	BEIDOU time
0x6	UTC (NTSC)
0x7	GST
0x8	UTC (GST)
0x9	GPS time (from GST time ref)

UTC(SU) is the Soviet Union UTC, it is derived from GLONASS time applying the UTC delta time downloaded from GLONASS satellites.

Value 4 is the GPS time derived from GLONASS time applying the GPS delta time downloaded from GLONASS satellites.

If the software is configured to work in GLONASS only mode, UTC(SU) is identical to UTC and GPS UTC FROM GLONASS is identical to GPS UTC.

For value 9, the reference time is GPS time, but it is corrected using the parameters downloaded by GST (for example, GALILEO).

Table 159. **PPS GNSS FIX CONDITION values**

Values	Definition
0x1	NO FIX
0x2	2D FIX
0x3	3D FIX

20.4 Line 2: PPS operating mode setting 2

Table 160. **[P20,L02] field description**

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**TRAIM CN0 THR** TRAIM CN0 threshold

20.5 Line 4: PPS operating mode setting 2

Allow setting different operating modes for the PPS signal generation. Full operating mode setting is achieved using both [P20,L01] and [P20,L04] parameters. This parameter includes different fields as reported in the following table.

Table 161. Field 0 [P20,L04] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b31]	See table below	**PPS MIX CONST FOR TIME CORRECTION ONOFF** Enable/disable mixing constellations for time correction. All bits to 0 means that mixing constellation feature is disabled (1)

1. *Mixing constellations for time correction means that satellites from one constellation are used to correct the reference time for other constellations. For example if GPS time is selected for PPS signal generation and B1 (or B7) is enabled, also Glonass satellites (or Beidou satellites) are used to correct the GPS reference time. If Glonass time is selected for PPS signal generation and B0 is enabled, also GPS satellites are used to correct the Glonass reference time.*

Table 162. PPS MIX CONST FOR TIME CORRECTION ON/OFF values

Values	Definition
0x0	mixing constellation disabled
0x1	GPS L1 constellation
0x2	GLONASS G1 constellation
0x4	QZSS L1 CA constellation
0x8	GALILEO E1 constellation
0x80	BEIDOU B1I constellation
0x800	GPS L5 constellation (used in timing MF PVT)
0x1000	GAL E5a constellation (used in timing MF PVT)
0x4000	BEI B2a constellation (used in timing MF PVT)

20.6 Line 8: path delay cfg1

This line is applicable only for STA86x0 dual freq L1–L5 PVT binary image (with or without DR).

Table 163. [P20,L08,F00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**L5 path delay** GPS L5 path delay [dm]. 2–Complement format on 16 bits
F01	[b16-b31]	0xFFFF0000	**G1 path delay** GLONASS path delay [dm]. 2–Complement format on 16 bits

20.7 Line 9: path delay cfg2

This line is applicable only for STA86x0 dual freq L1–L5 PVT binary image (with or without DR).

Table 164. [P20,L09] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**GAL E5a path delay** Galileo E5a path delay [dm]. 2–Complement format on 16 bits
F01	[b16-b31]	0xFFFF0000	**GAL E1 path delay** Galileo E1 path delay [dm]. 2–Complement format on 16 bits

20.8 Line 10: path delay cfg3

This line is applicable only for STA86x0 dual freq L1–L5 PVT binary image (with or without DR).

Table 165. [P20,L10] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**BEI B2A path delay** BeiDou B2A path delay [dm]. 2–Complement format on 16 bits
F01	[b16-b31]	0xFFFF0000	**BEI B1I path delay** BeiDou B1I path delay [dm]. 2–Complement format on 16 bits

20.9 Line 11: path delay cfg4

This line is applicable only for STA86x0 dual freq L1–L5 PVT binary image (with or without DR).

Table 166. [P20,L11] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**GPS L2C path delay** GPS L2C path delay [dm]. 2–Complement format on 16 bits
F01	[b16-b31]	0xFFFF0000	**Galileo E5B path delay** Galileo E5B path delay [dm]. 2–Complement format on 16 bits

20.10 Line 12: path delay cfg4

This line is applicable only for STA86x0 dual freq L1–L5 PVT binary image (with or without DR).

Table 167. [P20,L12] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**BEI B2I path delay** BEI B2I path delay Beidou B2I path delay [dm]. 2–Complement format on 16 bits

20.11 Line 14: DDNCO

Table 168. **[P20,L15] field description**

Field	Bit	Bit mask / value	Airborne mode threshold
F00	[b0-b27]	0xFFFFFFF	**DDNCO FREQ OUT** Disciplined NCO frequency output (supported range = 1 MHz to 30 MHz)
F02	[b31]	0x80000000	**DDNCO ENABLE** Enable disciplined NCO frequency output

20.12 Line 15: airborne mode configuration

This line defines the main configuration for airborne mode. This is applicable only for STA86x0 dual freq L1–L5 PVT binary image (with or without DR).

Airborne mode is a special mode which configures PVT dynamics to track fast (10 m/s) vertical motions more accurately, i.e. thought for applications like airborne or weather balloons. This mode is therefore forbidden for land vehicle or static applications because leading some regressions, especially in urban environments.

Table 169. **[P20,L15] field description**

Field	Bit	Bit mask / value	Airborne mode threshold
F00	[b0-b15]	0xFFFF	Airborne mode threshold
F01	[b31]	0x80000000	Airborne enable

21 Application configuration (page 21)

21.1 Application configuration mapping

Table 170. Page 21 layout

<table>
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<tr><th>Line</th><th>31</th><th>30</th><th>29</th><th>28</th><th>27</th><th>26</th><th>25</th><th>24</th><th>23</th><th>22</th><th>21</th><th>20</th><th>19</th><th>18</th><th>17</th><th>16</th><th>15</th><th>14</th><th>13</th><th>12</th><th>11</th><th>10</th><th>9</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0</td><td colspan="32">Application on/off 1</td></tr>
<tr><td>1</td><td colspan="32">Application on/off 2</td></tr>
<tr><td>2</td><td colspan="32">Application on/off 3</td></tr>
<tr><td>4</td><td colspan="32">Constellation mask on/off</td></tr>
<tr><td>5</td><td colspan="32">Constellation multi–frequency on/off</td></tr>
<tr><td>6</td><td colspan="32">Constellation fix mask</td></tr>
<tr><td>7</td><td colspan="32">Timing constellation mask</td></tr>
<tr><td>8</td><td colspan="15">Reserved</td><td colspan="3">max follow up time elapsed</td><td colspan="5">Threshold TAPP synchro interval error</td><td colspan="5">Threshold BRIDGE synchro interval error</td><td>Secure Com early msg Enable</td><td>Secure Com Enable</td><td>Time synchro Enable</td><td>E2E Enable</td></tr>
<tr><td>9</td><td colspan="32">E2E measurement source data ID</td></tr>
<tr><td>10</td><td colspan="32">E2E measurement LLI source data ID</td></tr>
<tr><td>11</td><td colspan="32">E2E time sync header source data ID</td></tr>
<tr><td>12</td><td colspan="32">E2E SCL header source data ID</td></tr>
<tr><td>13</td><td colspan="6">Warm up time</td><td colspan="13">Threshold synchro quality error</td><td colspan="13">Threshold BRIDGE time conv error</td></tr>
<tr><td>14</td><td colspan="16">Threshold BRIDGE rate jitter wander</td><td colspan="16">Threshold BRIDGE rate jitter error</td></tr>
<tr><td>15</td><td colspan="16">Threshold Teseo rate jitter wander</td><td colspan="16">Threshold Teseo rate jitter error</td></tr>
</table>

21.2 Line 0: application on/off 1

Table 171. **[P21,L00,F00] bits description**

Bit	Bit mask / value	Description
[b2]	0x4	**WAAS ON OFF SWITCH** Enable/disable SBAS satellite reporting in the GSV messages
[b3]	0x8	**WAAS SAT ON GSV ON OFF SWITCH** Enable/disable SBAS satellite reporting in the GSV messages (1)
[b5]	0x20	**NMEA ON OFF SWITCH** Enable/disable the NMEA protocol (2)
[b6]	0x40	RESERVED
[b7]	0x80	**ST HEADERS BOOT ONLY SWITCH** Enable/disable send of standard ST NMEA headers or config. text at boot Only
[b8]	0x100	**BIN IMG IN SHORT HEADER** Enable/disable sending of binary image version after GNSSLIB version in short header
[b9]	0x200	**SEND CFG TXT ON OFF SWITCH** Enable/disable sending config. text in the header message at start up
[b10]	0x400	**ST NMEA HEADERS ON OFF SWITCH** Enable/disable send standard ST NMEA headers
[b11]	0x800	**RTCM DATA PROC ON OFF SWITCH** Enable/disable the RTCM data processing. Note that this bit must be set to 1 if the RTCM protocol is enabled in P21,L01,bit17
[b12]	0x1000	**FDE ALGO ON OFF SWITCH** Enable/disable FDE algorithm
[b14]	0x4000	**WALKING MODE ALGO ON OFF SWITCH** Enable/disable walking mode algorithm
[b15]	0x8000	**STOP DETECTION ALGO ON OFF SWITCH** Stop detection algorithm
[b18]	0x40000	**NMEA INVALID COURSE DETECTION** Enable/disable invalid course detection. When enable, invalid course is reported empy field instead of 0.0
[b19]	0x80000	**NMEA GNGSV ON OFF SWITCH** Enable/disable NMEA GNGSV
[b20]	0x100000	**NMEA GNGSA ON OFF SWITCH** Enable/disable NMEA GNGSA
[b21]	0x200000	**NMEA GNGSA FILTERING ENABLE** Enable/disable NMEA GNGSA filtering. Do not report twice the same satellite (for exampe, if satellite used in L1+L5, report it only once in GSA message)
[b22]	0x400000	**NMEA PSTMxETPAR P63 ASCII STRING** Enable/disable the NMEA PSTMGETPAR and PSTMSETPAR [P63] (database settings page) in ASCII string
[b23]	0x800000	**NMEA SINGLE CONSTEL DETECT ENABLE** Enable/disable the single constellation detection for talker ID
[b24]	0x1000000	**PPS ON OFF SWITCH**

Bit	Bit mask / value	Description
		Enable/disable PPS
[b25]	0x2000000	**PPS POLARITY INV ON OFF SWITCH** PPS polarity inversion
[b26]	0x4000000	**POSITION HOLD ON OFF SWITCH** Enable/disable position hold
[b27]	0x8000000	**TRAIM ALGO ON OFF SWITCH** Enable/disable TRAIM algorithm
[b29]	0x20000000	**HIGH DYNAMICS ON OFF SWITCH** Enable/disable high dynamics
[b30]	0x40000000	**ST NMEA DSP RAW MSG ON OFF SWITCH** ST NMEA DSP raw messages enable

1. *The SBAS satellite ID, reported in the GSV messages, is in the range from 33 to 64 according to the NMEA specifications.*
2. *This bit must be set to 0 if the RTCM protocol is enabled in P21,L01,bit17.*

21.3 Line 1: application on/off 2

Table 172. [P21,L01,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**NMEA CMDIF ECHO ON OFF SWITCH** Enable/disable the command echo on the NMEA port
[b1]	0x2	**NMEA TTFF MSG ON OFF SWITCH** Enable/disable the time to first fix message on the NMEA port (1)
[b2]	0x4	**FEW SATS POS EST ON OFF SWITCH** Enable/disable the position estimation algorithm from 3 satellites (2D)
[b4]	0x10	**NAVM SUPPORT ON OFF SWITCH** Enable/disable the raw navigation data frame output. If activated, according to the protocol used, either RTCM NDF 4075 messages are sent either NMEA $PSTMNAVM messages are sent. For NMEA, bit5 NAV NMEA M in P32,L06 must also be enabled
[b5]	0x20	**NMEA IN OUT INTERFACE ON OFF SWITCH** Select the communication interface to be used over the NMEA port at start up
[b11]	0x800	**RTC USAGE DISABLING ON OFF SWITCH** Enable/disable the usage of RTC from the GNSS engine (2)
[b12]	0x1000	**GNSS FAST CN0 MODE ON OFF SWITCH** Enable/disable the fast satellite drop feature (3)
[b14]	0x4000	**SAT EXCL PRESENT GSA GGA ON OFF SWITCH** Enable/disable the excluded satellites reporting in the GGA, GSA, GNS and PSTMTG NMEA messages (4)
[b15]	0x8000	**WLS ALGO RUNTIME ON OFF SWITCH** Enable/disable wls algorithm
[b17]	0x20000	**RTCM3 ON OFF SWITCH** Enable/disable RTCM protocol. Note that bit11 of [P21, L00] must be set to 1 if RTCM protocol is enabled (5)
[b21]	0x200000	**EXT RTC OSCI ON OFF SWITCH** Enable/disable external RTC oscillator
[b26]	0x4000000	**RTC CALIBRATION ON OFF SWITCH**

Bit	Bit mask / value	Description
		Enable/disable RTC calibration
[b27]	0x8000000	**NMEA HIGH FIX RATE ON OFF SWITCH** Enable/disable high fix rate
[b30]	0x40000000	**LBAND MODE ON OFF SWITCH** Enable/disable LBand

1. *If enabled, the TTFF message is sent only one time as soon as the GNSS position fix is achieved.*
2. *This bit must be 0 when an external 32.768kHz crystal is used.*
3. *When fast satellite drop is enabled, the GNSS software reports NO FIX status immediately after the tunnel entrance; the position update is no more propagated for some seconds inside the tunnel.*
4. *If this bit is enabled, satellites excluded by positioning stage due to RAIM or FDE algorithms, are included in the number of used satellites (present in the GGA, GNS and PSTMG messages) and their satellites IDs are included in the list of used satellite (present in the GSA message). This bit is disabled by default.*
5. *This bit must be set to 0 if the NMEA protocol is enabled in [P21, L00],bit5.*

21.4 Line 2: application on/off 3

Table 173. [P21,L02,F00] bits description

Bit	Bit mask / value	Description
[b2]	0x4	**STD METRICS ON SWITCH** Enable/disable STD METRICS reporting
[b3]	0x8	**TDIFF METRICS ON SWITCH** Enable/disable TDIFF METRICS reporting

21.5 Line 4: constellation mask on/off

Table 174. Field 0 [P21,L04,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	Enable/disable GPS constellation
[b1]	0x2	Enable/disable GLONASS constellation
[b2]	0x4	Enable/disable QZSS L1 CA constellation
[b3]	0x8	Enable/disable GALILEO constellation
[b4]	0x10	RESERVED
[b5]	0x20	Enable/disable QZSS L1 SAIF constellation
[b6]	0x40	Enable/disable QZSS L1C constellation
[b7]	0x80	Enable/disable BEIDOU constellation
[b8]	0x100	Enable/disable BEIDOU B1C constellation
[b9]	0x200	Enable/disable GPS L2C frequency constellation
[b10]	0x400	Enable/disable IRNSS constellation
[b11]	0x800	Enable/disable GPS L5 frequency constellation
[b12]	0x1000	Enable/disable GALILEO E5A frequency constellation
[b13]	0x2000	Enable/disable GALILEO E6 frequency constellation
[b14]	0x4000	Enable/disable BEIDOU B2A frequency constellation
[b15]	0x8000	Enable/disable QZSS L2C frequency constellation

Bit	Bit mask / value	Description
[b16]	0x10000	Enable/disable QZSS L5 frequency constellation
[b17]	0x20000	Enable/disable GPS L1C frequency constellation
[b18]	0x40000	Enable/disable BEIDOU B3I frequency constellation
[b19]	0x80000	Enable/disable BEIDOU B2B frequency constellation
[b21]	0x200000	Enable/disable GLONASS L2 frequency constellation
[b22]	0x400000	Enable/disable BEIDOU B2I frequency constellation
[b23]	0x800000	Enable/disable GALILEO E5B frequency constellation

21.6 Line 5: constellation multi–frequency on/off

Table 175. [P21,L05,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	Enable/disable GPS multi–frequency: • 0 = OFF • 1 = L2C or L5
[b1]	0x2	Enable/disable GLONASS multi–frequency: • 0 = OFF • 1 = G2
[b2]	0x4	Enable/disable QZSS multi–frequency • 0 = OFF • 1 = L2C or L5
[b3]	0x8	Enable/disable GALILEO multi–frequency: • 0 = OFF • 1 = E5A or E5B or E6
[b7]	0x80	Enable/disable BEIDOU multi–frequency: • 0 = OFF • 1 = B3I or B1C or B2A or B2B or B2I
[b13]	0x2000	Select pilot or data component for GALILEO E6 signal: • 0 = Select pilot (CL) component • 1 = Select data (CM) component
[b19]	0x8000	Select pilot or data component for BEIDOU B2B signal: • 0 = Select pilot (CL) component • 1 = Select data (CM) component
[b20]	0x100000	Enable/disable BEIDOU BDS3-only acquisition/tracking: • 0 = Disable BEIDOU BDS3-only acquisition/tracking • 1 = Enable BEIDOU BDS3-only acquisition/tracking
[b21]	0x200000	Enable/disable BEIDOU GEO B1I acquisition/tracking; • 0 = Enable GEO B1I tracking • 1 = Disable GEO B1I tracking
[b22]	0x400000	Enable/disable BEIDOU GEO B2B tracking; • 0 = Enable all B2B tracking • 1 = Enable only GEO B2B tracking
[b23]	0x800000	Enable/disable autonomous acquisition of dual freq. (L5,B2A,E5A,E5B): • 0 = Disabled • 1 = Enabled

Bit	Bit mask / value	Description
[b24]	0x1000000	Enable/disable split band mode: • 0 = Disabled • 1 = Enabled
[b31]	0x80000000	**B2B cold/warm start assistance** B2B are dropped after the ephemeris download: • 0 = Disabled • 1 = Enabled

21.7 Line 6: constellation mask used for positioning

It is important to align the timing constellation mask in [P21,L07] with the constellation mask used for fix.

Table 176. [P21,L06,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	Enable/disable GPS constellation usage for positioning
[b1]	0x2	Enable/disable GLONASS constellation usage for positioning
[b2]	0x4	Enable/disable QZSS constellation usage for positioning
[b3]	0x8	Enable/disable GALILEO constellation usage for positioning
[b5]	0x20	Enable/disable QZSS L1 SAIF constellation usage for positioning
[b6]	0x40	Enable/disable QZSS L1C constellation usage for positioning
[b7]	0x80	Enable/disable BEIDOU constellation usage for positioning
[b8]	0x100	Enable/disable BEIDOU B1C constellation usage for positioning
[b9]	0x200	Enable/disable GPS L2 constellation usage for positioning
[b10]	0x400	Enable/disable IRNSS constellation usage for positioning
[b11]	0x800	Enable/disable GPS L5constellation usage for positioning
[b12]	0x1000	Enable/disable GALILEO E5A constellation usage for positioning
[b13]	0x2000	Enable/disable GALILEO E6 constellation usage for positioning
[b14]	0x4000	Enable/disable BEIDOU B2A constellation usage for positioning
[b15]	0x8000	Enable/disable QZSS L2C constellation usage for positioning
[b16]	0x10000	Enable/disable QZSS L5 constellation usage for positioning
[b17]	0x20000	Enable/disable GPS L1C constellation usage for positioning
[b18]	0x40000	Enable/disable BEIDOU B3I constellation usage for positioning
[b19]	0x80000	Enable/disable BEIDOU B2B constellation usage for positioning
[b21]	0x200000	Enable/disable GLONASS L2 constellation usage for positioning
[b22]	0x400000	Enable/disable BEIDOU B2I constellation usage for positioning
[b23]	0x800000	Enable/disable GALILEO E5B constellation usage for positioning

21.8 Line 7: timing constellation mask

The timing constellation mask shall be aligned with the constellation mask used for fix in [P21,L06]. If the timing mask does not match the used constellation mask, the system time for some constellations will not be properly updated.

Table 177. **[P21,L07,F00] bits description**

Bit	Bit mask / value	Description
[b0]	0x1	Timing mask for GPS constellation
[b1]	0x2	Timing mask for GLONASS constellation
[b2]	0x4	Timing mask for QZSS constellation
[b3]	0x8	Timing mask for GALILEO constellation
[b7]	0x80	Timing mask for BEIDOU constellation

21.9 Line 8: E2E and SCL configuration

Table 178. **[P21,L08] field description**

Field	Bit	Bit mask / value	Description
F00	[b0]	0x00000001	Enable/disable the E2E protocol
F01	[b1]	0x00000002	Enable/disable the time synchronization procedure
F02	[b2]	0x00000004	Enable/disable the secure communication
F03	[b3]	0x00000008	Enable/disable SC early measurements sending
F04	[b4-8]	0x000001F0	Time synchronization parameters: threshold of BRIDGE MASTER synchronization interval (percentage drift) error] Decimal value, default 25.
F05	[b9-13]	0x00003E00	Time synchronization parameters: threshold of BRIDGE TAPP synchronization interval (percentage drift) error Decimal value, default 25.
F06	[b14-16]	0x0001C000	Time synchronization parameters: Teseo maximum time elapsed between follow up for normal operation Decimal value, default 2.

21.10 Line 9: E2E measurement source data ID

Table 179. **[P21,L09,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**E2E measurement source data ID** Identification value of the measurement data transported by the packet

21.11 Line 10: E2E measurement LLI source data ID

Table 180. **[P21,L10,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**E2E measurement LLI source data ID** Identification value of the measurement LLI data transported by the packet

21.12 Line 11: E2E time sync header source data ID (STA9200 only)

Table 181. [P21,L11,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**E2E time sync header source data ID** Identification value of the time sync data transported by the packet

21.13 Line 12: E2E SCL header source Data ID

Table 182. [P21,L12,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**E2E SCL header source data ID** Identification value of the SCL data transported by the packet

21.14 Line 13: TimeSync configuration

Table 183. [P21,L13] bits description

Field	Bit	Bit mask / value	Description
F00	[b0-12]	0x00001FFF	Time synchronization parameters: Threshold of BRIDGE local time to grand master time conversion. Decimal, default value 400
F01	[b13-25]	0x03FFE000	Time synchronization parameters : Threshold of synchronization quality (time drift) error Decimal, default value 500
F02	[b26-31]	0xFC000000	Time synchronization parameters : Warm up time (before to consider TAPP BRIDGE MASTER rates are stable) Decimal, default value 10

21.15 Line 14: TimeSync configuration bridge to master threshold

Table 184. [P21,L14] bits description

Field	Bit	Bit mask / value	Description
F00	[b0-15]	0x0000FFFF	Time synchronization parameters: Threshold of BRIDGE to MASTER time slope rate jitter error. Decimal, default value 8000
F01	[b16-31]	0xFFFF0000	Time synchronization parameters: Threshold of BRIDGE to MASTER time slope rate wander error Decimal, default value 8000

21.16 Line 15: TimeSync configuration threshold Teseo to master

Table 185. [P21,L15] bits description

Field	Bit	Bit mask / value	Description
F00	[b0-15]	0x0000FFFF	Time synchronization parameters: Threshold of Teseo to MASTER time slope rate jitter error Decimal, default value 8000
F01	[b16-31]	0xFFFF0000	Time synchronization parameters: Threshold of Teseo to MASTER time slope rate wander error Decimal, default value 8000

22 RTCM3 protocol configuration (page 22)

It is possible to configure the RTCM3 MTI (see UM3401) value for each class of message in lines 0, 1, 2, and 3.

