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:

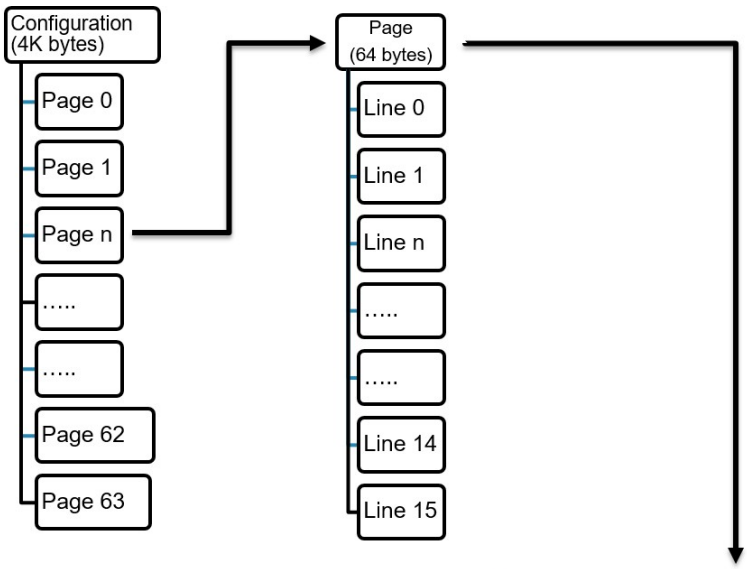
- *The DR parameters sections in CDB [P44], [P48], [P49] and [P50] are applicables only for the STA86x0 DR dual freq L1–L5 PVT binary image.*
- *The CDB [P62] is reserved for customer usage. This is up to customer to define his own data structure over the 15 lines of 32 bits. Customer can only read and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

1 Firmware configuration

1.1 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), which group bits with the same purpose. The field value range is 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.

1.2 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

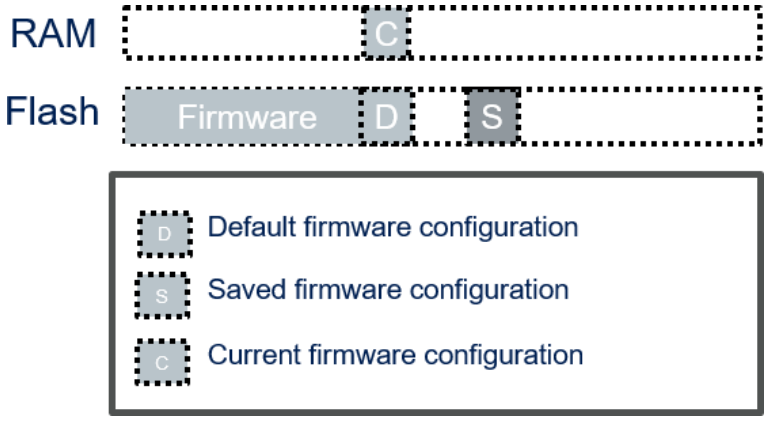
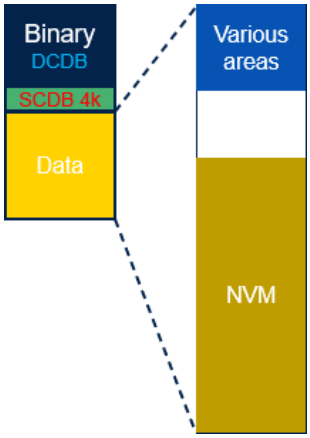


Figure 3. Generic view of flash organization and firmware configuration blocks location



2 Firmware setting configuration control

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

2.1 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
0	Reserved																															
1	Reserved																															
2	Reserved																															
3	Reserved																															
5	Reserved																															
6	Reserved																															

2.2 Line 0: reserved firmware setting

Table 2. [P00,L00] field description

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

2.3 Line 1: reserved firmware setting

Table 3. [P00,L01] field description

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

2.4 Line 2: reserved firmware setting

Table 4. [P00,L02] field description

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

2.5 Line 3: reserved firmware setting

Table 5. [P00,L03] field description

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

2.6 Line 4: firmware setting version

This line defines the version of firmware settings.

Table 6. [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 7. Product ID values

Values	Definition
0x90	Teseo ME
0x91	Teseo APP

2.7 Line 5: reserved firmware setting

Table 8. [P00,L05] field description

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

2.8 Line 6: reserved firmware setting

Table 9. [P00,L06] field description

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

3 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.
- Assign an UART or SSP port to DEBUG into DEBUG UART port number [P01, L13].
- Assign an UART or SSP port to RTCM into RTCM UART port number [P01,L15].

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] [P01,L15].

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 page21.
- 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].

3.1 Stream configuration mapping

Table 10. 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	Reserved							SSP1 CS PIN						SSP1 DALINE PIN									CDB SSP1 DALINE ENABLED	Reserved						Reserved		Reserved		Reserved	
11	Reserved																								DEBUG CORE1 PORT NUMBER							
12	Reserved																Output configuration								Stream layout							
13	DEBUG PORT NUMBER								Reserved															UART0 HWFC	UART0 BAUDRATE							
14	NMEA PORT NUMBER								Reserved															UART1 HWFC	UART1 BAUDRATE							
15	RTCM UART PORT NUMBER								Reserved															UART2 HWFC	UART2 BAUDRATE							

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

Table 11. [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	[b4-b7]	0xF0	Stream 0 options

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

Table 12. [P01,L01,F00] field description

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

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

Table 13. [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

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

Table 14. [P01,L03,F00] fields description

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

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

Table 15. [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

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

Table 16. [P01,L05] field description

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

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

Table 17. [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

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

Table 18. [P01,L07,F00] field description

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

3.10 Line 8: SSP1 configuration

This line defines how SSP1 port is configured.

Table 19. [P01,L08] fields description

Field	Bit	Bit mask / value	Description
F04	[b9]	0x200	SSP1 DA LINE pin enabled
F05	[b10-b17]	0x3FC00	SSP1 DA LINE pin
F06	[b18-b25]	0x3FC0000	SSP1 CS pin

3.11 Line 11: debug core1 port number

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

Table 20. [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 21. Debug core1 port number values

Values	Definition
0x0	Port 0
0x1	Port 1
0x2	Port 2

3.12 Line 12: stream layout

This line defines how NMEA, RTCM and DEBUG streams are activated. Refer to page 1 introduction for more details about configuration.

Table 22. [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)

3.13 Line 13: debug port number and UART0 baud rate

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

Table 23. [P01,L13] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	See Table 24. UART0 baud rate values	Set UART0 baud rate – allowed value in Table 24. UART0 baud rate values
F01	[b8]	0x100	HW flow control for UART0 (0: disable, 1: enable)
F03	[b24-b31]	See Table 25. DEBUG port number values	Set port number used for debug stream – allowed value in Table 25. DEBUG port number values

Table 24. 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

Values	Definition
0xA	115200 baud
0xB	230400 baud
0xC	460800 baud
0xD	921600 baud
0xE	1843200 baud
0xF	2400000 baud
0x10	3000000 baud

Table 25. DEBUG port number values

Values	Definition
0x0	Port 0
0x1	Port 1
0x2	Port 2

3.14 Line 14: NMEA port number and UART1 baud rate

This line defines the port number assigned to NMEA and the UART1 baud rate.

Table 26. [P01,L14]description

Field	Bit	Bit mask / Value	Description
F00	[b0-b7]	See table below	Set UART1 baud rate – allowed value in Table 27. UART1 baud rate values
F01	[b8]	See table below	HW flow control for UART1 (0: disable, 1: enable)
F03	[b24-b31]	See table below	Set port number used by NMEA stream – allowed value in Table 28. NMEA port number values

Table 27. 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

Values	Definition
0xF	2400000 baud
0x10	3000000 baud

Table 28. NMEA port number values

Values	Definition
0x0	Port 0
0x1	Port 1
0x2	Port 2

3.15 Line 15: RTCM port number and UART2 baud rate

This line defines the port number assigned to RTCM and the UART2 baud rate.

Table 29. [P01,L15] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	See Table 30. UART2 baud rate values	Set UART2 baud rate – allowed value in Table 30. UART2 baud rate values
F01	[b8]	0x100	HW flow control for UART2 (0: disable, 1: enable)
F03	[b24-b31]	See Table 31. RTCM UART port number values	Set UART port number used by RTCM3 stream – allowed value in Table 31. RTCM UART port number values

Table 30. 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 31. **RTCM UART port number values**

Values	Definition
0x0	Port 0
0x1	Port 1
0x2	Port 2

4 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).

4.1 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.

4.2 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.

4.3 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.

4.4 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 input, 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

5 GPIO bank 0 and GPIO bank 1 configuration

This section describes the GPIO banks 0 and 1 settings.

5.1 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																															
8	GPIO1 AFSLA																															
9	GPIO1 AFSLB																															
10	GPIO1 DIR																															
11	GPIO1 DATA																															
12	GPIO1 SLPM																															
13	GPIO1 PDIS																															

5.2 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)

5.3 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)

5.4 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

5.5 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)

5.6 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)

5.7 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)

5.8 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 41. [P02,L08] description

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

5.9 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 42. [P02,L09] description

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

5.10 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 43. [P02,L10] description

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

5.11 Line 11: GPIO bank 1 data register

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

Table 44. [P02,L11] description

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

5.12 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 45. [P02,L12] description

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

5.13 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 46. [P02,L13] description

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

6 GPIO bank 2 configuration

This section describes the GPIO bank 2 settings.

6.1 GPIO bank 2 configuration mapping

Table 47. 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																															
8	GPIO3 AFSLA																															
9	GPIO3 AFSLB																															
10	GPIO3 DIR																															
11	GPIO3 DATA																															
12	GPIO3 SLPM																															
13	GPIO3 PDIS																															

6.2 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 48. [P03,L00] description

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

6.3 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 49. [P03,L01] description

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

6.4 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 50. [P03,L02] description

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

6.5 Line 3: GPIO bank 2 data register

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

Table 51. [P03,L03] description

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

6.6 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 52. [P03,L04] description

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

6.7 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 53. [P03,L05] field description

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

6.8 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 54. [P03,L08] field description

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

6.9 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 55. [P03,L09]] field description

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

6.10 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 corresponding pin to be an output.

Table 56. [P03,L10]] field description

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

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

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

Table 57. [P03,L11] field description

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

6.12 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 58. [P03,L12]] field description

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

6.13 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 59. [P03,L13] field description

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

7 Hardware configuration (page 4)

Various hardware configurations.

7.1 Hardware configuration mapping

Table 60. Page 04 layout

<table>
<tr><th colspan="38">Page 4</th></tr>
<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></th><th>13</th><th>12</th><th></th><th>11</th><th>10</th><th></th><th>9</th><th>8</th><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th></th><th>3</th><th></th><th>2</th><th></th></tr>
<tr><td>2</td><td colspan="16">Reserved</td><td colspan="12">EXTMEM CFG FSPM</td><td colspan="5">EXTMEM CFG RESERVED1</td><td colspan="2">EXTMEM CFG RAMEN</td><td colspan="2">EXTMEM CFG FLASHEN</td></tr>
<tr><td>3</td><td colspan="16">Reserved</td><td colspan="3">EXTRF AFSI</td><td colspan="3">EXTRF AFSO</td><td colspan="3">EXTRF AFCLK</td><td colspan="3">EXTRF AFCS</td><td colspan="5">Reserved</td><td colspan="4">EXTRF C</td></tr>
<tr><td>4</td><td colspan="8">EXTRF GPIOSI</td><td colspan="8">EXTRF GPIOSO</td><td colspan="12">EXTRF GPIOCLK</td><td colspan="9">EXTRF GPIOCS</td></tr>
<tr><td>5</td><td colspan="8">Reserved</td><td colspan="8">GNSS BSP RF1 MAX GAIN</td><td colspan="12">GNSS BSP RF0 MAX GAIN</td><td colspan="9">GNSS BSP TOTAL LNA GAIN</td></tr>
<tr><td>6</td><td colspan="16">VTSENSE COMP1</td><td colspan="21">VTSENSE COMP0</td></tr>
<tr><td>7</td><td colspan="16">Reserved</td><td colspan="21">VTSENSE COMP2</td></tr>
<tr><td>8</td><td colspan="35">Reserved</td><td colspan="2">STANDBY IN PUN</td></tr>
</table>

7.2 Line 2: external memory configuration

This line details the configuration for external memory.

Table 61. [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	[b2]	0x4	Enable RAM usage
F04	[b4-b7]	0xF0	RESERVED
F05	[b8-b15]	0xFF00	Software protected mode value (read used flash datasheet to get the proper values)

7.3 Line 3: external RF configuration part 1

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

Table 62. [P04,L03] description

Field	Bit	Bit mask / value	Description
F00	[b0-b3]	0xF	Bus protocol selector: • 0: SSP, • 1: MSP
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

7.4 Line 4: external RF configuration part 2

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

Table 63. [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)

7.5 Line 5: GNSS BSP configuration

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

Table 64. [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

7.6 Line 6: temperature threshold for V_{TSENSE} comparators

This line details the temperature threshold values to set the V_{TSENSE} comparators.

Table 65. [P04,L06] description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	V_{TSENSE} temperature threshold for comparator 0 (low) (1)
F01	[b16-b31]	0xFFFF0000	V_{TSENSE} temperature threshold for comparator 0 (high) (1)

1. *Temperature threshold is: (sign)VALUE + (N*0.125).*

7.7 Line 7: temperature threshold for V_{TSENSE} comparators

This line details the temperature threshold values to set the V_{TSENSE} comparators.

Table 66. [P04,L07] description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	V_{TSENSE} temperature threshold for comparator 2 (very high) (1)

1. *Temperature threshold is: (sign)VALUE + (N*0.125)*

7.8 Line 8: hardware standby configuration

This line details the hardware standby configuration.

Table 67. [P04,L08] field description

Field	Bit	Bit mask / value	Description
00	[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

8 Antenna sensing configuration (page 5)

Describes all configurable parameters for antenna sensing.

8.1 Antenna sensing configuration mapping

Table 68. 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 RFSW 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																															

8.2 Line 0: antenna sensing main configuration

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

Table 69. [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

8.3 Line 1: antenna sensing power configuration

This line defines antenna sensing power configuration.

Table 70. [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

8.4 Line 2: antenna sensing RF switch and GPIO configurations

This line defines antenna sensing RF switch and GPIO configurations.

Table 71. [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

8.5 Line 3: antenna sensing main ADC configuration

This line defines antenna sensing main ADC configuration.

Table 72. [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)

8.6 Line 4: antenna sensing ADC algorithm parameters

This line defines antenna sensing ADC algorithm parameters.

Table 73. [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)

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

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

Table 74. [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)

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

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

Table 75. [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)

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

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

Table 76. [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)

8.10 Line 8: antenna sensing external component settings

This line defines antenna sensing external component settings.

Table 77. [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

9 Internal RF registers bank0 (page 8)

Setting of RF registers [0–15].

9.1 Internal RF registers bank0 mapping

Table 78. 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	Reserved																Register 0														
1	Reserved																Register 1														
2	Reserved																Register 2														
3	Reserved																Register 3														
4	Reserved																Register 4														
5	Reserved																Register 5														
6	Reserved																Register 6														
7	Reserved																Register 7														
8	Reserved																Register 8														
9	Reserved																Register 9														
10	Reserved																Register 10														
11	Reserved																Register 11														
12	Reserved																Register 12														
13	Reserved																Register 13														
14	Reserved																Register 14														
15	Reserved																Register 15														

10 Internal RF registers bank1 (page 9)

Setting of RF registers [16–31].

10.1 Internal RF registers bank1 mapping

Table 79. 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	Reserved																Register 16														
1	Reserved																Register 17														
2	Reserved																Register 18														
3	Reserved																Register 19														
4	Reserved																Register 20														
5	Reserved																Register 21														
6	Reserved																Register 22														
7	Reserved																Register 23														
8	Reserved																Register 24														
9	Reserved																Register 25														
10	Reserved																Register 26														
11	Reserved																Register 27														
12	Reserved																Register 28														
13	Reserved																Register 29														
14	Reserved																Register 30														
15	Reserved																Register 31														

11 Internal RF registers bank2 (page 10)

Setting of RF registers [32–63].

11.1 Internal RF registers bank2 mapping

Table 80. 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	Reserved																Register 32														
1	Reserved																Register 33														
2	Reserved																Register 34														
3	Reserved																Register 35														
4	Reserved																Register 36														
5	Reserved																Register 37														
6	Reserved																Register 38														
7	Reserved																Register 39														
8	Reserved																Register 40														
9	Reserved																Register 41														
10	Reserved																Register 42														
11	Reserved																Register 43														
12	Reserved																Register 44														
13	Reserved																Register 45														
14	Reserved																Register 46														
15	Reserved																Register 47														

12 Internal RF registers bank3 (page 11)

Setting of RF registers [48–63].