On each line, eight MTI groups are encoded, with the group with lower index encoded on the four least significant bits of such word.

The MTIs are therefore encoded on 4 bits for each class of message, SO-16 values of MTI are possible. A MTI value of 0 means that the corresponding class of message is sent when available.

A MTI value of 0xF means that the corresponding class of message is not sent.

Refer to the RTCM3 proprietary message interface document to get more details about the other possible values.

The observation legacy messages included in the group 0 are not compatible with the MSM messages included in the group 1, so if group 0 is enabled then group 1 must be disabled and vice versa.

The MTI groups 0 and 1 are allowed only the MTI values 0x0 and 0xF of 0x0 and 0xF only.

22.1 RTCM3 protocol configuration mapping

Table 186. Page 22 layout

Page 22																													
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	RTCM3 MTI CFG 0																															
1	RTCM3 MTI CFG 1																															
2	RTCM3 MTI CFG 2																															
3	RTCM3 MTI CFG 3																															
4	RTCM3 MTI CFG 4																															
6	RTCM3 message list 1																															
7	RTCM3 message list 2																															
8	Reserved																										MSM message type			Reserved	Height on 21 bits	NDF ID
9	RTCM3 metrics mask 2																															
10	OBSQM and OBSQM2 constellation message																Ephemeris constellation message						MSM7 constellation message						SIGQM2 and 3 constellation			
11	RTCM3 constellation message																															
12	RTCM3 metrics mask																															
13	prop id	ep Msg ovfl		ep Msg crit T					ep Msg max T								RTCM3 EPHEM SPLIT CNT				Reserved		IFM dbg	1013	1006	sat ex	sens	nosat	preamb	EPVT Time	PRR	OFDE
14	RTCM3 OBSQM and OBSQM2 metrics mask																															
15	RTCM3 OBSQM and OBSQM2 metrics mask 2																															

22.2 Line 0: RTCM3 MTI CFG 0

Table 187. [P22,L00,F00] bits description

Bit	Bit mask / value	Description
[b0-b3]	See Table 188. RTCM3 MTI CFG ID 0 values	**Legacy observations messages** Allow to enable or disable legacy observations messages 1002 and 1010
[b4-b7]	See Table 189. RTCM3 MTI CFG ID 1 values	**MSM7 observations messages** Allow to enable or disable MSM7 observations messages 1077, 1087, 1097,1117, 1127 and 1137
[b8-b11]	0xF00	**Ephemeris and additional messages** Allow to set MTI value for messages 1019, 1020, 1042, 1044, 1046, 1006 and 1013
[b12-b15]	0xF000	**Navigation data frame messages** Allow to set MTI value for the navigation data frame (NDF) messages
[b16-b19]	0xF0000	**Receiver safety status messages** Allow to set MTI value for the receiver safety status (RSS), and time global information (TG) messages
[b20-b23]	0xF00000	**Receiver configuration and control messages** Allow to set MTI value for the receiver configuration and control (RCC) messages
[b24-b27]	0xF000000	**Almanac messages** Allow to set MTI value for the Almanac (ALMANAC) messages
[b28-b31]	0xF0000000	**Sensor messages** Allow to set MTI value for the sensor (SENS) messages

Table 188. RTCM3 MTI CFG ID 0 values

Values	Definition
0x0	Enabled
0xF	Disabled

Table 189. RTCM3 MTI CFG ID 1 values

Values	Definition
0x0	Enabled
0xF	Disabled

22.3 Line 1: RTCM3 MTI CFG 1

Table 190. Field 0 [P22,L01,F00] bits description

Bit	Bit mask / value	Description
[b0-b3]	0xF	**Receiver PVT messages** Allow to set MTI value for the receiver PVT (PVT) messages
[b4-b7]	0xF0	**Position quality metrics messages** Allow to set MTI value for the position quality metrics (POSQM) messages
[b8-b11]	0xF00	**Observable quality metrics messages**

Bit	Bit mask / value	Description
		Allow to set MTI value for the observable quality metrics (OBSQM, OBSQM2) messages (1)
[b12-b15]	0xF000	**Satellite data messages** Allow to set MTI value for the DATUM RTCM3 messages
[b16-b19]	0xF0000	**GLONASS inter channel bias messages** Allow to set MTI value for the GLONASS inter channel bias (ICB) messages
[b20-b23]	0xF00000	**Inter frequency bias messages** Allow to set MTI value for the inter frequency bias (IFB) messages
[b24-b27]	0xF000000	**Ionospheric model parameters messages** Allow to set MTI value for the ionospheric model parameters (IONOPAR) messages
[b28-b31]	0xF0000000	**Response messages** Allow to set MTI value for the response messages (RESP)

1. *OBSQM and OBSQM2 are disabled for STA9200.*

22.4 Line 2: RTCM3 MTI CFG 2

Table 191. [P22,L02,F00] bits description

Bit	Bit mask / value	Description
[b0-b3]	0xF	**Auxiliary messages** Allow to set MTI value for the auxiliary (AUX) messages
[b4-b7]	0xF0	**Firmware version messages** Allow to set MTI value for the firmware version (FWVER) messages
[b8-b11]	0xF00	**RFS status messages** Allow to set MTI value for the RFS status (RFS) and RF AGC (RFAGC) messages
[b12-b15]	0xF000	**TXREQ response messages** Allow to set MTI value for the TXREQ response messages
[b16-b19]	0xF0000	**Signal quality metrics 2 and 3 messages** Allow to set MTI value for the signal quality metrics version 2 and 3 (SIGQM2, SIGQM3) messages
[b20-b23]	0xF00000	**Extended receiver PVT and OSNMA authenticated minimum specific data (STAMC) messages** Allow to set MTI value for the receiver EPVT and STAMC messages (1)
[b24-b27]	0xF000000	**IFB data messages** Allow to set MTI value for the IFBDATA messages
[b28-b31]	0xF0000000	**GNSS Satellites in view messages (STGSV)** Allow to set MTI value for the STGSV messages

1. *STAMC is disabled for STA9200.*

22.5 Line 3: RTCM3 MTI CFG 3

Table 192. [P22,L03,F00] bits description

Bit	Bit mask / value	Description
[b0-b3]	0xF	**GNSS Active satellites (STGSA) and OSNMA authenticated active satellites (STASA) messages** Allow to set MTI value for the STGSA and STASA messages
[b4-b7]	0xF0	**GNSS RAIM parameters (STGBS) messages** Allow to set MTI value for the STGBS messages
[b8-b11]	0xF00	**GNSS pseudo-range error statistics (STGST) messages** Allow to set MTI value for the STGST messages
[b12-b15]	0xF000	**GNSS range residuals (STGRS) messages** Allow to set MTI value for the STGRS messages
[b16-b19]	0xF0000	**GNSS prediction ephemeris (STGPE) messages** Allow to set MTI value for the STGPE messages
[b20-b23]	0xF00000	**Debug information message (STDBG) messages** Allow to set MTI value for the STDBG messages
[b24-b27]	0xF000000	**OSNMA and OSNMA event messages** OSNMA (STNMA) and OSNMA event (STNMAEVT) messages (1)
[b28-b31]	0xF0000000	**GNSS orbit correction messages (1057, 1240, 1258)** (2)

1. *STNMA and STNMAEVT are disabled for STA9200.*
2. *GNSS orbit correction messages are disabled for STA9200.*

22.6 Line 4: RTCM3 MTI CFG 4

Table 193. [P22,L04,F00] bits description

Bit	Bit mask / value	Descriptions
[b0-b3]	0xF	**GNSS clock correction messages** GNSS clock correction messages (1058, 1241, 1259) (1)
[b4-b7]	0xF0	**GNSS code bias correction messages** GNSS code bias correction messages (1059, 1242, 1260) (2)

1. *GNSS clock correction messages are disabled for STA9200.*
2. *GNSS code bias correction messages are disabled for STA9200.*

22.7 Line 6: RTCM3 fix message list 1 activation

Select the RTCM3 messages broadcasted to host at fix rate. If high fix rate is enabled, RTCM3 messages broadcasted to host at high rate are selected only in RTCM3 fix message list 2.

Table 194. [P22,L06,F00] bits description

Bit	Bit mask / value	Descriptions
[b0]	0x1	**RTCM3 FIX MSGLIST 1 STD 1006** Enable/disable RTCM3 standard message 1006
[b1]	0x2	**RTCM3 FIX MSGLIST 1 STD 1013** Enable/disable RTCM3 standard message 1013

Bit	Bit mask / value	Descriptions
[b2]	0x4	**RTCM3 FIX MSGLIST 1 PROP PVT** Enable/disable RTCM3 proprietary message GGA/PVT
[b3]	0x8	**RTCM3 FIX MSGLIST 1 PROP RCC** Enable/disable RTCM3 proprietary message RCC
[b4]	0x10	**RTCM3 FIX MSGLIST 1 PROP IONOPAR** Enable/disable RTCM3 proprietary message ionov
[b5]	0x20	**RTCM3 FIX MSGLIST 1 PROP ICB** Enable/disable RTCM3 proprietary message GLO ICB
[b6]	0x40	**RTCM3 FIX MSGLIST 1 PROP IFB** Enable/disable RTCM3 proprietary message IFB
[b7]	0x80	**RTCM3 FIX MSGLIST 1 PROP STDTM** Enable/disable RTCM3 proprietary message STDTM
[b8]	0x100	**RTCM3 FIX MSGLIST 1 PROP TXREQ** Enable/disable RTCM3 proprietary message TXREQ
[b9]	0x200	**RTCM3 FIX MSGLIST 1 PROP EPVT** Enable/disable RTCM3 proprietary message EPVT
[b10]	0x400	**RTCM3 FIX MSGLIST 1 PROP IFBDATA** Enable/disable RTCM3 proprietary message IFBDATA
[b11]	0x800	**RTCM3 FIX MSGLIST 1 PROP STGST** Enable/disable RTCM3 proprietary message STGST
[b12]	0x1000	**RTCM3 FIX MSGLIST 1 PROP STGRS** Enable/disable RTCM3 proprietary message STGRS
[b13]	0x2000	**RTCM3 FIX MSGLIST 1 PROP STGSA** Enable/disable RTCM3 proprietary message STGSA
[b14]	0x4000	**RTCM3 FIX MSGLIST 1 PROP STGBS** Enable/disable RTCM3 proprietary message STGBS
[b15]	0x8000	**RTCM3 FIX MSGLIST 1 PROP STGSV** Enable/disable RTCM3 proprietary message STGSV
[b16]	0x10000	**RTCM3 FIX MSGLIST 1 PROP STGPE** Enable/disable RTCM3 proprietary message STGPE
[b17]	0x20000	**RTCM3 FIX MSGLIST 1 PROP STASA** Enable/disable RTCM3 proprietary message STASA
[b18]	0x40000	**RTCM3 FIX MSGLIST 1 PROP STAMC** Enable/disable RTCM3 proprietary message STAMC
[b19]	0x80000	**RTCM3 FIX MSGLIST 1 PROP POSQM** Enable/disable RTCM3 proprietary message POSQM

22.8 Line 7: RTCM3 fix message list 2 activation

Select the RTCM3 messages broadcasted to host at high fix rate.

Table 195. [P22,L07,F00] bits description

Bit	Bit mask / value	Descriptions
[b0]	0x1	**RTCM3 FIX MSGLIST 2 STD 1006**

Bit	Bit mask / value	Descriptions
		Enable/disable RTCM3 standard message 1006
[b1]	0x2	**RTCM3 FIX MSGLIST 2 STD 1013** Enable/disable RTCM3 standard message 1013
[b2]	0x4	**RTCM3 FIX MSGLIST 2 PROP PVT** Enable/disable RTCM3 proprietary message GGA/PVT
[b3]	0x8	**RTCM3 FIX MSGLIST 2 PROP RCC** Enable/disable RTCM3 proprietary message RCC
[b4]	0x10	**RTCM3 FIX MSGLIST 2 PROP IONOPAR** Enable/disable RTCM3 proprietary message ionov
[b5]	0x20	**RTCM3 FIX MSGLIST 2 PROP ICB** Enable/disable RTCM3 proprietary message GLO ICB
[b6]	0x40	**RTCM3 FIX MSGLIST 2 PROP IFB** Enable/disable RTCM3 proprietary message IFB
[b7]	0x80	**RTCM3 FIX MSGLIST 2 PROP STDTM** Enable/disable RTCM3 proprietary message STDTM
[b8]	0x100	**RTCM3 FIX MSGLIST 2 PROP TXREQ** Enable/disable RTCM3 proprietary message TXREQ
[b9]	0x200	**RTCM3 FIX MSGLIST 2 PROP EPVT** Enable/disable RTCM3 proprietary message EPVT
[b10]	0x400	**RTCM3 FIX MSGLIST 2 PROP IFBDATA** Enable/disable RTCM3 proprietary message IFBDATA
[b11]	0x800	**RTCM3 FIX MSGLIST 2 PROP STGST** Enable/disable RTCM3 proprietary message STGST
[b12]	0x1000	**RTCM3 FIX MSGLIST 2 PROP STGRS** Enable/disable RTCM3 proprietary message STGRS
[b13]	0x2000	**RTCM3 FIX MSGLIST 2 PROP STGSA** Enable/disable RTCM3 proprietary message STGSA
[b14]	0x4000	**RTCM3 FIX MSGLIST 2 PROP STGBS** Enable/disable RTCM3 proprietary message STGBS
[b15]	0x8000	**RTCM3 FIX MSGLIST 2 PROP STGSV** Enable/disable RTCM3 proprietary message STGSV
[b16]	0x10000	**RTCM3 FIX MSGLIST 2 PROP STGPE** Enable/disable RTCM3 proprietary message STGPE
[b17]	0x20000	**RTCM3 FIX MSGLIST 2 PROP STASA** Enable/Disable RTCM3 proprietary message STASA
[b18]	0x40000	**RTCM3 FIX MSGLIST 2 PROP STAMC** Enable/disable RTCM3 proprietary message STAMC
[b19]	0x80000	**RTCM3 FIX MSGLIST 2 PROP POSQM** Enable/disable RTCM3 proprietary message POSQM

22.9 Line 8: RTCM3 configuration (part 2)

Table 196. [P22,L08] field description

Field	Bit	Bit mask / value	Descriptions
F00	[b0]	0x1	**RTCM3 NDF ID SWITCH** Defines which RTCM message ID to use for navigation data frame (NDF). Messages: • 0 = ID 4075 • 1 = ST proprietary ID
F01	[b1]	0x2	**RTCM3 HEIGHT 21 BIT and EPVT with velocity north/east and gdop/tdop** INITPOS, EPVT, STAMC height 20 bits or 21 bits configuration: • 0 = 20 bits height • 1 = 21 bits height and epvt with velocity north/east and gdop/tdop
F03	[b3-b5]	0x38	**RTCM3 MSM message type** Defines the MSM message type supported: • 4 = MSM 4 • 5 = MSM 5 • 7 = MSM 7 (default)

22.10 Line 9: RTCM3 metrics mask 2 on/off

Table 197. [P22,L09,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	Enable/disable signal strength (CN0) F4
[b1]	0x2	Enable/disable carrier loop discriminator output std estimate (mdeg) F4
[b2]	0x4	Enable/disable code loop discriminator output std estimate (cm) F4
[b3]	0x8	Enable/disable double–delta metric (cm) F4
[b4]	0x10	Auto–correlation metric 1, based on 10x correlations F4
[b5]	0x20	Enable/disable DSP flags F4
[b6]	0x40	Metrics flags F4
[b8]	0x100	Enable/disable DSP flags2 F4
[b10]	0x400	Enable/disable signal strength (CN0) F5
[b11]	0x800	Enable/disable carrier loop discriminator output std estimate (mdeg) F5
[b12]	0x1000	Enable/disable code loop discriminator output std estimate (cm) F5
[b13]	0x2000	Enable/disable double–delta metric (cm) F5
[b14]	0x4000	Auto–correlation metric 1, based on 10x correlations F5
[b15]	0x8000	Enable/disable DSP flags F5
[b16]	0x10000	Metrics flags F5
[b18]	0x40000	Enable/disable DSP flags2 F5
[b20]	0x100000	Enable/disable signal strength (CN0) F6
[b21]	0x200000	Enable/disable carrier loop discriminator output std estimate (mdeg) F6
[b22]	0x400000	Enable/disable code loop discriminator output std estimate (cm) F3
[b23]	0x800000	Enable/disable double–delta metric (cm) F6
[b24]	0x1000000	Auto–correlation metric 1, based on 10x correlations F6

Bit	Bit mask / value	Description
[b25]	0x2000000	Enable/disable DSP flags F6
[b26]	0x4000000	Metrics flags F6
[b28]	0x10000000	Enable/disable DSP flags2 F6
[b30]	0x40000000	Metrics user 2 on/off

22.11 Line 10: RTCM3 messages constellation mask on/off

Allow to filter SIGQM2, SIGQM3, MSM7, Ephemeris, OBSQM and OBSQM2 messages by constellation.

Table 198. [P22,L10,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	Enable/disable SIGQM2 and SIGQM3 GPS constellation message
[b1]	0x2	Enable/disable SIGQM2 and SIGQM3 GLONASS constellation message
[b2]	0x4	Enable/disable SIGQM2 and SIGQM3 QZSS constellation message
[b3]	0x8	Enable/disable SIGQM2 and SIGQM3 GALILEO constellation message
[b4]	0x10	Enable/disable SIGQM2 and SIGQM3 SBAS constellation message
[b5]	0x20	Enable/disable SIGQM2 and SIGQM3 COMPASS Constellation message
[b6]	0x40	Enable/disable SIGQM2 and SIGQM3 IRNSS Constellation message

Table 199. [P22,L10,F01] bits description

Bit	Bit mask / value	Description
[b8]	0x100	Enable/disable MSM7 1077 GPS constellation message
[b9]	0x200	Enable/disable MSM7 1087 GLONASS constellation message
[b10]	0x400	Enable/disable MSM7 1117 QZSS constellation message
[b11]	0x800	Enable/disable MSM7 1097 Galileo constellation message
[b12]	0x1000	Reserved
[b13]	0x2000	Enable/disable MSM7 1127 COMPASS constellation message
[b14]	0x4000	Enable/disable MSM7 1137 IRNSS constellation message

Table 200. [P22,L10,F02] bits description

Bit	Bit mask / value	Description
[b16]	0x10000	Enable/disable Ephemeris 1019 GPS constellation message
[b17]	0x20000	Enable/disable Ephemeris 1020 GLONASS constellation message
[b18]	0x40000	Enable/disable Ephemeris 1044 QZSS constellation message
[b19]	0x80000	Enable/disable Ephemeris 1046 GALILEO constellation message
[b21]	0x200000	Enable/disable Ephemeris 1042 COMPASS constellation message
[b22]	0x400000	Enable/disable Ephemeris 1041 IRNSS constellation message

Table 201. [P22,L10,F03] bits description

Bit	Bit mask / value	Description
[b24]	0x1000000	Enable/disable OBSQM and OBSQM2 GPS constellation message
[b25]	0x2000000	Enable/disable OBSQM and OBSQM2 GLONASS constellation message

Bit	Bit mask / value	Description
[b26]	0x4000000	Enable/disable OBSQM and OBSQM2 QZSS constellation message
[b27]	0x8000000	Enable/disable OBSQM and OBSQM2 GALILEO constellation message
[b29]	0x20000000	Enable/disable OBSQM and OBSQM2 COMPASS constellation message

22.12 Line 11: RTCM3 constellation message mask on/off

Table 202. [P22,L11,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	Enable/disable GPS constellation message
[b1]	0x2	Enable/disable GLONASS constellation message
[b2]	0x4	Enable/disable QZSS constellation message
[b3]	0x8	Enable/disable GALILEO constellation message
[b4]	0x10	Enable/disable SBAS constellation message
[b5]	0x20	Enable/disable QZSS L1 SAIF frequency message
[b6]	0x40	Enable/disable QZSS L1C frequency message
[b7]	0x80	Enable/disable COMPASS Constellation message
[b8]	0x100	Enable/disable BEIDOU B1C frequency message
[b9]	0x200	Enable/disable L2C frequency message
[b10]	0x400	Enable/disable IRNSS Constellation message
[b11]	0x800	Enable/disable GPS L5 frequency message
[b12]	0x1000	Enable/disable GAL E5 frequency message
[b13]	0x2000	Enable/disable GAL E6 frequency message
[b14]	0x4000	Enable/disable BEIDOU B2A B1I frequency message
[b15]	0x8000	Enable/disable QZSS L2C frequency message
[b16]	0x10000	Enable/disable QZSS L5 frequency message
[b18]	0x40000	Enable/disable BEIDOU B3I frequency message
[b19]	0x80000	Enable/disable BeiDou B2b frequency message
[b23]	0x80000	Enable/disable GALILEO E5b frequency message

22.13 Line 12: RTCM3 metrics mask on/off

Table 203. [P22,L12,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	Enable/disable signal strength (CN0)
[b1]	0x2	Enable/disable carrier loop discriminator output std estimate (mdeg)
[b2]	0x4	Enable/disable code loop discriminator output std estimate (cm)
[b3]	0x8	Enable/disable double–delta metric (cm)
[b4]	0x10	Auto–correlation metric 1, based on 10x correlations
[b5]	0x20	Enable/disable DSP flags
[b6]	0x40	Metrics flags
[b7]	0x80	Enable/disable satellite elevation angle

Bit	Bit mask / value	Description
[b8]	0x100	Enable/disable DSP flags2
[b10]	0x400	Enable/disable signal strength (CN0) F2
[b11]	0x800	Enable/disable carrier loop discriminator output std estimate (mdeg) F2
[b12]	0x1000	Enable/disable code loop discriminator output std estimate (cm) F2
[b13]	0x2000	Enable/disable double–delta metric (cm) F2
[b14]	0x4000	Auto–correlation metric 1, based on 10x correlations F2
[b15]	0x8000	Enable/disable DSP flags F2
[b16]	0x10000	Metrics flags F2
[b18]	0x40000	Enable/disable DSP flags2 F2
[b20]	0x100000	Enable/disable signal strength (CN0) F3
[b21]	0x200000	Enable/disable carrier loop discriminator output std estimate (mdeg) F3
[b22]	0x400000	Enable/disable code loop discriminator output std estimate (cm) F3
[b23]	0x800000	Enable/disable double–delta metric (cm) F3
[b24]	0x1000000	Auto–correlation metric 1, based on 10x correlations F3
[b25]	0x2000000	Enable/disable DSP flags F3
[b26]	0x4000000	Metrics flags F3
[b28]	0x10000000	Enable/disable DSP flags2 F3
[b30]	0x40000000	Metrics user 1 on/off
[b31]	0x80000000	Metrics mask 2 on/off