12.1 Internal RF registers bank3 mapping

Table 81. 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	Reserved																Register 48														
1	Reserved																Register 49														
2	Reserved																Register 50														
3	Reserved																Register 51														
4	Reserved																Register 52														
5	Reserved																Register 53														
6	Reserved																Register 54														
7	Reserved																Register 55														
8	Reserved																Register 56														
9	Reserved																Register 57														
10	Reserved																Register 58														
11	Reserved																Register 59														
12	Reserved																Register 60														
13	Reserved																Register 61														
14	Reserved																Register 62														
15	Reserved																Register 63														

13 External RF registers bank0 (page 12)

13.1 External RF registers bank0 mapping

Table 82. 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	Reserved																Register 0														
1	Reserved																Register 1														
2	Reserved																Register 2														
3	Reserved																Register 3														
4	Reserved																Register 4														
5	Reserved																Register 5														
6	Reserved																Register 6														
7	Reserved																Register 7														
8	Reserved																Register 8														
9	Reserved																Register 9														
10	Reserved																Register 10														
11	Reserved																Register 11														
12	Reserved																Register 12														
13	Reserved																Register 13														
14	Reserved																Register 14														
15	Reserved																Register 15														

14 External RF registers bank1 (page 13)

14.1 External RF registers bank1 mapping

Table 83. 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	Reserved																Register 16														
1	Reserved																Register 17														
2	Reserved																Register 18														
3	Reserved																Register 19														
4	Reserved																Register 20														
5	Reserved																Register 21														
6	Reserved																Register 22														
7	Reserved																Register 23														
8	Reserved																Register 24														
9	Reserved																Register 25														
10	Reserved																Register 26														
11	Reserved																Register 27														
12	Reserved																Register 28														
13	Reserved																Register 29														
14	Reserved																Register 30														
15	Reserved																Register 31														

15 External RF registers bank2 (page 14)

Setting of RF registers [32–63].

15.1 External RF registers bank2 mapping

Table 84. Page 14 layout

Page 14																														
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																Register 32															
1	Reserved																Register 33															
2	Reserved																Register 34															
3	Reserved																Register 35															
4	Reserved																Register 36															
5	Reserved																Register 37															
6	Reserved																Register 38															
7	Reserved																Register 39															
8	Reserved																Register 40															
9	Reserved																Register 41															
10	Reserved																Register 42															
11	Reserved																Register 43															
12	Reserved																Register 44															
13	Reserved																Register 45															
14	Reserved																Register 46															
15	Reserved																Register 47															

16 External RF registers bank3 (page 15)

Setting of RF registers [48–63].

16.1 External RF registers bank3 mapping

Table 85. Page 15 layout

Page 15																														
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																Register 48															
1	Reserved																Register 49															
2	Reserved																Register 50															
3	Reserved																Register 51															
4	Reserved																Register 52															
5	Reserved																Register 53															
6	Reserved																Register 54															
7	Reserved																Register 55															
8	Reserved																Register 56															
9	Reserved																Register 57															
10	Reserved																Register 58															
11	Reserved																Register 59															
12	Reserved																Register 60															
13	Reserved																Register 61															
14	Reserved																Register 62															
15	Reserved																Register 63															

17 GNSS configuration 1 (page 16)

17.1 GNSS configuration 1 mapping

Table 86. 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																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 CONFIG PARAMS																															
9	NMEA delay to next fix																															
10	NCO range maximum value																															
11	NCO range minimum value																															
12	NCO center value																															
13	Field 0																															
14 15	GNSS measurement rate																															

17.2 Line 0: GNSS settings 0

Table 87. [P16,L00] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	See Table 88. 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 89. 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 90. COLD START TYPE values	Cold start type: Set the cold start type with selective data erase

Table 88. Differential source type values

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

Table 89. 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 90. 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

17.3 Line 1: GNSS settings 1

Table 91. [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 including in the tracking. The default value is 5 degree
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.

17.4 Line 2: GNSS settings 2

Table 92. [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 93. MEASUREMENT GATING values	Enable/disable the gating at forbidden frequencies –1 kHz and 3K4 GPS. Bad measurements gating is disabled by default.
F05	[b11-b13]	See Table 94. 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 95. GATING BWTH CONFIG values	Configure the gating bandwidth at forbidden frequencies.

Table 93. 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 94. 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 95. GATING BWTH CONFIG values

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

17.5 Line 3: GNSS settings 3

Table 96. [P16,L03] fields descriptions

Fields	Bit	Bit mask / value	Descriptions
F00	[b0-b3]	See Table 97. 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 97. DYNAMIC MODE values

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

17.6 Line 4: GNSS settings 4

Table 98. [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.

17.7 Line 5: GNSS settings 5

Table 99. [P16,L05] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**GNSS integrity check configuration** Allow enabling/disabling integrity checks for: • Bit#0= position • Bit#1= time; • Bit#2= HPVT • Bit#3= clk estimation • Bit#4= PVT protection level monitor • Bit#5= time integrity action • bit#6= ı¿½ ????? • bit#8= 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

17.8 Line 6: GNSS setting 6

Table 100. [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)

17.9 Line 7: GNSS setting 7

Table 101. [P16,L07] field description

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

17.10 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 102. [P16,L08] field description

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

17.11 Line 9: GNSS setting 9

Table 103. [P16,L09] fields description

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

17.12 Line 10: NCO MAX range configuration

Table 104. [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.*

17.13 Line 11: NCO MIN range configuration

Table 105. [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.*

17.14 Line 12: NCO center value configuration

Table 106. [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.*

17.15 Line 13: GNSS setting 13

Table 107. [P16,L13] fields description

Field	Bit	Bit mask / value	Description
F00	[b0-b3]	0xF	**GNSS reported fix ratio** Configuration which allow 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

17.16 Line 14: GNSS setting 14

Table 108. [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 measurement. A system reboot is needed to have new setting in use. Expressed in second, 10 hz will give 0.1 ms **Warning:** *This is a 64–bits value, using next line too.*

18 GNSS configuration 2 (page 17)

18.1 GNSS configuration 2 mapping

Table 109. 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	Field 0																															
5	Field 0																															
6	Reserved												SSR mode	Smoothed PR mode	Slow PVT mode	Position antispoofing mode	Reserved																IONO compensa
7	Reserved											IFLC De–activation threshold					Reserved			IFLC activation threshold				Reserved		IFLC auto latitude threshold						
10 11	Position hold altitude																															
12 13	Position hold latitude																															
14 15	Position hold longitude																															

18.2 Line 0: default_2D DOPS setting

Table 110. **[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)

18.3 Line 1: default_3D DOPS setting

Table 111. **[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)

18.4 Line 2: start up 2D DOPS setting

Table 112. **[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)

18.5 Line 3: start up 3D DOPS setting

Table 113. [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)

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

Table 114. [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]

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

Table 115. [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)

18.8 Line 6: position algorithms options

Table 116. [P17,L06] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b2]	See Table 117. Iono compensation mode values	IONO Compensation mode: allow to configure Iono free linear combination mode
F02	[b16]	See Table 118. ASPF MODE values	Position antispoofing mode: apply antispoofing algorithm at position level
F03	[b17]	See Table 119. SPVTM MODE values	Slow PVT mode activation
F04	[b18]	See Table 120. SPRM MODE values	Smoothed pseudorange mode activation
F05	[b19]	See Table 121. SSR MODE values	SSR correction Usage

Table 117. 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 118. ASPF MODE values

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

Table 119. SPVTM MODE values

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

Table 120. SPRM MODE values

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

Table 121. **SSR MODE values**

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

18.9 Line 7: position algorithms options

Table 122. **[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

18.10 Line 10: position hold altitude setting

Table 123. **[P17,L10] field description**

Field	Bit	Bit mask / Value	description
Foo	[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.* **Warning:** *This is a 64–bits value, using next line too.*

18.11 Line 12: position hold latitude setting

Table 124. **[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.* **Warning:** *This is a 64–bits value, using next line too.*

18.12 Line 14: position hold longitude setting

Table 125. [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.* **Warning:** *This is a 64–bits value, using next line too.*

19 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 temporary 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.