22.14 Line 13: RTCM3 configuration

Table 204. [P22,L13] field description

Field	Bit	Bit mask / value	Description
F00	[b0]	0x1	**OFDE EXCLUSION ON OFF SWITCH** Enable/disable OFDE exclusion in RTCM3 output (0 = disabled, 1 = enabled)
F01	[b1]	0x2	**PRR CLKDRIFT VALUE** Set the clock drift value which is used in MSM7 pseudo–range rate calculation (0 = estimated, 1 = nominal)
F02	[b2]	0x4	**EPVT TIME** Select between master time or UTC time in the EPVT output (0 = master, 1 = UTC)
F03	[b3]	0x8	**PREAMBLE LOCK** Repot preamble–locked measurements only in MSM7 output
F04	[b4]	0x10	**MSM WITH NO SATS** MSM7 messages sent if no satellites are available (0 = disabled, 1 = enabled). If disabled (default), each MSM7 message for a constellation is reported in the output only if there is at least one satellite tracked for this constellation. If enabled, each MSM7 message for a constellation is reported in the output even if there is no satellite tracked in this constellation (as- sunming that the constellation is enabled)
F05	[b5]	0x20	**SENS COMMON** Sensor common message frame (0 disabled, 1 = enabled)
F06	[b6]	0x40	**SAT EXCL PRESENT PVT ON OFF SWITCH**

Field	Bit	Bit mask / value	Description
			Satellites excluded by positioning stage due to RAIM or FDE algorithms, are included in the number of used satellites (present in the pvt and epvt messages) and their satellites IDs are included in the list of used satellite (present in the pvt and epvt message)
F07	[b7]	0x80	**RTCM MESSAGE TYPE 1006 ONOFF SWITCH** Enable/disable 1006 message – stationary antenna reference point with height information (0 = disabled, 1 = enabled)
F08	[b8]	0x100	**RTCM MESSAGE TYPE 1013 ONOFF SWITCH** Enable/disable 1013 message – system parameters (0 = disabled, 1 = enabled)
F09	[b9]	0x200	**RTCM3 IFM DEBUG ONOFF SWITCH** Enable/disable IFM debug information message (0 = disabled, 1 = enabled)
F12	[b12-b17]	0x3F000	**RTCM3 EPHEM SPLIT CNT** Enable/disable ephemeris split over next epoch if number of ephemeris on the epoch reach this counter threshold
F13	[b18-b23]	0xFC0000	**Epoch msg max time** Maximum epoch time after which messages are not sent (from 0 = 80 ms to 63 = 143 ms). If Epoch_Msg_Overflow_Stop is enabled, all messages above the threshold Epoch_Msg_Max_Time time are dropped, except for remaining ephemeris messages that can be sent on next epoch if above the threshold Epoch_Msg_Max_Time time or if above the threshold RTCM3_EPHEM_SPLIT_CNT count. If RTCM3_EPHEM_SPLIT_CNT is 0 and above threshold Epoch_Msg_Max_Time time, remaining ephemeris messages will be sent on next epoch. If Epoch_Msg_Overflow_Stop is disabled, all messages are sent on the epoch, except for remaining ephemeris messages that will be sent on next epoch if above threshold RTCM3_EPHEM_SPLIT_CNT count. If RTCM3_EPHEM_SPLIT_CNT is 0, all the ephemeris messages are sent on the epoch.
F14	[b24-b29]	0x3F000000	**Epoch critical msg time** Epoch time after which safety messages will raise a MTM flag in monitor alarm mask of RSS message (from 0 = 37 ms to 63 = 100 ms). (1)
F15	[b30]	0x40000000	**Epoch msg overflow stop** Epoch message overflow stop (0 = send message after epoch msg max time, 1 = stop message after epoch msg max. time)
F16	[b31]	0x80000000	**RTCM3 PROP ID SWITCH** Defines which RTCM message ID to use for ST proprietary messages (0 = 999 (previous value, for backwards compatibility), 1 = 4050 (official ID for ST))

1. *Only for STA9200, see [3] and [6].*

22.15 Line 14: RTCM3 OBSQM and OBSQM2 metrics mask on/off

Table 205. [P22,L14,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**Code carrier div. F1** Code carrier divergence (main freq)
[b1]	0x2	**Code Carrier div. F2** Code carrier divergence (dual freq)
[b2]	0x4	**Code carrier div F3** Code carrier divergence (triple freq.)
[b3]	0x8	**Doppler range rate div F1** Doppler to range rate divergence (main freq.)

Bit	Bit mask / value	Description
[b4]	0x10	**Doppler range rate div F2** Doppler to range rate divergence (dual freq.)
[b5]	0x20	**Doppler range rate div F3** Doppler to range–rate divergence (triple freq.)
[b6]	0x40	**Dual freq carrier phase delta F12** Dual frequency carrier phase delta gradient (main, dual)
[b7]	0x80	**Dual frequency carrier phase delta F13** Dual frequency carrier phase delta gradient (main, triple)
[b8]	0x100	**Inter frequency code bias residual F12** Inter frequency code bias residual (main, dual)
[b9]	0x200	**Inter frequency code bias residual F13** Inter frequency code bias residual (main, triple)
[b31]	0x80000000	**OBSQM and OBSQM2 metrics mask 2 on off** OBSQM and OBSQM2 metrics mask 2 on/off

22.16 Line 15: RTCM3 OBSQM and OBSQM2 metrics mask 2 on/off

Table 206. [P22,L15,F00] description

Bit	Bit mask / value	Description
[b0]	0x1	**Code carrier div F4** Code carrier divergence (F4)
[b1]	0x2	**Code carrier div F5** Code carrier divergence (F5)
[b2]	0x4	**Code carrier div F6** Code carrier divergence (F6)
[b3]	0x8	**Doppler range rate div F4** Doppler to range rate divergence (F4)
[b4]	0x10	**Doppler range rate div F5** Doppler to range rate divergence (F5)
[b5]	0x20	**Doppler range rate div F6** Doppler to range rate divergence (F6)
[b6]	0x40	**Dual frequency carrier phase delta F15** Dual frequency carrier phase delta gradient (F1, F5)
[b7]	0x80	**Dual frequency carrier phase delta F16** Dual frequency carrier phase delta gradient (F1, F6)
[b8]	0x100	**Inter frequency code bias residual F15** Inter frequency code bias residual (F1, F5)
[b9]	0x200	**Inter frequency code bias residual F16** Inter frequency code bias residual (F1, F6)
[b16]	0x10000	**Dual frequency carrier phase delta F14** Dual frequency carrier phase delta gradient (F1, F4)
[b17]	0x20000	**Inter frequency code bias residual F14** Inter frequency code bias residual (F1, F4)

23 SIS configuration 0 (STA9200 only) (page 23)

This section describes the security, integrity and safety (SIS) configuration.

23.1 SIS configuration 0 (STA9200 only) mapping

Table 207. Page 23 layout

Page 23																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Reserved																									ESW	Reserved	Reset time				RST
1	Reserved																											Fault output mode – EOUT protocol		PS	SM	OD
2	Hardware monitor configuration																															
3	Hardware monitor configuration																															
4	Hardware monitor configuration																															
5	Hardware monitor configuration																															
7	Internal RF monitoring configuration 0																															
8	Internal RF monitoring configuration 1																															
9	Internal RF monitoring configuration 2																															
10	Reserved																															
11	CWM configuration																															
12	DFT 1 insertion threshold																DFT 1 detection threshold															
13	DFT 2 insertion threshold																DFT 2 detection threshold															
14	DFT 3 insertion threshold																DFT 3 detection threshold															
15	DFT 4 insertion threshold																DFT 4 detection threshold															

23.2 Line 0: SIS CFG 0

Table 208. [P23,L00] field description

Field	Bit	Bit mask / value	Description
F00	[b0]	See Table 209. SIS RESET CFG values	Reset self reset STA9200 once a transition to FAULT STOP occurred
F01	[b1-b4]	0x1E	Reset time perform a self reset or self suspend after RESET TIME seconds
F02	[b5]	See Section 23.2: Line 0: SIS CFG 0	NVM logging activate the SIS event NVM logging
F03	[b6]	See Table 210. EOUT SW ON OFF values	Enable EOUT pin software control

Table 209. SIS RESET CFG values

Values	Definition
0x1	Enabled
0x0	Disabled

Table 210. EOUT SW ON OFF values

Values	Definition
0x0	Disable EOUT pin software control
0x1	Enable EOUT pin software control

23.3 Line 1: FCCU configuration

Table 211. [P23,L01,F00] field description

Field	Bit	Bit mask / value	Description
F00	[b0]	See Table 212. FCCU OD CFG values	Open drain mechanism to select between push-pull and open drain (OD) mode for the error indicating pin(s)
F01	[b1]	See Table 213. FCCU SM CFG values	EOUT protocol (dual rail, time switching) switching mode. It has no effect on the bi–stable protocol
F02	[b2]	See Table 214. FCCU PS CFG values	Polarity selection active state here means a state indicating FAULT and applicable when pins are non–toggling in error phase
F03	[b3-b4]	See Table 215. EOUT FOM CFG values	Fault output mode - EOUT protocol

Table 212. FCCU OD CFG values

Values	Definition
0	Push-pull
1	OD

Table 213. FCCU SM CFG values

Values	Definition
0	Slow switching mode
1	Fast switching mode

Table 214. **FCCU PS CFG values**

Values	Definition
0	FCCU error output[1] active high, FCCU error output[0] active low
1	FCCU error output[1] active low, FCCU error output[0] active high

Table 215. **EOUT FOM CFG values**

Values	Definition
0x0	Dual rail (default state) FCCU error output [1:0] = outputs
0x1	Time switching FCCU eror output [1:0] = output to be used
0x2	Bi–stable

23.4 Line 2: hardware monitor configuration 0

Table 216. **[P23,L02,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**Hardware monitor configuration** Enable/disable FCCU error. Error number from 0 to 31

23.5 Line 3: hardware monitor configuration 1

Table 217. **[P23,L03,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**Hardware monitor configuration** Enable/disable FCCU error. Error number from 32 to 63

23.6 Line 4: hardware monitor configuration 2

Table 218. **[P23,L04,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**Hardware monitor configuration** Enable/disable FCCU error. Error number from 64 to 95

23.7 Line 5: hardware monitor configuration 3

Table 219. **[P23,L05,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**Hardware monitor configuration** Enable/disable FCCU error. Error number from 96 to 127

23.8 Line 7: RF monitor internal RF registers 0

Table 220. [P23,L07,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**Internal RF monitoring configuration 0** List of internal RF registers to compare with expected values. One bit per register address. Bit 0 = Reg0, Bit 1 = Reg1, Bit N = RegN

23.9 Line 8: RF monitor internal RF registers 1

Table 221. [P23,L08,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**Internal RF monitoring configuration 1** List of internal RF registers to compare with expected values. One bit per register address. From bit0 = Reg32 to bitN = Reg32+N

23.10 Line 9: Internal RF monitoring configuration 2

Table 222. [P23,L09,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**Internal RF monitoring configuration 2** List of internal RF registers to compare with expected values. One bit per register address. From bit0 = Reg64 to bitN = Reg64+N

23.11 Line 11: CWM configuration

Table 223. [P23,L11,F00] bits description

Bit	Bit mask / value	Description
[b0]	See Table 224. CWM MON ON OFF values	CWM monitoring activation Enable CWM monitoring
[b1]	See Table 225. NOTCH FILTERS PROG MODE values	Notch filters programming mode Enable HW programming of notch filters, otherwise SW programming (including some filtering)

Table 224. CWM MON ON OFF values

Values	Definition
0x1	Enabled
0x0	Disabled

Table 225. NOTCH FILTERS PROG MODE values

Values	Definition
0x1	HW programming
0x0	SW programming

23.12 Line 12: DFT 1 thresholds

Table 226. [P23,L12,F00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**DFT 1 detection threshold** Detection threshold in DFT 1
F01	[b16-b31]	0xFFFF0000	**DFT 1 insertion threshold** Insertion threshold of DFT 1 result in MCNF

23.13 Line 13: DFT 2 thresholds

Table 227. [P23,L13] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**DFT 2 detection threshold** Detection threshold in DFT 2
F01	[b16-b31]	0xFFFF0000	**DFT 2 insertion threshold** Insertion threshold of DFT 2 result in MCNF

23.14 Line 14: DFT 3 thresholds

Table 228. [P23,L14] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**DFT 2 detection threshold** Detection threshold in DFT 2
F01	[b16-b31]	0xFFFF0000	**DFT 2 insertion threshold** Insertion threshold of DFT 2 result in MCNF

23.15 Line 15: DFT 4 thresholds

Table 229. [P23,L15] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**DFT 4 detection threshold** Detection threshold in DFT 4
F01	[b16-b31]	0xFFFF0000	**DFT 4 insertion threshold** Insertion threshold of DFT 4 result in MCNF

24 SIS configuration 1 (STA9200 only) (page 24)

This section describes the security, integrity and safety (SIS) configuration.

24.1 SIS configuration 1 (STA9200 only) mapping

Table 230. Page 24 layout

Page 24																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	HPVT monitor configuration																															
1	Long average duration																															
2	Short average duration																															
3	Peak width																															
4	Differential threshold																															
5	Wide differential threshold																															
6	Wide absolute threshold																															
7	IFM DDC3 SHT MEAN											IFM DDC2 SHT MEAN										IFM DDC1 SHT MEAN								IFM DDC0 SHT MEAN			
8	IFM DDC7 SHT MEAN											IFM DDC6 SHT MEAN										IFM DDC5 SHT MEAN								IFM DDC4 SHT MEAN			
9	SIS measurement no cut mask																															
10	SIS cybersecurity monitor mask																															
11	SIS safety monitor mask																															
12	DFT 5 insertion threshold																	DFT 5 detection threshold														
13	DFT 6 insertion threshold																	DFT 6 detection threshold														
14	DFT 7 insertion threshold																	DFT 7 detection threshold														
15	DFT 8 insertion threshold																	DFT 8 detection threshold														

24.2 Line 0: SIS HPVT monitor configuration

Table 231. **[P24,L00,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	HPVT monitor configuration defines max. delta time, max horizontal error and max vertical error values

24.3 Line 1: SIS IFM monitor configuration

Table 232. **[P24,L01,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Long average duration defines the number of accumulation done in the long average

24.4 Line 2: SIS IFM monitor configuration

Table 233. **[P24,L02,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Short average duration defines the number of accumulation done in the short average

24.5 Line 3: SIS IFM monitor configuration

Table 234. **[P24,L03,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Peak width defines the width of a peak to be detected

24.6 Line 4: SIS IFM monitor configuration

Table 235. **[P24,L04,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Differential threshold defines the threshold used to detect peak in the differential approach

24.7 Line 5: SIS IFM monitor configuration

Table 236. **[P24,L05,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Wide differential threshold defines the threshold used to detect a wide peak in the differential approach

24.8 Line 6: SIS IFM monitor configuration

Table 237. **[P24,L06,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Wide absolute threshold defines the threshold used to detect a wide peak in the absolute approach

24.9 Line 7: SIS IFM monitor configuration

Table 238. **[P24,L07] field description**

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**IFM DDC0 SHT MEAN** Allow to set the minimal value of the DDC0 short FFT mean value
F01	[b8-b15]	0xFF00	**IFM DDC1 SHT MEAN** Allow to set the minimal value of the DDC1 short FFT mean value
F02	[b16-b23]	0xFF0000	**IFM DDC2 SHT MEAN** Allow to set the minimal value of the DDC2 short FFT mean value
F03	[b24-b31]	0xFF000000	**IFM DDC3 SHT MEAN** Allow to set the minimal value of the DDC3 short FFT mean value

24.10 Line 8: SIS IFM monitor configuration

Table 239. **[P24,L08] field description**

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**IFM DDC4 SHT MEAN** Allow to set the minimal value of the DDC4 short FFT mean value
F01	[b8-b15]	0xFF00	**IFM DDC5 SHT MEAN** Allow to set the minimal value of the DDC5 short FFT mean value
F02	[b16-b23]	0xFF0000	**IFM DDC6 SHT MEAN** Allow to set the minimal value of the DDC6 short FFT mean value
F03	[b24-b31]	0xFF000000	**IFM DDC7 SHT MEAN** Allow to set the minimal value of the DDC7 short FFT mean value

24.11 Line 9: SIS measurement no cut mask

Define mask of SIS alarms that should not cut measurements. If bit mask value = 0 : measurements of impacted constellation(s) are cut in case of alarm on the corresponding monitor; if bit mask value = 1 : measurements of impacted constellation(s) are NOT cut in case of alarm on the corresponding monitor

Table 240. **[P24,L09,F00] bits description**

Bit	Bit mask / value	Description
[b0]	0x1	**SIS monitor mask** Enable or disable cut of measurements corresponding to SIS monitor
[b1]	0x2	**CIM-L1 monitor (CIM-L1) mask** Enable or disable cut of measurements corresponding to CIM–L1 monitor

Bit	Bit mask / value	Description
[b2]	0x4	**Harware monitor (HWM) mask** Enable or disable cut of measurements corresponding to HWM monitor
[b3]	0x8	**Wideband interference monitor (IFM) mask** Enable or disable cut of measurements corresponding to IFM monitor
[b4]	0x10	**RF tuners monitor (RFM) mask** Enable or disable cut of measurements corresponding to RFM monitor
[b5]	0x20	**System time integrity monitor (SYSTM) mask** Enable or disable cut of measurements corresponding to SYSTM monitor
[b7]	0x80	**Inter-frequency bias monitor (IFBM) mask** Enable or disable cut of measurements corresponding to IFBM monitor
[b8]	0x100	**Non-volatile memory monitor (NVMM) mask** Enable or disable cut of measurements corresponding to NVMM monitor
[b9]	0x200	**PPS to observation sampling epoch monitor (PPSOBSM) mask** Enable or disable cut of measurements corresponding to PPSOBSM monitor
[b10]	0x400	**Narrow-band Interference monitor (CWM) mask** Enable or disable cut of measurements corresponding to CWM monitor
[b11]	0x800	**Timing and PPS integrity monitor (PPSM) mask** Enable or disable cut of measurements corresponding to PPSM monitor
[b12]	0x1000	**Receiver clock estimate monitor (CLKESTM) mask** Enable or disable cut of measurements corresponding to CLKESTM monitor
[b13]	0x2000	**E2E counter errors monitor (ECM) mask** Enable or disable cut of measurements corresponding to ECM monitor
[b14]	0x4000	**E2E CRC errors monitor (ECRC) mask** Enable or disable cut of measurements corresponding to ECRC monitor
[b15]	0x8000	**E2E frame errors monitor (EFM) mask** Enable or disable cut of measurements corresponding to EFM monitor
[b16]	0x10000	**Antenna sensing monitor (ASM) mask** Enable or disable cut of measurements corresponding to ASM monitor
[b17]	0x20000	**Data corruption monitor (DCM) mask** Enable or disable cut of measurements corresponding to DCM monitor
[b18]	0x40000	**Position protection level monitor (PLM) mask** Enable or disable cut of measurements corresponding to PLM monitor
[b19]	0x80000	**Spoofing monitor (SPFM) mask** Enable or disable cut of measurements corresponding to SPFM monitor
[b20]	0x100000	**Message timing monitor (MTM) mask** Enable or disable cut of measurements corresponding to MTM monitor

24.12 Line 10: SIS cybersecurity monitor mask

Define mask of SIS monitors that should be considered for cybersecurity. if bit mask value = 1 : monitor should be considered for cybersecurity

Table 241. **[P24,L10,F00] bits description**

Bit	Bit mask / value	Descirption
[b0]	0x1	**SIS monitor mask** Enable or disable cybersecurity corresponding to SIS monitor
[b1]	0x2	**CIM-L1 monitor (CIM-L1) mask** Enable or disable cybersecurity corresponding to CIM–L1 monitor
[b2]	0x4	**Harware monitor (HWM) mask** Enable or disable cybersecurity corresponding to HWM monitor
[b3]	0x8	**Wideband Interference monitor (IFM) mask** Enable or disable cybersecurity corresponding to IFM monitor
[b4]	0x10	**RF tuners monitor (RFM) mask** Enable or disable cybersecurity corresponding to RFM monitor
[b5]	0x20	**System time integrity monitor (SYSTM) mask** Enable or disable cybersecurity corresponding to SYSTM monitor
[b7]	0x80	**Inter-frequency bias monitor (IFBM) mask** Enable or disable cybersecurity corresponding to IFBM monitor
[b8]	0x100	**Non-volatile memory monitor (NVMM) mask** Enable or disable cybersecurity corresponding to NVMM monitor
[b9]	0x200	**PPS to observation sampling epoch monitor (PPSOBSM) mask** Enable or disable cybersecurity corresponding to PPSOBSM monitor
[b10]	0x400	**Narrow-band Interference monitor (CWM) mask** Enable or disable cybersecurity corresponding to CWM monitor
[b11]	0x800	**Timing and PPS integrity monitor (PPSM) mask** Enable or disable cybersecurity corresponding to PPSM monitor
[b12]	0x1000	**Receiver clock estimate monitor (CLKESTM) mask** Enable or disable cybersecurity corresponding to CLKESTM monitor
[b13]	0x2000	**E2E counter errors monitor (ECM) mask** Enable or disable cybersecurity corresponding to ECM monitor
[b14]	0x4000	**E2E CRC errors monitor (ECRC) mask** Enable or disable cybersecurity corresponding to ECRC monitor
[b15]	0x8000	**E2E Frame errors monitor (EFM) mask** Enable or disable cybersecurity corresponding to EFM monitor
[b16]	0x10000	**Antenna sensing monitor (ASM) mask** Enable or disable cybersecurity corresponding to ASM monitor
[b17]	0x20000	**Data corruption monitor (DCM) mask** Enable or disable cybersecurity corresponding to DCM monitor
[b18]	0x40000	**Position protection level monitor (PLM) mask** Enable or disable cybersecurity corresponding to PLM monitor
[b19]	0x80000	**Spoofing monitor (SPFM) mask** Enable or disable cybersecurity corresponding to SPFM monitor
[b20]	0x100000	**Message timing monitor (MTM) mask** Enable or disable cybersecurity corresponding to MTM monitor

24.13 Line 11: SIS safety monitor mask

Define mask of SIS monitors that should be considered for safety. if bit mask value = 1 : monitor should be considered for safety