19.1 Tracker configuration mapping

Table 126. 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 0 constellation mask																															
5	TrkGroup 0 constellation mask																															
6	TrkGroup 6 constellation mask																															
7	TrkGroup 7 constellation mask																															
8	Field 0																															
9	Field 0																															
10	Reserved																								TRK ELEV MASK							
11	TRK ATRK CFG																															
12	TRK DUAL ANT MASK																															
13	Reserved										Field 0																					

19.2 Line 0: tracker constellation mask group 0

Table 127. [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
[b2]	0x4	**CONSTELLATION QZSS L1 CA ON/OFF**

Bit	Bit mask / value	Description
		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

19.3 Line 1: tracker constellation mask group 1

Table 128. [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 GLONASS 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

19.4 Line 2: tracker constellation mask group 2

Table 129. [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 GLONASS 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

19.5 Line 3: tracker constellation mask group 3

Table 130. **[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 GLONASS 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

19.6 Line 4: tracker constellation mask group 4

Table 131. **[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 GLONASS 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

19.7 Line 5: tracker constellation mask group 5

Table 132. **[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 group5
[b2]	0x4	**CONSTELLATION QZSS L1 CA ON/OFF**

Bit	Bit mask / value	Description
		Enable/disable GLONASS 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

19.8 Line 6: tracker constellation mask group 6

Table 133. [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 GLONASS 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

19.9 Line 7: tracker constellation mask group 7

Table 134. [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 GLONASS 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

19.10 Line 8: tracking channel limits 0

Table 135. **[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

19.11 Line 9: tracking channel limits 1

Table 136. **[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

19.12 Line 10: tracking configuration 1

Table 137. **[P18,L10,F00] bits description**

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

19.13 Line 11: ATRK configuration

Table 138. **[P18,L11,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	**TRK ATRK CFG** Allow to set the tracking assistance configuration

19.14 Line 12: tracking dual antenna mask configuration

Table 139. [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

19.15 Line 13: tracking configuration 1

Table 140. [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

20 PPS configuration 1 (page 19)

20.1 PPS configuration 1 mapping

Table 141. 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																															

20.2 Line 0: time correction setting

Table 142. [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–bits value, using next line too.*

20.3 Line 2: GPS RF time correction setting

Table 143. [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–bits value, using next line too.*

20.4 Line 4: GLONASS RF time correction setting

Table 144. [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–bits value, using next line too.*

20.5 Line 6: COMPASS RF time correction setting

Table 145. [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–bits value, using next line too.*

20.6 Line 8: GALILEO RF time correction setting

Table 146. [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–bits value, using next line too.*

20.7 Line 10: PPS pulse duration setting

Table 147. [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.*

20.8 Line 12: timing TRAIM alarm setting

Table 148. [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–bits value, using next line too.*

21 PPS configuration 2 (page 20)

21.1 PPS configuration 2 mapping

Table 149. 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															
15	Airborne enable	Reserved															Airborne mode threshold															

21.2 Line 0: PPS hold auto survey samples

Table 150. [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

21.3 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 151. [P20,L01] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b3]	See Table 152. PPS GEN MODE values	**PPS GEN MODE** PPS generation mode
F01	[b4-b7]	See Table 153. PPS REF TIME SYNC values	**PPS REF TIME SYNC** Reference time on which the PPS signal is synchronized (1)
F02	[b8-b11]	See Table 154. 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 the minimun number. This parameter should be set to 0 is 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

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

Table 152. PPS GEN MODE values

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

Table 153. **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)

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 154. **PPS GNSS FIX CONDITION values**

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

21.4 Line 2: PPS operating mode setting 2

Table 155. **[P20,L02] field description**

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

21.5 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 156. 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 157. 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)

21.6 Line 8: path delay cfg1

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

Table 158. [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

21.7 Line 9: path delay cfg2

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

Table 159. [P20,L09] field description

Field	Bit	Bit mask / value	Description
Foo	[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

21.8 Line 10: path delay cfg3

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

Table 160. [P20,L10] field description

Field	Bit	Bit mask / value	Description
Foo	[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

21.9 Line 11: path delay cfg4

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

Table 161. [P20,L11] field description

Field	Bit	Bit mask / value	Description
Foo	[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

21.10 Line 12: path delay cfg4

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

Table 162. [P20,L12] field description

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

21.11 Line 15: airborne mode configuration

This line defines 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 163. [P20,L15] field description

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

22 Application configuration (page 21)

22.1 Application configuration mapping

Table 164. Page 21 layout

Page21																															
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	Application on/off 1																														
1	Application on/off 2																														
2	Application on/off 3																														
4	Field 0																														
5	Field 0																														
6	Constellation usage for positioning																														
7	Timing constellation mask																														
8	Reserved																													Secure communication layer enable	Time synchronization enable
9	E2E measurement source data ID																														
10	E2E measurement LLI source data ID																														
11	E2E time sync header source data ID																														
12	E2E SCL header source data ID																														
15	DDNCO frequency out enable	Reserved																												DDNCO frequency out	

22.2 Line 0: application on/off 1

Table 165. **[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]	0x80	**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 page 63 (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.*

22.3 Line 1: application on/off 2

Table 166. [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. *It is recommended keep this bit lowered whereas the RTC crystal oscillator is not mounted.*
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.*

22.4 Line 2: application on/off 3

Table 167. [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

22.5 Line 4: constellation mask on/off

Table 168. 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

22.6 Line 5: constellation multi–frequency on/off

Table 169. [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
[b21]	0x20000	Enable/disable BEIDOU GEO B1I acquisition/tracking; • 0 = Enable GEO B1I tracking • 1 = Disable GEO B1I tracking
[b23]	0x80000	Enable/disable autonomous acquisition of dual freq. (L5,B2A,E5A,E5B): • 0 = Disabled • 1 = Enabled
[b24]	0x100000	Enable/disable split band mode: • 0 = Disabled • 1 = Enabled

22.7 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 170. [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
[b7]	0x80	Enable/disable BEIDOU constellation usage for positioning
[b9]	0x200	Enable/disable GPS L2C frequency usage for positioning
[b10]	0x400	Enable/disable IRNSS constellation usage for positioning
[b11]	0x800	Enable/disable GPS L5 frequency usage for positioning
[b12]	0x1000	Enable/disable GAL E5 frequency usage for positioning
[b14]	0x4000	Enable/disable BEIDOU B2A frequency usage for positioning
[b15]	0x8000	Enable/disable QZSS L2C frequency usage for positioning
[b16]	0x10000	Enable/disable QZSS L5 frequency usage for positioning

22.8 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 171. [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

22.9 Line 8: E2E and SCL configuration

Table 172. [P21,L08] field description

Field	Bit	Bit mask / value	Description
F00	[b0]	0x1	Enable/disable the E2E protocol
F01	[b1]	0x2	Enable/disable the time synchronization procedure
F02	[b2]	0x4	Enable/disable the secure communication layer

22.10 Line 9: E2E measurement source data ID

Table 173. **[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

22.11 Line 10: E2E measurement LLI source data ID

Table 174. **[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

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

Table 175. **[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

22.13 Line 12: E2E SCL header source Data ID

Table 176. **[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

22.14 Line 15: DDNCO parameters

Table 177. **[P21,L15,F00]] bits description**

Bit	Bit mask / value	Description
[b0-b27]	0xFFFFFFF	**DDNCO FREQ OUT** Disciplined NCO frequency output (supported range = 1 MHz to 30 MHz)

Table 178. **[P21,L15,F02]] bits description**

Bit	Bit mask / value	Description
[b31]	0x80000000	**DDNCO ENABLE** Enable disciplined NCO frequency output

23 RTCM3 protocol configuration (page 22)

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

On each line are encoded eight MTI groups, 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.

For the MTI group 0 and 1 are allowed the MTI value of 0x0 and 0xF only.

23.1 RTCM3 protocol configuration mapping

Table 179. 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	RTCM3 MTI CFG 0																														
1	RTCM3 MTI CFG 1																														
2	RTCM3 MTI CFG 2																														
3	RTCM3 MTI CFG 3																														
8	Reserved																														
9	CN0 F4																														
10	Field 3								Field 2								Field 1								Field 0						
11	Field 0																														
12	CN0																														
13	prop id	Ep Msg Ov	Ep Msg Cri						Ep Msg max.						RTCM3 EPHEM SPLIT CNT						EPVT vn ve	Reserved	IFM dbg	1013	1006	sat ex	sens	nosat	preamb	EPVT TIME	PRR
14	CCD1																														
15	CCD4																														

23.2 Line 0: RTCM3 MTI CFG 0

Table 180. [P22,L00,F00] bits description

Bit	Bit mask / value	Description
[b0-b3]	See Table 181. RTCM3 MTI CFG ID 0 values	**Legacy observations messages** Allow to enable or disable legacy observations messages 1002 and 1010
[b4-b7]	See Table 182. RTCM3 MTI CFG ID 1 values	**MSM7 observations messages** Allow to enable or disable MSM7 observations messages 1077, 1087, 1097,1117 and 1127
[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 (4075)
[b16-b19]	0xF0000	**Receiver safety status messages** Allow to set MTI value for the receiver safety status (RSS) messages
[b20-b23]	0xF00000	**Receiver configuration and control messages** Allow to set MTI value for the receiver configuration and control (RCC) messages
[b28-b31]	0xF0000000	**Sensor messages** Allow to set MTI value for the sensor (SENS) messages

Table 181. RTCM3 MTI CFG ID 0 values

Values	Definition
0x0	Enabled
0xF	Disabled

Table 182. RTCM3 MTI CFG ID 1 values

Values	Definition
0x0	Enabled
0xF	Disabled

23.3 Line 1: RTCM3 MTI CFG 1

Table 183. 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** Allow to set MTI value for the observable quality metrics (OBSQM) messages (1)
[b12-b15]	0xF000	**Satellite data messages** Allow to set MTI value for the DATUM RTCM3 messages

Bit	Bit mask / value	Description
[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 are disabled for STA9200*

23.4 Line 2: RTCM3 MTI CFG 2

Table 184. [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) messages
[b12-b15]	0xF000	**TXREQ response messages** Allow to set MTI value for the TXREQ response messages
[b16-b19]	0xF0000	**Signal quality metrics v2 messages** Allow to set MTI value for the signal quality metrics (SIGQM2) messages version 2
[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 are disabled for STA9200.*

23.5 Line 3: RTCM3 MTI CFG 3

Table 185. [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 (1)
[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

Bit	Bit mask / value	Description
		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 (2)

1. *STASA are disabled for STA9200.*
2. *STNMA and STNMAEVT are disabled for STA9200.*

23.6 Line 8: RTCM3 configuration (part 2)

Table 186. [P22,L08,F00] bits description

Bit	Bit mask / value	Description
[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)

23.7 Line 9: RTCM3 metrics mask 2 on/off

Table 187. [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
[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
[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
[b25]	0x2000000	Enable/disable DSP flags F6

Bit	Bit mask / value	Description
[b26]	0x4000000	Metrics flags F6
[b30]	0x40000000	Metrics user 2 on/off

23.8 Line 10: RTCM3 messages constellation mask on/off

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

Table 188. [P22,L10,F00] bits description

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

Table 189. [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 and NDF GLONASS constellation message
[b10]	0x400	Enable/disable MSM7 1117 and NDF QZSS constellation message
[b11]	0x800	Enable/disable MSM7 1097 and NDF GALILEO constellation message
[b12]	0x1000	Enable/disable (no MSM7 1107) NDF SBAS constellation message
[b13]	0x2000	Enable/disable MSM7 1127 and NDF COMPASS constellation message
[b14]	0x4000	Enable/disable (no MSM7) NDF IRNSS constellation message

Table 190. [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

Table 191. [P22,L10,F03] bits description

Bit	Bit mask / value	Description
[b24]	0x1000000	Enable/disable OBSQM GPS constellation message
[b25]	0x2000000	Enable/disable OBSQM GLONASS constellation message
[b26]	0x4000000	Enable/disable OBSQM QZSS constellation message
[b27]	0x8000000	Enable/disable OBSQM GALILEO constellation message
[b29]	0x20000000	Enable/disable OBSQM COMPASS constellation message

23.9 Line 11: RTCM3 constellation message mask on/off

Table 192. [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

23.10 Line 12: RTCM3 metrics mask on/off

Table 193. [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
[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

Bit	Bit mask / value	Description
[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
[b30]	0x40000000	Metrics user 1 on/off
[b31]	0x80000000	Metrics mask 2 on/off

23.11 Line 13: RTCM3 configuration

Table 194. [P22,L13] field description

Bit	Bit mask / value	Description
[b0]	0x1	**OFDE EXCLUSION ON OFF SWITCH** Enable/disable OFDE exclusion in RTCM3 output (0 = disabled, 1 = enabled)
[b1]	0x2	**PRR CLKDRIFT VALUE** Set the clock drift value which is used in MSM7 pseudo–range rate calculation (0 = estimated, 1 = nominal)
[b2]	0x4	**EPVT TIME** Select between master time or UTC time in the EPVT output (0 = master, 1 = UTC)
[b3]	0x8	**PREAMBLE LOCK** Repot preamble–locked measurements only in MSM7 output
[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)
[b5]	0x20	**SENS COMMON** Sensor common message frame (0 disabled, 1 = enabled)
[b6]	0x40	**SAT EXCL PRESENT PVT ON OFF SWITCH** 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)
[b7]	0x80	**RTCM MESSAGE TYPE 1006 ONOFF SWITCH** Enable/disable 1006 message – stationary antenna reference point with height information (0 = disabled, 1 = enabled)
[b8]	0x100	**RTCM MESSAGE TYPE 1013 ONOFF SWITCH** Enable/disable 1013 message – system parameters (0 = disabled, 1 = enabled)
[b9]	0x200	**RTCM3 IFM DEBUG ONOFF SWITCH** Enable/disable IFM debug information message (0 = disabled, 1 = enabled)
[b11]	0x800	**RTCM3 MSG EPVT VN VE**

Bit	Bit mask / value	Description
		Enable/disable EPVT with velocity north and east (0 = disabled, 1 = enabled)
[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
[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, messages will not be sent on the epoch if above this threshold. If epoch msg overflow stop is disabled, only the ephemeris messages will be split on next epoch if above this threshold.
[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)
[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)
[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].*

23.12 Line 14: RTCM3 OBSQM metrics mask on/off

Table 195. [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.)
[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)

Bit	Bit mask / value	Description
[b31]	0x80000000	OBSQM metrics mask 2 on off OBSQM metrics mask 2 on/off

23.13 Line 15: RTCM3 OBSQM metrics mask 2 on/off

Table 196. [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)

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

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

24.1 SIS configuration 0 (STA9200 only) mapping

Table 197. 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	LOG	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	External RF monitoring configuration 0																															
10	External RF monitoring configuration 1																															
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															

24.2 Line 0: SIS CFG 0

Table 198. [P23,L00] field description

Field	Bit	Bit mask / value	Description
F00	[b0]	See Table 199. 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 Table 200. NVM LOG ON OFF values	NVM logging activate the SIS event NVM logging
F03	[b6]	See Table 201. EOUT SW ON OFF values	Enable EOUT pin software control

Table 199. SIS RESET CFG values

Values	Definition
0x1	Enabled
0x0	Disabled

Table 200. NVM LOG ON OFF values

Values	Definition
0x0	Disable the NVM log SIS event
0x1	Enable the NVM log SIS event

Table 201. EOUT SW ON OFF values

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

24.3 Line 1: FCCU configuration

Table 202. [P23,L01,F00] field description

Field	Bit	Bit mask / value	Description
F00	[b0]	See Table 203. 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 204. FCCU SM CFG values	Switching mode EOUT protocol (dual rail, time switching) switching mode. It has no effect on the bi–stable protocol
F02	[b2]	See Table 205. 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 206. EOUT FOM CFG values	Fault output mode - EOUT protocol

Table 203. FCCU OD CFG values

Values	Definition
0	Push-pull
1	OD

Table 204. **FCCU SM CFG values**

Values	Definition
0	Slow switching mode
1	Fast switching mode

Table 205. **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 206. **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

24.4 Line 2: hardware monitor configuration 0

Table 207. **[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

24.5 Line 3: hardware monitor configuration 1

Table 208. **[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

24.6 Line 4: hardware monitor configuration 2

Table 209. **[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

24.7 Line 5: hardware monitor configuration 3

Table 210. [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

24.8 Line 7: RF monitor internal RF registers 0

Table 211. [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

24.9 Line 8: RF monitor internal RF registers 1

Table 212. [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

24.10 Line 9: RF monitor external RF registers 0

Table 213. [P23,L09,F00] bits description

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

24.11 Line 10: RF monitor external RF registers 1

Table 214. [P23,L10,F00] bits description

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

24.12 Line 11: CWM configuration

Table 215. [P23,L11,F00] bits description

Bit	Bit mask / value	Description
[b0]	See Table 216. CWM MON ON OFF values	CWM monitoring activation Enable CWM monitoring
[b1]	See Table 217. NOTCH FILTERS PROG MODE values	Notch filters programming mode Enable HW programming of notch filters, otherwise SW programming (including some filtering)

Table 216. CWM MON ON OFF values

Values	Definition
0x1	Enabled
0x0	Disabled

Table 217. NOTCH FILTERS PROG MODE values

Values	Definition
0x1	HW programming
0x0	SW programming

24.13 Line 12: DFT 1 thresholds

Table 218. [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

24.14 Line 13: DFT 2 thresholds

Table 219. [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

24.15 Line 14: DFT 3 thresholds

Table 220. **[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

24.16 Line 15: DFT 4 thresholds

Table 221. **[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

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

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

25.1 SIS configuration 1 (STA9200 only) mapping

Table 222. 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	Field 0																															
10	Field 0																															
11	Field 0																															
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															

25.2 Line 0: SIS HPVT monitor configuration

Table 223. **[P24,L00,F00] bits description**

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

25.3 Line 1: SIS IFM monitor configuration

Table 224. **[P24,L01,F00] bits description**

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

25.4 Line 2: SIS IFM monitor configuration

Table 225. **[P24,L02,F00] bits description**

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

25.5 Line 3: SIS IFM monitor configuration

Table 226. **[P24,L03,F00] bits description**

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

25.6 Line 4: SIS IFM monitor configuration

Table 227. **[P24,L04,F00] bits description**

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

25.7 Line 5: SIS IFM monitor configuration

Table 228. **[P24,L05,F00] bits description**

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

25.8 Line 6: SIS IFM monitor configuration

Table 229. **[P24,L06,F00] bits description**

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

25.9 Line 7: SIS IFM monitor configuration

Table 230. **[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

25.10 Line 8: SIS IFM monitor configuration

Table 231. **[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

25.11 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 232. **[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
[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**