Table 242. **[P24,L11,F00] bits description**

Bit	Bit mask / value	Description
[b0]	0x1	**SIS monitor mask** Enable or disable safety corresponding to SIS monitor
[b1]	0x2	**CIM-L1 monitor (CIM-L1) mask** Enable or disable safety corresponding to CIM–L1 monitor
[b2]	0x4	**Harware monitor (HWM) mask** Enable or disable safety corresponding to HWM monitor
[b3]	0x8	**Wideband interference monitor (IFM) mask** Enable or disable safety corresponding to IFM monitor
[b4]	0x10	**RF tuners monitor (RFM) mask** Enable or disable safety corresponding to RFM monitor
[b5]	0x20	**System time integrity monitor (SYSTM) mask** Enable or disable safety corresponding to SYSTM monitor
[b7]	0x80	**Inter-frequency bias monitor (IFBM) mask** Enable or disable safety corresponding to IFBM monitor
[b8]	0x100	**Non-volatile memory monitor (NVMM) mask** Enable or disable safety corresponding to NVMM monitor
[b9]	0x200	**PPS to observation sampling epoch monitor (PPSOBSM) mask** Enable or disable safety corresponding to PPSOBSM monitor
[b10]	0x400	**Narrow-band Interference monitor (CWM) mask** Enable or disable safety corresponding to CWM monitor
[b11]	0x800	**Timing and PPS integrity monitor (PPSM) mask** Enable or disable safety corresponding to PPSM monitor
[b12]	0x1000	**Receiver clock estimate monitor (CLKESTM) mask** Enable or disable safety corresponding to CLKESTM monitor
[b13]	0x2000	**E2E counter errors monitor (ECM) mask** Enable or disable safety corresponding to ECM monitor
[b14]	0x4000	**E2E CRC errors monitor (ECRC) mask** Enable or disable safety corresponding to ECRC monitor
[b15]	0x8000	**E2E frame errors monitor (EFM) mask** Enable or disable safety corresponding to EFM monitor
[b16]	0x10000	**Antenna sensing monitor (ASM) mask** Enable or disable safety corresponding to ASM monitor
[b17]	0x20000	**Data corruption monitor (DCM) mask** Enable or disable safety corresponding to DCM monitor
[b18]	0x40000	**Position protection level monitor (PLM) mask** Enable or disable safety corresponding to PLM monitor
[b19]	0x80000	**Spoofing monitor (SPFM) mask** Enable or disable safety corresponding to SPFM monitor

Bit	Bit mask / value	Description
[b20]	0x100000	**Message timing monitor (MTM) mask** Enable or disable safety corresponding to MTM monitor

24.14 Line 12: DFT 5 thresholds

Table 243. [P24,L12] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**DFT 5 detection threshold** Detection threshold in DFT 5
F01	[b16-b31]	0xFFFF0000	**DFT 5 insertion threshold** Insertion threshold of DFT 5 results in MCNF

24.15 Line 13: DFT 6 thresholds

Table 244. [P24,L13] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**DFT 6 detection threshold** Detection threshold in DFT 6
F01	[b16-b31]	0xFFFF0000	**DFT 6 insertion threshold** Insertion threshold of DFT 6 result in MCNF

24.16 Line 14: DFT 7 thresholds

Table 245. [P24,L14,F00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**DFT 7 detection threshold** Detection threshold in DFT 7
F01	[b16-b31]	0xFFFF0000	**DFT 7 insertion threshold** Insertion threshold of DFT 7 result in MCNF

24.17 Line 15: DFT 8 thresholds

Table 246. Field 0 [P24,L15] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**DFT 8 detection threshold** Detection threshold in DFT 8
F01	[b16-b31]	0xFFFF0000	**DFT 8 insertion threshold** Insertion threshold of DFT 8 result in MCNF

25 Kalman satellite selector (page 25)

25.1 Kalman satellite selector mapping

The selector is responsible for selecting and/or sorting satellites before they are passed to the positioning module. This process optimizes the array of satellites that the positioning module will work with by including only those that are actually used and are the best according to the chosen criteria. This ensures that the positioning module operates more efficiently and effectively by focusing on the most relevant satellites.

Table 247. Page 25 layout

Page 25																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Reserved																				Sorting mode				Frequency filter							
1	Reserved																Min. elevation								Least square CN0 min.							
2	Min. tracked time threshold																															

25.2 Line 0: satellites selector sorting mode and filtering

Table 248. [P25,L00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	See Table 249. FREQ FILTER values	**Frequency filter** This filter determines which satellites are considered based on their frequency capabilities.
F01	[b8-b11]	See Table 250. SORT MODE values	**Sorting mode** This setting determines the mode of sorting satellites.

Table 249. FREQ FILTER values

Values	Definition
0x0	All satellites are considered regardless of their frequencies
0x1	L1L2 Only sat that have at least L1 and L2 frequencies are considered. If a sat has additional freq (for example, L1L2L5), all its freqs are considered
0x2	L1L5 Only sat that have at least L1 and L5 frequencies are considered. If a sat has additional freq (for example, L1L2L5), all its freqs are considered
0x3	L1L5 or L1L2 only sat that have either L1 and L5 or L1 and L2 frequencies are considered. If a sat has additional freq (for example, L1L2L5), all its freqs are considered
0x4	L1L2L5 only sat that have L1, L2, and L5 frequencies are considered. If a sat has additional freq (for example, L1L2L5L6), all its freqs are considered
0x5	L1L2L5L6

Table 250. SORT MODE values

Values	Definition
0x0	NONE
0x1	CN0 satellites are sorted based on their CN0 values, with higher CN0 values considered first
0x2	Elevation satellites are sorted based on their elevation, with higher elevations considered first
0x3	SBAS availability satellites with available SBAS corrections are considered first
0x4	SSR availability satellites with available SSR corrections are considered first

Values	Definition
0x5	Auto sorting default value that combines various sorting options based on automatic detection of the scenario and the type of ionospheric corrections applied: In urban environments, satellites are sorted by elevation. In open sky environments, satellites are sorted by SBAS availability. If DFIC correction is active, the L1L2 L1L5 filter is also applied

25.3 Line 1: satellites selector thresholds

Table 251. [P25,L01] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**Least square CN0 min.** Satellites with a CN0 value smaller than this threshold are discarded by the satellite selector. By default, this threshold is aligned with the positioning settings. If a higher threshold is set, all satellites with a CN0 value below this threshold will be discarded.
F01	[b8-b15]	0xFF00	**Min. elevation** Satellites with an elevation (in degrees) smaller than this threshold are discarded by the satellite selector. By default, this threshold is aligned with the positioning settings. If a higher threshold is set, all satellites with an elevation below this threshold will be discarded

25.4 Line 2: satellites selector thresholds

Table 252. [P25,L02,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**Min. tracked time threshold** Satellites with a tracked time smaller than this threshold (in ms) are discarded by the satellite selector

26 NMEA message activation part 1 (page 31)

NMEA message activation is accessible through the ”page 31” and ”page 32” of settings area.

26.1 NMEA message activation part 1 mapping

Table 253. Page 31 layout

Page 31																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
6	NMEA message list 0 line3																															
8	NMEA message list 2 line 3																															

26.2 Line 6: NMEA message list 0 activation, line 3 (dead-reckoning only)

Select the NMEA messages broadcasted to host at fix rate. If High Fix Rate is enabled, NMEA messages broadcasted to host at high rate are selected only in NMEA message list 2.

Table 254. [P31,L06,F00] bits description

Bit	Bit mask / value	Description
[b1]	0x2	**DR BASIC NMEA MSG** Enable/disable PSTMDRGPS, PSTMDRCAL, PSTMDRSINT NMEA messages
[b3]	0x8	**DR MMFB NMEA MSG** Enable/disable PSTMMMFB NMEA message
[b4]	0x10	**DR STATE NMEA MSG** Enable/disable PSTMDRPVA NMEA message
[b5]	0x20	**DR SVF NMEA MSG** Enable/disable PSTMDRSVF NMEA message
[b6]	0x40	**DR NVM ACCESS NMEA MSGL0** Enable/disable PSTMDRNVM WRITE, PSTM KALMAN INIT,PSTMDRNVM READ, PSTMDRDBGNVM WRITE, PSTMDRDBGNVM READ NMEA message
[b7]	0x80	**DR ATTITUDE NMEA MSGL0** Enable/disable PSTMDR1, PSTMDR2 NMEA message
[b8]	0x100	**DR COVARIANCE NMEA MSGL0** Enable/disable PSTMDRBSD (DRUM) or PSTMDRCONFID(DRAW) NMEA message
[b9]	0x200	**DR PVASD NMEA MSGL0** Enable/Disable PSTMDRPVASD NMEA message
[b10]	0x400	**DR EPE NMEA MSGL0** Enable/disable PSTMDREPE NMEA message
[b11]	0x800	**DR DEBUG NMEA MSGL0** Enable/disable PSTMDRDEBUG, PSTMDRUPD, PSTMDRTUNNEL, PSTMDRSTYPE, PSTMDRMMFBKF, PSTMDRGNSA, PSTM- DRDBG INIT, PSTMDRIMUAA, PSTMDRSAM NMEA messages
[b16]	0x10000	**DR ACC3D NMEA MSGL0**

Bit	Bit mask / value	Description
		if PSTMDRSEN [P32,L06] is disabled, Enable/Disable ACC3D NMEA message:PSTMDRSEN,30
[b17]	0x20000	**DR GYRO3D NMEA MSGL0** if PSTMDRSEN [P32,L06] bit 28 is disabled, Enable/disable GYRO3D NMEA message:PSTMDRSEN,31
[b18]	0x40000	**DR GYROTEMP NMEA MSGL0** if PSTMDRSEN [P32,L06] bit 28 is disabled, Enable/disable GYRO temp NMEA message:PSTMDRSEN,24
[b19]	0x80000	**DR ACC3D GYRO3D NMEA MSGL0** if PSTMDRSEN [P32,L06] bit 28 is disabled, enable/disable ACC3D and GYRO3D NMEA messages:PSTMDRSEN,33. This setting has precedence on bit17/bit18
[b20]	0x100000	**DR ACC3D PRES NMEA MSGL0** if PSTMDRSEN [P32,L06] bit 28 is disabled, enable/disable PRESSURE sensor NMEA message:PSTMDRSEN,32
[b21]	0x200000	**DR ACC3D TEMP NMEA MSGL0** if PSTMDRSEN [P32,L06] bit 28 is disabled, enable/disable TEMP NMEA message:PSTMDRSEN,25
[b22]	0x400000	**DR ACC3D ODO SPEED NMEA MSGL0** if PSTMDRSEN [P32,L06] bit 28 is disabled, enable/disable ODO or SPEED NMEA messages:PSTMDRSEN,1,3,5,6,7,8,9,10,11,12,14,15,16,17,18,19,21,22
[b23]	0x800000	**DR ACC3D REV NMEA MSGL0** if PSTMDRSEN [P32,L06] bit 28 is disabled, enable/disable REV NMEA message:PSTMDRSEN,2

26.3 Line 8: NMEA message list 2 activation, line 3 (dead-reckoning only)

Select the NMEA messages broadcasted to host at high fix rate. Any NMEA messages enabled in message list 2 must be disabled in message list 0 line 0.

NMEA message list 2 enabled with high fix rate enabled.

Table 255. [P31,L08,F00] bits description

Bit	Bit mask / value	Description
[b4]	0x10	**DR STATE NMEA MSG** Enable/disable PSTMDRPVA NMEA message
[b5]	0x20	**DR SVF NMEA MSG** Enable/disable PSTMDRSVF NMEA message
[b8]	0x100	**DR COVARIANCE NMEA MSG** Enable/disable PSTMDRBSD (DRUM) or PSTMDRCONFID(DRAW) NMEA message

27 NMEA message activation part 2 (page 32)

NMEA message activation is accessible through the ”page 31” and ”page 32” of settings area.

27.1 NMEA message activation part 2 mapping

Table 256. Page 32 layout

Page32																													
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Number of decimal digits in NMEA position messages								Reserved								NMEA speed/course digits CFG								Nb alt digits							
1	Message list 2 scaling factor								Message list 1 scaling factor								Message list 0 scaling factor								Reserved							
3	NMEA message list 0 line 0																															
4	NMEA message list 1 line 0																															
5	NMEA message list 2 line 0																															
6	NMEA message list 0 line 1																															
7	NMEA message list 1 line 1																															

27.2 Line 0: NMEA configuration

Table 257. [P32,L00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**Nb alt digits** Allow setting the number of decimal digits for altitude. Allowed values from 1 to 6.
F01	[b8-b11]	0xF00	**Nb speed digits** Allow setting the number of decimal digits for speed value in RMC and VTG messages. Allowed values from 1 to 5
F02	[b12-b15]	0xF000	**Nb course digits** Allow setting the number of decimal digits for course value in RMC and VTG messages. Allowed values from 1 to 5
F03	[b24-b31]	0xFF000000	**Number of decimal digits in NMEA position messages** Allow setting the number of decimal digits for the NMEA position messages. It is possible to set a different number of decimal digits for GGA and for both RMC and GLL messages. b[24..27] Allow setting the number of decimal digits for GGA (1 to 6) ; b[28..31] Allow setting the number of decimal digits for RMC/GLL (1 to 6)

27.3 Line 1: NMEA message list rate

Table 258. [P32,L01] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7	0xff	**Reserved**
F01	[b8-b15]	0xFF00	**Message list 0 scaling factor** Allow setting the message list output rate for the message list 0. It is a scaling factor referred to the selected fix rate. The default value is 1 and means that messages are sent out on every fix. Setting the scaling factor to N means that the corresponding message list is sent out every N fixes.
F02	[b16-b23]	0xFF0000	**Message list 1 scaling factor** Allow setting the message list output rate for the message list 1. It is a scaling factor referred to the selected measurements rate. The default value is 1 and means that messages are sent out on every measurement epoch. Setting the scaling factor to N means that the corresponding message list is sent out every N measurements epoch.
F03	[b24-b31]	0xFF000000	**Message list 2 scaling factor** Allow setting the message list output rate for the message list 2. It is a scaling factor referred to the selected measurements rate. The default value is 1 and means that messages are sent out on every measurement epoch. Setting the scaling factor to N means that the corresponding message list is sent out every N measurement epoch.

27.4 Line 3: NMEA message list 0 activation, line 0

Select the NMEA messages broadcasted to host at fix rate. If High Fix Rate is enabled, NMEA messages broadcasted to host at high rate are selected only in NMEA message list 2.

Table 259. [P32,L03,F00] bits descrption

Bit	Bit mask / value	Description
[b0]	0x1	**GNS NMEA MSG** Enable/disable GNS NMEA message
[b1]	0x2	**GGA NMEA MSG** Enable/disable GGA NMEA message
[b2]	0x4	**GSA NMEA MSG** Enable/disable GSA NMEA message (if OSNMA is enabled, ASA NMEA message is set too)
[b3]	0x8	**GST NMEA MSG** Enable/disable GST NMEA message
[b4]	0x10	**VTG NMEA MSG** Enable/disable VTG NMEA message
[b6]	0x40	**RMC NMEA MSG** Enable/disable RMC NMEA message (if OSNMA is enabled, AMC NMEA message is set too)
[b10]	0x400	**PA NMEA MSG** Enable/disable PA NMEA message
[b11]	0x800	**SAT NMEA MSG** Enable/disable SAT NMEA message
[b12]	0x1000	**RES NMEA MSG** Enable/disable RES NMEA message
[b13]	0x2000	**TIM NMEA MSG** Enable/disable TIM NMEA message

Bit	Bit mask / value	Description
[b14]	0x4000	**WAAS NMEA MSG** Enable/disable WAAS NMEA message
[b15]	0x8000	**DIFF NMEA MSG** Enable/disable DIFF NMEA message
[b16]	0x10000	**PSTMGSA NMEA MSG** Enable/disable PSTMGSA NMEA message
[b19]	0x80000	**GSV NMEA MSG** Enable/disable GSV NMEA message
[b20]	0x100000	**GLL NMEA MSG** Enable/disable GLL NMEA message
[b21]	0x200000	**PPS NMEA MSG** Enable/disable PPS NMEA message
[b22]	0x400000	**TEST NMEA MSG** Enable/disable TEST NMEA message
[b23]	0x800000	**CPU USAGE NMEA MSG** Enable/disable CPU USAGE NMEA message
[b24]	0x1000000	**ZDA NMEA MSG** Enable/disable ZDA NMEA message
[b25]	0x2000000	**TRAIM NMEA MSG** Enable/disable TRAIM NMEA message
[b26]	0x4000000	**POSHOLD NMEA MSG** Enable/disable POSHOLD NMEA message
[b27]	0x8000000	**KFCOV NMEA MSG** Enable/disable KFCOV NMEA message
[b28]	0x10000000	**AGPS NMEA MSG** Enable/disable AGPS NMEA message
[b30]	0x40000000	**NOTCH NMEA MSG** Enable/disable NOTCH NMEA message
[b31]	0x80000000	**TM NMEA MSG** Enable/disable TM NMEA message

27.5 Line 4: NMEA message list 1 activation, line 0

Select the NMEA measurements messages broadcasted to host at measurement rate.

Table 260. [P32,L04,F00] bits description

Bit	Bit mask / value	Description
[b5]	0x20	**NOISE NMEA MSG** Enable/disable NOISE NMEA message
[b7]	0x80	**RF NMEA MSG** Enable/disable RF NMEA message
[b8]	0x100	**TG NMEA MSG** Enable/disable TG NMEA message
[b9]	0x200	**TS NMEA MSG**

Bit	Bit mask / value	Description
		Enable/disable TS NMEA message
[b18]	0x40000	**RFTEST NMEA MSG** Enable/disable RFTEST NMEA message

27.6 Line 5: NMEA message list 2 activation, line 0

Select the NMEA messages broadcasted to host at high fix rate. Any NMEA messages enabled in message list 2 must be disabled in message list 0 line 0.

NMEA message list 2 enabled with high fix rate enabled.

Table 261. [P32,L05,F00] bits description

Bit	Bit mask / value	Description
[b1]	0x2	**GGA NMEA MSG** Enable/disable GGA NMEA message
[b4]	0x10	**VTG NMEA MSG** Enable/disable VTG NMEA message
[b6]	0x40	**RMC NMEA MSG** Enable/disable RMC NMEA message (if OSNMA is enabled, AMC NMEA message is set too)

27.7 Line 6: NMEA message list 0 activation, line 1

Select the NMEA messages broadcasted to host at fix rate. If high fix rate is enabled, NMEA messages broadcasted to host at High Rate are selected only in NMEA message list 2.

Table 262. [P32,L06,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**PV NMEA MSG** Enable/disable PV NMEA message
[b1]	0x2	**PVQ NMEA MSG** Enable/disable PVQ NMEA message
[b2]	0x4	**UTC NMEA MSG** Enable/disable UTC NMEA message
[b3]	0x8	**ADC NMEA MSG** Enable/disable ADC NMEA message
[b4]	0x10	**ANT NMEA MSG** Enable/disable ANT NMEA message
[b5]	0x20	**NAV NMEA M** Enable/disable NAV NMEA Message
[b7]	0x80	**DTM NMEA MSG** Enable/disable DTM NMEA message
[b8]	0x100	**EPHEM NMEA MSG** Enable/disable EPHEM NMEA message
[b9]	0x200	**ALM NMEA MSG** Enable/disable ALM NMEA message
[b10]	0x400	**IONO NMEA MSG**

Bit	Bit mask / value	Description
		Enable/disable IONO NMEA message
[b11]	0x800	**GGTO NMEA MSG** Enable/Disable GGTO NMEA message
[b12]	0x1000	**BIAS NMEA MSG** Enable/disable BIAS NMEA message
[b13]	0x2000	**GBS NMEA MSG** Enable/disable GBS NMEA message
[b14]	0x4000	**PVRAW NMEA MSG** Enable/disable PVRAW NMEA message
[b15]	0x8000	**SBAS NMEA MSG** Enable/disable SBAS NMEA message
[b16]	0x10000	**FEDATA NMEA MSG** Enable/disable FEDATA NMEA message
[b19]	0x80000	**IFB NMEA MSG** Enable/disable IFB NMEA message
[b20]	0x100000	**IFB EST DATA NMEA MSG** Enable/disable IFB EST DATA NMEA message
[b21]	0x200000	**INTEGRITY NMEA MSG** Enable/disable INTEGRITY NMEA message
[b22]	0x400000	**TEMPERATURE NMEA MSG** Enable/disable TEMPERATURE NMEA message
[b28]	0x10000000	**DR SENSORS NMEA MSG** Enable/disable SENSORS NMEA message. If Disabled, refer to [P31,L06] bit 16–24 to enable any sensor messages separately
[b31]	0x80000000	**IFBRES NMEA MSG** Enable/disable IFBRES NMEA message

27.8 Line 7: NMEA message list 1 activation, line 1

Select the NMEA measurements messages broadcasted to host at measurement rate.

Table 263. [P32,L07,F00] bits description

Bit	Bit mask / value	Description
[b18]	0x40000	**RFI NMEA MSG** Enable/disable RFI NMEA message
[b23]	0x800000	**SPFQ NMEA MSG** Enable/disable SPOOFING QUEUE NMEA message
[b25]	0x2000000	**SPFDA NMEA MSG** Enable/disable SPFDA message
[b26]	0x4000000	**RSS NMEA MSG** Enable/disable RSS NMEA message

28 NMEA/RTCM message dual host activation (page 33)

Table 264. **Page 33 layout**

Page 33																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	NMEA message list 0 for HOST1																															
1	NMEA message list 1 for HOST1																															
2	NMEA message list 0 for HOST2																															
3	NMEA message list 1 for HOST2																															
8	RTCM message list 0 for HOST1																															
9	RTCM message list 1 for HOST1																															
10	RTCM message list 0 for HOST2																															
11	RTCM message list 1 for HOST2																															

28.1 Line 0: NMEA message list 0 for HOST1

Select the NMEA messages broadcasted to HOST1.