Bit	Bit mask / value	Description
		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

25.12 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 233. [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**

Bit	Bit mask / value	Descirption
		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

25.13 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 234. **[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

25.14 Line 12: DFT 5 thresholds

Table 235. [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 result in MCNF

25.15 Line 13: DFT 6 thresholds

Table 236. [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

25.16 Line 14: DFT 7 thresholds

Table 237. [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

25.17 Line 15: DFT 8 thresholds

Table 238. 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

26 GNSS configuration 2 (page 25)

26.1 GNSS configuration 2 mapping

Table 239. 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 tim																Threashold															

26.2 Line 0: satellites selector sorting mode and filtering

Table 240. [P25,L00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	See Table 241. FREQ FILTER values	Frequency filter Frequencies filtered
F01	[b8-b11]	See Table 242. SORT MODE values	Sorting mode Satellites sorting mode

Table 241. FREQ FILTER values

Values	Definition
0x0	NONE
0x1	L1L2
0x2	L1L5
0x3	L1L5 or L1L2
0x4	L1L2L5
0x5	L1L2L5L6

Table 242. SORT MODE values

Values	Definition
0x0	NONE
0x1	CN0 sorting
0x2	Elevation sorting
0x3	SBAS availability sorting
0x4	SSR availability sorting
0x5	Auto sorting

26.3 Line 1: satellites selector thresholds

Table 243. **[P25,L01] field description**

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	**Least square CN0 min.** Satellites with a CN0 smaller than this threshold are discarded by satellites selector
F01	[b8-b15]	0xFF00	**Min. elevation** Satellites with an elevation (degrees) smaller than this threshold are discarded by satellites selector

26.4 Line 2: satellites selector thresholds

Table 244. **[P25,L02,F00] bits description**

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

27 NMEA message activation part 1 (page 31)

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

27.1 NMEA message activation part 1 mapping

Table 245. 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																															

27.2 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 246. [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** if PSTMDRSEN (p32.6 bit28) is disabled, Enable/Disable ACC3D NMEA message:PSTMDRSEN,30
[b17]	0x20000	**DR GYRO3D NMEA MSGL0** if PSTMDRSEN (p32.6 bit28) is disabled, Enable/disable GYRO3D NMEA message:PSTMDRSEN,31
[b18]	0x40000	**DR GYROTEMP NMEA MSGL0** if PSTMDRSEN (p32.6 bit28) is disabled, Enable/disable GYRO temp NMEA message:PSTMDRSEN,24
[b19]	0x80000	**DR ACC3D GYRO3D NMEA MSGL0** if PSTMDRSEN (p32.6 bit28) 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 (p32.6 bit28) is disabled, enable/disable PRESSURE sensor NMEA message:PSTMDRSEN,32

Bit	Bit mask / value	Description
[b21]	0x200000	**DR ACC3D TEMP NMEA MSGL0** if PSTMDRSEN (p32.6 bit28) is disabled, enable/disable TEMP NMEA message:PSTMDRSEN,25
[b22]	0x400000	**DR ACC3D ODO SPEED NMEA MSGL0** if PSTMDRSEN (p32.6 bit28) 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 (p32.6 bit28) is disabled, enable/disable REV NMEA message:PSTMDRSEN,2

27.3 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 247. [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

28 NMEA message activation part 2 (page 32)

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

28.1 NMEA message activation part 2 mapping

Table 248. 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								Field 1								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 1																															
4	NMEA message List 1 line 0																															
5	NMEA message List 2 line 0																															
6	NMEA message LIST 0 line 1																															
7	Field 0																															

28.2 Line 0: NMEA configuration

Table 249. [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)

28.3 Line 1: NMEA message list rate

Table 250. [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.

28.4 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 251. [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
[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
[b10]	0x400	**PA NMEA MSG** Enable/disable PA NMEA message
[b11]	0x800	**SAT NMEA MSG** Enable/disable SAT NMEA message
[b13]	0x2000	**TIM NMEA MSG** Enable/disable TIM NMEA message
[b14]	0x4000	**WAAS NMEA MSG** Enable/disable WAAS NMEA message

Bit	Bit mask / value	Description
[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

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

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

Table 252. [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** Enable/disable TS NMEA message
[b16]	0x10000	**PSTMGSA NMEA MSG**

Bit	Bit mask / value	Description
		Enable/disable PSTMGSA NMEA message
[b18]	0x40000	**RFTEST NMEA MSG** Enable/disable RFTEST NMEA message
[b29]	0x20000000	**QM NMEA MSG** Enable/disable QM NMEA message

28.6 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 253. [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
[b16]	0x10000	**PSTMGSA NMEA MSG** Enable/disable PSTMGSA NMEA message

28.7 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 254. [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**

Bit	Bit mask / value	Description
		Enable/disable EPHEM NMEA message
[b9]	0x200	**ALM NMEA MSG** Enable/disable ALM NMEA message
[b10]	0x400	**IONO NMEA MSG** 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
[b17]	0x20000	**ERR NMEA MSG** Enable/disable ERR NMEA message
[b20]	0x100000	**LOGGER NMEA MSG** Enable/disable LOGGER NMEA message
[b21]	0x200000	**INTEGRITY NMEA MSG** Enable/disable INTEGRITY NMEA message
[b22]	0x400000	**TEMPERATURE NMEA MSG** Enable/disable TEMPERATURE NMEA message
[b28]	0x10000000	**SENSORS NMEA MSG** Enable/disable SENSORS NMEA message. If Disabled, refer to p31.6 bit16–24 to enable any sensor messages separately
[b31]	0x80000000	**IFB NMEA MSG** Enable/disable IFB NMEA message

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

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

Table 255. [P32,L07,F00] bits description

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

29 Inter frequency bias (page 34)

29.1 Inter frequency bias mapping

Table 256. Page 34 layout

Page 34																														
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	IFB window								IFB rate window								Threshold IFB mean															
1	Threshold PSR rate																Threshold ADR rate														
2	Configuration flags				TRAIM minimum sats				TRAIM elevation mask								TRAIM max. residual														
3	IFB max. psr				Delta threshold				ADR rate threshold factor								PSR rate threshold factor								IFB mean factor						

29.2 Line 0: IFB configuration word 0

Table 257. [P34,L00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	Threshold IFB mean
F01	[b16-b23]	0xFF0000	IFB rate window
F02	[b24-b31]	0xFF000000	IFB window

29.3 Line 1: IFB configuration word 1

Table 258. [P34,L01] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	Threshold ADR rate
F01	[b16-b31]	0xFFFF0000	Threshold PSR rate

29.4 Line 2: IFB configuration word 2

Table 259. [P34,L02] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b15]	0xFFFF	TRAIM max residual
F01	[b16-b23]	0xFF0000	TRAIM elevation mask
F02	[b24-b27]	0xF000000	TRAIM minimum sats
F03	[b28-b31]	0xF0000000	Configuration flags

29.5 Line 3: IFB configuration word 3

Table 260. **[P34,L03] field description**

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	IFB mean factor
F01	[b8-b15]	0xFF00	SR rate threshold factor
F02	[b16-b23]	0xFF0000	ADR rate threshold factor
F03	[b24-b31]	0xFF000000	IFB max. psr delta threshold

30 Assisted GNSS configuration (page 35)

30.1 Assisted GNSS configuration mapping

Table 261. 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							CDB SBAS SEARCH LOGIC	Reserved																CDB SBAS SERVICE							
2	SBAS SAT PARAM1																															
3	SBAS SAT PARAM2																															
6	Reserved																													Reserved		CDB NAVDATA
12	Reserved																															AGNSS ON O
13	Reserved																								Assisted GNSS constellation mask							
15	Reserved																													AGNSS USEREALEPH	AGNSS UPDREALEPH	AGNSS TES

30.2 Line 0: SBAS configuration

Table 262. [P35,L00] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	See Table 263. CDB SBAS SERVICE values	**CDB SBAS SERVICE** Enable/disable SBAS
F02	[b24]	See Table 264. CDB SBAS SEARCH LOGIC values	**SBAS SEARCH LOGIC** Select SBAS search logic

Table 263. CDB 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
0xF	AUTO – SBAS service for satellite is automatic (default)

Table 264. CDB SBAS SEARCH LOGIC values

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

30.3 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, AUTO.

Table 265. [P35,L02,F00] bits description

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

30.4 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, AUTO.

Table 266. [P35,L03,F00] bits description

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

30.5 Line 6: navdata settings

Table 267. [P35,L06,F00] bits description

Bit	Bit mask / value	Description
[b0]	See Table 268. CDB NAVDATA GAL RED EPH values	**CDB NAVDATA GAL RED EPH** Set the activation status for Galileo reduced ephemeris feature

Table 268. CDB NAVDATA GAL RED EPH values

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

30.6 Line 12: assisted GNSS configuration

Table 269. [P35,L12,F00] bits description

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

30.7 Line 13: assisted GNSS constellation mask

Table 270. [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

30.8 Line 15: assisted GNSS settings for test

Table 271. **[P35,L15] field description**

Field	Bit	Bit mask / value	Description
F00	[b0]	0x1	**AGNSS TESTDISABLE**
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

31 Integrity

31.1 Integrity mapping (page 37)

Table 272. 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 double–delta metric (multipath metric, 5x) configuration																															
3	Observables auto–correlation metric (10x) configuration																															
4	Observables code – carrier divergence configuration																															
5	Observables doppler ¨ı¿ 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																					OSNMA hot start enable	OSNMA public key verification	OSNMA enable	Signal integrity threshold							

31.2 Line 0: noise2

Table 273. **[P37,L00,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables code loop discriminator configuration

31.3 Line 1: average phase noise

Table 274. **[P37,L01,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables carrier loop discriminator configuration

31.4 Line 2: DDM

Table 275. **[P37,L02,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables double-delta metric (multipath metric, 5x) configuration

31.5 Line 3: DDM ext

Table 276. **[P37,L03,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables auto-correlation metric (10x) configuration

31.6 Line 4: CCDT

Table 277. **[P37,L04,F00]] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables code - carrier divergence configuration

31.7 Line 5: doppler rate

Table 278. **[P37,L05,F00]] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables doppler code rate divergence configuration

31.8 Line 6: DFCP

Table 279. **[P37,L06,F00] bits description**

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables dual-frequency carrier-phase delta gradient configuration

31.9 Line 7: IFB PSR

Table 280. [P37,L07,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables inter-frequency bias (pseudo-range) configuration

31.10 Line 8: SIG STRENGTH

Table 281. [P37,L08,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Observables signal strength configuration: • Bit#0:7= CN0 threshold • Bit#8:15= BDS GEO CN0 threshold • Bit#16= Enable Pseudo–range threshold exclusion: • Bit#17= Enable drop–detection exclusion, • Bit#18= Enable NMA least square only • Bit#19:26= Dual–frequency carrier phase difference ratio threshold • Bit#7:31= Dual–frequency carrier phase difference ratio max threshold

31.11 Line 9: SPOOFING protection level monitor

Table 282. [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
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.*

31.12 Line 10: signal integrity threshold

Table 283. **[P37,L10] field description**

Field	Bit	Bit mask / value	Description
F00	[b0-b7]	0xFF	Signal integrity threshold.
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]	0x400	**OSNMA hot start enable** Enable the capability to do hot start by storing KROOT in NVM

32 Sensor configuration (STA86x0) (page 44)

32.1 Sensor configuration (STA86x0) mapping

Table 284. Page 35 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	Field 0																															
1	Field 0																															
2	Field 0																															
3	Field 0																															
4	Field 0																															
5	Field 0																															
6	Field 0																															
7	GYRO bandwidth																															
8	ACC bandwidth																															
9	GYRO full scale																															
10	ACC full scale																															
11	Field 0																															

32.2 Line 0: CFG1

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

Table 285. [P44,L00,F00] bits description

Bit	Bit mask / value	Decription
[b1]	0x2	**3D GYRO DATA ONOFF** Enable/disable on board 3axes 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 286. Bus type values	**BUS TYPE** Select the type of digital interface to connect local mems sensors
[b31]	See Table 287. Msg list en values	**MSG LIST EN** DR NMEA strings to log are defined in msg lists

Table 286. Bus type values

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

Table 287. **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 288. **[P44,L01,F00] field 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
[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 289. **[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 290. [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
[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 291. [P44,L04,F00] bits description

Bit	Bit mask / value	Description
[b0-b7]	See Table 292. 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 292. IMU TYPE values

Values	Definition
0x0	IMU UNKNOWN
0x7	IMU LSM6DS3
0x8	IMU BMI160 ; FFM supported
0xA	LSM6DSM-LSM6DSL 6 axes IMU
0xB	LSM6DSR / ISM330DHC – ASM330LHH 6 axes IMU

Values	Definition
0xC	IMU SMI130 ; FFM supported
0xD	IMU IAM20680
0xE	IMU SMI230 ; FFM supported
0xF	LSM6DSO 6 axes IMU

32.7 Line 5: sensors data and queuing configuration

Table 293. [P44,L05,F00] bits description

Bit	Bit mask / value	Description
[b0-b11]	0xFFF	**SENSORS BUFFER SIZE** Size of the internal queue used for sensor data
[b16]	See Table 294. 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 295. 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 294. RAW SENS OUTPUT values

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

Table 295. 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 296. [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)
[b8]	0x100	Wake-up enable Enable INT1 in LSM6DSR/ASM330LHH
[b9]	See Table 297. WAKE-UP INT LEVEL values	Wake-up interrupt activation level Interrupt activation level
[b10]	See Table 298. WAKE-UP OP MODE values	Wake-up operating mode

Bit	Bit mask / value	Description
		Accelerometer low power mode Operating mode
[b16]	See Table 299. 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 297. WAKE-UP INT LEVEL values

Values	Definition
0x0	Interrupt output pins active at low level
0x1	Interrupt output pins active at high level

Table 298. WAKE-UP OP MODE values

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

Table 299. 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 300. [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 line 11.*

32.10 Line 8: accelerometer low pass filter bandwidth

Table 301. [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 line 11.*

32.11 Line 9: gyroscope full scale

Table 302. [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 connected). 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 303. [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 304. [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 305. 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	Ticks per revolution																Reserved													Wheel circumference		
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 306. [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 307. 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 307. WS UNIT values

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

33.3 Line 1: vehicle geometry

Table 308. [P48,L01] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b11]	0xFFF	**Wheel circumference** This value is the wheel circumference (mm) (1)
F02	[b24-b31]	0xFF000000	**Ticks per revolution** This parameter represents the number of pulses equaling a full wheel revolution (2)

1. *Setting this parameter helps to improve DRUM performance.*
2. *This parameter is only functional for differential wheel speeds modes.*

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 309. [P48,L02,F00] field description

Field	Bit	Bit mask / value	Description
SDDF00	[b0]	See Table 310. GYRO UNIT values	**Gyro unit** This parameter is the yaw rate data unit
F02	[b4-b7]	See Table 311. GYRO SIGN values	**Gyro sign bit** This parameter represents the position of gyro data sign bit within payload

Table 310. GYRO UNIT values

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

Table 311. 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 312. [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-line2-bit0

33.6 Line 4: accelerometer sensitivity

Table 313. [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 314. [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 315. 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															
1	Reserved												GNSS CN0 threshold				Reserved		Max Cn0 noise													
2													Fie				ld 0															

34.2 Line 0: DR fix rate and operating mode

Table 316. [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 are 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 317. 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 1: GNSS signal strength acceptance

Table 318. [P49,L01] field description

Field	Bit	Bit mask / value	Description
F00	[b0-b13]	0x3FFF	Max Cn0 noise Coefficient to weight GNSS measure vs signal strength. Resolution: [1 m/LSB] (1)
F02	[b16-b21]	0x3F0000	GNSS CN0 Threshold This parameter defines an acceptance threshold for GNSS fix signal strength \(2)

1. *The default value is 100 m. Sensitive value.*
2. *The default value is 27 db. Sensitive value.*

34.4 Line 2: DR algorithm settings

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

Table 319. [P49,L02,F00] bits description

Bit	Bit mask / value	Description
[b3]	See Table 320. STOPPED CALIB values	Stopped calibration Enable/disable gyro bias estimation while vehicle static
[b4-b5]	See Table 321. OVT MODE values	OvT automatic calibration Enable/disable OvT estimation with thermal change given by IMU
[b6]	0x40	Automatic tilt Enable/disable the automatic estimation and compensation of the installation tilt angles (pitch, roll) (1)
[b7]	0x80	VFB Enable/disable the velocity feedback feature (2)
[b8]	0x100	MAP MATCHING FEEDBACK Enable/disable the usage of map matching feedback feature (3)
[b10]	0x400	3D DR Enable/disable 3D navigation with altitude estimation
[b16-b17]	See Table 322. VRO values	Virtual odometer Enable/disable the virtual odometer estimation (5)
[b18]	See Table 323. 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 324. CALIB LOW SPEED values	Calibration at low speed Enable/disable the calibration at low speed (4)
[b20]	See Table 325. TRUCK MODE values	Truck mode Enable/disable the truck mode (cabin tilt) (4)
[b21]	See Table 326. HEADING MODE values	Heading mode Enable/disable the absolute heading use
[b26]	See Table 327. MMFB X track values	MMFB Only X Track Enable/disable the MMFB X track only feature (6)
[b27]	See Table 328. DR HEAD NO CALIB values	Use DR heading if gyro is not calibrated Enable/disable using DR heading when no calibration
[b29]	See Table 329. DR NVM CAR STOPPED values	Save status to NVM when stopped Enable/disable saving DR in NVM when the car is stopped
[b30]	See Table 330. LIGHT CALIB values	Light calibration Enable/disable the light calibration: DR declared calibrated even if Gyro sensitivity is not calibrated (7)
[b31]	See Table 331. GIS values	Gyroscope integration when stopped Enable/disable the DR heading update when the CAR is stopped (8)