Table 265. **[P33,L00,F00] bits description**

Bit	Bit mask / value	Description
[b0]	0x1	**GNS_NMEA_MSG_HOST1** Enable/disable GNS NMEA message on HOST1
[b1]	0x2	**GGA_NMEA_MSG_HOST1** Enable/disable GGA NMEA message on HOST1
[b2]	0x4	**GSA_NMEA_MSG_HOST1** Enable/disable GSA NMEA message on HOST1
[b3]	0x8	**GST_NMEA_MSG_HOST1** Enable/disable GST NMEA message on HOST1
[b4]	0x10	**VTG_NMEA_MSG_HOST1** Enable/disable VTG NMEA message on HOST1
[b5]	0x20	**NOISE_NMEA_MSG_HOST1** Enable/disable NOISE NMEA message on HOST1
[b6]	0x40	**RMC_NMEA_MSG_HOST1** Enable/disable RMC NMEA message on HOST1
[b7]	0x80	**RF_NMEA_MSG_HOST1** Enable/disable RF NMEA message on HOST1
[b8]	0x100	**TG_NMEA_MSG_HOST1** Enable/disable TG NMEA message on HOST1
[b9]	0x200	**TS_NMEA_MSG_HOST1** Enable/disable TS NMEA message on HOST1
[b10]	0x400	**PA_NMEA_MSG_HOST1** Enable/disable PA NMEA message on HOST1
[b11]	0x800	**SAT_NMEA_MSG_HOST1** Enable/disable SAT NMEA message on HOST1

Bit	Bit mask / value	Description
[b12]	0x1000	**RES_NMEA_MSG_HOST1** Enable/disable RES NMEA message on HOST1
[b13]	0x2000	**TIM_NMEA_MSG_HOST1** Enable/disable TIM NMEA message on HOST1
[b14]	0x4000	**WAAS_NMEA_MSG_HOST1** Enable/disable WAAS NMEA message on HOST1
[b15]	0x8000	**DIFF_NMEA_MSG_HOST1** Enable/disable DIFF NMEA message on HOST1
[b16]	0x10000	**PSTMGSA_NMEA_MSG_HOST1** Enable/disable PSTMGSA NMEA message on HOST1
[b17]	0x20000	**PSTMRFAGC_NMEA_MSG_HOST1** Enable/disable PSTMRFAGC NMEA message on HOST1
[b18]	0x40000	**FRTEST_NMEA_MSG_HOST1** Enable/disable RFTEST NMEA message on HOST1
[b19]	0x80000	**GSV_NMEA_MSG_HOST1** Enable/disable GSV NMEA message on HOST1
[b20]	0x100000	**GLL_NMEA_MSG_HOST1** Enable/disable GLL NMEA message on HOST1
[b21]	0x200000	**PPS_NMEA_MSG_HOST1** Enable/disable PPS NMEA message on HOST1
[b22]	0x400000	**TEST_NMEA_MSG_HOST1** Enable/disable TEST NMEA message on HOST1
[b23]	0x800000	**CPU_USAGE_NMEA_MSG_HOST1** Enable/disable CPU USAGE NMEA message on HOST1
[b24]	0x1000000	**ZDA_NMEA_MSG_HOST1** Enable/disable ZDA NMEA message on HOST1
[b25]	0x2000000	**TRAIM_NMEA_MSG_HOST1** Enable/disable TRAIM NMEA message on HOST1
[b26]	0x4000000	**POSHOLD_NMEA_MSG_HOST1** Enable/disable POSHOLD NMEA message on HOST1
[b27]	0x8000000	**KFCOV_NMEA_MSG_HOST1** Enable/disable KFCOV NMEA message on HOST1
[b28]	0x10000000	**AGPS_NMEA_MSG_HOST1** Enable/disable AGPS NMEA message on HOST1
[b29]	0x20000000	**METRICS_NMEA_MSG_HOST1** Enable/disable METRICS NMEA message on HOST1
[b30]	0x40000000	**NOTCH_NMEA_MSG_HOST1** Enable/disable NOTCH NMEA message on HOST1
[b31]	0x80000000	**TM_NMEA_MSG_HOST1** Enable/disable TM NMEA message on HOST1

28.2 Line 1: NMEA message list 1 for HOST1

Select the NMEA messages broadcasted to HOST1.

Table 266. **[P33,L01,F00] bits description**

Bit	Bit mask / value	Description
[b0]	0x1	**PV_NMEA_MSG_HOST1** Enable/disable PV NMEA message on HOST1
[b1]	0x2	**PVQ_NMEA_MSG_HOST1** Enable/disable PVQ NMEA message on HOST1
[b2]	0x4	**UTC_NMEA_MSG_HOST1** Enable/disable UTC NMEA message on HOST1
[b3]	0x8	**ADC_NMEA_MSG_HOST1** Enable/disable ADC NMEA message on HOST1
[b4]	0x10	**ANT_NMEA_MSG_HOST1** Enable/disable ANT NMEA message on HOST1
[b5]	0x20	**NAV_NMEA_MSG_HOST1** Enable/disable NAV NMEA message on HOST1
[b6]	0x40	**DR_NMEA_MSG_HOST1** Enable/disable DR NMEA message on HOST1
[b7]	0x80	**DTM_NMEA_MSG_HOST1** Enable/disable DTM NMEA message on HOST1
[b8]	0x100	**EPHEM_NMEA_MSG_HOST1** Enable/disable EPHEM NMEA message on HOST1
[b9]	0x200	**ALM_NMEA_MSG_HOST1** Enable/disable ALM NMEA message on HOST1
[b10]	0x400	**IONO_NMEA_MSG_HOST1** Enable/disable IONO NMEA message on HOST1
[b11]	0x800	**GGTO_NMEA_MSG_HOST1** Enable/disable GGTO NMEA message on HOST1
[b12]	0x1000	**BIAS_NMEA_MSG_HOST1** Enable/disable BIAS NMEA message on HOST1
[b13]	0x2000	**GBS_NMEA_MSG_HOST1** Enable/disable GBS NMEA message on HOST1
[b14]	0x4000	**PVRAW_NMEA_MSG_HOST1** Enable/disable PVRAW NMEA message on HOST1
[b15]	0x8000	**SBAS_NMEA_MSG_HOST1** Enable/disable SBAS NMEA message on HOST1
[b16]	0x10000	**FEDATA_NMEA_MSG_HOST1** Enable/disable FEDATA NMEA message on HOST1
[b17]	0x20000	**ERR_NMEA_MSG_HOST1** Enable/disable ERR NMEA message on HOST1
[b18]	0x40000	**RFI_NMEA_MSG_HOST1** Enable/disable RFI NMEA message on HOST1
[b19]	0x80000	**IFB_NMEA_MSG_HOST1** Enable/disable IFB NMEA message on HOST1
[b20]	0x100000	**IFB_EST_DATA_NMEA_MSG_HOST1** Enable/disable IFB_EST_DATA NMEA message on HOST1

Bit	Bit mask / value	Description
[b21]	0x200000	**INTEGRITY_NMEA_MSG_HOST1** Enable/disable INTEGRITY NMEA message on HOST1
[b22]	0x400000	**TEMPERATURE_NMEA_MSG_HOST1** Enable/disable TEMPERATURE NMEA message on HOST1
[b23]	0x800000	**SPOOFING_QUEUE_NMEA_MSG_HOST1** Enable/disable SPOOFING QUEUE NMEA message on HOST1
[b24]	0x1000000	**DHRY_TEST_NMEA_MSG_HOST1** Enable/disable DHRY_TEST NMEA message on HOST1
[b25]	0x2000000	**DUAL_ANT_ANTISPOOF_NMEA_MSG_HOST1** Enable/disable DUAL_ANT_ANTISPOOF NMEA message on HOST1
[b26]	0x4000000	**RSS_NMEA_MSG_HOST1** Enable/disable RSS NMEA message on HOST1
[b27]	0x8000000	Reserved
[b28]	0x10000000	**DR_SENSORS_NMEA_MSG_HOST1** Enable/disable DR_SENSORS NMEA message on HOST1
[b29]	0x20000000	**GALNMA_NMEA_MSG_HOST1** Enable/disable GALNMA NMEA message on HOST1
[b30]	0x40000000	Reserved
[b31]	0x80000000	**IFB_RES_NMEA_MSG_HOST1** Enable/disable IFB_RES NMEA message on HOST1

28.3 Line 2: NMEA message list 0 for HOST2

Select the NMEA messages broadcasted to HOST2.

Table 267. [P33,L02,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**GNS_NMEA_MSG_HOST2** Enable/disable GNS NMEA message on HOST2
[b1]	0x2	**GGA_NMEA_MSG_HOST2** Enable/disable GGA NMEA message on HOST2
[b2]	0x4	**GSA_NMEA_MSG_HOST2** Enable/disable GSA NMEA message on HOST2
[b3]	0x8	**GST_NMEA_MSG_HOST2** Enable/disable GST NMEA message on HOST2
[b4]	0x10	**VTG_NMEA_MSG_HOST2** Enable/disable VTG NMEA message on HOST2
[b5]	0x20	**NOISE_NMEA_MSG_HOST2** Enable/disable NOISE NMEA message on HOST2
[b6]	0x40	**RMC_NMEA_MSG_HOST2** Enable/disable RMC NMEA message on HOST2
[b7]	0x80	**RF_NMEA_MSG_HOST2** Enable/disable RF NMEA message on HOST2
[b8]	0x100	**TG_NMEA_MSG_HOST2**

Bit	Bit mask / value	Description
		Enable/disable TG NMEA message on HOST2
[b9]	0x200	**TS_NMEA_MSG_HOST2** Enable/disable TS NMEA message on HOST2
[b10]	0x400	**PA_NMEA_MSG_HOST2** Enable/disable PA NMEA message on HOST2
[b11]	0x800	**SAT_NMEA_MSG_HOST2** Enable/disable SAT NMEA message on HOST2
[b12]	0x1000	**RES_NMEA_MSG_HOST2** Enable/disable RES NMEA message on HOST2
[b13]	0x2000	**TIM_NMEA_MSG_HOST2** Enable/disable TIM NMEA message on HOST2
[b14]	0x4000	**WAAS_NMEA_MSG_HOST2** Enable/disable WAAS NMEA message on HOST2
[b15]	0x8000	**DIFF_NMEA_MSG_HOST2** Enable/disable DIFF NMEA message on HOST2
[b16]	0x10000	**PSTMGSA_NMEA_MSG_HOST2** Enable/disable PSTMGSA NMEA message on HOST2
[b17]	0x20000	**PSTMRFAGC_NMEA_MSG_HOST2** Enable/disable PSTMRFAGC NMEA message on HOST2
[b18]	0x40000	**FRTEST_NMEA_MSG_HOST2** Enable/disable RFTEST NMEA message on HOST2
[b19]	0x80000	**GSV_NMEA_MSG_HOST2** Enable/disable GSV NMEA message on HOST2
[b20]	0x100000	**GLL_NMEA_MSG_HOST2** Enable/disable GLL NMEA message on HOST2
[b21]	0x200000	**PPS_NMEA_MSG_HOST2** Enable/disable PPS NMEA message on HOST2
[b22]	0x400000	**TEST_NMEA_MSG_HOST2** Enable/disable TEST NMEA message on HOST2
[b23]	0x800000	**CPU_USAGE_NMEA_MSG_HOST2** Enable/disable CPU USAGE NMEA message on HOST2
[b24]	0x1000000	**ZDA_NMEA_MSG_HOST2** Enable/disable ZDA NMEA message on HOST2
[b25]	0x2000000	**TRAIM_NMEA_MSG_HOST2** Enable/disable TRAIM NMEA message on HOST2
[b26]	0x4000000	**POSHOLD_NMEA_MSG_HOST2** Enable/disable POSHOLD NMEA message on HOST2
[b27]	0x8000000	**KFCOV_NMEA_MSG_HOST2** Enable/disable KFCOV NMEA message on HOST2
[b28]	0x10000000	**AGPS_NMEA_MSG_HOST2** Enable/disable AGPS NMEA message on HOST2
[b29]	0x20000000	**METRICS_NMEA_MSG_HOST2** Enable/disable METRICS NMEA message on HOST2

Bit	Bit mask / value	Description
[b30]	0x40000000	**NOTCH_NMEA_MSG_HOST2** Enable/disable NOTCH NMEA message on HOST2
[b31]	0x80000000	**TM_NMEA_MSG_HOST2** Enable/disable TM NMEA message on HOST2

28.4 Line 3: NMEA message list 1 for HOST2

Select the NMEA messages broadcasted to HOST2.

Table 268. [P33,L03,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**PV_NMEA_MSG_HOST2** Enable/disable PV NMEA message on HOST2
[b1]	0x2	**PVQ_NMEA_MSG_HOST2** Enable/disable PVQ NMEA message on HOST2
[b2]	0x4	**UTC_NMEA_MSG_HOST2** Enable/disable UTC NMEA message on HOST2
[b3]	0x8	**ADC_NMEA_MSG_HOST2** Enable/disable ADC NMEA message on HOST2
[b4]	0x10	**ANT_NMEA_MSG_HOST2** Enable/disable ANT NMEA message on HOST2
[b5]	0x20	**NAV_NMEA_MSG_HOST2** Enable/disable NAV NMEA message on HOST2
[b6]	0x40	**DR_NMEA_MSG_HOST2** Enable/disable DR NMEA message on HOST2
[b7]	0x80	**DTM_NMEA_MSG_HOST2** Enable/disable DTM NMEA message on HOST2
[b8]	0x100	**EPHEM_NMEA_MSG_HOST2** Enable/disable EPHEM NMEA message on HOST2
[b9]	0x200	**ALM_NMEA_MSG_HOST2** Enable/disable ALM NMEA message on HOST2
[b10]	0x400	**IONO_NMEA_MSG_HOST2** Enable/disable IONO NMEA message on HOST2
[b11]	0x800	**GGTO_NMEA_MSG_HOST2** Enable/disable GGTO NMEA message on HOST2
[b12]	0x1000	**BIAS_NMEA_MSG_HOST2** Enable/disable BIAS NMEA message on HOST2
[b13]	0x2000	**GBS_NMEA_MSG_HOST2** Enable/disable GBS NMEA message on HOST2
[b14]	0x4000	**PVRAW_NMEA_MSG_HOST2** Enable/disable PVRAW NMEA message on HOST2
[b15]	0x8000	**SBAS_NMEA_MSG_HOST2** Enable/disable SBAS NMEA message on HOST2
[b16]	0x10000	**FEDATA_NMEA_MSG_HOST2**

Bit	Bit mask / value	Description
		Enable/disable FEDATA NMEA message on HOST2
[b17]	0x20000	**ERR_NMEA_MSG_HOST2** Enable/disable ERR NMEA message on HOST2
[b18]	0x40000	**RFI_NMEA_MSG_HOST2** Enable/disable RFI NMEA message on HOST2
[b19]	0x80000	**IFB_NMEA_MSG_HOST2** Enable/disable IFB NMEA message on HOST2
[b20]	0x100000	**IFB_EST_DATA_NMEA_MSG_HOST2** Enable/disable IFB_EST_DATA NMEA message on HOST2
[b21]	0x200000	**INTEGRITY_NMEA_MSG_HOST2** Enable/disable INTEGRITY NMEA message on HOST2
[b22]	0x400000	**TEMPERATURE_NMEA_MSG_HOST2** Enable/Disable TEMPERATURE NMEA message on HOST2
[b23]	0x800000	**SPOOFING_QUEUE_NMEA_MSG_HOST2** Enable/disable SPOOFING QUEUE NMEA message on HOST2
[b24]	0x1000000	**DHRY_TEST_NMEA_MSG_HOST2** Enable/disable DHRY_TEST NMEA message on HOST2
[b25]	0x2000000	**DUAL_ANT_ANTISPOOF_NMEA_MSG_HOST2** Enable/disable DUAL_ANT_ANTISPOOF NMEA message on HOST2
[b26]	0x4000000	**RSS_NMEA_MSG_HOST2** Enable/disable RSS NMEA message on HOST2
[b27]	0x8000000	Reserved
[b28]	0x10000000	**DR_SENSORS_NMEA_MSG_HOST2** Enable/disable DR_SENSORS NMEA message on HOST2
[b29]	0x20000000	**GALNMA_NMEA_MSG_HOST2** Enable/disable GALNMA NMEA message on HOST2
[b30]	0x40000000	Reserved
[b31]	0x80000000	**IFB_RES_NMEA_MSG_HOST2** Enable/disable IFB_RES NMEA message on HOST2

28.5 Line 8: RTCM message list 0 for HOST1

Select the RTCM messages broadcasted to HOST1.

Table 269. [P33,L08,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**LEGACY_OBS_RTCM_MSG_HOST1** Enable/disable legacy observations RTCM messages 1002 and 1010 on HOST1
[b1]	0x2	**MSM7_RTCM_MSG_HOST1** Enable/disable MSM7 observations RTCM messages (1077, 1087, 1097, 1117 and 1127) on HOST1
[b2]	0x4	**EPH_ADD_RTCM_MSG_HOST1** Enable/disable ephemeris and additional RTCM messages (1019, 1020, 1042, 1044, 1046, 1006 and 1013) on HOST1
[b3]	0x8	**NDF_RTCM_MSG_HOST1**

Bit	Bit mask / value	Description
		Enable/disable navigation data frame (NDF) RTCM message on HOST1
[b4]	0x10	**RSS_RTCM_MSG_HOST1** Enable/disable receiver safety status (RSS) and time global information (TG) RTCM messages on HOST1 RTCM message on HOST1
[b5]	0x20	**RCC_RTCM_MSG_HOST1** Enable/disable receiver configuration and control (RCC) RTCM message on HOST1
[b6]	0x40	**ALMANAC_RTCM_MSG_HOST1** Enable/disable Almanac (ALMANAC) RTCM message on HOST1
[b7]	0x80	**SENS_RTCM_MSG_HOST1** Enable/disable sensor (SENS) RTCM message on HOST1
[b8]	0x100	Reserved
[b9]	0x200	**POSQM_RTCM_MSG_HOST1** Enable/disable position quality metrics (POSQM) RTCM message on HOST1
[b10]	0x400	**OBSQM_RTCM_MSG_HOST1** Enable/disable observable quality metrics (OBSQM, OBSQM2) RTCM message on HOST1
[b11]	0x800	**STDTM_RTCM_MSG_HOST1** Enable/disable datum reference (STDTM) RTCM message on HOST1
[b12]	0x1000	**ICB_RTCM_MSG_HOST1** Enable/disable GLONASS inter channel bias (ICB) RTCM message on HOST1
[b13]	0x2000	**IFB_RTCM_MSG_HOST1** Enable/disable inter frequency bias (IFB) RTCM message on HOST1
[b14]	0x4000	**IONOPAR_RTCM_MSG_HOST1** Enable/disable ionospheric model parameters (IONOPAR) RTCM message on HOST1
[b15]	0x8000	Reserved
[b16]	0x10000	**AUX_RTCM_MSG_HOST1** Enable/disable auxiliary (AUX) RTCM messages on HOST1
[b17]	0x20000	**FWVER_RTCM_MSG_HOST1** Enable/disable firmware version (FWVER) RTCM message on HOST1
[b18]	0x40000	**RFS_RTCM_MSG_HOST1** Enable/disable RFS status (RFS) and RF AGC (RFAGC) RTCM messages on HOST1
[b19]	0x80000	Reserved
[b20]	0x100000	**SIGQM2_RTCM_MSG_HOST1** Enable/disable signal quality metrics (SIGQM2, SIGQM3) RTCM message on HOST1
[b21]	0x200000	**EPVT_RTCM_MSG_HOST1** Enable/disable extended PVT (EPVT) and OSNMA authenticated minimum specific data (STAMC) RTCM message on HOST1
[b22]	0x400000	**IFBDATA_RTCM_MSG_HOST1** Enable/disable inter frequency bias data (IFBDATA) RTCM message on HOST1
[b23]	0x800000	**STGSV_RTCM_MSG_HOST1** Enable/disable GNSS satellites in view (STGSV) RTCM message on HOST1
[b24]	0x1000000	**STGSA_RTCM_MSG_HOST1** Enable/disable GNSS active satellites (STGSA) and OSNMA authenticated active satellites (STASA) RTCM messages on HOST
[b25]	0x2000000	**STGBS_RTCM_MSG_HOST1**

Bit	Bit mask / value	Description
		Enable/disable GNSS RAIM parameters (STGBS) RTCM message on HOST1
[b26]	0x4000000	**STGST_RTCM_MSG_HOST1** Enable/disable pseudorange error statistics (STGST) RTCM message on HOST1
[b27]	0x8000000	**STGRS_RTCM_MSG_HOST1** Enable/disable GNSS range residuals (STGRS) RTCM message on HOST1
[b28]	0x10000000	**STGPE_RTCM_MSG_HOST1** Enable/disable GNSS prediction ephemeris (STGPE) RTCM message on HOST1
[b29]	0x20000000	**STDBG_RTCM_MSG_HOST1** Enable/disable debug information (STDBG) RTCM message on HOST1
[b30]	0x40000000	**STNMA _RTCM_MSG_HOST1** Enable/disable OSNMA (STNMA) and OSNMA event (STNMAEVT) RTCM messages on HOST1
[b31]	0x80000000	**SSR_ORB_RTCM_MSG_HOST1** Enable/disable SSR orbit correction RTCM messages (1057, 1240, 1258) on HOST1

28.6 Line 9: RTCM message list 1 for HOST1

Select the RTCM messages broadcasted to HOST1.

Table 270. [P33,L09,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**SSR_CLK_RTCM_MSG_HOST1** Enable/disable SSR clock correction RTCM messages (1058, 1241, 1259) on HOST1
[b1]	0x2	**SSR_CB_RTCM_MSG_HOST1** Enable/disable SSR code bias RTCM messages (1059, 1242, 1260) on HOST1

28.7 Line 10: RTCM message list 0 for HOST2

Select the RTCM messages broadcasted to HOST2.

Table 271. [P33,L10,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**LEGACY_OBS_RTCM_MSG_HOST2** Enable/disable legacy observations RTCM messages 1002 and 1010 on HOST2
[b1]	0x2	**MSM7_RTCM_MSG_HOST2** Enable/disable MSM7 observations RTCM messages (1077, 1087, 1097, 1117 and 1127) on HOST2
[b2]	0x4	**EPH_ADD_RTCM_MSG_HOST2** Enable/disable ephemeris and additional RTCM messages (1019, 1020, 1042, 1044, 1046, 1006 and 1013) on HOST2
[b3]	0x8	**NDF_RTCM_MSG_HOST2** Enable/disable navigation data frame (NDF) RTCM message on HOST2
[b4]	0x10	**RSS_RTCM_MSG_HOST2** Enable/disable receiver safety status (RSS, TG) RTCM message on HOST2
[b5]	0x20	**RCC_RTCM_MSG_HOST2** Enable/disable receiver configuration and control (RCC) RTCM message on HOST2

Bit	Bit mask / value	Description
[b6]	0x40	**ALMMANAC_RTCM_MSG_HOST2** Enable/disable Almanac (ALMANAC) RTCM message on HOST2
[b7]	0x80	**SENS_RTCM_MSG_HOST2** Enable/disable sensor (SENS) RTCM message on HOST2
[b8]	0x100	Reserved
[b9]	0x200	**POSQM_RTCM_MSG_HOST2** Enable/disable position quality metrics (POSQM) RTCM message on HOST2
[b10]	0x400	**OBSQM_RTCM_MSG_HOST2** Enable/disable observable quality metrics (OBSQM, OBSQM2) RTCM message on HOST2
[b11]	0x800	**STDTM_RTCM_MSG_HOST2** Enable/disable datum reference (STDTM) RTCM message on HOST2
[b12]	0x1000	**ICB_RTCM_MSG_HOST2** Enable/disable GLONASS inter channel dias (ICB) RTCM message on HOST2
[b13]	0x2000	**IFB_RTCM_MSG_HOST2** Enable/disable inter frequency Bias (IFB) RTCM message on HOST2
[b14]	0x4000	**IONOPAR_RTCM_MSG_HOST2** Enable/disable ionospheric model parameters (IONOPAR) RTCM message on HOST2
[b15]	0x8000	Reserved
[b16]	0x10000	**AUX_RTCM_MSG_HOST2** Enable/disable auxiliary (AUX) RTCM messages on HOST2
[b17]	0x20000	**FWVER_RTCM_MSG_HOST2** Enable/disable firmware version (FWVER) RTCM message on HOST2
[b18]	0x40000	**RFS_RTCM_MSG_HOST2** Enable/disable RFS status (RFS) and RF AGC (RFAGC) RTCM messages on HOST2
[b19]	0x80000	Reserved
[b20]	0x100000	**SIGQM2_RTCM_MSG_HOST2** Enable/disable signal quality metrics (SIGQM2, SIGQM3) RTCM message on HOST2
[b21]	0x200000	**EPVT_RTCM_MSG_HOST2** Enable/disable extended PVT (EPVT) and OSNMA authenticated minimum specific data (STAMC) RTCM message on HOST2
[b22]	0x400000	**IFBDATA_RTCM_MSG_HOST2** Enable/disable inter frequency bias data (IFBDATA) RTCM message on HOST2
[b23]	0x800000	**STGSV_RTCM_MSG_HOST2** Enable/disable GNSS satellites in view (STGSV) RTCM message on HOST2
[b24]	0x1000000	**STGSA_RTCM_MSG_HOST2** Enable/disable GNSS active satellites (STGSA) and OSNMA authenticated active satellites (STASA) RTCM messages on HOST
[b25]	0x2000000	**STGBS_RTCM_MSG_HOST2** Enable/disable GNSS RAIM parameters (STGBS) RTCM message on HOST2
[b26]	0x4000000	**STGST_RTCM_MSG_HOST2** Enable/disable pseudorange error statistics (STGST) RTCM message on HOST2
[b27]	0x8000000	**STGRS_RTCM_MSG_HOST2** Enable/disable GNSS range residuals (STGRS) RTCM message on HOST2

Bit	Bit mask / value	Description
[b28]	0x10000000	**STGPE_RTCM_MSG_HOST2** Enable/disable GNSS prediction ephemeris (STGPE) RTCM message on HOST2
[b29]	0x20000000	**STDBG_RTCM_MSG_HOST2** Enable/disable debug information (STDBG) RTCM message on HOST2
[b30]	0x40000000	**STNMA _RTCM_MSG_HOST2** Enable/disable OSNMA (STNMA) and OSNMA event (STNMAEVT) RTCM messages on HOST2
[b31]	0x80000000	**SSR_ORB_RTCM_MSG_HOST2** Enable/disable SSR orbit correction RTCM messages (1057, 1240, 1258) on HOST2

28.8 Line 11: RTCM message list 1 for HOST2

Select the RTCM messages broadcasted to HOST2

Table 272. [P33,L11,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**SSR_CLK_RTCM_MSG_HOST2** Enable/disable SSR clock correction RTCM messages (1058, 1241, 1259) on HOST2
[b1]	0x2	**SSR_CB_RTCM_MSG_HOST2** Enable/disable SSR code bias RTCM messages (1059, 1242, 1260) on HOST2

29 Assisted GNSS configuration (page 35)

29.1 Assisted GNSS configuration mapping

Table 273. Page 35 layout

Page 35																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Reserved						SBAS use in test mode	SBAS search logic	Reserved																SBAS service enable							
2	SBAS SAT PARAM1																															
3	SBAS SAT PARAM2																															
4	Reserved																				SSR source BeiDou constellation				SSR source Galileo constellation			SSR source GPS			
6	Reserved																													NAV leap BeiDou only	Reserved	NAVDATA GAL RED EPH
12	Reserved																															AGNSS enable
13	Reserved																													Assisted GNSS constellation mask		
15	Reserved																													AGNSS UPDREAL EPH	AGNSS UPDREAL EPH	Reserved

29.2 Line 0: SBAS configuration

Table 274. [P35,L00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	See Table 275. SBAS SERVICE values	**SBAS SERVICE** Enable/disable SBAS
F02	[b24]	See Table 276. SBAS SEARCH LOGIC values	**SBAS SEARCH LOGIC** Select SBAS search logic

Table 275. SBAS SERVICE values

Values	Definition
0x0	WAAS – wide area augmentation system (WAAS) is the GPS (US) satellite–based Augmentation systems (SBAS)
0x1	EGNOS – European geostationary navigation overlay service (EGNOS) is the GALILEO (Europe) satellite–based augmentation systems (SBAS)
0x2	MSAS – Multi–functional satellite augmentation system (MSAS) is the QZSS (Japan) Satellite–based augmentation systems (SBAS)
0x3	GAGAN – GPS and GEO augmented navigation (GAGAN) is the IRNSS (India) Satellite–based augmentation systems (SBAS)
0x4	SDCM – System for differential corrections and monitoring (SDCM) is the GLONASS (Russia) Satellite–based augmentation systems (SBAS)
0x5	BDSBAS – Beidou satellite–based augmentation system (BDSBAS) is the BEIDOU (China) Satellite–based augmentation systems (SBAS)
0x6	KASS – Korea augmentation satellite system (KASS) is the south korean satellite based augmentation systems (SBAS)
0x7	OFF – SBAS service for satellite is OFF
0x8	SPAN - Australia and New Zealand Augmentation satellite system (SPAN) is the southern positioning augmentation network (Australia and New Zealand) satellite-based augmentation systems (SBAS)
0xF	AUTO – SBAS service for satellite is automatic (default)

Table 276. SBAS SEARCH LOGIC values

Values	Definition
0	Wait ephemerides download completion before searching
1	Always on search strategy after first fix

29.3 Line 2: SBAS satellites parameters part 1

This line defines the following parameters:

- Satellite ID: SBAS PRN (120–158).
- Longitude.
- Sense : sense of the longitude value, positive or negative.
- Service: WAAS, EGNOS, MSAS, GAGAN, SDCM, BDSBAS, KASS, OFF, SPAN, AUTO.

Table 277. **[P35,L02,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**SBAS SAT PARAM1** SBAS satellites parameters part 1

29.4 Line 3: SBAS satellites parameters part 2

This line defines the following parameters:

- Satellite ID: SBAS PRN (120–158).
- Longitude.
- Sense : sense of the longitude value, positive or negative.
- Service: WAAS, EGNOS, MSAS, GAGAN, SDCM, BDSBAS, KASS, OFF, SPAN, AUTO.

Table 278. **[P35,L03,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**SBAS SAT PARAM2** SBAS satellites parameters part 2

29.5 Line 4: SSR data source configuration

Table 279. **[P35,L04] bits description**

Field	Bit	Bit mask / value	Description
F00	[b0-3]	0x0000000F	Set the source of SSR data for GPS constellation [0: no SSR data usage for constellation] [1 : :used E6_HAS SSR data for constellation] [2 : :used B2B_PPS SSR data for constellation] [3 : used RTCM3 input SSR data for constellation] Default :1
F01	[b4-7]	0x000000F0	Set the source of SSR data for GALILEO constellation [0: no SSR data usage for constellation] [1 : :used E6_HAS SSR data for constellation] [2 : :used B2B_PPS SSR data for constellation] [3 : used RTCM3 input SSR data for constellation] Default :1
F02	[b8-11]	0x00000F00	Set the source of SSR data for BEIDOU constellation [0: no SSR data usage for constellation] [1 : :used E6_HAS SSR data for constellation] [2 : :used B2B_PPS SSR data for constellation] [3 : used RTCM3 input SSR data for constellation] Default :2

29.6 Line 6: navdata settings

Table 280. [P35,L06,F00] bits description

Bit	Bit mask / value	Description
[b0]	See Table 281. NAVDATA GAL RED EPH values	**NAVDATA GAL RED EPH** Set the activation status for Galileo reduced ephemeris feature
[b1]		Reserved
[b2]	See Table 282. NAVDATA GAL RED EPH values	**NAV leap Beidou only** Set the activation of Beidou only leap second configuration

Table 281. NAVDATA GAL RED EPH values

Values	Definition
0	Galileo reduced ephemeris feature not activated
1	Galileo reduced ephemeris feature activated

Table 282. NAVDATA GAL RED EPH values

Values	Definition
0	Beidou only leap second configuration not activated:leap second taken from any constellation available
1	Beidou only leap second configuration activated:leap second taken only from Beidou constellation

29.7 Line 12: assisted GNSS configuration

Table 283. [P35,L12,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**AGNSS ON OFF SWITCH** Enable/disable assisted GNSS (autonomous)

29.8 Line 13: assisted GNSS constellation mask

Table 284. [P35,L13,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	**STAGNSS GPS CONSTELLATION** Enable/disable GPS constellation in assisted GNSS
[b1]	0x2	**STAGNSS GLO CONSTELLATION** Enable/disable GLONASS constellation in assisted GNSS
[b2]	0x4	**STAGNSS GAL CONSTELLATION** Enable/disable GALILEO constellation in assisted GNSS
[b3]	0x8	**STAGNSS COM CONSTELLATION** Enable/disable COMPASS constellation in assisted GNSS

29.9 Line 15: assisted GNSS settings for test

Table 285. **[P35,L15] field description**

Field	Bit	Bit mask / value	Description
F00	[b0]	0x1	**Reserved**
F01	[b1]	0x2	**AGNSS UPDREALEPH** Set status of predicted ephemeris update in test
F02	[b2]	0x4	**AGNSS USEREALEPH** Set status of real ephemeris update in test

30 Integrity (page 37)

30.1 Integrity mapping (page 37)

Table 286. **Page 37 layout**

Page 37																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Observables code loop discriminator configuration																															
1	Observables carrier loop discriminator configuration																															
2	Observables multipath/double-delta metric (7x) configuration																															
3	Observables auto-correlation/double delta extented metric (10x) configuration																															
4	Observables code-carrier divergence configuration																															
5	Observables doppler-code rate divergence configuration																															
6	Observables dual-frequency carrier-phase delta gradient configuration																															
7	Observables inter-frequency bias (pseudo-range) configuration																															
8	Observables signal strength configuration																															
9	Horizontal protection level configuration								Anti-spoofing list threshold configuration								Anti-spoofing list timeout configuration														
10	Reserved												Preload PK ID				Preload PK MID				Preload MTR hash type		OSNMA public key verification		OSNMA enable		Signal integrity threshold				

30.2 Line 0: noise2

Table 287. **[P37,L00,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables code loop discriminator configuration OFDE threshold for code noise metric (16x scaled)

30.3 Line 1: average phase noise

Table 288. **[P37,L01,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables carrier loop discriminator configuration OFDE threshold for phase noise metric (16x scaled)

30.4 Line 2: DDM

Table 289. **[P37,L02,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables double-delta metric (multipath metric, 7x) configuration OFDE threshold for DDM (16x scaled)

30.5 Line 3: DDM ext

Table 290. **[P37,L03,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables auto-correlation metric (10x) configuration OFDE configuration for DDM ext (16x scaled)

30.6 Line 4: CCDT

Table 291. **[P37,L04,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables code - carrier divergence configuration OFDE threshold for code – carrier divergence metric (16x scaled)

30.7 Line 5: doppler rate

Table 292. **[P37,L05,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables doppler code rate divergence configuration OFDE threshold for doppler code rate divergence metric (16x scaled)

30.8 Line 6: DFCP

Table 293. [P37,L06,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables dual-frequency carrier-phase delta gradient configuration OFDE threshold for DF carrier–phase delta gradient metric

30.9 Line 7: IFB PSR

Table 294. [P37,L07,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables inter-frequency bias (pseudo-range) configuration OFDE threshold for satellite IFB/PSR (16x scaled)

30.10 Line 8: SIG STRENGTH

Table 295. [P37,L08,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables signal strength configuration: • Bit0-7= CN0 threshold • Bit8-15= BDS GEO CN0 threshold • Bit16= Enable Pseudo–range threshold exclusion: • Bit17= Enable drop–detection exclusion, • Bit18= Enable NMA least square only • Bit19-26= Dual–frequency carrier phase difference ratio threshold • Bit27-31= Dual–frequency carrier phase difference ratio max threshold *Note: 25 (30 for BDS Geo) as default.*

30.11 Line 9: SPOOFING protection level monitor

Table 296. [P37,L09] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**Anti-spoofing list timeout configuration** Spoofed satellites list timeout in 100 millisecond units *Note: Spoofing timeout is 300 secs (3000 U) by defaults.*
F01	[b16-b23]	0xFF0000	**Anti-spoofing list threshold configuration** Minimum number of spoofed satellites (5 by default) for the same constellation to exclude the constellation (1)
F02	[b24-b31]	0xFF000000	**Horizontal protection level configuration** PLM alert limit threshold in 2 meter units

1. *Spoofing satellites list can hold 16 satellites maximum.*

30.12 Line 10: signal integrity threshold

Table 297. **[P37,L10] field description**

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**Signal integrity threshold** Signal integrity threshold scale factor (max. is 100)
F01	[b8]	0x100	**OSNMA enable** Enable OSNMA feature
F02	[b9]	0x200	**OSNMA public key verification** Enable the verification of injected OSNMA public key by Merkle tree
F03	[b10-b11]	0xC00	**Preload MTR hash type** To be set when a preloaded MTR is present in page 38 line 0 to 7. [1 : use SHA256] [3 : use SHA512] (Other values are ignored)
F04	[b12-b15]	0xF000	**Preload PK MID** Message ID of the preloaded PK present in pages 38 and 39. Used only if preload MTR hash type is set.
F05	[b16-b19]	0xF0000	**Preload PK ID** ID of the preloaded PK present in pages 38 and 39. Used only if preload MTR hash type is set.
F06	[b20-b31]	0xFFF00000	Reserved

31 OSNMA MTR and PK preload (page 38–39)

31.1 OSNMA MTR and PK preload mapping (page 38)

Table 298. Page 38 layout

Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Preload MTR (bytes 0 to 3)
1	Preload MTR (bytes 4 to 7)
2	Preload MTR (bytes 8 to 11)
3	Preload MTR (bytes 12 to 15)
4	Preload MTR (bytes 16 to 19)
5	Preload MTR (bytes 20 to 23)
6	Preload MTR (bytes 24 to 27)
7	Preload MTR (bytes 28 to 31)
8	Preload PK (bytes 0 to 3)
9	Preload PK (bytes 4 to 7)
10	Preload PK (bytes 8 to 11)
11	Preload PK (bytes 12 to 15)
12	Preload PK (bytes 16 to 19)
13	Preload PK (bytes 20 to 23)
14	Preload PK (bytes 24 to 27)
15	Preload PK (bytes 28 to 31)

31.2 Line 0 to 7: Merkle tree root key

Table 299. [P38, L00 to L07, F00] bits description

Bit	Bit mask / value	Decription
[b0-b31]	0xFFFFFFFF	Merkle tree root key(1)(2)

1. *Those lines are considered only if MTR hash type in Page 37 Line 10 bit 10-11 is filled with a value different from 0.*
2. *Message ID and Public Key ID of the preload public key must be filled in Page 37 Line 10 bit 12-15 and bit 16-19.*

31.3 Line 8 to 15: public key

Table 300. [P38, L08 to L15, F00] bits description

Bit	Bit mask / value	Decription
[b0-b31]	0xFFFFFFFF	4 bytes part per line of a 33 or 67 bytes public key from byte 0 to 31(1)(2)

1. *Those lines are considered only if MTR hash type in Page 37 Line 10 bit 10-11 is filled with a value different from 0.*
2. *Message ID and Public Key ID of the preload public key must be filled in Page 37 Line 10 bit 12-15 and bit 16-19.*

31.4 OSNMA PK Preload mapping (page 39)

Table 301. Page 39 layout

Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Preload PK (bytes 32 to 35)																															
1	Preload PK (bytes 36 to 39)																															
2	Preload PK (bytes 40 to 43)																															
3	Preload PK (bytes 44 to 47)																															
4	Preload PK (bytes 48 to 51)																															
5	Preload PK (bytes 52 to 55)																															
6	Preload PK (bytes 56 to 59)																															
7	Preload PK (bytes 60 to 63)																															
8	Preload PK (bytes 64 to 66)																								Reserved							

31.5 Line 0 to 7: public key

Table 302. [P39, L00 to L07, F00] bits description

Bit	Bit mask / value	Decription
[b0-b31]	0xFFFFFFFF	4 bytes part per line of a 33 or 67 bytes public key from byte 32 to 63(1)(2)

1. *Those lines are considered only if Page 37 Line 10 bit 10-11 is filled with a value different from 0.*
2. *If the preload public key is 33 bytes long, bytes 33 to 66 must be filled with 0.*

31.6 Line 8: public key

Table 303. [P39, L08, F00] bits description

Bit	Bit mask / value	Decription
[b8-b31]	0xFFFFFF	4 bytes part per line of a 33 or 67 bytes public key from byte 64 to 66(1)(2)

1. *Those lines are considered only if Page 37 Line 10 bit 10-11 is filled with a value different from 0.*
2. *If the preload public key is 33 bytes long, bytes 33 to 66 must be filled with 0.*

32 Sensor configuration (STA86x0) (page 44)

32.1 Sensor configuration (STA86x0) mapping

Table 304. Page 44 layout

Page 44																															
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	—0
0	Sensor activation CFG																															
1	Sensor GPIO CFG1																															
2	Sensor GPIO CFG2																															
3	Sensor I2C CFG																															
4	IMU CFG																															
5	Sensor data CFG																															
6	IMU wake up/data ready event																															
7	GYRO bandwidth																															
8	ACC bandwidth																															
9	GYRO full scale																															
10	ACC full scale																															
11	Sensor sampling rate																															

32.2 Line 0: CFG1

This parameter is used to activate sensor on boards. It has the following bit fields.

Table 305. [P44,L00,F00] bits description

Bit	Bit mask / value	Decription
[b1]	0x2	**3D GYRO DATA ONOFF** Enable/disable onboard 3 axes gyroscope data sampling
[b2]	0x4	**3D ACC DATA ONOFF** Enable/disable onboard 3 axes accelerometer data sampling
[b4]	0x10	**PRESSURE SENSOR DATA ONOFF** Enable/disable onboard pressure sensor data sampling
[b16]	See Table 306. Bus type values	**BUS TYPE** Select the type of digital interface to connect local mems sensors
[b31]	See Table 307. Msg list en values	**MSG LIST EN** DR NMEA strings to log are defined in msg lists

Table 306. Bus type values

Values	Definition
0x0	SPI bus is selected as digital interface
0x1	I2C bus is selected as digital interface

Table 307. **Msg list en values**

Values	Definition
0x0	All DR strings are logged in NMEA
0x1	DR strings logged in NMEA are defined in msg lists

32.3 Line 1: SNSGPIOCFG1

This parameter is used to configure GPIO for odo and reverse. It has the following bit fields.

Table 308. **[P44,L01,F00] bits description**

Bit	Bit mask / value	Description
[b0-b7]	0xFF	**odo gpio config** GPIO used for odo discrete signal. GPIOs numbering runs from 0 to 127 (1)
[b8-b15]	0xFF00	**reverse gpio config** GPIO used for reverse discrete signal. GPIOs numbering runs from 0 to 127 (1)

1. *AF shall be defined in GPIO Configuration, page 2 or 3.*

32.4 Line 2: SNSGPIOCFG2

This parameter is used to configure GPIO for 3D gyroscope, 3D accelerometer and pressure sensors. It has the following bit fields.

Table 309. **[P44,L02,F00] bits description**

Bit	Bit mask / value	Description
[b0-b7]	0xFF	**cs 3dgyro gpio config** Select the GPIO to be used as SPI chip select for 3D gyroscope sensor. GPIOs numbering runs from 0 to 127
[b8-b15]	0xFF00	**cs 3dacc gpio config** Select the GPIO to be used as SPI chip select for 3D accelerometer sensor. GPIOs numbering runs from 0 to 127
[b16-b23]	0xFF0000	**cs pres gpio config** Select the GPIO to be used as SPI chip select for the pressure sensor. GPIOs numbering runs from 0 to 127

32.5 Line 3: SNSI2CCFG

This parameter defines the I2C slave address for 3D gyroscope, 3D accelerometer and pressure sensors. It has the following bit fields.

Table 310. [P44,L03,F00] bits description

Bit	Bit mask / value	Description
[b0-b7]	0xFF	**GYRO I2C SLAVE ADDRESS** Slave Address of the local 3D gyro mems sensor on I2C bus (1)
[b8-b15]	0xFF00	**ACCELEROMETER I2C SLAVE ADDRESS** Slave address of the local 3D accelerometer mems sensor on I2C bus (1)
[b16-b23]	0xFF0000	**PRESSURE I2C SLAVE ADDRESS** Slave address of the local pressure mems sensor on I2C bus (1)

1. *Only used if bit 16 of parameter Page44Line1 is set to 0x1 (sensors in I2C mode).*

32.6 Line 4: IMUCFG

This parameter is used to configure IMU type and IMU axes direction in the car. It has the following bit fields.

Table 311. [P44,L04,F00] bits description

Bit	Bit mask / value	Description
[b0-b7]	See Table 312. IMU TYPE values	**IMU type** IMU Identification
[b8-b11]	0xF00	**IMU g z dir** GYRO MASK Z; Define Gyro Z Axis direction (1)
[b12-b15]	0xF000	**IMU g y dir** GYRO MASK Y; Define Gyro Y Axis direction (1)
[b16-b19]	0xF0000	**IMU g x dir** GYRO MASK X; Define Gyro X Axis direction (1)
[b20-b23]	0xF00000	**IMU a z dir** ACC MASK Z; Define Acc Z Axis direction (2)
[b24-b27]	0xF000000	**IMU a y dir** ACC MASK Y; Define Acc Y Axis direction (2)
[b28-b31]	0xF0000000	**IMU a x dir** ACC MASK X; Define Acc X Axis direction (2)

1. *Mandatory for IMU type 0. Useless for other IMU types.*
2. *Mandatory for IMU type 0–5;7;9–10;13. Useless for other IMU types supporting full free mounting feature.*

Table 312. IMU TYPE values

Values	Definition
0x0	IMU UNKNOWN
0xA	IMU LSM6DSM–LSM6DSL
0xB	IMU LSM6DSR–ISM330DHC–ASM330LHH; FFM supported
0xC	IMU SMI130 ; FFM supported
0xD	IMU IAM20680

Values	Definition
0xE	IMU SMI230 ; FFM supported
0xF	IMU LSM6DSO ; FFM supported

32.7 Line 5: sensors data and queuing configuration

Table 313. [P44,L05,F00] bits description

Bit	Bit mask / value	Description
[b16]	See Table 314. RAW SENS OUTPUT values	**RAW SENS OUTPUT** When this bit is set (enabled) the raw sensors are managed by Teseo and are getting out in NMEA log. When this bit is unset (disabled) an external application is able to register to the queue and manage the raw sensors data
[b24]	See Table 315. ACCGYRO MSGTYPE values	**ACCGYRO MSGTYPE** When this bit is set (enabled) the IMU data (acc+gyro) are grouped in one output message. Corresponding message type must be selected in MsgList

Table 314. RAW SENS OUTPUT values

Values	Definition
0x0	No raw sensors managed by Teseo
0x1	Raw sensors printed out in NMEA log

Table 315. ACCGYRO MSGTYPE values

Values	Definition
0x0	IMU data grouped in one output message
0x1	IMU data are splitted into two output messages

32.8 Line 6: IMUINT

This parameter is used to configure IMU wake-up with LSM6DSR/ASM330LHH INT1 and data ready event with LSM6DSR/ASM330LHH INT2. It has the following bit fields.