1. *This setting is only effective without full free mounting feature. Ref. to IMU type P44/line4.*
2. *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.*
3. *Echo on NMEA input commands needs to be turned off (application on/off 2 line 1 bit0).*

4. *This setting does not apply to Teseo DRUM.*
5. *This setting applies to Teseo DRUM or Teseo DRAW in fallback mode.*
6. *If enable the along track component provided by host is not taken into account.*
7. *Only recommended in case of qualified IMU.*
8. *Only recommanded in case of perfect odometer. This feature does not apply to Teseo DRUM.*

Table 320. STOPPED CALIB values

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

Table 321. OVT MODE values

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

Table 322. VRO values

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

Table 323. RESET POS INIT values

Values	Definition
0x0	Enabled
0x1	Disabled

Table 324. CALIB LOW SPEED values

Values	Definition
0x0	Disabled
0x1	Enabled

Table 325. TRUCK MODE values

Values	Definition
0x0	Disabled
0x1	Enabled

Table 326. HEADING MODE values

Values	Definition
0x0	Disabled
0x1	Enabled

Table 327. MMFB X track values

Values	Definition
0x0	Disabled
0x1	Enabled

Table 328. DR HEAD NO CALIB values

Values	Definition
0x0	Enabled
0x1	Disabled

Table 329. DR NVM CAR STOPPED values

Values	Definition
0x0	Enabled
0x1	Disabled

Table 330. LIGHT CALIB values

Values	Definition
0x0	Disabled
0x1	Enabled

Table 331. 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 332. 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	Field 0																															
1	Odometer scale																															
2	Gyro offset																															
3	Gyro gain																															
4	Odometer scale standard deviation																															
5	Odometer scale process noise																															
6	Gyro offset standard deviation																															
7	Gyro offset process noise																															
8	Gyro gain standard deviation																															
9	Gyro gain process noise																															
10	Reserved								Installation pitch								Installation roll															Installation yaw
11	GNSS posfilt weight coef																															
12	GNSS heading filt weight coef																															
13	GNSS height filt v																															
14	GNSS vertical velocity filt weight coef																															

35.2 Line 0: DRCFG2

This parameter is used to initialize DR KF

Table 333. [P50,L00,F00] bits description

Bit	Bit mask / value	Description
[b0]	0x1	ODO SCALE ONOFF Enable/disable odo scale initialization (1)
[b1]	0x2	GYRO OFFSET ONOFF Enable/disable gyro offset initialization
[b2]	0x4	GYRO GAIN ONOFF Enable/disable gyro gain initialization (2)
[b3]	See Table 334. REV GEAR INV values	Reverse gear inversion Enable/disable the reverse gear inversion
[b4]	See Table 335. GYRO INV values	Gyro signal inversion Enable/disable the gyro signal inversion

1. *Not used in DRUM mode.*
2. *Not used in DRUM mode and in DRAW mode FFM.*

Table 334. 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 335. GYRO INV values

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

35.3 Line 1: odometer scale default value

Table 336. [P50,L01,F00] bits description

Bit	Bit mask /value	Description
[b0-b31]	0xFFFFFFFF	Odometer scale Parameter used to define the odometer scale initial value (1)

1. *Odometer scale multiplied by 10^5. Used only if page50/Line0 bit ODO SCALE ONOFF is 1.*

35.4 Line 2: gyro offset default value

Table 337. [P50,L02,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Gyro offset Parameter used to define the gyro offset initial value (1)

1. *Gyro offset multiplied by 10^5. Used only if page50/Line0 bit GYRO OFF ONOFF is 1.*

35.5 Line 3: gyro gain default value

Table 338. [P50,L03,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Gyro gain Parameter used to define the gyro gain initial value (1)

1. *Gyro gain multiplied by 10^5. Used only if page50/Line0 bit GYRO GAIN ONOFF is 1.*

35.6 Line 4: odometer scale standard deviation default value

Table 339. [P50,L04,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	odometer scale standard deviation Parameter used to define the Odometer scale standard deviation initial value (1)

1. *Resolution: [10^{-7} m/tick LSB].*

35.7 Line 5: odometer scale process noise default value

Table 340. [P50,L05,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Odometer scale process noise Parameter used to define the Odometer scale process noise initial value (1)

1. *Resolution: [10 − 7 m/tick LSB].*

35.8 Line 6: gyro offset standard deviation default value

Table 341. [P50,L06,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Gyro offset standard deviation Parameter used to define the gyro offset standard deviation initial value (1)

1. *Resolution: [10 − 7 V LSB].*

35.9 Line 7: gyro offset process noise default value

Table 342. [P50,L07,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Gyro offset process noise Parameter used to define the gyro offset process noise initial value (1)

1. *Resolution: [10 − 7 V LSB].*

35.10 Line 8: gyro gain standard deviation default value

Table 343. [P50,L08,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Gyro gain standard deviation Parameter used to define the gyro gain standard deviation initial value(1)

1. *Resolution: [10 − 7 rad/V*s LSB].*

35.11 Line 9: gyro gain process noise default value

Table 344. [P50,L09,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	Gyro gain process noise Parameter used to define the gyro gain process noise initial value (1)

1. *Resolution: [10 − 7 rad/V*s LSB].*

35.12 Line 10: installation angles

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

Table 345. [P50,L10,F00] field description

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

35.13 Line 11: GNSS position filter weight coefficient

Table 346. [P50,L11,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	GNSS pos filt weight coef. Parameter used to filter more (high value) or less (low value) GNSS position (1)

1. *Default value is 1.0. Resolution [0.01/LSB].*

35.14 Line 12: GNSS heading filter weight coefficient

Table 347. [P50,L12,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	GNSS heading filt weight coef Parameter used to filter more (high value) or less (low value) GNSS heading (1)

1. *Default value is 1.0. Resolution [0.01/LSB].*

35.15 Line 13: GNSS height filter weight coefficient

Table 348. [P50,L13,F00] bits description

Bit	Bit mask / value	Description
[b0-b31]	0xFFFFFFFF	GNSS height filt weight coef Parameter used to filter more (high value) or less (low value) GNSS height (1)

1. *Default value is 1.0. Resolution [0.01/LSB].*

35.16 Line 14: GNSS vertical velocity filter weight coefficient

Table 349. [P50,L14,F00] bits description

Bit	Bit mask / value	GNSS vertical velocity filt weight coef
[b0-b31]	0xFFFFFFFF	Parameter used to filter more (high value) or less (low value) GNSS vertical velocity (1)

1. *Default value is 1.0. Resolution [0.01/LSB].*

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 350. 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 351. [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 352. [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 353. **[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 354. **[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 355. **[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 356. **[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 357. **[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 358. **[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 359. [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 360. [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 361. [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 362. [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 363. [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 364. [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 365. [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 366. **[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 367. 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 368. [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 369. [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 370. [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 371. [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 372. [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 373. [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 374. [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 375. [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 376. [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 377. [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 378. [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 379. [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 380. [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 381. [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 382. [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 383. [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 recompile 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 range [1–63], (Page0 is reserved for internal usage and cannot be updated)
- <Line> is a decimal value in range [0–15]
- <Field> is a decimal value in range [0–32]
- <mode> is a decimal value is range [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 save

Syntax:

```
$PSTMSAVEPAR
```

The current configuration data block from RAM, including modified parameters, will be stored into the saved configuration data block (SCDB).

39.5 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 384. Acronyms

Acronym	Name
DCDB	Area included in binary customized setting or saved configuration or saved configuration data block
SCDB	Area that is part of flash and used as GNSS backup memory

Table 385. Reference documents

Document name	Document title
UM3407	Teseo VI and Teseo APP2–NMEA specifications and commands
UM3401	Teseo VI and Teseo APP2–RTCM3 proprietary interface

Revision history

Table 386. **Document revision history**

Date	Revision	Changes
25-Nov-2024	1	Initial release.

Contents

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