Table 316. [P44,L06,F00] bits description

Bit	Bit mask / value	Description
[b0-b7]	0xFF	**Wake-up threshold** Threshold for wake-up. ref ASM330LHH/LSM6DSR datasheet: WK THS[5:0] register WAKE UP THS(5Bh) (1)
[b10]	See Table 317. WAKE-UP OP MODE values	**Wake-up operating mode** Accelerometer low power mode Operating mode
[b16]	See Table 318. DATA READY INT2 values	**Data ready event on INT2** Data ready event enabled on INT2
[b24-b31]	0xFF000000	**GPIO number used for INT2** GPIO number used for LSM6DSR/ASM330LHH INT2

1. *Weight of 1 LSB of wakeup threshold: FS XL/(2^6); default FS XL=2g; Wake up duration event= 1 ODR time; default ODR=104 Hz.*

Table 317. **WAKE-UP OP MODE values**

Values	Definition
0x0	Accelerometer initialized in high performance mode
0x1	Accelerometer initialized in low power mode

Table 318. **DATA READY INT2 values**

Values	Definition
0x0	Data ready event disabled
0x1	Data ready event enabled on INT2

32.9 Line 7: gyroscope low pass filter bandwidth

Table 319. **[P44,L07,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**GYRO Bandwidth** Parameter used to define the desired gyroscope low pass filter bandwidth. This value is the frequency multiplied by 100 (1)

1. *Default value 0 means gyroscope low pass filter bw equal to ODR/2 or ODR/3 depending on the IMU type. Changing this bandwidth also changes the gyroscope ODR. ODR is defined by [P44,L11].*

32.10 Line 8: accelerometer low pass filter bandwidth

Table 320. **[P44,L08,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**ACC Bandwidth** Parameter used to define the desired accelerometer low pass filter band-width. This value is the frequency multiplied by 100. (1)

1. *Default value 0 means accelerometer low pass filter bw equal to ODR/2 or ODR/3 depending of the IMU type. Changing this bandwidth also changes the accelerometer ODR. ODR is defined in [P44,L11].*

32.11 Line 9: gyroscope full scale

Table 321. **[P44,L09,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	GYRO full scale parameter used to define the desired type= LSM6DSR/ASM330LHH). Unit is dps (1)

1. *Only effective with LSM6DSR/ASM330LHH IMU types in DRUM mode (do not connect). Default value 0 means gyroscope full scale= 125dps; Authorized values: 125,245,250,500,1000,2000,4000*

32.12 Line 10: accelerometer full scale

Table 322. [P44,L10,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**ACC full scale** Parameter used to define the desired accelerometer full scale. Unit is g (1)

1. *Only effective with IMU types 1–14. Default value 0 means accelerometer full scale= 2g; Authorized values: 2,4,8,16.*

32.13 Line 11: IMUSMPRATE

This parameter describes the sensors sampling rate. It fixes the IMU gyroscope and accelerometer ODR (output data rate) so that ODR > sampling rate.

Table 323. [P44,L11,F00] bits description

Bit	Bit mask / value	Description
[b0-b15]	0xFFFF	**Sampling rate** Parameter used to define the Sensors sampling rate. Unit is Hz (1)

1. *Default value 0 means sensors sampling rate set to 100Hz. Authorized values: [15;200].*

33 Dead-reckoning settings 1 (STA86x0 only) (page 48)

33.1 Dead-reckoning settings 1 (STA86x0 only) mapping

Table 324. Page 48 layout

Page48																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Wheel speed unit		Wheel speed resolution														Counter max. value															
1	Reserved																Reserved															
2	Reserved																								Gyro sign bit		Reserved				Gyro unit	
3	GYRO sensitivity																															
4	ACC sensitivity																															
5	Pressure sensitivity																															

33.2 Line 0: wheel pulse conversion

Table 325. [P48,L00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	**Counter max. value** This value is the maximum odometer pulses before wrapping (1)
F01	[b16-b29]	0x3FFF0000	**Wheel speed resolution** This parameter represents the resolution of wheel speed information multiplied by 10000
F02	[b30-b31]	See Table 326. WS UNIT values	**Wheel speed unit** This parameter represents the unit of the wheel speed resolution

1. *Mandatory for SPEED Information received by UART (sensors over UART solution) and with operating mode using SPEED Information.*

Table 326. WS UNIT values

Values	Definition
0x0	m/s
0x1	km/h
0x2	revolution/min

33.3 Line 1: vehicle geometry

Table 327. [P48,L01] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b11]	0xFFF	**Wheel circumference** This value is the wheel circumference (mm) (1)

1. *Setting this parameter helps to improve DRUM performance.*

33.4 Line 2: yaw rate conversion

This parameter contains settings needed to convert the signal from an external gyroscope (sensors over UART solution).

Table 328. [P48,L02] field description

Field	Bit	Bit mask / value	Description
F00	[b0]	See Table 329. GYRO UNIT values	**Gyro unit** This parameter is the yaw rate data unit
F02	[b4-b7]	See Table 330. GYRO SIGN values	**Gyro sign bit** This parameter represents the position of gyro data sign bit within payload

Table 329. GYRO UNIT values

Values	Definition
0x0	deg/s
0x1	rad/s

Table 330. GYRO SIGN values

Values	Definition
0x0	2–complement format
0xF	Signed format; ”15” indicates the bit15 as sign bit within the 2 bytes of the message

33.5 Line 3: gyroscope sensitivity

Table 331. [P48,L03,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**GYRO sensitivity** Gyroscope sensitivity multiplied by 10^5 if unit is dps/LSB or multiplied by 10^7 if unit is rps. Gyro unit is defined in [P48,L02]-bit0

33.6 Line 4: accelerometer sensitivity

Table 332. [P48,L04,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**ACC sensitivity** Accelerometer Sensitivity. Resolution :1/(16*10^3) mg/LSB (1)

1. *Default value 980=0.06125 mg/LSB.*

33.7 Line 5: pressure sensitivity

Table 333. [P48,L05,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**Pressure sensitivity** Pressure sensitivity. Resolution :1 hPa/LSB

34 Dead-reckoning settings 2 (STA86x0 only) (page 49)

34.1 Dead-reckoning settings 2 (STA86x0 only) mapping

Table 334. Page 49 layout

Page 49																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	DR fix rate																Operating mode															
2	DR algorithm settings																															

34.2 Line 0: DR fix rate and operating mode

Table 335. [P49,L00,F00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	See table 36.1	**Operating mode** This parameter describes which sensors information is used by DR(1)
F01	[b16-b31]	0xFFFF0000	**DR fix rate** This parameter defines the DR fix frequency (2)

1. *The classic operating mode is 1.*
2. *By default the DR fix rate is set at 1 Hz. Unit Hz.*

Table 336. OP MODE values

Values	Definition
0x1	Onboard IMU ; odometer/reverse
0x3	SoU IMU ; odometer/reverse
0x4	SoU 1 axe gyro ; OBDII speed PID
0x5	SoU IMU ; OBDII speed PID
0x14	SoU 1 axe gyro ; rear L/R wheel speed
0x15	SoU IMU ; rear L/R wheel speed

34.3 Line 2: DR algorithm settings

This parameter contains flags able to influence DR algorithm behaviors, either for calibration or navigation point of view.

Table 337. [P49,L02,F00] bits description

Bit	Bit mask / value	Description
[b3]	See Table 338. STOPPED CALIB values	Stopped calibration Enable/disable gyro bias estimation while vehicle static
[b6]	0x40	Reserved
[b7]	0x80	VFB Enable/disable the velocity feedback feature (1)
[b8]	0x100	MAP MATCHING FEEDBACK Enable/disable the usage of map matching feedback feature (2)
[b10]	0x400	3D DR Enable/disable 3D navigation with altitude estimation
[b16-b17]	See Table 340. VRO values	Virtual odometer Enable/disable the virtual odometer estimation (3)
[b18]	See Table 341. RESET POS INIT values	Fast PV reset at start up Enable/disable to reset the DR position and velocity to GNSS ones at start up in case of large error
[b19]	See Table 342. CALIB LOW SPEED values	Calibration at low speed Enable/disable the calibration at low speed(4)
[b20]	See Table 343. TRUCK MODE values	Truck mode Enable/disable the truck mode (cabin tilt)(4)
[b21]	See Table 344. HEADING MODE values	Heading mode Enable/disable the absolute heading use
[b26]	See Table 345. MMFB X track values	MMFB Only X Track Enable/disable the MMFB X track only feature (5)
[b27]	See Table 346. DR HEAD NO CALIB values	Use DR heading if gyro is not calibrated Enable/disable using DR heading when no calibration
[b29]	See Table 347. DR NVM CAR STOPPED values	Save status to NVM when stopped Enable/disable saving DR in NVM when the car is stopped
[b31]	See Table 348. GIS values	Gyroscope integration when stopped Enable/disable the DR heading update when the CAR is stopped (6)

1. *This parameter allows to toggle on/off the input of DR–estimated velocity into GNSS pseudo ranges KF, de–facto creating a tightly coupled filter architecture.*
2. *Echo on NMEA input commands needs to be turned off (application on/off 2 line 1 bit0).*
3. *This setting applies to Teseo DRUM or Teseo DRAW in fallback mode.*
4. *This setting does not apply to Teseo DRUM.*
5. *If enabled, the along track component provided by host is not taken into account.*
6. *Only recommended in case of perfect odometer. This feature does not apply to Teseo DRUM.*

Table 338. STOPPED CALIB values

Values	Definition
0x0	Disable gyro bias estimation while vehicle static
0x1	Enable gyro bias estimation while vehicle static

Table 339. OVT MODE values

Values	Definition
0x0	OvT constant
0x1	OvT estimated
0x2	Reserved
0x3	Reserved

Table 340. VRO values

Values	Definition
0x0	Enabled
0x1	Disabled
0x2	Reserved
0x3	Reserved

Table 341. RESET POS INIT values

Values	Definition
0x0	Enabled
0x1	Disabled

Table 342. CALIB LOW SPEED values

Values	Definition
0x0	Disabled
0x1	Enabled

Table 343. TRUCK MODE values

Values	Definition
0x0	Disabled
0x1	Enabled

Table 344. HEADING MODE values

Values	Definition
0x0	Disabled
0x1	Enabled

Table 345. MMFB X track values

Values	Definition
0x0	Disabled
0x1	Enabled

Table 346. DR HEAD NO CALIB values

Values	Definition
0x0	Enabled
0x1	Disabled

Table 347. DR NVM CAR STOPPED values

Values	Definition
0x0	Enabled
0x1	Disabled

Table 348. GIS values

Values	Definition
0x0	Enabled
0x1	Disabled

35 Dead-reckoning settings 3 (STA86x0 only) (page 50)

35.1 Dead-reckoning settings 3 (STA86x0 only) mapping

Table 349. Page 50 layout

Page 50																														
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	DR config																															
10	Reserved							Installation pitch									Installation roll													Installation yaw		

35.2 Line 0: DRCFG2

This parameter is used to initialize DR KF

Table 350. [P50,L00,F00] bits description

Bit	Bit mask / value	Description
[b3]	See Table 351. REV GEAR INV values	Reverse gear inversion Enable/disable the reverse gear inversion
[b4]	See Table 352. GYRO INV values	Gyro signal inversion Enable/disable the gyro signal inversion

Table 351. REV GEAR INV values

Values	Definition
0x0	”1” in the reverse message means that the car is in the reverse direction
0x1	”0” in the reverse message means that the car is in the reverse direction

Table 352. GYRO INV values

Values	Definition
0x0	No inversion of the gyro signal sign
0x1	Inversion of the gyro signal sign

35.3 Line 10: installation angles

This parameter is used to configure installation angles for gyro only system (no accelerometer).

Table 353. [P50,L10,F00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b8]	0x1FF	**Installation yaw** Difference between gyro x axis and vehicle forward direction (1)
F01	[b9-b17]	0x3FE00	**Installation roll** Difference between gyro y axis and gravity vertical direction (1)
F02	[b18-b26]	0x7FC0000	**Installation pitch** Difference between gyro x axis and gravity vertical direction (1)

1. *Resolution is 1deg/LSB range is 0–359 degrees. Follow counterclockwise convention.*

36 Customer reserved configuration (page 62)

This page is reserved for customer usage. It can be accessed by reading or writing the 32 bits of a line at once. There is no finest granularity. This is up to customer to apply the proper mask to retrieve the data stored into a line.

36.1 Customer reserved configuration mapping

Table 354. Page 62 layout

Page 62																															
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	CUST RESERVED P62 L0 BIT0 BIT32																															
1	CUST RESERVED P62 L1 BIT0 BIT32																															
2	CUST RESERVED P62 L2 BIT0 BIT32																															
3	CUST RESERVED P62 L3 BIT0 BIT32																															
4	CUST RESERVED P62 L4 BIT0 BIT32																															
5	CUST RESERVED P62 L5 BIT0 BIT32																															
6	CUST RESERVED P62 L6 BIT0 BIT32																															
7	CUST RESERVED P62 L7 BIT0 BIT32																															
8	CUST RESERVED P62 L8 BIT0 BIT32																															
9	CUST RESERVED P62 L9 BIT0 BIT32																															
10	CUST RESERVED P62 L10 BIT0 BIT32																															
11	CUST RESERVED P62 L11 BIT0 BIT32																															
12	CUST RESERVED P62 L12 BIT0 BIT32																															
13	CUST RESERVED P62 L13 BIT0 BIT32																															
14	CUST RESERVED P62 L14 BIT0 BIT32																															
15	CUST RESERVED P62 L15 BIT0 BIT32																															

36.2 Line 0: customer configuration line

Table 355. [P62,L00,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**CUST RESERVED P62 L0 BIT0 BIT32** Line reserved for customer usage

36.3 Line 1: customer configuration line

Table 356. [P62,L01,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**CUST RESERVED P62 L1 BIT0 BIT32** Line reserved for customer usage

36.4 Line 2: customer configuration line

Table 357. **[P62,L02,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**CUST RESERVED P62 L2 BIT0 BIT32** Line reserved for customer usage

36.5 Line 3: customer configuration line

Table 358. **[P62,L03,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**CUST RESERVED P62 L3 BIT0 BIT32** Line reserved for customer usage

36.6 Line 4: customer configuration line

Table 359. **[P62,L04,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**CUST RESERVED P62 L4 BIT0 BIT32** Line reserved for customer usage

36.7 Line 5: customer configuration line

Table 360. **[P62,L05,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**CUST RESERVED P62 L5 BIT0 BIT32** Line reserved for customer usage

36.8 Line 6: customer configuration line

Table 361. **[P62,L06,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**CUST RESERVED P62 L6 BIT0 BIT32** Line reserved for customer usage

36.9 Line 7: customer configuration line

Table 362. **[P62,L07,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**CUST RESERVED P62 L7 BIT0 BIT32** Line reserved for customer usage

36.10 Line 8: customer configuration line

Table 363. [P62,L08,F00] bits description

Bit	Bit mask / value	CUST RESERVED P62 L8 BIT0 BIT32
[b0-b31]	0xFFFFFFFF	Line reserved for customer usage

36.11 Line 9: customer configuration line

Table 364. [P62,L09,F00] bits description

Bit	Bit mask / value	CUST RESERVED P62 L9 BIT0 BIT32
[b0-b31]	0xFFFFFFFF	Line reserved for customer usage

36.12 Line 10: customer configuration line

Table 365. [P62,L10,F00] bits description

Bit	Bit mask / value	CUST RESERVED P62 L10 BIT0 BIT32
[b0-b31]	0xFFFFFFFF	Line reserved for customer usage

36.13 Line 11: customer configuration line

Table 366. [P62,L11,F00] bits description

Bit	Bit mask / value	CUST RESERVED P62 L11 BIT0 BIT32
[b0-b31]	0xFFFFFFFF	Line reserved for customer usage

36.14 Line 12: customer configuration line

Table 367. [P62,L12,F00] bits description

Bit	Bit mask / value	CUST RESERVED P62 L12 BIT0 BIT32
[b0-b31]	0xFFFFFFFF	Line reserved for customer usage

36.15 Line 13: customer configuration line

Table 368. [P62,L13,F00] bits description

Bit	Bit mask / value	CUST RESERVED P62 L13 BIT0 BIT32
[b0-b31]	0xFFFFFFFF	Line reserved for customer usage

36.16 Line 14: customer configuration line

Table 369. [P62,L14,F00] bits description

Bit	Bit mask / value	CUST RESERVED P62 L14 BIT0 BIT32
[b0-b31]	0xFFFFFFFF	Line reserved for customer usage

36.17 Line 15: customer configuration line

Table 370. [P62,L15,F00] bits description

Bit	Bit mask / value	CUST RESERVED P62 L15 BIT0 BIT32
[b0-b31]	0xFFFFFFFF	Line reserved for customer usage

37 Prompt configuration (page 63)

Prompt configuration is accessible through the ”page 63” of settings area. The string is composed of 4 lines, beginning at line 0 and must be a null–terminated string.

37.1 Prompt configuration mapping

Table 371. Page 63 layout

Page 63																															
Line	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	PROMPT 0 3																															
1	PROMPT 4 7																															
2	PROMPT 8 11																															
3	PROMPT 12 15																															
4	PROMPT 16 19																															
5	PROMPT 20 23																															
6	PROMPT 24 27																															
7	PROMPT 28 31																															
8	PROMPT 32 35																															
9	PROMPT 36 39																															
10	PROMPT 40 43																															
11	PROMPT 44 47																															
12	PROMPT 48 51																															
13	PROMPT 52 55																															
14	PROMPT 56 59																															
15	PROMPT 60 63																															

37.2 Line 0: prompt part 1

This line defines the content of prompt from character from 0 to character 3.

Table 372. [P63,L00,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 0 3** Prompt string – character from 0 to 3

37.3 Line 1: prompt part 2

This line defines the content of prompt from character from 4 to character 7.

Table 373. [P63,L01,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 4 7** Prompt string – character from 4 to 7

37.4 Line 2: prompt part 3

This line defines the content of prompt from character from 8 to character 11.

Table 374. [P63,L02,F00] bits description

Bit	Bit mask / value	description
32 bits	0x0	**PROMPT 8 11** Prompt string – character from 8 to 11

37.5 Line 3: prompt part 4

This line defines the content of prompt from character from 12 to character 15.

Table 375. [P63,L03,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 12 15** Prompt string – character from 12 to 15

37.6 Line 4: prompt part 5

This line defines the content of prompt from character from 16 to character 19.

Table 376. [P63,L04,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 16 19** Prompt string – character from 16 to 19

37.7 Line 5: prompt part 6

This line defines the content of prompt from character from 20 to character 23.

Table 377. [P63,L05,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 20 23** Prompt string – character from 20 to 23

37.8 Line 6: prompt part 7

This line defines the content of prompt from character from 24 to character 27.

Table 378. [P63,L06,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 24 27** Prompt string – character from 24 to 27

37.9 Line 7: prompt part 8

This line defines the content of prompt from character from 28 to character 31.

Table 379. [P63,L07,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 28 31** Prompt string – character from 28 to 31

37.10 Line 8: prompt part 9

This line defines the content of prompt from character from 32 to character 35.

Table 380. [P63,L08,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 32 35** Prompt string – character from 32 to 35

37.11 Line 9: prompt part 10

This line defines the content of prompt from character from 36 to character 39.

Table 381. [P63,L09,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 36 39** Prompt string – character from 36 to 39

37.12 Line 10: prompt part 11

This line defines the content of prompt from character from 40 to character 43.

Table 382. [P63,L10,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 40 43** Prompt string – character from 40 to 43

37.13 Line 11: prompt part 12

This line defines the content of prompt from character from 44 to character 47.

Table 383. [P63,L11,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 44 47** Prompt string – character from 44 to 47

37.14 Line 12: prompt part 13

This line defines the content of prompt from character from 48 to character 51.

Table 384. [P63,L12,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 48 51** Prompt string – character from 48 to 51

37.15 Line 13: prompt part 14

This line defines the content of prompt from character from 52 to character 55.

Table 385. [P63,L13,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 52 55** Prompt string – character from 52 to 55

37.16 Line 14: prompt part 15

This line defines the content of prompt from character from 56 to character 59.

Table 386. [P63,L14,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 56 59** Prompt string – character from 56 to 59

37.17 Line 15: prompt part 16

This line defines the content of prompt from character from 60 to character 63.

Table 387. [P63,L15,F00] bits description

Bit	Bit mask / value	Description
32 bits	0x0	**PROMPT 60 63** Prompt string – character from 60 to 63

38 Manage default configuration

Default setting of configuration data block is hard coded into the binary image file. Using a PC tool (FWConfigCmd.exe [1]), it is possible to change the software configuration without recompiling the source code. FWConfigCmd.exe [1] allows reading and writing configuration block inside binary images.

38.1 Read configuration

Read the configuration of a binary and print out result into text file. The output file name and path can be forced with option –o [output file path]. By default the result is a text file, compliant with format use to modify settings. A html format is used if the output file extension is .html. The reading can be limited to one page by following –r option with page number form 0 to 63.

```
FWConfigCmd.exe –f <binary image file name> –r <page> [–o <out file name>]
```

Where:

- <binary image file name> is the firmware binary image (.bin or .axf file format).
- <page> is an optional parameter which design a page number from 0 to 63.
- <out file name> is the file where reading is stored.

Read binary file (hex):

```
FWConfigCmd.exe –r –f TeseoBinary.bin
```

Read binary file (axf):

```
FWConfigCmd.exe –r –f TeseoBinary.axf
```

Read binary file and forced output file location:

```
FWConfigCmd.exe –r –f TeseoBinary.bin –o configuration.txt
```

Read binary file and get HTML format result:

```
FWConfigCmd.exe –r –f TeseoBinary.bin –o configuration.html
```

Read a selected page number. HTML format is also available:

```
FWConfigCmd.exe –r 2 –f TeseoBinary.bin
```

38.2 Write configuration

Modify the configuration of a binary. The command file contains operation on settings.

Syntax :

```
FWConfigCmd.exe –f <binary image file name> –c <config file name> [–o <out_file name>]
```

Where:

`<config file name>` is the configuration file.

The configuration file is a simple text file reporting the list of parameters to be changed and their new value (one parameter setting per line).

Each line of the configuration file has the following format:

```
 <page>.<line> : <value in hexadecimal>[,<mask in hexadecimal>]
```

Operation with mask can be resumed by :

```
line = line & ~mask
line | = value
```

Operation without mask can be resumed by :

```
line = value
```

Set value 0xAA2 in page 1 line 5:

```
1.5 : AA2
```

Set value 0x83402 in page 5 line 0 for all bit selected by mask 0xFFFFF :

```
5.0 : 83402,FFFFF
```

Set double value 0.5 in page 10 line 0:

```
10.0 : double(0.5)
```

Set signed value –15 in page 10 line 1:

```
10.1 : integer(-15)
```

Set String content from position line 0 at page 63:

```
63.0 : ”DEFAULT FW CFG”
```

Comments can be inserted in script file by inserting pound character.

Figure 4. Comment in command file

```
# DEBUG OFF
1.12 : 1,3

# DBG output on port 1, baudrate @ 460800 bps
1.13 : 0100000C

# NMEA output baudrate @ 460800 bps
1.14 : c,ffffff
```

Set new configuration in binary hex:

```
FWConfigCmd.exe -f TeseoBinary.bin -c config.txt
```

Set new configuration in binary axf:

```
FWConfigCmd.exe -f TeseoBinary.axf -c config.txt
```

Set new configuration in binary and force output file name:

```
FWConfigCmd.exe -f TeseoBinary.bin -c config.txt -o configuration TeseoBinary.bin
```

39 Manage configuration at run time with NMEA interface

At run–time the configuration parameters can be read, modified and stored using the system configuration commands: $PSTMSETPAR, $PSTMGETPAR and $PSTMSAVEPAR. There is also a command to restore the factory setting parameters: $PSTMRESTOREPAR.

Refer to [2] STA86x0 GNSS NMEA interface.

39.1 Command scope

The ”current configuration” is modified with $PSTMSETPAR command at run time. Nevertheless, a $PSTMSAVEPAR is needed to store changes into ”Saved configuration”. Else, changes will be lost at next restart of software.

The ”current”,”saved” and ”default” configuration blocks can be read with $PSTMGETPAR command.

The $PSTMRESTOREPAR command can be used to restore the factory settings also mentioned as ”default settings”. In this case, the ”saved configuration” is erased.

39.2 NMEA reading

The firmware configuration is accessible by host with NMEA protocol

Read a page :

```
$PSTMGETPAR,<configblock>,<Page>
```

Read a line :

```
$PSTMGETPAR,<configblock>,<Page>,<Line>
```

Read a field :

```
$PSTMGETPAR,<configblock>,<Page>,<Line>,<Field>
```

Where :

- <configblock> is a decimal [0=current 1=default 2=saved]
- <Page> is a decimal range [0–63]
- <Line> is a decimal value in range [0–15]
- <Field> is a decimal value in range [0–14]

Call: $PSTMGETPAR,1,1,14,1,0 or $PSTMGETPAR,1,1,14,1

Result: $PSTMGETPAR,1,P01,L14,F01,00000002*07

Comment: Dump the field 1 of line 14 of page 1.

Call: $PSTMGETPAR,1,1,14

Result: $PSTMGETPAR,1,P01,L14,0200000a*3D

Comment: Dump the line 14 of page 1.

Call: $PSTMGETPAR,1,2

Result:

```
$PSTMGETPAR,1,P02,0,3fc00000,00000600,00000000,ffffffff,00000000,00000000,00000000,00000000*7
0
$PSTMGETPAR,1,P02,8,6019f861,0140000a,00000000,fffffffef,00000000,00000000,00000000,00000000*7
8
```

Comment: Dump the page 2.

Call: $PSTMGETPAR,2

Result:

```
$PSTMGETPAR,2,P00,0,aef5321a,b0134ac0,3f855aa0,def0a534,90000001,00000000,00000000,00000000*7
0
$PSTMGETPAR,2,P00,8,00000000,00000000,00000000,00000000,00000000,00000000,00000000,00000000*7
9
$PSTMGETPAR,2,P01,0,00000000,00000000,00000000,00000000,00000000,00000000,00000000,00000000*7
0
$PSTMGETPAR,2,P01,8,00000000,00000000,00000000,00000000,0e801100,0100000c,0200000a,0100000c*7
6
$PSTMGETPAR,2,P02,0,3fc00000,00000600,00000000,ffffffff,00000000,00000000,00000000,00000000*7
3
$PSTMGETPAR,2,P02,8,6019f861,0140000a,00000000,fffffef,00000000,00000000,00000000,00000000*7
B
$PSTMGETPAR,2,.....
$PSTMGETPAR,2,P63,0,41464544,20544c55,43205746,00004746,00000000,00000000,00000000,00000000*2
2
$PSTMGETPAR,2,P63,8,00000000,00000000,00000000,00000000,00000000,00000000,00000000,00000000*7
C
```

Comment: Dump the complete default FW config.

Call: `$PSTMGETPAR,1,19,2,0,1`

Result: `$PSTMGETPAR,1,P19,L02,F00,6.330000e-07*15`

Comment: Dump the double type in line 2–3 of page 19.

Call: `$PSTMGETPAR,1,19,2,0`

Result: `$PSTMGETPAR,1,P19,L02,b884044b*64`

Comment: The field is not read as a double by default if parameter is not specified.

39.3 NMEA field writing

Syntax:

```
$PSTMSETPAR,<Page>,<Line>,<Field>,<mode>,<param value>
```

Where :

- <Page> is a decimal value in the range of [1–63], (Page0 is reserved for internal usage and cannot be updated)
- <Line> is a decimal value in the range of [0–15]
- <Field> is a decimal value in the range of [0–32]
- <mode> is a decimal value in the range of [0–2]
- <param value> hexadecimal or floating value to be written. If the Field corresponds to a floating point type, value must be given as xxx.yyy or xxx.yyyE[–/+]z.

<Mode> allows to perform bit–to–bit OR or AND operations between the selected field and the value in input. It has the following meaning:

- 0: The field is overwritten by the param value. This is the default action as in the case mode is omitted.
- 1: The field content is the result of bit–to–bit OR between old value and the param value. This is useful for bit mask setting.
- 2: The field content is the result of bit–to–bit AND between old value and NOT (param value). This is useful for bit mask resetting.

Call: `$PSTMSETPAR,35,00,01,0,0xAAAAAA or $PSTMSETPAR,35,00,01,0,0,AAAAAA`

Result: `$PSTMSETPAROK,P35,L00,F01,aaaaaaaa*0A`

Call: `$PSTMSETPAR,19,00,00,0,222.3333333`

Result: `$PSTMSETPAROK,P19,L00,F00,2.223333e+02*1D`

Call: `$PSTMSETPAR,19,00,00,0,99E-2`

Result: `$PSTMSETPAROK,P19,L00,F00,9.900000e-01*1A`

39.4 NMEA line writing

Syntax:

```
$PSTMSETPAR,<Page>,<Line>,<Field>,<mode>,<param value>
```

Where :

- <Page> is a decimal value in the range of [1–63], (Page0 is reserved for internal usage and cannot be updated)
- <Line> is a decimal value in the range of [0–15]
- <Line value> is a hexadecimal value to be writtenin selected line

Call: `$PSTMSETPARLINE,35,00,0xABC or $PSTMSETPARLINE,35,00,ABC`

Result: `$PSTMSETPARLINEOK,P35,L00,00000abc*3F`

39.5 NMEA save

Syntax:

```
$PSTMSAVEPAR
```

The current configuration data block from RAM, including modified parameters, will be stored into the saved configuration data block (SCDB).

39.6 NMEA restore

Syntax:

```
$PSTMSRESTOREPAR
```

The configuration data block stored into the backup memory is erased. All customized configuration previously saved will be lost.

The default setting parameters (factory settings from software binary) will be applied from next software initialization.

40 Manage configuration at run time with RTCM3 interface

At run–time the configuration parameters can be read, modified and stored at runtime assuming that the GNSS receiver is configured to use the RTCM protocol. It is also possible to restore the factory setting parameters.

Refer to UM3401.

40.1 RTCM RCC output message

The RTCM RCC message used by the GNSS receiver to report the current configuration to the host. Host can request to get the configuration of a specific page or all pages using the TXREQ input message.

Here is an example of a TXREQ request in bytes (as sent by a host) to return Page 00 to 63. Values are returned in subsequents RCC output messages.

Syntax:

```
3e 71 21 54 2b ff ff fc
```

where :

- Msg id = 0x3E7 = 999
- SubType Id = 0x12 = 18
- Resp ID = 0x55 = 85
- Retransmission message ID= 0xA = 10
- Config. page number = 0xFF = 255
- Config, page mask (all lines => 0xFFFF)

40.2 RTCM RCC input message

The RTCM RCC command is used by the host to set the FW configuration. Note that the RTCM RCC command cannot reach a single field within a line in FW configuration because it does not support bit mask. Therefore, if a single field value must be changed, it is the whole line which must be overwritten. The CDB write flag (DF50P) must be set to 1 to update the configuration in RAM and store it into the saved configuration data block (SCDB). Otherwise, only the current configuration in RAM is updated and the configuration is lost at the next start–up.

If several subsequent RCC messages are sent, the CDB write flag must be set only in the last message to guarantee the memory life. In such a case, for the first n–1 messages the CDB write flag can be set to 0, and the last message sets the flag to 1. Doing that, the configuration from all the RCC messages in the sequence will be written to the SCDB once at the end.

RTCM RESTART command with SW reset is mandatory to get the value applied.

Here is an example of a RCC command, in bytes (as sent by a host), to change the positionning CN0 threshold to 35 (0x23) in P16, L1.

Syntax:

```
3e 70 22 a0 10 40 00 88 c1 c1 41 40
```

Where:

- Msg id = 0x3E7 = 999
- SubType Id = 2
- Resp ID = 0xA8 = 168
- Page= 0x10 = 16
- CDB flag = 1
- Config. page mask (line 1 => 0x2)
- Word 1 (32 bits) = 0x23070505

40.3 Restoring factory settings

The factory setting parameters can be restored to their default values by sending the RTCM TEST input message with the TestID field (DF51P) set to 6.

Appendix A Acronyms and reference documents

Table 388. Acronyms

Acronym	Name
CLK (SPI)	Clock signal
DA (GPIO)	Data available line
EN (SPI)	Enable signal
LSB	Least significant Bit
MSB	Most significant Bit
MISO (SPI)	Master input slave output SPI signal
MOSI (SPI)	Master output slave input SPI signal
NMEA	National marine electronics association
RFU	Reserved for further use
RTCM	Radio technical commission for maritime services organization
SPI	Serial port interface
SSP	Synchronous serial port

Table 389. Reference documents

Document name	Document title
UM3401	Teseo VI and Teseo APP2–RTCM3 proprietary interface
UM3407	Teseo VI and Teseo APP2–NMEA specifications and commands

Revision history

Table 390. **Document revision history**

Date	Revision	Changes
25-Nov-2024	1	Initial release.
28-Feb-2025	2	Updated *Table 3. Product ID values.* Updated *Section 3: Stream configuration (page 01)* and *Table 5. [P01,L00] fields description.* Updated *Section 5: GPIO bank 0 and GPIO bank 1 configuration (page 02).* Updated *Section 6: GPIO bank 2 configuration (page 03).* Updated *Table 59. [P04,L02] field description*, *Table 60. [P04,L03] description*, *Table 63. [P04,L06] description* and *Table 64. [P04,L07] description.* Updated *Section 9.1: Internal RF registers bank0 mapping.* Updated *Section 10.1: Internal RF registers bank1 mapping.* Updated *Section 11.1: Internal RF registers bank2 mapping.* Updated *Section 12.1: Internal RF registers bank3 mapping.* Updated *Section 13.1: External RF registers bank0 mapping.* Updated *Section 14.1: External RF registers bank1 mapping.* Updated *Table 88. [P16,L02] field description* and *Table 103. [P16,L13] fields description.* Updated *Table 112. [P17,L06] field description*, *Table 118. [P17,L07] field description*, *Table 121. [P17,L10] field description*, *Table 122. [P17,L12] field descriptions* and *Table 123. [P17,L14] field descriptions.* Added *Section 16.10: Line 8 : constellation mask used for smooth pseudorange.* Updated *Table 126. [P18,L01,F0] bits description*, *Table 127. [P18,L02,F00] bits description*, *Table 128. [P18,L03,F00] bits description*, *Table 129. [P18,L04,F00] bits description*, *Table 130. [P18,L05,F00] bits description*, *Table 131. [P18,L06,F00] bits description* and *Table 132. [P18,L07,F00] bits description.* Updated *Table 149. [P20,L01] field description.* Updated *Table 157. [P20,L09] field description*, *Table 158. [P20,L10] field description*, *Table 159. [P20,L11] field description* and *Table 160. [P20,L12] field description.* Added *Section 21.6: Line 4: RTCM3 MTI CFG 4*, *Section 21.7: Line 6: RTCM3 fix message list 1 activation* and *Section 21.8: Line 7: RTCM3 fix message list 2 activation.* Updated *Section 21.9: Line 8: RTCM3 configuration (part 2)* and *Table 194. [P22,L13] field description.* Updated *Table 223. [P24,L00,F00] bits description*, *Table 224. [P24,L01,F00] bits description*, *Table 225. [P24,L02,F00] bits description*, *Table 226. [P24,L03,F00] bits description*, *Table 227. [P24,L04,F00] bits description*, *Table 228. [P24,L05,F00] bits description* and *Table 229. [P24,L06,F00] bits description.* Updated *Section 24: Kalman satellite selector (page 25)* , *Section 24.1: Kalman satellite selector mapping*, *Table 240. [P25,L00] field description*, *Table 241. FREQ FILTER values*, *Table 242. SORT MODE values* and *Table 243. [P25,L01] field description.* Updated *Table 251. [P32,L03,F00] bits descrption*, *Table 252. [P32,L04,F00]] bits description*, *Table 253. [P32,L05,F00] bits description* and *Table 254. [P32,L06,F00] bits description.* Removed "Inter frequency bias (page 34)" and its subchapters. Updated *Section 29: Integrity (page 37)*, *Table 278. [P37,L00,F00] bits description*, *Table 279. [P37,L01,F00] bits description*, *Table 280. [P37,L02,F00] bits description*, *Table 281. [P37,L03,F00] bits description*, *Table 282. [P37,L04,F00]] bits description*, *Table 283. [P37,L05,F00]] bits description*, *Table 284. [P37,L06,F00] bits description*, *Table 285. [P37,L07,F00] bits description*, *Table 286. [P37,L08,F00] bits description* and *Table 287. [P37,L09] field description.* Updated *Table 295. [P44,L03,F00] bits description*, *Table 297. IMU TYPE values*, *Table 298. [P44,L05,F00] bits description* and *Table 301. [P44,L06,F00] bits description.* Updated *Table 312. [P48,L01] field description.* Updated *Table 352. [P50,L14,F00] bits description.*

Date	Revision	Changes
17-Apr-2025	3	Removed *"Section 2.2 Line 0: reserved firmware setting", "2.3 Line 1: reserved firmware setting", "2.4 Line 2: reserved firmware setting", "2.5 Line 3: reserved firmware setting", "2.7 Line 5: reserved firmware setting" and "2.8 Line 6: reserved firmware setting"*.. Updated *Section 2.1: Firmware setting configuration control mapping, Table 4. Page 01 layout, Table 5. [P01,L00] fields description, Table 13. [P01,L08] fields description, Table 15. Debug core1 port number values, Table 19. DEBUG port number values, Section 3.14: Line 14: HOST1 settings and UART1 settings, Section 3.15: Line 15: HOST2 settings and UART2 settings, Section 7.1: Hardware configuration mapping, Section 7.2: Line 2: external memory configuration, Section 16.1: GNSS configuration 2 mapping, Section 16.8: Line 6: position algorithms options andTable 118. [P17,L07] field description.* Added *Section 16.11: Line 9: Position algorithms options*.. Updated *Section 17.1: Tracker configuration mapping, Table 162. Page 21 layout, Section 20.9: Line 8: E2E and SCL configuration, Section 21.1: RTCM3 protocol configuration mapping, Table 177. [P22,L00,F00] bits description, Table 181. [P22,L02,F00] bits description, Section 21.6: Line 4: RTCM3 MTI CFG 4, Table 189. [P22,L10,F01] bits description, Section 23.1: SIS configuration 1 (STA9200 only) mapping, Section 24.1: Kalman satellite selector mapping, Section 26.1: NMEA message activation part 2 mapping, Table 251. [P32,L03,F00] bits descrption and Table 253. [P32,L05,F00] bits description.* Added *Section 27.1: Line 0: NMEA message list 0 for HOST1* and all subchapters. Updated *Section 28.1: Assisted GNSS configuration mapping, Section 28.4: Line 3: SBAS satellites parameters part 2, Section 28.5: Line 6: navdata settings, Section 29.1: Integrity mapping (page 37), Section 30.1: Sensor configuration (STA86x0) mapping, Table 297. IMU TYPE values, Section 31.1: Dead-reckoning settings 1 (STA86x0 only) mapping, Table 312. [P48,L01] field description, Section 31.5: Line 3: gyroscope sensitivity, Section 32.1: Dead-reckoning settings 2 (STA86x0 only) mapping and Section 33.1: Deadreckoning settings 3 (STA86x0 only) mapping.* Added *Section 37.4: NMEA line writing.*
08-Jul-2025	4	Updated *Table 22. HOST1 purpose values and Table 23. HOST1 peripheral values.* Updated *Table 27. HOST2 purpose values and Table 28. HOST2 peripheral values.* Updated *Table 32. Page 02 layout.* Added *Section 5.8: Line 6: GPIO bank 0 data register for standby mode and Section 5.15: Line 14: GPIO bank 1 data register for standby mode.* Updated *Table 47. Page 03 layout.* Added *Section 6.8: Line 6: GPIO bank 2 data register for standby mode and Section 6.15: Line 14: GPIO bank 3 data register for standby mode.* Updated *Section 9.1: Internal RF registers bank0 mapping.* Updated *Section 10.1: Internal RF registers bank1 mapping.* Updated *Section 11.1: Internal RF registers bank2 mapping.* Updated *Section 12.1: Internal RF registers bank3 mapping.* Updated *Section 15.1: GNSS configuration 1 mapping.* Updated *Section 17.13: Line 11: ATRK configuration.* Updated *Table 171. [P21,L05,F00] bits description.* Updated *Table 180. Page 22 layout.* Updated *Table 194. [P22,L10,F02] bits description.* Updated *Table 196. [P22,L11,F00] bits description.* Updated *Table 243. Page 25 layout.* Updated *Table 259. [P32,L07,F00] bits description.*
10-Dec-2025	5	Added *Section 1: Preface*. Updated *Table 73. [P05,L00,F00] bits description*. Added *Section 4.11: Line 10: debug group enable mask*. Updated *Table 88. Page 16 layout*, *Table 94. [P16,L02] field description*, and *Table 153. Page 20 layout*. Added *Section 20.11: Line 14: DDNCO*.

Date	Revision	Changes
		Updated *Section 21.1: Application configuration mapping*, *Section 21.6: Line 5: constellation multi–frequency on/off*, *Section 21.7: Line 6: constellation mask used for positioning*, and *Section 21.9: Line 8: E2E and SCL configuration*. Added *Section 21.14: Line 13: TimeSync configuration*, *Section 21.15: Line 14: TimeSync configuration bridge to master threshold* and *Section 21.16: Line 15: TimeSync configuration threshold Teseo to master*. Updated *Table 186. [P22,L00,F00] bits description*, *Section 22.9: Line 8: RTCM3 configuration (part 2)*, *Section 22.10: Line 9: RTCM3 metrics mask 2 on/off*, *Table 197. [P22,L10,F00] bits description*, *Table 200. [P22,L10,F03] bits description*, *Section 22.13: Line 12: RTCM3 metrics mask on/off*, *Section 22.14: Line 13: RTCM3 configuration*, and *Section 22.15: Line 14: RTCM3 OBSQM and OBSQM2 metrics mask on/off*. Updated *Section 23.1: SIS configuration 0 (STA9200 only) mapping*, *Section 23.2: Line 0: SIS CFG 0*, and *Section 23.10: Line 9: Internal RF monitoring configuration 2*. Updated *Section 28.5: Line 8: RTCM message list 0 for HOST1* and *Section 28.7: Line 10: RTCM message list 0 for HOST2*. Updated *Section 29.1: Assisted GNSS configuration mapping*. Added *Section 29.5: Line 4: SSR data source configuration*. Removed "*Line 1: GNSS signal strength acceptance*", Updated *Section 33.3: Line 2: DR algorithm settings*, *Section 34.1: Dead-reckoning settings 3 (STA86x0 only) mapping*, and *Section 34.2: Line 0: DRCFG2*. Removed "*Line 1: odometer scale default value*", "*Line 2: gyro offset default value*", "*Line 3: gyro gain default value*", "*Line 4: odometer scale standard deviation default value*", "*Line 5: odometer scale process noise default value*", "*Line 6: gyro offset standard deviation default value*", "*Line 7: gyro offset process noise default value*", "*Line 8: gyro gain standard deviation default value*", "*Line 9: gyro gain process noise default value*", "*Line 11: GNSS position filter weight coefficient*", "*Line 12: GNSS heading filter weight coefficient*", "*Line 13: GNSS height filter weight coefficient*" and "*Line 14: GNSS vertical velocity filter weight coefficient*".
13-Apr-2026	6	Updated Section 1: Preface. Updated Table 130. Page 18 layout, title of Section 18.15: Line 13: tracking dual antenna parameters, Table 171. [P21,L00,F00] bits description, Table 172. [P21,L01,F00] bits description, Table 186. Page 22 layout, Table 187. [P22,L00,F00] bits description, Table 196. [P22,L08] field description, Table 273. Page 35 layout, Table 286. Page 37 layout, Table 297. [P37,L10] field description, and title of Table 304. Page 44 layout. Added Section 18.16: Line 14: tracking CN0 min. threshold, Section 31: OSNMA MTR and PK preload (page 38–39), Section 31.1: OSNMA MTR and PK preload mapping (page 38), Section 31.2: Line 0 to 7: Merkle tree root key, Section 31.3: Line 8 to 15: public key, Section 31.4: OSNMA PK Preload mapping (page 39), Section 31.5: Line 0 to 7: public key, and Section 31.6: Line 8: public key. Minor text changes.

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